POINT-BLOCK DEVELOPMENT
MAHARAJ ROAD, BANGKOK, THAILAND

by

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This thesis is dedicated

to

my country and my mother

PREFACE

Theoretically speaking, there are two ways of life: rural life and urban life. It is our assumption that the larger urban population grows, the greater the number of houses that are needed. Because housing is one of the most important basic necessities of life next only to food. However, the entire country to-day is facing a serious housing crisis due to increases of population, particularly in urban areas such as Bangkok. Her population in 1957 was about 2,159,000 persons, and has an average annual rate of increase of almost 3.2% a year.

Even though the government of Thailand and private organizations have provided land and have constructed single houses and row houses of two storeys for both the hire-purchase system and for rent for quite a number, these could not meet the demands of the increased population. (Housing situation in Thailand in Part I, section E, pages 55 to 59 in this research.) The reason is that these types of housing serve a low density which cannot compare with the high rents and high land value.

If we plan more and more construction of this kind in the limited area, there is no doubt it will lead to a crowded situation, a lack of adequate ventilation and public green space as a result. Therefore single houses and row houses will never be able to serve a high density as well as it can be done with high-rise apartments.

In order to create high density, the author makes a strong recommendation that "Point-Block Development" is a solution to the problem.

Even though "Point-Block" covers only a small ground surface, it is most suitable for tropical countries such as Thailand. On the other hand, each "Point-Block" could provide numerous units in a limited area and thus is suited to the high land value. With scientific and technological advances in construction, -- for instance, the prefabrication system, -- we would no longer face problems in construction of "Point-Blocks" which would not only serve the adequate needs of increased population in Bangkok, but these construction methods would also serve the economic balance, sociological point of view and save time as well.

The reason above was one of the most influential factors which encouraged the author to research and design "Point-Block Development for Bangkok, Thailand." If some parts of this research show an insufficient effort, it should be claimed that the author himself was inexperienced.

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PART I INTRODUCTION

A. Geographical Considerations

1. Situation and Boundaries:

Thailand, an area of about 200,000 square miles in the heart of Southeast Asia, stretches from latitude 5 30" North to 21 North, or not quite 1,000 miles. The longtitudinal extent is half this distance, from 97 30" East to 105 30" East. It thus falls entirely within the tropical climate region. The country is bordered on the north-east by Laos, on the south-east by Cambodia, (these two countries, together with North Vietnam and South Vietnam, comprising the area once known as French Indo-China,) on the south by the Gulf of Thailand and Malaya and on the north-west and west by Burma. The whole country is made up of river plains, forested mountains, and plateaus. It is a tropical land where rice cultivation in the river basins is the primary mode of existence for its approximately 25.5 million people. Historically, the focus of national life has been on the alluvial rice plains of the Chao Phraya basin, where Bangkok, the capital, is located.

To the Thai people, the geographical outline of their country resembles the head of an elephant with its trunk extending down the Malay Peninsula. This shape is significant to them since the elephant has provided invaluable

power, supported Thai soldiers in battle, carried Thai kings into combat, and appears on the royal arms and on the previous national flag which still remains the symbol of the Royal Thai Navy, and on the first minted coins. Above all, the elephant has traditionally been a symbol of good fortune, and a white elephant the symbol of divine approval.

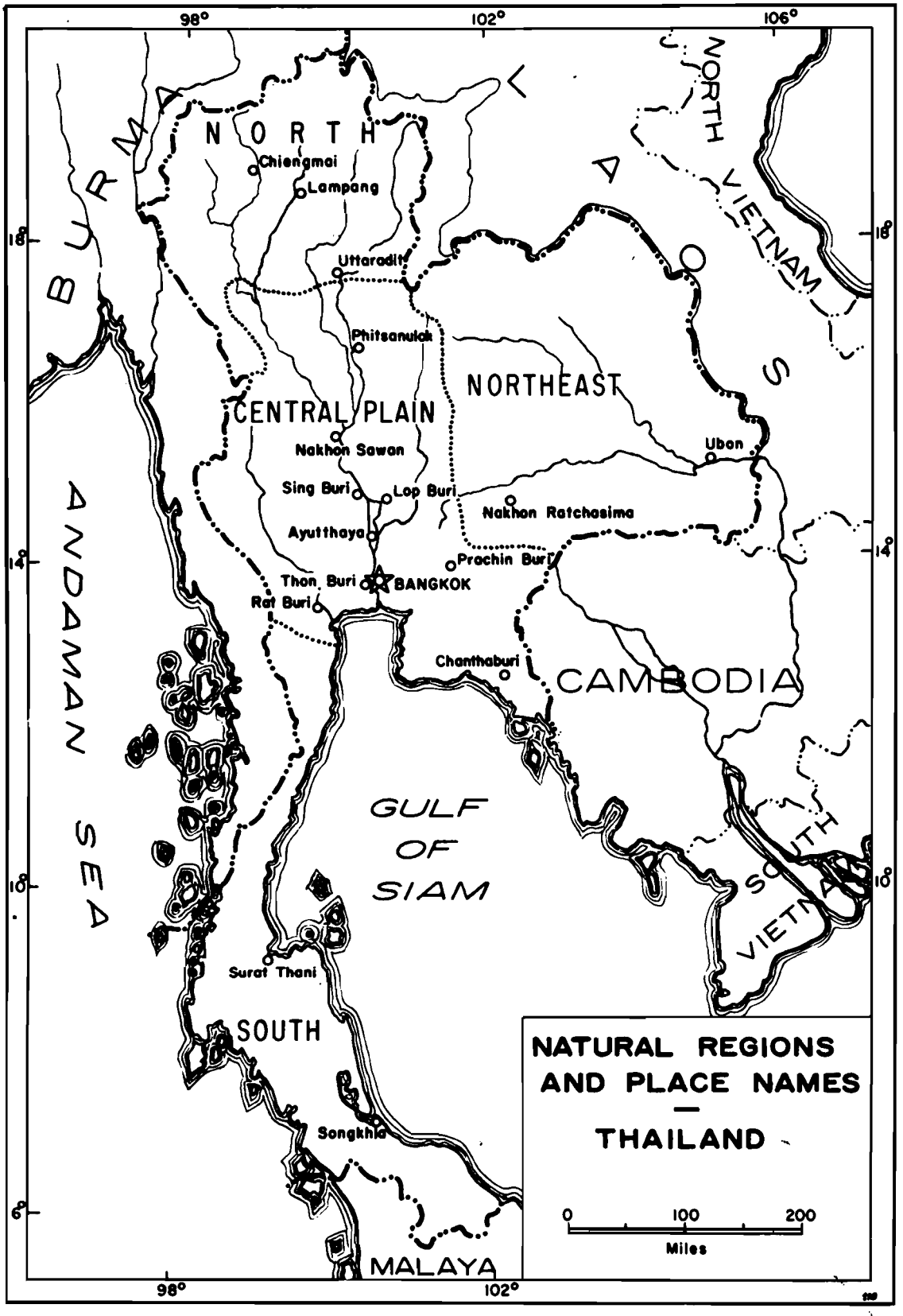
2. Regional Divisions:

The political geography of Thailand is that of a nation oriented toward one major river system, the Chao Phraya. Political power was then expanded to include the entire Chao Phraya drainage system. To the west of the basin are the Salween Valley and Irrawady Basin. To the east is the area drained by the Mekong.

There are four natural regions conveniently delineated by the pattern of the rivers and mountains in Thailand:

1. the North
2. the Central Plain (Chao Phraya Basin)
3. the Northeast (Khorat plateau)
4. the South (the Peninsula)

1. Northern Thailand includes the area drained by the upper reaches of the Chao Phraya tributaries. It is a 60,000 square-mile region of long north-south mountain ridges and deep narrow alluvial valleys. Villages and towns cluster in the valleys, making use of the alluvial rice soils that exist there. The political and economic capital of the


98°
102°
106°
18°
14°
10°
6°
BURMA
NORTH
Chiengmai
Lampang
Uttaradit
Phitsanulok
CENTRAL PLAIN
NORTHEAST
LAOS
NORTH VIETNAM
Nakhon Sawan
Ubon
Sing Buri
Lop Buri
Nakhon Ratchasima
Ayutthaya
Prachin Buri
Thon Buri
BANGKOK
Rat Buri
Chanthaburi
CAMBODIA
ANDAMAN SEA
GULF OF SIAM
SOUTH VIETNAM
Surat Thani
SOUTH
Songkhla
MALAYA
NATURAL REGIONS AND PLACE NAMES
—
THAILAND
0
100
200
Miles

region is Chiengmai, once the capital of the Kingdom of Chiengmai which extended over an area corresponding to the natural region. The ridges in this area are thickly forested and yield many types of valuable woods such as teak. Southwest of Chiengmai, the ridges reach their maximum height of 8,400 feet above sea level. The easternmost ridge in northern Thailand consists of the Luang Prabang Mountains, along the crest of which is the north-central portion of the Thai-Laotian border.

2. Central Thailand, the basin of the Chao Phraya, is the political and economic heart of the nation. Its northern limit is the Uttaradit area, and it stretches to the slope of the Khorat plateau. Here was based the historical Kingdom of Ayutthaya, predecessor of Bangkok and the Kingdom of Siam. Bangkok dominates the 50,000 square miles of the Central Plain, but there are other important regional centres such as Ayutthaya, Lop Buri and Rat Buri.

3. The Northeast is the least favored region of Thailand, sometimes known as the Khorat plateau. It is a huge shallow basin of land encircled by hills. About 70,000 square miles, (one-third of Thailand) is included in this area. The plateau is of sandstone dipping towards the south-east and thus away from Central Thailand and towards the Mekong. As the soil is rather poor and the rainfall unrealiable, it is a sparsely populated area characterized by thin jungle, and along the Menam Mun and Menam Chi Valley, huge tracts of marsh and swamp land.

4. The fourth region, 20,000 square miles, is that of South, or Peninsular, Thailand. Resulting from the expansion of the Thai down the Malay Peninsula during the sixteenth to eighteenth centuries, it is peopled by Moslem Malay as well as Buddhist Thai and Chinese. Its economy is based on tin mining and rubber-tree plantations as well as tropical agriculture. It is mountainous with narrow valleys plunging to the coast; only the east coast offers exploitable soil and adequate harbour facilities.

In the Southeast are the Cardamon Hills which seal off the narrow strip of coast surrounding Chanthaburi.

The westernmost mountain range in Thailand is a series of elongated blocks, along which most of the Thai-Burmese border runs, forming the watershed between the Salween and the Chao Phraya. To the south this range of many names becomes the spine of the Malay Peninsula. There are many passes and gaps through the mountains, but there has never been unlimited access, primarily because of military rivalry between Burma and Thailand.

3. Climate:

Although the whole country lies within the tropical monsoon climatic region, temperature is affected by local conditions and thus may vary perceptibly, but <u>three seasons</u> are experienced throughout the country.

The <u>rainy season</u> occurs from May to October, the rain being brought by winds from the south-west to most of the

country. There may be wide variations in rainfall from one year to another and this is one of the chief problems that Thailand's climate presents. Moreover, in spite of the fact that there is considerable annual rainfall in general, there are nevertheless some dry areas scattered through Thailand, especially those on the lee side of the mountains, as in the west portion of the central plain.

The dry cool season lasts from October to February, when the prevailing winds are from the northeast. In Peninsular Thailand at this time, however, and especially on the east coast which receives the full force of the northeast winds, there is considerable rain, particularly in December.

The hot season is the period from March to May, when the northeast winds have subsided. It remains hot and dry, except in the peninsula, until the southwest monsoons return.

The local variations of climate as they occur in the various regional divisions are as follows:

1. Northern Thailand. The absence of sea breezes makes this area hotter during the day than areas of the south, and also cooler at night. In the rainy season the temperature varies between 33.7 C (92.6 F) as a maximum and about 22.2 C (71.9 F) as a minimum; in the cool season the variation is between about 26.9 C (80.4 F) and 13 C (55.4 F). The annual rainfall is generally just over 1756.7 mm. (70.2 ins.) In the mountains themselves frost is sometimes experienced and there are very occasional hailstorms.

2. Central Thailand. This is the driest region of the country. The comparatively low annual rainfall (about 1537.4 mm. or 61.5 ins.) is determined by the Western mountains over the slopes of which the rain clouds, borne by the south-west monsoons, are dispersed. Thus the Chao Phraya valley, immediately to the east of these mountains, receives rain only when the wind blows directly from the south. In the rainy season the temperature rarely rises above 34.7 C (94.4 F) or falls below 24.3 C (75.5 F), while in the cool season the average maximum temperature is about 30.8 C (87.4 F) and the average minimum about 19.7 C (67.4 F). It has been pointed out that, since the streams of this region are comparatively short, their volume increases rapidly and very considerably at the onset of the rainy season in May. The rise in the volume of water continues until October and then it gradually falls to a minimum in April. The rain brings down a lot of dust and fine particles into the streams and rivers, which flood the fields in the central plain. The water-borne silt is deposited and becomes a natural fertilizer most essential for all vegetation.

3. North-eastern Thailand. The hills encircling this region largely cut it off from the cooling south-east winds. Exposed to the unmitigated heat of the sun, the land is scorched and the vegetation thin. It has a wide variation of temperature, the night temperature in the cool season being very low, the average maximum temperature is about 29.9 C (85.8 F) and the average minimum about 16.0 C (60.8 F).

In the hot season the temperature varies between about 36.3 C (97.3 F) as a maximum and about 24 C (75.1 F) as a minimum. The annual rainfall varies greatly from one area to another. On the higher reaches of the plateau it is as much as 2155 mm. (86.2 ins.) per year, while it is less than half of this in the lower areas.

4. Southern (Peninsular) Thailand. This region has the mildest climate in the country and the smallest variation in average temperature. This is mainly due to the sea winds which blow across the peninsula from east and west alternately. The temperature is rarely below 21.1 C (69.9 F) and rarely above 32.5 C (90.5 F), the same climate as North Malaya. The rainfall year round, including two distinct periods of heavier precipitation, is about 2702.9 mm. (108 ins.)

B. Sociological Considerations

1. Origin:

Before the Christian era, the Thai people were scattered through the lowland of central and southern China, and even to-day Thai stock is well represented in the population of southern China. The Thais were known by the Burmese as the "Shan" people, whereas to the Chinese they were known as "Seim". About 650 A.D. the Thai kingdom of Nanchao (1) was established in the southern Chinese province of Yunnan.

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(1) Wendell Blanchard, Thailand, Its People, Its Society, Its Culture
HRAF Press, New Haven, 1957

Nanchao declared independence from the Chinese, slowly extended its sway over nrighboring areas to the south and east, and successfully fought the armies of China on a number of occasions. The Thai invaded China in 750 A.D., capturing thirty-two villages, and again in 779 A.D., but this time they were repulsed. In 832 they pushed their forces as far as the delta of the Irrawaddy. They sent raiding parties against Tonkin and Annan, then under Chinese control. The state lost its remaining independence in 1253 when conquered by the Mongols under Kublai Khan. Then the movement south began down the river valleys, the Mekong, the Chao Phraya, the Salween and the Irrawaddy. In what is now northern Thailand, the first important Thai settlement had been established by about 860 A.D. The movement was slow but was carried out in such a way as to be sure and lasting. By the early part of the eleventh century the Thais were strongly established in the central plains down the length of the Chao Phraya valley and even into the peninsula.

Before the Thais began moving south they had come under the influence of different cultures, aspects of which they were able to absorb and use to their own advantage. For a long time, Nanahao acted as a buffer between the Chinese and Tibetan peoples. Partly as a result of these influences, the Thais reached a comparatively advanced stage of development.

2. Population Growth:

At the beginning of the seventeenth century, the population of Thailand (Siam) was low in relation to its agricultural productivity because of losses due to war, i.e. either killed in battle or forced to emigrate as captives. Siam continued her recurrent and bloody wars with Burma with only a brief respite during the reign of King Baromakot in the eighteenth century. The population of Thailand was severely depleted during the ruinous wars with Burma from B.E. 2302 (1759) on into the nineteenth century; at the fall of Ayutthaya in B.E. 2310 (1767) a large part of the city's population was marched back to Burma, and the turn-of-the-century Burmese attacks in peninsular Siam were characterized by the sacking of whole towns and the removal of their inhabitants. As a result, Siam entered the nineteenth century with a population of not more than four and a half million. Wars between Siam and Burma were ended by British intervention in the course of the century, while the occasional wars fought during Rama III's reign against the states of Cambodia and Laos were not continued after French intervention in Indo-China. Rama III's successors were able to avoid "shooting wars" altogether.

Consequently, from B.E. 2393 (1855), when King Mongkut approved the Bowring Treaty, through until B.E. 2453 (1910) the end of the reign of King Chulalongkorn, there was a period of peace with unparalleled economic activity and development as Thailand entered the stream of world trade.

This permitted the expansion of rice-paddy cultivation, increasing the basic product for domestic consumption and export, as well as greater production and export of rubber, tropical hardwoods (including teak), copper, tin and other products. These developments were accompanied by a continuing increase in population.

The social, administrative and physical development already begun during Chulalongkorn's reign, plus the improvement of public health measures and facilities further stimulated economic and population growth.

In spite of the widespread effects of World War II, Thailand largely escaped both war damage and post-war disorder. Since the war, trade has continued to flourish generally, and Thailand is well off by Asian standards. Intensification of economic activity has been reflected in a continuing increase in population. Chart I, which follows, shows the increase of population in Thailand since B.E. 2368 (1825) from approximately 4,750,000 to an estimated 22,800,000 in B.E. 2500 (1957). This data is compared with Burma and the Philippines -- countries of somewhat comparable size and possessing similar single major cities.

It will be noted that during the decades prior to World War I, Thailand grew more slowly than Burma and the Philippines, but that since World War II the rate in Thailand has been slightly greater than in the other two countries.

CHART 1 POPULATION GROWTH 2368 — 2500

THAILAND and comparision - BURMA and PHILIPPINES

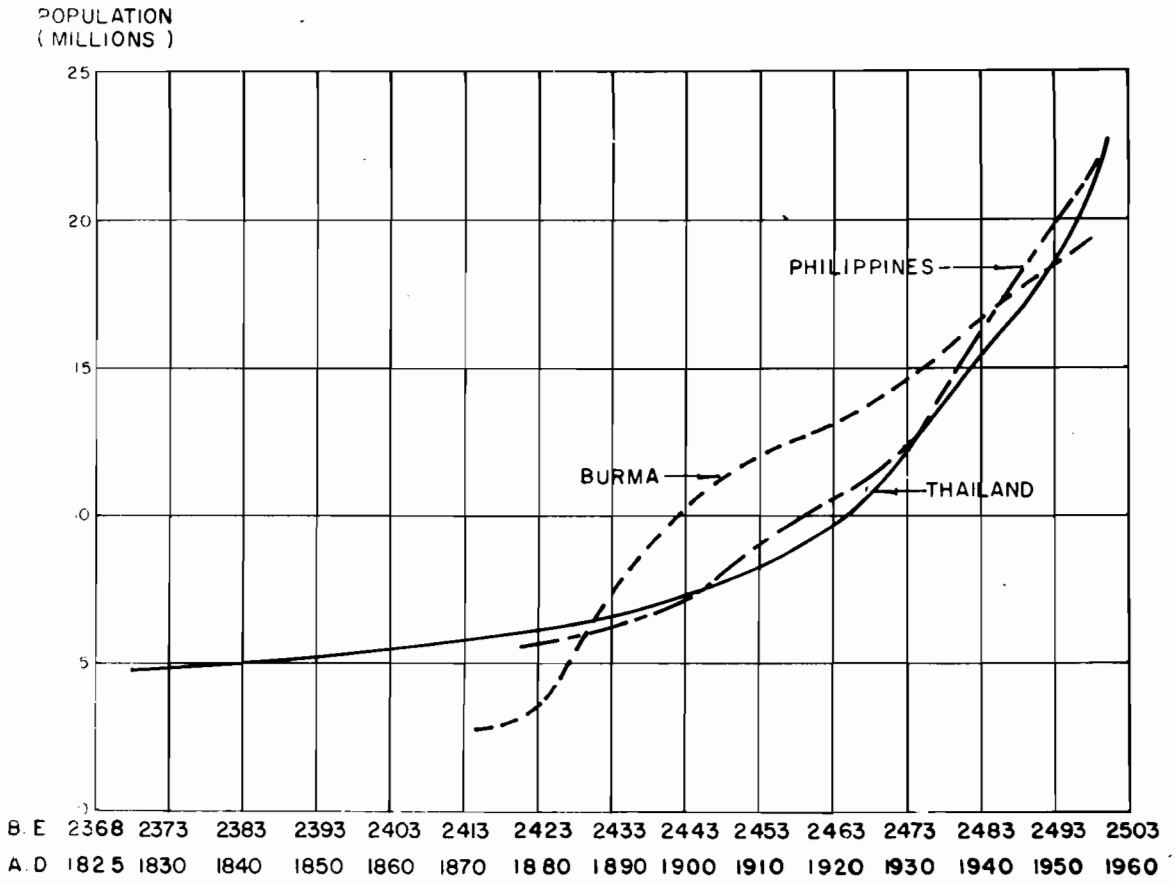

Table I

Population Growth in Thailand

B.E.2368 - 2500 (1825-1957) #

Compared with Burma and the Philippines

Year B.E.	Year A.D.	Thailand	Burma	Philippines
2368	1825	4,750,000		
2393	1850	5,200,000		
2415	1872		2,747,148	
2418	1875	5,950,000		
2420	1877			5,567,685
2424	1881		3,736,771	
2430	1887			5,984,727
2434	1891		7,722,053	
2443	1900	7,320,000		
2444	1901		10,490,624	
2446	1903			7,635,416
2453	1910	8,305,000		
2454	1911		12,115,217	
2460	1917	9,232,000		
2461	1918			10,314,310
2464	1921		13,212,192	
2465	1922	10,202,000		
2470	1927	11,419,000		
2472	1929			12,082,366
2474	1931		14,667,146	
2475	1932	13,087,000		
2482	1939			16,000,304
2484	1941		16,823,798	
2485	1942	16,066,000		
2490	1947	17,643,000		
2491	1948			19,234,182
2494	1951		18,600,000	
2495	1952	20,029,620		
2498	1955	21,645,556	19,434,000	21,849,000
2500	1957	22,811,801		

source: The National Economic Development Board

3. Immigration and Population Composition:

The Thai preference for village life and rice farming, plus an abundance of unused land which has absorbed expansions of population has caused the Thai not to compete in the areas of commerce and industrial labor. Thailand has therefore attracted large numbers of immigrants, many of whom have filled the commercial and industrial jobs. These immigrants have included Indians and Pakistani, plus peoples from Cambodia, Laos, and other surrounding countries. However, the vast majority have been Chinese. This latter group has been a significant factor affecting the population growth as well as the general economic development of the country.

As early as the seventeenth century, Chinese immigrated to Thailand at the rate of 4,000 to 5,000 annually. By B.E.2443 (1900), the rate had increased to 19,000 per annum, and during the period B.E.2461 to 2471 (1918-1928) it averaged 95,000. # The majority of the early Chinese immigrants were male, and despite the original plans of many to make their fortunes and return to China, a large proportion married Thai women and remained in Thailand. This immigration trend continued until it reached its peak in the latter part of the 1920's. It is estimated that the 1918-28 period resulted in an immigration surplus of approximately half a million china-born Chinese, -- a surplus larger than the estimated total from B.E.2365 through 2460 (1822 through 1917). Since B.E.2471 (1928),

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from the report of the National Economic Development Board

Chinese immigration has significantly declined.

Following B.E.2463 (1920), however, there was a gradual shift in the emphasis of Chinese immigration in that the peoportion of female arrivals increased from 15 percent in B.E.2464-2465 (1921-1922) to 27 percent between B.E.2479 and 2490 (1936 and 1947). # Since World War II, 70 percent of Chinese immigrants have been women and children. This has served to reinforce the Chinese community as a distinct group, and along with many other factors, to impede the earlier process of assimilation which had been occurring.

The net gain from such immigration has always been offset to carying degrees by departures of Chinese from Thailand, which ranged from a high 70 percent of arrivals between B.E.2449 and 2460 (1906 and 1917), to 40 percent between B.E.2489 and 2498 (1946 and 1955). # Both immigration and emigration have reflected Thai governmental policies regarding Chinese immigrants, as well as the presence of economic opportunities in Thailand and economic pressure in the various parts of China.

The table on the following page furnishes an estimate of the ethnic groups in Thailand for B.E.2500 (1957). Of those shown, only the Chinese and the Malay are of sufficient size to constitute significant ethnic groups. About seven-eighths of the latter are located in the southwestern peninsula, leaving only the Chinese as an ethnic minority with suffi-

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report of the National Economic Development Board

ciently large numbers to play a predominant role in the commercial and business life of the country, and this is mainly in the Bangkok-Thonburi area.

Thai	18,585,000
Chinese	3,000,000
Malay	670,000
Cambodian	185,000
Vietnamese	25,000
Indian & Pakistani	60,000
Mon	60,000
Kariang	60,000
Westerners	5,000
Others	150,000
Total	22,800,000

One study concludes that because of the decline of immigration, it appears that an increasingly rapid decline in China-born population is inevitable and that the proportion of the ethnic Chinese population to the total will continue to decrease in years to come. It appears, then, that in view of the Thai attitude which officially emphasizes nationality plus the rate of assimilation, the past and present problems regarding the Chinese minority will gradually diminish over the long run, in the absence of outside interference.

4. Age and Sex Composition:

Age distribution of the population is typical of a newly developing country. The median age is less than 20. Children under 15 years of age account for over 42 percent of the total population. Within the remaining 58 percent there is an almost even distribution between those aged 15 to 30 years and all others.

Sex distribution within each age group is never greatly uneven, although there may be regional maldistribution especially where rural males migrate for seasonal or permanent urban employment. Up to the age of 15, boys outnumber girls. From 15 to 30 years, there is a somewhat larger number of women than men.

From 30 to the age of 70, the sexes are virtually even, except for a slight predominance of males between 30 and 45 years, that may indicate the toll of intensive child-bearing on the women in this age group. Above the age of 70, there is a significant preponderance of women, with almost twice as many women as men surviving into very old age.

In B.E.2472 (1929) the expectation of life at birth was 31.6 years for males and 37.4 years for females. In B.E.2490 (1947) (the latest year for which data is available), the expectation of life was 48.5 years for males and 51.4 years for females.

5. Birth and Death Rates:

The reported death rate fell from 14.5 per thousand in B.E.2489 (1946) to 9.1 per thousand in B.E.2499 (1956). This decline may reflect the drop in the infant mortality rate during the same years from 94.6 per thousand to 55.2 per thousand. Simultaneously, the birth rate rose from 23.0 to 34.8 per thousand.

Table II

Birth and Death Rates, Thailand #

B.E.2489-2499 (1946-1956)

B.E.	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499
A.D.	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
Birth-rates	23.0	23.6	24.0	27.9	28.6	29.6	30.2	31.5	34.8	35.0	34.8
Death-rates											
Crude:	14.5	13.4	10.7	10.5	10.0	10.4	10.0	9.5	9.8	9.4	9.1
Infant:	94.6	79.8	68.1	65.9	62.4	65.3	62.8	64.9	63.6	56.1	55.2
Maternal:	7.4	7.5	6.9	7.1	6.6	6.6	6.4	6.0	5.2	5.5	5.4

"Thailand Past and Present" pp. 103-104
Department of Public Health, Ministry of Interior

6. Population density and distribution:

Average density in Thailand (about 114 persons per square mile) is relatively low when compared with the Philippines and Ceylon, but appreciably higher than in Burma.

Table III

Population Density: #
Thailand and selected countries

Country	Area	Population	Density
Thailand	518,000 sq.km.	22,800,000	44 per sq.km.
	200,000 sq.mi.	(1957)	114 per sq.mi.
Burma	677,950 sq.km.	19,434,000	29 per sq.km.
	261,756 sq.mi.		74 per sq.mi.
Ceylon	65,610 sq.km.	8,800,000	143 per sq.km.
	25,332 sq.mi.		371 per sq.mi.
Philippines	229,424 sq.km.	21,849,000	73 per sq.km.
	115,599 sq.mi.		189 per sq.mi.

from the report of the National Economic Development Board

As only approximately 18 percent of the total area is cultivated, there is more significance in the average density per cultivated square mile, which in the Chao Phraya valley is over 600, and in certain sections of the extremely narrow southwest coastal strip, over 3,000.

The population is concentrated in the river valley where alluvial soils and adequate water allow the traditional rice culture. The entire southern portion of the central plain (the lower reaches of the Chao Phraya) around Bangkok and Thonburi is the most thickly populated area, followed closely by the northern portion around Lopburi and Singburi.

In terms of population the Central Plain is coming more and more to dominate Thailand. In B.E.2454 (1911) about 30 percent of the total population lived in this area, and in B.E.2490 (1947), almost 40 percent.

7. Future Growth:

Within the recent past, Thailand has exhibited consistent, but not extreme population growth, and an attempt has been made herein to obtain a reasonable approximation of possible future growth by two means:

1. an analysis of the projection of population of Thailand from B.E.2493 (1950) through 2523 (1980) as prepared by the Population Branch of the United Nations, and

2. mathematical projections through B.E.2533 (1990) based on average annulal rates of growth for two periods --

(a) B.E.2460 through 2500 (1917 through 1957)

(b) B.E.2490 through 2500 (1947 through 1957)

Table IV and Chart II following present the results of the above.

Table IV

Estimated Population, Thailand #

B.E.2493-2533 (1950-1990)

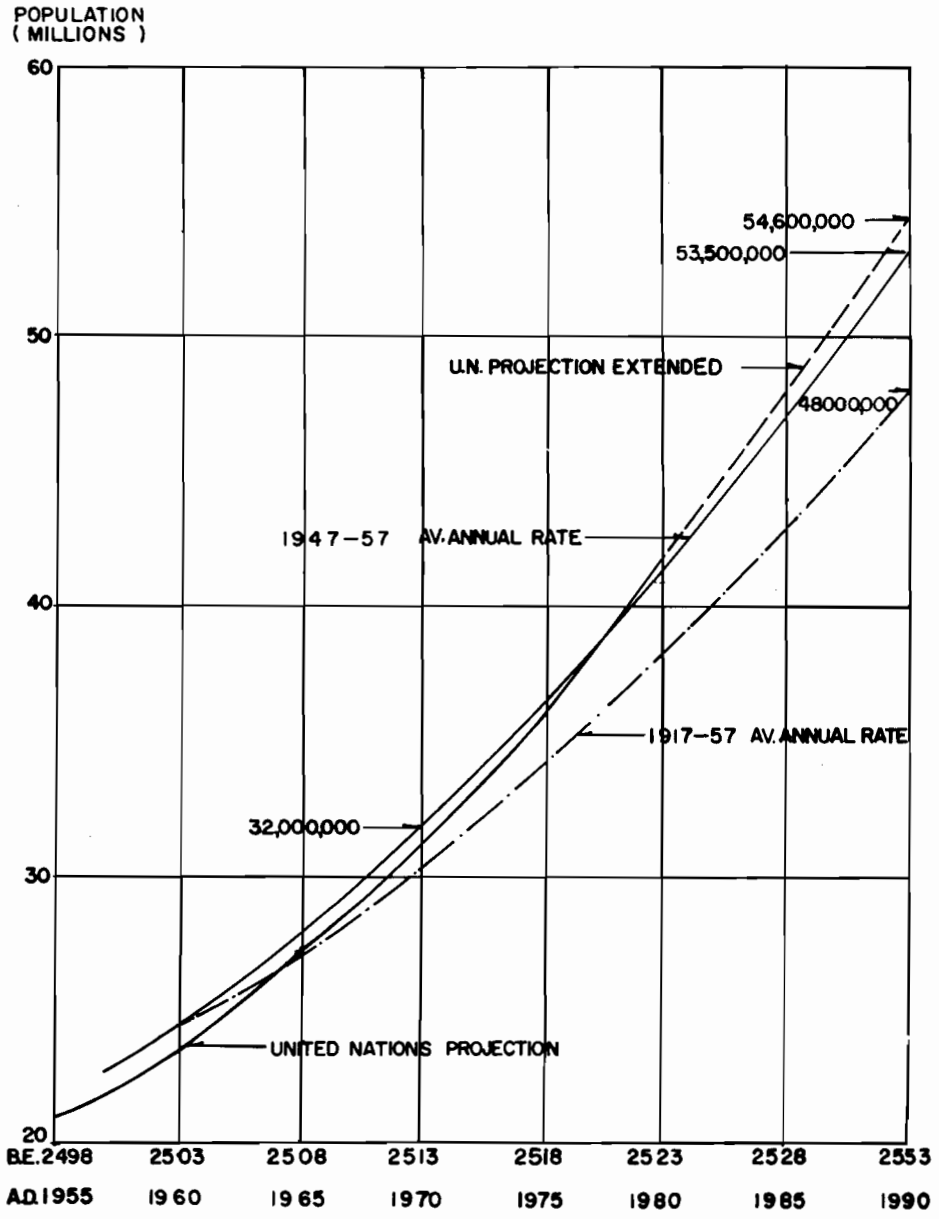
(all figures in thousands)

Year B.E.	Year A.D.	United Nations	B.E.2460-2500 1917-1957	B.E.2490-2500 1947-1957
2493	1950	18,600	--	--
2498	1955	20,900	--	--
2500	1957	--	22,800	22,800
2503	1960	23,700	24,400	24,600
2508	1965	27,100	27,300	28,000
2513	1970	31,100	30,600	32,000
2518	1975	35,800	34,300	36,300
2523	1980	41,600	38,400	41,300
2528	1985	47,800	43,000	47,000
2533	1990	54,600	48,000	53,500

from the statistics of the Ministry of Economic Development

CHART 2

POPULATION PROJECTIONS
THAILAND B.E. 2498–2533



C. Urbanization Trends of Bangkok

1. Evolution of Metropolitan Area:

Bangkok is a comparatively new city. Prior to B.E.2312 (1769) it was an insignificant small town or fort village and Thonburi, which is across the Chao Phraya River, is only slightly older.

The growth and development of Bangkok has mainly resulted from foreign processes. (2) Foreign trade previous to the middle of the nineteenth century was of relatively small importance consisting mainly of private trade and royal monopolies with China and her neighbors in Southeast Asia, but even so it probably constituted a significant portion of the total money transactions in the nation, and most of the goods imported, as well as the proceeds of exports, remained in Bangkok. During this period the city functioned as the court, or government center, as the major port for the country, serving at the same time as an entrepot for the trade of the south China Sea (3) and lastly as the major port of entry for Chinese immigration.

Accurate population data are not available covering the years before the early 1940's for the cities of Bangkok and Thonburi. These urban centers were not designated as municipalities until B.E.2480 (1937).

In B.E.2440 (1897) Bangkok was recognized as an administrative unit with the establishment of the Bangkok Sanitary Board

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(2) Murphy p.233
(3) Ingram p.26

to supervise sanitation and public health, but control remained in the hands of the Changwad governor and the central administration. Apparently no clear distinction was made therefore between the urbanized area and the rest of the Changwad for statistical and other purposes. With the data available, however, an estimate of the past growth trends in these areas has been constructed.

It is estimated that in B.E.2393 (1850), the population of Bangkok was about 400,000, and although no accurate data is available, evidently the area underwent a gradual increase in population and geographical extent. This increase followed the beginning of commercial development of southeast Asia in the latter half of the nineteenth century which drew the country into the activities of the world markets.

Table V

Estimated population of Bangkok-Thonburi area
B.E.2393-2480 (1850-1937)

Year	Population
1850	400,000
1901	600,000
1911	628,675
1916	630,000
1925	750,000
1937	650,000

On the basis of the above, it can be seen that the growth was relatively slow as the population only increased 62% in 87 years, or 7% a year. The fluctuation of the population up to 750,000 in 2468 (1925) and the subsequent drop to 650,000 by 2480 (1937) cannot be adequately explained.

These changes might reflect large military concentrations during the period, or simply registration error.

Following World War II, however, there occurred a sharp increase in the rate of growth and the population doubled in the ten-year period of 1948 through 1958.

Table VI

Population Growth, Bangkok and Thonburi # Municipalities, B.E.2480-2501 (1937-1958)

Year B.E.	Year A.D.	Bangkok	Thonburi	Total
2501	1958	1,286,422	336,039	1,622,461
2500	1957	1,204,894	321,821	1,526,715
2499	1956	1,127,923	302,732	1,430,655
2498	1955	1,024,502 /	289,457 /	1,313,959
2497	1954	971,570	259,869	1,231,439
2496	1953	924,990	246,664	1,171,654
2495	1952	845,374	227,590	1,072,964
2494	1951	803,046	217,245	1,020,291
2493	1950	757,636	205,990	963,626
2492	1949	713,641	194,207	907,848
2491	1948	675,929 /	184,778	860,707
2490	1947	604,520	177,132	781,652
2489	1946	565,642	168,357 //	733,999
2488	1945	734,208	163,678	897,886
2487	1944	735,373 /	153,415	888,788
2486	1943	696,097	147,334	843,431
2485	1942	674,172	not available	
2484	1941	653,767	"	
2483	1940	624,776	"	
2482	1939	598,306	"	
2481	1938	556,655	"	
2480	1937	533,104	"	

/ Boundary change

// Note that Thonburi did not decrease in population this year as did Bangkok. This is because Allied bombing was mainly concentrated in Bangkok, and evacuation was from Bangkok to outskirts, including the fringe of Thonburi.

Source: Registration office, Bangkok and Thonburi Municipalities

CHART 3

POPULATION GROWTH - BANGKOK THONBURI

URBANIZED AREA: 2393-2501 and PROJECTIONS to 2533

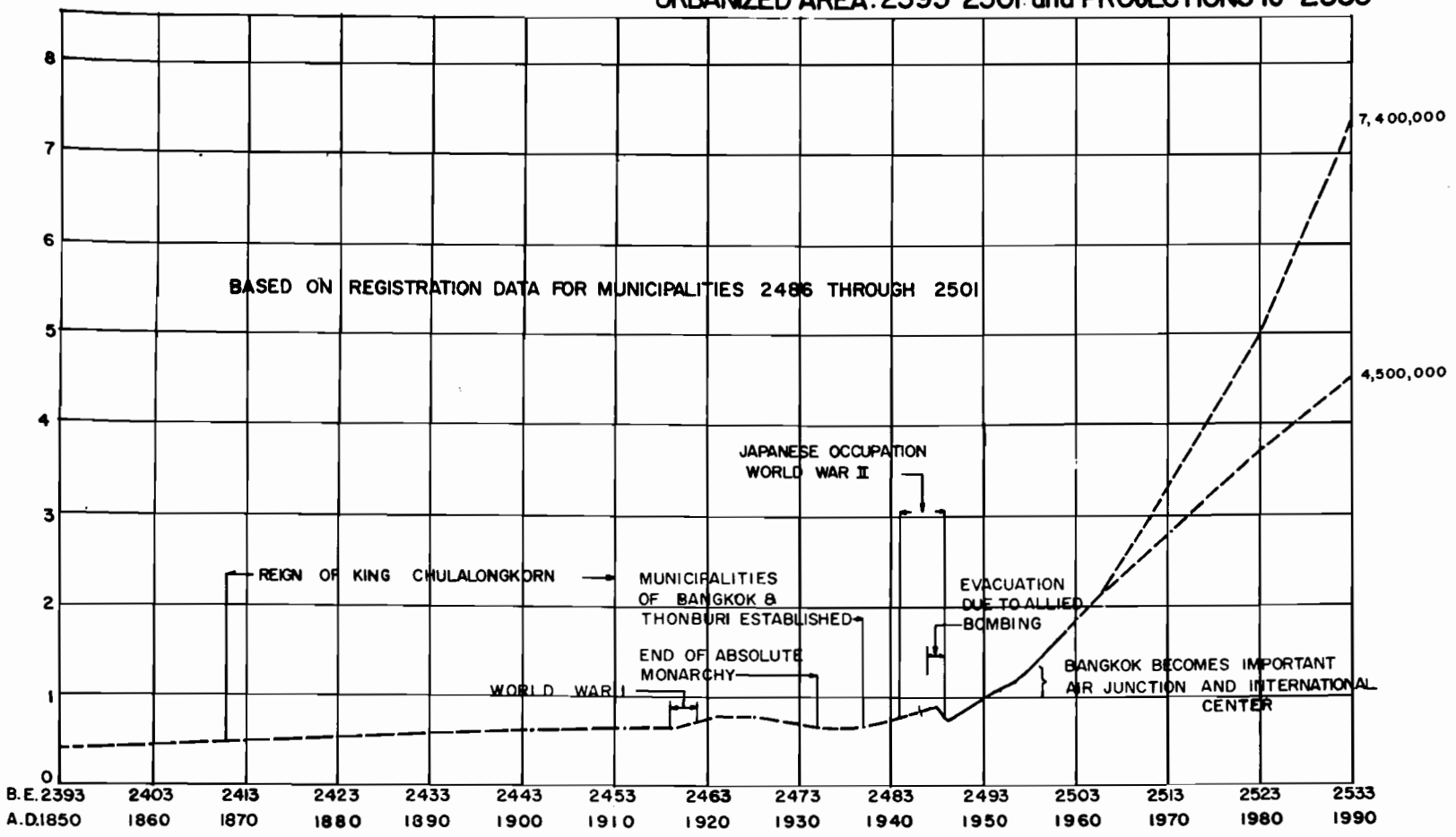


Chart III combines the date given in Table VI in a curve which illustrates this growth and also interprets the various fluctuations which appear in terms of significant local and international developments. The most important fact revealed by these data is that the growth following World War II bears no relationship to the growth of the earlier era.

This new trend is attributable to many factors. Before the war Bangkok was an out-of-the-way place, with the exception of some trade. Now it is the main air junction of southeast Asia, and attracts many tourists who come to see the palaces and temples which preserve the regal history of Siam. Also, its central position in southeast Asia, added to its ease of access by air has attracted a number of regional headquarters of international organizations such as ECAFE, ICAO, UNICEF, FAO and SEATO, and regional business offices and conferences. These all contribute significantly to the city's economy and attractiveness and consequently encourage its population growth and expansion.

Reflecting these factors, the rate of growth within the area during the past ten years has been unusually high. For the period B.E.2490-2500 (1947-1957), the average annual rates of growth have been:

Bangkok-Thonburi	6.9%
Bangkok	7.1%
Thonburi	6.2%

With respect to the two cities themselves, these periods of growth have caused the central administration to make boundary

adjustments to accommodate the expanding population. As previously noted, Bangkok and Thonburi both became municipalities in B.E.2480 (1937); however, since that time, the boundaries of Bangkok have been changed twice -- in B.E.2485 (1942) and again in B.E.2498 (1955). Thonburi has had only one boundary change, made in B.E.2498 (1955).

The present municipalities of Bangkok-Thonburi Metropolitan Area now contain all significant urbanization, although development was spilled out along the major roads into Changwad Nonthaburi to the north and Changwad Samuthprakan to the south. As a result, in this area of four Changwads comprising the Bangkok-Thonburi region, there are six municipalities, twenty-seven amphurs, five sub-amphurs and two hundred and twenty-nine tambols.

The use of this four-changwad area as a Greater Metropolitan Area is justified by two factors: (1) the area is more than sufficient to contain any foreseeable future growth of the Bangkok-Thonburi metropolitan area, and (2) at the present time the Thai government is considering the creation of a new special capital district embracing these same four changwads.

