

**BASIC DESIGN STUDY REPORT  
ON  
THE PROJECT FOR  
IMPROVEMENT OF MEDICAL EQUIPMENT  
FOR SIR J.J. HOSPITAL AND  
CAMA & ALBLESS HOSPITAL  
IN INDIA**

**MAY 2003**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
BINKO LTD.**

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**03-132**

## PREFACE

In response to a request from the Government of India, the Government of Japan decided to conduct a basic design study on the project for Improvement of Medical Equipment for Sir J.J. Hospital and Cama & Albles Hospital in India and entrusted the study to the Japan International Cooperation Agency (JICA).

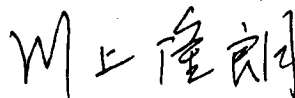
JICA sent to India a study team from January 20 to February 6, 2003.

The team held discussions with the officials concerned of the Government of India, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to India in order to discuss a draft basic design, 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 India for their close cooperation extended to the teams.

May, 2003



Takao Kawakami

President

Japan International Cooperation Agency

May, 2003

Letter of Transmittal

We are pleased to submit to you the basic design study report on the project for Improvement of Medical Equipment for Sir J.J. Hospital and Cama & Albles Hospital in India.

This study was conducted by Binko Ltd., under a contract to JICA, during the period from January to May, 2003. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of India 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,

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Shin-ichi KIMURA

Project manager,

Basic design study team on

The project for Improvement of

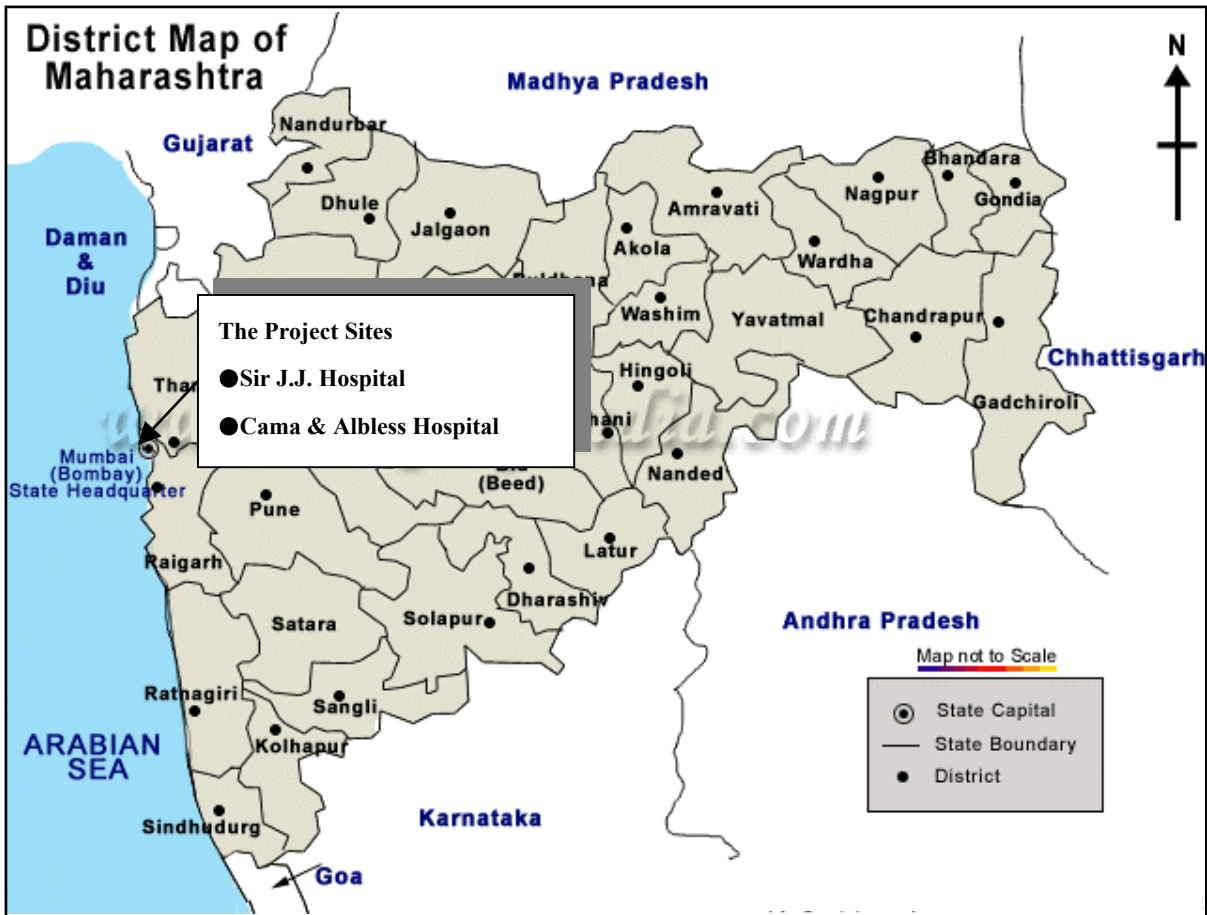
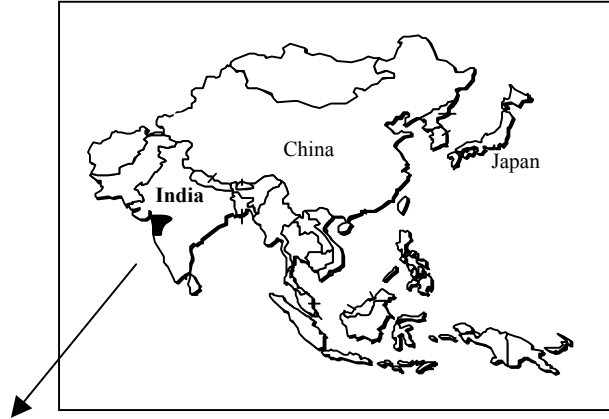
Medial Equipment for Sir J.J.

Hospital and Cama & Albles

Hospital in India

BINKO LTD.

# MAP OF PROJECT SITE



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## Abbreviation

A/P	Authorization to Pay
AVR	Auto Voltage Regulator
B/A	Banking Arrangement
CCU	Critical Care Unit
CT	Computer Tomography X-ray Unit
E/N	Exchange of Notes
GOI	The Government of India
ICU	Intensive Care Unit
IMR	Infant Mortality Rate
MCH	Maternal and Child Health
MMR	Maternal Mortality Rate
MRI	Magnetic Resonance Imaging
NGO	Non Governmental Organization
NICU	Neonatal Intensive Care Unit
OB/GY	Obstetric and Gynecology
PICU	Pediatric Intensive Care Unit
TFR	Total Fertility Rate
UPS	Uninterrupted Power Supply

## SUMMARY

The Government of India aims at redressing the regional disparity between the city areas and the rural areas, and systematically attends to the improvement of infrastructures and the budget increase for that purpose. In the health and medical field, the government has carried out various policies and programs, such as "the Family Welfare Program", with the aim of improving medical services in "the 7th 5-year National Plan" of the 1990s and thereafter. As a result of these efforts, the health indices have been improved considerably.

