

The Kingdom of Bhutan
Ministry of Health

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR IMPROVEMENT OF
MEDICAL EQUIPMENT
AT THE NATIONAL AND
REGIONAL REFERRAL HOSPITALS
IN
THE KINGDOM OF BHUTAN

February 2017

Japan International Cooperation Agency

International Techno Center Co., Ltd.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the Project for Improvement of Medical Equipment at the National and Regional Referral Hospitals in the Kingdom of Bhutan, and entrusted the survey to International Techno Center Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Royal Government of Bhutan, 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 Bhutan for their close cooperation extended to the survey team.

February, 2017

Akiko Kumagai
Director General
Human Development Department
Japan International Cooperation Agency

Summary

Summary

1. Overview of the country

The Kingdom of Bhutan is a landlocked country located in the southern part of the Himalaya Mountains bordering China and India, and is populated by 765,000 people (as of 2014). Bhutan has a total area of 38,394 km² with a huge difference in altitude from 300m to 7,000m, which causes the climate in the country to vary greatly. Precipitation increases throughout the whole country in the rainy season from June to September, and the lowest temperature sometimes drops below freezing and snow falls in winter from December to February. It takes a long time for intercity transfers in Bhutan because most of the roads are built along natural contours on the mountainsides. According to World Bank statistics, in Bhutan in 2015, GDP was 2,058 million US dollars, GDP per capita was 2,656 US dollars and GDP growth rate was 6.49%.

2. Background and outline of the requested assistance

Health indicators have improved in the last decade and mortality from communicable diseases has decreased significantly. On the other hand, non-communicable diseases (NCDs) have been increasing year by year and become the main causes of death in Bhutan.

In Bhutan, the 11th five-year plan is being implemented with the objective of improving access to quality health services through strengthening the diagnostic services of regional referral hospitals.

In addition, under the comprehensive program for the prevention and control of NCDs, necessary human resources are allocated and a minimum amount of medical equipment is distributed to primary and secondary health facilities. Trained specialists and engineers are in tertiary facilities. Early diagnosis and treatment of NCDs, however, are hindered by a budget shortage and delays in procurement of the necessary equipment such as computed tomography (CT). At present, a CT examination is available only at the Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), but visiting Thimphu for those examinations puts a great burden on patients and their families because of the traffic situation in Bhutan. It is an urgent matter to strengthen diagnostic services in both national and regional referral hospitals to reduce the burden on patients and to enable early diagnosis and treatment.

Under such circumstances, the government of Bhutan requested the government of Japan to extend a grant for the procurement of medical equipment in order to strengthen the diagnostic services of national and regional referral hospitals and to improve access to quality health services.

3. Summary of the survey results and contents of the project

In response to the request by the government of Bhutan, the Japan International Cooperation Agency (JICA) decided to conduct a preparatory survey and dispatched a survey team from August 13th to September 11th, 2016. After returning to Japan, the survey team compiled a draft report and visited Bhutan again to explain the contents of the report from November 26th to December 4th, 2016.

In the preparatory survey, the survey team visited three target hospitals, JDWNRH, the Mongar Eastern Regional Referral Hospital (MERRH) and the Gelephu Central Regional Referral Hospital (GCRRH), to confirm the actual situation regarding medical equipment, facilities and the level of medical services. Furthermore, in Thimphu, the appropriate assistance plan was discussed with the Ministry of Health (MOH), the Ministry of Finance (MOF) and the Gross National Happiness Commission (GNHC).

Based on the results of the preparatory survey, the essential equipment needed for diagnosis of NCDs, injuries and others will be procured for three target hospitals in the project with the purpose of strengthening diagnostic services in the national and regional referral hospitals in the country and to improve access to quality health services. The following equipment shall be procured in the project, and a one-year warranty and four-year Comprehensive Maintenance Contract (CMC) for the radiological equipment shall be included for adequate maintenance.

