

A SUBURBAN GENERAL HOSPITAL

by

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A MASTER'S THESIS

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requirements for the degree

MASTER OF ARCHITECTURE

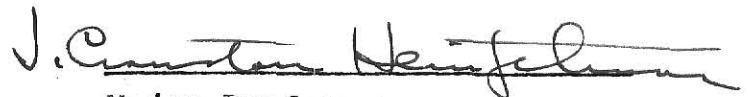
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## INTRODUCTION

In the area of medical facilities, Thai suburban districts are confronted with problems that could reach emergency proportions if not solved within a relatively short time.

There are two problems. One, the hospitals are mostly located in the urban area, where they had the advantage of location. But today, people are moving from the urban areas to the suburbs because of traffic jams, pollution, crowding etc.. It consumes much time to take trips from homes to the hospitals because of the distance and traffic in the urban area. Two, a small staff of doctors is struggling, with inadequate facilities, to serve an ever-increasing number of patients. Therefore the Thai government has initiated several projects that will improve these conditions. For example, in-training programs and additional facilities are being planned. A 300 bed suburban general hospital will help to improve the conditions.

AN INTRODUCTION TO THAILAND <sup>1</sup>

The people of Thailand call their country Muang Thai, but the Europeans of the sixteenth century called it Siam, because they associated it with the people of the Shan Highlands of Burma. However, in June 1939 the government decided once and for all to call their country " Thailand "-the land of the free.

Thailand is Malaysia's northern neighbour. Thailand's other neighbours are the Union of Burma to the west and the Khmer Republic and Laos to the east ( Map no. 1 ). Mountains enclose Thailand on the west north and north-east while to the east the boundary is chiefly along the Mekong River. Thailand stretches through 15 of latitude, that is, from 6° N. to 21° N., and 9 of longitude from about 97° E. to 106° E. It covers an area of 198,454 square miles compared with Malaysia's 130,000 square miles.

## Relief

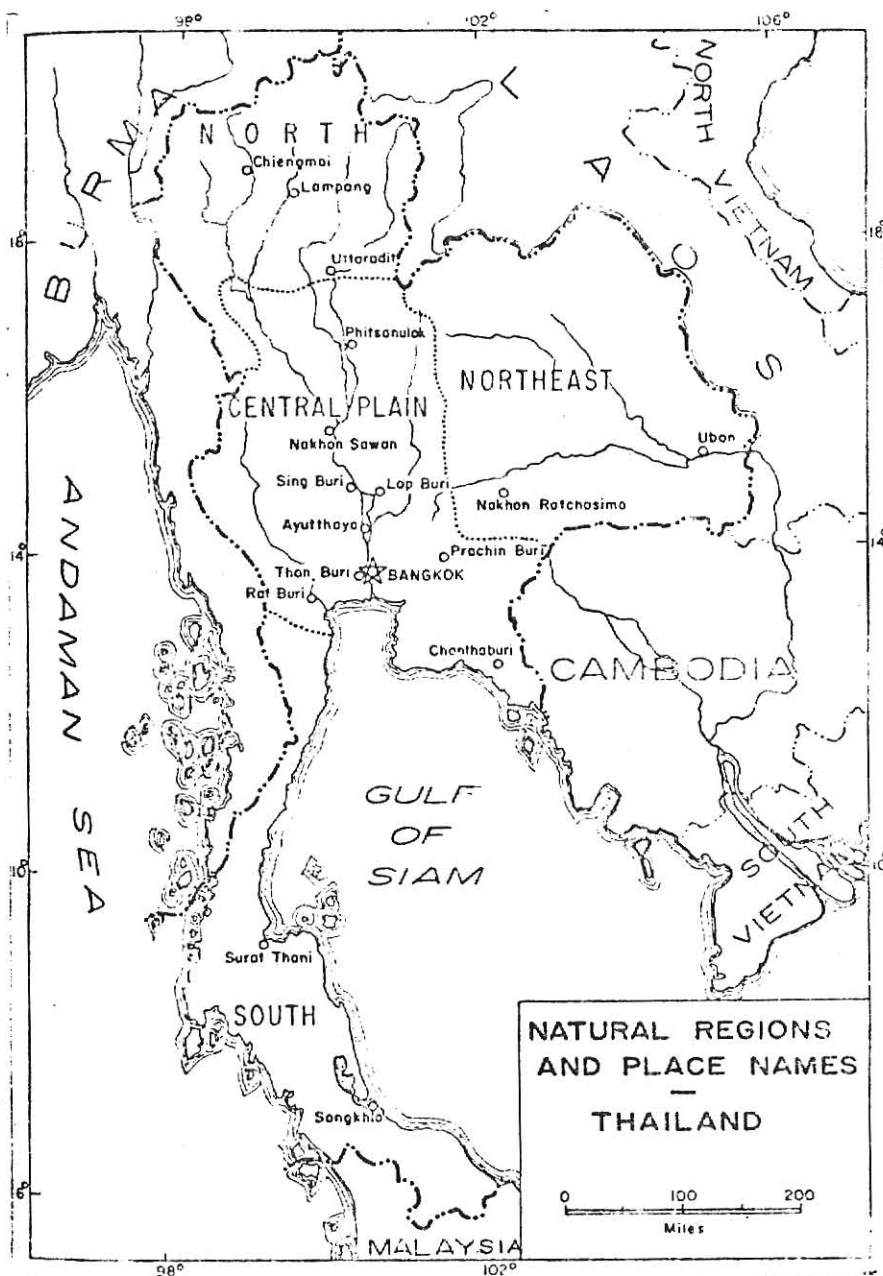
The mountains of Thailand are a continuation of the complex that extends southwards from Tibet through western Yunnan, China and Burma. Farther south these mountains form the Main Range of West Malaysia. Thailand also has considerable low-land areas. There are five relief regions ( Map no. 2 )

1. Northern and western highlands. The highest part of the country is in the north where some peaks reach 8,000 feet and many are about 6,000 feet. The region is one of parallel ridges and valleys, all trending roughly north and south. The

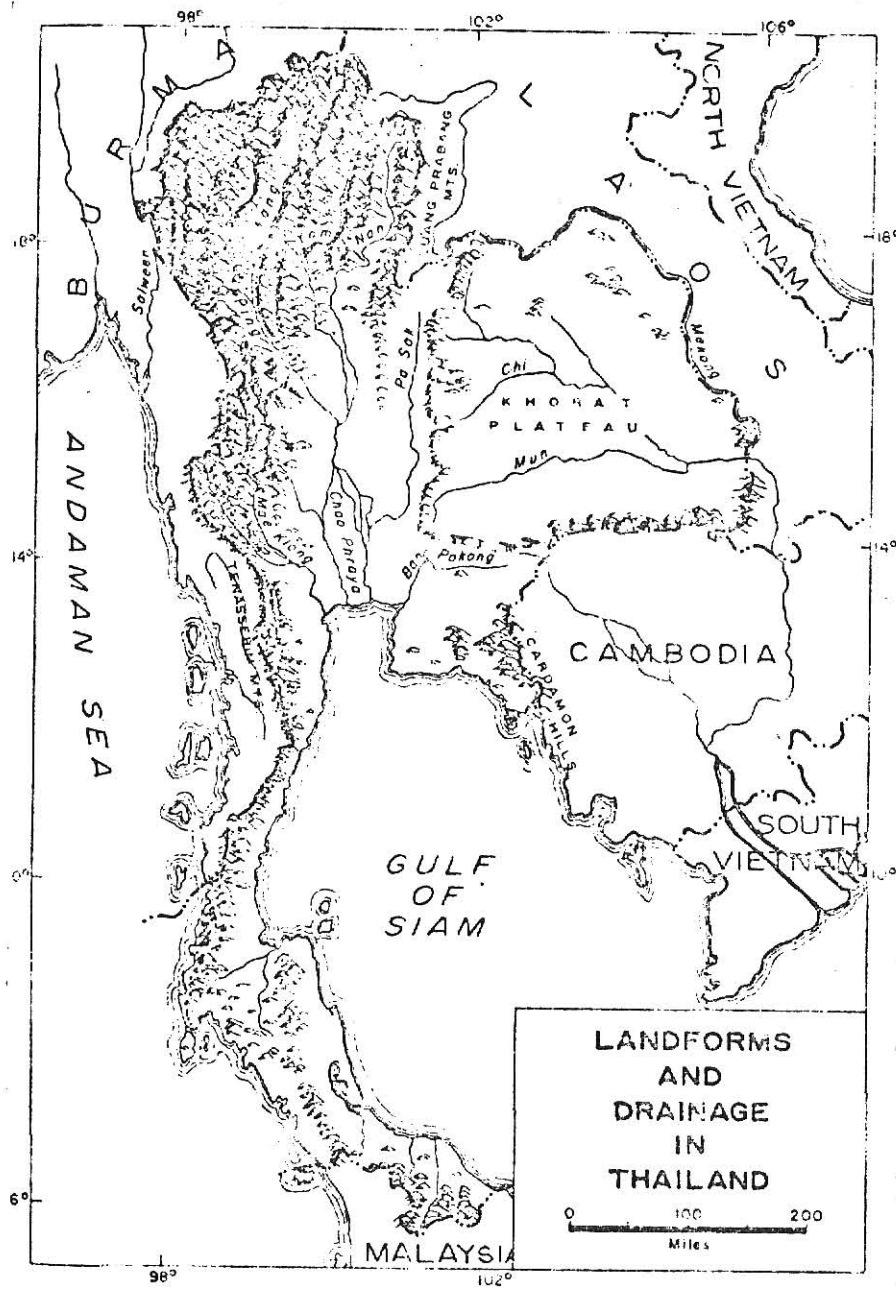
<sup>1</sup>Goh Cheng Leong. Certificate Regional Geography Southeast Asia.  
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Map no. 1, Natural Regions and Place Names, Thailand.



Map no 2, Landforms and Drainage in Thailand.

ridge are composed mostly of granite, shales and limestones. The limestone mountains rise abruptly from the valley floors, as they do in Malaysia but mountains formed in other rocks usually have lower foothills and less precipitous slopes. The northern boundary with Burma lies along the Tanen Taunggyi Range. This range extends southwards where it is called the Bilauktaung Range.

This northern section of Thailand is a valuable catchment area, in which rise the rivers Ping, Wang, Yom and Nan. These rivers flow in roughly parallel valleys separated by granite ranges of about 5,000 feet. These four rivers join north of Chainat to form the Menam Chao Phraya.

In the valleys and slopes of the northern and western highlands are found many vast areas of teak forests. These forests are of great value and earn a lot of money for the country. Chiangmai, 410 miles from Bangkok is a teak and tourist centre.

2. Korat Plateau. In the east is the Korat Plateau which is shaped like an irregular saucer. It is only about 500 feet high and is underlain by gently tilted red sandstone and other sedimentary rocks. The soils are very poor and the only important rivers are the Nam Mun and Nam Chi which drain eastwards to the Mekong. Because of the poor soils and drainage the population here is sparse, only about 50 persons per square mile. The region is dry with around 50 inches of annual rainfall, and droughts are common. Large areas on the eroded hill slopes have a savanna type of vegetation, suited to cattle rearing. Buffaloes are sold to the lowland regions as draught animals. Salt is obtained in salt springs. The lowlying marshes or "tungs", are

avoided by the people because they are unhealthy.

3. South-east Thailand. Some geographers prefer to call this area the Cardamon Hills because of the presence of these hills, which extend into the Khmer Republic. They are formed of sandstone with some crystalline rocks. Although they only reach a height of about 3,000 feet the relief is very varied and the rivers have fertile valleys that support rice, rubber and pepper.

4. Menam Chao Phraya Delta or Central Plain. This is an extensive lowland as large as the whole of West Malaysia, surrounded on all sides by hills and mountains. The soil here is mainly alluvium brought down by the Menam Chao Phraya and its tributaries, the most important of which is the Pasak. The Chao Phraya splits into several channels south of Chainat forming a delta 50 miles long. The land is flat with only a few old hills breaking the monotony. This is the most fertile part of the country and the whole area is planted with rice. There is a high density of population. The capital, Bangkok-Thonburi Metropolitan, is situated near the mouth of the Menam Chao Phraya.

5. Peninsular Thailand. Thailand's "panhandle" is narrowest at the Kra Isthmus but wider farther south. The landscape of this region is very similar to that of Kedah and Kelantan in Malaysia. It has broad alluvial valleys, densely forested hills about 1,000 feet high in some places and sandy palm-fringed beaches. The coastline is indented with numerous inlets and islands. The limestone caves yield phosphatic bat guano and edible birds' nests.

Fishing is important along the rugged coast; padi is cultivated in the narrow coastal plains, rubber on foothills and lumbering up the forested mountains. Tin-mining is actively carried on at Phuket, Ranong and Takuapa.

## Climate<sup>2</sup>

The monsoonal alternation of wet and dry seasons characteristic of the general area is complicated in Thailand by topography. The basic pattern is determined by the moisture-laden southwest wind which blows in from the sea from about May to October and the dry northeast wind which comes down out of the continental land mass during the rest of the year. Although the two-season cycle prevails over most of the country, the narrow southern peninsula receives rain almost throughout the year, with the bulk of it falling between October and January. Conditions are similar in the southeast. By contrast the western part of the Central Plain, and especially the western Korat Plateau, receives little moisture and may experience actual drought during the dry season. The range of these local extremes in average annual rainfall is from 750 millimeters to 3000 millimeters ( Table 1 ). Temperatures also vary regionally and with the season, from 18 C., in the cool months of December, January and part of February to as high as 38 C. during the hot months of March, April and May ( Fig. 1 ). The cool season occurs when the prevailing winds come over wintry lands to the northeast, and the warm season comes when the skies are cloudless and the sun is gaining in altitude.

<sup>2</sup>Foreign Areas Studies Division, Special Operations Research Office, The American University. Area Handbook for Thailand.

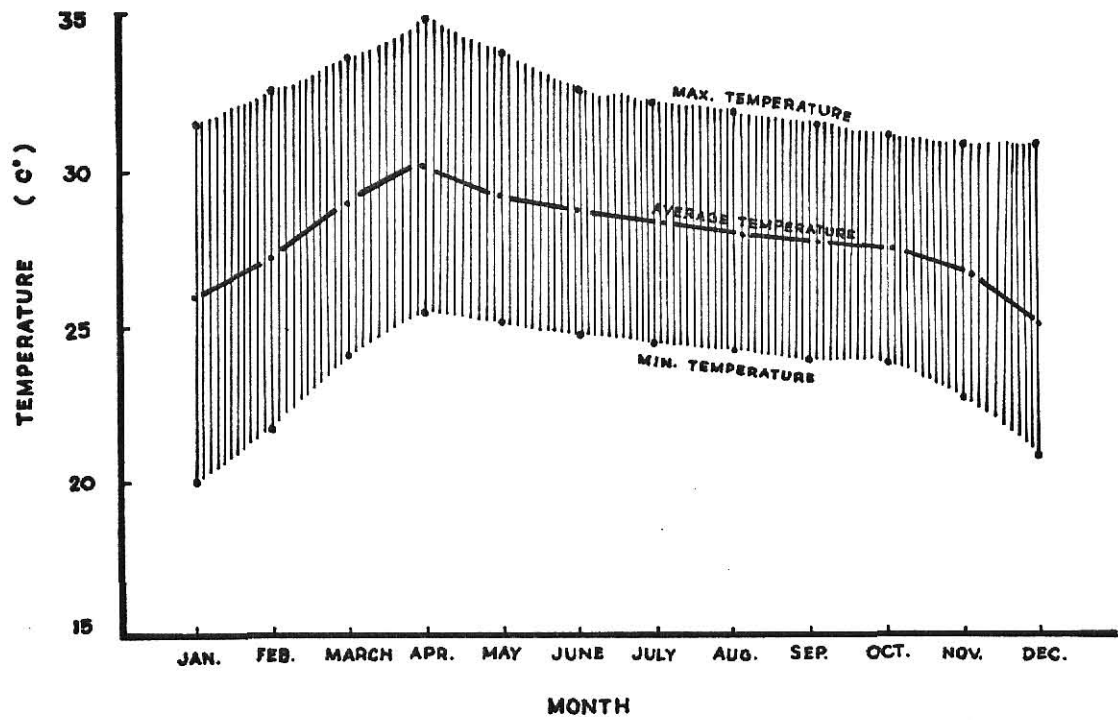


## MONTHLY NORMALS RAINFALL IN MM.

STATIONS MONTH	DON MUANG	BANGKOK
JANUARY	4.9	9.2
FEBRUARY	21.0	34.1
MARCH	36.8	26.3
APRIL	66.3	71.3
MAY	178.5	190.9
JUNE	172.0	161.9
JULY	172.9	183.0
AUGUST	241.2	203.7
SEPTEMBER	313.1	341.1
OCTOBER	254.5	229.7
NOVEMBER	37.8	44.9
DECEMBER	15.2	9.4
TOTAL	1514.2	1505.5

Source: Meteorological Department. The Office of the Prime Minister.

TABLE 1



### MONTHLY TEMPERATURE OF BANGKOK

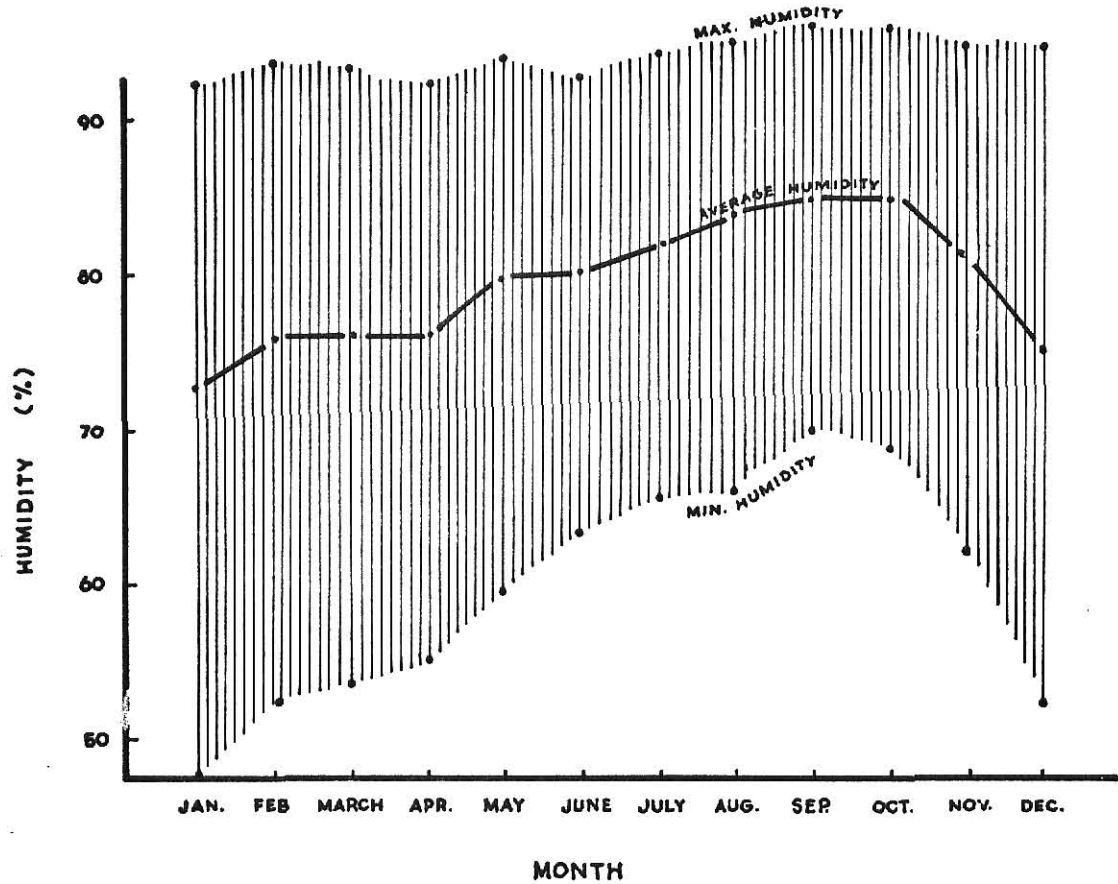


Fig. 1

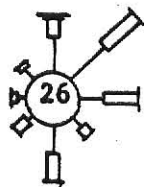
### MONTHLY HUMIDITY OF BANGKOK

Source: Meteorological Department. The Office of the Prime Minister.

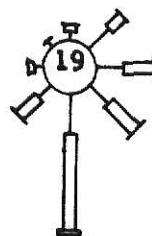
Fig. 2

BANGKOK-THONBURI METROPOLIS  
 Lat.  $13^{\circ}44'N$ . Long.  $100^{\circ}30'E$ .

