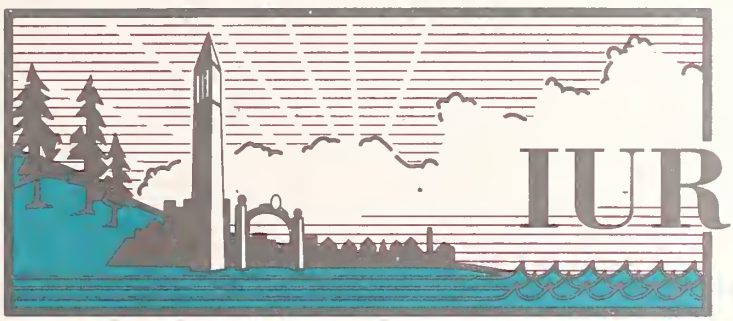


Institute of Urban and Regional Development

BART@20: Land Use and Development Impacts

Robert Cervero

with research assistance by
Carlos Castellanos, Wicaksono
Sarosa, and Kenneth Rich

BART @ 20

July 1995

University of California at Berkeley

BART@20:
Land Use and Development Impacts

Robert Cervero

with Research Assistance by Carlos Castellanos,
Wicaksono Sarosa, and Kenneth Rich

This paper was produced with support provided by the U.S. Department of Transportation and the California State Department of Transportation (Caltrans) through the University of California Transportation Center.

University of California at Berkeley
Institute of Urban and Regional Development

Table of Contents

TABLES

MAPS

FIGURES

FIGURES (cont'd)

FIGURES (cont'd)

FIGURES (cont'd)

PHOTOS

CHAPTER ONE
BART at 20: An Analysis of Land Use Impacts

1. INTRODUCTION

America has a rich history of rail transit investments shaping the form and character of metropolitan areas. Classic works by Warner (1962), Vance (1964), and Fogelson (1967) chronicled how the extension of electric streetcar lines around the turn-of-the-century led to massive decentralization in Boston, the San Francisco Bay Area, and Southern California. Many east coast cities today stand as testaments to rail transit's city-shaping abilities.

The Bay Area Rapid Transit (BART) system was planned to very much continue this American tradition. BART's planners hoped a modern-era rail system would guide future population and employment growth in the region. By providing one of the largest incremental additions to regional accessibility in the post-WWII era, BART was expected to strengthen the Bay Area's urban centers while guiding suburban growth along radial corridors, leading to a multi-centered metropolitan form. According to Johnston and Tracy (1983) , the entire BART project was premised on that basis — that it would eventually lead to minicommunities mushrooming around suburban rail stations. Merewitz (1971) suggests BART was also built to differentiate the region from its more freeway-oriented sibling to the south, Los Angeles. BART proponents felt it would help catapult San Francisco into the position of "Manhattan of the West."

In view of these expectations, the original BART Impact Studies placed a strong emphasis on gauging the land use impacts of BART. This study, carried out in the mid-1970s only a few years after the 1973 opening of the 72-mile BART system, is the most extensive work to date on the development impacts of a U.S. transit system. Based on tracking changes during the early and mid-1970s, researchers concluded that BART had a modest, though not inconsequential, influence on land uses and urban development in the Bay Area, both *directly* by improving accessibility and *indirectly* by inducing various policies supportive of compact development, such incentive zoning, and redevelopment financing. BART did not create new growth, but rather acted to redistribute growth that would have taken place even without a rail investment. The initial study also found that BART's primary land use impacts occurred at the local rather than regional level. For instance, BART was credited with focusing much of San Francisco's downtown office construction south of Market Street and rejuvenating inner-city Oakland (Dyett et al., 1979). BART, however, was only part of the reason. A redevelopment authority was formed at the same time BART was built to encourage development in the south of Market (SoMa) area. New zoning significantly increased allowable floor area ratios within 700 feet of stations and provided density bonuses for buildings adjacent to downtown stations. A $15 million beautification program, complete with new street furniture and landscaping and funded through a tax increment finance pro-

gram, helped lure new development to the Market Street corridor. In downtown Oakland and at the Lake Merritt station, significant public efforts to assemble land and site new public buildings around BART stations have also been critical to redeveloping these areas. Without these public initiatives, far less development would have occurred.

Outside of downtown, the original study found BART's land-use influences to be fairly modest, save for several stations in the East Bay suburbs. Local opposition to growth, downzoning, and siting of stations in freeway medians suppressed development outside of downtown. BART largely failed to attract high-density residential development around stations. Webber (1976) argued that BART's poor land use performance outside of downtowns was mainly because it was only marginally faster than buses and was markedly slower than its main competitor, the private automobile. Critics charged that fixed-guideway rail was the wrong technology for the Bay Area given the rapid growth in automobile and home ownership, and freeway building, that took place during the postwar period. Noted sociologist Homer Hoyt (1939) observed over a half a century ago that "urban form is largely a product of the dominant transportation technology during a city's prevailing period of growth." The Bay Area grew most rapidly during the 1950s and 1960s, a period of massive freeway construction and the automobile's ascendency. BART, critics argued, was too little, too late.

Overall, the original BART Impact Study found that BART affected land uses only when supportive conditions — such as incentive zoning, local citizens support, and a buoyant local economy — are present. In the absence of such factors, BART was found to have little influence on where growth occurred and in what form. The study also noted that because the BART district did not have the authority or entrepreneurial licenses to assemble excess land and leverage land development (unlike in Toronto and other cities abroad), it could not exploit the potential it had created.

While the original BART Impact Study found few instances of significant land use impacts, it did suggest that "BART's impacts on the Bay Area land uses may become more widespreadinthe future" (Metropolitan Transportation Commission: 25). A criticism of the original Impact Studies was that they were premature — it was perhaps unrealistic to expect any significant and measurable land use changes over the short 3-5 year time span in which post-BART evaluations were carried out. Large-scale land use changes often occur slowly, in fits and starts. While transportation investments always have some degree of short-term impacts on travel behavior, only over the long run do structural changes in urban form occur.

The purpose of this report is to provide a 20-year perspective into the land use impacts of BART. The analysis concentrates on historical changes in private residential and non-residential (e.g., commercial, industrial, office) land development for a collection of stations on various segments of the BART system. This report is admittedly not all encompassing. Other reports from the BART at 20 study are documenting BART's impacts on residential values, population and employment growth, and other indicators of development trends. This report concentrates on documenting land use changes around

specific stations, and, from these results, generalizing about the land use impacts of BART among classes of stations. For a sample of stations, differences in land use changes around BART stations and matched pairs of nearby freeway interchanges are also compared. The report concludes by merging the results of individual station-area studies, and drawing policy inferences from these findings.

References

Dyett, M., D. Dornbusch, M. Fajans, C. Falcke, V. Gussman, and J. Merchant. 1979. *Land Use and Urban Development Impacts of BART: Final Report*. San Francisco: John Blayney Associates/David M. Dornbusch & Co., Inc.

Fogelson, R. 1967. *The Fragmented Metropolis: Los Angeles from 1850 to 1930*. Cambridge: Harvard University Press.

Hoyt, H. 1939. *The Structure of Growth of Regional Neighborhoods in American Cities*. Washington, D.C.: U.S. Government Printing Office.

Johnston, R., and S. Tracy. 1983. "Suburban Resistance to Density near Transit Stations in the San Francisco Bay Area." *The Social Constraints on Energy-Policy Implementation*, N. Neiman and B. Burt, eds. Lexington, Massachusetts: Heath and Company.

Merewitz, L. 1972. Public Transportation: Wish Fulfillment and Reality in the San Francisco Bay Area. *Journal of the American Economic Association*.

Metropolitan Transportation Commision. 1979. *BART in the San Francisco Bay Area*. Berkeley: Metropolitan Transportation Commission.

Vance, J. E. 1964. *Geography and Urban Evolution in the San Francisco Bay Area*. Berkeley: Institute of Governmental Studies.

Warner, S. B. 1962. *Streetcar Suburbs*. Cambridge: Harvard University Press.

Webber, M. 1976. The BART Experience: What Have We Learned? *Public Interest* 12(3): 79-108.

CHAPTER TWO
Research Approach and Data Sources

Several comparative contexts were used to evaluate the land-use impacts of BART. One, changes in population and employment growth were examined for BART-served and non-BART-served parts of the Bay Area. Two, changes in residential and non-residential building areas, land consumption, and densities were examined both by geographic location (e.g., BART corridor) and station classes. Station classes were defined in terms of their similar land-use features using cluster analysis techniques. Third, changes in land uses and densities were compared between BART stations and nearby freeway interchanges for five station-interchange pairs. This provided a matched-pair context for examining whether regional rail nodes produced fundamentally different land-use outcomes than nearby regional freeway nodes. By triangulating the research to include different grains of analysis and comparative contexts, we believe a rich perspective into the 20-year land-use implications of BART could be gained.

Most of the land-use changes examined were for privately owned parcels of land. This was done for several reasons: one, the most significant development impacts of rail system have historically been felt in the private sector; two, an objective of rail systems, including BART, is to leverage private development through public infrastructure investment; and three, the most readily available data on land-use changes is from property tax records maintained on all privately owned parcels. Still, a fair amount of government office construction occurred around several BART stations, such as Oakland-12th Street and Richmond, since BART was opened. Government building activities are thus discussed around several BART stations since the early 1970s.

Several data bases were used for carrying out much of the analyses in this report. One was the TRW-REDI data base, providing on-line, digitized records on the square footage, lot area, year of construction, and other statistics for individual privately owned parcels of land. The TRW-REDI data base, a for-fee on-line service, consists of property tax records obtained from local taxing jurisdictions, typically county assessors' offices. From these data, we were able to construct vintage models, tracking the accumulation of total square footage of residential and non-residential development added to each BART station over time. This was done by maintaining a running account of the square footage added to each station area each year, based on the recorded year of construction. There are, however, two shortcomings of this data base for constructing vintage models. One, year of construction is not recorded for all of the parcels in the data base. Thus, parcels with missing data on year of construction had to be omitted from the analysis. From field checks, we found that buildings on most of the parcels without recorded construction dates tended to be fairly old, consistently predating BART and in almost all cases having been constructed during the first half of this century. Thus, the omission of these cases, we believe, did not seriously bias the estimates of square footage built just before BART up to the present. A second shortcoming is that the data base only defines the land use at the time a building was constructed and a permit

issued. If land uses change within the same building, this would not be known as long as a new construction permit was not issued. This, however, is also not thought to have posed a serious problem. In the case of residential development, homes are rarely converted directly to commercial, office, or industrial uses. If an apartment complex is demolished to make way for an office tower on a particular parcel, the deletion of a housing unit and addition of a office building would be recorded in the vintage model because permits would have been issued for these activities. Since we generally examined non-residential uses in combination, the conversion of a building from, say, a retail store to an office tower would not have affected the total count of non-residential square footage.

A second series of data bases used in this study were the U.S. census data, for 1970, 1980, and 1990. Data on population and employment were obtained for census tracts and block groups surrounding each station using Summary Tape File 3A for the San Francisco-Oakland Metropolitan Statistical Area (MSA). For examining employment at place of work, we used Part II of the 1990 Census Transportation Planning Package (CTPP).

In addition to these electronic data bases, we relied on a number of secondary sources, in-field observations, and windshield surveys to compile data. Much of the historical data for pre-BART and early-BART were obtained from the original BART Impact Studies. Additional data for more recent years were compiled from various local planning documents and specific neighborhood plans.[1] Data on the dominant land-use compositions for 100 square-meter (hectare) grid cells for 1990 were acquired from the Association of Bay Area Governments (ABAG) in digitized form. We also interviewed staff from local planning offices, redevelopment agencies, and private real estate firms to check and validate our data. Lastly, data which were not available from other primary or secondary sources were obtained through in-field surveys.

The analysis of changes in public-sector buildings was conducted using records provided directly by federal, state, county, and municipal agencies with offices in the San Francisco Bay Area. These were supplemented by secondary data sources and field surveys.

Notes

[1]Additional reports used include: *Downtown San Francisco Plan*, San Francisco City Planning Department, 1983; *El Cerrito Redevelopment Plan*, City of El Cerrito, 1989; and *Rockridge Neighborhood Plan*, City of Oakland.

CHAPTER THREE
Employment and Population Changes in BART and Non-BART Areas

The first comparative context was to examine changes in population and employment in Bay Area superdistricts with and without BART services. Compared to the analyses which follow, this is a macro-scale analysis. Map 3.1 shows the 34 superdistricts, defined by the Metropolitan Transportation Commission (MTC). Nine of the superdistricts, identified by the shaded areas in Map 3.1, presently receive BART services.

3.1. Population Changes

Over the 1970-1990 period, population grew faster in areas not served by BART. Table 3.1 shows that the number of inhabitants in non-BART superdistricts grew around two-thirds faster than in BART-served ones. The non-BART superdistricts had the greatest edge in population growth during the early BART years, 1970 to 1980.

Table 3.1. Comparison of 1970-80-90 Population Growth BART-Served and Non-BART Superdistricts, Nine-County Bay Area

				Percent Change		
	1970	1980	1990	1970-80	1980-90	1970-90
Nine BART-Served Superdistricts	1,787,965	1,853,873	2,093,355	3.7	12.9	17.1
25 Non-BART Superdistricts	2,906,611	3,325,911	3,930,222	14.4	18.2	35.2

Note:
[a]For 1970, population data were only available for the 30-zone BART superdistricts. 1970 population estimates for superdistricts in Contra Costa County were interpolated to 1980 superdistrict boundaries.

Breaking these data down by counties shows that population grew the fastest in the suburban and exurban parts of Alameda and Contra Costa counties that were not served by BART. Table 3.2 shows that population in the Pleasanton-Livermore part of Alameda County (superdistrict 15) grew more than three times faster than the remaining (BART-served) part of the county from 1970 to 1990. During the 1970s, population remained fairly stagnant in the BART-served parts of Alameda and actually declined in the BART-served parts of San Francisco. In Contra Costa county, however, population in the Walnut Creek-Pleasant Hill-Concord superdistricts grew slightly ahead of more outlying areas (like Danville, Pittsburg, and Antioch). During the 1980s, the situation reversed, with the outlying parts of Contra Costa County outgrowing the more central, BART-served parts.

Only in the case of San Francisco did population grow more faster in the BART-served parts of the city. The eastern, BART-served half grew by 4 percent from 1970 to 1990 whereas the remaining western half of the city lost some 4,000 residents.

Map 3.1. Map of the 34 Bay Area Superdistricts

Table 3.2. Comparison of 1970-80-90 Population Growth BART-Served and Non-BART Superdistricts, by Three Counties

COUNTY: Super-District	1970[a]	1980	1990	Percent Change 1970-80	1980-90	1970-90
SAN FRANCISCO:						
BART	387,180	368,137	402,538	-5.0	9.4	4.0
Non-BART	325,729	310,837	321,421	-4.6	3.4	-1.3
ALAMEDA:						
BART	990,497	1,000,973	1,143,347	1.1	14.2	15.4
Non-BART	77,637	104,406	135,835	34.5	30.1	75.0
CONTRA COSTA:						
BART	410,288	484,763	547,470	18.2	12.9	33.4
Non-BART	146,301	171,617	256,259	17.3	49.3	75.2
THREE-COUNTY TOTAL:						
BART	1,787,965	1,853,873	2,093,355	3.7	12.9	17.1
Non-BART	549,667	586,860	713,515	6.8	21.6	29.8

Note:
[a]For 1970, population data were only available for the 30-zone BART superdistricts. 1970 population estimates for superdistricts in Contra Costa County were interpolated to 1980 superdistrict boundaries.

Table 3.2 shows that within the three counties, the five non-BART superdistricts grew nearly three-quarters faster in population (29.8 percent vs. 17.1 percent) from 1970 to 1990. The early years of BART is again seen to be the period when non-served areas, particularly in eastern Alameda County, had a growth edge.

Table 3.3 shows a superdistrict comparison of population changes for two specific freeway corridor-areas.[1] The Interstate-680 corridor is a north-south freeway stretch in Alameda and Contra Costa counties which experienced explosive growth during 1970 to 1990. The northern part of I-680 parallels the BART line part of the way (in superdistricts 21 and 22) whereas the southern portion of the freeway is in the non-BART superdistricts (15 and 23). Over the 1970-1990 period, population grew twice as fast in the southern portions of I-680 unserved by BART. During the 1980s, it grew three times faster.

The other comparison shown in Table 3.3 is for the Interstate-880 corridor, running along the western edge of Alameda county between Oakland and northern Santa Clara County. BART lies between one and two miles east of the freeway for most of its stretch. I-880 continues southward to Milipitas (superdistrict 12); however, BART services presently terminate at Fremont. Table 3.3 shows that population in the southern flank of I-880 that was unserved by BART (Milipitas) grew more than 7 times faster the population in the BART-served areas (Hayward-Fremont).

Table 3.3. Comparison of 1970-80-90 Population BART-Served and Non-BART Suburban Corridors

I-680 Corridor	1970[a]	1980	1990	Percent Change 1970-80	1980-90	1970-90
BART: Walnut Creek-Pleasant Hill-Concord	254,870	300,612	331,634	17.9	10.3	30.1
Non-BART: Danville-San Ramon-Pleasanton-Livermore	140,260	167,713	227,094	19.6	35.4	61.9
South I-880 Corridor						
BART: Hayward-Fremont	439,653	465,104	559,252	5.8	20.2	27.2
Non-BART: Milpitas	107,630	232,151	316,978	115.7	36.5	194.5

Note:
[a]For 1970, population data were only available for the 30-zone BART superdistricts. 1970 population estimates for superdistricts in Walnut Creek-Pleasant Hill-Concord, Danville-San Ramon-Pleasanton-Livermore, and Milpitas were interpolated to 1980 superdistrict boundaries.

3.2. Employment Changes

Similar analyses were carried out on employment growth over the 1970-90 period. Table 3.4 shows that the relative employment gains of non-BART superdistricts were even greater than the population gains. Overall, employment grew two-and-one-half times faster in non-BART areas from 1970 to 1990, mirroring the trend toward suburbanization of jobs throughout the U.S.

Table 3.4. Comparison of 1970-80-90 Employment Growth BART-Served and Non-BART Superdistricts, Nine-County Bay Area

	1970	1980	1990	Percent Change 1970-80	1980-90	1970-90
Nine BART-Served Superdistricts	871,922	1,044,504	1,211,416	19.8	16.0	38.9
25 Non-BART Superdistricts	931,562	1,403,476	1,831,099	50.7	30.5	96.6

A similar pattern was found at the county level. Table 3.5 shows that, at the county level, employment growth was far faster in non-BART areas. This was especially the case in Alameda County, where many back-office jobs and new start-up firms located in office parks, like Hacienda Business Park in Pleasanton. Despite the attraction of many jobs near BART stations in Contra Costa County (Walnut Creek, Concord, Pleasant Hill), relatively more job growth in the county took place along I-680 to the south, especially in San Ramon, where the 585-acre, 6-million-square-foot Bishop Ranch Office Park opened in the mid-1980s. Still, 153,000 more jobs were created in BART-served superdistricts of Alameda and Contra Costa counties than non-BART superdistricts. Only in the case of San Francisco was the

Table 3.5. Comparison of 1970-80-90 Employment Growth BART-Served and Non-BART Superdistricts

COUNTY: Super-District	1970	1980	1990	Percent Change 1970-80	1980-90	1970-90
SAN FRANCISCO:						
BART	357,761	409,940	442,370	14.6	7.9	23.6
Non-BART	94,436	98,703	113,037	4.5	14.5	19.7
ALAMEDA:						
BART	393,755	461,198	532,872	17.1	15.5	35.3
Non-BART	19,908	36,332	71,817	82.5	97.7	260.7
CONTRA COSTA:						
BART	120,406	173,366	236,174	44.0	36.2	96.1
Non-BART	27,817	39,732	77,390	42.8	94.8	178.2
THREE-COUNTY TOTAL:						
BART	871,922	1,044,504	1,211,416	19.8	16.0	38.9
Non-BART	142,161	174,767	262,244	22.9	50.0	84.5

employment grow rate faster in BART than non-BART-served areas. (In MTC superdistrict 1, which encompasses downtown San Francisco, employment actually declined from 1980 to 1990; this was offset, however, by job gains in superdistrict 3, producing a net increase in employment in San Francisco's BART-served districts during the 1980s.)

These findings are amplified in Table 3.6, which compares job growth in the BART and non-BART parts of the I-680 and I-880 corridors. From 1970 to 1990, employment grew more than twice as fast in the superdistricts along these two freeway corridors that were not served by BART. Job growth in the San Ramon-Pleasanton-Livermore triangle was the fastest in the Bay Area over this period, increas-

Table 3.6. Comparison of 1970-80-90 Employment BART-Served and Non-BART Suburban Corridors

I-680 Corridor	1970[a]	1980	1990	Percent Change 1970-80	1980-90	1970-90
BART: Walnut Creek-Pleasant Hill-Concord	71,464	115,933	172,328	62.2	48.6	141.1
Non-BART: Danville-San Ramon-Pleasanton-Livermore	25,271	51,045	113,188	102.0	121.7	347.9
South I-880 Corridor						
BART: Hayward-Fremont	118,141	167,781	225,774	42.0	34.6	91.1
Non-BART: Milpitas	24,136	46,149	82,654	91.2	79.1	242.5

ing by a factor of three and a half. In absolute terms, however, the San Ramon-Pleasanton-Livermore area gained 13,000 fewer jobs during 1970-1990 than the BART-served northern I-680 corridor (Walnut Creek-Pleasant Hill-Concord).

These findings from the U.S. census are further corroborated by employment growth data available from the U.S. Department of Commerce's *County Business Patterns* that are disaggregated at the zipcode level for the 1981-1990 period. For the analysis of BART's employment impacts, shift-share analysis was used to measure employment growth differentials between 35 zipcodes with BART stations and the remaining 117 zipcodes without BART stations in the three BART-served counties (Alameda, Contra Costa, and San Francisco). The BART zipcodes gained 139,400 jobs from 1981 to 1990, growing by 30.3 percent and accounting for 57.1 percent of the employment growth in the three counties. Employment in the non-BART zipcodes increased by 110,300, or 19 percent. Almost all of the BART-related employment growth, however, occurred in downtown San Francisco; jobs in the East Bay's zipcodes, by comparison, increased just 1.1 percent. Among employment sectors, Finance-Insurance-Real Estate (FIRE) experienced the greatest absolute job growth and the fastest job growth rate (+108.2 percent) in the BART zipcodes, followed by non-business services (+52.9 percent), and business services (+46.2 percent).

Using data from Part II of the 1990 Census Transportation Planning Package (CTPP), we were further able to examine employment differentials by occupation. These data reveal that businesses near BART hire high shares of professional, technical, and executive workers (consistent with the finding that BART's primary locational influence was in the FIRE and consumer services sectors). For each of the three BART-served counties (including the city-county of San Francisco), Figures 3.1 to 3.3 compare the mixes of occupations countywide with those of the BART station areas (defined as the census tracts encompassing BART stations). In the case of Alameda County, for instance, 35 percent of those with jobs near BART stations were executives or professionals, compared to just 27 percent for the county as a whole. Along the Fremont-Richmond corridors, census tracts with BART stations were found to consistently average around 15-20 percentage points more of professional and technical workers than do businesses in census tracts in the parallel Interstate-80 and Interstate-880 corridors.

Overall, job growth has been consistently higher around BART stations than elsewhere in the region, though this is mainly attributable to gains in downtown San Francisco. In the East Bay, job growth has generally been faster away from BART, especially along the I-680 corridor. In the context of both national and regional trends toward office decentralization, these findings suggest that BART has helped slow the exodus of jobs from downtown San Francisco. To the degree that maintaining a dominant, primary commercial and employment center increases economic productivity for the region as a whole (e.g., due to the externalities accruing from agglomeration economies), BART has likely produced a real, though unmeasurable, economic benefit by helping to anchor job growth in downtown San Francisco.

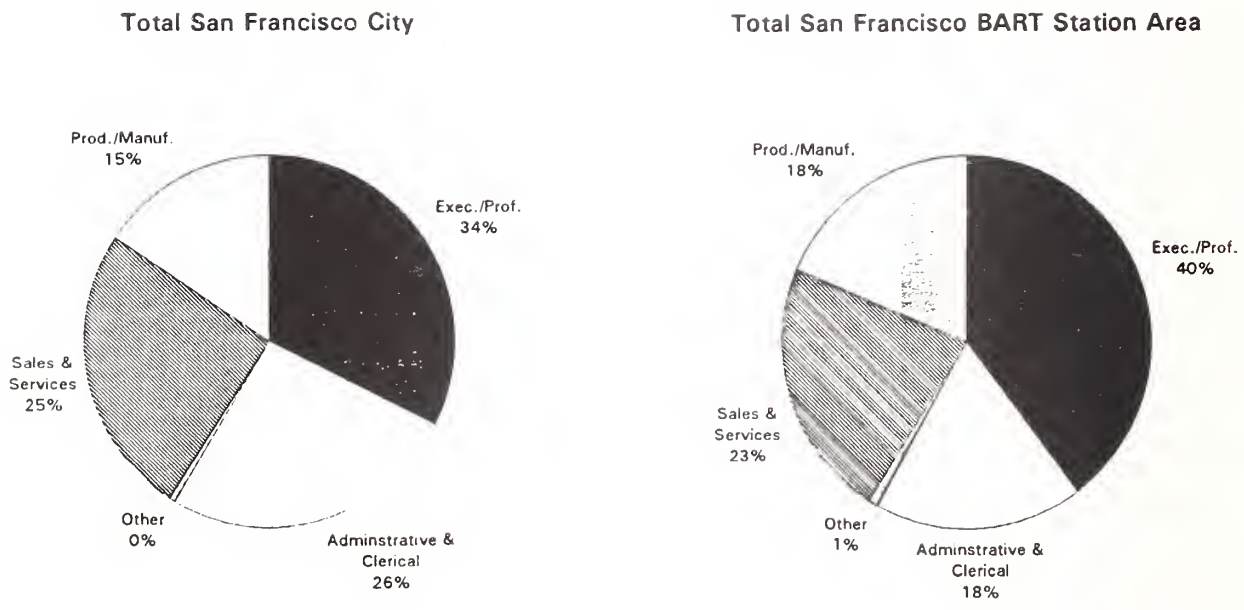


Figure 3.1. 1990 Occupational Totals: Total County and BART Station Areas in County

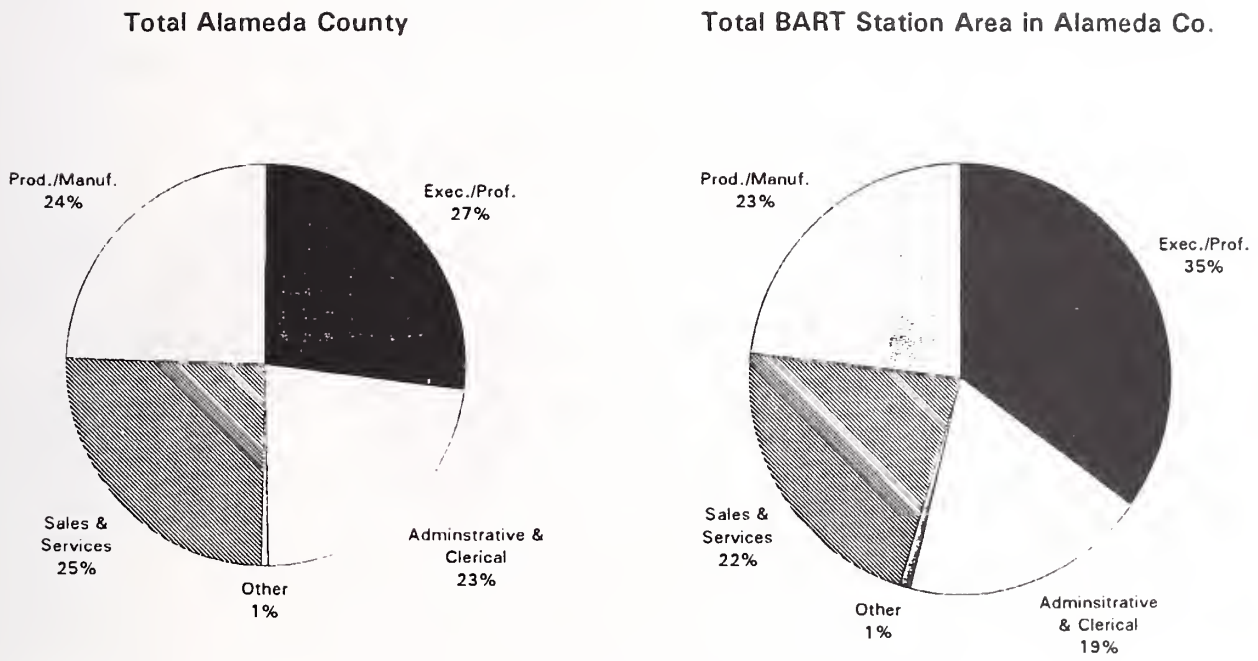


Figure 3.2. 1990 Occupational Totals: Total County and BART Station Areas in County

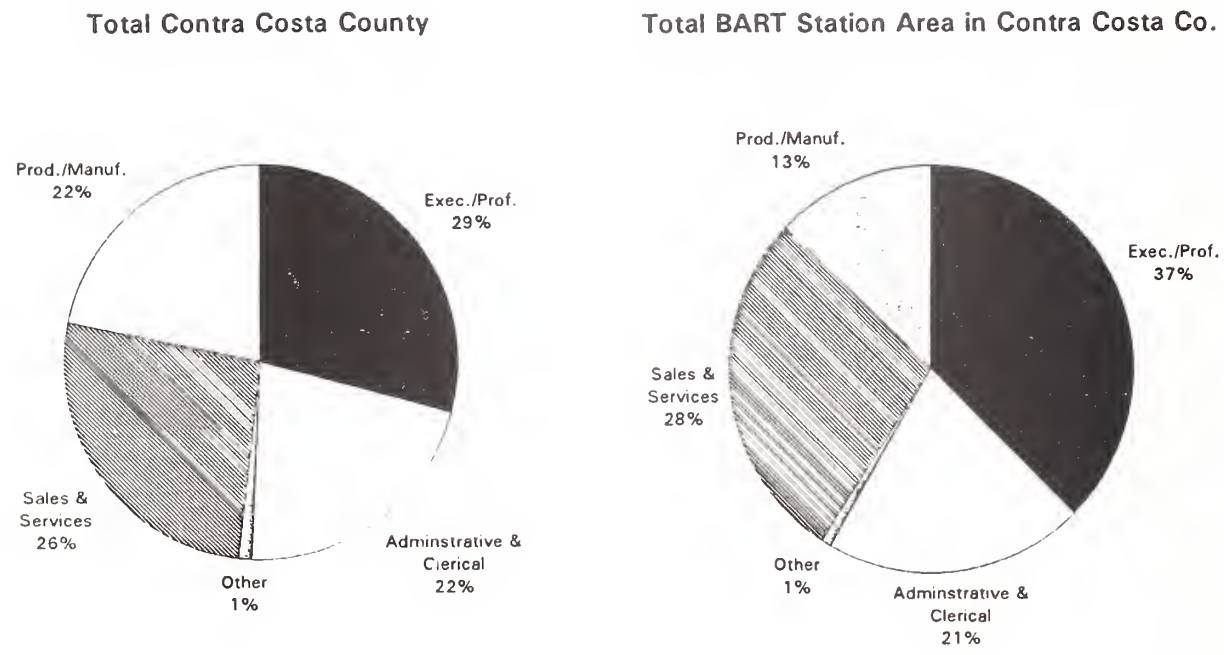


Figure 3.3. 1990 Occupational Totals: Total County and BART Station Areas in County

3.3. Population Densities

BART's spatial correlation with 1990 population densities is evident from Figure 3.4. Over 85 percent of the census tracts shown in Figure 3.4 with the highest population densities, over 7.5 persons per acre, contained a BART station or some segment of a BART line. Still, moderately high population densities are found outside of census tracts served by BART. Additionally, one cannot infer from these graphs that BART, itself, induced clustered development around stations; after all, BART was consciously planned to serve districts which already had sufficient densities to sustain services. For the most part, BART contributes to the support of high population, though it is by no means a sufficient condition.

3.4. Employment Densities

In 1990, BART's alignment was highly correlated with employment densities, as revealed by Figure 3.5 and the 3-dimensional map shown in Figure 3.6. Over the past half century, the Bay Area has transformed from a predominantly single-centered metropolis to one with multiple, hierarchical centers, many strongly oriented to BART. Data do not permit us to measure BART's role in bringing about this built form; however, based on employment growth differentials we believe its role has been significant.

Using census data on employment at place of work (i.e., the 1980 Urban Transportation Planning Package and the 1990 CTPP), we computed net employment densities (workers per net commercial-industrial-institutional acre) for 1980 and 1990 for stations on the Richmond-Fremont corridor. Figure 3.7 plots the employment density gradient from the downtown Berkeley station southward to the Fremont terminal station. Densities rose slightly over the 1980-90 period around all stations except Lake Merritt, a station surrounded by predominantly governmental offices, institutional uses, and light manufacturing. The loss of manufacturing jobs in the area largely accounted for Lake Merritt's density decline. For the same Berkeley-to-Fremont segment, 1990 employment densities were compared between census tracts around BART stations and census tracts around the closest freeway interchange to each station along the I-80 and I-880 corridors (most of which were around 1-2 miles away). Employment densities were three times higher near Berkeley's BART station than its University Avenue interchange, though only marginally higher in the more suburban station areas, except around the South Hayward station (Figure 3.8).

Overall, there was a slight trend toward employment densification on BART's Richmond-Fremont corridor during the 1980s. Employment also tended to be more concentrated around BART stations than matched freeway pairs. As shown in later chapters, commercial-office floor area ratios have also generally increased along all BART corridors, notably in downtown San Francisco and the outer segments of the Concord line. Collectively, these trends suggest BART has functions as a growth magnet, helping to organize office employment growth into nodes.

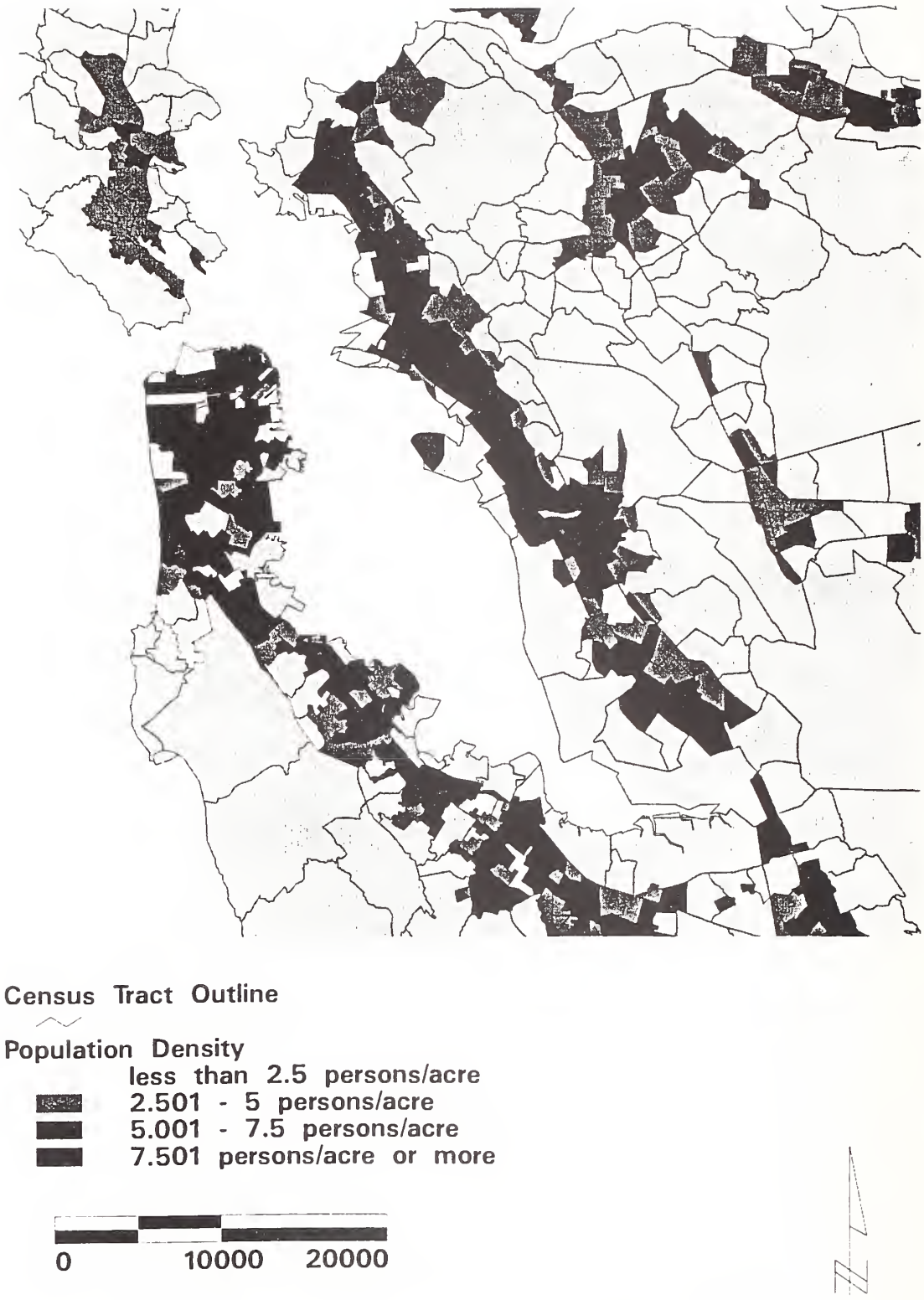


Figure 3.4. Population Density, San Francisco Bay Area, 1990

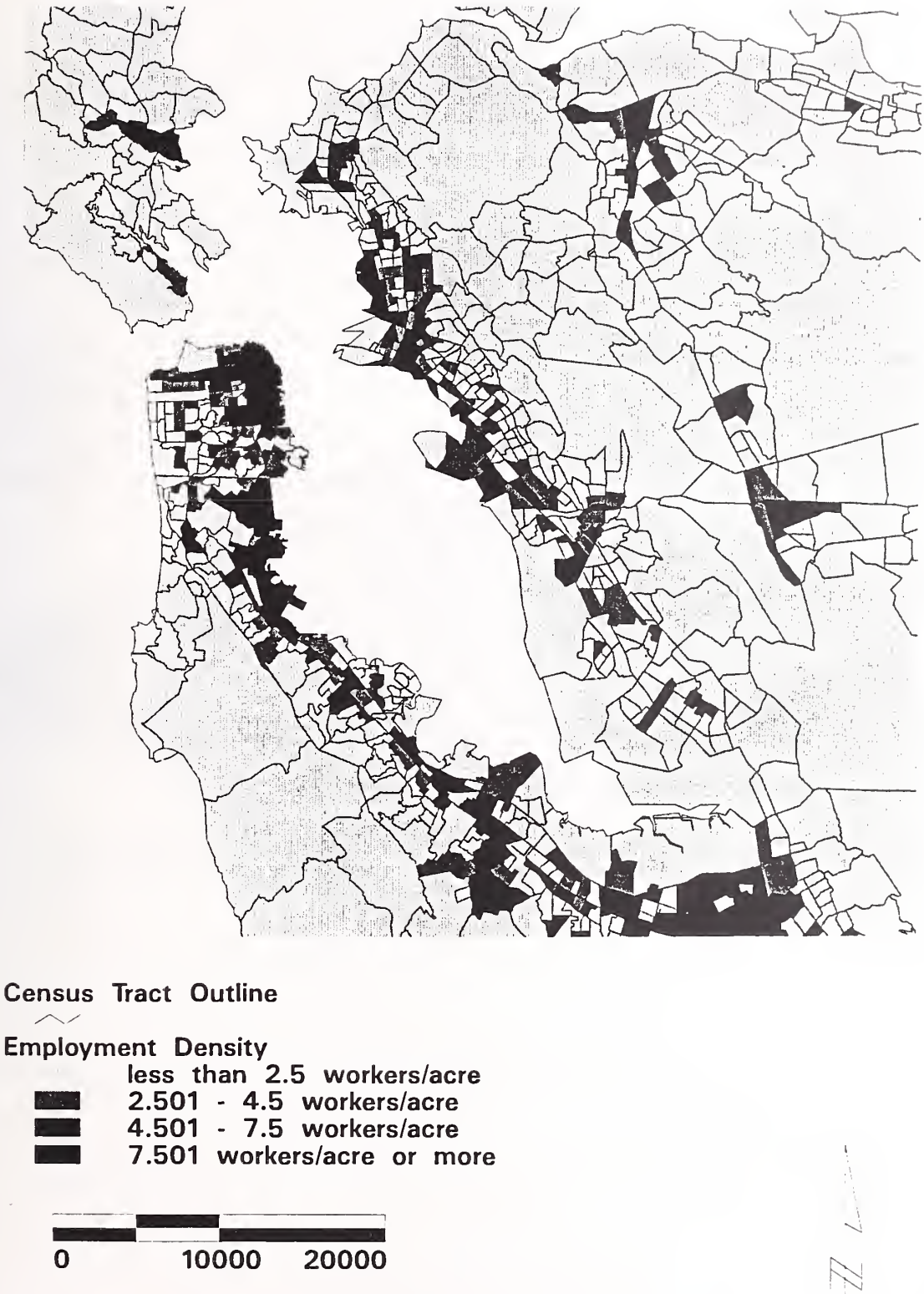


Figure 3.5. Employment Density, San Francisco Bay Area, 1990

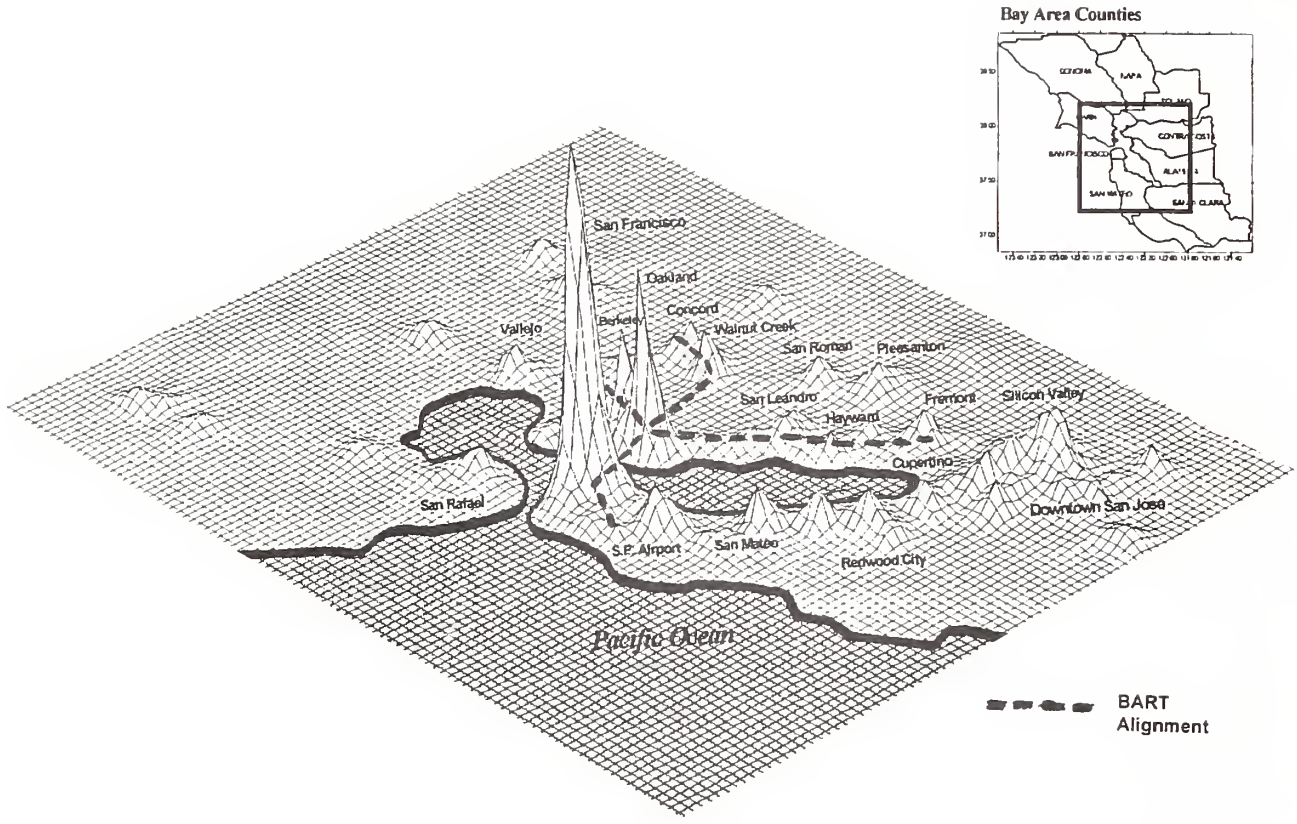
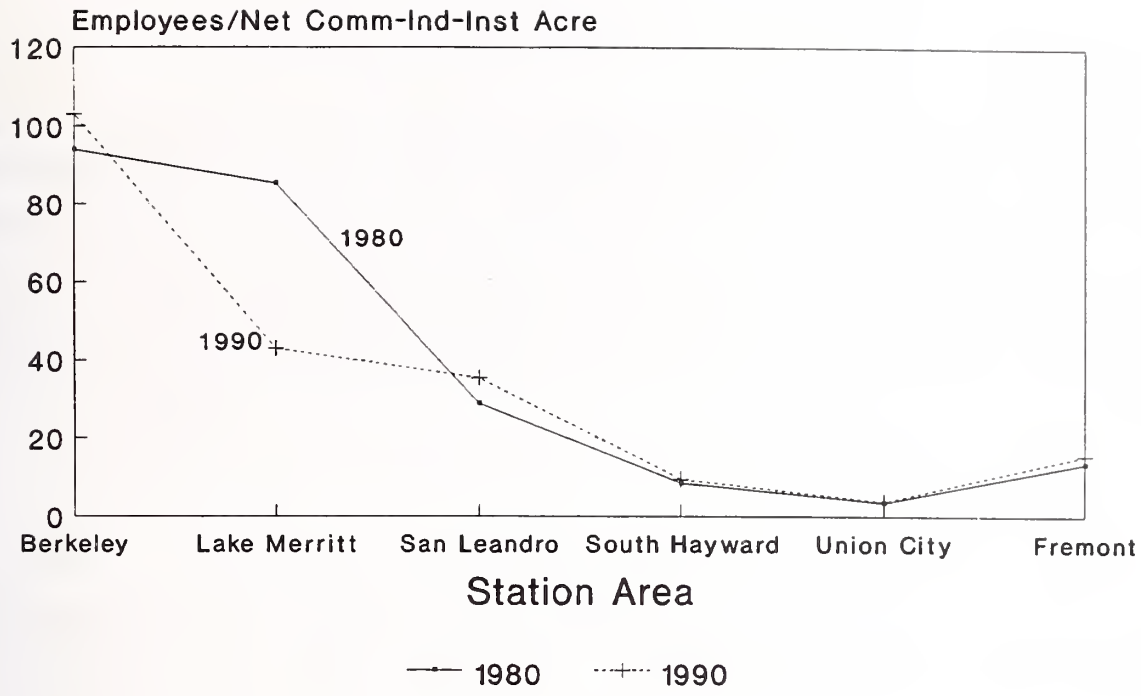
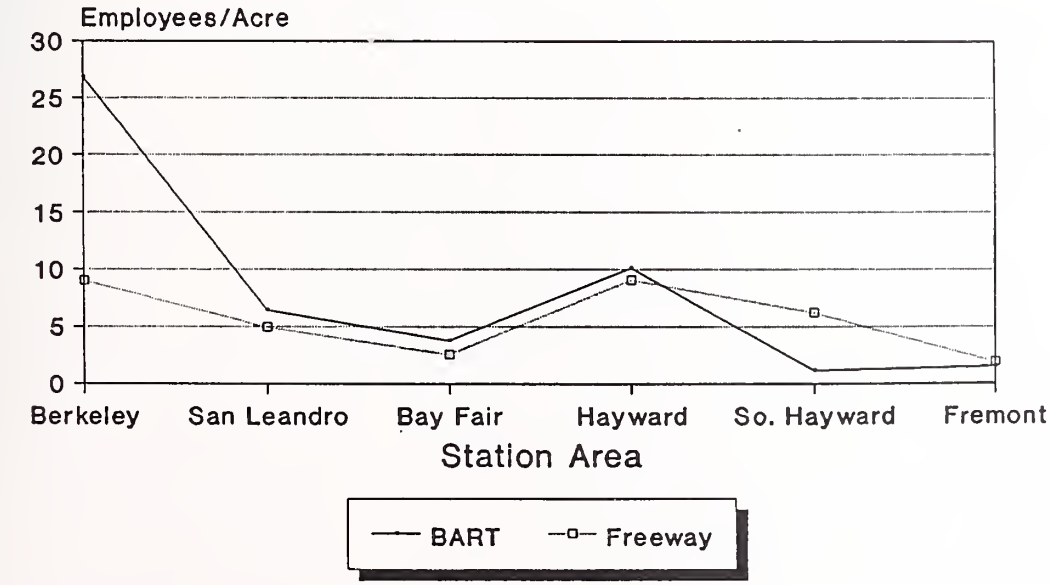


Figure 3.6. 3-D Employment Density Model for the Core of the San Francisco Bay Area, 1990



*census tracts surrounding stations

Figure 3.7. 1980-1990 90 Changes in Net Employment Densities of BART Station Areas*



1/2 mile radius

Figure 3.8. Employment Densities, 1990: BART vs. Freeway

3.5. Summary

In summary, both population and employment generally grew faster in parts of the Bay Area unserved by BART. This was the case when measured at the regional, county, or corridor-specific levels. Employment, in particular, grew far more rapidly in cities like Pleasanton, San Ramon, and Livermore, all unserved by BART, than BART-served cities like Walnut Creek and Concord. Only in San Francisco did BART-served neighborhoods grow faster than non-served ones, though differences were not very significant. Additionally, employment densities appear to have increased slightly, at least along the Fremont corridor.

Notes

[1]Corridor-area" is used instead of simply "corridor" to indicate that a geographic area larger and less linear in shape than a freeway corridor is used in these comparisons.

CHAPTER FOUR
Land Use Changes Over Time and by Corridor

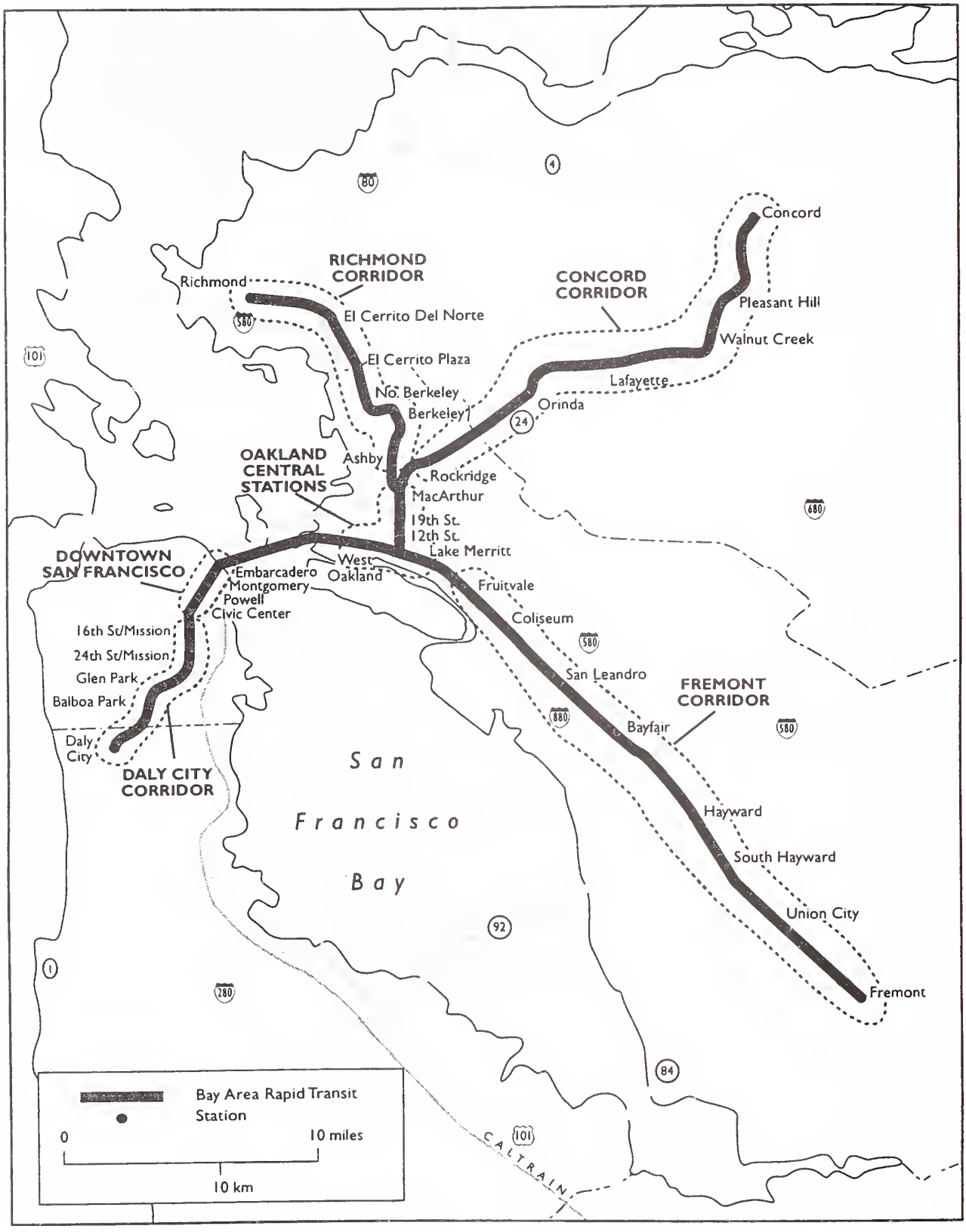
This chapter summarizes the results of the vintage models constructed on residential and non-residential growth around 25 of the 34 BART stations. Using the TRW-REDI data base, statistics were compiled for the following stations, grouped according to the station corridor or area (see Map 4.1):

- *Downtown San Francisco:* Embarcadero, Montgomery, Powell, Civic Center
- *Daly City Corridor:* Mission-16th St., Mission-24th St., Daly City
- *Central Oakland:* Oakland-12th St., Oakland-19th St., Lake Merritt
- *Fremont Corridor:* Fruitvale, San Leandro, Hayward, South Hayward, Union City, Fremont
- *Concord Corridor:* Rockridge, Walnut Creek, Pleasant Hill, Concord
- *Richmond Corridor:* Ashby, Berkeley, North Berkeley, El Cerrito del Norte, Richmond

Based on preliminary analyses, these stations were chosen as stations which experienced some of the most significant land uses changes since BART's opening.[1] They include all of the stations which experienced significant non-residential growth nearby, as well as those which were know to have received some new housing development in the vicinity. Thus, these stations do not necessarily represent a random or representative sample of stations; rather, they are the ones where some degree of land-use activity has occurred. In this sense, they provide a fairly comprehensive overview of land use changes for the entire BART system.

Land-use changes were examined for parcels that are located within approximately a one-half-mile radius around BART stations, except for downtown stations (Embarcadero, Montgomery, Powell, Civic Center, Oakland-12th Street, and Oakland-19th Street), where a one-quarter-mile radius catchment was used. Data for individual land parcels were examined only if a city block was within the one-half- or one-quarter-mile ring around stations.[2] Throughout the remainder of this report, these one-half-mile or one-quarter-mile catchments are also called "station areas" or "rings."

Data quality and completeness, it should be noted, varied among stations. Overall, complete data were available for 88.7 percent of residential parcels (27,879 in all) within the rings.[3] This varied considerably, from 50 percent for the Daly City station to 100 percent for the four downtown San Francisco stations. (See Table A.1 in the Appendix for a station-by-station accounting of parcel data obtained from TRW-REDI). Data were less complete for non-residential uses. Complete data were available for 59.9 percent of non-residential parcels (5,412 in all), ranging from 22 percent at the Fruitvale station to 95.8 percent at the downtown San Francisco stations.[4] As noted earlier, these missing cases posed little problem because most missing data were for parcels whose land uses predate BART. Analyses of proportional changes in development over the BART service period were largely unaffected by these missing cases. Moreover, data were most complete for the station areas known to have experienced the most land-use changes during the 1973-1993 period.



Map 4-1. Map of the BART System

In the analyses which follow, residential development is classified as either single-family or multi-family housing. Non-residential uses include commercial, office, mixed-use, industrial, and parking. For the summaries presented in this section, non-residential uses are combined into a single category. For station-by-station summaries in later chapters of this report, statistics for specific non-residential uses are presented. (Tables containing the data for the figures presented in Chapter 4, stratified by BART corridor and type of land uses, are in Appendix Table A.2.)

4.1. General Land-Use Trends

Figure 4.1 presents trend lines on the total square footage of building area for all parcels within the rings of the 25 stations studied. Data are shown for the pre-BART (1965-1973), early-BART (1973-1979), and later-BART (1979-1993) periods. Among the parcels studied, non-residential uses (commercial, office, industrial) accounted for the most station-area development; they increased from around 45 million square feet to nearly 100 million square feet from 1965 to 1993. Commercial and office development grew fastest during the pre- and later-BART eras. Among residential development, multi-family housing grew more rapidly in the vicinity of BART stations. Single-family home construction, by comparison, was fairly stagnant. This suggests an overall densification of housing development around BART, what BART's early supporters had hoped for.

Among the 33,291 station-area parcels studied, the distributions of non-public land uses, in terms of building square footage, for 1965, 1973, and 1993 are shown in Figure 4.2. Most prominent has been the growth in office space — from 27.9 percent of all square footage in 1965 to 45.4 percent in 1993. While multi-family housing in station areas increased by nearly 8 million square feet from 1965 to 1993 (as shown in Figure 4.1), its share of total building space fell from 22.6 percent to 17.9 percent. Shares of other land uses also fell. Around the four downtown San Francisco stations (Embarcadero, Montgomery, Powell, and Civic Center), the share of building space devoted to offices increased 32.4 percent in 1965, to 40.6 percent in 1973, and to 49.8 percent in 1993.

A more complete source for tracking office growth is the *Black's Guide to Office Leasing* (McGraw-Hill, 1993). Prior to 1962 (the year the bond issue authorizing the construction of BART was approved), around 9 million sq. ft. of office space was within a quarter mile of the four downtown San Francisco stations. During the 12 years of BART construction, from 1963 to 1974, the city of San Francisco's office inventory expanded by 16 million sq. ft., and more than two-thirds of this new space was within a quarter-mile of downtown stations. During the next 18 years, between 1975 and 1992, another 40 million sq. ft. of office space was built in San Francisco, and nearly three-quarters of this was in the immediate station area. Most of the major new building additions from 1977 to 1994 were within 1-2 blocks of the Embarcadero and Montgomery Street stations in the heart of downtown San Francisco.

In contrast to San Francisco, BART's influence on office development in the East Bay has been weak. As shown later in this report, the major changes have been in downtown Oakland, where around

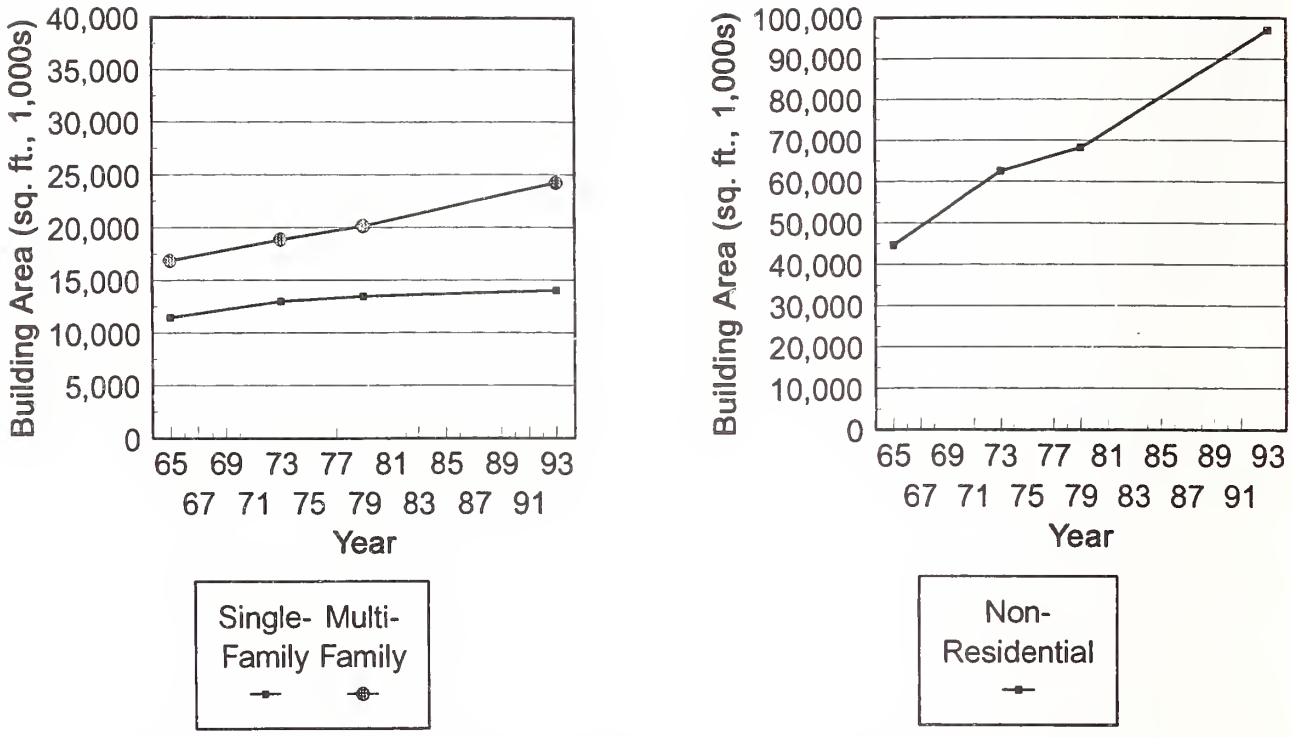


Figure 4.1. Changes in Residential and Non-Residential Building Area Around 25 BART Stations, 1965-1993

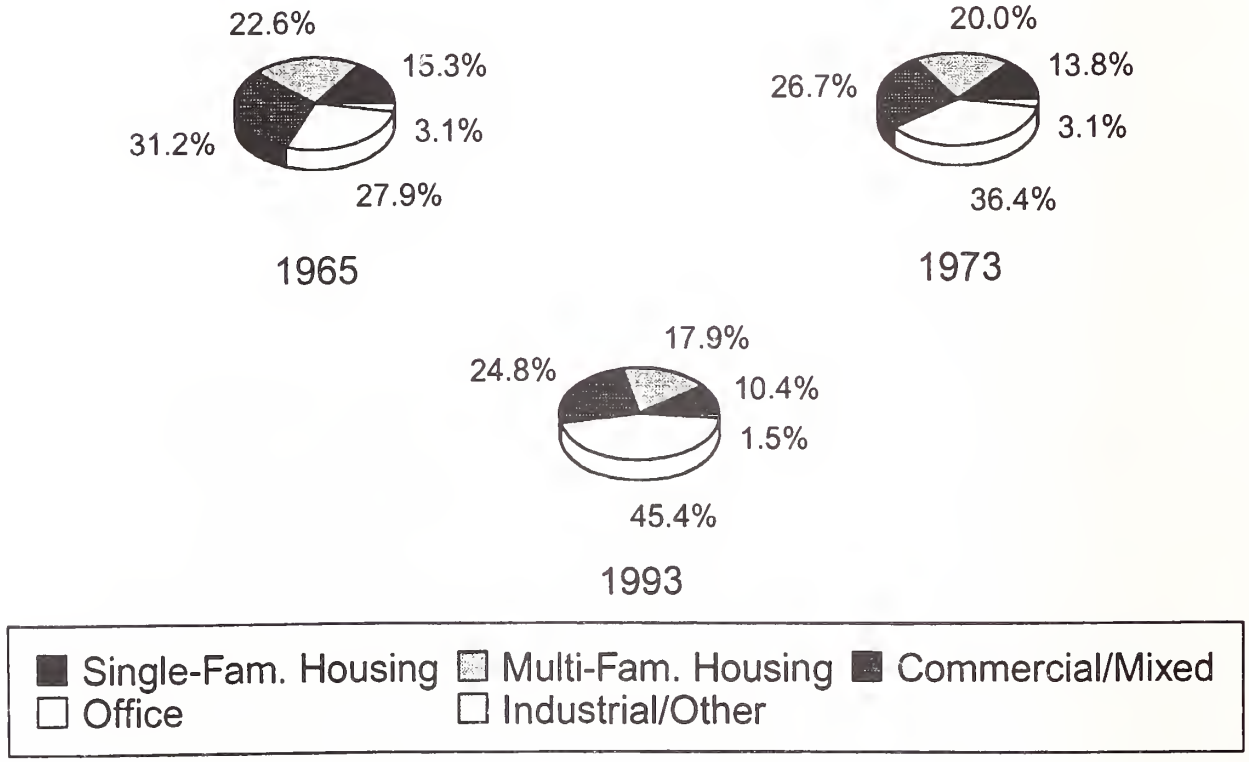


Figure 4.2. Land Use Composition Around 25 BART Stations, 1965, 1979, 1993

4.6 million sq. ft. of office space was added between 1975 and 1992; a significant share of this was for public buildings. The most significant office development in the suburbs has been around the Walnut Creek station, which added nearly 3 million sq. ft. of office space since 1975. However, this amount pales in comparison to over 54 million square feet of office space built in Alameda and Contra Costa Counties away from BART from 1975-1992, much of it in the form office parks and stand-alone spec-buildings sited near freeway interchanges. Nearly 22 million sq. ft. of the office additions from 1975 to 1992 occurred along the southern I-680 corridor, home to the 875-acre Hacienda Business Park in Pleasanton and the 585-acre Bishop Ranch Business Park in San Ramon. Of the 60 million sq. ft. of office inventory added to Alameda and Contra Costa Counties from 1975 to 1992, only around 10 million sq. ft., or 17 percent, was located within a half-mile of a BART station.

4.2. Pre-BART versus Post-BART

Changes in residential and non-residential building square footage in station areas were compared among corridors for the pre- (1965-1973) and post- (1973-1993) BART periods. Figure 4.3 shows there was relatively little single-family home construction during the 1965-73 (pre-BART) or 1973-93 (post-BART) eras in any of the corridors. Far more apartment and condominium development occurred. In the eight years prior to BART's opening, most multi-family development occurred along the Fremont and Concord lines. In the post-BART period, the greatest relative gains in multi-family development were along the Fremont corridor and in central Oakland, especially around the Lake Merritt station.

Figure 4.4 shows the growth rates for non-residential development. Prior to BART, the region's two major downtowns, San Francisco and Oakland, experienced the fastest commercial-office-industrial growth. After BART, the Concord corridor saw non-residential development increase the fastest, on the heels of considerable office development in the Walnut Creek, Pleasant Hill, and Concord station areas. Downtown growth slowed considerably following BART's opening.

For most station areas, the vast majority of non-residential development has been in the form of offices. Only in the case of San Francisco's downtown stations have a variety of non-residential activities sprouted. Figure 4.5 shows that mixed land uses grew the fastest among non-residential activities, typically consisting of buildings accommodating both office and retail. Since BART's opening, office building development grew the fastest, mainly in the form of high-rise towers south of Market Street. Significant amounts of structured parking was also built, also south of Market Street. This clearly has less to do with BART than with serving new downtown office development.

The use of statistics on percent changes in building activities says nothing about absolute changes or which corridor areas captured the largest share of building activities. Figures 4.6 and 4.7 shed light on these matters. Figure 4.6 shows that during the eight years prior to BART, around three-quarters of single-family housing development among all station areas was along the Richmond corridor (Ashby, Berkeley, North Berkeley, El Cerrito del Norte). The Concord line received around a half of all multi-family

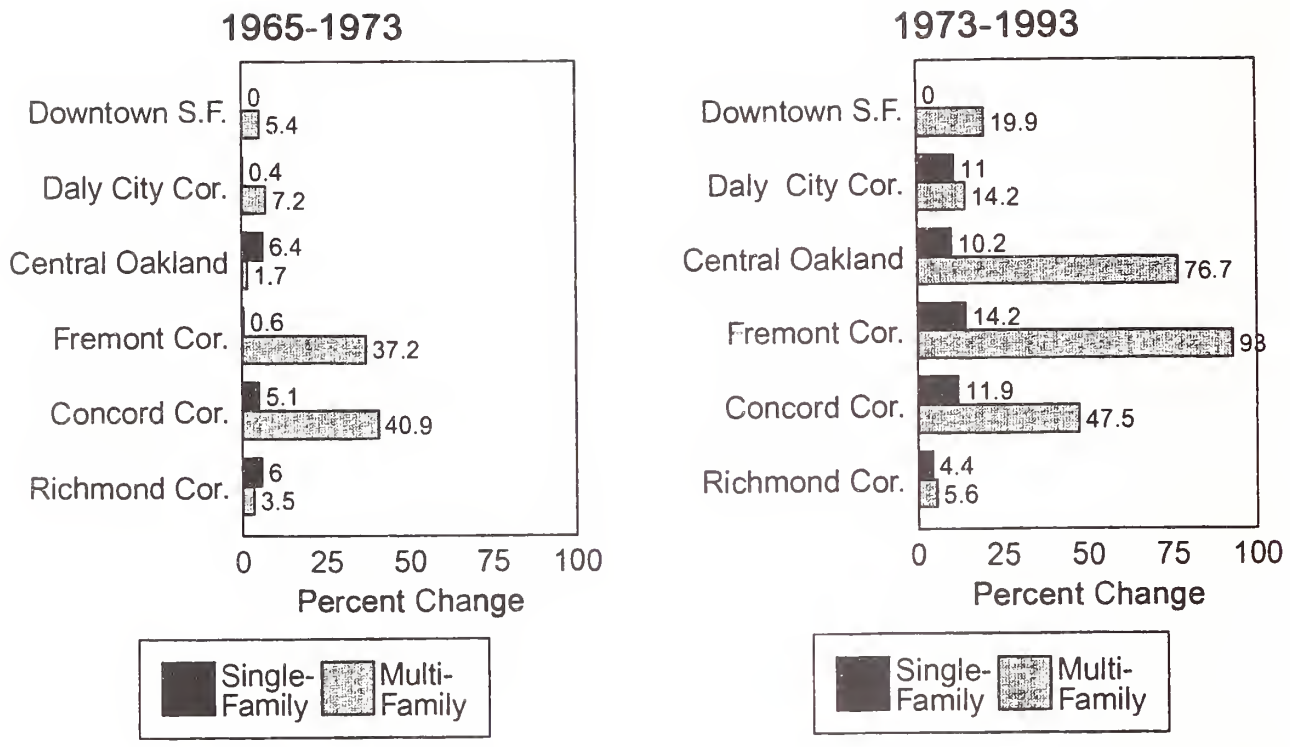


Figure 4.3. Percent Changes in Residential Building Area by BART Corridor, 1965-1973 and 1973-1993

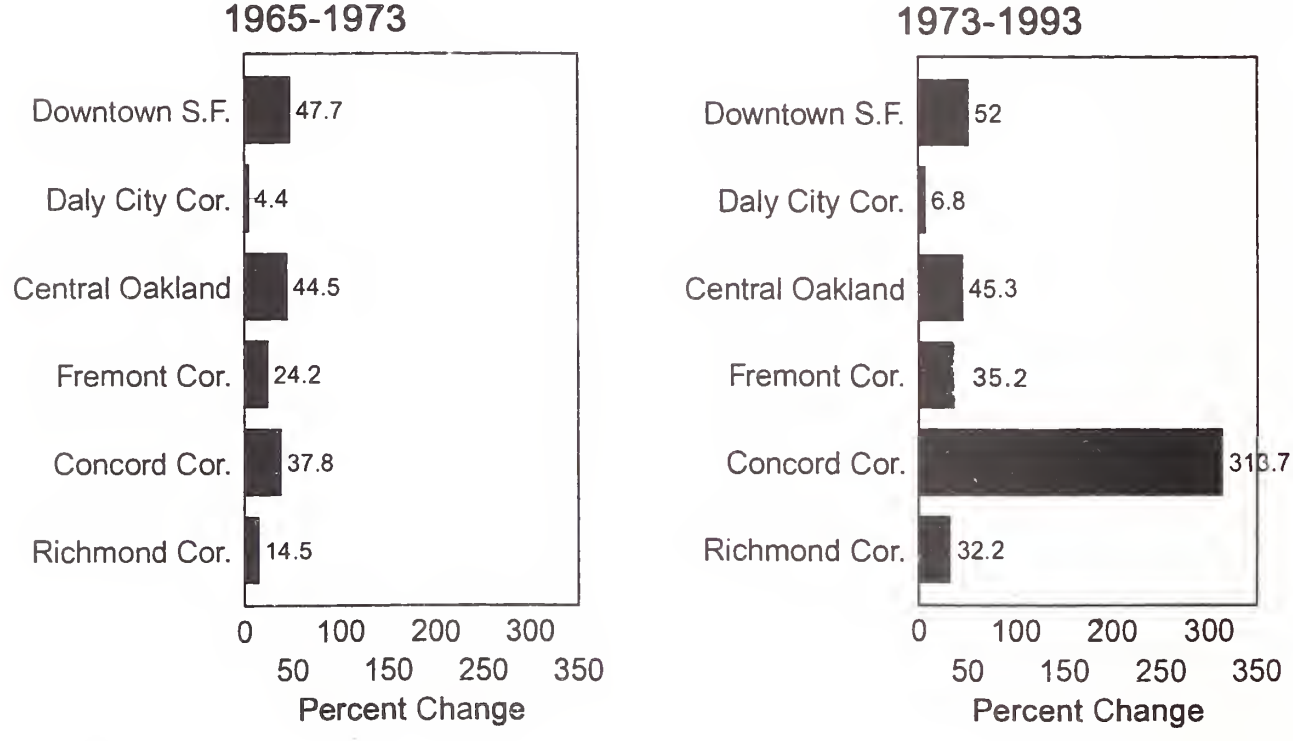


Figure 4.4. Percent Changes in Non-Residential Building Area by BART Corridor, 1965-1973 and 1973-1993

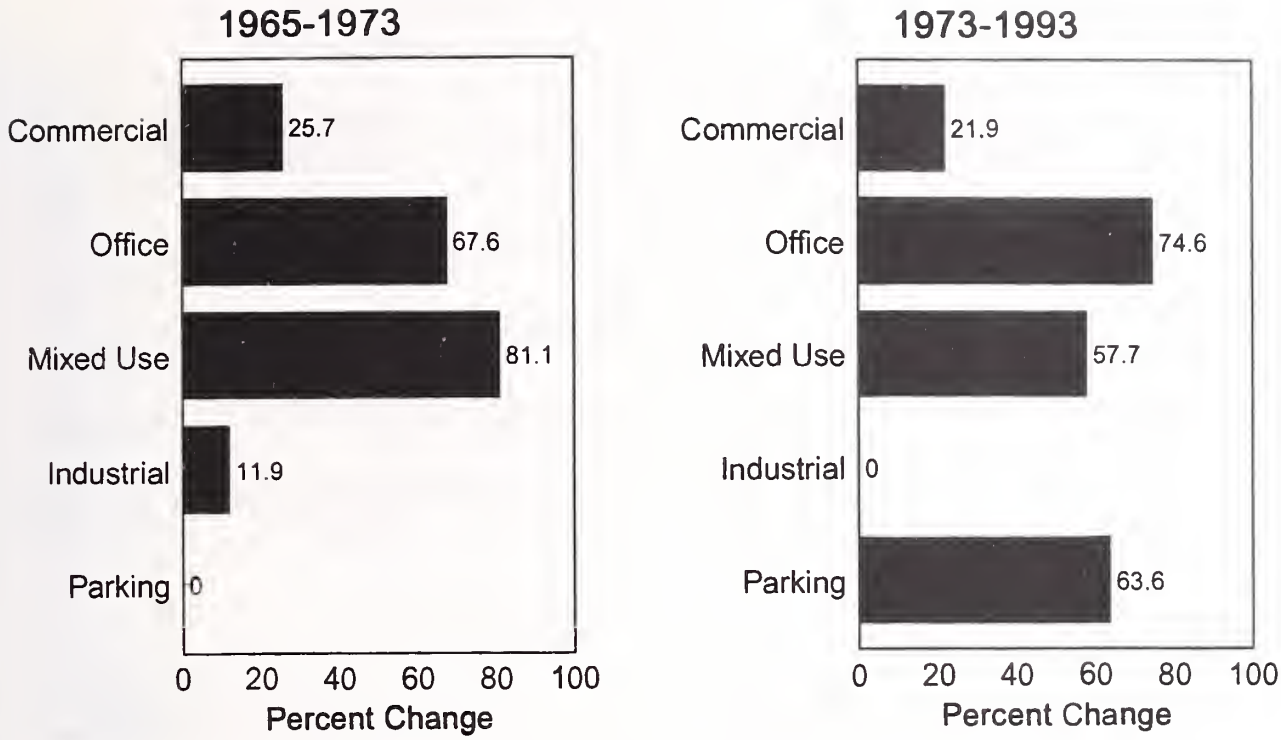


Figure 4.5. Percent Change in Non-Residential Building Area In Downtown San Francisco by Type, 1965-1973 and 1973-1993

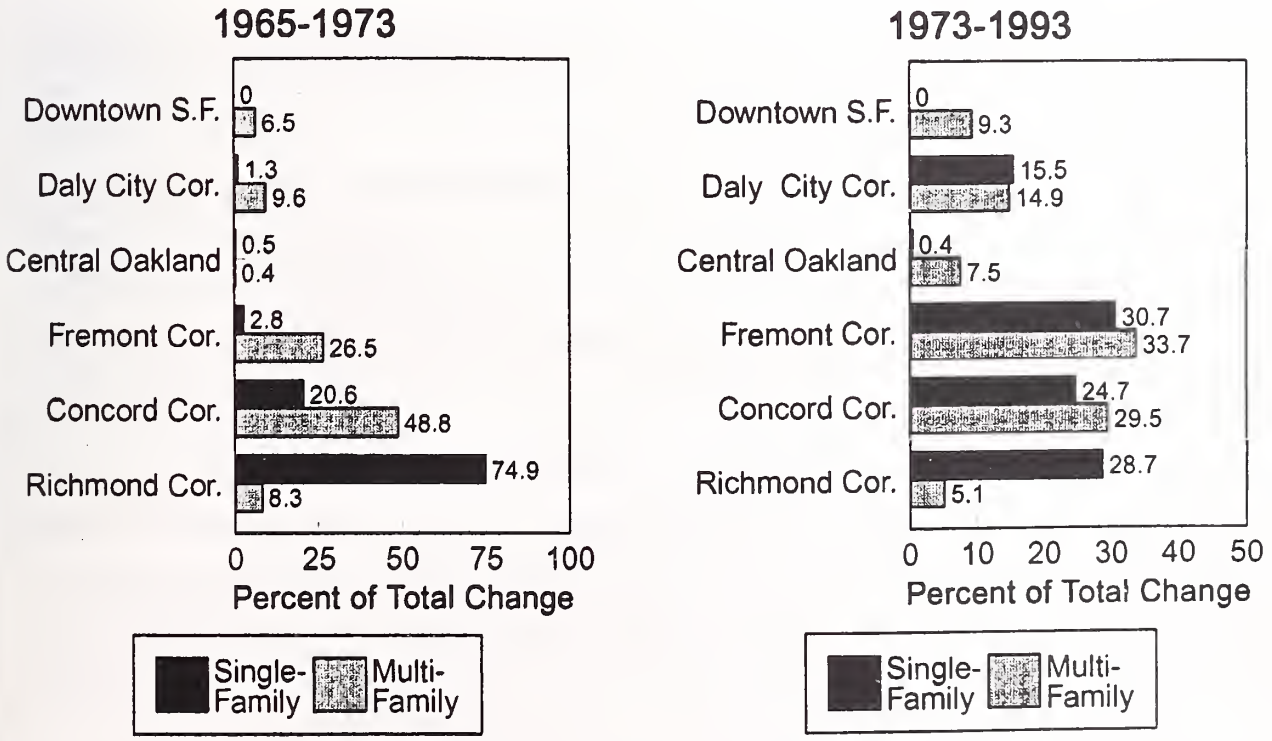


Figure 4.6. Percent of Total Change in Residential Building Area In Each BART Corridor, 1965-1973 and 1973-1993

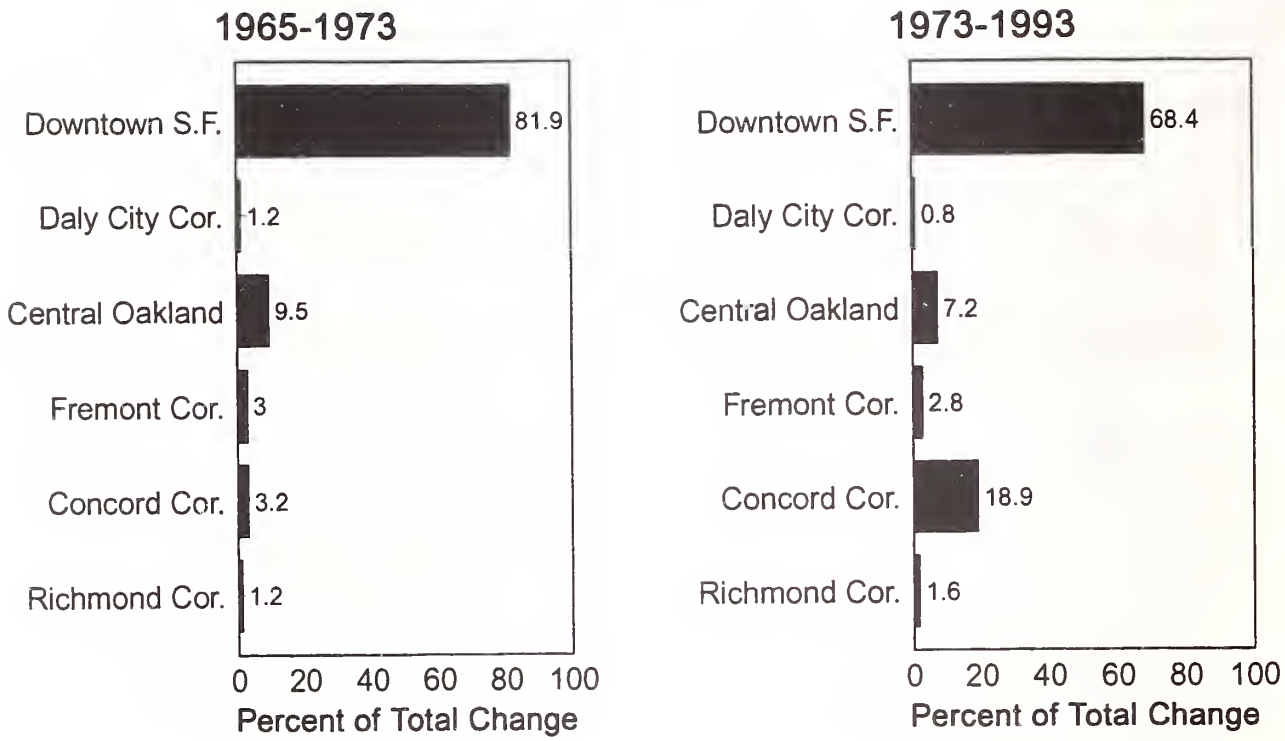


Figure 4.7. Percent of Total Change in Non-Residential Building Area In Each BART Corridor, 1965-1973 and 1973-1993

development among station areas during this period. Following BART's opening, housing development was more evenly spread among corridors. Roughly equal shares of single-family development occurred along the three East Bay suburban rail corridors. The Fremont and Concord corridors each captured around a third of multi-family development over the post-BART era. Relatively little housing development occurred in downtown San Francisco and central Oakland. Downtown San Francisco did, however, capture an overwhelming majority of non-residential development (among all station areas) prior to BART, and over two-thirds after BART's opening (Figure 4.7). The Concord corridor, and specifically the Walnut Creek, Concord, and Pleasant Hill station areas, accounted for nearly one-fifth of all non-residential development among the 25 station areas studied.

For purposes of determining whether there was relatively greater land development in station areas prior to or after BART, Figures 4.8 and 4.9 were prepared. In terms of single-family housing development, Figure 4.8 shows no strong pattern. For three of the six corridors, the annual growth rate in single-family home construction was faster prior to BART (notably along the Richmond corridor). Post-BART housing development was more significant along the Fremont and Daly City corridors. Overall, however, single-family housing development was fairly modest before and after BART.

