

PROGRAMING AND DESIGN CRITERIA FOR A HIGH
DENSITY URBAN RESIDENTIAL COMPLEX

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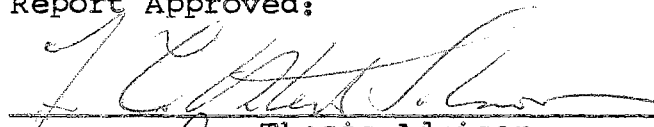
May, 1964

Submitted to the Faculty of the
Graduate School of the
Oklahoma State University
in partial fulfillment of
the requirements for
the degree of
MASTER OF ARCHITECTURE
May, 1968

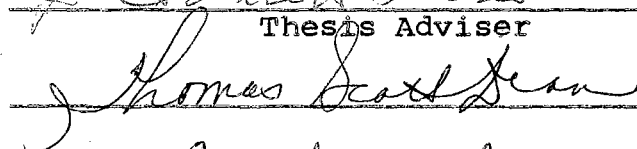
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688674

ACKNOWLEDGEMENTS

I take great pleasure in acknowledging my sincere appreciation to Professor F. C. Salmon, whose invaluable supervision, help and suggestions have made this study possible. Special gratitude is also extended to Professor George Chamberlain and Dr. Thomas Dean, who greatly aided in the completion of my masters program. Along with other members of the faculty of the School of Architecture, they have given me great respect and appreciation of architecture.

Appreciation for valuable assistance and encouragement in my studies is extended to Miss Beverly Braun and Mrs. David McCall. Gratitude for her untiring assistance in typing the manuscript is also expressed to Mrs. Eddie Barbre.

Very special thanks is given to my husband for his encouragement and patience which have contributed so much throughout my studies.

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NOMENCLATURE

N	Number of households in commercial study sample.
$P_{\%}$	Percent of national population in each income bracket.
N_1	$(N)(P_{\%})$, Conversion factor for sample data to national population data.
A	Average persons per household.
N_2	$(N_1)(A)$, Conversion factor to apply national data to development area data.
P_t	Proposed population of development site.
K	$\frac{N_2}{N_2}$, Percent of development area residents per income bracket.
P_i	Number of residents per income bracket.
D	$\frac{P_i}{A}$, Number of dwelling units in each income bracket.
ϕ	$(D)(N_2)$, Potential purchasing power.
C	Consumer good expenditures.
S	Shoppers' goods expenditures.
O	Expenditures for other goods and services.
P_{actual}	Actual purchasing power of residents
A_s	Store area needed.
A_p	Parking area needed.
E	Total enrollment for school.
K	Kindergarten enrollment.

NOMENCLATURE (continued)

S_C	Number of students per classroom. Total number of classrooms needed.
n_s	Number of sets needed.
n_r	Number of regular classrooms needed.
n_k	Number of kindergarten rooms needed.
S_k	Number of students per kindergarten room.
P_s	School age population.
E_{es}	Estimated elementary school enrollment.
E_{jh}	Estimated junior high school enrollment.
E_{hs}	Estimated senior high school enrollment.
G	Generative businesses.
S	Shared businesses.
Sus	Susipient businesses.

CHAPTER I

INTRODUCTION

Due to the recent trend toward urbanization, the problems of high density housing have become of urgent concern to architects, planners, sociologists, economists and public officials of central cities. Land is expensive and scarce in urban areas, a fact which justifies efforts now being made to provide homes for large numbers of people through high density development.

Physical design of housing alone cannot control human behavior. However, design has a unquestioned influence upon the comfort and attitudes of residents. The arrangement of housing units with respect to one another has been studied to determine social interaction patterns generated in housing areas. It was found that the physical location of a particular dwelling unit seemed to consistently generate certain leadership and friendship patterns.¹ Use of physical design elements in an attempt to create sociological interaction patterns would require the combined efforts of architects, sociologists, economists, and psychologists. However, investigation of such patterns may direct the concerned architect in eliminating at least some physical causes of problems in large housing projects. For instance, Jane Jacobs² believes that elimination of spaces which invite physical assault due to their isolation from frequent

pedestrian traffic and watchful eyes of residents can improve physical design. Social disorganization typified by vandalism, theft, and other attacks on the safety and property of residents is an acute problem in high density housing areas. Social control is often furnished only by the police forces in these communities. Residents do not know one another and have little concern for their neighbors. The individual's reputation in the community is not very important to his success, since few people are even aware of his existence. In this situation people tend to refuse to become involved in problems concerning others, even when a phone call to police might help a fellow resident in an emergency situation. Because people tend to become acquainted through accidental and frequent contact, the architect should take advantage of physical arrangement to at least provide opportunities for residents to observe the activities occurring in their neighborhoods. Once a development gets the reputation of having watchful and concerned residents, the crime rates will usually become much lower.

Designers have omitted essential elements for multi-family housing to reduce construction costs. These omissions may account for the apparent failure of some low-cost housing programs. When plumbing is defective or adequate recreational facilities are not provided, irritations with physical discomforts are often reflected by residents' attitudes. For instance, in the Pruitt-Igoe public housing project in Saint Louis, Missouri, the population

was too dense for the facilities provided.³ Because of "economization" design the elevator stopped every three floors giving "vandals" and "high-jackers" an excellent opportunity to fleece the residents without being detected. Vandals ripped the exposed plumbing from its brackets and sold it as scrap metal. Play areas consisted of flat unlandscaped open spaces without adequate play equipment to occupy active and poorly disciplined children. This resulted in children turning to more destructive forms of entertainment.

It is, perhaps, not a coincidence that another public housing project in Saint Louis, known as the Clinton-Peabody Terraces, seems to function much more smoothly than the Pruitt-Igoe development. School facilities are adequate there, play areas are plentiful and well equipped, and the crime rate is low in the Clinton-Peabody development, where consideration was given to the total environment of residents.

Many problems are found in communities where almost all residents are near the same age and in the same stage of the life cycle. Suburban community studies⁴ have revealed some of the disadvantages of homogeneous communities. When elderly persons are separated from other age groups and placed in retirement communities and rest homes, they often develop a feeling of uselessness and refuse to ask for help from younger persons or relatives when it is necessary because they do not want to impose upon them. Communication with young people then becomes difficult, and many times

these people begin to feel that they are simply "waiting for death." They may not be able to participate directly in vigorous activities, but they certainly may find pleasure in observing it. They seem to need an environment in which they feel useful.

In the same studies psychological disorders in the form of fear of pregnancy were thought to have been caused by the lack of contact with older women who were in more advanced stages of the life cycle. Their neighbors were approximately the same age, so they had little contact with women who had already experienced the problems they faced. They seemed to be unsure of their roles in the community, since there were no older women to set the example. Many social problems were easily solved in the "West End" area of Boston, another community studied.⁵ The age groups and stages of the life cycle found in it were of a wide variety.

The author has extensively investigated a number of studies made in urban, rural, and suburban communities. These included studies from several countries and a number of selections on racial and ethnic group problems. As a result, it is believed that high density urban development should offer residents the following elements: 1) a plan that could successfully house families of a variety of age groups, family sizes, and socio-economic backgrounds; 2) housing design that can give residents a feeling of intimacy and identity and does not neglect the human scale in the effort to supply the needed volume of enclosed living

space; 3) sufficient facilities for recreational and educational programs; 4) an atmosphere that attracts needed commercial and professional services to serve the residents; 5) living units that are acoustically insulated to prevent objectionable traffic noises from entering apartments; 6) acoustical design that prevents sound transmission from one dwelling unit to another; and 7) housing units that will attract long-term rather than short-term tenants, or offer a variety of unit sizes so that tenants can change to other apartments in the development area when their family size increases or decreases.

In this study a development site designated as the "Hunters Point Redevelopment Project Area G" by the San Francisco Department of City Planning has been chosen as the basis for developing a program and design criteria for a high density urban residential complex.

CHAPTER II

EXISTING CONDITIONS

General Characteristics

The one hundred forty acre development site is located very near the shore on San Francisco Bay in California. In order to understand the site and its proposed design possibilities, it is necessary to study the region, locality and vicinity of the project area. Figure 1 shows the San Francisco region in which the development site is located.⁶ The vicinity and locality maps in Figure 2 indicate the street pattern, which affords easy access to the proposed freeway (indicated by a heavy dashed line) and to other fast-moving major arteries which make other parts of the San Francisco Bay area and beyond easily accessible.

The aerial photo in Plate I shows the area surrounding the site. The "financial district" is very near the site and is conveniently located to U. S. Highway 101, which is also Interstate 80. The site is approximately three miles from San Francisco's Civic Center. It overlooks the Bay to the east, Candlestick Point to the south and the City to the west and north.

The weather seems to have had particular significance in the development of the San Francisco Bay Region. The

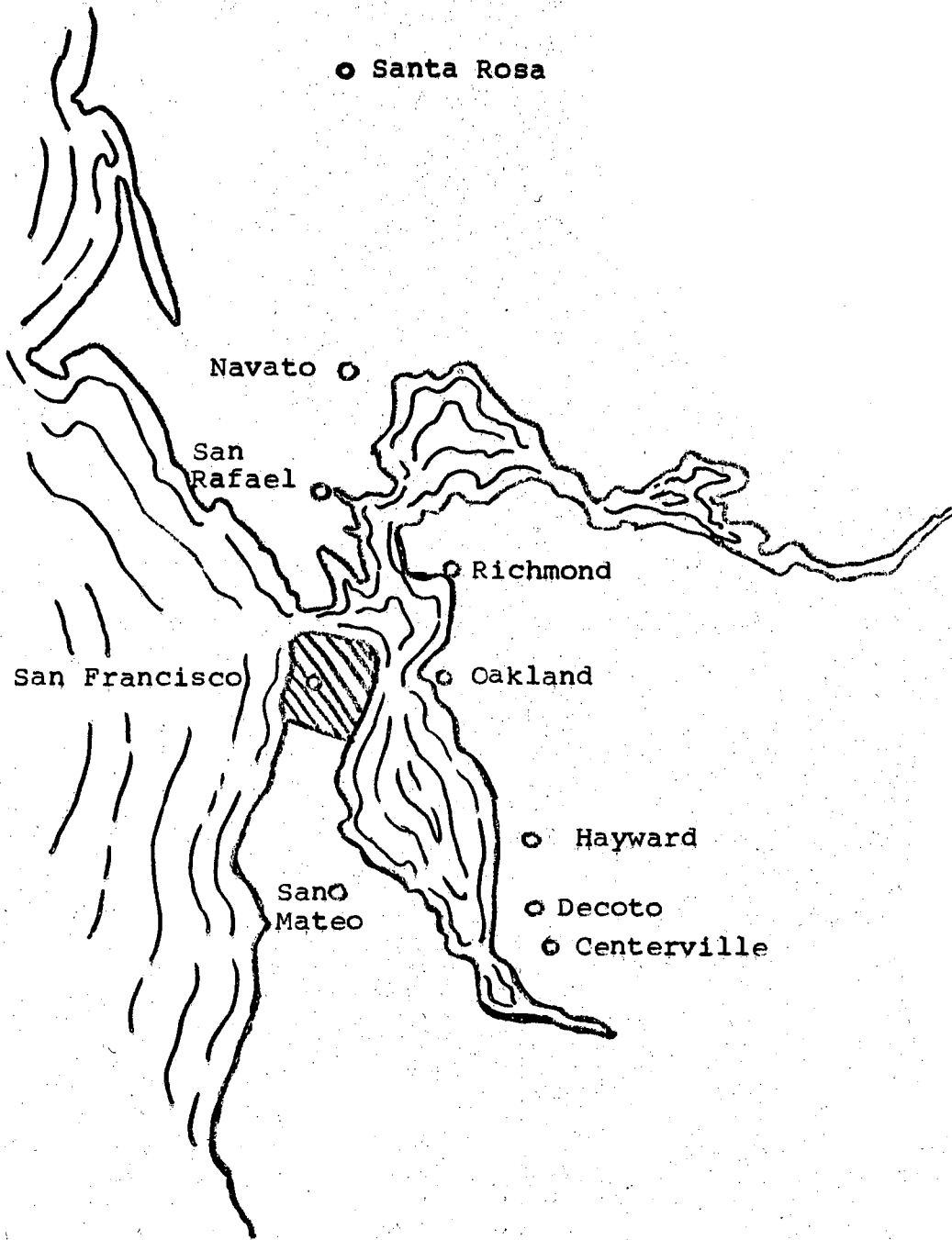


Figure 1. Map Showing Region of Redevelopment Site.

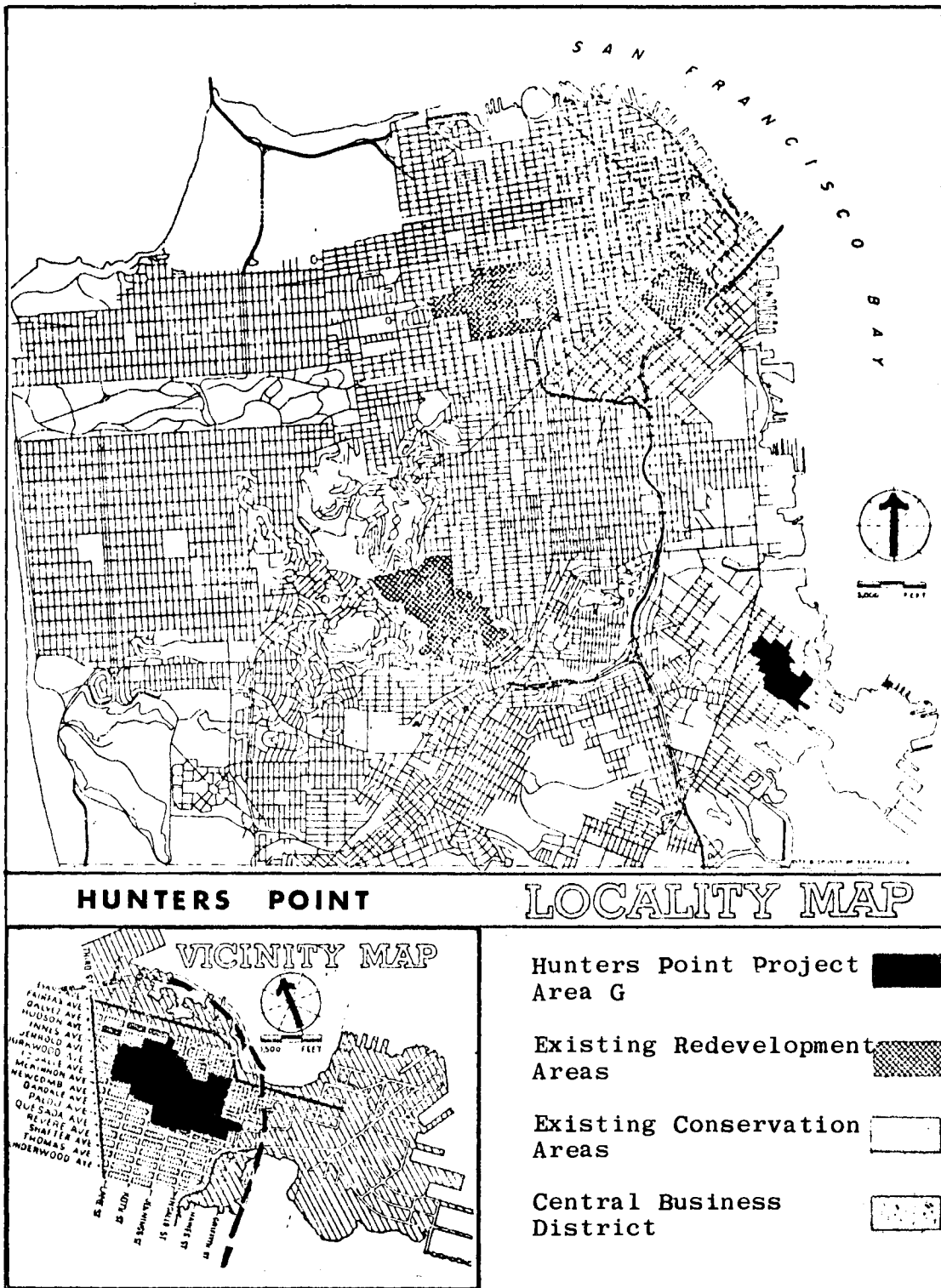


Figure 2. Locality and Vicinity Maps of Development Site.

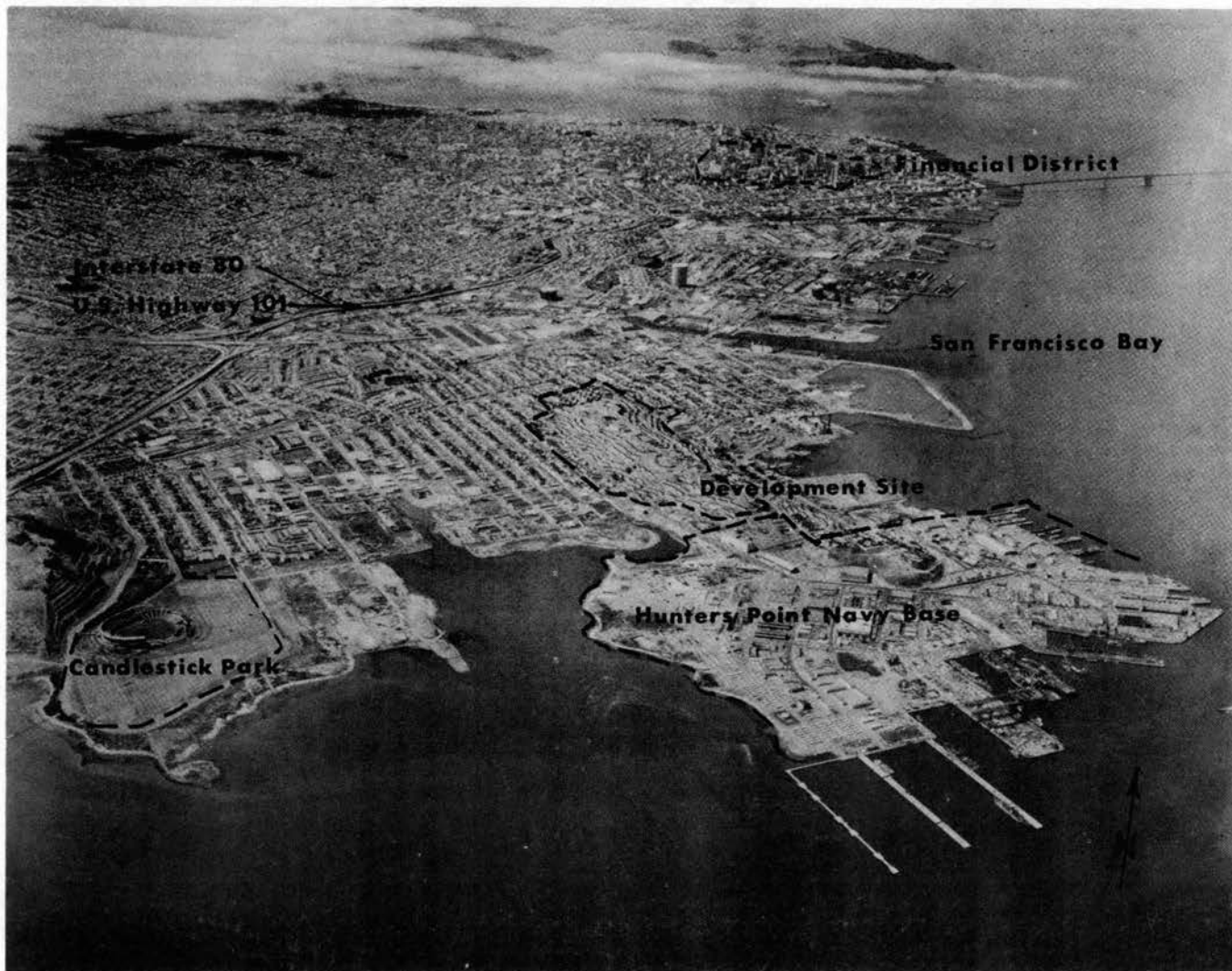


Plate I. Aerial Photo of Site Vicinity.

climate of the central city has attracted population and business firms through its many outdoor work days without freezing temperatures or uncomfortable heat. The data in Table I and II indicate the prevailing weather conditions.⁷

TABLE I

TEMPERATURE DATA FOR SAN FRANCISCO BAY REGION, 1959

Temperature	Amount
Monthly mean	56.5° F
Daily mean (maximum)	62.6° F
Daily mean (minimum)	50.4° F
Highest On Record	101.0° F
Lowest On Record	27.0° F
Average Relative Humidity	73.0%

TABLE II

PRECIPITATION DATA FOR SAN FRANCISCO BAY REGION, 1959

Precipitation	Amount
Total inches per year	22.18 inches
Days with .01 in. or more	67 days
Average snowfall, inches	0.20 inches
Sunshine, % of possible	66 %
Clear days per year	164 days
Average Wind Velocity	9.10 MPH

At the height of World War II the site became a temporary war housing project for men and women engaged in building and repairing ships. It is a hill located adjacent to San Francisco's Hunters Point Navy Base. Due to the condition of these dwellings they are scheduled for destruction by 1970. In Plates II and III an

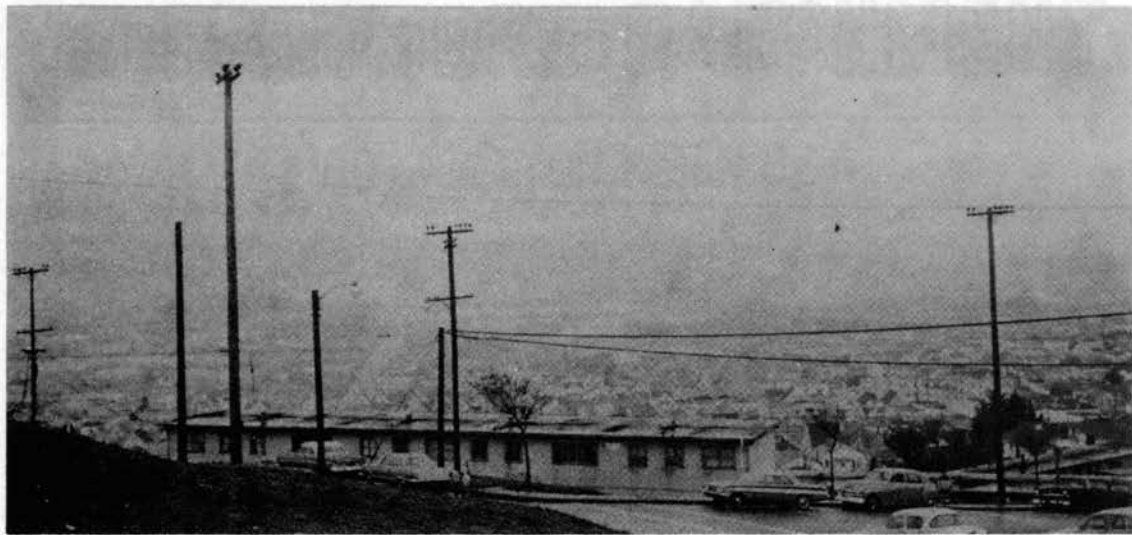


Plate II. Existing Development

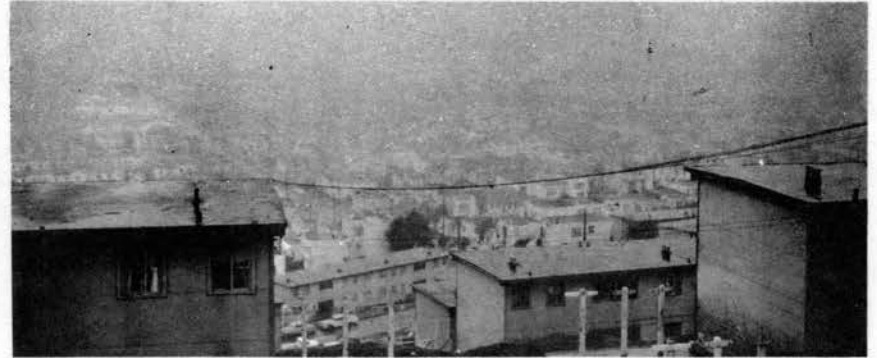


PLATE NO. III EXISTING DEVELOPMENT

impression of the existing dwelling units and commercial center can be seen. The waterfront to the north has mixed businesses; obsolete meat packing plants; junk yards; run-down boat repair facilities; and marginal shops, cafes, and taverns.

The Contour Map in Figure 3 shows the elevation changes in the site. Each contour line represents a twenty foot elevation change. The slope of the land is so great that special consideration must be given to the street systems, parking areas, storm drainage system, and building design.

The families now residing in the project area are housed in 1,800 units and, for the most part, have low incomes. These people will have to be relocated during the construction phase of the site development. It is possible that through rent subsidy program participation they may be able to return to the area when the construction is completed.

Existing Land Use

Existing land use in the redevelopment area is shown in Figure 4. The residential area bounded by India Street, Earl Street, Innes Avenue and Hanes Street is shown on the contour map; however, as it is presently under water, it is not shown on the existing land use map.

The waterfront area and the vacant land along Hunters Point Boulevard shall be given consideration in the preparation of the program and design criteria. The treatment of these areas are considered to be vital in successful redevelopment of the site, as they are in very poor condition at

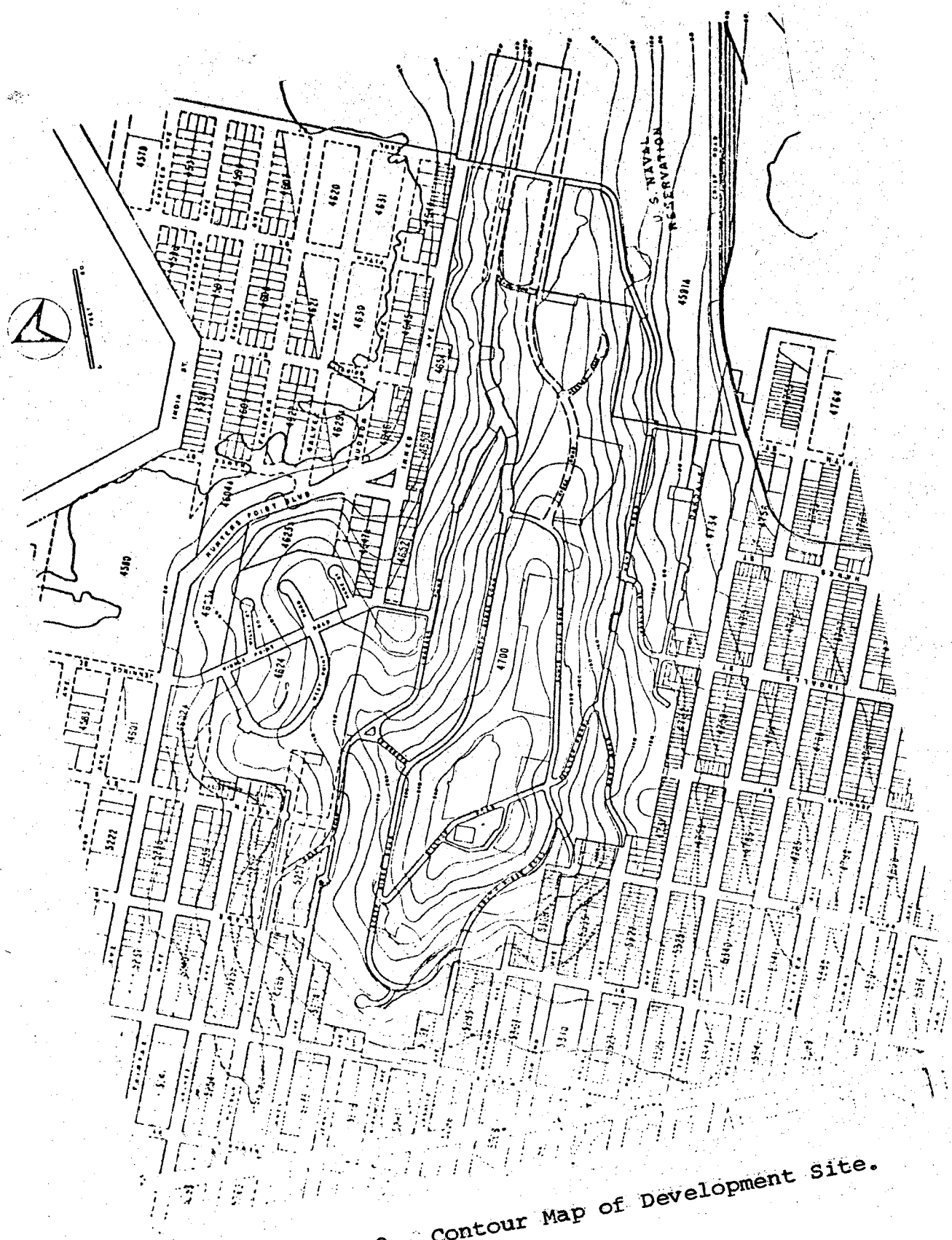


Figure 3. Contour Map of Development Site.