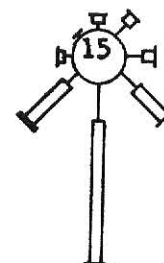
Height of Windvane 23.4 m. ( 39.4 m. above M.S.L. )



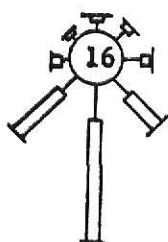
JANUARY



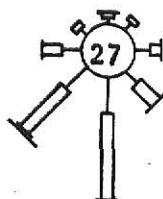
FEBRUARY



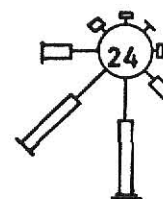
MARCH



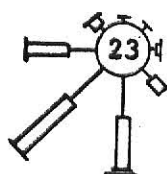
APRIL



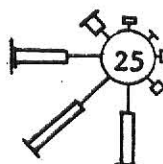
MAY



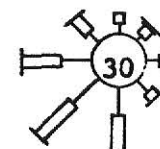
JUNE



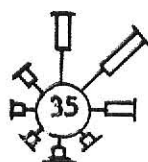
JULY



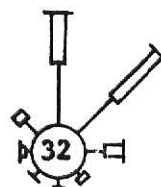
AUGUST



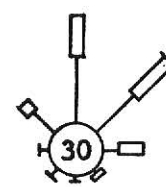
SEPTEMBER



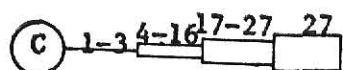
OCTOBER



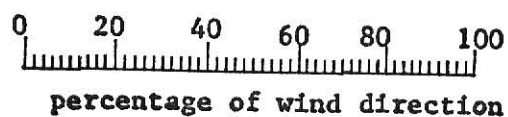
NOVEMBER



DECEMBER



Wind speed in knots  
 C = Calm



Source: Meteorological Department. The Office of the Prime Minister.

Thunderstorms in the afternoon and early evening are common between May and October in the northern areas and between March and November in the south. Toward the end of the dry season and again at the end of the rainy season typhoons of considerable violence sweep across the Indochina peninsula from the South China Sea into Thailand.

### Religion<sup>3</sup>

Buddhism, especially Theravada Buddhism, is the State Religion and the great majority of the Thai people are Buddhists. However, the Thai government of every period has bestowed upon people freedom to profess any faith they like, and has been pleased to welcome any missionary of any faith to preach its tenets anywhere in Thailand.

As equal opportunities to practice or preach any faith are open to people in Thailand, several religions and doctrines have been introduced into the country. Their centres of worship have been established throughout the kingdom. These Religions and doctrines are:

Religions: 1. Buddhism

2. Islam

3. Christianity

4. Hinduism ( Brahmanism )

5. Sikhism

Doctrines: 1. Confucianism

2. Taoism

3. Shintoism

<sup>3</sup>Thailand Official Year Book 1968. Printed at Government House Printing Office, Bangkok.

## 4. Animism

## 5. Others

## Bangkok-Thonburi Metropolitan

Bangkok-Thonburi Metropolitan, the capital, with a population of 4,096,521 in 1974, is the country's largest city. Bangkok situated on the east bank of the Chao Phraya River about 24 kilometers from the Gulf of Thailand, Bangkok proper is laced with klongs ( Canals ) which carry much of its traffic and give it a distinctively aquatic character.

Thonburi, the largest suburban, is on the west bank of the Chao Phraya, directly opposite the central part of Bangkok proper, to which it is joined by several bridges. The suburb is most densely built up along the river and along the principal canals, where the older port facilities and some small scale industrial installations are in use. Small commercial establishments are beginning to appear as the population increases. Thonburi was administered as a separate municipality until 1962, when the two cities were merged into a single metropolis under one mayor.

Each of the city's various districts and quarters, with its own temples and markets, functions almost as a self-contained small town. Almost everywhere thatched houses and rice paddies in the vicinity of shops, Western-style houses and modern government buildings mingle the rural and urban. There is relatively little formal separation of industrial, commercial and residential areas, the only exception being the newer residential

districts of Bangkok to the north and Bang Su to the east.

Bangkok is an important international port. It is the centre of the internal transport system, and all of the country's principal highways and rail, water and air routes converge upon it. Its large and well-equipped airport at Don Muang is one of the principal international air route junctions in the Far East.

Extensive building and reconstruction of roads have been carried out, and many narrow klong-lined sections of road have been superseded by broad highways. The main road to and through the important suburb of Bangkok is now a commuters' highway. Another modern road links the city with Don Muang airport, 32 kilometers to the northeast.

MEDICAL AND HEALTH SERVICES IN THAILAND<sup>4</sup>

## Organization and Administration

The nation's health today may be said to be in a much more favorable position than it has ever been before in the history of this country. From time immemorial fatal epidemic diseases, such as cholera and others, used to play havoc time and again, almost decimating the population of the affected areas during each of the various visitations. Malaria was also so prevalent that all fevers were treated as such and quinine was usually prescribed by physicians with good effects after the introduction of modern medicine about a century ago. However, the health of the general populace began to improve gradually step by step ever since the establishment of the first school of modern medicine at Siriraj Hospital in 1889 to provide qualified doctors for the country, and the subsequent setting up of the Department of Public Health in the Ministry of Interior on the 27th of November 1918, to care for the health of the nation.

In 1942 the Department of Public Health was transferred from the Ministry of Interior to the Ministry of Public Health, newly founded upon the recommendation of the National Health Reorganization Committee. All matters concerning health of the nation, either preventive or curative, are thus put under one control and under the sole responsibility of the Ministry of Public Health.

## Central Administration

<sup>4</sup>Thailand Official Year Book 1968. Printed at Government House Printing Office, Bangkok.

The enormous task of the Ministry is distributed among its four major component parts: the Office of the Under-Secretary of State, the Department of Health, the Department of Medical Services and the Department of Medical Sciences.

The Office of the Under-Secretary of State, besides its administrative function and correlation of the work of the various Department, exercises its duties through the Divisions of Medical Registration, International Health, Food and Drug Control and Nursing, and also through the Medical Council, the committee for the control of sale of Drugs, the committee for food Quality Control, the committee for TB Control, and the Filariasis Control Board. Latest addition to this office are the Division of Malaria Eradication, the Division of Filariasis Control, and the Division of Vital Statistics.

The Department of Health deals with prevention and control of diseases and promotion of health of the nation. This enormous amount of work is taken care by 17 divisions in the central administration, with 71 Provincial Health Offices and over 2,400 Health and Midwifery Centres in the provincial administration. This Department also maintains hospitals for tuberculosis, infectious diseases and leprosy

The Department of Medical Services provides medical and nursing care for the bodily and mentally sick in its 98 hospitals, 92 of which are located in the provinces. Plans are now underway to enlarge and expand facilities of the existing regional hospitals, commensurable to the annual budget allotment. District hospitals are also in the programme. The Buddhist Priests'



Hospital in Bangkok is perhaps one unique feature in this Department because of its specialized work for Buddhist monks who require medical care and hospitalization. Its popularity is amply testified by frequent and substantial additions of facilities from private donations. The work of this hospital is not confined to the institute alone but also extends outward to many Buddhist monasteries in the matters of health and sanitation-a very commendable undertaking.

The Department of Medical Sciences has as its main objectives the promotion of research in medical sciences and the provision of modern diagnostic procedures in the treatment and prevention of diseases. Thus, it really functions as the public health laboratories for the Ministry and also for the medical profession in general. Now this Department functions through its four divisions: Medical Research, Diagnostic Laboratories, Food and Beverage Analysis, and Drug Analysis.

#### Medical Registration

The Medical Registration Division in the Office of the Under-Secretary of State for Public Health is charged with the main responsibility to carry out the control of medical practice as well as medical care establishments.

#### Legal Provisions

The Medical Registration Division, in the discharge of its duties, is legally supported by two medical laws, namely, the Healing Arts Control Act of 1936 ( amended in 1961 ) and the Hospital Control Act of 1961. The first statute dealing

with medical registration in this country was the Medical Law of 1923 which was introduced for the purpose of controlling, regulating and raising the standards of the practice of the arts of healing.

The first law concerning hospital control was enacted in 1941, but was enforced in Bangkok and Thonburi only. This law, too, had to be revised in 1942 and 1950 to broaden its span of enforcement as well as to bring about more effective control. The new Hospital Control Act of 1961 requires both private hospitals and out-patient clinics to apply for registration and licence before opening for business. This law applied to dental clinic, maternity clinics and beauty salons as well.

### Hospitals

Projects laid out for the establishment of modern medical care in this country have had to be modified from time to time before these could be well established. Prior to 1918 there were only a few hospitals already operated according to the requirement of circumstances, some to serve as general hospitals, some for educational purposes, some to take care of the mentally sick, and others to cope with the cases of epidemic diseases prevalent at the time. Most of these hospitals, however, were financed by the government budget or subsidy, while the rest was maintained by private funds.

At the time of the establishment of the Ministry of Public Health, Thailand was under crucial pressure of World War II and the plan for the expansion of medical care services was delayed. In 1942 there was only 25 hospitals under the

Department of Medical Services. Of these, 15 were general hospitals, while the others were mental hospitals ( 4 ), leper hospitals ( 5 ), and a tuberculosis hospital. Although the need for more hospitals was acutely felt, it was not possible for the Ministry to add any new hospital until a few years later. This was attributed to the shortage of construction materials and the high cost of construction during the war. It was not until 1947 when a programme for the expansion of medical services was initiated. Since then the number of general hospitals has increased at a tremendous pace. By 1953 a total of 26 new hospitals had been opened and 8 were under construction. However, the medical services at that time were still far from adequate. Only 3,000 hospital beds were available in general hospitals owned and operated by the Department of Medical Services. With the objective to establish at least one general hospital in each province, the Department has endeavored to add 47 more provincial hospitals during the past nine years. At present the Department of Medical Services maintains the total of 128 general hospitals and 10 mental and neurological institutions in all part of the country. There is at least one hospital in every province. Further expansion is directed towards the programme of erecting more hospitals not only in the provincial towns, but also in the important, heavily populated districts. At the same time every effort is being made to expand and strengthen the services of existing hospitals with the aim to provide the rural population with the best medical care facilities available.

Generally speaking, government medical services

in Thailand are administered to the population by full-time salaried staff and are provided free-of-charge to the medically indigent. For those who can afford to pay, the nominal fees calculated just to cover the actual expenses are charged for drugs, special laboratory examinations and personal medical services. Special wards are available in all general hospitals for those who are willing to pay the hospital fees covering room, drugs, meals, surgery and other expenses ( laboratory services, special nursing, etc. ). Apart from the annual budget allotment, most government hospitals are financially supported by private donations which are uasually earmarked for an addition of a new building or an installation of a new equipment.

#### Private Social Welfare Agencies

##### The Thai Red Cross Society

Among voluntary social welfare agencies in Thailand, the Thai Red Cross Society is the oldest and the widest known. The work of the Thai Red Cross Society dated back to 1893, when, with the consent and support of the King and members of the Royal Family, the Thai Red Cross Society was established. The original purpose of the Thai Red Cross was to provide medical services, food, cloths and other necessities for wounded soldiers in time of war. In 1914, a hospital was built for the Thai Red Cross at the command of King Rama VI. It was named Chulalongkorn Hospital after King Chulalongkorn. Four years later, the Thai Red Cross Act was formally passed, thus making it a legal organization. In 1921, it was accepted as a member of the International Red Cross. As of January 1961, a Provincial Red Cross Unit

was established in each of the 71 provinces.

Health welfare and relief assistance are considered the main functions of the Society. In peace or in war, the Red Cross Society assists victims of disasters and catastrophes, and provides health education and services, medicines, medical treatment and other emergency needs. The Society owns and operated two hospitals, one convalescent home and nine local health centres. The Society is also responsible for the production of vaccines and serums which are distributed to hospitals and medical units throughout the country.

#### Disease Control and Health Promotion

##### Malaria

Malaria has long been a major public health problem in Thailand. It used to be prevalent throughout most parts of the country with varying degrees of endemicity and was until recent years the greatest cause of sickness and death. Between 40,000 and 50,000 deaths from malaria were reported in a single year. The anti-malaria campaign using the new technique of residual insecticide house spraying was commenced in 1949 with WHO/UNICEF assistance.

The large-scale control work had brought down the malaria death rate from 201.6 per 100,000 population in 1949 to 37.8 in 1958. However, since it has been illustrated elsewhere that malaria can be completely eradicated, the Government of Thailand decided to switch over the Malaria Control Programme to a programme of eradication of the disease from 1959. According

to the vital statistics, there has been a spectacular reduction of malaria death rate. In 1964 only 5,287 deaths from malaria were recorded and the death rate per 100,000 population was only 18.2 as compared with 328.9 in 1943. At present, malaria ranks fifth among the principal causes of death in Thailand and almost universally the Thai people have come to look upon malaria as a pestilence of the past, though very vigilant efforts will be necessary to achieve our ultimate goal-malaria eradication.

### Filariasis

Filariasis is a chronic disease which causes the elephantiasis of extremities, and has long been known to be prevalent in Southern Thailand. The preliminary investigation, with the assistance of WHO, was carried out in 1952 and yielded the results showing infection rates among the population to vary from 2.9 per cent to 40.8 per cent. *B. malayi* was found to be responsible for the cause of infection. The elephantiasis of legs was the most common clinical manifestation. However, the recent surveys indicated that periodic *B. malayi* is the predominant species whereas in some villages near the border of Malaysia, subperiodic type of *B. malayi* was found. The vectors of *B. malayi* either periodic or subperiodic type, are *Mansonia* mosquitoes with the natural infection rates varying from 0.3 per cent to 1.7 per cent. Nocturnal periodic *W. Bancrofti* also occurs in some villages along the border of Malaysia and in Western Thailand near the border of Burma, but the vector of *W. Bancrofti* is still unknown.

Since 1962, mass drug administration with

diethylcarbamazine has been carried out in a highly endemic area with a population of 48,020. The incidence of microfilaria carriers was reduced from 7.21 per cent to 3.19 per cent after one course of mass treatment.

#### Venereal Diseases

Venereal diseases have been for decades a major health problem of the country. The prevalence of syphilis, particularly, is estimated to be not less than 5 per cent of the population; and pre-natal syphilis is found to be about 8 per cent.

Concentration on case-finding has always been the policy in controlling venereal diseases. The aim is to give proper diagnosis and treatment to the patients as soon as possible. It is carried out by various means, such as by contact investigation, by prenatal blood tests and mass blood surveys among various groups of the people in areas of high prevalence.

As there is at present no law enforcing the registration of VD cases in the country, much has to depend on mass education on furnishing scientific instruction on sex hygiene and imparting basic information about venereal diseases to the public, as well as in persuading those who have been exposed to the diseases to come to examination and treatment.

#### Yaws

Yaws was formerly found to be endemically widespread in the rural areas of 45 provinces, affecting about 8 per cent of the population. In 1950, the Department of Health with the assistance of WHO and UNICEF launched a mass campaign



against yaws. The primary aim to reduce the incidence of the disease, through mass treatment, to such a level that further control could be continued by the rural health services.

The progress of the campaign has been very satisfactory. In the operation of this phase of yaws control, the rural health workers visit each village and each school for examination of yaws once a year. However, if any other diseases, besides yaws, is found, advice and necessary treatment will be promptly given. It is believed that this would greatly contribute to the promotion of rural health in general.

#### Tuberculosis

The tuberculosis control services, developed along the modern lines of diagnosis, treatment, and control procedures since 1951, continues to enjoy the assistance of WHO and UNICEF in the course of expansion. Following the pilot control project launched in Bangkok in 1960 and in Chiangmai in 1962 the intensive case finding by mass X-ray examination and ambulatory treatment have been expanded in both Bangkok and provinces of Chiangmai and Khon Kaen by the use of mobile units, not to mention patients seeking treatment at chest clinics by their own initiative.

The number of patients registered for treatment is approaching 45,000 per year, for whom ambulatory therapy is continuously prescribed until the disease is non-infections. Only patients who need emergency treatment, special diagnosis investigation, and thoracic surgery are referred to the Central Chest Hospital at Nonthaburi, where about 150 - 200 operations are



performed annually.

### Leprosy

Leprosy is prevalent in the northeastern and the northern region of Thailand. It is estimated that there are not less than 200,000 leprosy cases in the country. In order to help them, two leprosy hospitals and thirteen leprosy colonies have been established and maintained by the government. In addition to this, there is a colony at Chiangmai province run by private organization. As the hospitalization of all cases of leprosy is not practicable, the control by ambulatory means has therefore been adopted.

In order to facilitate the finding and treatment of leprosy cases in Bangkok and Thonburi, special skin clinics have been set up recently at different places, some in co-operation with the municipalities. At the end of 1962, there were in existence 7 clinics, each of which was staffed with a medical officer, a public health nurse and a laboratory technician. The next step in the control of this disease is an attempt to segregate vagrant lepers. In 1962 special budgetary allowance was provided for the improvement and construction of buildings in leprosaria and leper colonies for housing these vagrant lepers.

### Cholera

After an absence of eight years, the last cholera outbreak occurred in 1958-1959, when 18,998 cases with 2,373 deaths were recorded within the period of 18 months. The cases outnumbered those of any previous outbreaks, the record of which, in

1946, was about half as many. But the fatality rate was considerably lower, being about 12 per cent compared with 60 per cent of the previous epidemics.

During the recent years, cholera has lost much of its severity and importance. However, precautionary measures have to be constantly undertaken to avoid the importation of the disease from other countries, particularly during the year 1961-1962 when several outbreaks were occurring in the neighbouring countries. There were 2,204 cases with 159 deaths in 1963; 960 cases and 30 deaths in 1964; 63 cases and 3 deaths in 1965 and 314 cases and 30 deaths up to August 1966. Most of these cases were cholera El Tor. The people are persuaded to have immunizations against cholera every 6 months. The annual average number of immunization is around 2 millions, about half of which are immunized against both cholera and typhoid.

#### Smallpox

Two outbreaks of smallpox were of particular interest during the year 1961-1962. The first one, imported from beyond the Burmese border, occurred between August 1961 and January 1962 at a remote district of Chiang Rai province. About 8 months later, in September 1962, another imported case of smallpox was notified in Bangkok. The sufferer, an Indian who just arrived in Thailand from India, fell sick a few days after his arrival and died later at Bamras Naradura Infectious Disease Hospital.

To prevent future epidemics of smallpox in this country, the government has launched a national campaign for

smallpox eradication since 1961, aiming to cover at least 80 per cent of the population with 3-5 years. However, in the first year of campaign 7.2 million people were vaccinated, and in 1962, 14.5 million more were vaccinated. From 1963-1965, 7-12 million were vaccinated annually, from January to June 1966 more than one million population were vaccinated.

### Plague

Although several outbreaks of plague were reported from time to time in neighbouring countries, particularly near the western boundary of Thailand, yet the country has been free from this dreadful disease for ten years.

In the beginning of 1962, there was an outbreak of plague at the border near Tak province, where rats were found dead in large number. The border areas were promptly kept under control by the plague control units, thus stopping the disease from entering the country.

### Haemorrhagic Fever

This disease was first recognized in Thailand as an epidemic disease during a relatively small outbreak in Bangkok in 1954, and was first definitely diagnosed as Haemorrhagic Fever in 1958.

The disease has occurred every year during the rainy season. For preventive measures, mosquito breeding places were destroyed and the people were instructed to protect their children from mosquito bites.