Due to lack of effective referral system among hospitals in Maharashtra where the project facilities are located, it causes a regional disparity in the health indices between Maharashtra and other states. While the infant mortality rate is 36/1,000 births in the city areas, such as Delhi, it is 49/1,000 births in Maharashtra. While the maternal mortality rate is 160/100,000 births in the city areas, it is 180/100,000 births in Maharashtra. Both of them are far from the following targets in the health indices to achieve by the year of 2010, which are mentioned in the national population policy of "the Family Welfare Program". The target in the infant mortality is 30 persons or less per 1,000 births, and the target in the maternal mortality is 100 persons or less per 100,000 births.

The medical hierarchy of Maharashtra is composed with District Hospitals, Community Health Centers and Health Sub-Centers, under the General Hospitals attached with Medical College where specialized and advanced medical services are provided. As aforesaid, the problem is a delay in infiltration of the maternal and child health services into women, who are the weak in society. Also, these facilities have not been able to provide sufficient Primary Health Care services due to lack of medical equipment by chronic financial stringency.

The Government of India elaborated "the 10th 5-year National Plan (2002-2007)". Along "the National Health Principles" of the above-mentioned national plan, the Government of Maharashtra has been striving for enforcement and reinforcement of "the Family Welfare Program" and "the Improvement Program of Medical Services in Hospitals", in order to provide the public health services equally to all the residents.

The targeted facilities (Sir J.J. Hospital and Cama and Albless Hospital) belong to Grant Medical College<sup>1</sup>. Sir J.J. Hospital is a General Hospital attached with Medical College, and which has specialized departments for Neurosurgery and pediatric surgery. This hospital has 1,352 sickbeds, 350 doctors and 531 nurses, and annually accepts about 690,000 outpatients and about 25,000 inpatients. Cama and Albless Hospital is a maternal and child hospital, and which has a specialized department for radiotherapy. This hospital has 560 sickbeds, 13 doctors and 189

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<sup>1</sup> Grant Medical College (GMC): There are 4 institutions, Sir J.J. Hospital, Cama and Albless Hospital, St. George Hospital and GT Hospital, belong to GMC. The professors and doctors are engaged in clinical services in these hospitals, while also teaching at GMC.

nurses, and annually accepts about 90,000 outpatients and about 10,000 inpatients.

These hospitals provide the primary and the secondary medical services as well as the tertiary medical services for the low income residents living in Mumbai and its environs and the patients from the rural areas and thereabout. Due to delay in improvement of the facilities and the medical equipment by financial difficulties, the quality of medical services has fallen at the both hospitals.

Under "the Improvement Plan of Medical Equipment and Facilities" that is a part of mainstay programs in the above-mentioned national plan, the Government of India is aiming at reduction in the infant mortality and the maternal mortality by the functional improvement of the maternal and child health services in the concerned region. And, the government made a request for a Grant Aid to Japan in 1997 so as to make renewal and supplementation of the medical equipment for Sir J.J. Hospital and Cama and Albless Hospital.

In response to the request, the Government of Japan decided to conduct a Basic Design Study, and Japan International Cooperation Agency (hereinafter "JICA") dispatched a study team to India in April 1998. Due to the nuclear test carried out by the Government of India during field survey, the Government of Japan invoked economic sanctions and the project was interrupted. Following lifting of economic sanctions to India in October 2001, the study was to resume. JICA dispatched a Basic Design Study team to India from January 20 to February 6, 2003. The team held discussions with the officials concerned of the Government of India and the Government of Maharashtra on the background and the contents of this project, and made resource acquisition in India. After the team returned to Japan, further study was made. A mission was sent to India from March 3 to March 10, 2003, in order to give an account of the Draft Basic Design Study Report. Subsequently, this Basic Design Study Report was finalized.

As a result of the field survey, it is admitted that implementation of this project is necessary and appropriate according to the following reason.

- (1) The project facilities are the public hospitals, which provide the tertiary medical services in Obstetrics, Gynecology, Pediatric Surgery and Neuro Surgery, in Maharashtra. Implementation of this project is effective to further the health programs of "the National Health Principles", and to provide the medical services of good quality to the poor mainly in the city areas.
- (2) The existing equipment of each project facility has largely exceeded the service life, and it causes remarkable stagnation of the medical activities. The planned equipment is which mainly facilitates the qualitative improvement of Primary Health Care services. The project facilities are the ultimate hospitals, which accept the serious patients in OB/GY, Pediatric Surgery and other speciality. Therefore, it is urgently required for these facilities to improve the medical equipment and to proceed with their functional recovery.



- (3) The equipment to be procured in this project is planned mainly aiming at renewal and supplementation of the existing equipment in the project facilities. After implementation of this project, the equipment can be sufficiently operated and maintained at the current technical level of the existing personnel in India.
- (4) Each project facility also performs as teaching hospital for the students of Grant Medical College. By improvement of the medical equipment, some indirect effects can be expected such as good quality clinical trainings.
- (5) The purpose of this project is to support "BHN (Basic Human Needs)", and it is in line with the policy of Japan's Grant Aid.

On the other hand, the following equipment is excluded from the procurement plan of this project as a result of field survey.

- (1) As for the equipment such as Hospital Bed, Ankle Exercise Sandal, and Catheter, it is judged that the Indian side can procure them through their own resources.
- (2) Automated Rapid Bacterial Growth Detection System is excluded from the procurement plan, because it requires considerable costs for its maintenance and the bacteriological examinations can be made by alternative means.
- (3) Ambulance is excluded from the procurement plan, because the first aid system has not been established, and because the patient's conveyance, as it stands, can be sufficiently covered with the existing vehicles.

As for the selection of the equipment to be procured in this project, the following principles were established.