CHART 4 POPULATION GROWTH G.M.A. BY CHANGWATS 2462–2499

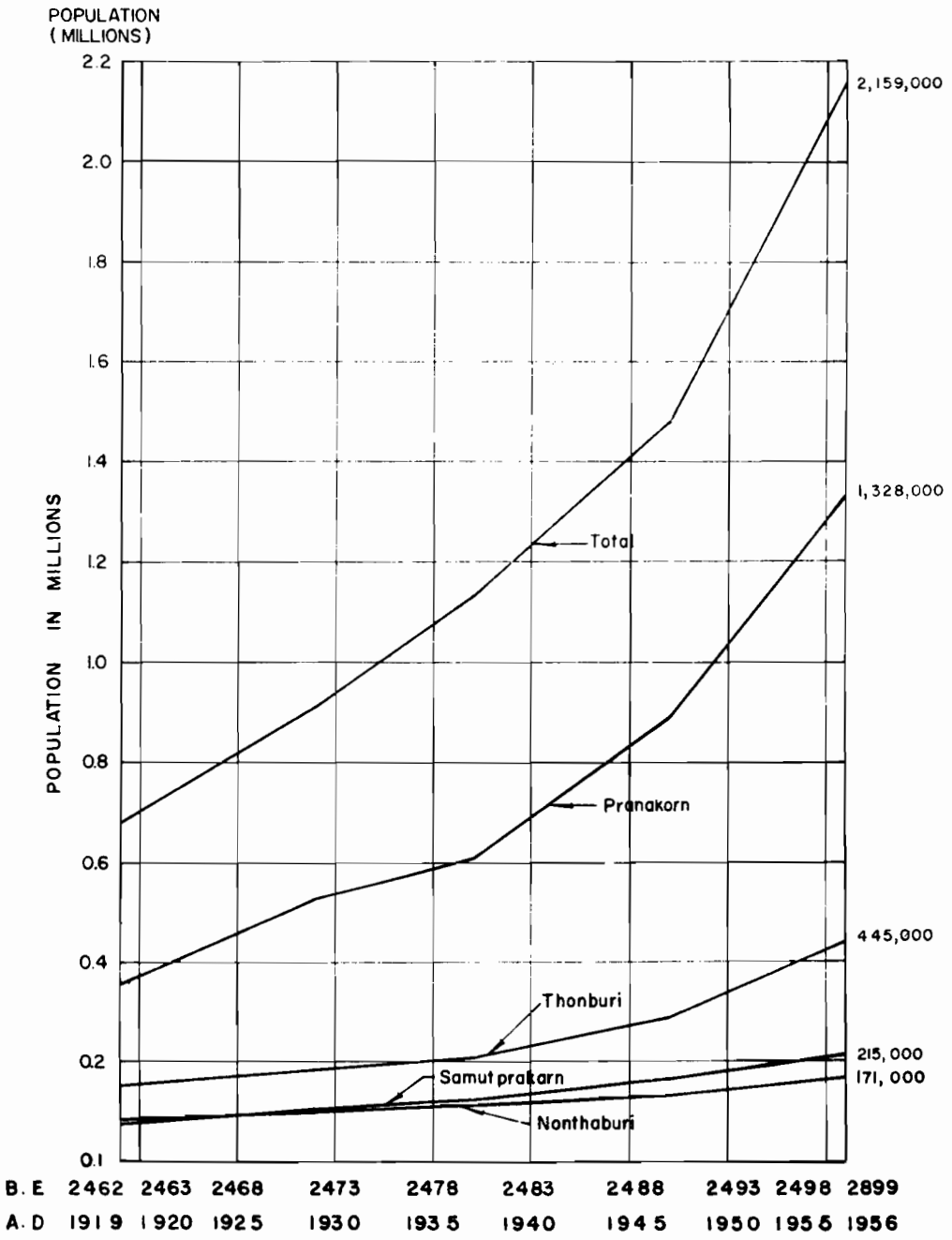
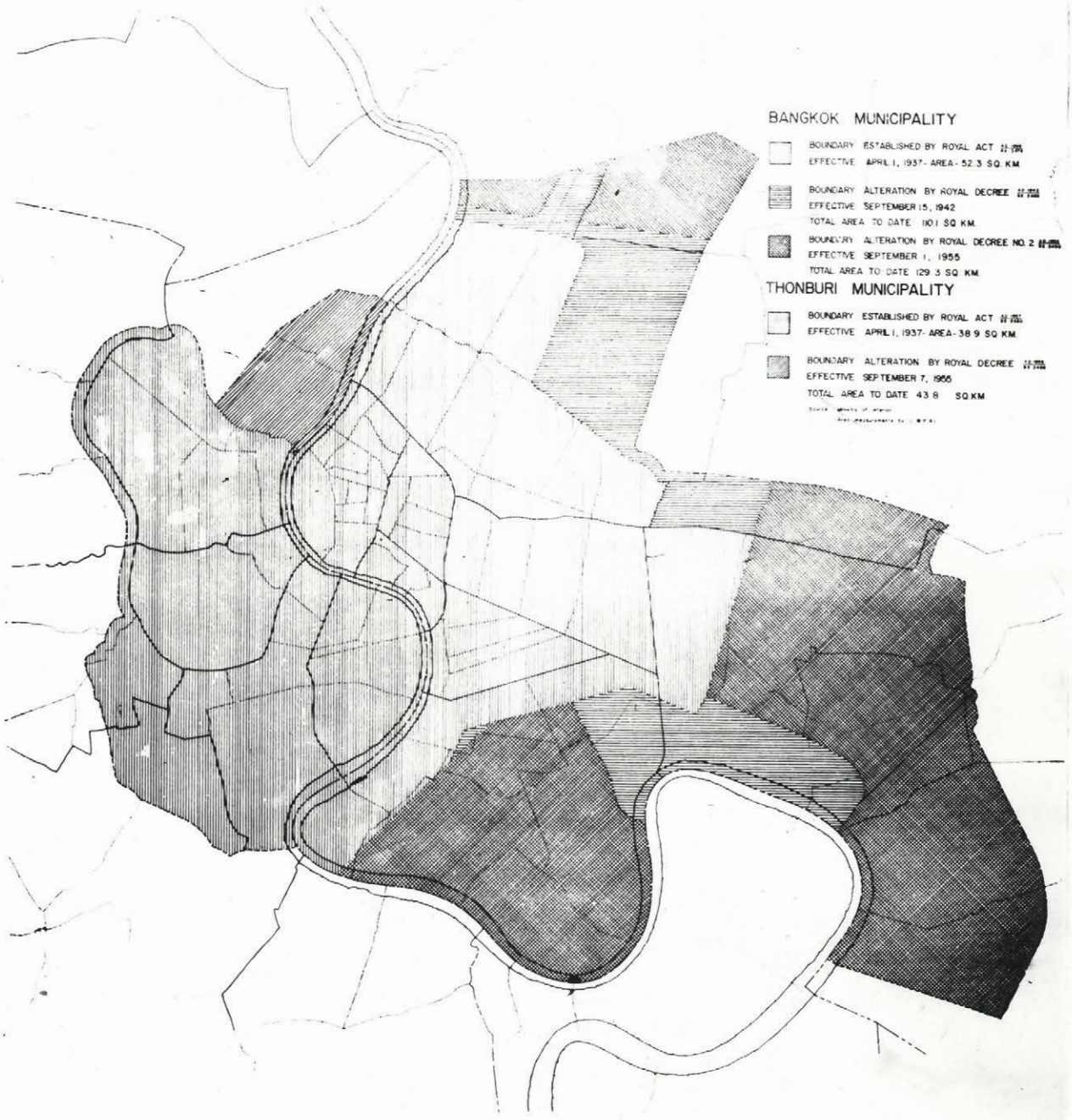


CHART 5

BOUNDARY CHANGES

BANGKOK · THONBURI MUNICIPALITIES

2480 —— 2498 B.E.
1937 —— 1955 A.D.



2. Population Characteristics:

(Birth and Death Rates)

Information on resident births and deaths was obtained for each year from B.E.2489 (1946) through B.E.2501 (1958) for Bangkok and Thonburi. The over-all rate trends are generally similar for both municipalities with the birth-rates increasing and the death-rates decreasing. (see Table VII and Chart VI, which follow.)

Table VII

Birth and Death Rates

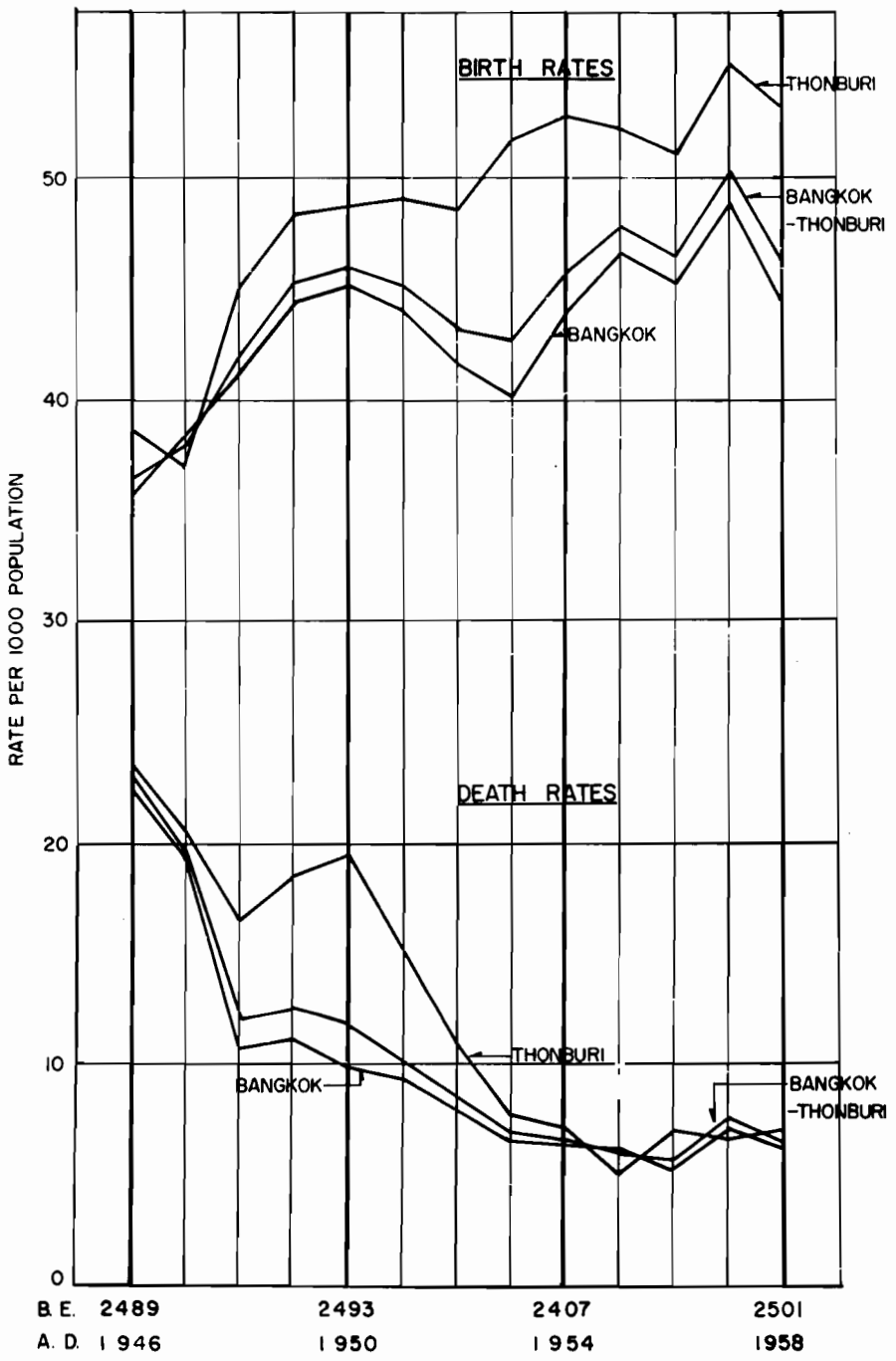
Bangkok-Thonburi Municipalities

Year B.E.	Year A.D.	Births	Birth-rate (per 1,000)	Deaths	Death-rate (per 1,000)
2501	1958	74,904	46.2	10,633	6.6
2500	1957	76,818	50.3	10,774	7.1
2499	1956	66,654	46.6.	8,240	5.8
2498	1955	62,933	47.9	7,987	6.1
2497	1954	56,495	45.9	8,280	6.7
2496	1953	49,931	42.6	8,122	6.9
2495	1952	46,320	43.2	9,243	8.6
2494	1951	46,008	45.1	10,944	10.2
2493	1950	44,241	45.9	11,522	12.0
2492	1949	41,070	45.2	11,615	12.8
2491	1948	36,180	42.0	10,365	12.0
2490	1947	29,707	38.0	15,488	19.8
2489	1946	26,734	36.4	16,842	23.0

Source: Registration office, Bangkok-Thonburi Municipalities

CHART 6

BIRTH AND DEATH RATES
BANGKOK•THONBURI MUNICIPALITIES



(Sex and Age)

The registration data for the Bangkok-Thonburi municipalities show a predominance of males, -- 105 males for every 100 females. This condition exists despite evidence that even with a slightly higher number of male births than female births, the male deaths run considerably greater than female deaths. The explanation for this is probably found in the fact that migration to the Bangkok area is predominantly a male movement.

Table VIII (following) was constructed using the 1958 registration data by sex, distributed by age group according to the percentage shown in the Economic and Demographic survey. On the basis of this table, Chart VII was drawn, showing the population by sex and age. As this chart reveals, the combined pyramid indicates a growing population, with the characteristic broad base for the younger age groups. The broad base of the pyramid for the 0-to-5-year and 5-to-9-year age groups undoubtedly reflects the effects of the rising birth rate.

Table VIII

Population by sex and age

Bangkok and Thonburi Municipalities
B.E.2501 (1958)

	Total		Male		Female	
	No.	%	No.	%	No.	%
Total	1,622,461	100	833,837	100	788,624	100
60 & over	65,565	4.0	26,387	3.2	37,698	4.1
50-59	83,476	5.2	42,206	5.1	41,130	5.2
45-49	64,226	3.9	33,525	4.0	30,557	3.9
40-44	82,467	5.1	49,001	5.9	40,089	5.1
35-39	98,019	6.1	50,032	6.0	47,975	6.1

(continued)

Table VIII (continued)

	Total		Male		Female	
	No.	%	No.	%	No.	%
30-34	115,589	7.1	59,741	7.2	55,861	7.1
25-29	148,710	9.2	75,903	9.1	72,950	9.2
20-24	176,790	10.9	91,036	10.9	79,520	10.1
15-19	162,582	10.0	83,727	10.0	85,103	10.8
10-14	164,934	10.2	86,300	10.3	78,698	10.0
5- 9	211,096	13.6	112,449	13.5	108,598	13.8
less than 5	239,001	14.7	123,530	14.8	115,499	14.6

Source: Population by sex obtained from the Registration office, Bangkok-Thonburi Municipalities. Age distribution based upon 1958. Economic and Demographic Survey, Table I, National Economic Council.

Table IX

Population Distribution by Sex

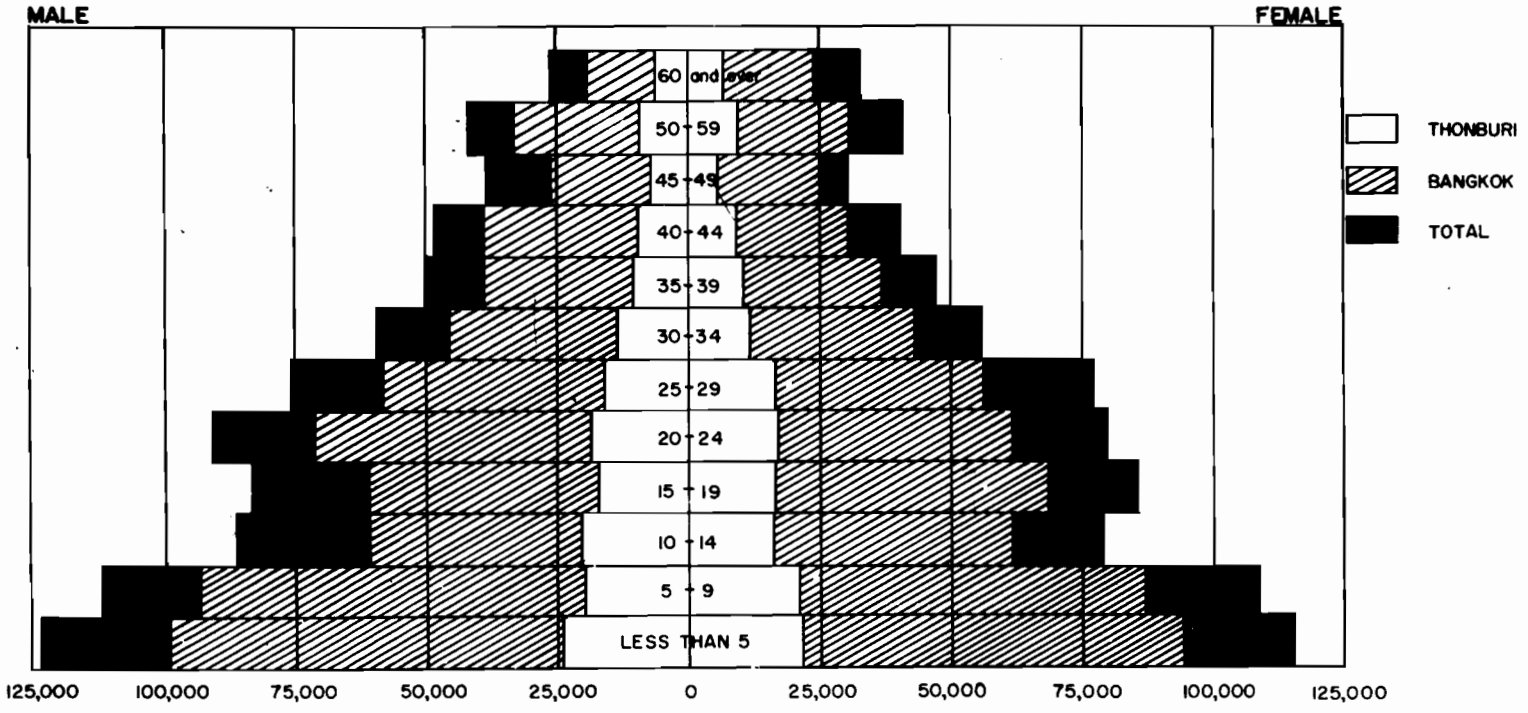
Greater Metropolitan Area, by Changwads
B.E. 2499 (1956)

		Population			
	Total	Males		Females	
Changwad	(100%)	No.	%	No.	%
Total	2,158,679	1,104,392	51.2	1,054,287	48.8
Ranakorn	1,328,228	686,740	51.7	641,488	48.3
Thonburi	445,093	224,329	50.4	220,764	49.6
Nonthaburi	170,660	86,668	50.8	83,992	49.2
Samuth-prakan	214,698	106,655	49.7	108,043	50.3

CHART 7

POPULATION BY SEX & AGE 2501 1958

BANGKOK • THONBURI MUNICIPALITIES



(Citizenship)

The Registration offices in both municipalities classify the population by citizenship or nationality. This data was obtained by amphurs for Bangkok from B.E.2490 (1947) through B.E.2500 (1957), and for Thonburi from B.E.2492 (1949) through B.E.2500 (1957). Table X summarizes this information by municipalities year by year.

Table X

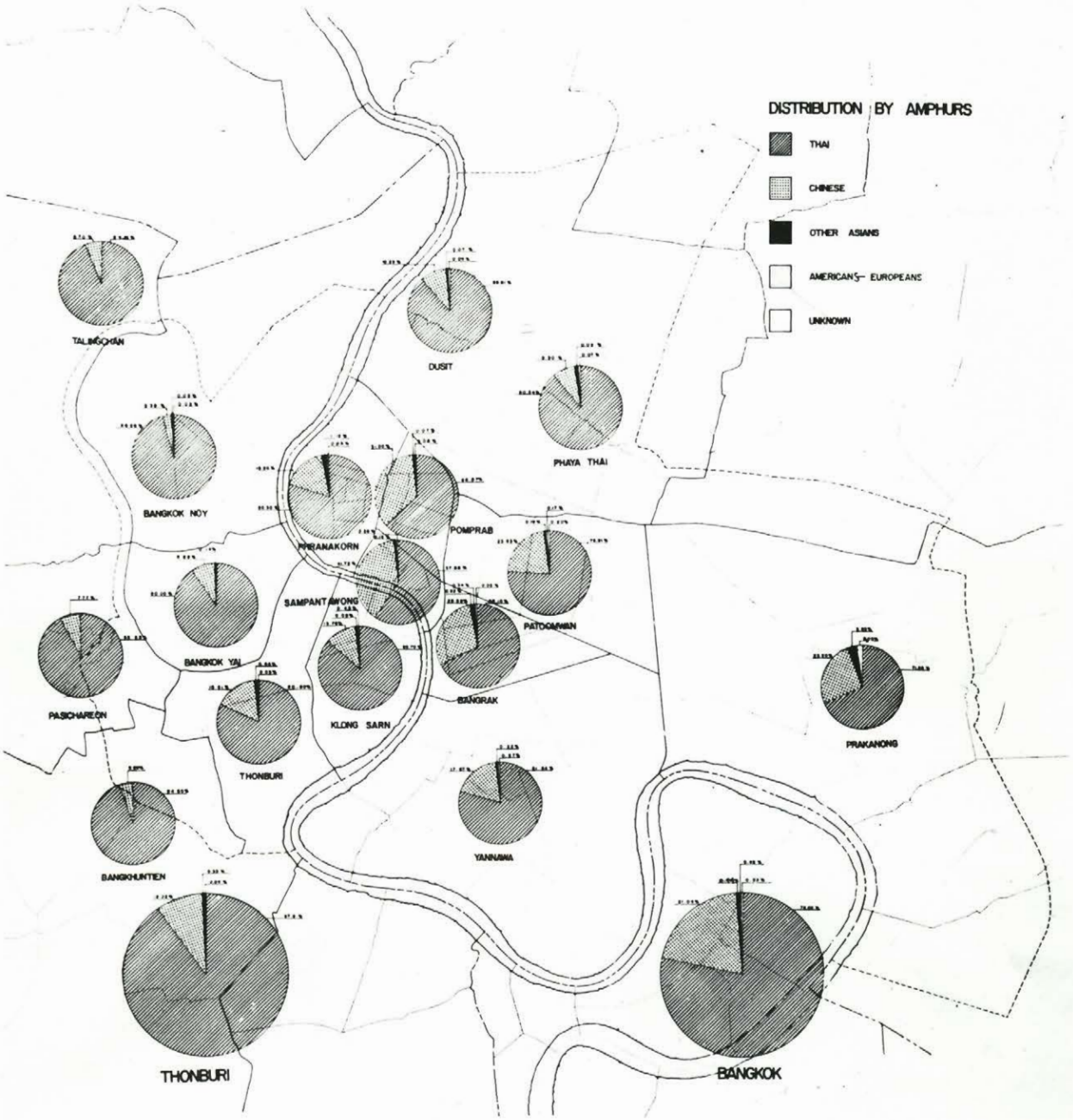
Population by Citizenship (in percent)

Bangkok-Thonburi Municipalities
B.E.2490-2500 (1947-1957)

Year B.E.	A.D.	Thai	Chinese	American, English & other Europeans	Other Asian	Unknown
Bangkok						
2500	1957	78.02	21.04	.48	.44	.03
2499	1956	77.35	21.05	.51	.46	.03
2498	1955	76.49	22.96	.27	.28	-
2497	1954	76.16	23.28	.25	.30	.01
2496	1953	75.40	23.96	.32	.31	.01
2495	1952	73.52	25.82	.33	.32	.01
2494	1951	72.39	26.98	.31	.31	.01
2493	1950	71.05	28.34	.31	.29	,01
2492	1949	69.64	29.76	.29	.30	.01
2491	1948	68.29	31.10	.29	.31	.01
2490	1947	65.38	33.90	.08	.64	-
Thonburi						
2500	1957	87.61	12.02	.04	.33	-
2499	1956	83.07	16.74	.06	.53	-
2498	1955	83.29	16.11	.05	.55	-
2497	1954	-	-	-	-	-
2496	1953	82.13	17.20	.05	.62	-
2495	1952	-	-	-	-	-
2494	1951	80.19	19.06	.07	.68	-
2493	1950	79.39	19.84	.06	.71	-
2492	1949	79.08	20.11	.07	.74	-

It is of interest to observe the increase in the proportion

CHART 8 CITIZENSHIP M. A.
PERCENT BY AMPHURS 2501 BE.(1957)



of Thai nationals and decrease in Chinese nationals which has occurred in both municipalities over the periods studied. This has been probably caused by the continual migration of Thais to the city, and a slackening off of Chinese immigration, in addition to deaths, and the emigration of China-born Chinese.

3. Population Mobility:

There has been no tendency among the Thai people to transfer readily from one section of the country to another, to shift radically their occupational interests, or to seek work beyond the borders of their country, and there is no evidence that mobility will increase. The vast majority of the people prefer life in the rural area, but occasional droughts or periods of economic distress drive some people to find work in cities, especially Bangkok. Once a man has saved the necessary money to solve his immediate problem at home, he usually returns.

Scanty evidence concerning land inheritance indicates that apparently although all sons and daughters inherit equal shares of rice lands, this has not resulted in fragmentation of land holdings. A partial explanation of this is perhaps found in the continual expansion of farming acreage which indicates a constant movement into new land. This, plus the fact that both sexes may inherit suggests that a married couple may have land in two or more villages and may partially explain the short-range mobility among rural Thai. #

A study of internal migration by the Institute of Public Administration of the University of Thammasat

In an analysis of inter- and intra-regional migration for the nine administrative regions of the country covering a seven-year period from B.E.2491 (1948) through B.E.2497 (1954), it was found that approximately 25 percent (5,600,000) of the population of 22,800,000 enumerated in B.E.2499 (1956) had migrated. Of these migrants, however, 93 percent moved within the same region, and the greatest intra-regional migration occurred in the two depressed regions of the northeast.

Inter-regional migration was relatively small, with only 8 percent moving between regions. Region I, which includes Bangkok, received the largest number of in-migrants, totalling 161,320 persons, or 39 percent of all inter-regional migrants. Region VI, north of the Central Plain (Pisamuloke, Tak, etc.) attracted 82,600 in-migrants, of whom sixty-six percent moved from Region I.

With the exception of Greater Bangkok Metropolitan Area, population shifts are predominantly movements between rural areas with only eleven percent of the migrants moving to urban areas. In-migration to Greater Bangkok involved 532,400 migrants, constituting 30 percent of the population enumerated there in B.E.2499 (1956)

In terms of net migration between regions (in- vs. out-migration), the ratios varied from a net loss of 83 percent to a net gain of 66 percent. For Region I, the net gain was 33.67 for every 100 in-migrants, which was the fourth highest behind Regions VI (Pisanuloke, Tak, etc.), IV (Udorn, Kalasin, etc.) and IX (Sangkta, Trang, etc.) The bulk of these migrants

moved into the urban areas of Greater Bangkok rather than the suburbs. The study concluded that the present pattern of population movements will continue until there is a much greater expansion of commerce and industry.

On the basis of the population growth figures, and the information on births and deaths, the following table was drawn up, showing the natural increase and net migration within the Bangkok-Thonburi area from B.E.2490 (1947) through B.E.2501 (1958). Natural increase is computed as the numerical difference between births and deaths, and net migration as the difference between natural increase and total recorded growth.

Table XI

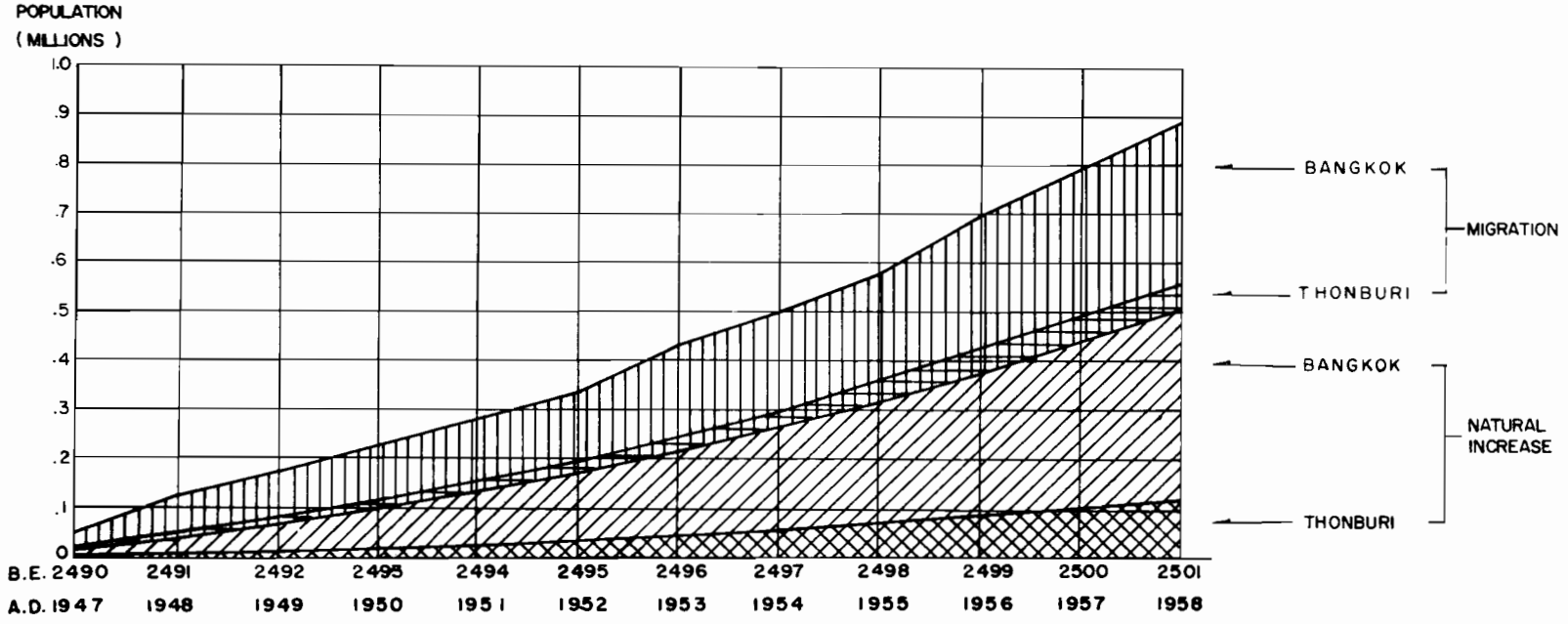
Natural Increase and Net Migration

Bangkok-Thonburi Municipalities
B.E.2490-2501 (1947-1958)

Year	Natural Increase			Migration		
B.E. A.D.	Bangkok	Thonburi	Both	Bangkok	Thonburi	Both
Total	391,497	116,551	508,048	329,283	51,131	380,414
2501 1958	48,888	15,383	64,271	32,640	-1,165	31,478
2500 1957	50,419	15,625	66,044	26,552	3,464	30,016
2499 1956	45,101	13,313	58,414	58,320	- 38	58,282
2498 1955	41,294	13,652	54,946	11,638	15,936	27,574
2497 1954	36,368	11,847	48,215	10,212	1,358	11,570
2496 1953	30,964	10,845	41,809	48,652	8,229	56,881
2495 1952	28,461	8,616	37,077	13,867	1,729	15,596
2494 1951	27,721	7,343	35,064	17,689	3,912	21,601
2493 1950	26,660	6,059	32,719	17,335	5,724	23,059
2492 1949	23,698	5,757	29,455	14,014	3,672	17,686
2491 1948	20,571	5,244	25,815	50,828	2,402	53,230
2490 1947	11,752	2,867	14,219	27,536	5,908	33,444

CHART 9

NATURAL INCREASE & NET MIGRATION B.E 2490 – 2501
BANGKOK & THONBURI MUNICIPALITIES



The figures on natural increase reveal a consistent upward tendency for both municipalities, however. The trends of migration show an extremely irregular pattern.

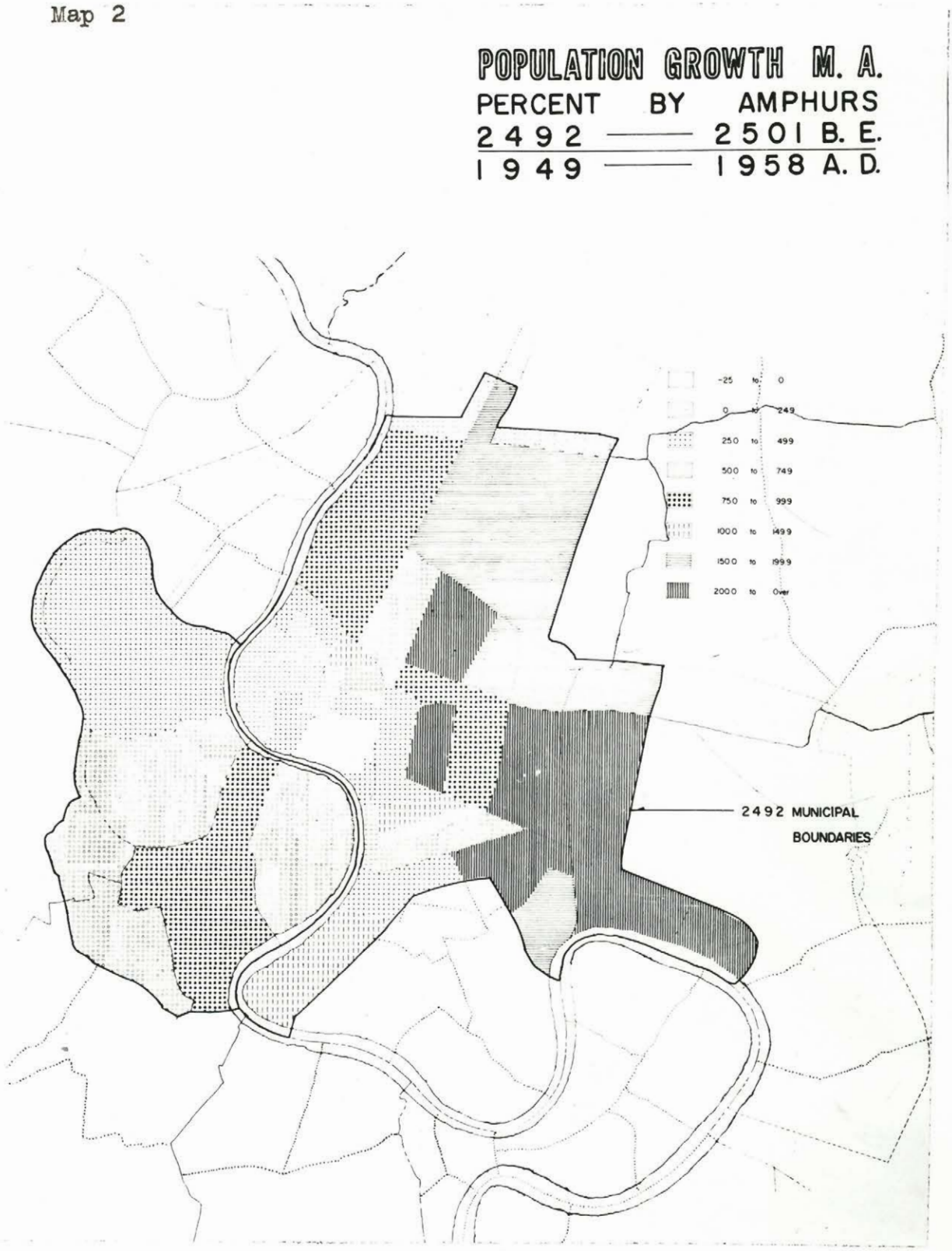
Using the data in Table XI, Chart VIII was constructed, showing the natural increase and migration for Bangkok and Thonburi for the year B.E.2490 (1947) through B.E.2501 (1958). The predominant role of the growth of Bangkok can clearly be seen, as well as the importance of natural increase to the growth of this area. Migration into Bangkok is also extremely high, and it alone is twice as great as the total increase during the period in Thonburi. Total growth in Bangkok has been over four times that of Thonburi.

4. Population Density and Distribution:

The map "Population Distribution" shows the distribution of population within the Greater Metropolitan Area in B.E.2499 (1956). This map reveals that the heaviest concentration of population is located in the central parts of Bangkok and Thonburi, and that as distance from Bangkok increases, the population distribution in areas outside of municipalities reflects the extensive and continuous cultivation which occurs in this Central Plain area.

The gross population density by amphurs in terms of persons per rai and per acre is shown on the map "Population Density". This map more definitely isolates the relatively densely populated amphurs in and around Bangkok, Thonburi and the other municipalities from the strictly agricultural land in the rest

Map 2


POPULATION GROWTH M. A.
PERCENT BY AMPHURS
2492 —— 2501 B. E.
1949 —— 1958 A. D.
-25 to 0
0 to 249
250 to 499
500 to 749
750 to 999
1000 to 1499
1500 to 1999
2000 to Over
2492 MUNICIPAL BOUNDARIES

of the area. The highest densities are found within the older section of Bangkok, especially amphur Sampantawong and amphur Pomprab. These amphurs possessed densities of 96 and 86 per rai respectively.

5. Future Growth:

Over a 37-year period from B.E.2462 to 2499 (1919 to 1956), the population of the Greater Metropolitan Area increased by 1,483,558 persons, -- that is, from 675,121 to 2,158,679. This represents an over-all percentage increase of approximately 220%, and an average annual rate of increase of almost 3.2% per year.

Table XII

Population Growth, G.M.A., showing total and average annual % increase by changwads # B.E.2462-2499 and 2490-2499 (1919-1956 and 1947-1956)

Changwad	Years			%increase		annual	
	2462 (1919)	2450 (1947)	2499 (1956)	2462-2499	2490-2499	620 99	90-99
Total	675,121	1,475,641	2,158,679	219.8	46.3	3.2	4.3
Ranakorn	356,572	889,538	1,328,228	272.8	49.2	3.6	4.6
Thonburi	152,214	289,343	445,093	192.4	53.8	2.9	4.9
Nonthaburi	86,732	133,623	170,660	96.8	21.7	1.8	4.7
Samuthprakan	79,603	163,137	214,698	169.7	31.6	2.7	3.1

Sources: Statistics of the National Economic Development Board

The estimate of the future population growth of the Greater Metropolitan Area was made by decision of the City Planning Department, Bangkok. Mathematical and graphic projections,

have been made, based on past growth trends using average annual rate of growth and extrapolation of the trends of the national population growth and the growth of the Greater Metropolitan Area.

Projections of the 2462-2499 (1919-1956) and 2490-2499 (1947-1956) average annual growth rates for the Greater Metropolitan Area yielded 2533 (1990) population estimates of 6,300,000 and 9,100,000 respectively (see Table XIII and Chart IX which follows).

Table XIII

Estimated Population, G.M.A. #

to B.E.2533 (1990)

Year		Average Annual Growth Rates		National	High Rate		Low Rate	
		1947-1956	1919-1956	Popula-	%of	Pop.	%of	Pop.
B.E.	A.D.	4.31%	3.19%	tion	Nat.		Nat.	
2462	1919		675	9,700	6.9	675		
2472	1929			12,100	7.6	922		
2480	1937			14,500	7.8	1,138		
2490	1947	1,476	1,476	17,600	8.4	1,476		
2499	1950	2,159	2,159	22,200	9.7	2,159		
Estimated:								
2503	1960	2,560	2,450	23,000	10.5	2,500	10.5	2,500
2513	1970	3,900	3,350	32,000	12.1	3,900	10.9	3,500
2523	1980	5,900	4,600	41,300	13.4	5,500	10.6	4,400
2533	1990	9,100	6,300	53,500	14.5	7,800	10.3	5,500

(all population figures in thousands)

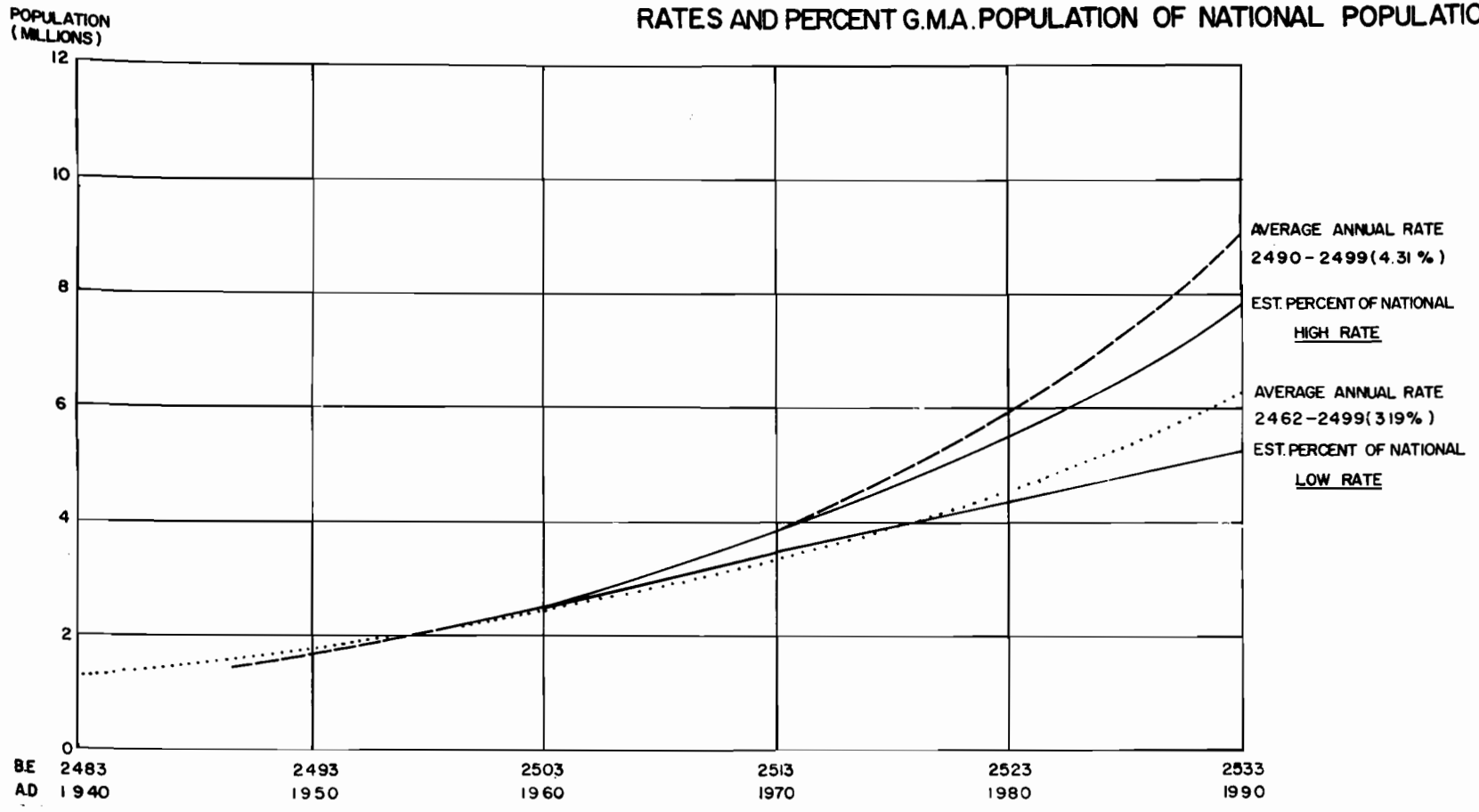
Sources: Data of the City Planning Department, Bangkok. (based on average annual growth rate and percent of G.M.A. population of national population).

In this Table, which presents comparable figures on past and projected growth, the columns headed "High Rate" shows the probably figures if no concerted action is taken to alter the ratios of growth between the Greater Metropolitan Area and the country. Under "Low Rate" is shown the population of the Greater Metropolitan Area which might reasonably be expected if plans for control are formulated and successfully applied.

CHART 10

PROJECTED POPULATION GROWTH G. M. A.

BASED ON AVERAGE ANNUAL GROWTH RATES AND PERCENT G.M.A. POPULATION OF NATIONAL POPULATION



D. Bangkok Social Structure and Pattern of Living

1. Bangkok Social Structure:

All Thai recognize themselves as belonging to a unified culture, of which the religious, political, social and economic capital is Bangkok. All parts of Thailand stand in various degrees of subordination to Bangkok. From the point of view of a unified national social structure, all Thai people would agree that in general people who live in Bangkok have higher social status than people of similar wealth and occupation who live elsewhere, but this is gradually changing now.

