

A RESIDENTIAL AND COMMERCIAL COMPLEX DEVELOPMENT

by 1050 710

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A MASTER'S THESIS

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Approved by:

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Major Professor

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INTRODUCTION

The program of social and economic development in Thailand has been taken into consideration over the last fifteen years. The social problems as well as slum clearances have been analyzed as the first stage of the development. Traditional city planners, civil engineers, conservationists, sociologists, urban designers and architects together have dealt with those questions, and development can be divided into three major stages:

1. Decentralization by means of population distribution.
2. Conservation program (ancient city and historical buildings).
3. Urban renewal.

The provision of jobs within each unit (as well as the decentralization of the population within the city) will be the key to a self-contained unit. In order to achieve this aim, the number of housing facilities and job opportunities within each unit should be supplied by the Government.

The conservation of the ancient city and historical buildings is also the main purpose of development. The development not only should assure decentralization, but also preserve monuments which can become the focal point of the city environment.

This project is the study of the feasibility of combining different functions within an appropriate single block in an urbanized area within city boundaries where there is medium density population. An additional purpose of the study is to examine the typical multi-functional unit within the city.

This study, "A Residential and Commercial Complex Development," therefore, will deal with a renewal project which will be undertaken in an urban environment and expressed through the means of modern technology.

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BACKGROUND

HISTORIC GROWTH

Fifteen hundred years ago, Bangkok and Thonburi were entirely beneath the water of the Gulf of Siam. When its predecessor to the north, the capital at Ayuthaya was founded around 1893 B.E. (1350), Bangkok was nothing more than a collection of mudbanks inhabited by a few scattered fishermen. The area assumed national importance when King Taksin established his capital in Thonburi in 2310 B.E. (1767), after the fall of Ayuthaya.

In 2325 B.E. (1782), for political and military reasons, King Rama 1 moved the capital to the Bangkok bank of the Chao Phraya River. He established a town surrounded by fortified walls and gates, further isolated from attack by the river and a great swampy plain. Within, the horizontal play of functional, pleasant streets, paths and waterways contrasted pleasingly with the vertical accents of temples, gates and forts, culminating with the grand palace, a walled city within a walled city. The inner citadel was the religious center of the country and the seat of the King.

Bangkok's growth during the reigns of Rama 2, 2352-2367 B.E. (1809-1824), and Rama 3, 2367-2379 B.E. (1824-1851), proceeded slowly. During this period, great emphasis was placed on the building of temples.

Under Rama 4, the prospering city grew, even extending outside the walls. A new boundary line had to be set, and in 2394-2397 B.E. (1851-1854) when the city had reached an estimated population of 400,000, King Mongkut had a new city moat dug called Klong Padung Krung Kasem, paralleling in a wide curve an earlier moat. The new canal at once encouraged great

expansion. By the end of his reign, Bangkok had almost tripled in area.

Modern Bangkok dates from King Chulalongkorn's (Rama 5) reign, 2411-2453 B.E. (1868-1910). Conscious emphasis was placed on road construction, the railway system was inaugurated, the post and telegram service organized, and the first tramway appeared. By 2433 B.E. (1900), the population was estimated at 600,000.

Today, Bangkok and Thonburi enclose some 173 square kilometers and in 2501 B.E. (1957) had a population of 1,622,460.

POPULATION GROWTH

Thailand, one hundred and sixty years ago, had a population of not more than four and a half million persons. During an ensuing period of one hundred years of peace, coupled with the entry into the stream of world trade, there occurred an increase in economic activity and population growth. The growth continued with an acceleration following World War I. In 2368 B.E. (1825) the population was approximately 4,700,000; this increased to an estimated 11,400,000 in 2470 B.E. (1927), and 22,800,000 in 2500 B.E. (1957). By comparison, Thailand has been growing at a slightly greater rate than its neighboring countries.

POPULATION CHARACTERISTICS--MIGRATION

According to the study of migration previously cited in the section on national population, in-migration to the Bangkok area over the seven years' period, 2491 B.E. through 2497 B.E. (1948-1954), amounted to 532,400 persons; this constituted 30 percent of the population enumerated there in 2499 B.E. (1956). The number of these migrants who settled in

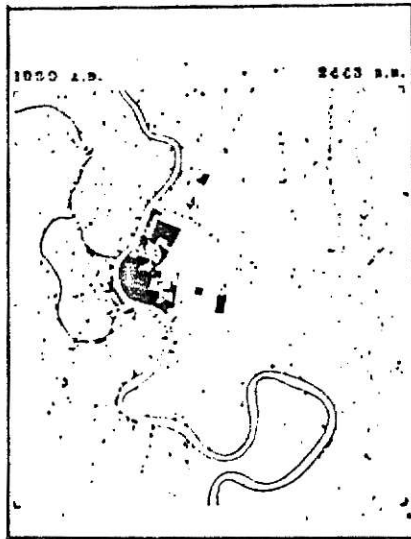
the municipalities of Bangkok and Thonburi was reported as being four times greater than the number moving to the rural areas.

The Thai preference for village life and rice farming plus the availability of an abundance of unused land which has absorbed expansions of population has caused the Thai not to compete in the area of commerce and industrial labor. Thailand has therefore attracted large numbers of immigrants, many of whom have filled the commercial and industrial jobs.

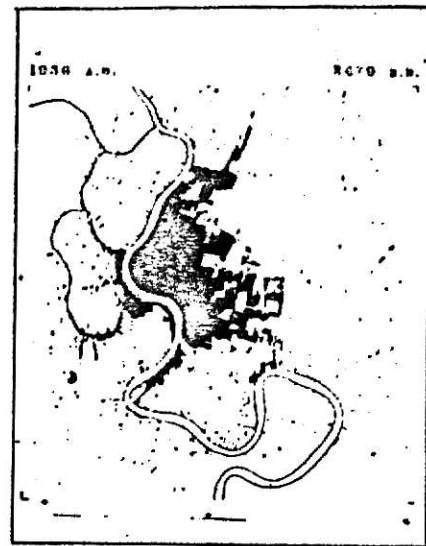
POPULATION DENSITY

Average density in Thailand (about 115 persons per square mile) is relatively low when compared with its neighbors. As only approximately 18 percent of the total area is cultivated, there is more significance in the average density per cultivated square mile, which is over 600 in the Chao Phraya Valley (where Bangkok is located).

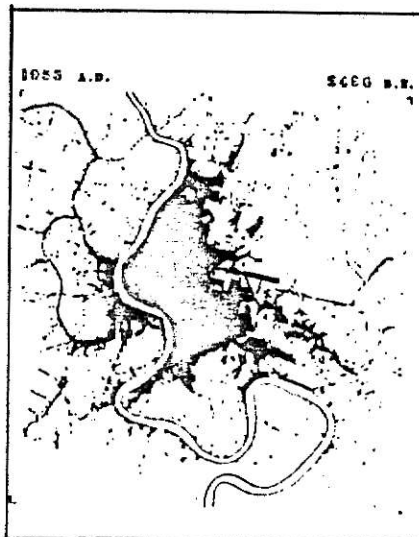
On the basis of detailed population data for Bangkok and Thonburi municipalities, and data for the rest of the area, map "population distribution" was created showing the distribution of population within the area in 2500 B.E. (1957). This map reveals that the heaviest concentration of population is located in the central parts of Bangkok and Thonburi. The highest density is found within the older sections of the Bangkok area.



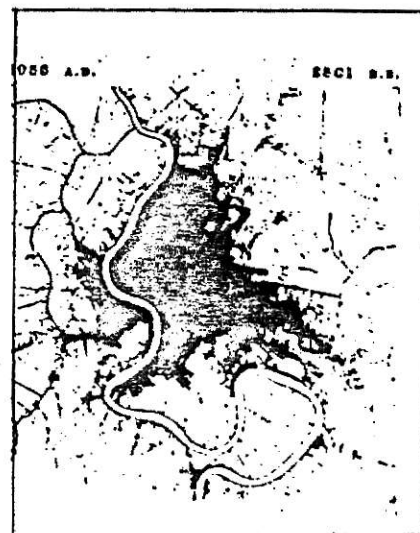
The urbanized area of
Bangkok, in 2443 B.E.



. 2479 B.E.

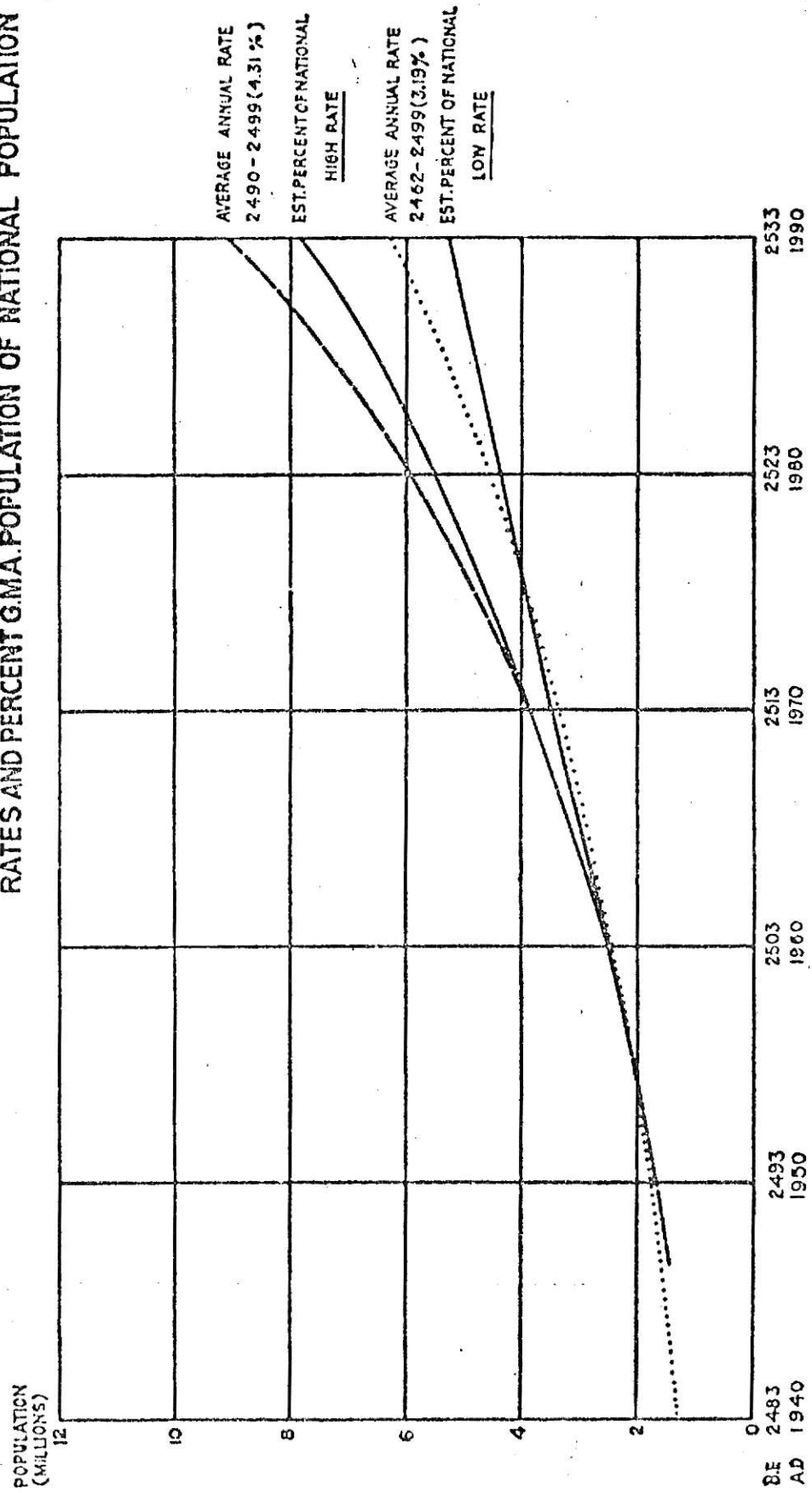


. 2496 B.E.



. 2501 B.E.

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

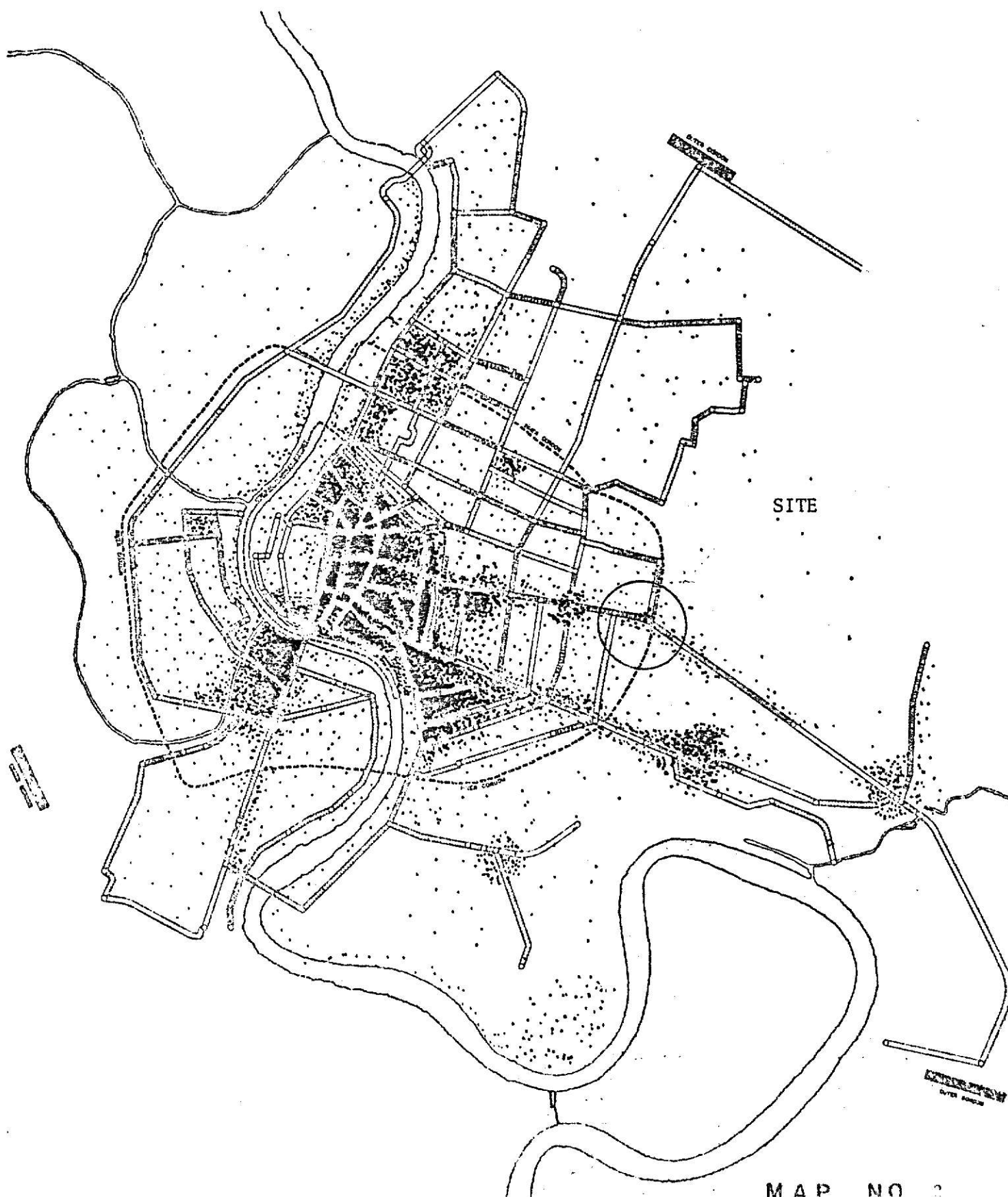


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POPULATION DENSITY 2501 (1958)



LAND USE

The rate of growth of a community, whether a capital city, a small industrial town, or a fishing village, is the direct measure of the magnitude of the development problem which the community must face.

In many areas of the world today, such problems are urgent due to many high rates of population increase. Medical advances have decreased the death rates, and in addition a great increase has occurred in birth rates; interaction of these has resulted in a high rate of natural increase. Also, there is a trend in all countries for people from the outlying areas to move to the city.

These forces are presently at work in the Bangkok area. The population increased from less than 700,000 to over 2 million between 2462 B.E. (1919) and 2499 B.E. (1957) and had an average annual increase of 4.3% over the last nine years of the period. The urban area, Bangkok and Thonburi municipalities, during the period from 2490 B.E. to 2500 B.E. (1947-1957) increased from 780,000 to over 1.5 millions, or double, averaging a 7.1% annual rate of increase.

Projections of the population growth indicate that these trends will continue and result in a population in the Bangkok area of at least 7,800,000 by 2533 B.E. (1990) in the absence of any policies or problems to retard this growth.

The large population increase in Bangkok and the resulting expansion of the area has created tremendous pressure to provide adequate municipal services, not to mention those improvements which must be made in the older sections of the city which are also inadequately served. The

expected future growth will increase these pressures and force the government to devote increasing attention to the problems of this area.

LAND USE ANALYSIS

A prerequisite to development of a future land use plan is the estimation of the amount of land to be utilized by the various land uses within the plan area and the plan period.

These land estimates are based upon an analysis of various trends and projections, or appraisals, of the various physical, economic, and social factors which combine to determine the utilization of land, and, from these, the working out of appropriate standards for each category of land use.

Residential

Residential areas include all areas occupied by housing except those in which residential use is mixed with other land uses and the latter predominates.

Compound Housing

The compound type housing generally consists of the larger houses for the upper income groups. Built of either wood or masonry, these houses are surrounded by a strong fence or wall for the dual purpose of security and privacy. In addition to the principal dwelling unit, the compound includes a kitchen, either as part of the main house or separate, and garages.