Table 2\*

Hospitals and Other Medical Establishments With Bed in Thailand.  
( 1972 )

A. = Total Establishments

C. = Private Non-Profit Est.

B. = Governmental Establishments

D. = Private Profit Est.

	Type of Establishment	Establishments	Beds	Admissions or Discharges	Patient-days
General Hospital	A.	44	9,771	336,883	2,034,853
	B.	26	8,752	295,534	1,806,999
	C.	3	605	33,603	178,237
	D.	15	414	7,746	49,617
Local or Rural Hospitals	B.	102	19,350	810,964	4,827,076
	C.	11	582	53,797	193,374
	D.	25	431	28,294	129,934
Medical Centers	A.	292	2,700	52,224	155,276
Specialized Hospitals					
Maternity Hospitals	B.	1	213	11,705	84,504
	C.	1	50	220	1,320
	D.	36	252	4,048	18,732
Infectious Diseases Hospitals	B.	1	150	3,559	43,949
Ophthalmology Hos.	C.	3	35	721	7,083
Tropical Diseases Hospitals	B.	1	100	982	-
Tuberculosis Hos.	B.	1	450	3,200	132,880
	C.	1	85	472	-
Mental Hospitals	B.	10	6,861	21,307	2,019,761
Establ. for Drug Addicts	B.	2	600	3,865	107,351
Leprosaria	B.	2	1,400	1,373	501,145

Table 3\*

Medical and Allied Health Personnel in Thailand  
( 1972 )

	Number	Personnel per 1,000 Pop.	Population per Personnel
Physicians	6,747	1.9	5,380
Dentists	763	0.2	47,560
Pharmacists	2,240	0.6	16,200
Veterinarians	157	-	-
Midwives	9,328	4.8	2,090
Nurses	7,993	2.2	4,540

Table 3\*

General Hospitals ( Principal ), 1972

	Beds per 10,000 Pop.	Admissions per 10,000 Pop.	Admissions per Bed.	Bed Occupancy rate(%)	Aver. length of stay(days)
Total	2.8	95.3	34.5	57.1	6.0

\* From World Health Statistics Annual 1972, Volume 3, Health Personnel and Hospital Establishments, p. 33,49,53,56,62,65,168,212

## THE HISTORY OF MEDICAL AND HOSPITAL

## Primitive Hospitals

People in primitive period believed that supernatural forces were the cause of disease, it was evident that to defend oneself against them or be cured, one must combated these malignant influences. The sick man, the crippled, and the aged were a burden on society because they were unable to contribute their share of labor to the common welfare. There were two basic attitudes toward them. One, they got rid of the handicapped because of fear, fear of evil spirits, and evil magic, and fear of contagion. Many patients were killed. Two, they accepted the burden, treated them kindly, fed them, and were prepared to bring any sacrifice to have the sick treated by the medicine man and if possible cured. Thus, there was the first physician-magician. It was his function to avert evil that may threaten the individual or tribe in any form, to propitiate the spirits for the benefit of his people, and to destroy the enemy. We can say that the first doctor in the world is the medicine man and his hospital is a hut where diagnosis and prognosis take place.

We must now watch the medicine man in action. An individual has fallen ill, seriously ill, so that house remedies would be of no avail. The family crowds together in the hut or in front of it, where the patient has been brought and where the patient has been brought and where he lies moaning. Neighbors come, look at the sick man, and everyone has a word of advice. Finally the medicine man is called. How does he act? <sup>5</sup>

<sup>5</sup>Henry E. Sigerist, M.D., " A history of Medicine " The Oxford University Press 1951. p. 180.

## Ancient Egypt

Egyptian therapeutics, we find, as in the medicine of all ancient peoples, a mixture of mystic and rational therapy. There is reason for believing that rational therapy is more ancient and represents the basis of Egyptian medicine. The papyri, the medical literature, contains an enormous number of prescriptions.

The art of medicine is thus divided: each physician applies himself to one disease only and not more. All places abound in physicians, some are for the eyes, others for the head, others for the teeth, others for the intestines, and others for internal disorders.<sup>6</sup>

There was no exacty hospital building. The diagnosis and prognosis took place in the king's palace, houses and temples.

The best physician of Egypt were attached to the king's court. They were the most highly remunerated, had their own boats that would bring them without delay wherever they might be needed and it must have been the highest ambition of a doctor to be able to add to his titles that of palace physician. The noblemen who surround the king, who administered provinces in his name, or the feudal landlords of the Middle Kingdom had households that were small courts in their own way and there can be no doubt that they had their physician-in-ordinary also, attached to the household, giving their services not only to the lord and the member of his family but to all those who belonged to the household, the servants,

<sup>6</sup>Arturo Castiglioni, M.D., " A History of Medicine " Alfred A. Knof 1941 p. 59-60.

the serfs in workshop and farm, and the slaves. Groups of laborers working on great building projects or groups of miners sent to the copper and turquoise miners of Mount Sinai was accompanied not only by clerks and officers of the commissary but also by physicians who were an integral part of such a labor group. Some physicians must also have been attached to temples. They were probably the ones who served the general public, that is, those people who did not belong to a household that included its own doctors.<sup>7</sup>

There is an indication that medical schools were established in this period too.

#### Ancient India

The great religious revival generated by the teaching of Buddha in the fourth century B.C. led to the foundation of hospitals in India, almost a thousand years before Christianity was to promote the same movement in western cultures. The close relation between religion and medicine is also reflected in the fact that four standard questions asked by the Hindu physicians are paralleled by the "four noble truths" of Buddha (birth, oldness, sickness, and death).

With the advent of Buddhism (especially in the fourth century B.C.) anatomy and surgery declined; but State medicine ) registry of births and deaths reporting dangerous diseases, extermination of pests, medico legal autopsies ) and hospitals and schools flourished.<sup>8</sup>

<sup>7</sup>Henry E. Sigerist, M.D., "A History of Medicine" The Oxford University Press, 1951 p. 321

<sup>8</sup>Arturo Castiglioni, M.D., "A History of Medicine" Alfred A. Knopf 1941 p. 95.



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From this information, we could determine that the first real hospital was formed in this period. It was both included medical treatment and medical school, but by the way that they approached the medical treatment, facilities, and hospitals were still concerned with religion and sometimes by supernatural ideas.

#### Ancient Greek

In the early times, the Greek medical was a noble art; the illustrious heroes who knew the art of war were expert in medicine, but there were lay physicians whose aid was sought for cure of sick. It was evident that Greek medicine was not predominantly magic or priestly. Greek culture medicine was empirical and practiced by layman, while it was only in later times that it became more mystical and priestly.

The centaur Chiron was generally regarded as the founder and master of medicine. Asclepius, the pupil of Chiron became the god of medicine. The origin of the Asclepius myth is to be sought in the transformation through the centuries of a number of Greek divinities, especially of the lower regions. The tradition of the serpent which had the greatest importance; the serpent being regarded in the most Biblical myths as a representative of subterranean forces and the gods of the lower regions. The serpent played an important part in the most ancient magic medicine. The most ancient center of the cult of Asclepius was at Titanos near Sicyon. The temple of Epidaurus in Argolis became the center of cult of Asclepius. In Athens the cult of Asclepius was introduced about 429 B.C.; the double hall of dreamer-patients

at the Asclepieion of Athens, founded fifth century B.C. The rooms were 24 feet deep by 108 and 96 feet long and completely closed on three sides and opening to the south with a row of pillars-the typical form of a Greek stoa ( portico )- oriented to the sun. In 273 B.C. the temple of Asclepius was erected in Rome. We can determine that the temples of Asclepius are the hospitals during this period.

The temples of Asclepius were usually built in places where the position and natural beauties of the surroundings made them particularly suitable as places to treat the sick. They were very often built near the sea, with its refreshing breezes; they were architectural masterpieces and were adorned with the works of art by the finest masters ( Lund ).

The indispensable accompaniment was a spring of pure water; often the temples were erected in place where were baths of mineral waters. Later, about the spring of the primitive sanctuaries, were erected magnificent theatres, gymnasia, stadia, and even hippodromes. Here the chronic patients were treated with gymnastic exercises, baths and inunctions; there were also living quarters for the patients.<sup>9</sup>

The patients were admitted to the ceremonies of the cult with suggestive prayers by the priest and finally the patients spent one or more nights in the abaton of the temple at the feet of the statue of Asclepius waiting for the healing dream. They believed that the gods would come and gave advice or suggestions for treatment during the dream.

<sup>9</sup>Arturo Castiglioni, M.D., " A History of Medicine " Alfred A. Knof 1941 p. 124.

There were private clinics called "latreia" where Greek physicians who were free citizens held consultations and treated their private patients.

Later, with the emergence of Greek philosophy, the scientific medicine was contemporary. There were many philosophic schools which had different concepts about human being. Later, many medical schools were developed and their concepts derived directly from the philosophic schools. We can conclude that during this period temples are still the hospitals with the addition of the halls for dreamers as the nursing quarters, and theatres, gymnasia, stadia, and hippodrome as the treatment departments.

#### Ancient Roman

The Roman medicine in its early periods was almost exclusively based on magic even though they had the contacts with Greek because Greek physicians were opposed by Cato, the Roman Senate, because he accused the Greek physicians of poisoning and killing the sick. Until the year 219 Greek physicians established themselves at Rome. During the last period of the Republic all the rights of citizens were granted to the physicians more freely. Slaves, barbers, and phlebotomists who had assumed the title and role of physician continued to exercise their trade in secret and to make their living by all sorts of practices. But Greek physicians still had the influence over Roman people. During the Empire period, scientific medicine came to Rome from Greek.

The great contribution of Rome to medicine is the hospital system. It is a scheme that naturally arose out of Roman

genius for organization and is connected with the Roman military system. There was no public hospital for the slaves during the Republic period, the slaves were exposed to the island to avoid the trouble of treatment them. A temple of Asclepius had been established on the Island of St. Bartholomew and Emperor Claudius declared that these slaves were free, if they recovered, they need not return to their masters. Thus, the island became a place of refuge for the sick people.

Later, there were the hospitals for the slaves, the athlets, the gladiators, and for the legions.

Just as there were hospitals for soldiers, so the slaves had hospitals called valetudinaria, and the physician who had the title of medicus commensalis was charged with the care of the slaves.

There were other valetudinaria for the athlets and for the wound gladiators, who were submitted to special treatment. Frictores and unguentarii were employed in their services. The physicians of athlets and gladiators called vulnerarii, included well-known physicians, even Galen himself. There were even valetudinaria for the legions with consisted of tents placed in the middle of camps.<sup>10</sup>

There were also private hospiatls. Physician's house might even be built somewhat on the lines of a modern nursing home. It was probably in the provinces that private institutions first developed into subventioned public hospitals.<sup>11</sup>

<sup>10</sup>Arturo Castiglioni, M.D., " A History of Medicine " Alfred A. Knof 1941 p. 239.

<sup>11</sup>Singer & Underwood, " A Short History of Medicine " Oxford University Press 1962 p. 58.

## Middle Ages

The condition of medical in Europe in the first centuries of the Middle Ages, can be divided into two parts. First, the existence of a lay medicine which followed the ancient Roman traditions. Second, the ecclesiastical medicine that had its centre in the monasteries. It was around the monasteris that the hospitals were built. The decline of monastic medicine, which reached its nadir in the tenth century, was due to several causes. It took the monks outside of the monastery and away from their religious duties, various Church councils restricted medical activities and finally forbade them entirely. Other factors are the rise of the Cathedral schools, the growth of large cities and great universities in the thirteenth century.

During the twelfth century, when towns were formed, trade flourished, and the town became wealthy, works of charity grew very numerous. Many foundations created hospitals that were open ward, taken over from the monasteries, adapted, enlarged, refined and eventually mass-producted. The open ward was provided with by the way of appendages, bed space, alter, kitchen and privies were a must.

In the late Middle Ages, the Christian times, the development of the hospitals from the Roman military valetudinaria occured.

The idea passed on to Christian times, and the pious foundation of hospitals for the sick and outcast in the Middle Ages is to be traced back to these Roman valetudinaria.<sup>12</sup>

<sup>12</sup>Singer & Underwood, " A Short History of Medicine " Oxford University Press 1962 p. 58.

## Renaissance

The Renaissance was a period with the revival of study of the ancient scientists and philosophers and the formulation of new ideas in science and philosophy. Botany and anatomy were emerging as new sciences, chemistry and physics were further developed.

During the Reformation, church property was confiscated and many religious organizations were disbanded in the newly Protestant countries. In the course of Henry VIII's contest with the Catholic church, he suppressed the monasteries and appropriated their revenues because the monks and friars in England were the most ardent advocates of papal authority. The immediate result of monastic dissolution was the continuance of the hospitals and refuges upon which the poor depended for charity. Henry VIII finally restored St. Bartholomew's hospital as a secular institution and endowed it with what had been its own revenues on condition that the people would provide an equal income. The Hospital of St. Mary of Bethlehem ( Bedlam ) was converted from a monastery to an asylum for the insane in 1547, and Christ's Hospital, also a monastery, was chartered for orphans in 1553.

The wars of the sixteenth century influenced the establishment of hospitals for those who became sick or were wounded in battle. The seventeenth century physicians distinguished themselves as mathematicians, astronomers, microscopists and chemists. During this era, universities and scientific societies were founded and periodic literature began to appear.

Medical teaching in the university progressed systematically. The first university clinic was instituted at Vienna by van Swieten in 1754, at Pavia a clinic was started by Borsieri in 1770.

The hospitals were for the most part still wretchedly maintained, so that served by poorly for instruction. In most of the great hospitals, such as the Hotel-Diers at Paris, toward the end of the century two or even more patients were habitually placed in one bed.<sup>13</sup>

#### Hospitals in the United States

Philadelphia, New York, New Port, Boston and Charleston in 1700, as these seaport towns grew, it became increasingly necessary to provide some kind of refuge for shipboard victims of infection diseases. Pesthouses, isolation hospitals, and quaratine station were organized to prevent the infection from spreading to the inhabitants. These buildings were located outside the cities or islands for complete isolation.

In many communities, private hospitals were set up by their physician or surgeon owners for people recovering from the effects of inoculation, for sergical cases, or for maternity patients. One method used in providing for the mentally ill or the poor was to sell them at auction to the lowest bidder who would take them and care for them for a period of one year at a stipulated fee.<sup>14</sup>

When the frontier moved westward, the danger,

<sup>13</sup>Arturo Castiglioni, M.D., " A History of Medicine " Alfred A. Knof 1941 p. 657

<sup>14</sup>Commission on Hospital Care, " Hospital Care in the United States " The Commonwealth Fund 1947 p. 427.



illnesses and injuries made hospitals a vital necessity. Hospitals for cholera and smallpox victims were often opened at the time of an emergency and closed again as soon as the epidemic abated.

Most of the hospitals in the United States in the early nineteenth century were dirty, unventilated and contaminated with infections. The neglect and ill-treatment of patients and the high death rate created a popular prejudice against hospitals. Florence Nightingale who was sent by the British government to the Crimea to take care of the war wounded and sick. She found that the sick and wounded soldiers suffering under chaotic conditions from lack of nursing service and supplies. So she reformed the hospital organization and administration, construction, sanitation and dietary service. When she returned to England, The Nightingale School was organized at St. Thomas's Hospital, London, in 1860 for training of nurses.

The social, economic, and scientific progress made in the sixty years prior to 1900 laid a firm ground work for the great twentieth century growth of hospital facilities and the concomitant improvement of hospital services.

The years 1840 to 1900 are most significant in the history of American hospitals. It was during this period that hospitals underwent a drastic evolution in purpose, function and number. From supplying merely food, shelter and meager medicine care to the pauper sick, to armies, to those infected with contagious diseases, to the insane, and to those requiring attention and nursing care to all people. Many church hospitals are founded

during this period.<sup>15</sup>

The last half century has witnessed the greatest changes in concept of hospitals and the care rendered in them in the United States. Every new advanced in medical science and in technological procedures has added strength to the popular demand for hospital service.

Hospitals in Thailand.

Traditional medicine.

Traditional Thai medicine is a mixture of Chinese and Indian theories. Buddhist and animist beliefs, and techniques developed through trial and error. Many common afflictions are recognized and easily diagnosed as being of physical origin. Others are thought to be the work of evil spirits which from whim or malice enter the body, with detrimental or fatal effects. Sarceners are frequently thought to be responsible for the freeing of these spirits. Behind much of the diagnosis, explanation and cure of disease is the idea, not always clearly articulated, that the body is composed of the four elements: wind, water, fire and earth, and that sickness result from or is a symptom of imbalance in the proportions or arrangements of these elements. Such imbalance may occur through supernatural or natural causes.

Tradition method of therapy include many home remedies and favored food and herbal mixtures which may be known generally or by a single family. These are usually prepared by the person who is ill, or by a member of his family, and taken without ritual thought of spiritual intervention.

<sup>15</sup>Commission on Hospital Care, " Hospital Care in the United States " The Commonwealth Fund 1947 p. 471.

In case of more serious illness, the patient or his family may decided to try propitiation of the house spirit or may solicit the help of the local practitioner. The latter may be a certified " old style doctor ", but he is more likely to be an unregistered nonprofessional, charging little or nothing for his services and working most of the time at some other occupation. He may be a man reputed to have magical curing abilities or one who has devoted himself to the study of herbal medicine.<sup>16</sup>

Western medical began when Dr. Dan Beach Bradley came to Thailand in 1835. In 1835 he established a public dispensary and surgical. In 1838 he introduced inoculation and vaccination. In 1839 he introduced the western method of obstetrics. In 1843 he established the first private hospital, and in 1851 began the practice of Homeopathic medicine.

The medical school in Bangkok dates back to 1880-81 when King Chulalongkorn was the reigning monarch. A terrible cholera epidemic struck Bangkok, taking about 30,000 lives. Temporary hospitals were put up in 48 districts. When the rainy season came the disease abated, and the hospitals were abandoned. His Majesty expressed a desire to establish a permanent hospital. In 1886-87 the cremation ceremony of Choa Phraya Jaya Siriraj was held. It was customary for the king to give liberally to such a cremation. On this occasion he determined to make the gift something of permanent value. He ordered that all the temporary houses required for the cremation ceremony be made of good timber. When the ceremony

<sup>16</sup>Foreign Areas Studies Division, " Area Handbook for Thailand " Social Operations Research Office, The American University. p. 259-260.

was over, the buildings were reerected in the form of a hospital on a selected site. This was the beginning of the modern Siriraja Hospital and the first governmental hospital in Thailand.

At that time Siriraja Hospiatal consisted of:

1. Two wooden buildings with tar roofs, each with beds for ten people.
2. Two wooden buildings with tar roofs, each with beds for eight people.
3. A two-storey home for the resident physicians.
4. An out-patient ward for storing medicine and treating out-patients.
5. Four wooden buildings for in-patients.
6. Two well-built building for patients of high rank. The staff consisted of one doctor and his assistant, three dispensary men, and five coolies.<sup>17</sup>

<sup>17</sup>Kenneth Perry Landon, " Siam in Transition " Greenwood Press Publishers 1968, p. 117.

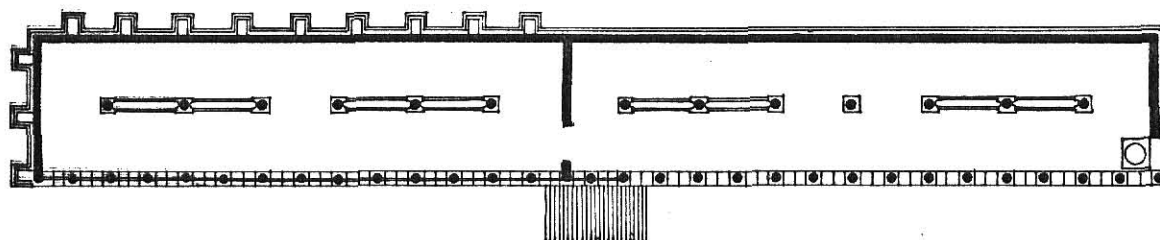


Figure 3 Double Hall for dreamer-patients at the Asklepieion of Epidauros, fifth century B.C..

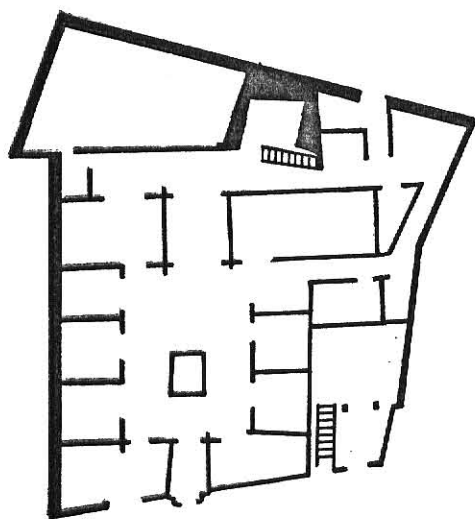
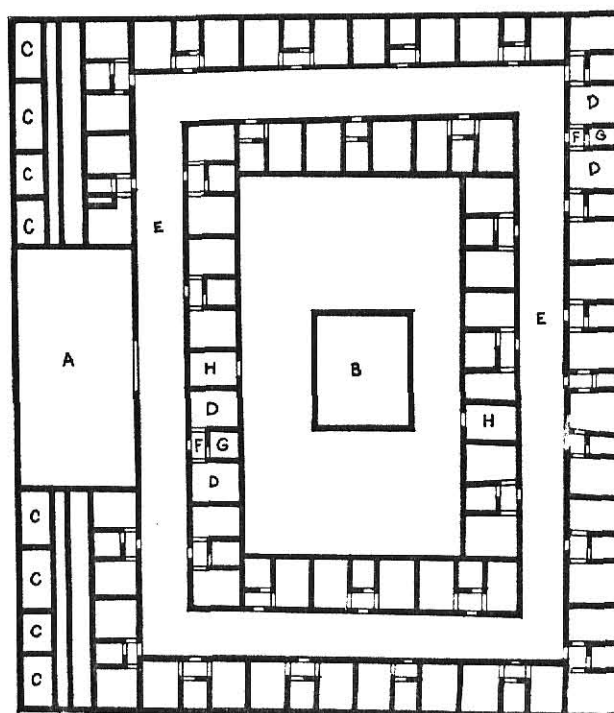


Figure 4 Greco-Roman latreia.