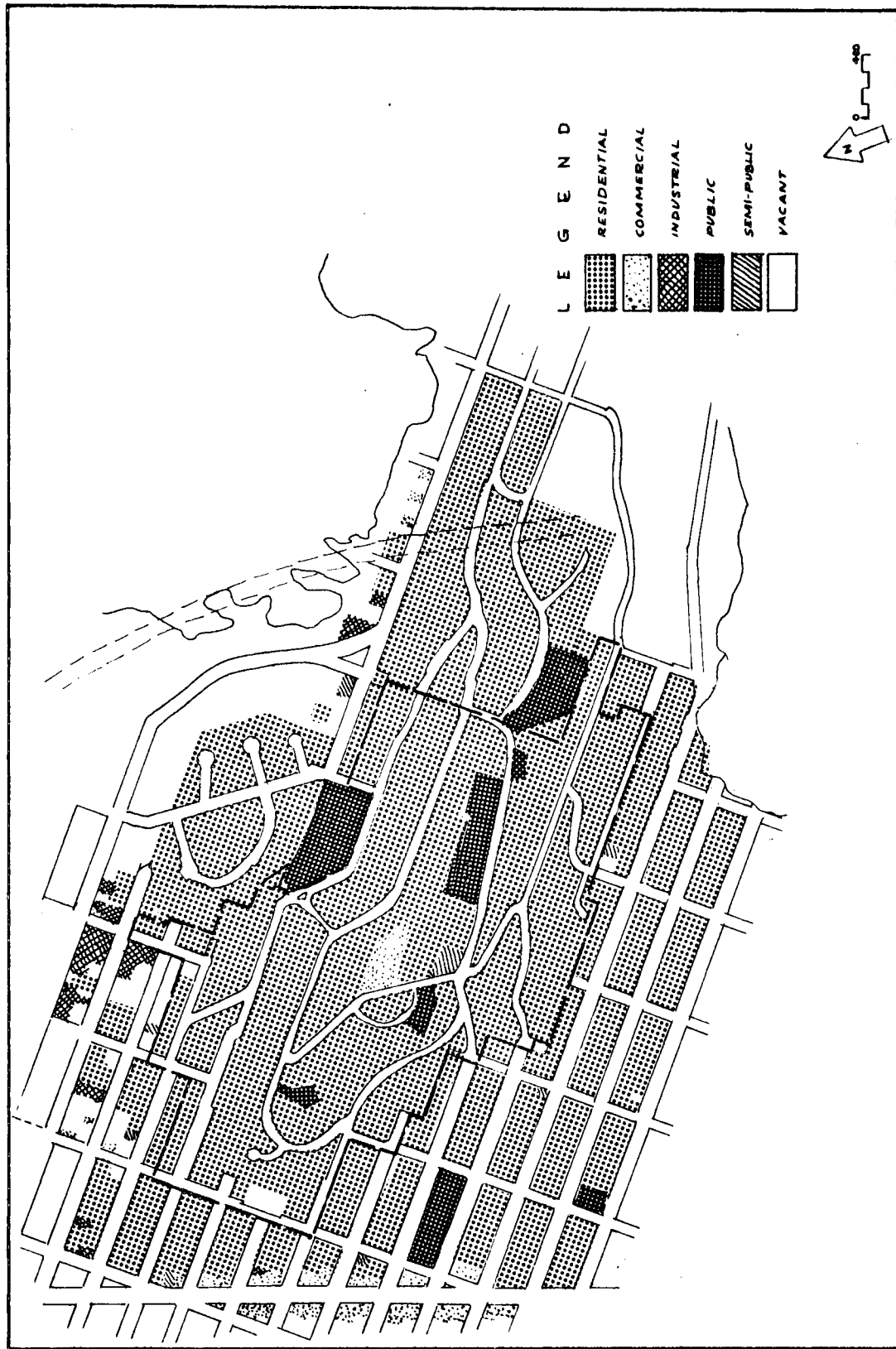


Figure 4. Existing Land Use Plan for Development Site.

this time. The residential area to the west and south is not included in the project area. However, it seems probable that certain industrial land uses, which are incompatible with the predominating residential uses, should be removed. If they remain they may continue to blight this area, which has been designated for rehabilitation by the San Francisco Department of City Planning.

CHAPTER III

GUIDELINES FOR DEVELOPMENT

Methods of Investigation and Analysis

Residential:

Methods of investigation and analysis will be developed for estimating space requirements for housing residents in the development area and furnishing needed community amenities. The proposed population will consist of 20,000 persons. The needs of the community can be classified as 1) residential, 2) commercial, 3) recreational, 4) educational, or other facility needs.

Residents may vary in personality traits, tastes, financial assets, age, stage of life cycle, and personal situations. It is necessary to classify residents for study if their various needs are to be considered in community and housing design. The following classification can be used:⁸ 1) single persons, 2) the beginning family, 3) the expanding family, 4) the expanded family, 5) the contracting family, 6) the contracted family, 7) the independent senior citizen, and 8) the dependent senior citizen.

The "single persons" include those who have never married and those who are divorced, widowed, or, for

other reasons, live alone. Among this group of people a wide variety of ages, personality traits, and personal situations will be found. A large proportion of these residents will be young people who have finished high school or college and are employed. They will probably be highly mobile, as many of them will marry within a short period of time and move into the "beginning family" stage of the life cycle. Some single persons will be middle aged or in the more advanced years and will never have married, while others will have been divorced or left alone by the death of a spouse. A special facility can be provided so single persons can enjoy a diversity of social activities and meet others with the same interests. Though apartment complexes will be designed primarily to house families, there will also be appropriate units for single persons and independent senior citizens. One bedroom units may be desired, or several persons may wish to share a larger apartment. In the case of the sharing of apartments, a maximum number of occupants per apartment size will have to be set to avoid problems of over-crowding. If single residents are new arrivals in the community, apartment complexes will not be able to offer as many opportunities for meeting other single adults as the resident hotel.

The "beginning family" consists of couples from the time of marriage until the birth of the first child. Apartments for them should be designed for the most part as one and two bedroom units. Many wives in this group may be working. The income of newly-weds is usually quite low in

comparison to couples in later stages of the life cycle. Many expenses are eliminated for some time because of wedding presents of appliances, clothes, linens, and other household items that would otherwise require considerable expenditures. The beginning family usually has more leisure time and fewer responsibilities than those in the next three stages of the life cycle. Physical health of the young couple is generally very good, resulting in few prolonged illnesses. The homemaking skills of the new bride may require alterations in living habits. She must adapt to the husband's eating habits and food choices, as well as assume responsibility for budgeting and doing laundry and other tasks not commonly done by the single girl. Few families in this stage buy homes, as they realize it is difficult to anticipate the amount of space they will need in the event of family expansion. Minimum housing requirements may consist of a combination dining and kitchen area, one bedroom, a living room and a bath. Less storage space is needed at this time than in later cycle stages. Table III gives minimum space requirements for housing for several household sizes.⁹

TABLE III

MINIMUM SPACE REQUIRED IN DWELLING UNIT

Number of Persons	Square Feet Required
1	400
2	750
3	1,000
4	1,150
5	1,400
6	1,550

The "expanding family" embraces the period of the life cycle from the birth of the first child to the birth of the last child. Expenses of the expanding family change because of 1) increased number of family members, 2) increased feeling of responsibility, and 3) increased incomes. Increased feelings of responsibility usually result in arrangements for security for families, such as insurance, college funds, savings, and financial investments. At this time medical expenses are usually higher, so that often health insurance policies covering the entire family are obtained. The expanding family has a tendency to purchase houses, furniture, and automobiles.

Activities of the expanding family may consist of resting, talking, visiting with guests, dancing, reading, keeping collections, needlework, thinking, listening to radios or record players, watching television, enjoying pets, displaying articles of interest, writing letters, playing games and showing films. Eating for these families may require a variety of food preparation for meals such as quick breakfasts, snacks, family meals, dress-up meals, dinner parties, refreshments, large luncheons, and holiday or other large celebrations. The requirements for laundry increase considerably over the previous stage of the life cycle.

The "expanded family" consists of the period of time from the birth of the last child until the time the first child leaves home. Many needs in this stage are the same as for the expanding family and vary with the number of

children and their age range. Adolescents require more space than younger children. Increased bedroom space requirements will occur when girls and boys must be provided with separate rooms as they grow older. Girls require more space for primping. Adolescent children feel a greater need for privacy than younger children. They often need a more quiet atmosphere for studies and a greater space for clothing storage.

The "contracting family" embraces the period of time between the first child's leaving home and the last child's leaving home. This stage requires considerable changes in space requirements due to alterations in functions and activity. Parents must make the difficult transition from very active activities of family rearing to reduced demands of time by the children as they begin to reorganize and construct their own lives. Often, when living at home, grandchildren or married children who have lost a spouse may slow the adjustment and make the transition smoother.

By the time a couple reaches the "contracting family" stage, the husband and/or the wife may be nearing occupational retirement. The individuals faced with this situation must often adjust by finding substitutes for paid work activities.

The contracted family requires a little more space than the beginning family for storage as a result of years of accumulation, yet not as much as families with children. Design of apartments for contracted families should be similar to, if not the same as, those for senior citizens,

since there is difficulty in persuading senior citizens to move to apartments equipped with safety devices designed to aid them in remaining independent for a longer period of time. People do not like to admit to themselves or to others that they are losing certain capacities to function; therefore, if the devices are installed when they move to smaller apartments after the children are grown, they will be adapted to them by the time the need for their use becomes critical. Actually, most of these safety devices are desirable for residents of all ages, but due to expense, they are seldom provided until they are acutely necessary.

The "independent senior citizen" group consists of residents over sixty-five years old who are capable of taking care of themselves. The income of persons in this stage is lower than it was previously. The expenses for necessities generally are less than when children were growing up, provided that all children have become self-supporting. However, medical expenses and prolonged illnesses often absorb much of the senior citizen's income. Most elderly people prefer to live independently as long as they are capable of caring for themselves. They would prefer to live near their children so that contact is easy and frequent visits with grandchildren is possible. The senior citizen should have special facilities in their homes for safety and for reduction of energy expended for household tasks. Hand rails, non-slip floors, louder doorbells, night lights, furniture that is easy to get in and

out of, well lighted work areas, and reduction of breakable objects are essential in this period of life. Some senior citizens will require extra space for hired help to stay during short-term illnesses which require constant surveillance.

The "dependent senior citizen" group consists of residents over sixty-five years of age who must have help, constant surveillance, or hospital care on a regular basis. The cost of such care is often prohibitive if acquired on an individual and private basis. For severe cases hospital facilities should be utilized; however, a special care complex should be provided to handle less severe cases and supplement the hospital facilities.

With a general understanding of the proposed population characteristics, it is possible to formulate a concept of housing facilities to provide for needs of residents. The single persons and single independent senior citizens might find a resident hotel suitable to their housing needs, while others will prefer apartment living. Families will have a wide variety of living unit sizes to choose from as they expand and contract during the life cycle. Dependent senior citizens and convalescents will be able to use the special care complex, if they desire.

The data in Table III were used in the preliminary estimates of the dwelling unit needs as a guide for estimating minimum housing needs. As a result, the distribution of dwelling units and densities are proposed as presented in Table IV.

TABLE IV
PROPOSED RESIDENTIAL NEEDS

Residential Complex	Number of Units	Type of Dwelling	Number of Residents	Density (Units per acre)
Residential Complex I				
Tower Courts	462	medium rise	1,155	230
Lakeshore Homes	228	townhouses	1,140	50
Hillside Homes	890	medium rise	4,959	250
	235	low rise	504	16
Residential Complex II				
Plaza Terrace	880	medium rise	2,640	207
Residential Complex III				
Bay View	2,160	high rise	6,480	277
Residential Complex IV				
Garden & Towers	380	high rise	1,140	111
	315	megastructure	2,205	102
	162	townhouses	486	208
Residence Hotel	500	high rise	1,000	---
TOTAL:	6,632		23,005	

Commercial:

The computations that resulted in the determination of the commercial needs for the development site are described in terms of data shown in Tables V through XIV, the basic commercial needs of the residents are dependent upon their financial resources and consumer expenditure patterns. Annual income is one of the determinate factors. National trends in consumer expenditures were used in determining what residents will need in terms of shopping facilities.

In Table V, annual income is divided into seven brackets to improve the accuracy of the total computation.

TABLE V

PER CENT OF FAMILY INCOME SPENT PER TYPE
OF ITEM PER INCOME BRACKET LEVEL

Type of Goods or Service	Income Bracket						
	Under \$2,000	\$2,000- \$2,999	\$3,000- \$3,999	\$4,000- \$4,999	\$5,000- \$6,999	\$7,000- \$8,999	\$10,000 or more
1. Foods, Beverages	36%	33%	30%	29%	28%	26%	24%
2. Clothing & Accessories	11%	11%	13%	13%	11%	13%	14%
3. Medical and Personal	7%	5%	6%	5%	5%	5%	6%
4. Home Operation & Improvement	17%	20%	18%	19%	19%	18%	18%
5. Home Furnishing	7%	8%	8%	8%	9%	9%	10%
6. Recreation	5%	5%	5%	6%	5%	5%	6%
7. Automotive	11%	13%	15%	14%	16%	15%	15%
8. Other goods and Services	6%	5%	6%	7%	7%	9%	7%
TOTAL	100%	100%	100%	100%	100%	100%	100%

TABLE VI

CHARACTERISTICS OF PROPOSED POPULATION
BY INCOME BRACKET

Characteristic	Income Bracket							Total
	Under \$2,000	\$2,000- \$2,999	\$3,000- \$3,999	\$4,000- \$4,999	\$5,000- \$6,999	\$7,000- \$9,999	\$10,000 or more	
A, average persons per household	2.7	3.2	3.4	3.4	3.6	3.7	3.8	
Average Expenses, all goods and services	\$1,933	\$2,924	\$3,839	\$4,363	\$5,016	\$6,063	\$7,946	
N, number of households in sample	1,940	1,546	1,544	1,882	1,934	913	484	
P _x , per cent of national population	18.9%	15.1%	15.1%	18.4%	18.9%	8.9%	4.7%	
N ₁ , (N) (P _x)	367	233	233	346	365	81	23	
N ₂ , (N ₁) (A)	990	735	792	1,176	1,318	300	87	5,409
P ₁ , (K) (P _t)	3,760	2,760	2,920	4,340	4,880	1,120	320	
D, number of dwelling units	1,392	863	860	1,278	1,355	303	84	6,135
<i>μ</i>	\$2,695,735	\$2,523,412	\$3,301,540	\$5,575,914	\$6,796,680	\$1,837,089	\$667,464	\$23,170,695

TABLE IX
ESTIMATED EXPENDITURES PER TYPE OF ITEM BY RESIDENTS

	Income Bracket						
	Under \$2,000	\$2,000- \$2,999	\$3,000- \$3,999	\$4,000- \$4,999	\$5,000- \$6,999	\$7,000- \$9,999	\$10,000 or more
Average Family Expenditure:	\$2,695,735	\$2,523,412	\$3,301,540	\$5,575,914	\$6,796,680	\$1,837,089	\$667,464
Expenditure per Type of Goods:							
1. Foods, beverages	970,465	832,726	990,462	1,617,015	1,903,070	477,641	160,191
2. Clothing & Accessories	296,531	277,575	429,200	669,110	747,635	238,822	93,445
3. Medical and Personal	188,001	126,171	198,092	278,796	339,834	91,854	40,048
4. Home Operation & Improvement	458,275	504,628	594,277	1,059,424	1,291,369	330,676	120,144
5. Home Furnishing	188,001	201,873	264,123	446,073	611,701	165,338	66,746
6. Recreation	134,787	126,171	165,077	333,855	339,834	91,854	40,048
7. Automotive	296,531	328,044	495,231	780,628	1,087,469	275,563	100,120
8. Other Goods and Services	161,744	126,171	198,092	390,314	475,768	165,338	46,722
TOTAL:	\$2,694,335	\$2,523,359	\$3,334,554	\$5,575,215	\$6,796,680	\$1,579,088	\$667,464

TABLE X
PERCENT OF EXPENDITURE PER TYPE OF PURCHASE

Type of Goods or Services	Per Cent Expenditure by Income Bracket						
	Under \$2,000	\$2,000- \$2,999	\$3,000- \$3,999	\$4,000- \$4,999	\$5,000- \$6,999	\$7000- \$9,999	\$10,000 or more
FOODS, BEVERAGES:							
Super Markets	89.5%	87.0%	88.4%	88.4%	88.0%	87.0%	87.3%
Liquor	1.0	3.0	1.6	1.2	2.0	2.2	4.7
Tobacco	9.5	10.0	10.0	10.4	10.0	10.8	8.0
CLOTHING & ACCESSORIES:							
Men & Boy Clothing	27.8	26.3	24.1	30.3	29.4	31.7	27.8
Men & Boy Shoes	7.0	7.3	7.0	4.9	6.1	5.5	3.9
Women & Girls Clothing	45.2	47.0	51.8	48.1	48.2	46.6	55.6
Women & Girls Shoes	9.0	7.6	7.0	6.6	6.7	9.3	7.0
Infant Clothes	3.5	5.5	4.6	4.4	3.5	2.9	1.9
Other Clothing	3.0	2.9	3.4	2.4	3.3	1.7	2.8
Other Shoes	4.5	3.3	2.1	3.3	2.8	2.3	1.0
Watches, Jewelry	36.2	27.0	27.3	30.8	30.3	34.4	23.0
Other Clothing & Care	63.8	73.0	72.7	69.2	69.7	65.5	77.0
MEDICAL & PERSONAL:							
Drugs	28.7	29.4	22.0	76.0	21.7	21.6	17.5
Medical Equipment	3.6	2.0	1.9	1.7	1.9	1.7	1.5
Cosmetics	4.3	6.5	5.3	4.4	5.7	4.5	4.7
Dental	1.6	2.0	1.9	1.7	1.9	2.0	1.4
Hair Preparation	2.1	2.6	3.4	2.6	2.2	2.8	2.3
Shaving Expenses	1.6	2.0	2.4	2.6	2.6	3.5	2.5
Tissues	3.2	3.9	3.8	3.5	3.4	3.5	2.3
Other Medical & Care	45.1	51.6	59.3	61.7	60.3	60.1	67.8
HOME OPERATION:							
Basic Materials	7.8	7.0	8.7	8.2	7.3	7.6	5.9
Communications	5.1	5.8	5.3	4.9	5.2	5.0	5.3
Home Decoration materials	2.3	2.5	2.4	2.4	2.5	2.4	3.1
Heat & Utilities	20.1	21.4	22.1	20.4	20.8	16.7	18.3
Housing	57.9	59.3	57.5	58.5	58.4	57.8	51.8
Other Home Operation	6.8	4.0	4.0	5.7	5.9	10.6	15.5
HOME FURNISHING & EQUIPMENT:							
Appliances (Major)	27.3	26.6	26.9	25.1	23.0	21.8	22.4
Appliances (Minor)	3.0	3.9	4.2	4.2	3.5	3.1	2.8
Bedding, linens	7.6	7.4	7.4	6.2	5.7	7.1	4.2
Dining Equipment	1.5	1.7	2.8	1.7	1.8	2.1	2.5
Floor Coverings	5.3	5.2	5.3	7.1	8.1	7.8	19.3
Furniture	11.4	17.5	16.4	17.5	18.6	22.8	18.5
Wax, Polish, Cleaners	1.5	1.7	2.1	1.7	1.3	1.5	1.0
Laundry Soaps	7.6	5.2	5.2	4.8	5.7	3.2	2.6
Tools, Hardware	9.1	7.9	4.5	5.9	8.5	6.5	4.0
Other	25.7	22.7	25.2	25.7	23.8	24.1	22.7
RECREATION:							
Games, toys	5.1	7.9	8.9	11.6	9.0	8.7	8.8
Pet Foods	3.1	2.2	3.1	3.0	3.5	3.4	3.3
Photography equipment	1.0	4.3	5.2	4.3	4.7	8.4	5.8
Radio, TV, Phonograph	21.4	28.3	27.6	18.4	18.4	14.0	11.9
Spectator Fees	14.3	13.8	12.5	14.2	12.1	12.7	12.7
Sports goods, equipment	3.1	3.6	3.1	7.7	6.2	11.5	14.4
Other Recreation & Equip.	52.0	39.9	39.6	40.3	46.1	41.3	43.1
AUTOMOTIVE:							
Automobiles	34.9	45.6	53.4	49.8	52.3	51.8	55.5
Batteries, etc.	1.9	1.8	1.5	1.4	1.3	1.2	1.2
Gasoline, Oil	38.4	33.1	26.5	27.0	23.9	22.2	20.4
Passenger car, tubes, tires, etc.	4.9	4.3	4.0	3.9	3.1	3.2	3.3
Other Automotive	19.9	15.2	14.6	17.9	19.4	21.6	19.6
OTHER GOODS & SERVICES:							
Writing Equipment	6.5	10.1	7.1	5.7	7.0	5.1	6.4
Other Goods & Services	93.5	89.9	92.9	94.3	93.0	94.9	93.6

TABLE XI
ESTIMATED EXPENDITURES OF DEVELOPMENT AREA
RESIDENTS PER TYPE OF PURCHASE

Type of Goods or Services	Expenditures by Income Bracket							Total
	Under \$2,000	\$2,000- \$2,999	\$3,000- \$3,999	\$4,000- \$4,999	\$5,000- \$6,999	\$7,000- \$9,999	\$10,000- or more	
FOODS, BEVERAGES:								
Super Markets	\$68,566	\$724,471	\$875,566	\$1,429,441	\$1,674,702	\$415,549	\$139,847	\$6,128,144
Liquor	9,705	24,982	15,847	19,404	38,061	10,508	7,529	126,036
Tobacco	92,194	8,327	9,905	168,170	19,031	51,585	12,815	362,057
CLOTHING & ACCESSORIES:								
Men & Boy Clothing	75,099	64,315	91,852	177,398	190,351	64,729	21,588	665,332
Men & Boy Shoes	18,910	17,852	26,679	29,688	39,495	11,231	3,028	145,863
Women & Girl Clothing	146,415	114,936	197,425	281,612	312,072	95,153	43,175	1,190,788
Women & Girl Shoes	24,313	18,585	26,679	38,641	43,379	18,990	5,436	176,023
Infant Clothes	9,455	13,450	17,632	25,761	22,661	5,922	1,475	96,356
Other Clothing	8,104	7,092	12,958	14,051	21,366	3,471	2,174	69,216
Other Shoes	4,052	8,070	8,004	19,321	19,129	4,696	777	63,049
Watches, Jewelry	9,553	8,918	13,123	25,761	30,355	11,947	3,633	103,290
Other Clothing & Care	16,838	24,113	34,947	57,878	69,828	22,683	12,159	238,496
MEDICAL AND PERSONAL:								
Drugs	53,956	37,084	4,358	211,885	73,744	14,840	7,008	402,875
Medical Equipment	6,768	2,523	3,764	4,740	6,457	1,562	601	26,415
Cosmetics	8,084	8,201	10,499	12,267	19,371	4,133	1,882	64,437
Dental	3,008	2,523	3,764	4,740	6,457	1,837	561	22,890
Hair Preparations	3,948	3,280	6,735	7,249	7,476	2,572	921	32,161
Shaving Expenses	3,008	2,523	4,754	7,249	8,836	3,215	1,001	30,586
Tissues	6,016	4,921	7,527	9,758	11,554	3,215	921	43,912
Other Medical & Care	84,788	65,104	117,469	172,017	204,920	55,204	27,153	726,655
HOME OPERATION:								
Basic Materials	45,745	35,324	51,702	86,873	94,270	25,131	7,088	346,133
Communications	23,372	29,266	31,497	51,912	67,151	16,534	6,368	226,102
Home Decoration	10,540	12,616	14,263	25,426	32,284	7,936	3,724	106,769
Heat & Utilities	92,113	107,990	131,335	216,122	268,605	55,223	21,986	893,374
Housing	265,341	299,244	341,709	619,763	754,159	191,131	62,235	2,533,582
Other Home Operation	32,763	20,185	23,771	60,387	76,907	35,052	18,622	267,687
HOME FURNISHINGS & EQUIP. EMP:								
Appliances (Major)	51,324	53,698	71,049	111,964	140,691	36,044	14,951	379,721
Appliances (Minor)	5,640	7,873	11,093	18,735	21,410	5,125	1,869	71,745
Bedding, Linens	14,288	14,939	19,545	27,657	34,867	11,739	2,803	125,838
Dining Equipment	2,820	3,432	7,395	7,583	11,011	3,472	1,669	37,382
Floor Coverings	9,964	10,497	13,999	31,671	49,548	12,696	12,882	141,457
Furniture	21,432	35,328	43,316	78,063	113,776	37,697	12,348	341,960
Wax, Polish, Cleaners	2,820	3,432	5,547	7,583	7,952	2,480	667	30,481
Laundry soaps	14,288	10,497	13,734	21,412	34,867	5,291	1,735	101,824
Tools, Hardware	17,106	15,948	11,886	26,318	51,995	10,747	2,670	136,672
Other	48,316	45,825	66,559	114,641	145,585	39,846	15,151	475,923
RECREATION:								
Games, toys	6,874	9,968	14,692	38,727	30,585	7,991	3,524	112,361
Pet Foods	4,178	2,776	5,117	10,016	11,894	3,123	1,322	38,426
Photography equipment	1,348	5,425	8,584	14,356	15,972	7,716	2,323	55,724
Radio, TV, Phonograph	28,844	35,706	45,561	63,099	62,529	12,860	4,766	253,365
Spectator Fees	19,275	17,412	30,635	47,407	41,120	11,665	5,086	162,600
Sports goods, equipment	4,178	4,542	5,117	25,707	21,070	10,563	5,767	76,944
Other Recre. & equip.	70,089	50,342	65,370	134,544	156,663	37,936	17,261	532,205
AUTOMOTIVE:								
Automobiles	103,489	149,588	264,453	388,753	568,746	142,742	55,567	1,673,338
Batteries, etc.	5,534	5,905	7,428	10,929	14,137	3,307	1,201	48,541
Susoline, Oil	113,868	108,583	131,236	210,770	259,905	61,175	20,424	905,961
Passenger car, tubes, etc.	14,530	14,106	19,609	30,444	33,712	8,818	3,304	124,723
Other Automotive	59,010	49,863	72,304	139,732	210,969	59,522	19,624	611,024
OTHER GOODS & SERVICES:								
Writing Equipment	10,513	12,743	14,065	22,247	33,303	6,432	2,990	104,293
Other goods & services	151,231	113,427	184,028	358,067	442,465	156,906	43,732	1,449,856

TABLE XII
PERCENTAGE OF PURCHASES ESTIMATED BY TRAVEL ZONE

Zone	Convenience Goods	Shoppers Goods	Other Goods & Services
½ mile	25%	26%	25%
1 mile	10%	20%	10%
1½ mile	none	11%	none
2 mile	none	4%	none

TABLE XIII

ESTIMATED DATA ON SHOPPING CENTER
FOR DEVELOPMENT AREA

Goods or Services	Potential Purchasing Power	% of Pp spent in center	Actual Purchasing Power	Sales Volume per S.F. G.L.F.A.	Minimum G.L.F.A.	Maximum G.L.F.A.	Type of Goods
FOODS, BEVERAGES:							
Super Markets	\$ 6,128,144	25%	1,532,036	105	14,590	36,475	C
Liquor	126,036	25%	31,509	115	274	685	C
Tobacco	362,057	25%	90,514	105	862	2,155	C
CLOTHING & ACCESSORIES:							
Men & Boy Clothing	665,332	26%	178,286	47	3,793	9,482	S
Men & Boy Shoes	145,883	26%	37,928	24	1,115	2,787	S
Women & Girls Clothing	1,190,788	26%	309,605	45	6,880	17,200	S
Women & Girls Shoes	176,023	26%	46,766	39	1,199	2,997	S
Infant Clothes	96,356	26%	25,053	39	643	1,607	S
Other Clothing	69,216	26%	17,996	42	428	1,070	S
Other Shoes	63,049	26%	16,393	40	410	1,025	S
Watches, Jewelry	103,290	26%	26,855	55	488	1,220	S
Other Clothing & Care	238,446	25%	59,611	25	2,384	5,960	O
MEDICAL & PERSONAL:							
Drugs	402,875	25%	100,719	56	1,798	4,495	C
Medical Equipment	26,415	26%	6,868	--	--	--	S
Cosmetics	64,437	25%	16,109	--	--	--	C
Dental	22,890	25%	5,722	--	--	--	C
Hair Preparation	32,181	25%	8,045	40	201	502	C
Shaving expenses	30,586	25%	7,647	105	73	182	C
Tissues	43,012	25%	10,978	105	104	260	C
Other Medical & Care	726,655	25%	18,664	--	--	--	C
HOME OPERATION:							
Basic Materials	346,133	26%	89,994	33	2,727	6,817	S
Communications	226,102	25%	56,525	--	--	--	C
Home Decoration Material	106,789	26%	27,765	--	--	--	S
Heat & Utilities	893,374	25%	223,343	--	--	--	C
Housing	2,533,582	25%	633,395	--	--	--	C
Other Home Oper.&Improv.	267,687	25%	66,922	--	--	--	C
HOME FURNISHING & EQUIPMENT:							
Appliances (Major)	379,721	26%	98,727	67	1,474	3,665	S
Appliances (Minor)	71,745	26%	18,654	67	278	695	S
Bedding, linens	125,838	26%	32,718	--	--	--	S
Dining Equipment	37,382	26%	9,719	17	572	1,430	S
Floor Coverings	141,457	26%	36,778	--	--	--	S
Furniture	341,960	26%	88,909	17	5,230	13,075	S
Waxes, polish, cleaners	30,481	25%	7,620	115	66	165	C
Laundry soaps	101,824	25%	25,456	115	221	551	C
Tools, Hardware	136,672	26%	35,534	32	1,110	2,775	S
Other	475,923	25%	118,981	--	--	--	C
RECREATION:							
Games, toys	112,361	26%	29,214	34	859	2,147	S
Pet foods	38,426	25%	9,606	42	229	572	C
Photography equipment	55,724	26%	14,488	78	186	465	S
Radio, TV, Phonograph	253,365	26%	65,875	57	1,156	2,890	S
Spectator fees	162,600	25%	40,650	--	--	--	C
Sports goods, equipment	76,944	26%	19,236	50	385	962	S
Other recre. & equip.	532,205	25%	133,051	--	--	--	C
AUTOMOTIVE:							
Automobiles	1,673,338	26%	435,067	45	9,668	24,170	S
Batteries, etc.	48,541	26%	12,620	45	280	700	S
Gasoline, oil	905,961	25%	226,490	45	5,033	12,582	C
Passenger car tubes & tires	124,723	26%	31,428	45	720	1,800	S
Other Automotive	611,024	25%	152,756	45	3,394	8,485	C
OTHER GOODS AND SERVICES:							
Writing Equipment	104,293	26%	27,116	50	542	1,355	S
Other goods & services	1,449,856	25%	363,464	--	--	--	C

TABLE XIV

DETERMINATION OF SHOPPING CENTER TYPE

Type of Center	Average sq. ft. Gross Leasable Floor Area	Minimum Sales Volume	Parking	
			Ratio	Sq. Ft.
Neighborhood	49,500	\$3,175,400	1: 1.5	74,250
Community	116,500	\$6,097,800	1: 2.5	291,250
Regional	370,200	\$19,468,700	1: 3.0	1,110,600

This Table is based upon a recent study in consumer expenditures¹⁰ which used a representative sample of population in the United States, through extensive surveys the investigators collected reliable economic data for use in market analysis.

Notations are used in Table VI to clarify the computational process necessary in estimating needs for the commercial facilities within the development. Where N is the number of households in the sample, and $P\%$ is the percent of national population in each income bracket, then

$$N_1 = (N)(P\%) \quad (1)$$

N_1 is a conversion factor used to apply the representative sample data to national population. Then,

$$N_2 = (N_1) (A) \quad (2)$$

where N_2 is the conversion factor used to apply national data to the development area population A is the average number of persons per household. If P_t , the proposed population for the development area, is 20,000 persons, and K is the percent of development area residents per income bracket, then

$$K = \frac{N_2}{\sum N_2} \quad (3)$$

$$P_i = (K)(P_t) \quad (4)$$

Where P_i is the number of residents per income bracket within the development area, assuming 100 percent occupancy.

The number of dwelling units needed for families in each income bracket, D , can then be found as:

$$D = \frac{P_i}{A} \quad (5)$$

The potential purchasing power, ϕ , of the proposed population can be found as:

$$\phi = (D) (N_2) \quad (6)$$

Table VII shows the proposed distribution of dwelling units, D , per income bracket according to type of unit, as classified by number of bedrooms. Table VIII was prepared from the consumer expenditure study previously mentioned and simply converts the data given in it to more easily used percentages. Table IX was computed with data from Table VI, along with data from pages 40, 64, 88, and 112 of the above mentioned consumer expenditure study. Table X was prepared by taking average family expenditures from Table V and converting it by multiplying ϕ by the percentages of expenditure items 1 through 8 in Table VIII.