- (1) Among the medical services provided in the project facilities, improvement shall be made for the equipment that submits to diagnosis and treatment for the women of reproductive age and the children under 5 years of age.
- (2) Since the project facilities are those providing the primary and the secondary medical services to the poor residents in the city areas, procurement is planned for the equipment that is indispensable for the basic medical services.
- (3) Procurement is planned for the equipment that is extremely in shortage, for the equipment that is indispensable for the basic medical services, and for the equipment that requires the urgent improvement, so that the project facilities can function as top-referral hospital.
- (4) In principle, procurement of the equipment is made for renewal or supplementation of the existing equipment. The following equipment is excluded from the procurement plan, i.e. ① the advanced medical equipment that requires acquisition of new operating and maintenance technique, ② the equipment that requires a new budget allocation for its operation and maintenance, and ③ the equipment that requires securing new personnel.

- (5) Considering the scale, the details of activity, the number of patients, and the disease tendencies for each project facility, the procurement plan should meet the current conditions of each project facility. Procurement is planned while considering appropriate specifications and an appropriate quantity of each item of equipment.
- (6) Considering the difficulty of acquiring foreign currency in India, equipment that can be procured in the local currency (the rupee) is selected.
- (7) Equipment requiring continuous technical support is procured from manufacturers with local agents for easy access to maintenance services and the supply of spare parts and consumables.

The equipment to be procured in this project is as follows.

Hospital Department	Equipment
Sir J.J. Hospital	
Pediatric	High Pressure Steam Sterilizer, Phototherapy Unit, Infant Ventilator
P/Surgery	Bedside Monitor, Operating Table, Anesthesia Apparatus
AIDS Unit	Central Monitor, Emergency Bed, Bronchofiberscope
Medicine Dept.	Apnea Monitor, ECG Unit, Emergency Cart
Biochemistry	Blood Gas Analyzer, Electrophoresis Apparatus, Spectrophotometer
Neuro Surgery	Defibrillator, Ventilator, Electrosurgical Unit
Phisiotherapy	Hydro Bubbler Bath, Parraffin Wax Bath, Infrared Ray Lamp
OB/GY	Pelvis Model, Instrument Cabinet, Operating Table
Pathology	Microscope, Histprocessor, Rotary Microtome
Ophthalmology	Indirect Ophthalmoscope, Slit Lamp, Refractometer
Orthopedic	Surgical X-ray C-arm TV System, Operating Table, Operating Light
Microbio	Biosafety Cabinet, Incubator, Medical Refrigerator
Radiology	Ultrasound Machine Color Doppler
Maintenance	Equipment for Maintenance Works (Osroscope, Multi-tester)
Cama & Albles Hospital	
Endoscope	Laparoscope Set (for diagnostics & operative), Cystofiberscope
ICU	ICU Bed
Laboratory	Blood Gas Analyzer, Medical Refrigerator, Spectrophotometer
Neonatal ICU	Oxygen Head Box, Neonatal Monitor, Syringe Pump
OB/GY	Examination Table for Gynecology (with examination unit), Doppler Fetus Detector, ECG Unit
OPD	Medicine Cabinet, Instrument Carriage, Portable Incubator
O.T.	Operating Table, Operating Light, Anesthesia Apparatus
Radiology	X-ray Unit with Image Intensifier, Mobile X-ray Unit, Automatic Film Processor
Ward	IV Stand

The observatory agency in charge of this project is the Ministry of Health and Family Welfare of the Government of India. The responsible agency is the Medical Education and Drugs Department, the Government of Maharashtra. The implementing bodies are Sir J.J. Hospital and Cama and Albless Hospital under the jurisdiction of the above department.

If this project is implemented using Japan's Grant Aid, the work period required for each task is 4.5 months for the implementation design and the tendering procedures, and 12.5 months for procurement of the equipment and the Soft Component. It is expected to take about 17 months in total.

The Maharashtra side bears the expense of workers conducting radiation-shielding work in the X-ray room and of installation of air conditioners in Cama and Albless Hospital, for the installation of air conditioners in the central clinical laboratory and the sonography room in Sir J.J. Hospital. This amounts to about 240,000 yen in total.

The annual maintenance cost newly required after implementation of this project shall be about 4.45 million yen. This sum includes expenditure for spare parts and consumables for the medical equipment to be procured in this project. It is only about 0.091% of the total budget of the Medical Education and Drugs Department, the Government of Maharashtra (the figures of Fiscal Year 2002). The maintenance cost in both project facilities is about 24.57 million yen (9.1 million rupees) in the current year. The Ministry of Health and Family Welfare of Maharashtra State has decided on a budget allocation of 121.5 million yen (45 million rupees) to Grant Medical College for Fiscal Year 2004 and thereafter. Over 45% of this budget is allotted to both the project facilities. Considering the annual inflation rate of 4% (2000~2001), the budget appropriation to both facilities shall be increased by 90% or more. The user charges introduced in 2002 enable the project facilities to procure consumables at their own expense.

Accordingly, it is possible for the Maharashtra side to defray the increments of the maintenance cost by procuring equipment in this project.

The following effects are expected through implementation of this project.

(1) Direct Effects

- 1) Improvement of equipment will contribute to enhancement of the medical service system, such as early diagnosis and early treatment, for the residents (about 13 million people) in Mumbai and its environs, where the residents have access to the project facilities.
- 2) In Sir J.J. Hospital that provides tertiary medical services in

Maharashtra, improvement will be made for medical equipment in maternal and child health and the equipment indispensable for the basic medical services, which are often obsolete and insufficient in quantity. Accordingly, the medical service system shall be improved. Good quality medical services will be provided annually to about 30,000 patients with serious health conditions including those with obstetric and gynecologic disease, and to about 1,000 premature babies.

- 3) In Cama and Albles Hospital, improvement will be made for medical equipment in maternal and child health that is in bad condition or too old for use. Accordingly, good quality medical services will be provided annually to about 100,000 patients in Obstetrics and Gynecology (the number of patients in the year of 2002), and to about 800 premature babies.

(2) Indirect Effects

- 1) The functional improvement of maternal and child health services will contribute to a reduction in the infant mortality rate<sup>2</sup> (IMR) and the maternal mortality rate<sup>3</sup> (MMR) in Mumbai and its environs.
- 2) Sir J.J. Hospital also functions as teaching hospital for Grant Medical College students. Improvement of medical equipment will contribute to the provision of effective clinical training to the medical students (about 550 students annually).

In order to make this project more effective, it is important to improve and secure the following points.

- (1) This project is designed to supply medical equipment that is now deficient, and to support improvement of the health and medical situation in Maharashtra from the equipment (hardware) side. It is also essential that the Indian side presses forward with improvement of the service (software) side, such as ① qualitative improvement of medical services by establishing a periodic retraining system for medical personnel, and ② promotion of the residents' understanding of health and medical care, and establishment of a medical system that enables lower charges for medical care through early diagnosis and early treatment.

