

## CHAPTER 2. CONTENTS OF THE PROJECT

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### 2-1 Objectives of the Project

Coast Provincial General Hospital (CPGH) is the top referral hospital in Coast Province, and is the country's second largest general hospital after Kenyatta National Hospital in Nairobi. The hospital is also playing a key role in the field of health care in Coast Province as the general hospital to train medical staffs.

However, the hospital, which was founded in 1951, is faced with a serious problem of superannuation of its facilities and equipment, although its facilities were extended in 1976. As a result, it is now difficult for the hospital to even maintain the required level of health care and fulfil its functions as the top referral hospital in the province. The hospital is in danger of losing the community residents' confidence in it.

The Government of Kenya is promoting decentralization of the operation and management of national medical facilities under its "Health Policy Framework." With the introduction in 1989 of the concept of cost sharing, it became possible for local medical facilities to appropriate, at their own discretion, part of their incomes from medical care services and the National Health Insurance Fund for the improvement of their respective health care services. The result is that local medical facilities are in the process of effecting structural reforms that will enable them to draw up their own health care service plans and to be responsible for the implementation of such plans.

Under the Government of Kenya's Health Policy Framework, of which "promotion of decentralization" and "establishment of a viable referral system" are the two main pillars for this hospital positioned at the top of the health care hierarchy in Coast Province, is in the midst of improving its maintenance

and management system with the aim of improving the quality of its medical care services and other operations through the introduction of a self-supporting system, as well as the concept and practice of cost sharing. This project is aimed at helping the hospital recover its original functions to provide upto secondary health care services as the key hospital in Coast Province and regain the community residents' confidence in it by improving its superannuated facilities and equipment.

(1) Policy of the Rehabilitation of the Buildings and Equipment

Rehabilitation policies of the Project are as follows;

- 1) To recover the primary health care services, which the hospital is supposed to have, by improving the existing facilities and equipment
- 2) To provide basic medical equipment and air-conditioning necessary for the secondary health care services at the departments related to the secondary health care such as surgical operating department, ICU, etc.
- 3) To provide facilities and equipment which will not burden the hospital with their cost of operation and maintenance

(2) Facilities to be Improved Under the Project

The contents of the request made by the Government of Kenya were discussed and confirmed during the preliminary survey. As regards the extension of the facilities of the maternity department and the renovation of the mortuary, both of which it was decided to consider in the basic design study, the Kenyan side has once again made a strong request that they should be included in the project. As result of the examination of the survey data in Japan, the basic design study team has reached the conclusion that the maternity block and the mortuary should be included in this project.

1) New Construction

- a) Maternity block (Delivery/Operating Dept.)
- b) Toilet & shower Block(for Wards No. 1 to No.9)
- c) Kitchen & Laundry Block

2) Facilities to be Renovated

- a) Existing maternity building (delivery and operating dept.)
- b) Mortuary
- c) Toilet and shower rooms in the existing ward 1 to 9
- d) Ventilation and air-conditioners for the operating dept., ICU, central sterile supply dept. (CSSD), and X-ray dept.
- e) Interior fixtures, security grilles, ventilation and air-conditioners for the clinical laboratory dept.
- f) Fans for outpatient dept. (dental, ENT and ophthalmology)

(3) Criteria for Selection of Items of Equipment

Shown below are the criteria for selection of items of equipment, to which the Ministry of Health of Kenya and Coast Provincial General Hospital have agreed.

1) Items of Equipment to be procured under the Project

- Those which are indispensable for the provision of basic health care services beneficial to patients
- Those which will be operated by the hospital's staff members with using common medical techniques
- Those for whose maintenance and management the hospital will be able to make budgetary appropriations
- Those which can be operated under the hospital's current staffing

system

2) Items of Equipment not to be procured under the Project

- Those which are intended for use in advanced medical research/health care
- Those which it will be both technically and financially difficult to operate
- Those which can be procured by the Government of Kenya and/or the hospital

**2-2 Basic Concept of the Project**

**2-2-1 Overall Plan**

(1) Present Situation of Coast Provincial General Hospital

Coast Provincial General Hospital (CPGH), which is positioned at the highest level in the field of health care in Coast Province in connection with the "promotion of decentralization" and the "improvement of the referral system" in the Ministry of Health of Kenya's "Health Policy Frame Work," is in the midst of improving its facility/equipment maintenance and management system with the aim of enhancing the quality of its operation/management and health care services through the introduction of a self-supporting system and the principle of cost sharing.

The Ministry of Health intends to make CPGH an autonomous institution within five years on condition that the hospital provide health care services for which it will be able to charge appropriate fees. The problem is, however, that with its superannuated facilities to even offer health care services it ought to.

Under such circumstances, it is expected that a project to improve the hospital's facilities and equipment in order to help the hospital recover its original functions with the grant aid cooperation of the Government of Japan will contribute to the improvement of the quality of health care services provided by the hospital, as well as to a drastic change in its medical and clerical/administrative staff members' attitude toward hospital management.

## (2) Details of the Project

CPGH is a medical institution which is to function as a top referral hospital that takes charge of advanced health care services in the province. Under the present circumstances, however, majority of health care services carried out in the hospital are treatment of slight injuries and diseases, which are to be carried out by dispensaries, health centers and prefectural hospitals, due to inadequacies of these other medical facilities and the country's referral system. In other words, special emphasis is presently placed on primary health care at the hospital. Judging from the present conditions of its existing facilities and equipment, it will be difficult for the hospital to offer satisfactory secondary health care services.

In order for the hospital to recover its original functions, it will be necessary first to recover an adequate environment for primary and secondary health care in the hospital. To that end, it will be necessary to consider the repair of the toilets and the shower rooms in Wards No. 1 to No. 9, the construction of a laundry, the improvement of ventilation/air-conditioning of the operating rooms, the ICU, the CSSD and the radiology department, the construction of a kitchen, installation of fans in the outpatient department, and the renovation of the mortuary. It will also be necessary to give priority to the procurement of basic items of equipment and those items of equipment which are required to perform abdominal operations and intensive care of

serious cases but exclude from this project the procurement of those items of equipment which are for use in special areas, such as care of specialized cases, diagnosis by the use of sophisticated medical equipment and heart/brain surgery.

(3) Expected Effects of the Implementation of the Project

1) Enhancement of the Quality of Basic Medical Examination and Treatment

At present, the hospital is unable to offer satisfactory health care services to patients due to the superannuation of its facilities and equipment and a shortage of facilities and equipment. It is expected that the implementation of this project will contribute to the enhancement of the quality of primary health care services offered by the hospital through the procurement of basic items of equipment, such as stethoscopes, sphygmomanometers, basic examination/ diagnosis equipment and trolleys (for use in treatment in the wards).

2) Enhancement of the Quality of Intensive Care Service

The intensive care unit requires to have clean air for patients' environment, however, due to the deterioration of the ventilating/ air-conditioning system, the department has no choice but to depend on natural ventilation by opening the windows, which were originally designed not to be opened. Further, the department finds it difficult to conduct continued monitoring of the patients' vital signs because of shortage of equipment for use in monitoring the patients' condition, hence, the hospital has no alternative but to rely on fragmented information such as physician's diagnoses and observations for monitoring of the patients' condition. Installation of new air-conditioning system will improve the patients' and staffs' environment and prolong life span of

medical equipment by stopping sea breeze from entering into the ICU. The procurement of monitoring equipment, respirators, defibrillators and infusion pumps under this project is expected to make it possible for the hospital to conduct continued monitoring and treatment of the patients' condition and as a result to offer secondary health care services which the hospital is supposed to.

### 3) Enhancement of the Quality of Diagnosis Service

Only basic clinical tests are presently conducted at the hospital. This seems to be mainly because of a shortage of basic items of equipment and inadequacies of the ventilating/air-conditioning system, the superannuation of the testing tables, although some external factors, including the huge number of clinical tests conducted at the hospital, may be involved. It is expected that the procurement of necessary items of equipment for use in blood and biological tests, as well as the improvement of the existing facilities, under this project will enhance the quality of the hospital's health care services by enabling it to improve its testing capabilities, speed up the process of test, carry out more precise diagnoses based the results of a wider range of medical tests.

### 4) Enhancement of the Hospital's Facility Operating Capabilities

At present, personnel expenses and basic facility operating expenses are defrayed by the central government. The amount from the central government, however, is not sufficient to cover all and the shortfall is compensated by the incomes from health care services by cost sharing. In order to improve the hospital's facility operating capabilities and to continuously carry out income increase scheme, this project will play a direct role to increase incomes from health care services by being able



to diversify the kinds of clinical tests, to increase the number of clinical tests and to increase the number of diagnoses and treatment of the patients.

#### **2-2-2 Facility Plan**

(1) Improvement of the toilets and the shower rooms in the Main Wards (Wards No.1 through No.9)

##### 1) Present Conditions

About 50 percent of the toilets and the shower rooms in Wards No. 1 through No. 9 are not functioning sufficiently and are therefore unusable. The work to repair those in Ward No. 7 is being carried out by CPGH but it is temporary repair work, including repainting of the ceilings and walls. It does not include repair of the plumbing for the toilets and shower rooms and is therefore not a complete solution to the problem.

##### 2) Outline of the Improvement Work

This work is to be carried out to repair the existing toilets and shower rooms including the plumbing. However, the usability of the existing toilets and shower rooms during the repair work is a prerequisite for the implementation of the project and it will be difficult to carry out the work to replace the superannuated pipes that pass through the walls and floors without disturbing the operations conducted in the ward. For this reason, two toilet/shower room buildings that connects to the existing ward building are to be newly constructed adjacent to the existing toilets and shower rooms under this project.

### 3) Improvement of Sanitary Conditions and Livability

The execution of the above-mentioned repair work is expected to lead to an improvement of the sanitary conditions for inpatients and the livability of the wards. Furthermore, it will be possible to secure an optimal number of toilets (1 for every 10 beds).

#### (2) Reconstruction of the Laundry Room

##### 1) Present Conditions of the Laundry Room

The roofs of the laundry room are broken and often leak badly. And its walls are cracked. All this represents a poor working environment. In addition, it has only one doorway, which poses a sanitary problem--soiled articles and clean articles cross each other at the doorway.

In principle, bed sheets are replaced three times a week at the hospital. In other words, 515 bed sheets ( $600 \text{ beds} \times 2 \times 3 \text{ times/week} \div 7 \text{ days/week}$ ) are to be washed every day. In actuality, however, only 150 to 200 bed sheets per day are washed with a washing machine.

##### 2) Outline of the Reconstruction Work

In the facility plan, traffic lines for the staff members are to be isolated for improvement of work efficiency and separate doorways are to be secured clean articles from soiled articles. Judging from the size of the existing wards and the quantities of soiled articles to be washed, four washing machines/spin-driers (capacity: 23kg), two stand-alone driers (capacity: 35 kg) and a press are to be procured under this project so that 550 to 600 bed sheets may be washed a day. The washing room reconstruction plan should be worked out taking equipment layout and traffic into consideration for obtaining work efficiency.

### 3) Contribution to the Improvement of Services

The provision of a comfortable environment for the patients and the staff members will contribute to the improvement of the quality of health care services and at the same time will provide a strong working support for the physicians and the nurses. The improved facilities will also ensure improved linen cleaning and management.

#### (3) Renovation of the Air-Conditioning System for the Surgical Operation Department, the ICU and the Central Sterile Supplies Department (CSSD)

##### 1) Present Conditions of the Air-Conditioning System

The building in which the above-mentioned facilities are located was constructed in 1976 and is therefore CPGH's newest building. It is provided with a central air-conditioning system, but the air-conditioning system is not functioning. Three out of the four operating rooms of the central surgical operation department are each equipped with a window frame-mounted air-conditioner as a stopgap measure. Since each operating room, where five to six of medical professionals (surgeons and nurses) work, is equipped with an operating lamp and many other items of medical equipment, all of which generate heat, air-conditioners of this type are not sufficient functionally in light of the amount of heat involved. One of the three air-conditioners has already been removed, and another is out of order. At present, therefore, only one of the operating rooms remains usable.

Two operating rooms of the emergency department are poorly ventilated and air-conditioned. Moreover, they are located on the Ground floor. For these reasons, the two operating rooms are very damp and their walls and ceilings are covered with mold. It is almost impossible to use these

operating rooms for surgical operations.

The ICU and the CSSD are equipped with no air-conditioners. These facilities are used with their windows open, which makes it very difficult to secure clean air these rooms ought to be provided with. All large-size sterilizers installed in the CSSD are out of order. When these sterilizers are replaced under this project, it will be of vital importance to ventilate the room satisfactorily.

The radiography room is not air-conditioned or ventilated either. Both the patients and the radiologists are therefore suffering from a very poor working environment.

## 2) Outline of the Renovation Work

This is the work to install new ventilators and air-conditioners. Under this project, stand-alone air-conditioners which are easy to maintain and manage are to be procured to secure a comfortable environment for both the patients and the medical professionals.

## 3) Contributions to the Improvement of the Quality of Services

This work is expected to result specifically in the following improvements.

(a) Clean air

(b) A more comfortable environment for the patients

(c) A more appropriate working environment for the physicians, the surgeons and other medical professionals

(d) Better environmental (thermal) conditions which are necessary for management and maintenance of medical equipment

#### (4) Renovation of the Kitchen

##### 1) Present Conditions of the Kitchen

The kitchen has a very small space and is not provided with a sufficient stockroom. Moreover, its floor is so poorly drained that there are always puddles in the kitchen. It is not provided with a sufficient space for the manager's office or sufficient numbers of locker rooms and toilets. Under such circumstances, it is very difficult to manage operations in the kitchen.

Meals are provided three times a day, 500 to 600 meals each time. Drinks, such as tea, are served in the morning and in the afternoon. Typical meals are porridge in the morning, soup and meat or vegetable meals or ugali or rice in the afternoon and cooked beans, vegetable meals and ugali or rice in the evening. Usually, two or three dishes are served in the afternoon and in the evening.

##### 2) Outline of the Renovation Work

This work is aimed at improving the functional and sanitary aspects of the kitchen. Facilities that help to solve the above-mentioned problems are to be provided.

##### 3) Contributions to the Improvement of Services

At hospitals, meals are provided to patients with the aim of providing them with foods that is nutrition enough to ease patients' minds and promote their health. They are also important in speeding the pace of patients' rehabilitation. In light of the present conditions of the kitchen facilities, it is difficult to say that the sanitary management of food preparation is well controlled. The reconstruction of the kitchen

facilities is therefore expected to make it possible to improve the working environment and the sanitary condition in the kitchen and thereby contribute to the enhancement of the quality of the hospital's services to patients.

#### (5) Repair of the Facilities of the Clinical Laboratory Department

##### 1) Present Conditions of the Facilities

Most of the laboratory tables are superannuated. Their tops are no longer flat or smooth, which means that these tables are unsanitary. All this poses an obstacle to the smooth flow of clinical examinations. Since this department's facilities are located adjacent to the mortuary and it is not well ventilated, there are always rotten smells in some of the laboratory rooms and the corridors, which poses a serious problem in terms of working environment. Even though these facilities are all located on the second floor, their structure makes it easy to enter them through the windows. It will therefore be necessary to cover the windows with security grilles to prevent thefts.

##### 2) Outline of the Renovation Work

The repair work will include repair of the tops of the laboratory tables, installation of air-conditioners and ventilators and installation of security bars.

##### 3) Improvement of the Working Environment

Improvement of the working environment will be attained by this work. This work will also contribute to improve the environment for the use of equipment (dust, humidity and temperatures) which greatly affects the precision and lives of individual items of equipment.

(6) Extension of the Facilities of the Maternity Department

1) Present Conditions of the Facilities

Lady Grigg Maternity Hospital, which is physically separated from other departments, is offering prenatal health care services. Its existing facilities include an operating room, a sterilizing room and seven delivery rooms, a labor room (with 12 beds), a prenatal ward (with 37 beds), a postnatal ward (with 45 beds) and two rooms for newborn babies (with a total of 25 beds and 3 incubators). The floors of some of the facilities have sunk and some of the ceilings leak. However, the reinforced concrete frames are judged to retain satisfactory strength.

The department's main health care services are delivery assistance and care of newborn babies, including premature babies. Recent annual statistical data on the department's health care services show that there were about 10,000 deliveries, about 500 stillbirths, about 50 deaths of prenatal mothers and 230 to 260 deaths of newborn babies (within 7 days of birth). There have been few changes in these statistical figures over the past five years.

2) Outline of the Improvement Work

In light of the deterioration of the health care service functions and the very poor conditions of the existing facilities, part of the delivery rooms and the operating rooms, both of which are closely related to prenatal and postnatal care, are to be extended.

In 1996, there were 9,922 normal deliveries and 713 deliveries by Caesarian section at the hospital. Usually, there are 30 to 35 normal deliveries a day and a delivery requires about 8 to 12 hours of monitoring (from start of labor to childbirth). There are 3 to 5 deliveries by Caesarian

section a day. Under this project, six beds for use in examinations, about eight beds for use at each of the two levels of danger in labor (normal and medium danger) and about six beds for use in high danger labors are to be provided. Caesarian sections are performed in the operating room of the department, and in an emergency case, the patient is taken to one of the operating rooms of the central operation department since it cannot be handled in the maternity department. It is considered appropriate, therefore, to provide two operating rooms under this project. In addition, about two or three beds will be necessary for recovery.

### 3) Improvement of the Working Environment

The improvement of the working environment is expected to lead to an improvement in sanitary condition and a reduction in the number of deaths at the hospital. It is also expected to contribute to cost sharing through a review of the medical service fee. Most of the women who have given birth leave the hospital within a day of childbirth. When the number of beds is increased through the improvement of the existing delivery rooms, it will become possible for them to stay at the hospital for about two days after childbirth, which will enhance the quality of postnatal care at the hospital.

### 4) Contribution to Cost Sharing

In 1996, the total amount of cash incomes of the maternity hospital was 1,051,160 Kshs. 782,500 Kshs. from normal deliveries and 268,660 Kshs. from Caesarian sections. It is difficult to forecast increases in incomes from deliveries, but given the present hospital charge system, it will be possible to have an increase of the annual total income of the department by 432,000 Kshs. (40 Kshs. x 30 x 360), since the number of days of stay for postnatal care can be increased. Thus, the extension of the



facilities will very likely lead not only to an improvement of the quality of health care services but also to an increase in incomes. As to the staffing, there will be no need to recruit new staff members since staffing can be arranged within the hospital. Since the cost of operation of the facilities can be covered by about 30 percent of the amount of increase in incomes, it will be possible to appropriate part of the amount of increase for the improvement of the quality of other health care services.

**Table 2-1 Trend of Medical Fee at Maternity Department**

(Unit Kenya shs.)

Delivery	1993	1994	1995	1996
(a) Normal		562,650	751,580	782,500
(b) Cesarean	67,010	261,015	284,880	268,660
<b>Total</b>	<b>67,010</b>	<b>823,665</b>	<b>1,036,460</b>	<b>1,051,160</b>

(source: CPGH)

#### 5) Evaluation of Appropriateness

The present trend of use of the hospital's facilities can be summarized as follows.

- a) The waiting room is always filled to overflowing.
- b) Mothers and their newborn babies occupy the postpartum rest rooms more than allowable numbers due to the small spaces. Some of them have to lie direct on the floor because of a shortage of beds.
- c) More than one couple of mother and baby occupies a bed in the postnatal ward due to a shortage of beds.

Under such circumstances, it is very difficult for the patients to receive proper health care services. The sanitary condition in the hospital is poor. All this poses an obstacle to the fulfillment of basic health care functions at the hospital. The improvement of such circumstances is in line with the objective of this project, that is recovering CPGH's ability to provide primary and secondary health care services. Furthermore, in

view of the fact that Lady Grigg Maternity Hospital is one of the key departments of CPGH and the prospect of such improvement contributing to the implementation of the decentralization policy, it is considered necessary and significant that such improvement be included in this project.

#### (7) Mortuary

##### 1) Present Conditions of the Mortuary

In Coast Province, there are a number of hospitals, including Pandya Hospital, Mombasa Hospital and Aga Khan Hospital, where dead bodies are kept, in addition to Coast Province General Hospital. But they are relatively few in number. The combined total number of dead bodies that can be kept at these hospitals is about 50. CPGH has a capacity to keep a total of 45 dead bodies. In actuality, however, it keeps nearly 150 dead bodies by keeping two to three dead bodies in a compartment for one dead body. Those dead bodies which cannot be kept in the refrigerators are left outside of the refrigerators wrapped in cloth. As a result, part of the body fluids and the dead bodies themselves are contacted to the floor and the walls. A survey of treatment of dead bodies at the hospital during the first four months of this year found that nearly 200 dead bodies were kept in the hospital at peak time. The main reasons for this include the relatively small number of mortuaries in the province, higher rates charged at the other hospitals, the need to keep dead bodies in mortuaries for a long time for religious reasons, the fact that postmortem/pathological examinations are conducted at CPGH (five to six dead bodies undergo postmortem examination a day at the hospital) and the fact that functions related to the keeping of dead bodies are concentrated in the hospital.

