

**MINISTRY OF HEALTH  
THE KINGDOM OF CAMBODIA**

**PREPARATORY SURVEY REPORT  
ON  
THE PROJECT FOR IMPROVEMENT OF  
BATTAMBANG PROVINCIAL REFERRAL  
HOSPITAL  
IN  
THE KINGDOM OF CAMBODIA**

**January, 2017**

**JAPAN INTERNATIONAL COOPERATION AGENCY**

---

**AZUSA SEKKEI CO., LTD.  
INTEM CONSULTING, INC.**



## PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey on the Project for Improvement of Battambang Provincial Referral Hospital in the Kingdom of Cambodia to the consortium consist of Azusa Sekkei Co., Ltd. and INTEM Consulting, Inc..

The survey team held a series of discussions with the officials concerned of the Royal Government of Cambodia, and conducted a field investigations. As a result of further studies in Japan, 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.

Finally, I wish to express my sincere appreciation to the officials concerned of the Royal Government of Cambodia for their close cooperation extended to the survey team.

January, 2017

Mitsuko KUMAGAI  
Director General,  
Human Development Department  
Japan International Cooperation Agency





## **Summary**



# Summary

## ① Outline of the Recipient Country

### 1) Geographical and Climatic Conditions

The Kingdom of Cambodia (hereinafter referred to as Cambodia) is a constitutional monarchy, which became independent from France in 1953, located in the southwest of Indochinese peninsula. The land area is 181,035 km<sup>2</sup> (approximately a half size of Japan) and has borders with Thailand, Vietnam and Laos.

The Köppen climate classification of Battambang is savanna climate (Aw), with the rainy season of each year generally lasting from May to October, and the dry season from November to April. Ninety percent of the annual rainfall of 1,290 mm falls during the rainy season. The period from the last half of the dry season in March until the rainy season starts in May is one of intense heat, and while the average temperature during the dry season is around 27°C, high temperatures can exceed 40°C during the rainy season. Battambang is located northwest of the capital city Phnom Pehn, 290 km inland on National Highway 5 and humidity is generally high at 80 to 90 percent. Most typhoons expire along the Vietnamese coastline, and hardly any reach Cambodia.

### 2) Socio-Economic Conditions

After the end of the civil war, Cambodia has been promoting reconstruction of the devastated nation with support from the international community. Reconstruction began in earnest after signing of the Paris Peace Accord in 1991, and despite the armed conflict in 1997 and economic deterioration due to the Asian Financial Crisis, the country achieved an average GDP annual growth rate of 6.2% between 1991 and 1999 (IMF World Economic Outlook Database, October 2016). Subsequently, Cambodia became a member of ASEAN in 1999, increased investment from overseas, and has made rapid advancements in its market economy and globalization. In the four years from 2004 to 2007, Cambodia recorded a high economic growth rate exceeding 10% (idem), and despite the drop in economic growth rate in 2009 to 0.1% (idem) due to the effects of the global recession triggered by the subprime mortgage crisis, it recovered to 6.1% (idem) in the following year 2010 and has continued to grow by 7% (idem) since 2011. In 2015, the per capita GDP was US\$1,144 (idem). Japan contributes more than a quarter of the overall economic assistance to Cambodia.

The GDP industrial composition ratio (ADB, 2014) is agriculture (30.5%), industry (27.1%), and services (42.4%) with remarkable growth in services and industry. Services, a tertiary industry, has surpassed the primary industry of agriculture, and foreign direct investment related to industry and services is also increasing. Steady economic growth is also expected in the future due to robust garment exports, as well as steady increases in construction, and services, and foreign direct investment. Direct investment from Japan has also been increasing recently, due not only to the low labor costs, but also to the accessibility to neighboring countries and the multitude of industrial parks. According to the CDC (Cambodia Development Council), the amount of approved investments by Japanese companies is rapidly increasing to approximately US\$56.8 million dollars in 2015 (US\$47.9 million dollars in the previous year).

Cambodia is transitioning dynamically toward a growth phase following the reconstruction, by, for example, making improvements to transportation networks to keep up with the rapidly growing number of vehicles. In particular, as was the case with the Tsubasa Bridge that opened to traffic in May 2016, National Roads No. 1 and 5, which are undergoing road renovation work with the assistance of Japan, form the backbone of the southern economic corridor connecting Bangkok and Ho Chi Minh, and further economic development can be expected after they are completed.

Along with the economic growth, the poverty rate decreased rapidly from 35% (2004) to 14% (2014). On the other hand, the new problem have arisen that the gap between the rich and the poor is widening. “National Social Protection Strategy for the Poor and Vulnerable (2011)” aiming for poverty prevention and improvement in access to the health, nutrition and education, Cambodia is also proceeding to expand the outreach funds and social securities also in healthcare sector. In order to accelerate further democracy, a variety of efforts are required such as the redistribution of wealth by introducing new taxation system, anticorruption measures, reform of the electoral system, etc.

The development of basic infrastructure is particularly lagging in rural areas, and there is a large disparity in the health sector between the capital and rural areas, with one of the long-standing problems that the number of medical staff and the development of healthcare facilities and equipment is lagging far behind. Although the human development index in 2015 was 143rd out of 188 countries, within the middle group, health indicators are still slow in improving compared with neighboring Asian countries. Issues that existed at the end of the civil war, such as basic infrastructure and health services infrastructure that had been devastated by the civil war, as well as shortages in human resources are gradually being solved. However, there are still insufficient numbers of highly-skilled personnel and not enough provision of high quality services, which are both major challenges for the future.

## **② Background and Outline of the Request for Japan’s Grant Aid Assistance**

The Cambodian Civil War, which began in the 1970s, caused a dramatic decrease in the number of medical practitioners and destroyed medical equipment and facilities, which devastated the nation’s health system. Since the end of the war, Cambodia has prioritized the recovery of the public health sector with national plans such as “National Strategic Development Plans” (NSDP), and assistance from multiple development partners in a number of efforts has reduced the under 5 mortality rate (from 117 in 1990 to 29 in 2015 (per 1,000 births)<sup>1</sup>) and the maternal mortality rate (from 472<sup>2</sup> in 2005 to 161<sup>1</sup> in 2015 (per 100,000 births)), and has produced other results that continue to improve health indicators. However, there is still room for improvement in comparison with neighboring countries. Moreover, as compared with the under 5 mortality rate of 18 in the capital of Phnom Penh, it is 45 (per 100,000 births<sup>1</sup>) in Battambang, exhibiting a large disparity between the capital of Phnom Penh and rural areas and denoting a need for improvement in medical services in rural areas.

---

<sup>1</sup> *The State of the World’s Children 2016, UNICEF*

<sup>2</sup> *Cambodia Demographic and Health Survey 2010 (CDHS2010)*

Battambang Province is located in northwestern Cambodia, sharing a border with Thailand, covering 1,166 km<sup>2</sup> of land area and having a population of 1.173 million (2016, Battambang PHD). The province's capital city of Battambang is located about 300 km northwest of Phnom Penh and is the second largest city in Cambodia. Although this area was the last outpost of the anti-government organization (Pol Pot regime), Battambang has been developing since the destruction of the said organization as the central city in the northwest region. Increases are expected in population inflow and number of traffic accidents as a result of economic growth of Battambang Province, as a logistical way point in the Southern Economic Corridor, and may also lead to increased demand for medical care.

The Battambang Provincial Hospital is a top referral hospital in the province and is expected to play a pivotal role in health-care in the second-largest city in Cambodia and as a core hospital in the northwest region of Cambodia. However, it has problems such as the progressive deterioration due to aging since it was constructed in the 1940's, the insufficiency of hygiene management, the lack even of covered walkways linking scattered buildings leading to the difficulty in providing efficient services. The 2-story building, which includes the Surgery department, Obstetrics/Gynecology department, Operation theater, and X-ray room, was constructed in 1967 and renovated in 2011 by University Research Co., LLC (URC), has a shortage of beds in Surgery ward and beds are laid outdoors under the piloti. The General Medicine ward is scattered into 4 buildings, which makes intra-service coordination difficult and, in addition, each of those buildings shows deterioration since they were constructed in 1969 and 1985 and in 1988 and although renovation works including wall repaint has been executed between 2010 and 2011. The Pediatric ward, constructed in 1991 and renovated in 2012 by UNICEF, also shows pronounced deterioration. In addition, the Outpatient ward was constructed in 2010 with an emergency room included and shows functional problems such as the distance separating the room from the Operation theater.

Under these conditions, the Government of Cambodia requested grant aid from the Government of Japan for the development and maintenance of Battambang Provincial Hospital, which is a top referral hospital in the province, with the purpose of improving health care conditions in Battambang Province.

This Project will contribute to improving the delivery of health services, which is one of the seven cross-cutting strategies (health service delivery, health care financing, health care human resources, health information, governance, medical materiel supports and improving health structure) listed in the Second Health Strategic Plan 2008-2015 (HSP2), and the Third Health Strategic Plan that is set to start in 2016 (HSP3). These plans are designated as national health projects by the Government of Cambodia. Strategies for the delivery of health services include strengthening the implementation of CPA in referral hospitals like Battambang Provincial Hospital, as well as strengthening the system for delivering medical services and the referral system.

The purpose of this Project is to improve health care conditions in Battambang Province. As a top referral hospital in the province and core hospital in the northwest region of Cambodia, it will strengthen the medical referral system and contribute greatly to the improvement of medical services.

Additionally, the Project is judged to have a high level of necessity and relevance, since it will also enhance the health care environment. By implementing this Project, the health systems of the hospital will be enhanced and the health situation of the Region including neighboring provinces will be improved.

### **③ Outline of the result of survey and contents of the Project (outline design, outlines of the facility and equipment Plan)**

Based on above mentioned request, Japan International Cooperation Agency decided to conduct preparatory survey and dispatched the survey team from June 12 to July 16, 2016. The survey team held a series of discussions with the officials concerned of the Government of Cambodia, and conducted a field investigation. As a result of further studies in Japan and the explanation of draft report from November 30 to December 10, 2016, the present report was finalized.

The upgrades to Battambang Provincial Referral Hospital to be implemented under this project will go a long way toward enhancing the medical care referral system and improving medical care services in Battambang Province. In accordance with the request from the Ministry of Health of Cambodia and the result of field investigation and discussions, the project plan was decided including the following policies.

#### **1) Design Policy**

##### **a) Site Selection**

- For the benefit of the Cambodia side, planning will be conducted within a scope such that facilities to be demolished are kept to a minimum, and so that construction does not interfere with medical care activities.
- In order to utilize the existing buildings, they will be organically connected; paths between buildings used by patients and staff will be planned in a manner keeping distances to a minimum.

##### **b) Facilities**

- Policy for selecting target components

Scattering of facilities across the property of Battambang Provincial Hospital makes traffic paths used by patients, staff and specimens very long, which hinders efficient operation. The scattering of buildings is found even within the same department, and this combined with the absence of cover over corridors between buildings makes it very difficult to transport patients on stretcher or the like especially in the rain. In addition, the hospital facilities have various problems such as the deterioration of the existing buildings themselves and the lack of bed space for inpatients in some wards where BOR exceeds 100%. In order to solve those problems so that Battambang Provincial Hospital will be able to implement efficiently and functionally CPA3 level medical activities, the basic policy of this Project is to select; ① the departments necessitating improvement to reorganize hospital functions by reintegrating the scattered facilities, ② the departments of which facilities are deteriorated, ③ the departments lacking space, ④ the departments having

difficulty/inconvenience in implementing medical activities, as the target components of the Project.

On the other hand, the departments whose problems can be resolved by simple renovation or relocation without big burden are considered as components to be implemented by Cambodia side, while departments which cannot be improved by simple renovation or relocation such as operation department, and departments which will enable the whole hospital operation to perform more effectively and efficiently if the existing buildings are organically united by constructing new facilities therein, will be selected as components to be included in the Japanese assistance.

- Policy for setting the scale

The planned scale will be set based on the number of patients forecast for a target year 2022, 3 years after the completion of the Project. The projection for the number of patients will be estimated based on the current increase rate of patients and by taking into account the inflow of patients from other provinces motivated by the facility/equipment improved by this Project.

### c) Equipment

- Equipment will be selected according to the Medical Equipment Standard for CPA 3 Referral Hospital First Edition, 2014 (Medical Equipment Standard List) formulated by the Ministry of Health, and plans will fully consider such aspects as technological innovations expected to improve the effectiveness and efficiency of current clinical services.
- Taking into consideration the role played by the target hospital in its area, plans will apply to internal medicine and pediatric departments that currently lack major equipment, though their facility buildings are not in the scope of the project.
- Plans will keep consistency with activities of the target hospital.
- Plans will take consideration of easy maintenance for the targeted hospital by such as selecting equipment in proper level.
- Plans will avoid overlaps with existing equipment or equipment supplied by other donors to ensure efficiency.
- For essential machinery requiring regular maintenance, including sophisticated equipment and that for which serious problems would arise if malfunctions occurred, maintenance management contracts will be concluded with manufacturers or local agents for 3 years after delivery. This cost will be borne by the Japanese side. Maintenance contracts will include 3 types of service: cost of periodic inspection service, for which a technician will visit the hospital at regular intervals to inspect and calibrate equipment, cost of on-call service, for which equipment inspection will be conducted at the request of the user when equipment fails, etc., and cost of repair and replacement parts.

2) Details and Scale

a) Facilities

**Table-i Construction Plan**

Building	Department	Major Rooms	Floor Area
Central Clinic/ Srugey Building	ER	Treatment Room, Consultation Room, Observation Room (ICU), Staff Station, Staff Duty Room	565.09m <sup>2</sup>
	Imagery Dept.	X-ray Room, Ultrasound Room, Film Storage, Reception, Patient Waiting, Staff Duty Room	144.26m <sup>2</sup>
	Ear, Nose, and Throat	Consultation/Treatment Room, 4-bed ward, Reception, Patient Waiting, Staff Duty Room	141.43m <sup>2</sup>
	Laboratory	Biochemical Examination Room (including general, blood and pathological examination), Culture Room (bacterial examination), Media Prep Room, Sterilization Room, Specimen Collection Room, Administration Office, Reception, Staff Duty Room	205.83m <sup>2</sup>
	Pharmacy Dept.	Pharmacy, Storage, Administration Office, Staff Duty Room	120.74m <sup>2</sup>
	Operation Dept.	Operation Theater, Recovery Room (ICU), Pre-op Room, Staff Station, Changing Room, Conference Room, Staff Duty Room, Machine Room, Intern Room	968.92m <sup>2</sup>
	Central Sterilization Dept.	Central Cleaning/Sterilization Room, Clean Storage, Laundry, Administration Office, Staff Duty Room	266.85 m <sup>2</sup>
	Outpatient Dept.	Outpatient Consultation/Treatment Room, Plaster Room, Urology / Hemorrhoid Consultation Room, 6-bed ward, Private Room, Staff Station, Staff Duty Room, Shower Room, Toilet	1179.77m <sup>2</sup>
	Others	Hallway etc.	135.89m <sup>2</sup>
Central Clinic/Surgery Building Total			3,728.78m <sup>2</sup>
Internal Medecine ICU/Energy Center Building	Internal Medicine ICU Dept.	ICU, Isolation Room, Staff Station, Staff Duty Room, Storage	376.16 m <sup>2</sup>
	Energy Supply Dept.	Water Tank, Pump Room, Medical Gas Room, Electrical Room,	215.74 m <sup>2</sup>
Internal Medecine ICU/Energy Center Building Total			591.90m <sup>2</sup>
Entrance Building	Entrance Hall, Slope, Elevated Water Tank		773.85m <sup>2</sup>
Others	Walkway, Septic Tank		94.81m <sup>2</sup>
Grand Total			5,189.34m <sup>2</sup>



b) Equipment

**Table-ii Major Planned Equipment**

Department	Major Equipment
Outpatient Dept.	Ultrasound Machine, Hemorrhoidectomy Set
Emergency Dept.	Ventilator, Emergency Bed, Patient Monitor, Aspirator
Operation Dept.	Anesthesia Machine, Ventilator, Infusion Pump, Operating Table, C-arm X-ray Machine, Electrical Surgical Unit
Operation Dept. (Recovery Room)	Patient Monitor, Stretcher, ICU Bed
Central Sterilization Dept.	Autoclave (Large), Autoclave (Medium), Washing Machin, Dryer
Imagery Dept.	General X-ray Machine, Ultrasound Machine, CR System, PACS
Pediatric Dept.	Syringe Pump, Nebulizer, Patient Monitor, CPAP, Infant Incubator
Internal Medicine Dept.	Holter ECG, Aspirator
Internal Medicine ICU Dept.	Ventilator, Aspirator, Patient Monitor, ICU Bed
Ear, Nose, and Throat	ENT Unit, Endoscope Surgery Set for ENT, Surgical Instrument Set for Ear
Laboratory	Semi-auto Biochemistry Machine, Hematology Analyzer, Laboratory Table
Pharmaceutical Dept.	Medical Refrigerator, Storage Shelves, Working Table

c) Soft Component

- Technical Assistance on CR system and Picture Archiving and Communication System (PACS)
- Support to establish a system for Laboratory waste liquid treatment

d) Maintenance Service of the Equipment

The Supplier shall provide maintenance services for the selected 8 items which requires the service. The maintenance services shall include periodic inspection for 3 years after the handover and on-call service for 2 years after guarantee period. This includes the expense to repair and replace parts. Every expense for consumables such as reagents, disposables parts, etc. shall be borne by user.

**④ Implementation Schedule and Cost Estimation**

The project would be implemented in a single fiscal year, taking 6.5 months for the detailed design, 17.5 months for the construction and equipment procurement and 3 months for the soft component. In case of implementation by Japan's Grant Aid, the initial cost to be borne by Cambodian side is estimated as 13 million Japanese Yen.

## **⑤ Project Evaluation**

In light of the following points, this project has recognized relevance as a focus project through Japan's Grant Aid.

### **1) Relevance**

#### **a) Focus of the project's benefits**

The focus region of the project is Battambang Province, in which the project site of Battambang Provincial hospital is located, and nearby provinces. Battambang Province has a population of 1,173,000 people (2016, Battambang PHD); when combined with the nearby provinces, a huge population will be the direct beneficiaries. The Tsubasa Bridge, a Japanese grant aid project on which National Route 1 crosses the Mekong River, opened in 2015. Battambang Province is set to become a hub of the Southern Economic Corridor in which Route 1 links National Route 5, which runs from the Cambodian border with Thailand through northwest Cambodia to Vietnam. Thus, it is expected that population influx and traffic will increase with the economic development, and that traffic casualties will also increase, further increasing the province's medical needs. In Battambang Province, where these types of health and medical needs are expected to increase further, the project will enhance the medical care referral system, improve medical care services, and greatly contribute to the training of medical staff in northwest Cambodia; therefore it is deemed to be highly relevant.

#### **b) From a Human Security Standpoint**

The project aims to enhance rural healthcare services through the improvement of Battambang Provincial Hospital, located in Battambang Province, one of the most economically important provinces in the country, to serve as a central hospital in the northwest region of Cambodia. The project concretely contributes to human security, by mainstreaming Universal Health Coverage (UHC), which advocates Japan's Strategy on Global Health Diplomacy (May 2013) ensuring safety against the ailments threatening the survival and lives of the habitants of the project target province. Therefore, it is highly necessary and relevant to implement the project under Japan's Grant Aid.

#### **c) Contribution to achieving Cambodia's targets for its mid- to long-term development plan**

This project exists to help strengthen the 7 strategic areas (health service delivery, health financing, human resources, drug supply, infrastructure improvement, health information, and governance) illustrated in HSP3, an implementation plan that is part of the NSDP of Cambodia. Strategies for improving infrastructure include strengthening facilities and equipment, as well improving referral systems based on the CPA of referral hospitals such as Battambang Provincial Hospital. Therefore, the project is deemed to be highly relevant.

#### **d) Consistency with Japan's Assistance Policy**

Section (2) Promotion of Social Development, (b) Enhancement of Health and Medical Care of the

Country Assistance Strategy for Cambodia (2012) established by the Japanese Ministry of Foreign Affairs, sets forth “strengthening of the insurance system centering on maternal and child health fields” as a priority area (central target). Improving Battambang Provincial Hospital as the core regional hospital will contribute to the improvement of not only maternal and child health, but also the health care conditions in the region, and therefore the project is sufficiently consistent with Japan’s assistance policy.

2) Effectiveness

Below are the expected target levels of implementing this project.

a) Quantitative Effects

**Table-iii Outcome Indicators for Quantitative Effects**

Indicators	Current Value (2015 Result Value)	Target Value (2020, three years after project completion)
No. of Patients Hospitalized for Surgery (people-days/year)	2,738	3,356
No. of Internal Medicine ICU Inpatients (people/year)	1,261	1,618
No. of Outpatient Surgeries (cases/year)	970	1,101

b) Qualitative Effects

- i) Quality medical service is provided, centered on emergency and surgery patients.
- ii) The referral system in northwest Cambodia is enhanced.
- iii) The training function is improved for medical staff and medical students in northwest Cambodia.
- iv) Motivation to work is improved among the medical staff at Battambang Provincial Hospital.



# Contents

Preface

Summary

Contents

Location Map/ Perspective

List of Figures & Tables

Abbreviations

Chapter 1	Background of the Project .....	1-1
1 - 1	Background and Outline of the Request for Japan's Grant Aid Assistance .....	1-1
1 - 2	Natural Conditions.....	1-2
1 - 3	Environmental and Social Considerations .....	1-5
1 - 4	Other (Global Issues, etc.) .....	1-5
Chapter 2	Contents of the Project.....	2-1
2 - 1	Basic Concept of the Project.....	2-1
2-1-1	Overall Goal and Project Goal.....	2-1
2-1-2	Outline of the Project.....	2-3
2 - 2	Outline Design of the Japanese Assistance.....	2-5
2-2-1	Design Policy.....	2-5
2-2-2	Basic Plan (Construction Plan/ Equipment Plan) .....	2-13
2-2-3	Outline Design Drawing .....	2-53
2-2-4	Implementation Plan .....	2-64
2-2-4-1	Implementation Policy .....	2-64
2-2-4-2	Implementation Conditions.....	2-66
2-2-4-3	Scope of Works.....	2-66
2-2-4-4	Consultant Supervision .....	2-68
2-2-4-5	Quality Control Plan .....	2-69
2-2-4-6	Procurement Plan .....	2-70
2-2-4-7	Operational Guidance Plan .....	2-71
2-2-4-8	Soft Component (Technical Assistance) Plan.....	2-72
2-2-4-9	Implementation Schedule.....	2-72
2 - 3	Obligations of Recipient Country .....	2-74
2 - 4	Project Operation Plan .....	2-77
2-4-1	Operation Plan .....	2-77
2-4-2	Maintenance Plan.....	2-78
2-4-3	Financial Planning .....	2-80
2 - 5	Project Cost Estimation .....	2-85
2-5-1	Initial Cost Estimation .....	2-85

2-5-2	Operation and Maintenance Cost.....	2-86
-------	-------------------------------------	------

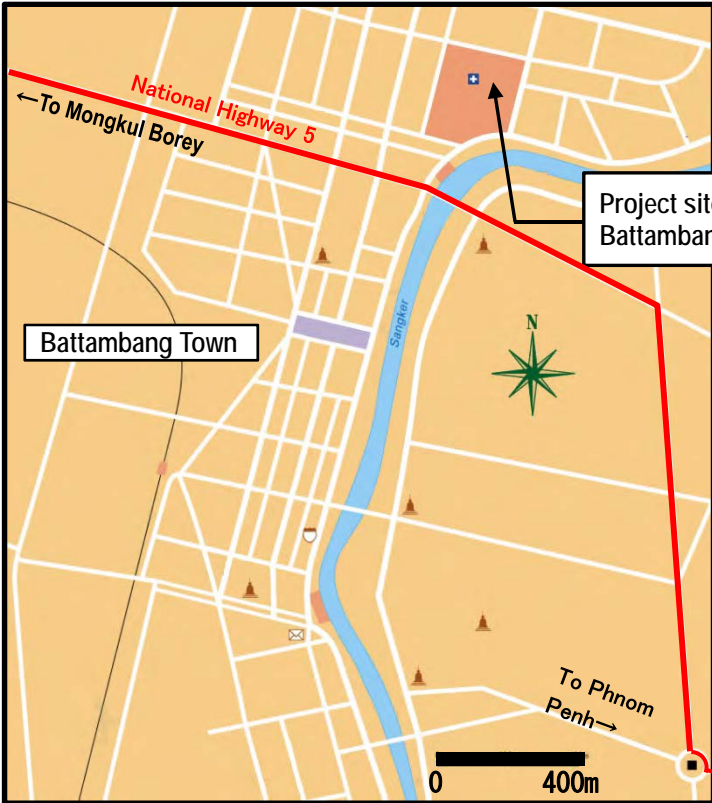
Chapter 3	Project Evaluation.....	3-1
3 - 1	Preconditions .....	3-1
3 - 2	Necessary Inputs by Recipient Country.....	3-1
3 - 3	Important Assumptions.....	3-1
3 - 4	Project Evaluation.....	3-1
3-4-1	Relevance.....	3-2
3-4-2	Effectiveness.....	3-3

[Appendices]

1.	Member List of the Study Team.....	A-1
2.	Study Schedule .....	A-2
3.	List of Parties Concerned in the Recipient Country .....	A-7
4.	Minutes of Discussions .....	A-9
5.	Soft Component (Technical Assistance) Plan .....	A-62
6.	Other Relevant Data.....	A-73
7.	References .....	A-74

# Location Map

Map of Cambodia



Map of Battambang Town







Perspective  
(Northwest Side Bird's Eye View)





Perspective  
(East Side)

## List of Figures and Tables

Figure 2- 1	Planned Construction Site .....	13
Figure 2- 2	Original Proposed Construction Site of the Study Team .....	13
Figure 2- 3	Construction Site .....	13
Figure 2- 4	Planned Hospital layout Drawing .....	14
Figure 2- 5	Central clinic/ Surgery building Ground floor floor plan .....	23
Figure 2- 6	Central clinic/ Surgery building 1st floor floor plan .....	24
Figure 2- 7	Central clinic/ Surgery building 2nd floor floor plan .....	25
Figure 2-8	Surgery Ward Floor Plan .....	26
Figure 2-9	Slope GF Floor Plan .....	26
Figure 2-10	ICU Department Floor Plan .....	26
Figure 2- 11	Typical Building Section .....	30
Figure 2- 12	Typhoon Hazard Map for Area around Cambodia (Source: UN OCHA).....	32
Figure 2- 13	Earthquake Hazard Map for Area around Cambodia.....	33
Figure 2- 14	Construction Administration System.....	70
Figure 2- 15	Proposed Facility Maintenance Management Structure .....	80
Table 1- 1	Weather Data for Battambang City.....	1-3
Table 2- 1	Overall Goal and Project Goal.....	2-2
Table 2- 2	Outline of the Project (Facilities).....	2-3
Table 2- 3	Outline of the Project (Equipment).....	2-4
Table 2- 4	Battambang Provincial Hospital Average Length of Stay .....	2-5
Table 2- 5	Current and Post-Project Conditions for Requested Target Departments.....	2-15
Table 2- 6	Number of Hospitalized Patients .....	2-19
Table 2- 7	Predicted Number of Hospitalized Patients .....	2-20
Table 2- 8	Increase in the Number of Surgeries.....	2-20
Table 2- 9	Predicted Number of Hospitalized Patients (with the Predicted Influx from .....	2-21
Table 2- 10	Number of Surgeries (Cases).....	2-22
Table 2- 11	Floor Area of Each Building .....	2-27
Table 2- 11	Comparison of Diameter and Strength of Rebar in Cambodia & Japan.....	2-31
Table 2- 12	Table of Movable Load Capacity (Unit : N/m <sup>2</sup> ) .....	2-32
Table 2- 13	Exterior Finish .....	2-39
Table 2- 14	Interior Finish .....	2-39
Table 2- 15	Evaluation Chart for Equipment Relevance .....	2-41
Table 2- 16	Arrangement of Equipment .....	2-48
Table 2- 17	Examination results of 3 year maintenance contract .....	2-53
Table 2- 18	Outline Design Drawing List.....	2-54

Table 2- 19	Procurement of Construction Materials .....	2-72
Table 2- 20	Project Implementation Schedule .....	2-74
Table 2- 21	Implementation Schedule .....	2-74
Table 2- 22	Number of Patients and Staff at Hospitals Targeted by Grant Aid.....	2-78
Table 2- 23	Battambang Provincial Hospital Facility Maintenance Management Costs.....	2-79
Table 2- 24	Building Maintenance Items .....	2-80
Table 2- 25	MOH and Battambang Province PHD Budgets .....	2-82
Table 2- 26	Income and Expenditure of Battambang Provincial Hospital.....	2-83
Table 2- 27	Battambang Provincial Hospital Budget from the PHD .....	2-84
Table 2- 28	Battambang Provincial Hospital Patient Number and Income from User Fees.....	2-84
Table 2- 29	Projected Income and Expenditures for 2022 .....	2-85
Table 2- 30	Expenses to be Borne by Cambodian Side .....	2-86
Table 2- 31	Price Inflation Projections for Cambodia.....	2-87
Table 2- 32	Staff Number Trends at Battambang Provincial Hospital (by Position) .....	2-87
Table 2- 33	Facility Maintenance Expense Estimates (Facilities Targeted in the Project).....	2-89
Table 3- 1	Outcome Indicators for Quantitative Effects.....	3-3

## Abbreviations

Abbreviation	Term
ADB	Asian Development Bank
AFD	Agence Française de Développement
AHS	Annual Health Statistics 2013
AIDS	Acquired Immune Deficiency Syndrome
ALOS	Average Length of Stay
AOP	Annual Operational Plan
ARI	Acute Respiratory Infection
ASEAN	Association of Southeast Asian Nations
AusAID	Australian Agency for International Development:
AVR	Auto Voltage Regulator
BHN	Basic Human Needs
BOR	Bed Occupancy Rate
BTC	Belgian Technical Cooperation
CDC	Council Development Cambodia
CDHS	Cambodia Demographic and Health Survey
CIOMAL	Committee of the Order of Malta for Leprosy Relief
CMAC	Cambodia Main Action Center
CMS	Central Medical Storage
CMDGs	Cambodia Millennium Development Goals
CPA	Complementary Package of Activities
CR	Computed Radiography System
CT	Computer Tomography
DAC	Development Assistance Committee
DES	Diplôme d'Études Spécialisées
DFID	Department for International Development
DMDP	Diagnosis of Microbiology Development Program
DU	Diplôme Universitaire
EDC	Electricite du Cambodge
ENT	Eye, Nose and Throat
EIA	Environmental Impact Assessment
EoJ	Embassy of Japan
EmONC	Emergency Obstetric Newborn Care
E/N	Exchange of Notes
EP	Emulsion Paint
FHI	Family Health International
G/A	Grant Agreement
GAVI	Global Alliance for Vaccination and Immunization
GDP	Gross Domestic Product
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GL	Ground Level
HC	Health Center

Abbreviation	Term
HEF	Health Equity Fund
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HP	Health Post
HSP3	Third Health Strategic Plan 2016-2020
HSP2	Second Health Strategic Plan 2008-2015
HSS	Health System Strengthening
HSSP2	Second Health Sector Support Program 2009-2013
ICU	Intensive Care Unit
IMF	International Monetary Fund
INC	Intensive Newborn Care
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standard
JOCV	Japan Overseas Cooperation Volunteers
KOFI	Kofi Annan Foundation
KOFIH	Korean Foundation for International Healthcare
KOICA	Korea International Corporation Agency
LAN	Local Area Network
MCH	Maternal and Child Health
MDGs	Millennium Development Goals
MEDEM	Project for Strengthening Medical Equipment Management at Referral Hospital
MEM-WG	Medical Equipment Management Working Group
MOH	Ministry of Health
MLMUJPC	Ministry of Land Management, Urban Planning and Construction
MPA	Minimum Package of Activities
MPWT	Ministry of Public Works and Transport
MSF	Médecins Sans Frontières
NCHADS	National Center for HIV/AIDS, Dermatology and STD
NGO	Non-Governmental Organization
NMCHC	National Maternal and Child Health Center
NSDP	National Strategic Development Plan 2014-2018
NWT	National Workshop Team
OD	Operational District
ODA	Official Development Assistant
OECD	Organisation for Economic Co-operation and Development
OMS	Order of Marta
OT	Operation Theater
PACS	Picture Archiving and Communication System
PHD	Provincial Health Department
RC	Reinforced Concrete
RH	Referral Hospital

Abbreviation	Term
RTC	Regional Training Center
SDG	Service Delivery Grant
SEZ	Special Economic Zone
STD	Sexually Transmitted Diseases
UHC	Universal Health Coverage
UNDP	United Nations Development Program
UNICEF	United Nations Children's Fund
UNPFA	United Nations Population Fund
URC	University Research, Cambodia
USCDC	Centers for Disease Control and Prevention
VAT	Value Added Tax
VCCT	Voluntary Confidential Counseling and Testing
VIP	Very Important Person
WB	World Bank
WHO	World Health Organization
WPRO	Western Pacific Regional Office





## **Chapter 1 Background of the Project**



# Chapter 1. Background of the Project

## 1-1 Background and Outline of the Request for Japan's Grant Aid Assistance

The civil war in the Kingdom of Cambodia (hereinafter called “Cambodia”) since the 1970s brought the persecution of medical personnel and the destruction of medical equipment and facilities, which resulted in a delayed development of health care in the country. However, after the end of the civil war, the Cambodian government and the development partners including Japan have taken various actions to jack up the level of health care which produced a certain result in improvement of health indicators measured as a country; e.g. decreases of the under-5 infant mortality rate (117 in 1990, 29 in 2015 per 1,000 live births, The State of The World's Children 2016, UNICEF) and the maternal mortality rate (472 in 2005, 161 in 2015 per 100,000 live births, ditto). On the other hand, there exist a huge gap between the province of Phnom Penh and other provinces, for example the under-5 infant mortality rate is 18 in the province of Phnom Penh as against 45 in Battambang, denoting a need for improvement of medical services in the provinces other than Phnom Penh.

The national health policy of Cambodia is currently in a state of waiting for the adoption by parliament of the Health Sector Strategic Plan 3, 2016-2020: HSP3, which aims for Universal Health Coverage (UHC) by adding Reinforcement of health system as a fourth priority area to the priority areas illustrated in the Health Sector Strategic Plan 2, 2008-2015: HSP2 ; ① Maternal and child health (expectant and nursing mothers and infants' health), ② Infectious diseases (HIV/AIDS, malaria, tuberculosis, etc.) and ③ Non-contagious maladies. Furthermore, to achieve this goal, 7 strategic areas are designed adding medical supplies support and infrastructure improvement (facility, equipment and information) to the 5 cross-sectional strategies over different areas (health service delivery, health financing, human resources, health information and governance).

Battambang Province, target area of this Project, is located in northwestern Cambodia sharing its border with Thailand, covering 1,166 km<sup>2</sup> of land area and numbering a population of 1.173 million (2016, Battambang PHD). The capital city of the province, Battambang, located about 300 km northwest of Phnom Penh is the second-largest city in Cambodia. Although the suburbs of the city were the last outposts of the anti-government organization (Pol Pot force), Battambang has been developing since the annihilation of the said organization as the central city in the northwest region. As a logistical transitpoint in the the southern economic corridor, the economic growth of Battambang Province is expected to result in increased population inflow and number of traffic accidents, which may lead to an increase in demand for medical care.

The Battambang Provincial Hospital is a top referral hospital in the province and supposed to play a pivotal role in health-care in the second-largest city in Cambodia and as a core hospital in the northwest region of Cambodia. However, it has problems such as the progression of deterioration due to age since it had been constructed in the 1940's, the insufficiency of hygiene management, the lack even of covered walkways linking scattered buildings leading to the difficulty in providing efficient services. The 2-story building, which includes Surgery department, Obstetrics/Gynecology department, Operation theater, X-ray room, was constructed in 1967 and renovated in 2011 by University Research Co., LLC (URC), shows a shortage of beds in Surgery ward and beds are laid outdoors under the piloti. The

General Medicine ward is scattered into 4 buildings, which makes intra-service coordination difficult and, in addition, each of those buildings show deterioration since they had been constructed in 1969 and 1985 and in 1988 and although renovation works including wall repaint has been executed between 2010 and 2011. The Pediatric ward, constructed in 1991 and renovated in 2012 by UNICEF, shows also pronounced deterioration. In addition, the Outpatient ward was constructed in 2010 with an emergency room included inside shows functional problems such as the distance separating the room from the operation theater.

