

STEP-DOWN APARTMENT UNITS IN DIAMOND  
HEIGHTS -- SAN FRANCISCO, CALIFORNIA

Submitted in partial fulfillment  
of the requirements for the degree  
of Bachelor of Architecture at the  
Massachusetts Institute of Tech -  
nology. May 16, 1952

by

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Dear Sir:

In partial fulfillment of the requirements for the degree of Bachelor of Architecture, I submit the following thesis entitled "Step-down Apartment Units in Diamond Heights, San Francisco, California."

Sincerely yours, / / /

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## INTRODUCTION

HISTORY

Shortly after the turn of the century, Daniel H. Burnham, the eminent architect-city planner, was brought to San Francisco to direct and execute a practical and comprehensive plan for the improvement and adornment of the city.

He established a residence and headquarters in the geographical center of the city- on a spur of Twin Peaks in the San Miguel Range of hills. This was an area he came to know well, and his proposals for these dramatic promontories played an important role in the Burnham Report published in 1905.

For one thing, Mr. Burnham found that the three steep hills just southeast of Twin Peaks had been subdivided into an impossible grid pattern of streets usually imposed on level land. In fact, subdividing and re-subdividing had been taking place in this section since Civil War times but had resulted in virtually no streets having been constructed and no residential developments. And even in 1905 San Franciscans were in search of land on which to build their homes.

Originally the grass and rock-covered hills and the deep and wild Glen Canyon to the west of the hills, were part of San Miguel Rancho. Large tracts were sold and early real estate developers subdivided and re-subdivided many times from the 1860's on. The present Glen Park Playground at the foot of the canyon at the turn

of the century was a picnic ground operated by a real estate developer to attract buyers.

The early city planner replanned these three hills; Red Rock; Gold Mine, and Fairmount. He of course discarded the grid street pattern which had existed on paper only, and he substituted contour streets "encircling the entire line of Hills." This would have promoted residential development on the slopes of these landmarks. To the west, The Burnham Plan advocated the creation of a park, city-wide in character, in deep and rugged Glen Canyon.

Then came the earthquake and fire of 1906.

As San Francisco began to rebuild, many of the features of the Burnham Plan were put into effect. Others were ignored, overlooked or forgotten.

"Forgotten" best describes the three hills of Diamond Heights, as this area is called today.

Nearly half a century more has passed since Mr. Burnham and the committee which sponsored his plan made recommendations which would have resulted in feasible, beneficial use of the land in the Diamond Heights area. But because of its grid street pattern, its diversity of land ownership and its lack of utilities, Diamond Heights has remained barren and useless while other sections of San Francisco, and of the Bay Area as a whole, for that matter, have grown around it.

In the Glen Park and Fairmount sections, bordering the southern end of the project area, many of the streets were built along the contours, and the lower slopes became relatively well built-up. But

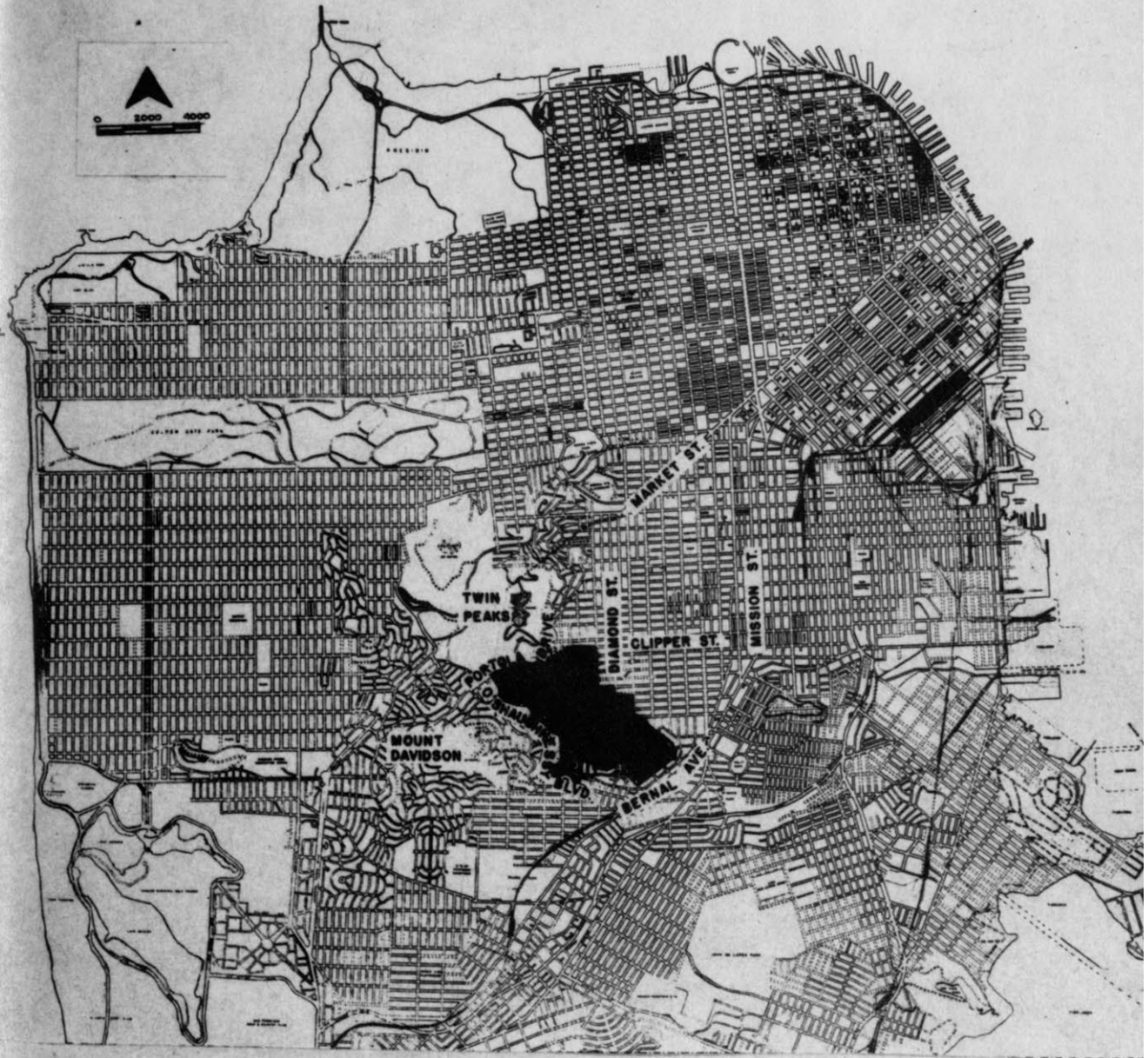


no attempt ever was made to lay out contour streets on Gold Mine Hill and Red Rock Hill in the central and Northern end of the project area. There was no plan to assure schools, stores or public transportation. It was a matter of speculative subdivisions where only a few houses were built. Formerly land was available in more level parts of the city where it was cheaper to put in utilities and build houses. Meanwhile, in Diamond Heights quarrying was carried on, and cows grazed on the hillsides. (There was a dairy in Glen Canyon until the early 1930's). The city acquired most of the canyon in 1912 as a possible site for a reservoir but later made other arrangements for water storage.

