



REFUGEE HOUSING FOR HONG KONG

Submitted in partial fulfillment  
of the requirements for the  
degree of Master in Architecture  
at the  
Massachusetts Institute of Technology



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September, 1961

279 Harvard Street  
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Dear Dean Belluschi:

In partial fulfillment of the requirements for the degree of  
Master in Architecture, I hereby submit this thesis entitled,  
"Refugee Housing for Hong Kong".

Respectfully,

Samuel Cheng-Mei Wang



ABSTRACT

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It is not uncommon in the past for people to suffer hardships of displacement which were not of their own making but were by-products of ideological or physical conflicts. These people were often part of the conflicts, but they had no control or influence over them. Ultimately they became victims of war or other forms of struggle. Thus, it would be presumptuous for one to claim the Hong Kong refugee problem as being a unique crisis. Indeed, such a claim could only be made at the risk of over-dramatizing the issue. Be this as it may, each crisis non the less has its own peculiar set of circumstances which are rich in their social implications. The problems often become more complex with each succeeding generation as local problems take on a greater world-wide significance. In this sense the solutions demanded are really unprecedented and unparalleled. This is especially true in Hong Kong as the condition of population growth within the physical setting and limitations is unprecedented.

The problem of housing refugees today is far from being purely an architectural one. Operational definitions and concepts such as occupancy and density standards (to say nothing of the less tangible and measurable values), are highly relative to both existing and anticipated conditions. These include the changes of housing needs due to not only the more "natural" physical and social development, but

those due to highly unpredictable political developments as well, the subjects in the Table of Contents have been itemized in a way so as to indicate the scope and contents of problems which this thesis attempts to deal with.

## TABLE OF CONTENTS

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	Page
I. BACKGROUND INFORMATION	
A. The Need Presented	10
B. General Description	11
Location and Facilities	
The Entrepôt Trade	
The Refugee and New Industry	
Hong Kong Today	
C. The Population	19
Ethnic Composition	
Population Growth	
D. Historical Notes	20
The Opium War	
Possession by Britain	
The Japanese Occupation	
II. TECHNICAL AND PROGRAMATIC CONSIDERATIONS	
A. Climate	22
The Monsoon	
Rainfall	
Temperature	
Humidity	
Sunshine	
Wind	
B. The Site	25
Description	
Access	
Boundary Determination	
The Soil	

C.	Density	31
	Density Measurements	
	Occupancy Standards	
D.	Program	39
III.	OBJECTIVES SUGGESTED BY GIVEN CONDITIONS AND NEEDS	
A.	Site Organization and Configuration	40
	Placement of Major Access	
	Central Distribution	
	Collection and Concentration of Open Spaces	
	The Wall	
B.	Scope and Extent of Solution	43
C.	Social and Political Considerations	43
	Nature of the Refugee Influx	
	Political Stability and Housing Design	
D.	Structure and Module	45
	Capitalization of the Small Span	
	Cellular Construction	
	Flexibility through Superimposition	
	Natural Air Flow	
IV.	CONCLUSION: REFLECTION AND REVALUATION OF PROBLEM	
A.	Standards of Living and Space Requirements	52
	Complexities Involved	
	Privacy and Internal Specialization	
	The Dependence of Housing Standards on Needs and Resources	
B.	The Dominance of Fiscal Policy	56
C.	Is It Architecture?	58

NOTES	60
BIBLIOGRAPHY	62
APPENDIX	65

## LIST OF ILLUSTRATIONS

---

	Page
1. Map of Hong Kong relative to Canton and Macau	12
2. General Map of the Colony of Hong Kong	13
3. View of Hong Kong looking east toward North Point	17
4. View of Hong Kong and Kowloon	18
5. Maps of Asia, winter and summer rainfall, pressure and winds	23
6. Monthly wind roses of Hong Kong	26
7. Simplified geological map of Hong Kong and the New Territories	26
8. A detailed map of Hong Kong and Kowloon showing location of project site	27
9. Outline Development Plan Area No. 8 North Point showing location of project site	28
10. View of the site from the sea	30
11. Cross harbour view of Kowloon from the site	30
12. View of area from Tong Shui Road to northern tip of the site	31
13. View of King's Road from the eastern side of the site	31
14. Downhill view from the northern edge of the site	32
15. Table I. Data from recent Hong Kong housing projects	35
16. Unit plans of some Hong Kong refugee housing	36
17. A play ground in the North Point Estate	37



18.	Isometric drawing of a refugee living unit	37
19.	Tai Hang Tung Resettlement Estate	37
20.	Cellular construction by Olgay and Olgay	46
21.	Diagrams, natural air flow around and through buildings	50, 51
22.	Table II. Comparative scale of floor areas per person in various countries	56

## I. BACKGROUND INFORMATION

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### A. THE NEED PRESENTED

Hong Kong has become one of the most densely populated areas in the world. Over 3 million people occupy an area of less than 400 square miles. The over-all (urban and rural) gross density is over 7,000 persons per square mile; but over 2 million people inhabit the 36 square miles of urban area which makes the urban gross density equal to about 55,600 persons per square mile, or 87 persons to the acre. However, in the 10 square miles of the built up city, densities of over 2,000 persons per acre are common.<sup>1</sup>

The housing shortage which already existed before the second world war was intensified when 20 per cent of tenement floors were damaged or destroyed during the Japanese occupation. This condition of housing shortage became even more serious after the war when the population of Hong Kong jumped from 600,000 in 1945 to an estimated 2,919,000 in 1960, a fivefold increase in fifteen years.

This high rate of population increase was due mainly to the influx of one million refugees from China as the result of the Chinese civil war and the subsequent establishment of the Communist regime there. The rate of natural population increase (births over

deaths) has also risen. By the end of 1959 about 300,000 people were without regular housing of any kind, while much of the rest of the population lived in conditions of gross overcrowding.

Thousands of people lived in wooden squatter huts on the fringes of the urban areas or on the rooftops of private tenement buildings. Several serious fires have occurred among these squatter settlements. In 1954 the Hong Kong Government established the Resettlement Department in addition to the Hong Kong Housing Authority. Since that time, some 310,000 persons have been resettled. Despite these efforts on the part of the Government, 500,000 persons in Hong Kong are still without a permanent home.

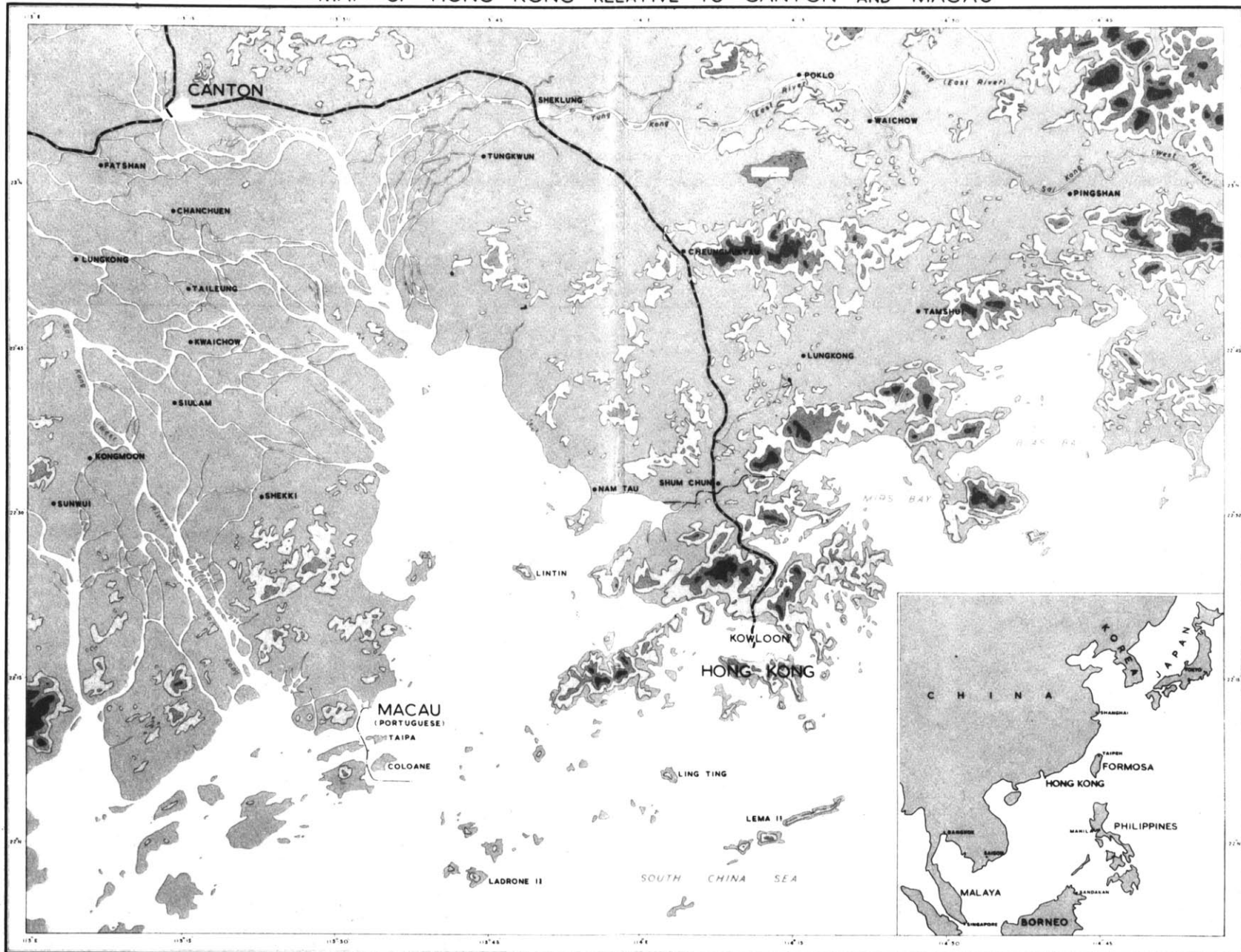
## B. GENERAL DESCRIPTION

### Location and Facilities

The British colony of Hong Kong is on the south-east coast of the Chinese province of Kwangtung, and is situated immediately east of the Pearl River estuary. It consists of Hong Kong Island (29 square miles); the ceded territory of Kowloon and Stonecutters Island (3 and 3/4 square miles); and the New Territories, including New Kowloon (365 and 1/4 square miles); as shown in the accompanying maps.

The heart of the Colony consists of the twin cities of Victoria on the north side of Hong Kong Island, and Kowloon on the mainland. Between them lies the port of Victoria, commonly agreed

MAP OF HONG KONG RELATIVE TO CANTON AND MACAU

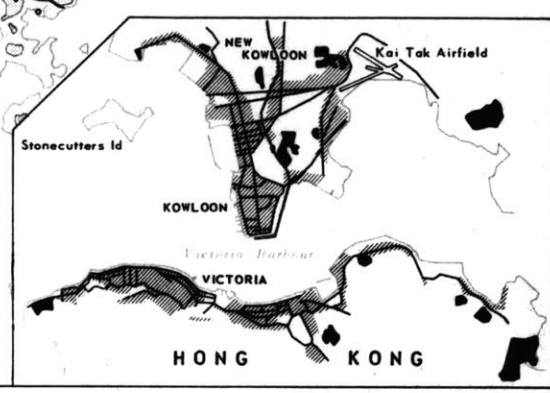
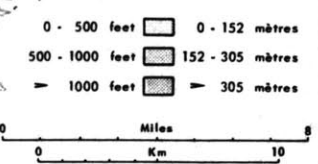
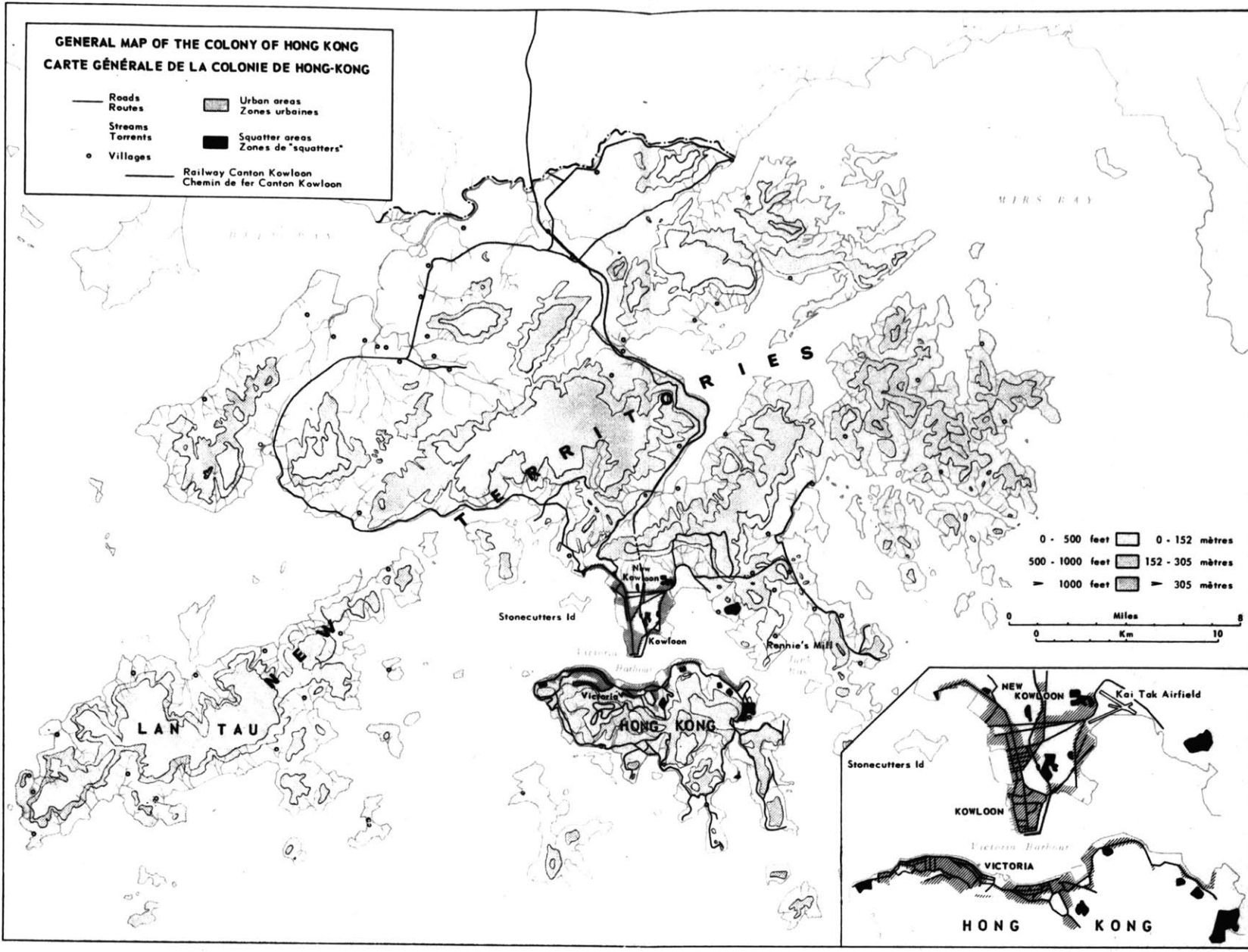