Then using Table IX, the expenditures for each subdivision item were computed to produce Table X. The "Total" column contains figures known as "Potential Purchasing Power." This means that if all expenditures, P_t , of the residents were made in the development area shopping facilities, these figures would indicate commercial needs. However, the assumption that all residents will make all purchases in any one center is absurd. To relate the realistic needs for commercial facilities, the "actual purchasing power" of residents must be found.

Using Table XII, taken from standards used in the Saint Louis metropolitan area by various planning and economics consultants and agencies for commercial center studies, the expenditures listed as items 1 through 8 in

Table X are classified as "consumer goods," "shoppers goods," or "other goods and services." This is done in Table XI under "Type of Goods." Then,

$$P_{\text{actual}} = C + S + O \quad (7)$$

where P_{actual} is the actual purchasing power of residents; C is the actual estimated amount that will be spent by residents for consumer goods; S is the actual estimated shoppers' good expenditures, and O represents the actual estimated expenditures for other goods and services.

For the study area the following values are estimated as:

$$C = \$ 2,058,684$$

$$S = \$ 1,740,592$$

$$O = \$ 1,881,129$$

$$\text{Therefore, } P_{\text{actual}} = 2,058,684 + 1,740,592 + 1,881,129$$

$$P_{\text{actual}} = \$ 5,680,405$$

Using Table XIV, which shows the nationally accepted types of metropolitan area shopping center with respect to their estimated minimum sales volume, the development site can, with its own residents, support a commercial center that is between the neighborhood and community classifications. It is assumed that the surrounding area will supply an actual purchasing power of approximately \$400,000 in addition to that of residents; therefore a "community center" would be suitable. Assuming the center will be classified as community, then from Table XIV the ratio of 2.5 square feet of parking space should be provided for each square foot of gross leasable floor area in the center.

A rough estimate of the square feet of gross leasable floor area needed can be made by dividing the average sales volume per square foot of gross leasable floor area, \$46.73, into the total estimated actual sales volume, \$5,680,405. The area needed for stores, A_s , will then be

$$A_s = \frac{5,680,405}{46.73} = 119,419 \text{ square feet}$$

Then the area required for parking, A_p , will be:

$$A_p = (119,419) (2.5) = 298,548 \text{ square feet.}$$

The total minimum area needed for the shopping center will be as $A_s + A_p = 417,967$ square feet. This area does not include inter-store circulation areas, malls, or other elements often found in a community shopping center.

Schools:

The school sites within each of the housing complexes are for kindergarten and elementary school children. The design of the complexes attempts to reduce the necessity of children crossing streets on their way to and from school. The senior high school site will be near the centrally-located community shopping center area. The high school students and faculty parking spaces will be in the community shopping center; however, there must be a definite limit on the number of student vehicles allowed.

For school building minimum needs to be estimated for the development area, certain standards and methods of determination must be used. Where E is the total enrollment for school; K equals enrollment in the kindergarten;

S_c is the standard class enrollment of twenty-five students per classroom; μ equals total number of classrooms needed; n_s is the number of sets needed (at 5 classrooms per set); n_r equals the number of regular classrooms needed; n_k equals the number of kindergarten classrooms needed, and S_k is the standard kindergarten enrollment of 50, then

$$\mu = \frac{E - K}{S_c} \quad (8)$$

$$n_s = \frac{\frac{1}{2} \mu}{5} \quad (9)$$

$$n_r = \mu - n_s(5) \quad (10)$$

$$n_k = \frac{K}{S_k} \quad (11)$$

From Table IV, the maximum enrollment for schools can be computed as shown in Table XV.

TABLE XV

ESTIMATE OF MAXIMUM NUMBER OF CHILDREN IN COMMUNITY

Type of Unit	Number	x	Estimated maximum number of children per unit	=	Estimate of number of children in development
2 bedroom	1,754	x	2	=	3,508
3 bedrooms	2,348	x	3	=	7,044
4 bedrooms	1,268	x	4	=	5,072
5 bedroom	124	x	6	=	744
TOTAL, P_c					16,368

Using the following breakdown, the proportion of children estimated to be of school age can be determined: 25% can be estimated as under school age, 62.5% are estimated as

school age, and 12.5% are estimated to be over high school age. Using these values, P_S , school age population, and the total from Table XV,

$$P_S = 62.5\%(P_C) \quad (12)$$

$$P_S = 0.625 (16,368) = 10,230 \quad (13)$$

Then, $K = 10\% P_S \quad (14)$

$$E_{es} = 65\% P_S \quad (15)$$

$$E_{jhs} = 10\% P_S \quad (16)$$

$$E_{hs} = 15\% P_S \quad (17)$$

where K is the estimated kindergarten enrollment; E_{es} is the estimated elementary school enrollment; E_{jhs} is the estimated high school enrollment; then,

$$K = .10 (10,230) = 1,023$$

$$E_{es} = .65 (10,230) = 6,649$$

$$E_{jhs} = .10 (10,230) = 1,023$$

$$E_{hs} = .15 (10,230) = 1,535$$

It will be assumed that at least one elementary school will be located in each of the residential complexes. The estimated maximum enrollment of each of the elementary schools (proportioned according to the population of each neighborhood complex) would be estimated as described in Chapter IV, using the data shown in Table XVI.

When the total enrollment for the school, E , and K , the enrollment for each school's kindergarten are determined, then N , n_s , n_r and n_k can be found.

According to school economics standards,¹¹ it is impractical to operate a regular elementary school with an enrollment of less than 350; yet the enrollment for such

a school should exceed 750, administrative services and special design elements must be incorporated. Because of the scarcity of land, it is becoming increasingly essential that designers of high density areas consider the changes necessary to provide schools with adequate facilities for larger enrollments. These facilities must be very versatile and offer great flexibility. Advancements in educational methods and intensification of facility use must be considered.

TABLE XVI
ELEMENTS COMPRISING RESIDENTIAL COMPLEXES
OF THE DEVELOPMENT SITE

Complex	Elements	No. of Units	Max. Pop.	Parking
Complex I	Tower Courts	462	1,155	693
	Lakeshore Homes	228	1,140	342
	Hillside Homes	1,125	5,499	1,688
Complex II	Plaza Terrace Apartments	1,300	3,900	1,950
Complex III	Bay View Apartments	1,320	3,960	1,980
Complex IV	Garden and Towers	<u>1,590</u>	<u>5,584</u>	<u>2,385</u>
		6,135	21,238	9,038

The minimum standards for urban schools can be computed from Table XVII, which was derived from a school standards study.¹² It will give a general estimate of area needs for school buildings. Recommended minimum play area has been set at 60 square feet per student¹³ to 100 square feet per student.¹⁴

TABLE XVII
MINIMUM SPACE REQUIREMENTS FOR SCHOOL BUILDINGS

Type of School Room	Minimum Area per room (square feet)
Classrooms	
Kindergarten room	2,400
Regular classroom	1,225
Classroom set:	
Art room	1,925
Library room	1,050
Vocal Music room	800
Gymnasium	5,000
Science room	1,225
Audio-visual room	700
Cafeteria	$E/4(20) = C$
Administrative Suite	
Principals Suite	300
General Office and Waiting Room	900
Teacher's conference or lounge	1,200
Assistant Principal or Counselor	300
Bookstore or storage	1,200
Miscellaneous Rooms	
Conference room	750
Mimeograph room	300
Vault	150
Mechanical Equipment & Storage	25% of total building area

Fire Station:

For the protection of the community, a fire station will be located next to the shopping center to serve the re-development area. Essential facilities to be provided within the fire station are dormitory, kitchenette, and educational facilities for training purposes, and other considerations standard for such services. Minimum apparatus would include: 1) Engines --- pumpers, hose trucks, and ladder

trucks; 2) director's car; 3) emergency equipment (on an ambulance); 4) hose drying equipment; 5) boat and equipment for aiding drowning cases; and 6) manpower --- 14 men to an engine, 16 men to a ladder truck. Ideally, firehouses should be about 140 feet in depth, with frontage of 100 feet per door and 25 additional feet for each door after the first.

Libraries:

Library facilities will consist of a community library to be centrally located on the redevelopment site and a number of neighborhood book centers, located near the center of each major residential complex. The community library supplements the area library (the large San Francisco City library system), bringing service to the most populous sections of the community. It should serve approximately 20,000 persons within a one mile radius. Its function would include: 1) collection: 18,000 to 20,000 volumes on subjects of most frequent interest in the community; reference materials; and small collections of pamphlets, documents and audio-visual materials; 2) services: open at least 48 hours per week; small professional staff for service to patrons, annual circulation of 100,000 volumes, and limited program of children's activities and community group services; and 3) physical requirements: a seating capacity of 60 to 65; floor area of 8,000 to 10,000 square feet; site of 1/2 to 1 acre, off-street parking and a small meeting room are recommended.

The neighborhood book center normally serves areas of populations between 10,000 to 15,000. In the development of this community, location of one of these units in each of the elementary schools on the site is possible. It is not a complete library unit, but soes attempt to provide good reading for adults and juveniles. A comprehensive collection is not provided nor is a professional staff. This facility has the following functions: 1) collection --- 8,000 to 10,000 volumes equally divided between children and adult books; a small number of reference materials such as encyclopedias, almanacs, and biographical sources; and a few hundred popular books for reading by young people, 2) services; open 40 hours per week, annual circulation of 20,000 to 40,000 volumes, and guidance or reference service to the community library; and 3) physical requirements: 2,000 square feet required with informal reading space for 20 to 25 persons.

Police Station:

The location of the police station would be determined by the amount of police protection needed according to population, land area, arteries of traffic and communication, variation in commercial and residential land uses, and incidence and distribution of crime. The size of community (area of enforcement) determines the number of men, the size of the physical facilities, and the equipment needed. A ratio of one man to every 1,000 persons residing in the enforcement area is the minimum police

force size recommended. The police station could be located with the community fire station. The following facilities are needed: 1) a building adequate for office space for administration, violations bureau, and squad room; detective bureau, cell space, and facilities for caring for the prisoners (perhaps some of these elements such as cell space, would be located within San Francisco's centralized facilities); 3) use of the central San Francisco city police garage for maintenance of vehicles.

Other Public and Semi-Public Facilities:

Collection of rent could be facilitated by placing a rent collections office in the shopping center, where residents may pay rent, utilities, and telephone bills and report their requests for maintenance. Every effort should be made to supply a maintenance crew large enough to keep all living units in good repair. To be satisfied with the community, tenants must have maintenance service of the same quality they would expect to have in a private home.

The community needs to have certain services that are usually supplied by semi-public institutions and organizations. These facilities may include churches, hospitals, non-profit recreation facilities, and charity organizations and non-profit social services. It is possible that the medical facilities proposed might be either a commercial operated or public sponsored facility; however, it is more probable that they would be operated as semi-public institutions.

Proposed Comprehensive Plan

The Comprehensive Plan is a guide to development which consists of proposals and plans directed at effecting the policies, design intent, physical placement, and/or relationships among facilities within the community. In this study the parts of the comprehensive plan presented are 1) the Land Use Plan, 2) the Transportation Plan, and 3) the Parks and Recreation Plan.

Land Use Plan:

The proposed Land Use Plan is a part of the Comprehensive Plan and indicates the locations and amounts of land allocated to specific land uses, as shown in Figure 5. General classifications of land use are: 1) residential, 2) commercial, 3) industrial, 4) parks and recreation, 5) other public, and 6) semi-public. In this study criteria for determining space for land uses are discussed with the exception of industrial land uses. Because of the limited amount of land in the site and the general incompatibility of industrial and residential land use, no industrial areas within the development site are proposed. Other areas outside the project area can more easily provide necessary utilities for industry and do not have the steep grades which make this site undesirable for industrial development.

Transportation Plan:

The efficiency of movement of traffic to and from the site, as well as through it, may be a factor determining the

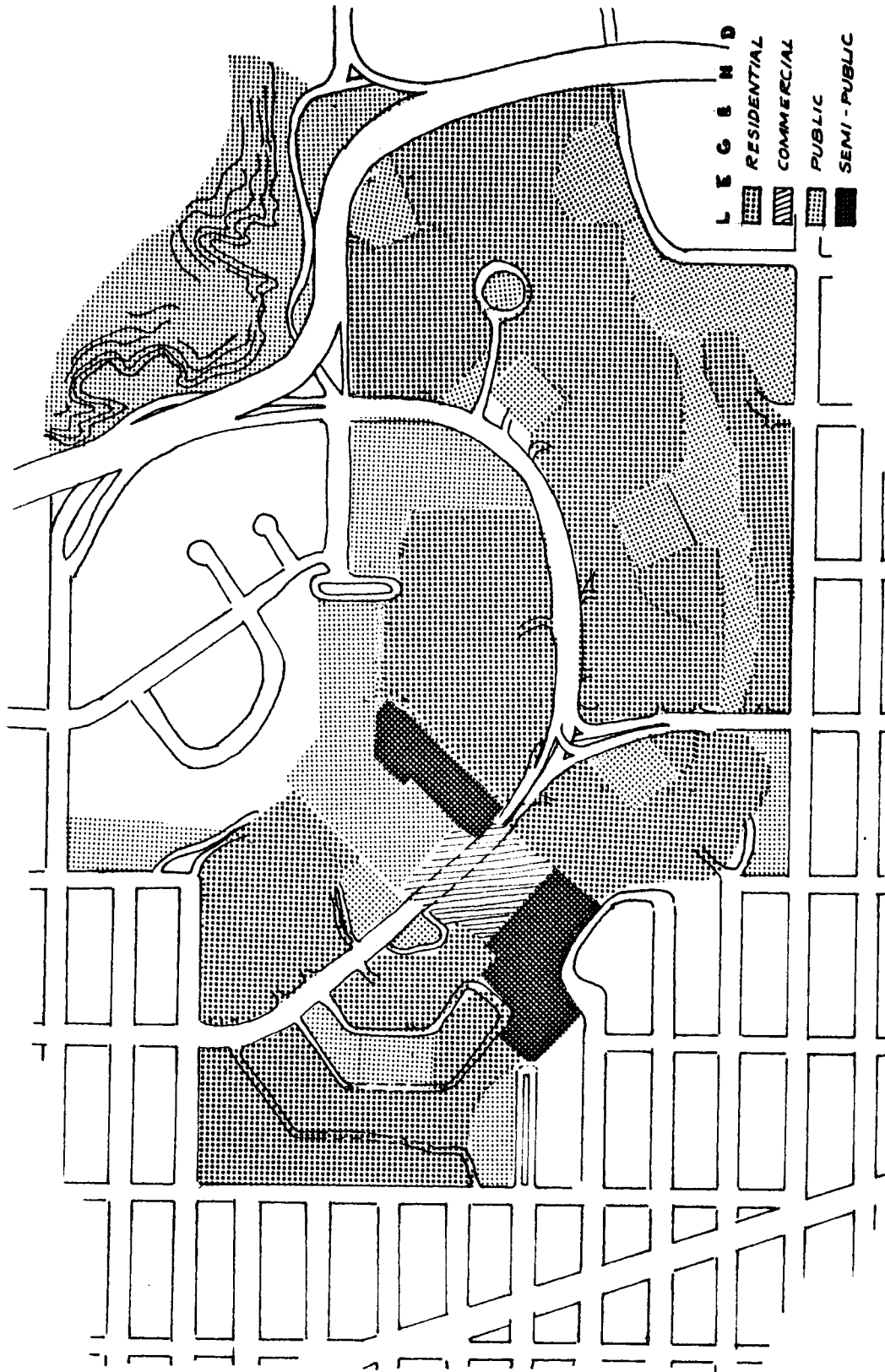


Figure 5. Proposed Land Use Plan.

success or failure of this project as a high density development. A variety of traffic treatments will be required since most parking will be in multi-story garages. This parking system is practical due to the severe slope of the land. Open air parking for the development would use too much of the land which is needed for other purposes. If rush hour traffic is handled efficiently, the street and parking systems must be carefully designed to facilitate rapid transfer of vehicles between streets and parking structures. Land slopes necessitate a unique solution for every parking garage and every portion of each street, and eliminate the possibility of preparing "typical solutions" which can be applied throughout the development plan.

The traffic on streets will be heavy, so that every attempt is made to minimize actual pedestrian contact with vehicular traffic, especially on major streets. Extreme care in design is necessary for protection of children, even within the housing structures. At times, automobile traffic at various points can furnish an interesting view, as long as it does not dominate in the residential design. The traffic may give a feeling of activity to otherwise underactive or inactive areas.

Expressways serving the area will be the existing State Highway 101 (interstate 80) and a proposed freeway along the coast. They will be a readily accessible means for traveling to other parts of the San Francisco Bay region, as shown in Figure 6.

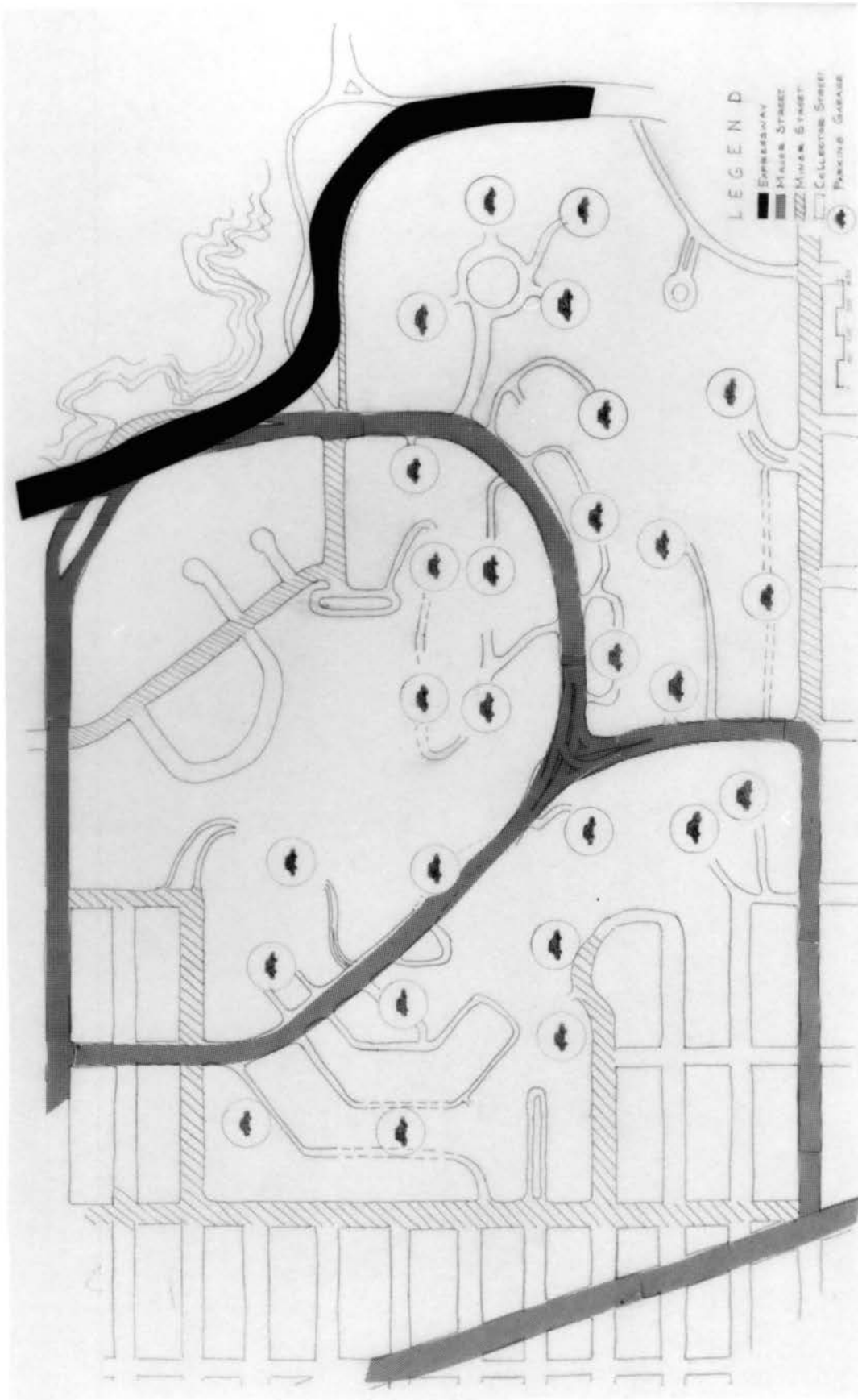


Figure 6. Transportation Plan.

Major Thoroughfares serving the development area from outside it's boundary are Lake Street and Evans Avenue, extending to a curved portion over part of Hunters Point Boulevard and Innes Avenue. The branched loop street passing through the central portion of the development site is also major. These will be rapid traffic-ways and will allow easy access to the expressways and other major streets.

Minor Streets are those arteries which connect the site's major street system to its surrounding neighborhood. These will handle less traffic than the major thoroughfares but they must still allow uninterrupted and unobstructed rapid transfer of vehicles from the major streets to collector streets are located on the periphery of the development site.

Collector Streets within the development area allow rapid access between certain major and minor thoroughfares. These streets are fed from the residential streets and are narrower than the minor streets, yet wider than the residential arteries.

Residential Streets are carefully developed systems of parking garages and driveways which feed the collector streets. They are generally under structures.

Residential Parking consists of a network of parking garages, throughout the complexes. Self-service parking garages with assigned spaces are desirable, but in some cases, attendants may be necessary for efficient movement of traffic. Residents should be able to remove their vehicles from the garages at all hours. Special attention

must be given to residents such as doctors, policemen and firemen, who must render emergency services.

Other Parking areas and structures need to be designed efficiently to handle large groups of vehicles and a high turnover of traffic. Pedestrian and mass transit circulation will be essential to these structures. Adequate elevator and pedestrian cart services should be used in restricted areas for the convenience of those using commercial, medical or other facilities. Arrangements for handicapped persons and the elderly must be considered, so that the community facilities are not made inaccessible by stairs, curbs and other obstructions. Facilities for handicapped and elderly persons can be incorporated into the design of structures without looking "tacked-on" or offensive to the aesthetic qualities of the structures. Most persons will never notice the ramps, rails, etc., if they are provided in the original construction. The entertainment facilities in the community shopping center operate primarily at night and will make use of the parking garage which is used by shoppers during the day. Church parking needs will be easily supplied by the same parking garage, since these activities will be held primarily on Sundays and on the evenings when shopping demands will be lower. Evening high school events will also be easily accommodated within the parking garage; however, student parking must be severely restricted and use of mass transportation encouraged.

The mass transportation system within the development site should be capable of transporting students between

their homes and schools to lighten the traffic load. It should not be necessary for students to drive or be taken by parents to school. Faculty parking should be supplied for each educational facility.

Parks and Recreation Plan:

In a high density urban complex it is unreasonable to expect to furnish park and recreation land in the amounts recommended for suburban communities. Through the use of consolidated facilities and well-designed spaces, it is possible to serve the urban population with adequate play spaces and passive areas. These urban standards, in the case of this development site, must approach approximately one-fourth the National Recreation Association standard of one acre per 100 total population. Methods for intensification of functions for park and recreation facilities can increase the serviceability of these spaces. The number of residents in a structure, neighborhood or community should determine the location and size of these facilities. Average family size will be useful in determining the types and amounts of space needed for active and passive recreation.

As school facilities are used by children in the neighborhood during the day and are available for recreational purposes during after-school hours, weekends and holidays, it is assumed that the school facilities should be considered as a part of the recreational facility network for the neighborhood to avoid duplication of these elements.

The parks and recreation plan involves creation of many types of activity spaces. Figure 7 shows the types considered in this study, which are 1) structure play area; 2) local play areas, neighborhood parks, and playgrounds; 3) community facilities and regional facilities

Structure Play Areas are small indoor facilities within large structures. These playgrounds are of two types: a) areas for children to play with small toys and tricycles, and b) sitting areas for residents to meet and visit. The sitting areas should have attractive views.

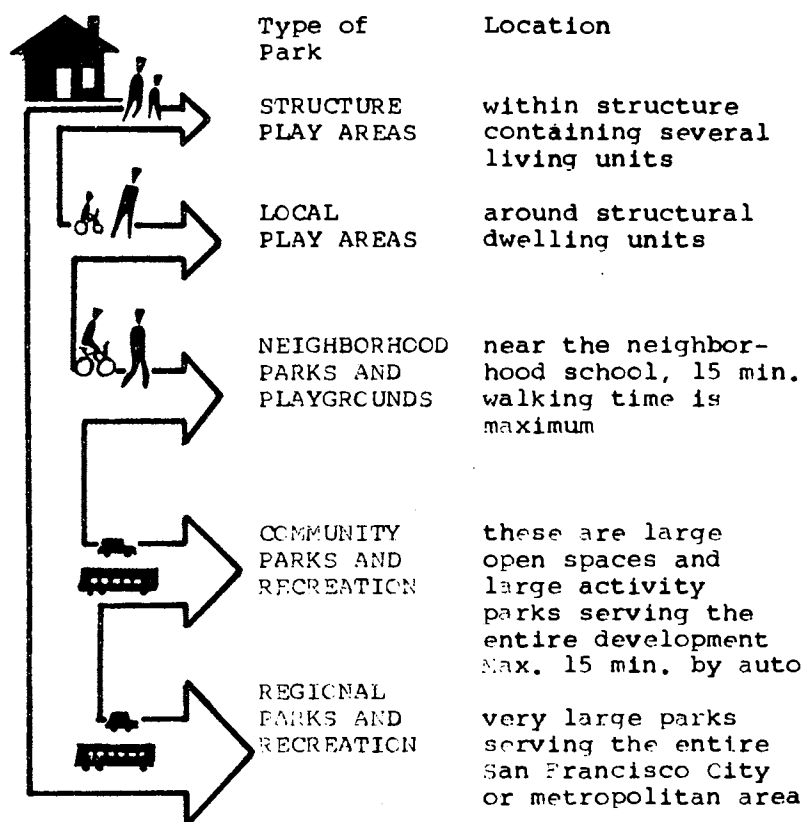


Figure 7. Types of Park and Recreation Facilities.

Local Play Areas are larger than structure play areas and provide outdoor activity for several dwelling structures. Active and passive activities should be created in them. Residents walk and sit near the residential structures and children can ride tricycles and bicycles, roller skate, and use playground equipment.

Neighborhood Parks and Playfields should be centrally located in the neighborhood. Accessibility by pedestrian and bicycle traffic is important. Play equipment, ball fields and other facilities must be integrated with the school facilities.

Community Parks and Recreation Facilities are larger than those of the neighborhood and have special attractions. In this development these park and recreation areas must be used collectively by the entire community. The marina and its park should serve as the focal point for the community's recreational needs. In addition to the marina, which would offer boating and related activities, the park could contain facilities for picnicking, golfing, bicycling and swimming.

Regional Parks and Recreation Facilities consists of large city-owned-and-operated or privately-owned-and-operated parks and recreation facilities that serve several communities. These parks usually offer large areas for passive enjoyment and a number of organized activities as well. However, it is possible for a park in this category to be devoted to a specialized activity and even to be of modest acreage, if it attracts and serves a large portion of the city or metropolitan area population.

The space requirements for equipment to be used in playlots for children are shown in Table XVIII ¹⁵. These figures would be applicable to structure and local play areas. Space requirements for playground areas and equipment are shown in Tables XIX and XX. This data is applicable to neighborhood, community and regional recreation facilities.

TABLE XVIII
SPACE REQUIREMENTS FOR PLAYLOTS

Type of Equipment or Area	Area per Unit (sq. ft.)	Capacity in Children	Suggested Number per Playlot
Apparatus			
Junglegym, Jr.	180	10	1
Low Slide	170	6	1-2
Low Swing	150	1	4-8
Low See-saw	100	2	4-8
Miscellaneous			
Open Space	48-50 per child	vary	vary
Block Building Platform	20 per child 150 per platform	7-8 per platform	1
Sand Box	18-20 per child	15	1-2
Benches & Tables	Optional	Optional	
Shelter	Optional	Optional	
Drinking Fountain	---	---	1

TABLE XIX
SPACE REQUIREMENTS FOR PLAYGROUNDS

Type of Equipment or Area	Area per Unit (Sq. Ft.)	Capacity in Children	Suggested No. per Playground
Apparatus			
Slide	450	6	1
Horizontal Bars	180	4	3
Horizontal Ladders	375	8	2
Traveling Rings	625	6	1
Giant Stride	1,225	6	1
Small Junglegym	180	10	1
Low Swing	150	1	4
High Swing	250	1	6
Balance Beam	100	4	1
See-saw	100	2	4
Medium Junglegym	500	20	1
Miscellaneous Areas			
Open Space for Games (Ages 6-10)	10,000	80	1
Wading Pool	3,000	40	1
Handcraft, Quiet Games	1,600	30	1
Outdoor Theater	2,000	30	1
Sand Box	300	15	2
Shelter House	2,500	30	1
Special Sports Areas			
Soccer Field	36,000	22	1
Playground Baseball	20,000	20	2
Volley Ball Court	2,800	20	1
Basketball Court	3,570	16	1
Jumping Pits	1,200	12	1
Paddle Tennis Courts	1,800	4	2
Handball Courts	1,050	4	2
Tether Tennis Courts	400	2	2
Horseshoe Courts	600	4	2
Tennis Courts	7,200	4	2
Straightway Track	7,200	10	1
Landscaping	6,000		
Paths, Circulation, etc.	7,000		

TABLE XX
SPACE REQUIREMENTS FOR ATHLETIC FIELDS

Type of Sports or Area	Area per Unit (Sq. Ft.)	Capacity in Player
Baseball Diamond	97,500	18
Baseball Court	6,000	10
Basketball Court (women's)	5,000	12-18
Bowling Alley	2,400	4-8
Clock Golf	706	---
Cricket	138,545	22
Croquet	1,800	---
Field Hockey	59,400	22
Football	75,600	22
Handball	2,000	2-4
Hand Tennis	1,250	2-4
Horseshoe Pitching	500	2-4
Paddle Tennis	1,800	2-4
Playground Ball	22,500	20
Polo	576,000	8
Quoits	2,000	2-4
Roque	1,800	4
Shuffleboard	750	2-4
Soccer	75,600	22
Tennis	7,200	4
Tether Tennis	400	2
Volley Ball	4,000	12-16

In figure 8 the Proposed Parks and Recreation Plan shows the areas allocated to the different types of park and recreational facilities. The plan does not indicate structure play area locations as their distribution is dependent upon three-dimensional placement and must be carefully placed within the structure when it is physically designed. There are no regional facilities provided within the development project, as residents will use those provided by the City of San Francisco. To recommend placement of regional facilities a comprehensive survey must be made of the entire San Francisco Bay region and such an investigation is beyond the scope of this study.

