

**TOWARDS A NEW HIGH TECHNOLOGY DEVELOPMENT IN THE
SILICON VALLEY: A 21st CENTURY URBAN DESIGN VISION**

by

Jonathan K. Pang

Bachelor of Architecture
University of Southern California, Los Angeles, CA.
1986

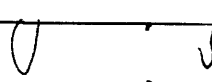
SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS OF THE
DEGREE
MASTER OF SCIENCE IN ARCHITECTURE STUDIES AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June, 1988

© Jonathan K. Pang 1988

The Author hereby grants to M.I.T.
permission to reproduce and to distribute publicity copies
of this thesis document in whole or in part

Signature of the author



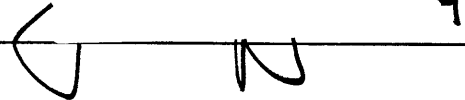
Jonathan K. Pang
Department of Architecture
May 6, 1988

Certified by

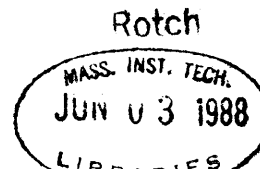


James R. Richardson
Edward H. Linde Professor of Urban Development (Visiting)
Thesis Supervisor

Accepted by



Julian Beinart
Chairman
Departmental Committee for Graduate Students



**TOWARDS A NEW HIGH TECHNOLOGY DEVELOPMENT IN THE
SILICON VALLEY: A 21st CENTURY URBAN DESIGN VISION**

by

Jonathan K. Pang

Submitted to the Department of Architecture on May 6, 1988
in Partial Fulfillment of the Requirements for the Degree of
Master of Science in Architecture Studies

ABSTRACT

Santa Clara Valley, perhaps better known as the Silicon Valley, is currently facing many problems and uncertainties. The explosion of the high technology industry has changed the regional scene faster than anyone could predict. The once agriculturally based community has become urbanized overnight. It fostered major growth with many new opportunities but at the same time brought many unforeseen physical and social problems to the region. New employment opportunities led to dramatic increase in population over the past twenty years and consequently, a greater demand in housing. An imbalanced land use distribution has caused limitations in residential land, emphasized the problem of chronic housing shortage and rapidly inflated housing prices. Housing prices in the valley are rising much faster than average household income in the region and is inevitably forcing most of the workers to live outside of the region. Intensive commuting patterns have caused traffic chaos, pollution and a deteriorating living and working environment.

Despite the imbalanced land use distribution, for tax base reasons alone, there is still the need to continue planning for more industrial land to accommodate the growing industries. In the heart of Silicon Valley region, San Jose will be the center of future high-tech industrial expansion. This is not only because it contains most of the industrial land available for this kind of development, but also because these sites are located in close proximity to the newly redeveloped CBD and are linked together by a new 20 mile light rail mass transit system and other major planned road networks. Since the manufacturing functions of the hi-tech industry are gradually moving out of the region, it is slowly changing its composition towards a heavier concentration of research, development, marketing, and corporate headquarter functions. This thesis explores for potential forms of future high technology industrial development, and an examines their implications in relationship to future urban form. The objective of this thesis is to envision the future through a hypothesized design in the context of San Jose. By resolving specific issues, the new prototypical design should represent an idealized physical model toward a better living and working environment.

Thesis Supervisor: James R. Richardson
Title: Edward H. Linde Professor of Urban Development (Visiting)

To my parents and Elaine

ACKNOWLEDGEMENTS

I would like to express my deep gratitude to the following people:

Professor Philip Herr of his guidance and enlightenment when serving as unoffical Thesis Advisor;
Professors Ric Richardson and Dennis Frenchman for reading the thesis and providing helpful comments;
Mr. Vasilios Tsakalos for his precious time to proof read the thesis.

Table of Contents**Introduction**

Context	1
Structure	2
Methodology	2
Definition	4

Chapter One:**Regional Transformation: The Birth of the Silicon Valley**

History and Setting	6
Evolution of High-Tech Development in the Valley	7
War and Post War Development	9
From Santa Clara Valley to Silicon Valley	10
Impacts from the High-Tech Wave	14

Chapter Two:**Next Wave: Prospect and Transformation of the High Technology Industry**

Background	22
Towards Post-Industrial Era: Information Society	22
Spatial Tendency: Agglomeration Factor	23
Metamorphosis of the High-Tech Sector	26
Future Form of the High-Tech City	30
The Industrial Cycle: Economic Outlook	31
The Future of the Silicon Valley	34

Chapter Three:**San Jose: Location for Future High Technology Growth**

Background	36
Context	36
Urban Setting	39
Industrial Expansion Tendency	41

Chapter Four:	
Edenvale: Locational Focus	
Background	44
Context	44
Circulation	48
Physical & Spatial Characters	50
Future Socio-Economic Projections	53
Opportunities	54
Chapter Five:	
Strategies and Responses: Accommodate Growth and Prevent Past Mistakes	
Shaping Future Development: Establishing New Guidelines	56
Housing/Employment	57
Transportation Network	58
Working Environment	59
Spatial Quality	60
Sense of Place	61
Land	61
Open Space and Amenity	62
Boundary and Edge Condition	62
Chapter Six:	
Vision: A Physical Model for Future High-Tech Development	
Passage to the Future	64
Physical Form Principle	65
Spatial Form Principle	68
Chapter Seven	
Vision: Towards a Integrated High-Tech Environment	
Mixed-Use development	72
Public Circulation and Transportation Network	74
Residential and Supportive Functions	76
Parking	77
Amenity	78
Summary	83
Conclusion	83
Bibliography	85

INTRODUCTION

This thesis is about the quality of future high technology industrial development in relationship to urban spaces and the living environment. It is aimed at devising a possible strategy to minimize the negative impacts created by the inadequate and badly planned industrial development of the 60's and 70's. The proposal will be based on an idealized vision in order to suggest what the future of our environment should be in accommodating high-tech industrial growth. The thesis will investigate forms of development, and their urban design implications. A design proposal which shares a vision of the future will hopefully help us to gain deeper understanding of this particular environment and the issues surrounding the growth of the high-tech industrial development.

Context

In order to analyze changes in the growing high-tech industry in the Silicon Valley, a contextual framework containing different levels of analysis will be used. This will allow a better understanding of the issues and problems to be faced. The contextual framework will be structured on three different levels. Regional context will deal with the entire Silicon Valley and the relationship of its parts. The metropolitan level analysis will focus on the City of San Jose as an urban design and development scenario. The last part of the contextual framework will deal with a specific site area for which a design will be proposed. Each contextual scale will be interrelated with each others allowing one to see the pattern of development, its location characteristics and linkages to the surrounding neighborhoods. These

linkages are particularly important since high-tech growth relies on their interdependence. The understanding of this relationship might provide clues as to the form of future developments.

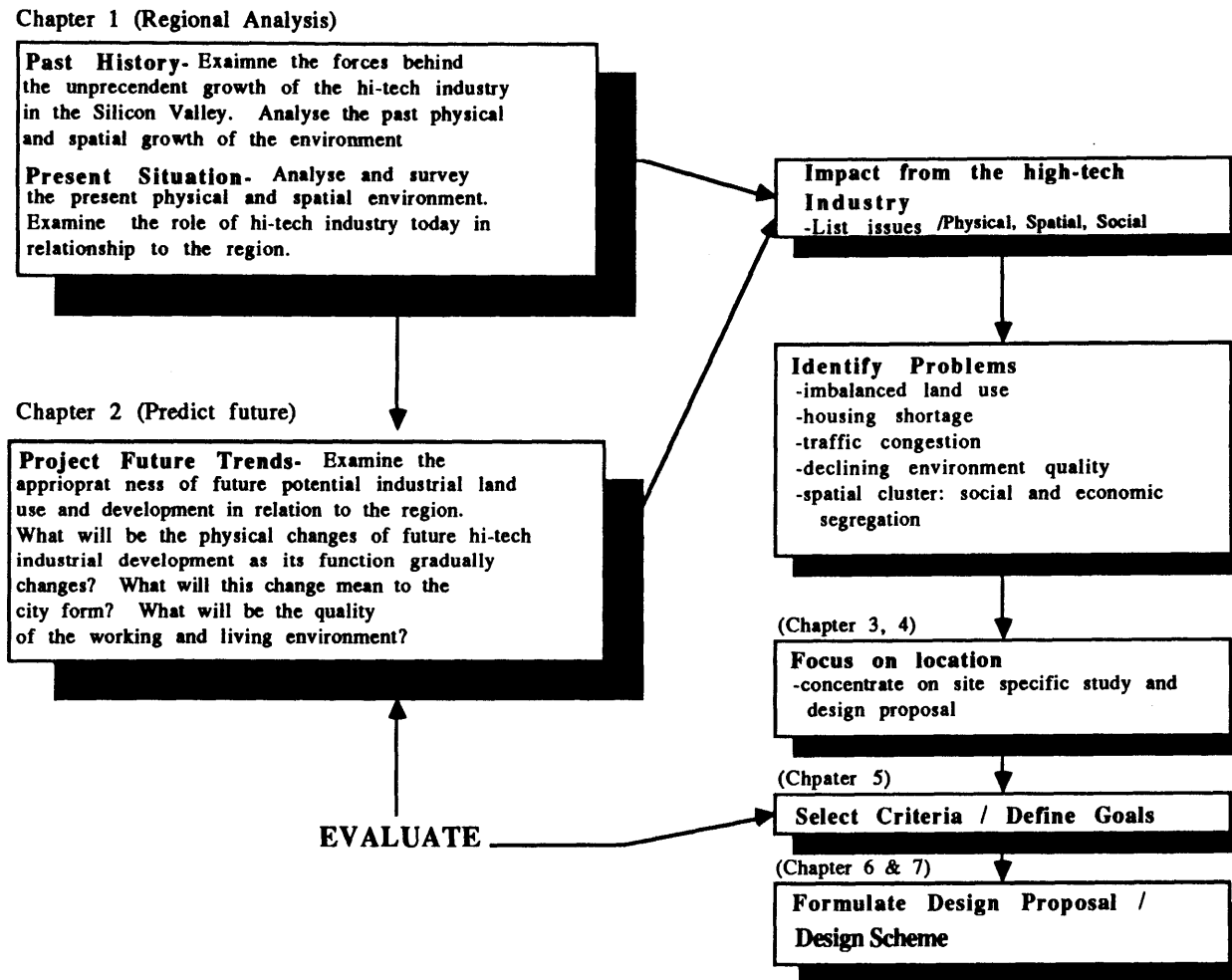
STRUCTURE

This thesis is structured in seven parts. The introductory chapter provides the background information and organization of the paper. The objective is to give the reader a sense of orientation and to bring clarity to the overall topic. Chapter one, **Regional Transformation**, examines the high-tech evolution. Chapter two, **Prospect and Transformation of the High Technology Industry** provides insight on future trends. The chapter on **San Jose** closely examines the built environment at a metropolitan scale. Chapter four, an examination of the micro scale of the contextual framework will focus on, **Edenvale District**, the selected site for the design proposal. Before going into the design stage, the chapter, **strategies & responses**, will give a broad overview of key impacts and design issues. The aim is to explore and develop new design guidelines and strategies for future industrial development. Criteria will be based on the synthesis of identified problems and projected future trends. A **vision** on the future form of high technology development and its impact on the city will result from the consideration of these issues and their analysis. Conclusion will be a synthesis of all the chapters and translate ideas into a illustrative design plan for the selected site area.

Methodolgy

The methodology used in preparing this thesis involves research leading to a

THESIS STRUCTURE



design proposal. The design process, which helps to visualize and create the future, will be in reference to the researched materials identifying issues and objectives. The design process of addressing the future is an important task since it can help gain new insights, avoiding past mistakes. New criteria and objectives for future high-tech industrial development are to be constructed to form a new strategy for their realization.

The research for this study involved the gathering of information from different sources. The primary sources of data and insights was drawn from books, magazines, newspaper, public publications. It ranged from a variety of local, state and federal documents. Further information on Silicon Valley was obtained by interviewing television producer Julio Moline of Station KTEH, San Jose.

Definition

The term 'high technology' is common-place today. It is most often associated with things that are functionally more efficient and aesthetically anti-traditional. Even more so, the term has suggested a strong relationship with scientific and technological breakthroughs. The term is over-used and often its meaning and implications are not fully comprehended.

In the context of this thesis "high technology" refers to the utilization of technology to advance efficiency associated with labor saving production processes and new products.(Glasmeier, 1983, pp.1) Associated with the involvement of highly skilled scientists and engineers, it can also offer economic growth. In the political context, it implies economic recovery acting as a constituent of America's competitive "edge" over foreign competition. It opens a worldwide

market for the U.S.A.'s products and a high ratio of research and development to sales. Lastly, specialized research and development are associated with high technology in the context of the academia.(Glasmeier, 1983, pp.3)

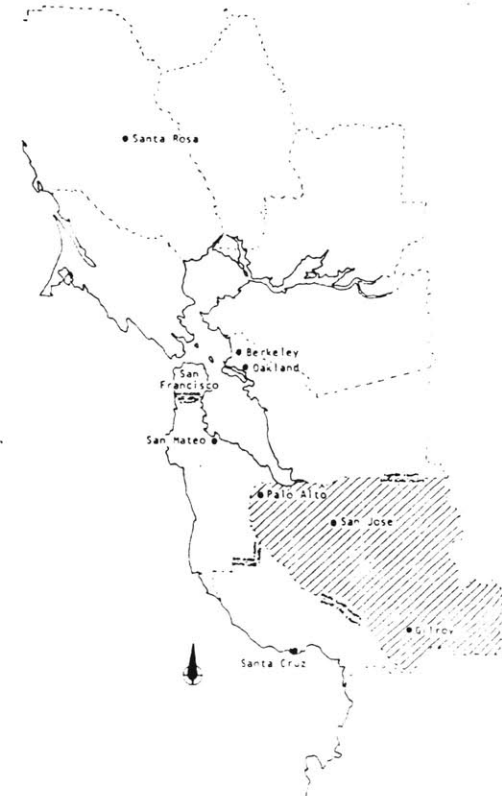
Chapter One - Regional Transformation: The Birth of the Silicon Valley

History and Setting

Situated at the southern end of the San Francisco Bay, Santa Clara Valley contains some of the most fertile land in this country. Encompassed by low mountain of the coastal range, the valley includes approximately 1300 square miles of land. The boundary of the Valley is defined by the Diablo Range at the eastern edge and by the Santa Cruz mountains of the southwest. The Valley floor is very flat, with an average grade changes from 0% to 2%. The region has a Mediterranean like climate with a slight mix of marine breezes from the Pacific Ocean. The principle weather of this kind of climate are relatively warm and with rainy winter and very dry cool and summer. (City of San Jose, 1984, pp.8)

Settlement in the Valley began during the late 18th century when it was colonized by the Spanish and it has enjoyed a long period of successful agrarian economy. During the late 19th century and early 20th century, Santa Clara County had undertaken intensive agricultural development and by the 1940's, the area was developed into a fully integrated agricultural community which has dominated the regional economy. This agricultural boom also brought in related business such as the food machinery industries and support services. The Food Machinery and Chemical corp known as FMC is one of the earliest agricultural processing business which transformed its agricultural machinery assembly to military machinery production later in the 40's.

Another important historical significance in this area was the opening of Stanford University in 1891. The university was established by railroad tycoon Leland



Regional context-Northern California

Stanford in memory of his son who died in 1884. The university is located in the northern edge of the Santa Clara Valley which occupied a 9000-acre farm in today's City of Palo Alto. Stanford University has developed into one of the nation's top universities and has played an important role in the development of high technology in the area.(Bernstein, 1977, p.4)

Evolution of High-Tech Development in the Valley

Within two decades, Santa Clara County had transformed from an agriculturally-based society to a high technology industrially-based society. The region contains the densest concentration of this type of industry in the world.

A critical examination of the history of the region will provide insight into this unprecedented high-tech growth. Factors influencing this have been physical, social, economic and political. A sequence of events during first half of the 20th century initiated the high technology development in the Valley. The first critical event took place in the summer of 1912 in a small house at 913 Emerson Street in Palo Alto. Lee deForest and two other colleagues of Federal Telegraph Company invented the vacuum tube. The invention was a technological breakthrough which marked the start of a new era in electronics development and established the first "building block" for the subsequent "high-tech" industry.

The establishment of Stanford University is closely link to the existence of Silicon Valley. But perhaps without one man, a pioneer with a influencing vision, Silicon Valley might not developed into what it is today. Professor Frederick Terman, dean of the electrical engineering department of Stanford University , later provost and Vice President was bestowed with the nickname "godfather of Silicon



The Cities of Santa Clara County



Professor Frederick Terman

Valley." A native of California, Terman spent his childhood years at Stanford where his father was a psychology professor. After earning his Bachelor degree in electrical engineering at Stanford, he went to M.I.T to pursue a doctorate. Following his graduation, Terman decided to reside in California due to poor personal health. Eventually he accepted a faculty position at Stanford University.

Before the electronics industry was developed in the Valley, most Stanford graduates migrated to for jobs. Terman encourage his students not to do so. But, rather to set up their businesses in close proximity to the university. He saw that the industry and the university would benefit each other.

Two of Terman students, William Hewlett and David Packard, became the first major success story in the Valley. Started with a \$538 loan in 1938 for producing oscillators, H-P continues to grow at about 20% per year and has developed into one of the biggest and most successful hi-tech firms in the world. The invention of the Klystron tube by the Varian brothers in 1937 was another major breakthrough for the electronic industry. These were closely related to the university since the physics department had provided lab space for their research activities.(Rogers, 1984, p.15-p.17)

Besides Terman, Dr. William Shockley was the second most important figure in the Valley's high technology history. He was one of the co-inventor of the transistor at Bell Laboratory in New Jersey and the co-founder of Silicon Valley who won the Nobel Prize in 1956. Later he left Bell Laboratory and found his own company, Shockley Semiconductor Laboratory with eight bright young engineers and physicists who sequently left his firm to start their own company, Fairchild Semiconductor. The spawning went on. When one got his own new ideas which did

not attract serious consideration, he left and started his own new company. Robert Noyce, one of the original "Shockley Eight" who was in Fairchild, left to start Intel which is famous for the development of microprocessor.

Terman, Shockley, Noyce, Hawlett and Packard marked the new era of the microelectronics industry which attracted many new entrants to the Valley to start their own firm. Their success stories set examples for those who had their own visions and ideas. Shockley's entrepreneurial spirit initiated the sequent, spawned by a subsequent conducive environment. It also stimulated many other related industries such as telecommunication which use semiconductoas a major component to their products. (Bernstein, 1977, p.9)

War and Post War Development

The outbreak of Second World War had played a significant role in providing a new environment for further development of the electronics industry. The shift from an agricultural economy to a war related economy had greatly stimulated the economy of California.

California, gateway to the Pacific, was shaping up to fight the war. Besides shipbuilding activity in California, major funding by the government for developing electronic components for military purposes was directed to Stanford University. The close proximity to the San Francisco harbour and the opening of Moffet naval air field had drawn a large number of military personnel into the area for training.(Bernstein, 1977, p.5) The location and above events established a bridge for future industrial growth.