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**GENERAL MAP OF THE COLONY OF HONG KONG**  
**CARTE GÉNÉRALE DE LA COLONIE DE HONG-KONG**

- Roads  
Routes
- Streams  
Torrents
- Villages
- Urban areas  
Zones urbaines
- Squatter areas  
Zones de "squatters"
- Railway Canton Kowloon  
Chemin de fer Canton Kowloon



as one of the most perfect natural harbours in the world with commercial wharves and piers which can accommodate vessels up to 750 feet in length with maximum draught of 32 feet. 25 of the 52 Government maintained moorings which are for hire are specially designed to withstand typhoon conditions. 100 million cu. ft. of storage space is equipped for ordinary, refrigerated, and dangerous goods. Two local companies operate ferries between the twin cities and also to other island and districts in the New Territories. There are 11 cross-harbour ferry services, including one passenger-cum-vehicle service.

There are about 505 miles of road in Hong Kong, 190 of which are in Hong Kong Island, 130 in Kowloon, and 185 in the New Territories.<sup>2</sup> Most of the roads are asphalt concrete surfaced. At the end of 1959 there were more than 40,000 vehicles registered in the colony.<sup>3</sup>

The high standards of the shipbuilding and repairing industry has often attracted ships as far away as Australia for repairs or refitting. The annual new building capacity is 80,000 gross tons.

### Entrepôt Trade

Prior to World War II the economy of Hong Kong was based primarily on its being a great entrepôt for trade between China and the rest of the world and was involved in the sorting and warehousing of imports or exports both to and from China. Over 40

per cent of Hong Kong's trade in 1938 was with China. By 1950 the post-war business boom had caused the foreign trade in Hong Kong to reach a new record. At that time, trade with China still amounted to about 30 per cent of the total foreign trade. However, due to the international embargo on trade with Communist China during the Korean War, the entrepôt trade with China deminished, so that by 1958 exports to China was less than 5 per cent of total exports.<sup>4</sup> The disappearance of the entrepôt trade is also due to changes in the commercial policies of Communist China in its preference for direct dealings with foreign governments, by-passing the entrepôt functions of Hong Kong.

Consequently, Hong Kong adapted its facilities to trade between many other parts of the world, and more significantly, the economy of Hong Kong changed from an emphasis on entrepôt trade to that of manufacturing industries.

#### The Refugee and New Industry

The refugees, the crux of Hong Kong's most critical social problem, have at the same time contributed much with their capital, industrial know-how, skill and labor in extricating Hong Kong from the very dangerous economic position when the entrepôt trade with China declined. With few natural resources and hardly any raw materials, Hong Kong now has a wide range of manufacturing industries which employ more than one-third of its workers and pro-

vided exports to the value of 142.6 million pounds (about 400 million dollars U.S.) in 1959 which was equal to 70 per cent of total exports.<sup>5</sup>

### Hong Kong Today

Good government along with good banking and insurance facilities promoted the economic and social development of Hong Kong, making it into the great trade center which it is today. Every year since 1946 the budget of the Hong Kong Government has been balanced, and surplus balances have been accumulated despite the fact that most capital expenditure is met from revenue.

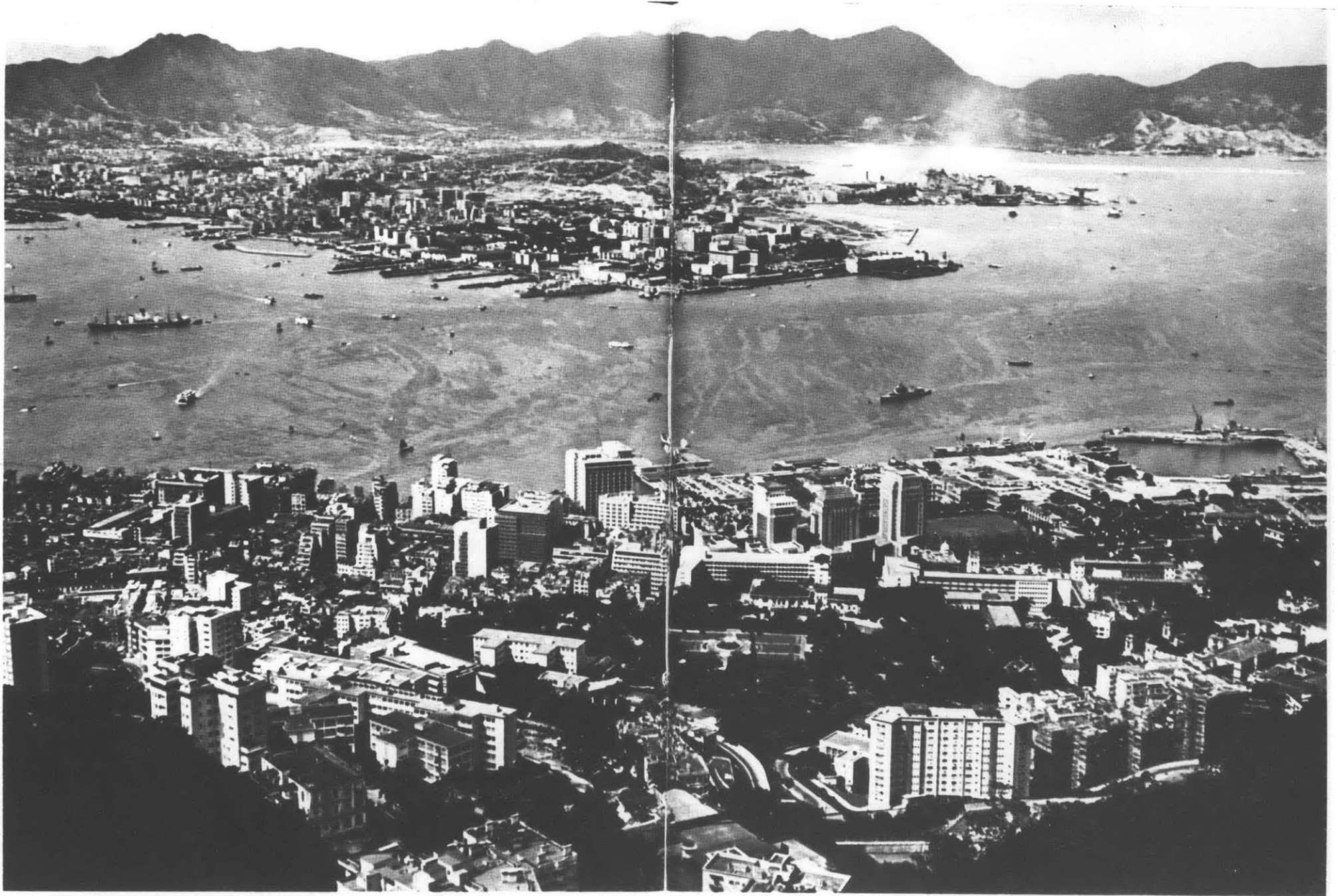
The following statistics reveal the scale of transactions in Hong Kong.<sup>6</sup> In 1959 alone:

1. Total value of Hong Kong's export and import was over 514 million pounds sterling. (1,439.2 million dollars U.S.).
2. More than 9,100 ocean going ships, with a net registered tonnage of 28.2 million tons, entered the port of Victoria.
3. The port handled 7.1 million tons of cargo.
4. 1.1 million passengers were embarked or disembarked.
5. 303,063 passengers were set down or picked up at the airport.
6. The Cross Harbor ferries transported more than 131.5 million people and 1.5 million vehicles.





View of Hong Kong looking east toward North Point



View of Hong Kong and Kowloon

## C. POPULATION

### Ethnic Composition

As of 1954, 98.7 per cent of the population of Hong Kong is Chinese. Of these, only 9.2 per cent consider Hong Kong their "native place", while 74.9 per cent are from Kwangtung Province (Cantonese), 6 per cent are from other provinces of South China, and 9.9 per cent are from other parts of China, including a small number of natives of Macao, Singapore, etc.<sup>7</sup>

The non-Chinese population include 18,700 residents of European origin (not including members of the arm forces and their dependents), and 11,300 of other Asians and people of mixed extractions.<sup>8</sup>

Since the establishment of the Communist regime in China the urban areas of Hong Kong contain large numbers of arrivals from Shanghai and neighbouring areas. A wide variety of Chinese dialects are used in Hong Kong, but Cantonese is by far the most commonly used; one might indeed consider it the "lingua franca". Being a British colony, English is of course used, especially in matters dealing with government and external relations.

### Population Growth

Hong Kong has always been declared a free port. This and other advantages attracted large numbers of both Chinese and Eu-

ropean traders. The population of Hong Kong increased with its importance as a port in the Far East trade. At the first census in 1841, the population was estimated at 5,650. It had reached 19,000 by 1844 and 72,000 by 1855.<sup>9</sup> This jump in population was due to the great influx of immigrants from neighbouring Kwangtung Province and the flow of refugees during the Taiping Rebellion on the Chinese mainland in 1850. Chinese immigrants were free to enter Hong Kong at will until 1950.

From 1881 to 1931 the decennial rate of population increase was constantly between 30 and 40 per cent, but a phenomenal increase occurred during the decade 1931-1941 when Hong Kong increased its population by 800,000 people, which is equal to a 95.2 per cent increase, and can be attributed to the large influx of immigrants from China at the outbreak of the Sino-Japanese hostilities of 1931-1933. The figure of nearly 1,640,000 was recorded at the count made in 1941 for air-raid precaution purposes.<sup>10</sup>

#### D. HISTORICAL NOTES

##### The Opium War

The deterioration of relations between China and England was, to a great extent, due to the failure of the British in their negotiations to obtain from the Chinese the complete removal of restrictions in their trade with China, to the exclusive advantage of the British. This, coupled with the British importation of opium from India to

China, which the Chinese Government was most anxious to suppress, finally resulted in the hostilities between England and China from 1839-1841, commonly known as the Opium War.

#### Possession by Britain

The British occupied Hong Kong on January 26, 1841. The war was officially ended with the Treaty of Nanking, signed on August 29, 1842, by which the island of Hong Kong was ceded to Britain in perpetuity. However, the British were not satisfied, and at the end of the second Anglo-Chinese War in 1860 there was the Convention of Peking in which the Kowloon peninsula and Stonecutters Island was also ceded to Britain. China and Britain continued their occasional hostilities, and the New Territories which includes part of the mainland section north of Kowloon plus 235 neighboring islands became leased to Britain for 99 years on July 1, 1898.

#### The Japanese Occupation

Japanese forces defeated the British along with the Americans and the Dutch in Southeast Asia during the early phases of the second world war. Along with Hong Kong, the colonial powers lost Malaya, the Philippines, and the Dutch East Indies (now Indonesia). Hong Kong was under Japanese occupation from December 25, 1941 to August 30, 1945. During this period the shortage of food and the many other disadvantages of the occupation caused great numbers of Chinese to leave Hong Kong so that by 1945 the population was less than 600,000.