The right-half of Figure 4.8 indicates a healthier multi-family housing market in the station areas, though again no strong pre- vs. post-BART pattern emerged. Only in the case of central Oakland, where

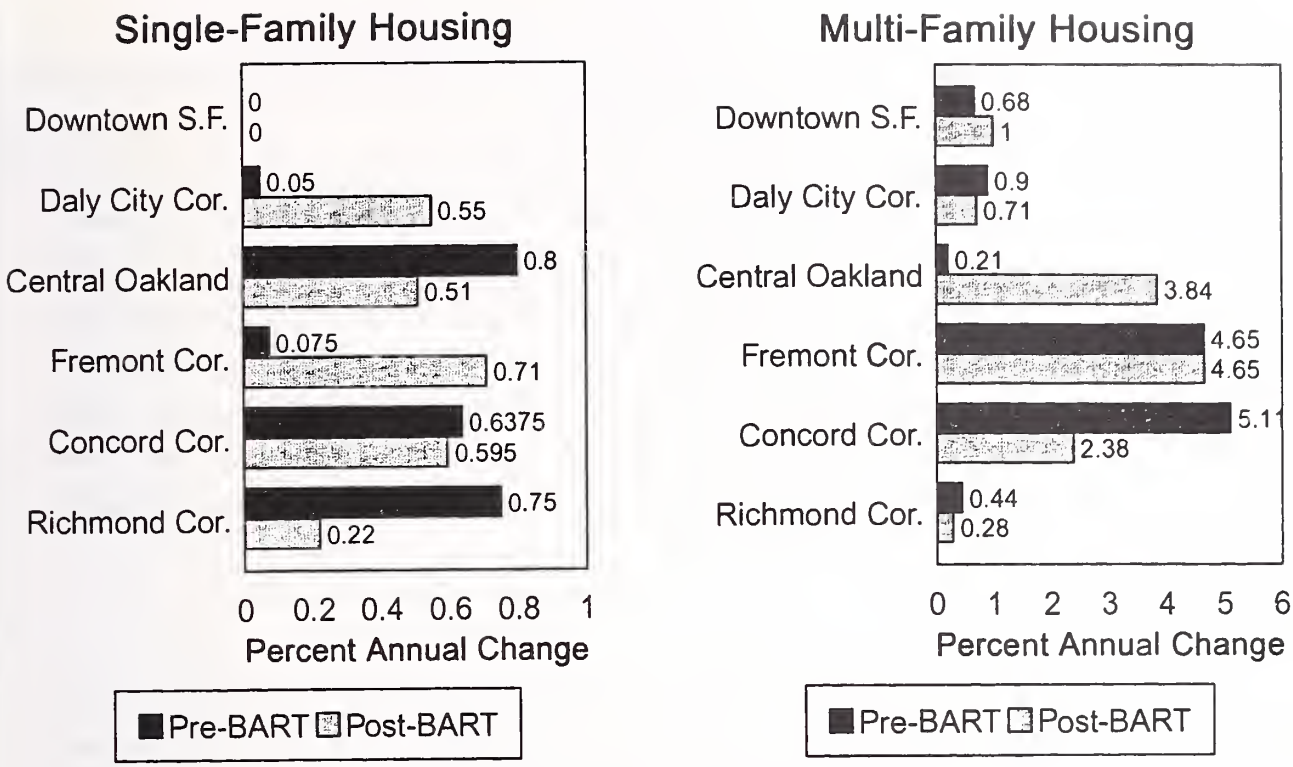


Figure 4.8. Comparison of Annual Growth Rate in Residential Development by BART Corridor, Pre- vs. Post-BART

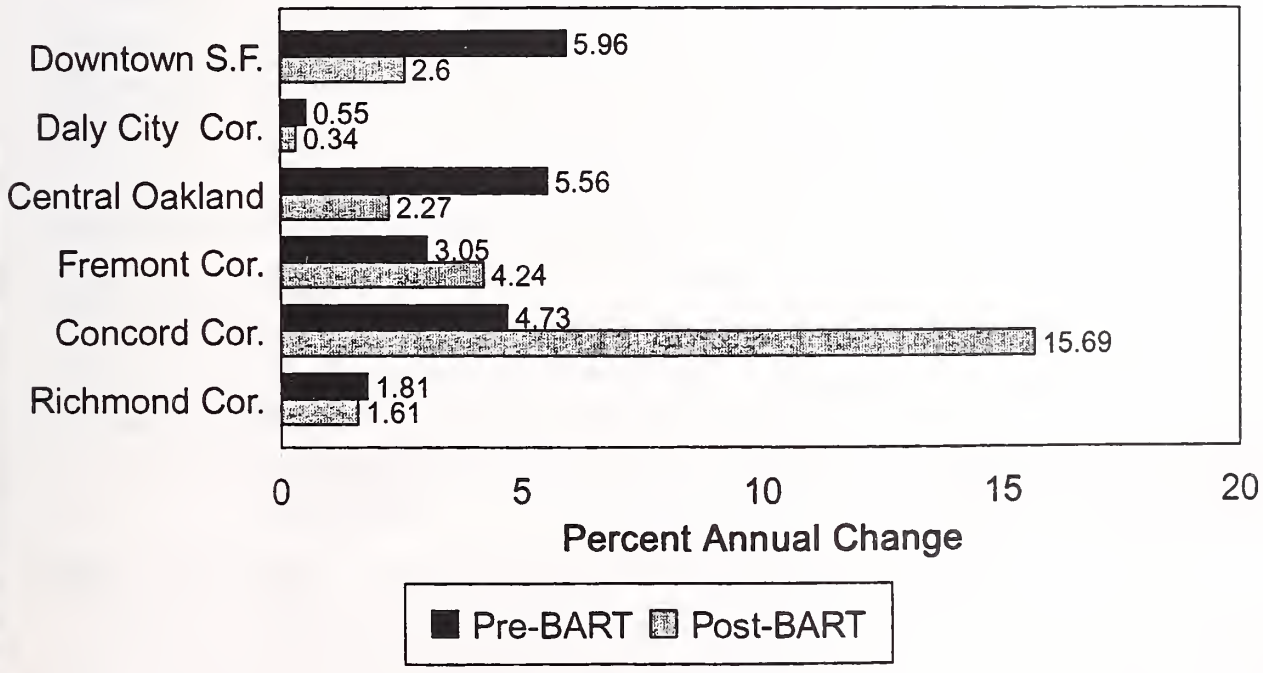


Figure 4.9. Comparison of Annual Growth Rate in Non-Residential Development by BART Corridor, Pre- vs. Post-BART

a number of mid-rise apartment towers were built within several blocks of the Lake Merritt station, was multi-family construction noticeably higher following BART.

Figure 4.9 reveals the strongest pattern in pre- vs. post-BART growth rates — among non-residential uses. In both downtown San Francisco and Oakland, office and commercial development grew twice as fast in the eight years prior to BART as the 20 years after BART. The two major suburban corridors, Concord and Fremont, on the other hand, enjoyed faster commercial-office growth following BART. Non-residential square footage in the Walnut Creek-Concord-Pleasant Hill station areas, in particular, grew at an impressive annual rate of 15.7 percent in the 29 years since BART's opening. Most of this consisted of office spaced added during the boom years of the 1980s. Commercial-office development in the two remaining corridors, Daly City and Richmond, has been relatively sluggish over the past 30 years, both before and after BART.

4.3. Early versus Later BART

This section presents analyses similar to previous one; however, data are compared for the early (1973-1979) versus later (1979-1993) periods. In the early years of BART, there was relatively little single-family housing construction, and the only significant multi-family development was in central Oakland (Figure 4.10). The lack of significant multi-family housing development, outside of Oakland's Lake Merritt station area, was due in part to downzoning and other slow-growth initiatives in reaction to neighborhood protests over proposed apartment construction near BART stations. In more recent times, multi-family housing has increased most rapidly along the Fremont corridor (mainly around the San Leandro, Union City, and Fremont stations) and Concord corridor (mainly near the Pleasant Hill station). Single-family development remained flat in BART's later years, in large BART because residential land around stations was consciously zoned for higher-density dwellings.

In terms of office and commercial development, the Walnut Creek-Concord-Pleasant Hill trio of stations on the Concord line stand out for their relatively fast growth rates in both the early and later BART years (Figure 4.11). Office development rose sharply during the 1980s along the I-680 corridor paralleling the BART Concord Line. Figure 4.12 breaks down non-residential development by specific land uses for the downtown San Francisco stations over the early and later periods. In more recent times, the fastest non-residential growth market in San Francisco has been for structured parking, followed by mixed-use buildings.

Of all the station-area housing growth that occurred in the early BART years, Figure 4.13 shows the largest share took place around the Fremont corridor stations. The Richmond corridor (Ashby, Berkeley, North Berkeley, El Cerrito del Norte, Richmond) accounted over 30 percent of single-family home construction near BART from 1973 to 1979, and central Oakland accounted for around one-quarter of multi-family construction. In more recent years, the Concord line has received the most single-family home construction, followed by the Richmond corridor. In the multi-family housing market, the Fremont

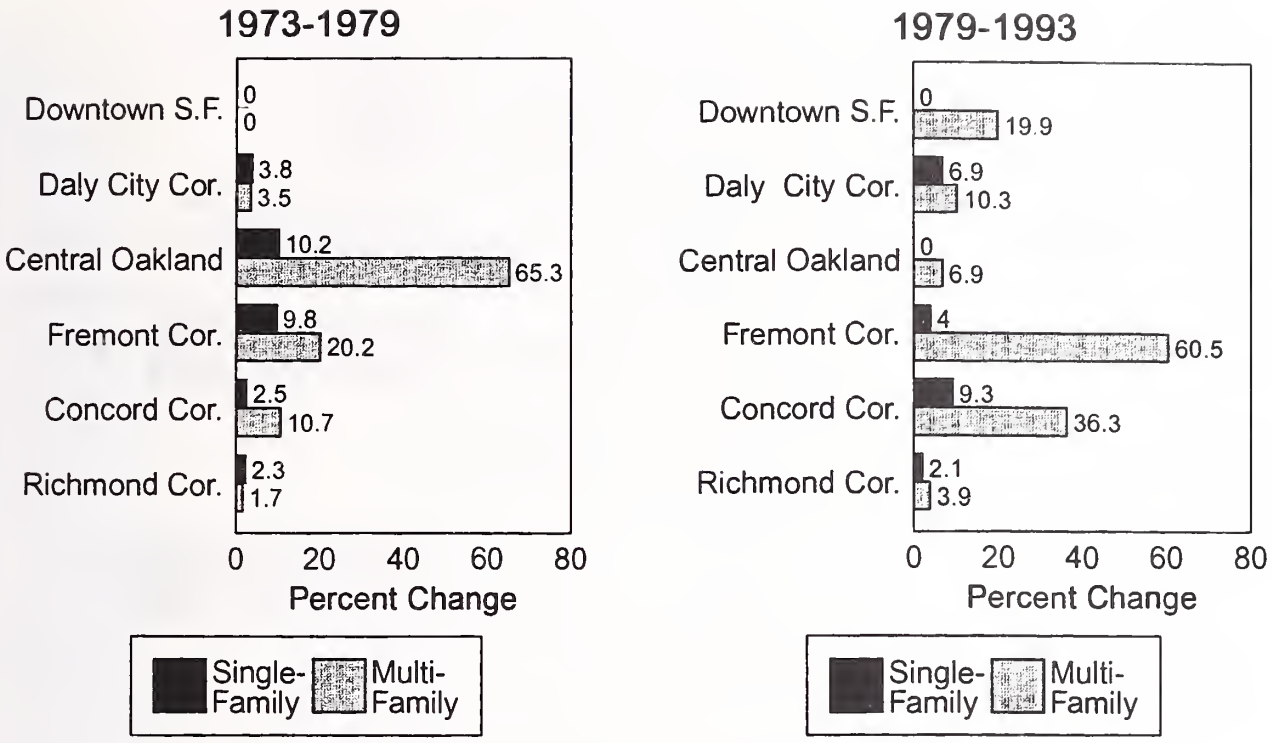


Figure 4.10. Percent Change in Residential Building Area by BART Corridor, 1973-1979 and 1979-1993

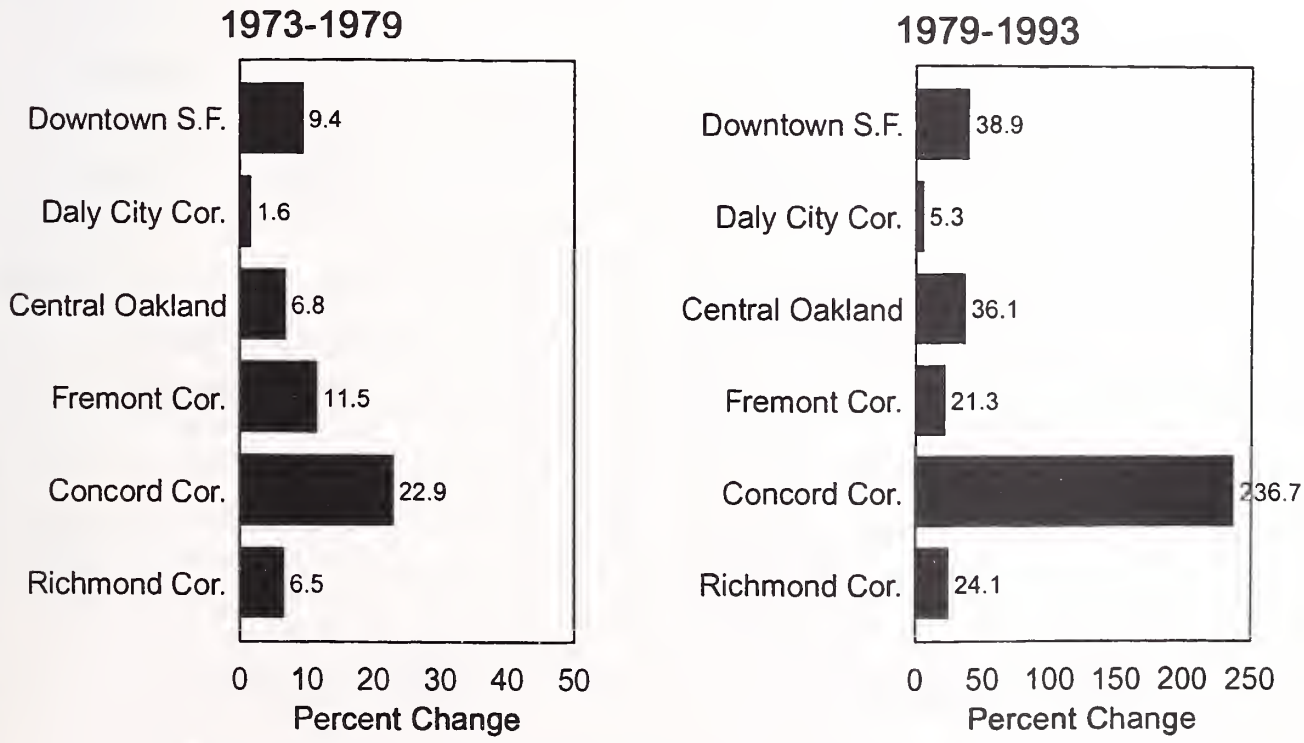


Figure 4.11. Percent Change in Non-Residential Building Area by BART Corridor, Early vs. Later BART Years

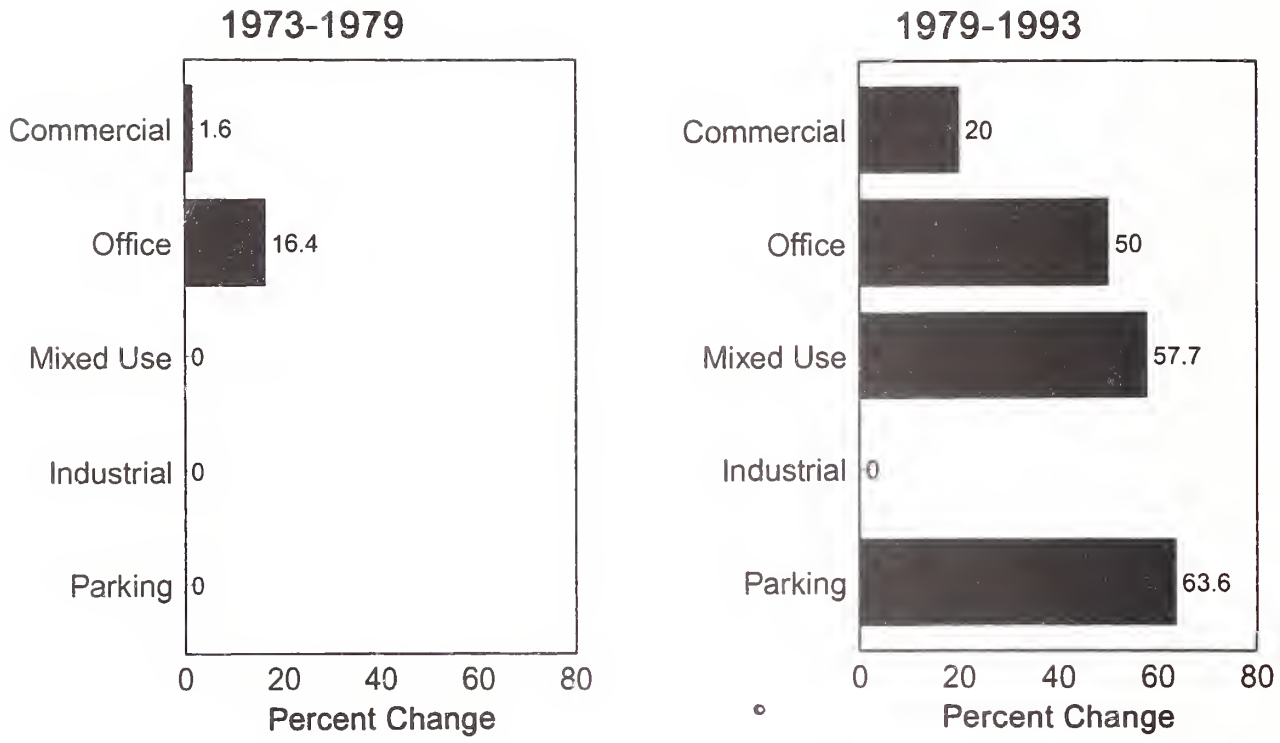


Figure 4.12. Percent Change in Non-Residential Building Area in Downtown San Francisco by Type, 1973-1979 and 1979-1993

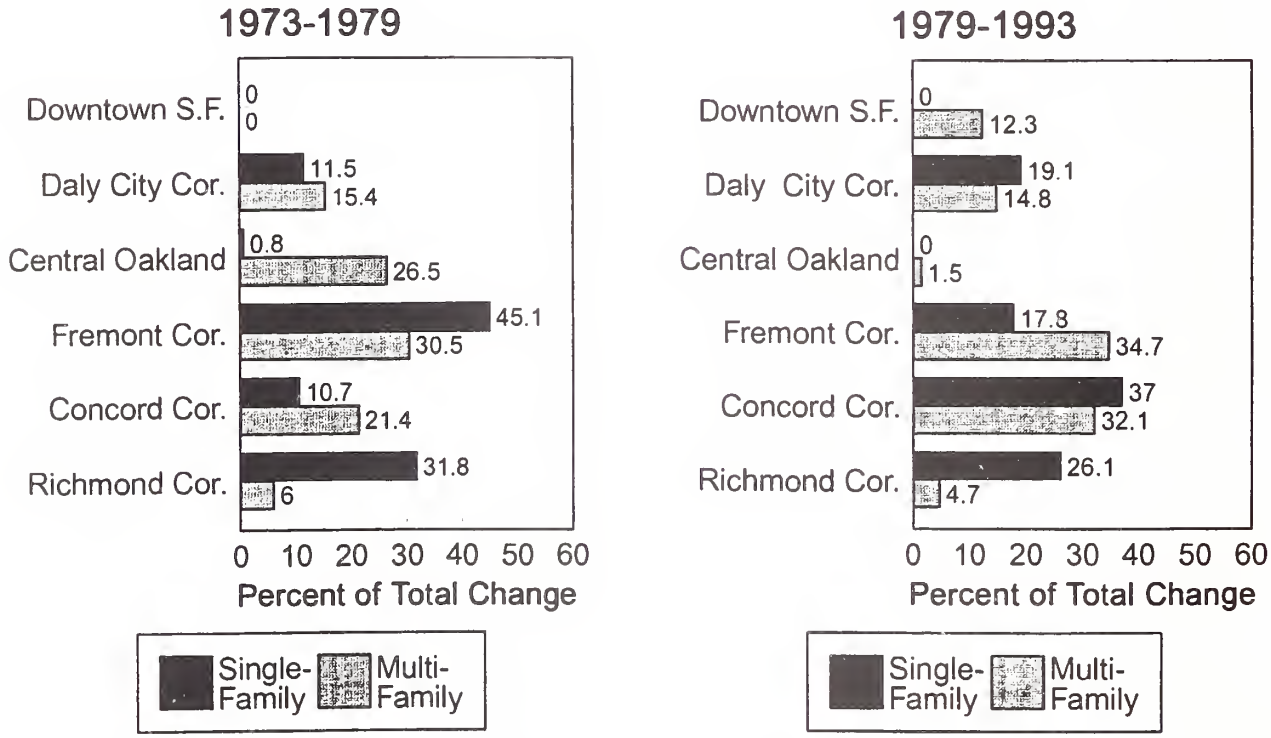


Figure 4.13. Percent of Total Change in Residential Building Area in Each BART Corridor, 1973-1979 and 1979-1993

and Concord corridors each accounted for around a third of all station-area construction from 1979 to 1993. (Figure 4.14 shows the percent of station area totals of both single-family and multi-family housing for each of the post-BART time points for which data were compiled – 1973, 1979, and 1993.)

While the Concord corridor was found to have experienced the most rapid increases in office-commercial development during the post-BART era, Figure 4.15 shows that downtown San Francisco stations still captured the lion's share of the total "piece" of non-residential growth — three-quarters in the early-BART years and two-thirds in the later-BART years. During the 1980s, around one-fifth of all BART station-area office-commercial construction was near the three surveyed Concord corridor stations. (Figure 4.16 shows the percent of station area totals of non-residential construction for each of the post-BART time points, further underscoring downtown San Francisco's dominance and the Concord corridor's gains by 1993.)

Overall, there were fairly distinct differences in the rate of growth during the early versus later BART years among land uses. What little single-family housing that was built generally occurred in the early BART years (Figure 4.17). Multi-family housing construction, on the other hand, has generally been a more recent phenomenon. With the exception of central Oakland, the annual growth in apartment and condominium square footage around station areas was faster in the 1980s than the 1970s. Similarly, with the exception of the Fremont line, the fastest growth in non-residential development around BART stations has occurred since 1980 (Figure 4.18). At the last three stations on the Concord line, non-residential building area increased by nearly 17 percent each year over the 1979-1993 period.

4.4. Trends in Non-Residential Densities

In addition to data on the building square footage of parcels, data were also compiled on lot sizes. From this, we were able to estimate the Floor Area Ratios (F.A.R.s) of individual parcels. (F.A.R. equals total building area divided by lot area.) Averaged over all parcels within a station area yielded an estimate of average net densities for each use.

Figure 4.19 summarizes changes in F.A.R.s over the 1965 to 1993 period for the six BART corridors. In general, net non-residential densities rose over this 28 year period. The only significant decline was along the Fremont corridor, due to land clearance and the demolition of several closed factories and warehouses along this corridor (particularly along the Oakland segments). Downtown San Francisco and Oakland averaged the highest non-residential densities. Throughout the time series, net non-residential densities were more than twice as high in downtown San Francisco as central Oakland. The fastest increase in densities occurred prior to BART, consistent with the finding that the greatest percentage increases occurred during the 1965-1973 period. During the post-BART years, office-commercial development intensified more rapidly in the later than the early years in downtown San Francisco and Oakland.

Among the non-downtown stations, Figure 4.19 reveals that non-residential densities rose most rapidly in the outer Concord corridor, though only during the later BART stage. The Concord line

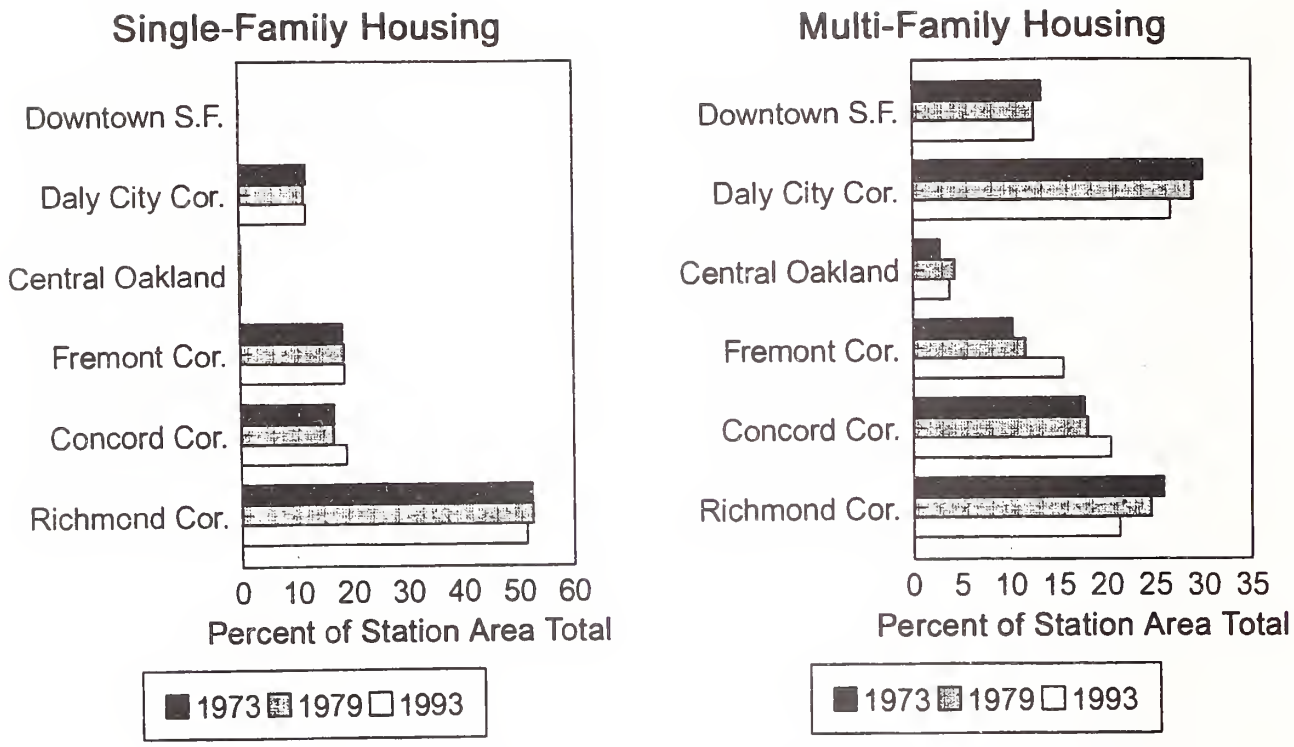


Figure 4.14. Percent of Total Station Area Housing Development in Each Corridor, 1973, 1979, 1993

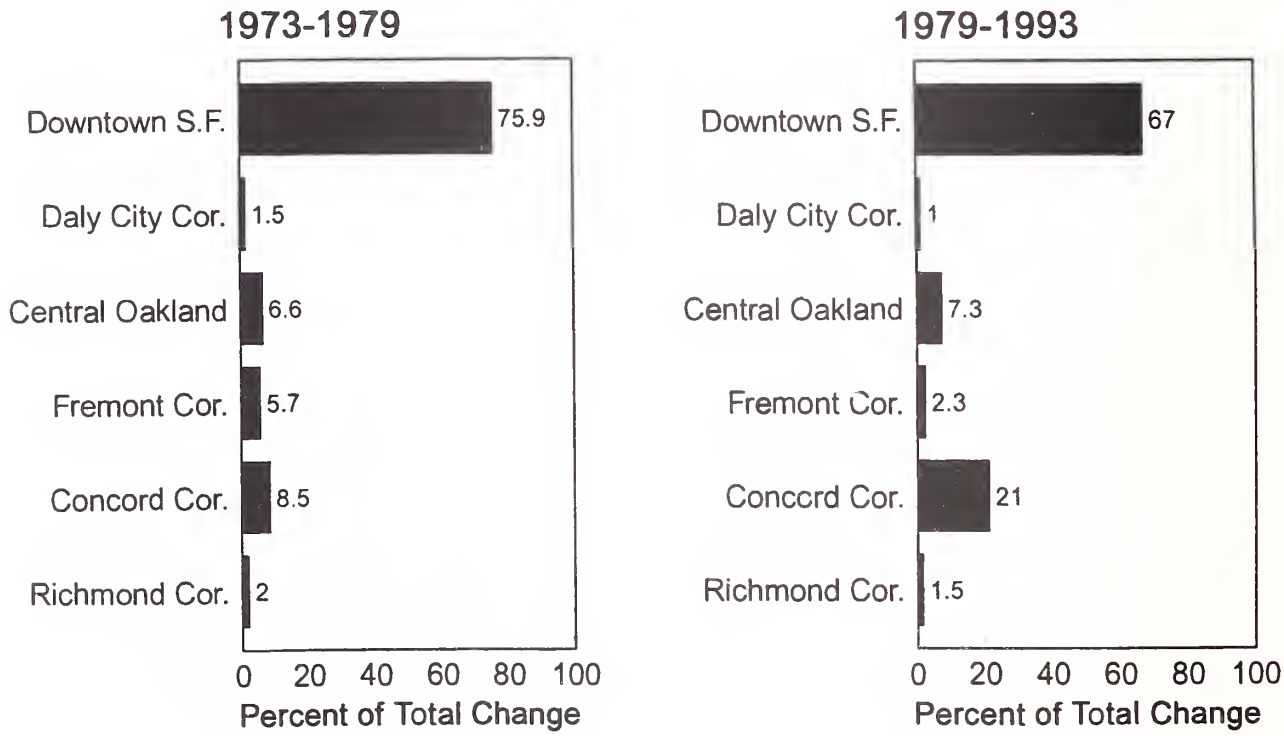


Figure 4.15. Percent of Total Change in Non-Residential Building Area in Each BART Corridor, 1973-1979 and 1979-1993

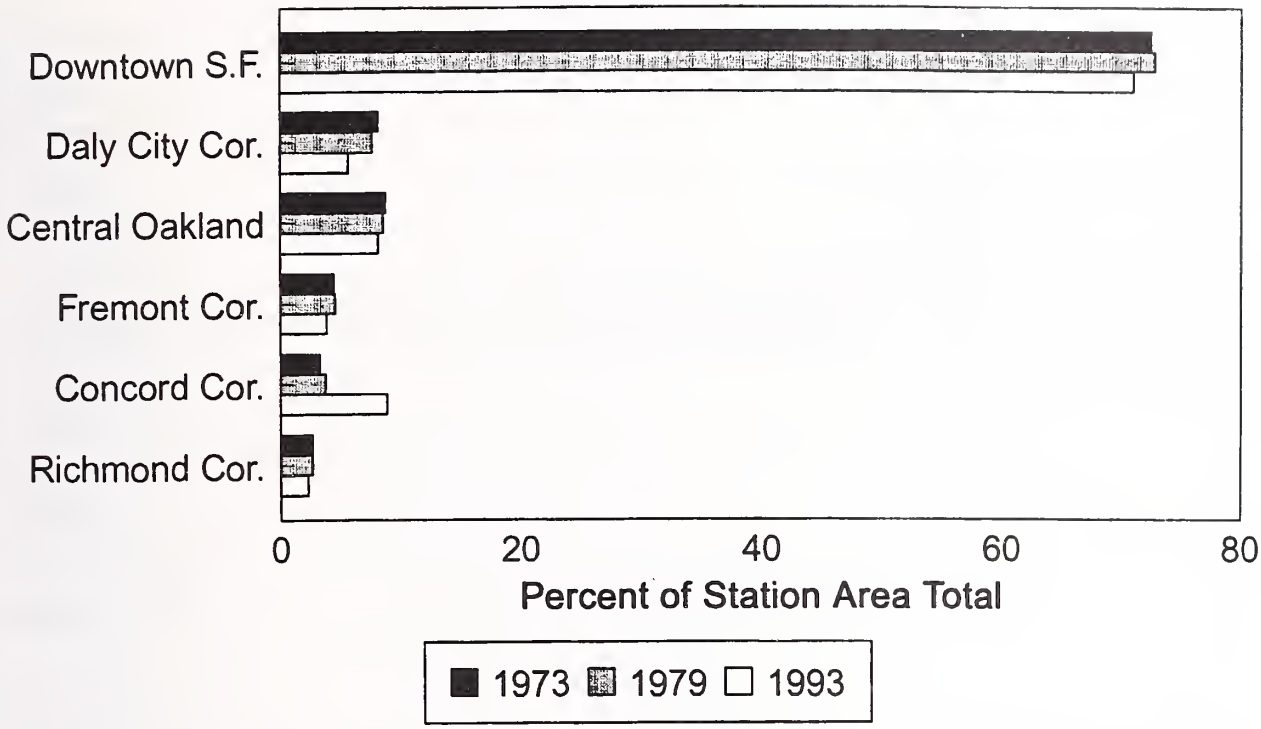


Figure 4.16. Percent of Total Station Area Non-Residential Development Near Each Station Type, 1973, 1979, 1993

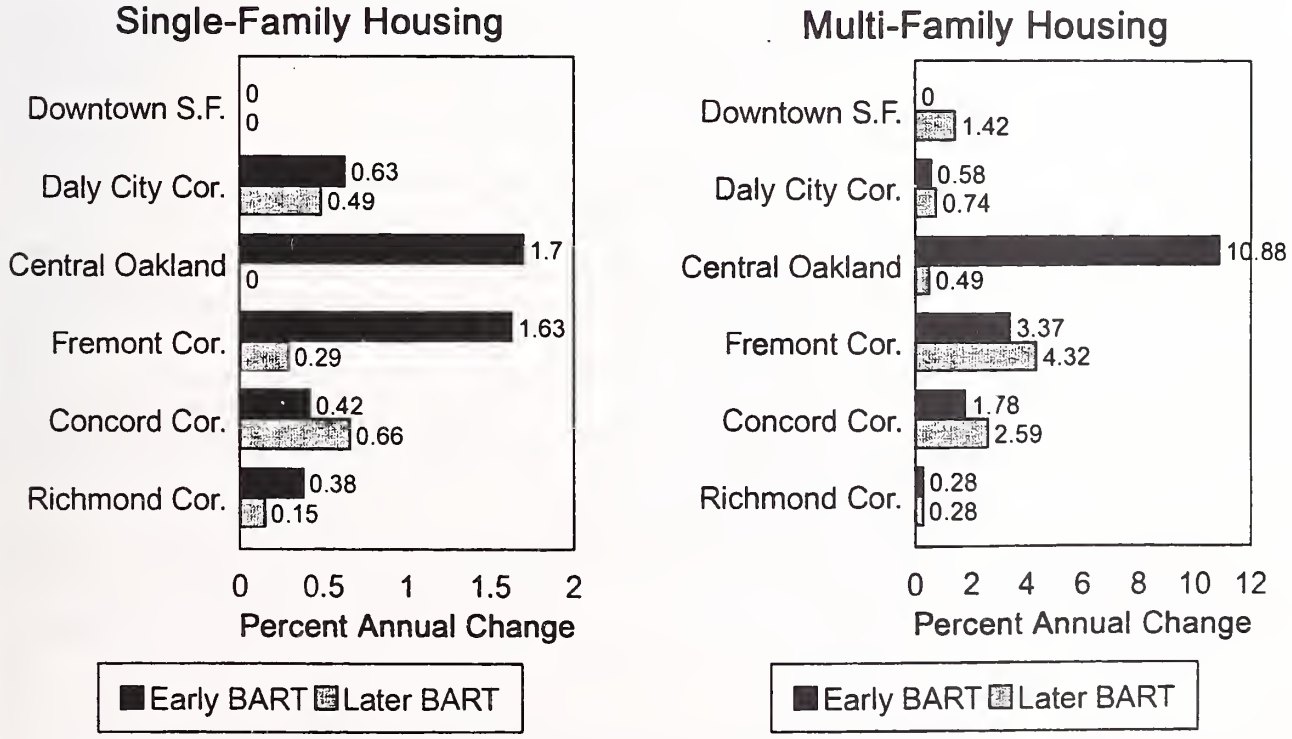


Figure 4.17. Comparison of Annual Growth Rates in Residential Development by BART Corridor, Early vs. Later BART

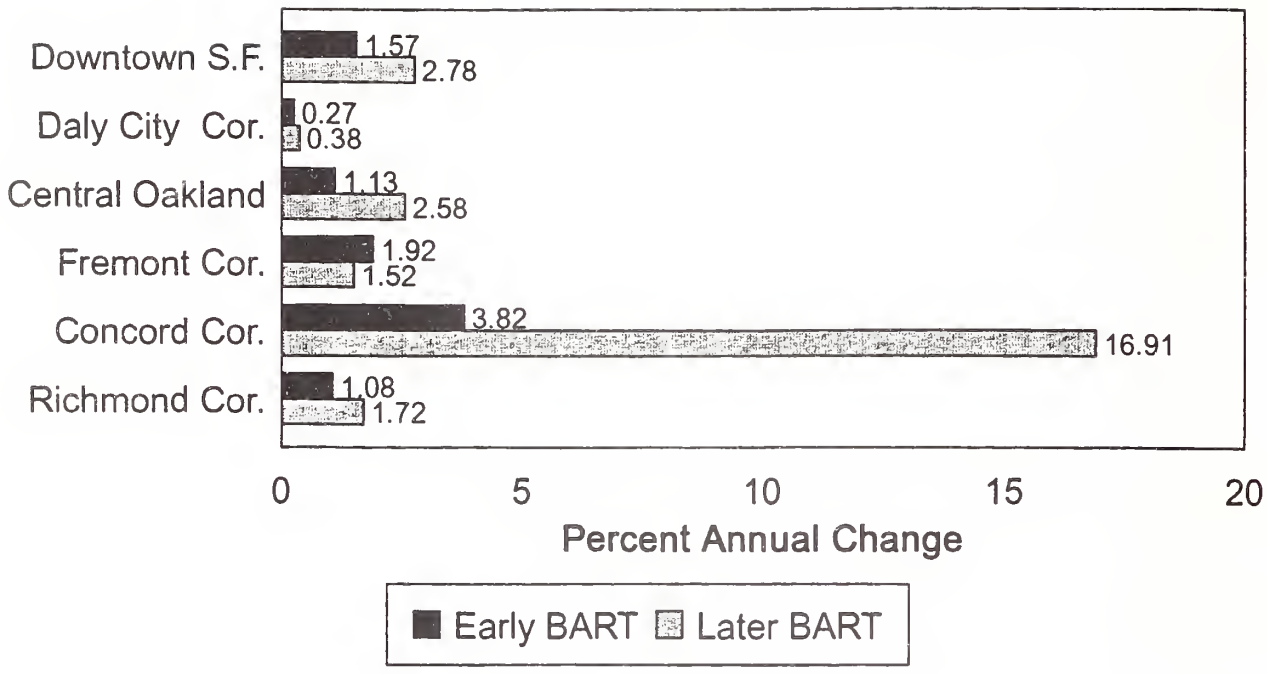


Figure 4.18. Comparison of Annual Growth Rates in Non-Residential Development by BART Corridor, Early vs. Later BART

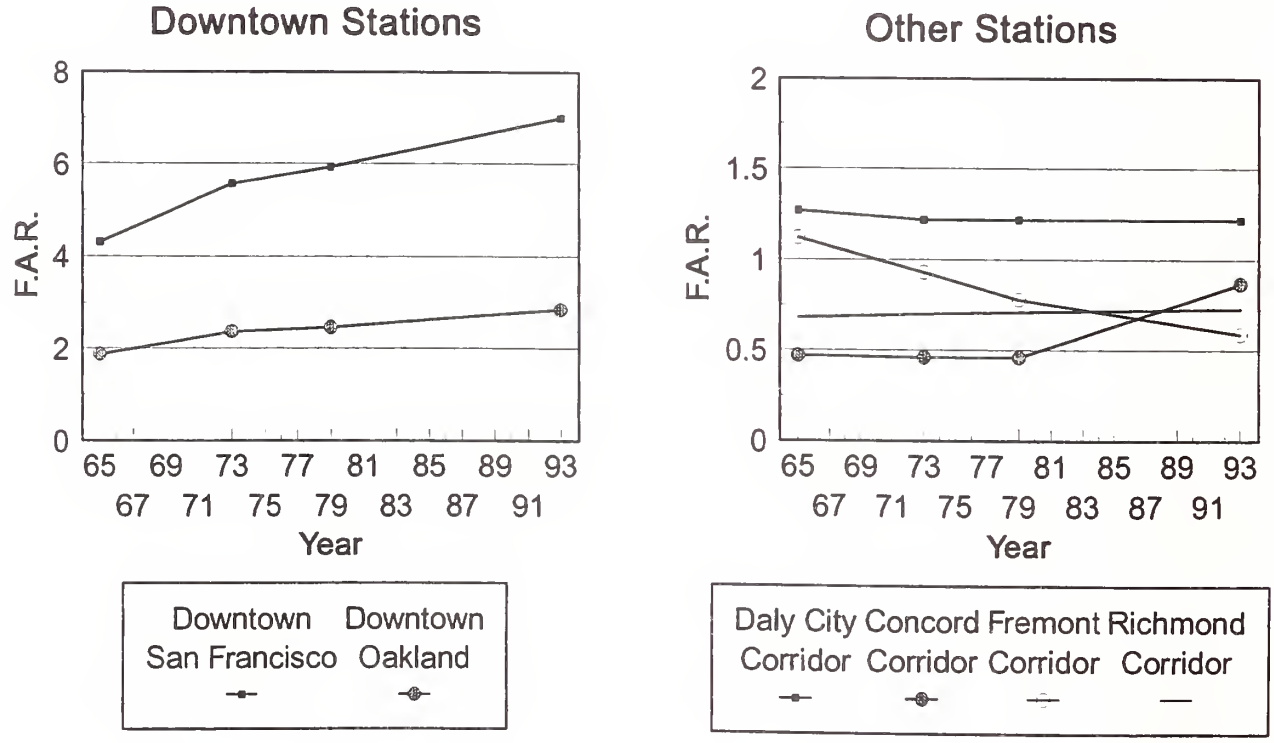


Figure 4.19. Floor Area Ratios for Commercial-Office Development Near BART Stations, by Corridor, 1965-1993

went from having the lowest commercial-office densities in 1979 to having the fourth highest in 1993. Along the three other corridors, net office-commercial-industrial densities have remained stagnant or, in the case of the Fremont corridor, declined.

4.5. Summary

In summary, office and commercial development has increased more rapidly around BART stations than any other land uses. Among all 25 station areas surveyed, office space increased from 27.9 percent of all square footage in 1965 to 45.4 percent in 1993, with most additions having occurred in downtown San Francisco. For both downtown San Francisco and Oakland, the fastest growth in existing station areas actually occurred prior to BART's opening. Since BART started operating in 1973, non-residential development has grown more rapidly in later years than earlier ones. The Walnut Creek-Concord-Pleasant Hill station areas, in particular, experienced a tremendous non-residential building boom during the 1980s, eclipsing a 16 percent annual increase in commercial-office building square footage.

Less housing has been built near BART stations, and what housing that has been built has been almost exclusively apartments and condominiums. Similar rates of multi-family development occurred prior to and after BART. Since BART's opening, apartment and condo construction has been more robust in later than earlier years. The Fremont and Concord lines have received the bulk of the multi-family construction along the BART system.

Overall, net non-residential densities have steadily risen near downtown BART stations. Except for the Concord corridor during the 1980s and early-1990s, net office-commercial-industrial densities have remained stagnant or declined in the vicinity of non-downtown stations.

Notes

[1]Because of resource constraints, we were not able to compile statistics for all 34 stations. For a number of stations, however, we knew virtually no land-use changes had occurred since BART's opening, so these cases were omitted.

[2]If a city block was both in and outside of a ring, it was included if the majority of the block was inside the ring. This was done judgementally by viewing maps.

[3]In addition, 8,846 residential parcels within a one-half mile ring of matched-paired freeway interchanges (discussed in chapter six) were surveyed, raising the total residential parcels studied to 36,665 (as shown in Table A.1).

[4]Also, 790 non-residential parcels within a one-half mile ring of matched-pair freeway interchanges (discussed in chapter six) were surveyed, raising the total non-residential parcels studied to 6,202 (as shown in Table A.1).

Reference

McGraw-Hill. 1993. *Black's Guide to Office Leasing: 1993 San Francisco Bay Area Edition*. San Mateo, California: McGraw-Hill.

CHAPTER FIVE
Land-Use Changes by Station Classes

This chapter presents a second comparative context for examining the land-use impacts of BART. Here, stations are grouped in terms of primarily their physical, land-use characteristics. This is in contrast to the previous section, wherein land-use changes were examined in terms of station corridors — i.e., stations which were geographically near one another. The land-use settings of BART stations are not alike. Some are in dense, downtown areas, some are in predominantly residential suburban communities, some are in the medians of freeways, some include acres of parking, and some have no parking. At least in part, the amount and density of residential, commercial, office, and industrial growth that occurs around BART stations will depend on features of the built environment. We might ask, for instance, "has apartment development been more intense around stations in denser, urban settings versus around traditional suburban stations?" We note at the outset of this chapter that the results are not dramatically different from those of the previous one, in large part because the land-use environments of BART stations do vary significantly by geographic location (e.g., downtown San Francisco versus the Fremont line).

The process of classifying objects, be they rail station areas, cities, or plants, involves two steps: (1) selecting a set of variables which define the dimensions along which stations areas will be grouped (e.g., densities, parking supplies); and (2) applying a clustering algorithm. Each of these steps is discussed below.

5.1. Grouping Variables

Variables which defined the land-use environments around BART stations were used for grouping stations into classes. Table 5.1 lists the variables initially considered. Land use variables gauged the densities, compositions, and levels of mixture of activities, generally for a one-half-mile radius around stations.[1] Other grouping variables measured characteristics of stations (e.g., parking supplies), ridership (e.g., rail modal splits), and neighborhoods (e.g., household incomes).[2] Table 5.2 presents a matrix of data values for the grouping variables for 22 of the stations studied.

5.2. Classification

The grouping of the 22 BART stations into homogenous classes was carried out using cluster analysis. The process involved combining cases into clusters on the basis of their "nearness" to each other when expressed as squared Euclidean distances.[3] Using the technique of agglomerative hierarchical clustering, clusters were sequentially formed by grouping cases into even larger clusters until all cases were members of a single cluster.[4]

A number of combinations of variables were attempted in creating decipherable and intuitive appealing clusters. Because of high collinearity among variables, employing all variables would have

Table 5.1. Candidate Variables for Classifying BART Stations

Land use characteristics

Resdens	Residential density, in dwelling units per acre in 1990. Measured for census tracts and block groups that encompass a one-half-mile radius around station. Source: 1990 census STF 3-A.
Popdens	Population density, in population per acre in 1990. Measured for census tracts and block groups that encompass a one-half-mile radius around station. Source: 1990 census STF 3-A.
Empdens	Employment density, in employees per acre in 1990. Measured for census tracts and block groups that encompass a one-half-mile radius around station. Source: 1990 Census Transportation Planning Package, Part II, Metropolitan Transportation Commission.
Commercial	Proportion of land area in commercial use for one-half-mile radius around station. Source: 1990 Association of Bay Area Governments land use inventory.
Industrial	Proportion of land area in industrial or office use for one-half-mile radius around station. Source: 1990 Association of Bay Area Governments land use inventory.
Residential	Proportion of land area in residential use for one-half-mile radius around station. Source: 1990 Association of Bay Area Governments land use inventory.
Entropy	Index of land-use mixture. Relative entropy = $\{\Sigma_i[p_i * \ln(p_i)]\}/\ln(k)$ where p_i = proportion of land area in land-use category i, and k = number of land-use categories; ranges between 0 and 1, where 0 signifies land devoted to a single use and 1 signifies all land area evenly spread among all uses.
Domlan	Dominant land use category: 1 = residential, 2 = commercial, 3 = industrial/office, 4 = public, 5 = other. Source: 1990 Association of Bay Area Governments land use inventory and field observations.
Vclnd	Vacant/developable land within one-half-mile of station: 1 = low (< 10 percent of land area, 2 = medium (10-25 percent land area), 3 = high (>25 percent of land area). Source: 1990 Association of Bay Area Governments land use inventory and field surveys.

Station Characteristics

Fwypx	Freeway proximity, where limited-access freeway lies the following distances from stations: 1 = 0-0.5 miles, 2 = 0.5-1.0 miles, 3 = 1.0-2.0 miles, 4 = > 2 miles. Source: Thomas Brothers Maps, 1994.
Fwymd	Freeway median station location: 1 = yes, 0 = no. Source: Field observations.
Parking	Park-and-ride spaces at station, surface and structured. Source: BART Systemwide Parking Inventory, 1993.
Stnfn	Station function: 1 = transfer, 2 = terminal, 3 = other. Source: BART system map.

Ridership Characteristics

Dayexits	Average weekday exists, 1992 (January-December). Source: BART planning department.
BARTcm	BART commutes as a percent of total journeys-to-work made by employed-residents living within one-half-mile radius of station. Measured for census tracts and block groups that encompass a one-half-mile radius around station. Source: 1990 census STF-3A.

Neighborhood Characteristics

Income	Annual household income for households within one-half-mile radius of station, 1990. Measured for census tracts and block groups that encompass a one-half-mile radius around station. Source: 1990 census STF-3A.
Redis	Redevelopment district encompasses station: 1 = yes, 0 = no. Source: interviews with local planning departments.
Speczone	Special zoning in station area: 0 = none, 1 = incentive zoning (e.g., density bonuses), 2 = restrictive zoning (e.g., downzoning of densities). Source: local planning departments.

introduced unnecessary redundancy and overemphasized certain variables. The most satisfactory results were obtained by using the following variables:

- Employment density (workers/acre)
- Residential density (households/acre)

Table 5.2. Station Characteristics: BART System

Station	Res-density	Fwy-px	Fwy-md	Stnfn	Day-exits	BART-cm	Dom-lan	Park-ing	Vclnd	Emp-density	Popden-sity	Redis	Pec-zone	Com-mercial	Indus-trial	Resi-dential	Entropy
Rockridge	8.6	1	1	3	4,016	10.7	1	889	3	7.0	18.0	0	2	0.0900	0.0604	0.7162	0.5456
MacArthur	8.1	1	1	1	4,407	9.5	1	609	3	5.5	18.9	0	0	0.1808	0.0687	0.5467	0.7524
W. Oakland	5.5	2	0	3	3,722	8.5	1	424	2	2.4	15.9	0	0	0.2010	0.1519	0.2365	0.9033
19th St. Oak.	7.9	1	0	3	7,855	15.2	3	0	3	64.8	11.5	0	0	0.3429	0.1004	0.3829	0.8029
Oak. City Ctr.	7.3	1	0	1	9,534	6.6	3	0	3	52.2	20.4	1	0	0.3032	0.1164	0.2753	0.9257
Lake Merritt	12.1	1	0	3	3,549	11.5	3	205	3	23.4	21.8	0	0	0.3637	0.1312	0.2669	0.8723
Fruitvale	5.0	1	0	3	5,741	7.7	2	1,103	3	4.4	18.1	0	0	0.3405	0.0903	0.5118	0.6349
Coliseum	3.6	1	0	3	5,571	3.5	3	1,059	2	2.6	12.5	0	0	0.2289	0.0848	-.3252	0.9013
N. Berkeley	10.1	3	0	3	3,181	10.0	1	840	3	7.7	20.8	0	2	0.1523	0.0601	0.7274	0.1533
Berkeley	14.1	4	0	3	10,055	10.8	2	0	3	24.4	23.0	0	0	0.1534	0.1862	0.6443	0.5304
Ashby	11.3	3	0	3	3,104	9.5	2	626	3	4.1	23.4	0	2	0.1762	0.0525	0.7259	0.4905
San Leandro	6.0	2	0	3	3,937	9.9	3	1,295	3	4.8	12.1	1	0	0.1233	0.0732	0.4480	0.7133
Bay Fair	6.3	2	0	3	5,247	7.2	1	1,903	3	3.5	14.7	0	0	0.2063	0.1005	0.6136	0.6250
Hayward	4.1	3	0	3	4,890	3.7	2	1,061	2	7.2	10.4	1	0	0.2084	0.1266	0.5912	0.6241
S. Hayward	4.0	3	0	3	2,845	9.5	1	1,307	3	1.1	14.2	0	0	0.1294	0.0992	0.4252	0.7332
Union City	2.2	4	0	3	3,807	1.1	3	1,218	2	2.1	6.5	1	0	0.0933	0.0521	0.4587	0.7899
Fremont	4.9	4	0	2	5,674	4.9	5	2,494	2	1.5	12.7	0	0	0.2221	0.1585	0.3399	0.7530
Pleas. Hill	4.8	1	0	3	6,088	16.9	1	3,245	1	4.1	8.6	1	1	0.1391	0.0671	0.7477	0.4548
Concord	2.8	2	0	2	7,730	13.0	1	1,975	3	1.6	7.6	1	0	0.1993	0.1211	0.6325	0.5911
Walnut Creek	5.3	1	0	3	5,308	13.7	3	1,518	3	19.0	9.0	0	0	0.2517	0.0392	0.6017	0.6105
Lafayette	0.7	1	1	3	3,179	13.6	1	1,521	3	0.5	1.7	0	0	0.1027	0.0482	0.5633	0.6494
Orinda	2.0	1	1	3	2,951	5.3	1	1,380	3	0.2	4.2	0	0	0.0334	0.0148	0.5058	0.5854
Richmond	5.9	2	0	2	2,704	10.7	1	796	1	4.3	17.7	1	1	0.1777	0.0909	0.6453	0.5686
EC del Norte	4.9	1	0	3	7,387	14.4	1	2,516	3	2.2	12.3	1	0	0.1089	0.1474	0.6318	0.6455
El Cerrito (EC)	6.6	2	0	3	3,769	15.6	1	795	3	4.9	14.1	1	0	0.1153	0.1303	0.6834	0.5774
Embarcadero	11.4	2	0	3	26,966	2.4	3	0	3	156.0	20.3	0	0	0.4456	0.0438	0.2046	0.7953
Montgomery St.	4.8	2	0	3	28,080	2.3	3	0	3	234.0	9.7	0	0	0.4109	0.0361	0.2489	0.7967
Powell St.	23.6	2	0	3	17,413	4.8	3	0	3	86.0	46.9	0	0	0.4503	0.0492	0.2105	0.7705
S.F. Civic Ctr.	42.1	2	0	3	12,931	6.0	3	0	3	75.0	75.7	0	0	0.4406	0.0382	0.2414	0.7537
Mission 16th St.	22.0	2	0	3	5,963	15.2	2	0	3	22.6	53.2	0	2	0.2548	0.0402	0.4685	0.7287
Mission 24th St.	21.6	2	0	3	8,659	12.0	1	0	3	16.1	63.6	0	2	0.1154	0.0445	0.7226	0.5529
Glen Park	10.3	1	0	3	5,795	15.4	1	55	3	2.4	27.4	0	2	0.0320	0.0276	0.8036	0.4319
Balboa Park	8.5	1	0	3	10,001	13.5	1	0	3	4.4	26.7	0	2	0.0440	0.0772	0.8067	0.4167
Daly City	7.8	1	0	2	10,250	8.7	1	2,228	2	2.5	28.6	0	0	0.0895	0.1328	0.5941	0.6828

Sources: BART, Thomas Bros. Maps, 1990 US Census, ABAG, MTC.

- Percent of station area devoted to residential land uses
- Entropy index of land-use mixture
- Parking supply, based on an ordinal scale of 0 to 4.
- Annual household income, in $1,000s
- Percent of commutes by station-area employed-residents by rail

All of these variables were drawn directly from the data base shown in Table 5.2 except for the variable measuring parking supply. Because of the large variation in parking supplies, with around one-third of stations having no parking and some stations having several thousand spaces, the use of original parking variable dominated all other variables in the formation of clusters.[5] The revised ordinal parking variable was scaled as follows: 0 = no parking, 1 = 1 to 1,000 spaces, 2 = 1,001 to 2,000 spaces, 3 = 2,001 to 3,000 spaces, and 4 = > 3,000 spaces.

The results of the cluster analysis are summarized in the hierarchical graph, called a dendogram, shown in Figure 5.1. This shows the clusters being sequentially combined and the normalized values of the coefficients (i.e., squared Euclidean distances) at each step. The judgemental part of cluster analysis is deciding at what stage to stop joining clusters. This is normally done when the distance coefficients

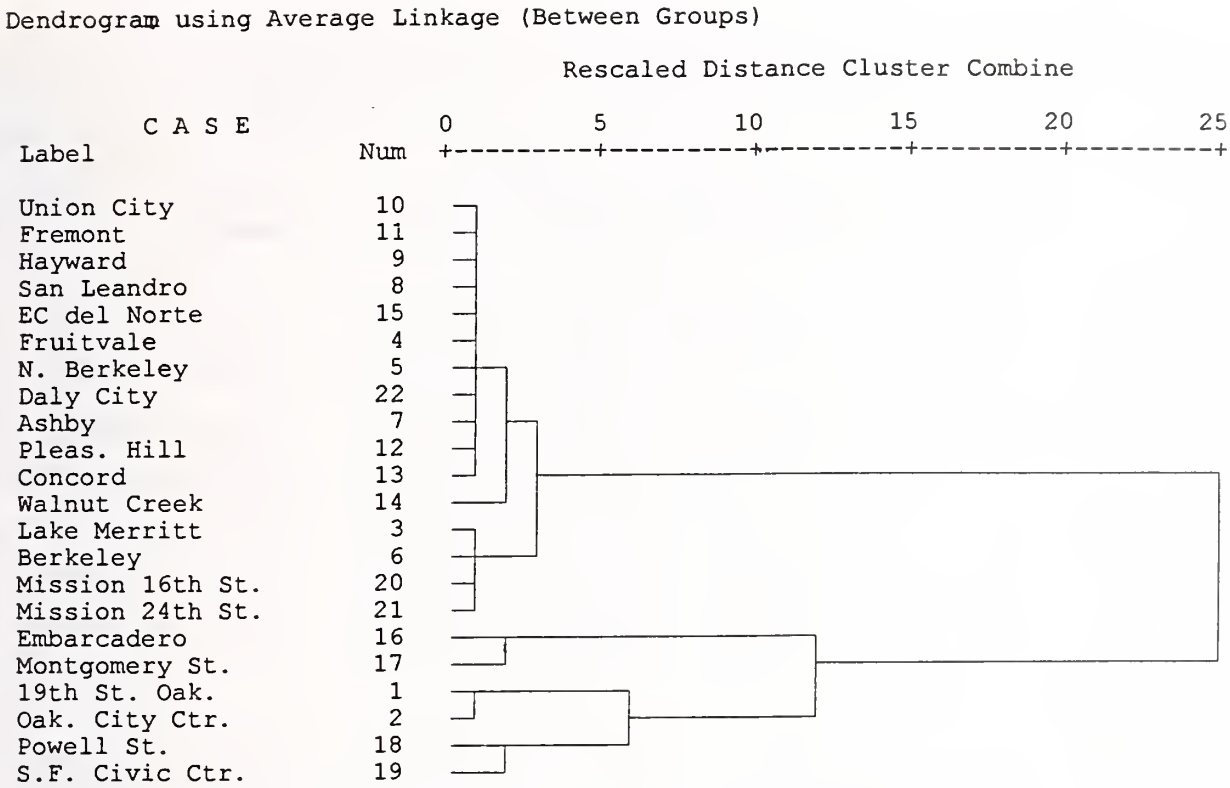


Figure 5.1. Dendogram for Clustering 22 BART Stations

dramatically increase from on agglomeration to another, or when an intuitive number, normally 4 to 6, of clusters have been formed. For this analysis, five station classes were considered to be the maximum acceptable. Five distinct classes were formed (between the 21st and 22nd stages of merging clusters).[6] This provided an intuitive and interpretative grouping of stations. The following five station classes were formed, with the BART stations that grouped into each class also listed:

- *Downtown San Francisco Office Center:* Embarcadero, Montgomery, Powell Street, and Civic Center
- *Downtown Oakland:* City Center (12th Street), 19th Street, and Lake Merritt
- *Urban Districts:* Berkeley, Mission 16th Street, and Mission 24th Street
- *Suburban Centers:* Walnut Creek, Pleasant Hill, and Concord
- *Low-Density Areas:* Fruitvale, San Leandro, Hayward, Union City, Fremont, Ashby, North Berkeley, El Cerrito del Norte, and Daly City.

Table 5.3 suggests why these particular titles were chosen for describing the five station classes; it presents the means, standard deviations, and low-to-high ranges of the seven variables used in forming clusters. The homogeneity of cases in each cluster is reflected by the low standard deviations relative to means (i.e., low coefficients of variation) for most variables. The distinctiveness of clusters is reflected by the relative large differences in means for variables across the six groups.

5.3. Station Classes

The following five station classes are presented in hierarchical order based on their level of urbanization. Level of urbanization is perhaps best reflected by the descending employment densities across

Table 5.3. Characteristics of the Six BART Station Classes

	Class of BART Station				
	Downtown San Francisco	Downtown Oakland	Urban Districts	Suburban Centers	Low-Density Areas
Density					
Employment Density (workers/acre)					
Mean (std. dev.)	137.5(74.8)	58.5(8.9)	19.3(4.6)	14.6(11.5)	5.9(6.4)
Range	75.0-234.0	52.1-64.8	16.1-22.6	1.6-18.9	1.5-7.7
Residential Density (dwelling units/acre)					
Mean (std. dev.)	20.5(16.4)	7.6(0.5)	21.8(0.3)	2.6(4.8)	6.8(3.6)
Range	4.8-42.1	7.12-7.9	21.5-22.0	2.8-12.1	2.2-14.1
Land Use					
Percent Land Area Residential					
Mean (std. dev.)	22.6(2.0)	32.9(7.6)	59.6(18.0)	50.0(20.3	29.3(12.3)
Range	20.5-24.9	21.0-24.1	27.5-38.3	26.7-72.3	50.6-74.8
Mixture of Use (relative entropy[1])					
Mean (std. dev.)	.779(0.21)	.864(.087)	.641(.124)	.691(.57)	.621(.111)
Range	.754-.797	.803-.926	.553-.729	.591-.872	.455-.790
Other Characteristics					
Parking Spaces at Station					
Mean (std. dev.)	0(0)	0(0)	0(0)	1928(770)	1116(725)
Range	0-0	0-0	0-0	1380-3245	0-2516
Annual Household Income ($1000, 1990)					
Mean (std. dev.)	28.6(24.7)	15.1(1.4)	17.9(1.3)	31.7(10.2)	24.2(5.1)
Range	35.4-43.5	14.4-15.7	17.1-18.9	10.5-39.4	14.4-31.1
Percent Residents Commuting by BART, 1990					
Mean (std. dev.)	3.91(1.8)	10.9(6.1)	13.6(2.2)	12.7(1.2)	8.87(4.5)
Range	2.27-6.01	6.60-15.19	12.03-15.16	11.5-13.71	1.11-16.88

[1]Relative entropy = $\{\Sigma_i[p_i * \ln(p_i)]\}/\ln(k)$ where p_i = proportion of land area in land-use category i, and k = number of land-use categories; ranges between 0 and 1, where 0 signifies all land devoted to a single use and 1 signifies all land area evenly spread among all uses.

these station classes. Other distinguishing land-use features of each station class are also highlighted in this section.

- *Downtown San Francisco*: The Embarcadero and Montgomery stations serve the heart of downtown San Francisco's high-rise office and financial district, surrounded by the tallest buildings in the Bay Area. They are characterized by extremely high employment densities, with relatively little housing nearby (reflected by the low percentage of residential land area). The two other downtown stations — Powell and Civic Center — serve the region's major shopping district (Powell) and institutional-cultural complex (Civic Center). Downtown San Francisco station have fairly high residential densities, though relatively little land area around these stations is devoted to housing. The relatively modest residential densities around these four stations reflect relatively few dwelling units per gross acre. (On a net residential acreage basis, densities would be fairly high.) As part of the downtown, these stations rate fairly high in terms of the levels of mixed uses. They have no parking; however, they have the highest levels of connecting transit services, including diesel and trolley buses, cable cars, light rail transit, trams,

and ferry services. Relatively few employed-residents in the area commute by rail in large part because many can walk to their jobs.

- *Downtown Oakland*: These three — City Center (12th Street), 19th Street, and Lake Merritt — serve the Bay Area's second-tier urban center, downtown Oakland. Employment densities in downtown Oakland fall below those of downtown San Francisco, but are considerably above those of the remaining Bay Area. Downtown Oakland is less segmented than downtown San Francisco, with office, retail, and services intermingled; this is reflected by the high relative-entropy index, signifying a rich mixture of land uses. Compared to downtown San Francisco, downtown Oakland has more housing in the immediate vicinity, though average household incomes are low. The City Center station lies in a redevelopment district; the redevelopment authority has recently used tax increment financing and other incentives to attract new development, including a mixed retail-office plaza with attractive landscaping that ties directly into the station and a large federal building complex. The Civic Center and 19th Street stations have no parking, but are the major terminuses of buses operated by AC Transit, which serves the urbanized parts of Alameda and Contra Costa Counties in the East Bay. The Lake Merritt station area is predominantly a government employment district surrounding by mid-rise housing and a sprinkling of retail uses. Oakland's Chinatown, cultural complex, and Laney College also flank the Lake Merritt station. The Lake Merritt station has parking (just 205 spaces that cost a quarter per day to park).

- *Urban Districts*: These three stations — Berkeley (downtown), Mission-16th Street, and Mission-24th Street — lie outside of the region's two big CBDs, but are in highly urbanized areas. In the urban hierarchy, they represent third-tier centers. They are mature districts, with considerable numbers of jobs (in low-to-mid-rise buildings) and significants amounts of housing. Among all station classes, they have the highest gross residential densities and relatively high shares of land devoted to residential uses. These station areas are also most balanced in terms of jobs and housing. Downtown Berkeley has the most mixed office-retail-residential development. The two Mission stations, serving the traditional Hispanic district of San Francisco, feature very similar mixes of small, independently owned retail outlets interspersed by moderate-income housing. None of these stations have parking, though all are well-served by bus transit connections. Also, relatively high shares of residents around these stations commute by rail transit.

- *Suburban Centers*: These three stations — Walnut Creek, Pleasant Hill, and Concord — are surrounded by fourth-tier commercial centers in the eastern suburbs of the Bay Area. They make up the three outermost stations on the Concord line in Contra Costa County, and thus match the "Concord corridor" designations used in the previous analysis. These three stations are surrounded by mid-rise office towers, and have apartments nearby (especially Pleasant Hill, which has over 1,600 apartment units within a quarter-mile of the station). Overall, gross residential densities are fairly low in these station areas and average household incomes are comparatively high. What most distinguishes these sta-

tions are the large volume of park-and-ride spaces — ranging from 1,380 at Orinda to 3,245 at Pleasant Hill.[7] Large shares of residents living within one-half mile of these stations commute to work by rail transit — on average, 12.7 percent. The Pleasant Hill station is distinguished from the other stations for being in an unincorporated area and being part of a redevelopment district. The formation of a redevelopment district in the early 1980s at the Pleasant Hill station has helped leverage over 1.5 million square feet of new office space construction and five large apartment complexes within a quarter-mile of the station in the past seven years (see Cervero, Bernick, and Gilbert, 1994).

Low-Density Areas: The remaining nine BART stations form a station class of low-density development. What most distinguishes these station areas is their comparatively low employment and residential densities. All lie in low-rise, suburban-like settings. Most are surrounded by predominantly residential development (e.g., Daly City), though some have prominent retail districts nearby (e.g., Fremont). In general, these areas have relatively low levels of land-use mixing. Most stations in this class have moderate supplies of parking, ranging from 626 at the Ashby Station in Berkeley Francisco to 2,516 at the El Cerrito del Norte station on the Richmond line. Bus transit connections tend to operate at lower service levels at these stations. El Cerrito del Norte on the Richmond line and several stations on the Fremont line (San Leandro and Union City) lie within redevelopment districts. The most significant redevelopment activities have been near the El Cerrito del Norte station, where new housing and retail projects have opened in recent years (see Cervero, Bernick, and Gilbert, 1994). Two of the station areas — North Berkeley and Ashby — are notable for the restrictive zoning introduced after BART was opened, aimed at limiting preserving the single-family residential characters of these neighborhoods.

5.4. Trends in Residential and Non-Residential Growth Among Station Classes

Figures 5.2 and 5.3 present trend lines on the total square footage of building area for parcels within the five station classes. Data are shown for the pre-BART (1965-1973), early-BART (1973-1979), and later-BART (1979-1993) periods. As noted previously, relatively little single-family housing has been built around BART stations. The fastest increase in single-family home buildings was around low-density station areas in the early-BART years (Figure 5.2). All station classes witnessed increase multi-family housing construction, with the fastest gains occurring around low-density and suburban centers station classes — i.e., in the suburbs.

Also as noted earlier, downtown San Francisco experienced rapid office-commercial development over the past 30 years, more than doubling its inventory (Figure 5.3). Non-residential floorspace increased rapidly in both the pre-BART and later-BART eras. During the 1980s, the station class experiencing the most rapid increases in commercial-office development was the suburban centers, consistent with the trends throughout the U.S. (Cervero, 1989). Downtown Oakland also experienced relatively healthy nonresidential development in the later-BART years.

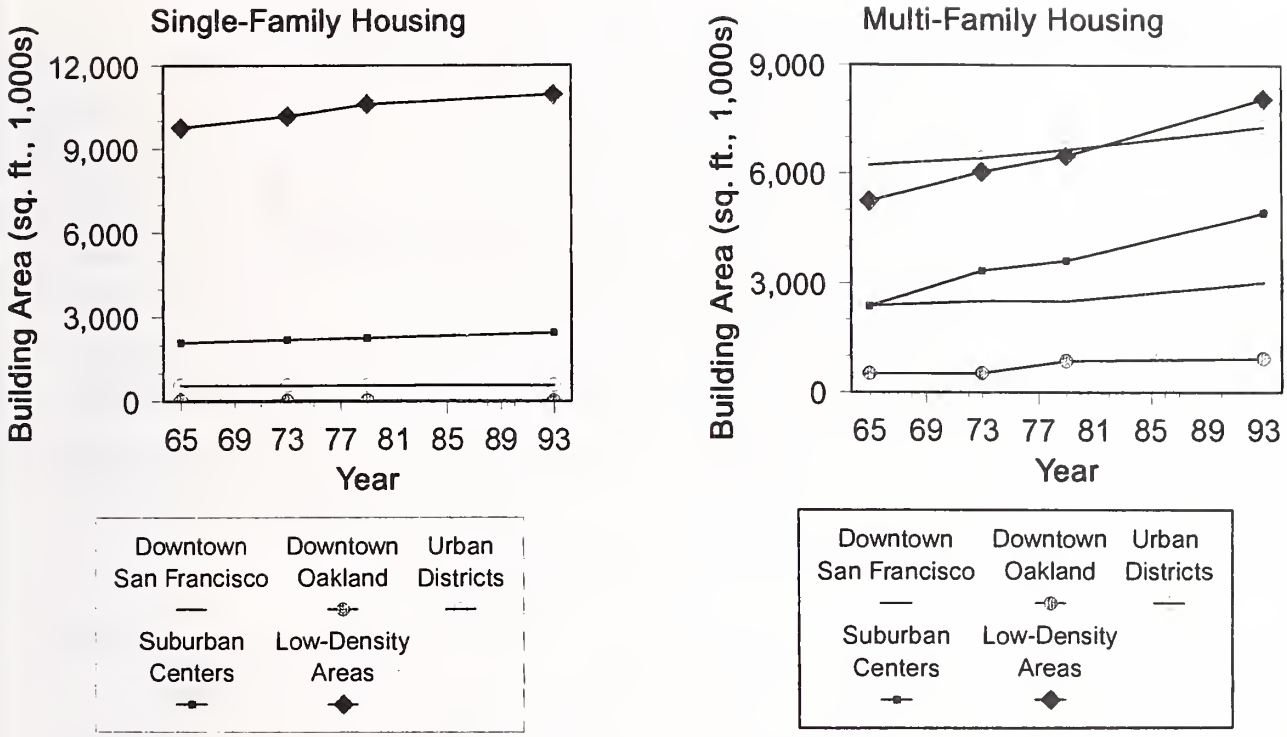


Figure 5.2. Changes in Single- and Multi-Family Building Area for Five BART Station Classes, 1965-1993

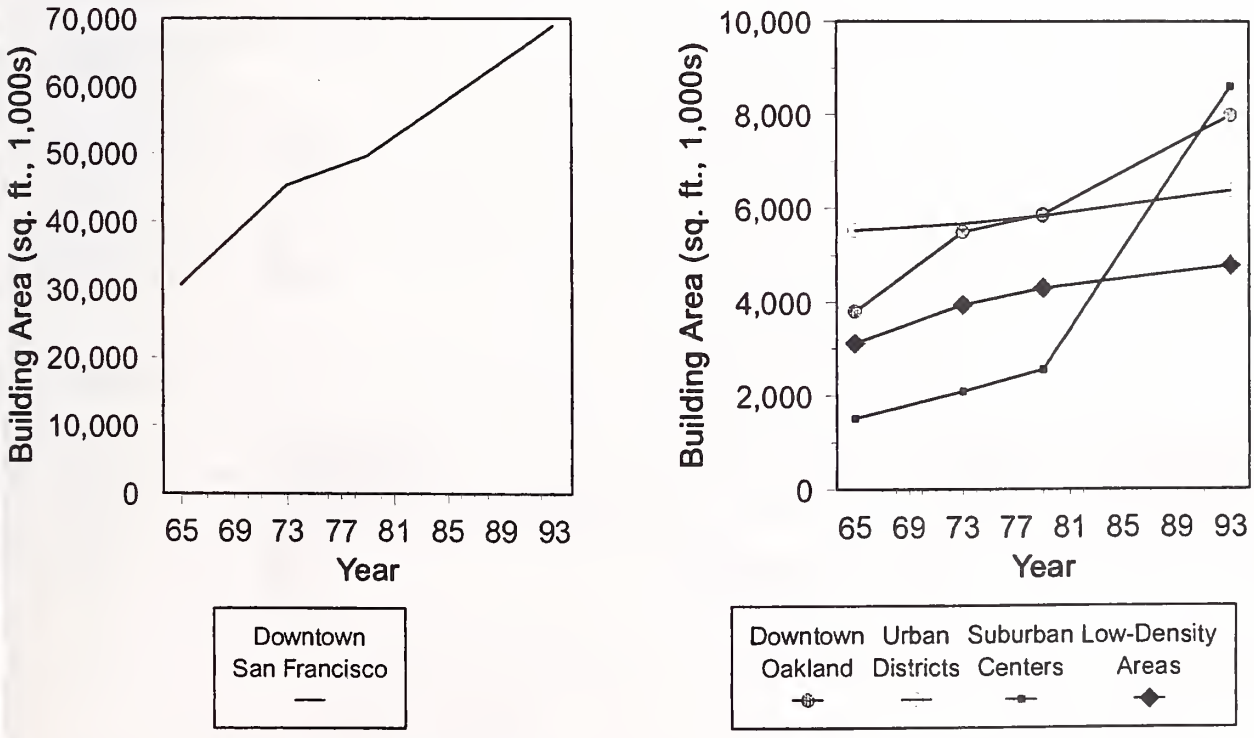


Figure 5.3. Changes in Non-Residential Building Area for Five BART Station Classes, 1965-1993

5.5. Percent Growth in Early- versus Later-BART Years Among Station Classes

Among the five station classes, downtown Oakland experienced the fastest multi-family housing construction in the early-BART years (mainly around the Lake Merritt station), and suburban centers won the honors in the later-BART years (Figure 5.4). For non-residential development, suburban centers experienced the fastest growth rates in both the early- and later-BART phases (Figure 5.5). Expressing growth on a per annum basis, Figures 5.6 and 5.7 show variation in the timing of development across station classes. For the two station classes which experienced the most multi-family housing construction — suburban centers and low-density areas — the fastest growth in apartment and condo development occurred in the latter-BART years (Figure 5.6). Non-residential construction grew the fastest after 1979 for four of the five station classes — most notably, near the suburban center stations (Figure 5.7)

5.6. Trends in Non-Residential Densities Among Station Classes

Commercial and office densities increased the fastest around the downtown San Francisco and suburban center stations, particularly during the 1980s (Figure 5.8). Floor Area Ratios for non-residential development around low-density stations have declined steadily since prior to and since BART's opening. These trends indicate there was a distinct patterning in employment and commercial-office growth around BART stations. Specifically, there was a distinct multi-tier level of nonresidential clustering, almost resembling a central-place hierarchy. At the top of the hierarchy is downtown San Francisco, the region's pre-eminent urban center. Oakland stands as the region's secondary center, and strengthened its hold on this position since BART's opening. BART seems to have had little impact on clustering in the urban district stations — specifically, near San Francisco's Mission District or downtown Berkeley. BART did, however, appear to play a role in the emergence of suburban centers — Walnut Creek, Pleasant Hill, and Concord — as important nodes of commercial and office development in their own right. At the end of the hierarchy were the low-density areas, which generally witnessed little new commercial-office-industrial development following BART, and, if anything, became less prominent in the hierarchy of centers (owing to the steady decline in F.A.R.s).

In summary, BART appears to have played a role in the emergence of a polycentric urban form in the San Francisco Bay Area that was more distinctive in 1993 than in 1965. We believe this was due to a combination of BART functioning as a magnet to attract commercial-office development in specific station areas, subregional market forces, and the role of government policies in leveraging new development, a topic discussed in later sections of this report.

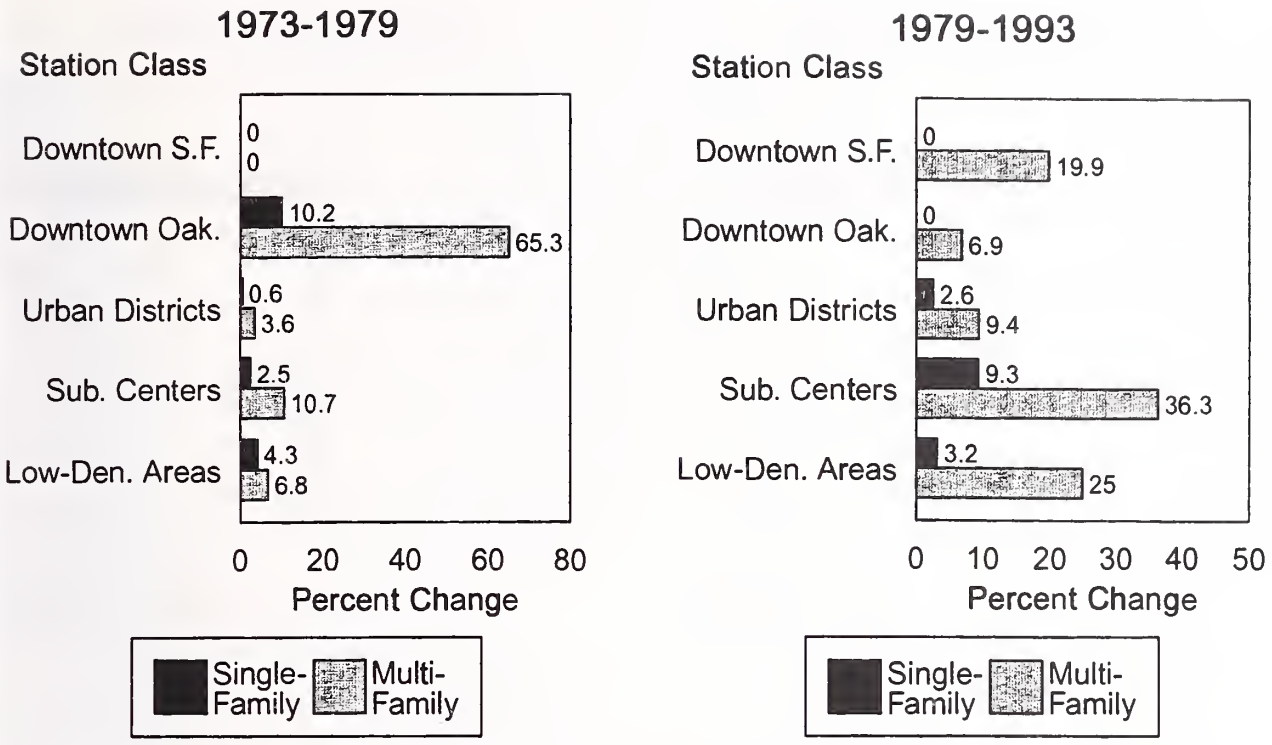


Figure 5.4. Percent Change in Residential Building Area by Five Station Classes, Early- and Later-BART

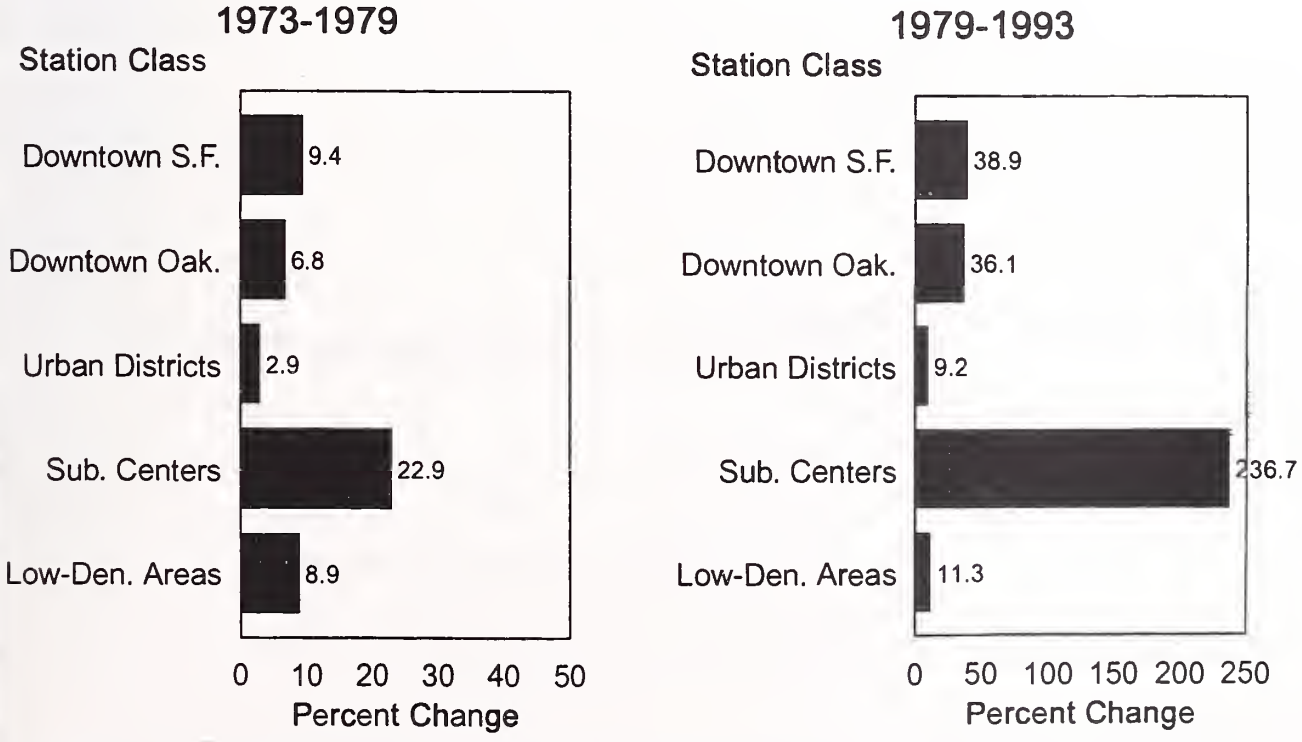


Figure 5.5. Percent Change in Non-Residential Building Area by Five Station Classes, Early- and Later-BART

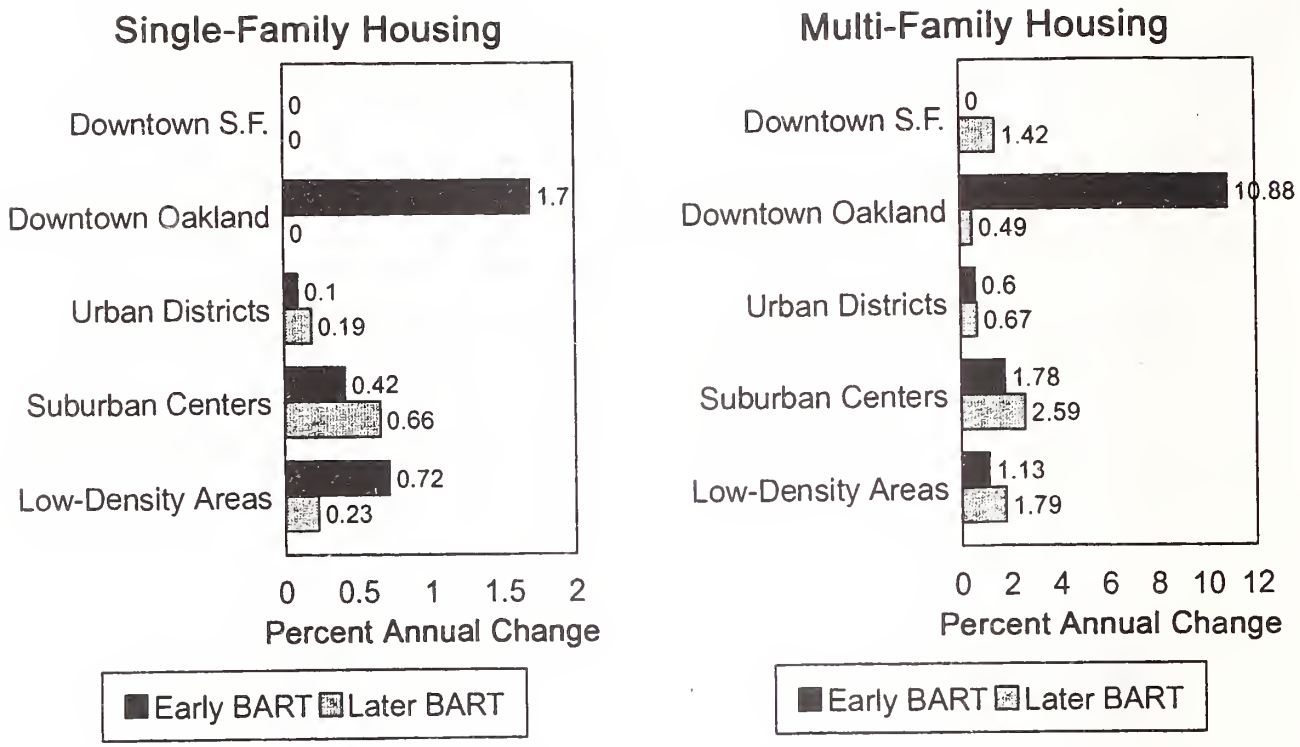


Figure 5.6. Comparison of Annual Growth Rates in Residential Development by Five Station Classes, Early- and Later-BART

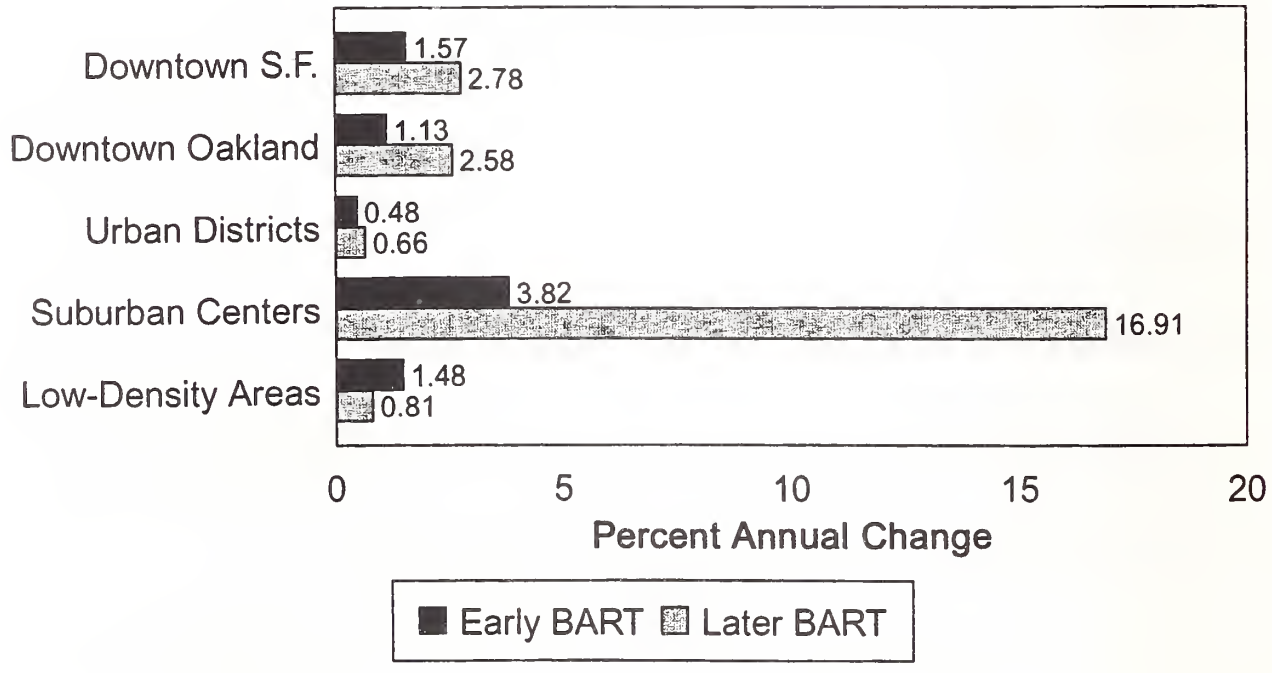


Figure 5.7. Comparison of Annual Growth Rates in Non-Residential Development by Five Station Classes, Early- and Later-BART

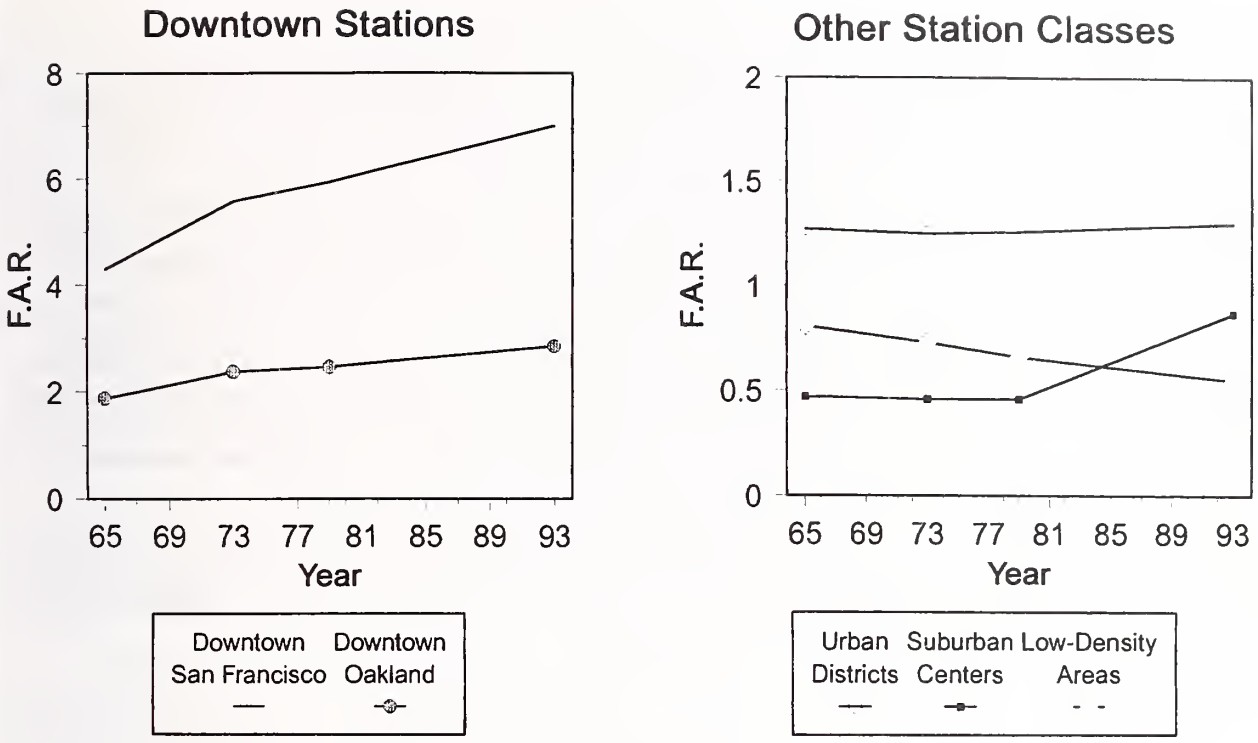


Figure 5.8. Floor Area Ratios for Commercial-Office Development for Five BART Station Classes, 1965-1993

Notes

[1]The principal land-use data used in this research was a 1990 inventory of the dominant land use within a hectre grid (100x100 meters), compiled by the Association of Bay Area Governments (ABAG) for the entire San Francisco Bay Area. Using the ArchInfo Geographic Information Systems (GIS) package, buffers were created to generate fairly precise estimates of the composition of land uses within a one-half mile radius of all 34 BART stations. (Summing information on the dominant land use for each hectre over the number of hectres within a half-mile radius of rail stations provided counts of the total square meters of land area devoted to each land use within a circle of one-mile diameter around each BART station.) While the ABAG inventory compiles data for over 40 individual land uses, these categories were collapsed into six major ones: residential, commercial, industrial/office, public, vacant, and other.

