MINISTRY OF HEALTH
THE KINGDOM OF CAMBODIA

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF REFERRAL HOSPITALS IN SIEM REAP PROVINCE
IN
THE KINGDOM OF CAMBODIA

May, 2020

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 Referral Hospitals in Siem Reap Province 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.

May, 2020

Jun SAKUMA
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^2 (approximately a half size of Japan) and has borders with Thailand, Vietnam and Laos.

Siem Reap, the state capital, of the site targeted for this project, is located inland about 300km down the northwest of National Route 6 from the capital city of Phnom Penh. There is Tonle Sap Lake about 16km south and Angkor Archaeological Park including Angkor Wat which is a world cultural heritage about 6km north of Siem Reap city center, attracting 5 million tourists annually in addition to population increase.

The climate of Siem Reap is classified as savanna climate (Aw) in the Köppen climate classification and belongs to the tropics. Due to the effects of the southwest monsoon in summer and the northeast monsoon in winter, the season is divided into a rainy season from May to October and a dry season from November to April. The annual rainfall in Siem Reap is approximately 1,300 mm ~ 1,500mm, 80% of which is in the rainy season. The average temperature is around 30 ºC throughout the year, the maximum temperature is around 35 ºC, and the minimum temperature is around 25 ºC, so the temperature difference is small. The average annual wind speed is about 2 m/s, and the maximum monthly average wind speed is 3.5 m/s.

（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, then the increase in foreign investment led to rapid progress toward 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 6.0% (idem) in the following year 2010 and has continued to grow by 7.0% (idem) since 2011. In 2018, the per capita GDP was 1,485 US dollars (idem). Japan contributes more than a quarter of the overall economic assistance to Cambodia.

The GDP industrial composition ratio (ADB, 2017) is agriculture (25.0%), industry (32.7%), and services (42.3%) 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. According to the CDC (Cambodia Development Council), the amount of approved investments by the direct investment from Japan was approximately 63 million US dollars in 2017.

Along with the economic growth, the rate of people living on less than 1.25 US dollars a day decreased rapidly from 44.5% (1994) to 11.1% (2014). On the other hand, the new problem has arisen that the gap between the rich and the poor is widening. “National Social Protection Strategy for the Poor and Vulnerable, NSPS (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 2017 was 146th out of 189 countries, within the middle group (Medium Human Development), health indicators are still slow in improving compared with neighboring Asian countries. The net enrollment rate in primary education (World White Paper 2017) was 94% (male) and 96% (female) in 2011-2016. The proportion of people using basic drinking water services (idem) was 96% in urban areas and 70% in rural areas in 2015, showing a large disparity between urban areas and rural areas. 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

As a result of the persecution of health care personnel and the destruction of medical equipment facilities during civil war in the 1970s, the development of the public health care system in Cambodia was delayed. However, since then, the Government of Cambodia and its development partners, including the Government of Japan, have undertaken various efforts to raise the level of health care, thus improving health indicators throughout the country. For example, there has been a decrease in both the under-5 mortality rate (per 1,000 births: 107 in 2000 and 28 in 2018, from UNICEF 2019) and the maternal mortality rate (per 100,000 births: 488 in 2000 and 160 in 2017, from UNICEF 2017). However, there is a large disparity between the capital of Phnom Penh and rural areas, e.g., the under-5 mortality rate in Phnom Penh is 23, compared to 56 in Siem Reap (per 1,000 births, from the Cambodia Demographic Health Survey 2014), indicating that the improvement of medical services in rural areas is an issue. The Government of Cambodia positioned the health sector as a priority issue in their National

Strategic Development Plan (NSDP) 2019-2023. Additionally, in the Health Strategic Plan 2016-2020 (HSP3), the provision of high-quality health services and ensuring equitable access to such were given as priority policies.

Siem Reap Provincial Referral Hospital is the main hospital in northern Cambodia. Patients come to the hospital from within Siem Reap Province, as well as from the six surrounding provinces. In particular, victims of traffic accidents with external injuries are often transported here. However, due to the deterioration of facilities built in the 1970s and lack of equipment, Siem Reap Provincial Referral Hospital is not currently meeting the health care needs of the provinces. In addition, the patients who have to be treated at lower level hospitals go to the provincial hospital because of a lack of equipment and personnel at lower level hospitals in the province. This causes an overconcentration of patients on Siem Reap Provincial Hospital. Through the implementation of provincial hospital improvement projects in Cambodia in the past, we have learned that when strengthening the functions of hospitals, it is also necessary to include lower level hospitals in these efforts, in order to avoid an overconcentration of patients at the improved provincial hospitals. Hence, the Project for Improvement of Referral Hospitals in Siem Reap Province (hereinafter referred to as “the Project”) intends to improve the four lower-level district hospitals in the province in addition to the provincial hospital to strengthen the health system for the entire province, moving toward the achievement of universal health coverage (UHC).

Under these circumstances, the Government of Cambodia has requested Grant Aid from the Government of Japan for the Project.

The outline of the request made to the Government of Japan is as follows.

Target areas (sites)

Siem Reap Province, Siem Reap City:	Siem Reap Provincial Hospital
Siem Reap Province, Kralanh OD:	Kralanh District Hospital
Siem Reap Province, Angkor Chum OD:	Angkor Chum District Hospital and Pouk District Hospital
Siem Reap Province, Sot Nikum OD:	Sot Nikum District Hospital

Facilities

Construction of facilities (10,290 m2) including the following units at the Siem Reap Provincial Hospital:

Surgery Department, Emergency Department, Operating Rooms, etc.

Equipment

The provision of necessary equipment and materials based on the standard equipment list and referencing the Complementary Package of Activities (CPA) guidelines at Siem Reap Provincial Hospital and the other target hospitals.

Soft components

Technical training for the appropriate usage and maintenance of the medical equipment.

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 May 26 to June 29, 2019. The survey team held a series of discussions with the officials concerned of the Government of Cambodia, and conducted a field investigation at the target areas. As a result of further studies in Japan and the explanation of draft report from January 26 to February 5, 2020, the present report was finalized.

The contents of this grant aid project was formulated based on the following policy to improve Siem Reap Provincial Hospital and lower level hospitals in order to strengthen the medical referral system and ameliorate medical services in Siem Reap Province in accordance with the request from the Ministry of Health of Cambodia, the result of field survey and discussion.

（1） Design Policy

1) Site Selection

- Examining the position of the Surgery and Central Medical Department (covered by the Project) in relation to other departments, the location will provide efficient flow lines for patients and staff throughout the hospital.
- The location takes into consideration the possible future placement of a general medicine department.
- If it is necessary to dismantle and remove existing facilities, the location will allow medical activities to continue, even during construction work.
- A location where the new building has a good visibility at the hospital main gate or the road to be able to show the Japanese ODA presence.

2) Policy for selecting target components

- The Project will improve the aging and inadequate facilities of the Surgery and Central Medical Departments.
- Components necessary for consolidating the functions of these departments will be selected.
- To avoid any overlap, departments that are covered by aid from other donors will be excluded from the Project.

3) Policy for setting the scale

- The scale will be set based on the estimated number of patients in 2026, which is the target year, three years after facility completion.
- The prediction of the number of patients assumes an increase in patients due to natural population increase, as well as an increase in the number of road accidents due to more traffic.
- Meanwhile, improving the equipment at lower level hospitals will improve medical services at these hospitals. This is expected to expand the scope of patients they can accept, including those who are transferred or go directly to Siem Reap Provincial Hospital, thereby decreasing the number of patients at Siem Reap Provincial Hospital.

4) Equipment

- All hospitals in the request will be the targets (one provincial hospital and four district hospitals).
- Equipment for surgical departments and other departments related to surgical treatment at each target hospital will be covered.
- The equipment plan for the Project is consistent with the activities and technical levels of each hospital, avoiding overlap with existing equipment.
- Appropriate operation of equipment on the operating costs and skill levels is able to be guaranteed.
- Consideration of cooperation with provincial and district hospitals (remote diagnoses and technical support from higher level hospitals to lower level hospitals).
- Maintenance contracts will be concluded with equipment manufacturers or agents for a period of two years after the completion of 1 year manufacture warranty for the equipment deemed necessary, e.g. advanced equipment or equipment for which malfunction would cause serious problems. This cost will be borne by the Japanese side. Maintenance contracts will include fees for two services: on-call service fees for performing equipment inspections when requested by the user in the event of malfunction; and the cost of repaired and replacement parts. During the one-year manufacturer's warranty period, all costs for replacement parts, etc. excluding failure due to user's defect will be covered by the manufacturer.
- Soft component will be conducted as initial technical guidance to ensure proper operation after the handover.

（2） Details and Scale

1) Facilities

Table–i　Building Plan

Building	Department	Major Rooms	Floor Area
Central Clinic and surgery ward Building	Outpatient Department	Consultation Room, Reception, Cashier, Pharmacy, Social Welfare Room, Triage Room, WC	218.80m^2
	Emergency Outpatient Department	Emergency Treatment Room, Minor Operation Room, Observation Room, Isolation Room, Staff Station, Utility, Storage, Duty Room	385.30m^2
	Imagery Department	CT Scan Room, X-Ray Room, Ultrasound Room, Reception, Office, Film Storage, Duty Room	250.47m^2
	ICU Department	Intensive Care Room, Isolation Room, Staff Station, Meeting Room, Utility, Duty Room, Storage	551.29m^2
	Operating Rooms	Operating Hall, Operating Room, Recovery Room, Stuff Station, Anesthesiology room, Conference Room, Changing Room, Duty Room, Septic Corridor, Storage	715.02m^2
	Central Materials	Washing Room, Sterilization Room, Sterile Storage, Office, Laundry	173.79m^2
	Surgery A (abdominal, thoracic)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	435.30m^2
	Surgery B (trauma, orthopedic, plastic, burn)	6 Beds Room, Private Room, Consultation Room, Plaster Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	842.87m^2

	Surgery C (urology)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	395.28m^2
	Surgery D (neurology)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	220.64m^2
	Surgery E (ENT, maxillofacial)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	222.32m^2
	Common areas	Entrance Hall, Corridor, Stairs, Day Room, WC, Storage	2,218.26m^2
	Machine Room	Electrical Room, Generator Room, Medical Gas Room, Water Receiving Tank, Pump Room, Elevated Water Tank Room, AC Machine Room, EV Machine Room, PS, EPS	631.57m^2
		Central Clinic and surgery ward Building Total	7260.91m^2
Other		Septic Tank, Power Receiving Facility Foundation	129.08m^2
		Grand Total	7,389.99m^2

2) Equipment

Table-ii Major Planned Equipment

Hospital	Department	Item Number	Major equipment
Siem Reap Provincial Hospital	Traumatology	15	C-arm, Arthroscope with knee operation instrument set, Hip prosthesis instrument set, etc.
	Urology	7	Cystofiberscope for examination, Resectoscope, Examination table for urology, etc.
	Abdominal surgery	8	Abdominal surgical instrument set, Surgical laparoscopic equipment, Gastroscope set, etc.
	Neurosurgery	2	Lumbar spine surgery instrument set and Neurology/ Craniotomy surgery instrument set
	ENT	3	ENT unit, ENT Surgical instrument set, etc.
	Emergency	10	Operation light mobile, Patient monitor, Ventilation machine, etc.
	ICU	13	Patient monitor, Ventilation machine, Mobile ultrasound machine, etc.
	Operation theatre	16	Operation table, Operation light, Anesthetic machine, Patient monitor, etc.
	Recovery room	7	Patient monitor, Ventilation machine, Stretcher, etc.
	Ward	2	Patient bed and Rehabilitation equipment set
	Outpatient	6	ECG machine, OPD examination set, Pulse oximeter, etc.
	Imagery	3	X-ray fixed type, PACS, Ultrasound machine, etc.
	CSSD	6	Autoclave, Washing machine, Dryer machine, etc.
Sot Nikum District Hospital	Department related to surgery	17	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.
Kralanh District Hospital	Department related to surgery	27	Anesthesia machine, Patient Monitor, X-ray Machine (mobile with table & stand), Ultrasound Scanner, etc.
Pouk District Hospital	Department related to surgery	17	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.
Angkor Chum District Hospital	Department related to surgery	26	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.

3) Soft Component

- Technical guidance on proper operation and maintenance for Picture Archiving and Communication Systems (PACS)
- Technical guidance on proper maintenance and infection prevention for target equipment
- Technical guidance on the implementation of a medical equipment maintenance system

4) Maintenance Service of the Equipment

A two-year maintenance contract following the expiry of the one-year warranty period will be included for equipment that requires maintenance performed by the manufacturer or sales agent. For equipment eligible for maintenance contracts, services are determined for each piece of equipment and included in the contract; this may include on-call service, periodic maintenance, and the cost of repair parts and replacement parts. These maintenance contract costs will be borne by the Japanese side, and the maintenance contract work will be the responsibility of the procurement contractor.

Furthermore, all consumables such as the reagents and disposable parts necessary each time the equipment is used will be the responsibility of the Cambodian side. Equipment failure due to user error will not be covered by the maintenance contracts.

4. Implementation Schedule and Cost Estimation

The project would be implemented in multiple fiscal years, taking 9 months for the detailed design, 22 months for the construction and equipment procurement and 2 months for the soft component. In case of implementation by Japan’s Grant Aid, the initial cost to be borne by the 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

1) Focus of the project's benefits

The target area of this project is the northern region of Cambodia, including Siem Reap Province and its surrounding provinces. The population of Siem Reap Province is 1.069 million (2019) (Resource: Siem Reap Province Health Department), and considering the population of surrounding provinces, about 1.5 million people will directly benefit. In addition, Siem Reap Province has the world heritage of Angkor ruins, which attracts more than 5 million Cambodian and foreign tourists annually. Moreover, National Route 6 that runs through Siem Reap City runs from the capital city of Phnom Penh to Sisophon through the north side of Tonle Sap Lake and is connected to National Route 5 (Southern Economic Corridor) that continues to the Thai border. National Highway 6 is the major arterial road in Cambodia

together with National Highway 5 which runs through the south side of Tonle Sap Lake. In recent years, the number of patients due to traffic injuries has increased with the increase in traffic volume. This project will greatly contribute to the improvement of medical services in the northern region of Cambodia by strengthening the medical referral system in Siem Reap Province, where health care needs are large, and the number of patients is expected to increase further.

2) From a Human Security Standpoint

The project aims to enhance rural healthcare services through the improvement of Siem Reap Provincial Hospital which serves as a central hospital in the northern region of Cambodia and its lower level hospitals. In order to realize Universal Health Coverage (UHC), which is positioned as an important issue in Japan's Strategy on Global Health Diplomacy (established in May 2013), this project aims to expand provision of basic health services in the target area.

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

This project is concerned with strengthening the health system aiming for universal health coverage which is one of the priority areas in the Third Health Strategic Plan formulated in line with Cambodia's National Strategic Development Plan and Sustainable Development Goals, etc. Seven strategies are set in the implementation of this plan, and this project contributes to the development of health infrastructure (facility, advanced medical equipment).

4) Consistency with Japan's Assistance Policy

"Promotion of initiatives in the field of healthcare and social security toward achieving Universal Health Coverage (UHC)" is stated in (2) Improvement of Quality of Life, Pillars of Priority (Goals) of Country Assistance Policy for Cambodia (July, 2017) established by the Japanese Ministry of Foreign Affairs, and Program for Strengthen Health System in Development Issue 2-2 Enhancement of Health Care and Social Security of Rolling Plan is being implemented. This project was planned based on this program.

（2） Effectiveness

Below are the expected target levels of implementing this project.

Quantitative Effects

Table-iii Outcome Indicators for Quantitative Effects

Indicator	Baseline (2018)	Target (2026) (3 years after completion)
Effects of Siem Reap Provincial Hospital facility improvement		
① Number of surgical inpatients (persons/year)	5,975	6,500
② Surgical bed occupancy rate (%)	191.2%	90%
③ Number of operations (excluding ophthalmology, OB/GYN) (cases/year)	3,306	4,732
Effects of lower level hospital equipment improvement		
④Proportion of critical surgical inpatients transferred from lower level hospitals to surgical inpatients (%)	27.9%	24.3%

2) Qualitative Effects

a) At the target hospitals, high quality medical services will be provided, centering on emergency and surgical patients.

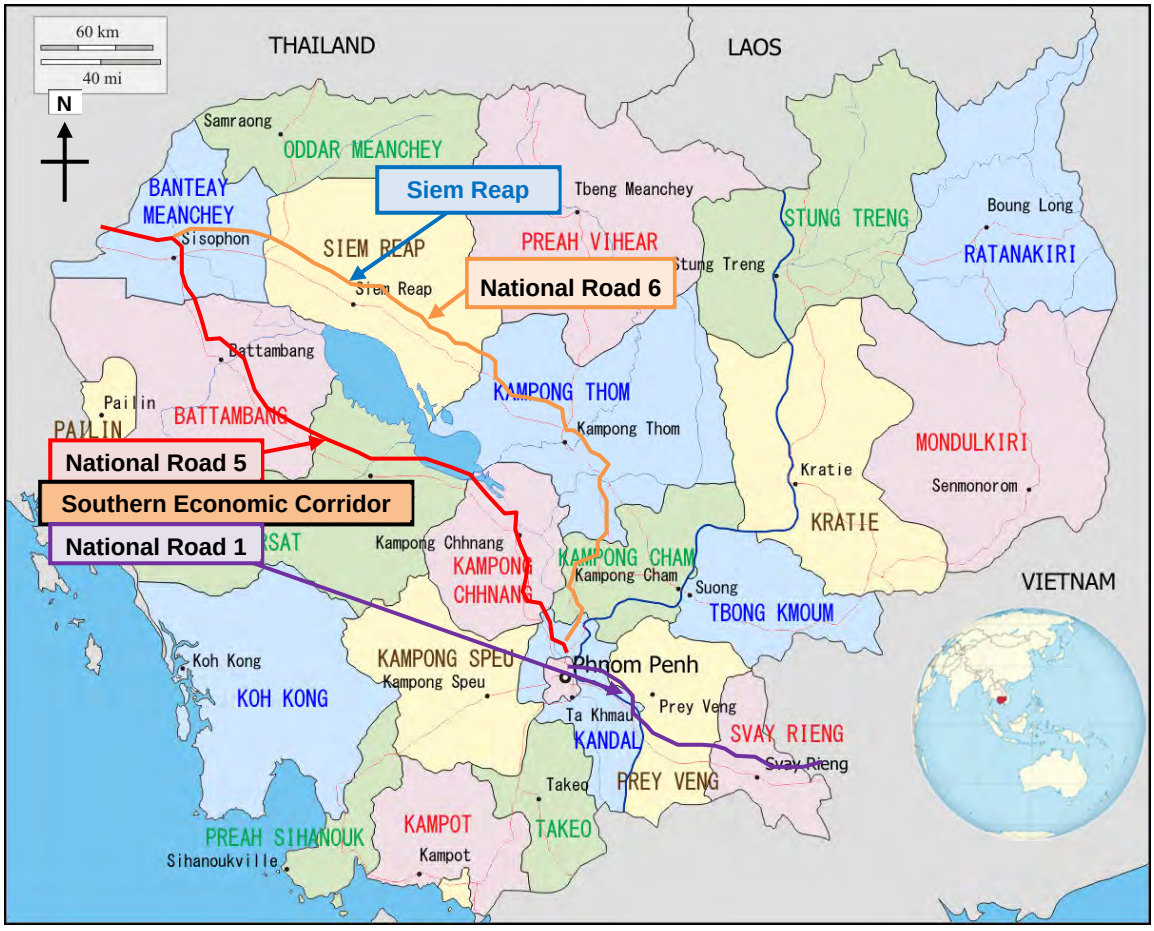
b) The medical referral system in northern Cambodia will be strengthened.

c) Medical staff’s motivation to work will be improved at the target hospitals.

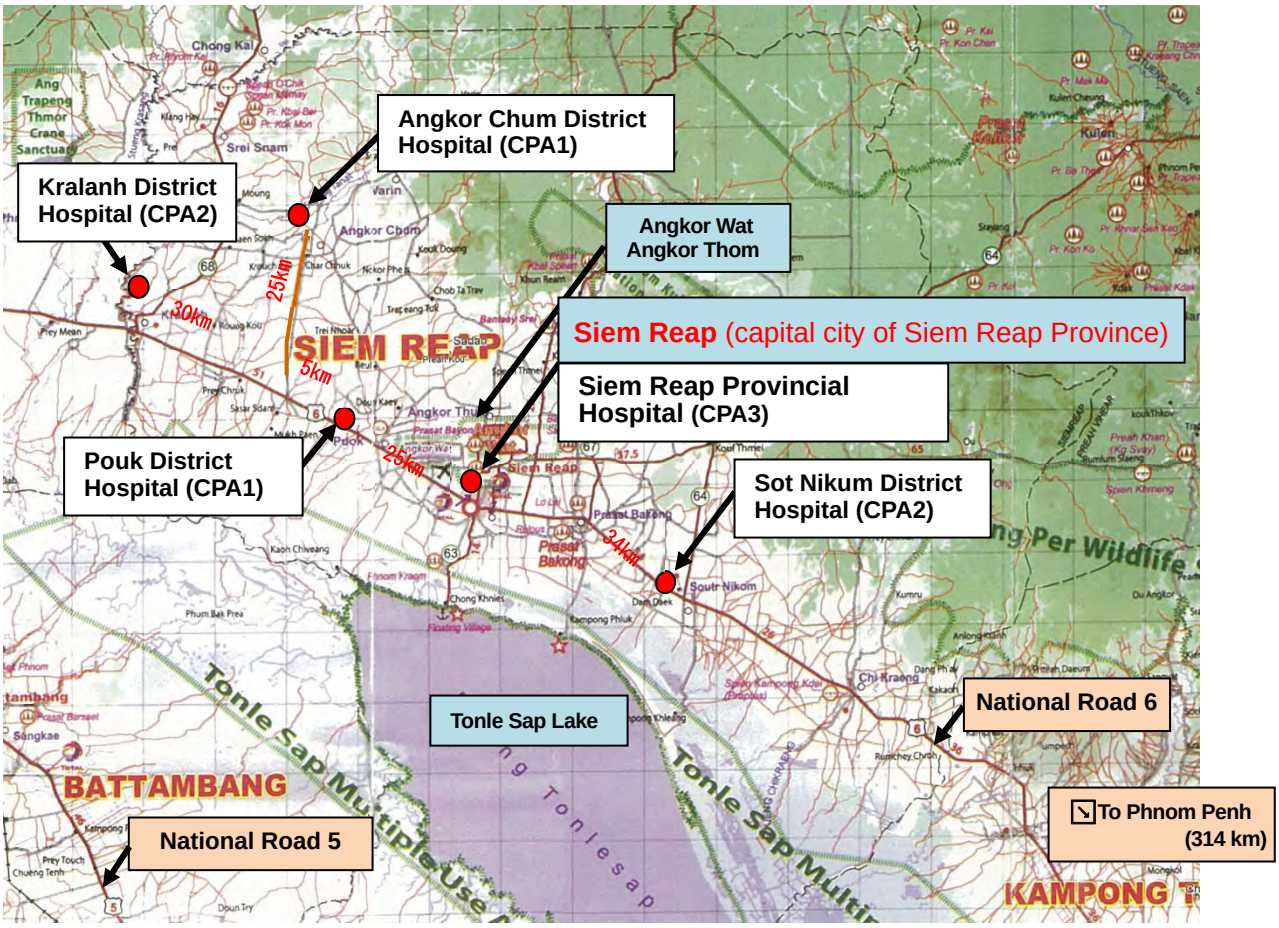
d) The maintenance management system is strengthened, and both new and existing buildings will be properly maintained and used continually over the long term.

Contents

Project Location Map



Map of Cambodia



*The km notations along roads show the distances between hospitals.

Location Map of Referral Hospitals in Siem Reap Province

Perspective – Northwest Bird’s Eye View

Perspective – Front of East Side

List of Figures and Tables

Abbreviations

Abbrevivation	Language	Term
ADB	English	Asian Development Bank
AFD	French	Agence Française de Développement
AFMC	French	Association France Médecine Cambodge
AHF	English	AIDS Healthcare Foundation
AIDS	English	Acquired Immune Deficiency Syndrome
ALOS	English	Average Length of Stay
AOP	English	Annual Operational Plan
ASEAN	English	Association of Southeast Asian Nations
AVR	English	Auto Voltage Regulator
BH	English	Borehole
BOR	English	Bed Occupancy Rate
CDC	English	Council Development Cambodia
CDHS	English	Cambodia Demographic and Health Survey
CMAC	English	Cambodia Mine Action Center
CMS	English	Central Medical Storage
CPA	English	Complementary Package of Activities
CR	English	Computed Radiography System
CT	English	Computer Tomography
DAC	English	Development Assistance Committee
D&D	English	Decentralization and De-concentration
EDC	French	Electricite du Cambodge
ENT	English	Eye, Nose and Throat
EIA	English	Environmental Impact Assessment
EoJ	English	Embassy of Japan
E/N	English	Exchange of Notes
EP	English	Emulsion Paint
G/A	English	Grant Agreement
GDP	English	Gross Domestic Product
GL	English	Ground Level
HC	English	Health Center
HEF	English	Health Equity Fund
HIS	English	Health Information System
HIV	English	Human Immunodeficiency Virus
HMIS	English	Health Management Information System
HP	English	Health Post
HSP3	English	Third Health Strategic Plan 2016-2020
HSS	English	Health System Strengthening
HSSP2	English	Second Health Sector Support Program 2009-2013
ICU	English	Intensive Care Unit
IMF	English	International Monetary Fund
JICA	English	Japan International Cooperation Agency
JIS	English	Japanese Industrial Standard
KOFIH	English	Korean Foundation for International Healthcare

Abbrevivation	Language	Term
KOICA	English	Korea International Corporation Agency
LAN	English	Local Area Network
MDGs	English	Millennium Development Goals
MEDEM	English	Project for Strengthening Medical Equipment Management at Referral Hospital
MMR	English	Maternal Mortality Ratio
MOH	English	Ministry of Health
MSF	French	Médecins Sans Frontiéres
NCD	English	Noncommunicable Disease
NGO	English	Non-Governmental Organization
NMR	English	Neonatal Mortality Rate
NSDP	English	National Strategic Development Plan 2014-2018
NSPS	English	National Social Protection Strategy
NSSF	English	National Social Security Fund
OD	English	Operational District
ODA	English	Official Development Assistant
OECD	English	Organisation for Economic Co-operation and Development
OT	English	Operation Theater
OWB	English	Osteosynthesis Without Border
PACS	English	Picture Archiving and Communication System
PHD	English	Provincial Health Department
PMRS	English	Patient Management and Registration System
RC	English	Reinforced Concrete
RH	English	Referral Hospital
RTC	English	Regional Training Center
SDGs	English	Sustainable Development Goals
STD	English	Sexually Transmitted Diseases
UHC	English	Universal Health Coverage
U5MR	English	Under 5 Mortality Rate
UNDP	English	United Nations Development Program
UNICEF	English	United Nations Children's Fund
VAT	English	Value Added Tax
VIP	English	Very Important Person
WHO	English	World Health Organization

Chapter 1 Background of the Project

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1-1 Background and Outline of the Request for Grant Aid

As a result of the persecution of health care personnel and the destruction of medical equipment facilities during civil war in the 1970s, the development of the public health care system in Cambodia was delayed. However, since then, the Government of Cambodia and its development partners, including the Government of Japan, have undertaken various efforts to raise the level of health care, thus improving health indicators throughout the country. For example, there has been a decrease in both the under-5 mortality rate (per 1,000 births: 107 in 2000 and 28 in 2018, from UNICEF 2019) and the maternal mortality rate (per 100,000 births: 488 in 2000 and 160 in 2017, from UNICEF 2017). However, there is a large disparity between the capital of Phnom Penh and rural areas, e.g., the under-5 mortality rate in Phnom Penh is 23, compared to 56 in Siem Reap (per 1,000 births, from the Cambodia Demographic Health Survey 2014), indicating that the improvement of medical services in rural areas is an issue. The Government of Cambodia positioned the health sector as a priority issue in their National Strategic Development Plan (NSDP) 2019-2023. Additionally, in the Health Strategic Plan 2016-2020 (HSP3), the provision of high-quality health services and ensuring equitable access to such were given as priority policies.

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1-2 Trends in Japanese Assistance

The amount of assistance provided by Japan to Cambodia in FY 2017 (using OECD/DAC reporting standards) was $58.55 million in ODA loans, $83.15 million in grant aid, and $41.58 million in technical cooperation. The cumulative total up to FY 2017 (using OECD/DAC reporting standards) was $299.25 million in ODA loans, $1.6359 billion in grant aid, and $918.3 million in technical cooperation, with grant aid accounting for the largest amount. Japan is Cambodia's largest donor country, providing an estimated $106 million in aid in 2015. In contrast, the next largest donor country is the U.S. at $80 million, showing Japan's large presence and outpacing all other donors. In the 2017 Country Assistance Policy for Cambodia, the three priority areas are the reconstruction of industry, improving quality of life, and fostering a sustainable society through the strengthening of governance. This contributes to the overall goal of supporting the further strengthening of economic and social infrastructure to achieve upper middle income country status by 2030. The heath care sector is positioned as a part of the goal of improving quality of life. While continuing to support the strengthening of the health systems and services, centering on maternal and child health, focus will also be placed on UHC, to support the expansion of the social health insurance system. Technical cooperation, ODA loans and grant aid projects in the health care sector that have been implemented thus far are shown in Table 1-1 to Table 1-3.

Table 1-1 Japanese Technical Cooperation Projects (Health Care Sector)

Implementation year	Project name	Summary
1995.4-2000.3	Maternal and Child Health Project	Strengthening of clinical services related to mothers and children, introduction of medical fee collection system, training of personnel, etc.
1999.7-2004.7	National Tuberculosis Control Project	Expansion of services for directly observed treatment, short course (DOTS), implementation of nationwide TB prevalence surveys in rural areas, training of related medical personnel
2000.4-2005.3	Maternal and Child Health Project (Phase 2)	Strengthening of maternal and child health center, establishment of rural maternal and child health services, nationwide improvement of medical equipment management capacities
2003.9-2008.9	Project for Human Resource Development of Co-Medicals	Standardization of basic education for co-medicals (nursing, clinical testing, radiology, physical therapy), teacher eligibility qualification requirements, creation systems for school establishment and management
2004.8-2009.7	National Tuberculosis Control Project Phase 2	Strengthening of National TB Control Project implementation functions, training of related medical personnel
2006.1-2008.12	Project on Promotion of Medical Equipment Management System (MEDEM-1)	Creation of a management system through the introduction of basic maintenance activities for medical equipment at public health care facilities
2007.1-2010.1	Project for Improving Maternal and Child Health Service in Rural Areas in Cambodia	Improvement of rural area maternal and child health services, including prevention of HIV maternal transmission, at a regional level
2009.10-2014.9	Project for Strengthening Medical Equipment Management in Referral Hospitals (MEDEM-2)	Strengthening of management system built in MEDEM-1, creation of system for diffusion to lower level hospitals, creation of management network and promotion of participation
2009.11-2012.11	Project for Improving the Capacity of the National TB Control Program through Implementation of the 2nd National TB Prevalence Survey	Strengthening of TB control capacity through implementation of a second nationwide TB prevalence survey
2010.3-2015.8	Project for Improving Maternal and Newborn Care through Midwifery Capacity Development	Strengthening of the midwife training system, including improving the capacity of midwife trainers in leadership positions in the region
2010.6-2015.6	Project for Strengthening Human Resources Development System of Co-Medicals	Establishment of rules for nurses and midwifes, human resource development for nursing and midwifery teachers
2016.5-2021.5	Project for Improving Continuum of Care with Focus on Intrapartum and Neonatal Care	Strengthening of services for newborn infectious disease prevention and control, reinforcement of systems and management for such services
2016.11-2018.5	Project for Development of Social Health Insurance for the Informal Sector	Through the formulation of action plans, detailed design, and frameworks for verification surveys for the introduction of a proposed health insurance system for the informal sector, the project will contribute to the establishment of systems and structures for its full-scale implementation.

Source: MOFA ODA Country Data Book

Table 1-2 Japanese ODA Loans Projects (Heath Care Sector)

Implementation Year	Project Name	Summary
2015.6	Emergency Life Saving Center Development Project	By establishing and operating a private hospital with emergency center, the project will provide medical services such as disease prevention, treatment and rehabilitation utilizing Japanese technology and know-how, and contribute to the improvement of the illness situation in the country.

Source: JICA

Table 1-3 Japanese Grant Aid Projects (Heath Care Sector)

Implementation Year	Project Name	Cost (100 million yen)	Summary
1993	Project for Improvement of Medical Equipment of Hospitals in Phnom Penh	5.17	Provision of medical equipment for national health facilities in Phnom Penh
1995	Project for Construction of National Maternal and Child Health Center	17.61	New construction of the inpatient ward and central medical department, etc. of the National Maternal and Child Health Center
1998	Project for Construction of National Maternal and Child Health Center	3.63	Procurement of medical equipment for the National Maternal and Child Health Center
1999	Improvement of the National Tuberculosis Center	8.03	New construction of administration department, outpatient department, and co-medical department at the National Tuberculosis Center
	Improvement of Medical Equipment of Siem Reap Hospital	1.12	Procurement of medical equipment for Siem Reap Hospital
2001	Project for Reducing Infant and Child Mortality and Morbidity	3.08	Procurement of medical equipment via UNICEF
2003	Project for Infectious Disease Control	3.95	Procurement of vaccines and vaccine cold storage equipment
	Project for Renovation of Technical School for Medical Care	7.74	Construction and renovation of main building of the Technical School for Medical Care
2005	Project for the Improvement of Mongkul Borey Hospital	6.83	Rebuilding of central medical department, etc. and procurement of medical equipment at Mongkul Borey Hospital
	Project for Infectious Disease Control	2.78	Procurement of vaccines and vaccine cold storage equipment
2007	Project for Improvement of Kampong Cham Hospital	0.60	Detailed design related to rebuilding of the hospital's central medical department
2008	Project for Improvement of Kampong Cham Hospital (1/3)	2.16	Rebuilding of the hospital's central medical department and procurement of medical equipment (JGB 1/3)
	Project for Infectious Disease Control	2.30	Procurement of vaccines and vaccine cold storage equipment
2009	Project for Improvement of Kampong Cham Hospital (2/3)	4.71	Rebuilding of the hospital's central medical department and procurement of medical equipment (JGB 2/3)
2010	Project for Improvement of Kampong Cham Hospital (3/3)	3.52	Rebuilding of the hospital's central medical department and procurement of medical equipment (JGB 3/3)
2012	Project for Improvement of Medical Equipment in National, Municipal, and Provincial Referral Hospitals	3.74	Procurement of equipment necessary for basic medical services at 21 hospitals
2012	Project for Improvement of Sihanouk Province Referral Hospital	15.54	Rebuilding of the hospital's central medical department and procurement of medical equipment
2013	Project for Expansion of National Maternal and Child Health Center	11.93	Construction of training ward, renovation of existing center, and procurement of medical equipment and training materials.
2014	Project for Improvement of Svay Rieng Provincial Referral Hospital	10.77	Rebuilding of the hospital's central medical department and procurement of medical equipment
2017	Project for Improvement of Battambang Provincial Hospital	14.53	Rebuilding of the hospital's central medical department and procurement of medical equipment

Source: MOFA ODA Country Data Book

1-3 Environmental Conditions

(1) Weather

The climate of Siem Reap is classified as savanna climate (Aw) in the Köppen climate classification and belongs to the tropics. Due to the effects of the southwest monsoon in summer and the northeast monsoon in winter, the season is divided into a rainy season from May to October and a dry season from November to April. The annual rainfall in Siem Reap is approximately 1,300 mm ~ 1,500mm, 80% of which is in the rainy season. The average temperature is around 30 °C throughout the year, the maximum temperature is around 35 °C, and the minimum temperature is around 25 °C, so the temperature difference is small. The average annual wind speed is about 2 m/s, and the maximum monthly average wind speed is 3.5 m/s. Meteorological data for Siem Reap Province in 2018 is shown in Table 1-4 and Figure 1-1.

Table 1-4 Meteorological data for Siem Reap Province in 2018

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Average/ Annual Total
Average Temperature (℃)	27	27	30	30	31	28	27	27	28	31	30	30	28.83
Maximum Temperature (℃)	32	33	35	35	35	32	31	31	32	33	33	33	32.92
Minimum Temperature (℃)	23	23	26	27	27	25	25	25	25	26	25	24	25.08
Precipitation (mm)	3.46	10.23	18.91	84.53	56.78	127.4	193.75	161.9	170.76	160.6	92.8	17.9	1099.02
Average Humidity (%)	61	54	57	63	65	75	81	81	78	70	67	63	67.92
Average Wind Speed (kmph)	6.3	6.2	5.8	6	5.1	9.4	12.7	12.3	6.8	8	7.8	7.9	7.86

Source worldweatheronline.com

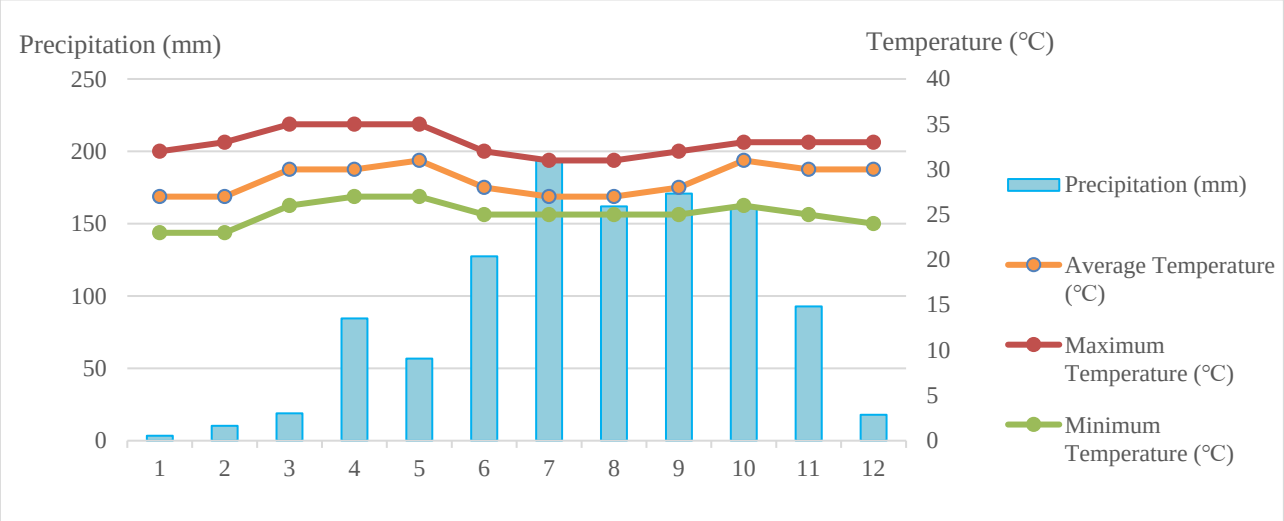

Figure 1-1 Meteorological data for Siem Reap Province in 2018

(2) Natural Environment Survey

Topographical surveys, geological survey and water quality tests were conducted mainly on the planned construction site of the Project on the premises of Siem Reap Provincial Hospital.

1) Topographical surveys

Siem Reap Province Hospital is located in the center of Siem Reap City. The Siem Reap River runs 150m to 200m southwest of the hospital premises. National Route 6 runs through Siem Reap city and traffic is very heavy. It runs from the capital city of Phnom Penh to Sisophon through the north side of Tonle Sap Lake and is connected to National Route 5 (Southern Economic Corridor) that continues to the Thai border. The land of the hospital is a triangle with sides approximately 250m, 280m and 270m, and the area is 36,600m2. The land is almost flat, and the altitude is about 14m above sea level.

The planned construction site for this project is the land of approximately 3,800 m2 located in the center of the hospital premises on the north side along the internal road that extends straight from the main gate of the hospital on the west side of the premises.