Under these conditions, the Government of Cambodia requested grant aid from the Government of Japan for the development and maintenance of Battambang Provincial Hospital, which is a top referral hospital in the province, with the purpose of improving health care conditions in the Battambang Province.

The outline of the request to Japan in the request form is as shown below.

**[Facilities]**

Facility construction, including the following departments 4,288 m<sup>2</sup>

Internal Medicine, Pediatrics, Surgical, Emergency, ICU, ENT, Operating Room, Imagery, Examination, etc.

**[Equipment]**

Necessary equipment for the above facilities, based on the medical facility standard equipment lists from Cambodia.

**[Soft Components]**

Technical guidance for proper use and maintenance of medical equipment.

## **1-2 Environmental Conditions**

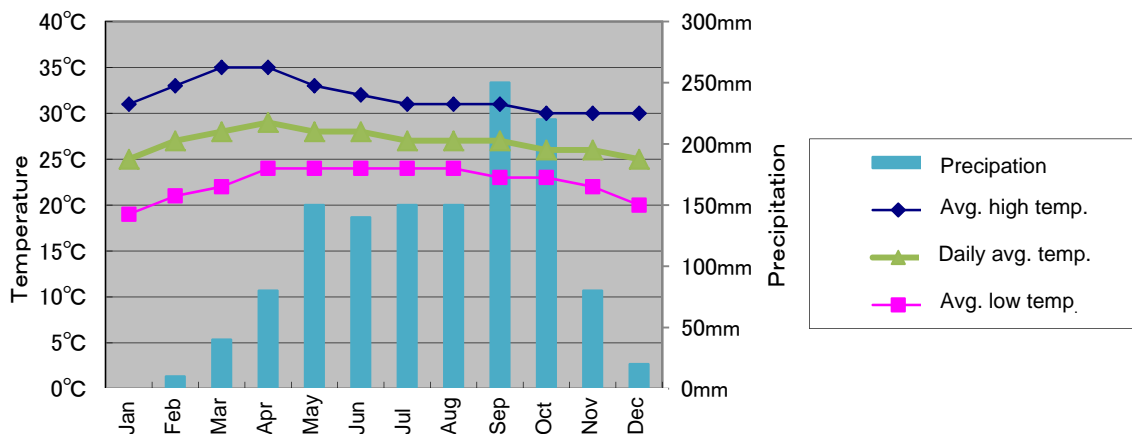
### **(1) Weather**

Battambang falls under “Aw” (savanna climate) according to the Köppen-Geiger classification, with the year broadly divided into the wet season in May-November and the dry season in November-April. The annual precipitation is approximately 1,290 mm, with 90% occurring in the wet season. Although the annual average temperature is around 27°C temperatures can exceed 40°C in the hottest season which corresponds to the period from the last half of the dry season in March to the beginning of the rainy season in May.

**Table 1- 1 Weather Data for Battambang City**

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual average Annual Total
Record high	37°C	38°C	40°C	41°C	40°C	38°C	36°C	35°C	34°C	33°C	33°C	35°C	36.7°C
Avg. high	31°C	33°C	35°C	35°C	33°C	32°C	31°C	31°C	31°C	30°C	30°C	30°C	31.8°C
Avg. temperature	25°C	27°C	28°C	29°C	28°C	28°C	27°C	27°C	27°C	26°C	26°C	25°C	26.9°C
Avg. low	19°C	21°C	22°C	24°C	24°C	24°C	24°C	24°C	23°C	23°C	22°C	20°C	22.5°C
Record low	10°C	14°C	16°C	16°C	18°C	21°C	21°C	22°C	20°C	19°C	12°C	10°C	16.6°C
Precipitation	0mm	10mm	40mm	80mm	150mm	140mm	150mm	150mm	250mm	220mm	80mm	20mm	1290mm
Avg. humidity	67%	66%	67%	67%	73%	75%	79%	80%	83%	83%	79%	75%	75%

Source weatherbase.com



Battambang Provincial Hospital abuts on the Sangkae River across a road on its southeast side but there have been no damage by flood/ inundation of the river in the past. However, considering the recent abnormal weather occurring on a global scale, and in preparation for the rare event of flooding, the new buildings to be constructed for this Project will have the ground floor height 500 mm above the ground level and the installation level for power receiving facilities will be raised by machine foundations so that they will not be damaged by flood disasters.

Battambang Provincial Hospital suffered in the past damages of trees and the kitchen (V building) by lightning strikes. This Project will install a lightning rod so that new buildings to be constructed will not be damaged by lightning strikes.

**(2) Natural Environment Surveys**

A recommissioned survey including a topographical survey, geographical survey, exploratory drilling, and water quality test was conducted focusing on the construction site on the property of the Battambang Provincial Hospital.

**1) Topographical Survey**

Battambang Provincial Hospital is located north of Battambang city, at the intersection of National Route 5 and the Sangkae River, which is part of the Southern Economic Corridor (Phnom Penh to Poipet to Bangkok). The hospital property is shaped roughly like a trapezoid, with a base length of about

200 m and 260 m and leg lengths of about 230 m each, and the area of the property is 54,620 m<sup>2</sup>. The property is flat, surrounded by a fence, and has facilities dotted across the property.

The planned construction site of this project is a corner on the southeastern side of the hospital property, on the north side of the outpatient building located immediately inside the front gate on the south side. The Ministry of Health and the hospital have confirmed that it is property owned by the hospital.

Currently, drug storage is built on the planned construction site. It has been agreed that this storage, along with an ambulance parking lot, pavement, trees, etc. will be removed and the site prepared by the Cambodia side before the bidding for facility construction.

## 2) Geological Testing

According to five boring surveys conducted at a depth of 20 m and 1 boring survey at a depth of 60 m in the planned construction site, the geological stratum of the site comprises a surface layer of about 2.0 m depth that is soft, viscous soil, under which is hard viscous soil. In some areas, a soft viscous soil reached down to 4.0 m from the surface, under which sandy, denser soil was observed. The N level is about 2 to 3 down to 2.0 m beneath the surface, 2 to 8 at around 3.0 m beneath the surface, 7 to 8 at around 4.0 m beneath the surface, and 7 to 14 at around 5.0 m beneath the surface. At depths of 4.0 m or more beneath the surface, layers with relatively high N levels are deposited, and therefore the plan is to improve the ground by compaction using sand and gravel from the foundation bottom to a depth of 4.0 m from the ground surface. Cambodia is far removed from the circum-Pacific seismic zone, thus there is no record of past earthquake damage. The borehole groundwater level observed in the boring survey was 0.7 to 1.2 m deep from the ground surface, and is located in the surface layer, thus a pressure-resistant plate is planned for the structural slab.

## 3) Exploratory Drilling

At the site planned for the construction of the project, exploratory drilling was conducted at 4 locations, 2 m square at a depth of 2 m. As a result, a currently unused old water pipe was found, but the drilling did not find any buried objects such as currently used water supply or drainage pipes or buried electric piping, nor did it find any rocks or foundations.

## 4) Water Quality Survey

The existing hospital is served by Battambang city water. Water used in the water quality survey was sampled from two places, one at the receiving tank water supply port and the other at an outdoor faucet after passing through the elevated tank. In the results of the water quality survey, water sampled from the receiving tank water supply port had residual chlorine concentration and color, and water sampled from the outdoor faucet after passing through the elevated tank had E. coli, color, and turbidity. Thus it was confirmed that neither sample met Cambodian water quality standards. The water supply facilities of the project will branch from the city water inlet pipe into the hospital property. The plan is to install a new receiving tank for the facilities under the project and to plan measures against the residual chlorine concentration in city water. The color of the city water is presumed to be due to the deterioration of

public water pipes. Because the water main is currently being updated under Japanese aid, improvements can be expected in the future. Furthermore, the combination of facilities prepared by the project with the existing facilities will provide sufficient water supply volume is for use in the hospital overall.

### 1-3 Environmental and Social Considerations

Since this project is for the construction of a hospital on preexisting hospital grounds, there is little environmental and social effect on the site and its surroundings; therefore the project is assessed as “Category C” according to the “JICA Guidelines for Environmental and Social Considerations”.

The project involves a hospital, thus the Environmental Act stipulated by the Ministry of Environment of Cambodia does not require an Environmental Impact Assessment (EIA). Similarly, since the land area of the project is less than 8,000m<sup>2</sup>, it is small enough that an EIA for general architectural structures is not required.

Regarding gender consideration, hospital personnel are often women, under the direction of the Battambang Hospital Director, and they are given consideration in hospital administration. More importantly, it is the patients and their attendant families that need to be enlightened. For instance, despite signage indicating that toilets and showers in a ward are separated for men and women, that signage is completely ignored.

### 1-4 Other (Global Issues, etc.)

The MDGs to UHC can be cited as trends of aid in global issues and in the health sector related to the project. Under the United Nations Development Program (UNDP) carried out from 2000 through 2015, the MDGs targeted infants, children under 5 years of age, pregnant women, HIV infected people, and the weak amongst the poor. In undertaking the MDGs, UHC is the concept proposed to achieve the MDGs. UHC, proposed by the WHO in 2005, means that “...all people and communities can use the promotive, preventive, curative, rehabilitative and palliative health services they need, of sufficient quality to be effective, while also ensuring that the use of these services does not expose the user to financial hardship.” At the United Nations General Assembly in December 2012, a resolution was made to promote UHC, and the Japanese government also emphasized UHC promotion in the “Strategy on Global Health Diplomacy” announced in May 2013. Improvement of health systems, one of the 4 priority areas the HSP3, which is Cambodia’s health development plan, is none other than the incorporation of UHC promotion. SDG3, which is a health goal of the UNDP’s Sustainable Development Goals (SDG) from 2016 to 2030, is to “Ensure healthy lives and promoting well-being for all at all ages.”, and is realized through the achievement of UHC.

The promotion of UHC requires (1) facilitating physical access, (2) facilitating economic access, (3) facilitating social access, (4) facilitating qualitative access, and (5) facilitating sustainable access. To facilitate (1) physical access, it is important to develop infrastructure especially in rural areas and to secure health human resources. In addition to the plan for improving Battambang Provincial Hospital in

the project, the improvement plans thus far for Mongol Borei Hospital, Kampong Chhnang Provincial Hospital, Sihanouk Provincial Hospital, and Svay Rieng Provincial Hospital are also infrastructure improvements that facilitate physical access in rural areas. Improvement of facilities and provision of medical equipment in this project also contribute to facilitating (4) qualitative access. Battambang Provincial Hospital has established a hospital training department and is working to secure and improve the quality of human health resources, which is considered to contribute to UHC promotion from this point as well.

In order to facilitate (3) social access, it is important to educate residents and encourage local communities to eliminate habitual and cultural factors that hinder the use of health services. Japan has been implementing such activities under the “Project for Improving Maternal and Child Health Services in Rural Areas” as well as through community health-type technical cooperation projects. Furthermore, the creation of a national health insurance system is one method of facilitating (2) economic access. JICA implemented the “Data Collection and Confirmation Survey on Cambodia’s National Health Insurance System” in FY2015.



## **Chapter 2 Contents of the Project**



## Chapter 2. Contents of the Project

### 2-1 Basic Concept of the Project

#### 2-1-1 Overall Goal and Project Goal

The civil war in the Kingdom of Cambodia (hereinafter called “Cambodia”) since the 1970s brought the persecution of medical personnel and the destruction of medical equipment and facilities, which resulted in a delayed development of health care in the country. However, after the end of the civil war, the Cambodian government and the development partners including Japan have taken various actions to jack up the level of health care which produced a certain result in improvement of health indicators measured as a country; e.g. decreases of the under-5 infant mortality rate (117 in 1990, 29 in 2015 per 1,000 live births, The State of The World’s Children 2016, UNICEF) and the maternal mortality rate (470 in 2005, 161 in 2015 per 100,000 live births, ditto). On the other hand, there exist a huge gap between the province of Phnom Penh and other provinces, for example the under-5 infant mortality rate is 18 in the province of Phnom Penh as against 45 in Battambang, denoting a need for improvement of medical services in the provinces other than Phnom Penh.

The national health policy of Cambodia is currently in a state of waiting for the adoption by parliament of the Health Sector Strategic Plan 3, 2016-2020: HSP3, which aims for Universal Health Coverage (UHC) by adding Reinforcement of health system as a fourth priority area to the priority areas designated in the Health Sector Strategic Plan 2, 2008-2015: HSP2 ; ① Maternal and child health (expectant and nursing mothers and infants’ health), ② Infectious diseases (HIV/AIDS, malaria, tuberculosis, etc.) and ③ Non-contagious maladies. Furthermore, the addition of medical supplies support and development of health infrastructure (facility, equipment and information) to the 5 cross-sectional strategies over these areas (health service delivery, health care financing, health care human resources, health information, and governance) brings the number of strategies up to 7.

Battambang Province, target area of this Project, is located in northwestern Cambodia sharing its border with Thailand, covering 1,166 km<sup>2</sup> of land area and numbering a population of 1.173 million (2016, Battambang PHD). The capital city of the province, Battambang, located about 300 km northwest of Phnom Penh is the second-largest city in Cambodia. Although the suburbs of the city were the last outposts of the anti-government organization (Pol Pot force), Battambang has been developing since the annihilation of the said organization as the central city in the northwest region. As a logistical transitpoint in the the southern economic corridor the economic growth of Battambang Province is expected to result in increased population inflow and number of traffic accidents, which may lead to an increase in demand for medical care.

The Battambang Provincial Hospital is a top referral hospital in the province and supposed to play a pivotal role in health-care in the second-largest city in Cambodia and as a core hospital in the northwest region of Cambodia. However, it has problems such as the progression of deterioration due to age since it had been constructed in the 1940’s, the insufficiency of hygiene management, the lack even of covered walkways linking scattered buildings leading to the difficulty in providing efficient services. The 2-story building, which includes Surgery department, Obstetrics/Gynecology department, Operation theater, X-ray room, was constructed in 1967 and renovated in 2011 by

University Research Co., LLC (URC), shows a shortage of beds in Surgery ward and beds are laid outdoors under the piloti. The General Medicine ward is scattered into 4 buildings, which makes intra-service coordination difficult and, in addition, each of those buildings show deterioration since they had been constructed in 1969 and 1985 and in 1988 and although renovation works including wall repaint has been executed between 2010 and 2011. The Pediatric ward, constructed in 1991 and renovated in 2012 by UNICEF, shows also pronounced deterioration. In addition, the Outpatient ward was constructed in 2010 with an emergency room included inside shows functional problems such as the distance separating the room from the operation theater.

Under these conditions, the Government of Cambodia requested grant aid from the Government of Japan for the development and maintenance of Battambang Provincial Hospital, which is a top referral hospital in the province, with the purpose of improving health care conditions in the Battambang Province.

This Project will contribute to improving the delivery of health services, which is one of the seven cross-cutting strategies (health service delivery, health care financing, health care human resources, health information, governance, medical material supports and improving health structure) listed in the Second Health Strategic Plan 2008-2015 (HSP2) and the Third Health Strategic Plan that is set to start in 2016 (HSP3). These plans are designated as national health projects by the Government of Cambodia. Strategies for the delivery of health services include strengthening the implementation of CPA<sup>3</sup> in referral hospitals like Battambang Provincial Hospital, as well as strengthening the system for delivering medical services and the referral system.

The purpose of this Project is to improve health care conditions in Battambang Province. As a top referral hospital in the province and core hospital in the northwest region of Cambodia, it will strengthen the medical referral system and contribute greatly to the improvement of medical services. Additionally, the Project is judged to have a high level of necessity and relevance, since it will also enhance the health care environment. By implementing this Project, the health systems of the hospital will be enhanced and the health situation of the Region including neighboring provinces will be improved.

The Overall Goal and Project Goal of this Project are summarized below.

**Table 2- 1 Overall Goal and Project Goal**

	Medical Service
Overall Goal	To improve the health systems of Battambang province and neighboring regions, thereby contributing to the improvement of the overall health situation.
Project Goal	To improve the quality of medical service at Battambang Provincial Hospital.
Project Results	Battambang Provincial Hospital shall be provided with the necessary medical facilities and equipment.

<sup>3</sup> Complementary Package of Activities (CPA) is a guideline of primary (CPA1) to tertiary (CPA3) hospitals in Cambodia which defines the necessary medical services and equipment at each level. CPA3 hospital is a general hospital with specialty clinic such as Eye and ENT.

## 2-1-2 Outline of the Project

In order to achieve the goals noted above, the Project will provide facilities and equipment for the improvement and expansion of health care services required by Battambang Provincial Hospital as a CPA3 hospital and for functioning as core hospital in the northwest region of Cambodia.

The facilities and equipment implemented for the Project are outlined below.

### ■ Facilities

**Table 2- 2 Outline of the Project (Facilities)**

Building	Department	Major Rooms	Floor Area
Central Clinic/ Surgery Building	ER	Treatment Room, Consultation Room, Observation Room (ICU), Staff Station, Staff Duty Room	565.09m <sup>2</sup>
	Imagery Dept.	X-ray Room, Ultrasound Room, Film Storage, Reception, Patient Waiting, Staff Duty Room	144.26m <sup>2</sup>
	Ear, Nose, and Throat	Consultation/Treatment Room, 4-bed ward, Reception, Patient Waiting, Staff Duty Room	141.43m <sup>2</sup>
	Laboratory	Biochemical Examination Room (including general, blood and pathological examination), Culture Room (bacterial examination), Media Prep Room, Sterilization Room, Specimen Collection Room, Administration Office, Reception, Staff Duty Room	205.83m <sup>2</sup>
	Pharmacy Dept.	Pharmacy, Storage, Administration Office, Staff Duty Room	120.74m <sup>2</sup>
	Operation Dept.	Operation Theater, Recovery Room (ICU), Pre-op Room, Staff Station, Changing Room, Conference Room, Staff Duty Room, Machine Room, Intern Room	968.92m <sup>2</sup>
	Central Sterilization Dept.	Central Cleaning/Sterilization Room, Clean Storage, Laundry, Administration Office, Staff Duty Room	266.85 m <sup>2</sup>
	Outpatient Dept.	Outpatient Consultation/Treatment Room, Plaster Room, Urology / Hemorrhoid Consultation Room, 6-bed ward, Private Room, Staff Station, Staff Duty Room, Shower Room, Toilet	1179.77m <sup>2</sup>
	Others	Hallway etc.	135.89m <sup>2</sup>
Central Clinic/ Surgery Building Total			3,728.78m <sup>2</sup>
Internal Medicine ICU/Energy Center Building	Internal Medicine ICU Dept.	ICU, Isolation Room, Staff Station, Staff Duty Room, Storage	376.16 m <sup>2</sup>
	Energy Supply Dept.	Water Tank, Pump Room, Medical Gas Room, Electrical Room,	215.74 m <sup>2</sup>
Internal Medicine ICU/ Energy Center Building Total			591.90m <sup>2</sup>
Entrance Building	Entrance Hall, Slope, Elevated Water Tank		773.85 m <sup>2</sup>
Others	Walkway, Septic Tank		94.81m <sup>2</sup>
Grand Total			5,189.34m <sup>2</sup>

■ Equipment

**Table 2- 3 Outline of the Project (Equipment)**

Department	Major Equipment
Outpatient Dept.	Ultrasound Machine, Hemorrhoidectomy Set
Emergency Dept.	Ventilator, Emergency Bed, Patient Monitor, Aspirator
Operation Dept.	Anesthesia Machine, Ventilator, Infusion Pump, Operating Table, C-arm X-ray Machine, Electrical Surgical Unit
Operation Dept. (Recovery Room)	Patient Monitor, Stretcher, ICU Bed
Central Sterilization Dept.	Autoclave (Large), Autoclave (Medium), Washing Machin, Dryer
Imagery Dept.	General X-ray Machine, Ultrasound Machine, CR System, PACS
Pediatric Dept.	Syringe Pump, Nebulizer, Patient Monitor, CPAP, Infant Incubator
Internal Medicine Dept.	Holter ECG, Aspirator
Internal Medicine ICU Dept.	Ventilator, Aspirator, Patient Monitor, ICU Bed
Ear, Nose, and Throat	ENT Unit, Endoscope Surgery Set for ENT, Surgical Instrument Set for Ear
Laboratory	Semi-auto Biochemistry Machine, Hematology Analyzer, Laboratory Table
Pharmaceutical Dept.	Medical Refrigerator, Storage Shelves, Working Table

■ Technical Assistance (Soft Component)

- Technical Assistance on CR system and Picture Archiving and
- Support to establish a system for Laboratory waste liquid treatment

■ Maintenance Service of the Equipment

The Supplier shall provide maintenance services for the selected 8 items which requires the service. The maintenance services shall include periodic inspection for 3 years after the handover and on-call service for 2 years after guarantee period. This includes the expense to repair and replace parts. Every expense for consumables such as reagents, disposables parts, etc. shall be borne by user.

## 2-2 Outline Design of the Japanese Assistance

### 2-2-1 Design Policy

As a core hospital in the northwest region of Cambodia, patients at this hospital are seen through introductions from lower medical institutions within the province. However, due to the shortage and deterioration of its facilities and equipment, it is not necessarily fulfilling its role sufficiently. From among the patients introduced from lower medical institutions, if it is too difficult to treat patients in critical condition or emergency patients at Battambang Provincial Hospital, they are transported to the national hospital in Phnom Penh. Additionally, since there are currently only a few medical facilities in the province, many patients go directly to Battambang Provincial Hospital for treatment. The bed occupancy rates for the four principal departments (General Medicine, Surgical, OB/GY, Pediatrics) are shown in the table below and as it shows, there are increasing bed occupancy rate for Surgery and OB/GY departments, making the improvement of the medical care environment a pressing issue.

**Table 2- 4 Battambang Provincial Hospital Average Length of Stay and Bed Occupancy Rates for four principal departments**

Number of beds as of 2016		2011	2012	2013	2014	2015	2016 (Jan. - May)
General Medicine Department 66 beds	ALOS	5.5	5.6	5.6	5.6	7.4	5.4
	BOR	70.9	79.5	78.4	87.2	89.0	91.6
Surgery Department 50 beds	ALOS	8.6	8.8	8.9	8.7	8.5	9.6
	BOR	98.1	102.4	106.6	129.9	142.2	148.4
OB Department 34 beds	ALOS	3.7	3.6	3.8	3.6	3.7	3.9
	BOR	97.9	103.3	111.2	101.4	109.1	104.9
GY Department 10 beds	ALOS	6.6	7.0	7.0	6.6	6.2	6.6
	BOR	67.2	78.6	84.8	103.6	96.2	106.5
Pediatric Department 27 beds	ALOS	5.2	4.0	4.0	4.2	3.8	3.4
	BOR	82.9	77.5	52.5	54.5	70.3	51.1
Total 270 beds*	ALOS	6.2	5.8	5.7	5.7	5.7	5.7
	BOR	78.5%	85.1%	84.0%	86.0%	90.0%	86.3%

ALOS: Average Length of Stay (Day)

BOR: Bed Occupancy Rate (%)

Source: Calculation made by the Study Team on the Battambang Province Hospital's Data

\* The number of total beds includes those of departments other than 4 principal departments, such as tuberculosis, ophthalmology, ENT, Leprosy.

This Japanese Grant Aid will directly strengthen the medical referral system in Battambang Province and the northwest region of Cambodia and contribute greatly to the improvement of medical services. Indirectly, it will contribute to the development of medical personnel such as nurses and midwives from Battambang Province and neighboring provinces, since Battambang Provincial Hospital will be a teaching hospital as well. In order to fulfill these objectives, the design of the facilities was planned based on the following policy.

## (1) Basic Policy

### 1) Site Selection

The existing buildings scattered within the precinct of Battambang Provincial Hospital make difficult to secure sufficient space for construction. Site selection was conducted based on the policy described below.

- ① For the benefit of the Cambodia side, planning will be conducted within a scope such that facilities to be removed are kept to a minimum, and so that construction work does not interfere with medical care activities.
- ② Traffic paths between new and existing buildings used by patients and staff will be planned in a manner keeping distances to a minimum.

### 2) Facilities

The scope and scale of cooperation were configured based on the following basic policies.

#### ① Policy for selecting target components

Scattering of facilities in the precinct of Battambang Provincial Hospital makes traffic paths used by patients, staff and specimens very long, which hinders efficient operation. The scattering of buildings is found even within the same department, and this combined with the absence of cover over corridors between buildings makes very difficult transporting patients on stretcher or the like especially in the rain. In addition, the hospital facilities have various problems such as the deterioration of the existing buildings themselves and the lack of bed space for inpatients in some wards where BOR exceeds 100% (See Table 2-5 for problems in each department). In order to solve those problems so that Battambang Provincial Hospital will be able to implement efficiently and functionally CPA3 level medical activities, the basic policy of this Project is to select; ① the departments necessitating improvement to reorganize hospital functions by reintegrating the scattered facilities, ② the departments of which facilities are deteriorated, ③ the departments lacking space, ④ the departments having difficulty/inconvenience in implementing medical activities, as the target components of the Project.

On the other hand, the departments whose problems can be resolved by simple renovation or relocation without big burden are considered as components to be implemented by Cambodia side, while departments which can not be improved by simple renovation or relocation such as operation department, and departments which will enable the whole hospital operation to perform more effectively and efficiently if the existing buildings are organically united by constructing new facilities therein, will be selected as components to be included in the Japanese assistance. Furthermore, departments subject to cooperation by other donors will be excluded from this Project to avoid overlap.

#### ② Policy for setting the scale

The planned scale will be set based on the number of patients forecast for a target year 2020, 3 years after the completion of the Project. The projection for the number of patients will be estimated based on the current increase rate of patients and by taking into account the inflow of patients from other provinces motivated by the facility/equipment improved by this Project.



### 3) Equipment

- ① Equipment will be selected according to the Medical Equipment Standard for CPA 3 Referral Hospital First Edition, 2014 (Medical Equipment Standard List) formulated by the Ministry of Health, and plans will fully consider such things as technological innovations t expected to improve the effectiveness and efficiency of current clinical services.
- ② Taking into consideration the role played by the target hospital in its area, plans will apply to ENT, dental and laboratory departments that currently lack critical equipment, though their facility buildings are not in the scope of the project.
- ③ Plans will keep consistency with activities of the target hospital.
- ④ Plans will take consideration of easy maintenance for the targeted hospital by such as selecting equipment in proper level.
- ⑤ Plans will avoid overlaps with existing equipment or equipment supplied by other donors to ensure efficiency.
- ⑥ For essential machinery, including sophisticated equipment and that for which serious problems would arise if malfunctions occurred, maintenance management contracts will be concluded with manufacturers or local agents for 3 years after delivery. This cost will be borne by the Japanese side. Maintenance contacts will include 3 types of service: cost of periodic inspection service, for which a technician will visit the hospital at regular intervals to inspect and calibrate equipment, cost of on-call service, for which equipment inspection will be conducted at the request of the user when equipment fails, etc. and cost of repair and replacement parts.

### (2) Policy on Natural and Environmental Conditions

#### ① Policy on weather conditions

Downpours accompanied by lightning and strong winds are often observed during the wet season. Therefore, roofs have protruding eaves, walls are finished with materials supposed to be waterproof to prevent mold from growing by rainwater penetration. Additionally, sunlight exposure and natural ventilation are taken into account for planning finishing materials in order to combat high humidity, especially in rooms where air conditioning facilities are not installed.

#### ② Flood countermeasures

Battambang Provincial Hospital abuts on the Sangkae River across a road on its east and south sides but there have been no damage by flood/ inundation of the river in the past. However, considering the recent abnormal weather occurring on a global scale, and in preparation for the rare event of flooding, the new buildings to be constructed for this Project will have the ground floor height 500 mm above the ground level and the installation level for power receiving facilities will be raised by machine foundations so that they will not be damaged by flood disasters.

#### ③ Measures against lightning strikes

Battambang Provincial Hospital suffered in the past damages of trees and the kitchen (V building) by lightning strikes. This Project will install a lightning rod so that new buildings to be constructed will not be damaged by lightning strikes.

#### ④ Other policies

- Plans will put precedence on properties of waterproofing, insulation, durability and other functional aspects, allow for the selection of materials that are relatively easy to maintain and enable the grade to be maintained.
- Plans will provide relatively large eaves against sunlight and rain and will prevent the exterior walls from dirtiness and leakage due to rain while making the most use of natural ventilation.
- Direct sunlight during the dry season (December through April) can cause temperatures to rise over 40°C, so the roof will be insulated and a gallery will be built to ensure sufficient ventilation beneath the roof.
- Windows will use the aluminum frame good for natural lighting intake and ventilation and excellent in durability.

### (3) Policy on Social and Economic Condition

Steeply sloped roofs and raised, wooden floors are characteristic of the construction style of the average private residence in Cambodia. The style seems to incorporate considerations for wind passage, waterproofing and other natural conditions. Pagoda construction also features steeply sloped roofs stacked up in many layers, which is adopted for temples. In olden times, temples were built with wood and brick; now, the relatively new construction style calls for temples to be built mostly of reinforced concrete with complex, light structural steel roofs.

These plans will rely on general construction methods in the local area and call for reinforced concrete rigid frames, outer walls made of brick. The exterior walls will be finished with mortar and washed gravel for beauty and durability, which is the current construction method in Cambodia. Roofs will be sloped and consist of cement tiles conforming to the townscape and a space will be left inside the roof for the purpose of insulation.

### (4) Policy on Construction and Procurement Conditions

#### 1) Facilities

As very few large-scale construction projects take place in the countryside urban areas outside of the Cambodian capital of Phnom Penh, there are not sufficient skilled workers in the countryside. Most of the skilled workers involved in construction are to be dispatched from Phnom Penh, while normal and light-duty workers will be procured from areas around the project site. For this Project, by adapting construction method generally used in the region, complicated and difficult construction which need Japanese engineers or from third country can be avoided. However, since the target hospital is a top referral hospital, skilled workers from Phnom Penh will be necessary.

All of the major construction materials used in the Project will be procured within Cambodia. Construction materials made in Cambodia are limited to aggregate, lumber, bricks, unglazed roof tile, and concrete blocks, etc. And other materials are imported goods from Thailand or Vietnam, but these goods are in general circulation through local sales agents.

## 2) Equipment

In general, equipment will be procured from Japan or locally, but the scope of procurement will be spread to include other countries if the competitiveness of equipment cannot be ensured in the course of bidding. However, regarding equipment require consumables or repair service from an agent in trouble, appropriate care will be taken to select the equipment handled by the agent locally or in surrounding countries to ensure smooth operation and maintenance.

## (5) Policy on Utilization of Local Contractors

### 1) Facilities

There are around 200 local construction companies in Cambodia, and 5 or 6 Japanese construction companies have made a foray into Phnom Penh. Some local construction companies have experience in construction works under Japanese construction companies within the framework of grand aid projects. The assumption of this project is to design facilities by using locally common construction method so that they can be constructed with the technological level of Cambodian construction companies, and to leave the construction work in local construction companies care under management of Japanese construction company.

### 2) Equipment

It has been confirmed that the manufacturers of the medical equipment to be procured under this project have local agents for equipment that requires after-sales services. It has been also confirmed the local agents in Phnom Penh had hired experienced engineers with the sufficient operating and installing skills and experience and were able to provide spare parts and other after-sales services. Thus, it is planned to make full use of these local agents for installation and instruction of operation. Additionally, to ensure proper operation and maintenance of the equipment procured under this project, the Japanese side will conclude maintenance contracts for a period of 3 years for which after-sales service is deemed necessary. This equipment will include high cost equipment, lifesaving equipment, and precision equipment. Thus, it will be necessary to be taken into consideration such as to include conditions on procuring equipment which requires making maintenance service contract with local agents.

## (6) Policy on Operation and Maintenance Capacity of Cambodian organization responsible for implementation

### 1) Facilities

At Battambang Provincial Hospital 6 persons are stationed as maintenance personnel and simple repairs on infrastructure such as electricity, water, etc. and medical equipment can be handled by the hospital itself however repairs of building or equipment which require expertise are outsourced to contractors. It is difficult to say that the technical level of facility maintenance capacity is sufficient, which leads this plan to call for facilities to stay within the technical operation and maintenance abilities of current maintenance staff and for the selection of facilities and equipment with low maintenance costs. The plan also aims to cut down on running costs.

## 2) Equipment

The following points will be duly considered to make it possible for the Cambodian side to sustain operation and maintenance with their own system after equipment is procured:

- ① Equipment that does not require high cost for operation will be chosen.
- ② Specifications of equipment should be corresponding with the technical level at the target hospital.
- ③ Procurement plans will be taken into consideration to prepare adequate time to instruct how to operate equipment in installation such that operation and maintenance capability can be improved.
- ④ Due consideration will be given during the planning or implementing stage, so that equipment handled by appropriate agents locally or surrounding countries will be chosen.

## (7) Policy on Grade Setting for Facilities and Equipment

### 1) Facilities

The assumption on which the facility plan is based is the scale of medical care, such as numbers of patients and operations, corresponding to the projected demand for a target year 2020, 3 years after the completion of this Project, estimated on the basis of the current increase rate of patients and also by taking into account the inflow of patients from other provinces motivated by the facility/equipment improved by the Project. The facility plan adopts the following policies.

- ① In the course of implementing this project, CPA guidelines shall be treated as the major basis for planning conditions. The content of these guidelines shall be fully understood and basic plans that conform to them shall be developed after considering the results of surveys pertaining to issues facing Battambang Provincial Hospital and the state of medical care in the province. The major criteria related to facility planning contained in the CPA Guidelines are as follows.

#### **CPA Facility Standards (excerpted)**

i	The total floor area of the hospital shall be 40 m <sup>2</sup> or more per bed.
ii	Guidance signs shall be easy to understand and written in both English and Khmer.
iii	Natural ventilation will be used, with the minimum ceiling height for habitable rooms with natural ventilation set at 4 m or more.
iv	In areas where flooding is expected, the floor height shall be elevated 2 m from the ground.
v	Door will be double doors, with each door having a width of at least 90 cm and 30 cm, totaling 1.20 m or more.
vi	Fire fighting vehicles must be able to approach all buildings.

- ② Establishing a plan of new facilities effective and efficient in terms of traffic paths of staff and coordination between departments and existing buildings in order to improve the effectiveness of clinical services through consolidating hospital functions.
- ③ To keep space for the future extension on the hospital premises, multi-story building will be planned for the new facilities and layout plan will be such that vertical access such as elevators and slopes are well located.
- ④ The bulkiness of the buildings will be kept to a minimum, and visual harmony with the existing buildings on the site will be taken into account.

- ⑤ Some private rooms will be provided in the Surgery ward for the purposes of accommodating isolation needs or increasing hospital revenue.
- ⑥ Facility grades and scales will be such that operation and maintenance expenses are not excessive.
- ⑦ As the top of RHs in the province, the structure will be strong enough to function as a critical location for treatment and recovery in case of disasters. Facilities will be planned to allow for continuous medical activities by securing infrastructure during disasters through the installation of an elevated water tank and an emergency power generator.
- ⑧ X-ray rooms will be provided with adequate radiation protection so as to eliminate the risk that nearby patients, family members and staff would be exposed to radiation.
- ⑨ Ultrasound Room and X-ray rooms to be built newly will be placed near the CT imaging room in the existing Outpatient department so that these rooms will be assembled into an Imaging diagnostics department to strive for efficient operation
- ⑩ The plan will take students' training into account by improving the cramped clinical and nursing environment as teaching hospital by for example providing training rooms and meeting rooms.

## 2) Equipment

Equipment plans will be developed based on CPA guidelines put forth by the Ministry of Health. Standard list shows descriptions and specifications as well, and the equipment from these plans will match the grades and specifications put forth in those standards. However they do not necessarily fit the current technical level or activities of the target hospital. Thus, these standards should serve as a reference while developing equipment plans, but appropriate grades should be selected with existing equipment at similar facilities and the activities and technical abilities of staff members at the target hospital in mind.