Figure 5 Floor plan of the Roman military hospital (valetudinarium).  
 A. Entrance hall.  
 B. Courtyard hall.  
 C. Small rooms behind the portico for nurses and administrators.  
 D. Typical patient rooms.  
 E. Corridor.  
 F. Vestibules.  
 G. Back rooms.  
 H. Passageways.



## FACTORS AFFECTING DESIGN

## Climate

Thailand is in moonsoon zone. There are three seasons: cool ( November-February ), hot ( March-June ), and rainy ( June-December ). Warmest month is very warm and damp to wet, coolest month is warm and dry to damp.

Temperatures<sup>18</sup>: The annual mean of maximum dry temperature in shade during dry season is approximately 91.5°F., during rainy season, can fall to 79°F. The annual mean of minimum night temperature is approximately 73.5°F. during dry season, and approximately 77°F. during rainy season. Sky temperature is lower than air temperature during dry season; the same as , or a little lower than air temperature during raining season. Ground temperature is higher than air temperature during dry season; about the same as air temperature during rainy season.

Humidity: Fairly high humidity ( vapour pressure ), 13-15 mb during dry season, 20-25 mb during rainy season. Relatively humidity 20-55 % during dry season, 55-99 % during rainy season.

Movement of air : Moonsoon from south-west during summer, from north-east during winter. Towards the end of dry season, uncomfortable heat in inland regions because persistant, strong, north-east wind abates.

It is essential to consider the various climate

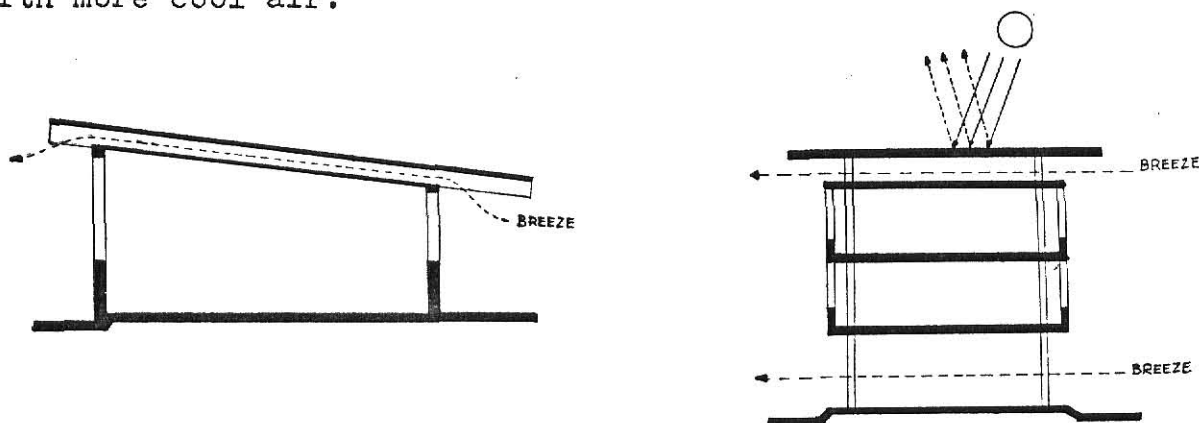
<sup>18</sup>Georg Lippsmeier, " Building in the Tropics " Callway Verlag Munchen 1969 p. 37-41.

factors to ensure appropriate planning and building. They are:

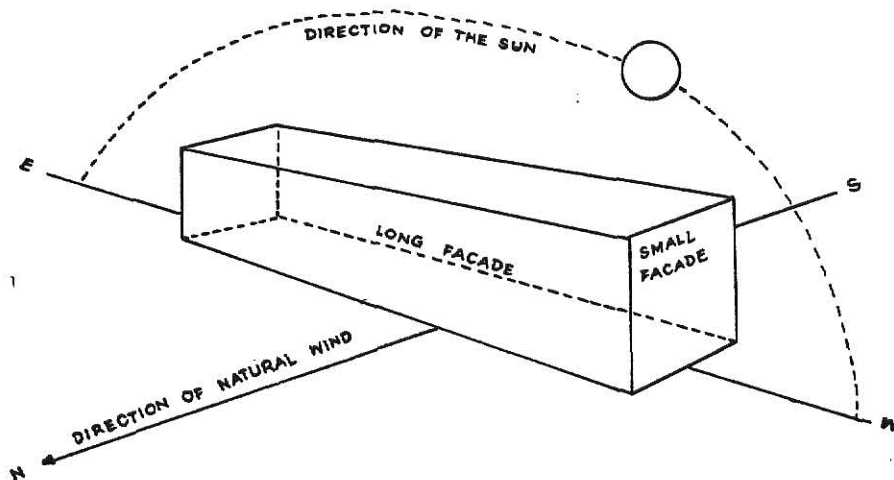
1. Sun and light.
2. Precipitation.
3. Ventilation.

1. Sun and light. Protection from the sun is always necessary in the tropics. Heat in the tropics comes from the sun in the form of light rays. When these strike a surface a certain percentage of the energy depending on the nature of the surface is converted to heat. The surface itself becomes hot, in turn radiating this heat to the air. Some surfaces, those that are light in colour and those that are both light and shiny, reflect the majority of the sun's rays and so absorb less energy in the form of heat than others.

The roof has the greatest exposure to sun. Great heats are generated during the day. Flat roofs of concrete without insulator, the heat will penetrate to the interior easily. Double roof is then formed, with an open cross-ventilated air space between the two layers. The hot air is quickly removed and replaced with cool air when it heats up and is in turn replaced with more cool air.



The sun's rays which create heat should not permitted to shine directly into the interior of a building, particularly at midday when the sun is strongest and the exteriors of a building which receive the sun's rays should be light in colour. Orientation should be concerned, the long facades of the building have to face the north and south which is the direction of the wind. The small facades which turn to the east and west will be hit by the direction of sun and will be easier to protect because of the small area. It is best to eliminate all doors and windows from the east and west elevations.

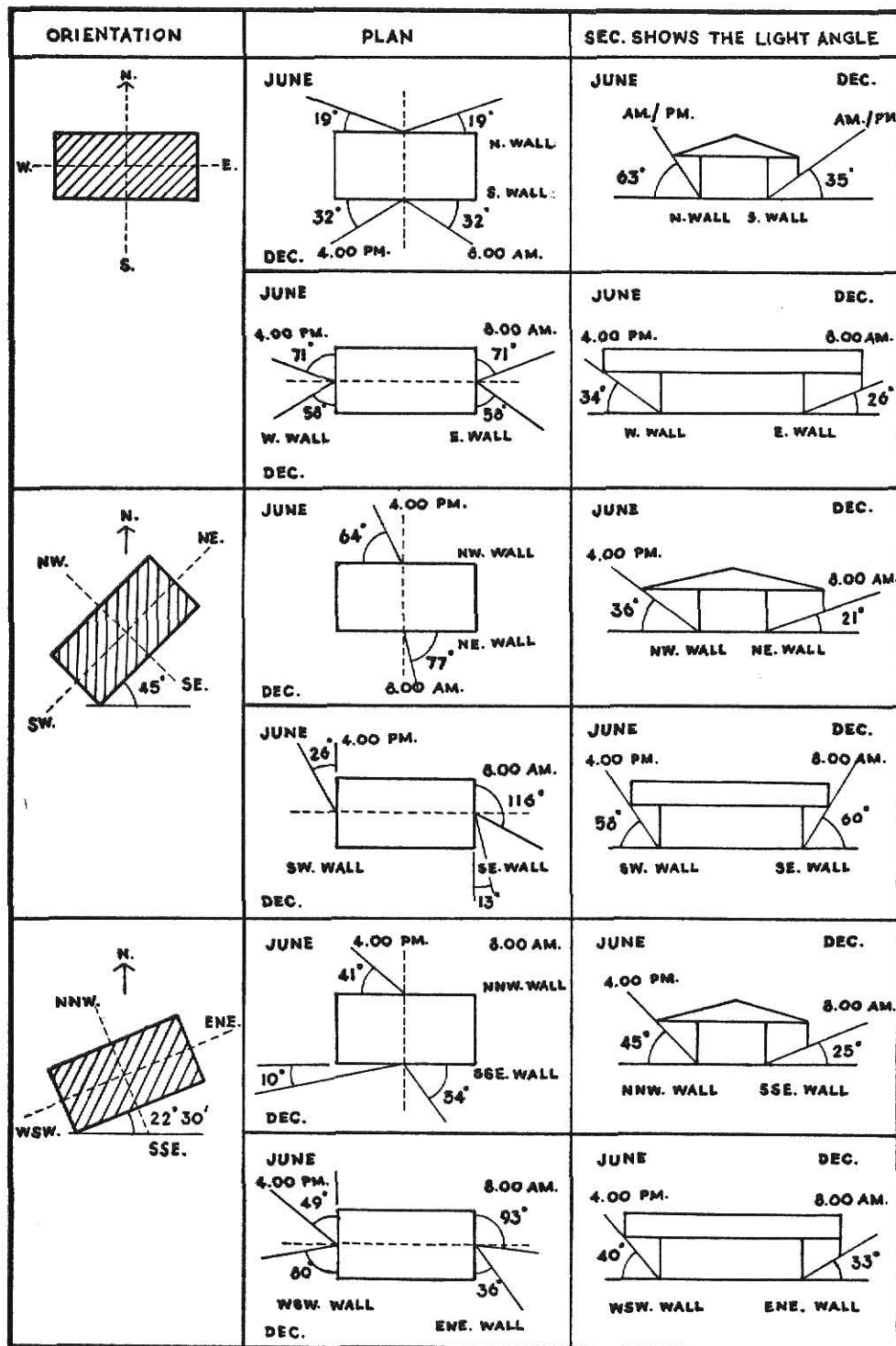


Another consideration is sun-breakers, either horizontal or vertical, may be used. We can determine the size of the sun-breakers ( Fig. 8 ). Sun-breakers, also give protection from driving rain so that the walls of the building may be as open as possible to allow air movement through the building.

Another effect of the sun in the tropics that need careful consideration is the discomfort that is often caused by glare from the sky. This can be solved by roof overhang and sun-breakers.



FIG. 8 shows the attitude of the sun during 8.00 A.M.-4.00 P.M. in Bangkok and other provinces at Latitude 14 N. to determine the size of the sun-breakers.



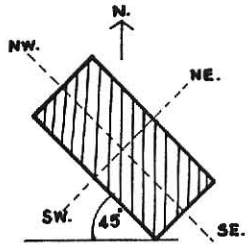
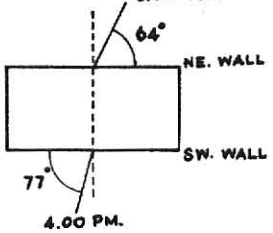
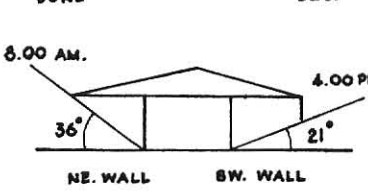
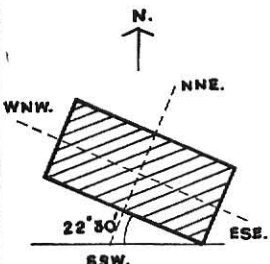
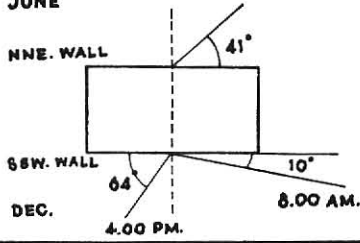
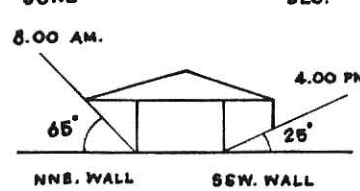
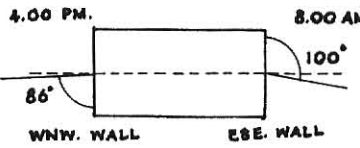
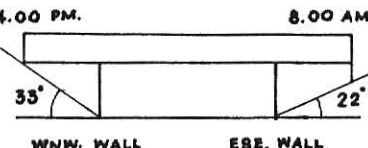
ORIENTATION	PLAN	SEC. SHOWS THE LIGHT ANGLE
	<p><b>JUNE</b> 8.00 AM. 64° NE. WALL</p>  <p><b>DEC.</b> 77° 4.00 PM. SW. WALL</p>	<p><b>JUNE</b> 8.00 AM. 36° NE. WALL</p>  <p><b>DEC.</b> 4.00 PM. 21° SW. WALL</p>
	<p><b>JUNE</b> 8.00 AM. 41° NNE. WALL</p>  <p><b>DEC.</b> 64° 4.00 PM. 10° SSW. WALL 8.00 AM. ESE. WALL</p>	<p><b>JUNE</b> 8.00 AM. 65° NNE. WALL</p>  <p><b>DEC.</b> 4.00 PM. 25° SSW. WALL</p>
	<p><b>JUNE</b> 4.00 PM. 8.00 AM. 100° WNW. WALL ESE. WALL</p>  <p><b>DEC.</b> 86°</p>	<p><b>JUNE</b> 4.00 PM. 33° WNW. WALL</p>  <p><b>DEC.</b> 8.00 AM. 22° ESE. WALL</p>

FIG. 9 The Declination of the Sun.

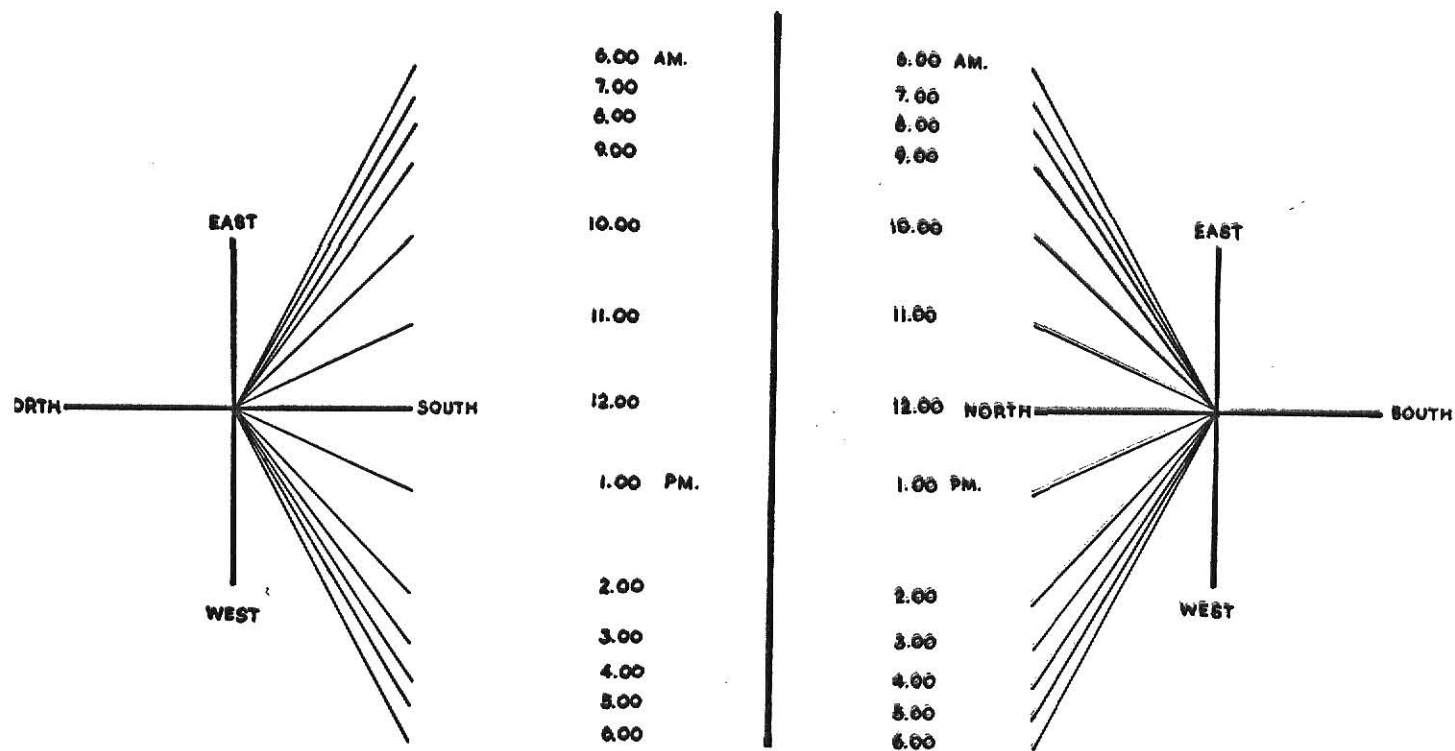


Fig. 9.1 shows the highest and the lowest angles between the attitude of the sun and Bangkok from February 15th. to October 31st., which are summer and rainy seasons.

Fig. 9.2 shows the highest and the lowest angles between the attitude of the sun and Bangkok from November 1st. to February 15th., which is cool season.

2. Precipitation. Tropical rain can fall suddenly with extraordinary intensity and is usually accompanied by a strong wind. Fundamentally, constructions for protection walls, windows and doors from the sun, at the same time, can serve to protect against rain.

The treatment of the ground surface near the building in the tropics is an important consideration. If there are no eaves-gutters and concrete aprons around buildings, erosion often occurs at the base of the walls where the rain falls like a waterfall from the eaves of the roof, spashing on the ground surface and washing away the soil.

3. Ventilation. It is unfortunately that air conditioning cannot install in every department because of high expenses, natural ventilation should be considered. Some departments have so many functions which need several rooms to serve, and so the compact plans have to be designed for providing the short distance circulations between them. From these facts, some rooms in the interior area will not receive the natural ventilation and natural light from the open space. The best way to solve this by providing the court with rooms which will be located around the court. Beside natural light and ventilation, court will serve as a decorative landscape of the hospital by bringing nature into the building.

Every room in the building has to touch the open area on at least one side for receiving the natural ventilation and evaporation of moisture from the interior space to the exterior. Moving air seems to be the most refreshing, because it

increases evaporation and thus, lower the skin temperature.

Interior air currents and how they may be affected will be shown in fig. 10.

## Materials

Building materials cannot be selected according to climate requirements only, because their suitability for a tropical country also depend on local availability, on import facilities and on the ease they can be worked by hand or machine.

### 1. The performance of building materials in the tropics.<sup>19</sup>

- 1.1. Timber. Hardwoods are little affected by climate. Degeneration of timber cells by water, heat, wind, air, and light. With proper care, normally very resistant to rain and periodical water. Medium heat insulation. Limited heat storage capacity. Resistant to wind and storms if suitably constructed. Medium reflectivity, about 50 % 9 less for dark wood ).
- 1.2. Concrete, reinforced concrete. Rain-proof, low thermal conductivity. Very high heat storage capacity. Wind-proof. Medium reflectivity about 40 %.
- 1.3. Concrete blocks. Without a rendering, limited impermeability to wind-driven rain. Low Thermal conductivity. Medium heat-storage capacity, according to self weight. Wind-proof, porous. Low reflective capacity if surface untreated.
- 1.4. Steel, cast iron. Air-tight and water-proof.

<sup>19</sup>Georg Lippsmeier, " Building in the Tropics " Callway Verlag Munchen 1969 p. 111-150.

FIG. 10 Interior air currents and how they may be affected.