Equipment	Total	Quantity			CMC
		JDWNRH	MERRH	GCRRH	
CT (64 slice)	1	1	0	0	✓
CT (16 slice)	2	0	1	1	✓
General Digital X-ray Apparatus	1	0	0	1	✓
Digital Mammography	1	1	0	0	✓
Spirometer	1	0	1	0	
ECG Holter System	1	0	1	0	

The health staff in JDWNRH basically can conduct CT examinations for most diseases except for heart disease, since the 16-slice CT has been used in the hospital thus far. The 64-slice CT, first installed in Bhutan in this project, is very new to them, and they need to obtain special knowledge and skills for cardiac CT scans and image diagnosis with the new CT. Accordingly, the project includes clinical training on patient management and image analysis of heart diseases as a soft component of the grant aid project.

4. Implementation period and project cost estimation

It is expected to take five months for tender-related work and 12 months for procurement, installation and soft component. Since there is a four-year CMC for the radiological equipment after a one-year warranty period, the entire implementation schedule shall be completed in five years after the completion of the equipment. The cost to be borne by the Bhutan side is approximate 5.5 million Japanese yen.

5. Evaluation of the project

(1) Relevance

The project provides medical equipment needed for diagnosis of NCDs, injuries and others for the national and regional referral hospitals to strengthen the diagnostic services of those hospitals with the objective of improving access to quality health services. The purpose of the project is consistent with the target of the health sector in the current five-year plan. The effort by the government of Bhutan to achieve equitable access to quality health services shall be continued so that the effect of the project contributes to the achievement of Universal Health Coverage (UHC).

In addition, the purpose of the project corresponds to the policy of Japanese cooperation with Bhutan, which supports sustainable economic growth through correcting the disparity between urban and rural areas. The project is thought to be adequate assistance under the Japanese grant in the health sector of Bhutan following past grant aid projects.

At present, a CT examination is only available at JDWNRH. Patients have to go to hospitals in India when they need examinations and treatment for heart diseases, breast cancer and others which require more advanced equipment and skills. It is an urgent matter to strengthen diagnostic services in both national and regional referral hospitals to reduce the physical and financial burden of transportation on patients. It is expected that introducing the medical equipment to the target hospitals enables early diagnosis and treatment for NCDs, injuries and others in each region and reduces the burden on patients. The whole nation, especially the poor in rural areas, will benefit from the project.

For these reasons, it is justified that the relevance of the implementation of the project is high.

(2) Effectiveness

By introducing the medical equipment needed for diagnosis of NCDs, injuries and others in the project, diagnostic services of national and regional referral hospitals will be improved. The following effects can be expected.

1) Quantitative effects

	Indicators	Baseline (2015)	Target* (2021)
1	Number of days for which use of CT is suspended in JDWNRH (days/year)	16	2
2	Number of CT examinations in JDWNRH (cases/year)	3,782	5,000
3	Number of CT examinations in MERRH (cases/year)	0	1,500
4	Number of CT examinations in GCRRH (cases/year)	0	1,500

*Target year is set as 3 years after completion of equipment procurement

2) Qualitative effects

- ① Improvement of health services at target hospitals by enabling early diagnosis and treatment
- ② Alleviation of burden on patients by reducing waiting time and/or travel time for CT examination with availability of CT examination at regional referral hospitals
- ③ Improvement of skills of health staff by introducing sophisticated equipment for diagnosis