## (8) Policy on Construction/Procurement Methods and Schedule

### 1) Facilities

By taking full account of the scale, durability, safety, constraints of construction work, future maintenance of the buildings, the facility plan will use construction methods commonly practiced locally. Given that most of common construction materials, including not only structure and finishing material but equipment/machines, can be procured in Cambodia, materials will basically be procured locally. However, most of construction materials available on local markets depend on imports from neighboring countries and a large scale construction requesting a huge quantity of materials like this Project may cause a shortage of stock. Hence, the procurement plan should allow surplus to accommodate construction schedule. As for construction schedule, the construction will commence from the beginning of the dry season so as to avoid that the rain affects foundation work and an appropriate construction schedule, which takes labor procurement status and construction capacity into account, will be prepared.

### 2) Equipment

Precision equipment that could have a huge effect on human life are abundant among medical equipment. Thus, equipment of high quality and precision must be selected and procured and engineers

familiar with said equipment must install and adjust it. It follows that careful consideration will be given such that equipment for this project is procured by experts with a wealth of experience procuring medical equipment for Japanese grant aid project. In addition, since this project concerns both facilities and equipment, schedules for equipment procurement, installation and such must coordinate properly with facility construction schedules and actual progress. Thus, those involved in equipment procurement will coordinate closely with those involved in the work for facilities, giving care to appropriate construction schedules.

## 2-2-2 Basic Plan (Construction Plan/ Equipment Plan)

### (1) Site/Facility Layout

#### 1) Layout Plan

The grounds proposed in the request as the planned construction site were located near the front gate on the south side of the compound in a way to stride over the driveway running north-south on the central part of the compound (See figure 2-3 left). However, Battambang Provincial Hospital confirmed during the field survey that they expect either of the portions, western or eastern, of the grounds divided by the driveway to be the construction site, because they want to avoid hindrance to traffic by a interruption of the driveway and obstruction by buildings at the front of the compound, and also to secure grounds for future extensions.

On the other hand, the mission has proposed the unoccupied ground at the end of the compound as the site for the new building because it is preferable that the function of Central clinical center planned to be integrated in the new building is adjacent to Obstetrics/Gynecology department (See Figure 2-3 center). However, it was decided to consider as the construction site either western or eastern portion of the grounds as desired by the Cambodian side in view of the conclusion that the relocation of the surgical operation section to a distant location from Obstetrics/Gynecology department will not comprise a major obstacle to clinical services in Obstetrics/Gynecology department since its operation section is independent and separated from the surgical operation section, and also because of a strong desire of the Cambodian side to construct on the said ground a medical faculty of university in the future. As a result, it was agreed with the Cambodian side to use the east part of the grounds in consideration of the link with Outpatient department but discussions were made with the Cambodian side upon use or demolition of the existing buildings in order to secure grounds large enough to this Project (See Figure 2-3 right).

As a result, it was decided that the plan will be prepared so that the building comprising the pharmacy (L1 building) will not be demolished since it is a historic building, the pharmacy storage (L2 building) will be demolished to be integrated on the planned construction site, and the existing General Medicine ward (H building) will not be demolished but used so as to minimize demolition/relocation of existing buildings, to reduce the amount of items for which the Cambodian side is responsible and make it easier for the hospital to continue activities during the period of construction.

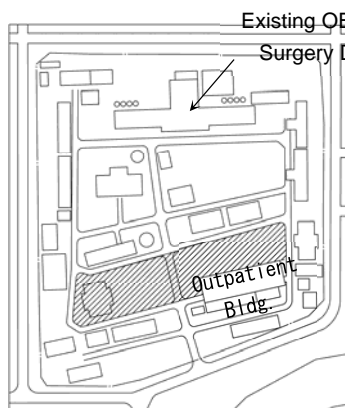


Figure 2- 3 Planned Construction Site in Written Request

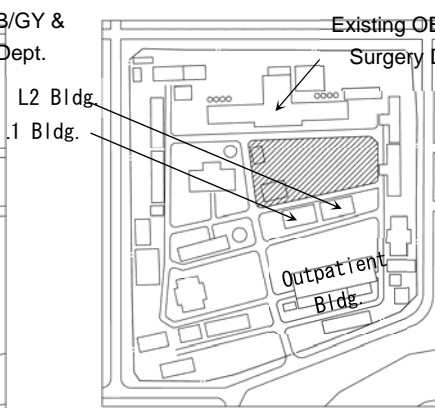


Figure 2- 3 Original Proposed Construction Site of the Study Team

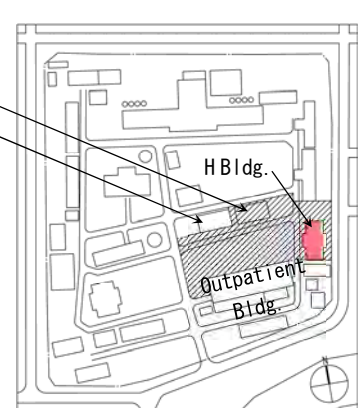
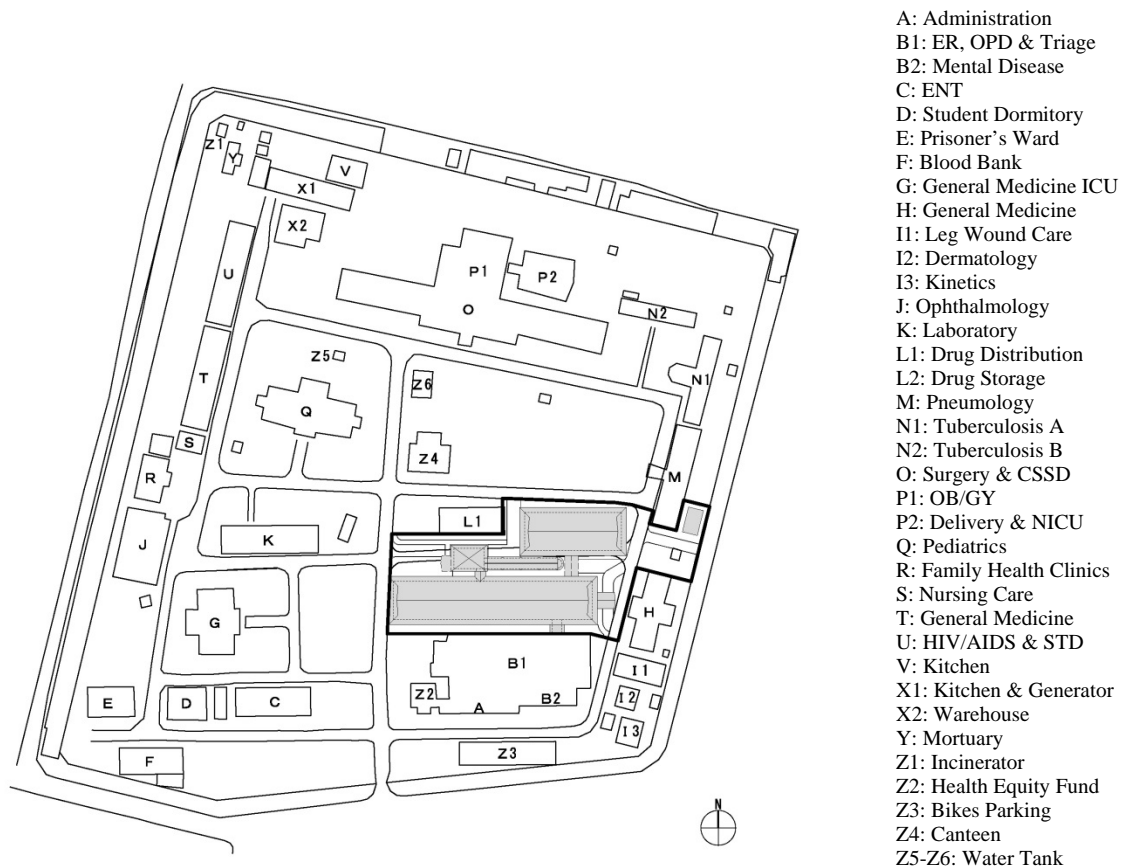


Figure 2- 3 Construction Site Finally Agreed Upon

The plan will be prepared so as to ensure good access from/to the existing Outpatient ward from/to the new central clinical center to be provided under this Project by placing the new building adjacent to the existing Outpatient ward, and to be able to provide efficient medical services by integrating the new Imaging diagnostics department to be provided under this project into the CT imaging room now being installed by linking them with a covered walkway.

The plan will be prepared so as to assemble General Medicine services scattered in the compound by using the existing General Medicine wards on the east side of the compound, and by relocating the General Medicine ICU ward to a place near to these existing General Medicine wards and with good access from the new Central clinical center to be provided. The plan will be prepared so as to have a Maternal and child health department by relocating the Surgical ward to a place with good access from the Central clinical center in the new building, and then relocating the Pediatric ward to the space left by the Surgery ward of the existing Gynecology/Surgery ward which will become a Gynecology/Pediatric ward.



**Figure 2- 4 Planned Hospital layout Drawing**

## (2) Building Plan

### 1) Selecting Target Facilities (Components)

Although the Pediatric department was targeted as a component in the request, it was excluded from the objects of the Project because of the plan to relocate the Surgery department on the first floor of Gynecology/Surgery ward (O/P1 building) to the new facility, and following the agreement with the Cambodian side on the policy to assemble medical service functions for Maternal and child health into a



Gynecology/Pediatric ward by relocating the Pediatric ward to the space left by the Surgery ward of the existing Gynecology/Surgery ward.

It was also agreed with the Cambodian side to exclude the General Medicine ward from the target facilities of the Project and instead to make the most use of the low priority pharmacy storage and equipment maintenance workshop as well as the existing wards in view of the fact that the budget size of the Project cannot allow to include all the facility components requested since the facility plan will be based on the reduced building area, hence 3 stories building, in order to secure space future extensions.

The components among those requested departments, which will be included in the new building under the Project are as shown in Table 2-5. Providing these components will enable to assemble hospital functions and improve the efficiency of medical services.

As for the utilization plan of the rooms of existing facilities which will be vacant after the completion of the new facility, the following was decided as a result of discussion with the Cambodian side:

- the existing Emergency department (part of B building) → Medical Record Storage
- the existing Otorhinolaryngology department (C building) → Pharmacy storage
- the existing Laboratory (part of K building) → Extension of the tuberculosis testing department
- the existing Pharmacy management department (L1 building) → Pharmacy storage
- the existing Surgical department (O building, 1<sup>st</sup>. floor) → Pediatric department
- the existing Pediatric ward (Q building) → Accommodations for trainees

**Table 2- 5 Current and Post-Project Conditions for Requested Target Departments**

Request No.	Department	Current conditions (problems)	Japanese side facilities targeted for Project	Post-project
1.1	Emergency/ICU Dept.	<ul style="list-style-type: none"> <li>• Due to its location next to the main entrance of the existing Outpatient Building, there is an overlap of general outpatient traffic and emergency traffic.</li> <li>• Emergency/ICU is located far from the operating theaters and the Imagery Department, making emergency response difficult.</li> </ul>	<ul style="list-style-type: none"> <li>○ Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>• The entrances for the Outpatient Dept. and the Emergency Dept. will be clearly separated.</li> <li>• Imagery and Operation Dept. will be built in an integrated fashion, improving emergency response.</li> </ul>
1.2	Surgical Ward	<ul style="list-style-type: none"> <li>• Because there is a shortage of rooms, beds are set up in the pilotis area of the adjacent building and inpatients are placed there.</li> </ul>	<ul style="list-style-type: none"> <li>○ Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>• Rooms corresponding to the number of patients, including expected future increases, will be created.</li> <li>• Each room will have 6 beds and space for nursing, practical training, and accompanying family, etc. will be improved.</li> </ul>
1.3	Ear, Nose, and Throat Dept.	<ul style="list-style-type: none"> <li>• Due to its location away from the Central Medical Department, clinical service efficiency is poor.</li> <li>• In 2014, the building's walls, windows, and doors were painted, and roof was repaired, but 54 years of aging since construction has taken its toll.</li> </ul>	<ul style="list-style-type: none"> <li>○ Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>• Since it will be built adjacent to the Central Medical Department, clinical service efficiency will be improved.</li> </ul>

Request No.	Department	Current conditions (problems)	Japanese side facilities targeted for Project	Post-project
1.4	Operation Dept.	<ul style="list-style-type: none"> <li>Due to its location on the 1<sup>st</sup> floor of the same building as the Obstetrics Ward and the Surgical Ward at the inside of the hospital grounds, access from General Medicine, Pediatrics, and Emergency Dept., etc. is poor.</li> <li>Since there are no covered walkways in the hospital, patients are transported from General Medicine, Pediatrics, and Emergency Dept., etc. outside.</li> <li>Facilities are old, making it difficult to keep the rooms clean.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>Due to its central location with respect to the Emergency Dept., General Medicine, and the Surgical Ward, access from each department to the Operation Dept. will improve.</li> <li>Providing covered walkways will clearly separate clean and dirty traffic and will make it easier to maintain cleanliness in the Operation Hall.</li> </ul>
1.5	Pediatrics Dept.	<ul style="list-style-type: none"> <li>Because it was constructed in a location far from Obstetrics and Gynecology, it is difficult to provide maternal and child healthcare services.</li> <li>Although the building has been repeatedly repaired, 25 years of aging since construction has taken its toll.</li> </ul>	<ul style="list-style-type: none"> <li>Existing Building O will be renovated and ward will be relocated (Borne by Cambodian side)</li> </ul>	<ul style="list-style-type: none"> <li>The department will be relocated to existing Building O and integrated with Obstetrics and Gynecology, improving the provision of maternal and child healthcare services.</li> </ul>
1.6	Internal Medicine Dept.	<ul style="list-style-type: none"> <li>Since the department is distributed within the hospital grounds, clinical service efficiency is poor, for example access to the Central Medical Department is poor and collaboration among various departments is difficult.</li> <li>Despite the fact that the building was constructed nearly 50 years ago and has aged, the roof and finishes have been improved and it is in relatively good condition.</li> </ul>	<ul style="list-style-type: none"> <li>Existing Buildings H, M, N1, and T will be renovated (Borne by Cambodian side)</li> </ul>	<ul style="list-style-type: none"> <li>Since the Central Medical Department will be set up in the new building adjacent to the existing Building H, access will be improved.</li> </ul>
	Internal Medicine ICU	<ul style="list-style-type: none"> <li>Due to its location far from other medical wards and the Central Medical Department, clinical service efficiency is poor.</li> <li>Although the building was refurbished in 2011, the floor and wall tiles are broken, mold is growing on the walls and ceiling, and the building is significantly aging.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>Since it will be newly constructed adjacent to the existing Building H, cooperation with the Internal Ward will be improved.</li> <li>Since it is adjacent to the newly set-up Central Medical Department, access will be improved.</li> </ul>
2.1	Laboratory	<ul style="list-style-type: none"> <li>Since it is located far from other departments, access is poor and it is difficult to move specimens and patients.</li> <li>Some laboratories are extremely small and difficult to work in.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>Since the Laboratory will be located adjacent to the Central Medical Department and the Outpatient Department, access from other departments will be improved.</li> <li>Since an appropriately-sized laboratory will be provided, the work environment will be improved.</li> </ul>

Request No.	Department	Current conditions (problems)	Japanese side facilities targeted for Project	Post-project
2.2	Imagery	<ul style="list-style-type: none"> <li>There is an X-ray imaging room in the Surgical Ward on the 1<sup>st</sup> floor of the existing Building O, which houses X-ray imaging apparatus and radiation protection box, both of which were provided through Japanese Grant Aid.</li> <li>Since Imagery is located far from the Outpatient Department and Central Medical Department, patient travel between them is long and access is poor.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>Imagery will be relocated to a new building, improving cooperation with the Emergency Dept. and the Operation Dept. and connecting with the existing Outpatient Dept., improving access.</li> <li>An X-ray room protected from radiation will be provided, preventing operators from radiation exposure.</li> <li>Since Imagery will be located adjacent to the CT room (under construction at the existing facility), ultrasonic chamber, and X-ray imaging room, enabling centralized management of the Imagery Dept., which handles expensive equipment.</li> </ul>
2.3	Pharmacy Dept.	<ul style="list-style-type: none"> <li>Although renovation work has been done twice, 58 years of aging since construction has taken its toll.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>By relocating to the new building and becoming integrated as a Central Medical Department, clinical service efficiency will be improved.</li> </ul>
	Drug Storage	<ul style="list-style-type: none"> <li>30 to 40 t of pharmaceuticals, a 3-month supply used by the hospital, is stored here.</li> <li>Because Drug Storage will be constructed inside the newly-constructed grounds, this will be dismantled and removed.</li> </ul>	<ul style="list-style-type: none"> <li>Existing Buildings C and L1 will be renovated and wards will be relocated (Borne by Cambodian side)</li> </ul>	<ul style="list-style-type: none"> <li>A truck receiving traffic flow will be established in the existing Building C, enabling the temporary storage of the 30 to 40 t of pharmaceuticals that are received at one time.</li> <li>The existing Building L1 is adjacent to the newly-established Pharmacy Dept. and will store pharmaceuticals to be consumed on a daily basis.</li> </ul>
3.1	Sterilization and Laundry Dept.	<ul style="list-style-type: none"> <li>The Sterilization Room is adjacent to the Operation Dept. on the 1<sup>st</sup> floor of existing Building O. Access from the Operation Dept. is good, but access from the other departments is poor.</li> <li>Because there is no clean warehouse, sterilized equipment is not stored with clear separation.</li> </ul>	<ul style="list-style-type: none"> <li>Relocation to new building</li> </ul>	<ul style="list-style-type: none"> <li>Access from various departments that use sterilized instruments such as the Operation Dept., Emergency Dept., and Outpatient Dept. will be improved.</li> <li>Work efficiency will be improved by establishing a workflow of collection -&gt; cleaning -&gt; assembly -&gt; sterilization -&gt; storage. The installation of a clean warehouse will ensure cleanliness of sterilized equipment.</li> </ul>
3.2	Storage	<ul style="list-style-type: none"> <li>Storage is located in the existing Building H, but it is almost unused since there is no staff present.</li> </ul>	<ul style="list-style-type: none"> <li>Existing building used</li> </ul>	<ul style="list-style-type: none"> <li>A facility maintenance and management system of the hospital will be established and the maintenance work room will be used.</li> </ul>
4.1	Power Receiving and Generating Facilities	<ul style="list-style-type: none"> <li>The generator is installed in the existing Building X1, but responses during emergency power failures is delayed due to manual switching.</li> <li>The capacity is insufficient to cover the power for both existing and new buildings.</li> </ul>	<ul style="list-style-type: none"> <li>Added for new building</li> </ul>	<ul style="list-style-type: none"> <li>Generators for new buildings will be provided, enabling continuous surgery and treatment even during power failures.</li> </ul>

Request No.	Department	Current conditions (problems)	Japanese side facilities targeted for Project	Post-project
4.2	Drainage Facilities	<ul style="list-style-type: none"> <li>▪ Sewage storage tanks and pipes are broken, leaking into the premises and permeating the grounds.</li> <li>▪ Part of the inspected waste water is released into and permeates the grounds.</li> </ul>	<ul style="list-style-type: none"> <li>○ Added for new building</li> </ul>	<ul style="list-style-type: none"> <li>▪ A septic tank for the new building will be provided and treated wastewater will be discharged to the public sewer system.</li> <li>▪ Inspected wastewater will be clearly separated and any dangerous waste liquid is recovered.</li> </ul>
5.1	Hallway, etc.	<ul style="list-style-type: none"> <li>▪ There is no covered corridor connecting the existing facilities, and transporting patients in rainy weather is especially difficult.</li> </ul>	<ul style="list-style-type: none"> <li>○ Added for new building</li> </ul>	<ul style="list-style-type: none"> <li>▪ A covered corridor connecting the newly-constructed buildings will be provided, in particular, improving the transport of patients who require the use of stretchers.</li> </ul>

Source: Q&A and field survey

## 2) Target Scale

The scale of medical care, such as numbers of patients and operations, on which the facility and equipment plans are based is set for a target year 2022, 3 years after the completion of the new building. The demand projection is made on the basis of the current increase rate of patients of the hospital and also by taking into account the inflow of patients from other provinces motivated by the facility/equipment improved by the Project.

### a) Calculating the number of hospital beds

The number of beds of each one of Surgical ward, General Medicine ICU ward and Otorhinolaryngology ward included in the Project is calculated using the actual number of inpatients during 5 years from 2011 to 2015.

The number of inpatients and the total number of inpatients based on the Questionnaire Answer Sheet provided from the hospital are shown below. Based on these, the increase rate of number of inpatients and the average length of stay are calculated.

**Table 2- 6 Number of Hospitalized Patients**

	Department	2011	2012	2013	2014	2015	Average Growth Rate
①Total No. of Inpatients (Man-days)	Surgery	16,834	17,561	18,292	21,330	23,356	---
	General Medicine ICU	4,297	4,608	4,878	5,031	5,345	---
	ENT	967	1,276	1,449	789	758	---
②No. of Inpatients (People)	Surgery	1,966	1,993	2,054	2,451	2,738	---
	General Medicine ICU	1,125	1,293	1,389	1,349	1,261	---
	ENT	124	173	192	120	137	---
③Inpatient Growth Rate (%)	Surgery	---	101.37%	103.06%	119.33%	111.71%	108.63% (102.21%)*
	General Medicine ICU	---	114.93%	107.42%	97.12%	93.48%	102.89%
	ENT	---	139.52%	110.89%	62.50%	114.71%	102.52%
④Average No. of Hospitalization Days (=①÷②) (Days)	Surgery	8.56	8.81	8.91	8.70	8.53	8.70
	General Medicine ICU	3.82	3.56	3.51	3.73	4.24	3.77
	ENT	7.80	7.38	7.55	6.58	5.53	6.97

Source: Hospital Q&A

\*Annual Average Growth Rate for 2011-2013

The number of patients in the Surgical ward shows an exponential increase in 2014. It is conjectured that this surge may be attributable to stopping free clinic in Handa private hospital (The World Mate Emergency Hospital) in Battambang city. The increase of number of inpatients in the Otorhinolaryngology ward in 2012 and 2013 is accounted for by the assistance by the Thai Otorhinolaryngological team.

Now number of inpatients in 2022, 3 years after the completion of construction, is estimated based on the ③ increase rate of number of inpatients in each department.

However for the ③ increase rate of number of inpatients in the Surgical department, the average value from 2011 to 2013, namely 102.21%, is used in the projection taking into account the sharp rise in number of inpatients and thus its increase rate following the Handa hospital's stopping free clinic in 2014.

As for the Otorhinolaryngology department, the average increase rate from 2011 to 2015 is used in the projection in view of the shift in increase rate which showed an increase in 2012 and 2013 under the Thai Otorhinolaryngological team's assistance but a decrease in 2014.

**Table 2- 7 Predicted Number of Hospitalized Patients**

	Department	2016	2017 Const. Start	2018	2019 Comple tion	2020	2021	2022 Target Year
⑤Predicted No. of Inpatients (=②x③/Year) (People)	Surgery	2,799	2,861	2,924	2,989	3,055	3,123	3,192
	General Medicine ICU	1,297	1,335	1,374	1,414	1,455	1,497	1,540
	ENT	140	144	148	152	156	160	164
⑥Predicted Total No. of Inpatients (=④x⑤) (Man-days)	Surgery	25,357	24,896	25,445	26,010	26,585	27,176	27,777
	General Medicine ICU	4,892	5,036	5,183	5,334	5,488	5,647	5,809
	ENT	976	1,003	1,031	1,059	1,087	1,115	1,143

At Kampong Cham Provincial Hospital, where a Japanese Grant Aid project was implemented in the past, the number of patients exceeded greatly the forecast due to a large influx of patients from the neighboring provinces. Especially in the Obstetrics and gynecology department the number of patients exceeded 500% while this Project does not include Obstetrics and gynecology department. In this Project, the influx from the neighboring provinces is estimated based on the annual average increase rate of number of operations in Kampong Cham Provincial Hospital. It is assumed that the increase due to the influx from the neighboring provinces corresponds to the difference (1.72%) between the annual average increase rate at the time of Basic Design study (2010) and the data from the completion year (2010) to 2 years after the completion of construction (2012).

**Table 2- 8 Increase in the Number of Surgeries  
at Kampong Chang Provincial Hospital (Cases)**

	2002	2003	2004	2005	Avg. Annual Growth Rate	2010 Completion Year	2012	Avg. Annual Growth Rate	Difference ⑦
No. of Surgeries	1,334	1,301	1,545	1,669	107.75%	2,977	3,568	109.48%	1.72%

The table below shows the inpatients number estimation taking into account the above. Based on this estimation, the number of beds of each one of Surgical ward, General Medicine ICU ward and ENT ward in calculated. The bed occupancy rate is supposed to be 90%.

**Table 2- 9 Predicted Number of Hospitalized Patients (with the Predicted Influx from Neighboring States) and Calculation of the Number of Hospital Beds**

	Department	2016	2017 Const . Start	2018	2019 Completi on	2020	2021	2022 Target Year
⑧Increase in No. Patients after Estab. New Hospital (=2x(③+⑦)/Year) (People)	Surgery				2,989	3,107	3,229	3,356
	General Medicine ICU				1,414	1,470	1,547	1,618
	ENT				152	158	165	172
⑨Total No. of Inpatients (=④x⑧) (Man-days)	Surgery				26,010	27,037	28,099	29,204
	General Medicine ICU				5,334	5,579	5,838	6,103
	ENT				1,059	1,101	1,150	1,198
⑩Calculation of the No. of Beds (=(⑨)÷365 Days) ÷90%) (Beds)	Surgery							88.9 Beds
	General Medicine ICU							18.6 Beds
	ENT							3.6 Beds

As a result, the number of beds of each department is determined as follows.

Surgical ward: The calculation results in 88.9 beds. Supposing that the General Surgery ward is composed of 13 six-bed rooms (78 beds in total) and 2 one-bed (VIP) rooms (2 beds in total), the total number of beds is 80 which is less than the estimated number, however by adding 10 beds in recovery room after operation and ICU, the total number of beds amounts to 90 which is sufficient for the ward operation.

General Medicine ICU ward: The calculation results in 18.6 beds. Although 19 beds are needed, the plan is based on 18 beds because of the bed layout. The ward is short one bed compared to the estimation, however this is supposed to be within possible range for the ward operation.

Otorhinolaryngology ward: The calculation results in 3.6 beds. 4 beds are necessary.

**b) Calculating the number of operation theaters**

The number of operations from 2011 to 2015 is as shown in the Table below. The number of operations in operation theaters to be constructed under the Project excludes those provided in the dedicated treatment room of Ophthalmology department and those of Obstetrics/Gynecology to be carried out in the existing operation theater after the completion of the Project. The annual average increase rate does not show any particular increasing trend and the annual number is around 1,000.

**Table 2- 10 Number of Surgeries (Cases)**

Surgical Details	2011	2012	2013	2014	2015	Avg. Annual Growth Rate
Ophthalmic Surgery	1,335	2,053	2,761	2,107	1,334	
ENT Surgery	19	137	71	59	64	
Abdominal Surgery	689	711	660	654	680	
OB/GY Surgery	542	686	741	956	879	
Other	258	355	298	131	226	
Total	2,843	3,942	4,531	4,316	3,603	
Total excluding Ophthalmic and OB/GY	966	1,203	1,029	844	970	+0.1%

Source: Battambang Provincial Hospital

In the same way as with the estimation of number of beds, the number of operations, which takes into account the influx of patients from the neighboring provinces and an annual increase of 0.1%+1.72%, is estimated to 970 operations  $\times 101.82\%^7 = 1,101$  in the target year 2022. The planned number of operations per day is 4.7. This is calculated by dividing the annual number of planned operations by 234 days in a year, excluding holidays (public holidays, Saturdays and Sundays). Supposing that each operation takes 3 hours on average, including preparations and clean-up/ sterilization before and after operation, and 2 operations are performed per room per day, 3 rooms are necessary.



### 3) Floor Plan

【Central clinic/ Surgery building 1<sup>st</sup> floor】

#### ① Emergency Outpatient Department

- The plan will provide an entrance of the Emergency department separated from that of the Outpatient department so that the traffic paths of emergency patients should not cross those of outpatients.
- The plan will provide a waiting space for family members attending the patient in the emergency patient hall in order to prevent them from entering the treatment room and the observation room more than necessary.
- The plan will provide an emergency entrance hall in front of the treatment room so as to allow to carry out triage/examination/treatment prior to emergency treatment/operation when receiving patients in case of large-scale accidents and severe patients.
- The plan will provide room layouts based on determination of traffic paths for medical care so as that the emergency medical care can be carried out rapidly and efficiently.
- The plan will provide the possibility to take X-ray photographs, when it is necessary, by using the shortest traffic path.
- The plan will provide an elevator for stretcher in the emergency hall so as to provide rapid access to the Operation department upstairs by using the shortest possible path.
- The plan will provide 10 beds in the observation room under the Project since it plans a general emergency department including surgical or other emergency patients as against 5 beds in the existing observation room which is dedicated to emergency patients of General Medicine department.
- The plan will provide air-conditioning and ventilation system in the treatment/consultation room and the observation room.
- The plan will provide a doctors' duty room and a nurses' duty room so as to improve work environment for health care personnel.

#### ② Imaging Diagnostics Department

- The plan will place an Imaging diagnostics department between the Outpatient department and the Emergency patient department so as to shorten the traffic path to/from the Emergency department and to improve access from the Outpatient department.
- The plan will facilitate management by providing a reception to imaging diagnostics so as to ensure record management of patients diagnosed by image.
- The plan will provide a control room to the general use X-ray room for the radioprotection of operators.
- The plan will not provide a darkroom since X-ray images will be digitized by the equipment plan.
- The plan will place an Imaging diagnostics department near the CT imaging room now being installed by the Cambodian side in the existing Outpatient building in order to streamline the traffic path.
- The plan will provide a X-ray technicians' duty room and a nurses' duty room so as to enable the rapid taking of X-ray photograph for nighttime emergency patients.

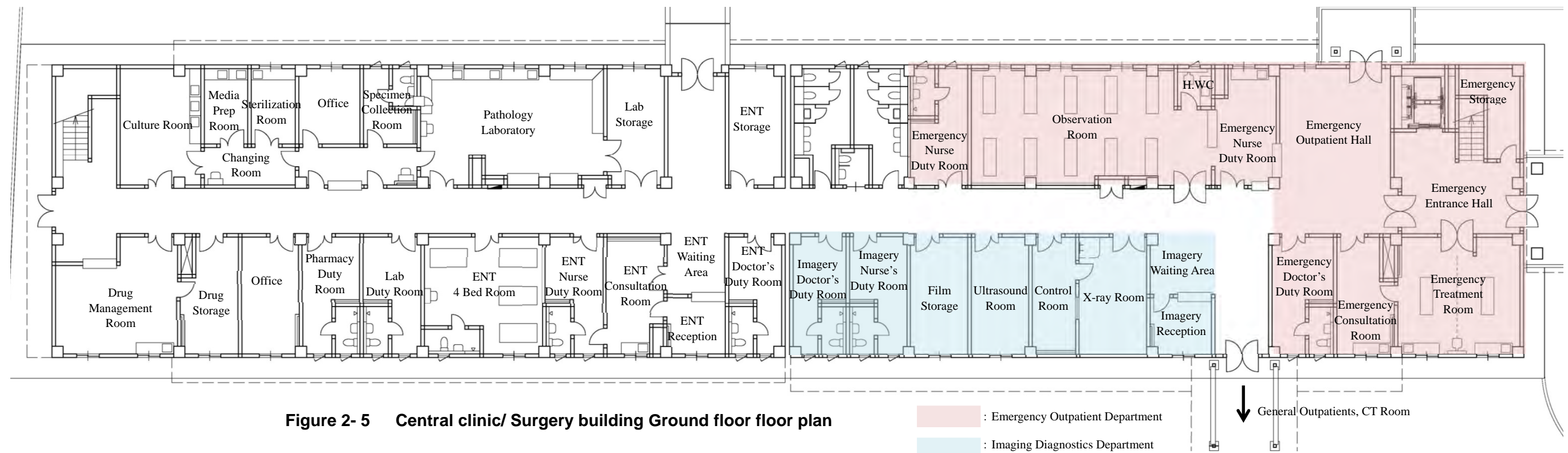


Figure 2-5 Central clinic/ Surgery building Ground floor floor plan

Emergency Outpatient Department  
Imaging Diagnostics Department

General Outpatients, CT Room

【Central clinic /Surgery building 1<sup>st</sup> floor】

③ Otorhinolaryngology Department

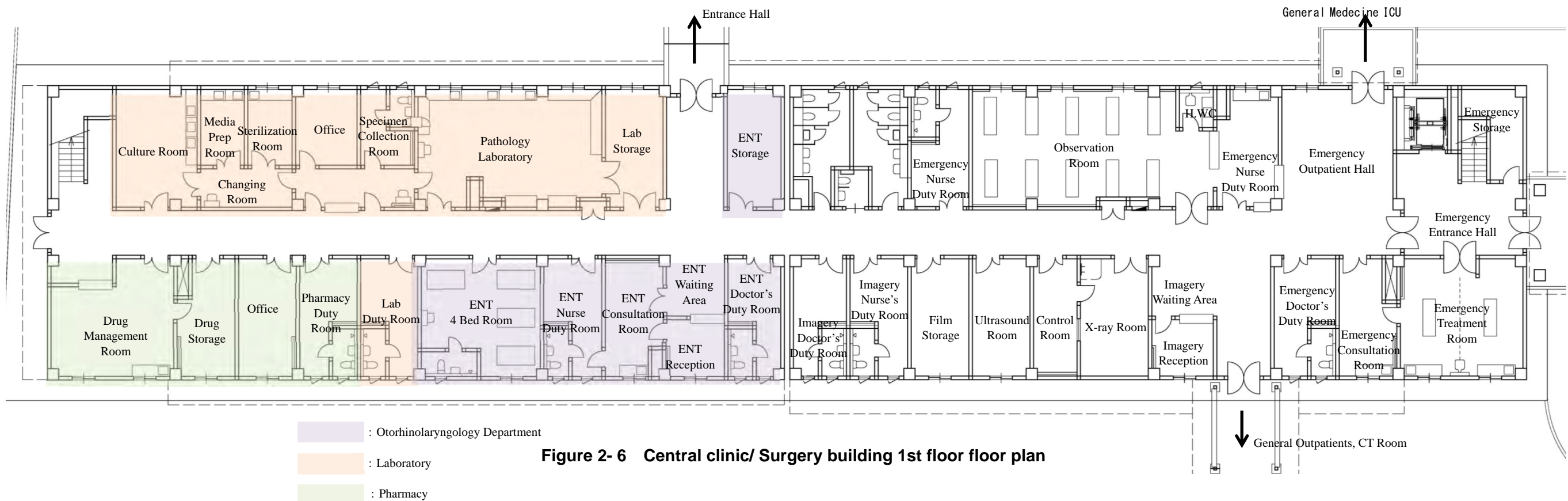
- The plan will place it in a place with good access near the building main entrance so that there should be no crossing between the traffic paths of the Otorhinolaryngology patients and those of the Central clinical center.
- The plan will place a reception and a waiting space in an easy-to-understand manner for patients.
- The plan will provide a four-bed room for inpatients, a doctors' duty room and a nurses' duty room.

④ Laboratory

- The plan will provide a laboratory near the Emergency Outpatient Department and also with good access from the Outpatient Department in order to shorten traffic paths of patients so that Laboratory tests are quickly available in case of emergency and to improve efficiency of medical services.
- The plan will place a reception and an office in the center of the Laboratory to facilitate management of examination reception and so as to secure specimen management.
- The plan will give attention to privacy and hygiene of patients when collecting specimen from them.
- Wash hand bowl stand will be provided near the entrance of each room for the sake of hygiene and to prevent hospital infection.
- For the purpose of preventing environment pollution and pathogenic bacteria proliferation, the plan will provide a drainage facility which separates distinctly Laboratory waste liquid and also a soft component which aims to provide assistance in building of a Laboratory waste liquid treatment system.
- The plan will provide a Laboratory technicians' duty room so as to improve their work environment and at the same time to provide Laboratory tests in case of nighttime emergency.

⑤ Pharmacy

- Pharmacy will be arranged near the center of the entire hospital and in a manner to avoid traffic paths from other departments crossing since the staff will come from other departments to collect medicine.
- Pharmacy will be arranged in a position which facilitates delivery of medicaments.
- The plan will provide a gathering spot in order that the crowd in front of Pharmacy's reception and delivery counters formed by hospital staff coming to collect medicine will not obstruct the traffic.
- Pharmacy storage equipped with air-conditioner will be provided adjacent to the Drug control room in order to preserve medicine quality and to facilitate inventory management.
- The plan will provide a Pharmacists' duty room so as to cope with nighttime emergency patients and emergency operations and to improve work environment.