The development stimulated by wartime continued to grow even once the war

ended. This was primarily determined by nation's political leaders who wanted to continue the research and development activities of military products. Funds continued pouring into the university, while electronic firms around the bay area were recruited for basic research and development. The Korean war during 1950's activated the the assembly lines once again. The high technology research and development activity of Stanford Research Institute, established in 1946, helped to stimulate the industry. The enthusiasm of Professor Terman ensured research funding and the status of Stanford's electrical engineering department as being one of the best along with M.I.T. Terman believed of a 'community of technical scholars' between the university and the industry had drawn much attention.

Another of Terman's visions was the Stanford Industry Park established in the early 1950's. It is based on a different kind of partnership between academia circle and industry. The idea came when the university wanted to develop some part of its 8800 acres of land. But the original Stanford Family forbade the sale of the land, so leasing it to the local high-tech industry proved more advantageous. The transferring of newly developed technology from the university to the industry in the park resulted, in part, from proximity of one. The creation of Stanford Research Park had later become a model for many other similar parks in the United States as well as around the world. It was an unique development because rules and standards were designed to create a positive environment including landscaping, low profile buildings made to resemble the campus buildings, and a sense of a clean, modern industry.



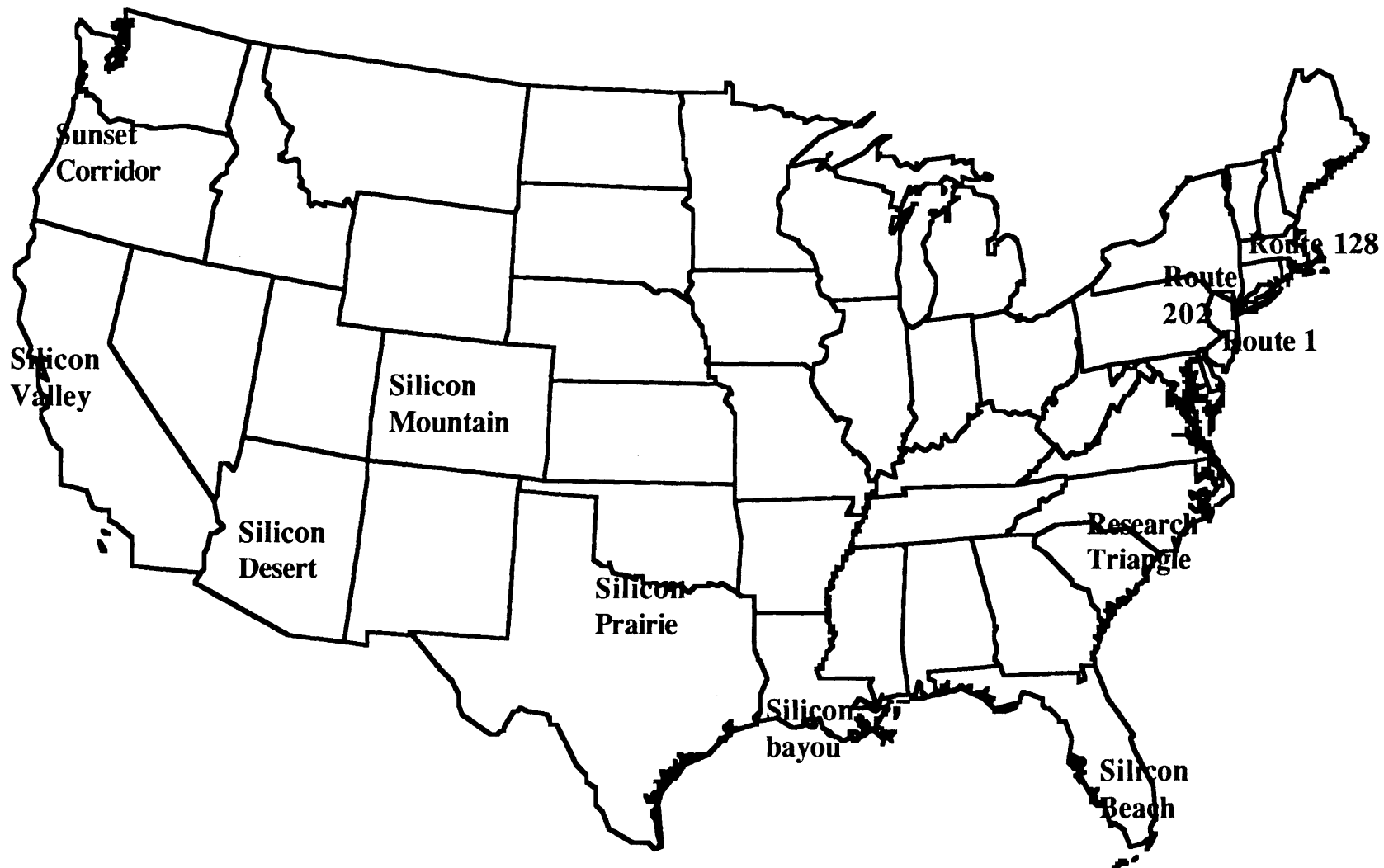
Aerial view of the heart of Silicon Valley: semiconductor plants and other microelectronics facilities in Santa Clara and Sunnyvale

From Santa Clara Valley to Silicon Valley: Boomtown Town

The name "Silicon Valley" was first coined by Don. C. Hoefler who is the editor of Microelectronics News in 1971.(Rogers, 1984, p.26) Since the name has reflected a strong relationship in which the basic high-tech products of semiconductor chips made out of silicon, it immediately attracted many public attention and was readily adopted.

It was an ordinary place with an ordinary name, but the evolution of the microelectronics industry over the past 20 years in the Santa Clara Valley coined its famous name, "Silicon Valley", the home of many high technology industries. The high-tech growth phenomenon is astonishing. Several metropolitan areas in the United States have a version of the Silicon Valley known by names such as "Silicon Forest", "Silicon Desert" or "Silicon Mountain". According to the Urban Land Institute, the high-tech growth corridor represents the fastest segment of the real estate market.

Availability of financial resources was a major initiator for the subsequent boom. The market demand during the war and the amount of government research funding after the war period played a crucial role in the early development stage. The federal government spent over 3 billion a year since 1950 in research and development. By 1975, the funding had reached 15 billion more than thirty percent of it goes to the Silicon Valley. The advantage of the prior concentration of aircraft and aerospace industry was clear to the young semiconductor firms, primary market being military contractors and subcontractors. It created a huge market for semiconductors, of which approximately 40% of the high-tech products were brought by the U.S Department of Defense. On the other hand, the strong physical and social connection to Stanford University and its research institute is another



High Technology Growth Corridor in the United States

important attribute to this growth. Each year, Stanford's Engineering School has produced a large supply of scientific brainpower to meet the demand of the work force. Terman vision of Silicon Valley in conjunction with the university has come true. As he described the place:

"We have been pioneers in creating a new community, one that I have called a 'community of technical scholars. Such a community is composed of industries using highly sophisticated technologies, together with a strong university that is sensitive to the creative activities of the surrounding industry. This pattern to be the wave of the future."(Hall, 1985, p.23)

In order to draw in professional engineers and scientists, social status and desirability of the area should not be underestimated as a factor in the continued success of the industry in Santa Clara County. The pleasant climate and the suburban landscape provided an attractive environment for a new lifestyle, a social and cultural milieu in the valley for the scientists. Thus the amenity and desirability of the place and the social status of these highly paid professional has created an image that they all can associate with. As some of the high-tech professionals put it,

"It is a particularly pleasant place to live and work-a beautiful landscape of hills and plains, a bounteous garden of nature where fruit trees and wild flowers bloom even in February....Few places on earth so agreeably mix nedomistic delights with the excitement of urbanity....It enjoys mild winters, fog-free summers and a balmy spring and fall. Outdoor sports and recreation are year-round attractions....The area boasts 4,000 PH.Ds....There are also at least 12,000 horses, some kept by those PH.DDs right on their home acreages, which are often within minute of work. And within an hour's drive are shops, restaurants and cultural offering of San Francisco."(Saxenian, 1981, pp.61)

For reasons of greater tax revenue, cities within the region have encouraged more

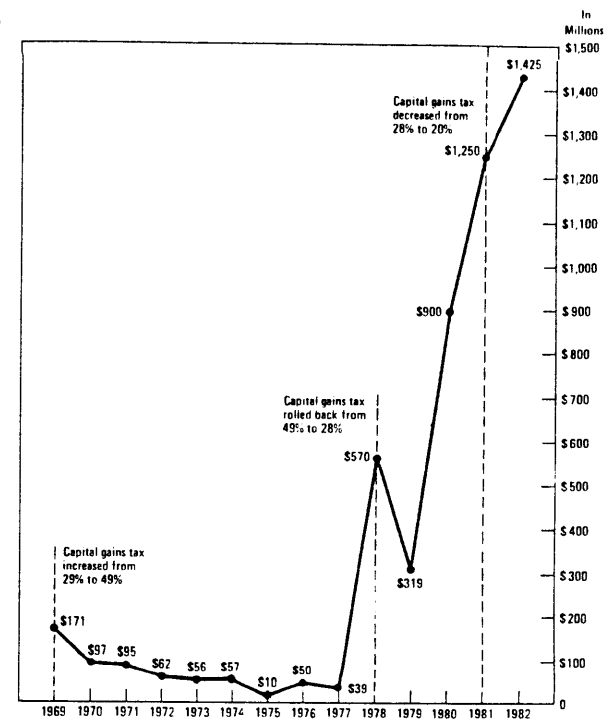
industrial development. Since residential land can not be taxed as highly as industrial land, it was concluded by cities that residential land was less desirable and more industrial land was designated. In the extreme cases, cities have tried to raise more tax by rezoning the originally designated residential land to industrial.

The high-tech phenomenon of Silicon Valley is a distinctive one: there are firms constantly starting-up, spinning-off, merging with other companies, being acquired and for some, going bankrupt. Although business is highly competitive and risky, one can still see many new entrants. But what is the key drive for the new comers? Social transformation depends not only on technology but also on a new set of social values. The gradual shifting from an industrial society to a information society has created a new set of social values centering on entrepreneurial spirit.(Rogers, 1985, p.18) This spirit is the major motivating force behind innovation, breakthrough and wealth.

To start a business in this area requires significant financial backing. During the 60's and 70's, to get started required founders' capital and also investment money from venture capitalists. As time passed by, venture capital became cheaper and easier to obtain since the venture capitalists believed that the high-tech industry would be growing steadily.(Rogers, 1984, p.62) So, along with the availability of financial resources and the other factors as mentioned above, an environment has been created for the entrepreneurial culture encouraging the rapid growth of the industry.

Impacts from the High-Tech Wave

The development of high technology over a period of three decades has fostered



Venture capital investments since 1969

many changes to the region. It is perhaps more appropriate to describe it as the "process of urbanization". Physical, spatial, environmental, socio-economic changes are significant throughout the region. However, all the changes that occurred are two fold. Some changes brought in opportunities while others caused problems.

Parallel to the high-tech industrial growth, the population growth rate within the last few decades was tremendous. By looking at population statistics of Santa Clara County, one can immediately notice the contrast. With a population of less than 200,000 in the 40's, it started to rise dramatically later. Between 1950 to 1960, population more than doubled and in the 70's, it had surpassed the one million mark. The population growth pace between 1950 to 1975 was considered the fastest in the United States. (Hall, 1985, p.29) The rapid population growth depended on the availability of employment. Along with the increase in industrial and population growth, employment opportunities also broadened. The growth of high-tech brought in other business such as chemicals and special production equipment essential to manufacturing semiconductors. Also, employment nearly doubled between 1940 to 1950 and again more than doubled between 1950 to 1960. More than 400,000 jobs were created between the decades. Perhaps the most amazing fact is that in a period 40 years between 1940 to 1980, employment grew from 59,000 to 651,000, about 1000 percent difference. A break down into categories of employment show that more than one third of the Silicon Valley workers belong to the 700 high-tech companies in the region. In 1969, the average median income of the county was already 30% higher than the whole United States, making it one of the wealthiest counties in the country. (Hall, 1985, p.33)

There is a negative aspect to the growth. The imbalance of land use distribution

Year	Total Population		Total increase		Components	
	Interval	Number	Per Cent	Natural increase	Net immigration	
1940	175,000	1940-1950	115,500	66.8	n.a.	n.s.
1950	290,500	1950-1960	351,815	121.1	23%	77%
1960	642,315	1960-1970	442,998	65.8	28%	72%
1970	1,065,313	1970-1980	184,687	17.3	57%	43%

Source: County of Santa Clara Planning Department (1980) *Components of Yearly Population Increase, 1950-1979, Santa Clara County*, INFO No. 660.

Population growth and components of increase: Santa Clara County, California 1940-1980

	1969	1975
Santa Clara County	\$12,456	\$18,500
California	10,732	14,069
United States	9,586	14,095

Source: US Bureau of the Census (1970) *Census of Population: 1970*. California, Washington, DC: US Government Printing Office.
Stanford Research Institute (1980) *The Mid-Peninsula in the 80s*. Palo Alto, CA: SRI International.

Median family income, 1969 and 1975: San Jose SMSA, California and the United States.

is costly to the residents of the region as well the environment. The land use crisis began with the unprecedented high-tech industry which grew dramatically without a vision. Public policies of many cities within the county were to encourage industry. This enabled the city to raise a lot of taxes which residential and agricultural land were not capable of. Inevitably, this created a positive attitude to think more industrial land, which was seen as benefiting the city while discriminating against other land uses since they were not profitable. Some cities were more successful in attracting industry and most of them cluster around Stanford University, at the northern part of the County. The area to the south such as the City of San Jose has turned into a 'bedroom city' for the less skilled workers. This has also created a distinct physical and spatial pattern of social and economical segregation. Also, it had posted a change in the spatial structure where employment is highly concentrated but the working population is widely dispersed.

The imbalance of distributing land use has caused a chronic shortage in affordable housing. Housing prices were rising much faster than the average income of people in the region. The lack of affordable housing is due to several factors: scarcity of land, prohibitive building costs and soaring interest rates. The high prices of housing in the county has forced many lower income workers and families to move elsewhere, only the rich can stay. Currently, the price of a "decent middle class" home in the north county is at least \$150,000 and according to San Francisco Examiner:

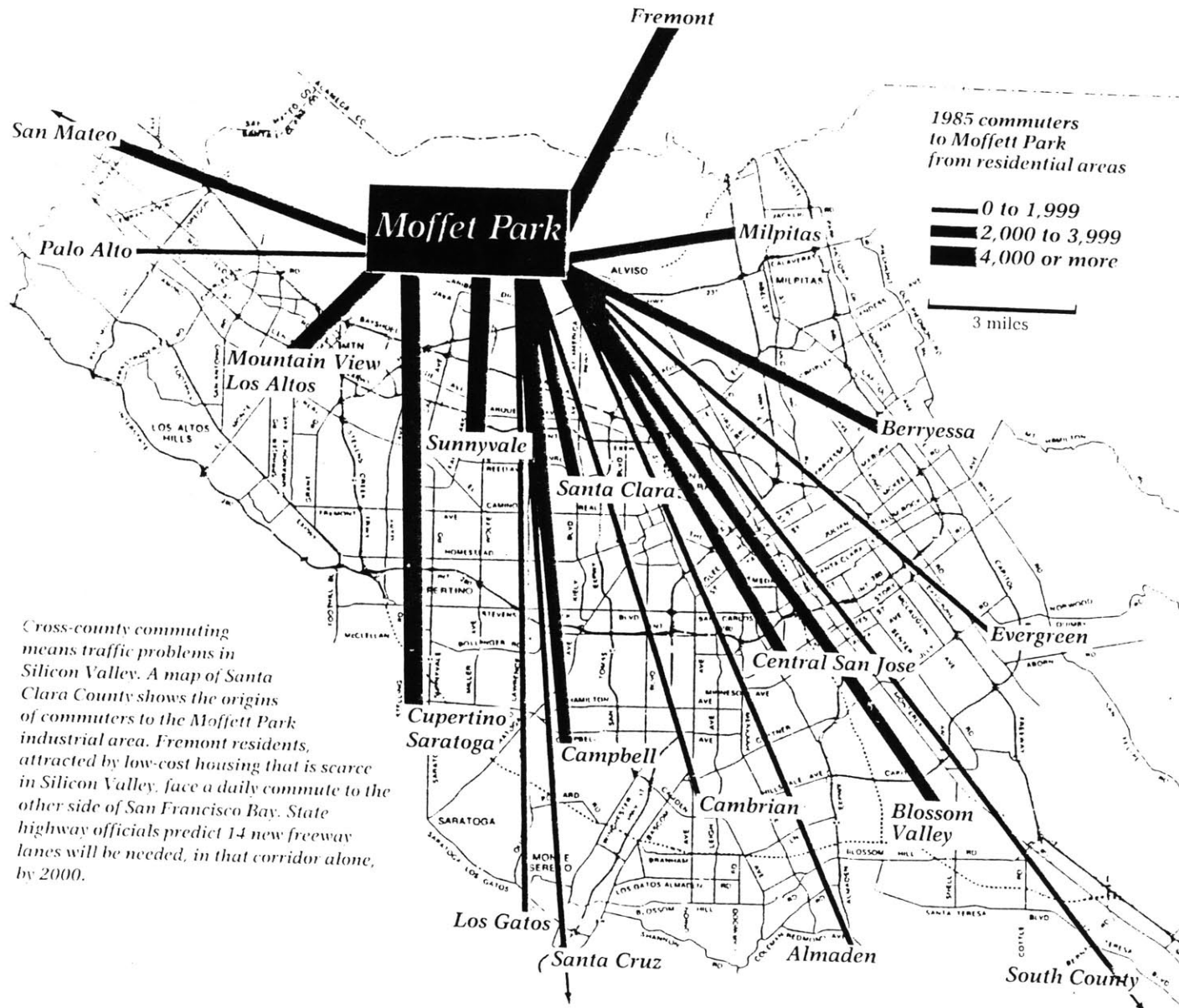
"The type of home an executive might want, one with three or more bedrooms and several baths, would cost about \$400,000 in the Saratoga or Los Gatos areas: favorite home-hunting grounds for up-and-coming electronics executives." (Saxenian, 1981, p.95)

According to Lenny Siegel of Pacific Studies Center, the high-tech industry created an opposite pattern to the old industrial economies where the rich lived far away. High-tech industry has a physical image of cleanliness, and, as a consequence, the rich stay close by. Less affluent people are forced to search for other places within or outside of the county. Also, projection tells us that if employment continues to grow as predicted, 325,000 workers will be unable to find housing within the county by the year 1990, regardless of what they are willing to pay. (Stanford Environment Law Society, 1971) Problems also include the substandard, overcrowded housing units, and decline in the production of rental housing. In the future, there will be need for more housing not only because of population increase but also due to the decrease of household size. Economist Richard Carlson said that the projected normal growth continues to expand in the Silicon Valley, but the employment level of the region had already reached that predicted for 1995. He also said that a recession in the valley means that only 10,000 more new jobs will be created rather than. (Newsweek, 2/25/1985, p.92)

The housing situation has led to transportation chaos in area in which over four million automobile trips were taken daily in Santa Clara Valley. Since public transportation is inadequate to the workers, more than 500,000 people are dependent on automobiles and faced with a long commute every working day along congested freeways. If an increase in population and employment is allowed to continue, the already overly used transportation systems such as the freeway will most likely cause more problems. Planning new roads and highways perhaps will not necessarily solve the traffic chaos, but it is more likely to induce more problems. The decentral residential development pattern has forced almost total reliance on the



Scene of traffic chaos in Santa Clara County



Cross-county commuting means traffic problems in Silicon Valley. A map of Santa Clara County shows the origins of commuters to the Moffett Park industrial area. Fremont residents, attracted by low-cost housing that is scarce in Silicon Valley, face a daily commute to the other side of San Francisco Bay. State highway officials predict 14 new freeway lanes will be needed, in that corridor alone, by 2000.

automobile for personal transportation. This trend has also resulting a new life style described in "The Highway and the City" by Lewis Mumford as follows:

"In using the car to flee from the metropolis, the motorist finds that he has merely transferred congestion to the highway and thereby doubled it. When he reaches his destination, in a distant suburb, he finds that the countryside he sought has disappeared: beyond him, thanks to the motorway, lies only another suburb, just as dull as his own. To have a minimum amount of communication and socialibility in this spread-out life, his wife becomes a taxi driver by daily occupation, and the sum of money it costs to keep this whole system running leaves him with shamefully overtaxed schools, inadequate police, poorly staffed hospitals, overcrowded recreation areas, ill-supported libraries.