## II. TECHNICAL AND PROGRAMATIC CONSIDERATIONS

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### A. CLIMATE<sup>11</sup>

#### The Monsoon

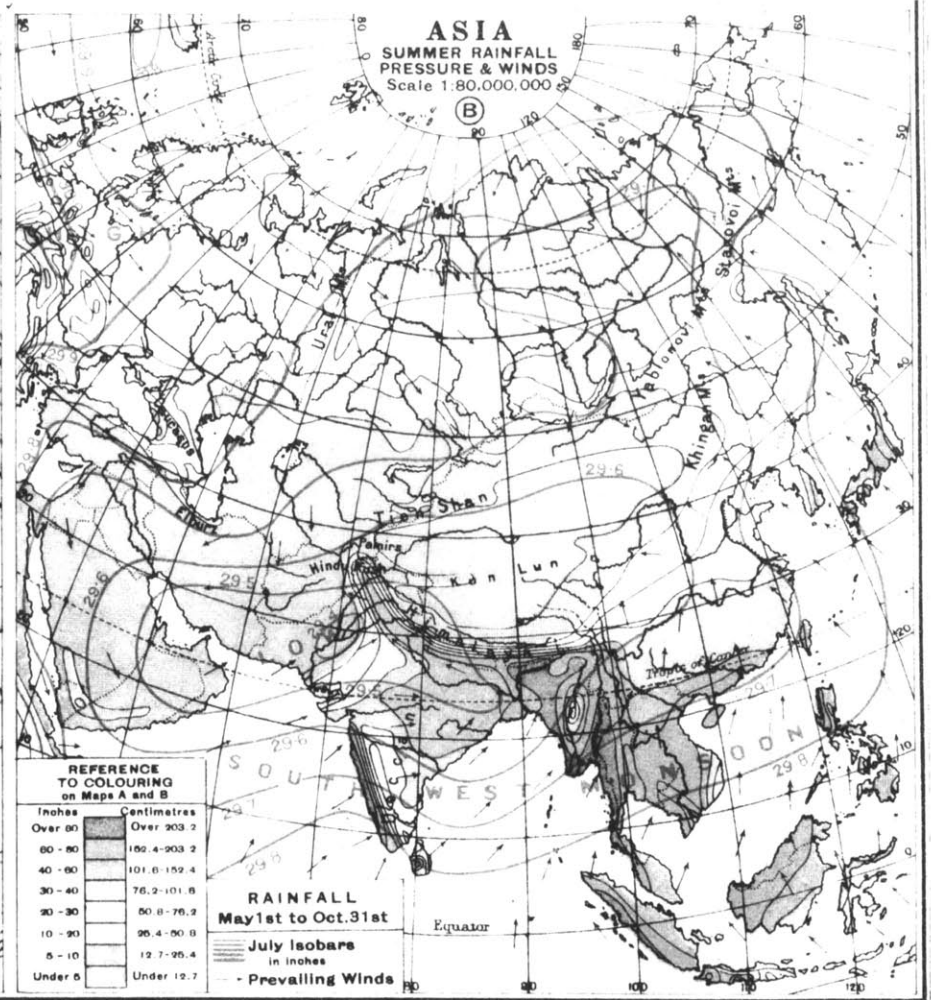
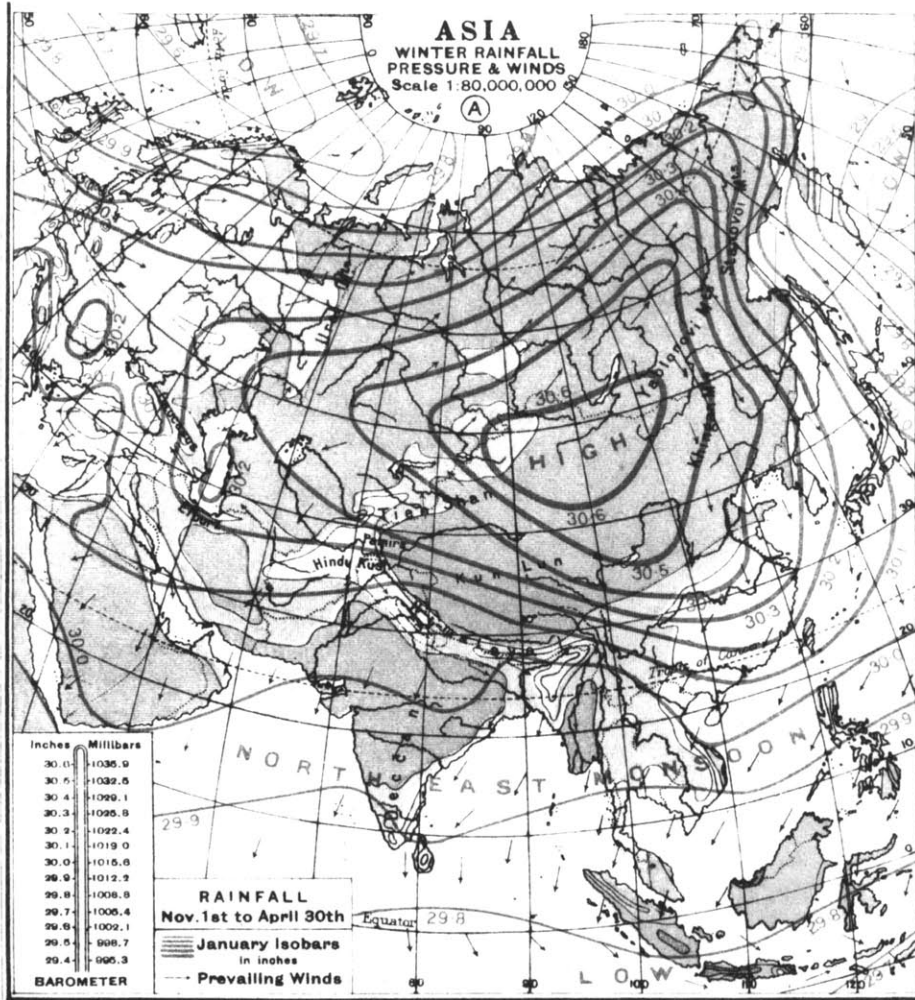
Although Hong Kong lies within the tropics, it enjoys a range of weather unusual for tropical regions. This is due largely to the monsoonal type of climate. The fact that Hong Kong is on the south-eastern side of the great Asian land mass causes it to be influenced by the high pressure in the winter and low pressure in the summer on the continent. Thus, the summers are generally hot and wet while the winters are cool and dry. The winter or north-east monsoon generally sets in during October and persists with occasional breaks until April. The south-west monsoon lasts from June to August (see maps showing isobars in January and July).

#### Rainfall

Fifty per cent of the annual average rainfall of 2152.8 mm (about 84.6 inches) occur during June, July, and August, while 90 per cent of it occur during the 7 month period between April to October (south-west monsoon).

#### Temperature

Monthly means, maximum and minimum temperatures are shown on Fig. II. Only once (1893) is there a recorded minimum



of 32 F., and only in five years between 1884 and 1950 did the temperature fall below 40. The mean minimum temperature for January is 56,1 F. Midday maxima during the summer months are often above 90, although the highest recorded temperature is 97 on August 19, 1900. Temperature variations within the day is usually no more than 10 degrees, and this holds true for all seasons.

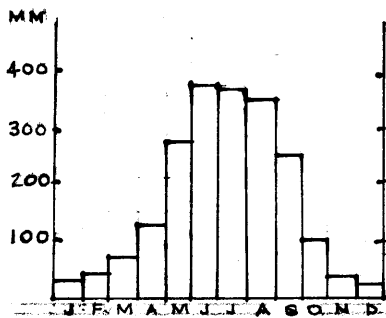


Fig. I  
Monthly Average Rainfall  
60 years

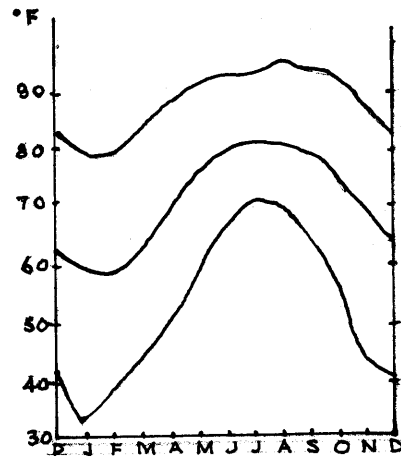


Fig. II  
Mean Monthly Temperature  
60 years

Humidity

From April to August the average monthly humidity of Hong Kong stays above 80 per cent. April has the highest mean percentage of 85, while the minimum mean of 69 per cent occurs in November.

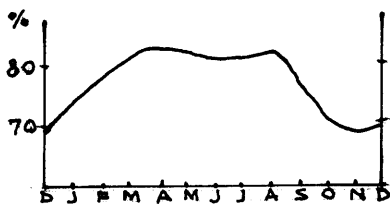


Fig. III  
Average Monthly Relative Humidity  
60 years



Fig. IV  
Average Monthly Sunshine  
60 years



### Sunshine

As the chart on the previous page shows, the sunniest months are from July to October, with July and October as peak months. March and April have the least bright sunshine and are the cloudiest months.

### Wind

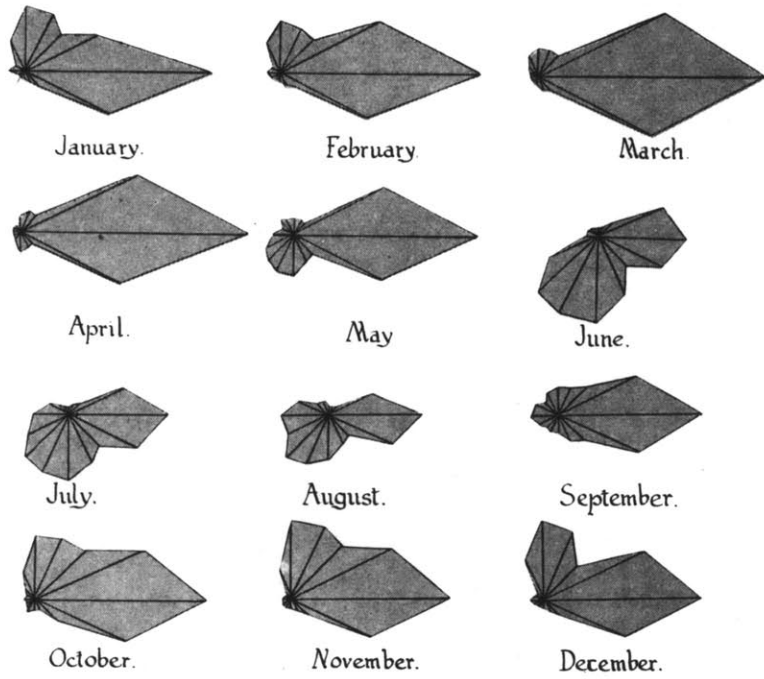
The prevalent wind direction for Hong Kong is from the east. However, during the summer months of June, July, and August, the wind from the south and south-west directions increases appreciably. In fact, in June, the wind from the south is the predominant one (see chart of monthly wind roses). During November, December, and January, when the Asian high pressure is dominant, some colder northerly winds are received.

Being just within the track of the typhoons of the South China Sea, Hong Kong often experiences spells of bad weather with strong winds and heavy rains. Passage of gales are likely from July to September.

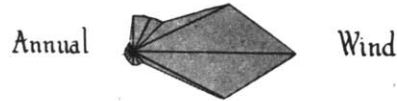
## B. THE SITE

### Description

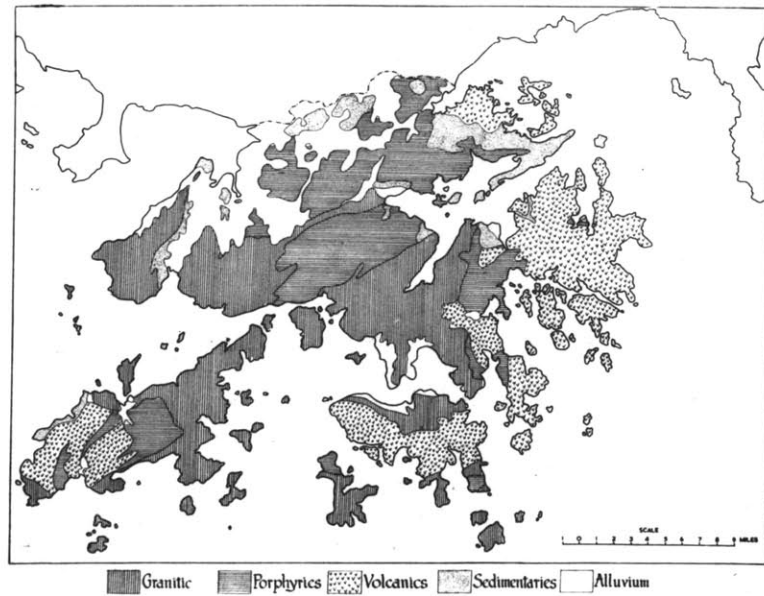
The site for the proposed project is in the North Point area on the north eastern slope of Hong Kong Island, less than 4 miles east of the down town area. It includes approximately 11 acres of steep land which rises from 200 feet to 450 feet above sea level



Statistics from Peacock's Hong Kong Meteorological Records, 60 Years.