Recommended Administrative Policy

Vance Packard in his studies, The Status Seekers¹⁶ and The Pyramid Climbers,¹⁷ has made extensive comment on the modern man's characteristics. Whyte studied characteristics of executives in the American culture.¹⁸ Helen Lynd has dealt with identity characteristics of Americans.¹⁹ In the complex urban community, man is exposed to a vastly different set of influences than he is in a rural or small community. He becomes a "non-person" in the urban environment. His contacts with others may be more numerous, but they are impersonal interactions. He is faced with the anxieties and frustrations of mobility as described in The Split Level Trap, previously mentioned. The city thrives on mobility. It is the pass word to success for the modern man. Often mobility drives lead to physical and mental illnesses.

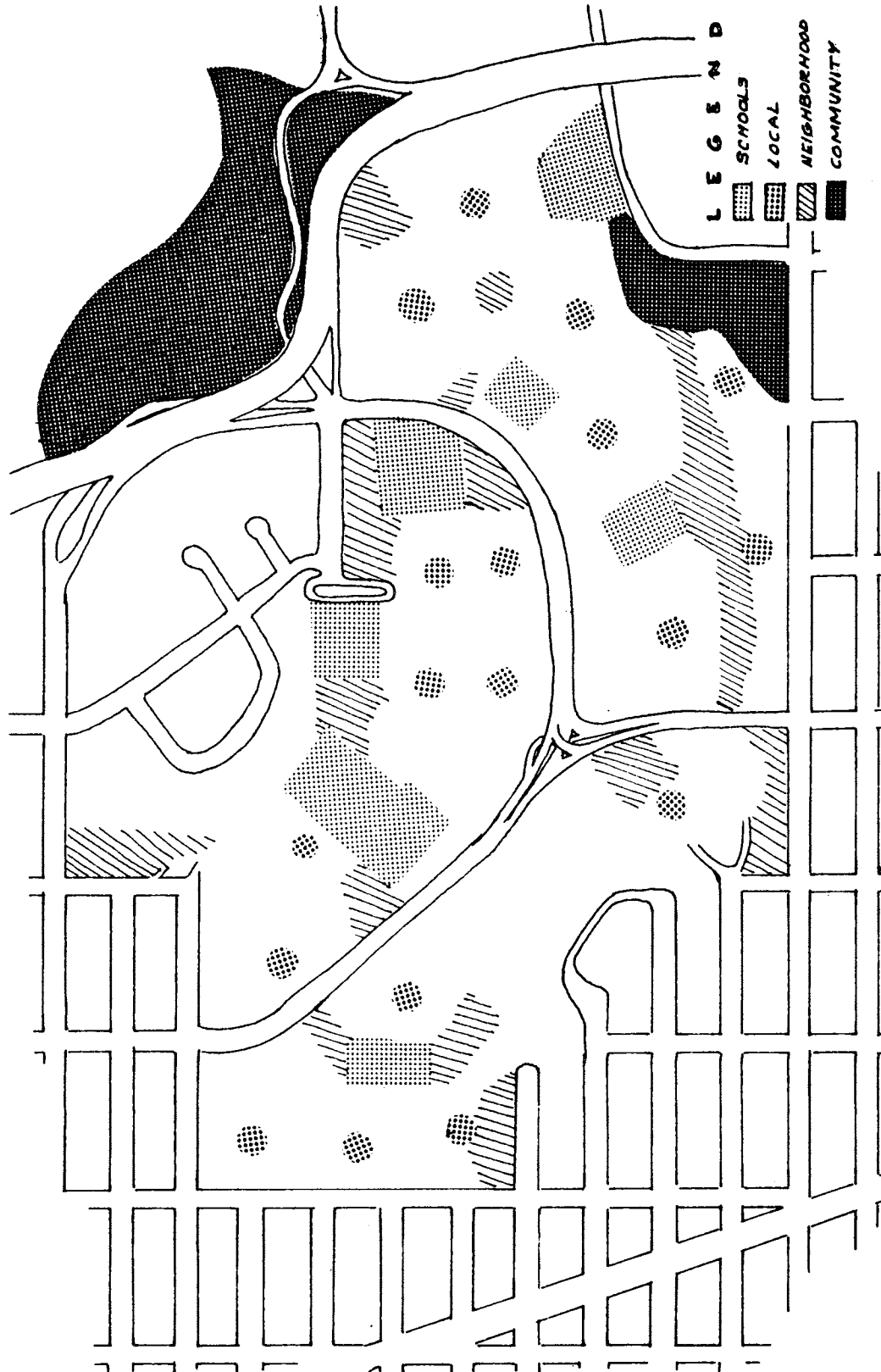


Figure 8. Schools, Parks, and Recreation Plan.

The success of a high density development may be found partially through the social atmosphere tenants experience as they enter and reside within the community. In Brentwood, Missouri, the management of Audubon Park Apartments has initiated and encouraged a process for creating a friendly atmosphere for its tenants. The residents vary greatly in age, stage of life cycle, and personal, racial, ethnic, and economic characteristics. They use a program similar to that outlined in Figure 9 though they have a multi-family design in a suburban area, the process seems applicable on a larger, higher density scale.

The process of introducing the prospective resident to the community starts at the time the family or individual investigates the possibility of living within the development. When the applicants come to the administrative office for information and to see the display living units they are met with friendly greetings and informed about the types of homes available and activities offered within the community.

A neighborhood welcoming committee furnishes an initial contact to the newcomer. A friendly visit and the leaving of information helpful to the new resident releases the frustration of trying to find things and places in the first days after moving into the new home.

The family must then take the next important step in adjustment to the community by entering the activities within the neighborhood or within the community. In Audubon Apartments the development activities were supplemented by

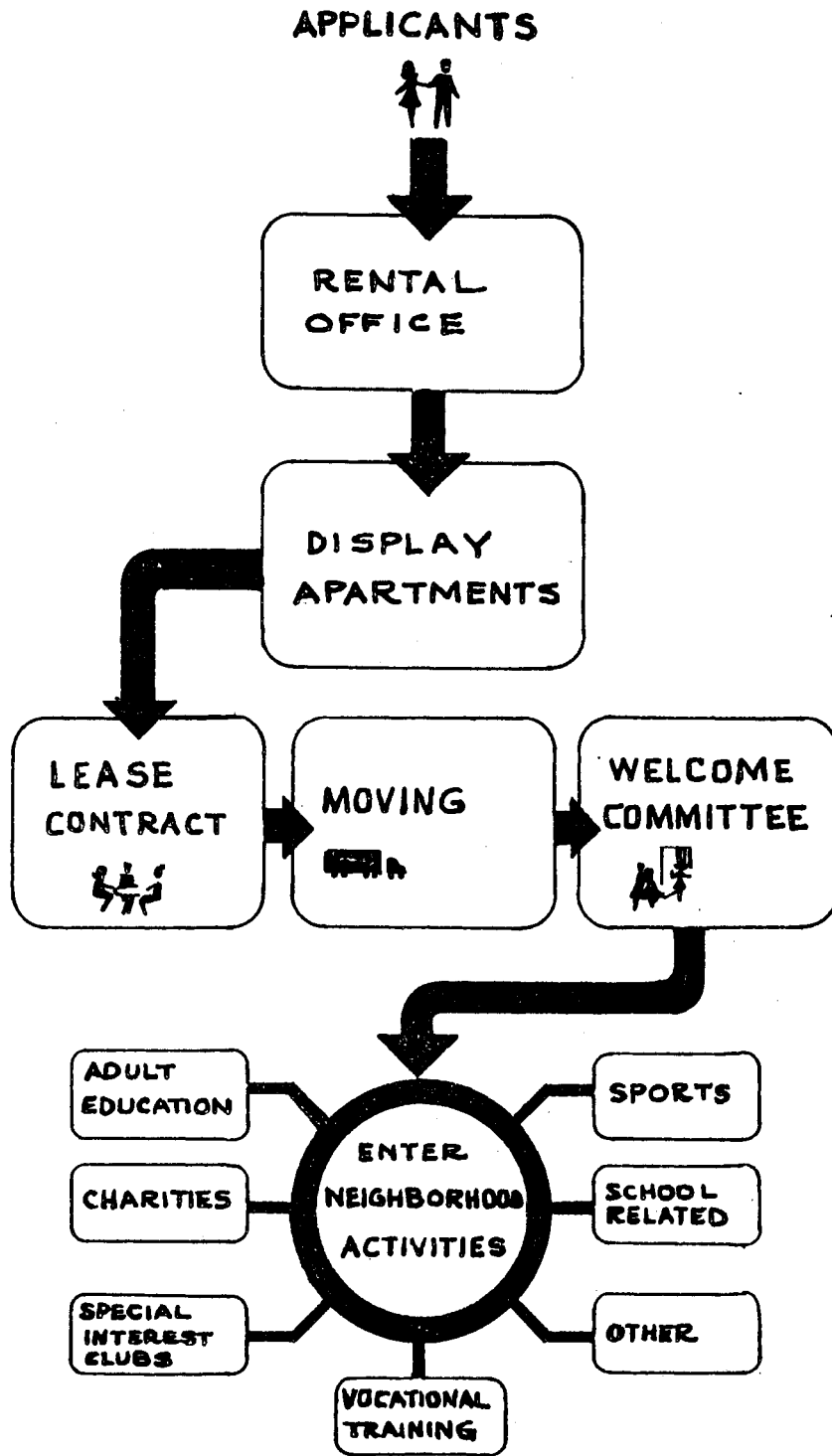


Figure 9. Activity Program for New Residents.

the City of Brentwood. A similar process is used in the Plaza Apartments in Saint Louis, Missouri. This high density complex is in the downtown area and has a high occupancy rate. Residents seem to identify themselves with their neighborhood and enjoy the social activities sponsored for the residents. These examples indicate the possible merit of applying the recommended administrative policy to the proposed high density urban residential complex.

CHAPTER IV

ARCHITECTURAL CONCEPTS FOR ELEMENTS OF THE COMMUNITY

The Development Plan

The development plan in Figure 10 reflects the generalized application of programming and design criteria developed in Chapter III. The plan shows the following elements, which will be discussed in this chapter: 1) Residential Complex I, including a) Tower Courts, b) Lakeshore Homes, and c) Hillside Homes; 2) Residential Complex II, consisting of Plaza Terrace Apartments; 3) Residential Complex III, being Bay View Apartments; 4) Residential Complex IV, consisting of Garden and Towers; 5) the Residence Hotel; 6) Medical Complex; and 7) the Community Shopping Center.

Some of the features which may be incorporated into such a development are: a) condominium home ownership, b) contract maintenance, c) near downtown employment establishments, d) near downtown shopping and entertainment facilities, and e) rental residential units.

With both rental and owner-occupied units, the community would be stable, yet offer the opportunity for residents to change units when their families increase or decrease. Maintenance can be furnished by contracting a full-time crew on a community basis and charging owners a nominal fee for the services. The areas in which families own

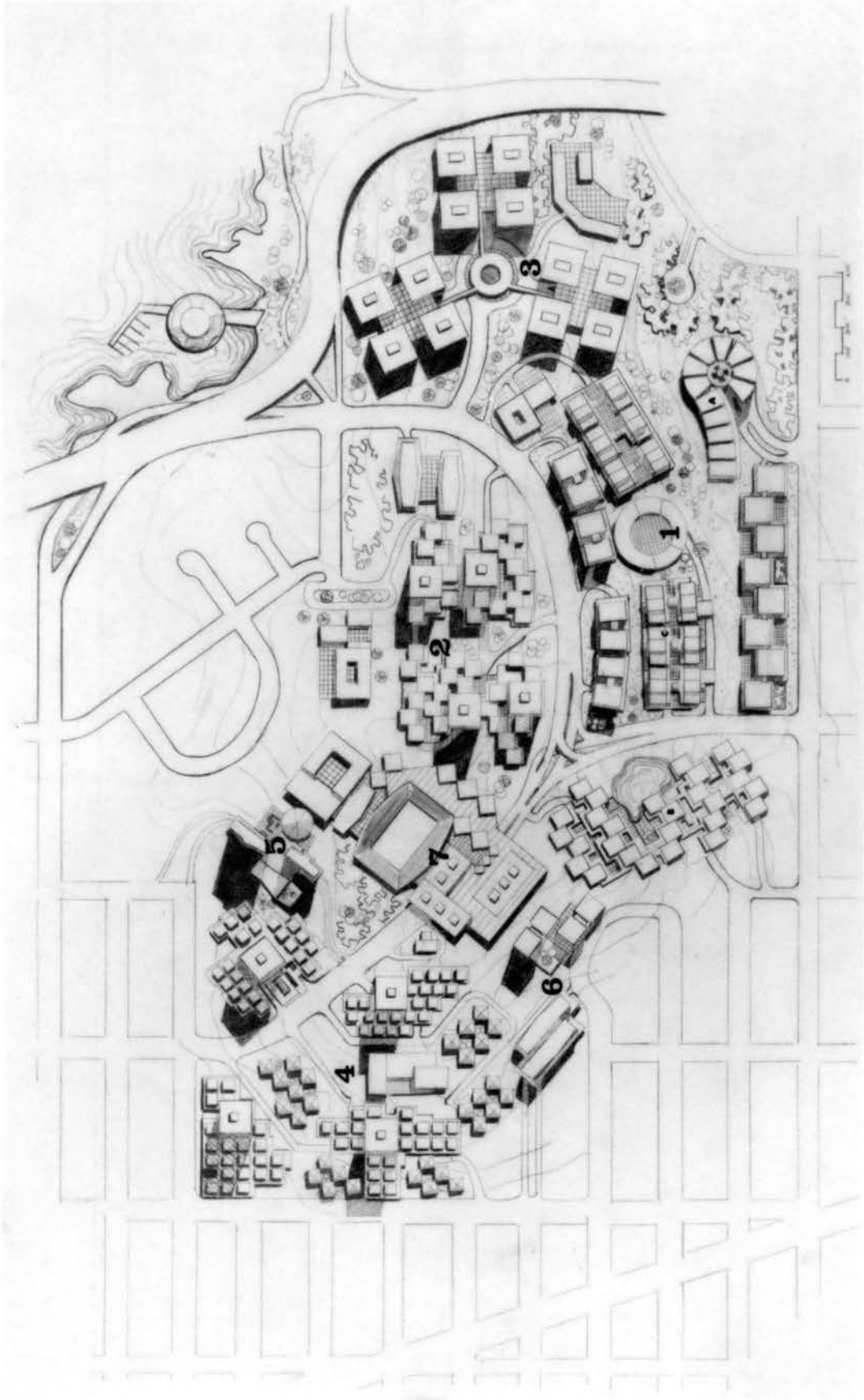


Figure 10. Proposed Development Plan.

their homes also tend to be more stable. Rental application toward purchase of a home can be an effective means of providing incentives for home ownership. Senior citizens may live here, if they desire, instead of being committed to a village of retired, physically declining, and relatively inactive people. They can serve an important role as examples of future stages of life cycles for younger people. Coming in contact with persons of all ages would seem to give a better perspective of life to all residents.

Persons whose families are grown can help struggling young couples in times of stress and need. Young people can supply that "spark of activity" so many older people enjoy. The child who experiences the love and affection of all ages of people will grow up more at ease in the society than the one who is isolated and knows only his parents' generation and that of the children at school, or has the inadequate contact of an occasional visit from grandparents who stay only a few days each year.

An elevation of the development site is shown in Figure 11. The steep slope of the site necessitates the variety of levels of the structure on the site. This variety offers both problems and advantages in design of the parking structures. Design of open recreation spaces will often require fill or excavation to provide level land for play spaces. Figure 12 shows an aerial view of the proposed development site. The various features included in the site design will be more specifically described in the discussion that follows. The emphasis will be put upon residential complex design.

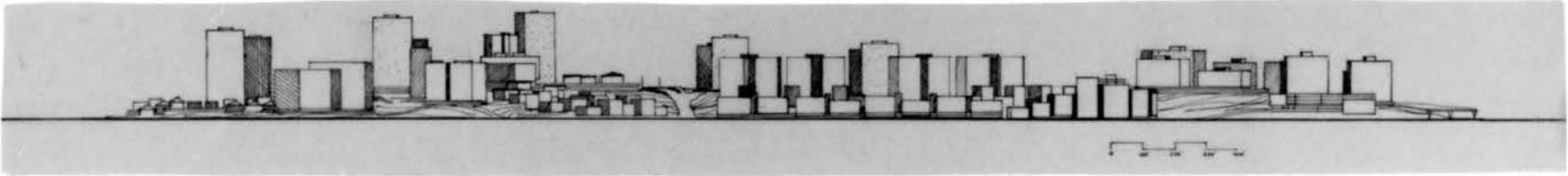


Figure 11. Elevation of Development Site.

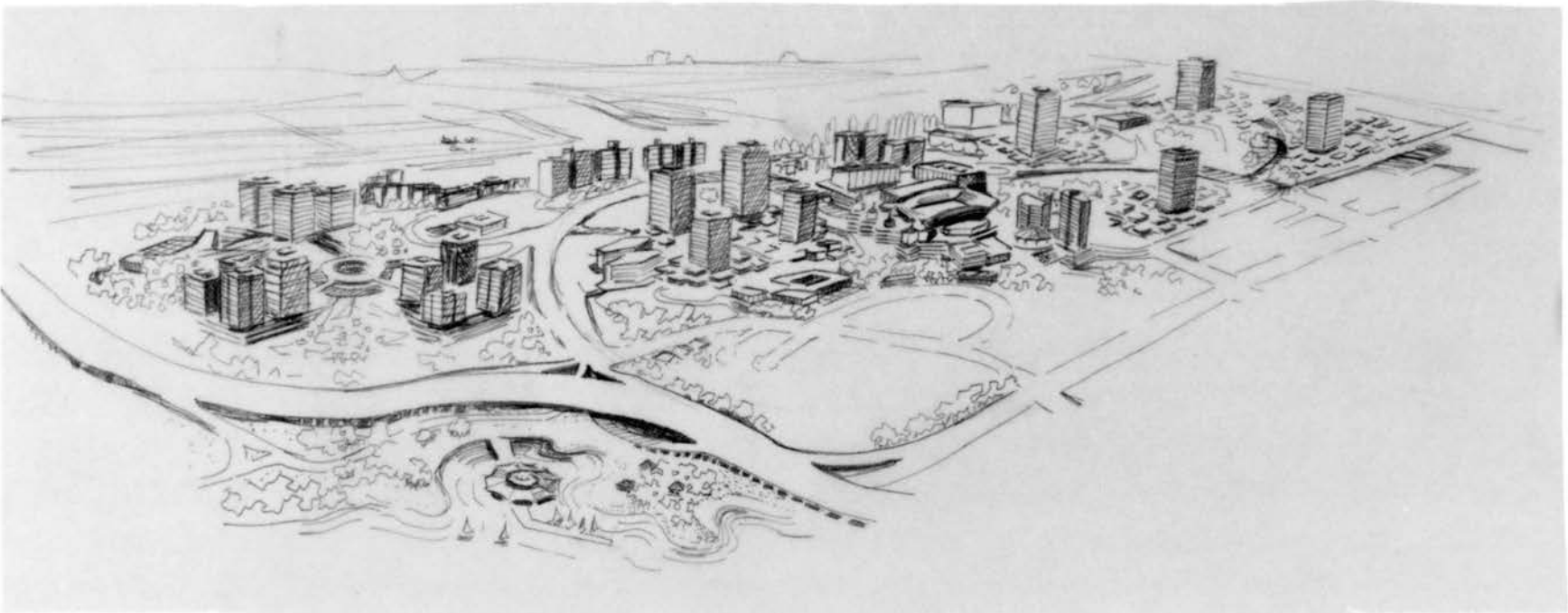


Figure 12. Perspective of Development Site.

Residential Complex I

Tower Court:

Tower Court, shown in Figure 13, consists of a curvilinear shaped series of thirteen apartment towers containing 462 units with an estimated 1,155 residents. The central courtyard of this structure is encircled by the towers with 693 parking spaces tucked beneath. The entrance to this structure is from the perimeter street on the south rather than from the central major street within the site.

Lakeshore Homes:

This area is conceived to be of multi-family design having a townhouse atmosphere. It has twenty-seven towers housing 1,140 people in 228 units. The special attraction of this area is a small lake around which the dwelling units are placed. The design for the area should give the feeling of a peaceful setting, restful, yet filling the needs of the urban life. In this area vehicular circulation should be well hidden as shown in Figure 14, and the landscaping should reflect an informal atmosphere. The site plan of this area is shown in Figure 15. Figure 16 shows a north-south section through Lakeshore Homes and which indicates the slope and elevation difference for the structures. A view of the lake area is shown in Figure 17. A concept of living unit arrangement is shown in Figure 18.

Hillside Homes:

Hillside Homes consists of three styles of urban housing. There are two elementary schools located within the complex. These should become the focal points for neighborhood

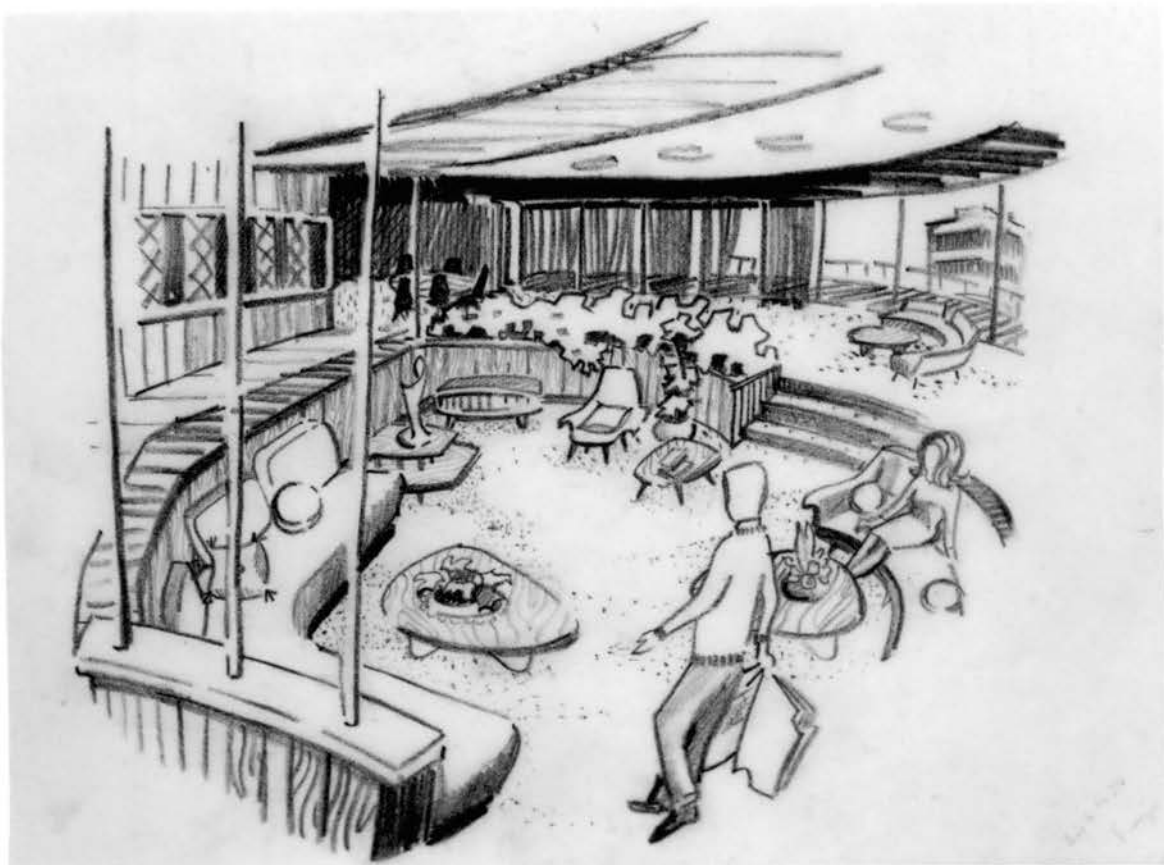
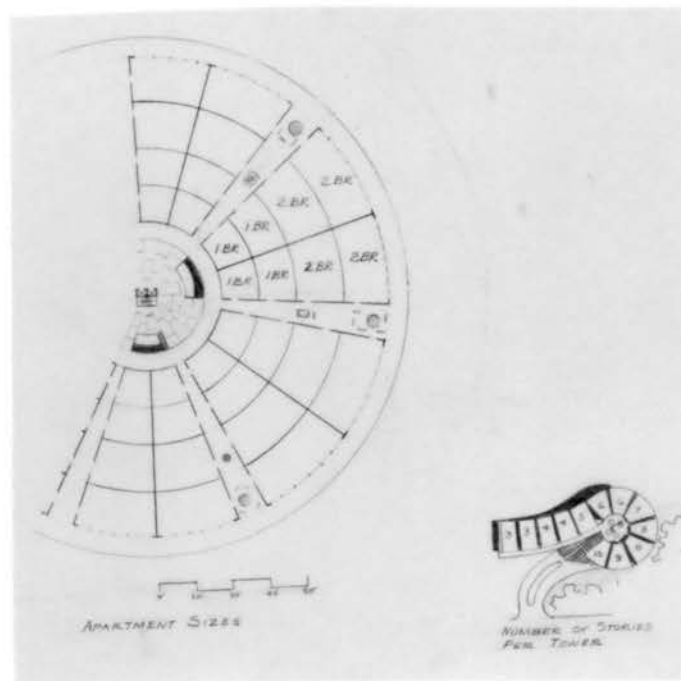


Figure 13. Design Concepts for Tower Courts.

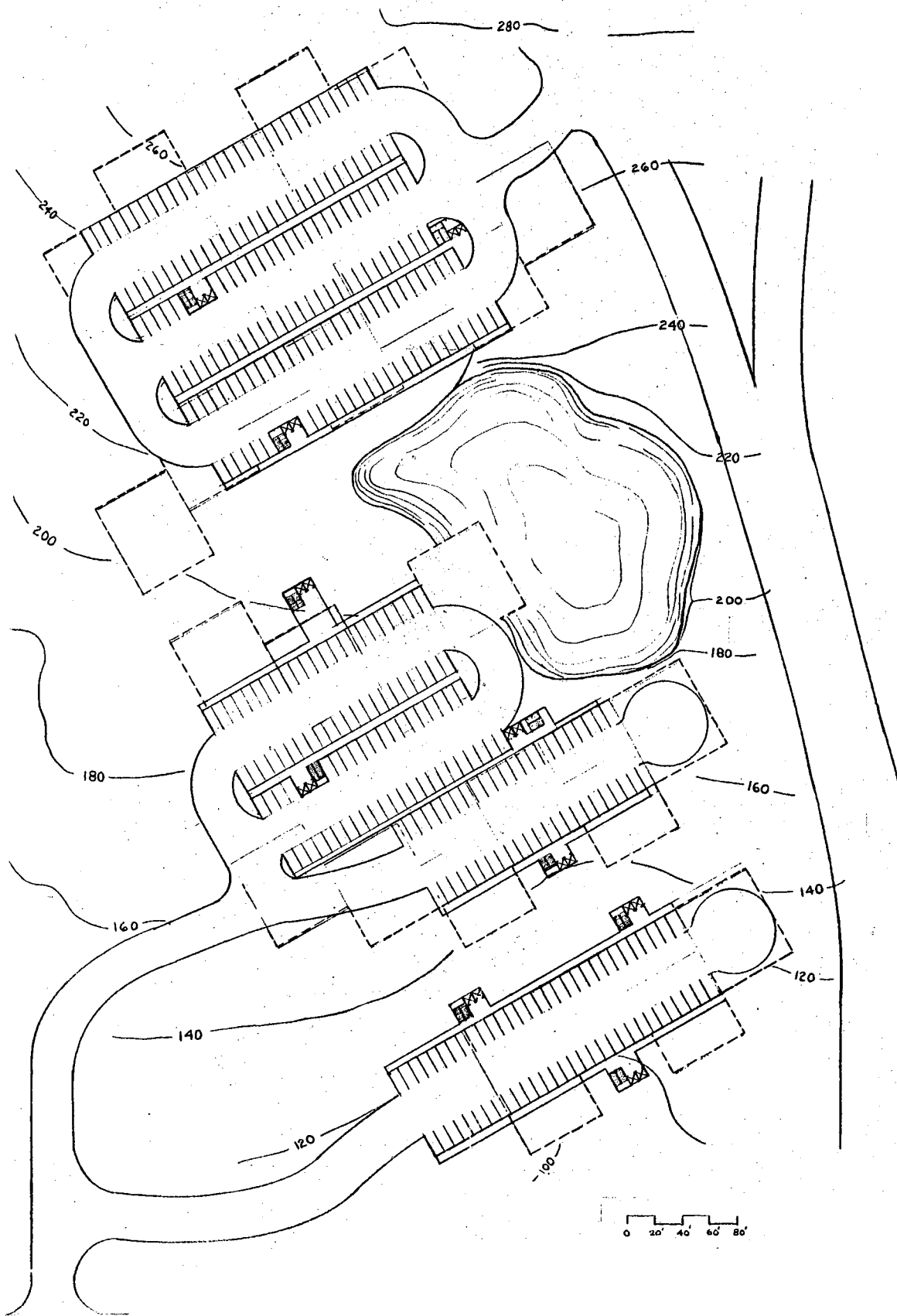


Figure 14. Parking Level of Lakeshore Homes

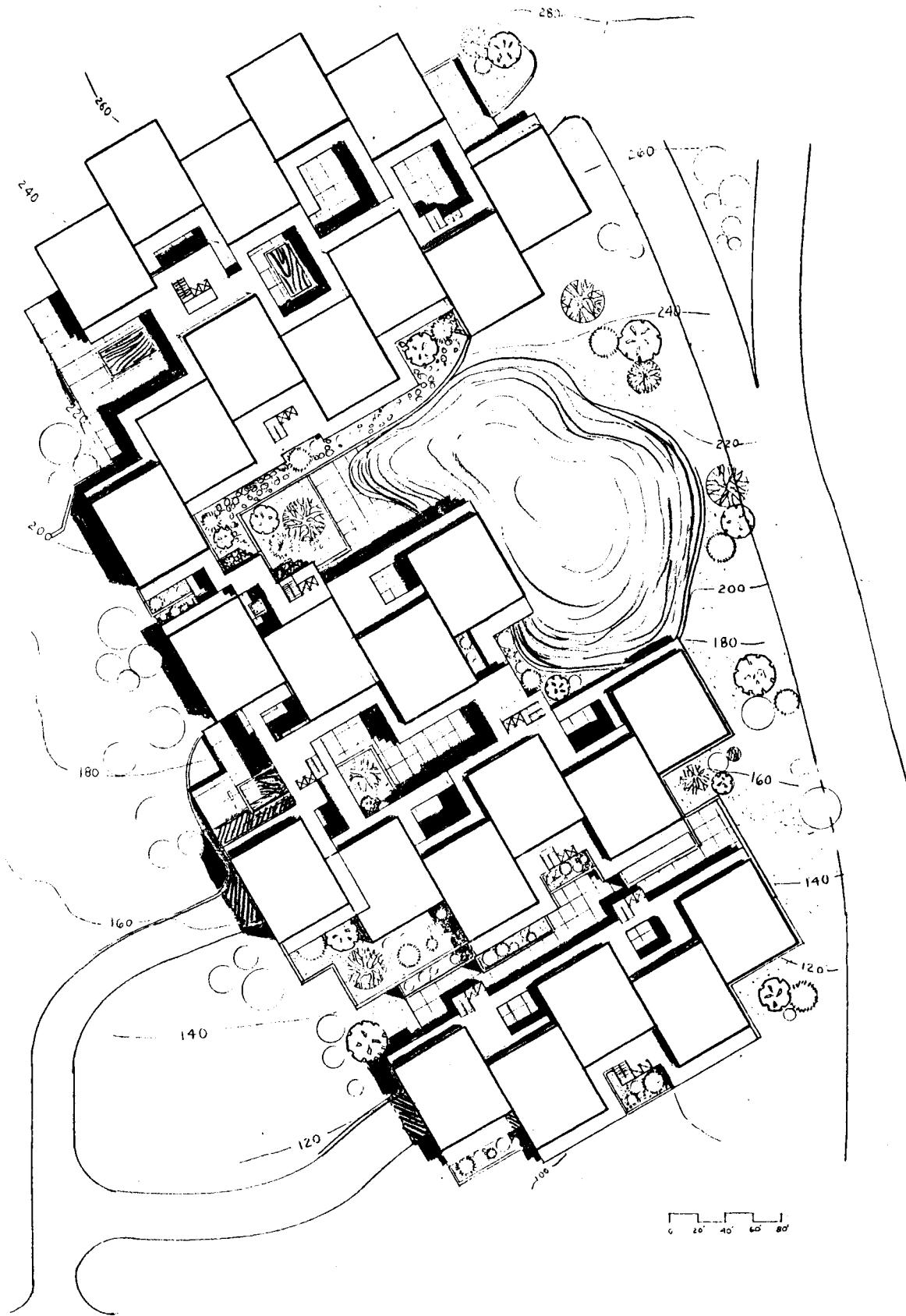


Figure 15. Site Plan of Lakeshore Homes

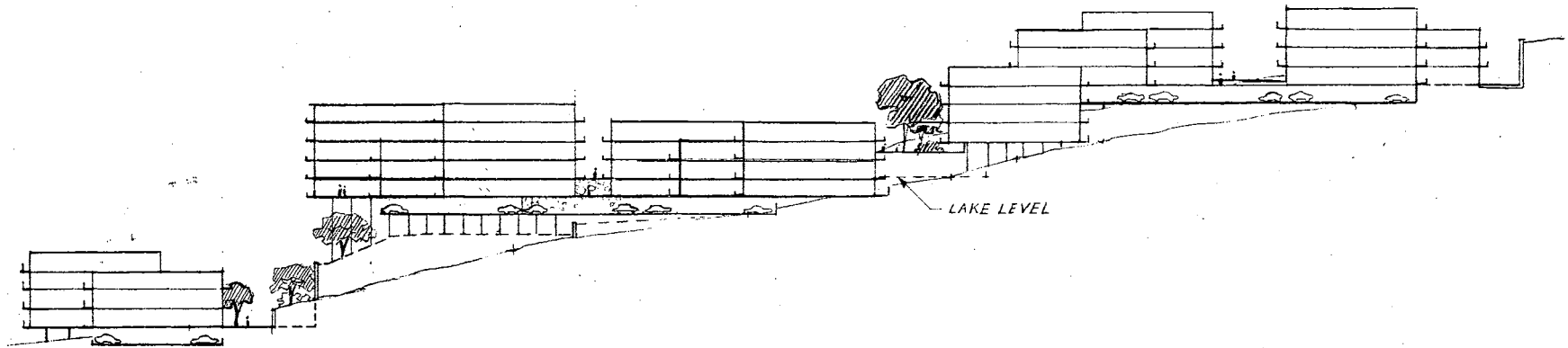


Figure 16. North-South Section of Lakeshore Homes.