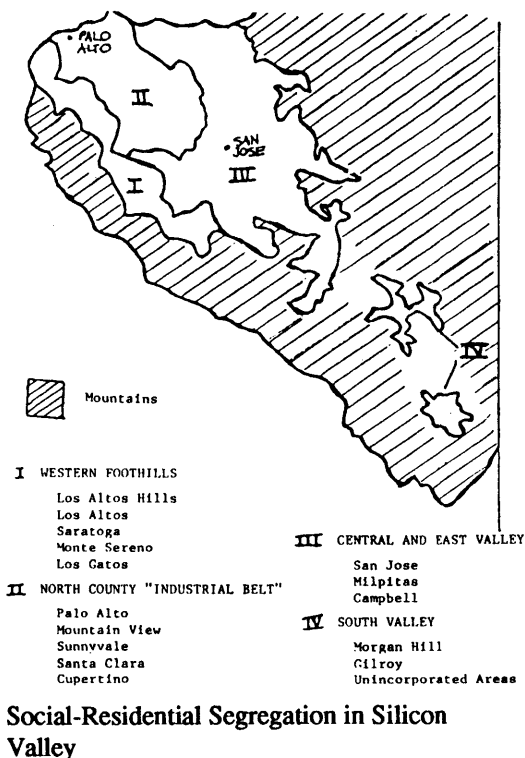
In short, the American has sacrificed his life as a whole to the motor car, like someone who, demented with passion, wrecks his home in order to lavish his income on a capricious mistress who promises delights he can only occasionally enjoy....."(Mumford, 1970, p.183)

The transformation of Santa Clara County from a beautiful and natural environment to a highly industrialize region has created many environmental problems. It is best to describe this change in Santa Clara as "urban sprawl," the intense development of industrial parks, freeways and housing tracts have caused the deteriortation of our land, water, air and other natural and human resources. Air pollution is perhaps the most visible and harmful environmental problem in the Santa Clara County. The neat, white-roofed, low profile campus style buildings produce little visible evidence of pollution. However, it is highly deceptive. High technology firms, particularly the semiconductor industries, use large quantities of toxic chemicals in their production processes which are hazardous if not neutralized before discharge.

The lack of open space is another environmental issue the region is facing. Surveys have shown in 1971 that there were about 8 acres of recreation open space per 1000 residents. New York State's 25 acres per 1000 residents is a quite a contrast. It might be deceptive to feel spaciousness with the large acreages of privately owned, vacant land within the region. If future development is encouraged, the inadequacy of 8 acres per 1000 people will become apparent.(Stanford Environment Law Society, 1971, p.9)

The culture of entrepreneurship of the industry has created many social problems. The obsession of success and perhaps greed has turned workers and founders into workaholics, many work over 80 or more hours a week. The long hours of work had have affected personal relationships, and Santa Clara County has the highest divorce rate in the nation. The breakdown of social structure has caused other problems. Abuse of drugs have become more serious. San Jose Police investigators sited one company of 400 employees as being mostly on drugs. (Newsweek, 2/25/1985, p.9)

Silicon Valley is a place with two different faces. One face is reflected in the Yuppie, a highly paid professional such as programmer-manager living close by his/her office. The other face is the production worker mostly women, immigrants and minorities, earning not much more than minimum wage, often unable afford to live close to their work place. The wealth inequality in the county has created different residential communities which shaped the urban geography of Santa Clara County. While the high-paid professionals and engineers tended to settle in the northern part of the Santa Clara County such as city of Palo Alto. For the less skilled immigrants, most gather in the sprawling southern city of San Jose. The



county's 15 cities can be divided into 4 homogeneous spatial clusters representing a specific social and economic function.

The cities of the western foothills region (Region I) are the newest in which many professionals and executives live. The 5 cities of the north county (Region 2) are the heart of the high-tech industrial complexes which contain half of the county's jobs. The residential composition in this area has shown an intermediate socioeconomic mix. Older cities culminate in the central and east valley (Region III) which contains over half of the population of the region. San Jose in particular, has served as a landing spot for the influx of unskilled workers, mostly immigrants who were attracted by the high-tech boom. Remaining, are the cities of south valley and unincorporated areas (Region IV). These are composed of the 10% making up the county's poorest population. The area remains rural and agricultural with minimal access to the industrial areas. The pattern of the high-tech industry is determined by the above influences where most industrial development is concentrated in cities within the north county with the southern county becoming a socially and economically segregated residential communities. (Castells, 1985, p.87)

Chapter Two - Next Wave: Prospect and Trends

Background

Human society is constantly shifting, developing and advancing. Nearly two centuries ago, the start of the "Industrial Revolution" affected many aspects of human lives, providing many opportunities and new avenues for people. The first revolution occurred in the period from 1785 to 1842. It was induced by the invention of steam engine, the development of cotton spinning and weaving and the smelting and refining of irons. Following this period was the development of railroads and steel from 1842 to 1895. The more recent industrial revolution in the 1890's owes its beginning to the automobile, the chemical industry and the electrical industry. Silicon Chips, the basis of the development in microelectronics, had dominated the fourth industrial revolution-the high technology invasion. In this chapter the nature and its future prospects of the high-tech revolution will be examined. Particular emphasis will be placed on examining its prospects in the Silicon Valley to gain an insight on the future needs for this type of development.

Towards Post-Industrial Era: Information Society

Society seems to go through phases, and perhaps with little notice, a new phase began in America two decades ago. We have entered a new revolution of an information society which is dramatically different from its predecessor.

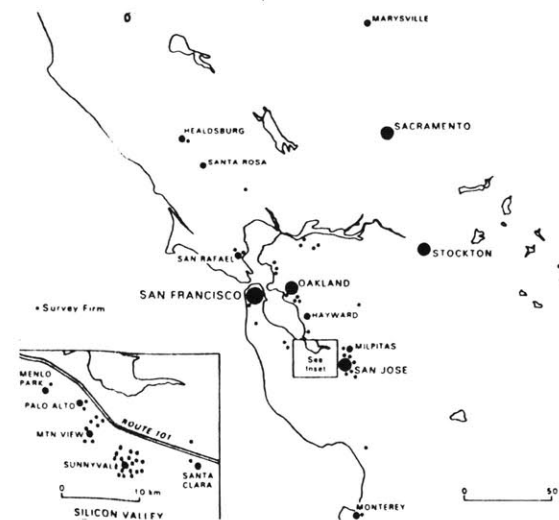
According to Professor Daniel Bell, an information society is a post-industrial society based on services. (Rogers, 1985, p.3) The most important ingredient of this society is not muscle power or energy, but rather it is dependant on information

exchange. In another words, tool technology is serves as an extension of man's physical power, and communication technology essentially to extend one's perception and knowledge and enlarge one's consciousness. This leads to the important conclusion that communication technology is a basic requirement to all other technologies. Unlike previous one-way communication technology such as radio, the new information technology allows in a two-way interactive communication.

The shift from an industrial to an information society is dependant on new technological developments on mircoelectronics. The high technology microelectronic companies of Silicon Valley have played an important role in this development. These companies base their survival on innovation in the early stage of development. The high-tech innovation of Silicon Valley is based directly on information-exchange. The shift to an information society in Silicon Valley has developed many related high-tech products. It has also created a physical and spatial pattern which will be introduced later in the chapter.

Spatial Tendency: Agglomeration Factor

The development of Stanford Industrial Park had attracted many high-tech industries, and developed a cluster pattern for each industry. The clustering tendency of the high-tech industry has several reasons behind it. First, the nature of the firms are essentially dependant on the same skilled labour pool and also the accessibility of scarce information. Since the technology industry is constantly changing, it is critical to get first hand information about others in order to stay competitive. Secondly, the clustering effect will create high-tech environment that



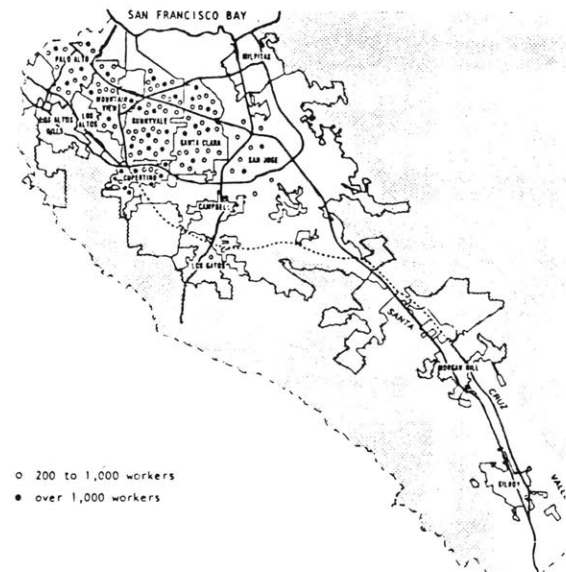
Clustering of high-tech companies in Northern California

the workers can associate with. This environment will generate an atmosphere of scientific excitement both physically and socially. Thirdly, the proximity to a major university serves a number of purposes both social and functional. Young professionals desire to be near universities in order to continue their education and to upgrade themselves. Many of high-tech firms' employees take university classes to keep up with the changing technology and to obtain advanced degrees. Universities also affect the character of a community, providing a social and physical environment with the image of clean, modern industry of research institutions and an academic community which is desirable for the high-tech professional strata. Lastly, a large university also guarantees an easily accessible supply of skilled labour, so that firms do not need to import all their technical power.

Another agglomeration factor is related to social reasons. Silicon Valley could be compared as the high-tech professionals' living essential, a spiritual configuration that they can hand on to. Cut them off from place is like a fish out of water, their creative energies may just die. C. Lester Hogan, a consultant to the President and the president of Fairchild Camera & Instrument Corporation said:

" you have to have lived here and participated in Silicon Valley to really appreciate the intellectual stimulus that exists here. Where else on a weekly basis can you talk to giant industrial figures like Ken Oshman, Jim Treybig, Jerry Sanders, Gordon Moore or Sandy Kurtzig? Where else but here? The kind of spirit that's been here from the beginning. It's entrenched, and I'm not sure you can transfer it. You can bring a lot of people, even some intellectual giants, and build a lot of plants but I don't think you really capture the favor, the spirit of the Valley. The magic is still here."(Business Week, 6/11/1984)

The distinctive philosophy behind the Silicon Valley microelectronics firms is



Location of electronics employment in Santa Clara County

plausible. Compared with earlier industrial societies, they believe that employees should be treated in a more humane manner. Employees are subject to financial reward and treated with what is termed "California laid back" which is the Silicon Valley life and management style.

ROLM, a well established Silicon Valley electronic firm specializing in communication devices, is famous for its attitude to workers. Its facilities are set in landscaped areas with ample amount of open spaces. The company has also spend millions of dollars to include an indoor and outdoor athletic complex for their employees. It is the largest recreational facility owned by a high-tech firm in the Valley and the operating budget for all the activities runs well over \$150,000 per month. Other companies have followed this example in order to stay competitive and attract a highly skilled work force.(Management Review, December, 1984)

The relative location for high-tech industry to urban centers is of interest. It is perhaps another version of the traditional industrial quarter in the inner areas of the great Victorian cities. The differences between the two is that the tradition quarters tends to located near the Central Business District for financial purposes. However, this reasoning no longer applies to the high-tech industry today since it is founded on venture captial on either a regional or national scale. Consequently, the industry is no longer forced to lock in the inner parts of the city to establish itself.

The industry is basically looking for locations that are high-amenity environments in order to attrack highly-qualified, highly paid and highly-mobile workforce. This is one of the reasons why industries which do not locate in the older, less attractive industrial core of the city. According to Saxenian interviewa with corporate site planners, they unanimously stressed such attributes as "livability for professionals"

and an "attractive quality of life" as the prime consideration in selecting a new site for high-tech industrial development. As one individual put it, "the key to success in the industry is the ability to attract and hold on to engineers and technicians....If you create job in an attractive location, people will flock in." So there was widespread agreement on what constituted such an attractive and desirable location in repeated emphasis on such things as a clean, modern environment with a nice landscape, access to urban culture, proximity to a university and an academic community, ample recreational opportunities, affordable housing, and a comfortable place to settle and raise a family.

The spatial pattern of silicon Valley established itself over a period of several decades. The future spatial structure will most likely stay unchanged, the individual elements clustering and keeping in touch with each other in order to maintain a high-tech community.

Metamorphosis of the High-Tech Sector

The structure of the semiconductor industry at the beginning of the high-tech era was clear. The industry's control, research, production development, design operations(R& D) and advanced manufacturing facilities stayed in close spatial proximity to each other. This spatial pattern lasted about 25 years and is posting a significant change. The change in spatial proximity began in late 1970's when began to encounter a series of difficulties. The manufacturing function of the high-tech sector has gradually moved out of the region. Silicon Valley's high-tech companies are now restructuring and dispersing their manufacturing operations to locations outside of the County rather than continuing to grow in the region. Santa

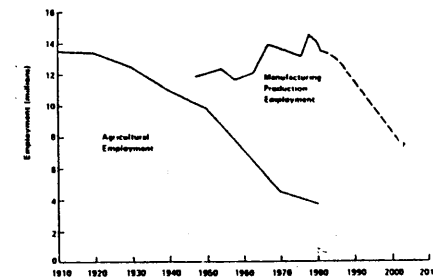
Clara Count's era as a manufacturing center has ended.(Saxenian, 1981, p.133) Also, as the urban problems of Silicon Valley intensify, local high-tech firms were faced with shortages of labor and increasing socio-political threats to the stability of production. Another reason for this separation is simple, wages for manufacturing workers are rising and foreign competitive is great. While some giant company still can afford to retain their production function close by, other smaller producers cannot afford to do so. In order to compete with other foreign countries such as Japan, many firms exported their assembly phase of production to low wage overseas country such as Indonesia and Hong Kong. All the above forces encourage this sector to search for more profitable and reliable sites for production.

Many of the large size firms has already dispersed their production to places with cheaper labor and land in order to escape the extraordinary high costs of the Silicon Valley. Firms such as Hewlett Packard Associates has been the pioneer of decentralizing manufacturing out of the Santa Clara County. And since 1975, the county's largest electronics firms have consistently moved their production function to other locations. Many of those firms had also established polices to disallow future manufacturing expansion in the County.

Other reasons indicating the continuing decline in manufacturing employment are the advancement in computer applications such as robotic and plant automation technology to replace human labor. These advanced technology techniques create massive increases in output per worker. This applies not only to the production processes themselves, but also design and management of the entire manufacturing process.

On the other hand, the R& D function and corporate headquarters of the

An Analogy Between Agricultural and Manufacturing Employment, United States
(Source: Bureau of Census, *Statistical Abstract of the US and Historical Statistics of the US: From Colonial Times to 1957*, and Bureau of Economic Analysis, *Survey of Current Business*, 1982)



semiconductors industry remained concentrated in the Santa Clara County. Firms such as HP, AMD and Varian Associates had constructed their new international corporate headquarter buildings in the county and many others followed this example. Besides building headquarters, many companies are building highly sophisticated basic research laboratories in the the county.

The future pattern of semiconductor industrial employment as a result of the above is clear: The highly paid engineers, scientists and managerial segments of the industry's workforce will remain in this high-tech mecca for carrying out control and R & D functions, while the manufacturing sector will move to other places with a concentration of unskilled and less highly paid workers. Another advantage for the high-tech manufacturing sector that there is often less control and regulation.

Transformation of classes is inevitable when industrial restructuring occurs. This is a phenomenon which is already happening to Silicon Valley. The employment structure has been changing dramatically and will continue to alter. Employment is shifting towards a white collar workforce. The population of today's white collar electronics workforce in Silicon Valley is more than 65 percent, twice as much as the national level. This shift again is very simple, the shortage of industrial land and a slow down of manufacturing employment has created this situation.

Another trend developing is the diversification of the high-tech industry. The high-tech industry started approximately 45 years ago predominately in the field of microelectronics, however, it is believed that growth will occur in at least three other areas of high technology. The first is the complex of computer applications, information systems and automatic control systems such as robotic equipment. Secondly, the area of biotechnology such as genetic engineering and fermentation is

advancing quickly. Lastly, the oil crisis of the 70's has inevitably forced people to think photovoltaics.(Hall, 1985, p.16) All three areas are very likely to merge and interrelate. For instance, the development of computer hardware and software will be extremely helpful to energy exploration and conservation, or it might apply to analyse complex chemical structuring in the field of biotechnology. With the prospect of these growing industries, the employment level of the high-tech industry will also rise respectively in the future.

The structure of new entrants to the high-tech industry are most often small, but in some cases they may be large conglomerates, firms that merge together to strengthen their marketing power. Past experience has shown that firms which are able to stay competitive in the business world demonstrate a need for future expansion. This pattern growth for firms that stay competitive is expected to continue into the future.

The gradual functional changes from heavy manufacturing to light manufacturing, research and development, and corporate administration has suggested a new physical trend for the high-tech industry in the future. The original concept of the science and technological park evokes the images of well designed, attractive landscapes, high quality building designs which resemble the low profile campus style buildings and low-density coverage. Visual quality is still an important element in the future design of high-tech development. However, due to the limitation of land availability and functional and operational changes, the low density low profile building type might not be appropriate anymore. The physical form of the future high-tech industrial development is predicted to shift towards middle to high density. If this transformation occurs, the once "science park" of Silicon Valley

might evolve into a city sub-center similar to the traditional CBD carrying out business primarily related to high technology

Lastly, the nature of competition within the semiconductor industry sector has changed. In the past, survival depended on innovation but today a firm with a technological edge might not be able to stay ahead. Technological innovation has become less and less significant in altering market shares, more traditional forces such as capital formation, labor cost and productivity, or expanding markets are dominating competition and dictate the success or failure of a high-tech firm. (Saxenian, 1981, p.128) The shift from innovation to business orientation perhaps suggest that the image of the future high-tech corporation is an important factor to its marketability.