The fact is that Diamond Heights comprises one of the few tracts of vacant land in San Francisco still available for residential development; yet it has remained unappreciated and unknown to most residents of the metropolitan center.

THE SITE

The 371 acres of the Diamond Heights Redevelopment area are located close to the geographic center of San Francisco, southeast of Twin Peaks between the southwest portion of the Mission District and O'Shaughnessy Boulevard, the latter forming its western boundary. Portola Drive and Clipper Street fix the area's northern boundary. To the east is Noe Valley, forming the edge of the inner Mission District. The Fairmount and Glen Canyon Park sections are located in the southern part of the area.



LOCATION

The Diamond Heights Project area, selected by the City Planning commission in May of 1951, consists of 325 of the 371 acres designated as a redevelopment area by the Board of Supervisors in July 1950. The 46 acres excluded are relatively well built up sections on the southern and eastern fringes of the redevelopment area. It is the 325 acre site which will be referred to in this report.

The Diamond Heights area comprises a chain of three hills and a canyon. The most northerly hilltop, called Red Rock Hill, has an elevation of 690 feet above sea level. South from this height, the land slopes sharply to a relatively level saddle, and then rises again to a summit, known as Gold Mine Hill, which is 680 feet above sea level. Southeasterly from Gold Mine Hill lies Fairmount Heights which rises to an elevation of 540 feet above sea level. The lowest point in the area, approximately 220 feet above sea level, is at the mouth of Glen Canyon at the edge of Glen Park Playground.

The topography of Diamond Heights' 325 acres is comparatively barren, relieved only by an occasional rock outcropping and scattered vegetation. Only 15 percent of the land has a slope of less than 10 percent; 18 percent of the land has a slope of 10 to 20 percent; 30 percent of the land has a slope of between 20 and 30 percent; and the remaining 37 percent of the site has a slope of over 30 percent. The slope located on the west side and near O'Shaughnessy Boulevard has been graded so steeply that erosion has caused an unsightly embankment. Quarries now exist in two locations on the tract. One, centrally located, is a definite hazard and requires regrading. The Red Rock Hill quarry, while relatively shallow, also needs to be

filled or regraded. However, the major portion of the site is buildable.

In general, little is known of the specific soil and foundation conditions in the area, but the information available concerns general geologic formations found in the Diamond Heights area, as reported by the University of California's Department of Agriculture.

1. Los Osos: Parent material is sandstone. Grayish-brown in color. Gray-loam, good for planting, satisfactory structurally.
2. Colma: Parent material is sandstone. Dark in color. Clay loam, excellent for planting, satisfactory structurally.
3. Serpentine Rocks: Can be seen as outcropping, does not spread out over much greater area underground than of that seen on the surface; almost vertical strata. Poor for planting, and generally satisfactory for structures.
4. Marine Sand: Result of geologic fill.

The existing eucalyptus and cypress plantings are of native and hearty growth and should be retained where possible. Shrubbery existing on the tract is of little value and should be disregarded.

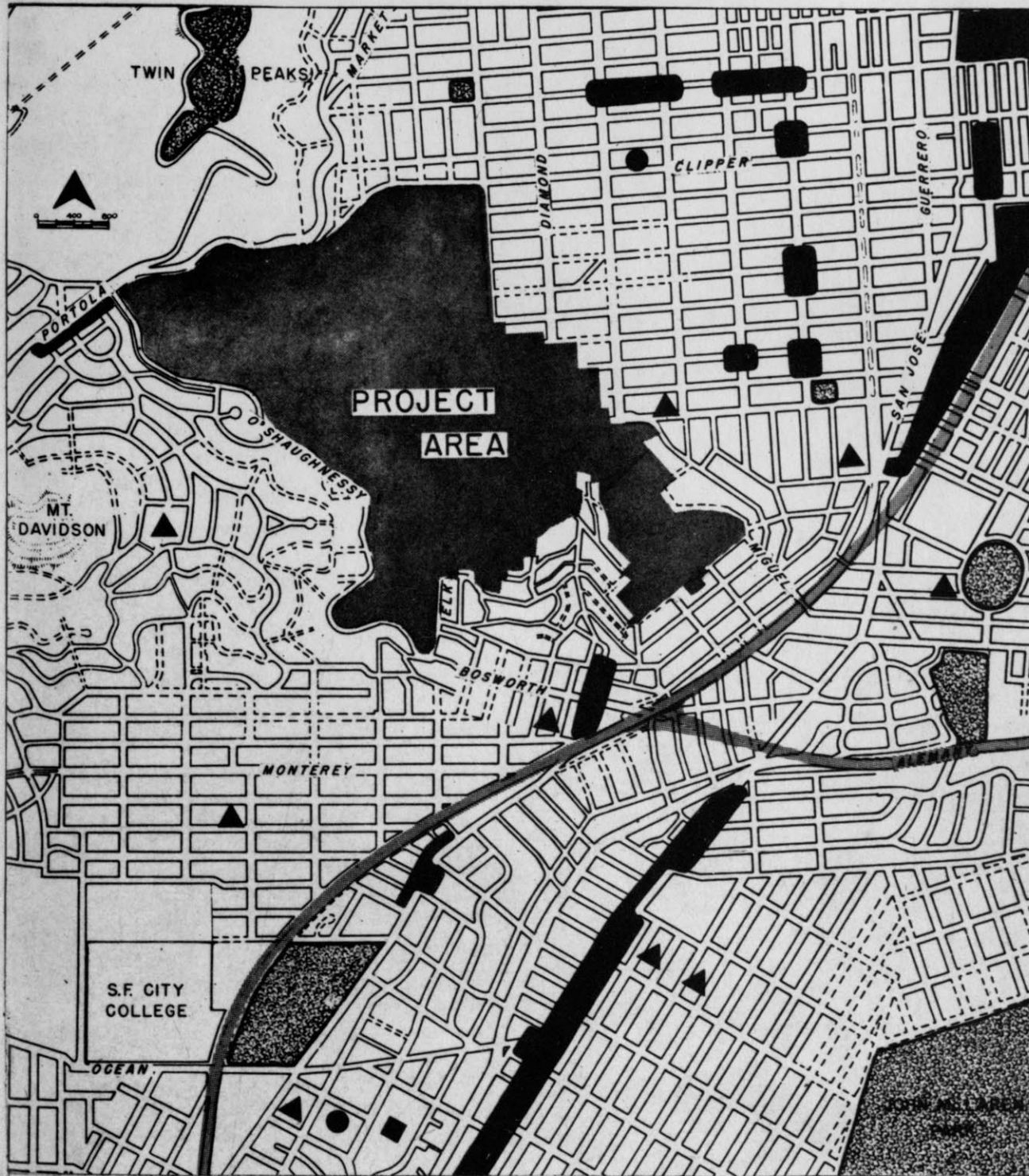
## THE CLIMATE

The following data has been recorded only for downtown San Francisco owing to the location of the United States Weather Bureau's observing station. Wind velocity will be somewhat greater and fog will occur more often in the Diamond Heights area. Winds usually prevail from the west to northwest in the summer and southwest to northwest in the winter. Average temperature ranges from 29 degrees F to 100 degrees F with an average of 59 degrees F. The site received approximately 20 inches of rainfall annually, with the months of May and August being the dry periods. Fog conditions are of great importance, for it is found that fog eliminates 65 percent of the sun on the west slopes and 50 percent of the sun on the east slopes. The sun is at an altitude of  $37^{\circ} 48'$  N latitude by  $122^{\circ} 23'$  longitude.

