

**Basic Design Study Report
on
The Project for Improvement
of
The General Hospital Ratnapura
in
The Democratic Socialist Republic of Sri Lanka**

January 2000

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Japan International Cooperation Agency

Nihon Sekkei, Inc.

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PREFACE

In response to a request from the Government of the Democratic Socialist Republic of Sri Lanka the Government of Japan decided to conduct a basic design study on the Project for Improvement of the General Hospital Ratnapura and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team from March 15th to 26th and from April 22nd to May 12th, 1999.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, missions were sent to Sri Lanka in order to discuss a draft basic design from July 21st to August 7th, 1999, and to explain a draft final report from October 19th to November 5th, 1999, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the teams.

January 2000

Kimio Fujita
President
Japan International Cooperation Agency



115534011

January 2000

Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Improvement of the General Hospital Ratnapura in the Democratic Socialist Republic of Sri Lanka.

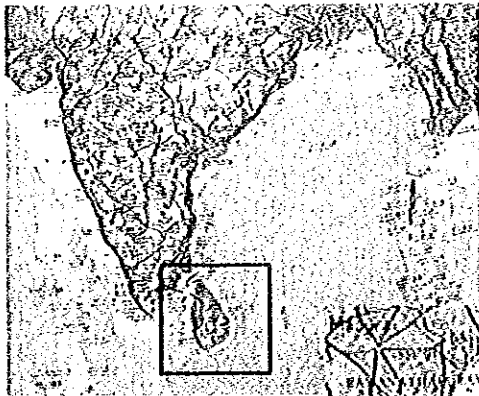
This study was conducted by Nihon Sekkei, Inc., under a contract to JICA, during the period from March 5th, 1999 to January 28th, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

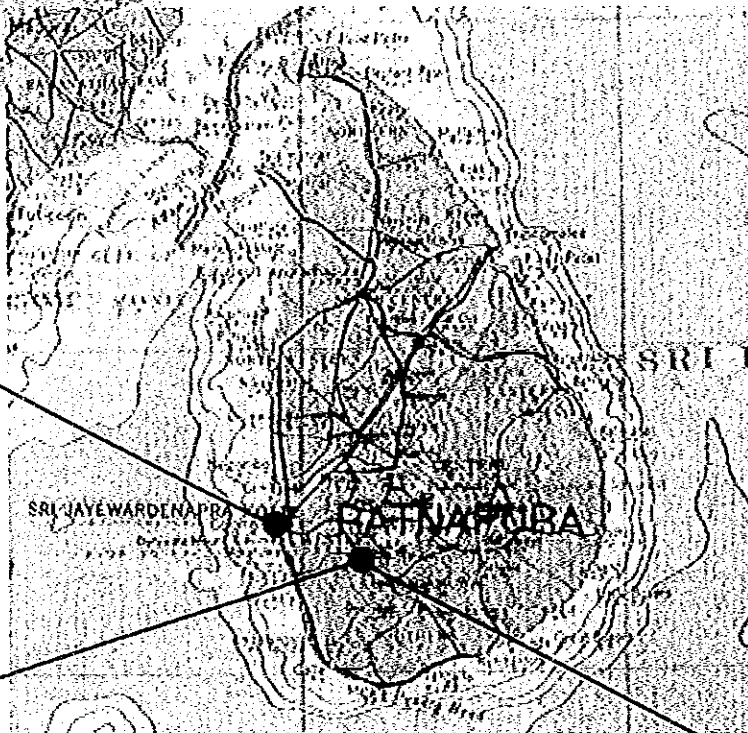
Masahiro Ikawa
Project manager,
Basic design study team on
The Project for Improvement of the General Hospital Ratnapura
Nihon Sekkei, Inc.

Location Map

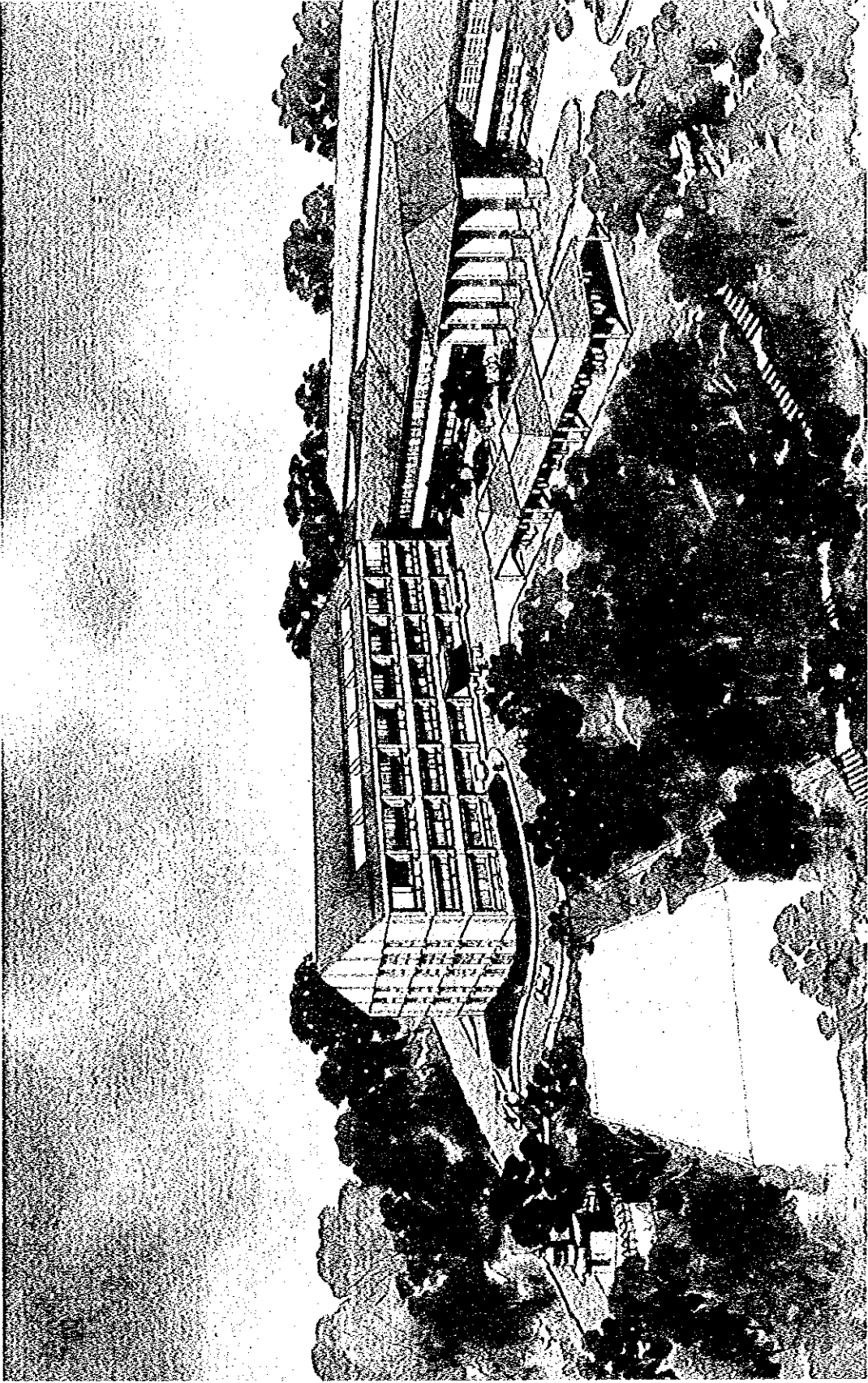


Colombo

$1/5,000,000$



$1/40,000$



Perspective drawing

ABBREVIATIONS

BES	Biomedical Engineering Services
BS	British Standard
CEB	Ceylon Electricity Board
CSSD	Central Supply and Sterilization Department
E/N	Exchange of Notes
ERD	External Resources Department
GHR	General Hospital Ratnapura
ICU	Intensive Care Unit
JIS	Japan Industrial Standard
MDF	Main Distribution Frame
MHD	Maternal High Dependency Room
MOF	Ministry of Finance and Planning
MOH	Ministry of Health & Indigenous Medicine
OPD	Outpatient Department
PBU	Premature Baby Unit