In addition, a climate of high temperatures and humidity, poor ventilation of the hospital's facilities due to the breakdown of the central air-conditioning system and poor refrigeration of dead bodies due to excessive numbers of dead bodies being kept in the refrigerators accelerate the decomposition of dead bodies, causing rotten smells to linger. The rotten smells even reach the adjacent facilities of the clinical test department, adversely affecting the working environment in the department. Such situation is a serious impediment to operations carried out by the department's staff members. Moreover, complaints about the rotten smells are continuously being received from the residents of the surrounding area, which has indeed been one of the main reasons for the loss of community residents' confidence in CPGH.

## 2) Outline of the Improvement Plan

It will become possible to safely keep 135 dead bodies by installing new refrigerators (capacity: 90 bodies) in addition to the existing refrigerators (45 bodies) in the rooms not in use on the grand floor. The viewing room for the families of the deceased and the lobby will be improved and the ventilating/ air-conditioning system will be repaired.

## 3) Improvement of Working Environment

Work environment of the mortuary and the clinical laboratories will be improved because the rotten smells will not be generated as much by having sufficient number of body refrigerators and the remaining smell will not hang in the air in the postmortem room, clinical laboratory and around the building by having the improved ventilation/exhaust system.

## 4) Contributions to Cost Sharing

At present, a rate of 100 Kshs. per day is charged for the service of

keeping a dead body at the hospital. In 1996, a total of 1,687 dead bodies (140 bodies a month on average) were kept at the hospital. The average length a dead body was kept was about 30 days. If the formal rate collection system had been applied without exception, the rates would have amounted to 5,061,000 Kshs. In actuality, however, only 1,913,600 Kshs. in rate was collected. This was mainly because the sanitary condition in the mortuary was so poor that it was impossible to charge the rates without omission and because the dead bodies kept in the mortuary included unclaimed bodies. When such circumstances are improved through the implementation of this project, it will be possible to collect 4,000,000 Kshs. in rates, which amount is about twice as large as at present. Such an increase in the amount of rates collected will make it possible for the hospital to invest more in the improvement of the quality of its health care services in the face of an increase in the cost of operation of the facilities.

**Table 2-2 The Storage fee for Dead Body**

					(Unit: Kshs)
Item	1992	1993	1994	1995	1996
Storage Fee	995,600	1,343,500	1,831,100	1,967,400	1,913,600

(Source: CPGH)

#### 5) Evaluation of Appropriateness

As a result of this work, cleanliness in the air and of the floor, which is an important factor for a hospital to maintain, will be obtained in and around the mortuary and in the laboratories. Hence, this will contribute to regain the community residents' confidence in the hospital. As stated in 4) Contribution to Cost Sharing, this work will enhance the hospital's capability for charging the official rate for storing bodies and results more income. All of the above leads to a conclusion that it is appropriate and necessary to include this work in this project.

(8) Results of a Survey on the Oxygen Plant

1) Present Conditions of Purchase of Gases for Medical Use

During 1995/96 (October 1995 to September 1996), the hospital purchased 1,458,090 Kshs.'s worth of oxygen (O<sub>2</sub>) and 711,359 Kshs.'s worth of nitrous oxide (N<sub>2</sub>O). The central government's share of the cost for 1996/97 is about 1,100,000 Kshs., which is about half of the total cost, the remaining half being covered by incomes from health care services offered to patients. The annual amount of such incomes is about 1,000,000 Kshs.

**Table 2-3 Purchasing Record of Oxygen and Nitro Oxide (Oct., '95 - Aug., '96)**

Item	Oct.	Nov.	Dec.	Jan	Feb	Mar	Apr.	May	Jun	Jul	Aug	Sept	Total
Oxygen, m <sup>3</sup>	823	1,002	942	859	561	633	1,381	1,028	736	839	1,043	559	10,406
Nitro Oxide, m <sup>3</sup>	106	84	105	60	83	65	82	104	85	90	99	40	1,003

(Source: BOC Gases, Mombasa)

According to BOC Gase, the supplier of these gases, the unit price of oxygen (per cubic meter) is 122.79 Kshs., that of nitrous oxide being 702.89 Kshs. In the case of purchase of liquid oxygen, on the other hand, the unit price is 70.29 Kshs., a little over half of that of oxygen gas. If liquid oxygen is purchased instead of oxygen gas, it will be possible to reduce the annual cost of purchase of oxygen by more than 40 percent. The monthly rent of a liquid oxygen tank is 18,000 Kshs. There is no significant difference between the amount of the above-mentioned monthly rent and the monthly cylinder rent (15,000 Kshs.) charged to CPGH.

2) Outline of the Plan

The hospital is provided with a central oxygen supply system, in which oxygen is supplied to the casualty department, the ICUs and the operating rooms from the cylinder manifold adjacent to the casualty. The hospital is to replace the existing cylinder manifold with a liquid oxygen tank and a vaporizer and supply oxygen. Under this project, therefore, the portions of the piping where the gas leaks are to be repaired.

3) Improvement of the Working Environment

When the plan is implemented, there will be no gas leakage and health care services provided by these departments will become more efficient. There will be no more work to change the cylinders, which in turn will result in a reduction in workload.

4) Contributions to Cost Sharing

When a liquid oxygen tank and a vaporizer are introduced, it will become possible to reduce the cost of oxygen by about 40 percent. In the case of the 6.8 m<sup>3</sup> cylinders which are widely used in the hospital, the present cost is 835 Kshs./cylinder. When liquid oxygen is purchased, the unit cost for the cylinders will be 478 Kshs./cylinder. Thus, the annual cost will be 731,340 kshs. (478 Kshs. X 1,530 cylinders), which means a saving of about 546.000 Kshs. (about ¥1,100,000). The equipment maintenance cost is included in the rent.

The following table shows the portions of the facilities to be extended or repaired.

**Table 2-4 Summary of Rehabilitation**

	Contents					
	New Building	Repair				
		Partition	Air. Vent.	Water	Medical Gas	Interior
1. Ward 1-9	○	○				
2. Laundry	○					
3. OT, ICU, CSSD			○		○	
4. kitchen	○	○				
5. Laboratory			○			○
6. OPD(Dental, ENT, Eye)			○			
7. Maternity	○	○				
8. Mortuary		○	○			

### 2-2-3 Utility Plan

#### (1) Electric Equipment

##### a) Power Supply Equipment

There is a substation along Kisuani Road bordering on the project site, where 10 KV electricity received from KP & L is transformed into 415V/240V. There are only a few power failures in a year. Since the voltage fluctuation rate is about six percent, however, it will be necessary to take steps to stabilize the voltage of electricity supplied to precision instruments. It should also be noted that a generator for use with the refrigerators installed in the mortuary are to be installed. Emergency power supply for the new maternity block, which is to be constructed under this project, will be secured by utilizing the existing power line from the existing generator.

##### b) Lighting Fixtures/Wall Sockets

Fluorescent lamps are to be the main lighting fixtures in consideration of lighting efficiency and ease of maintenance. The existing wall sockets are to be used for power supply for the equipment procured under this project.

##### c) Telephone System

Telephones are to be installed in the nurse station of the maternity block and the staff members' rooms of the kitchen & laundry block. No switchboard is to be newly installed since the existing one has enough capacity.

##### d) Alarm Bells

Alarm bells are to be installed in the corridors of the maternity block and the kitchen & laundry block. A receiving set is to be installed

in the office room of the existing administration building.

(2) Air-conditioning/Ventilating Equipment

- a) In light of the present conditions of equipment maintenance and management, separate air-conditioners (wall-type, separate room air-conditioners) are to be installed. No air filter systems are to be installed in the existing and newly constructed operating rooms in light of the present conditions of equipment maintenance and management.

(3) Plumbing System

- a) An elevated water tank for each zone that utilizes the water pipe from the existing main elevated water tank is to be installed under this project. Two water main pumps are also to be newly procured and one of the main elevated tanks (62m<sup>3</sup>) is to be replaced under this project.
- b) In principle, sewage and ordinary waste water are to flow separately indoors and then to be discharged into the existing drainpipes.

**2-2-4 Equipment Plan**

The same criteria for selection of items of equipment that applied in the preliminary survey--namely, replacement or replenishment of the existing items of equipment, basic items of equipment for use in the provision of primary and secondary health care, items of equipment which can be used within the framework of the present equipment maintenance and management system and items of equipment for whose operation sufficient budgetary appropriations are certain to be made--apply in the equipment plan.

The basic design study team discussed the requested items of equipment with the Kenyan side in accordance with the above mentioned criteria for selection



of items of equipment during the basic design study, and in the course of the analysis of the results of the basic design study in Japan examined the necessity of the implementation of this project, as well as the appropriateness of the planned quantities of the requested items of equipment, on the basis of the following order of priority set for the requested items of equipment.

A: items of equipment which need to be renewed in light of the degree of deterioration/superannuation, items of equipment which need to be replaced in light of the scale of the facility concerned, items of equipment which are expected to contribute to the provision of primary and secondary health care

B: items of equipment which it is judged appropriate to procure under this project but which need to be reexamined in light of the scale and details of health care services presently offered

C: items of equipment which it is judged difficult to procure under this project

#### (1) Overall Plan

This project is aimed at replacing those superannuated or out of order items of equipment which are the cause of a marked decline in the health care functions of the facilities. Items of equipment to be given priority, therefore, are those which are indispensable for basic health care activities. In principle, the equipment plan is to be drawn up and implemented on the basis of the existing items of equipment and within the framework of the present health care service activities (by the medical doctors and technicians). However, in view of the fact that Coast Provincial General Hospital, for which this project is going to be implemented, is the top referral hospital to offer health care services to the poor and needy in the region, such items of equipment as will help the hospital work closely with the other referral hospitals in the region are to be newly procured.

## (2) Equipment Plan

Shown below are the details of the examination of each department for the equipment plan.

### 1) Administrative Department

The administrative department, which is responsible for personnel management, medical examination record management, accounting, matters related to the National Health Insurance Fund, etc. is faced with problems in the areas of development, management and storage of medical examination statistics, as well as computation and management of incomes and expenditures. For this reason, the minimum quantities of personal computers, copiers, typewriters and printers are to be procured for this department so that they may be utilized for the unification and simplification of forms and to achieve work efficiency.

No computer software is to be procured under this project since the existing software, including medical statistics compiled under the guidance of the Ministry of Health, can be utilized. Computerized management of goods and materials related to medical equipment is being conducted with the support of the Government of Germany's technical cooperation agency (GTZ), and therefore the introduction of personal computers for use in basic data management under the project is judged to be timely.

### 2) Rehabilitation Department (Physiotherapy and Occupational therapy)

#### a) Analysis of the Present Situation

##### (a) Physiotherapy Department

At this department, four physiotherapy paramedical provide medical care to 40 to 50 outpatients a day, and physiotherapy paramedical stationed in each ward take care of inpatients. There are seven

of them stationed in the surgical ward, three in the internal medicine ward and two in the gynecological/obstetrical ward. Their main jobs are to provide medical care to, and assist in the rehabilitation of, physically disabled persons (particularly those whose limbs are impaired) using a variety of physical therapy techniques (electric, thermal, optical and pulling techniques).

(b) Occupational Therapy Department

At this department, an occupational therapist and an occupational therapy paramedical provide medical care to about 15 physically disabled persons (particularly those whose limbs are impaired) a day. In assisting in the patients' rehabilitation, they use foot-operated jigsaw boards, woodwork tools, pottery sets, weaving sets and tile mosaics. The ratio of children under five years of age who visit this department is relatively high. Most of them come to this department for rehabilitation of the limbs.

b) Outline of the Procurement Plan

Rehabilitation is a process in which medical professionals help physically disabled persons to live normal lives again as soon as possible by beginning to provide medical care to them at the earliest opportunity. It is desirable that these patients undergo rehabilitation without being isolated from their respective communities. At present, a review is being made of the need for rehabilitation at hospitals, both large and small, where cerebral apoplexy, arthritis, nervous disorder and orthopedic patients are undergoing medical care.

At this hospital, which is visited by many patients as a key hospital in the province, necessity of this department is very high. Of the nearby medical institutions, some of the private hospitals are provided with rehabilitation facilities. The hospital is the

region's only national hospital provided with rehabilitation facilities.

The present state of the hospital's existing rehabilitation equipment and the need to procure additional basic items of equipment for the department were examined on the basis of the contents of the following table. In principle, except for the walking sticks and wheelchairs which have to be procured in more than one pair, only one unit of each of these items of equipment is to be procured with particular emphasis on the maintenance of necessary health care service functions.

**Table 2-5 Study on Requested Equipment**

Name	Existing	Requested	Renew	New
1. Apparatus for test and evaluation				
Goniometer	○	○	○	
Apparatus for physical test		○		
Wrist roller		○		
Apparatus for gait analysis		○		
2. Apparatus for physiotherapy				
Training bed	○	○	○	
Tilt table	○	○	○	
Apparatus for muscle training	○	○	○	
Cybex machine				
Pedal apparatus	○	○	○	
Treadmill				
Parallel Bars	○	○	○	
Stick, Crutch, Walking frame	○	○	○	
Exercise stairs	○	○	○	
Apparatus for leg training	○	○	○	
Training mat	○	○	○	
Wheel chair	○	○	○	
3. Apparatus for occupational therapy				
Wood-working machine		○		○
Work bench	○			
Standing table		○	○	
Floor Seat				
Ceramic set		○		○
Tile mosaic set	○			
Apparatus for splint				

3) Wards

a) Analysis of the Present State of the Wards

(a) Inpatients' Diseases and the Scale of the Wards

A survey of inpatients' condition during the first quarter (January

to March) of 1996 shows that many infants are suffering from malaria, intestinal infectious diseases, anemia, electrolyte metabolism disorder, nutrition disorder, acute upper digestive tract disorder, bronchial pneumonia and measles, that main women's diseases are early gravidic bleeding, prenatal/postnatal infectious diseases, vaginal diseases and miscarriage, and that main adult diseases are malaria, anemia, bronchial pneumonia and tuberculosis. It has also been found that many of the patients visiting the orthopedics department are suffering from bone fractures and arthritis. The classification of the hospital's wards is based on that of its clinical departments--internal medicine, surgery, orthopedics, gynecology, obstetrics and pediatrics. The internal medicine department's ward is provided with about 150 beds, the surgical ward with about 150 beds, the gynecologic ward with about 56 beds, the obstetrical ward with about 90 beds, the pediatric ward with about 70 beds, and the single-bed room ward with 26 beds.

(b) Changes in the Number of Inpatients

The following tables show changes in the number of inpatients between 1993 and 1995. As is clear from these tables, the number of inpatients is on the decrease. On the other hand, however, the length of hospitalization is on the increase. As a result, both the bed occupancy rate and the average length of hospitalization are increasing.

**Table 2-6 Condition of Impatient (1993)**

	Admis- sions	Dis- charge	No. of Deaths	Beds	Cots	Total days of beds occupied	Average occupancy (%)	Average length of stay
Ward No. 5 (Internal Medicine, Male)	1,996	1,724	179	38	0	22,354	161.05	11.70
Ward No. 6 (Internal Medicine, Male)	2,018	1,695	248	38	0	18,606	134.21	9.60
Ward No. 1 (Internal Medicine, Female)	1,528	1,334	148	38	0	13,147	94.73	8.90
Ward No. 2 (Internal Medicine, Female)	1,575	1,366	144	41	0	17,912	119.75	11.90
Ward No. 3 (Surgical, Male)	1,144	1,071	58	39	0	15,790	111.02	14.00
Ward No. 4 (Surgical, Male)	997	956	49	38	0	18,655	134.47	18.60
Ward No. 7 (Surgical, Female & Pediatric)	1,751	1,699	69	38	12	16,684	91.40	9.40
Ward No. 8 (Orthopedic Male)	448	446	12	35	0	11,631	91.14	25.40
Ward No. 9 (Gynecology)	3,005	2,901	48	56	0	17,439	85.35	5.90
Ward No. 10 (Pediatrics)	4,853	4,585	192	23	49	72,449	275.69	15.20
Pediatrics (ORT)	1,559	1,370	173	7	30	14,460	107.02	9.40
Private Ward (IRW)	433	461	36	26	1	6,924	70.37	13.90
ICU	72	42	43	10	0	2,916	80.00	34.30
Casualty	1,020	780	11	16	0	6,518	111.87	8.20
nursery (L.G.M.H.)	1,166	227	336	0	44	12,340	76.81	36.70
Prenatal Ward (L.G.M.H.)	1,614	807	1	36	0	28,022	213.33	34.70
Postnatal Ward (L.G.M.H.)	8,744	8,737	0	53	0	63,080	326.03	7.20
Neonatal Ward (L.G.M.H.)	7,960	7,942	0	0	0	26,567		3.30
Total	41,883	38,143	1,747	532	136	385,494	158.10	15.46

(Source :CPGH)

**Table 2-7 Condition of Impatient (1995)**

	Admis- sions	Dis- charge	No. of Deaths	Beds	Cots	Total days of beds occupied	Average occupancy (%)	Average length of stay
Ward No. 5 (Internal Medicine, Male)	1,636	1,092	137	38	0	31,266	225.52	25.50
Ward No. 6 (Internal Medicine, Male)	1,747	1,444	207	38	0	21,893	157.89	13.30
Ward No. 1 (Internal Medicine, Female)	1,332	1,087	157	38	0	23,566	170.00	18.90
Ward No. 2 (Internal Medicine, Female)	1,239	1,001	109	41	0	27,774	185.60	25.00
Ward No. 3 (Surgical, Male)	896	804	39	39	0	13,011	91.28	15.40
Ward No. 4 (Surgical, Male)	762	642	41	38	0	16,867	121.57	24.70
Ward No. 7 (Surgical, Female & Pediatric)	1,328	1,177	48	38	12	27,966	201.57	22.50
Ward No. 8 (Orthopedic Male)	426	415	9	35	0	11,910	93.14	28.10
Ward No. 9 (Gynecology)	2,480	2,285	46	56	0	35,949	175.89	15.40
Ward No. 10 (Pediatrics)	3,940	3,303	216	23	49	50,071	190.55	14.20
Pediatrics (ORT)	1,589	1,381	152	7	30	6,496	48.10	4.20
Private Ward (IRW)	392	400	45	26	1	5,287	53.70	11.90
ICU	77	23	55	10	0	2,257	62.00	28.90
Casualty	1,155	969	58	16	0	6,723	115.00	6.50
nursery (L.G.M.H.)	1,071	363	275	0	44	22,050	137.27	34.60
Prenatal Ward (L.G.M.H.)	1,106	641	0	36	0	27,042	205.83	42.20
Postnatal Ward (L.G.M.H.)	8,403	8,414	0	53	0	36,137	186.79	4.30
Neonatal Ward (L.G.M.H.)	7,596	7,666	0	0	0	34,736		4.50
Total	37,175	33,107	1,591	532	136	401,001	164.46	18.91

(Source :CPGH)

#### b) Outline of the Plan

As the results of the analysis of the present condition of the wards show that the wards' items of equipment--notably the beds, the headrests and the carts--are deteriorated and they are in short supply. Operations carried out at the wards are mainly 1) nursing (recording, treatment, examination, drug administration, thermometry, making preparations for surgical operations and rounds of visit), 2) services (disposal of filth, supply of meals, care, giving baths), and 3) clerical work related to hospitalization and discharge. In view of the fact that the above-mentioned deterioration and small number of the existing items of equipment are hindering these operations, it was decided to replace or replenish these items of equipment as follows.

- Main Items of Equipment to Be Replaced/Replenished

##### [Bed]

The beds installed in the internal medicine, orthopedic and other wards, which are badly deteriorated, are to be replaced. The wards to be covered by this project are the internal medicine ward, the surgery/orthopedic ward, the maternity ward, the single-bed room ward and the obstetrical ward.

##### [Cart]

The carts used in the main wards (Wards No. 1 to No. 9) and the special wards (the pediatric, obstetric) are to be replaced or replenished at a rate of one or two units per ward.

#### 4) Clinical Laboratories

##### a) Analysis of the Present Condition of the Clinical Laboratories

The hospital's laboratory department consists of a blood bank, a blood

test room, a biochemical test room, a public health test room, a pathological test room, a bacteriological test room, a serum examination room and an HIV/AIDS test room. The department's staff members are working in three shifts. At night, one of the staff members stands ready for emergency case. Many of the emergency cases taken to the hospital are suffering from malaria and these emergency cases undergo testing for a malarial parasite. Public health examinations conducted at the department include examinations of foods and water. In 1994 when there was a high incidence of cholera, as much as 25,000 public health examinations were carried out at the department. The following tables show statistics on the examinations conducted at the department over the past five years.