Bangkok residents set standards of behaviour, dress, world out-look and creature comforts that are imitated in varying degrees by farmers and provincial Thai who aspire to higher social status, and they can be ranked according to the degree to which they conform or seek to conform to Bangkok ways. The differences between rural and urban social structure are striking. Whereas the Thai village has a virtually classless society, the city has a highly stratified class system. A good number of formal associations exist in Bangkok; virtually none in villages. The criteria for assigning people to different statuses are different in village and city. In Bangkok, a schoolteacher is just another government employee, perhaps a member of the urban middle class; in a village, he would by virtue of his education and occupational role be considered a potential community leader. To achieve higher status in the urban setting, the teacher would have to exhibit additional

qualifications such as money, political power or connections, and distinctive family background; in the rural setting, where few people have any of these things, such qualifications are not necessary.

The rural Thai look up to the standards set by Bangkok, and the urban Thai look slightly down upon the farmers as their "country cousins". The rural population does not stand in the position of a "lower peasant class". It is separate and distinct. The rural population has never been in a condition of serfdom to a feudal lord.

2. Social Classes:

Bangkok society must be viewed in terms of both social classes and ethnic groups. Five classes may be identified:

"An aristocracy" composed largely of descendants of royalty and the old nobility. The major values of this class are based on their belief in birth and breeding, and individuals of this class possess each in varying degrees and with a proportionate feeling of security. Money is important, but its chief importanee is to allow one to live properly. Their residences are likely to be the large compound housing (mansions). (for detail see page 62)

"An elite", comprising the top political, professional and business leaders. This class also believes in birth and breeding. They cannot use their money to buy birth, but they can spend it to acquire the proper aristocratic secular rituals

which they hope will secure them the high rank they seek. Money is very important to them, but they are willing to spend large amounts of it to secure proper recognition for themselves and their children and to marry their children into the aristocratic class above them. They also identify their position with the large compound type of housing. (See page 62)

"Upper middle class", made up of merchants, small business men and white-collar workers. They believe in money and comfort. Some of them know that money is not enough to be at the top. Nevertheless, most try to get more money to gain higher status. They want money for its own sake and because its mere accumulation has value. Their typical residences are the small-lot house, or attached or apartment housing (See page 61).

"Lower middle class", made up mostly of craftsmen and skilled laborers. They also want more money and more comfort. They believe that money and morals are the keys to all of their problems. They are more secure, and most of them have greater psychological security than the people of the upper middle class. They also live in the small-lot housing and attached (row house) housing but are found in the low land-value area. (Refer to page 61).

"Low class", made up of unskilled laborers, domestic servants, peddlers and the like. They care little for education. Money is important but it is not of such importance that a parent would force his children to go to school so that they might acquire an education in order to get better jobs. Money is to be spent and not saved. The poor condition of their

housing distinguishes them from all the classes above. (See page 62).

There is also the large institution of the Buddhist order, whose members are on a level with the top ranks of this pyramidal structure, but cannot really be fitted into it. The king, above all others in the social scale, is in a "class" by himself. (See Plate, "Bangkok Social Structure"). Within the classes, there are two main ethnic divisions: Thai, and ethnic Chinese. Ethnic Chinese are defined as those individuals who speak a Chinese and Thai dialect but identify themselves as Chinese,--including many Chinese who are Thai nationals.

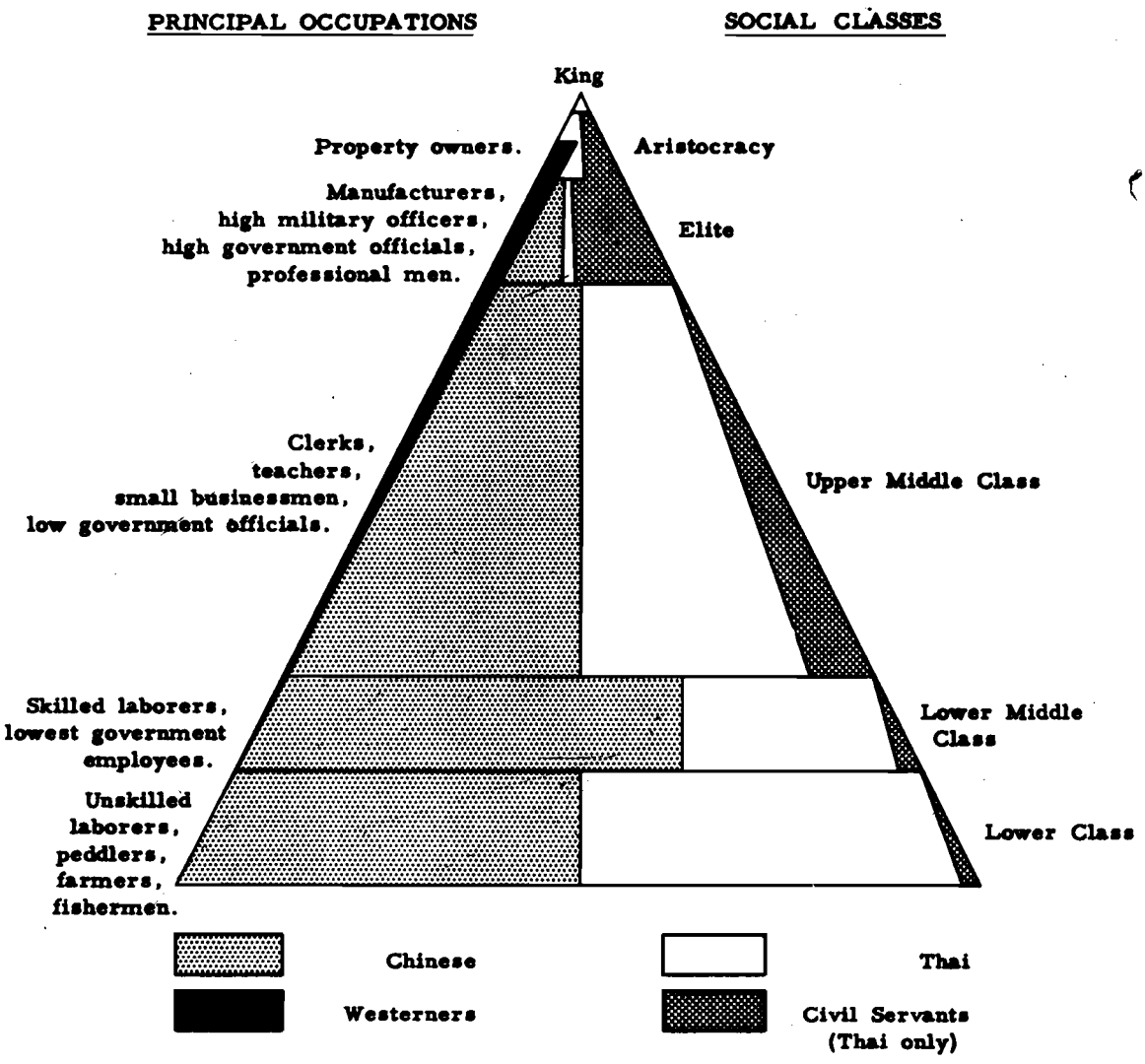
The class system of Bangkok is not drawn along ethnic lines. There are Chinese and Thai in all classes except the aristocracy, which numerically is now very small. The Thai and Chinese members of a particular class may belong to that class for different reasons. In the elite, for example, most Thai belong because of their political power, the Chinese because of economic influence; but they have equal status and prestige. Of the other ethnic groups in Bangkok none approaches the Thai and Chinese communities in size, none has entered so broad a range of classes, and none can compare in importance to the Thai and Chinese groups. However, the small group of Westerners is attaining considerable importance because of the great influence it has in Thai society.

As shown in the Plate,"Bangkok Social Structure", the social classes form the horizontal strata, the ethnic groups the

vertical divisions. Most Bangkok people are aware of general class distinctions and of their own status in relation to others, but large numbers of members of a particular class do not have a strong sense of identity with other members of their own class, because of its openness and its general lack of both acute class consciousness and common class interests. Thus Bangkok society cannot be said to have a class system in the traditional European sense of the term. Moreover, Bangkok society is in no way marked off into static social compartments out of which people never move. Present urban society is characterized by an extraordinary amount of status or class mobility, both up and down the scale: people are constantly changing jobs, changing their prestige and class position, moving in and out of the city. As a result, class lines tend to become blurred and unclear.

The numerical size of the class groups is difficult to determine. A very crude estimate may be made on the basis of occupation, which is a fairly good measure of social status in Thailand, usually indicating economic standing, political power, and amount of education, though not clearly reflecting the other social valuations involved. For purposes of comparison only, it may be estimated that less than one percent of the Bangkok population can be placed within the old elite (including the aristocracy and a few others), approximately four percent in the new elite, possibly fifty percent in the upper middle class, about twenty percent in the lower middle class and approximately twenty-five percent in the lower class.

BANGKOK SOCIAL STRUCTURE

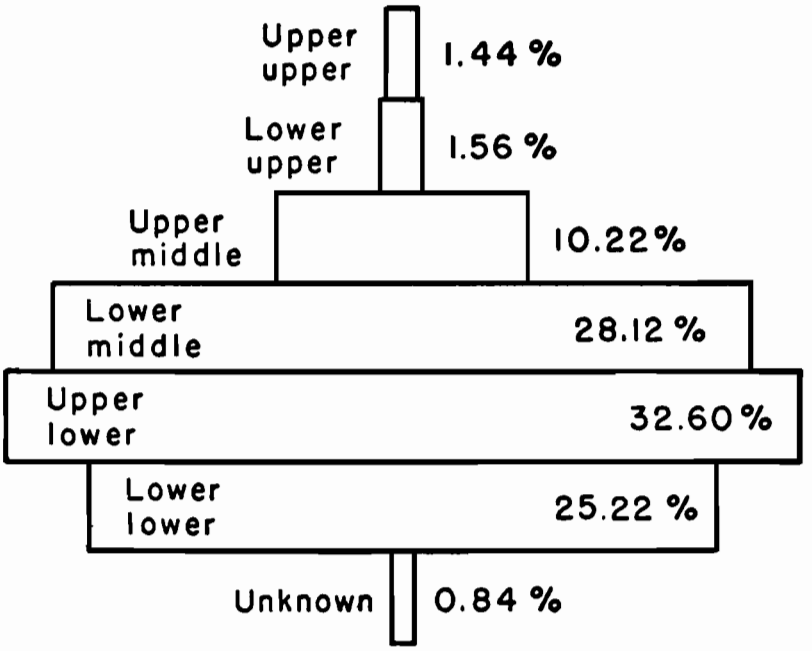


Source: Wendell Blanchard: Thailand

(New Haven, HRAF Press, 1957)

Chart XII

Class Structure in U.S.A.



Class Structure in "Yankee City."

SOURCE: Adapted from W. L. Warner and P. S. Lunt, *The Social Life of a Modern Community* (New Haven: Yale University Press, 1941), p. 88.

3. Patterns of Living:

There are two different standards of living in Thailand -- urban and rural. Ninety percent of the population lives in rural areas. The farmers think that conditions in Bangkok are "better" but they do not envy the town-dwellers' way of life.

Rural: The adequate diet of the rural Thai is an indication of the country's generally ample standard of living. Rice remains the basis of all meals in all classes, but with increased prosperity, a Thai family includes more of other foods in its diet, particularly fish, eggs, meat, vegetables and fruit. Regional variations are slight, although the inhabitants of the north and north-east must often be satisfied with beans, pulses and pork rather than sea-fish. The farmer usually eats three regular meals a day.

A gradual revolution in dress has been occurring as the Thai come more and more to adopt Asiatic variations of western fashions, and traditional dress is gradually disappearing. The women still wear the panung, or phasin, a length of material wrapped around the waist in the manner of a skirt, and worn with a blouse, while the men wear cotton pants fastening around the waist and a polo-necked shirt.

Most rural Thai are remarkably indifferent about their housing. The climate is so mild that elaborate shelter is not required, and heating arrangements are unnecessary except in certain sections of the mountains in the north. Rural dwellings vary from the humble huts of the itinerants to the

elaborately carved teak houses of the wealthy peasants. Although there are relatively not many landless itinerants or outcasts, each village has a few such families from time to time. One general type of house is basic to all rural groups. Bamboo and palm mats are used for its walls, palm leaves for the roof, and ill-fitting wood slats for the floor. A somewhat prosperous family may have a professional carpenter make teak door and window frames, and perhaps also build the eaves of the roof: for those who can afford a little more, the teak is elaborately carved, offering a rather striking contrast to the plain mat walls. The finest rural houses are entirely of teak but it is now increasingly rare to find a new house built of teak, even in the north where once the moderately well-to-do farmer could easily afford it. A farmer in the Central Plain who now builds a new house entirely of teak shows thereby that he possesses great wealth. Regardless of the material used, the style of the house is the same, -- a large central room and small, plain bedrooms, with the kitchens built away from the main dwelling.

Furniture and household goods are much the same in all rural households, -- a low table, a brick or earth-and-box stove, earthenware water pots and water jars, porcelain or aluminium bowls and pots, bamboo or cane baskets, kapok mattresses for sitting and sleeping, a wood chest or two, a Buddha statue and perhaps a loom. More prosperous families will probably have brass bowls instead of porcelain, teak chests, an iron stove. The very prosperous usually have a few pieces such as cane chairs and table.

The compound is a family island, attempting to achieve self-sufficiency. The number and variety of outbuildings in a farmer's compound are an indication of his degree of wealth; the prosperous families may have granaries, animal sheds, a bathing shed, a kitchen, storage huts, houses for servants and extra laborers, perhaps a privy, and a house for the son or daughter who has stayed at home.

Urban: The kind of food eaten in urban Thailand does not differ from that in the rural areas. In Bangkok and its vicinity more vegetables and meat or fish products are eaten. Among the old elite, and most of the upper class, cooking continues to be a traditional art: the women of the family take pride in creating for their guests the sauces, savories, curries, condiments, sweets and desserts which are the variants of the Thai rice diet.

More working-class Thai have begun to wear western-type trousers. Middle-class civil officials are now required to wear either a uniform or the trousers, coat, shirt and tie of acceptable western fashion. Women wear blouses and skirts when working in offices or shopping; for social occasions modified western dress is worn. When lounging or entertaining intimate Thai friends, upper and middle-class men and women are apt to wear traditional Thai clothing or Thai silks. It is now fashionable for women to dress in a different color each day of the week.

The houses of the elite are scattered about Bangkok and in the outskirts. They are surrounded by a walled compound,

in which the attached buildings and servants' quarters are located.

A typical middle-class Thai house in Bangkok is a small two-storey structure with wooden walls and tile roof. The lower floor is usually of concrete. A large veranda or room at the entrance is used for receiving general guests; it may contain a hat tree of deer antlers, a teak table, teak chair or chairs, framed picture of the King, Queen and the parents, and a raised platform with mat and pillows for those who prefer lounging to sitting. A room nearby serves for toilet and bathing. There may be one or two private rooms on the ground floor. The kitchen is invariably apart from the house but connected to it by a covered passage. The family rooms and a room for receiving intimate guests are upstairs; they are generally Thai in style, with a low table, mats, porcelain, chests and so on.

Urban housing, especially in Bangkok, for the laboring and lower-class is mostly the hang tao (row house), or condensed house. The merchants and shopkeepers usually live above their establishments, in what are called the shop-houses. The households of Thai follow a modified pattern of the extended family system.

E. Housing in Thailand

1. Situation before World War II:

Before World War II, housing was not a problem in Bangkok because the population numbered less than 700,000 persons, while land, construction materials and labor were cheap and adequately available. In cities, houses for rent could be found easily at a low rent because building houses for rent was recognized as a good means of investment. In 1945 the total population in the Bangkok Metropolitan Area was 897,886 with a density of 7.09 persons per rai, or 2.83 persons per acre.

Nevertheless, government action in the housing field in Thailand, which was usually limited to the housing of the government's own employees, was intended to develop land-use in this particular area. In Bangkok, the urban housing development sponsored by the city authority consists of two schemes for that government's employees and teachers, with concessional rents. The more important is the Rangnam Estate. Mention should be made of the other interesting scheme, because it was associated with slum clearance. This is the Rajadamnœrn Avenue Project, which was developed on Crown Land. As early as 1943, the previous governments had announced plans to build new housing and modernize existing housing but unfortunately these efforts were halted by World War II.

2. The Present Situation and its Problems:

After the end of the Second World War, some millions of people were left without homes or shelters to protect themselves because of the destruction of the war. In addition, thousands of families lived in crowded, unsanitary habitations. On the other hand, the government had to take into consideration the fact that starvation was the vital problem for the rural people. They were searching for a better place to earn a living for their families, therefore Bangkok was their destination. This added more and more to the number of people in Bangkok, and is one of the many factors of population increase. Another factor is that medical knowledge and technique has increased the life span so that the government has to face a problem of population increase as well. However, the government has increased its responsibility for financing housing, as part of its socio-economic policy. Participation in the work of the United Nations Economic Commission for Asia and the Far East has strengthened the government's policy relating to development of housing programmes. The work of this United Nations organization has helped to find appropriate ways of cooperation among the housing authorities in Thailand, for example by exchange of information through the regional housing centers, studies, researches and so forth.

The seriousness of the problem has forced the government to act. It has announced as its policy in the National Assembly the construction of low-cost housing in order that needy families may have adequate shelters.

The government works with regard to housing welfare in two ways:

(a) through the Ministry of Interior, which is directed by the Public Welfare Department to take charge of the work. After the second World War, construction of houses started in 1949.

(b) through the Bank of Housing Welfare. Operations of this concern have functioned since 1953.

To carry out the work of housing welfare, there are three main programmes to aid the people:

(a) giving mortgage loans to land owners for construction or renovation of buildings,

(b) providing land and constructing houses for the hire-purchase system,

(c) constructing houses for rent.

From the beginning of the project, which is directed by the Public Welfare Department, 4,360 units have been built both in Bangkok and other provinces, at a total cost of 105,965,847 bahts, equivalent to about $5,298,792 (at the rate of 20 bahts to one dollar). #

Report of the housing project, Public Welfare Department, Ministry of Interior

The annual budgetary appropriations for housing projects are:

A. In Bangkok and Thonburi #

Year	Number of House Units	Cost of Construction (in bahts)
1949	6	200,000
1950	93	4,750,000
1951	180	5,000,000
1952	372	7,240,150
1953	214	4,096,000
1954	102	2,531,100
1955	341	12,933,496
1956	464	8,053,270
1957	1,700	30,000,000
Total	3,472	75,804,016

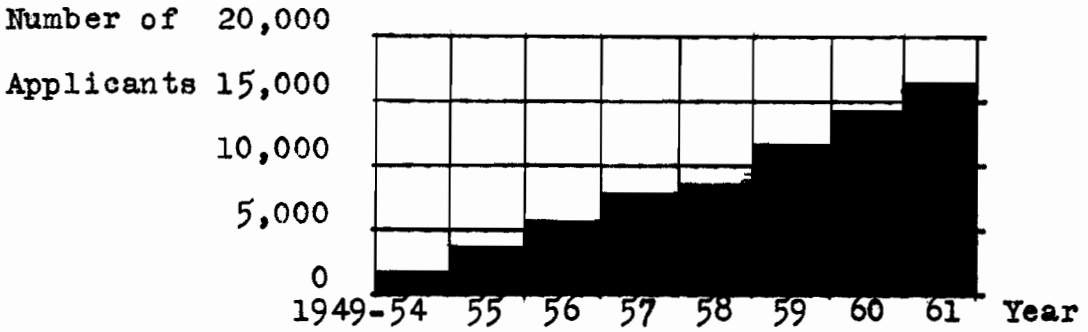
B. In other provinces #

Year	Number of House Units	Cost of Construction (in bahts)
1950	20	250,000
1951	9	407,000
1952	73	1,459,332
1953	302	8,765,098
1954	159	4,971,207
1955	138	2,492,670
1956	110	6,462,000
1957	77	5,354,524
Total	888	30,161,831

Report of the housing project, Public Welfare Department, Ministry of Interior.

Since the number of houses completed under these projects is still small, the needs for housing have been widely left unmet. The number of applicants for houses in Bangkok and Thonburi only in the year 1961 is 16,000.

Number of Applicants in Bangkok and Thonburi
1949-1961



The number of people, compared with the number of houses existing in the municipal areas of Bangkok and Thonburi is:

Year	Population	Number of Houses	Average Number of Persons per House
1951	1,020,300	136,108	7.50
1952	1,073,828	141,942	7.56
1953	1,171,658	150,905	7.76
1954	1,231,403	158,070	7.79
1955	1,312,960	167,641	7.83
1956	1,430,651	210,032	6.81
1957	1,344,803	213,513	6.30
1958	1,622,461	222,050	7.31
1959	1,725,566	232,639	7.42
1960	1,800,378	240,768	7.48

The average population density in Bangkok-Thonburi is 13.07 persons per rai, or 33.07 persons per acre, but differs in various amphurs. In amphur Sampantawong, the population density is 96.28 persons per rai or 243.49 persons per acre; Pornprab has 85.74 persons per rai or 217.09 persons per acre; and Pranakorn has 37.85 persons per rai or 95.89 persons per acre. (See Table XIIIA)

Table XIIIA

Population Density, Bangkok-Thonburi

B.E.2499(1956)

	Population	Area	Density per rai	Density per acre
GRAND TOTAL	1,474,455	112,819	13.07	33.07
G.M.A. Pranakorn:	1,127,923	80,838	13.95	35.31
Bangrak	100,466	2,499	40.20	101.79
Sampantawong	84,247	875	96.28	243.49
Pomprab	129,385	1,509	85.74	217.09
Patoomwan	145,499	5,036	12.81	32.41
Pranakorn	128,876	3,405	37.85	95.89
Bangkapi	10,127	3,273	3.09	7.83
Prakanong	104,918	25,698	4.08	10.33
Yannawa	134,096	17,345	7.73	19.56
Dusit	285,814	18,028	15.85	40.12
Bangkhen	4,545	3,151	1.43	3.63

3. Housing Standards:

Residential areas include all areas occupied by housing, except where commercial (shop-houses) or industrial use is combined with the living quarters and is dominant, or more important than the provision of housing. The total land area devoted to residential use in Bangkok is 27 percent (22,221 rai), while in Thonburi only 16 percent (4,287 rai) of the municipality is used in this way. It is interesting to note for comparative purposes that 39 percent of the total land area of highly industrialized city in North America # is devoted to residential land use.

Classification may be made within the residential area in this way:

(1) Farmers' housing --

Metrop'n Area	1,625 rai,	1.5% of total Metrop'n A.
Bangkok	1,554 rai,	1.9% of Bangkok Municip'y
Thonburi	71 rai,	0.3% of Thonburi "

The farmers' indigenous housing is usually built on piles and raised about 2.00 metres off the ground. The surrounding small plot of ground is often fenced, and there is usually a threshing ground and a place for rice storage. Chickens and ducks live in and around the compound and the water buffalo spends the night in an adjacent shed. Generally, the structure has walls of wood, and a roof of palm-thatch, or

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Philadelphia, Pennsylvania

corrugated galvanized sheet or corrugated asbestos sheet, and is owner-built. These farmers' houses are usually found strung out or in clusters along the bank of the klongs (canals) or in clusters a short distance from the klong. The klongs provide both water supply and the means of transportation by boat. The farmhouse is found within the municipalities of Bankok and Thonburi, but it is a minor housing type.

(2) Small lot housing --

Metrop'n Area	6,671 rai,	6.2% of total Metrop'n A.
Bangkok	4,345 rai,	5.4% of Bangkok Municip'y
Thonburi	2,326 rai,	8.5% of Thonburi "

The single small lot house is generally an improved wooden variation on the native indigenous housing described above as "Farmers' housing". Improvements consist of the use of innumerable variations of more lasting construction material, such as concrete piling, shuttered windows, etc. For the most part, they are found more in Thonburi, mainly along klongs and in fruit gardens. This type of housing unit accounts for 50% of the total residential area in Thonburi, but only 19% of the total residential area in Bangkok. This is a complete reveraal of percentages from those shown in the compound type of housing described above.

(3) Condensed housing --

Metrop'n Area	8,853 rai,	8.2% of total Metrop'n A.
Bangkok	7,571 rai,	19.4% of Bangkok Municip'y
Thonburi	1,282 rai,	4.7% of Thonburi "

The condensed housing type appears to serve as the living quarters of the low-income groups in Bangkok-Thonburi. The housing type prevalent in these areas seems substandard, overcrowded, and in many cases, blighted. Many of the residents appear to be in-migrants from the rural areas who build the type of indigenous house which is common in the villages. The relatively high land cost and the resulting high land rentals are probably one of the principal causes of overcrowding.

(4) Compound housing --

Metrop'n Area	9,089 rai,	8.4% of total Metrop'n A.
Bangkok	8,564 rai,	10.6% of Bangkok Municip'y
Thonburi	525 rai,	1.9% of Thonburi "

The compound type of housing is practically limited to the upper-middle and upper classes and to foreigners. A strong fence or wall for the dual purpose of security and privacy encloses these western-influenced houses and forms the compound. In addition to the principal dwelling unit, the compound includes a kitchen, either as part of the main house or separate, servants' quarters, garages and other auxiliary buildings. The size of the lot ranges from 600 square metres to 2 or more rai. The vast majority of the housing found in the newer residential area of Bangkapi and Bangsue is the compound type. The houses are usually situated on dead-end lanes, the width of two cars. This type of housing is also found intermixed with other housing types in the older residential areas. Compound housing comprises almost 40% of the total residential land area of Bangkok, but only 12% of the total residential area in Thonburi.

(5) Attached, apartment housing --

Metrop'n Area	270 rai,	0.3% of total Metrop'n A.
Bangkok	187 rai,	0.2% of Bangkok Municip'y
Thonburi	83 rai,	0.3% of Thonburi "

The attached housing type, or row house, plus the appartment type, have little acceptance as shown by the land area findings above. The popularity of apartment houses has grown since the end of Worl War II. Most of the attached housing is found in government housing projects, sponsored by the Welfare Department, the Ministry of Interior, the Department of Railways, the Ministry of Communications or the Thai Tobacco Monopoly, the Siam Cement Company, etc.

(a) Size and number of habitable rooms:-- Most regulations specify the minimum amount of floor space to be provided per person. This may be in terms of cubic volume of air space or preferably floor area, the ceiling height being defined separately.

Minimum sizes are given for single and double bedrooms and for living rooms. The actual number of rooms provided depends on the size of the family. The minimum size of a room should be determined by its use. In the Bangkok Municipal law, the minimum floor area for single bedrooms is mentioned as 9 square metres (100 square feet). Bangkok municipal law also mentions that the smallest house should have at least two living-sleeping rooms.

A reasonable basis for determining the number of rooms is

that of sex segregation. Except for husband and wife, two persons over 10 years of age and different sex should not sleep in the same room. It is generally recommended that not more than four persons of the same sex should sleep in one room which has an area of about 16 square metres (170 square feet).

(b) Height of ceiling:-- Two main considerations govern ceiling heights, -- adequate head room and comfort. Bangkok municipal law requires that ceiling height be between 2.5 and 3 metres (8.4 to 10 feet). For comfort in a warm climate, the ceiling should be cool, and this will depend on the construction system of the ceiling and the roof. Where the ceiling temperature is about the same as the room air temperature, the high ceiling is enough. Where there is no ceiling or the ceiling temperature is warmer than the room, heights become important. The minimum ceiling heights should be related to the kind of roof used, roof material and the ventilation system.

(c) Openings: -- Thailand is a humid tropical country with strong sunshine alternating with cloudy skies, especially during the middle part of the day, and the light can be very bright. The window being the usual main source of light, the bright-blue sky seen outside creates a strong contrast with the surrounding wall, causing a sensation of glare. This reflection of the sun can be reduced by means of a sun-breaker in the horizontal and vertical line.

Many regulations specify a minimum window area for habitable rooms, generally expressed as a percentage of the floor area.

Bangkok Municipal law requires that the opening be not less than 10% of the floor area.

(d) Ventilation: -- For health reasons there must be a minimum amount of fresh air supplied to a room by means of cross ventilation, which is extremely important, especially in Bangkok. Thus the correct orientation is absolutely important so as to make use of prevailing winds. For this reason, adequate ventilation is provided for in the Bangkok Municipal Law.

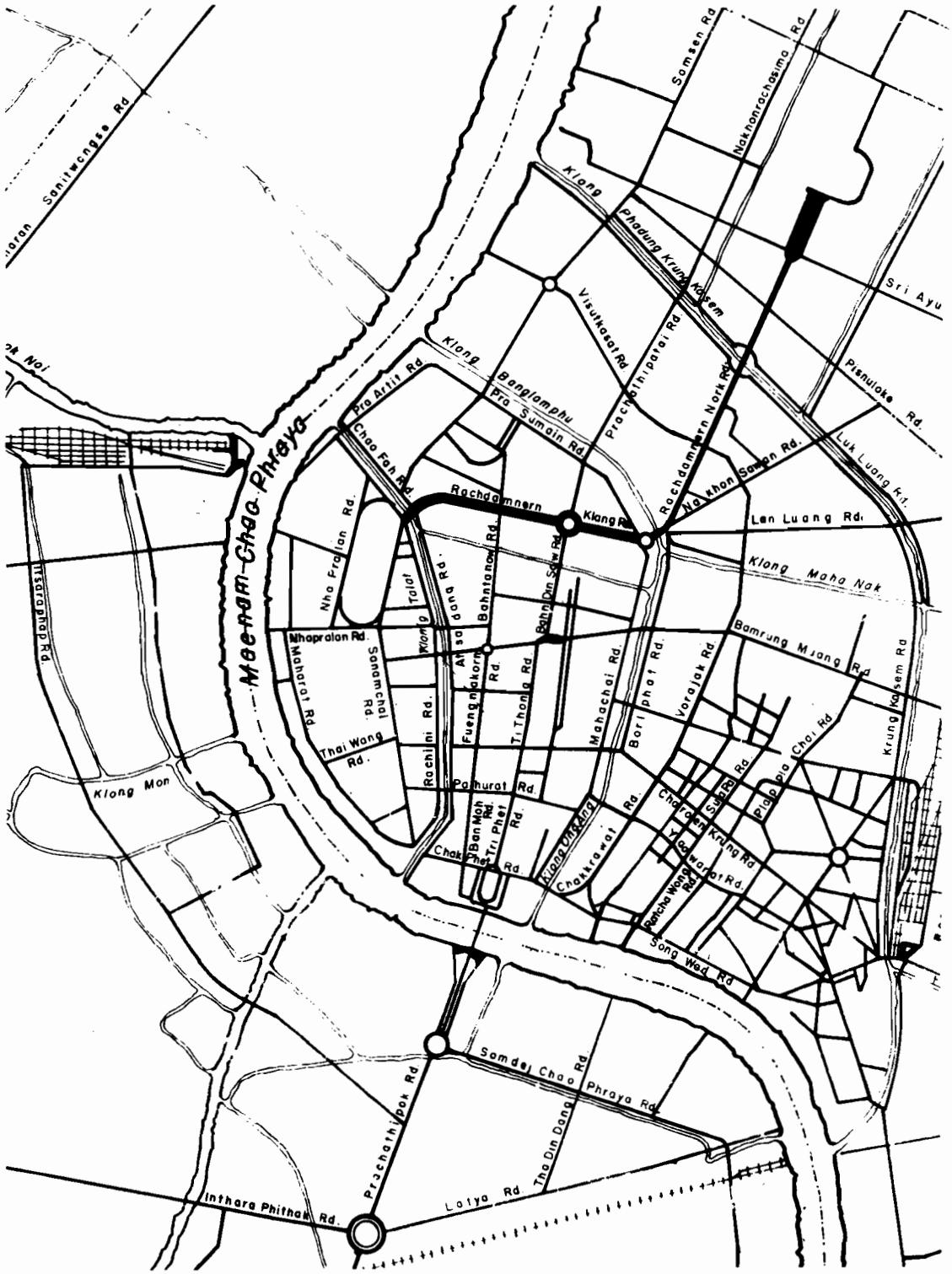
PART II HOUSING RE-DEVELOPMENT ON A SELECTED PROPERTY

A. Building Site

1. Location:

The selected site is located in the western part of Bangkok, in the old city section, Tambol Phra Baroam Maha Rajawang, Amphur Phranakorn on the bank of the Chao Phraya river, about 300 metres in length along the river, and 150 metres wide from the Manam to Maharaj Road. It is therefore convenient to transportation on both land and water. If we stand on the site and look to the north we will see the Tha-tion Market and shops, with a large number of attractive stores to serve every need for various kinds of fresh food, vegetables and meats. From here to the Grand Palace is a distance of about 500 metres. The southern part of the site is close to Rachinee (Queen) school, and beyond this school about 200 metres, there is the market for fresh fruit. Beyond the market is the Praput Yoadpha Bridge, which is one of the most distinctive landmarks of Bangkok. Now if we look at the Maharaj Road direction, we find that near this road to the east is the Wat Phrachettuporn Monastery. This monastery is said to be the first ancient temple-university of the ancient Thai people. In the southeast part are located the Ministry of Economic Affairs and the Police Station. To the west is the Chao Phraya river which is the cardinal river of Thailand. When we look across the river, the Temple of Dawn with its colourful spire pointed against the blue sky, and the gentle

Map 3



NAME: BANGKOK–THONBURI METROPOLITAN AREA
(Simplified)

breeze from the river make the whole atmosphere most pleasant.

2. Ownership:

This site is the property of the crown (Crown Land). If we look at the financial statement of His Majesty's Property Office itself, we can see that not much was received from the tenants at all, -- about 40 baht ($2.00) a month for each room. The outstanding fact is that this site is in a desirable location in every way, as explained above. Because of this fact, it cannot be denied that at present the revenue earned by His Majesty's Property Office and the standard of living of the people on this site are not at all well balanced according to the land value and surrounding conditions.

If His Majesty's Property Office would make use of this land by appropriate construction, there is no doubt at all that more profit will be derived from this site, and especially as it belongs to the crown, there will be no problem of compensation for clearance. No process of law would be required, since His Majesty's Property Office could provide new residences for the tenants. His Majesty's Property Office may realize the fact that high-rise apartments not only can make a profit but also create a high density of population in this specific site as well as keeping a balance with the circumstances of a dynamic society.

3. Neighbourhood conditions:

Type and character of existing buildings -- The buildings

Map 4

NAME : BANGKOK-THONBURI METROPOLITAN AREA

in this area consist of two-storey houses, row houses and shop houses which date back sixty to eighty years. The general condition of the buildings is usually poor and suffers from lack of maintenance.

In the case of the row house or shop house, the wall-bearing construction is about two or three bricks thick, and diamond-cement tile is used for the roof. But for the wooden two-storey houses, skeleton construction is the most popular. The second floors are hardwood, while the partitions are generally made of soft-wood. The roof may be either diamond-cement tile or corrugated galvanized sheet. The other two types of building mentioned have the first floor close to the ground and made of concrete. This type of flooring is often used when manufacturing is done in the family dwelling, or for small stores, where the business of selling is carried on. Sometimes the first floor serves as the dining-room, sitting room, and the kitchen is at the back near the bathroom and toilet. The second floor, which is made of wood, contains the bedrooms.

Population -- As mentioned before, this site is the property of the crown. Therefore the people who live here are tenants and the rent is very low. The total population in this area is approximately 1870 persons in 57 rai and the density is about 33 persons per rai. The majority of the people here are Chinese and belong to the low-income group. They earn their living by selling small, variety goods and carry on their business or manufacture within the household. The total

in each family is quite crowded, -- more than 8 or 10 members. (See Table XV) These crowded conditions may lead to ill-health and unhygienic sanitation. The whole situation seems undesirable and untidy. In the same manner, the possibility of infectious diseases and epidemics in this area is very high.

I personally have a strong feeling that these buildings should have been torn-down or re-developed because the buildings themselves should not be used any longer. Otherwise, it will be most dangerous for the tenants.

Table XIV

Population of the Selected Site

Number of Families	Males	Females	Total
202	1,032	838	1,870

Table XV

Family Composition

Number of Persons per Family	Number of Families	Number of Persons	Number of Persons per Family	Number of Families	Number of Persons
1	4	4	13	11	143
2	7	14	14	2	28
3	11	33	15	5	75
4	13	52	16	4	64
5	16	80	17	4	68
6	13	78	18	2	36
7	18	126	19	6	114
8	15	120	20	6	120
9	25	225	21	4	84
10	10	100	22	2	44
11	8	88	23	4	92
12	6	72			
			Total	202	1,870

Average: 9.2 persons per family

Zoning Laws -- At present, the site is used for residential purposes and there is no possibility of changing this even in the future. It cannot be a commercial or industrial area because:

--it is too far from the commercial centre

--the fact that the site itself is too small

--it is crown land

--it would not suit the surroundings, e.g. the Grand Palace, monastery, Government Offices and schools.

--it is restricted by law; the industrial section must be located out of the city.

As for the height of the buildings, this does not conflict with the laws on housing standards of Bangkok municipality. Therefore, constructing high-rise apartments on this site would present no problem with the law or with the city-planning program in Bangkok.

4. Nieghbourhood facilities:

(a) Commercial centre and shopping districts --

Availability of employment Because the surroundings of the site include government employment areas, shopping district and commercial centre within a radius of one or two kilometres from the site, it is easy for residents to look for jobs around the neighbourhood.

Shopping facilities On Pahurat Road, Chalern Krung Road and Yoawaraj Road (about 300 to 800 metres from the site) there are shopping districts full of various goods at reasonable price.

About 100 metres away from the northern part of the site there is a fresh food market; the fresh fruit market is about 150 metres south of the site. These are within walking distance for the people who live in this area. Those who do not like to walk can take any public transportation to the other points mentioned.

(b) Theatres -- There are a lot of first class theatres in a radius of one kilometre from the site, such as Chalermkrung Theatre 400 metres from the site, Empire Theatre on Chakraphong Road 150 metres from the site. Queen Theatre, King Theatre and Grand Theatre in the Wan Burapha shopping centre district about 550 metres from the site. Besides that, there are two theatres on Yoawaraj Road, one on Chareankring Road and the other on Mahachai Road.

(c) Schools -- In the southern part is Rachinee School, one of the most famous girls' schools in Bangkok, teaching from Grade 1 to 12. The Sunkurab School is about 250 metres from the site. It is a famous boys' school with Grades from 1 to 12. The Sawapa girls' handicraft school and a school of art and handicraft for boys are near the Sunkurab School on Chakrapet Road. The Bophitpemuk commercial and accounting school for boys and girls and the Chakrawat School (Grades 1 to 6) are on the Chakrawat Road.

North of the site, there are the Thantronchit commercial school in Wat Poo, Mahatad school for boys (Grades 1 to 6) on the Tha Prachan Road. Beside this road is located Thammasat

(political science) University. Across this road and the Chao Phraya river Siriraj Medical University is located. The Fine Art University is located on the Nha Pralan Road.

East of the site are the Banjama Racharai girls' school which teaches from Grade 6 to 12, on Unakan Road and also Satri-Vitaya girls' school (Grades 6 to 12) on Rajadamnern Road.

Distances are not too far for walking, or there is bus service if desired, because both the schools and the universities, as explained, are located in a radius of one or two kilometres from the site.

(d) Churches or temples -- In the surroundings there are many Wats or Temples or Monasteries. A short walk across Maharaj Road about five minutes to the east is Wat Prachettuporn which is the royal monastery; a walk of about 900 metres leads to Wat Rajapradit, next door is Wat Rajbopit and one block beyond is Wat Sutat Dheb Vararam. All of them are most important historical monasteries. To the west just across the Chao Phraya river by boat, about five minutes away, Wat Arun Thebvararam (Temple of Dawn) is on the left bank of the Manam river and next to the right is Wat Kalyanamitra in the province of Thonburi. To the south, there is Wat Rajburana at the foot of Praput Yordpha Bridge. It is available for all the people who might live in the high-rise apartments and it is very convenient to go anywhere in only five or ten minutes.

(e) Hospitals and clinics -- There are quite a number of private clinics along each side of the Chakraphong Road, such as the

dental clinics, medical clinics and drug stores (pharmacies). If a specialist is required, the specialists' clinics can be reached in five minutes by car, and fifteen or twenty minutes by bus or tram. A lot of specialists' clinics and optometrists' clinics are in the Van Burapa shopping centre district.

As to a General Hospitals, Siriraj Hospital is located on the left side of the Chao Phraya river opposite to Thammasat University. Its capacity is about 1,000 beds. It can be reached by two means, either by boat from the site, taking about half an hour, or about six minutes by car to Prachan ferry yard at the end of Tha Prachan Road, then across the river by boat or ferry, taking about five minutes. To go directly by car, crossing the river by Brabhudha Yodpha Bridge to Thonburi, takes about half an hour.

(f) City services --

Garbage and trash collection Bangkok municipality provides a service of garbage disposal daily in Bangkok-Thonburi metropolitan area. In the high-rise apartments to be built, there will be incinerators and garbage containers on the ground floor to make it easier for garbage collection.

Police and fire protection This site is located near the police station, in fact only 150 metres away; the police department provides policemen on patrol on land both day and night, and there is also police patrol along the canal and the river.

For fire protection there are two fire stations near this site; one is on Shana Sonkram Road, about 1500 metres northeast of the site; the other one is on Mahachai road about 700 metres

to the southeast of the site. In addition there will be a fire jet head in the site of the high-rise apartments also.

Street Cleaning and lighting Bangkok municipality provides enough street-cleaners and a street-cleaning car which collects even pieces of paper and dust, so that clean streets can be expected.

On both sides of the footpath, electric lamp poles are equally spaced 50 metres apart, with sufficient intensity of light for walking and driving at night.

(g) Parks, playgrounds and public libraries -- About 900 metres north of the site is Pramain Ground, in area about 12,000 square metres, which is the place for week-end or sunday markets where gardeners, farmers or others sell such goods as fresh fruit, fresh food, flowers, small plants, small domestic animals etc. at a low price. In summer, the municipality devotes this ground to outdoor games such as kite-flying, Tha Kro or football. People may spend their evenings watching kite-fighting, which is a famous tropical game. They may sit on folding chairs, drinking, eating or talking together. Since these Grounds are located where they are exposed to the wind all the time, they are a very pleasant place in the summer.

To the northeast is Dusit Park in combination with the Zoo, an area of about 360,000 square metres. To the south in the Brabhudha Yordpha district there is a small park, with many coloured flowers and decorative fountains. People may spend their leisure time here.

Playgrounds for children will have to be arranged within the boundaries of the site for the people who will live in the high-rise apartments. The primary aim of parks and playgrounds here is to encourage them to see the value of maintaining physical and mental health in normal conditions as much as possible, by means of exercise or other outdoor games.

