2-6 Outline of Nakhon Si Thammarat Hospital

2-6-1 Conditions of the Site

The ground of the existing hospital property shapes like a trapezoid with the approximate measurement of 750 m lengthwise east-to-west, 200 m side on west end and 300 m on east end. 200 m side on west end is facing the highway main road and 300 m side is facing a farm land vehicle road which is expected to be a future by-pass of highways. The area is almost half of the property in which the existing roads line up from west to east is heaped up, and paddy fields and woods are left in the eastern area of the site. The difference in height between the heaped-up area and the paddy fields is 1.5∿2.0 m.

The area between the existing hospital buildings and a river in the north part of the precinct is to be secured as the construction site for the new hospital. At present, some of this area is used for the residences of hospital workers, whereas other sections remaining vacant lots, some of which is turfed.

The roads between existing hospital buildings are paved, whereas those in the project area are not paved.

As for the difference in height within the project area, the site slopes down toward the river. The sunk area in the maximum height is 1.5 m lower than the average level in several places. (Fig. 2-6-1)

In the rainy season, the site is flooded by the river to a depth of 50 cm, 1.0 m in some places, two or three times a year.

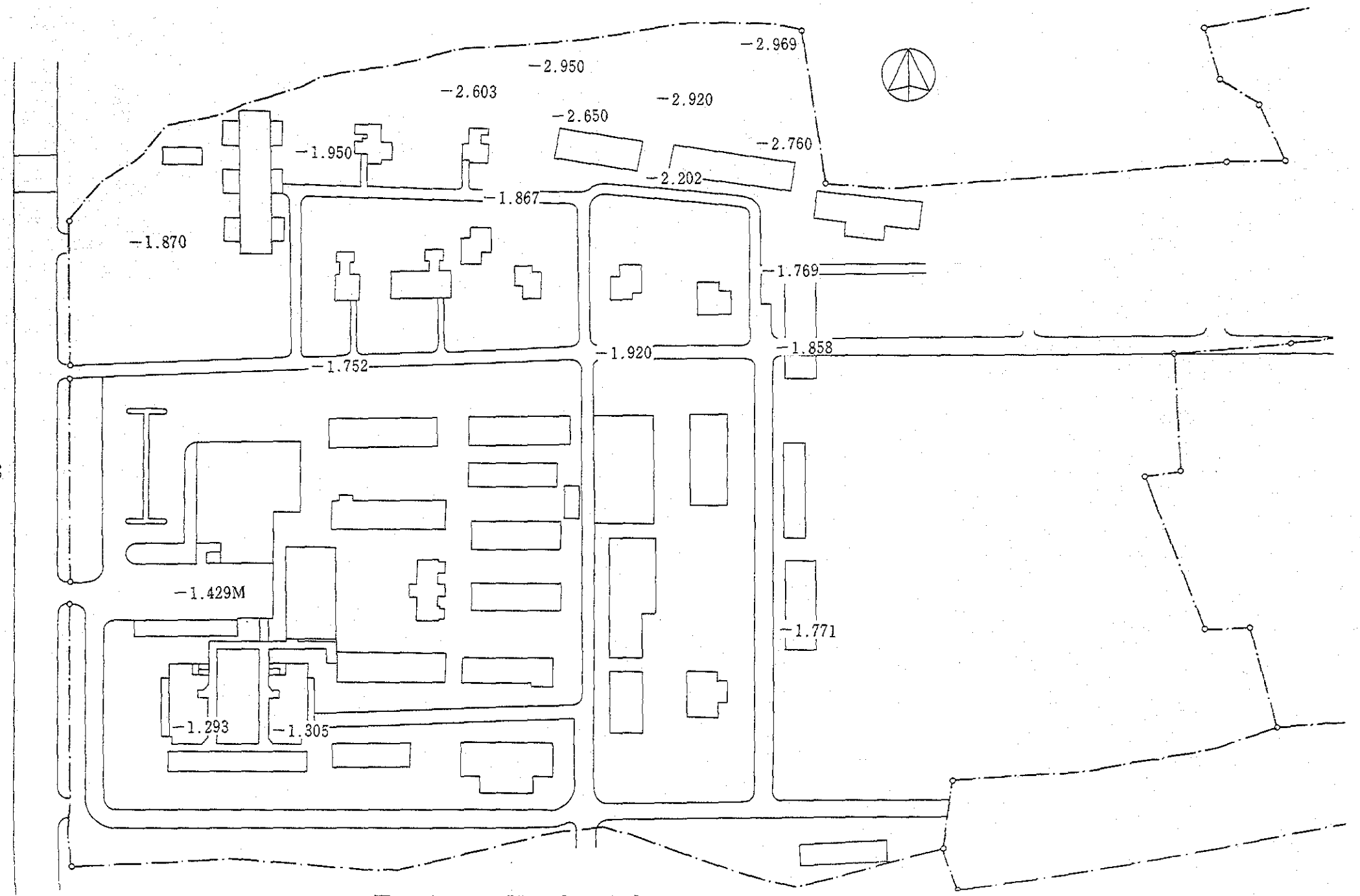


Fig. 2-6-1 Height of the site

2-6-2 Outline of Existing Buildings

The existing Nakhon Si Thammarat Hospital has 334 beds, including 100 beds for internal medicine, 100 for surgery, 80 for gynecology, 54 beds for pediatrics and 25 for ENT. A ward for 25 beds is under construction. Plans are also afoot for the construction of a 100-bed ward in the future.

The buildings of this hospital are arranged as indicated in Fig. 2-6-2. Buildings are connected by a concrete corridor.

(1) The OPD consists of a two-storied reinforced concrete building with a total floor area of 2,300 m^2. The department, of internal medicine, gynecology and obsterics, dentist, pediatrics and surgery (a emergency department is to be established in the near future) are located on the first floor, while the second floor is used for the administration department (office of the hospital director, conference room, library and administrative office). The office of the hospital director and the conference room are air-conditioned. A waiting hall is located at the entrance of the first floor.

(2) An operation room and an X-ray room are housed in a one-storied reinforced concrete building located between the OPD and the wards. It has a total floor area of about 470 m^2. An additionally constructed rest room for physicians is located in the western section.

As stated before, the wards are divided for the departments of surgery, internal medicine, pediatrics, gynecology and obsterics. Each room is big enough to accommodate 50∿60 beds, and temporary beds are prepared on the corridors. The southern section of the internal medicine ward has space for extra beds. A ward with private rooms is under construction.

(3) The central laboratory is two-storied reinforced concrete building with a total floor area of about 800 m^2. The central supply room for sterilization and the rehabilitation department are located on the first floor, whereas a blood bank is located on the second floor. The laboratory has a shed of experiment animals.

(4) The laundry and the cafeteria for doctor, nurses and staffs are located west to the wards. They are housed in one-story buildings. The columns are reinforced concrete and the roofs are wooden trusses.

The hospital kitchen in capable of supply 1,500 meals, or food enough for 500 persons each meal three times a day. However, the kitchen facilities are not worthy of paticularity distinguished and most of the operation is done manually.

Propane gas is used for the fuel of the hospital kitchen.

For meal supply to the wards, a variation of the central meal supply system is adopted (food is dished out at each ward, and large food containers are carried to each ward by wagon).

Like the kitchen, every laundry work is done manually with the exception of dehydration and sterilization. The laundry is narrow space and is not big enough to process the present requirement. The laundry is done at a rate of 2,500 pieces/day. As the requirement is estimated at 4,000~ 5,000 pieces/day, restrictions seem to be provided against the laundry at present.

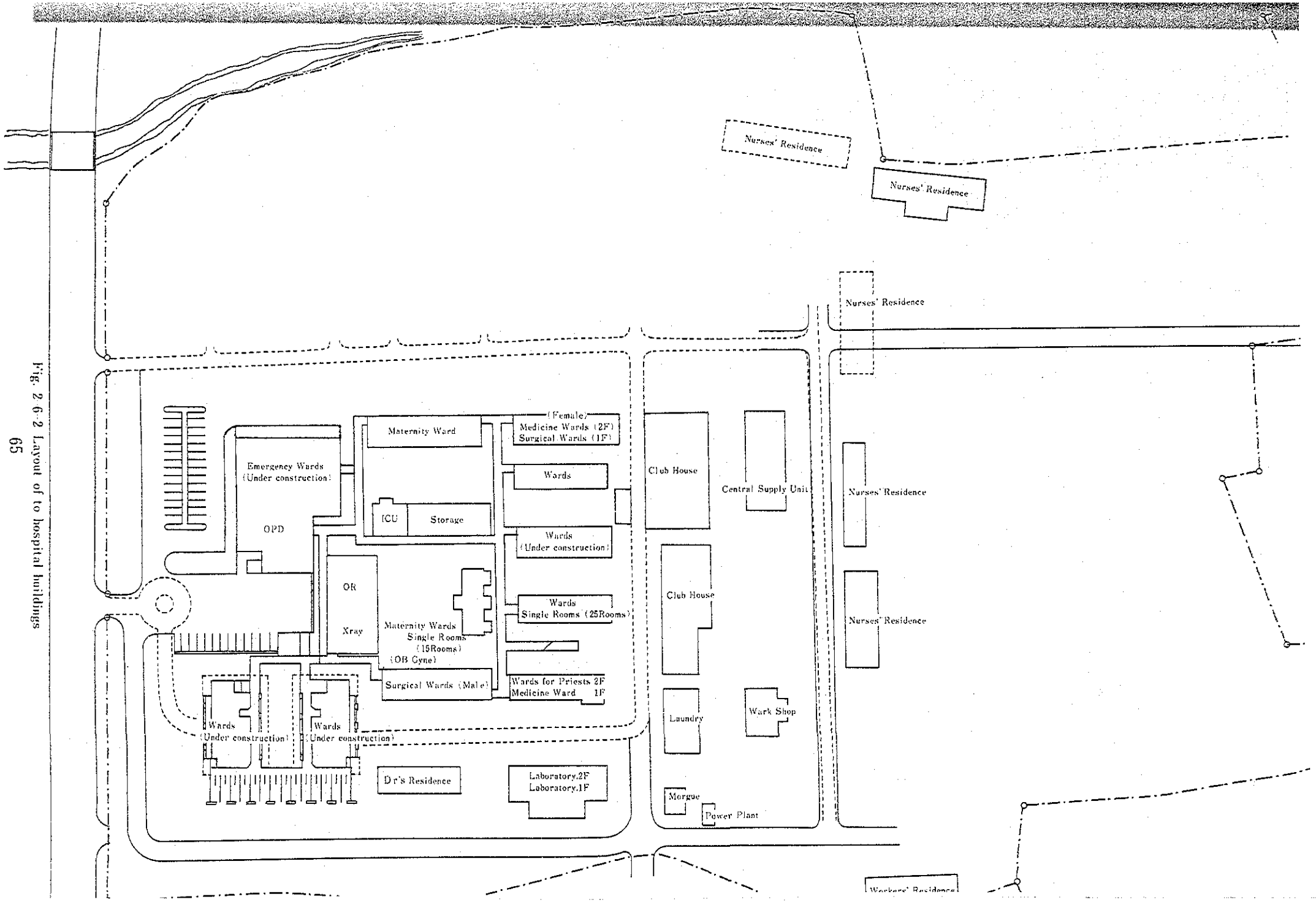
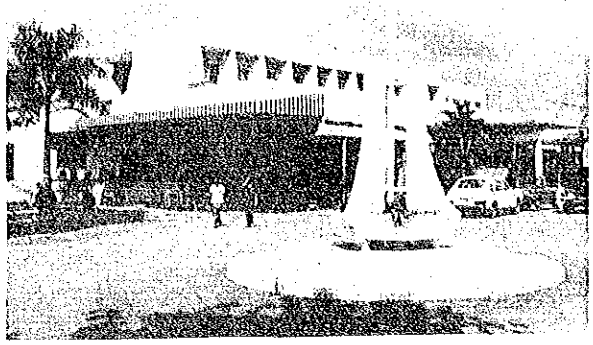
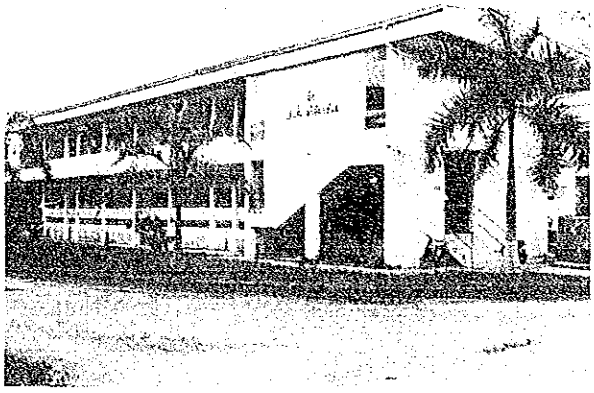


Fig. 2 6-2 Layout of to hospital buildings

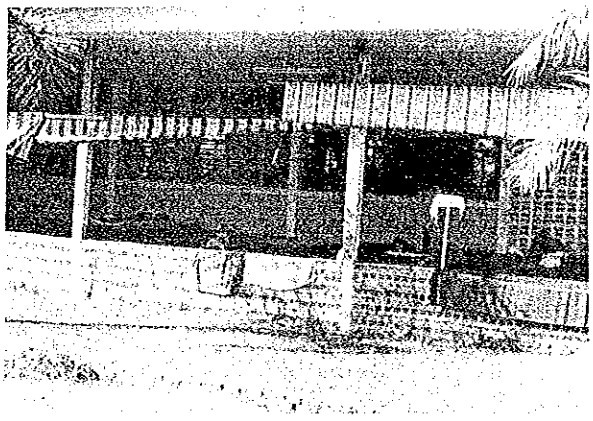
NAKHON SI THAMMARAT
Provincial Hospital



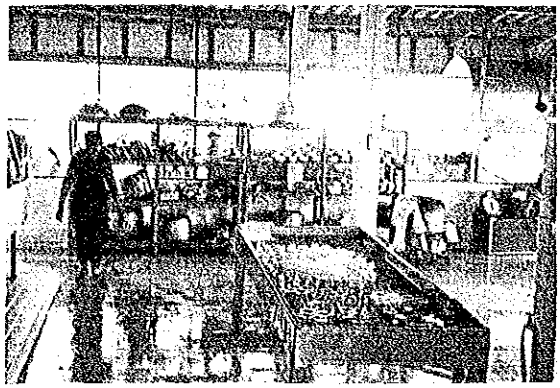
O.P.D.



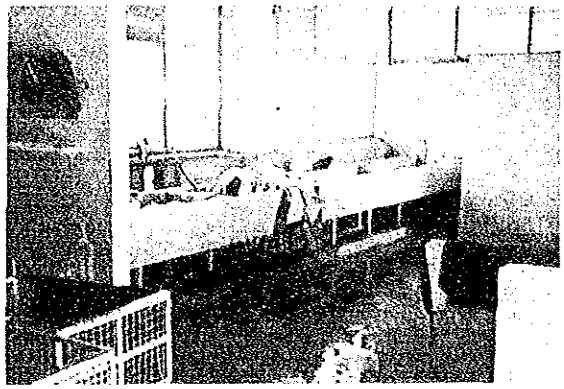
Ward



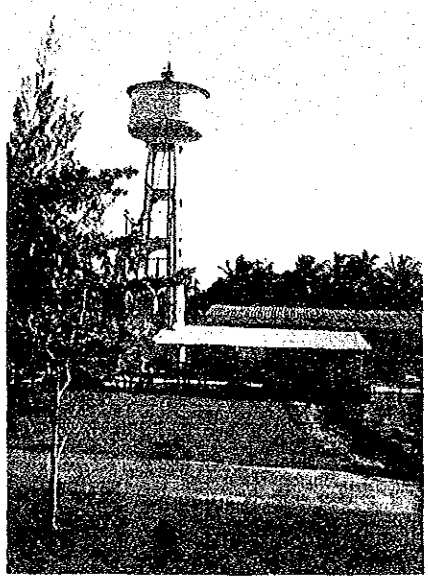
Temporary ward



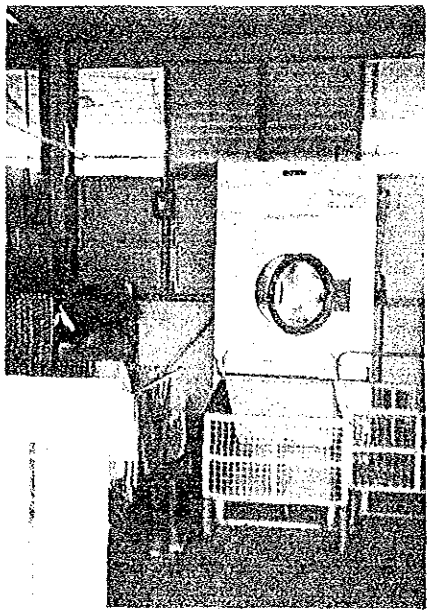
Kitchen



Laundry



Elevated
water tank



Hydro extractor

2-6-3 Medical Facilities

(1) Operation rooms:

There are four operation rooms at present. Each operation room has an old operating table and an anesthetic meter. There also are one electric scalpel, eight ICU units, three heart monitors and one Bird's respiratory. For the air-conditioning of the operation rooms, only air-cooling machines of the window type are available.

(2) X-ray room:

The X-ray room is located in the same building as the operation rooms. Only one 50 MEA, produced by Toshiba six years ago, is available for the purpose of radiography and fluoroscopy and other X-ray machine, produced by PIKER 20 years ago, is unusable due to some mishaps. In addition, there are one X-ray machine for dentist and one portable X-ray 30MA machine but they appear to be unusable. In the film developing process, washing is done manually not automatically. Some 40 radiographs are taken a day. Therefore, what is mostly done is radiography and fluoroscopy is seldom done. The X-ray room is neither isolated with thick reinforced concrete walls nor air-conditioned.

(3) Central Laboratory:

The central laboratory is located on the second floor of the same building as the central supply room for sterilization. With three microscopes (two for the calculation of blood cells and one for the observation of bacteria), blood tests, biochemical tests and microbiological tests are performed. Next to the central laboratory there are a blood transfusion department and a serum test room but their facilities are extremely insufficient for this hospital's scale. A blood bank is required as there appear many cases

with traumata. At present, total blood is collected, but the blood is not thrown away after expiration of the preservation period. A blood cell separator is required.

(4) The central supply room:

The central supply room is equipped with three autoclave (two fueled with propane gas and one with light oil) and three water distillation machine. All these equipment are on the threshold of unserviceability.

(5) Maternity delivery room:

The instruments in the department of obsterics are generally superannuated.

The points of which the study team took note during a observation and inspection tour of the hospital are listed below:

(a) Hospital officials say that there is some shortage of private patient rooms at this hospital, but when the conditions are checked against the present situation of this country, the shortage does not seem to be conspicuous, but there are some points for improvement. For example, no plumbing is available for the supply of oxygen to the rooms of patients with serious diseases. It also has to be put into consideration that no isolated wards are available for patients with contagious diseases.

(b) The number of physicians and nurses is considerably small as against that of patients. The plenishment of medical staffs -- particularly, X-ray technicians and clinical examination technicians -- is just as necessary as that of physicians and nurses.

(c) With respect to medical equipment, the existing equipment for examination and treatment are completely superannuated,

and the years of serviceability has already passed practically for every instrument. Priority should given to their replacement and addition.

2-6-4 Conditions of the Ground

As for the conditions of the ground in the project area, it is discernible according to the data of the Thai Ministry of Public Health on the boring of the site that the conditions of the ground differ to some extent between the section near the river and other sections. (Fig. 2-6-4)

The conditions of the project area appear to be the same as in Boring Data Nos. 1-3 but may be summarized as follows:

To a depth of about 5 m from the ground surface, there is a layer of coarse sand and sandy clay, about 10 in N value, and at a depth of about 6 m, there is a layer of clay, about 20 in N value. The layers are 1.5∿2.0 m in thickness. At depths of 7∿15 m, there is a layer of silty clay, 15∿20 in N value, and at depths of more than 17 m, there is a continuous layer of sandy clay, 40∿50 in N value.

The ground water level is high. The constant water surface is 40 cm lower the ground surface along in places the river and about 60 cm in other places. The boring test in question was conducted toward the end of October or in the middle of the rainy season, and the ground water level is likely to go down in the dry season. It would be reasonable to assume, however, that there is not much difference in fluctuation.