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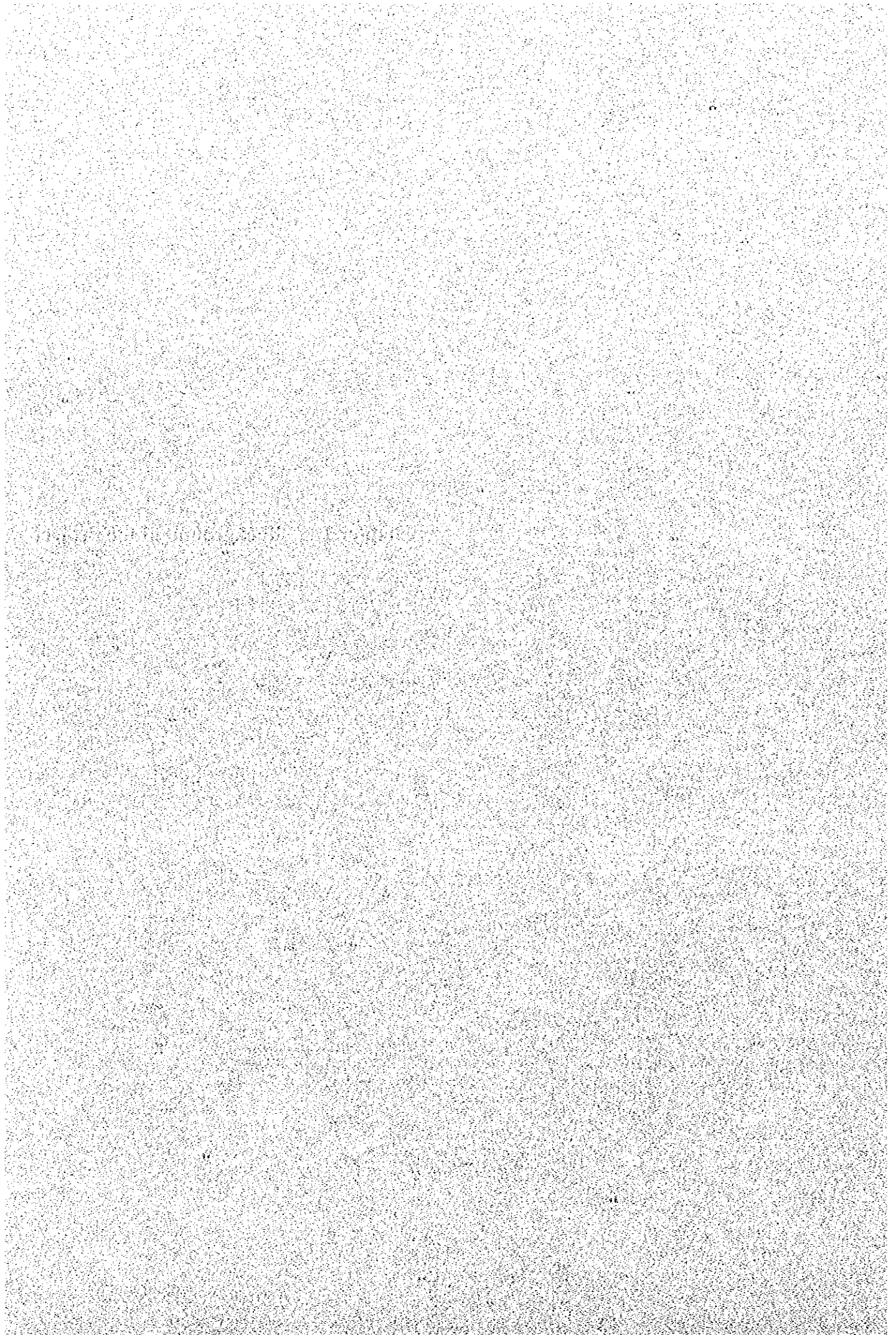
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Chapter 1. Background of the Project



CHAPTER 1 BACKGROUND OF THE PROJECT

The government of Sri Lanka has attached a high priority to medical and health care services to the people in its national development plan, or "Five-year Public Investment Plan" formulated in a rolling-plan fashion. The "Medical and Health Care Service Improvement Five Year Plan (1999 to 2000)" aims to redress the regional disparity in medical and health care service and reallocation of nation's resources in this field so that medical and health care services may reach all nationals without exception. Specifically, improvement of regional medical service centers is one of the highest priority policies of the government.

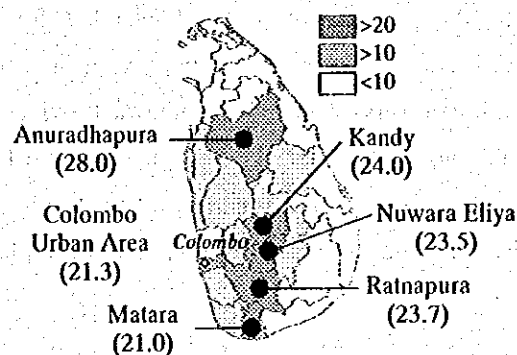
The government of Sri Lanka has promoted medical and health care services as a priority policy since independence. Consequently, the infant mortality rate, an indicator of medical and health care quality, is relatively low compared with many of its neighboring countries, as indicated in Table 1-1.

Table 1-1 Infant Mortality Rate in Southwest Asian Countries

Country	Infant Mortality Rate
Sri Lanka	17
India	71
Bangladesh	81
Pakistan	95
Nepal	104

As indicated in Figure 1-2, there is still tangible regional disparity in infant mortality rate in Sri Lanka. Ratnapura District where the subject hospital is located ranks the third worst among the 25 Districts of Sri Lanka, or 23.7 per 1,000 newborns against the national average of 17.

Figure 1-2 Infant Mortality Rate in Sri Lanka



Districts exhibiting infant mortality rates higher than Ratnapura District are Anuradhapura and Kandy Districts. Anuradhapura District is located close to the terror-stricken north and the hospitals there have to treat wounded soldiers. Kandy District is relatively well equipped with medical and health care facilities because of it being an old capital where a large number of sightseers visit. Against such a background, the government has decided to give priority to improving medical and health care facilities in the southern part which includes Ratnapura District.

The General Hospital Ratnapura (GHR), the hospital of this project, is the only general hospital in Sabaragamuwa Province which has a population of about 1.8 million. As of 1998 GHR had 911 beds and treated 266,435 general outpatients and 200,262 outpatients to clinics. GHR has undergone a number of expansions and additions to meet the local need for medical and health services during the past 47 years since its establishment in 1952 without a clear design concept. As a result, GHR has become quite inefficient with its functions disorderly laid out.

The Departments of Obstetrics & Gynecology and Internal Medicine are most seriously suffering from insufficient number of beds. In these departments one bed is being shared by two or more patients. Furthermore, patients are lying on the floor until they can be accommodated on the beds. Patients in the Departments of Dermatology and Maxilla Facial share the same ward, a situation feared to cause infection inside hospital.

The two operation rooms now in service and another two now in repair combined are not enough to meet the need for operations. GHR is obliged to execute two operations in the same room at the same time. There is no clear demarcation between the sterilized and non-sterilized areas. All these add up to increase the rate of infection after operation, estimated at higher than 50 percent.