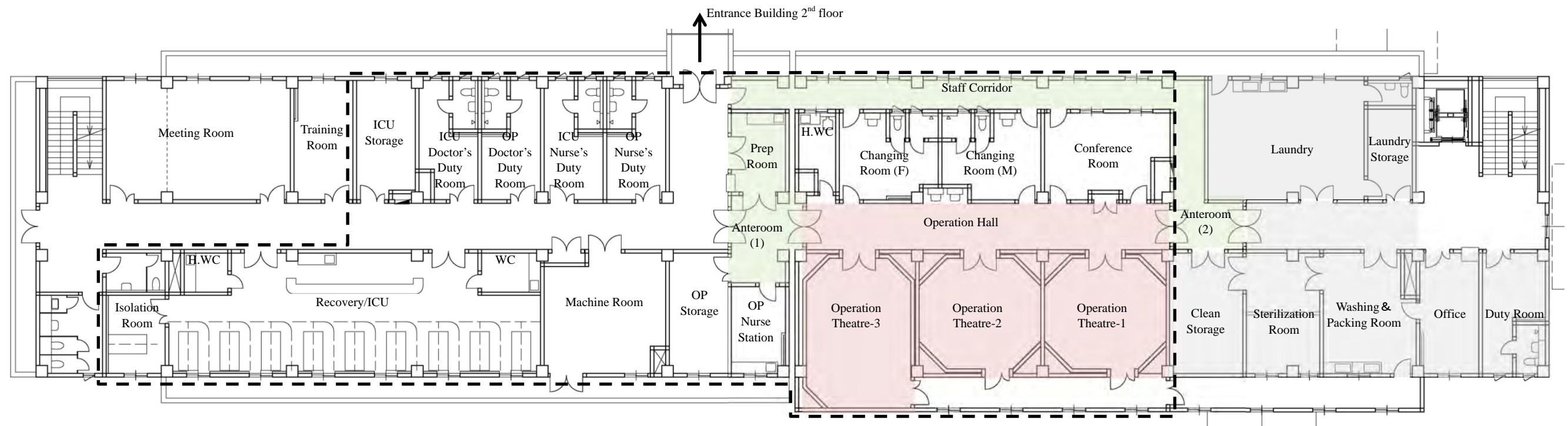
【Central clinic/ Surgery building 2<sup>nd</sup> floor】

⑥ Operation Department

- The plan will place the Operation department on the 2nd. floor to shorten the traffic path from the Emergency outpatient department enabling to cope rapidly with emergency operations, to give good access to other departments of the Central clinical center, and to increase efficiency in medical services.
- The plan will provide an elevator in order to bring patients quickly and easily from the Emergency outpatient department and other departments.
- The plan will provide 3 operation theaters based on the above-mentioned estimation, of which one room will be equipped with radioprotection since C-arm X-ray unit will be provided in it, and the other will have sufficient space for training.
- The operation theaters will be of the type surrounded by disposal corridor, which facilitates to keep them clean with clear division of clean and unclean.
- Changing room for staff or anteroom will be placed at the entrance of the Operation department to clearly demarcate the clean and semi-clean zones.
- The plan will provide a recovery room /ICU (10 beds including 1 bed in special recovery room) to facilitate transportation of patients after operation and nursing.
- The plan will provide conference rooms and training rooms in consideration of the teaching function of the hospital.

⑦ Central Sterilization Department

- The plan will place it adjacent to the operation theaters and link it to the disposal corridor in order that equipment and supplies can be delivered/collected efficiently for the sake of infection control.
- The plan will provide a layout which gives the staff good access but prevents patients from entering by separating clearly traffic paths of patients and those of the staff since the latter goes/comes to/from the Outpatient departments and hospital wards to deliver/collect equipment and supplies.
- In the Central sterilization department, the plan will place rooms according to the "collect-clean-dry-sterilize-store" flow for better work efficiency.
- A reception office and a duty room will be provided to secure control of materials to be supplied and collected.



: Clean Zone  
 : Semi-clean Zone

Figure 2- 7 Central clinic/ Surgery building 2nd floor floor plan

: Operation Department  
 : Central Sterilization Department

【Surgical OT and Ward Building Second Floor】



⑧ Surgical Department

- The plan will place the Surgical department on the 3<sup>rd</sup> floor to shorten the traffic path to/from the central clinical area enabling to efficiently provide medical services.
- The plan will provide an elevator to give good access to/from the Central clinical center downstairs and to facilitate transportation of patients on stretcher and wheel chair.
- The plan will provide 80 beds basically in six-bed rooms with ceiling height of 4 m in accordance with CPA guideline and ceiling fan for the sake of both comfort and running cost reduction.
- The plan will provide private wards in addition to six-bed rooms to contribute to improving hospital revenue or to cope with patients requiring an isolation ward.
- The plan will provide air conditioning system in each private ward and air conditioned wards will be clearly separated from natural ventilated corridors considering reduction in running costs.

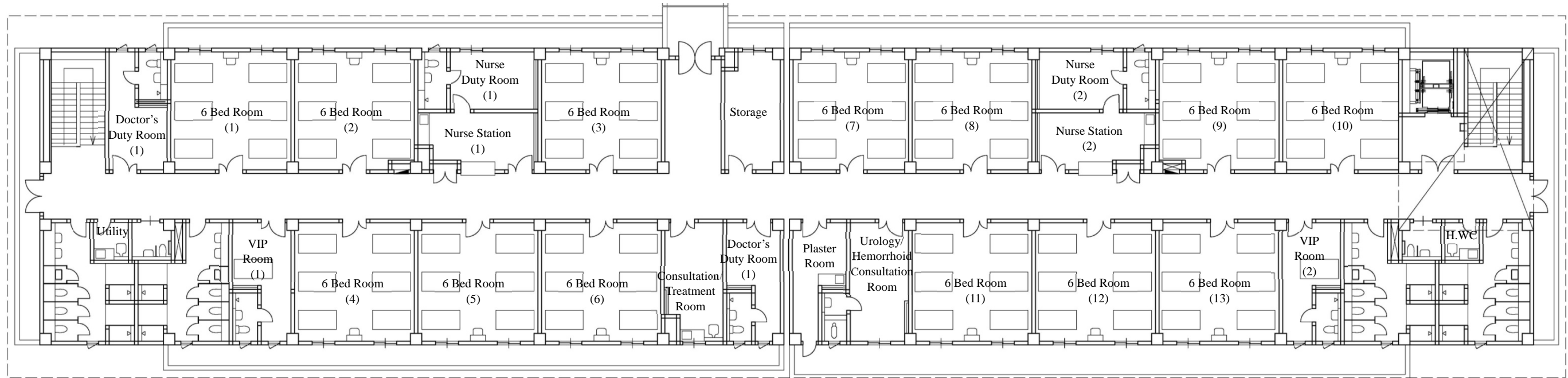


Figure 2-8 Surgery Ward Floor Plan

⑨ Internal Medicine ICU Department

- The plan will place it between the new central medical area and the existing Internal Medicine ward so as to distinguish clinical traffic paths, to facilitate transportation of patients and give coherence as a Internal Medicine department.
- The plan will connect it to the new central medical area with a covered walkway to facilitate transportation of patients on stretcher.
- The plan will provide a staff station at the center of ICU so as to keep watch on the whole patients.
- The plan will provide 18 beds including the 2 special rooms based on the above-mentioned estimation on number of beds.
- A doctors' duty room and a nurses' duty room will be provided for 24 hour nursing system.

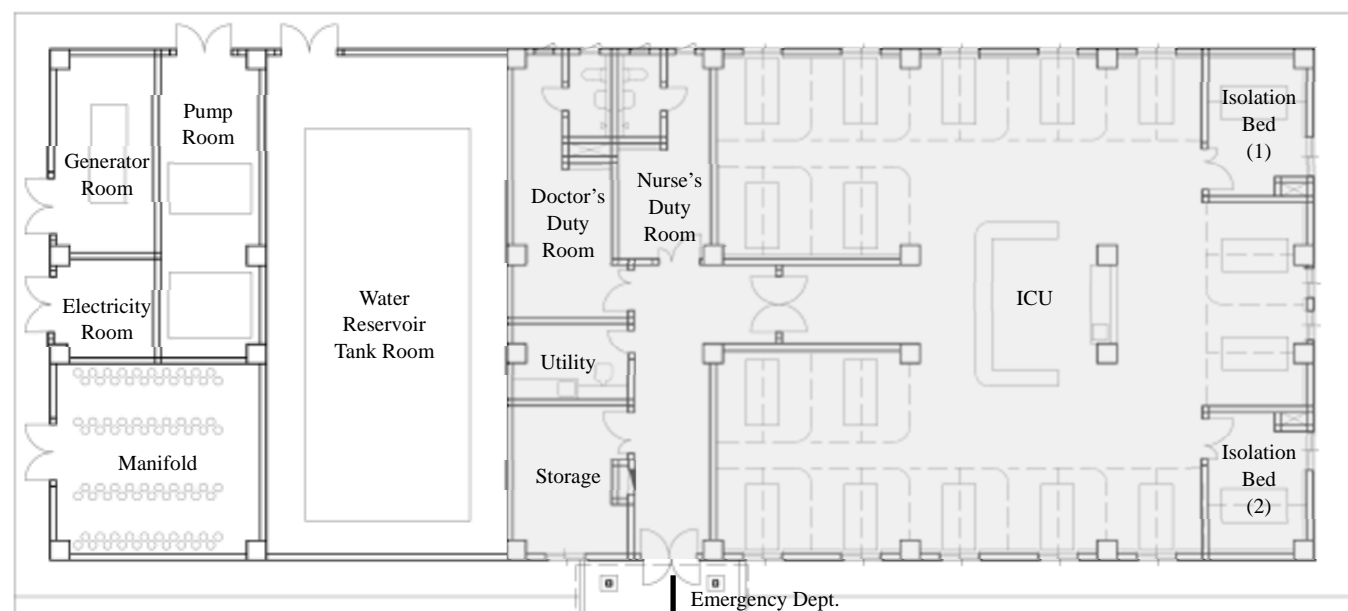


Figure 2-10 ICU Department Floor Plan

⑩ Entrance building/Slopes/Walkways

- A slope will be provided beside the 3-story Surgical OT and Ward Building to support the vertical transportation of patients on stretcher and wheel chair, as well as the back-up in case of elevator being out-of-service due to power failure or checking/repair.
- An elevated water tank will be installed using the structure of the Entrance building for the reduction in construction cost.
- The plan will provide a roof over the slope and walkway so as to enable patients to move without getting wet with rain.

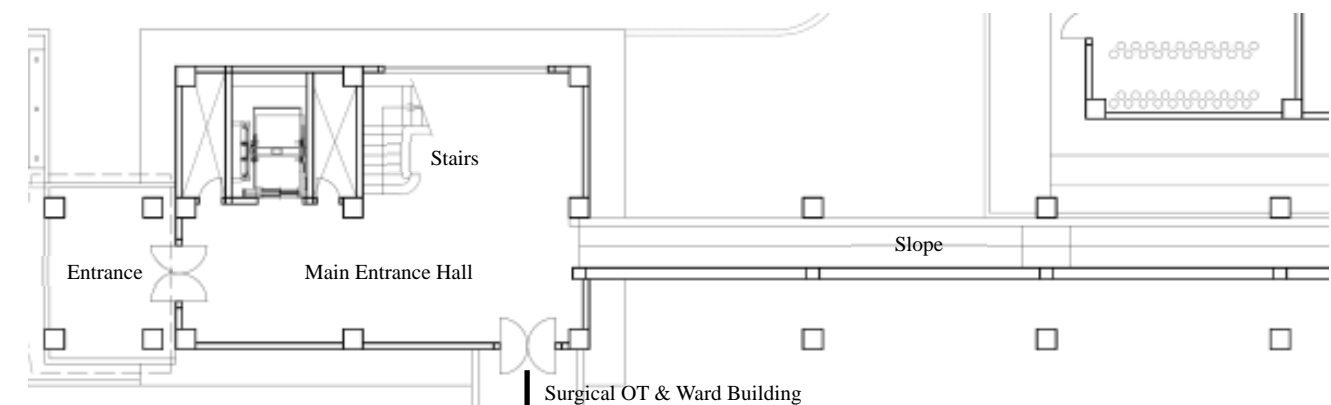


Figure 2-9 Slope GF Floor Plan

4) Floor Size Table

**Table 2- 11 Floor Area of Each Building**

Building	Department	Room No.	Room Name	Floor Area (m <sup>2</sup> )
Central Clinic/ Surgery Bldg. 3728.78 m <sup>2</sup>	Emergency Dept. 565.09 m <sup>2</sup>	ER-01	ER Entrance Hall	39.04
		ER-02	Emergency Hall	31.99
		ER-03	Treatment Room	42.98
		ER-04	Consultation Room	18.96
		ER-05	Doctor's Duty Room	18.09
		ER-06	Nurse Station	21.03
		ER-07	Observation Room	77.43
		ER-08	Nurse's Duty Room	16.78
		ER-09	ER Storage	12.13
		ER-10	Stairs	5.18
		ER-11	Utility	4.41
		ER-12	WC (F)	17.56
		ER-13	WC (M)	16.63
		ER-14	H.WC	4.31
		ER-15	WC	4.06
		ER-16	WC	4.06
		ER-17	Corridor	230.45
	Imagery Dept. 144.26 m <sup>2</sup>	IM-01	Imagery Waiting Area	11.07
		IM-02	Reception	11.07
		IM-03	X-ray Room	24.33
		IM-04	Control Room	16.03
		IM-05	Ultrasound Room	20.83
		IM-06	Film Storage	20.83
		IM-07	Nurse's Duty Room	16.78
		IM-08	Imagery Duty Room	15.20
		IM-09	WC	4.06
		IM-10	WC	4.06
	ENT Dept. 141.43 m <sup>2</sup>	EN-01	ENT Waiting Area	10.42
		EN-02	Reception	10.42
		EN-03	Consultation Room	19.56
		EN-04	Nurse's Duty Room	16.78
		EN-05	ENT Ward	36.94
		EN-06	Doctor's Duty Room	15.20
		EN-07	ENT Storage	19.26
		EN-08	WC	4.06
		EN-09	WC	4.06
		EN-10	WC	4.73
	Laboratory 205.83 m <sup>2</sup>	LB-01	Laboratory Storage	20.71
		LB-02	Biochemical Laboratory	61.43
		LB-03	Reception	14.33
		LB-04	Specimen Collection Room	9.50
		LB-05	Laboratory Office	14.53
		LB-06	Changing Room	11.12
		LB-07	Sterilization Room	10.70
		LB-08	Media Preparation Room	10.51
		LB-09	Culture Room	28.85
		LB-10	Duty Room	16.78
		LB-11	WC	3.31
		LB-12	WC	4.06
	Pharmacy 120.74 m <sup>2</sup>	PH-01	Drug Management Room	37.80
		PH-02	Drug Storage	19.12
		PH-03	Pharmacy Office	20.83
		PH-04	Pharmacy Duty Room	16.78
		PH-05	WC	4.06
		PH-06	Stairs	22.15
	Operation Theatre 968.92 m <sup>2</sup>	OP-01	Corridor	120.24
		OP-02	Preparation Room	12.91
		OP-03	Storage	20.83
		OP-04	Nurse's Duty Room	14.14
		OP-05	Anteroom (1)	16.84
		OP-06	Operation Hall	52.05

Building	Department	Room No.	Room Name	Floor Area (m <sup>2</sup> )
		OP-07	Anteroom(2)	9.83
		OP-08	Utility	7.85
		OP-09	Changing Room (F)	20.22
		OP-10	Changing Room (M)	19.77
		OP-11	Conference Room	28.55
		OP-12	Operation Theatre-1	50.88
		OP-13	Operation Theatre-2	41.67
		OP-14	Operation Theatre-3	41.67
		OP-15	Septic Corridor	47.48
		OP-16	Staff Corridor	50.64
		OP-17	OT Nurse Duty Room	16.78
		OP-18	ICU Nurse Duty Room	16.78
		OP-19	OT Doctor's Duty Room	16.78
		OP-20	ICU Doctor's Duty Room	15.50
		OP-21	ICU Storage	20.14
		OP-22	Training Room	20.83
		OP-23	Meeting Room	62.50
		OP-24	Machine Room	38.94
		OP-25	Recovery/ ICU	110.66
		OP-26	Isolation Room	13.67
		OP-27	Utility	7.17
		OP-28	Utility	5.41
		OP-29	WC (M)	7.17
		OP-30	WC (F)	14.53
		OP-31	WC	4.06
		OP-32	WC	4.06
		OP-33	WC	4.06
		OP-34	WC	4.06
		OP-35	WC	1.50
		OP-36	Shower Room	2.55
		OP-37	Shower Room	2.55
		OP-38	WC	1.50
		OP-39	Stairs	22.15
	Central Sterilization & Supply Dept. (CSSD) 266.85 m <sup>2</sup>	ST-01	Corridor	55.91
		ST-02	CSSD Duty Room	17.53
		ST-03	CSSD Office	20.83
		ST-04	Washing & Packing Room	30.18
		ST-05	Sterilization Room	25.64
		ST-06	Clean Storage	25.64
		ST-07	Laundry	53.17
		ST-08	Laundry Storage	12.28
		ST-09	WC	3.75
		ST-10	WC	4.61
		ST-11	Stairs	17.31
	Surgery Ward 1179.77 m <sup>2</sup>	SG-01	Corridor	221.95
		SG-02	Nurse Station (1)	19.07
		SG-03	Nurse Station (2)	19.07
		SG-04	6 Beds Room (1)	41.67
		SG-05	6 Beds Room (2)	40.96
		SG-06	6 Beds Room (3)	41.67
		SG-07	6 Beds Room (4)	41.67
		SG-08	6 Beds Room (5)	41.67
		SG-09	6 Beds Room (6)	41.67
		SG-10	6 Beds Room (7)	40.09
		SG-11	6 Beds Room (8)	41.67
		SG-12	6 Beds Room (9)	40.98
		SG-13	6 Beds Room (10)	40.35
		SG-14	6 Beds Room (11)	41.67
		SG-15	6 Beds Room (12)	41.67
		SG-16	6 Beds Room (13)	41.67
		SG-17	VIP Room (1)	16.78
		SG-18	VIP Room (2)	16.78
		SG-19	Consultation/ Treatment Room	19.72

Building	Department	Room No.	Room Name	Floor Area (m <sup>2</sup> )
		SG-20	Doctor's Duty Room (2)	15.20
		SG-21	Plaster Room	15.20
		SG-22	Urology/ Hemorrhoid Consultation Room	20.83
		SG-23	Doctor's Duty Room (1)	16.22
		SG-24	Nurse's Duty Room (1)	15.37
		SG-25	Nurse's Duty Room(2)	15.37
		SG-26	WC & Shower (F)	26.90
		SG-27	WC & Shower (M)	26.47
		SG-28	H.WC	4.86
		SG-29	Utility	4.31
		SG-30	WC & Shower (M)	26.47
		SG-31	WC & Shower (F)	26.90
		SG-32	H.WC	4.86
		SG-33	Utility	4.31
		SG-34	WC	4.61
		SG-35	WC	4.06
		SG-36	WC	5.46
		SG-37	WC	4.06
		SG-38	WC	4.06
		SG-39	WC	5.47
		SG-40	WC	4.06
		SG-41	2F Elevator Hall	10.40
		SG-42	Storage	19.24
		SG-43	Stairs	22.15
		SG-44	Stairs	22.15
	Others		PS, etc.	135.89
	135.89 m <sup>2</sup>			
Internal Medicine ICU/ Energy Center Bldg. 591.90 m <sup>2</sup>	internal Medicine ICU 373.50 m <sup>2</sup>	IM-01	Corridor	27.68
		IM-02	ICU	246.48
		IM-03	Isolation Bed (1)	13.85
		IM-04	Isolation Bed (2)	13.85
		IM-05	Nurse's Duty Room	15.17
		IM-06	Doctor's Duty Room	22.25
		IM-07	Utility	9.26
		IM-08	Storage	16.84
		IM-09	WC	4.06
		IM-10	WC	4.06
	Energy Center 215.74 m <sup>2</sup>	SV-01	Water Reservoir Tank Room	116.96
		SV-02	Pump Room	30.16
		SV-03	Generator Room	19.89
		SV-04	Electricity Room	10.27
		SV-05	Manifold	38.46
Others		PS, etc.	2.66	
2.66 m <sup>2</sup>				
Entrance Bldg. 773.85 m <sup>2</sup>	Entrance 497.48 m <sup>2</sup>	AS-01	Main Entrance Hall	54.67
		AS-02	Stairs	27.63
		AS-03	1F Elevator Hall	54.49
		AS-04	1F Stairs	18.78
		AS-05	2F Elevator Hall	53.97
		AS-06	2F Stairs	19.13
		AS-07	3F Elevator Hall	69.04
		AS-09	3F Stairs	3.11
		AS-10	4F Hall	82.33
		AS-11	4F Stairs	9.96
		AS-12	Elevated Water Tank Room	94.41
		AS-13	5F Stairs	9.96
		Others		Slope
	276.37 m <sup>2</sup>		PS, etc.	90.37
Others 94.81 m <sup>2</sup>	Outside Corridor 94.81 m <sup>2</sup>		Outside Corridor (ICU-Surg)	37.67
			Outside Corridor (Ent.-Surg)	39.93
			Outside Corridor (Sur.-OPD)	17.21
Total				5189.34

## 5) Cross-Section Plan

- ① The appearance will feature the pitched roof after Cambodian tradition like the hipped roofs found in large number especially in Battambang city.
- ② The floor level of the ground floor will be approximately 500 mm above the ground level to prevent flooding from heavy rains. Thus, slopes will be built accordingly around the building in order to secure smooth passage for wheelchairs and stretchers, and for the loading and unloading of supplies.
- ③ Ceilings will be raised in patient rooms designed to take advantage of natural wind passage to ensure an air volume.
- ④ Eaves will be built to block direct sunlight from entering rooms and prevent rainwater from seeping into the walls.
- ⑤ Ceiling heights in each department will be determined based on the following ceiling heights:
  - Ceiling height will be 2.7m in air-conditioned rooms.
  - Ceiling height will be 4.0m in rooms that take advantage of natural wind passage in line with CPA standards.
  - As necessary, the room not air-conditioned will be equipped with a ceiling fan so that the room can keep a comfortable environment and with suppressed running cost. Taking into account of the ceiling fan's dimension which is about 350-450mm height, ceiling height will be 3.0m.
  - Ceiling height in corridors will be 3.0m to take advantage of natural wind passage.
- ⑥ To keep maintainability, underground pit to lay piping will be installed so that workers can inspect and repair the piping directory in the pit.
- ⑦ Glass wool will be installed in the ceiling of the Machine Room on the top floor to improve cooling efficiency.
- ⑧ In order to reduce heat radiated from the sun in the attic, cemented excelsior board will be used for the roof substrate since it has a higher level of thermal insulation than plywood. Louvers will also be installed in the attic for ventilation.

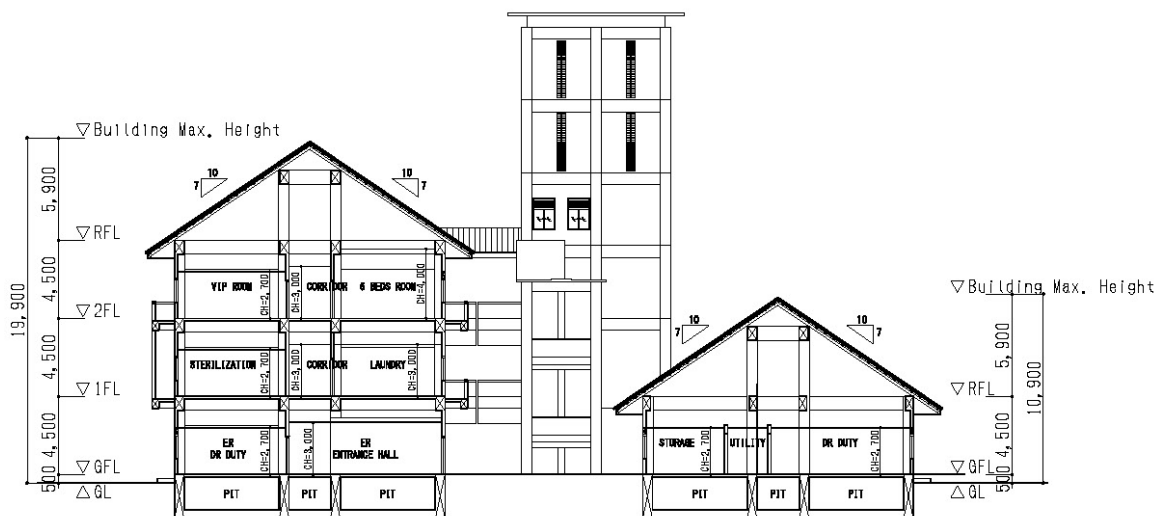


Figure 2- 11 Typical Building Section



## 6) Structure Plan

### a) Outline of structure plan

- The building is divided into five separate structures; i.e. the Central clinic/ Surgery Building (2 structures), the General Medicine ICU/Energy Center Building, the Entrance Building and the Slope and they have respectively 3 stories, one story, 6 stories and 3 stories above ground.
- These structures are of reinforced concrete construction and all they all use rigid-frame on both of X and Y axes.
- As for foundation, the spread foundation (mat foundation) with compaction will be used.
- The structures will be designed based on Japanese Building Standard Act since law system for seismic design is not yet developed and there is no definite seismic design standard established in Cambodia.

### b) Materials

- For reinforcement, deformed bars procurable in Cambodia will be used. For material strength, values in Table 2-12 will be used.

**Table 2- 12 Comparison of Diameter and Strength of Rebar in Cambodia & Japan**

Cambodia				Japan				
Nominal Diameter	Standard	Current Field Ref. Values		Nominal Diameter	AreaJ (mm <sup>2</sup> )	Area / AreaJ	Allowable Unit Stress	
		Area (mm <sup>2</sup> )	Min Yield Point (MPa)				Long-term ft (N/mm <sup>2</sup> )	Short-term ft (N/mm <sup>2</sup> )
D10	SD390	71.33	469.1	D10	71	1.00	195	295
D12	SD390	113.10	459.9	D13	127	0.89	195	295
D16	SD390	201.06	484.6	D16	199	1.01	195	295
D20	SD390	314.16	472.1	D19	287	1.09	215	390
D22	SD390	380.13	478.9	D22	387	0.98	215	390

- The design strength of concrete is  $F_c=24 \text{ N/mm}^2$  (strength for proportioning shall be  $F_c=30 \text{ N/mm}^2$ )

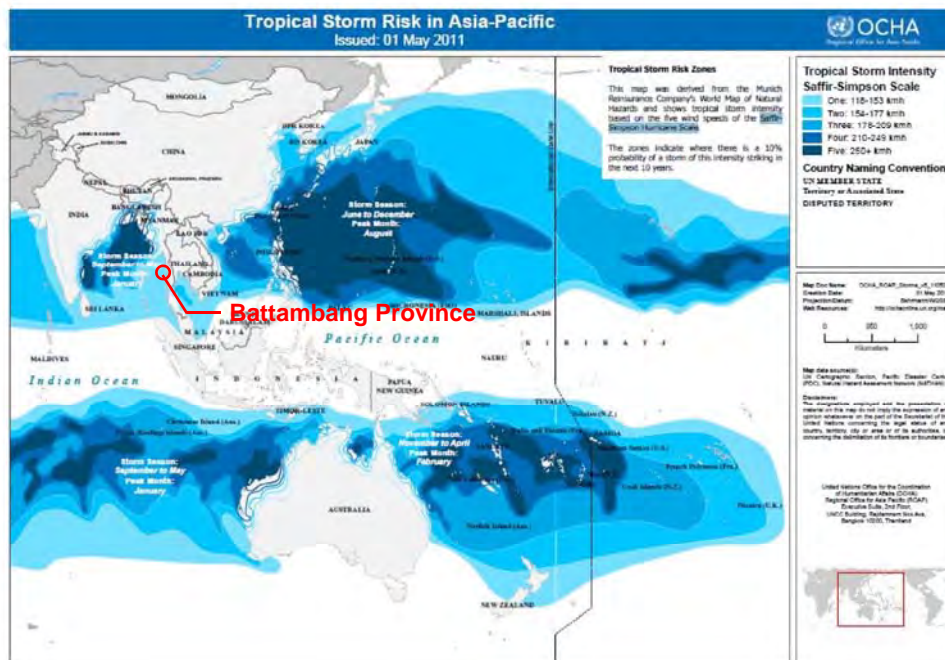
### c) Design Load

- Dead load : It will be designed based on Article 84 of the Order for Enforcement of the Japanese Building Standard Act. It will be calculated according to type of materials and size of structural components.
- Live load : It will be designed based on Article 85 of the Order for Enforcement of the Japanese Building Standard Act and according to Table 2-13 in reference to Standard for Structural Design of buildings (2013).

**Table 2- 13 Table of Movable Load Capacity (Unit : N/m2)**

Room Name	For Floor	For Framework	For Earthquakes	Remarks
Roof	1000	0	0	Article 85 (Stand. const. of gym rooftop)
Hospital Room, Night-duty Room	1800	1300	600	Article 85 (Residence room, hospital room)
Office, Reception	2900	1800	800	Article 85 (Office)
Corridor, Common-use Space	3500	3200	2600	Article 85 (Meeting rooms and others)
Laboratory	3900	2400	1600	Building Structural Design Guidelines (Laboratory)
Machine Room	4900	2400	1300	Building Structural Design Guidelines (Machine room)
Storage	7800	6900	4900	Article 85 (Storage)
Pit	1000	600	400	Article 85 (Rooftop)

- Wind load : Figure 2-12 shows a typhoon hazard map around Cambodia. This map assesses wind speeds with 100-year return period in 5 levels, and according to which Cambodia falls under the Category I or less (wind speed 32 to 42.5m/s). This Project will design the structures on the basis of the Japanese minimum reference wind speed in consideration that wind speeds with 50-year return period is used in Japan. Wind load shall conform to Article 87 of the Order for Enforcement of the Japanese Building Standard Act and to Notification No.1454 of the Ministry of Construction of Japan. Members supporting materials such as roofing/facing materials, and furrings and the like shall conform to Notification No.1458 of the Ministry of Construction of Japan (2000).
  - Category of ground surface roughness : (Inland area)
  - Reference wind speed :  $V_0=30\text{m/s}$

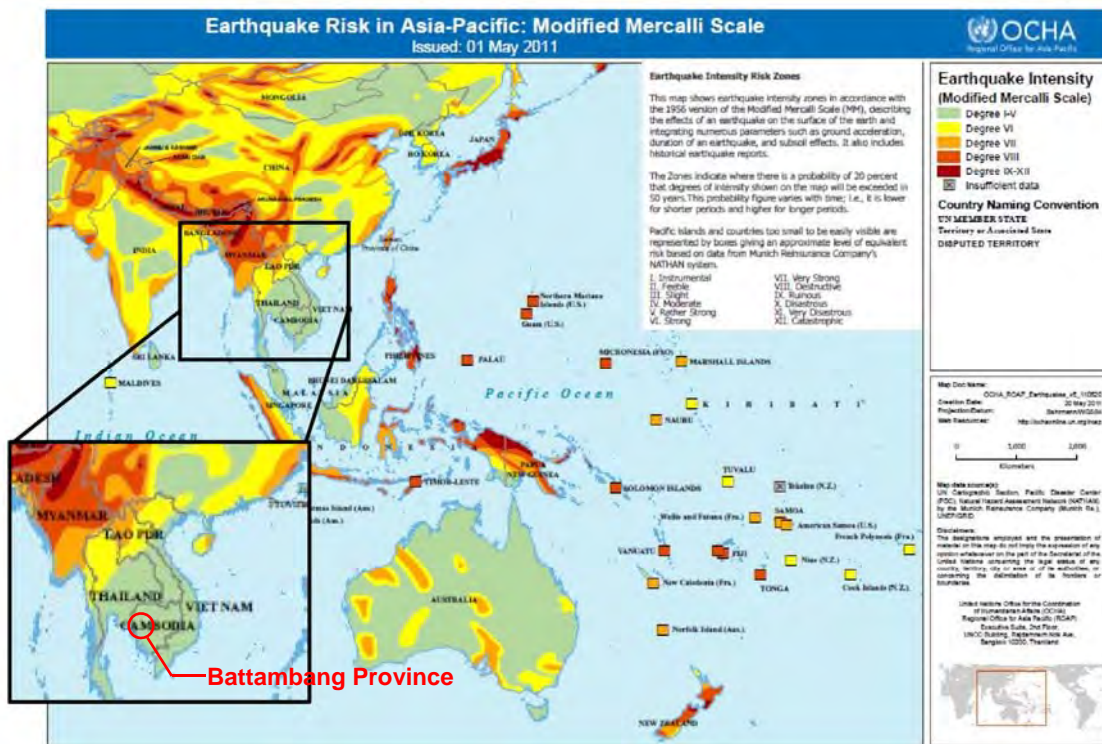


**Figure 2- 12 Typhoon Hazard Map for Area around Cambodia (Source: UN OCHA)**

- Seismic force : Figure 2-13 shows a seismic hazard map around Cambodia. According to this map, the seismic acceleration in Cambodia can be assumed to be about 20 gal with 100-year return period. Supposing that the seismic acceleration required for the Project is 40 gal, taking into account that a high earthquake resistance should be demanded for the facility like hospital, the acceleration of the ground, after multiplying with the dynamic magnification of 2.5, is estimated to be 100 gal, which corresponds to a half of the seismic force used in design in Japan. Accordingly,  $C_0=0.1$  (1/2 of the seismic force used in design in Japan) will be used in design for the Project.

Seismic force shall conform to Article 88 of the Order for Enforcement of the Japanese Building Standard Act.

- Ground category : 2nd. category ground
- Reference shear coefficient :  $C_0=0.1$  in primary seismic design



**Figure 2- 13 Earthquake Hazard Map for Area around Cambodia**  
(Source: UN OCHA)

d) Superstructure Plan

- Superstructures will be of reinforced concrete construction taking into account the ease to procure materials locally, cost and past results.
- The plan will provide expansion joints on the long side, almost 80 m long, of the main building in consideration of concrete pouring accuracy.

- Rigid-frame structure will basically be used in lieu of concrete wall on both of X and Y axes in each building considering the poor accuracy in local concrete wall pouring, except for the rooms requiring radioprotection, X-ray room and the operation theater to be provided with C-arm X-ray unit, as well as the structures around the slope.
- Cement tiles will be used as roofing material and roof pitch will be determined by supporting steel member.
- The plan will provide a reinforcement anchorage which takes into account that construction joint will be placed at the beam bottom for the ease of construction work.
- The plan will provide circumferential girders where appropriate since walls will be brick finished.

#### e) Foundation Plan

- According to the soil survey report on the Project site, its surface is covered with poor cohesive soil (CL layer) while solid cohesive soil (CH layer) with N-value about 6 to 20 is found from GL-2 m and further in depth at BH2 - BH4, whereas at BH1 a deposit of poor cohesive soil (CL layer) and dense sandy soil (SC layer) with N-value about 14 were found respectively from the surface to GL-4.0 m and at GL-4.0 m and further in depth. Water tables are found at GL-0.8 m and at the surface level.
- As for foundation type, the spread foundation (mat foundation) with compaction will be used since it is estimated that there would be no liquefaction or the like.
- The design will be conducted to ensure a bearing capacity of 100 kN/m<sup>2</sup> at the foundation bottom by compacting sand/gravel and sand from the foundation bottom to GL-4.0 m since the deposit of layer with relatively high N-value is found at GL-4.0 m and further in depth.
- The mat foundation will a structural slab since the groundwater level is estimated to be high.

#### f) Materials

- Concrete: In the vicinity of the site, there is a ready-mixed concrete plant where Cambodian aggregate and cement are used. Design strength will be secured with adequate mix proportion and trial mix carried out in the plant.
- Reinforcement bars : JIS standard will be applied to reinforcing bars since JIS standard-based re-bars are available on Cambodian market. Quality of reinforcing bars will be checked with mill sheet and by carrying out tensile strength test in an official laboratory in Phnom Penh.
- Steel beams : JIS standard will be applied to steel beams since JIS standard-based products can be procured in Cambodia. Steel beams will be processed and welded basically in a factory in Phnom Penh and connection between members will be secured basically with high strength bolts.