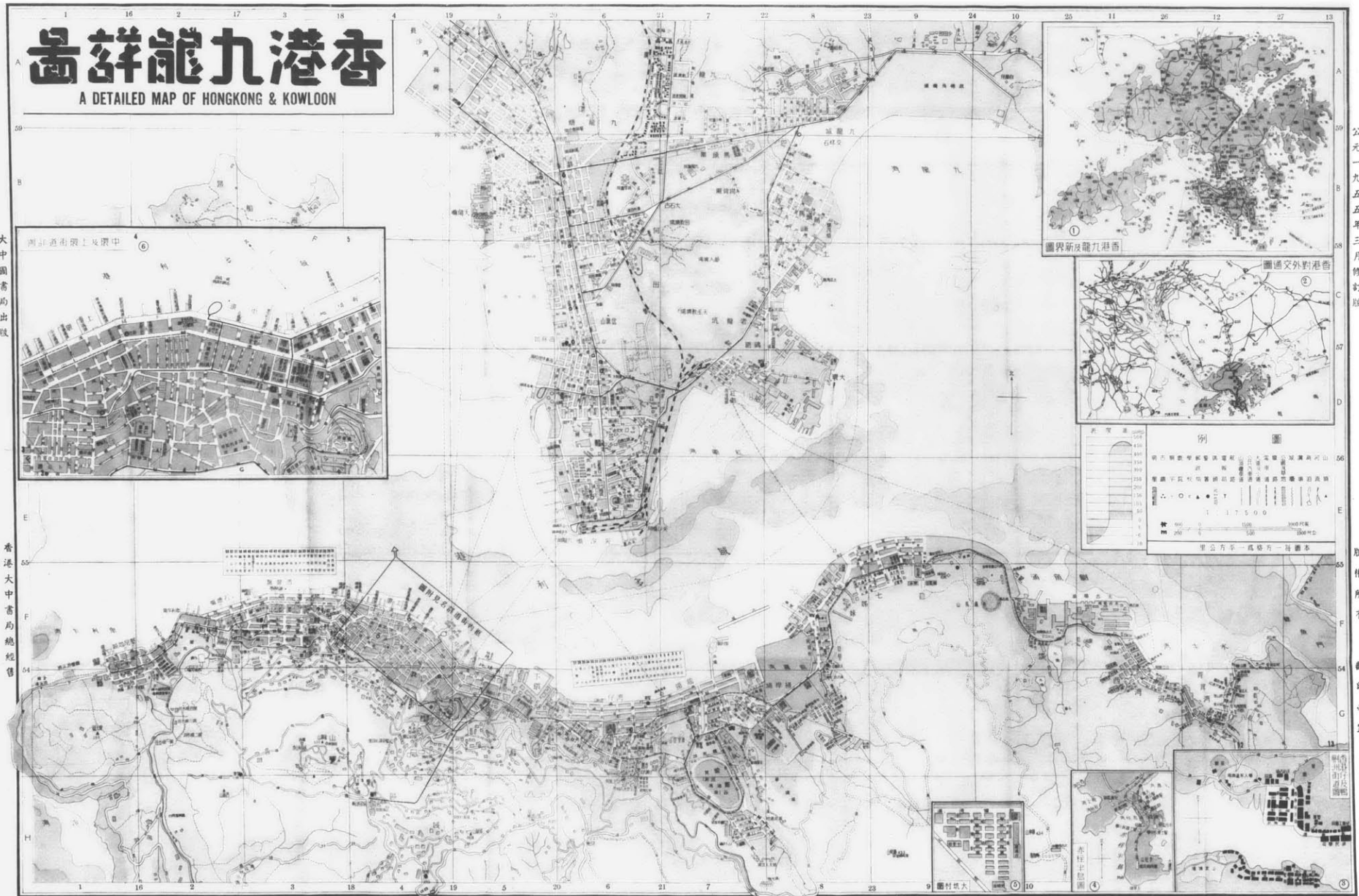
Monthly wind roses of Hong Kong



Simplified geological map of Hong Kong and the New Territories

# 香港九龍詳圖

A DETAILED MAP OF HONGKONG & KOWLOON



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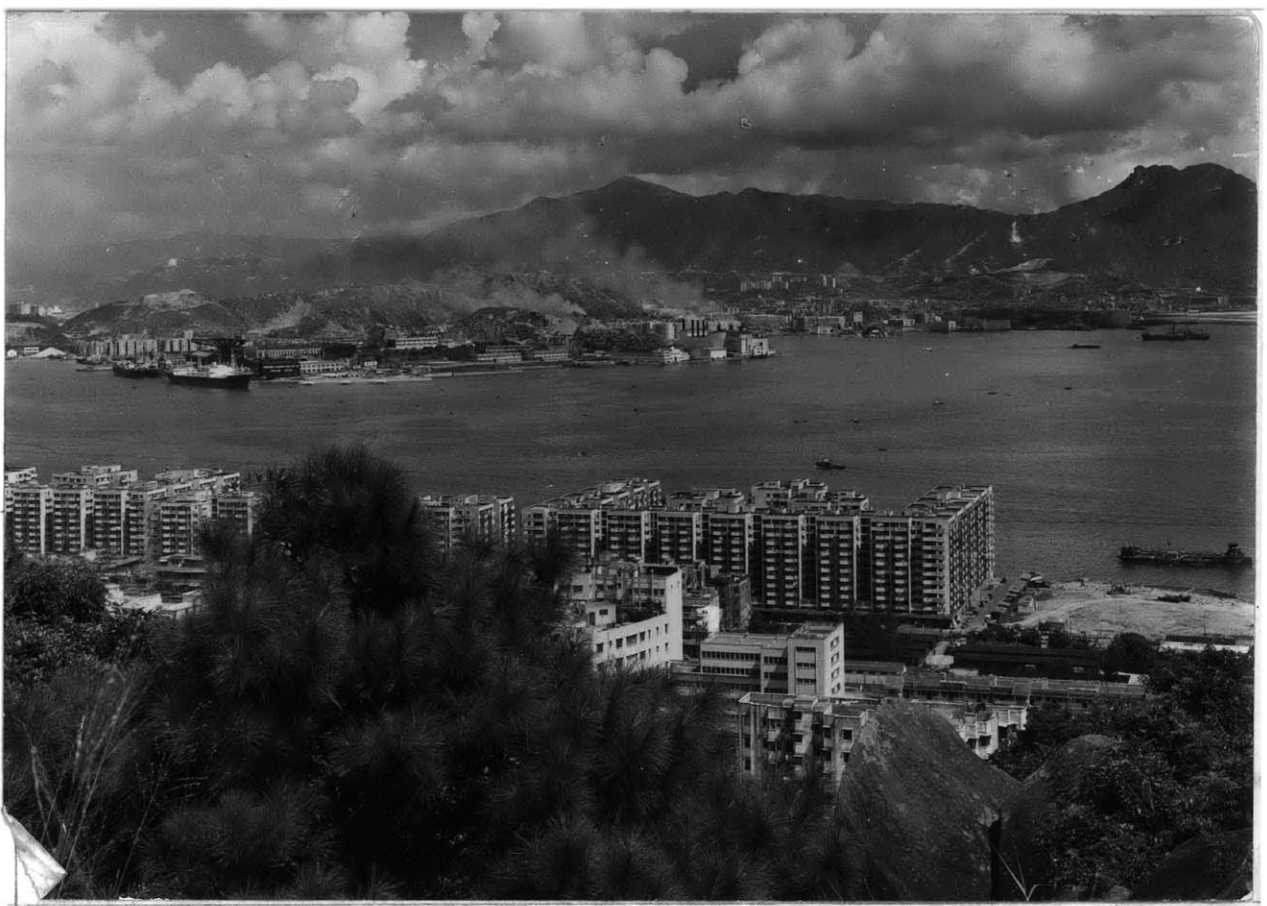
### Access

King's Road, one of the main thoroughfares on the Island, is less than 100 yards from the site at the closest point, and is therefore the primary existing access to it. The Government authorities are proposing the extension of Tin Hau Temple Road which will pass through the site at about 400 feet above sea level and is to join King's Road at the bottom of the hill (see site plan).

### Boundary Determination

The size and boundaries decided upon for the site were determined on one hand by physical considerations: topography, orientation, existing structures and pattern; and on the other hand by programmatic considerations: number and type of people to be accommodated, community facilities to be provided, density and area requirements which will be discussed in greater detail in the section devoted to the determination of density for the project.

It became apparent that the housing should start from a safe distance from the reservoir on the hill top both to keep the integrity of the reservoir and for architectural reasons, as it is desirable, when building on a steep hill, to either maintain the original definition of the hill, recognizing it by clearly exposing the summit, or to emphasize it by building up the slope and crowning the top with a tall or impressive mass as in the case of Mont St. Michel. The position of the reservoir precludes the latter treatment. The existing



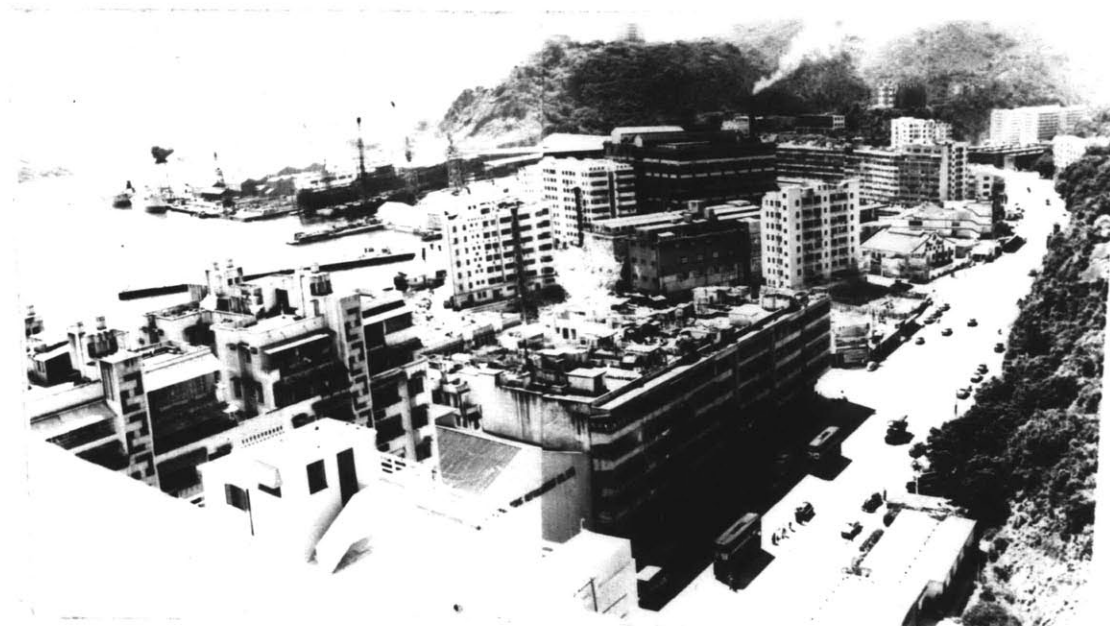
Cross harbour view of Kowloon from the site

View of site from the sea





View of area from Tin Chiu Street to northern tip of site



View of King's Road from the eastern side of the site



Downhill view from the northern edge of the site



structures along the base of the hill and on the west side of the site also present themselves as boundaries. The site, however, has an open south-eastern front which can conceivably be extended along a line parallel to King's Road. Here the existing topography of the hill becomes the determining element. A concavity or recession which marks a break in the hill exists approximately along the boundary line of Planning District No. 8, and it is expected that this will be a major channel in the drainage of rainfall. Thus it is taken as a natural and logical boundary.

### The Soil

The soil is granitic (see accompanying geological map), and is suitable to build on as indicated by the fact that the Hong Kong Town Planning Board has designated the site for possible future housing.

## C. DENSITY

### Density Measurements

At the outset, it deserves reminding that one should be cautious when dealing with density figures, as it is all too easy to appear arbitrary and dogmatic over a measurement, the significance of which depends on many variables, some of which are directly measurable (e.g. hours of sunlight, volume of air, etc. ), and others not (e.g. comfort and psychological well being). Here, also, we encounter the added complication of the time element as it is intended that this

housing project is to be designed so as to meet varying density demands as time progresses. The increment and rate of change, however, is highly speculative, depending on the stability, or the lack of it, of the political and social developments underfoot in Hong Kong and the rest of the world.

While density considerations necessarily play an important part in influencing the direction of design in a refugee housing project such as this, it must be noted, however, that a "feed back" condition exists here, as the resultant solution calls for the reconsideration of the measurements of density originally used. Indeed, it is not uncommon for feed back conditions to exist between a design solution and its program as a whole, as large parts of it is altered when the solution clarifies or modifies the original needs.

Thus the application to this project of the terms:"gross density" and "net density" needs commenting on. "Gross density" being the ratio of people to land area including roads and other public spaces and facilities, while "net density" is a ratio of people to the land area occupied by the housing structure and immediate gardens and paths only. Since in this project the road, school, and other community facilities are designed as an integral part into the housing complex (see section on site organization and configuration) the difference which these two terms imply diminishes.

Since density is expressed as a ratio of number of people to unit land area, in cases when the numerator is high compared to the

total area considered, the often small difference in the denominator (which differentiates gross from net density) will not change the value of the ratio by much. Such is the case with this project. It can easily be seen that the smaller the total area under consideration is, the closer gross density approaches net density, especially when the gross density is high to start with. Thus "gross density" will be considered as the more meaningful term in this project, as the net density is misleading in this case.

#### Occupancy Standards

Many minimum housing occupancy standards have been proposed by different authorities for different parts of the world. The density of the flats built by the Hong Kong Housing Authority in the past five or six years varies from more than 1,000 persons per acre to almost 1,900 persons per acre. Table I shows the scope and densities of three recent projects.<sup>12</sup>

	Cadogan Street	So Uk	North Point
Total Area	3.7 Acres	18.79 Acres	6.5 Acres
Number of Flats	636	4,600	1,955
Number of people	4,000	30,000	12,000
Persons/Acre	1,080	1,450	1,845
Persons/Flat (Ave.)	6.3	6.2	6.1

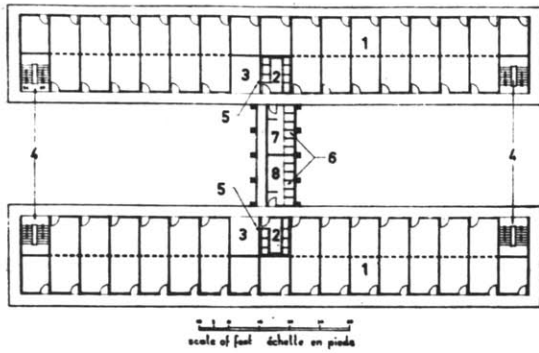
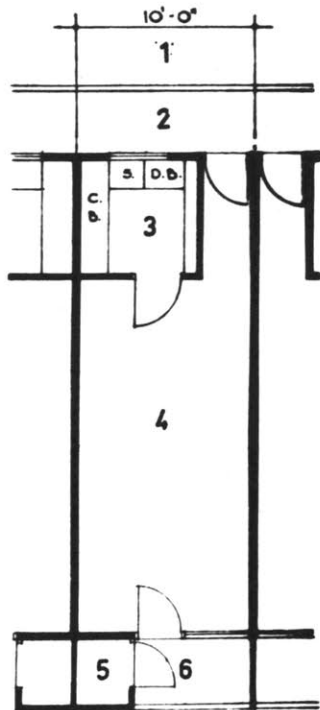


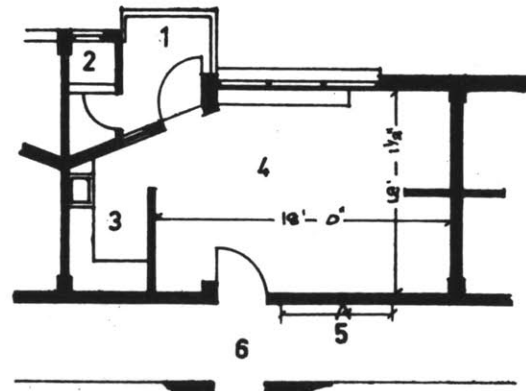
Fig. 6. 1. Partition variable = cloison variable.  
2. Bath = bain.  
3. Washing area = buanderie.  
4. Stairs = escaliers.  
5. Standpipe (mains water) = prise d'eau.  
6. Flush latrines = W.C.  
7. Females = femmes.  
8. Males = hommes.