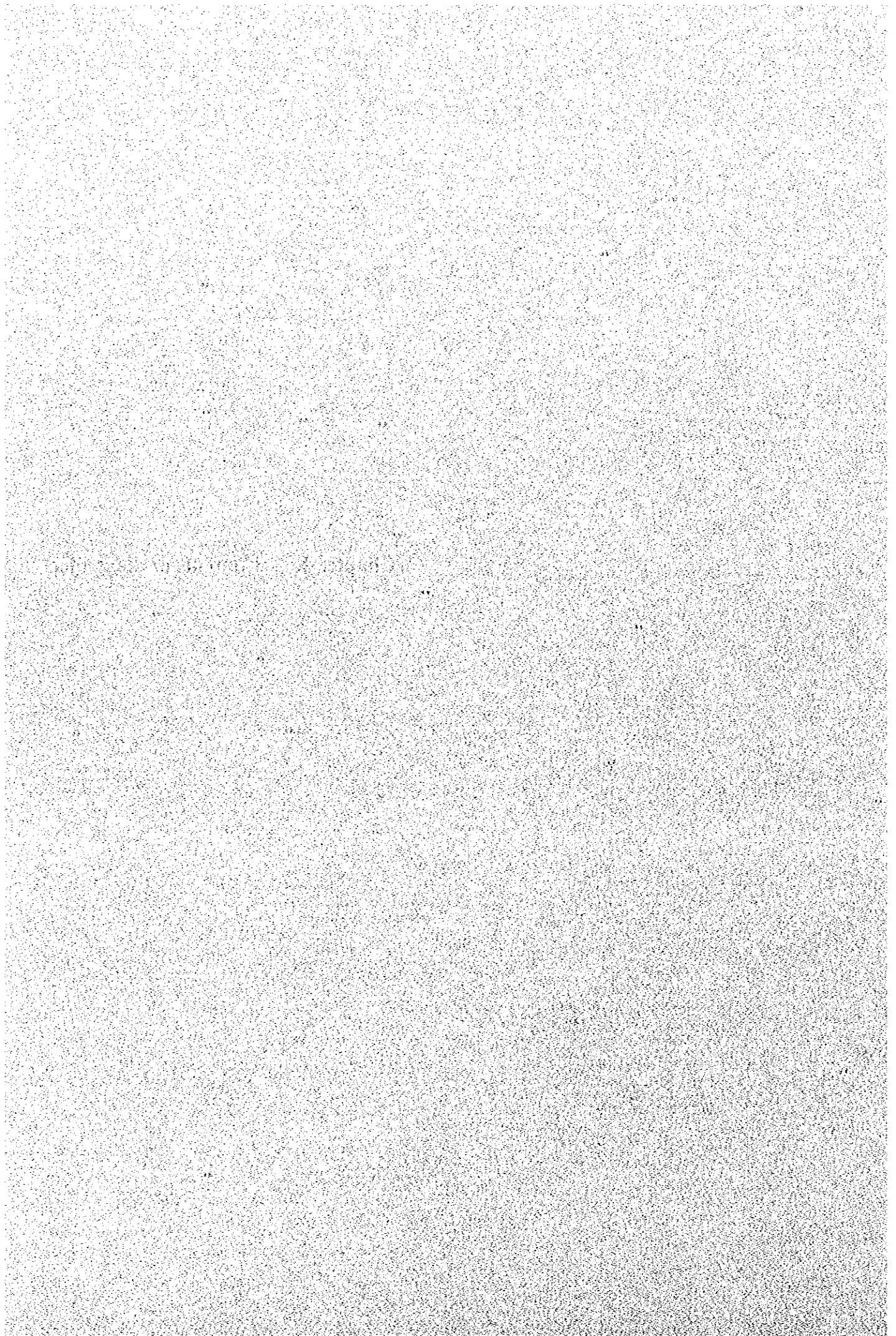
Under such a circumstance, the government of Sri Lanka has formulated "the Project for Improvement of GHR" with a view to restoring and improving the functions of GHR, thereby upgrading medical and health care service in Sabaragamuwa Province and improving regional medical and health care conditions. However, the government of Sri Lanka found it difficult to implement the project by itself because of the financial difficulty the government faced. The government of Sri Lanka therefore filed a request for grant aid for implementation of this project with the government of Japan.

This project is to improve the facilities and medical equipment of GHR. The contents (outline) of the request are as shown in Table 1-3.

Table 1-3 Contents of the Request (Outline)

Date of request	August 1998
Responsible organization	Ministry of Health & Indigenous Medicine (MOH)
Executing agency	Department of Health Services, MOH
Implementing agency	General Hospital Ratnapura (GHR)
Construction of facilities	Operation rooms, sterilization center, examination rooms for the Department of Obstetrics and Gynecology, radiographic examination rooms, premature baby rooms and others
Provision of equipment	Basic pieces of medical equipment needed for operation of the above facilities and replacement of existing obsolete equipment

Chapter 2. Contents of the Project



CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Objectives of the Project

The General Hospital Ratnapura (GHR), the implementation agency of the Project, is one of the five General Hospitals located in areas other than the Colombo Metropolitan Area and officially plays a role of the top referral institution in Sabaragamuwa Province. The Government of Sri Lanka promotes improvement of regional medical institutions such as GHR, as one of highest priority projects in its six-year Health Development Programme starting in 1999, to redress regional disparity in the level of medical service and also to smoothly implement reallocation of nation's health care and medical resources.

In this circumstances, the Ministry of Health & Indigenous Medicine (MOH) is carrying out its own plan for partial renovation of GHR's facilities and medical equipment that have become obsolete. Nevertheless, the facilities and equipment of the hospital are generally deteriorating. Besides, the number of patients is rapidly increasing. The improvement of the medical facilities by the Government falls short of meeting the added load by the increasing patients. As a result, the quality of medical services is significantly deteriorating. The present conditions of the hospital are such that the general waste water from the existing facilities of the hospital is discharged to the river without being adequately treated for disinfection.

The Project aims to upgrade the levels of health care and medical services and public hygiene in rural areas of Sabaragamuwa Province by recovering and further improving GHR's capability for medical service through improvement of its medical facilities and medical equipment.

2-2 Basic Concept of the Project

2-2-1 Policy of Cooperation

- (1) GHR is the only General Hospital in Sabaragamuwa Province and serves as the referral medical center of the Province. The Government attaches the highest priority in its national development plan to improvement of regional medical centers with a view to redressing the regional disparity in the quality of medical services offered to the people. In view of such a government policy, the Project will develop a plan which will enable GHR to offer its intended health care and medical services to the fullest extent.
- (2) In addition to the Request for the Project to the Government of Japan, the Government of Sri Lanka is implementing its own renovation project to improve the GHR's capability for medical services. Therefore, after GHR's functions, facility layouts and their own plan are carefully studied, a basic design of the Project will be developed.
- (3) The Project will preferentially improve obstetrics and gynecology functions of GHR, one of the departments with the highest bed occupancy rate, in view of the fact that the infant mortality rate in Sabaragamuwa Province is higher comparing with the other provinces. The Project also will incorporate improvement of the functions of the X-ray Department, Laboratory Department, Outpatient Department and Operation Department.
- (4) In order to rehabilitate and improve the total functions of GHR, the related functions should be located in same area. Therefore, the renovation of the existing building, including the relocation of the existing medical functions, should be incorporated into the Project.
- (5) Incorporation of the existing functions into the Project makes some vacant space in the existing facilities. The Project will propose a comprehensive plan for the future of entire GHR which includes effective utilization of the vacant space thus generated to alleviate the congestion of the existing facilities.
- (6) In deciding the floor area of the facilities and in selecting the medical equipment, the Project gives due consideration to the managing capability of GHR as indicated by the number of people engaged in medical service, level of medical technology, financial ability to cover costs, and ability to maintain facilities and equipment. In this way the Project proposes a

practical plan that should ensure independent and sustainable technical and financial development of GHR.

- (7) The Project is intended to support GHR's ability to maintain the level of GHR's medical services worth being a regional medical referral center, which takes care of 1.8 million people living in it's catchment area.
- (8) The actual situation of the medical buildings and medical equipment, such as Sri Jayawardenepura General Hospital, Faculty of Dental Sciences at University of Peradenia and School of Nurse at Sri Jayawardenepura, which were constructed and procured under the Japan's grant aid should be confirmed, and improvement points, if any, should be reflected in the Project.
- (9) The Project develops a plan which considers environmental impacts upon the hospital and the surrounding areas.

2-2-2 Study of the Request (Facilities)

GHR is the only General Hospital in Sabaragamuwa Province. However, the facilities of GHR have been considerably deteriorated since 47 years from construction. In spite of the self-help effort of the Government of Sri Lanka to renovate some facilities of the GHR, improvement of the facilities cannot adequately cope with the recent increase in the number of patients. Consequently, the functions of the entire hospital are on the decline. The field survey has identified the following major problems.