## 7) Equipment Plan

### a) Electrical Facilities

#### ① Power receiving and sub-station facilities

- For electrical power lead-in, a 22kV distribution line to the Project site will be installed by bifurcating high-tension side of the existing transformer located in the northwest of the hospital compound.
- A new sub-station will be constructed in the Project site to supply electrical power to the new hospital.
- For the division of works, the distribution line related improvement works which will become necessary to accommodate the increase in energy demand will be effectuated at the expense of EDC, Cambodian side electric company, and further works including installation of distribution lines in the compound and the sub-station will be carried out at the expense of the Japanese side.
- The power supply resulted in by the works under the Project is dedicated to the new facilities to be constructed by the Project and the existing facilities will not be considered as supply destination of such power.

#### ② Trunk line facilities

- The electrical room will be provided with a low-tension switchboard which will be connected to lighting distribution boards and power control boards.
- The power line type will be of 3Φ4W400/230V.
- Medical equipment requiring stable power supply will be provided with a separated power system and AVR.

#### ③ Emergency Generators

- Considering the high frequency of power failure in this region, emergency generator will be provided in order that medical activities in strategic rooms such as operation theaters, ICU, emergency room, etc. will not be hindered by power failure.
- Equipment to be powered by the generator circuit will be carefully screened in order not to oversize generator's capacity.

#### ④ Lighting/outlets facilities

- The plan will provide a comfortable lighting which corresponds to indoor environment. Sufficient illuminance will be secured to meet the purpose of each room.
- Lighting fixtures will primarily use fluorescent bulbs since they can be replaced locally at low cost. Additionally, low-maintenance long-life LED lighting will be used in places where it is difficult to change the fixtures.
- General-use outlets and medical-use outlets will be adequately placed according to usages.
- One medical-use outlet will be provided on each bed in patient's bed room.

⑤ Communication facilities

- Internet line will be led in from outside to provide Wi-Fi in the facility.
- As means of communication, cell-phones and intercoms will be used and no fixed-line telephone will be provided in the new wards.
- Medical-use LAN will be of wire system and wiring and piping will be installed and information outlets will be provided in rooms where they are necessary. Equipment such as server will be planned in medical equipment works.
- Intercoms will be provided to link rooms where they seems to be necessary to carry out medical activities and where the staff are.
- TV outlets will be provided in staff rooms and in spaces where patient families are waiting to allow TV reception.
- Nurse call system will not be provided as in the case of the existing buildings since the wards are actually left open to allow keeping watch on them from the outside.
- Communication facilities to be provided under the Project are destined only for the new facilities to be built by the Project and are not intended to be connected with the existing facilities.

⑥ Disaster management facilities

- As emergency lighting, the plan will provide basically spotlights with built-in batteries.
- Emergency evacuation lights will be provided at emergency exits and on evacuation route.
- Emergency alarm system, consisting of transmitters and sound alarms, will be installed where necessary in public areas such as corridors, etc.

⑦ Lightning protection facilities

- Considering the lightning strikes in this region, the plan will provide an outside lightning protection system consisting of lightning rod and an inside protection system to protect equipment from induced lightning.
- The protection facilities will cover the new facilities to be built.

b) Mechanical Facility Plan

① Water supply facilities

- For water supply, the Battambang Province public water supply system will be used in consideration of its capacity to supply water in sufficient quantity and its good quality.
- The water main installed around the compound will be branched with a feeder pipe dedicated to the new hospital wards and a water meter will be installed.
- For the division of works, the branching and meter installation works will be effectuated by the Cambodian side Waterworks department and the works after the meter will be carried out by the Japanese side.
- Water supply system will be of type with elevated water tank to be able to cope with power failure and water cut-off. Receiving tank will be made of high-safety FRP or stainless steel

panels and allow the regulatory maintenance space from 6 sides. Elevated water tank will be stainless-steel tank easily procurable locally.

- Water supply facilities to be provided under the Project are destined only for the new facilities to be built by the Project and are not intended to supply water to the existing facilities.

② Hot water facilities

- Hot water will be provided through a local system consisting of wall-mounted electric instantaneous water heaters installed where it is necessary.
- Hot water will be supplied in the shower room of the Emergency department, the preparation room of the Operation department and the central sterilization room.

③ Sewage facilities

- Sanitary sewage and non-fecal wastewater generated in the building will be carried through a separate sewer system inside the building to be gathered in the No.1 outdoor catch basin and then will be carried to the septic tank by natural gradient.
- The sewage will be sedimented to eliminate solids and pumped into the public sewer.
- For sewage from the Laboratory, undiluted medical liquid and water used for the first washing will not be discharged into the public sewer but stored in a container for future disposal by the Cambodian side. Water used for the second and succeeding washings, which is less harmful, will be discharged into the underground by percolation through a percolation-type septic tank.
- A sewer will be installed as an obligation of recipient country on the north side of the compound, to which a sewer from the septic tank will be connected by the Project. For the division of works, the Japanese side will carry out the construction as far as the last catch basin and the Cambodian Sewer department will take charge of the construction from the catch basin to the sewer main including connection.
- Rain water and air conditioners' drain will basically be treated by natural percolation.
- Sewage facilities to be provided under the Project are destined only for the new facilities to be built by the Project and are not intended to be used to receive sewage from the existing buildings.

④ Sanitary equipment

- Sanitary equipment such as toilet basins, wash basins, utility sinks, and the like will be provided in the toilets.
- All toilet basins will be of Western-style (low tank type) with hand shower except for examination room for hemorrhoids.

⑤ Firefighting facilities

- Fire extinguishers and indoor fire hydrants will be installed as fire control facilities that can be maintained locally.

- Firefighting facilities to be provided under the Project are destined only for the new wards to be built by the Project and are not intended to be used for the security of the existing wards.
- ⑥ Septic tanks
- Septic tanks with a trickling filter system will be installed for its simple structure and low maintenance cost.
  - Septic tanks to be provided under the Project are destined only for the new hospital wards to be built by the Project and are not intended to treat sewage from the existing wards.
- ⑦ Medical gas facilities
- Oxygen is supplied from Central gas supply facility to Emergency treatment room, Observation room, ICU, Operation theaters, and Recovery room.
  - Oxygen will be delivered from cylinders placed in the manifold rooms to outlets in places where oxygen is necessary. 2 banks of cylinders with automatic changeover system will be provided.
  - In principle, every bed will be provided with one outlet.
- ⑧ Air conditioning facilities
- Air conditioning system will be provided in rooms such as Operation theaters, ICU, VIP patient rooms, X-ray rooms, Ultrasound room, Pharmacy, Conference rooms, Duty rooms, etc.
  - For the Operation theaters, a dedicated air conditioning machine room will be provided, in which a floor type air-cooled packaged unit will be installed to supply conditioned air through duct.
  - For rooms other than operations theaters, an air-cooled split air conditioner will be provided. The plan will provide a wall-mount-type family-use air conditioner for the ease of maintenance in lieu of mechanically complicated multi-split type.
  - Ceiling fans will be provided in rooms which will be used by people but not equipped with air conditioner.
- ⑨ Ventilation facilities
- In order to reduce initial and running costs, rooms without air conditioner and rooms with air conditioner and window are planned to be ventilated by natural ventilation.
  - Similarly to the existing buildings, ventilation will be planned based on natural ventilation.
  - Air will enter from the corridor and exit from the outside wall of each room.
  - In places without draught will be ventilated mechanically by wall-mount ventilating fan (exhauster).
  - Ventilator fans will be provided in Operation theaters, Pharmacy, etc.



## 8) Construction Materials Plans

General construction materials and methods used locally that are easy to maintain will be used as the standard specifications. Construction specifications will be examined taking into the account the following cautionary points.

- The plan will basically based on the materials generally available in Cambodian markets, having good durability and easy to maintain.
- The site is located inland, and no salt damage was observed, but the use of steel will be avoided as much as possible. If steel is used, it is to be coated with rust proofing. Fittings (doors and windows) will consist mainly of aluminum sash and aluminum doors.
- To keep durability, utilization of lumber will be avoided as much as possible, and if used, antiseptic and anti-termite agent will be applied.

**Table 2- 14 Exterior Finish**

Parts	Finishing
Roof	Cement roof tile on steel beam and purlin, fiber cement board with asphalt roofing
Exterior Wall	Emulsion paint on mortar trowel (below GL+400), Washed gravel finish (above GL+400)
Doors & Windows	Colored Aluminum Sash

**Table 2- 15 Interior Finish**

Rooms	Finishing			
	Floor	Base board	Floor	Ceiling
Entrance Hall	Non-slip ceramic tile	Ceramic tile	EP-G	Acoustic rockwool board
Corridors, Stairs	Ditto	Ditto	Ditto	Ditto
Offices, Wards, Nurse Station, etc.	Ditto	Ditto	Ditto	Ditto
Consultation Room, Treatment Room, etc.	Ditto	Ditto	Ceramic tile Spandrel Wall + EP-G above cross bar	Ditto
Operation Theater, Emergency Room	long-length vinyl sheet	long-length vinyl sheet	Ditto	Cement board +EP-G
Utility, Toilet, Shower Room, etc.	Non-slip ceramic tile	Ceramic tile	Ditto	Ditto
Storage, Medical Record Storage, Film Storage	Ditto	Ditto	EP-G	Acoustic rockwool board
Machine Room, Generator Room, Pump Room	Dust preventive resin	Dust preventive resin	Glasswool mat	Acoustic rockwool board+ Glasswool mat
Electric Room, Manifold, Water Tank Room	Ditto	Ditto	Mortar trowel	Acoustic rockwool board

### (3) Equipment Plan

#### 1) Investigating Request Details

Final request equipment organized through field surveys will be selected according to the CPA Guideline Standard Equipment List put forth by the MOH, and, in general, the details are relevant. However, another investigation of relevance was performed within the country by setting the following selection criteria and adding investigations for each piece of equipment.

#### [Equipment Selection Criteria]

- ① Conformity to the content of activities  
Verification will be made on whether the equipment is necessary for medical care that is currently implemented at the hospital, is planned for implementation in the future, and is guaranteed to be implemented.
- ② Relevance in terms of frequency of use  
Although it conforms to the nature of activities, the level of necessity will be evaluated in terms of if the equipment is expensive but used very infrequently.
- ③ Conformity to the skill level of users  
Verification will be made on whether the requested equipment is currently in use, if the hospital has experience in using it, and that there are no problems in its operation.
- ④ Relevance in terms of costs related to operations  
Even if relevance is recognized for other items, it is sometimes the case that adequate operation of equipment is difficult after its installation if it is expensive to do so. From this viewpoint, verification will be made on whether the costs necessary to operate the requested equipment can be covered by the hospital's operational budget.
- ⑤ Conformity to facilities  
Verification will be made on whether there is a suitable location for placing the requested equipment, and if a suitable environment and necessary utilities have been maintained.
- ⑥ Priorities of the Target Hospital  
Requested equipment is evaluated according to the priority of the target hospital.
- ⑦ Relevance in terms of overlap with existing equipment or equipment planned for procurement  
Verification will be made regarding the necessity of equipment upgrades or additions if the equipment requested has the same functions as existing equipment and can be procured.

Evaluations regarding the evaluation items above are made using the following three levels.

Evaluation criteria

5: No problems

4: Generally, no problem

3: Relevance is recognized, but there some concerns

2: There are some points for concern.

1: Many points for concern

For the overall evaluation for each piece of equipment, the score for all of the above items will be totaled. Equipment with more than 80% (28 points out of 30) of full points will be adapted. The evaluation results for all of the equipment are as shown in Table 2-16.

**Table 2- 16 Evaluation Chart for Equipment Relevance**

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
<b>Imagery Department</b>											
IM-01	PACS	5	5	4	5	5	5	5	34	Planned as requested due to relevance.	1
IM-02	CR System	5	5	5	5	5	5	5	35	Ditto	1
IM-03	Dosimeter	5	5	5	5	5	3	5	33	Ditto	7
IM-04	Radiology Protection Instruments set	5	5	5	5	5	3	5	33	Ditto	1
IM-05	Ultrasound Machine	5	5	5	5	5	5	5	35	Ditto	1
IM-06	Examination Bed for Ultrasound Machine	5	5	5	5	5	3	5	33	Ditto	1
IM-07	Film Viewer	2	3	5	5	3	3	5	26	Unnecessary due to the introduction of the CR system.	0
IM-08	C-arm X-ray Machine	5	3	4	5	5	5	5	32	Ditto	1
IM-09	General X-ray Machine	5	5	5	4	5	5	3	32	Ditto	1
IM-11	Coach for Waiting Space	5	5	5	5	5	5	5	35	Ditto	1
IM-12	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
<b>Emergency Dept.</b>											
EM-01	Stethoscope	5	5	5	5	5	5	4	34	Planned as requested due to relevance.	5
EM-02	Stretcher	5	5	5	5	5	5	4	34	Ditto	2
EM-03	Dressing Cart	5	5	5	5	5	5	4	34	Ditto	1
EM-04	Instrument Cart	5	5	5	5	5	5	4	34	Ditto	1
EM-05	Irrigation Stand	5	5	5	5	5	5	5	35	Ditto	3
EM-06	Wheelchair	5	4	5	5	5	5	5	34	Ditto	1
EM-07	Patient Monitor	5	5	5	5	5	4	3	32	Ditto	4
EM-08	Pulse Oximeter	5	5	5	5	5	3	5	33	Ditto	1
EM-09	Mobile Operation Light	5	5	5	5	5	3	4	32	Ditto	1
EM-10	Suction Machine	5	5	5	5	5	5	5	35	Ditto	1
EM-11	Ventilator	5	3	4	5	5	5	3	30	Ditto	1
EM-12	Emergency Bed	5	5	5	5	5	5	2	32	Ditto	5
EM-13	Flowmeter for Central Oxygen Supply System	5	3	5	5	5	5	5	33	Ditto	6
EM-14	Suction Machine (Small)	5	5	5	5	5	5	5	35	Ditto	1
EM-15	Medicine Cabinet	5	5	5	5	5	5	5	35	Ditto	1
EM-16	BIPAP	5	3	3	5	5	3	3	27	Excluded from plan due to low overall evaluation.	0
EM-17	Upper Gastrointestinal Endoscope	5	3	4	4	5	3	3	27	Ditto	0
EM-18	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
<b>Internal Medicine ICU Dept.</b>											
MI-01	Desk & Stool Set	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	1

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
MI-02	ICU Bed	5	5	5	5	5	5	5	35	Ditto	18
MI-03	Stretcher	5	4	5	5	5	5	5	34	Ditto	2
MI-04	Dressing Cart	5	5	5	5	5	5	5	35	Ditto	1
MI-05	Stethoscope	5	5	5	5	5	5	5	35	Ditto	4
MI-06	Irrigation Stand (Hanger Type)	5	5	5	5	5	5	5	35	Ditto	18
MI-07	Wheelchair	5	4	5	5	5	5	5	34	Ditto	2
MI-08	ECG	5	4	5	5	5	5	5	34	Ditto	1
MI-09	Patient Monitor	5	5	5	5	5	5	5	35	Ditto	3
MI-10	Defibrillator	4	1	2	5	5	5	4	26	Excluded from plan due to low overall evaluation.	0
MI-11	Pulse Oximeter	5	5	5	5	5	5	5	35	Ditto	3
MI-12	Ultrasound Machine(Mobile)	5	4	5	5	5	5	5	34	Ditto	1
MI-13	Examination Light	5	5	5	5	5	5	5	35	Ditto	1
MI-14	Suction Machine	5	5	5	5	5	5	5	35	Ditto	1
MI-15	Ventilator	5	5	3	5	5	5	5	33	Ditto	1
MI-16	Flowmeter for Central Oxygen Supply System	5	5	5	5	5	5	5	35	Ditto	18
MI-17	Suction Machine (Portable)	5	4	5	5	5	3	5	32	Ditto	1
MI-18	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
General Medicine Dept.											
MD-02	Holter ECG	5	4	4	5	5	5	5	33	Not a facility target for this department, but planned as requested since the necessity is high.	1
MD-04	Screen	5	5	5	5	5	5	5	35	Ditto	3
MD-07	Stethoscope	5	3	5	5	4	3	1	26	Not a facility target for this department, so it was removed from request since the priority from other areas is low.	0
MD-08	Sphygmomanometer	5	3	5	5	4	3	1	26	Ditto	0
MD-10	Dressing Cart	5	3	5	5	4	3	1	26	Ditto	0
MD-11	Irrigation Stand	5	3	5	5	4	3	1	26	Ditto	0
MD-12	Stretcher	5	3	5	5	4	3	1	26	Ditto	0
MD-15	Medical Record Cart	5	3	5	5	4	3	1	26	Ditto	0
MD-16	Film Viewer	5	3	5	5	4	3	1	26	Ditto	0
MD-17	Suction Machine	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	3
CSSD											
CS-01	Autoclave (Large)	5	5	5	5	5	5	4	34	Planned as requested due to relevance.	1
CS-02	Autoclave (Medium)	5	5	5	5	5	5	4	34	Ditto	1
CS-04	Laminator	5	5	5	4	5	3	5	32	Ditto	1
CS-05	Shelves	5	5	5	5	5	5	5	35	Ditto	1
CS-06	Labeler	5	5	5	4	5	3	5	32	Ditto	1
CS-07	Instrument Cart	5	5	5	5	5	3	3	31	Ditto	1
CS-08	Working Table (for Sterilization Room)	5	5	5	5	5	5	3	33	Ditto	1

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
CS-10	Tube Washing and Dryer	5	5	5	5	5	5	5	35	Ditto	1
CS-12	Office Table/Chair	5	5	5	5	5	5	5	35	Ditto	1
CS-13	Sterilizing Container Set	5	5	5	5	5	5	5	35	Ditto	1
CS-14	Washing Machine	5	5	5	5	5	5	3	33	Ditto	2
CS-15	Dryer	5	5	5	5	5	5	5	35	Planned as requested due to relevance.Changed from 1 to 2 to meet required specifications.	2
CS-16	Working Table for Laundry	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	2
CS-17	Shelves for Laundry	5	5	5	5	5	5	5	35	Ditto	1
CS-18	Trolley for Laundry	5	5	5	5	5	5	5	35	Ditto	2
Pediatrics Dept.											
PD-01	Infant Incubator	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	3
PD-02	Oxygen Cylinder Set	5	5	3	5	5	2	1	26	Not a facility target for this department, so it was removed from request since the priority from other areas is low.	0
PD-03	Patient Monitor	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	4
PD-04	Infusion Pump	5	5	5	4	5	5	3	32	Ditto	1
PD-05	CPAP	5	4	4	5	5	5	3	31	Ditto	2
PD-06	Weighing machine for neonatal (digital)	5	5	5	5	5	5	5	35	Ditto	1
PD-08	Ambu Bag	5	4	5	5	5	5	3	32	Ditto	1
PD-09	Stethoscope	5	5	5	5	5	5	5	35	Ditto	1
PD-10	Sphygmomanometer	5	5	5	5	5	5	2	32	Ditto	1
PD-14	Wheelchair	5	3	5	5	4	3	1	26	Not a facility target for this department, so it was removed from request since the priority from other areas is low.	0
PD-15	Film Viewer	5	3	5	5	4	3	1	26	Ditto	0
PD-16	Nebulizer	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	2
PD-17	Mobile Suction Machine	5	5	5	5	5	5	3	33	Ditto	1
PD-18	Syringe Pump	5	5	4	3	5	5	5	32	Ditto	2
Laboratory											
LB-01	CO2 Incubator	5	5	5	5	5	3	5	33	Planned as requested due to relevance.	1
LB-02	Ultra-low Freezer	5	5	5	5	5	5	5	35	Ditto	1
LB-03	Medical Refrigerator	5	5	5	5	5	5	5	35	Ditto	1
LB-04	Water Purified System	5	5	5	5	5	5	5	35	Ditto	1
LB-05	Centrifuge	5	5	5	5	5	5	5	35	Ditto	1
LB-06	Water Bath	5	5	5	5	5	5	5	35	Ditto	1
LB-07	Blood Cell Counter	5	5	5	3	5	5	5	33	Ditto	1
LB-08	Storage Cabinet	5	5	5	5	5	3	5	33	Ditto	1

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
LB-09	Semi-auto Biochemistry Machine	5	5	5	3	5	5	5	33	Ditto	1
LB-10	Hemoglobin Meter	5	5	5	4	5	5	5	34	Ditto	1
LB-11	Automatic Pipette	5	5	5	4	5	5	5	34	Ditto	1
LB-12	Microscope with Monitor	5	5	5	5	5	5	5	35	Ditto	1
LB-13	Electrolyte Analyzer	5	4	5	3	5	3	1	26	Excluded from plan due to low overall evaluation.	0
LB-14	Safety Cabinet	5	4	5	4	4	3	1	26	Ditto	0
LB-15	Laboratory Table	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	1
Surgery											
SG-01	Cystoscope Set	5	4	4	5	5	5	3	31	Planned as requested due to relevance.	1
SG-02	Resectoscope	5	4	3	4	5	3	2	26	Excluded from plan due to low overall evaluation.	0
SG-03	Urological Examination Chair	5	4	5	5	4	3	5	31	Planned as requested due to relevance.	1
SG-04	Bougie Set	5	4	5	5	5	5	5	34	Ditto	1
SG-05	Ultrasound Machine	5	5	5	5	5	5	5	35	Ditto	1
SG-06	Patient Bed	5	5	5	5	5	5	5	35	Ditto. Since the size of the facility was unknown at the time of request, it was assumed to be 1 set. But, after a domestic analysis consistent with the facility's scale, 80 units will be planned.	80
SG-07	Film Viewer	4	3	5	5	5	5	5	32	Ditto	1
SG-08	Dressing Cart	5	5	5	5	5	5	5	35	Ditto	3
SG-09	Instrument Cart	5	5	5	5	5	5	5	35	Ditto	4
SG-10	Surgical Equipment Set for Hemorrhoid	5	3	5	5	5	5	5	33	Ditto	1
SG-11	Examination Table for Hemorrhoid	5	3	5	5	4	3	1	26	Ditto	1
SG-12	Irrigation Stand	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	20
SG-13	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
Operation Theater											
OT-01	Electric Artery Tourniquet	5	4	5	5	5	5	5	34	Planned as requested due to relevance.	2
OT-02	Proctoscope	5	4	4	4	5	2	2	26		0
OT-04	Surgical Instrument Set for Infant	5	4	5	5	5	5	5	34	Planned as requested due to relevance.	1
OT-05	Gastroenterology Instrument Set	3	2	5	5	4	5	2	26	Excluded from plan due to low overall evaluation.	0
OT-06	Cholecystectomy Instrument Set	5	4	5	5	5	5	5	34	Planned as requested due to relevance.	1

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
OT-07	Nephrectomy Instrument Set	5	4	5	5	5	5	5	34	Ditto	1
OT-08	Prostatectomy Instrument Set	5	4	5	5	5	5	5	34	Ditto	1
OT-09	Thyroidectomy Instrument Set	5	4	5	5	5	5	5	34	Ditto	1
OT-10	Emergency Tracheotomy Instrument Set	5	3	5	5	5	5	5	33	Ditto	1
OT-11	Appendectomy Instrument Set	5	5	5	5	5	5	5	35	Ditto	4
OT-12	Phlebotomy Instrument Set	5	3	5	5	5	2	1	26	Excluded from plan due to low overall evaluation.	0
OT-13	Pneumatic Bone Drill	3	3	2	5	5	3	5	26	Excluded from plan due to low overall evaluation.	0
OT-14	Electrical Surgical Unit	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	2
OT-15	Brain Retractor	4	3	2	5	5	2	5	26	Necessity is recognized, but it was removed in light of the possibility of problems with the hospital's technical level.	0
OT-16	Brain Surgery Instrument Set	4	3	2	5	5	2	5	26	Ditto	0
OT-17	Electric Bone Drill	4	4	2	5	5	2	5	27	Planned as requested due to relevance.	1
OT-18	Kirschner Wire Traction Instrument Set	5	5	5	5	5	5	5	35	Ditto	1
OT-19	Orthopedic Instrument Set	5	5	5	3	5	5	5	33	Ditto	1
OT-20	Vascular Anastomosis Instrument Set	4	3	2	5	5	2	5	26	Excluded from plan due to low overall evaluation.	0
OT-22	Gypsum Cutter	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	1
OT-23	Cast Spreader	5	5	5	5	5	5	5	35	Ditto	1
OT-24	Gypsum Table	5	5	5	5	5	5	5	35	Ditto	1
OT-25	Dermatome Set	5	5	5	5	5	5	5	35	Ditto	1
OT-26	Patient Monitor	5	5	5	5	5	5	5	35	Ditto	3
OT-27	Syringe Pump	5	4	5	4	5	5	5	33	Ditto	2
OT-28	Operation Table	5	5	5	5	5	5	5	35	Ditto	3
OT-29	Operation Light	5	5	5	5	5	5	5	35	Ditto	3
OT-30	Suction Machine	5	5	5	5	5	5	4	34	Ditto	3
OT-31	Anesthesia Machine	5	5	5	4	5	5	5	34	Ditto	3
OT-32	Infant Anesthesia Circuit	5	3	5	5	5	5	5	33	Ditto	1
OT-33	Anesthesia Table	5	5	5	5	5	5	5	35	Ditto	3
OT-34	Laryngoscope	5	5	5	5	5	5	5	35	Ditto	3
OT-35	Ambu Bag for Neonatal	5	5	5	5	5	5	5	35	Ditto	1
OT-36	Airway	5	5	5	5	5	5	5	35	Ditto	10
OT-37	Stool	5	5	5	5	5	5	5	35	Ditto	3
OT-38	Irrigation Stand	5	5	5	5	5	5	5	35	Ditto	3
OT-39	Suction Machine (small)	5	5	5	5	5	5	5	35	Ditto	1

Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
OT-40	Instrument Table	5	5	5	5	5	5	5	35	Ditto	3
OT-41	Foot Step	5	5	5	5	5	5	5	35	Ditto	3
OT-42	Instrument Cabinet	5	5	5	5	5	5	5	35	Ditto	3
OT-43	Film Viewer	5	5	5	5	5	5	5	35	Ditto	3
OT-44	Hysteroscope	5	2	3	5	5	5	5	30	Excluded from plan due to low overall evaluation.	0
OT-45	Cryosurgery Machine	5	3	5	4	5	5	5	32	Planned as requested due to relevance.	1
OT-46	Vaginal Speculum	5	4	5	5	5	5	5	34	Ditto	4
OT-47	Ambu Bag	5	4	5	5	5	5	5	34	Ditto	2
OT-48	Laryngoscope for Neonatal	5	4	5	5	5	5	5	34	Ditto	1
Recovery Rooms/ICU Rooms											
RE-01	ICU BED	5	5	5	5	5	5	4	34	Planned as requested due to relevance. Since the size of the facility was unknown at the time of request, it was assumed to be 1 set. But, after a domestic analysis consistent with the facility's scale, 10 units will be planned. .	10
RE-02	Patient Monitor	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	5
RE-03	Defibrillator	5	3	3	5	5	3	5	29	Ditto	1
RE-04	Ventilator	5	5	5	5	5	5	5	35	Ditto	1
RE-05	Stretcher	5	5	5	5	5	5	4	34	Ditto	2
RE-06	Wheelchair	5	4	5	5	5	5	5	34	Ditto	2
RE-07	Dressing Cart	5	5	5	5	5	5	5	35	Ditto	1
RE-09	Irrigation Stand	5	5	5	5	5	5	5	35	Planned as requested due to relevance. Since the size of the facility was unknown at the time of request, it was assumed to be 1 set. But, after a domestic analysis consistent with the facility's scale, 10 units will be planned.	10
RE-11	Instrument Cabinet	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	2
RE-12	Stool	5	5	5	5	5	5	5	35	Ditto	2
RE-13	Working Table	5	5	5	5	5	5	5	35	Ditto	1
RE-14	Ambu Bag	5	4	5	5	5	5	5	34	Ditto	1
RE-15	Suction Machine (small)	5	5	5	5	5	5	5	35	Ditto	1
RE-16	Laryngoscope	5	5	5	5	5	5	5	35	Ditto	1



Code No.	Description of Medical Equipment	Evaluation Criteria							Overall Evaluation	Remarks (Special Notations)	Planned Q'ty
		①	②	③	④	⑤	⑥	⑦			
RE-17	Flowmeter for Central Oxygen Supply System	5	5	5	5	5	5	5	35	Planned as requested due to relevance. Since the size of the facility was unknown at the time of request, it was assumed to be 1 set. But, after a domestic analysis consistent with the facility's scale, 10 units will be planned.	10
RE-18	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
ENT											
EN-01	Endoscope Surgery Set for ENT	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	1
EN-02	Septoplasty Instrument Set	5	2	4	5	5	2	3	26	Excluded from plan due to low overall evaluation.	0
EN-03	Audiometer	5	3	5	5	1	2	5	26	Excluded from plan due to low overall evaluation.	0
EN-04	Tonsil Dissector Instrument Set	5	4	5	5	5	5	5	34	Planned as requested due to relevance.	1
EN-05	Adenoidectomy Instrument Set	5	4	5	5	5	3	5	32	Ditto	1
EN-06	Laryngoscope Operation Set	5	3	5	5	5	3	5	31	Ditto	1
EN-07	Binocular Operating Microscope	5	4	5	5	5	3	5	32	Ditto	1
EN-08	Drill for Surgery	4	2	3	5	5	2	5	26	Excluded from plan due to low overall evaluation.	0
EN-09	ENT Chair	5	5	5	5	5	5	5	35	Planned as requested due to relevance.	1
EN-10	Head Light	5	5	5	5	5	5	2	32	Ditto	1
EN-11	Electrocautery Device	5	4	3	5	5	5	5	32	Ditto	1
EN-13	Irrigation Stand	5	5	5	5	5	5	5	35	Ditto	3
EN-14	Mastoidectomy Instrument Set	5	3	5	5	5	5	5	33	Ditto	1
EN-15	ENT Microdebrider	5	3	5	5	5	5	5	33	Ditto	1
EN-16	Film Viewer	5	5	5	5	5	5	5	35	Ditto	1
EN-17	Patient Bed	5	5	5	5	5	5	5	35	Ditto	6
EN-18	Coach for Waiting Space	5	5	5	5	5	5	5	35	Ditto	1
EN-19	Office Table/Chair	5	5	5	5	5	3	5	33	1 will be planned for unsolicited request.	1
Pharmacy											
PH-01	Shelves	5	5	5	5	5	3	5	33	Planned as requested due to relevance.	1
PH-02	Storage Cabinet	5	5	5	5	5	5	5	35	Ditto	1
PH-03	Working Table	5	5	5	5	5	5	5	35	Ditto	1
PH-04	Chair	5	5	5	5	5	5	5	35	Ditto	10
PH-05	Medical Refrigerator	5	5	5	5	5	5	5	35	Ditto	1
PH-06	File Cabinet	5	5	5	5	5	5	5	35	Ditto	1

## 2) Planned Equipment

The above investigation resulted in the 123 planned equipment items shown below in Table 2-17.