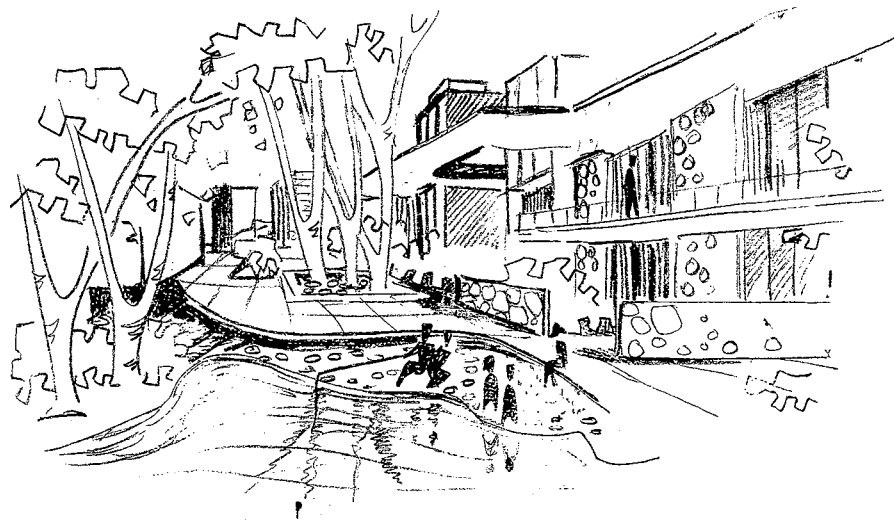


Figure 17. View of Lake Area of Lakeshore Homes.

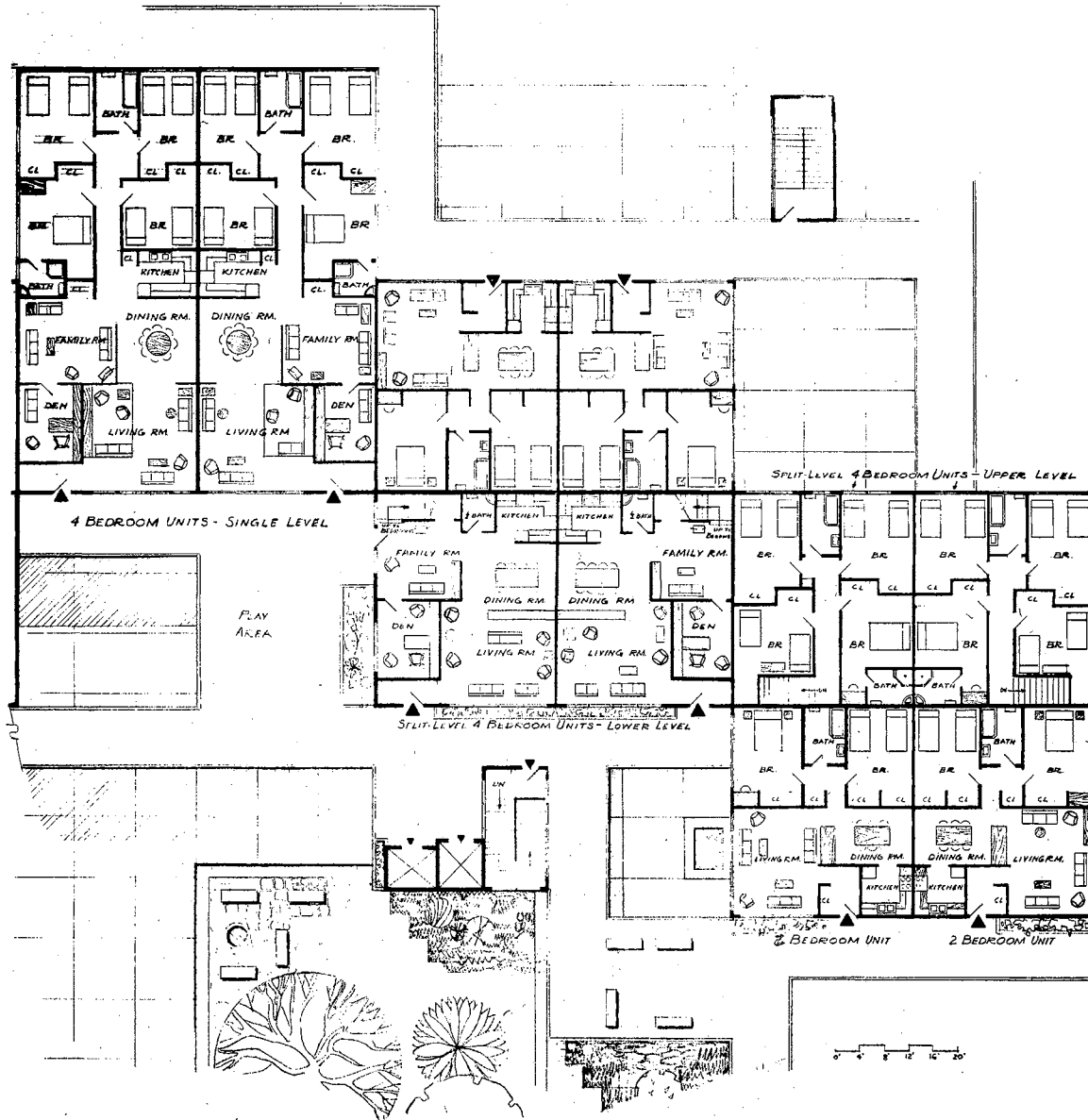


Figure 18. Concept of Living Unit Arrangement in Lakeshore Homes.

activity for the entire complex. A neighborhood park forms a "green belt" through this complex and connects the schools, residences and a community park. The steep slope of the land on the south offers the opportunity of developing on terraces, making excellent views from the units. Large amounts of open space have been retained and parking will be hidden in garages below the terraces. Using the ratio of 1.5 parking spaces per dwelling unit, there will be a need for a total of 1,688 parking spaces in the entire Hillside Homes area.

Sitting on the topmost level is the housing shown in Figure 19. It consists of ten towers, joined in couples by their elevator cores and housing approximately 2,025 people in 405 units. The housing in the central portion of Hillside Homes area south of that described above is shown with 28 towers grouped around two different garden and circulation cores. (See Figure 20.) These structures house an estimated 2,934 persons in 485 units. The southern most level of housing is comprised of 235 units in 8 towers. This single structure houses an estimated population of 540 persons. The parking garage and site plan for this structure is shown in Figure 21. A perspective of a courtyard for this structure is shown in Figure 22.

Residential Complex II

Plaza Terrace Apartments:

This area is a multi-level mega-structure housing 420 units with 1,260 persons in four high rise towers and 880

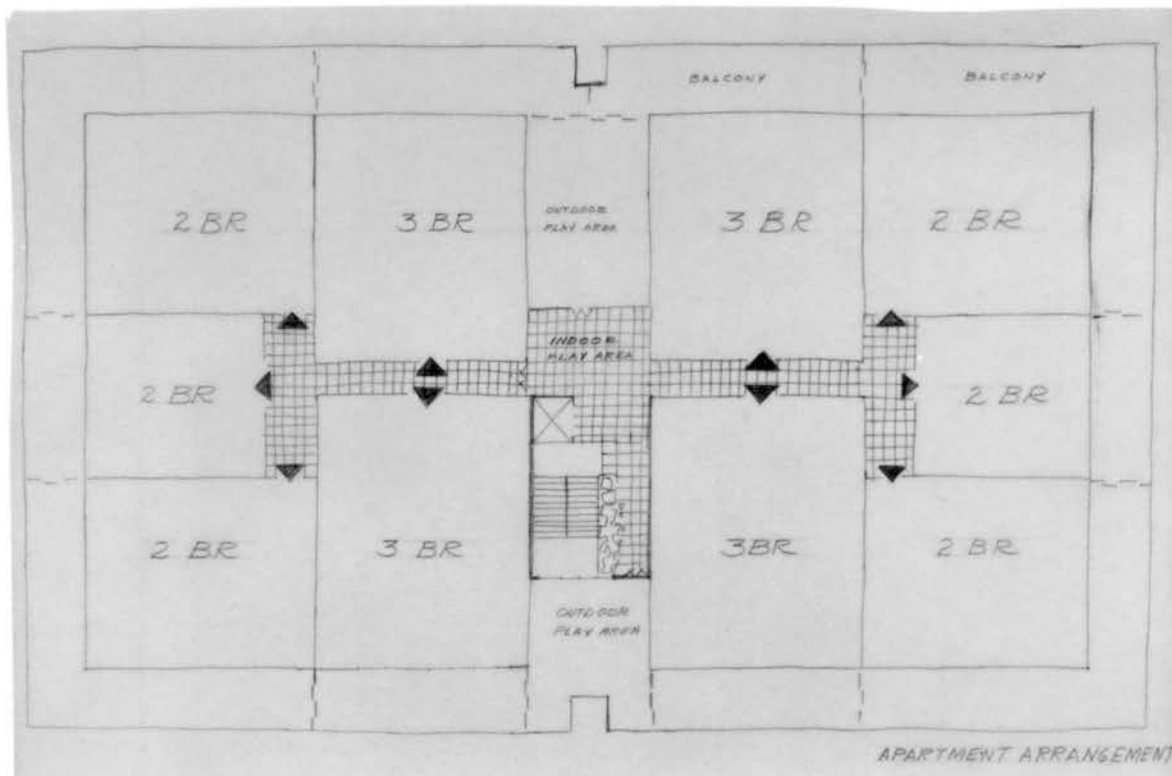
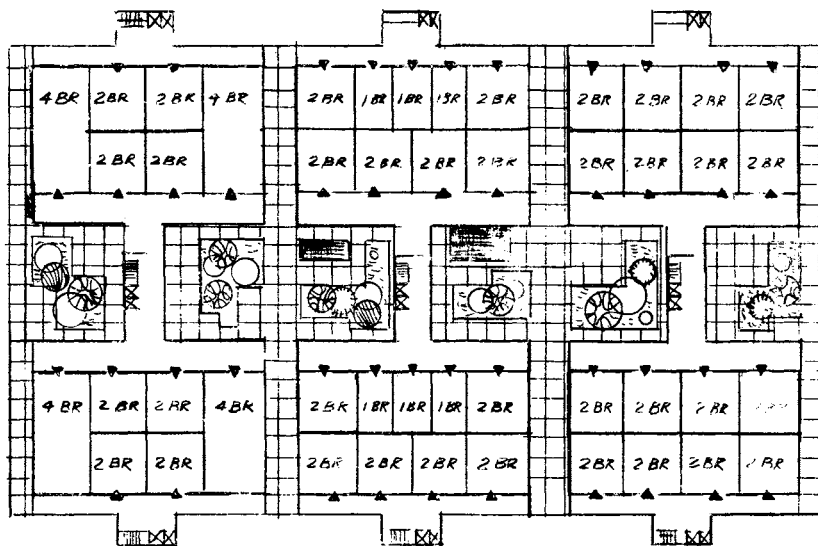
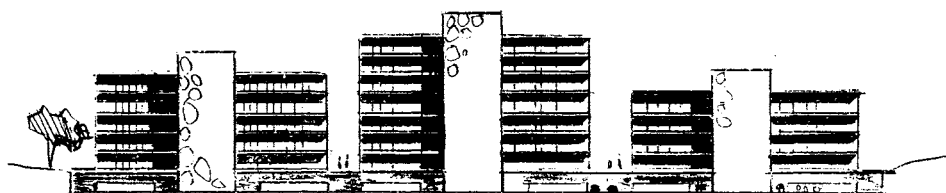
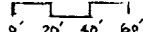


Figure 19. Plan and Play Area
in Structure of Hillside
Homes, North Area.



APARTMENT ARRANGEMENT



ELEVATION

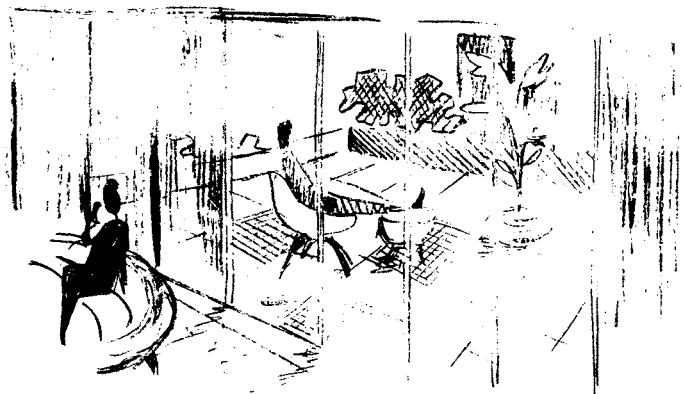


Figure 20. Plan and Elevation of Structure in Hillside Homes, Central Area.

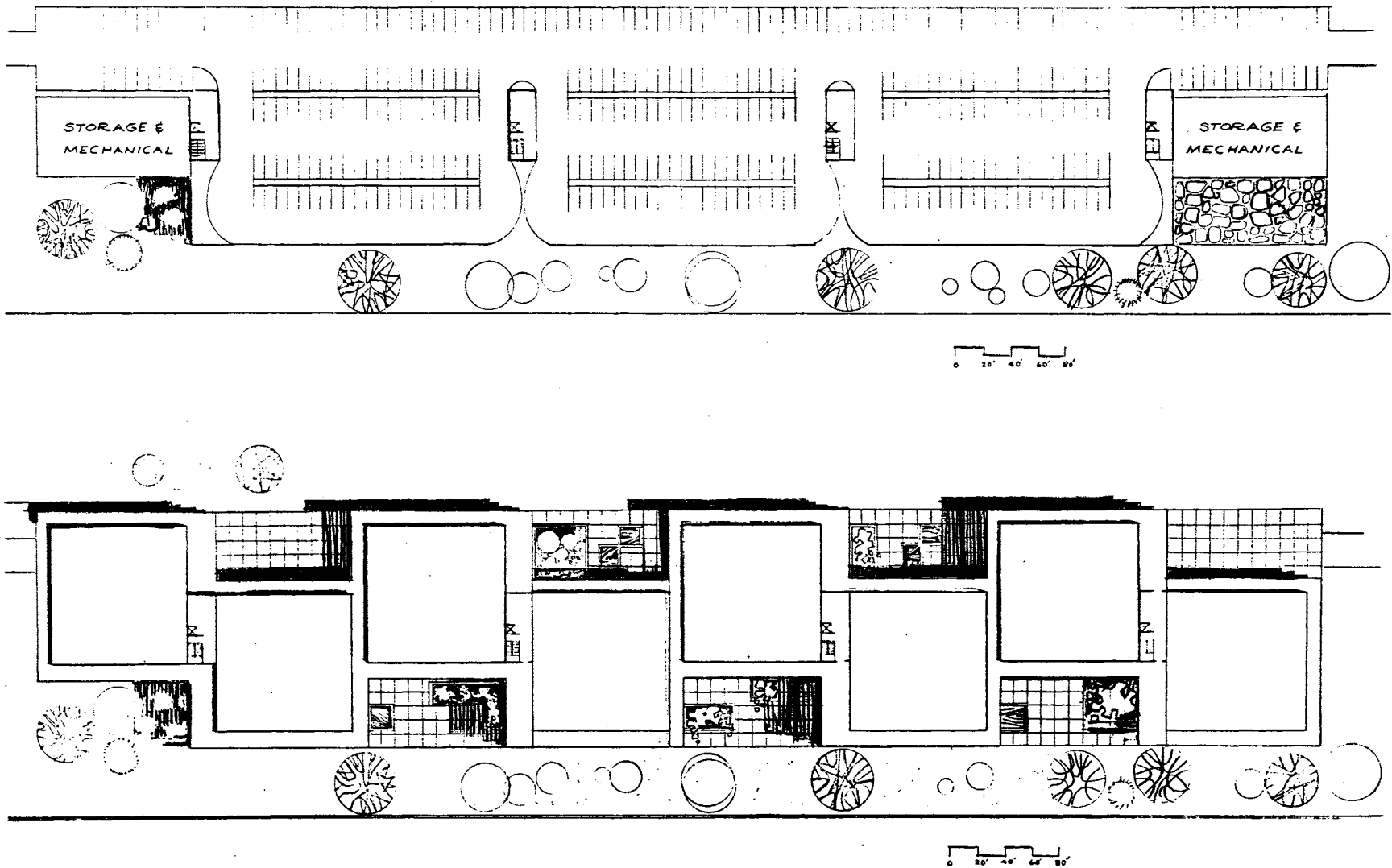


Figure 21. Parking and Site Plans for Hillside Homes, South Area.

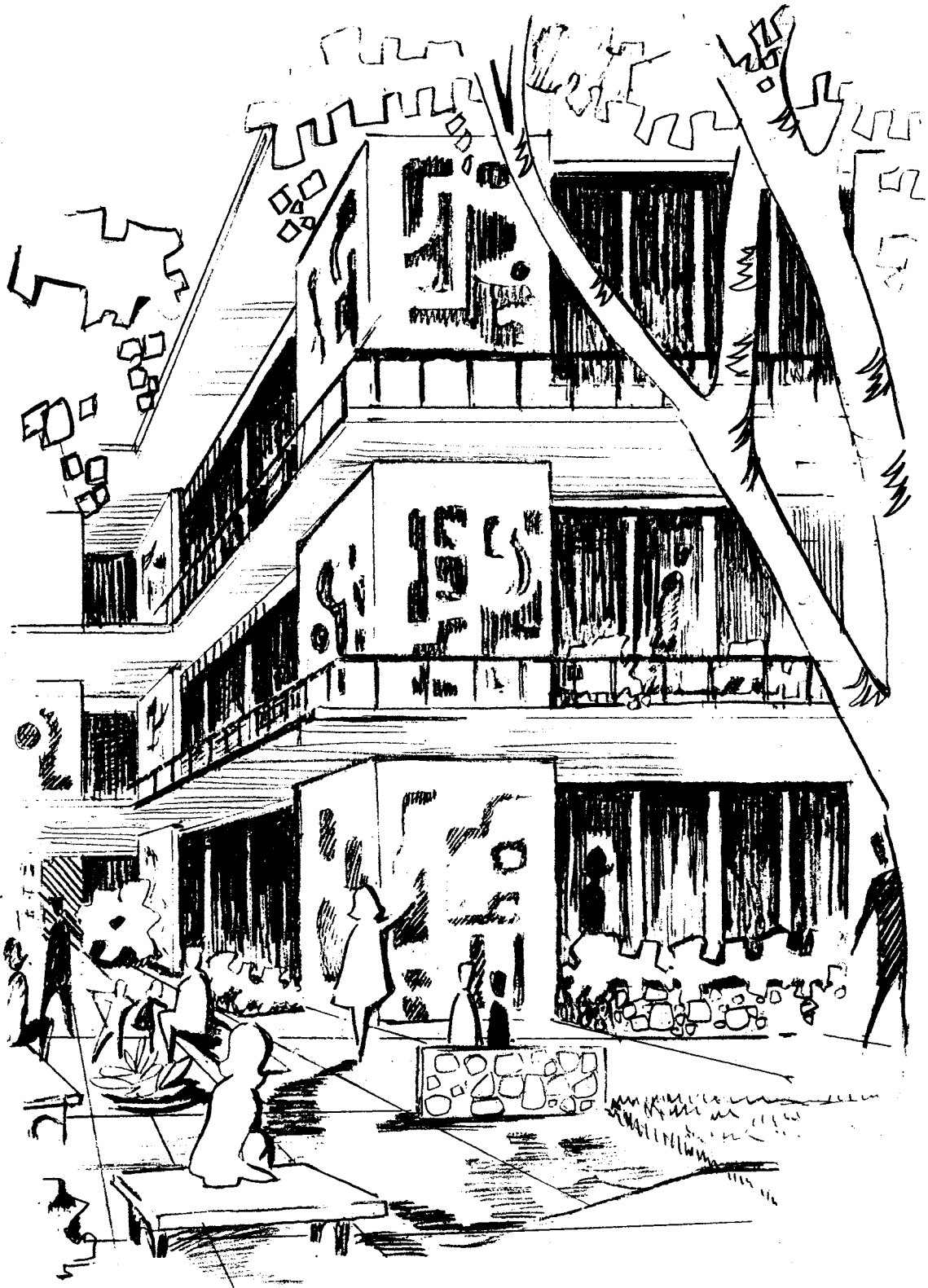


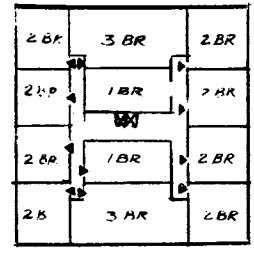
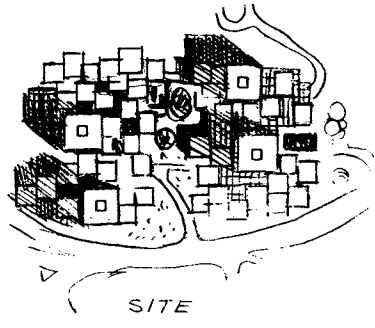
Figure 22. Courtyard of Hillside Homes, South Area.

units having 2,640 persons in 38 low rise towers, shown in Figure 23. Its neighborhood elementary school, is located to the north of the residential structures. This area should have a sculptural effect, yet retain human scale to the residents as they walk, live and play within it. Great care must be given to the design to prevent the structure from being too overpowering to the individual, yet it should be bold and strong in its statement of urbanity.

Residential Complex III

Bay View Apartments:

The Bay View Apartments have what the designer considers the most valuable residential land in terms of its location to the view of the Bay. This complex consists of three clusters of four towers each, containing a total of 1,320 units and housing a population of 3,960. It adjoins the right-of-way of the proposed expressway bordering the east side of the development site. The view of the waterfront area influences the total atmosphere of this neighborhood design. The area will include an elementary school, as the other residential complexes, serving the children residing there and having facilities for neighborhood recreation activities. The Bay View Apartments are designed for a rather small average family size and offer great flexibility necessary for the functioning of this type of structure. The design of a typical floor is shown in Figure 24 and illustrates the wide design possibilities. Figure 25 shows an interior concept of a dwelling unit.



TOWER APARTMENT ARRANGEMENT

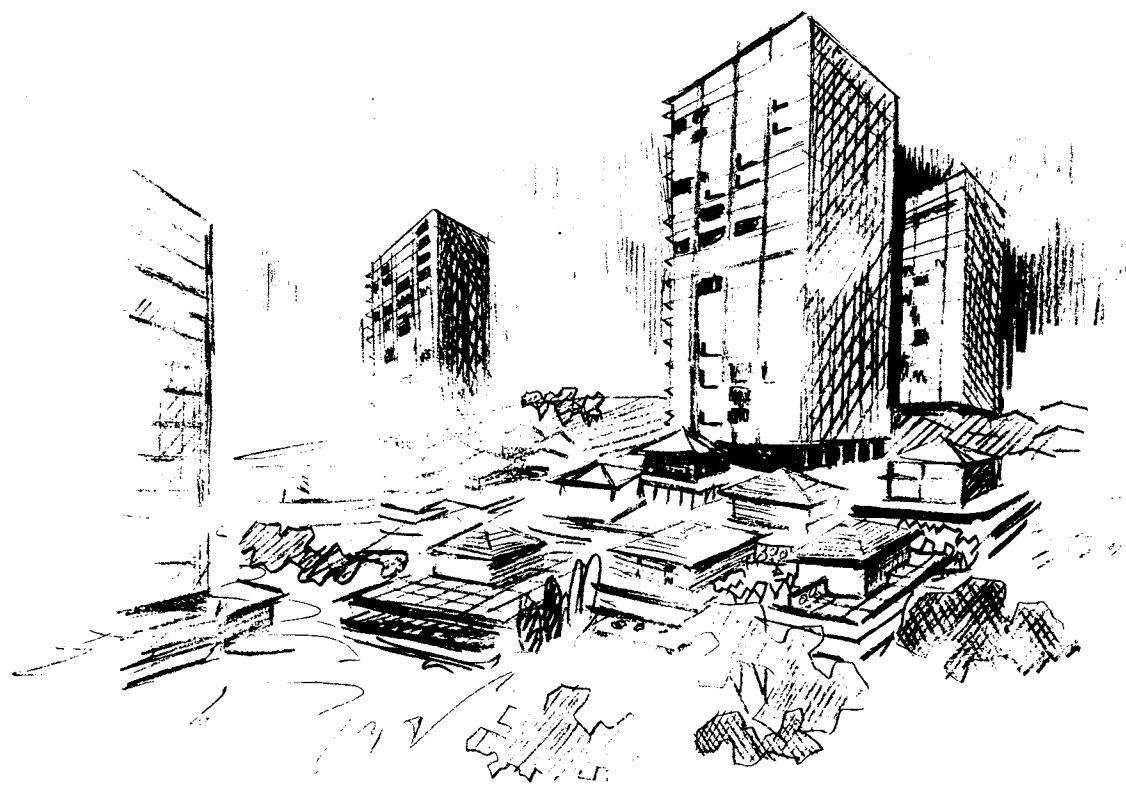
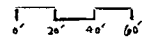
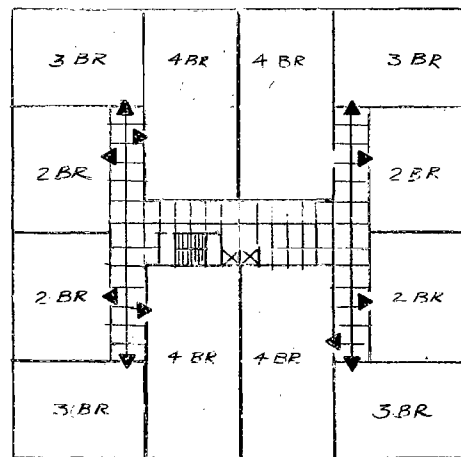
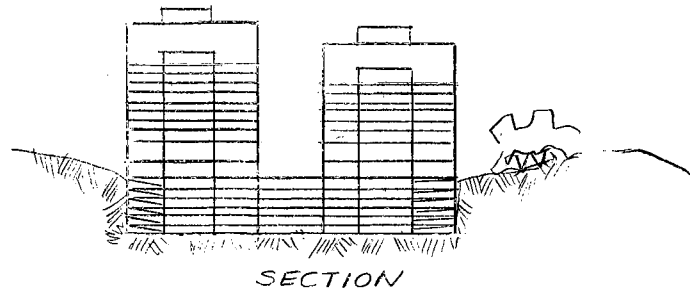
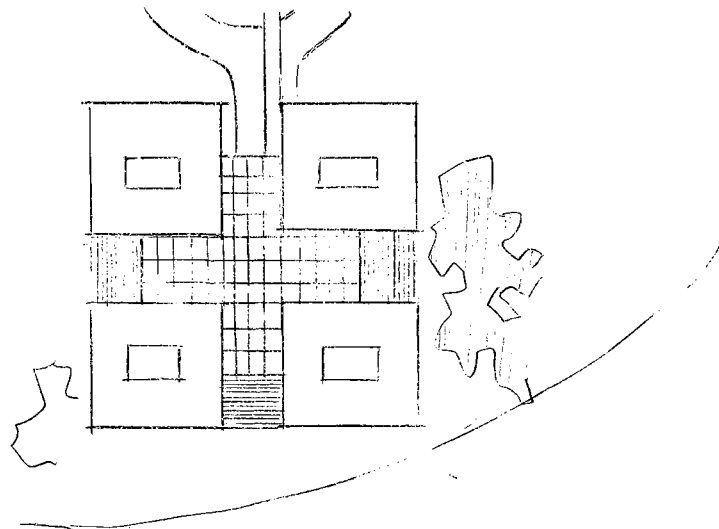


Figure 23. Plaza Terrace Apartments.