**Table 2-8 Laboratory Test**

Section	1991	1992	1993	1994	1995	1996
Hematology	20,262	18,097	20,785	14,566	16,922	15,505
Biochemistry	9,743	7,318	14,454	11,528	11,645	10,150
Microbiology	22,952	19,711	22,950	17,844	18,118	22,341
Histology	1,392	1,538	1,397	1,076	1,312	1,177
Serology	13,698	14,851	16,876	11,460	13,395	10,943
Virology	9,141	8,362	5,972	5,567	4,888	4,276
Pubic Health	1,205	1,411	482	25,065	2,140	480
Night Duty	21,934	25,750	24,723	27,904	31,865	31,724
Parasitology	51,532	51,017	37,156	32,116	34,419	57,872
Total	151,859	148,055	144,795	147,126	134,704	154,468

(Source : CPGH)

**Table 2-9 Activity of Blood Bank**

Contents	1991	1992	1993	1994	1995	1996
Whole Blood Collection	2,258	4,194	2,334	2,386	2,111	1,792
Syphilis Serological Test	2,258	4,194	2,334	2,386	2,111	1,792
HBs Antigen Test	2,258	4,194	2,334	2,386	2,111	1,792
HIV-I, II Antibody Test	2,258	4,194	2,334	2,386	2,111	1,792
Test of Blood Transfusion	10,881	12,009	11,372	10,609	9,072	8,196

(Source : CPGH)

#### Outline of the Plan

The clinical Laboratory rooms to be covered by this project are (a) the blood test/biochemical test room, (b) the blood bank, (c) the



bacteriological examination room, (d) the HIV/AIDS test room and (e) the pathological test room. The blood bank and the biochemical examination room, both of which are now operating at peak capacity in terms of test items and sample testing ability will be supplied with automated equipment.

(a) Blood Test/Biochemical Laboratory Room

Blood tests conducted at the department are divided into blood tests and biochemical test. In blood tests, the numbers of red cells, white cells and blood platelets are counted and their shapes are tested. In biochemical tests, the quantities of such minerals as iron, magnesium, phosphorous and sodium and potassium, proteins and bilirubin that are contained in the blood are determined. The items of equipment to be replaced under this project due to superannuation include spectrophotometer, microscope, colorimeter, hemoglobin meter and centrifuge.

Examination of the Requested Items of Automated Equipment

The requested items of automated equipment include blood gas analyzer, electrolyte analyzer, automatic red cell coefficient device and automatic biochemical analyzer. A number of medical professionals, such as medical examination technicians, have experience of using these items of equipment. But all these items of equipment, except for the automatic blood cell coefficient device, are to be introduced in the hospital for the first time.

[Blood gas analyzer/electrolyte analyzer]

The blood gas analyzer is used to correct the standard of determination of the concentration of an anesthetic in the blood of a patient undergoing an operation and the body fluid balance of a seriously injured or serious patient before or after an operation by analyzing the acid-base balance. In the

case of infants whose blood has to be collected in a very small quantity, in particular, the blood gas analyzer and the electrolyte analyzer are used frequently. These items of equipment are used most frequently at private hospitals in the Mombasa district. These items will be procured on condition that CPGH gets maintenance contracts with the local distributors of the equipment.

[Automatic blood cell coefficient device]

An automatic blood cell coefficient device was once introduced in this hospital. A request for an additional unit was made because the existing device is out of order due to superannuation and remains irreparable. It was therefore judged appropriate to replace the existing one.

[Automatic biochemical analyzer]

Automatic biochemical analyzers have not yet come into widespread use even at private hospitals in the Mombasa district. As a result of a survey of three private hospitals in the district, it has been found that it is difficult to introduce this equipment because of the high running cost, the relative difficulty of the necessary repair skill and the need to pay special attention to the environment in and around the facility where this equipment is to be installed. Judging from the hospital's present staffing system, it will be possible to process the necessary number of samples with a spectrophotometer which is to be procured to replace the existing one. Therefore, Automatic biochemical analyzer is not procured for this project.

(b) Blood Bank

The blood bank is responsible for collecting and testing blood

for use in blood transfusions. The microscope, the blood refrigerator and the centrifuge, all of which are necessary for the operations carried out at this blood bank are superannuated, which is hindering such operations. These items are to be replaced since the necessities for them were determined very high.

(c) Bacteriological Laboratory Room

The main operations being carried out at this room are to test samples of the blood, pancreatic juice, urine, sputum and excrement of living organisms for bacteria, as well as their qualitative and quantitative examinations. These examinations are conducted to test the samples for mycelia, decide on the methods of diagnosis of their species and types, examine disease-causing germs' sensitivity to scientific therapies and provide data for use in actual medical treatment. Of the existing items of equipment for use in these examinations, the culture tubes, the microscope and the like are to be replaced under this project.

(d) HIV/AIDS Laboratory Room

At present, screening centered around antibody tests of HIVs is conducted. Tests of HIV-I and HIV-II by the use of the Eliza Method and counting of Western Plots and CD4s are conducted. In view of the fact that the numbers of HIV patients and AIDS patients are on the increase in the country, the Government of Kenya is in the midst of stepping up measures to combat AIDS with the cooperation of USAID as one of the top priorities in its health care policy.

The tests are carried out using one set each of plate readers, incubators and washers. But the total number of tests is less

than half of the desired total number of examinations. Since there will be no problem with the running cost (the hospital has the financial assistance of the Ministry of Health), these items of equipment are to be procured.

(e) Pathological Laboratory Room

At this room, diagnosis based on the results of microscopic examinations conducted using general samples, samples for use in biopsy and samples for use in pathological dissection which were obtained during surgical operations is conducted. Percutaneous needle biopsy and even cytodiagnosis to examine cells exfoliated in body fluid are also conducted at this room, although not so frequently. This room is provided with a microtome, a constant temperature water tank, a microscope and a paraffin bath, all of which are necessary for these tests. But most of these items of equipment are out of order or badly deteriorated. These items are to be replaced to solve the situation.

5) Mortuary

a) Analysis of the Present Condition of the Mortuary

Included in the Government of Kenya's list of requested items of equipment were dissecting table, operating lamp for use in dissection, vehicle for transporting dead bodies, dissecting tool set and device for preservative treatment of organs. At present, three to five dissections are conducted a day at the mortuary.

b) Outline of the Plan

In light of the degree of deterioration of the existing items of equipment, it was judged appropriate to replace them under this project. Antiseptic treatment apparatus (Embalming machine) is to inject

formalin into body and preserve internal organs when the dead body need to be transported to other places. The transportation of dead body are taken place 5 to 7 times per month on average at the CPGH. But, since the operation of antiseptic treatment requires a lot of time and a great deal of work, it is difficult to achieve a complete work on injecting formalin into dead body at present condition of CPGH. Therefore, the effect of antiseptic treatment is not acceptable and it is not possible to transport dead body beyond the certain distance. In order to improve this situation, a new antiseptic treatment chiane will be provided under this plan.

## 6) Pharmacies

### a) Analysis of the Present Condition of the Hospital's Pharmacies

The central department, the emergency department and the pediatric department for outpatients have their respective pharmacies, but in actuality many outpatients and inpatients are utilizing the central pharmacy. It appears that immediately after the opening of the hospital such items of equipment as are necessary for dispensing simple ointments, tablets, powder and solutions were installed in the central pharmacy. But most of them are now out of order or superannuated.

In view of the fact that many patients stand in a long line in front of the pharmacy and that the pharmacy's cost of purchase of drugs are on the increase because of the increase in purchases of already prepared medicine, it was judged necessary to replace those items of equipment which can be used for dispensing powder and solutions.

### c) Outline of the Plan

As a result of the examination of the requested items of equipment with emphasis on those which are required to recover the original functions the pharmacy had at the time of its opening, it was decided

to replace the pressure furnace, the drug filler, the vial preparing equipment, the distilled water generator and the ointment/cream filler.

7) Main Operating Department/Minor Operating Room/V.S.C. Room

a) Analysis of the Present Condition of These Facilities

The central operating department has four operating rooms, but in actuality two of them (Operating Rooms No. 1 and No. 2) are used for operations due to the present condition of the items of equipment installed. Of those items of equipment which are installed in Operating Rooms No. 1 and No. 2, the operation lamps, the operating tables, the anesthesia machine, the radio knives and the aspirators are in use although superannuated. However, the operating tables cannot be moved up and down freely because of the failure of its hydraulically operated parts and the aspiration bottles of the respirators are damaged and remain unrepaired. These items of equipment will also have to be replaced. On the other hand, Operating Rooms No. 3 and No. 4 are equipped only with operation lamps and operating tables and therefore cannot be used for operations. Monitoring of patients undergoing operations is not conducted satisfactorily. It is judged urgently necessary to introduce such monitoring equipment.

Four to six surgical operations are conducted a day on average. Many patients have to wait long for their turn. Often they have to wait for their turn for two to three months. This is mainly because of a shortage of operating rooms and operating tools.

In the case of the maternity department, its facilities are badly deteriorated and some of them will have to be extended under this project. Statistics on this department show that 30 to 50 normal deliveries are assisted a day and that three to five Caesarean sections

are performed a day. At present, there is only one operating room in the department. In an emergency, the patient is taken to the central operation building.

One of the minor operating rooms, which is located in the emergency department, is responsible for simple treatment of emergency cases and the other for V.S.C. (Voluntary Surgical Contraception). The minor operating room for V.S.C. is provided with an anesthesia machine and an operation lamp, all of which are superannuated. These items of equipment have to be replaced. About 10 minor operations are performed a day. In addition, four to six patients suffering from a burn or slight injury are treated a day. At the V.S.C. room, two to three patients receive treatment a day.

b) Outline of the Plan

(a) Main Items of Equipment Installed in the Main Operating Room

The equipment plan for the main operating rooms is to be worked out based on the results of the examination of the existing items of equipment to be replaced or replenished. The equipment plan must be one that makes it possible to use four operating rooms. And as indicated in the table below, there are enough staff members to run all four operating rooms.

**Table 2-10 Operating Staff**

Surgeons	Anesthesiologists	Nurses	Asst. Nurses
13	6	23	12

The existing operating tables, operation lamps, radio knives, respirators and monitoring equipment are to be replaced or replenished.

(b) Main Items of Equipment Installed in the Maternity Operating Department

The equipment plan for this department is to be worked out based on the facility plan for it, under which two operating rooms are to be provided. There is one operating room at present and used for Caesarean Section. In case of emergency or after being used by patient with infectious disease, patient will be taken to Main Operating room to get operated.

**Table 2-11 No. of Delivery**

Mode	1991	1992	1993	1994	1995	1996
Spontaneous Vertex	9,459	8,774	8,456	7,828	7,459	9,648
Vacuum Extraction	68	68	101	0	0	6
Assisted Breech Delivery	280	239	293	248	792	713
Caesarean	657	722	746	598	792	713
Others	56	46	27	18	22	22
Total	10,520	9,849	9,623	8,692	9,065	11,102

(Source : CPGH)

Superannuated items of equipment installed in the existing operating room are to be replaced and two units each of the operating table, the operation lamp, the anesthesia machine, the respirator, the radio knife and the monitoring device are to be procured under the equipment plan.

(c) Minor Operating Room/V.S.C. Room

The operating tables, the operation lamps, the anesthesia machine, the respirators, the radio knives and the monitoring devices are to be replaced under this project.

(d) Operating Tools

Abdominal operations and abdominal drainage account for about 30 percent of the total number of operations. The other operations



include bioassay, operations to remove tissues and portion of organs, operations for hernia, tonsillectomy, operations to remove polyps, operations to remove cancer cells in choana, operations to remove foreign bodies, operations for chalazion, operations for hordeolum, operations for glaucoma, operations for detached retina, operations to fix plates, coaptation of fractures, operations on the palate, operations for cleft lip, operations for external injuries, dysgnatic probes and operations for tumors. Obstetrical operations represent about half of the total number of operations. The main obstetrical operations are delivery assistance by the use of a respirator and Caesarean sections.

**Table 2-12 Number of Operation**

Causes of operation		1991	1992	1993	1994	1995	1996
General Surgery	Major Operation	506	639	466	396	618	529
	Minor Operation	603	846	906	450	448	521
E.N.T.	Major Operation	42	74	64	27	56	63
	Minor Operation	55	30	27	33	33	45
Orthopedics	Major Operation	73	65	81	47	67	72
	Minor Operation	30	44	63	31	32	39
Dental	Major Operation		18	32	18	31	23
	Minor Operation		3	17	14	17	18
Gynecology & Obstetrics	Major Operation	896	471	257	212	221	178
	Minor Operation	1,205	865	1,063	709	541	217
Ophthalmology	Major Operation	141	110	181	106	113	140
	Minor Operation	20	36	40	18	28	22
Total		3,571	3,201	3,197	2,061	2,205	1,867

(Source : CPGH)

When all necessary items of equipment are procured, it will become possible to increase the total number of working operating rooms in the main operating department from two to four. It is expected that the annual total number of operations will be 1.5 to 1.7 times as many as in 1996, or nearly equal to that for 1991 (3,500). For these reasons, it was decided to replenish the basic items of

equipment in light of the present level of operating skill and the past record of operations under this project.

8) Intensive Care Unit (ICU)

a) Analysis of the Present Condition of the ICU

The ICU has a total of 10 beds--eight general beds and two for the isolation room. At present, the eight general beds are used for the care of serious cases. The items of equipment requested by the hospital are those which can be used for intensive monitoring of the condition of serious cases, such as respirators and infusion pumps, not those for use in nursing. The existing items of equipment include only a retractor, a sphygmomanometer and an irrigator stand. In examining the items of equipment to be installed in this facility, it will also be necessary to find ways to improve the hospital's nursing system.

The equipment plan for this facility is premised on the selection of those items of equipment which can be managed through a personnel reshuffle. The hospital's nursing system should also be changed so that two more nurses may be added to those working in the morning and those working in the afternoon, respectively, one more nurse being added to one nurse working at night.

b) Outline of the Plan

At present, four to five patients (mainly outpatients suffering from serious diseases and those who have just undergone operations) on average are nursed in the ICU. As the number of patients is expected to increase by about two in keeping with the increase in the number of surgical operations, the intensive care/monitoring system was examined from the standpoint of the hospital's staffing plan for nurses, as well as the necessary items of equipment. It appears that a

monitoring device was once installed in this facility, but that was more than five years ago. In consideration of such circumstances, it was decided to procure six monitoring devices, three respirators for the use of adult patients and a respirator for the use of children and infants although this ICU is provided with 10 beds.

9) Central Sterile Supplies Department (CSSD)

a) Analysis of the Present Condition of the CSSD

Two large-size sterilizers were installed at the time of opening of the hospital, but both of them are out of order and irreparable. As a result, two medium-size sterilizers are used instead. Operating tools are first washed at the washing room located adjacent to each of the operating rooms and then carried to the CSSD for sterilization. As spare operating tools are few in number, the hospital finds it difficult to meet the growing need for emergency operations.

b) Outline of the Plan

The CSSD's three main functions are treatment/recycling, supply/recovery and management/storage. The large-size, high-pressure sterilizer, which is included in the requested items of equipment, is indispensable for treatment/recycling. For this reason, it was decided to replace the existing one with a new one with two doors so that effective use may be made of the traffic lines established at the time of construction of the facility.

It is necessary to establish a system for management and storage of spare tool sets to ensure smooth supply and recovery of basic tool sets to and from the wards and the operation departments. For this reason, a replenishment plan was worked out taking into account the present level of supplies of these tool sets.

## 10) Outpatient Department

This department is responsible for a wide variety of medical examinations, including those in the fields of dentistry, ENT and ophthalmology. Since it is difficult for other medical institutions to conduct medical examinations in the fields of dentistry, ENT and ophthalmology, many patients visit the hospital for these medical examinations. In principle, medical examinations for outpatients are offered free of charge. The costs of drugs used in treatment and medical supplies such as bandage are charged to outpatients. Dental, ENT and ophthalmology departments do not have their own wards. Outpatients who have to be hospitalized after operations are cared for at the general wards.

### 10)-1 Dental Department for Outpatients

#### a) Analysis of the Present Condition of the Dental Department for Outpatients

This department has five units of dental equipment which were installed more than 10 years ago, but only one of them is in use now. All the others are unusable because of the breakdown of the air turbines and other parts. The department also offers prosthodontic services. As there are only a few medical institutions capable of dental care and surgery, this department is very valuable to the residents of Coast Province.

Brushing teeth has not yet commonly practiced in the country, and as a result many young people under 20 years of age are suffering from decayed teeth and/or pyorrhea.

#### b) Outline of the Plan

The items of equipment requested for this department are for use in treatment of caries. Of the existing items of equipment, those which are superannuated are to be replaced under this project.

10)-2 ENT Department

a) Analysis of the Present Condition of the ENT Department

This department, which accepts about 50 patients a day, has three consultation rooms, one treatment room and one audiometry room. The main diseases treated at this department are chronic otitis, otopolypus and hypacusic. At this department, operations to remove tonsils, operations to remove polyps, operations to remove cancer cells and operations to remove foreign bodies (coins and the like) are conducted.

b) Outline of the Plan

The existing items of equipment, such as head mirror and audiometer, which are indispensable for dental care and surgery, are to be replaced. Those which are to be newly procured include bronchial endoscope, laryngoscope and esophagoscope. Judging from the present ENT disease structure in the country, these items of equipment are very useful, and in light of the present level of the medical technology used in the hospital, these items of equipment can be operated with ease. The other requested items of equipment include forceps.

10)-3 Ophthalmology Department

a) Analysis of the Present Condition of the Ophthalmology Department

This department, which, as is the case with the ENT department, accepts about 50 patients a day, has a medical staff of 11--two medical officers, two clinical officers, three interns serving as clinical officers, two nurses and two nursing school students. Outpatients' main diseases are allergic conjunctivitis, purulent conjunctivitis, external injuries and benign cornea disorder. Children under five years of age account for about 30 percent of the total number of the patients visiting this department. The main surgical operations

conducted at this department are operations for epidemics, such as chalazion, stye, glaucoma and retinal detachment.

b) Outline of the Plan

The fundus camera which is used to record changes in blood pressure of patients suffering from hypertension, arteriosclerotic retinopathy and diabetic retinopathy to examine changes with the lapse of time in blood pressure, the slit lamp which is used to examine the turbidity of the cornea, the degree of seriousness of cataract and diagnose iritis and the lens set required to conduct eye tests, all of which are superannuated, are to be replaced.

10)-4 Pediatric Department

a) Analysis of the Present Condition of the Pediatric Department

The pediatric department for outpatients, which is providing medical care to children under 12 years of age, has a medical staff of 11--two medical officers, three clinical officers, three nurses and three nursing school students. It accepts 50 to 60 patients a day, of which 60 to 70 percent are infants under five years of age. Most of the diseases diagnosed and treated at this department are infectious diseases and dystrophy. It should be noted that the number of patients suffering from these diseases increases particularly during the rainy season.

b) Outline of the Plan

As a result of the examination of the degree of superannuation of the existing items of equipment, it was decided to replace the thermometers, the basic diagnosis tool set, the stethoscopes, the aspirators, the desktop sterilizers, the scales for infants and the resuscitators.

## 11) Radiology Department

### a) Analysis of the Present State of the Radiology Department

This department has seven rooms. About half of the X-ray machines used for taking simple radiographs of chests are out of order and remain unusable. Room No. 1 is provided with an X-ray machine for taking radiographs of teeth and breasts. But the dental X-ray machine, which was installed more than 12 years ago, is badly superannuated. At present, six to ten patients visit this room a day for radiography. The osofantom and the breast radiography machine were installed about three years ago and are still functioning well. The two items of equipment are used to take radiographs of about 20 patients/day and one or two patients/week, respectively. Room No. 2 is equipped with two X-ray machines to take simple radiographs, but both of them often break down and are therefore hardly used. Room No. 3 is also equipped with two X-ray machines to take simple radiographs, one of which is working at full capacity. It is used mainly to take radiographs of chests and limbs of 30 to 35 patients a day. X-ray machines in Rooms No. 2 and No. 3 were both installed 17 years ago. Room No. 4 is equipped with an X-ray machine to take radiographs of heads, which has not been in use since it broke down 10 years ago. An X-ray machine to take radiographs was installed in Room No. 5 about three years ago. It is used to screen and take radiographs of upper parts of digestive organs of about five patients a day. It often breaks down and remains unusable for a long time. This is because the hospital's payment for the repairs of this machine is sometimes delayed. Room No. 6 is equipped with an X-ray machine to take simple radiographs, which has not been in use since it broke down about 10 years ago. Room No. 7, which is an ultrasonic diagnosis room, is equipped with one unit of ultrasonic diagnosis equipment. The equipment has not been in use since it broke down a few months ago. The department has two darkrooms--one for manual development and the other for automatic development. The automatic development room has not been in use since

the automatic equipment broke down. At the department, about 100 films are developed a day.

The examination/radiography charges are 250 Kshs. for X-ray screening, 20 Kshs./film for dental radiography, and 75 Kshs. for simple radiography such as breast, respectively. On average, two radiographs are taken of a patient.

The department has a staff of 20--two radiologists, 12 radiographers, four developers and two staff members in charge of record management. At night, a radiographer and a developer stand ready for emergency radiography.

#### b) Outline of the Plan

The main items of equipment include X-ray machines to take simple radiographs and ultrasonic diagnosis equipment. The former are used to take a wide variety of radiographs, including those of chests and limbs, and are therefore playing a key role in the radiological and radiographic activities carried out at the department. In light of the present condition of these machines, one of them is to be replaced so that at least two of them may always be working.

The existing ultrasonic diagnosis equipment is to be replaced and an additional unit is to be procured for use in the obstetric and gynecological department. It is expected that ultrasonic diagnosis equipment will come into widespread use in the future because of its serviceability. The staff members in charge have the know-how to operate this equipment. For these reasons, the use of this equipment will have far greater positive effects than at present if the equipment chosen can be used for diagnosis of diseases of both adults and children (obstetric/gynecological diseases, thyroid gland diseases, liver diseases, biliary tract diseases and kidney diseases).