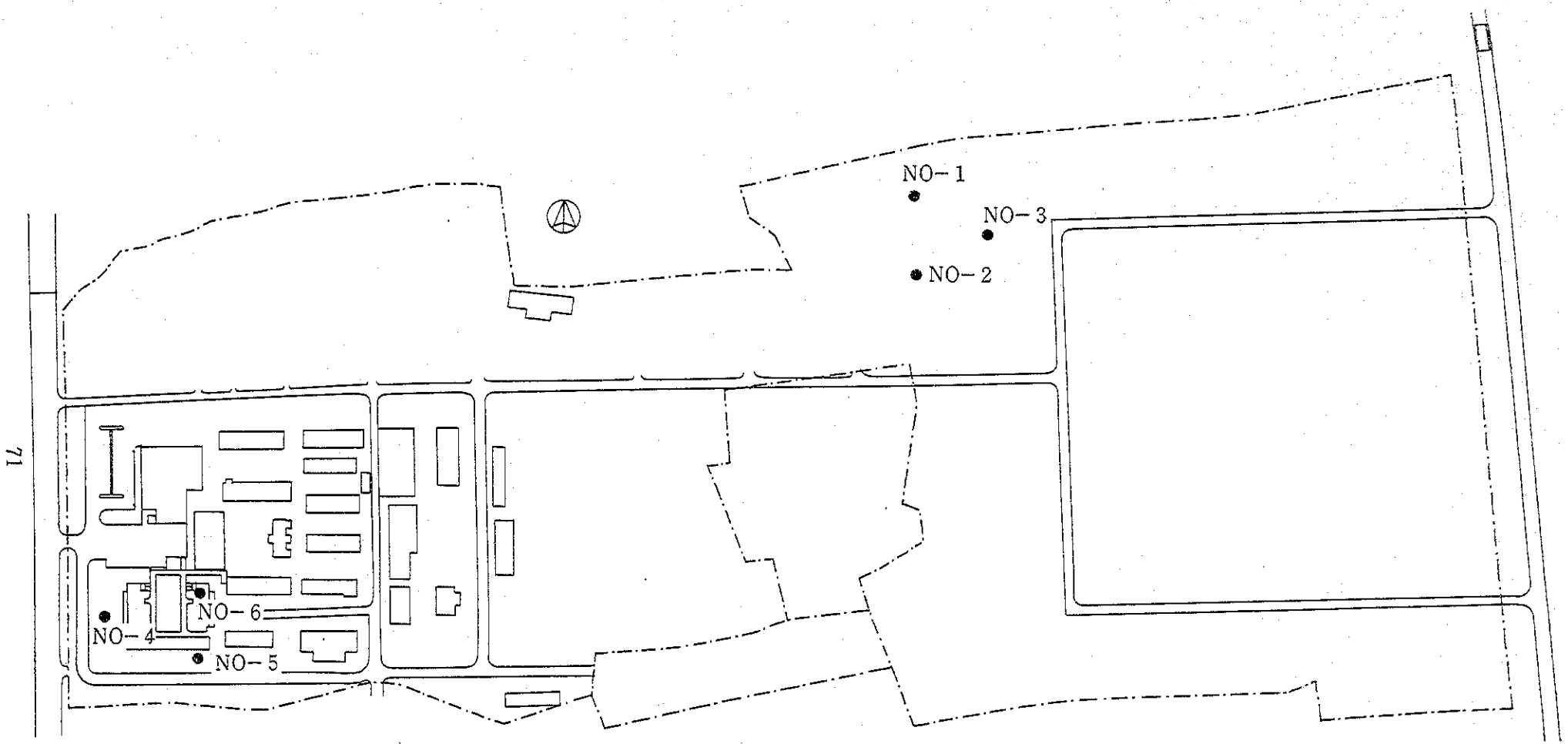
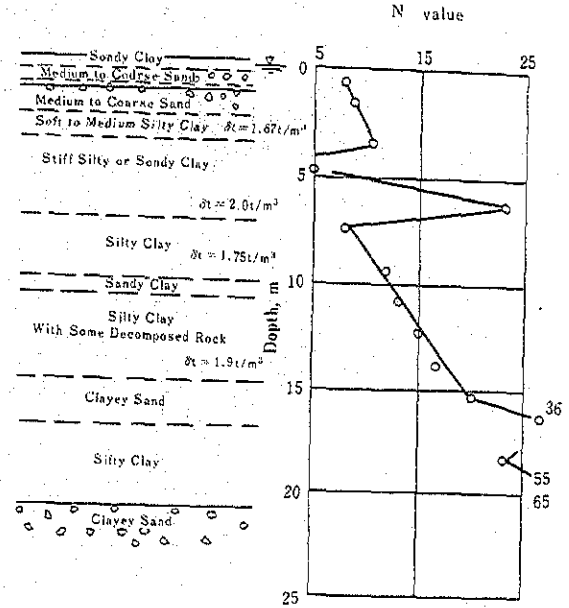
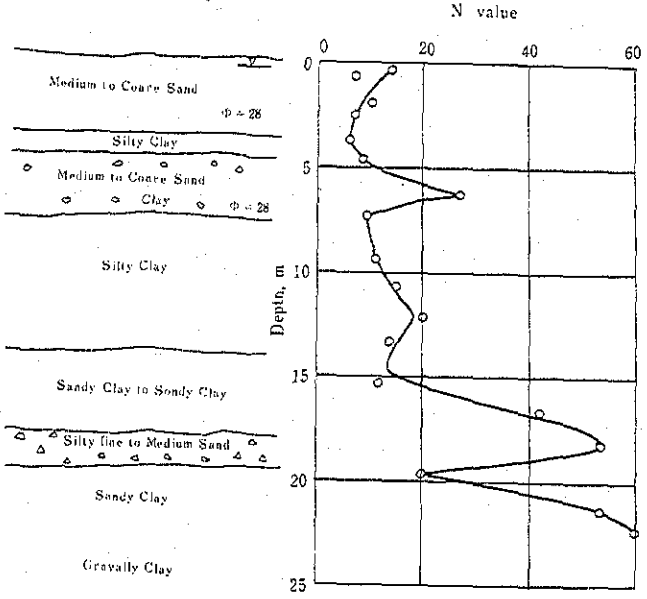


Fig. 2-6-4 Boring Points in the Site

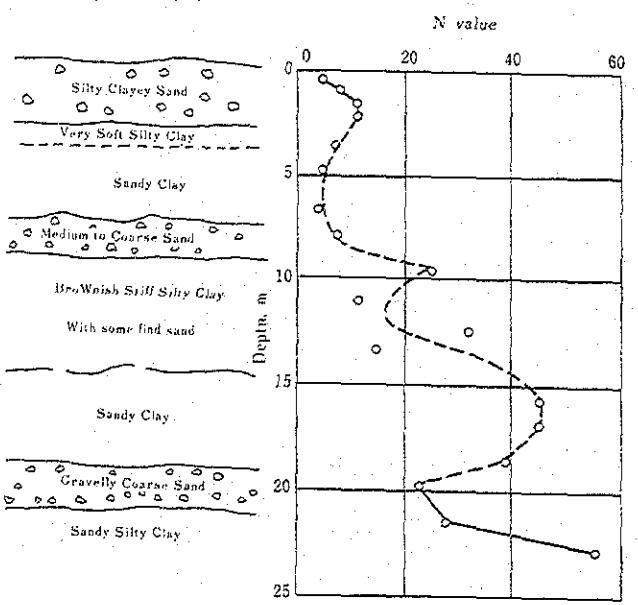
Boring Point No－1



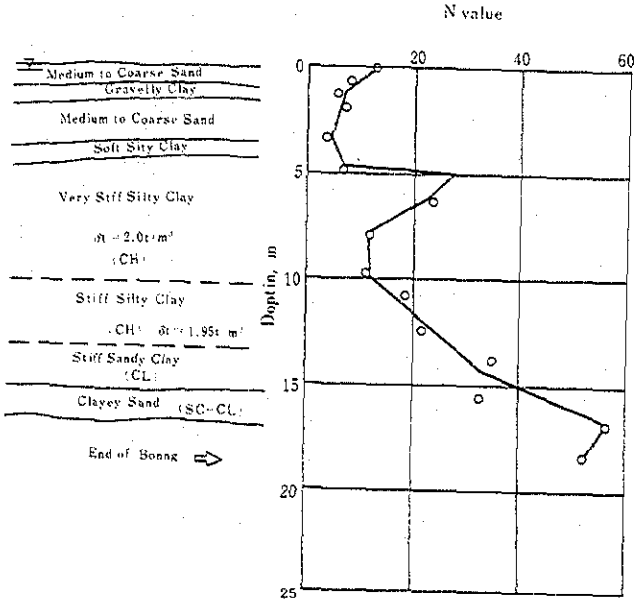
Boring Point NO－3



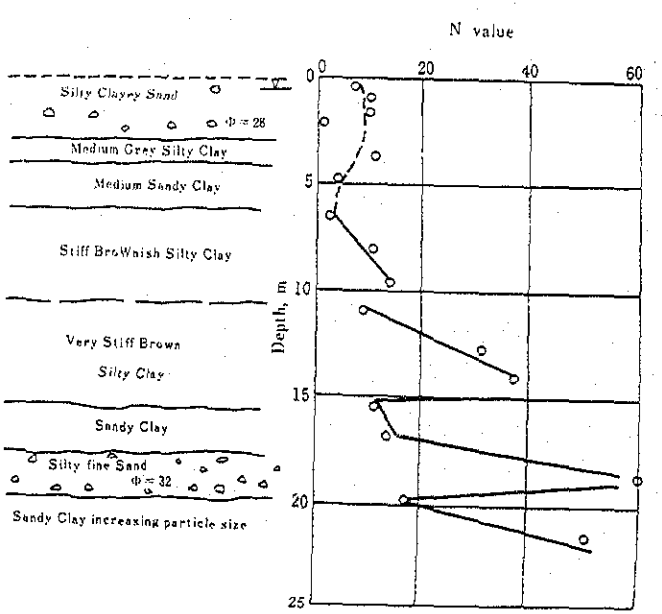
Boring Point NO－5



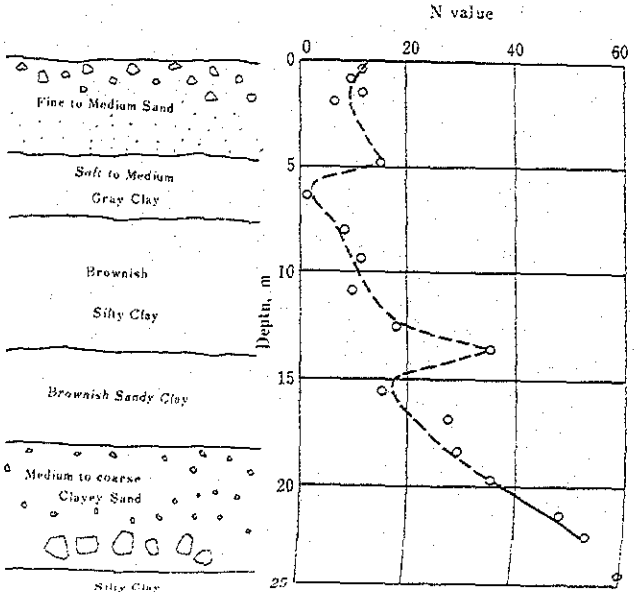
Boring Point No 2



Boring Point NO－4



Boring Point NO－6



2-6-5 Conditions of Basic Facilities

The basic facilities include electric power facilities (including emergency power generating facilities), wells, simple well water purifying facilities, elevated water tanks, city water facilities and outdoor hydrants.

The capacities of well water, city water and electric power are not sufficient at present.

Some of the electric power generation facilities are superannuated.

2-6-5-1 Outline of Each Facility

(1) Electric Supply Facilities

Overhead electric power lines come in along the south borderline of the hospital site. There are two overhead transformers to receive electric supplies. The capacities are 250 KVA and 100 KVA. The primary voltage is 33 KV and the secondary voltage 380/220V with three phases and four lines, and electricity is supplied to each building. The transformer of 100 KVA supplied to the physicians' residences and the dormitory. To back up the electric source, emergency generators are available. Two emergency generators are installed, one for medical care and the other for the physicians' residences. The power distribution line is shown in Fig. 2-6-5-(1).

The specifications of the generator sets are as follows:

Items	Generator No. 1	Generator No. 2
Year installed	1970	1976/7
Capacity	37.5 KVA	125 KVA
Starting	Manual	Batteries
Fuel	Heavy oil	Heavy oil
Fuel consumption	15 ℓ/hr	25 ℓ/hr
Cooling	air	air
Load supply	Physicians' residences	Medical equipment (OPD, X-ray, Lab, OP)
Phase, voltage	3 phases, 4 lines 380/220V	3 phases, 4 lines 400/230 V
Revolution, frequency	1,500 rpm 50 Hz	1,500 rpm 50 Hz

The driving time of emergency generator depends on times of power failures, as it is used at a power failure. Power fialures is very few in this district. The generators are operated for 10 minutes once a week for maintenance. Fuel is readily available. The quantity of its use varies, depending on the frequency of power failures a month. The cost is 5∿6 Baht/ℓ.

The power consumption of the hospital is shown below for a reference purpose.

Electric Consumption of the Hospital and Electric Charges (Actual Values in 1979)

Month	Jan.	Feb.	Mar.	Apr.	May	June
Power consumed (KWH)	38,920	38,610	41,310	No data	35,730	44,775
Electric charge (Baht)	35,661	35,378	37,808		32,786	40,926

Month	July	Aug.	Sept.	Oct.	Nov.	Dec.
Power consumed (KWH)	33,435	42,795	40,500	40,500	36,000	-
Electric charge (Baht)	30,720	39,144	37,079	37,079	33,029	-

Note: The electric charge includes that of the physicians' residences, which account for about 15% of the total hospital's power consumption. Payment is made individually by each residencial watt hour meter.

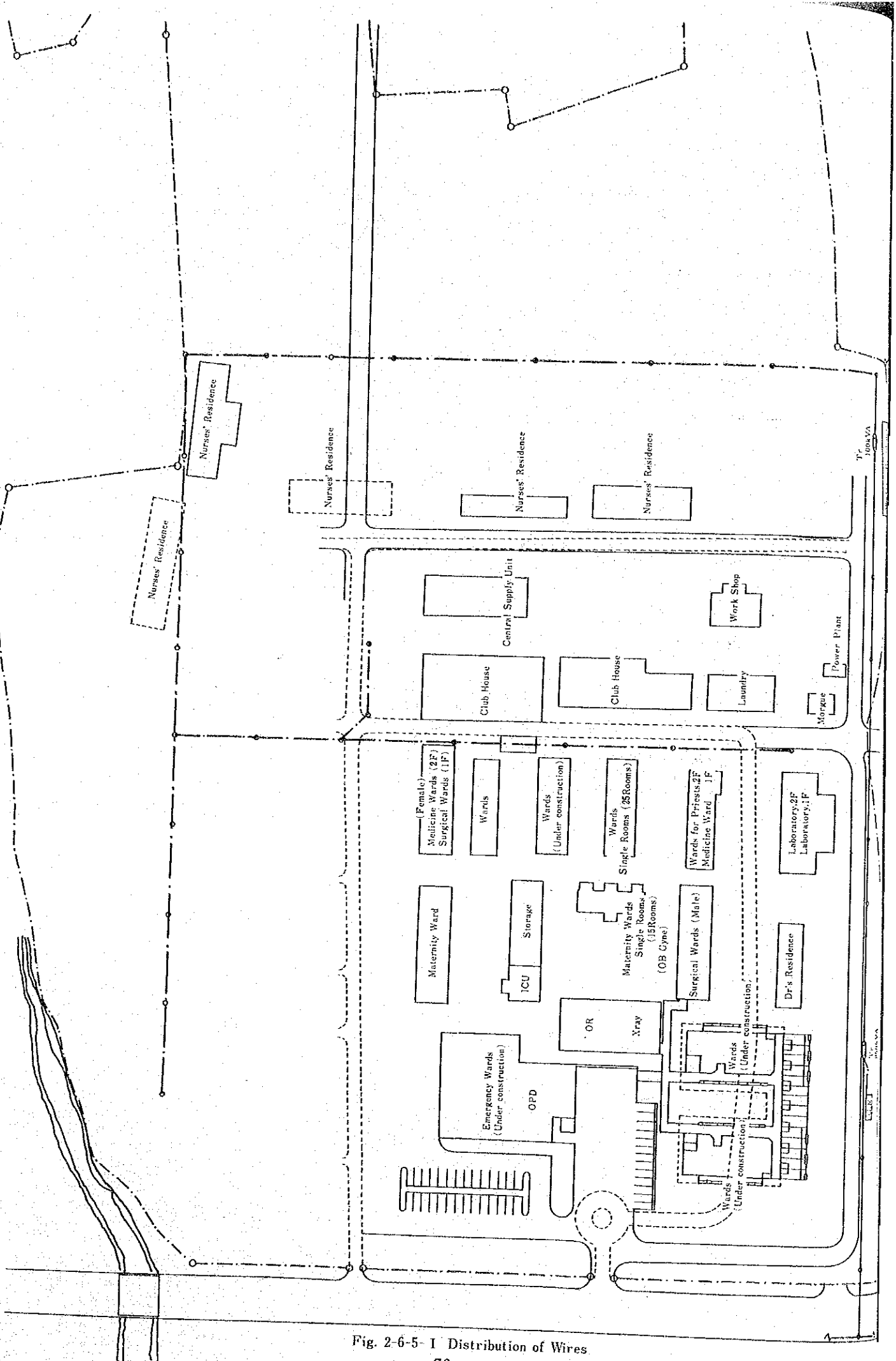
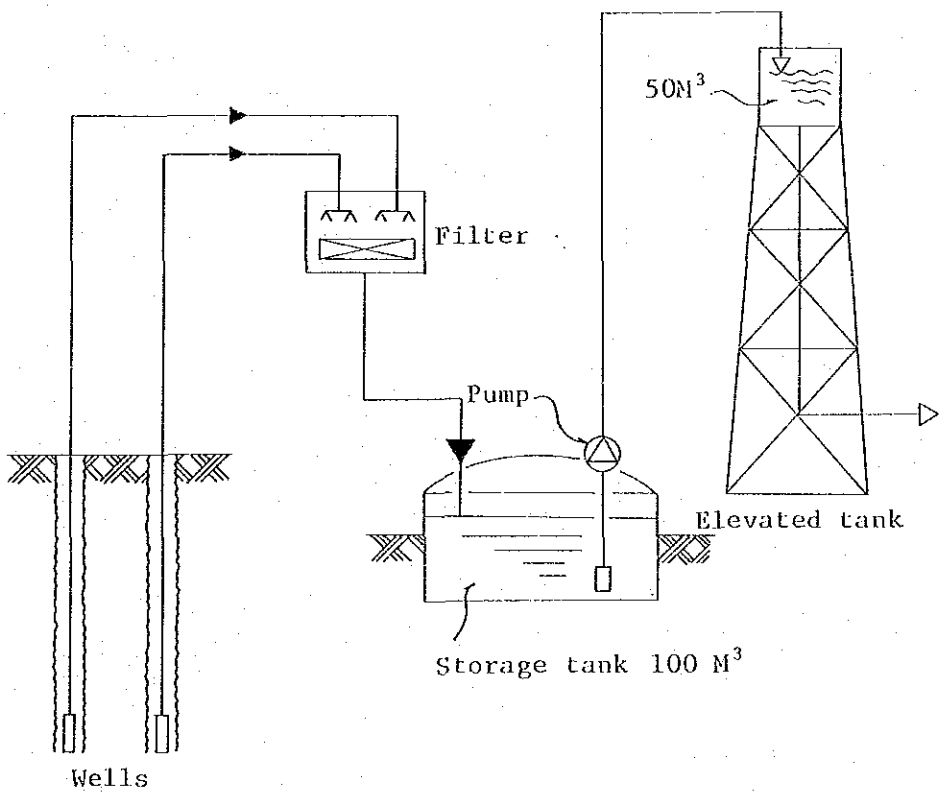


Fig. 2-6-5- I Distribution of Wires

(2) Well Water, City Water and Hydrants

Well and city water are used for water supplies. Qualitatively, well water excels city water. In normal circumstances, well water is used for medical care in most cases, and city water used in the toilets of wards and other places. Arrangements are so made that city water may be put to emergency use, whenever it is impossible to use well water.

There are two wells in the hospital site. As shown in the following figure, water is pumped, oxidized, bleached and filtrated before it is stored in a tank. The water is then pumped into an elevated tank for supply to each building. City water is separately drawn in for supply to each building. Neither well water nor city water alone is sufficient to satisfy the demand of the hospital in terms of capacity, so that both types of water are used at all times.



The specifications of the equipment are as follows:

Wells

Depth:	150 m
Diameter:	3 inches × 2 (Steep pies coated with zinc)
Pump capacity:	15 HP × 1, 10 Hp × 1
Pumping:	20 m^3/hr × 1 (not data available for the other well)

Storage Tank

Capacity:	100 m^3, made of concrete (semi-underground)

Elevated Tank

Structure:	Concrete poles and tank
Capacity:	50 m^3
Height:	About 30 m

City Water

Diameter:	3 inches

Water is supplied to the outdoor hydrants from well water pipes. Three types of pipes are used for the supply of well and city water -- steel coated with zinc, cast iron and vinyl chloride. The distribution of water supply pipes is shown in Fig. 2-6-5-II.

(3) Drainage Facilities

There are two separate drainage systems at the hospital site -- drainage for livelihood waste water and rainwater. U-shaped ditches are prepared around each building and along each road to discharge rainwater into the river.

A septic tank is installed in each building.

Qualitatively, the value of processed water appears to be considerably high value (about 100 in BOD). As no sterlizing equipment is installed, there is a need to pay need to the processing of waste water.