5. Accessibility:

(a) Public transportation by bus and tram --

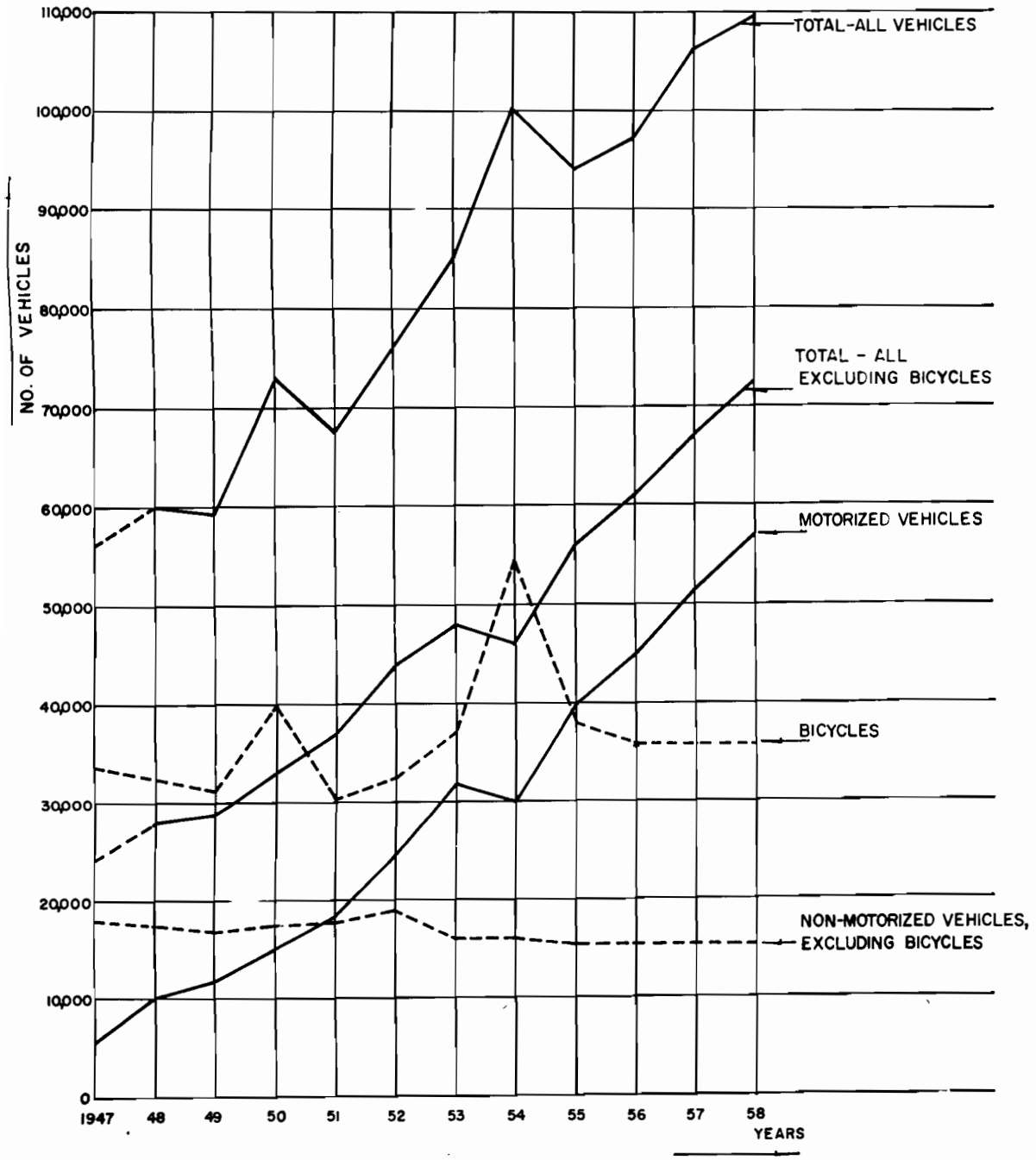
Walking time from site to bus stop The site is convenient for transportation lines. For instance, the tram and the bus are part of a regular service. The bus stop and the tram stop are close by on Maharaj Road. Bussservices are provided for every road and lead to various parts of Bangkok, e.g. at Atsadang Road, about 200 metres or three to five minutes' walk from the site; at Triphet Road, near Praput Yoadpha Bridge, about eight or ten minutes walk from the site, etc. A general examination of transportation shows that around the site the situation is satisfactory.

Fares The tram fare is about 10 stang (equivalent to ½¢) per kilometre. The bus fare is 50 stang (2.5¢) for a trip as far as the bus goes. We have no system of transfers like Montreal, and passengers have to buy a new ticket every time they change buses. It costs a lot to travel a long distance not covered by a single bus service.

Frequency, speed and adequacy of services The tram service is every five minutes; its speed is about 20 to 25 kilometres per hour. The bus service is every five or ten minutes; its speed

CHART 13

VEHICLE REGISTRATIONS 1947-1958
BANGKOK · THONBURI PROVINCES

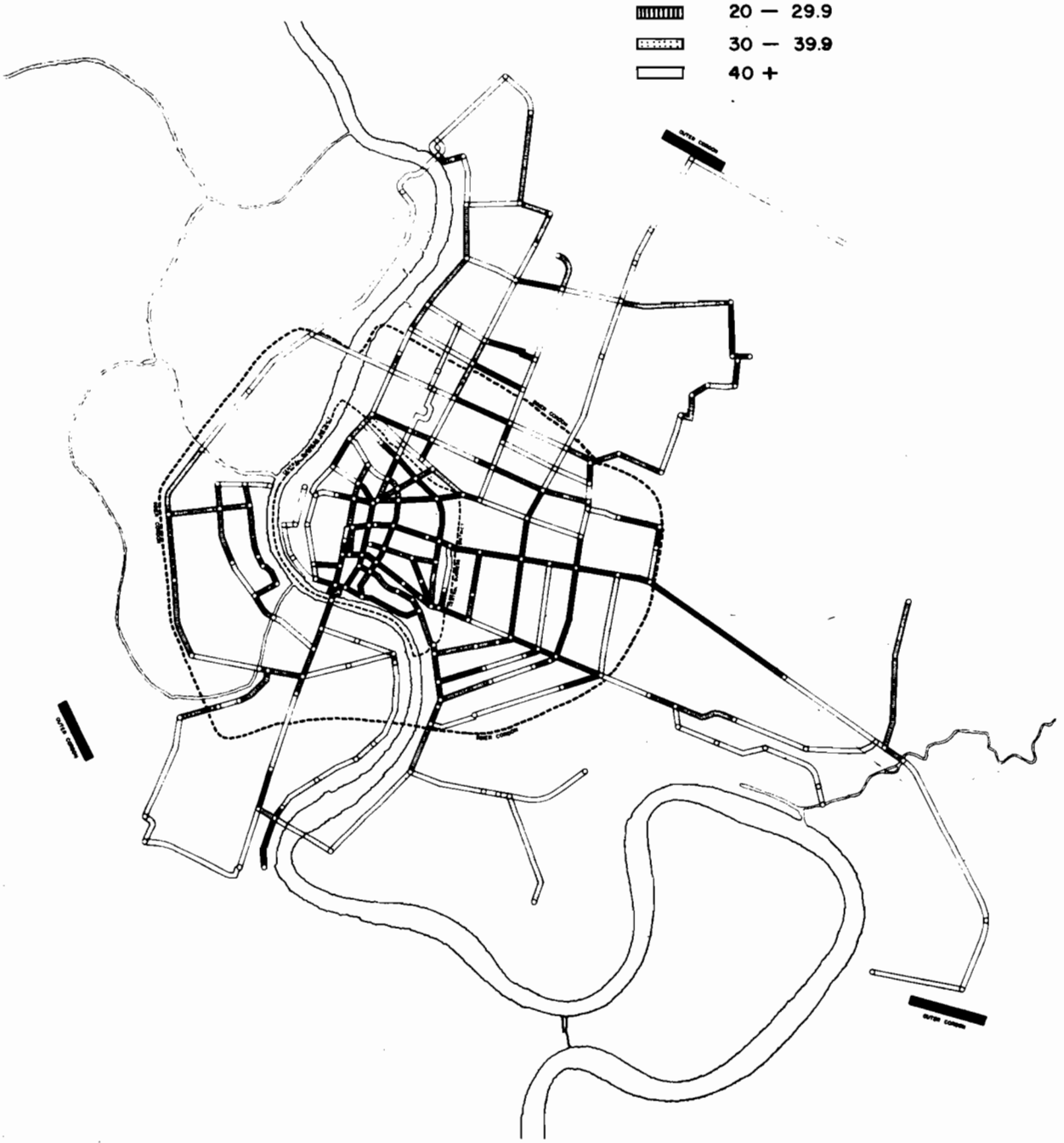


Map 5

PEAK HOUR TRAVEL TIME 1959
BANGKOK · THONBURI

Map 6

AVERAGE ROAD SPEED 1959
BANGKOK · THONBURI



is 40 kilometres per hour.

The total number of buses and trams is adequate to meet the demands of the people. The statistics of the Vehicle Registry Office of the Police Department of Bangkok show that in 1958 there were 1,840 buses, 156 trams, 6,109 taxis and 6,618 motor-tricycle taxis.

Travelling time to usual destinations Travelling time depends on the distance to be covered. Some examples show the time by bus from the site to various other parts of Bangkok:

- 15 minutes to Banglampoo, shopping centre to the north;
- 1 hour to Bangkapee, the district of separate houses of moderate and high-income people, in the eastern section of Bangkok;
- 30 minutes to Thonburi railway station
- 10 minutes to Van Burapa shopping centre and theatre south-east of the site, etc.

Therefore the time consumed in travelling for people living on this site is not at all great, and makes it one of the most suitable places to live.

(b) Taxi Services -- There are two kinds of taxi; one is an automobile, the other is called a motor-tricycle (motor-samlor). The total number of taxis in 1958 was 6,109. At present there must be more than 8,000 of them. Unlike cities in western countries, Bangkok has the other form of taxi in addition, the motor-tricycle, which can accommodate at least two or three passengers. Statistics show that there were 6,618 motor-tricycles in 1958. The figure to-day may have risen to 7,000 or 8,000.

The taxis have a taxi metre system (but radio cars are not common yet). The minimum charge is about 3 bahts and 1.5 bahts for the next kilometre. For the motor-tricycle, the price is usually agreed on between the passenger or rider and the driver. The average price is not more than 1 baht per kilometre.

(c) Convenience for Private Cars --

Capacity and type of public road Generally speaking, the streets in Bangkok are two-lane or four-lane. Some of them are six or eight lanes. The traffic system of rules and regulations, parking hours, one-way traffic, etc. depend on the heavyness of the traffic.

Parking Space Usually, drivers can park on one side of the street, or on both sides if that street has no tramway and if the street is wide enough. On some streets there are parking metres, which cost 50 stang per hour.

To provide parking area for the high-rise apartments, one space for each family within the limited site would have to be allowed.

B. Physical Features

1. Topography:

(a) Amount of Grading Required -- According to the land of this site, which is flat, and the houses, which are small and old, grading will not be necessary. Some money will be required for clearance. The cost of tearing down is not more than

20,000 bahts ($1,000) and probably this money would not have to be allowed at all, depending on the contract between the owner and the contractor. The latter may acquire the material, bricks, etc., which is torn down, and may be worth the price of the work. Sometimes the contractor may gain more profit than he expects. So it is hard to estimate the cost of the clearance, because an accurate estimate must be related to the real condition of the buildings and must be carefully calculated.

(b) Need for Retaining Walls -- The site is located near the Chao Phraya river but it already has a retaining wall along the side towards the river, and this would not require rebuilding.

(c) Natural Features -- This land is in rectangular shape, 150 metres wide and 300 metres long. It is flat and there is no contour. The west side faces the Chao Phraya river. The surface is loamy soil. There is a small number of trees in the southern part of the site, but the northern part has no trees because the two-storey row-houses in that section are crowded together. The water table is two metres below the ground surface.

(d) Surface Drainage Conditions -- The surface drainage conditions are good, because it is near the river, and is therefore easy to drain.

2. Soil Condition:

The soil condition is common in Bangkok. The surface is loamy soil and clay. The soft soil strata are mostly found

some six or seven metres below the surface and have a depth of three or four metres. The bearing value of the soil indicates that it may safely carry four to six tons per square metre; if a heavier load is required, it is necessary to introduce the friction pile. This method can be calculated from the results of soil tests. According to the Siam Cement Company and the Faculty of Engineering, Chulalongkorn University, tests were made by boring the soil at the site of Bangkok Beer Factory and Thammasat University (both of them near the Chao Phraya river) to the 22 metres depth, and taking another sample of soil from various depths. These were incubated in the soil laboratory of the Chulalongkorn University. The results are:

Sample No.	Depth	Water Content in percent	Maximum Compression Stress #
1	3.00- 3.50 m.	94.13	0.133
2	8.00- 8.50 m.	85.40	0.28
3.	12.00-12.50 m.	53.33	0.3577
4.	16.00-16.50 m.	31.17	4.26
5.	22.00-22.50 m.	30.83	8.00 more

The result of maximum compression stress from the Faculty of Engineering, 1962.

The friction of the pile can be calculated from this soil-test by the following method:

Ex 1. from sample No. 2 at 8.00-8.50 m. depth from surface,

Maximum compression stress 0.28 kg/cm^2

Shearing stress $\frac{0.28}{2} = 0.14 \text{ kg/cm}^2$
$= 1400 \text{ kg/cm}^2$

Use factor of safety (F.S.) 3

Allowable friction between piles & soil $\frac{1400}{3} = 466 \text{ kg/m}^2$

Ex 2. from sample No. 4

Maximum compression stress 4.26 kg/cm^2
Shearing stress $\frac{4.26}{2} = 2.13 \text{ kg/cm}^2$

$= 2130 \text{ kg/m}^2$

Allowable friction between pile & soil $\frac{2130}{3} = 7{,}100 \text{ kg/m}^2$

Ex. 3. from sample No. 5

Maximum compression stress 8.00 kg/cm^2
Shearing stress $\frac{8}{2} = 4 \text{ kg/cm}^2$

$= 40{,}000 \text{ kg/m}^2$

Allowable friction between pile & soil $\frac{40{,}000}{3} = 16{,}667 \text{ kg/m}^2$

Average friction $\frac{466+16{,}667+7{,}100}{3} = 8{,}077 \text{ kg/m}^2$

Using concrete pile size 35x4x14 $= 19.6 \text{ m}^2$

Friction of long pile (22 m.) $= 19.6 \times 8{,}077 = 158$ tons

Amount usually used is only 50 tons

The best method to-day to get the safe load-carrying capacity of cohesive soils is the determination of the shear strength by the so-called VANE TEST, in which the vane (two plates in a cross) is rotated horizontally at the end of a drilling rod. The torsional movement determines to shear strength C (acting on the surface of the solid cylinder cut the rupture provided that the time of applying the movement until rupture is at least one minute.

In fissured clays (as from the bottom of the Chao Phraya river in Bangkok) the vane test may lead to too high a value for load-carrying capacity because it cuts (cylindrically) through homogeneous soil parts, whereas an actual, large rupture surface (that is, sliding surface) will follow the

fissures to a great extent. For such clays, the shear strength should be measured on small undisturbed samples cut into specimens the diameters of which are half their height.

If the shear strength is C (f/m^2) the ultimate load-carrying capacity of a square or circular footing is p=6.2C. The analogous expression for a continuous footing is p=5.2C. In order to obtain the permissible pressure, the above-mentioned ultimate figures should be divided by a safety factor of at least 2.5 or 3, unless conditions are studied carefully by specialists. #

3. Foundation Conditions:

Foundation design in Thailand is complicated by the fact that a great variety of soils is met with, from soft silt soil which may safely carry four to six tons only per square metre, to excellent building grounds which may safely carry ten or fifteen times that load, disregarding firm rock, which needs of course no precaution beyond a survey of attack from weathering, dangerous cracks, cavities etc.

The soils met with in the delta of the Manam river improve in load-carrying capacity with their geological age, i.e. roughly speaking with their distance from the Gulf of Thailand. As an example, it may be safe to load the soil with four tons per square metre in the area of the new Bangkok harbour,

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from the research of the Siam Cement Company and the Concrete Product and Aggregate Company, Limited.

with five tons per square metre in the centre of Bangkok, and with six tons per square metre just north of Bangkok, for instance at Bangsue, whereas going a further 100 km. north to Ta Luang, twenty or thirty tons per square metre may be safe figures to reckon with.

Another complication is met with in and near Bangkok and no doubt at other places too in the Manam delta, namely the peculiar exceptionally soft soil strata, mostly met with some six or seven metres below the surface and having a depth of three or four metres or even more, necessitating pile foundations to penetrate well below these strata.

Spread footing As long as it is feasible to carry the load from the structure in question, i.e. the net foundation load (which is equal to the structural load plus weight of foundation less weight of displaced soil) by spread-footing, without the net foundation pressure (= $\frac{\text{net foundation load}}{\text{area}}$) exceeding the permissible value, such foundations will normally be most economical.

Column footing In the case of column footing they may be made still more economical by changing the old-fashioned crosswise slab reinforcement. Such foundation slabs, if made circular, will actually require no reinforcement except a ring at the perimeter of the slab, provided, however, that the column will not shear itself through the slab. The saving in reinforcement, compared with standard practice, is quite substantial.

Raft foundation If several separate spread-footings and column footings cannot carry the structure in question, piles may be driven under the footings or a raft foundation may be made, or in cases of exceptionally heavy loads, the raft foundation may even be strengthened by friction piles. Raft foundations, the principle of which is outlined below, are admittedly expensive but, on the other hand, they safeguard better than any other type of foundation the structure to be carried against uneven settlement and unsightly dangerous cracks. They should therefore be used more often than is actually the case.

Long piles, preferably at least fifteen metres long, will on the other hand, materially help in carrying heavy structures. If the pile heads always remain in moist soil, wooden piles will serve the purpose as long as they are cheaper than reinforced concrete piles or pre-stressed concrete piles, but otherwise concrete piles should be specified (since steel piles are in most cases out of the question in Thailand because their price is very high.) The newly introduced 18x18x700 cm. prestressed S.C.C. concrete piles, supplied with steel caps, whereby several piles can easily and quickly be joined during driving, should meet a demand for long concrete piles which are easy to transport and do not require an expensive pile-driver. Such composite piles can however take neither any horizontal forces nor upward pull.

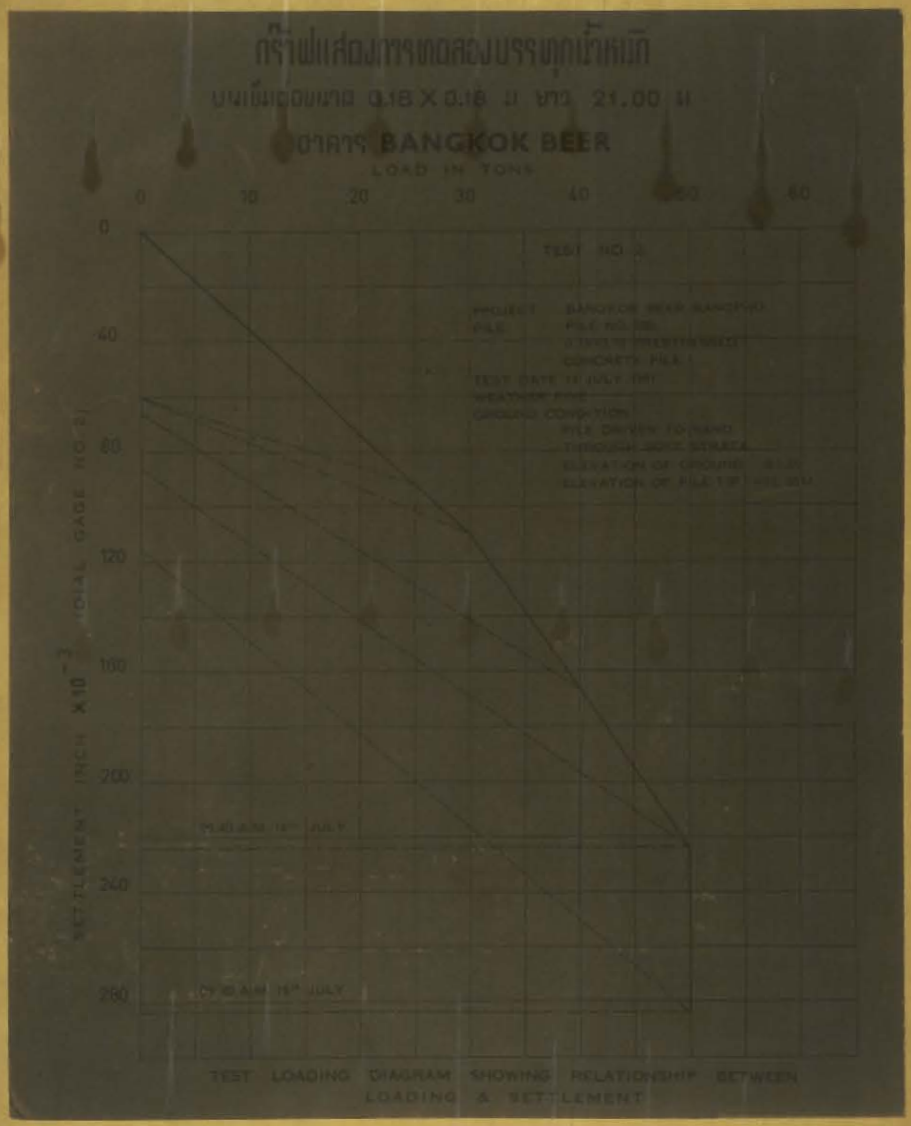
The graph of the test-loading diagram below shows the relationship between loading and settlement of 18x18x700 cm. prestressed S.C.C. concrete piles.

Pile: Pile No. 580, c.18 x 0.18 pre-stressed concrete

Ground Condition: Pile driven to sand through soft strata

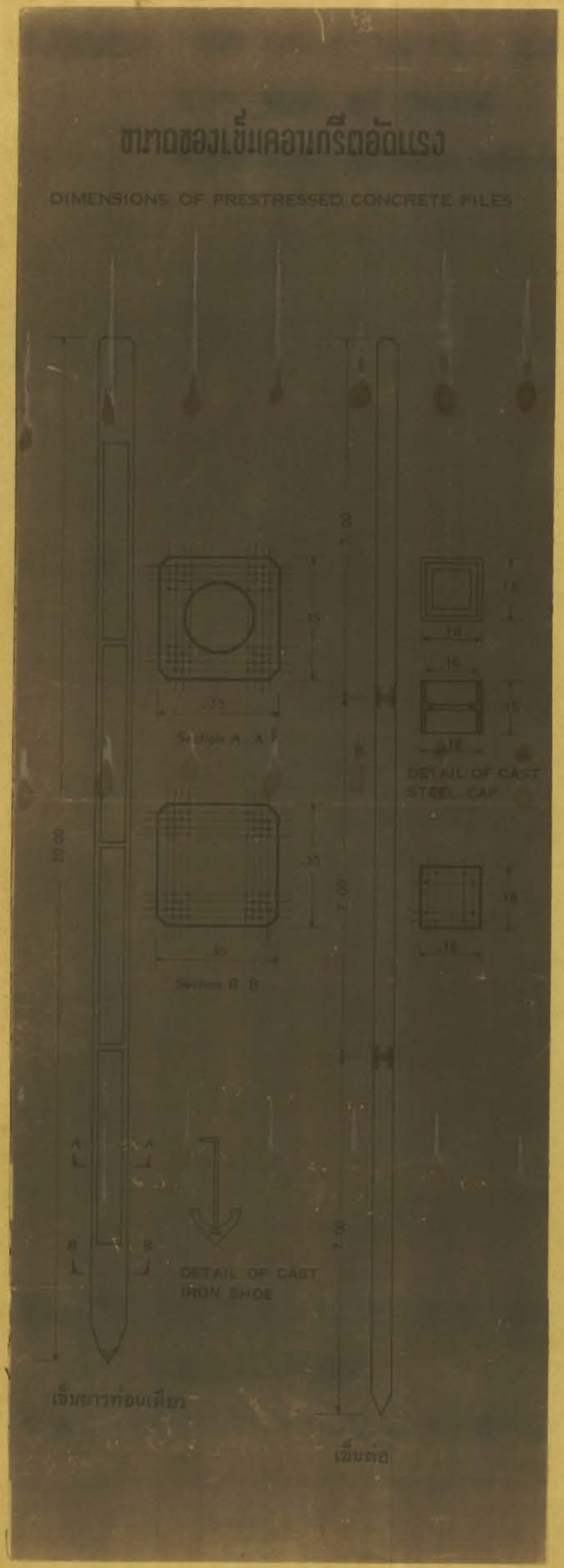
elevation of ground

elevation of pile tip - 19 metres



TEST LOADING DIAGRAM SHOWING RELATIONSHIP BETWEEN LOADING AND SETTLEMENT OF 18x18x2100 cm. PRE-STRESSED S.C.C. CONCRETE PILE

Plate - Dimensions of Pre-stressed Concrete Pile



Besides this, there is also the 35x35x2000 cm. pre-stressed S.C.C. concrete pile which safely can carry a load of more than fifty tons per pile,(as shown in the calculated method under "soil conditions" on pages 78-80).

4. Utility Lines:

Geographically, Bangkok is seven metres above sea-level. Therefore it is impossible to establish a proper system of sanitation as it is done in some Western countries. Arrangement for the removal of sewage is especially difficult; the combined system is ineffective. Other systems might be used such as the sucking system. However it is too expensive; Bangkok municipality could not afford this service.

Sanitary and storm sewer A separate system is indicated, by means of a "Septic Tank" in the site. Extending from the apartments (main building), the house main (house sewer) is a continuation of the cast iron soil line to the septic tank and there is an effluent sewer connecting the septic tank with the leaching cess pool. The size of a septic tank, and therefore the size of its related siphon tank is governed wholly by the number of gallons of sewage to be treated every 24 hours.

The drainage system in Bangkok usually uses a sewer on both sides of the road or street under the footpath. The size of this sewer is 1.00 x 1.00 metres, 1.50 x 1.50 metres or 2.00 x 2.00 metres, connecting to the klong (canal) or the Manam river whichever is conveniently near each point, or in between various points. Besides that, Bangkok is called the Vanice of the East, because she has a lot of klongs to be used

to carry goods by water. At the same time, the klong is usually used as natural drainage according to geographical conditions. The depth of line below grade is .30 to 1.00 metres in some places, according to the pitch of the line.

Water supply The public water supply is adequate and is an underground pipe system at an average depth of one metre, beneath the footpath along one of both sides of the street. Any demand for these services is the responsibility of tthe Bangkok Water Supply; the cost of the service is related to the cost of the pipe plus labour.

The water pressure is about 60 pounds per square inch. The quality of the water is "potable", and the potability of the public water supply is maintained by government agencies.

Electricity The electricity line in some parts of Bangkok is the underground type and the other parts have the overhead type. But in this selected site it is still the overhead type. The capacity of the current is 220 volt, 50 cycles AC (alternating current), with two and three phase available. The cost of the current is one baht (5¢) per unit.

Gas Gas service is not fully established in Bangkok. The manufacturing of gas requires heavy investment and a favourable location. As a matter of fact, the location of manufacturing activities depends upon various factors: accessible raw materials, power, capital, labour and consuming markets; otherwise, the concern will fail financially or cease to operate. But anyway Bangkok has the factories to produce it such as the Italia-Thai Gas Service Company, and Shell of Thailand to serve

those who want gas. Residents of the high-rise apartments can use gas in the building by two different means:

(i) by having gas tank containers for individual units

(ii) by having a gas-producer used as a central system in the building.

The price of gas in the tank is not too expensive. It is a little higher only than wood charcoal because the government no longer allows the cutting of small trees. It costs about 60 baht ($3.00) per tank (capacity .05 cubic metre) and usually lasts for one month, depending on use.

Telephone The telephone service in Bangkok is the direct line type. The cost of the service varies, for example, for a private house it is 50 baht ($2.50) per month, but for stores or offices it is 100 baht ($5.00) per month.

5. Orientation:

The site lying about 15 degrees North, with its length parallel with the Chao Praya river, has the prevailing breeze always blowing from the South, South-West and South-East in the summer and rainy season. (See monthly frequencies of wind direction in Bangkok, page 99). This site especially gets the wind from these directions after it blows across the river, which makes it cooler than most other places. In order to get the prevailing winds and minimize the direct sunlight, the building should always face to the South. In this location, the view of the river is a direct advantage. Therefore this site has an excellent orientation.

6. Hazards:

In the immediate surroundings of the site there is neither a commercial nor an industrial area. According to Adam Howard and Greenley, "Heavy commercial concentrations occur in P.A.D. B2, which contains the Chinese Sampong District". #

The industrial area is concentrated in the suburbs or outside the city, by Bangkok Municipal Law.

Besides, the results of a survey of traffic peak hours made by the City Planning Department of Bangkok show that the traffic on Maharaj Road is not heavy at all (See map of Peak Hours of Traffic, page 89).

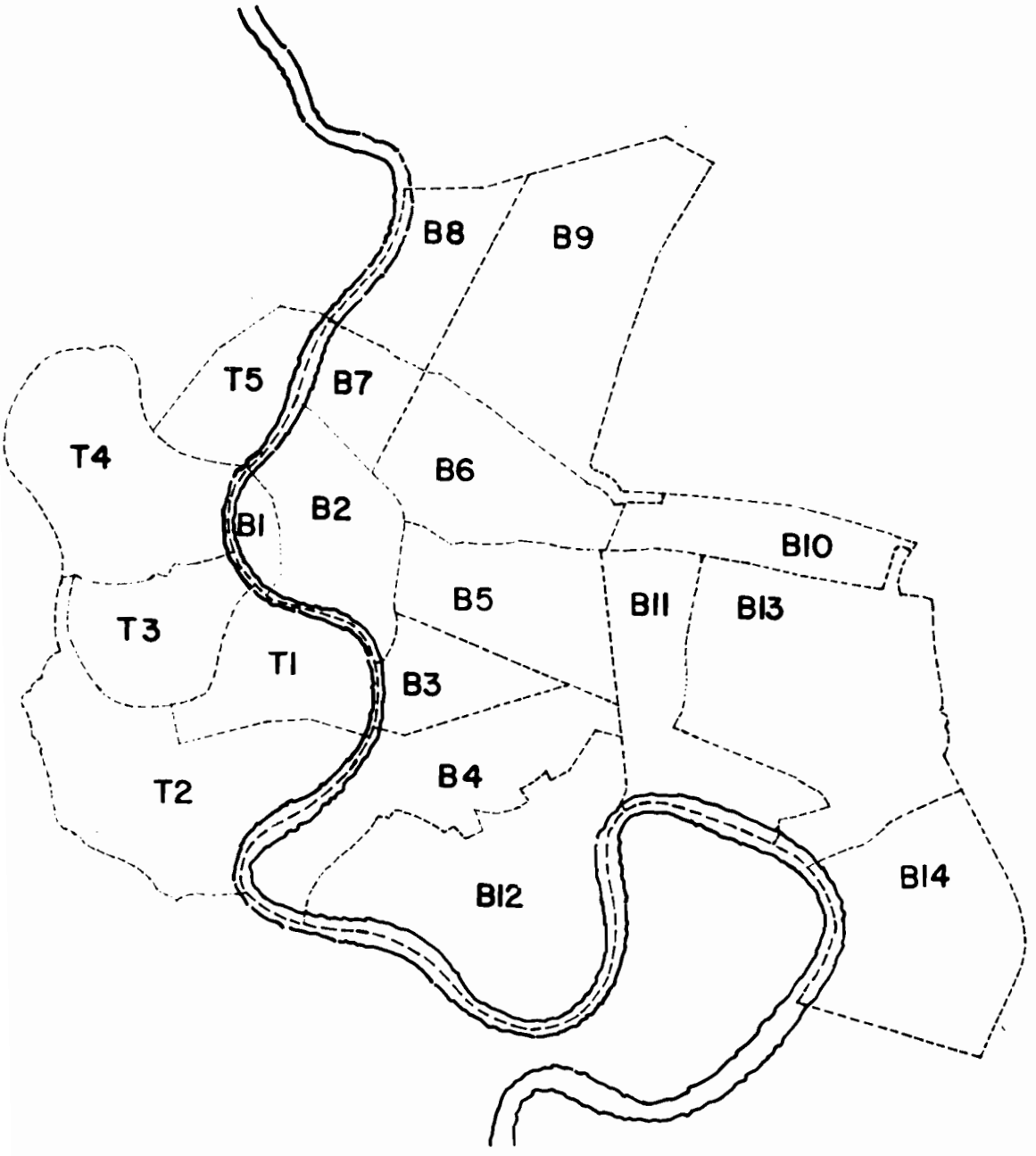
Therefore this site does not suffer from noise and dust from traffic or smaoke and odours from industrial factories.

Source: A Study of Existing Land Use by the Municipalities of Bangkok and Thonburi.

Map 7

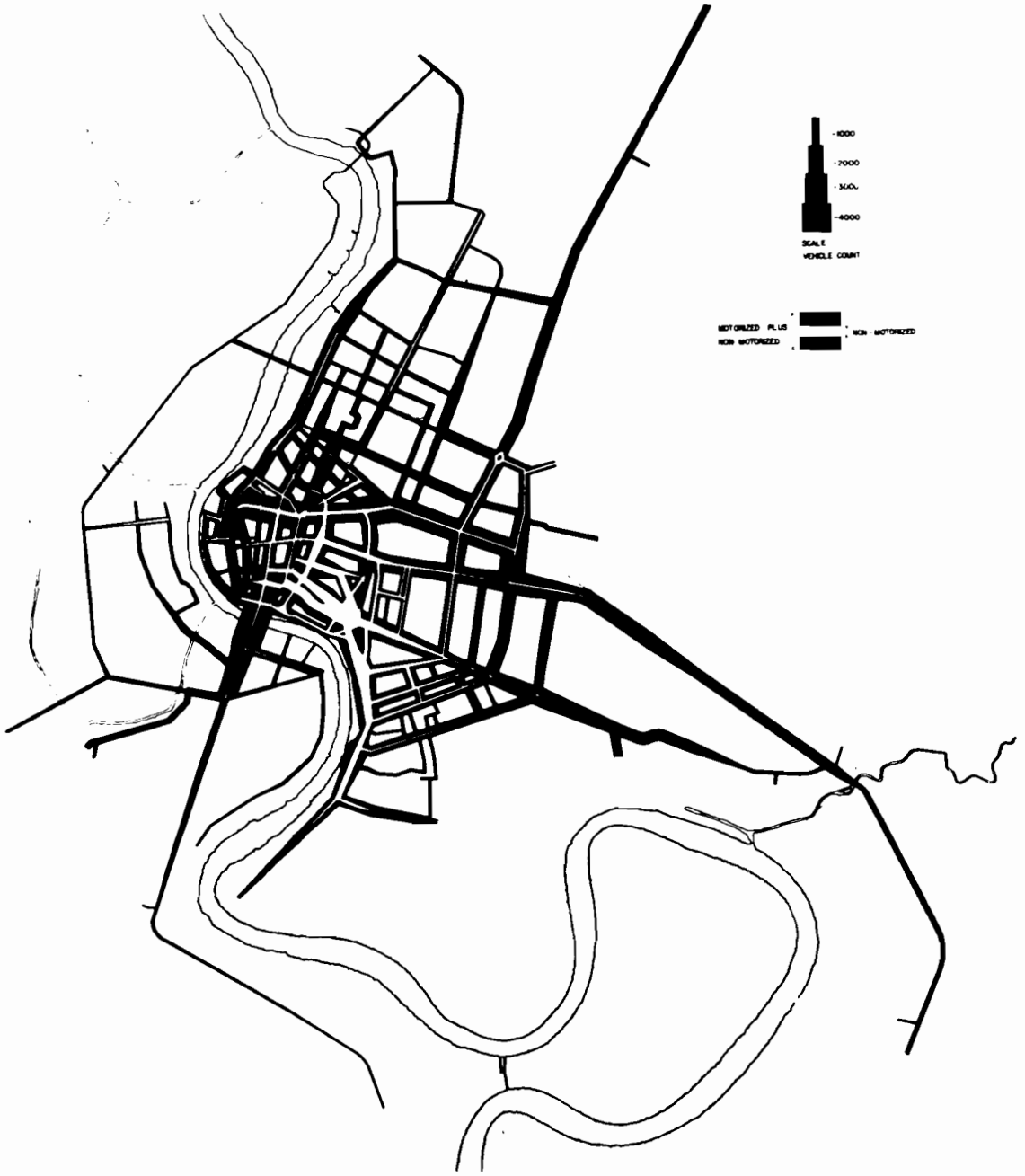
PLANNING ANALYSIS DISTRICTS

BANGKOK THONBURI



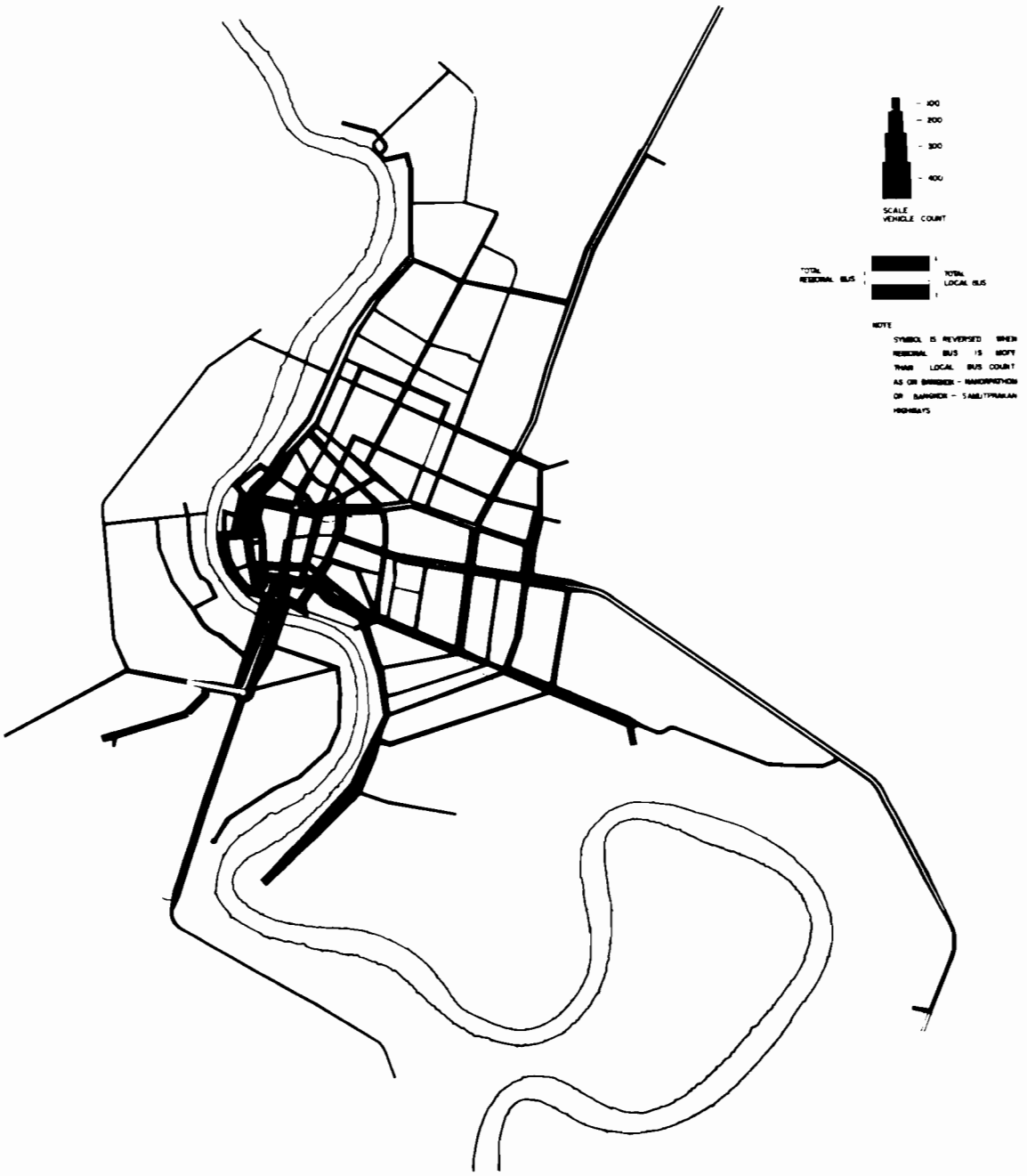
Map 8

TOTAL TRAFFIC PEAK HOUR 1959
BANGKOK · THONBURI



Map 9

BUS TRAFFIC PEAK HOUR 1959
BANGKOK · THONBURI



Map 10

TRUCK TRAFFIC PEAK HOUR 1959
BANGKOK · THONBURI

PART III FACTORS INFLUENCING THE BUILDING DESIGN

A. Climatic Factor

1. Position and Duration of Sun:

The rising and setting of the sun is definite at different times of the day and year. The position and the angle of the sun in Bangkok can be presented by these diagrams:

13 44' North Latitude, Bangkok

Declination of the Sun

Date		Declination	Date		Declination
Dec.	21	-23 25'53.8"	April	1	4 09'55.1"
Jan.	1	-23 04'43;4"		11	7 57'26.8"
	11	-21 41'59.7"		21	11 31'34.9"
	21	-20 06'38.7"	May	1	14 46'44.1"
Feb.	1	-17 22'07.4"		11	17 38'36.8"
	11	-14 20'03 "		21	19 59' 0.6"
	21	-10 54'11.9"	June	1	21 55' 5.1"
March	1	- 7 57'13 "		11	23 00'50.8"
	11	- 4 20'03 "		21	23 26'14.7"
	21	- o 08'48.9"			

Angle 'A' = Azimuth
Angle 'B' = Altitude

Chart XI V

Azimuth and Altitude of the Sun, Bangkok
13 44' North Latitude

December 21

AM	PM	Azimuth	Altitude
noon		180	52 50'
11	1	157 58'	50 06'
10	2	141 23'	42 41'
9	3	129 49'	32 25'
8	4	129 00'	20 37'
7	5	116 29'	7 51'
sun-rise	sun-set	114 9'	0

Jan. 1				Jan. 11		Jan. 21	
AM	PM	Azimuth	Altitude	Azimuth	Altitude	Azimuth	Altitude
noon		180	53 11'	180	54 19'	180	56 09'
11	1	158 40'	50 17'	157 21'	51 24'	156 06'	53 05'
10	2	141 15'	42 52'	140 48'	43 45'	138 09'	44 14'
9	3	126 06'	36 32'	128 27'	33 12'	126 29'	34 18'
8	4	121 47'	20 41'	120 27'	21 11'	118 43'	22 00'
7	5	116 22'	7 56'	115 02'	8 18'	113 21'	8 53'
SR	SS	113 50'	0	112 35'	0	110 44'	0

Feb. 1				Feb. 11		Feb. 21	
AM	PM	Azimuth	Altitude	Azimuth	Altitude	Azimuth	Altitude
noon		180	58 54'	180	61 56'	180	65 22'
11	1	156 06'	54 31'	151 38'	58 9'	148 04'	61 79'
10	2	138 09'	47 2'	132 26'	44 4 '	128 11'	51 22'
9	3	126 29'	35 49'	120 41'	37 15'	116 45'	39 04'
8	4	118 43'	23 9'	113 04'	24 17'	109 26'	25 36'
7	5	113 21'	9 44'	107 50'	10 40'	104 28'	11 40'
SR	SS	110 44'	0	104 11'	0	101 13'	0

Chart XIV, continued

Azimuth and Altitude of the Sun, Bangkok
13 44' North Latitude

March 1				March 11		March 21	
AM	PM	Azimuth	Altitude	Azimuth	Altitude	Azimuth	Altitude
noon		180	68 19'	180	71 56'	180	76 07'
11	1	144 45'	63 40'	139 41'	66 30'	132 01'	69 37'
10	2	128 25'	53 09'	119 25'	55 06'	112 19'	57 11'
9	3	113 13'	40 20'	109 05'	41 46'	104 04'	43 16'
8	4	106 15'	26 38'	102 34'	27 47'	99 41'	29 02'
7	5	101 28'	12 39'	97 41'	13 27'	93 37'	14 30'
SR	SS	98 12'	0	94 28'	0	90 09'	0

June 1				June 11		June 21	
AM	PM	Azimuth	Altitude	Azimuth	Altitude	Azimuth	Altitude
noon		180	81 49'	180	80 43'	180	80 18'
11	1	57 21'	73 26'	153 06'	72 52'	52 32'	72 35'
10	2	69 21'	60 17'	68 42'	60 04'	66 35'	59 57'
9	3	73 00'	46 26'	76 34'	46 21'	70 24'	46 24'
8	4	72 22'	32 35'	72 11'	33 18'	70 55'	32 39'
7	5	71 06'	18 46'	69 54'	18 54'	69 34'	18 57'
6	6	68 36'	5 05'	67 41'	5 19'	67 05'	5 24'
SR	SS	67 25'	0	66 16'	0	65 55'	0

The duration of the sunshine varies for each day of the year as shown:

Table XVI

Duration of Sunshine, Bangkok (in hours)

1957 - 1961

Year	Jan.	Feb.	Mar.	Apr.	May	June	July
1957	284.3	252.8	263.0	238.5	275.5	158.1	139.7
1958	275.2	235.9	273.7	251.3	271.5	162.1	141.5
1959	302.8	279.4	241.0	271.0	225.5	207.0	135.0
1960	292.7	260.3	296.8	268.1	198.5	187.7	171.7
1961	292.6	214.4	270.6	268.6	180.6	167.4	132.3

Year	Aug.	Sept.	Oct.	Nov.	Dec.
1957	168.2	127.1	175.0	265.4	289.5
1958	167.2	132.6	206.2	277.6	291.8
1959	154.5	125.8	186.0	264.3	279.9
1960	143.9	157.3	204.0	226.3	291.0
1961	150.5	143.1	215.4	265.0	265.8

The explanation from the diagrams and Table XVI above tells that sunlight in Bangkok is extremely strong almost every day of the year. Therefore sun-breakers, louvers and fins are necessary in building design.