[2]These data were obtained directly from BART as well as from the 1990 U.S. census, Summary Tape File 3A.

[3]The measure used for joining clusters was the average linkage between groups, often called UPGMA (unweighted pair-group method using weighted average (see Everitt, 1980). Here, the distance measured between two clusters is the average of distances between all pairs of cases in which one member of the pair is from each of the clusters.

[4]Under this approach, all cases are initially considered as separate clusters, i.e., there are as many clusters as cases. As the second step, the two cases with the most comparable squared Euclidean distances (i.e., the ones whose sum of squared factor scores are the most alike) are combined into a single cluster. At the third step, either a third case is added to the cluster already containing two cases, or two additional cases are merged into a new cluster. The process continues until all cases are grouped together. See Everitt (1980) for further discussions of this approach.

[5]This is because the squared Euclidean distances between station cases for the parking variable was so huge that the distance metrics for other variables were comparatively small and thus played a small role in fusing together cases in the clustering algorithm.

[6]The final grouping of stations into clusters did not exactly follow the dendogram outputs. For downtown San Francisco, the Embarcadero and Montgomery stations grouped together, separate from the Powell Street and Civic Center stations. For this analysis, these two station groupings were combined into a single cluster. Also, the Lake Merritt station was grouped with Oakland Civic Center and 19th Street stations because of its urban characteristics in very close proximity to the downtown core, even though technically it was grouped with Berkeley and the Mission Street stations. Adding several grouping variables actually aligned Lake Merritt with the downtown Oakland stations, so making this assignment was considered reasonable. Additionally, Walnut Creek stood out as a unique station and grouped with Pleasant Hill and Concord only at a later stage in the cluster algorithm. Since a significant amount of non-residential development occurred at the Pleasant Hill and Concord stations following 1990, the latest year for the land-use data used in the cluster analysis, we felt that these three stations were far more similar in 1993 and should thus be joined into a single cluster. In the case of Pleasant Hill, for instance, around one million square feet of office floorspace and over 1,000 dwelling units were added between 1990 and 1992 within a one-half mile ring of the station. Thus, by 1992, Pleasant Hill clearly had the character of a suburban center, similar to Walnut Creek and Concord. Basing classifications on land-use characteristics after 1990 was considered appropriate since TRW-REDI land-use data were compiled up to 1993.

[7]Six hundred new spaces were added to the Concord station in the summer of 1994, bringing the total up to 2,575 spaces. In 1992, the year for which the BART passenger data were compiled, however, the parking supplies shown in Table 5.3 existed. With the new parking supply at the Concord station, the average number of parking spaces at the Suburban Centers class of BART station is currently 2,446.

References

Cervero, R. 1989. *America's Suburban Centers: The Land Use-Transportation Link*. Boston: Unwin-Hyman.

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

Everett, B. 1980. *Cluster Analysis*. New York: Halstead Press, second edition.

CHAPTER SIX
Matched-Pair Comparisons of Land-Use Changes near BART Stations Versus Freeway Interchanges

A final summary comparison was carried out by studying land-use changes around specific BART stations matched against changes around nearby freeway interchanges. The central question addressed here is: "has there been relatively more development and different types of land-use changes around regional rail nodes versus nearby freeway nodes?" Since BART stations are the access points to the regional rail system and interchanges are the access points to the regional freeway system, this analysis allows land-use changes around BART to be compared to those of its chief competitor, nearby freeways. At minimum, we would expect relatively more apartment and condominium construction and denser non-residential development near BART since rail, in theory, depends on a concentration of nearby urban activities to attract riders.

The matched-pair analysis could only be conducted for parts of the Fremont and Richmond corridors since suitable freeway pairs were only available for this stretch. (Most of the Concord line lies in the median of a freeway, meaning freeway interchanges and BART stations are in near-identical locations, thus precluding any analysis; major aterials generally flank stations along the Daly City corridor, moreover, providing few suitable freeway matches.) The chief matching criteria were that the station and freeway interchange be: (1) within 1 to 2½ miles of each other; and (2) be connected by the same arterial highway. Invoking these criteria produced seven suitable pairs, five on the Fremont line and two on the Richmond line. The Fremont corridor proved to be best suited for matched-pair analysis because most stations and freeway interchanges were 1-2 miles apart, connected by the same arterial. This provided sufficient separation to attribute development uniquely to each node, yet close enough to control for factors like similar geographic and city location (which could, for instance, remove the influences of restrictive growth policies of an individual city).

Table 6.1 lists and describes characteristics of the BART station/freeway interchange pairs. On the Fremont line, they are San Leandro vs. Davis St.(I-880); Hayward vs. Winston Ave. (I-880); South Hayward vs. Tennyson Rd. (I-88); Union City vs. Alvarado Niles Rd. (I-880); and Fremont vs. Mowry Ave. (I-880). On the Richmond line, a corridor of BART stations and freeway interchanges was chosen to represent one of the matched pairs: Ashby/Berkeley/North Berkeley vs. Ashby Ave. (I-80)/University Ave.(I-80)/Gilman Ave. (I-80). These three stations and three freeway interchanges were combined to form a single pair because of their close proximity. Treating them as separate pairs would have resulted in considerable overlap for the half-mile ring around Berkeley's freeway interchanges. Additionally, Berkeley's three BART stations were fairly equidistant to interchanges — e.g., the North Berkeley station, for instance, is around 1½ miles to both the University Avenue and Gilman Avenue interchanges on I-80. In addition, the Richmond corridor included the matched pair of the Richmond station vs. the San

Table 6.1. Characteristics of Matched Pairs

BART Station	Comparison Freeway Site	Distance Between Paired Sites (Miles)	Connecting Arterial	Predominant Land Use, 1990 Station Area	Predominant Land Use, 1990 Freeway Area	Employment Density (Workers/Acre) Station Area	Employment Density (Workers/Acre) Freeway Area
FREMONT CORRIDOR							
San Leandro	Davis St./I-880	7/8	Davis St.	MFR	SFR	6.4	5.3
Hayward	Winston Ave./I-880	1-3/4	Winton Ave.	C, SFR	SFR	7.2	6.1
South Hayward	Tennyson Rd./I-880	1-1/2	Tennyson Rd.	SFR, V	SFR	1.1	6.2
Union City	Alvarado-Niles Rd./I-880	2	Alvarado-Niles Rd.	I	SFR	1.4	1.2
Fremont	Mowry Ave./I-880	2	Mowry Ave.	O, A, C	SFR	1.5	1.9
RICHMOND CORRIDOR							
Ashby	Ashby Ave./I-80	2	Ashby Ave.	SFR	I	4.1	8.5
Berkeley	University Ave./I-80	2	University Ave.	O, C, R	I	24.4	8.5
North Berkeley	Gilman Ave./I-80	1-3/8	Cedar St.	SFR	I	2.3	8.5
Richmond	San Pablo Ave./I-80	1	Barret Ave.	SFR, C	SFR	4.3	3.1

Note: MFR = Multi-Family Residence; SFR = Single-Family Residence; C = Commercial; V = Vacant; I = Industrial; O = Office; A = Agricultural; R = Retail

Pablo Ave. (I-80) interchange. (While this section refers to seven matched-pairs, the actual number of stations and freeway interchanges examined was seven — five pairs in the Fremont corridor, three pairs (consolidated into one pair) for the Berkeley area, and one pair for the Richmond station.)

In the analyses that follow, differences in residential and non-residential growth are compared for one-half-mile rings around the matched BARTstation/freeway interchange pairs. TRW-REDI data were used for compiling land-use data for both stations and interchanges.[1] The ArchInfo GIS package was used to create buffers that corresponded to half-mile radii around stations and interchanges for extracting TRW-REDI data.

The analyses in this section are presented for the combination of all pairs on the Fremont line as well as the Berkeley pairs on the Richmond line. Differences in land-use changes for each station-interchange pair are presented in chapters 10 and 12 of this report for the Fremont corridor and Richmond corridor, respectively.

6.1. Trends in Residential and Non-Residential Growth Among Matched Pairs

For all the stations and freeway interchanges combined, Figure 6.1 reveals little difference in the growth of single-family housing between BART stations and freeway pairs over the post-BART era. BART stations, however, outperformed their freeway-interchange counterparts in terms of multi-family housing construction, especially during the 1980s.

For non-residential development, Figure 6.2 shows that building area increased at a similar pace until 1979; from that year onward, commercial-office development near BART stations increase at a slightly faster rate. From both figures, we see that there was more square footage of all uses — single-

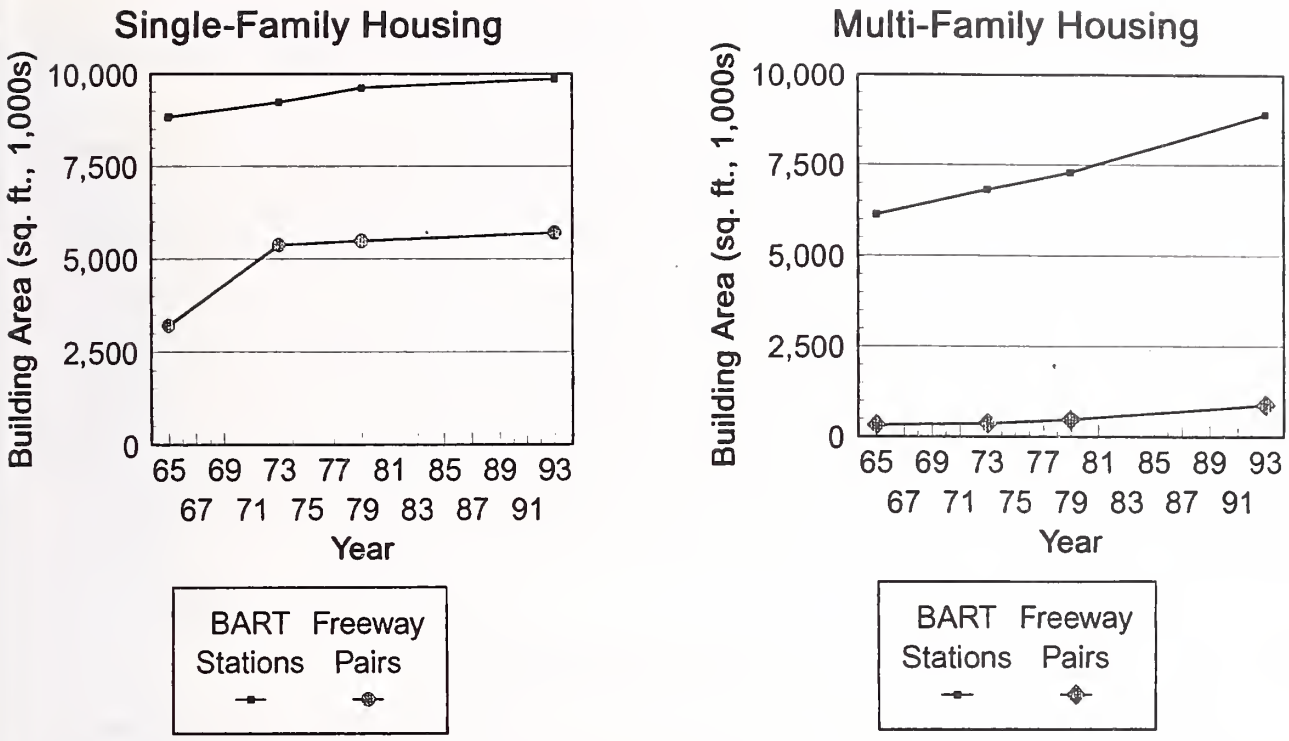


Figure 6.1. Changes in Residential Building Area for BART Stations vs. Freeway Pairs, 1965-1993

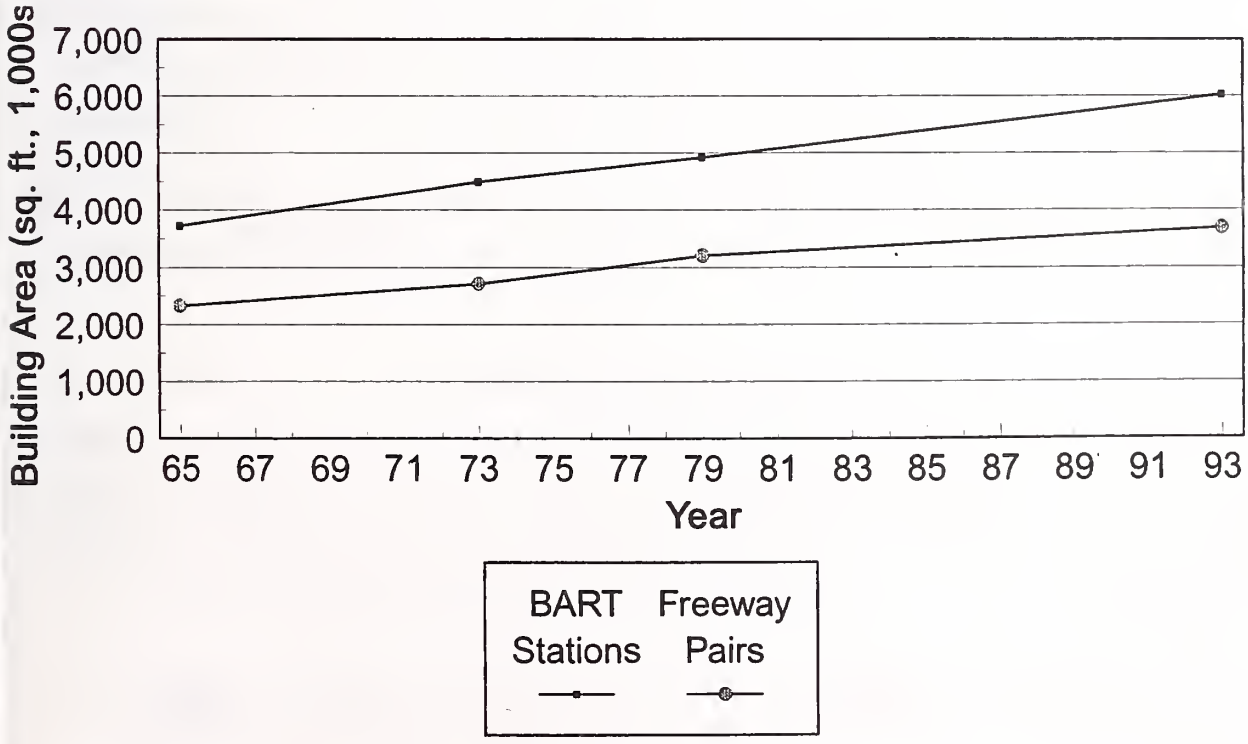


Figure 6.2. Changes in Non-Residential Building Area for BART Stations vs. Freeway Pairs, 1965-1993

family housing, apartments/condominiums, and non-residential development -- around BART stations than nearby freeway interchanges.

Another way to compare trends between stations and interchanges is to track total pair-by-pair differences. (Statistically, this is the correct way of examining matched-pair differences.) Figure 6.3 shows the total pair-by-pair differences for the 1965-1993 period — i.e., the square footage in the ring around each BART station minus the square footage in the ring around each paired freeway interchange, summed over all five pairings, for 1965-1993. For periods where the line slopes upward, this represents more development around BART stations; downward slopes signify the opposite. These graphs reinforce the finding that, in relative terms, multifamily housing around BART stations increased most rapidly in the pre-BART and later-BART years. For commercial-office development, freeway pairs experienced faster growth until 1979; after that date, non-residential growth was much higher around BART stations.

6.2. Pre- versus Post-BART Comparisons for Matched Pairs

Prior to BART's opening, there was relatively more single-family housing construction near freeway interchanges and relatively more multi-family housing development near station areas; the opposite relationship held for the Berkeley pairs along the Richmond line (Figure 6.4). In the post-BART era, these relationships reversed for the Fremont line but remained the same for the Richmond line.

In terms of non-residential development, there was little difference in growth rates for parcels near stations or interchanges in the pre-BART period (Figure 6.5). After BART's opening, non-residential development grew much faster near freeway interchanges in the Fremont corridor, and much faster near stations in Berkeley (the Richmond corridor.)

Overall, no meaningful patterns emerged regarding differences in growth rates during pre- versus post-BART. For all land uses, square footage growth rates varied across station areas and freeway interchange areas.

6.3. Early- versus Later-BART Comparisons for Matched Pairs

In BART's early years, the most significant land-use change, in percentage terms, for residential uses was multi-family housing development near freeway interchanges on the Fremont corridor (Figure 6.6). In later years, the rapid growth in multi-family housing near the Richmond corridor (i.e, Berkeley) interchanges stands out. Thus, in percentage terms, freeway-oriented multi-family development was prominent.

A weakness of tracking land-use changes only in percentage terms is that the absolute amounts of building square footage are ignored. The faster rate of multi-family housing development around freeway interchanges stems, in part, from the low base-level of apartments and condominiums in these

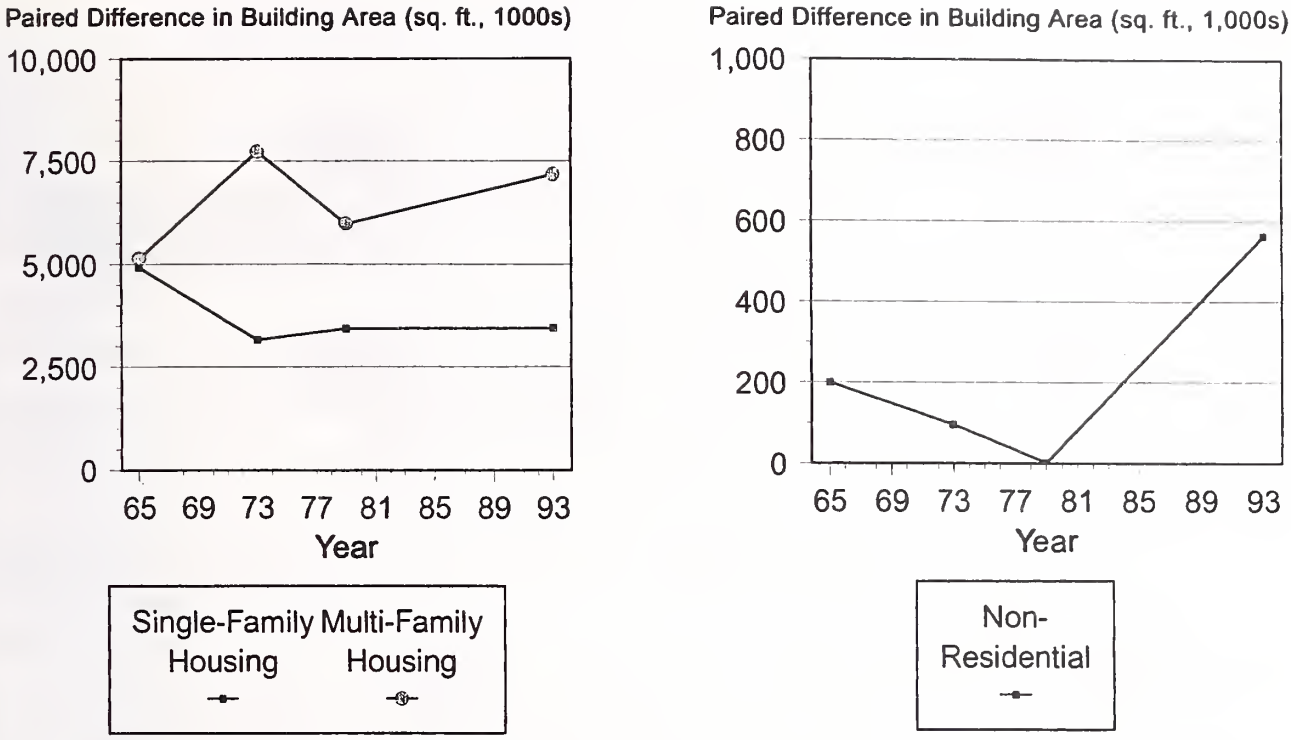


Figure 6.3. Paired Differences in Residential and Non-Residential Building Area for BART Stations vs. Freeway Pairs, 1965-1993

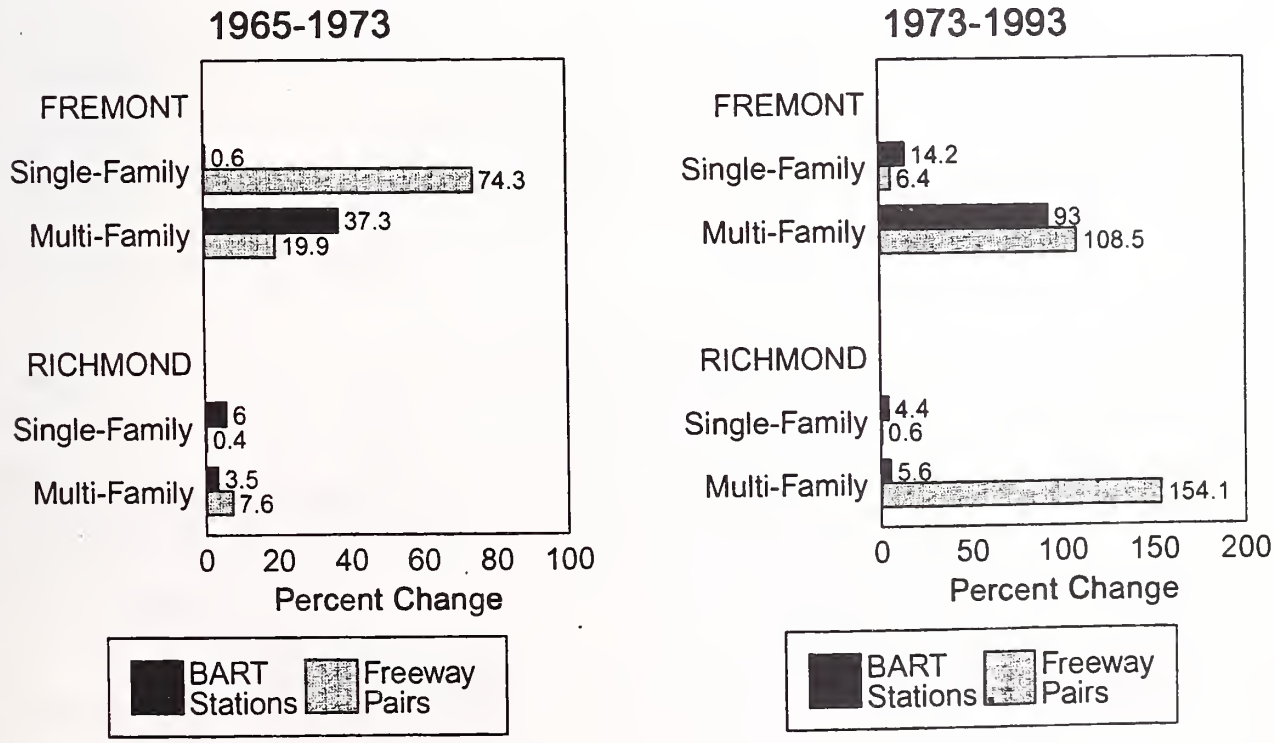


Figure 6.4. Percent Change in Residential Building Area, BART Stations vs. Freeway Pairs, Pre- and Post-BART

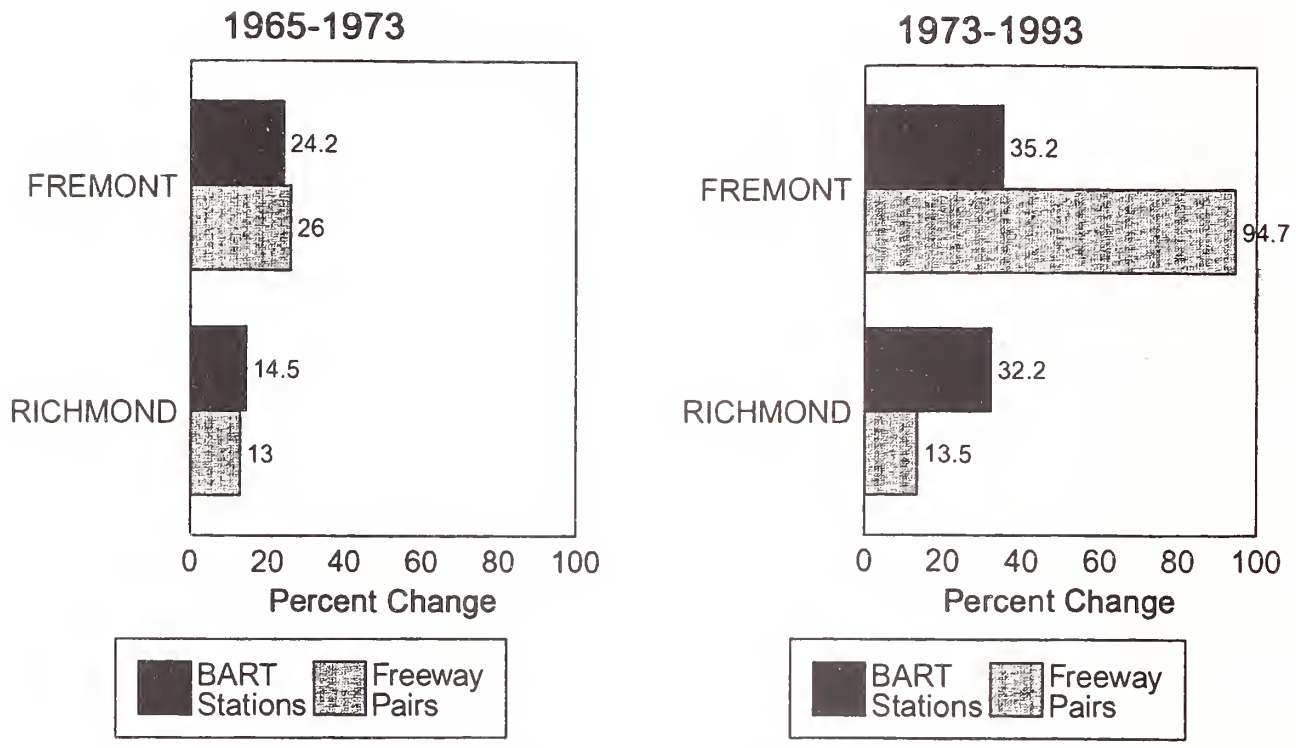


Figure 6.5. Percent Change in Non-Residential Building Area, BART Stations vs. Freeway Pairs, Pre- and Post-BART

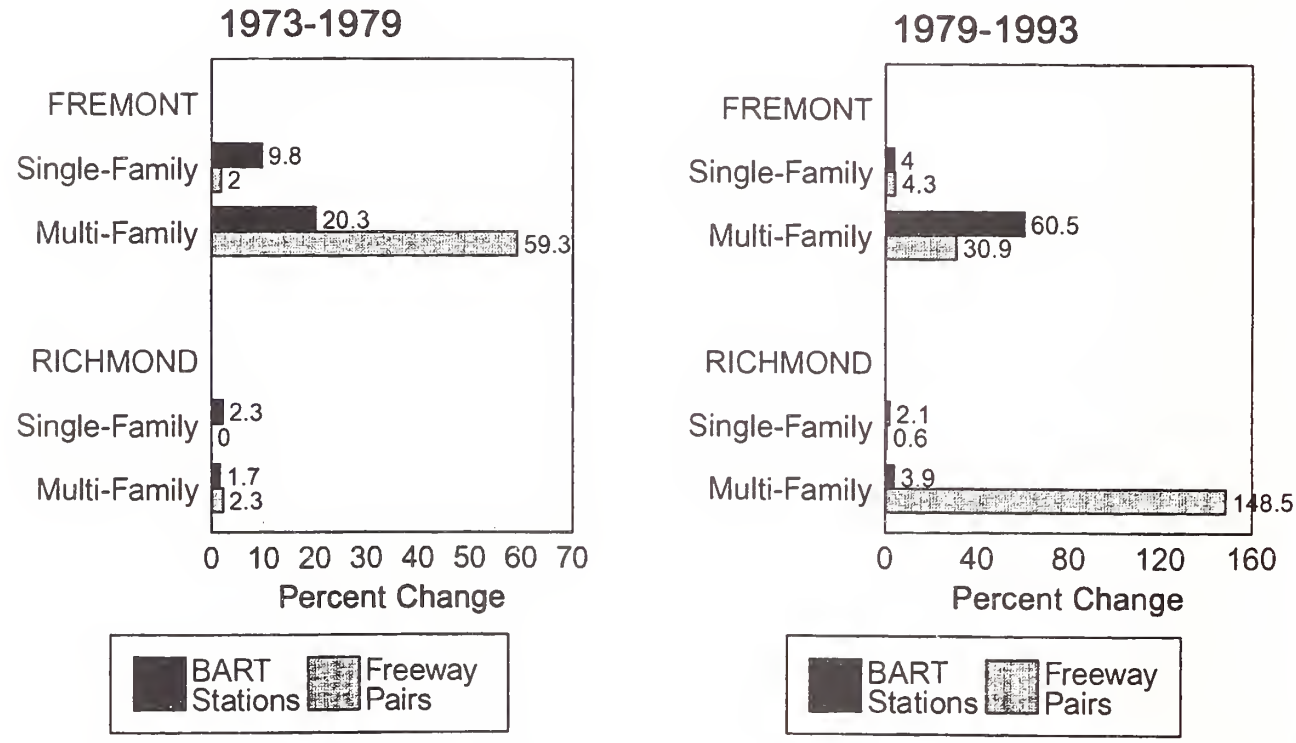


Figure 6.6. Percent Change in Residential Building Area, BART Stations vs. Freeway Pairs, Early- and Later-BART

settings. With a low initial base, even moderate levels of multi-family construction will register as very rapid increases. Figure 6.7 examines the absolute differences in residential building square footage for early- and later-BART years. In absolute terms, we see far more housing development occurred within the half-mile ring of BART stations than freeway pairs, especially in the early years. During 1979-1993, over 1.3 million more square footage of multi-family housing was built near BART stations on the Fremont line than near the I-880 interchanges. In Berkeley, however, more apartment and condominium square footage was added near the I-80 interchanges than near BART stations. As discussed in Chapter 12, this is partly attributable to the downzoning that occurred around the Ashby and North Berkeley stations in reaction to neighborhood concerns over densification.

Overall, around 2 million more square feet of housing was built within the one-half-mile ring of the seven BART stations studied than the seven paired freeway interchanges between 1973 and 1993. The most significant activity was multi-family housing construction near BART stations along the Fremont line.

In terms of non-residential development, Figure 6.8 shows a considerably faster growth rate along the Fremont corridor in early-BART. For later-BART, commercial-office-industrial square footage increased at a faster rate near Berkeley's stations than its freeway interchanges. In absolute terms, we see that over 400,000 more square feet of non-residential building space was added near the Fremont corridor stations during 1979-93, and over 200,000 more was added near the Berkeley stations (Figure 6.9).

6.4. Trends in Non-Residential Densities Among Matched Pairs

No strong patterns emerged in terms of non-residential F.A.R. differences among pairs (Figure 6.10). Only in the case of BART station areas along the Fremont corridor was there a noticeable decline in net densities. Elsewhere, densities have remained fairly constant over the past 30 years.

6.5. Matched-Pair Summary

In summary, the most significant differences were the far more rapid increases in multi-family housing construction and commercial-office-industrial development near BART stations in the later-BART period. While in relative growth terms, freeway interchanges held their own against BART stations; in absolute terms, however, far more building activity was occurring within the one-half-mile rings of BART stations than the one-half-mile rings of nearby freeway interchanges. Overall, BART stations gained 403,000 more sq. ft. of single-family space, 1.58 million more sq. ft. of multi-family housing, and 553,000 more sq. ft. of non-residential inventory from 1973 to 1993 than their freeway counterparts.

The remainder of this report summarizes the research findings for specific stations within each of the six corridors. These materials provide a far more micro-level perspective into land-use changes near BART stations over the 1965 to 1993 period.

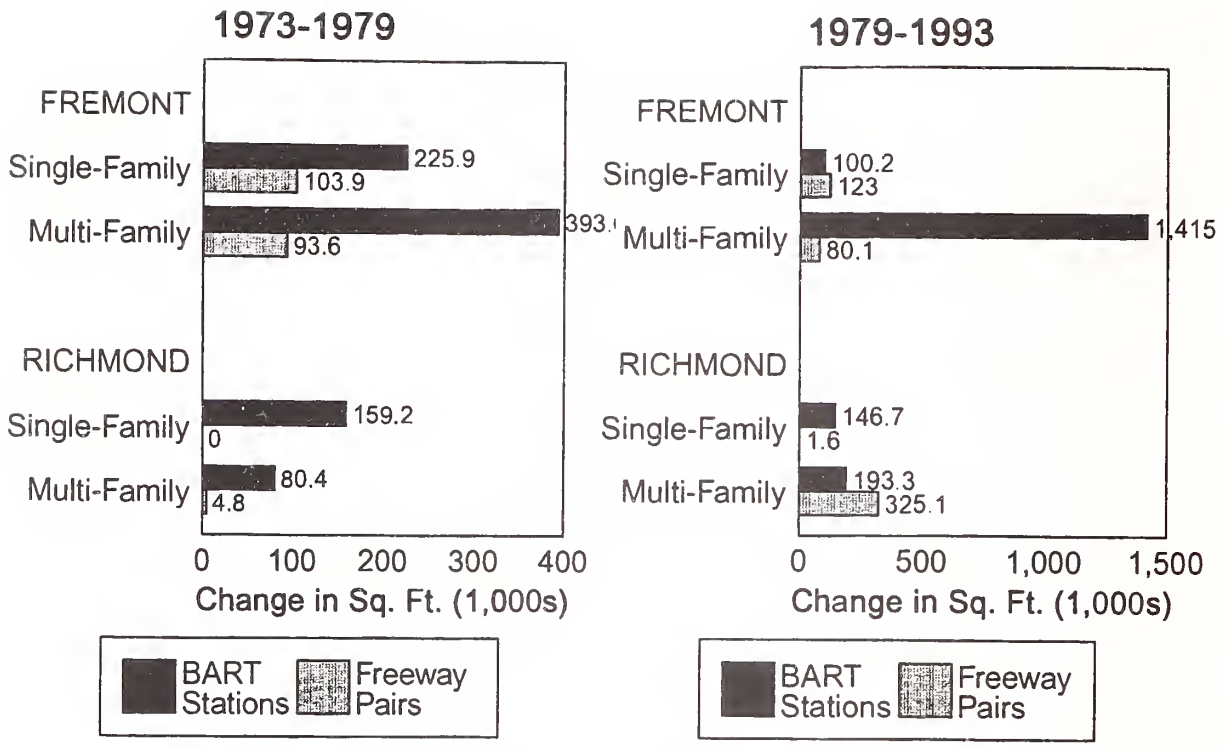


Figure 6.7. Absolute Change in Residential Building Area, BART Stations vs. Freeway Pairs, Early- and Later-BART

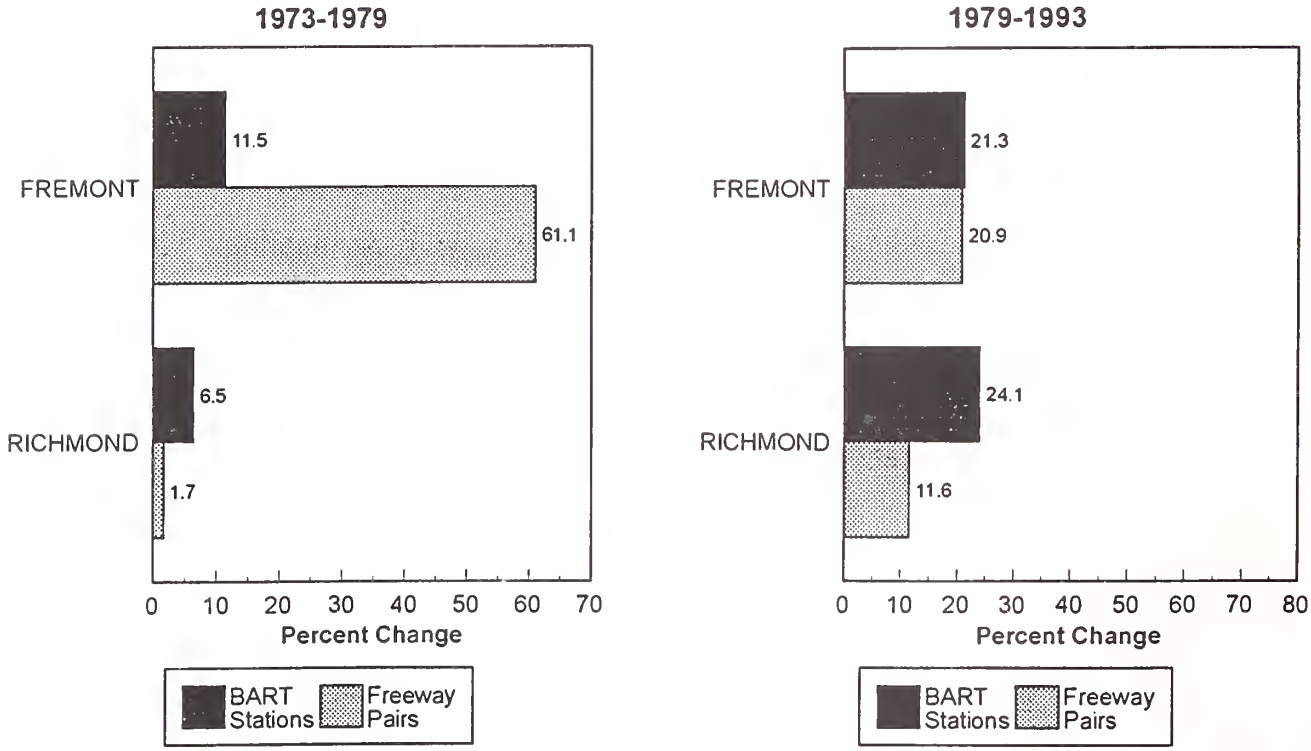


Figure 6.8. Percent Change in Non-Residential Building Area, BART Stations vs. Freeway Pairs, Early- and Later-BART

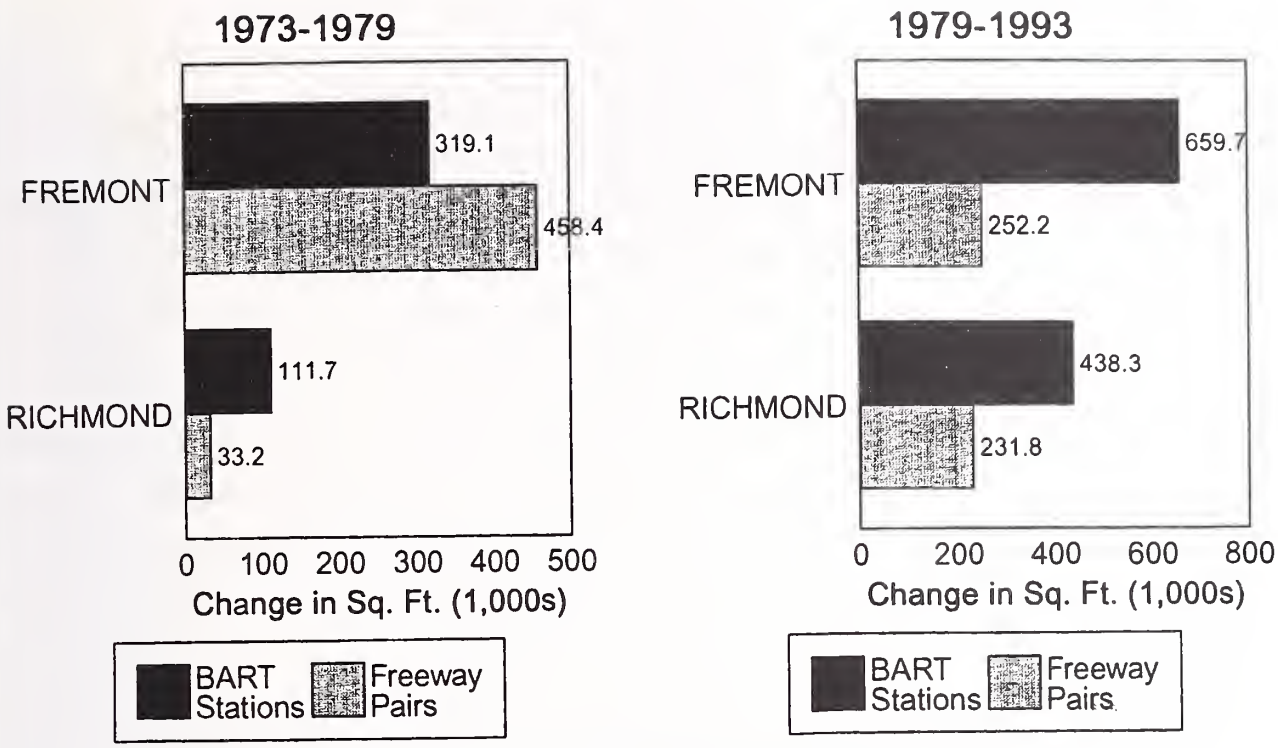


Figure 6.9. Absolute Change in Non-Residential Building Area, BART Stations vs. Freeway Pairs, Early- and Later-BART

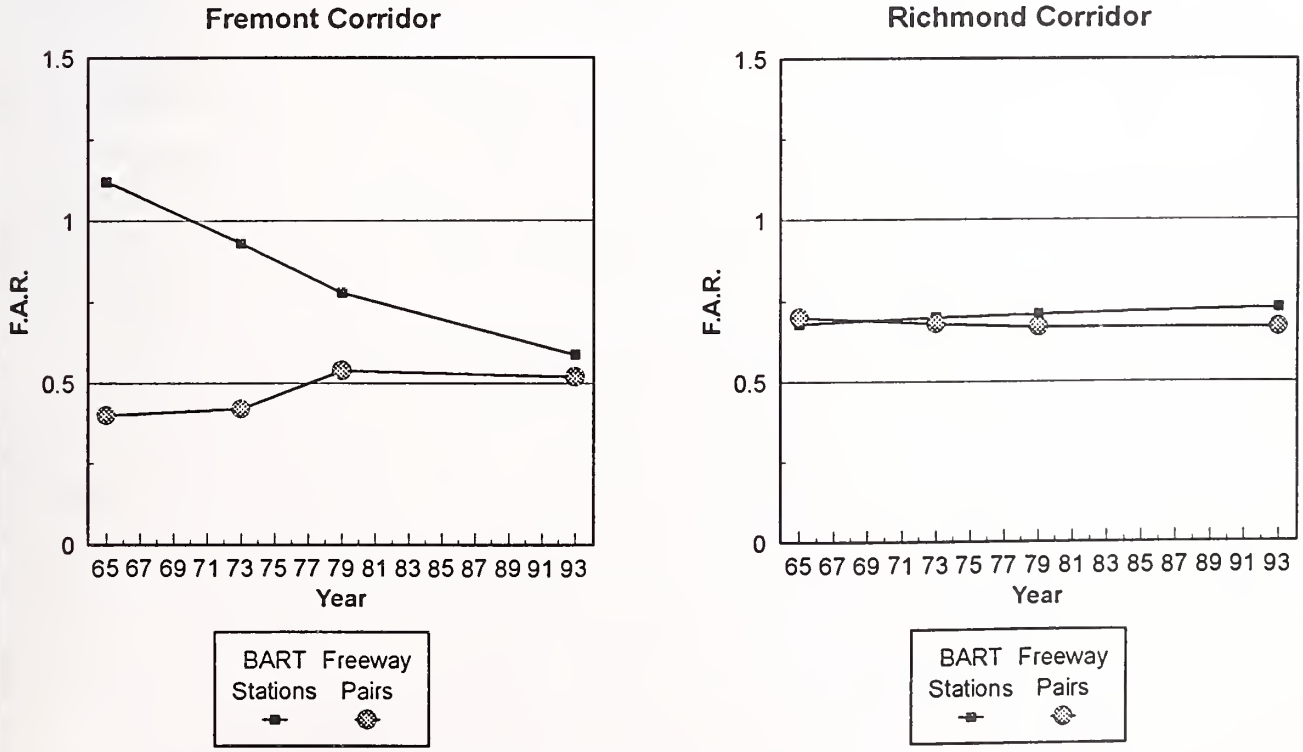


Figure 6.10. Floor Area Ratios for Commercial-Office Development Near BART Stations vs. Freeway Pairs, 1965-1993

Notes

[1]The total number of parcels examined from the TRW-REDI data base were: Fremont corridor – station area (residential = 6,215, non-residential = 990) and freeway area (residential = 6,067, non-residential = 203); Richmond corridor – station area (residential = 9,483, non-residential = 813) and freeway area (residential = 2,779, non-residential = 587). Thus, a total of 17,501 parcels near BART stations and 9,636 parcels near paired freeway interchanges were examined in carrying out this analysis.

CHAPTER SEVEN
Factors Influencing Land-Use Changes

What factors were most strongly associated with land-use changes that took place around stations during BART's first 20 years? Have factors like BART surface parking, land-use densities, and proximity to freeways been contributors or deterrents to land-use changes around stations? This chapter probes these questions using regression analysis to identify factors related to the built environment and transportation supply associated with station-area land-use changes.

The regression models presented in this chapter estimate the percent increases in building square footage during 1973 to 1993 within the catchments of the 25 surveyed stations for the following land use categories: multi-family residential, commercial, office, and non-residential. The non-residential category includes commercial, office, industrial, and institutional uses. All of the variables listed previously in Table 5.1 were candidate predictor variables for the models presented in this chapter. Because of high multi-collinearity among many candidate variables and for purposes of presenting more parsimonious model structures, only those variables with reasonably high partial correlations and coefficient signs consistent with expectations were included in the models shown. Some of the models presented are as noteworthy for the variables that did not enter the questions as for the ones that did. Because many factors other than those considered in this analysis have no doubt shaped land-use changes around BART stations, these models should not be viewed as fully specified predictor equations but rather as aids in furthering our understanding of the dynamics of land-use changes around BART over the past 20 years.

7.1 Multi-Family Residential Growth Rates

As already noted, most housing development that has occurred around BART stations to date has involved the construction of apartments and condominium units. Relatively few single-family houses have been built. Accordingly, among residential uses, this section presents a model for predicting multi-family building activities only.

Table 7.1 lists four variables that, in combination, were the strongest predictors of the percent change in multi-family building floorspace within BART station catchments for the 1973 to 1993 period. The model suggests that multi-family housing additions tended to occur in settings with relatively high residential densities (as recorded in 1990). This could reflect the tendency for apartment and condo builders to concentrate construction in station areas that were already moderately dense because of more receptive zoning and the greater likelihood of community acceptance. Residents of several established low-density residential areas, like Rockridge and North Berkeley, strongly opposed proposed apartment and condominium projects, and pressured city officials to enact building moratoria.[1]

Table 7.1 also suggests that multi-family housing construction increased most rapidly in settings with more mixed land uses. That is, having retail shops, offices, and other activities nearby (as measured

Table 7.1. Regression Model for Predicting Multi-Family Residential Growth Rates Around BART Stations, 1973-1993

Dependent Variable: Percent Change in Multi-Family Residential Building Floorspace Within BART Station Catchments,[1] 1973-1993

Variable:	Coefficient	Standard Error	Probability
Dwelling units per acre within station catchment, 1990	9.049	6.938	.194
Park-and-ride spaces at station, 1993	0.172	0.049	.003
Distance of the nearest freeway to the station: 1=0-0.5 miles, 2=0.5-1.0miles, 3=1.0-2.0 miles, 4= >2.0 miles.	97.557	31.203	.007
Entropy index of land-use mixture within station catchment[2]	667.928	287.786	.035
Constant	-828.309	255.739	.006

Summary Statistics:

R^2 = .600
F = 5.62, prob. = .006
No. of cases = 25

Notes:
[1]Catchment area equals a one-half mile radius from stations except for downtown San Francisco, Oakland, and Berkeley stations. For these downtown stations, catchments are one-quarter mile in radius.
[2]Entropy = $\{\Sigma_i[p_i * \ln(p_i)]\}/\ln(k)$ where p_i = proportion of land area in land-use category i, and k - number of land-use categories. Ranges between 0 and 1, where 0 signifies land devoted to a single use and 1 signifies land area evenly spread among all uses.

in 1990) increased the rate of multi-family housing additions in a station area. Thus, station areas with relatively high residential densities as well as mixed land uses generally witnessed the most apartment and condominium additions. This is another way of saying that apartments and condominiums were most accepted in neighborhoods that were not established, single-family neighbhorhoods.

Interestingly, Table 7.1 reveals that parking-and-ride supplies were not deterrents to multi-family housing development around BART stations. In fact, every 1,000 increase in parking spaces was associated with a 172 percent increase in multi-family housing additions over the 1973 to 1993 period, holding all other factors constant. Also interesting is the finding that distance to the nearest freeway was associated with a higher rate of multi-family housing construction.

Overall, Table 7.1 suggests that multi-family housing development tended to occur in relatively dense, mixed-use station areas with high parking supplies that are not immediately close to freeway interchanges. One inference is that this describes the kind of physical setting where less community opposition to mid-rise apartment and condomium towers might be expected.

7.2 Office Growth Rates

As noted in Chapter Four, far more office space has been added around BART stations than any other land use. Table 7.2 indicates that office construction was most active in station areas with relatively

Table 7.2. Regression Model for Predicting Office Growth Rates Around BART Stations, 1973-1993

Dependent Variable: Percent Change in Office Building Floorspace Within BART Station Catchments,[1] 1973-1993

Variable:	Coefficient	Standard Error	Probability
Employees per acre within station catchment, 1990	16.082	5.634	.013
Vacant land as a share of total area within station catchment, 1990: 1 = < 10%, 2 = 10-25%, 3 = > 25%	789.454	184.507	.001
Park-and-ride spaces at station, 1993	0.736	0.169	.001
Terminal or near-terminal station (0 = no, 1-yes)[2]	-1239.479	352.439	.003
BART commutes as a percent of total commute trips made by employed-residents living within station catchment, 1990	106.901	26.194	.001
Constant	-2512.740	446.645	.000

Summary Statistics

R^2 = .785
F = 10.27, prob. = .000
No. of cases = 25

Notes
[1]Catchment area equals a one-half mile radius from stations except for downtown San Francisco, Oakland, and Berkeley stations. For these downtown stations, catchments are one-quarter mile in radius.
[2]Near-terminal represents stations toward the end of the line that function like terminals because they are closer to freeways than actual terminals and thus serve a larger catchment area. BART's near-terminal stations, El Cerrito del Norte and Pleasant Hill, have larger supplies of parking than terminal stations since they are easier to reach by freeway.

high supplies of vacant land and park-and-ride spaces. Vacant, developable land is usually a necessary, though certainly not sufficient, precondition for office development to occur around transit stations. Park-and-ride supplies could attract office development by creating buffer spaces (as well as possibly overflow parking opportunities). More likely, however, parking supply serves as a proxy for relatively low residential density environments, settings where some of the greatest percentage increases in office space have been registered (e.g., Walnut Creek, Pleasant Hill).

Table 7.2 also reveals that office floorspace was added most rapidly in settings with relatively high employment densities (in 1990), high shares of employed-residents who commute by BART, and non terminal (or near-terminal) stations. Having high employment densities could reflect more permissible zoning and a receptive local attitude to office additions; however, this could also simply be a tautological relationship (e.g., rapid office growth created higher employment densities). The model shows that office development was relatively slow around terminal or near-terminal stations, controlling for factors like parking supplies; this could reflect the perception that station areas with numerous cars accessing and egressing park-and-ride lots during the a.m. and p.m. peaks are not attractive for siting office buildings.

7.3 Commercial Growth Rates

Table 7.3 indicates that floorspace for retail shops and other commercial ventures increased most rapidly in settings where a redevelopment district was formed and where major freeways are relatively far away. All else being equal, having a redevelopment district increased the amount of building floorspace devoted to retail-commercial uses by around 300 percent during the 1973 to 1993 period. BART stations which today lie within redevelopment districts are Oakland City Center, San Leandro, Hayward, Union City, Pleasant Hill, Concord, Richmond, El Cerrito del Norte, and El Cerrito Center. Through assistance with land assemblege and tax increment financing of infrastructure improvements, redevelopment authorities have attracted commercial uses in many of these station areas.

Table 7.3. Regression Model for Predicting Commercial Growth Rates Around BART Stations, 1973-1993

Dependent Variable: Percent Change in Commercial Building Floorspace Within BART Station Catchments,[1] 1973-1993

Variable:	Coefficient	Standard Error	Probability
Redevelopment District encompasses station (0=no, 1=yes)	301.475	137.772	.043
Distance of the nearest freeway to the station: 1=0-0.5 miles, 2=0.5-1.0miles, 3=1.0-2.0 miles, 4=>2.0 miles.	109.684	62.519	.098
Constant	-260.426	175.041	.071

Summary Statistics

R^2 = .340
F = 2.74, prob. = .077
No. of cases = 25

Notes
[1]Catchment area equals a one-half mile radius from stations except for downtown San Francisco, Oakland, and Berkeley stations. For these downtown stations, catchments are one-quarter mile in radius.

7.4 Non-Residential Growth Rates

A final regression model, shown in Table 7.4, was estimated for all non-residential land uses combined: office, commercial, industrial, and institutional (excluding government activities). Accordingly, some of the relationships shown previously in Sections 7.2 and 7.3 are nested in this model. (Separate regressions for industrial and institutional land uses were not estimated since many station areas had none of these uses.) The non-residential model presented incorporates all of the variables presented in Tables 7.2 and 7.3, and sheds light on the factors associated with the growth of building space other than for residential uses.

Consistent with earlier findings, Table 7.4 reveals that non-residential building activities increased the fastest in station areas with relatively high: supplies of vacant land, employment densities,

Table 7.4. Regression Model for Predicting Non-Residential Growth Rates Around BART Stations, 1973-1993

Dependent Variable: Percent Change in Non-Residential Building Floorspace Within BART Station Catchments,[1] 1973-1993

Variable:	Coefficient	Standard Error	Probability
Employees per acre within station catchment, 1990	5.644	2.853	.067
Vacant land as a share of total area within station catchment, 1990: 1 = < 10%, 2 = 10-25%, 3 = > 25%.	243.585	87.618	.014
Park-and-ride spaces at station, 1993	0.312	.085	.003
Terminal or near-terminal station (0=no, 1-yes)[2]	-335.596	165.727	.062
Distance of the nearest freeway to the station: 1=0-0.5 miles, 2=0.5-1.0miles, 3=1.0-2.0 miles, 4= >2.0 miles.	75.871	46.733	.126
Constant	-684.009	187.466	.002

Summary Statistics

R^2 = .678
F = 5.90, prob. = .004
No. of cases = 25

Notes
[1]Catchment area equals a one-half mile radius from stations except for downtown San Francisco, Oakland, and Berkeley stations. For these downtown stations, catchments are one-quarter mile in radius.
[2]Near-terminal represents stations toward the end of the line that function like terminals because they are closer to freeways than actual terminals and thus serve a larger catchment area. BART's near-terminal stations, El Cerrito del Norte and Pleasant Hill,have larger supplies of parking than terminal stations since they are easier to reach by freeway.

and park-and-ride spaces. Being a terminal station or relatively near a freeway, on the other hand, were associated with lower growth rates in non-residential floorspace.

7.5 Conclusion

The findings of this chapter are summarized in Table 7.5. This table converts regression coefficients into midpoint elasticities by using the mean values for dependent and independent variables for the models presented. By summarizing the results in elasticity form it is possible to gauge the relative sensitivity of land use changes to the predictor variables.

Overall, Table 7.5 reveals fairly elastic relationships — that is, building activities around BART stations tended to be highly sensitive to factors like degrees of land-use mixture, shares of vacant land, and supplies of park-and-ride facilities. Growth in floorspace was generally less sensitive to factors like land-use densities and whether stations were terminals (or near terminals). Additionally, residential uses were generally more sensitive to changes in these factors than were non-residential uses.

Table 7.5. Midpoint Elasticities of 1973-1993 Land-Use Growth Rates in BART Station Catchments as Functions of Characteristics of the Built Environment and Other Variables

	LAND USE CATEGORIES			
	Multi-Family Residential	Office	Commercial	Non-Residential
Built Environment & Policy Variables:				
Employees per acre	—	.672	—	.491
Dwelling units per acre	.888	—	—	—
Entropy index of land-use mixture	2.760	—	—	—
Vacant land as a share of total land area	—	2.362	—	—
Redevelopment district	—	—	1.136	—
Transportation Supply & Demand Variables:				
Park-and-ride spaces at station	1.891	1.587	—	1.381
Terminal or near-terminal station	—	-1.131	—	-0.637
Distance of nearest freeway to the station	1.535	—	1.422	0.873
Percent commute trips by BART among employed residents	—	2.151	—	—

It is important to note that many policy-related variables that were considered for this analysis, such as identified in Table 5.1, did not emerge as significant predictors. For example, the siting of a station in a freeway median was not associated with any lowering in the rate of building activities around stations, as some analysts have postulated. Variables indicating whether or not any form of incentive zoning (e.g., density bonuses) or restrictive zoning (e.g., downzoning of densities) was enacted around a station during the 1973 to 1993 period also did not enter any of the equations as significant predictors. The existence of a redevelopment district had a bearing on the growth in building floorspace only for commercial uses.

The remainder of this report summarizes the research findings for specific stations within each of the six corridors (identified previously in Map 4.1). These materials provide a far more micro-level perspective into land-use changes near BART stations over the 1965 to 1993 period.

Note

[1]The association of multi-family building increases with 1990 residential densities could also be tautilogical. That is, station areas with relatively rapid growth in multi-family floorspace from 1973 to 1993 could very well have achieved relatively high residential densities by 1990. However, rapid growth in apartment and condominium shares does not necessarily mean high average residential densities; this might be the case when there were virtually no apartments or condominiums in the 1973 base year. More likely, fairly rapid increases in multi-family housing construction reflected a more receptive neighborhood environment for densification.

CHAPTER EIGHT
Land-Use Changes in Downtown San Francisco

By far, of all the commercial and office inventory built near BART over the past two decades, the lion's share has been added around the four downtown San Francisco subway stations — Embarcadero, Montgomery, Powell, and Civic Center. BART, in and of itself, might not have been a sufficient or decisive factor in triggering this growth; however, its presence as a connector to the East Bay and peninsula was without question a necessary precondition to the tremendous building activities that occurred.

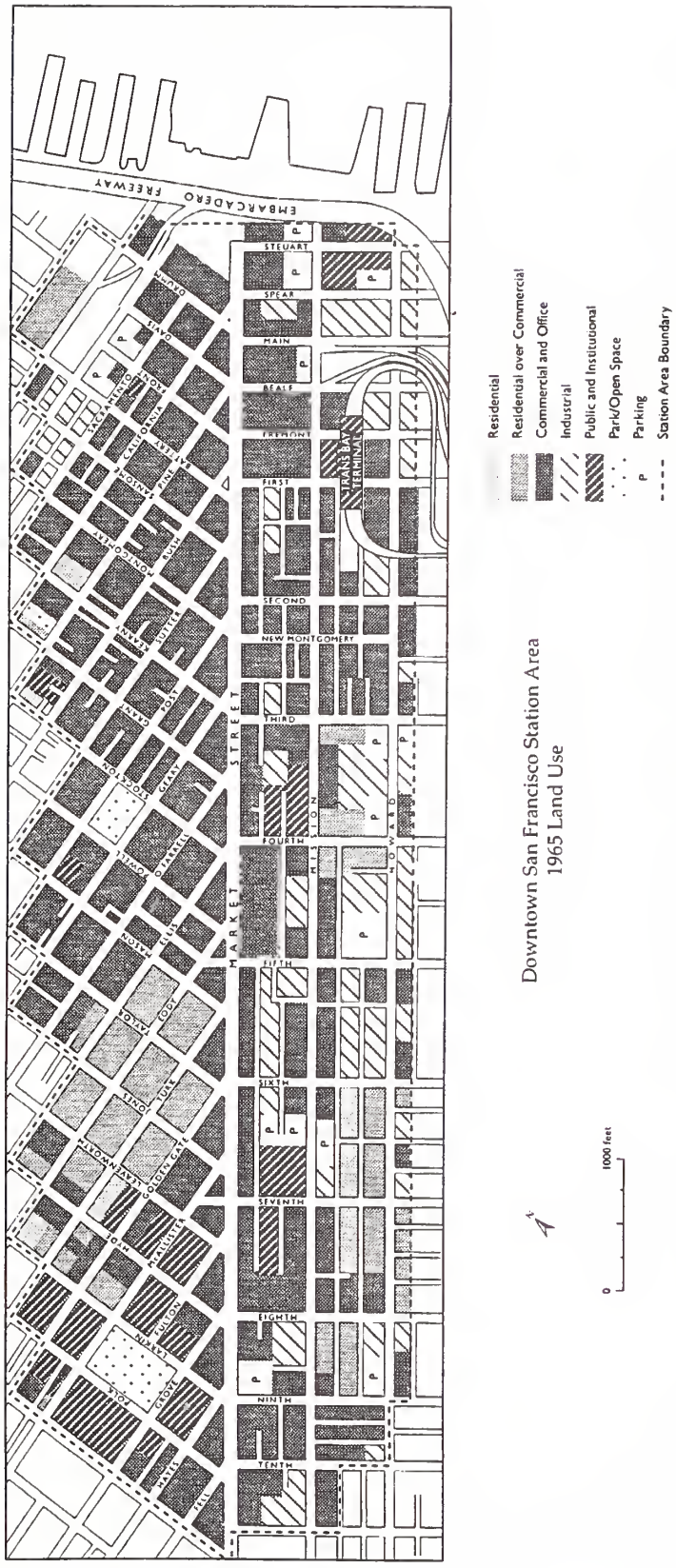
Map 8.1 shows the land uses along the Market Street corridor in downtown San Francisco in 1965, eight years prior to BART's opening. Land uses are plotted for approximately a one-quarter-mile band north and south of Market Street. Toward the eastern end of Market Street, commercial and office development was dominant in 1965. Farther west, land uses were more varied, and included substantial blocks of mid-rise housing and institutional uses.

Between 1965 and 1977, little new development occurred adjacent to BART, the notable exception being the addition of the Embarcadero shopping complex near the Embarcadero station (Map 8.2). Rather, commercial-office development tended to occur several blocks away from the Embarcadero station during this pre-BART/early-BART period. In terms of land coverage, the most noticeable change from 1965 to 1977 was the creation of parking lots, especially south of Market. This was partly attributable to the slow-down in the downtown office real estate market, prompting owners to convert land that had been slated for office towers to surface parking lots for revenue generation purposes.

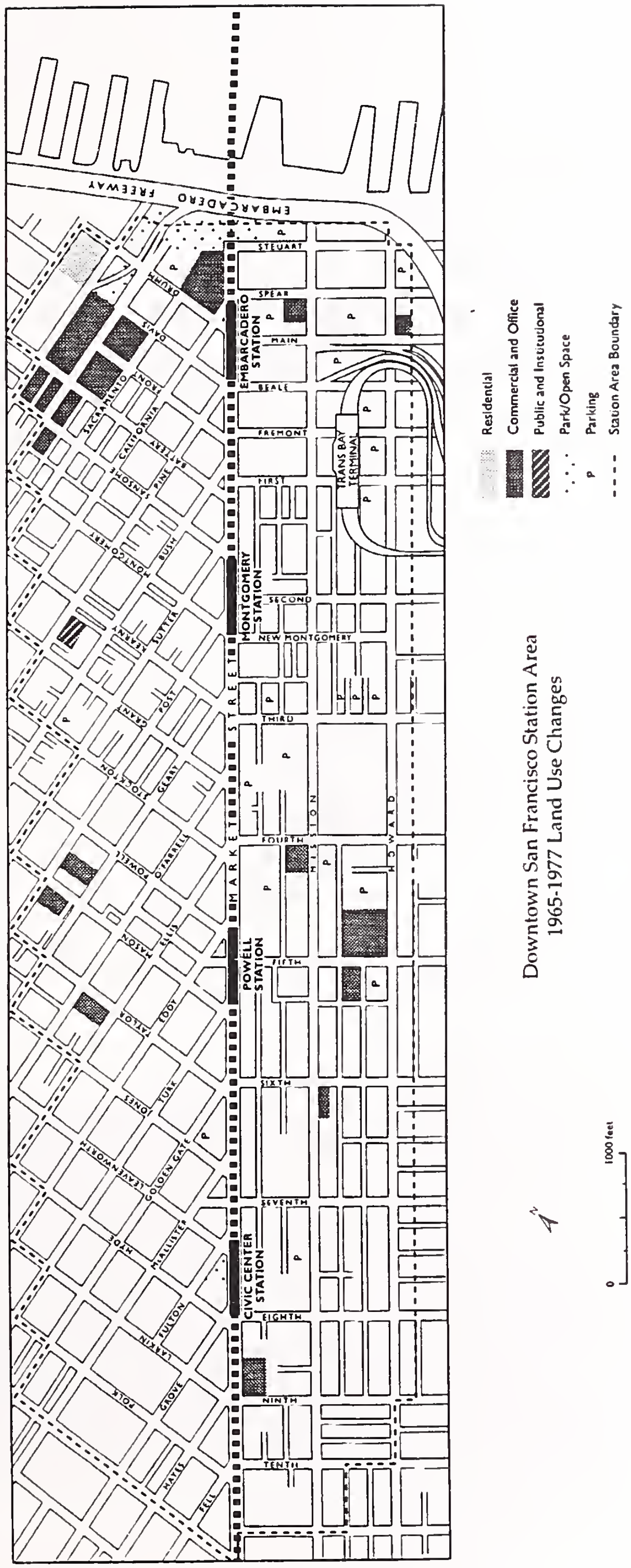
Since 1977, Map 8.3 reveals there has been far more building activity along Market Street within the vicinity of the Embarcadero, Montgomery, and Powell stations. The most significant consumer of land has been the Moscone Center, a convention complex built south of Market between the Montgomery and Powell stations. This map, it should be noted, indicates only new buildings erected during this era. There were also significant land-use changes within older structures, new tenant occupancies, and building renovations throughout this period that are not reflected by the map. An example was the opening of the San Francisco Shopping Centre adjacent to BART's busiest station, Powell. The four-story structure was converted to the shopping center in 1989, and contains over one million square feet of retail space, two large anchor tenants, and a number of specialty stores.

8.1. Residential Development in Downtown San Francisco

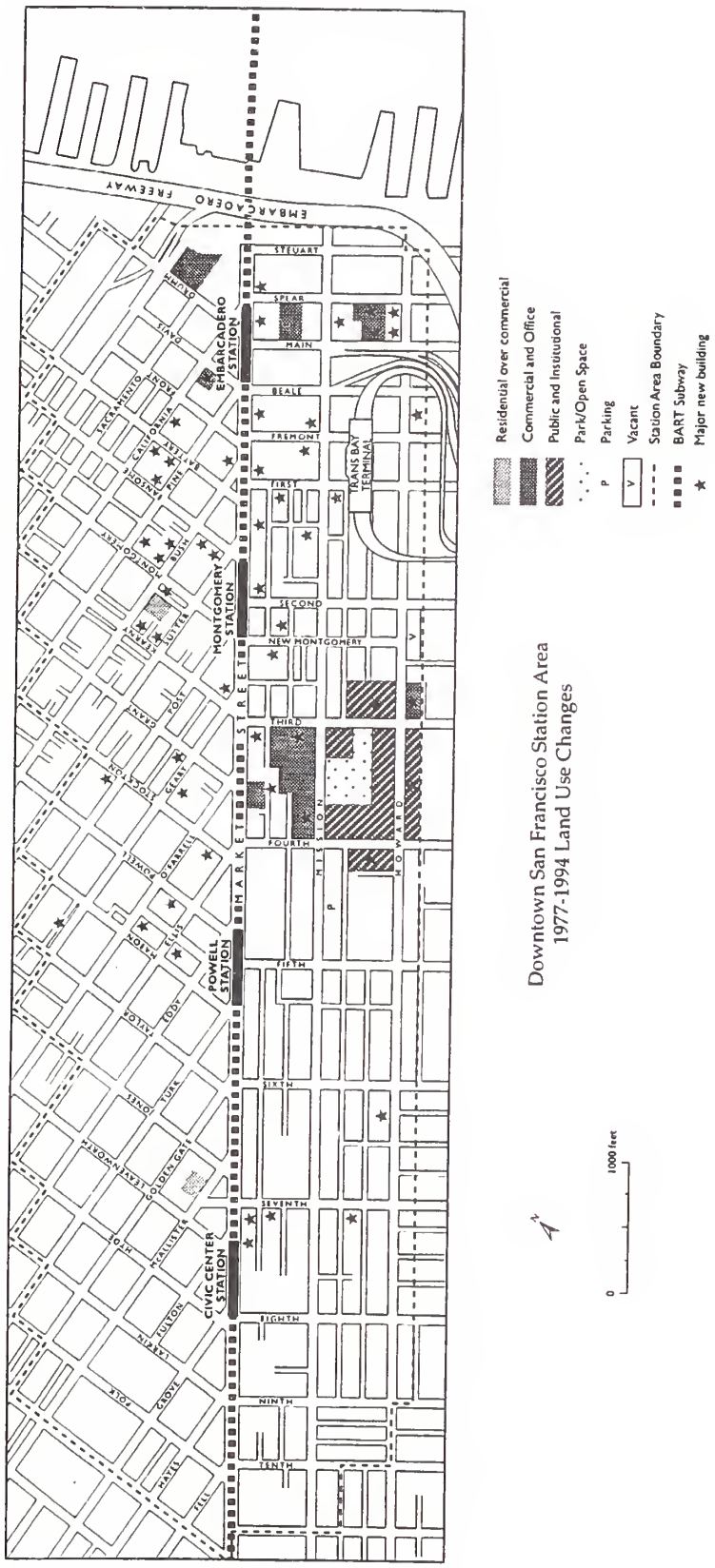
The vintage models for downtown San Francisco indicate relatively little housing additions over the 1965-1993 period. There was no residential construction in the several years before and after the introduction of BART (Figure 8.1). What residential development did occur was almost exclusively apartments and condomiums (Figure 8.2). The most significant housing additions occurred in the mid-to-late 1980s, when nearly a half million square feet of multi-family space was constructed. Among the projects



Map 8.1. Downtown San Francisco Station Area 1965 Land Use



Map 8.2. Downtown San Francisco Station Area
1965-1977 Land Use Changes



Map 8.3. Downtown San Francisco Station Area 1977-1994 Land Use Changes

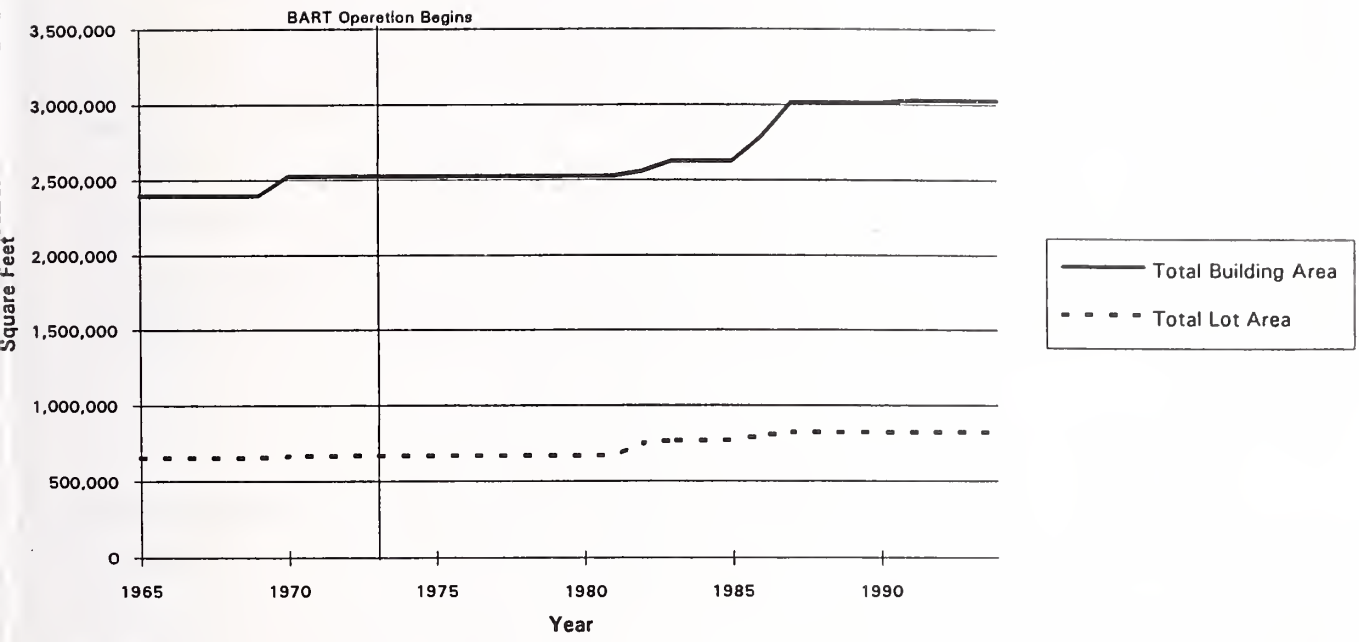


Figure 8.1. San Francisco Downtown Residential Vintage Model (Since 1965)

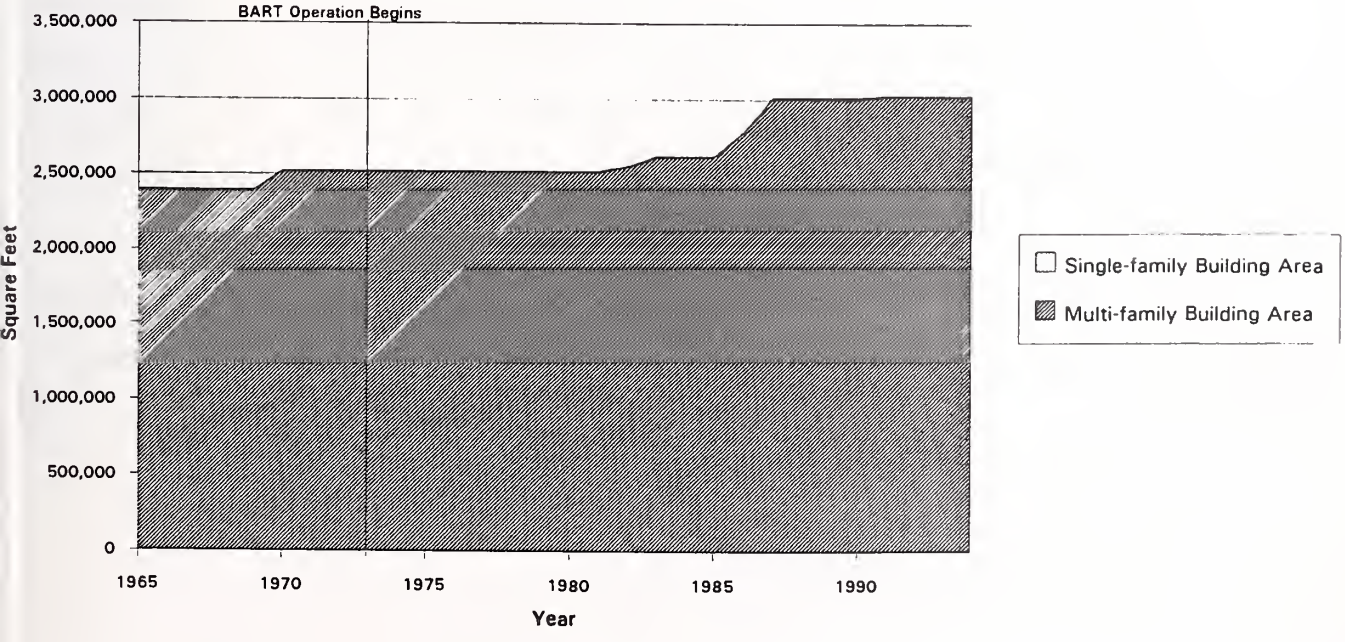


Figure 8.2. San Francisco Downtown Residential Vintage Model (Since 1965)

built were: a 62,000-square-foot apartment building at 302 Eddy Street (1983); an 85,000-square-foot apartment building at 477 O'Farrell Street (1986); a 90,300-square-foot apartment building at 440 Turk Street (1987); a 70,000-square-foot condominium with ground-floor retail on Pine Street (1987); and a 65,000-square-foot condominium at 333 Bush Street (1987). By far, the largest multi-unit housing additions near downtown San Francisco has been the new-town/in-town project, Yerba Buena, adding several thousand moderately dense (2- to 3-story) units three-quarter-miles south of Market Street, beyond the one-quarter-mile catchment defined in this study for downtown stations. Most important to the siting of this project was the availability of redevelopable land, though proximity to BART as well as the I-80 freeway was viewed by project developers as a market asset.

8.2. Non-Residential Development in Downtown San Francisco

The Market Street corridor has experienced healthy increases in office, commercial, and mixed-use development both prior to and some 15 years after BART's opening (Figure 8.3). Growth leveled off in the late 1980s, mainly because of the region's economic downturn and a saturated office market. Between 1973 and the late 1980s, around 28 million square feet of office floorspace (Figure 8.4) was built and 1.5 million square feet of land was consumed for office construction (Figure 8.5) along the Market Street corridor. Net Floor Area Ratios (F.A.R.s) rose from 4.2 in 1965 to 7.0 in the early 1990s (Figure 8.6). Thus, the bulk of office development that took place during the BART years consisted of high-rise office towers. Some of the large office structures built after the introduction of BART were:

- One Market Plaza (1,646,000 sq. ft.) in 1976
- Bank of America Data Processing Center at 1455 Market (1,038,000 sq. ft.) in 1977
- Bechtel Building at 333 Market/Fremont (1,184,000 sq. ft.) in 1979
- 101 California (1,350,000 sq. ft.) in 1982
- Four Embarcadero Center (840,000 sq. ft.) in 1982
- Five Fremont Center (791,000 sq. ft.) in 1983
- 50 Fremont Street (756,000 sq. ft.) in 1985
- 275 Battery Street (611,000 sq. ft.) in 1985
- One Sansome Street (606,700 sq. ft.) in 1983

While there were many other office structures built in the second half of the 1980s, most of them were under a half million square feet in floor area, and provided spec space as opposed to built-to-suit facilities, such as:

- 100 First Street (396,000 sq ft.) in 1988
- 123 Mission Street (345,000 sq. ft.) in 1987
- 71 Stevens Street (335,000 sq. ft.) in 1986
- 235 Pine Street (148,000 sq ft.) in 1991
- 1145 Market Street (137,000 sq. ft.) in 1990
- 49 Stevenson Street (109,000 sq. ft.) in 1989

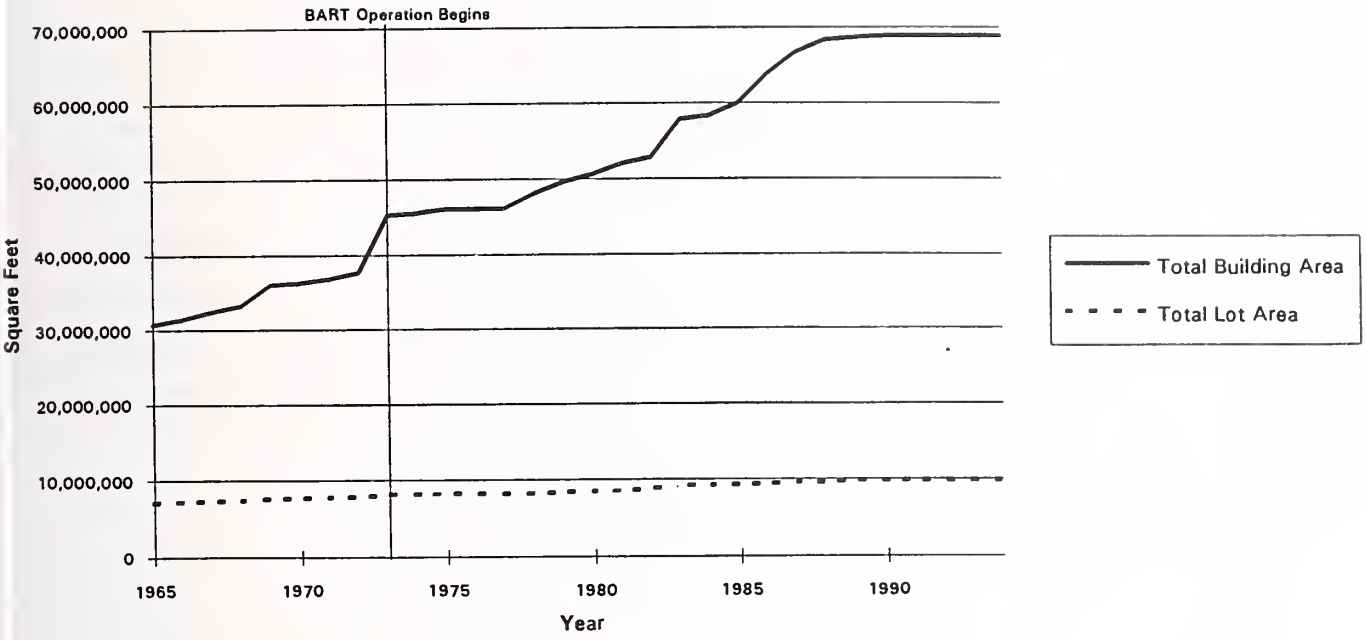


Figure 8.3. San Francisco Downtown Non-Residential Vintage Model (Since 1965)

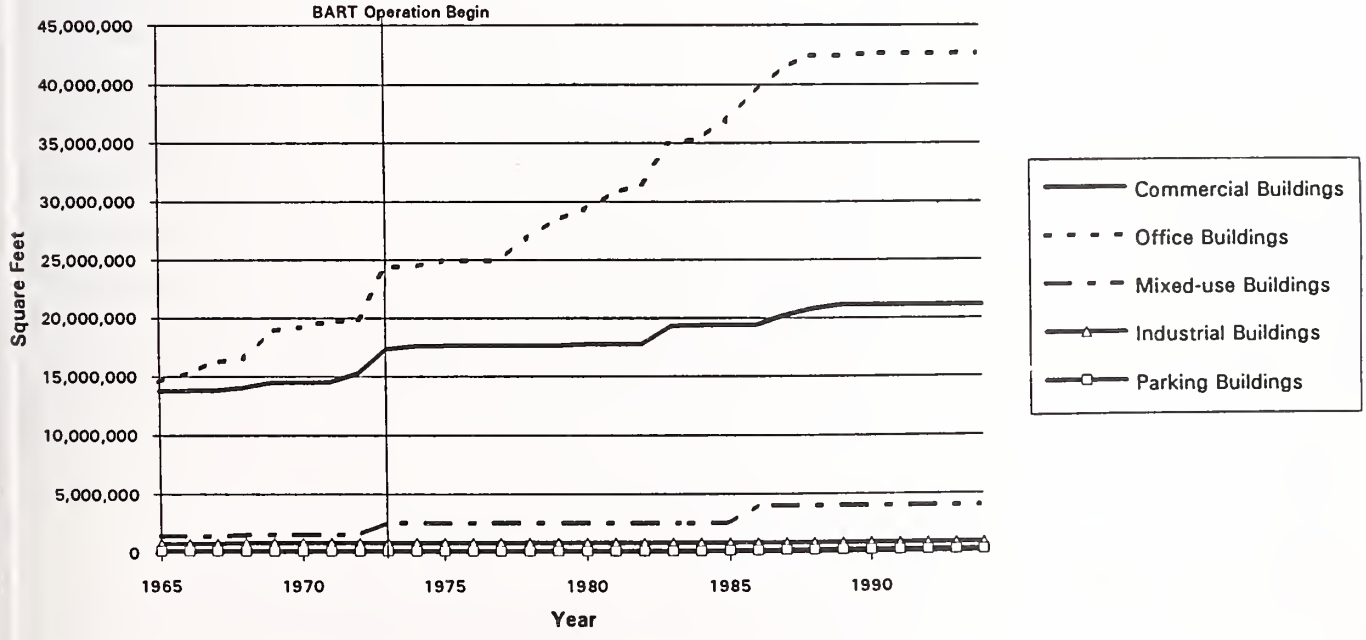


Figure 8.4. San Francisco Downtown Non-Residential Vintage Model (Since 1965)

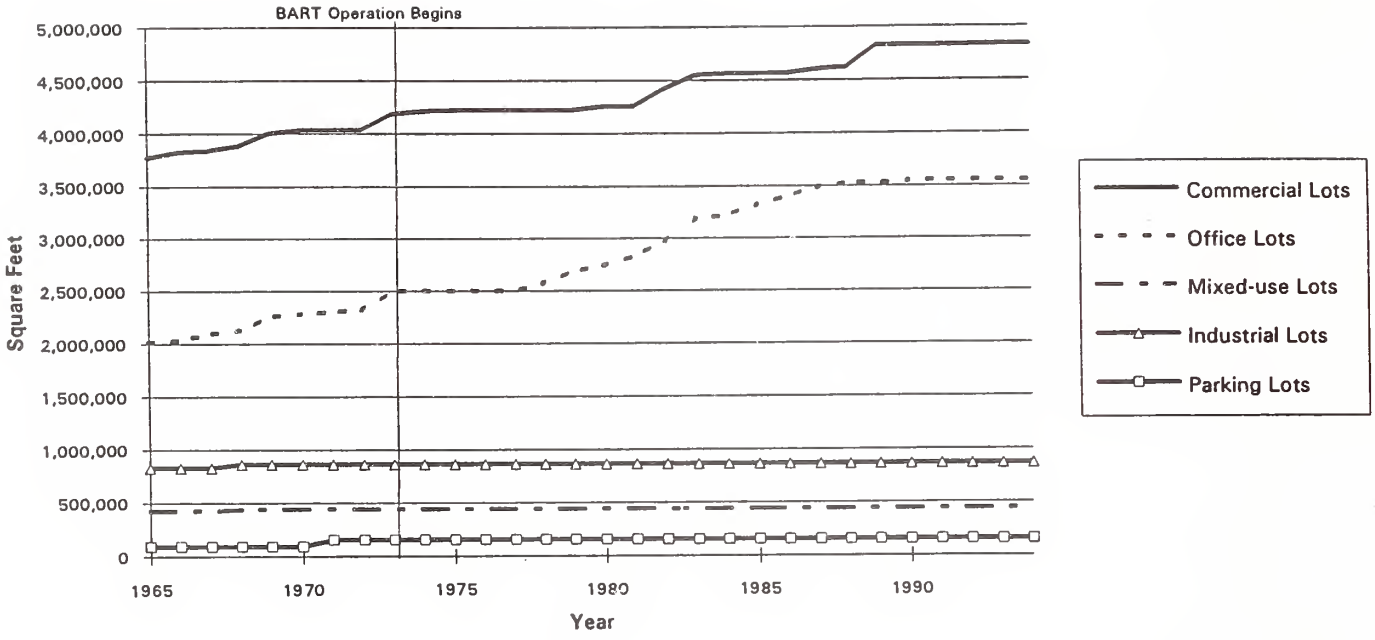


Figure 8.5. San Francisco Downtown Non-Residential Vintage Model (Since 1965)

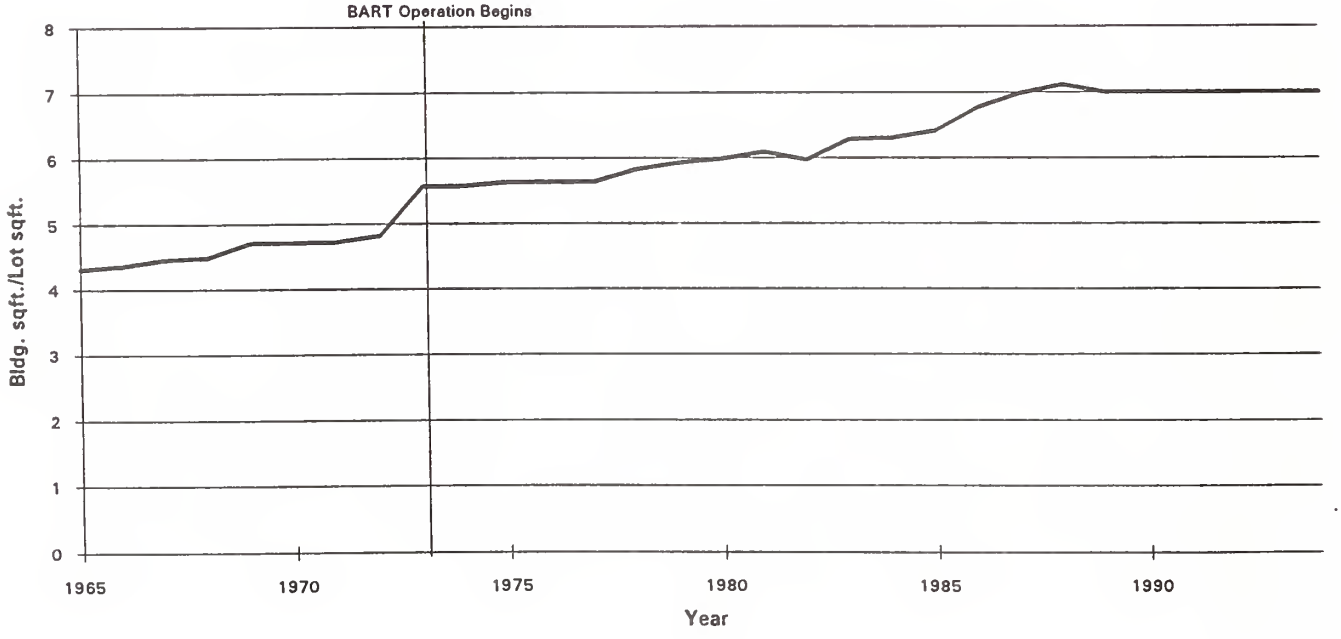


Figure 8.6. San Francisco Downtown Non-Residential F.A.R. Vintage Model (Since 1965)

8.3. Overall Changes in Land Use Composition

The increasing dominance of office development along the downtown San Francisco BART corridor is revealed by Figure 8.7. In 1965, offices constituted 45 percent of building area in the BART catchments. By 1993, this share had risen to 60 percent. Retail-commercial ventures, on the hand, made up only 29 percent of building space in 1993, down from 42 percent prior to BART's opening.