## CITY-WIDE ASPECTS

Certain elements in the physical plan for a given area within San Francisco must be related to the city-wide patterns as embodied in the Master Plan. Three such patterns which directly affect the redevelopment of Diamond Heights are those of general land use, the transportation network, and that of recreation facilities.

A major concept of land use planning in San Francisco has been that the city should be further developed into two separate areas; living and non-living. Diamond Heights falls well into the major pattern of living areas.



- |   |                   |   |                   |
|---|-------------------|---|-------------------|
| ▲ | ELEMENTARY SCHOOL | ■ | SHOPPING CENTERS  |
| ● | JR. HIGH SCHOOL   | ▨ | PARKS             |
| ■ | HIGH SCHOOL       | ▩ | PROPOSED FREEWAYS |

VICINITY OF PROJECT AREA

Fortunately, none of the major thoroughfares proposed for San Francisco will cut through the project area. The Mission Freeway and the Circumferential Expressway will provide future residents of Diamond Heights access to the major circulation pattern and to the downtown area for the present. Clipper Street will provide a direct route to the east, where other major employment centers are located. The circulation plan within the proposed redevelopment area should allow ready access to these important streets.

In a recent study it has been established that existing travel time between the proposed redevelopment area and Market and Montgomery Streets is from 35 to 40 minutes. This would be cut to approximately 20 minutes by the proposed subway and rapid transit systems. However, areas closer in will retain approximately the same relative advantage that now exists in travel time differentials. It seems reasonable to assume that the majority of single people now living close to the downtown area will continue to consider such a residential location desirable. Practically the entire city will be within a transit time zone of 20 minutes or less, which does not afford Diamond Heights a relative advantage in this respect. However, this area will have good access to employment centers south of Market Street, in the Mission Community, and along the Bayshore.

Diamond Heights' relation to employment centers suggests that it will appeal to a cross section of occupational groups fairly representative of the entire city. Since occupational groups and family size have been found to have a correlation, it seems reasonable to assume that size of household composition in the area should reflect

city-wide composition, with adjustments made for fewer single persons, under the assumption that they will continue to concentrate in close-in areas.

There are two recreation areas at the present time in Diamond Heights: Douglass Playground and Glen Park. Although Douglass Playground covers a larger area at the present time, Glen Park, with the rugged qualities of Glen Canyon directly north, offers greater possibilities as a recreation area of city-wide importance.



**SUMMARY OF THE TENTATIVE  
REDEVELOPMENT PLAN**

## REDEVELOPMENT AREA DESIGNATED

In July of 1950, Diamond Heights was designated Redevelopment Area "B" by official action of the San Francisco Board of Supervisors. This was done in accordance with the provisions of California's Community Redevelopment Law (known as the Community Redevelopment Act until September 22, 1951) which provides for combined public and private replanning and rebuilding of wasted or blighted areas. Under the terms of the law, clearing and preparing of the land and providing public facilities are undertaken with Federal and City and County funds, while private builders and individuals construct and own all the dwellings and other appropriate structures.

The July 1950 action by the Board of Supervisors authorized the San Francisco Redevelopment Agency and the Department of City Planning to replan Diamond Heights. The Tentative Plan is the result of several months of study by the two departments and the Agency's private consultants, with the assistance and recommendations of the city departments concerned with the project.

The proposal to re-design Diamond Heights into a model neighborhood conforms to the Master Plan of the city. It incorporates the latest knowledge in urban planning and provides for up-to-date neighborhood and community facilities and sites for 2300 private homes and rental units.



AERIAL VIEW



Project area boundary  
Redevelopment area

Specifically, the project area as shown on the Tentative Plan includes all but a few thickly settled blocks of the redevelopment area designated by the Board of Supervisors. It is bounded by Portola Drive and Clipper Street on the north; O'Shaughnessy Boulevard on the west; and irregular lines generally following Sussex, Diamond, and Bemis streets on the south and Beacon, Diamond, and Douglass streets on the east.

#### NEW STREET SYSTEM PLANNED

The proposed street system for this area fits into the officially adopted Trafficways Plan of the city as a whole. It has been designed to give access to every buildable site and to neighborhood and community facilities; but it is intended not to encourage city-wide through traffic.

Diamond Heights' principal streets, connecting with existing thoroughfares of major importance outside the project area, have been laid out with special emphasis on the future requirements of the public transit system. Buses and trackless trolleys will provide service to the heart of the city and connect with other city-wide lines.

Minor streets, winding around the contours of the hills, may be subject to modification by private developers when building begins.

The new street pattern avoids steep grades and includes comparatively few major intersections. Street tree planting is considered of great importance in the over all program for the beautification.

of Diamond Heights.

Supplementing both the proposed principal and minor streets will be a network of pedestrian ways. These will connect different levels of the project area by paths and stairways and will provide access to informal observation points atop the three promontories.

#### NEIGHBORHOOD CENTER FEATURED

A feature of the site plan is the neighborhood center situated in the saddle of land between Red Rock and Gold Mine Hills. Here on the principal streets running north and south through Diamond Heights will be grouped together a modern shopping center with adequate parking; one or more churches and possibly a library facing a small plaza; an elementary school, and recreational facilities for children and adults alike.

Thus, the Diamond Heights housewife, after taking her children to school, will be able to attend to her shopping, browse in the library and visit with her friends in the plaza. The parking facilities in the center will be available to those citizens attending church or assemblies in the school auditorium at night or Sundays.

The neighborhood center, therefore, will become the focal point for all the residents of Diamond Heights, recapturing in many ways the spirit of Main Street or Courthouse Square in American small towns.

On the west, the school and its playground will adjoin Glen Canyon Park with its day camp for all San Francisco children. Its

mountain-like banks, great rock outcroppings, groves of eucalyptus and willow trees, and its creek bed make this canyon one of the beauty spots of San Francisco. It is a part of the almost unbroken natural green belt extending over Twin Peaks and Mount Sutro to Golden Gate Park.

The head of Glen Canyon, where Portola Drive and O'Shaughnessy Boulevard meet, will be reserved as the site for a future junior high school.

Because of the steep topography in Diamond Heights, considerable grading will be required for both street work and building sites. A large portion of the earth obtained by grading will be used to fill in a ravine adjacent to the elementary school in the neighborhood center. This will provide a small playground for this section.

The remainder of the earth obtained will be used to fill in a jagged and treacherous abandoned quarry in the vicinity of Thirty-first and Diamond Streets. This recovered land will provide a site for another small playground laid out on different levels. Next to this playground, there will be a site for a home school to accommodate children in the kindergarten and the first several grades.

Above this quarry site will be sites for three or four small shops to serve the residents of the southern end of Diamond Heights and for a fire station and additional churches.

#### VARIETY OF DWELLING UNITS PROPOSED

Set aside for new residential development are the peaks and

slopes of the three hills and all of the remaining vacant land between them. Here will be found sites which should interest most builders, large and small, and many of the individuals and families anxious to find a home in San Francisco.