2. Temperature:

Temperature in Bangkok is generally high. The distribution of temperature is shown on Chart XII on page 95. Study of Bangkok isothermal maps for 1932 to 1955 shows that many isotherms vary considerably from part to part especially in the interior where areas are overcrowded, and along the bank of the river where areas are open.

In April, the temperature of 30.1 Centigrade (86.2 F) from records of 1957-1960 is the warmest, and in December, the temperature of 19.7 Centigrade occur in the northern interior of Bangkok. During November to February, the weather in Bangkok

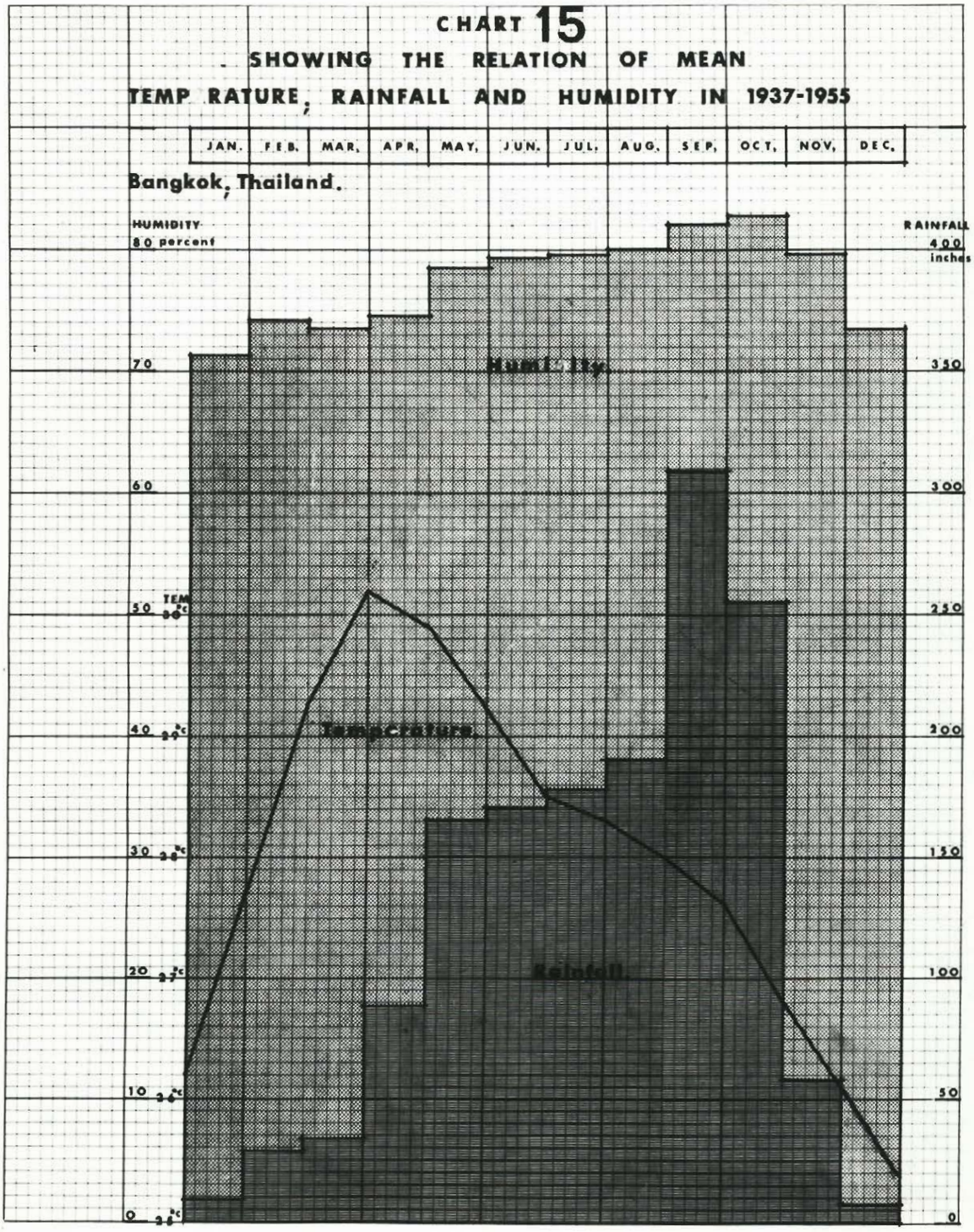


CHART 15
SHOWING THE RELATION OF MEAN
TEMP RATURE, RAINFALL AND HUMIDITY IN 1937-1955
JAN. FEB. MAR. APR. MAY. JUN. JUL. AUG. SEP. OCT. NOV. DEC.
Bangkok, Thailand.
HUMIDITY
80 percent
RAINFALL
400
inches
70
60
50
40
30
20
10
0
350
300
250
200
150
100
50
0
Humidity.
Temperature.
Rainfall.

BEE 10x10

is delightful because of cold air from the China mainland, which reduces the temperature to 19.7 Centigrade at least.

In order to provide comfort in the house, the building design must lay special emphasis on:

(i) double brick walls

(ii) cement block or hollow brick for the wall

These two items serve as air-insulators.

(iii) soft wood is suited mainly for the outside partitions of wooden structures and plywood for inside partitions

(iv) cross-ventilation under the roof

(v) careful examination of material for the roof, -- for instance, asbestos is a desirable material because it absorbs less heat than other material.

(vi) selection of appropriate type of roof; a high-pitched type is used mostly in tropical countries to gain more air volume and encourage diffusion of heat, also to improve the cross-ventilation system.

As long as we can provide an adequate amount of insulation, a flat roof may allow enough comfort to the dwellers.

3. Rainfall:

Thailand is a humid tropical country. Since humid air is lighter, it tends to rise, to cool adiabatically by expansion, and produce clouds or rain. Once condensation begins, removal of water molecules from the air reduces the volume and pressure,

and allows air from regions of higher pressure to flow in, bringing fresh supplies of warm humid air, so that once rain starts, it may continue for a considerable time.

In Bangkok rainfall varies in cycles (see Chart XII, page 95), that extend over a term of years. Rainfall is barely sufficient for crop farms, which may be abandoned from April to October. During the cold season (from November to February) Bangkok has very little rainfall, but it helps grain mature better, and straw is easier to cure than in the wet season. In any case, Bangkok has some rainfall throughout the year.

The building design for this type of country must include awnings, eaves, gutters and down-spouts and provide for proper drainage of rain water.

4. Relative Humidity:

When a given volume of air contains the maximum quantity of moisture at a certain temperature, it is said to be saturated. Relative humidity represents the amount of water vapour actually in the air compared with the amount the same volume of air could contain if saturated at the same temperature. If air is completely saturated and then cooled, less water can exist in vapour form and condensation begins. When the temperature increases, a given volume of air can contain more water vapour. Thus relative humidity drops with a rise in temperature, without any change in actual quantity of vapour.

In Bangkok during November to February (the cool season), the weather is governed by modified Siberian air masses,

so that relative humidity (see Chart XII, page 95) is generally low. The lowest relative humidity is about 49.7 - 71 percent in January. In October the relative humidity reaches its peak of about 95.4 - 83 percent.

Relative humidity of air affects many natural phenomena as well as building design. When relative humidity is low, air seeks moisture everywhere, for example, in woods and creates the constriction of the wood and may alter its structure. The problem may be solved by seasoning or steaming the wood.

2. Prevailing Wind:

A horizontal movement of air is termed wind, blowing at the surface of the earth from regions of high atmospheric pressure toward those of lower air pressure. Winds are named from the direction from which they blow.

The prevailing wind in Bangkok blows from the south, south-west and south-east in the afternoon and evening hours. In the early part of the day the wind is generally variable.

The direction of the wind shows in Table XVII on the following page.

Climate affects men in a multitude of ways and is probably the most important of all geographic elements. It exerts a large influence upon building design, as I mentioned above. Therefore the outside appearance of tropical houses has a style and character of its own, different from that in Western countries or in cold climatic regions.

Table XVII

Monthly Frequencies of Wind Direction

Bangkok, 1950-54

Percent from	J	F	M	A	M	J	J	A	S	O	N	D
N	15	5	3	2	1	1	1	1	5	21	34	35
NE	23	12	7	5	3	1	1	1	4	17	23	24
E	15	17	8	6	5	2	3	2	5	8	7	6
SE	4	13	11	14	12	10	9	6	8	6	1	1
S	8	21	35	38	30	36	26	26	19	7	1	1
SW	5	14	19	17	18	25	27	26	21	6	2	0.1
W	4	2	3	5	8	8	12	21	13	6	3	2
NW	8	3	1	1	1	1	2	3	4	7	11	19
Calm	20	14	14	14	22	18	19	16	21	22	20	13
Average Velocity (B.F.)	1.2	1.5	1.7	1.9	1.4	1.5	1.5	1.6	1.3	1.2	1.1	1.3
Average Maximum Velocity (B.F.)	5.0	5.8	6.4	7.4	7.4	7.8	7.8	7.6	6.2	6.4	6.8	5.2

(note: Frequencies given to nearest whole number)

B. Building Materials

Building materials include building stone, concrete, cement, lime and clay products like brick, tile, etc. Sand and gravel are generally distributed over wide areas and are not expensive so that they are used only to supply local demands.

An approximate estimate of the proportionate application of local materials to housing construction throughout Thailand can be shown as follows: #

	Percent
Brick and concrete	12
All timber	35
Timber and bamboo	30
Bamboo	23

1. Native Materials:

Bulky building materials like cement are preferably manufactured near large cities or other densely populated areas. At present there are two cement factories in Thailand. The Siam Cement Company Ltd. is in the outskirts of Bangkok. Its yearly capacity was 750,000 tons in 1958. The second plant with a capacity of 109,500 tons a year in 1958 is in Chainaet. Its primary aim is to provide the cement for the large Yan Hee Dam (Phomephol Dam).

Various brands of cement have been made to meet the demands

Luang Saman Vanakit, "Forestry in Thailand and their Preservation", Royal Thai Forestry Dept., April, 1956

of the building trade. These two brands are well known: Portland cement and Silica cement.

Portland Cement is a cement conforming to the requirements of standard specifications which may vary a little from country to country. Its mixture consists in the main of lime, silica and alumina with a little iron-oxide, made into clinkers which are ground into a fine powder.

Silica Cement is made by intergrainding 70 percent Portland cement clinker and 30 percent sand, which acts as filler, with the addition of a small percentage of gypsum. Silica cement has always been popular in countries poor in natural fuel, because the manufacture of silica cement requires less fuel than does the manufacture of Portland cement. Therefore a first-class Silica cement is suitable for all ordinary concretes.

Cement Products The Siam Cement Company Ltd. is also manufacturing the following cement and asbestos products:

(a) Asbestos cement corrugated roofing sheets of two types -- Twin corrugated sheet, 50 cm. wide and in standard lengths of 90, 120, 150 or 180 cm.; and corrugated sheets 60 cm. wide and in lengths of 120 or 180 cm. with corrugations 5 cm. deep.

(b) Flat Boards with wire mesh reinforcing in various thicknesses from 4 to 10 mm. thick, 100 by 200 cm. for partition boards or as school blackboards. Ceiling boards are 60 by 60 cm. or 90 by 90 cm.

(c) Venetian Screens, 40 cm. wide and in standard lengths of 80 cm. used as louvers and partitions in factories.

(d) Low-pressure Piping in dimensions of 2½", 4", 6" and 8" finds a ready use in all sanitary installations.

(e) Cement Block at present regarded as a more economical form of construction than clay brick and in consequence very widely used as partitions, screens, etc. The standard sizes are 40.64 by 20.32 by 20.32 cm. (16 by 8 by 8 ins.) and 40.64 by 10.16 by 10.16 cm. (16 by 4 by 4 ins.). It is produced by numerous private firms.

All products listed above are in increasing quantities. Other cement products, such as concrete circular section linings for cess-pools, water-butts, and paving slabs, terrazzo floor tiles are moulded by hand, or by simple machines by numerous private firms. The standard of finish is very good.

Terrazzo work and a type of imitation granite facing, applied by trowel and machine-polished, is much in evidence.

Steel Although the deposits of iron in Thailand are widely distributed, steel production is only on a small scale. Because steel manufacture requires large investment, we are seriously handicapped both in industrial development and in promoting efforts for national defense. There is only one steel plant in Thailand, at Taluang, smelting iron from local ore. It produces at present some 36,500 tons per year of round plain steel bars and ribbed steel bars from 6 to 25 mm. in diameter, used in reinforcing concrete. Other production includes wire, nails, cast iron, milled steel, rimmed steel, binding reinforcement rods and steel castings.

They are made in qualities which compete well with imported goods, and compete in price also with imported materials. But the amount of production could not meet the demand in this market. Therefore steel is imported from abroad, mainly from Japan and the U.S.A.

Clay Products

(a) Bricks There are two kinds of brick that are used in Thailand; one is machine-made bricks and tiles, called B.B.T. at Bangbuathong and B.P.K. at Thonburi. It is a standard dry-pressed brick of good quality, in size about 7.5 by 10 by 20 cm. usually used for wall-building and decorative purposes, exposing their smooth texture and natural colour without rendering. The other one is the common brick, in wide use throughout the country, and is a smaller-sized rural-made product, invariably under-burned and soft; The size is 3 by 7 by 17 cm. approximately, and is used as filling-in panels for reinforced concrete framed structures, and finished by rendering both sides.

The Siam Cement Factory is manufacturing facing hollowed brick in sizes 5 by 15 by 15 cm. and unglazed tile approximately 1.5 by 15 by 15 cm. for wall- and floor-finishing purposes. There is also fire brick in the standard sizes of 65 by 20 by 20 and 6.5 by 9.8 by 20 cm. as well as full and half arch bricks in order to suit any curvature.

(b) Tiles Burnt clay roofing tiles are used for the decorative roofs of Buddhist Wats (temples), other Thai-style buildings

and Thai-style housing. These tiles are hand-made, of a rectangular shingle pattern approximately 30 by 28 by 1.7 cm. with semicircular ends. They are specially coloured and highly glazed. Colour ranges from various shades of yellow through browns, greens, blues to bright reds and oranges. When fixed in patterns on the elaborate pitched gable roofs of Thai-style buildings, the general effect is most striking and colourful. In the provinces, particularly those in the north and south, a very fragile shingle type of clay tile is still to be seen in use in towns and villages. This tile is approximately .5 by 12.5 by 25 cm.

(c) Other Clay Products -- There is an abundance of good quality clay throughout the delta of the Manam Chao Praya. The chief sources of brick clay are Bangbuathong and Bangpakod, while pottery clay is also dug at Nonthaburi and Pakgret. All sorts of pots, jars, water butts, pipes and cooking utensils are made on a home industry basis, invariably by hand.

Plywood Thai plywood factory was established in 1955 at Phra Khanong, Bangkok, in accordance with a policy to develop production of teak, redwood and other valuable plywoods and veneers for the export market, as well as supplying local demands for all grades and all standard sizes.

Block boards and flush doors are also the other production of this factory. The great demand for these items has encouraged extension of the plants to increase present quantities.

Building Boards There are good prospects for the manufacture

of building boards of the soft variety, made from sugar-cane trash. To date this valuable secondary product of the sugar factories has customarily been fed back as fuel, in conjunction with firewood, to the factory boilers. The Lignite-Thermal-Power Organization, which is developing the mining and marketing of lignite from deposits at Meh Moh in the northern part of Thailand, is experimentally modifying one of the furnaces at the Lampang Sugar Factory, with a view to converting it to burning lignite. There is every indication that the installation of a plant for the manufacture of soft-boards from the sugar-cane trash thus made available would be a paying proposition at this and the other factories in the north.

Cellocrete This is a new product since 1956, and is manufactured on a large scale by a private firm, located at Bang Ken, in the outskirts of Bangkok. It is composed of wood fibre, chips from various kinds of cheap soft wood and Portland Cement. Drum mixers with hydraulic presses have been imported from Japan. A unit factory with one press can produce up to 5,000 boards a day, size 1 by 2 metres (3'4" by 6'8"). There are different thicknesses from ½" to 1". It is claimed that the product will be insect proof and water-repellent. It can be used for panelling of a timber house or plastering. Finished, both sides gain a half-timber appearance. It may also be used, with soud-proofing effect on ceilings, providing insulation as well, or can be used as a mould for flat slab.

Shaving Board Another new process has been established in

the same period by Sri-Maha-Raja Manufactures at Sri-Raja, a sea-side province about 270 km. southeast of Bangkok. This process uses various kinds of chip woods. This firm is planning to produce 1,400 sheets per day, of a standard size of 1.25 by 2.5 metres (4'2" by 8'3"), and other sizes from 60 cm to 180 cm. (25" to 75"). It is claimed that the product will be insect-proof, water-repellent and fire-retarding. It is usually used as a house interior partition, for ceilings, and for furniture, and on some occasions it is also used as flooring material because its price is less than half the price of hard wood flooring in the same area.

Zinc Galvanized Sheet In 1961, the Thai Zinc Manufactures was established at Samut Prakam province, about 30 km. from Bangkok. This was done by a private firm, in accordance with the policy saving foreign currency and supporting industry within the country. It produces zinc galvanized flat sheets and corrugated sheets in different sizes and thicknesses, such as 4' by 6', 4' by 7', 4' by 8' for the export market to neighbouring countries as well as supplying local demands for every grade.

Glass In 1957, a glass factory was constructed at Phra Khanong, Bangkok, which is operated by the military authorities. It will compete with another glass factory which is owned by Swiss interests and operated by Australian technicians.

Pre-cast concrete, Pre-stressed concrete,

Pre-tensioning and post-tensioning:

Precast Concrete These units are made beforehand, inserted and

fixed afterwards in their final position so as to perform the same function there as if they had been cast in situation as a part of the structure in question. Precast units therefore act as a whole in time, not as single units.

Pre-stressed Concrete (pre-tensioning) is reinforced concrete in which the reinforcement has been stressed before being embedded in the concrete and later on, after concreting, made to transfer these stresses as compression stresses to the concrete.

Pre-stressed Concrete (post-tensioning) In all respects Pre-stressed concrete (post-tensioning) functions like pre-stresed concrete (pre-tensioning) and differs only in the way in which it is made. As the name implies, cables composed of high-tension steel wire are inserted through openings in the hardened concrete and subsequently stressed, anchored and grouted.

Pre-tensioning lends itself well to precast units, whereas post-tensioning is normally applied to structures cast in situation, but there are exceptions to this general rule.

The following building construction units may often be executed better and cheaper in pre- or post-tensioned concrete than in ordinary reinforced concrete;

Beams for bridges, and building constructions in general,

Posts, poles and piles

Pipe and Slab.

If a structure is composed of many identical elements, it lends itself well to be split up and built from precast units which will, normally, present the following advantages:

(1) saving in framework, because forms can be standardized and used many times,

(2) keener control, because the making of precast units can be modelled on normal factory practice; better control also entails a possible saving in concrete,

(3) nicer and more permanent exterior surfaces, resulting in a better appearance of the whole structure,

(4) saving in labour, and cheaper than ordinary reinforced concrete.

Pre-stressed concrete products are a new production of the Siam Cement Factory in recent years, and they have become very popular in the construction field, from the point of view of structural efficiency and economy both of production and use. Numbers of highway-bridges, workshops, office buildings, schools and even electricity poles and piles are signs of how popular its use is.

Raw Materials

(a) Stone and Gravel -- In Thailand, crushed stone is made from various types of rock, mostly limestone. It is plentiful throughout most of Thailand. The crushed limestone originates from quarries belonging to the Government and to private firms at Saraburi (150 km. north of Bangkok) and at Rajaburi (180 km. southeast of Bangkok). Supplies are also drawn from Ko Sichang, an island in the gulf at the mouth of the Chao Phraya river.

Crushed stone for concrete is obtainable in Bangkok in the following three gradings, in addition to larger pitching stones:

Stone No.	Size
1	3/16 to 3/4 inch
2	3/4 to 1½ inch
3	1½ to 3 inch

River gravel, or stream gravel, found in the river at Chainat (250 km. north of Bangkok) and at Karnburi (150 km. northwest of Bangkok) is of a size graded variously from 3/4 to 1½ inches. It is brought to Bangkok by boat.

(b) Sand -- The plentiful quantity of local sand which predominates in concrete mixture, plaster and mortar is brought from Saraburi and Angthong, dug from the bottom of the Chao Phraya river, also from Rajburi and Ban Pang. There are two kinds: coarse sand (from Rajburi and Ban Pang), used as a component in concrete mixture and mortar; and fine sand (Angthong sand) used for plastering.

Fine sand is often also found on the seashore. If, however, sufficient coarse sand can be found on the seashore, it may be used as a concrete aggregate.

(c) Lime -- Lime is one of the traditional construction materials used for plastering, and it is produced from natural limestone. The quality is better than lime which is produced from the sea coral. The lime-kilns are widely scattered throughout Thailand, particularly in Rajburi and Saraburi provinces.

(d) Marble -- Marble quarries are maintained by the Ministry of Industry and by private firms at Saraburi. The quality is as high as that of Italian marble, and there is a variety of colour, marbled-stain and size. Encouragement by the present government is increasing the quantities.

(e) Forestry and Timber -- Forest types and estimated areas are as follows: #

Tropical evergreen	93,525 km^2
Coniferous	2,378 "
Mangrove	1,620 "
Mixed deciduous (teak bearing)	65,000 "
Deciduous dipterocraps	147,000 "

Thailiand possesses a very rich and greatly diversified flora, with a total of probably 10,000 species and those of economic importance run into several hundreds. Experimental research are necessarily being centered around a comparatively few species of the more important economic types. Among all of these the teak (Lectora grandis) is pre-eminent.

The following types of hard woods are recommended by the Royal Thai Forestry Department: Taback (Lager stroemic calyculata), Dang (Hylia herrii), Pradu (Pterocarpus macrocarpus), Ta-Kien-Thong (Hopeaodorate), Ta-Kien-Nu (Anogeissus acuminate), Kun-Krao (Fragrea fragrans), Ching-Chan (Dalbergia spp.), Chan-Chan (Shanea sp.), Ma-Klua (Dyospyros mollis), Phayung (Dalbergia cochinchionsis), Bunnag (Mesua ferra), Non (Viten sp.), Lao-Tao (Mopea ferra), Maka-Tea (Sindora siamensis), Phut (Gardina sp.), Yomhom (Cedrela toona) and 25 other species of similar qualities, allowing for use in different regions.

(f) Iron Ore -- Two iron ore deposits of fair quality were reported discovered in 1946 at Ukrum Mountain, fifty miles

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Source - The Report of the Royal Thai Forestry Dept. 1962

north of Kon Buri. They are now being surveyed by a Japanese firm. German Krupp interests have also made a survey for installation of a large mill with a capacity of 300 tons a day. The Thai Government is anxiously watching the final results which will be coming very soon.

(g) Wolfram (tungsten) -- has become increasingly important during recent years. Mined in the northwest provinces and in the southern peninsula, its production averaged about 1,200 tons a year.

(h) Tin -- Deposits located mostly in the southern peninsula. The production has not regained its pre-war levels, and its been gradually increasing, until in 1956 it was 13,600 tons. All tin is now exported, but the presence of the deposites constitutes a valuable resource for the development of local manufacture of cans which could assist the expansion of the food industry for preserving agricultural products, meat and fish.

Other minerals produced to some degree include lead, gypsum, antimony and salt.

(i) Lignite -- Lignite deposits at Mae Moh in the north and at Krabi in the south have been explored and developed by the government from 1951 to 1953 with assistance from the United States Aid programme, and promise a good yield. Mining deposits at Mae Moh which have proved reserves are estimated at 28 million tons. Mining started in 1955 and production was 260,000 tons in 1958.

2. Imported Materials:

There is a variety of building materials which are imported. These are mainly steel products, hardwares, lavatory equipment, plumbing fittings, door and window fittings, electrical fittings, mosaics, ceramics, vinyl asbestos tiles, asphalt and rubber tiles, accoustic tiles and paints.

C. Construction Methods

Construction and design techniques in the past have been evolved under the powerful influence of readily available indigenous materials. Characteristic of Thai architectural style are big-scale buildings made of brick masonry bearing walls with superimposed layers of roof, or wooden structures with accentuated roofs covered with colourful glazed tiles.

About sixty percent of houses in Bangkok are timber construction requiring highly-skilled labour. They are built with skeleton construction, the partitions being fitted later. There is one partition type of this kind called "Pakol"; it is a very popular prefabrication partition employed with teak wood frame and teak panelling without nailing. Joinery and wedging are the principles used to join separate part together. It is a panelled wall type used ever since ancient times and still used and very useful in the present.

The other kind of construction method is "Lath and Plaster" using chemically treated split bamboo woven vertically and horizontally and fixed in the timber frame, with plaster

applied thoroughly on both sides. Its structure is the skeleton type using harwood as posts, beams, frame and floor, all of which were teak wood in ancient times.

Proportions in plaster mixing:

	Cement	Sand	Lime	Straw Fibre in Lime
First coat	1/4	3	1	
Second "	1	5	2	1½

This type of lath and plaster is widely used in many types of buildings, for example, the State Railway Construction project, the Tobacco Monopoly, the Siam Cement Company, the Department of Irrigation and the housing projects of the Ministry of the Interior throughout the country.

In the prefabricated system, the Siam Cement Factory has attempted to produce a fully-prefabricated house in different sizes and prices, approved by the government, but the capital cost has been found to be higher than that of the timber house, because almost all materials used in these houses have to be pre-cast concrete of a certain standard. Numerous private firms have made the same attempt, but the products have been found to be unsatisfactory in quality and design.

For government offices and office buildings in Bangkok and rural areas, reinforced concrete skeleton construction is used with hand-made brick filling, and rendering cement finishing. Timber construction is used for secondary building, because it is light-weight, cheaper and suitable to the country's climate.

The low cost of the building does not depend only on the choice of a cheap material; the construction system and the design are also important things to reduce the cost.

D. Construction Cost

1. Land:

After World War II, land costs increased through the country, particularly in Bangkok, because of the population explosion and people migrating to Bangkok, as explained in "Urbanization Trends in Bangkok" (Part I). More dwellings were needed, due to the march of industrialization and urban expansion. Land once devoted to agriculture, rice paddies, and orchards entered the market as land for homes, factories, offices, shops and stores etc. The existing land cost in the outskirts of Bangkok has increased from 15 baht per square metre to 500 to 800 baht per square metre ($25 to $40);# in the suburbs it costs up to 1,000 baht per square metre ($50) # and in the centre of Bangkok in the commercial area, the cost increased most, to about 15,000 to 30,000 baht per square metre ($750 to $1,000). # The cost of land is expected to be higher than this in the coming year because the demand in various ways is greater than the supply.

Land cost estimates by the Department of Housing of the Ministry of Public Welfare, July, 1959

2. Material:

Industrial development, particularly in building materials, would be a great help toward reducing the cost of construction, but on the other hand, the need for transportation would increase the price. Bangkok has an extensive network of klongs (canals) which still constitute one of the main means of freight transport within and around the city. Sand, stone and gravel are brought up to Bangkok or the construction site by boat.

The estimated cost can be calculated in two ways. One is the average cost of construction per square metre of floor area including material and labour costs; the other one is to calculate the cost of building by taking each group of material and labour separately, then finally summing all up together. The latter system is more correct than the first one.

Average costs of construction in Bangkok per square metre of floor area are of the following order:

(a) One-storey timber house (high quality)	1,000 baht per sq. m. $ 5 per sq. ft.
(b) Two-storey timber house (high quality)	1,500 baht per sq. m. $ 8 per sq.ft.
(c) One-storey timber house (mixing hard and soft wood)	400-500 baht per sq.m. $ 2- 2.5 per sq.ft.
(d) Two-storey timber house (mixing hard and soft wood)	800-1,000baht per sq.m. $ 4- 5 per sq.ft.
(e) One-storey building (reinforced concrete structure and brick wall)	1,800 baht per sq.m. $ 9 per sq.ft.

(f) Two-storey building (reinforced concrete structure and brick wall) — 3,000 baht per sq.m. / $ 15 per sq.ft.

(g) Half-timber building (reinforced concrete structure, wood partition or lathing) — 2,000 baht per sq.m. / $ 10 per sq.ft.

Note: the cost is calculated on only the ground floor for each type. #

Average cost of the materials for construction in Bangkok are as follows:

Bricks (ordinary)	1,000	70 baht
" (good grade)	"	120 "
Gravel	1 cubic yard	68 "
Stone	"	84 "
Sand	"	38 "
Silica cement	1 ton	550 "
Portland cement	"	650 "
Concrete	1 cubic metre	250 "
Steel	1 ton	2,600 - 2,900 baht
Hardwood	1 cubic foot	32 baht
Softwood	"	21 "
Teakwood	"	75- 150 "

Partitioning:

½ brick wall with plastering both sides	35	baht	sq.m.
Yang (softwood) partition with Yang studs	25	"	"
"Shaving board" both sides with Yang studs	70	"	"
Thai plywood both sides (Yang faced) with Yang studs	30	"	"
Thai plywood both sides (Teak faced) with Yang studs	90	"	"
"Cellocrete" both sides (plastering included)	70	"	"
"Shaving board" one item (thickness varies)	50 - 125	"	"
"Cellocrete" one item (thickness varies	25 - 44	"	"

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from the cost estimates of the Design and Construction Division, Vocational Dept., Ministry of Education, 1962

Roofing:			
	Corrugated aluminum	7 baht	sq.m.
	Corrugated asbestos sheet	23 "	"
	Cement tile	15 "	"
	Vibulsri tile (Marseilles type)	21 "	"
	Glazing clay tile	160 "	"
Ceiling:			
	Timber (softwood)	12 baht	sq.m.
	Hard board	23 "	"
	Shaving board	23 "	"
	Accoustic board	30 "	"
	Cellocrete	20 "	"
	Plywood	25 "	"
	Asbestos sheet	12 - 15 "	"
	Hard board 1.20 x 2.40 m.	50 "	
	Shaving board 1.25 x 2.50 m.	50 "	
	Thai plywood 1.20 x 2.40 m. (Yang faced)	40 "	
	Thai plywood 1.20 x2.40 m. (Teak faced)	80 "	
	Accoustic board 1.20 x 2.40 m.	68 "	
	Cellocrete 1.00 x 2.00 m.	40 "	
	Asbestos sheet 1.00 x 1.00 m.	12 "	
Floor:	Clay tile 8" x 8"	20 "	sq.m.
	Terrazzo tile 8" x 8"	25 - 30 "	"
	Vinyl asbestos tile	60 "	"
	Rubber tile	80 "	"
	Cork tile	75 "	"

#

3. Labour Costs:

Practically, the labour involved in home building in Bangkok is divided into two classes of work, namely,

(a) Skilled work:
Carpentry, including finishing and roofing
Masonry, including concrete work and plastering
Tile setting
Plumbing
Electrical wiring
Painting

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from the cost estimates of the Design and Construction Division, Vocational Dept., Ministry of Education.

(b) Unskilled Work:

Actually the labour involved in the skilled work is frequently subcontracted by the contractor and the labour involved in unskilled work is employed by the skilled workers. The total number employed in construction in Bangkok during 1954 was about 11,480, skilled labour being about fifty percent of the total. #

Generally, house building labour is more skilled than labour in general and is paid more for the same working time, nine hours a day. The trend in wages is shown here:

Carpenter	45 - 100	baht	s	daily
Bricklayer, mason (including concrete work & plastering)	65 - 80	"		"
Tile setter	50 - 60	"		"
Plumber	45 - 50	"		"
Electrical worker	35 - 40	"		"
Painter	45 - 60	"		"
Work inspector and advisor	70 - 90	"		"
Common labourer	15 - 20	"		"

The proportion of the cost of the house represented by labour including that provided by the subcontractors ranges from one-third to one-half of the total cost; and one-third for office buildings.

Statistics of the economically active population aged 15 and over by principal industries, -- National Economic Development Board, 1954

PART IV HIGH-RISE APARTMENT DEVELOPMENTS

The origin of the apartment dates from the period when the influx of country dwellers in search of work in industrial areas had so concentrated the density of population in towns that the increased demand for land, and its consequent rise in value, made it unreasonable to build every individual urban house on its own individual plot.

According to Sidney Perks #, flats were built on the Aventine in ancient Rome as early as 455 B.C. and in later times, flats in high buildings became necessary in walled cities like Paris and Edinburgh, where population grew within inflexible boundaries. There are flats still standing in Edinburgh that date from the end of the sixteenth century.

The only similar dwellings in England were chambers in the Inns of Court and the Universities, until in 1804 York House (The Albany) in Piccadilly was converted and extended to form bachelor apartments.

When the lift was invented, apartments in multi-storey buildings were too inconvenient to be popular in places where two- or three-storey houses could still be found, and there was no real development until the early fifties. Flats built as a speculation in Westminster in 1851 were described at the

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Sidney Perks, F.R.I.B.A.: "Residential Flats", 1905

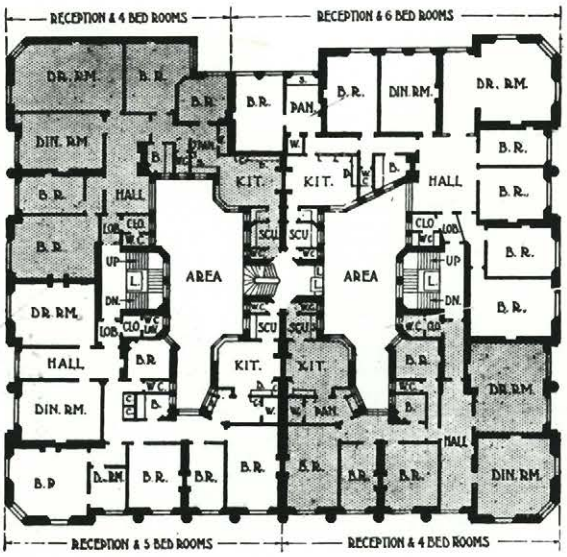
time as supplying "What has long been a desideratum in London, namely, complete residences on floors as in Paris and Edinburgh".

The flat, developed as a compromise necessary to enable a great number of people to be housed on a small but expensive piece of ground, was not at first considered as a new and better type of home that might revitalize the town and save the countryside, but as a substitute for the traditional house, flattened out on to one floor, so that a block of flats was treated as a stack of superimposed bungalows.

Frontage is the expensive item in land cost. Frontage means light and air, and in order to obtain enough of it economically, and more of it than existed on the street, it had to be created inside the building. So the early flats were planned around an internal court, and the kitchen, bathrooms and some of the bedrooms overlooked these dark areas, which were as small as the Building Acts would allow. They trapped stale air, and smelt, and dirt hung around the plumbing pipes that descended through them.

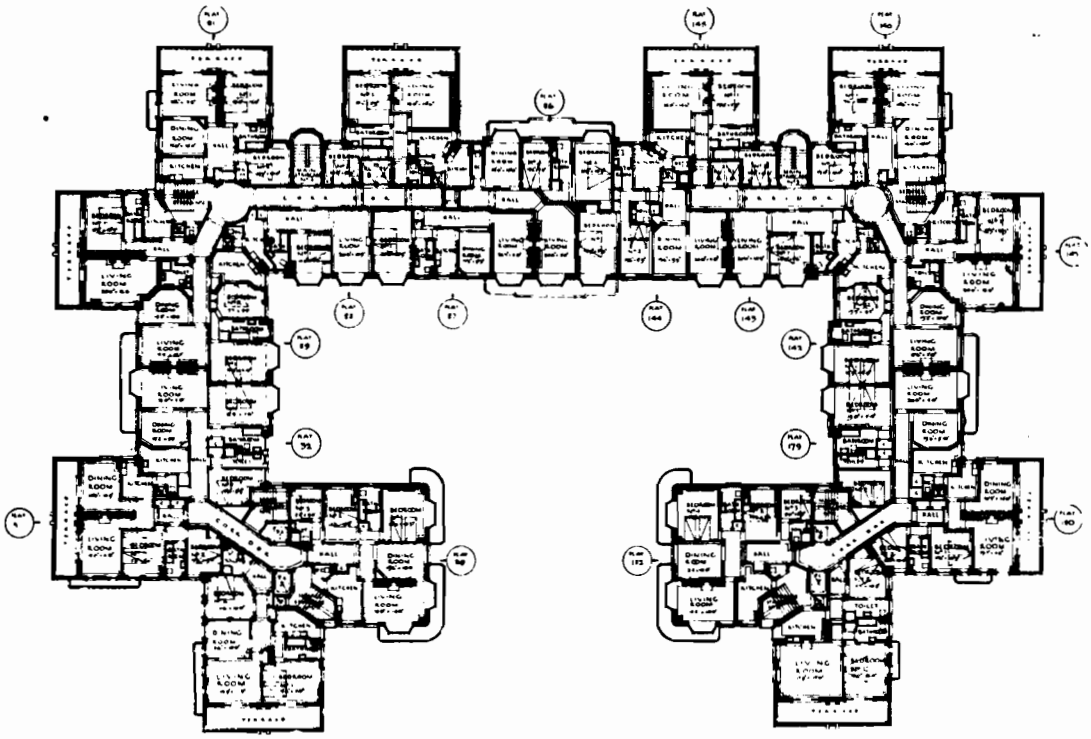
Although to-day the number of flats permitted on a site can be limited by the provisions of the Town Planning Act; and as an indirect consequence there is a tendency for the plan to open out, and for the totally enclosed inner court to disappear, (plan 2, 3, 4) and although many ideal schemes have been prepared, and although it is now generally accepted that the aim should be towards tall buildings, single flat

Plan 1

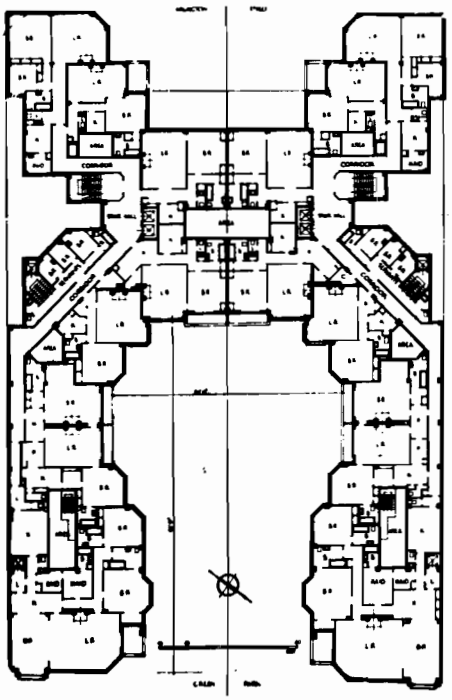


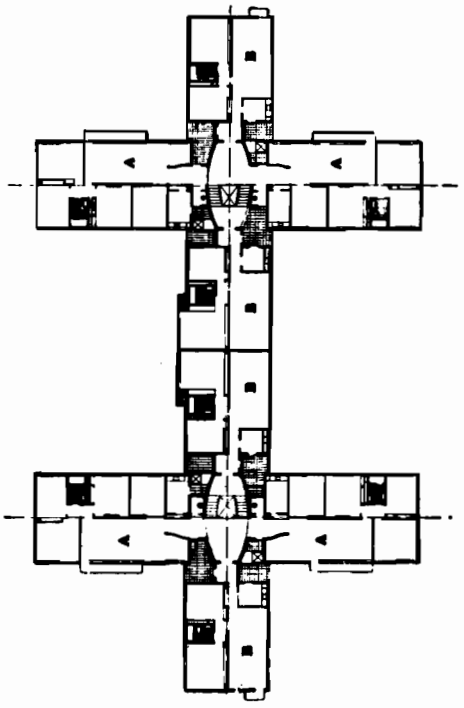
CIRCA 1900. Luxury flats planned round internal areas.

Plans 2, 3, 4



DEVELOPMENT FROM ENCLOSED COURT TO OPEN PLAN . Dorset House, Marylebone. Architects : T. P. Bennett & Son. Arlington House, St. James. Architect : Michael Rosenauer. Highpoint, Highgate. Architects : Lubetkin and Tecton. As the plan opens out, there is less need for such devices as bay windows, irregular room shapes and projections to secure adequate lighting ; and dark rooms in internal angles are avoided.





in thickness, without courts or areas and with wide spaces between the blocks, the general attitude of the speculator has not changed. His demand is still for the greatest number of flats on the site and his architect is forced to prepare his scheme with this end in view. Thus he must commence his work by fitting in a number of units on the site and think of these units as dwellings afterwards, rather than consider the individual flat as a proper dwelling unit from the outset. This results in amazing virtuosity in planning, but not the provision of proper homes for human beings.

Under the present system this is inevitable. Companies formed with the object of erecting flats must work from a purely financial point of view. When the land is found, the scheme prepared, the question is "does it show ten percent interest on invested capital?", and not "are these reasonable dwellings?" Thus a popular prejudice against flats persists because the homes they provide are not planned with sufficient consideration for the point of view of those who have to live in them. It is still common for a flat to have poor aspect, insufficient light, no view, ill-shaped rooms, noise because of ineffective insulation, and dust because of too close proximity to a traffic road. And conditions cannot be improved while the only flats provided are those in relatively small blocks, on sites cleared for them in already built-up areas.

In an attempt to improve "amenities" by controlling density, the building height is restricted by the Town Planning Act.

But it is not the height of buildings that produces bad conditions, it is the space between them that matters, and it seems reasonable to conclude that as buildings are made bigger, so the space between them can be made greater. There is no sound reason why the building should not be high, provided open space around it is sufficient. The high building has many advantages. It gives better views, and more light and fresh air than a low one. Lifts become an economic proposition, since they are a necessity in any building of more than three storeys, but do not normally become economical until a building has at least six floors or more in low rental work. The angle of light is improved, both for the building and for adjacent properties. #

A. Variations in Design; Building Types

1. Corridor Access:

Corridor-type apartments are those to which access is provided by means of internal passages with flats on one or both sides, fed by staircases, or staircases and lifts, at convenient points. #

The corridor type is suitable for one-room or two-room flats, which are similar in character and function to hotel rooms. It is the crudest flat plan and normally the easiest

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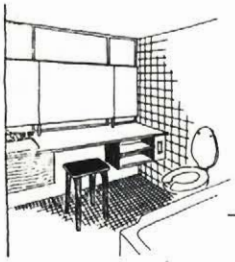
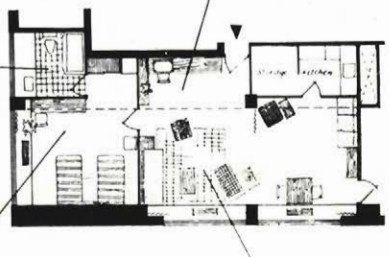
Yorke, F.R.S., (F.R.I.B.A.) and Gibberd, Frederick (F.R.I.B.A.) "The Modern Flat", London, The Architectural Press, 1950

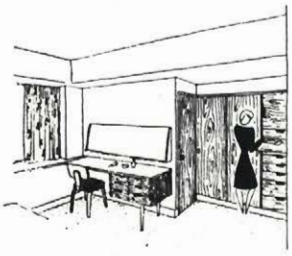
Corridor Flats

Left : Flats in Baker Street, London : large flats planned with corridor access necessitate duplication of access through parallel public and flat corridors. But with single room flats very economical planning is possible. Right: One-room flats Mount Royal, Oxford Street, London, 1933. - Architects : Sir John Burnet, Tait & Lorne.