**Table 2- 17 Arrangement of Equipment**

No.	Code No.	Description of Medical Equipment	Q'ty	Unit	Imagery	Emergency	General ICU	General Medicine	CSSD	Pediatrics	Laboratory	Surgery	Operation Theatre	Recovery Room	ENT	Pharmacy
1	Req-1	Adenoidectomy Instrument Set	1	Set											1	
2	Req-3	Airway Set	10	Sets									10			
3	Req-4	Ambu Bag for Child	1	Set						1						
4	Req-5	Ambu Bag for Neonatal	2	Sets									2			
5	Req-6	Ambu Bag Set	2	Sets									1	1		
6	Req-7	Anesthesia Machine	3	Sets									3			
7	Req-8	Anesthesia Table	3	Sets									3			
8	Req-9	Appendectomy Instrument Set	4	Sets									4			
9	Req-11	Autoclave (Large)	1	Set					1							
10	Req-12	Autoclave (Medium)	1	Set					1							
11	Req-13	Automatic Pipette	1	Set							1					
12	Req-14	Tube Washing and Dryer	1	Set					1							
13	Req-15	Binocular Operating Microscope	1	Set											1	
14	Req-17	Blood Cell Counter	1	Set							1					
15	Req-18	Bougie Set	1	Set								1				
16	Req-19	C-arm X-ray Machine	1	Set	1											
17	Req-20	Cast Spreader	1	Set									1			
18	Req-21	Centrifuge	1	Set							1					
19	Req-22	Chair	10	Sets												10
20	Req-23	Cholecystectomy Instrument Set	1	Set									1			
21	Req-24	CO2 Incubator	1	Set							1					
22	Req-25	Coach for Waiting Space (Imagery)	1	Set	1											
23	Req-26	Coach for Waiting Space (ENT)	1	Set											1	
24	Req-27	CPAP	2	Sets						2						
25	Req-28	CR System	1	Set	1											
26	Req-29	Cryosurgery Machine	1	Set									1			
27	Req-30	Cystoscope Set	1	Set								1				
28	Req-31	Defibrillator	1	Set										1		
29	Req-32	Dermatome Set	1	Set									1			
30	Req-33	Desk & Stool Set	1	Set			1									
31	Req-34	Weight Height Scale	1	Set						1						
32	Req-35	Dosimeter	7	Sets	7											
33	Req-36	Dressing Cart	6	Sets		1	1					3		1		

No.	Code No.	Description of Medical Equipment	Q'ty	Unit	Imagery	Emergency	General ICU	General Medicine	CSSD	Pediatrics	Laboratory	Surgery	Operation Theatre	Recovery Room	ENT	Pharmacy
34	Req-37	Dryer	2	Sets					2							
35	Req-38	ECG	1	Set			1									
36	Req-39	Electric Artery Touraiquet	2	Sets									2			
37	Req-40	Bone Drill Unit	1	Set									1			
38	Req-41	Electrical Surgical Unit	2	Sets									2			
39	Req-42	Electrical Surgical Unit for ENT	1	Set											1	
40	Req-44	Emergency Bed	5	Sets		5										
41	Req-45	Emergency Tracheotomy Instrument Set	1	Set									1			
42	Req-46	Endoscope Surgery Set for ENT	1	Set											1	
43	Req-47	ENT Chair	1	Set											1	
44	Req-48	Examination Bed for Ultrasound Machine	1	Set	1											
45	Req-49	Examination Light	1	Set			1									
46	Req-50	Examination Table for Hemorroid	1	Set								1				
47	Req-51	File Cabinet	1	Set												1
48	Req-53	Film Viewer (Wall-monted)	5	Sets								1	3		1	
49	Req-55	Flowmeter for Central Oxygen Supply System	34	Sets		6	18							10		
50	Req-56	Foot Step	3	Sets									3			
51	Req-59	General X-ray Machine	1	Set	1											
52	Req-60	Gypsum Cutter	1	Set									1			
53	Req-61	Gypsum Table	1	Set									1			
54	Req-62	Head Light	1	Set											1	
55	Req-63	Hemoglobin Meter	1	Set							1					
56	Req-64	Holter ECG	1	Set				1								
57	Req-66	ICU Bed	28	Sets			18							10		
58	Req-67	Infant Anesthesia Circuit	1	Set									1			
59	Req-68	Infant Incubator	3	Sets							3					
60	Req-69	Infusion Pump	1	Set							1					
61	Req-70	Instrument Cabinet	5	Sets									3	2		
62	Req-71	Instrument Cart	6	Sets		1			1			4				
63	Req-73	Instrument Table	3	Sets									3			
64	Req-74	Irrigation Stand (Mobile type)	29	Sets		3						20	3		3	
65	Req-75	Irrigation Stand (Hanger type)	28	Sets			18							10		
66	Req-76	Kirschner Wire Traction Instrument Set	1	Set									1			
67	Req-77	Labeling gun	1	Set					1							
68	Req-78	Laboratory Table	1	Set							1					
69	Req-79	Laminating Machine	1	Set					1							
70	Req-80	Laryngoscope	4	Sets									3	1		

No.	Code No.	Description of Medical Equipment	Q'ty	Unit	Imagery	Emergency	General ICU	General Medicine	CSSD	Pediatrics	Laboratory	Surgery	Operation Theatre	Recovery Room	ENT	Pharmacy
71	Req-81	Laryngoscope for Neonatal	1	Set									1			
72	Req-82	Laryngoscope Operation Set	1	Set											1	
73	Req-83	Medical Refrigerator for Laboratory	1	Set							1					
74	Req-84	Medical Refrigerator for Pharmacy	1	Set												1
75	Req-85	Medicine Cabinet	1	Set		1										
76	Req-88	Microscope with Monitor	1	Set							1					
77	Req-90	Nebulizer	2	Sets						2						
78	Req-91	Nephrectomy Instrument Set	1	Set									1			
79	Req-93	Office Table/Chair	7	Sets	1	1	1		1			1		1	1	
80	Req-94	Operation Light (Ceiling Mount)	3	Sets									3			
81	Req-95	Operation Light (Mobile)	1	Set		1										
82	Req-96	Operation Table	1	Set									1			
83	Req-97	Orthopedic Instrument Set	1	Set									1			
84	Req-99	PACS	1	Set	1											
85	Req-100	Patient Bed	86	Sets								80			6	
86	Req-101	Patient Monitor	19	Sets		4	3			4			3	5		
87	Req-102	Prostatectomy Instrument Set	1	Set									1			
88	Req-103	Pulse Oximeter	4	Sets		1	3									
89	Req-104	Radiology Protection Instruments set	1	Set	1											
90	Req-108	Screen	3	Sets				3								
91	Req-109	Semi-auto Biochemistry Machine	1	Set							1					
92	Req-110	Shelves for CSSD	1	Set					1							
93	Req-111	Shelves for Pharmacy	1	Set												1
94	Req-112	Shelves for Laundry	1	Set					1							
95	Req-115	Sphygmomanometer for Infant	1	Set						1						
96	Req-116	Sterilizing Container Set	1	Set					1							
97	Req-117	Stethoscope for Adult	5	Sets		5										
98	Req-118	Stethoscope for Adult/Child	4	Sets			4									
99	Req-119	Stethoscope for Infant/Child	1	Set						1						
100	Req-120	Stool	5	Sets									3	2		
101	Req-121	Storage Cabinet for Laboratory	1	Set							1					
102	Req-122	Storage Cabinet for Pharmacy	1	Set												1
103	Req-123	Stretcher	6	Sets		2	2							2		
104	Req-124	Suction Machine (Large)	8	Sets		1	1	3					3			
105	Req-125	Suction Machine (Small)	6	Sets		1	1			1			1	1	1	

No.	Code No.	Description of Medical Equipment	Q'ty	Unit	Imagery	Emergency	General ICU	General Medicine	CSSD	Pediatrics	Laboratory	Surgery	Operation Theatre	Recovery Room	ENT	Pharmacy
106	Req-126	Surgical Equipment Set for Hemorroid	1	Set								1				
107	Req-127	Surgical Instrument Set for Ear	1	Set											1	
108	Req-128	Surgical Instrument Set for Infant	1	Set									1			
109	Req-129	Sylinge Pump	4	Sets						2			2			
110	Req-130	Thyroidectomy Instrument Set	1	Set									1			
111	Req-131	Tonsil Dissector Instrument Set	1	Set											1	
112	Req-132	Trolley for Laundry	2	Sets					2							
113	Req-133	Ultra-low Freezer	1	Set							1					
114	Req-134	Ultrasound Machine	1	Set	1											
115	Req-135	Ultrasound Machine (Mobile)	2	Sets			1					1				
116	Req-136	Urological Examination Chair	1	Set								1				
117	Req-137	Vaginal Speculum	4	Sets									4			
118	Req-139	Ventilator	3	Sets		1	1							1		
119	Req-140	Washing Machine	2	Sets					2							
120	Req-141	Water Bath	1	Set							1					
121	Req-142	Water Purified System	1	Set							1					
122	Req-143	Wheelchair	5	Sets		1	2							2		
123	Req-144	Working Table	4	Sets					2					1		1

### 3) 3 year Maintenance Contract

According to interviews to the hospital's medical equipment maintenance department and manufacturers' local agents, the equipment becomes unused after the manufacturers' guarantee period (normally 1 year) in Cambodia for generally the following reasons:

- ① The hospital's medical equipment maintenance department cannot repair and no request is made to local agents for repair.
- ② Even though the local agent visits the hospital and identifies the cause of failure, repair parts are too expensive to proceed to repair.
- ③ Failure even the local agent cannot repair (e.g. the manufacturer cannot provide repair parts because they went out of production)

As for the Battambang Provincial Hospital, the attitude of the hospital to continue using the limited equipment for a long period is seen through actions such as its medical equipment maintenance department's periodical checking on equipment conditions and carrying out simple repairs when failures appear. Furthermore, if it is a repair the maintenance department cannot handle, requests for repair are made to the agents in Phnom Penh and it is not impossible to finance the necessary cost out of the budget. Consequently if the equipment becomes unused in the hospital it would be attributable mainly to the reasons ② and/or ③ above. Especially, most of the equipment installed in the Battambang Provincial Hospital is secondhand and has reached its end-of-life or, even if it is new, of poor quality made by cheap makers like Chinese-made, accordingly reasons in almost all the cases fall under ③. Effective countermeasures against ② and ③ are to impose strict conditions when procuring equipment and to conclude a maintenance service contract.

From the above, it is deemed effective to associate this Project with a contract for equipment maintenance including spare parts and repair parts as its condition.

#### [Examination of Target Equipment]

A periodic inspection service for 3 years after handover of equipment, an on-call service for 2 years after expiration of manufacture's guarantee period and the cost of repair parts and replacement parts will be borne by the Japanese side for certain equipment among the planned equipment, whose failure would seriously affect the clinical activities or with which frequent failure during operation is anticipated.

In order to select target equipment, all equipment was first screened according to the criteria below as a preliminary selection. The equipment which passed the preliminary selection were then submitted to plural manufactures for consultation. At the same time, the existence of local agents capable of implementing the maintenance contract was confirmed based on the result of interviews to manufacturers and the field survey.

The preselected equipment and the result of examination are as follows:

#### [Selection criteria of Target Equipment]

- ① Equipment which may cause fatal accident if there is a fault
- ② Expensive equipment
- ③ Equipment which frequently fails considering the past experience
- ④ Equipment that the hospital's maintenance department cannot maintain

[Preliminarily Selected Equipment and Study Result]

- ① Anesthesia Machine: Its failure can cause serious disabilities.
- ② Automatic Hematology Analyzer: It is known by experience that it fails frequently.
- ③ CR system: It is a machine which will be used frequently.
- ④ Infusion pump: Its failure can cause serious disabilities.
- ⑤ PACS: It is a machine to be installed newly and indispensable to clinical examination
- ⑥ Biochemistry Machine: It is known by experience that it fails frequently
- ⑦ Syringe Pump: Its failure can cause serious disabilities
- ⑧ Ventilator : Its failure can cause serious disabilities

[Contents of Maintenance Contract]

In the maintenance contract, numbers of inspections will be determined for each equipment because the necessary frequency of inspection depends on equipment. Contents of the contract are as follows:

- ① Periodic inspection for 3 years
- ② On-call inspection for 2 years with ceiling (for the 1st. year, manufacturer's guarantee repairs against failures)
- ③ Cost for spare parts and replacement parts (during 1 year guarantee period, the cost will be borne by manufacturer)
- ④ Consumables will be borne by the recipient country

[Monitoring on Maintenance Services]

Consultant will monitor the progress of the maintenance services and confirm whether the maintenance services are carried out adequately or not for three years after the handover. Consultant will visit the hospital and equipment agency every year to check the status of implementation and to report the progress to MOH, hospital and JICA.

[Target equipment]

Equipment to be covered by this service and numbers of maintenance activities deemed as appropriate for each equipment on the basis of the above examination are as follows:

**Table 2- 18 Examination results of 3 year maintenance contract**

No.	Code No.	Equipment Name	Quantity		Periodic Maintenance/year/machine x 3 years	On Call Service frequency/year/machine x 2 years
6	Req-7	Anesthesia Machine	3	Sets	2	5
14	Req-17	Blood Cell Counter	1	Set	2	5
24	Req-28	CR System	1	Set	1	3
60	Req-69	Infusion Pump	1	Set	1	3
84	Req-99	PACS	1	Set	0	3
91	Req-109	Semi-auto Biochemistry Machine	1	Set	2	5
109	Req-129	Syringe Pump	4	Sets	1	3
118	Req-139	Ventilator	3	Sets	2	3

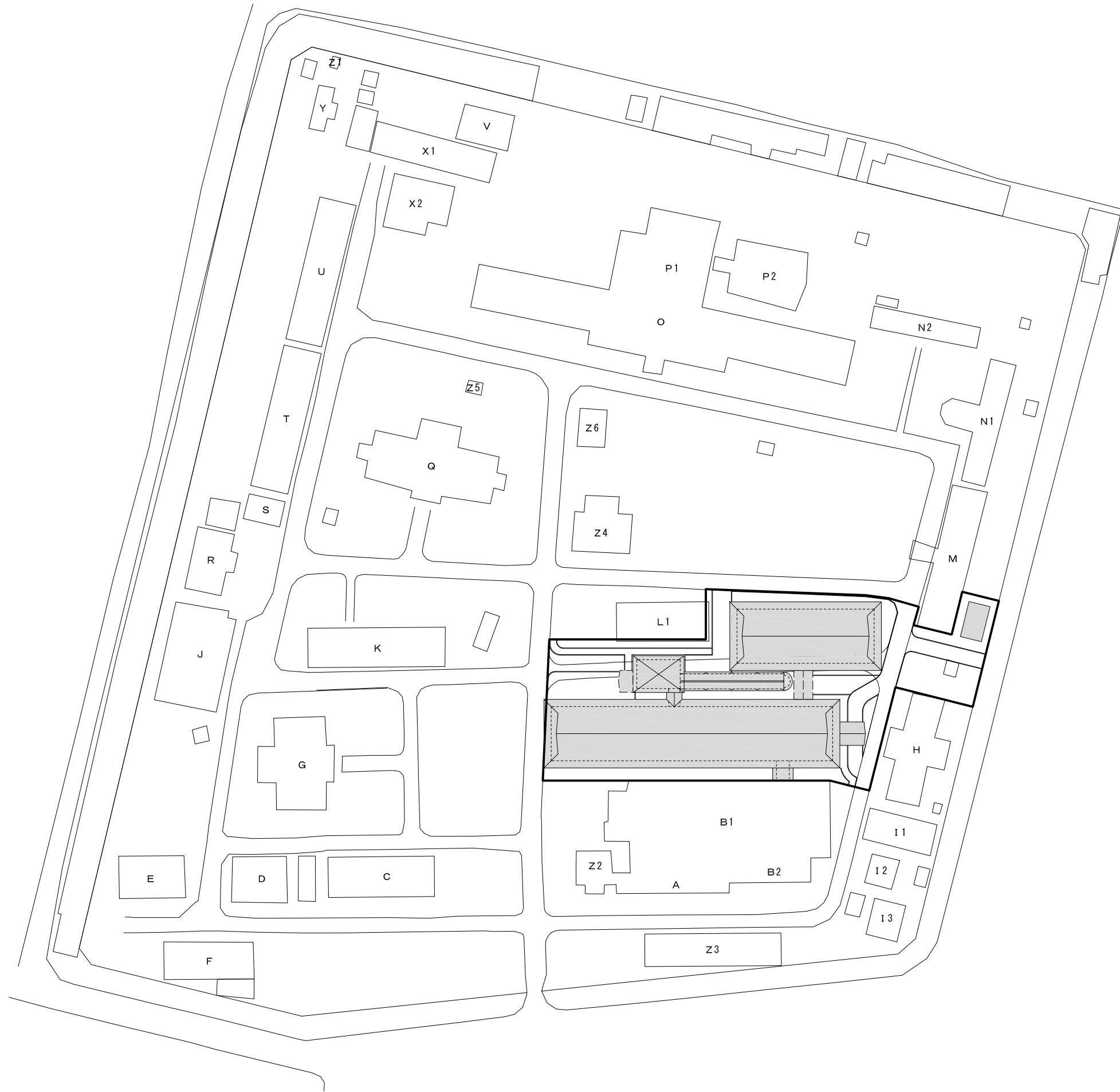
2-2-3 Outline Design Drawing

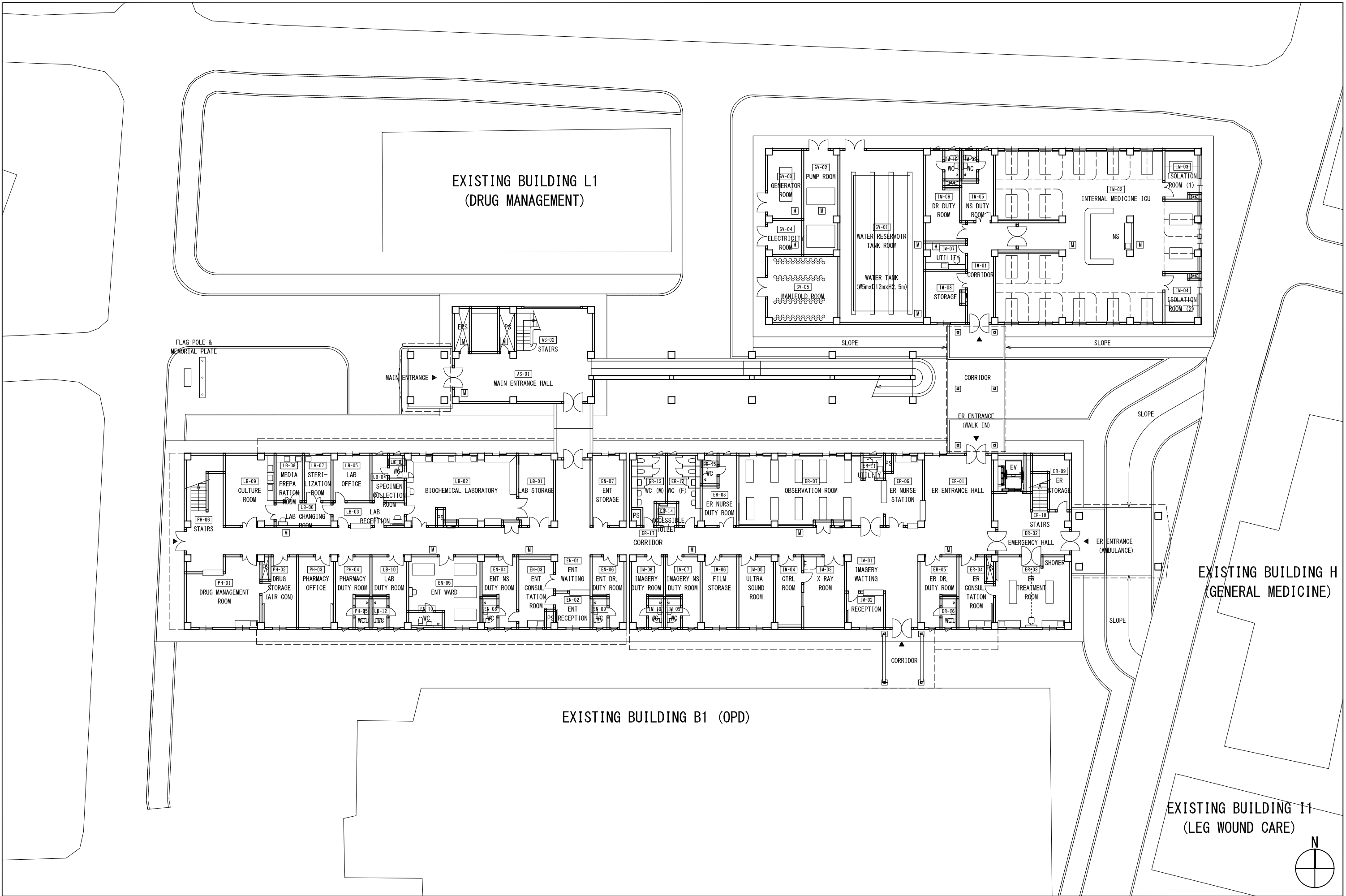
**Table 2- 19 Outline Design Drawing List**

No.	Building Name	Drawing Name	Scale
A-1	Entire Hospital	Site Plan	1/1,200
A-2	Surgical OT and Ward Bldg./Internal Medicine ICU/Entrance Bldg.	Ground floor plan	1/300
A-3	Surgical OT and Ward Bldg./Entrance Bldg.	1 <sup>st</sup> floor plan	1/300
A-4	Surgical OT and Ward Bldg./Entrance Bldg.	2 <sup>nd</sup> floor plan	1/300
A-5	Entrance Bldg.	3 <sup>rd</sup> floor-roof plan	1/300
A-6	Surgical OT and Ward Bldg. (North,South)	Elevation Plan	1/300
A-7	Surgical OT and Ward Bldg./Internal Medicine ICU/Entrance Bldg. (West), Internal Medicine ICU (North)	Elevation Plan	1/300
A-8	Surgical OT and Ward Bldg./Internal Medicine ICU/Entrance Bldg. (East), Internal Medicine ICU (South)	Elevation Plan	1/300
A-9	Entrance Bldg. (South, North)	Elevation Plan	1/300
A-10	Surgical OT and Ward Bldg./Internal Medicine ICU	Elevation Plan	1/300



Building List	
A:	Administration
B1:	ER, OPD & Triage
B2:	Mental Disease
C:	ENT
D:	Student Dormitory
E:	Prisoner's Ward
F:	Blood Bank
G:	General Medicine ICU
H:	General Medicine
I1:	Leg Wound Care
I2:	Dermatology
I3:	Kinetics
J:	Ophthalmology
K:	Laboratory
L1:	Drug Distribution
L2:	Drug Storage
M:	Pneumology
N1:	Tuberculosis A
N2:	Tuberculosis B
O:	Surgery & CSSD
P1:	OB/GY
P2:	Delivery & NICU
Q:	Pediatrics
R:	Family Health Clinics
S:	Nursing Care
T:	General Medicine
U:	HIV/AIDS & STD
V:	Kitchen
X1:	Kitchen & Generator
X2:	Warehouse
Y:	Mortuary
Z1:	Incinerator
Z2:	Health Equity Fund
Z3:	Bikes Parking
Z4:	Canteen
Z5:	Water Tank
Z6:	Water Tank



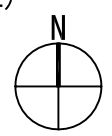


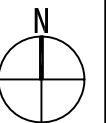
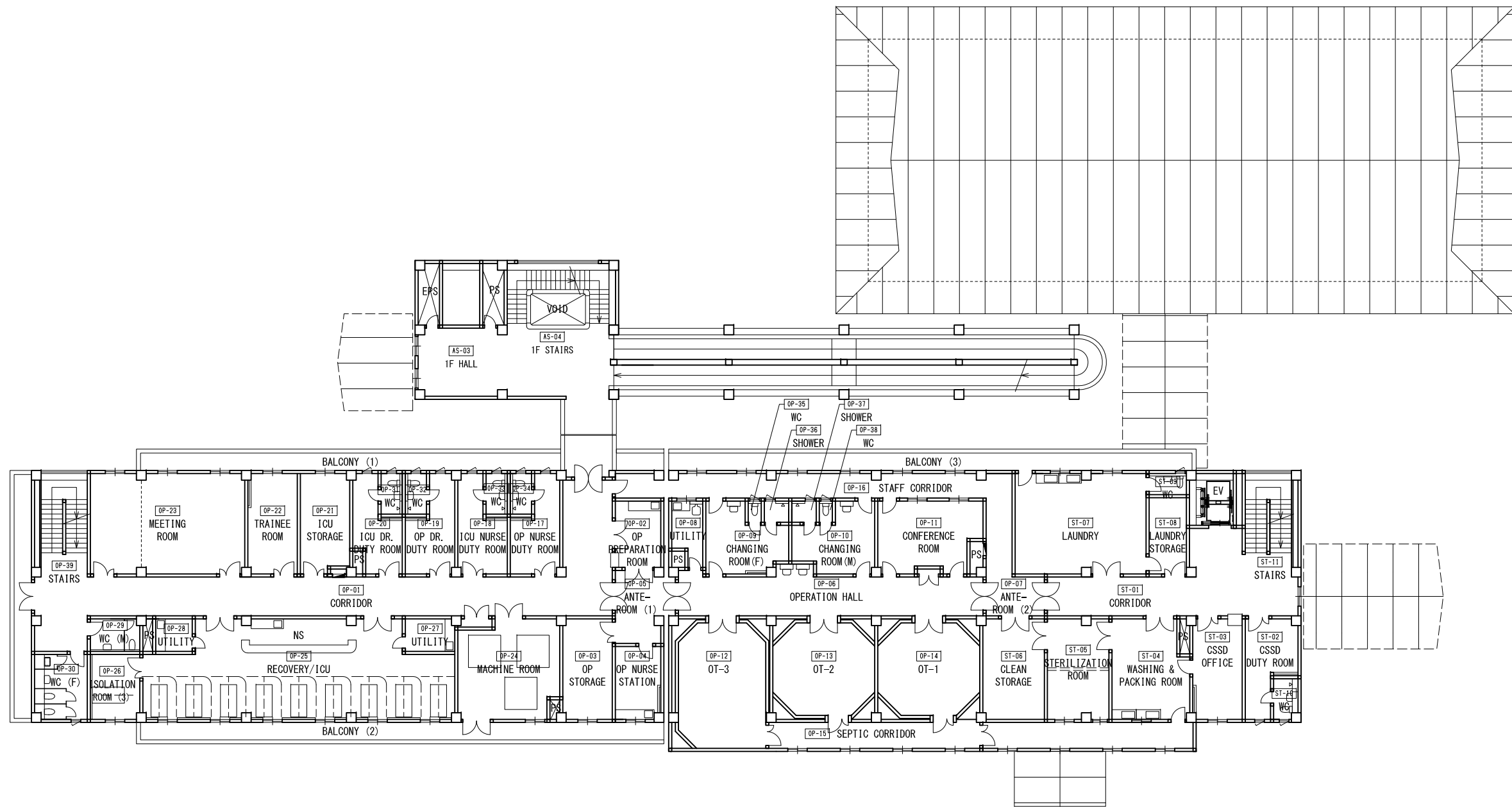
EXISTING BUILDING L1  
(DRUG MANAGEMENT)

EXISTING BUILDING H  
(GENERAL MEDICINE)

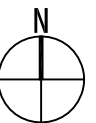
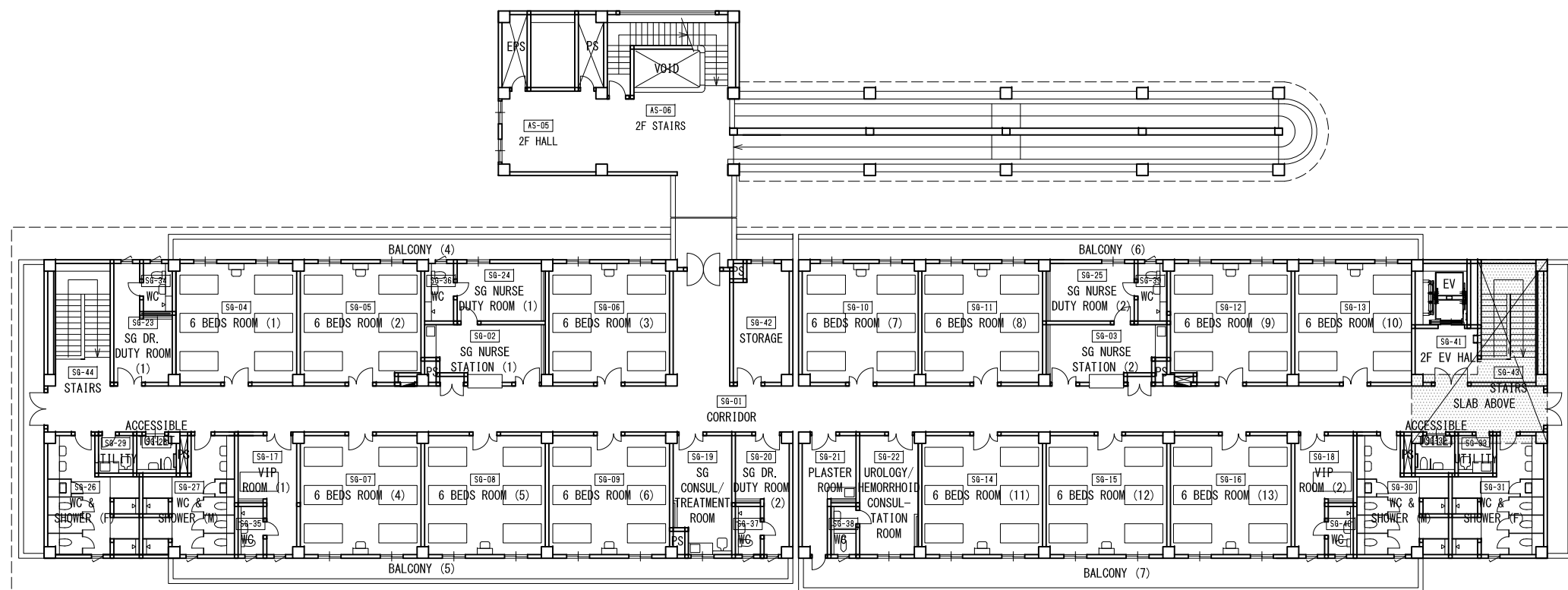
EXISTING BUILDING B1 (OPD)

EXISTING BUILDING I1  
(LEG WOUND CARE)

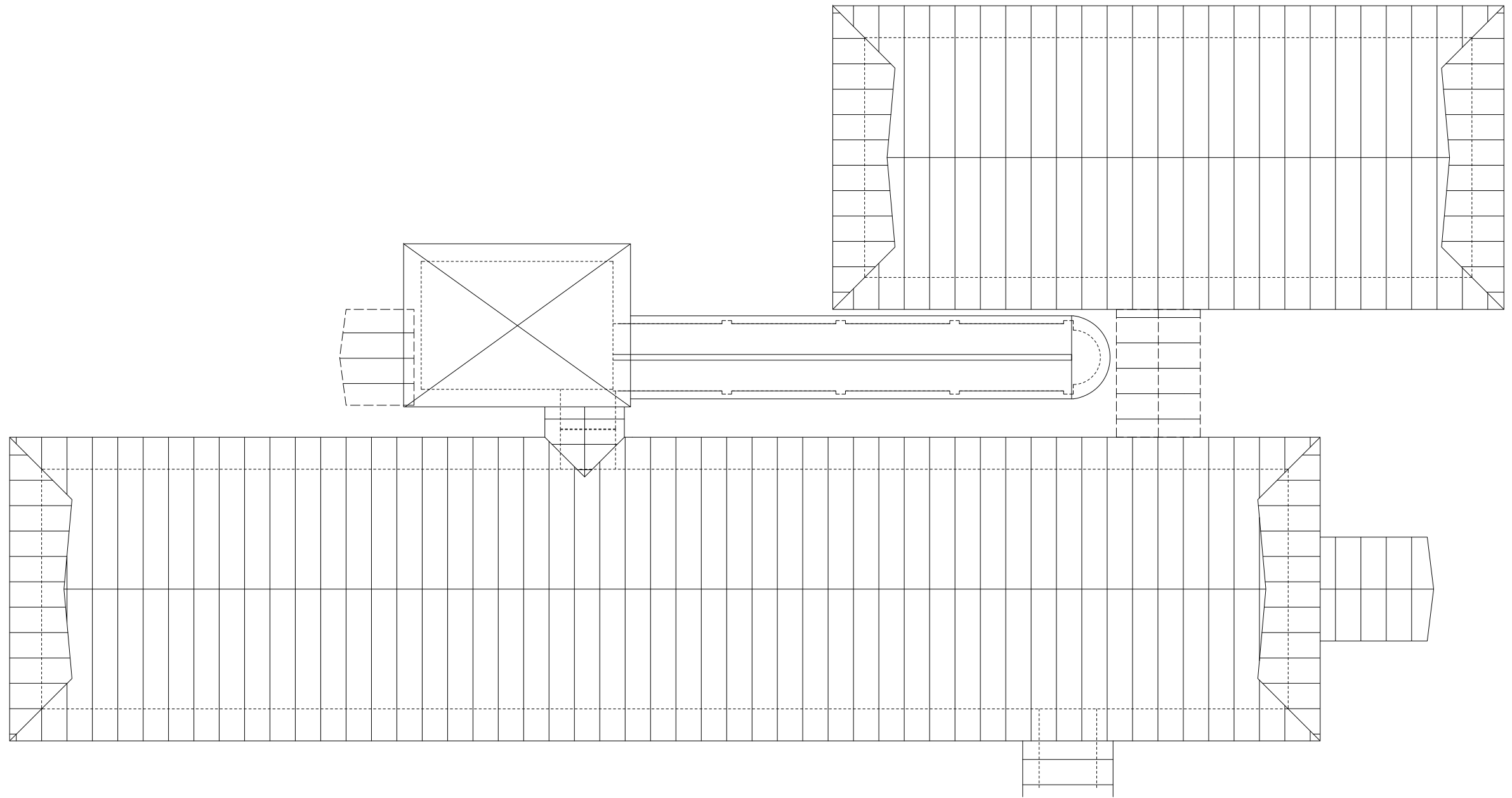




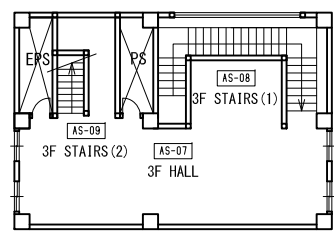
PROJECT	The Project for Improvement of Battambang Provincial Referral Hospital	DWG TITLE	FIRST FLOOR PLAN			
SITE	Battambang Provincial Referral Hospital	SCALE	SCALE A3: 1/300 A1: 1/150	DATE	JAN 2017	PROJECT No. DWG No. A — 3



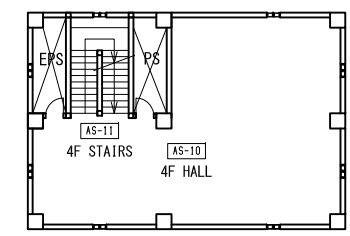
PROJECT	The Project for Improvement of Battambang Provincial Referral Hospital	DWG TITLE	SECOND FLOOR PLAN			
SITE	Battambang Provincial Referral Hospital	SCALE	SCALE A3: 1/300 A1: 1/150	DATE	JAN 2017	PROJECT No. DWG No. A - 4



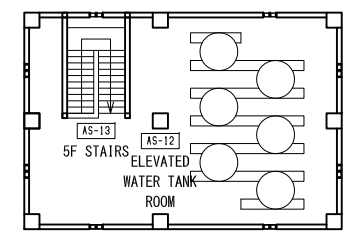
ROOF PLAN



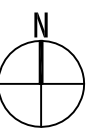
3FL PLAN



4FL PLAN

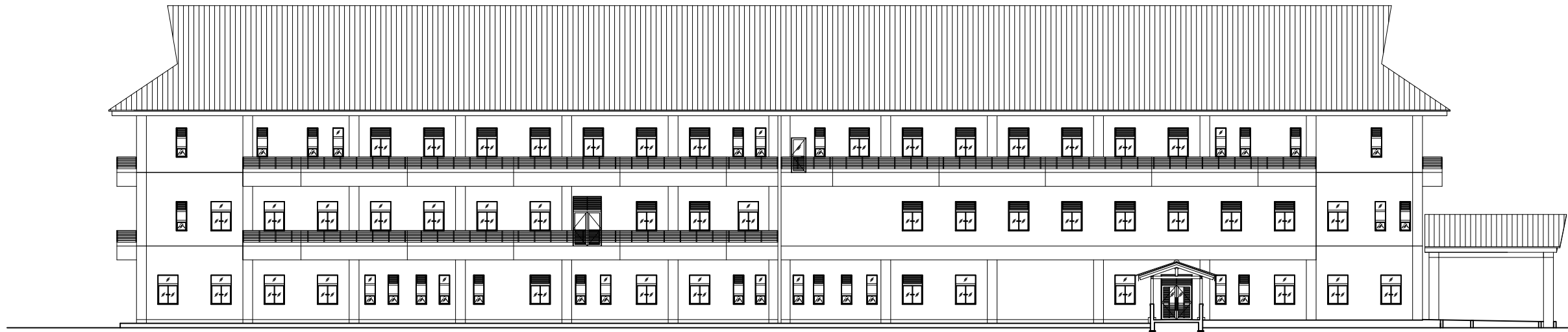


5FL PLAN





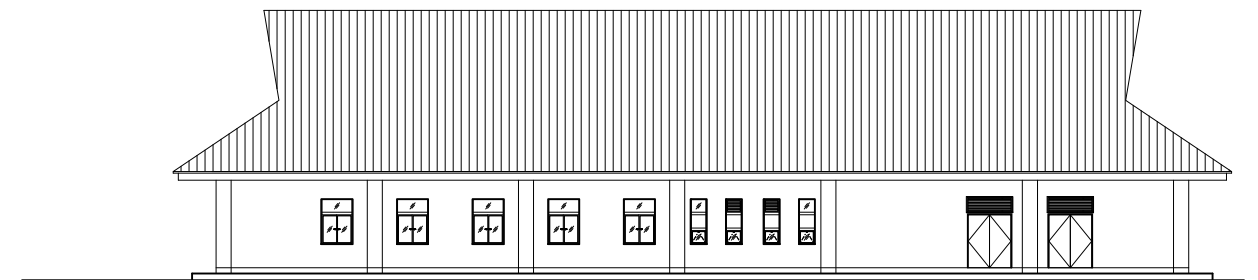
Surgical OT and Ward Bldg. North Elevation



Surgical OT and Ward Bldg. South Elevation



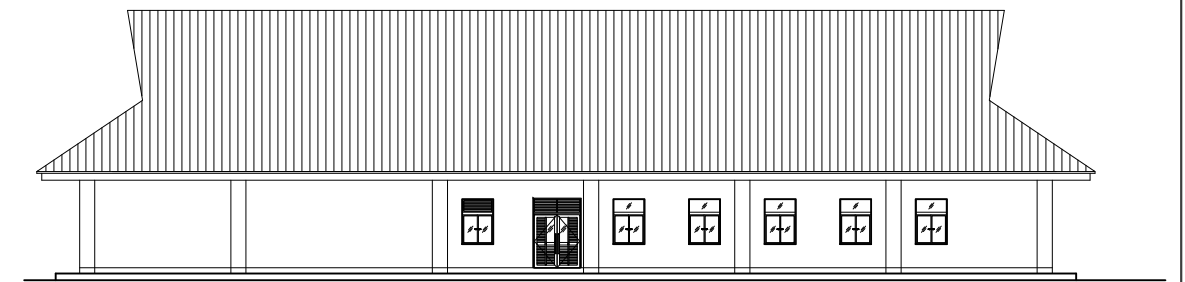
Surgical OT and Ward Bldg./Internal Medicine ICU/Entrance Bldg. West Elevation