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<sup>2</sup> Annual maternal mortality rate (MMR):

$$\frac{\text{The annual number of deaths caused by pregnancy/delivery in a specific population}}{\text{The number of women of reproductive age in the same year and in the same population}} \times 100,000$$

<sup>3</sup> Annual infant mortality rate (IMR):

$$\frac{\text{The annual number of deaths of infants under the age of one in a specific population}}{\text{The annual number of births in the same population}} \times 1,000$$

- (2) It is essential to elaborate the equipment control plan for the all the equipment of the project facilities, and that the biomedical engineers operate and maintain the medical equipment in order to execute the maintenance management plan that reflects the budget for maintenance costs.

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(Basic Design Study, Explanation of Draft Report)
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## Chapter 1. Background of the Project

# Chapter 1 Background of the Project

## 1-1 Background of the Request

A general hospital and a maternal and child hospital, which are ranked high in the maternal and child health system of Maharashtra, provide the primary, secondary and tertiary medical services. The existing equipment is too old to provide effective tertiary medical services. Therefore, even low-income earners have to go to private hospital for medical care where patients have to bear expensive medical costs. The Government of Maharashtra aims for the "improvement of the maternal and child health services" that is the main object in "The Family Welfare Program" as a national health policy. The government has elaborated an improvement plan for Sir J.J. Hospital and Cama and Albles Hospital, where tertiary medical services are provided for maternal and child health in Mumbai, the capital of Maharashtra, and made a request for a Grant Aid of Japan.

## 1-2 Outline of the Request

The request was made to improve medical equipment for a general hospital and a maternal and child hospital in Mumbai. The main requested equipment from each project facility is as follows.

<b>A Sir J.J. Hospital</b>	
Non-Invasive B.P. Monitor	Flame Photometer
High-Pressure Steam Sterilizer	Semi Auto Analyzer
Infant Ventilator	Micro-Neurosurgery Operating Table
Mobile X-ray Unit	Hydro Bubbler
PH/ Blood Gas Analyzer	Ultrasound Colour Doppler System
Bio-chemical Analyzer	Mammographic X-ray System
Bedside Monitor	Operating Microscope
Operating Table (Pediatric)	Defibrillator
Anesthesia Machine	Operating Light
Ped. Colonofiberscope Set	Surgical X-ray TV System
Percutaneous Nephroscope Set	Automated Rapid Bacterial Growth Detection System
Infant Warmer	Mortuary Cabinet (4 Bodies)
Central Monitor	Ambulance
<b>B Cama &amp; Albles Hospital</b>	
Examining Table for Gynecology	Cystofiberscope
Delivery Table	Anesthesia Apparatus
Ultrasound Color Doppler System	Blood Gas Analyzer
Laparoscope Set	X-ray Unit with Image Intensifiers
Examination Couch	Mobile X-ray Unit
Gastrointestinal Fiberscope	Defibrillator (Pediatric)
Colono Fiberscope	Bio-chemical Analyzer



## Chapter 2. Contents of the Project

## Chapter 2 Contents of the Project

### 2-1 Basic Concept of the Project

#### (1) Superordinate aims and project aims

The Ministry of Health and Family Welfare, the Government of Maharashtra, aims at improvement of the level of health indices in maternal and child health, such as reduction in the infant mortality rate, the maternal mortality rate and improvement of the total fertility rate, by enforcement of "The National Health Principles and Population Policy" in "the 10th 5-year National Plan (2002~2007)." The situation has been improving for infant mortality and the maternal mortality, but not enough to reach the target figures due to a chronic shortage of medical equipment caused by financial stringency.

The equipment of the project facilities is in an exhausted condition and its function is remarkably low. This interrupts daily medical activities. This results in a number of problems, such as patients having to wait too long for medical care, and not receiving appropriate diagnoses or sufficient treatment. Public medical institutions provide medical services to poor residents without charge, and they are essential to these residents. This free treatment places stress on hospital finances, causing a functional decline in medical services at the targeted facilities.

In order to solve this situation, the Government of Maharashtra has been promoting an improvement plan of the medical facilities through improvement of medical equipment (this project). This project aims at the qualitative and quantitative improvement of medical services in maternal and child health, especially for newborn babies and pregnant women in Mumbai, as well as of essential medical services.

#### (2) Outline of the project

In order to achieve the above-mentioned superordinate aims, the Government of Maharashtra is promoting the following plans for public medical institutions (district hospitals, community health centers, etc.) in Mumbai where the functional decline is remarkable, i.e. through ① establishment and renovation of public medical institutions, ② improvement of medical equipment, and ③ budget increase for operating expenses. Of these plans, this project undertakes improvement of the medical equipment for Sir J.J. Hospital and Cama and Albless Hospital, which are categorized as tertiary medical facilities in maternal and child health in Mumbai, the capital of Maharashtra.

Implementation of this project facilitates ① the reinforcement of medical services in maternal and child health and basic medical services beneficial to poor residents, and ② recovery of medical function. Accordingly, it shall improve the

lifesaving rate and the cure rate of the residents in Mumbai and its environs, especially of newborn babies/infants/pregnant women.

## **2-2 Basic Design of the Requested Japanese Assistance**

### 2-2-1 Design Policy

#### (1) Basic Policy

In this project, procurement shall be made for equipment useful in improving the medical function for maternal and child health, and of the equipment necessary to maintain the basic medical activities of the hospitals. The purview of cooperation of each project facility is summarized as follows.

1. Of the medical services that the project facilities provide, improvement shall be made of the equipment used for diagnosis and treatment of women of reproductive age and children under 5 years of age.
2. Since the project facilities also provide primary and secondary medical services to poor residents, procurement is planned for the equipment essential for basic medical services.
3. Procurement is planned for equipment that is in extreme shortage, for equipment that is essential for basic medical services, and for the equipment that requires urgent improvement, so that the project facilities can function as top-referral hospitals in Maharashtra.
4. In principle, procurement of the equipment is made as renewal or supplementation of the existing equipment. The following equipment is excluded from the procurement plan: ①advanced medical equipment that requires acquisition of new operating and maintenance techniques, ②equipment that requires a new budget allocation for operation and maintenance, and ③equipment that requires securing new personnel.
5. Considering the scale, the details of activity, the number of patients, and the disease tendencies of each project facility, the procurement plan should meet the current conditions of each project facility. Procurement is planned while considering appropriate specifications and an appropriate quantity of each item of equipment.
6. Considering the difficulty in acquiring foreign currency in India, equipment whose consumables can be procured in rupees is selected.
7. For equipment requiring continuous technical support, procurement is made for equipment whose manufacturer has a local agent in India to easily receive maintenance services and obtain spare parts and consumables.