8.4. Summary

Downtown San Francisco has been the recipient of the most significant amount of commercial-office development along the BART system. Since 1973, more than twice as much office space was added near the four downtown BART stations as near the other 30 BART stations put together.

The exact role BART played in attracting this development is unknown. It was likely one of many factors that helped downtown San Francisco maintain its pre-eminence as region's office and financial center over the past 20 years; other contributing factors include San Francisco's emergence as an international finance center, agglomeration and urbanization economies, cultural attractions, and supportive public policies (e.g., tax increment financing, density bonuses) that helped leverage private investment. Regardless, it is unlikely that 28 million square feet of office space built since BART's 1973 opening could have been accommodated without a regional rail network. Because the San Francisco-Oakland Bay Bridge is filled to capacity during rush hours, the estimated 80,000 jobs added to downtown San Francisco since 1970 could not have been accommodated without the high-capacity access provided by BART.[1] According to the 1990 journey-to-work census (CTTP — Part II), 46 percent of workers in the census tracts surrounding the Embarcadero and Montgomery stations commuted to work by rail transit. If three-quarters of the new workers added to downtown San Francisco since 1970 drove their cars instead, this would have added over 28,000 automobiles to the bridges and roads leading into downtown San Francisco. During rush hours, these facilities would struggle to accommodate even a fraction of this additional traffic. More likely, nowhere near the amount of employment growth that took place would have been possible without BART. While BART might not have not been the decisive factor influencing downtown office and retail construction over the past 20 years, BART's presence was unquestionably a vital and necessary pre-condition for much of the growth that did occur.

Note

[1]These job additions are the four census tracts encompassing the Market Street corridor, an area which is roughly three times the size as the quarter-mile catchment zone used in this analysis.

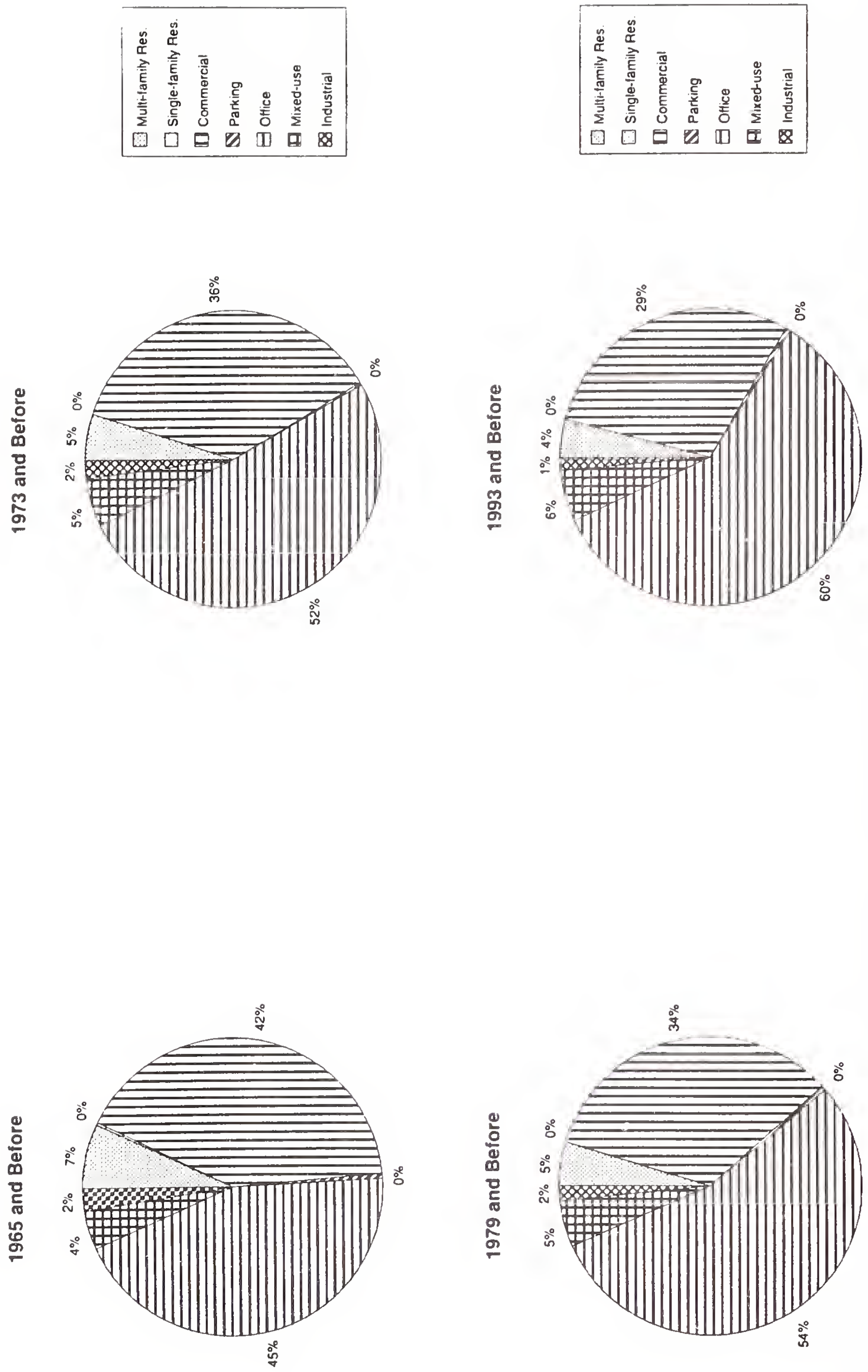


Figure 8.7. San Francisco Downtown Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 4 Downtown Station Areas)

CHAPTER NINE
Land-Use Changes in the Daly City Corridor

9.1. Mission District

Prior to BART, Map 9.1 shows the Mission District had a mixture of retail uses aligned along the area's main street, Mission Street, surrounded by housing and institutional uses. Relatively little land use changes occurred in the Mission District, one of the most ethnically diverse communities in San Francisco, during the five-year window before and after BART's opening (Map 9.2). Around the 16th Street underground station, more land was cleared than built upon. During the 1977-1994 period, several retail shops and restaurants were constructed near the 24th Street subway station (Map 9.3).

At least one reason for the sluggish growth in the Mission District was the downzoning and enactment of building height limits soon after the 1973 opening of the area's two BART stations. Concerned over worsening traffic congestion and high-rise development, local citizens successfully blocked several proposed apartment and mixed-use proposals near the 16th and 24th Street stations and pressured planning officials to lower permissable densities.

9.2. Mission-16th Street Station

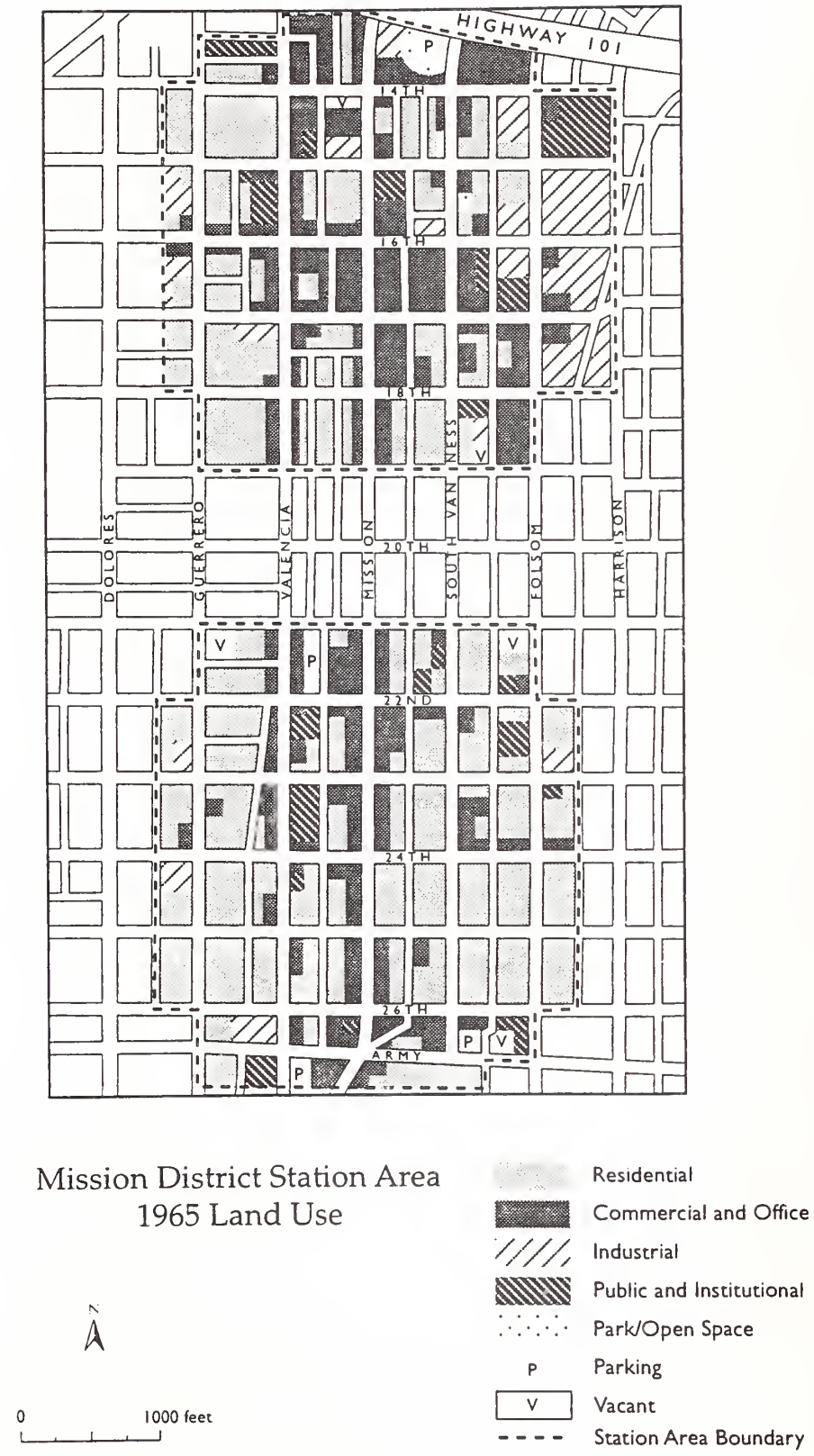
The half-mile ring around the Mission-16th Street station has experienced little residential (Figures 9.1 and 9.2) or non-residential development (Figure 9.3) over the last two decades. Around 320,000 square feet of multi-family floorspace (or about 13 percent of the area's current stock) was added since BART's opening. Because of building demolitions, net commercial-office F.A.R.s have fallen slightly over the past 30 years (Figure 9.4).

9.3. Mission-24th Street Station

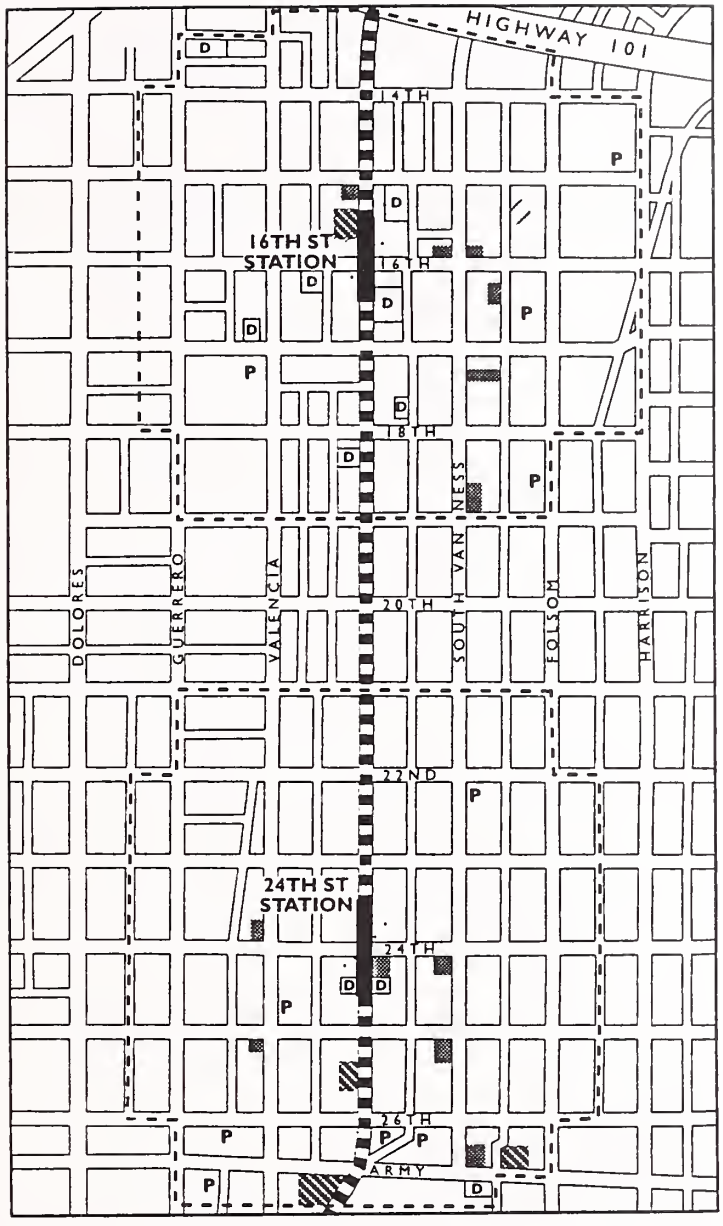
Similarly, land-use activities have remained largely unchanged around the Mission-24th Street station (Figures 9.5 through 9.8). Since 1973, around 450,000 square feet of apartment and duplex/triplex space was added within several blocks of the station. Overall, the pattern of non-residential growth or F.A.R.s did not change following BART's introduction.

9.4. Daly City Station

For the first 20 years of BART's operation, Daly City functioned as a terminal/bus-transfer station, enveloped by 2,228 surface parking spaces. (In mid-1995, the Colma Station opened, becoming BART's western terminus.) A significant share of BART patrons passing through the Daly City turnstiles each day are downtown San Francisco workers living to the south in San Mateo County. The elevated station itself is surrounded by predominantly middle-income, single-family neighborhoods. Many nearby residents also work in the city. Daly City's standing as a bedroom community is



Map 9.1. Mission District Station Area
1965 Land Use



Mission District Station Area
1965-1977 Land Use Changes

N

0 1000 feet

Residential
Commercial and Office
Industrial
Public and Institutional
Park/Open Space
P Parking
D Demolition (no new use)
Station Area Boundary
BART Subway

Map 9.2. Mission District Station Area 1965-1977 Land Use Changes

Map 9.3. Mission District Station Area 1977-1994 Land Use Changes

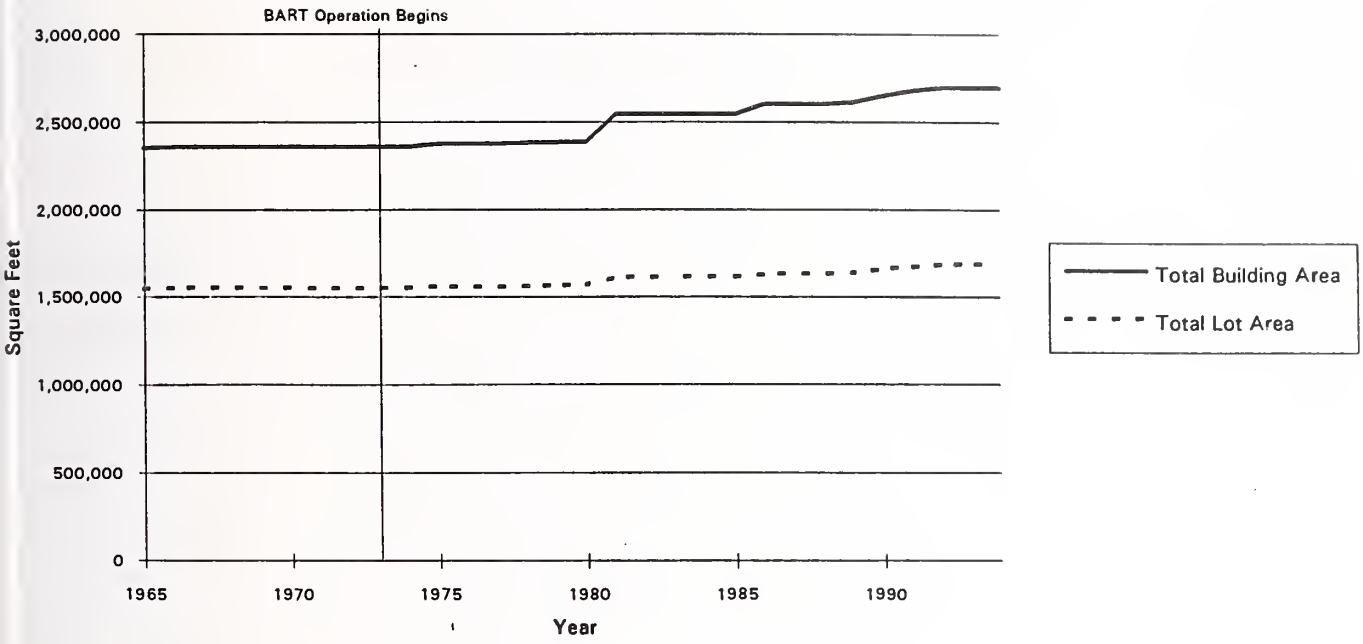


Figure 9.1. Mission & 16th Residential Vintage Model (Since 1965)

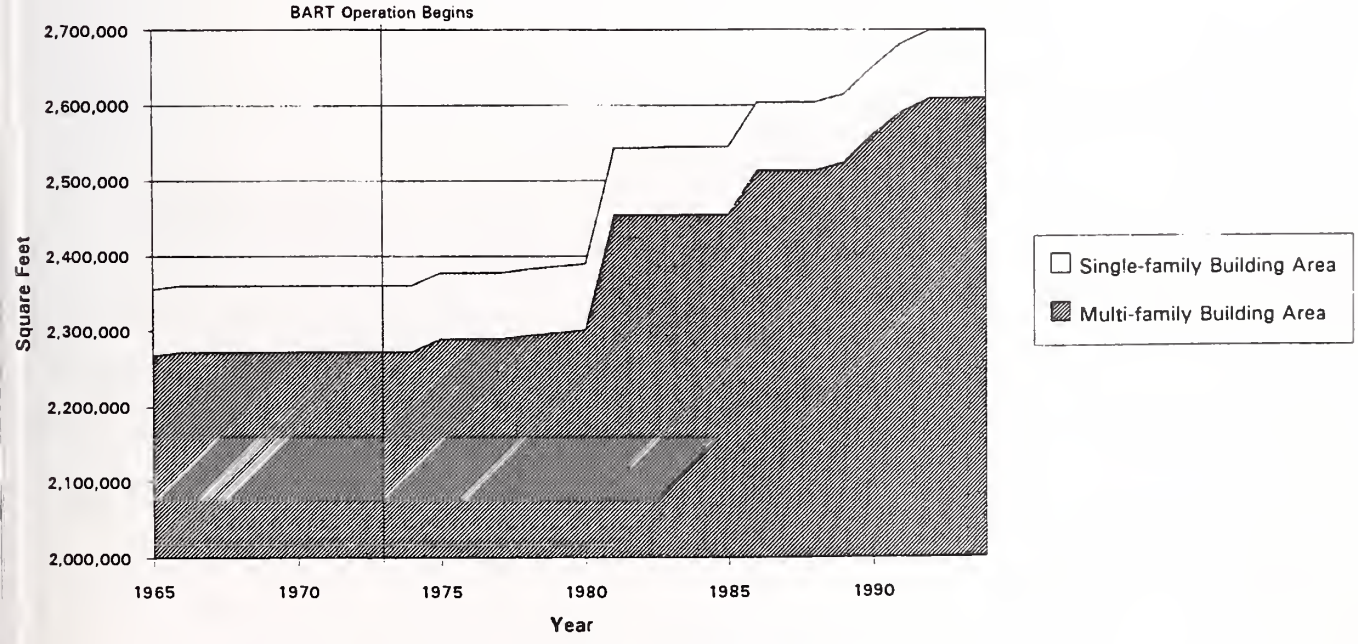


Figure 9.2. Mission & 16th Residential Vintage Model (Since 1965)

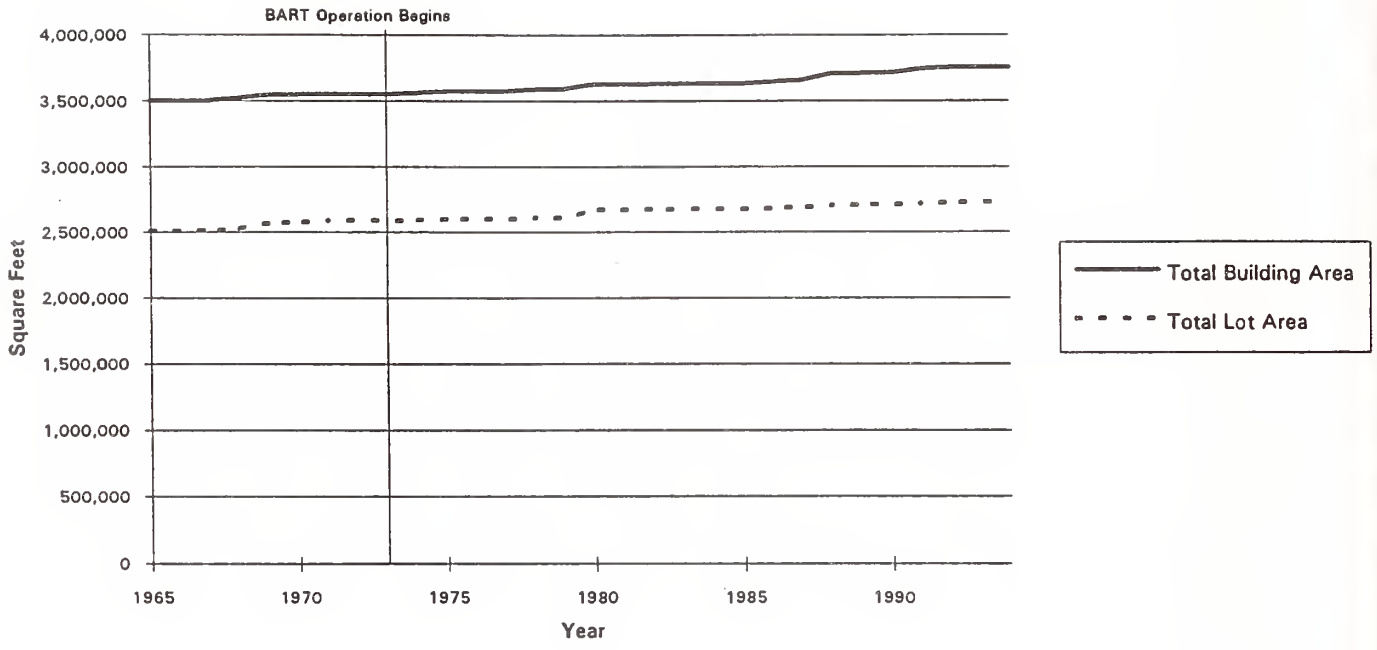


Figure 9.3. Mission & 16th Non-Residential Vintage Model (Since 1965)

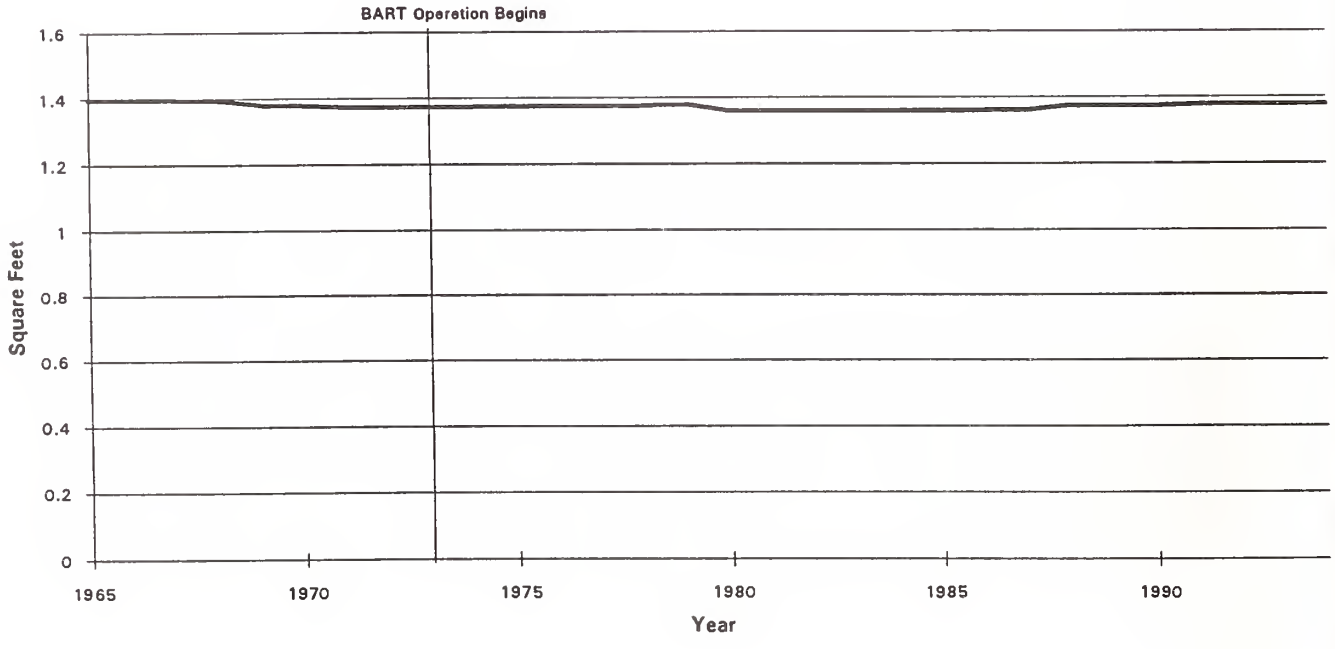


Figure 9.4. Mission & 16th Non-Residential F.A.R. Vintage Model (Since 1965)

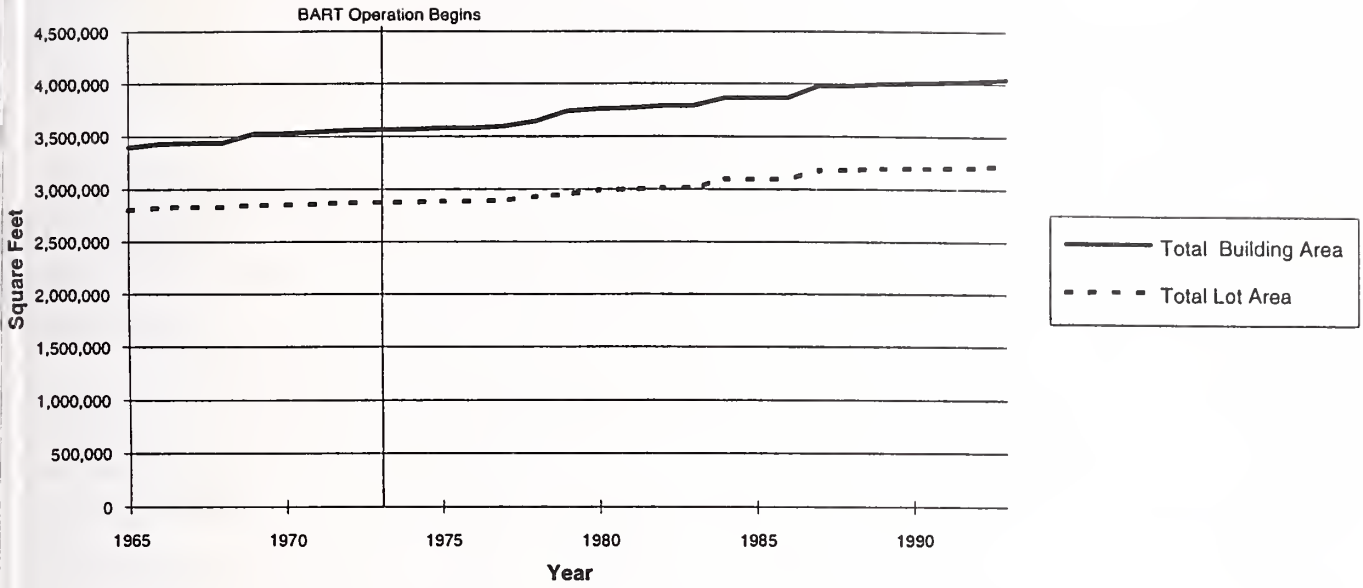


Figure 9.5. Mission & 24th Residential Vintage Model (Since 1965)

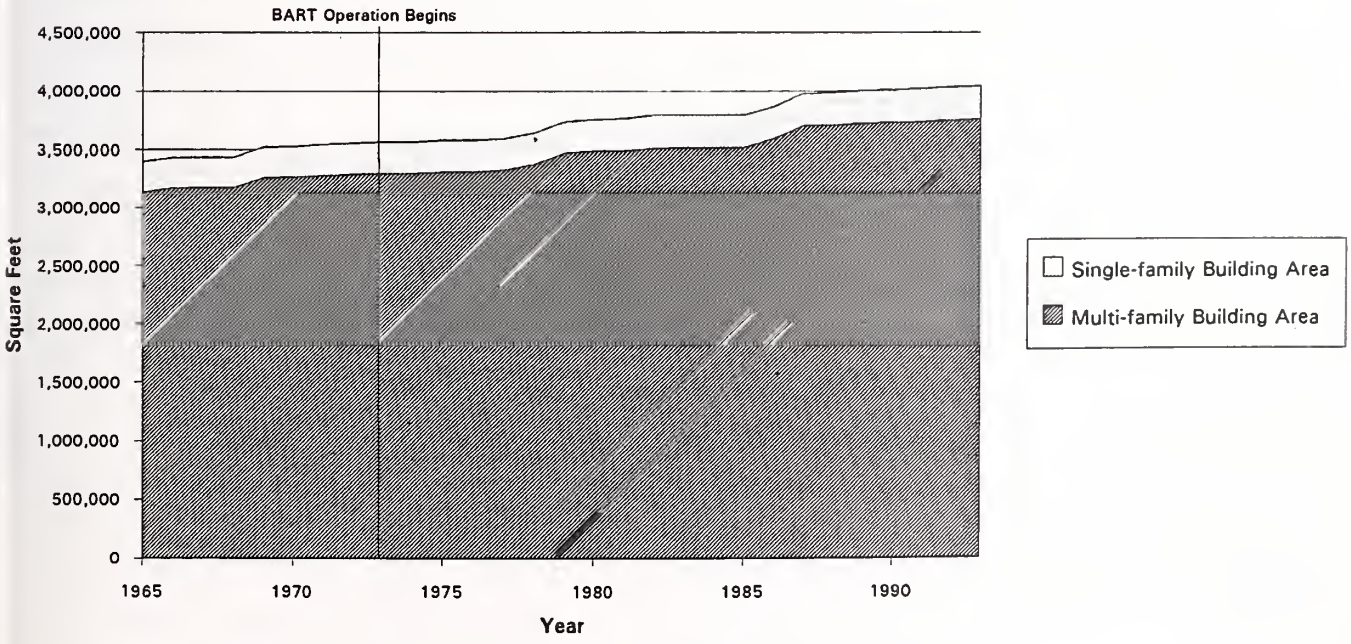


Figure 9.6. Mission & 24th Residential Vintage Model (Since 1965)

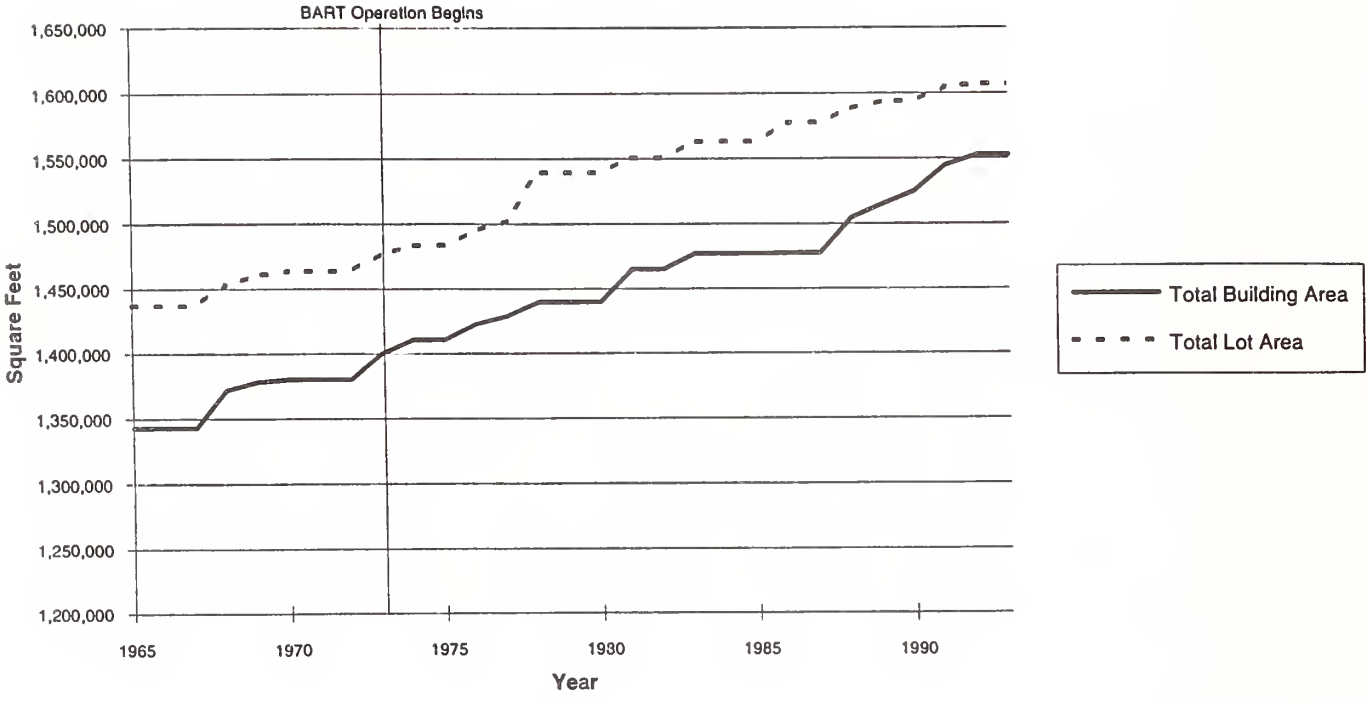


Figure 9.7. Mission & 24th Non-Residential Vintage Model (Since 1965)

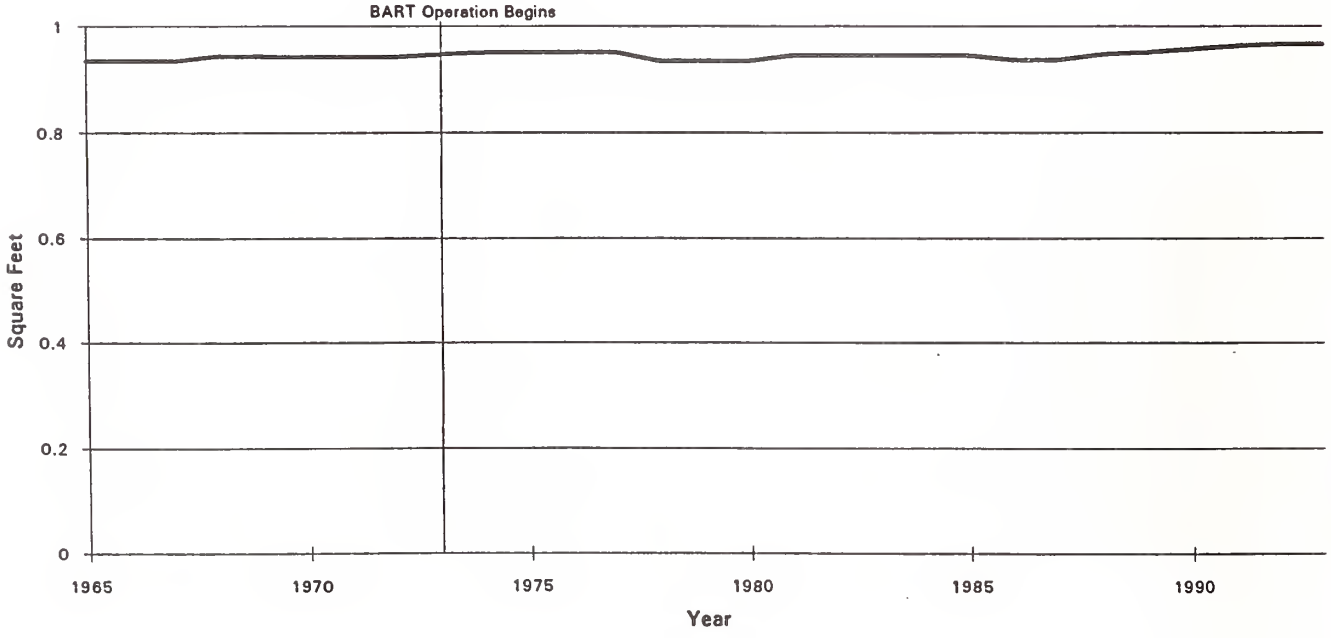


Figure 9.8. Mission & 24th Non-Residential F.A.R. Vintage Model (Since 1965)

underscored by 1990 journey-to-work statistics showing that 88 percent of its employed residents worked outside the city, the lowest share in the San Francisco Bay Area.[1]

A GIS plot of the dominant land uses, plotted by hectare grid cells, in 1985 and 1990 for a half-mile ring around the Daly City station (Map 9.4) shows that most of the development to the east consists of moderately dense housing, typically bungalows on small lots and duplexes (code = RESH, for "residential-high").[2] To the west lies most retail, including shops and restaurants (code = URBO, for "urban-high"). The plot shows there were no changes in dominant land uses for any of the hectare grid cells. Thus, during more recent times, the land-use environment around the Daly City station has been fairly stagnant.

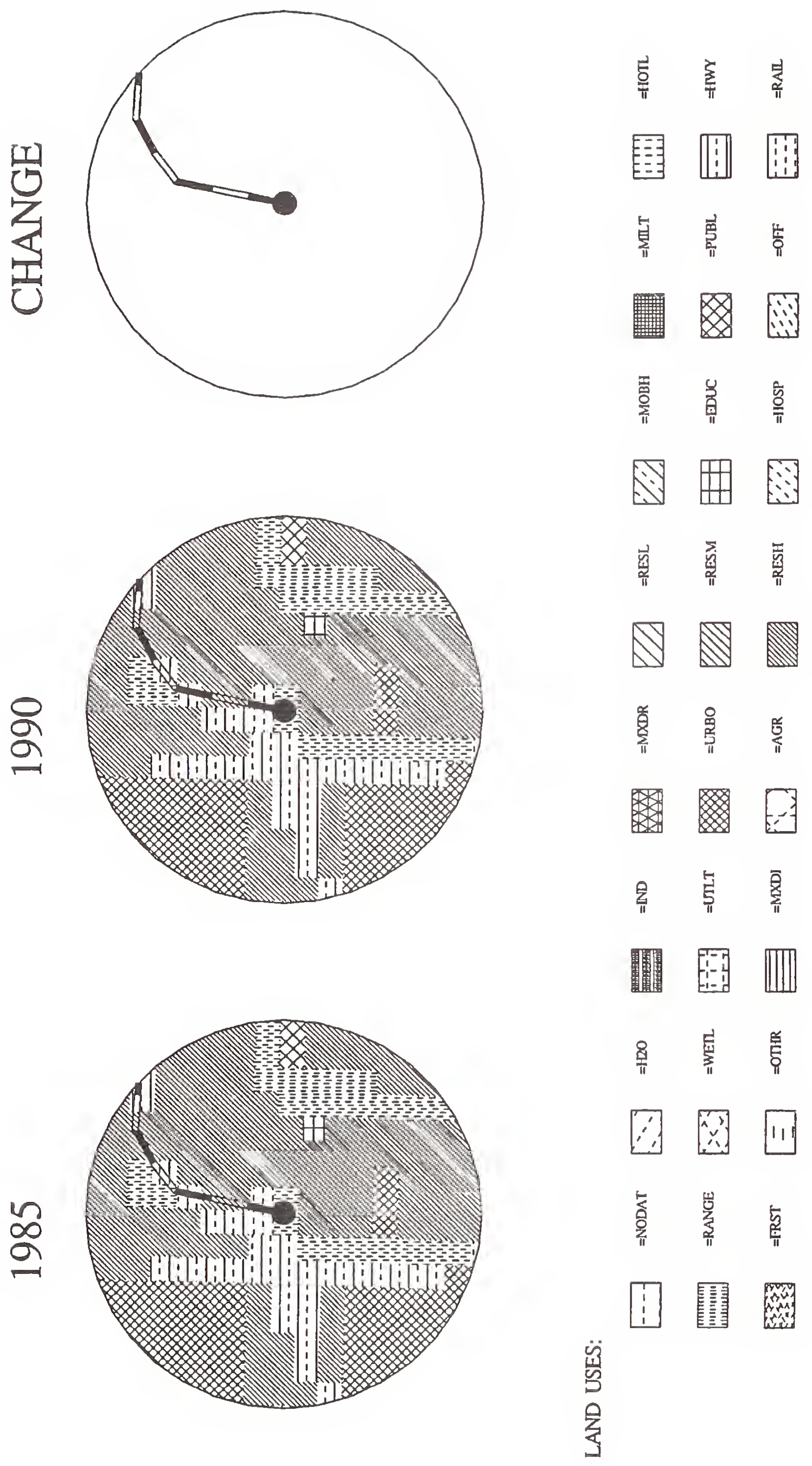
This inference is reinforced by vintage models produced for the Daly City station catchment area. Over the past 20 years or so, the Daly City station area has remained pretty much the same in terms of its land-use make-up (Figure 9.9). Of the approximately 200,000 square feet of residential building space added to the half-mile ring around the Daly City BART station since 1973, almost all has been small, single-family, detached housing (Figure 9.10). Zoning restrictions have prevented any densification of housing.

The most significant retail-commercial development near the Daly City station took place during the decade previous to the opening of BART (Figure 9.11).[3] Several small retail plazas and restaurants were opened a few blocks west of the station during the 1960s and early 1970s. Since BART services began, there have been no changes in Daly City's retail-commercial building stock.

Whether the retail building upsurge prior to BART was speculative and in anticipation of BART is uncertain. More likely, it was attributable to the general suburbanization occurring along the San Mateo County peninsula over the post-World War II period. With dozens of new housing developments having been built in the Daly City-Pacifica area during the 1950s and 1960s, it was natural for consumer retail outlets to follow. The close proximity of the Daly City station to I-280 and Mission Street (the major north-south arterial in north-central San Mateo County) attracted retail development to the area.

Figure 9.12, showing trends in non-residential F.A.R., suggests retail establishments building in the late 1970s and early 1970s were generally built on larger lots than their predecessors. This was primarily due to the higher surface parking standards introduced at the time, leading to more land-consumptive development.

The opening of the Colma BART station could spark some redevelopment around the Daly City station, though this would likely occur only if existing surface park-and-ride lots were converted to other uses. To date, there has been no movement in this direction. The existing Daly City parking lot already fills at 7:15 a.m., and the surrounding streets (John Daly Boulevard/Junipero Serra Boulevard) are already at capacity (currently at Level-of-Service "E") during rush hours.



Map 9.4. Daly City BART Station Area Land Uses, Half-Mile-Radius Area

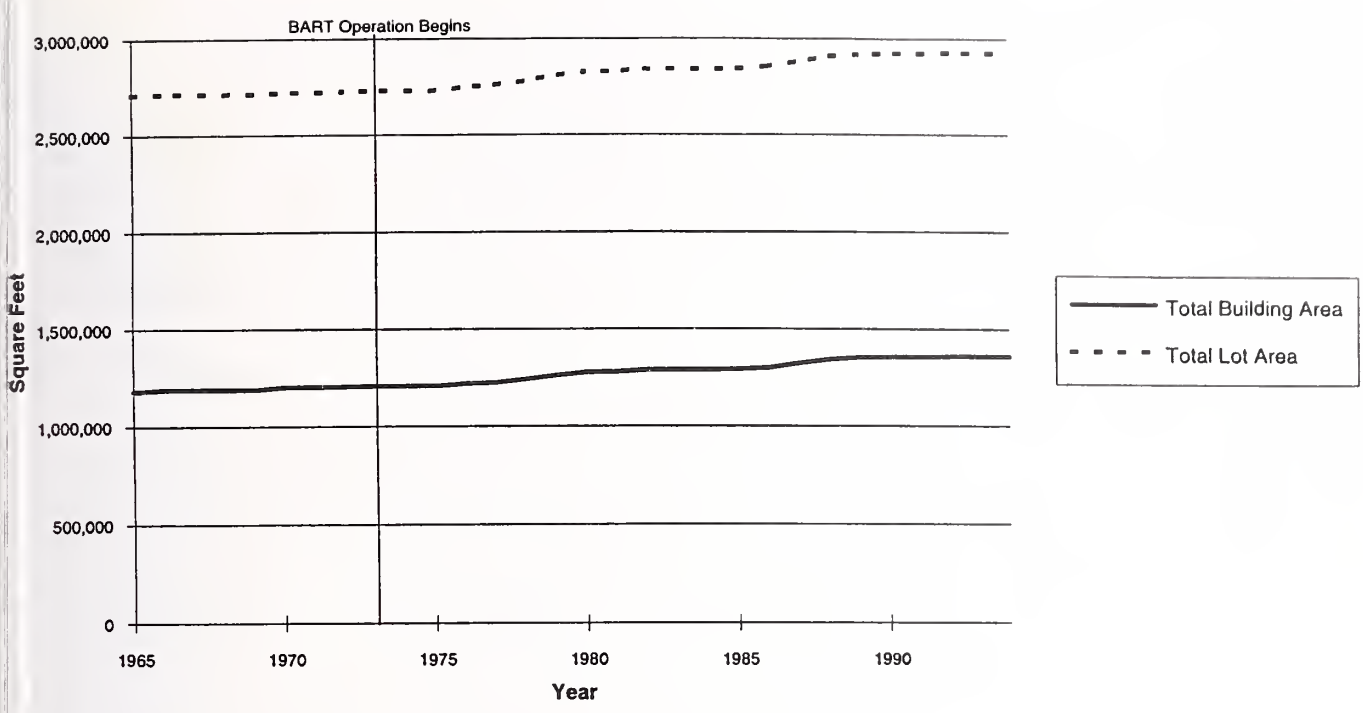


Figure 9.9. Daly City Residential Vintage Model (Since 1965)

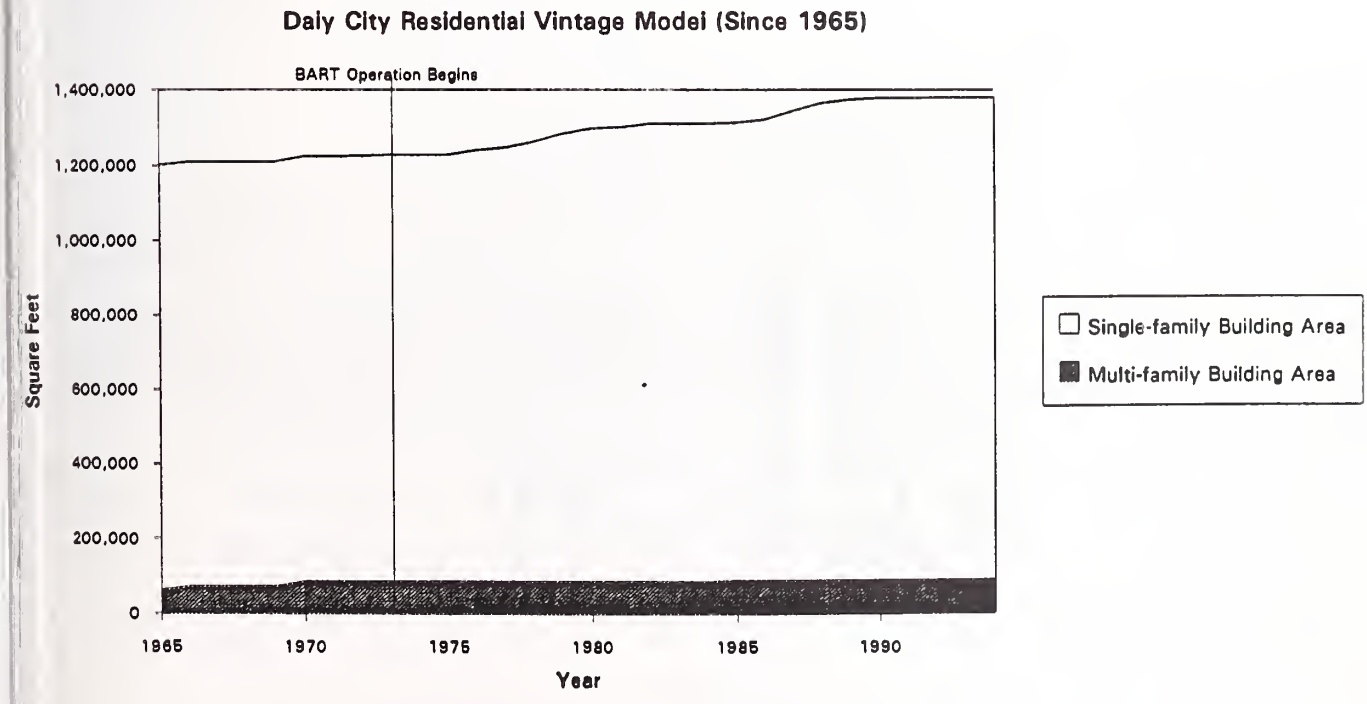


Figure 9.10. Daly City Residential Vintage Model (Since 1965)

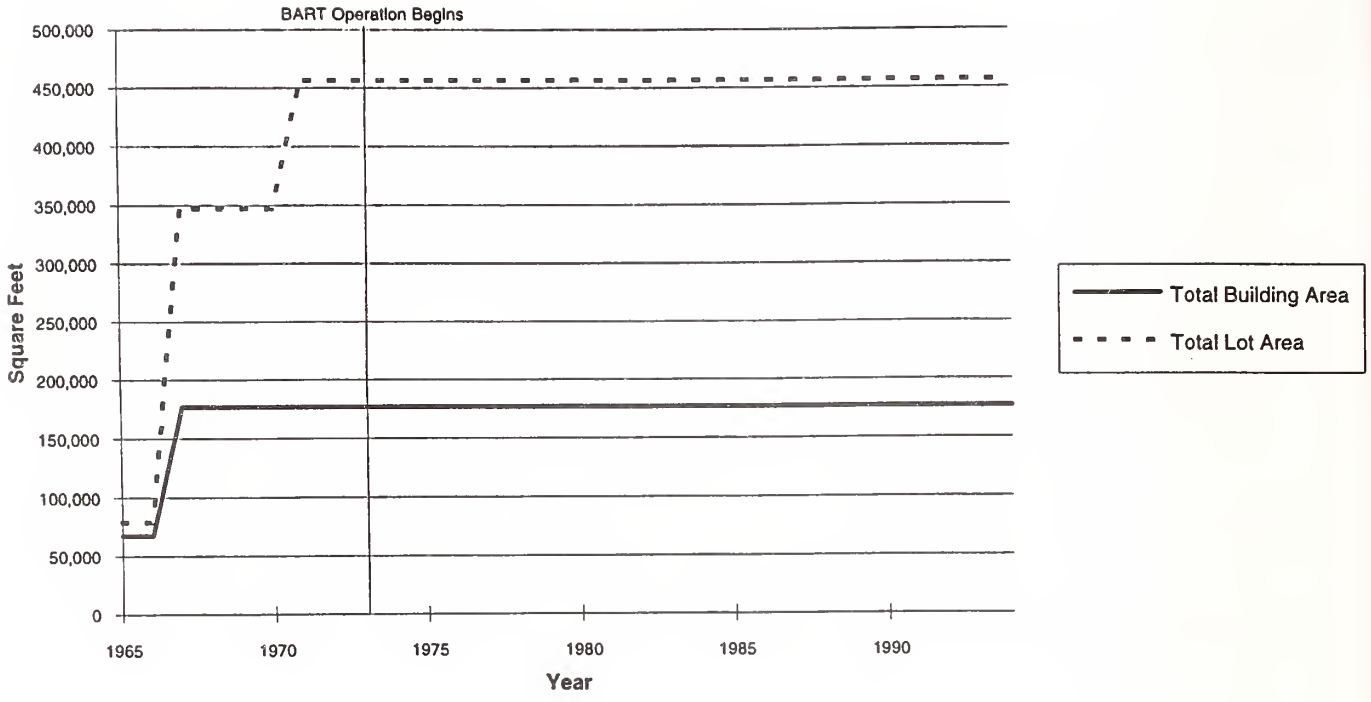


Figure 9.11. Daly City Non-Residential Vintage Model (Since 1965)

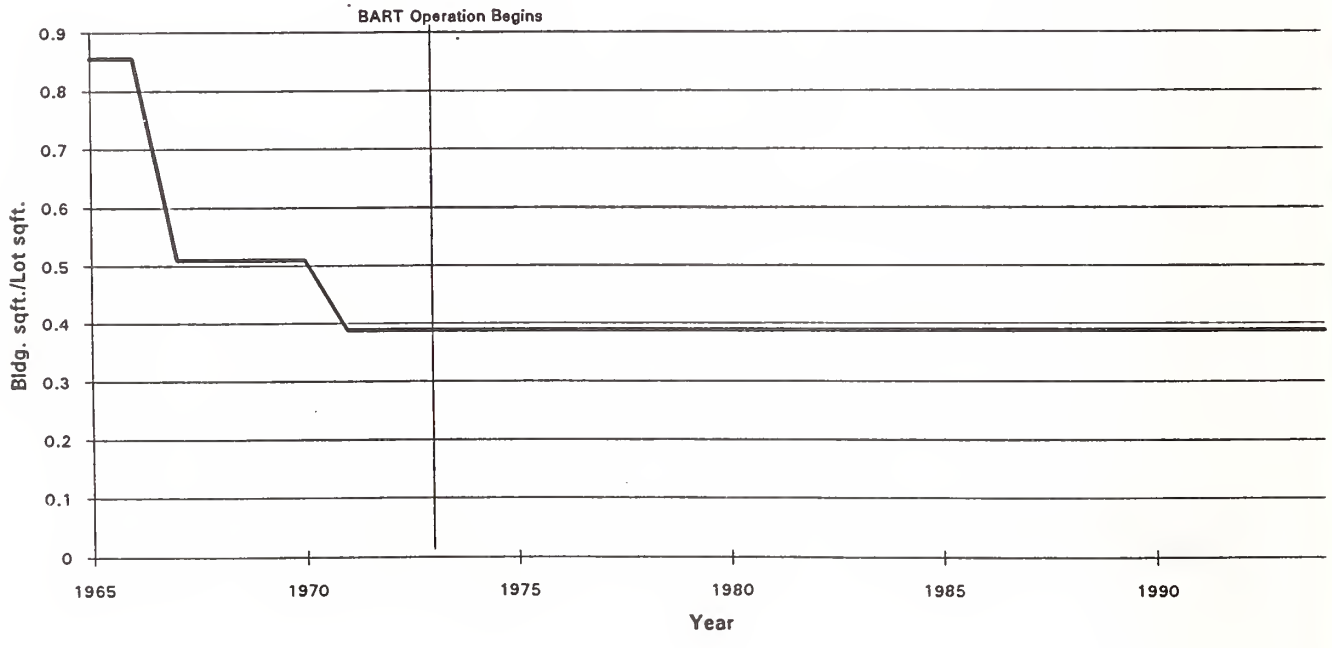


Figure 9.12. Daly City Non-Residential F.A.R. Vintage Model (Since 1965)

9.5. Overall Changes in Land-Use Composition

The absence of significant land-use changes along the Daly City corridor is underscored by the pie charts showing land-use compositions in 1965, 1973, 1979, and 1993 (Figure 9.13). For each of these time points, multi-family housing constituted nearly one-half of building space, and single-family residences fairly consistently made up 12 percent of space. Retail-commercial activities likewise maintained their market shares — 17 percent of building area.

9.6. Summary

To date, the Daly City corridor, from Mission 16th Street to the Daly City terminus, has been largely unaffected by BART's presence. As shown previously in Chapter Four, less land-use activity has occurred along the Daly City corridor than at any other part of the BART system, perhaps with the exception of parts of central Oakland. While data were only presented in this chapter for three stations, field observations indicate there have also been no significant changes around the other two stations in the corridor — Glen Park and Balboa Park. The absence of significant land-use changes along this corridor is likely attributable to at least two factors: one, the BART line was sited in a fairly mature, built-out area with relatively little vacant land and little development potential; and two, neighborhood opposition to densification led to the enactment of zoning restrictions (including in the area surrounding the Glen Park station, which, while not discussed in this chapter, witnessed downzoning following BART's opening).

Notes

[1]Source: U.S. Bureau of Census, 1990 Summary Tape File 3A.

[2]Source: Association of Bay Area Governments, data base on dominant land uses for hectare (100 x 100 meter) grids, 1990.

[3]These statistics have to be interpreted with caution since over 80 percent of the parcels for the half-mile ring around the Daly City station had missing data on year of building construction. Again, most of these missing cases pre-dated BART, so the general observation of little non-residential development following the opening of the Daly City station still holds.

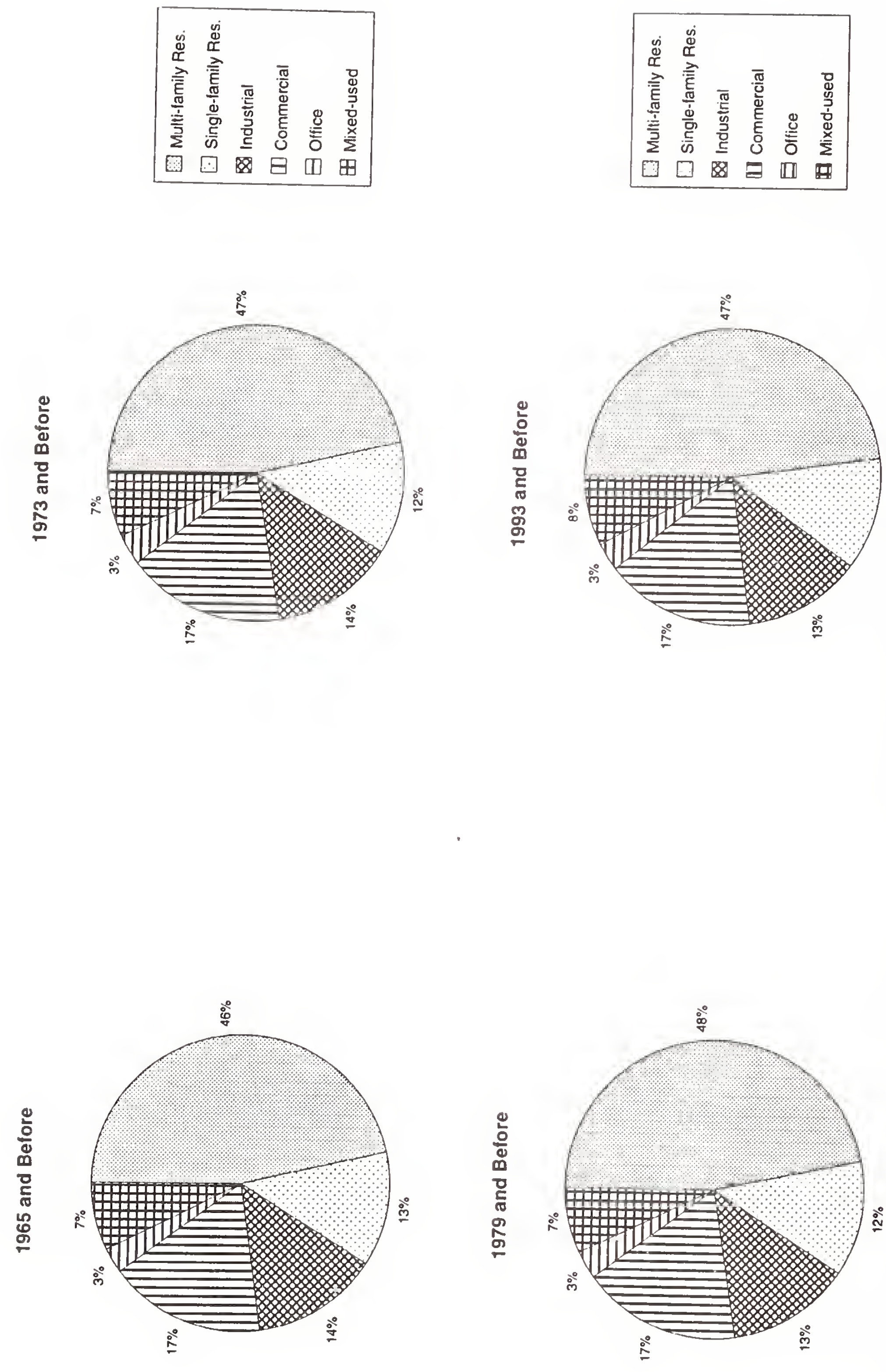


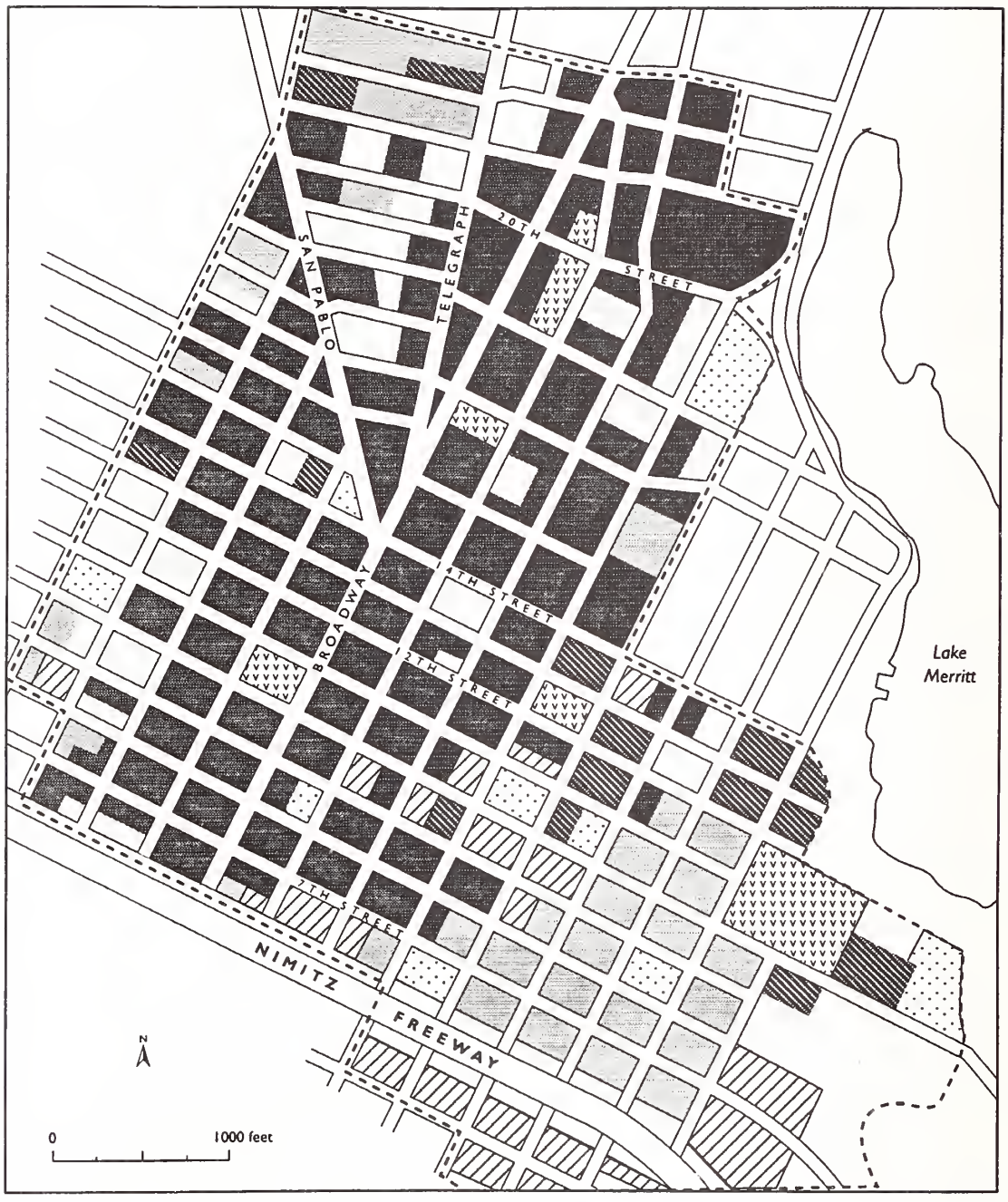
Figure 9.13. Daly City Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 3 Station Areas)

CHAPTER TEN
Land-Use Changes in Downtown Oakland

Considerable office development has occurred in downtown Oakland since the opening of BART, though much less than in downtown San Francisco or the suburban centers of Walnut Creek and Concord. By far, downtown Oakland has attracted more institutional and public-sector building activities over the past 20 years than any other area served by BART. Government agencies have been drawn by Oakland's economical prices, prodevelopment attitude of civic leaders, and good transportation services. Accordingly, this chapter discusses the expansion of both public and private building space in downtown Oakland.

Map 10.1 shows the land-use composition in downtown Oakland in 1965, eight years prior to BART opening. Commercial and office activities predominated, with some light industrial uses and pockets of apartment towers. By 1977, Map 10.2 shows there were a moderate number of land-use changes for the zone within a quarter-mile of the three downtown subway stations: 12th Street, 19th Street, and Lake Merritt. The most significant private-sector office development occurred several blocks northeast of the 19th Street station, oriented toward the north-west shore of Lake Merritt. Virtually no development occurred around the 12th Street (Civic Center) station, in the heart of downtown Oakland. For the most part, parcels to the immediate west and south of the 12th Street station were cleared and either left vacant or covered with asphalt parking as part of downtown redevelopment. Far more commercial development occurred in these early BART years along the Nimitz Freeway (I-880) and toward the Jack London Square/Embarcadero waterfront retail-restaurant complex. The most significant building activity from 1965 to 1977, however, occurred around the Lake Merritt station, mainly in the form of institutional uses, including the opening of Laney College, offices for the Oakland Park department, several county office buildings, and the BART headquarters building (directly atop the Lake Merritt station).

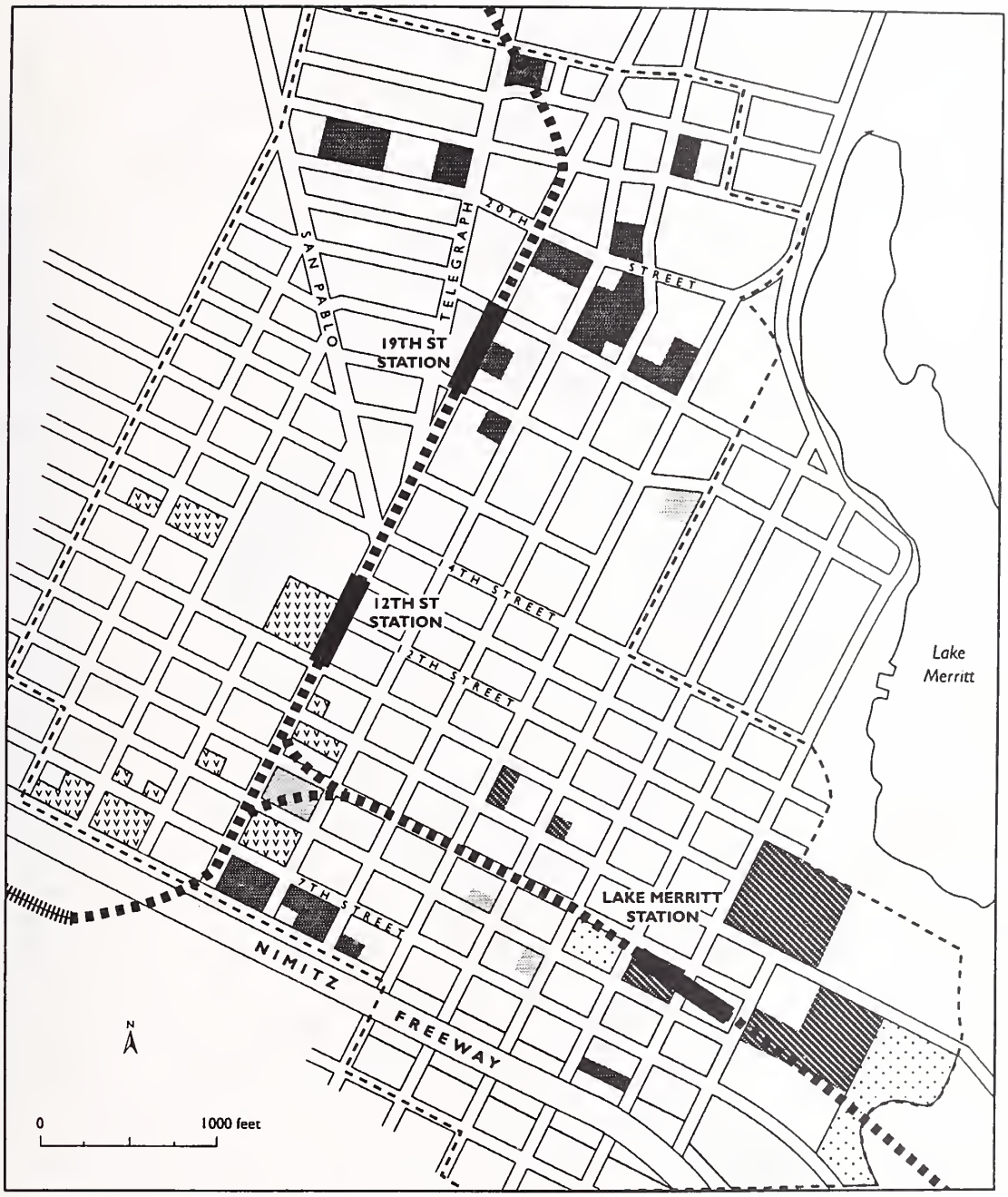
Since 1977, Map 10.3 shows that the most substantial commercial development in downtown Oakland occurred immediately adjacent to the 12th Street station. The centerpiece has been the Oakland City Center, a mixed retail-office complex that is architecturally integrated with the station and that has won awards (e.g., the Urban Land Institute's Design Excellence award) for its design and aesthetic qualities. Flanking the City Center complex have been several new multi-tenant office towers (20-25 stories in height), a convention hotel (downtown Oakland's largest), and the new twin-tower federal building (forming a western terminus to the City Center complex). An art-deco district of small shops and restaurants has also been restored to the south of the station, and is only beginning to show some signs of nightlife. The other notable commercial development has been the emergence of Oakland's Chinatown district, situated between the 12th Street and Lake Merritt stations. Much of the development in this zone has consisted of indoor retail plazas, mixed-use buildings, and several institutional buildings [e.g., CalTrans district office, East Bay Municipal Utility District (EBMUD) headquarters]. Commercial



Downtown Oakland Station Area
1965 Land Use

- Residential
- Commercial and Office
- Public and Institutional
- Industrial
- Park/Open Space
- Parking
- Vacant
- Station Area Boundary

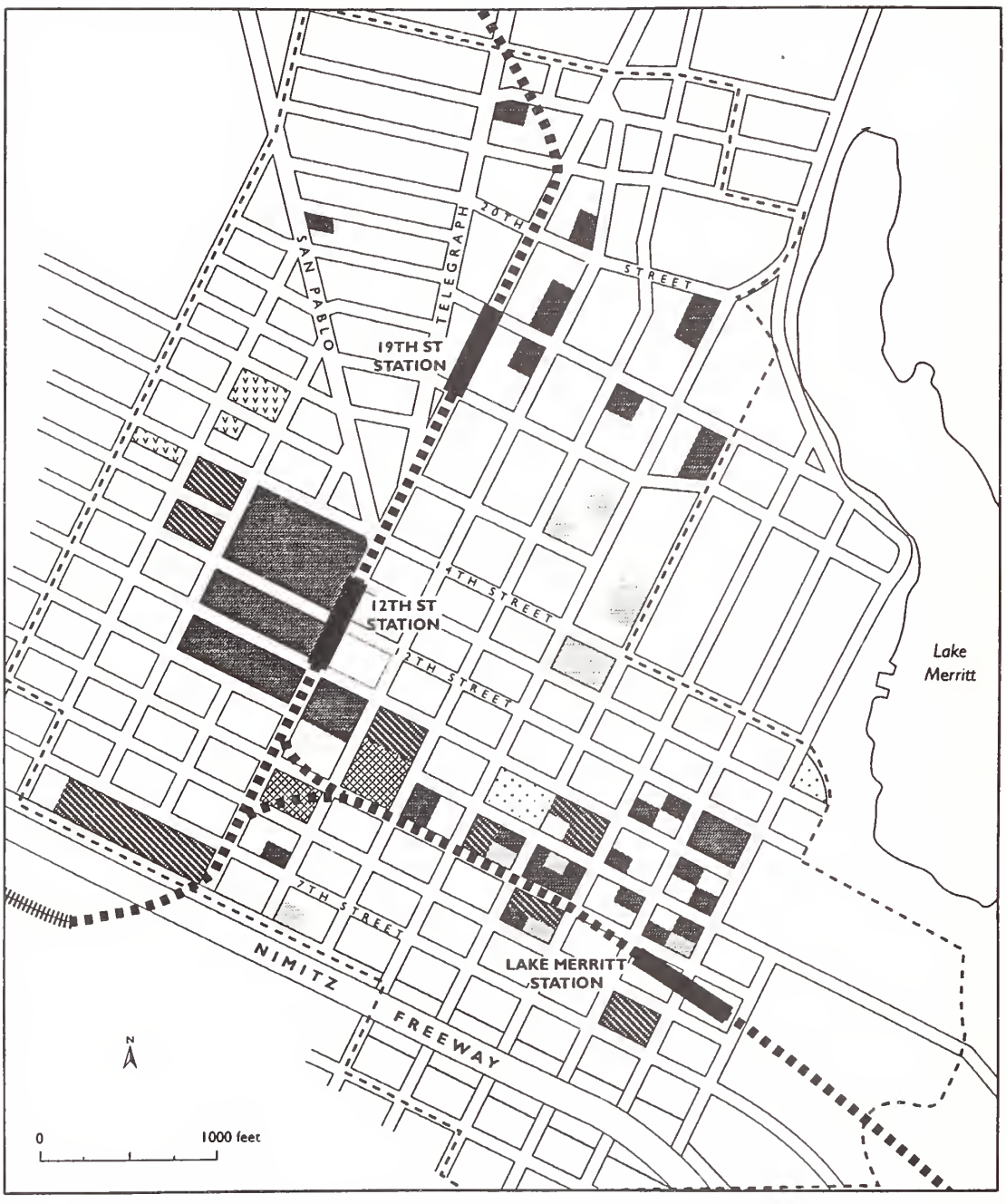
Map 10.1. Downtown Oakland Station Area 1965 Land Use



Downtown Oakland Station Area
1965-1977 Land Use Changes

- Residential
- Commercial and Office
- Public and Institutional
- Park/Open Space
- Parking
- Vacant
- Station Area Boundary
- BART Subway

Map 10.2. Downtown Oakland Station Area 1965-1977 Land Use Changes



Downtown Oakland Station Area
1977-1994 Land Use Changes

- Residential
- Commercial and Office
- Public and Institutional
- Park/Open Space
- Parking
- Vacant
- Mixed use
- Station Area Boundary
- BART Subway

Map 10.3. Downtown Oakland Station Area 1977-1994 Land Use Changes

development slowed down around the 19th Street station during the 1977-1994 period, with only a handful of mid-rise office and mixed-use buildings being added, most three or four blocks to the east of the station. The Lake Merritt station witnessed the addition of several government-tenant office buildings, some apartment and condominium construction, and the Joseph P. Bort Metrocenter (home to the regional comprehensive planning and transportation planning organizations — the Association of Bay Area Governments and the Metropolitan Transportation Commission).

10.1. Residential Development in Downtown Oakland

The vintage model, plotted in Figure 10.1, shows the only significant jump in residential square footage in central Oakland occurred during 1975-1977. This consisted largely of some 250,000 square feet of apartment space built in and around Chinatown, and within several blocks of the Lake Merritt Station (Figure 10.2). Surveys show that 17 percent of all non-walk trips made by the residents of the 150-unit Nobel Towers Apartments, a quarter mile from the Lake Merritt station, are by BART.

From 1970, prior to BART's opening, to present, net residential densities have declined significantly around the 12th Street and 19th Street stations (Figure 10.3). They have remained fairly flat at the MacArthur transfer station, just north of downtown, and the Lake Merritt station. A consequence of (and perhaps a contributor to) stagnant residential development is that downtown Oakland generally has little night life. Except for the restaurant-goers in Chinatown and the neighboring Jack London Square waterfront, much of downtown Oakland appears vacant after nightfall.

10.2. Non-Residential Private Development in Downtown Oakland

Since 1965, downtown Oakland has experienced a steady increase in private-sector non-residential building inventory (Figure 10.4). (This graph, it should be noted, represents only 38 percent of downtown parcels with complete year-of-built information; most missing records are for pre-BART structures, thus the gains in square footage over the 1973-1993 period are probably fairly accurate.) As shown in Figure 10.5, office construction accounted for virtually all of this growth. Sharp rises in office development appear to have followed 10-year cycles — 1970, 1980, and 1990. Around 1980, office uses became the largest consumer of land in downtown Oakland, eclipsing retail-commercial uses (Figure 10.6). Because of the erection of several high-rise office towers since BART's opening, downtown Oakland net non-residential densities have increased by around 20 percent over the past two decades (Figure 10.7).