Future Form of the High-Tech City

The high concentration of high-tech industrial development in Silicon Valley has resulted in a city form called "urban villages." The physical characteristic of it is manifested in cities such as San Jose. It consists of an intensely developed core and surrounded by low density residential development. The urban village concept has two implications for our society. The socio-economic implication of this concept intended it as an employment/entertainment center where a large numbers of people work and live. On the other hand, the physical/spatial implication is that it serves as an organizing mechanism for the suburban sprawl phenomenon.

The advancement of communication technology has suggested that our society is evolving from an industrial to an informational base. This trend has suggested a future form of our city which might be towards a society of decentralized

workplaces. The development of sophisticated electronic communication device has enabled individual workers to stay home at their workplace. This trend is already happening in some high-tech companies where some of software engineers work at their homes and come in to the office once every two weeks to collect their pay check. The lower skill level employment such as the production assembly sector is also following the decentralize process where manufacturing is moving out of the region to locations with sources of cheaper labor forces. As mentioned earlier, the companies are expected to agglomerate in close proximity so that they could associate closely with each other physically and socially to create the high-tech spirit of a place.

Two trends indicating a future for the city are taking place. As the high-tech industry matures, the once industrial park will probably become a sub-center within a city due to the large influx of population and employment. The city will become networks that organize these sub-centers. The traditional CBD and surroundings will increasing lose their significance. The next stage of growth in the city will belong to these high-tech industrial based sub-centers. As employment level demands rise, the development of more dense housing will occur. Other supportive functions have to be developed such as infrastructure, commercial, entertainment.

The Industrial Cycles: Economic Outlook

The basis of the industrial wave is technical innovation and technological breakthrough. However, technical innovation has a dual nature. Technological developments might not be of any significance if they are not commercially viable. If, however, the products can meet a certain needs, new technical developments do

not have to be complex in order to gain significance.

The high technology industry in the Silicon Valley throughout the United States is constantly fluctuating. The ups and downs in the high-tech sector is tremendous due to foreign and domestic competition. One can see that the early intense electronic development grew from government war and post-war spending. The defense budget cut of the 80's and the over supply and lack of demand has entered the industry into a "Dark Age," with many high-tech industries collapsing. These symptoms have suggested that the long enduring fourth wave of industrial revolution will soon be ending. Subsequently, the beginning of the fifth wave will only be a matter of time.

During the early 1920's, a Russian professor named Nikolai Kondratieff had published a paper on economic cycle of the capitalist society.(Hall, 1985, p.6) In his paper, Kondratieff strongly argued that capitalist development follows a regular cycle of approximately fifty-five years. The central argument of his thesis was based on technological development as a triggering device. This technological development as he pointed out, creates new economic opportunities and also promotes economic expansion. The economic cycle in a sense is very simple: the market will reach its peak and become saturated, recession begins and depression soon follows. This period will sustain until a new wave of innovation sets off the cycle again. Some refinement by others had suggested that there is two shorter cycles within the Kondratieff cycle. The relationships of all these cycles can be simply explain in the process of economic expansion and contraction in modern capitalism.

Since the early 70's, the history of industrial cycles have been traced in an

attempt to verify Kondratieff's hypothesis. Gerhard Mensch, a German scholar, had assembled historical information from the first Industrial Revolution onward. His remarkable findings surprised many people in which he traced in detail the progress from original breakthrough to industrial innovation. The years, as he concluded, are 1764, 1825, 1886 and 1935 which almost exactly correspond to the periods identified by Kondratieff. Mensch made predictions based on these findings. He projected that half of the innovations by mid-1970's will reach the stage of commercial applicability. He predicted the peak innovation will start in the year 1984 and generate an economic upswing well into the 1990's. A great deal of criticism was drawn on the accuracy of his interpretation. Another significant discovery was by the Dutch economist, van Duijn. When he superimposed the dates of the long waves by pre-World War One Dutch writer van Gelderen, the waves had become a curve representing economic growth.

Although there is agreement on the existence of the cycles, their length and their occurrence has been questioned. Let us accept the theory for a moment and postulate upon the future. Tracing back to history, the first and second wave belongs to Great Britain which was joined by the United States and Germany in the second. The third wave was dominated by the latter two countries. It appears that from World War two until the present time, the fourth wave has been dominated by the United States, with Japan beginning to join in.

The hypothesis behind the triggering mechanism of a relatively small industry that could lead to an enormous economic one is interesting. It is applicable to the innovative high-technology industry in Silicon Valley. The result is quite clear, it will create a large income and employment multiplier effect in other sectors such as

construction, real estate, recreation and personal service industries.

Although the industrial cycles theory is controversial it cannot be completely ignored. Many clues in the Silicon Valley have suggested there might be an end to the microelectronic age. Then again, if one applies the Mensch findings of the wave cycle, the present high-tech industry is approaching to the end of the fourth wave. This will open the way for the fifth wave to lead into the 21st century. Hopefully it will bridge the end of the present industrial cycle and resemble the next industrial era for our society. Perhaps it is the next hope for national economic survival. Although many are trying to predict what it will be like, perhaps it is more important to concentrate on creating the future.

The Future of Silicon Valley

The future for Silicon Valley is in question. Many believe that it is already losing its edge to foreign competition. On the other hand, many argue that competition eventually will help stimulate the industry in the valley. Julio Moline, the producer of a television documentary series on Silicon Valley, argued that the region will continue to prosper. The reason behind his assumption is that the high-tech industry behaves differently from previous industries which were based on local or regional economies. High technology industry is critical to the whole nation's economy since it has been developed to an international scale. Silicon Valley is the high-tech capital of our nation, its failure will have implications on the national economy. This suggests that government policies will intervene if there is evidence of an impending recession. (Moline, 1987)

Regardless of whether one assumes the above to be correct, the question is

whether there is a future for Silicon Valley or not-especially on future progress of technological innovation. Some people think the future lies with Pittsburgh, Cleveland, or Detroit once the industry is mature and the micro chips reach their ultimate barrier to further miniaturization. Optimists suggest that there is no limit to technological breakthrough and innovation. They also expect entrepreneurial talent in the valley to overcome the ultimate barriers of chip miniaturization and also the entrepreneur spirit to invent the future. New companies will rise and replace the old, they will go through the same development process, ensuring that the cycle continues. It is expected that the Silicon Valley will become a dominate information society which eventually will gain the status of the R & D capital of America and the world withthe manufacturing function continuing to move out of the region.

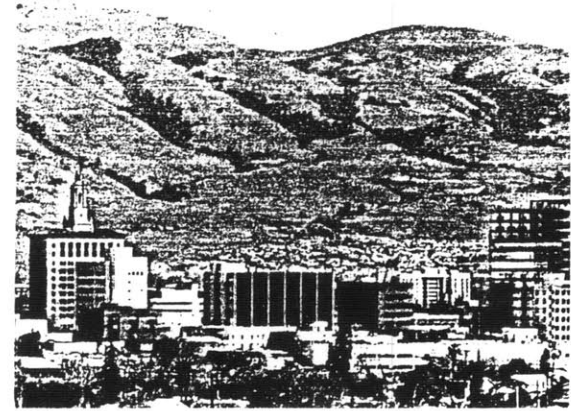
Chapter Three - San Jose: Location for Future High Technology Growth

Background

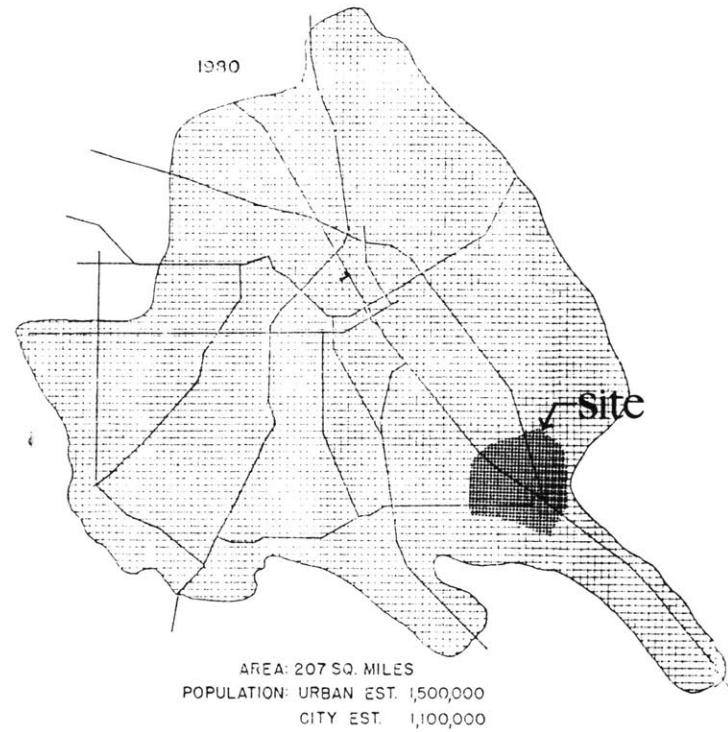
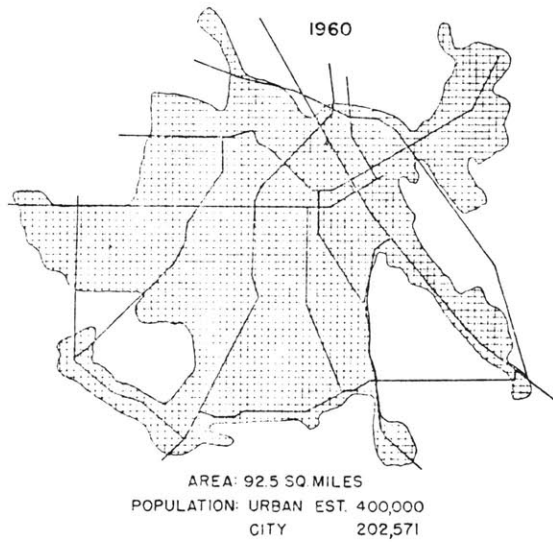
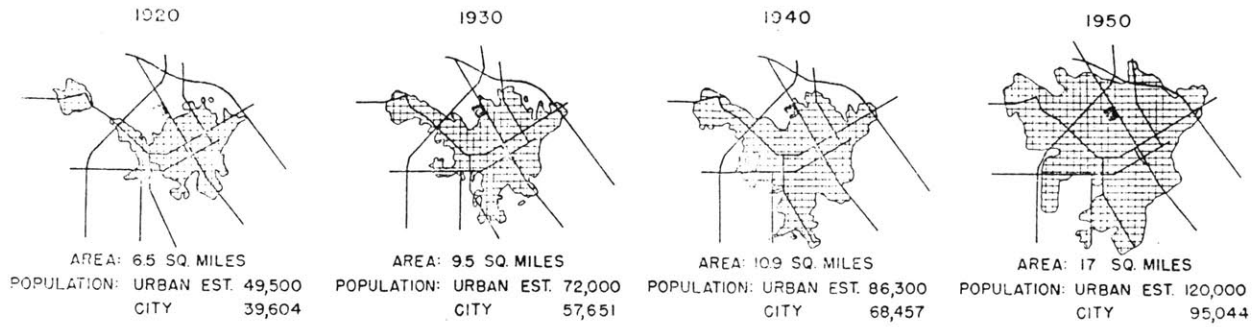
San Jose, the fourth largest city in California and the largest within Santa Clara County, has been experiencing explosive growth over recent decades. Besides external forces which contributed a large part to this growth, local advocates promoted and facilitated this growth. For many years before the 50's, it was a city surrounded by gardens of prunes, apricots, and cherry orchards. When the high technology industry found its home in the 50's, the once fertile agricultural land has gradually converted for urban development. In order to accommodate the growth, the city continued to expand from an area of 6.5 square miles in the 20's to more than 200 square miles in the present. For several decades, San Jose has served as a "bedroom community" for the high-tech unskilled assembly workers and was unable to attract the high-tech industrial to settle. Due the limitation of land in the region and most of the future available industrial sites in the region lie between San Jose and cities further south. The trend for these industries to move toward the southern parts of the county is inevitable. Today, San Jose is changing its appearance to attract industry. There are on going major improvements in the city such as new transportation networks and the redevelopment of the Central Business District area. This thesis focuses on the industrial land of San Jose as the study area and it will be a testing ground for the later urban design proposal.

Context

The City of San Jose lies in the heart of Santa Clara Valley. It is located at the



San Jose Downtown



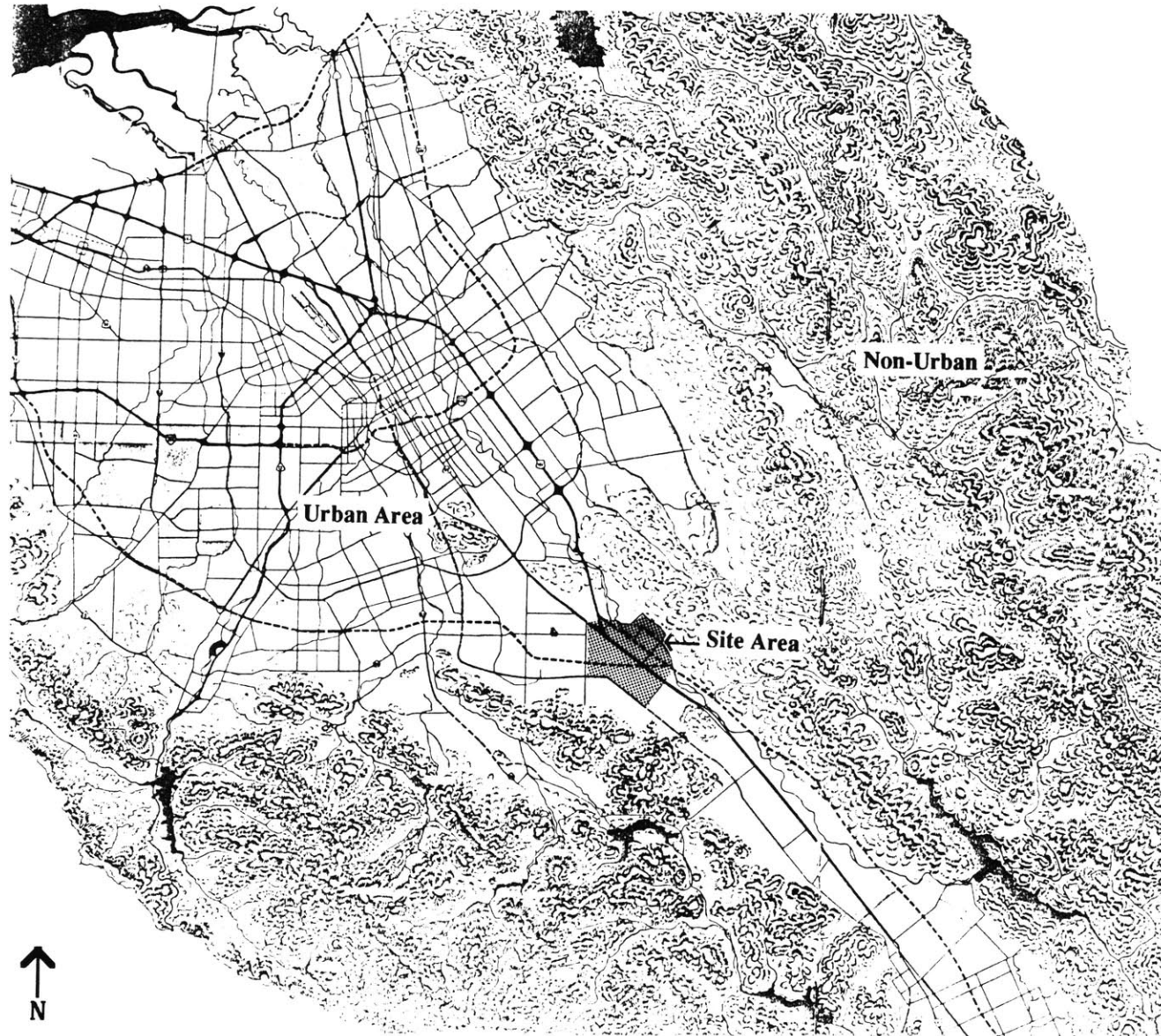
The development of San Jose urban area from 1920 to 1980

Urban Setting

There is a significant amount of undeveloped land remaining on the floor of the valley. However, the hillsides surrounding of the City contain an extensive land resource devoted to non-urban uses such as watershed, range land and wildlife habitat.

The most prevalent land use in San Jose is residential. This residential development is typically low density, single-family detached housing. Multi-family developments are characterized by two or three story moderate density apartment complexes. Multi-family housing is dispersed throughout the City, located mainly in the central and western parts of the City along major streets. An analysis in 1975 had shown that the employment and housing in Santa Clara County as a whole was relatively well balance. However, San Jose was not equitably sharing in the balanced economic condition.(Bernstein, 1977, p.39) Although San Jose had a higher portion of the county's population, most of the employment opportunities were located in the surrounding cities. Thus, San Jose has become the bedroom community for other employment centers surrounding it.

On the other hand, commercial development in San Jose has a distinctive character. Commercial developments outside the CBD exist in the form of neighborhood and community commercial centers, strip commercial developments along major streets and regional shopping centers with massive amount of area for parking. The Central Business District presently is under major redevelopment and it is evolving into a financial, office, cultural and entertainment center. The redevelopment of the CBD is a crucial element of attracting new industry for future development. This has helped create a new image for the city that shows it as



Urban Development Map of San Jose

growing up to be a multi-use center rather than monolithic residential environment.

Industrial Expansion Tendency

The most appropriate key to study urban expansion of the metropolitan area of San Jose is by examining population growth. With a present population of more than 600,000, the city of San Jose has drawn up a projected increase of population to around 1.533 million by the year of 2000, more than double in 12 years!(City of San Jose, 1984, p.17) The projected increase is due to the in-migration and natural increase. It has also concluded that in-migration is closely related to the increase in employment.

The designation of the new industrial area such as North San Jose and Coyote Valley has come a long way. During the 70's, there were disputes on whether there should be more industrial land for high-tech expansion. San Jose citizens were very concerned because the previous uncontrolled-growth taught them that this was more damaging than beneficial. There were many political contests to the pro-growth and controlled-growth issues. Coyote Valley, the City's last major preserve of agricultural land in the southern part of the city, was a major focus at that time. The City's planning department was against designating it as industrial. A report by them concluded that the opening of Coyote Valley would devastate the city's economy due to the cost of flood control improvements, sewage system, and police and fire services. However, the turning point was 1982 when the Planning Department revised its last recommendation. The new report stated that the city needed more large industrial sites to accommodate "the particular needs of large, high-technology companies." The San Jose Economic Task Force concluded in a

study that unless San Jose made large sites available, it would not be able attract the range of industrial firms that the City's economic development strategy was seeking.