Currently, there are an internal medicine ICU building and a surgical B ward building on the planned construction site. It was agreed that the Cambodian side will remove the existing buildings including the ambulance parking lot, pavement, trees, etc. and prepare the land before bidding for facility construction.

2) Geological Survey

Ten boring surveys were conducted at the planned construction site of this project. Each boring survey was carried out until the depth of 5 m or more of support layer with continuously N value of 50 or more could be confirmed. As a result, the ground layer of the site is a sandy soil layer with N value of 3 to 10 from the surface layer to GL-10.0m, a sandy soil layer with N value of 10 to 20 from GL-10.0m to -27.0m, a sandy soil layer with N value of 20 to 50 from GL-27.0m to -35.0m (partly -40.0m), and a sandy soil layer with N value of 50 or more from GL-35.0m to -40.0m. The groundwater level is GL-0.5m at BH-9, which indicates the groundwater exists the shallow layer.

3) Water Quality Tests

The water used at the existing hospital is city water of Siem Reap, well water, and well water that has passed through water purification equipment. As a result of conducting water quality tests on the water at these three locations, the water at all three locations met the drinking water quality standards in Cambodia. Regarding the water supply facilities for this project, it is planned to branch off from the city water intake pipe to the hospital premises and to newly install a water tank for the facilities to be constructed under this project.

1-4 Environmental and Social Considerations

The Project is for a medical facility to be built on the land of an existing hospital, thus having little environmental and social impact on the site and surrounding area; therefore, it is classified as Category C under the JICA Guidelines for Environmental and Social Considerations. As the Project is a medical facility, an Environmental Impact Assessment (EIA) is not required by the Environment Law set forth by the Cambodian Ministry of Health. However, although the Project has a total area of 8,000 m^2 or less, the building height exceeds 12 m, making it necessary to obtain an assessment from the Impact Assessment Department of the Ministry of Environment. In regard to gender considerations, the Project will ensure that facilities are easy to use, regardless of gender, by providing separate gender water closets, shower rooms, and changing rooms for both staff and patients.

1-5 Other (Global Issues, etc.)

“From MDGs to UHC” can be cited as the trend of assistance in the global issue and health sector related to this project. From 2000 to 2015, the United Nations Development Program (UNDP) -led MDGs target infants, children under the age of 5, maternal, HIV-infected persons, and the vulnerable of the poor. UHC is one of the proposals for the action on MDGs. The UHC advocated by WHO in 2005 is that "everyone can receive health services related to health promotion, prevention, treatment, and functional recovery at a cost that can be paid when needed". The United Nations General Assembly in December 2012 made a resolution to promote it, and the Japanese government also emphasized promotion of UHC as an important action in the “Japan’s Strategy on Global Health Diplomacy” announced in May 2013. The HSP3, which is Cambodia's health development plan, has strengthened the health system as one of the four priority areas, and it suggests intention to promote UHC. Of the UNDP's sustainable development goals (SDGs) from 2016 to 2030, SDG3 as a health goal is " Ensure healthy lives and promote well-being for all at all ages". It will be realized by the achievement of UHC.

To promote UHC, 1) facilitate physical access, 2) facilitate economic access, 3) facilitate social access, 4) facilitate qualitative access, and 5) facilitate sustainable access are needed. In order to 1) facilitate physical access, it is important to develop infrastructure and secure human resources for health, especially in rural areas, and the previous projects for improvement of provincial hospitals, of course this project too, are infrastructure development that facilitates physical access in rural areas. Improvement of facilities and provision of medical equipment by this project will also contribute to 4) facilitate qualitative access. In addition, Siem Reap Provincial Hospital is conducting in-service education for doctors and nurses of lower level hospitals and is working to secure health personnel and improve the quality of health personnel. From this point as well, it is considered to contribute to promotion of UHC.

Regarding the action of 3) facilitate social access, it is important to educate the local people and encourage local communities to remove customary and cultural factors that hinder the use of health services. Such activities have been implemented in the technical cooperation projects for community health, including "The project for improving maternal and child health service in rural areas in Cambodia". In addition, one approach to 2) facilitate economic access is to establish a national health insurance system, and JICA conducted a survey for “Data collection survey on the social health protection system in the Kingdom of Cambodia” in Fiscal Year 2015.

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

As a result of the persecution of health care personnel and the destruction of medical equipment facilities during civil war in the 1970s, the development of the public health care system in Cambodia was delayed. However, since then, the Government of Cambodia and its development partners, including the Government of Japan, have undertaken various efforts to raise the level of health care, thus improving health indicators throughout the country. For example, there has been a decrease in both the under-5 mortality rate (per 1,000 births: 107 in 2000 and 28 in 2018, from UNICEF 2019) and the maternal mortality rate (per 100,000 births: 488 in 2000 and 160 in 2017, from UNICEF 2017). However, there is a large disparity between the capital of Phnom Penh and rural areas, e.g., the under-5 mortality rate in Phnom Penh is 23, compared to 56 in Siem Reap (per 1,000 births, from the Cambodia Demographic Health Survey 2014), indicating that the improvement of medical services in rural areas is an issue.

Siem Reap Provincial Referral Hospital is the main hospital in northern Cambodia. Patients come to the hospital from within Siem Reap Province, as well as from the six surrounding provinces. In particular, victims of traffic accidents with external injuries are often transported here. However, due to the deterioration of facilities built in the 1970s and lack of equipment, Siem Reap Provincial Referral Hospital is not currently meeting the health care needs of the provinces. In addition, the patients who have to be treated at lower level hospitals go to the provincial hospital because of a lack of equipment and personnel at lower level hospitals in the province. This causes an overconcentration of patients on Siem Reap Provincial Hospital. Through the implementation of provincial hospital improvement projects in Cambodia in the past, we have learned that when strengthening the functions of hospitals, it is also necessary to include lower level hospitals in these efforts, in order to avoid an overconcentration of patients at the improved provincial hospitals. Hence, the Project for Improvement of Referral Hospitals in Siem Reap Province, intends to improve the four lower-level district hospitals in the province in addition to the provincial hospital to strengthen the health system for the entire province, moving toward the achievement of universal health coverage (UHC). The Government of Cambodia positioned the health sector as a priority issue in their National Strategic Development Plan (NSDP) 2019-2023. Additionally, in the Health Strategic Plan 2016-2020 (HSP3), the provision of high-quality health services and ensuring equitable access to such were given as priority policies. This project is positioned as a project that contribute to these plans.

Table 2-1 Overall Goal and Project Goal

	Medical Service
Overall Goal	To strengthen the health systems of Siem Reap province, thereby contributing to the improvement of the overall health situation in the region including neighboring provinces.
Project Goal	To improve the quality of medical service at Siem Reap Provincial Hospital and four District Hospitals in the province.
Project Results	Siem Reap Provincial Hospital shall be provided with the necessary medical facilities and equipment. Four District Hospitals in the province shall be provided with the necessary medical equipment.

2-1-2 Outline of the Project

In order to achieve the goals noted above, the Project will provide medical facility and equipment for the surgical department of Siem Reap Provincial Hospital (CPA3), and medical equipment for the surgical departments of its lower hospitals which are Kralanh District Hospital (CPA 2), Angkor Chum District Hospital (CPA 1), Pouk District Hospital (CPA1), and Sot Nikum District Hospital (CPA2) for the strengthen the medical services for the surgical patients increasing recently.

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

1) Facilities

The facility outline of the project at Siem Reap Province Hospital is shown in Table 2-2.

Table 2-2 Outline of the Project (Facilities)

Building	Department	Major Rooms	Floor Area
Central Clinic and surgery ward Building	Outpatient Department	Consultation Room, Reception, Cashier, Pharmacy, Social Welfare Room, Triage Room, WC	218.80m^2
	Emergency Outpatient Department	Emergency Treatment Room, Minor Operation Room, Observation Room, Isolation Room, Staff Station, Utility, Storage, Duty Room	385.30m^2
	Imagery Department	CT Scan Room, X-Ray Room, Ultrasound Room, Reception, Office, Film Storage, Duty Room	250.47m^2
	ICU Department	Intensive Care Room, Isolation Room, Staff Station, Meeting Room, Utility, Duty Room, Storage	551.29m^2
	Operating Rooms	Operating Hall, Operating Room, Recovery Room, Stuff Station, Anesthesiology room, Conference Room, Changing Room, Duty Room, Septic Corridor, Storage	715.02m^2
	Central Materials	Washing Room, Sterilization Room, Sterile Storage, Office, Laundry	173.79m^2
	Surgery A (abdominal, thoracic)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	435.30m^2
	Surgery B (trauma, orthopedic, plastic, burn)	6 Beds Room, Private Room, Consultation Room, Plaster Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	842.87m^2
	Surgery C (urology)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	395.28m^2
	Surgery D (neurology)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	220.64m^2
	Surgery E (ENT, maxillofacial)	6 Beds Room, Private Room, Consultation Room, Stuff Station, Meeting Room, Chief Doctor's Room, Duty Room, Storage, Utility, WC	222.32m^2
	Common areas	Entrance Hall, Corridor, Stairs, Day Room, WC, Storage	2,218.26m^2
	Machine Room	Electrical Room, Generator Room, Medical Gas Room, Water Receiving Tank, Pump Room, Elevated Water Tank Room, AC Machine Room, EV Machine Room, PS, EPS	631.57m^2
		Central Clinic and surgery ward Building Total	7260.91m^2
Other		Septic Tank, Power Receiving Facility Foundation	129.08m^2
		Grand Total	7,389.99m^2

2） Equipment

The equipment outline of the project at each hospital targeted by this project is shown in Table 2-3.

Table 2-3 Outline of the Project (Equipment)

Hospital	Department	Item Number	Major equipment
Siem Reap Provincial Hospital	Traumatology	15	C-arm, Arthroscope with knee operation instrument set, Hip prosthesis instrument set, etc.
	Urology	7	Cystofiberscope for examination, Resectoscope, Examination table for urology, etc.
	Abdominal surgery	8	Abdominal surgical instrument set, Surgical laparoscopic equipment, Gastroscope set, etc.
	Neurosurgery	2	Lumbar spine surgery instrument set and Neurology/ Craniotomy surgery instrument set
	ENT	3	ENT unit, ENT Surgical instrument set, etc.
	Emergency	10	Operation light mobile, Patient monitor, Ventilation machine, etc.
	ICU	13	Patient monitor, Ventilation machine, Mobile ultrasound machine, etc.
	Operation theatre	16	Operation table, Operation light, Anesthetic machine, Patient monitor, etc.
	Recovery room	7	Patient monitor, Ventilation machine, Stretcher, etc.
	Ward	2	Patient bed and Rehabilitation equipment set
	Outpatient	6	ECG machine, OPD examination set, Pulse oximeter, etc.
	Imagery	3	X-ray fixed type, PACS, Ultrasound machine, etc.
	CSSD	6	Autoclave, Washing machine, Dryer machine, etc.
Sot Nikum District Hospital	Department related to surgery	17	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.
Kralanh District Hospital	Department related to surgery	27	Anesthesia machine, Patient Monitor, X-ray Machine (mobile with table & stand), Ultrasound Scanner, etc.
Pouk District Hospital	Department related to surgery	17	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.
Angkor Chum District Hospital	Department related to surgery	26	Ultrasound Scanner, X-ray Machine (mobile with table & stand), Autoclave, etc.

3） Technical Assistance (Soft Component)

- Technical guidance on proper operation and maintenance for Picture Archiving and Communication Systems (PACS)
- Technical guidance on proper maintenance and infection prevention for target equipment
- Technical guidance on the implementation of a medical equipment maintenance system

4） Maintenance Service of the Equipment

A two-year maintenance contract following the expiry of the one-year warranty period will be included for equipment (two items) that requires maintenance performed by the manufacturer or sales agent. The maintenance contract includes on-call service, periodic maintenance, and the cost of repair parts and replacement parts. On the other hand, all consumables such as the reagents and disposable parts necessary each time the equipment is used will be the responsibility of the Cambodian side.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

Siem Reap Provincial Hospital is the top referral hospital in the province. Since it plays a large role as a core hospital in northern Cambodia, there is an overconcentration of patients at the hospital, including referral patients from lower level medical facilities outside the province. However, due to the lack and aging of facilities and equipment, it has become difficult to provide adequate medical care that corresponds to the necessary level of treatment and number of patients. Furthermore, since the medical equipment at the secondary hospitals (CPA2 hospitals) and primary hospitals (CPA1 hospitals) under Siem Reap Provincial Hospital is also aging, they are unable to provide sufficient medical care to patients who should be normally be seen there, as stipulated by CPA regulations. Because of this, many patients are either transferred to or come directly to Siem Reap Provincial Hospital.

In addition, although health indicators in Cambodia have been improved overall, there is still a large disparity between Phnom Penh and rural areas, and the improvement of healthcare services in these rural areas is an issue. In a move to achieve UHC, one of the priority policies put in place by the Government of Cambodia is the provision of high quality health services and ensuring equitable access to these services.

In response to these issues, the Project will not only strengthen the functions of the provincial hospital, but also the four district hospitals under it, in order to reinforce the health system across the entire province. Working under a basic policy of preventing patient overcrowding at the provincial hospital, facilities and equipment will be prepared to correspond with Siem Reap Provincial Hospital's level of medical treatment and number of patients. Additionally, aging and inadequate medical equipment at lower level hospitals will also be prepared.

(1) Basic Policies

1) Site Selection

The current situation of Siem Reap Provincial Hospital is that facilities for each department are scattered around the site in separate buildings; facility development for each department is progressing with assistance from other donors. Because of this, flow lines for patients and staff are not only long, but also force people to move outdoors. In order to improve this situation, a site was selected based on the following policies.

① Examining the position of the Surgery and Central Medical Department (covered by the Project) in relation to other departments, the location will provide efficient flow lines for patients and staff throughout the hospital.

② The location takes into consideration the possible future placement of a general medicine department.

③ If it is necessary to dismantle and remove existing facilities, the location will allow medical activities to continue, even during construction work.

④ A location where the new building has a good visibility at the hospital main gate or the road to be able to show the Japanese ODA presence.

2) Facilities

The scope and scale of the Project are set based on the following basic policies.

a) Policy for selecting target components

In the application, there was a request for a new building that includes a surgical department, emergency department, and operating rooms, as well as the medical equipment necessary for treatment activities. In order to strengthen the functions of Siem Reap Provincial Hospital as a top referral hospital, the Project will improve the aging and inadequate facilities of the Surgery and Central Medical Departments. Components necessary for consolidating the functions of these departments will also be selected. To avoid any overlap, departments that are covered by aid from other donors will be excluded from the Project.

b) Policy for setting the scale

The scale will be set based on the estimated number of patients in 2026, which is the target year, three years after facility completion. The prediction of the number of patients assumes an increase in patients due to natural population increase, as well as an increase in the number of road accidents due to more traffic. Meanwhile, improving the equipment at lower level hospitals will improve medical services at these hospitals. This is expected to expand the scope of patients they can accept, including those who are transferred or go directly to Siem Reap Provincial Hospital, thereby decreasing the number of patients at Siem Reap Provincial Hospital.

3) Equipment

① All hospitals in the request will be the targets (one provincial hospital and four district hospitals).
② Equipment for surgical departments and other departments related to surgical treatment at each target hospital will be covered.
③ The equipment plan for the Project is consistent with the activities and technical levels of each hospital, avoiding overlap with existing equipment.
④ Appropriate operation of equipment on the operating costs and skill levels is able to be guaranteed.
⑤ Consideration of cooperation with provincial and district hospitals (remote diagnoses and technical support from higher level hospitals to lower level hospitals).
⑥ Maintenance contracts will be concluded with equipment manufacturers or agents for a period of two years after the completion of 1 year manufacture warranty for the equipment deemed necessary, e.g. advanced equipment or equipment for which malfunction would cause serious problems. This cost will be borne by the Japanese side. Maintenance contracts will include fees for two services: on-call service fees for performing equipment inspections when requested by the user in the event of malfunction; and the cost of repaired and replacement parts. During the one-year manufacturer’s warranty period, all costs for replacement parts, etc. excluding failure due to user's defect will be covered by the manufacturer.
⑦ Soft component will be conducted as initial technical guidance to ensure proper operation after the handover.

(2) Policy on Natural and Environmental Conditions

1) Weather Conditions

Siem Reap province falls under a tropical monsoon climate and is hot and humid throughout the year. In the rainy season, there are frequent rainstorms accompanied by strong winds and lightning. Installing balconies and a roof with deep eaves will prevent sunlight and rain from hitting the outer wall and openings. The plan will include a pitched roof to create a large air space in the attic, which will suppress high temperatures on the top floor caused by solar heat. It will also have good air flow, creating a comfortable indoor space with maximum natural ventilation. For rooms equipped with air conditioners, the external walls will be double wall structures, providing air space that will stop external wall temperatures from rising.

2) Flood Countermeasures

The Siem Reap River flows along the west side of Siem Reap Provincial Referral Hospital. There was flooding and inundation caused by the river overflowing every year until 2012, with the hospital having been flooded by knee-height waters on the ground floor. At present, no flooding has occurred since 2012, when river widening work was completed. However, because rainwater pipes in the city of Siem Reap are currently under construction, the level of the ground floor will be raised to 60 cm above the ground surface in order to mitigate any risk.

3) Lightning Strike Countermeasures

The facility to be built for the Project is a four-story building; since it is taller than all surrounding buildings, lightning protection equipment will be installed.

4) Other

- The finishing materials to be selected are those that are resistant to functional problems in terms of functionality, waterproofing, heat insulation and durability. These materials will also be easy to maintain and manage locally.
- Since the region is hot and humid, materials resistant to mold will be used.
- Metals fittings will be used, as they are less prone to problems in a hot and humid environment.

(3) Policy on Social and Economic Conditions

1) Social Conditions

- From a UHC perspective, wards will generally consist of 6-bed rooms, so that hospitalization fees can be set at a lower rate. Some private rooms will be created for isolation and/or to increase hospital income.
- Facilities will take gender into consideration, with separate water closets, showers, and changing rooms for men and women.
- A distinctive architectural style used for homes in Cambodia involves houses raised on wooden stilts

with a steeply-pitched roof. This style is compatible with natural conditions, as it prevents flooding and takes ventilation into account. In addition, temple architecture is characterized by pagodas with stacked layers of steeply-pitched roofs. The Project facility plan models the Project building after Cambodian architecture so that it will blend into cityscape and existing facilities.

2) Economic Conditions

- In recent years, prices have continued to rise in Cambodia with economic growth in the country. For the Project cost estimates, the IMF consumer price index (CPI) inflation rate is used to estimate price fluctuations from the month after the estimate is conducted to the assumed time of bidding. This is included in the projected costs for local unit prices of materials and labor, as well as construction equipment rental costs.

(4) Policy on Construction and Procurement

1) Facility Plan

Since there are few large-scale construction projects in regional Cambodian cities, the development of skilled workers has not advanced, with most of these workers being concentrated in Phnom Penh. Therefore, for large-scale construction projects in more rural cities, only ordinary and light workers can be procured from the area around the site; most of the skilled workers will be procured from Phnom Penh.

For this Project, general Cambodian construction methods will be used as the base so that local workers, including skilled workers from Phnom Penh, are able to perform the construction work. The structural frame will be a reinforced concrete rigid-frame structure, and the walls will be brick covered in mortar. The exterior wall finishing will be an exposed-aggregate finish, which is a local construction method that takes both aesthetics and durability into consideration. The roof will be a sloped roof of cement tiles, as is commonly used for Cambodian buildings, with good workability and easy maintenance.

Construction materials used in the Project can all be procured in Cambodia. Construction materials made in Cambodia are limited to aggregate, lumber, bricks, unglazed roof tile, and concrete blocks, etc. Other materials used will be imported goods from Thailand or Vietnam, but that are in general circulation in Cambodia through local sales agents.

2) Equipment Plan

In principle, equipment and materials will be procured in Japan or Cambodia. However, the scope of procurement will be extended to third countries for equipment for which competitiveness cannot be ensured in some of the tendering. However, from the aspect of operation and maintenance after handover, thorough consideration will be given to ensure that equipment that has a sales agent in Cambodia or neighboring countries is selected for any equipment requiring consumables and/or that must be repaired by an agent if malfunctions occur.

(5) Policy on the Utilization of Local Contractors

1) Facilities Plan

There are about 200 construction companies operating in Cambodia, with several Japanese construction companies also having expanded into Phnom Penh. Some local construction companies have experience in construction work on grant aid projects working under Japanese construction companies. For the Project, general Cambodian construction methods will be employed for a facility design that can be executed with the level of skill held by Cambodian construction companies, thus assuming a system where a local construction company will work under the management of a Japanese construction company.

2) Equipment Plan

It was confirmed with the various medical equipment manufacturers who carry the equipment planned for procurement that they have established local agents for equipment requiring after-sales service. Upon investigation of these agents, it was also confirmed that engineers with sufficient skills and experience in operating and installing the equipment are available. After-sales service, including spare parts, can also be supplied via a Phnom Penh equipment agent. Therefore, these local agents will be used effectively for the installation of planned equipment and for explaining their operation. Additionally, to ensure proper operation and maintenance of the equipment procured for the Project, the Japanese side will conclude maintenance contracts for a period of two years after the completion of 1 year manufacture warranty. This equipment will include high-cost equipment, lifesaving equipment, and precision equipment. Therefore, for equipment subject to maintenance contracts, the system for repair services performed by local agents should be included in the equipment procurement conditions.

(6) Policy on Operation and Maintenance Capacity of the Implementing Agency

1) Facility Plan

One biomedical engineer and three engineers are assigned to the Siem Reap Provincial Hospital Maintenance Department to maintain and make simple repairs to the building, equipment, and medical devices. There are no engineers specializing in architecture or equipment; therefore, specialized repair work on the building or equipment is outsourced to a company offering such professional services. Facilities for the Project will be built within a technical scope that can be handled by current operation and maintenance personnel, and equipment with low maintenance costs will be selected. Additionally, the Project aims to keep running costs low.

2) Equipment Plan

The following points should be taken into consideration so that after the equipment is procured, it can be adequately operated and maintained under the recipient country's system.

① Equipment that does not have high operating costs should be selected.

② Equipment specifications should be consistent with the technical level of the target hospital.

③ An appropriate procurement plan should be formulated to enhance the operation and maintenance capacity of the recipient country, e.g. taking a sufficient amount of time to explain operating methods when the equipment is installed.

④ When formulating and implementing the equipment plan, due consideration should be given so that equipment with appropriate agents in Cambodia or neighboring countries is selected.

⑤ Implement soft components related to operation and maintenance of procured equipment in order to support the establishment of a maintenance system after delivery.

(7) Policy on Setting the Grade for Facilities, Equipment, and Materials

1) Facility Plan

The facility will be planned according to the following policies.

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

CPA Facility Standards (excerpted)

a.	The total floor area of the hospital shall be 40 m^2 or more per bed.
b.	Guidance signs shall be easy to understand and written in both English and Khmer.
c.	Natural ventilation will be used, with the minimum ceiling height for habitable rooms with natural ventilation set at 4 m or more.
d.	In areas where flooding is expected, the floor height shall be raised to a level 2 m from the ground.
e.	Doors will be double doors, with each door having a width of at least 90 cm and 30 cm, with a combined total width of 120 cm or more.
f.	Firefighting vehicles must be able to access all buildings.

② In order to consolidate hospital functions and make medical services more efficient, effective and efficient facilities should be planned in terms of the flow of patients and staff, as well as coordination between different departments and existing facilities.

③ In order to secure as much future expansion space on the hospital premises as possible, this Project will plan a multi-story facility, and an elevator will be installed for easy vertical access.

④ The bulkiness of the buildings will be kept to a minimum, and visual harmony with the existing buildings on the site as well as neighboring buildings will be planned.

⑤ Some private rooms are planned for the inpatient ward for quarantine purposes and to increase hospital revenue.

⑥ The facilities will be of an appropriate grade and scale so that operation and maintenance work is not excessive.

⑦ As a top referral hospital in the province, the hospital will have a solid structure that will also function as a hub for evacuation and medical treatment in times of disaster. The electrical and mechanical facility plan will allow for continuous medical activities by securing disaster-time infrastructure that includes elevated water tanks and an emergency power source.

⑧ The X-ray room will have appropriate radiation protection to eliminate the risk of patients, their families, and staff members being exposed to radiation.

⑨ The CT equipment installed in the existing Obstetrics and Gynecology Department and the X-ray-room currently in a separate building will be moved to the Imagery Department. By placing the Imagery Department adjacent to the Emergency Department and Outpatient Department to be developed in the Project, this equipment can be used for critical care while also becoming more operationally efficient.

⑩ Because in-service education is being conducted at Siem Reap Provincial Hospital for staff members, including doctors and nurses from lower level hospitals, the plan will include appropriate conference rooms for such training.

2) Equipment Plan

The equipment and materials plan are basically formulated in accordance with the standard equipment list stipulated in the CPA Guidelines formulated by the Ministry of Health. This list also shows general specifications, and the planned equipment will be of a grade and specification in line with these standards. However, some parts of the list do not necessarily conform to the current levels of medical technology and activities of the hospital. Therefore, when formulating the equipment plan, appropriate grades shall be set in consideration of existing equipment at hospitals with same level, activities of the target hospital, and technical capacity of personnel, while also referring to the aforementioned standard.

(8) Policy on Construction/Procurement Methods and Construction Period

1) Facility Plan

Specifications of works are planned by the reference to in order 1. the Japanese Architectural Standard Specification for Public Buildings of Ministry of Land, Infrastructure, Transport and Tourism of Japan, 2. Japanese Architectural Standard Specification “JASS” of Architectural Institute of Japan, and consideration to the scale, durability, safety, workability, and future maintenance of the building, a general Cambodian construction method. General construction materials will be mainly procured locally, as most materials including structural and finishing materials, as well as equipment can be procured in Cambodia. However, imported materials from neighboring countries are relied upon for much of the construction materials used in Cambodia, and there is a possibility that stock will be insufficient for the high-volume procurement needed in large-scale construction work like this Project. Therefore, it is necessary to have a procurement plan with some latitude that matches the construction schedule. The construction schedule will be planned so that earthwork, foundation work, structural framing work, and roof work avoids the rainy season to the greatest extent possible. An appropriate construction period will also be formulated, taking into consideration the local labor procurement situation and construction work capacity.

2) Equipment Plan

Much of the medical equipment consists of precision devices or machines that can impact a patient's life. Therefore, when procuring the equipment, it is necessary to select devices that are of high quality and accuracy. Installation and calibration of the equipment must be conducted by an engineer who is familiar with each device. For the implementation Project, thorough consideration will be given to ensure that equipment is procured by equipment supplier with ample experience in procuring medical equipment in Japanese grant aid projects. This Project is a complex project of facilities and equipment, and the schedule for procurement and installation of equipment must be planned appropriately, according to the construction period for the facilities and actual progress. Therefore, those involved in equipment procurement should set an appropriate construction period while closely coordinating with facility construction personnel.

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

(1) Site/Facility Layout

1) Layout Plan

The planned site for construction as noted in the request letter is the area within the dashed blue line shown in Figure 2-1. However, because the existing operating rooms, Imagery Department, and Surgery Department must be torn down and removed, it will be difficult to secure operating rooms and imagery rooms to use temporarily during the period of construction. Meanwhile, the planned site of the surgery ward (this Project) as noted on a request letter to South Korea for development of a general medicine department is shown as the area within the dashed red line on the same figure below. Since the ICU and Surgery Department falls within this area, it will be necessary to secure rooms for them during the construction period. However, even if there is no need to secure operating rooms or imagery rooms, it is more realistic than the planned construction site shown in the request letter. On the other hand, an L-shaped building does not provide a desirable flow line for the hospital as a whole, because such a shape would divide the road that goes around the site. Based on the above, the Study Team has proposed the area within the green dashed line on the figure below. If within this area, after the operating rooms, imagery, and surgery departments are built and relocated in this Project, these buildings or land can be used for the general medicine department in the future. In the facility layout and flow plan for the entire hospital (including future construction), the outpatient reception area and Central Medical Department to be built for the Project will be connected to the general medicine department and laboratory, making a functional facility plan possible. The Cambodian side also agreed that the location proposed by the Study Team would be the planned construction site for the Project, after which the Minutes were exchanged.

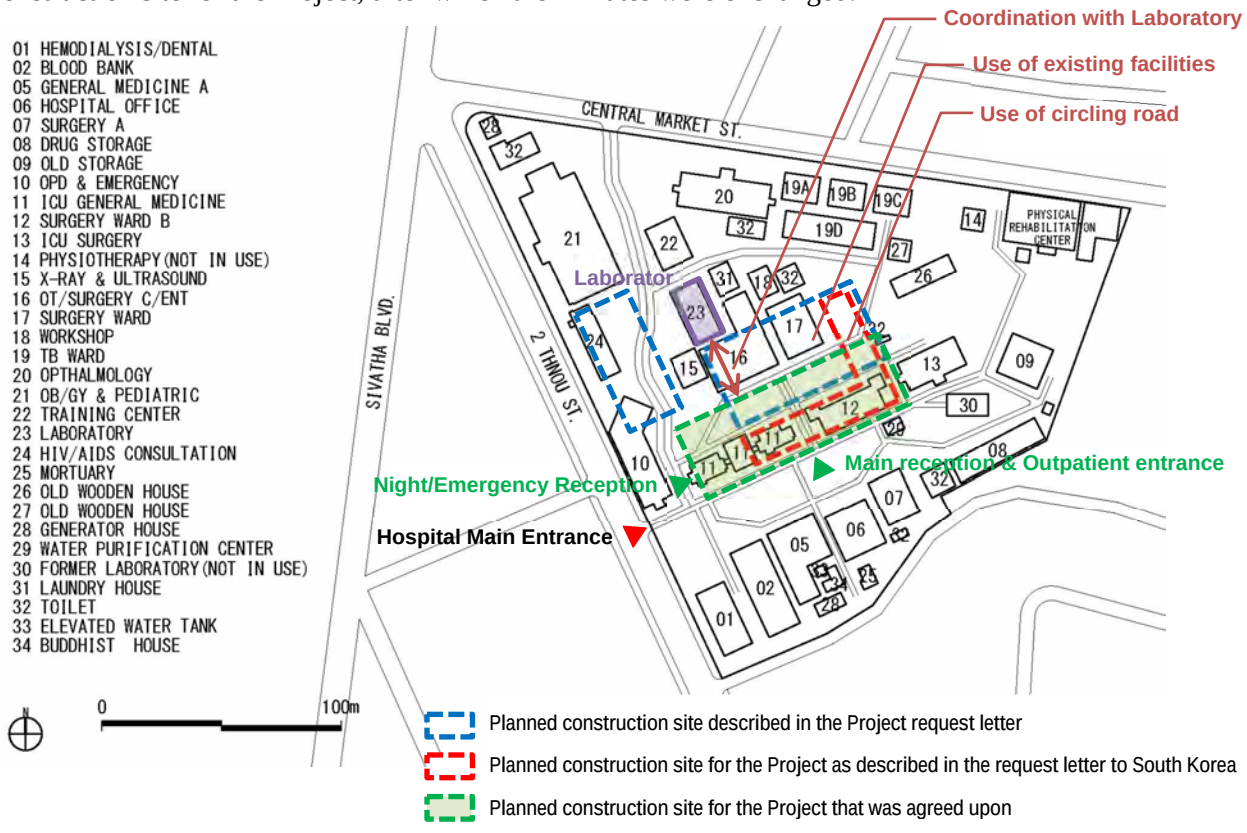

Figure 2-1 Location Map of Planned Construction Map

(2) Architectural Plan

1) Selecting Target Facilities (Components)

The major facilities listed in the request letter submitted by recipient country are shown in Table 2-4.

Table 2-4 Initially Requested Facilities

Facility	Clinical Departments
Emergency, ICU, Outpatient Ward	Triage, Cashier, Pharmacy, Medical Emergency, Medical ICU, General Outpatient, Diabetes/Hypertension Department, Physiotherapy, Psychiatry, OI/ARV, Dermatology, STDs
Emergency Trauma, Medical Imagery	ENT/Maxillofacial, Dental Clinic, Thoracic Surgery Ward
Surgery Ward	Abdominal Surgery, Thoracic Surgery, Urology, Burn Center, Plastic Surgery, Cardiovascular Surgery
Operating Rooms, Central Materials Unit	Operating Rooms, Neurology, Trauma, Recovery Room, ENT/Maxillofacial/Abdominal Surgery, Thoracic Surgery, Urology, Plastic Surgery, Burn Surgery, Cardiovascular Surgery

Source: Request Letter

During the field survey, discussions based on the above request were conducted with the hospital regarding the target facilities for the Project. As a result, it was decided that general medicine department will be developed with assistance from other donors or with Government of Cambodia budget. It was also agreed upon that existing facilities will be used for other departments including the Dental Clinic, Psychiatry, OI/ARV, and STDs, narrowing the target for the Project to facilities related to the Surgery Department. In addition, by developing the Central Medical Department, which includes outpatient services, emergency, surgery, and medical imagery in the same building as the Surgery Inpatient Ward, a facility where efficient medical activities can be conducted will be created.

The surgical unit is now divided into three departments; Surgery A (thoracic and abdominal surgery), Surgery B (trauma and plastic surgery), and Surgery C (urology). Since plastic surgery, burn treatment, neurosurgery, and maxillofacial surgery, which were listed in the requested facilities, are currently being practiced, and because there was a request from the provincial hospital for reorganization of the Surgery Department, the Project will divide the surgical unit into the following five sections for development.

Surgery A: Abdominal and thoracic surgery
Surgery B: Trauma, orthopedic, plastic, and burn surgery
Surgery C: Urological surgery
Surgery D: Neurological surgery
Surgery E: ENT and maxillofacial surgery

Based on the above, the target components for the Project that were finally agreed upon with the Cambodian side during the field survey are shown in Table 2-5, which describes the current state and post-Project state of each department.

Table 2-5 Current and Post-Project State of Target Components

Department	Target components	Current state (problems)	Post-Project state (improvements)
Triage, Emergency, Outpatient	Triage	・The building was built in 1958 and shows significant deterioration. ・Small compared to the number of patients.	・This must be integrated with the outpatient department, because it is incorporated in the flow of outpatient medical care. ・Adequate waiting space is secured.
	Surgical and Trauma Emergency	・The building was built in 1958 and shows significant deterioration. ・Emergency response is difficult because the operating rooms and imagery department are in a separate building.	・Emergency response is improved by securing a resuscitation room and integrating it with the imagery and surgical departments.
	Surgical Outpatient Consultation Room	・The building was built in 1958 and shows significant deterioration. ・Small compared to the number of patients.	・Surgical services are efficient because imagery is integrated with the surgical departments, ICU, and inpatient ward. ・Adequate waiting space is secured.
	Physiotherapy Outpatient Consultation Room	・The building was built in 1958 and shows significant deterioration. ・Consultation room is very small.	・Consultation room with adequate space is secured.
	Minor Surgery Room	・There is a shortage of operating rooms because they are also used for minor surgery.	・By establishing a minor surgery room within the emergency room, minor surgery can be performed efficiently and operating rooms can be secured for major surgeries.
Imagery	X-Ray Room	・The building was built in 1995 and shows significant deterioration. ・Since CT imaging equipment is installed in the Ob/Gyn Ward, the Imagery Department is scattered, making medical efficiency poor.	・Medical treatment efficiency is improved because the imagery department is integrated with emergency, surgical, and outpatient departments in the same building. ・X-ray protection is adequately secured.
	Ultrasound Room		
	CT Scanner Room		
Inpatient Ward	Surgical ICU	・The building was built in 1995 and shows significant deterioration. ・Not enough beds.	・An adequate number of beds for the number of patients is secured.
	Surgery A	・Surgery Inpatient Wards are scattered throughout the site. ・Inpatient wards have been secured by building expansions on to old existing facilities, but the number of beds is insufficient.	・Medical services are efficient because the central medical department, including operating rooms and imagery, is integrated with all surgical inpatient wards within the same building. ・The shortage of beds is resolved.
	Surgery B		
	Surgery C		
	Surgery D		
	Surgery E		
Operating Rooms, Anesthesiology, Central Materials	Laundry Room	・Small and attached to operating rooms. ・Cleaning/assembly, sterilization, and clean storage are not clearly divided, making it difficult to maintain cleanliness.	・By clearly dividing the collection/ cleaning/assembly room, sterilization room, and clean storage, it is easy to prevent hospital-acquired infection and maintain instrument cleanliness.
	Sterilization Center and Storeroom		
	Anesthesiology	・The building was built in 1965,	・Operating room cleanliness is

	Operating Room (Neurology, Spinal, Thoracic, Cardiovascular, Burns)	and it is difficult to maintain cleanliness in the operating rooms. ・ Operating rooms are small and do not have enough space for the equipment used for surgery. ・ The number of operating rooms is insufficient compared to the number of operations. ・ People must go outside to access the operating rooms from each department.	secured. ・ Adequate space for placing equipment used for surgery is secured in operating rooms. ・ A sufficient number of operating room for the number of operations is secured. ・ Access to operating rooms from emergency, outpatient, and surgical inpatient wards is improved.
	Operating Room (Trauma, Orthopedic, Plastics, ENT, Maxillofacial)		
	Operating Room (Abdominal, Urology)		
	Operating Room (Emergency)		
	Operating Room (Infectious Disease Patients)		
	Recovery Room		
	Storage		

Source: Field Study Technical Notes, interviews

Regarding the use of existing facilities that will become vacant when the new facilities are constructed, since there is an extremely large number of inpatients and a shortage of inpatients wards, it is desirable to use the aforementioned vacant facilities as described in Table 2-6.

Table 2-6 Proposed Usage of Existing Facilities

Existing facility no.	Existing usage	Proposed usage
07	Surgery A Inpatient Ward	General Medicine Inpatient Ward
10	Outpatient, Emergency Ward	Parking area (after dismantling and removal)
13	Surgical ICU Ward	General Medicine Inpatient Ward
15	X-ray, Ultrasound Ward	General Medicine Outpatient, Trauma
16	Operations, Sterilization, Surgery C, ENT Inpatient Ward	General Medicine Inpatient Ward, General ICU
17	Currently under renovation (used as a temporary relocation site for Surgery B Inpatient Ward during the Project construction period)	General Medicine Inpatient Ward

2) Target Scale

The plans for facilities and equipment are based on the scale of medical services, which includes the number of patients and surgical operations. The scale will be planned with the target set for 2026, three years after completion of the new building. To forecast future demand, the current rate of patient increases at Siem Reap Provincial Hospital including natural population growth and an increase in the patients due to traffic accident and the decrease in the number of patients at lower level hospitals due to equipment improvement will be examined.

After the completion of hospital improvement through the Project, the inflow of patients to Siem Reap Provincial Hospital from other provinces is not expected to increase at an enormous rate, taking the following points into consideration.

・ Kampong Cham Provincial Hospital, which was improved as a Japanese grant aid project in the past, was inundated with patients after its completion, with the number of patients from other provinces greatly exceeding estimates. The influx of patients was especially noticeable in the

obstetrics and gynecology department, but since ob/gyn is not included in this Project, the inflow of patients from other provinces should be low.

- As the main hospital in the northern region, Siem Reap Provincial Hospital already has many patients. Other comparable hospitals in the region are pediatric clinics and expensive, foreign-owned private hospitals. These private hospitals mainly serve wealthy patients or foreign tourists, and since the development of a pediatrics department is not included in the Project, a large inflow of patients from these hospitals is not expected.

① Calculating the number of hospital beds

a) Current rate of patient increase

As mentioned above, the existing surgical departments at Siem Reap Provincial Hospital are currently divided into Surgery A to C, but after the implementation of the Project, this will be reorganized as Surgery A to E. For the Surgery Inpatient Ward, which is a target of the Project, the number of hospital beds is calculated for each department based on actual inpatient numbers for the five years from 2014 to 2018.

The cumulative number of inpatients and number of inpatients in the surgical departments during the above period is shown in Table 2-7 . Based on this, the increase rate for the number of inpatients and the average length of hospital stay are calculated.