Apartment Housing

The attached housing type, or row house, is found in government housing projects.

Condensed Housing

This land use classification is based more on residential area conditions than on housing types, since the housing type prevalent in these areas seems substandard, overcrowded, and in many cases, blighted. Other land uses, such as commercial, industrial, and even agricultural, are found in these areas that fall within this land use classification, but the primary use is residential.

Commercial

Commercial land use is dominated by the commercial-residential classification, which consists mainly of the shop-house type of building evident everywhere. Pure commercial uses, such as retail stores, gas and auto repairs, offices, hotels, restaurants, movies, and community markets, are also included.

FUTURE LAND DEVELOPMENT

Residential

The most important category, in terms of its functions as well as the percentage of land it occupies, is the land used for residential purposes. Residential density, even in the most crowded parts of Bangkok, is much less than that in most large cities. Nevertheless, in many sections the land is excessively crowded with low buildings, and these overcrowded areas should be cleared wherever possible. When the areas are replaced with better housing, or when new housing areas are opened up, there must be assurance that space is provided for adequate access, for sufficient light and air, and for sufficient space around the houses to allow people,

particularly small children, to play outside the house but not in the streets.

Another equally important factor in the future demand for residential land requirements is the proposed method of providing for the disposal of wastes, particularly sanitary sewerage. As stated previously under "planning policy," areas which are not designated for high density sewered development should be maintained at a low enough density to permit satisfactory disposal of sewage into the land without creating health hazards. The close mixture of high and low densities, therefore, would not be efficient.

Low density--the unsewered category--is planned for a minimum of 20 persons on a 500 square meter lot. This maximum may be exceeded to a limited extent on individual lots, provided it is maintained as an average within relatively small areas. Within the density range, the following types of housing could be provided: (1) single family houses on lots varying from 400 down to 150 square meters; (2) row houses and garden apartments with a ground area varying from 150 to 100 square meters per unit; (3) apartments with a ground area per unit varying from 82 square meters down to 28 square meters, with building coverage varying from 50% to 25% and with F.A.R. (ratio of floor area to ground area) varying from .75 to 4.0.

Because the sewered category covers so extensive a density range, it has been divided into two sub-categories: medium, and high density. The breakpoint has been set at 30 square meters/person, thus placing the sewered area's single family houses, row houses and garden apartments in

the medium range and its standard apartments in the high density range. The breakpoint also has a particular significance with respect to sewerage: it separates out of the sewerage range those densities low enough to make feasible, though relatively expensive, the temporary use of on-lot sewage disposal facilities.

The recommended distribution of population across the entire (low, medium, high) density range is based on the values operating within the framework of economic realities. As a result, housing with private yards has been stressed despite the greater economy of high density apartment housing.

The total residential land requirement includes streets and services within the residential community. Such services consist primarily of community schools, recreation areas and retail shops. Also included are public and semi-public facilities that serve the community, for example, temples and churches, branch libraries, police and fire stations, social clubs, branch post-offices, etc.

Table 1. The distribution of population and allocation of land area in residential districts (1990).

population & land area	residential districts			
	res. districts	low density districts	medium density districts	high density districts
PERSON				
Bangkok	3,765,000	1,063,000	1,997,000	765,000
Inner ring	285,000	-	28,000	270,000
Outer ring	3,507,000	1,063,000	1,969,000	495,000
SQUARE (km)				
Bangkok	305,040	146,640	132,960	25,440
Inner ring	9,040	-	1,680	9,360
Outer ring	296,000	146,640	131,380	18,080

Table 2. Average and maximum population densities in low, medium, and high density districts (1990).

density types	density districts					
	low		medium		high	
	ave per 1.6m ²	max	ave per 1.6m ²	max	ave per 1.6m ²	max
Net residential	16	20	49	96	144	256
Gross residential	14	17	39	75	125	216
Gross community	12	14	54	76	92	108
- outer ring	12	14	24	36	42	52
- inner ring	-	-	30	40	50	56

Commercial

The present commercial activity is located primarily in the central section of Bangkok. Total land devoted to this use in Bangkok and Thonburi is approximately 4,800 square kilometers and most of this is in establishments that may be termed "mixed commercial," in that residence is combined with the business use.

It is proposed, in accordance with the policy of dispersing the population of Bangkok, that the new commercial growth assume more of a "pure" commercial form, as opposed to the traditional shop-house type of development; and that a significant portion of these growths take place in new, outlying commercial, primarily shopping, centers. Expansion around the southeastern periphery of the present central area, where considerable commercial expansion has already occurred is also proposed. The commercial growth proposed for this area is mainly for office space and space for related functions including hotels and other associated services. In the older commercial areas, provision is also made for warehousing facilities.

In contrast to the older facilities which depend upon mass transportation, foot traffic, and extremely limited curb parking, the new commercial area should not have more than 30% of the site occupied by buildings, with the rest devoted to customer parking to accommodate the ever increasing numbers of automobiles.

On the basis of these considerations, it is estimated that a Bangkok population of 4.5 millions will require 25,900 square kilometers of commercial area, including land devoted to an associated residential area and institutional facilities, and to interior and boundary streets.

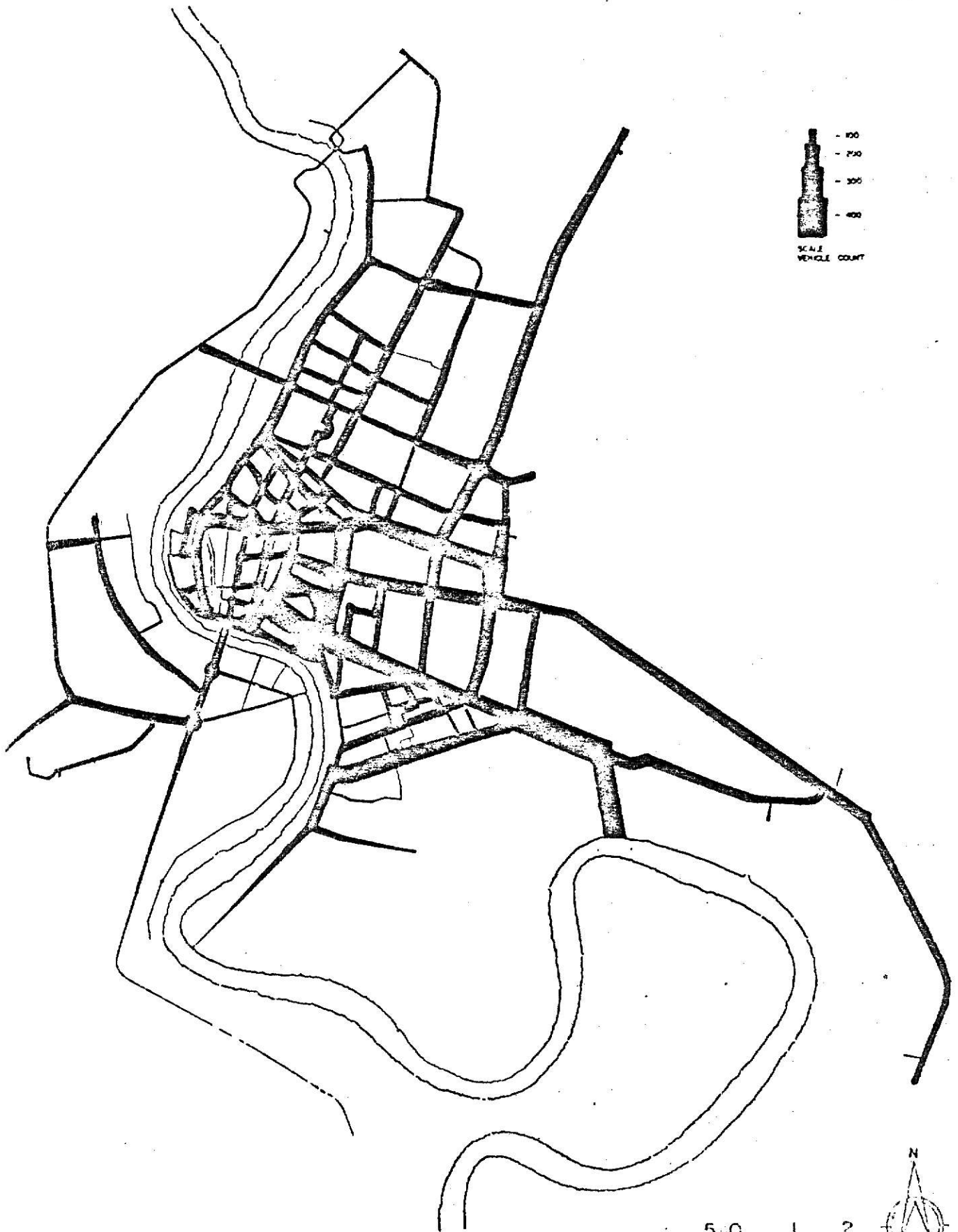
Circulation

The circulation system is the vital link which ties together the many land uses and activity of a city into a functioning whole. It also serves to tie the city to the region and to the rest of the country. In Bangkok, circulation is achieved by many means: by road, railroad, water, and by air, each serving definite needs with respect to the movement of people and goods within as well as to and from the area. It is an objective of the circulation plan to organize these internal movements in accordance with the Land Use Plan to assure that they are convenient, safe, economical and swift; and, in addition, to relate this metropolitan system to the overall system so as to realize these same objectives on a larger scale.

The rapid growth of these areas, and the continuing changes in the speed of vehicles requires that plans for circulation facilities will have to be constantly reviewed to accommodate future demands or trends. Within the proper area, the road system is a major tool for achieving decentralization of the central city area through the creation of sub-center areas and planned dispersal and grouping of industrial activities. The road system, which is regarded as a fundamental framework to guide future growth into the land use patterns, has been developed within the framework of an originally water-oriented transportation system. It consists of a few major streets which provide limited cross-city travel, and extremely narrow residential lanes branching off the major streets. Many of these lanes dead-end at canals or simply end at the limits of development.

MAP NO. 5

TRAFFIC VOLUME



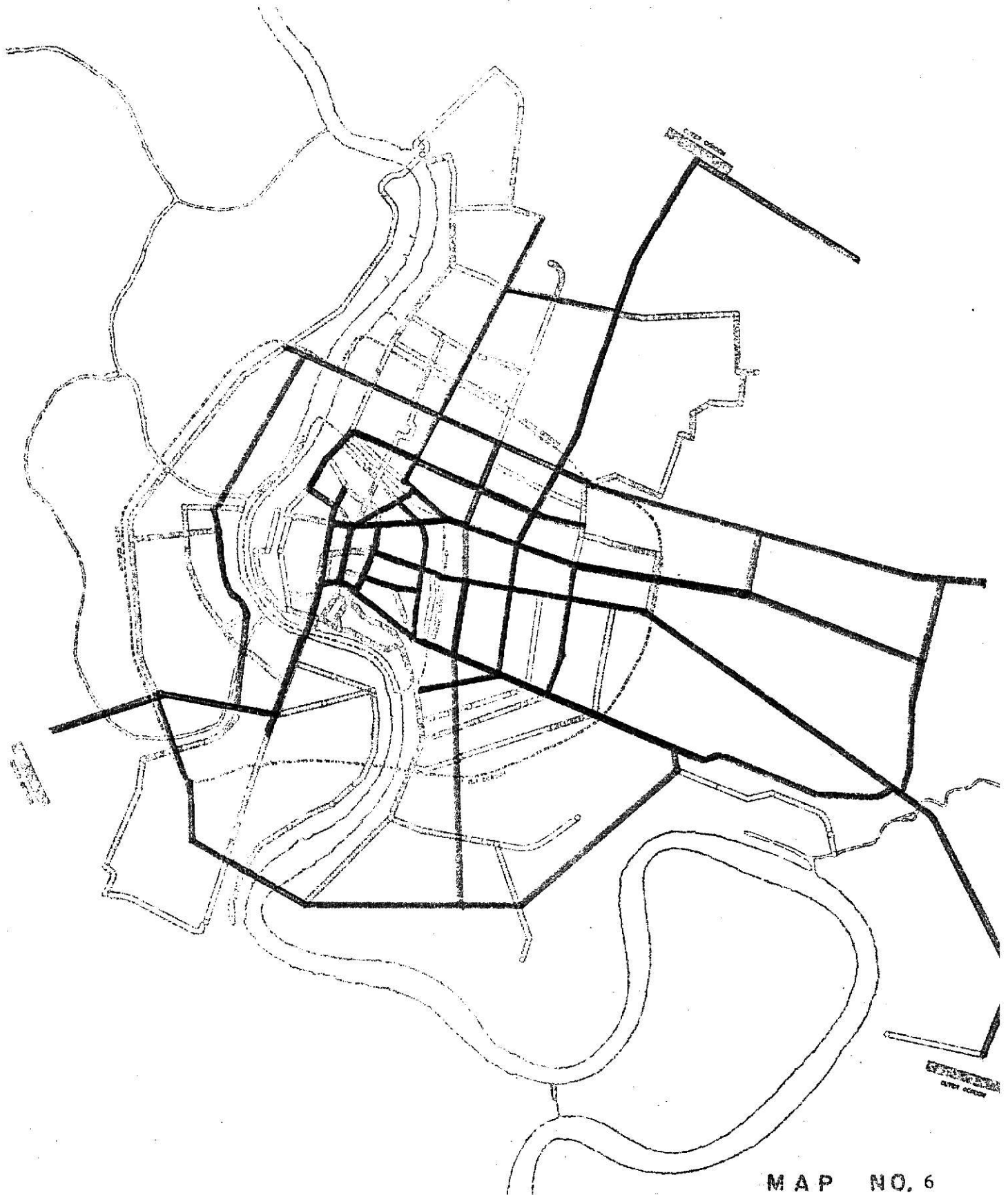
STREET MAP (1990)



EXISTING MAJOR STREET



PROPOSED STREET



THE CLIMATIC DESIGN

ORIENTATION

The basic design for warm climates is totally different from that of cool climates. Among the factors which cause tropical climates to vary are wind, rain, the relationship of land to sea level, and the presence or absence of vegetation. With some understanding of climatic conditions, it is often possible to secure a comfortable environment without the necessity of mechanical air-conditioning. As a matter of fact, it is not so much the heat that bothers a man as it is the subjective feeling of warmth due to a combination of static heat and humidity when air movement is lacking. Aside from the choice of location, orientation is the first consideration in planning. In Thailand, particularly the north and south sides of buildings need less protection from the sun than do the east and west sides; therefore, the most suitable orientation for reducing the solar heat gain in the building is to plan its long axis east-west.

It will be assumed that the orientation of the building or group of buildings is variable. But, if the shape of the site permits only one orientation, the ways of improving the interior climate are limited. There are several factors that determine the correct positioning of a building.

Factor a: Solar Radiation

The solar orientation of long, narrow buildings is more important than that of square ones because the bulk of the solar radiation and, thus, heat load falls onto two facades. The solar angle of incidence is important, since the heat load increases as the angle of incidence relative to the surface in question approaches 90° . Thus it is deduced that north and south facades take up less heat from the overhead sun in the tropics than

do east and west facades. The narrow sides of buildings should therefore face the low sun positions, i.e. the long axis should be east-west.

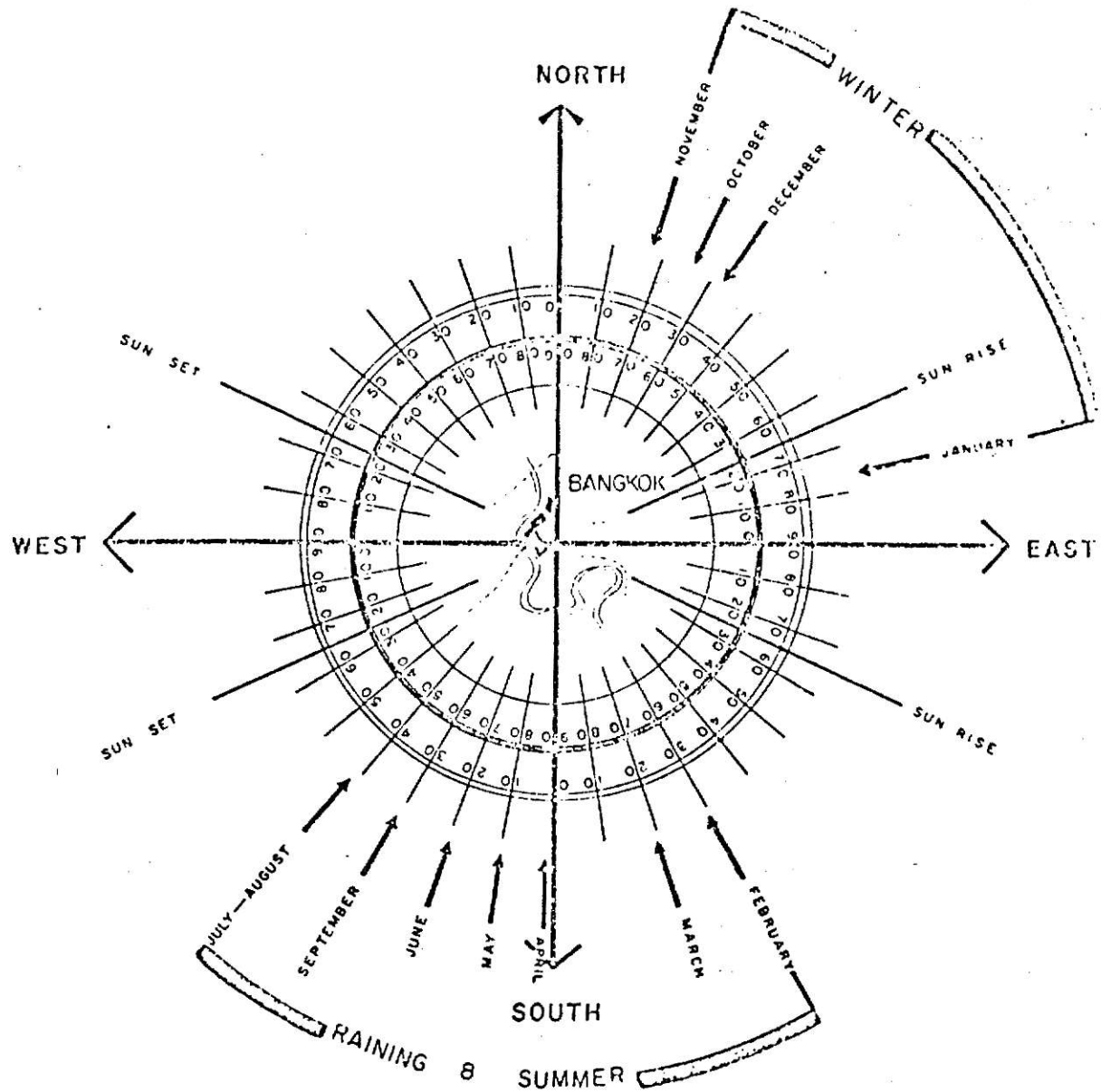
Factor b: Wind Direction and Force.