Corridor Flats



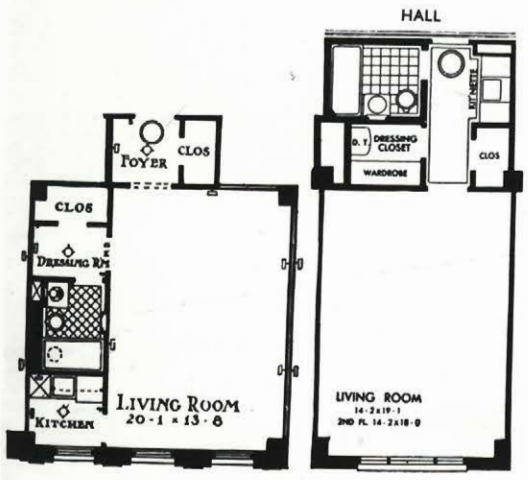


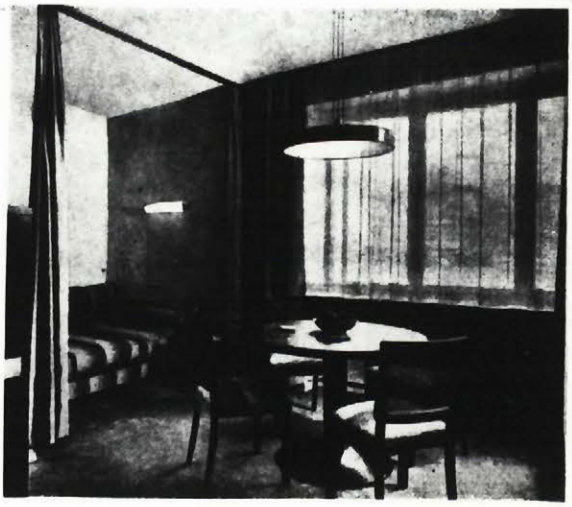


Corridor access is most suitable for one and two-room flats, particularly when they are similar in character to hotel rooms.

One of the twelve two-room flats planned on the top of the Terrace Plaza Hotel, Cincinnati, 1947. Skidmore, Owings & Merrill, Architects.

One-room apartments 319 East 50th St. N.Y. City. Architect: G. Miller. Kitchen on external wall, and indirect ventilation to bathroom. Another American example, in this case a kitchenette opens off the lobby. One-room flat with bed recess, Berlin. Architect: Rudolf Frankel.





to devise. It is consequently very popular.

The first disadvantage is that the tenant, having made his vertical ascent by lift or staircase, is required to travel some distance horizontally along the corridor of the building before arriving at the entrance to his apartment.

Secondly, the corridor type is uneconomical in floor space; the large flat is less suited to the system, because the rooms become strung out with long internal corridors connecting them, and communication between them is by secondary internal corridors.

Thirdly, it is expensive to run; there are heavy maintenance items in artificial light, cleaning, etc. The corridors need heavy carpets against noise, and accoustic treatment for walls and ceilings.

Fourthly, the corridor flats are hygienically inferior to other types and each flat has only one external wall, making it difficult to obtain proper cross-ventilation in the rooms. (See plans on following page)

2. Gallery Access:

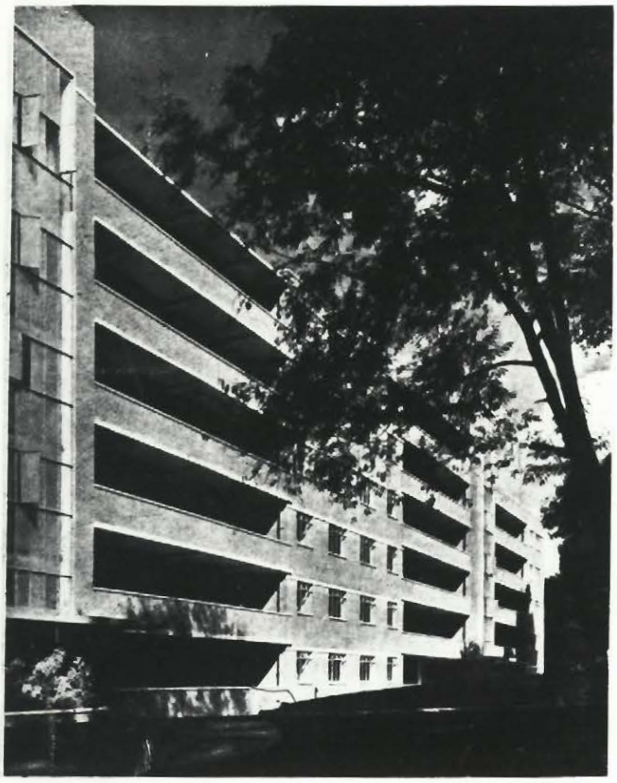
Gallery-type flats are those to which access is provided by means of open galleries, fed by staircases, or staircases and lifts, which may be open or enclosed. #

Yorke and Gibberd, "The Modern Flat"

Gallery Access

GALLERY ACCESS. Flats at St. Gall, Switzerland. Architect : H. Hauser.

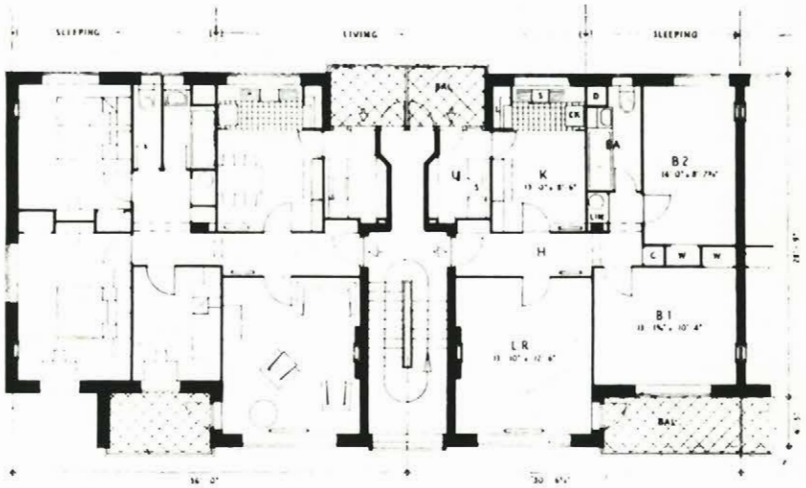
Gallery Access



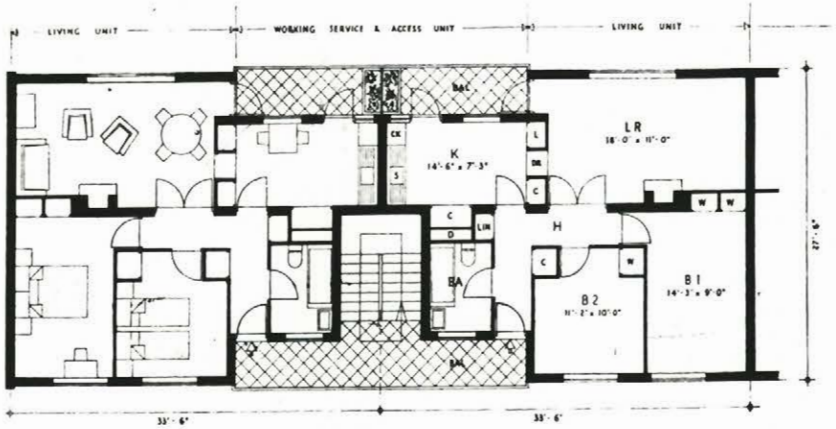
Gallery access flats are generally limited to one or two-room type, as they can be very economically designed without habitable rooms overlooking the gallery. Left : Flats at Brae Court, Kingston-on-Thames. Architects : Armstrong and Bayne.

Gallery Access

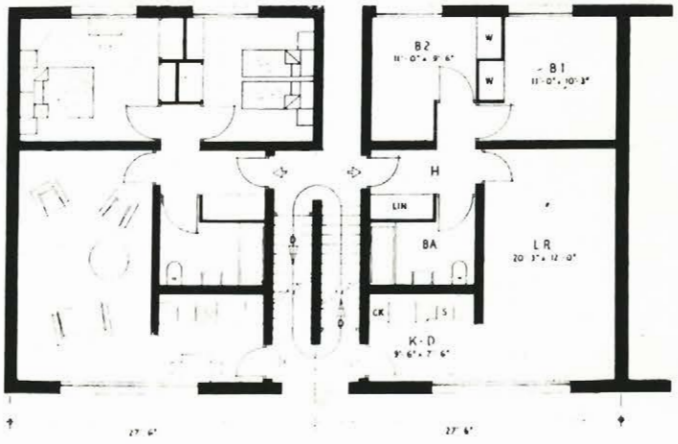
VARIATIONS IN THE DIRECT IN PAIRS FAMILY FLAT PLAN. Top: Dwelling arranged in two distinct zones, sleeping and living, giving better sound insulation between party walls. Separate tradesmen's entrance through utility room. Balconies provided for both living room and kitchen. Centre: The working and access parts of both flats are arranged together as a single working, service, and access unit. The habitable rooms form an independent unit. Bottom: Separate public and tradesmen's entrance to hall and to kitchen, by means of a pair of staircases parallel on plan and arranged like a pair of scissors in section.



Flats at Kensington, 1946. Architect : Edward Armstrong.



Flats for the British Steelwork Association, 1944. Architect : Frederick Gibberd.



Flats at Illinois Institute of Technology, 1943. Architects : Skidmore, Owings & Merril.

The access gallery-type building consists in its simplest form of a series of flats, side by side, with an open gallery to the air, usually on the north, connecting them. The gallery-type of flat, like the corridor plan, may be objected to because it involves traversing the building horizontally, after the vertical ascent has been made. It's simplicity in plan shape, simple cross-ventilation and the ease with which one or two staircases can be made to serve a large number of flats, make the gallery plan especially popular for low rent flats.

One disadvantage is that the gallery is open to the air, and in cases where the staircase is enclosed, tenants must go back into the open air again after having entered the building. If the gallery is closed, it is difficult to obtain proper cross-ventilation, and it is too expensive to put windows on the exterior side of the gallery. Owing to the fact that the gallery is open to the air, it requires only a cheap floor finish such as terrazzo, terra-cotta tile, and a brick or concrete balustrade, so that footfalls, talking and shouting make it impossible to get rest and quiet. It has been argued that few people use the gallery at nights and therefore bedrooms may look on to it. This is not reasonable, because the rooms may be used by children who go to bed in the evening, and in any case, workers who start out early may be on the gallery at five or six o'clock in the morning.

3. Gallery Access, Maisonette Type:

A solution to the problem of providing a large flat with

an economical form of access can be found in the maisonette or duplex plan. Here the flats are planned on two floors, with gallery access to one floor only and internal staircase in each flat to the other floor. The Building is virtually a series of superimposed terrace houses. #

The common form is shown in the diagram on the following page. On one floor is the living room facing south, with hall, W.C. and kitchen facing the gallery access on the north (in tropical countries). The bedrooms are usually projected out over and under the gallery, so that the maximum space is obtained and a large flat or a tall apartment can be provided.

An argument often raised is that the maisonette plan is bad from the noise point of view as the living room floor of one apartment is over the sleeping floor of another, and that the maisonettes should be alternated in section, so that the party wall in a form such as a floating floor to insulate impact noise should come between living rooms, between bedrooms or between bedrooms and living room in each dwelling. This certainly has the great advantage that quiet zones are adjacent but there is one disadvantage. This is a psychological drawback, in that the tenants, having left the lift, must climb up the stair or go down the stair to their bedrooms. And in the case of the design of Mr. Dex Harrison, the tenants must after

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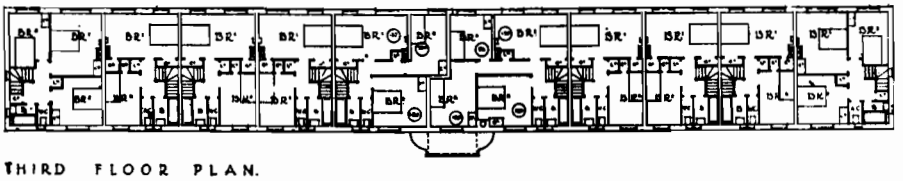
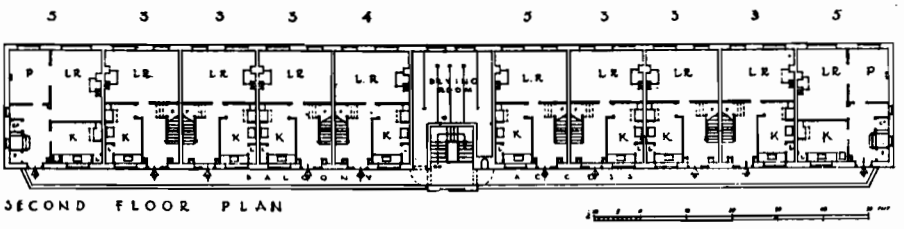
Definition from Yorke and Gibberd, "The Modern Flat"

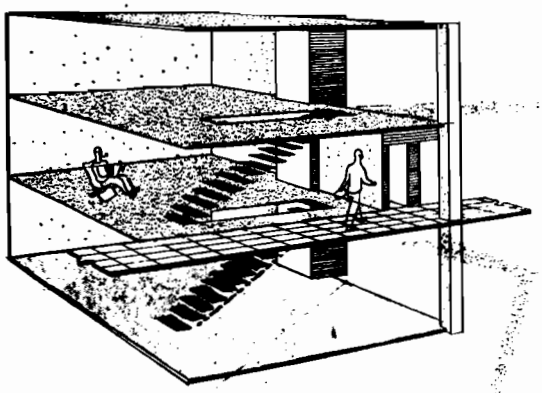
Maisonettes

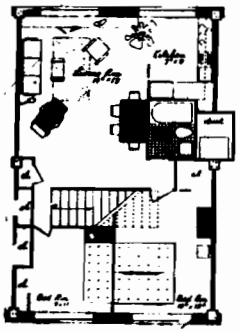


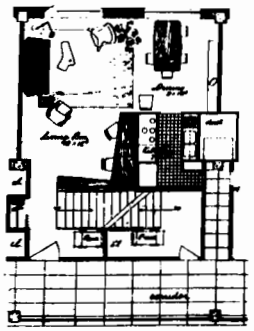
THIRD FLOOR PLAN.

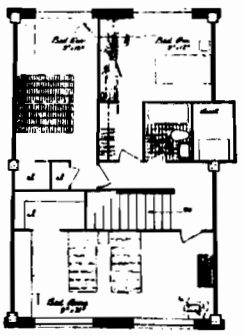


SECOND FLOOR PLAN







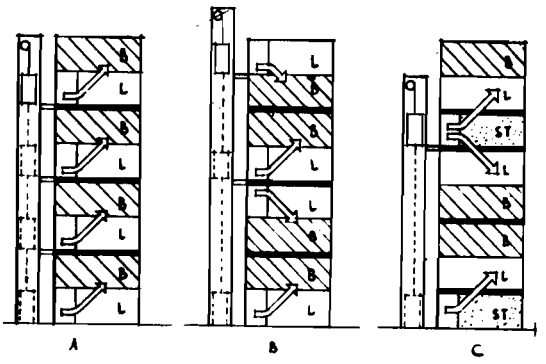


London County Council four storey three- and four-room maisonette type, 1946. The ground and first floors are similar except that the drying room becomes a pram store.

Michael Rees Housing Project, Chicago, by Michael Rees Hospital Planning Staff.

Sixteen floor flat blocks, divided into three storey sections, each section accommodating a flat and a maisonette. The access gallery is on the centre floor from which one enters the ground floor of the maisonette, or walks down a flight to the three-room flat.

Maisonettes



Section through gallery access maisonettes. A. Normal planning. B. Bedrooms on party floors for better sound insulation. C. Introduction of access and storage floor forming sound baffle between dwellings and requiring only one lift stop.

having left the lift, climb two flights of stairs to go to bed.

The gallery access maisonette is generally planned as a tall building, as it enables a large number of dwellings to be served by only one lift or a pair of lifts if precaution against breakdown is required. And further, the lift only stops at alternate floors, thereby reducing the running and maintenance costs.

4. Direct Access:

Direct access flats are those entered immediately from halls fed by staircases, or in tall buildings by staircases and lifts. With direct approach, once the vertical ascent is made, the tenant is at the entrance door of his home. Furthermore, the means of access occupies only a small amount of floor area, and is economical in landlord's services, -- heating, lighting and cleaning. Its advantage over the other enclosed access type, the corridor, is that in direct access flats it is possible to provide proper cross-ventilation. #

(a) Direct Single -- The form of direct plan is simple; there is only one flat per floor fed directly by stair and lift access. The building looks like a tower of superimposed bungalows, and to distinguish it from the other direct access types

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Definition from Yorke and Gibberd, "The Modern Flat"

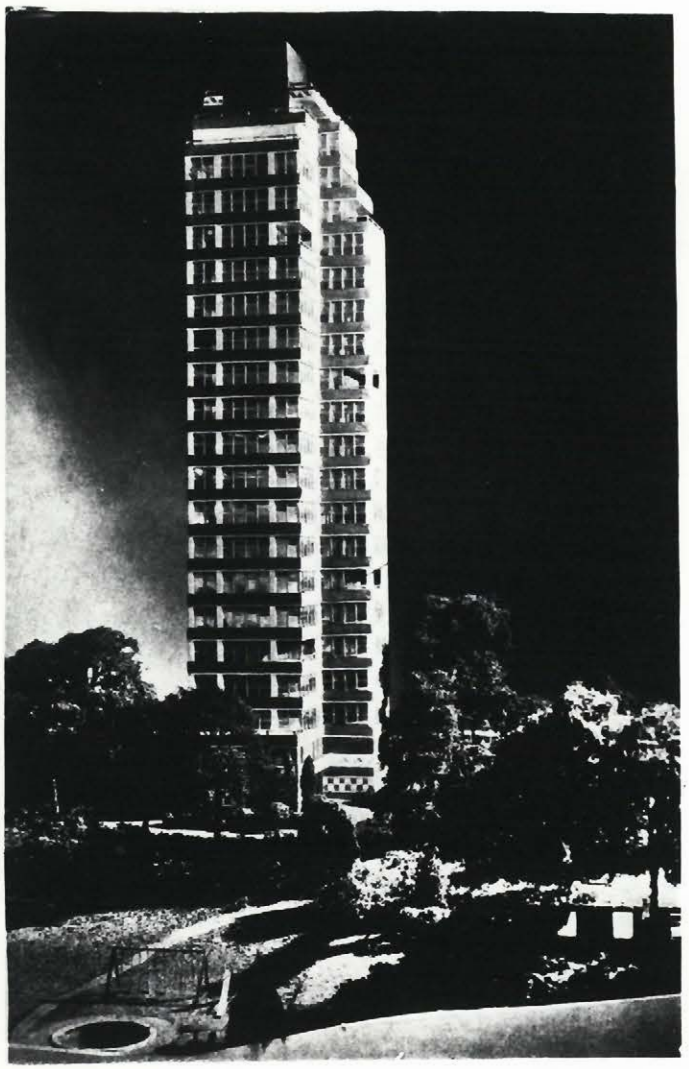
it should be called "Direct Single". It is suitable for luxury or semi-luxury dwellings, and it is a type that is commonly planned to be built between party walls on a relatively narrow town site.

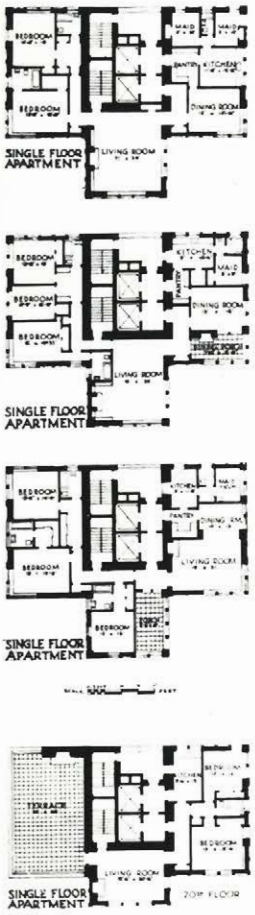
The disadvantage of Direct Single access type is the cost, since the cost of the staircase, the lift and the hall can be spread over only a few flats, making this a rather expensive form of building. Thus it is not economical for low-cost housing in any country, although if the building is tall, it can be far more economical in land cost than a terrace form, owing to the higher density obtained.

(b) Direct in Pairs -- Apartments planned on either side of a staircase, or lift and staircase, provide each flat with complete cross-ventilation, and the building shape is ideal for large open sites where the blocks can be arranged in series, running east and west (in tropical countries) to expose living rooms to the south breeze on one side, and bedrooms to north light on the other.

(c) Direct Grouped -- When three or more flats are grouped around a staircase and lift hall, they may be termed direct grouped. Groups have many of the advantages of pairs and are generally cheaper in cost, particularly if there are four or more flats per floor, as the initial and maintenance costs of means of access can be shared by a larger number of tenants.

Direct Access Flats



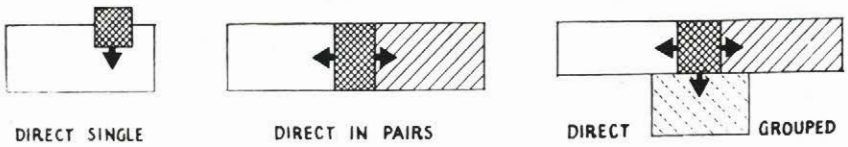


ACCESS DIRECT SINGLE. Project for apartment tower in the country. One flat per floor. Architect: Raymond Hood. The plans show variations in floor lay-out

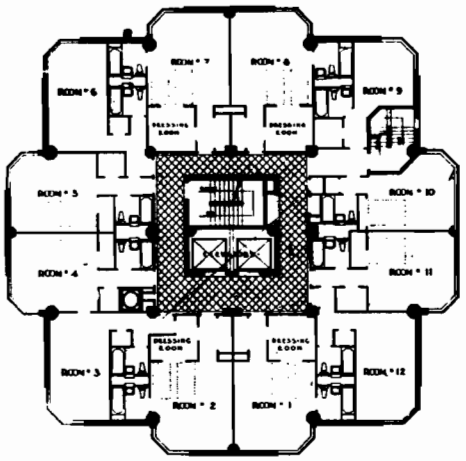
DIRECT ACCESS

Direct access flats are those entered immediately from halls, fed by staircases, or in tall buildings by staircases and lifts.

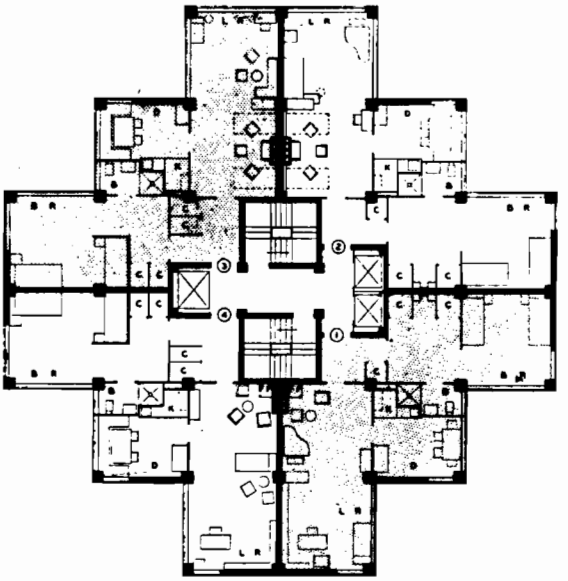
With direct approach, once the vertical ascent is made, the tenant is at the entrance door of his home. Furthermore, the means of access occupies only a small amount of floor area, and is economical in landlord's services :—heating, lighting and cleaning. Its advantage over the other enclosed access type, the corridor, is that in direct access flats it is possible to provide proper cross-ventilation.



Direct Access Flats



ACCESS DIRECT GROUPED. One-room apartments in groups of twelve. Seattle, Washington. Architect : R. C. Reamer. Sunlight Towers apartments in groups of four, New York. Architects : Lawrence Kocher and Gerhard Ziegler.



The cruciform plan is the most common, and this presents few planning disadvantages when the stair and lift are placed in the dark area in the centre. The problem of lighting the central hall and staircase can be overcome when the plan is not regular. Cross-ventilation must be sacrificed when a large number of flats is arranged on all sides of a central hall, but building regulations in England and also in Thailand require the atair to open onto the external air, which usually means that the circulation core must be unduly large.

Direct-Grouped flats present a more difficult problem in planning because ingenuity is required to give the rooms a suitable aspect, to keep the construction system simple, and to obtain well-lighted and well-ventilated lift and staircase halls in a reasonably small space.

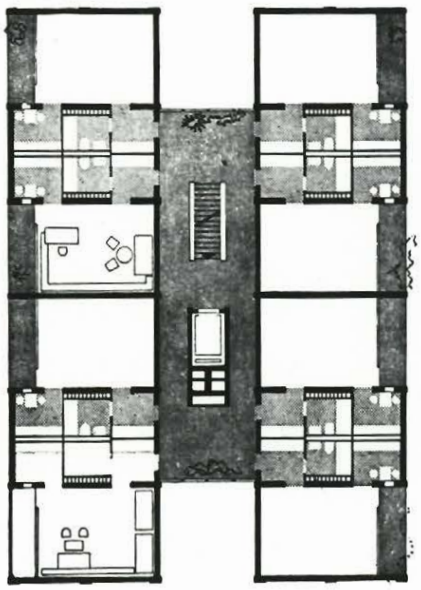
POINT-BLOCK

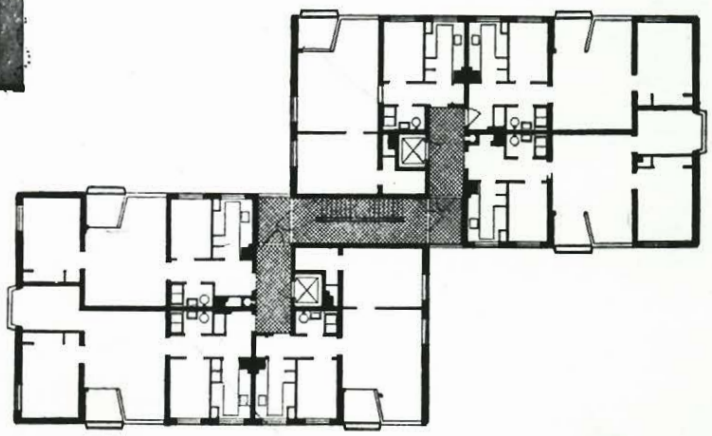
B. Point-Block Design and its Advantages

The Point-block is a special type of multi-storey apartment and a new concept of housing development which F.R.S.Yorke and Frederick Gibberd called "Direct Access Grouped Apartment" in "The Modern Flat" (1950), and which was called "Tall Block" in "Public Authority Housing" by Robert H. Mathew in 1958.

"Wohnhochhauser 1958" by Paulhans Peters had given the definition of Point-block as follows: "Point-blocks are a special type of multi-storey apartment blocks and as such

Types of Point-block





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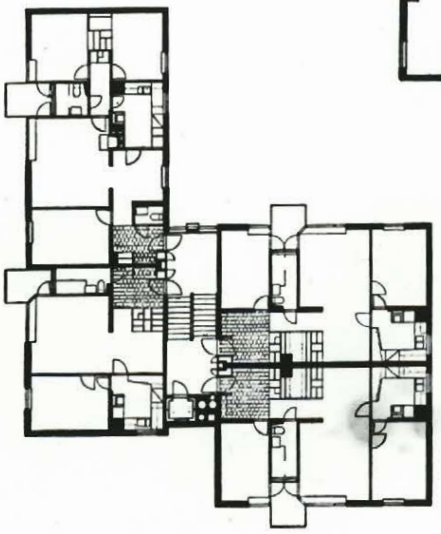
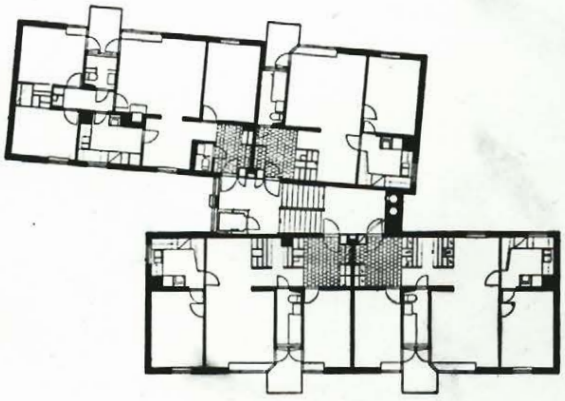
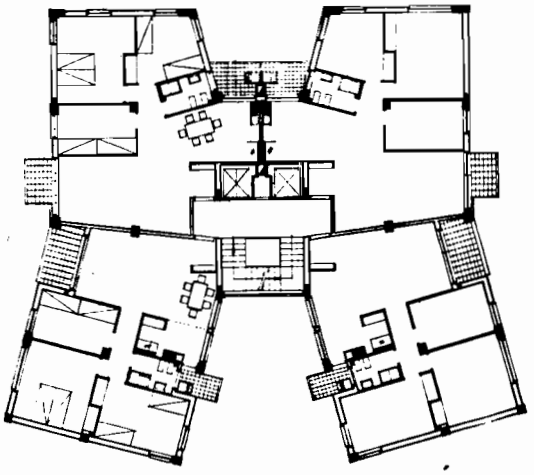
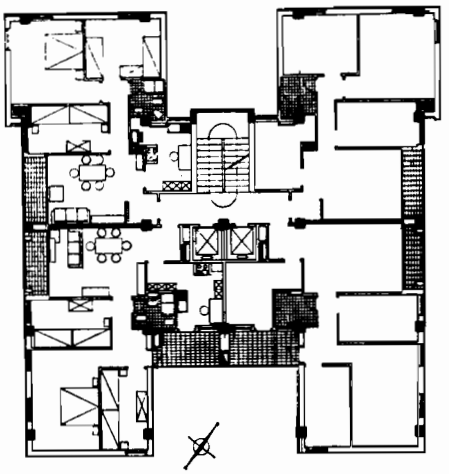
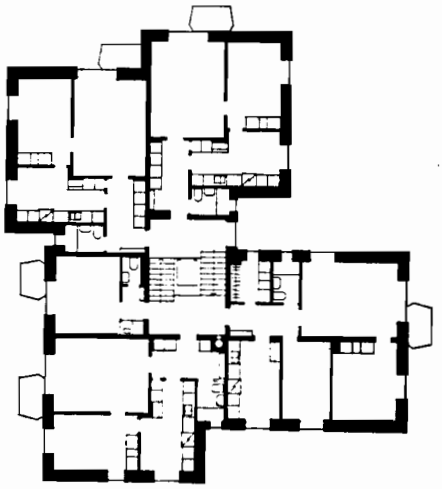




Types of Point-block







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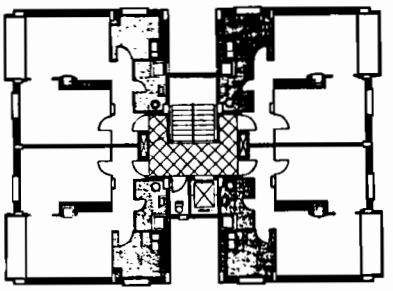

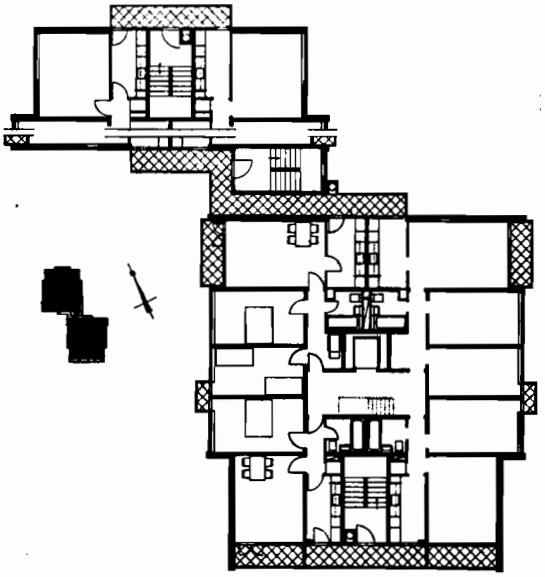

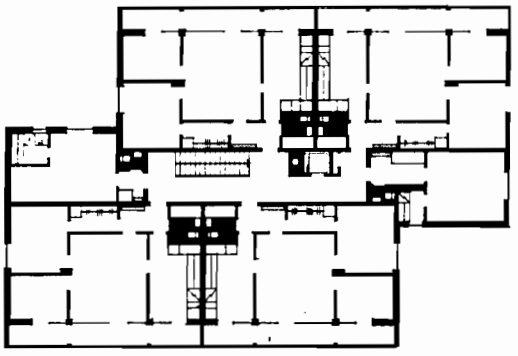

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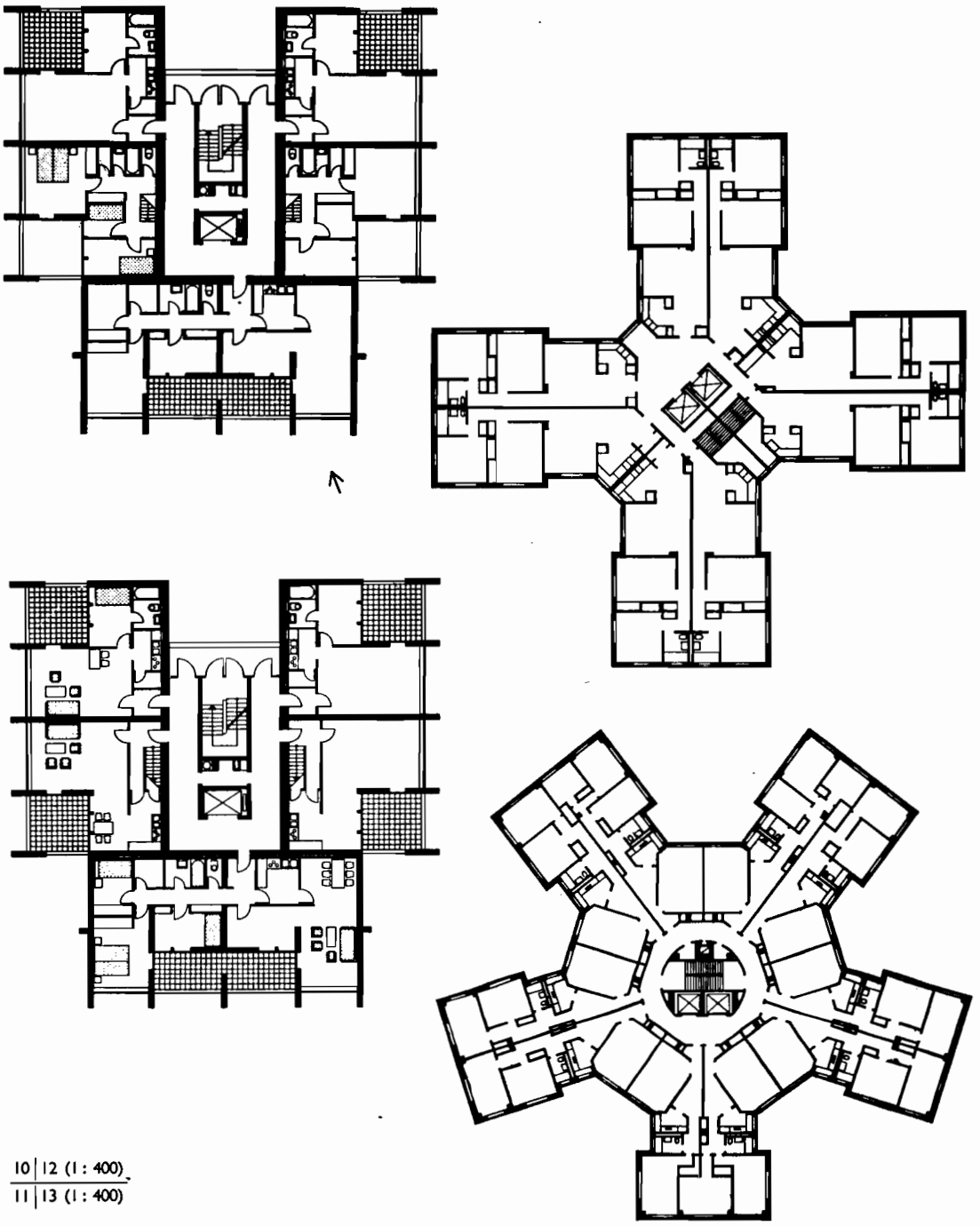

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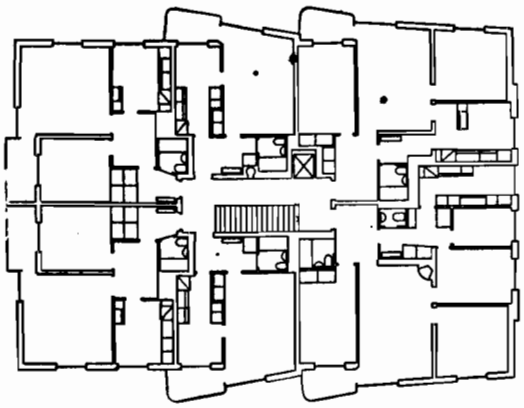
Types of Point-block



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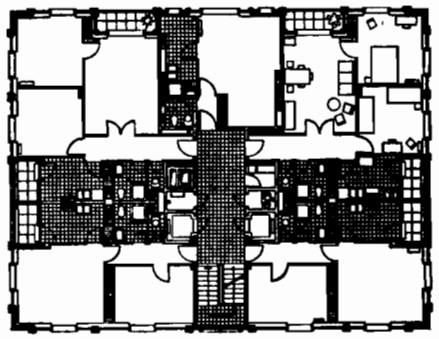
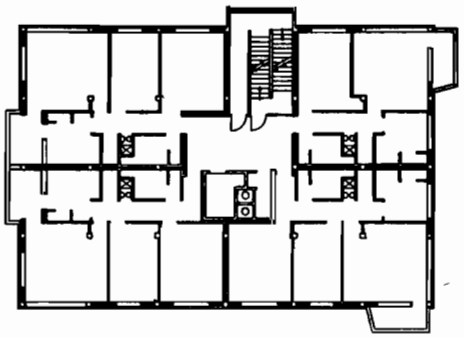
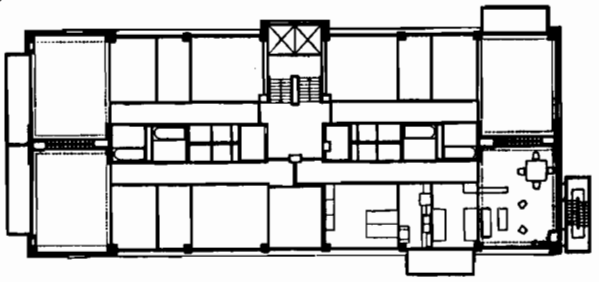
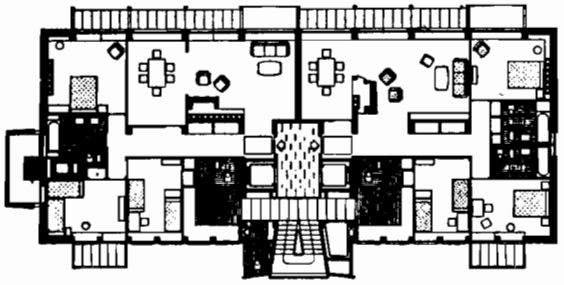
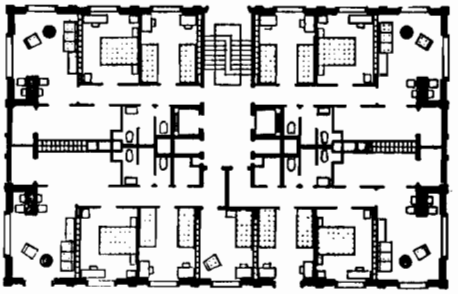
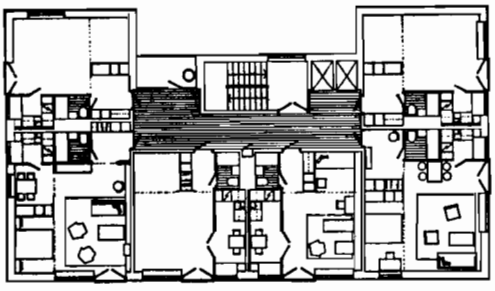


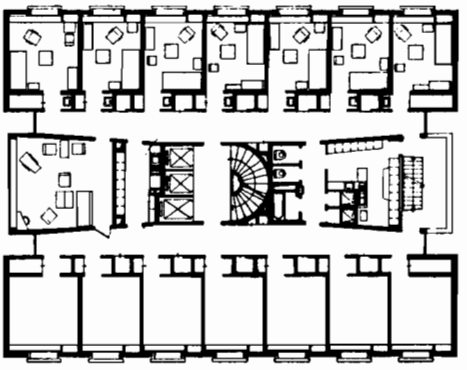




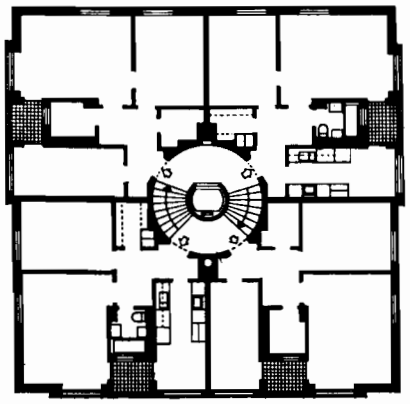


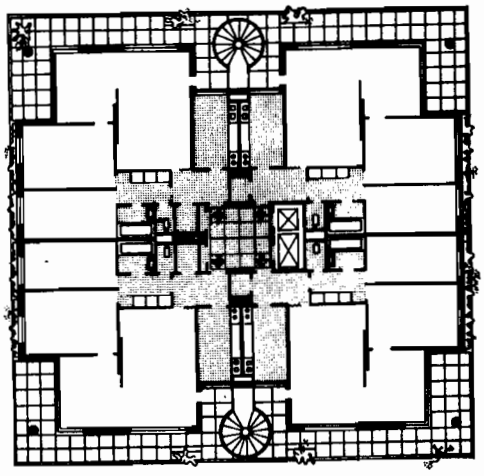


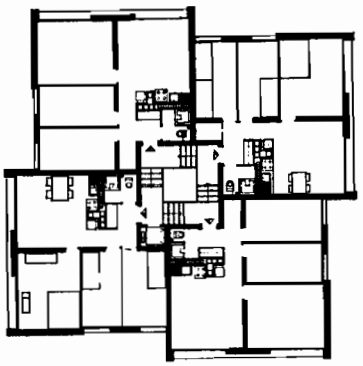




Types of Point-block







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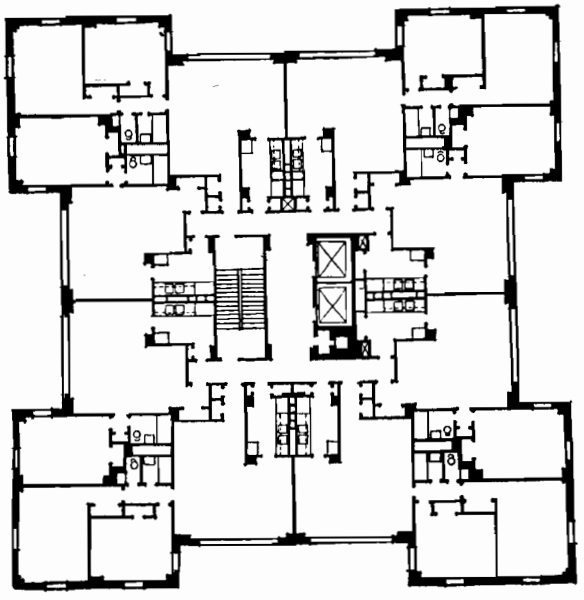

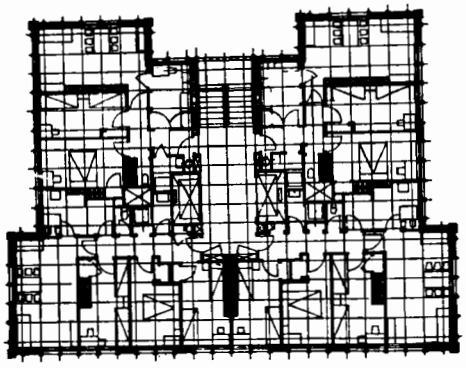

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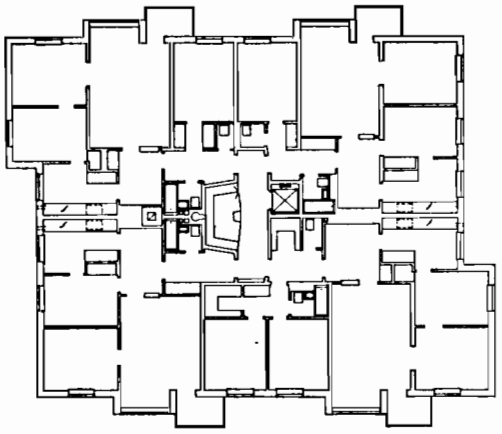

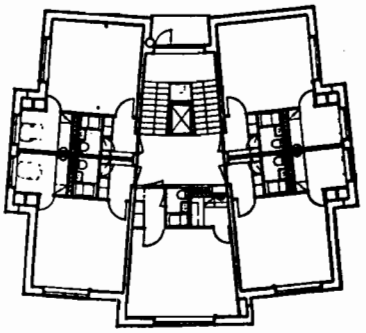

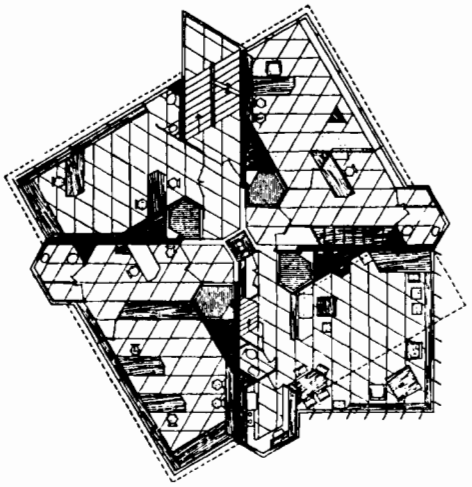

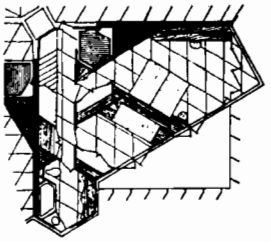

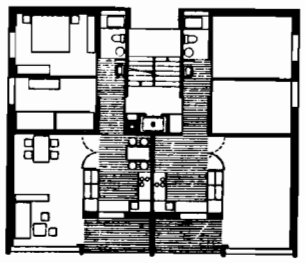

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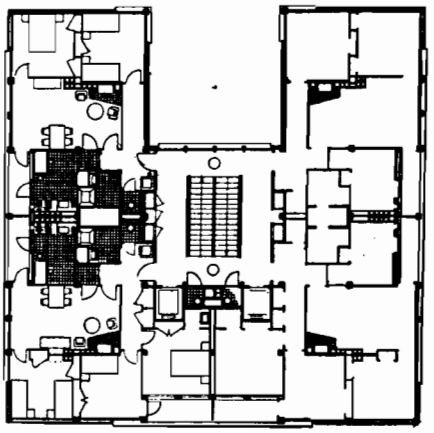
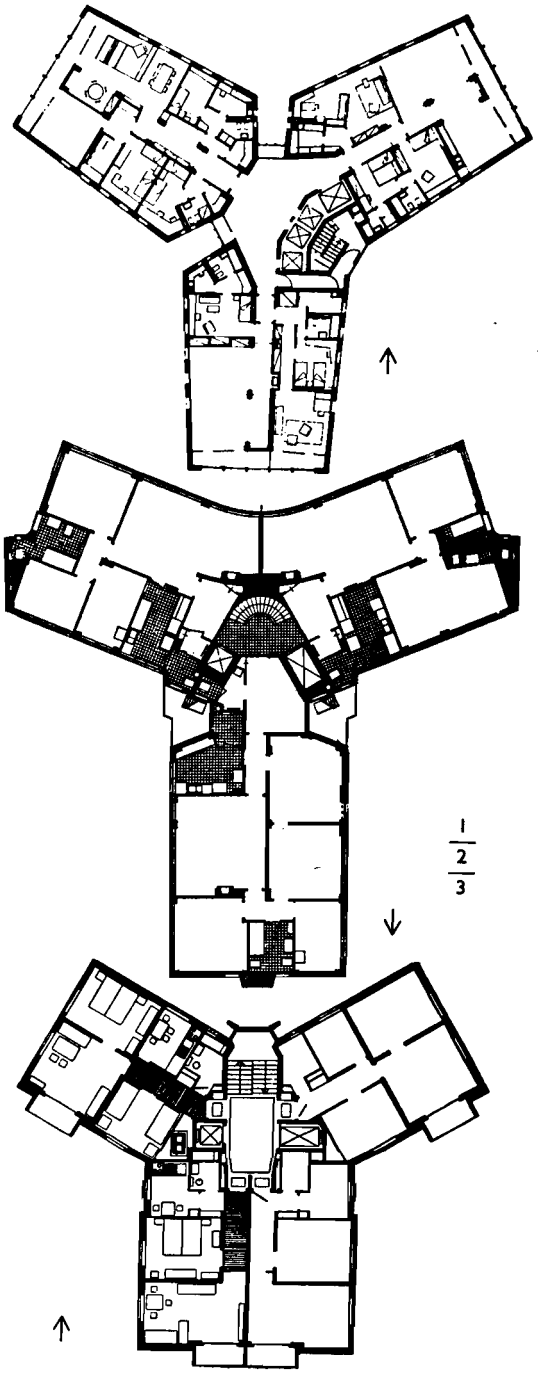


Types of Point-block



must be treated separately with regard to their ground plan and their suitability in a town planning scheme. Generally speaking, opinions differ as to whether multi-storey apartments fit into town-planning schemes and whether they are suitable for families with children."