Table 2-7 Number of Surgical Inpatients at Siem Reap Provincial Hospital

	Department	2014	2015	2016	2017	2018	Average increase rate
① Cumulative number of inpatients (person-days)	Surgery A	9,838	10,483	11,058	12,414	13,342	7.9%
	Surgery B, D	18,041	20,134	21,053	22,614	25,129	8.6%
	Surgery C	7,012	8,561	9,187	10,264	10,368	10.3%
	Surgery E	3,397	3,545	3,206	3,778	3,902	3.5%
	Total	38,288	42,723	44,504	49,070	52,741	8.3%
② Number of inpatients (persons)	Surgery A	1,507	1,623	1,760	1,838	1,929	6.4%
	Surgery B, D	2,010	2,272	2,409	2,481	2,330	3.8%
	Surgery C	534	641	754	873	1,060	18.7%
	Surgery E	416	454	449	557	656	12.1%
	Total	4,467	4,990	5,372	5,749	5,975	7.5%
③ Average length of hospital stay (=①÷②) (days)	Surgery A	7	6	6	7	7	7
	Surgery B, D	9	9	9	9	11	9
	Surgery C	13	13	12	12	10	12
	Surgery E	8	8	7	7	6	7
	Average	9	9	8	9	9	9

Source: Siem Reap Provincial Hospital

It is assumed that the number of patients is increasing every year in all departments and will continue to grow at the same rate. The predicted number of inpatients for each department in the target year of 2026 (three years after completion), based on the annual average increase rate is shown in Table 2-8.

Table 2-8 Predicted Number of Surgical Inpatients at Siem Reap Provincial Hospital

	Department	2019	2020	2021 (construction start)	2022	2023 (completion)	2024	2025	2026 (target year)
④ Predicted number of inpatients (=② × annual average increase rate) (persons)	Surgery A	2,052	2,182	2,321	2,469	2,626	2,794	2,971	3,161
	Surgery B, D	2,418	2,509	2,603	2,701	2,803	2,908	3,017	3,131
	Surgery C	1,258	1,493	1,773	2,104	2,498	2,965	3,519	4,177
	Surgery E	735	824	923	1,034	1,159	1,299	1,456	1,631
	Total	6,463	7,008	7,620	8,309	9,086	9,965	10,963	12,100

b) Decrease in the number of patients due to lower level hospital improvements

This Project includes the improvement of diagnostic, laboratory, and surgical equipment at four district hospitals under Siem Reap Provincial Hospitals. Together with this, it is expected that in the future, treatments or surgery for non-severe cases will be done at district hospitals, as surgical training is being implemented for doctors at district hospitals. Of the patients transferred from lower level hospitals to Siem Reap Provincial Hospital, severe cases such as serious injuries, bone fractures, head trauma, acute abdomen, pneumonia, and pleural infections will continue to require treatment at Siem Reap Provincial Hospital. Although these patients are included in the estimated number of inpatients at Siem Reap Provincial Hospital, other transferred patients and patients who directly come to Siem Reap Provincial Hospital from other OD are expected to be treated at hospitals in each OD, and thus subtracted from inpatients numbers at Siem Reap Provincial Hospital.

Then number and percentage of patients coming to Siem Reap Provincial Hospital is shown by area of residence in Table 2-9.

Table 2-9 Number of Patients at Siem Reap Provincial Hospital by Area of Residence (January-June 2019)

Department	Siem Reap Province								Other provinces		Total
	⑤ Siem Reap OD		Sot Nikum OD		Angkor Chum OD		Kralanh OD				
Emergency	502	59.7%	128	15.2%	46	5.5%	11	1.3%	154	18.3%	841
General Med. ICU	236	41.4%	73	12.8%	47	8.2%	31	5.4%	183	32.1%	570
Surgery ICU	179	45.1%	53	13.4%	26	6.5%	16	4.0%	123	31.0%	397
Surgery A	370	38.8%	176	18.5%	160	16.8%	57	6.0%	190	19.9%	953
Surgery B,D	536	43.8%	152	12.4%	173	14.1%	85	6.9%	278	22.7%	1,224
Surgery C	277	54.0%	68	13.3%	52	10.1%	25	4.9%	91	17.7%	513
Surgery E	103	43.5%	37	15.6%	27	11.4%	12	5.1%	58	24.5%	237
Sub total (SurgeryA~E)	1,286	43.9%	433	14.8%	412	14.1%	179	6.1%	617	21.1%	2,927
Ophthalmology	213	34.0%	134	21.4%	178	28.4%	65	10.4%	37	5.9%	627
Obstetrics	618	57.5%	72	6.7%	125	11.6%	46	4.3%	213	19.8%	1,074
Gynecology	339	40.7%	117	14.0%	98	11.8%	28	3.4%	251	30.1%	833
Pediatrics	71	54.2%	6	4.6%	22	16.8%	5	3.8%	27	20.6%	131
General Med.	1,582	48.1%	465	14.1%	329	10.0%	129	3.9%	782	23.8%	3,287
Tuberculosis	145	44.2%	58	17.7%	46	14.0%	22	6.7%	57	17.4%	328
Total	5,171	46.9%	1,539	14.0%	1,329	12.1%	532	4.8%	2,444	22.2%	11,015

Source: Siem Reap Provincial Hospital

Next, the total number of patients transferred from lower level hospitals to Siem Reap Provincial Hospital and the number of serious cases within that number are shown in Table 2-10 .

Table 2-10 Number of Transferred Inpatients from Lower Level Hospitals to Siem Reap Provincial Hospital

	Department	2014	2015	2016	2017	2018	Average increase rate
⑥ Total number of inpatients (persons)		16,257	18,625	20,074	21,669	23,722	109.9%
⑦ Number of transferred inpatients (persons)		3,846	3,650	3,896	4,325	5,397	108.8%
⑧Percentage of transferred inpatients in all inpatients (=⑦÷⑥) (%)		23.7%	19.6%	19.4%	20.0%	22.8%	21.1% average
⑨Number of transferred inpatients with serious surgical cases (persons)	Surgery A	487	445	671	425	605	105.6%
	Surgery B, D	777	811	1,003	850	1,065	108.2%
	Surgery C	0	0	0	0	0	---
	Surgery E	0	0	0	0	0	---
	Total	1,264	1,256	1,674	1,275	1,670	7.2%

Source: Siem Reap Provincial Hospital

It is assumed that the number of patients transferred from lower level hospitals to Siem Reap Provincial Hospital will continue to increase at the same rate. The predicted number of transferred patients for each department in the target year of 2026 (three years after completion) is shown in Table 2-11 .

Table 2-11 Predicted Number of Transferred Inpatients from Lower Level Hospitals to Siem Reap Provincial Hospital

	Department	2019	2020	2021 (construction start)	2022	2023 (completion)	2024	2025	2026 (target year)
⑩ Predicted number of transferred inpatients (=⑦×annual average increase rate) (persons)		5,874	6,393	6,958	7,573	8,243	8,972	9,765	10,628
⑪Predicted number of transferred inpatients with serious surgical cases (=⑨×annual average increase rate) (persons)	Surgery A	639	674	712	752	793	838	884	934
	Surgery B,D	1,152	1,247	1,349	1,460	1,579	1,709	1,849	2,001
	Surgery C	0	0	0	0	0	0	0	0
	Surgery E	0	0	0	0	0	0	0	0
	Total	1,791	1,921	2,061	2,211	2,373	2,547	2,734	2,935

c) Calculating the required number of hospital beds

Based on the predicted number of patients coming to the hospital from the Siem Reap OD and the predicted number of patients with serious cases transferred from lower level hospitals in the 2026 target year, the estimated required number of hospital beds is shown in Table 2-12.

Table 2-12 Estimated Required Number of Hospital Beds at Siem Reap Provincial Hospital in 2026

	Department	⑫ No. of inpatients from Siem Reap OD (=④×⑤) (persons)	⑬No. of inpatients incl. transferred inpatients with severe cases (=⑫+⑪) (persons)	⑭Cumulative no. of inpatients incl. transferred inpatients with severe cases(=⑬×③) (person-days)	⑮Required no. of beds (=⑭÷365÷90%) (beds)
2026	Surgery A	1,227	2,161	15,127	46
	Surgery B, D	1,371	3,372	30,348	93
	Surgery C	2,255	2,255	27,060	83
	Surgery E	709	709	4,963	16
	Total	5,562	8,497	77,498	238

d) Planned number of beds

The patient rooms for each department are, in principle, 6-bed rooms, with private rooms provided as appropriate. For Surgery C (urology), the use of existing general medicine facilities is included in the plan, because urology treatment is covered by both the Surgery and General Medicine Department. The planned number of beds for each department is shown in Table 2-13.

Table 2-13 Planned Number of Hospital Beds for Each Department at Siem Reap Provincial Hospital

Department	6-bed room General patients	1-bed room VIPs	Total number of beds
Surgery A (thoracic surgery, abdominal surgery)	7	2	44
Surgery B (trauma surgery, orthopedics, plastic surgery, burns)	13	3	81
Surgery C (urological surgery)	6	2	38
Surgery D (neurosurgery)	2	1	13
Surgery E (ENT, maxillofacial surgery)	2	1	13
Total	29	10	189
Surgical ICU	-	-	23

② Calculating the number of operating rooms

The number of operations performed from 2014-2018 in the Surgery Department are shown in Table 2-14. The annual average increase rate is 9.7% for scheduled operations and 15.9% for emergency operations. Obstetrics/gynecology and ophthalmology operations are excluded from the numbers, as operating rooms for these categories are available in facilities developed by other donors.

Table 2-14 Number of Operations at Siem Reap Provincial Hospital

Type of operation	2014	2015	2016	2017	2018	Annual average increase rate
Ophthalmological	737	1,354	1,493	1,094	1,239	13.9%
ENT	58	54	47	47	70	4.8%
Head and neck	90	68	48	95	117	6.8%
Respiratory	94	80	71	97	129	8.2%
Abdominal	839	1,100	1,083	1,131	1,257	10.6%
Ob/Gyn	787	872	945	1,014	1,330	14.0%
Orthopedic	632	602	599	809	1,039	13.2%
Urological	356	396	402	512	553	11.6%
Neurological	46	53	54	74	86	16.9%
Other operations	93	168	49	44	55	-12.3%
Scheduled operations	2,389	3,317	3,131	2,919	3,454	9.7%
Emergency operations	1,343	1,430	1,660	1,998	2,421	15.9%
Total	3,732	4,747	4,791	4,917	5,875	12.0%
Number excluding ophthalmology and obstetrics/gynecology operations						
Scheduled operations	1,413	1,762	1,538	1,668	1,943	8.3%
Emergency operations	795	759	815	1,141	1,363	14.4%
Total	2,208	2,521	2,353	2,809	3,306	10.6%

Source: Siem Reap Provincial Referral Hospital

Based on the current rate of increase in the number of operations, with the annual increase rate for scheduled operations at 8.3% and emergency operations at 14.4%, the annual number of operations in the target year of 2026 is estimated as follows.

Scheduled operations = 1,943×108.3%＝3,674 operations

Emergency operations = 1,363×114.4%＝4,007 operations

Like inpatients, other patients also come to the hospital from outside the Siem Reap OD, but one goal of the Project is to enable the district hospitals in each OD to perform operations, with the exception of serious cases. Therefore, only patients who come from the Siem Reap OD are reflected in the number of operations. Applying the Siem Reap OD population ratio of 37.3%, the number of operations on patients coming to the hospital from the Siem Reap OD is estimated as follows.

Scheduled operations = 3,674×37.3%＝1,370 operations

Emergency operations = 4,007×37.3%＝1,495 operations

Conversely, patients with serious cases whose operations are difficult for district hospitals will continue to be transferred to Siem Reap Province Referral Hospital; therefore, these numbers will also be taken into account. In 2026, of the predicted 12,120 surgical inpatients, there are a predicted 2,935

transferred inpatients with serious cases, which is a rate of 24.3%. Assuming the ratio of the number of operations for transferred patients with serious cases compared to the total number of operations is the same, the number of operations will be as follows.

Scheduled operations = 3,674×24.3%＝893 operations

Emergency operations = 4,007×24.3%＝974 operations

Taking these numbers into account, the annual number of operations is as follows.

Scheduled operations = 1,370＋893＝2,263 operations

Emergency operations = 1,495＋974＝2,469 operations

The number of operations per day, based on the annual number of operations shown above, is the number of scheduled operations divided by 230 days (which excludes weekends and Cambodian holidays) and the number of emergency operations divided by 365 days.

Scheduled operations = 2,263÷230＝10 operations

Emergency operations = 2,469÷365＝7 operations

Assuming that the average operation time is three hours, including preparations beforehand and cleaning/sterilization afterward, if there are three scheduled operations per room per day, and four emergency operations per room per day, the required number of operating rooms is shown below.

Scheduled operations = 10÷3 times＝4 rooms

Emergency operations = 7÷4 times＝2 rooms

Based on the calculations above, the Project will plan for six operating rooms, of which one will be an operating room for infectious patients.

3) Floor Plans

Ground Floor

① Emergency Outpatient Department

- The entrance will be separated from the Outpatient Department to ensure that flow paths with regular outpatients do not cross.
- A treatment room will be built next to the emergency outpatient entrance so that triage, consultations, and treatment can be conducted in a swift manner.
- By arranging rooms to create clear flow lines for medical services, emergency medical care can be performed swiftly and efficiently.
- By placing the Imagery Department adjacent to both the Emergency Outpatient Department and the General Outpatient Department, the X-ray and CT rooms can be accessed by each, without the lines of flow crossing. Medical imaging can also be performed quickly.
- In order to quickly transport patients to the surgical unit on the floors above, an elevator for beds can be accessed from the emergency outpatient hall. Use of the elevator is shared by general patients, visitors and staff, but the elevator doors on the ground floor only will open on two opposite sides so that emergency patients do not cross paths with other users.
- The nurse station will be placed adjacent to the emergency outpatient hall to manage the movement of people coming to and leaving the hospital. This placement will also enable nurses to see through the observation room and treatment room so that emergency outpatients can be handled smoothly.
- Air conditioning and ventilation facilities will be installed in the Emergency Outpatient Department.
- By building a doctor duty room and nurse duty room in the departments, the work environment for medical personnel will be improved.

② Imagery Department

- By placing the Imagery Department between the General Outpatient Department and the Emergency Outpatient Department, the flow line to the emergency department will be shortened and access will be improved from the General Outpatient Department. In addition, considerations are made so that the flow lines for each department do not cross each other.
- In order to accurately manage the records of patients receiving imaging services, a reception desk for medical imagery will be established for easier management.
- A control room will be built to protect the technician from radiation.
- A darkroom will not be installed, since following the Equipment Plan, the X-ray images are to be digital.
- Because the CT currently used in the Obstetrics and Gynecology Ward will be relocated to this facility, a CT scan room will be built adjacent to the general x-ray room.
- An ultrasound testing room will also be placed in this department, giving technicians and nurses easier access.
- A duty room for x-ray technicians and nurses will be established so they can perform X-rays quickly on after-hours emergency patients.

③ Outpatient Department

- Planned for the central area of this facility, consultation rooms will be placed next to the Imagery Department in the central hall, which includes a waiting area. This will shorten the flow line for patients.
- By placing the reception desk, cashier, and pharmacy near the main entrance, the facility plan will be easy for users to understand.
- The pharmacy reception desk and delivery window will be lined up next to the general outpatient reception desk. This will shorten the flow line for staff as well as patients purchasing drugs after consultations, enabling the hospital to provide services efficiently.
- The pharmacy will have a room for sorting, storing, and dispensing drugs and a room for handing over and accounting to patients.
- By creating a dedicated staff corridor for consultation rooms and the office, staff will not cross paths with patients and can work efficiently.
- Access to existing facilities such as the Laboratory and General Medicine Department is taken into consideration by creating additional entrances on the north and east sides of the central hall.

④ Vertical Traffic Flow

- By installing a staircase near the main entrance, it will be possible to move up and down floors smoothly, without going through the Outpatient Department when going to the Central Medical Department or inpatient wards on upper floors.
- There will be two elevators, considering the number that can be maintained by the partner country in terms of maintenance and repairs.

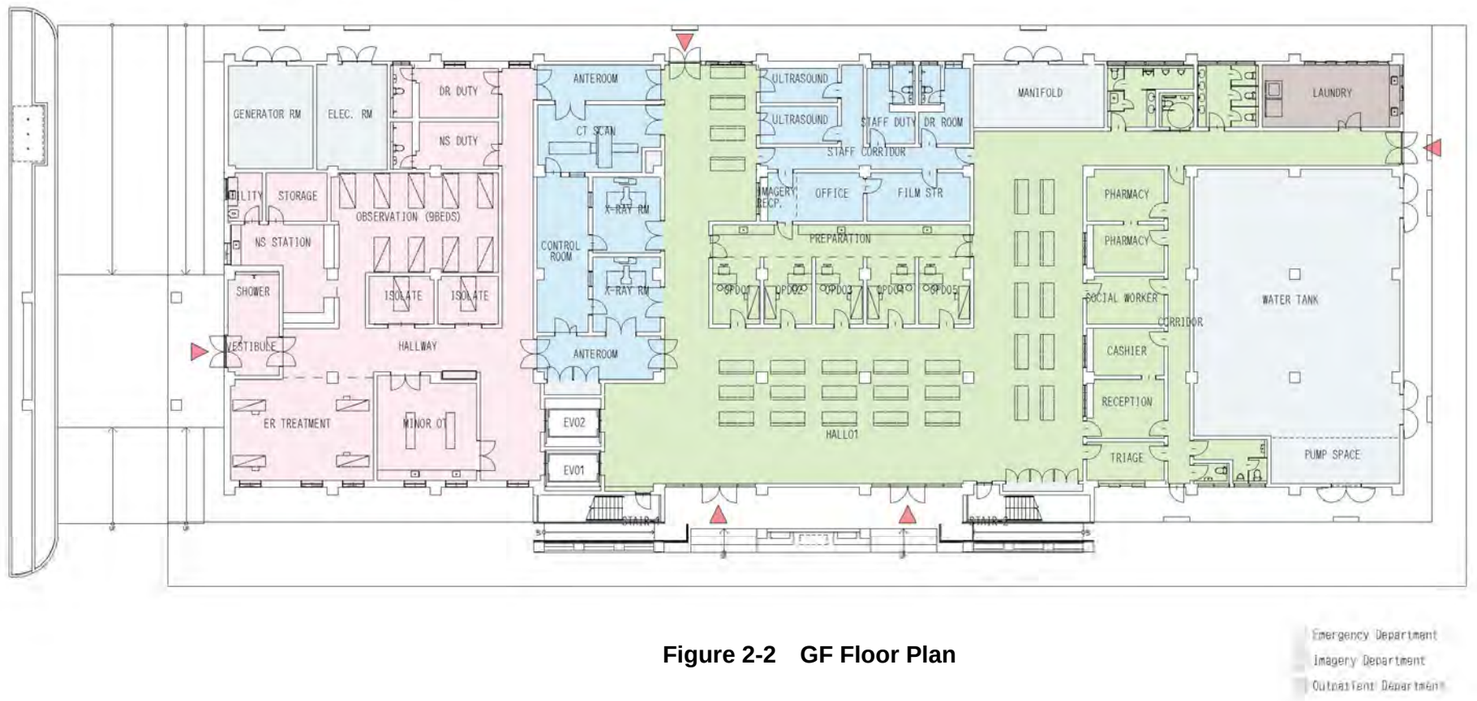

Figure 2-2 GF Floor Plan

First Floor

① Operating Rooms

- By placing the Surgery Department on the first floor and installing an elevator, it will possible to move easily using a short flow line to the Emergency Outpatient Department on the floor below and the inpatient wards on the floors above.
- Based on discussions with the partner country and size calculations, there will be five normal operating rooms and one operating room for patients with infectious diseases.
- The operating rooms will have a septic collection corridor, which will make it easy to maintain cleanliness in the operating rooms by clearly separating dirty and clean items.
- Operating Room 01 for infectious patients will have a dedicated anteroom to clearly separate it from other surgical areas.
- Changing rooms and anterooms are placed at the entrance of the operating rooms to clearly designate the clean and semi-clean zones.
- A recovery room (six beds) will be placed adjacent to the anesthesiologist's room, making it easy to check the condition patients waking up from anesthesia after surgery.
- The ICU (20 beds, including three beds in private rooms) will be built next to the operating rooms, enabling easy transport and care for patients after surgery.

② ICU Department

- By placing the ICU next to the Surgery Department, patients can be transported on a short path from the operating rooms.
- By building the ICU around a nurse station, nurses can see all the patients and respond to them quickly and smoothly.
- Based on discussions with the partner country and patient number calculations, the number of beds is planned at 23, which includes three beds in private rooms.
- In preparation for a 24-hour nursing system, night duty rooms will be built for doctors and nurses.

③ Central Sterilization Department

- By placing this next to the Surgery Department, the supply and collection of instruments will be smooth, and hygiene management will be easier.
- By connecting operating rooms and the cleaning/assembly room to the septic collection corner, instruments can be collected after use without contaminating the clean zone.
- Equipment and materials will be supplied to and collected from the Emergency Department, Outpatient Department, and inpatient wards, which allows for easier access from each department and prevents patients from entering the area.
- Rooms in the Central Sterilization Department are arranged according to the flow of processes (collection, cleaning, drying, assembly, sterilization, storage), which improves work efficiency.
- An office will be set up to ensure that the supply and collection of materials is consistently managed.
- The laundry room will be placed on the ground floor, in consideration of sun drying articles outdoors and deliveries to and from departments in other buildings.

④ Other

- A curtain wall will be installed in the south corridor to maximize the width of the corridor, providing a break space for doctors, nurses, and other employees, as well as a waiting area for patient families.

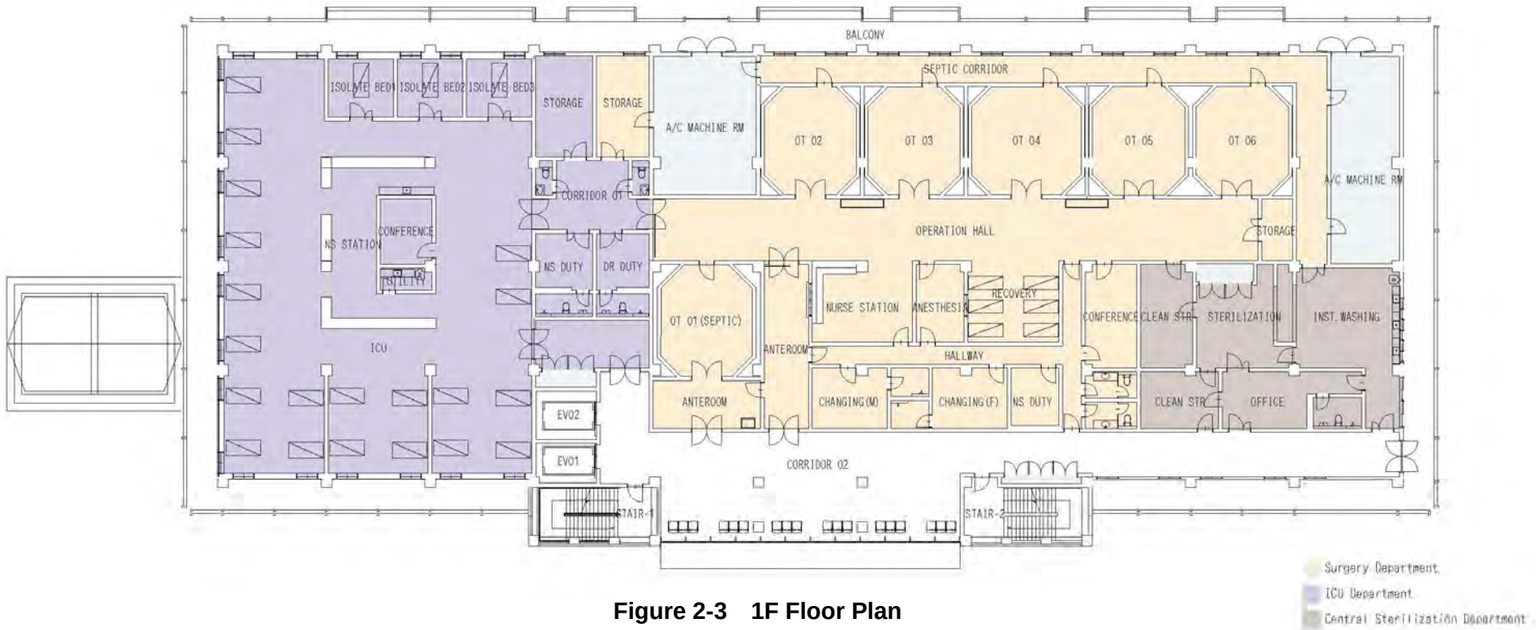

Figure 2-3 1F Floor Plan

Second and Third Floor

- Inpatient wards for Surgery B (trauma, orthopedics, plastic surgery, and burns) and Surgery E (ENT, maxillofacial surgery) will be located on the second floor, which is nearer to the Surgery Department, while inpatient wards for Surgery A (thoracic surgery, abdominal surgery), Surgery C (urology), and Surgery D (neurosurgery) will located on the third floor.
- Based on discussions with the partner country and size calculations, the number of beds for each department will be as follows.
- Second floor: 81 in Surgery B (thirteen 6-bed rooms, three private rooms), 13 in Surgery E (two 6-bed rooms, one private room)
- Third floor: 44 in Surgery A (seven 6-bed rooms, two private rooms), 38 in Surgery C (six 6-bed rooms, two private rooms)
- Surgery D will have 13 beds (two 6-bed rooms, one private room)
- Surgery A-E will each be supplied with a nurse station, consultation room, doctor/nurse duty rooms, and meetings rooms. Since orthopedics is included in Surgery B, a casting room and physiotherapy space will be built.
- Surgery B has a large number of patients, so it will be planned with two nursing units.
- The nurse stations will be located in positions with good visibility of the ward, and where it is easy to manage the movement of patients and visiting families.
- Nurse stations will be equipped with a water closest, in consideration of creating a better working environment for nurses.
- Hand-washing sinks and lockers will be installed in 6-bed rooms.
- Water closets and showers will be shared by patients in the 6-bed rooms, separated by gender. Private rooms will be equipped with toilets and showers.

Figure 2-4 2F Floor Plan

Figure 2-5 3F Floor Plan

Fourth Floor and Tower Floor

- The fourth floor will have an elevator machine room and storage.
- The towers will be the location for the two elevated water tanks.

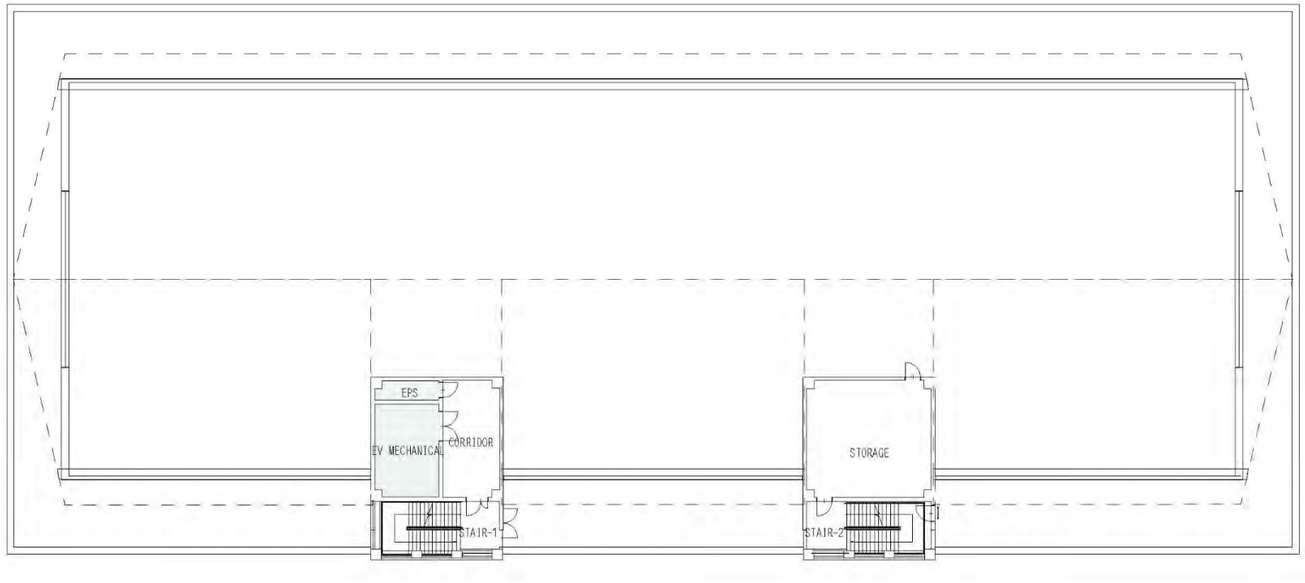

Figure 2-6 4F Floor Plan

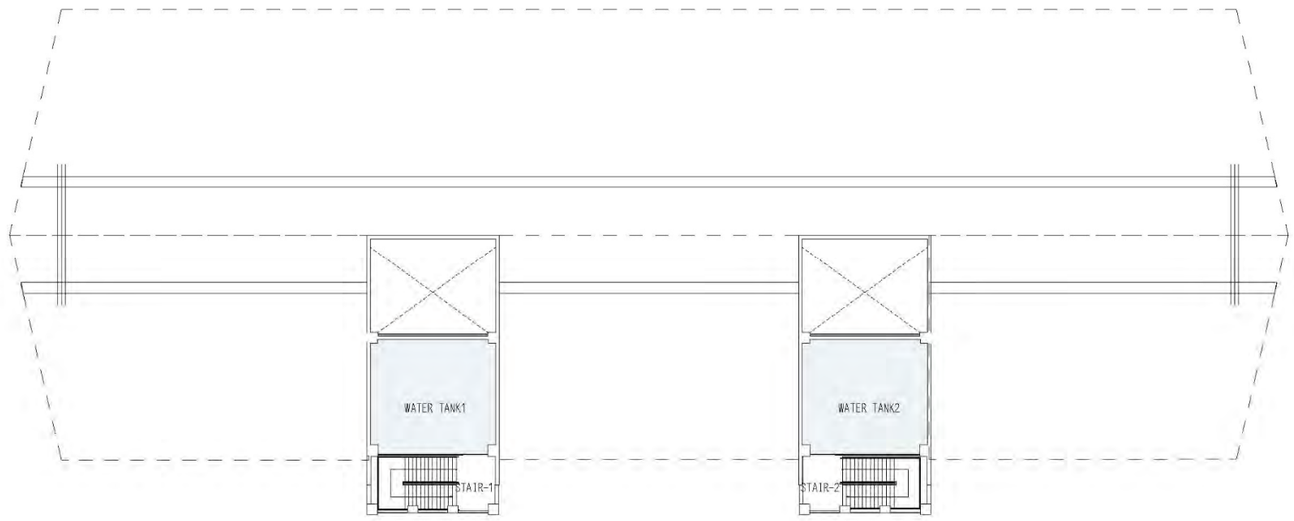

Figure 2-7 5F Floor Plan

4) Elevation Plan

- Blending in with the existing facilities and Cambodian landscape, the roof will be a tiled roof that is generally used locally.
- Deep eaves are created by overhanging the roof slab, which can block direct sunlight into the rooms and be used as rain gutters that can sufficiently drain large amounts of rainwater in the rainy season.
- Installing balconies and floors 1-3 will block direct sunlight to lower floors and serve as a location for the outdoor units of air conditioners to be placed.
- For the walls of the staircases, perforated blocks in random patterns will be used to allow for soft natural lighting and good ventilation.

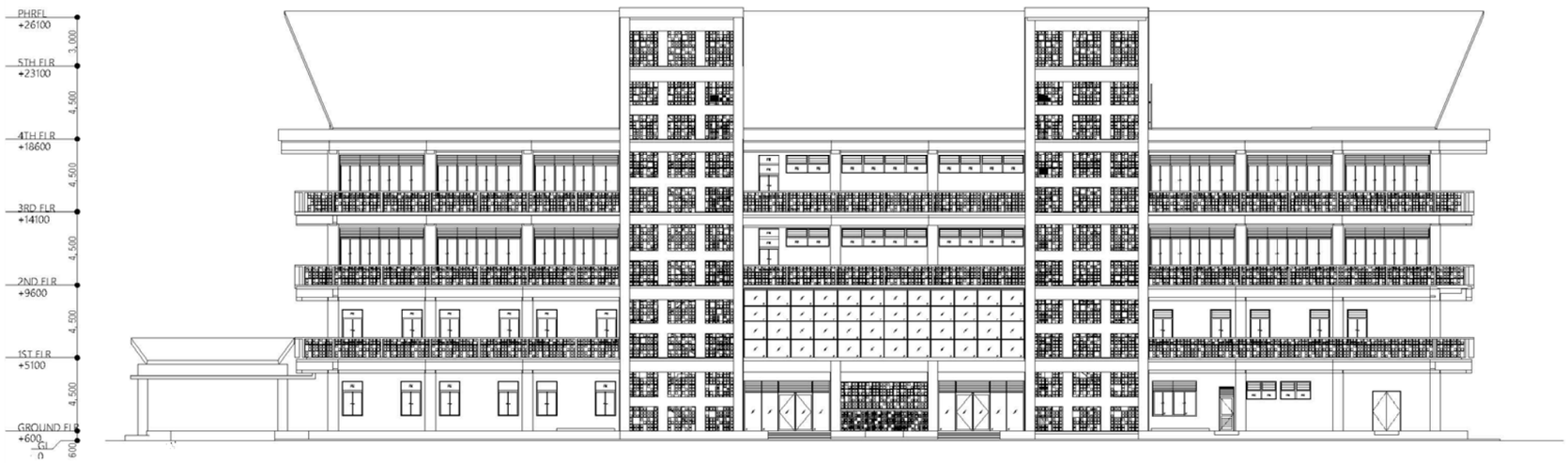

Figure 2-8 South Elevation Plan

Figure 2-9 West Elevation Plan

5) Cross Section Plan

- Hospital rooms using natural ventilation will have a ceiling height of 4.0 m, in accordance with Cambodian hospital standards to ensure sufficient airspace.
- The ceiling height of rooms where there is air conditioning will generally be 2.4 m, taking air conditioning efficiency into account. However, considering the sizes of the room and what is installed on the ceiling, the operating hall, operating rooms, and X-ray rooms will have a ceiling height of 3.0 m.
- The ceiling height of halls, corridors, etc. will be 3.0 m, considering natural ventilation and the installation of ceiling fans.
- The floor height will be 4.5 m, taking into account the ducts above the ceiling, piping space, and the height of the hospital rooms ceilings.
- By installing an underground pit and piping inside the pit, facility maintenance and repairs will be easier.
- In order to suppress temperature rise in the rooms on the top floor, insulation materials will be installed in the roof with ventilation louvers in the attic.
- The floor height of the ground floor will be approximately 600 mm above the ground surface to prevent flooding during heavy rains.