A radiograph film developer, film cassettes and film hangers, all of which are in short supply, are to be replenished.



## 2-3 Basic Design

### 2-3-1 Design Concept

#### (1) Guideline in Relation to Natural/Facility Conditions

The Mombasa district belongs to the tropical zone, situated right on the equator, and therefore has a climate of high temperatures and humidity. In working out the facility design and installing the equipment, special attention must be paid to the ventilation and air-conditioning system to be provided under this project in light of the need to secure an optimal environment for both the facilities and the equipment. In installing individual items of equipment in the clinical laboratory department, the operation department, the intensive care unit and the radiology department, in particular, due consideration must be given to the ventilating/air-conditioning equipment. In consideration of possible fluctuations in voltage, an automatic voltage stabilizer is to be attached to each of those items of equipment which are likely to be affected by fluctuations in voltage. Furthermore, since there are frequent power stoppages in and around the project site, an uninterruptible power supply system (UPS) is to be attached to each of the respirators and so on, whose breakdown may directly affect patients' lives.

**Table 2-13 Weather in Mombasa**

Month	High Temp (°C)	Low Temp (°C)	Rain (mm)	Mean Humidity (9:00 a.m.)	Mean Humidity (Noon)	Rainy Day
Jan.	31.9	21.4	2.5	82	62	1
Feb.	32.9	21.9	1.3	77	61	0
Mar.	32.4	22.5	47.0	80	65	2
Apr.	31.6	22.5	158.8	82	69	9
May	30.0	21.0	330.1	86	73	18
Jun	29.0	19.5	4.1	85	62	3
July	28.2	19.1	69.4	86	69	12
Aug.	26.9	19.2	180.1	87	71	10
Sept.	28.6	19.2	44.6	84	68	11
Oct.	29.5	20.1	154.1	83	67	12
Nov.	29.9	20.8	98.0	82	70	8
Dec.	31.7	21.3	32.9	80	67	6

(Source: CPGH)

## (2) Guideline in Relation to Social Conditions

Since this project is aimed mainly at repairing the hospital's existing facilities and replacing or replenishing its existing medical equipment, although it includes the extension of part of the existing facilities, there seems to be almost no need to pay special attention to the customs in Kenya for designing the facilities. It should be noted, however, that deliveries are assisted in stages in the flow of operations at the obstetrical facilities - from prenatal examinations to deliveries and Caesarean sections - in view of the dangers involved and that dead bodies are kept for a long time in the mortuary. In carrying out designing of the facility extension work and the facility renovation work, due consideration should be given to these facts.

## (3) Guideline in Relation to the Present State of the Local Construction Industry and the Local Building Laws and Regulations

In Kenya, construction of buildings is subject to the Ministry of Public Works and Housing's (MOPWH) approval. This project, which is to be implemented with the grant aid cooperation of the Government of Japan, is no exception. For this reason, the Ministry of Health, which is the Kenyan project implementing organization, is required to make the necessary arrangements to have the drawings and specifications for the project approved by the MOPWH. The facility plan should be worked out in compliance with the Building Standards Law of Kenya.

## (4) Guideline for Utilization of Local Contractors' Services and Locally Available Building Materials/Machines

### 1) Local contractors and Locally Available Building Materials

Contractors active in and around Mombasa are smaller in scale than those active in Nairobi. Usually Nairobi-based contractors receive orders for major construction works in and around Mombasa and recruit construction

workers there. It is, therefore, possible for the Japanese contractor to use the services of Nairobi-based contractors in implementing this project and there will be no problem to secure workers in Mombasa. Major building materials manufactured in and around Mombasa are mostly cement products and coral stones. The other building materials will be procured in Nairobi except for the ones whose supplies are not reliable or whose quality is not acceptable. The latter will be procured in Japan or other countries.

## 2) Medical Equipment

Virtually no medical equipment is manufactured in Kenya. Trolleys and machine cabinets are manufactured in the country but their quality is open to question. Those installed in the hospital are rusted, their coatings having peeled off. It is judged to be inappropriate to procure such products for this project. Almost all items of equipment are therefore to be procured in countries other than Kenya. In so doing, however, priority should be given to those which are supplied by local distributors and whose repairing parts (including expendables) are available for a certain period of time (at least about eight years) in the country. In procuring such products, careful attention should be paid to ease of maintenance and management, stability and compatibility with the existing items of equipment. Local distributors of these products are concentrated in Nairobi and they are dealing mainly in European-made products.

Products made in third countries, which are to be put out to tender, should be limited to those made in OECD member countries in consideration of quality and safety. Whether those made in South Africa are to be procured, as well as their quality and delivery time, will be examined when it is judged possible to procure such products for this project, which is to be implemented with the grant aid cooperation of the Government of Japan.

(5) Guideline in Relation to the Project Implementing Organization's Facility Maintenance and Management Capabilities

At present, the hospital can expend 75 percent of the medical fees collected at its own discretion as a result of introduction of the cost sharing system. In actuality, however, most of that amount is used to make up for the shortfall in the central government's budget allotment or is appropriated for the purchase of drugs which are often in short supply. The hospital is in the process of taking necessary steps to increase the total amount of medical fees, including a plan to raise the medical fees, and these steps are considered highly feasible.

The building management department within the existing maintenance and management building, which is a local agency of the Ministry of Works, is to be responsible for the maintenance and management of the facilities. In implementing this project, building materials which make it easy to clean the floors and the walls and which are highly durable should be chosen in light of the present condition of the existing facilities so that the cost of facility maintenance and management may be minimized.

Both the Ministry of Health and the hospital are taking a positive attitude toward technical tie-up with Mombasa Polytechnic concerning the maintenance and management of equipment. Under such circumstances, priority is to be given to equipment manufacturers who have distributors in Nairobi and who are capable of making the best use of Mombasa Polytechnic's know-how.

(6) Guideline in Relation to the Range of Facilities/Equipment, Grade Setting

The grades of the facilities, the range of items of equipment and grade setting were determined as follows on the basis of the basic design study team's basic policies and the results of the surveys and discussions in Kenya and the analytical work in Japan. These facilities and items of equipment are to be procured on the assumption that they are to contribute to the provision of primary and secondary health care by the hospital. The quantity of each

item of equipment was decided based on the stated rationale.

#### 1) Facility Grades

In the process of designing the facilities, facility grades are set with reference to other similar facilities in Kenya. Basically, these grades are to be similar to those applicable to the existing facilities so that the facility maintenance and management cost may be minimized.

#### 2) Range of Equipment

- Items of equipment which are necessary for medical care services at the department concerned.
- Those which are so much damaged and/or superannuated that it is considered necessary and appropriate to replace them.
- Those which it is considered necessary and appropriate to replace to meet the hospital's needs in the provision of health care services.

#### 3) Setting the Grades of Equipment

- Basic items of equipment indispensable for the provision of primary and secondary health care.
- Items of equipment which can be operated effectively and safely with the techniques established within the hospital.
- Those which meet the hospital's needs in terms of the epidemiologic profile, the number of patients/test samples.
- Those which the hospital can maintain and manage at its own expense.

#### 4) Rationale for the Determination of Quantities of Equipment

- Necessary number of the existing items of equipment which need to be replaced.
- Number of the existing items of equipment which are in short supply in light of the demand for the hospital's health care services.
- Consistency with the number of other related items of equipment.

- Spaces for equipment installation after the repair of the existing facilities.

(7) Guideline in Relation to the Period of Project Implementation

The implementation schedule is to be worked out taking into consideration the actual situation, including natural conditions, in Kenya. The implementation schedule must also be such that when health care operations at the hospital are suspended or part of its existing facilities need to be shifted during the construction work or the equipment installation work, its effects may be minimized.

**2-3-2 Basic Plan**

(1) The premises of Coast Provincial General Hospital, where this project is to be implemented, are interspersed with an maternity ward which was constructed in 1939, a main ward which was constructed in 1951, a new building which was constructed in 1976, staff members' lodging houses and other facilities. The objectives of this project are to repair the hospital's existing facilities whose functions have declined and to extend those facilities which are badly superannuated or which are too small for the increased workload. The site plan must be such that the newly constructed facilities may function in unison with the existing ones.

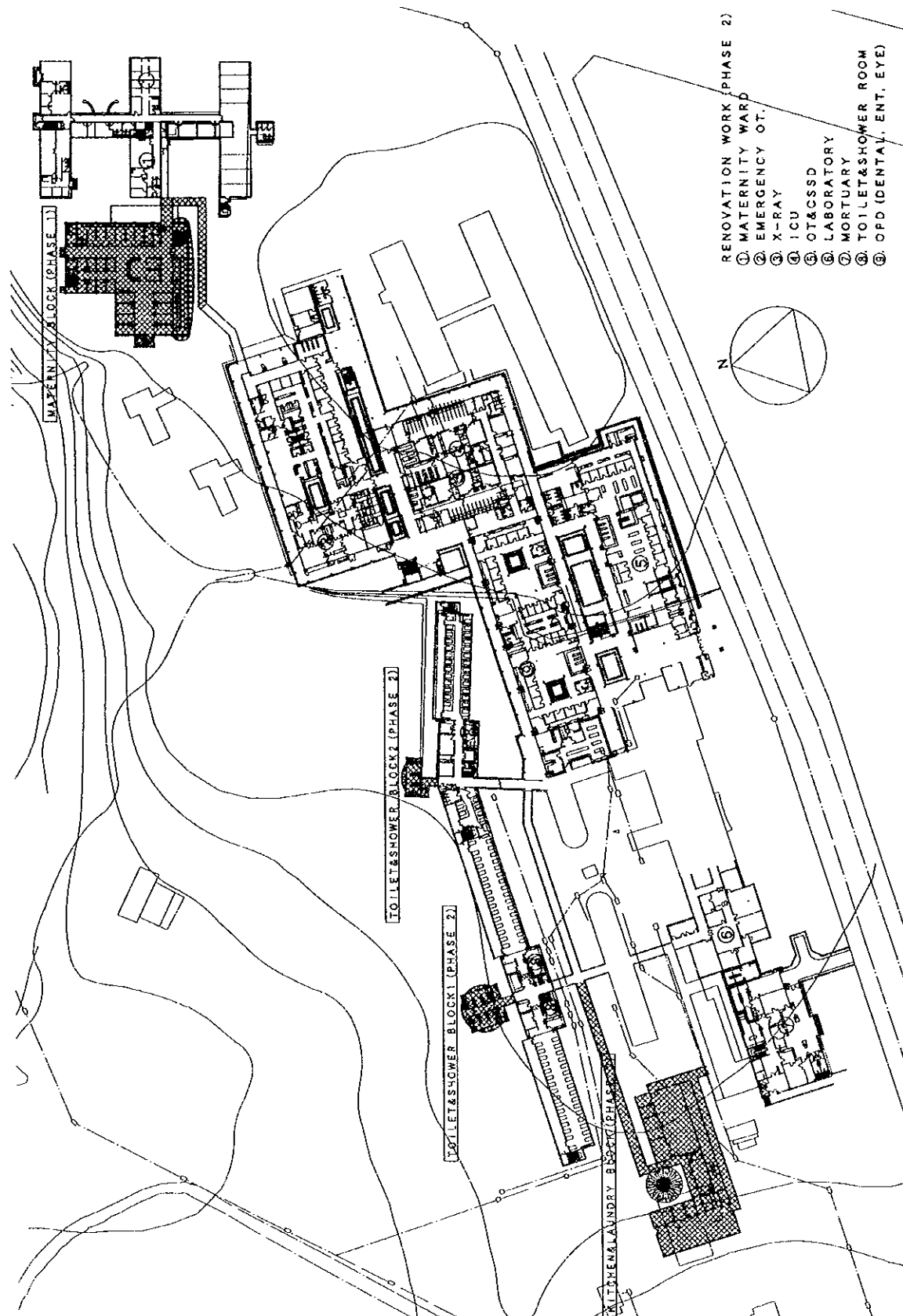


Fig. 2-1 Site plan

(2) Facility Plan

1) Floor Plan

① Toilet & Shower Block 1

Room	No. of rooms	Floor area	Remarks
Ward 1 toilet/shower room	1	32 m <sup>2</sup>	4 toilets and 3 showers for a ward with 35~40 beds
Ward 2 toilet/shower room	1	32 m <sup>2</sup>	"
Sluice rooms	2	16 m <sup>2</sup>	Rooms where filth from the wards is treated
Connection corridor	-	20 m <sup>2</sup>	Connects the wars and the toilet building.
Ward 3 toilet/shower room	1	32 m <sup>2</sup>	4 toilets and 3showers for a ward with 35-40 beds.
Ward 4 toilet/shower room	1	32 m <sup>2</sup>	"
Sluice rooms	2	16 m <sup>2</sup>	Rooms where filth from the ward is treated.
Connection corridor	-	20m <sup>2</sup>	Connects the ward and the toilet building.
Ward 5 toilet/shower room	1	32 m <sup>2</sup>	4 toilets and 3 showers for a ward with 35-40 beds.
Ward 6 toile/shower room	1	32 m <sup>2</sup>	"
Sluice rooms	2	16 m <sup>2</sup>	Rooms where filth from the ward is treated.
Connection corridor	-	20 m <sup>2</sup>	Connects the ward and the toilet building.
Total		300 m <sup>2</sup>	

② Toilet & Shower Block 2

Room	No. of rooms	Floor area	Remarks
Ward 7 toilet/shower room	1	40 m <sup>2</sup>	4 toilets and 3 showers for a ward with 35-40 beds.
Filth treatment room	1	6 m <sup>2</sup>	A room where filth from the ward is treated.
Connection corridor	-	8 m <sup>2</sup>	Connects the ward and the toilet building.
Ward 8 toilet/shower	1	40 m <sup>2</sup>	4 toilets and 3 showers for a ward with 35-40 beds.
Sluice room	1	6 m <sup>2</sup>	A room where filth from the ward is treated.
Connection corridor	-	8 m <sup>2</sup>	Connects the ward the toilet building.
Ward 9 toilet/shower room	1	40 m <sup>2</sup>	4 toilets and 3 showers for a ward with 35-40 beds.
Sluice room	i	6 m <sup>2</sup>	A room where filth from the ward is treated.
Connection corridor	-	8 m <sup>2</sup>	Connects the ward and the toilet building
Total		162 m <sup>2</sup>	



③ Kitchen & Laundry Block

Room	No. of rooms	Floor area	Remarks
<b>1. Laundry</b>			
Laundry room	1	108 m <sup>2</sup>	4 washing machines, 3 dryers and 1 sheet roller
Linen room	1	24 m <sup>2</sup>	A room where washed line is put in order and stored.
Mending room	1	12 m <sup>2</sup>	A room where simple rips are sewn up
Laundry manager room	1	12 m <sup>2</sup>	A room for a person in charge of laundry
Staff room	2	24 m <sup>2</sup>	A room where 6 staff members and change their cloths and take rest
<b>2. Kitchen</b>			
Preparation	1	35 m <sup>2</sup>	An area where vegetables and meat are prepared for cooking.
Kitchen	1	75 m <sup>2</sup>	The cooking is done using 6 kettles and 6 gas cookers.
Washing room	1	20 m <sup>2</sup>	An area where kitchen utensils are washed.
Storage-1	1	16 m <sup>2</sup>	A storage for kitchen utensils are stored.
Storage-2	1	8 m <sup>2</sup>	A storage for vegetables
Storage-3	1	8 m <sup>2</sup>	A storage for make and grain
Cold store 1	1	8 m <sup>2</sup>	Cold storage for meat.
Cold store 2	1	8 m <sup>2</sup>	Cold storage for vegetables.
Staff members' room	2	16 m <sup>2</sup>	A rooms where 11 staff members change their cloths and take rest.
Kitchen manager room	1	12 m <sup>2</sup>	A room for a person in charge of Kitchen.
<b>3. Common rooms</b>			
Toilets	2	20 m <sup>2</sup>	A toilet for men and a toilet for women, both of which are for the use of staff members working at the laundry and the kitchen.
Machine room	1	28 m <sup>2</sup>	A room to supply heat source to the laundry and the kitchen.
Corridor	-	106 m <sup>2</sup>	Common portions
Sub-Total		540 m <sup>2</sup>	
Connecting corridor	2	232 m <sup>2</sup>	Corridor for connecting the existing buildings and the Kitchen & Laundry Block
Total		772 m <sup>2</sup>	

④ Maternity Block

Room	No. of room	Floor area	Remarks
Reception room	1	12 m <sup>2</sup>	A room to control traffic to and from the delivery/operation department.
Sister's room	1	12 m <sup>2</sup>	A room for the use of the head of the delivery/operation department.
Shower room	1	6 m <sup>2</sup>	A shower room for the use of pregnant women.

Room	No. of room	Floor area	Remarks
Nurses' room	1	21 m <sup>2</sup>	A room for the use of the nurses of the delivery department.
Examination rooms	6	90 m <sup>2</sup>	Room here pregnant women are examined before immediately before delivery (6 rooms, each with a floor space of 15m <sup>2</sup> )
Physician's room	1	15 m <sup>2</sup>	A room for the use of the physician for the delivery department.
Nurses' station 1	1	30 m <sup>2</sup>	A station for the nurses, where the nurses can take an extensive view of all facilities of the delivery department.
Delivery rooms 1	8	90 m <sup>2</sup>	15m <sup>2</sup> per bed
Delivery rooms 2	8	110 m <sup>2</sup>	15m <sup>2</sup> per bed
Toilets	3	26 m <sup>2</sup>	Attached to the examination rooms and the delivery rooms.
Sluice rooms	2	17 m <sup>2</sup>	Attached to the examination rooms and the delivery rooms
Store 1	1	18 m <sup>2</sup>	A store for equipment and drugs
Delivery rooms 3	6	120 m <sup>2</sup>	15 m <sup>2</sup> per bed
Doctor's room (night duty room)	1	23 m <sup>2</sup>	A night duty room for the doctor
Store 2	1	7 m <sup>2</sup>	A store for equipment and drugs
Recovery area	2	36 m <sup>2</sup>	An area for recovery to accommodate 2 stretchers
Nurse's station 2	1	30 m <sup>2</sup>	A station for the nurses of the operation department
Locker room 1	1	19 m <sup>2</sup>	A locker room for the use of nurses to attend surgical operations
Locker room 2	1	19 m <sup>2</sup>	A locker room for the use of nurses to enter the operating rooms
Resting room	1	45 m <sup>2</sup>	A resting room for the use of the nurses of the operation department
Operating rooms	2	76 m <sup>2</sup>	40 m <sup>2</sup> each
Washing room	1	15 m <sup>2</sup>	A room where soiled things from the operating rooms are washed
Sterilizing room	1	24 m <sup>2</sup>	A room which also serves as a stockroom of sterilizes
Scrub room	2	30 m <sup>2</sup>	A room to be used as a gowning room as well as a scrubb room
Stretcher changing area	1	14 m <sup>2</sup>	An area for changing stretchers
Store	1	5 m <sup>2</sup>	A warehouse where operating equipment is stored
Toilet	1	18 m <sup>2</sup>	Attached to Delivery Room 3
Sluice room	1	9 m <sup>2</sup>	Attached to Delivery Room 3
Staircase	1	162 m <sup>2</sup>	-
Slope	1	160 m <sup>2</sup>	A ramp used for the transportation of patients to the operating rooms located on the second floor
Other	-	347 m <sup>2</sup>	Spaces for the hall and the corridors (about 20% of the total floor space)
Sub-total		606 m <sup>2</sup>	
Connecting corridor	2	80 m <sup>2</sup>	Corridor for connecting the existing building and the Maternity Block
Total		1,686 m <sup>2</sup>	

⑤ Renovation of the Existing Facilities

The portions to be renovated of the existing facilities and the outline of the renovation work are as shown in the following table.

**Table 2-14 List of the Renovation Work (1)**

Department	Outline
1) Operation dept., ICU., CSSD, Radiography room	Air-conditioners are to be installed in each of the existing major operating room, minor operating room, ICU and radiography room. A large ventilator for sterilizer is to be installed in the CSSD.
2) Clinical laboratories	Old building: The wall/ceiling are to be painted and the laboratory tables are to be replaced. Air-conditioners and ventilators are to be installed.  New building: Tops of the laboratory tables are to be repaired or replaced and grilles are to be attached to the windows.
3) Outpatient (Dental, ENT, Eye)	Installation of ceiling fans in examination rooms.
4) Mortuary	An exhaust chimney is to be installed to discharge bad smells from the refrigerators in the mortuary located on the second floor. Air-conditioners are to be installed in the autopsy room.  The viewing room 1 the waiting anteroom, the lobby 1, the interview room and the waiting room for the families of the deceased are to be converted into an anteroom and a refrigerator room (to house a total of 90 dead bodies). As a result of this arrangement, it will become possible to keep a combined total of 135 (90 + a total of 45 dead bodies kept in the existing refrigerators) dead bodies in the refrigerators.