As cross-ventilation is essential for a comfortable interior climate, it is often more important to orient a building perpendicular to the direction of the prevailing wind than to concentrate on solar-radiation screening. The optimum for orientation is to select a position relative to the wind so as to secure the maximum duration--ideally 24 hours--of cross-ventilation with suitably open facades and without mechanical aids. The cross-ventilation achieved depends on the type, position, and size of the window openings.

As experience shows that the wind, varying in direction and force, cannot be set out precisely in tables, it is recommended that a thorough investigation be made before planning begins to determine whether the surrounding landscape is open or not, whether other buildings are in close proximity and whether there are wind lanes or wind shaded areas, etc. Only a generalized picture can be obtained from the meteorological data; details of the micro-climate conditioned by the immediate surroundings of the site are more relevant.

Factor c: Topography.

Heating up of the ground and intensity of reflection can be reduced by selecting a site with the smallest possible angle relative to solar radiation. The thermal air movement, which may result, is a welcome accompanying phenomenon. However, the costs of changing the topography of a site, if this is possible at all, are so high that this climatic advantage



PREVAILING WIND IN BANGKOK

should not be sought if it is not already present.

The surface treatment in the immediate vicinity of the building has a considerable effect on the micro-climate. Vegetation and areas of water will be considered in detail. Light colored, smooth ground-surfaces (sand, stone, etc.) reflect solar radiation as well as does water. If these surfaces cannot be hidden by planting or other means, the orientation of the building should be planned accordingly.

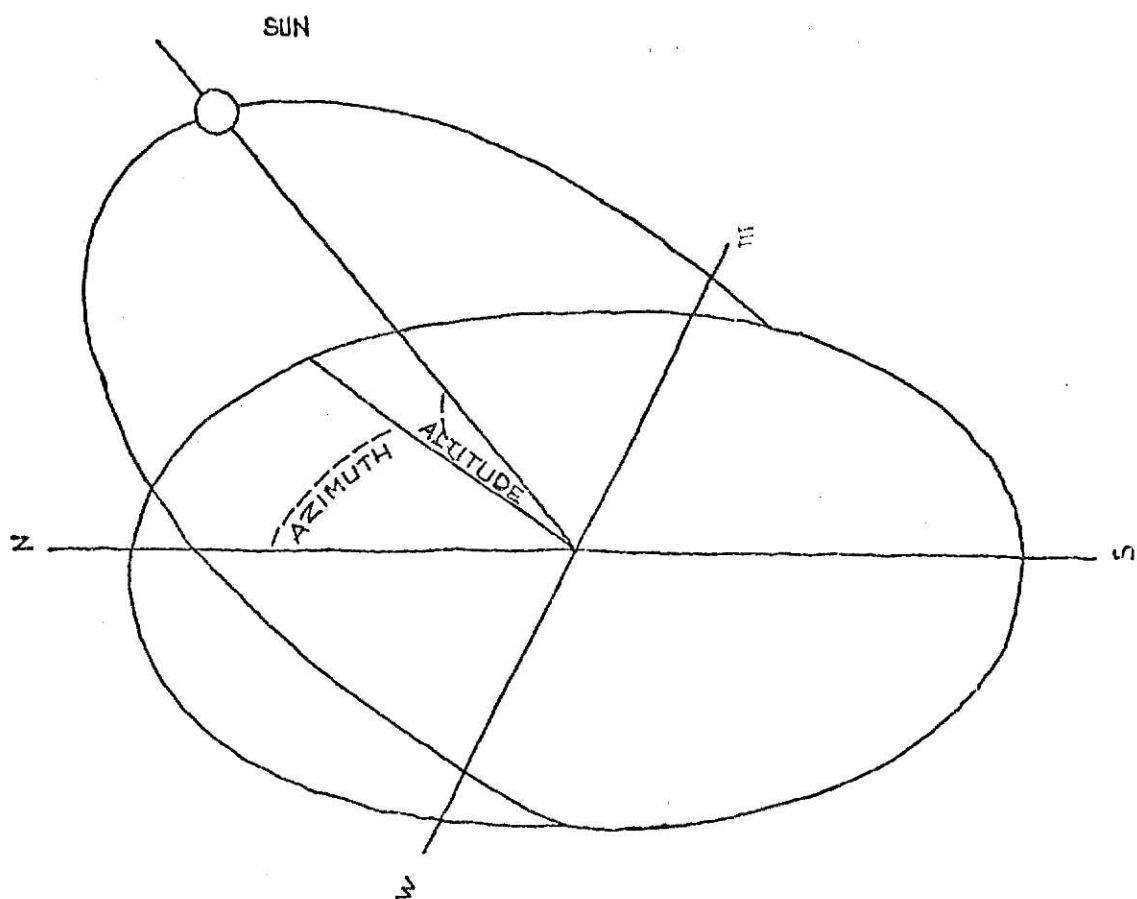
The following fundamental rules for orientation and solar control are generally valid:

1. Intense sunlight and strong, reflected sunlight are typical phenomena of a tropical climate. Usually, very strong light as well as marked brightness contrasts are found to be uncomfortable. Windows and doors, as a medium of ventilation, must also be protected against dazzling light.
2. Open facades should face north or south to avoid direct radiation from a low sun and the consequent intensive concentration of heat.
3. In the hot, humid climates it is necessary to screen all openings and in some circumstances, complete facades, against direct and indirect radiation because an overcast sky acts as a source of radiation.
4. Each facade of a building must be separately considered to achieve the most effective solar control. There is no justifiable reason for using the same screening device on all four facades of a building.

In some cases, architects may consider the orientation of the building for the sake of shading and breezing. If screens are provided to protect the building against sunlight they must not create darkness inside, and

they must not obstruct the breeze, which is very desirable for hot-humid zones.

Moving air will be cooled by the presence of vegetation. At the same time, planting enhances the functional and aesthetic development of the land.

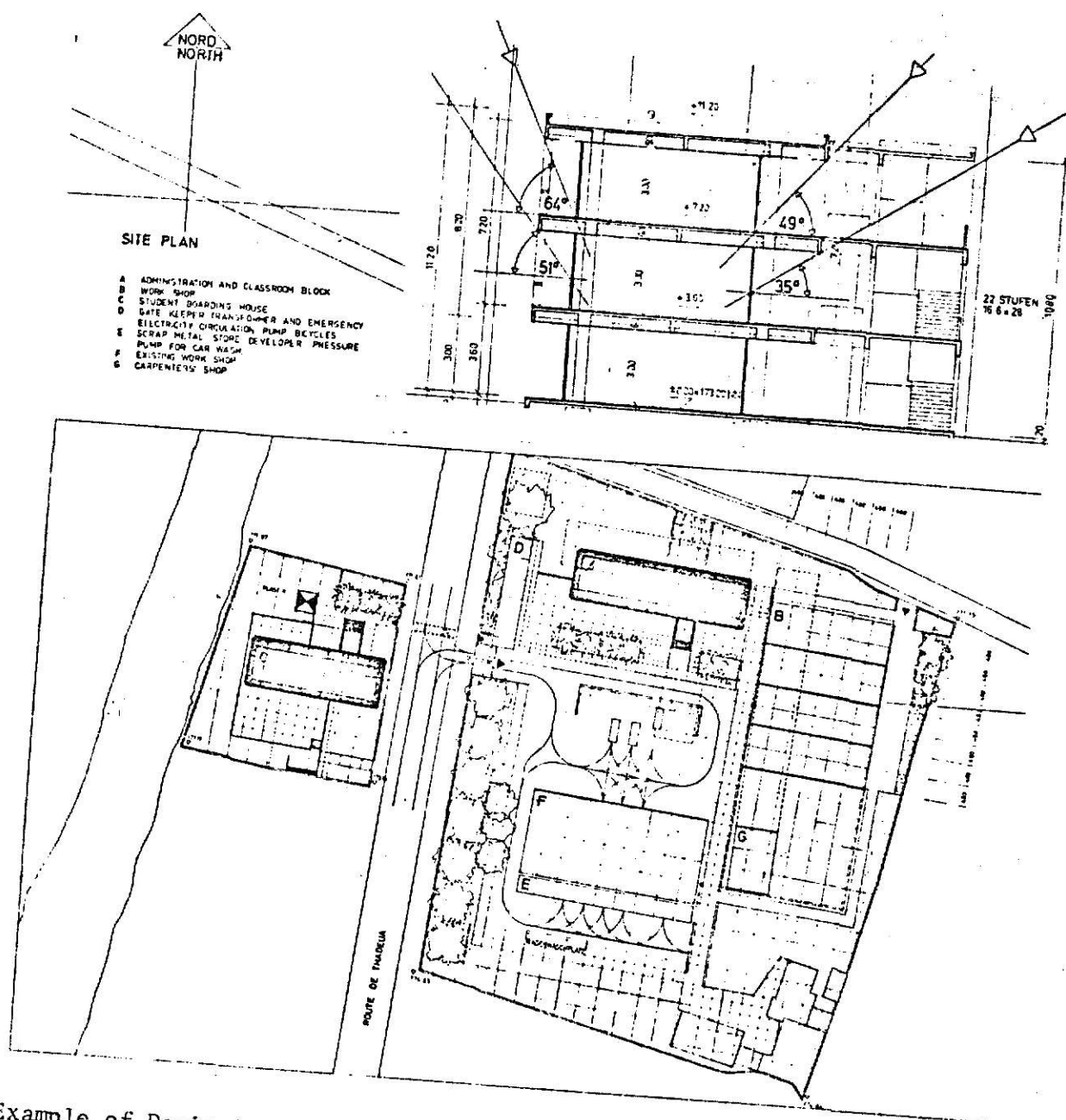


Azimuth: declination of the sun from north measured, clockwise, in degrees from north to east, south, west, and back to north.

Altitude: the angle between the horizon and the sun measured in degrees.

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An Example of Designing Based on Orientation Showing Identical Buildings
Situating with their Access Sides One to the North and One to the South.

East Facade: Closely Spaced, Overlapping, Vertical Fins Pointing Southeast.

West Facade: Closely Spaced, Overlapping, Vertical Fins Pointing Southwest.

Fig. Solar Angle of Incidence

Fig. Technical School

SOLAR RADIATION

Solar radiation is the cause of all climatic phenomena and thus has a decisive effect on the lives of people. Its effective strength is determined by radiant energy from the sun, outward radiation from the earth's surface and loss of energy through evaporation and atmospheric radiation. On its way to the earth the radiation must penetrate the atmosphere, which is interspersed with differing concentrations of dust particles and water vapor. The shortest path is where penetration is vertical.

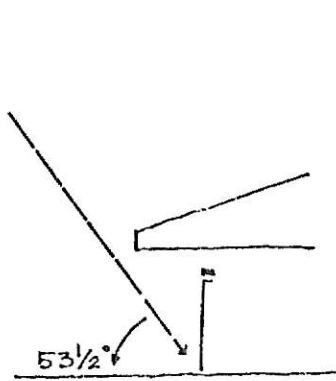
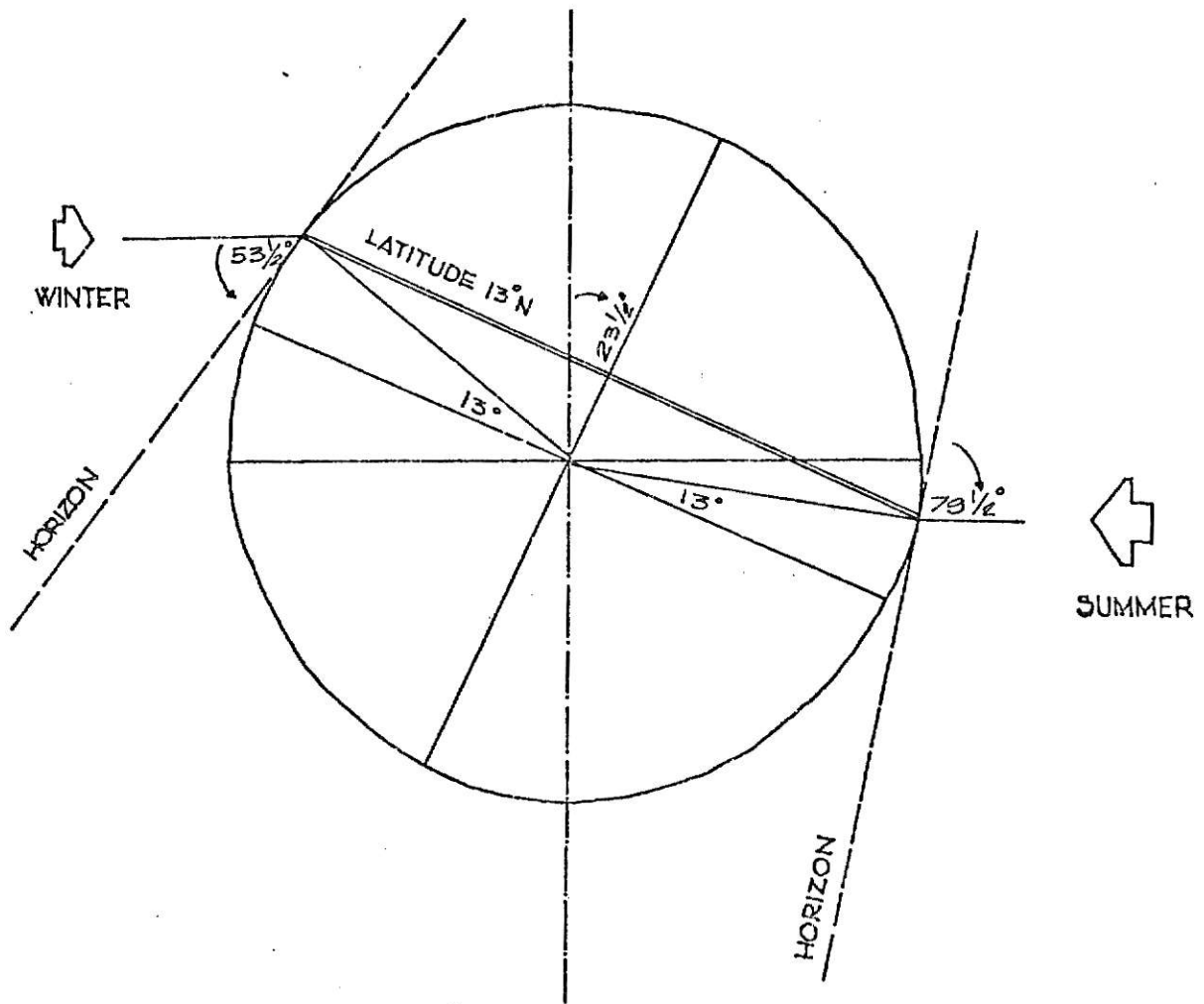
Solar altitude is the vertical angle between the horizontal plane and a line from the sun:

Solar altitude in summer = $90 - \text{latitude} - 23 \frac{1}{2}^{\circ}$

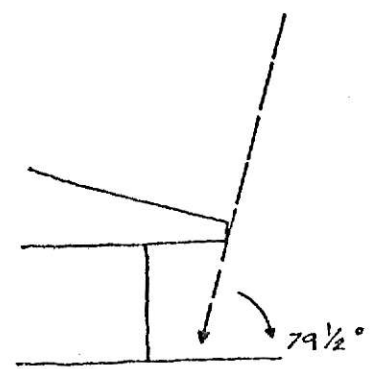
Solar altitude in winter = $90 + \text{latitude} - 23 \frac{1}{2}^{\circ}$

As solar radiation loses part of its energy while penetrating the earth's atmosphere, there is a minimum loss where the radiation impinges perpendicularly on the earth, namely near the equator. Here about 15% of the energy is lost. Thus more radiation energy is used up when the incidence is less and there is more of the earth's atmosphere to penetrate. Cloud, smoke, dust, and water droplets reduce the solar radiation considerably.

Land areas heat up twice as quickly as the same area of water. Water surfaces lose some heat energy by evaporation. As the air temperature is largely determined by contact of the air with the earth's surface, it follows that particularly high temperatures are found in conjunction with low humidity, and relatively moderate temperatures in conjunction with



WINTER



SUMMER

CRITICAL SOLAR ALTITUDES

high humidity.

During the course of the day, the maximum temperature is reached about 2 hours after midday, for then the effects of the direct solar radiation and the high air temperature already prevailing are combined. The greatest heat gain is thus found on south-west and west facades.