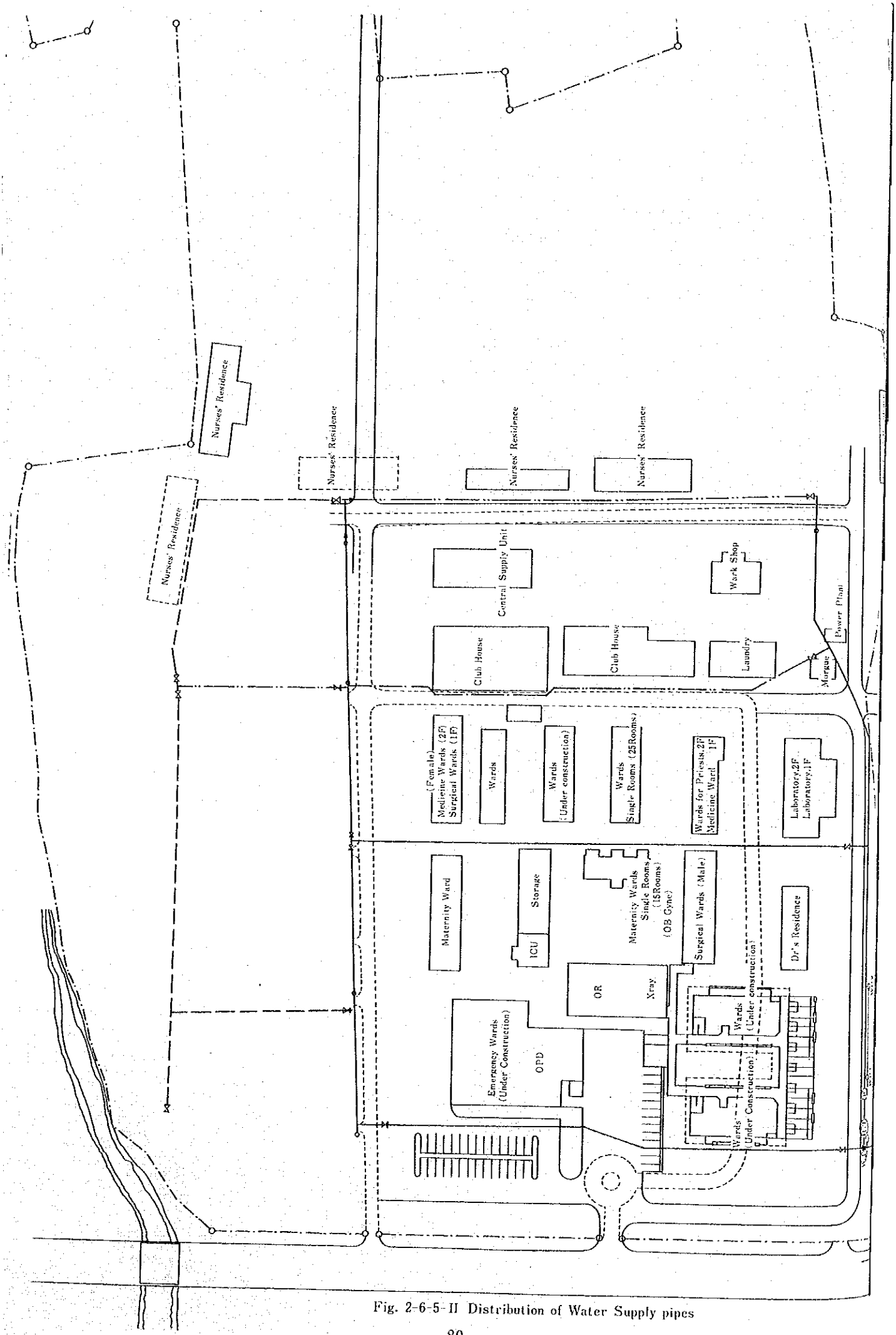
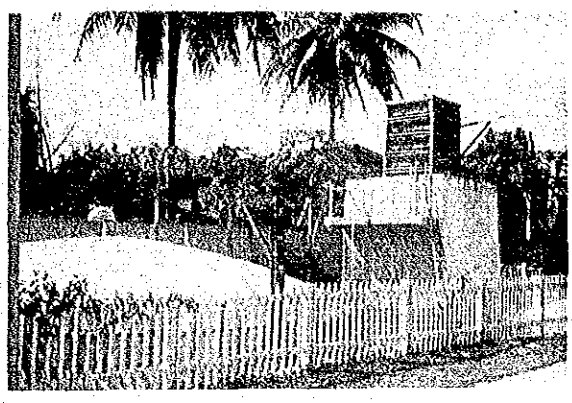
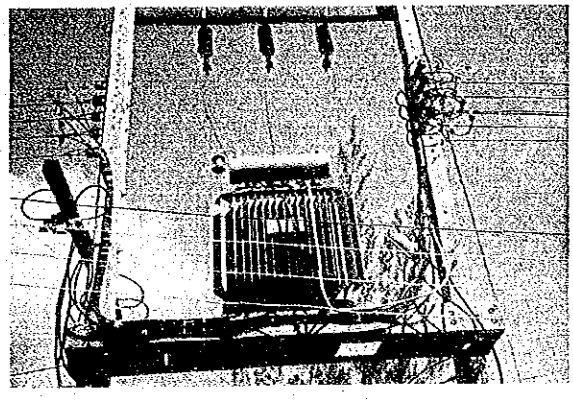


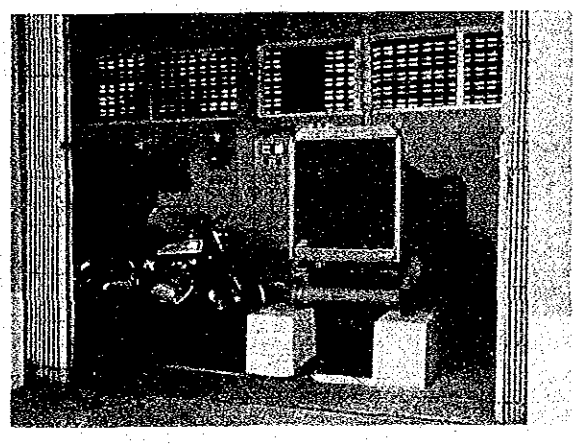
Fig. 2-6-5-II Distribution of Water Supply pipes



Storage tank
& Filter



Incoming Line &
High voltage transformer



Emergency Generator

Chapter 3
PRELIMINARY DESIGN

Chapter 3. Preliminary Design

3-1 Preliminary Planning

This plan was prepared and compiled after making discussions with government authorities of Thailand, receiving necessary informative materials, making few design proposals, and coordinating viewpoints of both teames of the preliminary survey and design study made for the purpose of establishment of new Maharaj Hospital. The following targets are presented in the stage of preliminary planning:

(1) Hospital is to be able to function as an unity comprizing the existing facilities and newly proposed facilities to be combined together.
Ancillary department is to have the scale and functions appropriate to serve to existing wards as well as new ones.

(2) Hospital is to well suite to the situation and the environment of village life in southern sector of Thailand. In reality, low-rise building with ample space for patients and family attendants should be provided.

(3) Hospital is to be flexible to cope with renovation and expansion in future.

(4) Each Hospital buildings are to be of blocks is to be individually feasible to correspond to construction fiscal year and be adaptable to become prototype of regional hospital in Thailand in future.

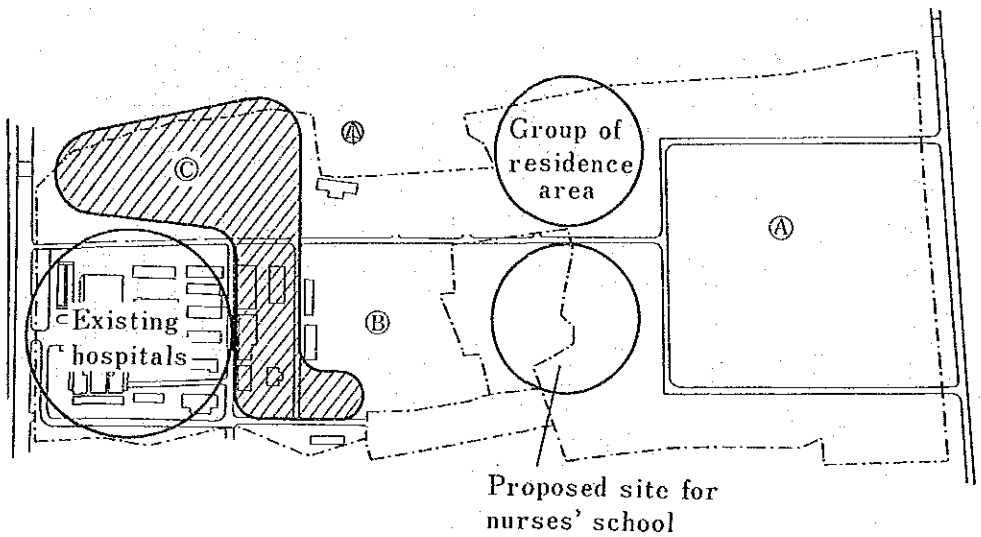
(5) Rooms to require sanitation and cleanliness are to be concentrated, and equipment with high efficiency and easiness in maintenance should be provided.

(6) Contents of medical services provided by existing hospital and of existing medical equipment are to be fully under-

stood first, and planning is to be made in such a manner that complemental functions will be added to raise gradually the service level and to avoid the sudden increase in manpower requirement.

3-1-1 Utilization Planning of Site Area

Though this was already described in Paragraph for preliminary design study, more detailed description will be given here.

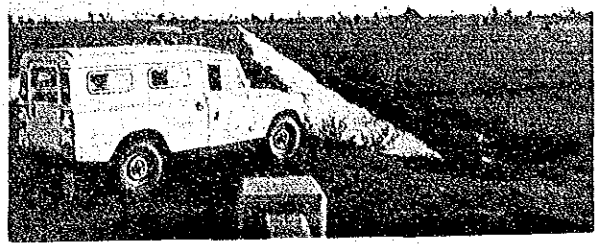


(A) Initially new 1000-bed hospital was proposed in this site, but presently it is being used as rice field and the hospital scheme was changed later to a new unified scheme with existing hospital combined together with the new hospital. Planning an independent hospital in this site is very wasteful in view of functions and management and also not economical for the hospital as a whole.

(B) Though this site may be combined with existing hospitals, it is located behind existing buildings so that approach-

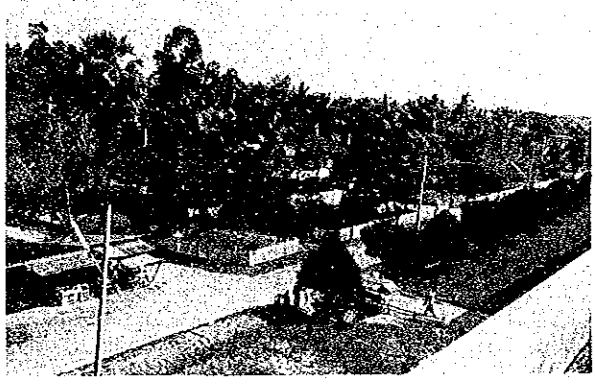
ing by outpatients is not good and ancillary department will be inconveniently located. Thus, site (B) will not be used. This is planned as the site for future nurses' school.

(C) This site with some existing residences is located in the north of and partially in the east of existing hospital, and it is preferable to use it as proposed site for this project since it provides good approaches for outpatients and good connection to the existing hospital. The government of the Kingdom of Thailand is supposed to demolish these residences in advance, then this area has to be filled and prepared as site for the new hospital.



Eastern part of project site

Proposed site for nursing school



Proposed site for the New Hospital

3-2 Planning for Site Land Formation

Normally land is filled considerably high on roads and building sites in Thailand because of its peculiar climate. Height of land filling above the natural land level is normally 1.5 m approximately.

A river is located at north side in the proposed site and, thus, land filling of about 2.0 m above existing land level will be required to prevent flooding from the river. However, in consideration of difficulty expected in maintaining good relation to the floor level of existing hospitals and of increased construction cost due to land filling, land filling up to new level 50 cm higher than existing land level seems to be the most appropriate. However, existing marsh along the river at the north side of this site will require about 2.5 m high land filling and constructing hospital over the filled land will create considerable technical problem, so that careful approach will be necessary for the treatment of land filling. In any case, the first priority must be given to the water drainage plan for this site in consideration of high rainfall expected, and building of retaining wall or dyke along the river seems to be the best solution for eliminating flooding within the site. Thus, this possibility should be examined.

Concerning the time and method of filling, thorough compaction and rolling are required, and best results are obtained by performing compaction and rolling separately in many layers. Filling should be done as early as possible and conditions of filled land must be well grasped at the time of commencement of building construction work.

3-3 Architectural Planning

3-3-1 Various Conditions of Planning

(1) Medical Treatment aspect:

The presumed hospital scale comprizes 400 beds by new buildings through this project and 25 beds by building under construction in addition to 344 beds by existing buildings. Medical consultation, treatment and laboratory functions of new building must have the scale sufficient to provide services to all beds of the whole hospital.

The number of outpatients to be served per day is about 1,000 since the same rate approximately as that of inpatients is seen. About 3 to 4 family attendants are normally accompanied per patient and there are also many family attendants in wards.

The emergency department will perform important functions because many accident persons visit this hospital. System of hospital administration and management and securing of manpower will require further studies in future.

(2) Architectural aspect:

(a) Buildings are to suit to environment, climate and weather conditions.

(b) Buildings are to be well laid out to overall site plan.

(c) Presence of existing hospitals is to be fully taken into consideration.

(d) The scale of new buildings will become about 15,000 m^2.

3-3-2 Main Objective in Architectural Planning

In addition to the targets stated in Paragraph 3-1, following objectives are also considered in architectural planning:

(1) Functions:

(a) Simple floor plans of which purposes of the whole and each portion can be easily understandable to the users. This simplicity is also effective for evacuation and prevention of fire.

(b) No elevator is used but ramps are to be provided since quick repairing of elevator in case of troubles cannot be expected for. Due to poor soil conditions, 2-story building will be the reasonable height.

(c) Scale should be applicable to offer ancillary and other services to about 900 beds, and part of existing hospital buildings should be also utilized for ancillary (emergency department, rehabilitation department, etc).

(2) Environment

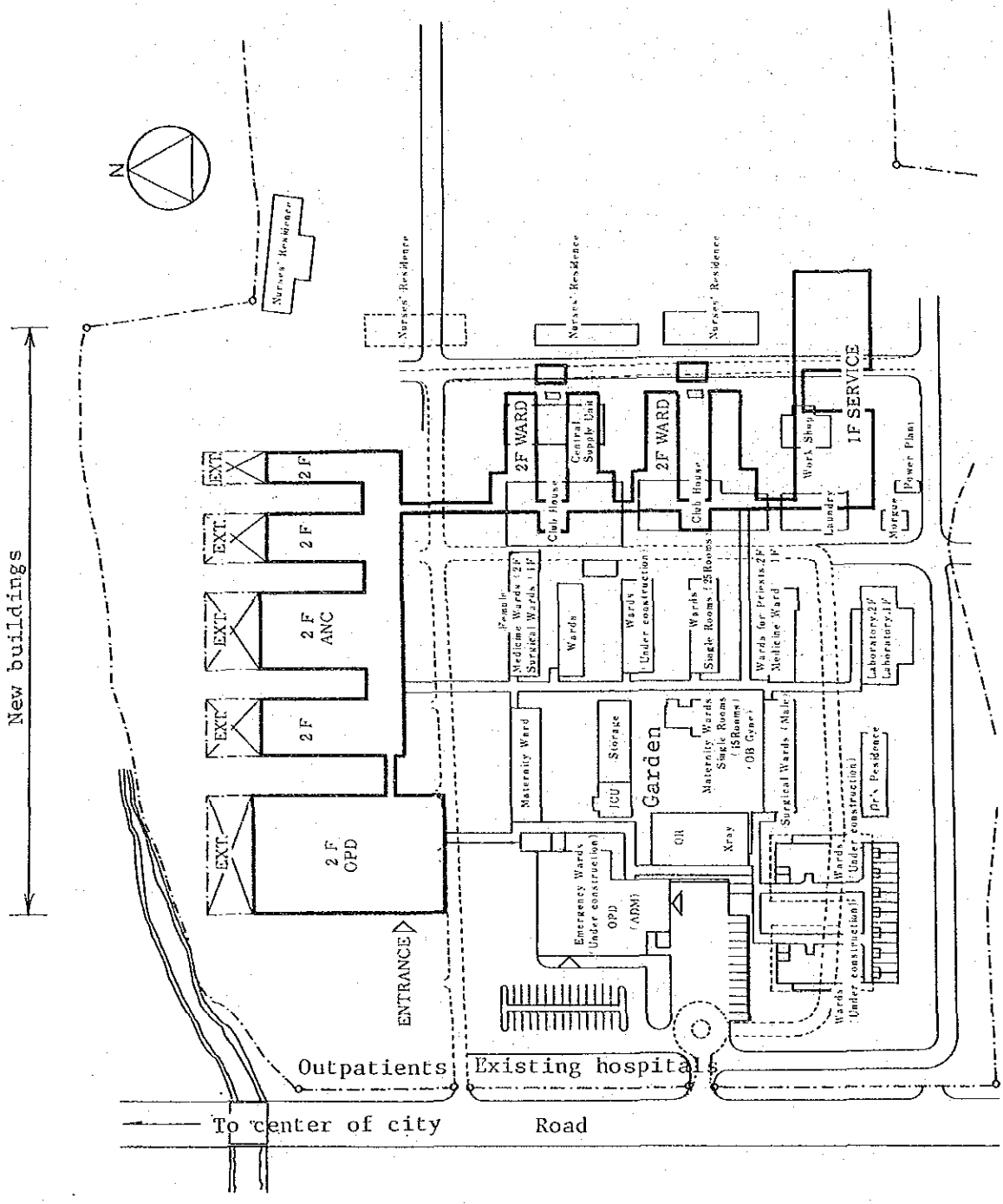
(a) Through new buildings planned this time and existing buildings are combined together as an unity, a courtyard should be provided between them as a buffer zone to provide open space easily noticeable visually.

(b) Buildings should suit to local climate particularly in ventilation, thermal insulation and rainfall. Special precautions should be taken for designing of ceiling height, balcony, eaves, shape of roof, and their dimensions from ground surface.

(3) Maintenance and management:

Easy maintenance and management as well as energy conservation should be considered to reduce economic burdens.

3-3-3 Site Planning



(a) Outpatients will approach to outpatient department of new hospital building, and emergency patients will go to the emergency department of adjacent existing building. Hospital employees living in street zones will enter directly to existing administration building while staffs living within the hospital site will approach from the rear of new buildings. A service department building should be located at the south side of the existing laundry building and be connected to each department building by roofed corridor. As traffic to the housing zone in the rear of the site, it is desirable to extend the road at the south side of the premises and to provide new passage to the housing zone with beginning point of the passage located far away from the hospital buildings.

The front yard of new outpatient department building should be used as parking area.

(b) The courtyard between new buildings and existing buildings will help easier understanding of the building layout and provide buffer zone during construction work. Thus, examination-treatment functions should be laid out around the courtyard where the looped interior traffic line is provided through the whole hospital, and the loop layout will make various traffic movement easier and provide route of trunk line of utilities.

(c) Service building will be located near part of existing service functions where good connection can be made both to new and existing buildings.

(d) New buildings will have three groups consisting of outpatient department building, ancillary building and wards in the order. In addition, outpatient department building and ancillary building can be independently expanded toward north in future and wards can be also expanded to the east side of the hospital whenever necessary.

(e) Three new wards will be constructed in view of the nursing units and they have been laid out so as to maintain the shortest traffic to service building for dietary and laundry and to assure easier identification for these buildings. One of wards is closely connected to the ancillary department since it has ICU and obstetrics department.

(f) It is desired to remove centrally located existing ICU and storage and provide a new courtyard there in order to provide comfortable open space instead of merely paralleling buildings.

3-3-4 Floor Planning

(1) New buildings:

(a) Outpatient building

This building should have outpatient consultation and treatment rooms at 1st and 2nd floors. Reception, screening and pharmacy should be located in 1st floor to provide smooth rotation of patients in the order of examination. Pharmacy should be so located that good connection to the existing hospital can be made, while providing some space for future extension in front of the pharmacy.

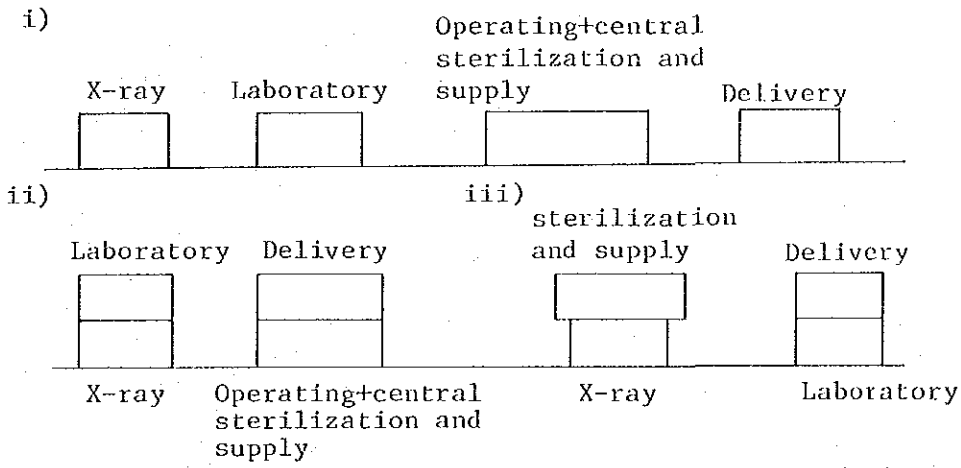
About 1000 patients per day will be expected with many family attendants accompanied so that spacious rooms with good ventilation should be planned. Also, a large roof overhang should be provided in the front yard as outdoor waiting space for the family attendants.