Hong Kong Resettlement Department (1958). Seven storey tenements; typical floor plan. The occupants of the 62 rooms share 2 water standpipes, 2 bathing spaces and 12 flush latrines. Floor area 9.6 m<sup>2</sup>.

Hongkong Resettlement Department (1958). Logements à sept étages; plan type. Les occupants des 62 pièces partagent 2 prises d'eau, 2 salles de bain et 12 W.C.'s. Surface habitable par pièce 9.6 m<sup>2</sup>.



200 sq. ft. Bay converted into a self-contained flat  
Surface de 240 pieds carrés entre deux murs qui a été réarrangée comme un appartement indépendant



**6-family unit**  
**unité pour famille à six personnes**

Fig. 7. 1. balcony = balcon.  
2. Flush latrines = W.C.  
3. Kitchen = cuisine.  
4. Living area = salle de séjour.  
5. Windows over = fenêtres en dessus.  
6. Corridor = corridor.

Hong Kong Housing Society (1952). One room self-contained flat for a 6 person family at Shamshuipo. Floor area, 26 m<sup>2</sup>.

Hongkong Housing Society (1952). Appartement indépendant à une pièce pour une famille à six personnes à Shampshuipo. Surface habitable 26 m<sup>2</sup>.

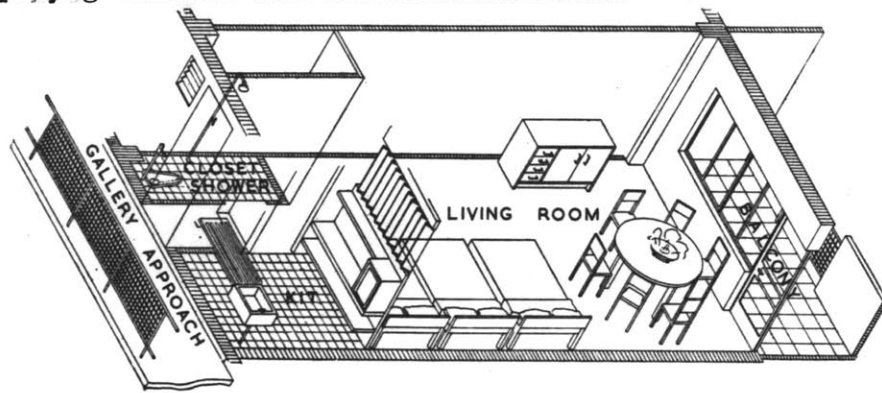
Fig. 8. 1. Unit width = largeur d'unité.  
2. access balcony = balcon d'entrée.  
3. Kitchen = cuisine.  
4. Living accomodation = salle de séjour.  
5. W.C. = W.C. shower = douche.  
6. Private balcony = balcon privé.

Hong Kong Resettlement Department (1958). Conversion of two tenement rooms into a one room self-contained flat. Floor area, about 20 - 25 m<sup>2</sup>.

Hongkong Resettlement Department (1958). Réarrangement de deux pièces d'habitation en un appartement indépendant à une pièce. Surface habitable de 20 - 25 m<sup>2</sup> environ.

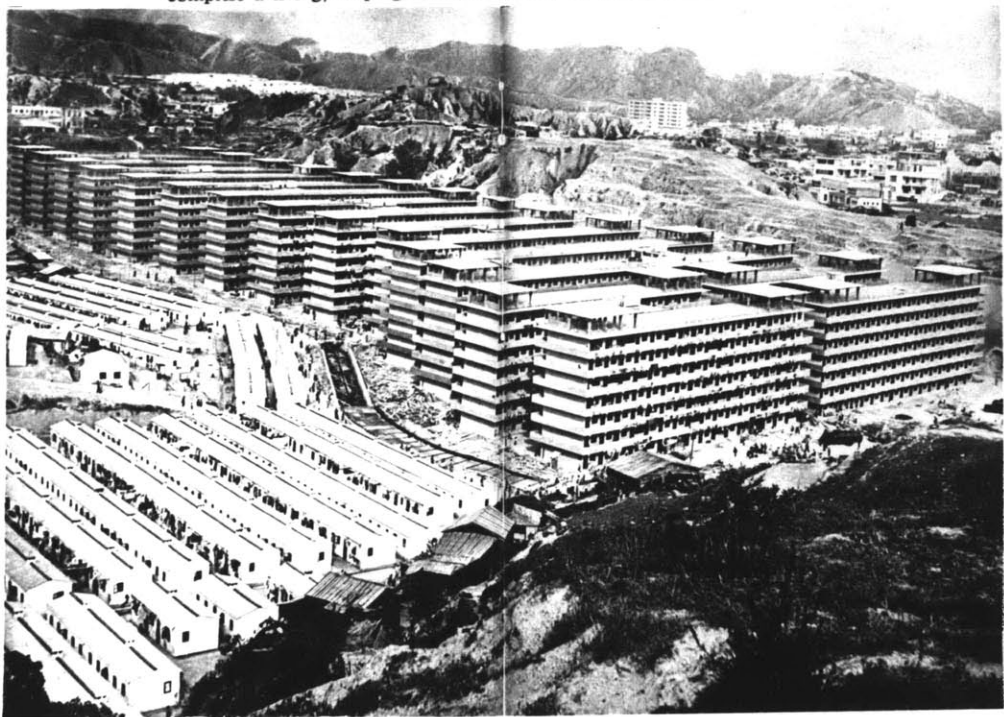


A play ground in the North Point Estate



Isometric Drawing: The accommodation provided in this project will comprise a living/sleeping room, a kitchen, a bathroom and a verandah.

Tai Hang  
Tung Re-  
settlement  
Estate



Tai Hang Tung Re-settlement Estate, completed in 1975, cost HK\$800,000,000 and housing 24,000 people, covers a hilly area of Hong Kong's programme of providing homes for squatters and refugees. The whole programme ranks among the largest and most quickly implemented post-war housing schemes in the world.

The community facilities usually provided in the Hong Kong Housing Authority Projects include an estate office, 18 classroom schools, play grounds, medical clinic, post office, and shops.

The average area per person net (excluding bath rooms and corridors) in these projects is less than 40 sq.ft., while the legal minimum for Hong Kong is 35 sq. ft..

In my project 50 sq. ft. per person is taken to be a reasonable preliminary design objective. It is much easier to set occupancy standards through square footage per person requirements than it is to set site standards through density requirements. However, for the purpose of commencing with the design, a general order of magnitude was established. A density of less than 1,000 people per acre when applied to the 11 acre project site would result in a community of more than 10,000 people. Keeping in mind the projects done by the Hong Kong Housing Authority, this seemed to be a suitable figure to start on, subject to later revaluations (and "feed-back" processes as mentioned above).

Both the size and quality of housing to be provided are influenced by concepts of minimum living standards based on local social-economic criteria and the more technical (and more easily measurable) hygienic and housing standards. A more detailed discussion of these factors will be included in the concluding parts of this report.

## D. PROGRAM SUMMARY

The following is a summary tabulation of the given conditions and requirements adopted for this project. The kind and size of facilities included are based on those currently used in comparable projects done by the Hong Kong Housing Authority.

11.5 acres

10,000 people

2,000 flats

1 school -- 18 class rooms

1 auditorium -- 500 seats

1 clinic -- 10,000 sq. ft. (min.)

1 community and welfare center

1 estate office

2 bus terminals

870 people per acre

5 persons per flat average

11 persons per flat maximum

50 sq. ft. per person average (excluding kitchen and w.c.)

### III. OBJECTIVES SUGGESTED BY GIVEN CONDITIONS AND NEEDS

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#### A. SITE ORGANIZATION AND CONFIGURATION

##### Placement of Major Access

In the design of a high density housing project a steep site provides advantages which a flat site does not. A steep site allows the buildings to be placed closer together up the slope with less interference of view, light and air. It lessens the general sense of confinement which would otherwise be imposed by a flatter site.

It seemed logical that on a site with more than 250 feet difference in height between the lowest and highest points, to place at least one of the major access roads at an in-between height so as to minimize both the vertical and horizontal distance of travel from this access road to units either above or below it. Thus this road is to serve as a unifying element rather than as a dividing one. Another alternative would be to have two roads, one to run along the top contour while the other along the bottom contour. This seemed to be an uneconomical solution, not only in terms of the cost of building two roads instead of one, but also in principle and concept of execution, since each of these two roads would serve only in one direction as compared to the one-mid-height road which could serve areas both above and below it. Yet another alternative would be to have two in-



intermediate level roads, each serving areas above and below it. This was considered inferior to the one intermediate level road as it would cut up the comparatively small site into rows of narrow linear strips of tall buildings (necessary to meet the density objective of 1,000 people per acre).

### Central Distribution

The magnitude of the site's height differential demands at least supplementary mechanical means of vertical access. If the vertical circulation system for the site were to be located at or near the mid-level road, an efficient central distribution system for both vertical and horizontal access would exist. This distribution system or structure should be architecturally significant as a connector and joining element of the different sections and levels throughout the whole complex.

### Collection and Concentration of Open Spaces

A well proven principle especially for high density housing is that of the conservation and collection of open spaces into concentrated and meaningful public spaces. The less available the open spaces, the more important this principle becomes. The concept of increasing the usefulness of assets through its conservation and concentration is obvious in many fields, but it seemed to have often escaped architecture as one observes the uneconomic use of land when buildings are indiscriminately dispersed at equal, monotonous, and mea-

ningless intervals throughout the landscape.

### The Wall

The concentration of open spaces necessarily imply the collection of the housing structures, either into concentrated clusters or into a more linear form around the periphery of the open spaces and thereby defining them. The advantages and logic of row-housing can be extended to larger, wall-like structures. Among the more obvious advantages of the long continuous structure over the cluster of many smaller buildings are those of less exposed exterior surfaces, more common walls, and often a greater and more effective use of modular systems. The resulting economy both in cost and space is highly desirable in this type of project. However, an equally obvious problem exists, that of design execution : to organize the resulting vast surfaces into visually more manageable groups, thus achieving a scale hierarchy.

The walls also tend to unify the entire complex and minimize anarchical distinctions which would be chaotic when within tight confines. The long wall sections allow the many living units contained in them to have maximum variety of size and composition and afford a high degree of flexibility to meet the uncertain needs of the future (see section on political stability and housing design).

One also cannot dismiss the possible psychological element of security provided by the walls which enclose and protect the communi-

ty core, while at the same time affords a sharp and defined view of the world outside. The social stigma and many other related problems of living in a high rise, low cost housing project amidst single family houses such as in some American cities, are minimized in Hong Kong, since most housing in Hong Kong is of the high density type, and comparatively few people live in single family houses

#### B. SCOPE AND EXTENT OF SOLUTION

A high density housing project, such as the one under consideration, being rich in its social implications, cannot be treated merely as a site planning problem. Indeed, in order to achieve any degree of effectiveness, the unit, down to the nature and placement of furniture within it, must be considered and designed.

Material status symbols often appear as paramount among the poor as well as the equally social-conscious people with newly acquired wealth. This consciousness takes on a different emphasis in different countries; however, the predilection for size and quantity of furniture, regardless of space considerations seems to be a very common symptom. Thus it becomes imperative to consider carefully the furniture in each unit type, if the solution is to be of usefulness at all.

#### C. SOCIAL AND POLITICAL CONSIDERATIONS

##### Nature of the Refugee Influx

The rate of influx of refugees from China is not constant. The

future of the refugee problem will to a great extent depend on the situation both on the mainland of China and on the Republic of China on Formosa. From 1945 to 1954, the annual percentage of refugees unwilling to return immediately from Hong Kong to the mainland of China varies from 96.6 per cent to 100 per cent. Approximately half of these people surveyed by the United Nations Mission gave political reasons for their unwillingness to return.<sup>13</sup> The other reasons given were economic and family reasons. Of the Hong Kong population surveyed in 1954, 57 per cent were willing to be resettled in Taiwan (Formosa). The willingness to go to Taiwan due to political reasons accounted for 17.5 per cent.<sup>14</sup> Small percentages of the population were willing to emigrate to other parts of the world. Of the heads of household surveyed, 15 per cent actually attempted to leave Hong Kong, 13.8 per cent of these wanted to go to Taiwan.<sup>15</sup>

Even if the refugee situation were a constant one, it would still be undesirable to make emergency facilities unadaptable to possible changes. Once a building is built, it tends to be a permanent part of the landscape, even if it was originally intended to be temporary. Thus this project demands a flexible unit design and structure system so as to meet varying demands in times of greater prosperity or lesser degrees of housing shortage.

#### Political Stability and Housing Design

The political stability of Hong Kong itself is debatable. Two of the more likely possibilities are that of remaining under British rule,

or the repossession by China under the mainland regime. If the later should evolve, it would be highly speculative for one to design buildings to be adaptable to the housing needs and patterns under the new order, as the development of that new order in mainland China itself is in a state of flux. Thus one may, without too much difficulty, justify the assumption of the continuence of the present regime in Hong Kong, at least for the purposes of this project.