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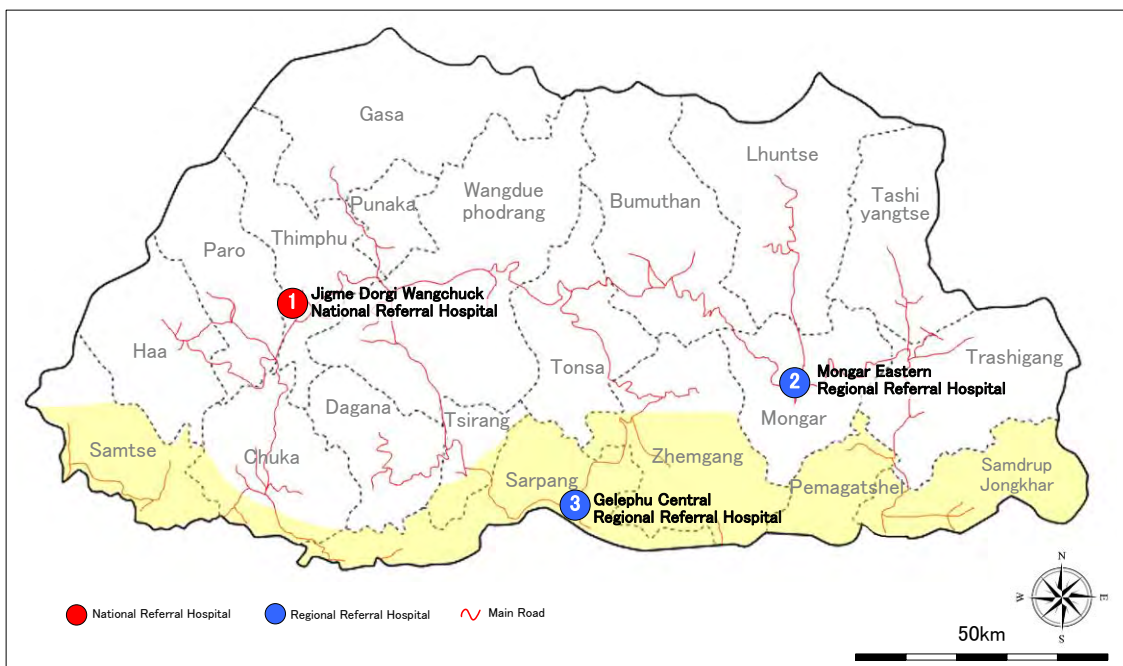
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Abbreviations

AMC	Annual Maintenance Contract
A/P	Authorization to Pay
B/A	Banking Arrangement
BMED	Bio Medical Engineering Division
BTN	Bhutanese Ngultrum
CMC	Comprehensive Maintenance Contract
CT	Computed Tomography
E/N	Exchange of Notes
G/A	Grant Agreement
GCRRH	Gelephu Central Regional Referral Hospital
GDP	Gross Domestic Product
GNH	Gross National Happiness
GNHC	Gross National Happiness Commission
HHC	Health Help Centre
INR	Indian Rupee
JDWNRH	Jigme Dorji Wangchuck National Referral Hospital
JICA	Japan International Cooperation Agency
MERRH	Mongar Eastern Regional Referral Hospital
MOF	Ministry of Finance
MOH	Ministry of Health
MRI	Magnetic Resonance Imaging
NCDs	Non-Communicable Diseases
UHC	Universal Health Coverage
UPS	Uninterruptible Power Supply

Chapter 1 Background of the Project

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1-1 Background of the Project

Health indicators have improved in the last decade and mortality from communicable diseases has decreased significantly. On the other hand, non-communicable diseases (NCDs) have been increasing year by year and become the main causes of death in the Kingdom of Bhutan.

In Bhutan, the 11th five-year plan is being implemented with the objective of improving access to quality health services through strengthening the diagnostic services of regional referral hospitals.

In addition, under the comprehensive program for the prevention and control of NCDs, necessary human resources are allocated and a minimum amount of medical equipment is distributed to primary and secondary health facilities. Trained specialists and engineers are in tertiary facilities. Early diagnosis and treatment of NCDs, however, are hindered by a budget shortage and delays in procurement of the necessary equipment such as computed tomography (CT). At present, a CT examination is available only at the Jigme Dorji Wangchuck National Referral Hospital (JDWNRH), but visiting Thimphu for those examinations puts a great burden on patients and their families because of the traffic situation in Bhutan. It is an urgent matter to strengthen diagnostic services in both national and regional referral hospitals to reduce the burden on patients and to enable early diagnosis and treatment.

Under such circumstances, the government of Bhutan requested the government of Japan to extend a grant for the procurement of medical equipment in order to strengthen the diagnostic services of national and regional referral hospitals and to improve access to quality health services.