Thermal conditions inside a structure depend primarily on the heat exchange between the outer walls and the immediate surroundings. The direct emission of a wall is conditioned by its orientation with respect to the sun. In tropical countries the east and west facades are those most exposed to solar radiation. The indirect radiation present with a more or less overcast sky acts evenly on all facades and parts of a building from all directions. Some materials absorb some of the solar radiation; others reflect the maximum of heat. This is valid above all for white-washed walls. A freshly white-washed wall absorbs no more than 20% of the solar radiation; an old coat of paint permits greater absorption. Material is heated up by that portion of the heat or solar radiation which is not reflected but absorbed. The heat taken up through the wall or roof material of a building will be forced to the interior if no precautions are taken for its elimination. Surface air currents draw off some heat; any boosting of the movement over the surface, whether naturally or artificially produced, will increase the dissipation of the heat.

The amount of solar radiation, which is reflected from the pavement surrounding the building also causes discomfort. An unprotected pavement may register 110° F. when the surrounding temperature is 90° F. Landscaping or greenery can help reduce solar radiation to a substantial degree.

SOLAR CONTROL

Protection from the sun is always necessary in the tropics. Screening can be provided by vegetation, and horizontal and vertical screening. The fundamental rules for orientation and solar control are generally valid: open facades should face north or south to avoid direct radiation from a low sun and the consequent intensive concentration of heat; it is necessary to screen all openings, and in some circumstances, complete facades, against direct and indirect radiation because an overcast sky acts as one source of radiation. Existing trees and shrubs provide the simplest way of protecting a building or part of it from solar radiation.

Horizontal screening is the most suitable form of screening with overhead sun, i.e. for all north or south facades. It can also be used for south-east, south-west, north-east or north-west facades, though here it is less effective. The simplest form is a roof overhang, a projecting floor slab or a balcony. A permanent overhang fixed according to the position of the sun is most frequently used, and often combined with projecting elements.

Vertical screening is suitable for west, south-west, north-west, east, south-east, and north-east facades against low sun.

CLIMATE

Thailand is dominated by the monsoon, which is essentially seasonal winds blowing from one direction part of the year and the opposite direction the remainder of the year. On this basis, three seasons may be recognized in most parts of the country: the rainy season (July-October) in which the strong monsoon rain occurs; winter (November-February), the mildest season of the year; and summer (March-June), a hot and humid season.

Prevailing Wind

The prevailing winds in the summer and rainy season come across the Indian ocean from the southeast and southwest, carrying moisture which condenses into rains when it meets the cool air above the ground. During winter, wind comes from the northeast.

The best orientation for catching the cooling and de-humidifying breeze and dispersing the heat, obviously, is to design the building with long opening sides facing the wind directions.

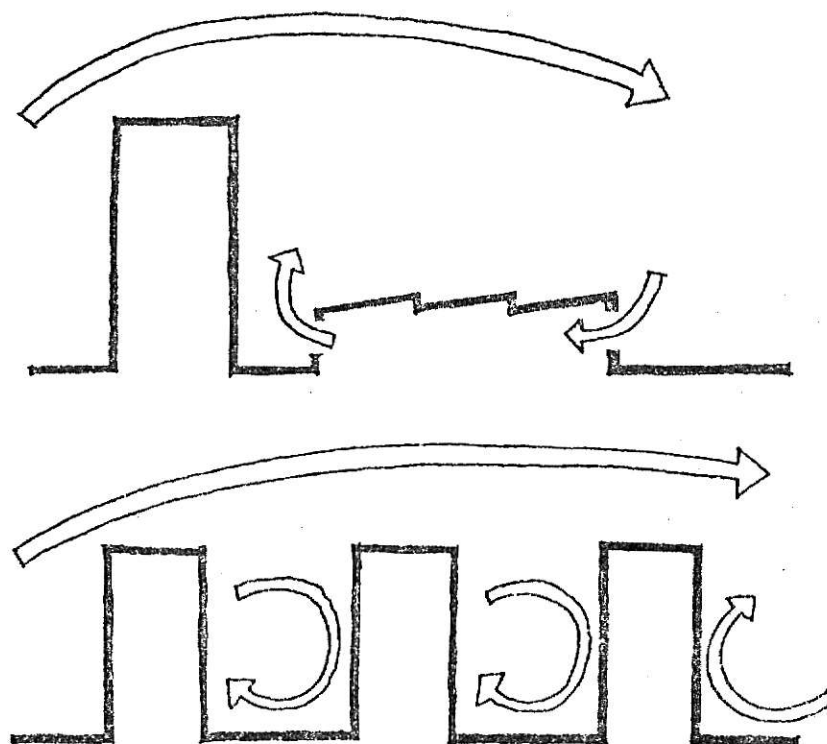
Humidity

In order to establish a range of comfort, the reaction of a number of people to change in these factors was tested. The result of many such experiments is that the temperature range for comfort in the vicinity of the equator lies mainly between 72.5° F. and 85° F. at a relative humidity of 20% to 50%. This still does not give a value of comfort that includes all the pertinent factors in one figure.

The yearly average humidity varies little between 75% to 85% because of the high temperature and high humidity amidst heavy rainfall.

MOVEMENT OF AIR

Air movements in the immediate vicinity of the ground can be quite different from those high up. A flat, open landscape does not affect air currents very much, and the wind will always blow in various directions across it. Directional changes up to 180° can be brought about by mountains, towns and valleys, and the velocity is accordingly reduced. Tests in large towns showed that wind speed at street level is, on the average, one-third of that in an open landscape. Tall buildings are better ventilated on the upper floors because the air movement is greater. The eddies and contrary rotating air currents occurring behind tall buildings provide ventilation for low buildings sited in the lee of such tall structures (Fig.). Close, parallel rows of houses need to be spread at a distance corresponding to about seven times their height. The wind can regain its original speed only after this distance when it has returned to ground level (Fig.).

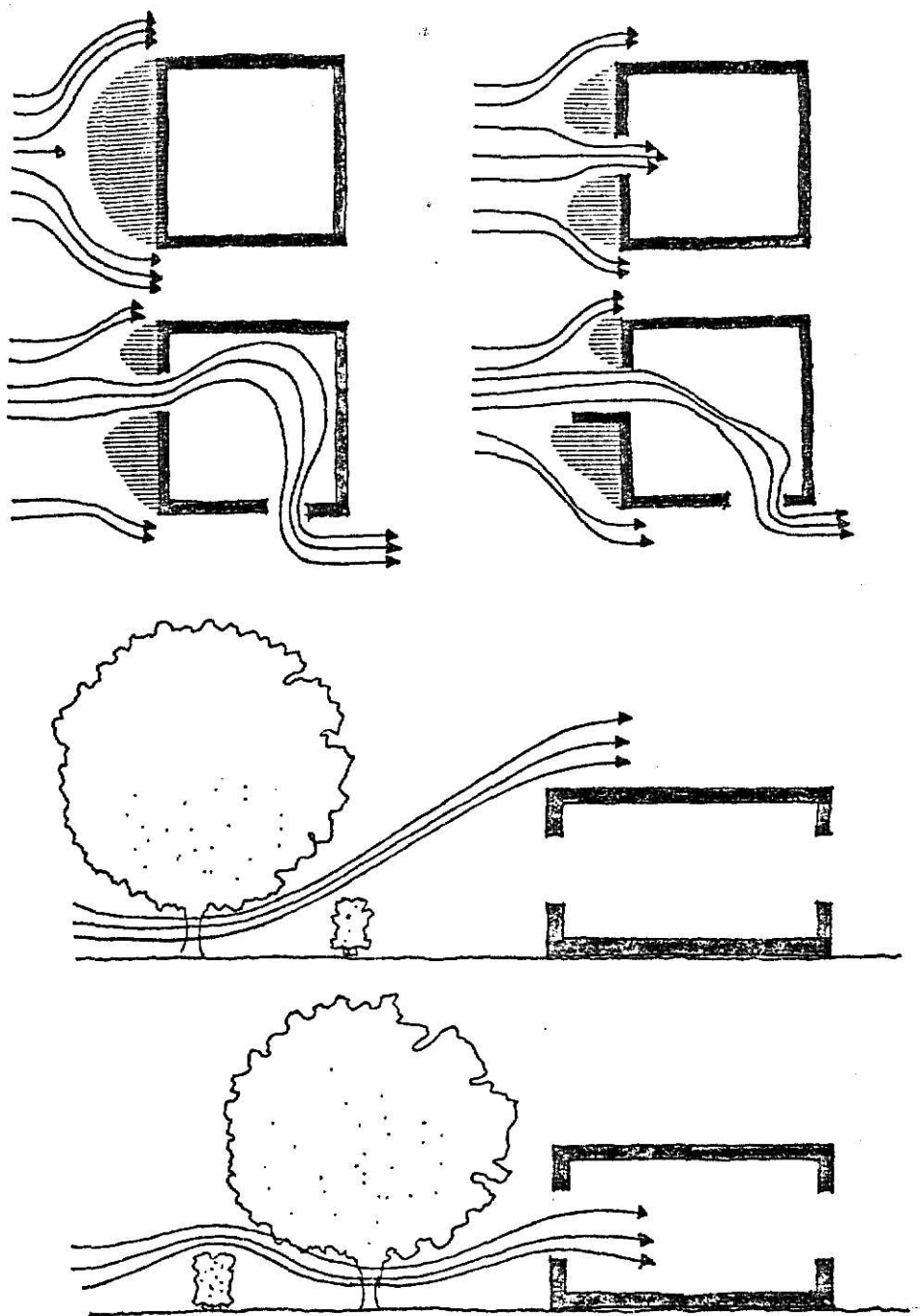


VENTILATION

The continuous ventilation of a room has various purposes. It serves primarily to improve the interior climate. In the area, the air outside an occupied room is normally cooler and drier than the air within it; the need for ventilation may be acute when there is little or no wind late in the afternoon. Moving air seems to be the most refreshing because it increases evaporation and thus lowers the skin temperature. Non-saturated air is repeatedly brought into contact with the body, absorbing body moisture (perspiration), and the body becomes cooler. A rise in humidity can be counteracted by increasing the air speed.

Interior air movement can be achieved by taking advantage of the wind or of the contrast between insulated and shaded facades. These two forces can, according to the orientation of the building and disposition of its windows, reinforce or oppose each other. The efficiency depends either on the difference of the temperature between two sides of the building or on the pressure difference. Windows on opposite sides of a building are needed for cross ventilation. The interior velocity can be increased if the outlet is larger than the inlet. Briefly, this means that to achieve the most effective cooling, the air inlet should be designed and positioned according to the course to be taken by the air inside; suitably positioned outlet windows should be as large as possible--in any case, larger than the inlets. The air-speed can be varied by a number of adjustable openings in the outlet windows, resulting in controllable, natural air-conditioning.

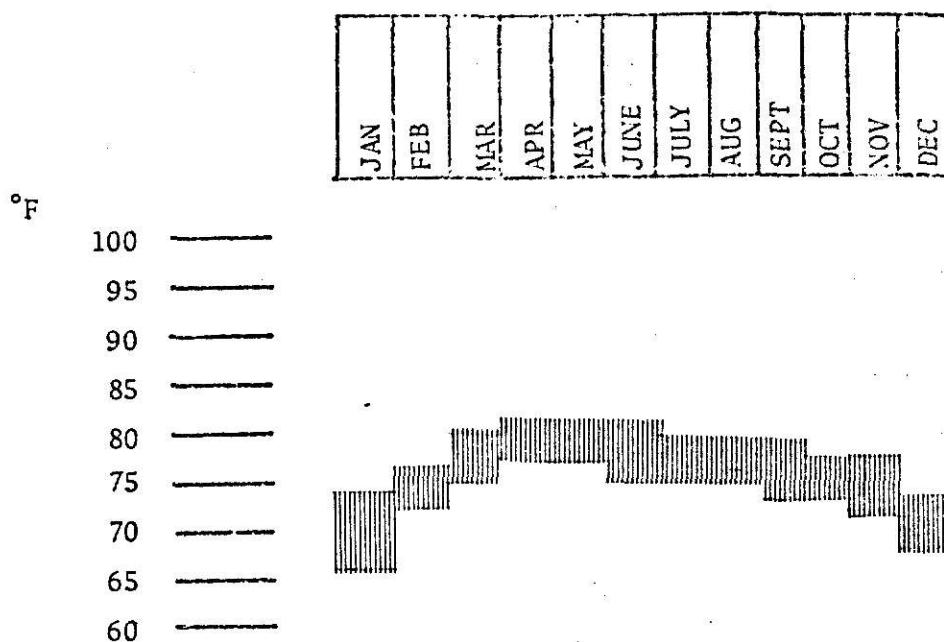
It must be emphasized that partition-walls, obstructions, non-rectangular planning of rooms, etc. do not only change the direction of the air



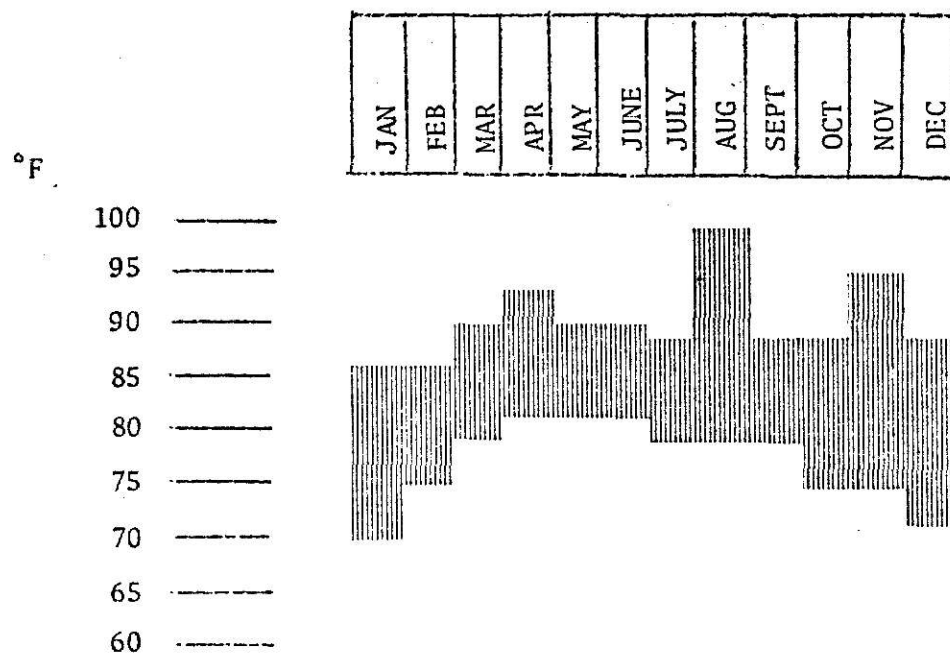
- Fig. Wind striking a building creates a region of high pressure on the windward side.
- Fig. The air-flow does not take the shortest route.
- Fig. Equal pressures on both sides of symmetrically located inlet.
- Fig. Unequal pressures on both sides of inlet, air-flow deflected to a different route.
- Fig. The distribution of the pressure and suction on the facades and around the building.

stream, but also drastically reduce it. Partition-walls should therefore be completely perforated or have air-openings even if the doors in them are kept permanently open. Obviously, the maximum air-speed is achieved if the air-inlets and outlets are exactly opposite one another and if there are no intervening obstructions.

Good cross ventilation requires that the wind approach the building from the most favorable direction. Horizontal or vertical louvers (fixed or movable), overhangs, canopies, and verandas must necessarily be adopted. They will allow for cross ventilation through windows which may remain open even when it is raining.