It will also be possible to make up for the present shortfalls in functions by renovating and making effective use of the existing rooms of the main wards and the maternity ward whose functions overlap those of the extensions. This will result in the improvement of the working environment for the staff members as well as the living environment for the patients, which in turn will contribute to the enhancement of the quality of primary and secondary health care offered by the hospital.

**Table 2-15 List of the Renovation work (2)**

Department	Outline
1) Existing Ward (No.1 to No.9) Toilet/shower rooms	Plumbing for the existing toilet/shower rooms is to be removed, and the rooms are to be converted into nurse stations locker rooms/resting rooms, and storage. This will contribute to an increase in spaces for beds although to a limited extent.
2) Maternity operation room/delivery rooms	The arrangement of the partitions between the existing operating room, sterilizing room, and delivery rooms (easy, medium, difficult) are to be converted, a postnatal ward and a storage.

2) Sectional Plan

In working out the sectional plan, due consideration should be given to the need to secure natural ventilation/lighting and protect against direct sunshine and rainwater. The story heights should be optimal from the standpoint of structural plan, securing the necessary ceiling height, as is the case with the existing facilities. They should be 3.8m for the Toilet & Shower Block (Ground to Second stories), 4.5m for the Kitchen & Laundry Block and about 3.8m for the Maternity Block. To protect against floods after heavy rainfalls, the ground floor should be high enough, as is the case with the existing facilities, and drain ditches are to be installed around the buildings.

3) Structural Plan

Given below is the outline of the structural features of the planned buildings.

① Outline of the Structural Features of the Planned Facilities

**Table 2-16 Outline of Structural Features**

	Toilet & Shower Block	Kitchen & Laundry Block	Maternity Block
No. of stories	3	1	2
Story height	3.8m	4.5m	3.8m
Basic span	4.0m×4.5m	6.0m×6.0m	5.0m×7.0m
Structure	Reinforced concrete rigid frame structure		
Foundation	Spread foundation		

② Design Standards

The structural design is to be worked out in accordance with the following local design standards or (when such local standards are not applicable) the Japanese design standards.

- Building Code 1968
- Structural Manual 1973
- Code of Practice for the Design & Construction of Building & Other Structures in Relation to Earthquakes 1973
- BS, CP110 (Concrete Structure Design Standard)

③ Live Load

The value of live load is to be determined in accordance with the BS. Shown in the following table are the values of live load for the main rooms.

**Table 2-17 Values of Live Load for the Main Rooms**

Room	Live load (in kg/m <sup>2</sup> )
Consulting room/delivery room	300
Operating room	300
Nurses' room/doctor's room	300
Office room	300
Storage	600
Corridor	400

④ Selection of Structures

The structures of portions of the facilities are as shown in the following table.

**Table 2-18 Structures of Portions**

Portion	Structure
Foundation	Continuos and individual footing
Frame	Reinforced concrete rigid frame structure
Slab on earth	Wire mesh reinforced concrete on polyethylene sheets
Slab	Reinforced concrete
Exterior wall	Concrete blocks, Paint finish on cement plaster
Partition	Concrete blocks

⑤ Structural Materials

In principle, the following materials are to be used as structural materials.

- Cement : BS12 Ordinary Portland Cement
- Reinforcing bars : JIS G 3112, SD 345 or BS 461 twisted

4) Electric Equipment

① Substation

Electric power is to be supplied to the low-tension panel board room from an elevated electric power pole located near Kisauni Road Via the high-tension switch room and the transformer room (both are managed by KP & L), both of which are located in the project site.

- Power receiving system : 3  $\phi$  3W 10kV
- Low-tension power system : 3  $\phi$  4W 415-240V
- Transformer capacity : 1000kVA

Since the hospital's total power consumption ranges between 180 kVA and 200kVA, there will be no problem with power supply to the project site. Two service wires are connected to the power line so that when power supply from one of them stops the other may be used for continued

power supply. Every year there are a number of power stoppages due to the electric works and so on (each power failure lasts 4 to 6 hours). Since the voltage fluctuation rate is relatively high (about six percent), it will be necessary to attach a voltage stabilizer to each item of precision medical equipment.

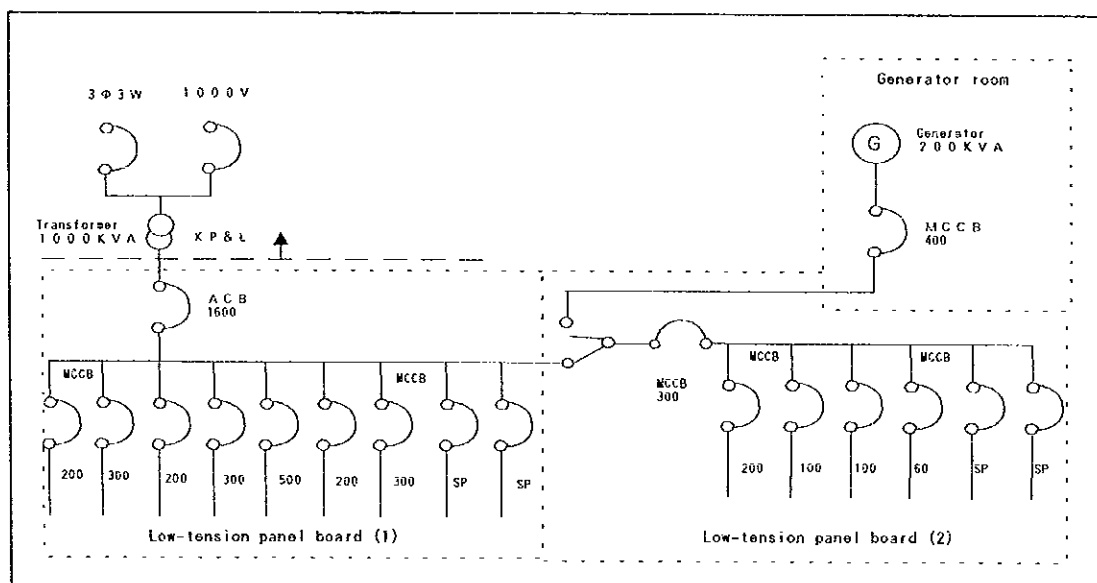


Fig. 2-2 Power Supply System

② Power Generator

The existing 200 kVA power generator covers the facilities of the following departments.

- Emergency department
- Operation departments
- Maternity department
- Pharmacy
- Outpatient department

Since the existing power generator's capacity is not large enough, it will be necessary to procure an additional generator under this project (outdoor type, capacity : 50kVA) to cover those refrigerators in the mortuary.

③ Main Power Line

Electric power is to be supplied to the panel boards and the power boards of the Maternity Block, the Kitchen & Laundry Block and the mortuary from the low-tension panel board (There is an extra space for circuit breakers) in the electric room. The common underground culvert is to be used as the wiring route.

- Power : 3  $\phi$  3W 415V
- Lighting wall sockets : 3  $\phi$  4W 415V-240V

④ Lighting Fixtures and Wall Sockets

• Lighting Fixtures

Fluorescent lamps are to be the main light sources because of high efficiency and ease of maintenance. The switch circuit is to be segmented for energy saving purposes. The target illuminance for each of the main rooms is as shown in the following table.

**Table 2-19 Target Illuminance for Each of the Main Rooms**

Room	Target illuminance
Consulting room, delivery rooms 1, 2 & 3, nurses' station	400~500 Lux
Operation room	1000 Lux
Kitchen, washing room, sterilizing room, physician's room, nurses' room	200~300 Lux
Corridor, warehouse, locker room	50~150 Lux

• Wall Sockets

Wall sockets that meet the BS are to be procured under this project. Those for use in the operating rooms are to be connected to the emergency power generator. As the result of a survey of the wall sockets for the medical equipment installed in the existing facilities, it was confirmed that the number of existing wall sockets is sufficient.



⑤ Telephone System

The telephone switchboard room in the existing building has nine (9) service lines from Kisauni Road. The telephone switchboard (300 extensions) is installed in the telephone equipment room to provide telephone service within the hospital. With the present combination of the telephone line and the extensions, it will be possible to add extensions to the nurse stations in the Maternity Block and the offices in the Kitchen & Laundry Block.

⑥ Alarm Bell System

Alarm bells are to be installed for early detection of a fire and quick guidance for evacuation. A receiving set is to be installed in the administration building's office room, and red indicator lamps, alarm bells and transmitters are to be installed in the Maternity Block and the Kitchen & Laundry Block.

⑦ Lighting Arresting System

A lightning arresting system that meets the BS is to be installed.

⑧ Outdoor Lamps

Outdoor lamps are to be installed around the Maternity Block and the Kitchen & Laundry Block for safety purposes.

3) Air-conditioning/Ventilating System

① Air-conditioning/Ventilating System

In consideration of the present condition of the existing facilities, wall-type room air-conditioners which are easy to maintain and manage are to be installed.

Room air-conditioners are also to be installed in the newly constructed

operating rooms and the existing operating rooms. In light of the present level of cleanliness of the operating rooms and the present system for their maintenance and management, expensive air filtration systems are not necessary to keep clean the air in the operating room.

② Ventilating System

Ventilating equipment is to be installed in each of the newly constructed facilities and the existing facilities. In principle, Class 1 mechanical ventilators are to be installed in the operating rooms, the CSSD and the ICU. Simple washable filters are to be mounted on the air intake parts of the ventilators. Ceiling fans are to be installed in the new Maternity Block.

**Table 2-20 List of Facilities Which Are to Be Provided with Air-conditioning /Ventilating Systems**

Type of facility	Building	Room	Air-conditioner (separate-type room air-conditioner)	Mechanical ventilating equipment			Remarks
				Air intake/exhaust	Exhaust	Ceiling fan	
Renovation	Ward	Toilet (extension)			○		
		Renovated nurses' station			○		
	Operating building	Operating room	○	○		With air intake filter	
	Operating building	ICU	○	○		#	
	Operation building	CSSD		○		#	
	Radiography	X-ray	○		○		
	Examination	Examination room	○		○		
	Mortuary	Mortuary	○		○		Bad smells are to be discharged above the roof via chimney.
		Autopsy	○		○		#
OPD	Dental, ENT, Eye				○		
New construction	Maternity	Operating room	○				With air intake filter
		Delivery 1, 2, 3			○	○	
		Consultation room			○	○	
		Bed room				○	
	Kitchen/Laundry Block	Toilet			○		
		Laundry			○		
		Kitchen			○		
		Staff room				○	
		Food storage, store				○	
Linen storage, mending room				○			

4) Plumbing System Plan

① Water Supply System Plan

The existing water supply system is in a critical situation due to poor maintenance. Of the two main pumps, which are playing a pivotal role in the hospital's water supply network, one is out of order. If the other pump should stop functioning due to a breakdown, the entire water supply network will stop functioning.

Water is supplied to each of the existing facilities from the main elevated water tank via an elevated water tank installed on the roof. In this water supply system, the main elevated water tank's capacity is not sufficient. Moreover, the inside of the main elevated water tank has gotten rusty. All this is causing insufficient water supply within the hospital. For this reason, the main pumps are to be improved so that water may be supplied to both the existing facilities and the newly constructed facilities. Shown below is the outline of the hospital's present water supply system.

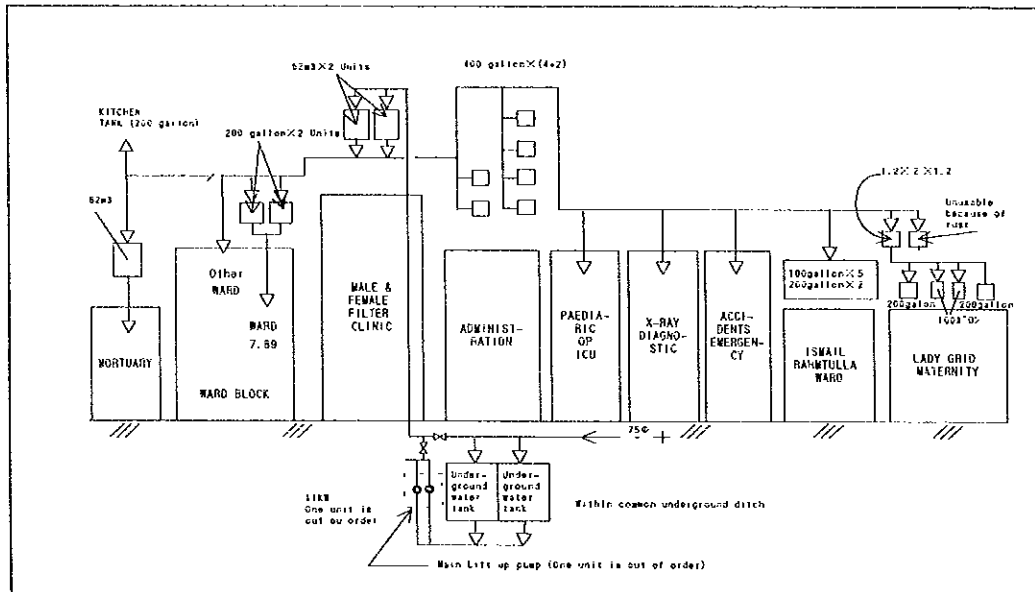


Fig. 2-3 Outline of the Hospital's Present Water Supply System

An elevated water tank is to be installed on the roof of each of the new Maternity Block and the Toilet & Shower Blocks of the ward for the supply of water to the facilities built under this project. Two additional main pumps and an elevated tank (63m<sup>3</sup>) for a replacement of one of the main elevated water tanks are also to be installed.

Water is to be supplied to these facilities by connecting new water pipes to the existing ones. However, there is no sufficient difference in level between the main elevated water tanks (each with a capacity of 62 m<sup>3</sup>) on the roof of the existing male and female filter-clinic and the roof of the new Toilet and Shower Block, making it difficult to supply water to these facilities using the present gravity method. Therefore, water is to be supplied using a pressure type water supply unit. Water is to be supplied to the new Kitchen & Laundry Block from an elevated water tank installed on the roof of the new Toilet & Shower Block.

■ Quantity of Water Supplied to the Maternity Block and the Elevated Water Tanks' Estimated Capacity

- Women in childbirth: 40 persons, 1,500ℓ/person day x 0.2 (20% of the MOPWH guideline)
- Physicians, nurses : 40 persons, 300ℓ/person day x 110ℓ/person

Daily quantity of water

- Supplied : 40 persons x 300ℓ/person day + 40 persons x 110 ℓ/person day = 16,400 ℓ/day

In light of the present condition of the existing facilities, each elevated water tank's capacity is to be one third of the daily quantity of water supplied.

Elevated water tank's

Capacity :  $16,400\ell/\text{day} \times 1/3 = 5,500\ell$  (effective capacity)

- (Dimensions: 2,000 x 2,000 x 2,000H)

■ Quantity of Water Supplied to Toilet Building-1 and Estimated Capacity of the Elevated Water Tank

The number of beds to be covered is 240 (two-thirds of the total number of beds (360) in the existing ward). An additional elevated water tank to cover the kitchen and washing buildings is to be installed in this building.

[Ward]

Daily quantity of water supplied:  $240 \text{ beds} \times 1,500\ell/\text{bed day} \times 0.2 = 72,000\ell/\text{day}$

- It is assumed that the elevated water tank's capacity is one third of the daily quantity of water supplied.

Elevated water tank's capacity:

$$72,000\ell \times 1/3 = 24,000\ell \text{ (effective)}$$

- (Dimensions: 4,000 x 4,000 x 2,000H)

[Kitchen & Laundry Block]

- For the kitchen :  $600 \text{ meals/time} \times 3 \text{ times/day} \times 25\ell/\text{meal} = 45,000\ell/\text{day}$

For washing :  $260 \text{ sheets/day}, 0.7 \text{ kg/sheet}, \text{ quantity of water supplied: } 30\ell/\text{kg}$

- $260 \text{ sheets/day} \times 0.7 \text{ kg/sheet} \times 30\ell/\text{kg} = 5,460\ell/\text{day}$

For employees : For about 40 employees

- $40 \text{ persons} \times 110\ell/\text{person day} = 4,400\ell/\text{day}$

Daily total quantity of

- Water supplied :  $45,000\ell/\text{day} + 5,460\ell/\text{day} + 4,400\ell/\text{day}$   
 $= 54,860\ell/\text{day}$

It is assumed that the elevated water tank's capacity is one third of the daily total quantity of water supplied.

Elevated water tank's capacity:  $54,860\ell \times 1/3$   
 $\cong 18,300\ell$  (effective)

- (Dimensions: 4,000 x 3,000 x 2,000H)

#### ■ Quantity of Water Supplied to Toilet Building-2 and Estimated Capacity of the Elevated Water Tank

The number of beds to be covered is 120 (one third of the total number of beds in the existing ward).

Daily total quantity of water supplied:  $120 \text{ beds} \times 1,500\ell/\text{bed day}$   
 $\times 0.2 = 36,000\ell/\text{day}$

- It is assumed that the elevated water tank's capacity is one third of the daily total quantity of water supplied.

Elevated water tank's capacity:  
 $36,000\ell \times 1/3 = 12,000\ell$  (effective)

- (Dimensions: 3,000 x 3,000 x 2,000H)

#### ■ Main Pump's Capacity

It is estimated that actual lift will be about 22.4 meters (3.8 m (story height) x 3 layers + 6 meters (underground) + 5 meters (height of elevated water tank)). Given that plumbing loss is 0.04 m/m, bend loss is 50% and plumbing length is 100 meters, loss attributable to the plumbing is 73 meters ( $=100 \text{ meters} \times 0.04 \times 1.5$ ).

The pump lift is 29.7 meters (=22.4 meters + 7.3 meters). Making an allowance of 10 percent, it is 33 meters.

Given that the existing main elevated water tank's capacity is 124 m<sup>3</sup> (=62 m<sup>3</sup> x 2) and that the quantity can be pumped up in two hours, the total quantity of water pumped up is:

$$124 \text{ m}^3 \div 2 \text{ hours} = 62 \text{ m}^3/\text{hour} \approx 1,030\ell/\text{min}$$

Therefore, the main specification for the pump is: multilayer whorl (80 x 65) x 1,030ℓ/min x 33 m x 11 kW (2 units).

The existing pump's power is 11 kW, which seems almost the same as that of the above-mentioned pump.

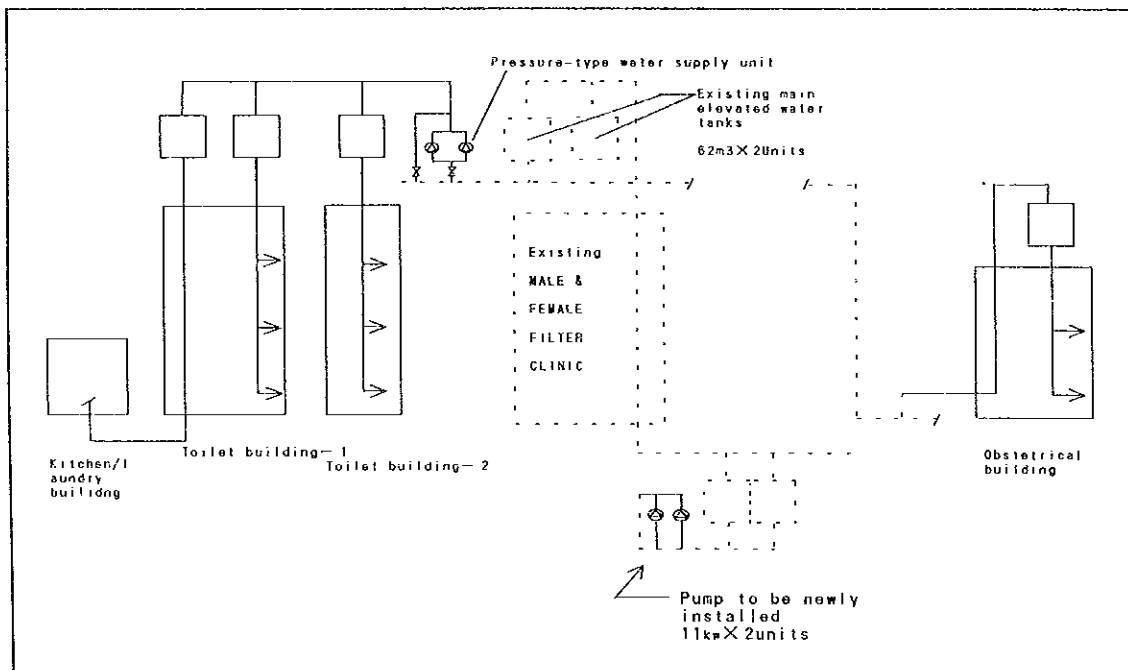


Fig. 2-4 Outline of the Water Supply Facility to Be Newly Constructed

② Hot Water Supply System Plan

In principle, no water heaters are to be procured under this project. But hot water has to be supplied to part of the newly constructed Maternity Block. Such hot water is to be supplied from a natural

circulation-type solar water heater so that the running cost may be minimized.

- Solar water heater with a capacity of 300ℓ (with booster heater):  
4 units

No hot water is to be supplied to the general shower rooms in the Maternity Block, with the exception of those for the use of the doctors and the nurses.

### ③ Drainage Plan

Drainage for the newly constructed facilities and the renovation area is to be installed. Waste water from these facilities is to be discharged directly into the existing drainpipes.