1-2 Natural Conditions

Bhutan is a landlocked country located in the southern part of the Himalaya Mountains bordering China and India, and is populated by 765,000 people (as of 2014). Bhutan has a total area of 38,394 km² with a huge difference in altitude from 300m to 7,000m, which causes the climate in the country to vary greatly. The altitudes of project sites are 2,300m (Thimphu), 1,500m (Mongar) and 500m (Gelephu).

Average temperatures and precipitation in these areas are shown in Table 1-1. Precipitation increases throughout the whole country in the rainy season from June to September, and the lowest temperature sometimes drops below freezing and snow falls in winter from December to February.

In Bhutan, it takes a long time for an intercity transfer, because most of the roads are built along natural contours on the mountainsides, and the road conditions are not good, although road-widening and improvement works are ongoing throughout the whole country.

Accordingly, the inland transportation of equipment should be scheduled with consideration of these natural conditions in the country.

Table 1-1 Average temperatures and precipitations of project sites

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Thimphu	Max. Temperature (°C)	10.6	12.1	15.3	18.1	20.0	21.2	21.6	21.3	20.6	18.7	15.0	12.1
	Min. Temperature (°C)	-2.8	-0.8	2.5	6.3	9.5	12.6	13.8	13.4	12.1	6.9	1.6	-1.7
	Precipitation (mm)	11	21	50	90	164	306	364	284	215	76	14	4
Mongar	Max. Temperature (°C)	16.1	18.0	21.5	23.8	24.7	25.9	26.2	26.0	25.5	23.7	20.2	17.3
	Min. Temperature (°C)	3.1	5.6	9.1	12.6	15.3	17.8	18.8	18.5	17.4	13.1	8.0	4.3
	Precipitation (mm)	13	13	65	121	323	562	519	395	292	117	17	7
Gelephu	Max. Temperature (°C)	22.4	24.7	28.7	30.2	30.1	30.5	30.9	30.9	30.6	29.5	26.4	23.3
	Min. Temperature (°C)	10.2	12.3	16.1	19.6	21.9	23.7	24.7	24.9	23.9	20.8	16.0	11.6
	Precipitation (mm)	18	12	89	196	574	883	818	527	414	171	19	11

Source: CLIMATE-DATA.ORG (1982-2012)

Chapter 2 Contents of the Project

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2-1 Basic Concept of the Project

In Bhutan, the 11th five-year plan is being implemented with the development philosophy of Gross National Happiness (GNH). In the 11th five-year plan, the achievement of Universal Health Coverage (UHC) is targeted in the health sector and improved and equitable access to quality health services is focused upon. In addition, priority is given to the implementation of the comprehensive program for the prevention and control of NCDs, which have become more important in the country.

In order to achieve UHC, the challenges in Bhutan are the shortage of health human resources, poor access to health care, and traveling costs borne by the patients. In such circumstances, the government of Bhutan established the Health Help Centre (HHC) in 2011 and strengthened patient transportation services. For the provision of ambulances controlled by HHC, the government of Japan extended grants twice in 2010 and 2014. As a result, access to health facilities significantly improved.

The improvement of accessibility requires not only access to health facilities but also the quality of services provided in those facilities. Because of the increasing number of patients with NCDs and injuries, these cases need to be diagnosed and treated at regional referral hospitals. At present, however, a CT examination is available only at JDWNRH using one old piece of equipment. It is an urgent matter to strengthen diagnostic services in both national and regional referral hospitals to reduce the burden on patients and to enable early diagnosis and treatment.

The project provides medical equipment for the national and regional referral hospitals in order to strengthen the diagnosis services of those hospitals with the objective of improving access to quality health services. The purpose of the project is consistent with the target of the health sector in the current five-year plan. The project is also thought to be adequate assistance under the Japanese grant in the health sector of Bhutan following past grant aid projects. The effort by the government of Bhutan to achieve equitable access to quality health services shall be continued so that the effect of the project contributes to the achievement of UHC.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

(1) Basic Policy

The essential equipment needed for diagnosis of NCDs, injuries and others will be procured for JDWNRH, the Mongar Eastern Regional Referral Hospital (MERRH) and the Gelephu Central Regional Referral Hospital (GCRRH) in the project with the purpose of

strengthening diagnostic services in the national and regional referral hospitals in the country and to improve access to quality health services.