#### D. STRUCTURE AND MODULE

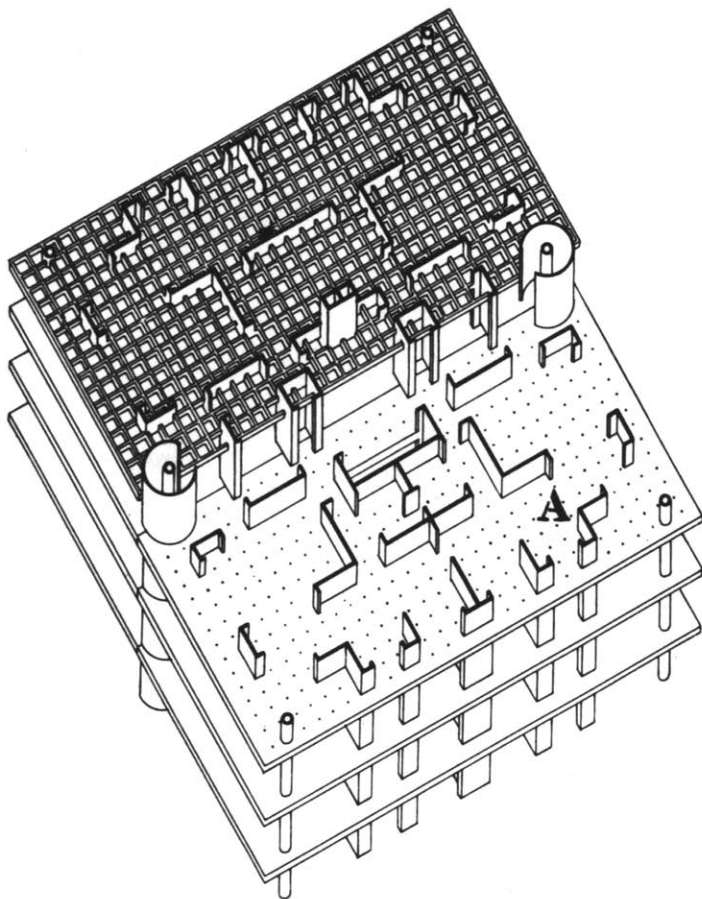
##### Capitalization of the Small Span

In projects with a high occupancy rate, it is to be expected that there will be comparatively many more partition walls, and at smaller intervals. One could capitalize on this situation if the vertical load bearing elements were placed at the same interval as the partition walls, thereby cutting down the span. But it is not always economical to minimize the span. Although the beam size or the slab thickness decreases with the span, the number of vertical supports must necessarily increase. There is therefore an optimum balance for each situation.

However, if at least some of the partition walls, which must be there anyway, could be made to serve as load bearing elements at regular intervals as well, then one could conceivably realize the benefits of the inherent small span in this project.

In the Far East where labor costs are small compared to the

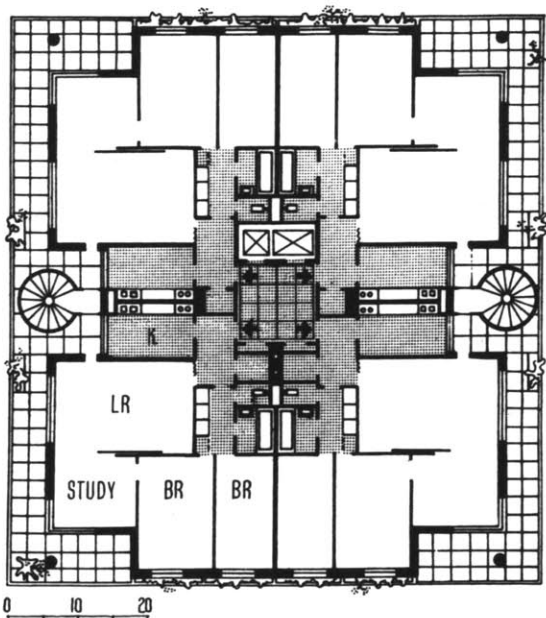
ARCHITECTS' DESIGN FOR ELEVATOR-TYPE APARTMENTS



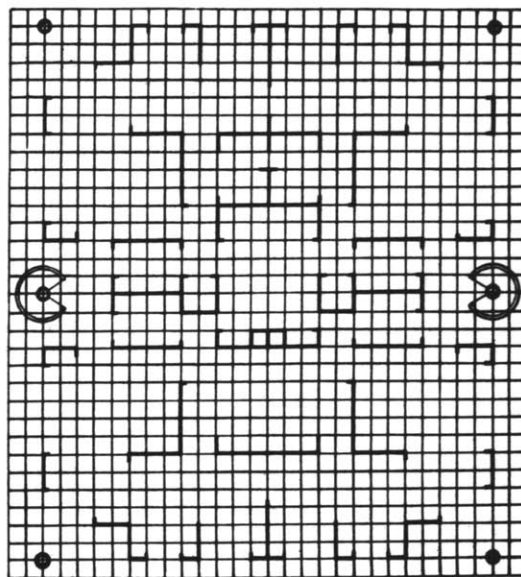
Upper floor in this structural sketch shows the two-way beam grid and how the load-bearing partitions lace through it. In the system as proposed for use in Europe, hollow core gypsum blocks fill in the spaces between the beams. These blocks may be left out to provide space for lighting fixtures. Ceilings are plastered and various types of flooring materials may be placed on top of the blocks. Partition

Elevator-type building designed with 12 floors. Four apartments on each floor are symmetrically arranged around the elevator lobby. The fire stairs are located outside the building itself, being accessible from terraces off the kitchens. There are four mechanical cores going through the building, ventilated by a central fan at the top

One module equals 2½ ft



Typical Floor Plan



Plan of Load-bearing Partitions Only

high costs of building materials, reinforced concrete have become a widely used building material, as is the case in some European countries.

The development of the flat slab in reinforced concrete represents the transition from linear column-girder construction into the three dimensional rigid frame. If the linear, one-dimensional column is replaced by the two-dimensional bearing partition wall, then the objectives of capitalizing on the small span discussed above approaches feasibility. This leads to the consideration of the relatively recent development of an economical structural system called "Cellular Construction".

### Cellular Construction

"Cellular Construction" makes use of broken shape load bearing partition walls together with tow-way ribbed floors. The following is a description of this system by Paul Weidlinger:<sup>16</sup>

Efficiency of building construction often is expressed on the basis of ratio of total dead load to utilizable live load-efficiency inversely with this ratio. The system of construction presented here, called "cellular"... is aimed at reducing ratio to a practical minimum.

Partitions by virtue of their shape, obtain maximum utilization of strength of materials, following somewhat the idea of light gage steel construction. The partitions are functional otherwise in that horizontal ribs used to stiffen the vertical sections can serve as shelves.

...The design of concrete wall sections to avoid over-all torsional and local buckling is no simple task. However,...these problems can be met today with advanced methods of engineering analysis, but would not have been practicable a short time ago.

In a six storied apartment in Budapest, the load bearing partitions were built 2 to 3 and 1/2 in. thick. Spans of floor grid varied, with 24 ft. as maximum.

Care has to be taken in design that the load-bearing partitions are placed in more or less equal "density". Due to the two-way floor grid it is not necessary that they line up. The amount of reinforcing necessary depends on how close partitions are spaced.

...Elimination of all columns means increased floor area. Reduced depth of floor construction means reduced building height. Lightness of structure means smaller footings. All these spell more economical construction.

One of the apartment houses designed with this "Cellular" system was 12 stories high, but excessive height would render this system impractical as the result of the necessary wall thickness.

#### Flexibility through Superimposition

The superimposition of a different rhythmic interval of the service core in plan on the structural system which has a specific regular interval of its own, results in a multiplicity of unit plan possibilities.

#### Natural Air Flow

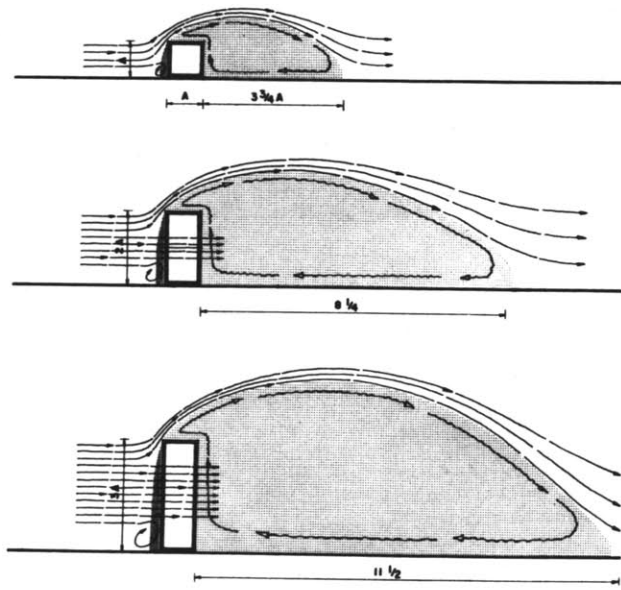
Because the winters in Hong Kong are not too cold, no heating is required (even in luxurious residences). This is why a single loaded corridor system is much more economical than usual, since the corridors neednot be enclosed and no heat loss will be involved any way. Breezes will be highly desirable in the hot summers while cold winter winds are to be avoided in the unheated buildings. Thus



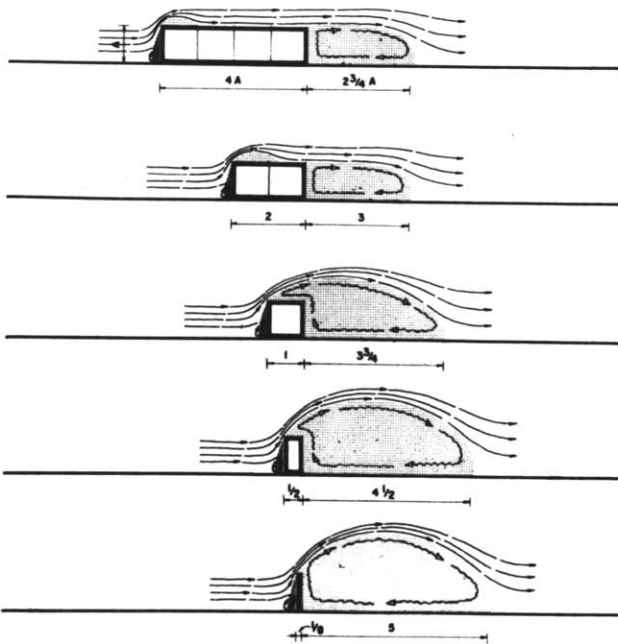
advantage should be taken of the affect of building shapes and orientation on the natural air flow around and through buildings. The accompanying diagram illustrate the principles involved.\*

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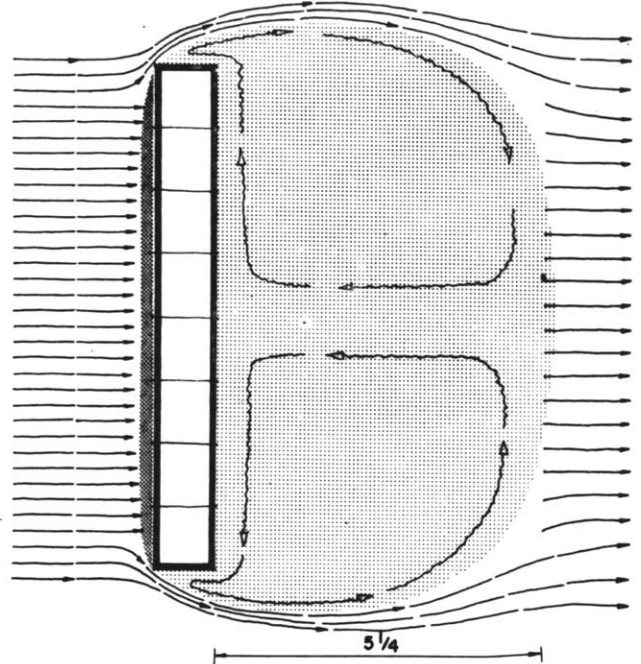
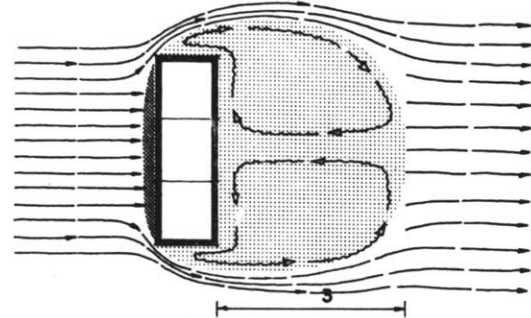
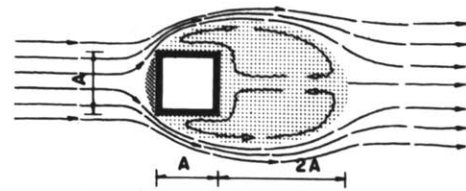
\* The diagrams are from item 10 in the bibliography. An attempt will be made to approximate the last three conditions of Test 24 by proper orientation of the buildings in relation to the prevailing winds (see monthly wind roses on p.26.)



Test 2.

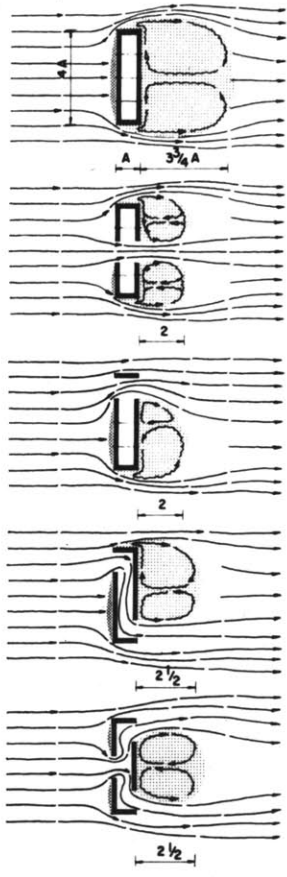


Test 8.