WET BULB TEMPERATURE
AVERAGE MONTHLY

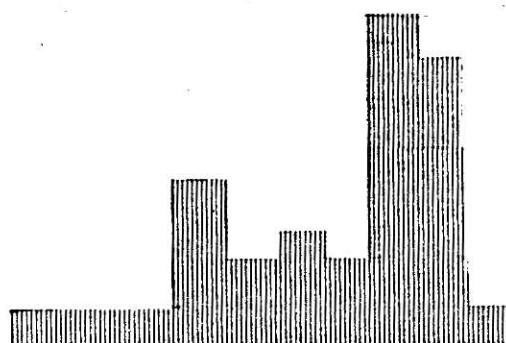


DRY BULB TEMPERATURE
AVERAGE MONTHLY

M.M

350
300
250
200
150
100
50
0

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
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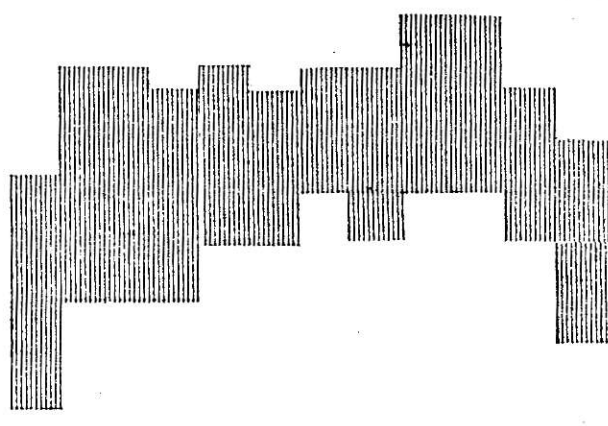
RAINFALL

AVERAGE NUMBER OF DAYS OF RAIN PER YEAR

PERCENT

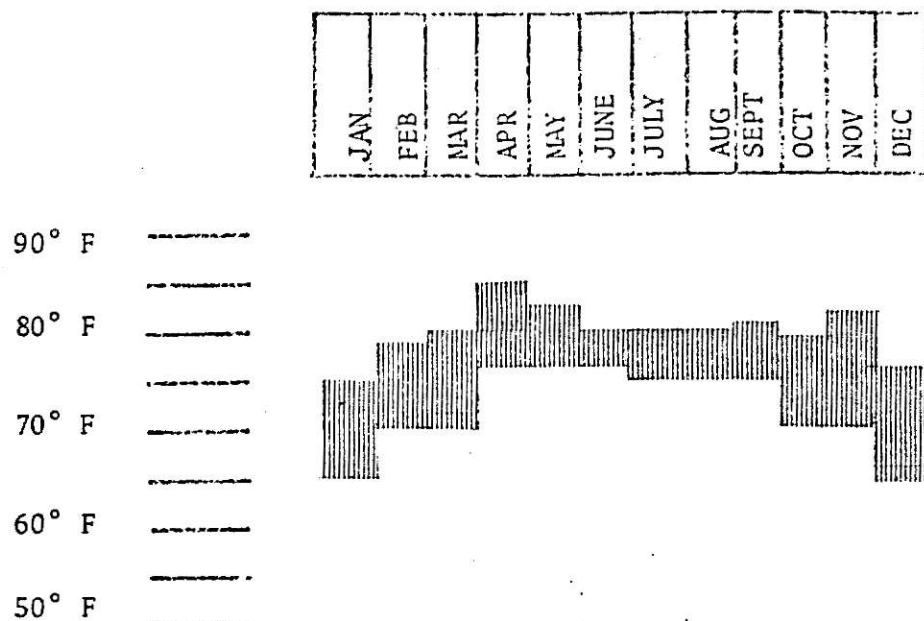
90
80
70
60
50

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
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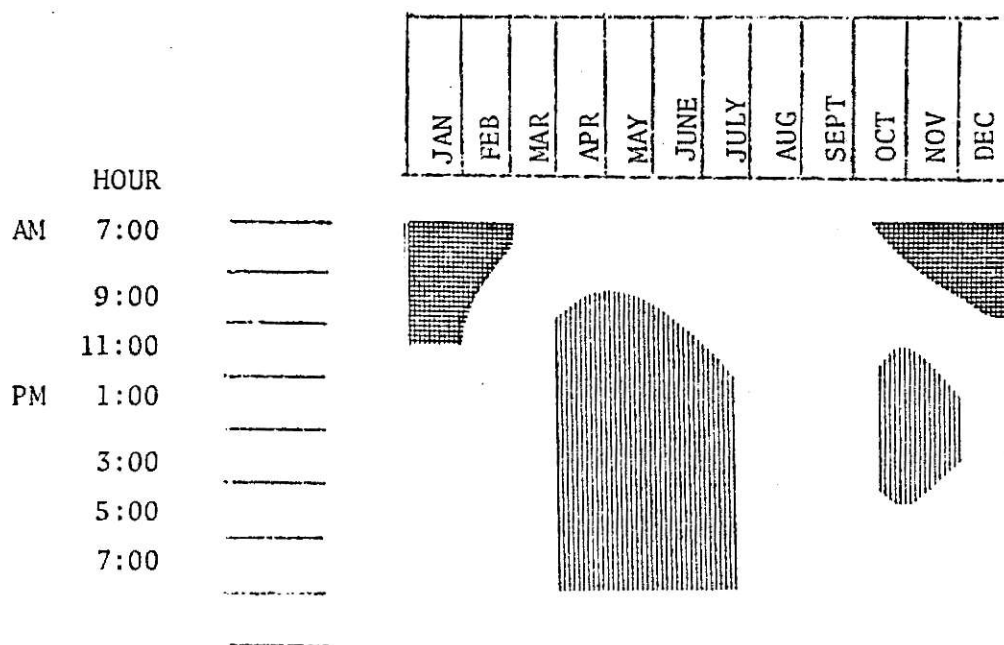


RELATIVE HUMIDITY

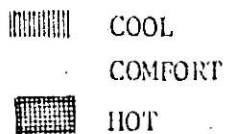
AVERAGE MONTHLY



EFFECTIVE TEMPERATURE
AVERAGE MONTHLY



EFFECTIVE TEMPERATURE



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BACKGROUND

URBAN FORM

Every city and most of the larger towns today should be considered urban regions, inhabited by those who, in one way or another, are dependent for their livelihood and for their life's expression upon the city. The boundaries of the metropolitan region usually do not coincide with legally established city lines, but reach far beyond into areas that were once countryside. Regardless of the political boundaries, the problem of urban areas theoretically is concentrated on the activities which determine the actual functioning of the city.

- A. The Metropolitan Core. This is the area known as "downtown" or "the central business district." The term "metropolitan core" means the most highly urbanized area, which ideally should contain a complete range of the highest productive uses and most significant urban functions, not only in the fields of business and civic administration, but also in cultural, recreational, social and spiritual activities as well, and, in addition, residential quarters of high quality and density.
- B. Secondary Cores. These are areas in which highly urbanized functions have developed at a point geographically removed from the metropolitan core.
- C. The Core Frame. This is an area of intensive development containing secondary urban functions, such as residential developments of high density, which are needed immediately adjacent to the core.
- D. The Core Fringe. This is an area containing facilities serving the metropolitan core and the secondary cores, but of lesser productivity and density than that occurring in the core frame.

THE DESIGN CONCEPT

URBAN FORM

Every city and most of the larger towns today should be considered urban regions, inhabited by those who, in one way or another, are dependent for their livelihood and for their life's expression upon the city. The boundaries of the metropolitan region usually do not coincide with legally established city lines, but reach far beyond into areas that were once countryside. Regardless of the political boundaries, the problem of urban areas theoretically is concentrated on the activities which determine the actual functioning of the city.

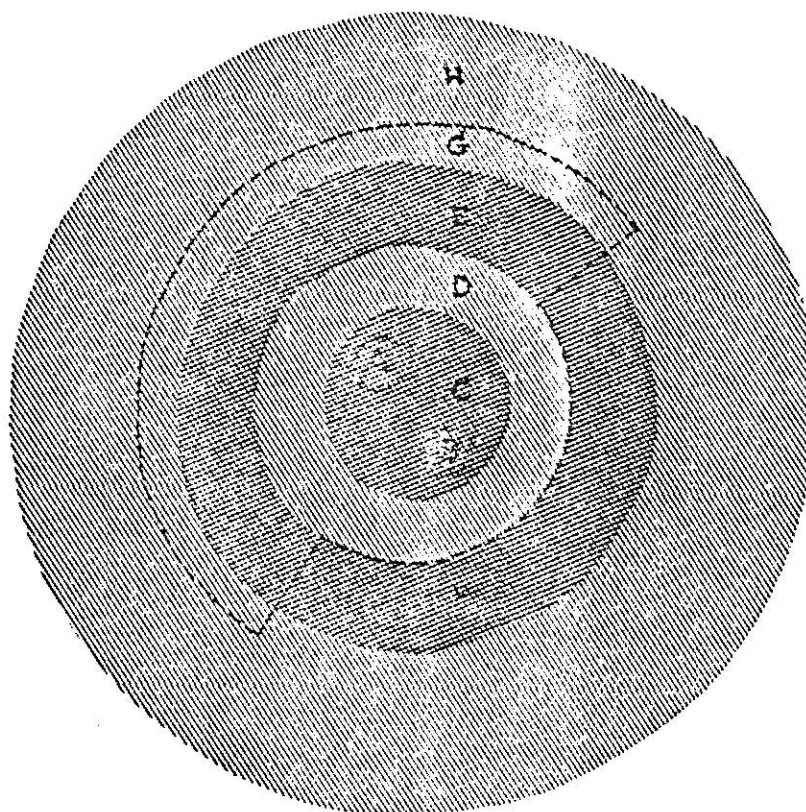
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- D. The Core Fringe. This is an area containing facilities serving the metropolitan core and the secondary cores, but of lesser productivity and density than that occurring in the core frame.

E. The Urbanized Area Within the City Boundaries. This is an area occupied by multiple housing units (apartment houses), related local retail, cultural, civic facilities and other urban functions, and working places that are devoid of undesirable characteristics (noise, smoke, poisonous fumes); this would include all types of light industry, laboratories, offices, etc.

F. The Urbanized Area Outside the City Boundaries. This is an area which, in character and use is identical to that of the area within the city boundaries, but which, by some historical accident, happens to be located outside the geographical city line.

G. The Suburbanized Area Within City Boundaries. This is devoted mostly to single residential units (detached houses) and to a sprawling development for other functions.

H. The Metropolitan Region. This includes all areas located outside the city limits which depend, as far as employment or other activities of its inhabitants are concerned, more than 50 percent on the economic vitality of the urbanized area within the city boundaries. Within this metropolitan region one usually finds unplanned patterns of residential subdivisions intermingled with languishing cores of former cities and towns, which have been absorbed by the metropolis, industries of all types (including those with undesirable characteristics), warehouses, and retail facilities which occur either along highways in stringlike form or in organized shopping centers.



CITY BOUNDARY

Schematic Diagram of Typical Metropolitan Region

- A. The Metropolitan Core
- B. The Secondary Core
- C. The Core Frame
- D. The Core Fringe
- E. The Urbanized Area Within City Boundaries
- F. The Urbanized Area Outside City Boundaries
- G. The Suburbanized Area Within City Boundaries
- H. The Metropolitan Region

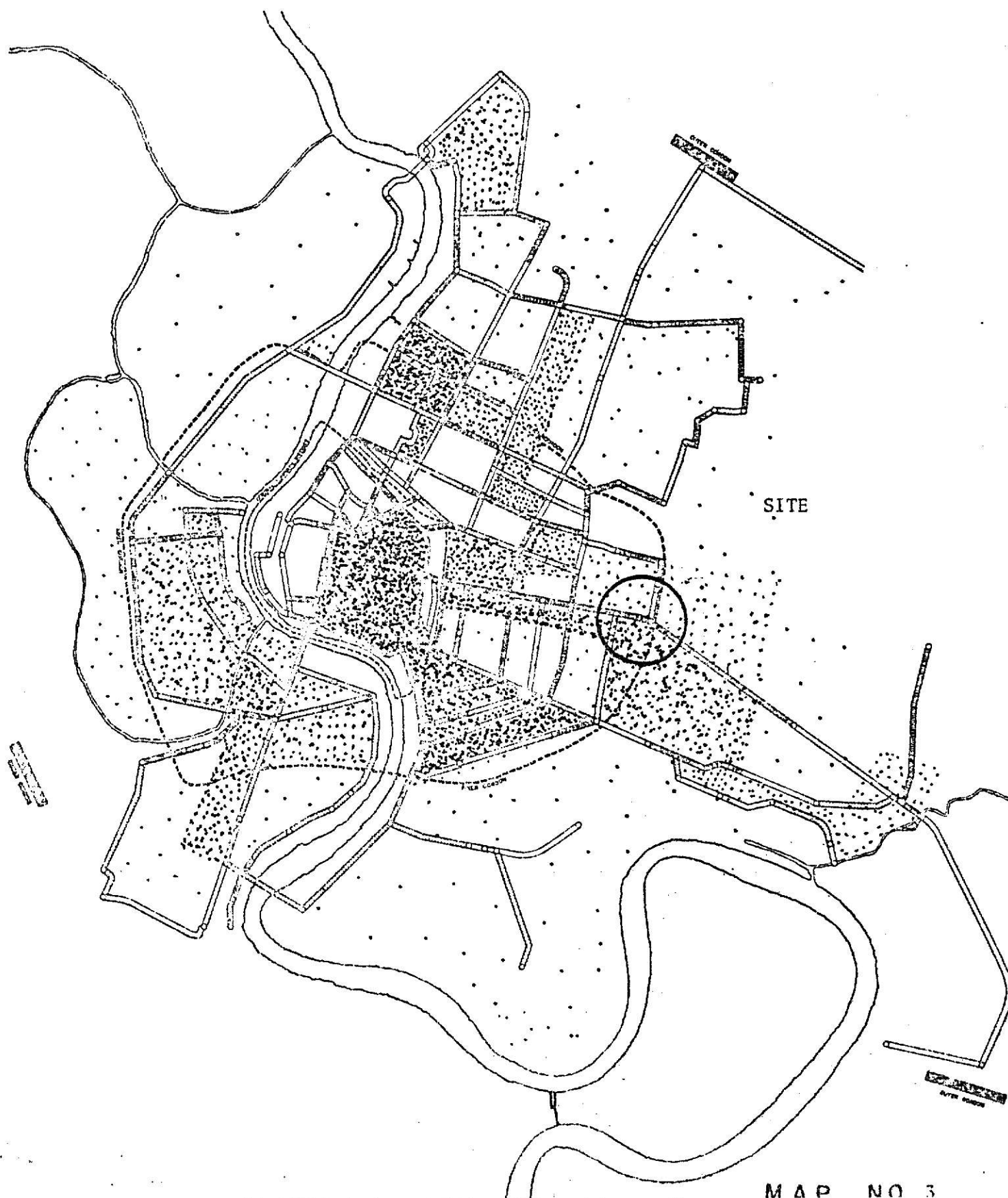
SITE SELECTION

The increase in population in Bangkok during the last decade adds to the problems of urbanization. This problem is fundamentally a question of urban structure itself and its capacity to evolve new and creative forms in response to the population pressures and new patterns of physical growth. Horizontal development may help, but vertical development obviously is going to be more important in our answer. This, of course, is the basic technique employed to develop the whole complex.







The commercial building is a complex of many elements, hotels, office buildings, apartment housing, etc. The first step in creating good buildings is to select a site of the right size, the right proportions and the right location.

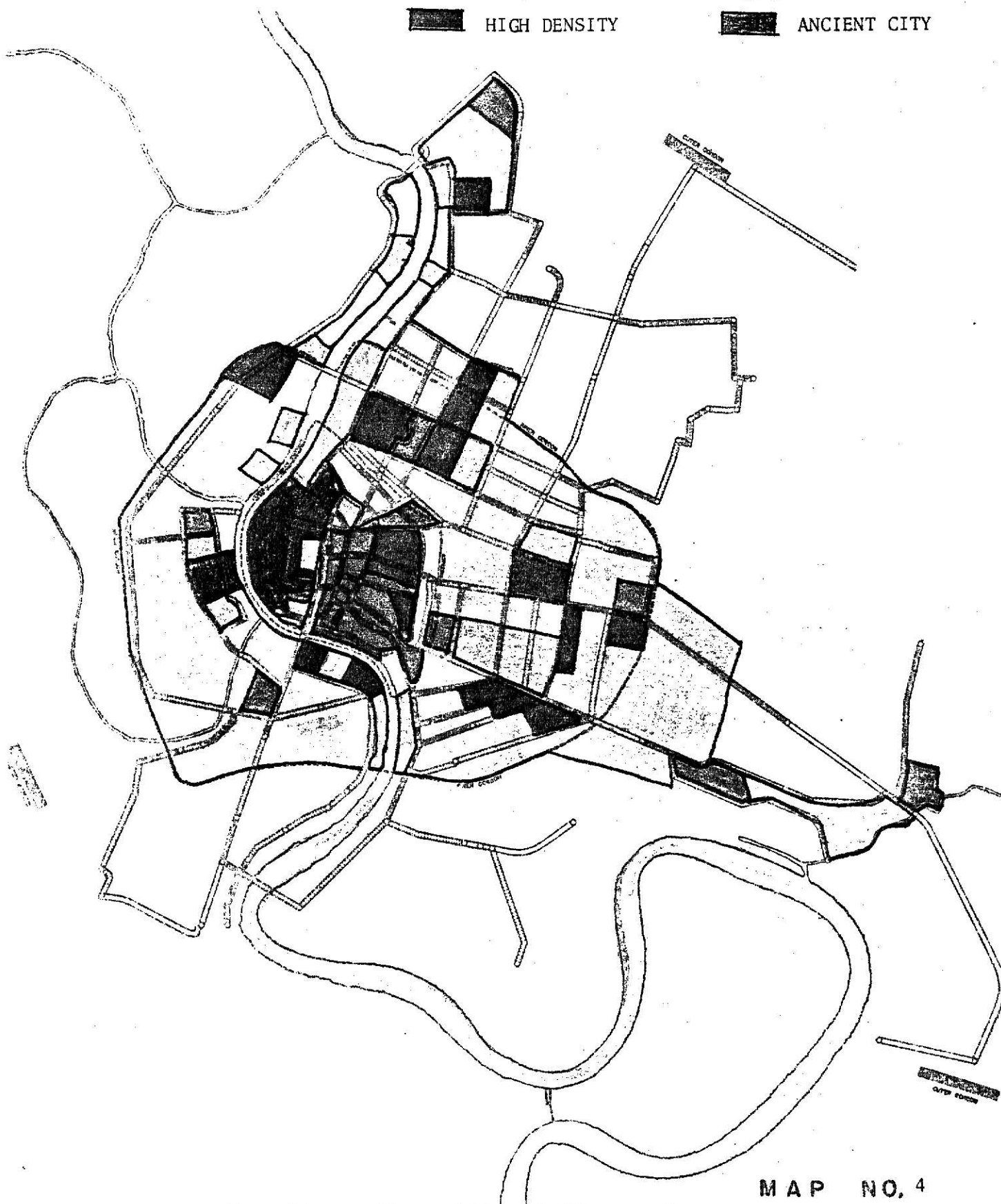
The site is selected at the outer-ring in the medium density and close to a major transportation line. Since employees must get to work and get out again at the end of the day, the site should be considered in relation to the main arteries nearby. In the city setting, the surrounding neighborhood is a vital factor to consider, not only the quality of the area but also the actual physical conditions of the area.