In the case of the Kitchen and Laundry Block which are to be newly constructed, there already exists an underground drainpipe in the central part of the site. This drainpipe is therefore to be diverted.

### ④ Plumbing System Plan

Various items of sanitary equipment are to be installed in both the newly constructed facilities and the existing ones. All toilet seats are to be of Asian type.

### ⑤ LP Gas Equipment Plan

LP gas equipment to provide fuel to the kitchen is to be installed in the Kitchen & Laundry Block. LP gas is to be provided from the existing large-size LP gas cylinders.

### ⑥ Fire Extinguishing Equipment Plan

This plan is to cover the Maternity Block and the Kitchen & Laundry



Block, both of which are to be newly constructed. The fire extinguishing equipment is to include fire hose reel equipment for use in fire fighting. Moreover, fire pump units that meet the BS are to be installed in the two Blocks.

⑦ Kitchen Equipment Plan

The new kitchen equipment is to replace the existing one and is therefore to cover all facilities of the hospital. Of the six existing soup kettles, three are out of order, which is causing delays in the provision of meals. Vapor is the only heat source for the soup kettles. This means that if the boiler should break down, all the soup kettles might stop functioning. The other main items of equipment include six gas heaters.

In light of the present condition of the kitchen as stated above, more than one heat source is to be secured under this project for better risk management. Under this project, LP gas and electric power are to be utilized, in addition to vapor.

The items of kitchen equipment to be procured under this project will be almost the same as the existing ones.

[Main items of kitchen equipment]

- Steam rotary kettle (capacity: about 110ℓ) 3 units
- LP gas rotary kettle pot (capacity: about 120ℓ) 3 units
- Gas low range (single heater) 4 units
- Electric low range (single heater) 2 units

Necessary numbers of sinks, working tables and meal supply carts are also to be procured.

⑧ Washing Equipment Plan

As is the case with the kitchen equipment, the washing equipment is

to cover all facilities of the hospital. It is estimated that the washing equipment's required capacity will be about 600 sheets a day.

$$600 \text{ sheets/day} \times 0.7 \text{ kg} \times 1.1 = 462 \text{ kg/day}$$

If the washing machine with spin dryers are to be operated six times a day,

$$462 \text{ kg/day} \div 6 \text{ times/day} = 77 \text{ kg/time}$$

More than one unit is to be procured to prepare for possible breakdowns.

If four units are procured,

$$77 \text{ kg/time} \div 4 \text{ units} \approx 20 \text{ kg/unit time}$$

If the driers are to be operated eight times a day,

$$462 \text{ kg/day} \div 8 \text{ times/day} \approx 60 \text{ kg/time}$$

More than one unit is to be procured to prepare for possible breakdowns.

If two units are procured,

$$60 \text{ kg/time} \div 2 \text{ units} = 30 \text{ kg/unit time}$$

A sheet roller is also to be procured.

[Main items of washing equipment]

- Washing machines with spin drier: about 20 kg/load;  
power supply: 18 kW 4 units
- Drier: about 30 kg/load; power supply: 30 kW 2 units
- Sheet roller: vapor: 245 kg/h; power supply: 5.5 kW 1 unit

Laundry wagons and related articles are also to be procured.

#### ⑨ Vapor Supply System Plan

A vapor supply system to supply vapor to the kitchen equipment and the washing equipment is to be procured under this project. Two oil-powered vapor generators are to be installed.

The estimated vapor generating capacity of each of the vapor generators is:

- For the kitchen equipment: 66 kg/h x 3 units = 198 kg/h
- For laundry: 245 kg/h x 1 unit = 245 kg/h

Total: 443 kg/h -- 500 kg/h

[Main items of equipment]

- Vapor generator: 500 kg/h x 2 units
- Oil tank: 2,000 ℓ 1 unit
- Water softener: 1 unit
- Water supply equipment: 1 unit
- Water circulating box: 1 unit

Plumbing is also to be procured.

#### ⑩ Medical Gas Equipment Plan

Equipment to supply oxygen (O<sub>2</sub>) and nitrous oxide (N<sub>2</sub>O) to the two operating rooms and the three delivery rooms in the new Maternity Block and outlet equipment are to be procured.

These gases are to be supplied from the gas supply equipment installed in the existing emergency department via extended piping.

#### 7) Building Materials Plan

Materials for use in the construction work under this project should be those which are suited for the local climatic conditions, customs and methods of construction and which meet the stated performance requirements. They should also be highly durable, easy to maintain and manage, and economical.

##### ① Main structural materials

List of main structural materials to be used

Portion	Material	Remarks
Foundation, column/beam, floor	Reinforced concrete	These are structural materials used widely in the country. Concrete is to be supplied from a concrete plant to be assembled on the project site. Reinforcing bars are to be imported.
Wall	Concrete block	Concrete blocks are used widely in the country. They are easy to work and very economical.

② Exterior Finish Materials

List of exterior finish materials to be used

Portion	Material	Remarks
Roof	Asphalt membrane waterproofing lightweight block	These materials are used widely in the country.
Wall	Concrete block	Concrete blocks have long been used in the country. They are highly durable and easy to maintain and manage.
Fittings	Aluminum sash	Aluminum sashes can be assembled in the country and therefore there will be no problem with their maintenance and management. They are highly durable and are of good design.

③ Interior Finish Materials

List of interior finish materials to be used

Room	Floor	Wall	Ceiling	Remarks
Consultation room, delivery room, doctor's room, nurse station	Terrazzo	Coated mortar	Rock wool sound absorbing board	These finish materials are highly durable, functional, and of good design.
Laundry room, kitchen	Terrazzo	Coated mortar	Exposed concrete	These finish materials are highly durable and economical. They are also easy to repair.
Storage, machine stockroom	Coated mortar	Brick	Exposed concrete	These finish materials are highly durable and easy to maintain and manage.
Toile & shower room	Mosaic tile	Ceramic tile	Coated calcium board	These finish materials are highly durable and highly functional. They are also easy to maintain and manage.
Operating room	Terrazzo	Coated mortar	Exposed concrete	These finish materials are highly durable and economical. They are also easy to maintain and manage.

(3) Equipment Plan

The following table shows the items of equipment, which were selected according to the guideline for selection of the equipment, to be procured under the project.

## Equipment list

### 1. Administration

Code	Department	Item	Equipment	Q'ty
1.1	Account	1	Computer with printer	1
		2	Typewriter	1
1.2	Personnel	1	Photocopier	1
		2	Computer with printer	1
		3	Typewriter	1
		4	Electrical duplicating machine	1
1.3	Records	1	Computer with printer	1
		2	Photocopier	1
		3	Typewriter	1
1.4	Office	1	Computer with printer	1
		2	Typewriter	1
1.5	NHIF	1	Photocopier	1

### 2. Rehabilitation

Code	Department	Item	Equipment	Q'ty
2.0	Physiotherapy	1	Ultrasound unit	2
		2	Short wave diathermy	2
		3	Hydrocollator unit for cold & hot therapy	1
		4	Tens unit	1
		5	IRR unit	1
		6	Wax bath	1
		7	Electrical traction machine	1
		8	Pulley system	1
		9	Rowing machine with body guard	1
		10	Wall bar unit	1
		11	Suspension unit complete set	1
		12	Wrist roller	1
		13	Pedal apparatus	1
		14	Muscle stimulator	1
		15	Wheel chair	2
		16	Walking frame, adult & child	5
		17	Tripod walking stick	3
		18	Quadripod walking stick	3
2.1	Occupational Therapy	1	Hammock	3
		2	Sitting aid for child (adjustable seat/chair)	2
		3	Kneel standing aid for child	2
		4	Box and T(standing aid)	2
		5	Roller with cover(big & medium)	2
		6	Tricycle	3
		7	Push cart	3
		8	Walking aid for child	1

	Department	Item	Equipment	Code
		9	Refrigerator	1
		10	Goniometer (small)	2
		11	Goniometer (large)	2
		12	Pottery wheel machine, manual	1
		13	Foot power loom	1
		14	Uplight rug loom	1
		15	Wire twisting machine	1
		16	Foot treadal drilling machine	1
		17	Wheel chair for adult	1
		18	Walking aid for adult	1
		19	Walking aid without caster, for adult and child	2

### 3. Wards

Code	Department	Item	Equipment	Q'ty
3.0	Ward: 1-9	1	Bed, general	260
		2	Trolley, general purpose	10
		3	Trolley, medicine lockable	10
		4	Diagnostic set	10
		5	Urinal	50
		6	Bed pan, stainless steel	50
		7	Sputum mug, stainless steel	90
		8	Vomitus bowl, stainless steel	20
		9	Basin, stainless steel	30
		10	Instrument table, stainless steel	30
		11	Spot light	10
		12	Wheel chair	20
		13	Stretcher	20
		14	Bed, orthopaedic	40
		15	Suction unit, electric	10
		16	Suction unit, foot	10
		17	Trolley, linen	12
		18	Trolley, food	12

3.1	Ward: 3 & 4 Surgery	1	Autoclave, table top	2
		2	Trolley, dressing	2

3.2	Ward: 7 Orthopaedic	1	Autoclave, table top	1
		2	Trolley, dressing	2
		3	Splint frame, Thomas	25
		4	Pulley	50
		5	Steinmans pin	20
		6	Stirrup	20
		7	Steinmans pin introducer T function type	2
		8	Plaster spreader, stainless steel	4
		9	Steinmans pin introducer T function type	2

Code	Department	Item	Equipment	Q'ty
3.3	Ward: 10 Paediatric	1	Weighing scale	3
		2	Pot with handle	15
		3	Cot	40
		4	Diagnostic set	2
		5	Sphygmomanometer	3
		6	Spot light	2

3.4	Ward: Maternity unit	1	Delivery bed	24
		2	Weighing scale for adult	2
		3	Examination couch	6
		4	Bedpan	10
		5	Trolley, general purpose	4
		6	Trolley, medicine	4
		7	Wheel chair	2
		8	Suction unit	4
		9	Laryngoscope, adult	2
		10	Laryngoscope, paediatric	3
		11	Suction unit, foot	2
		12	Infant warmer	1
		13	Cusco speculum	5
		14	Delivery tray	10
		15	Kocher's hemostatic forceps	8
		16	Ambu bag, adult	2
		17	Ambu bag, paediatric	2
		18	Instrument trolley	10
		19	Basin, stainless steel	10
		20	Vacuum extractor	2
		21	Sterilizing drum	5
		22	Autoclave, table top	1
		23	Diagnostic set	1
		24	Doppler fetus detector	3
		25	Bed	30

3.5	Ward: Nursery	1	Incubator	5
		2	Infant warmer	3
		3	Ambu bag, naeonatal	4
		4	Trolley, general purpose	2
		5	Phototherapy unit	2
		6	Suction unit	2

3.6	Ward: Gynaecology	1	Gynaecology examination couch	2
		2	Autoclave, table top	1
		3	Kick bucket	2
		4	Spot light	2
		5	Trolley, dressing	2
		6	Flip bin	1
		7	Bucket, stainless steel	2

Code	Department	Item	Equipment	Q'ty
3.7	Casualty	1	Stretcher	6
		2	Trolley, general purpose	5
		3	Bucket, stainless steel	10
		4	Suction unit	2
		5	Flip bin	3
		6	X-ray film viewer	2
		7	Diagnostic instrument set	2
		8	I.V. hanger rod	5
		9	Spot light	1
		10	Trolley, dressing	2
		11	Wheel chair	5
		12	Work table	1
		13	Basin, stainless steel	5
		14	Electric plaster saw	1
		15	Kick bucket	3
		16	Autoclave, table top	1
		17	Cupboard	1

#### 4. Laboratory

Code	Department	Item	Equipment	Q'ty
4.0	Laboratory	1	Hematology analyzer (Blood cell counter)	2
		2	Binocular microscope	4
		3	Research microscope with photographic attachment	1
		4	Blood gas analyzer	1
		5	Electrolyte analyzer	1
		6	Spectrophotometer	2
		7	pH meter	1
		8	Hemoglobin meter	2
		9	Glucose analyzer	2
		10	Food blender (glass bottles)	1
		11	Refrigerator	4
		12	Blood bank refrigerator	1
		13	Centrifuge, table top	2
		14	Autoclave, table top	1
		15	Analytical balance	2
		16	Hot air oven (large)	1
		17	Incubator	1
		18	HIV machine (Incubator/Washer/Reader)	1
		19	Microplate shaker	1
		20	Colony counter	1
		21	Automatic tissue processor	1
		22	Water bath for tissue floating	1
		23	Rotary microtome	1
		24	Water bath	1
		25	Wax embedding station	1
		26	Automatic knife sharpener	1
		27	Histology/cytology automatic staining machine	1
		28	HB/Protein electrophoresis apparatus	1



Code	Department	Item	Equipment	Q'ty
4.1	Mortuary	1	Autopsy light	3
		2	Autopsy table	3
		3	Body trolley (Ordinary)	5
		4	Complete post mortem set	3
		5	Cranial saw	2
		6	Embalming machine	1
		7	Weighing scale for organs	2

#### 5. Pharmacy

Code	Department	Item	Equipment	Q'ty
5.0	Pharmacy	1	Electronic balance	2
		2	Heavy duty weighing machine	1
		3	Mixer	1
		4	Filter press (heavy duty)	1
		5	Filling machine (low speed)	1
		6	Filling machine (small volume)	1
		7	Capping machine	1
		8	Autoclave, table top	1
		9	Water distiller	2
		10	Refrigerator	1
		11	Mixer/blender	2
		12	Homogenizer	1
		13	Filling machine for ointment and cream	1
		14	Suction pump	2

#### 6. Operating theatre

Code	Department	Item	Equipment	Q'ty
6.0	Major operating theatre	1	Anaesthetic machine with ventilator	6
		2	Anaesthetic trolley with two drawer	6
		3	Autoclave, table top	6
		4	Cholecystectomy set	2
		5	Craniotomy set	1
		6	Endoscopic urological set	1
		7	Defibrillator	2
		8	Electrosurgical unit	6
		9	Horseshoe shaped head rest	2
		10	I.V. hanger rod	10
		11	Instrument cabinet	6
		12	Kick bucket	12
		13	Laparotomy set	2
		14	Laparoscope set	1
		15	Mastectomy set	1
		16	Mayo instrument table	7
		17	Nephrectomy set	1
		18	Operating instrument set (adult)	5
		19	Operating instrument set (pediatric)	2
		20	Operating light	6

Code	Department	Item	Equipment	Q'ty
		21	Operating table	6
		22	Patient monitor	6
		23	Prostatectomy set	1
		24	Pulse oximeter	6
		25	Spot light	2
		26	Stretcher	10
		27	Suction unit	6
		28	Suction unit, foot	2
		29	Surgeon's foot steps	4
		30	Surgeon's stool	9
		31	Thyroidectomy set	2
		32	Trolley, dressing	7
		33	Trolley, gown	5
		34	Trolley, suture	7
		35	Vascular & stripping of varicose vein	1
		36	Wash basin stand, single	10
		37	General thoracic set	1
		38	Scrub unit, for two persons	2

6.1	Major operating theatre (Dental & ENT)	1	Dental fracture set	1
		2	Mandible set	1
		3	Postnasal space set	1
		4	Tonsillectomy set	1
		5	Tracheotomy set	1

6.2	Major operating theatre (Orthopaedic)	1	Amputation set	2
		2	AO orthopedic set	1
		3	Bone plating & screw tray	2
		4	Bone wiring set	1
		5	Pneumatic drill & drill bit	1
		6	External fixation set	2
		7	General bone instrument set	2
		8	Kuntsher nail set	2
		9	Orthopedic operating table	1
		10	Plaster saw (small & big)	2
		11	Plaster shear	2
		12	Trolley, plaster	1
		13	Pneumatic tourniquet	2
		14	Skull traction set	2
		15	Steinmans pin set	2
		16	Tendon set	1
		17	Vesico vaginal fistula set	2

6.3	Obstetric Surgery	1	Maternity theatre caesarean set	3
		2	Hysterectomy set	2
		3	Evacuation set	1
		4	Decapitation set	1
		5	Dilation & Curettage set	1

Code	Department	Item	Equipment	Q'ty
		6	Abdominal hysterectomy set	1
		7	Wertheimes hysterectomy set	1
		8	Vaginal hysterectomy set	1

6.4	Minor operation theatre	1	Anaesthetic machine	2
		2	Anaesthetic trolley with two drawer	2
		3	Autoclave, table top	2
		4	Defibrillator	1
		5	Electrocardiograph, 1-ch	1
		6	Electrosurgical unit	1
		7	I.V. hanger rod	4
		8	Instrument cabinet	2
		9	Operating instrument set(adult)	1
		10	Operating instrument set(pediatric)	1
		11	Kick bucket	4
		12	Mayo instrument table	2
		13	Operating light	2
		14	Operating table	2
		15	Pediatric instrument set	1
		16	Patient monitor	2
		17	Pulse oximeter	2
		18	Resuscitator	2
		19	Spot light	2
		20	Stethoscope	2
		21	Stretcher	2
		22	Suction unit	2
		23	Suction unit, foot	2
		24	Surgeon's foot step	2
		25	Surgeon's stool	4
		26	Trolley, dressing	2
		27	Trolley, gown	2
		28	Trolley, instrument	2
		29	Wash basin stand, double	2
		30	Wash basin stand, single	2
		31	X-ray film viewer	2

6.5	ICU	1	All purpose trolley	4
		2	Autoclave, table top	1
		3	Bed	4
		4	I.V. hanger rod	12
		5	Electrocardiograph	1
		6	Incubator(Infant warmer)	1
		7	Infusion pump	6
		8	Trolley, instrument	1
		9	Refrigerator	3
		10	Patient moniter	6
		11	Spot light	6

Code	Department	Item	Equipment	Q'ty
		12	Portable X-ray machine	1
		13	Resuscitation trolley with defibrillator	1
		14	Suction unit	6
		15	Ventilator	4

6.6	CSSD	1	Autoclave, large	2
		2	Collecting delivery trolley	4
		3	Container delivery trolley	4
		4	CSSD service trolley	4
		5	Drier	2
		6	Glove washing and drying machine	1
		7	Basic dressing pack set	40
		8	Lumbar puncture tray	4
		9	Catheterization tray	6
		10	Stitching tray	20
		11	Bone marrow tray	2
		12	Abdominal tapping tray	1
		13	Bladder irrigation tray	2
		14	Tracheotomy tray	1
		15	Blood exchange tray	1
		16	Cut down tray	4
		17	Stomach washout tray	2
		18	Rectal washout tray	2
		19	Vaginal examination tray	15
		20	Incision and drainage tray	15
		21	Liver biopsy set	1
		22	Chest aspiration set	2
		23	Emergency delivery set	2
		24	Episiotomy set	30
		25	Intercostal drainage set	10
		26	Intubation set	10
		27	Dilatation and curetage set	5

#### 7. Out-Patient department

Code	Department	Item	Equipment	Q'ty
7.0	Dental	1	Complete dental chair system	4
		2	Dental autoclave(large, small)	2
		3	Portable dental suction machine	2
		4	Dental compressor machine-air-cooled	4
		5	Dental suction machine for dental chair unit	4
		6	Dental instrument cabinet(movable)	5
		7	Camera with zoom lens-scientific	1
		8	Ultrasonic scaler	1
		9	Micromotor unit, portable	1
		10	Straight handpiece, for micromotor unit	2
		11	Portable dental X-ray machine	1
		12	X-ray protection apron	1
		13	Conservative instrument-assorted	10

Code	Department	Item	Equipment	Q'ty
		14	Surgical instrument-assorted	2
		15	Dental mirror	50
		16	Instrument cabinet-lockable	2
		17	Porcelain furnace	1
		18	Micromotor	4
		19	Handpiece for micromotor	1
		20	Hot air curing bath	1
		21	High frequency casting machine	1
		22	Resin curing machine	1
		23	Model trimer	1
		24	Vacuum mixing machine	1

7.1	ENT	1	Complete consultant ENT examination table	2
		2	Antral wash-out set (trocher, cannulal, higginson syringe)	2
		3	Head mirror	5
		4	Nasal cavity set	3
		5	Alligator-forceps	5
		6	Nasal speculum	5
		7	Jobson home probe	5
		8	Wax hook/curette	5
		9	Aural syringe	3
		10	Audiometer (pure+speech)	1
		11	Tympanometer	1
		12	Operating microscope	1
		13	Bronchoscope-complete with fiber lighting (infant, child, adult)	1
		14	Larygoscope-complete with lighting (Pediatric, adult)	1
		15	Esophagoscope-complete with lighting (Pediatric, adult)	1
		16	Electric drill and set of bur	1
		17	Sinus endscope (complete with lighting)	1
		18	Head light with light source	2
		19	Tympanoplasty set	2

7.2	Eye	1	Monocular (indirect ophthalmoscope)	1
		2	Goldman perimeter for visualised assessment	1
		3	Slit lamp	1
		4	Streak retinoscope with bar	1
		5	Trial lense set	1
		6	Trial frame	1
		7	Operating light	1
		8	Cataract operating set (surgical instrument)	1
		9	Eye lid and conjunctiva set (surgical instrument)	1
		10	Basic and emergency set	1
		11	Bipolar diathermy	1
		12	Autoclave	1
		13	Wall chart	1
		14	Binocular loupe	1