10.3. Overall Changes in Private-Sector Land-Use Composition

Figure 10.8 shows that presently, office space constitutes over half of downtown Oakland's private-sector building inventory. A decade prior to BART's opening, office space made up less than a fifth of building space. Correspondingly, Oakland's role as a retail-commercial center has declined dramatically. Downtown Oakland's retail sector suffered from the opening of several large suburban shop

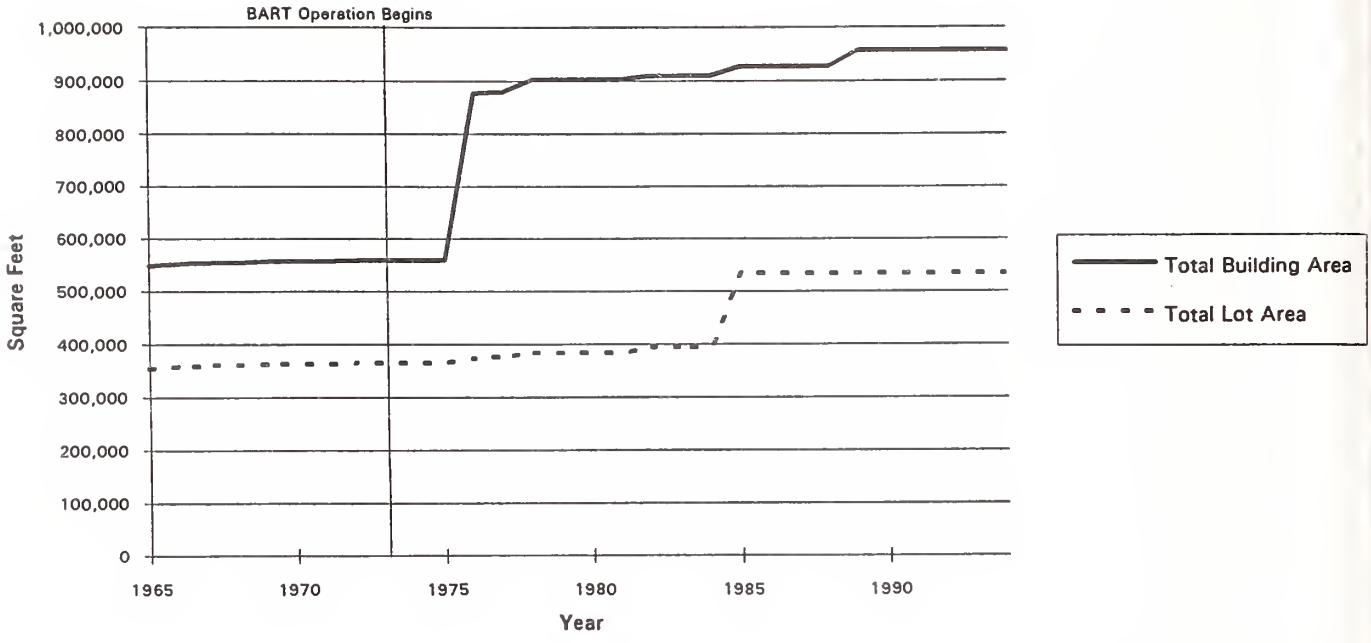


Figure 10.1. Oakland Downtown Residential Vintage Model (Since 1965)

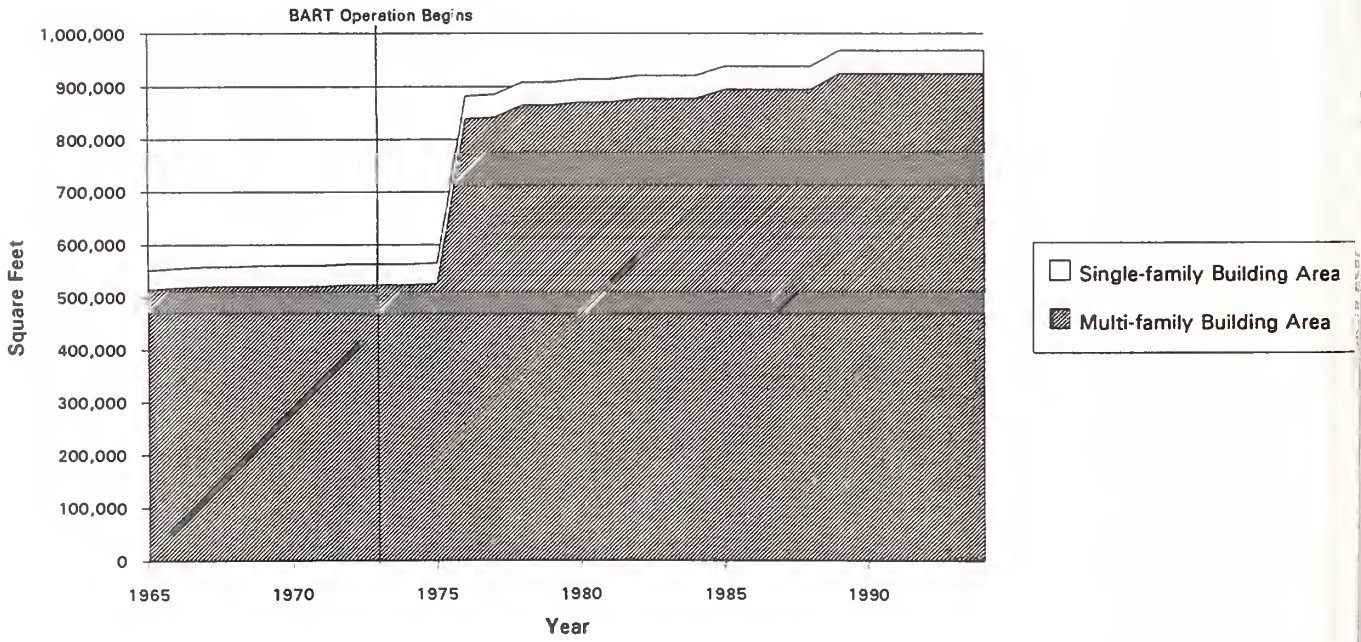


Figure 10.2. Oakland Downtown Residential Vintage Model (Since 1965)

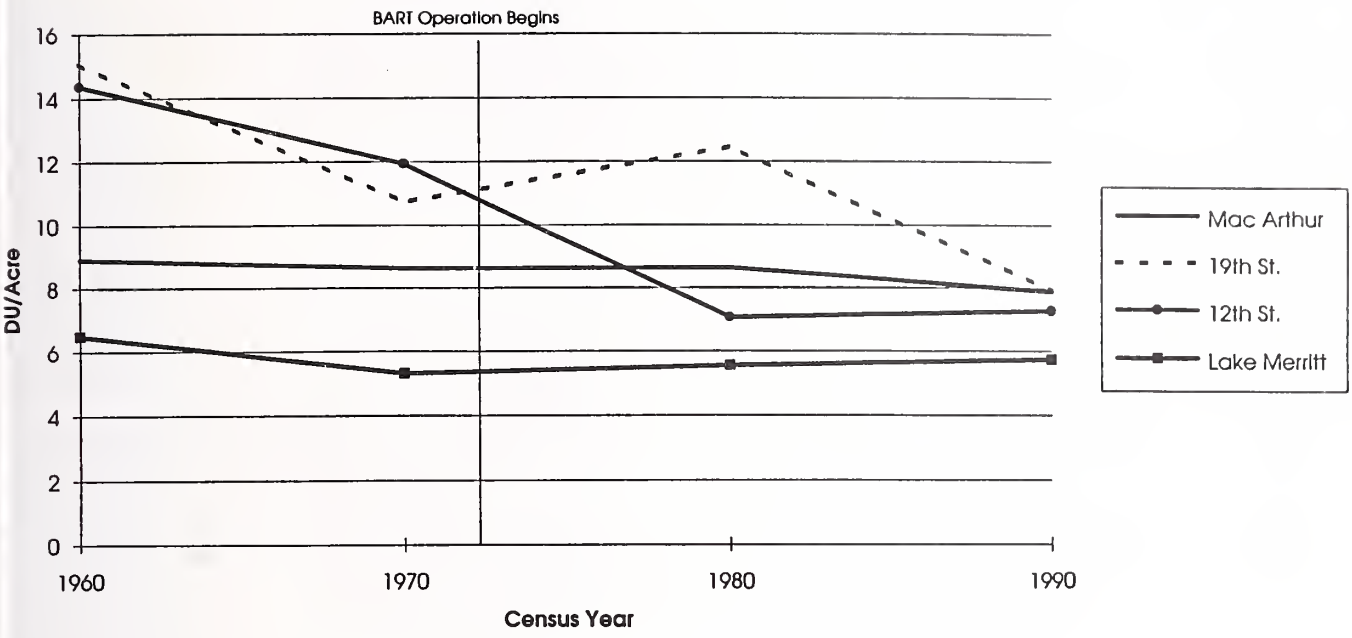


Figure 10.3. Central Oakland Residential Density Comparison

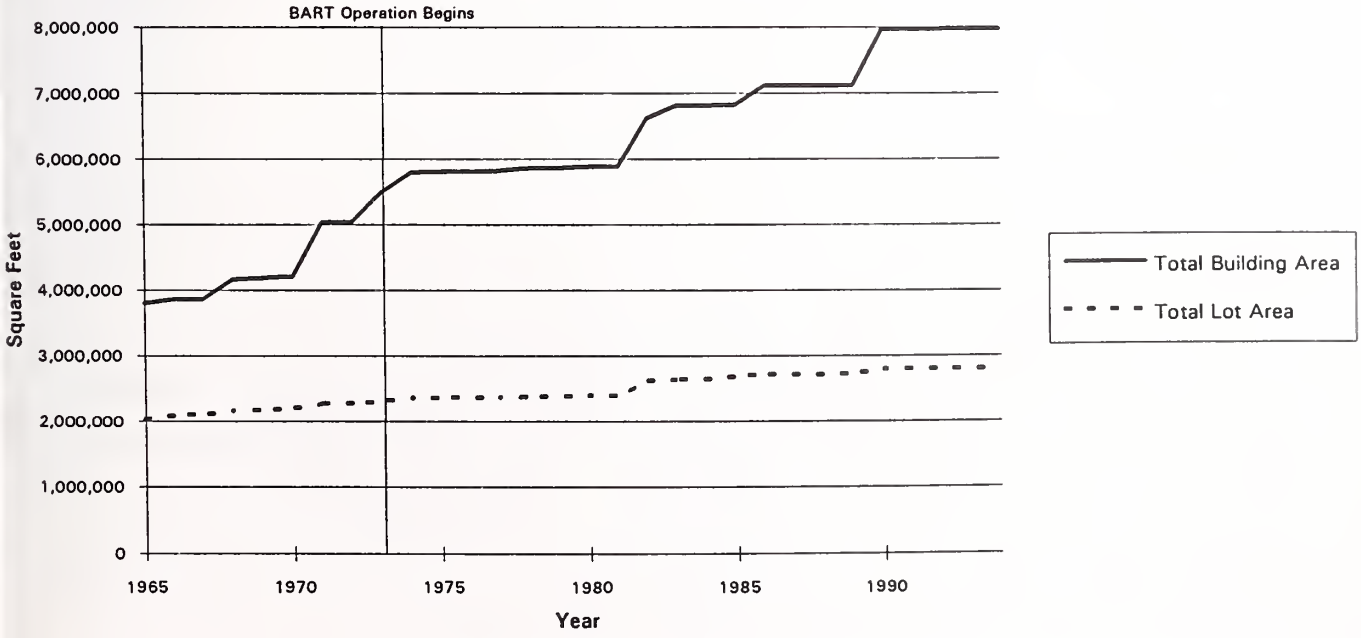


Figure 10.4. Oakland Downtown Non-Residential Vintage Model (Since 1965)

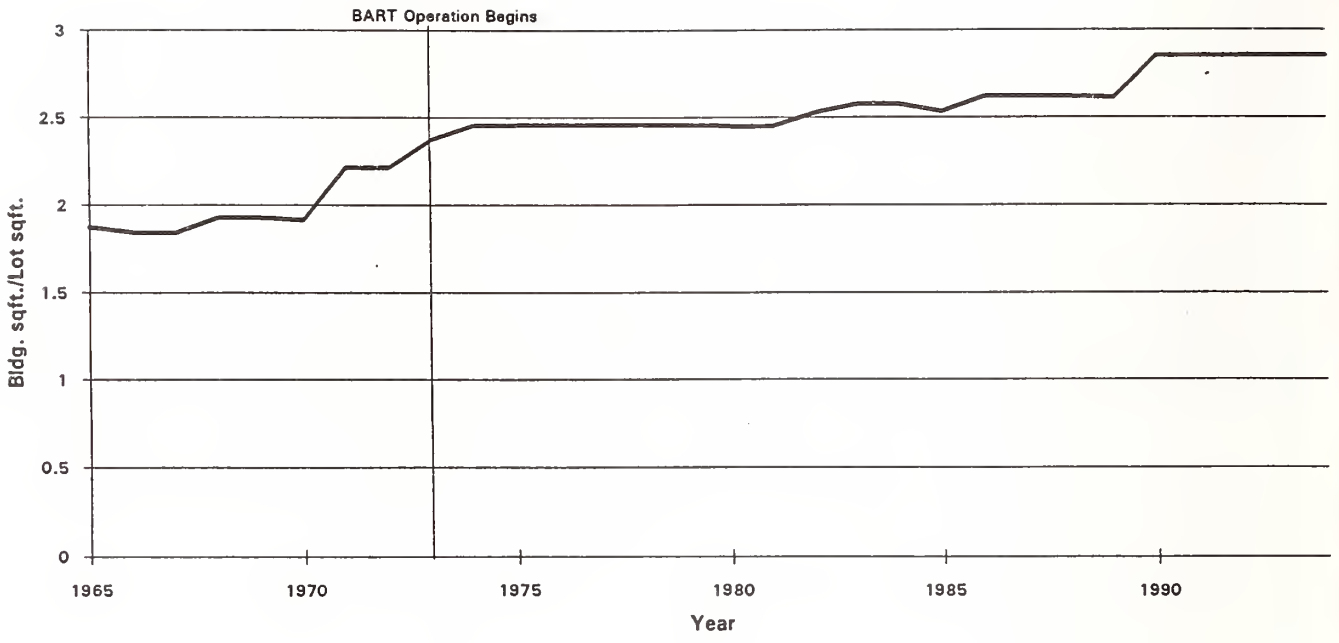


Figure 10.7. Oakland Downtown Non-Residential F.A.R. Vintage Model (Since 1965)

ping malls in the East Bay during the 1970s and 1980s, resulting in the closure of several large retailers. Overall, downtown Oakland has changed from a more traditional downtown with varied retail land uses to a predominant office orientation since BART's opening. This has had less to do with BART than with a shifting market orientation of the retail sector throughout the Bay Area.

10.4. Public and Institutional Developments in Downtown Oakland

More government offices space has been added in downtown Oakland than anywhere else on the BART line. This is mainly due to Oakland's attractive rents, its central location in the Bay region, and the city's proactiveness in lobbying for and leveraging new public-sector development.

Map 10.4 chronicles the addition of public-sector buildings in downtown Oakland over four eras: early years (1909-1964), pre-BART (1965-1973), early-BART (1973-1979), and recent years (1980-1996).[1] Historically, many public buildings have located near Oakland's 12th Street and Lake Merritt stations, the former being the locus of a municipal complex and the latter being the site of most county and special district functions. Some institutional uses (e.g., a judicial complex and protective services compound) amassed along the freeway corridor (I-880). During the post-BART period, nearly all public-sector office development occurred within two blocks of a BART station.

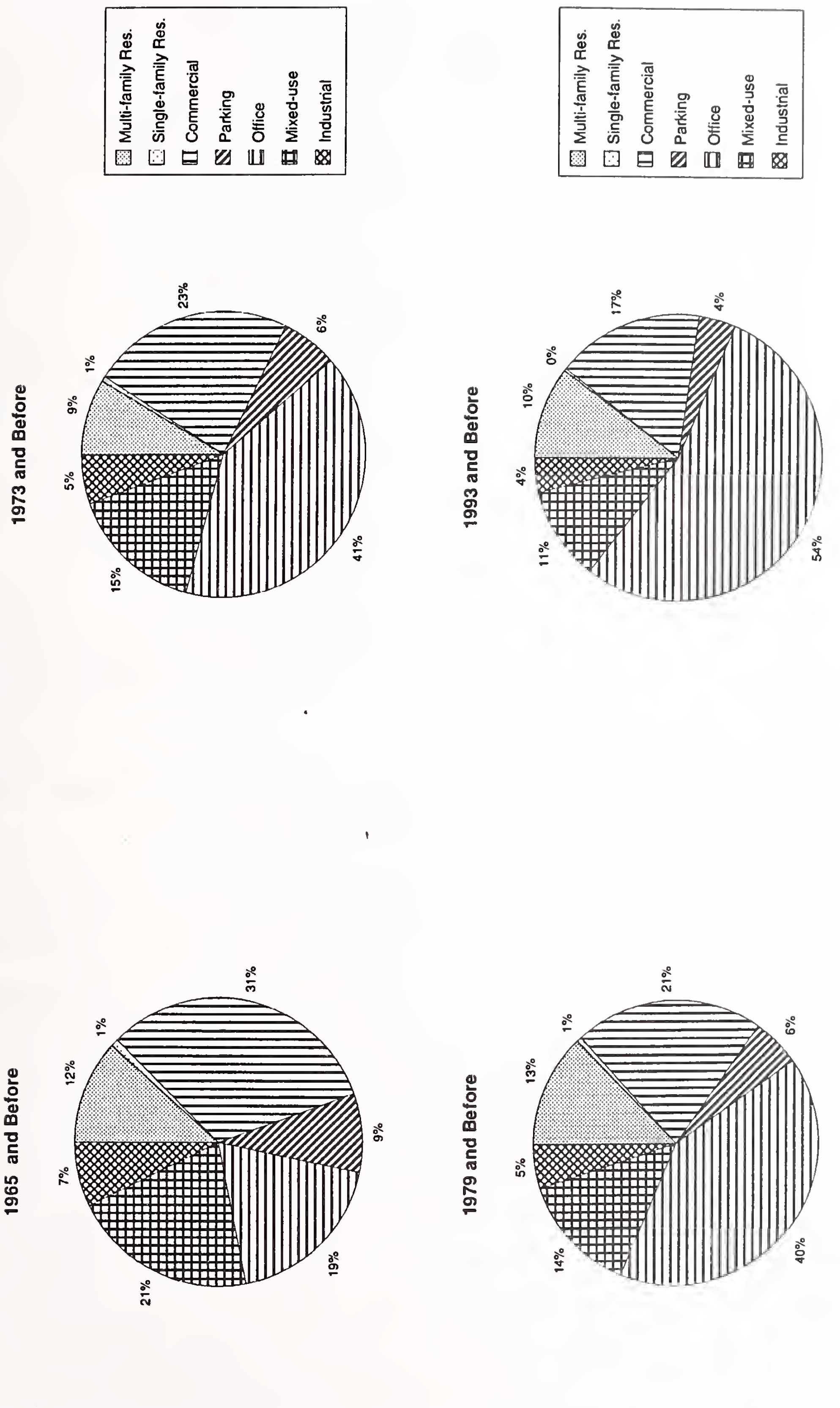
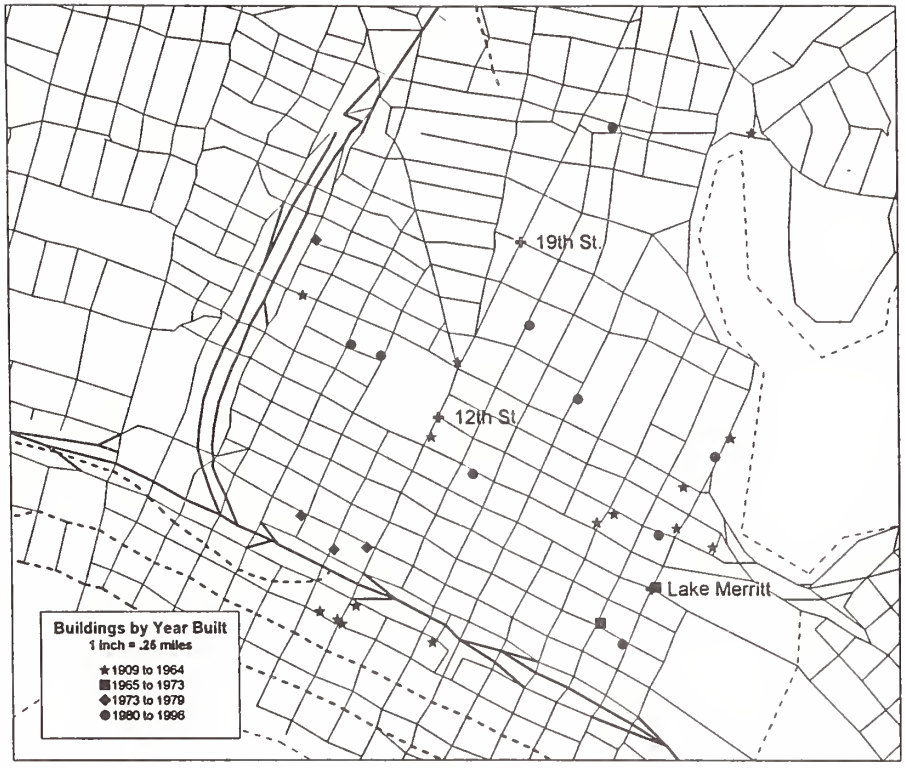


Figure 10.8. Oakland Downtown Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 3 Downtown Station Areas)

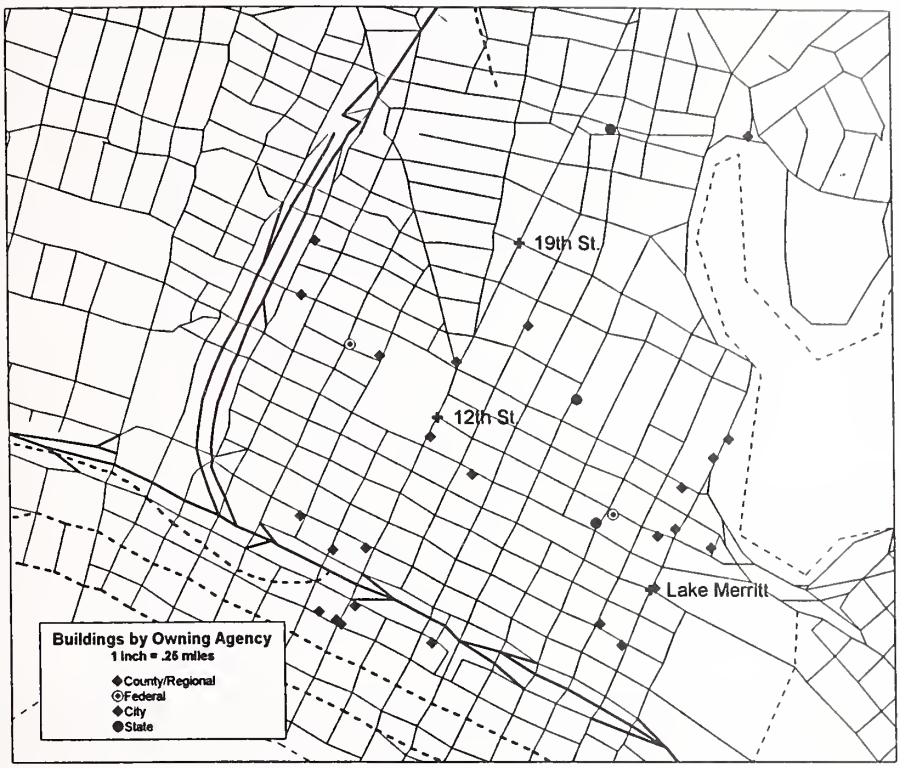


Map 10.4. Downtown Oakland: Distribution of Public Buildings by Year Built

A breakdown of these public sector buildings by owning government agencies is shown in Map 10.5, as of 1995. Local (city, county, and regional) facilities constitute most public-sector buildings that are sited near BART.

Since BART's opening, the five largest public office structures built in downtown Oakland have all been within a quarter-mile of a BART station, adding 1.6 million square feet of floorspace (or 29 percent of the downtown total) — Metro Center, AC Transit Headquarters, EBMUD headquarters, County Administration building (at 12th and Oak Street), and the largest of all, the new twin-tower Federal Building (1,060,000 square feet). Two new buildings within a quarter-mile of a BART station — the City Hall Annex and a state office building (on Harrison Street) — are slated to open in 1996, and will add another 1.1 million square feet to Oakland's office inventory.

Figure 10.9 shows a vintage model for public-sector and private-sector office development in downtown Oakland since 1965.[2] Government building activities did not increase as rapidly of private-sector office construction in BART's early years. Only with the opening of the Federal building in 1992-1993 did public-sector office construction outpace that of the private sector. (The graph also shows the two new public office buildings that will come on-line in 1996, continuing the upward trajectory of downtown Oakland's office inventory.) Overall, while downtown Oakland's public-sector building activities have been appreciable by regional standards, they have been more than matched by private-sector office inventories. It is likely the case, however, that siting public buildings near BART stations



Map 10.5. Downtown Oakland: Distribution of Public Buildings by Owning Agency, 1955 (Including 2 Buildings to be Constructed)

helped lure private office investments by providing a critical mass that could sustain more restaurants, shops, and ancilliary business-related services.

10.5. Summary

Downtown Oakland has witnessed a healthy expansion of office development since BART's opening — less than downtown San Francisco and the outer Concord line; however, more than downtown Berkeley and other BART station areas. New office towers did not spring up in BART's early years, but rather a good decade or more after the 1973 opening of downtown stations. Unlike downtown San Francisco, where the bulk of commercial-office development was largely market-driven, in Oakland the city redevelopment authority played an active and crucial role in orchestrating new development activities that took place. The city leveraged much of the private as well as public office construction that occurred through a combination of assistance with land assemblege (by exercising eminent domain powers), tax increment financing of public infrastructure, securing federal urban renewal grants, subordination of loans, and equity participation (including majority ownership of the downtown convention hotel built in the early 1980s). Even before BART, the city had prepared a redevelopment plan which

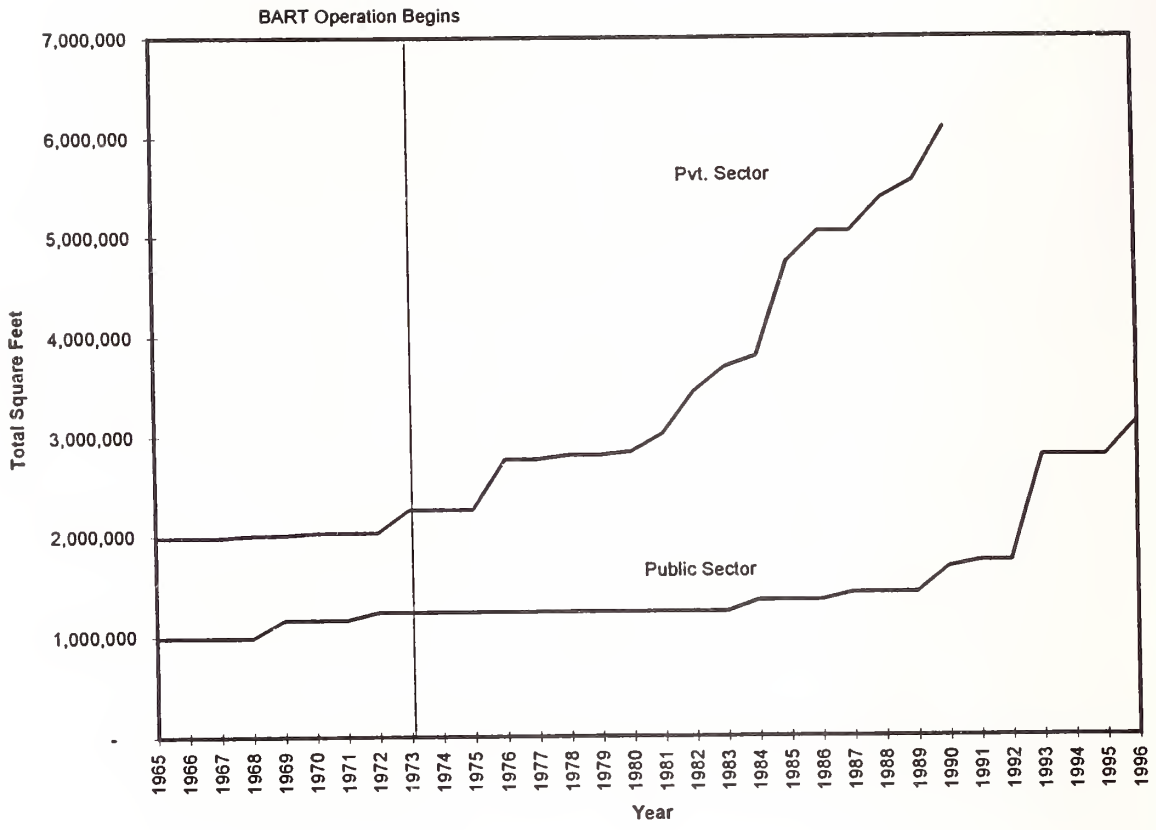


Figure 10-9. Downtown Oakland Office Development Within 1/4 Mile of BART Stations, Vintage Model Since 1965

served as a blueprint for guiding growth, and over the course of 20 years has managed to implement a good portion of the early planning visions. Negotiating with government authorities to site new public office buildings in the city was also crucial to the post-1980 upswing in downtown Oakland's construction. Public buildings were likely instrumental in leveraging private office development by helping to create agglomeration and urbanization economies that could sustain more downtown services and ancilliary business-related functions.

Notes

[1]Data were compiled only for office-related buildings that housed only agencies from the federal, state, county, and municipal level governments as well as special districts (e.g., AC Transit, EBMUD). Data on building age and square footage were obtained from building inventories supplied by federal, state, and county real estate or facilities departments. (Since government entities are tax-exempt, no data were available from the county assessor's rolls.) Only buildings related to office or general public use (e.g., libraries) were included in the inventory. Field surveys were conducted to fill in missing data. For municipal and special-district buildings, assessor's data for all "exempt" class parcels were obtained; since no details are recorded for tax-exempt parcels, data on square footage and year built were obtained from field surveys and personal contacts (e.g., with building managers). Last, it should be

stressed this analysis is presented using buildings as the observation units, and not government agencies. A number of government agencies lease space in private, multi-tenant office buildings. The building space they occupy would thus be shown under the "private-sector" heading rather than "public-sector." Thus, this analysis pertains only to new buildings added to downtown Oakland that were occupied exclusively by tax-exempt public agencies.

[2]Data on building inventory for private office development were compiled from the Black's *Office Market Guide*, which provides a more complete accounting of office space than the county assessors' records from TRW-REDI. Since a 100 percent inventory of federal, state, and county office buildings was compiled, it was necessary to have a complete inventory of private office development for comparison purposes. Private-sector office inventory data from the Black's Guide were only available through 1990, however.

CHAPTER ELEVEN
Land-Use Changes Along the Fremont Corridor

As discussed in Chapter Four, the Fremont corridor experienced the fastest growth in multi-family housing development during the post-BART era, accounting for one-third of all apartments and condominiums built within a half mile of the BART system. Non-residential building space increased an estimated 35 percent from 1973 to 1993 near the corridor's eight stations; however, this only amounted to around 3 percent of the total BART station-area commercial-office development.

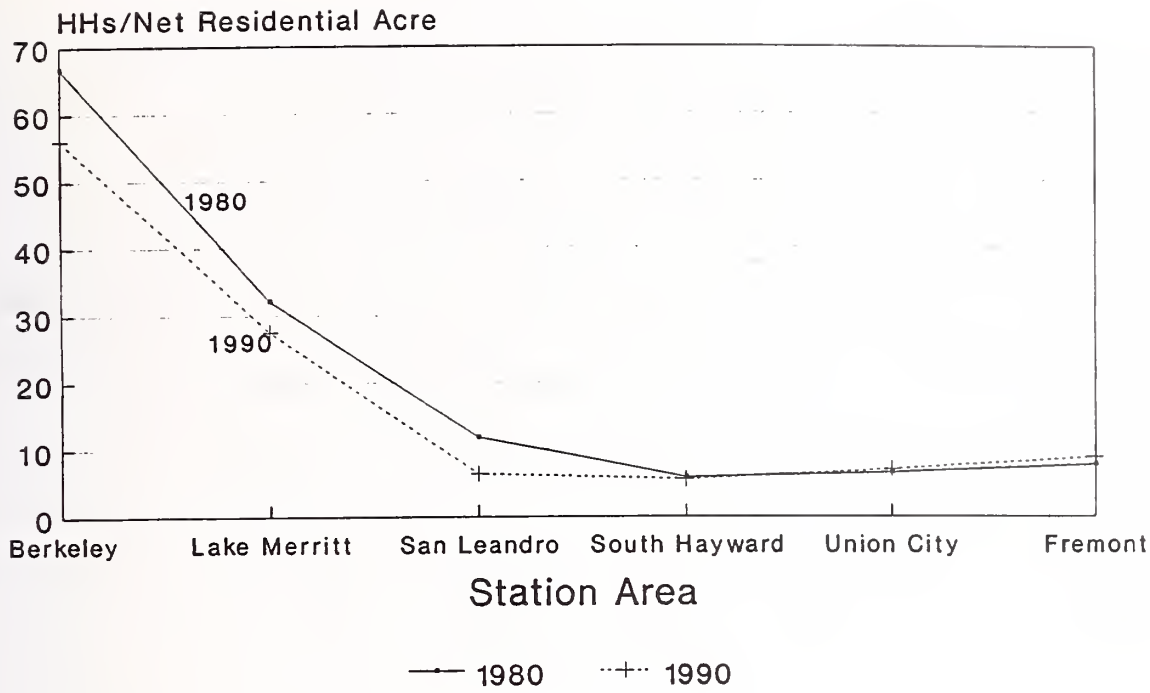
Despite the bouyancy in multi-family home construction, net residential densities have generally fallen or remained flat along the corridor. This is shown in Figure 11.1, which compares 1980 and 1990 net residential densities for census tracts surrounding four stations on the corridor, plus a downtown Oakland station (Lake Merritt) and the downtown Berkeley station. This graph shows the density gradients from the densest residential portion of the East Bay, central Berkeley (near the University of California campus) to the suburban periphery (Union City and Fremont). The sharpest declines in residential densities were around the inner-city stations; however, densities fell sharply near San Leandro and increased only modestly around the two outermost stations. These changes have not been due to residential land clearance. Figure 11.2 shows that for the same set of stations, the percent of developable land that was developed in surrounding census tracts increased from 3 percent to 13 percent, with the greatest gains occurring around the Fremont terminal station. This indicates that most development during the 1980s tended to be on larger lots at lower densities.

As noted in Chapter Six, the Fremont line has more BART station and freeway interchange pairs that are suited for matched-pair comparisons than any other corridor. In this chapter, land-use changes are discussed for all but the Coliseum station, a largely industrial-warehousing district with the region's largest sports complex nearby that has seen no nearby residential or commercial-office development since BART's opening. For the San Leandro, Hayward, Union City, and Fremont stations, matched-pair results for the station and nearby interchange are also presented.

The entire Fremont corridor consists of aerial structures, the only BART corridor where this is the case. Based on residential growth rates around stations relative to other corridors, the elevated alignment does not appear to have been a deterrent to station-area development.

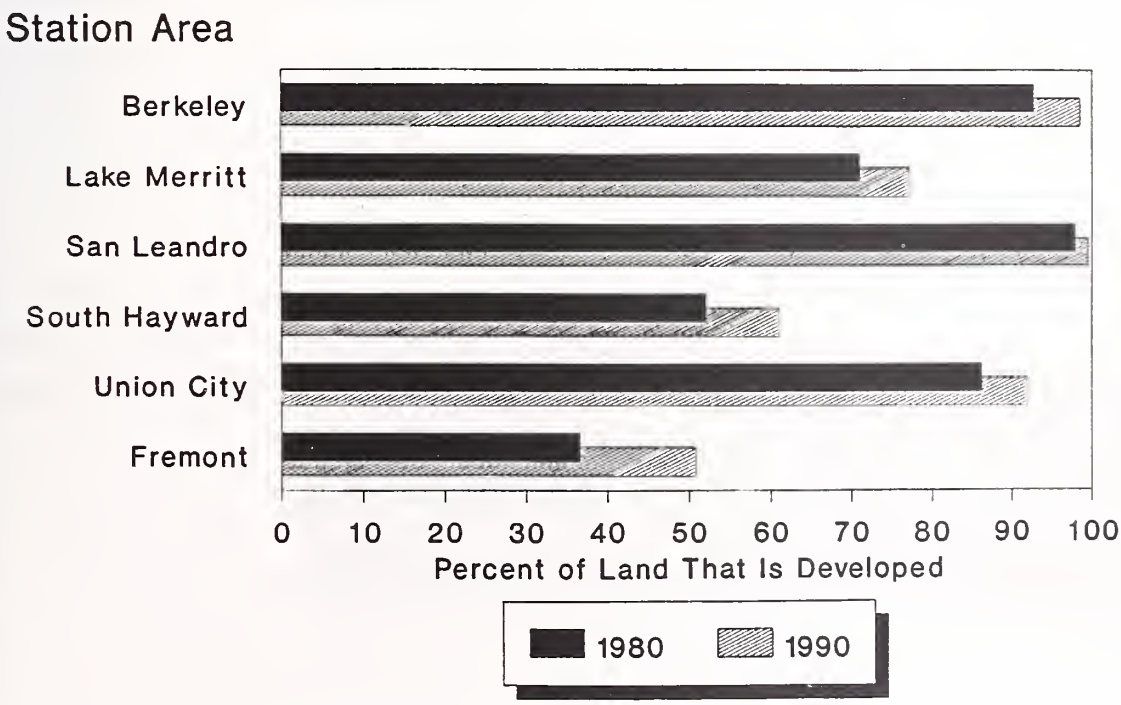
11.1. Fruitvale Station

Not a lot of residential (Figures 11.3 and 11.4) or commercial-office (Figure 11.5) development has occurred around Oakland's Fruitvale station since BART opened.[1] Only a warehouse addition on 38th Avenue was recorded in the TRW-REDI data base for 1973-1993. Commercial-office densities have remained fairly constant at an F.A.R. of around 0.78 since 1965.



•census tracts surrounding stations

Figure 11.1. 1980-1990 Changes in Net Residential Densities of BART Station Areas



•census tracts surrounding stations

Figure 11.2. 1980-1990 Changes in Percentage of Station Area* Land That Is Developed

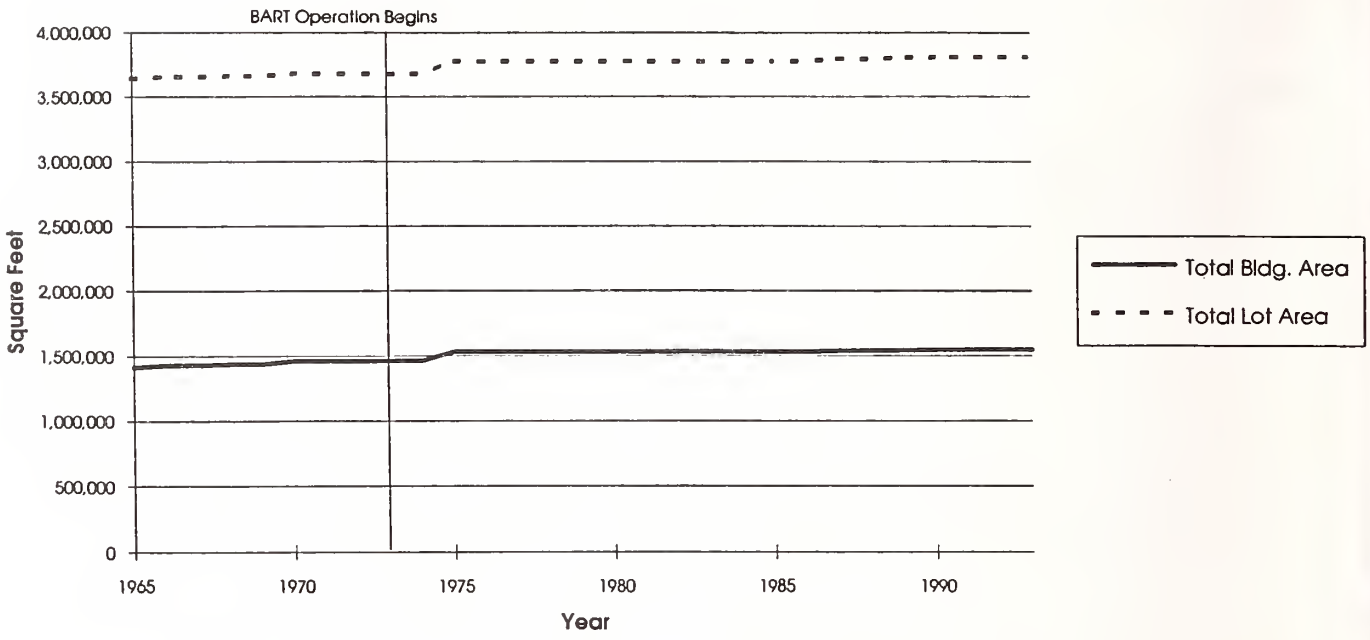


Figure 11.3. Fruitvale Residential Vintage Model (Since 1965)

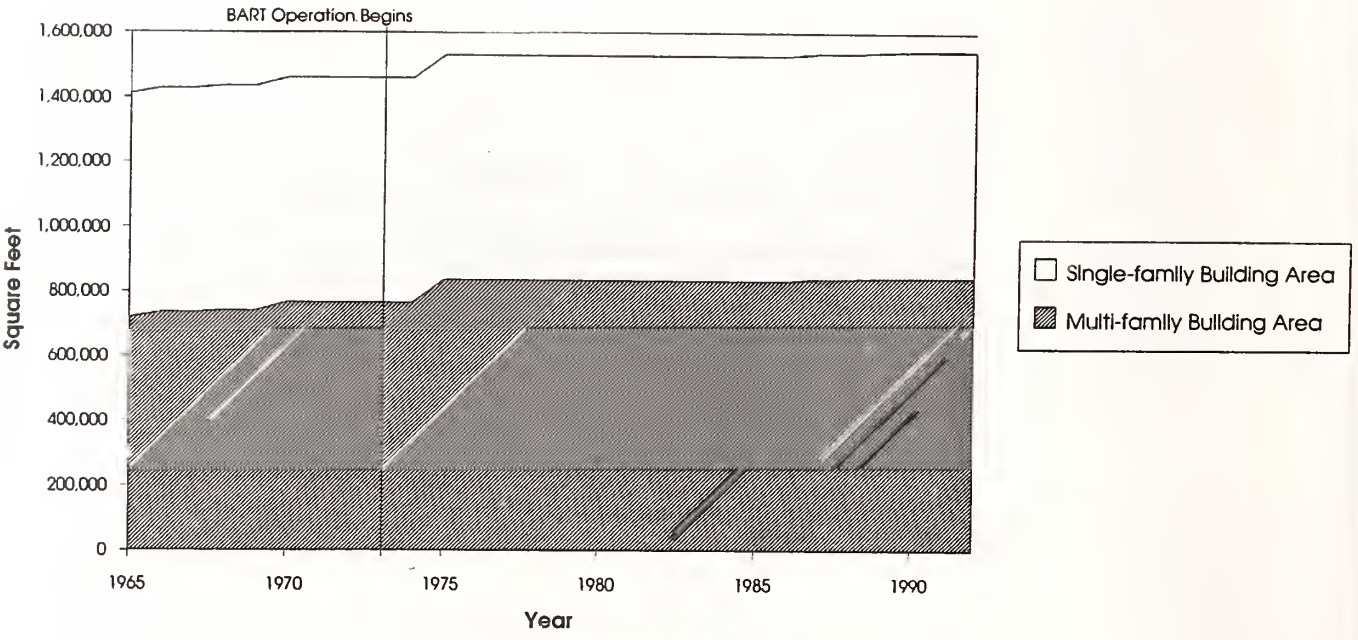


Figure 11.4. Fruitvale Residential Vintage Model (Since 1965)

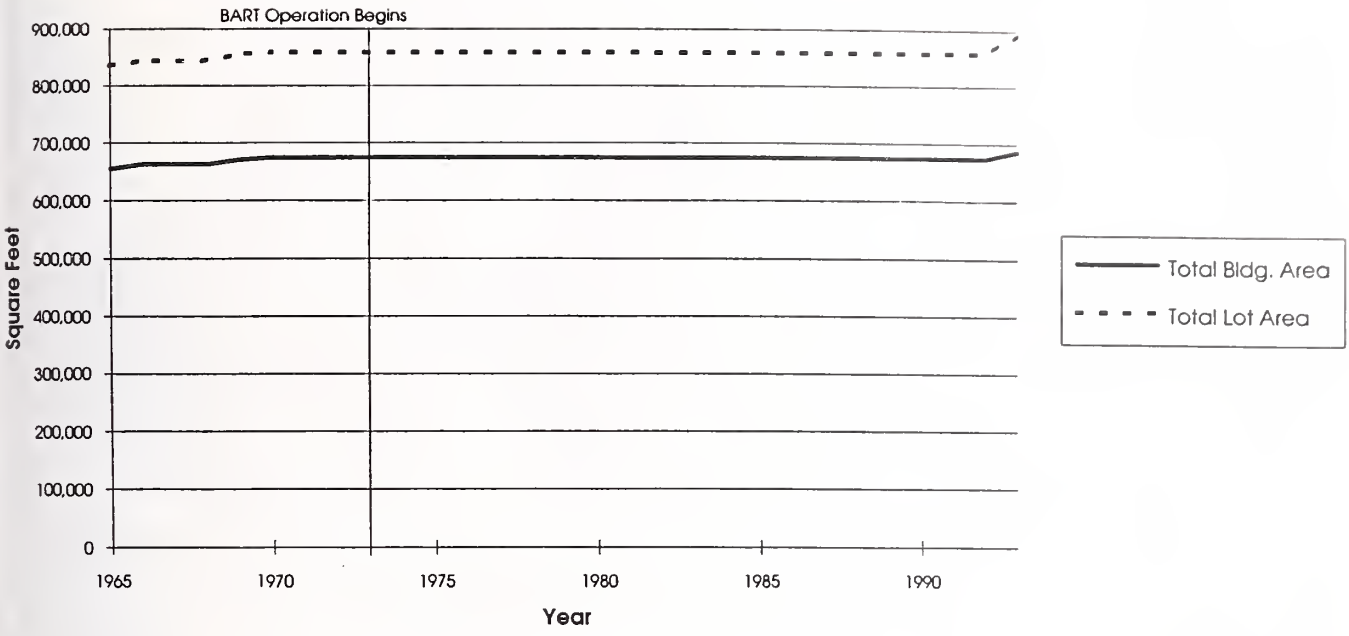


Figure 11.5. Fruitvale Non--Residential Vintage Model (Since 1965)

The predominantly Hispanic commercial district around the Fruitvale station has been in a state of decline since the 1970s. A 1,100-space surface parking lot separates the station from the many small shops on East 14th Street. While BART has had little relationship to the surrounding community for the past two decades, the Spanish Speaking Unity Council, a local community development corporation, hopes to change this. The council has developed a transit village plan that calls for new housing, a community medical center, and a revitalized retail strip. According to the council's director, ". . . instead of a vast sea of parking, we want housing and a pedestrian plaza linking the station to 14th Street" (Knack, 1995: 18). To date, the Unity Council has received $750,000 in ISTEA enhancement funds to build the pedestrian plaza, and has won $5.4 million in Housing and Urban Development Section 202 funds for new senior housing. The city of Oakland plans to locate a senior center on the site, and negotiations are underway with various private developers to build market-rate housing and major retail outlets near the station. Fruitvale has also been designated one of a dozen or so "livable communities" by the Federal Transit Administration, which will give it access to additional funding for establishing community-based paratransit programs, such as specialized reverse-commute bus services, as well as possibly child care centers and other ancilliary projects on BART property.

11.2. San Leandro Station

The San Leandro station, in the heart of the city of San Leandro, has experienced the most condominium development within a quarter-mile walking distance of any BART station. It also has a suitable matched pair — the Davis St./I-880 interchange, a miles to the west. Davis Street runs perpendicular into both the station and freeway (also known as the Nimitz Freeway). Matched-pair results are presented in this section.

Map 11.1 shows a GIS-generated map of dominant land uses for hectare grid cells within a half-mile ring of both the San Leandro station and Davis St./I-880 interchange. Moderately dense housing dominates in both settings (code = RESH, for residential-high). The San Leandro station also has a fair amount of retail-commercial nearby (code = COMM for commercial and URBO = for other urban), whereas the Davis St./I-880 interchange is flanked by large amounts of industrial land (code = IND).

Since BART's 1973 opening, around 460,000 square feet of residential building space was added around the San Leandro BART station (Figure 11.6), nearly all of it multi-family housing (Figure 11.7). By comparison, only 96,000 square feet of apartments and condominiums and no detached homes were built within a half-mile of the Davis St./I-880 interchange over the same 20-year period (Figure 11.8) The multi-family housing built in 1982 and 1983 around the San Leandro stations consists of low- and mid- rise condominiums: Peralta Creek Adope (44 units), Peralta Creek Towers (40 units), and Pacific Plaza Condominiums (150 units, situated directly across the parking lot and entrance to the station).

Nearly a third more non-residential floorspace was built around the Davis Street interchange than the San Leandro station from 1973-1993 (Figures 11.9 and 11.10). Industrial and retail-commercial uses have constituted most of the non-residential floorspace and occupied land area added to the station area since BART (Figures 11.11 and 11.12). Two major projects built within a half-mile of the station were: Washington Plaza, a 108,000-sq.-ft. shopping center opened in 1981 on the corner of Davis St. and E. 14th St.; and a small light industrial park opened in 1982. The major addition near the Davis St./I-880 interchange has been a number of large warehouse-retail outlets, including Costco, Home Depot, Sportmart, and Office Depot — together occupying a three-acre lot with 107,000 sq. ft. of building space. Prior to BART, the site was occupied by a Caterpillar Tractor factory. Overall, net commercial-industrial densities are considerably higher near the BART station but have fallen a bit since the early 1980s, whereas densities have increased slightly near the interchange (Figures 11.13 and 11.14). Despite having higher densities, much of the development around San Leandro's BART station has been auto-oriented (e.g., abundant parking, low-densities), as it has been around the Davis St. interchange.

11.3. Bayfair Station

While vintage models were not prepared for the Bayfair station area, land-use trends have been similar to those around the San Leandro station. Map 11.2 reveals that both the station area and Hesperian Blvd./I-880 interchange, three-quarters of a mile away, are surrounded mainly by retail-commercial

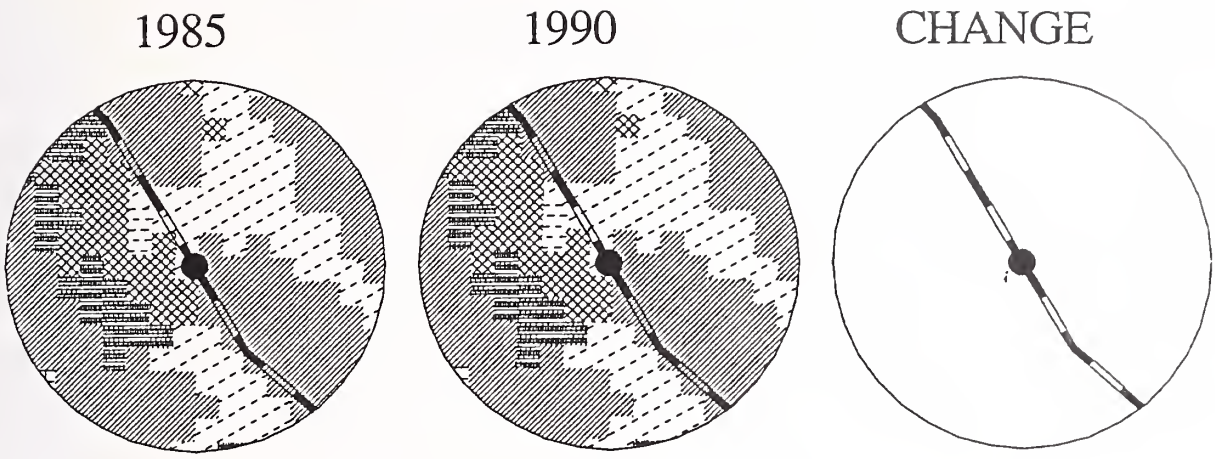


FIG 1: SAN LEANDRO BART AREA

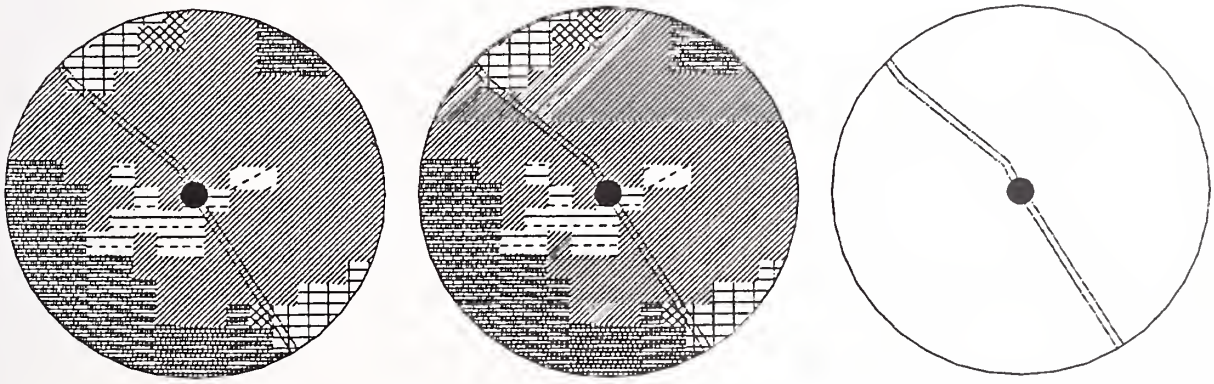
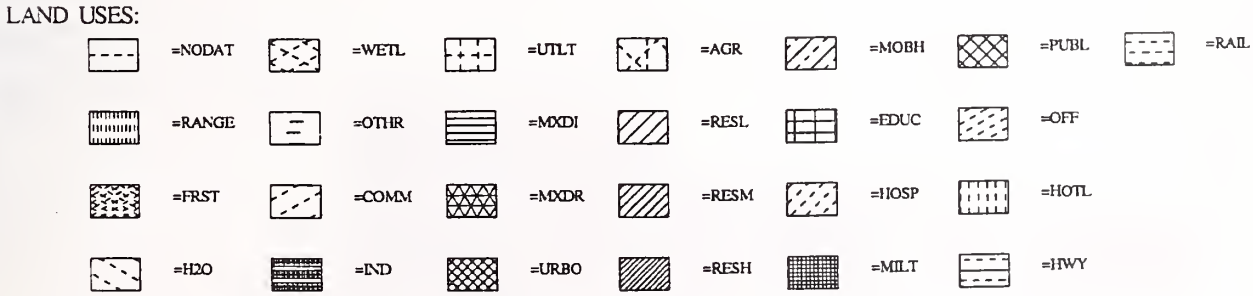


FIG 2: DAVIS ST./ I-880 INTERCHANGE



Map 11.1. San Leandro Station and Freeway Site Land Uses: Half-Mile Radius Area

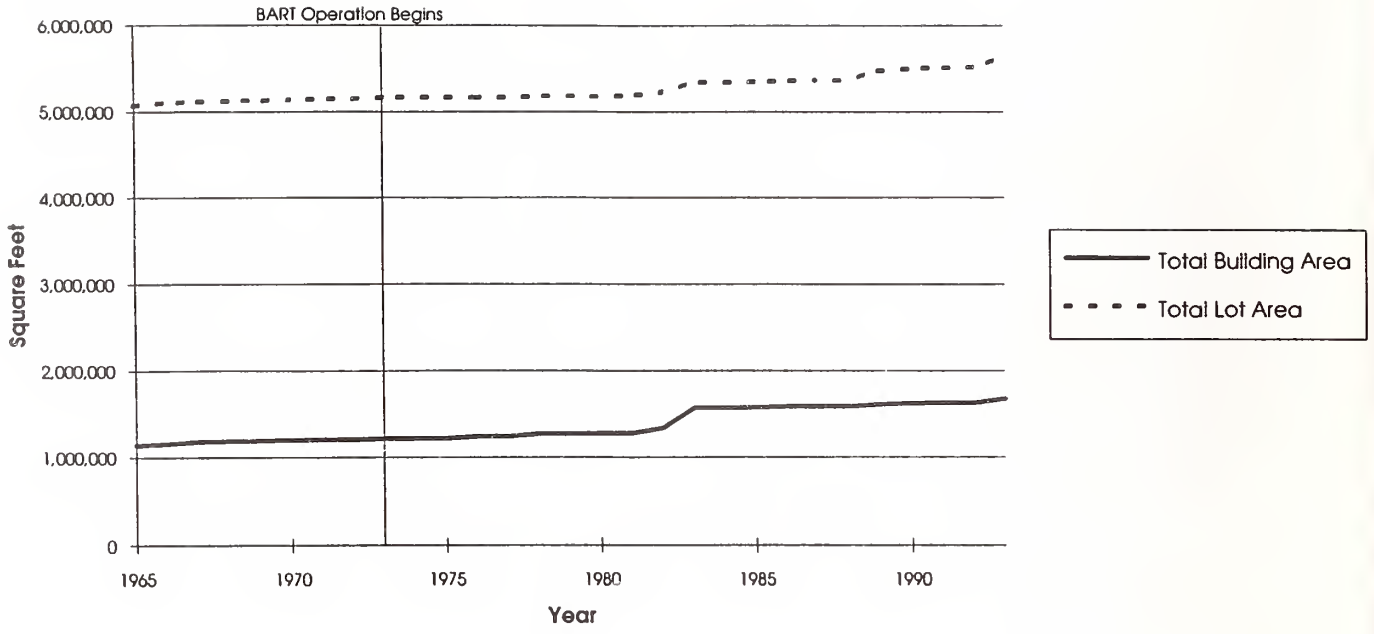


Figure 11.6. San Leandro Residential Vintage Model (Since 1965)

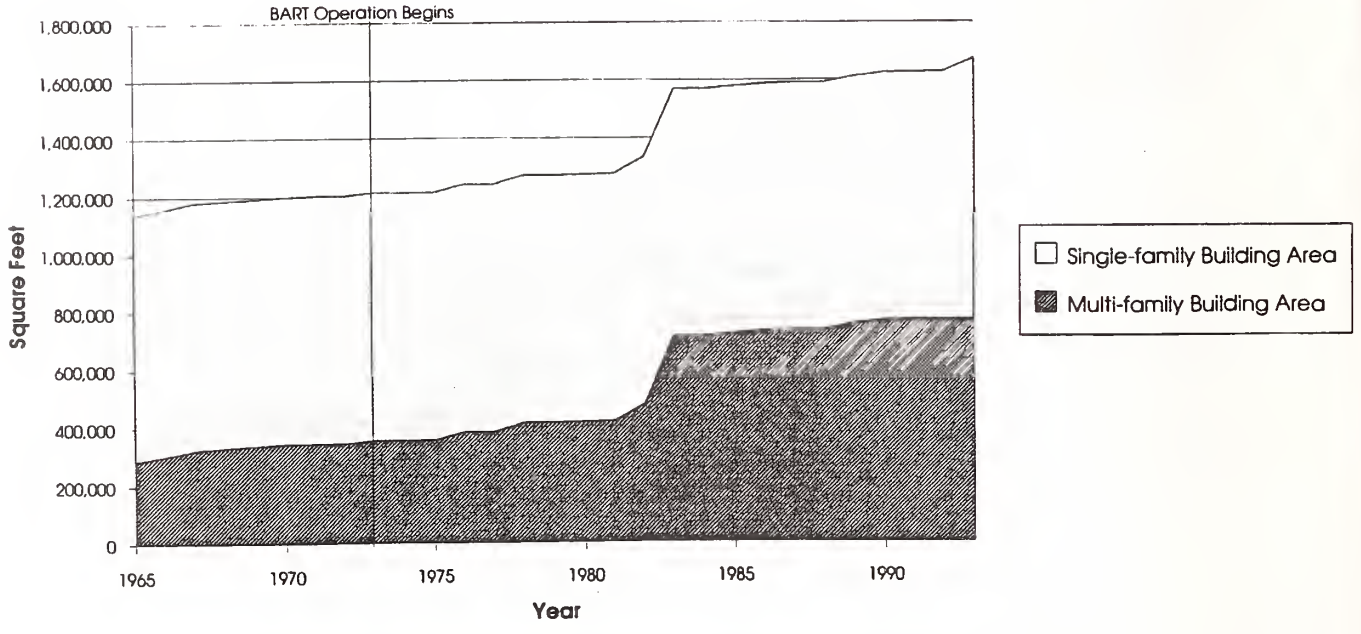


Figure 11.7. San Leandro Residential Vintage Model (Since 1965)

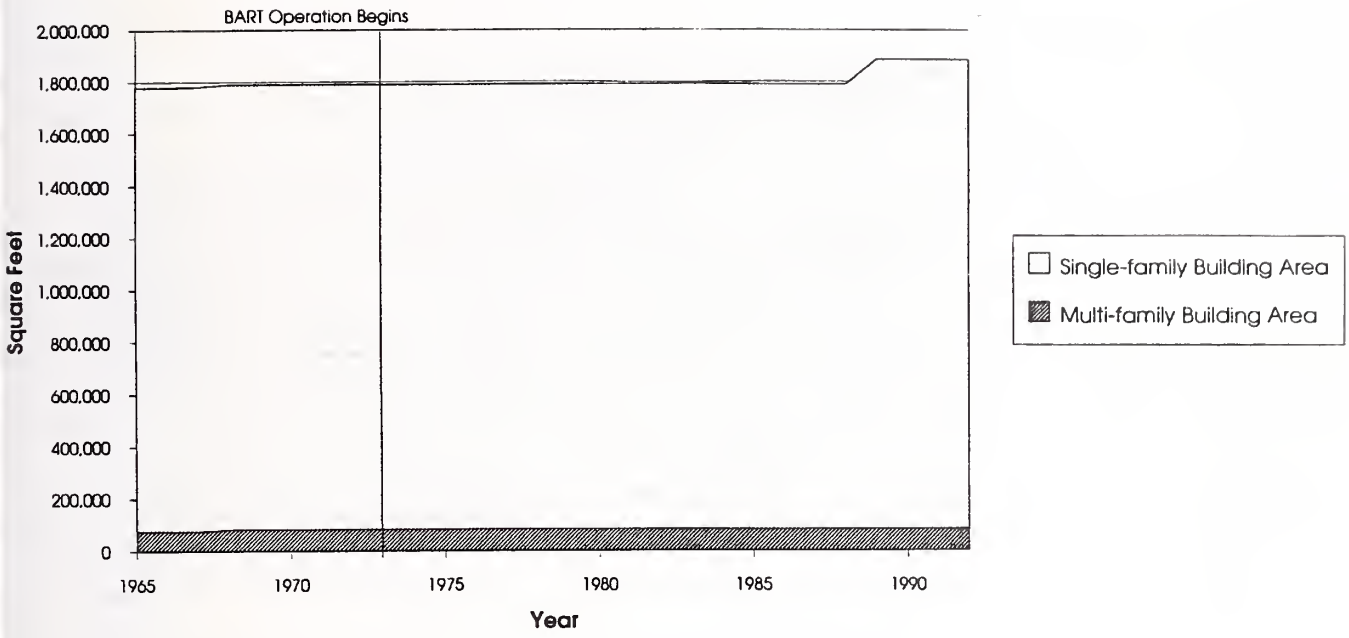


Figure 11.8. I-880/Davis St. Residential Vintage Model (Since 1965)

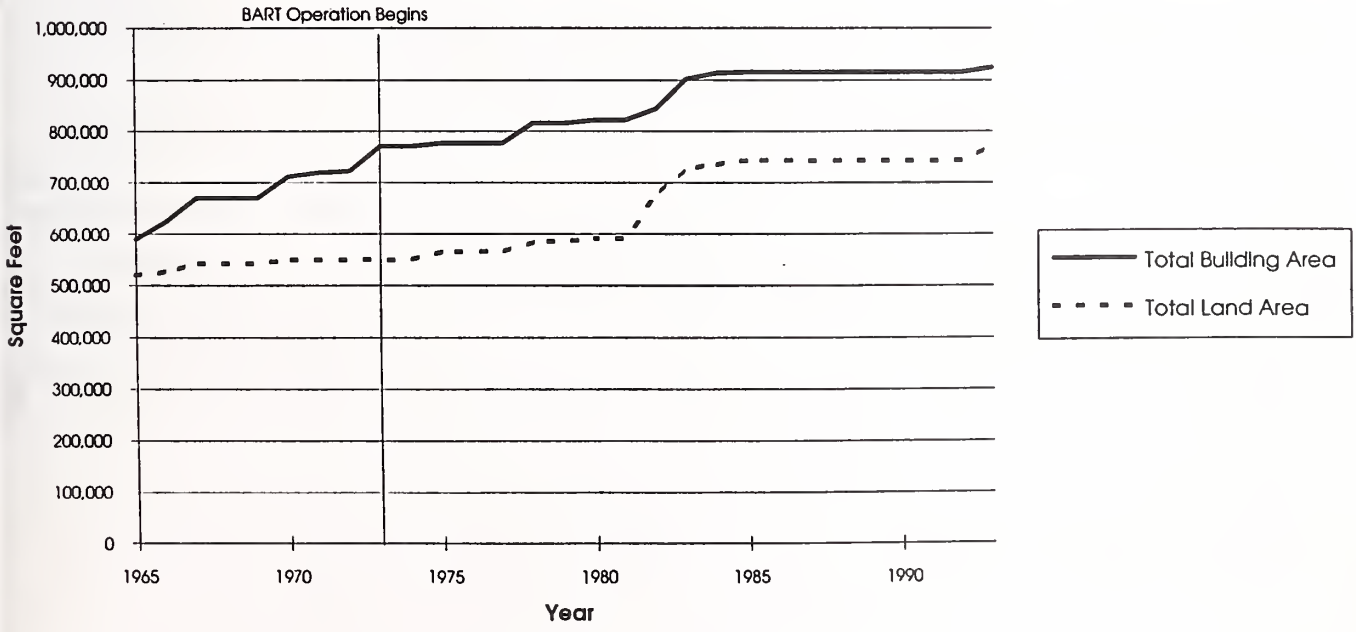


Figure 11.9. San Leandro Non-Residential Vintage Model (Since 1965)

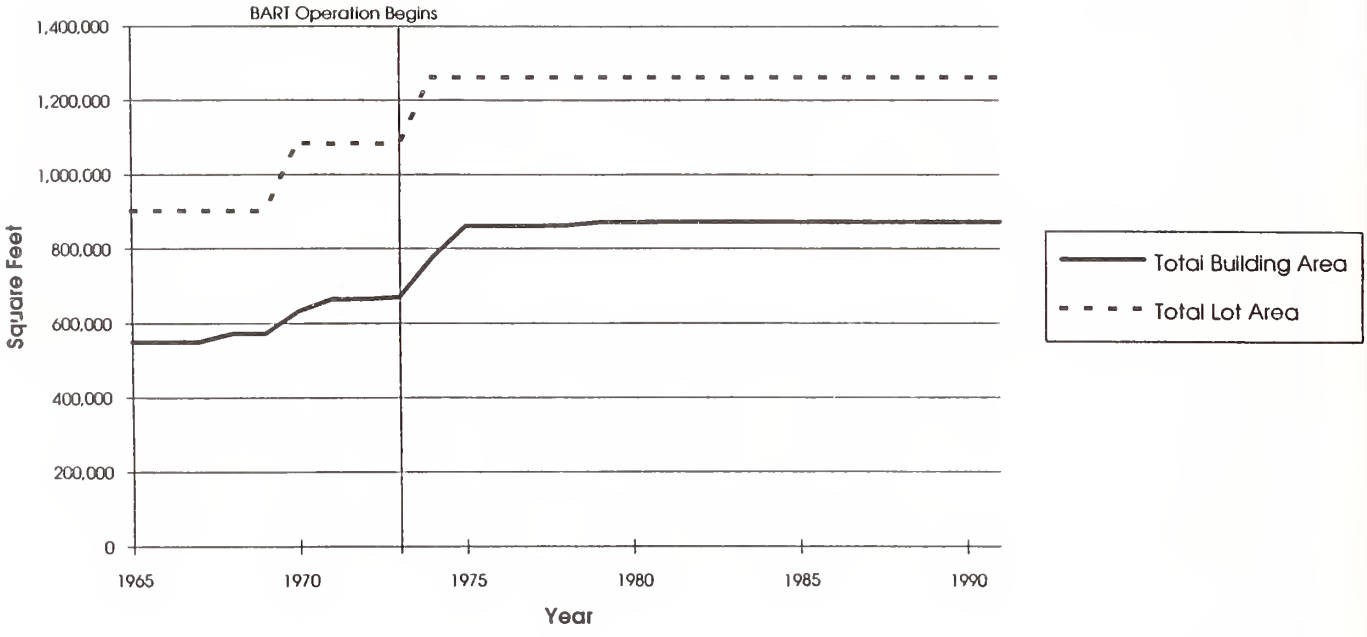


Figure 11.10. I-880/Davis St. Non-Residential Vintage Model (Since 1965)

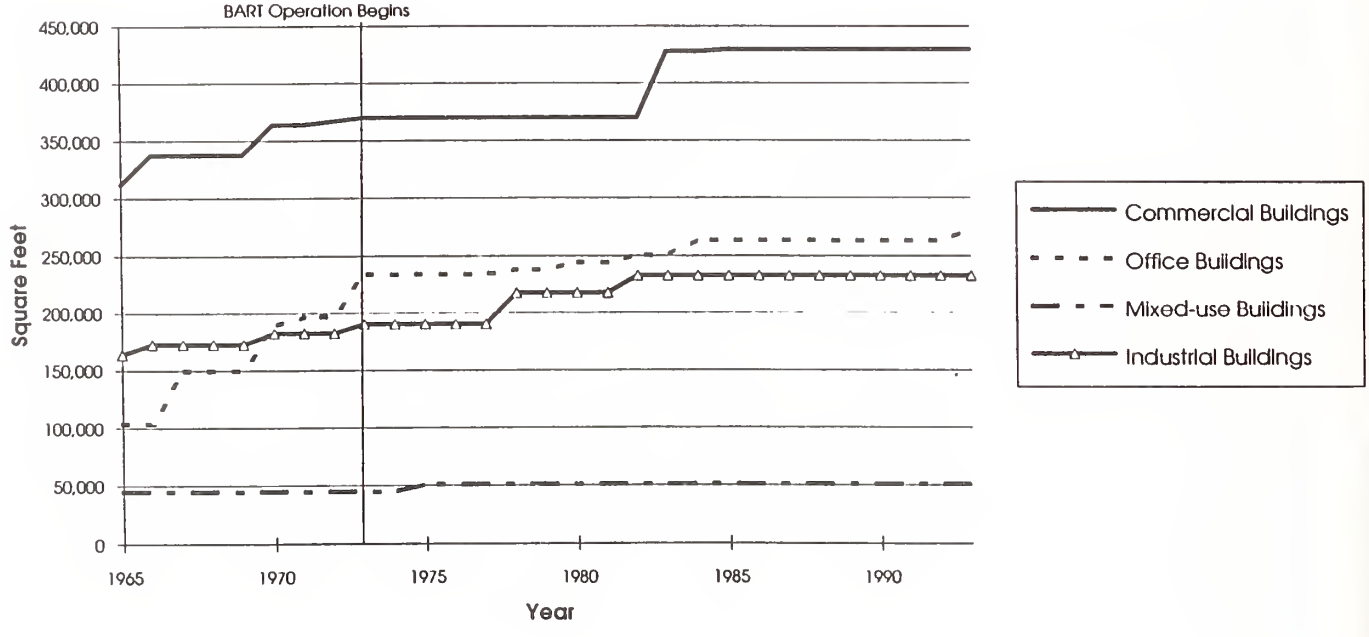


Figure 11.11. San Leandro Non-Residential Vintage Model (Since 1965)

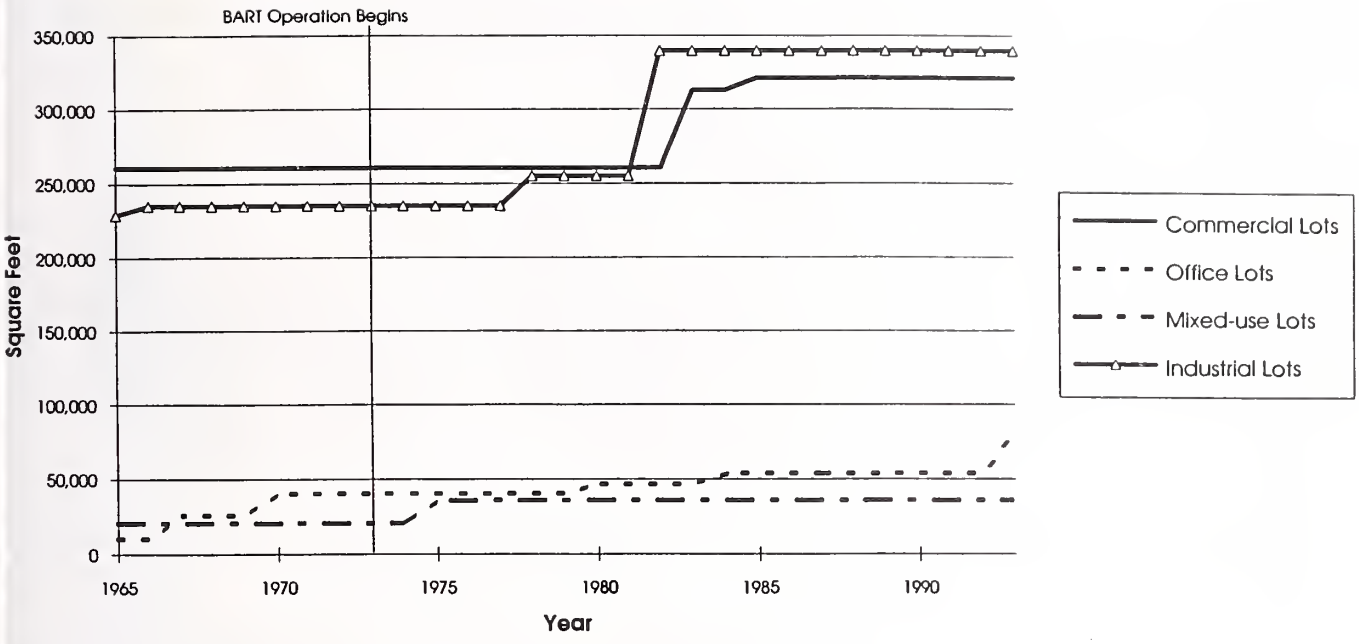


Figure 11.12. San Leandro Non-Residential Vintage Model (Since 1965)

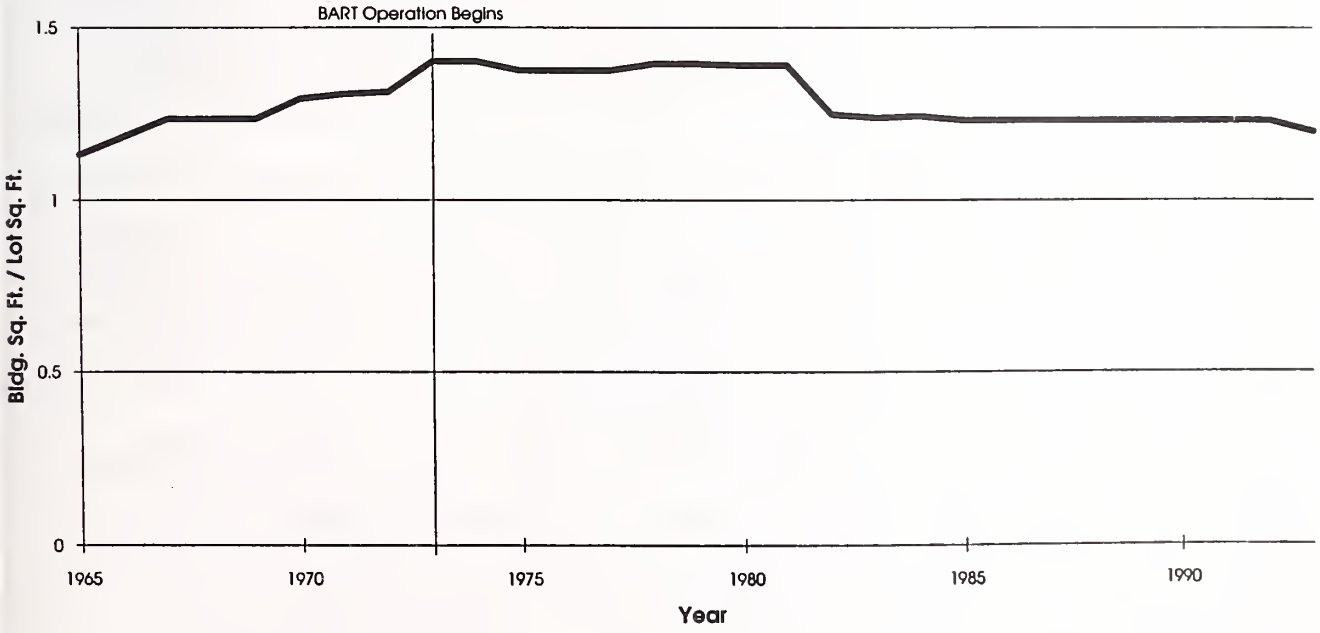


Figure 11.13. San Leandro Non-Residential F.A.R. Vintage Model (Since 1965)

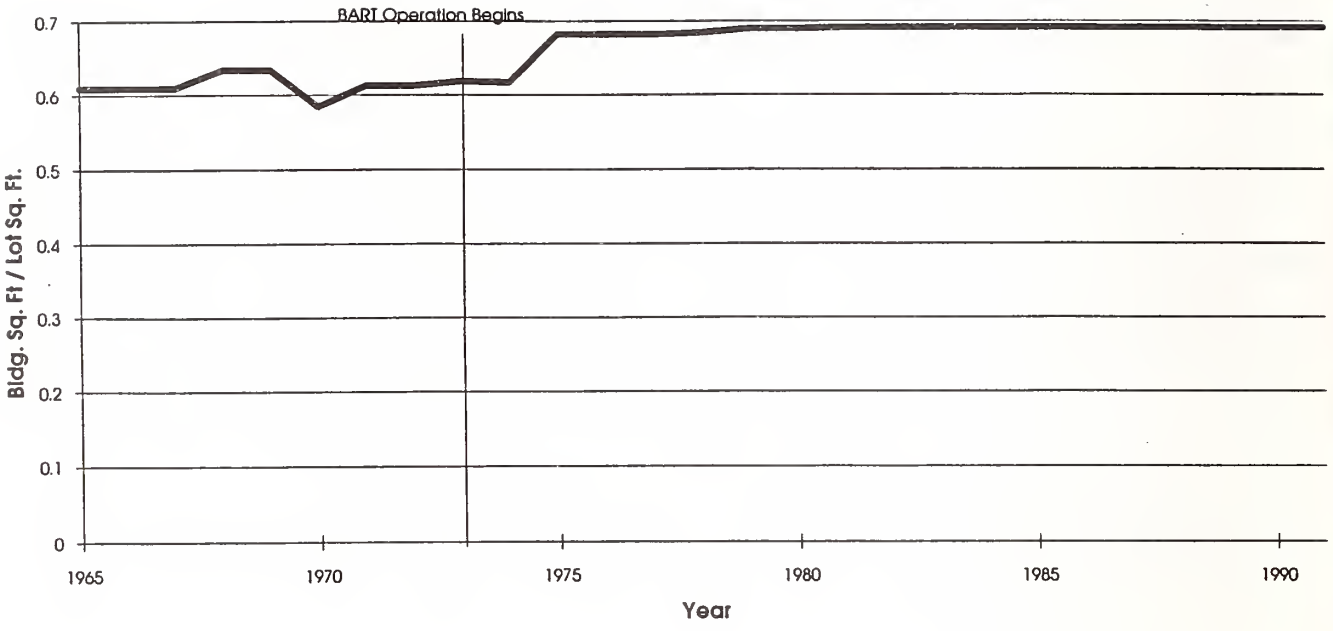


Figure 11.14. I-880/Davis St. Non-Residential F.A.R. Vintage Model (Since 1965)

development and residential neighborhoods.[2] Most prominent around the Bayfair station is the Bayfair Mall, a 760,000-sq.-ft. indoor shopping complex with 3,800 parking spaces that predates BART and that has recently been renovated. Several other retail plazas, strip commercial development, and garden apartment complexes are located throughout the area. The Hesperian Boulevard interchange is likewise flanked by several small retail plazas and strip commercial development (including a large Target retail outlet). Overall, while a significant amount of commercial floorspace has been added in the area since BART's introduction, all of it is auto-oriented and not related to BART in any functional way. The Bayfair station, with 1,903 surface parking spaces, functions mainly as a commuter rail stop rather than a destination station for retail-related travel. Surveys show that only 7 percent of shoppers at suburban East Bay shopping malls near BART travel by rail (Cervero, 1993).

The largest apartment complex within a half-mile ring of Bayfair station is the Hamlet Apartments, with 150 units. Around 42 percent of employed tenants living in the Hamlet Apartments commute to work by BART (Cervero, 1993). This is considerably above the 1990 citywide average for San Leandro-employed residents of 6 percent.[3] Within two-thirds of a mile of the station are two other large-scale apartment projects — Bayfair East and Summerhill Terrace Apartments. High shares of employed residents in both of these more distant projects likewise rail-commute — 22 percent in 1993. These very

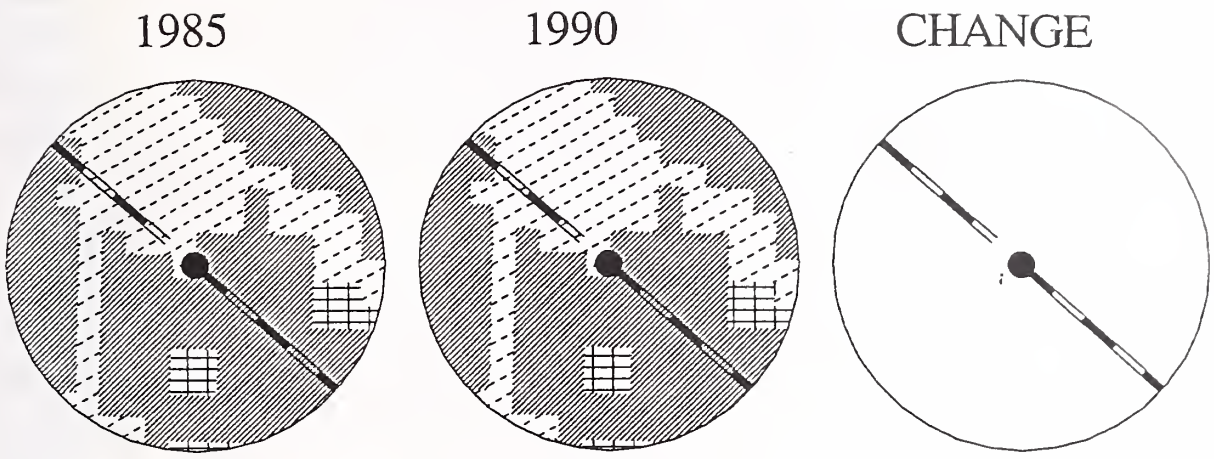


FIG 1: BAYFAIR BART AREA

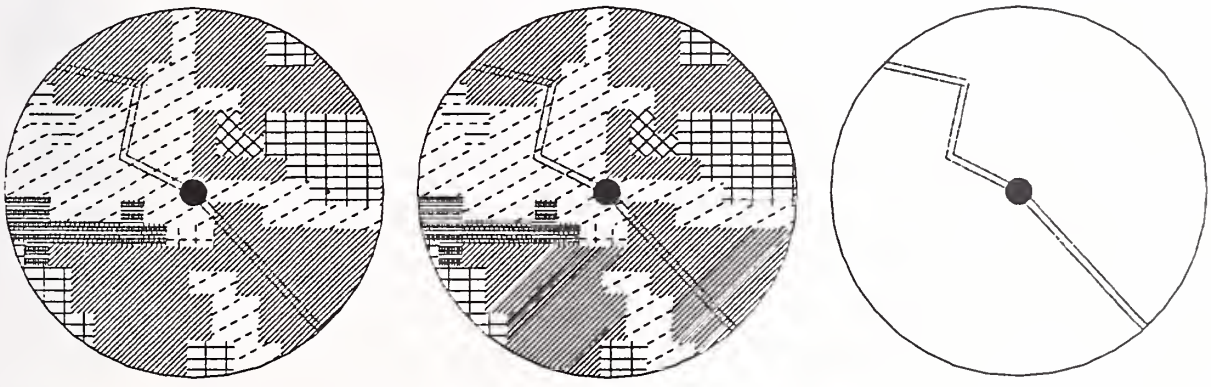
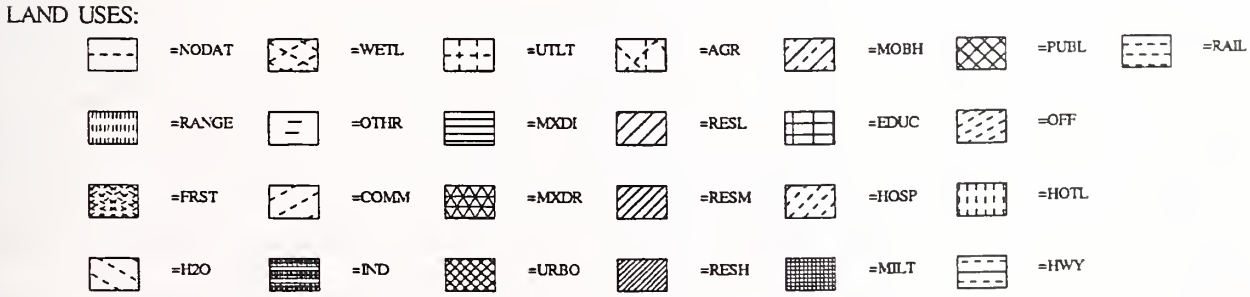


FIG 2: HESPERIAN BLVD./ I-880 INTERCHANGE



Map 11.2. Bayfair Station and Freeway Site Land Uses: Half-Mile Radius Area

high shares of rail commuting for suburban residents suggest occupants consciously chose to rent near a BART station in order to economize on commuting.

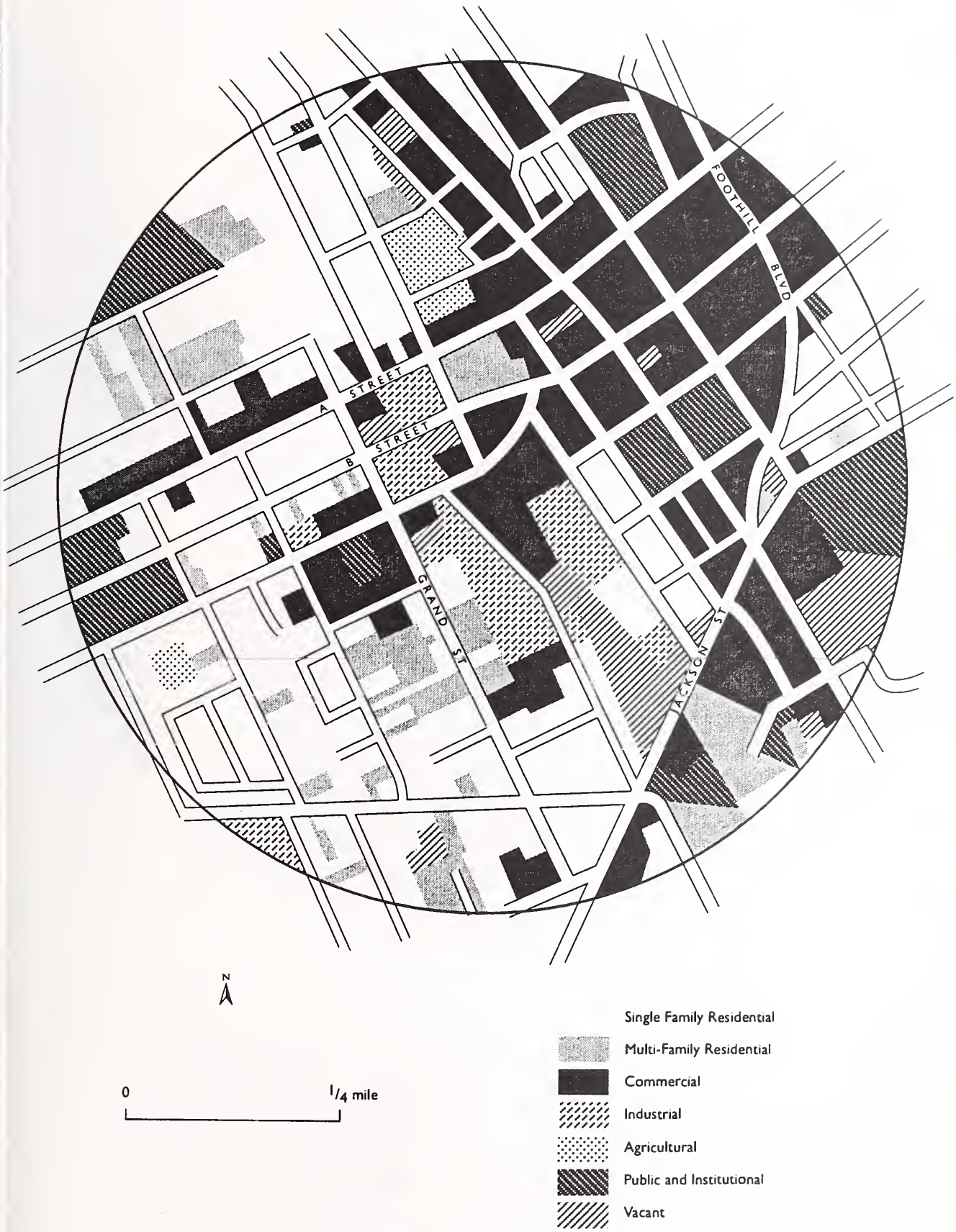
The Bayfair station will become a major transfer station in a few years once the BART extension to Dublin and Pleasanton is completed and in operation. This could help spur a new round of development around the station; however, based on the experiences at the MacArthur station and other BART transfer points, more than likely the most noticeable change will be the expansion of surface bus routes connecting to the station.

11.4. Hayward Station

The Hayward station lies near downtown Hayward, flanked by a mixture of retail, office, and multi-family development. Map 11.3 shows the land-use pattern in 1965 and Map 11.4 reveals the development that has been added over the ensuing 30-year period. A few retail buildings were erected south of the station, and pockets of condominiums, duplexes, and apartments have also been added. The matched-pair for downtown Hayward is the Winton Avenue Interchange. Map 11.5 shows that in 1965, the Southland mall abutted the southwest ramp of the interchange. A city and county government complex was also aligned along Winton Avenue. Single-family housing spans between these uses. The most significant development since the 1980s has been a complex of condominiums located just off the Winton Avenue/I-880 (Nimitz Freeway) on-ramp (Map 11.6).