POPULATION DISTRIBUTION 2533 (1990)

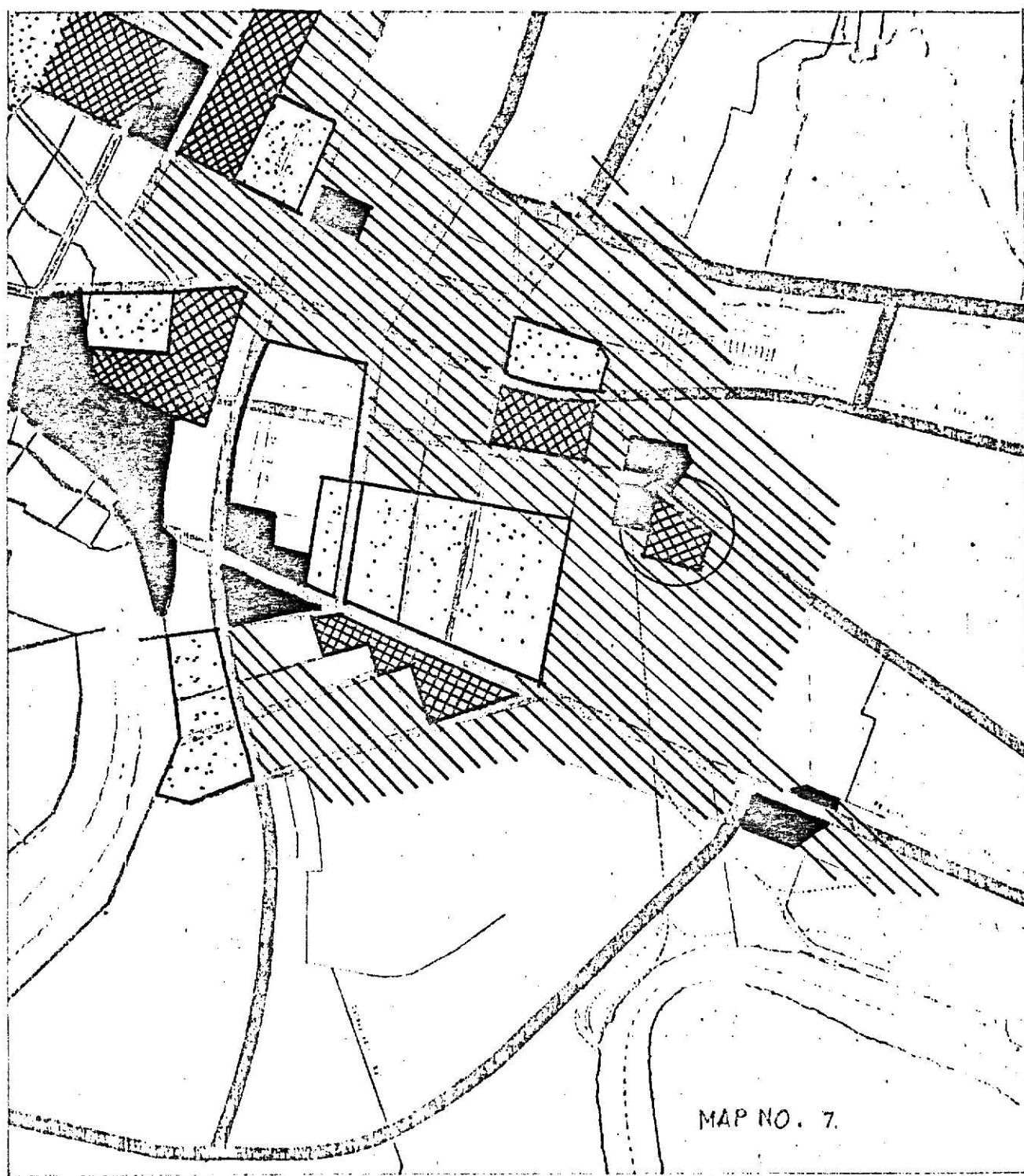
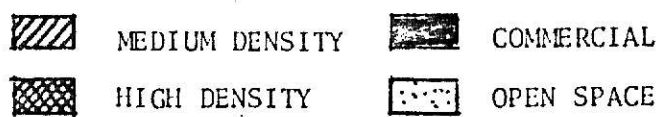


LAND USE MAP

	LOW DENSITY		COMMERCIAL
	MEDIUM DENSITY		OPEN SPACE
	HIGH DENSITY		ANCIENT CITY



LAND USE MAP (SCALE 1:50,000)



PLANNING APPROACH

The site which was selected for the project was the single block within the limits of the outer ring of Bangkok. It was partly occupied by minor structures (old warehouses, garages, repair shops, etc.) which have to be acquired by the developer, and partly by major buildings (a department store, a hotel, and an office building combined with living quarters). The site, totally flat (0% slope), which is the single block, is served by a major route and a minor street. It is particularly favored in respect to accessibility by public and private transportation.

Planning Goals

The project is a combination of commercial (public uses) and residential areas. Functions covered will be shopping facilities, offices, hotel, housing, and all necessary service amenities, such as parking garages, and technical services. Vertical connection between all levels is achieved by escalators, stairways and elevators. Escalators serve as the links between the parking garage and the hotel's main lobby as well as the department stores. High speed elevators are recommended for the vertical connection of 20-storied office buildings. Regular speed elevators are most efficient for hotel and apartment houses.

The objective of the project is based on the specificity of its type and its characteristic for an urban environment and a technological society.

DESCRIPTION OF THE PROJECT

This project is developed as a complex, containing the following functions:

1. Office Space
2. 250 Room Hotel
3. Department Store
4. Residential Area: about 98 units

Supporting Functions:

- a. Parking Garage for Approximately 550 Cars

The project site is determined within the urbanized area within the city boundaries. The site selection is chosen in regard to the following functions:

An accessibility by public and private transportation.

The size of the site which is large enough to accommodate:

- a. The proposed building
- b. Parking area
- c. Necessary landscaping

The relation of site to services:

- a. Convenient public transportation facilities
- b. Nearby banking services, school, etc.

Physical facilities of the site which offer:

- a. Easy access to power, steam, gas, plumbing and sewage, etc.

Topography and soil.

- a. Firm soil which will support the building weight without unusual structural foundations.

The size of the site is approximately acres.

The front part of the site, which is close to a major transportation line, is reserved as a commercial zone, and the inner site is reserved as a residential zone.

Commercial Zone

The base structure consists of a subterranean level containing a garage, mechanical facilities, delivery roads, basement sales areas for the department stores, and storage areas. The ground level (first floor) consists of the department store, lobbies of the office and hotel building.

The upper three floors of the building, including the roof, are used as parking areas for cars. The amount of parking to be provided is calculated on the basis of the minimum uses of cars.

Office 1/4 - 1/8 car spaces per 100 sq. ft.

Hotel 1/2 - 1 car spaces per unit

Apartment House 1/2 - 1 car spaces per dwelling*

The superstructures contain a 20-story office building, which is approximately square feet, and a 9-story hotel building for units.

Residential Zone

The residential buildings are set back from the commercial zone because of the need for privacy and a quiet area. There is an open space provided for multipurpose use, an indoor recreation area, and an area for

the children and the old; one open space is provided out of every three floors.

MATERIALS AND METHODS OF CONSTRUCTION

The factors which affect the selection of materials are availability, cost, requirements of building regulations, the ability of the materials to stand up to prevailing climatic conditions, and the standard of workmanship. As communications and transportation improve, the range and choice of available building materials increase. Since the cost of imported materials, due to shipping, insurance, and custom charges, is high, there is a marked tendency towards the utilization of local materials. This is evident with cement, with resulting greater uses of concrete and concrete products. The cost of building construction in Thailand is based on the rates of labor cost both for the construction and manufacturing of materials, which is usually low in most tropical countries. The cost of building, however, should not be estimated exclusively on the basis of its initial cost. The cost of maintenance while exposed to harsh conditions is also a vital factor for consideration.

The structural design in this project consists of two different systems. The reinforced concrete flat slab and two-way grid system are to be used in the garage levels and the lower parts of the buildings. It is obvious that the two-way grid system offers total design efficiency. It is widely employed for garages, stores, restaurants, and public halls as parts of the buildings with or without the use of a hung ceiling.

The open-web joist floor system is used in the high-rise buildings. Open web steel joists are lightweight steel trusses fabricated for use in buildings with relatively light loads to carry floor and roof loads between the supporting members, beams, girders, or bearing walls.

A flexible construction joint will be provided for between the connection of the tower and the other part of the complex. The matter of expansion joints for the other parts of the building is to be taken care of by resting intermediate slabs on cantilevers extending from two sides of the flexible gap.

MECHANICAL SYSTEMS

Air conditioning is the vital step in attaining the ideal atmospheric conditions to enable employees to do their jobs efficiently. In addition to providing air cleanliness, adequate ventilation, control of temperature and relative humidity, and elimination of drafts through proper supply and distribution systems, air-conditioning also serves to eliminate outside noise and dust, since windows are kept closed at all times.

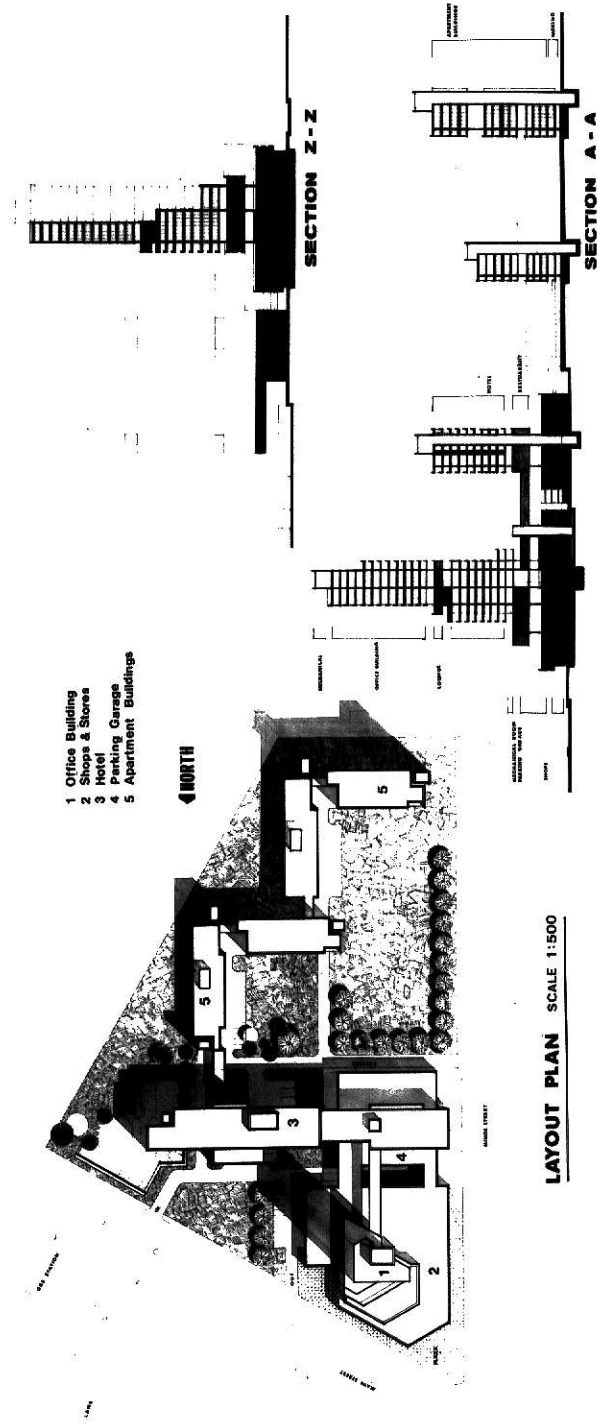
In this complex, the chilled-water system with fan-coil will be used. The cooling medium will be supplied from a remote source and circulated through the coils in the fan-coil terminal, which is located in each conditioned space. Ventilation is obtained through different methods. For the office space and guest rooms, an opening in the wall will be provided. For large spaces, such as hotel lobbies, restaurants, department stores, etc., air handling units with ducted air distribution will be provided to permit zoning of each large space.

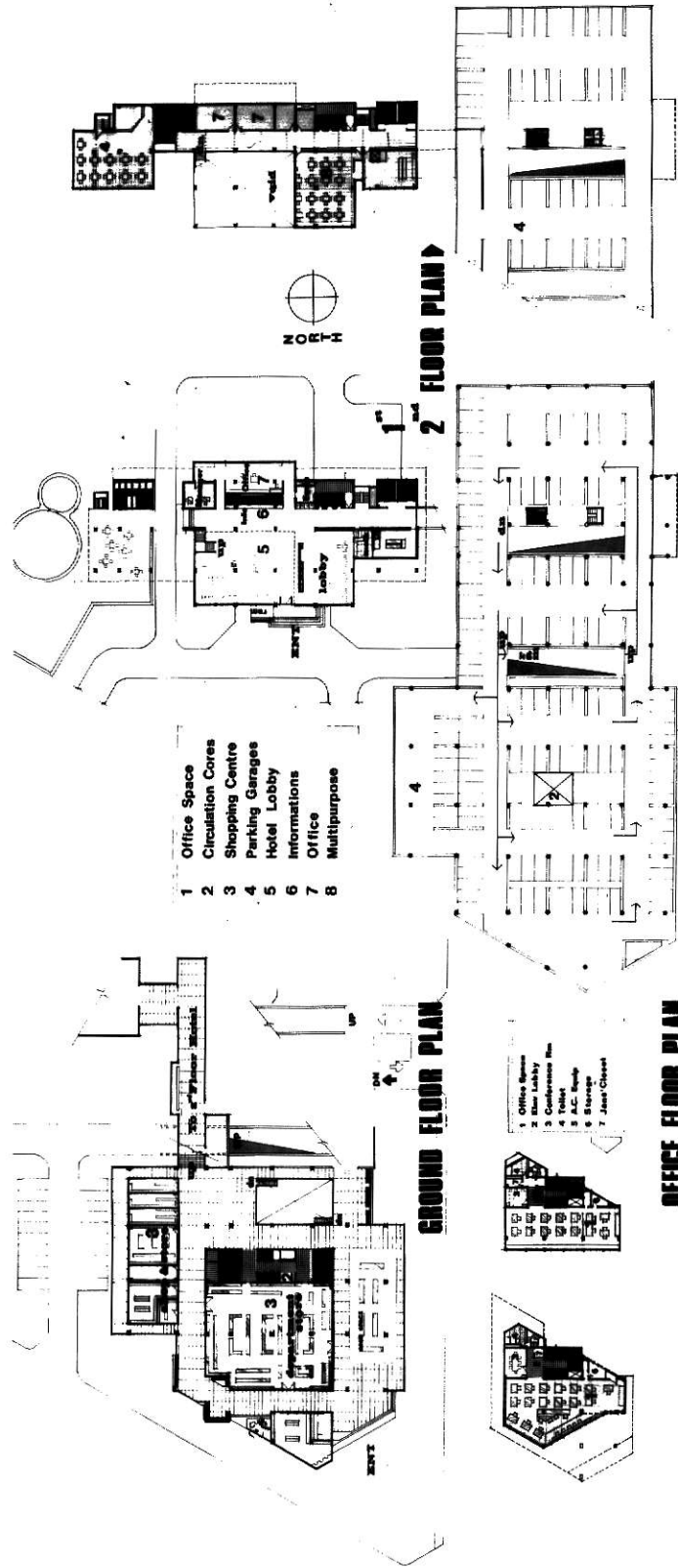
The mechanical space will be provided in the basement. The cooling towers will be placed on the top of the elevator core and the roof.

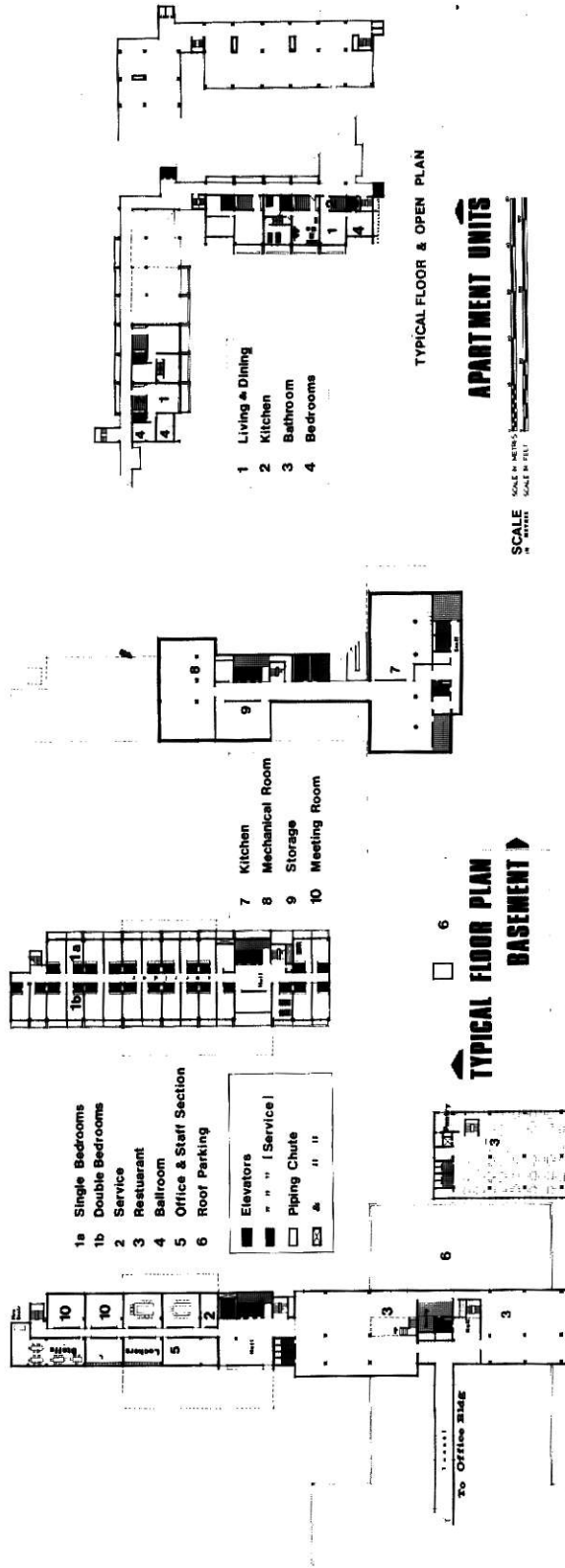
The other part of the complex, a residential building, will be zoned according to the solar orientation and prevailing wind.