Environmental impacts due to the high-tech development were taken into account. For the past two decades, the jobs/housing imbalance has been a familiar scene in Santa Clara County. The heavy commuting pattern has put a enormous strain on the transportational facilities provided by the region localities. The opening of Coyote Valley to industrial usage was seen as a means to correcting this imbalance, however, this will probably not known until the area is fully developed in the coming years. In short, the goals are to bring jobs closer to where people live, reverses the commuting pattern, thus improving the jobs/housing imbalance of San Jose and the region. The development of a new light rail transit system running from the northern part of the city through the newly revitalized downtown area to Coyote Valley was proposed. Other new transportation networks are being planned such as the extension of Highway 85 from the northern part of the County to this area.

The present mayor of San Jose, Tom McEnery has been a major influence in the change of attitude among City politicians. The message he gave was to make San Jose "the heart of Silicon Valley," aim at attracting high-tech companies of all sizes. With an agreement to open 1,800 acres of virgin land for industrial development, San Jose has sent a clear message to the business world. Anticipating industrial growth also has another meaning as Major Tom McEnery has said, "If we become the Capital of Silicon Valley, Whatever that means, I think the basic rationale behind it is that it will make the average neighborhood in San Jose a better place to live." (Zarchami, 1983)



San Jose CBD: street scene with light rail transit

San Jose is the largest city in Santa Clara County, both in terms of population and area. Twenty-two percent of the 87,000 acres of Urban Service Area is vacant or unused. Future industrial development in San Jose is distributed along the First Street/Monterey Highway axis through the city. The Central City industrial areas historically developed with manufacturing and heavy industrial uses. To the north near airport area and to the south towards City of Gilroy, new industrial areas are developing to accommodate the growing high-tech companies. Administration offices, control, research and development and light manufacturing will be the primary functions in these new industrial areas.

Similar to the the connection between Stanford University and the established high-tech industrial development in the northern part of the County, these newly destined industrial sites in San Jose also have the advantage of being located close to two major universities in the area, San Jose State University and Santa Clara University, which will cross benefit each other as mentioned in earlier chapters.

Chapter Four: Edenvale: Locational Focus

Background

After the final recommendation in 1982 to open the vacant land in south county for industrial expansion, the area has been experiencing dramatic growth. Located within the redevelopment area, Edenvale is the scene of dramatic industrial growth. Past experience of rapid growth without sufficient planning has caused problems such as a decline in the quality of the environment. It is now appropriate to provide guidelines to improve the urban environment. A need exists to precribe a new set of urban design principles to the growing high-tech industry to accomodate its gradually changing shape and function. Since this change will inevitable alter existing urban form a clear vision towards a desirable urban environment is needed.

The reason for chosing this designated industrial area as a testing ground, arises from the logic that future expansion will take place further south to Morgan Hill and Gilroy area. Edenvale will be the starting point for this expansion and by establishing a future scenario with new urban design principles for the high technology industrial development, the chosen site will serve as a gateway and a role model for later developments.

Context

Edenvale is located approximately seven miles from downtown San Jose. The immediate surrounding is charaterized by its rural setting. The redevelopment area for industrial and commercial purposes totals more than 1,000 acres, the second



Districts of San Jose

largest quantity next to the North San Jose area. The area surrounding the industrial land is mostly low density single-family residential development with pockets of open space. To the east side, it is surrounded by non-urban hillside and also lie adjacent to an existing green belt.

To the northeast of the Edenvale industrial area, the Silver Creek planned residential community encompasses more than 3,000 acres of land for future residential development. The unique rural nature of this area is surrounded on three sides by urban development. The planned objective in this area set forth by the City is to take this advantage to create a low density suburban community.

From the aerial photograph, one can see that the cityscape is relatively flat except for the downtown area where most of the highrises are situated. The photograph reveals that is already some major industrial developments in the site in the area while remaining land is used for agricultural purposes. The landscape of the area is quite bare due to the dry climate of California. The mild climate and rich soils of the Santa Clara Valley are suitable to the luxuriant growth of trees and other vegetation in public and private landscape spaces. This is integral to outdoor-living lifestyle of San Jose. The above nature qualities forming the image of the City could allow it to be considered as a "garden city." The Coyote Greenbelt preserve the scenic backdrop of the hillsides surrounding the area, maintaining the link between this "garden city" environment and the region's open space resources. The greenbelt is intended to be developed as a clear identity for the City and defining where the City begins and ends. The hillsides are the most extensive and visually prominent feature of the greenbelt. Planned uses in the hillsides include valuable watersheds, wildlife



Aerial photo of Edenvale and the proposed site

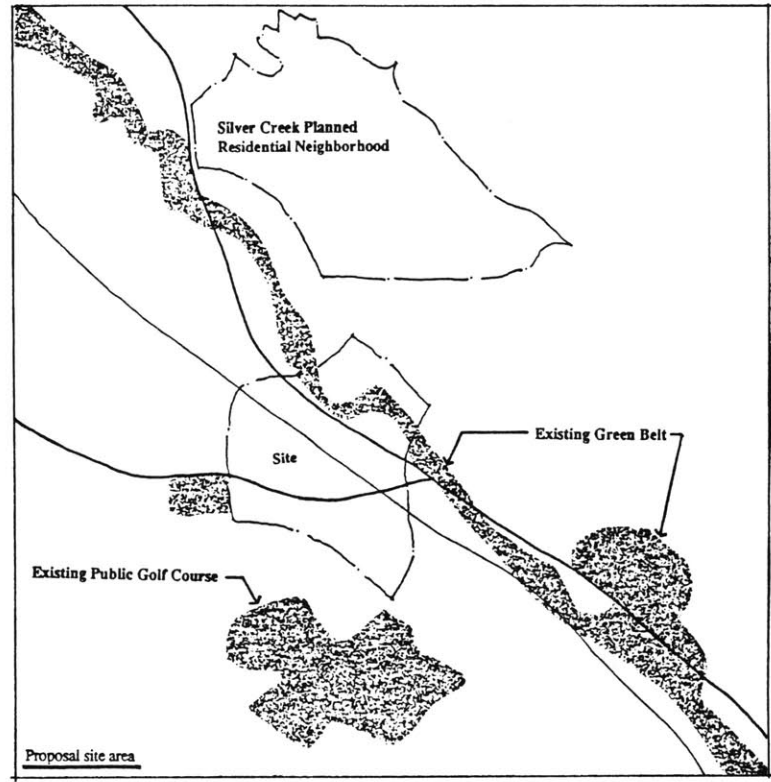
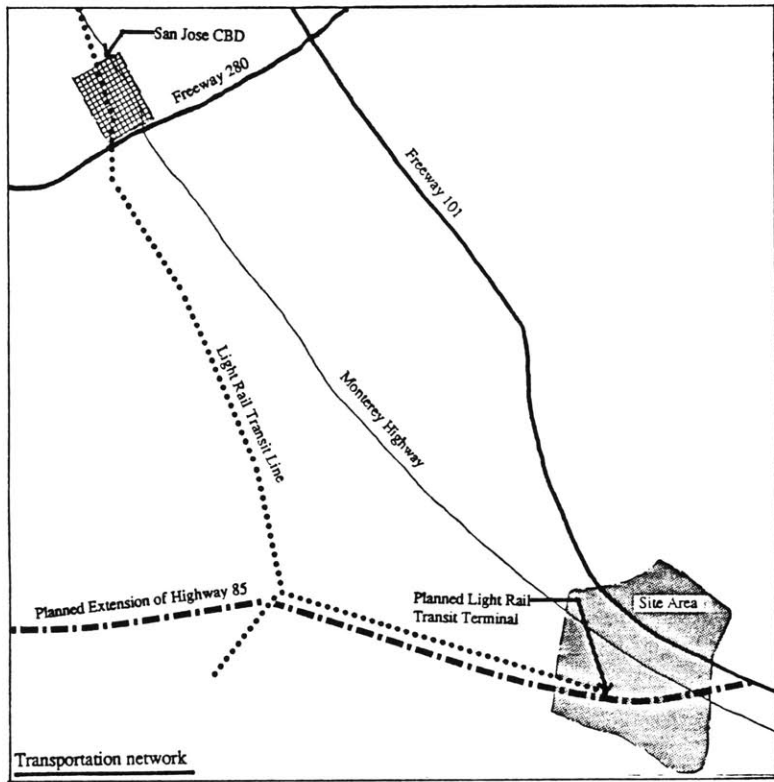
habitat areas and rangelands for agriculture and glazing.

Circulation

We have learned from the previous chapter that the concentration of high-tech employment in the north county and the "bedroom community" nature of San Jose has caused many problems in the County's transportation system. The commuting travel times and distances for the residents of San Jose are among the longest anywhere in the region. The jobs/housing imbalance, together with inadequate State and Federal transportation funding for construction of freeways has resulted in severe peak hour congestion on existing freeways, expressways and arterial streets throughout the County. It also caused commuting traffic to seek alternate routes through the community, including neighborhood streets.

The area is connected to the center city and the northern industrial areas by two major highways and a light rail transit system. U.S. Highway 101, a 6 lanes freeway connect San Francisco all the way to Los Angeles, passes through the area. Monterey Highway is a four lane expressway linking San Jose Central Business District to the area. Another major transportation network underway is the extension of Highway 85 which connects the area with the northern part of the county where most of the high-tech companies are located. Once this expansion is complete, it will alleviate the traffic between the north and south county areas. It will also help to decongest the overburdened freeways such as U.S. 101.

The 20-mile long Guadalupe Corridor Expressway/Light Rail Transit Project is under construction and expected to be completed in 1990. Some parts of it are already in operation. Anchored at both ends by the Edenvale and North San



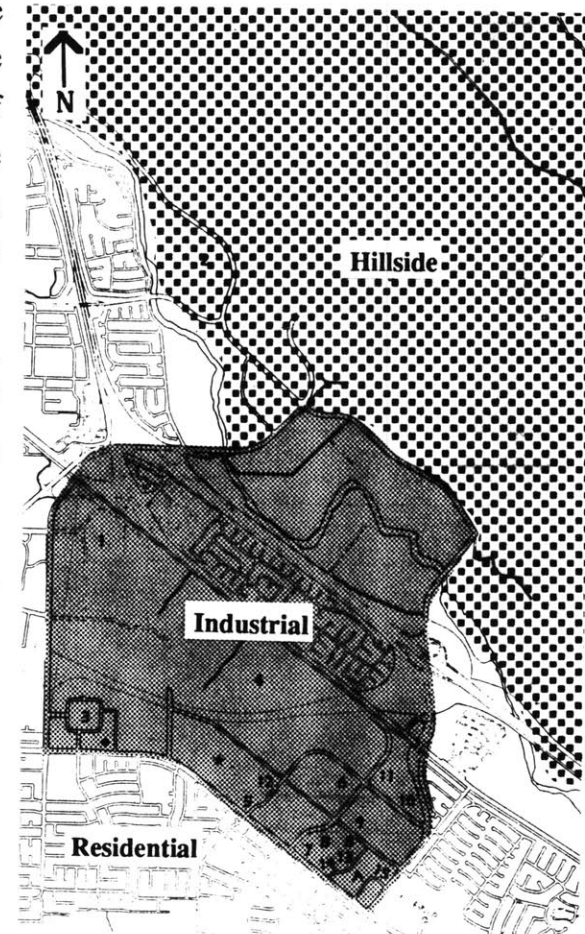
Jose/Santa Clara industrial parks, the Corridor encompasses the Downtown Core Area and the developing residential neighborhoods of Edenvale. Because there are major employment centers at both ends of the light rail line, maximum utilization of the system's reverse commute potential is expected. Another advantage is that if the light rail transit and the expressway can attract commuters, it will probably ease a great amount of the peak hour traffic and traffic impacts in neighboring areas. It will also redistribute the commute traffic from the surface street network.

Aside from the major road network in the area, one can see from the aerial photo that many of the internal roads of the large housing development consist of dead end roads. It is perhaps a result of the developer trying to maximize the area for development. Many residents prefer this kind of layout because it cuts down the amount of through traffic thus providing more privacy. However, in some instances this has disrupted the continuity of the fabric and infrastructure system of a city.

Physical & Spatial Characters

The intensity of the housing development can be easily distinguished from the low-lying and scattered industrial development. The large tract housing developments have become a significant part, dominating the landscape of the surrounding area. The resulting built environment can be attributed to the real estate market and the booming period of the high-tech industry during the 1970's. Under these conditions the city has evolved into a bedroom city for lower income employees.

Due to time and economics, much of this large tract housing was developed in a



Site Context

very standard manner. Each of this type of development usually has several models to choose from and each model has its own floor layout and exterior appearances. Standardization enables fast track construction and substantially reduce construction cost. The lot sizes are usually very tight and subdivision can go up to 8 to 10 individual parcels per acre. The concept of 0 zero lot line has enabled this to happen. Essentially, residents share a wall with their next neighbor and lose a side yard area.

Industrial development has usually occurred parallel to the major roadways and created visual associations with automobile movement. The Edenvale industrial area is characterized by a strip of existing residential houses along Highway 101 and the Monterey Highway. Spatially, it has interrupted the continuity of the industrial land use and also created an island sandwiched by two major roadways. It is most likely that these houses were developed before the industrial area surrounding it was designated. Physically, it is undesirable to develop housing along the freeway because of the noise and exhaust air from the automobile. Due to the futuristic nature and the objective of generating an idealized physical model of this thesis, it will be assumed that the strip of housing located in the middle of the selected site will be converted into industrial land over a period of time. This assumption is based on the future need for high-tech industrial expansion and the limitation of available land eventually forcing the rezoning the land by the City and the high-tech companies will subsequently paying high prices to buy out the existing residential land.

There is a clear spatial separation between the residential areas and the industrial areas. The road becomes the boundary and there is not any buffer or transitional

area between them. The houses face directly across to the parking lot of the industrial buildings.

It is clear that this type of environment is oriented towards the automobile; it relates to speed, parking and massive buildings. There is little pedestrian space or activity in this type of environment. The industrial areas consist of large open parking lots. The ground plain is dominated by asphalt and landscaped areas surrounding the buildings. Workers usually park and go directly to their buildings. There is no interaction between people in these spaces. Similarly, residents go to their garage and drive out. The residential sidewalks become useless. Leading to other streets within the neighborhood they have little pedestrian activity due to the monolithic nature of the land uses. But it seems odd not to have pedestrian activity on the streets since the climate really encourages it.

The place lacks any sense of being a cohesive living and working environment. Buildings are everywhere, and although some of them have been designed with good intentions, they are lacking a dialogue between each other. These individual pieces do not help make a coherent environment. People living in these areas accept these conditions as the "norm".

Future Socio-Economic Projections

The present population of Edenvale is approximately 99,500, the largest among the thirteen subdivided areas in San Jose. Employment level is about 25,310, the second highest next to North San Jose area. Projections of growth by the City of San Jose has suggested tremendous growth. By the year of 2000, Edenvale area will have a population of more than 120,000 and the employment level will also rise to

**Planned Growth (1980-2000)
Households, Population and Employment**

Planning Areas	Existing-1980				20 Year Incremental Change				Year 2000 Projections			
	Residential			Non-Res	Residential			Non-Res	Residential			Non-Res
	Single Family	Multi-Family	Population	Employment	Single ² Family	Multi- ² Family	Population	Employment	Single Family	Multi-Family	Population	Employment
Almaden	8190	630	31800	10367	2940	800	8300	4000	11130	1430	40100	14350
Alum Rock	22570	9070	100900	19850	3020	3800	6800	2650	25590	12870	107700	22500
Alviso	550	50	1900	917	80	60	200	6300	630	110	2100	7200
Berryessa	12010	2350	49300	16994	2120	4040	17200	8700	14130	6390	66500	25700
Cambrian/Pioneer	15040	5290	60500	13063	560	2870	1900	2950	15600	8160	62400	16000
Central	14130	16270	78500	70510	640	6150	6300	29900	14770	22420	84800	100400
Coyote	1020	70	1800	3613	0	8870	24100	25050	1020	8940	25900	28650
Edenvale	25910	6240	99500	25310	4130	7710	24900	31900	30040	13950	124400	57250
Evergreen	8440	2730	41800	7112	8880	2950	40300	9450	173200	5680	82100	16550
North San Jose	1500	330	6200	36431	0	40	(600)	47000	1500	370	5600	83450
South San Jose	12010	5940	54400	15892	510	8210	21300	5400	12520	14150	75700	21300
West Valley	18930	16890	90800	29217	790	1100	(3400)	2200	19720	17990	87400	31400
Willow Glen	18800	9990	70900	19829	920	1850	(2300)	2500	19720	11840	68600	22350
City-wide Totals ¹	159330	75970	691000	269105	24590	48460	145000	178000	183940	124420	836000	447100

**Vacant Land By General Plan Designation
San Jose Urban Service Area**

PLANNING AREA	July 1, 1983 (Gross Acres)								
	Non-Urban	Single Family	Multi Family	Commercial	Industrial	Public Quasi-Pub.	Pub. Park & Open Sp.	Other	Total
Almaden	208.7	650.2	44.0	18.1	51.1	19.9	218.5	547.4	1757.8
Alum Rock	3.2	433.4	217.8	55.4	166.7	29.3	124.1	15.5	1045.3
Alviso	0	13.1	0	7.8	731.3	272.2	0	62.6	1086.9
Berryessa	134.9	399.2	368.9	18.0	664.4	14.1	97.2	0	1696.8
Cambrian/Pioneer	0	18.2	137.7	38.4	14.9	0	1.0	0	210.1
Central	0	39.4	57.1	26.6	110.0	13.7	7.1	95.2	319.0
Coyote	0	0	0	0	779.1	0	0	0	779.1
Edenvale	784.6	546.9	353.2	59.9	984.7	82.4	250.4	8.0	3070.1
Evergreen	1069.0	3765.8	175.7	67.7	509.6	128.1	177.5	5.5	5898.8
North San Jose	0	0	0	74.7	1426.9	101.2	29.0	0	1631.7
South San Jose	439.3	66.5	216.5	29.7	506.2	36.5	89.2	0	1383.9
West Valley	0	8.2	57.6	18.1	0	2.2	7.8	0	93.9
Willow Glen	0	28.6	66.6	29.9	1.6	2.2	9.5	0	138.4
Total	2639.6	5969.4	1695.1	444.1	5946.4	704.8	1011.3	734.2	19144.9

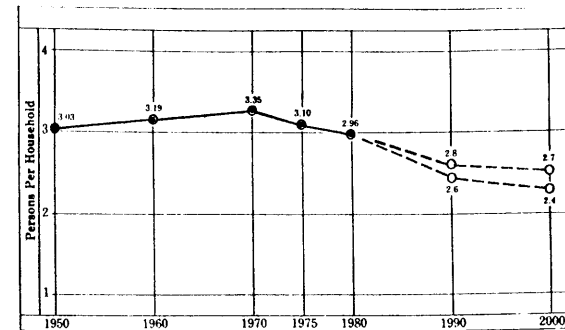
57,250, more than a 100 percent growth within a period of twenty years. In addition to the above, the City has also projected San Jose future household size. The study had concluded that there is a continuing declines in average household size, dropping from approximately 3.0 persons per household in 1980 to between 2.4 and 2.7 persons per household in the year of 2000. Also, new household formation will increase at a faster rate than population growth.(City of San Jose, 1984)

These projections are also closely related to the issue of housing. Presently, the area contains about 32,000 residential housing units of which 26,000 belongs to single-family and the rest belongs to multi-family units. The 20 years projection of residential development growth will be around 12,000 additional units and about 70 percent of it will be multi-family type units. The above projections and limited supply of land indicates a need for a more multi-family housing with its logical location close to the light rail transit stations.