APARTMENT LAYOUT

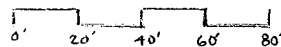


Figure 24. Plan of Typical Floor in the Bay View Apartment Complex.

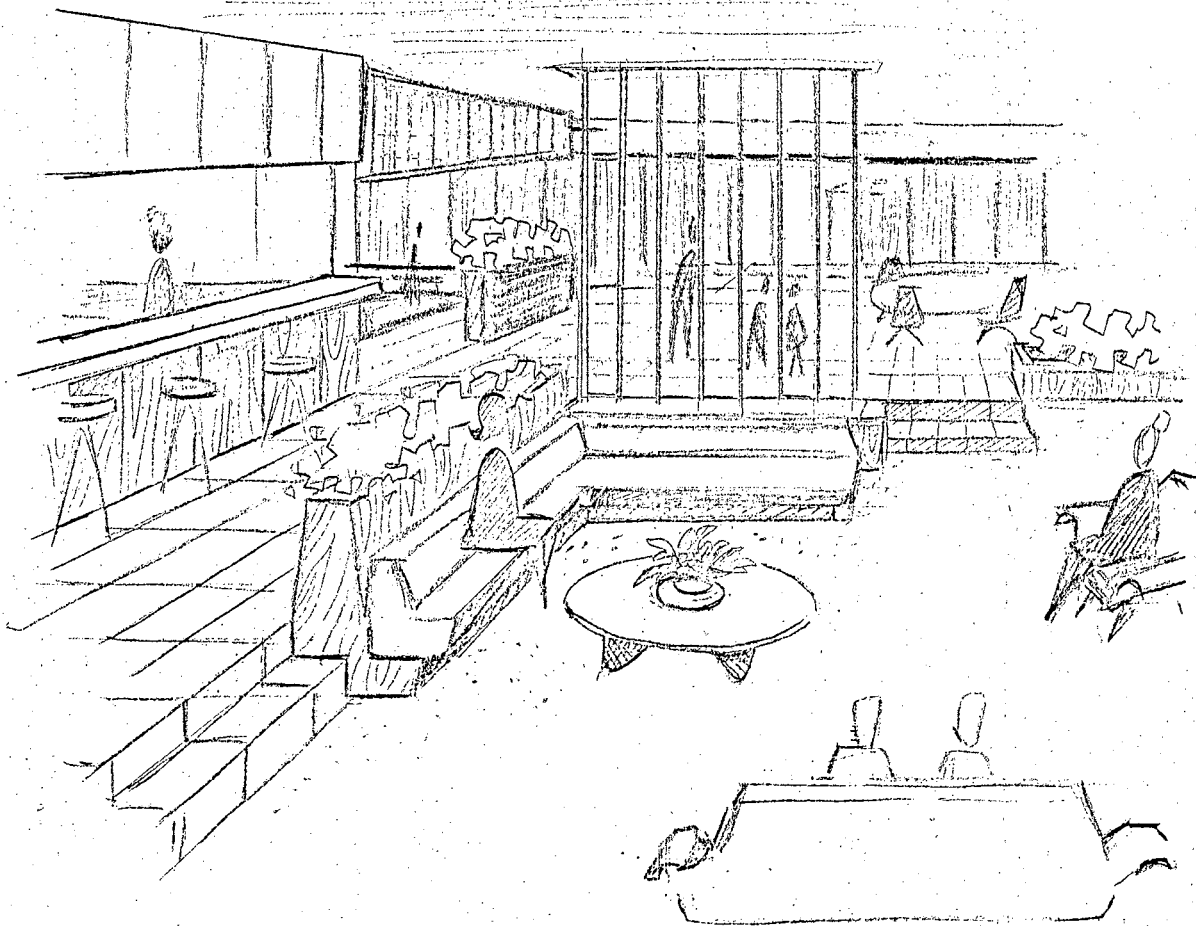


Figure 25. Interior View of Tower Unit
in Bay View Apartment Complex.

The core is in the center of each tower, containing the essential circulation elements needed in the high rise structure. The lobby areas will be located in the lower floors, just below and dwelling units, and above the parking garages. The parking will consist of six garage levels below the plaza in each of the three structures. Small convenience goods shops will be located in the area of the lobbies of the three clusters of towers, but, for the most part, residents are expected to journey from the residential complex to the community shopping center to make their purchases. Located in each cluster will be a coffee lounge, beauty shop and a barber shop. All stores in the Community shopping center will have quick delivery service for all large purchases, making it unnecessary for residents to carry packages with them when shopping. All deliveries will be made to a central area in the lower levels of the core within each of the clusters; and then the personnel of the structure will distribute them rapidly to the residents. Children will be able to walk to school; however, on rainy days a mini-bus service could be provided.

Residential Complex IV

Garden and Towers Apartments:

This area consists of multi-leveled megastructures with low rise units sprinkled around four high rise towers, as well as semi-detached multi-story town house units, offering variety in design potential. The total complex contains 1,590 units which house approximately 5,584 persons and

require a total of 1,950 parking spaces. Design concepts are shown in Figure 26.

Residence Hotel

Located on the site near the Community Shopping Center is a large Residence Hotel. It is designed to furnish a relatively economical living environment for 1,000 persons. Residents will be housed in two towers with dining, recreational, and commercial facilities located in lower levels to serve residents of both towers.

Figure 27 shows the service area for the north residence tower and the lower level of the visitor lobby of the Residence Hotel. Figure 28 shows the visitor entry area with its parking lot and the first level of the parking garage. The parking garage floors three through eight, inclusive, are shown in Figure 29. These floors are essentially identical in design except that the elevation levels are ten feet higher on each floor.

Attendants will park visitor automobiles, while employees and residents will be assigned parking stalls and will use a self-service method for parking in the ramped garage which will have a total capacity of 1,168 automobiles.

Adequate dining facilities with food preparation, storage, and service areas must be integrated into the design. Recommended types of dining accommodations consist of a large cafeteria, a small table service restaurant, and a snack and cocktail lounge. Figure 30 shows the service and receiving area for the dining facilities, the top floor of

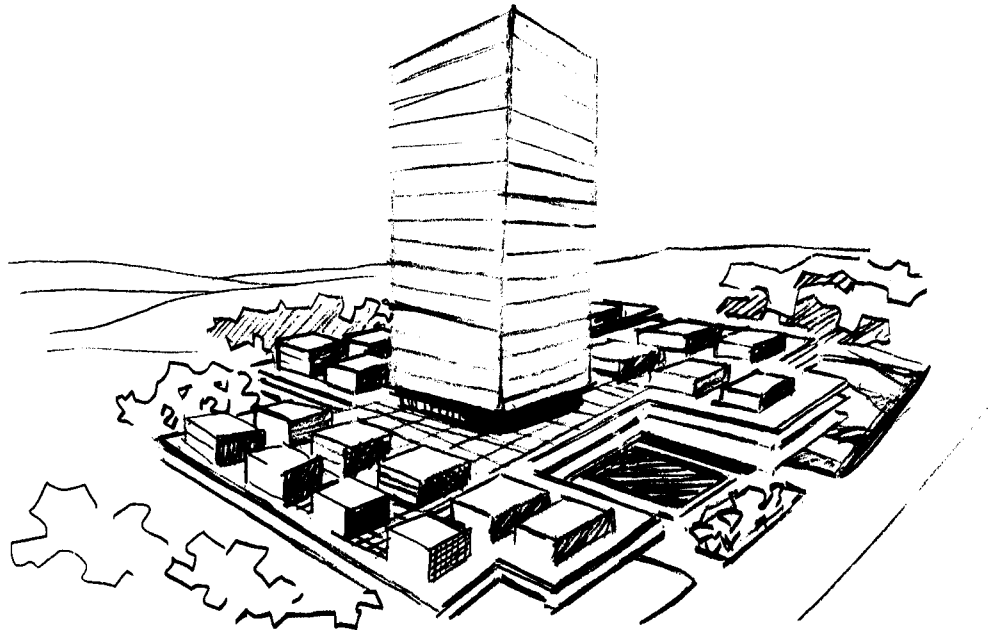


Figure 26. Design Concepts of Garden and Towers Apartments.

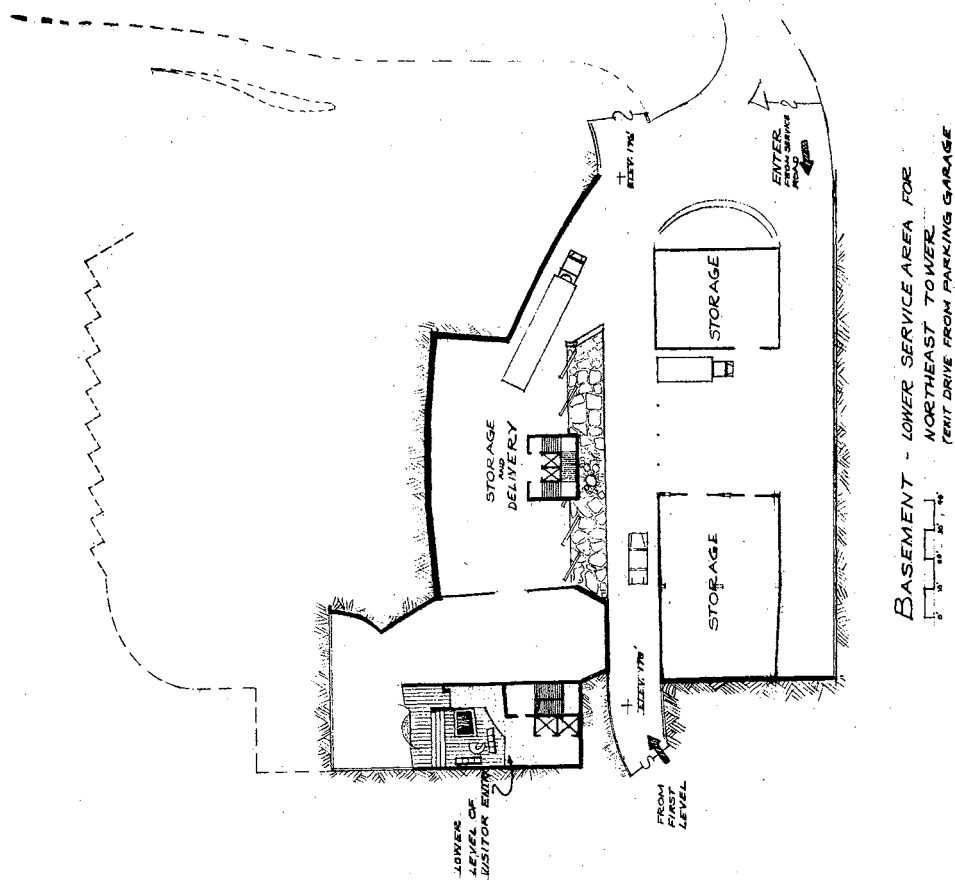


Figure 27. Residence Hotel.

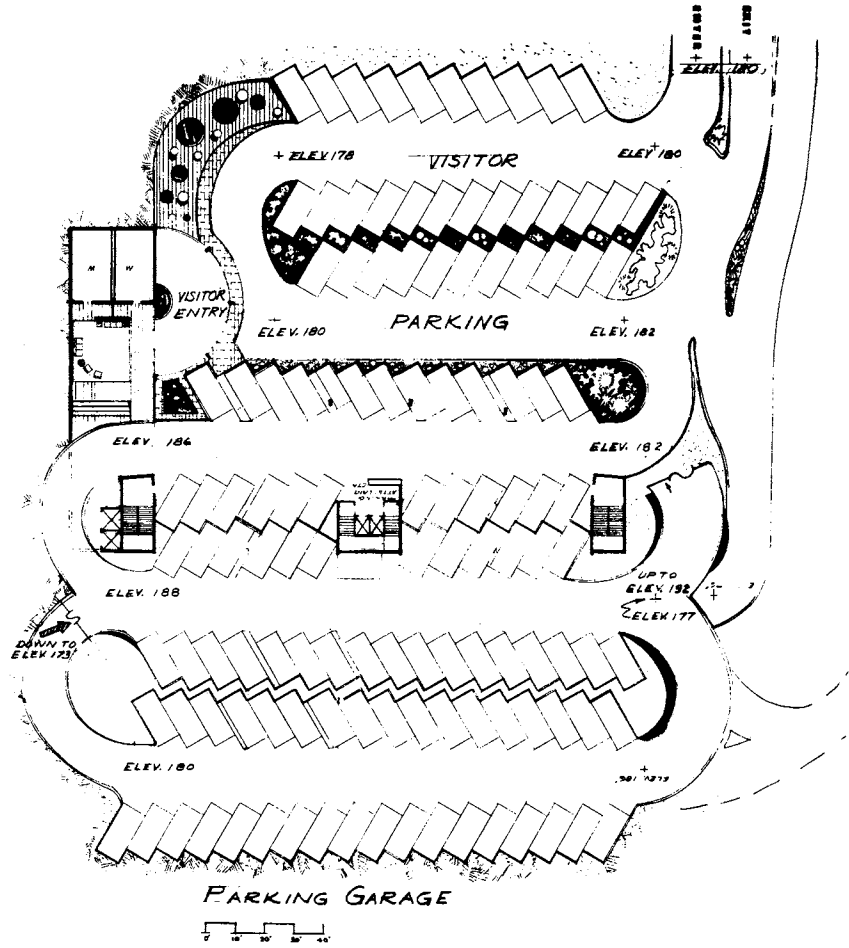
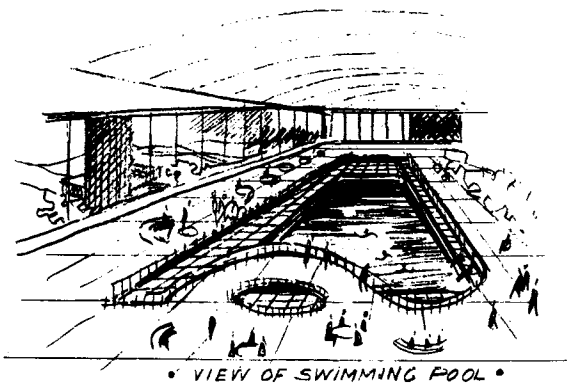
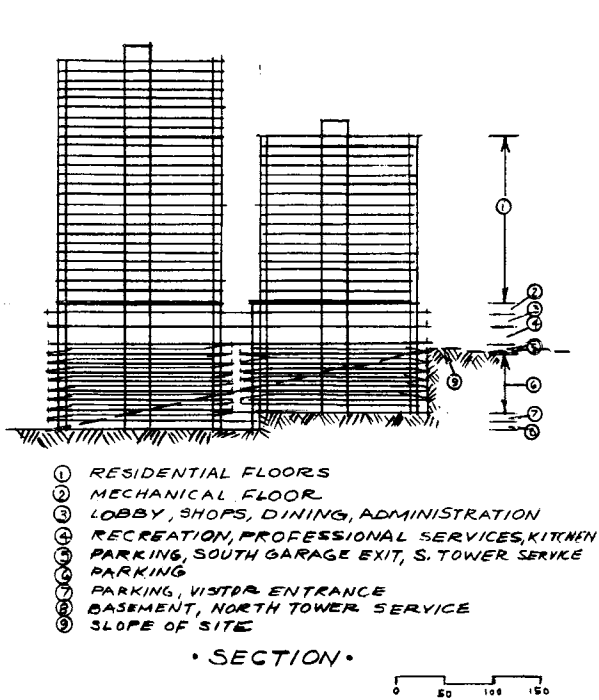


Figure 28. Residence Hotel.

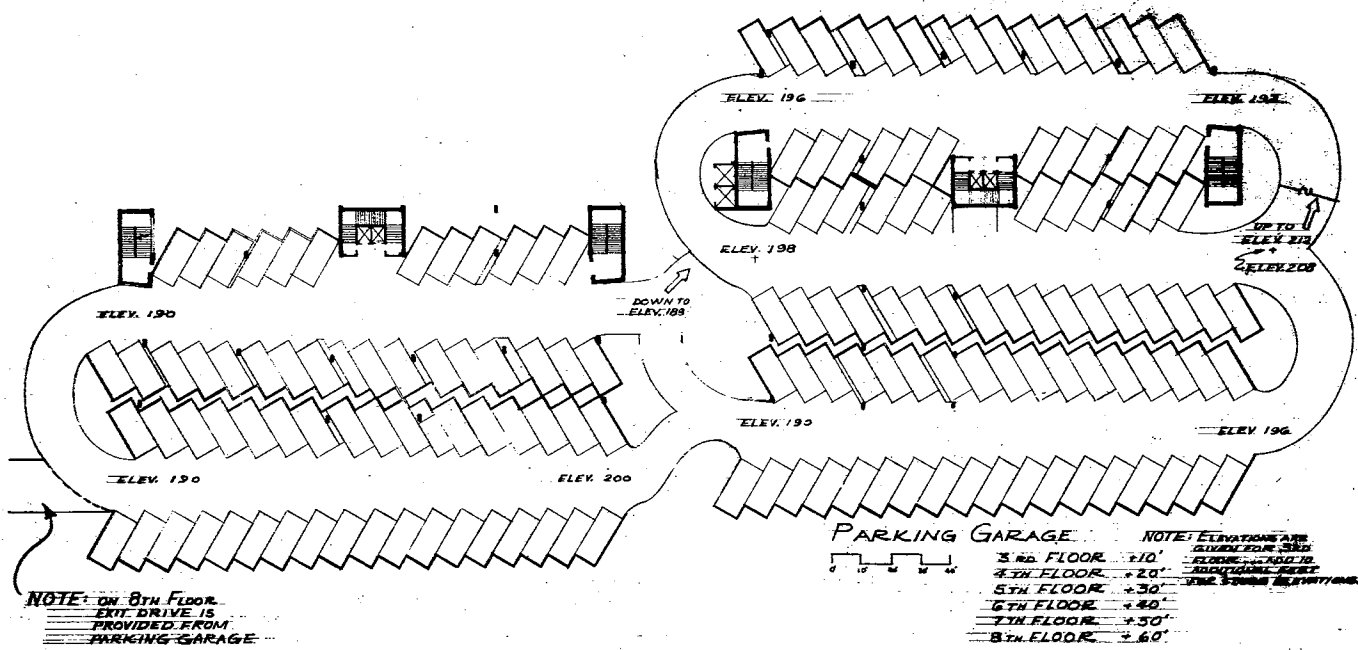


Figure 29. Residence Hotel.

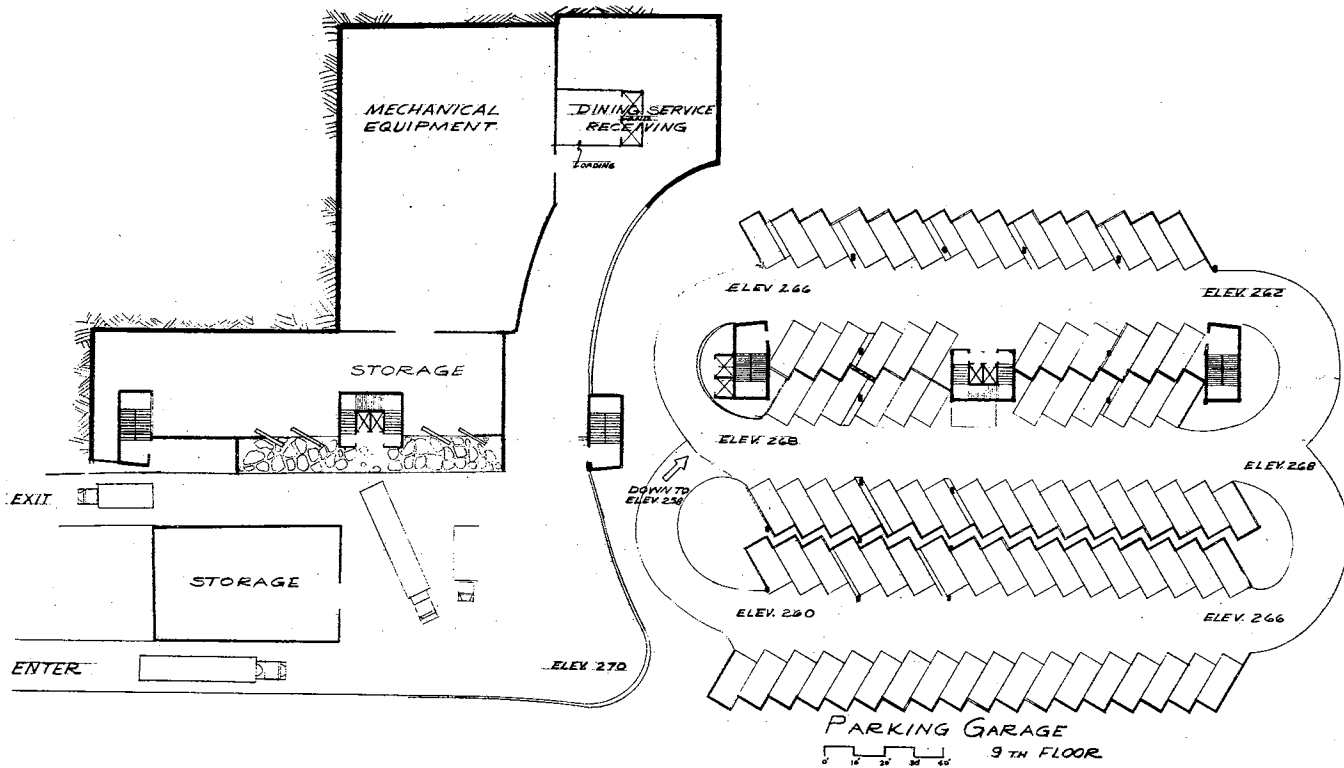


Figure 30. Residence Hotel.

the parking garage, and a service for the south residence tower.

The kitchen with its service and storage areas is located above the kitchen's receiving area as shown in Figure 31. In the same figure, professional services and recreational facilities are shown.

Living units will be designed to embrace a wide variety of facilities and costs to suit the heterogeneous socioeconomic characteristics of residents and their needs. The room arrangement should allow a high degree of privacy for each resident. However, the whole complex should initiate social interaction among residents as much as possible. The dining and recreational facilities are desirable generators of social interaction among the 1,000 residents of the complex.

Adequate counseling, vocational guidance, and other professional services should be provided for the residents, since many of them may require some social and vocational guidance and adjustment. A resident doctor and a resident nurse will be necessary personnel for the Residence Hotel. Some psychological and social work services can be furnished on a part-time basis from the medical center or by persons in practice in the vicinity. There should be provisions for adequate numbers of counselors to reside in an orderly distribution among the tower floors where they are easily accessible to the individuals desiring their services.

It is conceivable that the education levels of residents might vary from less than a high school diploma to those who

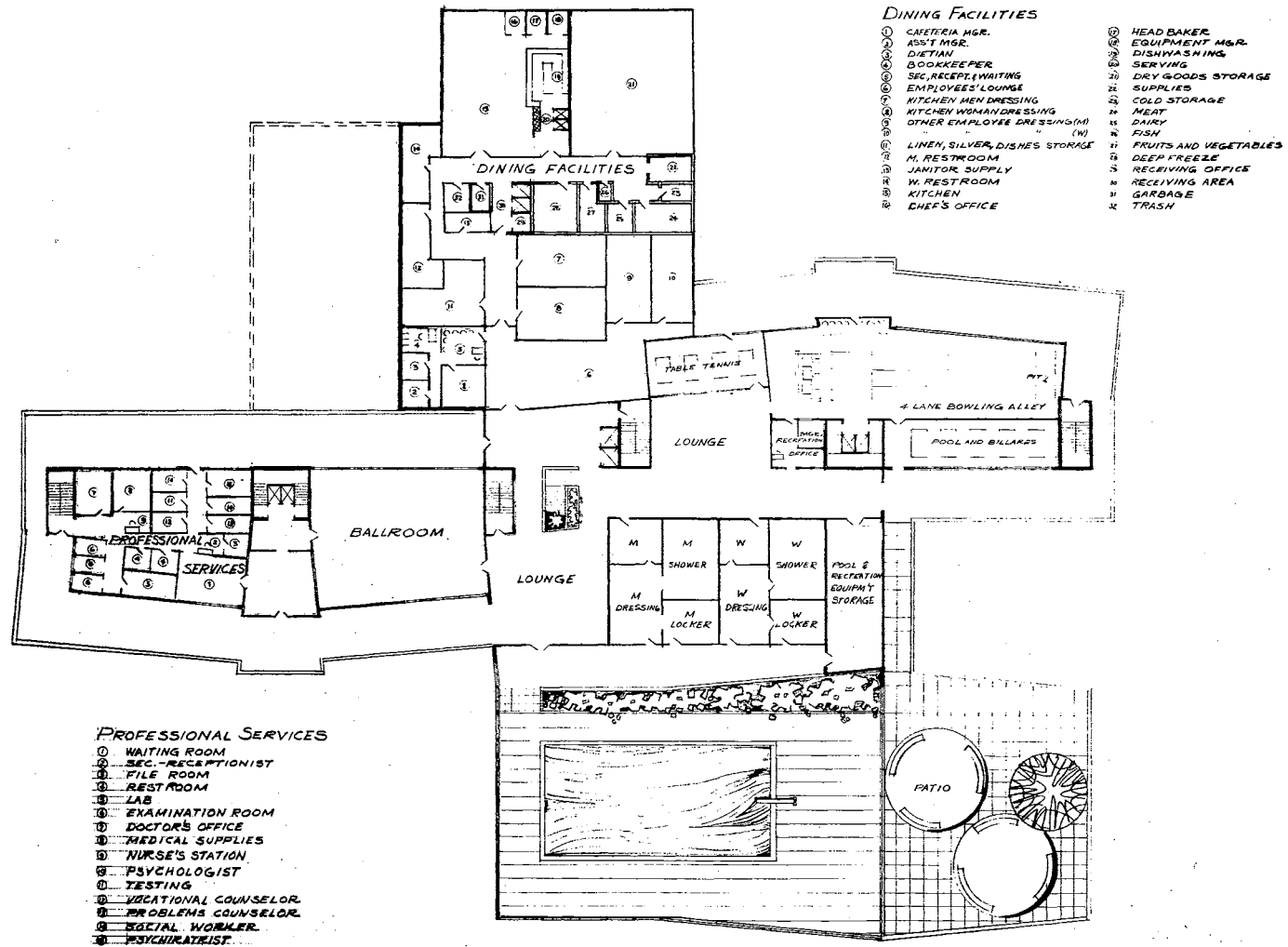


Figure 31. Residence Hotel.

are college educated and might include persons who are temporary or part-time employees, summer residents who will attend school during the regular terms, persons permanently employed, as well as those who have retired. Controls and protective devices must be designed under the assumption that persons living here will probably come from all walks of life; however, a "togetherness" attitude should prevail if such a variety of persons share this living atmosphere. Personal problems in such a group of residents may require special consideration, dictating a flexibility and variance of room design for the individual needs. The management must be well-trained and preferably have professional counselors on the staff. Organized activity areas and a creatively-planned total physical environment should be a basic consideration in the design.

Figure 32 shows the seating and serving areas of the dining facilities, the garden area, the commercial shops area, the main lobby with lounges, and the administrative office area.

Administrative staff needs are to be carefully planned to provide services required by the residents. These facilities should include management offices, communication facilities, and certain professional services. Service areas and mechanical equipment design must be carefully considered for the building to insure efficient functioning of the complex operations and diversified activities carried on within the structure.

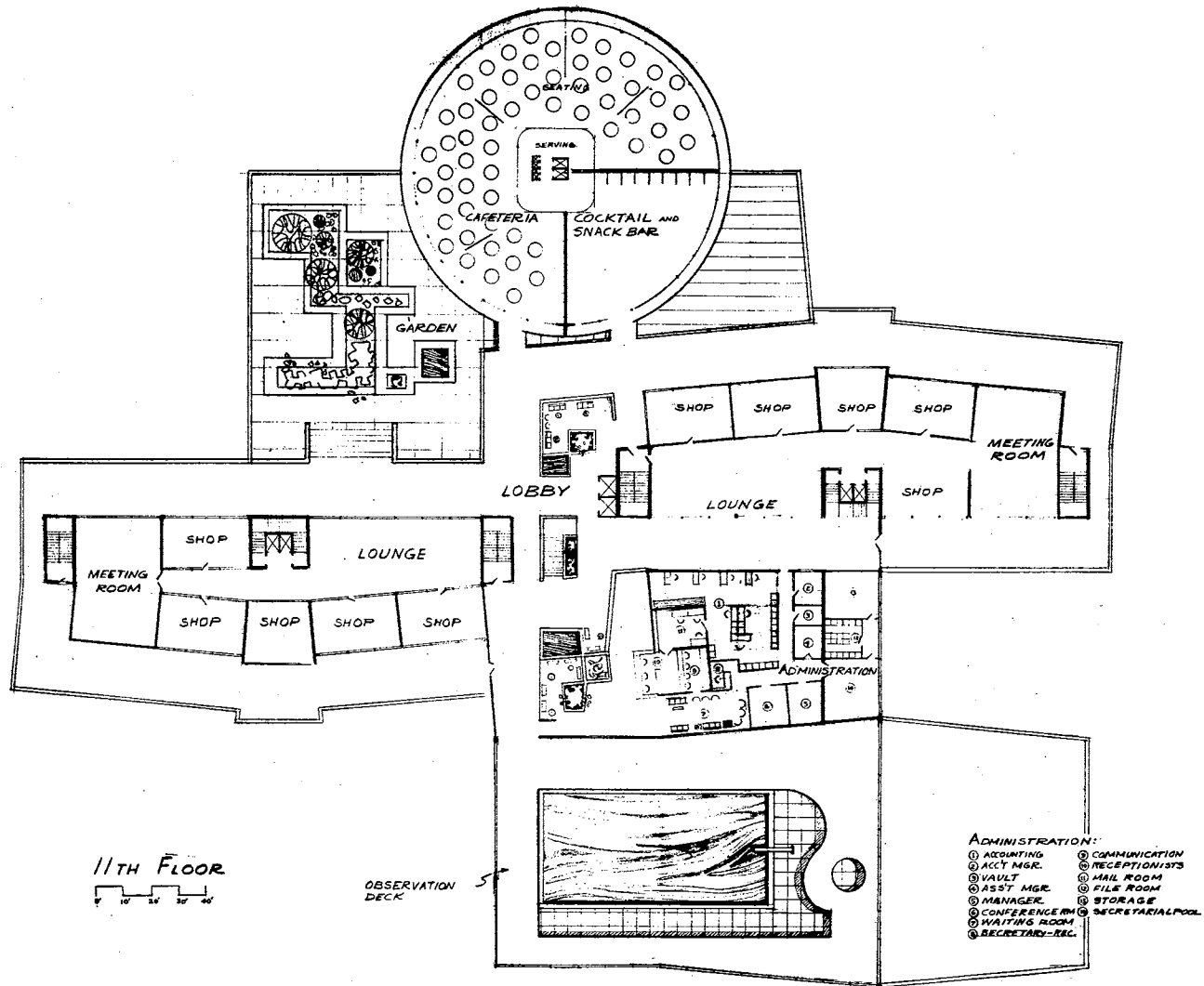


Figure 32. Residence Hotel.