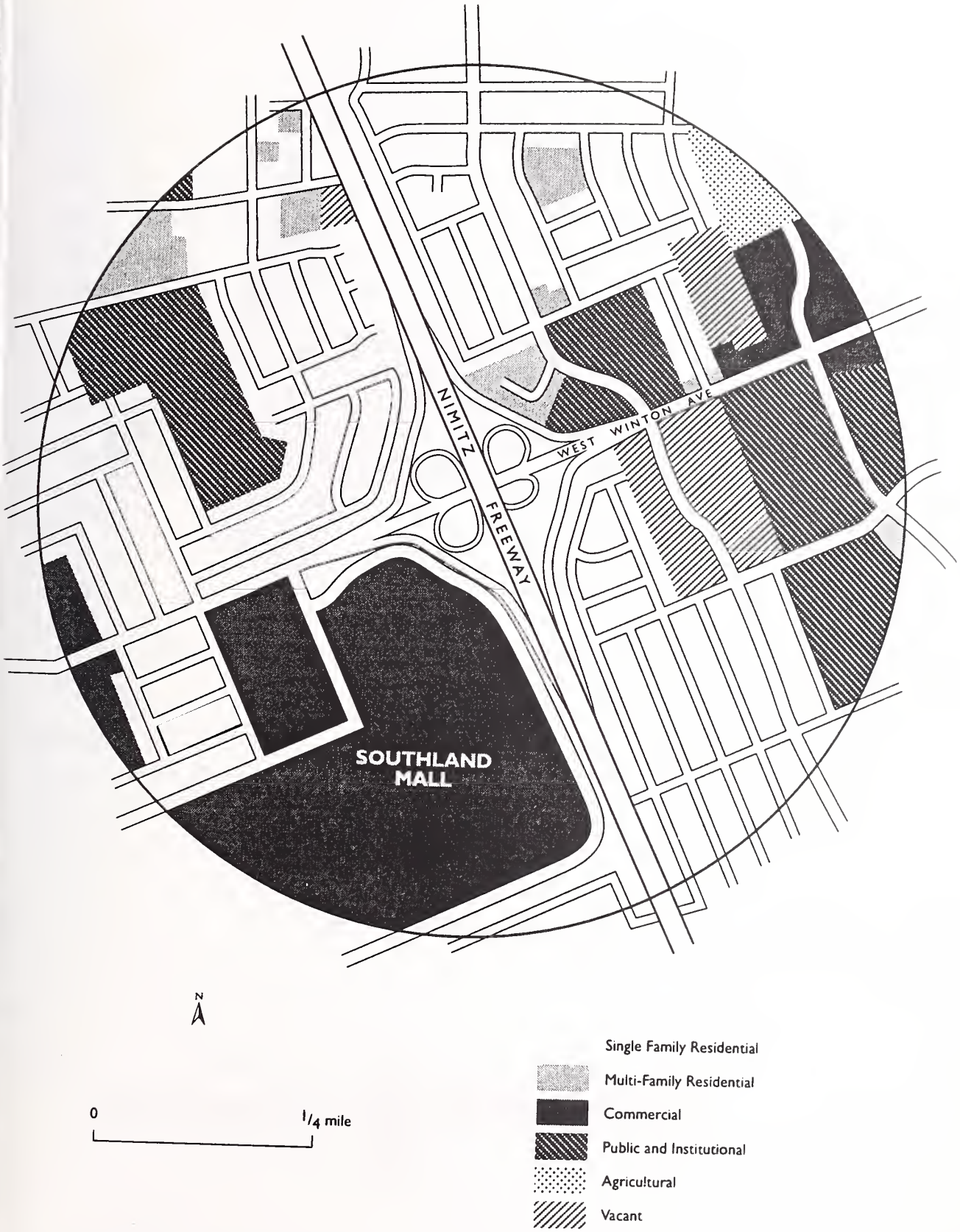
While downtown Hayward has considerably more multi-family units than the half-mile ring around the Winton Avenue interchange, since 1973 more multi-family square footage was built around the freeway than the BART station (Figures 11.15 and 11.16). The commercial real estate market has generally been flat both downtown and around the interchange throughout the post-BART era. Only a few light industrial buildings (24,000 sq.ft.) and retail shops (23,000 sq. ft.) post-date BART (Figure 11.17). No new non-residential building activity was recorded around the Winton Avenue interchange, though the Southland Mall was renovated and expanded in the early 1990s.

Overall, BART has failed to induce any significant land-use changes in downtown Hayward. City officials hope to turn this around. A redevelopment plan was approved in 1991 to create a moderately dense, mixed-use village around the Hayward station. With downtown Hayward's Art Deco facades and fine-grained grid street pattern, the city hopes the BART station will become the centerpiece of an attractive, pedestrian-oriented core. The plan emphasizes mixed-income housing development to create an 18-hour-a-day pedestrian presence. Proposals for senior housing and several market-rate condominium and apartment complexes with ground-floor retail have been stalled by lack of financing. Currently, the county plans to build a government complex and the city of Hayward is contemplating relocating city hall near the station; civic leaders hope these initiatives will jump-start private-sector investment in the station area.

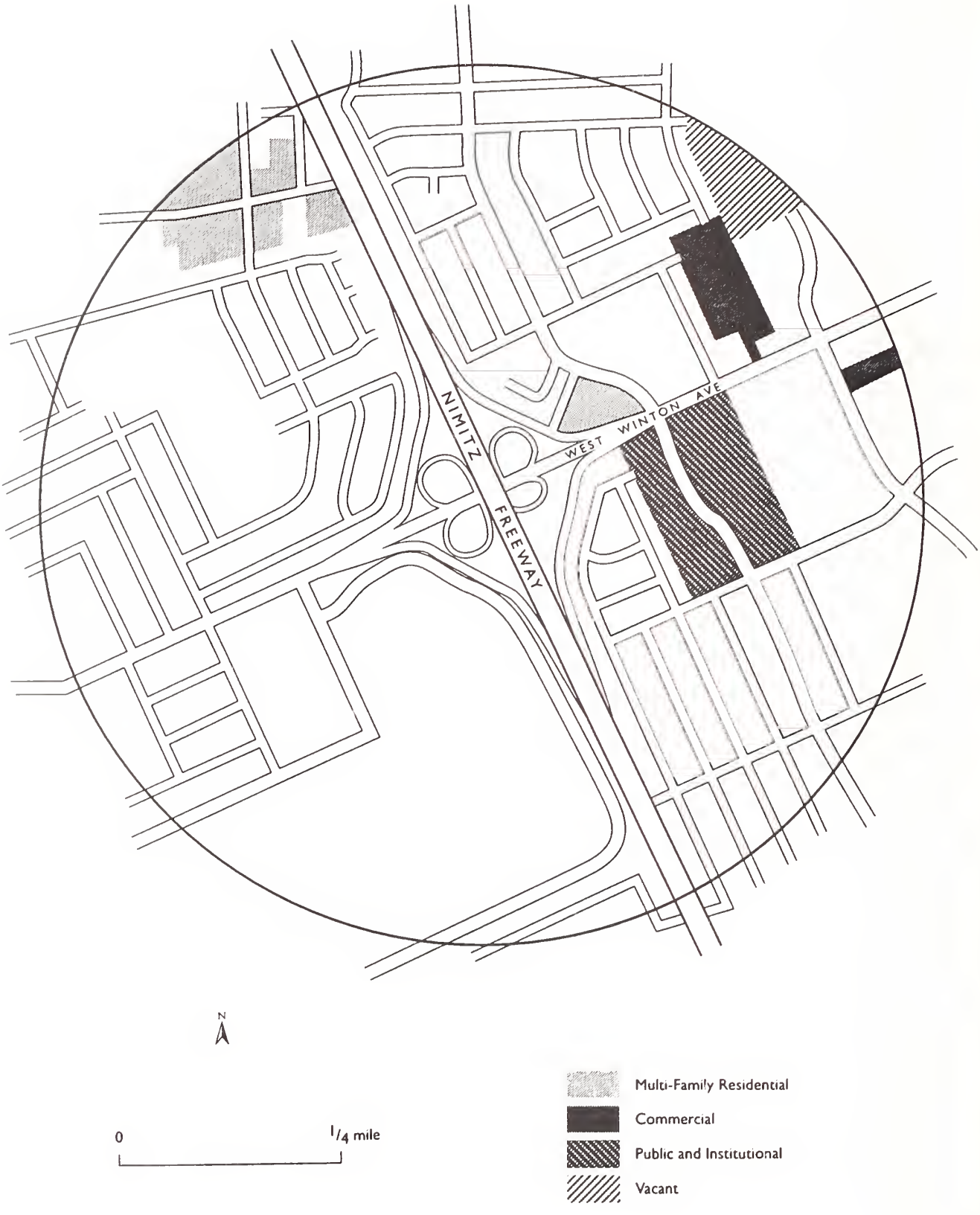


Map 11.3. Hayward BART Station Area 1965 Land Use

Map 11.4. Hayward BART Station Area 1965-1994 Land Use Changes



Map 11.5. City of Hayward Winton Avenue Interchange: 1965 Land Use



Map 11.6. City of Hayward Winton Avenue Interchange: 1965-1994 Land Use Changes

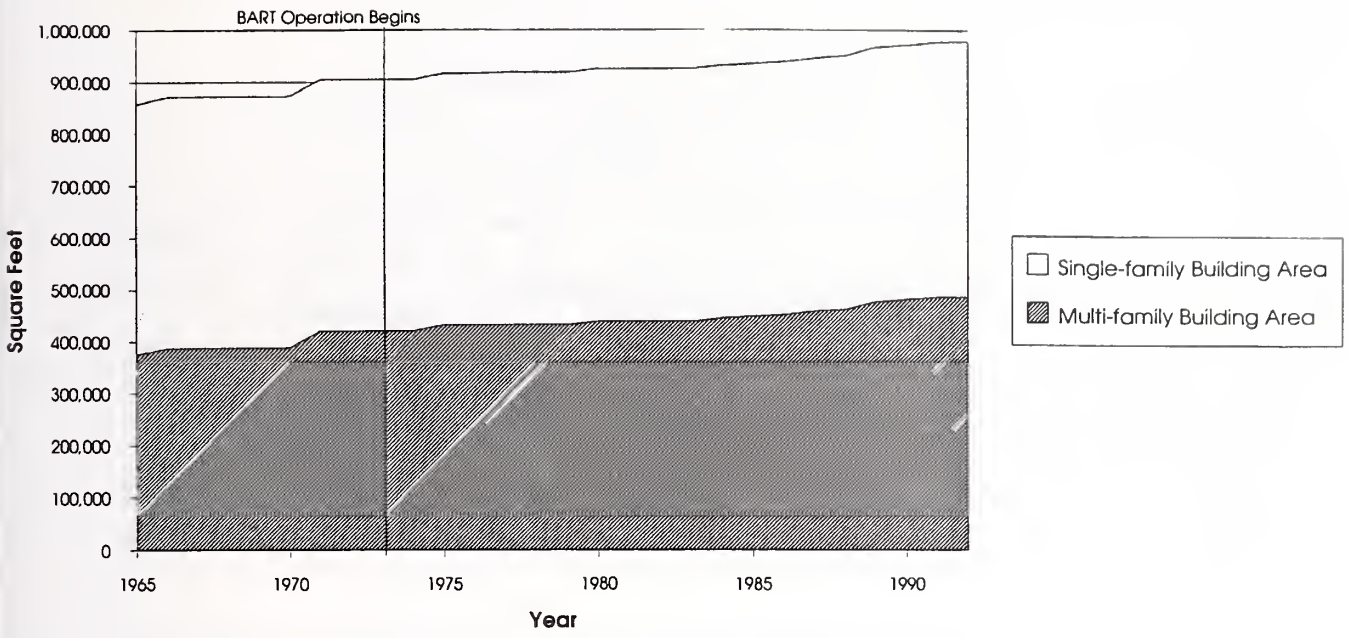


Figure 11.15. Hayward Residential Vintage Model (Since 1965)

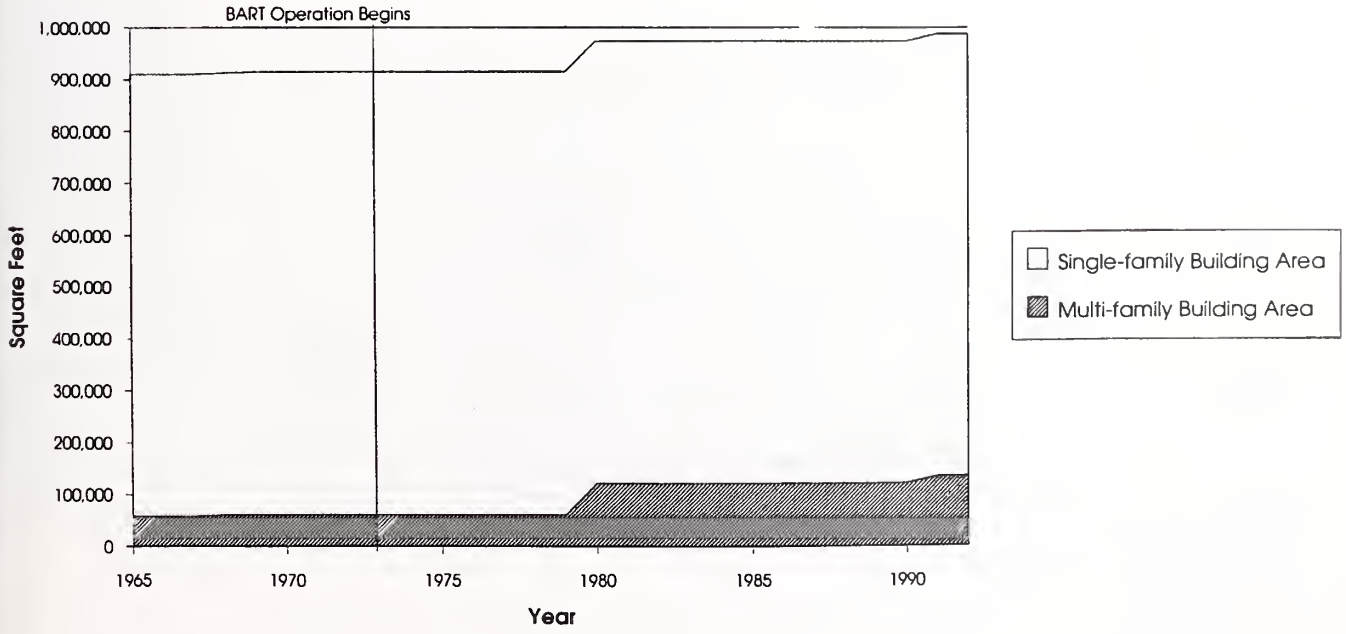


Figure 11.16. I-880/Winton Ave. Residential Vintage Model (Since 1965)

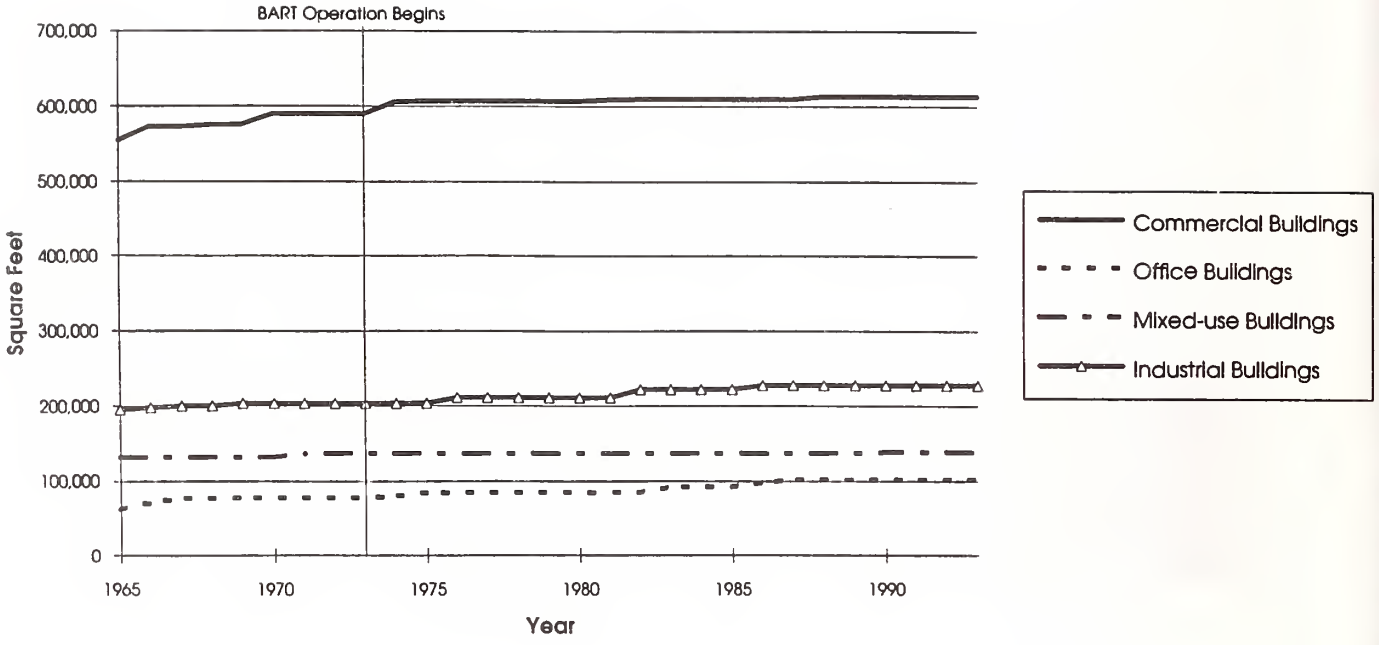


Figure 11.17. Hayward Non-Residential Vintage Model (Since 1965)

11.5. South Hayward Station

In 1965, the neighborhood surrounding the present site of the South Hayward station consisted of a mix of commercial, industrial, institutional, and residential uses (Map 11.7). Since BART's opening, a considerable amount of public, commercial, and apartment building activity has occurred (Map 11.8). The South Hayward station has attracted considerably more development than its freeway interchange matched-pair — Tennyson Road (Maps 11.9 and 11.10). Neighborhoods surrounding the freeway interchange consist mainly of single-family homes, the notable exception being government functions to the north of the Tennyson interchange. County officials are presently considering relocating some of these functions to the redeveloped Hayward station area.

Two large apartment complexes near the South Hayward station built since the opening of BART are the Foothill Apartments (210 units, 750 feet away from the station) and the Mission Heights Apartments (145 units, one-half mile from the station). Both projects appear to be catering to transit users, which might have been what attracted some tenants to these rail-based housing projects. In 1993, 12.9 percent of Mission Heights' employed residents commuted by BART and 30.9 percent of the Foothill Apartments residents were rail commuters (Cervero, 1993). These modal splits compare to the 1990

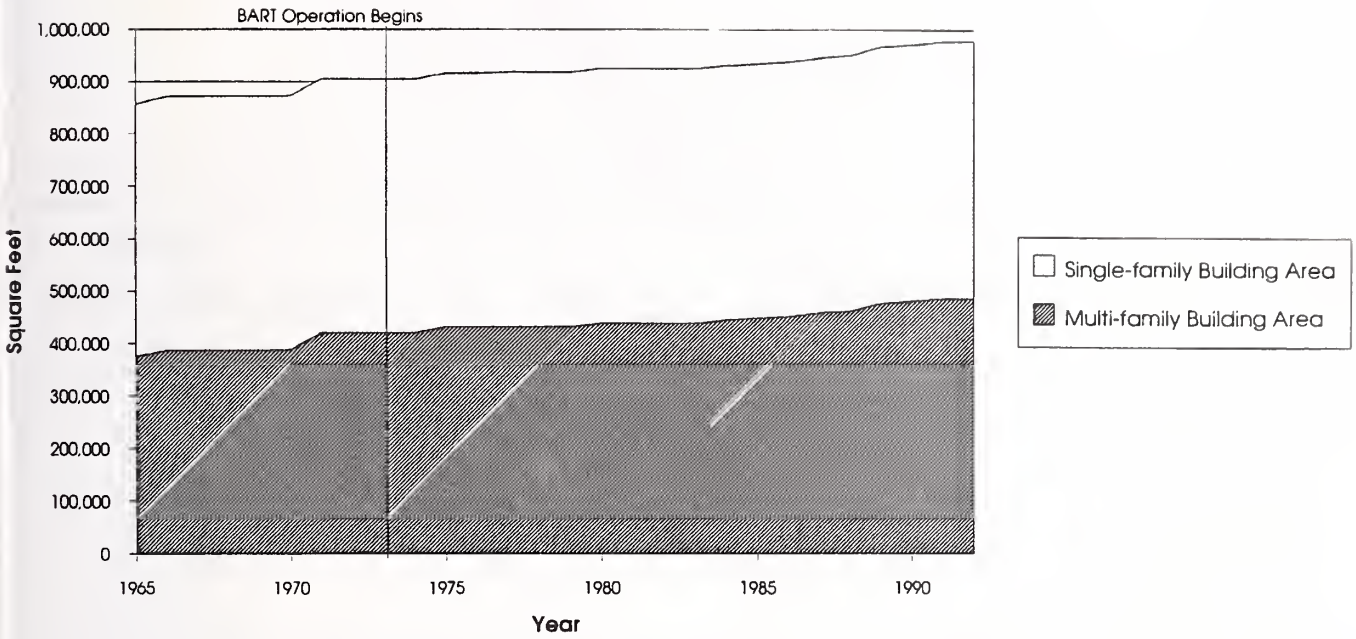


Figure 11.15. Hayward Residential Vintage Model (Since 1965)

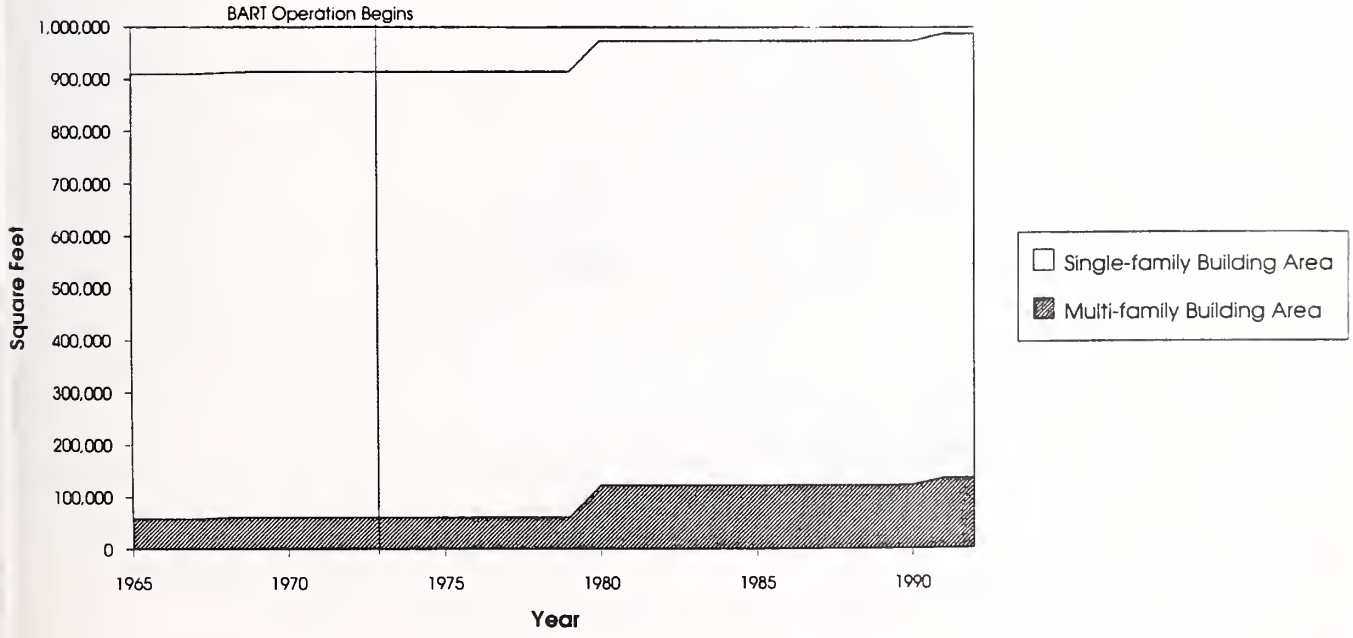


Figure 11.16. I-880/Winton Ave. Residential Vintage Model (Since 1965)

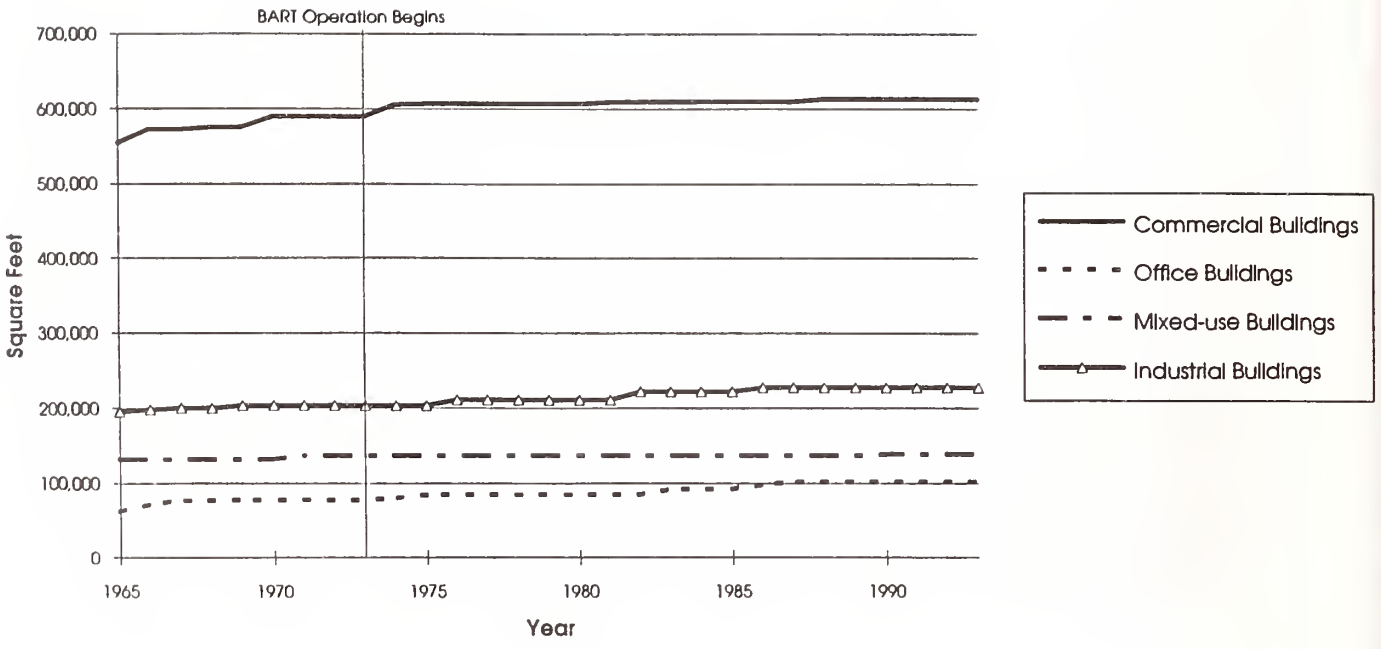
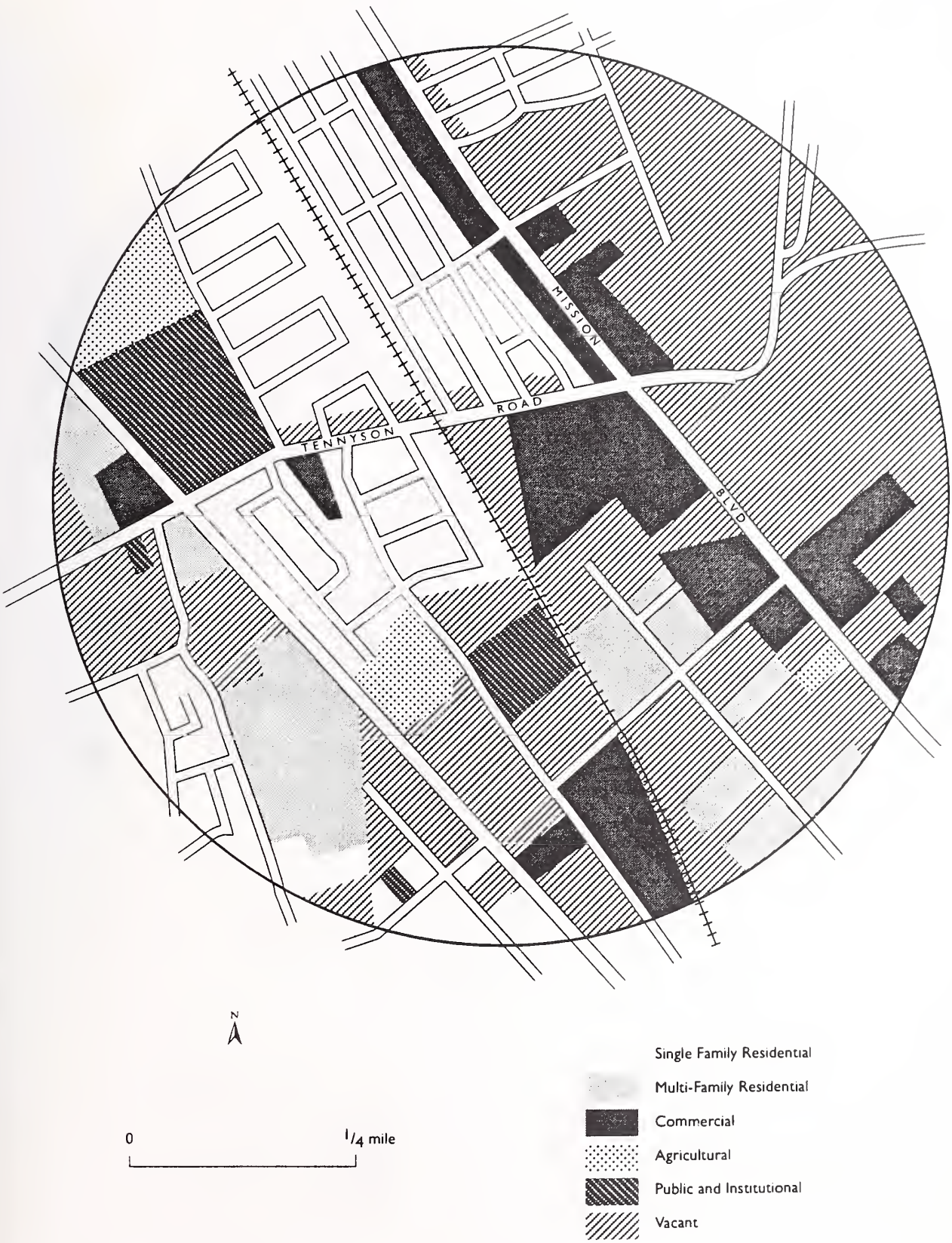


Figure 11.17. Hayward Non-Residential Vintage Model (Since 1965)

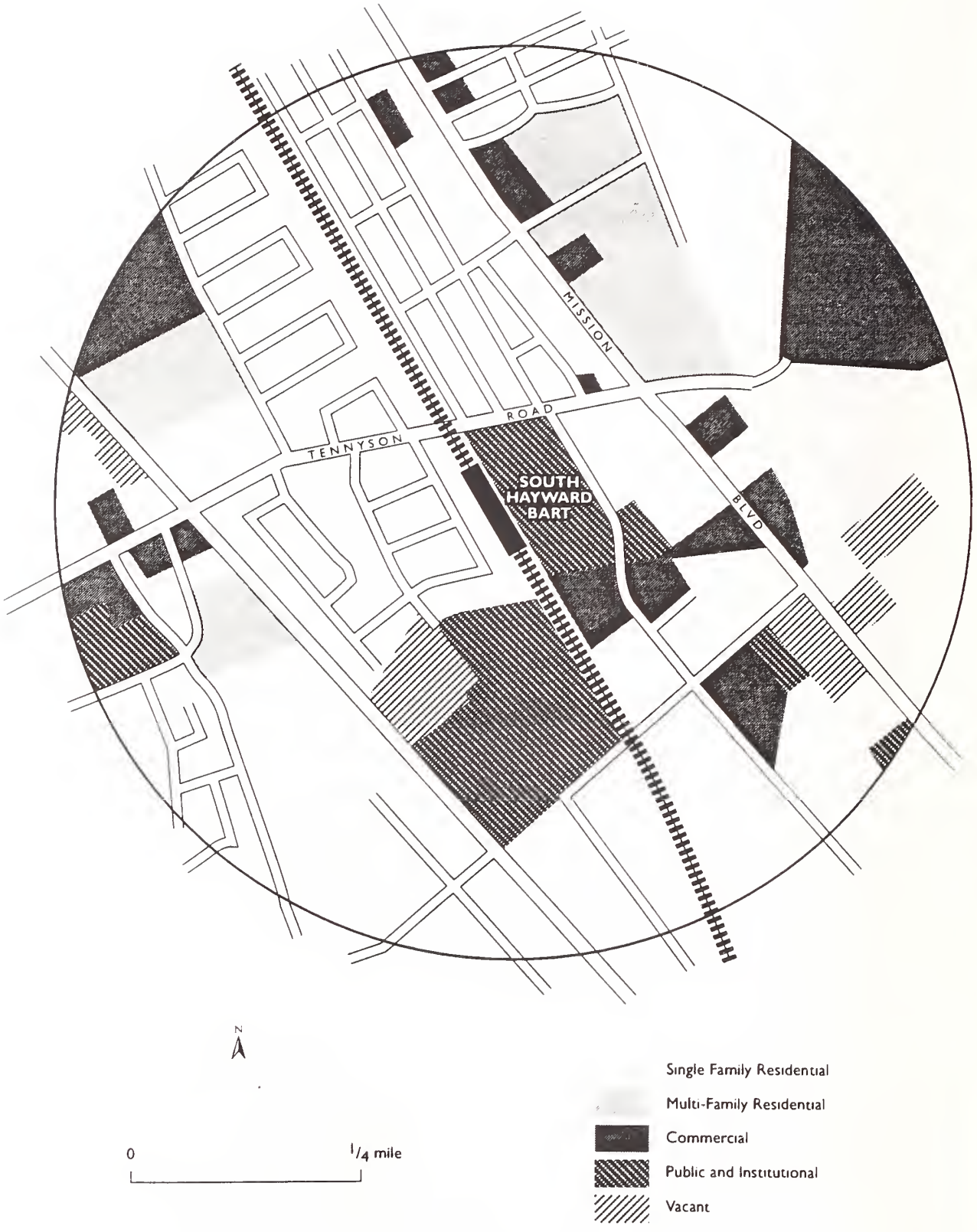
11.5. South Hayward Station

In 1965, the neighborhood surrounding the present site of the South Hayward station consisted of a mix of commercial, industrial, institutional, and residential uses (Map 11.7). Since BART's opening, a considerable amount of public, commercial, and apartment building activity has occurred (Map 11.8). The South Hayward station has attracted considerably more development than its freeway interchange matched-pair — Tennyson Road (Maps 11.9 and 11.10). Neighborhoods surrounding the freeway interchange consist mainly of single-family homes, the notable exception being government functions to the north of the Tennyson interchange. County officials are presently considering relocating some of these functions to the redeveloped Hayward station area.

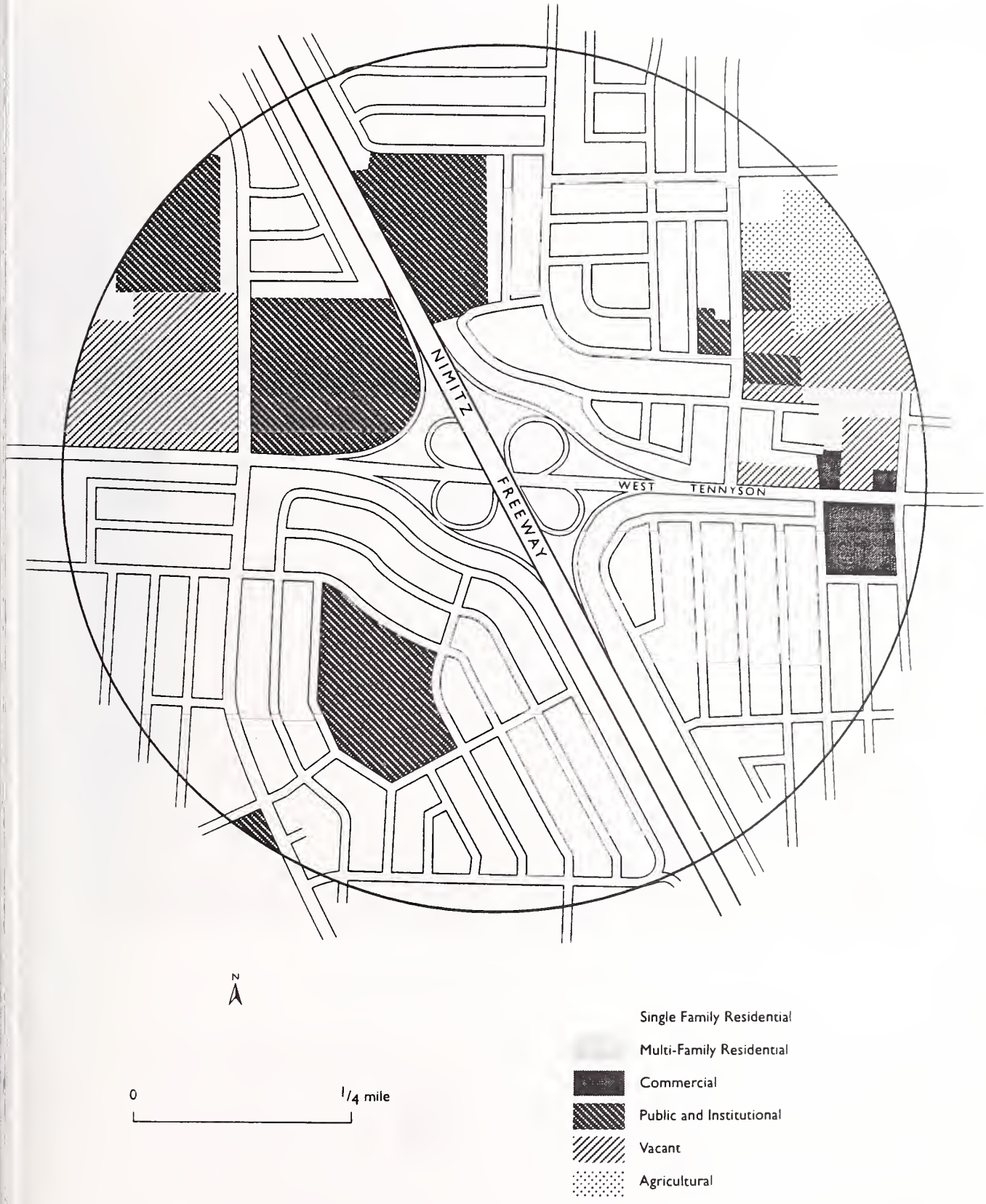
Two large apartment complexes near the South Hayward station built since the opening of BART are the Foothill Apartments (210 units, 750 feet away from the station) and the Mission Heights Apartments (145 units, one-half mile from the station). Both projects appear to be catering to transit users, which might have been what attracted some tenants to these rail-based housing projects. In 1993, 12.9 percent of Mission Heights' employed residents commuted by BART and 30.9 percent of the Foothill Apartments residents were rail commuters (Cervero, 1993). These modal splits compare to the 1990



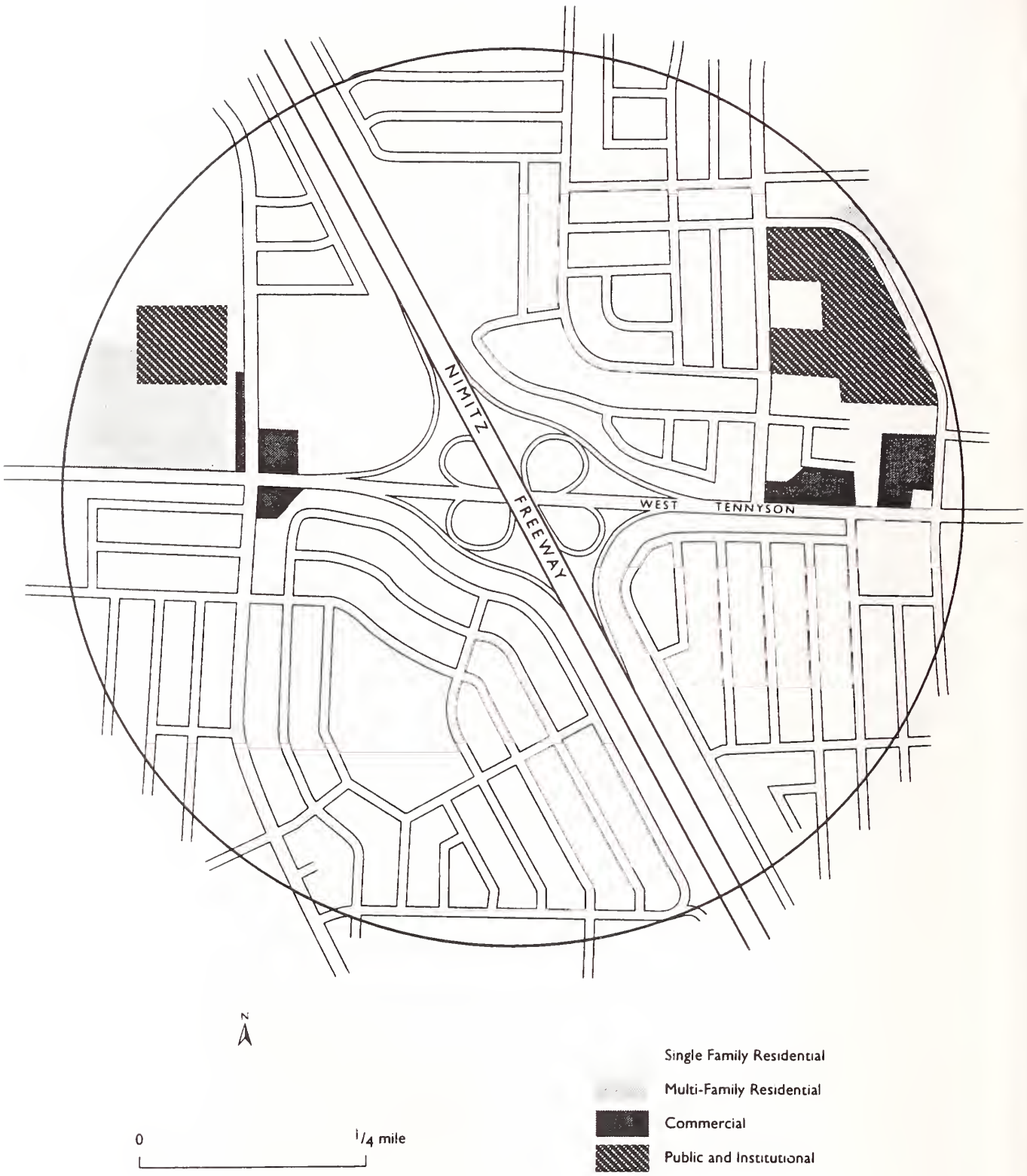
Map 11.7. South Hayward BART Station Area 1965 Land Use



Map 11.8. South Hayward BART Station Area 1965-1994 Land Use Changes



Map 11.9. City of Hayward Tennyson Road Interchange: 1965 Land Use



Map 11.10. City of Hayward Tennyson Road Interchange: 1965-1994 Land Use Changes

citywide average of 4.4 percent. The only other significant multi-family development in the area is the Mission Bay Condominiums (52 units, around 1,700 feet from the station).

11.6. Union City Station

Considerable multi-family housing and commercial-retail development has been built around the Union City BART station since it opened (Photo 11.1). Map 11.11 shows that in 1990, industrial activities were dominant to the immediate east of the station, with mixed commercial and multi-family housing development sited to the west. The matched-pair, the Alvarado-Niles Road/I-880 interchange, has far more single-family housing nearby and less retail-commercial development.

Photo 11.1. Union City Station Area

The apartment building boom around the Union City station is revealed in Figure 11.18 — 96 percent of current inventory has been added since 1965. The Alvarado-Niles Road interchange, however, has seen hardly any apartments built nearby, though its stock of single-family homes has risen from virtually nothing in 1965 to over 2 million square feet today (Figure 11.19).

Two fairly large apartment complexes lie within a quarter mile of the Union City station, and are among the most prominent examples of transit-based housing in the Bay Area: Parkside Apartments, built in 1979 on 7.2 acres with 210 units; and the Verandas Apartments, a massive 380-unit complex

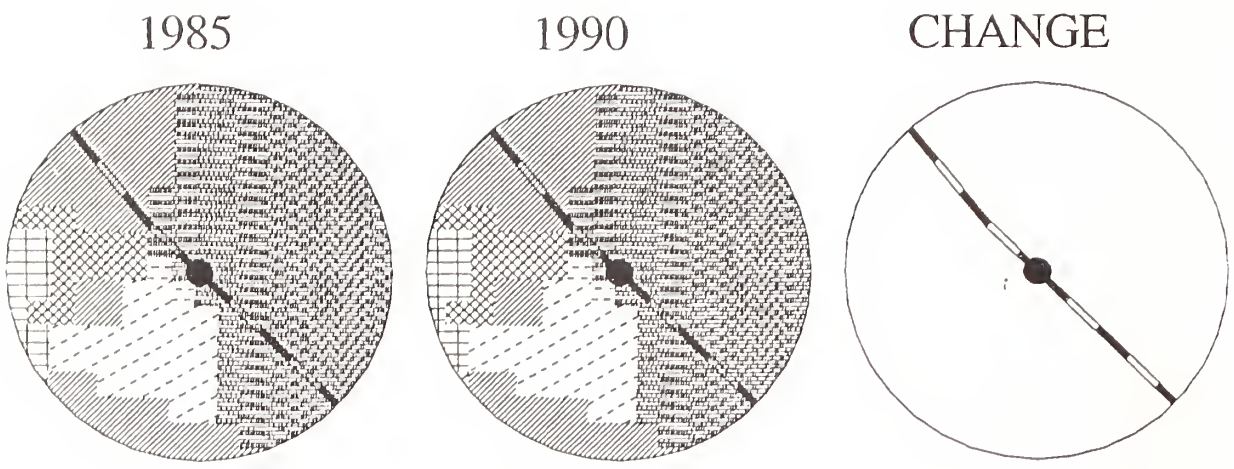


FIG 1: UNION CITY BART AREA

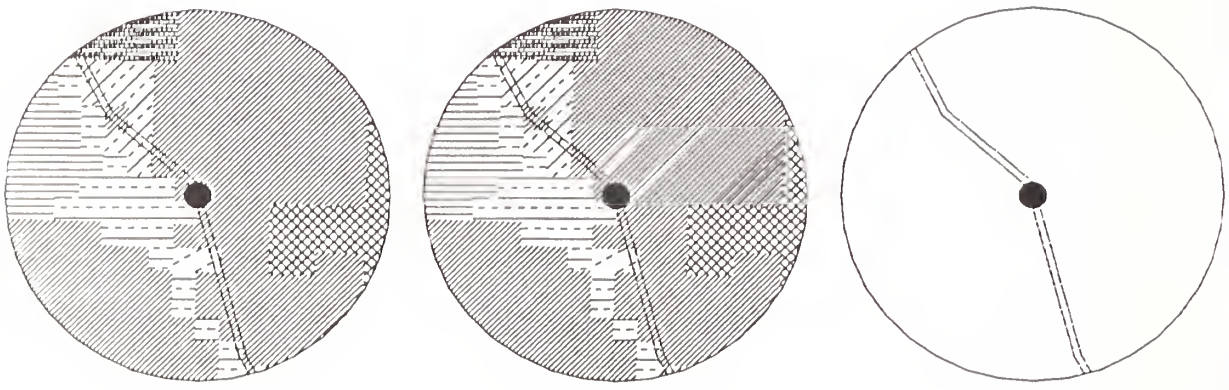
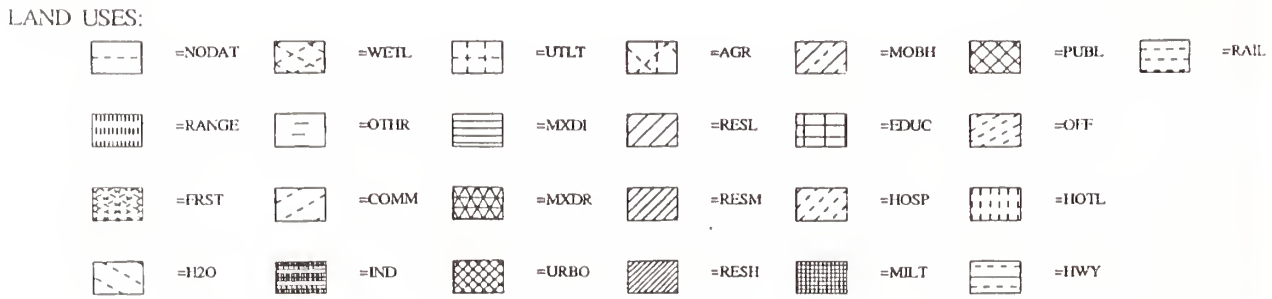


FIG 2: ALVARADO-NILES RD./ I-880 INTERCHANGE



Map 11.11. Union City Station and Freeway Site Land Uses: Half-Mile Radius Area

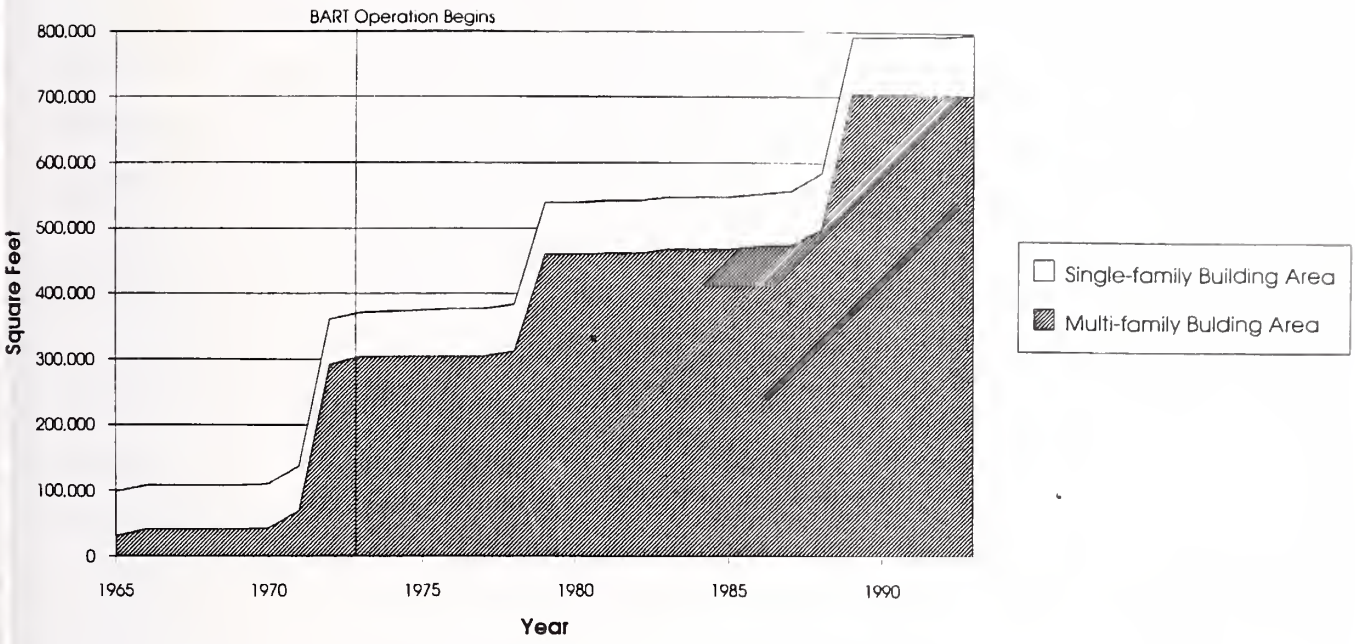


Figure 11.18. Union City Residential Vintage Model (Since 1965)

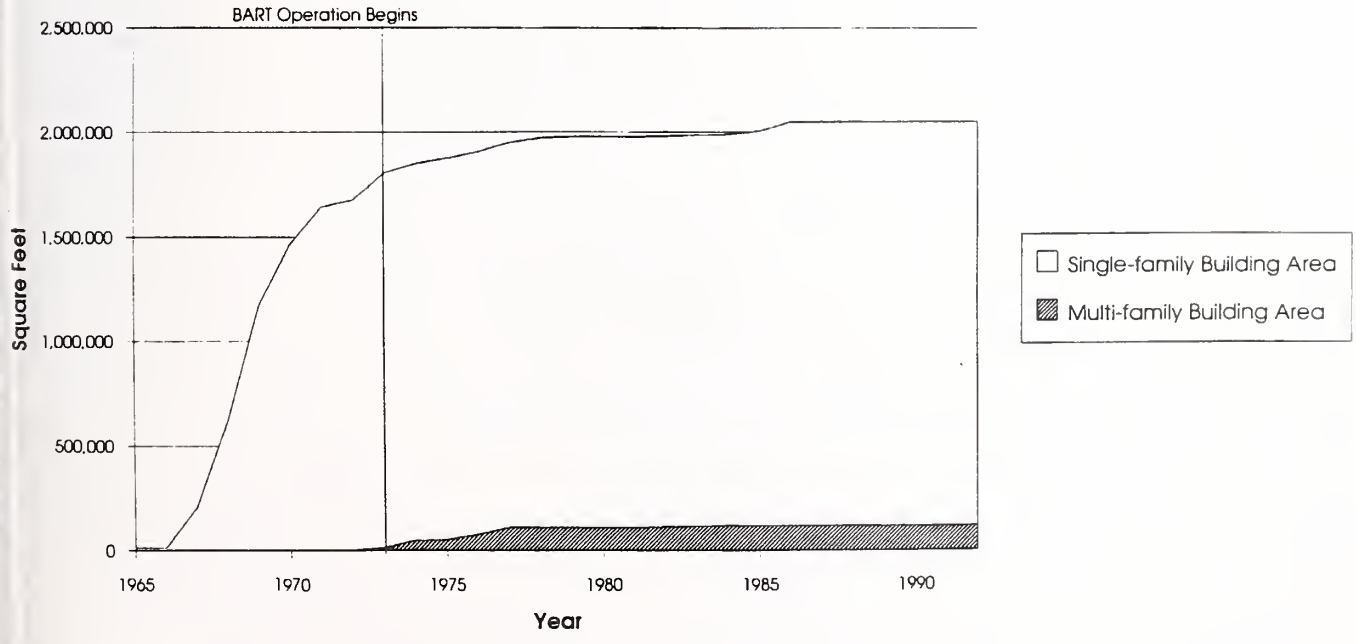


Figure 11.19. I-880/Alvarado-Niles Rd. Residential Vintage Model (Since 1965)

opened in 1989. Both are fairly upscale projects with on-site amenities like swimming pools, spas, and fireplaces. Research shows the Verandas Apartments are fully occupied and rent for $1.30 per month per square foot, the highest per-square-foot rents of any apartments in the Union City-Fremont area (Bernick, Cervero, and Menotti, 1994). Research also suggests the residents of these complexes are selecting into these residences because they work in locations well-served by BART. In 1993, 22.6 percent of the employed residents of these two projects worked in downtown San Francisco or Oakland, compared to just 9.3 percent of all employed residents of Union City (Cervero and Menotti, 1994). Moreover, 20 percent of the employed residents in Parkside and 30 percent of working residents living in the Verandas commuted by rail in (Cervero, 1993). This compares with a citywide average of just 3.8 percent.

Considerably more non-residential floorspace has built over the past two decades around the Union City station than the Alvarado-Niles Road interchange (Figures 11.20 and 11.21) — in all, 490,000 square feet of commercial-office-industrial building area has been added to the station area since 1973. The two major commercial uses built are El Mercado Shopping Center (98,000 square feet of building at an F.A.R. of 0.24) and The Marketplace at Union Square (147,000 square feet at an F.A.R. of 0.11). Both are heavily auto-oriented despite their close proximity to BART. Light industrial plants lie to the east of the station.

11.7. Fremont Station

The Fremont station has experienced a significant amount of nearby development, and is one of the best examples of moderately dense, transit-based housing built after BART's opening. Its nearby development also stands in contrast to the exclusively single-family housing around the nearby freeway interchange, Mowry Avenue/I-880. Considerable retail-commercial and institutional growth has occurred around the Fremont station as well; however, these projects have been matched by growth along the freeway corridor.

Map 11.12 shows that eight years prior to BART's opening, the present Fremont terminal station consisted mainly of agricultural land and one prominent institutional use, Washington Hospital. The Fremont Hub Shopping Center was opened in 1962 just west of the present station site. By 1977, four years after BART services began, the station was enveloped mainly by a 2,500-space surface parking lot, agricultural land to the north, and several multi-tenant medical buildings (across from Washington Hospital). Commercial and multi-family housing development accelerated during the 1977-1994 period. The most significant addition was the Fashion Center, a 125,000-square-foot shopping plaza located across the station parking lot on Civic Center Drive. Across the street on Paseo Padre Parkway another shopping center opened in the late-1970s, the Princeton Gateway Plaza, with a large grocery chain as anchor tenant. Considerable office development has also occurred within a half mile of the station since the late-1970s: Murco Plaza (a spec building with over 100,000 sq. ft. of space opened in 1978); Fremont Office Center (over 180,000 sq. ft. of space within a quarter mile of the station, opened in 1985); next door, the

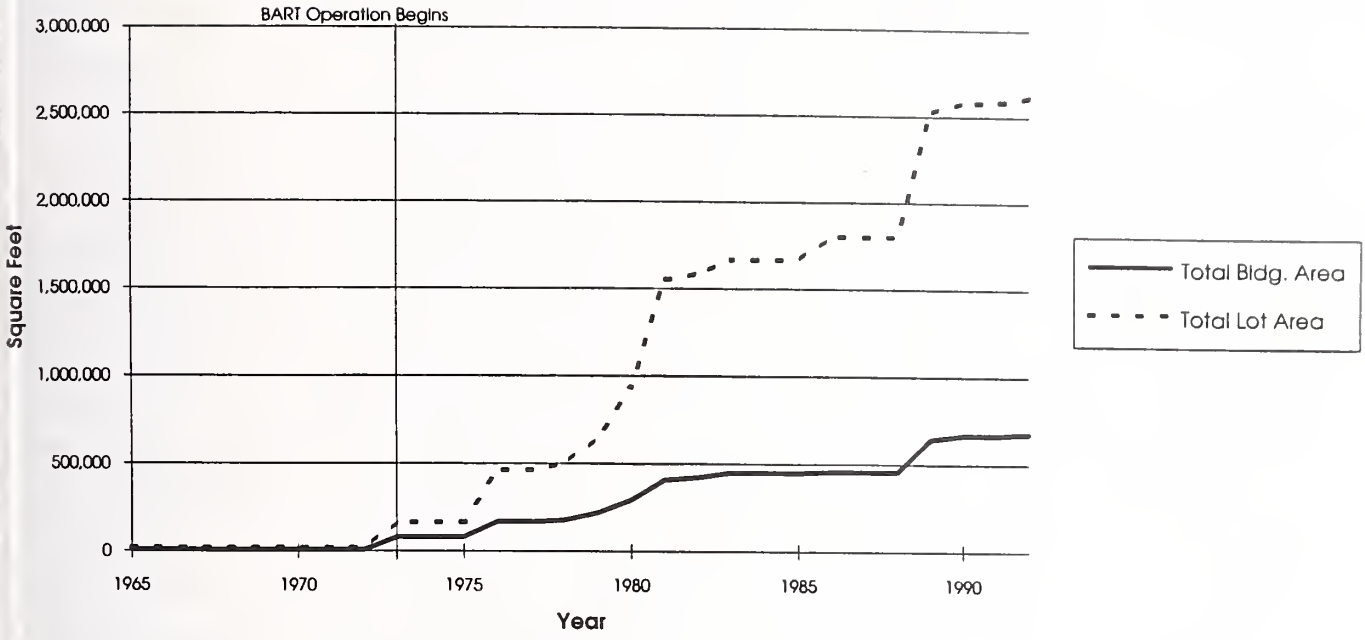


Figure 11.20. Union City Non-Residential Vintage Model (Since 1965)

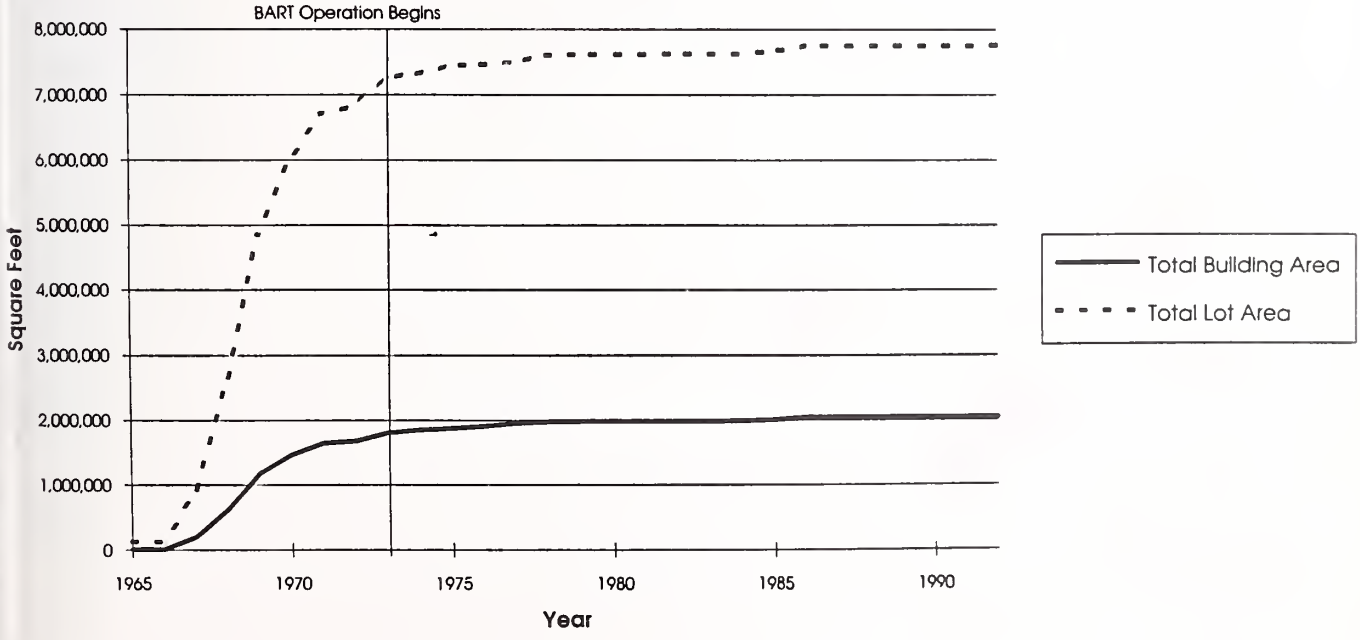
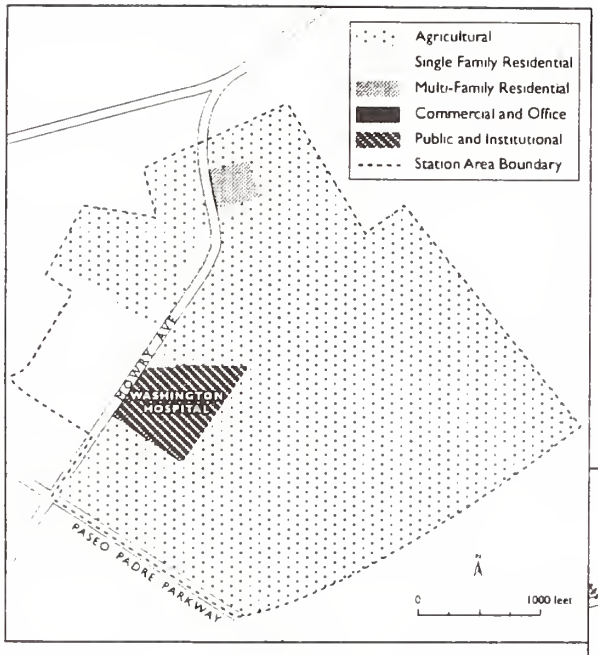
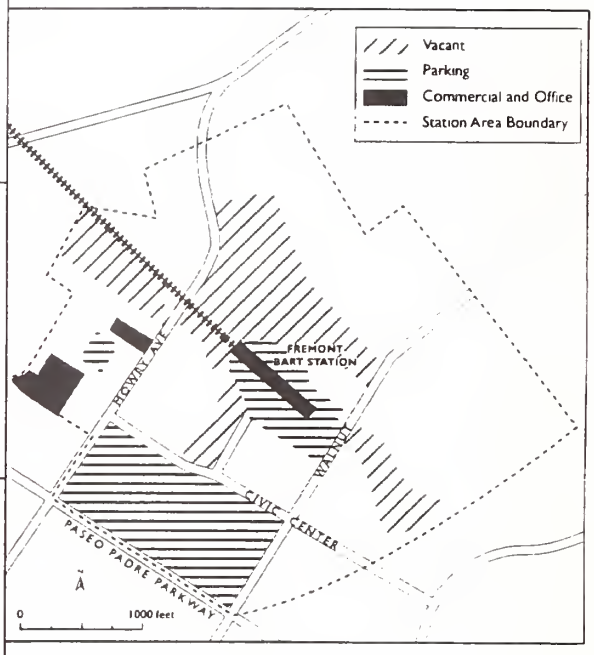


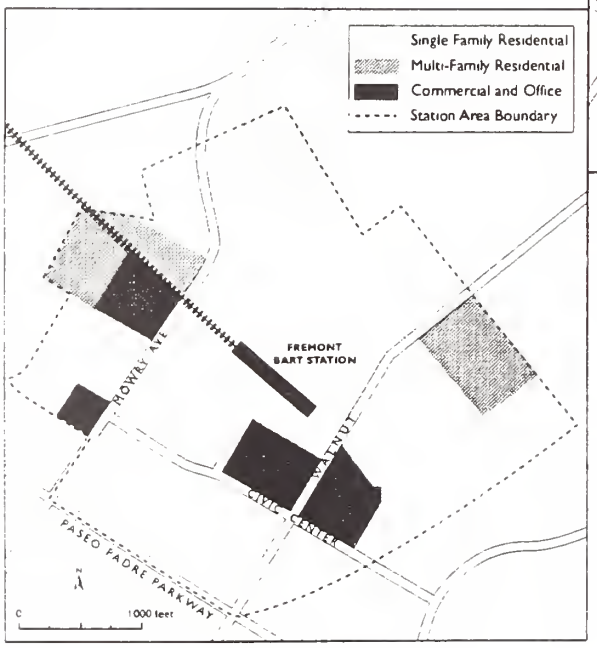
Figure 11.21. I-880/Alvarado-Niles Rd. Residential Vintage Model (Since 1965)



1965



1965-1977



1977-1994

Map 11.12. Fremont Station Area Land Use Changes 1965-1994

Leighton Business Center (over 70,000 sq. ft. of space built in 1987); and an assortment of medical office buildings, one of the largest being the Kaiser Group's Medical Offices. Surveys of employees of several office buildings within a half mile of the station show that around 14 percent commute by BART (Cervero, 1993).

Just as impressive has been the large amount of multi-family housing additions around the Fremont station. Since 1973, over 800 condominium and apartment units have been built within a half-mile ring of the station. The most prominent is the three-story Mission Wells apartment complex, situated around a quarter-mile from the station. Open in 1987, the 392-unit project features a swimming pool spa, exercise room, and tennis courts. To encourage a transit-oriented project, the city of Fremont zoned the Mission Wells site for 30 dwelling units per acre for the first project phase and 50 units to the acre in the second phase. The city also reduced parking standards from 2.0 to 1.65 spaces per unit. These initiatives appear to be paying off financially. Mission Wells's average rent per square foot is around 12 percent higher than that of other apartment projects in Fremont that are of a similar age and have a similar amenity package, partly reflecting the rent premium associated with being close to rail (Bernick, Cervero, and Menotti, 1994). Research also shows that 17 percent of Mission Wells' employed tenants commute by BART, compared to just 2.4 percent of all Fremont employed residents (Cervero, 1993). This lends further support to the hypothesis of residential sorting (Voith, 1991) — many tenants of transit-based housing choose these locations in order to economize on commuting

Not all of the Fremont station area has been developed. Just east of the station are agricultural uses and vast open spaces. The Hayward fault line runs parallel to the station in this area. Environmentalists and some neighborhoods leaders have pressed the city to keep this area undeveloped both for seismic reasons and to preserve open space.

Using ABAG data on dominant land uses for hectare grid cells, we generated GIS comparisons of land-use changes around the Fremont station and its matched pair, Mowry/I-880, for 1985-1990, the only years for which ABAG data were available (Map 10.13). Over this fairly recent time span, the only recorded changes in dominant land uses occurred around the BART station, comprising 36 hectares (89 acres) of change (from open space to apartments, medical offices, and light industrial). By comparison, the Mowry Avenue interchange, 2½ miles from the station, experienced no land development during the latter half of the 1980s.

Comparing vintage models on residential development, Figures 11.22 and 11.23 indicate far stronger building activity around the Fremont station than the Mowry Avenue interchange; the strongest surge was in multi-family housing in the late 1980s, due mainly to the opening of the Mission Wells complex. Almost exclusively single-family homes surround the freeway interchange, and growth has been fairly stagnant for the past 25 years. More significant has been the non-residential development around the interchange, which has outpaced commerical-office development around the Fremont station (Figure 11.24 and 11.25). From 1973 to 1993, the inventory of commercial-office-industrial floorspace around the

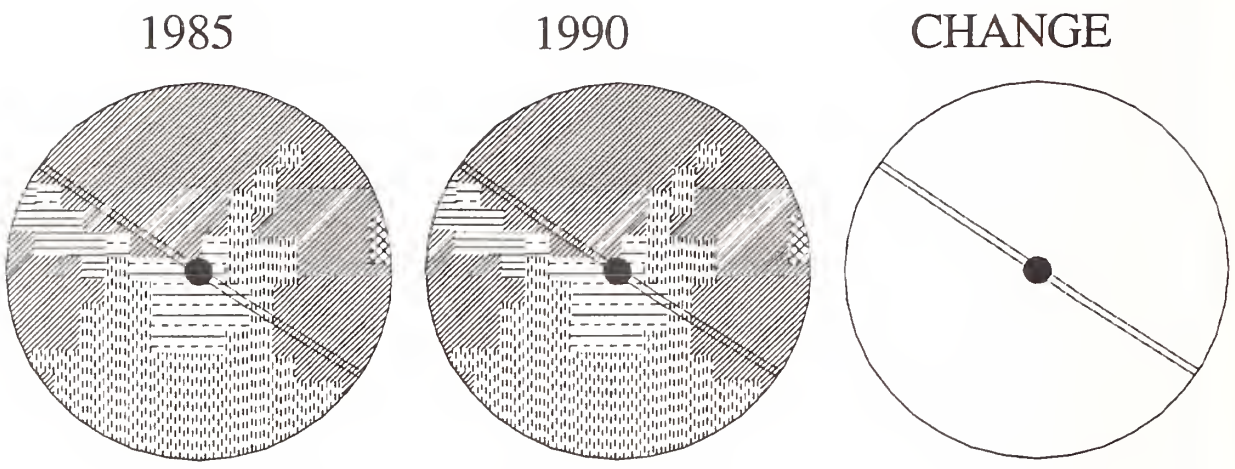


FIG 1: MOWRY/ I-880 INTERCHANGE

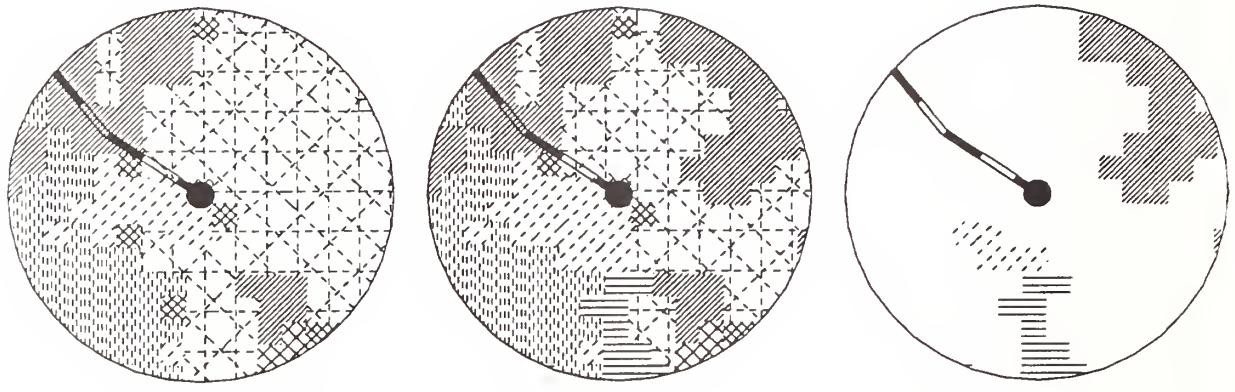
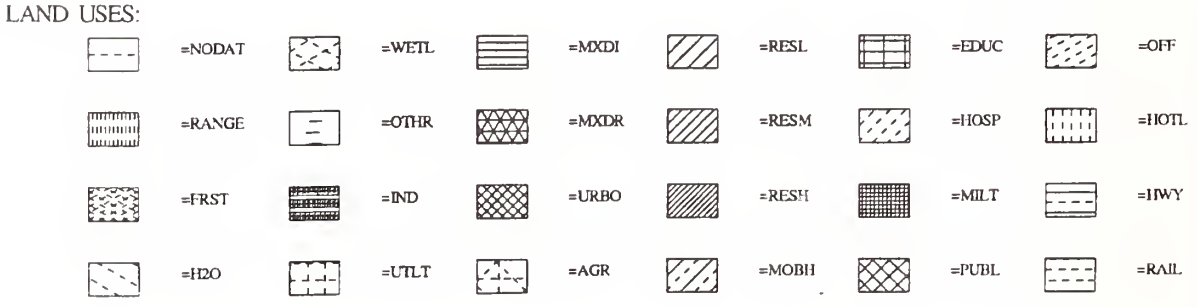


FIG 2: FREMONT BART AREA



Map 11.13. **Fremont Station and Freeway Site Land Uses: Half-Mile Radius Area**

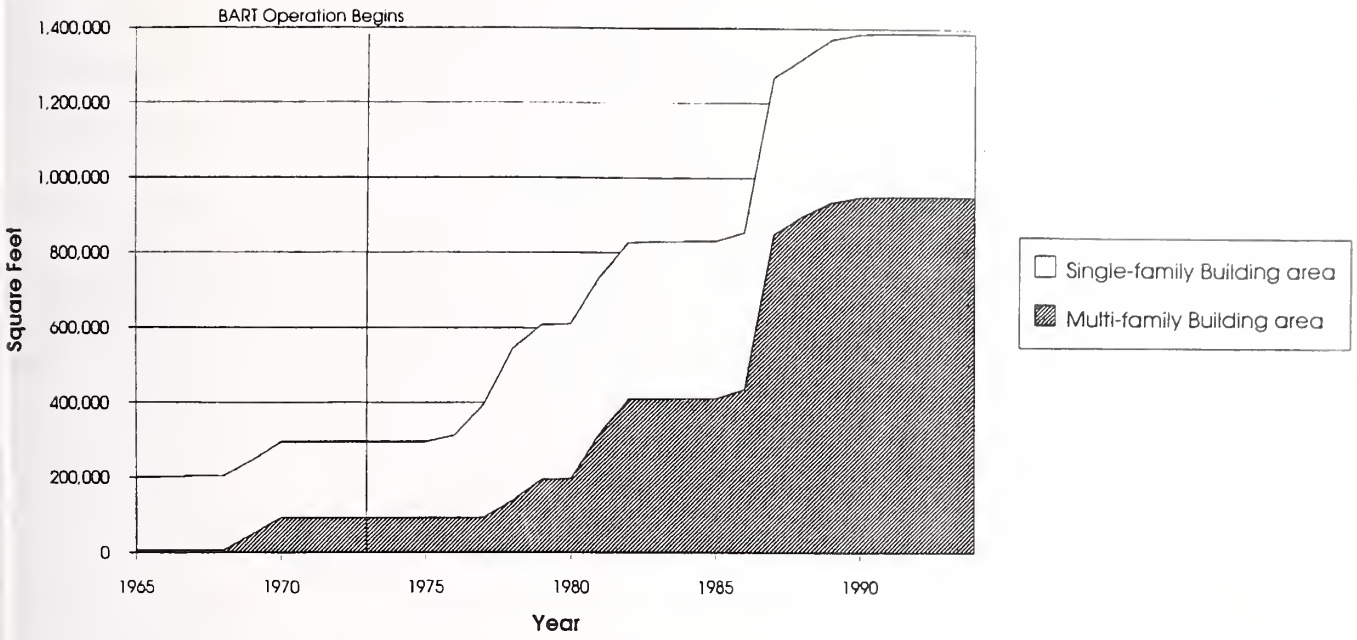


Figure 11.22. Fremont Residential Vintage Model (Since 1965)

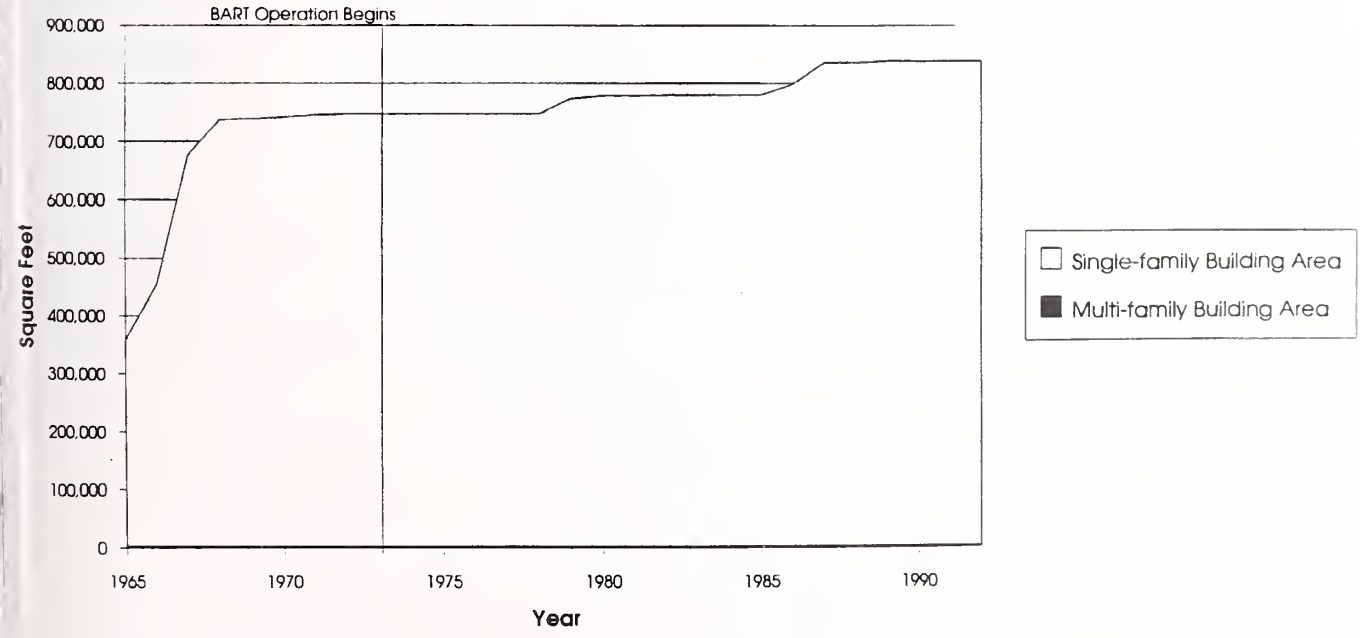


Figure 11.23. I-880/Mowry Ave. Residential Vintage Model (Since 1965)

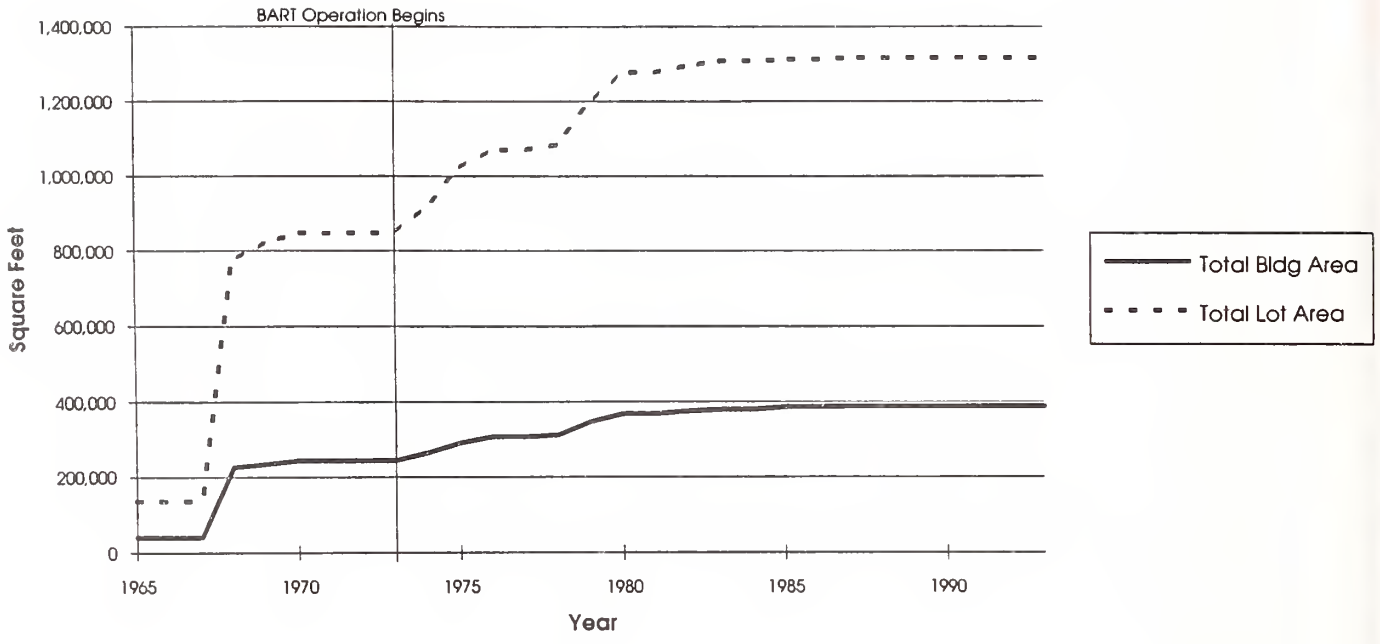


Figure 11.24. Fremont Non-Residential Vintage Model (Since 1965)

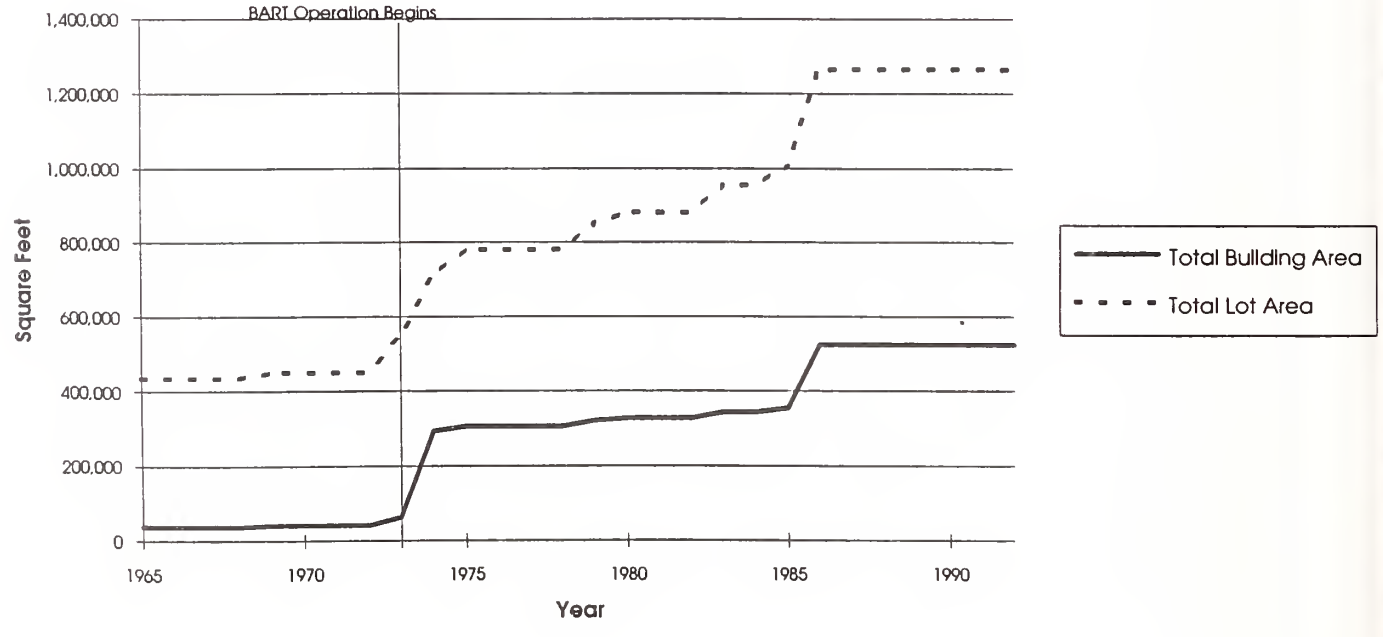


Figure 11.25. I-880/Mowry Ave. Residential Vintage Model (Since 1965)

interchange increased by 460,000 sq. ft. (by 730 percent), compared to an increase of 145,000 sq. ft. (60 percent) around the station. Most development around the Mowry Avenue interchange has involved small retail plazas, motel chains, and eateries. Because of this upsurge in commercial activities, net non-residential densities increased from an F.A.R. of 0.12 in 1973 to 0.41 in 1993. Over the same period, non-residential F.A.R.s have remained fairly constant at around 0.28 around the Fremont station.

11.8. Overall Changes in Land-Use Composition

The dramatic pace of land-use conversions along much of the Fremont corridor is highlight by the pie charts in Figure 11.26. A decade or so before BART services began, single-family dwellings occupied nearly twice as much building space as apartments and condominiums. By 1993, 20 years after BART's opening, multi-family housing dominated the half-mile ring around BART stations — making up 35 percent of floorspace, compared to 29 percent for single-family housing. Non-residential uses, by comparison, remained fairly static in terms of their market share of building space.

11.9. Fremont Corridor Summary

The Fremont corridor has captured a third of all multi-family housing built within a half mile of the BART system since 1973. Matched-pair comparisons revealed that there has been much higher levels of apartment and condominium development around the rail nodes than nearby freeway interchanges, the only exception being the Hayward Station. New multi-family housing has been particularly prominent around the San Leandro, Bayfair, South Hayward, Union City, and Fremont corridor. Residential development, however, has been uneven. Virtually no housing additions have come on line around the Coliseum, Fruitvale, and Hayward stations, though in the case of the latter two, current transit village plans hope to reverse this trend. In general, the intensity of residential development rose with distance from downtown Oakland — since 1965, virtually nothing happened in Fruitvale and the Coliseum station areas; San Leandro had 63 percent of its current 1.27 million sq. ft. of multi-family housing built; Union City had 96 percent of its current 900,000 sq. ft. of multi-family space built; and Fremont had 99 percent of its 1.5 million sq. ft. of multi-family housing built. A number of new apartments are commanding rent premiums and have high shares of tenants who rail-commute. The pattern of activities intensifying the farther out ones goes on the Fremont line also held for non-residential development — the Fremont station area had 90 percent of its present 400,000 sq. ft. of floorspace added since 1965, and Union City had 99 percent of its 50,000 sq. ft. added. However, there was little difference in the type or rate of growth in commercial and office floorspace between BART stations and paired interchanges. In both settings, retail space was generally low-density and auto-oriented. In fact, floor area ratios generally increased over time around freeway interchanges but remained flat around BART stations (e.g., in Fremont and San Leandro). And unlike in the case of downtown San Francisco and Oakland, planning interventions,

Figure 11.26. Fremont Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 6 Station Areas)

outside of normal zoning practices, appear to have played very little role in shaping development patterns along the Fremont corridor, with the exception of the Fremont station itself. Most growth has been market-driven.