Code	Department	Item	Equipment	Q'ty
7.3	Paediatric unit	1	Diagnostic set	3
		2	Paediatric stethoscope	5
		3	Suction unit	2
		4	Autoclave, table top	1
		5	Weighing scale for baby	1
		6	Pot with handle	20
		7	Trolley, treatment	3
		8	Oxygen flowmeter with humidfier	2
		9	Jacson lees resuscitator	1
		10	Weighing scale for paediatric	1

#### 8. X-ray Department

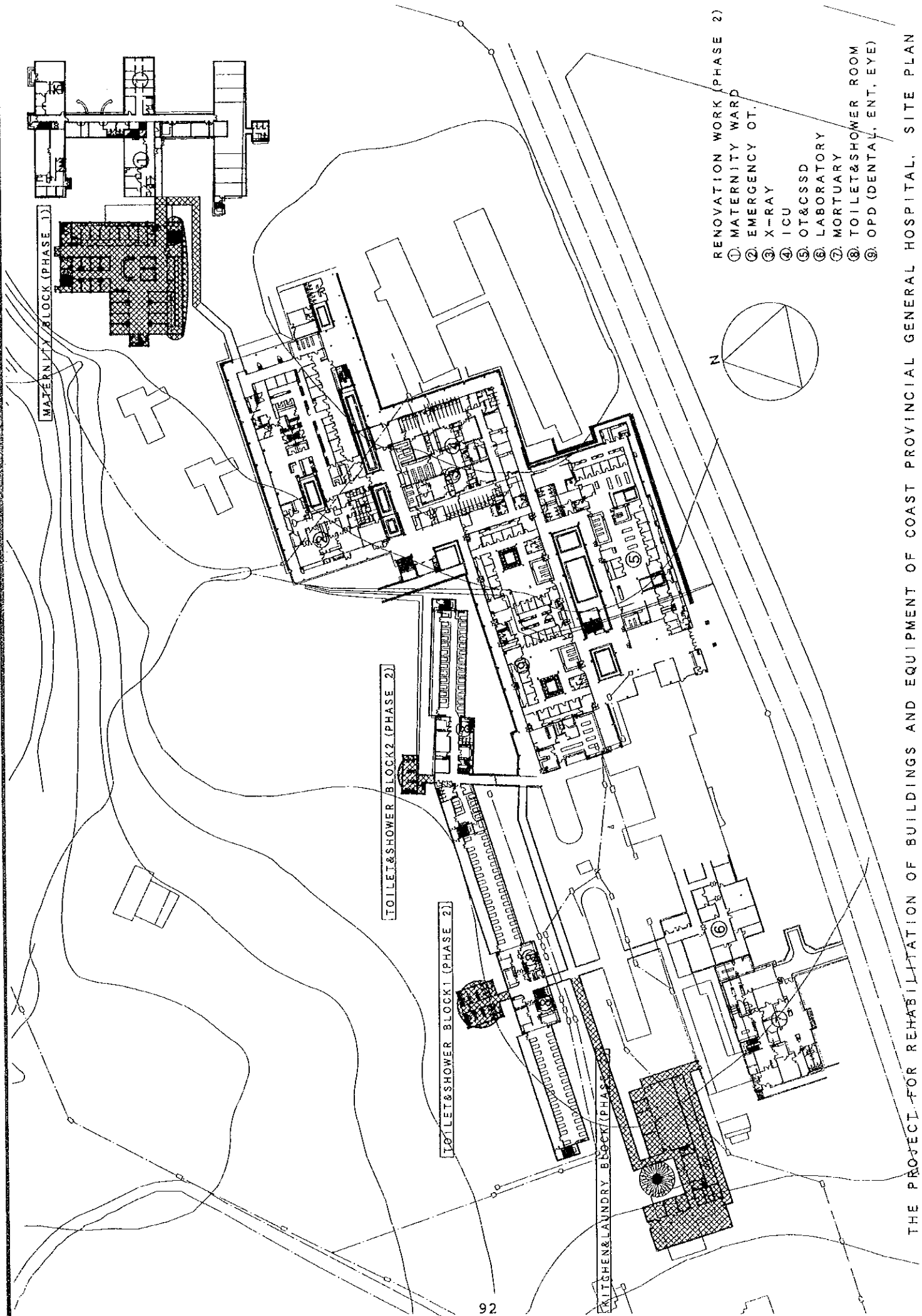
Code	Department	Item	Equipment	Q'ty
8.0	X-ray	1	General X-ray unit	1
		2	Ultrasound unit (General)	1
		3	Ultrasound unit (Obstetric)	1
		4	Mobile X-ray unit	1
		5	Automatic proccessor	1
		6	Manual proccessor	1
		7	Dental film proccessor	1
		8	Cassette and screen, 35 x 43 cm	5
		9	Cassette and screen, 35 x 35 cm	5
		10	Cassette and screen, 30 x 15 cm	5
		11	Cassette and screen, 24 x 30 cm	15
		12	Cassette and screen, 24 x 18 cm	5
		13	Grided cassette with screen	3
		14	Curved cassette with screen	2
		15	Stationary grids-sizes, 35 x 43 cm	5
		16	Stationary grids-sizes, 24 x 30 cm	3
		17	Automatic side marker	5
		18	Actinic light	1
		19	Pelvimetry ruler	2
		20	Vertical bucky stand	2
		21	Lead/rubber glove	3
		22	Lead/rubber apron	3
		23	Rare earths screen	3
		24	Film hopper	2
		25	Enema can and set	2
		26	Pneumocolon and accessory tubing	2
		27	Victria ring(enema)	2

#### 9. Others

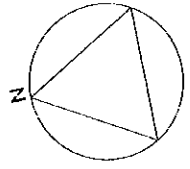
Code	Department	Item	Equipment	Q'ty
9.0		1	Medical gas piping material	1

(4) Drawings

1. Site Plan
2. Maternity Block                      Plan                      (Ground Floor)
3. Maternity Block                      Plan                      (First Floor)
4. Maternity Block                      Elevation
5. Maternity Block                      Elevation
6. Maternity Block                      Section
7. Toilet & Shower Block              Plan                      (G~Second Floor)
8. Toilet & Shower Block              Elevation
9. Toilet & Shower Block              Section
10. Kitchen & Laundry Block           Plan                      (Ground Floor)
11. Kitchen & Laundry Block           Elevation
12. Kitchen & Laundry Block           Section

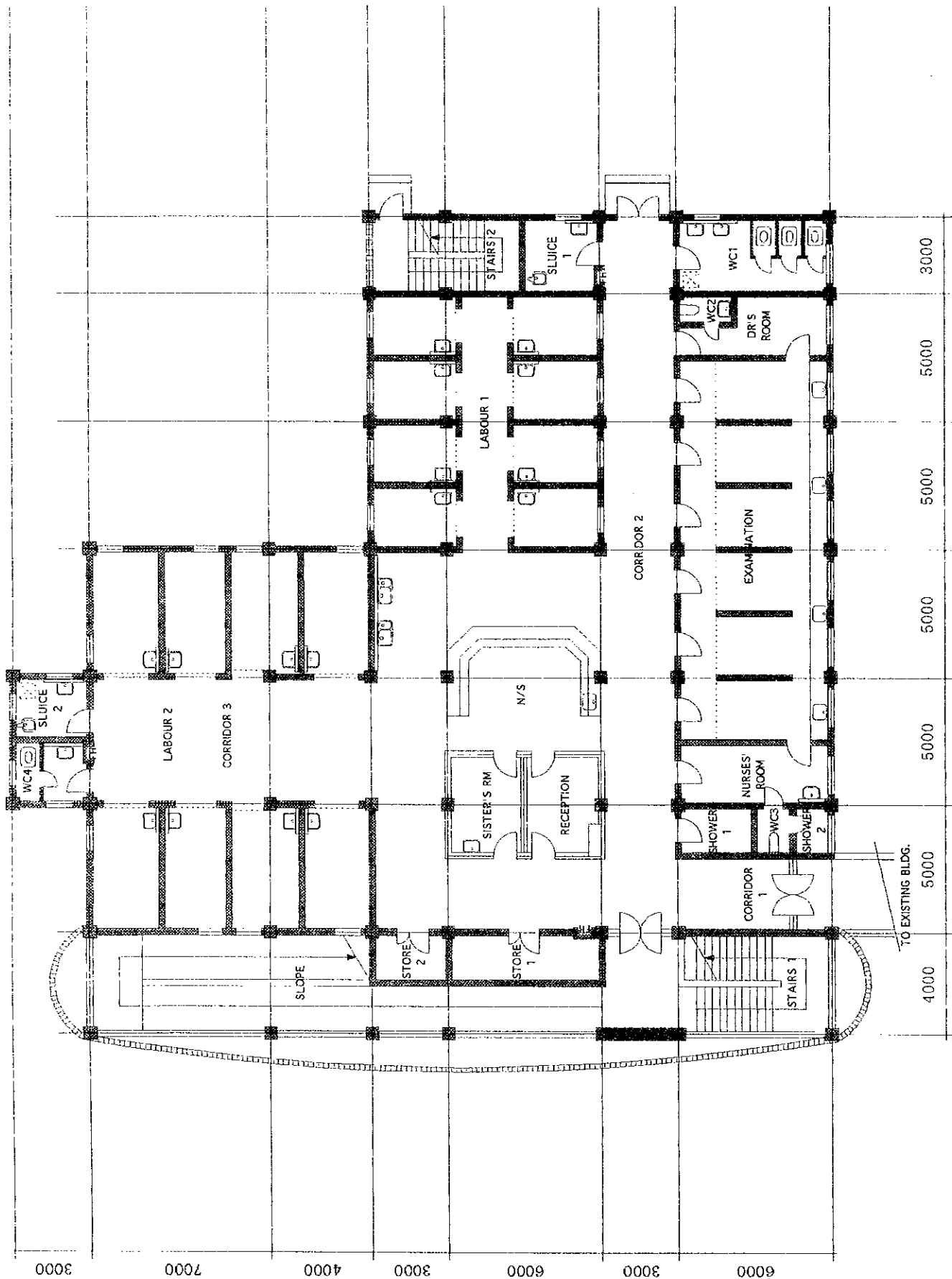


- RENOVATION WORK (PHASE 2)
- ①. MATERNITY WARD
  - ②. EMERGENCY OT.
  - ③. X-RAY
  - ④. ICU
  - ⑤. OT & CSSD
  - ⑥. LABORATORY
  - ⑦. MORTUARY
  - ⑧. TOILET & SHOWER ROOM
  - ⑨. OPD (DENTAL, ENT, EYE)