(b) Ancillary buildings

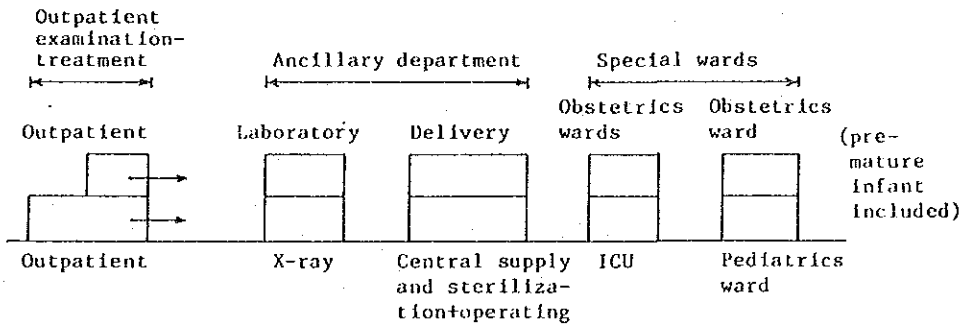
X-ray department, laboratory department, operating department, central sterilization & supplies department, and delivery department should have individual functions

for each department but be connected together to achieve overall medical functions. Also, X-ray and laboratory departments should be closely located to the outpatient department building.

Following three types of building sections are considered:



In consideration of limitation imposed by size of site, limitation imposed by floor area allotment (particularly, operating + central sterilization & supply tend to become too wide), connection to emergency department, and connection between ICU + obstetrics ward and ancillary building, the building section (ii) will be developed and the following configuration will be arranged:



(c) Though it is desirable to have surgery and delivery departments on the same floor because of Caesarean operation and other reasons, the section as shown above was selected to meet various conditions such as large floor areas required for the delivery departments. Therefore, operating room is also provided in delivery department on 2nd floor and staffs will be able to move up and down through rear stair.

(d) Sterilized supplies to the delivery department at 2nd floor should be supplied from the central supply room at 1st floor through dumbwaiter.

(e) Each department of ancillary building can be expanded in future whenever necessary.

(f) As part of the ancillary, ICU + recovery rooms should be provided in 1st floor and obstetrics + premature infant room in 2nd floor as special ward.

(g) Wards:

Nursing units (NU) ..... According to the present situation and request made by the hospital, Nightingales type ward with 30 to 36 beds/NU is desirable. Then, 35 beds/NU with several rooms for serious patients should be provided this time. Nurse station should be so located on plan that bed rooms can be always observed easily from the station.

(h) Ward allotment ..... Allotment and configuration by a kind disease and by condition of patient for existing wards (about 500 beds) and new wards (400 beds) are uncertain. Use of new wards for acute diseases seems to be probable but further discussions on this matter with the management of hospital will be required in future.

(i) Service buildings

These buildings should be divided into three groups of kitchen building, laundry building, and partial pump building in accordance with the usage. Service yard should be provided near the buildings.

(2) Existing portion:

Though both demolition of and renovation to existing buildings are the work to be done by the government of Thailand, the following recommendations and proposals are suggested to obtain the integrated functions of the hospital as a whole:

(a) Renovation or change of use

i) Existing outpatient examination-treatment, emergency, administration building (2-story reinforced concrete structure with 2,300 m^2 floor area), and emergency department under construction should be used as they are, but outpatient portion should be combined with 2nd floor to create administration department and medical staff room.

ii) Maternity ward (1-story wooden structure)

This should be used as rehabilitation department since it is close to ancillary and new outpatient buildings.

iii) Central laboratory and rehabilitation building (2-story reinforced concrete structure with about 800 m^2 floor area):

This should be remodeled to isolated ward but its existing equipment may be partially utilized.

iv) Operation + X-ray building (1-story reinforced concrete structure with about 470 m^2):

This should be partially remodeled to medicine manufacturing area and medicine storage as well as office storage and waiting room for shift workers.

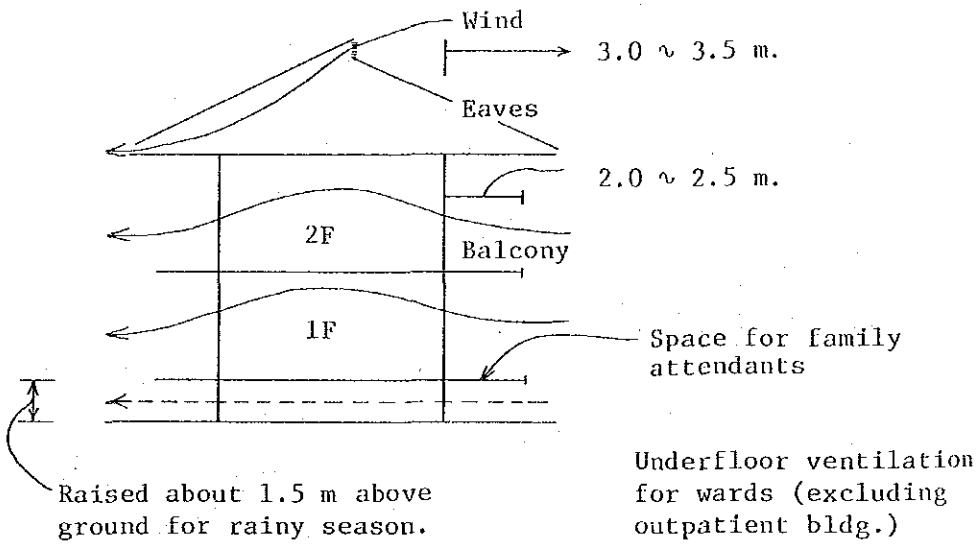
(b) Buildings to be demolished ..... After completion of new buildings

Existing kitchen, laundry, central supply storage room, club house and ICU + storage will be demolished. But existing morgue will be used as it is. But it must be considered to build new morgue combined with specimen room at north side of the site in future. In addition, it seems to be more desirable to use part of existing ward exclusively as priest ward which is peculiar to this country.

3-3-5 Structural method and others

(1) Regular span of building will be 6 m.

(2) Building section:



3-4 Structural Planning

3-4-1 Basic Principle in Structural Planning

Lateral forces due to earthquakes and wind can be almost neglected in Thailand. However, a few consideration may be necessary for earthquake since many earthquakes have occurred in western section of the Malay Peninsula as shown in Fig. 3-4-1-(I) "World Earthquake Distribution Map" and Fig. 3-4-1-(II) "Southeast Asia Earthqauke Distribution Map" instead of fully ignoring them. As far as wind is concerned, the maximum wind velocity is 55 knots (28.3 m/sec) that is considered to be not strong. Therefore, wind load of 100 kg/m^2 for the roof height less than 15 m prescribed in "The Control of The Construction of Building Act" will be adopted. Though reinforced concrete shear walls can be considered as resisting element against lateral forces, this method is generally not being used in Thailand. Thus, locally available brick or concrete blocks will be used for both interior and exterior walls together with pure rigid frame structure consisting of columns and beams to resist to both vertical and horizontal loads since buildings are either 1-story or 2-story construction.

It was found out through the investigation in Thailand that reinforced concrete structures were widely being used and, therefore, the reinforced concrete structure will be best suited to the buildings of this project but steel or wooden trusses will be adopted for the roof structure.

3-4-2 Policy of Structural Planning

(1) Policy in structural planning for the new hospital are as follows:

a) The intensity of external forces and assumed loads acting to building will be determined basing upon the local

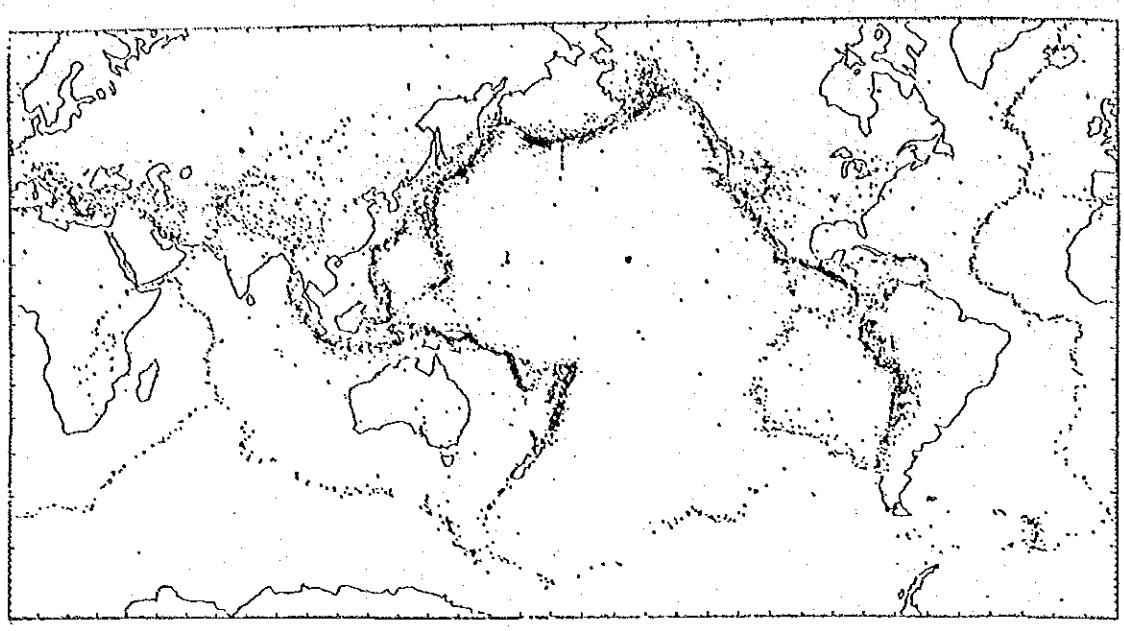


Fig. 3-4-1(I) Global Earthquake Distribution
(According to M.Barazangi and J.Dorman)

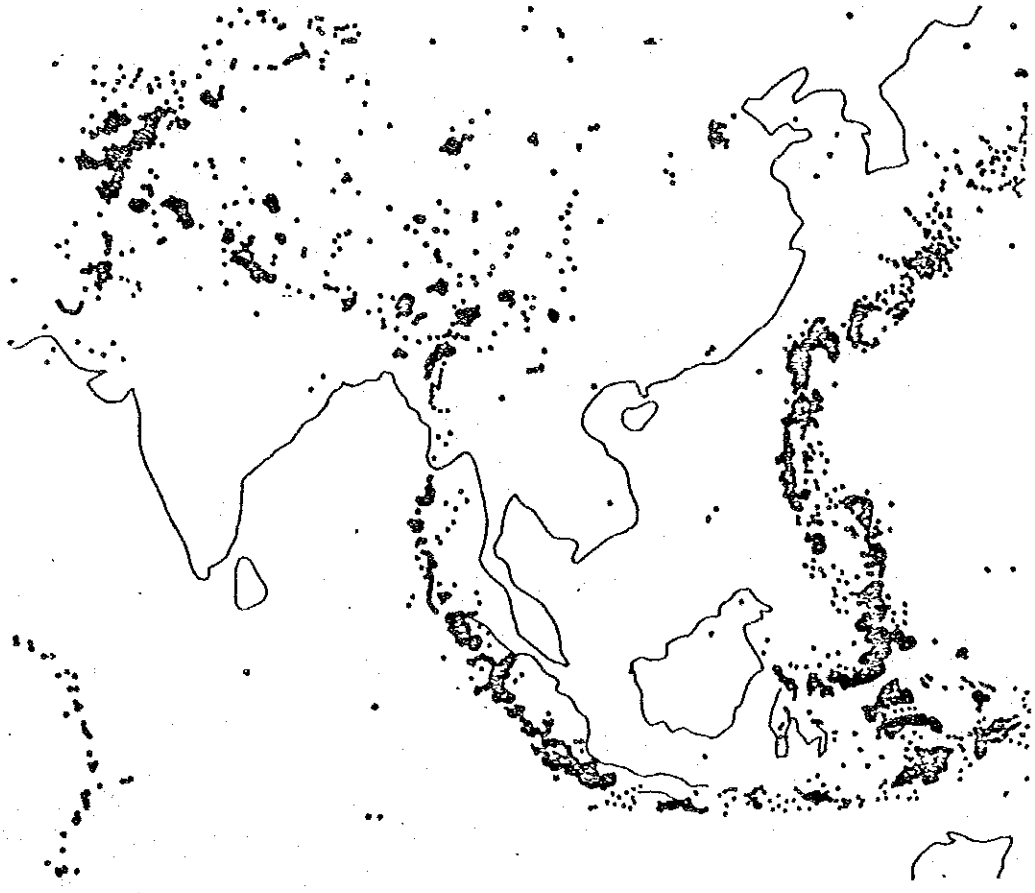


Fig. 3-4-1 (II) Epicenter Distribution in Southeast Asia
(1961 ∿ 1967. Depth 0 - 100 km)

meteorology, geography, soil conditions and use of building.

b) Allowable stresses of materials will be determined basing upon the various standards of Thailand as a rule but the quality of materials will be also taken into consideration for selection.

c) Stress analysis of rigid frame and calculations of sections will be made by considering various standards of Architectural Institute of Japan and ACI code.

(2) External forces and loads acting to buildings will be considered as follows:

(a) Dead load

Dead load will be determined after making calculations for materials used.

(b) Live load

Live loads will be determined in consideration of Japanese Building Code, standards of American Standard Association, and Bye-laws of the Bangkok Building Metropolis. In addition, values corresponding to actual conditions will be adopted for special-purpose rooms.

List of Live Loads

Type of Use	Load (kg/m^2)
Operating room	290
Ward	180
Public space	300
Office	300
Storage	500
Roof	50

(c) Wind pressure

As described before, 100 kg/m^2 is used as wind load for the roof height less than 15 m.

(d) Seismic force

Though seismic design is rarely being practiced in Thailand, one-fifth of seismic coefficient (k = 0.2) established by Japanese Building Code will be applied. However, seismic design will be applied only to main buildings.

3-4-3 Design Strength of Concrete

Fc = 210 kg/cm^2 will be used as design standard strength of concrete, and deviation will be in the range of 50 kg/cm^2. Thus, exploratory strength will be Fc = 240 - 260 kg/cm^2.

3-5 Electrical Equipment Planning

3-5-1 Preconditions for Equipment Design

Nakohn Si Thammarat Provincial Power Plant belonging to EGAT has power generating capacity of 2×1 MW, and generated power is stepped up at substation and then transmitted. Transformer capacity is 1×10 MVA. Voltage of transmission line is 33 kV. Power is sent to transformer on electric pole in the hospital site, stepped down from 33 kV to 380/220V and distributed to each hospital facility in form of 3-phase 4-wire system.

In making plan for electrical equipment of the New Hospital, the following items will be considered:

- Power supply to existing buildings will not be considered and supply power will be planned only for the new construction hospital.

- Electrical construction Thai-made materials or easily obtainable in Thailand will be used as much as possible in planning of electrical work, because maintenance, management and operation in later days will be taken into consideration.
- Standard of electric materials will accord with T.I.S.

3-5-2 Incoming Facilities Power Supply and Distribution System

Power line to the new hospital will be branched from 33 kV high tension overhead line (already extended), and two transformers each having approximately 400 KVA capacity will be installed above ground in the site. 33 kV primary voltage will be stepped down to secondary voltage of 380/220V, 3-phase, 4-wire and supplied to the new hospital. Power is supplied to each load through main distribution panel in electrical room in the service facility. Rough estimate on the load capacity is shown below.

Name of load	Load capacity (KVA)
X-ray (fluoroscopy, radiography, dentistry)	180
Lighting, convenience outlets	350
Air conditioning & ventilation	210
Sanitary facilities	40
Medical equipment	50

3-5-3 Stand-by Generator Sets for Emergency

Though power failure is very few in this area, AC generator sets will be installed for emergency case as a power source during power failure in order to supply power constantly to surgery, laboratory and other kind of departments and also to lighting fixtures to be used as safety lights.

Specifications of generator should be determined by considering the following items:

1. Oil filter and ignition point will be considered because of poor quality of fuels or heavy oil poorer than class B.

2. Air-cooled system is to be used because water quality is questionable.

3. Air starting system is desirable for maintenance.

4. Manual start and stop will be considered in view of maintainability.

3-5-4 Power Supply System for Each Power Panel

Power to various loads such as power control board, lighting panel, medical power source, X-ray power source, etc. will be supplied from low-voltage main distribution panel in the service facility.

For starting and stopping the machinery, the simplest and clearest system will be used by avoiding trouble, and start and stop will be performed at the machine location as a rule.

3-5-5 Wiring to Lighting Fixtures and Convenience Outlets

Wiring to lighting panels and subsequent lighting fixtures, switches, and convenience outlets will be made. Except for special department and rooms in ancillary department, exposed wiring system will be used to reduce construction time and cost.

3-5-6 Lighting Fixtures

Fluorescent lamps will be mainly considered as light sources but lamps should not need to get too much illumination level.

Intensity of illumination of main rooms:

Room	Lux
Operating room	500
Laboratory	300 ∿ 400
Outpatient	100 ∿ 200
Ward's bedroom	100 ∿ 200

3-5-7 Telephone Facilities

Though automatic exchange is presently being used in administration department, only one outside call line is available so that hospital wants to extend more four out side call line, independently from this project. Therefore four or five additional outside call line and an automatic exchange will be extended to correspond to construction of the new hospital. And besides, telephone sets usable for communication for outside call and inside call will be installed to each department reception, rest room and nurse stations.

3-5-8 Nurse Call System

Devices for making mutual communication between each bed in ward and nurse station will be planned to assure full nursing services for the patients.

3-5-9 Alarm System

Fire code scarcely prescribes the installation of fire safety devices, and automatic fire detecting system is not installed in existing hospital. However, alarm bell system that can be activated manually after detecting fire by people will be planned in this project for the purpose of fire fighting and rescuing.

3-5-10 Paging System

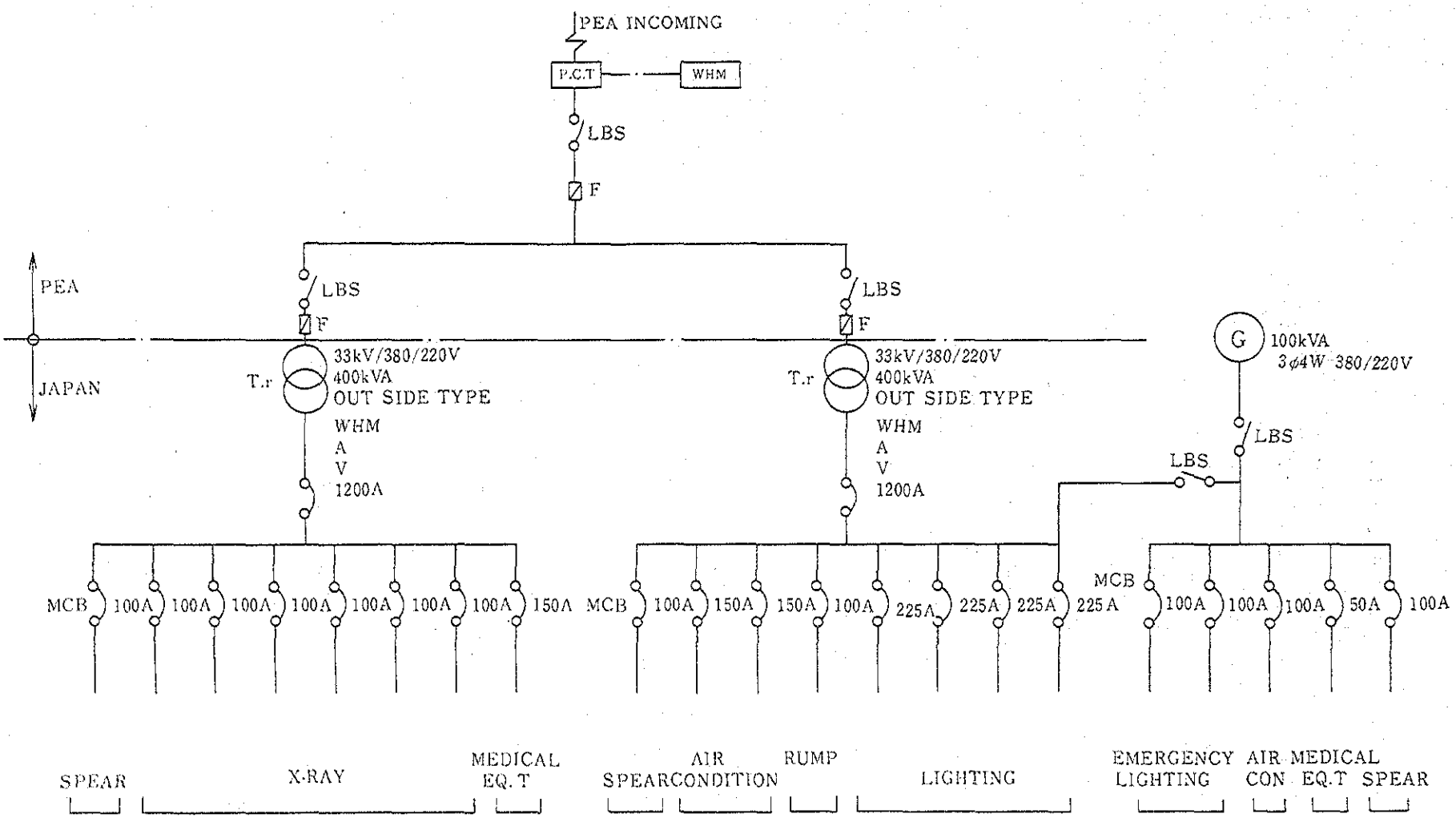
Paging devices for callout and connection will be planned to assure the smooth medical care of doctors and nurses.