Notes

[1]TRW-REDI data for residential building activities were fairly complete for the Fruitvale stations; only 14 percent of the parcels had no year-of-construction information. Data were sketchier for non-residential uses — 80 percent were incomplete.

[2]Because the interchange is less than a mile from the rail station, a more detailed matched pair analysis was not carried out for the Bayfair station.

[3]Source: 1990 journey-to-work census statistics, Summary Tape File 3A.

Reference

Knack, R. 1995. "BART's Village Vision," *Planning* I: 18-21.

CHAPTER TWELVE
Land-Use Changes Along the Concord Line

The Concord line has received among the least and the most commercial-office development within a half-mile ring of its stations than any other corridor. Overall, little densification or new development has occurred near the three innermost stations — Rockridge, Orinda, and Lafayette. The three outermost stations — Walnut Creek, Pleasant Hill, and Concord, on the other hand, have witnessed an explosion of office and commercial development, with floorspace within a half-mile ring having more than quadrupled since 1973. Geography perhaps partly explains why land-use impacts have varied so markedly between these two sets of stations — specifically, Walnut Creek, Pleasant Hill, and Concord have been part of a powerful trend toward suburbanization of employment during the past two decades. The fact that the three innermost stations lie in a freeway median while the three outermost ones do not might have also had some bearing on land-use outcomes. (All stations on the Concord line are elevated.) However, government policies have perhaps played the most significant role. Stiff opposition to proposed apartment and commercial development in the affluent communities of Rockridge, Orinda, and Lafayette, followed by building moratoria and downzoning, all but eliminated any possibility of large-scale development occurring along the inner Concord line. In contrast, a staunch pro-development attitude by local officials, coupled with community acquiescence, led to ambitious efforts to attract dense, mixed-use development along the outer line.

This chapter concentrates on the land-use experiences of the three outermost stations on the Concord line. Because few land-use changes took place, there is to tell about the innermost stations. Since Rockridge has emerged into a vibrant retail district with traditional main street qualities and is commonly viewed as one of the best examples in the U.S. of transit village development, land-use trends there are also discussed. No matched-pair comparisons were possible for the Concord corridor because the BART line lies in the median of the Highway-24 freeway for the Rockridge-Lafayette section, and closely hugs the I-680 for most of the Walnut Creek-Concord segment.

12.1. Rockridge Station

The Rockridge neighborhood of north Oakland has gained a reputation as one of the most attractive and pedestrian-friendly retail and restaurant districts in the Bay Area. College Avenue, the main artery serving the neighborhood, connects Rockridge to the University of California at Berkeley to the north and central Oakland to the south. College Avenue has a classical main street character, with an asssortment of restaurtants, boutiques, specialty shops, grocery stores, apartments, loft space, and offices.

BART has had little influence on Rockridge's land-use patterns over the past three decades, mainly due to neighborhood opposition to higher residential densities, all part of a grass-roots effort to maintain the small-town character of Rockridge. Since 1965, less than 100,000 square feet of additional housing

space has been built within a half mile of the station (Figure 12.1). Caps on housing supplies and increasing competition to live near Rockridge have driven up housing prices. Today, a Rockridge address is highly sought-after. Tree-lined residential streets dotted with a mix of victorian-style homes, duplexes, and four-plexes run perpendicular to College Avenue; all are within an easy walk of Rockridge's vibrant commercial district. A third of housing within a half-mile radius of the BART station consists of multi-family units; 11 percent of residences are converted rear-lot accessory units. In 1990, the Rockridge neighborhood's net residential density was 6.3 dwelling units per acre, compared to an Oakland city average of 4.3 units per acre. By East Bay standards, Rockridge is a fairly affluent community — its 1990 mean household income was $52,500, compared to an Oakland city average of $37,100.

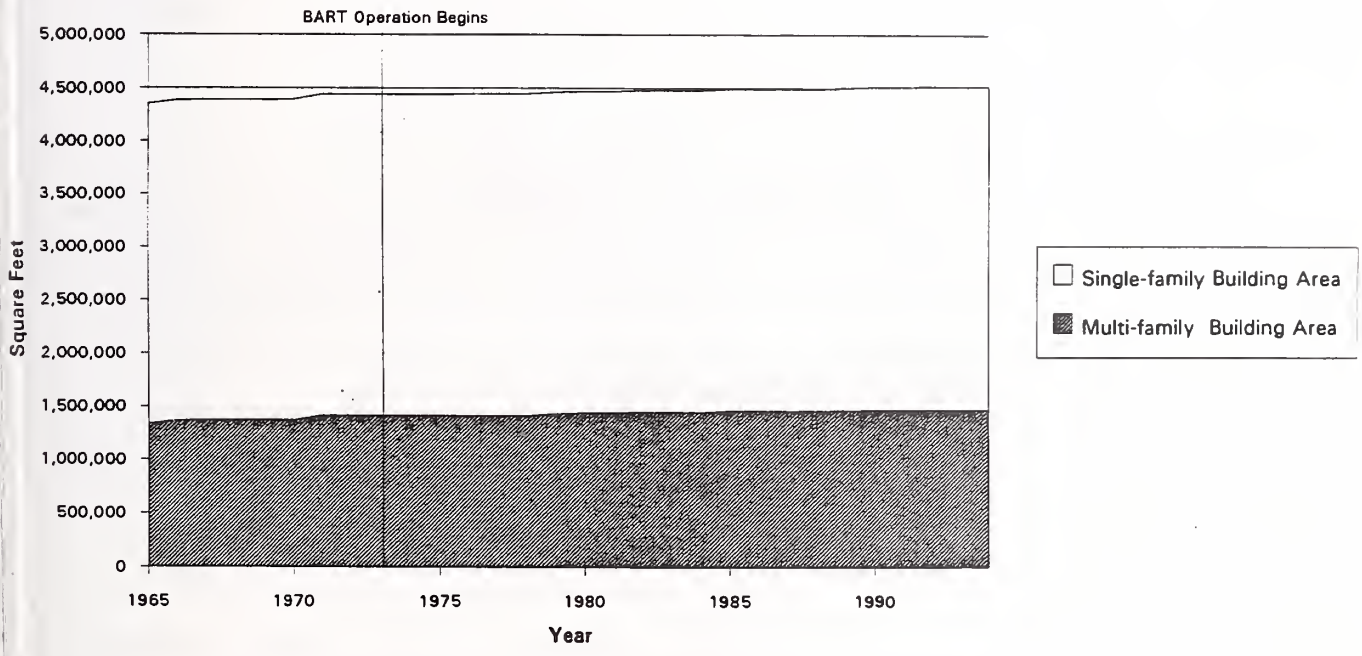


Figure 12.1. Rockridge Residential Vintage Model (Since 1965)

According to the recently approved *Rockridge Area Plan*, more rail-oriented housing might be added in coming years. Based on an intensive citizens' input campaign and after numerous community meetings, the plan found that "the density around the BART station is too low" and calls for zoning revisions that would allow densification of housing near the station (Brady and Associates, 1994: 4). It is unlikely, however, that mid-rise residential towers will be built any time soon in the vicinity of the Rockridge station.

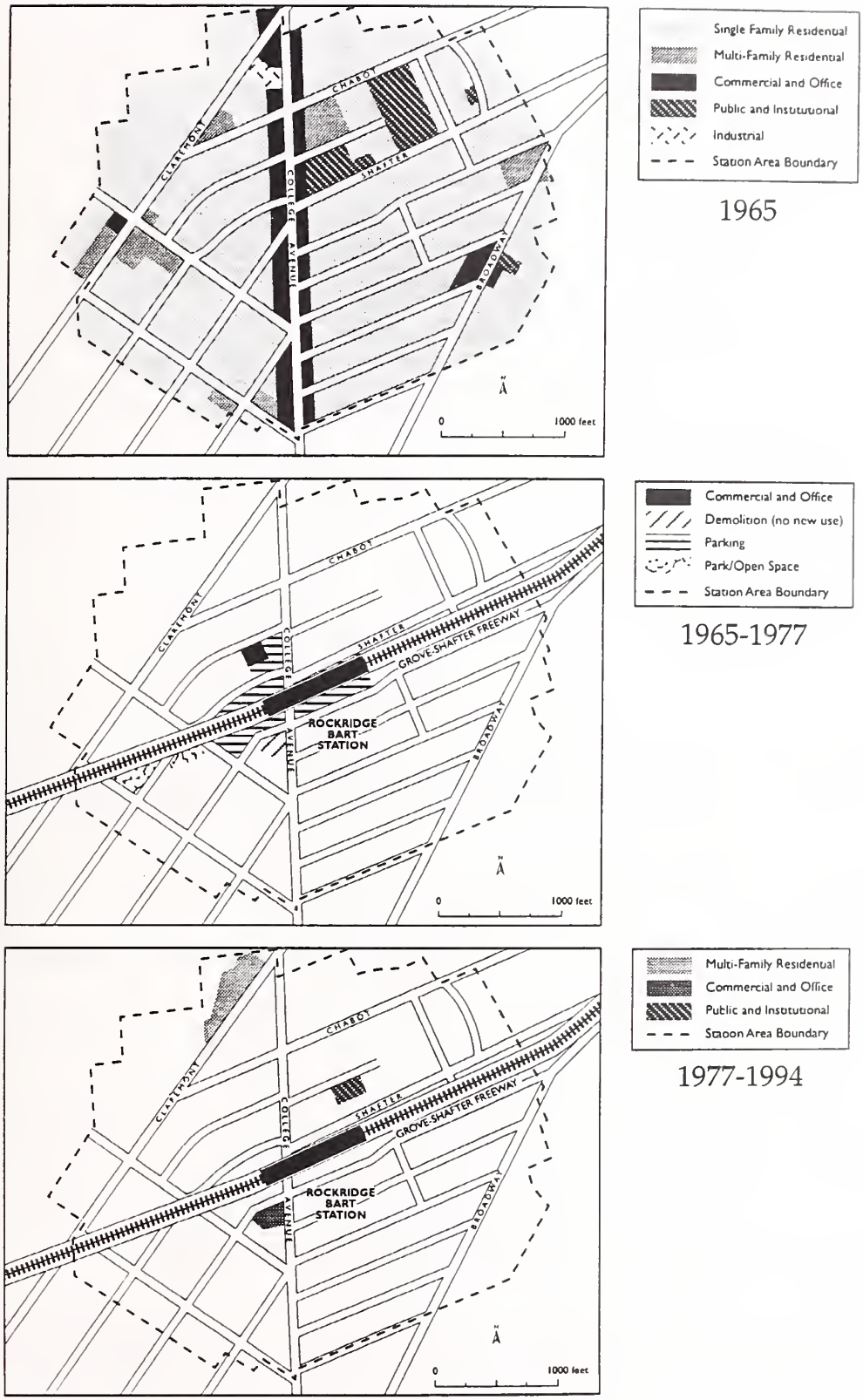
The modest level of land use changes that have occurred in the Rockridge neighborhood since 1965 is further revealed by Map 12.1. Besides the addition of a Lucky's grocery store, BART and the surrounding parking lot were the only new large-scale land uses added between 1965 and 1977. Since 1977, the only significant land-use changes have been the addition of a handful of duplexes and small retail shops along Claremont Avenue, an elementary school, and Market Hall, a successful mixed-use project with eateries and specialty shops on the ground floor, and offices, studios, and loft space above. The noticeable impacts of opening Market Hall and several other retail projects in the early 1990s on Rockridge's inventory of non-residential floorspace and commercial densities are revealed by the vintage model plots in Figures 12.2 and 12.3. Net retail densities have increased by around 20 percent since 1990. More money has gone toward retail renovations, however, than new retail construction along College Avenue. This has pushed up rents and forced many shops to turnover tenancies. The most substantial retail renovations have occurred to the immediate south of the station. The two-blocks immediately to the south of the station today contain 33 specialty retail shops and eateries catering to young professionals, upper-middle-income households, and local college students.

12.2. Walnut Creek Station

Walnut Creek has emerged as one of the Bay Area's premier edge cities. The cluster of mid-rise office towers that has sprouted around Walnut Creek's BART station in the past 20 years is perhaps one of the best American examples of rail transit's city-shaping abilities. In all, nearly 4 million sq. ft. of modern, class-A office space has been built within a half-mile catchment of the station since BART opened.

Map 12.2 shows that numerous parcels around the station changed land uses in both the pre-BART/early years (1965-1977) and in more recent times (since 1977). A single-family neighborhood was removed to accommodate BART and its surface parking, and numerous retail, office, and apartment projects soon followed. By 1990, mid-rise office towers had occupied the parcels immediately to the north, east, and south of the BART station. Among the major office structures built since 1977 are: North Main Center (191,000 sq. ft. 10-story structure on 1.15 acres); Riviera Office Building (122,000 sq. ft., four-story building); California Plaza (a 279,000 sq. ft., 10-story structure); Tishman Office Center (two 10-story office towers totalling 321,000 sq. ft. On a 3 acre site); and the Promethus (a 130,000 sq. ft., four-story building on a 1.44-acre site). Most of these are multi-tenant, speculative structures erected during the height of the suburban office building boom in the early-to-mid 1980s.

The vintage model in Figure 12.4 shows that total residential building area has increased gradually over the past 30 years. BART appears to have had no discernible effect on the pace of residential development. Although total residential building area is dominated by multi-family housing (Figure 12.5), the total lot area is dominated by single-family uses (Figure 12.6), indicating that single-family homes in the area generally sit on fairly large lots.



Map 12.1. Changes in Land Use Around the Rockridge BART Station, 1965-1994

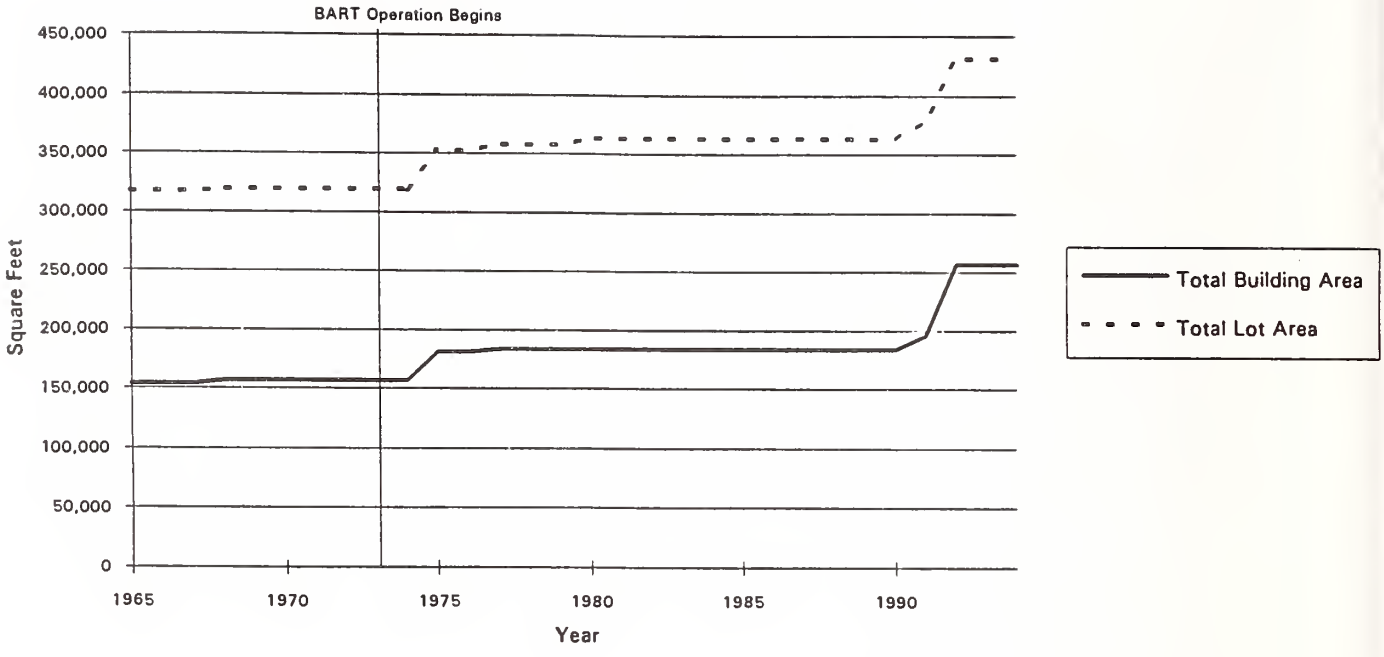


Figure 12.2. Rockridge Non-Residential Vintage Model (Since 1965)

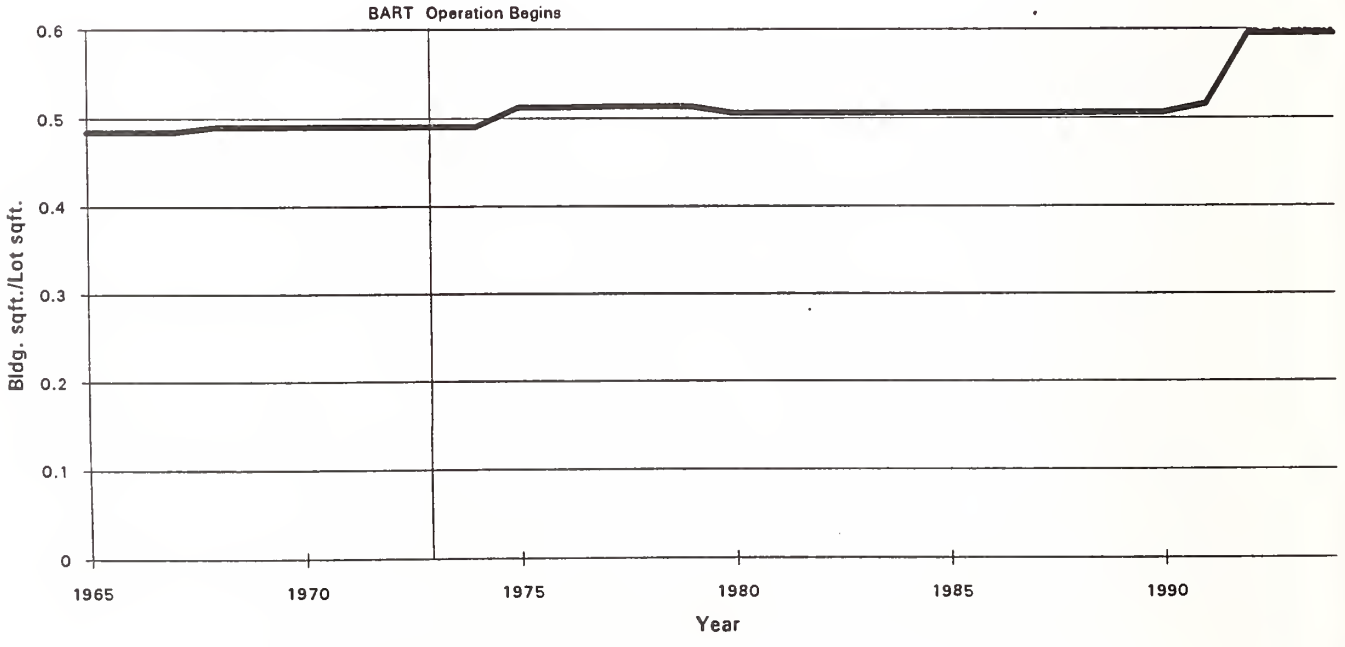
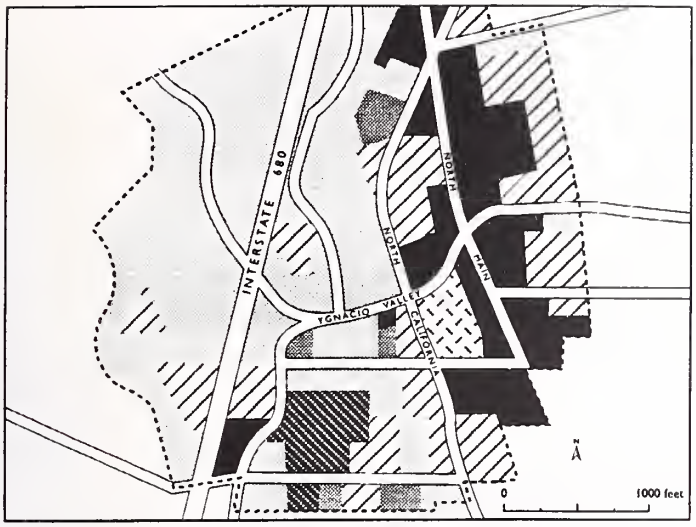
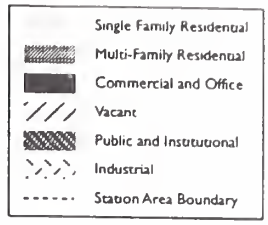
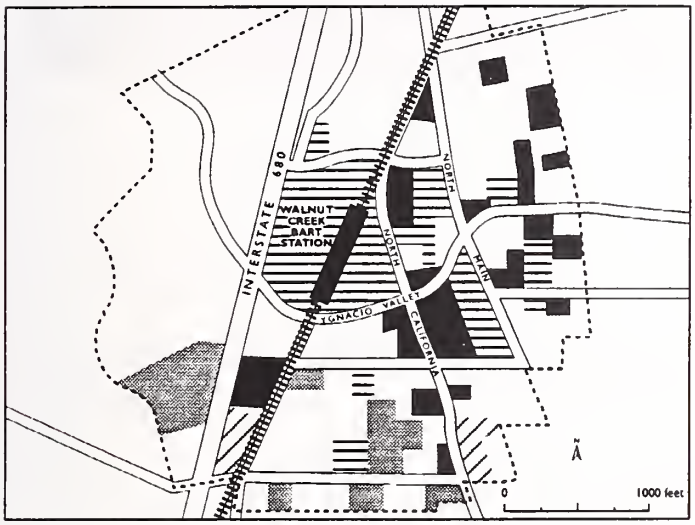


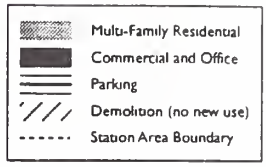
Figure 12.3. Rockridge Non-Residential F.A.R. Vintage Model (Since 1965)



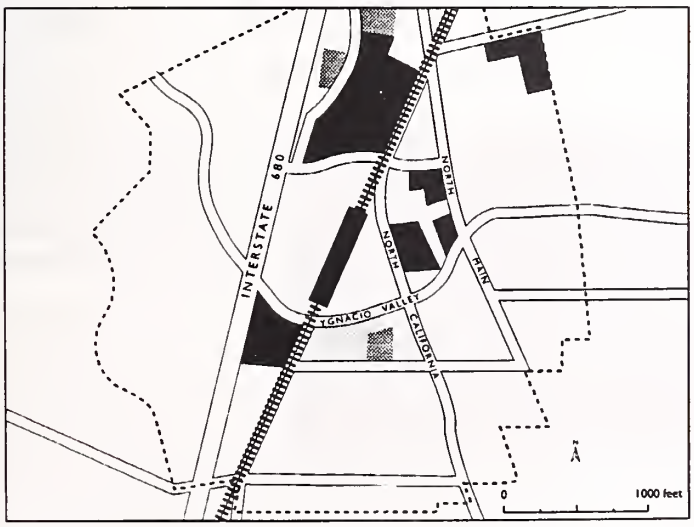


1965





1965-1977



1977-1994

Map 12.2. Walnut Creek Station Area Land Use Changes, 1965-1994

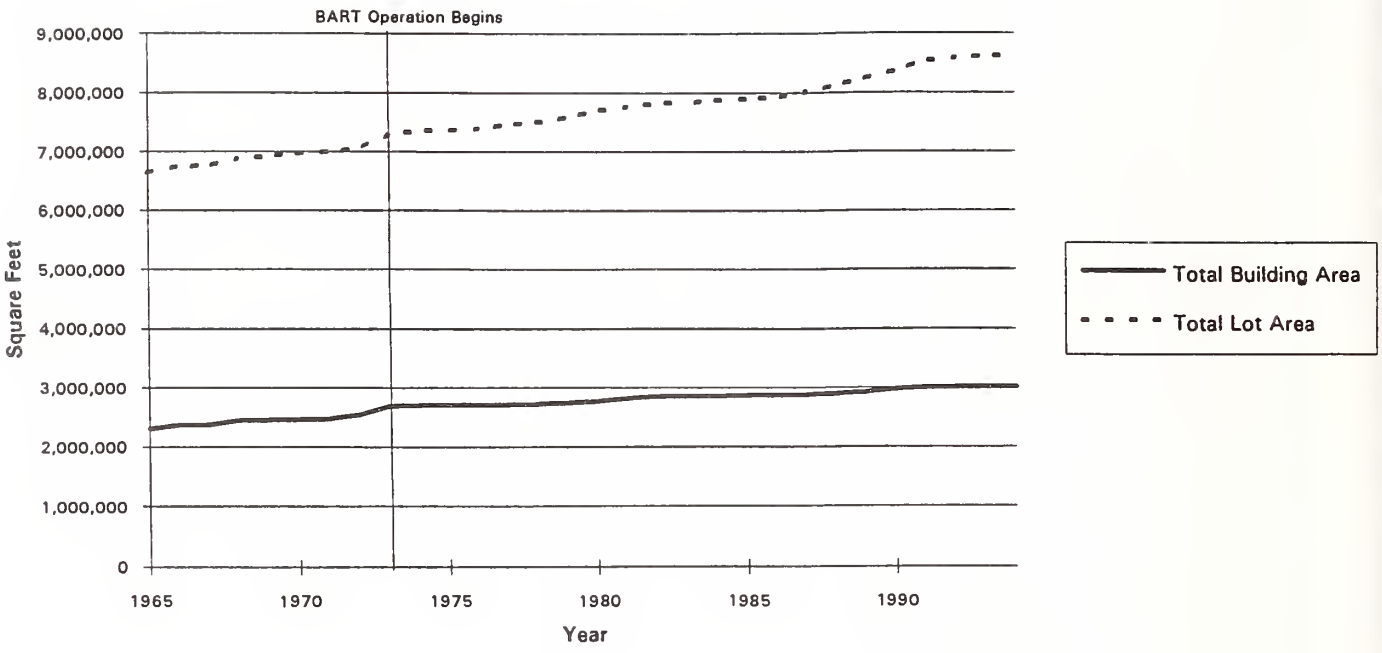


Figure 12.4. Walnut Creek Residential Vintage Model (Since 1965)

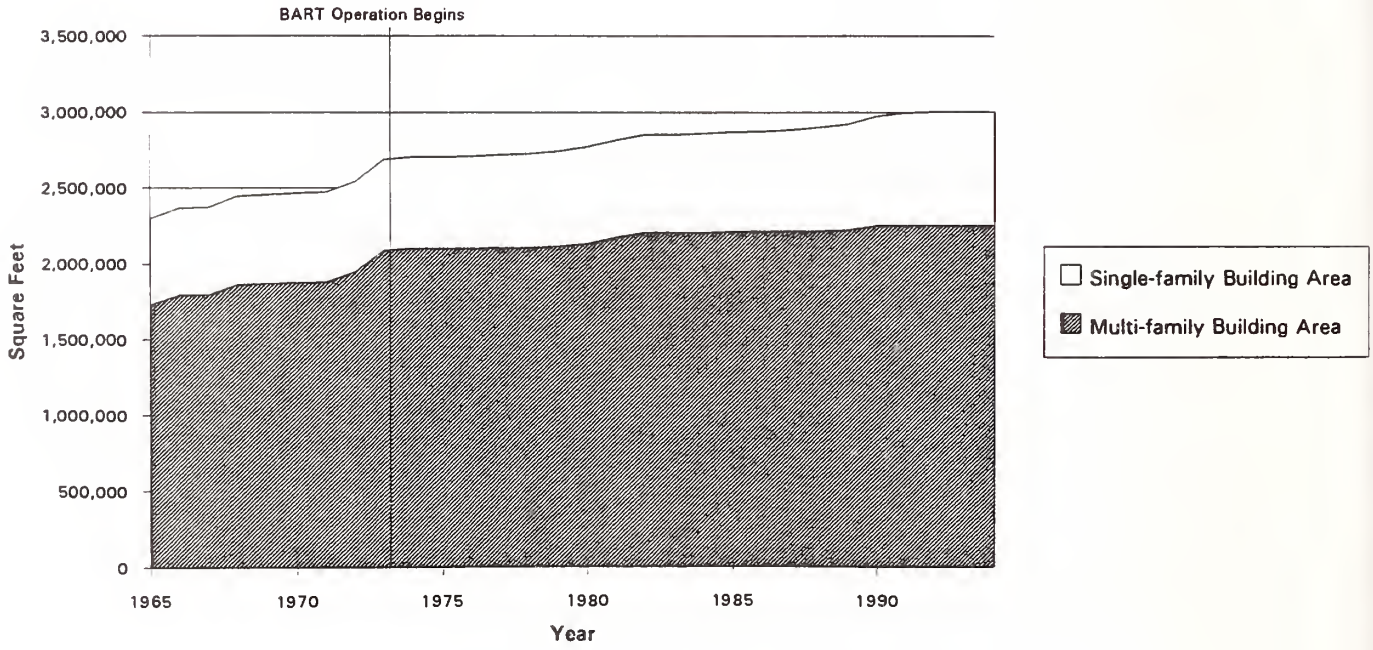


Figure 12.5. Walnut Creek Residential Vintage Model (Since 1965)

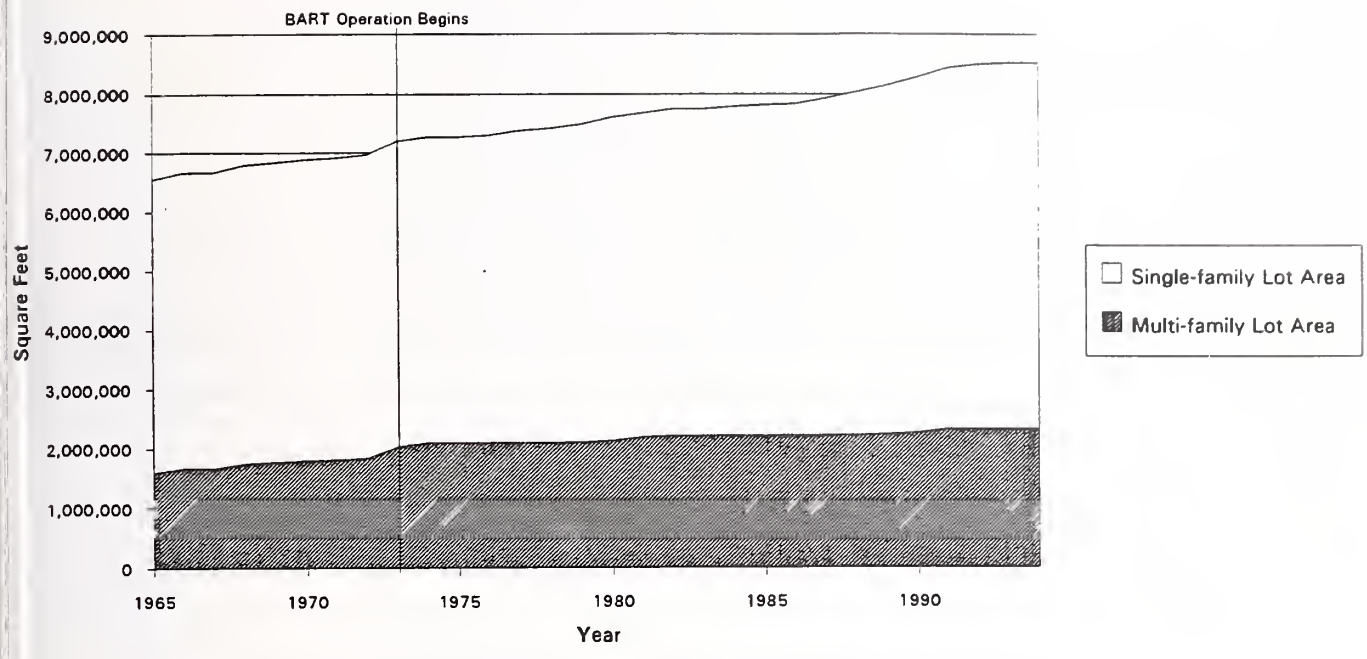


Figure 12.6. Walnut Creek Residential Vintage Model (Since 1965)

Figure 12.7 shows that the pace of non-residential development gain momentum in the mid-1980s, despite a growth moratorium (Proposition H) that banned commercial development over 10,000 square feet as long as traffic congestion remained a problem.[1] By 1990, when the region's economy began to sputter, when federal tax laws that encouraged speculative office investments as passive-loss write-offs were repealed, and when office vacancies began to rise, the boom came to an abrupt halt. Continuing concerns over worsening traffic congestion also forced the municipal officials to hold growth in check.

Nearly all non-residential growth that occurred around the Walnut Creek station in the 1980s involved white-collar office development (Figure 12.8). Most new retail stores and restaurants were sited in downtown Walnut Creek, around a mile to the south, and connected to the BART station by a free shuttle. With office clustering came higher residential densities — net F.A.R.s jumped from 0.5 in 1982 to 0.88 in 1990 (Figure 12.9).

In summary, an impressive amount of office development has congregated around the Walnut Creek station since BART's opening. Most of the growth has been market-driven, aided by permissive zoning that encouraged dense office development. While this development would have occurred in the suburbs without BART, it more than likely would have been more freeway-oriented, in the form of office and executive parks and stand-alone structures. Walnut Creek stands as a prominent example where the BART node functioned as a magnet for growth in the area, creating a built form that encourages transit riding.

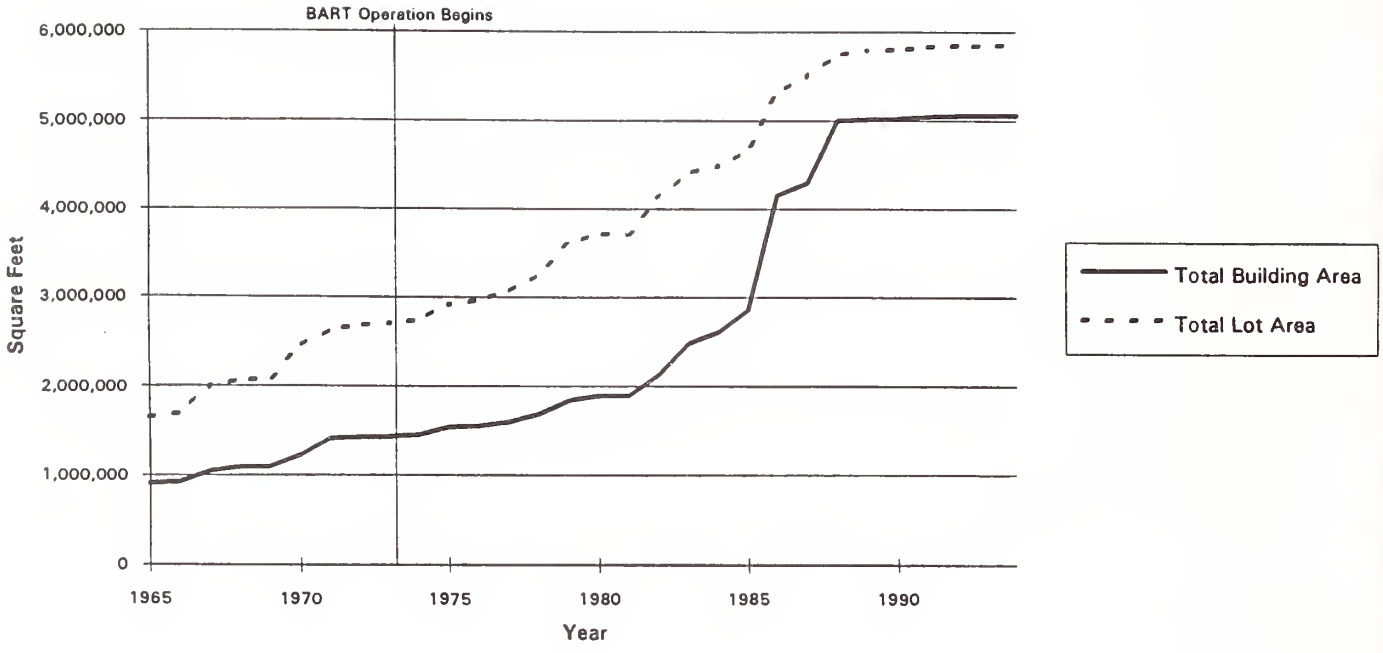


Figure 12.7. Walnut Creek Non-Residential Vintage Model (Since 1965)

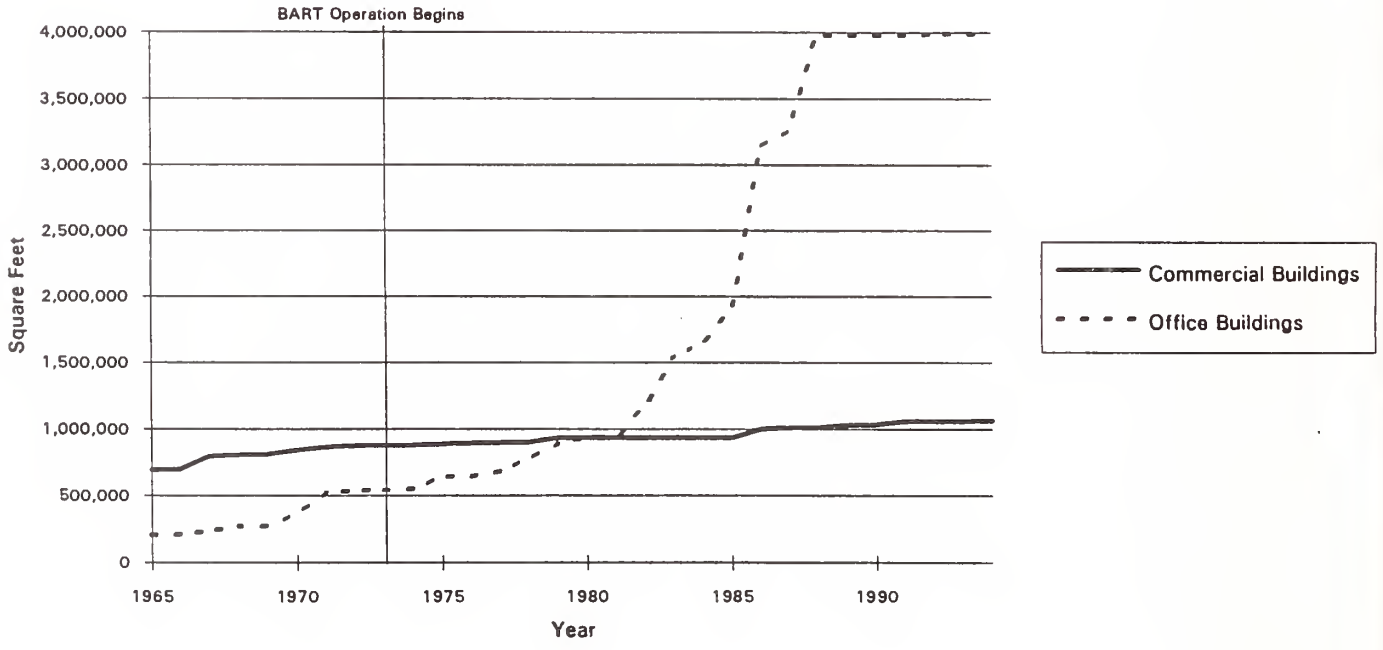


Figure 12.8. Walnut Creek Non-Residential Vintage Model (Since 1965)

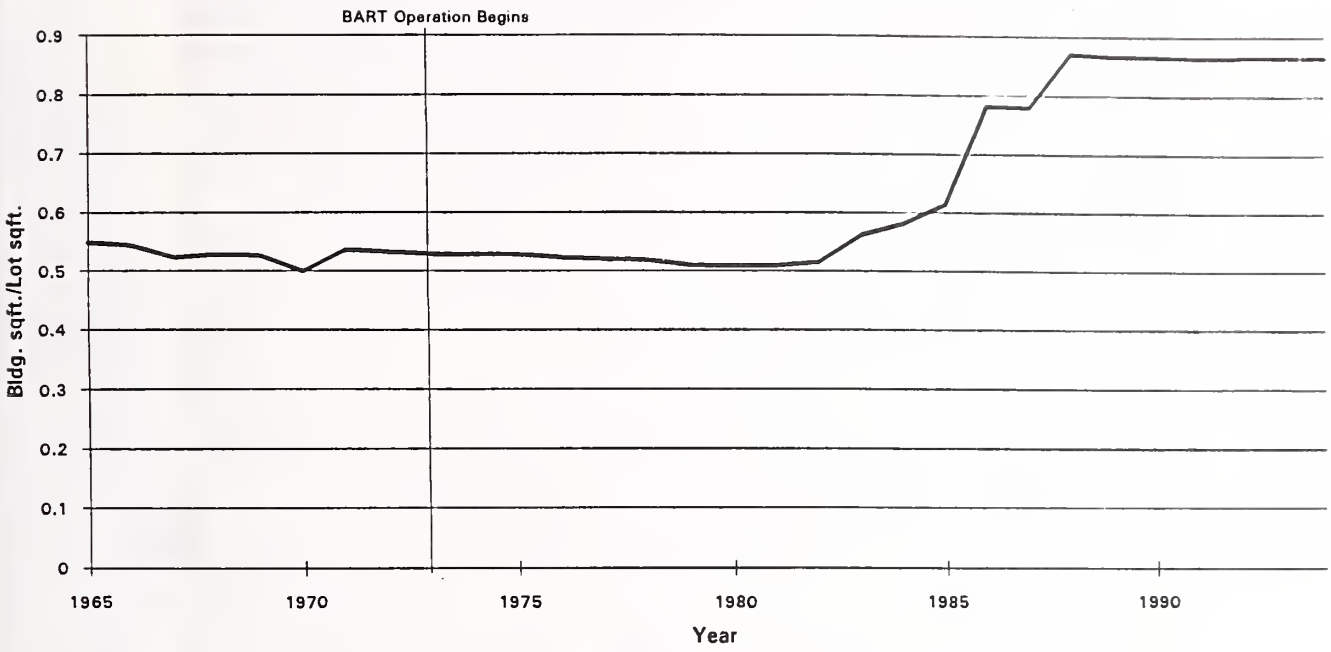


Figure 12.9. Walnut Creek Non-Residential F.A.R. Vintage Model (Since 1965)

12.3. Pleasant Hill Station

The Pleasant Hill BART station area is one of the best examples of suburban transit-oriented development in the U.S. It represents a victory in town planning and public-private coordination of land development. Between 1988 and 1993, over 1,600 housing units and 1.5 million square feet of class A office space was built within a quarter mile of the Pleasant Hill station (Photo 12.1). This development occurred despite the fact that during BART's first 20 years, the Pleasant Hill station was surrounded by BART's largest parking lot (3,245 spaces) and because of its proximity to I-680, has functioned as a terminal station — factors that normally suppress land development. The station area also lies in an unincorporated part of Contra Costa County, which in many situations might have retarded development; however, in Pleasant Hill's case, aggressive measures taken by county officials helped leverage a considerable amount of private investment in the area.

Pleasant Hill's success in attracting housing and office development is attributable to three key factors: first, the creation of specific plan in the early 1980s that served as a blueprint for targetting growth near the rail station over the ensuing 15 years; second, the existence of a proactive redevelopment authority whose staff aggressively sought to implement the plan by assembling irregular parcels into developable parcels, seeking out private co-ventures, investing in public infrastructure, and issuing tax-exempt bond financing for public and private improvements; and third, having a local elected official

Photo 12.1. Housing and Commercial Development Around the Pleasant Hill BART Station

who became the project's "political champion," working tirelessly and participating in innumerable public hearings to shepard the project through to implementation (Cervero, Bernick, and Gilbert, 1994). Current plans call for converting two BART parking lots at the Pleasant Hill station into structured replacement parking in order to open up land for restaurants, retail shops, and a regional cultural complex, activities that are currently missing but are widely viewed as vital toward creating a more village-like atmosphere.

The healthy growth in multi-family housing development near the Pleasant Hill station is underscored by the vintage model shown in Figure 12.10. Since BART opened, apartment building space has doubled within a half-mile ring of the station, reaching around 2.5 million square feet in 1993. Among the multi-unit complexes built within a quarter-mile walking distance of the station over the past decade have been: Wayside Plaza — 156 condominiums and 211 rental units at 24-60 units per acre; Treat Commons — a 510-unit complex at 43 units per acre built in 1988; Bay Landing — 282 rental units at 43 units per acre opened in 1988; and Park Regency — an 892-unit complex at 70 units per acre opened in 1992. These are very high residential densities by suburban standards, and well exceed the minimum thresholds of 15 units per acre commonly viewed as necessary to sustain rail transit. All of the apartment projects near the Pleasant Hill station cater to an upscale market, featuring swimming pools, spas, and recreational facilities. Three-quarters of the Park Regency's occupants are in the 18- to 34-year age group, and more

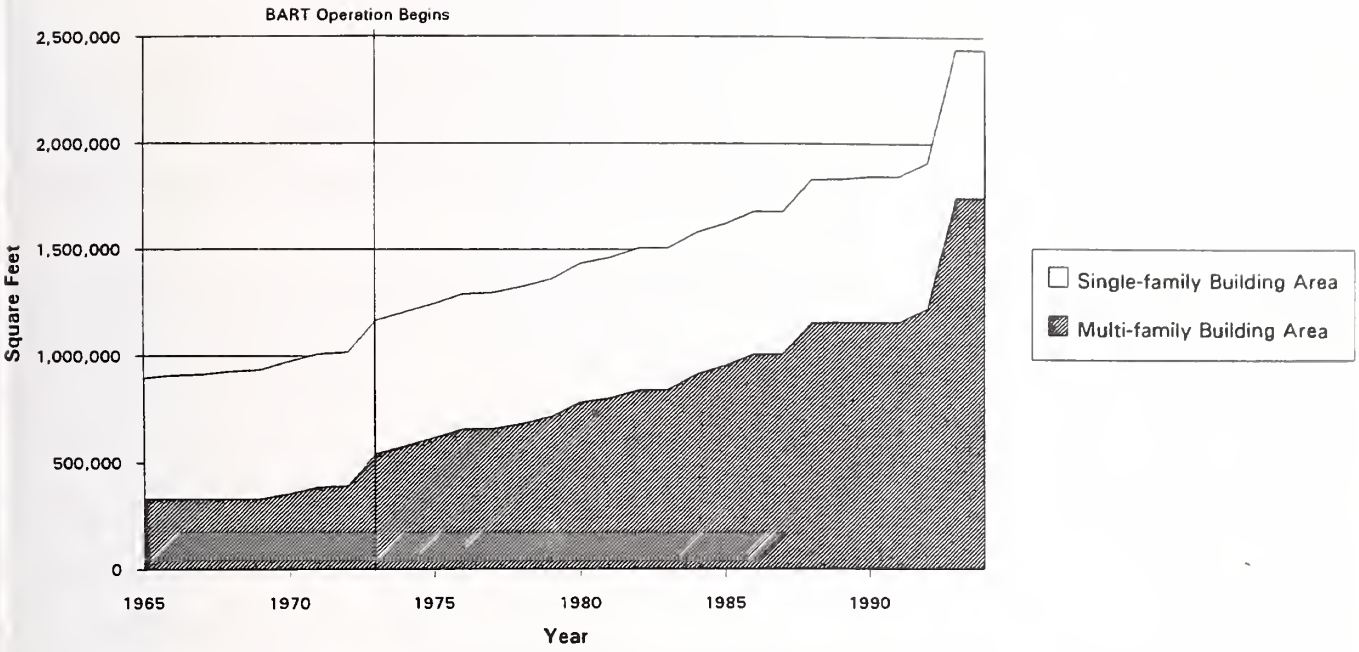


Figure 12.10. Pleasant Hill Residential Vintage Model (Since 1965)

than 50 percent earn over $40,000 annually (Cervero and Menotti, 1994). An estimated one-half of the residents of employed tenants work in downtown San Francisco or Oakland, compared to a citywide average of just 10 percent. Many take BART to work — a 1993 survey found that 36.8 percent of Park Regency's employed residents commuted via BART and that 54.9 percent of those living in Wayside Plaza did likewise (Cervero, 1993).

The strong demand for apartments near the Pleasant Hill station has produced a rent premium. Comparisons were recently made between 1994 rents at multi-unit projects within a quarter mile of the Pleasant Hill BART station versus otherwise similar projects in Pleasant Hill and the nearby cities of Walnut Creek and Concord that were beyond walking distance of a rail stop (Bernick, Cervero, and Menotti, 1994). Rents per square foot for one-bedroom/one-bathroom units near the Pleasant Hill station were $1.20, compared to an average of $1.09 for similar projects (in terms of size, age, and amenities) in the same geographic submarket but away from BART. Two bedroom/two bathroom units near the Pleasant Hill stations leased for around $1.09 per square foot compared to around $0.94 per square foot for comparable units away from BART. These findings translate into a 10 to 15 percent rent premium associated with being near BART. It was for the very reason that premium rents could be commanded that developers of Bay Landing and Treat Commons actively sought out sites near a rail station (Bernick and Carroll, 1991).

While the private sector provided the risk capital for these apartment projects, the public sector also played a vital leveraging role. To encourage higher densities around the station, Contra Costa County zoned for minimum densities of 35 units per acre.[2] The redevelopment authority promoted office development through a number of mechanism: by assisting with land assemblege through acquiring and conveying nearby property; by assisting in tax-exempt financing by forming an assessment district; and by subordinating loans.

Pleasant Hill's pattern of commercial-office development has paralleled that of Walnut Creek. There was a strong surge in office development in the mid-1980s, a period when a tremendous number of central city jobs were relocated to the suburbs (Figure 12.11). Office F.A.R.s increased commensurately (Figure 12.12). Among the largest office structures in the area today are: The Terraces (six-story, 132,000-square-foot office building opened in 1987); Oak Hill Capital Corporation (six-story, 102,000-square-foot structure); Pacific Plaza (a 254,000-square-foot office structure); Oak Court (ten-story, 206,000-square-foot tower); and Embassy Suite hotel (249-rooms and conventional/conference facilities). Noticeably absent from the Pleasant Hill BART area are retail shops, restaurants, and other consumer services. Plans call for attracting these uses in the future in hopes of creating a more pedestrian-oriented village environment.

12.4. Concord Station

The Concord BART station area, the current terminus of the Concord line, has also experienced an impressive amount of commercial-office development since BART's opening, though considerably less than in Walnut Creek and slightly less than in Pleasant Hill. Also, far less apartment construction has occurred than around the Pleasant Hill station. The Concord station is not as freeway-accessible as other stations on the Concord line, which might have suppressed development relative to Walnut Creek and Pleasant Hill. The recent opening of a 600-space parking structure increased the station's parking supply to 2,575 units, still some 700 fewer spaces than the next station in, Pleasant Hill. The extension of the Concord line to West Pittsburg, currently under construction and scheduled to open in 1997, will convert Concord to an intermediate station and likely reduce its ridership catchment area.

The vintage model of residential development (Figure 12.13) shows a steady increase in housing inventory, led mainly by apartment construction. The sharpest increases in multi-family building space was during the eight years prior to BART, a period when the entire city of Concord was growing rapidly. Single-family homes still, however, remain dominant within the station's half-mile catchment.

Relative to the Walnut Creek and Pleasant Hill stations, the Concord station was a late bloomer in attracting office development. Figure 12.14 shows that non-residential floorspace remained fairly constant until 1985; over the next three years, inventory increased nearly fourfold. Both office buildings and mixed retail-office development rose sharply over this period (Figure 12.15), nearly tripling the net non-residential floor area ratios to 0.9 (Figure 12.16), comparable to Walnut Creek's. As in Pleasant Hill, the

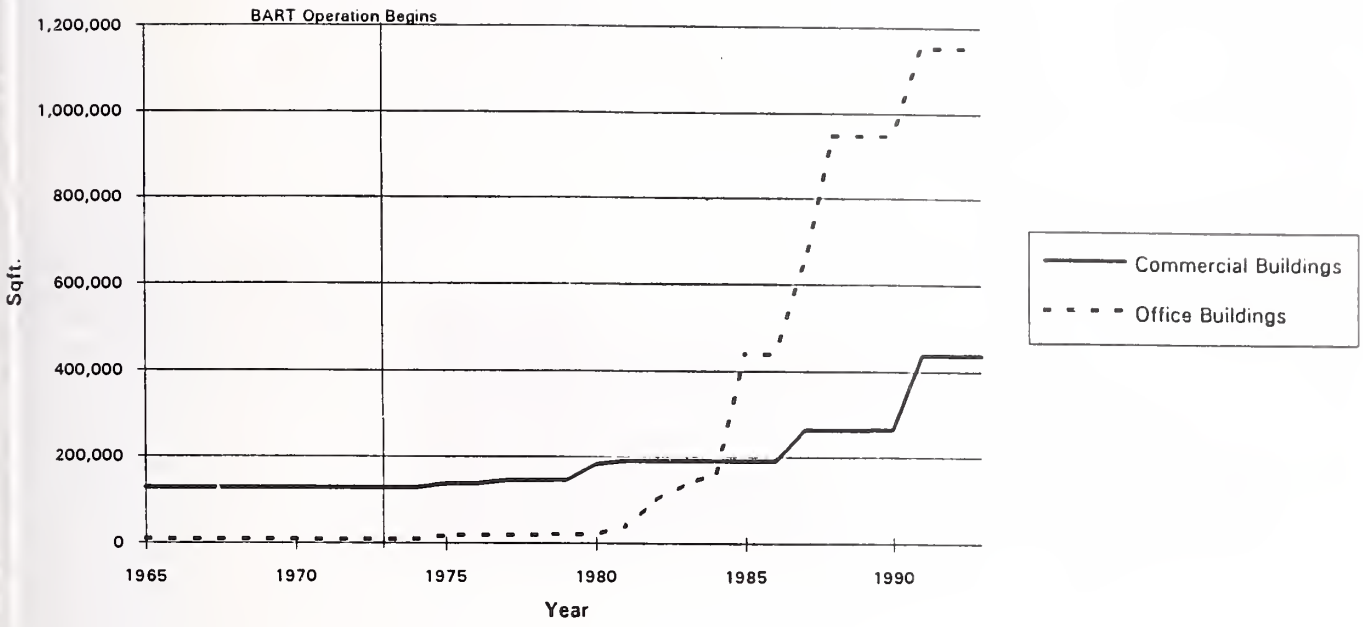


Figure 12.11. Pleasant Hill Non-Residential Vintage Model (Since 1965)

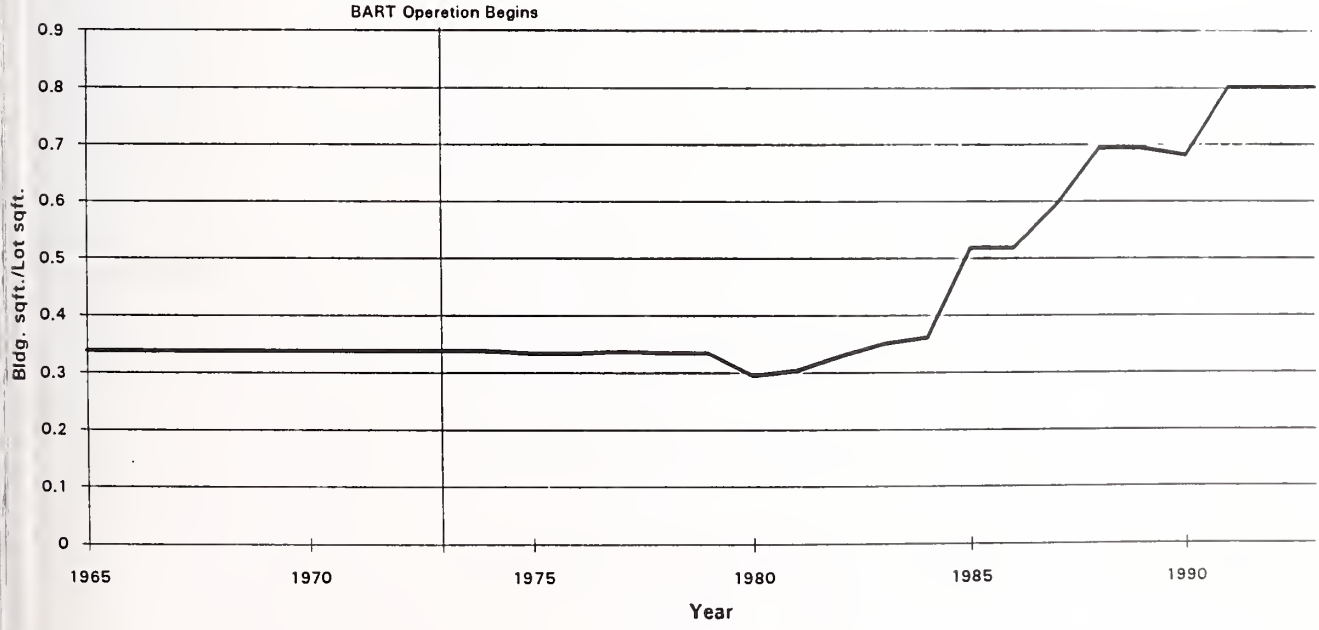


Figure 12.12. Pleasant Hill Non-Residential Vintage Model (Since 1965)

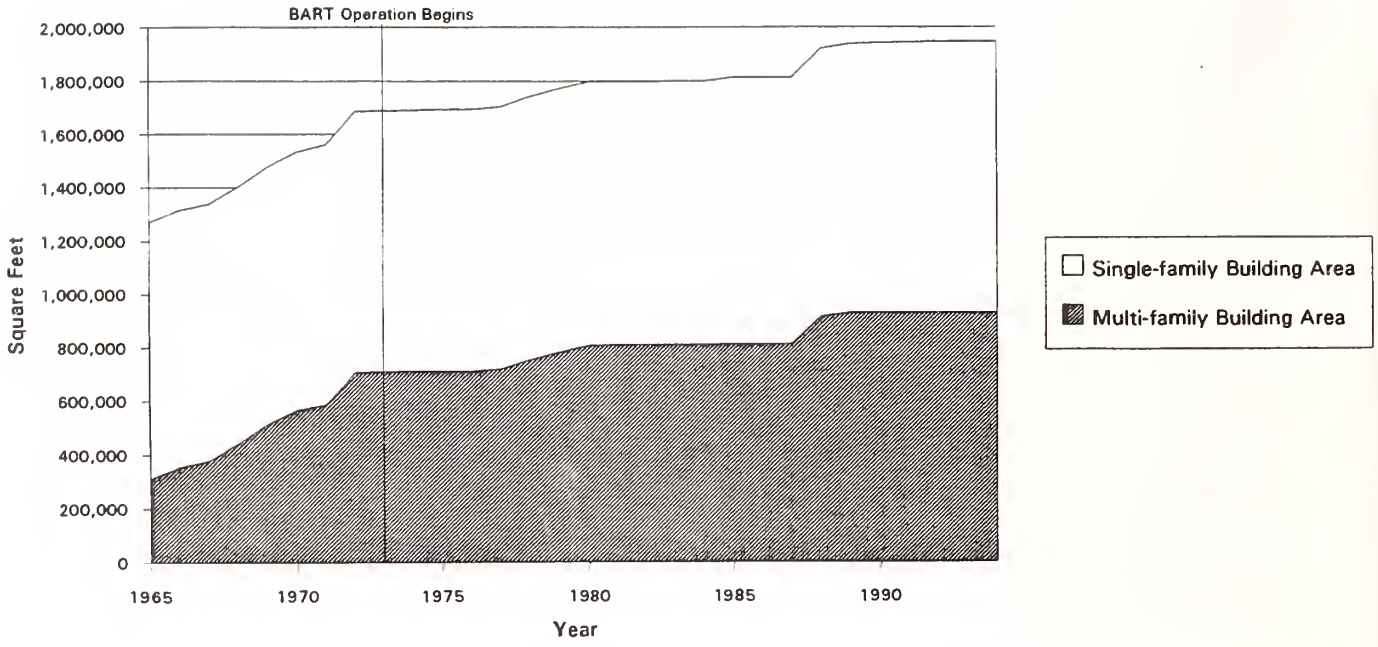


Figure 12.13. Concord Residential Vintage Model (Since 1965)

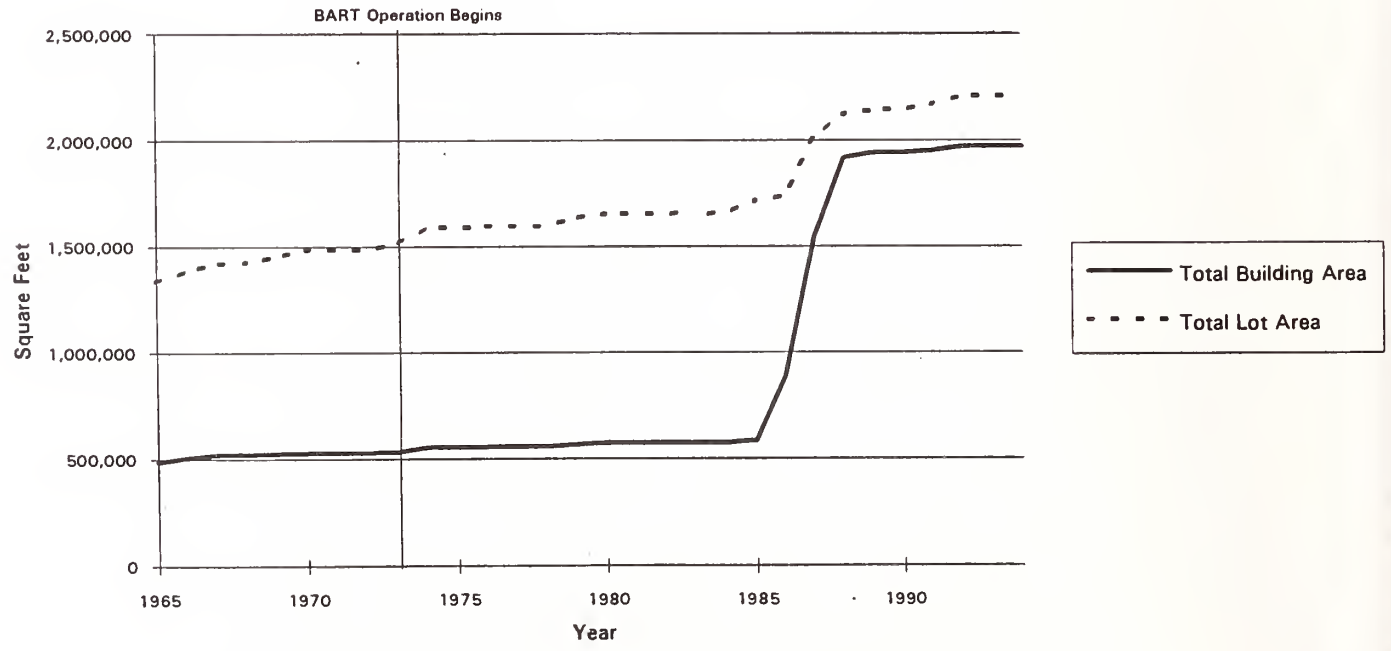


Figure 12.14. Concord Non-Residential Vintage Model (Since 1965)

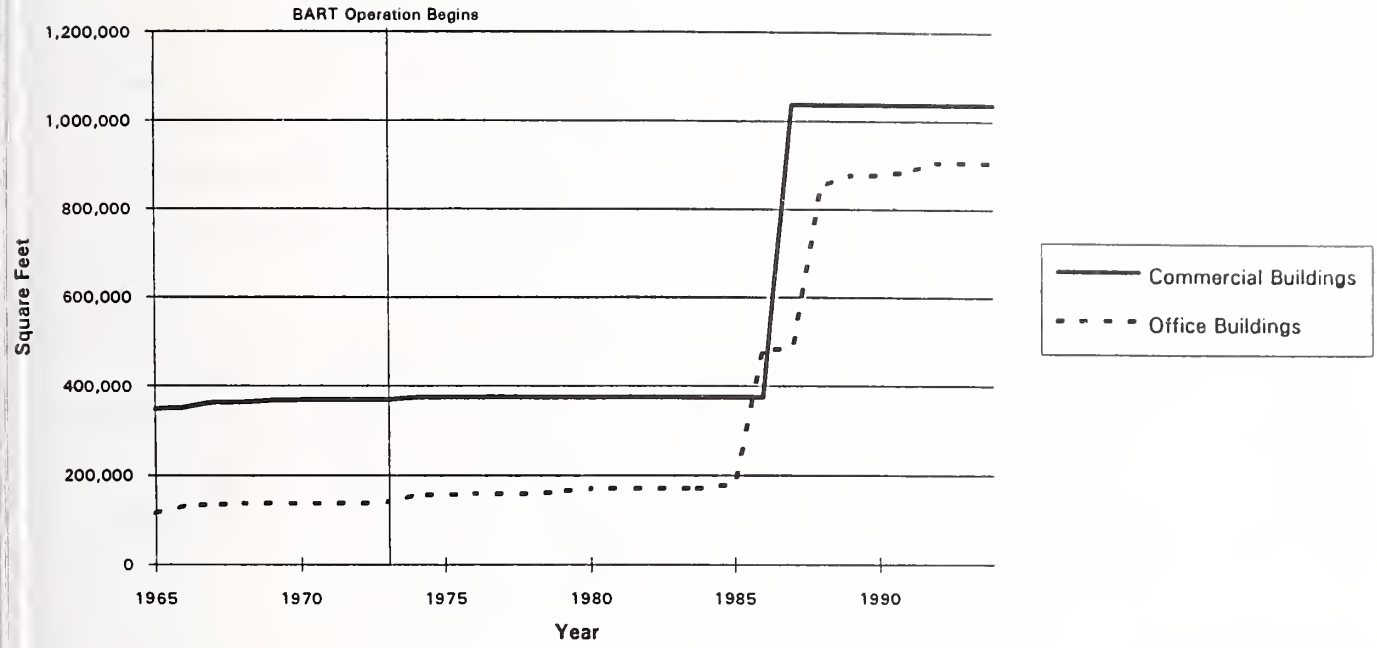


Figure 12.15. Concord Non-Residential Vintage Model (Since 1965)

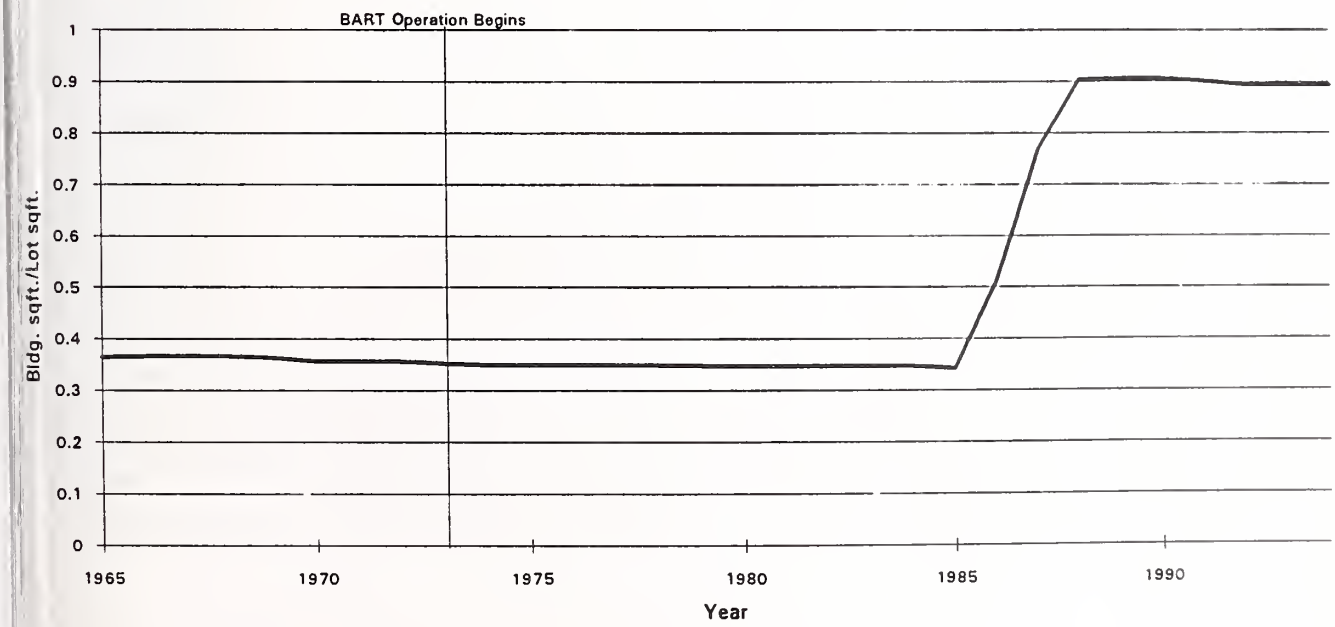


Figure 12.16. Concord Non-Residential F.A.R. Vintage Model (Since 1965)

local redevelopment agency spearheaded much of the station-area development in Concord by helping to assemble land and financing complementary public infrastructure improvements. Among the major medium-rise buildings added during the 1985-1988 boom period were: Seeno/Gateway Towers (two ten-story buildings totalling 635,000 sq. ft.); Bank of America Technology Center (a 1.1-million-sq.-ft. office complex with a 2,500-space parking garage); Tishman/Concord Center (two 15-story office towers with 731,000 sq. ft. of office space); Salvio Pacheco square (mixed retail-restaurant-office complex with 79 residential units; and the Concord Plaza (191,000-sq.-ft. office structure with ground-floor retail).

12.5. Overall Changes in Land-Use Composition

The dramatic gains in office floorspace along the Concord line are highlighted in Figure 12.17. In 1965, offices made up just 3 percent of total building area in the half-mile rings around the Rockridge, Walnut Creek, Pleasant Hill, and Concord stations. By 1993, offices comprised nearly 30 percent of total floorspace. These gains were matched by markedly lower shares of single-family housing, which fell from 49 percent of all floorspace in 1965 to 27 percent in 1993.

12.6. Concord Line Summary

All three BART stations along the I-680 corridor experienced a significant amount of office development during the 1980s. Pleasant Hill also gained more housing units than any other BART station area. As noted in Chapter Three, much of the I-680 corridor without BART services also experienced an office building boom during the 1980s, highlighted by the 875-acre Hacienda Business Park in Pleasanton and the 585-acre Bishop Ranch Business Park in San Ramon. This suggests that the outer Concord line's surge in office development was part of a much larger dynamic of employment decentralization. Corporate relocations from San Francisco have been a major contributor to the I-680 corridor's growth (Sedway and Associates, 1993). Without BART, however, it is unlikely that office development in Walnut Creek, Pleasant Hill, and Concord would have been nearly as concentrated. Office densities around the three BART stations are around 0.80-0.90, considerably above the 0.10-0.15 found at Bishop Ranch and Hacienda Business Park. Surveys show much larger shares of workers with jobs near the Pleasant Hill station commute by transit — 12 percent versus only 1.6 percent of workers at Hacienda Business Park (Cervero, 1993; City of Pleasanton, 1993). Thus, while BART unlikely had much influence on the number of jobs that ended up along the Walnut Creek-to-Concord axis, it likely had a strong influence on the built form that the development took — namely, concentrated, mixed-use development.

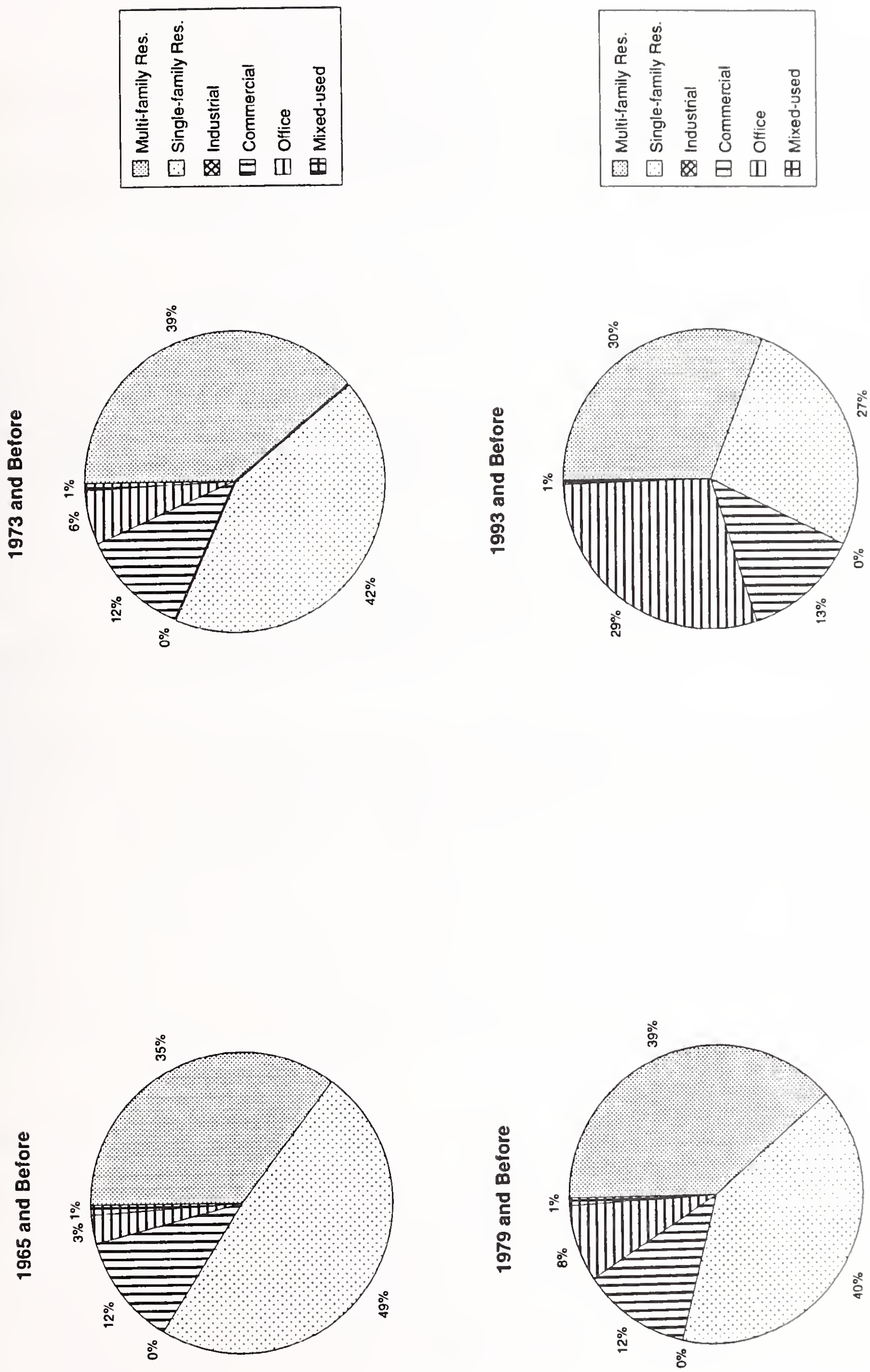


Figure 12.17. Concord Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 4 Station Areas)

Notes

[1]Office construction continued around the Walnut Creek station mainly because most of the projects were grandfathered-in as having been approved prior to the passage of Proposition H. The growth ban was eventually ruled unconstitutional by the courts, and by 1989, growth limits had been lifted.

[2]Since the Pleasant Hill station lies in an unincorporated part of Contra Costa County, the county planning department maintains jurisdiction over zoning.

References

Bernick, M., and M. Carroll. 1991. *A Study of Housing Built Near Rail Transit Stations: Northern California*. Berkeley: Institute of Urban and Regional Development, Working Paper No. 546.

Bernick, M., R. Cervero, and V. Menotti. 1994. *Comparison of Rents at Transit-Based Housing Projects in Northern California*. Berkeley: Institute of Urban and Regional Development, Working Paper No. 624.

Brady Associates. 1994. *Rockridge Plan*. Oakland: Oakland City Planning Department.

Cervero, R. 1993. *Ridership Impacts of Transit-Focused Development in California*. Berkeley: Institute of Urban and Regional Development, Monograph No. 46.

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

Cervero, R., and V. Menotti. 1994. *Market Profiles of Rail-Based Housing Projects in California*. Berkeley: Institute of Urban and Regional Development, Working Paper No. 622.

City of Pleasanton. 1993. Pleasanton Employer Travel Survey. Pleasanton: mimeo.

Sedway and Cooke, Associates. 1993. San Francisco Market. *Urban Land* 9: 12-15.

CHAPTER THIRTEEN
Land-Use Changes Along the Richmond Line

Among all suburban, East Bay BART corridors, the Richmond line has witnessed the fewest land-use changes. The one notable exception is the El Cerrito del Norte station, which in the past few years has attracted a large mixed apartment-retail project and several large retailers nearby. Elsewhere, the real estate market has been flat. Community opposition to apartment proposals has suppressed development around the Ashby and North Berkeley stations. The largest inventory of housing, offices, and retail floorspace to come on line along this corridor has been in Emeryville — one of the few East Bay shoreline cities without a BART station.

Because I-80 lies one to two miles west of the BART line between the Ashby station and North Berkeley stations, it was possible to conduct a matched-pair analysis for this stretch. A single matched-pair analysis is conducted, however, because the stations along this segment are approximately equal distance to several freeway interchanges. Thus, the matched-pair analysis presented is for all Berkeley stations (Ashby, Berkeley, North Berkeley) versus all Berkeley I-80 interchanges (Ashby, University, Gilman). Also, matched-pair comparisons are presented for the Richmond station and nearby I-80/San Pablo Avenue exit.

13.1. Ashby Station

The Ashby station area has experienced hardly any residential or commercial-office growth since BART's opening (Figures 13.1 and 13.2). Two small office buildings were built along Adeline Avenue in the 1980s and a few multi-family units were also added. As a mature, nearly built-out neighborhood, there was little expectation that the Ashby area would dramatically change after BART services commenced. Neighborhood opposition to the possibility of higher-density development also prompted Berkeley city officials to zone the area almost exclusively for single-family housing, duplexes, and triplexes. Because of isolated land clearing, net office-commercial densities have fallen slightly since BART opened, from 0.78 to 0.72.

13.2. Berkeley Station

Downtown Berkeley has also been fairly stagnant over the past 20 years. Relatively little new housing (Figure 13.3) has been built since BART opened, and the commercial-office floorspace has not grown much when compared to downtown Oakland or suburban stations like Walnut Creek, Pleasant Hill, or Fremont (Figure 13.4). Unlike these suburban stations, the downtown Berkeley station is underground — financed by a special assessment approved by Berkeley voters. No new air-rights development has occurred over the subway.

Most of Berkeley's office development preceeded the opening of BART. The only significant post-BART addition has been the Golden Bear Center — a 170,000 sq. ft. mixed retail-office that opened

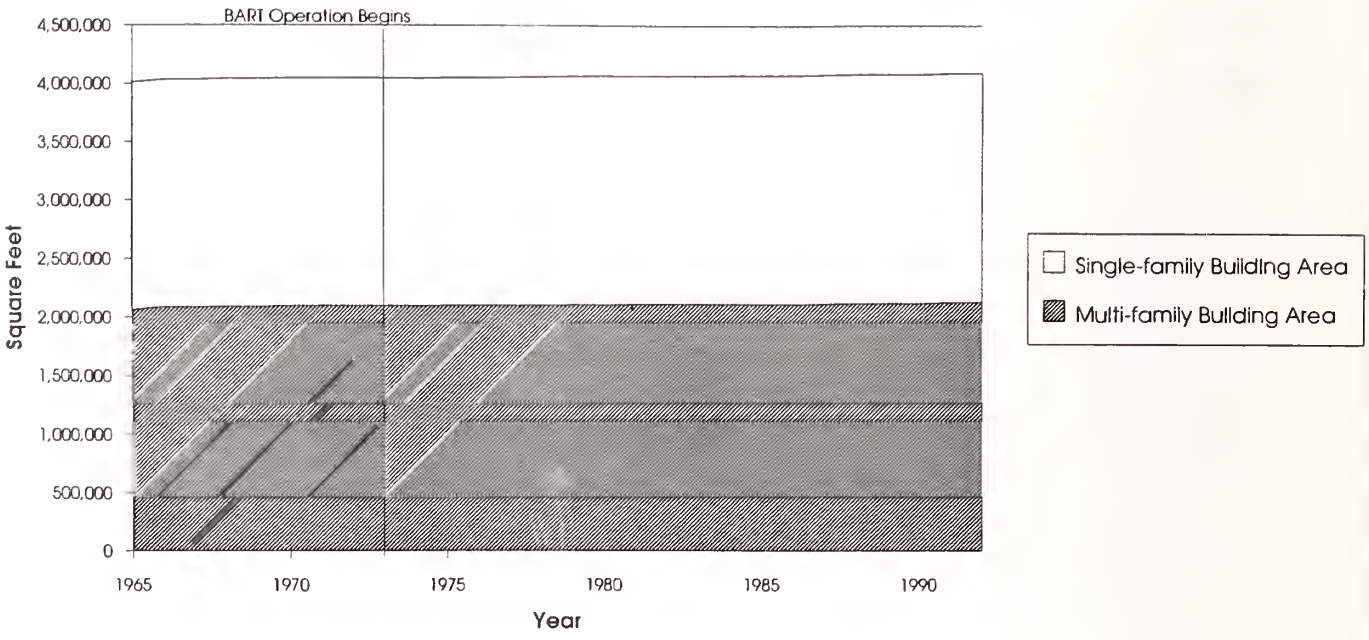


Figure 13.1. Ashby Station Residential Vintage Model (Since 1965)

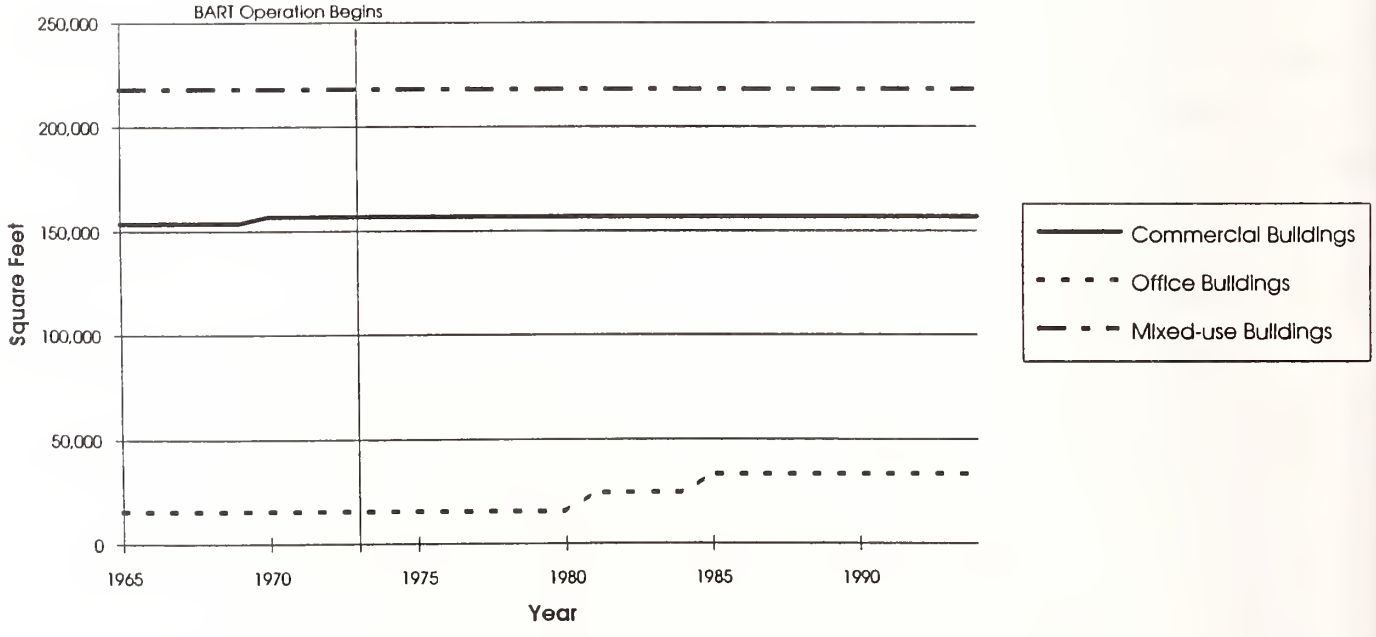


Figure 13.2. Ashby Station Non-Residential Vintage Model (Since 1965)

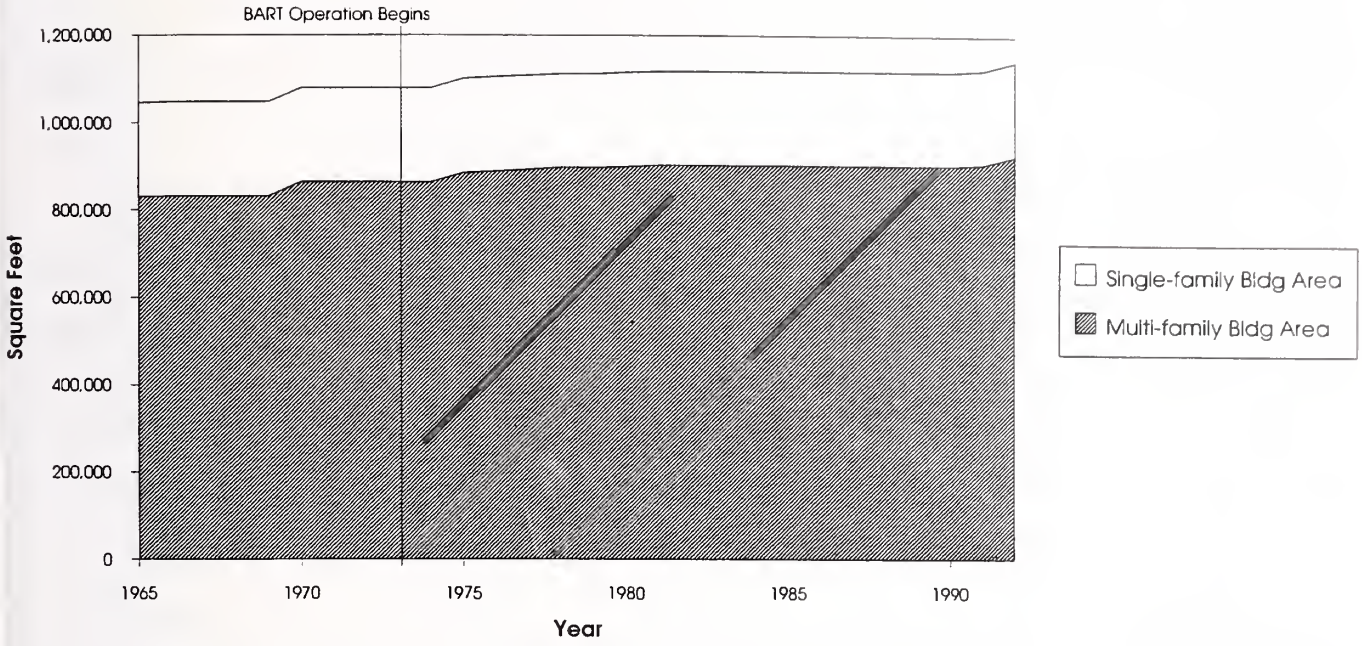


Figure 13.3. Berkeley Downtown Residential Vintage Model (Since 1965)

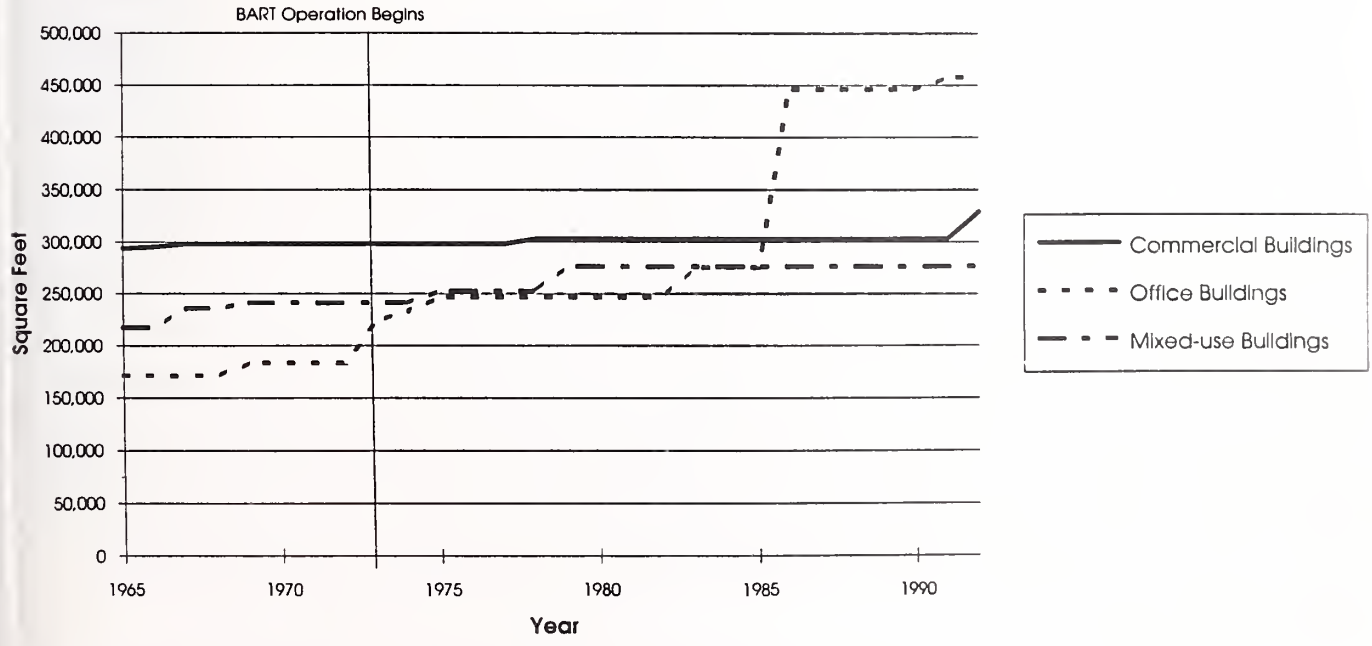


Figure 13.4. Berkeley Downtown Residential Vintage Model (Since 1965)

in 1987 around a quarter mile west of the station. Most other office developments built in the 1980s have been fairly small, all under 30,000 square feet in size. The largest office structures in downtown Berkeley, the 12-story Great Western Building and Milvia Center Building, were built during the decade prior to BART's opening. Since 1970, downtown Berkeley's non-residential densities have increased only slightly — from an average of 1.55 to 1.60 F.A.R.