- a. Insufficient number of Operation Theatres,
- b. Insufficient numbers of Obstetrics and Gynecology Rooms and PBU,
- c. Insufficiency arising from decentralized function of CSSD,
- d. Insufficient number of consultation rooms for outpatients,
- e. Inadequate radiation shield of the X-ray Department,
- f. Insufficient floor area of the Laboratory Department and deterioration of the equipment, and
- g. Insufficient numbers of beds for patients to be accommodated, in the Departments of Obstetrics and Gynecology, Internal Medicine and Surgery in particular

The purpose of the request on the facilities lies in recovery and improvement of the functions of the hospital as a whole through resolution of the above problems. More specifically, the request aims at development of a plan for future improvement of the entire hospital, incorporating relocation of various decentralized functions of the hospital without significantly altering the present organization and manning, to improve efficiency of the medical services through the synergistic effect of the Project.

With GHR's future plan duly considered, each item of the request is studied below.

(1) Operation Department

Operation theatres for obstetrics and gynecology are requested.

GHR's Operation Department now has four operation theatres of which two are under repair. The repair work includes such an improvement as supply of medical gases by a central piping system. Two beds are placed in one of the two operation theatre now in use to supplement the functions of the operation theatre under repair. More than 50 percent of the patients reportedly suffer from infection after operation.

GHR conducted 14,372 operations in 1998 including minor operations, or 44 operations per day on average for the working 325 days. The operations related to obstetrics and gynecology amounted to as high as 12 cases per day, or 30 percent. Addition of operation theatres for obstetrics and gynecology in the Project is considered adequate, because this will relieve the congestion of entire operations.

The obstetrical and gynecological operations routinely conducted are mostly such simple ones as cesarean sections, tubal ligation and curettage of uterus which do not take long. One operation theatre can presumably conduct four operations a day; therefore, three operation rooms are needed.

(2) Delivery Room

The existing delivery rooms have a total of 18 delivery beds including those for labor. The delivery rooms occupy part of the obstetrics and gynecology wards and have too small an area for the number of inpatients. The delivery rooms are located apart from the Operation Department and therefore cannot quickly respond to emergencies requiring immediate operations.

Inclusion of delivery rooms in the Project would give some vacant of space to the existing obstetrics and gynecology wards. This could permit locating delivery rooms adjacent to the operation theatres to be newly constructed by the Project. Thus, the above problem will be resolved.

The annual average number of deliveries in the five-years period from 1994 to 1998 was 8,900, or 24 cases per day on average. Supposing that one delivery bed can support three deliveries a day, eight delivery beds are needed. Counting the existing beds for labor, addition of eight delivery beds would enable GHR to cope with the situation. For preventing nosocomial infection, an isolated delivery room for infected inpatients is indispensable.

(3) Maternal High Dependency Room (MHD)

About 10 percent of women delivering babies, or two to three deliveries a day, in GHR require intensive cares. About 20 percent of babies are born by cesarean section in GHR, a rate much higher than the normal rate of 10 percent. The request for MHD can be judged quite reasonable in view of the direct contribution this request could make to reduction of maternal mortality rate.

Assuming that one patient requires two days of intensive care on average, the number of beds required is six.

(4) Premature Baby Unit (PBU)

Annual average number of premature births totaled 1,800 during the five-year period from 1994 to 1998, accounting for about 20 percent of the total births. Premature birth occurs in GHR five times a day on average. GHR now holds 10 beds in a temporary room. The beds are so insufficient that GHR has to put two babies in one bed. Under such a circumstance, the request for PBU is justifiable in view of the direct contribution to reduce of Infant Mortality Rate.

Assuming that 10 percent of total births in GHR will be premature as are the case with average developing countries and that such babies require one week of intensive care, GHR will have 2.5 premature births a day and seven day's stay in PBU, requiring 17.5 beds. As it is also necessary to have isolated beds to guard babies against infection, the total requirements are 19 beds (15 beds in PBU, 4 isolated beds).

(5) X-ray Department

The number of X-ray examinations steadily increased during the five-year period from 1994 to 1998. In 1998 GHR conducted 52,389 X-ray examinations, or 210 examinations a day on average for 250 working days. Presently, GHR has three X-ray examination rooms. GHR has in operation two X-ray machine (one of them was installed in June 1999) and two mobile X-ray machine.

The existing X-ray examination rooms have not built-in radiation shields but use mobile radiation shields. GHR does not have a waiting lounge for X-ray examination. Therefore, patients and their families wait for their turns standing in the corridor, resulting in extreme congestion. Serious as it is, these people are exposed to radiation without being aware of it. The space of the existing facilities is not large enough to permit a modification effective enough to resolve the congestion and to provide sufficient radiation shield. Therefore, it is considered better to relocate the entire X-ray examination facility.

The Project plans to install three X-ray examination rooms, the number equal to that of the existing ones. One of them will be equipped with a X-ray machine to be procured by the Japanese side and two of them will be equipped with the existing machines. The transfer of these two X-ray machine from the existing rooms to the new rooms will be undertaken by the Sri Lank side.

(6) Laboratory Department

The existing Laboratory Department is located in the Administration Department of the hospital and is isolated from the medical services departments. Therefore, the movements of staff and patients interfere with other functions and are inconvenienced. The rooms are also small which lowers efficiency of work.

It is considered reasonable that the Laboratory Department is included in the Project instead of being renovated in the present place in order to secure an adequate working space and to resolve the conflicts of people's movements with other works.

(7) Central Supply and Sterilization Department (CSSD)

The existing autoclave room are located on the lower floor than the operation theatres and are isolated from people's movement. The sterilized linens and equipment are stored in a small room of the ward on the second floor. Thus, the functions of the CSSD are scattered and the entire work is made very inefficient. Although, three autoclaves are installed, only one is operable; the other two are too obsolete to be usable.

Renovation work of the existing facilities could not put together the decentralized functions. All these functions should be included in the Project and should be centralized. The DSSD will be located close to the new Operation Department for the sake of efficiency.

The existing autoclave rooms will be used exclusively for the adjacent Emergency Department.

(8) Patient's Wards

The average bed occupancy rate in GHR in 1998 was 110 percent; the obstetrics & gynecology wards and surgery & medical wards were especially crowded at 137 and 157 percent, respectively.

Incorporation of the existing delivery rooms, PBU, OPD and Laboratory into the Project will generate some vacant space in the existing facilities. GHR plans to install inpatients' wards in the excess space thus generated and reorganize and rationalize some of the functions of the existing hospital building, and will thus ameliorate the present congestion and improve their efficiency. Besides, GHR's own plan to build a new administration building is underway. Upon completion, once dispersed administrative functions will be centralized in this new building. GHR plans to effectively use the old administrative spaces as inpatients' wards.

The request includes establishment of a neurology department and maxilla facial department. A study on the allocation of wards indicates that some rooms to be vacated in the existing facilities could be converted into wards of these departments.

(9) Outpatient Department

The OPD sections are now separated into the ground floor and the first floor at the existing building. About 470,000 outpatients come every year, or at a rate of about 800 per day. Since GHR does not have enough space for them, outpatients have to wait in the corridor. GHR does not have enough consultation rooms; accordingly, the same consultation rooms have to be used by different medical departments at different time zones.

Ideally, operation theatres and delivery rooms should be placed on the same floor of the existing obstetrics wards to provide effective medical service. If this should be implemented, the existing OPD on the first floor would remain between the new operation theatres and the existing obstetrics wards. This would interfere with the intended effective coordination between the two functions.

To relieve the congestion of the OPD and to streamline the medical services of Obstetrics Department, it is necessary to include the OPD functions in the Project. Specifically, relocation of the existing OPD from the first floor to the ground floor could simultaneously achieve the above two objectives. Besides, this measure could concentrate majority of the OPD functions on the first floor which is easier to access for the outpatients, thereby relieving the problem of area shortage and improving the functions of the OPD.

(10) Pharmacy

With the relocation of the existing OPD functions, OPD will be more efficient by improving the functions and layouts of consultation rooms of OPD and pharmacy.

Presently, the pharmacy is used by approximately 1,550 prescriptions every day. Because of the spatial constraints the pharmacy has only three window which reduces the capacity of

the pharmacy. In addition, the waiting space is so limited that the patients have to wait standing in the corridor which, in turn, disturbs medical services of the adjacent Emergency Department. Relocation of the pharmacy to an appropriate place would help solve the congestion of traffic lines of people and materials.