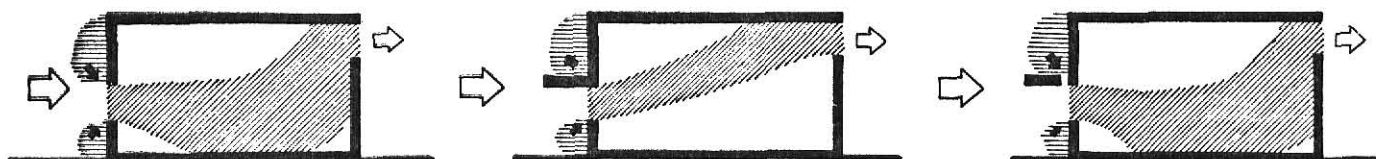


Fig.10.1 Each building-measure alters the interior air-stream. If a window in the facade is placed to provide an air-stream at body height, it can be lost by window-screening, fixed close to the facade, or by a vertical projecting wall. If the screening or the projecting wall is set away from the facade, with an air-slit, the required conditions are restored.

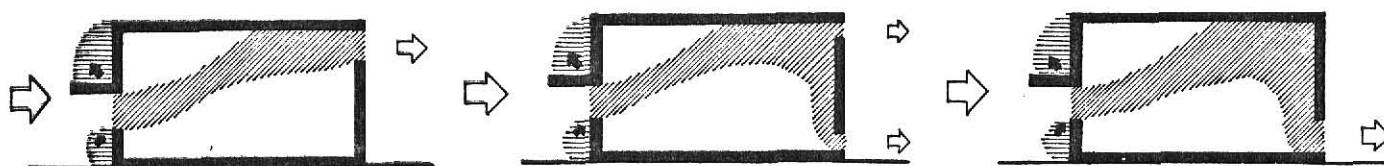


Fig.10.2 Location of outlet is not important. The air flow is determined only by pressures around the inlet

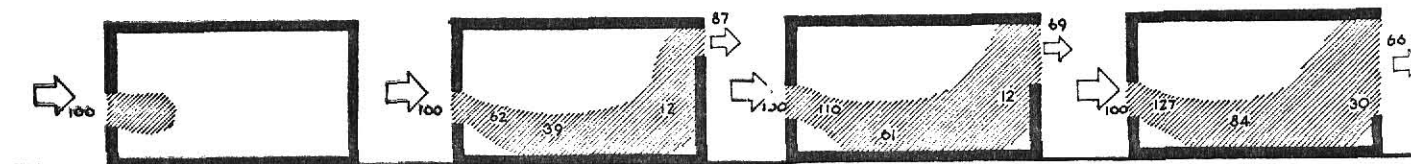


Fig. 10.3 The size of the outlet compared to the inlet is decisive. The air speed outside the building is taken as 100, the inside values are expressed as a percentage of this.

Thermal conductivity for unalloyed steel much higher at 30 BTU/ft.h F., than for stainless steel e.g. chrome nickel steel at 8 BTU/ft.h F. High heat-storage capacity. Storm and earthquake-proof. Reflectivity according to surface treatment, very high for finely ground or burnished stainless steel. High electrical conductivity. High thermal expansion.

- 1.5. Aluminium, Rain- and water-proof ( noisy ), high thermal conductivity. High heat-storage capacity ( insignificant because of thinness and weight of material used ), air tight, non porous. Reflectivity extremely good, anodised aluminium about 85 %.
- 1.6. Glass. Rain- and water- proof. Low thermal conductivity. Good heat storage capacity. Win-proof, low reflectivity of clear glass, solar radiation converted to heat energy.
- 1.7. Fire clay bricks. Permeable to continuous rain and persistent high humidity. Low thermal conductivity. High heat-storage capacity. Wind proof, but porous. Medium reflectivity about 30-40 %. Cellular bricks ( 25-30 % cavity content ), low heat transmission and heat-storage.
- 1.8. Paints. Extremely varied, depending upon chemical composition. From water paints to to water-proof paints, low thermal conductivity, porous ( emulsion paints ) to air-tight ( glass finished ), reflectivity according to colour and surface finish.

## 2. Local availability.

- 2.1. Wood. Wood is commonly used in Thailand because there are many areas of forest. The

qualities of wood are catergorized into three grades A, B, and C.

Teak is the most valuable timber and has the highest quality ( grade A ). It is suitable for all purposes of use. But at the present time, it is so expensive because the demand is greater than supply.

Red wood, Takien, Teng Rang and Maka are in grade B. They are cheaper than Teak and may be used for major structure members.

Yang is in grade C. It is used only for temporary buildings.

2.2. Cement blocks. They are made of cement and sand and useful in the tropical zone. They can stand high pressure eventhough they are light in weight.

2.3. Concrete. This is becoming more extensively used in Thailand. Cement and cement products are produced by many cement factories in the country. Reinforced concrete is widely popular also as pre-cast concrete, prestressed concrete, shell concrete, rearly mixed concrete, floating concrete foundation and assorted reinforced concrete pile.

2.4. Roofing materials. Terra-cotta, and glazed



tiles have used for roofing materials. They are made in 8" by 12 " size. There are new materials, composed of cement and asbestos which more lightness and strength than older glazed tiles.

2.5. Plywood. It is very popular and used for ceiling, partition and furniture. It has different thickness and texture depended on the kinds of wood that it is made from.

2.6. Asbestos cement sheet. It is used for ceiling and partition in the less expensive building and has high acoustical absorbtion value.

2.7. Iron and steel. Thailand produces some of these building materials but the factories can produce only small iron and steel work. So some iron and steel materials are imported from many countries.

2.8. Glass. It is the same as iron and steel materilas, some of glass materials are imported from many countries.

### 3. Import facilities,

Aluminium, copper, iron and steel, glass, bitumen, and paints are imported from many countries, such as the United States, Japan, Germany and so on.

MUNICIPALITY OF BANGKOK AUTHORITIES AND BUILDING REGULATION<sup>20</sup>

The Municipal Architect: approves proposed building scheme.

The Municipal Sewage Engineer: sewage system and engineering works.

The Municipal Surveyor: site surveys, etc., issue certificate of fitness for occupancy.

Building By-Law ( Bangkok ): building regulations and requirement.

A.) Public building.

" Public building " means a building used or constructed or adapted to be used as a school, hotel, college, hospital, church or used or constructed or adapted to be used for any other public purpose.

B.) Open Area in Rear of.

Public buildings, warehouses abutting a back lane should have an open space inclusive of half of the back lane equal to 10 % of the building area and such buildings shall be provided with quarters for a watchman and such quarters shall be provided with bathroom and latrine.

C.) Detached House Boundaries.

For a detached house, there shall be at least two meters clear between the building and the boundaries of its plot.

D.) Corridor Width.

No corridor shall be constructed less than one and

<sup>20</sup> Department of Technical and Economic Cooperation, Ministry of National Development, Thailand.

one-half meters wide.

E.) Corridor lighting.

All corridors shall be efficiently lighted by openings to the external air.

F.) Fire Escape.

Every building used for manufacturing, trade purposes, or public essemblies shall be provided on every story with separate and adequate means of escape in case of fire as the Municipal Commissioners may direct.

G.) Buildings of Iron or Glass.

Building known as frame buildings or buildings made wholly or partly of glass, iron or other material not provided for in these By-Laws shall be subjected to the approval of the Municipal Commissioners in each particular case. Plans and specifications and calculations shall be submitted.

H.) Projection of Footings.

The projection at the widest part of the footings of every wall on each side of such wall should be at least equal to one-half of the thickness of such wall at its base unless an adjoining wall exists, in which case the projection may be omitted where that wall abutts.

I.) Width of Offset of Footings.

The dimension of the footings shall be in regular off-sets or in one offset at the top of the

footings and the height from the bottom of the footings to the base of the wall shall be at least equal to two-thirds of the thickness of the wall at its base, the lowest footing to be at least two courses high. No one course offset shall project more than 70 centimeters beyond the course above it.

J.) Every Building to Have a Separate Approach.

Every building not abutting on street shall have a right of way for an approach from the street open to the sky and at least 6 meters in width.

K.) Thickness of Walls in Public Buildings.

Every wall of a public building shall be constructed of the following thickness.

1.) In buildings 7 meters high or under, the thickness of the wall shall be 30 centimeters throughout.

2.) In buildings from 7-12 meters high, the thickness of the wall shall be 40 centimeters for the first story, 30 centimeters all above.

L.) Height of Story.

No story of public building shall be less than 3 meters and shall be over 6 meters high without the permission in writing of the Municipal commissioners who may in every such case prescribe to what extent the walls shall be increased in thickness or

otherwise strengthened.

M.) Thickness of Cross Walls.

The thickness of every internal cross wall shall be at least two-third of the thickness prescribed for an external or partly wall of the same height and length provided that if such cross wall supports a load the whole of such cross wall shall be of the thickness prescribes for an external or partly wall and all cross wall shall be bounded to the main walls to which they abut.

N.) Openings in Walls.

Every building having an extent of opening in any external wall which is greater than one-half of the vertical face or elevation of that wall or of the story in which the opening is left, shall be constructed with such piers of bricks or other support of incombustible material and so disposed as to be sufficient to carry to the superstructure.

O.) Reinforced Walls.

Approved reinforcement properly tarred and sanded and bedded in cement or other suitable bonding shall be built in the walls where required by the Municipal Building Surveyor.

For a floor intend to be used for purpose of:	Equivalent dead load in kilograms per sq. meter.
classrooms in school buildings	500
offices	450

For a floor intend to be used for purpose of:	Equivalent dead load in kilograms per sq. meters.
--	---

churchs	500
lecture rooms	500
public assembly	500
workshops	500
domestic buildings	300

P.) Staircase Not Less Than 1 Meter Clear Width.

Every main staircase shall be not less than 1 meter clear width with not more than 17.5 centimeters risers and not less than 20 centimeters going.

Q.) Handrails and Exits.

All staircases shall have proper handrials and balusters, and shall be situated in such portion of a building as will reasonably afford the best means of exit in case of fire and shall be adequately lighted.

R.) Building 20 Meters Deep to Have Two Staircases.

All buildings 20 meters or more in depth abutting on a street shall have at least one staircase in addition to the main staircase not less than 1 meter wide, from uppermost floor to the ground floor.

S.) Staircases to be Enclosed by Brick Walls.

The floor of every lobby, corridor passage and landing and every flight of stairs and all supports of such floor and flight of stairs in every public

buildings and business premises shall be constructed of incombustible and fire resisting materials.

T.) Gable to be Vented.

All external gables shall be provided with sufficient openings to promote circulation of air.

U.) Ventilation of Room.

No room in any building shall be a greater depth than 12 meters unless it is sufficiently lighted laterally, or at both ends, by one or more opening free of any obstruction and communication directly with the external air. Where one air-well is provided, it shall not be less than 12 square meter for three story buildings, but in such case no single air-well shall have a less area than 5 square meters, of unobstructed daylight.

V.) Area of Rooms.

No room, used as a bed room cubicles excepted, shall be of less than 14 square meters or less than 2.40 meters wide and when not cross ventilated not less than 16 square meters in area.

W.) Width of Buildings.

No domestic building shall have a less width than 4.80 meters in the clear, such width shall be measured at ground floor level between walls of any shop house or terrace house. For corner sites 3.50 meters in the clear.

X.) Height of stories.

No ground floor story shall be constructed of less than the following height measured vertically from floor to ceiling.

1. In building other than outbuilding, 3 meters.
2. In outbuilding consisting of
  - a. Rooms other than bathrooms or latrines, 2.50 meters.
  - b. Bathrooms or latrines or both, 2.20 meters.

On upper story shall hereafter be constructed so as to be less than 2.50 meters in height.

Y.) Height of Buildings.

The height of any building, measured to the top of the wall plate above the center of the street, not being a domestic building in a business or office area abutting on the street, may not exceed in height one and one-half times the width of the street except with the sanction of the Municipal Commissioners.

The decision of the Municipal Commissioners as to whether an area is a dwelling house area or office area shall be final.



## TYPES OF HOSPITALS

### 1. Special Hospitals.

A special hospital is one which is devoted to someone or a group of related diseases, the treatment of which usually requires protected period. There are all kinds of special hospitals: contagious disease, tuberculosis, cancer , chronic disease, psychiatric, cardiac etc. And also nursing homes and homes for the aged which should be considered hospitals, or extended care institutions. Most special hospitals came into being because general hospitals were not able to undertake certain functions or responsibilities.

1.1. Contagious Disease Hospitals. The need for contagious diseases hospitals has been increasing in the tropical countries, where the epidemics of many tropical diseases often occur. When designing these hospitals, architect should consider how to protect any infection among patients and visitors.

To insure as much as possible against infection, the entrance and admitting facilities of a contagious disease hospital should be handled in a manner to prevent contact between patients and between public and patients. The wards should not be larger than 4 to 6 beds. At least one-third of the beds in each nursing unit should be individual rooms. The nursing units should be small, from 12 to 18 beds, unless serious measures are taken against atmospheric infection. Even in the small wards the beds should be separated by partitions from floor to ceiling as a physical barrier against air-borne infection. At each bed there should be a shelf underwhich there would be hooks on which to

hang the doctors' and nurses' gowns in special manner consistent with aseptic techniques. The gown is hung so that one can slip his arms into the sleeves without touching the outside gown which is considered contaminated.

Other precautions would be a maximum of daylight in all spaces, supplements by a use of ultraviolet irradiation at night and in the daytime in spaces that cannot be reached by daylight in sufficient quantity. To prevent bacteria from entering through windows, the hospital would be air-conditioned by the type of system that does not involve recirculation of air.

1.2. Tuberculosis Hospitals. In the early stages of understanding tuberculosis, the treatment consisted largely of aiding nature to overcome the disease. The hospitals were constructed definitely out of town. But setting up hospitals in the country is expensive, difficult to attracting skilled surgeon and other medical talent, nurses to stay and have isolated life in the country and the social factor of the patient being separated by great distances from friends and relatives and feeling abandoned.

Today, progressive communities erect tuberculosis hospitals in or near the larger city centers, or in separate buildings with independent medical boards as part of existing general hospitals.

In tuberculosis hospitals, the screens dividing bed groups in the ward sections are full partitions going to the ceiling to prevent air-borne bacteria and the sound of coughing. For the latter reason ward ceilings are acoustically treated. In

the bathing and toilet sections there are flushing rim dental bowls in addition to the ordinary wash basins. This is done in order to eliminate the unpleasantness of tuberculosis sputum in wash bowls.

On every ward floor there is a suite of room peculiar to tuberculosis work. It is referred to as the pneumothorax suit and consists of a pair of treatment rooms with a fluoroscopy room between. It is understood that treatment procedures other than pneumothorax could also be performed in these rooms.

1.3. Cancer Hospitals. There are two types of patients, those who are subject to active medical and surgical intervention, and those who may not benefit from such active intervention.

For the active cases, they should be nursed in small nursing units. The rooms should have not more than 6 beds, plus a goodly proportion of single and double quiet rooms. The partitions between all rooms should go to ceilings as cancer cases of the digestive system are attended by unpleasant odors. It is also desirable to provide acoustical treatment in the wards and rooms. Aspirators should be provided at all beds.

The out-patient clinic is an essential part of the cancer hospital. It should be planned that special diagnostic and therapeutic facilities should be as accessible to the in-patient as to the out-patient.

1.4. Chronic Disease Hospitals. There are three types of chronic patients who need medical and nursing services.

Class A. - Patients requiring intensive care for diagnosis and treatment.

Class B. - Patients requiring chiefly skilled nursing care.

Class C. - Patients requiring only custodial or attendant care.

For Class A., the hospital, in addition to having full facilities for diagnosis and treatment of chronic diseases, is equipped for medical teaching and research in chronic diseases. The Class B. hospital involved on the whole very sick people who has passed the active stage of therapy, the patient is on the way to recovery and still needs active nursing care. The Class C. hospital deals with the patients who have passed beyond the B stage. Their disease is no longer active, but it has left them permanently incapacitated in one way or another.

The patients will remain the shortest time in the Class A hospital, the length is determined by the time required to cure the disease. The length to stay in the Class B institution will be determined by the time the patient will remain in need of active nursing. The patients in the Class C institution will generally remain the rest of their lives. Occupational rehabilitation work should begin in the Class A institution and should be continued through B and C. The patients in a Class C institution should be rehabilitation so the Class C institution need not be regarded as the end of all hope, but rather a prospect of a new useful life.

1.5. Psychiatric Hospitals. The problem of

planning mental institutions is different from planning hospitals in general. In hospitals we generally deal with people who are mentally healthy but physically sick. It is found that physical sickness is a matter of psychiatric approach and that mental illness can be dealt with through physical and chemical therapeutics, but new forms have appeared in recent years. They are electric shock treatment, insulin, metrazol, fever therapy, monopolar ( electric current ) treatment, psychoanalysis, and hypnotism.

The modes of treatment most widely practiced are electric shock and insulin. The physical plant generally employed for electric shock consists of a waiting room, a treatment room large enough for two treatment tables on wheels, and a room containing enough bed to provide for a turnover of about 30 minutes duration. Metrazol treatment requires the same arrangement. Insulin treatment requires a much more complex arrangement. The patients are in beds, well covered with blankets, and the beds must be clearly visible to the supervising staff at all times. There must be an adjoining preparation room where all medicaments, injections, and sugar content drinks are prepared. There must be a wheeled carriage suitable for taking the preparations to the patients. The treatment room should be preferably be air conditioned or in any case ventilated so as to make it unnecessary to open windows.

One of the important in the planning for mentally sick is to arrange the structure to control the patient. It is necessary to prevent the patient from injuring himself and to reduce the destruction of property. Also avoiding the cross

circulation by public and others.

Toilet and bath compartments should be without doors altogether to permit vision or in any case doors should open outwardly without means of locking from the inside. Doors to patients' rooms must always open outwardly. Vision panels must be provided for observation in all doors to rooms enclosing patients. These should be relatively small to prevent breakage and the glass should be of a special non-breakable kind. The windows present a special problem. Windows are made with small panes making it impossible for a person to crawl through. The sashes of windows are arranged to open but slightly for the same reason. Mention should be made here that general practice calls for key operation of all electric switches in patients' quarter on the corridor side so that only the nurse or attendant can operate them. A key operated emergency call system must be provided in patient and treatment quarters. All details of construction that would facilitate or invite self destruction must be avoided.

## 2. General Hospitals.

The hospitals which, are not special and which perhaps function in various ways, are considered to be general hospitals. General hospitals might take care of the vast group which have not been mentioned under any special subdivision.

## PLANNING FOR GENERAL HOSPITALS

### General Considerations.

1. Location. The location of a general hospital for town, city or community is necessarily restricted to readily accessible sites. Accessibility of the hospital for patients, doctors and visitors has an important bearing on the well-being of the patients. Distance and transportation facilities indirectly affect the improvement of the patient. Attention should be given to existing and future transportation facilities. The site should be readily accessible by public conveyance.

2. Site. Physical characteristics of the site should be concerned. It must be dry and well drained. The site should be as far from noise, odors, and dust as possible. There should be available at or near the site the proper public utilities such as water supply, sewage disposal, electricity. The site should be selected to meet not only present needs but future developments.

3. Orientation. The orientation of a hospital is most important. In the tropics, the desire for coolness and cross ventilation is importance, and therefore the wards are placed on the shady side of the building with emphasis on cross draughts and prevailing winds. The roofs should have overhangs to shade the wards from the hot sun.

4. Planning. Vertical circulation between departments occurs mainly in the modern hospital because it is cheaper, faster and more satisfactory than horizontal. In tropical area , the underground water level is very high, and it varies between



1.20 m. to 0.5 m. So, it is impractical to have a basement because it needs to be waterproofed which is expensive.

5. Safety and Comfort of Patients. The safety of patients must be carefully considered. The patient should not be hospitalized above the second floor of a non-fireproof building. Interior steps, ramps, and slippery floors present a constant hazard. The comfort of the patient, with freedom from annoyance, will have much to do with the progress of his recovery.

6. Circulation. Circulation of all services is important to the welfare of the patients and the efficiency of the hospital. For the patients, this involve a study of admission procedure, ambulance and emergency enreances, and out patient department layout. Food and other supplies must be brought into the institution by separate entrances without disturbing patients. Visitors always create a troublesome circulation problem. So, cross traffic should be avoided.

7. Esthetics. The esthetic purpose in hospital architecture is to create an atmosphere of quiet, healthfulness, cleanliness, and secure cheerfulness. The patient within the hospital should be made to feel uplifted rather than let down, the friends or relatives of patients should be made to feet that the patients are in the presence of kindliness, considerateness, and scientific certainly, and of course the doctors, nurses, and other employees should be made to feel that they are in atmosphere where the exercise of care, kindliness, and service is a natural expectation.



## The Site

The site is on Ladprow Sreet. In the Bangkok District. The area is 70,851 sq. meters ( 59,239 sq.yards ) The distance from the site to the center of the city is 11 kilometers, 3.8 kilometers from Highway number 1 and 31 and 7 kilometers from the Bangkok District Office.