(2) Policy on Natural Environment Conditions

In Bhutan, there is a risk of landslides and road collapses during the rainy season from June to September. Especially in Thimphu and other regions at high altitude, the average temperature sometimes drops to below freezing in winter from December to February. Accordingly, the inland transportation of equipment should not be scheduled for the rainy season or winter.

Generally, the cooling efficiency of X-ray tubes may decrease at an altitude of 2,000m or more. Given that the altitudes of project sites are 500m (Gelephu) to 2,300m (Thimphu), an operational explanation including the influence of high altitude on X-ray tubes shall be clearly given to the users after installation.

(3) Policy on Socio-Economic Conditions

In Bhutan, medical services are basically free of charge. The cost of transportation, however, shall be borne by patients except for those using ambulances. In addition, patients sometimes have to pay out-of-pocket for materials of treatment. These difficulties are much more apparent in rural areas. In this context, the strengthening of regional referral hospitals is of utmost importance in order to mitigate the burden in rural areas. Considering these socio-economic conditions of Bhutan, the equipment plan of the project has been drafted focusing on the strengthening of diagnostic services in regional referral hospitals.

(4) Policy on Procurement

In accordance with Japan's grant aid scheme, the products of Japan and/or Bhutan shall be procured in principle. Since the target items are not currently manufactured in Bhutan, Japanese products will be procured in the project. However, there is a possibility that products from third countries will also be considered for procurement for competitive bidding.

(5) Policy on Determination of Grades and Specifications of Equipment

The grades and specifications of the equipment to be procured shall be determined referring to the equipment currently used in Bhutan and neighboring countries where Bhutanese health staff go for training.

(6) Policy on Operation and Maintenance

Necessary radiologists, radio-technologists and radio-technicians who operate the

equipment shall be allocated to respective target hospitals by the Bhutan side before the equipment is installed.

In Bhutan, great importance is attached to the sustainable use of medical equipment, and a five-year comprehensive maintenance contract (CMC) is required according to the guidelines of the Ministry of Health (MOH) for equipment that costs more than 10 million Bhutanese ngultrum (BTN) or any other equipment that is indispensable for medical services in the country. Considering such importance, a four-year CMC in addition to a one-year warranty shall be included for CTs, X-ray apparatus and digital mammography equipment to be procured in the project. These pieces of equipment shall be procured from manufacturers that have an agent located in Bhutan or India. After the period of the warranty and CMC, the equipment shall be maintained by the government of Bhutan. The financial capacity and budgets for the hospitals shall be taken into consideration in the project.

(7) Policy on Consumables and Spare Parts

To assure the smooth start of operation after the installation of equipment, minimal consumables required for an initial period or one to three months shall be included. Spare parts shall not be included in principle, but a CMC for the radiological equipment includes X-ray tubes and other spare parts.

(8) Policy on Operation Guidance

As mentioned above, the equipment will be mainly Japanese products with which the health staff in Bhutan may not be familiar. Even though the grade and specification do not differ from the equipment currently in use, the operation in details may be different.

Consequently, sufficient operational guidance shall be given to the health staff of target hospitals after the installation of the equipment.

(9) Policy on Soft Component

Among the equipment to be procured, a 64-slice CT will be installed in Bhutan for the first time. In addition, a cardiac CT scan and image analysis requires specialist knowledge and skills. For these reasons, clinical training on patient management and image analysis of heart diseases shall be included in the project under the framework of the soft component in Japan's grant aid.

(10) Policy on Project Schedule

Procurement of the equipment shall be completed in approximately 17 months after the conclusion of the Exchange of Notes (E/N) and Grant Agreement (G/A). The procurement

period shall be scheduled targeting completion by the rainy season in 2018. The entire period of the project will be some 60 months, including a one-year warranty and four-year CMC.