Extensive architectural and engineering studies have been made to determine the best use of the land in Diamond Heights. Because of the steep terrain, virtually every building site will command a wide view, and the land disposition policy of the Redevelopment Agency will be designed to protect these views.

Most of the sites for single-family residences lie on the western slopes of the hillsides overlooking Glen Canyon. To the East, steeper sites commanding views of downtown skyscrapers, the Bay Bridge and the hills of the east bay, are better suited for apartment building.

One of the advantages of this plan is that it locates most of the single-family residences (where most of the children will live) in the areas which will have access to the neighborhood center and the elementary school without crossing a principal street.

For some of the families interested in living in Diamond Heights, there will be a few wide lots for detached houses along the boundary of Glen Canyon. This will provide a gradual transition between the open canyon and closely built row and multiple dwellings higher on the hills. Many sites will be suitable for semi-detached and one and two-story row houses. There will be still other locations for those San Franciscans who want to build or own small income property - for instance, duplexes and rental row units.

There will be larger sites for all types of multi-family dwellings. Some blocks are best suited to row houses built around a central court. Proposed for a number of the steepest sites are "step-down" apartments (buildings which follow the contours of the hillsides and thus provide balconies and roof decks for each unit). The suggested development of Red Rock Hill, the closest of the landmarks to downtown San Francisco, includes three ten-story apartment buildings.

In reaching the Tentative Plan stage of planning, every effort has been made to preserve the neighborhood characteristics of the blocks just inside the project and to make gradual the transition from the old to the new.

There are only 158 houses now existing in the area. Most of these will remain in their present locations, with some of them marked for rehabilitation. About 45 structures will require moving or demolition in order to carry out the anticipated redevelopment.

All told, an estimated 7500 persons will live in the proposed Diamond Heights project.

#### THE REDEVELOPMENT PROCESS IS GRADUAL

The redevelopment process is the step-by-step replanning, clearing and rebuilding into good neighborhoods of areas of the city which have become blighted or wasted. Each step required by the Community Redevelopment Law must receive the approval of designated public bodies before the next stage of work can be undertaken.





For example, the Tentative Plan must have the approval of the San Francisco Board of Supervisors before the staff of the Redevelopment Agency can start work on the Final Plans. And the Final Plan also must have the Board of Supervisors' consent before acquisition and preparation of the land can get under way.

Sixty-five percent of the land in Diamond Heights already is in public ownership. Approximately 55 percent is to remain in public ownership as Glen Canyon Park, as sites for future junior and senior high schools and for other public purposes. The remainder will be available for private development. Of the land now in private hands, a few individuals or groups own acreages comprising an entire city block or more. The remainder of the property is owned by more than 500 widely scattered individuals.

Following the approval of the Final Plan, during a scheduled waiting period before the Agency may buy any land, those private property owners who desire and are able to develop their own land in the project area without changes in property lines may negotiate with the Agency for this purpose. Such private participation, of course, will be carried out in conformity with the street system, land uses, standards and other provisions of the approved Final Plan for the area.

After the period set aside for owner participation sign-up, under terms of the Law, the Agency acquires the remainder of the land, provides necessary streets, utilities and other improvements, and prepares the land for sale or lease to private enterprise for building.

Allowing time for the completion and approval of plans, the "bulldozer stage" of redevelopment in Diamond Heights may begin in 1953.

## FINANCING DIAMOND HEIGHTS

To finance the acquisition of land and subsequent site improvements, the Redevelopment Agency will seek a Federal loan, estimated at \$5,000,000, under the provisions of the United States Housing Act of 1949. The City and County of San Francisco, at the same time, will finance certain public improvements and facilities normally furnished by the local government in consideration of the tax revenue anticipated from new developments; these will include the new elementary school, new playground improvements, a fire station and a portion of a trunk sewer in Glen Canyon.

The Federal loan will be paid off by the sale or lease of the improved land by the Agency to the public at its fair value in accordance with the use to be made of it under the plan.

Although no exact determination can be made until the property is finally sold, it is estimated that the funds derived by the Agency from the sale of the land will defray all but about \$31,000 of the Agency's expenses. This amount will be covered by a Federal grant to the Agency.

Private investment in new homes, apartments, stores and private institutions in Diamond Heights will amount to an estimated \$30,000,000 to \$35,000,000. The present negligible tax return to San Francisco from the area will increase to more than one-half million dollars annually.

## MARKET FOR DWELLING UNITS

The market for 400 dwelling units in buildings of two to four units each and of 1300 apartments in larger multi-family structures planned for Diamond Heights has been studied with particular care.

It is notable that during the period of 1946 through 1950, an annual average of 1350 privately owned multi-family units were started in San Francisco and more than 3500 in the metropolitan area. Because compared with the single-family homes, the number of dwellings in multi-family buildings represents a larger proportion of the total probable production as well as a considerably greater total volume, it is expected that they will be built and occupied over a somewhat longer period of time. If this period is, as anticipated, from four to five years, an annual construction of from 350 to 400 units is indicated.

The marketability of these dwellings will depend particularly upon their desirability as compared with other new and existing multi-family dwellings available to prospective occupants. Clearly they will offer decided advantages over much of the existing supply in terms of accessibility to the center of the city, places of employment and public open areas. They will enjoy fine views and a climate relatively free from fog, especially on the eastern slopes. In addition to these geographic advantages, the Diamond Heights dwellings will present other desirable aspects from the point of view of market appeal. A survey taken a few months ago in San Francisco gives some data on housing preferences. In order to estimate the

relative demand for dwellings of different kinds, the survey interviewers not only asked for preferences in a general way, but showed to the families occupying new dwellings in San Francisco photographs of residential structures of various types and asked them their specific preferences. Since these families recently had sought and found new apartments and houses, and thus recently had been in the market, their expressed preferences probably reflect well-informed and considered judgments.

Perhaps the most significant fact shown by this data is the wide diversity of preferences expressed. This and other evidence from the surveys strongly suggest that a development like Diamond Heights offering a variety of housing types has a much broader and stronger appeal than does a development confined to a single type of structure.

There is, however, a concentration of preference for rental row and duplex types. This is particularly true of families with children. It is evident that in order to tap the widest market for multiple dwellings, many should be of these types.

The step-down apartments, a building type to be used on steep slopes, certainly then, has a great appeal. This type of building combines the row house and duplex, and also allows each unit a private garden or roof terrace, and possibly both.

#### POPULATION DENSITIES

In establishing population densities for Diamond Heights as required by the Community Redevelopment Law, one of the primary

considerations is that they shall be in conformity with the Master Plan for the city. The Master Plan adopted in 1945 and subsequent Master Plan studies indicate how the expected future population can best be accommodated in residential areas, based on such factors as existing building development, topography and proximity to employment shopping centers, transportation, and open spaces.

Although the city-wide plan does not directly establish population densities for Diamond Heights, it does give a basic framework within which Diamond Heights densities have been established. Diamond Heights, as one of the few remaining large tracts of vacant land in San Francisco, should provide dwellings for as large a number of families as possible without sacrificing desirable living conditions.

#### MULTI-FAMILY AREAS AND BUILDING STANDARDS

In general the multi-family areas lie on the tops and the steep eastern slopes of the three hills, which are most easily accessible from downtown and where the most dramatic Bay views are obtained. Both large-scale and smaller building operations would be encouraged. On the steeper hillsides, two story and step-down units can be built with protected decks and balconies.