3-5-11 Interphone System

Interphone required for communication between inside and outside (also, darkroom and operating room) of the hospital will be planned.

3-5-12 Television Distribution System

TV antenna will be installed at the top of the new out-patient building and outlets for television sets be installed in waiting area, office, rest room, and others.



POWER SERVICE SYSTEM

3-6 Design Condition in Mechanical Equipment Planning

3-6-1 Mechanical equipment of the proposed buildings will be planned by considering the following items:

- Natural and living conditions in Thailand will be considered in planning.
- Equipment that can be easily procured in Thailand will be used.
- Equipment with high durability will be used.
- Easily operative equipment will be used.
- Maintenance and repair of equipment used must be very easy.
- Operating costs of mechanical system used should be low.
- Installation of equipment used should be easy.
- Local construction method should be adoptable as much as possible for the euqipment used.

3-6-2 Planning for Air Conditioning and Ventilation

Weather in Nakohn Si Thammarat City is represented by high air temperature and high humidity. Its maximum air temperature is 37°C and the minimum is 17°C, and its relative humidity is normally greater than 80% to 90%. In planning air conditioning and ventilation of this hospital, natural conditions will be fully considered and, in principle, architectural method will be utilized with which shielding of direct sunlight and natural ventilation will be fully utilized to the maximum degree. Thus, no air conditioning will be provided for outpatient building and wards and others.

Air conditioning will be provided only for operating room, ICU, X-ray room, laboratory and premature infant room

which have closed spaces and require high cleanliness and specific conditions in temperature and humidity.

Forced mechanical ventilation will be planned only for closed spaces such as toilets. The air conditioning system stated above will be divided to several zones depending upon the purposes of use to allow partial operation by zone control. Air-cooled type air conditioning package will be adopted. Though air conditioning has not been widely used in Thailand as yet, local construction method will be adopted as much as possible for installing the euqipment, and Japanese method will be used for the remaining portion.

3-7 Planning for Water Supply and Sanitary Facilities

Domestic water supply and sanitary facilities, and special facilities such as laundry equipment, kitchen equipment, fire extinguishing equipment, and sewage water treatment system and inciuerating system will be considered in this planning.

3-7-1 Water Supply Facilities

Amount of water used is estimated to be about 250 m^3/day. Newly installed well in the site of hospital will be used as water source. Sanitation will be fully considered in supplying water from the well and, for this purpose, facilities for sedimentation, filtration and sterilization will be installed. Gravity method utilizing high water tank will be used for the water supply to both inside and outside of buildings.

3-7-2 Water Drainage Facilities

Combined drainage method will be used for draining both sewage and miscelleneous drain water. However, drain water containing harmful matters and heavy metals ejected from

laboratory and other areas will be drained through the pipes of separate system and stored in an outdoor storage tank, then it will be treated and disposed in treatment and disposal facilities outside of this hospital.

3-7-3 Sanitary Fixtures

Types of sanitary fixtures will be selected so as to meet the purposes of use of fixtures as well as life style in Thailand. Sanitary ceramic fixtures of white color will be used. As flushing method for both water closets and urinals, flushing valves or low tanks may be selected.

3-7-4 Gas Facilities

Propane gas will be planned as gas source. Individual piping system will be adopted for gas. Gas is used in laboratory, kitchen and others.

3-7-5 Fire Extinguishing Equipment

Though not requested by the standards for fire fighting facilities, interior fire hydrants and faucets will be installed to the places where they seem to be necessary for self-protection.

3-7-6 Laundry Equipment

Laundry equipment will be installed in service building. Sheets and white robes for doctors and nurses can be washed by the laundry equipment. Steam will be used as heat source of laundry equipment. Major laundry equipment will include washing machines, hydroextractors, dryers and sheets rolls.

3-7-7 Kitchen Equipment

Kitchen equipment will be installed in service building, and equipment will be planned mainly for cooking by hand work.

Thus, in selecting the kitchen equipment, mainly the equipment related to sanitation such as refrigeration, freezing and sterialization, and the equipment that cannot be easily obtained in Thailand such as water coolers, electronic ovens and ice makers will be selected for installation. These machines will be laid out so as to assure their sanitary and rational uses.

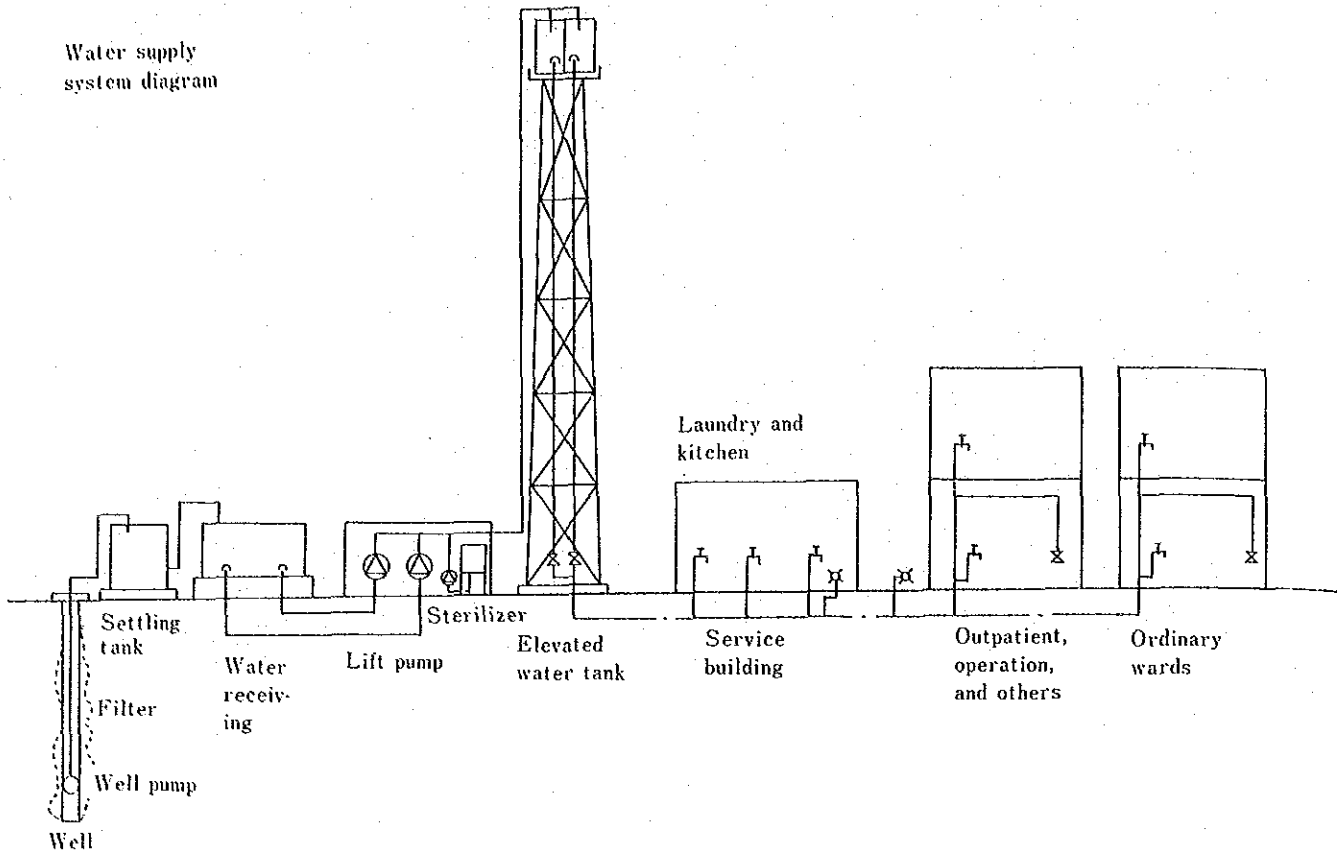
3-7-8 Sewage Water Treatment System

Waste treatment facilities will be used for treating sewage and miscellaneous wastes combined together. Activated sludge method will be adopted for waste water treatment. Each facility will have the portion for existing buildings and the other portion for new hospital buildings separated from each other in order to respond to change in water quantity. However, the same facility will be used if this is desirable in treatment process. Also, waste water containing harmful matters and heavy metals ejected from laboratory will be treated and disposed in waste water treatment facilities outside the hospital as stated in Paragraph 3-7-2. Quality of flowed in raw water and of treated water at the treatment facility are shown below.

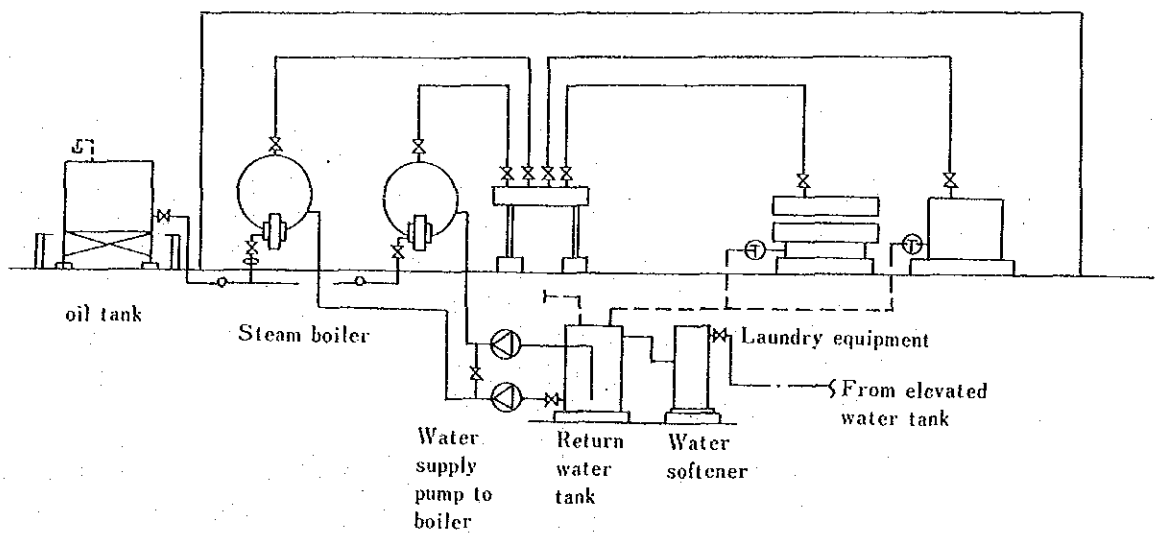
(Unit: PPM)

	BOD	SS
Quality of flowed in raw water	200	250
Quality of treated water	20	50

Water supply system diagram



Laundry heat source system diagram



3-8 Planning for Medical Equipment

The purpose of this planning is to renew and add medical equipment since existing equipment is very old and deteriorated. Kinds of diseases of outpatients of Nakohn Si Thammarat Provincial Hospital are (1) Upper Respiratory Tract Infection, (2) Pultnonary Tubercu-losis, (3) Gestro-Intestinal Tract, (4) accidents, and kinds of diseases of inpatients are (1) acute diarrhea, (2) car accidents, (3) abortion, (4) appendicitis, in the order of listing respectively, which indicates that most of them are infectious in nature. However, it can be easily forecasted that current disease structure will greatly change in near future through the improvement and enrichment in social medical services promoted by the medical authorities. Therefore, ability of medical equipment to respond to change in disease structure in future will be taken into considration in this planning. In addition, special attention will be given to the ANC (ancillary) department particularly to the improvement of diagnosis accuracy, surgical operating, OB GYN and pediatric departments. Since hospital upgrading is usually performed in several steps through many years instead of doing once, medical equipment must be also improved one by one in parallel with filling of doctors, technicians and nurses and with other economic factors. Thus, by adding or supplying medical equipment in response to real situation, better medical effects can be expected. List of the medical equipment is shown below.

DEPARTMENT

X-RAY

MEDICAL EQUIPMENT	UNIT	REMARK
1. X-ray TV unit DT-BAK (150kV 300mA)	1	Diagnostic X-ray
KXO-15 (150kV 300mA)	2	
2. Surgical X-ray TV set (100kV, 20mA)	1	
3. X-ray set, mobile (125kV, 450mA)	1	
4. Automatic X-ray film developer	1	
5. X-ray film viewer 8 sheets of largesize mobile	1	
6. Cassette change box	6	

DEPARTMENT

OPERATING ROOM

MEDICAL EQUIPMENT	UNIT	REMARK
1. Operating table, Operating lamp Electric caute rizer Anesthetic machine Electric suction O_2, NO_2, Piping System	8 8 8 8 8	include or thopdic operation
2. Bronchoscope (camera cine etc.)	1	
3. Gastroscope	1	
4. Colonoscope	1	
5. Microsurgical instruments set	1	
6. Electro cardiograph, portable	1	
7. Fiberscope for duodenum Fiberscope for esophagus Fiberscope for gastic biopsy	1 1 1	
8. Endoscope stand & power instrument	2	
9. Sphygmomanometer	7	
10. Bone-operating instrument	1	
11. Operating instrument set	1	
12. Sterilizing board stard	7	

DEPARTMENT

OB GYN

MEDICAL EQUIPMENT	UNIT	REMARK
1. Fetal monitoring unit	2	
2. Infant resuscitation unit	1	
3. Ultrasound diagnostic device	1	
4. Suction unit & Vacuum extractor	1	
5. Bed, for delivery & operation	2	
6. Histeroscope	1	
7. Lochia carriage	2	
8. Delivery monitoring unit	1	

DEPARTMENT

ICU

MEDICAL EQUIPMENT	UNIT	REMARK
1. Cardiac monitor 10 Scope	10	
2. Defibrillator and Cardiac pacemaker	1	
3. Portable electro Cardiogram	2	
4. Beside resuscitator	2	
5. O_2 tent	1	
6. Bird's respirator	4	

DEPARTMENT

CSSD

MEDICAL EQUIPMENT	UNIT	REMARK
1. Big sized electric autoclave	2	High pressure vapor autoclave
2. Electric gauze cutter	1	

DEPARTMENT

ANESTETICS

MEDICAL EQUIPMENT	UNIT	REMARK
1. Blood pressure, cardiac respiration rate monitor	4	
2. Miscelanous consumption	-	
3. Anesthetic machine for children	2	
4. Resuscitator for children	1	

DEPARTMENT

LAB-RESEARCH-1

MEDICAL EQUIPMENT	UNIT	REMARK
1. Photoelectric Spectrophotometer	1	
Spectrophotometer, self recording	2	
Two-wave spectrophotometer	1	
2. Blood pH, Gas analyzer	1	
3. Blood WBC count, hemoglobin analyzer	1	
4. CO_2 and chlorideanalyzer	1	
5. Flame photometer	1	
6. Electrophoresis for HAA & abnormal protein	1	
7. Thermostat drier	1	
Dry heat sterillizer	1	
8. Big bacteria incubator	1	
Medium bacteria incubator	2	
CO_2 incubator	1	
9. Deep Freezer (-80°C)	1	
10. Refrigerator 10 CU.FT	3	
11. Centrifuge 32 heads	3	
12. Expiration gas analizer	1	
13. Electroence phalograph 13 ch	1	
14. Distilled water producing instrument	1	
15. Direct indicating balance	1	
16. Shaker, for tissue-sample fixing	1	

DEPARTMENT

LAB-RESEARCH-2

MEDICAL EQUIPMENT	UNIT	REMARK
17. Thermostat water bath, electric	2	
18. Lung-function testing apparatus	1	
19. Paraffin melting apparatus	1	
20. High-pressure sterilizer	1	
21. Draft chamber	1	
22. Paraffin Lengher instrument	1	

DEPARTMENT

PATHOLOGY

MEDICAL EQUIPMENT	UNIT	REMARK
1. Microtome	2	
2. Tissue processing Machine	1	
3. Frozen section microtome	1	
4. Teaching microscope	1	For five persons
5. Microtome sharpening roter	1	
6. Binocular microscope (camera, cine, etc.)		
Microscope List		
Binocular microscope	4	
"	2	
Triocular microscope	1	
Multi-purpose microscope with camera	1	
Microscope, with fluorescant unit	1	
Binocular microscope with lighting	1	
and accessories list		
Micrometer (OB)×5		
" (OC)×5		
and other, etc.		

DEPARTMENT

BLOOD BANK

MEDICAL EQUIPMENT	UNIT	REMARK
1. Machine for separating plasma & blood cells	1	
2. Blood storage refrigerator	1	

DEPARTMENT

OPHTHALMOLOGY

MEDICAL EQUIPMENT	UNIT	REMARK
1. Trial Lens Set	1	
2. Digital Lensmeter	1	
3. Retinoscope	1	
4. Fundus Camera	1	
5. Opthalmologic instrument unit, eye washing	1	

DEPARTMENT

DENTAL

MEDICAL EQUIPMENT	UNIT	REMARK
1. Dental unit & chair	4	
2. Ultrasonic Scaler	2	
3. Mobile Aeroter	1	
4. Dental X-ray	1	
5. Sterilizer	4	Electric small one

DEPARTMENT

FOOD SERVICE

MEDICAL EQUIPMENT	UNIT	REMARK
1. Large Boiling Pot	4	
2. Large Freezer	4	
3. Large Meat Grinder	2	
4. Large Blender	2	
5. Microwave Cooker	2	
6. Water Cooler	3	
7. Ice Cube Maker	2	
8. Large Pressure Cooker	2	
9. Sterilizer Cabinet	5	
10. Gas Range	1	

DEPARTMENT

SOCIAL MEDICINE

MEDICAL EQUIPMENT	UNIT	REMARK
1. Color T.V. Set & Video Cassette Recordar & Color Video Camera	1	
2. 16 Sound Cinema Projector and Cinema Camera	1	
3. Picture projector & Cassette tape Recorders	2	

DEPARTMENT

OPD

MEDICAL EQUIPMENT	UNIT	REMARK
1. Cryo surgical instruments & uterine cervical cauterization	1	
2. Small size Electric Autoclave	1	
3. Non Heating Lamps	5	
4. Pelvic Examination Tables	2	
5. Plaster bandage cutter and stand	1	
6. Sphygmomanometer	2	
7. Attachment for revlew for fiber-scope	1	
8. Instruments table	1	

DEPARTMENT

PHARMACY

MEDICAL EQUIPMENT	UNIT	REMARK
1. Washing machine for Bottle & Infusion Set	1	Ultrasound washing type.
2. Water distillation machine	1	
3. Formulating stand, for power & liquid	1	
Formulating stand for tablet & power	1	

DEPARTMENT

PEDIATRIC

MEDICAL EQUIPMENT	UNIT	REMARK
1. Resuscitator	2	
2. Centrifuge with Hematocrit Meter	1	
3. Respirator for infant	2	

DEPARTMENT

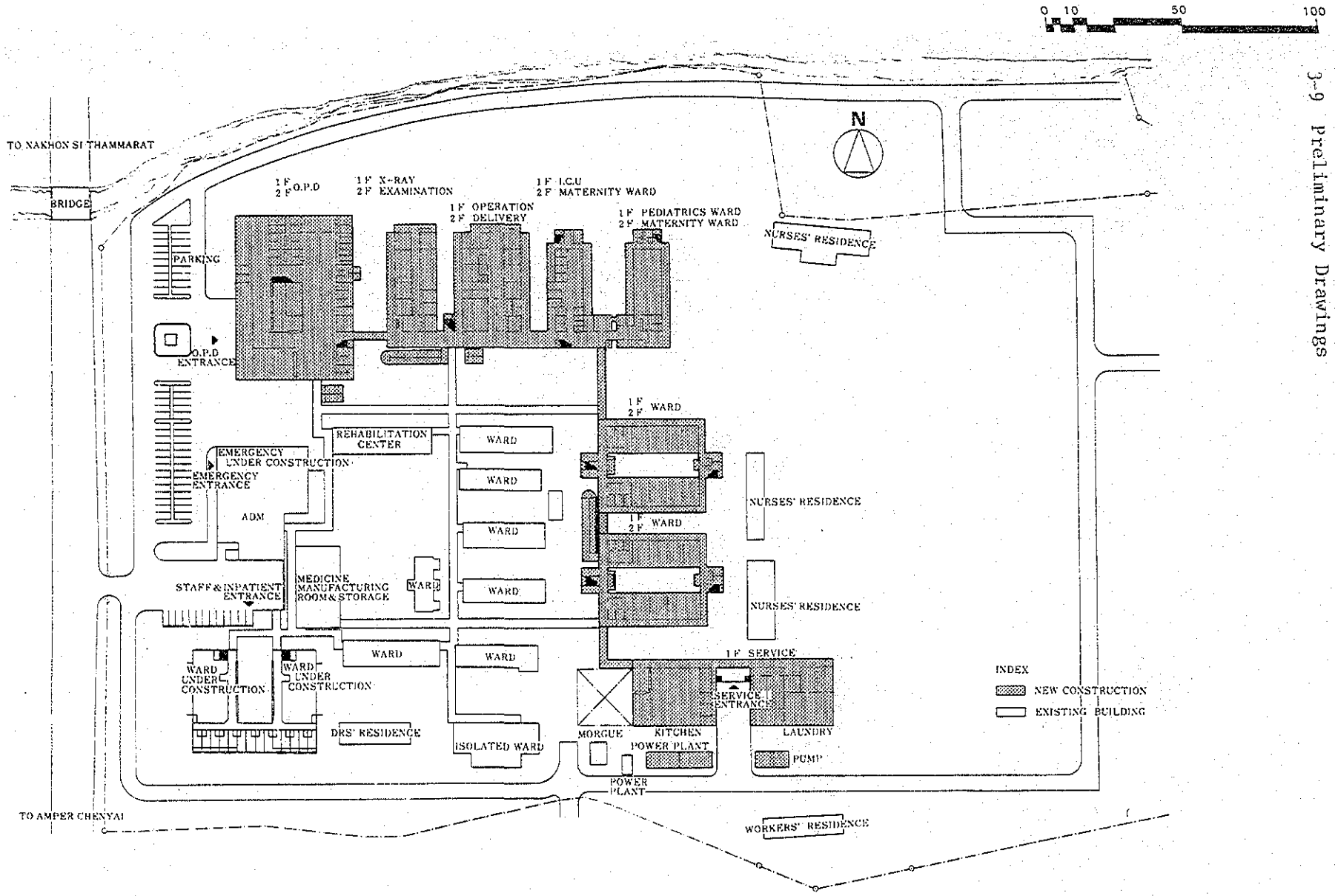
NURSING

MEDICAL EQUIPMENT	UNIT	REMARK
1. Bed	400	
- Fowler's	(200)	
- Fowler's for children	(50)	
- Normal	(120)	
- Stryker Frame	(10)	
- Delivering Bed	(20)	
2. Refrigerator 200 (ℓ)	8	
3. O_2 tent for children	4	
O_2 tent for adult	4	
4. Incubator for Premature Body	2	
5. Automatic ice machine	8	
6. X-ray film viewer, the lower part reclining, with a movable stand	8	