(2) Policy for selection of equipment

[Policy on demand]

1. Procurement shall be made for equipment that is essential for basic medical services, and for equipment that requires urgent improvement, so that the project facilities can function as tertiary medical facilities in Maharashtra.
2. The equipment shall be beneficial to poor residents who account for more than half of the region's residents.
3. The equipment shall be used for the diagnosis and treatment of diseases, and shall not be used for research.
4. The procurement of the equipment shall be made as a renewal or supplementation of the existing equipment that is too old for practical use.
5. The equipment is essential for the medical care of serious cases.

[Policy on technical aspects]

1. The planned equipment shall not require any training of special medical technicians, and can be operated and maintained at the current technical level of the existing personnel.

[Policy on financial analysis]

1. The operational costs after procurement of the planned equipment shall be comparatively low so that each project facility can maintain them financially.
2. The scale of the project shall be kept within the scope in which each project facility can operate and maintain the planned equipment on the current equipment operational budget. If the operational costs of the planned equipment are deemed to drastically exceed the budget as a result of financial analysis (considering the economic growth rate, the price increase rate, the rate of budgetary increase, etc.), the equipment plan shall be cut back to within the range that the Maharashtra side can bear.
3. The scale of the project shall be kept within the scope in which each project facility can perform their duties within their administrative capacity, and their financial and technical sustainability is secured. (If the equipment requires large sums to purchase consumables, or the continuous purchase of consumables from a specific manufacturer is required, this equipment is excluded from the procurement plan.)

[Policy on infrastructure and natural conditions]

1. The planned equipment shall be sufficiently resistant to the hot, humid climate of Mumbai.

2. The distribution of air conditioners and dehumidifiers is requested of the Maharashtra side for equipment that is not proof against these climatic conditions, such as X-ray units, ultrasound machines, and automatic biochemical analyzers.
3. The procurement of an uninterruptible power supply (hereinafter "UPS") shall be planned for equipment that requires a continuous, stable power supply in service, such as blood cell counters and automatic biochemical analyzers. UPS enables the use of this equipment even during a power failure or power drop. Accordingly, the electric circuits of the equipment can be protected from sharp power fluctuation.
4. For electromedical apparatus such as ventilators and bedside monitors, the distribution of the auto-voltage regulators (AVR) workable within voltage fluctuations of  $\pm 15\%$ , or high-voltage, high-current breakers, shall be planned.
5. In order to avoid the influence of water quality on the equipment, consideration shall be given to attaching a water softener to the equipment, depending on the hardness of supplied water.

(3) Introducing the principles of the Soft Component

While this project is implemented, technical support shall be also provided by the Soft Component aiming at establishment of a maintenance system for the equipment. The Soft Component consists of ① examination and analysis of the maintenance system at each project facility, ② guidance on routine maintenance works and establishment of an on-call maintenance system in case of machine problems, and ③ introduction of a centralized control system of the equipment using a computer. In this project, technical experts are to be dispatched. They give operational support for the computerization of the equipment control system, and provide courses and practical training in maintenance. The contents of the Soft Component plan are described in "2-5 Soft Component" of Chapter 2.

(4) Design policy on operation and maintenance

1. For medical equipment that is relatively expensive such as X-ray units, automatic biochemical analyzers and central monitors, procurement shall be made for equipment that can be sufficiently covered by the maintenance capability currently available from the local agents of equipment manufacturers in India. Considering the difficulty in acquiring foreign currency in India, selection shall be made for equipment whose consumables can be procured in rupees.
2. For relatively expensive medical equipment, procurement shall be made on the premise that each project facility enters into a maintenance contract with the local agent of each equipment manufacturer. The Ministry of Health and

Family Welfare, the Government of Maharashtra, is required to secure the budget for these expenses.

3. On delivery and installation of the equipment, guidance shall be given on equipment operation and daily maintenance to those in charge of its handling at each project site, and to the engineers of HERM (Hospital Equipment Repair & Maintenance). For major equipment such as X-ray units, automatic biochemical analyzers, central monitors, and high-pressure steam sterilizers, guidance shall be given on equipment operation and daily maintenance by a responsible engineer certified by the equipment manufacturer or the local agent.
  4. The indications on the front panel (control panel) of the equipment and the instruction manuals shall be presented in English. Short operating procedures should be supplied in English especially for equipment whose accurate indications are necessary for operation, such as X-ray units, high-pressure steam sterilizers, and ultrasound machines. The operating procedures should be preserved in a case and attached to the equipment.
- (5) Policy for procuring method and work period
1. On condition that this project is implemented with a single annual budget, the work period for the project shall be within 17.0 months after conclusion of the Exchange of Notes (E/N).
  2. For the planned equipment that requires the purchase of consumables for its operation, the minimum quantity of consumables (it takes 3~6 months from order to delivery) shall be supplied.
  3. Procurement of equipment from a third country (Europe, USA, or other countries) may be considered after due deliberation if the medical technicians in the region are familiar with operation of the equipment, if maintenance services by a local agent are secured, if the competing principle is expected, and if the equipment has penetrated the local market.
  4. For equipment that does not require any special techniques for operation and maintenance, procurement of locally manufactured products may be considered in view of the cost effectiveness of the procurement (ocean freight and packing costs).

## 2-2-2 Basic Plan

### (1) Overall plan

#### 1) Examination of the requested equipment

The requested equipment was examined according to the above-mentioned basic policies, considering the activities of each department and the condition of each existing item of equipment. The following is the process to determine the procuring quantity, the equipment items, and the allocation of the main equipment.

#### ● Sir J.J. Hospital

The request for procurement was made from the thirteen (13) departments of this hospital of equipment for Pediatrics, Pediatric Surgery, Medicine Dept., Medicine Dept. (AIDS), Biochemistry, Neurosurgery, Physiotherapy, Obstetrics and Gynecology, Pathology, Ophthalmology, Orthopedics, Microbiology, and Administrative Services.

#### 1. Pediatrics

Pediatrics has 120 beds (30 beds × 4 units), PICU (15 beds) and NICU (20 beds in addition to the delivery rooms in the Obstetric and Gynecologic ward). The aging degradation of the existing equipment of this department including patient beds is remarkable. Due to the insufficiency of existing equipment in PICU, immediate procurement is required. In this project, procurement shall be made mainly for equipment in a deteriorated condition in the Pediatric Ward, PICU, and NICU.