### 1. Boundary

Northern - Dwelling units.

Eastern - Dwelling units and vacant land.

Southern - Chokchai Lane.

Western - Ladprow Street.

2. Geography. It is a plain area. The elevation is 1.80 meters above the mean sea level. There is a Ladprow Canal, just 180 meters from the site, is a natural water drainage which removes water from the public water drainage system.

3. Utilities. Usual facilities are already installed near the site and connection to various agencies, such as The Metropolitan Electric Agency etc., need only to be requested.

4. Zoning. Bangkok-Thonburi Metropolitan has only the proposed zoning which someday will pass The House of Representatives to be a Zoning Regulation. The site used to be rice fields but with the proposed zoning, this area will be converted to a residential area with the exception for some necessities such as schools, hospitals, fire station etc.

5. Transportation. Ladprow Street is a modern thoroughfare with 6 lanes of traffic and leads to many major highways and streets.

## Hospital Elements and Circulation

There are five major divisions in the hospital.  
( Fig. 11 ).

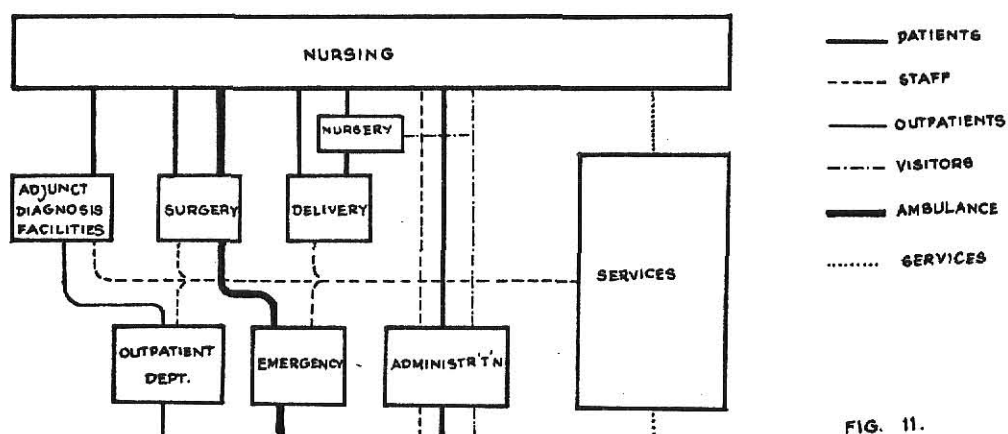


FIG. 11.

1. Diagnostic and Therapeutic.
2. Patient Quarters.
3. Ancillary Services.
4. Administration.
5. Grounds and Parking.

The requirements for hospital in Thailand are almost the same as the requirements for hospital in the United States.

1. Diagnostic and Therapeutic. This division may be termed the doctors' workshop. All services comprising the diagnostic-therapeutic division should be assembled into one entity.

### 1.1. Emergency Services ( Fig. 12 ).

Patients are received and examined in this department, emergency treatment is given those who are suffering

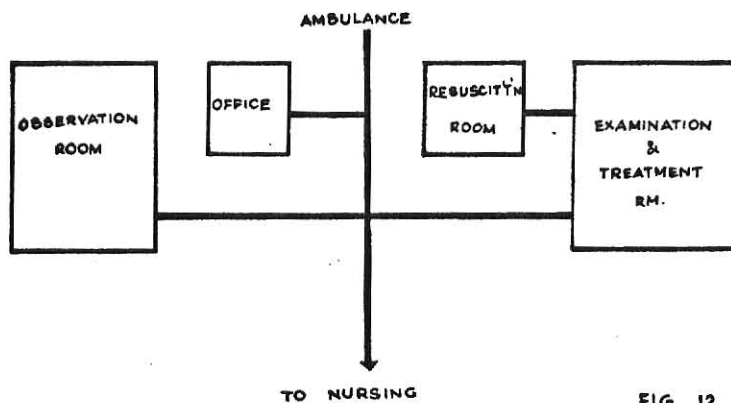


FIG. 12.

from major or minor injuries, a patient may be detained here for purposes of observation and more careful diagnosis, or merely to rest until he can be sent home, or a patient may be kept here overnight because taking him to the nursing unit would disturb the sleeping patients there.

Emergency service should be an easily accessible recognizable location from the outside.

#### 1.2. Out-patient Services. ( Fig. 13 )

The hospitals in Thailand are not expected to have the following:

- Interview spaces for private interview relating to social service, credit.
- General or individual offices for business transection because physicians are not allowed to operate their own businesses in the hospital.
- Treatment rooms because the patients will recieve the treatment in the examination rooms.

- Observation rooms because the patients will be kept in nursing unit for observation.

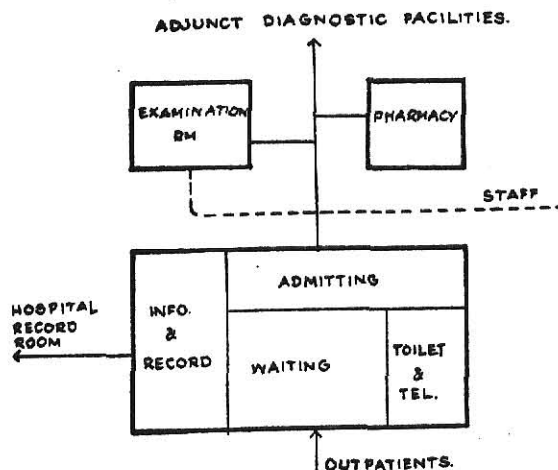


FIG. 13.

The functions of an out-patient department should be education, prevention, diagnosis and treatment of illness among ambulatory patients not enrolled as in-patients.

Out-patient department can function efficiently when it is incorporated in the hospital building. As part of the hospital, many services, such as x-ray, pharmacy, laboratories, records and administrative office can be used in common. The entrance and exit of this department must be close to street level and accessible from the public thoroughfare, and there will be no inference with ambulances, motor traffic, hospital patients and visitors.

### 1.3. Laboratories ( Fig. 14 ).

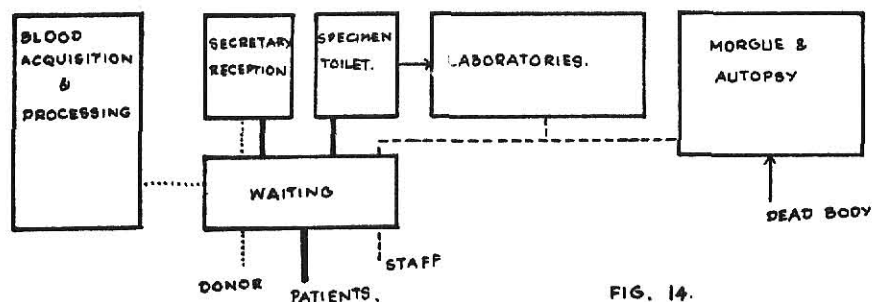


FIG. 14.

This department is the hospital workshop for making tests, analyses, examinations and solving pathological problems.

In general, the laboratory service should be placed on the north side of the hospital building, if possible. Horizontally contiguous to the out-patient department in the hospital which they are apt to serve most. It must be located where deliveries can be made without inconvenience and where the attendant activities are out of sight, sound, smell of the rest of the hospital or the public.

A. Hematology, urinalysis, biochemistry, histology, bacteriology laboratories should have an office for the pathologist and perhaps a secretary. A small waiting room as well as a small room for taking specimen should be provided for patients.

B. Blood acquisition for transfusions, and the processing of same. Blood taking requires a comfortable reception room with easily accessible toilets and receptionist's desk so situated that the donor can answer questions for the record. The blood drawing room should be quiet, and should be divided into cubicles for privacy. After the blood has been drawn the donor should return to the reception room where in allocated space he can sit down to rest and have some light refreshment.

The functions of acquisition and processing of blood are usually not done in the same room. After processing, the blood is kept in a blood bank within the blood processing room in special refrigerators.

C. Morgue and autopsy. The dead body is stored in the mortuary, investigated and dissected in the autopsy room. The morgue and autopsy rooms should be arranged so as to prevent unnecessary contact of the public. It should be convenient to the elevator, with an isolated exit. Adequate ventilation of the room is necessary. A refrigerated compartment for bodies will be needed. It should be finished in materials which can be easily flushed down with a hose and there should be adequate floor drains.

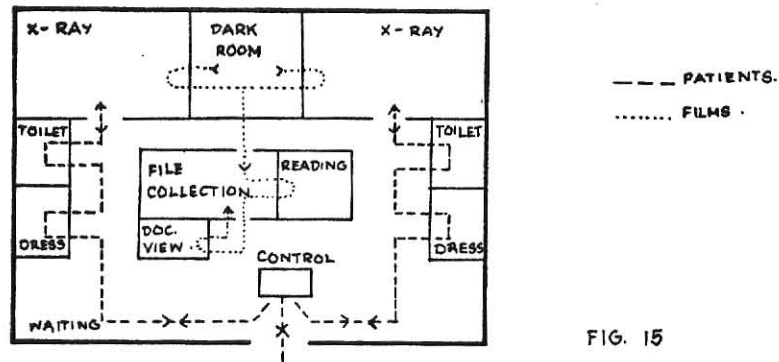
#### 1.4. Radiology

X-rays have been used in a hospital both for diagnostic and therapeutic purposes. But, we now have x-rays florescopy, radium, cobalt 60 and isotopes and others for diagnosis and therapeutic.

As the radiology department is used for patients with all type of infirmities, as well as for out-patients, it should be in a central location, preferably near the administrative section or the out-patient department. Radiation service should be placed between the laboratory services and operating suit. There are occasions when a patient is found to need surgery as soon as certain laboratory and x-ray determinations have been made.

A. X-ray suit ( Fig. 15 ) consists of:

- Waiting room. General waiting space for about 10 patients is located at the entrance. From here the patient is directed to an assigned dressing room. A separate area is provided for



wheelchair and stretcher patients.

- Secretary-receptionist. The desk is centrally located, directly in front of the entrance between the waiting room and administrative area, so that the secretary-receptionist may supervise waiting patients and have access to correspondence and report files.
- Doctors' viewing room. The doctors' viewing room is located near the office of the radiologist so that he may be immediately available for consultation.
- Radiologist's office. This office is conveniently situated near the x-ray rooms, the secretary-receptionist's desk and filing distribution area.
- Film files. The film files are located in the collection and distribution area and convenient to the radiologist's office.

- X-ray rooms. The room is equiped with combination x-ray and fluroscopic machines with spot film devices. The machine and transformer should be placed so as to allow adequate space for admittance of a bed or stretcher in the room.
- Control booth. It is essential that the control booth be located to the right of the machine so that the patient may be observed when the table is inclined and the cassette changers are placed to the extreme left. Furthermore, additional sheilding is required to protect films and personnel in the department because the primary beam would not be directed toward outside wall. In the present scheme, the sheilding necessary in the interior walls is pricipally to safe-guard against the scatter radiation.
- Dark room. This room is located adjacent to the x-ray rooms to facilitate handling of films. A lightlock between darkroom and lightroom, is necessary to allow entrance into the darkroom of other personnel during film processing.
- Collection and distribution. After the processing procedures, the film is passed



through the radiologist for interpretation and returns the film in a file cart or through a slot which leads into a box under the distribution counter.

- Barium preparation. There should be an alcove for barium preparation.

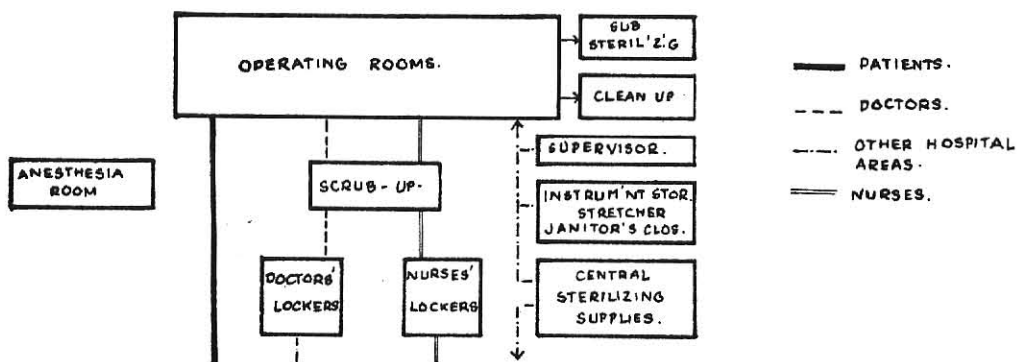
B. Cobalt 60. The cobalt suit should adjoin the x-ray department. This location permits the joint use of waiting, dressing, toilet and consultation rooms. A corner location for the cobalt room is usually desirable, only two interior walls require shielding. The shielding necessary for a room must not only be considered in terms of floor, ceiling and wall shielding, but also such things as doors, windows, ventilation, and safety locks. Radiation that might escape through such possibilities could result in overexposure to personnel, if proper precautions are not taken. Lead door, lead strip under the door and having the door to the telatherapy room open into a maze should be considered.

C. Isotope. There are two rooms for this activity: one where the isotopes are kept and when necessary, processed, and another where they are applied and their indications observed and measure. When designing and constructing radioisotope facilities, the possibility of both external and internal hazards must be considered. To protect personnel against the radiation from external located radioactive materials, shielding usually made of lead, should be provided where necessary. To protect against the internal hazards of radioactive

materials is the prevention of their ingestion or inhalation through safe operating techniques.

D. Cystoscopy room. This room should be adjacent to surgery because its procedure may call for aseptic techniques and sometimes local anesthesia and even surgery and also adjacent to the radiology because x-ray examination are involved.

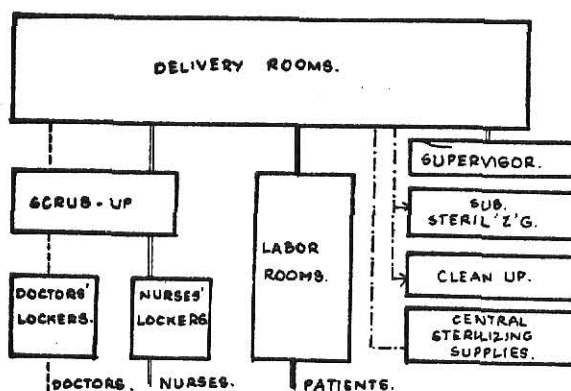
#### 1.5. Surgical and obstetrical ( Fig. 16 ).



A.) Surgical. Today, operating suits are planned on any floor of a hospital building. It should be located in a separate wing with convenient access by elevators to all patient floors and located that there will be no traffic through it. It should be chunky and have its own independent circulation in the interest of asepsis and order.

B.) Obstetrical. Good practice requires that obstetrical suit and maternity patients, plus infants, be housed in horizontal contiguity, and that together they should be isolated from other hospital patients

and activities as much as possible.



Surgical. Within the surgical suit we have three basic zones predicated on three types of activities and circulation involved, and the degree of sterility to be maintained.

Outer zone. Administrative elements and basic control when personnel enter the department, patients are received and held or sent to proper holding areas of inner zone, locker spaces.

Intermediate. Predominantly work and storage areas outside personnel will deliver to this area but should not penetrate the inner zone. The recovery suit, if completely integrated with the surgical suit, is an intermediate or outer zone activity.

Inner zone. The actual operating rooms, the scrub areas, the patient holding or induction areas. All alien traffic should be eliminated. Here we want to maintain the highest level of cleanliness and aseptic conditions.

Obstetrical. The delivery suit includes three areas of activities: labor, delivery, and recover. Labor, delivery and recover rooms should be located and related for easy movement of patients from one area to another and for good patient observation. For the standpoint of asepsis, location of delivery room

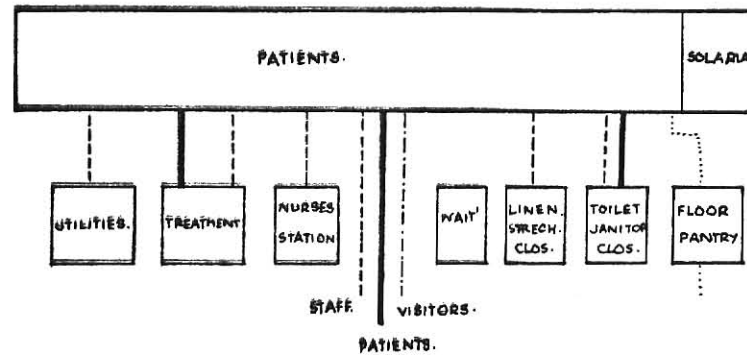


FIG. 17

Nursing unit is the space where the patient actually lives during his sojourn in the hospital. This involved the various services and auxiliaries which are necessary for ministering his wants and needs.

2.1. Intensive care units. They are the space that nursing of the urgently sick could be best accomplished by concentrating them in a single, especially equipped location under the care of specially trained nurses.

2.2. Maternity nursing units. These units should not be separated from the delivery suit by interim of cross circulation.

2.3. Nursery. Full-term nurseries should be located in the maternity nursing unit as close to the mothers as possible and away from the line of traffic of other than maternity services. Fixed-view windows between the nursery and the corridor permits visitors to view the infants from the corridor. Fixed-view windows in partitions between two nurses' stations or between two nurseries facilitate observation of all infants in the area. Premature infants require more specialized care than full-term infants, a reasonable ratio of staff to premature infants is set at one to

and service facilities is critical. A location as remote as practicable from the entrance to the suit will reduce traffic, cause less air turbulence, and provide greater privacy for the patient. A recover room should be located within the unit in an area: 1.) adjacent to delivery rooms or 2.) near the entrance of the unit. Labor rooms should be close to delivery rooms but not so close that the two areas are intermixed or that patients in labor can overhear or view delivery room procedures.

1.6. Physiotherapy. Physiotherapy concerns itself primarily with the reeducation of muscles and body, such as learning to walk again after orthopedic surgery etc.

The area selected for physical therapy should be centrally located to minimize problems of transporting patients and to facilitate giving bedside treatment when necessary. A ground floor location, convenient for both in and out patient and for access to an outdoor exercise area, is recommended.

The principal divisions of the department are for electrotherapy, hydrotherapy and exercise. There is an exercise room or gymnasium, a series of curtained-off cubicles for massage and various forms of electro-therapy and hydrotherapy with various tanks containing surging water to produce stimulation and toughening of muscle or skin.

2. Patient Quarters. ( Fig. 17 ) In Thailand we have nursing units for poverty which each unit consists of 20-25 and in the single room only one relative is allowed to stay with the patient all night, so bed should be provided.

five. An observation nursery should be provided for infants suspected of infection and should be a completely separate unit, but it should be located adjacent to a full-term nursery with a glazed partition between to permit observation by nursery staff. If the diagnosis is not positive the infant may be returned to the regular nursery.

2.4. Pediatric units. The one-bed rooms are required for critically ill-patients, those who need quiet or those who are disturbing to other patients. Some of the one-bed rooms, should be large enough to accommodate two beds, to provide overnight accommodations for parents. It is essential that each pediatric unit be provided with one or more isolation rooms. The isolation room should be large enough to permit the use of an additional full-sized bed for a second patient with the same infection or for a mother to stay with her child. Every pediatric unit should have a play room for group activities and recreation. It should be placed next to the nurses' station for control.

2.5. Day room. It is customary to provide a day room on each nursing unit. It is desirable that a patient should be able to get away from his room, sit with a visitor or newfound friend in comfort, chat with fellow patients or watch television.

2.6. Nurses' stations. A nurses' station is a necessity for each nursing unit and should be situated to save as many steps as possible for the nurse. It should be open to the corridor with, perhaps, counter or rail separation from the corridor. These stations should preferably be located in the center of the nursing unit and if possible when visitor entry by stairs and

elevators can be controlled. In large hospitals where there is more than one nursing units to a floor, the nurses' station will be centrally located in the nursing unit and a floor supervisor's station will command the visitor entry. The nurses' station will have space provided for a chart desk and rack as well as for an extra desk for the use of nurses and inturns in writing up charts.

The station will be equipped with a nurses' call annunciator, a medicine cabinet with separate locked section for narcotic; other cabinet space; a small instrument sterilizer; an acid resistant sink below the medicine cabinet, having gooseneck spout for hot and cold water with knee or elbow control; clock; bukkitin board; toilet; intercommunicating telephone.

Each nursing unit to comprise approximately 25 patient beds.

2.7. Doctor lockers' room and lounge. This room should have toilet and a shower. It is desirable to provide a rest area for the doctors to relax or talk with other doctors. Beds should be provided in this room when the doctors have to stay all night.