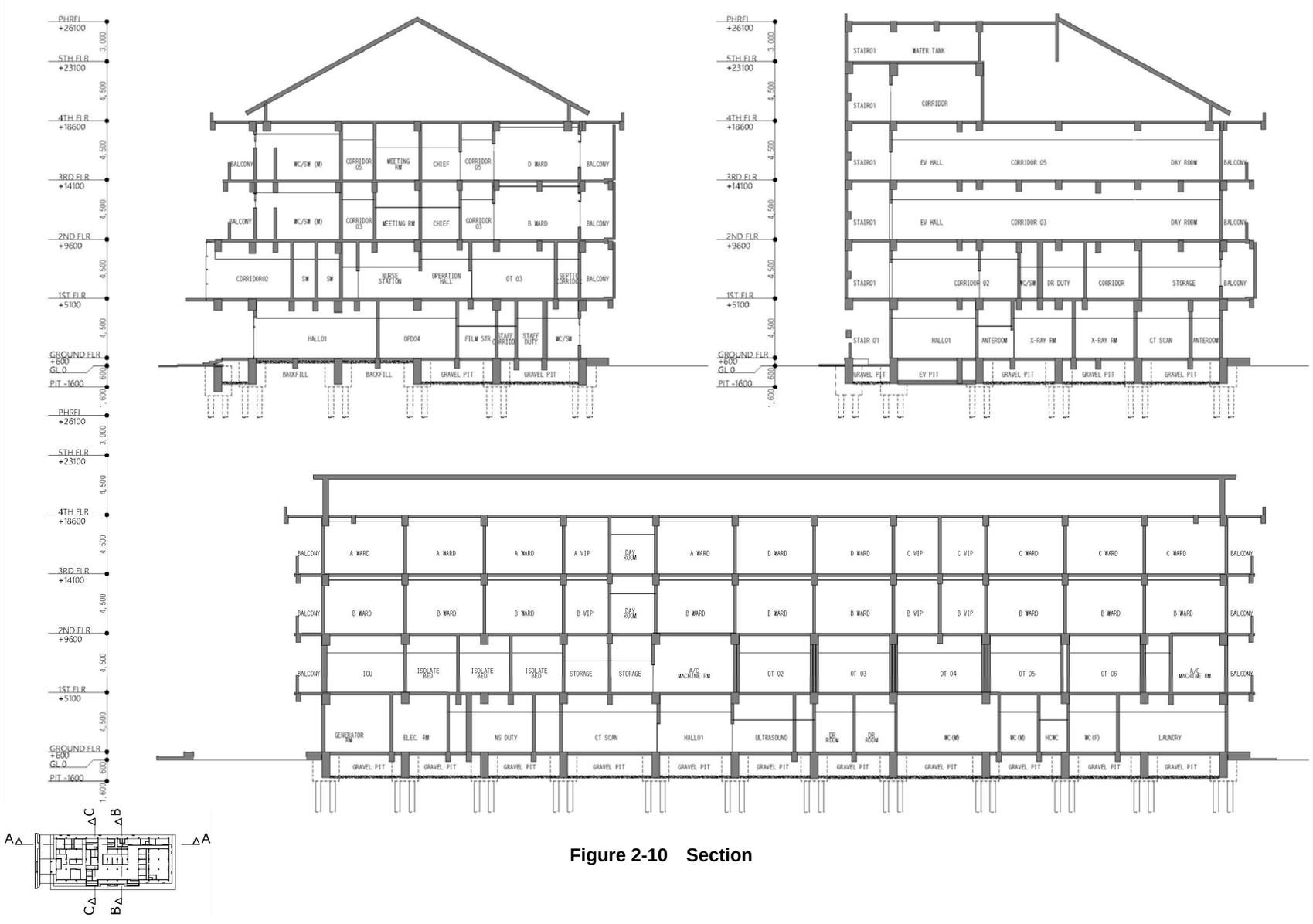

Figure 2-10 Section

6) Planned Floor Areas

Table 2-15 Floor Area by Building

Building Name	Department	Floor	Room No.	Room Name	Area (m2)
Main Building	Outpatient Department	GF	OP-01	Preparation Hall	30.43
7260.91m^2	218.80 m^2	GF	OP-02	Outpatient Consultation Room 01	12.00
		GF	OP-03	Outpatient Consultation Room 02	12.00
		GF	OP-04	Outpatient Consultation Room 03	12.00
		GF	OP-05	Outpatient Consultation Room 04	12.00
		GF	OP-06	Outpatient Consultation Room 05	12.86
		GF	OP-07	Pharmacy	15.16
		GF	OP-08	Pharmacy	14.15
		GF	OP-09	Social Welfare Room	14.15
		GF	OP-10	Cashier	14.14
		GF	OP-11	Reception	17.21
		GF	OP-12	Triage Room	12.42
		GF	OP-13	Staff Corridor	27.75
		GF	OP-14	Water Closet (M)	9.30
		GF	OP-15	Water Closet (F)	3.23
	Emergency Outpatient Department	GF	ER-01	Emergency Treatment Room	54.77
	385.30 m2	GF	ER-02	Minor Operation Room	37.92
		GF	ER-03	Emergency Hall	98.42
		GF	ER-04	Staff Station	28.31
		GF	ER-05	Observation Room	63.71
		GF	ER-06	Isolation Room	12.00
		GF	ER-07	Isolation Room	11.25
		GF	ER-08	Vestibule	9.64
		GF	ER-09	Shower Room	10.42
		GF	ER-10	Utility	6.65
		GF	ER-11	Storage	11.35
		GF	ER-12	Doctor Duty Room	16.43
		GF	ER-13	Nurse Duty Room	15.00
		GF	ER-14	Water Closet/Shower	4.50
		GF	ER-15	Water Closet/Shower	4.93
	ICU Department	1F	IN-01	Intensive Care Room	366.09
	551.29 m^2	1F	IN-02	Staff Station	38.25
		1F	IN-03	Isolation Room	15.14
		1F	IN-04	Isolation Room	15.14
		1F	IN-05	Isolation Room	15.14

	1F	IN-06	Meeting Room	12.86
	1F	IN-07	Nurse Duty Room	12.25
	1F	IN-08	Doctor Duty Room	11.50
	1F	IN-09	Water Closet/Shower	5.25
	1F	IN-10	Water Closet/Shower	4.93
	1F	IN-11	Utility	4.82
	1F	IN-12	Storage	21.16
	1F	IN-13	Corridor	23.33
	1F	IN-14	Water Closet	2.69
	1F	IN-15	Water Closet	2.74
Operating Rooms	1F	OT-01	Operating Room 01	43.18
715.02 m^2	1F	OT-02	Operating Room 02	39.00
	1F	OT-03	Operating Room 03	39.00
	1F	OT-04	Operating Room 04	45.50
	1F	OT-05	Operating Room 05	39.00
	1F	OT-06	Operating Room 06	39.00
	1F	OT-07	Septic Corridor	79.90
	1F	OT-08	Operating Hall	122.20
	1F	OT-09	Storage	18.66
	1F	OT-10	Anteroom	11.09
	1F	OT-11	Anteroom	19.29
	1F	OT-12	Anteroom	27.06
	1F	OT-13	Staff Station	28.29
	1F	OT-14	Anesthesiology Room	14.14
	1F	OT-15	Recovery Room	25.93
	1F	OT-16	Connecting Hall	31.12
	1F	OT-17	Nurse Duty Room	11.15
	1F	OT-18	Changing Room (F)	17.83
	1F	OT-19	Changing Room (M)	15.97
	1F	OT-20	Conference Room	19.98
	1F	OT-21	Shower Room	5.00
	1F	OT-22	Shower Room	3.91
	1F	OT-23	Water Closet (F)	5.61
	1F	OT-24	Water Closet (M)	5.64
	1F	OT-25	Storage	7.57
Surgery A (abdominal and thoracic)	3F	A-01	6-bed Room	38.80
435.30 m^2	3F	A-02	6-bed Room	37.69
	3F	A-03	6-bed Room	37.69
	3F	A-04	Private Room	18.57
	3F	A-05	6-bed Room	37.69

		3F	A-06	6-bed Room	37.68
		3F	A-07	6-bed Room	37.69
		3F	A-08	6-bed Room	38.80
		3F	A-09	Private Room	16.80
		3F	A-10	Consultation Room	18.07
		3F	A-11	Nurse Duty Room	15.81
		3F	A-12	Staff Station	23.47
		3F	A-13	Chief Doctor's Office	12.16
		3F	A-14	Meeting Room	13.77
		3F	A-15	Doctor Duty Room	16.67
		3F	A-16	Storage	10.07
		3F	A-17	Utility	5.07
		3F	A-18	Water Closet/Shower	4.18
		3F	A-19	Water Closet/Shower	4.10
		3F	A-20	Water Closet/Shower	4.10
		3F	A-21	Shower Room	3.21
		3F	A-22	Water Closet	3.21
	Surgery B (trauma and orthopedic) 842.87 m^2	2F	B-01	6-bed Room	38.80
		2F	B-02	6-bed Room	37.69
		2F	B-03	6-bed Room	37.69
		2F	B-04	Private Room	18.57
		2F	B-05	6-bed Room	37.69
		2F	B-06	6-bed Room	37.69
		2F	B-07	6-bed Room	37.69
		2F	B-08	Private Room	18.57
		2F	B-09	Private Room	18.58
		2F	B-10	6-bed Room	37.69
		2F	B-11	6-bed Room	37.69
		2F	B-12	Doctor Duty Room	16.66
		2F	B-13	6-bed Room	39.08
		2F	B-14	6-bed Room	39.09
		2F	B-15	Physiotherapy Room	30.46
		2F	B-16	6-bed Room	37.68
		2F	B-17	6-bed Room	37.69
		2F	B-18	6-bed Room	38.80
		2F	B-19	Nurse Duty Room	15.81
		2F	B-20	Storage	10.07
		2F	B-21	Chief Doctor’s Office	12.07
		2F	B-22	Staff Station	24.60
		2F	B-23	Consultation Room	15.83

		2F	B-24	Plaster Room	18.07
		2F	B-25	Staff Station	21.25
		2F	B-26	Nurse Duty Room	16.06
		2F	B-27	Chief Doctor’s Office	12.87
		2F	B-28	Meeting Room	14.81
		2F	B-29	Storage	6.84
		2F	B-30	Water Closet/Shower	4.18
		2F	B-31	Water Closet/Shower	4.18
		2F	B-32	Water Closet/Shower	4.17
		2F	B-33	Water Closet/Shower	4.10
		2F	B-34	Water Closet/Shower	4.10
		2F	B-35	Utility	5.07
		2F	B-36	Shower Room	3.17
		2F	B-37	Water Closet	4.29
		2F	B-38	Shower Room	3.79
		2F	B-39	Utility	5.99
		2F	B-40	Water Closet	3.17
		2F	B-41	Doctor Duty Room	16.80
		2F	B-42	Meeting Room	13.77
	Surgery C (urology)	3F	C-01	6-bed Room	37.69
	395.28 m^2	3F	C-02	6-bed Room	37.69
		3F	C-03	6-bed Room	39.08
		3F	C-04	6-bed Room	39.09
		3F	C-05	6-bed Room	37.69
		3F	C-06	6-bed Room	37.69
		3F	C-07	Private Room	18.57
		3F	C-08	Private Room	16.79
		3F	C-09	Staff Station	22.65
		3F	C-10	Consultation Room	19.34
		3F	C-11	Doctor Duty Room	16.77
		3F	C-12	Nurse Duty Room	14.51
		3F	C-13	Chief Doctor’s Office	12.07
		3F	C-14	Meeting Room	10.68
		3F	C-15	Storage	8.82
		3F	C-16	Utility	7.36
		3F	C-17	Water Closet/Shower	4.18
		3F	C-18	Water Closet/Shower	4.10
		3F	C-19	Water Closet/Shower	4.13
		3F	C-20	Shower Room	3.19
		3F	C-21	Water Closet	3.19

Surgery D (neurology) 220.64m2	3F	D-01	6-bed Room	37.69
	3F	D-02	6-bed Room	37.69
	3F	D-03	Private Room	18.57
	3F	D-04	Doctor Duty Room	15.89
	3F	D-05	Consultation Room	15.83
	3F	D-06	Staff Station	21.24
	3F	D-07	Chief Doctor’s Office	12.87
	3F	D-08	Meeting Room	14.69
	3F	D-09	Nurse Duty Room	16.18
	3F	D-10	Water Closet	4.29
	3F	D-11	Shower Room	3.79
	3F	D-12	Utility	5.99
	3F	D-13	Storage	6.84
	3F	D-14	Water Closet/Shower	4.90
	3F	D-15	Water Closet/Shower	4.18
Surgery E (ENT) 222.32 m^2	2F	E-01	6-bed Room	39.08
	2F	E-02	6-bed Room	37.69
	2F	E-03	Staff Station	24.60
	2F	E-04	Nurse Duty Room	14.51
	2F	E-05	Meeting Room	10.68
	2F	E-06	Chief Doctor’s Office	12.07
	2F	E-07	Storage	8.82
	2F	E-08	Utility	7.36
	2F	E-09	Doctor Duty Room	16.77
	2F	E-10	Private Room	16.79
	2F	E-11	Consultation Room	19.34
	2F	E-12	Water Closet/Shower	4.10
	2F	E-13	Water Closet/Shower	4.13
	2F	E-14	Shower Room	3.19
	2F	E-15	Water Closet	3.19
Imagery Department 250.47 m^2	GF	ID-01	CT Scan Room	28.91
	GF	ID-02	X-Ray Room	19.62
	GF	ID-03	X-Ray Room	19.52
	GF	ID-04	Control Room	29.85
	GF	ID-05	Anteroom	16.98
	GF	ID-06	Anteroom	20.17
	GF	ID-07	Ultrasound Room	11.34
	GF	ID-08	Ultrasound Room	11.22
	GF	ID-09	Reception	6.65
	GF	ID-10	Office	12.00

		GF	ID-11	Film Storage	18.65
		GF	ID-12	Staff Corridor	25.82
		GF	ID-13	Staff Duty Room	10.60
		GF	ID-14	Doctor Duty Room	11.54
		GF	ID-15	Water Closet/Shower	3.85
		GF	ID-16	Water Closet/Shower	3.75
	Central Materials	GF	CM-01	Laundry Room	31.59
	173.79 m^2	1F	CM-02	Sterilization Room	31.52
		1F	CM-03	Washing Room	45.04
		1F	CM-04	Office	22.91
		1F	CM-05	Sterile Storage	20.14
		1F	CM-06	Sterile Storage	16.59
		1F	CM-07	Water Closet/Shower	6.00
	Common areas			Entrance Hall	434.12
	2218.26 m^2			Corridor	1135.51
				Stairs	302.76
				Day Room	41.54
				Other (Water Closet, storage building)	304.33
	Machine Room	GF	UT-01	Generator Room	32.78
	631.57 m^2	GF	UT-02	Electrical Room	26.71
		GF	UT-03	Medical Gas Room	29.93
		GF	UT-04	Pump Room	21.49
		GF	UT-05	Water Receiving Tank Room	191.96
		1F	UT-06	Air Conditioning Machine Room	51.78
		1F	UT-07	Air Conditioning Machine Room	51.50
		4F	UT-08	Elevator Machine Room	22.64
		5F	UT-09	Elevated Water Tank Room	52.02
		5F	UT-10	Elevated Water Tank Room	52.02
				Other (PS, EPS, etc.)	98.74
Other				Septic Tank	115.08
129.08 m^2				Power Receiving Facility Foundation	14.00
Total					7,389.99

7) Structure Plan

① Overview of structure plan

- The buildings are structurally divided into the main hospital building and two carriage porches, which are a 4-story building, 1-story building, and 4-story building, respectively.
- The structure type is reinforced concrete, and a pure rigid-frame structure will be used for all buildings in X and Y directions.
- The foundation structure will be a pile foundation using end-bearing piles (precast piles).
- In Cambodia, legislation for seismic design has not been developed and no clear seismic design standards have been established. Therefore, the design will be formulated using the Japanese Building Standards Law, institutional standards.

② Materials to be used

- The reinforcing bars to be used will be deformed bars that can be procured in Cambodia. The values shown in Table 2-16 will be used for the material strengths.

Table 2-16 Comparison of Diameter and Strength of Rebar in Cambodia and Japan

Cambodia				Japan				
Nominal diameter	Standard	Local reference test values		Nominal diameter	Area J (mm^2)	Area / Area J	Allowable stress	
		Area (mm^2)	Minimum yield point (MPa)				Long term ft (N/mm^2)	Short term ft (N/mm^2)
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 standard strength for concrete is Fc=24 N/mm^2. (Strength for proportioning will be Fm=30 N/mm^2.)

③ Design load

- Fixed load: As specified in Article 84 of the Enforcement Order, Building Standard Law of Japan. Also calculated according to material type and member measurements.
- Live load: As specified in Article 85 of the Enforcement Order, Building Standard Law of Japan. Also using values stated in the Building Structural Design Standards (2018 edition), as shown in Table 2-17.

Table 2-17 Live Load Values (Units: N/m2)

Room name	For floors	For frame	For earthquake	Remarks
Roof	1000	0	0	Ordinance Article 85 (steel gymnasium roof)
Hospital rooms, duty rooms	1800	1300	600	Ordinance Article 85 (inhabited rooms, hospital rooms)
Office, reception	2900	1800	800	Ordinance Article 85 (offices)
Corridors, common areas	3500	3200	2600	Ordinance Article 85 (assembly rooms, other)
Laboratory	3900	2400	1600	Building Structure Design Guidelines (laboratory)
Machine Room	4900	2400	1300	Building Structure Design Guidelines (machine room)
Storage	7800	6900	4900	Ordinance Article 85 (storage)
Pit	1000	600	400	Ordinance Article 85 (roof)

- Wind pressure: Figure 2-11 shows the typhoon hazard map for the area around Cambodia. This hazard map evaluates wind speed for a 100-year recurrence interval on a five-point scale, and Cambodia falls in the region classified as Category 1 or lower (wind speed 32-42.5 m/s). Taking into consideration the fact that Japan uses a recurrence interval of 50 years for its reference wind speed, design for the Project will be performed with the Japanese minimum standard (reference wind speed 30 m/s). Wind pressure shall be in accordance with the provisions of Ordinance Article 85 and Ministry of Construction Notification No. 1454 of 2000. The furring strips and purlins supporting the roof cladding and exterior materials, etc. shall be in accordance with Ministry of Construction Notification No. 1458 of 2000.

  a) Ground surface roughness classification: III (inland area)

  b) Reference wind speed: V_0=30m/s

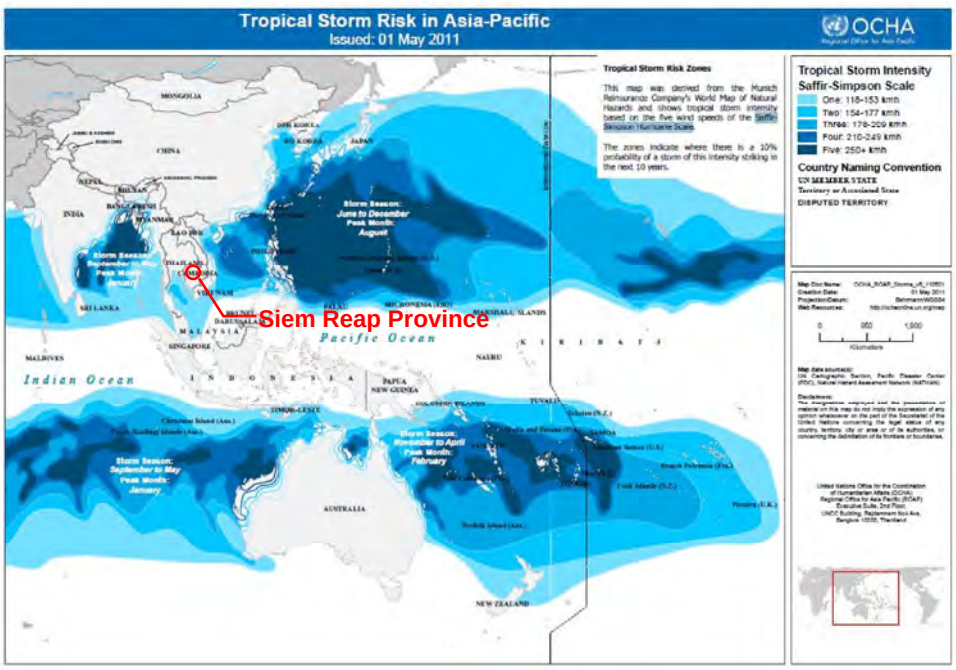

Figure 2-11 Typhoon Hazard Map Around Cambodia (Source: UN OCHA)

- Seismic force: Figure 2-12 shows the earthquake hazard map for the area around Cambodia. Based on this hazard map, it is estimated that seismic acceleration in Cambodia is about 20 gal for a recurrence interval of 100 years. In addition, since hospitals require high seismic performance, if the earthquake acceleration is assumed to be 40 gal for the Project, ground acceleration would be 100 gal, which is half the size of the design seismic force used in Japan. Therefore, Co=0.1 (one-half of Japan's design seismic force) will be used for the design of the Project. Seismic force shall be as specified in Article 88 of the ordinance.

  a) Ground classification: Class II

  b) Standard shear force coefficient: Primary design C_0=0.1

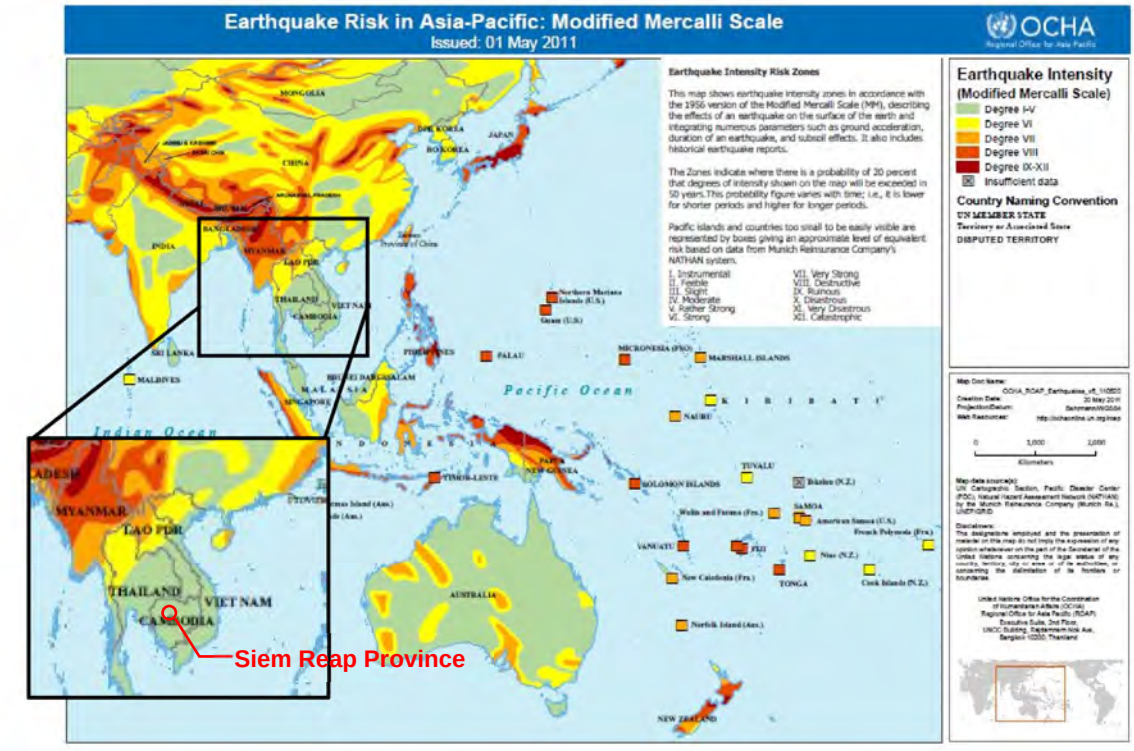

Figure 2-12 Earthquake Hazard Map Around Cambodia (Source: UN OCHA)

④ Superstructure plan

- Structure types are reinforced concrete structures, taking into account cost, performance, and the ease of procuring materials locally.
- Since concrete wall placement in Cambodia is not precise, in principle, concrete walls will be not used except for the X-ray room, where protection from radiation is necessary, in operating rooms where a C-arm is installed, and areas around slopes. A pure rigid frame structure will be used for both X and Y directions.
- Cement tiles are used as roofing material, and the roof slope will consist of a steel frame base.
- The plan will take joints under the beams into account, considering the workability of fixing the reinforcing bars.
- Lap joints will used, considering workability of reinforcing bar joints.
- Since walls will have a brick finish, bond beams will be installed as appropriate.

⑤ Foundation structure plan

- According to the ground survey report, the site has a sandy soil layer with an N-value of 3-10 from the surface layer to GL -10.0 m, and a sandy soil layer with an N-value of 10-20 from GL -10.0 m to -27.0 m. At the depth of GL -27.0 m to -35.0 m (-40.0 m in some areas) there is also sandy soil layer with an N-value of 20-50, and from GL -35.0 m to 40.0 m and going deeper, there is a sandy soil layer with an N-value of 50 or greater. The groundwater level is BH-9, located in the surface layer at a depth of GL -0.5 m.
- The foundation type will be a pile foundation, because the soil layer with an N-value of 30 or more is deep at GL -27.0 m.
- The piles will be end-bearing piles (precast piles), and the bearing soil is a sandy soil layer at a depth of approximately GL -27.0 m or deeper.
- The bearing capacity of the ground is as specified in the ground survey report.
- Since the groundwater level is high, the bottom of underground floor will be designed as a RC slab.

⑥ Materials

- Concrete: There is a concrete plant near the site, and concrete will be fabricated using aggregate and cement from Cambodia. Appropriate mix proportioning and test mixing will be performed to confirm design strength at the concrete plant.
- Reinforcing bar: JIS standards will be applied, because the reinforcing bar available in Cambodia conforms to JIS standards. The quality of the reinforcing bar will be confirmed by the mill test certificate and through tensile strength testing conducted at a Phnom Penh official testing agency.
- Steel frame: JIS standards will be applied, because steel frame conforming to JIS standards can be procured in Cambodia. Machining will be performed a plant in Phnom Penh; using shop welding as a base, the members will be joined using high-strength bolt connections.

8) Electrical and Mechanical Facility Plans

① Electrical facility plans

a) Substation facilities

- The electrical power lead-in will be connected to the extra circuit breaker in the existing switchgear (controlled by EDC) on the road to the west of the site, and a 22 kV underground distribution line will be installed leading to new high-voltage power receiving facilities to be built on the site.
- A package-type transformer will be installed on the site, supplying electricity to the new hospital.
- In terms of the division of work with EDC, everything after the connection of cables to the existing switchgear, including installation of substation facilities, will be part of the owner's work. Regarding the division of work with Cambodia, work outside the site (connecting cables to existing switchboards, excavating roads and laying buried piping/cables, and connecting primary transformers) will be performed by the Cambodian side. The Japanese side will be responsible for the substation facilities and on-site distribution lines after the installation of transformer equipment.
- The power supply facilities installed with this work will only be connected in the new facilities built for the Project. Connections to existing facilities will not be considered.

b) Trunk line facilities

- A low-voltage switchboard will be installed in the electrical room, with wiring to the light switchboard and power control board.
- The electrical system will be 3-phase 4-wire system of 400V/230V.
- The electric system to supply electricity to medical equipment requiring a stable power supply will be separated with an AVR installed.
- If UPSs are required for equipment, it will be arranged for in the equipment plan.

c) Emergency generator facilities

- Install an emergency power generators (200kVA) and supply emergency power to lighting, air conditioning, electrical outlets for equipment, and 2 elevators for operating rooms, ICU, and the emergency department so as not to interfere with medical treatment.
- Since the EDC-side distribution line is a line for hospitals, and thus experiencing few power outages, the equipment supplied with electricity on the generator circuit will be thoroughly inspected to ensure that generator capacity is not excessive.
- Fuel reserves will be enough for approximately nine hours between 8 a.m. to 5 p.m., when EDC may be working on the power distribution grid. The fuel tank will be mounted on the body of the generator.

d) Lighting/outlet facilities

- A comfortable lighting plans will be created to match the indoor environment. Brightness levels according to the usage of each room will be ensured.
- Lighting fixtures will use long-life, low-power LED lights.
- Ordinary outlets and medical outlets will be appropriately installed according to usage.
- One medical outlet per bed will be installed in inpatient rooms.

e) Telecommunications facilities

- An internet line will be brought on site and Wi-Fi will be installed inside the facility. The cable lead-in work will be separate.
- Computers that use the PMRS will have wired internet connections. Piping/cables and multimedia electrical outlets will be installed.
- The medical LAN will be wired, and conduits/cables will be installed. Multimedia electrical outlets will also be installed in rooms where so required. Equipment such as servers will be included in the plan for medical equipment and the construction of a network using SW-HUB, etc. will be included in the electrical facility plan.
- No landlines will be installed in the new hospital building. Mobile phones and intercoms will be used for communication.
- Intercoms will be installed in rooms where they are required for medical activities and in rooms where staff members are stationed.
- In staff rooms and in spaces where patient families wait, television terminals will be installed,

allowing for tv reception.

- Nurse call buttons will not be installed, similar to the existing facilities.
- In-house broadcasting equipment will be installed so that announcements can be made in the outpatient waiting areas.
- Empty piping will be laid so that surveillance cameras can be installed in patient waiting spaces and important medical rooms such as the ICU.
- The communications equipment installed with this work will only be connected in the new facilities built for the Project. Connections to existing facilities will not be considered.

f) Disaster management facilities

- Spotlights with built-in batteries will be installed as the main emergency lighting.
- Guide lights will be installed at evacuation exits and in evacuation corridors.
- As emergency alarm equipment, transmitters and district bell alarms will be installed as appropriate in common areas such as hallways.

g) Lightning protection facilities

- Exterior lightning arrester equipment using lighting rods and roof conductors will be installed, as will interior lightning protection facilities to protect equipment and devices from indirect lightning strikes.
- The scope of protection covers the newly constructed facilities and areas exceeding 20 m in height.

② Mechanical Facility Plan

a) Water supply facilities

- Since the water source can supply a sufficient amount of water and the water quality is satisfactory, the Siem Reap Province public water supply will be used.
- There is a water main near the hospital grounds, and new piping will be laid for the exclusive use of the new hospital building. Water meters will also be installed.
- For the division of construction work, water supply lead-in work and installation of water meters will be handled by the waterworks bureau (construction fees to be paid by the hospital), and construction after the water meters will be hospital construction work.
- Water will be supplied through an elevated water tank method that can be accessed during power outages and water shut-offs. The water receiving tank is constructed of highly safe FRP or stainless steel panels that enable inspections from five directions. The elevated water tank will be made of stainless steel (cylindrical type), which can be easily procured locally.
- The water supply facilities installed with this work will only be connected in the new facilities built for the Project. Connections to existing facilities will not be considered.

b) Hot water facilities

- Hot water will be provided through a localized system, with wall-mounted electric instantaneous water heaters installed in necessary places.

- Hot water will be supplied in the shower rooms of the Emergency Department, operating room preparation hall, and the central sterilization room.

c) Drainage facilities

- Sewage and miscellaneous wastewater from inside buildings leaves the building in separate pipes, merges together in the first sump outside the building, and is carried via a natural slope to the septic tank.
- In the septic tank, wastewater is treated in the following order: solid waste separation, aeration, sediment separation. It then flows to the connected public sewer system (rainwater main).
- Rainwater and drainage from air conditioners will be discharged to the public sewer through the rainwater drainage pipes and catch basins.
- The drainage facilities installed with this work will only be connected in the new facilities built for the Project. Drainage in existing facilities will not be considered.

d) Sanitation facilities

- Toilet basins, wash basins, utility sinks, and other sanitary equipment will be installed in the water closets
- All toilet basins will be Western-style (low-tank type) with attached handheld showers.

e) Fire control facilities

- Fire extinguishers and indoor fire hydrants will be installed as fire control facilities that can be maintained locally.
- Only wards newly constructed for the Project will benefit from the construction of these fire control facilities. No such precautions will be considered for existing wards.

f) Septic tank facilities

- The septic tank will be an aerobic type, ready-made product that is easy to work with and for which performance can be checked easily.
- Only the wards newly constructed for the Project will benefit from this septic tank facility construction. Waste treatment for existing wards will not be considered.

g) Medical gas facilities

- Oxygen will be supplied centrally to the emergency treatment room, ICU, and operating rooms.
- Oxygen cylinders will be installed in the manifold rooms, and oxygen will be delivered through outlets in rooms that require oxygen. Two banks will be installed per manifold room for the cylinders, and switching between cylinders will be automatic.
- In principle, the number of outlets will be one for each bed in the emergency treatment room and ICU, and two for each operating room.

h) Air conditioning facilities

- Air conditioners will be installed in the following rooms.

Table 2-18 Air conditioning rooms

Department	Air conditioning rooms
Operation	Operation room, Operation hall, Nurse station, Anesthesia room, Recovery room, conference room, Duty room, Sterilization room, Office
ICU	ICU, Nurse station, Private room, Conference room, Nurse duty room, Doctor duty room
Surgery Ward	Doctor duty room, Nurse duty room, Chief nurse room, Meeting room, Consultation room, Plaster room, VIP bedroom
Imagery	CT room, X ray room, Control room, ultrasound room, Duty room, Office
Pharmacy	Pharmacy, Pharmacy accounting room
Outpatient	Outpatient consultation room, Preparation corridor, Reception, Account
Emergency	ER treatment, Nurse station, Observation room, Private room, Minor operation room, Doctor duty room, Nurse duty room

- For operating rooms, a dedicated machine room will be built, and air-cooled package-type floor units that blow through ducts will control air temperature.
- Except for in the operating rooms, air-cooled, separate-type air conditions will be installed. Wall-mounted household-use air conditioners will be selected for small rooms so that they can be easily upgraded in the future by the partner country.
- In large rooms, the indoor unit will be a four-way cassette-type unit, and small rooms will have one- or two-way cassette type or wall-mounted indoor units.
- Ceiling fans will be installed in rooms that are used by people, but that do not have air conditioners installed.

i) Ventilation facilities

- Natural ventilation through windows or louver grills will be applied to the rooms which have no air conditioning.
- Ventilation system by the air-exhaust ventilator is basically applied to rooms which have air conditioning, or which are not able to available natural ventilation. Fresh air is supplied from the corridor through louver grills of doors, and the air is evacuated to the outside through ducts.
- Ventilating system by the fresh air supply fan is applied to clean areas of operating rooms to keep the positive pressure in the rooms. However, operation rooms for dirty or infected patients, ventilating system by the fresh air supply fan and the air-exhaust ventilator is applied to the rooms to keep the negative pressure in the room for avoiding air flow to the clean areas from the rooms.

9) 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 the following cautionary points into account.

- Materials will mainly be durable and easy to maintain materials that are generally available in Cambodia.

- The site is located inland, and no salt damage has been 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 will consist mainly of aluminum sash and aluminum doors.
- In order to ensure durability, the use of wood materials will be avoided as much as possible. If it is used, it is to be treated with preservative and anti-termite agents.

Based on the above, the standard specifications are shown in Table 2-19 and Table 2-20.

Table 2-19 Exterior Finishing

Part	Finishing
Roof	Steel joints/purlins, glass-wool, cement board base, asphalt roofing, cement tiles
Exterior Wall	Exposed aggregate finish (by washing) after trowel finish of mortar
Fittings	Colored aluminum sash, colored aluminum doors, steel doors

Table 2-20 Interior Finishing

Room group	Finishing			
	Floor	Baseboard	Walls	Ceiling
Entrance hall	Non-slip ceramic tile	Ceramic tile	Melamine veneer wainscoting+ mortar for upper portion+ EP	Cement board + EP
Corridors, Stairs	Same as above	Same as above	Mortar+ EP	Rockwool sound absorbing panel
Inpatient rooms, office, nurse stations, etc.	Same as above	Same as above	Same as above	Same as above
General consultation rooms, treatment rooms	Same as above	Same as above	Ceramic tile wainscoting+ EP upper portion	Same as above
Operating rooms, emergency treatment room	Vinyl floor sheet	Vinyl floor sheet	Same as above	Cement board +EP
Utility, water closets, shower rooms, etc.	Non-slip ceramic tile	Ceramic tile	Same as above	Same as above
Storage, medical chart storage, film storage	Same as above	Same as above	Mortar+ EP	Rockwool sound absorbing panel
Air conditioning machine room, generator room, pump room	Dustproof coating	Dustproof paint	Glass wool mat	Rockwool sound absorbing panel +Glass wool mat
Electrical room, manifold room, water receiving tank room, etc.	Same as above	Same as above	Trowel finished mortar	Rockwool sound absorbing panel

(3) Equipment and Materials Plan

1) Examining the content of the request

The final list of requested equipment compiled in the field survey was selected based on the standard equipment list in the CPA guidelines set by the Ministry of Health. Although the content is basically relevant, the following selection criteria were re-formulated in Japan. In addition to reviewing the criteria for each piece of equipment, relevance was also verified.

Equipment Selection Criteria

[Provincial hospitals]

Qualitative assessment

① Priority assigned by Cambodian side
The priority assigned by the department in charge of requesting the equipment is noted.
② Relevance

Based on the qualitative assessment above, the first stage of narrowing the list was performed.

Quantitative assessment

In addition to the qualitative evaluation, the request was narrowed for a second time using the evaluation items and criteria shown in Table 2-21. Within the ceiling of the budget, the equipment with the lowest score was deleted in order.

Table 2-21 Quantitative Assessment for Provincial Hospital Equipment Selection

No.	Evaluation Item	Points	Evaluation Criteria
①	Frequency of use (necessity of equipment)	10	Equipment regularly used every day=10 points; Equipment used 3-4 times per week=8 points; Equipment used 4-5 times per month=6 points; Equipment used several times per year=4 points; Equipment used less frequently than above=3 points.
②	Presence or absence of existing equipment	10	For the presence of existing equipment in the following condition: None=10 points; C=8 points; B=6 points, A=4 points.
③	Experience in usage	10	Currently in use=10 points; Used in past but not currently in use due to break-down, etc.=8 points; Used in past but not very often=6 points; Used only during training/educational periods= 4 points; No usage past or present= 2 points.
④	Costs related to operation	10	Equipment that does not use consumables=10 points; Equipment uses inexpensive consumables=8 points; Equipment uses somewhat expensive consumables (1,000 yen per usage)=6 points; Equipment with expensive consumables=4 points.
⑤	Availability of consumables	10	Equipment that does not require consumables or that uses consumables readily available in Cambodia=10 points; Uses consumables that are available in Cambodia but are not stocked by sales agents and must be ordered=8 points; Uses consumables that must be ordered from countries outside of Cambodia= 6 points; Uses consumables that must be directly ordered from the country of origin=4 points.
⑥	Presence or absence of alternative ways	10	Equipment without readily available alternatives=10 points; Equipment with readily available alternatives that can be used, such as biochemical analyzers for urinalysis apparatus=6 points.

⑦	Ensuring quality of procured equipment	10	Equipment for which quality is important, thus requiring and Japanese, American, or European products: On a 10-point scale, up to 6 points are assigned, depending on the importance of quality. For equipment for which there is no problem if procured in Cambodia=4 points.
⑧	Economic efficiency of procurement	10	Equipment with a high unit price that is appropriate for procurement by the Project= 10 points; Equipment that is somewhat expensive but can be procured by the Cambodian side=8 points; Equipment that can be procured by the Cambodian side and is also inexpensive=6 points; Equipment appropriate for procurement by the Cambodian side=2 points.
⑨	Consistency with the content of currently implemented medical treatment	10	Equipment used for medical care currently performed=10 points; Equipment used for medical care not currently performed=6 points.
Total		90	

[District hospitals]

For the selection for district hospitals, the request was narrowed using the evaluation items and criteria shown in Table 2-22.

Table 2-22 Quantitative Assessment for District Hospital Equipment Selection

No.	Evaluation Item	Evaluation Criteria
①	Priority level assigned by the Cambodian side	A = yes (○); B or C = no (x)
②	Whether equipment is directly used for diagnosis and treatment	Equipment used for diagnosis and treatment = yes (○); Auxiliary equipment such as furniture and carts, not directly used for treatment = no (x).
③	Equipment not related to surgical consultations and treatment is excluded.	Equipment for treating disorders surgically = yes (○); Equipment not directly related to treating disorders surgically = no (x). Laboratory equipment is essential equipment as a basic diagnostic function for hospitals, but due to budget limitation this equipment was excluded because it is not directly related to surgical treatment.
Total		If there is even one “no” or “x”, it shall not be included in the plan.