Opportunities

It is time to rethink and revise what our environment could and should be in the future. Developments which fill the urban fabric and create a more cohesive and stimulating environment to live and to work in are needed. Past history, present situations and future projections have provided us a basis for further exploration of new ideas and possibilities, and to generate new insights that will apply to the future form of development.

Edenvale is a place to start with new design ideas. There are both external and internal influences that may affect future developments. However, these should not constrain an effort to steer the development towards a particular vision.. A physical



Projection of San Jose Household Size

design model should be created to retrofit the existing development to create a better environment. The gradual change in shape and functions have indicated that a new stage of development is beginning. It is appropriate to direct developments with new guidelines and policies, to correct past mistakes, and create an identity and cohesiveness within the environment. Clearly, Edenvale has the advantages that no other site in the County has-new transportation facilities and more land for future housing development.

Chapter Five - Strategies and Responses: Accommodate Growth and Prevent Past Mistakes

Shaping Future Development: Establishing New Guidelines

The high-tech industry is evolving into a new form of development and is reshaping the suburban landscape. The future functional trend of the high-tech industry is geared towards research and development, and business development in which the possibility of a future sub-center based on high-tech industry will develop. The resulting future built form will require us to look at posing problems and issues in another perspective. As this type of new environment continues to evolve into a more sophisticated form, one can begin to perceive what it could be. A strategy for designing and managing the future environment is needed. New design guidelines are needed to improve the future city form.

What are the attributes of a good urban environment? Kevin Lynch has argued that one should be able to measure the performance of cities based on spatial qualities. (Lynch, 1981, p. 111) He has defined a normative theory as a coherent set of ideas about proper city form. There are a number of such theories and they focus on their own metaphor of what a city is and how it works. (Lynch, 1981, p.73) Along with his notion of a normative theory for the city, he stresses the importance of creating a sense of place in order to enable people to use their senses to feel the environment. Based on the above premise, one should be able to develop the appropriate objectives and design implications for the future form of the city and its high-tech development. This chapter will identify issues and problems that are fostered in high-tech industrial development. The parts will be organized in the following manner: stating of problems, defining goals based on normative

principles as a response to identified problems and future projections, and, exploration of design implications for future implementation.

Housing/Employment

Problem:

The imbalance of housing and employment as a result of imbalanced land use distribution. San Jose has encountered this problem for the past two decades and has been a bedroom city for lower income, high-tech manufacturing workers. As the high-tech industries continues to grow, population and employment level will increase and more housing will be needed. The projected decline in household size also add another level of difficulty to the problem.

Goal:

Offer people and workers, when seeking housing, ample opportunity to live in economically and racially mixed neighborhoods near where they work.

Design Implication:

Higher residential densities should be distributed throughout San Jose. Locations near commercial and financial centers, employment centers, the light rail transit stations and along bus transit routes are preferable for higher density housing. The development of multi-family housing will provide more opportunities for workers to live close by and should be integrated into the peripheries of industrial areas. Introduce new regulations and land use zoning to include and integrate housing into future high-tech development. In the past, most cities have taxed any new high-tech

developments to subsidize for low-income housing. For future high-tech development, these taxes should go directly to the construction of affordable housing units within the development. Another regulation is the requirement of each new individual high-tech development within a designated industrial area to build a certain number of affordable housing units within close proximity to the workplace.

Transportation Network

Problem:

Every working day, people have to drive and struggle on the congested freeways for hours before they reach their destinations. Traffic congestion on major freeways and city streets is due to this heavy commuter patterns. Travel times and distances for the residents of San Jose are among the longest in the region. This problem is a result of the imbalance of land use which causes workers to live great distances from their places of work. Automobiles have become a way of life and people are dependent upon them.

Goal:

Shorten or reverse commuter patterns. Make people less dependent on private automobile.

Design Implication:

Provide higher density housing around or within industrial areas. Provide more efficient public transportation facilities. Provide an internal public transportation network in the high-tech development that connects to existing public transportation

facilities. The present location of the light rail terminal is close to the edge of the designated site area. It would be more advantageous to extend the rail line and terminate in the center of the site since it will create more equal distribution point. The center location is perhaps more rational since it is bounded by two major existing highways providing good accessibility to the site.

Working Environment

Problem:

Intense business competition has caused the working environment to become very stressful. Many physical and social problems are directly associated with long working hours. Problems such as divorce, drug abuse and deteriorating health are commonly seen. Also, workers are often locked inside an office without much interaction to the exterior environment. For example, a worker can either take his lunch in his/her company's cafeteria or go out to the parking lot, get inside the car and drive elsewhere.

Goal:

Reduce tension in the living environment. Provide convenient access and connection from working to recreation, entertainment or other commercial activity.

Design Implication:

Integrate working and living environments in a single structure or separate structures in close proximity. Provide more shared or private recreation and entertainment facilities in future high-tech development. Provide an ample amount of

public open space and activities generating uses to encourage social interaction.

Spatial Quality

Problem:

Lynch has stated that a 'good' region has no large, continuous area of exclusion, and there are only inequalities of access between different groups.(Lynch, 1976, p.23) Traditionally designated industrial areas were like fortresses imprinted onto the landscape. The shape contrast and segregation of land uses between industrial and residential made the living environment monolithic. Besides industrial developments, there is no other supportive functions. People usually have to drive elsewhere such as a regional shopping centers to shop. After working hours, people go home and the workplace is then converted from high activity to no mans land at night. This typical suburban living leaves people with few choices.

Goal:

Create an intergrated working and living environment which offers a variety of activities.

Design Implication:

Provide a mixture of compatible commerical, residential, entertainment and industrial uses in new high-tech developments to create more stimulating working and living environment. Provide workers and residents with residential, cultural and recreational advantages. Provide a self-sufficient mixed-use community.

Sense of Place

Problem:

Industrial buildings are relatively flat and do not create any visual interest in the landscape. The large subdivisions of land in the designated industrial area do not create any hierarchy in space. Lack of a sense of place and disorientation are typical problems in this type of environment.

Goal:

Create a center of importance and framework for orientation. Clarify movement, connection and approach. Create an identity that everyone can associate with.

Design Implication:

Create a center for the workers as well as for the neighborhood. Allow higher density development towards the center. Develop notions as defined by Lynch such as main streets, squares, routes, districts, nodes, landmarks, and view corridors that can structure an area in full extent. (Lynch, 1981) Create gateways along major freeways to establish a sense of entering or existing to the area.

Land

Problem:

Limited supply of land in the region.

Goal:

Maximize the degree of utilization on land.

Design Implication:

Mixed-use development and higher density land use zoning.

Open Space and Amenity

Problem:

Open spaces are mostly devoted to asphalt parking lots which create a giant grey land cutting across the rural landscape. It discourages outdoor activity or social exchange in this area.

Goal:

Provide well designed outdoor spaces that will encourage more social exchange. Encourage more interaction for people with their environment.

Design Implications :

Utilize and connect the existing Coyote Greenbelt to future developments. Create a pedestrian network within the individual developments leading to an outdoor civic center for the whole development to share. Minimize on grade parking and provide shared parking structures that as equally distributed throughout the development.

Boundary and Edge Condition

Problem:

Traditionally, incompatible land use such as residential and industrial are not allowed to occur simultaneously. The streets and highways becomes the boundaries

which act as walls separating the two places. However, this separation and segregation had made a large part of the city unuseable after working hours. Another problem is that some of the low density single family residential developments have direct frontage to major highways which produce many negative environmental impacts to these residents.

Goal:

Integrate the residential area and the future high-tech industrial area. Soften the edge condition and avoid a strong physical boundary which separate the two places.

Design Implication:

Create a transitional zone of mixed-use development of commercial and higher density residential along the edge of the residential area to the industrial area. Pedestrian connections should be developed.

Chapter Six - Vision: A Physical Model for Structuring Future High Technology Development

Passage to the Future

The image of the old industrial city is not a particularly pleasant one. The industrial revolution might provide an answer to the economics of our city, but it caused many social, physical and spatial problems in our city. The remains of the deteriorated industrial park can enable us to imagine what it used to be. A place which was densely developed with little open space. Factories and offices were often standardized boxes. Smoke stacks discharged steam causing pollution to the environment. Working in a nine to five mode it became a dead space after working hours. The age of this old industrial city is now over.

The second generation industrial city focused on the development of science and technological parks. The images of these parks were a counter part to the older industrial city. The concept of this kind of development was set with similiar rules. It evoked images of attractive, natural and designed landscape, high-quality building design, low-density site coverage and a highly-skilled labour force,(Hall, 1985, p.137) However, these images are not always a true reflection of reality. The failure of these parks has been high. There was one major reason behind their failure. The nature of the development was based on commercial speculation and not upon a proper perception of supporting elements, such as the subordinate infrastructure or a high-order of transportation networks.(Hall, 1985, p.138) The failure of this type of industrial park development was also coming to an end due to many existing pressures, as discussed in earlier chapters. It is important to plan and rethink on how to improve the next generation of high-tech development. The end of

the fourth long wave and the emerging fifth Kondratieff wave is shaping future development. It is important for us to utilize the present opportunities for correcting past mistakes and to create an identity in the future development.

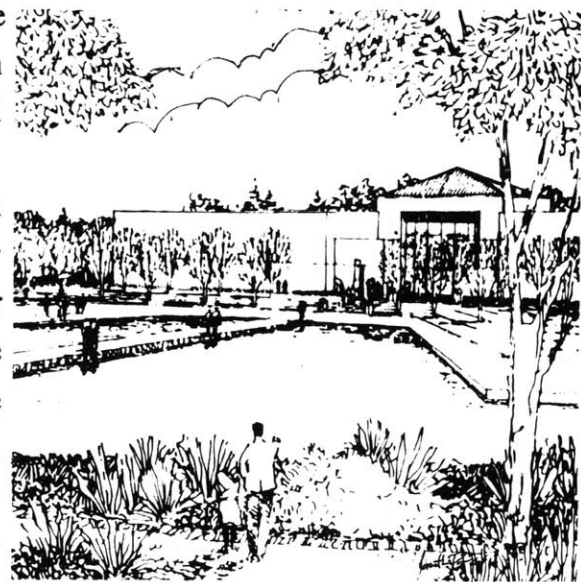
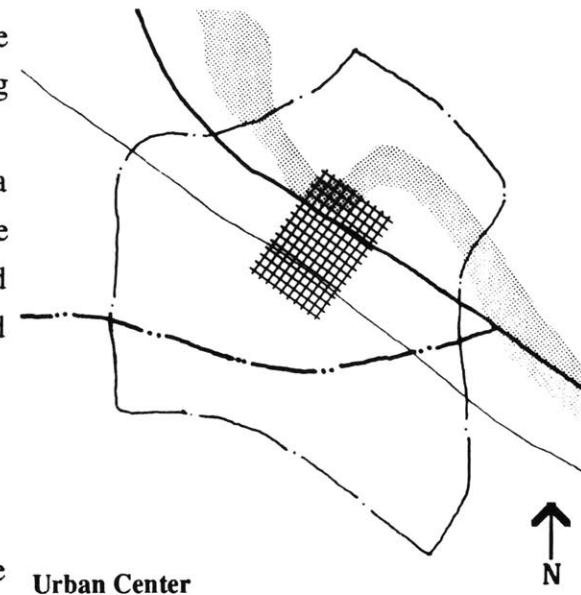
Lastly, the traditional subdivision of land and separate ownership creates a significant disadvantage of uncoordinated individual developments that have little relationship to each other. For this reason alone, this thesis will assume an idealized situation where the future high-tech center will be master planned and designed under a single ownership in order to create a highly coordinated environment.

Physical Form Principle

Urban Center:

The traditional CBD of a city serves as a center for business exchange. The agglomeration factor for such clustering of business is due to the advantage of close personal contact. It enables one to get updated information in the business circle. In addition to the above, the establishment of an urban center will serve several different roles in future high-tech development.

Although the present high technology industrial park evokes the image of a pleasant and highly structured environment with attractive landscaped outdoor spaces, each individual development does not contribute to a sense of place or belonging to the whole. A center is needed to create an identity that will tie the whole development together so that every worker can associate with it. Also, the center is intended to integrate social activity with shared facilities and cultural advantages. In order to have a stronger relationship with the surrounding neighborhood, the intention for a center is to create stronger links by providing

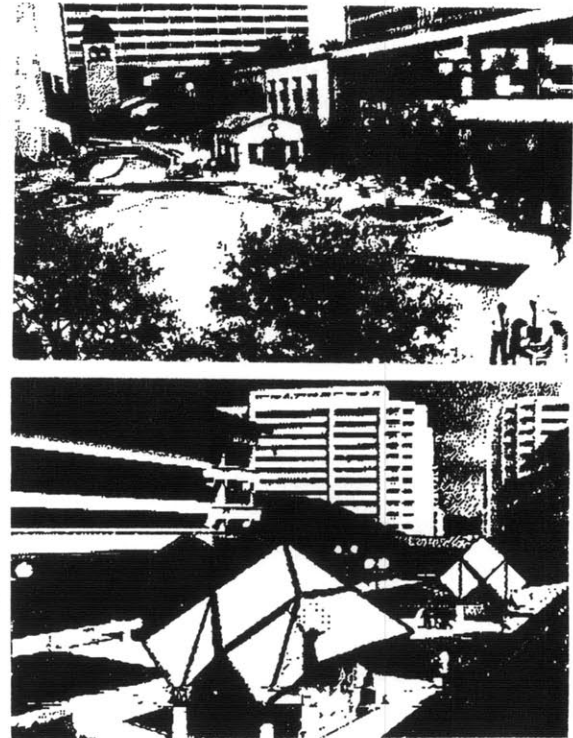


services to the residents as well as the workers. As previously discussed, the nature of competition no longer relies solely on innovation but is business oriented, the urban center will also serve as a place for information exchange and conducting business activities. The center is located in close proximity to major highway networks in order to gain greater accessibility. The center will also provide open spaces that links with the existing greenbelt.

Density:

As the functions of the high-tech industry gradually changes from heavy manufacturing to more of a business and research and development oriented one, the requirement of physical spaces alter. The image of the low-lying high-tech building is no longer be appropriate for of a high-tech headquarter. Buildings of a more significant scale are needed to evoke a stronger image of the international corporate headquarter. The particular site being considered is bisected by a network of three major road. High speed automobiles cannot relate to the flatness of the landscape. The limitation of land and the growing industry inevitably force us to think of other alternatives.

Based on the above premise, the physical form of future developments will be closely related the planning of density. The highest density shall be set in the central part of the site and along major roadways, so that built forms can be comprehended by incoming automobile travelling with speed. From the center moving outward, the density shall decrease accordingly to the capacity of the transportation network and with care to avoid creating any negative impacts to the surrounding residential neighborhoods.



Images of Urban Center /
Density of Commercial Development

The projected future shift to a total concentration of research and development activities suggests that area requirements will be different from manufacturing. Typically, high-tech research and development concentrations are housed in 20,000 to 50,000 square feet buildings.(Fulton, May 1986, p.7) Floor area ratios (FAR) ranging from 0.3 to 0.8 are the result when compared to a typical block side of 250 feet by 250 feet. This has indicated that the density of buildings will be relatively low allowing more open spaces.

In order to test against whether this type of FAR could support the projected employment levels or not, a more elaborate quantitative measure is needed. The FAR calculation on the left compares the future employment level versus the designated development. The conclusion that can be drawn from these numbers is that if the development only creates low density high-tech offices, the FAR will be around 0.4. Varying the FAR will produce a greater flexibility to future developments. The introduction of other uses such as residential or commercial will force this overall FAR to increase. In order to accommodate the character of low density high-tech office and at the same time allow other types of uses to occur, a higher density in the center spine between the two major roadways should be developed.

Gateway:

An individual high-tech development needs to have a cohesive image for the sub-centers of the various high-tech and business functions. An identity could be created by the formation of gateways to give a sense of arrival to the place. Such gateway effect could be created by change of scale in the landscape. The proposal to create a gateway to this new high-tech development consists of two highrise

Office Density

Site area:	42,688,880sq.ft.
Typical block size:	250 ft. by 250 ft. (62,500 sq.ft.)
Employment level in year 2000:	57,000
Worker space:	300sq.ft./person
R&D office:	20,000-50,000 sq.ft.
FAR (from average R&D office):	0.3-0.8
FAR (from site area to projected employment level):	0.4

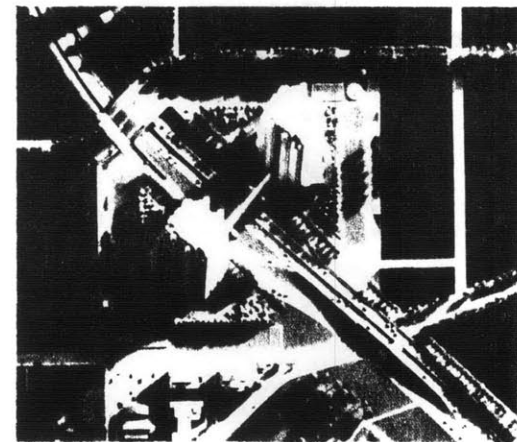


Image of Gateway

office towers complemented with lower scale retail shopping and entertainment.

Housing and Working:

Higher density multi-family housing should be set around the perimeter of the high-tech development. Also, high density housing developments such as towers or slab buildings dispersed within the working environment will provide convenient access to their work place. In order to get an idea of how much residential development should go into the entire development, one should again employ a quantitative measure to validate the proposal. Since the projected household size will decrease to around 2.5 person per household by the year 2000, there is a clear need for more housing units. It is perhaps very difficult to determine how much housing one should put into the development due to the uncertainty of people's preferences. In order to illustrate the possible inclusion of housing to accommodate, 10% to 15% of the employment level might be appropriate. Converting this percentage into housing units represent a total of close to 3,500 housing units.

Housing Density

Average household size in year 2000:	2.5 person/household
Projected working living within the new development:	15%=8850 persons
Housing units:	3500 units

Spatial Form Principle

Subdivision

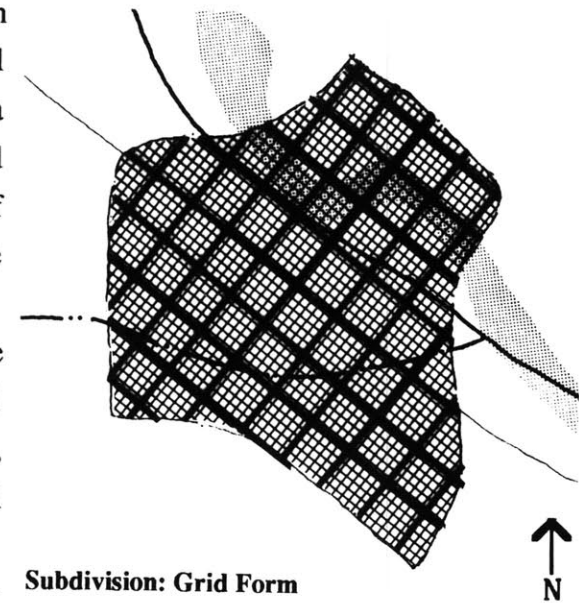
The traditional large land subdivision for high-tech development within an industrial area has several reasons behind it. Manufacturing functions require an ample amount of continuous space. The design of the low-lying warehouse types of industrial buildings need to spread out into larger pieces of land. For reasons relating to "image", the science park idea by Professor Terman wanted to resemble the low scale campus type of environment of highly structured and clean

development in opposition to the chaotic old industrial city. The birth of an automobile oriented society was a result of the housing and employment spatial patterns. More and more dependence was placed on the private automobile as a means of transportation. The availability of land in the earlier stages had enabled large parcel subdivision to devote much of the land to parking lots. This kind of subdivision pattern clearly shows disadvantages which limit accessibility from one place to another and do not present a clear sense of orientation.