2-2-3 Study of the Request (Equipment)

As a result of a review on the request the study team considers that the items on the list of request are generally acceptable as constituting a minimum requirement to maintain operation of GHR. The study team further analyzed the list in the light of the present medical service of GHR and its system for maintenance and management of medical equipment, and has come to think that some additions to and deletions from the list should be made. Generally, GHR's medical equipment has been used beyond usable life and has become obsolete; under such a circumstance, GHR is not necessarily up to the quality of medical services it should provide.

Explained below are the results of a study on the necessity and adequacy of the requested items from the standpoints of restoring the general functions of the hospital and improving the quality of medical service.

(1) Operation Department

Operation theatre table, Anaesthetic machine and Ventilator etc. are deteriorated badly and some of them can not be used. Operation theatres which is target for this project are four existing operation theatres (Two of them are under improvement construction now) and three operation theatres for obstetrics and gynecology. Since among requested equipment, 10 ECG monitor or 11 Pulse oximeters are imbalance compared with No. of operation theatre, in consideration to existing equipment such as Operating light as substitute, regarding requested equipment q'ty were adjusted properly.

(2) ICU

Regarding existing equipment, Syringe pump, which is necessary infusion of solution and Ventilator used for life-support of serious patients, is short and almost all the equipment are deteriorated. Among requested equipment, regarding 8 Adult ventilator and 10 ECG monitor, etc. q'ty were adjusted because judging from the present bed No., No. of equipment are included too much. Equipment which is replaced by other equipment, ex. Infusion pump and Syringe pump are requested, however, since the purpose for use is almost the same, existing Syringe pump is planned and Infusion pump were excluded from this plan. Blood gas analyser were excluded from this plan since it will be purchased on hospital side. Regarding request of consumables such as Nasal prong, they were excluded from this plan since hospital side has to attempt to purchase.

(3) Premature Baby Unit (PBU)

Although cot and incubator are deteriorated, since many of them are judged to continue to be used from now on, on the premise that existing equipment is used as many as possible, requested equipment were adjusted. Although Bed for adult and Ventilator for paediatric are included, they were excluded from this plan due to out of target in room for premature. Regarding Suction apparatus and Glucometer, although each 10 units are requested, since these are not used continuously for one patient, it was judged that 2 units is proper.

(4) Central Supply and Sterilization Department (CSSD)

Although one Autoclave is requested, from the present average operation No. per day (No. 44), in consideration to No. of operation instruments necessary for sterilization after operation at the three operation theatre, whose extended construction is planned, it was judged that two Autoclaves are proper. Sterilizer (table top type) were excluded from this plan since only Autoclave is judged to be enough,

(5) Laboratory Department

As clinical test, equipment for hematology test, biochemical test, histology test and bacteriology test are requested. Regarding the present situation of existing equipment, most of them are equipment such as microscope or mixer easy to operate and maintenance and whose cost is a little and they are good condition. The requested equipment such as Semi auto analyser, whose operation and maintenance cost is high, was excluded. Electrophoresis necessary for the dissection of red cell and Automatic stainer which is now out of order, and is used for tissue test, are requested on hospital side additionally. It was judged that they are necessary equipment for the test in this hospital. Since Flame photometer will be purchased on hospital side, it was judged to be excluded.

(6) X-ray Department

Regarding Fluoroscope, since the improvement of clinic function is expected by digestive tract double contrast barium enema and in obstructive jaundice external drainage, it was judged that the request is proper. Digital type of Fluoroscope is requested. Since only a few Fluoroscope have ever delivered in Sri Lanka and digitalization of X-ray machine is under development, it is judged to be premature. Regarding the rest 2 x-ray Room, it is judged that the two existing General X-ray machine are moved and transferred.

Although Movable X-ray machine (C-arm type) as inspection of abdominal surge and orthopedics are requested, Portable X-ray machine, which can be used on spot situation, was judged to be enough.

X-ray machine (for dental) was excluded from this plan since existing equipment whose condition is good was judged to be moved and transferred.

Ultrasound system is used for 40 patients per day. Since BES is considering 20 patients per day (use frequency), this use frequency is judged to be very high. In consideration to two radiologists simultaneously necessary for X-ray inspection, this necessity and propriety is judged to be high.

(7) Outpatient Department

By ten diagnosis sections such as surgical unit, medical unit and ENT unit , diagnosis and test equipment necessary for each section was requested.

Neurology section requested EMG machine and EEG machine. At present regarding EEG , the patients are transferred to Colombo city. But since the demand is high, on condition that expert doctors are trained, they are planned in this project.

Regarding three examination rooms among four rooms whose expansion are planned, Dental and oral surgery planned oral surgery unit is planned and the rest examination room, it was judged that existing equipment is moved and transferred.

On local survey, in accordance with the expansion plan of six High pregnancy women care units in obstetrics and gynecology section, Beds, ECG monitor and Defibrillator were included in this plan.

On local survey, due to arrival of new orthopedist in orthopedic unit , necessity of operation equipment for orthopedics is judged to be high and they were included in this plan.

(2) Results of the Study on Selection Standards

The necessity and adequacy of requested equipment were studied on the basis of the following selection standards. Table 2-1 shows the results of the study.

1) Equipment Indispensable to Basic Medical Services

These equipment falling into this category is considered necessary for basic medical service and should be of the specifications comparable to the corresponding existing equipment.

○: Equipment which should be replaced, supplemented or newly supplied

×: Equipment for which supply by the project is hardly justifiable for the following reasons:

- Its beneficial effect is low.
- It is procurable by the Sri Lanka side.
- The existing equipment corresponding to the requested equipment is still usable.
- Other equipment may be used for the intended purpose of the requested equipment.

2) Equipment Fit for the Technical Level of the Hospital

The equipment should be fit for the technical levels of the doctors, nurses and medical technicians going to use it.

○: Equipment which could be used by present technical level

△: Equipment which could be used by the present staff if the staff is given a proper training at the time of procurement

3) Equipment Maintainable by GHR and BES

The equipment should be maintainable by GHR and BES.

○: Equipment which could be maintained by the present operation and maintenance system and cost

(Annual operation and maintenance cost being 500 thousand yen or less)

△: Equipment which requires a slightly higher operation and maintenance cost but within the means of the Sri Lanka side, though it may demand more effort

(Annual operation and maintenance cost being from 500 thousand to 100 thousand yen)

×: Equipment which requires a high operation and maintenance cost, making a substantial budget increase necessary
(Annual operation and maintenance cost being more than 100 thousand yen)

4) Overall Assessment

The results of overall assessment are indicated in the following two classes.

○: Equipment of which procurement by the project is justifiable

×: Equipment of which procurement should be outside the scope of the project

Table 2-1 Result of The Examination of Requested Equipment

(13)