And "The Point-Block Concept" was published by Professor Norbert Schoenauer in "Habitat" March-April, 1962, explaining that "the point-block concept is a new approach to multi-family housing, employing detached tower-like structures several storeys high. This concept is the result of conscious search for a new housing form which evolved from an endeavour to produce a design that enables every apartment to have windows facing all four points of the compass."

The point-block concept had its cradle in Sweden, where the first housing project of this kind was designed by S. Frolen and featured six-storey structures with five apartments per floor. During World War II, shortly after the erection of Frolen's "Punkthus", the city of Stockholm arranged a housing and town-planning competition. Submissions for the competition included the Point-block housing type and displayed it next to other dwelling forms, and solidified the position of the new concept.

Acceptance of the "Punkthus" or "Punkthauser" or "Point-block" idea followed in other countries such as in Denmark, where Morgens Irming and Tage Nielson designed featuring Point-blocks as the dominant building type, and won a major

housing competition in 1944. Similarly, France, Germany, Italy, Switzerland and many other countries in European continent used this concept.

In England, the London County Council's architectural office has developed Point-block designs in Roehampton, Portsmouth Road and Clarence Avenue.

During more recent years, many residential areas featuring Point-blocks were designed in the United States of America; the best-known example is Mies van der Rohe's Lakeshore Drive in Chicago. The most spectacular, the 60-storey point-block apartments of Marina City near downtown Chicago, which looks like two stacks of giant poker chips piled on the north bank of the Chicago River, was designed by Bertrand Goldberg. The latest proposal utilizing the point-block concept is an existing design for the Santa Monica Ocean Front redevelopment area of San Francisco, showing a well-conceived marriage between low and high-rise dwelling structures.

When we return to consider "Why does the Point-block concept find a good reception in different part of the world?", we see that it is because Point-blocks have the advantage over slab blocks in that, owing to their compact ground plan, they do not act as a visual barrier, and furthermore do not break up the general plan of an estate. Even when arranged in groups or rows their features remain distinct, and they cast less shadow, thereby reducing inconvenience to neighbouring residents to a bare minimum. Another advantage is that views,

even from the lower storeys are not blocked out.

From an economic standpoint, flats in Point-blocks are of course ten to fifteen percent dearer than flats of comparable size in maisonettes, but are in comparison rather more comfortable. There will always be enough people willing to pay slightly higher rents for the privilege of living high up above the noise and dirt of the city, with fresh air and pleasant views, especially if they are also spared unnecessary house-work.

And it is possible to analyze the physical advantages accruing from these new housing types. A close examination reveals five major advantages inherent in the point-block concept: #

(a) The circulation core of scheme "A" is smaller than that of "B". The stairway and the elevator areas are equal in both cases, but because of the close proximity of the four dwelling units in "A" the corridor space is revealed by the smaller cross-hatched public area of the point-block apartment. The above factor not only brings about savings in costs, but also renders the apartment units more desirable since entry to the different dwelling units is gained from the smaller and more

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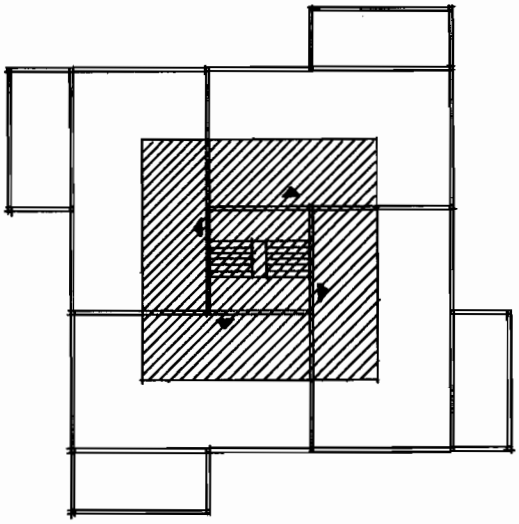
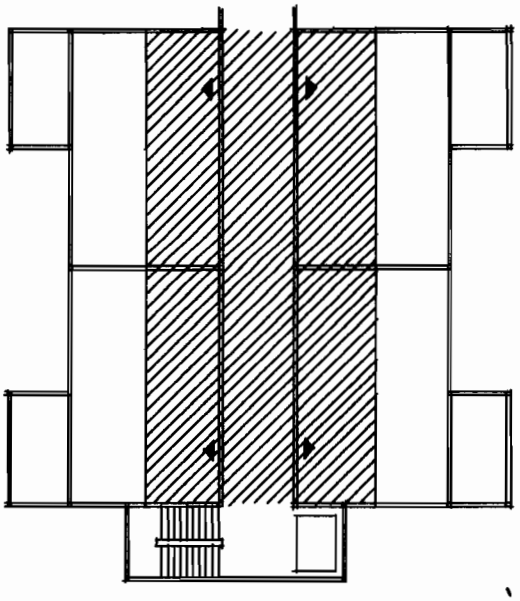
Shoenauer, Prof. Norbert, "The Point-Block Concept", pub. in "Habitat" March-April 1962 page 4

Comparison between Point-block and Double-road Corridor Flats



'A'



'B'

intimate public space. In contrast, slab apartments have generally impersonal and unsightly long hotel-like corridors.

(b) The proportion between well-lighted and dark floor areas is more favorable in scheme "A". Comparing the shaded area in our diagrams with the extent of well-lighted floor areas, the advantages offered by point-block developments must be recognized. Since areas where light penetration is subdued are only suitable for secondary rooms, less dependent upon daylight, it is evident that scheme "A"'s characteristics reflect the requirements of a dwelling more satisfactorily. The unfortunate practice of extending habitable rooms into the shaded area of the dwelling units is greatly invalidated with the point-block concept.

(c) The point-block is a detached structure; consequently each apartment has at least two exposures towards the sun. This advantage in northern sections of our hemisphere where the sunlight is at a premium, is invaluable. Furthermore, two-sided orientation of the fenestration is followed by the advantage of cross-ventilation, a factor which has little importance during the winter months, but conversely has some merit in the hot summer. However, it could be

argued that effective mechanical ventilation in our day and age makes this aspect somewhat less important.

(d) Closely related to the characteristic of two-sided orientation of each apartment unit in scheme "A" is the notion of privacy with respect to balconies. Having four apartments per floor, the typical point-block may accommodate one balcony on each side and thereby assures each dweller complete privacy. A similar arrangment is, of course, physically impossible with the slab apartments unless the expensive solution of recessing all balconies completely within the building is used.

(e) Finally, the last attribute of the point-block concept derives from its slender structure. This feature enables the siteing of several tall blocks of flats without visual disruption of the natural topographical environment; moreover, the numerous apertures between building structures will prevent a total blockage of any vistas. Compared to slab Apartment blocks, the tall tower-like structures have only a narrow shadow sweeping the ground with less ground area in perpetual shade. This fact is beneficial for landscaping as well as recreational activities in the outdoors.

The Construction

The construction of Point-blocks varies from country to country. At first the skeleton construction was taken over from the United States, but this involved certain difficulties regarding installation and sound insulation. The advantage of this method is that the ground plan is variable, making it the most suitable type of construction for offices and administrative buildings. When considering flats, variability is not an important factor.

Another method, this time from Sweden, is to erect supporting walls of poured concrete. The advantage is that the shuttering can be put in place by unskilled labour, and can be used many times. This type of wall possesses, on account of its great weight per square yard, excellent sound insulating properties and are also suitable for thermal insulation. Two systems are in common use:--

(a) A composite structure consisting of an internal supporting core of solid concrete (reinforced or plain), and external layer of porous concrete slabs which act as thermal insulation, bonded wood, wool, or some other effieient insulant, and an internal slab with a smooth surface, and frequently of room height, which on account of its finish, need not be plastered.

(b) In the second system, porous concrete is used because of its thermal insulating properties, and

the walls are made thick enough to enable them to bear all loads. Local conditions and cost of materials will determine which method is the more economical in each given case.

For completeness' sake it should be mentioned that in recent years, point-blocks have been constructed at Basel, in Mittlere Strasse by A. Gfeller and H. Mahly, and at Munich, in Schwanseestrasse by F. Ruf and G. Roemmich, with supporting walls of brickwork, and excellent sound and thermal insulation was attained. It is unlikely however, on account of high labour costs, that this type of construction has any chance in the future as far as point-blocks are concerned.

Pre-fabrication of exterior wall components, stairs, general installations and partition walls is very popular in the Scandinavian countries, in the United States and also in Canada, because there is appreciable saving in labour costs on site. Construction by assembly of pre-fabricated parts has proved successful, but it does tend to limit building to large numbers of point-blocks of similar dimensions in order to be economic.

Planning Systems

Since there are no public horizontal connections in point-blocks, and flats are accessible directly from the lift, stairs and lifts are the only means of communication. It can be assumed that lifts will always be in operation, so that stairs are used only in the case of failure and fire escape. The

laws concerning this vary according to the country. In Sweden, the country where point-blocks originated, internally situated, artificially lit and ventilated staircases are allowed, whereas other countries permit only two separate staircases linked by landing and fire-proof doors, one staircase at least being on the external wall. Sometimes additional emergency staircases are prescribed above a certain heights which corresponds to the length of an extended fire escape ladder, if there is only one other main staircase in the building. In England, legislation requires the stair to open onto the external air. German law decrees that there need only be one staircase as long as it is accessible from every flat by an open landing whose bannisters must be at least 4 ft. high and fireproof up to a height of 3 ft. In this case, the staircase need not be on the outside, and does not have to have windows. German regulations also demand that all supporting parts shall be fireproof. The roof and roofing materials must be of fire-proof materials, window sills should have a height of at least 3 ft., lintels should be fire-proof and reach down from the ceiling for about 10 inches; if they are fixed into incombustible frames and made of fire-proof glass, they should reach down 2 ft. Such lintels are not required underneath balconies which jut out for more than 2 ft.

The collection of ground plans found on the next page shows a number of typical plans of buildings. Division into section according to their method of construction, such as square, rectangular, circular and even triangular, and those of composite forms represented by Y-shaped, T-shaped, U-shaped, H-shaped, cruciform, cross or star-shaped and cluster-shaped, irregular or twin structured, stress the characteristics of each type, and is intended to facilitate the designer's task.

Square plans have a minimum outside area for a given area of ground covered, and thus show the least possible thermal loss. This is a reason why the square form is particularly favoured in the Scandinavian countries. In the case of rectangular plans, the ratio of width to depth must be kept within certain limits in order to prevent corridors inside becoming too long. In the case of the circular form, Bertrand Goldberg explained that it gave the highest ratio of useable floor space to exterior skin, that secondly, it reduces actual wind loads and wind stresses, and that lastly, the circular shape reduces the length of supply and return runs for utilities. The group of T- and Y-shaped plans illustrates how fullest possible use is made of sunlight, but it also shows how with fullest exploitation of available space, domestic hygiene is effected. Two-storey maisonettes are not treated separately, as they are seldom used in point-block and are more often encountered in slab blocks.

The triangular form indicates new possibilities not yet fully utilized, and the plastic effect gained by loosely grouping the individual living units around a central staircase. Twin plans offer very economical solutions since up to three rooms can be grouped around a staircase with an even more ambitious building programme, provision must be made for additional lifts and stairs, which cancels out the economic gain. Also, there is a danger with twin blocks that several rooms of a number of flats receive less than their fair share of sunshine and are pushed between the two halves of the building, resulting in bad ventilation, mutual interference and general inconvenience.

PART V A PROPOSAL FOR A POINT-BLOCK DEVELOPMENT IN BANGKOK, THAILAND

Point-block developments have living units arranged and equiped for housekeeping and grouped in one of many ways, varying in size, appointments and facilities, providing a wide degree of flexibility to satisfy all requirements of urban living. Gropius suggested that Point-blocks should have an economical height of ten to sixteen storeys with centralized services, and should be built in districts zoned for high density. # According to Friedberger's conclusions from his investigations, "high-rise buildings surrounded by as much landscaping as possible thus appear to be the only housing types suitable for metropolitan areas. The sin of a fallacious housing policy and particularly of incorrect land use during the growth period of our metropolitan cities have virtually brought the only type of housing appropriate for large cities into disrepute." ##

Most of the articles on the subject mention that the majority of people prefer to live in tall-block apartments, and Matthew from his surveys found that about 60% of people prefer to live in eleven-storey tall-blocks. ### To add to this, Gropius found that 60 percent declared themselves in favour

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Walter Gropius: Scope of Total Architecture, 1962

Ibid. p. 106

Robert H. Matthew: Public Authority Housing, p.180

of apartment-house dwelling. #

Probably reasons for the trend toward point-block apartments may be found in increased living costs, high taxation and in the changing pattern of living brought about by the influence of present-day civilization.

Frankly speaking, the author feels that point-block apartments are much airier, well separated one from another, provide a maximum of wide park areas to offer more quiet, more seclusion and greater peace in the upper storeys (no noise from streets or playground and an unobstructed view), more recreation facilities for the children as well as for the adults. It might be noted that the safety of elevators must be increased sufficiently so that children can use them without danger.

Gropius also stressed that only Point-block can assure the urban population of a maximum in living comfort with regard to health, provide economical centralized services for housekeeping and ensure short commuting distances with transportation at a price it can afford. ##

A. Principal Objectives

The principal objectives of this thesis would be as follows:

1. to alter the previous land use by creating high density in an area of high land values, thus helping to prevent the waste of

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Walter Gropius, Scope of Total Architecture, p.108

Ibid. p.105-106

government funds on housing of excessive size, while facilitating the financing of construction of minimum dwellings for which an upper limit of apartment size must be established.

2. to serve the needs of those who could not afford houses of their own, and of increased population.

3. to develop a new way of life and improve the living conditions, standard of living, social life and a better community.

4. to ensure short commuting distance, save time and cost of transportation to and from working places and at the same time reduce the use of them.

5. to relieve the individual occupant of a large portion of the most tedious and time-consuming domestic chores by means of centralized service installations. This is also important from the point of view of the national economy because of the over-all saving in material and time.

6. to inspire the government's organization to build dwellings themselves for people to live in as cheaply as possible and remove them from the hands of speculators.

7. to introduce the prefabrication system or mass production methods for reducing the cost of dwelling construction, save time and labour cost at the construction site. This system can be performed under any conditions of weather and season.

B. General Characteristics of Point-Block Development For Moderate-income Residents

"The large city must assert itself; it requires a development of its own, a type of dwelling adapted to its own life which provides a maximum of air, sunlight and vegetation with a minimum of traffic and maintenance needs." #

Point-block apartments surrounded by as much landscaping as possible would normally be expected in the design in which there is variety of architectural form and silhouette, with inherent possibilities of exciting contrast between building and building as well as between building and landscape. The creation of good outdoor amenities in the form of public open space, children's playground, paved court, and full use of landscaping and of all available space on the ground and on roofs can be carried out in order that nature may become a daily experience, not merely a Sunday excursion.

The five groups of Point-blocks each consists of three Point-blocks, covering little ground. The three parking garages represent the centre of the Point-block grouping and divide the whole site into three main sections. Each of the garages is lifted up from the ground to a different level, according to the design, so that adults and children can use that area for playing and resting during the period

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Walter Gropius, Scope of Total Architecture, p.112

when the sun is strong, and in this way the design has succeeded in reconquering the land which is lost on the ground when a regular building is built. At the same time, the breeze can pass through efficiently, and a flowing space is created.

Each parking garage consists of three storeys for tenants' cars; shops and stores for daily living needs are located on the ground floor. The diving pool and cabanas are on the roof-top of the first parking garage. The second garage also provides a restaurant combining both indoors and outdoors, partly covered by canvas or wood screen for protection from the sun. The minigolf course with landscaping and the interior bowling alley are on the roof-top of the third garage. Five passageways connect the three garages to the five groupings of point-blocks around them. The kindergarten and nursery school are also located in the landscaped areas between the paralell point-blocks. Near the Chao Phraya River, the club-house is intended as the centre of the neighbourhood community.

In designing the layout plan of the Point-block development, the author looked for the safest solution, and finally made an absolute separation between the car access and the pedestrian, so there would be no question of interference of traffic within the site.

Connecting all Point-block groups there are pedestrians' paths with a surface which avoids glare and slipperiness.

The pedestrian is properly considered in regard to green growing landscaping, since along both sides of the footpaths there are many kinds of trees, flower, ground-covers, gardens, rock gardens and so on. Service access to each group of Point-blocks is in the core of the parking garage on the ground floor.

Each Point-block grouping consists of three tall-blocks of ten to sixteen storeys. The circulation core is the centre of the grouping; it consists of one reinforced concrete staircase for emergency exit or fire escape, and two elevators which stop at every second floor (for economy in operation). Besides this, two incinerators, washing machine and dryer are provided for on each floor.

1. Number of Families:

Total number of families	1,579
(a) Bachelor type (standard)	576
(b) Bachelor type (large)	176
(c) One-bedroom type	376
(d) Two-bedroom type	176
(e) Three-bedroom typw	260
(f) Penthouse type	15

2. Types of Apartments:

There are six types of apartment unit.

(a) Bachelor Unit (standard)

Sometimes called Bed-sittingroom units, these meet the needs of unmarried individuals (men or women) and consist of one bed-sitting room with bathroom, kitchen, working-, dressing- and closet-space suitable to their requirements.

The total floor area per unit is 48 square metres
or 516 square feet.

(b) Bachelor Unit (large)

Bed-sitting room with bathroom, dressing- and closet-space the same size as the bachelor unit(standard), but the bachelor unit (large) has larger kitchen, dining alcove and more working space than the bachelor unit (standard). This could serve the needs of some individuals who might require the bigger unit.

The total floor area per unit is 67.35 square metres
or 724.00 square feet

(c) One-bedroom unit

So-called efficiency unit, consisting of one bedroom with living-dining room, bathroom, kitchen, working-, dressing- and closet-space frequently provides an answer to the requirements of the young married couple, both of whom are working or away from home in the day. Because of being suitably located near place of work, such units can be adapted to the needs of unmarried individuals, such as two or three men or women joining together for the maintenance of living accommodations.

The total floor area per unit is 96 square metres
or 1032 square feet.

(d) Two-bedroom unit

This consists of two bedroom in a duplex arrangement; one bedroom with bathroom, dressing-, working- and closet-space is on the upper floor, and the other bedroom with bathroom, dressing-, working- and closet-space, living-dining room, and kitchen are all on the lower floor. It should be designed to provide as a minimum all the advantages found in the small house and at the other end of the scale of degree of amenity which can be arranged for, and contain sufficient space to fulfil the primary functions of household life.

The total floor area per unit is 124.65 square metres
or 1339.98 square feet

(e) Three-bedroom unit

Arranged as a so-called duplex type, it consists of three bedrooms which are on the upper floor with bathroom, dressing-, working- and closet-space, and with gardening balcony next to the master bedroom. This unit offers the most privacy and cuts down horizontal distance. The living room, separate dining room, with kitchen and large working space are on the lower floor with the front balcony which must be included in a comprehensive scheme to accommodate the requirements of various incomes within the moderate income group, and various age groups.

The needs of one family may change several times

during the course of a few years as family income and size change. The unit can be made flexible by moving or adding partitions or changing the position of the furniture to adjust to the requirements of the tenants and their ability to afford the accessories.

The total floor area per unit is 184 square metres
or 1978 square feet

(f) Penthouse unit

This is suitable for people who prefer to live on the roof-top for more privacy, fresh air and no noise with a roof garden and large terrace. This unit consists of three bedrooms with bathroom, living room, separate dining room, kitchen, bar, working-, dressing- and closet-space on the same floor.

The total floor area per unit is 192 square metres
or 2064 square feet

Each unit type as described above has its own large balcony, on which tenants can arrange deck chairs or a table for four to six persons in any way they like. The partitions between units and both side walls of the tall-blocks are double walls made by prestressed prefabricated panels and there is air space between them for both acoustic and cross-ventilation purposes. This method reduces the radiation of heat from the sun on the tall-block's wall and the wind can flow through the air space from the first floor level up to the roof-top.

Following the same method is the prestressed prefabricated slab floor, but the lower layer uses acoustic material under a longitudinal band-beam, while the upper layer in living-room, dining-room and bedroom is faced by teak-wood or red-wood parquet (it is cheap in Thailand). The upper layer of balcony and corridor floors is faced with domestic ceramic for protection against glare and slipperiness. Kitchen floors are faced with vinyl-asbestos tile, but bathroom floor and walls are faced with domestic mosaic. The outside partition of every unit beside the corridor is made of prefabricated wooden louvers for cross-ventilation purposes. The doors of apartment units and the panel covering the closet space are the same.

Double prestressed prefabricated slabs are used for the roof to reduce the radiation of the sun's heat, for moisture-protection and to provide air space between them which the wind can flow through. On the slightly pitched roof is used three layers of built-up roofing with two layers of aluminium foil which has a guaranteed life of 20 years. The face of the upper layer is covered by gravel or clay tile to serve as the roof garden and at the same time used as insulation.

The elevation sides of the Point-block which face southeast and southwest have horizontal prefabricated sun-breakers for protection against sunlight. The window panels use wooden louvers and teak-wood frame. The windows also have Whitco window fittings which can open or close at different angles from 0 to 110 to act as sun-breakers in the vertical direction.

All the types of apartment units are flexible because the author decided to design on the module or on the modular system. The results show that the number of apartments of each unit type can be changed to correspond to whatever the tenants' requirements for unit types may be.

3. Facilities:

The facilities in this community are as follows:

(a) Parking space for the occupants -- tenants' cars can be parked 124 cars per floor of each of three storeys of the parking garage, making the total number 1116 cars.

(b) Parking space for visitors -- at two sides of the building site is for 69 cars.

(c) Shops and stores -- on the ground floor of the parking garage will be

3 super markets	3 shoe stores
3 variety stores	3 beauty shops
3 drug stores	3 bakery and candy stores
3 banks	3 cleaners shops
3 women's wear	3 barber shops
3 children's wear	

1 restaurant
1 diving pool with cabanas
1 bowling alley and minigolf
} on roof-tops of the parking garages

(d) Kindergarten and Nursery School -- there is one kindergarten and one nursery school located in the landscaped areas between the parallels of the Point-block grouping.

(e) Club-house -- the centre of the community, consists of a men's lounge, women's lounge, game room, restaurant and dancing hall, kitchen, office and W.C. on the upper floor.

The lower floor contains men's locker room, women's locker room with shower and w.c., janitor's room, storage, and space for sitting and playing games such as table tennis. Besides, there are two piers for sailing boats and yacht yard.

(f) Play facilities --in the Point-block development, the author divides this into two sections (i) Playgrounds
(ii) Sport fields

(i) Children's playgrounds are subdivided in relation to age groups into three grades: toddlers between the age of 2 and 5, junior between 6 and 10, and senior between 11 and adult.

Toddlers are in the sight of the mother or parent. The playground for this age group consists of grass, part paving, wheel toys, fixed tables and seats, play sculpture, small swings with cradle seat and guard rail back and front, miniature fixed climbing object, tunnels, baffle wall, sand pit and nature learning through animal sculptures.

Junior ages will have some hard paving, which may be asphalt, granulated cork or other slightly resilient, not gravelly, firm surface with some areas of grass, and some very robustly built equipment such as the ladder, wall, horizontal bars, fixed seat and table, low zig-zag wall and high ball-game wall, commando net or similar climbing frame, climbing tree, wading pool with nozzles and boating pool 9 inches deep, with water 6 inches deep, in an irregular shape, fitted with drain and overflow, swing with guard-rails, jiggle-ring and jiggle-rail.

Senior and adolescent : Brown # suggests some interesting characteristics of the adolescent which he has in common with children and adults, but he has some that set him apart. He is adventurous, idealistic, enthusiastic, aggressive, optimistic, sensitive and filled with boundless energy. Thus it is important for those thinking of providing recreation facilities for these years to relate them to his interests. There are many sport fields located in different areas between gardens , public open space in the form of reserved lawns and shrubs and space for children's play.

The enclosure for ball games should be surfaced with asphalt or similar material in case of falls, and well-drained. For net-ball, volley-ball and basketball, posts fixed to a metal angle base make such an enclosure more attractive. Pitch marking can be made in different colours to avoid confusion. Such a large enclosure can generally only be included in estates with a good drainage system.
All such areas should have a bench and a row of clothes hooks but they should be placed so that children do not run into them.

(ii) Sport fields (with lighting) are as follows:

Two basketball courts

Three tennis courts

Six badminton courts

Three volley-ball courts

Joseph Brown, Professor of Sculpture, Princeton, quoted in Wayne R. Williams: Recreation Places p.195

One diving pool and swimming pool for children
(in the sight of the trainers and parents)
One diving pool for adults and adolescents
One swimming pool of water-polo standard size,
for adults and adolescents.

To quote, "Ordinarily, the play facilities for 6 to 18-year olds can be had in the school site in every city. Just as schools, -- primary, secondary, technical, and so on, -- are sited in relation to their respective catchment, so during the out-of-school hours every child should be able to play within, not only in relation to, new blocks of flats..... School playgrounds should be made available as part of these facilities." #

4. Landscaping:

Flat land, although more readily adaptable to economic construction of Point-block development, offers less in esthetic opportunity. Flatness is conducive to monotony, and limits the scope of design. However the author tried to design more attractively by using the free-form landscape to divide the land into an irregular shape, and made the paths between place to place like natural gardens. The monotony of seeing a group of Point-blocks is avoided by staggering the buildings and placing them at an angle to one

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Albert Barr, quoted in "Public Authority Housing, by Robert H. Mathew, London, 1958

another to get away from parallel and perpendicular planes.

The author has also broken up the dull planes by grouping trees and shrubs, vegetation, ground covers and flowers, and used contrasts in the form, size, and colours of trees, vegetation, flowers and so on, which can achieve a sense of informality and openness, relaxing in contrast with the much too usual stiff, tight, tense feeling.

C. Design and Drawing

		Scale
Plate I	Layout plan with landscape	1:500
Plate II	1st, 5th, 9th, 13th floor plan 2nd, 6th, 10th, 14th floor plan	1:100
Plate III	3rd, 7th, 11th, 15th floor plan 4th, 8th, 12th, 16th floor plan	1:100
Plat IV	Ground floor plan Roof plan and penthouse	1:100
Plate V	South-west elevation of Point-block South-east elevation of Point-block	1:100
Plate VI	North-east elevation of Point-block North-west elevation of Point-block	1:100
Plate VII	Section at x - x Section at y - y	1:100
Plate VIII	Enlarged floor plan, Type A Enlarged section, Type A at A - A Enlarged floor plan, Type C Enlarged section, Type C at C - C	1:50
Plate IX	Enlarged floor plan, Type B Enlarged section, Type B at B - B Enlarged floor plan, Type D Enlarged section, Type D at D - D Enlarged floor plan, Type E	1:50
Plate X	Parking garage floor plan 1st, 2nd, 3rd floors Ground floor plan with shops and stores	1:200
Plate XI	Elevation of the parking garage, section at H - H Roof plan with bowling alley and minigolf	1:200
Plate XII	Elevation of the club-house, section at I - I Upper floor plan Lower floor plan Folded cupola roof plan	1:200

Plate XIII Interior Perspective, Type A
Interior Perspective, Type B

Plate XIV Interior Perspective, Type C
Interior Perspective, Type D

Plate XV Exterior Perspective, seen from the Chao Phraya River and looking towards the community

Plate XVI Exterior Perspective, seen from the Point-block and looking towards the children's playground

Plate XVII Exterior Perspective seen from the circulation core and looking towards the Point-block

Plate XVIII Model of the neighbourhood community Scale: 1:500

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Note

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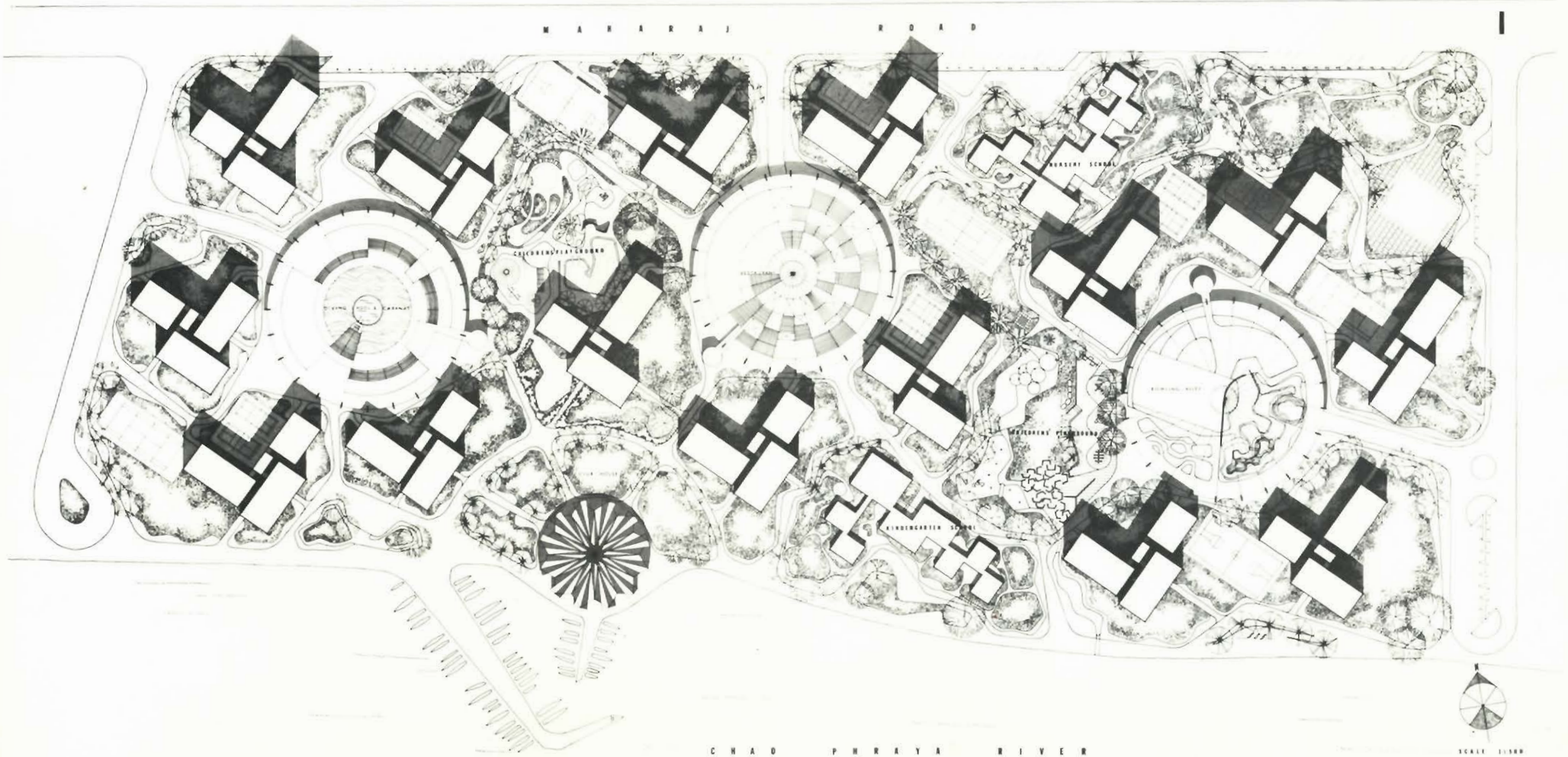
Office of the Governor, Changwad Thonburi

Central Statistics Office, National Economic Development Board, Ministry of National Development

Climatological Division, Meteorological Department, Bangkok

City Planning Department, Bangkok Municipality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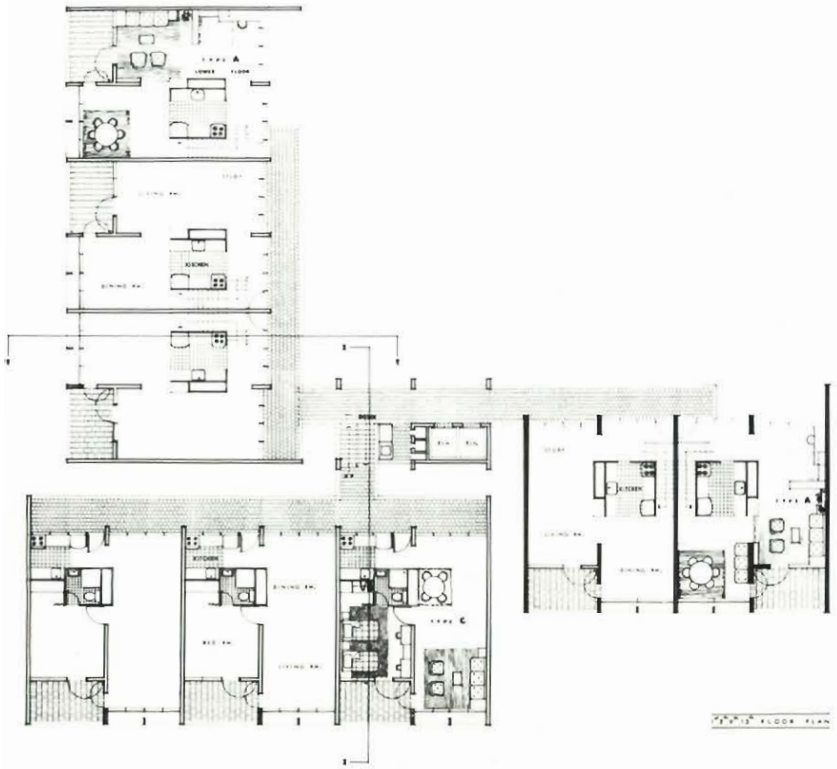

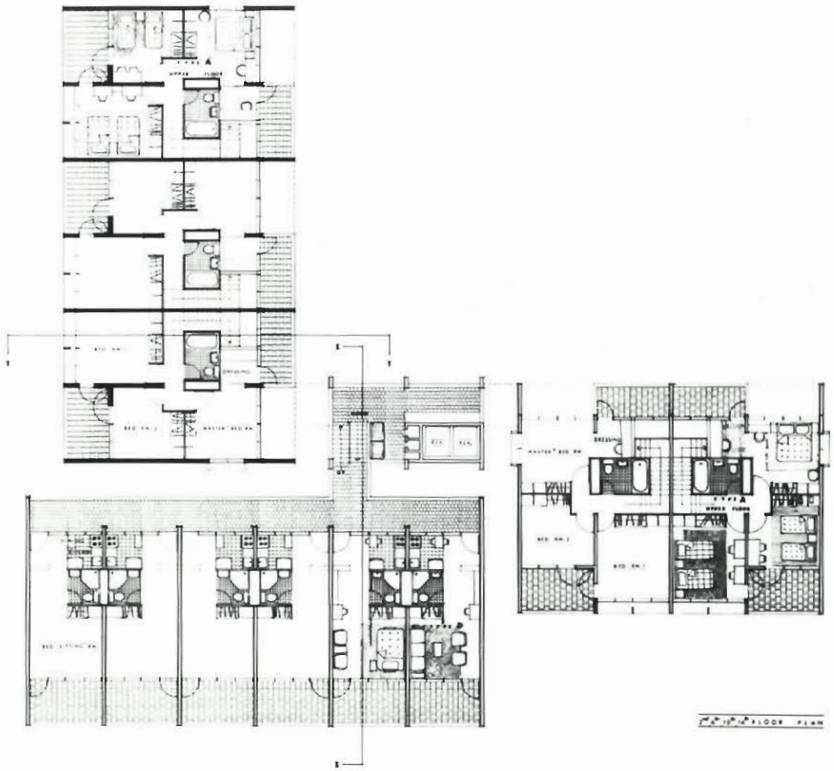

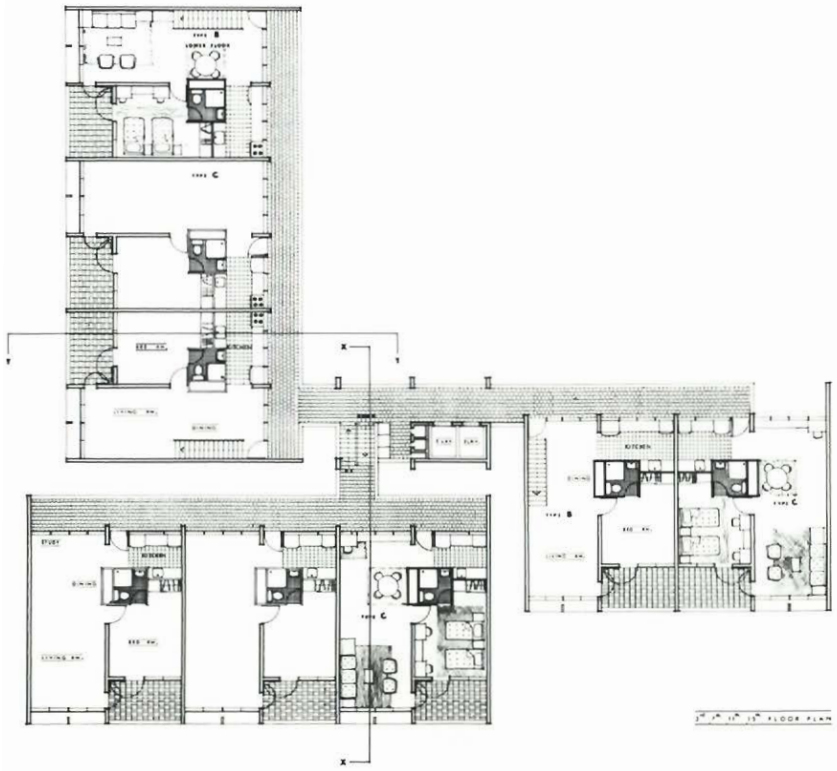

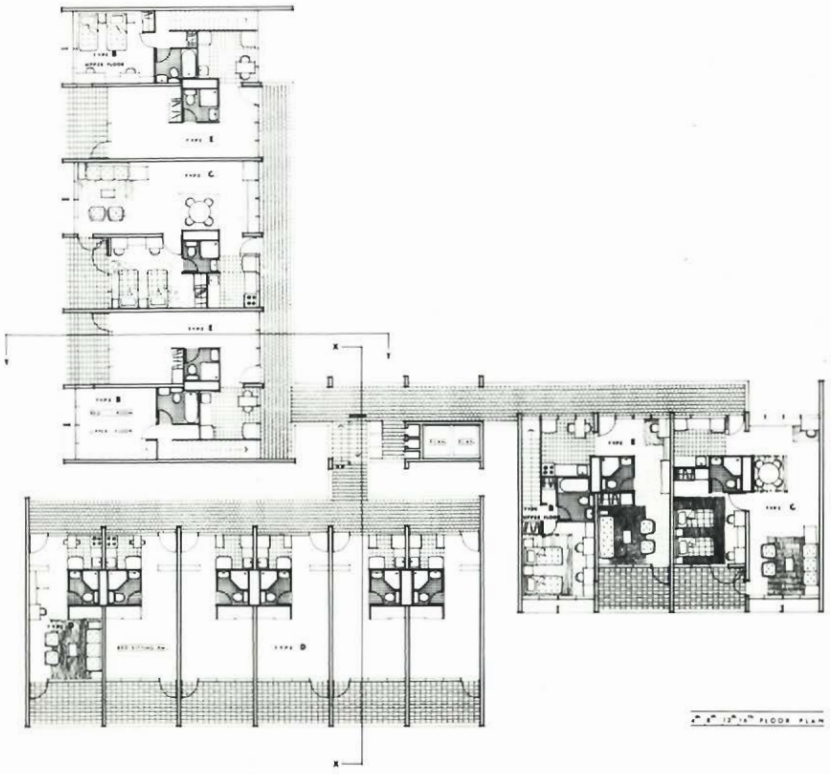

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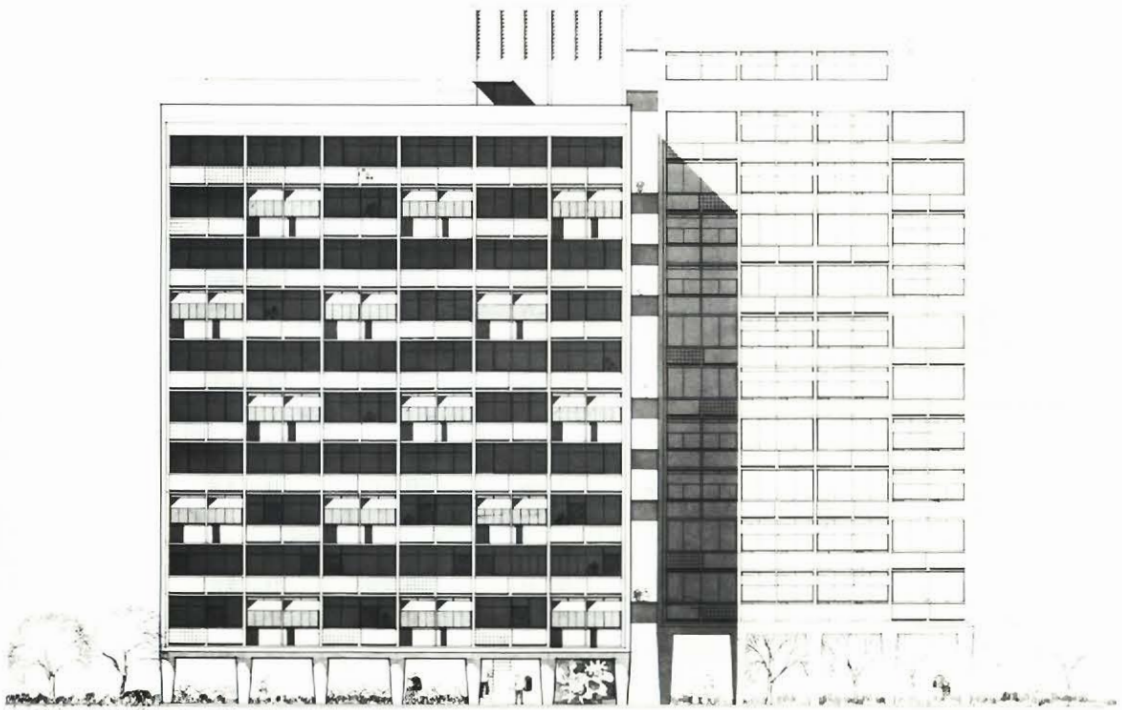