In order to regain the sense of a place, one needs to re-examine the size and scale of street blocks and the relationship of open spaces. Leon Krier has hypothesized that "urban blocks should be as small in length and width as is topologically viable, they should form well defined streets and squares in the form of a multi-directional horizontal pattern of urban space.(Krier, 1982, p.43)

Since the manufacturing function is moving out of the region, it no longer presents a barrier for a new spatial pattern. The centralized parking concept enables the elimination of large open parking areas. The imposition of a new grid that clearly defines hierarchical order is needed. The grid should give a sense of place and orientation with different internal road network and open spaces that have physical and visual linkage.

The network of roadways and street turn toward a forty-five degree north south orientation when entering the Edenvale area. One clear indication of this shift can be provided by the aerial photo. It reveals that the topographic features of the immediate land area sandwiched between mountain ranges forms this particular orientation. The proposed new grid follows the immediate topography and land forms in order to blend in with the existing context and to preserve a sense of



continuity. The site is subdivided into a number of superblocks, approximately twelve hundred feet by twelve hundred feet square defined by the primary roadway. These superblocks are further subdivided into small parcels at about two hundred fifty feet square defined by secondary internal roadways.

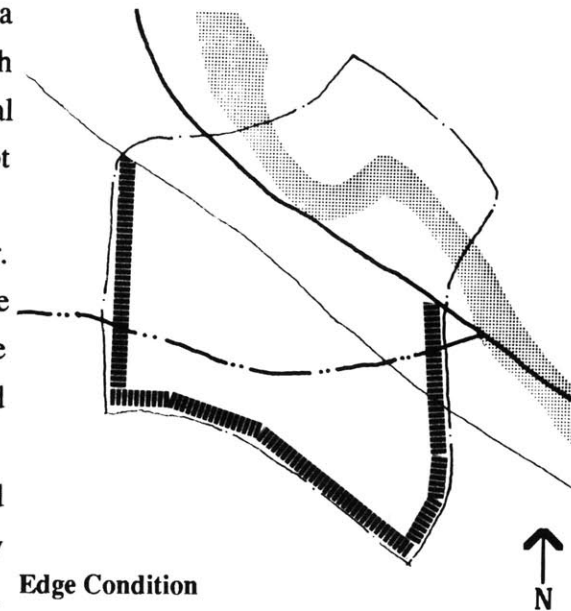
Since the new development is master planned and under one single ownership, the subdivisoning of blocks enables the whole development to be treated as a series of precincts which will allow the development to occur in different phases systematically over a period of times. Being able to divide the whole development into several phases will help insure a balanced development.

Boundary / Edge

The direct adjacency of industrial development to single family residential is a common conflict that can be seen. The high speed roadway becomes the wall which divides the place into two. The most unfortunate place for single family residential houses exist where they are situated directly facing this edge and the parking lot across.

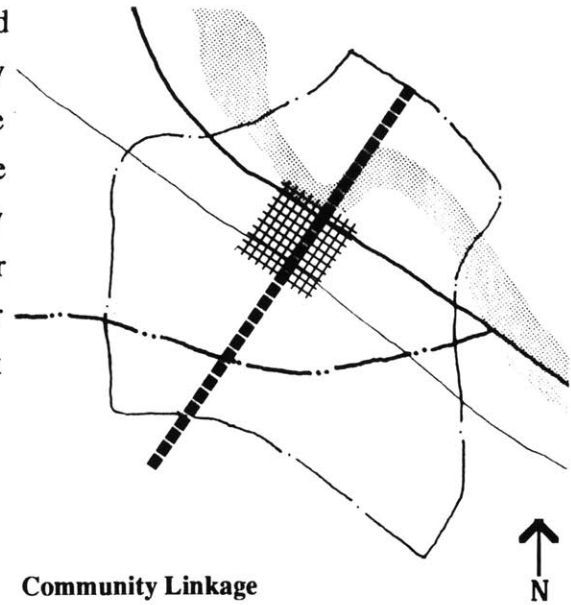
Integration is needed so that the two different development can co-exist together. On the other hand, there is a need for separation to insure the living quality of the residential neighborhood. The edge of the residential area shall allow mixed-use development of commercial/retail and higher density multi-family housing and provide sufficient green space to offset from the roadways.

To establish the edge along the major highways is another consideration. Instead of random arrangements, a visually cohesive environment could be accomplished by creating a standard building frontage open space with landscaping elements.



Community Linkage

Although there is a distinct difference between the residential neighborhood and the industrial area, there are advantages to provide linkages between the two. By linking the two places together, they can become supportive of each other and the industrial areas will no longer be isolated areas which are imprinted into the landscape. The provision of a "visual corridor" such as a pathway as defined by Kevin Lynch is intended to link places together. (Lynch, 1976, p.99) Another technique to link the communities together is to creating a traditional "main street" or "boulevard" which contains a variety of activities and creates a pedestrian network within.



Chapter Seven-Vision: Towards an Integrated High-Tech Environment

Mixed-Use Development

According to the Urban Land Institute, mixed use development can be defined as a relatively large-scale real estate project characterized by three points: 1) Three or more significant revenue producing uses such as retail, office, residential, hotel or recreation which in well planned projects are mutually supporting. 2) Significant functional and physical integration of project components and thus a highly intensive use of land of a minimum floor area ratio of 3.0 is needed, including uninterrupted pedestrian connections. 3) Development in accordance with a coherent plan. (Colden, sept. 1977, pp.32-33)

The concept of mixed use development is not new. Examples includes, the medieval Greek marketplace, the Agora, although it is the mix of commercial and residential uses found in American and European 19th century cities which were the precursors of mixed use development. In their configuration, mixed use developments tend to be either a megastructure, a group of individual structures on a common platform, or free-standing structures with a pedestrian connections. Large size is necessary to provide an adequate mix of uses, project a significant public image and capture a large market area.

Why should one choose mixed use development for the 21st century high-tech development? Perhaps the answer is two folded. On the private side, mixed use developments frequently prove to offer higher financial returns than conventional forms of development because of the economies of scale and, stronger demand than for individual locations. Operating efficiencies also come into being once the project

is in use. On the public side, mixed use development can be used as a tool for treating blight and decay and activating a place in nonworking hours. The above could be performed in several different manners such as blending with established residential where other types of high-density developments were unacceptable, or by providing a means for organizing metropolitan growth.

High-tech headquarters should be located in the center of the development to conduct business activities whereas their research and development activities will take place outside the center. Residential within the development should have connection and easy access to the headquarters. Besides high-tech companies in this new development, other supportive activities and services such as commercial offices, retail shopping, hotels, entertainment and recreation should be included. Physically it will be a more stimulating environment than the single use land planning. Functionally it provides more choice for people and economically it could be more efficient and viable. Residential development inside the high-tech development is an important element to create an integrated environment. Housing should be located within walking distance to these support functions, thus making residents less dependent on the private automobile.

The above functions of the future high-tech development should be developed with some degrees of compactness and higher densities because of the limited supply of land, as projected in the future, and in order to reduce the need for mobility; reduce trip distances, discourage the increase in motorization, and justify the development of a rapid public transport system.

Along with the excellent climate of California, the supportive functions offer local workers and near-by residents the opportunity to gain more interaction with the

environment and create an identity for themselves—a mixed-use high-tech center of the city. The urban center, as mentioned earlier in the chapter, will become the center of focus, thus creating a sense of place. Besides corporate headquarters in this center, it is logical that other functions such as hotels or gourmet restaurants will be necessary for traveling business people.

Public Circulation and Transportation Network

The planned light rail transit which terminates at the chosen site will benefit the development if it can be successfully integrated into the proposal. It should be located in proximity to the urban center, tying in with a proposed regional shopping center. The intention is to encourage use of public transport by convenient access to a center of attraction. In order to attract more workers to take advantage of this system, the development has to provide internal connection to other transportation facilities. A bus system called "transfer transit system" is a good example. This bus system runs on overhead electric net and has the ability to extend its capacity as required by adding other carriages accordingly. The bus route should circle within the development and provide adequate stops to service the various buildings. The central internal bus station should be connected to the newly located light rail terminal in the center of the site as described earlier. The concept of equally distributed parking structures connected to the internal bus stops create a more cohesive transportation network.

Beside the light rail system and the internal bus system, the public transit system of Santa Clara County will include a 750 bus fleet by the year of 2000. It is comprised of approximately one hundred 150 passenger coaches and 600 of these

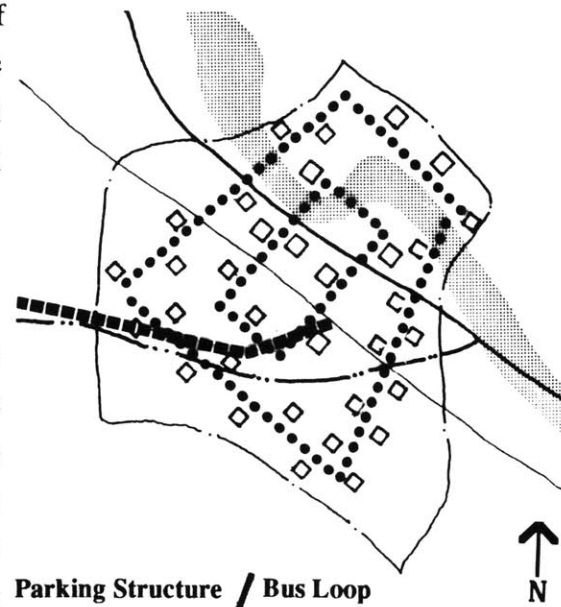




Image of Streetscape

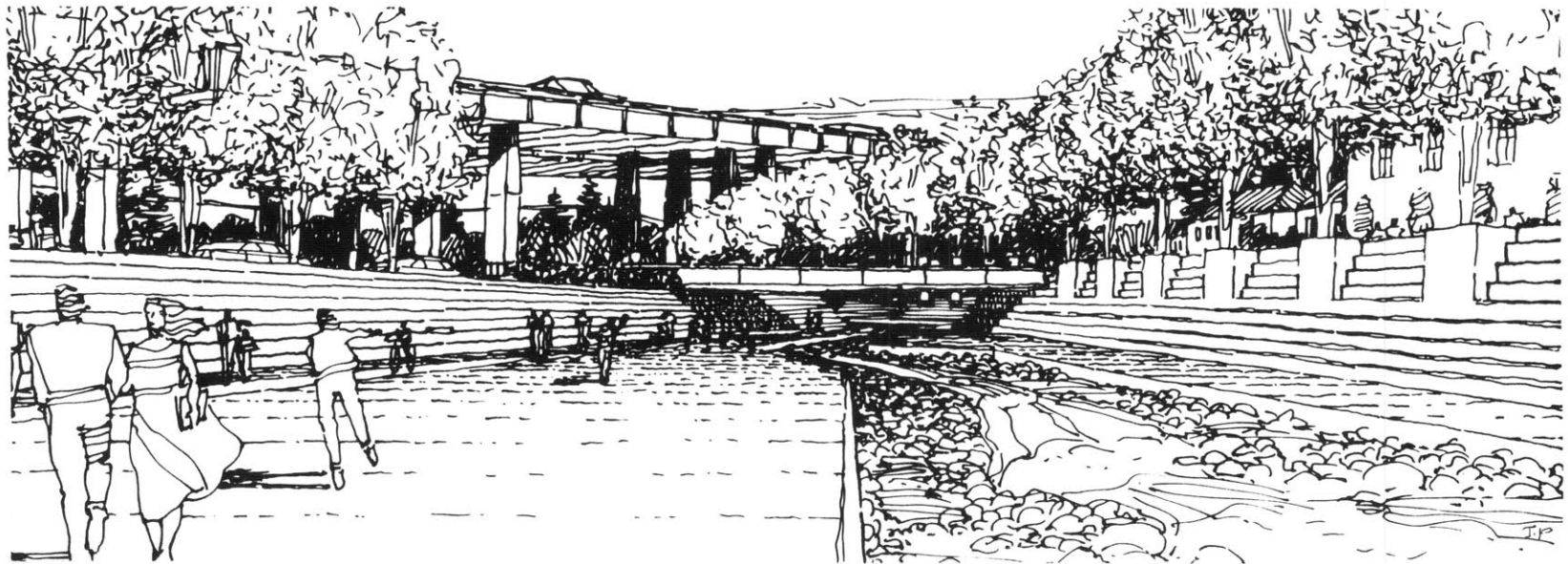


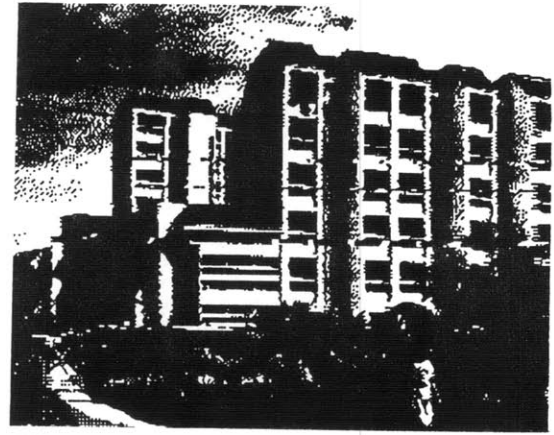
Image of Elevated Freeway and Surrounding

coaches in service during the peak commute hours. In addition to the regularly scheduled service, the Transit District will provide express bus service to high intensity employment centers such as Edenvale.(City of San Jose, 1981, p.57)

The primary goal of the circulation system is to enable people to move to their destination. The effectiveness depends on the coordination and integration of public infrastructure such as transportation system, streets, water, sewer and electricity. For the internal circulation, the focus will be at how the streets and public space works and the integration to the larger system such as the highways. The extension of Highway 85 which cut through the site will be elevated in order to provide continuity to the newly proposed street network in the development. Also, because of the principle to allow for efficient circulation in the shortest distance possible, broadened job-choice and maximum social interaction, the new location of the light rail terminal should be in the center where the highest density of development will take place.

Residential and Supportive Functions

One of the major characteristics of mixed use development is the inclusion of the residential component. Housing in the future high-tech mixed use development should serve a majority of the workers within this employment center. The danger is that it might fall into the problem of the worker housing in the late 19th century and early 20th century where housing occurs next to the air pollution generated factory with minimal supportive facility. Also, the quality of these worker housing designs and the outdoor space is rather cruel and insensitive to the need of human being. In the new development, planning of the housing should pay with particular



Images of Housing Development

attention to integrate with the other supportive functions and the work place. The residential area should have an ample amount of designed open spaces in order to promote social activities. Supportive functions such as retail shopping, entertainment and service oriented activities are vital to the residential development located in close proximity with each other. One typical arrangement is to locate the retail shopping on a ground or mezzanine level plaza level shopping mall with a high density highrise residential tower above.

Parking

The existing open parking lot is to be replace by the distribution of concentrated parking structures in the development. The introduction of these parking structure will enable the asphalt parking lot to be convert into more useful open space. The scene of workers who drive in to their company's parking lots, lock the car and walk directly into their work place will alter. These parking structures serving as a collector of automobiles will enable people to leave their car and walk through open spaces such as plazas so that they can appreciate and interact with pleasant environments, thus encouraging more social interaction. The parking structure will be shared among several companies which are within walking distance.

Within a subdivided superblock, the outer perimeter will be devoted primarily to high-tech office uses while the interior blocks will be used for open space, parking structures, internal transportation bus stops and retail. In order to provide clear access points for private automobiles and the buses to the interior functions of the superblock, clear visual street element such as rows of trees or signage should be provided. The streets which connect with the access points should be designed with

Parking Density

Area per parking stall including circulation:	300 sq.ft./stall
Parking:	1 stall per 250 sq.ft of office space
Paking within 12 blocks within a superblock:	1500 spaces/375,000 sq.ft. of office space
Area required for 1500 parking spaces:	450,000 sq.ft.
Blocks(4) within a superblock for open space, services & parking:	250,000 sq.ft.
Suggested FAR for parking structure per block within a superblock:	2.0

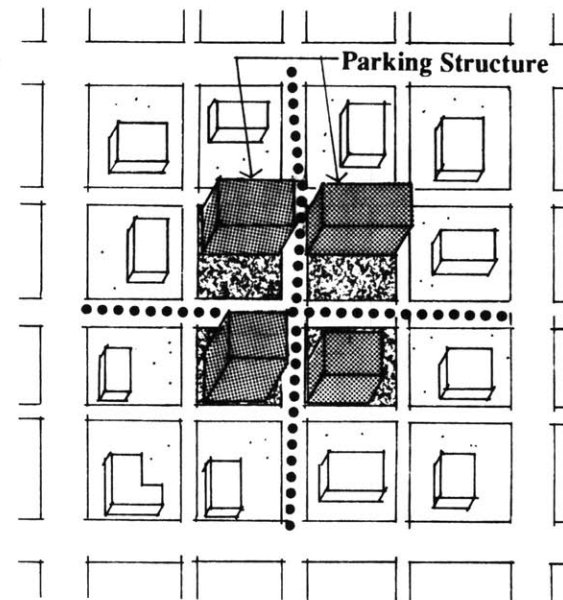
larger capacity to accommodate anticipated higher traffic volume. The numbers and the diagram on the left suggested the density level and the organization of the interior blocks.

Amenity

Since the climate of California is suitable for year round outdoor activities, there should be more outdoor public spaces so that people can relate to their natural environment. Amenity can be perhaps described as urban design elements which transcend pure utilitarian purposes. The goal is to facilitate the relationship between people and their fellows, as well as the natural and built environment. Therefore, public spaces should be treated as an important piece of the urban artifact that deserves special attention and deeper understanding beyond its physical appearance.

In order to achieve a high level of environmental amenity, it requires a combination of natural and man-made elements. Natural vegetation such as trees, shrubs, grass and water can mitigate the effects of sun, rain, wind, glare and reflective heat. Man-made elements such as arcades, overhangs, covered walkways and walls can provide protection from environmental effects. Water perhaps is an important element since the California climate can be quite hot in the summer. Well design and planned water elements such as fountains, pools and ponds can provide a sense of relief from the summer heat. Also, wider circulation and rest areas are needed since future development called for a large amount pedestrian public spaces for residents' activities and workers living within the development to walk or to take the internal transportation system to their workplace.