Vehicular traffic for the resident hotel must be separated according to the purpose it serves. Services will have a separate entrance, inconspicuous to the route taken by the residents and visitors. Employees can be assigned a portion of the parking spaces in the garage.

The parking garage entrance will have a visitor parking lot and attendants will park these vehicles in the garage for visits of long duration. An entry lobby will be at the visitors' entrance and will lead to a vertical transfer core to the main lobby level. From the main lobby level visitors can be dispersed to their destinations from a central reception area.

The dining facilities, commercial facilities, garden area, and administrative offices will be located on the main lobby level. The swimming pool, indoor recreation activity area, professional services and kitchen of the dining facilities will be located one floor below the main lobby, being reached by elevators or a grand staircase. An observation deck of the swimming pool will be accessible from the main lobby level and will serve as a sitting area for residents and their guests.

Figure 33 shows the mechanical equipment and storage level of the towers. Figure 34 shows the layouts for the residence towers. The two residential towers will project above the other functional elements, one containing rooms for 600 residents (25 stories) and the other for 400 (17 stories).

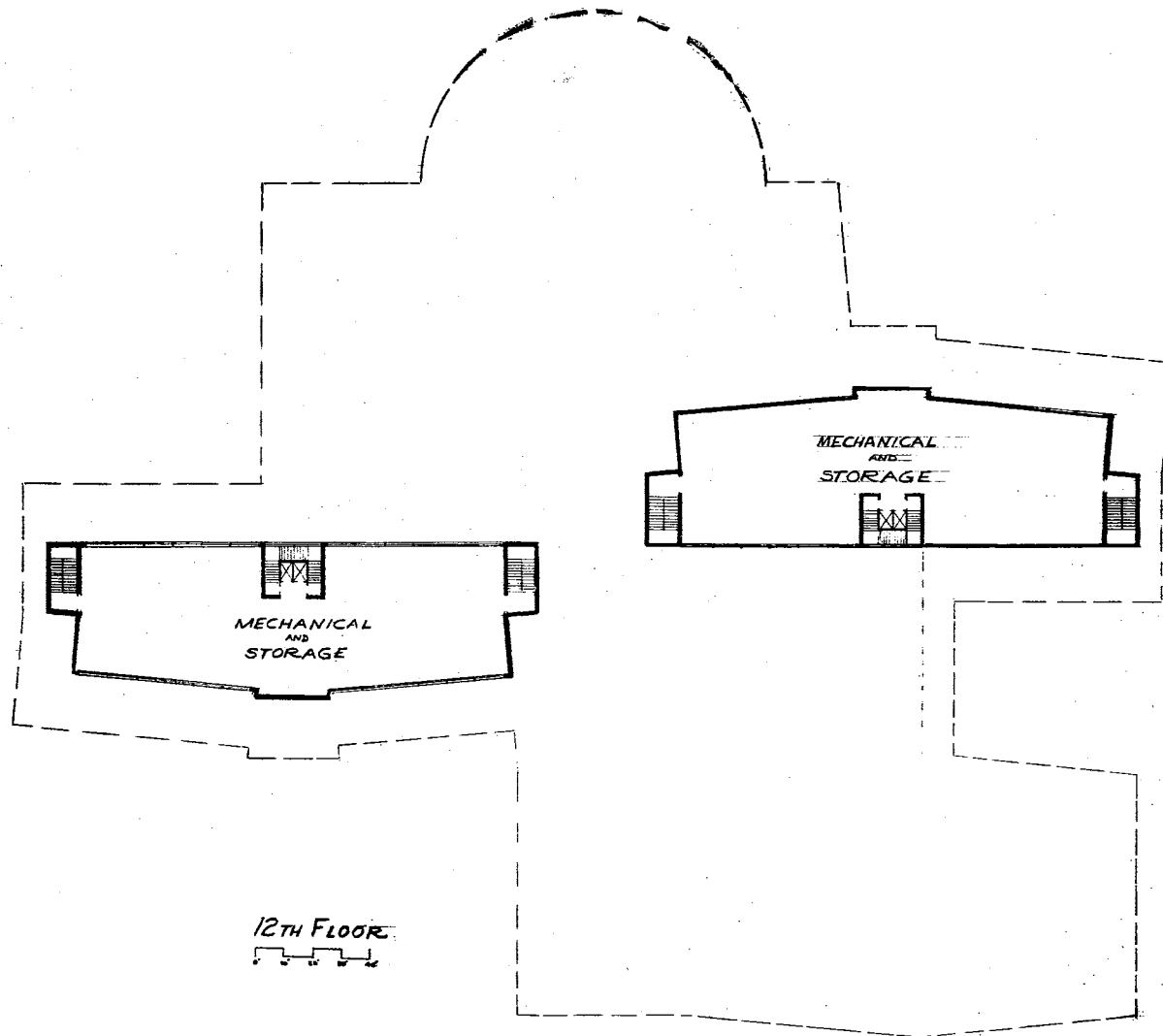


Figure 33. Residence Hotel.

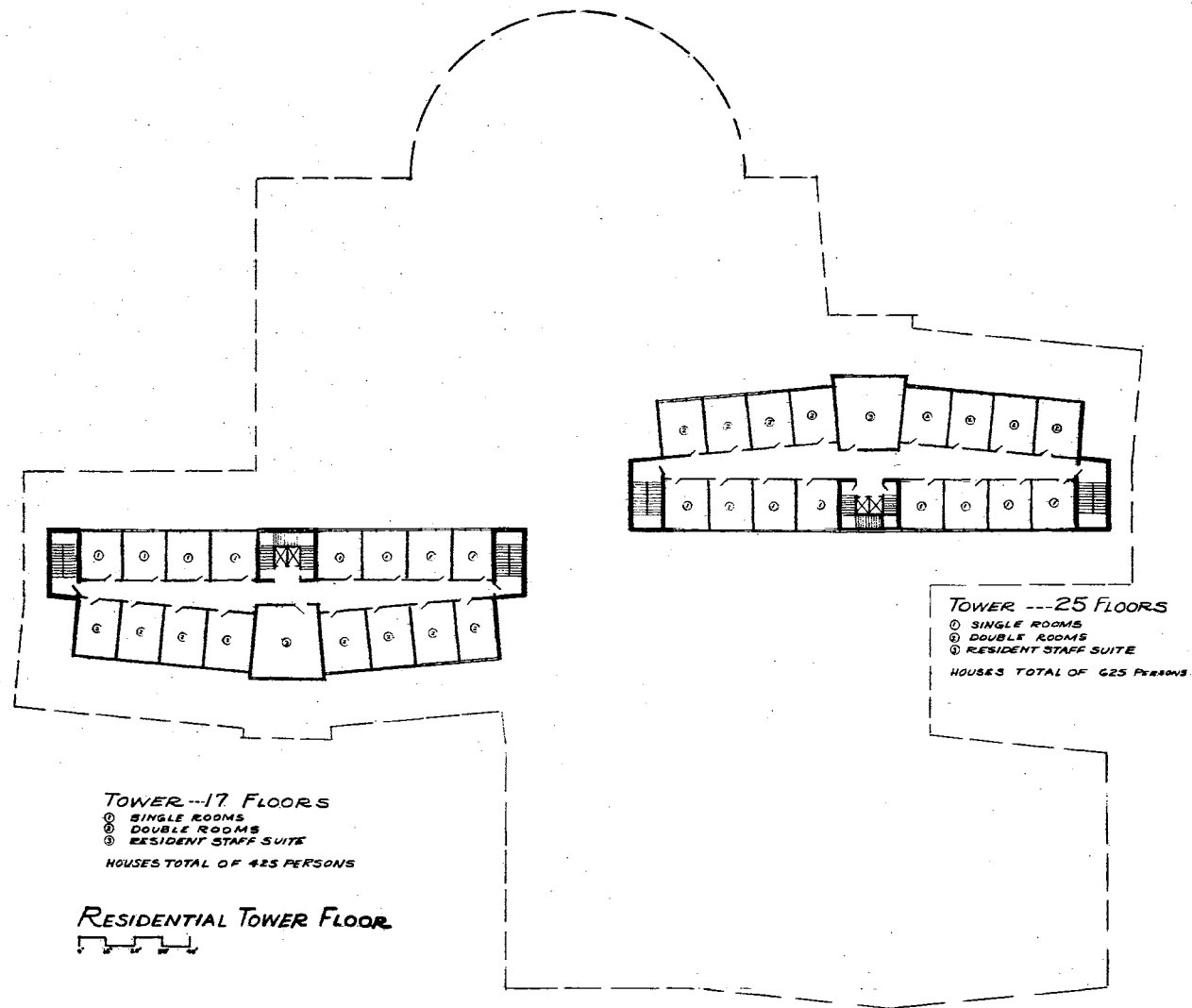


Figure 34. Residence Hotel.

Administration:

The success or failure of this type of residence facility could conceivably depend upon the functioning and attitude of the administration. The persons chosen for this difficult task should be given the essential advantage of having a comfortable and convenient physical environment at their disposal. Care must be taken to provide a degree of flexibility of space and arrangement for the administrative offices and service facilities.

The functional relationships among various administrative elements are shown in the diagram in Figure 35. The offices which might benefit from physical separation from the general administrative facilities are professional services and cafeteria facilities. Personnel organization for the administrative offices is shown in Figure 36. This organization should guide the design of space devoted to administrative employees' activities, with respect to their relative locations. The estimated number of administrative employees is given in Table XXI.

The professional services area provided for residents will require the functional relationships shown in Figure 37. These services are considered essential to this type of living environment because of the great diversity of problems, backgrounds, and financial conditions expected of residents.

Though there are limited medical facilities provided, it is expected that, for the most part, cases will be re-

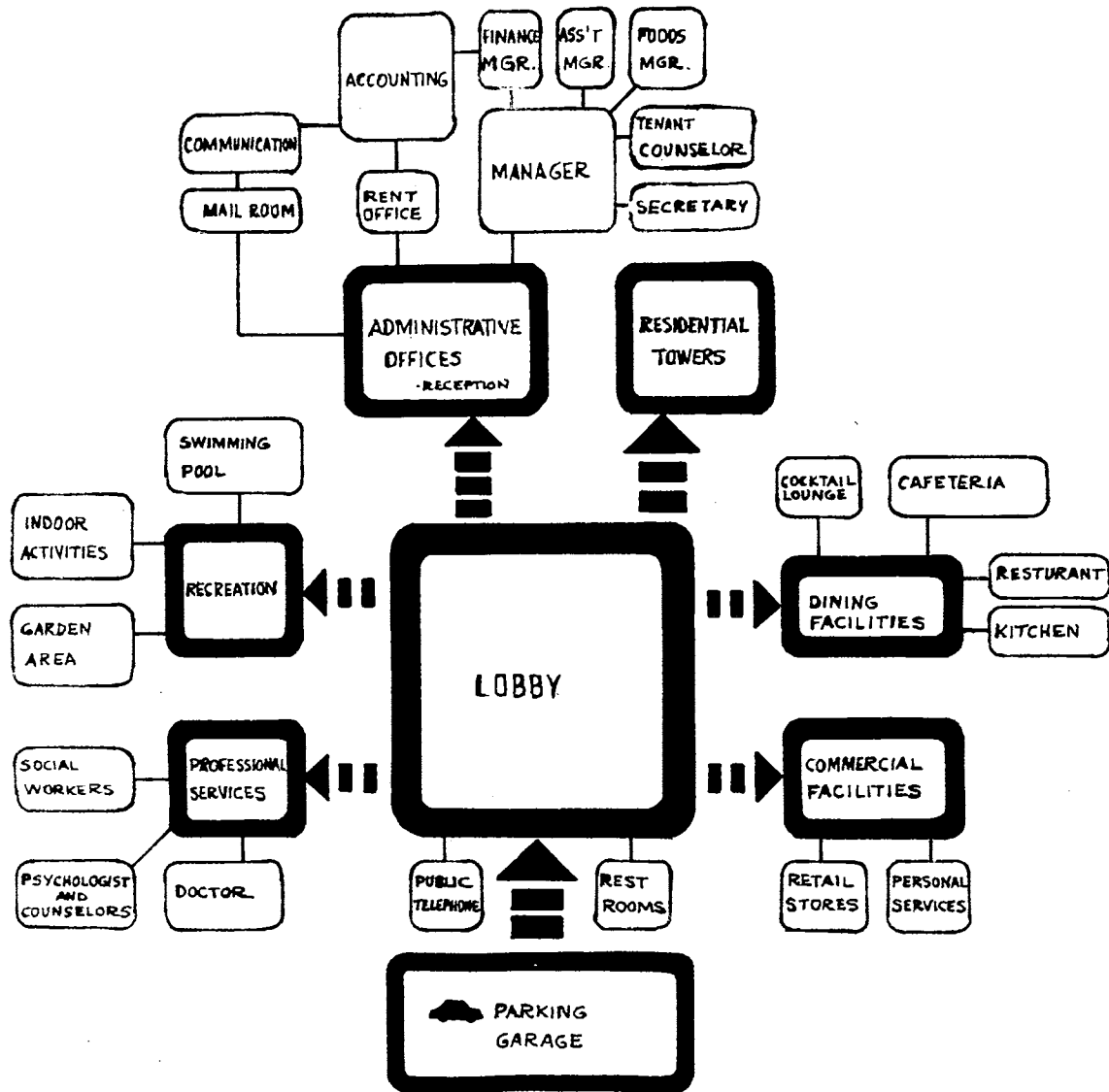


Figure 39. Functional Relationship of Cafeteria and Dining Facilities.

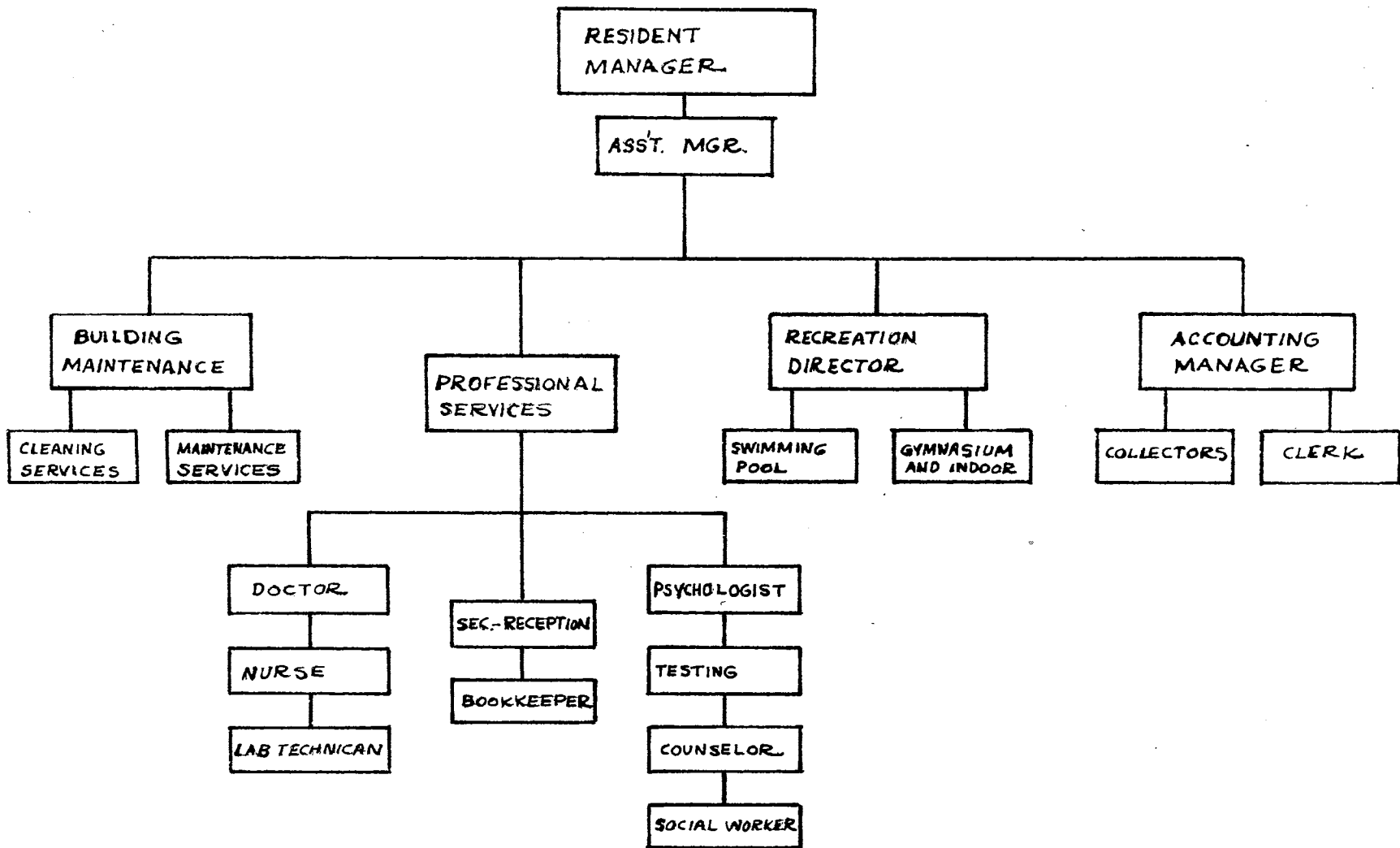


Figure 36. Administrative Offices Organization Chart.

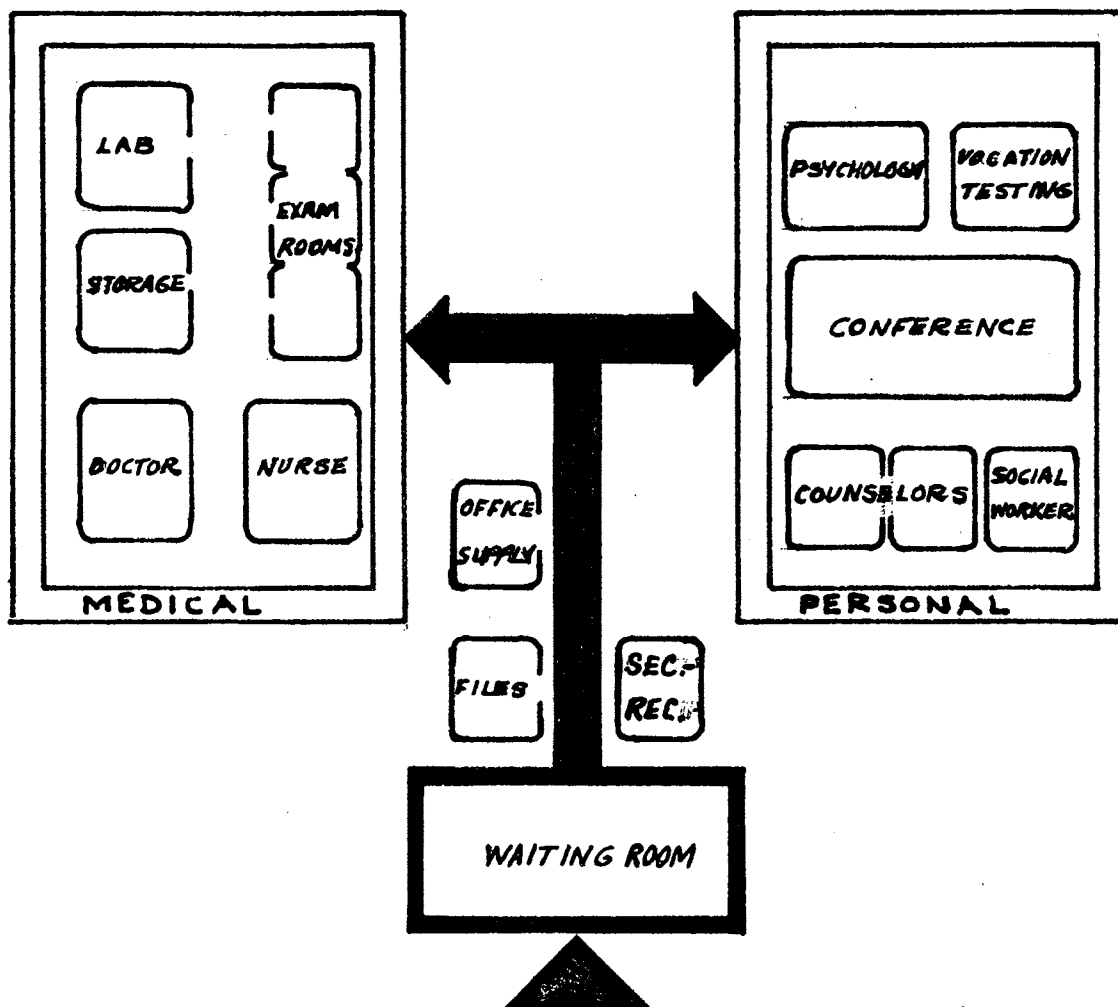


Figure 37. Element Relationships
for Professional Services

ferred to the larger medical services available, either in the community's medical complex or to institutions outside the community.

TABLE XXI

ESTIMATED NUMBER OF ADMINISTRATION EMPLOYEES

Position	Number
Resident Manager	1
Secretaries	2
Assistant Manager	1
Resident Counselors	8
Secretaries	2
Receptionists	3
Communications	4
Main Room	3
Accounting Department Manager	1
Collections Office	3
Clerks	3
Recreation Director	1
Swimming Instructor and Life Guards	4
Gymnasium Supervisors	2
Professional Services	
Resident Doctor	1
Resident Nurse	1
Psychologists (part time)	2
Preference and Aptitude Examiner	1
Problems Counselors	2
Social Workers	2
Receptionist-Secretary	1
Bookkeeper	1
Lab Technician	1

Dining Facilities:

Residential elements of the size planned for the Residence Hotel should have adequate food services, as dining in their rooms would not be practical. No kitchen facilities will be provided except in the apartments of residence staff. The estimated dining area capacities required are

given in Table XXII and will determine the facilities needed, the space requirements for each type of facility, and the number of hours or meals for which each facility opens. From the estimated data in Table XXII, the following indications are obvious:

TABLE XXII
DINING AREA CAPACITIES

Meal	Hours Open Daily	Number of Meals <u>Served per day</u>			Meals per Week	Seating Capacity Required	Seating Area Required (Sq. Ft.)
		Week- days	Sat.	Sun.			
Breakfast	3	800	700	700	5,400	400	7,200
Lunch	2	120	650	850	2,340	425	7,650
Dinner	4	900	650	850	7,800	450	8,100
Total		1,820	2,000	2,400	15,540		

1. The largest number of meals anticipated to be served on weekdays will be during the evening or dinner hours. This constitutes the basis for the recommended cafeteria space requirements.

2. The estimated weekday lunch meals served will not justify the opening of the cafeteria, so that table service dining and snack-bar services are assumed adequate.

3. The kitchen space and service areas can be integrated to a great extent for cafeteria and table service dining.

The cafeteria staff is organized as shown in Figure 38 and Figure 39 shows the functional relationship diagram.

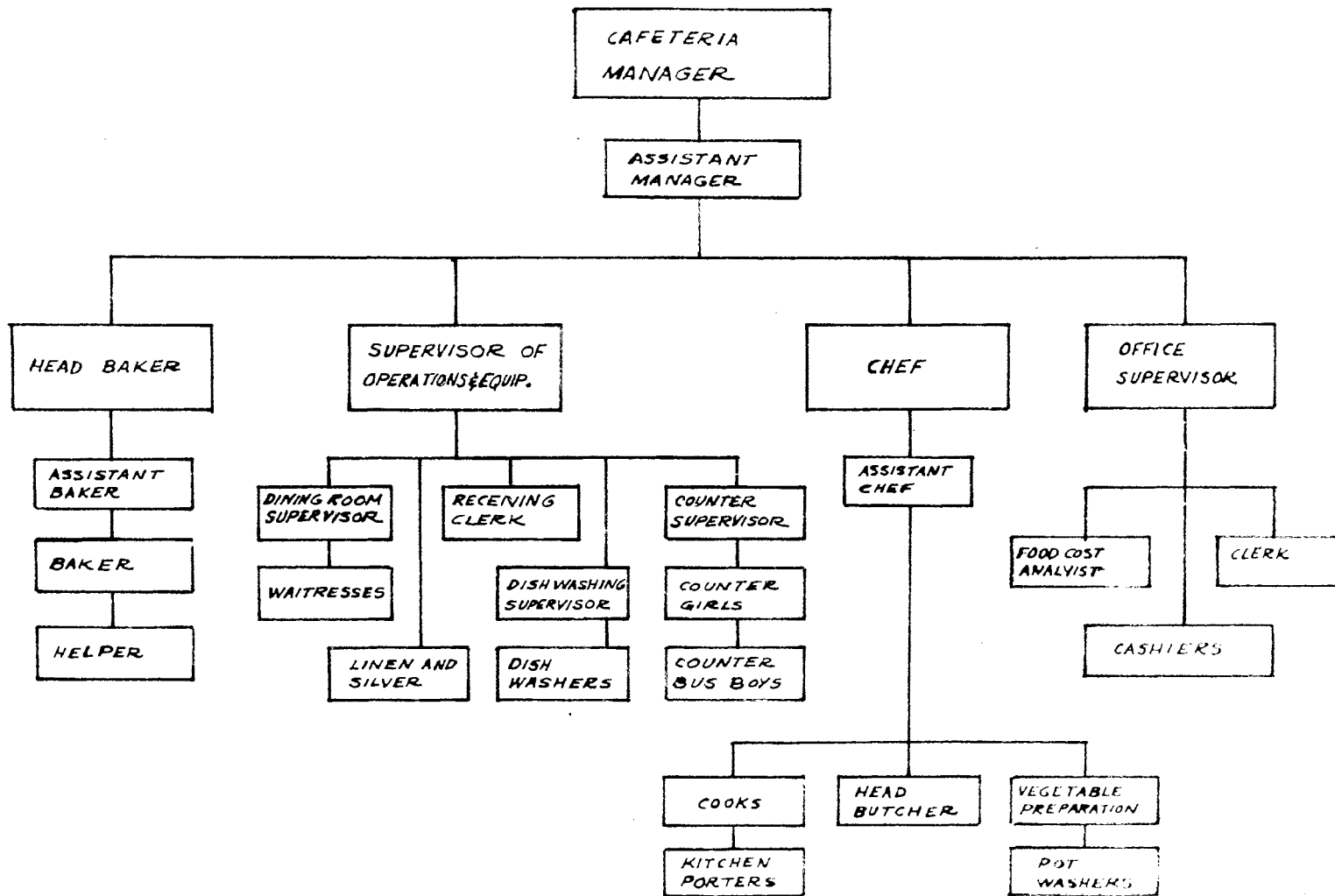


Figure 38. Dining Facilities Organization Chart.

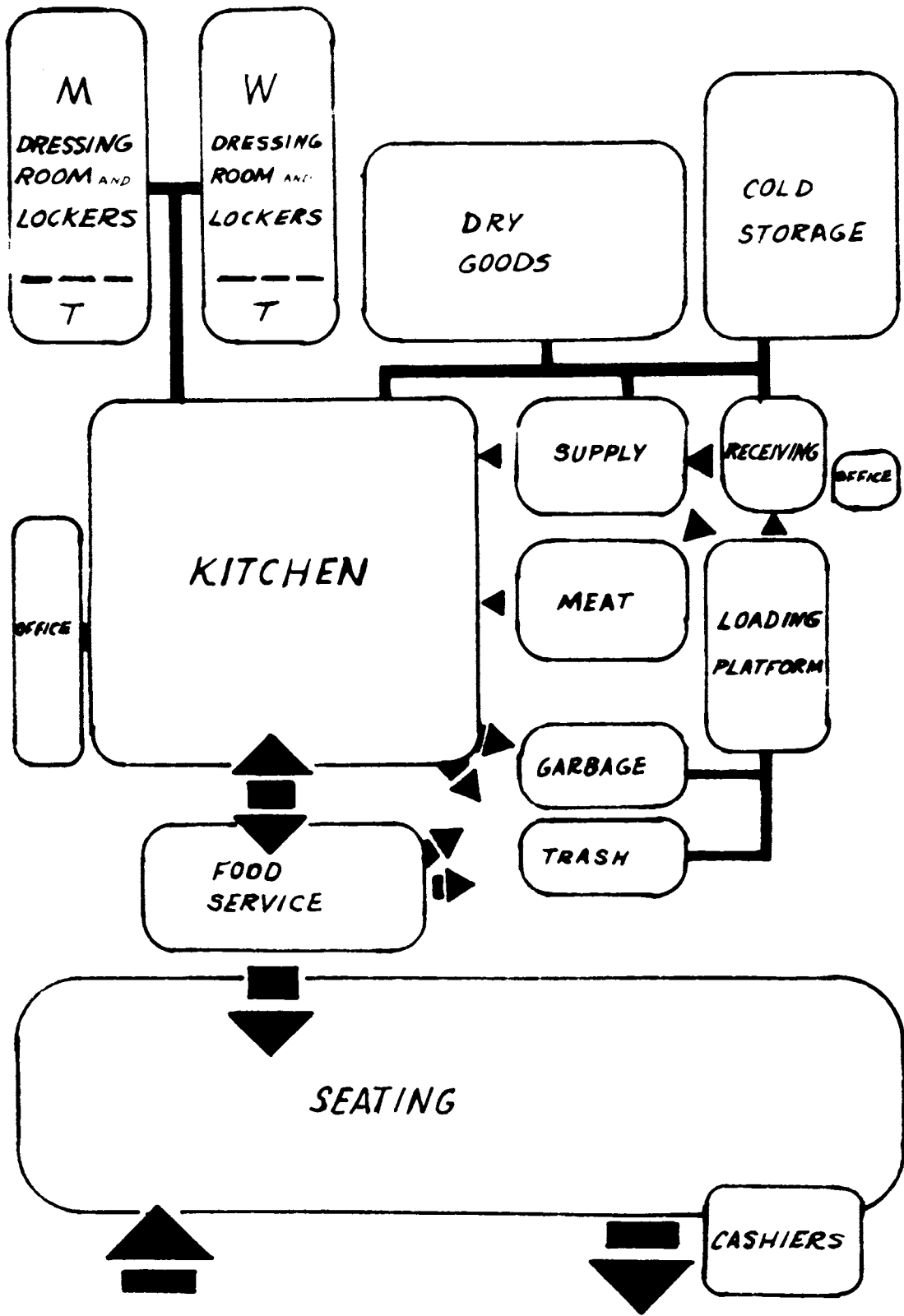


FIGURE 1. Kitchen layout showing the flow of food and supplies.

The following elements should be considered in the design of the dining facilities:

1. General: a) an optimum walking distance of 1,000 feet, b) one cafeteria line handling 10 persons per minute, c) one person spending approximately 30 minutes in the cafeteria, and d) an area of eight to eighteen square feet allowed per seat.