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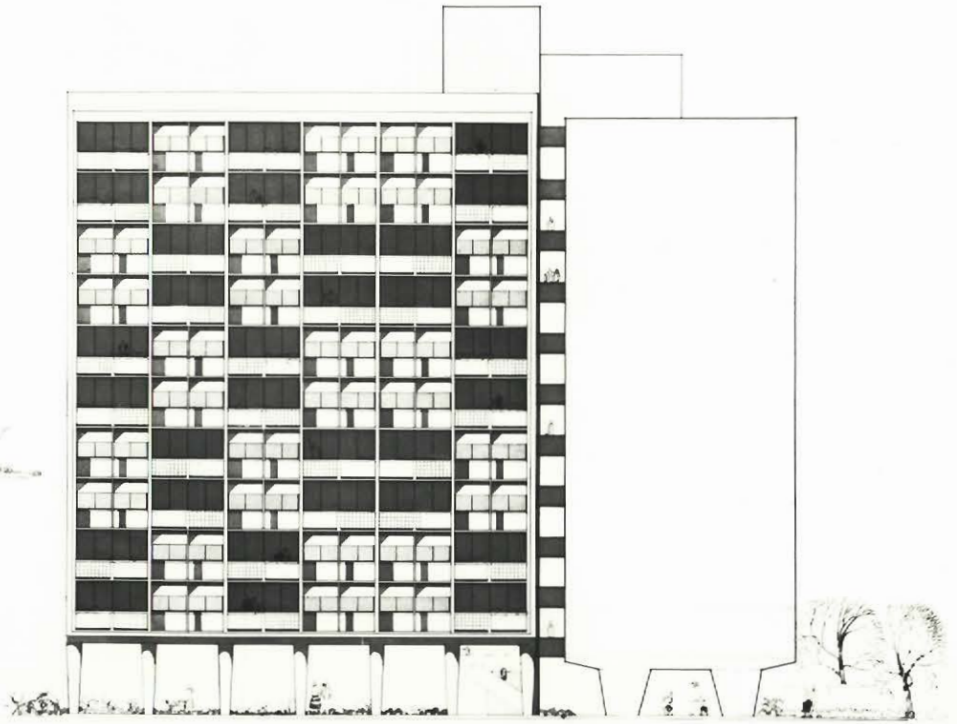

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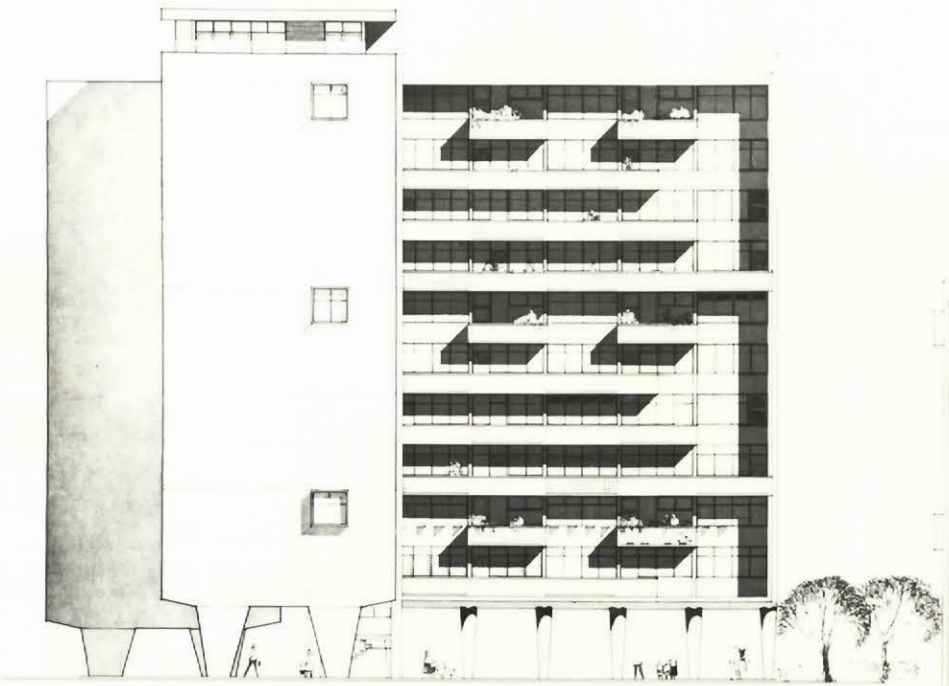

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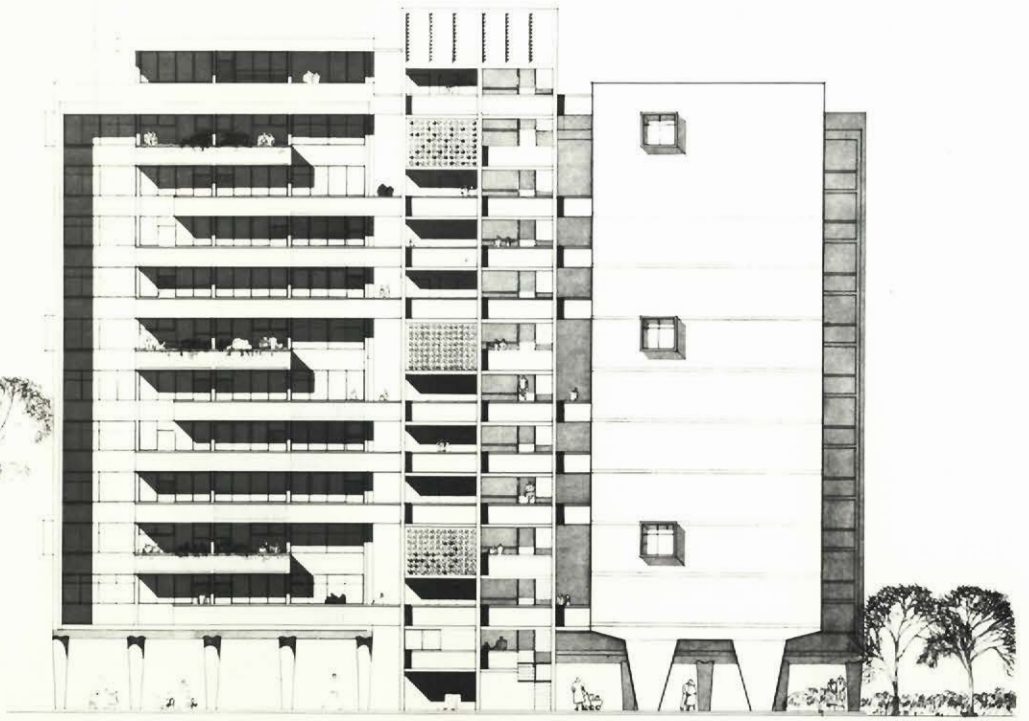

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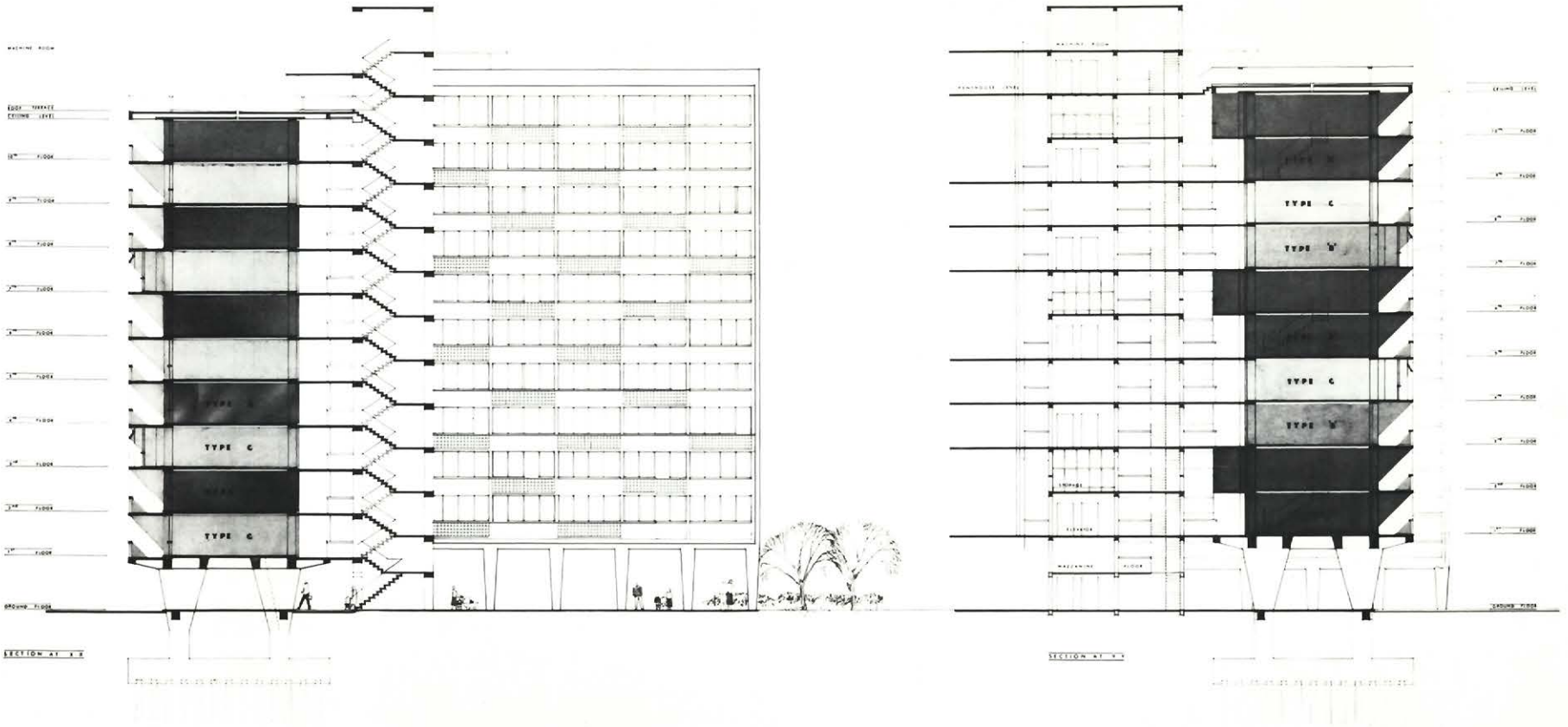
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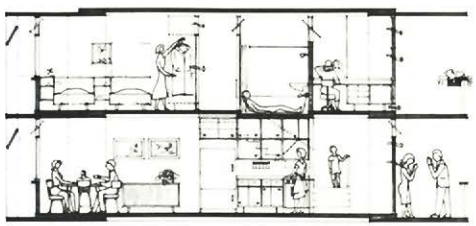
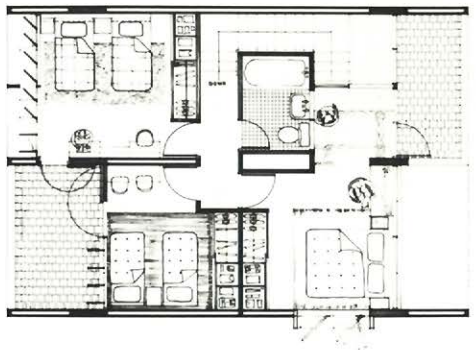
TYPE C

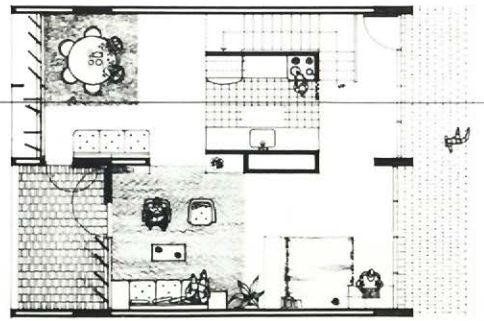
TYPE A



SECTION AT A-A

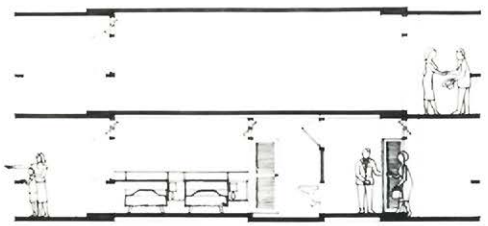


UPPER FLOOR PLAN

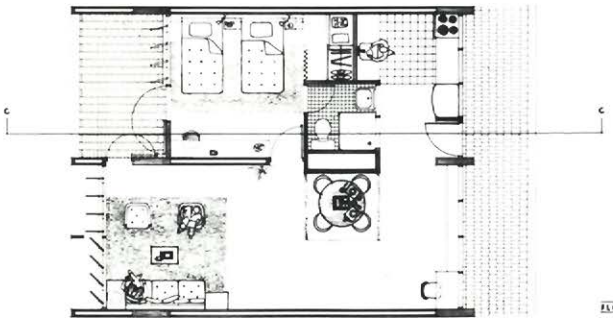


LOWER FLOOR PLAN

TYPE C



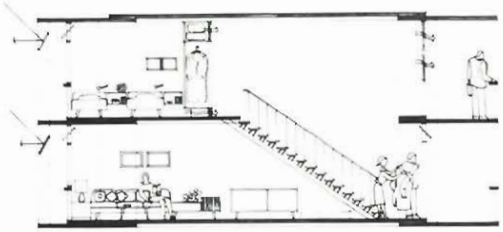
SECTION AT C-C



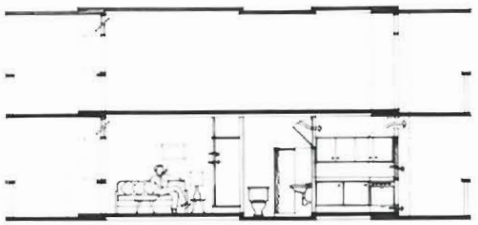
FLOOR PLAN

TYPE A	THREE BED ROOM UNIT	
	TOTAL FLOOR AREA	184.00 SQ.M.
		1978.00 SQ. FT.
TYPE C	ONE BED ROOM UNIT	
	TOTAL FLOOR AREA	94.00 SQ.M.
		1012.00 SQ.FT.
TYPE F	PENTHOUSE UNIT	
	TOTAL FLOOR AREA	192.00 SQ.M.
		2064.00 SQ.FT.

TYPE B



SECTION AT B-B



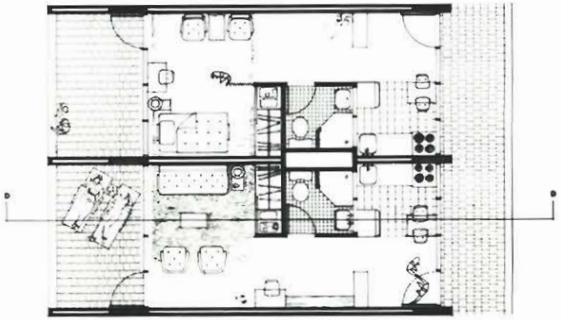
TYPE D

SECTION AT D-D

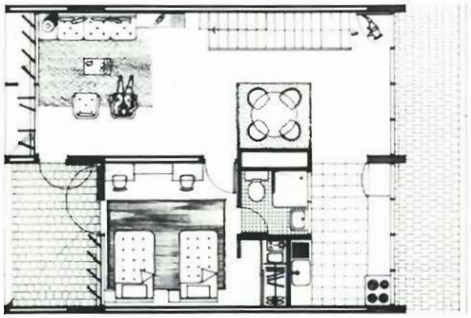
UPPER FLOOR PLAN

TYPE E

FLOOR PLAN



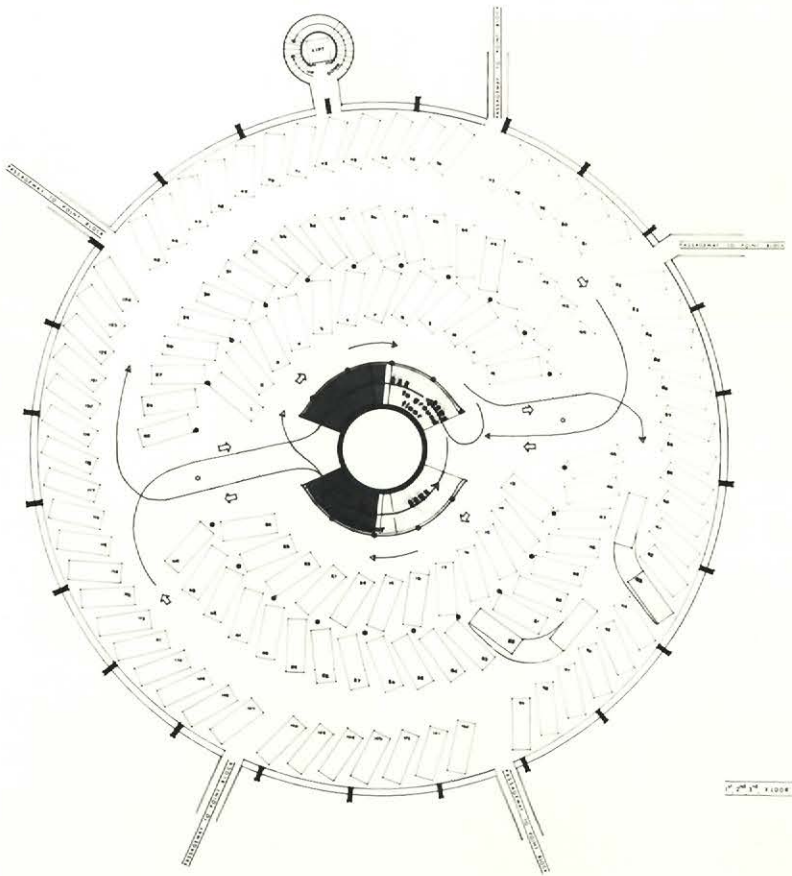
FLOOR PLAN



LOWER FLOOR PLAN

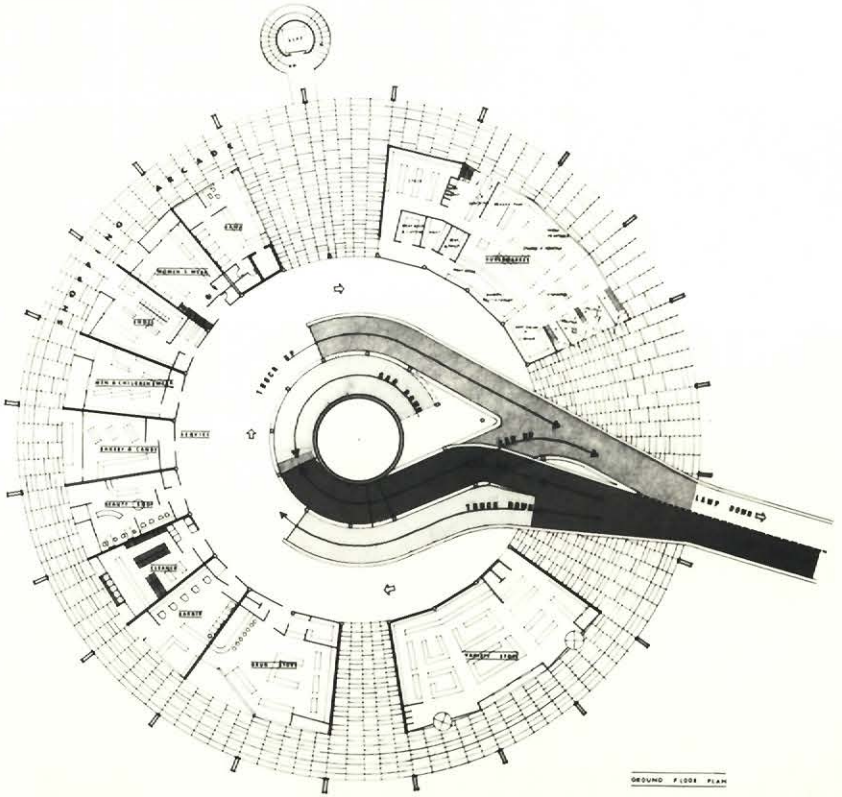
TYPE B	TWO BED ROOM UNIT
	TOTAL FLOOR AREA [illegible] SQ.M.
	[illegible] SQ.FT.
TYPE D	BACHELOR UNIT - STANDARD
	TOTAL FLOOR AREA [illegible] SQ.M.
	[illegible] SQ.FT.
TYPE E	BACHELOR UNIT - LARGE
	TOTAL FLOOR AREA [illegible] SQ.M.
	[illegible] SQ.FT.

PARKING GARAGE

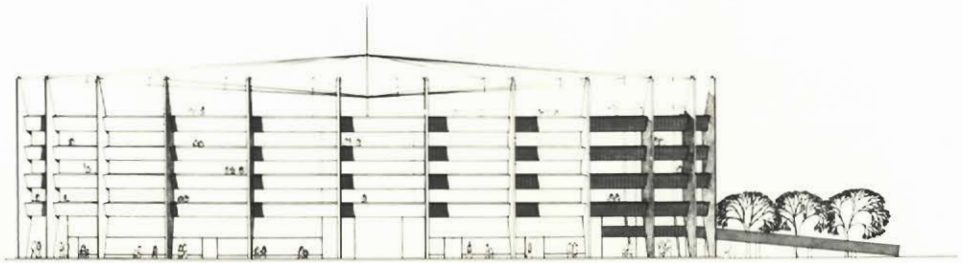


1ST 2ND 3RD FLOOR PLAN OF THE PARKING GARAGE

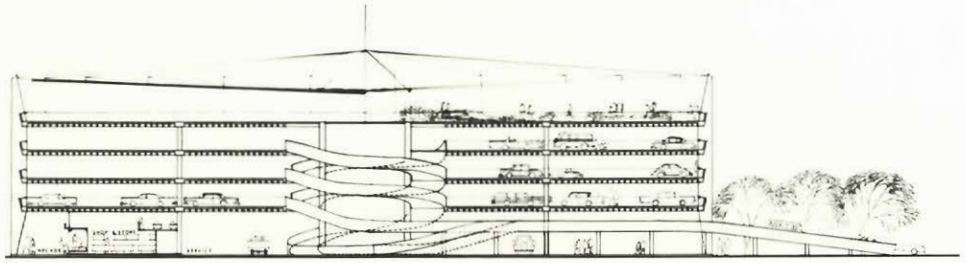
SHOPS AND STORES



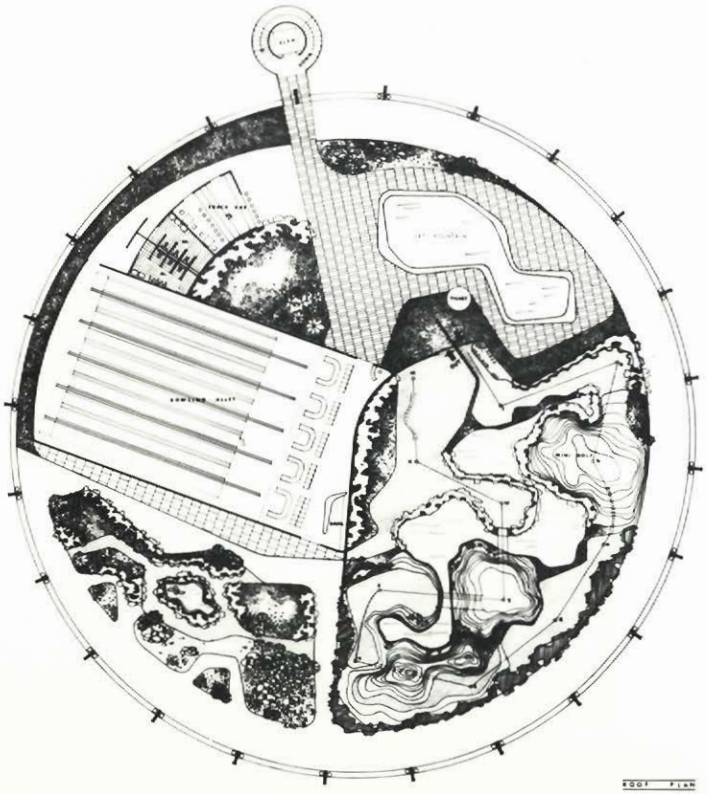
GROUND FLOOR PLAN



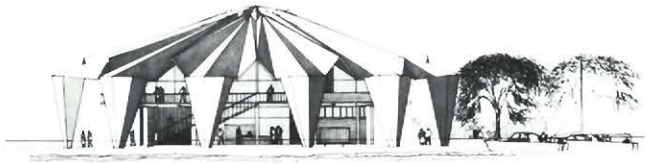
ELEVATION OF THE PARKING GARAGE



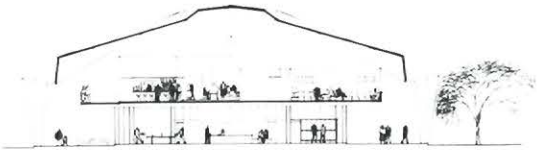
SECTION AT H-H



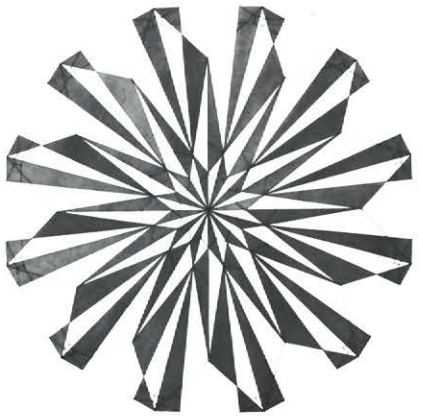
ROOF PLAN



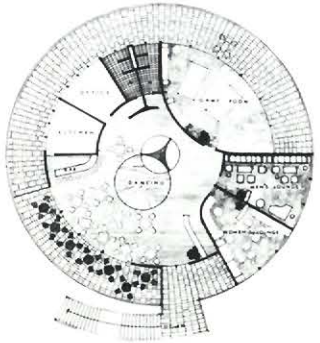
ELEVATION



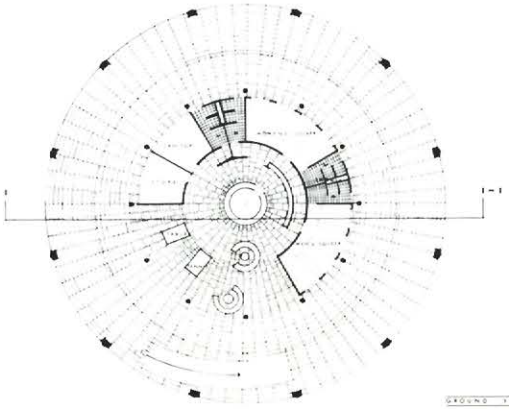
SECTION AT



FOLDED CUPOLA ROOF PLAN

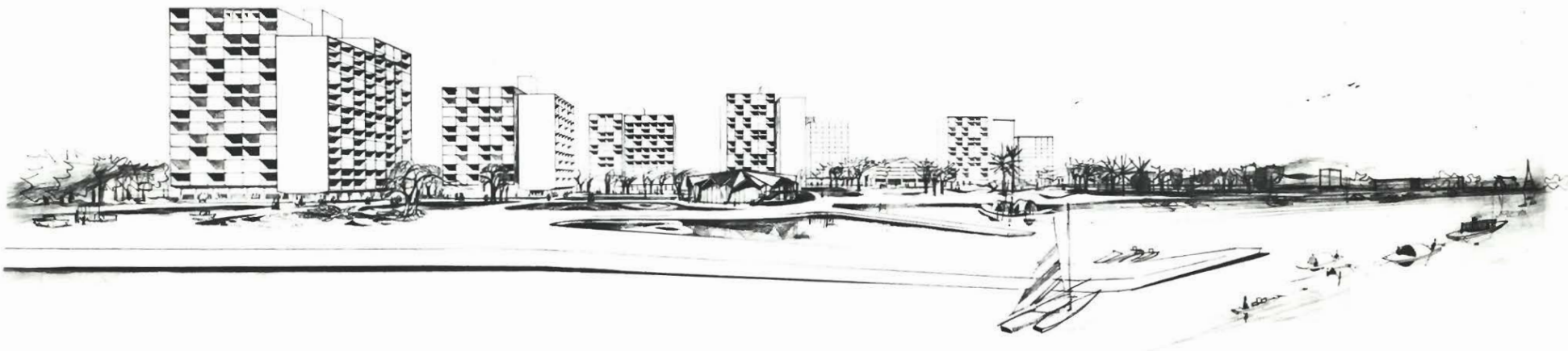


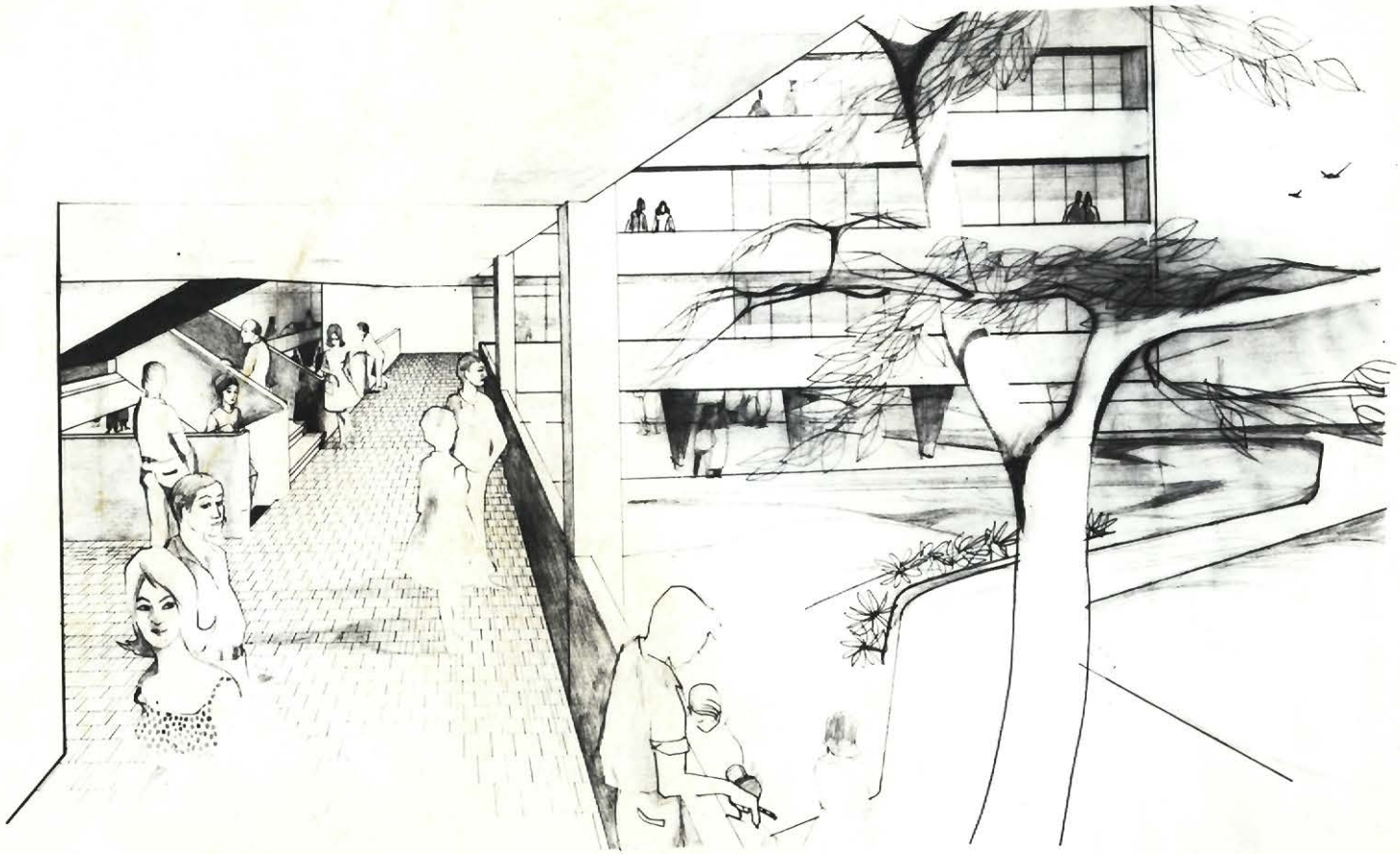
UPPER FLOOR PLAN



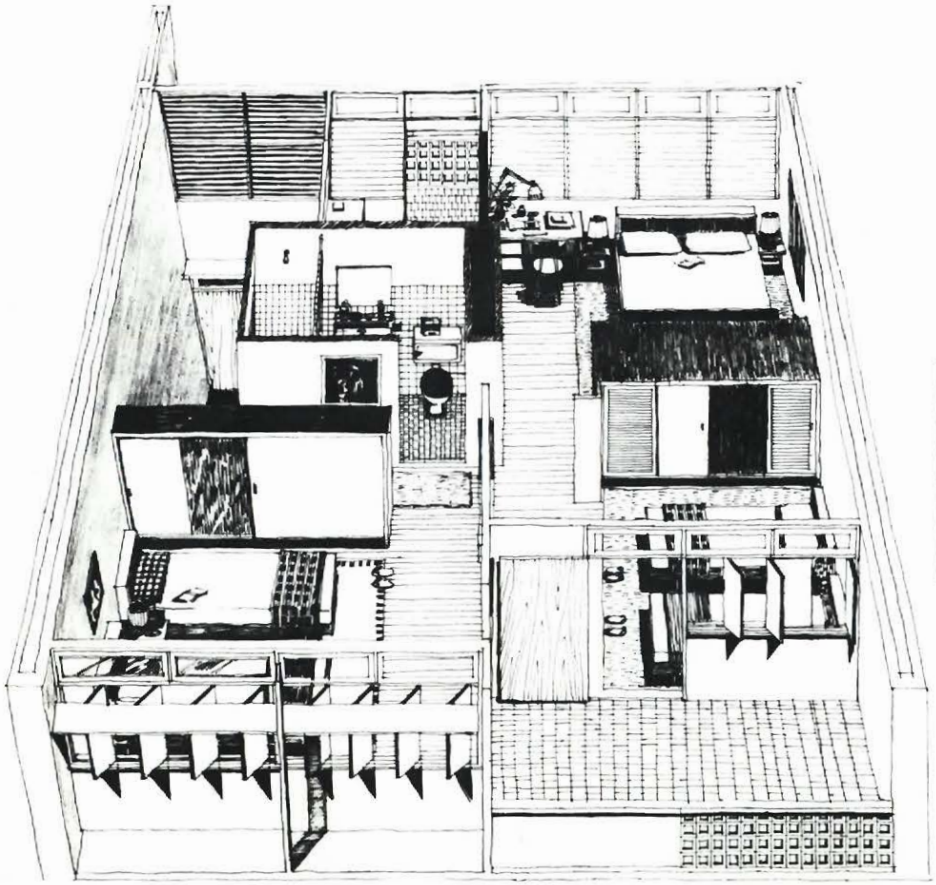
GROUND FLOOR PLAN

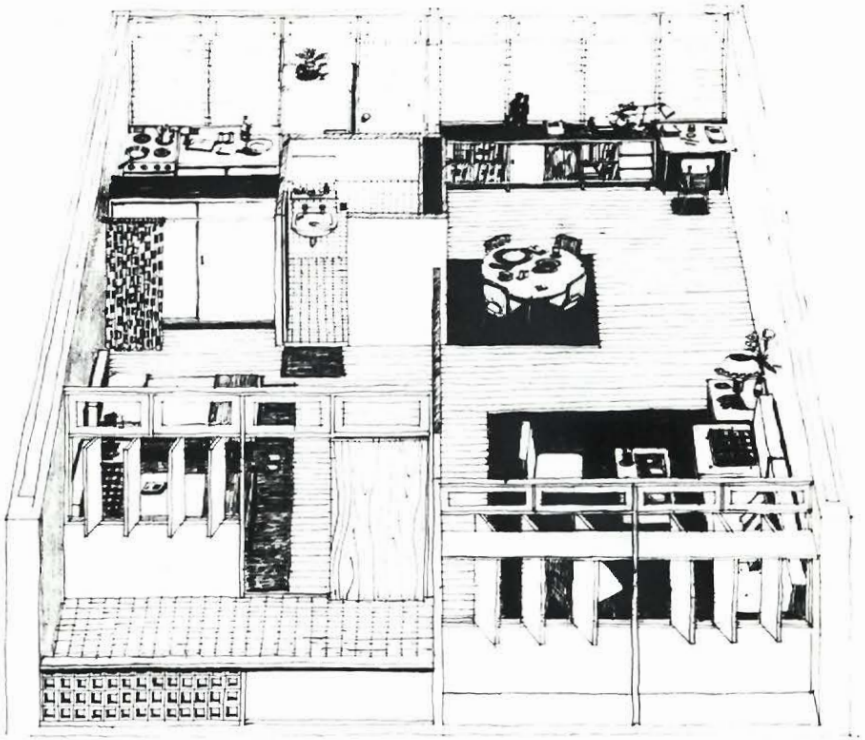
CLUB HOUSE





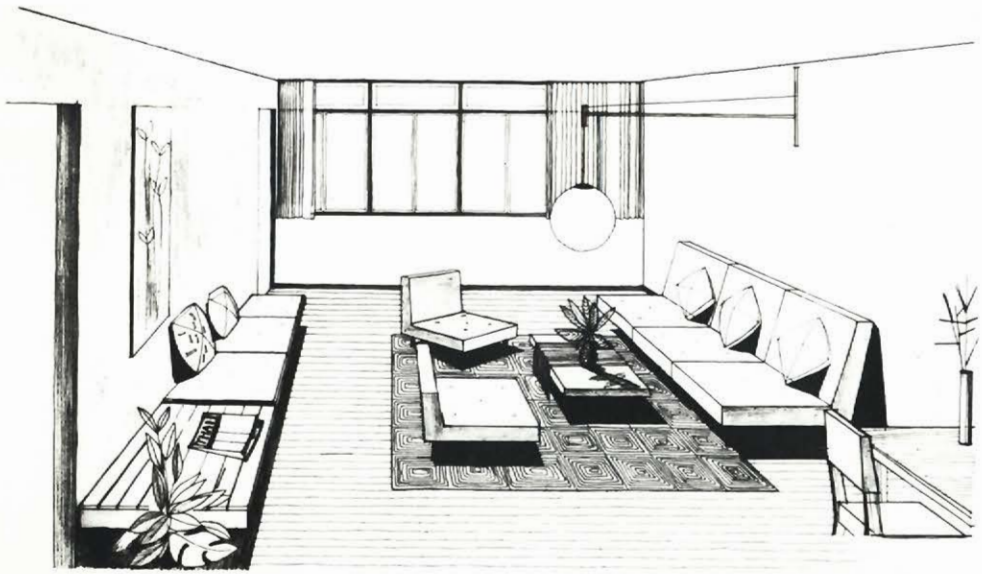
INTERIOR PERSPECTIVE OF THREE BED ROOM UNIT

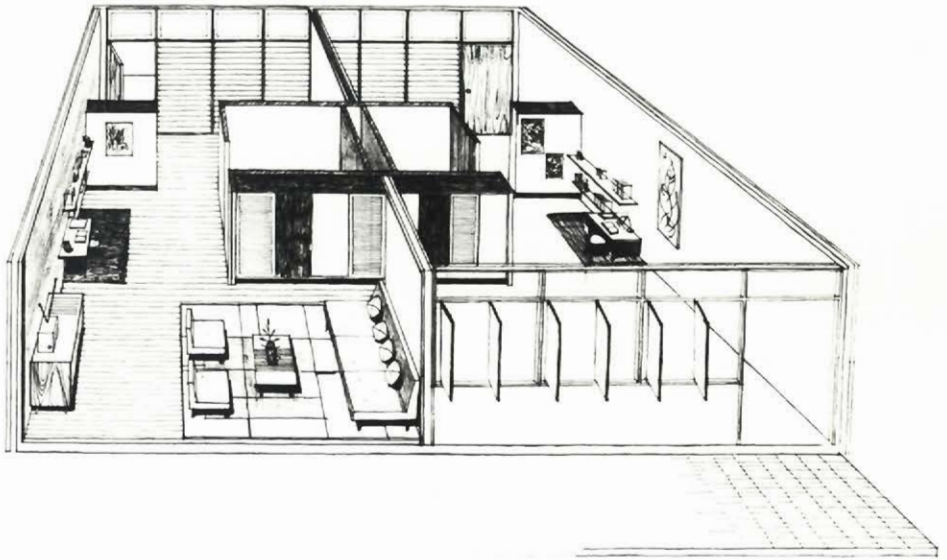




INTERIOR PERSPECTIVE OF ONE BED ROOM UNIT

LIVING ROOM OF TWO BED ROOM UNIT





INTERIOR PERSPECTIVE OF BACHELOR UNIT - STANDARD