3. Ancillary Services. Many service departments are like the work behind the stage in the theatre. We have to know what it takes to operate the hospital.

3.1. Pharmacy. This department should be located next to the out-patient department. It is well to place the pharmacy off the main lobby, preferably near the exit, as the majority of patients will get their prescriptions on the way out after their examinations or treatments.

### 3.2. Supply.

A.) Delivery platform. It should be one well-chosen place where goods are to be delivered, examined for conformance to quality and quantity specifications, stored, processed, and then distributed. There should be a delivery platform to which vehicles discharge their burden.

B.) Purchasing. The purchasing office should be planned very near the point of their delivery, and if possible overlook the delivery platform. The purchasing office would consist of waiting space to accommodate salesman, plus receptionist-secretary and an office for the purchaser and his assistants.

C.) Stores. There are specialized storerooms.

- The pharmacy stores are usually handled by the pharmacist rather than by general storekeeper. When this room is kept separate, pharmacy stores are available without allowing access to the other storage areas.
- The furniture store must be available at any hour as a bed or fresh mattress may be needed in an emergency. This room should have double doors because of the size of the items stored in it.
- The anesthetics store is located at the entrance for availability in case of fire and for easy access in handling heavy oxygen tanks. Besides the anesthetic



gases, oxygen will be stored here.

- The general store may be made up of a series of interchangeable shelving units which can be neatly set in rows, back to back.

D.) Delivery of supplies. There is a office for storekeeper. He has a person or group responsible for a receipt and distribution of goods within the storerooms, who loads the wheel racks, lines them up in the issue room, and keeps things moving to ultimate points of delivery and use.

### 3.3. Processings.

A.) Laundry. The soiled linen area is designed for a weighing, sorting and checking rooms for all soiled laundry from the hospital. The soiled linen room should be adjacent to the " soiled " end of the laundry. The laundry room should be clean and airy and air conditioned where possible. The room should be kept clean and should be designed constructed for easy cleaning. Each laundry should have a storeroom for soaps, detergents and the like. Central linen rooms are designed to furnish all linen supplies for the hospital. In this room, space and equipment are needed for mending and sewing, as well as for making new linens. Space for linen carts and their loading will be required. The central linen room should be located adjacent to the " clean " end of the laundry and with convenient access to the elevators.

B.) Central sterile supply. The location of central sterile supply should not adjacent to the operating suit or any other diagnosis-therapeutic service because it involves

a great deal of traffic of supplies from stores, linen from the laundry and its attendant traffic implies the risk of carrying contamination through parts of the hospital. It can be arranged to adjoin stores, laundry, the issue room and the pharmacy. For local sterilizing, instruments and utensils can also be sterilized through the use of chemicals and supersonic vibration.

C. ) Oxygen supply. The oxygen supply consists of a cylindrical tank resting on a concrete pad. To discourage mischief the tank is surrounded by a metal fence with a gate under lock. The tank containing oxygen gas should be to one side of the hospital service yard so that a vehicle holding the liquid oxygen can discharge the cargo, which is automatically converted to gas. The tank may not be closer than 200 ft. from the hospital.

#### 3.4. Food service.

A.) Food stores are segregated in a separate enclosed area in order to keep vermin out and to aid in keeping the area clean. It should be placed next to the kitchen. All storerooms for food must be constructed so that rats, mice and insects cannot enter and must be without space which they can hide.

B.) The kitchen. The kitchen should lie in a space between the source of supplies and the means of distribution of its product. The distribution systems may consist of elevators, capable of transporting whole tray carts or tray conveyors. The kitchen may consist of: supply and waste disposal, dry and perishable stores, preparation facilities, cooking and baking areas, pot washing and dish washing space, means of transporting, administration offices for dietician and sanitation

area.

C.) Dining rooms. The dining room should adjoin the kitchen or if not at the same floor, the two could be connected by dumbwaiter, or a vertical conveyor. To locate the dining room, favorable environment should be considered.

### 3.5. Engineering.

A.) Boiler room. Steam in the hospital is used to generate hot water for laundry, for general use, cooking etc. This room should be adjacent to laundry because laundry is a heavy consumer of pressure steam. The boiler room can be planned to abut the hospital building or within the hospital building.

B.) Emergency electricity. The hospital needs a standby or emergency source of electricity of its own. This is usually an emergency gasoline-driven generator which turns itself on automatically when the public source fails. This generator is usually in or near the steam generating room.

C.) Housekeeping and sanitation. The housekeeper's office is usually situated near the employee's entrance and should not be far removed from stores, so that requisition of mops, vacuum cleaners, soap, detergents can be filled. Next door to the housekeeper's office should be a room where the apparatus, supplies, cleaning carts are kept.

D.) repair and replacement shops. Each shop should have a place for parts and supplies, and special racks for lumber and pipe. There should be an ample sink for soaking, washing water procurement, ample outlets for power tools, electrically-powered machinery, appliances.

E.) Garaging of vehicles. When a hospital has its own ambulances, it is necessary to provide a resting room with cots plus a shower and toilet for the driver. The location of the ambulances should relate to the emergency service.

F.) Lockers and other employee conveniences. Each locker room should have a toilet and, when necessary, a shower. It is desirable to provide a rest room for each category of employees in the locker component, where workers can relax after meals etc.

G.) Disposal. The hospital waste is taken to the city dump, but there should be waste incineration for some waste materials such as soiled linen or surgical supplies.

There are requirements for waste water drainage for the hospitals in Thailand.

1.) Ordinary waste water can be drained to the public drainage system, but not allowed to drain to the river or canal.

2.) Waste water which contained with chemical must be purified by centrifugation or oxidation system before it is drained.

3.) Sewage disposal must use purification system which has saftic tank, or centrifugation. For left water can be drained by infiltration or drained to the public drainage system.

### 3.6. Communication.

A.) Telephone. There should have telephone switchboards and their operators at or as near the front doors

as possible.

B.) Nurses' call system. It is the backbone of communication between patient and nurse. When the patient pushed the button the light was turned on over the door and at the nurse's station so the nurse would be guided to the calling patient.

### 3.7. Transportation within the hospital.

A.) Elevators. They are considered the vertical transportation system. Determination of probable loading patterns to provide enough cars of sufficient size to give service during peak loads, even with one car out for maintenance. There is a requirement that the hospital with more than 4 stories should have 1 elevator for 100 beds.

B.) Service elevators. They are essential for the movement of beds and stretcher-beds, and carts.

C.) Dumbwaiters and conveyors. They are vertical and horizontal transportation systems for moving stacks of linen, central supply goods, pharmaceuticals, food, records and so on.

D.) Stairs. There are usually three stairways in a linear building, two as near the ends as possible, used almost exclusively as fire escapes and central stair used both as a fire escape and as interstory means of communication.

E.) Ramps. They are regarded as dangerous because the risk of losing control while directing a wheel stretcher or cart downward.

4. Administration. There are two major divisions

of administration: medical and non-medical.

- Medical.

4.1. Medical record room. The medical record room should be accessible from the admitting department and the out-patient department. Space should be available in the record room for completely medical record and for reviewing records.

- Non-medical.

4.2. Main public entrance and lobby areas. The main lobby of the hospital is used primarily to accommodate patients, members of their families and friends. The main lobby area is a composite of the following four subareas 1.) main public entrance and entry 2.) information center 3.) lounge waiting 4.) public toilets. The main public entrance should be conveniently near the parking area.

4.3. Admitting department. The primary function of the admitting department is to admit patients to the hospital. It should be the same level as the hospital's main entrance and easily accessible to it and should be located to serve all patient admissions to the hospital - inpatient, out-patient, and emergency.

This area consists of 1.) admission patients' waiting area 2.) admitting reception desk area 3.) admissions work area 4.) wheelchair alcove.

4.4. Business area. This area is the composite of the following subareas 1.) cashier' work area 2.) administrative's office and administrative assistant's office

- 4.) general accounting clerical work area
- 5.) conference room
- 6.) mail handling area.

5. Grounds and parking. A hospital should be planned to a compact pattern for ease of movement of patients, staff, visitors, supplies, and intercommunication. But we have to consider the following stand out.

1. There should be room for parking of cars.
2. There should be an expanse of ground attractively landscaped.
3. Hospitals have an unpredictable way of growing, there are demands for ground space for future medical practice, population growth.
4. We must not ignore the well-worn admonition not to build a hospital in a negative environment.

One of the most ground-space-consuming elements in in hospital is parking. The parking space is for staff cars, personnel cars in the visiting public. Esthetic parking is appreciated. People generally assume that a parking lot has to be a flat surface. It requires space to provide generous strips of ground between rows of cars, to plant with grass, hedges and trees and has lighting poles for night lighting. The amount of parking required varies with the kind of hospital and nature of public transportation.

## ENVIRONMENTAL TECHNOLOGY

1. Light and colour. Light and colour relate to a person's feeling of well-being. They are psychologic and esthetic facts of life. They are also involved with optics, ophthalmology, engineering, economics and with emotional and physical health.

Light. Hospitals are complex inconstant entities, and opportunities for an arranging proper light to respond to these complexities is the task of hospital lighting. If a space in the hospital, or anywhere else obtains its daylight from the skylight or a clerestory then it would be desirable to arrange, in the evening or on dull days, to have the necessary artificial light emanate from the same location. In this way, shadows are not reversed with the shifting from light source to light source and a calm atmosphere is preserved.

With the development of fluorescent lighting, more efficient as well as more pleasant types of illumination will become available for hospitals. In nursing unit, whenever possible the source of light should be from behind the patient, and the rays deflected so that light will not glare into the eyes of any other patients. In operating room, the light over the operating tables is shadowless pinpoint of lighting of high intensity.

Colour. It is desirable to design or use the different colours in the hospital, for pediatric service, it should have an expression to amuse the children or in the lobby to make an impression on the public or in the operating room, green which is complementary to red, present a restful background. In the patient's room, the walls and ceilings in a neutralized white



perhaps leaving one wall, usually the partitions against which the head of the bed rest, in some neutralized bright primary colour.

2. Air conditioning. Hospital planning in tropical zone is ill suited to air conditioning, and it is usual to restrict it to the surgical, radiology and laboratories, leaving wards to be naturally ventilated and protected only from fly-borne disease by mosquito screening with the need for correct orientation to catch prevailing breezes, avoid low angle sun and high angle glare. Anyway, individual wall air conditioning units are used in all the single rooms. Because of high expenses, it can not be installed in every rooms and also that some patients do not like to stay in an air conditioned rooms. In the single room patient who can afford to pay the extra fee for air conditioned can use the air conditioning unit. Another advantage for individual wall air conditioning unit is that it is easy to control the temperature in each room.

## AREA DISTRIBUTION

## Emergency Service.

- Examination/treatment room	20 sq. meters
- Observation room for 6 beds	45 sq. meters
- Resuscitation room for 1 bed	12 sq. meters

## Out-patient Service.

- General examination room	7.5 sq.meters
- Special examination room	7.5 sq.meters

## Laboratories.

- Module for technical area	20 sq. meters
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## Radiology.

- X-ray room	25 sq. meters
- Cobalt 60 room	25 sq. meters
- Isotope ( Scanning room and laboratory )	42 sq. meters

## Surgical and Obstetrical.

- General operating room	34 sq. meters
- Cystoscopic surgical	24 sq. meters
- Delivery room	28 sq. meters
- Labor room	7.5 sq.meters

## Patient Quarters.

- Single-bed room	10 sq. meters
- Mulibed room	8 sq. meters
- Intensive care room	12 sq. meters
- Nursery for each regular bassinet	2.5 sq.meters
isolation bassinet	4 sq. meters
- nurses' station	18 sq. meters

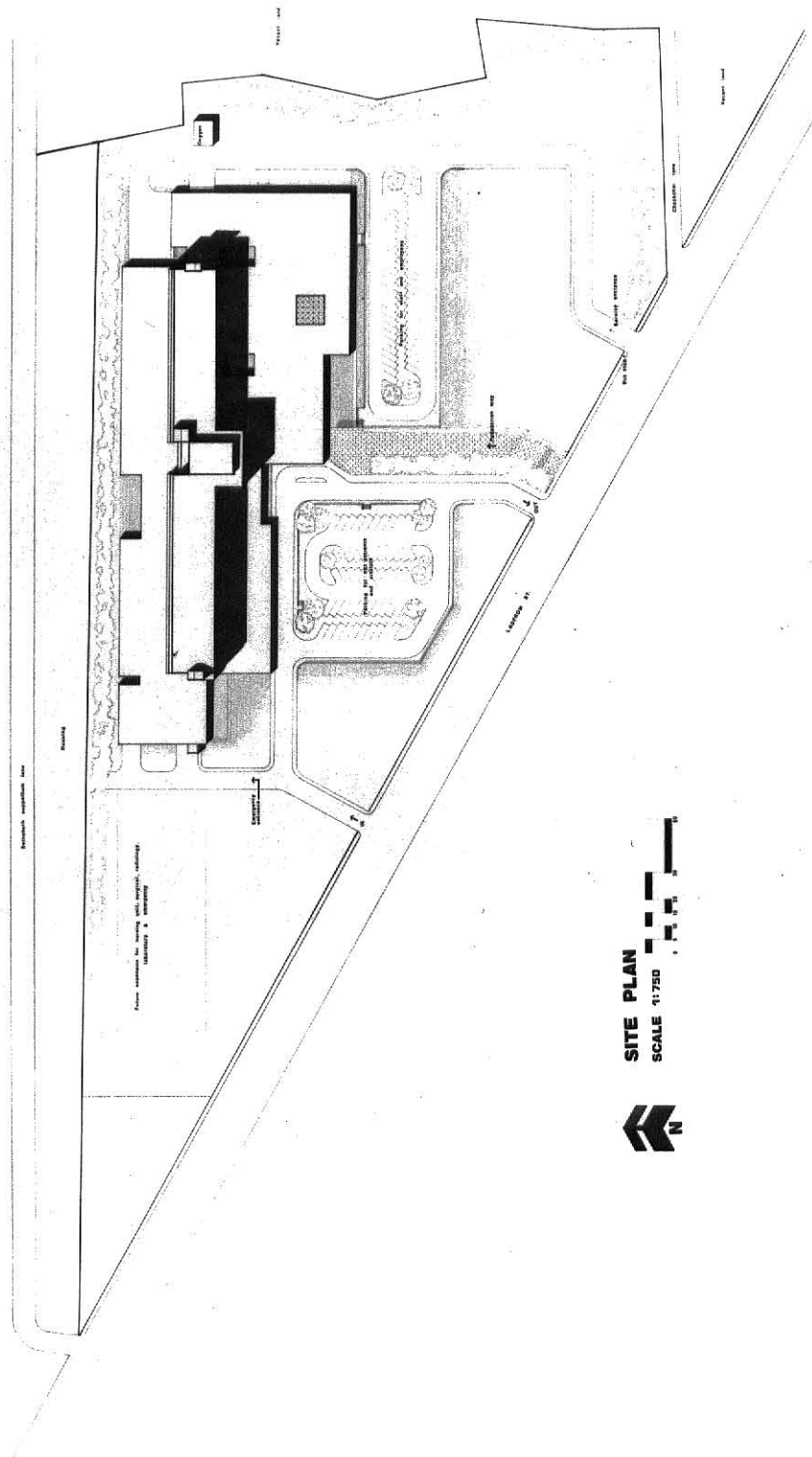
## Services.

- Kitchen - per bed	1.85	sq. meters
- Dinning - per person	1.39	sq. meters

## Administration.

- Entrance and lobby	153	sq. meters
- Admission department	72	sq. meters
- Business area	110	sq. meters

## PRESENTATION



# A SUBURBAN GENERAL HOSPITAL

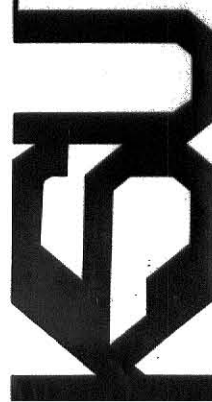
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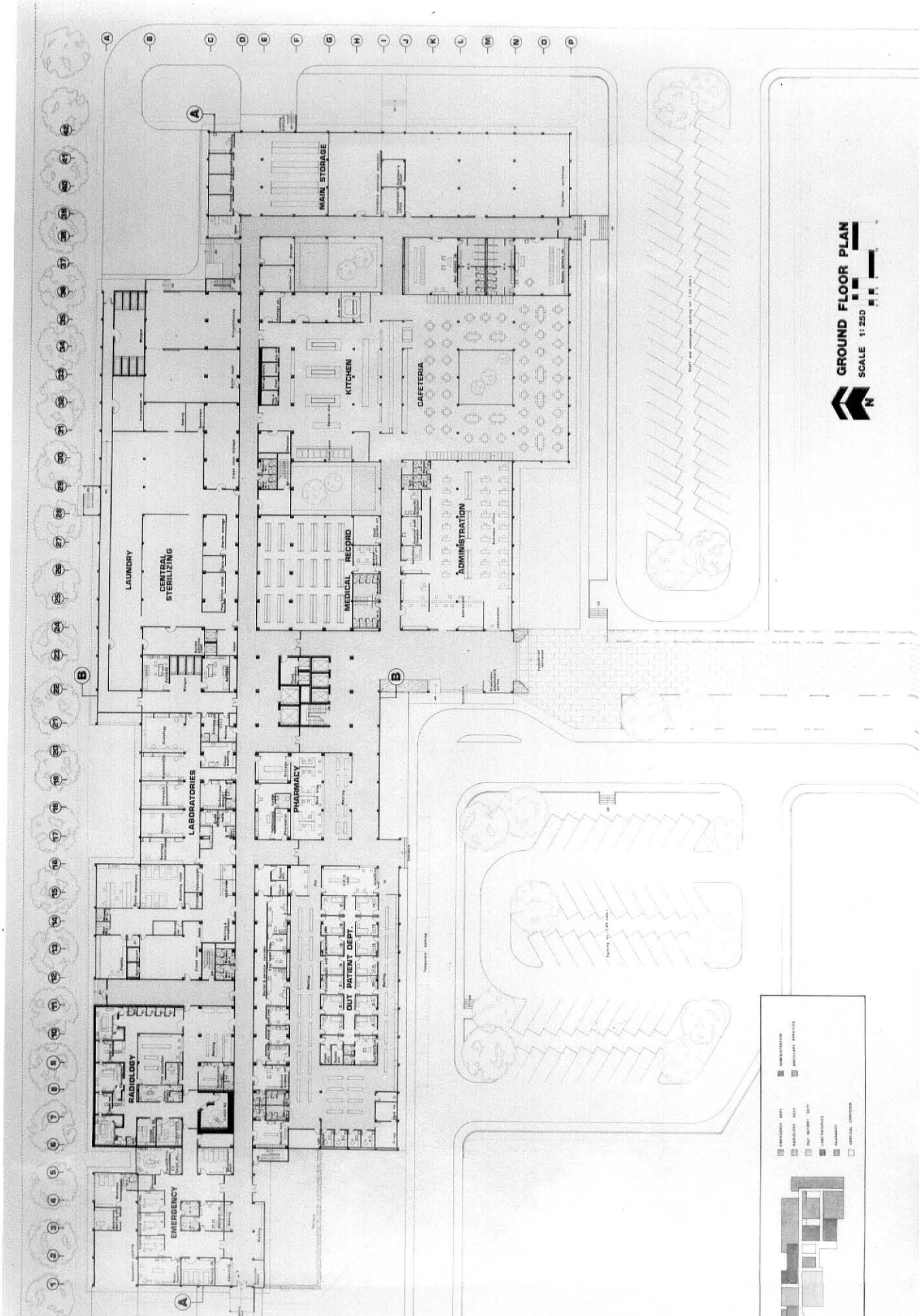
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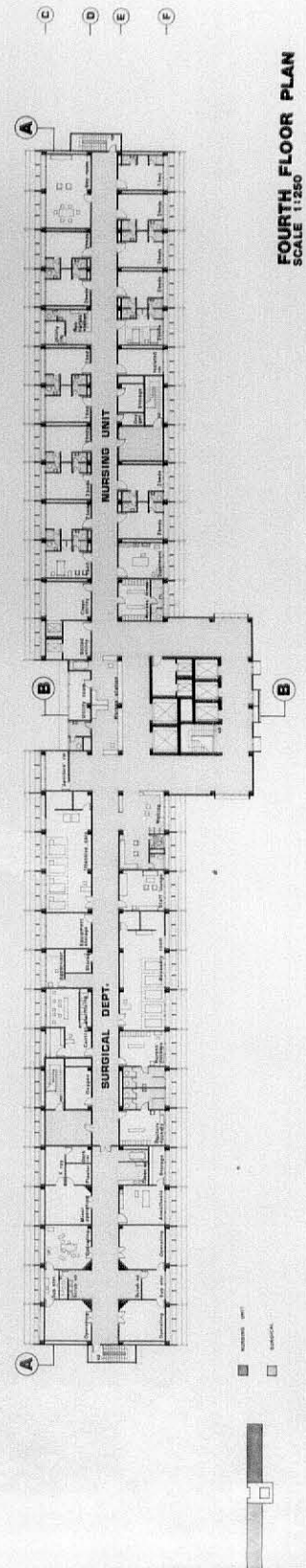
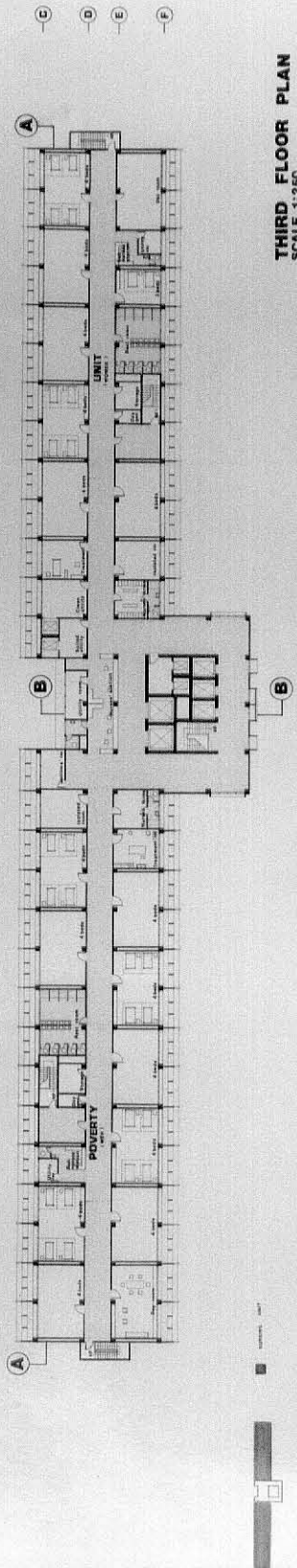
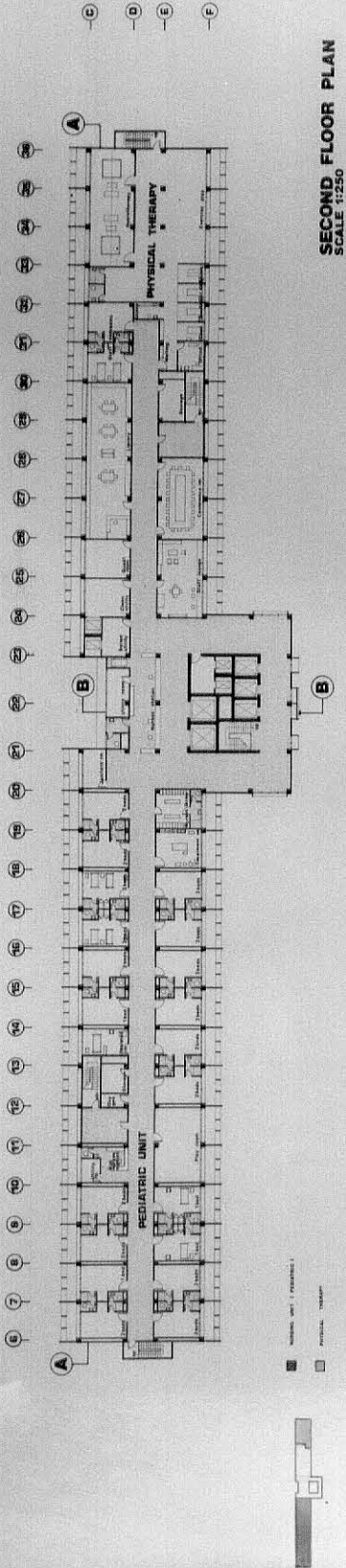