Table 2-23 Evaluation Chart for Equipment Relevance (Siem Reap Province Referral Hospital)

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Qualitative evaluation			Planned Q'ty	Quantitative evaluation																						Remarks
				Priority	Validity	Result		①	Frequency of use	②	Existing equipment	③	Experience in use	④	Costs related to operation	⑤	Availability of consumables	⑥	Alternative way	⑦	Ensuring quality of procured equipment	⑧	Economic efficiency of procurement	⑨	currently implemented medical treatment	Sum (90 points)	
				○/×				10		10		10		10		10		10		10		10		10			
Siem Reap PRH																														
(1) Traumatology																														
1	TR-1	C-arm	2	○	A	△	○	1	10	2-3 cases/day	8	1C	10	○	10	-(no need)	10	-	10	-	10	○	10	○	10	○	88	
2	TR-2	Operation microscope	1	×	B	○	×	-		1 cases/week		-		○		-		-		-		○		○		○	–	
3	TR-3	Surgical headlight	1	×	B	○	×	-		2-3 cases/day		-		○		-		-		-		△		△		○	–	
4	TR-4	Arthroscope with knee operation instrument set	1	○	A	○	○	1	5	1 cases/month	8	1C	10	○	8	-	9	△	10	-	10	○	10	○	10	○	80	
5	TR-5	Shoulder arthroscopy instrument set	1	×	B	○	×	-		1 case/month		1C		○		-		△		-		○		○		○	–	
6	TR-6	Knee prosthesis instrument set	1	○	A	×	×	-		1-2 cases/month		-		○		△（need implant）		△		-		○		○		○	–	
7	TR-7	Hip prosthesis instrument set	1	○	A	○	○	1	8	1-2cases/week	8	1C	10	○	4	△（need implant）	9	△	10	-	10	○	10	○	10	○	79	
8	TR-8	Orthopedic table surgery	2	○	A	○	○	1	8	1-2cases/week	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	86	
9	TR-9	Orthopedic traction accessories for bed	20	○	A	○	○	10	10	everyday	10	1D(hand made)	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
10	TR-10	Hand surgery instrument set with electric drill	1	○	A	○	○	1	5	1case/week	6	1C	10	○	10	-	10	-	10	-	10	○	8	○	10	○	79	Deleted due to budget limitation
11	TR-11	Micro surgery instrument set	1	○	A	○	○	1	5	1case/week	6	1C	10	○	10	-	10	-	10	-	10	○	8	○	10	○	79	Deleted due to budget limitation
12	TR-12	Large fragment surgery instrument set with drill	1	○	A	○	○	1	9	1-2cases/day	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	87	
13	TR-13	Small fragment surgery instrument set	1	○	A	○	○	1	9	1-2cases/day	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	87	
14	TR-14	Dermatome	1	○	A	○	○	1	5	?	8	1C	10	○	10	-	10	-	10	-	5	△	10	△	10	○	78	Deleted due to budget limitation
15	TR-15	Cancellous cannulated screws instrument set	1	○	A	○	○	1	5	2-3cases/month	8	-	10	○	4	△（need implant）	6	△	8	-	10	○	10	○	10	○	71	Deleted due to budget limitation
16	TR-16	DHS/DCS instrument set	1	○	A	○	○	1	7	1-2cases/week	8	1C	10	○	4	△（need implant）	9	△	10	-	10	○	10	○	10	○	78	
17	TR-17	Gamma 3 nail instrument set	1	○	A	○	○	1	7	1-2cases/week	10	-	10	○	4	△（need implant）	9	△	10	-	10	○	10	○	10	○	80	
18	TR-18	Nail fixtation instrument set	1	○	A	○	○	1	9	2cases/day	10	-	10	○	4	△（need implant）	6	△	8	-	10	○	10	○	10	○	77	Deleted due to budget limitation
19	TR-19	Plaster remove set	1	○	A	○	○	1	10	everyday	10	-	10	○	10	-	10	-	8	△（normal ）	6	△	8	△	10	○	82	
(2) Urology																														
1	UR-1	Patient monitor	1	×	B	○	×	-		everyday		-		○		△（gel, etc., but it is not expensive）		○		-		○		○	10	○	–	
2	UR-2	Ultrasound machine	1	×	B	○	×	-		3cases/day		-		○		△（gel, etc., but it is not expensive）		○		-		○		○	10	○	–	
3	UR-3	C-arm	1	○	A	○	○	1	9	1-2cases/day	6	1B(share with other dep.）	10	○	10	-	10	-	6	share with C-arm in Traumatology dep.	10	○	10	○	10	○	81	Deleted due to budget limitation, share with
4	UR-4	Urology surgical instrument set	1	×	B	○	○	-																			–	Open surgical instrement set Apply to kidney tumor, etc
5	UR-5	Cystofiberscope for examination	1	○	A	○	○	1	9	1-3cases/day	8	1C	8	△（no experience on a part of equipment）	10	-	10	-	10	-	10	○	10	○	10	△	85	For examination of outpatient
6	UR-6	Endoscopic surgical equipment set																										Below compositions
6	UR-6-1	Cystofiberscope for treatment	1	○	A	○	×	-	6	2-3cases/month	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	84	Share with cystofiberscope for examination
6	UR-6-2	Cystoscope (Ligid)	1	○	A	○	○	1	6	3-4cases/month	8	C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	84	For removing bladder stone
6	UR-6-3	Resectoscope	1	○	A	○	○	1	6	1-2cases/day	8	C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	84	Benign prostatic hyperplasia, bladder tumor removal
6	UR-6-4	Urerthrofiberscope	1	○	A	○	○	1	6	2-3cases/month	10	?	8	△	10	-	10	-	10	-	10	○	10	○	10	○	84	Removal of ureteral stent
6	UR-6-5	Urerthroscope (Ligid)	1	×	B	○	×	-		3-4cases/month		?		○		-		-		-		○					–	Removal of ureteral stones
6	UR-6-6	Laser surgical unit	1	○	A	○	○	1	6	3-4cases/month	10	-	8	△	10	-	10	-	10	-	10	○	10	○	10	○	84	Stone crushing during urinary stone removal
6	UR-6-7	Nephoscopy	1		?	×	×	-		3-4cases/month		?						-		-		○					–	Kidney stone removal
6	UR-6-8	Ultrasound aspirator	1	○	A	○	×	-	6	3-4cases/month	10	-	8	△	10	-	10	-	10	-	10	○	10	○	10	○	84	Stone crushing during urinary stone removal
6	UR-6-9	Urethrotomy	1	×	B	○	×	-		2-3cases/month		C				-		-		-		○					–	Urethral stenosis treatment
6	UR-6-10	Laparoscope	1	×	B	○	×	-		5-8cases/month		-		○		-		-		-		○					–	Share with laparoscope in Abdominal dept.
7	UR-7	Examination table for urology	1	○	A	○	○	1	10	3-4cases/day	10	1D(use normal bed）	10	○	10	-	10	-	9	△（Normal bed）	10	○	10	○	10	○	89	
(3) Abdominal, Thoracic surgery																														
1	AB-1	Surgical headlight	1	10	A	○	○	1	9	1-2cases/day	10	-	10	○	10	-	10	-	10	-	6	△	8	△	10	○	83	
2	AB-2	Abdominal surgical instrument set	3	10	A	○	○	3	9	3cases/day	8	3C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	87	
3	AB-3	Chest surgical instrument set	1	10	A	○	○	1	6	1case/week	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	84	
4	AB-4	Surgical laparoscopic equipment	2	10	A	○	○	1	7	3cases/week	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	85	
5	AB-5	Laparoscopic smoke evacuation set	1	6	B	○	×	-		3cases/week		-		○		-		-		-		○		○		○	–	
6	AB-6	Surgical tissue management system electro surgical generator set	1	10	A	×	×	-		?		-		○		-		-		○ can use Ligasure instead of this equipment		○		○		○	–	
7	AB-7	Cavitron ultrasonic surgical aspirator (CUSA) set	1	10	A	○	○	1	6	1case/week	8	1C	10	○	10	-	10	-	5	can complete operation without this equipment	10	○	10	○	10	○	79	Deleted due to budget limitation
8	AB-8	Ligasure valley lab set	1	10	A	○	○	1	9	2cases/day	8	-(have normal electrical surgery set)	8	△（have experience on normal electrical surgery set）	10	-	10	-	5	Normal electrical surgery equipment can use as alternative way	10	○	10	○	10	○	80	Deleted due to budget limitation
9	AB-9	Gastroscope set	1	10	A	○	○	1	7	2-3cases/week	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	85	
10	AB-10	Ultrasound machine	1	10	A	○	○	1	6	1case/week	10	1B(use shared equipment)	10	○	8	△（gel, etc., but it is not expensive）	10	○	10	-	10	○	10	○	10	○	84	

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Qualitative evaluation				Planned Q'ty	Quantitative evaluation																						Remarks
				Priority	Validity	Result			①	Frequency of use	②	Existing equipment	③	Experience in use	④	Costs related to operation	⑤	Availability of consumables	⑥	Alternative way	⑦	Ensuring quality of procured equipment	⑧	Economic efficiency of procurement	⑨	currently implemented medical treatment	Sum (90 points)	
				○/×					10		10		10		10		10		10		10		10		10			
Siem Reap PRH																															
(4) Plastic surgery																															
1	PL-1	Plastic surgical instrument set	1	6	B	○	×	-		?		1C		△		-		-		-		○		○		×	–	
(5) Neurosurgery																															
1	NU-1	Cervical spine surgery instrument set	1	10	A	×	×	-		2-3cases/month		-		○		-		-		-		○		○		×	–	
2	NU-2	Lumbar spine surgery instrument set	1	10	A	○	○	1	7	10cases/month	10	-	10	○	10	-	10	-	10	-	10	○	10	○	6	×	83	
3	NU-3	Neurology/ Craniotomy surgery instrument set/ Fast drill	1	10	A	○	○	1	7	5-6cases/month	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	6	×	81	
(6) ENT																			10												
1	ET-1	ENT Surgical instrument set	1	10	A	○	○	1	7	10cases/month	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	85	
2	ET-2	ENT unit	1	10	A	○	○	1	10	everyday	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
3	ET-3	ENT examination set	1	10	A	○	○	1	10	everyday	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
4	ET-4	ENT endoscope	1	6	B	○	×	-		1-2cases/month		1C		○		-		-		-		○		○		○	–	
5	ET-5	ENT headlight	2	6	B	○	×	-		everyday		-		○		-		-		-		△		△		○	–	
(7) Emergency																			10												
1	ER-1	Operation light mobile	1	6	B	○	×	1	10	10cases/month or more	8	2C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
2	ER-2	Patient monitor	10	10	A	○	○	5	10	everyday	8	2C	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	86	
3	ER-3	Ventilation machine	3	10	A	○	○	1	9	3cases/day	8	1C	10	○	6	△ (need breathing circuit)	10	○	8	△(Ambu bag)	10	○	10	○	10	○	81	
4	ER-4	Suction machine	5	10	A	○	○	2	10	everyday	6	3B	10	○	10	-	10	-	10	-	10	○	10	○	10	○	86	
5	ER-5	Mobile ultrasound machine	2	8	1A,1B	○	△	1	10	20cases/day	8	1C	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	86	
6	ER-6	Mobile X-ray	1	10	A	○	○	1	10	20cases/day	6	1B	10	○	7	△ (need film, etc.)	10	○	10	-	10	○	10	○	10	○	83	
7	ER-7	ECG machine	1	10	A	○	○	1	10	10-20cases/day	8	2C	10	○	8	△ (need recording paper, etc.)	10	○	10	-	10	○	10	○	10	○	86	
8	ER-8	Defibrillator	1	6	B	○	○	-				-		○		-		-		-		○		○		○	–	
9	ER-9	Syringe pump	5	10	A	○	○	2	10	everyday	10	-	10	○	7	○ (need specific sylinge)	9	△	10	-	10	○	10	○	10	○	86	
10	ER-10	Laryngoscope	1	10	A	○	○	1	10	3-5cases/day	4	1A	10	○	10	-	10	-	10	-	6	△	10	○	10	○	80	
11	ER-11	Stretcher	2	10	B	○	○	-		everyday		2B		○		-		-		-		△		△		○	–	
12	ER-12	Emergency bed	15	10	A	○	○	15	10	everyday	6	10B	10	○	10	-	10	-	10	-	10	○	10	○	10	○	86	
(8) Surgery ICU																															
1	IU-1	Patient monitor	26	10	A	○	○	10	10	everyday	8	5C	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	86	
2	IU-2	Ventilation machine	4	8	3A,1B	○	△	2	10	2-3cases/day	8	1C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
3	IU-3	Suction machine	8	10	A	○	○	4	10	5cases/day	6	4B	10	○	10	-	10	-	10	-	10	○	10	○	10	○	86	
4	IU-4	Mobile ultrasound machine	2	10	A	○	○	1	10	10cases/day	6	1B	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	84	
5	IU-5	Mobile X-ray	1	10	A	○	○	1	9	3cases/day	10	-	10	○	7	△ (need film, etc.)	10	○	10	-	10	○	10	○	10	○	86	
6	IU-6	ECG machine	1	10	A	○	○	1	10	5-6cases/day	6	1B	10	○	7	△ (need recording paper, etc.)	10	○	10	-	10	○	10	○	10	○	83	
7	IU-7	Defibrillator	1	10	A	○	○	1	9	1case/day	10	-	10	○	10	-	10	-	10	-	10	○	10	○	10	○	89	Share with ICU dept.
8	IU-8	Syringe pump	10	10	A	○	○	5	10	15cases/day	6	2B	10	○	7	○ (need specific sylinge)	9	△	10	-	10	○	10	○	10	○	82	
9	IU-9	Laryngoscope	2	10	A	○	○	1	10	2-3cases/day	6	1B	10	○	10	-	10	-	10	-	6	△	10	○	10	○	82	
10	IU-10	Resuscitation bag set	10	8	5A,5B	○	△	5	9	everyday	6	3B	10	○	10	-	10	-	10	-	6	△	8	△	10	○	79	
11	IU-11	Stretcher	2	10	A	○	○	1	10	everyday	10	-	10	○	10	-	10	-	10	-	10	○	8	△	10	○	88	
12	IU-12	Mobile bronchoscopy	1	6	B	○	×	-		1case/day		-		○		-		-		-		○		○		○	–	
13	IU-13	ICU bed	26	8	20A, 6B	○	△	20	10	everyday	8	6	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
14	IU-14	Infusion pump	5	10	A	○	○	2	10	everyday	10	-	10	○	7	○ (need infusion bag set)	9	△	7	△ (Normal I.V. stand)	10	○	10	○	10	○	83	
15	IU-15	Blood gas analyzer	1	2	C	○	×	-		?		-		△ (staffs in dep has no experience)		○(need reagents)		△		△(Pulse oxymeter)		○		○		○	–	

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				○/×					10		10		10		10		10		10		10		10		10			
Siem Reap PRH																													
(9) Operation theatre																													
1	OT-1	Operation table and their accessories	6	10	A	○	○	6	10	everyday	8	4C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
2	OT-2	Operation light	6	10	A	○	○	6	10	everyday	8	4C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
3	OT-3	Patient monitor	6	10	A	○	○	6	10	everyday	6	2B	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	84	
4	OT-4	Anesthetic machine	6	10	A	○	○	6	10	everyday	7	1B,3C	10	○	7	○ (need anesthetic gas, soda lime, etc.)	9	△	10	-	10	○	10	○	10	○	83	
5	OT-5	Electro surgical unit	6	10	A	○	○	6	10	everyday	8	4C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
6	OT-6	Suction machine	12	8	7A,3B	○	△	6	10	everyday	8	8C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
7	OT-7	Mobile ultrasound machine	1	10	A	○	○	1	10	10cases/day	8	1C	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	86	
8	OT-8	ECG machine	1	6	B	○	×	-	9	1-2cases/day		-		○		△ (need recording paper, etc.)		○		-	10	○	10	○	10	○	–	
9	OT-9	Defibrillator	1	6	B	○	×	-	6	5cases/month		-		○		-		-		-	10	○	10	○	10	○	–	Share with ICU dept.
10	OT-10	Syringe pump	6	10	A	○	○	3	10	1-2cases/day	8	4C	10	○	7	○ (need specific sylinge)	9	△	10	-	10	○	10	○	10	○	84	
11	OT-11	Laryngoscope	6	10	A	○	○	3	10	everyday	6	4B	10	○	10	-	10	-	10	-	6	△	10	○	10	○	82	
12	OT-12	Resuscitation bag set	6	10	A	○	○	3	10	8cases/day	8	8C	10	○	10	-	10	-	10	-	6	△	10	○	10	○	84	
13	OT-13	Stretcher	2	10	A	○	○	2	10	everyday	8	?C	10	○	10	-	10	-	10	-	6	△	8	△	10	○	82	
14	OT-14	Anesthesia cart	6	10	A	○	○	6	10	everyday	10	-	10	○	10	-	10	-	10	-	6	△	10	○	10	○	86	
15	OT-15	Warmer for operation theatre	6	10	A	○	○	3	10	half of total operation	10	-	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
16	OT-16	Tourniquet	2	8	1A, 1B	○	△	1	6	2-5cases/month	10	1D	10	○	10	-	10	-	6	△ (normal tourniquet (non-electrical type))	10	○	8	△	10	○	80	
17	OT-17	Negatoscope	6	10	A	○	○	6	10	everyday	8	4C	10	○	10	-	10	-	10	-	10	○	8	△	10	○	86	
18	OT-18	Furniture set for Operation theatre	6	10	A	○	○	6	10	everyday	8	4C	10	○	10	-	10	-	10	-	6	△	10	○	10	○	84	
(10) Recovery room																													
1	RC-1	Patient monitor	6	10	A	○	○	3	10	everyday	4	2A	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	82	
2	RC-2	Ventilation machine	2	8	1A, 1B	○	△	1	9	1case/day	10	-	10	○	7	△ (need breathing circuit)	9	△	10	-	10	○	10	○	10	○	85	
3	RC-3	Suction machine	2	10	A	○	○	1	10	everyday	8	2B	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
4	RC-4	Defibrillator	1	6	B	○	×	-		1case/day?		-		○		-		-		-		○		○		○	–	Share with ICU dept.
5	RC-5	Laryngoscope	2	8	1A, 1B	○	△	1	9	1case/day?	10	-	10	○	10	-	10	-	10	-	6	△	10	○	10	○	85	
6	RC-6	Resuscitation bag set	2	10	A	○	○	1	9	1-2cases/day	10	-	10	○	10	-	10	-	10	-	6	△	8	△	10	○	83	
7	RC-7	Stretcher	6	10	A	○	○	6	10	everyday	8	?C	10	○	10	-	10	-	10	-	6	△	8	△	10	○	82	
8	RC-8	Emergency cart	1	10	A	○	○	1	10	everyday	10	-	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
(11) Surgery Inpatient																													
1	IP-1	Patient bed	184	10	A	○	○	184	10	everyday	8	?C	10	○	10	-	10	-	10	-	6	△	8	△	10	○	82	
2	IP-2	Rehabilitation equipment set for IPD	1	6	B	○	×	-		everyday		-		○		-		-		△ (Rehabilitation with walking frame)		△		○		○	–	
(12) Surgery Outpatient																													
1	OP-1	ECG machine	1	10	A	○	○	1	10	20cases/day	10	-	10	○	8	△ (need recording paper, etc.)	10	○	10	-	10	○	10	○	10	○	88	
2	OP-2	OPD examination set	4	10	A	○	○	4	10	everyday	8	2B	10	○	10	-	10	-	10	-	6	△	8	△	10	○	82	
3	OP-3	Stethoscope	4	10	A	○	○	2	10	everyday	10	-(use individual equipment)	10	○	10	-	10	-	10	-	6	△	8	△	10	○	84	
4	OP-4	Pulse oximeter	4	10	A	○	○	2	10	all patients	10	-	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
5	OP-5	Glucose test	2	10	A	○	○	2	10	30-40patients	2	1A	10	○	7	△(need reagents.)	10	○	7	△ (measure with biochemistry analyzer in laboratory)	10	○	10	○	10	○	76	
6	OP-6	Blood pressure	4	10	A	○	○	2	10	everyday	2	2A	10	○	10	-	10	-	10	-	6	△	8	△	10	○	76	
7	OP-7	Rehabilitation equipment set for OPD	1	10	A	×	×	-		everyday				○		-		-		-		△		○		○	–	
(13) Imagery																													
1	IM-1	X-ray fixed type	1	10	A	○	○	1	10	50patietns/day	8	2C	10	○	7	△ (need film, etc.)	10	○	10	-	10	○	10	○	10	○	85	
2	IM-2	PACS	1	10	A	○	○	1	10		10	-	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
3	IM-3	Ultrasound machine	2	10	A	○	○	1	10	35-40cases/day	8	1B, 1C	10	○	8	△ (gel, etc., but it is not expensive)	10	○	10	-	10	○	10	○	10	○	86	
(14) CSD														○															
1	CS-1	Autoclave	3	10	A	○	○	2	10	everyday	9	3B, 2D	10	○	10	-	10	-	10	-	10	○	10	○	10	○	89	
2	CS-2	EO Gas sterilization machine	1	6	B	○	×	-		everyday		-		×		○ (need EO gas)		×		△ (Use disinfectant cleaning agent)		○		○		○	–	
3	CS-3	Washing machine	2	10	A	○	○	1	10	everyday	8	3C	10	○	10	-	10	-	10	-	10	○	10	○	10	○	88	
4	CS-4	Dryer machine	2	10	A	○	○	1	10	everyday	10	-	10	○	10	-	10	-	8	△(Drying under sunshine)	10	○	10	○	10	○	88	
5	CS-5	Furniture set for CSD	1	10	A	○	○	1	10	everyday	8	1C(unknown specific Q'ty)	10	○	10	-	10	-	10	-	6	△	8	△	10	○	82	
6	CS-6	Sterilization box set	1	10	A	○	○	1	10	everyday	8	1C	10	○	10	-	10	-	10	-	10	○	8	△	10	○	86	
7	CS-7	Tube washer	1	10	A	○	○	1	10	everyday	10	1C(hand made)	10	○	10	-	10	-	10	-	10	○	10	○	10	○	90	
8	CS-8	Endoscope washer	1	6	B	○	×	-		everyday		-		×		△ (need disinfectant cleaning solution)		△		△ (Soak in disinfectant)		○		○		○	–	

Table 2-24 Evaluation Chart for Equipment Relevance (Kralanh District Hospital)

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Quantitative Assessment				Overall Evaluation	Planned Q'ty
				①	Priority	②	③		
(1) Kralanh District Hospital									
1) Surgery									
1	KR-1	Aspirator, electric	1	×	B	○	○	×	-
2	KR-2	Cart dressing/dispensing	1	○	A	×	×	×	-
3	KR-3	Minor surgery set	2	○	A	○	○	○	1
4	KR-4	Drum sterilizing cylindrical	1	○	A	○	○	○	1
5	KR-5	Oxyflow care	2	○	A	○	○	○	1
6	KR-6	Sterilizer, dressing, pressure type	1	○	A	○	○	○	1
7	KR-7	Scissors plaster	1	○	A	○	○	○	1
8	KR-8	Stretcher army type folding	1	○	A	×	×	×	-
9	KR-9	Operating lamp stand type	1	×	B	○	○	×	-
2) Operation theatre									
1	KR-10	Apparatus anesthesia w/accessories	1	○	A	○	○	○	1
2	KR-11	Aspirator, electric	1	○	A	○	○	○	1
3	KR-12	Adult resuscitator (Ambu bag 6 Mask)	1	○	A	○	○	○	1
4	KR-13	Sterilizer (Autoclave) big capacity	1	○	A	○	○	○	1
5	KR-14	Laryngoscope set	1	○	A	○	○	○	1
6	KR-15	Oxygen flowmeter	1	○	A	○	○	○	1
7	KR-16	Patient Monitor	1	○	A	○	○	○	1
8	KR-17	Stretcher, combination wheel and carry	1	○	A	×	×	×	-
9	KR-18	Sterilizer, table top	1	×	B	○	×	×	-
10	KR-19	Table anesthesia without tray	1	○	A	×	○	×	-
3) Emergency									
1	KR-20	Adult resuscitator	1	×	B	○	○	×	-
2	KR-21	Pediatric resuscitator	1	○	A	○	○	○	1
3	KR-22	Airway, Adult	2	×	B	○	○	×	-
4	KR-23	Airway, Infant	2	○	A	○	○	○	1
5	KR-24	Aspirator, electric	1	○	A	○	○	○	1
6	KR-25	Emergency bed	3	×	B	×	×	×	-
7	KR-26	Laryngoscope set of 3 blades, Adult	1	○	A	○	○	○	1
8	KR-27	ECG Unit	1	○	A	○	○	○	1
9	KR-28	Patient Monitor	2	○	A	○	○	○	1
10	KR-29	Blood pressure machine, manual	2	○	1A,1B	○	×	×	-
11	KR-30	Nebulizer	2	○	1A,1B	○	○	○	1
12	KR-31	Aspirator, manual	1	○	A	○	○	○	1
13	KR-32	Pediatric resuscitator	1	○	A	○	○	○	1
14	KR-33	Airway, children	2	○	A	○	○	○	1
4) Imagery									
1	KR-34	Scanner Ultrasound, portable	1	○	A	○	○	○	1
2	KR-35	X-ray diagnostic table, stand	1	○	A	○	○	○	1
3	KR-36	X-ray dosimeter	3	○	A	○	○	○	3
4	KR-37	ECG Unit	1	○	A	○	○	○	1
5) Laboratory									
1	KR-38	Analyzer (N+,K+,Cl-,Ca+, Mg+)	1	×	B	○	×	×	-
2	KR-39	Biochemistry analyzer	1	○	A	○	×	×	-
3	KR-40	Complete blood count machine	1	×	B	○	×	×	-
4	KR-41	Pipet set	1	○	A	○	×	×	-

Table 2-25 Evaluation Chart for Equipment Relevance (Angkor Chum District Hospital)

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Quantitative Assessment				Overall Evaluation	Planned Q'ty
				①	Priority	②	③		
(2) Angkor Chum District Hospital									
1) Emergency									
1	AC-1	Blood presser machine, automatic	1	○	A	○	○	○	1
2	AC-2	ECG Unit, 6ch.	1	×	B	○	○	×	-
3	AC-3	Laryngoscope	1	○	A	○	○	○	1
4	AC-4	Nebulizer	2	○	A	○	○	○	1
5	AC-5	Oxygen flowmeter	2	○	A	○	○	○	1
6	AC-6	Patient monitor (ECG, Plus any vital sign)	2	○	A	○	○	○	1
7	AC-7	Pulse oxymetry	2	○	A	○	○	○	1
8	AC-8	Suction unit, electric	2	○	A	○	○	○	1
9	AC-9	Diagnostic set	1	○	A	○	○	○	1
10	AC-10	Hematocrit machine	1	○	A	○	×	×	-
11	AC-11	Refrigerator	1	○	A	○	×	×	-
2) Laboratory									
1	AC-12	Analyzer (N+,K+,Cl-,Ca+, Mg+)	1	○	A	○	×	×	-
2	AC-13	Biochemistry analyzer	1	○	A	○	×	×	-
3	AC-14	Complete blood count machine	1	○	A	○	×	×	-
4	AC-15	Coagulator machine (INR) (APTT)	1	○	A	○	×	×	-
5	AC-16	Urine analyzer	1	○	A	○	×	×	-
6	AC-17	Centrifuge	1	○	A	○	×	×	-
7	AC-18	Refrigerator	1	○	A	○	×	×	-
3) Surgery/ Operation Theatre									
1	AC-19	Ultraviolet lamp	1	○	A	○	○	○	1
2	AC-20	Sterilizer (Autoclave), big	1	○	A	○	○	○	1
3	AC-21	Sterilizer (Autoclave), small	1	○	A	○	×	×	-
4	AC-22	Anesthesia apparatus	1	○	A	○	○	○	1
5	AC-23	Cesarean instrument set	1	○	A	○	×	×	-
6	AC-24	Abdominal instrument set	1	○	A	○	○	○	1
7	AC-25	Minor surgery instrument set	2	○	A	○	×	×	-
8	AC-26	Operation table and their accessories	1	○	A	○	○	○	1
9	AC-27	Suction unit	2	○	A	○	○	○	1
10	AC-28	Coagulator (surgical unit)	1	○	A	○	○	○	1
11	AC-29	LED snowholes surgical operating lamp	1	○	A	○	○	○	1
12	AC-30	Defibrilator	1	×	B	○	○	×	-
13	AC-31	Digital ventilation machine	1	×	B	○	○	×	-
14	AC-32	BP machine	1	○	A	○	×	×	-
15	AC-33	Patient monitor (ECG, Plus any vital sign)	1	○	A	○	○	○	1
4) Imagery									
1	AC-34	Ultrasound machine	1	○	A	○	○	○	1
2	AC-35	X-ray Machine	1	○	A	○	○	○	1
3	AC-36	X-ray dosimeter	2	○	A	○	○	○	1

Table 2-26 Evaluation Chart for Equipment Relevance (Pouk District Hospital)

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Quantitative Assessment				Overall Evaluation	Planned Q'ty
				①	Priority	②	③		
(3) Pouk District Hospital									
1) Emergency									
1	PO-1	Blood presser machine, automatic	1	○	A	○	○	○	1
2	PO-2	ECG Unit, 6ch.	1	×	B	○	○	×	-
3	PO-3	Laryngoscope	1	○	A	○	○	○	1
4	PO-4	Nebulizer atomizer w/Electric compressor	4	○	2A,2B	○	○	○	1
5	PO-5	Oxygen flowmeter	3	○	A	○	○	○	1
6	PO-6	Patient monitor (ECG, Plus any vital sign)	3	○	A	○	○	○	1
7	PO-7	Pulse oxymetry	2	○	A	○	○	○	1
8	PO-8	Suction unit, electric	1	○	A	○	○	○	1
9	PO-9	Otoscope	2	○	A	○	○	○	1
2) Laboratory									
1	PO-10	Analyzer (N+,K+,Cl-,Ca+, Mg+)	1	○	A	○	×	×	-
2	PO-11	Biochemistry analyzer	1	○	A	○	×	×	-
3	PO-12	Complete blood count machine	1	○	A	○	×	×	-
4	PO-13	Microscope	1	○	A	×	×	×	-
5	PO-14	GeneXpert	1	○	A	×	×	×	-
3) Surgery/ Operation Theatre									
1	PO-15	Sterilizer (Autoclave), large	1	○	A	○	○	○	1
2	PO-16	Sterilizer (Autoclave), small	1	○	A	○	×	×	-
3	PO-17	Anesthesia apparatus	1	×	B	○	○	○	-
4	PO-18	Cesarean instrument set	1	×	B	○	×	×	-
5	PO-19	Orthopedic instrument set	1	×	B	○	○	×	-
6	PO-20	Operation table and their accessories	1	×	B	○	○	×	-
7	PO-21	Suction unit	2	○	A	○	○	○	1
8	PO-22	Coagulator (surgical unit)	1	○	A	○	○	○	1
4) Imagery									
1	PO-23	Ultrasound machine	1	○	A	○	○	○	1
2	PO-24	X-ray Machine	1	○	A	○	○	○	1
3	PO-25	X-ray dosimeter	2	○	A	○	○	○	2

Table 2-27 Evaluation Chart for Equipment Relevance (Sot Nikum District Hospital)

No. in Dep.	Code No.	Equipment Name	Requested Q'ty	Quantitative Assessment				Overall Evaluation	Planned Q'ty
				①	Priority	②	③		
(4) Sot Nikum District Hospital									
1) Surgery									
1	SO-1	Aspirator, electric	1	○	A	○	○	○	1
2	SO-2	Cart dressing/dispensing	2	○	A	×	○	×	-
3	SO-3	Minor surgery set	1	×	B	○	○	○	-
4	SO-4	Drum sterilizing cylindrical	2	○	A	○	○	○	1
5	SO-5	Oxygen flowmeter	2	○	A	○	○	○	1
6	SO-6	Ultraviolet Lamp	2	○	A	○	×	×	-
7	SO-7	Instrument cart	1	○	A	×	○	×	-
8	SO-8	Mayo table	1	○	A	×	○	×	-
2) Operation theatre									
1	SO-9	Apparatus anesthesia w/accessories	1	×	B	○	○	×	-
2	SO-10	Aspirator, electric	2	○	A	○	○	○	1
3	SO-11	Sterilizer (Autoclave)	1	○	A	○	○	○	1
4	SO-12	Electro surgical unit	1	○	A	○	○	○	1
5	SO-13	Oxygen flowmeter	1	×	B	○	○	×	-
6	SO-14	Patient Monitor	1	○	A	○	○	○	1
7	SO-15	Stretcher, combination wheel and carry	1	○	A	×	×	×	-
8	SO-16	Table anesthesia without tray	1	○	A	×	×	×	-
3) Emergency									
1	SO-17	Adult resuscitator	2	×	B	○	○	×	-
2	SO-18	Airway, Adult	3	○	A	○	○	○	1
3	SO-19	Aspirator, electric	2	○	A	○	○	○	1
4	SO-20	Emergency bed	5	×	B	×	×	×	-
5	SO-21	Patient Monitor	2	○	A	○	○	○	1
6	SO-22	Blood pressure machine	2	○	A	○	×	×	-
7	SO-23	Nebulizer	2	○	A	○	○	○	1
4) Imagery									
1	SO-24	Scanner Ultrasound	1	○	A	○	○	○	1
2	SO-25	X-ray mobile with table, stand	1	○	A	○	○	○	1
3	SO-26	X-ray dosimeter	6	○	A	○	○	○	6
4	SO-27	ECG Unit	1	×	B	○	○	×	-
5) Laboratory									
1	SO-28	Analyzer (N+,K+,Cl-,Ca+, Mg+)	1	○	A	○	×	×	-
2	SO-29	Biochemistry analyzer	1	○	A	○	×	×	-
3	SO-30	Complete blood count machine	1	○	A	○	×	×	-
4	SO-31	Electrophoresis system	1	×	B	○	×	×	-
5	SO-32	Hemoglobin A1C analyzer	1	○	A	×	×	×	-

2) Planned Equipment

As a result of the above study, there are 108 pieces of planned equipment, as shown in Table 2-28.

Table 2-28 Equipment Allocation Chart

No.	Req No.	Equipment	Provincial hospital Q'ty		Regional hospital Q'ty		Siem Reap PRH												Sotnikum					Kralanh					Puok				Angkor Chum			
							Traumatology	Urology	Abdominal	Neurosurgery	ENT	Emergency	Surgery ICU	Operation theatre	Recovery room	Surgery Inpatient	Surgery Outpatient	Imagery	CSD	Surgery	Operation theatre	Emergency	Imagery	Laboratory	Surgery	Operation theatre	Emergency	Imagery	Laboratory	Surgery	Emergency	Imagery	Laboratory	Surgery	Emergency	Imagery	Laboratory
1	S-1	C-arm	1	Set			1																												
2	S-2	Arthroscope with knee operation instrument set	1	Set			1																												
3	S-3	Hip prosthesis instrument set	1	Set			1																												
4	S-4	Accessory set for operationtable of orthopedic surgery	1	Set			1																												
5	S-5	Orthopedic traction accessories for bed	10	Sets			10																												
6	S-8	Large fragment surgery instrument set	1	Set			1																												
7	S-9	Small fragment surgery instrument set	1	Set			1																												
8	S-12	DHS/DCS instrument set	1	Set			1																												
9	S-13	Gamma 3 nail instrument set	1	Set			1																												
10	S-15	Plaster remove set	1	Set			1																												
11	S-17	Cystofiberscope for exaamination	1	Set				1																											
12	S-18	Cystoscope (Ligid)	1	Set				1																											
13	S-19	Resectoscope	1	Set				1																											
14	S-20	Urerthrofiberscope	1	Set				1																											
15	S-21	Laser surgical unit	1	Set				1																											
16	S-22	Examination table for urology	1	Set				1																											
17	S-23	Surgical headlight	1	Set					1																										
18	S-24	Abdominal surgical instrument set	3	Sets					3																										
19	S-25	Chest surgical instrument set	1	Set					1																										
20	S-26	Surgical laparoscopic equipment	1	Set					1																										
21	S-29	Gastroscope set	1	Set					1																										
22	S-30	Ultrasound machine	2	Sets					1										1																
23	S-31	Lumbar spine surgery instrument set	1	Set						1																									
24	S-32	Neurology/ Craniotomy surgery instrument set/ Fast drill	1	Set						1																									
25	S-33	ENT Surgical instrument set	1	Set							1																								
26	S-34	ENT unit	1	Set							1																								
27	S-35	ENT examination set	1	Set							1																								
28	S-36	Operationg light mobile	1	Set								1																							
29	S-37	Patient monitor	24	Sets								5	10	6	3																				
30	S-38	Ventilation machine	4	Sets								1	2		1																				
31	S-39	Suction machine	13	Sets								2	4	6	1																				
32	S-40	Mobile ultrasound machine	3	Sets								1	1	1																					
33	S-41	Mobile X-ray	2	Sets								1	1																						
34	S-42	ECG machine	3	Sets								1	1													1									
35	S-43	Syringe pump	10	Sets								2	5	3																					
36	S-44	Laryngoscope	6	Sets								1	1	3	1																				
37	S-45	Emergency bed	17	Sets								17																							
38	S-52	Defibrillator	1	Set									1																						
39	S-55	Resuscitation bag set	9	Sets									5	3	1																				
40	S-56	Stretcher	9	Sets									1	2	6																				
41	S-57	ICU bed	22	Sets									22																						
42	S-58	Infusion pump	2	Sets									2																						
43	S-59	Operation table and their accessories	6	Sets										6																					
44	S-60	Operation light	6	Sets										6																					
45	S-62	Anesthetic machine	6	Sets										6																					
46	S-63	Electro surgical unit	6	Sets										6																					
47	S-70	Anesthesia cart	6	Sets										6																					
48	S-71	Warmer for operation theatre	3	Sets										3																					
49	S-72	Tourniquet	1	Set										1																					
50	S-73	Negatoscope	6	Sets										6																					
51	S-74	Furniture set for Operation theatre	6	Sets										6																					
52	S-81	Emergency cart	1	Set											1																					
53	S-82	Patient bed	189	Sets												189																				
54	S-83	Rehabilitation equipment set for IPD	1	Set												1																				
55	S-85	OPD examination set	4	Sets													4																			
56	S-86	Stetoscope	2	Sets													2																			
57	S-87	Pulse oxymeter	2	Sets													2																			
58	S-90	X-ray fixed type	1	Set														1																		
59	S-91	PACS	1	Set														1																		
60	S-93	Autoclave	1	Set															1																	
61	S-94	Washing machine	2	Sets															2																	
62	S-95	Dryer machine	1	Set															1																	
63	S-96	Furniture set for CSD	1	Set															1																	
64	S-97	Sterilyzation box set	1	Set															1																	
65	S-98	Tube washer	1	Set															1																	
66	S-99	Furniture set for examination rooms	1	Set														1																		
67	G-1	Suction machine (electric)			9	Sets														1	1	1			1	1			1	1			1	1		
68	G-2	Sterilizing Drum set (cylindrical)			2	Sets														1					1										
69	G-3	Oxygen Treatment equipment set			5	Sets														1					1	1				1				1	
70	G-4	Autoclave			5	Sets															1				1	1			1				1		
71	G-5	Electro surgical unit			3	Sets															1								1				1		
72	G-6	Patient Monitor			7	Sets															1	1			1	1				1			1	1	
73	G-7	Airway (Adult)			1	Set																1													
74	G-8	Nebulizer			4	Sets																1				1				1				1	
75	G-9	Ultrasound Scanner			4	Sets																	1				1			1					1
76	G-10	X-ray Machine (mobile with table & stand)			4	Sets																	1				1			1					1
77	G-11	X-ray dosimeter			13	Sets																	6				3			2					2
78	G-15	Minor surgery instrument set			1	Set																		1											
79	G-16	Plaster Scissors			1	Set																		1											
80	G-17	Anesthesia machine			2	Sets																			1								1		
81	G-18	Ambu bag (Adult)			1	Set																			1										
82	G-19	Laryngoscope set			4	Sets																			1	1			1					1	
83	G-20	Ambu bag (Pediatric)			1	Set																				1									
84	G-21	Airway (Infant)			1	Set																				1									
85	G-22	ECG Unit			2	Sets																				1	1								
86	G-23	Suction machine (manual)			1	Set																				1									
87	G-24	Ambu bag (Infant)			1	Set																				1									
88	G-25	Airway (pediatric)			1	Set																				1									
89	G-26	Blood presser machine (automatic)			2	Sets																								1				1	
90	G-27	Pulse oxymeter			2	Sets																								1				1	
91	G-28	Diagnostic instrument set			2	Sets																								1				1	
92	G-31	Ultraviolet lamp			1	Set																											1		
93	G-32	Abdominal operation instrument set			1	Set																											1		
94	G-33	Operating table			1	Set																											1		
95	G-34	Operating Light (Mobile)			1	Set																											1		

3) Three-year Maintenance Contract

To prevent a situation in which equipment malfunctions becomes unusable, and is left in that state relatively soon after it is delivered, a two-year maintenance contract following the expiry of the one-year warranty period will be included for equipment that requires maintenance performed by the manufacturer or sales agent. For equipment eligible for maintenance contracts, services are determined for each piece of equipment and included in the contract; this may include on-call service, periodic maintenance, and the cost of repair parts and replacement parts. These maintenance contract costs will be borne by the Japanese side, and the maintenance contract work will be the responsibility of the procurement contractor.

Furthermore, all consumables such as the reagents and disposable parts necessary each time the equipment is used will be the responsibility of the Cambodian side. Equipment failure due to user error will not be covered by the maintenance contracts.

Selection Criteria

① Equipment for which accidents can be expected to be fatal to patients
Equipment for which there is no alternative. If this equipment becomes unusable due to malfunction, a serious medical accident is expected.

② High-priced equipment
Equipment that is considered difficult to handle due to the high cost of repairs and maintenance, in addition to the price of the equipment itself.

③ Equipment that breaks down frequently while in operation
Equipment such as lab equipment with delicate drive parts (has a fine structure such as narrow flow path for samples or reagents to pass through) that must be inspected by a specialized technician, requires the regular replacement of consumable parts, and calibration of measured values, in addition to daily maintenance and inspection.

Target Equipment

As a result of the above review, the equipment eligible for this service and the number of times maintenance is thought to be appropriate for each piece of equipment is shown in Table 2-29.

Table 2-29 Three-year Maintenance Contract Review Chart

Equip. no.	Request no.	Name of equipment	Quantity for provincial hospital		Quantity for district hospitals		Periodic maintenance: No. of times per year per device	On-call service: Max no. of times per year per device	Remarks
68	S-91	PACS	1	set			0	5	
84	G-10	X-ray machine (mobile type)			4	sets	0	5	Only CR system eligible for maintenance contract

4) Implementation of Remote Diagnosis

The study results confirmed there was a significant difference in clinical levels between provincial and district hospitals. In fact, basic surgery cannot be performed at district hospitals, and patients who need surgery basically go to the provincial hospital. Sometimes patients who are seen at district hospitals are referred to the provincial hospital, but in most cases, it is thought patients themselves decide that district hospitals cannot handle their treatment and go directly to the provincial hospital first (district hospital directors had the same opinion.) Therefore, simply supplying equipment to district hospitals will not significantly improve the level of medical treatment at these hospitals. From this aspect, after confirming the possibility of introducing remote medicine (telemedicine) with the director of the Provincial Health Department, it was determined that it is possible for the provincial hospital to provide technical support to district hospitals. It is also possible for the doctor in charge at the provincial hospital to provide support for diagnosing patients using X-ray images and test results obtained at district hospitals. In addition, it was determined that doctors from the provincial hospital can be dispatched to district hospitals (periodically or spot coverage) to provide support for operations, etc.

Based on these results, the equipment plan for the Project was premised on transferring medical imagery and lab testing data via email. Specifically, data is exchanged with each district hospital using an externally connected PC (connected via internet) installed at the provincial hospital. At the district hospitals, X-ray equipment will be set up for digital image processing, and along with images from ultrasound diagnostic equipment, this data can be forwarded to Siem Reap Provincial Referral Hospital via internet. For the internet connection at district hospitals, the use of mobile routers will be studied.