Internal Medicine ICU North Elevation

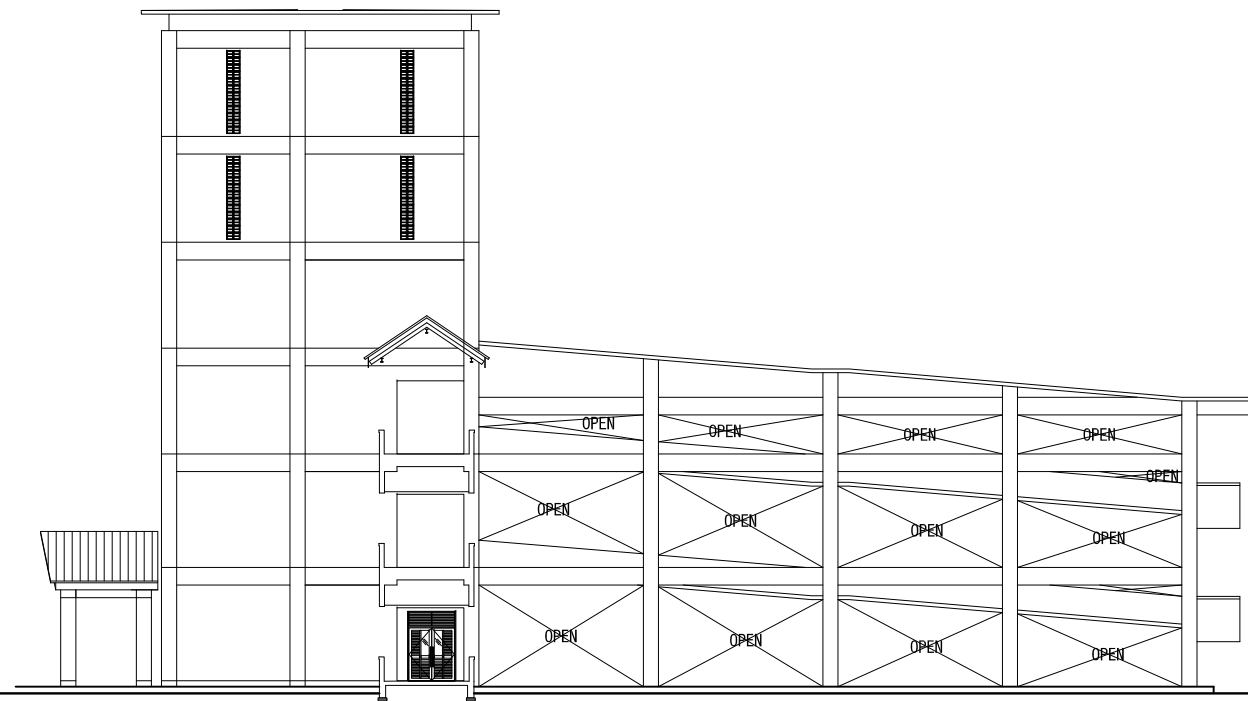


Surgical OT and Ward Bldg./Internal Medicine ICU/Entrance Bldg. East Elevation

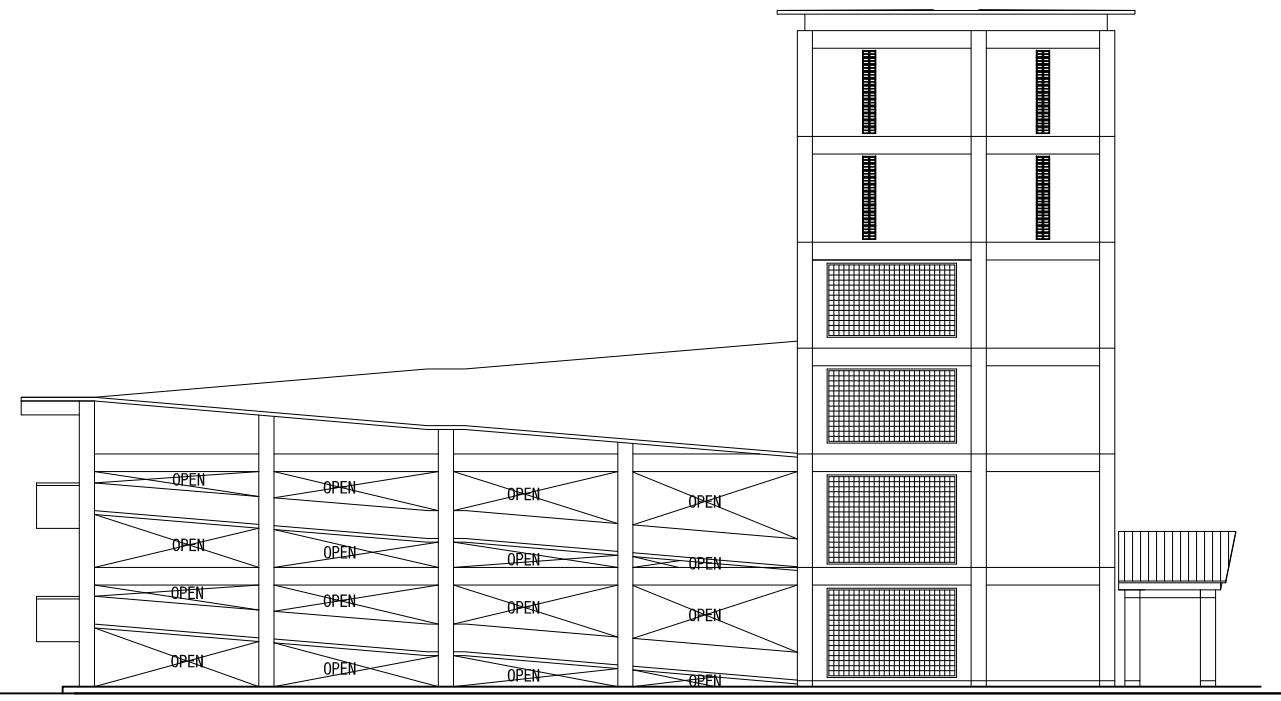


Internal Medicine ICU South Elevation

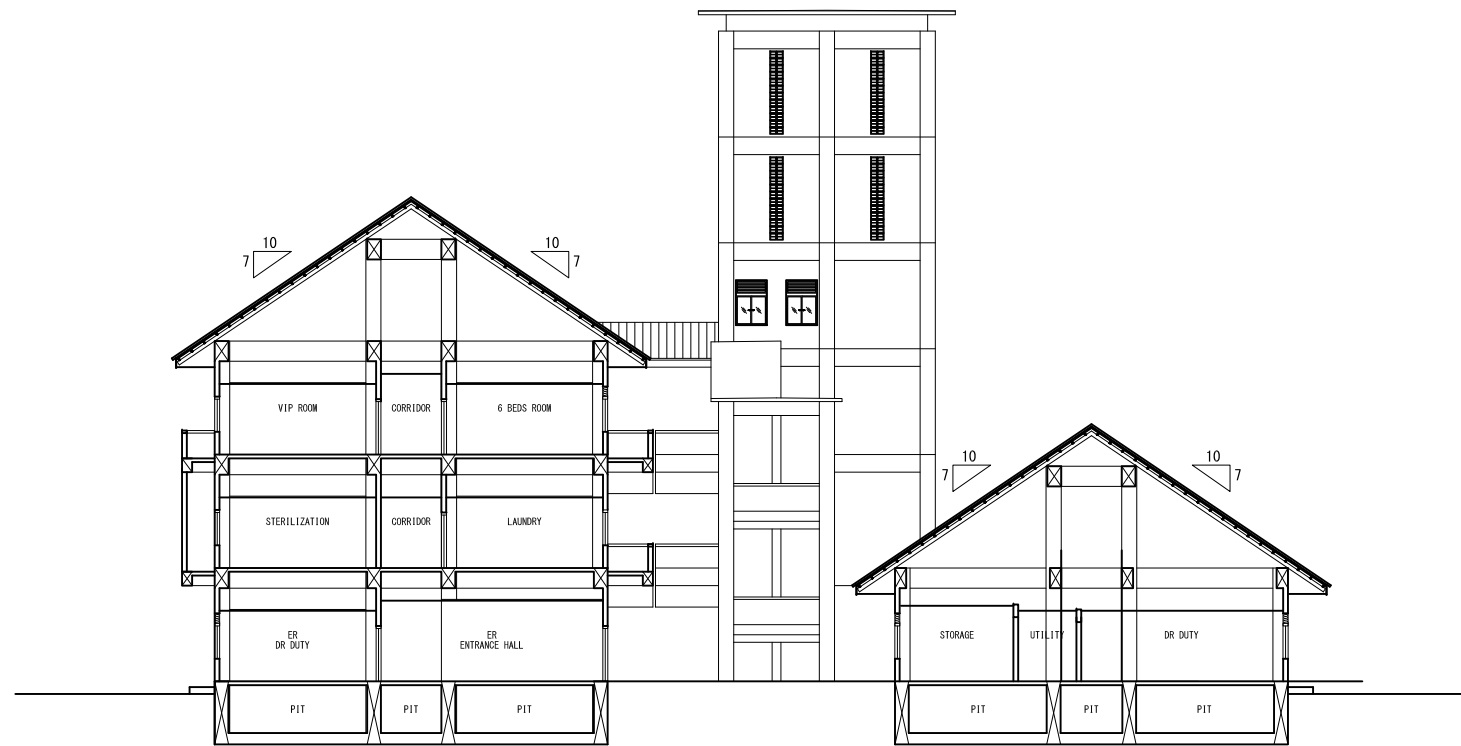




Entrance Bldg. South Elevation



Entrance Bldg. North Elevation



Surgical OT and Ward Bldg./Internal Medicine ICU Section

## 2-2-4 Implementation Plan

### 2-2-4-1 Implementation Policy

The elements of this project include facility construction work, supply and installation of equipment, and the scope of cooperation regarding to the project will be implemented according to the framework of grant aid by Japan. Implementation of this plan shall be initiated officially only after it is approved by the Governments of both countries and the exchange of notes (E/N) and the grant agreement (G/A) is signed. Immediately after signing of the E/N and the G/A, the Cambodian organization that is responsible for implementation of this project and the Japanese consultant firms shall enter a contract and initiate the detail design work of the project. When the design is completed, the Japanese construction companies and equipment supply and installation companies participate in the tender for their works. The successful tenderers for construction of facilities and supply and installation of the equipment proceed to their work. The basic principles and items to be proposed for implementation of this project are described below.

#### 1) Implementing Organizations

The implementing organization in the project is the Ministry of Health (MOH) in Cambodia, and the Battambang Provincial Health Department (PHD) and the Battambang Provincial Hospital will be responsible for operation and maintenance of the facilities and the equipment provided by Japan.

#### 2) Consultant

After signing of the E/N and the G/A, the Japanese consultant firm and the Cambodian implementing organization enter a consultant contract according to the formal procedure for the grant aid system of the government of Japan. This consultant firm executes the following activities under this Contract.

- ① Implementation design of the project: To prepare the design documents (specifications and technical reference materials on the facilities and equipment included in the project).
- ② Tender: To cooperate in selection of the contractor(s) and supplier(s) through the tender and in transaction of procedures required under the contract.
- ③ Construction supervision: To supervise the instructions for the construction of the facilities and delivery, installation, operation and maintenance of the equipment.
- ④ Inspection of defects and inspection before expiration of manufacturer's warranty : To be witness of the inspection of defects conducted 1 year after the delivery and the inspection before expiration of manufacturer's warranty of 1 year for supplied equipment.

In the detail design stage, the consultant determines the construction plan and the equipment supply plan in detail based on the Preparatory Survey of the project, and prepares the tender documents which include specifications of the plans, tender terms and conditions, and draft of the contracts regarding construction work and procurement of equipment.

Cooperation to the tender procedure means to observe selection of the contractor(s) and the supplier(s) through the tender conducted by the implementing organization and to help them transact the formal procedures required for execution of their contracts and preparation of the reports to be submitted to the government of Japan.

Construction supervision means to check whether or not the contractor and the supplier implement

their works as specified in their contracts to make sure that the contents of their contracts are implemented appropriately. In addition, to promote smooth implementation of the project, the consultant shall, in the neutral position, provide related parties with advice and guidance and serve as a coordinator among them. Listed below are major items in the scope of the construction supervision work.

- ① Procedures required for verification and approval of the work implementation plan, implementation drawings, equipment specifications and other documents submitted by the contractor(s) and supplier(s).
- ② Inspection and approval prior to shipment of qualities and performances of the construction materials and equipment to be supplied.
- ③ Confirmation of instructions for supply, installation and handling of the construction materials and equipment.
- ④ Checking and reporting the progress of the construction.
- ⑤ Observation of handing over the completed facilities and equipment.

The consultant shall execute above items and report to the related authorities of the government of Japan about the progress of this project, the payment procedure and handover.

### **3) Contractor(s) and Supplier(s)**

The contractor(s) and the supplier(s) shall be selected through the open tender for the Japanese corporations that are qualified to the specific requirements. In principal, contracts will be made between the MOH and the contractor(s) and the supplier(s) that proposed the lowest price and succeed in the subsequent negotiations.

The contractor(s) and the supplier(s) shall construct the facilities, supply, deliver and install necessary construction materials and equipment according to the contracts, as well as provide technical guidance for operation, maintenance and management of the procured equipment to the Cambodian side. In addition to the 1 year guarantee period, the Project will require the suppliers, manufacturers and agents to include the periodic inspection for 3 years after the handover, on-call service for 2 years after 1 year guarantee period, and supply of repair parts and spare parts so that the hospital can continuously utilize the procured equipment. Furthermore, the contractor(s) and supplier(s) provide guidance for securing a supply system where suppliers, manufacturers and agencies supply spare parts and consumables needed for continuous use of the equipment after procured, as well as support to make it possible to receive services such as paid repair after the period of guarantee and technical guidance, etc. even after the above maintenance service period expired.

### **4) Japan International Cooperation Agency**

The Japan International Cooperation Agency shall give due advice to the consultant so that the project is implemented in conformity with the grant aid system. Also, it shall hold consultations with the implementing organizations of this project as necessary for untroubled implementation of the project.

### **5) Preparation for Implementation Plan**

The representatives of the implementing organization on the Cambodian side and the consultant shall review the implementation plan during the detail design period. They shall make clear the scopes

of the construction work of which Japanese and Cambodian sides take charge, confirm through consultations the starting time and the method of each work and discuss so that all the works will be carried out smoothly according to the implementation schedule in this report. In particular, attention should be paid to some works which must be carried out by the Cambodian side at its own expense before commencement of the facility construction work, such as to secure and prepare the land, to demolish the existing buildings.

#### **2-2-4-2 Implementation Conditions**

Described below are those items to be noted for implementation of the project. They should be fully taken into consideration when making the implementation plan.

##### **1) Schedule Management**

Since the project site is in a region where it rains frequently in the wet season of May to November, a schedule will be planned with sufficient time should be allocated to excavation and foundation work, avoiding the wet season to the extent possible. Also, allocating enough curing time for each finishing task will ensure finish quality of the buildings. Therefore, the project will fully take the construction schedule into consideration.

##### **2) Dispatch of Technicians for Equipment Installation**

It is extremely important to impart knowledge and skills regarding appropriate operation and maintenance of the equipment so as to contribute to medical services through continuous proper operation of the procured equipment after implementation of the project. That being the case, technicians who are thoroughly familiar with the operation of the each piece of equipment will be selected as the equipment installation technicians, and sufficient time will be allotted for them to explain operation thereof (operation techniques, simple repair techniques, inspection methods, etc.) and to make sure that those concerned on the receiving side acquire sufficient understanding concerning its operation and maintenance.

##### **3) Safety Control**

Taking into consideration the character of the project that construction will be implemented in the site of an operating hospital, great attention shall be paid to safety control which includes installing temporary enclosures on the border of the hospital and allocating guides at the site.

#### **2-2-4-3 Scope of Works**

It is mutual cooperation between Japan and Cambodia that makes implementation of this project successful. If this project is implemented under the Japan's grand aid, the scopes of works undertaken by the governments of both countries shall be as described below.

##### **1) Undertakings Borne by the Government of Japan**

The government of Japan bears cost to undertake consultation of this project and the works related to construction of the facilities, procurement and installation of equipment as described below.

- ① Consultation
  - i) To prepare detail design documents for the facilities and equipment subject for this project and their tender terms documents.
  - ii) To cooperate in selecting the contractor(s) and supplier(s) as well as executing contracts for the project.
  - iii) To supervise the instructions for the construction of the facilities and delivery, installation, operation and maintenance of the equipment.
- ② Construction of facilities, supply and installation of the equipment
  - i) To construct facilities subject to this project.
  - ii) To procure construction materials and equipment subject to this project, transport and deliver them to the site.
  - iii) To instruct installation of the equipment subject to this project, conduct a trial run and make adjustments.
  - iv) To explain and instruct operation and maintenance methods for the equipment subject to this project.

## 2) Undertakings Borne by the Cambodian Side

The Cambodian side will bear and implement the following tasks concerning land development of the construction site, clearance of the existing facilities, wiring and equipment installation needed for power supply into the construction site, procedures for tax exemption, etc.

- ① Preparation of the Construction Site
  - i) To secure and prepare the land for the construction and the temporal works
  - ii) To clear the existing facilities and trees at the project site
  - iii) To secure and prepare the project site
  - iv) To draw electricity into the project site, set up a leading-in pole, and make applications
- ② Exterior Works
  - i) Construction of the Boundary Fence
  - ii) Planting
- ③ Renovation Works
  - i) Renovation works of the Surgery & CSSD Ward (O) after relocating surgery department from Surgery & CSSD Ward (O) to the new building and pediatrics department to the space left by the surgery
  - ii) Renovation works of the General Medicine ICU Ward (G) after relocating general medicine ICU(G) department to the new building and drug storage (L2), which will be removed for the new construction, to the space left by the general medicine ICU
- ④ To purchase or transfer medical equipment, furniture and appurtenances to be procured by the Cambodian side

- ⑤ To exempt customs duties, internal taxes and other fiscal levies which may be imposed in Cambodia with respect to the supply of the products, services, and equipment necessary for the Project.
- ⑥ To ensure prompt unloading and customs clearance at the points of disembarkation and internal transportation for the equipment and materials to be exported from Japan and other foreign countries according to the approved contracts
- ⑦ To provide arrangements necessary for entrance and stay to those Japanese who enter and stay in Cambodia to carry out their roles for the project
- ⑧ To issue approvals and permissions required for implementation of this project
- ⑨ To pay all the necessary expenses other than those borne by the government of Japan

#### **2-2-4-4 Consultant Supervision**

##### **1) Construction Supervision Policy**

Under the grant aid policy of the government of Japan, the consultant forms, based on the concept of the outline design, a team that is consistently responsible to execute the project including preparation of the detail design to achieve smooth and successful implementation. The construction supervision policy for this project is outlined below.

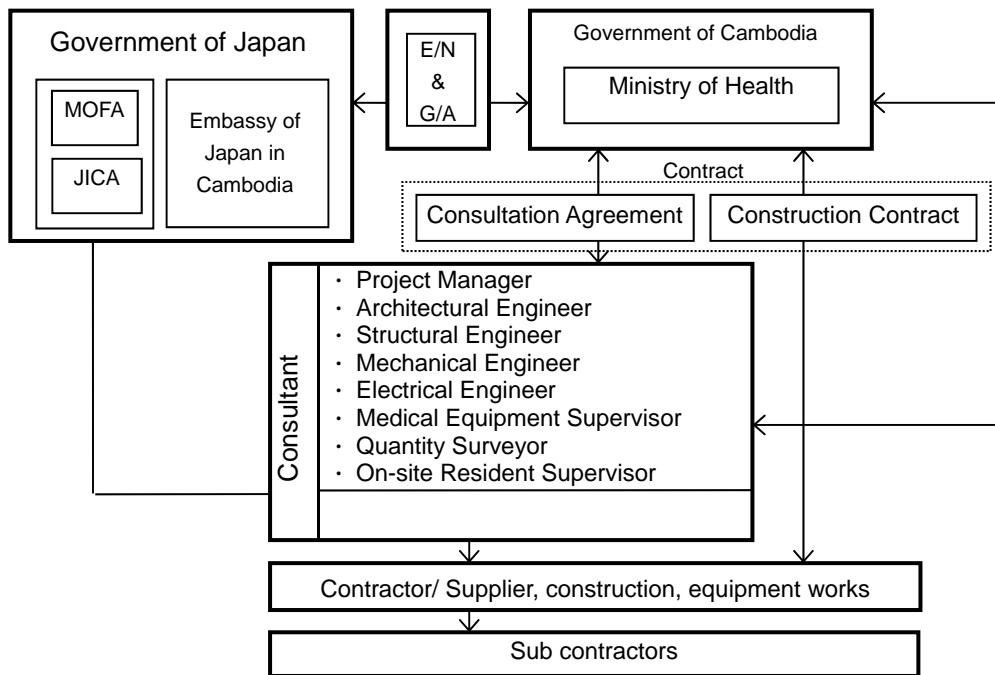
- ① To keep close contact with those who are in charge of the project representing related organizations of both countries so that construction of the facilities and installation of equipment will be completed without delay.
- ② To provide quick and appropriate advice and suggestions from the neutral standpoint to the contractor(s), supplier(s) and others concerned.
- ③ To provide appropriate guidance and suggestions regarding suitable equipment layout and adjustment of tie-in with facilities as well as operation and management after handing over. And to confirm that construction has been completed and terms of each contract are fulfilled, to observe handing over the facilities and equipment and obtain an approval of receipt from the Cambodian side.

##### **2) Construction Supervision Plan**

As the types of construction works involved in this project are versatile, a resident supervisor (in charge of construction) is appointed and the following engineers are dispatched from time to time, keeping step with the progress of the construction works.

- ① Manager of general affairs (Overall coordination, process control)
- ② Engineer in charge of construction (Confirmation of construction methods, design concept, construction drawings, specifications of materials, etc.)
- ③ Engineer in charge of structure (Confirmation of the ground conditions, foundation work, framework)
- ④ Engineer in charge of electrical installation (Power supply and distribution equipment, power receiving and transforming equipment, etc.)
- ⑤ Engineer in charge of mechanical installation (Utility supply and processing system, air conditioning, water supply, drainage and hygiene system, etc.)

- ⑥ Engineer in charge of equipment (Supervision of equipment installation, adjustment with the facility, confirmation of operation instructions, etc.)



**Figure 2-14 Construction Administration System**

**3) Monitoring of Maintenance Service by Supplier after Handover**

Consultant will monitor the progress of the maintenance services and confirm whether the maintenance services are carried out adequately or not for three years after the handover. Consultant will visit the hospital and equipment agency every year to check the status of implementation and to report the progress to MOH, hospital and JICA.

**2-2-4-5 Quality Control Plan**

**1) Quality Control Plan of the Facilities**

The Contractor(s) will submit the documents of construction plans in advance to the consultant according to the construction contract (drawings, specifications, etc.). The consultant will, prior to the commencement of construction, verify the adequacy of the construction plan by specifically setting inspection items and frequency to secure high level of quality control.

Major items to supervise are listed below.

① **Material**

On-site resident supervisor will implement the inspection of receiving construction materials.

- i) Reinforcing mill sheets, results of tension strength tests and manufacturers names
- ii) Analysis tables of cement material identification, tables of test results and manufacturers names



iii) Analysis of salt components in sands/gravels, size distributions, specific gravities and percentages of absorption

iv) Reinforced concrete

iv)-1 Verification of Mixing Plans

Confirmation and determination of the sands/gravels quantity, slump, cement-water ratio, air quantity and salt components through test mixings

iv)-2 Compression Tests

Determination of the standard control values from analysis of result tables

iv)-3 Control of material quantity measures and complete control of material storage

iv)-4 Prior submittals of concrete casting plans

② Standards of Control

The consultant will carry out the construction supervision with certain standards of control based on the approved construction schedule plans. The standards of control will be basically governed by the standards of Japan.

③ Soil Bearing Capacity

Confirmation of the soil bearing capacity will be carried out with the presence of on-site resident supervisor on the site by implementing plane table loading tests.

## 2) Quality Control Plan of Equipment

Ready-made medical equipment to be procured for this project will be selected from the equipment that complies with JIS, UL, IEC, ISO and other international standards. The consistencies between the equipment to be procured and the contents of the contract will be confirmed at the inspections carried out before shipment together with the inspections carried out by the third agencies for the components of shipment and containers.

### 2-2-4-6 Procurement Plan

#### 1) Construction Materials

It is not easy to obtain quality construction materials around Battambang. All of the materials including aggregates such as sand and gravel will need to be brought from the capital Phnom Penh. For the selection of materials, it is essential to comprehensively examine usage purpose, durability, economic efficiency, etc., and conduct detail planning with full consideration of the maintenance necessary for primary structures, as well as finishings and facility equipment. For this reason, the project should procure as many materials capable of local maintenance as possible.

Taking into account that Battambang Province has few Cambodian engineers, and skilled engineers need to be dispatched from Phnom Penh, the labor situation is not good. It is therefore essential to dispatch Japanese staff to supervise the site in accordance with the progress of the project.

**Table 2- 20 Procurement of Construction Materials**

Materials	Procurement from			Remarks
	Cambodia	Japan	Third country	
Cement	o			
Sands/ Gravels	o			
Plywood form	o			
Brick	o			
Hollow Concrete Brick	o			
Reinforcement Bar	o			
Structural Steel	o			
Lumber	o			
Roofing materials	o			
Ceramic tile	o			
Paintings	o			
Heat insulation materials	o			
Aluminum D&W frames	o			
Steel D&W frames	o			
Glass	o			
D&W hardwares	o			
Wooden furniture	o			
Distribution panels	o			
Lighting equipment	o			
Electricity wirings	o			
Wiring accessories	o			
Incoming panel	o			
Transformer	o			
Light electrical appliances	o			
PVC pipe	o			
Plumbing fixtures	o			
Pump	o			
Water receiving tank	o			

## 2) Equipment

In Battambang Province where the Project's target hospital is located there isn't any agency which deals in hospital-use medical equipment and appliances associated to it, which necessitates to deal with the agencies in Phnom Penh city in case of need for procurement or repair.

Since there are little medical equipment produced in Cambodia, Japanese or third-country products will be procured. In Phnom Penh city, there are many agencies specialized in dealing in medical equipment. A survey conducted on the agencies showed that they have experience in procuring almost all the equipment listed in the request and they don't seem to have any particular problem as for procurement of spare parts and the like. In the same way, it was confirmed that after-sales services can also be handled in Cambodia by making request to each manufacturer directly from or via local agency.

Transportation plan for the equipment to be procured from Japan and third-countries will consist of the sea transportation to the Sihanouk Port in Cambodia and the land transport from the port to the Battambang Provincial Hospital.

### 2-2-4-7 Operational Guidance Plan

Equipment setting guidance and Normal operation guidance will cover only specific contents of the

procured equipment since the equipment planned under the Project are basic equipment in line with the activities in the target hospital and its personnel have sufficient experience in operation of each equipment. Technicians will be dispatched from Japanese manufacturers or local agents.

#### **2-2-4-8 Soft Component (Technical Assistance) Plan**

It is assumed that any problems regarding operation and maintenance will not occur. However, for the which have not used in the hospital before or have necessity of building system for operation, the both side of Japan and Cambodia confirmed the necessity of technical assistance with soft component as described below in this project to promote more effective utilization of procured equipment during field survey.

- Technical Assistance on CR system and Picture Archiving and Communication System (PACS)  
Although providing explanation on equipment setting and guidance on normal operation will suffice to operate those systems, providing the assistance technique is considered to be effective in consideration of the need to build a new operation system with a changeover in data management system from analog films to digital images. Furthermore, assistance technique provided in digital processing technology etc. would contribute to efficient operation and more effective maintenance management including trouble shooting, etc. in case of failure.
- Support to establish a system for Laboratory waste liquid treatment  
Laboratory is planned to be built in the new building and its equipment will be reinforced. In the new Laboratory, it is planned that treatment method of waste liquids will be determined according to possible environmental impact of each liquid, such as use of different sinks for specific liquids. Waste liquids were not sorted in the past while the treatment of waste liquids in this new facility will necessitate establishment of new treatment system. Therefore, a support to establish a system for sorting and treatment of waste liquids will be provided after installation.

#### **2-2-4-9 Implementation Schedule**

##### **1) Project Implementation Schedule**

Following the tendering and contract signing concerning construction and equipment procurement after the exchange of notes (E/N) and the grant agreement (G/A), which were signed between the two countries for implementation of the project under the grant aid system of the government of Japan, facility construction, equipment procurement and installation will be implemented within a single fiscal year. The following shows approximate time needed for detail design, tendering and construction/procurement/installation:

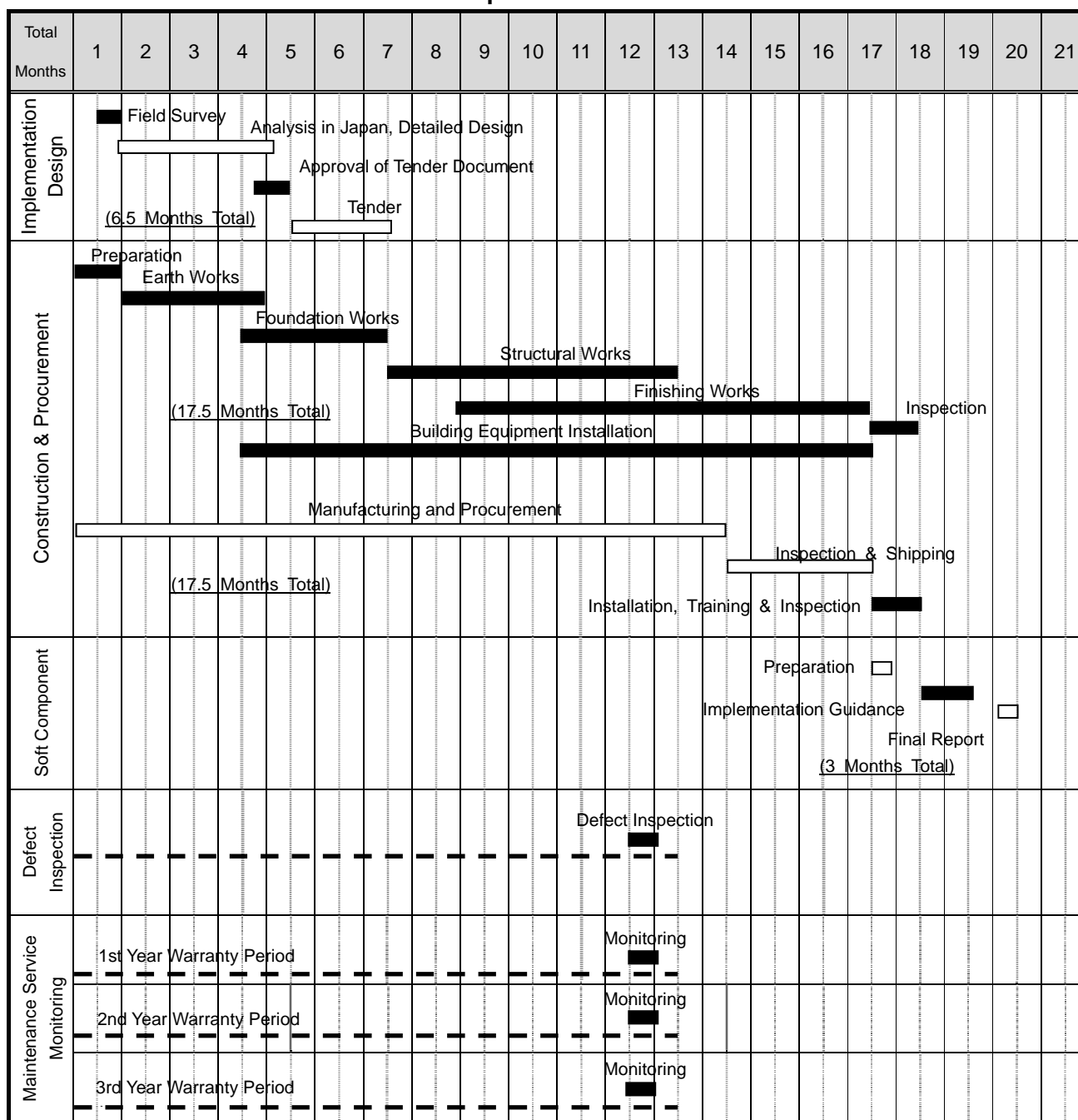
**Table 2- 21 Project Implementation Schedule**

Project Contents		Time Period	
Implementation Design	Detailed Design Stage (including field survey)	3.5 months	24.0 months
	Tender Stage	3.0 months	
Construction and Procurement	Construction and Procurement Stage	17.5 months	
Soft Component		3.0 months	3.0 months

2) Implementation Schedule

Table 2-22 shows the implementation schedule of this project

**Table 2- 22 Implementation Schedule**



Works in Cambodia  
 Works in Japan

## 2-3 Obligations of Recipient Country

The scope of work under the plan is described in “3-2-4-3 Scope of Works.” The following describes overview of work borne by Cambodia.

### (1) Process-Related

#### 1) Land acquisition

The Project site is under the property of MOH of Cambodia.

#### 2) Tax exemption

If Japanese firm(s) and construction firm(s) engaged in the project procure construction materials and equipment inside Cambodia during the construction period to implement the project, or import them from overseas, it is necessary to make an arrangement to exempt from Japanese firm(s) and construction firm(s) customs, consumption tax, other tax-inclusive pricing or charges. An arrangement for unloading procedure involved with swift import clearance is also required.

#### 3) Arrangements for equipment/materials imported from Japan or third countries

MOH shall make arrangements which will be needed for swift clearance and inland transportation procedures for materials and equipment imported from Japan or third countries.

#### 4) Acquisition of land use permission

There is no need to undergo procedures to apply for building permits regarding the project, but required documents must be submitted to the Ministry of Land Management, Urban Planning and Construction through the MOH and land use permission must be granted. Additionally, the MOH must report the fire control facility plan, which are to include facility plan drawings to the Battambang Provincial Police Department.

#### 5) Banking Arrangement and issuance of Authorization to Pay

MOH will become a contact institution for this plan to promptly handle Banking Arrangement and issue Authorization to Pay based on the consultant agreement and contractor/suppliers' contracts.

### (2) Work Borne by the Cambodian Side

The following is an overview of the Cambodian scope of work, which is essential for smooth implementation of the plan.

#### 1) Clearance of obstacles and land development at the project site

The Cambodian side will remove the following existing buildings and structures on the site planned for construction of the main building. The land must be prepared, including the removal of trees and buried structures. This is to be completed before facility construction tendering.

- Drug storage (Existing Building L2)
- Parking lots for ambulances
- Pavement on hospital premises

None of the work above will be expensive, nor are special skills necessary for the work. Therefore, this can be adequately handled by the Cambodian side.

## 2) Search for mines/unexploded shells in the construction site

Any remaining mines/unexploded shells were found in the construction site of the Project as a result of the search for mines/unexploded shells effectuated with a search depth of 2.5 m. However, further search is necessary since the foundation work of the Project needs an excavation with a depth of about 4 m from the ground level. The equipment owned by CMAC Bamttabang does not allow search beyond 2 m depth from the ground level. Therefore, it is planned that at the time of construction work of the Project, the excavation work being executed by construction company will be interrupted when the excavation reaches the depth of 2 m to allow the Cambodian side to carry out, without causing any delay to the construction schedule, a search for mines/unexploded shells and, after safety is confirmed, the excavation work will resume.

## 3) Infrastructure improvement

### ① Electric Power

Electrical power is led in presently from the 22 kV high-voltage feeder of EDC, Electricité du Cambodge, located along the perimeter of the compound, to the existing pole-mounted transformer located in the northwest of the compound. The Project plans to install a 22kV distribution line to the Project site by bifurcating high-tension side of the existing transformer. A new sub-station will be installed in the Project area to step down the power to 380V/220V and supply it to the new wards. For the division of works, the distribution line related improvement works, which will become necessary to accommodate the increase in energy demand, will be carried out by EDC, Cambodian side electric company, and further works including installation of distribution lines in the compound and the sub-station will be effectuated by the Japanese side.

### ② Water supply

There is a water main near the hospital grounds, and new piping will be installed for the exclusive use of the new hospital building. For the division of construction work, the Cambodian side will handle pipe-laying work from the water main to the water meter installed near the road border, and the Japanese side will handle the construction from the newly installed lead-in water meter.

### ③ Drainage

Sewage and miscellaneous wastewater from inside buildings leaves the buildings in separate pipes, merges together in the first sump outside the building, and is carried via a natural slope to a simple septic tank. The sewage will be sedimented to eliminate solids and pumped into the public sewer. A sewer will be installed as obligation of recipient country on the north side of the compound, to which a sewer from the septic tank will be connected by the Project.

#### ④ Medical gas

The Cambodian side must supply oxygen tanks regularly in the manifold rooms in order to supply oxygen to the operation theaters, ICU, minor operation room, observations room, and delivery room.

#### 4) Renovation of existing buildings and change of intended usage

After the completion of construction for the Project and relocation of the hospital functions to the new Main Building, renovation work in the rooms that are vacated from the existing buildings shall be conducted by the hospital. The intended use of these rooms will be changed and they will continue to be used. The usage plan for the existing buildings after completion of construction is proposed as follows.