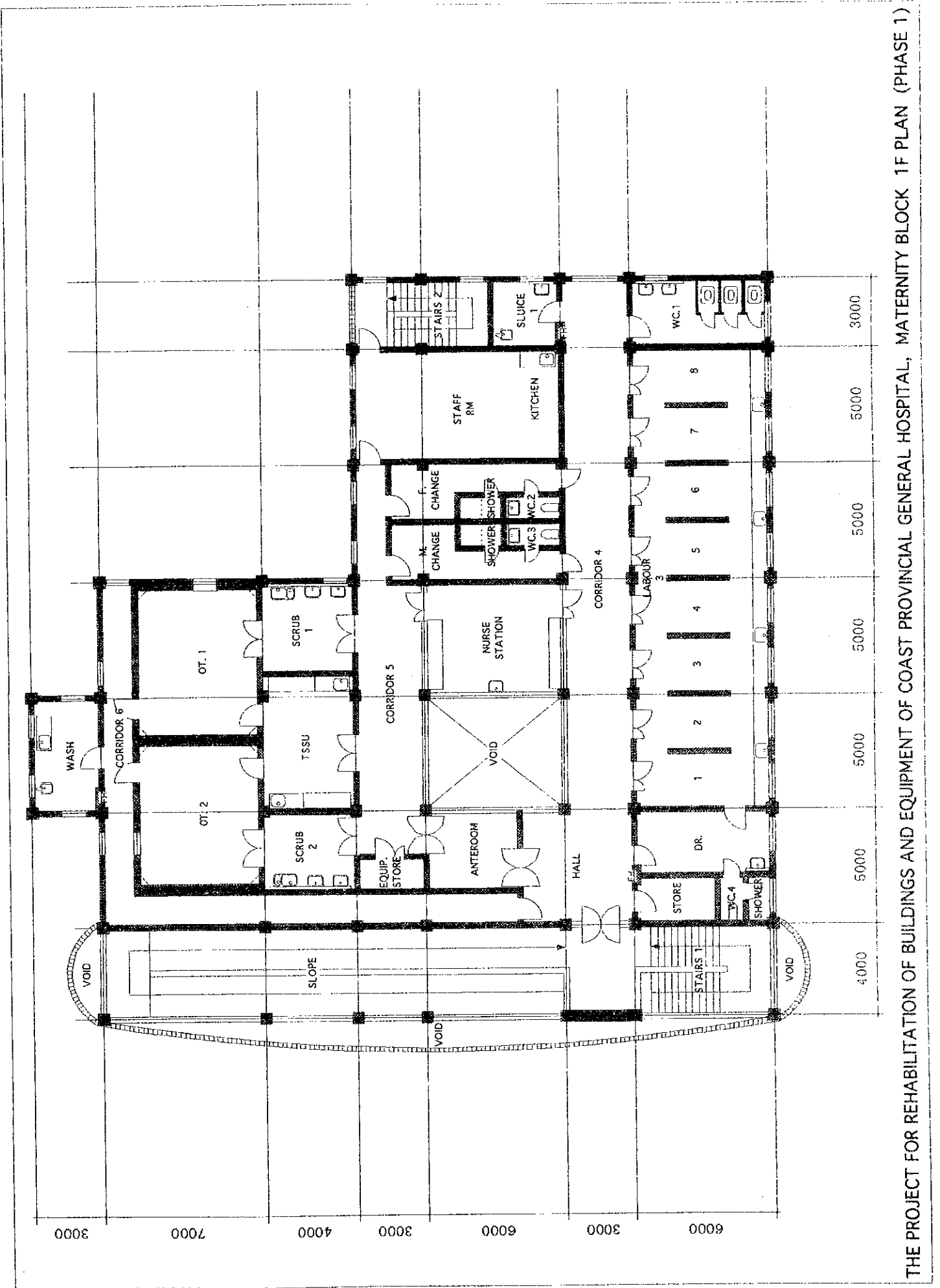


THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL. SITE PLAN

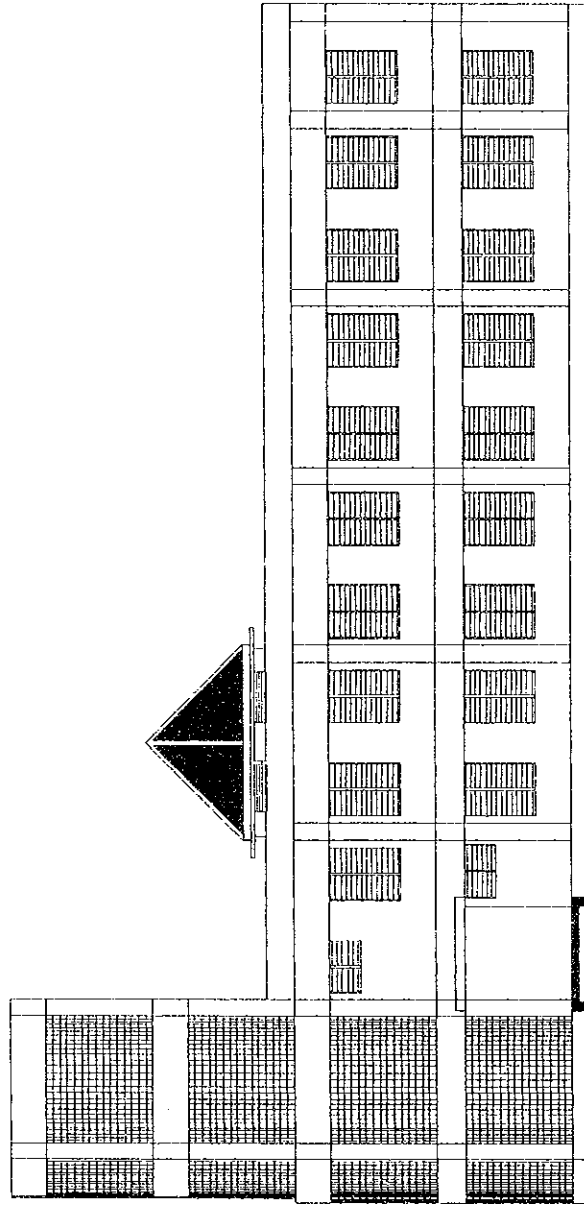




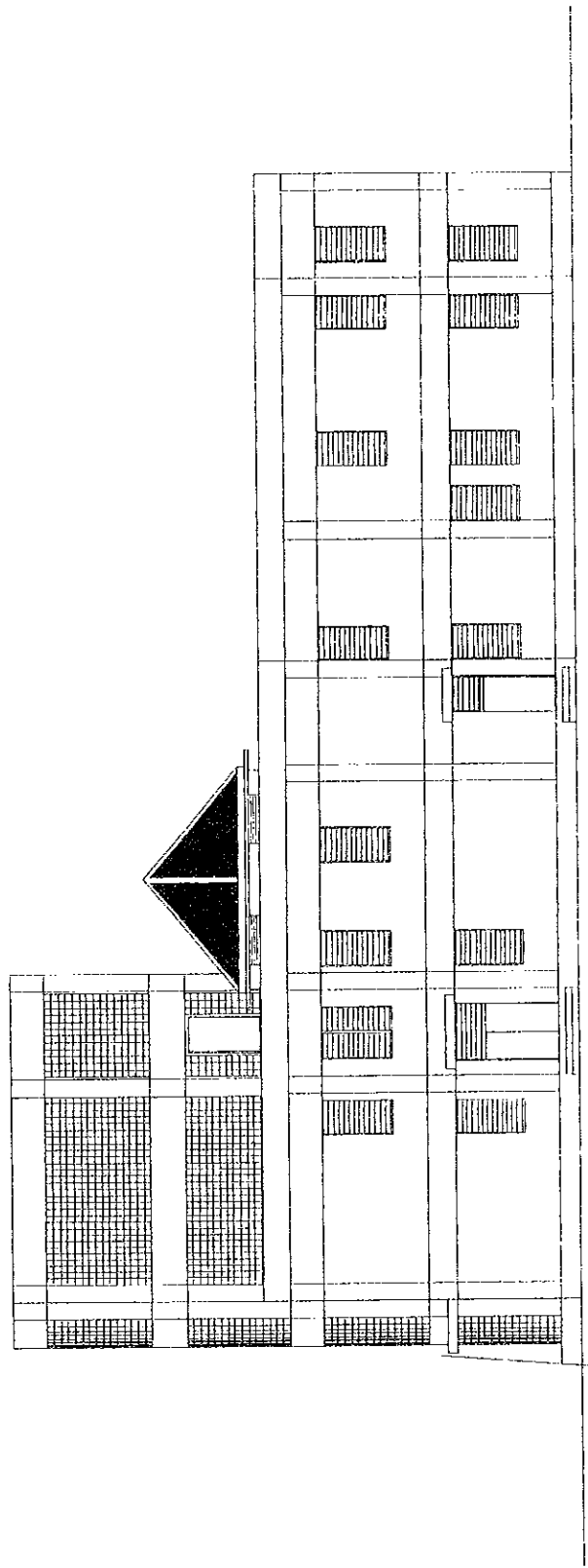
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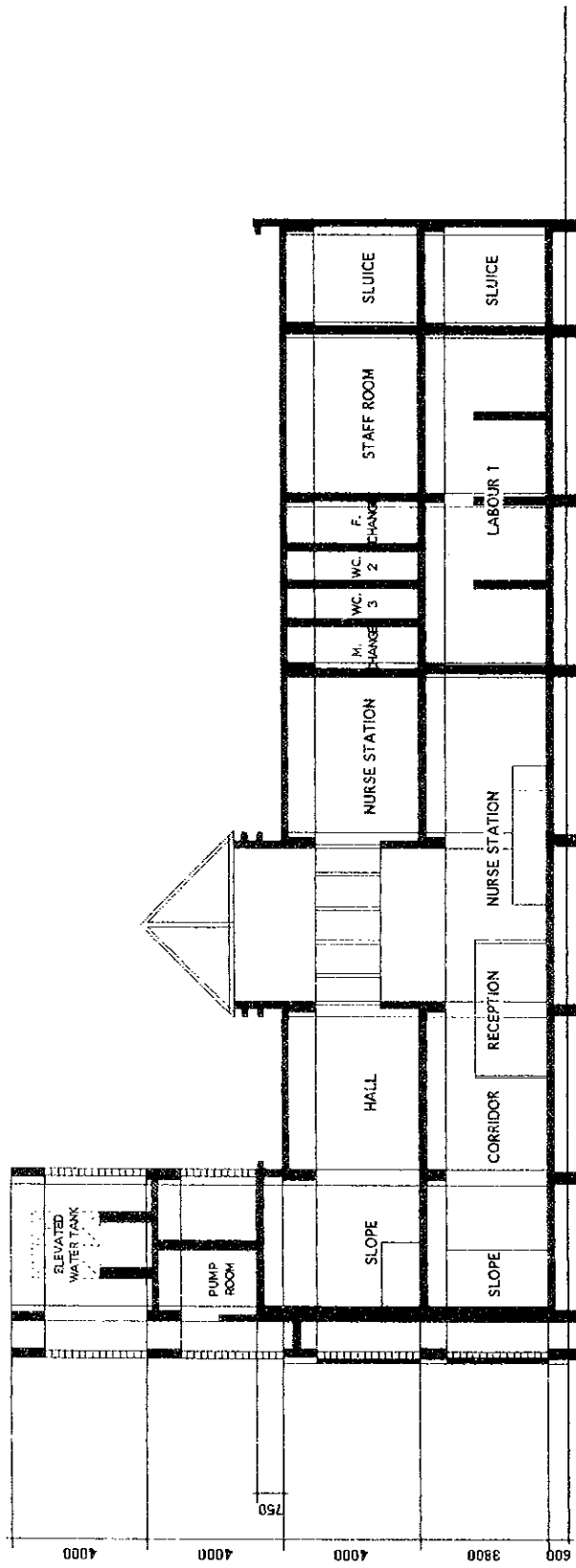
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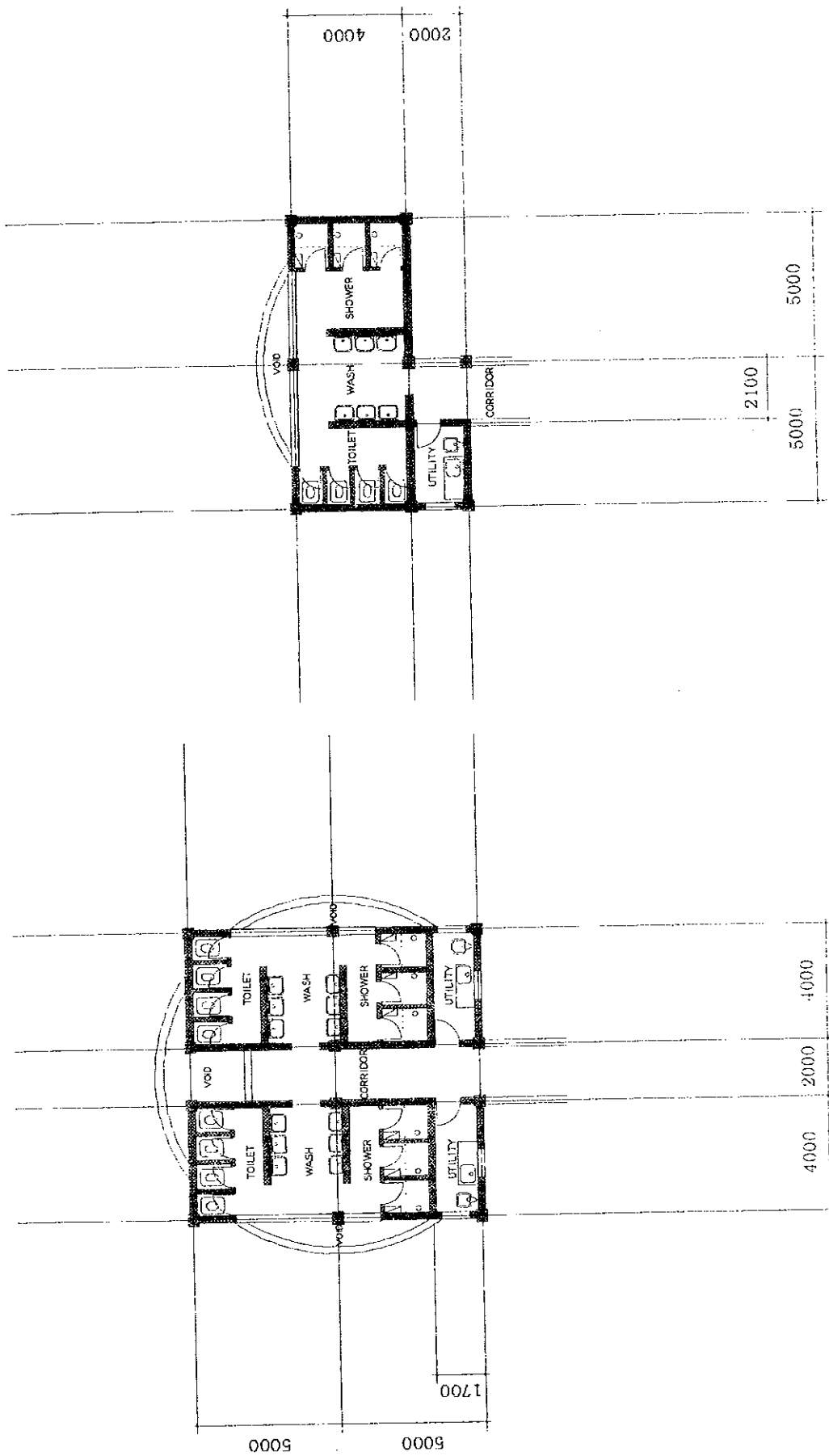
THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
MATERNITY BLOCK EAST ELEVATION (PHASE 1)



THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
MATERNITY BLOCK NORTH ELEVATION (PHASE 1)



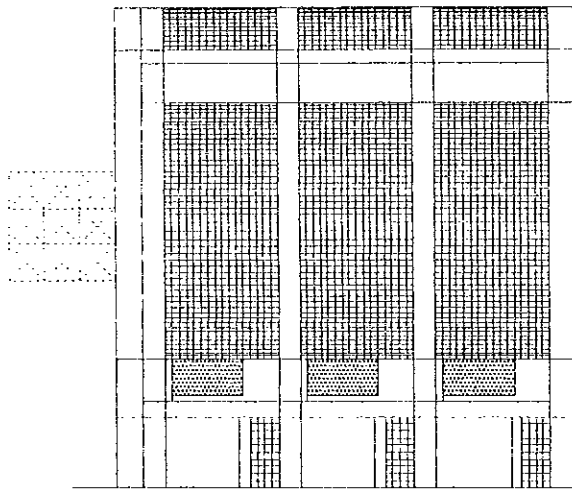
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 MATERNITY BLOCK SECTION (PHASE 1)



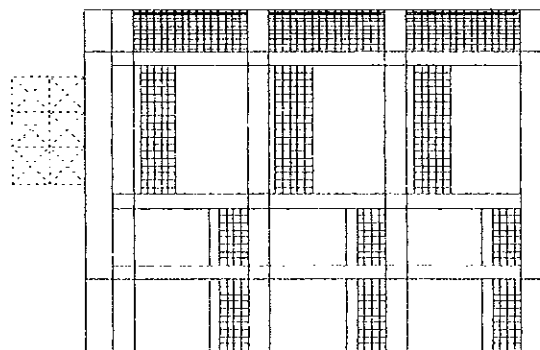
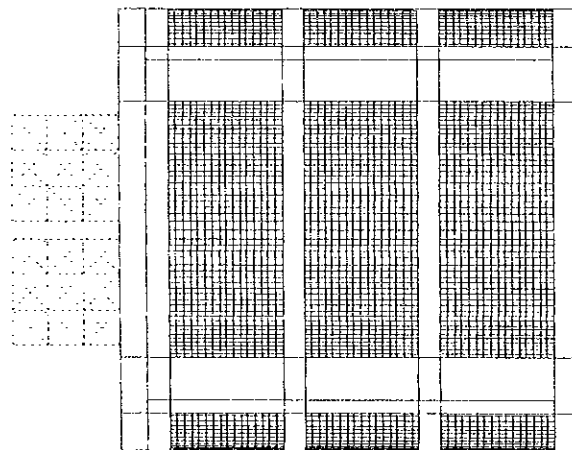
BLOCK-2

BLOCK-1

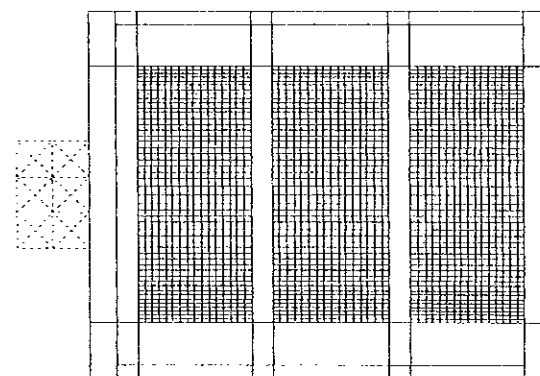
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TOILET & SHOWER BLOCK GF, 1F, 2F PLAN (PHASE 2)



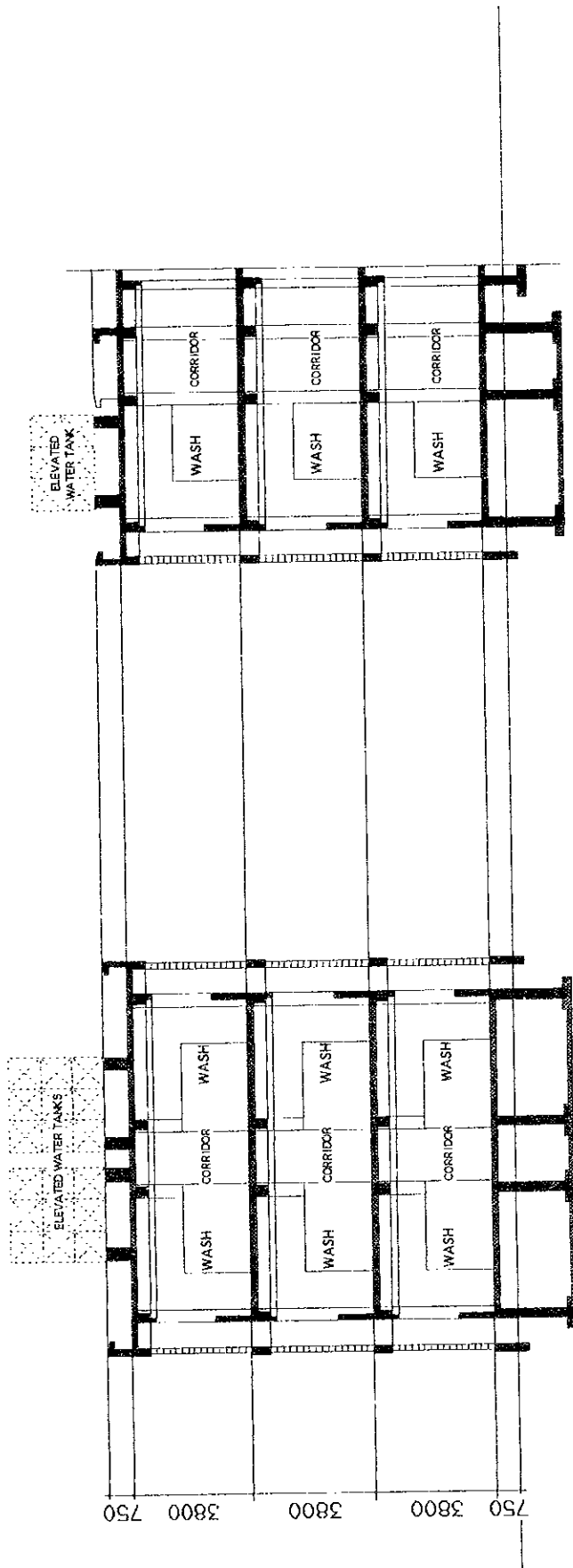
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BLOCK-2



THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
TOILET & SHOWER BLOCK ELEVATION (PHASE 2)

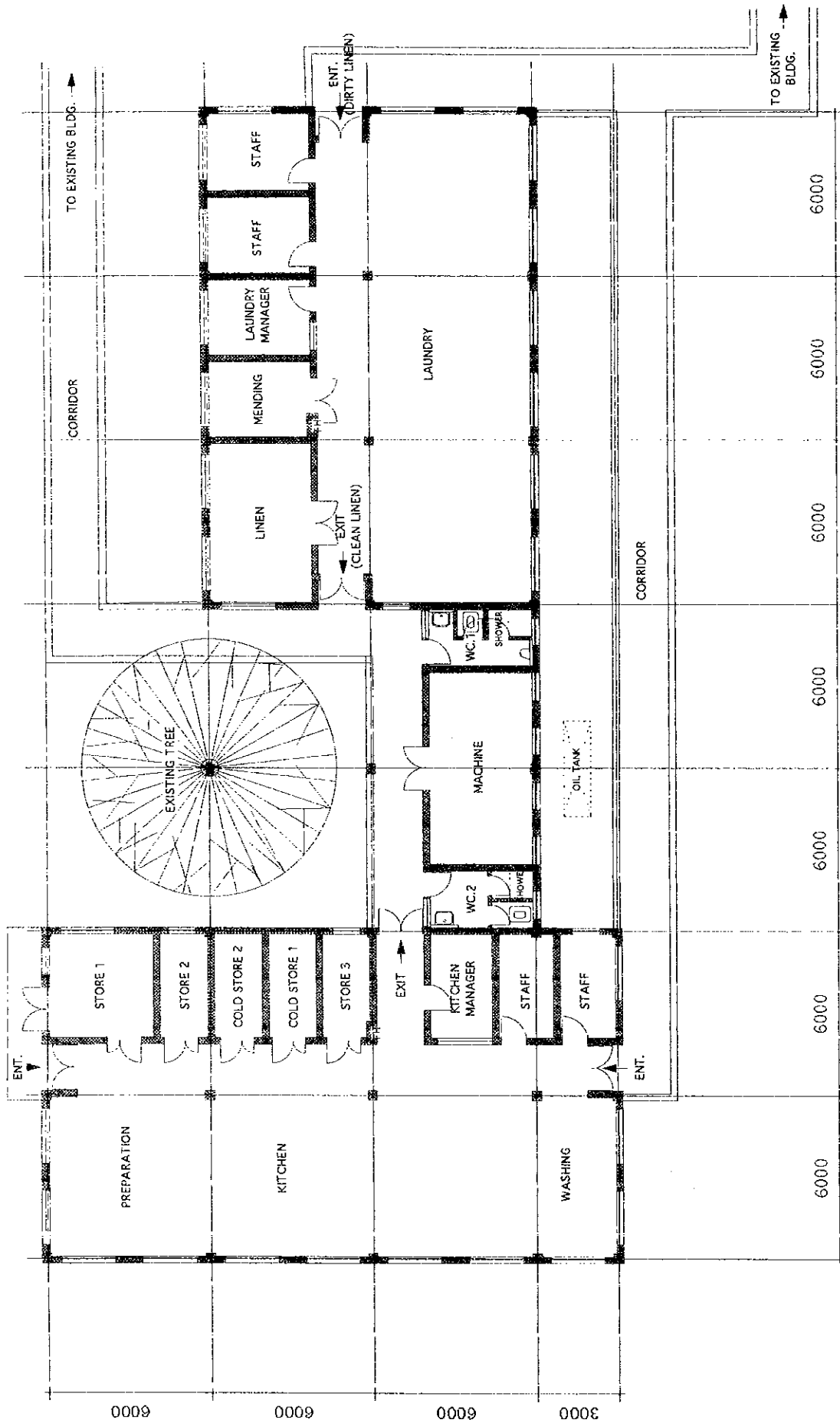


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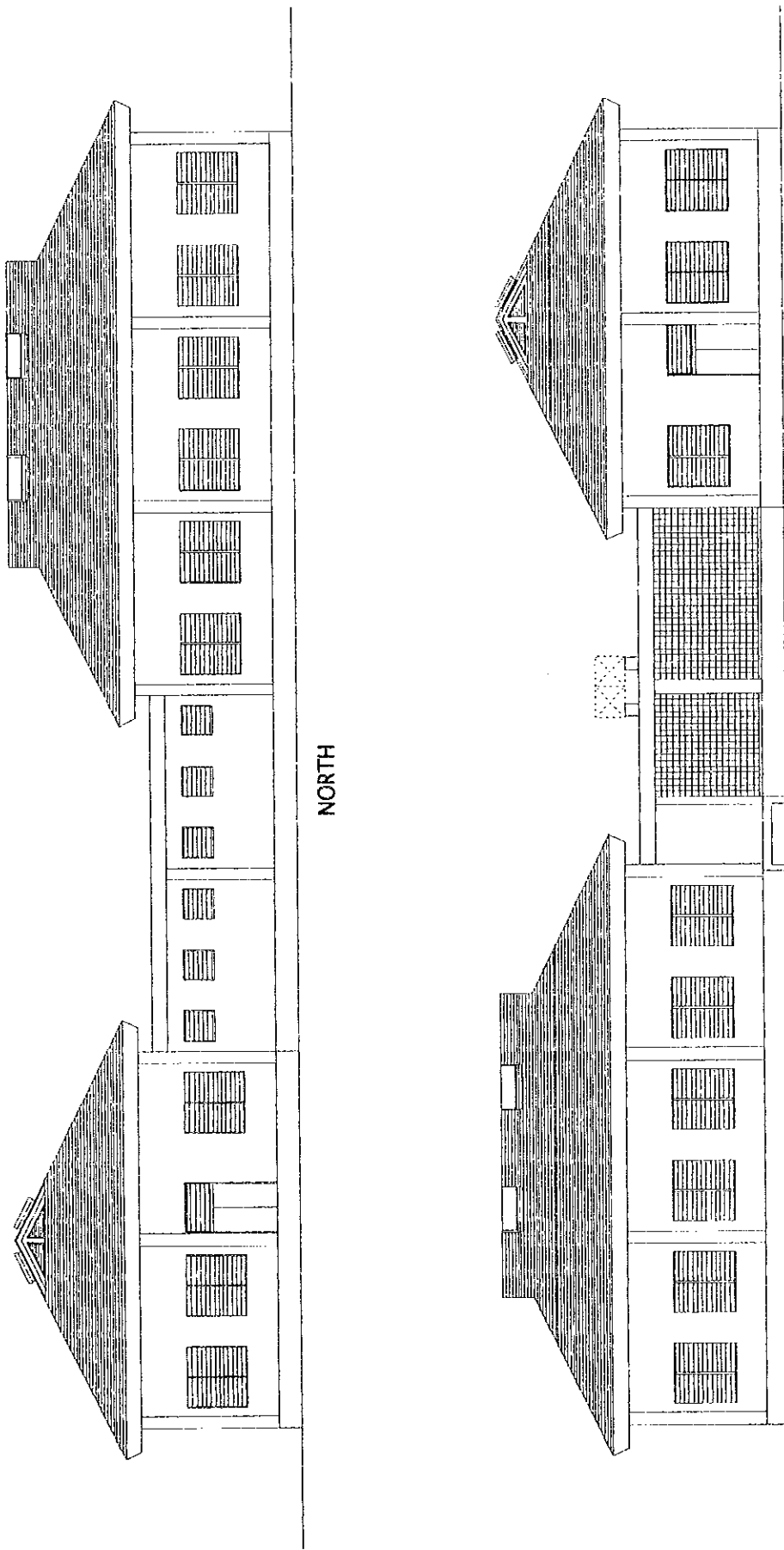
BLOCK-1

THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
TOILET & SHOWER BLOCK SECTION (PHASE 2)





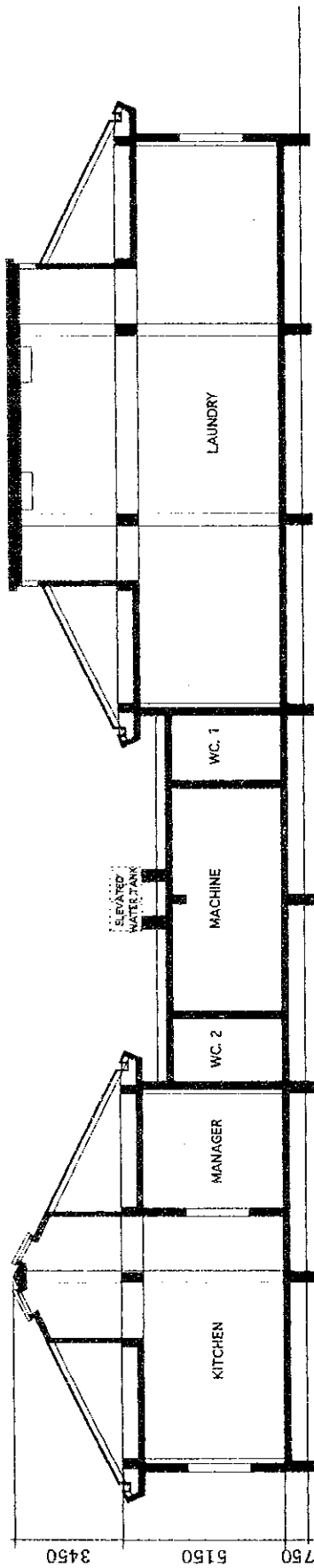
THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
 KITCHEN & LAUNDRY BLOCK GF PLAN (PHASE 2)



NORTH

SOUTH

THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
KITCHEN & LAUNDRY BLOCK ELEVATION (PHASE 2)



THE PROJECT FOR REHABILITATION OF BUILDINGS AND EQUIPMENT OF COAST PROVINCIAL GENERAL HOSPITAL  
 KITCHEN & LAUNDRY BLOCK SECTION (PHASE 2)