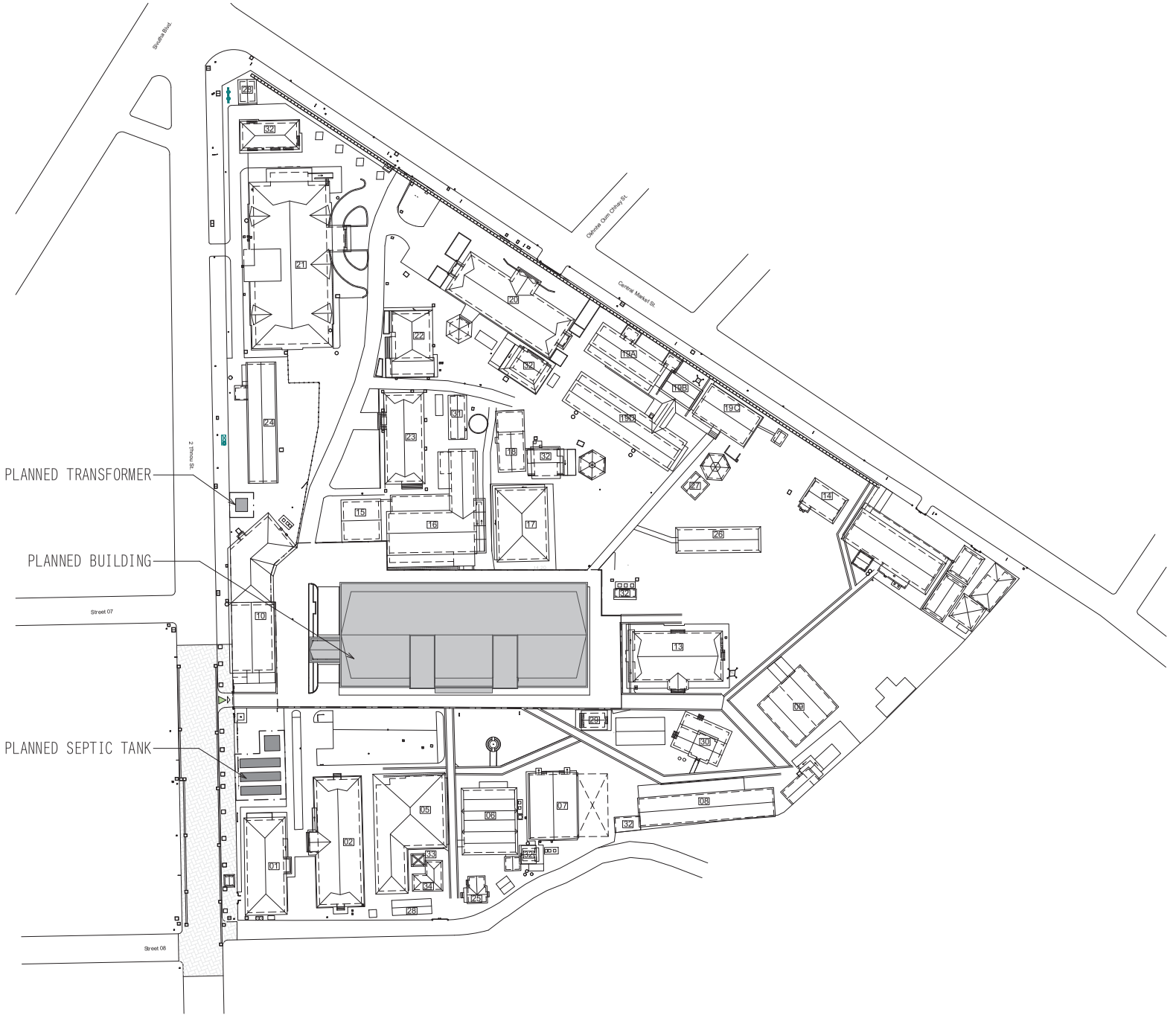
Furthermore, a market survey on telemedicine confirmed that there are already U.S. service providers operating in Phnom Penh.

2-2-3 Outline Design Drawings

Table 2-30 Outline Design Drawings

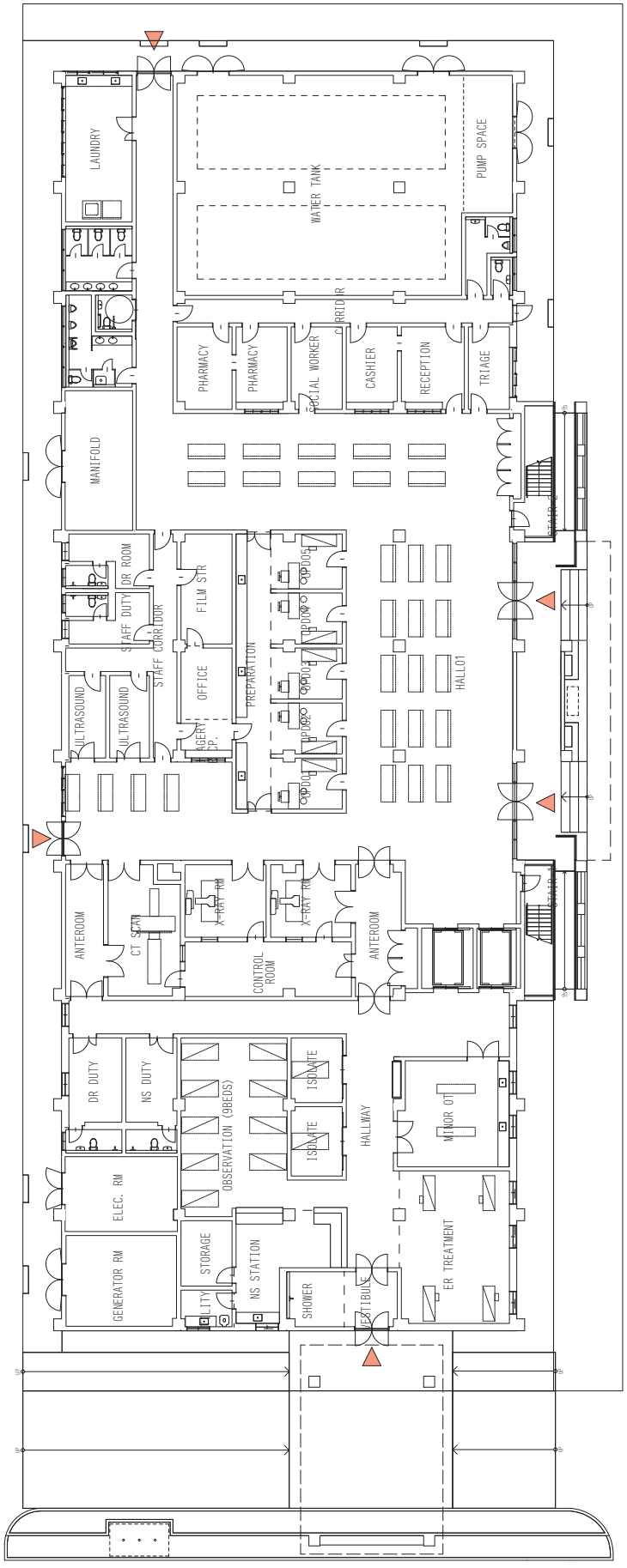
No.	Name of ward or department	Name of drawing	Scale
A-1	Entire hospital	Overall Layout Drawing	A3: 1/1,200
A-2	Emergency outpatient, general outpatient, imagery	GF Floor Plan	A3: 1/250
A-3	ICU, operating rooms, central materials	1F Floor Plan	A3: 1/250
A-4	Surgery inpatient ward (trauma, orthopedics, plastic surgery, burns, ENT, maxillofacial)	2F Floor Plan	A3: 1/250
A-5	Surgery inpatient ward (abdominal, thoracic, urology, neurology)	3F Floor Plan	A3: 1/250
A-6	Elevator machine room, storage	4F Floor Plan	A3: 1/250
A-7	Elevated water tank room	Tower Floor Plan	A3: 1/250
A-8	Roof	Roof Plan	A3: 1/250
A-9	South elevation/west elevation	South / west elevation	A3: 1/250
A-10	North elevation/east elevation	North / east elevation	A3: 1/250
A-11	Cross section	Cross Section Plan	A3: 1/250

01 HEMODIALYSIS/DENTAL
02 BLOOD BANK
05 GENERAL MEDICINE A
06 HOSPITAL OFFICE
07 SURGERY A
08 DRUG STORAGE
09 OLD STORAGE
10 OPD & EMERGENCY
13 ICU SURGERY
14 PHYSIOTHERAPY(NOT IN USE)
15 X-RAY & ULTRASOUND
16 OT/SURGERY C/ENT
17 SURGERY WARD
18 WORKSHOP
19 TB WARD
20 OPTHALMOLOGY
21 OB/GY & PEDIATRIC
22 TRAINING CENTER
23 LABORATORY
24 HIV/AIDS CONSULTATION
25 MORTUARY
26 OLD WOODEN HOUSE
27 OLD WOODEN HOUSE
28 GENERATOR HOUSE
29 WATER PURIFICATION CENTER
30 FORMER LABORATORY(NOT IN USE)
31 LAUNDRY HOUSE
32 TOILET
33 ELEVATED WATER TANK
34 BUDDHIST HOUSE



2-56

	SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	10000 50000 N	1/1, 200
	SITE PLAN	0 20000	A-1



SIEM REAP PROVNICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA

FLOOR PLAN - GROUND FLOOR

1/250

A-2

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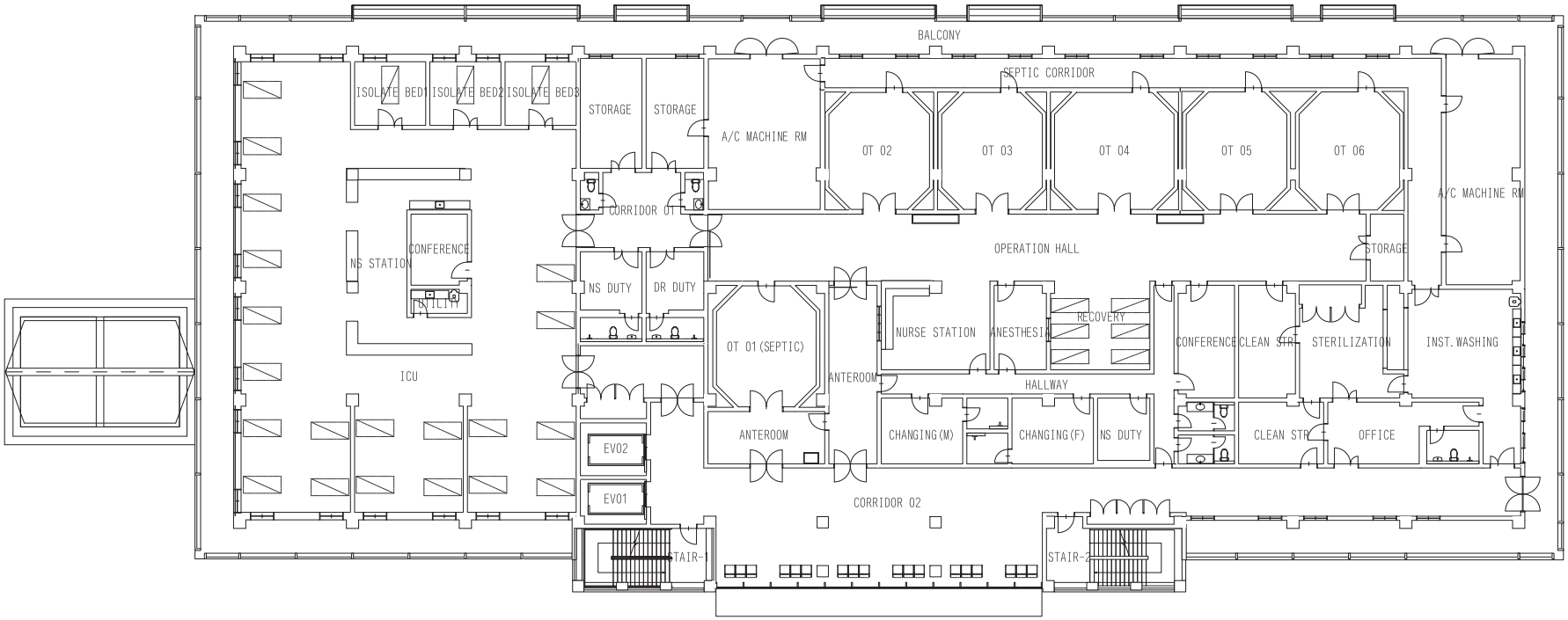
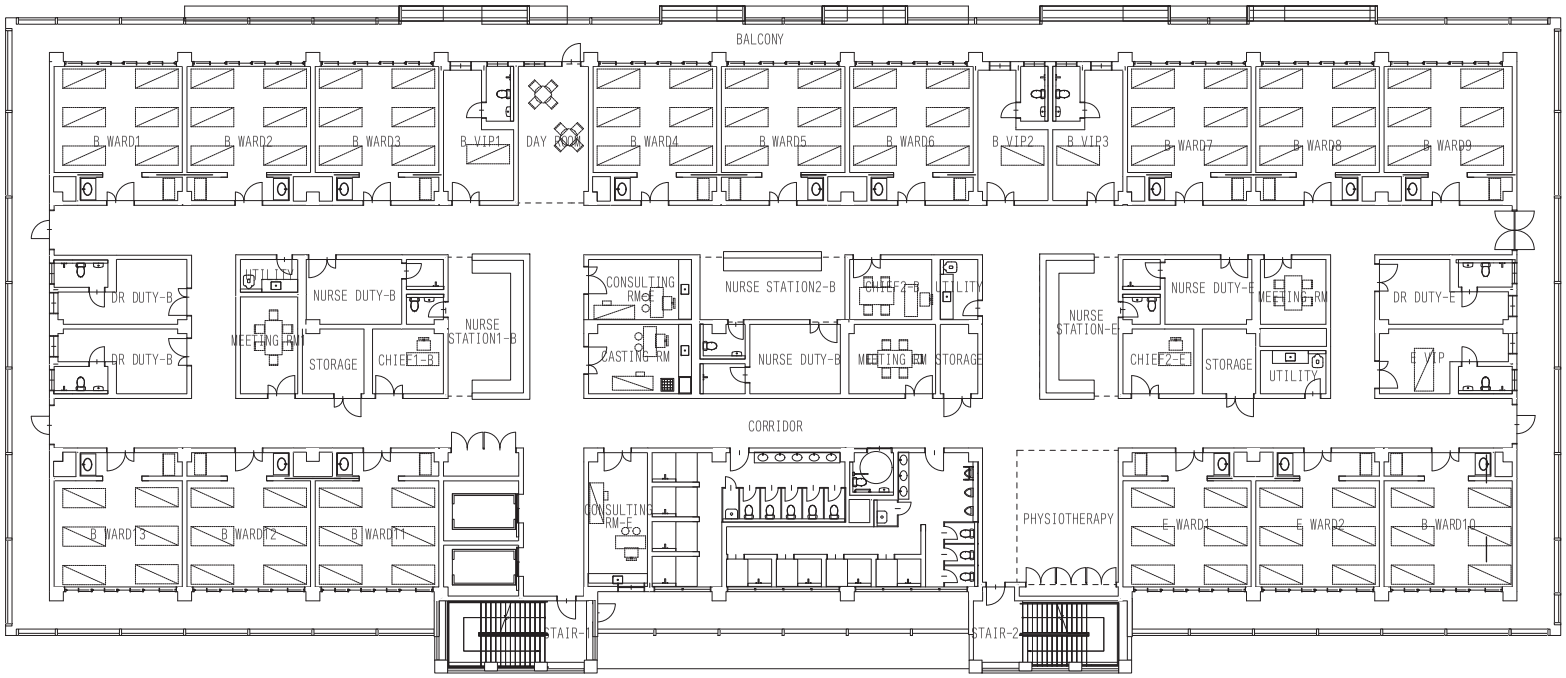
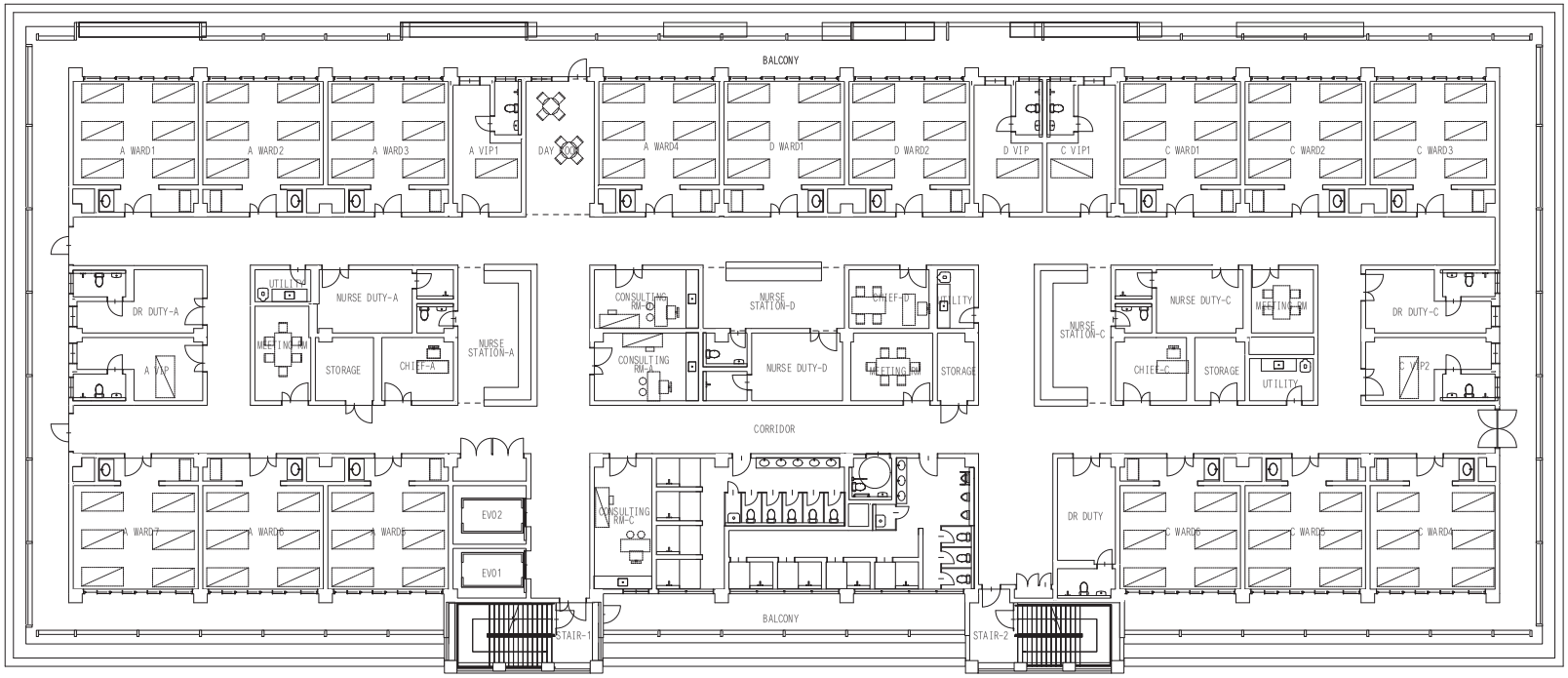


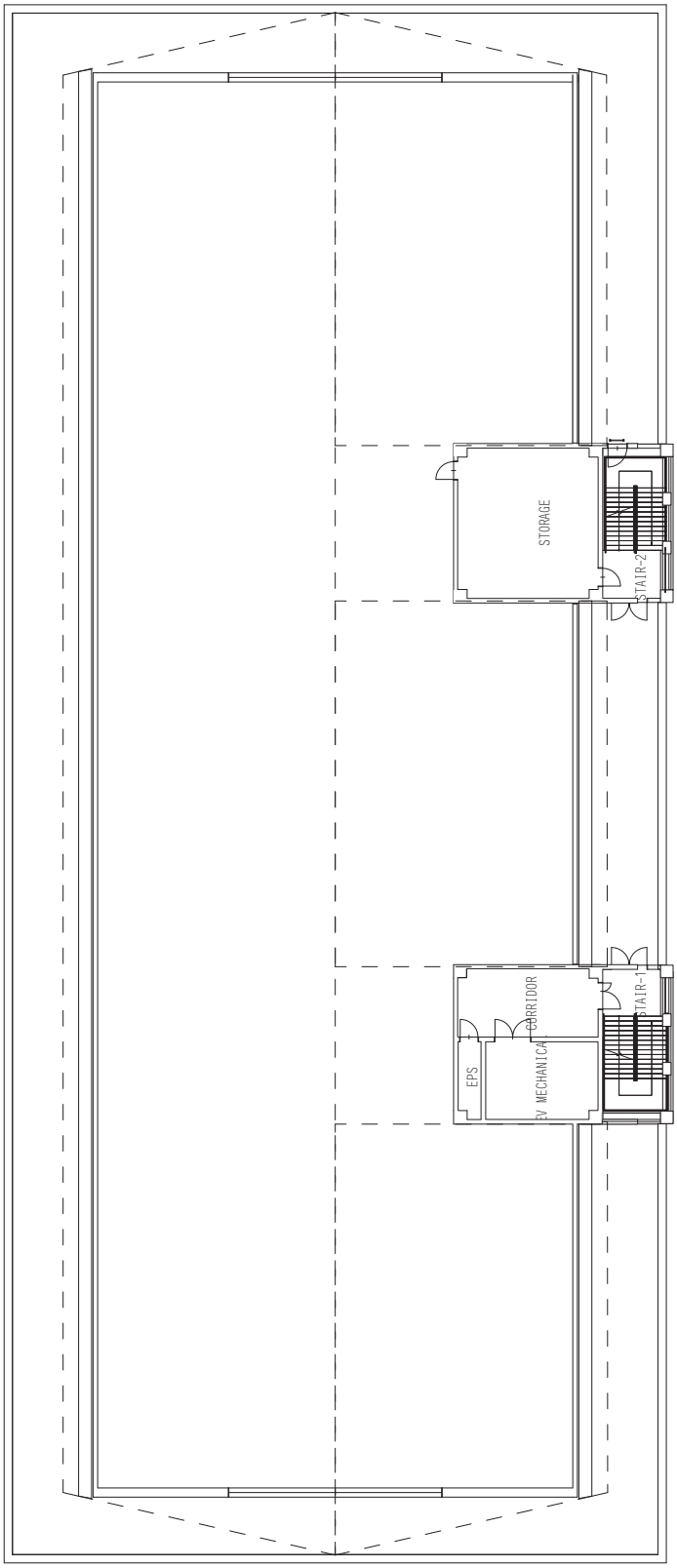
	SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000 N	1/250
	FLOOR PLAN - 1ST FLOOR		A-3



	SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000 N	1/250
	FLOOR PLAN -2ND FLOOR		A-4



SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000	N	1/250
FLOOR PLAN - 3RD FLOOR			A-5



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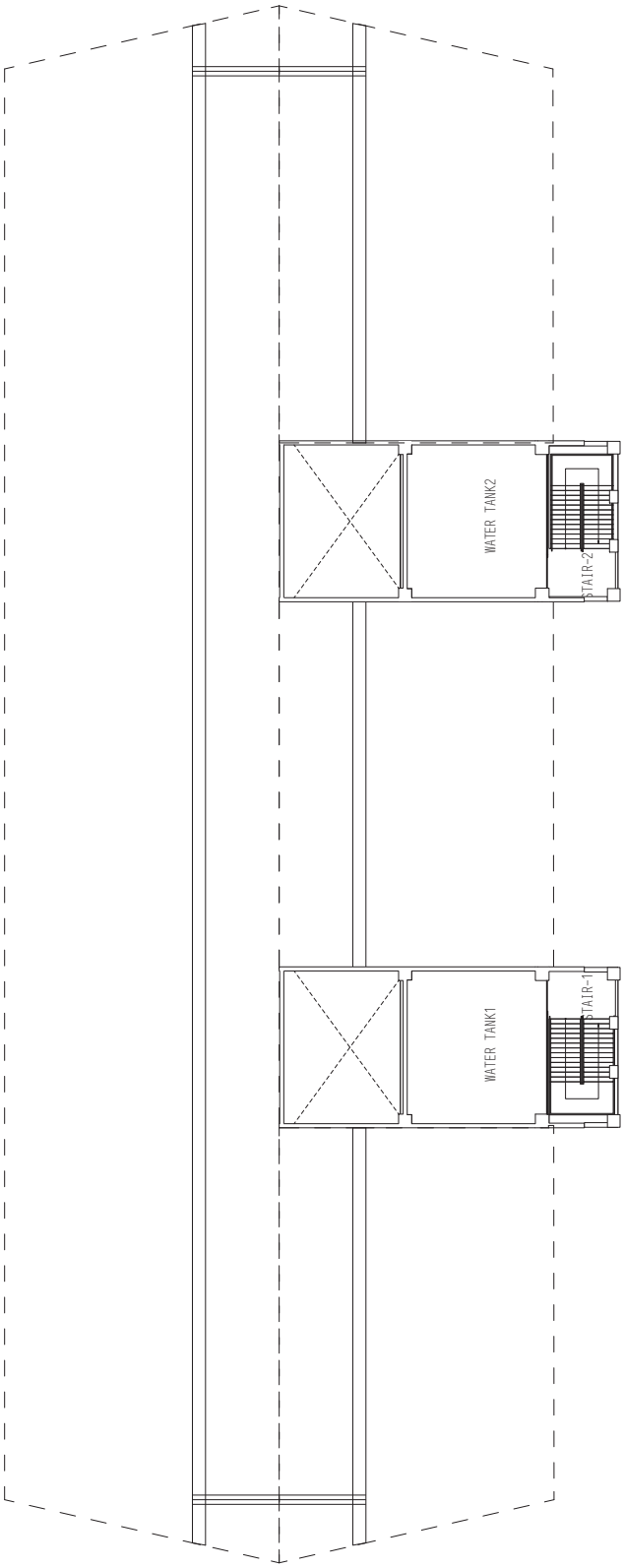
SIEM REAP PROVINCIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA

LOOR PLAN - 4TH FLOOR



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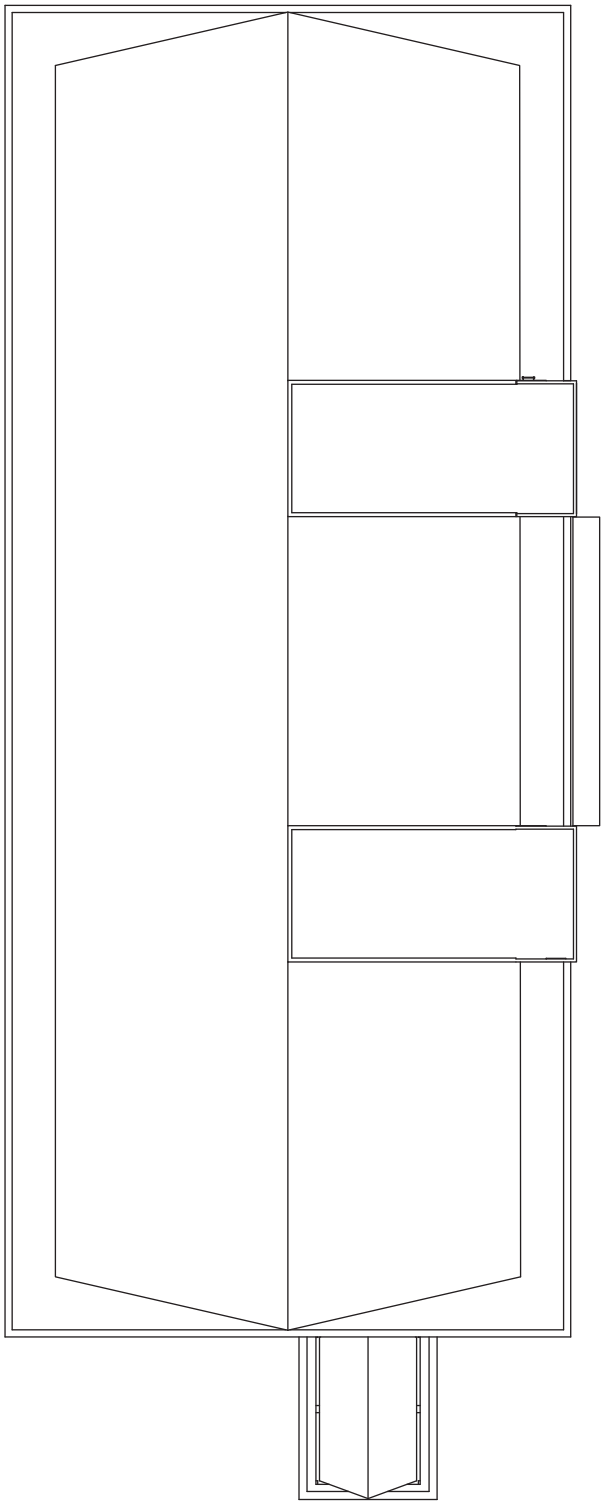
SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA

PENTHOUSE FLOOR



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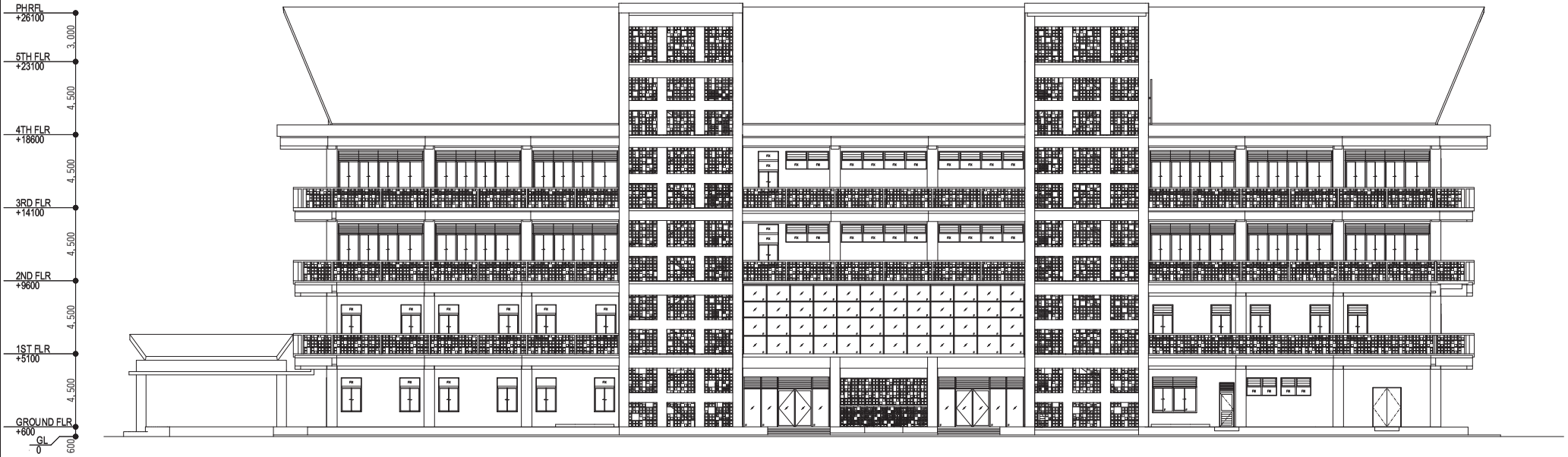
SIEM REAP PROVNICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA

ROOF PLAN



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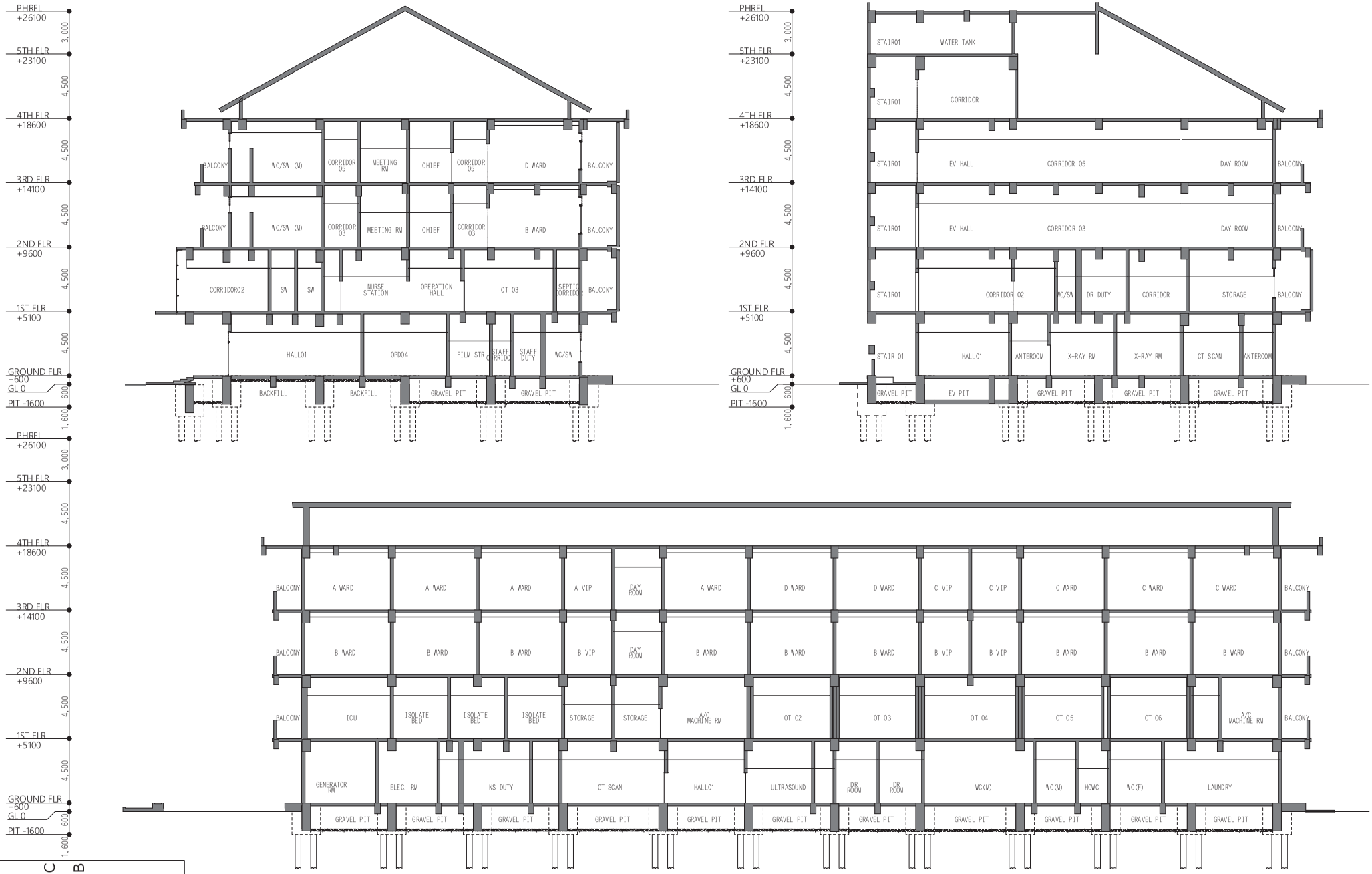
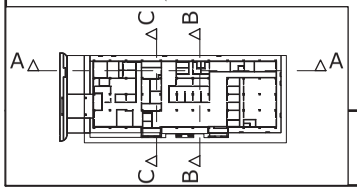
	SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000 N	1/250
	SOUTH AND WEST ELEVATIONS		A-9

2-65

	SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000 N	1/250
	NORTH AND EAST ELEVATIONS		A-10





SIEM REAP PRONVICIAL REFERRAL HOSPITAL, KINGDOME OF CAMBODIA	1000 5000 / 0 3000 10000 N	1/250
SECTION		A-11

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Project consists of facility construction work and equipment procurement and installation work. The scope of cooperation from the Japanese side for the Project will be implemented in accordance with the Grant Aid framework of the Government of Japan. The Project will be formally implemented after both governments have approved its implementation and signed the Exchange of Notes (E/N) and the Grant Agreement (G/A). After the signing of the E/N and G/A, a consultant contract shall be swiftly concluded between the implementing agency on the Cambodian side and a Japanese consultant company, upon which implementation design work for the Project will begin. After the implementation design is completed, bidding for Japanese construction contractors and equipment procurement/installation contractors will be conducted. Facility construction work and equipment procurement/installation work will then be implemented by the respective contractors determined by the bidding process. The basic items for implementation of the Project and matters that should be considered are as follows.

1) Implementing Agency

The implementing agency of this project is the Ministry of Health (MOH) of Cambodia. The Siem Reap Provincial Health Department (PHD), Siem Reap Provincial Hospital, Kralanh District Hospital, Angkor Chum District Hospital, Pouk District Hospital, and Sot Nikum District Hospital are responsible for operating and maintaining the facilities built and equipment procured by Japan.

2) Consultant

After the signing of the E/N and G/A by the governments of both countries, the Japanese Consultant will immediately conclude a consultant contract with the implementing agency of the Cambodian side, in accordance with the procedures for Japanese Grant Aid. In accordance with this contract, the following work will be implemented.

① Implementation design: Creation of implementation design documents (specifications related to facilities and equipment included in the Project and technical documents)

② Bidding work assistance: Assistance in the selection of construction contractors and equipment procurement/installation contractors through bidding, and work related to contracting conducted by the implementing agency

③ Construction/procurement supervision: Supervision of facility construction work and equipment procurement, installation, operational guidance, and maintenance instruction

④ Inspections for defects and inspections prior to expiration of the manufacturer's warranty period: Work related to inspections for facility defects one year after completion of construction and handover of the facilities, and inspections of equipment prior to expiration of the one-year warranty period

"Implementation design" refers to a process in which, based on this preparatory survey, the details of the architectural plan and the equipment plan will be decided, and bidding documents consisting of specification sheets, bidding conditions, and contract drafts for construction work and equipment

procurement will be prepared.

"Bidding work assistance" refers to being present for the selection of construction contractors and equipment procurement/installation contractors through bidding conducted by the implementing agency, assistance in administrative processes required by each contract, and assistance in making reports to the Government of Japan.

"Construction/procurement supervision" refers to checking whether or not the work by the construction contractor and equipment procurement/installation contractor is being implemented in accordance with the contract, and confirming the appropriate execution of the content of the contract. Furthermore, in order facilitate Project implementation, we shall provide advice and guidance to stakeholders and perform coordination between relevant parties from a neutral position, with the main duties listed below.

① Verification and approval procedures for construction plans, construction drawings, equipment specification sheets, and other drawings submitted by the construction contractor and equipment procurement/installation contractor.
② Pre-shipment inspection and approval of procured construction materials and equipment, and quality and performance of equipment.
③ Checking building facility equipment, equipment procurement/installation, and instructions for use.
④ Assessing and reporting construction progress.
⑤ Being present for handover and delivery of the completed facilities/equipment.

In addition to engaging in the work above, the Consultant will report on the progress of the Project, payment procedures, and completion/handover, etc. to the relevant agencies of the Government of Japan.

3) Construction Work Contractors and Equipment Procurement/Installation Contractors

The construction contractor and procurement contractor will be selected through open bidding among Japanese companies with certain qualifications. In principle, successful bidders will be determined after negotiations with the lowest bidder, upon which they will conclude a construction contract and procurement contract with the Cambodian Ministry of Health.

Based on the contract, the construction work contractor and equipment procurement contractor will build the facilities and supply, deliver, and install the necessary equipment and construction materials/equipment. They will also provide technical guidance to the Cambodian side regarding operation and maintenance of the procured equipment. Moreover, in order to ensure that the equipment can be used continuously after procurement, in addition to the one-year manufacturer's warranty, periodic inspection services for three years after delivery, as well as on-site on-call inspection services and the provision of repair/replacement parts for two years after the manufacturer's warranty period ends will be included in the contracts with procurement contractors, manufacturers, and sales agents. They will also be instructed to secure a supply system for the consumables necessary for each piece of equipment. Support will be provided so that services such as paid repair work and technical guidance may also be received after the aforementioned warranty period has ended.