Although each private builder will plan his own multi-family dwellings, the building standards and minimum land prices for each parcel will be set in such a way as to encourage a combination of dwelling types throughout the project that will have the broadest appeal to as many families as possible.

**THE PROBLEM**

## BUILDING PARCEL

In doing my thesis I have taken the role of an architect, working for a private investor who has purchased a small parcel in the Diamond Heights Redevelopment Project.

My client has decided to build apartment units, and prefers a building type which would permit the tenant to take care of as much of the grounds as possible. That is, he would rather have some sort of walk-up, or row house development than a multi-story building.

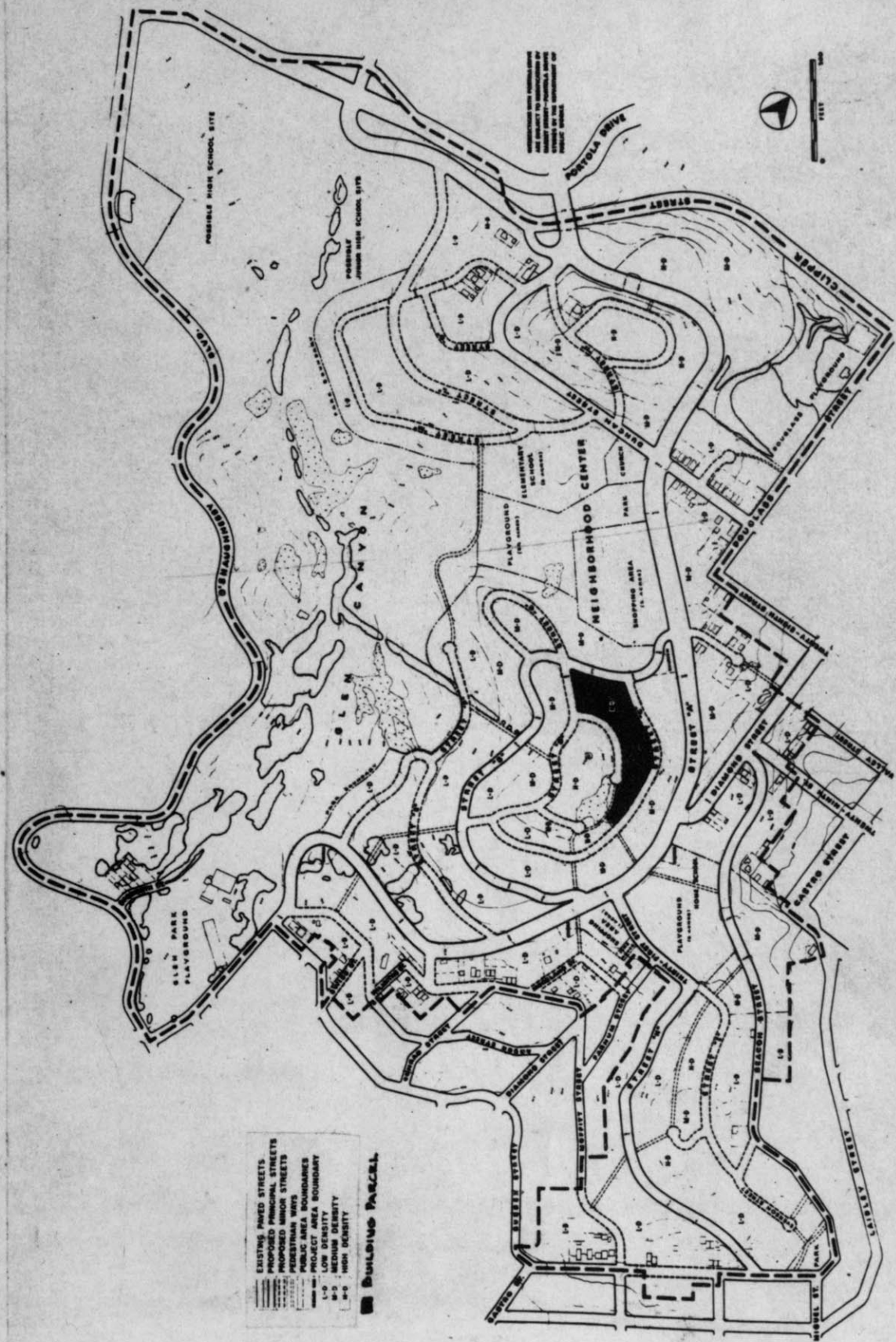
The parcel we have chosen is on the northern slope of Gold Mine Hill. The site is bordered by Street "C" on the north; Street "B" on the west; and Street "D" on the south. The eastern lot line is a large out-cropping of red rock which runs between the site and an S-3 single family development.

The site chosen commands one of the most spectacular views of the project, as well as in San Francisco. Being on the northern slope of the hill, it overlooks both the Bay Bridge, and the Golden Gate Bridge. Also, a splendid view of downtown San Francisco can be seen in the foreground.

This particular site also has an advantage over other hill sites in the city. Due to the shielding positions of the other hills nearby, the northern sites on Gold Mine Hill are well protected from the heavy wind storms which are frequent in this area.

Certainly any buildings on this site should make full use of the view and the chance for outdoor living, which this climate permits.





EXISTING PAVED STREETS  
 PROPOSED PRINCIPAL STREETS  
 PROPOSED MINOR STREETS  
 PUBLIC AREAS WITH  
 PROPOSED PLANTINGS  
 PROJECT AREA BOUNDARY  
 LOW DENSITY  
 MEDIUM DENSITY  
 HIGH DENSITY

**BUILDING FOOTPRINT**

**PRELIMINARY REDEVELOPMENT PLAN**

The two and one-half acre site is one of the steepest in the project, having a slope of 40 degrees in some areas. Being between two streets, one on the lowest part of the site, the other on the highest, the site seems to be well suited for "step-down" apartment units. And this type of unit would be in line with what the client has in mind.

The step-down unit has many advantages of the single house, as each unit is a separate building, with its own entry from the outdoors. No space is used for long hallways or public foyers. Along with saving space in this way, the apartment in the "step-down" unit is more private.

On such a steep site the cost of grading is an important consideration. As said before, outdoor living is an all around feature in this climate. The "step-down" unit is well adapted for this without any extensive grading, as the roof of the unit below can and should be used for an outdoor terrace. This, then, would be the formal place for outdoor living, and could be used at very little additional cost of insuring good insulation on the roof.

In determining our program we have talked to members of the San Francisco City Planning Department. The need seems to be mostly for two-bedroom units, with one-bedroom units being next in demand. They also felt that some three-bedroom units would be necessary.

"Efficiency" apartments would not be included in this type of building, but should rather be placed in multi-story apartments, as most of the people renting such units would want the services offered in this type of dwelling unit.

## NUMBER OF UNITS

The site which we have chosen has been zoned by the Redevelopment Agency as an M-2 area. This imposes the following density restrictions:<sup>2</sup>

Minimum square feet of  
net lot area per room<sup>1</sup> ..... 400

Equivalent in number of  
dwelling units per net  
acre<sup>2</sup>:

1-bedroom units .....	36
2-bedroom units .....	27
3-bedroom units .....	18

1. For purpose of this standard, a room is defined as a living room, a kitchen or a bedroom. Dining rooms or dining space, baths, foyers, halls, dressing rooms or closets are not counted. Thus, an efficiency apartment consisting of a living room, dining room and kitchen space, and a bath, and possibly a dressing room or closet, is counted as two rooms. The net lot area is defined as the total number of square feet within private property lines. It does not include public streets, but does include private drives and access ways.
2. A two-bedroom unit is counted as four rooms. Larger apartments are counted as two rooms plus the number of bedrooms.