- Emergency department (Existing B2 building) → Medical Record Storage
- Otorhinolaryngology department (Existing C building) → Pharmacy storage
- General Medicine ICU department (Existing G building) → Accommodations for trainees
- Laboratory (Existing K building) → Extension of the tuberculosis testing department
- Drug control department (Existing L1 building) → Pharmacy storage
- Surgery department (Existing O building) → Pediatric department
- Pediatric department (Existing Q building) → Accommodations for trainees

#### 5) Relocation of existing furniture and equipment

The Cambodian side is responsible for the relocation of current equipment and furniture in the existing facilities, and for the purchase of necessary equipment. Hospital staff can move the existing equipment and furniture piece by piece. Therefore, since it is not necessary to request the services of a professional company, no additional costs will be incurred. However, it will be necessary to contract the services of a company to relocate from existing Building O to the lower hospital the existing X-ray machine which was procured through “the Project for Improvement of Medical Equipment in National, Municipal and Provincial Referral Hospitals” under Japan’s Grant Aid. The cost will be borne by the Cambodia side.

Relocation period will be after completion of the work in appropriate timing.

#### 6) Construction related to inspection wastewater storage and processing

Inspection wastewater will be stored on hospital premises until an appropriate processing system can be established in Cambodia. Construction of the wastewater storage facility and maintenance of the storage containers will be borne by the Cambodia side.

## 2-4 Project Operation Plan

### 2-4-1 Operation Plan

#### (1) Operational Structure and Organization

Although the Cambodian MOH is the supervisory and executing body of the Project, the PHD of Battambang Province and the Battambang Provincial Hospital are responsible for its operation and maintenance after delivery. The purpose of the Project is to improve the medical services of the hospital, the health care services of which are declining both qualitatively and quantitatively. However, because the current departments will be maintained without establishing new departments, the operational structure can continue without changing the organizational system.

#### (2) Personnel Plan

The Surgical Ward and Internal Medicine ICU Ward are targeted for the Project, with a planned increase in the nominal number of beds from 50 to 80 beds in Surgical and 16 to 18 beds in Internal Medicine ICU. The nominal number of beds in the entire hospital will be increased from 270 to 302. New functions are not included in the Project and the scale of the Project is set to allow for operations to continue with the current number of staff members, so there will be no major difficulties in hospital operations after the final delivery.

Table 2-23 shows the number of patients and staff members at hospitals constructed under Japanese Grant Aid in the past, at the time of the Preparatory Survey. Although the number of patients at Battambang Provincial Hospital is quite high, the number of staff is also large, so we can see that the number of patients per staff member does not differ greatly from other state hospitals.

**Table 2- 23 Number of Patients and Staff at Hospitals Targeted by Grant Aid**

	Mongkul Borey Hospital	Kampong Cham Provincial Hospital	Sihanouk Province Hospital	Svay Rieng Provincial Hospital	Battambang Provincial Hospital
Year data collected	2004	2005	2011	2013	2015
Number of hospitalized patients	3,942	8,152	5,064	10,706	15,530
Doctors (excluding medical assistants)	15	28	27	18	51
Nurses (including nursing assistants)	57	90	55	65	164
Total number of hospital staff	151	211	155	165	401
Number of hospitalized patients per doctor	263	291	188	595	304
Number of hospitalized patients per nurse	69	91	92	165	94

Source: Q&A at each hospital



## 2-4-2 Maintenance Plan

### (1) Facilities

#### 1) Maintenance Management System

There is no department within the MOH to manage the maintenance of hospitals across the country, with each hospital conducting their own maintenance management of facilities and equipment independently. The facility maintenance management department at Battambang Provincial Hospital has six staff, however, they do not possess any technical qualification and can carry only easy maintenance of electrical and water infrastructure. If facility repairs are necessary, the hospital is outsourcing such technical repairs work. The expenses related to maintenance and repairs at the Battambang provincial hospital from 2012 to 2015 are shown below. These expenses account for 0.5~1.1% of the total hospital expenditures. The breakdown of maintenance expenses is not managed appropriately, and it is unclear how much was spent on what type of maintenance activities.

**Table 2- 24 Battambang Provincial Hospital Facility Maintenance Management Costs**

Unit: 1000 Riel

	2012	2013	2014	2015
Building maintenance/repair costs	102,506	75,107	130,147	178,848
Total hospital expenditure	15,049,977	15,091,068	15,379,296	16,655,262
Percentage of overall hospital expenditure	0.7%	0.5%	0.8%	1.1%

Source Battambang Provincial Hospital

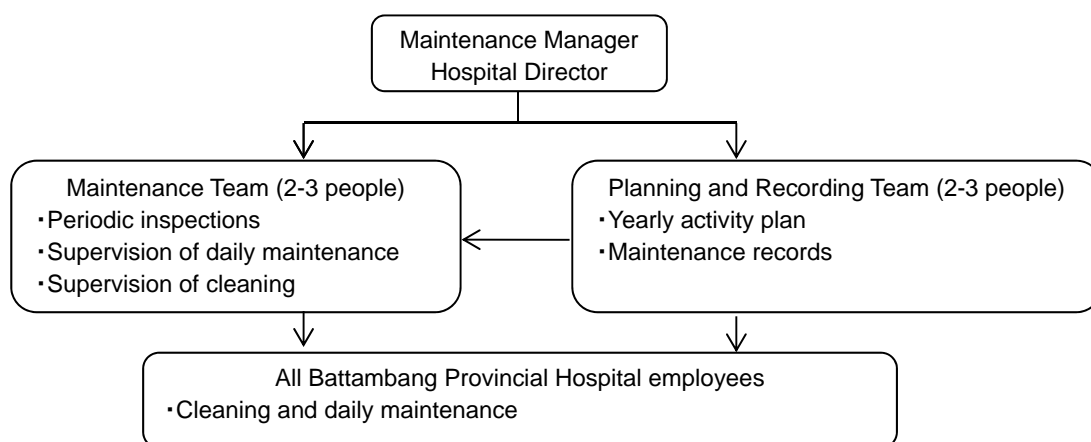
As it is shown above, even if a sufficient number of staff is allocated, budget and technical capacity are still insufficient and the maintenance management system has not yet established. Thus, it is essential to improve the maintenance management system before the completion of this Project.

#### 2) Maintenance Plan

The planned facilities have a design for easy maintenance, eliminating high-level systems and complicated specifications. However, in order to maintain satisfactory building conditions over the long term, it is necessary to implement regular cleaning/inspections, and to swiftly respond to problems caused by wear, damage, or deterioration due to age.

- Periodic cleaning: A cleaning schedule will be established by frequency (i.e. daily, weekly, quarterly), and periodic cleaning by cleaning staff will be implemented.
- Periodic facility repairs: In terms of repairs for facility wear, damage or deterioration, the following is necessary: fixture inspections/adjustments (once per year), repair of painted areas (once every 3 years), repainting (once every 10-15 years).
- Building facility maintenance management: For building facilities, it is important to conduct daily preventative maintenance before malfunction repairs or part replacements are required. In addition to the length of operation start-up time, the lifespan of facility apparatus can also be extended through normal operation and regular inspections, lubrication, adjustments, cleaning, and repairs.
- Establishment of a maintenance management system: A maintenance management team will be formed, and a manager will be designated to implement the above items. Additionally,

systematic maintenance management will be executed by formulating a yearly maintenance management activities plan and keeping a maintenance record. The structure and the activities of the maintenance management team are summarized in the figure below.



**Figure 2- 15 Proposed Facility Maintenance Management Structure**

The following work items are necessary for building maintenance on the facilities side.

**Table 2- 25 Building Maintenance Items**

Item	Frequency	Details
Elevator	When needed	Inspection and reparation on the basis of on-call service by the contractor
	Monthly	Periodic inspection by the contractor
Power receiving and transforming equipment	Daily	Visual inspection
	Annually	Inspection and maintenance by a technician
Generator	Daily	Visual inspection
	Annually	Inspection and maintenance by a technician
Lighting fixture	When needed	Bulb replacement
Guidance lighting/ emergency light equipment	Weekly	Lighting test
Air-conditioner	Weekly	Visual inspection
	Quarterly	Filter cleaning/ replacement
	Annually	Air vent cleaning
Ventilation equipment	Monthly	Visual inspection, Fan belt adjustment
	Annually	Air vent cleaning
Water receiving tank	Weekly	Visual inspection
	Annually	Inner tank cleaning
Elevated water tank	Weekly	Visual inspection
	Annually	Inner tank cleaning
Feed-water pump	Daily	Visual inspection of the equipment
Drainage equipment	Daily	Visual inspection of the drainage equipment
Sanitary equipment	Weekly	Water flow inspection
Septic tank	Daily	Visual inspection of inner tank, garbage cleaning, disinfectant replenishment
	Every 4 months	Sludge extraction
Oxygen supply equipment	Daily	Visual inspection of the manifold and alarm system
	When needed	Oxygen cylinder replacement
	Annually	Inspection and maintenance by a technician

## (2) Equipment

The medical equipment requires the following maintenance activities. Currently, an equipment management team consisting of 4 members trained at MEDEM has been assigned to the hospital. These members oversee these operations, but there are no assigned engineering technician. Therefore, the services of a local equipment agency must be requested to handle repairs in the event of machinery failure, with the exception of light repairs. In the future, it would be desirable to allocate engineers within the hospital.

### 1) Start-up inspection

Currently, equipment is inspected by the staff responsible for each of the items at any given time, and minor failures are also handled by the responsible staff. However, given that inspection is expected to be done on a daily basis, it is now recommended that the staff inspect the equipment at the beginning of work every day.

### 2) After-work cleaning/inspection

Although the hospital staff does not currently conduct regular cleaning and inspection for the medical equipment, it is important to clean each of the equipment at the end of work and to inspect failures to keep it in a good condition. Hence, if this plan is implemented, it will be recommended that a technician for installation of the equipment provide the staff with cleaning/inspection instructions at the time of the delivery.

### 3) Calibration

For measurement accuracy, measurement devices need to be calibrated at a certain interval. For a period of 3 years after delivery of the equipment in the Project, equipment will be calibrating during the periodic inspections included in the maintenance contracts concluded by the Japanese side for equipment that needs regular maintenance inspections. However, after the 3 years of said maintenance contracts have ended, the recipient side must conduct this calibration work. An engineer from the manufacturer will provide an explanation on equipment components and operations at the time of equipment delivery or during period inspections.

### 4) Repair in the event of failure

Currently, there is no section or engineer with the capacity to repair medical equipment at PHD or the hospital. As a result, basically, an agent in Phnom Penh is requested for the repair work of broken equipment from one to two times a year. We shall propose the establishment of a system that enables quick response to failures as well as the use of operation manual (in English and Khmer) to provide technical education to perform repair work.

## 2-4-3 Financial planning

### (1) MOH and Battambang Province PHD Budgets

Table 2-26 shows the MOH budget and the Battambang Province PHD Budgets. The MOH budget has increased steadily at approximately 5 to 15% every year. In the 10 years between 2005 (141,934 million Riel) and 2015, it has actually increased by more than 7 times.

The Battambang Province PHD budget has increased yearly along with the MOH budget increases, and has increased by 12 to 13% yearly from 2013 to 2015. Also, the proportion of the MOH expenditures at the local level represented by the Battambang Province PHD budget is approximately 8.0%. This number slightly exceeds the ratio of population in Battambang Province to the entire Cambodian population (7.3%), and shows that it is an appropriate budget allocation when considering the concentration of patients from the surrounding provinces. From the Battambang Province PHD budget, allocations are made to the budgets of Battambang Provincial Hospital, referral hospital, health centers, and health post.

**Table 2- 26 MOH and Battambang Province PHD Budgets**

	2011	2012	2013	2014	2015
MOH Budget (million riel)	694,331.4	794,213.5	901,500.8	977,651.3	1,023,141.0
Compared to prev. year (%)	+7.6	+14.4	+13.5	+8.4	+4.7
MOH Total Expenditure (million riel)	667,293.7	777,933.9	853,828.9	825,199.9	765,651.9
National level (million riel)	469,995.4	563,532.8	617,455.7	550,138.1	458,066.5
Local level (million riel)	197,298.3	214,401.1	236,373.2	275,061.8	307,585.4
Battambang Province PHD Budget (million riel)	16,232.0	17,077.0	19,359.0	21,803.8	24,609.9
Rate of increase (%)	-	+5.2	+13.4	+12.6	+12.9
Referral hospital allocation	5,734.7	5,366.3	5,760.4	6,216.0	6,883.0
Health center & health post allocation	5,467.1	5,601.6	4,855.9	6,680.6	7,744.9
Percentage of Battambang Province PHD Budget in the MOH regional level expenditure (%)	8.2	8.0	8.2	7.9	8.0

Source: Ministry of Health and Battambang Province Public Health Department

## (2) Operating Conditions of Battambang Provincial Hospital

The budget of public hospitals in Cambodia is established by a set mechanism in which the PHD in each province gathers the required amounts from referral hospitals, health centers, and health posts in the province through OD and submits a request to the MOH. Based on the evidence shown in AOP, the MOH makes the decision on the final amount to be allocated.

With respect to income, Battambang Provincial Hospital manages separately the budget received from the MOH and income received from treatment. The budget received from the MOH has been increasing in recent years, and currently represents 35% of the income. The budget from the MOH is used for salary and other expenditures, and salary increases are significant. Payment in kind of pharmaceuticals and equipment are received from the CMS (Central Medical Stores), but the amount is recorded and expenditures are equal to income. The proportion of the total income has decreased to less than 50%. While treatment income (user fees) have increased by about 20% yearly, income from HEF increased only slightly, suggesting that poverty is not spreading in Battambang Province. As the number of patients is expected to increase further through implementation of this Project, an increase in treatment income can be expected.

With respect to expenditures, CMS, which is payment in kind, represents about 50% of the total expenditures, followed by staff salaries and bonuses (60% of user fees and HEF), which together

represent about 30% of the total. Expenditures, which are next after salaries, are considered other expenditures from the MOH budget. These are medical equipment, furniture, and office equipment, etc. that are payment in kind from MOH and account for 12 to 13% of the budget. The above items alone account for 90% or more of the total expenditures. In addition, the cost of pharmaceuticals other than those distributed by CMS accounts for approximately 1.5 to 2.5%. Pharmaceuticals supplied from Central Medical Stores (CMS) alone cannot cope with the increase in patients, and therefore expenditures are increasing to compensate for this shortfall. With respect to the overall expenditures of Battambang Provincial Hospital, facility maintenance costs are 0.5 to 1.5% and equipment maintenance costs are less than 0.5%. After implementation of this Project, it will be necessary to secure a budget to cope with these increases.

**Table 2- 27 Income and Expenditure of Battambang Provincial Hospital** (Unit: 1000 riel)

	2013		2014		2015		2016 (Budget)	
	Amount	%	Amount	%	Amount	%	Amount	%
<b>Income:</b>								
Budget from MOH	4,186,540,000	27.8	4,467,540,000	29.0	4,975,600,000	29.8	6,278,850,000	34.5
Compared to prev. year (%)	-		6.7		11.4		26.2	
From Treatment Fees (user fee)	957,939,455	6.4	1,157,161,120	7.5	1,385,901,660	8.3	1,516,537,200	8.3
Compared to prev. year(%)	-		20.8		19.8		9.4	
HEF (poverty relief fund)	1,370,190,200	9.1	1,480,308,000	9.6	1,528,228,000	9.2	1,538,304,000	8.5
Compared to prev. year(%)	-		8.0		3.2		0.7	
CMS (Central Medical Storage) Supply	8,556,400,521	56.7	8,249,696,829	53.6	8,808,195,542	52.7	8,800,000,000	48.4
Compared to prev. year(%)	-		-3.6		6.8		-0.1	
Carry-over from Prev. Year	48,415,100	0.3	28,417,647	0.2	3,827,295	0.02	46,490,942	0.3
Total income	15,119,485,276	100	15,383,123,596	100	16,701,752,497	100	18,180,182,142	100
Compared to prev. year(%)	-		1.7		8.6		8.9	
<b>Expenditure:</b>								
Salary	2,450,840,000	16.2	2,425,840,000	15.8	2,961,000,000	17.8	3,959,250,000	21.8
CMS Expenditure	8,556,400,521	56.7	8,249,696,829	53.6	8,808,195,542	52.9	8,800,000,000	48.4
Expenditure from other MOH Budget	1,735,700,000	11.5	2,041,700,000	13.3	2,014,600,000	12.1	2,319,600,000	12.8
Pharmaceuticals	205,742,600	1.4	332,097,200	2.2	347,194,000	2.1	439,204,800	2.4
Training & Workshops	13,263,700	0.1	11,856,200	0.1	10,795,000	0.1	8,536,400	0.05
Hospital Support	39,086,000	0.3	82,234,800	0.5	107,867,400	0.6	97,969,600	0.5
Contract Staff	246,106,000	1.6	153,996,000	1.0	83,560,000	0.5	-	
Medical Equipment	71,577,600	0.5	87,889,300	0.5	98,798,300	0.6	101,772,000	0.6
Equipment Maintenance	24,538,800	0.2	8,056,000	0.1	44,302,900	0.3	33,790,400	0.2
Facility Maintenance	75,106,500	0.5	130,146,900	0.8	178,848,400	1.1	262,006,400	1.4
Copy Expenditure	19,466,900	0.1	22,823,100	0.1	27,955,900	0.2	36,076,000	0.2
Printing, Clerical Work, Materials	37,017,000	0.2	51,349,700	0.3	47,984,900	0.3	29,080,800	0.2
Gas and Fuel	58,859,900	0.4	80,265,800	0.5	65,976,800	0.4	57,894,800	0.3
Vehicle Maintenance	12,442,300	0.1	10,611,300	0.1	13,441,300	0.1	22,829,200	0.1
Misc.	138,462,800	0.9	96,680,100	0.6	82,404,300	0.5	157,115,600	0.9
60% of user fees and HEF	1,396,877,793	9.3	1,582,481,472	10.3	1,748,477,796	10.5	1,832,904,720	10.1
Government Payment (1% of user fee)	9,579,400	0.1	11,571,600	0.1	13,859,017	0.1	15,165,372	0.1
Total Expenditure	15,091,067,814	100	15,379,296,301	100	16,655,261,555	100	18,173,196,092	100
Compared to prev. year(%)	-							
Balance (Carry-over for subseq. year)	28,417,462		3,827,295		46,490,942		6,986,050	

Source: Battambang Provincial Hospital

### (3) Financial Plan

Based on the latest results from 2015, as of the target set year in this Project of 2022 the income and expenditures of the Battambang Provincial Hospital are expected to be as shown below.

#### 1) Income estimates

##### a) Budget allocation from MOH:

The budget allocation from MOH to Battambang Provincial Hospital is shown in Table 2-28. It has increased yearly from 2012, and in 2016 it increased some 26% compared with the previous year. Using the average annual increase of 3.5% from 2011 through 2015, the budget allocation from the MOH is expected to be as shown below as of the year 2022.

$$6,278,850 \text{ thousand Riel} \times 103.5\%{}^6 = \underline{7,718,310 \text{ thousand Riel}}$$

**Table 2- 28 Battambang Provincial Hospital Budget from the PHD**

	2011	2012	2013	2014	2015	2016	2011-15 Avg. Growth Rate
Budget from PHD (1000 riel)	4,337,400	4,007,504	4,186,540	4,467,540	4,975,600	6,278,850	+3.5%
Compared to prev. year (%)		-7.6%	+4.5%	+6.7%	+11.4%	+26.2%	

##### b) Income from treatment fees (user fees) and income from HEF:

A comparison of the movement in outpatient/inpatient numbers and movement in the total income from treatment fees and HEF from 2011 through 2015 is shown in Table 2-29. It can be seen that the rate of increase for the total number of patients and that for total income from treatment fees+HEF is nearly equivalent. (Since treatment unit prices were raised in 2015, the rate of treatment fee income is higher compared to the rate of patient number increase.)

**Table 2- 29 Battambang Provincial Hospital Patient Number and Income from User Fees**

	2011	2012	2013	2014	2015	2011-2015 Avg. Growth Rate	2022 (proje cted)
No. of outpatients (people)	32,336	40,825	39,316	44,380	39,363	+5.0%	55,388
No. of inpatients (people)	12,450	14,419	14,503	14,779	15,530	+5.7%	22,893
Total (people)	44,786	55,244	53,819	59,159	54,893		78,281
Compared to prev. year (%)		+23.4%	-2.6%	+9.9%	-7.2%		
Income from user fees (1000 riel)	1,031,088	1,060,744	957,939	1,157,161	1,385,901		
HEF income (1000 riel)	818,094	1,316,663	1,370,190	1,480,308	1,528,228		
Total (1000 riel)	1,849,182	2,377,407	2,328,129	2,637,469	2,914,129		
		+28.6%	-2.1%	+13.3%	+10.5%		

Source: Battambang Provincial Hospital

Because the forecast number of patients in 2022 is 42.6% more than the number in 2015, income

from user fees is also expected to increase 42.6%. The expected user fee income is as shown below. However, income from HEF has only increased slightly in recent years, so it is forecast that HEF income will not increase much at all.

User fee income: 1,385,901 thousand Riel x 142.6% = 1,976,295 thousand Riel

HEF income: 1,528,228 thousand Riel

### c) CMS budget

CMS expenditures are payment in kind and do not have a direct impact on the income and expenditures of the hospital administration because the CMS budget and expenditures are recorded in the hospital balance at the same amount. The CMS budget from 2012 through 2016 has been in the range of 8,250 million Riel to 8,800 million Riel. Based on an average of 8,560 million Riel, the CMS budget for 2022 is forecast with consideration for inflation (see below).

8,560,000 thousand Riel x 116.1% = 9,938,160 thousand Riel

## 2) Expenditure projections

The projections for income at Battambang Provincial Hospital are shown in the previous item, while details on expected expenditure items are described in section 3-5-2 Operation and Maintenance Plan. As a summary of these items, the projected expenditures for 2022 are shown in table 2-30. The balance is in the black, and with the Cambodian MOH's budget increasing 3.5% annually, and if the number of patients increases as projected, adequate operation and maintenance is possible.

**Table 2- 30 Projected Income and Expenditures for 2022**

Items	2015 (1000 riel)	2022 Projections (1000 riel)	Rate of increase (%)
<b>Income</b>			
MOH Budget	4,975,600	7,718,310	155.1%
Income from user fees	1,385,901	1,976,295	142.6%
HEF Income	1,528,228	1,528,228	100.0%
CMS Budget	8,808,196	9,938,160	112.8%
Carry-over from prev. year	3,827	-	
<b>Total Income</b>	<b>16,701,752</b>	<b>21,160,993</b>	<b>126.7%</b>
<b>Expenditures</b>			
Salary	2,961,000	3,437,721	116.1%
CMS Expenditure	8,808,196	9,938,160	112.8%
Other MOH Expenditure	2,014,600	2,338,951	116.1%
Pharmaceuticals	347,194	574,810	165.6%
Training and Workshops	10,795	25,066	232.2%
Equipment Maintenance	44,303	270,900	611.5%
Facility Maintenance Expenses	178,848	266,444	149.0%
Gas	65,977	82,752	125.4%
Bonuses	1,748,478	2,102,714	120.3%
Government Payments	13,859	19,763	142.6%
Misc.	462,011	1,296,196	280.6%
<b>Total Expenditure</b>	<b>16,655,261</b>	<b>20,353,477</b>	<b>122.2%</b>
<b>Income</b>	<b>46,491</b>	<b>807,516</b>	

Source: Battambang Provincial Hospital

## 2-5 Project Cost Estimation

### 2-5-1 Initial Cost Estimation

With the conditions of expenditure projection in (3) below, breakdowns of the expenditures borne by Japan and Cambodia under the said classification can be estimated as follows:

#### (1) Expenses to be borne by Japanese Side

Expense to be borne by Japanese Side is closed due to the confidentiality.

#### (2) Projection of Expenditures to be Borne by Cambodian Side

**Table 2- 31 Expenses to be Borne by Cambodian Side**

Expense	Project Cost Estimation	
	(US\$)	JPY Equivalent (thousand JPY)
1) Demolition of Existing Buildings	21,050	2,295
2) Backfilling of Soil, Land Preparation	14,375	1,567
3) Infrastructure Lead-in, Connection Work	8,450	921
4) Land Mine Investigation	4,700	512
5) Relocation and Procurement of Equipment/Furniture	34,000 7,600	3,707 829
6) Planting of Trees	12,500	1,363
7) Construction of Waste Storage	13,756	1,500
8) Banking Commissions		
Total	116,431	12,694

#### (3) Condition of Expenditure Projection

- i) Period of Cost Estimation: July 2016
- ii) Exchange Rate: US\$ 1 = 109.04 JPY (Average from April to June 2016)
- iii) Construction Period: It is estimated that the project would be implemented in a single fiscal year, and the period of detailed design, construction and procurement of equipment is identified in the implementation schedule.
- iv) Others: This project will be implemented through the system of the grant aid by the government of Japan.



## 2-5-2 Operation and Maintenance Costs

Here, each expenditure item of the hospital will be examined, and the expenditures for 3 years after delivery of the Project (2022) will be estimated. To estimate, the latest results of 2015 are used as a base and price increase rates are estimated based on Table 2-32. It is expected that prices will rise 16.1% over 2015 prices by 2022.

The results of the estimation are summarized in Table 2-30. With the Cambodian MOH's budget increasing 3.5% annually, and if the number of patients increases as projected, adequate operation and maintenance is possible.

**Table 2- 32 Price Inflation Projections for Cambodia**

	2015	2016	2017	2018	2019	2020	2021	2022
Price Inflation	1.225%	3.068%	2.733%	3.025%	2.918%	3.165%	0.249%	n.a.
Compared to 2013	100.0%	103.1%	105.9%	109.1%	112.3%	115.8%	116.1%	116.1%

Source: IMF World Economic Outlook Database, October 2016

### (1) Salary

The trends in the number of staff members at Battambang Provincial Hospital are shown in Table 2-33. With the increasing number of patients in recent years, staff numbers have also increased. There is a particularly pronounced increase in the number of Nurses and Primary Midwives. Even when the number of staff members that should be allocated at a CPA3 hospital as described in CPA Guidelines, the number of staff members is sufficient. Accordingly, an increase in staff under the implementation of this Project is not forecast.

**Table 2- 33 Staff Number Trends at Battambang Provincial Hospital (by Position)**

	2011	2012	2013	2014	2015	2016	CPA3 Standard (No. of Employees)
Doctors	34	34	36	36	34	34	23-40 (Surgery: 6; Anesthetist, Pediatrician, Ophthalmologist, ENT, Psychiatrist: 1; Image Diagnostician 2)
Specialists	10	10	10	9	9	11	
Doctors (Contract)	0	0	2	5	6	6	
Medical Assistant	10	10	9	9	9	8	
Dentist	4	4	5	6	6	7	2-3
Pharmacist	8	8	8	7	7	8	6-8
Physiotherapist	3	5	6	6	6	5	3-4
Senior Nurse	99	99	119	120	120	114	50-80
Beginner Nurse	16	16	16	17	17	15	14-20
Nurse (Contract)	5	6	15	22	34	35	
Senior Midwife	65	65	72	72	72	77	12-14
Beginner Midwife	2	3	3	3	3	1	2-4
Lab Technician	11	11	13	13	13	11	8-10
Clerical/ Accounting	1	2	2	2	2	2	2-4
Maintenance	3	3	5	5	6	6	5-7
Misc.	30	30	40	47	58	61	
<b>Total</b>	<b>301</b>	<b>306</b>	<b>361</b>	<b>379</b>	<b>402</b>	<b>401</b>	<b>179-276</b>

Source: Battambang Provincial Hospital, CPA Guidelines 2014

Thus, expenditures for salary, using 2015 as a base and taking the increase in prices into account, are

as follows:

$$2,961,000,000 \text{ riel} \times 116.1\% = \underline{3,437,721,000 \text{ riel}}$$

## (2) CMS expenditures

CMS expenditures are payment in kind, the CMS budget and expenditures are recorded at the same amount CMS. CMS expenditures for 2022 are as shown below, from the forecasted CMS budget described earlier in 3-1-3 (3) Financial Planning.

$$\text{CMS expenditures: } \underline{9,938,160,000 \text{ Riel}}$$

## (3) Other expenditures from MOH budget

These are medical equipment, furniture, and office equipment, etc. that are payment in kind from MOH and account for 12 to 13% of the total hospital expenditures. This figure trends around 2,000,000 Riel every year. Using the 2015 expenditures of 2,014,600,000 Riel as a base and considering the rate of price increases, the 2022 transportation expenses are estimated.

$$2,014,60,000 \text{ Riel} \times 116.1\% = \underline{2,338,951,000 \text{ Riel}}$$

## (4) Pharmaceutical Expenses

Although the total amount of pharmaceutical expenses has decreased since 2012, it has continued to increase since then and the proportion of the total expenditures is trending toward 2 to 2.5% in recent years. Pharmaceutical expenses are expenses that compensate for shortfalls in pharmaceuticals supplied by CMS, but it is expected that pharmaceutical expenses will increase as the number of patients increases after the Project is implemented. Based on the 2015 expenditures of 347,194,000 Riel, pharmaceutical expenses in 2022 are estimated considering the rate of patient increases and rate of price increases.

$$347,194,000 \text{ Riel} \times 142.6\% \times 116.1\% = \underline{574,810,000 \text{ Riel}}$$

## (5) Training and Workshop Expenses

The cost of implementing training and workshops has been trending around 10 million Riel annually. Through this Project, the space required for training and practical training will be adequately secured and the training function will be improved, so the frequency of training is expected to increase. It is forecast that the 2015 expenditures will be close to doubled, and considering further price increases, the 2022 training and workshop expenses are expected to be as shown below.

$$10,795,000 \text{ Riel} \times 2 \times 116.1\% = \underline{25,066,000 \text{ Riel}}$$

## (6) Medical Equipment Maintenance Expenses

Fees for maintenance contracts with agents are necessary as part of the maintenance expenses for medical equipment. For the Project, maintenance contract fees for important equipment will be borne by the Japanese side for 3 years after implementation. The hospital side will be responsible for the necessary equipment maintenance expenses from the 4<sup>th</sup> year after the equipment is procured. Using current calculations, the yearly maintenance contract fees are estimated at approximately US\$58,500. These expenses must be included in the budget in the 3rd year after implementation.

$$\text{USD } 58,000 \times 4,000 \text{ Riel} = 232,000,000 \text{ Riel}$$

The maintenance expenses for the existing equipment is 8,000,000 Riel to 57,000,000 Riel annually. Using the 2012 to 2013 average of 33,506,000 Riel as a base, and considering the rate of price increases, the maintenance expenses for existing equipment are estimated.

$$33,506,000 \text{ Riel} \times 116.1\% = 38,900,000 \text{ Riel}$$

Therefore, the total maintenance expenses for equipment in 2022 are estimated as follows.

$$38,900,000 \text{ Riel} + 232,000,000 \text{ Riel} = 270,900,000 \text{ Riel}$$

## (7) Facility Maintenance Expenses

The maintenance expenses for the existing facilities has increased annually since 2013. Expenditures in 2015 are approximately 2.5 times the expenditures of 2013. Using the 2015 expenditures of 178,848,000 Riel as a base, and considering the rate of price increases, the maintenance expenses for existing facilities are estimated.

$$178,848,000 \text{ Riel} \times 116.1\% = 207,643,000 \text{ Riel}$$

In addition to the above, the estimated maintenance expenses for facilities built under the Project are as shown in Table 2-34.

**Table 2- 34 Facility Maintenance Expense Estimates (Facilities Targeted in the Project)**

Type	Item	Work Content/Method of Estimation	Frequency	Approx. Amount (riel)
Buildings	Inspection and adjustments of fittings	Inspection by employees	Once/year	
	Repairing painted areas	Work by professional company; estimated as 5% of painted areas	Once / 3 years	5,835,000/year
	Repainting painted areas	Work by professional company; estimated from painting costs	Once / 15 years	23,340,000/year
Facilities	Substation facilities	Inspection by employees	Once/month	
	Generator facilities	Inspection by employees	Once/month	
	Cleaning water receiving tank	Cleaning by professional company	Once/year	439,000/year
	Cleaning elevated water tank	Cleaning by professional company	Once/year	152,000/year
	Septic tank sludge removal	Work by professional company	3 times/year	747,000/year
Consumables	Lighting fixtures	20% of fluorescent bulbs replaced annually	When needed	2,286,000/year
	Filters	Filter replacement; estimated from number of filters	Once/year	6,221,000/year
Total				39,020,000/year

In addition, an interview with the local agent indicates that maintenance and inspection fees for the elevator are about USD100 monthly and it is also necessary to pay travel expenses, accommodation expenses, and a daily allowance for the inspector from Phnom Penh, which is approximately USD150 monthly. Also, 2% of the cost of the elevator itself is generally forecast as the expense of replacement parts.

$$(\text{USD}150/\text{mo.} \times 12 \text{ months} + 55,335 \text{ USD} \times 2\%) \times 4,000 \text{ Riel/USD} = \underline{11,627,000 \text{ Riel}}$$

Therefore, considering the increase in prices, the facility maintenance expenses for 2022 are estimated as follows:

$$207,643,000 \text{ riel} + (39,020,000 \text{ riel} + 11,627,000 \text{ riel}) \times 116.1\% = \underline{266,444,000 \text{ Riel}}$$

#### (8) Fuel Expenses

Fuel expenses include fuel costs for generating electricity during power failures. The frequency of power failures is about once a week for about 2 hours per instance, and the fuel cost necessary for the generator (100kVA, fuel consumption 17 l/h) installed under this Project is calculated as follows.

$$3,480,000 \text{ Riel/l} \times 17 \text{ l/h} \times 2 \text{ h} \times 52 \text{ days/year} = \underline{6,153,000 \text{ Riel}}$$

To this, with the added price increases in fuel costs for 2015, the estimated fuel cost for 2022 is as follows.

$$65,977,000 \text{ Riel} \times 116.1\% + 6,153,000 \text{ Riel} = \underline{82,752,000 \text{ Riel}}$$

#### (9) Bonuses

Since 60% of the income from user fees is allotted for bonuses, using the aforementioned user fee income estimates, the projection for 2022 is as follows:

$$\text{User fees: } 1,385,901,000 \text{ Riel} \times 142.6\% = \underline{1,976,295,000 \text{ Riel}}$$

$$\text{HEF income: } \underline{1,528,228,000 \text{ Riel}}$$

$$(1,976,295,000 \text{ Riel} + 1,528,228,000 \text{ Riel}) \times 60\% = \underline{2,102,714,000 \text{ Riel}}$$

#### (10) Government Payments

Since 1% of the income from user fees is allotted for payments to the government, using the user fee income estimates shown in 3-1-3 (3) Financial Planning, the projection for 2022 is as follows:

$$1,976,295,000 \text{ Riel} \times 1\% = \underline{19,763,000 \text{ Riel}}$$

#### (11) Miscellaneous

Using the 2015 average of 462,011,000 riel as a base, and considering the rate of price increases, the miscellaneous expenses for 2022 are estimated.

$$462,011,000 \text{ Riel} \times 116.1\% = \underline{536,395,000 \text{ Riel}}$$

Also, miscellaneous expenses include electricity, water fees, and medical gas charges. Those expenses related to the facilities of this Project are estimated as follows:

Electricity fees:

$$\begin{aligned} &\text{Estimated electricity usage quantity of } 56,960 \text{ kWh/month} \times 676 \text{ Riel/kWh} \times 12 \text{ months} \\ &= \underline{461,923,000 \text{ Riel}} \end{aligned}$$

Water fees:

$$\text{Estimated water usage quantity of } 6,820 \text{ m}^3/\text{month} \times 1,600 \text{ Riel/m}^3 \times 12 \text{ months} = \underline{130,944,000 \text{ Riel}}$$

From the above, the electricity and water fees for the facilities in this Project for 2022 are calculated with the forecast price increases on the above total:

$$(461,923,000 \text{ Riel} + 130,944,000 \text{ Riel}) \times 116.1\% = \underline{688,319,000 \text{ Riel}}$$

Since the medical gas charges for 2015 are unknown, the medical gas charges for 2022 are estimated based on the 2012 to 2014 average of 43,176,000 Riel taking into account the increase rate in accordance with the increase in patient numbers. Because the forecast number of patients in 2022 is a 42.6 increase over 2015, the medical gas cost is also expected to increase by 42.6%. Also, price costs are expected to increase.

$$43,176,000 \text{ Riel} \times 142.6\% \times 116.1\% = \underline{71,482,000 \text{ Riel}}$$

From the above, the total of miscellaneous expenses is as follows:

$$536,395,000 \text{ Riel} + 688,319,000 \text{ Riel} + 71,482,000 \text{ Riel} = \underline{1,296,196,000 \text{ Riel}}$$