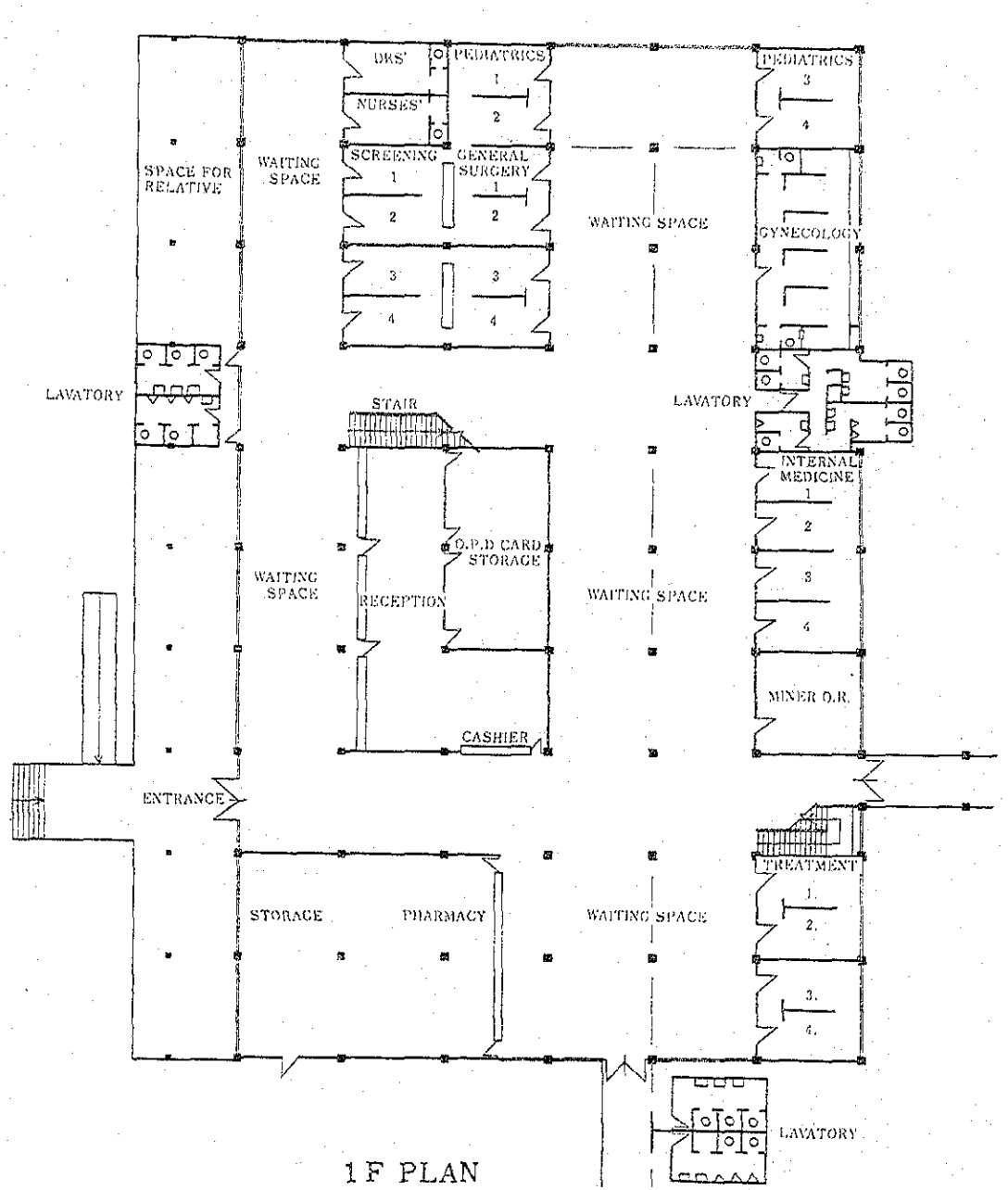
DEPARTMENT

LAUNDRY

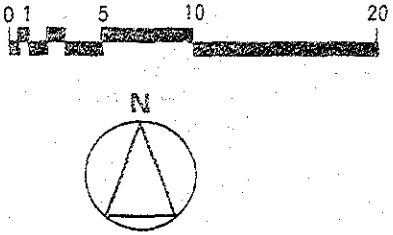
MEDICAL EQUIPMENT	UNIT	REMARK
1. Washer (65∿75 kg)	3	Divide works for each machine
Hydro Extractor (max. 64 kg)	2	
Open-end Tumber (max. 20 kg/hr)	4	
2. Flat-work Ironer 3 Roll (5 m/min.)	1	

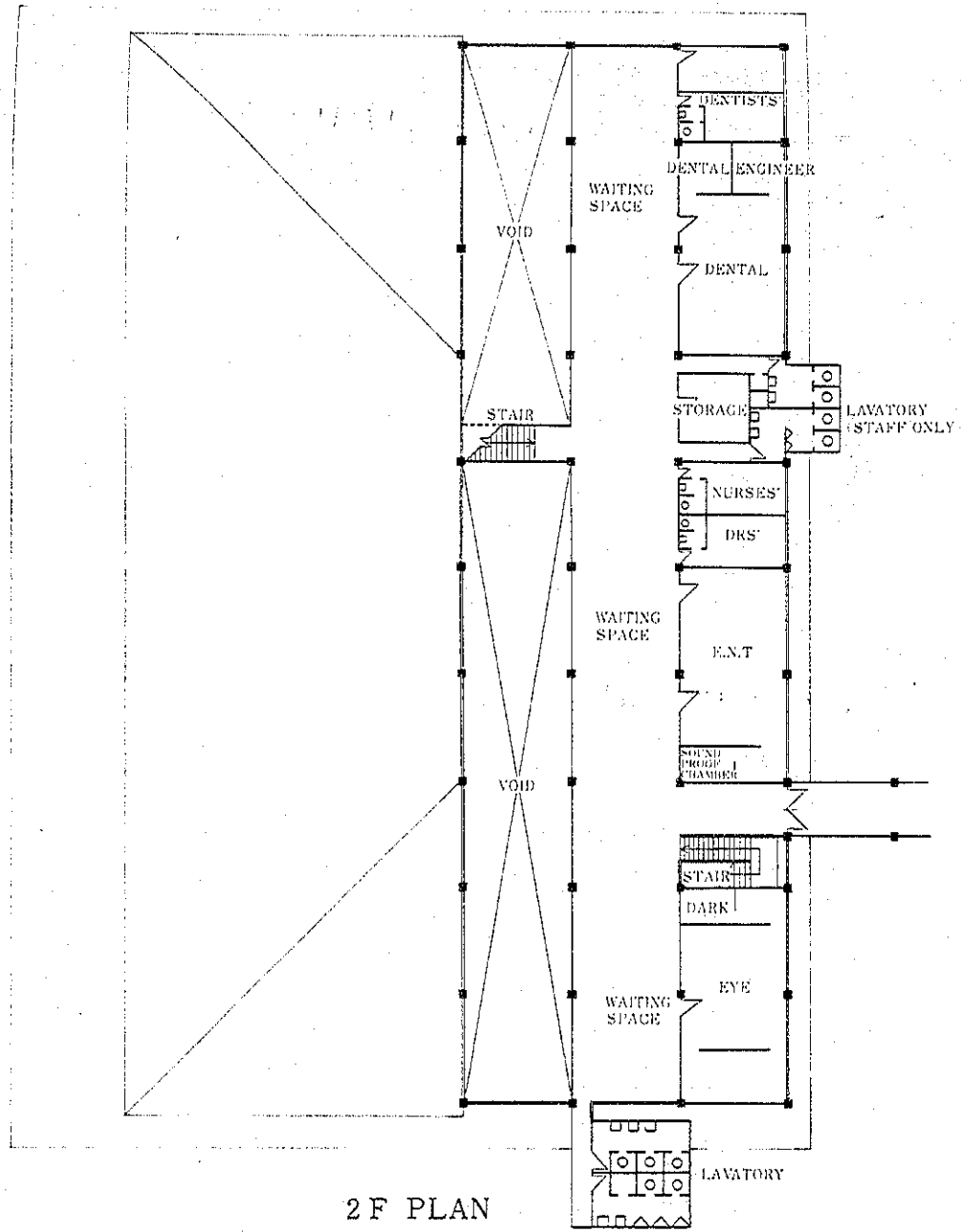

0 10 50 100
N
TO NAKHON SI THAMMARAT
BRIDGE
1 F O.P.D
2 F O.P.D
1 F X-RAY
2 F EXAMINATION
1 F OPERATION
2 F DELIVERY
1 F I.C.U
2 F MATERNITY WARD
1 F PEDIATRICS WARD
2 F MATERNITY WARD
NURSES' RESIDENCE
PARKING
O.P.D ENTRANCE
REHABILITATION CENTER
WARD
EMERGENCY UNDER CONSTRUCTION
EMERGENCY ENTRANCE
ADM
1 F WARD
2 F WARD
NURSES' RESIDENCE
STAFF & INPATIENT ENTRANCE
MEDICINE MANUFACTURING ROOM & STORAGE
WARD
WARD UNDER CONSTRUCTION
DRS' RESIDENCE
ISOLATED WARD
1 F SERVICE
SERVICE ENTRANCE
MORGUE
KITCHEN
LAUNDRY
POWER PLANT
PUMP
POWER PLANT
INDEX
NEW CONSTRUCTION
EXISTING BUILDING
TO AMPER CHENYAI
WORKERS' RESIDENCE

SITE PLAN 01

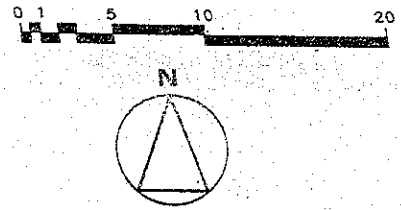

DRS'
PEDIATRICS
NURSES'
SCREENING
GENERAL SURGERY
SPACE FOR RELATIVE
WAITING SPACE
WAITING SPACE
PEDIATRICS
GYNECOLOGY
LAVATORY
STAIR
LAVATORY
INTERNAL MEDICINE
O.P.D CARD STORAGE
WAITING SPACE
RECEPTION
WAITING SPACE
MINER O.R.
CASHIER
ENTRANCE
TREATMENT
STORAGE
PHARMACY
WAITING SPACE
LAVATORY

1F PLAN

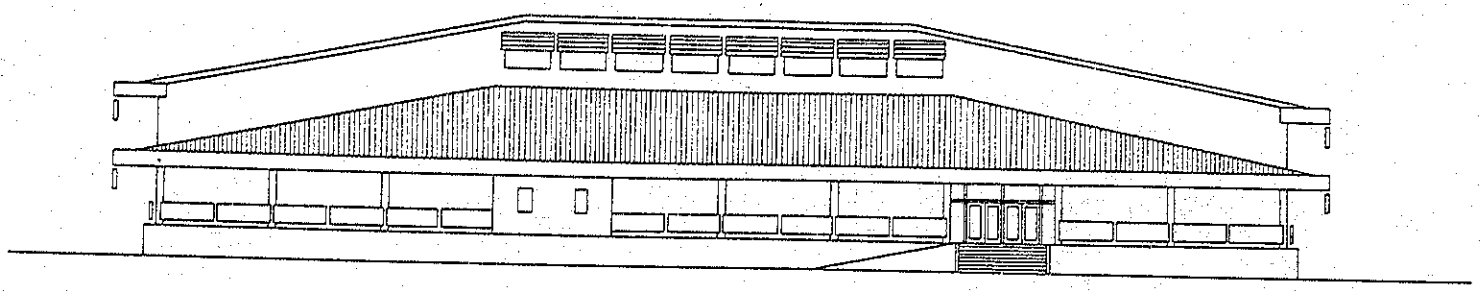

0 1 5 10 20
N


DENTISTS
DENTAL ENGINEER
WAITING SPACE
VOID
DENTAL
STAIR
STORAGE
LAVATORY STAFF ONLY
NURSES'
DRS'
WAITING SPACE
E.N.T
SOUND PROOF CHAMBER
VOID
STAIR
DARK
EYE
WAITING SPACE
LAVATORY