PICU and NICU have 3 infant warmers altogether. One of them in NICU frequently has problems due to aging degradation, and the other 2 in PICU are unavailable. Since it seems necessary to distribute an infant warmer to every 4 beds, procurement of 6 units shall be made for PICU and NICU to supplement the 3 existing units and of the 3 units in bad condition shall be renewed.

The existing mobile X-ray unit is too old for use and often has problems, and its function is remarkably low. It is necessary to renew this equipment. While a request has been made for procurement of 1 unit each to the Pediatric Department and the Pediatric Surgery Department, these departments are located in the same building, and relatively few patients require X-ray diagnosis. Accordingly, procurement of 1 unit is planned for common use between both departments.

#### 2. Pediatric Surgery

This is the only department of Pediatric Surgery in the State of Maharashtra for infants from neonate to 15 years old. The department has 1 Unit (30 beds), a main operating theater, a secondary operating theater, a treatment room,

a recovery room, and NICU (5 beds). Between 900 and 1,000 operations are performed annually, mostly for serious diseases. Most of the existing equipment is too old for use, and immediate procurement is required.

A request was made for procurement of 9 bedside monitors, considering the capacity of the main operating theater, the secondary operating theater, the recovery room, and NICU. Considering the average number of operations, procurement is planned for 3 units for NICU, 2 units for the operating theaters, 1 unit for the treatment room, and 1 unit for the recovery room, namely 7 units in total.

The existing anesthesia machines have been used for more than 15 years since procurement, and they are no longer serviceable due to the discontinuance of the production of spare parts. Accordingly, the renewal of the existing 2 units is planned for the main operating theater and the secondary operating theater.

The existing patient beds in the Pediatric Ward are obsolete, and their renewal is necessary. Considering cost and procurement, availability on the domestic market, it is deemed that the procurement can be made through the resources of the Indian side. Therefore, this equipment is excluded from the procurement plan of this project.

### 3. AIDS Unit (in the Medicine Department)

This unit has 15 beds, and accepts last-stage patients of tuberculosis accompanying AIDS for palliative care. Almost no equipment except a pulse oximeter is provided, and therefore, this unit borrows equipment from the other departments if necessary.

A request has been made for procurement of a bedside monitor for every bed; however, patients with serious cases comprise only 1/3 of all the patients. Accordingly, procurement is planned for 4 units.

A request was made for procurement of a central monitor. This unit has many patients who are in a serious condition. The nurses currently make walk-around checks of these patients at their own discretion, but sometimes the nurses cannot meet sudden changes in the condition of the patients. In addition, there are many patients suffering from tuberculosis. It is essential to set up a system that enables the nurses to safely monitor the condition of the patients. Procurement is planned for 1 unit of this equipment, so that it is connected with the above-mentioned bedside monitors and enables the centralized control of the bio-information of each patient.

### 4. Medicine Department Wards

These wards have 6 units in each ward for male and female patients (360 beds in total, 30 beds × 12 units), CCU (15 beds in the serious patient care



section), and MICU (7 beds in the Medical Intensive Care Unit). Almost no equipment except the patient beds and the drug cabinets is provided, and even the patient beds are obsolete.

A request was made for procurement of 12 ICU beds. A total of 5% of all the patients require monitoring on the ICU beds. In this project, procurement is planned for an ICU bed for every unit, namely 12 beds in total.

MICU has 7 beds with 2 ventilators. According to the disease data of this department, 70% of the patients in MICU are in a serious condition and require respiratory care. Assuming that the distribution of at least 5 units is necessary, procurement is planned in order to make up for a shortfall of 3 units in this project.

#### 5. Neurosurgery

Neurosurgery has 30 beds in each ward for male and female patients, 2 beds in the operating theaters, 4 beds in the recovery room, and 6 beds in ICU. Between 5 and 7 operations are performed a day, or between 1200 and 1400 operations a year. This department performs craniotomy for treatment of hydrocephalus and brain tumor in infant patients.

A request was made for procurement of 3 ventilators. This department now has 2 units of this equipment (1 unit is portable and the other unit is for adults). Of the 4 beds in the recovery room (2 beds each for male patients and female patients) and 6 beds in ICU (3 beds each for male patients and female patients), about 30% of the patients require continuous respiratory care. Procurement is planned in order to make up for a shortfall of 1 unit in this project.

The existing surgical X-ray unit has been used for 23 years. Aging degradation is remarkable and it often has problems. Urgent renewal of this equipment is required. Procurement is planned for 1 unit in this plan.

#### 6. Physiotherapy

About 40,000 patients annually visit this department as inpatients or outpatients. This department supports the basic function of medical services in the hospital. The existing equipment is too old to use. Equipment such as the ultrasound therapy unit, paraffin wax bath, treadmill, galvanization & faradization unit, and microwave therapy unit, often has problems. The decline in medical services due to malfunction is evident. Procurement is planned for a set of physiotherapeutic equipment in this project.

#### 7. Obstetrics and Gynecology

Obstetrics and Gynecology has 40 beds in the prenatal ward (including patients with infectious diseases), 35 beds in the postnatal ward, 30 beds

in the gynecology ward, 8 beds in the delivery room, and a recovery room. The annual number of deliveries is 2,000 (about 8~10 cases a day). Most of the pregnant women are poor.

A request was made for procurement of 1 unit of an ultrasound machine with a color Doppler function. This equipment is widely used in various departments such as the department of Obstetrics and Gynecology, the Department of Angiocardiology, and the Department of Digestive Organs. Therefore, it is disposed in the Imaging Diagnostic Department. Procurement of 1 unit of ultrasound machine B/W portable for fetus detection is planned for this department.

A request was made for procurement of a laparoscope set. Between 500 and 700 patients annually receive treatment and diagnosis under laparoscopy. This department performs laparoscopy for 3~5 patients a day. Only 1 set is now functioning, which was procured by aid from the central government under the family planning program. Since the laparoscope set requires sterilization before and after service, operations are limited to 3 a day. Procurement is planned for another set of this equipment in this project, so that over 5 operations can be performed a day.

A request was made for procurement of 2 units of fetal actocardiograph. Two units of the old model are now distributed and are serviceable. The number of deliveries is 8~10 cases a day, and 1/3 of these cases require obstetric care with this equipment. Accordingly, it is deemed necessary to distribute at least 3 units. Procurement is planned in order to make up for a shortfall of 1 unit in this project.

#### 8. Ophthalmology

Ophthalmology has 2 beds in the operating theaters and 60 beds in the ward. Between 50 and 60 operations are performed a day, such as operations for cataract and glaucoma. Half of these are performed for infant patients.