No.	Item	Req. Q'ty	Evaluation (1)	(2)	(3)	Overall Evaluat.	Plan Q'ty	Remark
1. Theatre								
1.	Twin Lamp	2	○	○	○	○	3	Planned 3 for new building theatre
2.	Mobile Theatre Lamp	8	○	○	○	○	4	One for existing theatre and three for new building theatre
3.	Anaesthetic Ventilator (power driven)	6	○	○	○	○	5	Two for existing theatre and three for new building theatre
4.	Anaesthetic Machine	3	○	○	×	○	4	One for existing theatre and three for new building theatre
5.	Compact Anaesthetic Machine with Ventilator	2	×	○	○	×	0	Compliant by the above Anaesthetic machine
6.	Operation Theatre Table	3	○	○	○	○	6	Three for existing theatre and three for new building theatre
7.	Suction Apparatus	7	○	○	○	○	6	Three for existing theatre and three for new building theatre
8.	Electro Surgical Unit	3	○	○	○	○	3	Three for new building Theatre
9.	Table Top Autoclave	1	○	○	○	○	1	One for preparation room of Theatre block
10.	Pulse Oximeter	11	○	○	○	○	7	Four for existing theatre and three for new building theatre
11.	Washing Machine & Dryer	2	○	○	○	○	2	Two for preparing room of Theatre block
12.	ECG Monitor	10	○	△	○	○	3	One for existing theatre and three for new building theatre
13.	Defibrillator	3	○	○	○	○	1	One for new building Theatre
14.	BP Apparatus (NIBP)	10	○	○	○	○	6	Three for existing theatre and three for new building theatre
15.	Capnometer (EtCO2 analyzer)	3	○	○	○	○	1	One for existing theatre
2. ICU								
1.	Adult ICU Bed	10	○	○	○	○	4	Four for existing ICU
2.	Paediatric Bed	8	×	○	○	×	0	The bed of this specification is deleted because adult bed is compliant for paediatric patients.
3.	Blood Gas Analyser	2	×	○	△	×	0	Deleted due to confirmation of purchase by BES
4.	Electrolyte Analyser	2	○	○	×	○	2	Two for existing ICU
5.	Suction Apparatus	12	○	○	○	○	8	Eight for existing ICU
6.	ECG Monitor	10	○	○	×	○	4	Four for existing ICU
7.	Direct Arterial BP Monitor	2	×	△	×	×	0	Deleted because NIBP is compliant and also consumables are expensive.
8.	Pulse Oximeter with Adult & Paediatric Sensor	11	○	○	○	○	5	Five for existing ICU
9.	Defibrillator with Adult & Paed. Paddle	2	○	○	○	○	1	One for existing ICU
10.	Nebulizer	4	○	○	○	○	4	Four for existing ICU
11.	Adult Ventilator	8	○	○	×	○	2	Two for existing ICU
12.	Paediatric Ventilator	3	×	○	○	×	0	Deleted because the target of this ICU is adult patients.
13.	Blood Pressure Apparatus (Electronic)	15	○	○	○	○	2	Two for existing ICU
14.	Capnometer (EtCO2)	4	○	○	○	○	1	One for existing ICU
15.	Patient Controlled Analgesia Pump (PCA pump)	5	○	○	○	○	2	Two for existing ICU
16.	Syringe Pump	13	○	○	○	○	7	Seven for existing ICU
17.	Infusion Pump	12	×	○	○	×	0	Deleted. Infusion pump is not urgent necessary because of the plan of syringe pump
18.	Portable Ventilator to Transport Patient	2	○	○	○	○	1	One for existing ICU
19.	Paediatric Resuscitation Cot	2	×	○	○	×	0	Deleted because the target of this ICU is adult patients.
20.	Refrigerator to Store Drug	2	×	○	○	×	0	Deleted because this can be purchased by local procurement
21.	Venti-Mask - 28%, 35%, 40%, 60%	1	×	○	○	×	0	Deleted because this can be purchased by local procurement
22.	PVO Face Mask for Administration for Oxygen	1	×	○	○	×	0	Deleted because this can be purchased by local procurement
23.	Nasal Prong	1	×	○	○	×	0	Deleted because this is consumables
3. PBU								
1.	ICU Bed	2	×	○	○	×	0	The type of this specification is deleted because the target is premature baby.
2.	Ventilator	2	×	○	○	×	0	The type of this specification is deleted because the target is premature baby.
3.	Infusion Pump	2	○	○	○	○	2	Two for existing renovating premature baby room
4.	Cardiac Monitor	2	○	○	○	○	2	Two for existing renovating premature baby room
5.	Paediatric Nebulizer	5	×	○	○	×	0	The type of this specification is deleted because the target is premature baby.
6.	Phototherapy Unit	1	○	○	○	○	1	Two machines are planned but because existing one is transferred, one is deleted.
7.	Paediatric Cot (Infant Bassinet Stand with Acrylic Cot)	20	○	○	○	○	5	In consideration with existing equipment and facility plan
8.	Neonatal Ventilator	1	○	○	○	○	1	One for existing renovating premature baby room
9.	Syringe Pump	2	○	○	○	○	2	Two for existing renovating premature baby room
10.	ECG Monitor	2	○	○	○	○	2	Two for existing renovating premature baby room
11.	Suction Apparatus	10	○	○	○	○	5	Five for existing renovating premature baby room
12.	Incubator	6	○	○	○	○	5	In consideration with existing equipment and facility plan
13.	Glucometer	10	○	○	○	○	2	Two for existing renovating premature baby room
4. CSSD								
1.	Autoclave Machine	1	○	○	○	○	2	Two for new building, because two autoclave are operated at present.
2.	Table Top Mini Autoclave Machine	1	×	○	○	×	0	Deleted because large autoclave is compliant
5. Laboratory								
1.	Semi Auto Analyser	2	×	○	△	×	0	At present there are a few specimens and operation and management cost is expensive. Deleted because existing manual type is compliant.
2.	Water Distilling Plant	1	○	○	○	○	1	One for new building laboratory because installation is necessary
3.	Centrifuge	4	○	○	○	○	4	Two for existing laboratory and two for new building room
4.	P.H. Meter	1	○	○	○	○	1	One for new building laboratory.
5.	Water Bath Adjustable with Thermostat	2	○	○	○	○	2	Because of deterioration existing equipment, in consideration to urgent necessity, two is planned for existing building
6.	Refrigerator	4	×	○	○	×	0	Deleted because this can be purchased by local procurement
7.	Hot Air Oven	4	×	○	○	×	0	Deleted because existing equipment is compliant
8.	Microscope	7	×	○	○	×	0	Deleted because existing equipment is compliant
9.	Micro Centrifuge Hematometer	2	○	○	○	○	2	Two for new building laboratory
10.	Microtome Compatible with Automatic Knife Sharpener Rotary Type	1	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
11.	Microtome Knife	1	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
12.	Honing Stone	1	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
13.	Flame Photometer	2	×	○	○	×	0	Deleted due to confirmation of purchase by BES
14.	Electronic Balance	1	×	○	○	×	0	Deleted because existing equipment is compliant
15.	Sterilizes (Boiling Water)	1	○	○	○	○	1	One for new building laboratory
16.	Rapid Weighing Balance	1	○	○	○	○	1	One for new building laboratory
17.	Mixer	1	○	○	○	○	1	In consideration to urgent necessity, one is planned for existing building
18.	Water bath	1	○	○	○	○	1	In consideration to urgent necessity, one is planned for existing building
19.	E.S.R. Rack	7	×	○	○	×	0	Deleted because this can be purchased by local procurement
20.	Automatic Stainer	0	○	○	○	○	1	Existing equipment are out of order
21.	Automatic Pipette (Large Capacity)	0	○	○	○	○	4	Judgement of highly necessity to improve accuracy of test reagent
22.	Automatic Pipette (Small Capacity)	0	○	○	○	○	2	Judgement of highly necessity to improve accuracy of test reagent
23.	Blood Sample Mixer	0	×	○	○	×	0	Can be handled by existing manual type
24.	Electronic Cell Counter	0	×	○	○	×	0	Can be handled by existing manual type
25.	Electrophoresis Machine	0	○	○	○	○	1	This is necessary in laboratory because type of red blood cell can be judged easily by standard electrophoresis apparatus
26.	Trophine Biopsy Needle (Bone Marrow Biopsy Needle)	0	○	○	○	○	2	Two for existing building in consideration to urgent necessity