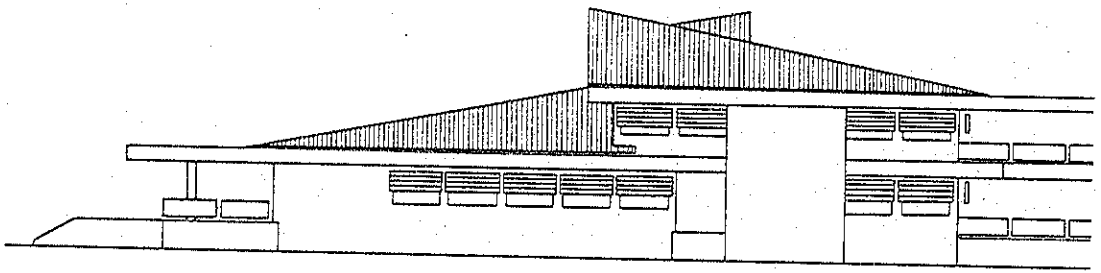
2 F PLAN


0 1 5 10 20
N

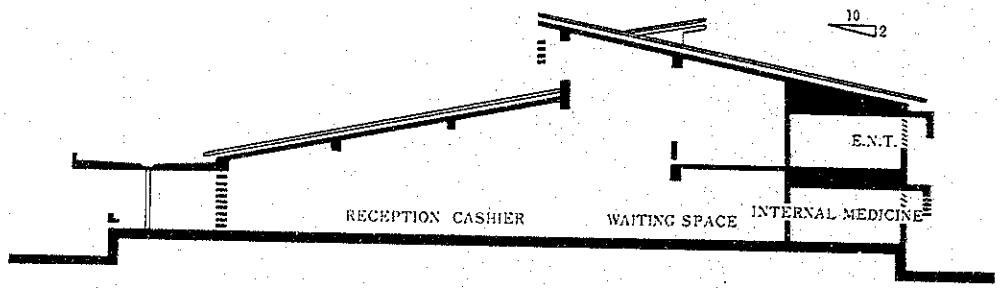
0 1 5 10 20



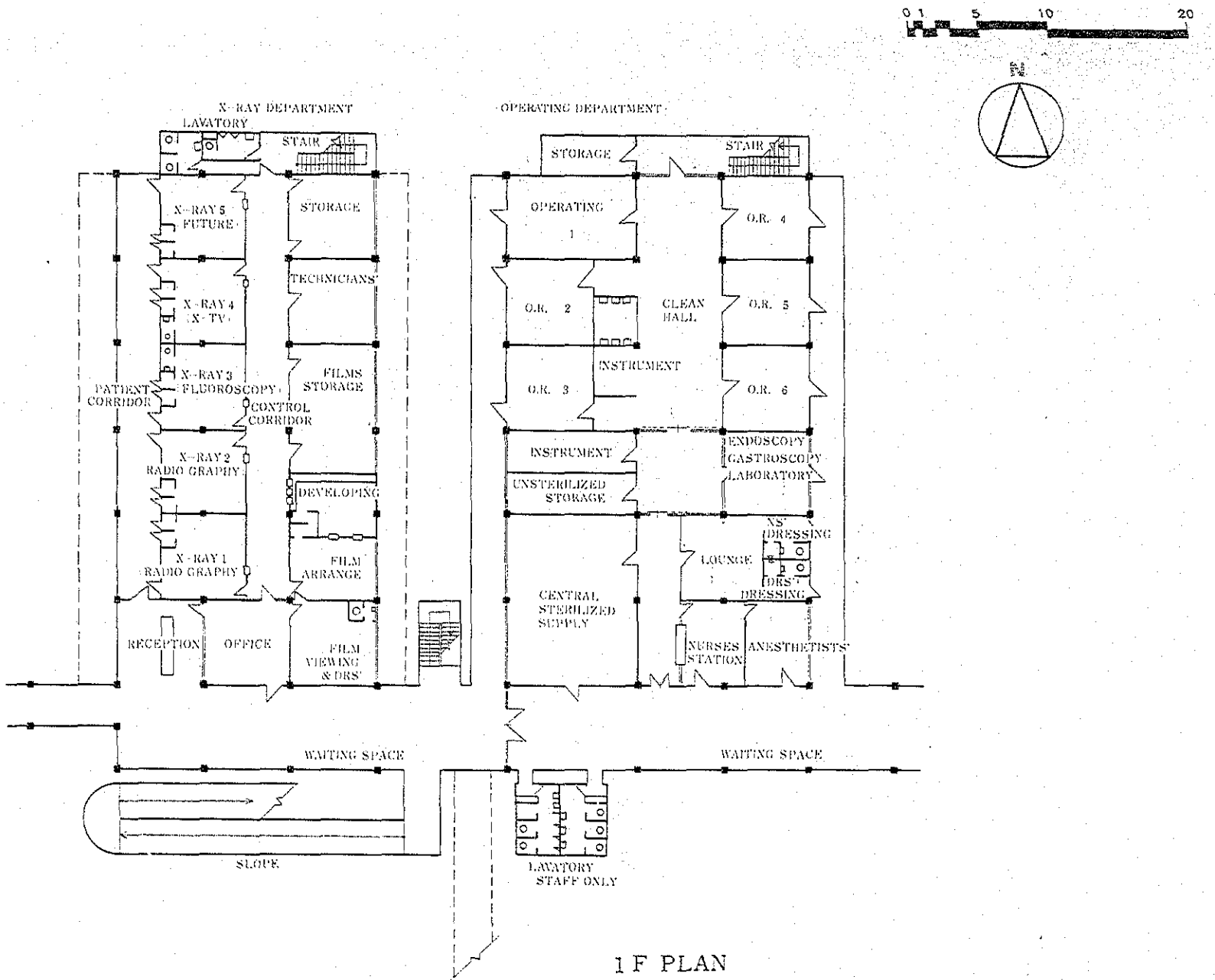
WEST ELEVATION



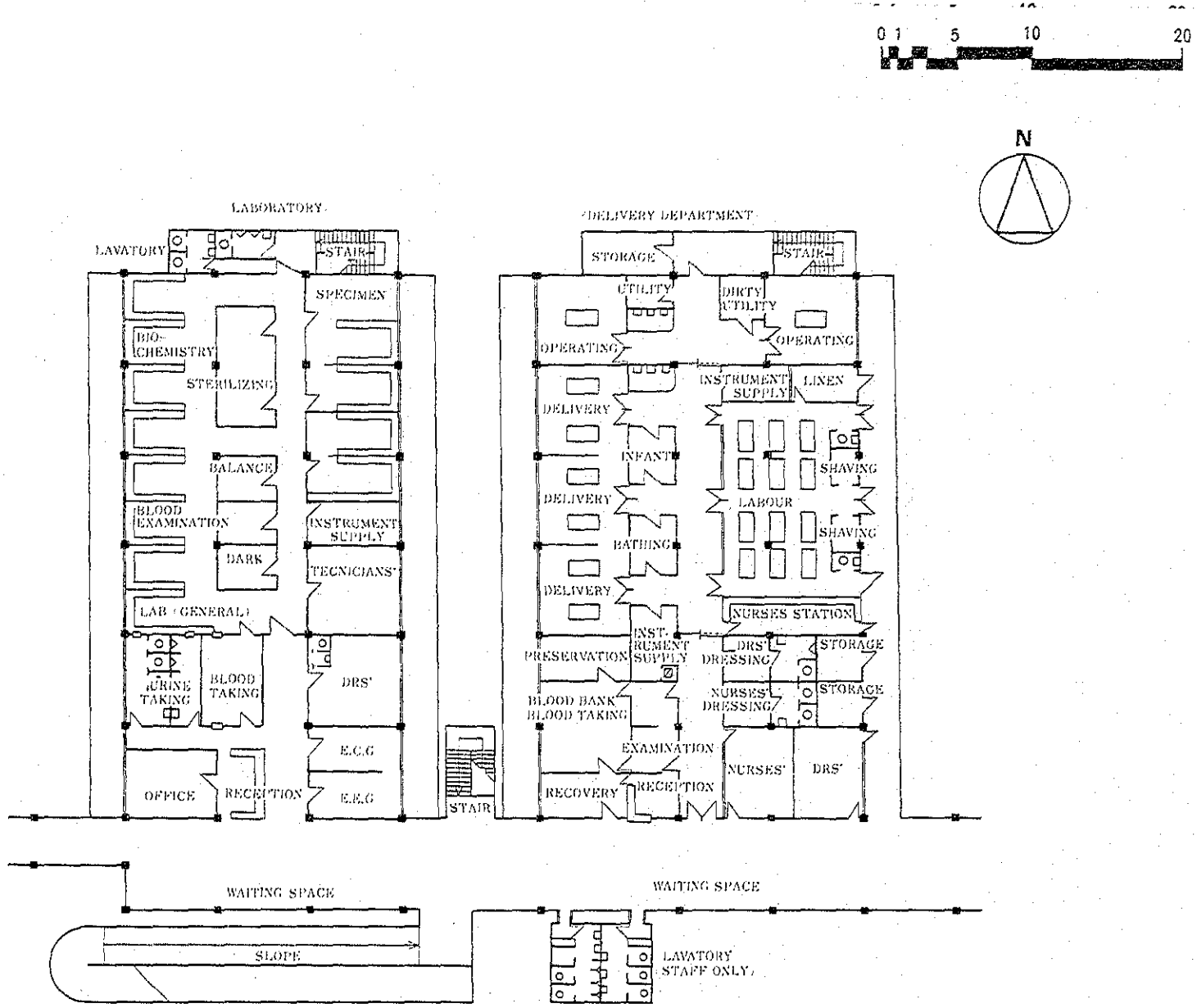
SOUTH ELEVATION



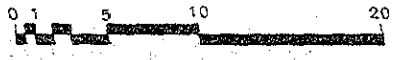
SECTION

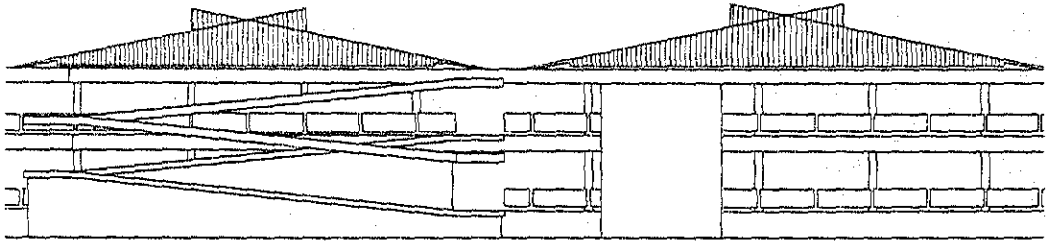

0 1 5 10 20
X-RAY DEPARTMENT
LAVATORY
STAIR
X-RAY 5 FUTURE
STORAGE
TECHNICIANS'
X-RAY 4 (X-TV)
X-RAY 3 FLUOROSCOPY
PATIENT CORRIDOR
CONTROL CORRIDOR
FILMS STORAGE
X-RAY 2 RADIO GRAPHY
DEVELOPING
X-RAY 1 RADIO GRAPHY
FILM ARRANGE
RECEPTION
OFFICE
FILM VIEWING & DRS'
WAITING SPACE
SLOPE
OPERATING DEPARTMENT
STORAGE
STAIR
OPERATING 1
O.R. 4
O.R. 2
CLEAN HALL
O.R. 5
INSTRUMENT
O.R. 3
O.R. 6
INSTRUMENT
ENDOSCOPY GASTROSCOPY LABORATORY
UNSTERILIZED STORAGE
NS' DRESSING
LOUNGE
DRS' DRESSING
CENTRAL STERILIZED SUPPLY
NURSES STATION
ANESTHETISTS'
WAITING SPACE
LAVATORY STAFF ONLY

1 F PLAN

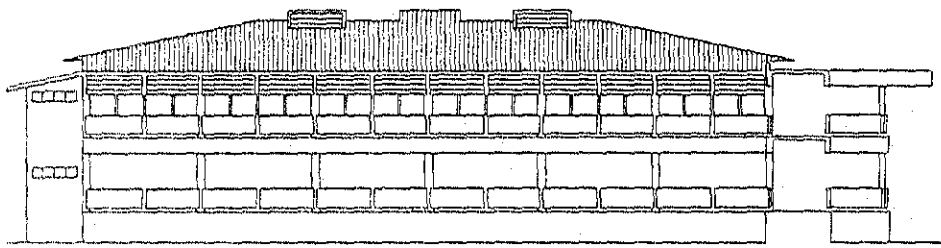

0 1 5 10 20
N
LABORATORY
LAVATORY
STAIR
SPECIMEN
BIO-CHEMISTRY
STERILIZING
BALANCE
BLOOD EXAMINATION
INSTRUMENT SUPPLY
DARK
TECNICIANS'
LAB (GENERAL)
URINE TAKING
BLOOD TAKING
DRS'
E.C.G
E.E.G
OFFICE
RECEPTION
STAIR
DELIVERY DEPARTMENT
STORAGE
STAIR
UTILITY
DIRTY UTILITY
OPERATING
OPERATING
INSTRUMENT SUPPLY
LINEN
DELIVERY
INFANT
SHAVING
DELIVERY
LABOUR
SHAVING
BATHING
DELIVERY
NURSES STATION
INST-RUMENT SUPPLY
DRS' DRESSING
STORAGE
PRESERVATION
BLOOD BANK BLOOD TAKING
NURSES' DRESSING
STORAGE
EXAMINATION
RECOVERY
RECEPTION
NURSES'
DRS'
WAITING SPACE
SLOPE
WAITING SPACE
LAVATORY (STAFF ONLY)

2F PLAN

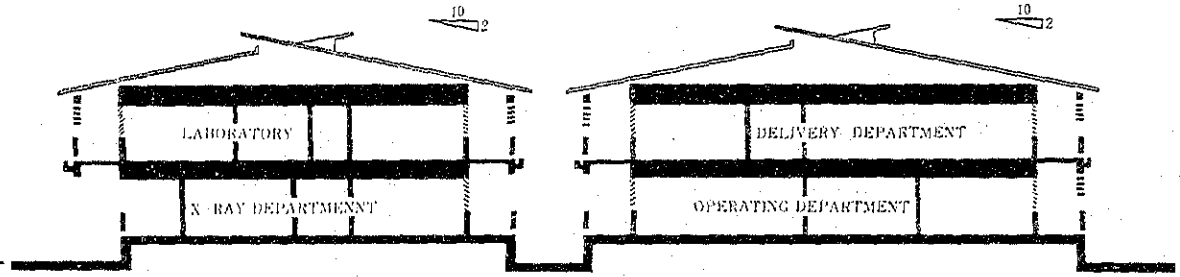




SOUTH ELEVATION

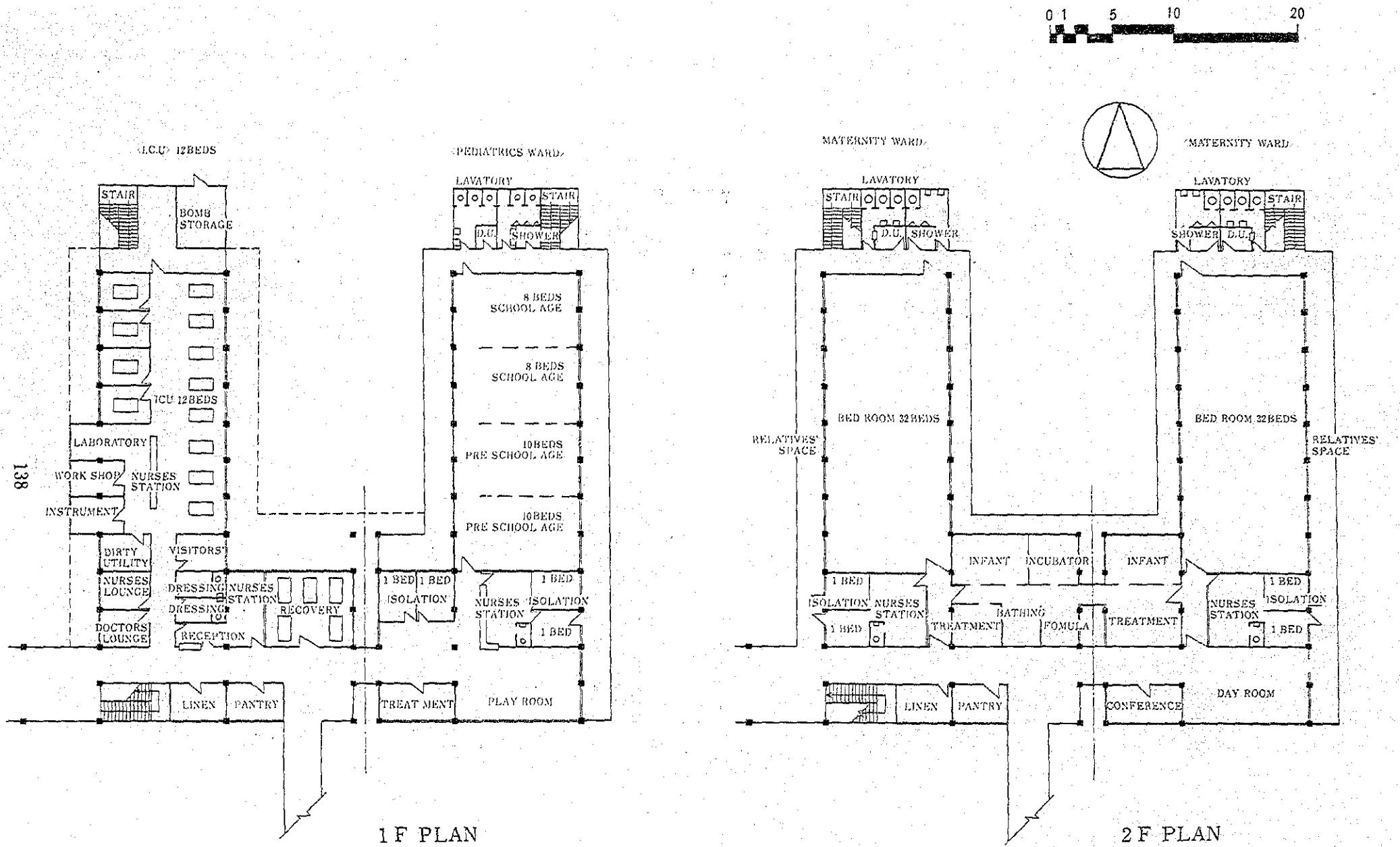


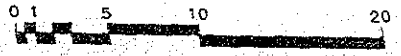
WEST ELEVATION

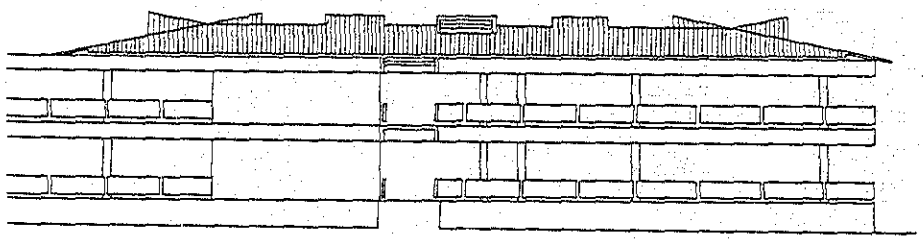


SECTION

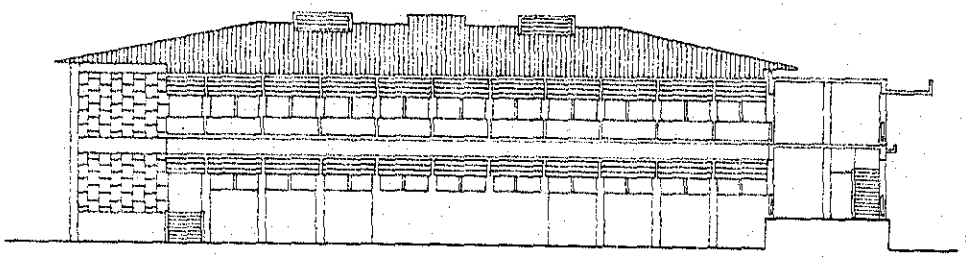
ANCILLARY DEPARTMENT 07


0 1 5 10 20
(I.C.U) 12BEDS
(PEDIATRICS WARD)
(MATERNITY WARD)
(MATERNITY WARD)
STAIR
BOMB STORAGE
LAVATORY
STAIR
D.U.
SHOWER
8 BEDS SCHOOL AGE
8 BEDS SCHOOL AGE
ICU 12BEDS
10BEDS PRE SCHOOL AGE
LABORATORY
WORK SHOP
NURSES STATION
INSTRUMENT
10BEDS PRE SCHOOL AGE
DIRTY UTILITY
VISITORS'
NURSES LOUNGE
DRESSING
NURSES STATION
1 BED
ISOLATION
1 BED
DRESSING
RECOVERY
NURSES STATION
ISOLATION
1 BED
DOCTORS LOUNGE
RECEPTION
1 BED
LINEN
PANTRY
TREAT MENT
PLAY ROOM
1 F PLAN
LAVATORY
STAIR
D.U.
SHOWER
SHOWER
D.U.
STAIR
BED ROOM 32BEDS
BED ROOM 32BEDS
RELATIVES' SPACE
RELATIVES' SPACE
INFANT
INCUBATOR
INFANT
1 BED
ISOLATION
NURSES STATION
1 BED
BATHING
TREATMENT
FOMULA
TREATMENT
NURSES STATION
ISOLATION
1 BED
LINEN
PANTRY
CONFERENCE
DAY ROOM
2 F PLAN

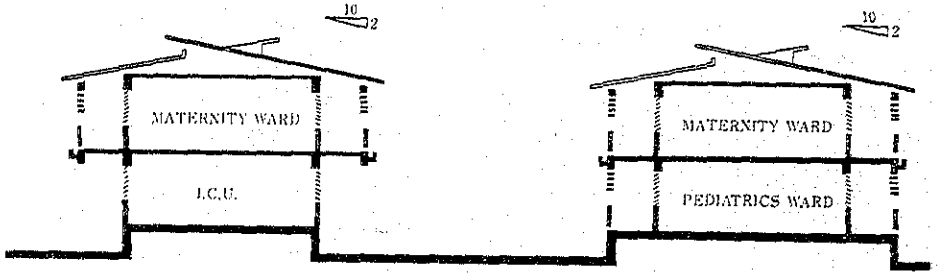




SOUTH ELEVATION

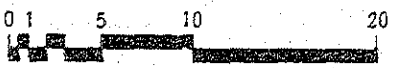


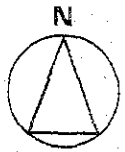
WEST ELEVATION

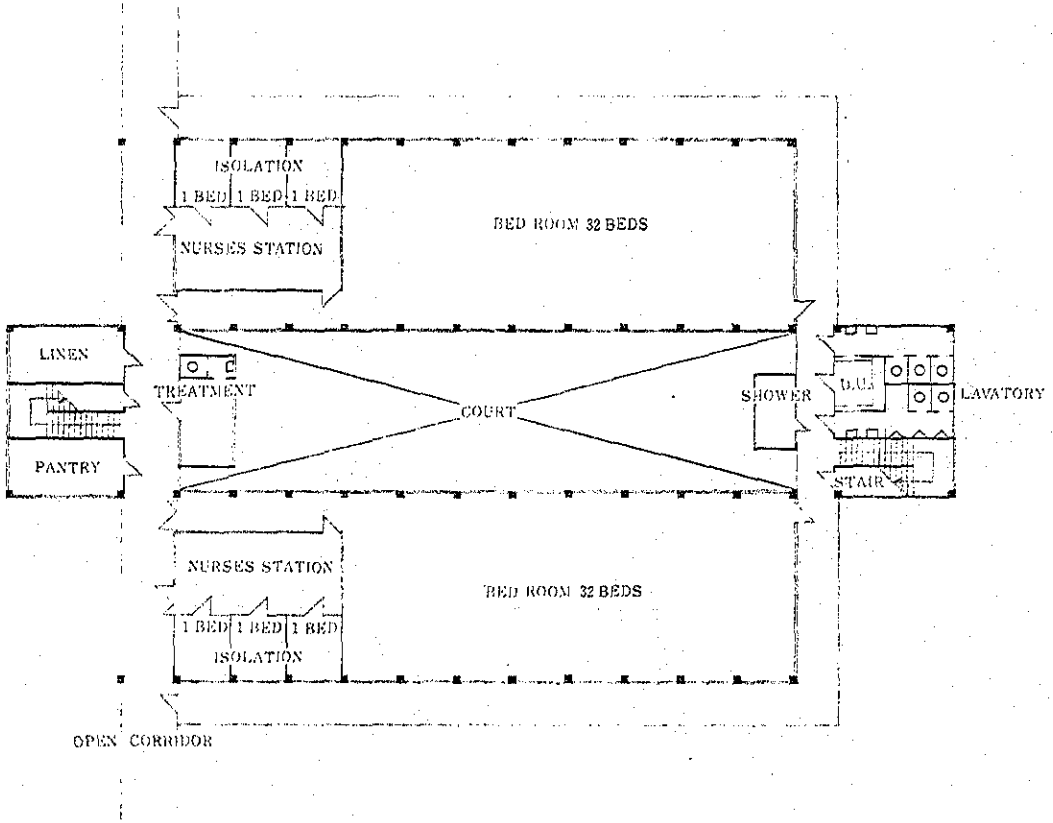


SECTION

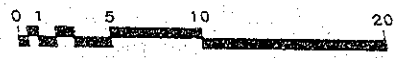
ICU, MATERNITY & PEDIATRICS WARD 09

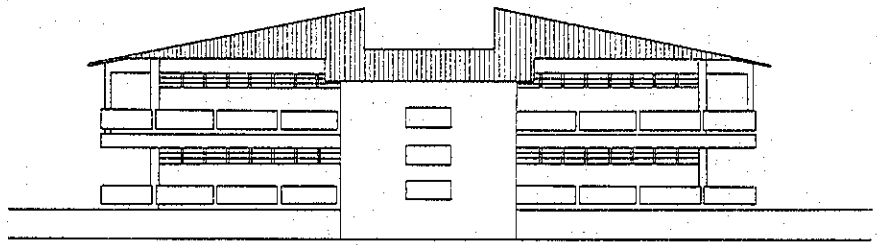

0 1 5 10 20


N

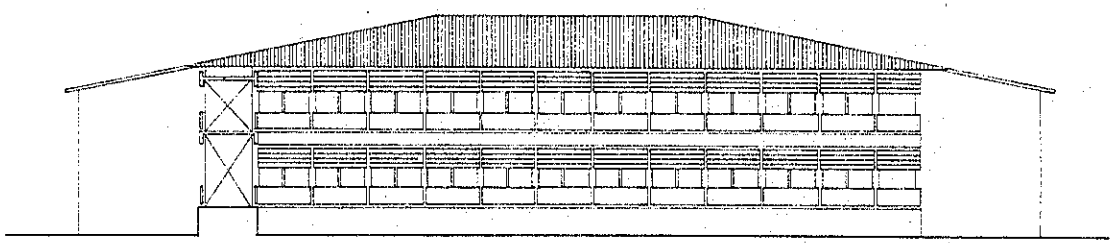

ISOLATION
1 BED 1 BED 1 BED
NURSES STATION
BED ROOM 32 BEDS
LINEN
TREATMENT
COURT
SHOWER
D.U.
LAVATORY
PANTRY
STAIR
NURSES STATION
BED ROOM 32 BEDS
1 BED 1 BED 1 BED
ISOLATION
OPEN CORRIDOR