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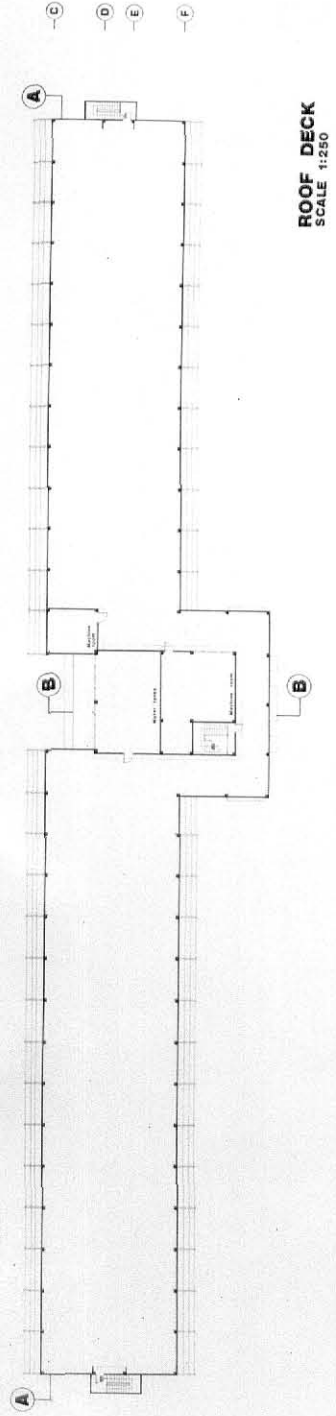
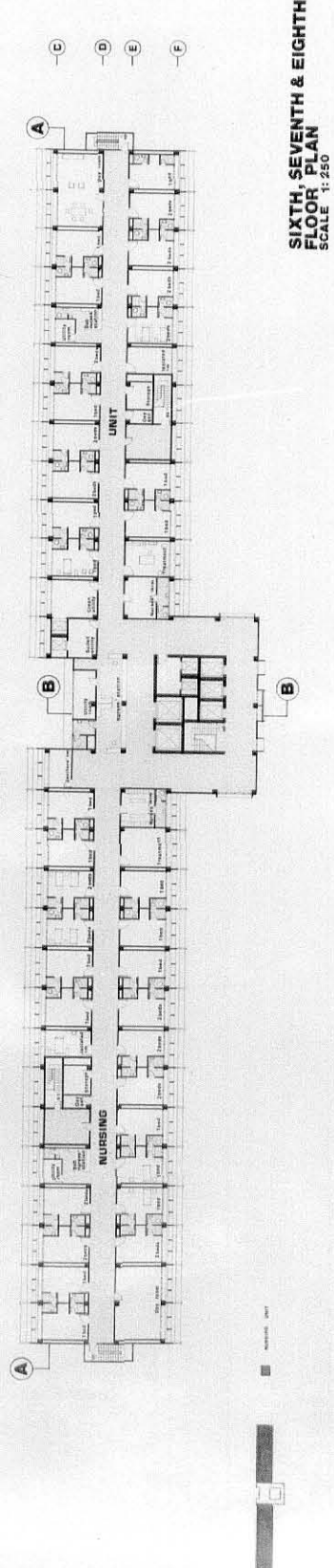
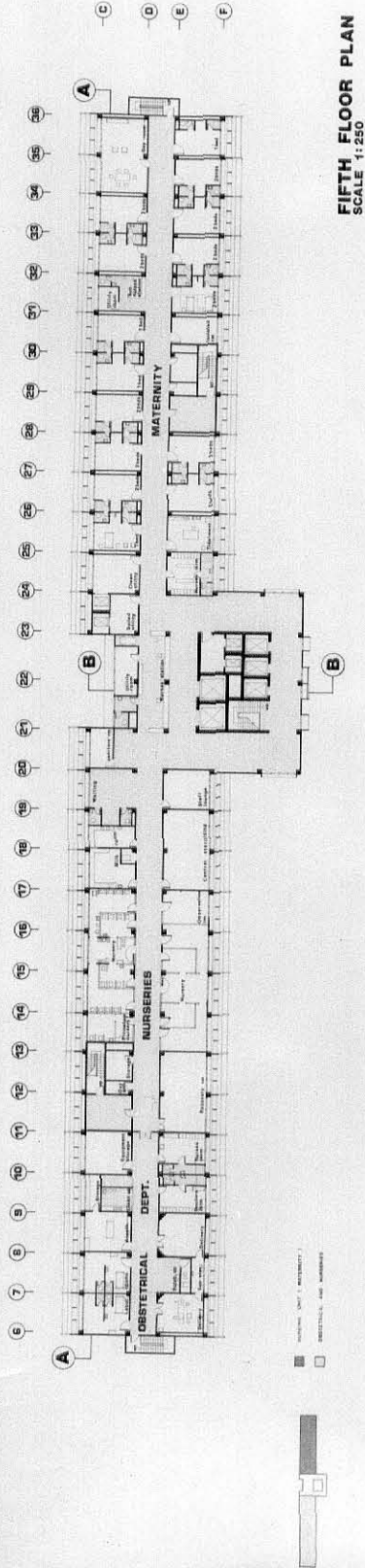
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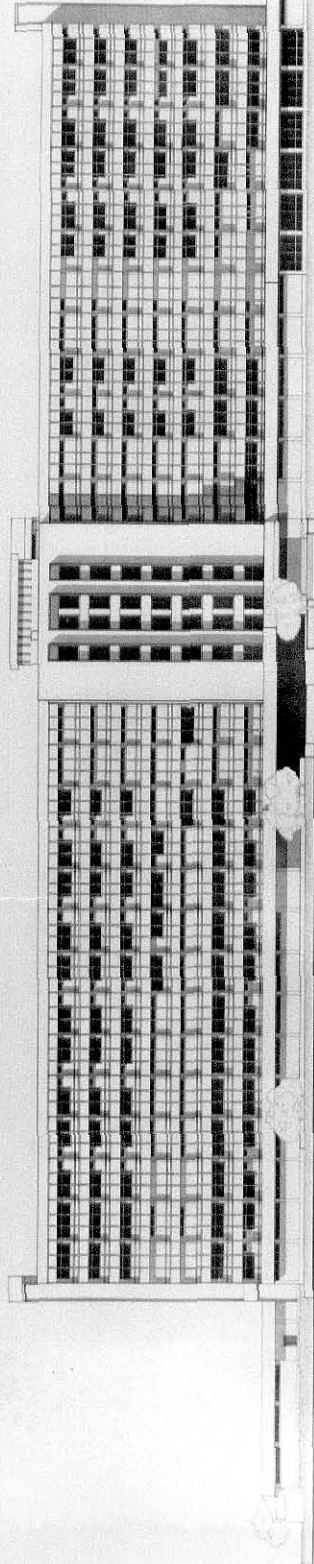
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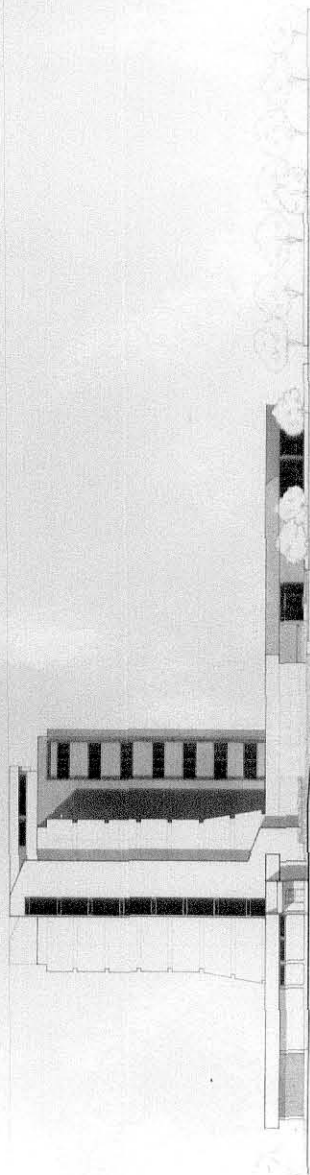
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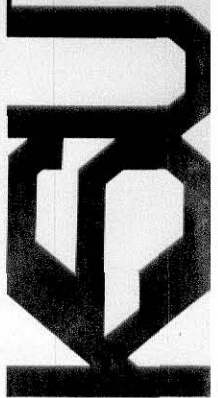




**SOUTH ELEVATION**  
SCALE 1:250



**WEST ELEVATION**  
SCALE 1:250



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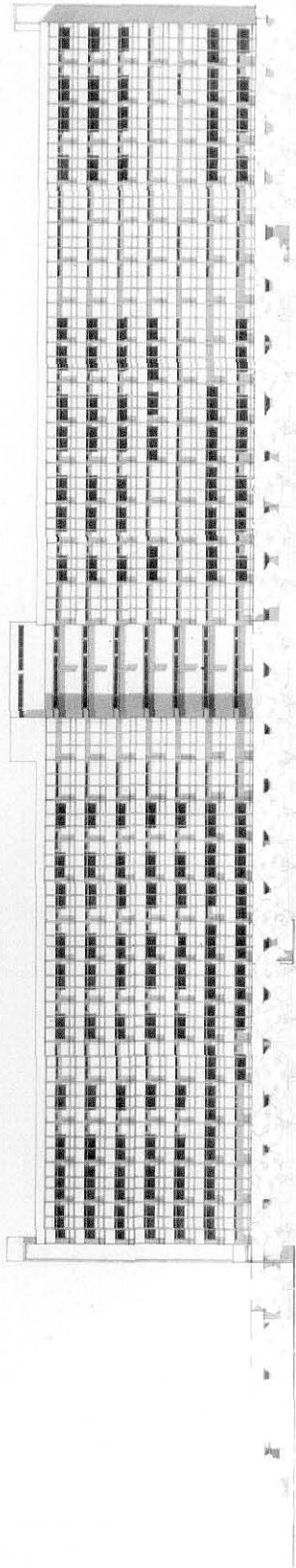
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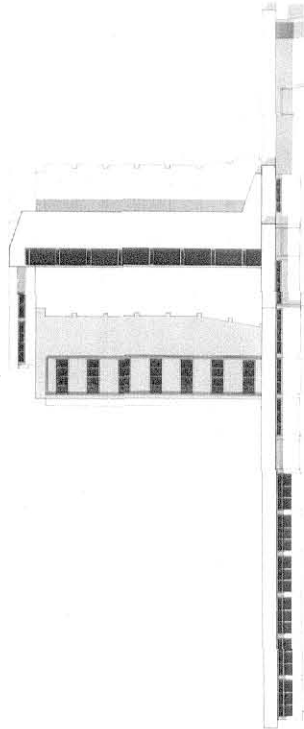
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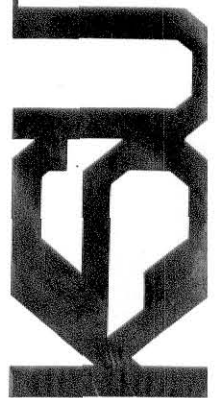
8



**NORTH ELEVATION**  
SCALE 1:250



**EAST ELEVATION**  
SCALE 1:250



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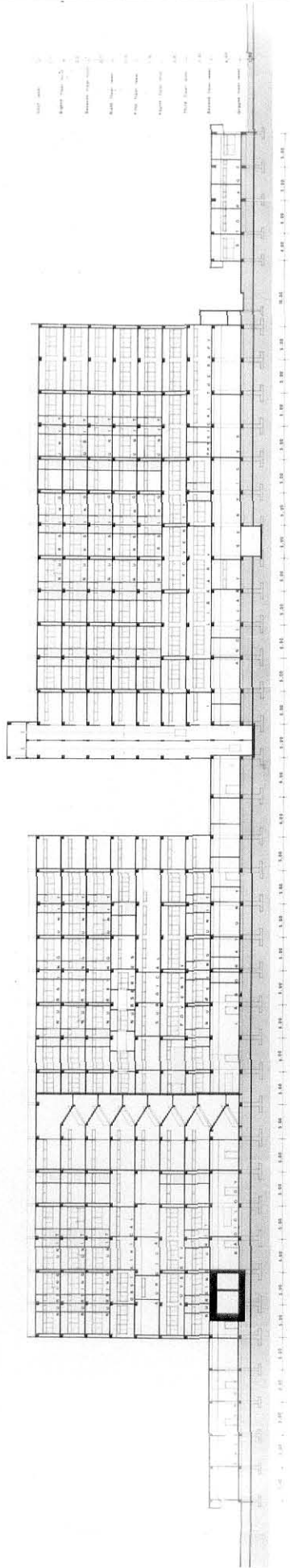
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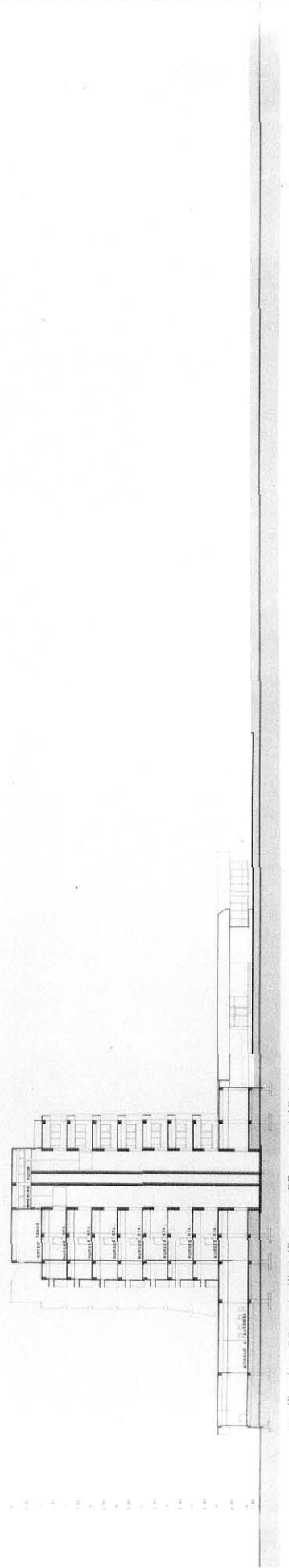
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SECTION A-A  
SCALE 1:250



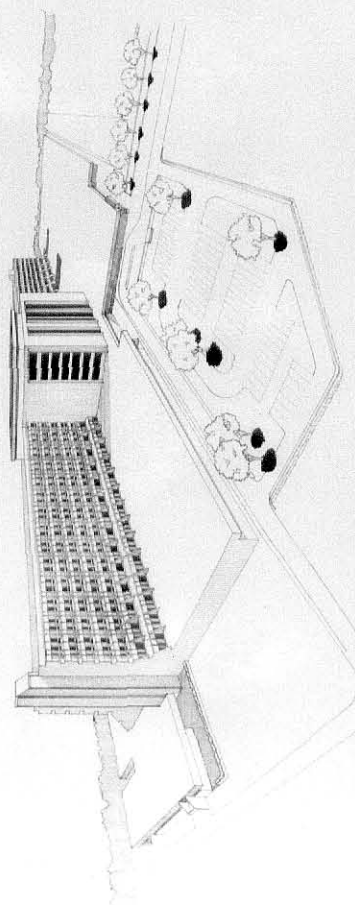
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PERSPECTIVE



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## ACKNOWLEDGEMENT

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by

TEEKATAS SARASALIN

B.S. Arch., Mapua Institute of Technology, 1975

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AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF ARCHITECTURE

Department of Architecture

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1977



## ABSTRACT

One of the main problems faced by the government of Thailand is health care service. In urban areas, there are many hospitals. However, in the suburbs of Bangkok-Thonburi Metropolitan where the population is growing rapidly, there are insufficient in numbers to serve the people. An additional suburban hospital, which now is in the consideration of the government is foreseeable needs. The ministry of Health has projected the need to build the hospitals in the four suburban areas around the Bangkok-Thonburi Metropolitan area.

The proposed suburban hospital is not only improving the problem of the ratio of beds per patients in the country, especially in this suburb, but also keeping the people in the general area from going to the hospitals in the city core which are already overcrowded. Most people in the suburbs are poor. There are existing private hospitals which have few available beds but are beyond the reach of the poor. Governmental hospitals provide service free-of-charge.

The design is based on the natural and social environments as well as functional aspects. These are exemplified by the provision of overhangs and sunshades to prevent the suns rays and rain from entering the building, the provision of a poverty nursing unit for poor patients living in the area, and the location of related departments in close proximity to each other. The aesthetics of the building reflect the characteristics of a hospital in a Tropical climate and its efficiency of design lowers the cost of the building which is an important factor in

a developing country. This design is an attempt to solve the problem of health care in an efficient way, that takes into consideration the ever changing developments in medicine and the peculiar needs of the people of Thailand.