2. Loading Platform: a) minimum depth of six feet, b) minimum area of 60 square feet for three hundred meals per day or 180 square feet where 1,000 or more meals are served, c) slip resistant concrete with integral hardener, protected by heavy steel angle iron on the edge and having a bumper of resilient material, d) entrance to receiving area same level as the platform, e) roof covering the entire platform, minimum clear height of twelve feet and six inches.

3. Receiving Area: a) 60 square feet, b) dial platform scales for meat, heavy table, and platform trucks.

4. Garbage and Trash Storage: a) well screened, b) garbage room refrigerated or garbage disposal connected to the sewage system.

5. Dry Goods Storage: a) steel shelving 18 inches deep with 14 inches between upper and 36 inches between lower shelves, b) capacity adequate for a week's supply, or approximately one-half cubic foot per person served.

6. Supplied Storage: a) minimum of 40 square feet, b) maximum of one square foot per 100 meals served.

7. Storage for Perishables: should be cool dry storage
a) meat, 31° to 34° F, approximately 35 to 40 percent of the

total refrigeration capacity; b) dairy box, 33° to 37° F capacity of 20 to 25% of the total refrigeration capacity; c) deep freeze, 5° to 10° F, 1 cubic foot stores approximately 30 to 35 pounds; d) fruit and vegetable box, 40° to 45° F, capacity of 20 to 25% of the total refrigeration capacity; and e) fish box, 31° to 40° F, capacity according to needs. Personnel requirements for the dining facilities are given in Table XXIII.

TABLE XXIII

ESTIMATED NUMBER OF DINING
EMPLOYEES REQUIRED

Position	Number
Manager	1
Assistant Manager	1
Baker, Head	1
Baker, Assistant	1
Baker	1
Baker's Helper	1
Supervisor of Operations and Equipment	1
Dining Room Supervisor	1
Waitresses	5
Linen and Silver	1
Receiving Clerk	1
Dish Washing Supervisor	1
Dishwashers	10
Counter Supervisor	1
Counter Girls	20
Chef	1
Assistant Chef	1
Head Butcher	1
Cooks	5
Kitchen Porters	2
Vegetable Preparation	2
Pot Washers	2
Bookkeeper	1
Food Cost Analyst	1
Dietitian	1
Clerk	1
Cashiers	4

Using data found in Table XXIV the necessary space requirements for the kitchen can be computed for each type of meal to be served in the facility, as given in Table XXV.

TABLE XXIV

KITCHEN SPACE REQUIREMENTS

Maximum Meals Per Hour	Sq. Ft. per Meal		
	Minimum	Maximum	
Below 200	7.5	to	5.0
200 to 400	4.0	to	3.2
400 to 800	3.5	to	2.0
800 to 1,300	3.0	to	2.0
1,300 to 8,000	2.5	to	1.7

The above figures are obtained by multiplying the maximum number of meals in a given hour times the square feet required per meal to find the area needed, or by doing the same thing for the minimum space requirement figures.

TABLE XXV

COMPUTED SPACE REQUIREMENTS FOR KITCHEN

Meal	Kitchen Space Required	
	Maximum Sq.Ft.	Minimum Sq.Ft.
Breakfast	1,600	800
Lunch	1,488	850
Dinner	1,575	900

The total area requirements for the Residence Hotel have been computed as shown in Table XXVI and become the space requirement criteria for design of the structure.

TABLE XXVI

Element	Area in Sq. Ft.
Professional Services	
General	
Supply Storage	90
File Room	80
Waiting Room	300
Toilets	200
Medical	
Resident Doctors Office	100
Nurse Station	100
Medication Storage	80
3 - Examination Rooms	180
Laboratory	90
Bookkeeper	50
Files	50
Psychological and Counseling	
Testing	60
Psychiatrist	100
Marriage Counselor	60
Personal Problems Counselor	60
Social Worker	100
Secretary	50
Receptionist	50
Files	50
Conference Room	150
Total	1,940
Dining Facilities	
Seating	8,100
Kitchen Space	1,575
Loading Platform	200
Receiving Room	80
Garbage Storage (refrigerated)	60
Trash Storage	80
Dry Goods Storage	2,000
Supplies Storage	150
Storage for Perishables	
Meat	200
Dairy Box	100

TABLE XXVI (Continued)

Element	Area in Sq. Ft.
Deep Freeze	350
Fruit and Vegetable Box	100
Fish Box	50
Serving Area	220
Administrative Space	
Cafeteria Manager	200
Assistant Cafeteria Manager	100
Office Supervisor, Clerk, Food Cost Analyst	200
4 Cashiers	80
Chef, Supervisor of Equipment, Head Baker	200
Employee Parking 73 Employees	

Medical Center Complex

The medical complex consists of two elements, a two hundred bed hospital and a special care center. Even though these elements are separate structures, they have complementary functions. The hospital would be a general care facility fully equipped for handling the usual hospital functions, especially short range illnesses. However, the special care center will be offering services for convalescent patients, long-range or long-term illness cases, terminal illness cases, and care for the elderly. Patients would be of all ages, and a high degree of flexibility in types of accommodations provided will be required for proper functioning of the center. A day-care clinic for out-patients and therapy facilities supplement the in-patient services. Certain

units are designed to offer a rarely-found atmosphere of home life. There must be a lack of "institutional character" in this facility, because the patients will reside in it for prolonged periods of time and a "hospital" or clinical atmosphere is not pleasant for such cases. The design must consider the various degrees of surveillance which would be required. Patients might require anything from complete bed confinement with emergency treatment instruments available to considerable mobility with scheduled medication, therapy, or observation.

Community Shopping Center

The focal point of commercial activity of the community will be concentrated and centrally located on the site. The modern retailer realizes the need for consolidation of commercial establishments as a vital part of effective operation. Certain businesses are considered to be "generative" when the consumer has as his primary objective the desire to shop in the establishment. "Shared" businesses receive their patronage primarily as a result of the generative power of their neighboring stores. A "susipient" business is one which generates no business on its own, but serves those who pass it, and must be located at a specific point with maximum exposure, as shown in Figure 40.

It is the relationship and compatibility among generative, shared, and susipient businesses which is called 'cumulative attraction' that justifies concentration of commercial enterprises. They support and intensify the con-

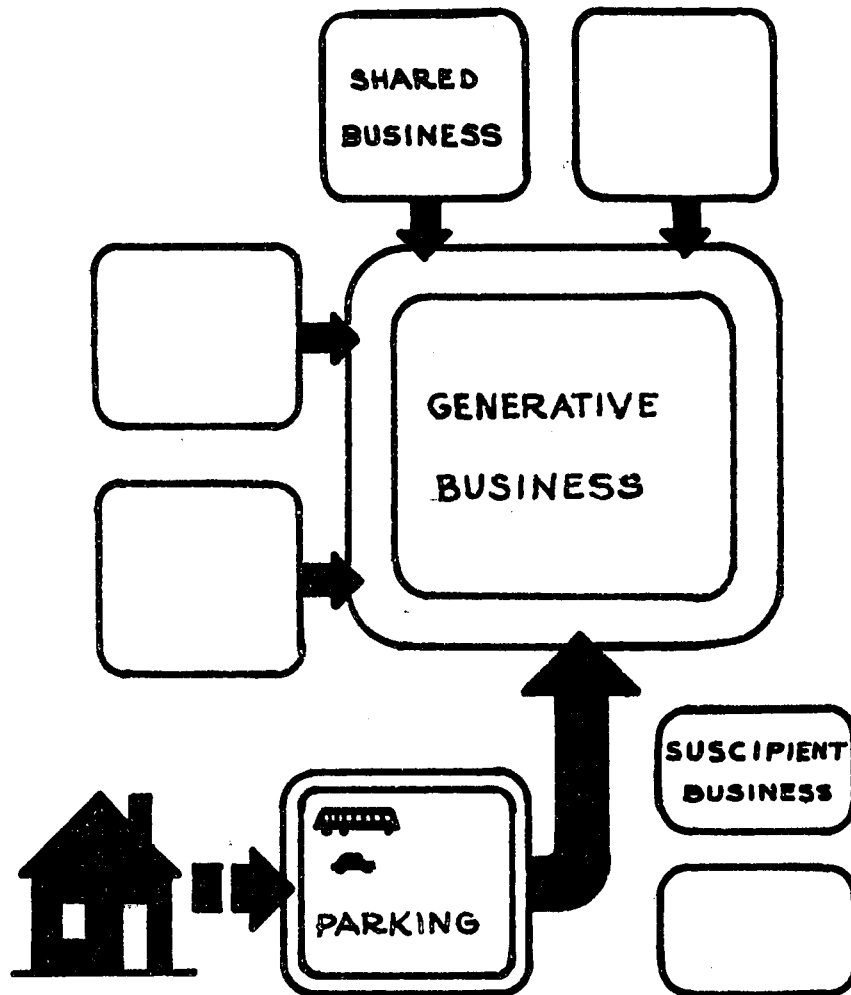


Figure 40. Commercial Element Relationship Concept.

sumers' desire to shop where they need to park only once in a free parking lot to do several types of shopping and to be provided a variety of services. Collectively the retailers can provide more efficient and convenient parking facilities than they can provide separately. The concentration becomes known by a "name" which can be easily identified throughout the consumer population market, and thus offers a free advertising gimmick to the businesses. Most stores serving the residential population sell shoppers' goods, convenience goods, or provide personal services. Shoppers' goods consist of large, long-lasting purchases such as automobiles, furniture, etc. Personal services establishments are businesses such as barber and beauty shops.

In explaining the functions of commercial facilities in the urban environment, one must consider the concentrations of these establishments by the type of goods and services provided; these characteristics can be classified as regional, community, neighborhood, and local facilities. See Figure 41.

The regional center is one with several generative, shared and suscipient businesses, offering a great diversity of goods and services to the residents of the whole city or metropolitan area. It is a facility that is used by all residents, regardless of the location of their residence with respect to the center. Downtown or central business districts are examples of this type of center, but some special interest centers, such as entertainment, finance, auto sales, etc., also are in this classification because they offer selective consumer buying in a specialty good or

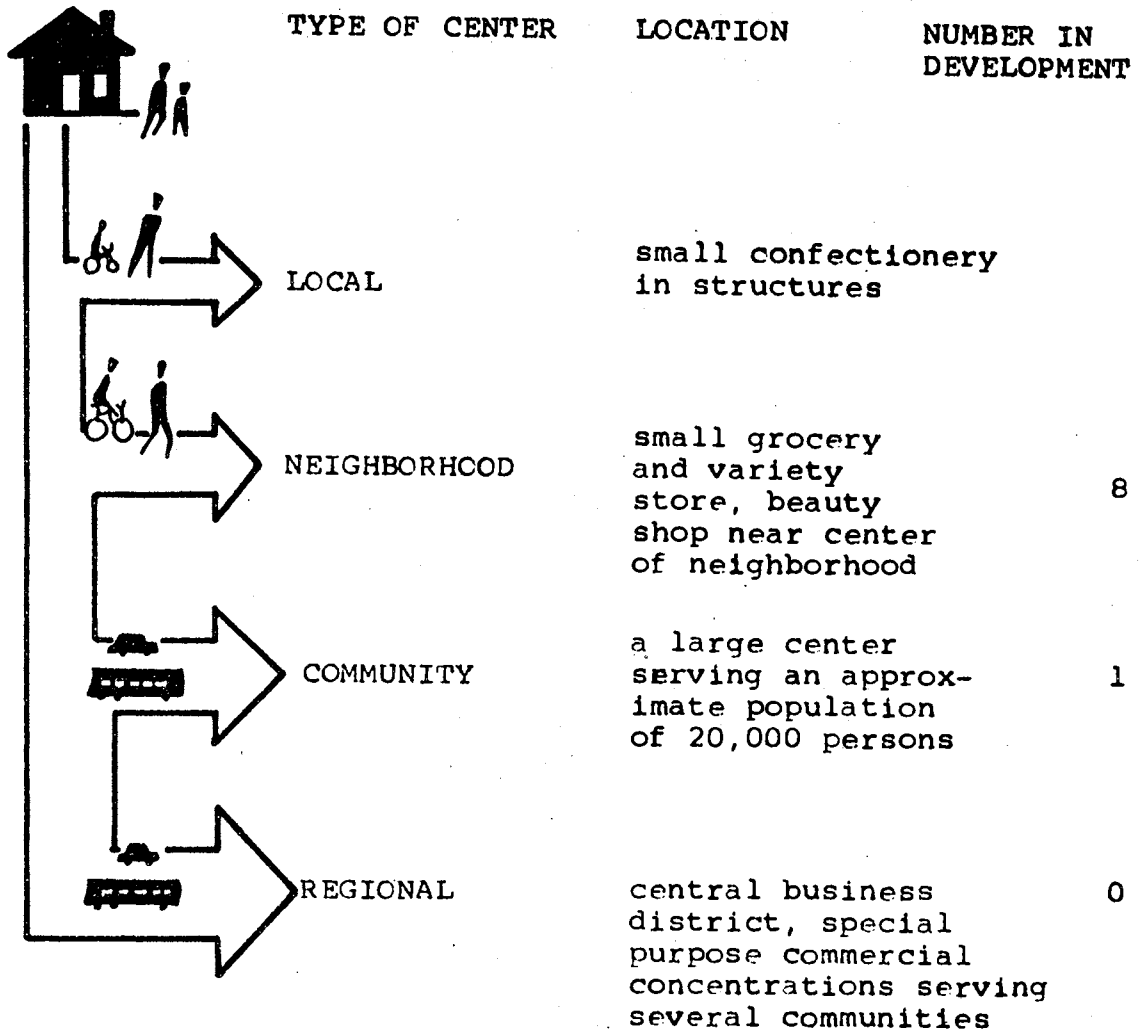


Figure 41. Types of Commercial Concentrations

service. Even though the development site has no such center, outside its boundaries are suitable facilities available to the residents within a few minutes of driving or transit time.

Community centers serve a group of neighborhoods and should have adequate mass transit service as well as ample parking. Usually such a concentration will have one or more department stores and a junior department store, as well as shared and susceptible businesses. This type of center in a city is usually auto-oriented, with a small amount of pedestrian patronage for convenience and shoppers goods.

Neighborhood centers consist of a small concentration of convenience goods and personal services businesses designed to serve one residential neighborhood. These centers should be located near and integrated with schools, parks, and other public and semi-public land uses and planned with careful consideration for a pedestrian walk system, as this type of center will likely be pedestrian-oriented to a great extent.

Local shopping facilities would consist of a very limited convenience goods store, such as a confectionery, and could be considered as almost entirely pedestrian-oriented as it serves a very small population and is within easy walking distance of all residents served by it.

On the site the Community Shopping Center is centrally-located to the residents of the community and offers a complete line of goods and services usually found in such a center. There are certain features of the center which will give it extreme versatility, offer the residents a most

efficient shopping atmosphere, and provide an active area in which other activities in addition to shopping can be carried out. The element relationships in the Community shopping center are shown in Figure 42.

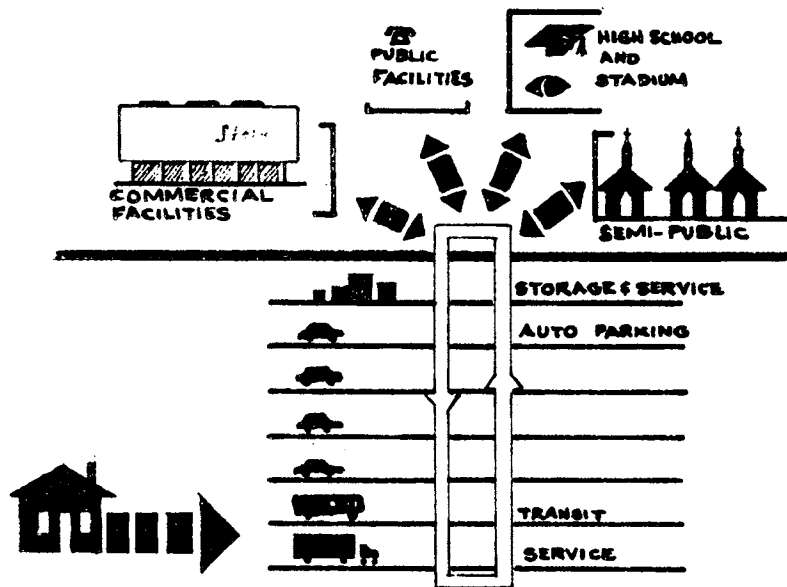


Figure 42. Element Relationships in the Community Shopping Center

Several sites for churches are provided within the structure and, by a carefully scheduled program of usage, the center will claim the majority of the parking spaces in the daytime hours and on two shopping nights a week. As it is customary to hold mid-week services at most churches, perhaps the scheduling of events at the high school and church and stadium can be carried out by alternating with peak shopping times. Nearing a full-time usage of the parking facilities will be more economical than if all three major activity

uses were to provide separate parking lots or garages. The consolidation of parking facilities is a means of intensifying land use.

The stores will be primarily in the three large rectangular structures which form sheltered enclosures for the mall area, as shown in Figure 43. In Chapter III it was determined that the estimated needs for stores in the center would total a minimum of 67,382 or a maximum of 173,423 square feet of gross leasable floor area. Also from that data, the estimated number of square feet per type of establishment was given.²¹

The specific commercial establishments recommended for the center are given in Table XXIV. They are all classified according to the type of businesses with respect to their generative, G; shared, S; or suscipient, Sus, functions in the center. The stores will receive service from the lower level by means of the vertical transfer core, as there is a total parking garage level devoted solely to storage, shipping, and receiving.

The parking spaces required can be computed as indicated in Chapter III by taking the total, A_s , square foot area of gross leasable floor area from Table XXIV and multiplying it times the standard ratio $R_1: R_2$ to find A_p , the total parking area required. Therefore,

$$\frac{A_s}{R_1} = \frac{A_p}{R_2} \quad (17)$$

thus, where A_s equals 138,648 square feet, $R_1 = 1$, and $R_2 = 2.5$, then $A_p = (138,648)(2.5) = 346,620$ square feet. Considering the size of the parking garage area beneath the

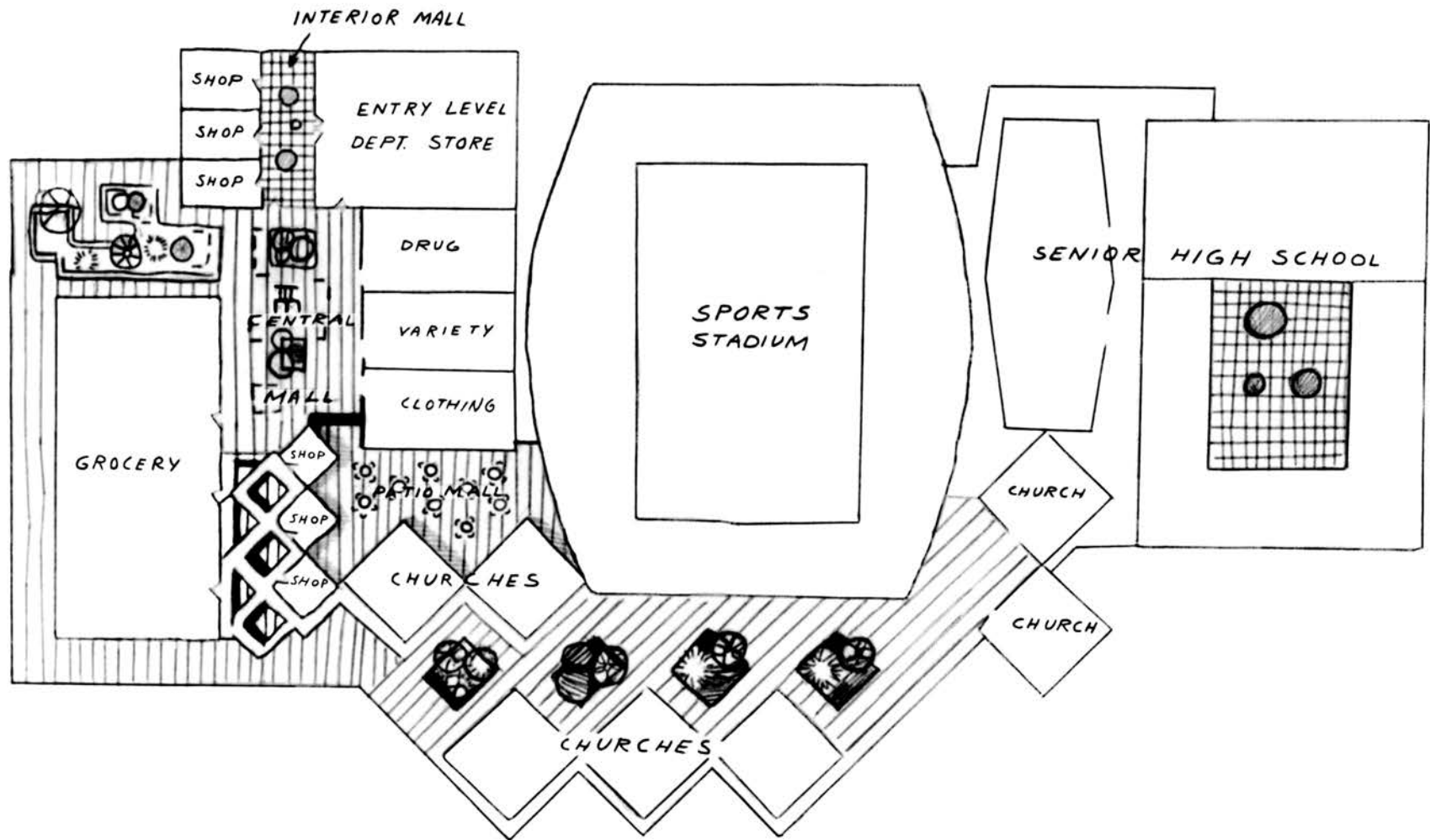


Figure 43. Community Shopping Center Concepts.

shopping facilities in the center, the parking for commercial purposes alone will require approximately three levels.

There will be an area devoted to mass transit delivery and pick-up so that those residents who wish to travel to the center by bus may avoid the traffic and yet enter the vertical transfer core to arrive and depart in a minimum of time.

TABLE XXVII

RECOMMENDED COMMERCIAL ESTABLISHMENTS
FOR COMMUNITY SHOPPING CENTER

Number of Stores	Type of Store	Sq.Ft. of GLFA per Store	Sq. Ft. of GLFA Total	Class
2	Grocery	12,100	24,200	G
1	Liquor Store	685	685	S
2	Cigar Store	862	1,724	S
2	Jewelry	488	976	S
2	Dry Cleaners & Laundry	1,000	2,000	S
3	Clothing Shops	1,320	3,960	S
1	Department Store	41,228	41,228	G
3	Drug Store	1,498	4,494	S
2	Beauty Shops	150	300	S
2	Barber Shops	100	200	S
2	Decorator Shops	3,408	6,816	G
2	Furniture	7,252	14,504	G
1	Toy Shop	300	300	S
1	Variety Store	1,847	1,847	S
2	Pet Shop	286	572	S
2	Photo Shop	200	400	S
1	Music Store	1,500	1,500	S
2	Radio & Television	695	1,390	S
1	Sporting Goods	962	962	S
1	Bakery	900	900	S
1	Auto Service	24,000	24,000	G
4	Gas Station	1,000	4,000	S
3	Accessories Shop	300	900	S
2	Stationery	650	1,300	S
3	Shoe Stores	300	900	S
1	News Stand	90	90	Sus
Total			141,648	

Schools, Parks and Recreational Facilities

The schools, as well as the other elements of the urban environment, must undergo revolutionary changes if they are to supply students with required educational training in the modern environment. The enormous cost of educational facilities to the community makes it necessary for them to be utilized to the fullest extent and to be as efficiently designed as possible, yet give children every educational opportunity.

From Chapter III computations it can be determined that the approximate proportions of the population in each of the complexes are as shown in Table XXVIII.

TABLE XXVIII
PERCENT OF COMMUNITY POPULATION
IN EACH COMPLEX

Complex	Population	Percent of Total
Complex I	7,794	36%
Complex II	3,900	18%
Complex III	3,960	19%
Complex IV	5,584	27%

To make an estimate of needed elementary school sizes, the community enrollment data determined in Chapter III for these schools can be proportioned with respect to the percentage of population in each complex. Therefore, the elementary school enrollment will be as shown in Table XXIX.

TABLE XXIX
ESTIMATE OF ELEMENTARY SCHOOL ENROLLMENT

Complex	Percent of Population Distribution	Ees	K
Complex I	36%	2,394	368
Complex II	18%	1,197	215
Complex III	19%	1,263	240
Complex IV	27%	1,795	200
Total		6,649	1,023

Though the enrollment in these schools can be considered high in compared to most communities, the special design of the urban schools should allow a very desirable educational experience. The enrollments of elementary schools are maximum estimates, with the possibility of the enrollment being that high very unlikely; however, in many cases of the urban educational system designs, it has been a wise policy to plan for the reasonable maximum rather than trying to expand many times as the facilities become increasingly inadequate.

The problem of over-crowding can be eliminated by supplying an adequate number of regular classrooms for the students along with the special purpose rooms that are required by modern teaching methods. The old concept that schools should be only one, two or three stories high must be abandoned in these times, as this practice will not be possible in the

urban setting where there is a scarcity of land. School land use can be intensified by a number of means: 1) multi-story structures; 2) play areas beneath buildings on raised supports; 3) roof-top play areas; 4) multi-purpose rooms; 5) sub-classes within classes, accoustically isolated; 6) mass media teaching methods; and 7) schools facilities combined with neighborhood parks and recreation.

The approximate square foot area needed for each school building and for playground space is found in Table XXX along with an estimated number of teachers and faculty parking spaces required. This data was computed using equations (8), (9), (10) and (11) from Chapter III.

TABLE XXX
AREA REQUIREMENTS FOR ELEMENTARY SCHOOLS

School	n_s	n_r	n_k	Total Building Area Required	Playground Required	Estimated No. teachers
Complex I	4	20	6	83,925 s.f.	82,080 s.f.	52
Complex I	5	31	0	107,931 s.f.	83,640 s.f.	56
Complex II	5	23	4	99,325 s.f.	84,726 s.f.	56
Complex III	5	26	5	108,206 s.f.	90,780 s.f.	61
Complex IV	7	37	4	137,875 s.f.	119,700 s.f.	80

Estimated junior high school classroom needs are found as, $\mu_{jhs} = \frac{E_{jhs}}{25} = \frac{1,023}{25} = 40.9$ or 41 classrooms, classroom needs for senior high school is computed as follows:

$$\mu = \frac{E_{hs}}{25} = \frac{1,535}{25} = 62 \text{ classrooms}$$

One community park, Marina Park, has a very special recreational purpose. It will provide boating and related water activities as well as a camp site serving the community residents with a unique recreational experience. Entertainment establishments, bicycling paths, horseback riding and other facilities could be incorporated into such a facility.

Other Public and Semi-Public Facilities

Certainly it is important in the planning of any community to consider the public and semi-public facilities needed by the residents. These amenities may determine the desire, to a great extent, of residents to live in the community on a long-term basis. The school and recreation systems are often of great importance for prospective residents in choosing their homes. These facilities have already been extensively discussed; however, there are other public and semi-public facilities which enter into the smooth functioning of a community, also.

There is a concentration of churches recommended for a portion of the community shopping center structure. No attempt will be made here to determine the sizes appropriate, but only to designate a suitable location for such establishments. Likewise, no attempt will be made to determine the square footage required for the hospital and special care center.

The other facilities supplied for the community would consist of satisfactory water, waste disposal, sewage dis-

posal, sewage disposal, storm drainage, and electric utility services. There will be no attempt to advance designs for these facilities, but their importance cannot be overlooked in any residential development, especially when it is a high density residential community.

CHAPTER V

CONCLUSIONS

The development of high density urban complexes may offer one solution to the problem of supplying adequate housing in large cities. The program and design criteria developed are uniquely applicable to the site chosen. Features that prevent direct application of analyses are 1) the unusual terrain of the site, 2) the size of the site, 3) the location of the project area with respect to the bay, 4) the large population concentration potential of the City of San Francisco, and 5) the existing San Francisco area population's acceptance of apartments as places of residence.

The program and design criteria were applied to a generalized design for the redevelopment site in order to illustrate the concepts advanced in this study.

It is believed that programing and development of design criteria are essential prerequisites in planning high density urban housing complexes. The complexity of coordinating functional design elements demands intense investigation. A number of designs and solutions could have evolved from the program and criteria presented. It should be realized that the proposal advanced reflects only one possibility. This study is the first step in the

architectural design of a high density residential complex and could be followed by more intense and detailed study resulting in specific designs for individual structures.

SELECTED BIBLIOGRAPHY

1. Dean, John P. Housing Design and Family Values, Harper and Brothers Publishing Company (1945), pp. 129-141.
2. Jacobs, Jane. The Death and Life of Great American Cities, Random House, New York (1961).
3. Bailey, J. "Case History of a Failure, Pruitt-Igoe Housing Project, Saint Louis," Architectural Forum, Vol. 123 (December, 1965), pp. 22-25.
4. Gordon, Richard E., Gordon, Katherine K. and Gunther, Max. The Split-level Trap, B. Geis Associates, New York (1961).
5. Gans, Herbert J. The Urban Villagers, Free Press of Glencoe, New York (1962).
6. Bollens, John C. The Problems of Government in the San Francisco Bay Region, University of California (1948).
7. San Francisco Chamber of Commerce. San Francisco and the Bay Area, an Economic Survey and Yearly Report (1959), p. 8.
8. Gross, Irma H. and Crandall, Elizabeth Walbert. Management for Modern Families, Appleton, Century, Crofts, Inc., New York (1956).
9. Agan, Tessie. The House, Its Plan and Use, J. B. Lippincott Co., New York (1959).
10. Life Magazine. Study of Consumer Expenditures, Vol.1, Life Publishing Co., (1956).
11. Sumption, Merle R. and Landers, Jack L. Planning Functional School Buildings, (1957).
12. Board of Education, City of St. Louis. School Playground Standards (1967).
13. City Managers' Association. Planning Administration, City Managers' Association, Inc., New York (1962).
14. Sumption, Merle R. and Landers, Jack L. Planning Functional School Buildings (1957).

15. Callender, John Hancock. Time-Saver Standards, A Handbook of Architectural Design, McGraw-Hill Book Company, New York, (1966), p. 1216, 1260, and 1267.
16. Packard, Vance Oakley. The Status Seekers, D. McKay Co, New York (1959).
17. Packard, Vance Oakley. The Pyramid Climbers, D. McKay Co., New York (1962).
18. Whyte, William H., Jr. The Organization Man, Simon and Schuster, New York (1956).
19. Lynd, Helen Merrell. On Shame and the Search for Identity, Harcourt, Brace and Company, New York (1958).
20. Nelson, Richard Lawrence. The Selection of Retail Locations, F. W. Dodge, Corp., New York, (1959).
21. Urban Land Institute. The Dollars and Cents of Shopping Centers (1966).

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