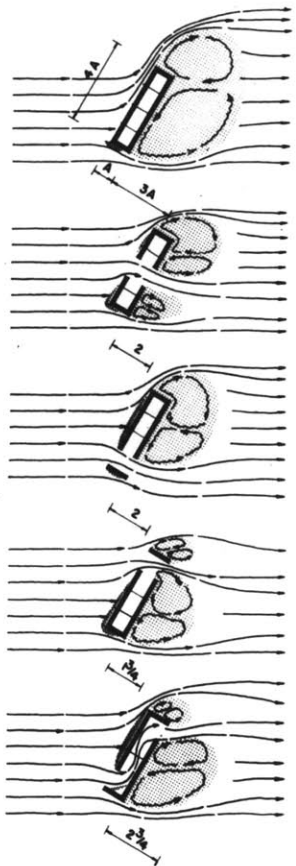


Test 9.

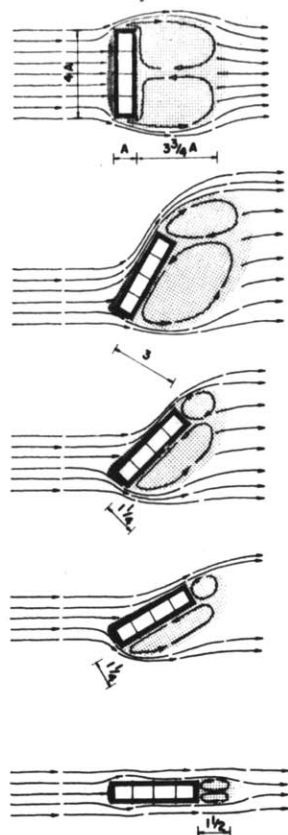
Test 9 concerns the effect of the length of a shape on the downwind eddy. As the length of the shape increases, the depth and height remaining constant, the length and depth of the eddy also increases. The test results shown in the first column of Figure G indicate that this relative increase continues until the length of the building reaches 28A and possibly farther. The space available in the wind tunnel limits the practicality of such measurements to a length of about twenty-eight units under these conditions. However, this appears to be a length beyond practical application for ordinary buildings, so that the general statement may be made that for all practical purposes the longer the building the deeper and longer will be the downwind eddy.



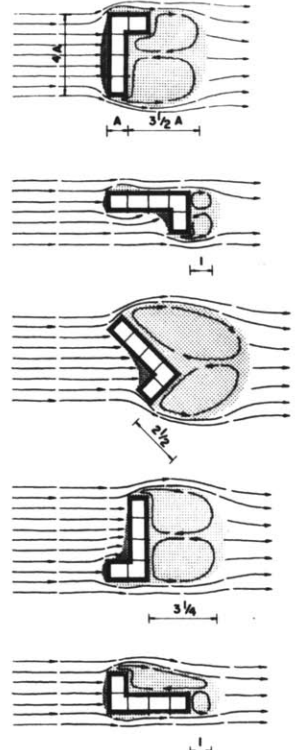
Test 19. Openings are from ceiling to floor.



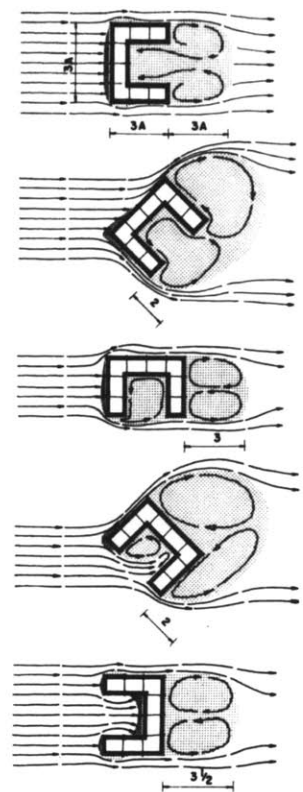
Test 20. Openings are from ceiling to floor, 30° breeze.



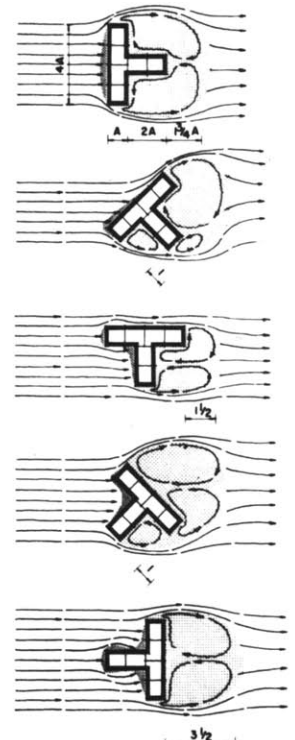
Test 24.



Test 25.



Test 26.



Test 27.

IV. CONCLUSION: REFLECTION AND  
REVALUATION OF PROBLEM

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A. STANDARDS OF LIVING AND SPACE REQUIREMENTS

Complexities Involved

It would be highly presumptuous for anyone to think that the problems of refugee housing or the problems of human settlements in general can be evaluated with a concise system of measurements. Any assessment of housing and settlement standards involves the assessment of the local standard of living. A demanding problem presents itself as one considers the kind of elements or components that should be included in concepts denoted by the expression "standard of living".<sup>17</sup> the elements usually included in most "standard of living" evaluations often may be divided into two general categories. One is that of the state or condition (objective or subjective) of the person, e.g. physical and mental health, the state of personal security and education. The other is that of non-personal facilities or means, e.g. available food, housing conditions, number of doctors and teachers, hospitals and schools. The evaluation of any of these elements are complicated by the problems of cultural and climatic relativity.

However, in order to have a workable means of attacking the  
18
 problem, more tangible indicators of a standard of living which takes into account both the available facilities or means, and the actual consumption of the resources, must be used.

Although it is necessary to be at least cognizant of the complexities involved in the consideration of living standards, this report is also so necessarily confined to the discussion of housing, which is one of the more easily measurable components which make up a "standard of living."

Area or volume per person, minimum dimensions (e.g. ceiling height), and types of facilities constitute the principal measurements of housing conditions, and most minimum standards of the various governments are based on the considerations of these basic items. Considerable variation exists in the proposed minimum floor areas, though a general consensus of opinion have come to the fore among some Asian countries relating to other aspects of low cost housing. It is generally agreed, for example, that "a minimum dwelling unit for an average size family of four to six persons should consist of two rooms, in addition to a kitchen and water closet." <sup>19</sup> Presumably more than one room is necessary for any degree of privacy.

#### Privacy and Internal Specialization

Standards of privacy, indeed, the concept of "privacy" itself varies according to culture, time, and conditions of need or urgency. In medieval times members of a workshop or a merchant's counting house lived as members of a family. They ate together at the same table, worked, and even slept in the same common hall. To quote Mumford:

Michelangelo, on occasion, slept with his workmen, ~~four~~ to a bed. As late as the seventeenth century, maidservants often slept in trundle beds (rolled under the big bed by day) at the foot of their master and mistress.

Mumford goes on to describe the medieval dwelling as being:

Characterized by a general absence of functionally differentiated space. In the cities, however, this lack of internal specialization was offset by a completer development of domestic functions in public institutions. Though the house might lack a private bake-oven, there was a public one... Though it might lack a private bathroom, there was a municipal bath-house...<sup>20</sup>

Thus we see that specially designated rooms such as "dining room", "bedroom", or the further distinction of the "pantry" from the "kitchen" resulted not only from an increased awareness of the need for privacy, but more significantly, from an increase of specialization as the various activities of life took on almost a ritualistic connotation.

Clearly, many of the space distinctions today are unnecessary for healthy living conditions, indeed the pattern is a changing one, as less "dining rooms" appear in new houses in favor of the "powder room" or the "family room" (ironically in a country where the family structure is less stable than in most other countries).

However, it would be difficult for one to try to alter certain assigned room functions (be they valid or invalid) of any specific locality once a special consciousness is acquired and a pattern is established. Only when the state of urgency and need demand it, can one resort to relatively more objective or "scientific" considerations of occupancy

standards and required household facilities. The urgency and need as presented in this report are rather obvious, but means for the objective determination of space requirements are still far from being obvious, though various attempts have been made.

#### The Dependence of Housing Standards on Needs and Resources

Petten Kofer, the German health specialist of the last century, established the minimum sanitary standard of 27 cu.m. (957 cu.ft.) of space per person. "It is based on the quantity of carbon dioxide in the outside atmosphere, its density in the air of the apartment, the amount of carbon dioxide exhaled per hour, and the frequency of air turn over through ventilation."<sup>21</sup> This became the generally recognized standard in Russia. This standard is also expressed in terms of a minimum area of 9 sq.m.. Despite the existence of such a standard in the Soviet Union, the urban dwelling space per person there from 1923 to 1950, according to one study, was never more than 6.45 sq.m., and was as low as 3.98 sq.m. in 1950.<sup>23</sup>

Numerous government standards enforceable under penalty exist.<sup>22</sup> These standards themselves often vary both with the local condition of need and the available resources of the housing authorities. Table II is a comparative scale of the gross floor area per person usually available, for a household of 5 under various circumstances in different countries.

Table II<sup>†</sup>

Conditions of Serious Overcrowding	0.7-2.5
3-berth European sleeping car compartment	0.76
Housing in Some Large Asian Cities	3-5
Static Caravan (U.K.)	3-4.5*
Hong Kong legal minimum	3.25
Legal minimum for labour housing in some tropical countries	3.7
Hong Kong Housing Society, one-room flat (1953)	4.3**
Housing in Africa and Similar Tropical Areas	5-10
Kenya, two-room flats (1947)	5.9
Southern Rhodesia, detached bungalow (1955)	7.0
Congo (former Belgian Congo), two-story terrace house	8.8
Fiji, two-story police housing (1958)	10.2
Housing in E. Europe, Parts of the Mediterranean, & Latin Am.	8-12
Warsaw, flats (1953)	8.8-11.2**
Greece, nucleus house, (1951)	9.6
Latin America, recommended minimum for social housing (1953)	12
Social Housing in W. Europe	12-17
Netherlands, minimum flats at Vlaardingen (1952)	12.6
England, Welwyn workers' cottages (1925)	13
England, Housing Manual (1944): houses	15-16.7

\* based on 4-person household.      \*\* based on 6-person household.

## B. THE DONIMANCE OF FISCAL POLICY

All kinds of minimum standards can be established, and they may be based on scientific factors, social factors, political factors, or a

<sup>†</sup> Table II is from item 2 in the bibliography.



combination of these and many other factors. But in order to have buildings built, and more importantly, actually occupied by those who need housing, the necessity for a sound coordination of both fiscal and physical planning policies cannot be underrated. In the final analysis, minimum housing standards are very much dependant on the economic policy and philosophy of a government at any one time. Dr. C. A. Doxiadis was asked at a conference on the problem of financing low cost housing and the influence of cost on standards. The following is a report of Dr. Doxiadis' comment:

There were several ways of approaching it. One was to accept a standard house as the minimum. If we set standards, we could not but set such that the maximum the housing authority would be able to build would be, say, five hundred houses for a population which might need twenty thousand. All right, we stuck to our standards, and we didn't build houses. The other way was to start by saying, 'Now let us be practical. How much can the Government and the Municipality afford to spend on housing...during the next five or ten years?' If it was £20,000, you had £20,000 a year for the twenty thousand families, which would be two or three hundred thousand in a few years. Should we spend £500 on our minimum-standard house for only one twentieth of the families and leave the other nineteen-twentieths wondering what had happened? Or should we say, 'We cannot afford to give you a house, we will give you only a corrugated iron roof, so that everybody can put a roof over his head'? With the remaining part of the money we would bring a water supply. Instead of trying to impose a plan providing squares and requiring one third of the squatters' houses to be demolished, we should let all the squatters live happily within such a sector and just provide for a network of roads. The most practical way to be a planner was...to concentrate on the principles, and the basic principle was to serve the people. If they were served by not building houses, by

not making a town plan, we should refrain from doing so. <sup>25</sup>

This certainly represents one pole of housing philosophy, and in one sense it is ironical as it negates, or at least drastically alters the roles of the architect and planner from those of their original calling. However, this serves to illustrate the degree of dependance of the architectural and planning professions on demographic and economic factors. But this thesis is based on the assumption that it is financially prudent to build structures which would be an asset to the community not only for the present, but for the long run as well (see page 42 ).

### C. IS IT ARCHITECTURE ?

A legitimate question which logically follows in any consideration of low cost mass housing challenges the relevance of the architect in dealing with such problems. Those who try to minimize the role of the designer view such problems as being primarily social and economic phenomena beyond the realm of architecture. The architect, however, has an obligation. It is precisely because housing projects of this unique nature have such important bearing on social and economic developments that it becomes imperative for the architect to make claim to these problems. The mere physical magnitude and mass of high density emergency mass housing imparts to it an architectural significance, even if they be only mounds of earthworks or a multitude

of caves. It should not be treated as a combination of social planning and mass industrial design problem. Minimum housing is either an architectural entity or it is a non-architectural entity. Even if it qualifies as architecture only due to its mass and permanence on the urbanscape, it would still demand the full capabilities of the architect. The full application of the architectural mentality and outlook is thus both valid and desirable.

## NOTES

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1. Reference Division, Central Office of Information, Hong Kong, pp.1 and 15.
  2. Hong Kong Housing Authority, Annual Report, 1959-1960, p.229
  3. Reference Division, Central Office of Information, op.cit., p. 9
  4. ibid, p. 5.
  5. ibid, p. 2.
  6. ibid, pp. 6-9.
  7. Hambro, The Problem of Chinese Refugees in Hong Kong, Table VIII, p.151.
  8. ibid, p.12.
  9. Reference Division, Central Office of Information, op.cit., p. 4.
  10. Hambro, op.cit., pp.11-13.
  11. The data contained in this section on climate are freely adopted from Tregear, Land Use in Hong Kong and the New Territories, pp.17-24.
  12. Compiled from information found in Hong Kong Housing Authority, Annual Reports, 1955-1959,
  13. See Hambro, op.cit., Table XV, p. 154.
  14. See ibid., Table LIII, p.187.
  15. See ibid., Table LIV, p.188.
  16. Editors of Architectural Record, Apartments and Domitories, pp. 24-29.
  17. See United Nations, Some Background Notes of International Definition and Measurement of Standards of Living, pp. 3-12.
  18. See Annex C, ibid.