2-2-2 Basic Plan

(1) Overall plan

The project aims to strengthen diagnostic services for NCDs, injuries and others in JDWNRH, MERRH and GCRRH, which are tertiary health facilities. A 64-slice CT, two 16-slice CTs, general digital X-ray apparatus, digital mammography equipment, a spirometer and an ECG Holter system will be procured in the project.

Procurement shall be scheduled considering the seasonal changes of road conditions. The clinical training on the 64-slice CT shall be implemented for the effective use of newly introduced equipment, and a one-year warranty and four-year CMCs for the radiological equipment shall be included for adequate maintenance.

(2) Equipment Plan

In the field survey, the final request and priority by item of the recipient side were confirmed as the following table.

Table 2-1 Confirmed request and priority

Initial request

No.	Equipment	Total	Quantity		
			JDWNRH	MERRH	GCRRH
1	MRI (1.5 Tesla)	1	1	0	0
2	CT (64 Slice)	1	1	0	0
3	CT (16 Slice)	2	0	1	1
4	Ultrasound 3D	3	1	1	1
5	C-arm	3	1	1	1
6	Angiography	3	1	1	1



Final request and priority

No.	Equipment	Total	Quantity			CMC	Priority
			JDWNRH	MERRH	GCRRH		
1	CT (64 Slice)	1	1	0	0	✓	A
2	CT (16 Slice)	2	0	1	1	✓	A
3	MRI (1.5 Tesla)	1	1	0	0		B
4	General Digital X-ray Apparatus	1	0	0	1	✓	B
5	Digital Mammography	1	1	0	0	✓	B
6	Spirometer	1	0	1	0		B
7	ECG Holter System	1	0	1	0		B
8	Ultrasound 3D	3	1	1	1		C
9	C-arm	3	1	1	1		C
10	Angiography	1	1	0	0		C
11	Potable Digital X-ray Apparatus	1	1	0	0		C
12	Potable Ultrasound	1	0	1	0		C
13	Fiberscope	1	0	1	0		C
14	Blood Gas Analyser	1	0	1	0		C

The items to be procured have been selected from the requested items with high priority which are necessary for diagnosis of NCDs and urgent cases.

A 64-slice CT applicable for diagnoses of heart diseases shall be procured for JDWNRH, which is a top-referral hospital in Bhutan. The general X-ray apparatus and mammography equipment shall be digital models, since film-less image diagnosis has been enhanced to reduce the medical costs in Bhutan. The magnetic resonance imaging (MRI) and CT images are analyzed on the monitor, and the X-ray images on the CD-R are sent as well as the patients referred. Additionally, the digital model has the advantage of less exposure to radiation and clearer images. Although MRI also has high priority in the request, it is not included because the MRI currently in use can be inexpensively upgraded by replacing some parts.

A list of equipment to be procured in the project is shown in Table 2-2 and a list of consumables required for initial three months is shown in Table 2-3.

Table 2-2 Equipment list

No.	Equipment	Compositions and Specifications	Quantity
1	CT (64 slice)	1. CT Aperture : 700mm or more Min. scan cycle : 0.40 sec. or less Slice numbers : 64 slices or more X-ray tube heat capacity : 7.0MHU or more X-ray tube voltage : 80~135kV or more X-ray tube current : 10~500mA or more Table : Equipped Console : Equipped 2. Additional Workstation : Equipped (include CT cardiac analysis package) 3. Injector : Equipped 4. ECG monitor : Equipped 5. Color printer : Equipped 6. Protection apron : Equipped 7. UPS : 150kVA or more 8. Lead glass : Equipped 9. X-ray shield door and frame : Equipped 10. Lead panel for entrance wall : Equipped	1
2	CT (16 slice)	1. CT Aperture : 750mm or more Min. scan cycle : 0.75 sec. or less Slice numbers : 16 slices or more X-ray tube heat capacity : 5.0MHU or more X-ray tube voltage : 80~135kV or more X-ray tube current : 10~400mA or more Table : Equipped Console : Equipped Additional Workstation : Equipped 2. Injector : Equipped 3. Color printer : Equipped 4. Protection apron : Equipped 5. UPS : 75kVA or more 6. Cooling AC Unit : Equipped (only for MERRH) 7. Lead glass : Equipped (only for MERRH) 8. X-ray shield door and frame : Equipped (only for MERRH)	2