A request was made for procurement of a set of instrumentation of vitrectomy. This hospital procured vitrectomy equipment 5~6 years ago with their own resources. Because it is an old-fashioned model without a light source, the function is insufficient. In this project, procurement is planned for an ophthalmic illuminator, a set of operational lenses, and forceps for vitrectomy. Accordingly, this will enable 2~5 vitrectomies a day.

#### 9. Orthopedics

Orthopedics has 52 beds, 4 beds in the operating theaters, 6 beds in ICU, and 4 beds in the recovery room. Between 5 and 8 operations are performed a day.

A request was made for procurement of a surgical X-ray C-arm TV system. The existing equipment made in India does not work properly despite short-term use (6 years since its procurement). As for operations relating to osteopathy and orthopedics, fluoroscopy of the patient is essential before and during the operation. Procurement is planned for 1 unit of this equipment in this project.

#### 10. Imaging Diagnosis

This department is equipped with MRI, a CT scanner, an X-ray unit, an ultrasound machine and other imaging diagnostic instruments, and performs imaging diagnosis for the whole hospital. MRI and the CT scanner were recently procured, and the diagnostic cost has been charged to the patient for medical examinations with these instruments.

The ultrasound machine with color Doppler is not currently available, and patients who require diagnosis with this equipment are introduced to other, private hospitals in the neighborhood. This equipment is essential for the improvement of diagnostic function at this hospital, and beneficial to patients with the following symptoms. At the additional request of this hospital, procurement is planned for one ultrasound machine with color Doppler. (This unit was originally requested for OB/GY.)

Table 2-1 Statistical Data of Blood Flow Insufficiency (the year of 2002)

	Name of Disease	Patient / per year	Rate
OB/GY	Placental blood flow from mother to baby	480	1.08%
	Acute venous embolism	330	0.85%
Pediatric	Deep vein thrombosis	180	0.40%
	Peripheral vascular disease	86	0.20%
	Intraventricular bleed	50	0.10%
Internal Medicine	Arterio-venous malformation	7,700	17.25%
	Carotid atenosis	7,300	16.36%
	Transient ischemic attack	6,500	14.57%
	Vascular liemours	1,020	2.28%
	Aneurysms	860	1.98%
	Gmtracardiac shunts	670	1.50%
	Coronary artery disease	67	0.13%
	Other (including impossibility of diagnosis)	19,375	43.24%
Total		44,618	100.00%

\* Data from hearing at Sir J.J. Hospital

#### 11. Biochemistry

This laboratory mainly performs biochemical examinations for outpatients and inpatients. Considering the huge number cases to be examined, examinations for inpatients are mainly conducted in the side laboratory provided in each department. About 2,000 outpatients require clinical tests a day, and most of these tests are performed manually. Therefore, it takes

a lot of time to get the results, and the results are lacking in accuracy. It is necessary to provide this laboratory with modern automatic calibration equipment.

A request was made for procurement of 2 units of blood gas analyzer. The existing equipment is an old model that has been used for more than 15 years since its procurement. The functional decline is remarkable due to aging degradation. Since 200~300 test bodies are analyzed daily with this equipment, the necessary clinical tests cannot be conducted swiftly. This project aims at the functional recovery of this laboratory, and supplementation is planned for 1 unit of blood gas analyzer.

A request was made for procurement of a chemistry auto-analyzer. Between 2000 and 2500 test bodies are analyzed at this laboratory a day. There is 1 unit of the old model (150 test bodies are analyzed an hour), but it does not have much processing capacity and often breaks down due to aging degradation. This causes a decline in diagnostic function at this hospital. This project aims at recovery of the inspection mechanism and diagnostic function, and renewal is planned for the existing old equipment.

## 12. Microbiology

Microbiology has a bacteriological and parasitological section, a virological and AIDS section, a serological section, etc. A request for microorganism tests has been made from every department of the hospital, and the microorganism tests have been conducted by the 13 experts stationed in this laboratory. Most of the equipment other than the microscope that was recently procured with their own resources is too old for use, and this equipment should be renewed.

A request was made for procurement of 2 biosafety cabinets. The existing cabinet has been used in the tubercular examination section for 10 years since its manufacture. Moreover, this equipment is for common use with the bacteriological examination section, which causes contamination among test bodies. The existing equipment cannot exercise proper ventilation control due to aging degradation, and there is a safety problem. In this project, renewal is planned for 1 unit for the tubercular examination section and supplementation is planned for 1 unit for the bacteriological examination section.

A request was made for procurement of an automated rapid bacterial growth detection system. The number of test bodies that require rapid bacterial culture is 10 cases a month on average, which is relatively few. Moreover, it requires the continuous purchase of consumables from a specific manufacturer, and it costs a great deal to maintain this equipment. It is excluded from the procurement plan of this project.

### 13. Administrative Services

A request was made for procurement of an ambulance. This hospital now has 3 ambulances. An emergency medical system that is in effect in other countries is not employed in the targeted facilities. These ambulances are mainly used to transfer referral patients among hospitals. As a result of examination, renewal is not deemed necessary. Accordingly, it is excluded from the procurement plan of this project.

### 14. Hospital Equipment Repair and Maintenance Department

A request was made for procurement of 1 set of the equipment for maintenance works. The existing equipment such as the oscilloscope, multi-tester and tools, has been used for 15 years or more since its procurement, and functional decline is remarkable. It interferes with precise measurement and proper maintenance of the medical equipment, and urgent provision of these tools is required. This project aims at improvement of maintenance function, and renewal is planned for a set of equipment for maintenance works. In addition, registering and controlling equipment are now conducted in each department. This project aims at establishment of a centralized control system using a computer and a change of equipment control system from the existing one a new system by introduction of a Soft Component.

## ● Cama and Albless Hospital

This hospital provides medical services to gynecologic cancer patients (including male patients with malignant tumor). This hospital has 560 beds in total. It has 120 beds in OB/GY, 40 beds in Pediatrics, 41 beds in the Surgical Department, 15 beds in ICU, 3 beds in the operating theaters, 6 beds in the delivery rooms, etc. The prenatal clinic accepts 400~500 outpatients a day. The request for procurement was made from the 3 departments of this hospital for equipment for OB/GY, Pathological Examination, and Pediatrics.

### 1. Operating Theater

As for operating tables, anesthesia apparatus, operating lights and electrosurgical units, a request was made for procurement of 4 units of each item. This hospital has 2 main operating theaters and 1 secondary operating theater. Each operating theater is equipped with the above-mentioned surgical instruments, but they are too old, and only one set of these instruments in the main operating theater is fit to be used after repair. Therefore, renewal is planned for 2 sets of the above instruments, which are no longer serviceable, for the other main operating theater and the secondary operating theater.