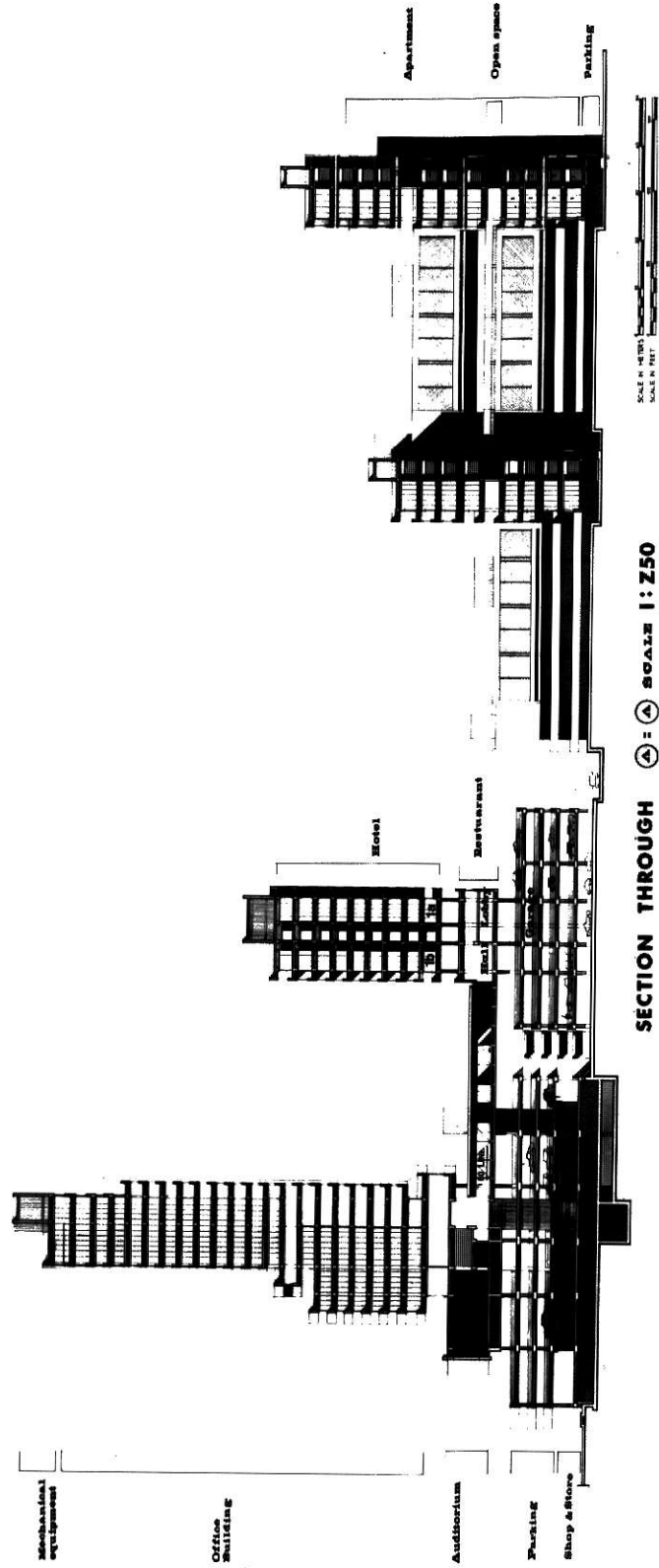
GRAPHIC PRESENTATION

1. Site Plan and Section
2. First Floor Plan
3. Second Floor Plan
4. Typical Floor Plan
 - Office Building
 - Hotel
 - Apartment Building
5. Elevations
6. Sections
7. Model











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CONCLUSION

From studies of the historical background of urbanization in the Bangkok area, and the recognition of the need for urban development, we arrived at the conclusion that this "Residential and Commercial Complex" is not only one of the center of urban environment but a typical example of multi-functional development.

According to the program of urban renewal, we have arrived at two major objectives: the population distribution within the city boundaries and the redevelopment of land use. Also considered was the concept of a traffic pattern in which the use of the automobile was minimized.

It is my hope that this complex will be considered as a proposal for the solution of the urban problem in Bangkok.

CASE STUDY I

Name of project: Houston Center

Location: Adjoining the existing downtown area of Houston, Texas

Master Planners and Architects: William L. Pereira Associates

Project Managers: Brown and Root Inc., engineering and construction firm

Developer: Texas Eastern Transmission Corporation

This project covers 75 acres, directly adjoining the existing CBD area of the city of Houston. It is planned to include offices, hotels, retail stores, apartments, and cultural and recreational facilities, which together will provide 23,000,000 square feet of revenue-producing area. The residential function, with 5,000 units in apartments and town houses, will be strongly represented.

The project--which will be lifted off the ground--includes provision for 40,000 parking spaces. These parking facilities, together with all communication functions, will be located below the platform level, which provides a pedestrian area from which all major structures will rise. The superstructures will be clustered around plazas and promenades, some open and some enclosed. The highly developed internal transportation system will consist of elevators, escalators, moving sidewalks and high-speed "people-movers."

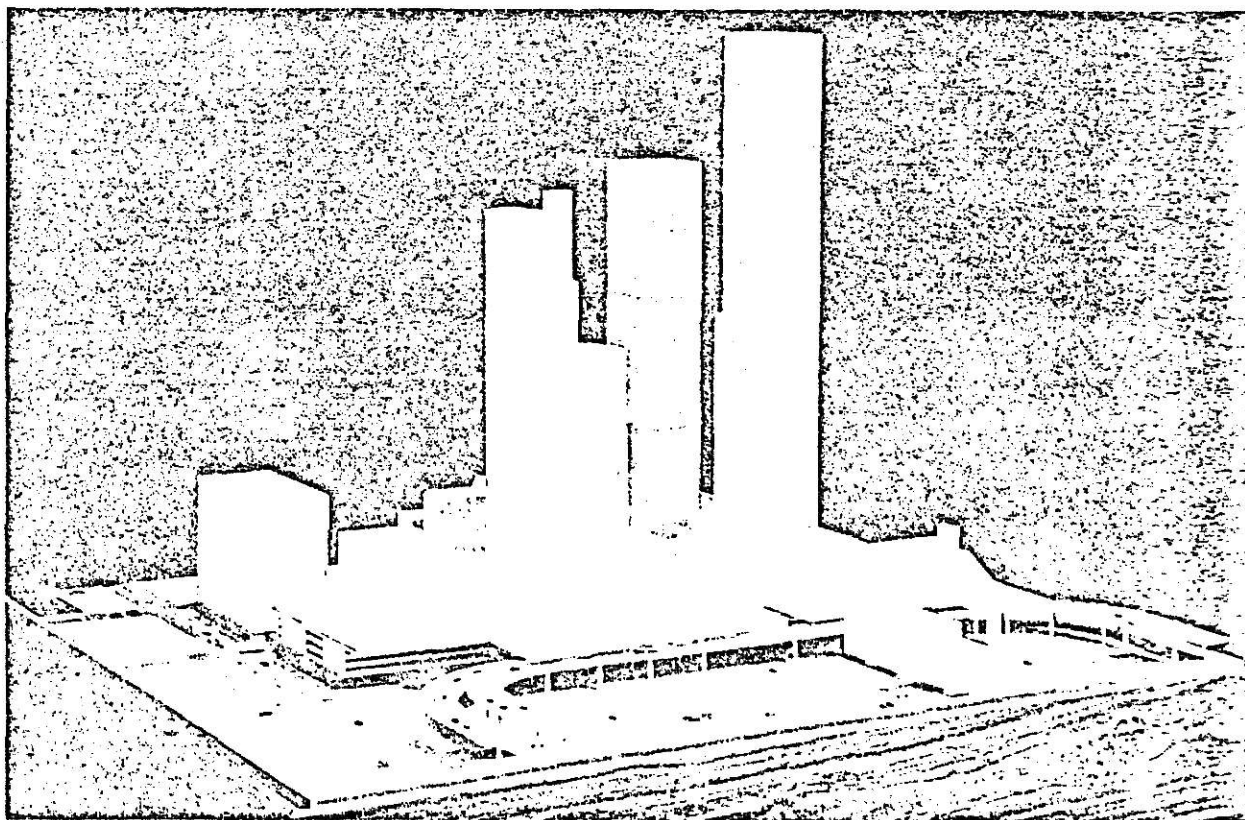


Figure 5-17 Houston Center: Model showing the projected first phase.

CASE STUDY II

Name of Project: The City

Location: Orange County, California

Architect: Minoru Yamasaki and Associates

Associated Architects: Naramore, Baine Brady and Johnson

Economic Consultants: Economic Research Associates

Developer: City Management Corporation, Orange

A land area of approximately 200 acres has been set aside for a multi-functional center which will serve the large surrounding suburbanized areas, including the communities of Garden Grove, Santa Ana, and Orange.

This project has a long history which began in the late 1950's. It appears that many difficulties and problems had to be overcome and that even now the planning of the entire concept is still in a state of flux. The execution is planned to occur in a number of phases. The first phase, consisting of a large office building and a shopping center, opened in May 1970. In the meantime, a second department store has been constructed, 441 apartment units in 8 3-story buildings have been completed, a twin movie theater is under construction (as part of a projected entertainment center), and a medical clinic has been erected. A 6-story hotel is in operation.

If all the intentions of the developers and master planners can be carried out, the following functions should be strongly represented:

1. Retail shopping facilities.
2. Living quarters (1,650 units).
3. Entertainment facilities.
4. Medical facilities.
5. Office buildings (including a financial center).

The program for phase 1 is described in a document by the master planning architect as follows:

Gross built-up area = 3,810,325 square feet.

Parking space for approximately 14,700 cars. (Surface utilized for parking, which is to be partly on the ground and partly in structures, is 4,839,120 square feet.)

Separately mentioned in the program outline are the apartment buildings which during phase 1 and phase 2 will provide approximately 1,124,500 square feet of built-up area. An additional 1,700 parking spaces are foreseen for these apartment units.

On the basis of this information, it would appear that (using the terminology which I have set up and by including the apartment buildings), a total of about 6,000,000 square feet of revenue-producing area is to be provided. If one considers this figure in relation to the land use area, a building density of about 0.70:1 between revenue-producing surfaces and land area results.

This signifies a higher land use than the one found in traditional unifunctional centers, but, due to the fact that parking is partly on the ground and only partly in two-level structures, it is considerably lower than that found in other multifunctional centers discussed. It can thus be stated that although The City project does constitute a multifunctional center, it cannot, probably due to the fact that it has to be developed in

various phases, be characterized as an integrated multifunctional center. In this project, the tools of three-dimensional planning and the platform principle have not been employed.

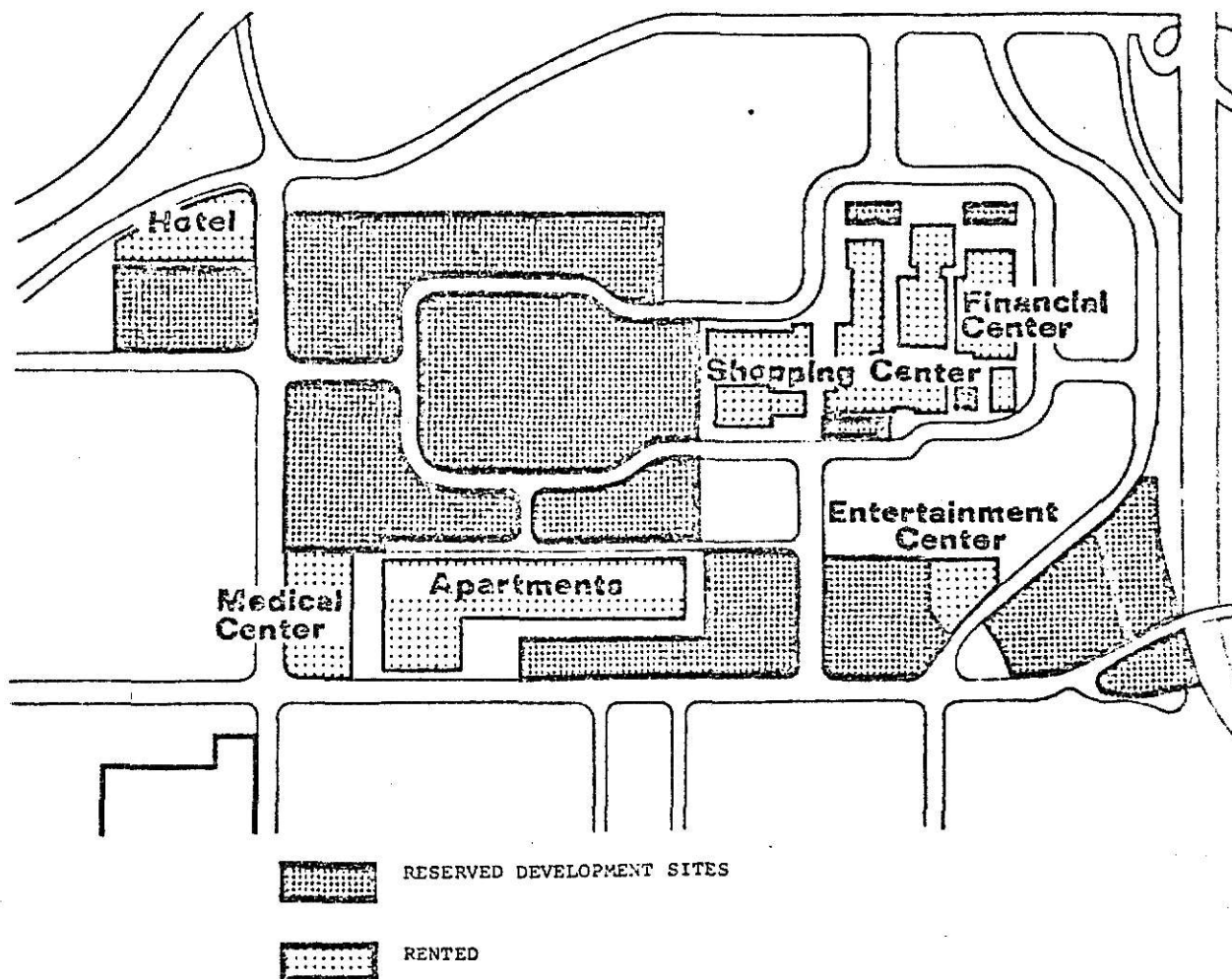
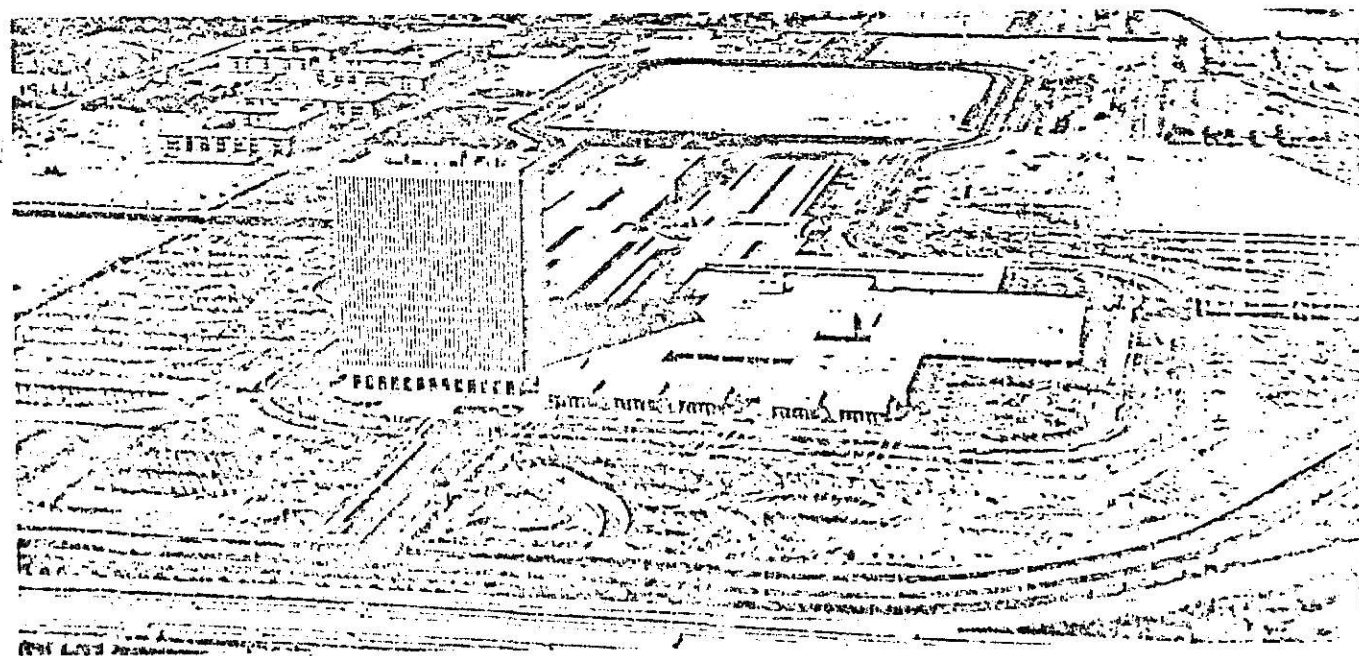


Figure 5-21 "The City": Status of the project as at the opening of phase 1.