1 F, 2 F PLAN

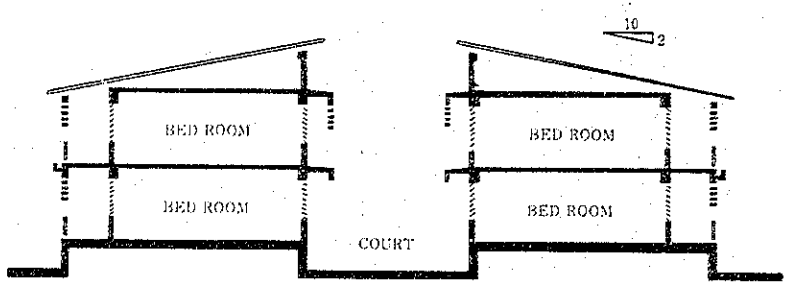




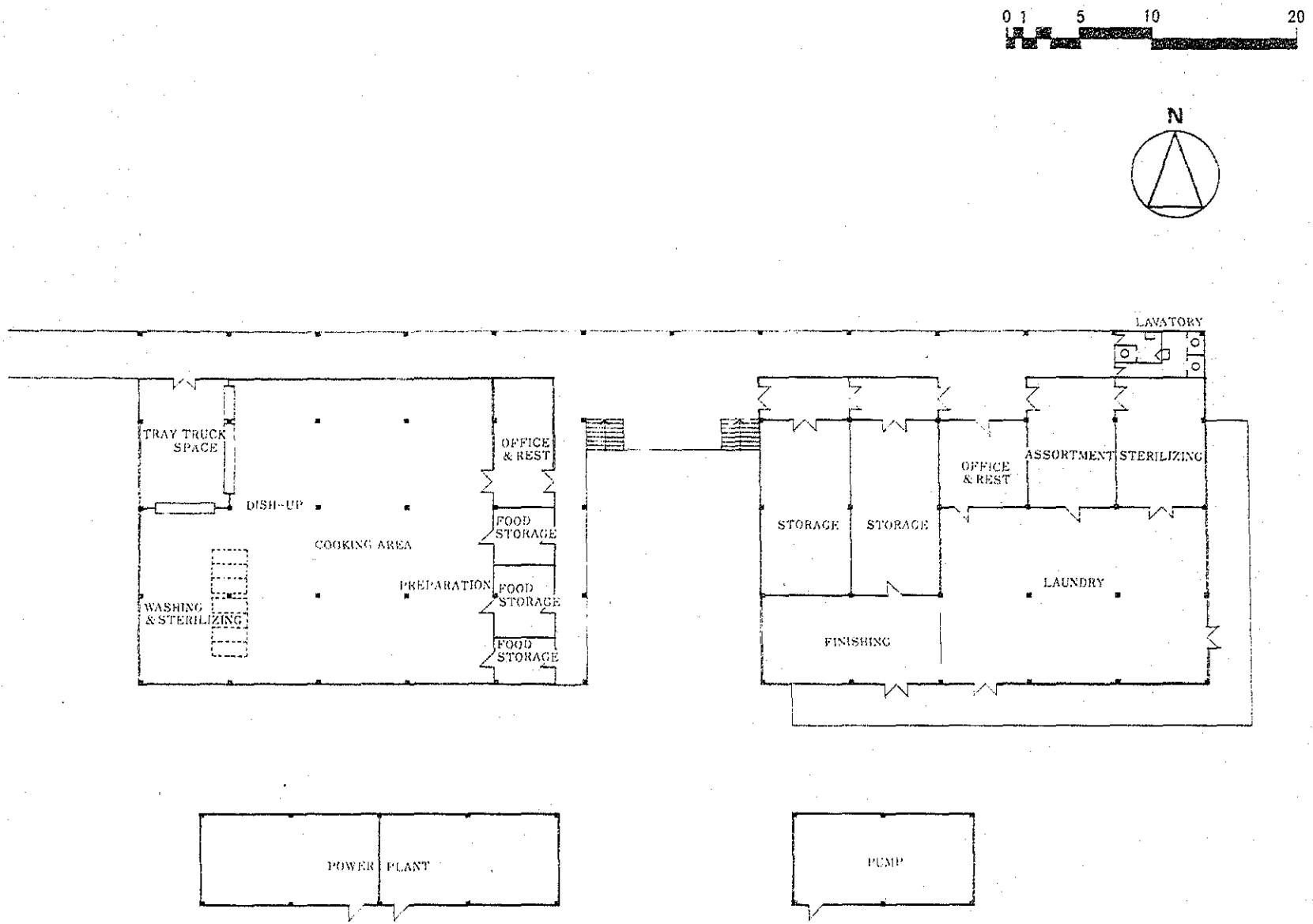
WEST ELEVATION



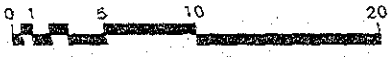
SOUTH ELEVATION

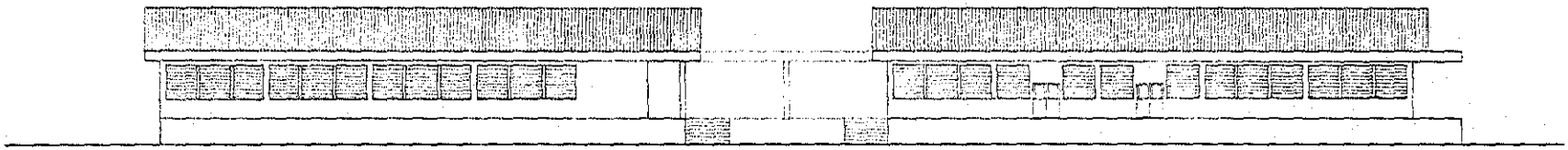


SECTION.

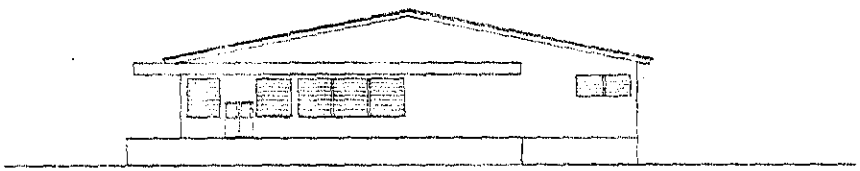

0 1 5 10 20
N
LAVATORY
TRAY TRUCK SPACE
DISH-UP
COOKING AREA
PREPARATION
WASHING & STERILIZING
OFFICE & REST
FOOD STORAGE
FOOD STORAGE
FOOD STORAGE
STORAGE
STORAGE
OFFICE & REST
ASSORTMENT
STERILIZING
LAUNDRY
FINISHING
POWER PLANT
PUMP

1 F PLAN

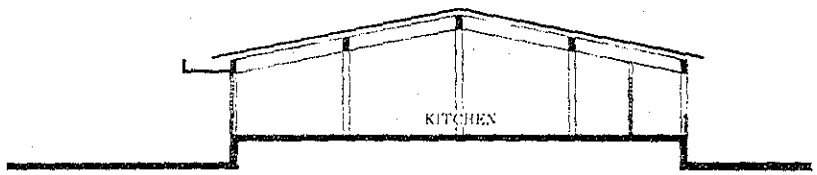




SOUTH ELEVATION



EAST ELEVATION



SECTION

SERVICE DEPARTMENT 13

3-10 Rough Estimate of Construction Cost

3-10-1 Condition of Rough Estimate

Rough estimate of construction cost for the new hospital was made under the following conditions:

1) Time of rough estimate on construction cost: As of December, 1979

2) Exchange rate of foreign currency: US$ 1.00 = 20.5 BHT = 250 Yen

3) Construction materials and medical equipment

As a rule, products made in Thailand and Japan will be used, and costs of materials and equipment to be imported from Japan will include packing cost, F.O.B cost, domestic transportation cost, and insurance premium. However, customs duties and other taxes for the above are assumed to be exempted.

4) Domestic taxes and other duties on contractors with Japanese nationality engaging in construction of this hospital project are assumed to be exempted.

5) Others

Rough estimate on this construction cost was made basing upon the data available at the time of December, 1979 by considering ordinary inflation but revision of project will become necessary if amount of fluctuation is too high due to severe inflation.

3-10-2 Rough Estimate of Construction Cost

	Phase I (In million yen)
1) Building construction cost:	1,231
2) Infrastructure construction cost related to the building construction:	83

3) Medical equipment and other construction cost:	141
4) Consultant fee (including site suppervision):	145
Total:	1,600

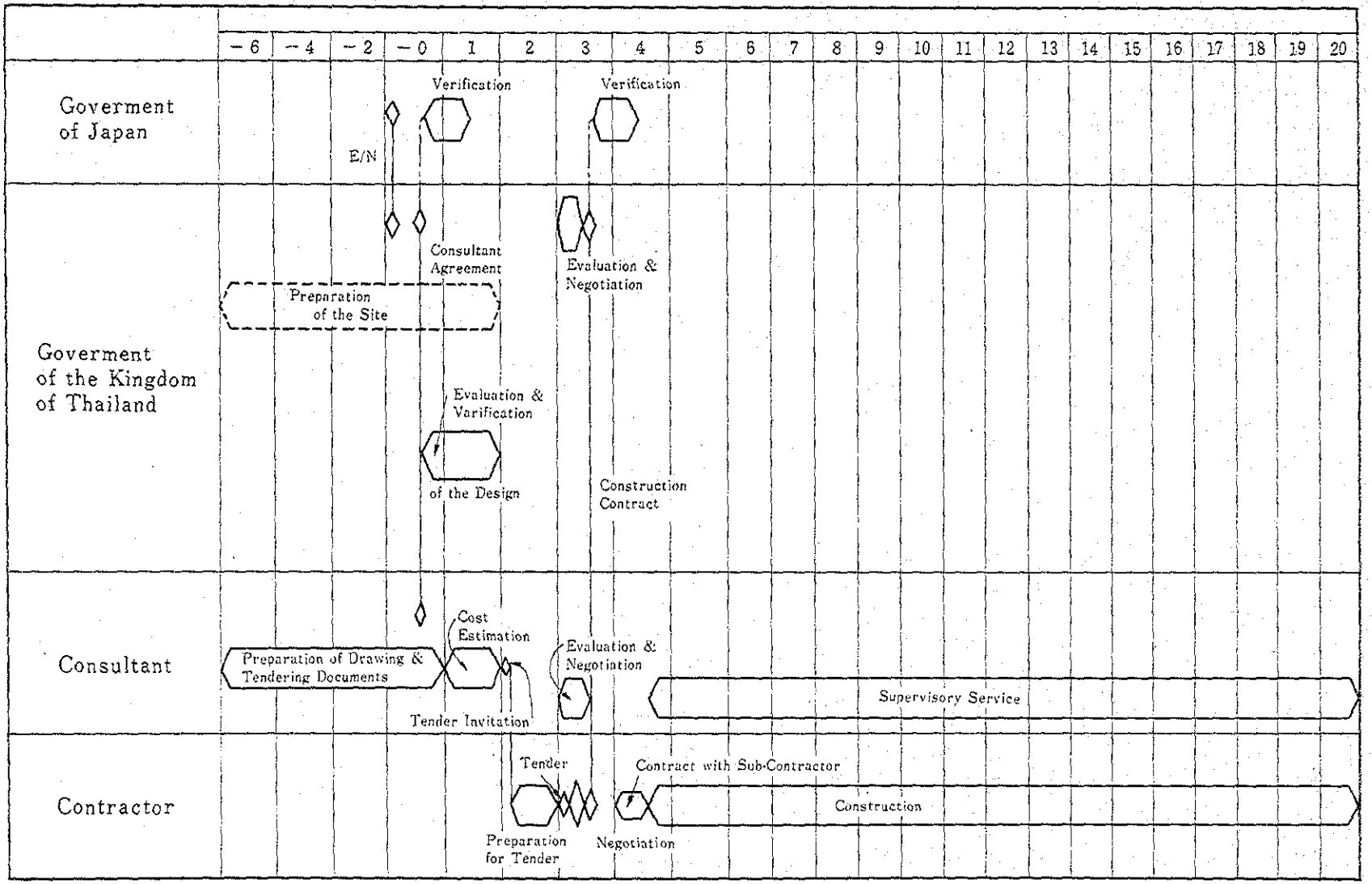
3-10-3 Contents of Construction Work for Phase I

	Phase I
1) Building construction work	• Building for outpatient examination-treatment department • Building for ancillary department (including obstetrics ward and ICU) • Ramps and exterior walkways
2) Infrastructure construction work related to the building construction	• Well and piping in site • Electric wiring in site • Drain pipes in site
3) Medical equipment and others	• Part of medical equipment • Shielding for radioactivity
4) Consultant work (including site supervision)	• Final design fee • Supervision fee • Cost for dispatching inspectors

3-11 Construction Period

Upon completion of signing on Exchange of Note between the Government of The Kingdom of Thailand and the Government of Japan, contract for final architectural design and specification will be made, and preparation and production of design documents, building specifications, and documents necessary for tendering and contract for construction will begin. When all of these documents are completed, approval for the contents of documents by the Government of The Kingdom of Thailand will be obtained, building contractors will be invited for tendering, and tendering will be held. Then, contractor selected through the tendering will sign the contract for construction work with the Government of The Kingdom of Thailand, then the contractor will begin the construction work after obtaining the verification of the Government of Japan.

Construction Program of Maharaj Hospital in The Kingdom of Thailand



3-12 Owner's Obligation

In connection with the execution of the above project, the Owner shall carry out the following works in time for the commencement of the Work or according to the progress of the Work;

(1) Site preparation work such as removal of the existing houses, fences and buried obstacles if any, transplanting of the existing trees and relocation of the electrical poles, cables and water pipes, etc.

(2) Land formation for the project site.

(3) Intake of the water for the project are (including well).

(4) Intake of the electrical power for the project area.

(5) Intake of the telephone wire for the project area.

(6) Construction of the drainage line to the river.

(7) Installation of furniture and other miscellaneous except beds.

(8) Lawn and planting in the proposed site.

(9) Road.

Chapter 4
CONDITIONS OF CONSTRUCTION WORK

Chapter 4. Conditions of Construction Work

4-1 Climate of Nakhon Si Thammarat

4-1-1 Outline

The province of Nakhon Si Thammarat with a total area of 10,168 square kilometers is the largest province in southern part of Thailand. This province is about 830 km away from Bangkok, both being connected with a complete road running between them. This province meets the borders of Surathani Province in the north, Songkla, Trang and Pattalung Provinces in the south, and Krabi Province in the west, and faces the coastline in the east.

Topographically the province mainly consists of tropical forest zone and mountainous zone with rainy season from June to January and dry season from February to May, but a considerable amount of rainfall is expected even in the dry season and thus it may be said that the rainy season practically will exist throughout the year.

4-1-2 Political, Economic and Other Aspects

The population of the Province of Nakhon Si Thammarat is approximately 1,210,000 and it has rich reserves of natural resources including plenty of minerals, fishery products and fruits. Accordingly, the industrial population mostly engages in mining, fishing and farming, and the agricultural products are so plenty that some of them are being shipped even to other provinces. Thus, economically, the average income of workers in this province is higher than that of other provinces.

With respect to the religion, about 95% of total population comprizes buddhists and remaining 5% consists of Moslems. In addition, some communists are hiding in this province and occasionally cause troubles.

4-1-3 Meteorological Conditions in Nakhon Si Thammarat

The air temperature is 37°C maximum and 17°C minimum approximately and the annual mean air temperature is about 26.8°C. The humidity is high throughout the year and rarely drops below 70%, and a high humidity of 80% to 90% is normally maintained. There is no so-called winter season in this province but, if we must choose, two months from January to February when the minimum temperature drops below 20°C can be called "winter".

Rainfall is concentrated in rainy season from October to January and the precipitation will exceed 600 mm.

Concerning wind velocity and direction, east wind occurs from January to April in the whole city area, southwest wind from May to September, and north wind from October to December. Wind velocity is 28 m/sec but the mean wind velocity is 2.6 m/sec. The data of the elements of various meteorological conditions are indicated in figures presented in the following pages.

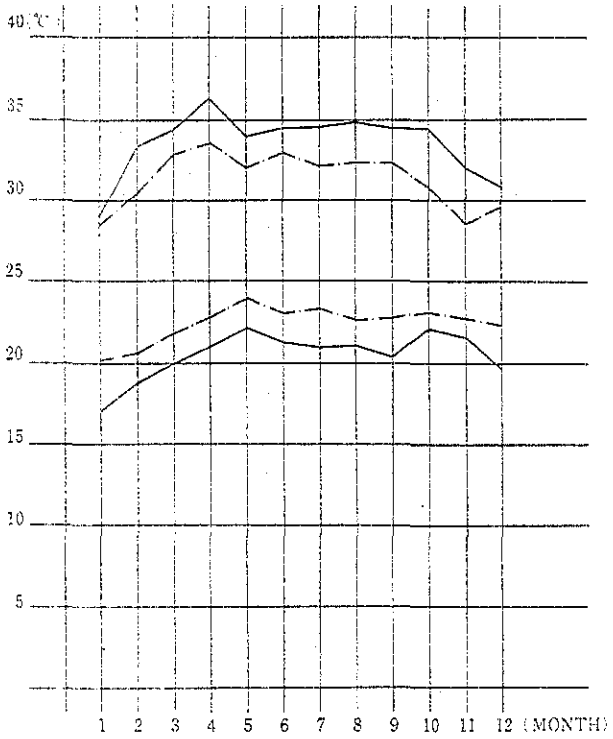


Fig. 4-1-3 (I) Air Temperature 1976

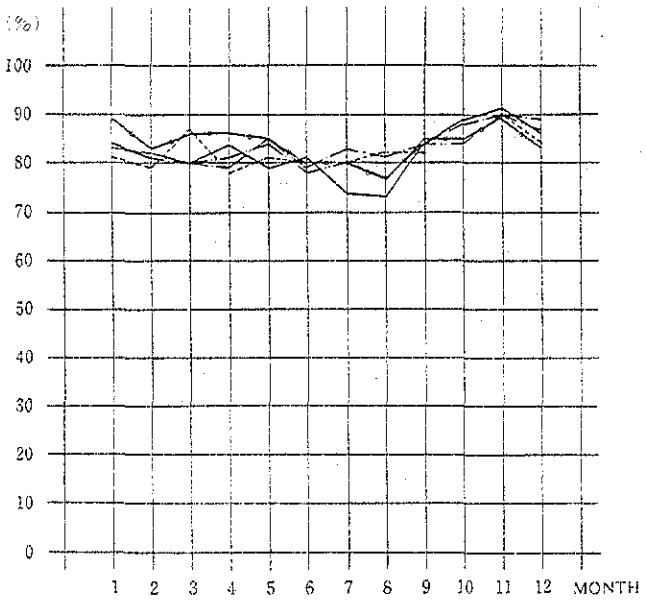


Fig. 4-1-3 (II) Monthly Humidity

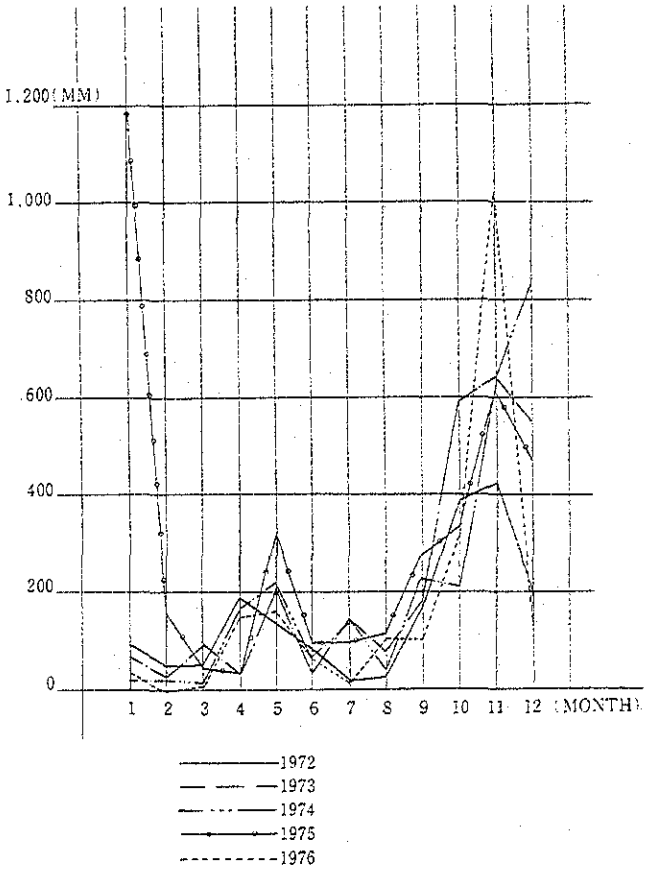


Fig. 4-1-3 (III) Monthly Precipitation

Table 4-1-3(I) Number of Occurrences of Haze, Fog, Hail, Thunder Storm and Squall

Month	1	2	3	4	5	6	7	8	9	10	11	12	Total of annual mean value
HAZE	21.8	23.5	27.6	23.4	15.2	18	20.6	20.5	18.8	14.1	11.1	15.0	229.6
FOG	1.9	3.9	5.8	4.3	1.2	2.1	3.9	1.9	5.0	2.9	0.7	1.1	34.7
HAIL	0	0	0	0	0	0	0	0	0	0	0	0	0
THUNDER STORM	1.1	1.0	5.7	13.3	17.4	11.1	11.6	9.2	11.2	12.2	7.9	4.0	105.7
SQUALL	0	0	0	0	0	0.1	0.1	0.1	0.1	0	0	0	0.4

Table 4-1-3(II) Wind Direction and Velocity

Month	1	2	3	4	5	6	7	8	9	10	11	12
Wind Direction	E	E	E	E	SW	SW	SW	SW	SW	N	N	N
Wind velocity in knots	5.1	5.3	5.1	4.8	4.9	5.9	5.5	5.6	4.9	4.4	4.6	5.3
Maximum wind velocity and wind direction	40 E	30 E	32 SW	40 SW	44 WNW	40 SW NNW	35 SW W WSW	55 WSW	47 SW	50 NW	32 E	27 SE

Table 4-1-3(III) Mean Hours of Cloudiness during Day (0 ∿ 8)

Month	1	2	3	4	5	6	7	8	9	10	11	12	Mean
Mean Hours	5.6	4.8	4.5	5.1	6.2	6.2	6.2	6.5	6.5	6.4	6.4	6.0	5.9

Note: Station. Nakhon Si Thammarat
DATA for the period 1951∿1970