In order to make a rough estimate, we might assume that we would have largely two-bedroom units, say 50 percent. About 30 percent of the units will be one-bedroom units with the remainder being three-bedroom units. This seems to be in line with what the City Planning Agency of San Francisco found to be reasonable.

From this data we can now make a tentative program of the units which will be needed. The following, then, is a breakdown of these findings:

1-bedroom units .....	20
2-bedroom units .....	32
3-bedroom units .....	12

This would mean a total of 64 apartment units, with 64 inclosed garages, or car ports, as the Development Agency Tentative Plan requires 100 percent off-street parking.

#### PROBABLE RENT RANGES

Intensive study has been made of construction and operating costs, tax incidence and available financing methods in order to forecast the probable rent ranges which may prevail in the various types of rental dwellings proposed for Diamond Heights. In the course of this study the Redevelopment Agency has sought and received the assistance of private contractors, engineers and architects and the various local and Federal agencies most intimately acquainted with the cost and rental picture in San Francisco and the Bay Area.

In order to arrive at some rent ranges for apartment units on the site in question, various alternatives are shown as to overall per square foot construction costs and the rate of return on total construction costs, after operation expenses and taxes. These variations are indicated, as the relative availability of financing and general cost picture at the time of construction cannot be precisely predicted now. The operating cost figures were determined on the basis of recent experience in similar new developments in San Francisco and exclude any allowance for heat, light or cooking fuel, as do the resulting rentals. The amount of real estate tax indicated reflects current experience in San Francisco while the seven percent vacancy and contingency figure is usual for rental developments in this area.

In figuring the proposed rental, and average of 1000 sq. ft. per unit was used, the three-bedroom units having somewhat more area, and the one-bedroom units running under this figure.

A total of 64 units were used in this analysis, with a site area of two and one-half acres.

The cost of the land was found to be about \$20,000 per acre. Then the total cost of land would be \$50,000. The total area of the 64 apartment units would be 64,000 square feet. The rate of return was assumed to be 6 percent.

Construction cost should run between \$10 and \$14 per square foot, and three figures have been used to estimate the rental charges.

ESTIMATED COSTS AND RESULTING PROBABLE MONTHLY RENTS  
 FOR A TYPICAL "STEP-DOWN" APARTMENT UNIT ON SITE IN  
 DIAMOND HEIGHTS

CONSTRUCTION COSTS dollars per sq. ft.	10	12	14
TOTAL CONSTRUCTION COST	\$640,000	\$780,000	\$896,000
TOTAL LAND COST	50,000	50,000	50,000
TOTAL COST	690,000	830,000	946,000
COST PER ROOM	\$2,690	\$3,220	\$3,670
MONTHLY COST PER ROOM rate of return 6%			
FINANCING	\$13.25	\$14.10	\$16.95
OPERATING COSTS	4.87	4.87	4.87
REAL ESTATE TAX	4.75	4.75	4.75
7% VACANCY	1.73	1.78	2.00
TOTAL MONTHLY RENT PER ROOM	\$24.60	\$25.50	\$28.60
APPROXIMATE RENT PER MONTH FOR:			
ONE-BEDROOM UNIT	\$73.80	\$76.50	\$85.80
TWO-BEDROOM UNIT	98.40	102.00	114.40
THREE-BEDROOM UNIT	123.00	127.00	143.00

From this study, then, it was found that the following rent ranges are probable for the different multi-family dwelling sizes included in the project:

ONE-BEDROOM UNITS .....	\$73 to \$85
TWO-BEDROOM UNITS .....	\$98 to \$114
THREE-BEDROOM UNITS .....	\$123 to \$143

If the customary 25% ratio of rent to income is used, this would suggest that the rental units in this project potentially will serve families with incomes of \$3,600 per year and up (assuming the \$12 per square foot figure for building costs). This would mean that a large number of the families served would fall within the middle income group as indicated by data from the 1950 census which shows that the median family income for San Francisco for 1949 was \$3,907 per year. Fifty-eight percent of the families in San Francisco had annual incomes of more than \$3,500 in 1949.<sup>3</sup>

It is interesting to note that in a recent survey conducted by the San Francisco City Planning Agency with respects to rents, people in this middle income group seem to be willing to pay between \$15 and \$20 a month more for rent, if the unit has a good view of the Bay. This would seem to justify the increased grading costs which might be involved on this site in order to give the units a better orientation with respect to view.

## BUILDING REQUIREMENTS

The building requirements shall follow those in the Diamond Heights Tentative Plan as well as those set down in the San Francisco Building Code and the California State Housing Act.

The building codes may be referred to for most of the requirements, but a few of the more important items, and requirements will be listed and discussed below.

Along with building intensities, which have been mentioned before, the Diamond Heights Report has several other building requirements.

Every walk-up or "step-down" apartment unit must be reached by climbing no more than two flights of stairs. However, if some sort of outdoor elevator were used, an exception to this might be in order. Some such elevator units have been used in the hills of Berkeley and seem to be successful in operation.

Where garages must be placed underneath apartments along street frontages, because there is no other accessible level land, no more than two living floors are possible.

Considering the location of Diamond Heights, the probable income level of residents and the car owning and using habits of San Franciscans, it seems necessary that multi-family site layouts should provide at least one garage or carport for each dwelling unit.

Whenever the land falls away or rises sharply from the street



level, all garages or carports must be placed along the street. In addition, except where off-street parking for visitors is possible, there must be adequate parking space at the curb which is not taken up by garage entrances.

In addition to the applicable city ordinances and a revised zoning map based on the Tentative Plan, the safeguards to be proposed will include:<sup>4</sup>

1. Minimum square feet of net lot area per room for multi-family areas (for the site under consideration the minimum area per room is 400 square feet).
2. Building height restrictions, with variations for each parcel, to preserve views for each of the dwelling units.
3. Minimum yard and building spacing standards to assure light, air, and privacy.
4. Provisions to assure minimum usable level open space yards, for adult and child open-air activities. In the case of multi-family buildings, accessible and usable space on roof decks or balconies may be substituted for yard space at a ratio which will count one square foot of private balcony or deck space as equivalent to two square feet of level open yard space.

A few articles in the California State Housing Act which apply to this project are listed below according to the article number listed in the Housing Act.

15680

There shall be a rear yard immediately behind every apartment house on the lot which the latter is situated.

15686

If either a corner or interior lot extends from one street to another street, a public alley or public park, one half of the width of the street, public alley, or public park which is the narrowest may be considered a part of the lot in computing the minimum depth of a rear yard of an apartment house.

15852

The height of a wooden apartment house or hotel shall not exceed any of the following:

- a. Three stories for living or sleeping purposes at any point.
- b. More than two times the width of the widest street abutting the lot on which the building is situated.
- c. Fifty feet at any point above the adjoining sidewalk or actual ground levels.