CASE STUDY III

Name of Project: Lancaster Square

Location: An urban renewal project in downtown Lancaster, Pennsylvania

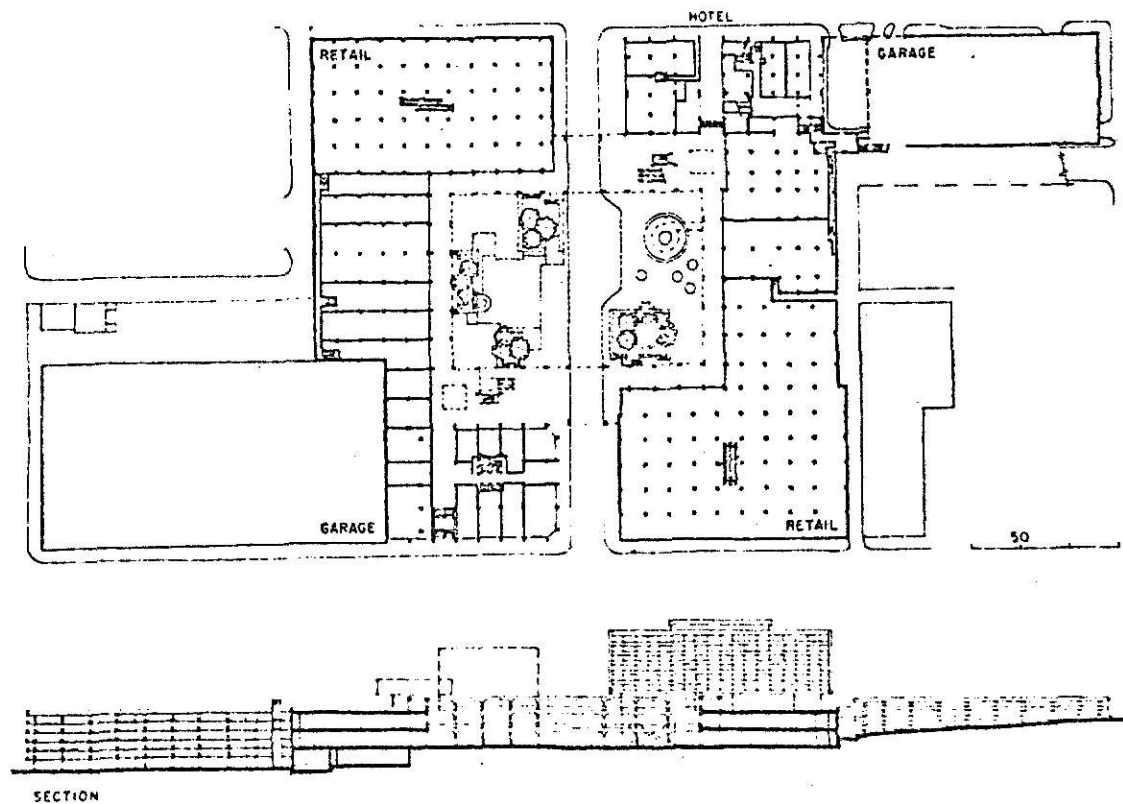
Architects: Gruen Associates

A multifunctional development within an existing core area. Functions are: a hotel; a 900-seat theater; a department store; an apartment building with 288 units; offices, retail stores.

The major functions are arranged around a square providing a number of public amenities. Pedestrian circulation is provided on three levels overlooking the square.

Status of Project: Completed in September 1971.

Figure -- Plan and section of the project of Lancaster Square.



CASE STUDY IV

Name of Project: Midtown Plaza

Location: In the core area of Rochester, New York

Developer: The Midtown Holdings Corporation. (Established by two department stores: McCurdy & Company and B. Foreman Company.)

Center Team: Planners and architects, Victor Gruen Associates; planning consultant to the city, Ladislav Segoe; economic consultant, Larry Smith & Company; traffic consultants, Wilbur Smith & Associates; supervising architects for the city, Bohacket & Flynn.

Background for Planning: In 1956, the owners of two large department stores, concerned about the future of their enterprises located within a slowly deteriorating core area, called on Victor Gruen Associates for guidance. It was obvious that they had two choices. Either to follow the general trend and establish branches in outlying districts which undoubtedly would lead to further deterioration of business in the core area and finally to the closing of central stores, or to strengthen their central locations. However, they realized that the latter could only be successful if, through a combination of public and private efforts, a revitalization of the entire core area could be achieved.

On investigating the situation, we found that a progressive city administration had, with the help of federal funds, projected and started a number of measures directed toward the revitalization of the core area. We therefore recommended discussing the individual problems of the two department stores with the municipal authorities, and to attempt to bring about an integration.

In order to win the support of the city government, it was necessary to prove that Midtown Plaza could be effectively coordinated with the overall planning concept of the city and that it could form a logical part of a future, larger central development project.

In April 1957, we submitted a schematic plan which took its departure from the already projected belt highways. This plan recommended that in order to save land, an underground garage should be constructed instead of the multilevel parking structures already projected in the vicinity of Midtown Plaza. We also stated that the Midtown Plaza project could only be executed if the city were willing to cooperate with regard to the following:

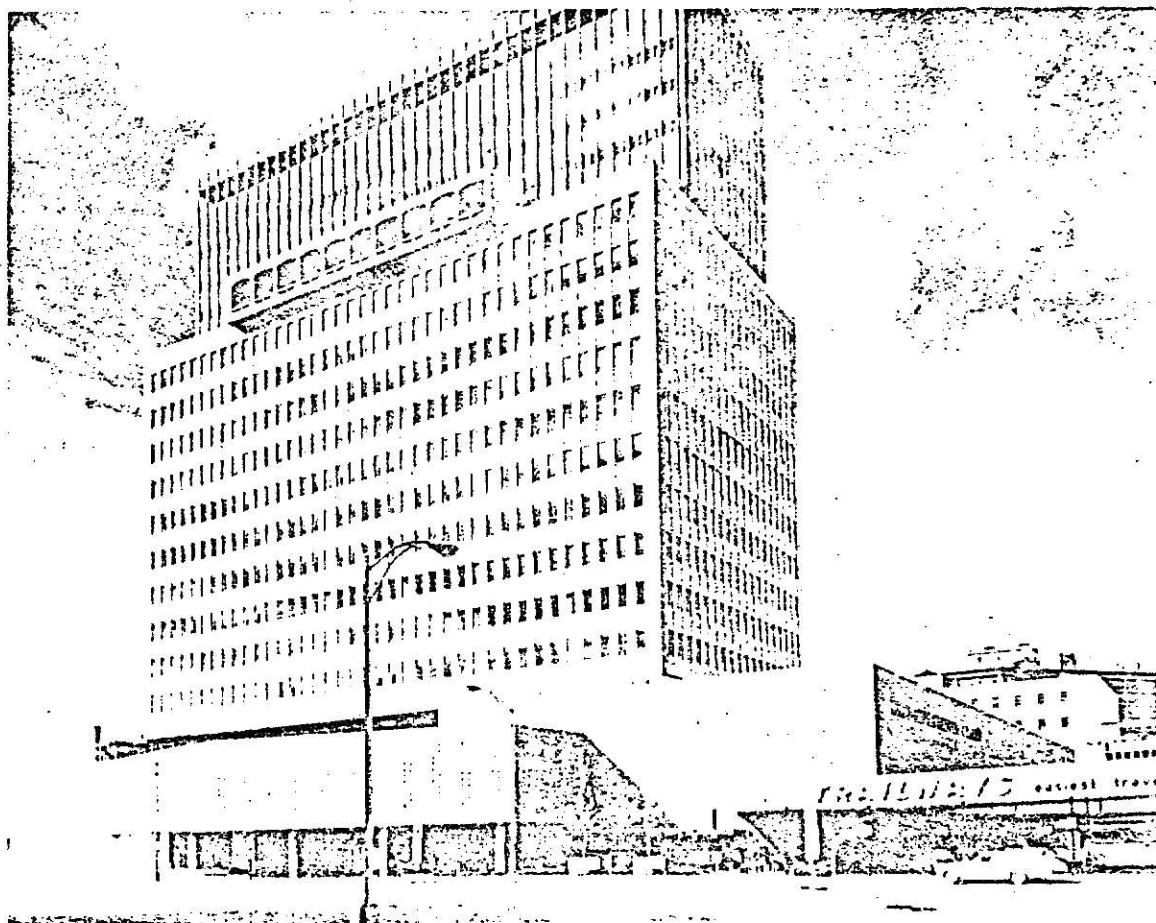
1. Immediate construction of the first link of the projected inner loop road.
2. Permission to close two traffic congested streets and to convert them into pedestrian ways.
3. Readiness of the city, to build a multilevel underground parking garage below the land owned by the developers. (The developers would put the underground rights at the disposal of the city.)

Thanks to the energetic and enthusiastic assistance of the mayor, agreement was reached in a comparatively short time. (One of the additional conditions which the city insisted upon was that the public streets which would be converted into pedestrian ways would remain municipal property).

On the basis of this overall agreement, the owners decided to proceed with the project. They did this in spite of the findings of the economic consultant who pointed out that land costs within the core area were very high compared to those in suburban areas, and that it was doubtful whether

one could attract tenants willing to pay an adequate rent. The economist also pointed out that there was a large supply of unrented office and store space in the core, available at low rents. He concluded that as a real estate venture, the project entailed great risks. The owners based their decision to proceed on their strong belief in the future of their city and on their wish to contribute something toward the revitalization of its core area and by so doing, assure the future of their stores.

Figure 5-39 Midtown Plaza: An exterior view as seen from Broad Street. On the right of the photograph, the bus terminal.



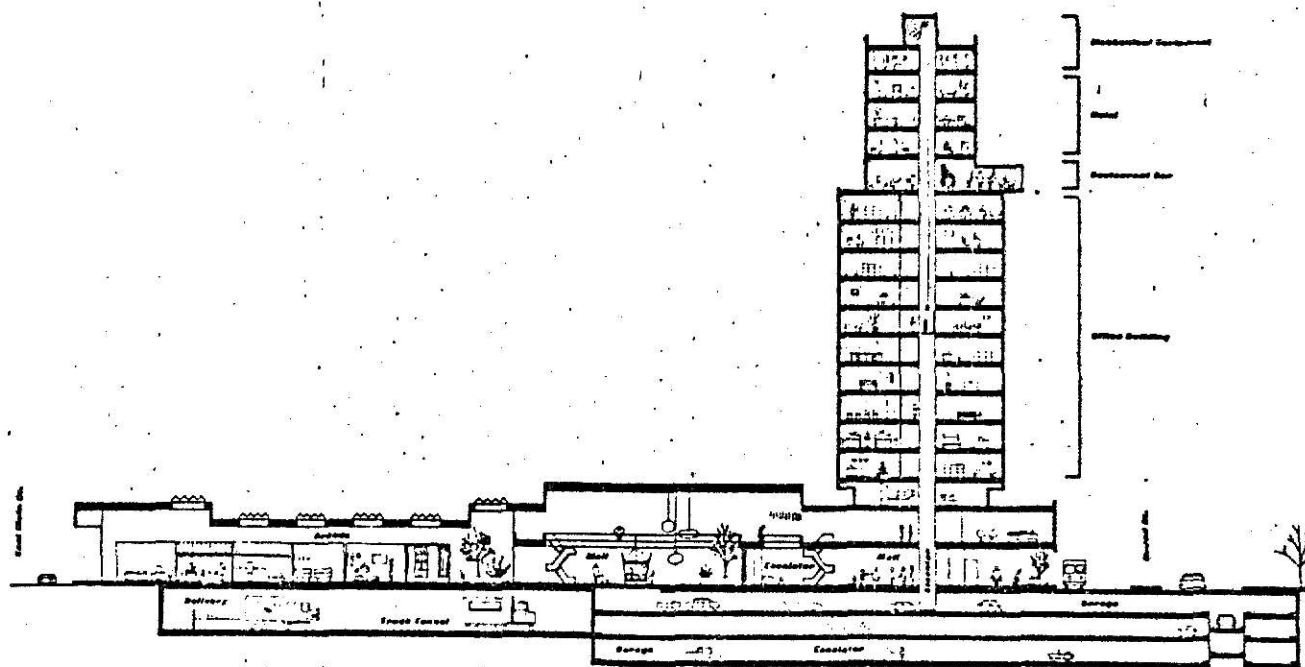


Figure 5-37 Midtown Plaza: A schematic section showing use of subterranean levels for garages, delivery roads, loading facilities and storage. Two levels of the base structure above ground level for retail and other related facilities, surrounding a spacious garden court. From the roof of the base structure, rise superstructures, of which only one is shown on this section. This building contains, on the lower levels, offices, on the middle level, a public restaurant and bar, on the upper levels, a hotel, and on the top level, mechanical equipment.

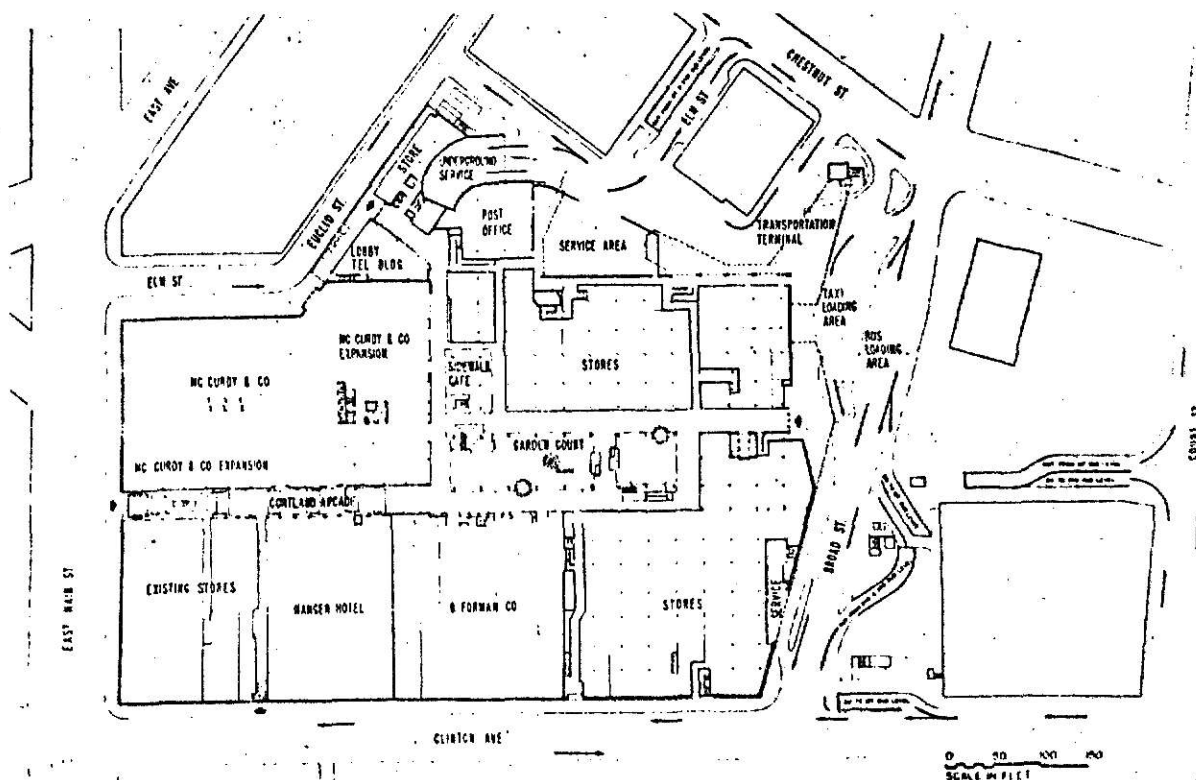


Figure 5-35 Midtown Plaza: Plan of the lower activity area (plan for upper activity area is similar).

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A RESIDENTIAL AND COMMERCIAL COMPLEX DEVELOPMENT

by

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AN ABSTRACT OF A MASTER'S THESIS

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This thesis is a study of an urban development in one of the blighted areas within the outer ring of the core of Thailand's capital city, Bangkok. This kind of area, which is a veritable slum and sporadically owned by one single land owner or the Government, is occupied by neglected structures, such as old warehouses, deserted garages, and repair shops, etc., a situation which makes it easily acquirable by the developer. Since the last decade of economic development and population growth, the need for housing and urban development has been in greater demand, especially for the low and middle income families whose lots have been improved. Due to the higher price, this land could hardly develop horizontally, and, besides, urban growth tends to resort to a vertical solution--high-rise buildings. Following the policy of dispersing the population of Bangkok, the new commercial growth in the form of shopping centers, department stores, and office buildings, etc. have been developed to replace the traditional "shop house," which serves the dual functions of commerce and housing.

The purpose of this thesis is to understand the combination of commercial (public uses) and residential usages. Specifically, it is a project which studies the functional relationship between amenity services, such as parking garages, and modern technical facilities. In order to accommodate this purpose, the site chosen is the single block within the outer ring of the Bangkok area where the population is only medium density and its location close to a major transportation line.

A related problem is the increasing number of automobiles in the city as a whole. More automobiles not only cause accidents and air

pollution, but also create an urban situation in which traffic congestion is intolerable. A long journey to and from where one works and shops is very undesirable. An aim of this thesis, then, is to indicate how to minimize the traffic problem and guarantee accessibility to facilities for those who cannot afford to own an automobile, or, for that matter, for those who cannot drive. We simply have to assume that it is a more desirable situation when people can live and work within areas that are accessible by walking.

In this study, the co-existence of neighborhood and high-rise building concepts has become the theme. Other factors, economic, sociological, climatic, etc., are nevertheless taken into consideration. In terms of utilization, this project, of course, applies to the urban environment, the characteristic of which is rational and technological efficiency. The development suggested in this thesis represents an attempt to create a living environment. In short, the development should offer the best and avoid the worst aspects of urbanism which often are in opposition to the human spirit.