19. International Labour Organization, Workers' Housing Problems in Asian Countries, pp. 2-4.
20. Mumford, The City in History, pp. 286-287.
21. See Sosnovy, The Housing Problem in the Soviet Union, footnote, p. 5.
22. See United Nations, Minimum Standards of Occupancy and Fitness for Habitation of Urban Dwellings Enforceable Under Penalty.
23. See ibid, Chart 5, p. 269.
24. From Fig. 4 in Atkinson, Mass Housing in Rapidly Developing Tropical Areas: An Introduction.
25. The Town Planning Institute, Report of Proceedings, Town and Country Planning Summer School, Southampton, 1959, p. 129.

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1. Association for Planning and Regional Reconstruction, Climates of Region, Locality and Site, and Factors in Lay-out, London, 1946.
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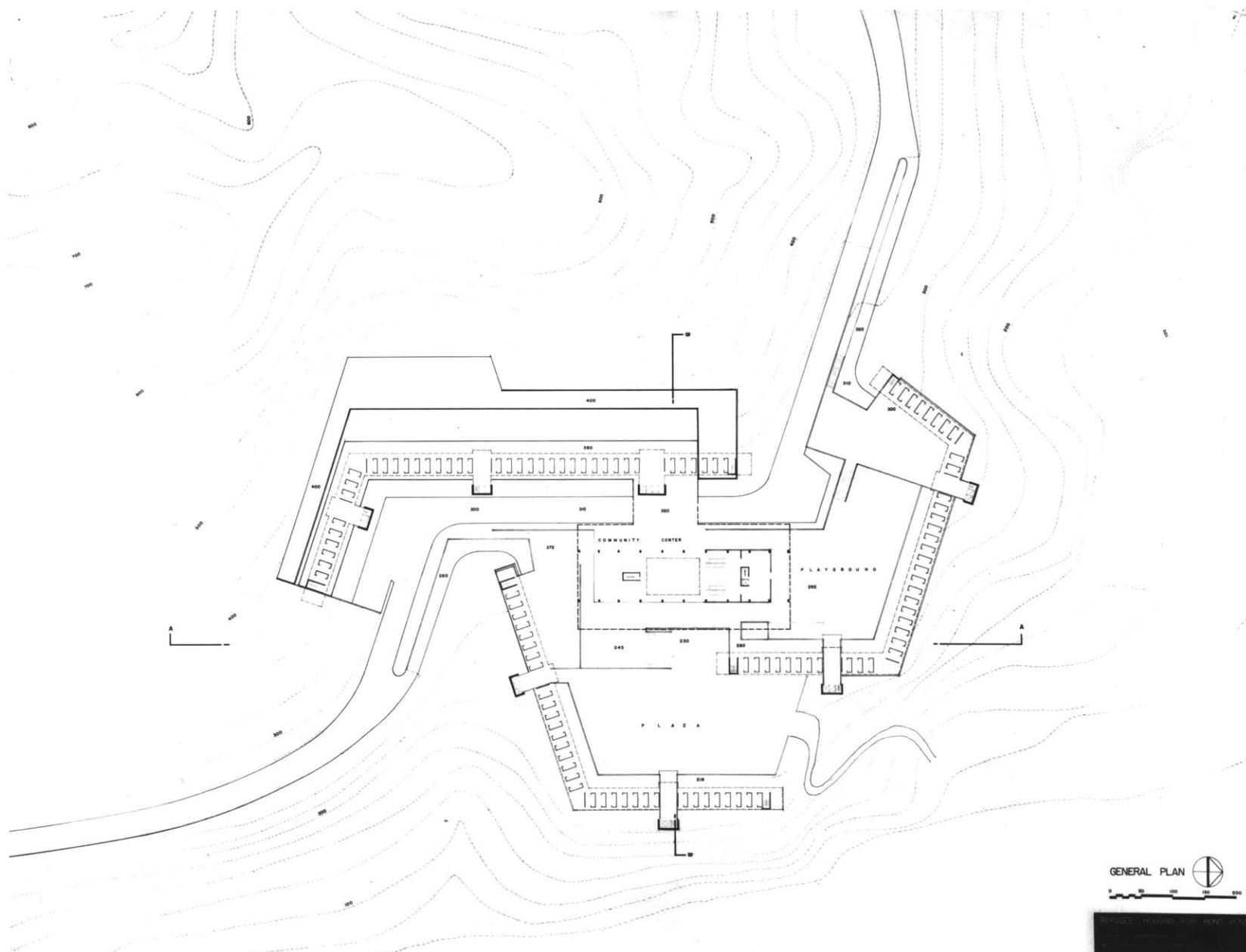
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SITE PLAN

0 100 200 300 400

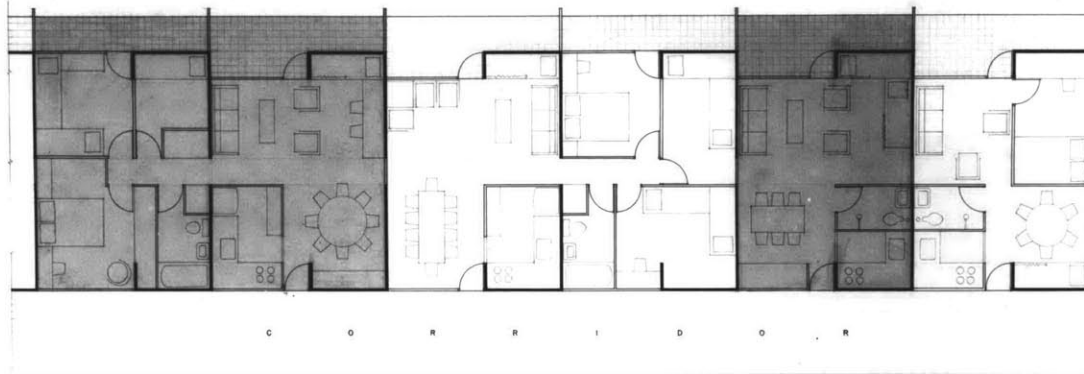


GENERAL PLAN



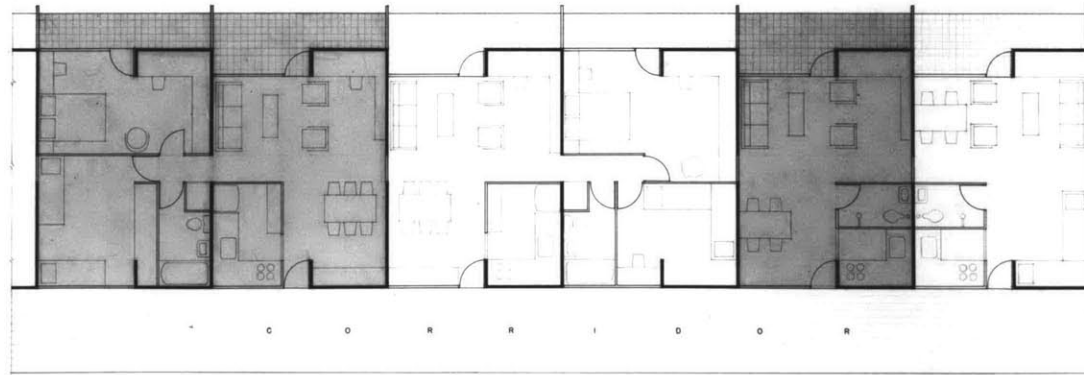
PRESENT

DENSITY 970 PERSONS PER GROSS ACRE  
85 SQUARE FEET PER PERSON  
45 SQUARE FEET PER PERSON, NOT  
INCLUDING CORRIDOR, KITCHEN & W.C.



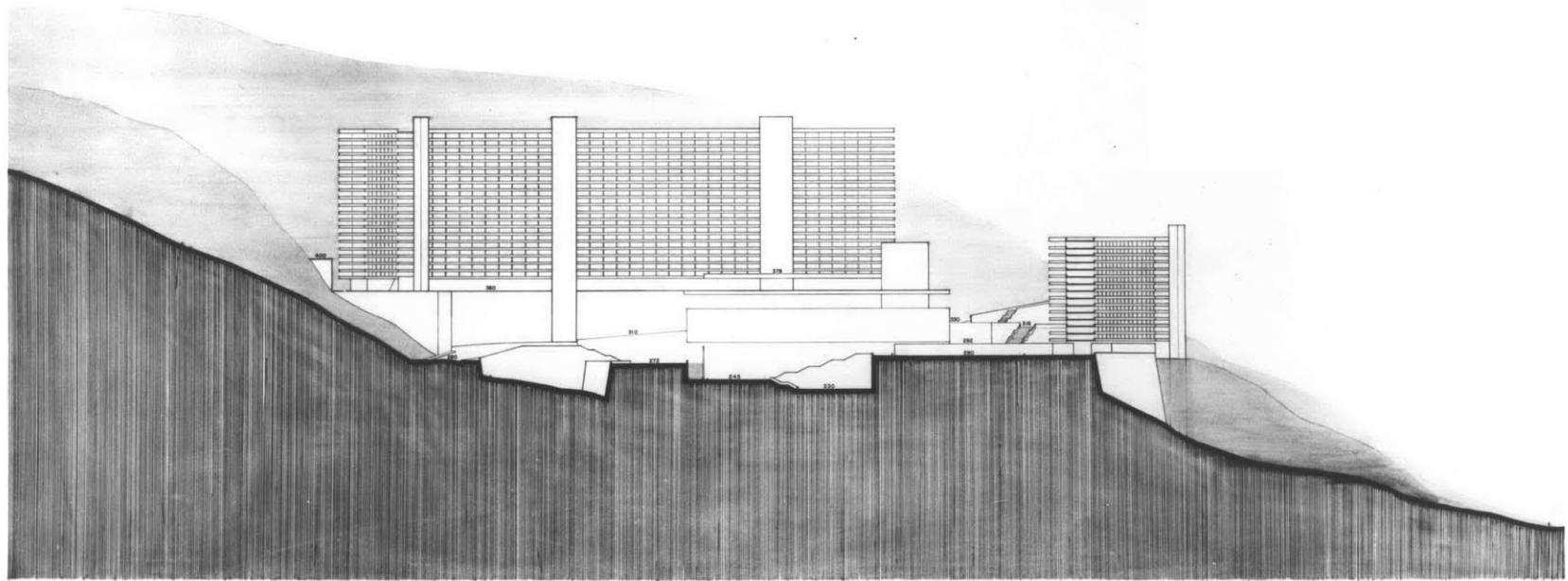
FUTURE

DENSITY 325 PERSONS PER GROSS ACRE  
255 SQUARE FEET PER PERSON



UNIT PLANS

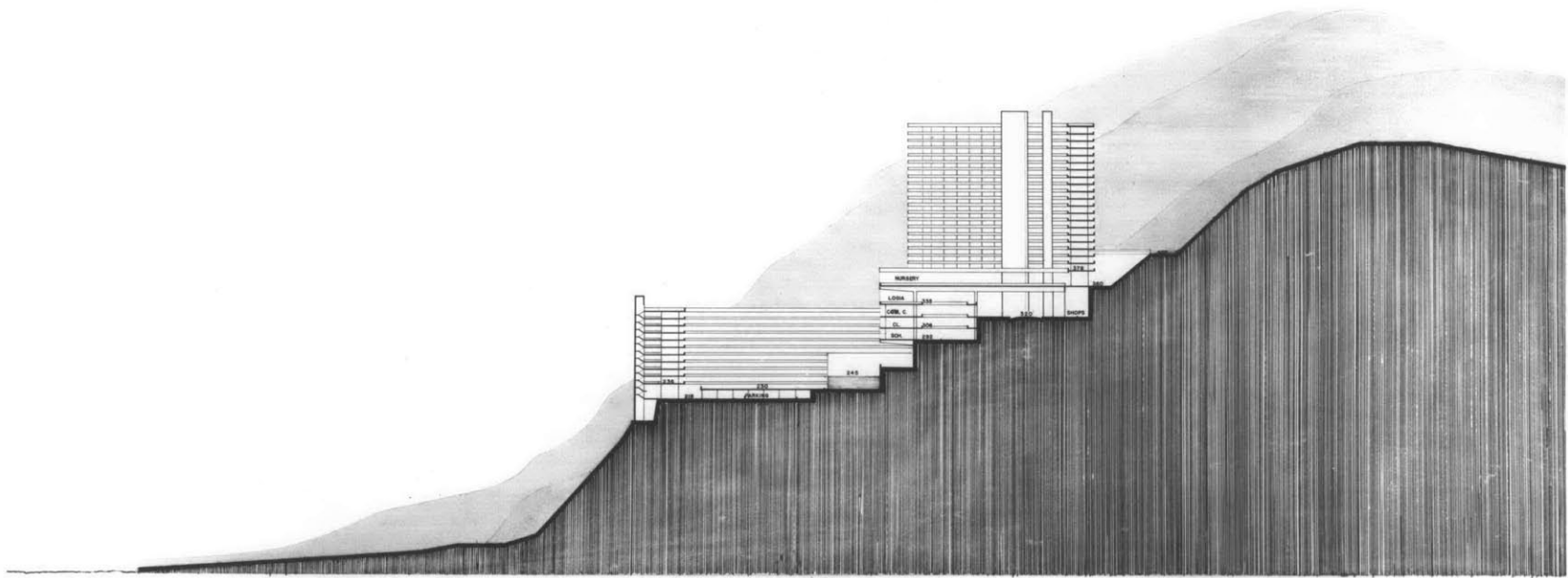




SECTION A-A



REFUGEE HOUSING FOR 1949



SECTION B-B



REFUGEE HOUSING UNIT (REHU) UNIT

5