15854

Any wooden apartment house or hotel with not more than three stories for living or sleeping purposes at any point may have, in addition, a basement with a ceiling height of not more than eight feet above the adjoining sidewalk or ground levels.

16057

Every room in a dwelling or apartment house not more than

two stories in height shall have a ceiling height of not less than eight feet, measured from the finished floor to the finished ceiling.

17257

Each floor in a building shall be constructed to sustain safely a live load of not less than 40 pounds per square foot.

17258

Each roof of a building shall be constructed to sustain safely a live load of not less than 20 pounds per square foot.

#### SITE PLANNING CONSIDERATIONS

The parking problem is one of the most difficult to solve on this site, due to the steepness and the requirements of 100 percent off street parking. On the lower street there is no difficulty, as the garages or carports can be placed into the hill. But on the upper street, due to the steepness, this is not possible. One solution would be to design units under the car inclosures, or to put units above the carports, and to lift the entire unit up on stilts on the back side. However, it seems to be a better solution to provide 100 percent parking on the lower street, and rent out 50 percent to the owner of the site below. Then it would be necessary for the owner of the site above to build more car inclosures on his side of the street, to be rented out to tenants living on the site my client owns. It also might be possible for my client to build the car inclosures for both sites and rent out to both the sites below and above.

The orientation of the buildings on the site is a difficult problem due to the orientation and steepness of the site. The view is of prime importance in this area, and should be a major planning consideration. However, the facing of buildings toward the view means also facing the buildings away from the sun. Possibly, buildings should be placed in a north-south direction, giving them morning and afternoon sun, and having the living area on the second level, overlooking the roof terrace of the building below and also the view.

Due to the steepness of the site, care must be made minimize the grading problem, to preserve the view, and to get maximum sunlight in all units. Stairs will have to be used for entrance, and it seems logical to combine the stairways for two units in order to reduce the amount and cost of grading.

In general, the unique features of this site make this land a difficult one to plan, and this is certainly one of the major aspects of the design. And if such features of design such as orientation with respect to sunlight, view and outlook; relation of buildings to each other; privacy; and parking are not solved, the project cannot possibly be a successful one.

#### LIVABILITY AND UNIT PLANNING

The importance of livability **cannot** be minimized. A well thought-out apartment unit is essential. How planning and livability affects rental units can be shown by the following table which gives

the reasons why people move:<sup>5/</sup>

APARTMENT LAYOUT .....	% 20.2
MORE LIGHT AND AIR .....	12.1
CHANGE IN SIZE OF FAMILY .....	15.2
NEARNESS TO WORK .....	14.1
NEARNESS TO SCHOOL .....	6.1
NEARNESS TO TRANSPORTATION .....	5.2
OTHERS .....	27.1

The first two items show us that by raising the standard of living conditions within any unit we can improve rentability by nearly one third.

The apartment floor plan, with regard to size of room and relationships of one room to another, is the most important feature of livability. There are several major zones which must be considered. They are: sleeping area, separated as much as possible from the noisier sections of the apartment unit; a work center, including kitchen; and a living area or social area. The latter also includes outside space as well as interior areas. These areas do not form strict boundaries, but overlap. That is, much of the living area will also be used as working space, and some work may be done in sleeping areas.

Bedrooms, whether single or double, should have enough room for reading and work space, or play areas in the case of children, besides areas for circulation and placement of beds and other furniture.

The orientation should be such as to prevent early morning sunlight from waking up the occupants, but should also permit some direct sunlight to reach the room sometime during the day. The master bedroom should have access to some outdoor living area, as often this is a second living area within the family.

As the housewife spends most of her time in the kitchen, it should be given special consideration. The orientation should permit both sunlight and a good view. If possible, the mother should be able to view the children at play in the outdoor space provided for this activity.

Work centers should be organized and planned so that each operation performed by the housewife in the kitchen is located next to the preceding operation. Space should also be planned so as the family can gather in the kitchen before the meal, as today much of the social life of the family centers around this function.

Dining space should, of course, be adjacent to the kitchen. A separate dining room seems to be unnecessary, as it is used only about 10 percent of the time. An alcove off the living area seems to be the most desirable area for this function. It should, however, be a separate unit, so clearing and cleaning does not occur in the living area. Dining in the kitchen area seems to be undesirable, due to the cooking odors, and often interferes with the preparing of the meal.

The living area is the center of all activity in the unit. A conversation area should be in a dead end of the room, with smaller groups of furniture for reading and working space, centered around

this main grouping. The conversation area might well be centered around a fireplace, although in this climate this is not necessary. The living area should, however, lead out to the outdoor space provided. Bookshelves and a place for a sound system should be included in the plan for the living area. This room should be planned so as to permit space for the children to play. It should be a room which is suited for the entire family, and not at all the room to be used only for company or for show. View and sunlight should be of prime importance in this room.

About one-sixth of the total area of the unit should be provided for storage. This is one area which is so often forgotten in the newer apartments, and is a must for good rentability.

Storage space should be located near the function to which it is to be used. There should be separate storage areas for children's toys and games. A place for out-of-season clothes should be provided. Personal clothing storage space should be located in or near the bedrooms. The latter is better because it permits more free space in the bedrooms, but then the storage space should be next to the bathroom. Both hanging space and drawers are necessary and should be provided in the unit.

Even if all these items are carried out the apartment will not be livable unless a proper circulation plan between these areas is also carried out. No room should be used as circulation space. Isolation of the noisy and quiet areas is essential in a small apartment unit. Also, the work and play areas should be, as far as possible, separated.

In grouping the units, privacy must be preserved between each apartment unit. If living will be done on the roof of the units, care must be taken to insulate the roof.

The entry problem is of prime importance. If possible, a separate entry for the kitchen is advisable. Certainly some method for getting out the kitchen waste without tracking it through the kitchen and living area must be provided. It is also advisable to provide a foyer for the main entry, where coats and boots may be taken off, and to act as an air lock for the living area. This foyer should then open onto the living area, as this is where guests should be received.

Finally, the building must be attractive and pleasing to the eye. Without this last feature, the building will certainly not be rentable.



**THE SOLUTION**

## THE SITE PLAN WITH RESPECT TO ORIENTATION

Of the total acreage, all but a small out-cropping of red rock on the eastern side of the site is suitable for building.

As stated previously, the orientation of the site with respect to view and sunlight do not coincide. The view of the Bay and downtown San Francisco are in a northerly direction, with the slope rising to the south. This means some sort of compromise in orientation is necessary.

In the solution, I have placed the buildings in a north-south direction. This gives each unit sunlight either in the morning or afternoon, and all units are oriented with respect to the view.

The other possible solution was to place the buildings along the perimeter of the site, giving all the units a view. But this would not permit sunlight on the living side of the units and so was discarded. This also gave the site a very confined appearance, closing in the center area of the site.

## GROUPING THE UNITS

The row units have been grouped in pairs in order to gain as large a living area for each apartment unit as possible. The distance between two rows of units on the service side was kept to a minimum, governed by the visual distance which was thought to be pleasant. This gave a minimum distance of sixty feet between each row of units

on the living side, and in most cases much more. All the units within any row step down one floor, so as to give each apartment unit a view directly toward the north, while the rooms on the side get oblique view down the slope.