13.3. North Berkeley Station

The story on development around the North Berkeley underground station is similar to that of Berkeley's other two stations — little housing construction (Figure 13.5) or non-residential development (Figure 13.6). The siting of the North Berkeley station in an established single-family residential neighborhood, coupled with community opposition to proposed apartment development in the mid-1970s, explain this status quo. What little retail development that has occurred within a half-mile catchment of the North Berkeley station has occurred along the commercial strips — University Avenue and Shattuck Avenue.

13.4. Matched-Pair Comparison of Berkeley Station and Freeway Interchange Areas

The composite change in housing stock for half-mile rings around the Ashby, Berkeley, and North Berkeley stations has been almost nil (Figure 13.7). Housing development around the three freeway interchanges was similarly flat until 1988, when the Emery Bay condominiums and apartments opened within a half-mile of the Ashby Avenue/I-80 interchange (Figure 13.8)

Emery Towers, which lies in Emeryville, contains over 500 units in a high-rise structure that stands prominently off of I-80. The city of Emeryville approved this project to help offset the widening jobs/housing imbalance it was experiencing, owing to a rapid influx of biotechnology firms and computer software companies. The Emery Bay towers were approved in part because of the site's good access to the interstate freeway. The only other housing development that has occurred within the freeway catchment is a smaller 12-unit condominium project near the University Avenue/I-80 interchange.

In terms of non-residential development, there has been slightly more growth around Berkeley's BART stations than its freeway interchanges (Figures 13.9 and 13.10). Much of the land near Berkeley's freeways are in industrial, warehousing, and parkland uses. The most significant non-residential development along the I-80 waterfront has been in Emeryville — over 1.2 million square feet of retail-commercial development was built in the city between 1990 and 1994. A key factor behind this growth was the closure of a number of industrial plants in Emeryville, opening up large tracts of land for redevelopment. An entrepreneurial redevelopment agency helped further spur these investments. Without question, retail development in the Emeryville-Berkeley area has been more attracted to the Interstate-80 corridor than BART.

13.5. El Cerrito del Norte

The one exception to land-use stagnation along the Richmond corridor has been El Cerrito del Norte. Like Pleasant Hill, Fremont, and Concord, the local redevelopment agency has played a vital role

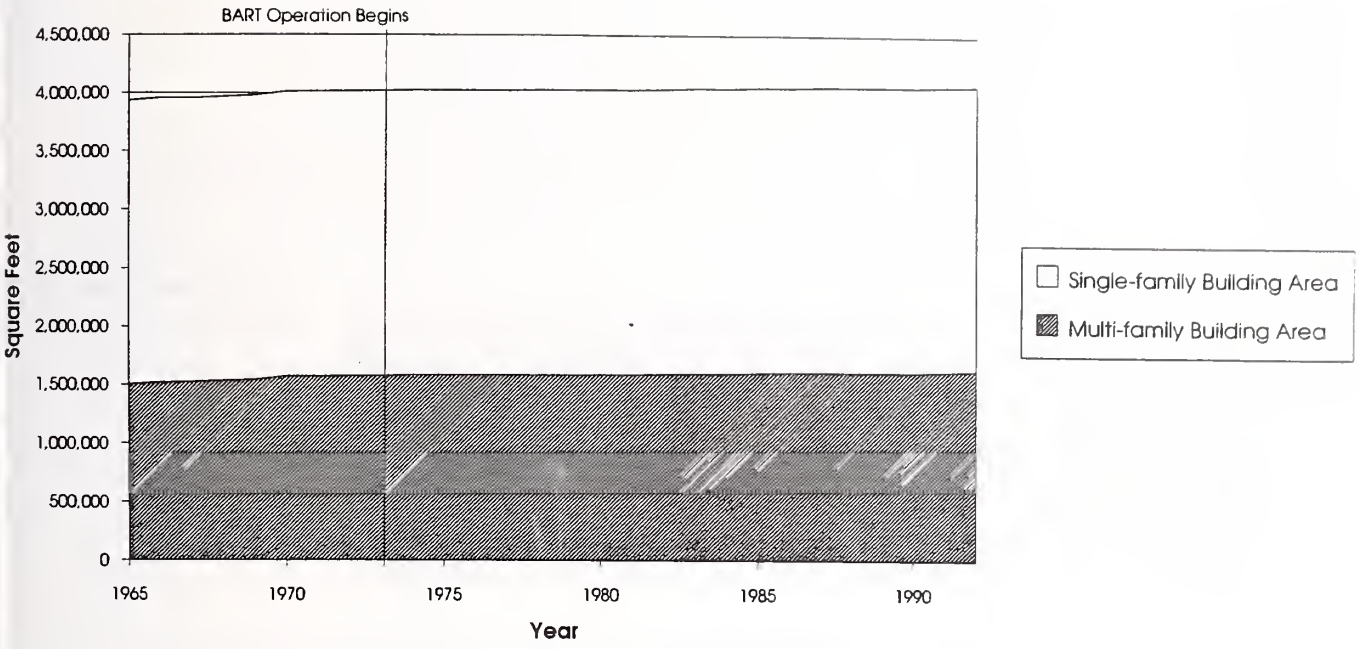


Figure 13.5. North Berkeley Residential Vintage Model (Since 1965)

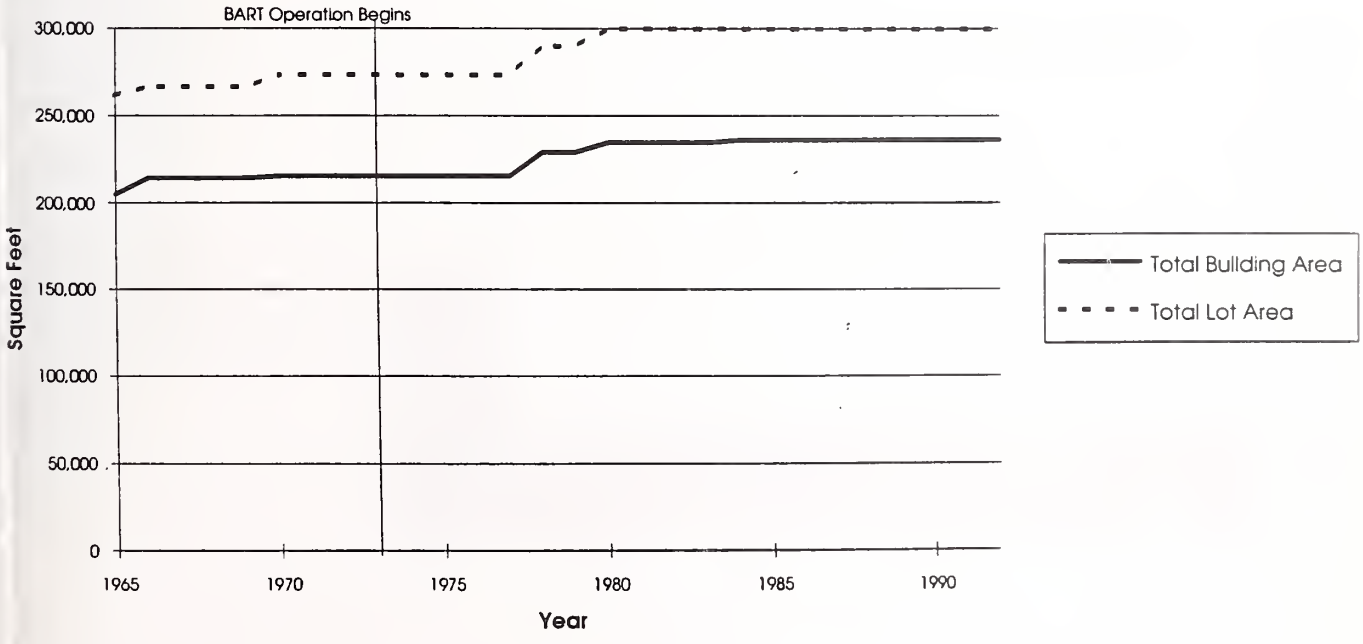


Figure 13.6. North Berkeley Residential Vintage Model (Since 1965)

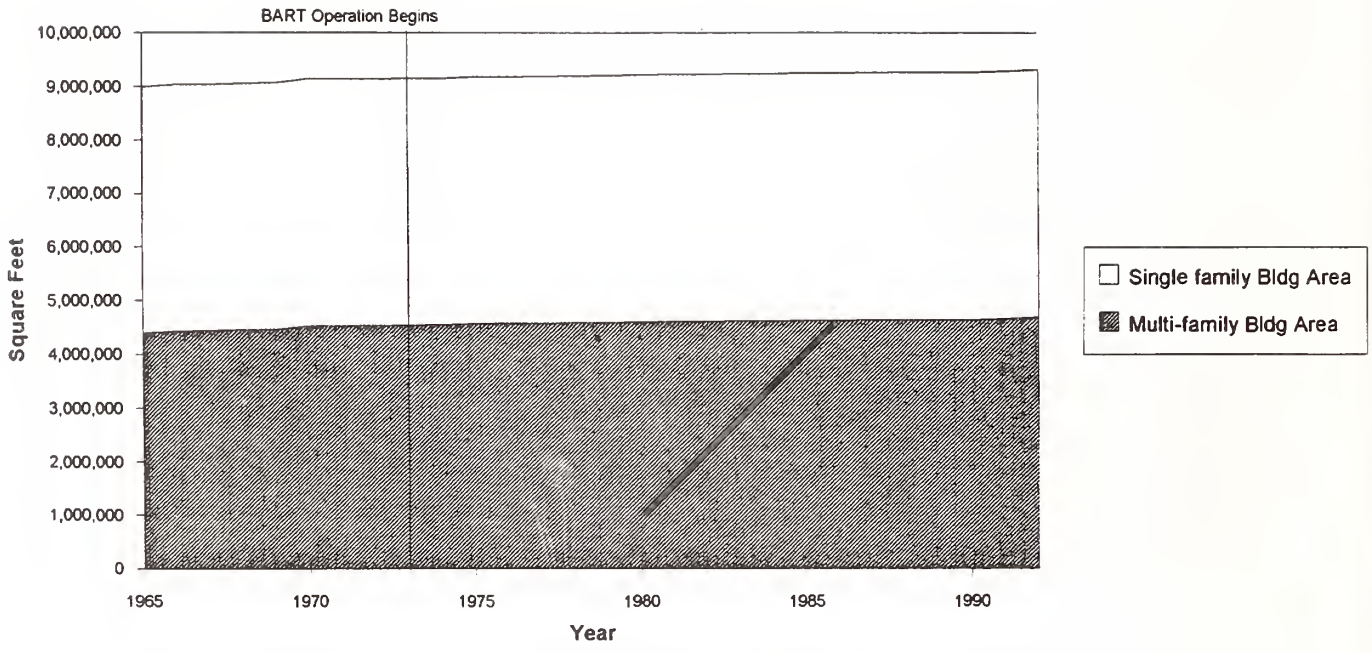


Figure 13.7. All Berkeley Stations Residential Vintage Model (Since 1965)

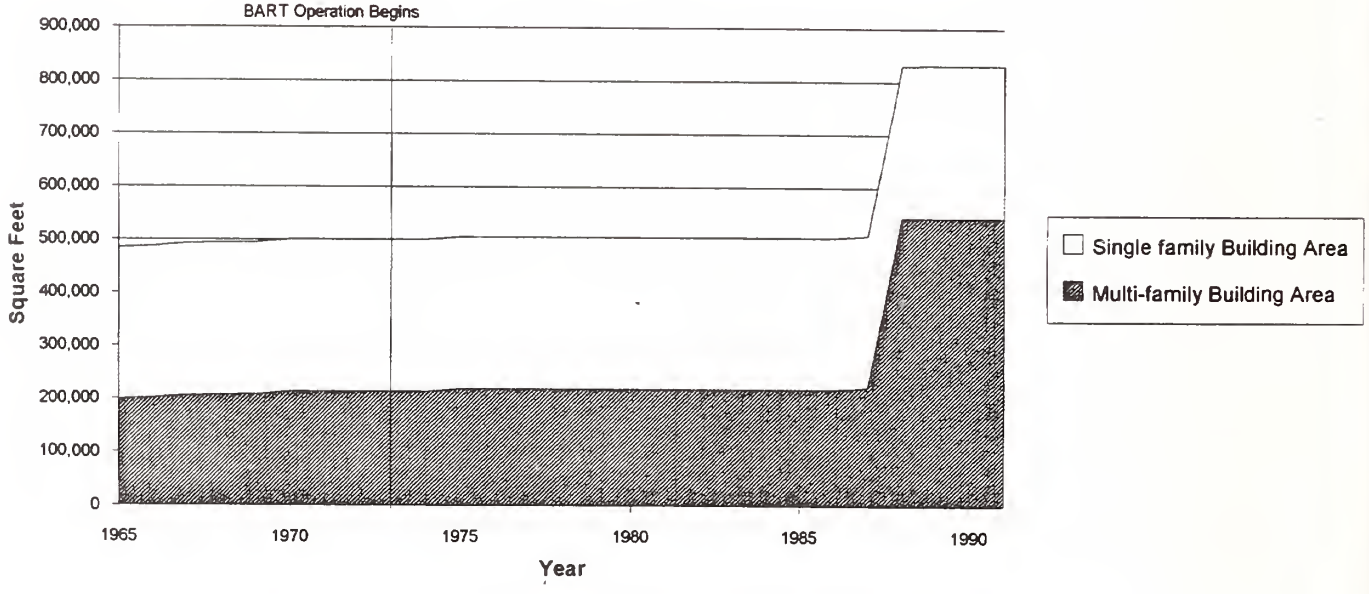


Figure 13.8. I-80 Exits in Berkeley, Residential Vintage Model (Since 1965)

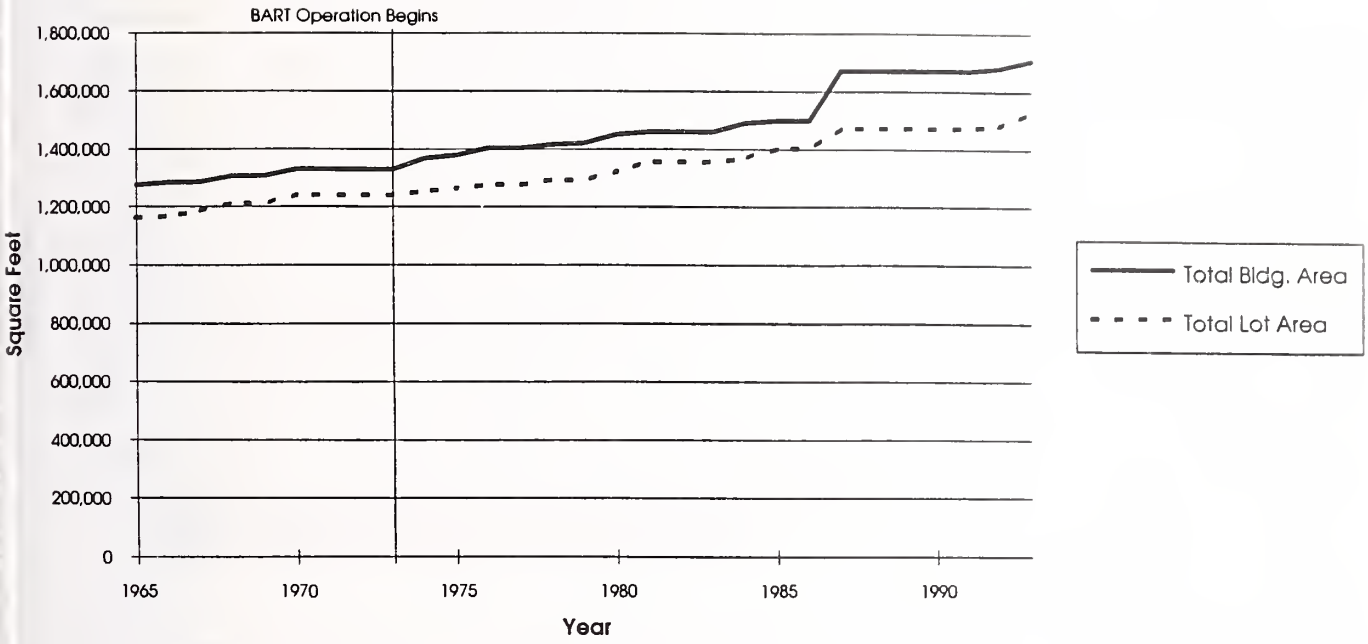


Figure 13.9. All Berkeley Stations Non-Residential Vintage Model (Since 1965)

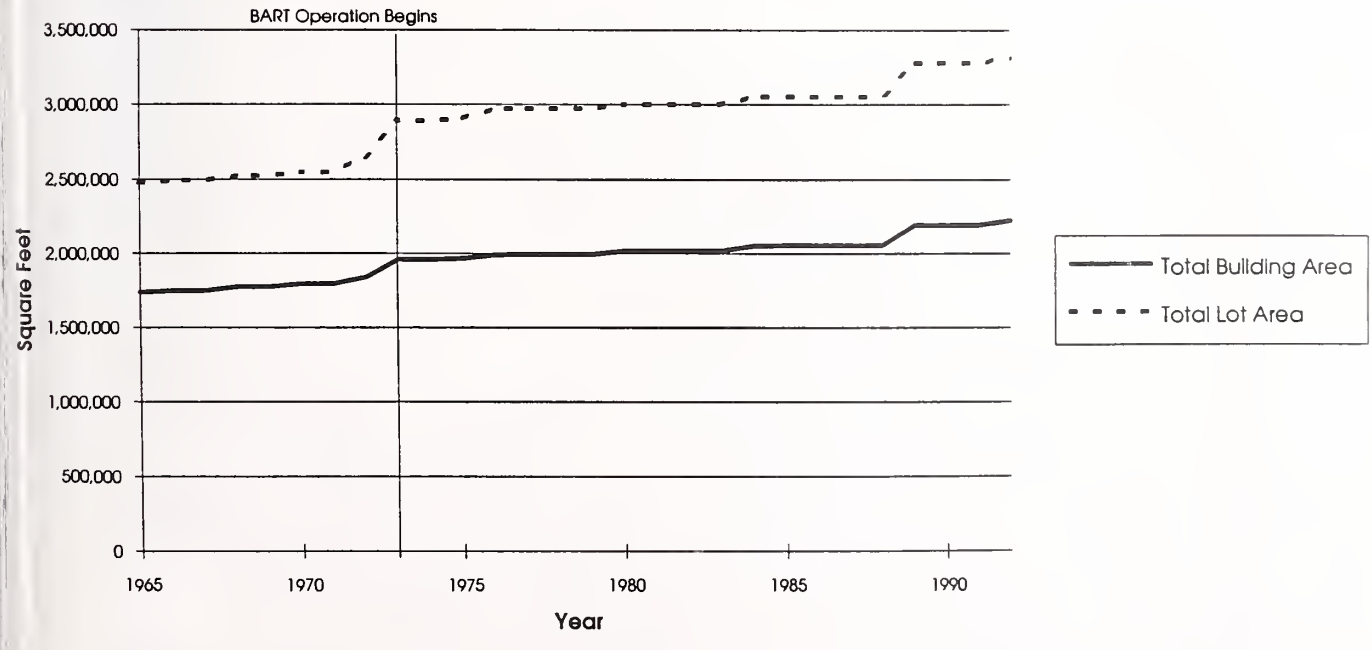


Figure 13.10. I-80 Exits in Berkeley, Non-Residential Vintage Model (Since 1965)

in assembling land, making public improvements through tax increment financing, seeking out developer interest in the station area, and sheparding projects through to implementation.

The El Cerrito del Norte area is dominated by single-family housing, which has increased by around 400,000 square feet since BART's opening (Figure 13.11). Apartment and condominium square footage has remained fairly constant, with the notable exception of the recently opened Del Norte Place project — a 135-unit apartment complex with 19,000 square feet of ground-floor retail (Photo 13.1). Twenty-seven of Del Norte Place's apartment units are priced below market as set asides for low- and moderate-income families. El Cerrito's redevelopment authority used tax-exempt financing to help underwrite the cost of assembling land and financing nearly $10 million of the $14 million in infrastructure improvements necessary to support the Del Norte Place project and other nearby planned developments. The redevelopment authority also became an equity partner, leasing land to the project's developer for $1 per year and 15-20 percent of cash flow. To date, del Norte Place has leased rapidly. It opened in mid-1992 and by mid-1993, 97 percent of its apartments were occupied. In an interview with the New York Times, the project developer stated that he aggressively put in a bid to the El Cerrito redevelopment authority to build on the site because he believes living near rail stations will become increasingly attractive as regional traffic congestion worsens (McCloud, 1992). A recent survey of employed residents of El Cerrito del Norte found that 29 percent of all commute trips to work are by BART, considerably above the 8 percent for all El Cerrito working residents (Menotti and Cervero, 1995). Several other projects have been proposed for BART-owned land at El Cerrito del Norte, including the proposed Grand Central Apartments, a 210-unit complex with ground floor retail. Under agreements between the BART Board and a developer, parking would be shared by residents of the project and BART users. When completed, the Grand Central Apartments and other proposed projects will add housing to what proponents hope will eventually become a thriving transit village.

The del Norte station has also gained nearly 200,000 square feet of retail-commercial floorspace since BART's opening (Figure 13.12), increasing average non-residential densities slightly (Figure 13.13). This increase is mainly attributable to two new "big box" retail projects: a Target department store, adding 90,000 sq. ft. of space in 1992; and Home Depot, adding a similar amount a year later.

13.6. Richmond Station

When BART was extended to the Richmond station, city officials had high hopes it would trigger a building boom because of the area's intermodal facilities and large inventory of vacant land (Map 13.1). The only significant additions were the opening of the Social Security Administration Building west of the station in BART's early years (Map 13.2) and the development of several small multi-family projects and retail outlets in more recent times (Map 13.3). None of these developments were tied to projects and retail outlets in more recent times (Map 13.3). None of these developments were tied to BART in any physical

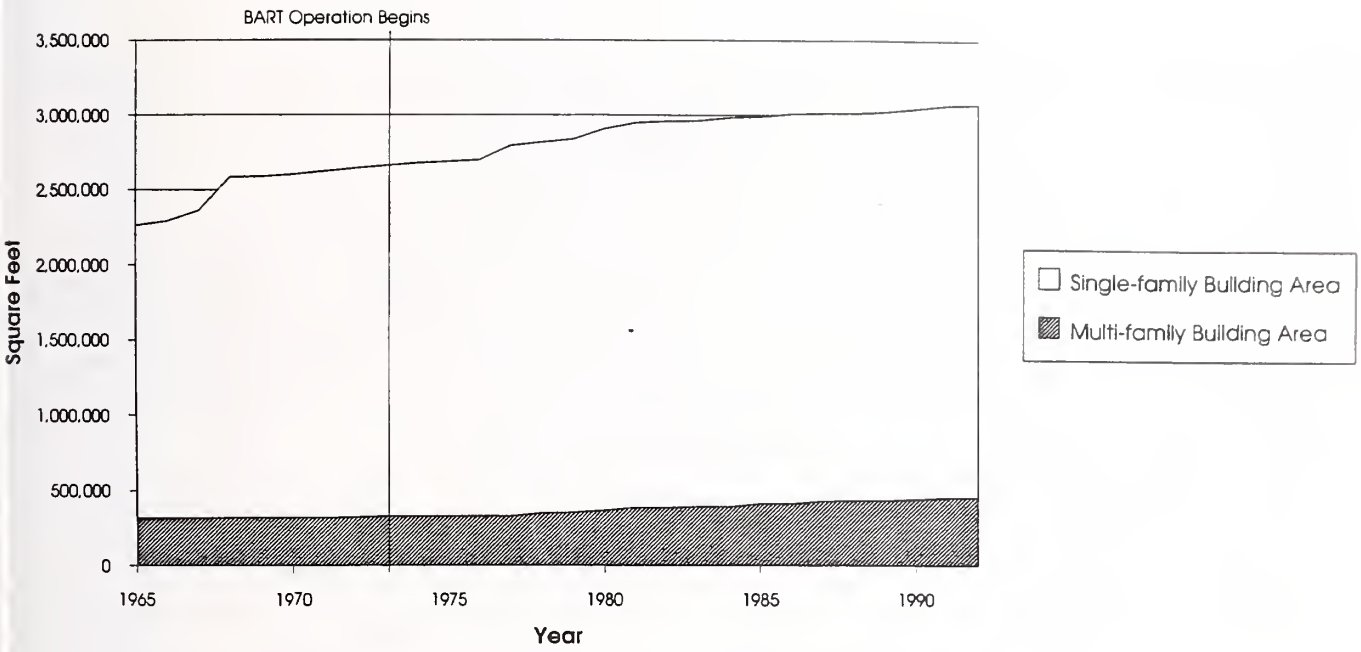


Figure 13.11. El Cerrito Del Norte Non-Residential Vintage Model (Since 1965)

Photo 13.1. Del Norte Place Project Near El Cerrito Del Norte Station

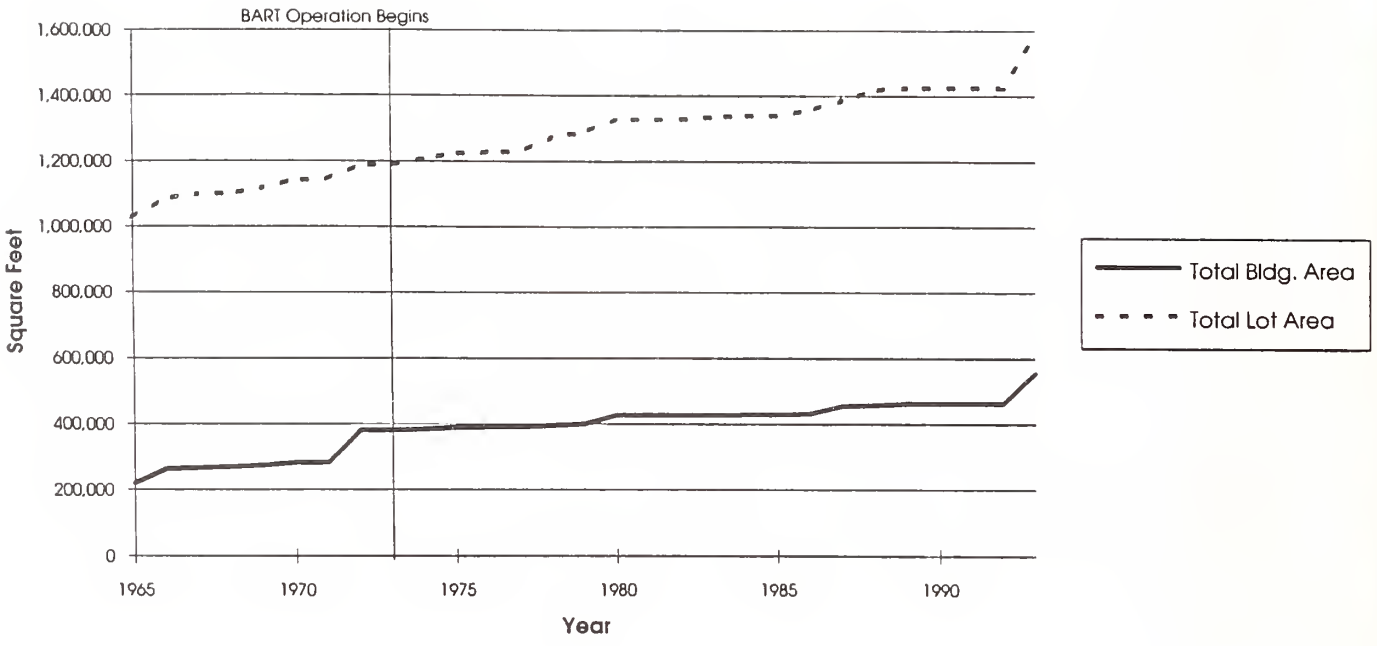


Figure 13.12. El Cerrito Del Norte Non-Residential Vintage Model (Since 1965)

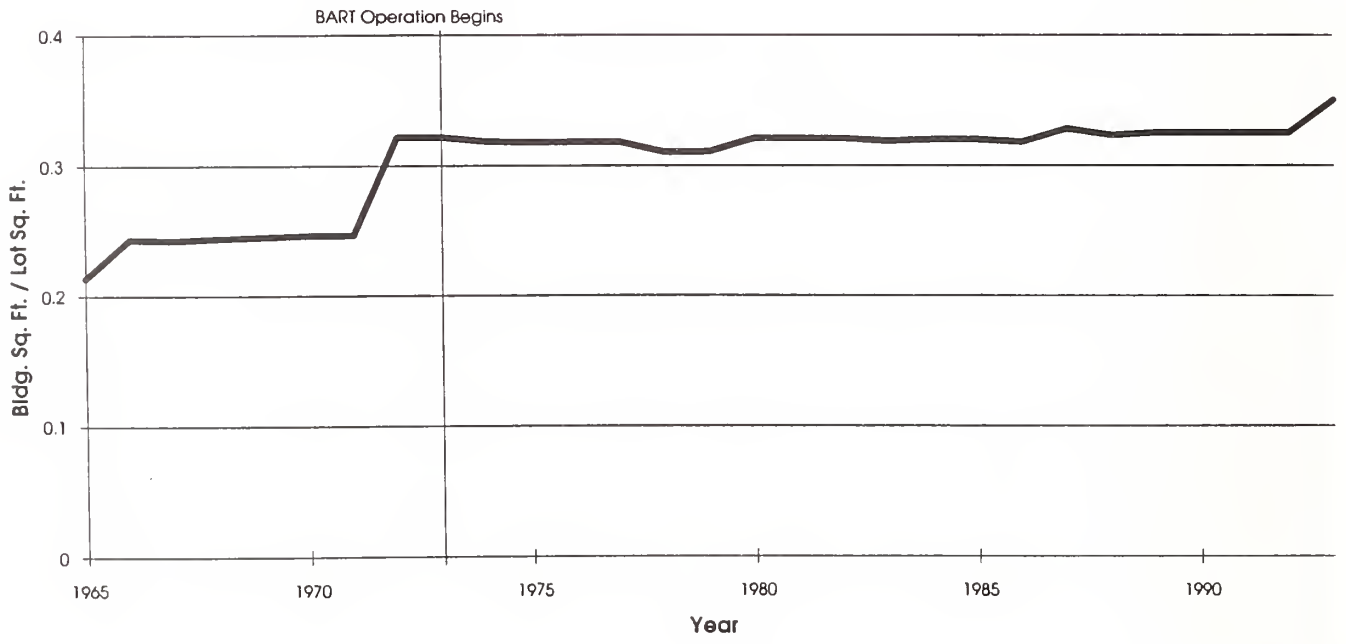
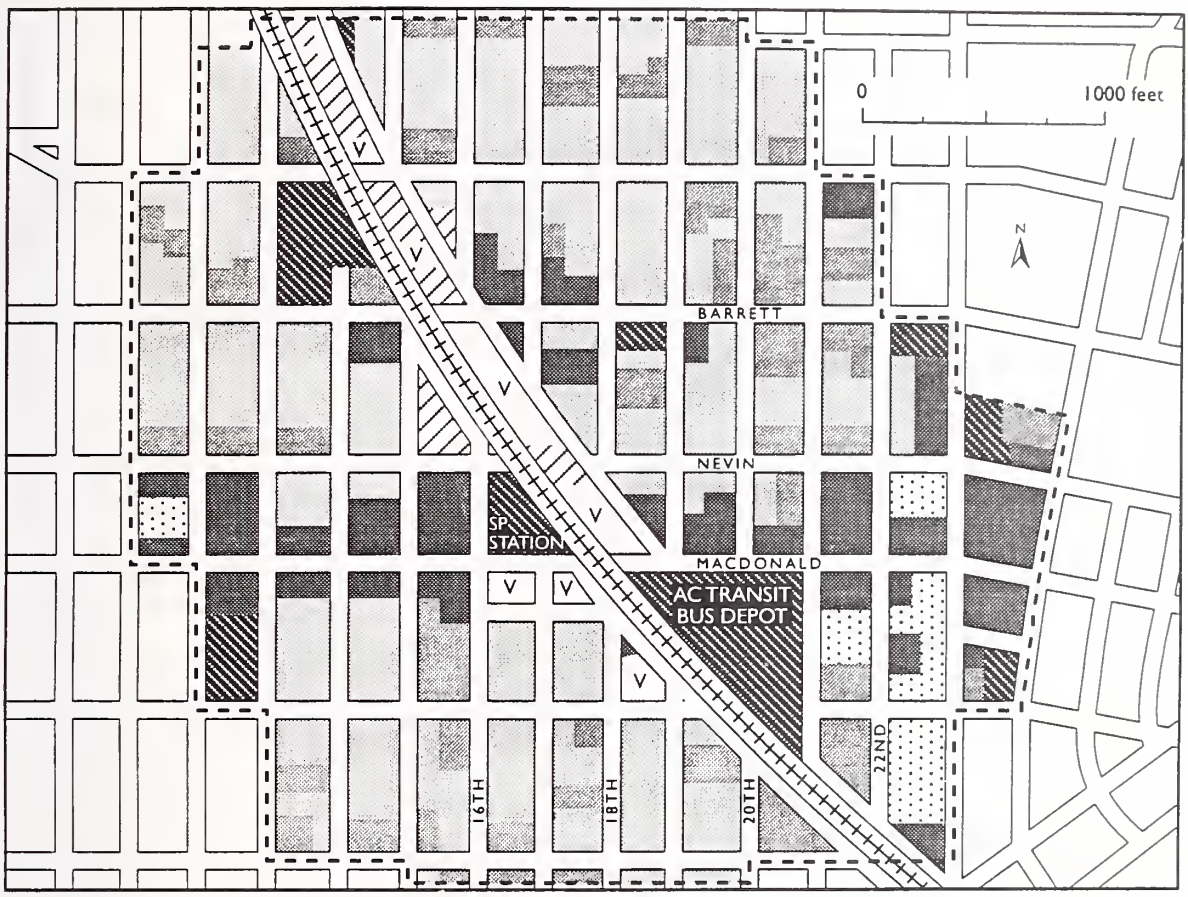


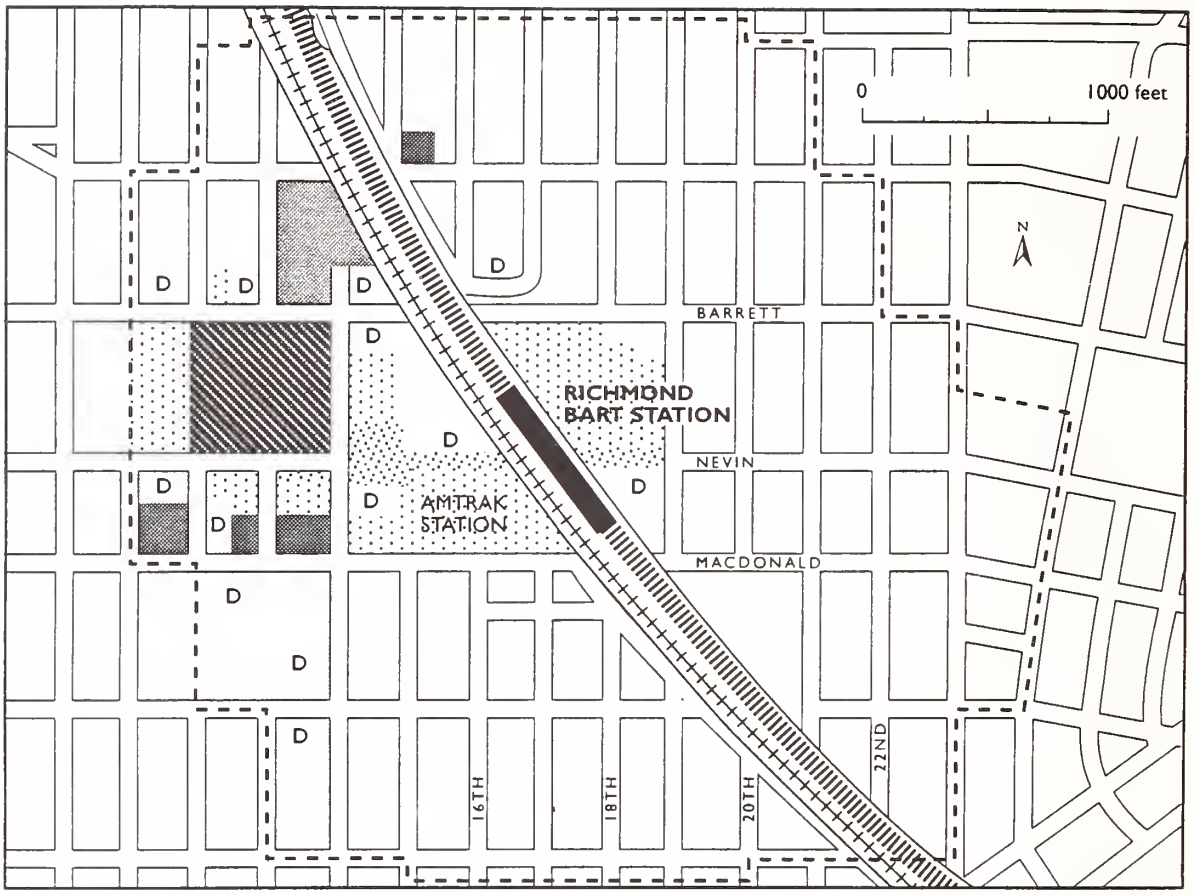
Figure 13.13. El Cerrito Del Norte Non-Residential F.A.R. Vintage Model (Since 1965)



Richmond Station Area
1965 Land Use

Single Family Residential
Multi-Family Residential
Commercial and Office
Public and Institutional
Industrial
Parking
V Vacant
Station Area Boundary

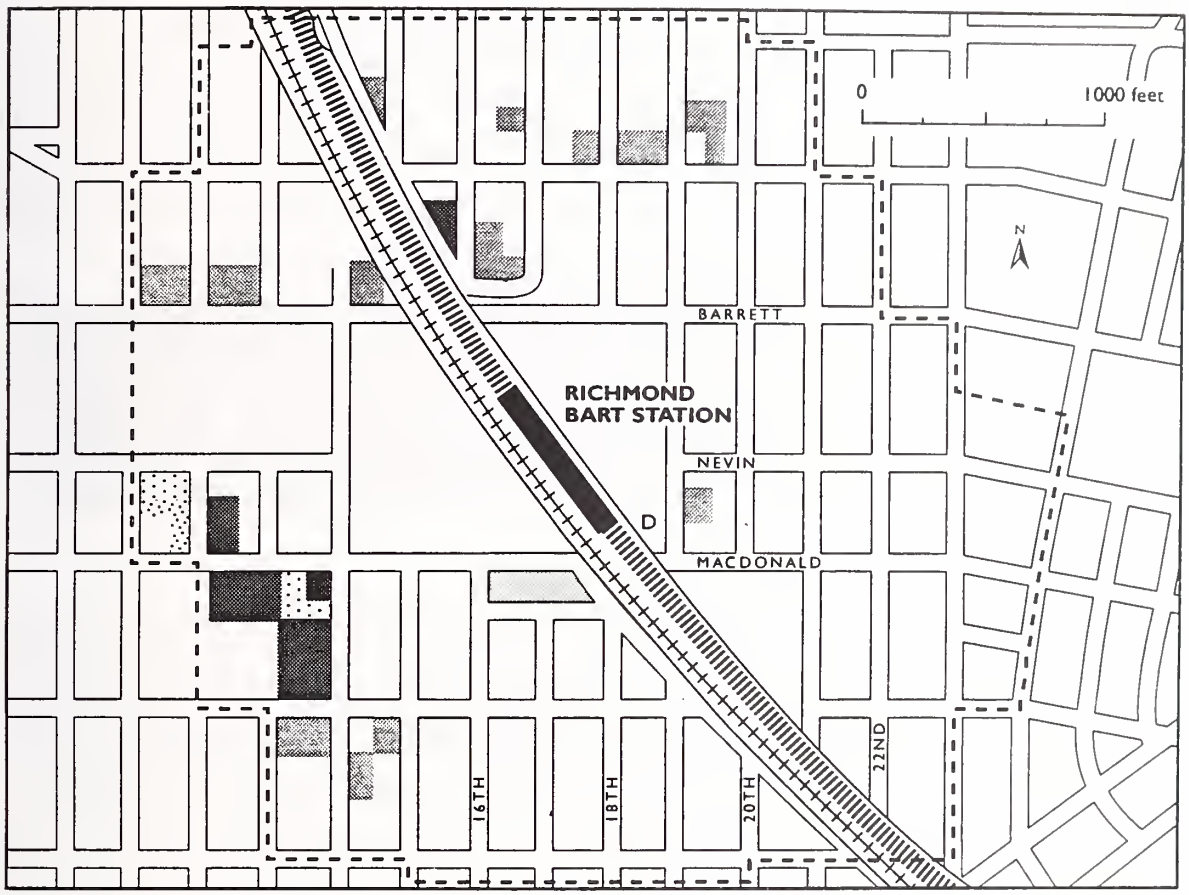
Map 13.1. Richmond Station Area 1965 Land Use



Richmond Station Area
1965-1977 Land Use Changes

- Multi-Family Residential
- Commercial and Office
- Public and Institutional
- Park/Open Space
- Parking
- D — Demolition (no new use)
- Station Area Boundary

Map 13.2. Richmond Station Area 1965-1977 Land Use Changes



Richmond Station Area
1977-1994 Land Use Changes

Single Family Residential
Multi-Family Residential
Commercial and Office
Park/Open Space
Parking
D Demolition (no new use)
Station Area Boundary

Map 13.3. Richmond Station Area 1977--1994 Land Use Changes

or architectural sense. More prominent were the large number of parcels that were cleared in anticipation of growth.

Matched-pair comparisons reveal that the Richmond station area attracted more residential construction though less retail-commercial development than neighborhoods surrounding the nearby I-80/San Pablo freeway interchange. Some 100,000 square feet of apartment floorspace was added to the station area between 1980 and 1993 (Figure 13.14), whereas no changes occurred around the I-80/San Pablo interchange (Figure 13.15). A modest amount of office development has occurred near the Richmond station since BART's opening (Figure 13.16); noticeably more retail floorspace was added around the freeway (mainly in the form of restaurants, retail outlets, and service stations) (Figure 13.17).

Overall, Richmond's experiences underscore the reality that building a transit station, in and of itself, will not stimulate major land-use changes unless there is a reasonably strong market for new commercial development. Richmond officials hope to change the fate of the area through aggressive redevelopment planning, following the successful lead of the neighborhoring city of El Cerrito. However, local market conditions must significantly improve if much private investment is to be attracted to the area.

13.7. Overall Changes in Land-Use Composition

The lack of significant changes along the Richmond corridor is underscored by the near identical composition of land uses over the period of 1965 to 1993 (Figure 13.18). For the half-mile catchments around the five stations studied along this corridor, multi-family housing comprised between 48 and 50 percent of total building space over the four time slices. All other land uses retained nearly identical market shares of building space over this 28-year period.

13.8. Richmond Corridor Summary

Overall, BART has had little effect on land-use patterns along the Richmond corridor, with the exception of one large-scale development at the El Cerrito del Norte station. Current redevelopment planning in El Cerrito and Richmond is seeking to reverse this trend; however, more favorable local market conditions will be prerequisites to meaningful land use changes. The largest inventory of dense housing, office, and retail-commercial floorspace to come on line has been in Emeryville, the only waterfront East Bay city not served by BART. In the absence of favorable market conditions and supportive public policies, BART itself has been unable to stimulate much new development in one of the densest corridors in the Bay Area.

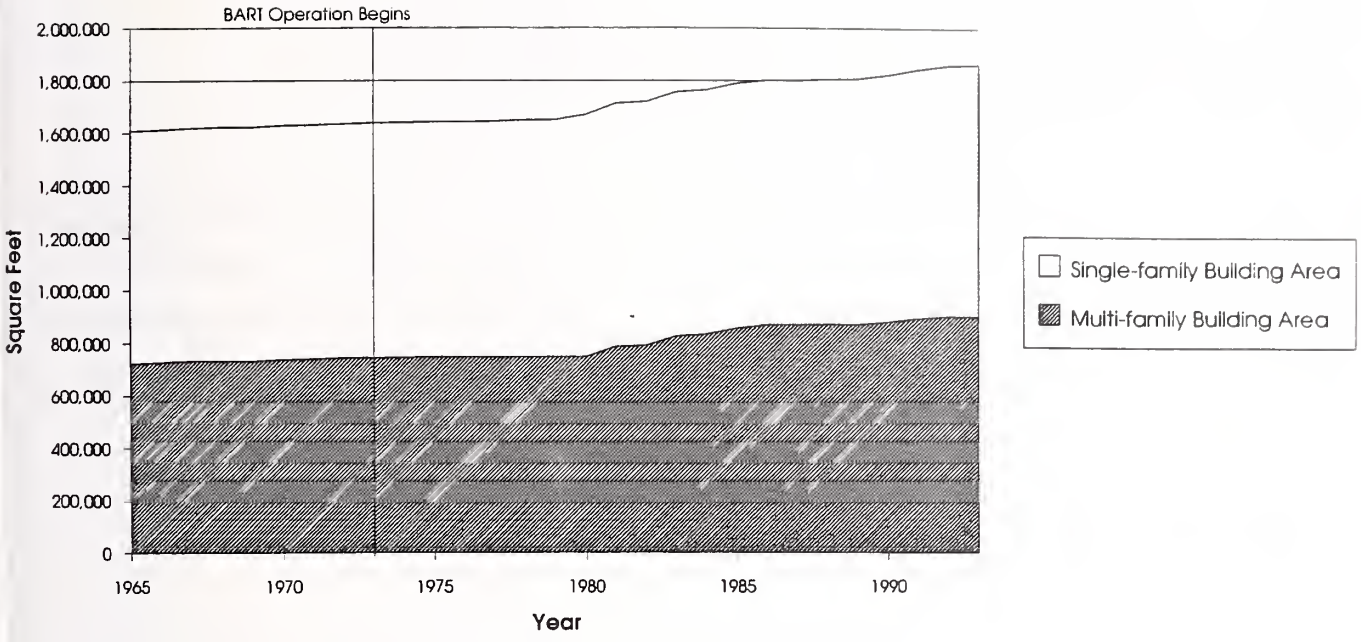


Figure 13.14. Richmond Residential Vintage Model (Since 1965)

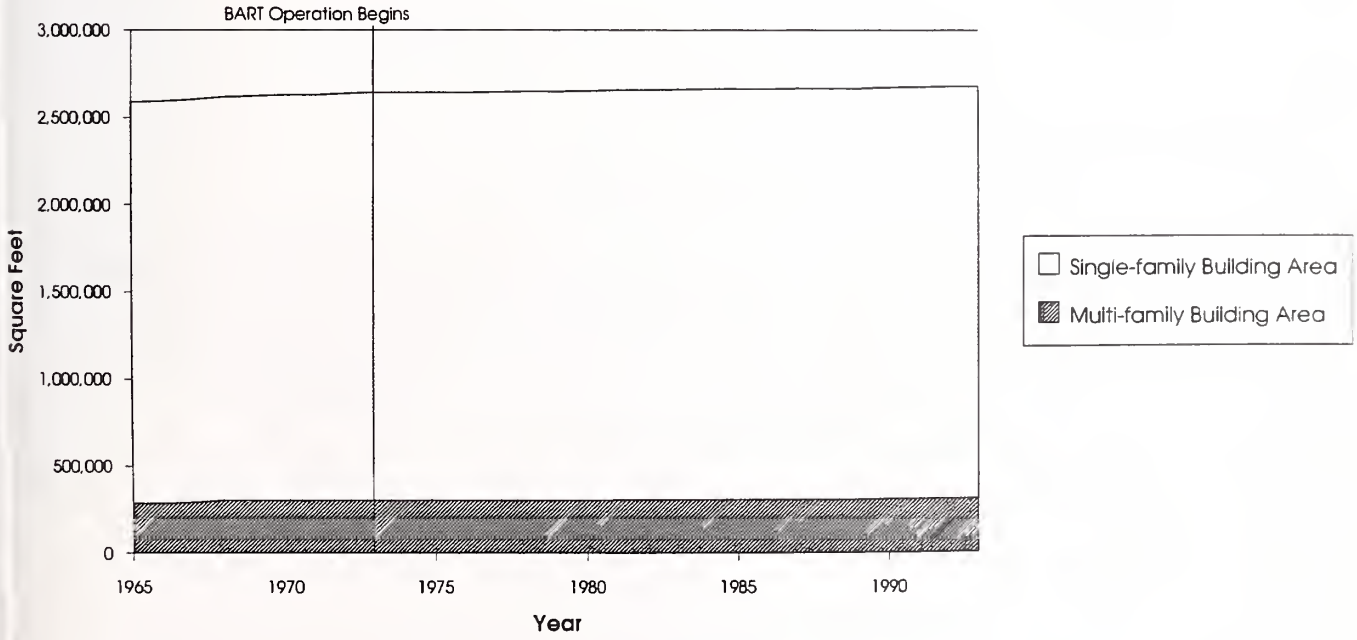


Figure 13.15. I-80/San Pablo Ave. Residential Vintage Model (Since 1965)

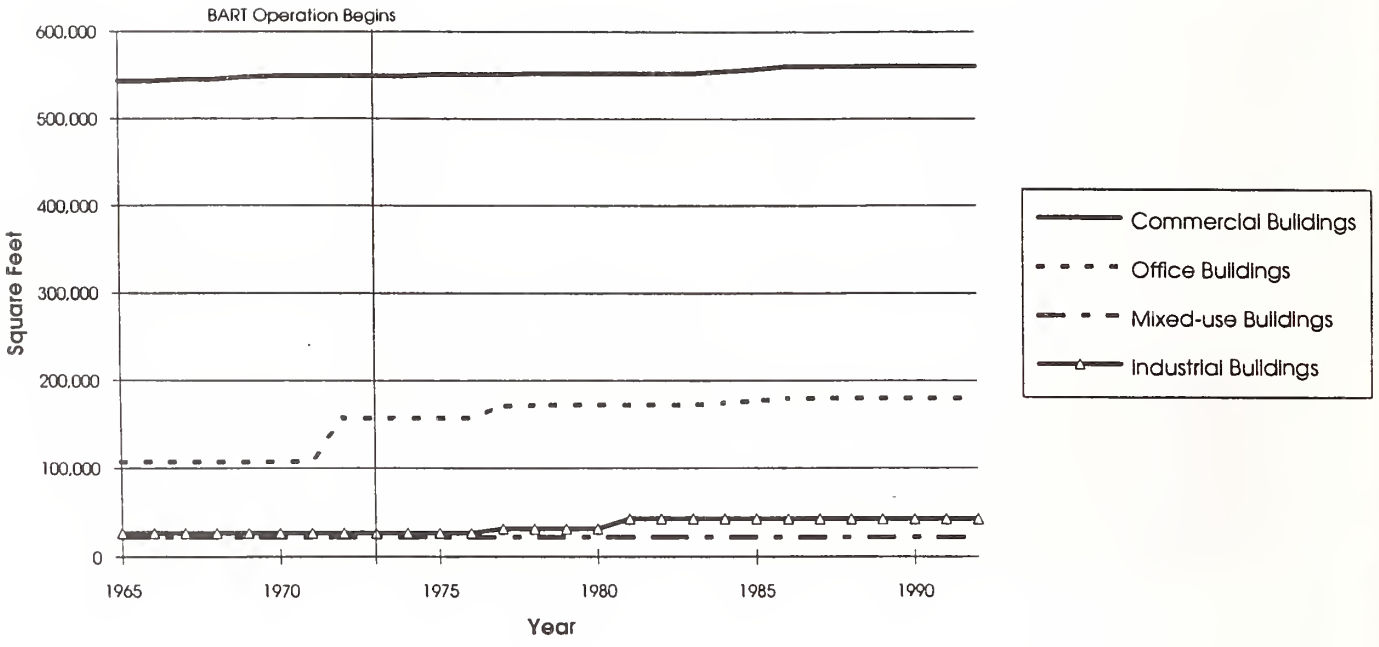


Figure 13.16. Richmond Non-Residential Vintage Model (Since 1965)

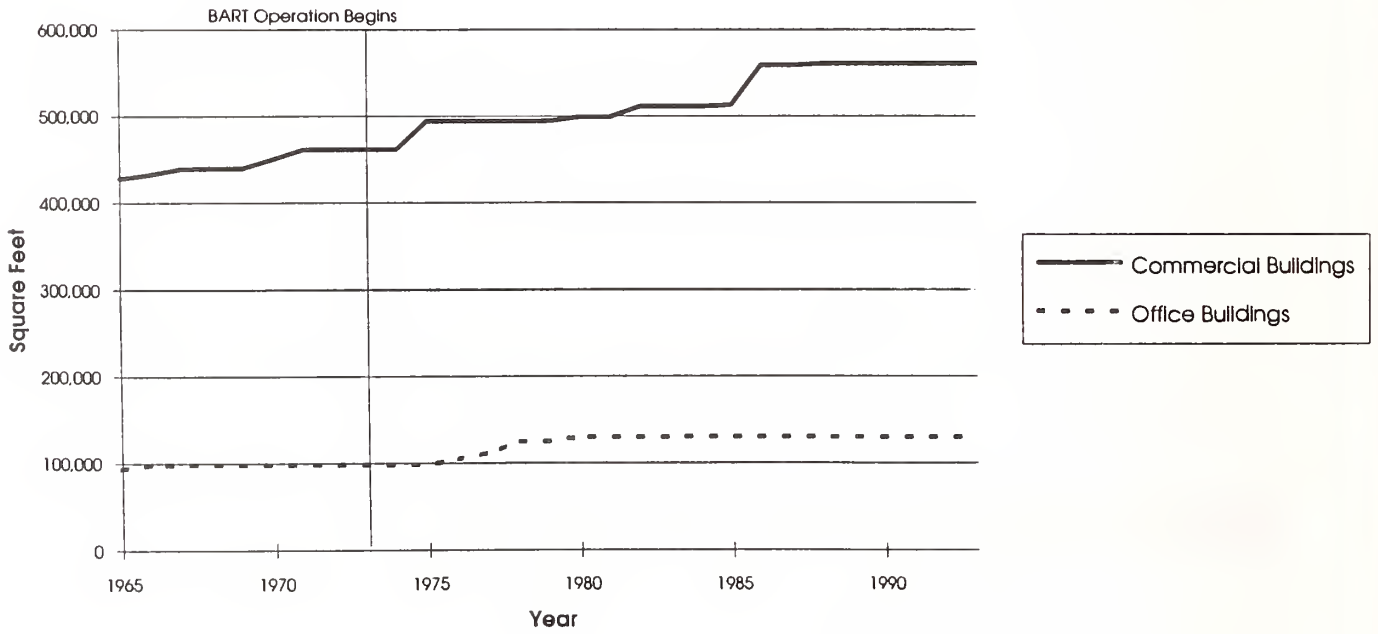


Figure 13.17. I-80/San Pablo Ave. Exit Non-Residential Vintage Model (Since 1965)

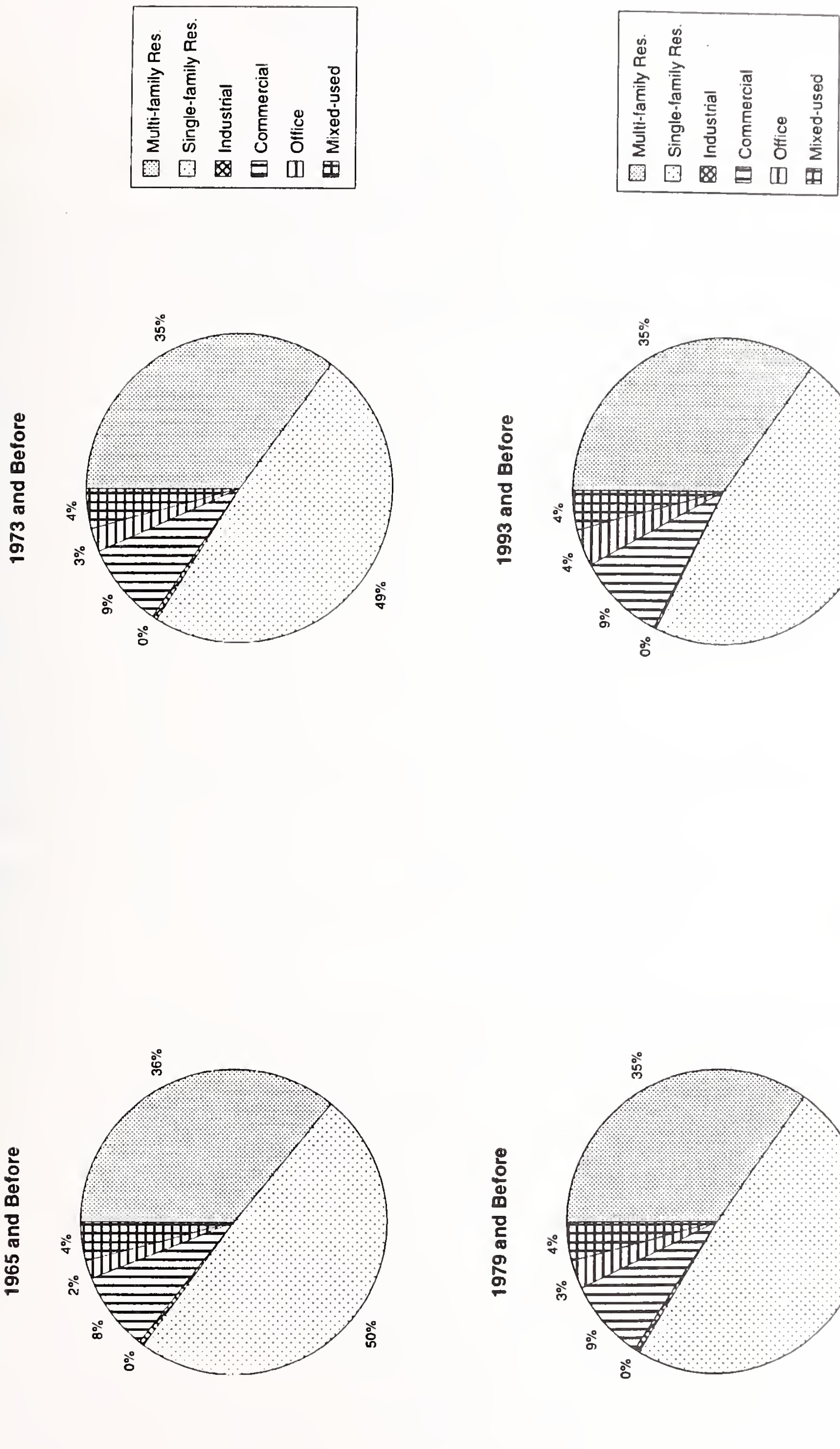


Figure 13.18. Richmond Corridor Building Square-Footage Ratio
(Based on Cumulative Data of the Yearbuilts of Existing Buildings in 4 Station Areas)

References

McCloud, J. 1992. High-Density Housing Near San Francisco: Builder Betting Proximity to Commute Line. *New York Times* Vol. 141, Section 1, July 5: 23.

Menotti, V., and R. Cervero. 1995. *Transit-Based Housing in California: Profiles*. Berkeley: Institute of Urban and Regional Development, Working Paper 638.

CHAPTER FOURTEEN
Conclusion

We conclude that the findings of the original BART Impact Study have not been altered much by the passage of two decades. We too have found that in a larger regional context, BART has played a fairly modest, though not inconsequential, role in shaping metropolitan growth in the San Francisco Bay Area. Its impacts have been highly localized and uneven. BART has allowed downtown San Francisco to continue to grow and maintain its primacy in the urban hierarchy. Downtown Oakland has lured both public and private investment, in part because of the excellent regional accessibility provided by BART. BART has also played a role in the emergence of a multi-centered metropolitan form. Walnut Creek boasts a moderately dense concentration of offices, Pleasant Hill features 1,600 apartments units within a quarter-mile ring of the station, and Fremont has attracted a mix of residential, retail, and institutional uses in recent years. Around most other stations, few significant land-use changes have occurred, often for market reasons though in some instances because of neighborhood opposition.

Among all BART corridors, downtown San Francisco captured the lion's share of office growth — accounting for over three-quarters of all office construction within a half-mile of all BART stations since 1973. Average downtown building sizes have increased by 370,000 sq. ft. and net commercial-office densities have risen by 70 percent since BART opened. While downtown San Francisco is still no Manhattan, as BART's backers had predicted it would become, it is the closest thing to it on the west coast. Outside of downtown San Francisco, Oakland, and a few suburban stations, however, most employment and office growth over the past two decades has turned its back on BART, oriented toward freeway corridors instead. Far more office construction has taken place in cities like Pleasanton and San Ramon than Hayward or Richmond.

Perhaps the biggest difference in station-area land uses since the original BART Impact Studies has been the addition of a considerable amount of multi-family housing within a quarter-mile walk of BART stations. Much of this is attributable to aggressive actions on the part of local redevelopment authorities to entice housing development by underwriting infrastructure investments, assisting with land assemblege, and, in several instances, becoming equity partners in building transit-based housing. Many people residing in these projects consciously sought out housing near transit in order to economize on commuting. Research shows they are three to five times more likely to rail commute than others living in the same city but away from BART. Many apartments near rail are also commanding rent premiums, which bodes well for the future of transit-based housing in the Bay Area. The most multi-family housing has been built around the Pleasant Hill, Fremont, and El Cerrito del Norte stations, though current plans call for considerable housing construction in coming years around the Fruitvale, Richmond, and Hayward stations as well. Transit-based housing, however, will only draw commuters to trains if there is continued growth in transit-based office development. Cities like Toronto and

Stockholm have proven this to be the case. In the Bay Area, the greatest job growth has occurred outside of BART corridors. For BART to be able to effectively compete with the private automobile for commute trips in coming years, it will need to capture even larger shares of future development, including offices and retail shops, as well as housing.

The important role of government in promoting station-area development is clearly underscored by BART's experiences. BART has created opportunities for attracting new development and reinvigorating existing station-area activities that some communities have successfully capitalized upon. However, BART, in and of itself, has been unable to turn around flat or declining local real estate markets — for example, around the Richmond or Fruitvale stations. The presence of a BART station clearly has not been a sufficient condition to significant land development around stations, however under the right circumstances, it has proven to be an important contributor. The current efforts of neighborhood leaders to build a transit village around the Fruitvale, at neighborhood that languished during BART's first 20 years, underscores the essential role of government initiatives in jump-starting new development in historically depressed real estate markets.

The finding that BART's land-use impacts have largely been localized reflects the fact that land uses are largely locally controlled. In the absence of any regional forum to manage and guide growth, these outcomes were predictable. Over the past 40 years, the Bay Area has flirted with the idea of strengthening the role of regional government; however, political opposition at the local and state levels has stonewalled these efforts, as it has elsewhere in the U.S. In recent years, market-based strategies, such as road pricing, have gained greater acceptance as policy instruments for shaping transportation-land use outcomes. BART is presently embarking on the largest expansion program in its history, with some 25 miles of suburban extensions at various stages of planning and implementation. The degree to which the Bay Area embraces stronger regional planning, turns to market-based incentives, or continues with the status quo will, we believe, largely determine the land-use impacts of both existing and future corridors in coming years. We hope there will be a BART @ 40 study to see if we are right.

APPENDIX A-1

The Numbers of Parcels Identified by 1994 TRW REDI Real Property Data

(With Thomas Bros Maps Searching Approach)

BART Stetione/Freewey Pairs	Reeidential			Non-residentiel			Totel		
	Percele identified	Percels with "0"s	% Percels with "0"e	Parcele identified	Parcels with "0"s	% Parcele with "0"s	Parcels Identified	Parcels with "0"s	% Parcels with "0"s
Daly City Station	2,227	1,122	50.4	122	99	81.1	2,349	1,221	52.0
Mission & 16th. Station	633	70	11.1	367	25	6.8	1000	95	9.5
Mission & 24th. Station	2,063	1,024	49.6	405	144	35.6	2,468	1,168	47.3
Sub Total 1 (Daly City Corridor)	***4,923***	***2,216***	45.0	***894***	***268***	***30.0***	***5,817***	***2,484***	***42.7***
San Francisco Downtown (4 Sts.)	463	0	0.0	1,199	50	4.2	1,662	50	3.0
Sub Total 2 (SF Downtown)	***463***	***0***	0.0	***1,199***	***50***	***4.2***	***1,662***	***50***	***3.0***
Oakland Downtown (3 Stations)	695	157	22.6	840	522	62.1	1,535	679	44.2
Sub Total 3 (Oakland Downtown)	***695***	***157***	22.6	***840***	***522***	***62.1***	***1,635***	***679***	***44.2***
Rockridge Station	2,611	135	5.2	156	121	77.6	2,767	256	9.3
Walnut Creek Station	854	18	2.1	297	34	11.4	1,151	52	4.5
Pleasent Hill Station	1,276	10	0.8	55	3	5.5	1,331	13	1.0
Concord Station	1,299	17	1.3	168	34	20.2	1,467	51	3.5
Sub Total 4 (Concord Corridor)	***6,040***	***180***	3.0	***676***	***192***	***28.4***	***6,716***	***372***	***5.5***
Berkeley (3 Stations)	6,273	814	13.0	571	379	66.4	6,844	1,193	17.4
El Cerrito Del Norte Station	1,938	6	0.3	95	24	25.3	2,033	30	1.5
Richmond Station	1,272	45	3.5	147	14	9.5	1,419	59	4.2
Sub Total 5 (Richmond Corridor)	***9,483***	***865***	9.1	***813***	***417***	***51.3***	***10,296***	***1,282***	***12.5***
Berkeley Freeway Exits (3)	906	101	11.1	484	422	90.9	1,370	523	38.2
Richmond Freeway Exit	1,873	7	0.4	123	5	4.1	1,996	12	0.6
Sub Total 6 (Richmond Freeway Pairs)	***2,779***	***108***	***3.9***	***587***	***427***	***72.7***	***3,366***	***535***	***15.9***
Fruitvale Station	1,108	160	14.4	266	212	79.7	1,374	372	27.1
San Leandro Station	1,357	132	9.7	203	76	37.4	1,560	208	13.3
Hayward Station	1,534	189	12.3	338	132	39.1	1,872	321	17.1
South Hayward Station	935	34	3.6	73	35	47.9	1,008	69	6.8
Union City Station	430	20	4.7	44	17	38.6	474	37	7.8
Fremont Station	851	16	1.9	66	36	54.5	917	52	5.7
Sub Total 7 (Fremont Corridor)	***6,215***	***551***	***8.9***	***990***	***508***	***51.3***	***7,205***	***1,059***	***14.7***
San Leandro Freeway Exit	1,698	3	0.2	50	19	38.0	1,748	22	1.3
Hayward Freeway Exit	973	23	2.4	14	9	64.3	987	32	3.2
South Hayward Freeway Exit	1,972	4	0.2	23	9	39.1	1,995	13	0.7
Union City Freeway Exit	851	16	1.9	66	36	54.5	917	52	5.7
Fremont Freeway Exit	573	2	0.3	50	32	64.0	623	34	5.5
Sub Total 8 (Freemont Freeway Pairs)	***6,067***	***48***	0.8	***203***	***105***	***51.7***	***6,270***	***153***	***2.4***
TOTAL STUDY AREAS	**36,665**	**4,125**	**11.3**	**6,202**	**2,489**	**40.1**	**42,867**	**6,614**	**15.4**

Notes:

Parcels with "0" are those with no year-built recorded end those with year-built before 1901.

SF and Oakland downtown station ereas are within e querter mile redius, ell other station end freeway exit areas are within half a mile radius.

No chart is developed for Hayward Freewey Exit Non-residential development because the number of parcels identified is too small

On-line data retrieval is conducted between February 1994 - Jenuary 1995

Appendix Table A-1. The Numbers of Parcels Identified by 1994 TRW REDI Real Property Data

APPENDIX A-2

San Francisco Downtown Corridor 1965							
	MFR	SFR	Commercial	Mixed-used	Office	Industrial	Parking Bldg.
4 Downtown stations	2,389,047	6,195	13,776,208	1,415,608	14,566,173	775,058	163,558

San Francisco Downtown Corridor 1973							
	MFR	SFR	Commercial	Mixed-used	Office	Industriel	Perking Bldg.
4 Downtown stations	2,517,521	6,195	17,317,334	2,563,274	24,412,374	867,119	163,550

San Francisco Downtown Corridor 1979							
	MFR	SFR	Commerciel	Mixed-used	Offlce	Industriel	Perking Bldg.
4 Downtown statlons	2,517,521	6,195	17,585,336	2,563,274	28,421,184	867,119	163,550

San Francisco Downtown Corridor 1993							
	MFR	SFR	Commerciel	Mixed-used	Offlce	Industriel	Perking Bldg.
4 Downtown stations	3,019,426	6,195	21,108,978	4,036,438	42,624,957	867,119	267,628

Appendix Table A-2. Summary Building Area Data, San Francisco Downtown Corridor, 1965-1993

Daly City Corridor 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Mission & 16th.	2,266,926	88,314	1,300,921	372,626	160,052	1,564,127
Mission & 24th.	3,132,932	265,909	642,268	477,063	160,248	63,222
Daly City	63,346	1,139,179	30,281	27,054	10,078	0
Total	5,463,204	1,493,402	1,973,470	876,743	330,378	1,627,349

Daly City Corridor 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Mission & 16th.	2,272,562	88,314	1,326,650	372,626	160,052	1,589,499
Mission & 24th.	3,296,266	267,819	653,957	477,063	205,825	63,222
Daly City	86,164	1,143,809	139,721	27,054	10,078	0
Total	5,654,992	1,499,942	2,120,328	876,743	375,955	1,652,721

Daly City Corridor 1979						
	MFR	SFR	Commerciel	Mixed-used	Office	Industriel
Mission & 16th.	2,298,361	88,314	1,340,390	386,492	160,052	1,604,964
Mission & 24th.	3,469,889	271,111	682,935	487,849	205,825	63,222
Daly City	86,164	1,198,098	139,721	27,054	10,078	0
Total	5,854,414	1,557,523	2,163,046	901,395	375,955	1,668,186

Daly City Corridor 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Mission & 16th.	2,608,772	89,794	1,390,268	415,184	188,697	1,648,393
Mission & 24th.	3,758,887	284,368	701,955	574,428	211,025	65,222
Daly City	89,192	1,290,984	139,721	27,054	10,078	0
Total	6,456,851	1,665,146	2,231,944	1,016,666	409,800	1,713,615

Note: No data on the existing parking buildings other than on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Daly City Corridor, 1965-1993

Oakland Downtown Corridor 1965							
	MFR	SFR	Commercial	Mixed-used	Office	Industrial	Parking Bldg.
3 Downtown stations	515,314	36,957	1,393,196	901,001	813,156	313,809	381,435

Oakland Downtown Corridor 1973							
	MFR	SFR	Commercial	Mixed-used	Office	Industrial	Parking Bldg.
3 Downtown stations	523,881	39,331	1,397,554	917,201	2,468,615	328,229	381,425

Oakland Downtown Corridor 1979							
	MFR	SFR	Commercial	Mixed-used	Office	Industrial	Parking Bldg.
3 Downtown stations	865,973	43,343	1,455,745	927,646	2,771,229	328,229	381,435

Oakland Downtown Corridor 1993							
	MFR	SFR	Commercial	Mixed-used	Office	Industrial	Parking Bldg.
3 Downtown stations	925,521	43,343	1,481,804	940,471	4,840,899	336,934	381,435

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Oakland Downtown Corridor, 1965-1993

Fremont Corridor 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Fruitvale	719,290	591,554	96,873	146,468	40,467	372,624
San Leandro	285,053	853,566	312,249	44,893	103,617	163,758
Hayward	375,747	479,888	554,302	132,616	62,476	196,732
South Hayward	99,360	661,830	86,291	3,991	0	8,844
Union City	30,997	67,160	8,184	0	0	0
Fremont	6,911	184,037	0	0	40,469	0
Total	1,617,368	2,948,136	1,067,899	328,988	246,919	741,068

Fremont Corridor 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Fruitvale	768,063	691,664	100,093	146,468	49,132	379,824
San Leandro	367,970	866,753	370,120	44,893	234,027	190,317
Hayward	421,126	483,813	689,849	137,066	78,078	203,768
South Hayward	167,148	667,128	123,083	3,891	0	16,344
Union City	304,319	67,968	8,184	0	0	73,326
Fremont	94,470	200,773	186,000	0	67,418	0
Total	2,113,096	2,867,878	1,377,309	331,418	418,666	862,569

Fremont Corridor 1979						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Fruitvale	836,844	693,182	100,093	145,468	49,132	379,824
San Leandro	414,549	866,753	370,120	61,093	238,031	217,417
Hayward	432,179	486,520	607,312	137,066	86,069	211,473
South Hayward	240,616	671,467	126,698	3,981	0	17,624
Union City	460,228	79,236	49,977	0	9,240	160,361
Fremont	195,788	411,971	186,000	0	161,671	0
Total	2,680,104	3,198,129	1,440,098	337,618	643,143	986,699

Fremont Corridor 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Fruitvale	845,669	698,803	100,093	146,468	49,132	392,624
San Leandro	767,574	907,103	429,491	61,093	467,719	232,672
Hayward	485,902	492,661	612,978	139,194	102,121	228,037
South Hayward	422,647	730,190	128,220	3,991	0	17,624
Union City	704,833	92,280	400,611	0	30,324	244,296
Fremont	951,361	436,147	185,000	0	202,710	0
Total	4,177,986	3,357,084	1,857,393	339,746	862,006	1,115,252

Note: No data on the existing parking buildings other then on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Fremont Corridor, 1965-1993

Fremont Freeway Pairs 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
San Leandro	75,167	1,702,738	37,821	1,703	0	584,161
Heyward	58,628	850,650	NA	NA	NA	NA
South Heyward	0	2,164,125	42,424	0	0	0
Union City	0	12,452	NA	NA	NA	NA
Fremont	2,140	356,370	NA	NA	NA	NA
Total	135,935	5,086,335	80,245	1,703	0	584,161

Fremont Freeway Pairs 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
San Leandro	82,847	1,706,818	39,044	1,703	0	716,942
Heyward	61,706	852,315	NA	NA	NA	NA
South Heyward	19,910	2,166,986	62,192	0	0	0
Union City	16,272	1,788,649	NA	NA	NA	NA
Fremont	2,140	745,766	NA	NA	NA	NA
Total	182,875	7,260,534	101,236	1,703	0	716,942

Fremont Freeway Pairs 1979						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
San Leandro	82,847	1,706,818	148,338	1,703	0	724,392
Heyward	61,706	852,315	NA	NA	NA	NA
South Heyward	90,744	2,166,986	72,783	0	0	0
Union City	112,930	1,866,811	NA	NA	NA	NA
Fremont	2,140	771,488	NA	NA	NA	NA
Total	350,367	7,364,418	221,121	1,703	0	724,392

Fremont Freeway Pairs 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
San Leandro	82,847	1,802,017	37,821	1,703	0	584,181
Heyward	135,062	852,315	NA	NA	NA	NA
South Heyward	158,397	2,170,462	42,424	0	0	0
Union City	119,704	1,929,708	NA	NA	NA	NA
Fremont	2,140	836,389	NA	NA	NA	NA
Total	498,150	7,590,889	80,245	1,703	0	584,161

Note: No data on the existing parking buildings other then on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Fremont Corridor, Freeway Pairs, 1965-1993

Concord Corridor 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Rockridge	1,338,371	3,014,595	66,013	78,116	9,523	0
Walnut Creek	1,730,401	569,021	691,514	11,465	202,358	0
Pleasant Hill	330,883	566,912	126,408	0	8,342	0
Concord	311,669	959,009	347,265	7,052	114,300	1,190
Total	3,711,324	5,109,537	1,231,200	96,633	334,523	1,190

Concord Corridor 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Rockridge	1,420,830	3,021,795	66,013	78,116	12,403	0
Walnut Creek	2,089,080	600,567	875,384	13,655	540,012	0
Pleasant Hill	543,017	625,827	126,408	0	8,342	0
Concord	712,416	976,022	368,489	7,052	139,423	1,190
Total	4,765,343	5,224,211	1,436,294	98,823	700,180	1,190

Concord Corridor 1979						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Rockridge	1,435,597	3,028,825	93,176	78,116	12,403	0
Walnut Creek	2,118,311	625,590	934,218	13,655	893,012	0
Pleasant Hill	717,152	642,891	144,133	0	19,652	2,094
Concord	785,022	987,930	373,864	12,610	163,861	1,190
Total	5,056,082	5,285,236	1,545,391	104,381	1,088,928	3,284

Concord Corridor 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Rockridge	1,475,357	3,045,355	104,844	78,116	73,673	0
Walnut Creek	2,254,029	753,279	1,057,535	13,655	3,989,506	0
Pleasant Hill	1,748,530	694,828	437,378	0	1,152,359	2,094
Concord	930,442	1,016,923	1,035,713	12,610	905,584	1,190
Total	6,408,358	5,510,385	2,635,470	104,381	6,121,122	3,284

Note: No data on the existing parking buildings other than on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Concord Corridor, 1965-1993

Richmond Corridor 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Ashby	2,062,655	1,949,649	153,853	218,034	15,525	26,788
Berkeley	830,513	214,825	293,689	217,264	171,339	0
North Berkeley	1,503,471	2,431,680	70,758	132,117	2,058	3,060
El Cerrito Del Norte	317,920	1,945,340	194,333	7,800	13,998	2,900
Richmond	724,284	884,306	542,827	22,124	107,009	26,858
Total	5,438,843	7,425,800	1,255,460	597,339	309,929	59,606

Richmond Corridor 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Ashby	2,099,312	1,949,649	156,853	218,034	15,525	26,788
Berkeley	865,265	214,825	298,287	241,294	223,493	0
North Berkeley	1,584,488	2,435,498	71,838	141,508	2,058	3,060
El Cerrito Del Norte	330,178	2,331,824	349,919	7,800	20,998	2,900
Richmond	744,596	893,924	548,808	22,124	156,857	26,858
Total	5,623,839	7,825,720	1,425,705	630,760	418,931	59,606

Richmond Corridor 1979						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Ashby	2,110,398	1,957,125	156,853	218,034	15,525	26,788
Berkeley	898,259	214,825	303,329	276,634	246,773	0
North Berkeley	1,594,310	2,437,273	71,838	155,108	2,058	3,060
El Cerrito Del Norte	356,699	2,481,772	368,450	7,800	20,998	2,900
Richmond	749,140	901,510	551,558	22,124	171,508	31,448
Total	5,708,806	7,992,505	1,452,028	679,700	456,862	64,196

Richmond Corridor 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Ashby	2,131,268	1,960,235	156,853	218,034	33,225	26,788
Berkeley	926,795	214,825	328,900	276,634	457,551	0
North Berkeley	1,637,942	2,442,996	77,428	155,108	3,550	3,060
El Cerrito Del Norte	457,007	2,619,616	516,553	7,800	25,951	2,900
Richmond	904,726	959,700	551,558	22,124	171,506	31,448
Total	6,057,738	8,197,372	1,631,292	679,700	691,783	64,196

Note: No data on the existing parking buildings other than on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Richmond Corridor, 1965-1993

Richmond Freeway Pairs 1965						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Berkeley (3 Exits)	198,941	285,385	82,586	6,200	20,260	1,632,742
Richmond	288,022	2,300,274	427,753	7,627	93,464	7,970
Total	486,963	2,585,659	510,339	13,827	113,724	1,640,712

Richmond Freeway Pairs 1973						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Berkeley (3 Exits)	214,025	286,551	118,226	6,200	32,390	1,809,650
Richmond	304,432	2,337,580	461,769	98,134	7,627	7,970
Total	518,457	2,624,131	579,995	104,334	40,017	1,817,620

Richmond Freeway Pairs 1979						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Berkeley (3 Exits)	218,841	286,551	118,226	6,200	32,390	1,842,887
Richmond	304,432	2,345,626	494,088	7,627	124,496	7,970
Total	523,273	2,632,177	612,314	13,827	156,886	1,850,857

Richmond Freeway Pairs 1993						
	MFR	SFR	Commercial	Mixed-used	Office	Industrial
Berkeley (3 Exits)	543,898	288,191	123,451	6,200	43,470	2,058,348
Richmond	311,858	2,365,794	560,708	7,627	129,996	7,970
Total	855,756	2,653,985	684,159	13,827	173,466	2,066,318

Note: No data on the existing parking buildings other than on those in San Francisco and Oakland downtown areas.

Appendix Table A-2 (Cont'd.). Summary Building Area Data, Richmond Corridor, Freeway Pairs, 1965-1993

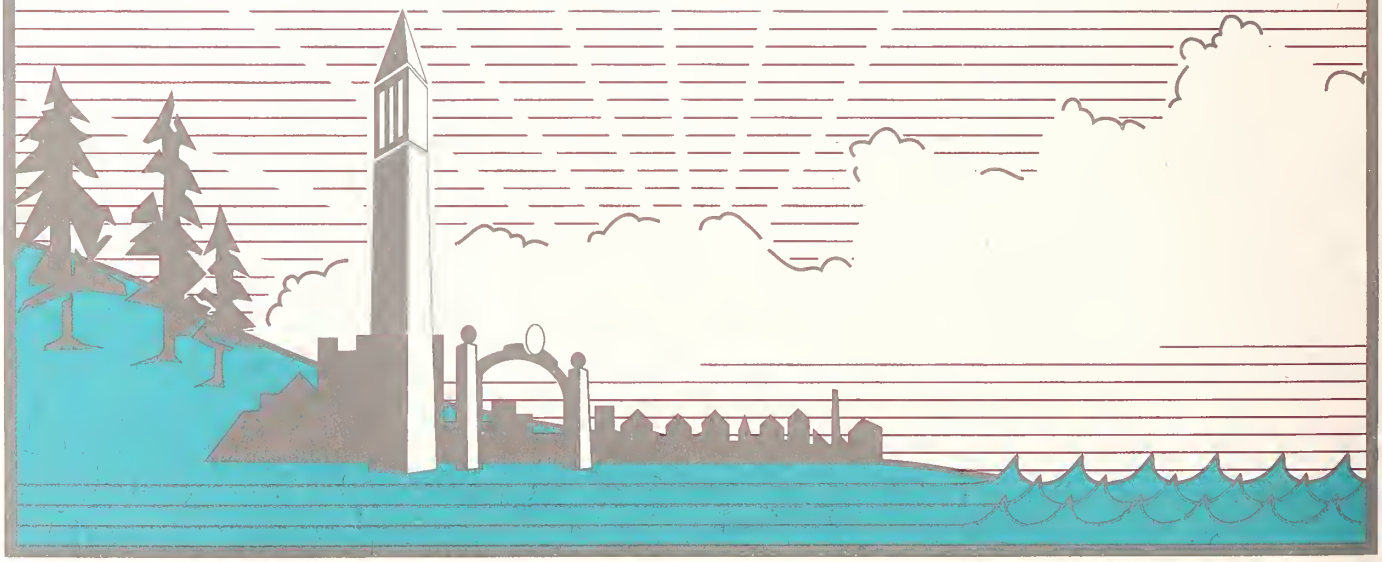
DOT LIBRARY
00399487

The Institute of Urban and Regional Development (IURD) serves faculty and students of the University of California at Berkeley, conducting research into processes of urban and regional growth and decline, and effects of governing policies on patterns of development. Institute research is supported by federal and state government agencies and by private foundations. Current research is directed to simulation of urban growth and land use; sustainable development; information technology; disaster preparedness; social and economic impacts on urban life, including defense conversion in California; evolving patterns using Geographic Information Systems; social policy and urban poverty; transportation alternatives, including high-speed rail and transit-based land development; and improvements in methods of analysis, evaluation, and planning.

The Institute maintains Berkeley's Environmental Simulation Laboratory (ESL), where potential effects of major urban development projects are assessed using computer-aided design and three-dimensional models to project environmental impacts of development scenarios. Research into international economic policy issues takes place at the Berkeley Roundtable on the International Economy (BRIE). The National Transit Access Center (NTRAC) evaluates impacts of transit usage of residential, mixed-use, and joint development around urban rail transit stations throughout the country. The University-Oakland Metropolitan Forum brings together local community and business leaders in a partnership with the University to improve the quality of life in the Oakland area.

The Institute publishes working papers describing current research projects and other topics of interest to faculty associates and visiting scholars. A catalog of publications, a newsletter, and an annual report are available on request.

Institute of Urban and Regional Development
316 Wurster Hall
University of California
Berkeley, California 94720
(510) 642-4874; (510) 643-9576 FAX



Institute of Urban and Regional Development