No.	Item	Req. Qty	Evaluation			Overall Evaluat.	Plan Qty	Remark
			(1)	(2)	(3)			
6. Radiology								
1.	X-ray Fluoroscopic Machine	1	○	△	×	○	1	Only two screening machines have been supplied so far and this supply is premature.
2.	Portable X-ray Machine	2	○	○	○	○	1	One for new building X-ray room
3.	X-ray Machine for Dental	1	×	○	○	×	0	Although existing equipment is deteriorated, can be used.
4.	Automatic X-ray Processing Unit	1	○	○	○	○	1	Two were requested for three X-ray room but because the one in existing building is transferred, additional one is necessary.
5.	Cassettes and Intensifying Screen Size (Large)	12	○	○	○	○	6	Three for existing x-ray room and three for new building x-ray laboratory
6.	Cassettes and Intensifying Screen Size (Small)	12	○	○	○	○	6	Three for existing x-ray room and three for new building x-ray laboratory
7.	Spot Lamp	12	×	○	○	×	0	Deleted because this can be purchased by local procurement
8.	Illuminator (double)	6	○	○	○	○	3	Three because three x-ray rooms are planned
9.	Ultrasound System	1	○	○	○	○	1	In consideration to 40 patients diagnostic a day by 2 radio-therapists, one similar type is planned for existing building
7. Neurology								
1.	E.E.G Machine (electroencephalogram)	1	○	△	×	○	1	One for existing building in consideration to urgent necessity, because patients are transferred in Colombo hospital. Can be used by site training.
2.	EMG Machine	1	○	△	○	○	1	One for existing building in consideration to urgent necessity, because patients are transferred in Colombo hospital. Can be used by site training.
3.	Myelogram	1	×	△	○	×	0	Deleted because same function is included in E.E.G. machine
8. Maxillo Facial Unit								
1.	Integral Dental Unit	3	○	○	○	○	3	Four is planned for new building because one is transferred from existing building.
2.	Dental / ENT Drill	1	○	○	○	○	1	One for new building
3.	Lightcuring Halogen Machine	2	×	○	○	×	0	Deleted because this can be purchased by local procurement
4.	Cavitron	2	×	○	○	×	0	Deleted because manual type is compliant at present in consideration to existing water quality trouble.
9. ENT Unit								
1.	Pure Tone Audiometer	1	○	○	○	○	1	Versatile one for new building
2.	Impedance Meter	1	○	○	○	○	1	One for new building
3.	ENT Micro Electric Drill	1	×	○	○	×	0	Deleted because other equipment is compliant
4.	Speech Level Meter	1	×	○	○	×	0	Deleted because same function is included in audiometer
5.	ENT Examination Console Unit	3	○	○	○	○	3	Three for new building
6.	ENT Head Lamp with Fibber Optic Light Source	1	×	○	○	×	0	Deleted because this can be purchased by local procurement
7.	Fibre Optic Naso-Laryngoscope	2	○	○	○	○	1	One for existing building in consideration to urgent necessity
8.	Pulse Oximeter	1	×	○	○	×	0	Deleted because the measurement of pulse and SpO2 is judged to be unnecessary in this unit.
10. Eye Surgery								
1.	Indirect Binocular Ophthalmoscope	1	×	○	○	×	0	Deleted because other equipment has the same function
2.	Slit Lamp with Tonometer	2	○	○	○	○	2	One for existing building and one for new building. Building in consideration to medical activity of tonometer
3.	Visual Field Analyzer	1	○	○	○	○	1	One for existing building in consideration to urgent necessity
4.	Lenometer	1	○	○	○	○	1	One for existing building in consideration to urgent necessity
5.	Keratometer Microscope	1	×	○	○	×	0	Deleted because slit lamp has the same function
6.	Mobile Binocular Operating Microscope	1	○	○	○	○	1	One for theatre because fix type is used at present
11. Gynaecology & Obstetric								
1.	Laparoscope	1	○	○	○	○	1	One because this is used at existing theatre
2.	Cardiotocogramme	2	○	○	○	○	2	Two for existing building because of high risk delivery monitoring
3.	Vacuum Extractor	3	○	○	○	○	3	Three for existing building in consideration to urgent necessity
4.	Bed for High Dependency Ward	0	○	○	○	○	6	Added because urgent need of high risk pregnancy women care by local survey
5.	ECG Monitor	0	○	○	○	○	2	Added because urgent need of high risk pregnancy women care by local survey
6.	Pulse Oximeter	0	○	○	○	○	2	Added because urgent need of high risk pregnancy women care by local survey
7.	Defibrillator	0	○	○	○	○	1	Added because urgent need of high risk pregnancy women care by local survey
12. Psychiatry Unit								
1.	ECT Machine	1	×	○	○	×	0	Deleted because existing equipment is compliant
2.	Suction Apparatus	2	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
3.	Boyles Apparatus	1	×	○	○	×	0	Deleted because there is little use rate for patients
13. Surgical Unit								
1.	Bronchoscope (fibre optic)	1	○	○	○	○	1	One for new building
2.	Gastroscope (fibre optic)	1	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
3.	Sigmoidoscope	1	×	○	○	×	0	Deleted because colonoscope are compliant
4.	Colonoscope	1	○	○	○	○	1	One for existing building in consideration to urgent necessity
5.	Cysto-Urithroscope	1	○	○	○	○	1	One for existing building in consideration to urgent necessity
14. Medical Unit								
1.	Defibrillator	2	○	○	○	○	2	Two for existing building in consideration to urgent necessity
2.	Ventilator	2	×	○	○	×	0	Deleted because necessity is judged to be low because this is used in ICU
3.	Nebulizer	4	○	○	○	○	4	Four for existing building in consideration to urgent necessity
4.	Ophthalmoscope	4	○	○	○	○	4	Four for existing building in consideration to urgent necessity
5.	Liver & Pleural Biopsy Needle	20	×	○	○	×	0	Deleted because this can be purchased by local procurement
6.	Sphygmomanometer (Mercury portable)	20	○	○	○	○	5	Five for existing building in consideration to urgent necessity
7.	Glucometer	10	○	○	○	○	4	Four for existing building in consideration to urgent necessity
8.	Suction apparatus	10	○	○	○	○	4	Four for existing building in consideration to urgent necessity
15. Rheumatology and Rehabilitation Unit								
1.	Short Wave Therapy Unit	1	○	○	○	○	1	One for new building
2.	Infra Red Lamp	1	○	○	○	○	1	One for new building
3.	Ultrasound Therapy Unit	1	×	○	○	×	0	Deleted because short wave therapy unit and others are compliant
4.	Muscle Stimulator	1	○	○	○	○	1	Because of deterioration existing equipment, in consideration to urgent necessity, one is planned for existing building
5.	Traction Bed	1	×	○	○	×	0	Deleted due to confirmation of purchase by Sri Lanka
6.	Interferatist Therapy Machine	1	○	○	○	○	1	One for existing building in consideration to urgent necessity for rheumatism patients
7.	Quadricep Bench	1	×	○	○	×	0	Deleted because existing equipment is compliant