In designing the site plan it was found that in order to meet the maximum density requirements which the code allows, the buildings had to be in longer rows than the Diamond Heights code would allow. Therefore it was necessary to provide some sort of tramway up the slope between the rows of units.

Although each apartment unit can be reached from either the lower or upper road, the middle units in the five and six-unit rows still have to walk up or down more than two floors. Also in this type of building, i.e. step-down apartments, the problem of how to get large packages, baby carriages, etc., to the units would be a difficult problem without some sort of mechanical tram. The garbage disposal is another problem which would be tedious without some sort of tram.

The problem became one of economics. Was it possible to design such a tram which would ride up and down this slope at a cost which could be supported by the units? In a meeting with Mr. Krapel of Otis Elevator's design staff in New York, this problem was discussed. Threotypes of lift were proposed.

The first was an escalator which would run up the 200 foot slope. This would mean that only one-way traffic would be possible unless two such units were placed between each row unit. But this type of tram was thrown out early in the meeting, due to the high first cost,

and the low volume of travel. This type of lift would pay only when the volume of traffic was extremely high.

The next type under consideration was a type much like a ski lift. This type of tram would be hung from supports and ride about six inches off the ground stopping at platforms at each apartment unit. It would allow passage of people across the line of travel and the building of two stairs would not be necessary. A small car, open with railings, would carry up the passengers at a slow speed (about 50 feet per minute), letting them off at the apartment unit levels.

The third type was much like the second, except the car would be on rails on a concrete foundation, and ride up between two sets of stairs servicing each row. This type of car would be drawn by cables with the motors set in a housing at the end of the row units. It would also be a slow speed car, but could travel at about 70 feet per minute, as no one would be passing over the track. This type of lift would be on the order of the cable cars now in operation in San Francisco.

This cable type of lift was chosen for several reasons. First the cost was the lowest, even considering the cost of the extra stairs which would be needed. It was also thought that this would be the most attractive, as it would be difficult to design supports of the ski lift type of tram which would not be offensive in the tight area between the rows of units. Also the safety controls on the cable type of lift would be less expensive than any of the other types.

The problem, then, was to determine if the cost of this lift was

prohibitive. Although extensive engineering would be necessary to get an exact price on such a unit, Mr. Krapel ventured a rough estimate of \$8,000 to \$12,000 per tram unit. If the tram was not used, in order to follow the code requirements as to allowable distance which can be walked, about 15 apartment units would have to be taken out of the site plan. The loss of rent from these units would be about \$2,000 per year. This would indicate that by putting in the lift, a return on the investment would be about 15 percent. Therefore it was decided to use the cable type of lift.

Controls would be installed on the lift to prevent children from using the units, and also a system in which tenants could call the lift from the apartment units so as no waiting outside would be necessary in poor weather. The lift would stop at platforms at each apartment unit level, and would be used for garbage disposal as well as passengers, as the lift would contain two separate units.

The car itself would be of very light construction. A small platform with railings and a top canopy would be all that was required. A maximum of five persons was the design load thought to be feasible for the car. The railings would be removable in order to lift large pieces of furniture to the apartment units.

Although Otis Elevator was not willing to design such a unit, they were sure it could be done, and that many small companies on the West coast would take the job.

## UNIT DESIGN

In designing the units there were two large problems. The first was to decide on a basic module in which one-, two- and three-bedroom units would all fit. The second problem was to design the units so that all living occurred on the court side of the site, in order to keep the entry side to a minimum demension.

Using an 8-foot module, it was found that both these conditions were met. The living areas (living room, dining room and kitchen) were placed on the top level, giving the living room a view to the north and access to the terrace. The bedrooms then have an outside terrace facing the court on the ground floor.

All the units have two outdoor living areas, with the exception of the one-bedroom units which have been placed on the lower end of the rows.

The entrances of the units are on the second level, and the effect on the entry side of the row units is of a one story building. This was done in order to give a wider visual effect of the entry space, as the distance between the two rows of units on the entry side has been kept to a minimum to gain maximum space on the court side.

In designing step-down units of this type, one of the largest problems is to keep the units from visually sliding down the hill. Also it is a difficult problem to separate visually the separate apartment units. In order to solve these problems, large vertical planes of redwood siding have been used. These large planes tend to stop the horizontal sliding. On the entry side of the apartment units the

planes are of a very heavy character, while on the court side, the buildings have an open quality.

#### CONSTRUCTION

In order to give the units a very open feeling, a material was desired which would span the entire width of the units. Flexicore was chosen, as it seemed to fit in well with this type of span.

The first story of the units, except for the garden side, will have poured concrete walls, and on the garden side, fireproofed steel columns extend up to the roof. The roof on the entry side is also supported on steel fireproofed columns, and is of Flexicore, with insulation (acoustical) and decking. Steel fireproofed beams are used to support the Flexicore. Glass and stucco filler panels are used throughout.

Due to the high insurance rates in San Francisco, fireproof construction seemed necessary. Although no figures were available, it seemed that the initial cost of this type of construction over that of wood frame was justified due to the large reduction in the insurance rates.

The above were the main design considerations which determined the layout and design of this project. The appendix contains the minimum area requirements which were suggested by the American Public Health Association Committee on the Hygiene of Housing which somewhat determined the layout of the apartment units. The appendix also contains

an outline of the specifications for the project.

In doing this thesis, the design objective throughout was to provide high quality housing for the middle income group which would capture the flavor, tradition, and spirit which makes San Francisco such a charming and interesting city.

The hill site, the view, the type of buildings used (step-down units) as well as the materials of construction, all seem to add up to a design which satisfy the criterion in this program.



**APPENDIX**

MINIMUM FLOOR SPACE REQUIRED FOR BASIC HOUSEHOLD ACTIVITIES <sup>6</sup>

Number of Persons	1	2	3	4	5
Sleeping and dressing.....	74	148	222	296	370
Personal cleanliness and sanitation..	35	35	35	35	35
Food preparation and preservation....	8	76	97	97	118
Food service and dining.....	53	70	91	105	119
Recreation and self-improvement.....	125	164	221	286	357
Extra-familial association.....	17	17	34	34	51
Housekeeping.....	48	91	110	127	146
Care of the infant or the ill.....	-	124	124	124	124
Circulation.....	20	20	20	20	20
Operation of utilities.....	-	20	35	35	45

## ADDITIONAL SPACE REQUIREMENTS FOR THE DWELLING UNDER DIFFERING CONDITIONS

Number of persons	1	2	3	4	5
Basic requirements.....	380	765	989	1159	1420
Operation of utilities: Laundry.....	36	48	65	80	96
Household maintenance.....	-	42	42	42	42
Circulation, two story.....	-	32	32	32	32
Total design space required.....	416	887	1128	1313	1590

## FOOTNOTES

1. Footnotes have been excluded from the Introduction and Summary of the Redevelopment portions of this report in order to increase the readability. However, I wish to give credit to the San Francisco Redevelopment Agency and the Department of City Planning, from whose reports much of this material was drawn.
2. Diamond Heights, A report on the Tentative Redevelopment Plan:  
p. 27
3. 1951 World Almanac
4. Diamond Heights, A report on the Tentative Redevelopment Plan:  
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5. Flats, Modern Developments in Apartment House Construction -  
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6. Planning the Home for Occupancy - A.P.H.A. p. 36

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