In addition to the above, visual amenity is crucial to the success of the



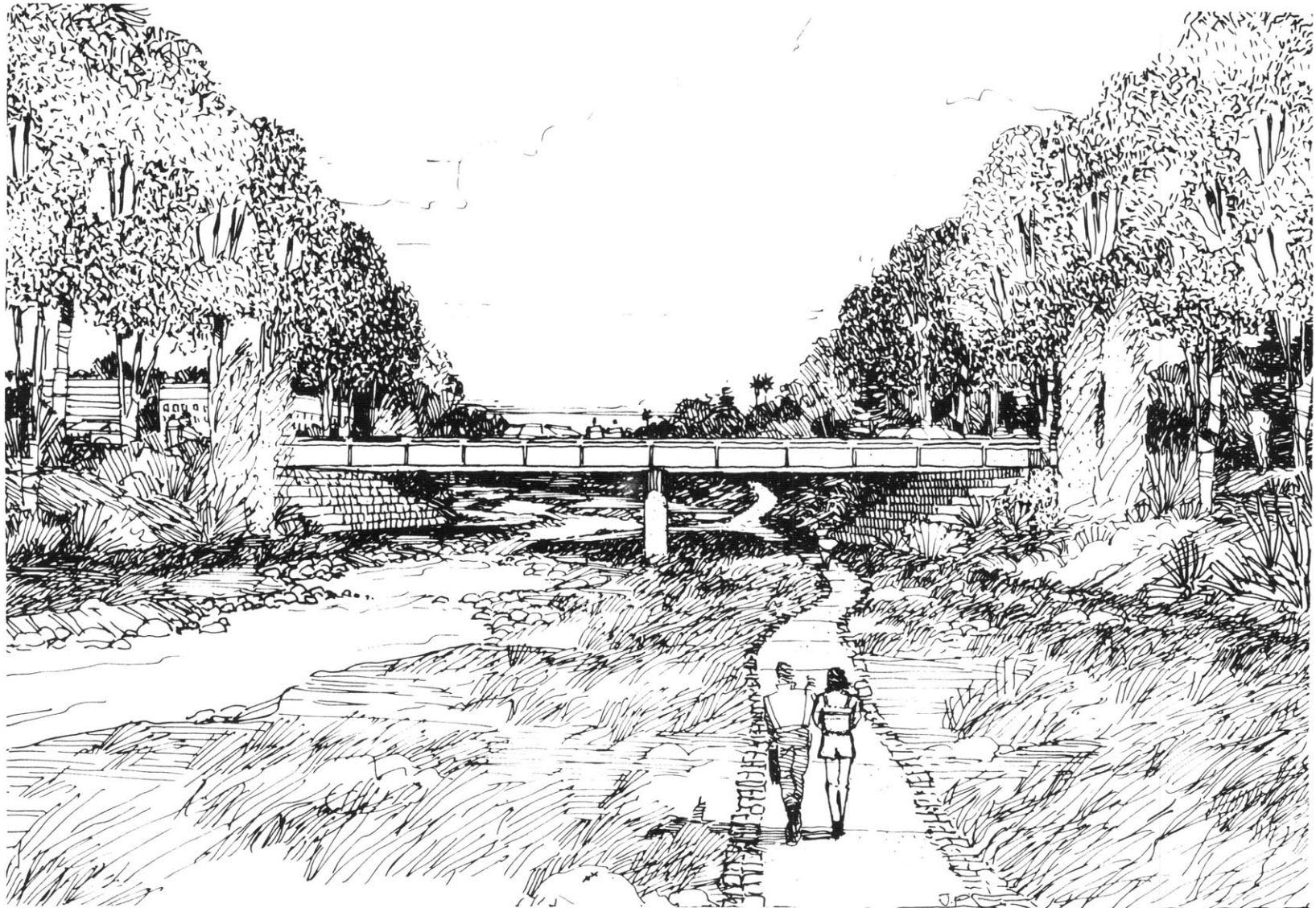


Image of the Greenbelt

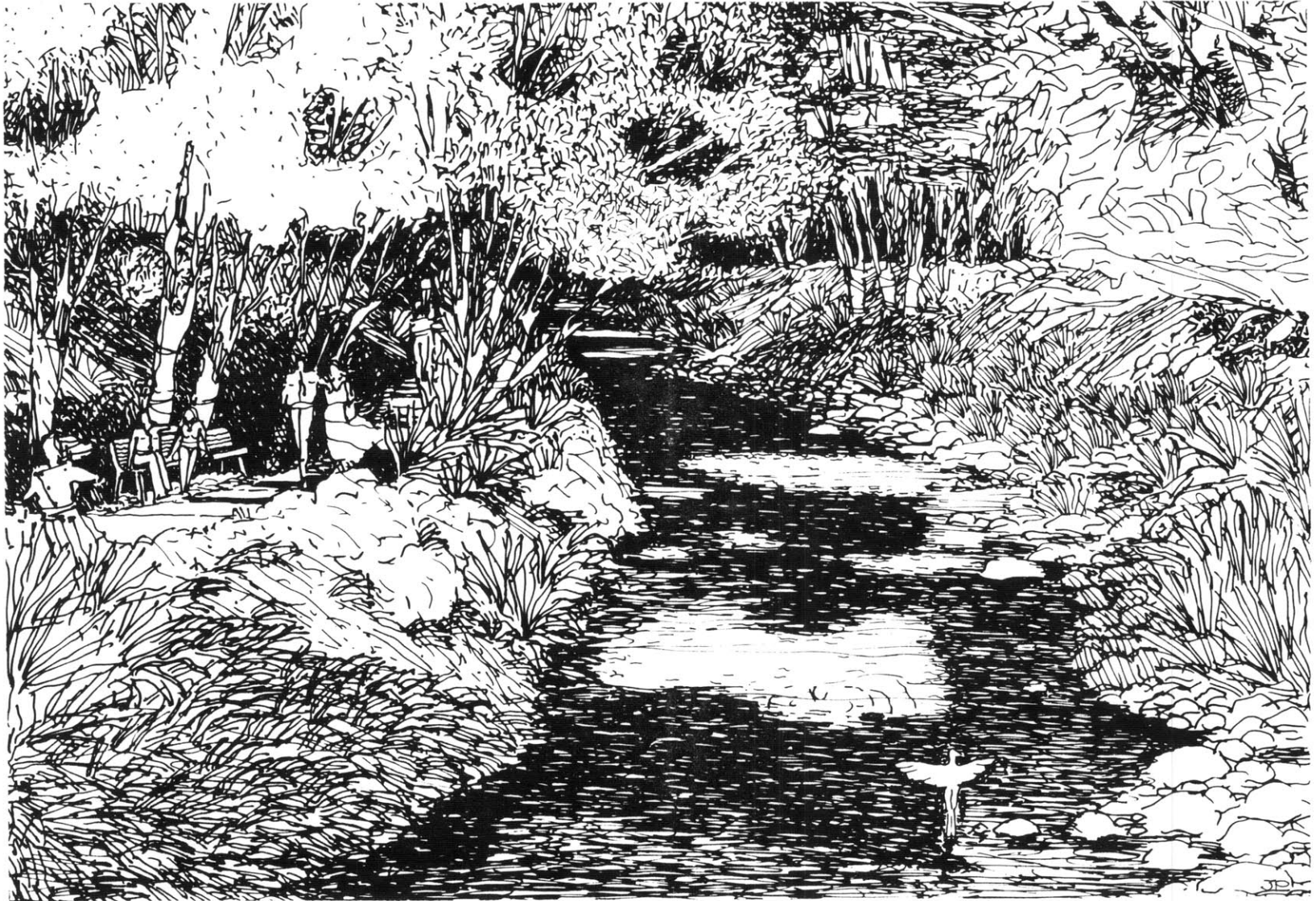
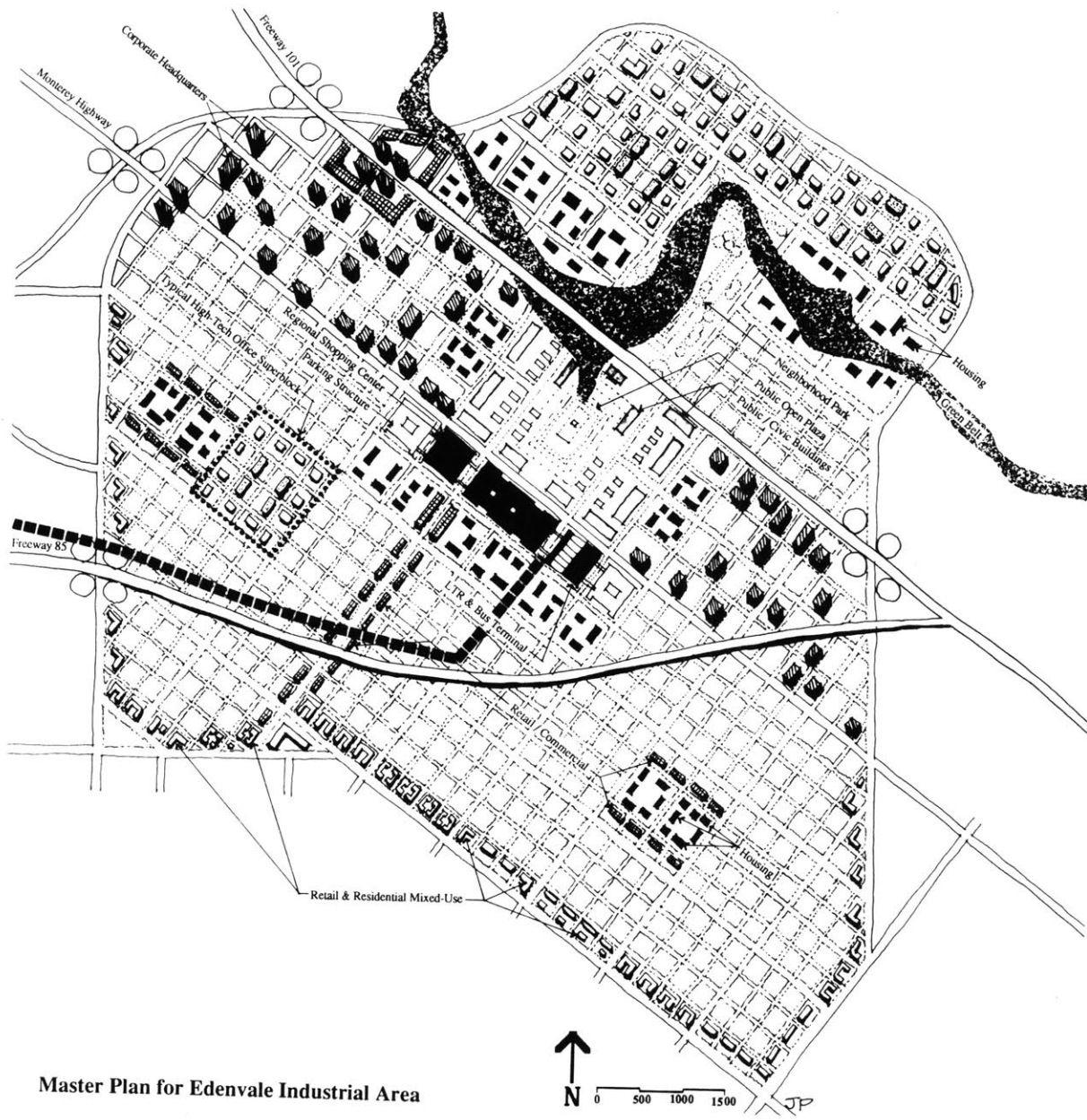


Image of the Greenbelt



Image of Neighborhood Park



Master Plan for Edenvale Industrial Area

development, both functionally and aesthetically. Sign, symbols, rich patterns and textures such as building materials or artwork can provide public information, safety, orientation and sensation.

Summary

The future mixed use high-tech industrial sub-center will achieve a "new sense of place" With the characteristics of mixed use development as described above, this thesis is an attempt to use mixed use development as a tool to create a more stimulating environment to live and to work in. The 21st century high-tech industrial center will no longer be a monolithic environment. Traditional high technology parks contain only a place for working during the day which makes the place useless after working hours. Internal changes within the industry itself and a greater awareness of the impacts of such developments will inevitably force such conditions to change. The development of these new mixed use sub-center in San Jose will form a series of city network links together, coexisting with the dominant business center in the downtown area. The image and status of Silicon Valley as being an international high-tech center will be further enhanced and improved by these new self-sustained sub-center, reflecting its unique entrepreneurial spirit, atmosphere and energy.

Conclusion

This thesis is a point of termination as well as a new starting point for the future urban design and planning work that is constantly needed for the expanding high technology industry in the United States. Using Edenvale as a case, the thesis has at a broader level tried to assess the relationship between the working environment and

its surrounding context. It pin points particular problems caused by the existing high-tech development in the Silicon Valley, thus raising additional questions about the future form of high-tech development. In doing that, this thesis has provided a framework to outline a range of goals and design implication for its future and serve as the initial basis for further design and development for the studied area.

It has been shown that there have been both positive and negative changes to the physical, social and economic structure of the Santa Clara Valley. Postulations on the nature of this ongoing metamorphosis have been based on the assumption that the high-tech industry will grow, although in a somewhat unpredictable manner, and thus increase its affect upon the valley and its urban characteristics. Recognized as a continuing process examined within the limits of a specific program, several generic principles have been implemented as a demonstration of the means available to achieve desirable environments. It is through a strategy of the application of these principles as appropriate to specific sites that the prototypical model can be shown to be valid.

SELECTED BIBLIOGRAPHY

BOOKS and PAPERS

Brotchie, John. The Future of Urban Form: The Impact of New Technology. New York: Nichols Publishing Company, 1985.

Castells, Manuel. Urban Affairs Annual Reviews, Volume 28. High Technology, Sapce, and Society. Beverly Hills: Sage Publicating, 1985.

Gappert, Gary. Urban Affairs Annual Reviews, Volume 23. Cities in the 21th Century. Beverly Hills: Sage Publications, 1982.

Glasmeier, Amy K. High Technology Industries in the Mid-1970s: The Distribution of Industries and Employment. Berkeley: Institute of Urban & Regional Development, 1984.

Glasmeier, Amy K., Hall, Pater & Markusen, Ann R. Defining High Technology Industries. Berekely; Institute of Urban & Regional Development, June 1983.

Glasmeier, Amy k., Hall, Peter & Markusen, Ann R. Recent Evidence on High-Technology Industries' Spatial Tendencies: A Preliminary Investigation. Berkeley: Institute of Urban & Regional Development, 1983.

Hall, Peter G. & Markusen, Ann. Silicon Landscape. Boston : Allen & Unwin, 1985.

Krier, Leon. Houses, Palaces, Cities. A.D. Profile. New york: St. martins Press.

Lynch, Kevin. Good City Form. Cambridge: MIT Press, 1985

Lynch, Kevin. Management the Sense of a Region. Cambridge: MIT Press, 1985

Lynch, Kevin. The Image of the City. Cambridge: MIT Press, June 1985

Markusen, Ann. High Tech America. Boston: Allen & Unwin, 1986.

Markusen, Ann. Defense Spending and the Geography of High-Tech Industries. Berkeley: Institute of Urban

& Regional Development, 1984.

Mumford, Lewis. The Highway and the City. New York: Ballantine Books, 1970.

Rogers, Everett M. The High Technology of Silicon Valley. Maryland: The University of Maryland Institute for Urban Studies, 1985.

Rogers, Everett M. & Larsen, Judith K. Silicon Valley Fever: Growth of High-Technology Culture. New York: Basic Book, Inc., 1984.

Saxenian, AnnaLee. Silicon Chips and Spatial Structures: The Industrial Basis of &Urbanization in Santa Clara County, California. Berkeley: Institute of Urban & Regional Development, 1981.

Starbird, George. The New Metropolis. San Jose, California: The Rosicrucian Press, Ltd, March, 1972.

PUBLIC DOCUMENTS

Alesch, Daniel J., and Levine, Robert A. Growth in San Jose: A Summary Policy Statement. California: Rand, 1973.

Association of Bay Area Governments. Silicon Valley and Beyond: High Technology Growth for the San Francisco Bay Area. Berkeley, 1981.

Bernstein, Alan. Silicon Valley: Paradise or Paradox. Mountain View :Pacific Studies Center., 1977.

City of San Jose. Horizon 2000-General Plan. San Jose, Department of City Planning, 1984.

City of San Jose. Planning San Jose: The Master Plan. San Jose: City Planning Commission, 1965.

City of San Jose. Design for Tomorrow. San Jose: City Planning Department, 1961.

City of San Jose. Urban Development Policies. San Jose: City Council, 1972.

County of Santa Clara Planning Department. A Study of the Economy of Santa Clara County, California. San

Jose, 1977.

National Association of Real Estate Boards. New Goals for Renewal in San Jose and Santa Clara. 1964.

Real Estate Research Corporation. Economic Survey and Analysis. San Jose, 1967.

Stanford Environment Law Society. San Jose: Sprawling City -a report on land use policies and practices in San Jose, Ca. Palo Alto: Stanford University, 1971.

ULI Research Report. Effects of Regulation on Housing Costs: Two Case Studies. Washington D.C.: The Urban Land Institute, 1977.

ARTICLES

_____ "Boom Town," Newsweek. September 4, 1970.

_____ "Correcting San Jose's Boomtime Mistake," Business Week. September 19, 1970.

Florance, Colden. "MXD" AIA Journal. September, 1977

Davidson, Joanne. "Gloom in the Valley...But a Silver Lining, Too," U.S.News & World Report. August 20, 1984.

Donlan, Thomas G. "Can This be Silicon Valley?" Barron's. March 30, 1987.

Fulton, William. "Silicon Strips" Planning. May, 1986.

Garcia, Art & Barnett, Chris. "Silicon Valley: where has it been, where it's going," Business Week. June 11, 1984.

Karmin, Monroe W. "High Tech: Blessing or Curse?" U.S. News & World Report. January 16, 1984

Kotkin, Joel. "racing to Stay in Place," INC. October, 1984.

McCusker, Tom. "In Focus: Reality Hits the Valley," Datamation, April 15, 1985.

Neal, Roger. "Because the Land was Cheap," Forbes, September 24, 1984.

Rogers, Michael. "Trouble in the Valley," Newsweek, February 25, 1985.

Skrentny, Roger. "Spotlight on Silicon Valley's 'laid back' Style of Management," management Review, December, 1984.

Slutsker, Gary. "The Silicon Valley Greater Co-prosperity Sphere," Forbes, December 17, 1984.

UNPUBLISHED MATERIALS

Cavanagh, Carlos R. Urban Expansion and Physical Planning in San Jose, California: a Case Study. (Master's Thesis: University of California, Berkeley, 1977.)

Rodriguez, David. Land Use Planning in the City of San Jose. (Master's Thesis: San Jose State University, 1984.)

Tanaka, Richard K. The Politics of Growth in San Jose and the 1980 Annual Review of the General Plan. (Master's Thesis: San Jose State University, 1979.)

Zarchami, Fereshteh. A Study of Growth in San Jose 1940-1943. (Master's Thesis: San Jose State University, 1983.)

OTHER SOURCES

Moline, Julio. Television Series-Silicon Valley: Boom Town. San Jose: KTEH 54(PBS), 1987.