4) Japan International Cooperation Agency

The Japan International Cooperation Agency (JICA) will advise the Consultant to ensure that the

Project is appropriately implemented in accordance with Japanese Grant Aid schemes. In addition, JICA will hold discussions with the implementing agencies of the Project as necessary to facilitate implementation.

5) Formulation of Execution Plan

Examination of the execution plan will be conducted between relevant parties of the Cambodian implementing agency and the Consultant during the implementation design period. Additionally, the responsibilities of both the Japanese side and the Cambodian side will be clarified, the timing for the start of each work item and the methods to be used will be confirmed, and discussion will be held so that the work on both sides is conducted smoothly, based on the implementation schedule of this report. In particular, construction site preparation and the removal of existing facilities are responsibilities of the Cambodian side, which they must complete prior to the start of facility construction work. These work items must be performed without fail.

2-2-4-2 Implementation Conditions

The following points of note must be considered when formulating the implementation plan for the Project.

1) Schedule Management

The planned construction site is in a region where there is heavy rainfall, with a rainy season from May to October. Therefore, the construction schedule must have some leeway, with the rainy season being avoided to the greatest extent possible, especially for root cutting work and foundation work. Additionally, quality must be secured by creating a construction schedule that takes into account necessary curing times for concrete work, plastering work, and painting, etc.

2) Dispatch of Equipment Installation Engineers

In order for the procured equipment to operate properly and continuously, and to be fully utilized after the Project is implemented, equipment users must fully understand the appropriate operation and maintenance methods of the equipment. Therefore, equipment installation engineers who are proficient at handling the equipment should be chosen, and they should dedicate a sufficient amount of time to explaining its use (operational techniques, simple repair skills and inspection methods, etc.). This explanation should be done while confirming that personnel on the receiving side have a thorough understanding of it.

3) Safety Management

Since construction work for the Project will be performed on the premises of a currently operating hospital, a thorough safety management system is necessary. A temporary enclosure will thus be set up to clearly divide the existing facilities from the construction site, and workers will also be allocated to guide construction personnel and vehicles. Scaffolding will also be set up to provide adequate safety for workers and the surroundings, and to ensure workability. The safety standard conforms to the Guidance for the Management of Safety for Construction Works in Japanese ODA Projects of JICA.

2-2-4-3 Scope of Works

The Project will be implemented with mutual cooperation between Japan and Cambodia. If the Project is implemented with Japanese Grant Aid, the scope of the work responsibilities for each government is as follows.

1) Responsibilities of the Government of Japan

The Japanese side shall be responsible for funding the following work related to consulting, facility construction, and equipment procurement/installation for the Project.

① Consultant work

i. Creation of implementation design documents and bidding documents for the facilities and equipment covered by the Project
ii. Assistance in the selection of construction contractors and equipment procurement/installation contractors, and work related to contracting.
iii. Supervision of facility construction work and equipment procurement, installation, operational guidance, and maintenance instruction.
iv. Inspections for defects and inspections prior to expiration of the manufacturer's warranty period.

② Facility construction and equipment procurement/installation

i. Construction of facilities covered by the Project
ii. Procurement of equipment and construction materials for facilities covered by the Project and their transport and move-in to the target facility
iii. Installation guidance and test operation/adjustments of equipment covered by the Project
iv. Explanation/guidance on operation and maintenance methods for equipment covered by the Project

2) Responsibilities of the Government of Cambodia

The Government of Cambodia will be responsible for implementing the following tasks related to land preparation on the construction site, removal of existing facilities, infrastructure lead-in to the construction site, and tax exemption measures.

① Banking arrangements and issuance of payment authorizations

② Preparation of construction site

i. Securing land for the construction site and temporary site
ii. Removal of existing buildings, facilities, infrastructure, buried objects, trees, etc. on the planned construction site
iii. Land preparation/levelling at the planned construction site
iv. Search and removal landmines and unexploded ordinances
v. Lead-in work for electricity and water supply lines to Project facilities and applications procedures for such

③ Exterior construction

i. Planting work

④ Renovation work

i. Renovation work related to the use of existing facilities

⑤ Purchase or relocation of medical equipment, furniture, and other furnishings that should be procured by the Cambodian side

⑥ Exemption from customs duties, internal taxes, and various financial burdens on the purchase of goods and the provision of services by Japanese workers under a certified contract.

⑦ Provision of support for ensuring swift customs and inland transport procedures for equipment and materials imported from Japan or other foreign country through a certified contract.

⑧ Provision of necessary immigration/visa support for Japanese personnel entering and staying in Cambodia who are engaged in work related to project implementation.

⑨ Issuance of various permissions necessary for Project implementation.

⑩ Provision of all necessary costs apart from those falling under the responsibility of the Japanese side.

2-2-4-4 Consultant Supervision

1) Construction Supervision Policy

Based on the policies of Japanese Grant Aid and to enable work to be implemented smoothly, the Consultant will follow the intent of the Outline Design to form an integrated project team to engage in the Project, including implementation design work, and perform construction supervision for the Project based on the following policies.

① Meticulous reporting shall be performed so that the stakeholders of both countries are always aware of the status of construction work and equipment procurement.

② Guidance and advice shall be provided to the construction work contractors and equipment procurement/installation contractors from an impartial standpoint.

③ In order to avoid problems on the site, facility construction work and equipment procurement/installation work will be fully coordinated.

④ When handing over the facilities and equipment, it will be confirmed that all of the construction work and equipment procurement/installation work has been completed.

⑤ Thorough explanations regarding the operation and maintenance of equipment and facilities shall be provided to their users.

2) Construction Supervision Plan

Due the diverse range of work items in the Project, one resident supervisor (architectural officer) will be assigned, and the following engineers will be dispatched in a timely manner, according to the progress of the construction work.

① Chief consultant (overall coordination, supervises construction schedule)

② Architectural officer (communicates design intent, checks construction materials and methods)

③ Structural officer (checks ground, foundation work, framework)

④ Electrical officer (communicates design intent, checks construction materials and methods)

⑤ Mechanical officer (communicates design intent, checks construction materials and methods)

⑥ Equipment officer (checks equipment procurement and installation, coordinates with facility construction work, checks operation and maintenance explanations)

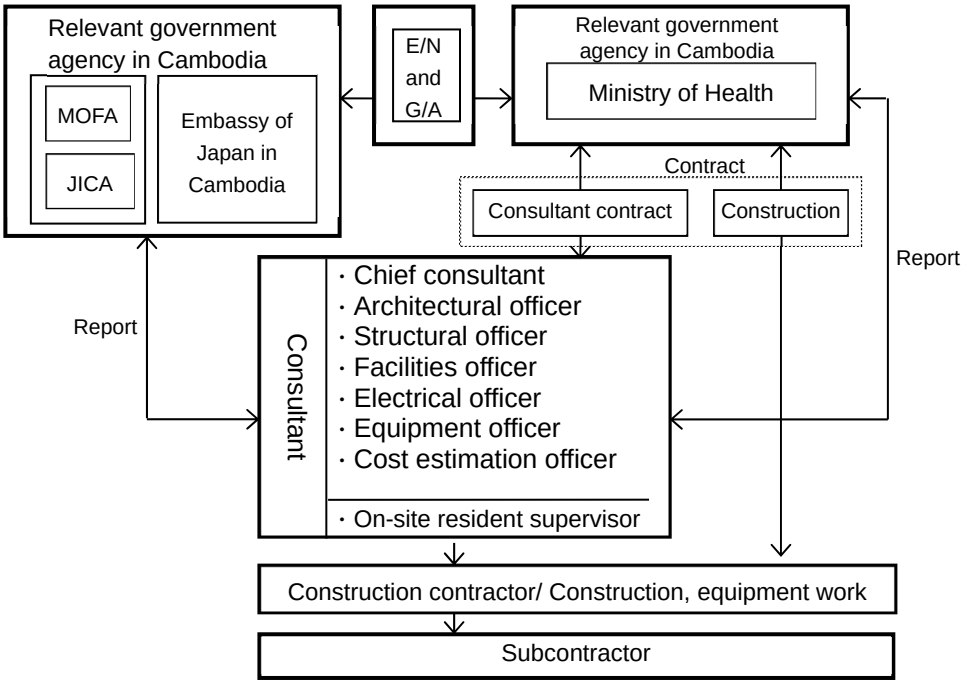


Figure 2-13 Construction Supervision System

3) Monitoring of Implementation of Maintenance Services by the Contractor after Handover

The equipment officer will visit the hospital and equipment sales agents once per year for a period of three years after delivery/handover of the equipment, confirm the status of maintenance services included in the procurement contract, and report the findings to the Ministry of Health, the hospital, and JICA.

2-2-4-5 Quality Control Plan

1) Quality Control Plan for Facilities

The construction contractor will submit construction plan documents to the Consultant in advance, in accordance with the construction contract (drawings, specification sheets, etc.). At the start of construction, the Consultant will check the validity of the construction plan, set specific inspection items and frequency, and work to ensure good quality control.

The main supervision items are shown below.

① Materials

Construction materials will be received and inspected by the on-site resident supervisor. The items to be checked for the main materials are shown below.

- Rebar mill test certificate, stamp, tensile/bending test results
- Cement test report (chemical composition, physical test)
- Aggregate test report (sieving, density/water supply rate, unit volume mass, organic impurities, abrasion, fine particle content, clay mass, chloride content)
- Fresh concrete mix proportion plan, test mix, acceptance test (slump, flow, air content, temperature, chloride ion concentration, mass), compressive strength test

② Control standards

The Consultant will supervise construction according to the management standards based on the approved construction plan. In principle, management standards will be based on in order 1. the Japanese Architectural Standard Specification for Public Buildings of Ministry of Land, Infrastructure, Transport and Tourism of Japan, 2. Japanese Architectural Standard Specification "JASS" of Architectural Institute of Japan, and be conformed to the construction situation of Cambodia.

③ Bearing capacity of soil

To confirm the bearing capacity of the soil, a flat plate loading test will be conducted on site, in the presence of the resident supervisor.

2) Quality Control Plan for Equipment

The medical equipment planned for procurement in the project will be selected as ready-made products that conform to international standards such as JIS, UL, IEC, and ISO. In addition, consistency between the procured equipment and content of the contract will be confirmed through inspections prior to shipment. The content of the shipment and packaging will be inspected by a third-party organization.

2-2-4-6 Procurement Plan

1) Construction Materials

All of the major construction materials used in the Project can be procured within Cambodia. Construction materials made in Cambodia are limited to the aggregate, lumber, bricks, and unglazed roof tile, etc. procurable around Siem Reap. Other materials are imported goods from Thailand or Vietnam, but these goods are generally available through local sales agents.

There is a concrete plant near the site, so procurement of ready-mixed concrete from this plant is planned for the Project. MOH and the hospital have agreed to the use of the northwest area of the planned construction site for the Project as a temporary site. At this temporary site, the on-site office will be placed and a work area will be secured for storing materials and assembling rebar/steel frames.

The procurement plan for the main construction materials is shown in Table 2-31.

Table 2-31 Procurement Source of Construction Materials

Item	Procurement source			
	Phnom Penh	Japan	3rd Country	Remarks
Cement	○			
Aggregate	○			
Wood for formwork	○			
Bricks	○			
Perforated concrete blocks	○			
Reinforcing bar	○			
Steel frame	○			
Lumber	○			
Roof materials	○			
Floor and wall tile	○			
Paint	○			
Insulation	○			

Aluminum fittings	○			
Steel fittings	○			
Glass	○			
Finish hardware	○			
Wood furniture	○			
Distribution board	○			
Lighting fixtures	○			
Electrical wire and conduit	○			
Wiring accessories	○			
Switchboard	○			
Transformer	○			
Light electrical equipment	○			
PVC pipe	○			
Sanitary equipment	○			
Pumps	○			
Water receiving tank	○			

2) Labor Procurement Conditions

There are few Cambodian engineers, and it is difficult to procure skilled workers, even in Siem Reap; therefore, skilled workers will be procured from Phnom Penh. Procurement from the area around the site will be limited to ordinary and light workers. The skill level of these engineers cannot be deemed satisfactory, thereby making construction management and design supervision by Japanese personnel essential for ensuring quality.

3) Equipment

There are no sales agents who handle hospital-grade medical equipment and related devices in Siem Reap Province, where the target hospital for the Project is located. If procurement or repair is necessary, communication must be done with agents in Phnom Penh.

As there is almost no medical equipment manufactured in Cambodia, Japanese or third-country products will be procured. However, there are many sales agents specializing in medical equipment in Phnom Penh. An investigation of these sales agents revealed they have experience in procuring most of the equipment requested for the Project, and there appears to be no problems in purchasing spare parts, etc. It was also confirmed that after-sales service is possible in Cambodia, with either a local agent responding directly, or by placing a request to manufacturer via the local agent.

In regard to the transportation plan, equipment to be procured from Japan or a third country will be transported by sea to Sihanouk Port in Cambodia, and then by land to Siem Reap Provincial Referral Hospital and District Hospitals.

2-2-4-7 Operational Guidance Plan

In principle, the planned equipment will be basic equipment that is consistent with the activities of the applicable hospital, and personnel in these Cambodian hospitals have sufficient experience in using such equipment. Initial operational guidance will be specific to each piece of procured equipment. Engineers will be dispatched from Japanese manufacturers or local agents.

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

As described above, the equipment planned for the Project is mainly basic equipment, and does not include equipment for which operational problems such as control and maintenance may arise. However, for equipment that has not been used in the hospital before, or for equipment that requires systematic maintenance, technical guidance will be provided using the following soft components for operation and maintenance. This will allow for the procured equipment to be used more effectively. For details, refer to the Soft Component Plan in the attached documents.

1) Technical guidance on proper operation and maintenance for Picture Archiving and Communication Systems (PACS)

Although the equipment can be adequately used by having the equipment procurement company provide initial operation instructions and guidance, it is necessary to create an operational system by digitalizing and shifting away from a data management system that uses traditional analog film. In addition, operations can become more effective by providing guidance on digital processing technology. This is also applicable to maintenance management as well, as such guidance will be effective when troubleshooting any problems that may arise.

2) Technical guidance on proper maintenance and infection prevention for target equipment

As part of the daily inspection of endoscopes (including rigid and flexible scopes), end-users and engineers in maintenance department will learn how to clean and disinfect the scopes before and after use, and about regular maintenance and inspection methods at the user level. By creating an operational system that includes maintenance and inspections, the quality of medical services at the target hospitals will be improved.

3) Technical guidance on the implementation of a medical equipment maintenance system

It was confirmed that the maintenance system developed by a previous JICA technical cooperation project has not been appropriately operated at the district hospitals. Therefore, in order to implement the maintenance system for the Project at district hospitals, simple manuals for the daily maintenance and inspection of the medical equipment brought in this time will be created and attached to equipment management logbooks, which will also be created. Through this, the maintenance management system for equipment will continue to improve in the future.

2-2-4-9 Schedule

1) Project Implementation Schedule

For implementation of the Project using Japanese Grant Aid, after the Exchange of Notes (E/N) and Grant Agreement (G/A) is concluded between the two countries, bidding and contracting for the construction work and equipment procurement will be performed, after which facility construction, equipment procurement, and installation work will be implemented in multiple fiscal years. The approximate time needed for the detail design work, bidding work, construction and procurement work, and soft components is shown in Table 2-32.

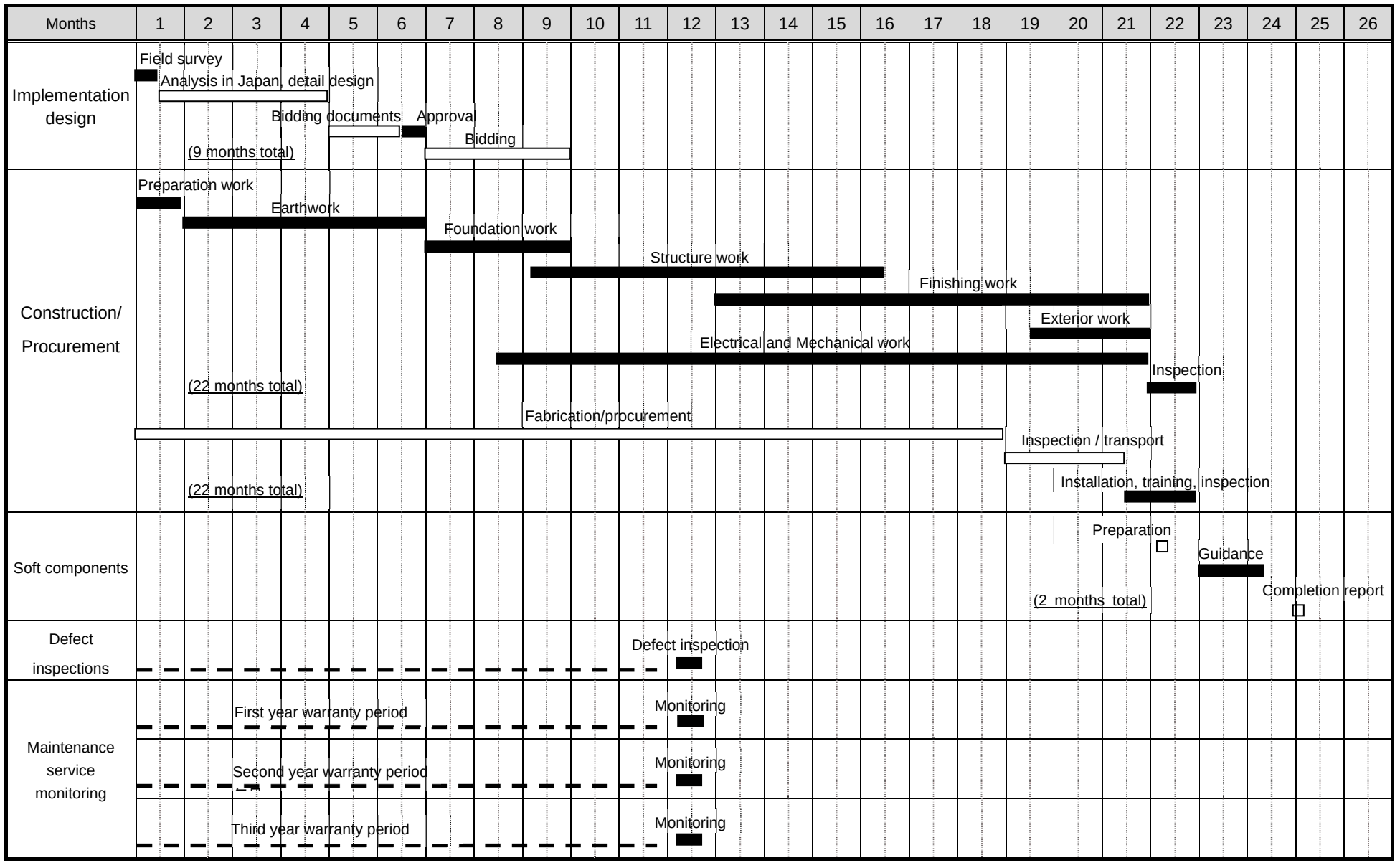
Table 2-32 Project Implementation Schedule

Project components		Period	
Implementation design	Detail design (including field survey)	4.0 months	31.0 months
	Bidding	5.0 months	
Construction/ procurement	Construction and procurement	22.0 months	
Soft components		2.0 months	2.0 months

1) Implementation Process Schedule

The schedule for project implementation processes is shown in Table 2-33.

Table 2-33 Implementation Processes Schedule



2-3 Obligations of the Recipient Country

The division of work for the Project is as described in the previous section 2-4-3 Scope of Works. The following is an overview of the obligations of the Cambodian side.

(1) Procedures

1) Acquisition of Land

The construction site is located on land owned by the Cambodian Ministry of Health with an existing hospital.

2) Application for Building Certification

For private construction, a building permit must be submitted to the Ministry of Land Management, Urban Planning and Construction. In addition to the deed for the land, layout drawings, architectural drawings, structural drawings, soil test results, and the qualifications of the designer must be submitted; it will take one to three months for the construction permit to be issued.

Because this Project is a public building, it is not necessary to follow the above procedure. It is sufficient for the Siem Reap PHD to apply for permission from the Siem Reap Provincial Government. The construction permit procedure must be completed by the start of the Project.

3) Environmental Impact Assessment

In Cambodia, under the Law on Environmental Protection and Natural Resources Management (1996), environmental and social considerations are required in development projects. The medical facility, which is the target facility of this project, is not included in the projects that require the environmental impact assessment, but the buildings of 12 m / floor or more, or 8,000 m2 or more require the environmental impact assessment.

In this project, the facility with a maximum height of approximately 26 m and a floor area of approximately 7,400 m2 is planned, therefore it is a target building for environmental impact assessment.

Regarding the environmental impact assessment procedure, in accordance with the Sub-decree on Environmental Impact Assessment Process, No. 72 ANRK.BK (1999), the reports on the contents according to the Declaration on General Guidelines for Developing Initial and Full Environmental Impact Assessment Reports, No. 376 BRK.BST (2009) must be submitted to the Ministry of Environment, Department of Environmental Impact Assessment (DEIA) for examination and approval. It takes about one month for the examination.

4) Tax Exemptions

The Ministry of Health and other relevant organizations will perform tax exemption procedures for the duties, VAT, other internal taxes, and surcharges, etc. imposed on construction materials and equipment procured from within Cambodia or imported from other countries by Japanese companies and construction contractors for the Project.

The tax exemption procedures for each tax category are as follows.

① Corporate tax: Tax exemption for only the prime contractor

② Personal income tax: Tax exemption for only the prime contractor

③ VAT: Refund for only the prime contractor

For the three tax exemption procedures above, the implementing agency (MOH) will apply for the exemptions from the General Department of Taxation (GDT). After approval from the GDT and the Ministry of Finance, the GDT issues the tax exemption certificate.

④ Import duties: Tax exemption for only the prime contractor and importer

For the fourth tax exemption above, the contractor must create a master list of the imported materials and submit it to the Cambodian Development Council via the implementing agency (MOH). After approval by the Cambodian Development Council, it is submitted to the GDT, after which the Cambodian General Department of Customs and Excise will issue the tax exemption certificate. The contractor is to submit this certificate to the customs clearance office.

5) Provision of Conveniences Regarding Equipment and Materials Imported from Japan or a Third Country

The Ministry of Health will provide the necessary conveniences ensuring swift customs clearance and inland transport procedures for equipment and materials required for the Project that are imported from Japan or a third country.

6) Acquisition of Land Use Permits

The Ministry of Health must submit the necessary documents to the Ministry of Land Management, Urban Planning and Construction to obtain permission for land use. Additionally, MOH must file a report regarding the fire control equipment plan, including facility plan drawings with the Siem Reap Police Department.

7) Banking Arrangements and Issuance of Payment Authorizations

The Ministry of Health will act as the point of contact for the Project, promptly making banking arrangements and issuing payment authorizations based on the consultant contract and contractor contracts.

(2) Undertakings of the Cambodian Side

A summary of the Cambodian side undertakings which are essential for the smooth implementation of the Project is shown below.

1) Removal of Obstacles and Land Preparation Work at the Planned Construction Site

The following existing buildings, trees, and buried objects at the planned construction site of Siem Reap Provincial Hospital should be removed at the expense of the Cambodian side by the time bidding

for facility construction starts. The land should also be levelled and prepared.

- General Medicine ICU (existing facility No. 11)
- Surgical Inpatient Ward B (existing facility No. 12)
- Tuberculosis Ward (existing facility No. 19C)
- Wooden house (existing facilities No. 26 and 27)
- Ambulance garage, corridors, road pavement
- Buried piping
- On-site electricity distribution lines
- Existing trees

2) Detection of Landmines and Unexploded Ordinances at the Planned Construction Site

After dismantling and removing the existing buildings on the planned construction site at Siem Reap Provincial Hospital, the PHD will ask the Cambodian Mine Action Center (CMAC) to search for landmines and unexploded ordinances and remove any that are found. A meeting with CMAC was held during the field survey, and because this is a JICA project and the area is small, they agreed to search for the landmines free of charge. A pile foundation is planned for the Project building, and the depth of the piles will be approximately 30 meters from the ground surface. However, since it is unlikely that landmines and unexploded ordinances will be buried deeply, the search will be conducted to the depth of the bottom slab of the foundation. For the building, this will be a depth of 2.5 meters from the ground surface, and for the septic tank area, this will be a depth of 5.0 meters from the surface.

3) Development of Infrastructure

① Electricity

Electricity will be connected to the extra circuit breaker in the existing switchgear (controlled by EDC) on the road to the west of the site, and a 22 kV underground distribution line will be installed leading to new high-voltage power receiving facilities to be built on the site. In terms of the division of work with EDC, the Cambodian power authority, everything after the connection of cables to the existing switchgear, including installation of substation facilities, will be part of the owner's work. Regarding the division of work with Cambodia, work outside the site (connecting cables to existing switchboards, excavating roads and laying buried piping/cables, and connecting primary transformers) will be performed by the Cambodian side. The Japanese side will be responsible for the substation facilities and on-site distribution lines after the installation of transformer equipment.

② Telecommunications

In order to use internet and Wi-Fi in the facility, a lead-in internet line from outside the site will be installed; this work will be performed by the Cambodian side.

③ Water supply

There is a water main installed near the hospital grounds, and piping will be branched from the on-site lead-in pipe and dedicated for use by the new hospital building. Water meters will also be installed. In terms of the division of construction work, branching the pipes and installing the water meters will

be handled by the Waterworks Bureau on the Cambodian side, and construction after the water meters will be performed by the Japanese side.

④ Drainage

Sewage and miscellaneous wastewater from inside buildings leaves the building in separate pipes, merges together in the first sump outside the building, and is carried via a natural slope to the septic tank. In the septic tank, sedimentation is separated and solid matter is removed, after which it is connected and pumped up to the public sewer system. A sewer pipe will be installed on the north side of the site by the recipient country, and construction work for the Project will include connecting a wastewater pipe from the septic tank to this sewer pipe.

⑤ Medical gas

The Cambodian side must supply oxygen tanks regularly in the manifold rooms in order to supply oxygen to the operating rooms, ICU, emergency treatment room, and observation rooms.

4) Renovation of Existing Buildings and Change of Intended Use

After the new facility is completed, departments targeted by the Project will be relocated to their new building. It is proposed that the vacated rooms of the existing facility be repurposed for different usage, as shown in Table 2-34.

Table 2-34 Proposed Usage of Existing Facilities

Existing facility no.	Existing usage	Proposed usage
07	Surgery A Inpatient Ward	General Medicine Inpatient Ward
10	Outpatient, Emergency Ward	Carpark (after dismantling and removal)
13	Surgical ICU Ward	General Medicine Inpatient Ward
15	X-ray, Ultrasound Ward	General Medicine Outpatient, Trauma
16	Operations, Sterilization, Surgery C, ENT Inpatient Ward	General Medicine Inpatient Ward, General ICU
17	Currently under renovation (used as a temporary relocation site for Surgery B Inpatient Ward during the Project construction period)	General Medicine Inpatient Ward

5) Relocation of Existing Furniture and Equipment

The existing medical imagery equipment at Siem Reap Provincial Hospital will be relocated by the Cambodian side as shown in Table 2-35. It will be necessary to contract the services of a specialized company for the relocation of this equipment; the cost of this will be borne by the Cambodian side. In addition, regarding PACS which will be installed in the Project, the Japanese side will have responsible on connection with newly provided imagery equipment (General X-ray machine, Ultrasound machine, and Mobile X-ray machine) and sharing images obtained from this equipment in the new building. On

the other hand, connecting the existing diagnostic imaging equipment such as CT scan and existing X-ray machine to the new PACS and transferring the images to the PACS server will be borne by the Cambodian side. The work cost for these connections shall be included in the relocation cost. The Cambodian side will also be responsible for the relocation of other equipment and furniture in the existing facilities, as well as the purchase of other necessary equipment. However, this existing equipment and furniture can be moved individually by hospital staff members, without the need to use a specialized contractor. Relocation will be performed at the appropriate timing immediately after the completion of construction.

Table 2-35 Relocation Destination of Medical Imagery Equipment

Device	Current location	Destination
CT scanner	Existing OB/GYN ward (No. 21)	Imagery Department in Project facility
X-ray machine (Provided by Japanese ODA)	Existing X-ray/ultrasound room (No. 15)	Imagery Department in Project facility
X-ray machine (Provided by Korean ODA)	Existing X-ray/ultrasound room (No. 15)	Existing OB/GYN ward

2-4 Project Operation Plan

2-4-1 Operation Plan

(1) Operational Structure and Organization

Although the MOH of Cambodia is the supervising authority and implementing agency of the Project, the PHD of Siem Reap Province and each hospital are responsible for operation and maintenance after the handover. In order to strengthen the referral system in Siem Reap Province, the Project will provide facilities and equipment for Siem Reap Provincial Hospital and equipment for Kralanh District Hospital, Angkor Chum District Hospital, Pouk District Hospital, and Sot Nikum District Hospital. However, since the current departments will continue to operate without any new departments being created, the operational organization can continue to use the existing organizational structure, without making changes.

(2) Personnel Plan

The number of inpatients per doctor and nurse at Siem Reap Provincial Hospital and other Cambodian hospitals of the same level is shown in Table 2-36 . There is no significant difference in the number of patients served by staff at Siem Reap Provincial Hospital compared to other hospitals. At present, the allocation of personnel can be considered sufficient for operations.

The Project targets the Surgery Department (including ENT), and the estimated number of surgical inpatients in the target year of 2026 is 8,497, which is 1.4 times that of the 5,975 patients in 2018. In 2018, Siem Reap Provincial Hospital had 25 surgeons, 63 registered nurses, and 12 assistant nurses. Assuming the number of patients served per doctor or nurse is currently the same, 35 surgeons, 88 registered nurses, and 17 assistant nurses are necessary. Therefore, an additional 10 surgeons, 25 registered nurses, and 5 assistant nurses must be hired.

Table 2-36 Number of Patients and Staff at Hospital Receiving Japanese Grant Aid

	Mongkul Borey Hospital	Kampong Cham Hospital	Sihanouk Provincial Hospital	Svay Rieng Provincial Hospital	Battambang Provincial Hospital	Siem Reap Provincial Hospital
Data year	2004	2005	2011	2013	2015	2018
No. of inpatients	3,942	8,152	5,064	10,706	15,530	23,722
Doctors (not including physician assistants)	15	28	27	18	51	80
Nurses (not including nurse assistants)	57	90	55	65	164	258
Total no. of hospital staff	151	211	155	165	401	465
No. of inpatients per doctor	263	291	188	595	304	297
No. of inpatients per nurse	69	91	92	165	94	92

Source: Questionnaires given to each hospital

2-4-2 Maintenance Plan

(1) Facilities

1) Maintenance System

There are four people currently allocated as maintenance personnel at Siem Reap Provincial Hospital. Hospital staff take care of simple repairs on medical equipment, as well as electrical and plumbing repairs. However, specialized repair or construction is outsourced to specialized companies. The expenditures related to maintenance and repairs at Siem Reap Provincial hospital from 2014 to 2018 are shown in Table 2-37 ; these expenditures accounted for 0.2%-0.6% of total hospital expenditure. For maintenance conducted after the Project is implemented, it is expected that the current personnel system will continue, with specialized repairs and construction outsourced to outside companies. In this case, facility operation and maintenance costs will be 422 million riels (2026 estimate), as shown in Table 2-43 in 2-4-3(3) Financial Plan. This is approximately 1.0% of the total expenditure, which is a slight increase compared to pre-Project expenditures, but since income from medical service fees is expected to increase due to facility improvement, these costs can be sufficiently borne.

Table 2-37 Siem Reap Provincial Hospital Facility Maintenance Management Costs

(Units: riels)

	2014	2015	2016	2017	2018
Building maintenance/repair costs	143,811,700	110,710,380	88,846,300	111,763,100	163,674,400
Total hospital expenditure	69,467,377,292	19,149,089,923	20,456,615,879	72,067,059,201	25,967,303,525
Percentage of overall hospital expenditure	0.2%	0.6%	0.4%	0.2%	0.6%

2) Maintenance Plan

The planned facilities are designed for easy maintenance, eliminating high-level systems and specifications with high-level construction technology. 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 repairs on malfunctions 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 without fail. Additionally, systematic maintenance management will be executed by formulating an annual maintenance management activities plan and keeping a maintenance record. The structure and the activities of the maintenance management team are summarized in Figure 2-14.

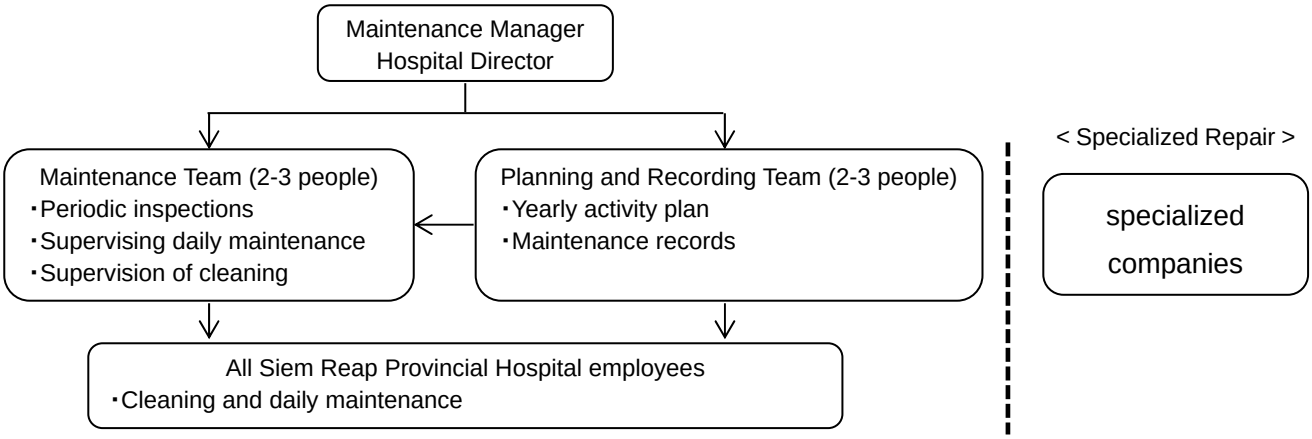


Figure 2-14 Proposed Facility Maintenance Management Structure

The work items shown in Table 2-38 are necessary for building maintenance, in terms of facilities.

Table 2-38 Facility Maintenance Items

Item	Frequency	Content of work
Elevator	As needed	On-call maintenance/repairs by contractor
	Once per month	Periodic inspections by contractor
Substation facilities	Daily	Visual inspection
	Once per year	Inspection and maintenance by a technician
Generator	Daily	Visual inspection
	Once per year	Inspection and maintenance by a technician
Lighting fixtures	As needed	Bulb replacement
Guide lights, emergency lights	About once per week	Lighting is checked
Air conditioning equipment	Once per week	Visual inspection
	Once per months	Filter cleaning
	Once per year	Air vent cleaning
	Twice per year	Inspection and maintenance by a technician and filter replacement
Ventilation equipment	Once per month	Visual inspection, fan belt adjustment
	Once per year	Air vent cleaning
Water receiving tank	About once per week	Visual inspection
	Once per year	Internal cleaning
Elevated water tank	About once per week	Visual inspection
	Once per year	Internal cleaning
Water pump	Daily	Visual inspection of equipment
Drainage facilities	Daily	Visual inspection of drainage equipment
Sanitary equipment	About once per week	Water flow is checked

Septic tank	Daily	Visual inspection inside water tank, trash removal
	Once per 4 months	Sludge removal
Oxygen supply apparatus	Daily	Visual inspection of manifold and alarm equipment
	As needed	Oxygen tank replacement
	Once per year	Inspection and maintenance by a technician

(2) Equipment

Siem Reap Provincial Hospital has a maintenance department with one biomedical engineer and three biomedical technicians. Staff members are on site between Monday and Friday at the workshop located in the hospital, but if there is an emergency, they will come in on Saturdays and Sundays as well. In the workshop, there is a repair area and an equipment storage area. Repair parts are basic equipment (multimeters, oscilloscopes, other various instruments), but they are managed properly.

In addition to the MEDEM-2 technical cooperation project conducted by JICA, the maintenance department manager has also participated in equipment maintenance training held by Korea International Cooperation Agency (KOICA) and Engineering World Health (EWH, U.S.-based non-profit organization), and has a high level of technical skill. However, apart from the department manager, the other staff members are contracted workers, and there are concerns about maintenance when the manager is not present.

On the other hand, there are no maintenance departments at district hospitals. Doctors and radiology technicians are in charge of the medical equipment and updating inventory lists. Because of this, repairs and maintenance are not performed, and if there is a malfunction, they contract the sales agent where the equipment was purchased to do the repairs.

To improve this situation, a soft component for implementation of a medical equipment maintenance system is planned.

After the equipment provided by the Project, the following maintenance system must be followed.

1) Start-up Inspection

Currently, equipment inspections are conducted as necessary by personnel in charge of each piece of equipment. These personnel ask the maintenance department to perform repairs for minor malfunctions. In the future, start-up inspections should also be implemented by these personnel on a daily basis.

2) Shut-down Inspection and Cleaning

Currently, equipment is not regularly cleaned or inspected, and when a problem occurs, the maintenance department is asked to repair it. However, to maintain the equipment in good condition, each piece of equipment should be cleaned at the end of the day when shut down, and regular inspections should be performed. Therefore, when implementing the Project, installation engineers will provide guidance on wiping down and inspecting the equipment at the time of equipment handover.

3) Calibration

From the aspect of ensuring measurement accuracy, it is necessary to calibrate analysis instruments used for testing at regular intervals. For the Project, equipment will be calibrated during the periodic

inspections included in the maintenance contracts concluded by the Japanese side for equipment that needs regular maintenance inspections. However, after the three-year maintenance contracts have ended, the recipient side must perform this calibration work. An engineer from the manufacturer will provide an explanation on the equipment components and operations at the time of equipment delivery or during periodic inspections.

4) Repairs for Equipment Malfunctions

Currently, if equipment malfunctions or fails at the provincial hospital, it is taken to the workshop or a workshop staff member is contacted. It will be fixed on the spot if possible, and no report is issued. If repair parts or spare parts are needed, even inexpensive items like alkaline batteries, a designated form must be filled out with the name of the required part (e.g. halogen lamp), the model name, country of origin, quantity, and price, and submitted to the accounting department. After approval, the part is purchased by a staff member from the accounting department or the maintenance department. If the repair part is expensive, a meeting is held at the hospital, where is it discussed whether it is possible to purchase the part. For large amounts, purchases are paid for in installments, and budget allocations may be requested from the PHD. If a sales agent is contracted for repairs, the cost of the technician's trip to the hospital, spare parts, and/or repair parts is covered by user fees (self-payment portion), which is part of hospital income. It is recommended that this process continue to be used for resolving equipment malfunctions after the handover.

Conversely, there are no staff members at district hospitals who can make repairs, so the personnel in charge of each piece of medical equipment outsources repairs to the sales agent where it was purchased. When the equipment is handed over, a list of the sales agents, contact person, and contact number will be given to the hospitals, and a system will be established that will allow medical activities to continue smoothly if equipment malfunctions.

5) Equipment Inventory Lists

Up to May 2019, inventory lists created from MEDEM were updated twice per year; however, from June, the MOH MEDEM SYSTEM created by the Ministry of Health has been used. With this, inventory is managed by accessing the website, logging in (editing can only be done by the maintenance department manager), and entering the equipment ID number (all equipment in the hospital is numbered sequentially), department, person in charge of use, model name, serial number, year of manufacture, installation year, equipment condition (good, fair, bad), and frequency of use (almost daily, sometimes, not used). This system is currently used only at CPA3 and national hospitals, and will be introduced at lower level hospitals as appropriate. At the time of equipment handover, it is recommended that the new equipment be entered into the existing inventory list and updated twice per year.