No.	Item	Req. Qty	Evaluation (1)	(2)	(3)	Overall Evaluat.	Plan Qty	Remark
16. Orthopaedic Unit								
1.	Basic Instrument Set LC-DCP,DCP	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
2.	Screw Set Stainless Steel 4.5 & 6.5mm	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
3.	Plate Set DCP (Stainless Steel)	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
4.	DHS,DCS Instrument Set	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
5.	Angled Blade Plate Instrument Set	0	x	0	0	x	0	Deleted because this is judged to be consumables
6.	Small Fragment Instrument Set DCP	0	x	0	0	x	0	Deleted because this is judged to be consumables
7.	Mini Instrument Set with Stainless Steel Implant	0	x	0	0	x	0	Deleted because this is judged to be consumables
8.	Instrument Set Large Cannulated Screw	0	x	0	0	x	0	Deleted because this is judged to be consumables
9.	Universal Intramedullary Nailing System Reaming	0	x	0	0	x	0	Deleted because this is judged to be consumables
10.	External Fixation Instrument	0	x	0	0	x	0	Deleted because this is judged to be consumables
11.	Bone Forceps Set	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
12.	Wire Instrument Set	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
13.	Universal Air Drill & Accessories	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
14.	Small Air Drill & Accessories	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
15.	Oscillating Bone Saw	0	0	0	0	0	1	Judged to be highly necessary because of arrival of orthopaedist in local survey
16.	Hemiarthroplasty Instrumentation Set	0	0	0	0	0	1	Judged to be highly necessary because of arrival of new orthopaedist in local survey
17. ECG Examination Unit								
1.	ECG	0	0	0	0	0	1	Judged to be highly necessary in local survey
18. Additional Equipment								
1.	Operation Theatre Table (Minor Operation)	0	0	0	0	0	2	Added because of necessity in consideration to conformity of domestic analysis and facility plan
2.	Examination Couch (Clinic, Treatment, OB&GY, Labo.)	0	0	0	0	0	50	Added because of necessity in consideration to conformity of domestic analysis and facility plan
3.	Delivery Table	0	0	0	0	0	2	Added because of necessity in consideration to conformity of domestic analysis and facility plan
4.	Gynaecology Examination Table	0	0	0	0	0	3	Added because of necessity in consideration to conformity of domestic analysis and facility plan
5.	Washing Machine & Dryer	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
6.	Film Loading & Unloading Table	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
7.	Film Illuminator(2 pcs.)	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
8.	Instrument Cabinet	0	0	0	0	0	3	Added because of necessity in consideration to conformity of domestic analysis and facility plan
5.	Washing Machine & Dryer	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
6.	Film Loading & Unloading Table	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
7.	Film Illuminator(2 pcs.)	0	0	0	0	0	41	Added because of necessity in consideration to conformity of domestic analysis and facility plan
8.	Instrument Cabinet	0	0	0	0	0	49	Added in this plan in consideration to the function of operation theatre.
9.	Operating Light(4 lamp)	0	0	0	0	0	23	Added in this plan in consideration to the function of operation theatre.
10.	Instrument Cabinet(for operation theater)	0	0	0	0	0	6	Added in this plan in consideration to the function of operation theatre.
11.	Film Illuminator(for operation theater)	0	0	0	0	0	6	Added in this plan in consideration to the function of operation theatre.
12.	Cooler Storage(for operation theater)	0	0	0	0	0	3	Added in this plan in consideration to the function of operation theatre.
13.	Warmer Storage(for operation theater)	0	0	0	0	0	3	Added in this plan in consideration to the function of operation theatre.
14.	Medicine Box	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
15.	Examination Light(wall mount)	0	0	0	0	0	46	Added because of necessity in consideration to conformity of domestic analysis and facility plan
16.	Desk	0	0	0	0	0	82	Added because of necessity in consideration to conformity of domestic analysis and facility plan
17.	Chair(for doctor)	0	0	0	0	0	82	Added because of necessity in consideration to conformity of domestic analysis and facility plan
18.	Chair	0	0	0	0	0	137	Added because of necessity in consideration to conformity of domestic analysis and facility plan
19.	Chair(for patient)	0	0	0	0	0	67	Added because of necessity in consideration to conformity of domestic analysis and facility plan
20.	Chair(for nurse, etc.)	0	0	0	0	0	33	Added because of necessity in consideration to conformity of domestic analysis and facility plan
21.	Working Table(for CSSD)	0	0	0	0	0	3	Added because of necessity in consideration to conformity of domestic analysis and facility plan
22.	Working Table(for bio medical)	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
23.	Meeting Table(Large)	0	0	0	0	0	9	Added because of necessity in consideration to conformity of domestic analysis and facility plan
24.	Meeting Table(Small)	0	0	0	0	0	2	Added because of necessity in consideration to conformity of domestic analysis and facility plan
25.	Instrument Cabinet(glass door)	0	0	0	0	0	8	Added because of necessity in consideration to conformity of domestic analysis and facility plan
26.	Instrument Cabinet(stainless steel)	0	0	0	0	0	5	Added because of necessity in consideration to conformity of domestic analysis and facility plan
27.	Table(for equipment)	0	0	0	0	0	1	Added because of necessity in consideration to conformity of domestic analysis and facility plan
28.	Bench	0	0	0	0	0	5	Added because of necessity in consideration to conformity of domestic analysis and facility plan
29.	Cabinet(steel door)	0	0	0	0	0	69	Added because of necessity in consideration to conformity of domestic analysis and facility plan
30.	Cabinet(glass door)	0	0	0	0	0	2	Added because of necessity in consideration to conformity of domestic analysis and facility plan
31.	Cabinet(for medicine)	0	0	0	0	0	15	Added because of necessity in consideration to conformity of domestic analysis and facility plan

2-3 Basic Design

2-3-1 Design Concept

The basic design considers natural conditions, environments and social conditions and establishes the basic policy as explained below.

(1) Policy concerning Natural Conditions

1) Winds

The wind velocity at Ratnapura is 0.9 meters per second on yearly average. Wind prevails from the direction between South Southwest and West Northwest (from January to March) and from the direction between North and Northwest (from April to December). GHR is located on the eastward slope of a hill 500 meters high above sea level; therefore, GHR is generally exposed to the north wind. The buildings of GHR are therefore designed to have as many openings as possible on the north and south sides to have good natural ventilation. In other words, the buildings are designed to stretch longitudinally in the east to west direction.

Sri Lanka is not usually hit by cyclones. However, the strong wind blows just before the squall.

2) Rain

The annual precipitation at Ratnapura is about 4,500 millimeters. From December to February, it rains very little at about 100 millimeters per month. In May and June average monthly precipitation is more than 600 millimeters. Because there is a record of daily precipitation of 144 millimeters in last five years, the catch basins and roadside gutters should be designed to have enough drainage capacities for such precipitation intensities.

Openings of buildings such as doors and windows should be designed to withstand the strong winds of squalls and to prevent rain from leaking into the buildings.

3) Humidity

As may be surmised from the precipitation in this area, humidity is very high at Ratnapura. The recorded lowest average daily humidity is 77 percent and the recorded

highest average daily humidity is 99 percent. During the rainy season humidity rises as high as 90 to 99 percent at night. Since wind stops at night it is very sultry and uncomfortable. Rooms should have roof fans on principle if they do not need air conditioning or forced mechanical ventilation because of their functions.

4) Sunlight

Ratnapura is located at latitude $6^{\circ} 40'$ North and its Sun's angle of elevation is high. The buildings are exposed to the strong sunlight from straight above. The design of buildings requires good insulation of the roofs and good ventilation through the spaces between the roofs and top ceilings. The buildings are laid out long in the east to west direction and therefore the effect of evening sunlight is not significant. However, the rooms are exposed to direct sunlight both from the north and the south during certain hours of given seasons. Therefore design of the buildings should consider the Sun's angles of elevation and should provide eaves of sufficient lengths to prevent the sunlight from entering the rooms. Louvers and other means of shielding the sunlight should be provided.

5) Thunderbolts

Thunder is common in this area throughout the year and causes damages. Lightning arresters should be provided as necessary.

6) Earthquakes

There has been no recorded great earthquake in Sri Lanka and therefore buildings are not legally required to withstand earthquakes. In 1992, an earthquake of the intensity 1 according to the Japanese system occurred. Therefore, the design of the new building incorporates some earthquake proofing capacity.

(2) Policy concerning Environments and Social Conditions

1) Waste Water Treatment

GHR now discharges untreated general waste water to a nearby channel through an open gutter. Because of insufficient gutter slope, there are points of stagnation of flow where offensive odors are generated. These points presumably provide nurseries for pathogenic bacteria and mosquitoes. Conversion of the gutter into an underground sewer and treatment of the general waste water are essential environmental considerations.

2) **Incinerator**

GHR's general solid wastes are collected by the city authority. GHR however burns open some medical wastes in its premises. Complete combustion of medical waste is a necessity to rule out possibility of infection. Installation of an incinerating facility is therefore an indispensable element of the Project.

3) **Preservation of the Existing Trees**

Mahoganies stand tall on and around the construction site. The Project has to cut down some of them. Hospital personnel and people in this area have cherished these trees; therefore, the Project will minimize the number of trees that will be cut down.

(3) **Policy concerning Construction**

1) **Site Conditions**

In addition to the construction site being a slope, there are sporadic soft filled places. In designing the foundations, ground conditions will be thoroughly examined and the obtained soil data will be fully analyzed to secure the safety of buildings.

2) **Effects on the Medical Services**

About 1,500 patients visit GHR every day. More than 3,000 people come to the hospital every day counting the hospital personnel and people accompanying the patients. The construction plan will secure safe and smooth access of people and vehicles to the hospital under the circumstances of the limited space in the GHR premises and also will minimize the effect, caused by noise, vibration, dust on the medical services of the hospital during the construction period.

3) **Design for Durability and Easy Maintenance**

In selecting the materials for finishing the building, the damages, tears and wears on the existing buildings will be studied. With the results of this study in mind, the materials which are durable, not expensive and locally available are preferentially chosen. This would facilitate and economize the maintenance works expected in the future.

4) **Design for Safety**

Hospitals are buildings of highly public nature; therefore, safety measures more effective than those of general buildings are required. The design naturally will

incorporate sufficient safety measures in the emergency escapes of stairways and corridor and also in fire-fighting facilities.

5) Design and Other Standards

The JIS will be adopted in addition to the BS generally adopted in Sri Lanka as the design and other standards. In specific cases standards to be selected will be discussed with the concerned parties of the Sri Lank side.