## 2. Radiology

A request was made for procurement of an X-ray unit with image intensifiers. This department has 2 fluoroscopes. One of them is out of order. The other has been used for more than 15 years since its installation. The failure frequency is high, and the functional decline is remarkable. X-ray radiograph/fluoroscopy is performed for 50~60 patients a day (12,800 patients in the year of 2002). Considering the above situation, it is deemed necessary to renew at least 1 unit of this equipment.

## 3. Obstetrics and Gynecology

This department performs prenatal checkups for 60~90 patients a day. A request was made for procurement of a B/W portable ultrasound machine. This hospital has 1 unit of an old-model ultrasound machine in the prenatal clinic. Patients with labor pains also go to the examination room for sonography in the same way as outpatients. This project aims at resolving this inconvenience, and procurement is planned for 1 portable unit for the prenatal ward (60 beds) and another 1 unit to the obstetric outpatient clinic (1st floor of the outpatient department).

A request was made for procurement of an ultrasound machine with a color Doppler function. The existing equipment was manufactured in Japan in 1990. Due to aging degradation, the image quality has remarkably deteriorated. While the request was made for procurement of a model with a Doppler function, the necessity of the Doppler function is low in Obstetrics and Gynecology. Sonography can be sufficiently covered with the ordinary (B/W) type of ultrasound machine. Therefore, renewal is planned for one ultrasound machine without a Doppler function.

2) Study of the power and water situation

Power situation:

The power supply is stable in Maharashtra (including Mumbai city) because the power distribution company was recently privatized. The following table indicates the voltage fluctuation data of the project facilities. Because the voltage was detected in the daytime when power consumption is relatively high, the data given here are generally low, and the voltage fluctuation is within 3%. The majority of the equipment to be procured in this project is hardly influenced by this voltage drop.

As for the electronic equipment, procurement of a UPS system and the voltage regulator is planned for sudden voltage fluctuation.

Table 2-2 Fluctuation of the Electricity

Hospital	Sir J.J. Hospital	Cama & Albless Hospital
Date of Measurement	2003/1/29	2003/1/31
Fluctuation Ratio	± 0.2%	± 1.1%
Average	230.1	227.0
Maximum	233.1	233.1
Minimum	230.07	223.4

Source: Site Inspection Data

Water situation:

The result of water analysis shows that the water is hard. For high-pressure steam sterilizers that use a large quantity of water, procurement of the water softener is planned in order to reduce the hardness of the water. The results of water analysis are shown below.

Table 2-3 Results of Water Analysis at the Project Facilities

Inspection Item	Result	Japanese Standard
Chlorine Ions	7	200 mg/l and below
organic matter, etc. (potassium permanganate consumed)	1.5	10 mg/l and below
pH value	7.1	5.8~8.6
Turbidity	under 0.5°	2° and below
Ca, Mg, etc. (hardness)	360 mg	300 mg/l and below

Source: Catchment on the spot

3) Study of local agents of equipment manufacturers

There are many local agents in India who handle products made in Japan, Europe, or USA. On the other hand, many products of foreign manufacturers, which do not have a local agent in India, have recently come onto the market. In repairing

this equipment, there are many problems in the maintenance service system. In addition, as for certain Japanese products, a sales agent has been set up in India but handles only a few commodities. The sales agent does not stock sufficient spare parts or consumables, resulting in users spending a lot for operation and maintenance of the equipment. In order to ensure maintenance management after procurement of equipment that requires a continuous maintenance contract, this equipment is in principle limited to that whose manufacturers have appointed a local agent or have their own branch office in India.

The possibility of procuring equipment from a third country will be considered in view of the cost effectiveness, market penetration, and the competing principle of tender.

## (2) Equipment plan

### 1) Selection of equipment

The equipment to be procured in this project was finally selected according to the following principles, the "Basic criteria for selection of equipment." The results of assessment are shown in Table 2-4 "Examination of the Requested Equipment."

#### 【 Basic criteria for selection of equipment 】

##### < Criteria for being given high priority >

- a. Equipment that aids the safe delivery and care of newborn babies
- b. Equipment that directly benefits the basic maternal and child health service
- c. Equipment for diagnosis and medical treatment of women of reproductive age (18~49 years old) and patients of 5 and under
- d. Equipment that replaces the existing old equipment
- e. Equipment of which there is an obvious shortage
- f. Equipment that is essential for the basic medical services of the hospital
- g. Equipment that is easy to operate and maintain
- h. Equipment that benefits the designated facility
- i. Equipment that is highly cost-effective
- j. Equipment whose medical usefulness and necessity is proved

##### < Criteria for being given low priority >

- a. Equipment that does not directly benefit the basic maternal and child health service
- b. Equipment that requires high operation and maintenance cost
- c. Equipment that has limited benefit for the designated facility
- d. Equipment that is not cost-effective



- e. Equipment that is not used for diagnosis and treatment, but for academic research purposes
- f. Equipment that can be substituted with simple equipment
- g. Equipment that may cause environmental pollution through medical waste, etc.
- h. Equipment whose medical usefulness and necessity is not proved
- i. Equipment that is not for medical use but for private use by hospital staff
- j. Equipment of which the designated facility has more than the minimum required quantity (inefficient or redundant equipment)

<Additional criteria for being given high priority after considering the local conditions>

- a. Equipment that can be operated with the current technical capability of the designated facilities
- b. Equipment that is or is to be maintained by hospital personnel or outside personnel entrusted with maintenance
- c. Equipment that suits the social position and function of the designated facility (referral system and local needs)
- d. Equipment whose usefulness is expected in cooperation with other donors

<Additional criteria for being given low priority after considering the local conditions>

- a. Equipment whose spare parts and consumables are difficult to procure locally
- b. Equipment that cannot be operated with the current technical capability of the designated facilities
- c. Equipment that is not or will not be maintained by hospital personnel or outside personnel entrusted with maintenance
- d. Equipment that does not suit the social position and function of the designated facility (referral system and local needs)
- e. Equipment that requires a large scope of infrastructure work (water and power supply, drainage, etc.) for its installation
- f. Equipment that can be substituted by efficient use of existing equipment

Selection of the equipment to be procured was made through the above-stated process, and each item of equipment is comprehensively assessed.

Comprehensive assessment:

- .....Equipment whose the procurement is deemed appropriate
- × .....Equipment that is not included in the project