2-4-3 Financial Plan

(1) Ministry of Health and Siem Reap PHD Budget

Table 2-39 shows the MOH budget and the Siem Reap PHD budget. The Ministry of Health budget

is increasing steadily every day, at a rate of about 5-15%. In the thirteen years from 2005 (141,934 million riels) to 2018, it has increased almost ten-fold.

On par with the MOH budget increase, the Siem Reap PHD budget has also been growing every year, showing an increase of 10-30% since 2016. In 2018, the Siem Reap PHD budget accounted for 6.0% of MOH spending at the local level. This is slightly lower than the population ratio of Siem Reap to all of Cambodia (6.5%), suggesting that this budget allocation is appropriate. From the Siem Reap PHD budget, allocations are made to the budgets of referral hospitals such as the Siem Reap Provincial Hospital, as well to health centers and health posts. In 2016, referral hospital and health center/health post allocations decreased sharply because salaries previously included in each allocation were paid directly from the PHD, and thus included in the PHD allocation. The budget allocated from the PHD to Siem Reap Provincial Hospital is on a real value basis, including salaries, and is roughly based on 15% of the total PHD budget.

Table 2-39 Budget of MOH and Siem Reap PHD

	2014	2015	2016	2017	2018
MOH budget (million riel)	977,651.3	1,023,141,0	1,110,791,3	1,201,854.6	1,393,974.0
Year-on-year (%)	+8.4	+4.7	+8.6	+8.2	+16.0
Total MOH expenditure (million riel)	825,199.8	765,651.9	1,050,177.6	1,147,419.0	1,378,106.1
Central level (million riel)	550,138.1	458,066.5	653,198.9	679,835.3	825,783.2
Local level (million riel)	275,061.8	307,585.4	396,978.7	497,583.3	552,367.9
Siem Reap PHD budget (million riel)	20,487.7	21,696.7	28,073.8	32,742.2	37,017.3
Rate of increase (%)	-	+5.9	+29.4	+11.7	+13.1
Siem Reap PHD expenditure (million riel)	18,496.9	20,044.2	25,773.7	30,420.3	33,190.9
Referral hospital allocation from PHD expenditure	4,758.0	5,855.4	2,108.2	3,049.3	3,134.1
Health center/health post allocation from PHD expenditure	5,844.3	7,080.8	2,021.2	2,504.2	2,360.3
Percentage of Siem Reap PHD expenditure from MOH local level expenditure (%)	6.7	6.5	6.5	6.1	6.0

Source: MOH, Siem Reap PHD

(2) Operational Status of Siem Reap Provincial Hospital

In order to understand the trends of Siem Reap Provincial Hospital income and expenditure more easily, the items have been organized as seen in Table 2-40 . Under income, medical service fees are the sum of user fees, HEF, and other sources (health insurance). The expected decrease in income from HEF due to the expected decrease in the number of poor people will lead to an increase in user fees, and the increase in the number of people covered by health insurance will lead to a reduction in user fees. Thus, it is appropriate to estimate medical services fees from future estimates of patient numbers.

Table 2-40 Siem Reap Provincial Hospital Income and Expenditure

(Units: thousand riels)

	2016		2017		2018		2019 (Jan-Mar)	
	Amount	%	Amount	%	Amount	%	Amount	%
ncome:								
Budget from MOH	4,679,945,080	22.8	6,004,958,860	8.3	6,409,916,185	24.6	1,467,324,155	20.5
Year-on-year (%)	-		28.3		6.7		-	
Medical service fees	5,035,205,500	24.6	5,779,398,800	8.0	6,807,760,600	26.2	1,892,221,007	26.5
Year-on-year (%)	-		14.8		17.8		-	
CMS (Central Medical Storage) distributions	10,773,365,499	52.6	60,291,895,751	83.7	12,791,734,713	49.2	3,782,979,351	53.0
Year-on-year (%)	-		459.6		-78.7		-	
Total Income	20,488,516,079	100	72,076,253,411	100	26,009,411,498	100	7,142,524,513	100
Year-on-year (%)	-		251.8		-63.9			
Expenditure:								
Salaries, etc. (for PHD-hired staff)	3,057,086,002	14.94	4,251,564,150	5.90	4,727,798,320	18.21	1,140,245,095	16.03
CMS expenditure	10,773,365,499	52.66	60,291,895,751	83.66	12,791,734,713	49.26	3,782,979,351	53.19
Other expenditure from MOH budget	547,131,000	2.67	815,455,800	1.13	994,194,000	3.83	245,133,300	3.45
Pharmaceutical costs	1,040,057,000	5.08	1,129,564,700	1.57	1,338,268,800	5.15	347,030,800	4.88
Training and workshop costs	22,723,000	0.11	40,420,000	0.06	32,662,000	0.13	6,656,000	0.09
Medical/office equipment maintenance expenses	194,338,700	0.95	200,556,200	0.28	278,774,500	1.07	35,824	0.00
Facility maintenance expenses	133,595,800	0.65	159,234,250	0.22	203,951,400	0.79	30,000,000	0.42
Fuel expenses	97,966,000	0.48	96,875,600	0.13	97,879,750	0.38	22,750,000	0.32
60% of medical service fees (for bonuses for PHD-hired staff and Hospital-hired staff)	3,010,588,800	14.72	3,449,154,000	4.79	4,206,663,942	16.20	1,132,104,600	15.92
Payment to government (user fee 1%)	42,138,200	0.21	50,725,100	0.07	58,496,400	0.23	15,522,100	0.22
Other	1,537,625,000	7.52	1,581,613,650	2.19	1,236,889,800	4.76	389,855,836	5.48
Total expenditure	20,456,615,879	100	72,067,059,201	100	25,967,303,525	100	7,112,321,906	100
Year-on-year (%)	-		252.3		-64.0		-	
Single fiscal year balance	31,900,200		9,194,210		42,107,973		30,202,607	

Source: Siem Reap Provincial Hospital

(3) Financial Plan

Based on the most recent results of 2018, the budget of Siem Reap Provincial Hospital in 2026, the target year of the Project, is estimated as follows.

1) Income Estimates

① Budget allocations from MOH

Budget allocations from the PHD to Siem Reap Provincial Hospital were 18.2% in 2016, 19.7% in 2017, and 19.3% in 2018, for a three-year average of 19.1%. Siem Reap PHD budget allocations from the MOH have been increasing annually since 2015, as shown in Table 2-41 . In 2016, it increased 29%

over the previous year. The sharp increase in PHD budgets from 2016 to 2018 was due to the increased local allocation of MOH budgets. Therefore, the budget growth rate of the MOH from 2019 is calculated in line with the country's economic growth rate, which is based on the Asian Development Bank's projected economic growth rate for Cambodia of 6.8%. Assuming that the budget of 37,066 million riels from the MOH to the PHD in 2019 will continue to increase by 6.8% for seven years until 2026, the project budget allocation from the MOH to Siem Reap Provincial Hospital in 2026 will be 19.1% of the 2026 PHD budget. The formula for calculations is shown below. 11,221 million riels is 75.1% more than the 6,410-million-riel budget from the MOH in 2018.

37,006 million riels × 1.068^7 × 0.191 = 11,221 million riels

Table 2-41 Siem Reap PHD Budget from MOH

(Units: million riel)

	2014	2015	2016	2017	2018	2019	2014-19 Average increase rate
Budget from MOH to PHD	20,488	21,697	28,074	32,742	37,017	37,066	12.6%
Year-on-year (%)	-	5.9%	29.4%	16.6%	13.1%	0.1%	

② Medical service fees

A comparison of the shifts in the number of outpatients and inpatients (by surgical type) and medical service fees from 2014 to 2018 is shown in Table 2-42 . The total fee per patient, calculated by dividing the total fee by the total number of patients, has increased as the level of medical treatment has become more sophisticated; the average rate of increase for 2014-2018 was 7.7%.

Table 2-42 Number of Patients and Medical Service Fees at Siem Reap Provincial Hospital

	2014	2015	2016	2017	2018	2014-2018 Average increase rate	2026 (Predicted)
Number of outpatients	58,687	59,994	63,479	67,151	78,022	7.4%	119,599
Number of surgical inpatients	4,467	4,990	5,372	5,749	5,975	7.5%	8,497
Number of inpatients excluding surgical cases	11,787	13,635	14,802	15,898	17,747	10.8%	40,231
Total	74,941	78,619	83,653	88,798	101,744	7.9%	168,327
Year-on-year (%)	-	4.9%	6.4%	6.1%	14.6%	-	-
Medical service fees (million riels)	3,733	4,293	5,035	5,779	6,808	16.2%	17,150
Year-on-year (%)	-	15.0%	17.3%	14.8%	17.8%	-	-
Medical service fees per patient (thousand riels)	49.81	54.61	60.19	65.08	66.91	7.7%	101.90

Source: Siem Reap Provincial Hospital

The projected number of patients in 2026 is 168,327, an increase of 65.4% compared to the 101,744 patients in 2018. The increase in medical service fees per patient is expected to be 7.7% per year, and the projected income from user fees is shown below.

Income from user fees: 6,808 million riels × 65.4% ×$7.7\%^8$ ＝ 20,383 million riels

③ CMS Budget

CMS expenditure is payment in-kind, so as the CMS budget and expenditures are the same, they are not included in hospital balance sheet and does not directly affect income and expenditures in hospital operations. The CMS budget for 2026 is assumed to be the 2018 budget of 12,792 million riels plus inflation (see below). The inflation rate for 2026 is 25.9%.

12,792 million riels × 125.9% = 16,105 million riels

2) Expenditure Projections

The projections for income at Siem Reap Provincial Hospital are shown in the previous item, while details on expected expenditure items are described in section 3-5-2 Operation and Maintenance Costs. As a summary of these items, the projected expenditures for 2026 are shown in Table 2-43 . The balance is in the black; with the Cambodian MOH's budget increasing 6.8% annually, if the number of patients increases as projected and if there is an increase in the per patient medical service fees due to a higher level of medical treatment, adequate operation and maintenance is possible.

Table 2-43 Projected Expenditures for 2026

Item	2018 (million riels)	2026 projection (million riels)	Rate of increase (%)
Income			
MOH budget	6,410	11,221	75.1%
Medical service fees	6,808	20,383	199.4%
CMS budget	12,792	16,105	25.9%
Total income	26,010	47,709	83.4%
Expenditures			
Salaries, etc. (for PHD-hired staff)	4,728	7,418	56.9%
CMS expenditure	12,792	16,105	25.9%
Other expenditure from MOH budget	994	1,252	26.0%
Pharmaceutical costs	1,338	2,787	108.3%
Training and workshop costs	33	58	75.8%
Medical/office equipment maintenance expenses	279	253	-9.3%
Facility maintenance expenses	204	422	106.9%
Fuel expenses	98	133	35.7%
60% of medical service fees (for bonuses for PHD-hired staff and Hospital-hired staff)	4,207	12,230	190.7%
Government payments	58	204	251.7%
Other	1,237	2,504	102.4%
Total expenditure	25,968	43,366	67.0%
Balance	42	4,343	10240.5%

Source: Siem Reap Provincial Hospital

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

The cost to be borne by the Cambodian side for implementing this Project is estimated as below, based on the estimation conditions shown in (2) below.

(1) Expenses Borne by the Cambodian Side

Table 2-44 Expenses Borne by the Cambodian Side

Expenditure item	Estimated Project Cost	
	(US$)	Converted to JPY (thousand yen)
1) Removal of existing facilities	66,700	7,467
2) Land preparation	8,750	980
3) Infrastructure lead-in and connection work	6,061	679
4) Relocation and procurement of equipment/ furniture	42,000	4,702
5) Planting	11,400	1,276
6) Bank charges	19,652	2,200
Total	154,563	17,304

(2) Estimation Conditions

1) Time of estimate: June 2019
2) Exchange rate: USD 1.00 = JPY 111.95 (average rate between March 1, 2019 and May 31, 2019)
3) Construction/procurement period: As B government bond construction, the detail design, construction work, and equipment procurement period will be as shown in the construction schedule.
4) Other: The Project will be implemented in accordance with the Grant Aid scheme of the Government of Japan.

2-5-2 Operation and Maintenance Costs of Siem Reap provincial Hospital

Here, each expenditure item of the Siem Reap Provincial Hospital will be examined, and the expenditures for three years after handover of the Project (2026) will be estimated. For the estimation, the most recent actual values from 2018 are used as the base data, and the inflation rate is estimated based on Table 2-45 . For 2025 and 2026, it is assumed that a 103.4% year-on-year increase from 2024 will continue. It is expected that by 2026, prices will rise 25.9% over 2018 prices.

Results of the estimation are as shown in Table 2-43 in 2-4-3 (3) Financial Plan. Compared to the total expenditure of 43,366 million riels, the total income was 47,709 million riels, showing a surplus balance of 4,343 million riels. Compared to the 41 million riel balance of 2018, the balance is expected to improve significantly. Possible factors for the improvement of the balance are the expected increase in medical service fees once the system for receiving patients is improved through the creation of facilities under the Project, as well as the expected increase in budget allocations from the MOH due to Cambodia's economic growth. After the Project, while expenditures such as facility maintenance costs and staff salaries will increase, a significant increase in income is also expected. Therefore, it is expected that operation and maintenance can be performed sufficiently.

Table 2-45 Price Increase Projections for Cambodia

	2018	2019	2020	2021	2022	2023	2024	2026
Consumer price index	173.925	178.346	183.398	188.837	194.502	200.337	206.374	n/a
Compared to 2018	100.0%	102.5%	105.4%	108.6%	111.8%	115.2%	118.7%	125.9%

Source: IMF World Economic Outlook Database, April 2019

(1) Labor Costs (Salaries)

Expenditures for labor costs includes salaries for staff hired by PHD covered by MOH budget and 60% of medical service fees, which is used for bonuses for PHD-hired staff and staff hired by Siem Reap Provincial Hospital. The trends in the number of staff members at Siem Reap Provincial Hospital are shown in Table 2-46 . With the increasing number of patients in recent years, the number of staff members has also increased. In particular, the number of contracted doctors and nurses has shown a marked increase.

Table 2-46 Staff Number Trends at Siem Reap Provincial Hospital (by Position)

Position	2014	2015	2016	2017	2018	2019
Doctor	35	35	37	40	38	39
Specialist	11	12	16	16	16	16
Doctor (contract)	0	2	3	7	13	21
Specialist (contract)	0	1	0	0	2	4
Dentist	2	3	3	3	3	3
Pharmacist	8	10	8	8	8	8
Medical Assistant	2	2	2	2	2	2
Physiotherapist	8	8	9	10	10	10
Graduate nurse	0	0	0	3	3	3

Graduate midwife	0	1	3	1	1	1
Registered nurse	57	53	63	64	63	66
Registered midwife	29	28	34	32	33	33
Assistant nurse	12	13	13	13	12	13
Assistant midwife	12	10	11	10	10	8
Nurse (contract)	0	79	67	82	122	135
Radiology technician	3	3	3	3	3	3
Lab technician	3	4	11	22	15	16
Administration/accounting	4	4	4	6	6	6
Medical equipment management	1	1	1	1	1	1
Other (engineering)	3	3	4	15	8	8
Other (administrative)	1	1	1	1	1	1
Other (contract engineering)	3	14	7	10	15	14
Other (contract administrative)	49	109	58	60	66	68
Total	**243**	**396**	**358**	**409**	**451**	**479**

Source: Siem Reap Provincial Hospital

The increase in the number of staff members with the implementation of the Project is envisaged to be ten additional surgeons, 25 registered nurses, and five assistant nurses. In 2018, the average annual salary for specialists was 33,904,560 riels, 27,814,200 riels for registered nurses, and 25,979,040 riels for assistant nurses (source: Siem Reap Provincial Hospital). Therefore, labor costs in the target year of 2026 are calculated based on the labor costs of 2018, taking the price increases shown in Table 2-45 into account. These calculations are shown below.

Increase in annual labor costs due to increased staffing

Surgeons: 33,905 thousand riels × 10 people =	339,050 thousand riels
Registered nurses: 27,814 thousand riels × 25 people =	695,350 thousand riels
Assistant nurses: 25,979 thousand riels × 5 people =	129,895 thousand riels
Total	1,164,295 thousand riels

Estimated labor costs for 2026

(4,727,798 thousand riels + 1,164,295 thousand riels) × 125.9 % = 7,418,145 thousand riels

(2) CMS Expenditure

CMS expenditure is payment in-kind, making the CMS budget and expenditure amounts equal. From CMS budget projections described in section 3-4-3(3) Financial Plan, CMS expenditure for 2026 is as follows.

CMS expenditure = 16,105,000 thousand riels

(3) Other Expenditure from MOH Budget

This is the cost of medical equipment, furniture, and office equipment, etc. provided in-kind from the MOH, accounting for 1%-4% of total hospital expenditure. In recent years, these costs have been increasing, reaching approximately one billion riels. The costs for 2026 are estimated based on the 2018 expenditure of 994,194 thousand riels, taking into account the price increases shown in Table 2-45 .

994,194 thousand riels × 125.9% = 1,251,690 thousand riels

(4) Pharmaceutical Costs

Pharmaceutical costs continue to increase, accounting for about 5% of total expenditures. These pharmaceutical costs are the costs that make up for the shortfall in the drugs supplied by CMS. However, with an increased number of patients after Project implementation, pharmaceutical costs are also expected to rise. The pharmaceutical costs for 2026 are estimated based on the 2018 expenditure of 1,338,269 thousand riels, taking into account the patient increase rate of 165.4% from 2018 to 2026 brought about by the Project, as well as the price increases shown in Table 2-45 .

1,338,269 thousand riels × 165.4% × 125.9 % = 2,786,793 thousand riels

(5) Training and Workshop Costs

The costs associated with implementing training and workshops are about 30-40 million riels per year. As described in section 3-4-1(2) Personnel Plan, training and workshops are expected to increase in line with the increased numbers of doctors and nurses. The training and workshop costs for 2026 are estimated based on the 2018 expenditure of 32,662 thousand riels, taking into account a staff increase rate of 140% and inflation rates shown in Table 2-45 . This calculation is shown below.

36,662 thousand riels × 140% × 125.9% = 57,570 thousand riels

(6) Medical Equipment Maintenance Expenses

Equipment maintenance costs consist of repairs costs and the cost of consumable and replacement parts. Consumables will be needed from the first year after equipment handover, but breakdowns are covered by manufacturer warranties. Repair costs will not be incurred for equipment covered by maintenance contracts until the third year, but repairs costs will be incurred for other equipment. Since the maintenance contracts will expire for all equipment after the fourth year, the Cambodian side will have to renew the contracts or call the manufacturers' sales agent to outsource repairs. Repairs costs and the cost of consumables and replacement parts are shown in Table 2-47 .

Table 2-47 Medical Equipment Maintenance Expenses of Siem Reap Provincial Hospital

	First year after handover (thousand riels)	2nd-3rd year (thousand riels)	After 4th year (thousand riels)
Repair costs	0	195,520	151,480
Consumables/ replacement parts	101,440	101,440	101,440
Total	101,440	296,960	252,920

The details for consumables expenses are shown in Table 2-48 .

Table 2-48 Expense List for Consumables of Siem Reap Provincial Hospital

Sequential no.	Estimation no.	Name of equipment	Provincial hospital quantity		Name of consumable	Required quantity		Units (riels)	Subtotal (thousand riels)
13	S-19	Resectoscope	1	Set	Electrodes	20	electrodes	160	3,200
22	S-30	Ultrasound machine	3	Sets	Gel	2	bottles	48	288
					Paper	10	rolls	32	960
26	S-34	ENT unit	1	Set	Spray set	1	set	388	388
					Light bulb	1	bulb	32	32
					Filter	1	filter	44	44
					Compressor hose	1	hose	52	52
					Suction hose	1	hose	52	52
29	S-37	Patient monitor	24	Sets	Probe	1	probe	856	20,544
					Electrodes	50	electrodes	4	4,800
					Paper	5	roll	8	960
					Battery	1	battery	1,000	24,000
30	S-38	Ventilation machine	4	Sets	Adult breathing circuit set	2	sets	1,648	13,184
					Bacterial filter	2	filters	44	352
32	S-40	Mobile ultrasound machine	3	Sets	Gel	2	bottles	48	288
					Paper	10	rolls	32	960
34	S-42	ECG machine	3	Sets	Gel	2	bottles	48	288
					Paper	10	rolls	32	960
35	S-43	Syringe pump	10	Sets	Syringe	1000	syringes	1.08	10,800
42	S-58	Infusion pump	2	Sets	Infusion set 20 drops/ml	500	sets	3.2	3,200
					Infusion set 60 drops/ml	500	sets	3.2	3,200
44	S-60	Operation light	6	Sets	Handle	3	handles	300	5,400
45	S-62	Anesthetic machine	6	Sets	Anesthetic gas	1	set	64	384
					Soda lime	1	set	76	456
58	S-90	X-ray fixed type	1	Set	X-ray film	3	boxes	1,496	4,488
60	S-93	Autoclave	1	Set	Filters	2	filters	76	152
					Prefilter	2	prefilters	192	384
					Paper	3	rolls	8	24
					Ink	2	sets	152	304
					Salt	2	sets	92	184
					Gasket	2	gaskets	556	1,112
								Total	101,440

(7) Facility Maintenance Expenses

Maintenance costs for the existing facilities are increasing every year, and expenditure from 2018 was approximately 1.5 times that of 2016. The maintenance costs for the existing facilities are estimated based on the 2018 expenditure of 203,951 thousand riels, taking into account the inflation rates shown in Table 2-45 .

203,951 thousand riels × 125.9% = 256,774 thousand riels

In addition to the above, the estimated maintenance expenses for facilities built for the Project are as shown in Table 2-49 .

Table 2-49 Facility Maintenance Expense Estimates (Facilities Targeted in the Project)

Category	Item	Work content / Method of estimation	Frequency	Estimated amount (thousand riels)
Architecture	Inspection and adjustments for fittings	Inspections by employees	Once per year	
	Repairing painted areas	Work by professional company / Estimated as 5% of painted portions	Once per 3 years	8,140 thousand riels/year
	Repainting painted areas	Work by professional company / Estimated from painting costs	Once per 15 years	32,561 thousand riels/year
Facilities	Substation facilities	Inspections by employees	Once per month	
	Generator facilities	Inspections by employees	Once per month	
	Water receiving tank maintenance and cleaning	Maintenance and Cleaning by professional company	Once per year	3,400 thousand riels/year
	Elevated water tank maintenance and cleaning	Maintenance and Cleaning by professional company	Once per year	4,000 thousand riels/year
	Septic tank maintenance	Maintenance by professional company	Once per year	2,000 thousand riels/year
	Septic tank sludge removal	Work by professional company	3 times per year	7,200 thousand riels/year
	Air conditioning machine maintenance	Maintenance and filter replacement by professional company	2 times per year	17,920 thousand riels/year
Consumables	Lighting fixtures	Replacement of LED lighting fixtures	Once per 10 years	33,500 thousand riels/year
			Total	108,721 thousand riels/year

In addition, interviews with local sales agents revealed that elevator maintenance and inspection costs are approximately USD 100 per elevator per month, and it is necessary to pay inspectors' travel costs from Phnom Penh, as well as accommodation and a daily allowance, bringing the total to roughly USD 300 per month. The cost of replacement parts is also expected to be 2% of the price of the elevator.

(300 USD/month × 12 months + 52,080 USD × 2 elevators × 2%) × 4,000 riels/USD
= 22,733 thousand riels

Therefore, considering the increase in prices shown in Table 2-45 , the facility maintenance expenses for 2026 are estimated as follows.

256,774 thousand riels + (108,721 thousand riels + 22,733 thousand riels) × 125.9%
＝422,275 thousand riels

(8) Fuel Expenses

Fuel expenses include the fuel costs for operating the generators during power outages. In addition to the existing generator, a new one will be installed for the Project. The electricity lead-in lines are for hospital use, and outages are infrequent, but they do occur when the electric company works on the regional power grid. This work is done for nine hours between 8 a.m. and 5 p.m., but is completed in as short a time as possible. The frequency of power outages is unknown, but assuming they occur about once every two months, the fuel costs needed for the generator (200 kVA, fuel consumption 32 l/h) installed by the Project are calculated as follows.

4,400 riels/ℓ×32ℓ/h×9h×6 days/year = 7,603 thousand riels

The fuel costs for 2026 are estimated based on the 2018 fuel costs plus the fuel costs noted above, taking into account the price increases shown in Table 2-45 .

(97,880 thousand riels + 7,603 thousand riels) × 125.9% = 132,803 thousand riels

(9) Bonuses

Sixty percent of the medical service fees (including income from HEF and health insurance) are allocated to bonuses. As described in section 3-4-3(3)1) Income Estimates, the estimated income from user fees in 2026 is 20,383,000 thousand riels, and the bonuses for 2026 are estimated as follows.

20,383,000 thousand riels × 60% = 12,229,800 thousand riels

(10) Government Payments

Since 1% of the income from user fees is allotted for payments to the government, from the projected income from user fees described in section 3-4-3(3)1) Income Estimates, the 2026 payments are estimated as follows.

20,383,000 thousand riels × 1% = 203,830 thousand riels

(11) Miscellaneous

The miscellaneous costs for 2026 are estimated based on the 2018 expenditure for items other than mentioned above of 1,237,000 thousand riels, taking into account inflation rates shown in Table 2-45 .

1,237,000 thousand riels × 125.9% = 1,557,383 thousand riels

Electricity and water charges, as well as charges for medical gas are also included in the miscellaneous expenses. These expenses associated with Project facilities are estimated below, taking into account inflation rates shown in Table 2-45 and assumed usage quantities.

Electricity charges:
Estimated electricity usage 56,960 kWh/month × 636 riels/kWh × 12 months = 434,719 thousand riels
434,719 thousand riels × 125.9% = 547,311 thousand riels

Water charges:
Estimated water usage 180 m^3/day × 365 days × 2,000 riels/m^3 = 131,400 thousand riels
131,400 thousand riels × 125.9% = 165,433 thousand riels

Medical gas (oxygen) charges:
After Project implementation, the number of surgical patients is expected to be 77,498 in 2026, compared to the 52,741 inpatients in 2018, for an increase of 46.9%. Medical gas usage is expected to increase with the increase in the number of patients. The cost of medical gas in 2018 was 126,567 thousand riels. Taking into account the increase in the number of patients and inflation rates shown in Table 2-45 , medical gas charges for 2026 are estimated as follows.

36,662 thousand riels × 146.9% × 125.9% = 234,082 thousand riels

Adding up the above, miscellaneous costs are estimated as follows.

1,557,383 thousand riels + 547,311 thousand riels + 165,433 thousand riels + 234,082 thousand riels
= 2,504,209 thousand riels

2-5-3 Operation and Maintenance Costs of 4 District Hospitals

The maintenance cost of the medical equipment to be provided at the 4 district hospitals under this project is shown in Table . After the end of the three-year maintenance contract, the total annual maintenance cost of the four district hospitals from the fourth year onward is 229,640 thousand Riel. The Provincial Health Department allocates the budget from the Ministry of Health to each hospital under its jurisdiction. The budget of Siem Reap Provincial Health Department was 37,017,300 thousand Riel in 2018. The ratio of the total medical equipment maintenance costs of the four district hospitals to be procured under this project to the budget of Siem Reap Provincial Health Department was approximately 0.6% (based on 2018), indicating that the operation and maintenance can be sufficiently performed.

Table 2-50 Medical Equipment Maintenance Expenses of 4 District Hospitals

		Sot Nikum District Hospital	Kralanh District Hospital	Pouk District Hospital	Angkor Chum District Hospital,
First year after handover (thousand riels)	Repair costs	0	0	0	0
	Consumables/ replacement parts	6,852	7,664	6,012	7,832
	Total	6,852	7,664	6,012	7,832
2nd-3rd year (thousand riels)	Repair costs	6,000	25,600	3,600	24,000
	Consumables/ replacement parts	6,852	7,664	6,012	7,832
	Total	12,852	33,264	9,612	31,832
After 4th year (thousand riels)	Repair costs	41,520	61,120	39,120	59,520
	Consumables/ replacement parts	6,852	7,664	6,012	7,832
	Total	48,372	68,784	45,132	67,352

The details for consumables expenses of four District Hospitals are shown in Table .

Table 2- 51　Expense List for Consumables of 4 District Hospitals

Sequential no.	Integrated no.	Name of equipment	District hospital quantity				Name of consumable	Required quantity		Units (riels)	Subtotal Sot Nikum (thousand riels)	Subtotal Kralanh (thousand riels)	Subtotal Pouk (thousand riels)	Subtotal Angkor Chum (thousand riels)
			Sot Nikum	Kra lanh	Pouk	Angkor Chum								
70	G-4	Autoclave	1	2	1	1	Gasket	1	gasket	556	556	1112	556	556
72	G-6	Patient Monitor	2	2	1	2	Probe	1	probe	856	1712	1712	856	1712
							Electrodes	50	electrodes	4	0	0	0	0
							Paper	10	rolls	8	0	0	0	0
							Battery	1	battery	1,000	0	0	0	0
75	G-9	Ultrasound Scanner	1	1	1	1	Gel	2	bottles	48	96	96	96	96
							Paper	10	rolls	32	0	0	0	0
76	G-10	X-ray Machine (mobile with table & stand)	1	1	1	1	X-ray film	3	boxes	1,496	4488	4488	4488	4488
80	G-17	Anesthesia machine	0	1	0	1	Anesthetic gas	1	set	64	0	64	0	64
							Soda lime	1	set	76	0	0	0	0
85	G-22	ECG Unit	0	2	0	0	Gel	2	bottles	48	0	192	0	0
							Paper	10	rolls	32	0	0	0	0
89	G-26	Blood presser machine (automatic)	0	0	1	1	Battery	1	battery	8	0	0	8	8
90	G-27	Pulse oxymeter	0	0	1	1	Battery	1	battery	8	0	0	8	8
95	G-34	Operating Light (Mobile)	0	0	0	1	Handle	3	handles	300	0	0	0	900
										合計	6852	7664	6012	7832

Chapter 3 Project Evaluation

Chapter 3. Project Evaluation

3-1 Preconditions

For this Project, in order to strengthen the medical referral system in Siem Reap Province, some of the existing facilities at Siem Reap Provincial Hospital will be removed, as they are aging or too small for the increasing number of patients. In addition to central medical departments such as surgery, emergency, and radiology, a surgical ward will also be built and supplied with the necessary medical equipment. Together with this, the medical equipment necessary for surgical treatment will be supplied to Kralanh District Hospital, Angkor Chum District Hospital, Pouk District Hospital, and Sot Nikum District Hospital, which are lower level hospitals under Siem Reap Provincial Hospital. The Siem Reap Provincial Hospital site where the facilities are to be constructed is owned by the Ministry of Health, and thus has no preconditions for land acquisition. However, it is assumed that the obligations of the Cambodian side will be carried out without delay, as not to hinder implementation of the Project. These obligations include tax exemptions, the provision of conveniences regarding imported equipment and materials, land use permits, banking arrangements, issuance of payment authorization, removal of obstacles and land preparation work at the planned construction site, detection and removal of landmines, infrastructure development, renovation of existing buildings and changing of intended use, and relocation of existing furniture and equipment, as described in section 3. Obligations of the Recipient Country.

3-2 Necessary Inputs by Recipient Country

In order to achieve the overall plan of the Project, it is necessary for the following items to be appropriately implemented or prepared by the Cambodian side.

- Implementation of the partner country responsibilities, as described in section 3. Obligations of the Recipient Country
- Securing of the personnel and budget necessary to use the constructed facilities and maintain the procured equipment.

3-3 Important Assumptions

This Project will construct facilities and procure medical equipment for Siem Reap Provincial Hospital, as well as procure medical equipment for Kralanh District Hospital, Angkor Chum District Hospital, Pouk District Hospital, and Sot Nikum District Hospital. It is expected that these facilities and equipment will be effectively utilized by hospital staff, that the medical referral system will be strengthened, and medical services will be improved. Soft components are also planned, including technical guidance for the appropriate operation and maintenance of digital systems and the medical imagery sharing system (PACS), technical guidance for the appropriate operation and maintenance of endoscopes, operating room equipment, and sterilization equipment, and technical guidance for introducing a medical equipment maintenance management system. It is hoped that hospital staff will continue to provide in-hospital training after these activities have been completed.

3-4 Project Evaluation

Based on the following points, the Project is deemed relevant as a project eligible for Japanese Grant Aid.

3-4-1 Relevance

(1) Benefits of the Project

The target area of the Project is northern Cambodia, centering on Siem Province and including its surrounding provinces. Siem Reap Province has a population of 1.096 million people (in 2019, according to the Siem Reap PHD), and when combining this with the people in surrounding provinces, approximately 1.5 million people will directly benefit. In addition, Siem Reap Province has more than five million Cambodian and foreign tourists every year because of the ruins of Angkor, which is a World Heritage Site. Also, National Highway 6, which runs thought the city center of Siem Reap, starts in the Cambodian capital of Phnom Penh, passes north of Tonle Sap Lake, and connects to National Highway 6 (Southern Economic Corridor), leading to the Thai border at Sisophon. National Highway 6 is a main arterial road in Cambodia, along with National Highway 5, which passes along the south side of Tonle Sap Lake. In recent years, the number of patients with traffic accident injuries has been increasing, caused by increased road traffic. The Project will contribute significantly to the improvement of medical services in the northern region of Cambodia by strengthening the medical referral system in Siem Reap Province, where health care needs are great, and the number of patients is expected to further increase.

(2) Human Security Aspect

The Project aims to strengthen medical services in northern Cambodia by improving Siem Reap Provincial Hospital, the main hospital in the region, as well as the lower level hospitals under it. In order to achieve universal health coverage (UHC), which is positioned as a priority issue in Japan's Strategy on Global Health Diplomacy (formulated in May 2013), the Project will expand the provision of basic health care services in the target region.

(3) Contribution to Achieving the Goals of Cambodia's Medium- to Long-term development Plan

The Project falls under one of the priority areas in Cambodia's National Strategic Development Plan and the Third Health Sector Strategic Plan, which was formulated in line with Sustainable Development Goals, and is related to the strengthening of a health care system that aims for universal health coverage. Seven strategies were outlined in these development plans, and of those, the Project will contribute to the development of health care infrastructure (facilities, advanced medical equipment).

(4) Consistency with Japan's ODA Policies

In the MOFA's Country Assistance Policy for Cambodia (July 2017), "the advancement of initiatives in health care and social security working toward the achievement of universal health coverage (UHC)" is

listed under the Priority Area 2: Promotion of Social Development. In the Rolling Plan, Development Issue 2-2: Enhancement of Health and Medical Care, programs for strengthening the health care system are being implemented. This Project has been planned based on this program.

3-4-2 Effectiveness

The target values expected from implementation of the Project are shown below.

(1) Quantitative Effects

Based on the number of patients assumed in the scale calculations shown below, the following project effect indicators can be considered at this time.

① Number of surgical inpatients

Because the improvement of facilities for the Project focuses on improvement of the Surgery Department at Siem Reap Provincial Hospital, the change in the number of surgical inpatients at this hospital will be used as an indicator. Using 2018 as the baseline, because annual statistics for the year were available at the time of this survey, the target is set for 2026, three years after the Project completion. The projected number of surgical inpatients in 2026 is 12,100 (see Table 2-8), by calculating simply from the average annual growth rate alone. Meanwhile, the Project plans to improve medical equipment for diagnosis, testing, and surgery at 4 district hospitals of Kralanh, Angkor Chum, Pouk and Sot Nikum. This, along with technical training for doctors and staff to be implemented by the partner country, will improve the medical referral system in Siem Reap Province after completion of the Project. It is expected that patients who goes directly to Siem Reap Provincial Hospital from Kralanh OD, Angkor Chum OD and Sot Nikum OD now, will be treated at the district hospitals in their area of residence. In terms of number of the patients transferred from these district hospitals to Siem Reap Provincial Hospital, it is greatly affected by the status of human resources such as doctors, then it is not included in this indicator. In addition, Table 3-1 shows the predicted number of patients by residence from neighboring provinces based on the actual results in 2019. In Banteay Meanchey Province in 2005, and in Battambang Province in 2017, Mongkol Borei Referral Hospital and Battambang Provincial Hospital, which are the top referral hospitals in the province, were improved by the Japanese grant aid, then medical services in these provinces have been strengthened. Oddar Meanchey Province is located on the north side of Siem Reap Province and is adjacent to Banteay Meanchey Province, so the area on the west side of the province has good access to Mongkol Borei Referral Hospital and Battambang Provincial Hospital through National Route 5. Therefore, it is assumed that half of the patients from the province will go to Siem Reap Provincial Hospital. Since Kampong Thom Province is located between Siem Reap Province and the capital city of Phnom Penh, it is also assumed that half of the patients will go to Siem Reap Provincial Hospital. Preah Vihear Province and Stung Treng Province are located on the eastern side of Siem Reap Province and border with Thailand and Laos. Due to insufficient medical system, it is assumed that patients will go to Siem Reap Provincial Hospital. Therefore, The projected number of surgical inpatients in 2026 is estimated to be approximately 6,500, including the patients from Siem Reap OD, half of the patients from Oddar Meanchey Province and

Kampong Thom Province, and the patients from Preah Vihear Province and Stung Treng Province.

Table 3-1 Predicted Number of Surgical Inpatients by Residence at Siem Reap Provincial Hospital in 2026

2026 year	Siem Reap Province				Other Province							Total
	Siem Reap OD	Kralanh OD	Angkor Chum OD	Sot Nikum OD	Banteay Meanchey	Battambang	Oddar Meanchey	Kampong Thom	Preah Vihear	Stung Treng	Other	
Projected numbers of surgical inpatients	5,312	738	1,706	1,791	423	218	774	375	557	73	133	12,100
Proportion	43.9%	6.1%	14.1%	14.8%	3.5%	1.8%	6.4%	3.1%	4.6%	0.6%	1.1%	100%

Source of proportion: Siem Reap Provincial Hospital

② Surgical Bed Occupancy Rate

Since surgical inpatient rooms will also be built, the improvement of the surgical bed occupancy rate is also expected as an effect of the Project. A target of 90% is set as an appropriate bed occupancy rate.

③ Number of operations (excluding ophthalmology, OB/GYN)

Since the Project includes the expansion of the existing four operating rooms to six, the number of operations is expected increase. Ophthalmology and OB/GYN are excluded, because they already have their own operating rooms in the facility. Taking into consideration the predicted changes in patient numbers, in the same manner as above, the predicted number of operations in 2026 will be 4,732 for both scheduled and emergency operations.

④ Proportion of critical surgical inpatients transferred from lower level hospitals to surgical inpatients

As an effect of equipment improvement at district hospitals, a decrease in the number of surgical patients transferred from lower level hospitals to Siem Reap Provincial Hospital is expected. In 2018, the ratio of 1,670 transferred surgical inpatients with critical cases (see Table 3-10) to 5,975 surgical inpatients (see Table 3-7) was 27.9%. Assuming the number of surgical inpatients will increase from 2019 onwards at the same rate as the average of past five years, the estimated number of surgical inpatients in 2026 will be 12,100 (see Table 3-8) and the estimated number of transferred surgical inpatients with critical cases will be 2,935 (see Table 3-11), and thus the ratio of transferred surgical inpatients with critical cases to the number of surgical inpatients will be 24.3%.

Table 3-2 Quantitative Effects

Indicator	Baseline (2018)	Target (2026) (3 years after completion)
Effects of Siem Reap Provincial Hospital facility improvement		
① Number of surgical inpatients (persons/year)	5,975	6,500
② Surgical bed occupancy rate (%)	191.2%	90%
③ Number of operations (excluding ophthalmology, OB/GYN) (cases/year)	3,306	4,732
Effects of lower level hospital equipment improvement		
④Proportion of critical surgical inpatients transferred from lower level hospitals to surgical inpatients (%)	27.9%	24.3%

(2) Qualitative Effects

① At the target hospitals, high quality medical services will be provided, centering on emergency and surgical patients.

② The medical referral system in northern Cambodia will be strengthened.

③ Medical staff's motivation to work will be improved at the target hospitals.

④ The maintenance management system is strengthened, and both new and existing buildings will be properly maintained and used continually over the long term.