No.	Equipment	Compositions and Specifications	Quantity
3	General Digital X-ray Apparatus	1. General Digital X-ray Apparatus X-ray generator voltage : 40~125 kV or more X-ray generator current : 10~500mA or more Anode heat capacity : 200kHU or more X-ray tube support : Floor stand type Bucky stand : Equipped Table : Equipped Flat Panel Detector : Dual type, 17×14 inch Control computer : Equipped 2. Color printer : Equipped 3. Protection apron : Equipped 4. UPS : 50kVA or more	1
4	Digital Mammography	1. Digital Mammography X-ray generator voltage : 40kV or more X-ray generator current : 200mA or more Anode heat capacity : 250 kHU or more Mammography stand : Floor stand type Flat Panel Detector : Dual type, 17×14 inch Control computer : Equipped Tomosynthesis system (3D) : Equipped Biopsy unit : Equipped CAD : Equipped Workstation : Equipped Other Accessories : Equipped 2. Color printer : Equipped 3. Protection apron : Equipped 4. UPS : 20kVA or more 5. X-ray shield door and frame : Equipped 6. Lead panel for wall : Equipped	1
5	Spirometer	1. Main unit Test item : SVC, FVC, MV, MVV or more Flow range : 0~ 14.0L/s Volume range : 0~ 10.0L 2. Flow sensor : Equipped 3. Flow sensor head, if necessary : Equipped 4. Calibrator (Calibration syringe) : Equipped 5. Spiro filter : Equipped 6. Paper mouthpiece : Equipped 7. Nose clip : Equipped 8. Printer paper : Equipped	1
6	ECG Holter System	1. ECG recorder Recording period : Continuous 24 hours or more Recording channel : 2 or 3 channel or more Power : AAA alkaline Battery 2. Controller, if necessary : Equipped, Remote type 3. Analysis software : Equipped 4. Desktop type computer : Equipped 5. Color printer : Equipped	1

Table 2-3 List of consumables

Equipment	Items	Unit Price (BTN)	Quantity	Amount (BTN)
CT (64 Slice)	Syringe (200 ml) Extension tube	1,231	200 sets	246,200
	ECG electrode	76	300 pcs	22,800
	Printer cartridge (black and color)	6,918	10 sets	69,180
CT (16 Slice)	Syringe (200 ml) Extension tube	1,231	200 sets×2 HPs=400 sets	492,400
	Printer cartridge (black and color)	6,918	10 sets×2 HPs=20 sets	138,360
General Digital X-ray Apparatus	Printer cartridge (black and color)	6,918	10 sets	69,180
Digital Mammography	Printer cartridge (black and color)	6,918	10 sets	69,180
Spirometer	Printer paper	882	10 rolls	8,820
	Disposal mouthpiece	9	200 pcs	1,800
	Spiro filter	147	100 pcs	14,700
	Flow sensor head	1,059	10 pcs	10,590
ECG Holter System	ECG electrode	76	300 pcs ×5 units=1,500 pcs	114,000
	Printer cartridge (black and color)	6,918	10 sets	69,180
Total				1,326,390

(3) Renovation Plan

When the radiological apparatus is installed, physical work on the rooms and buildings shall be carried out; namely, the removal or enlargement of doors, the provision of a power source and air-conditioning, and radiation-shielding of the room.

As a result of a radiation leakage test at the CT room of JDWNRH in the field survey, brick walls with a thickness of 30 cm and floors above and below the room did not show any leakage, but some leakage was detected around the lead-lined doors and windows with wooden frames. The doors and windows and their frames shall be replaced. It is thought these are also necessary at MERRH.

Furthermore, the thickness of the wall is partially insufficient in the CT room of JDWNRH, and the access window of the room for mammography is not protected. These shall be sealed with radiation protection boards.

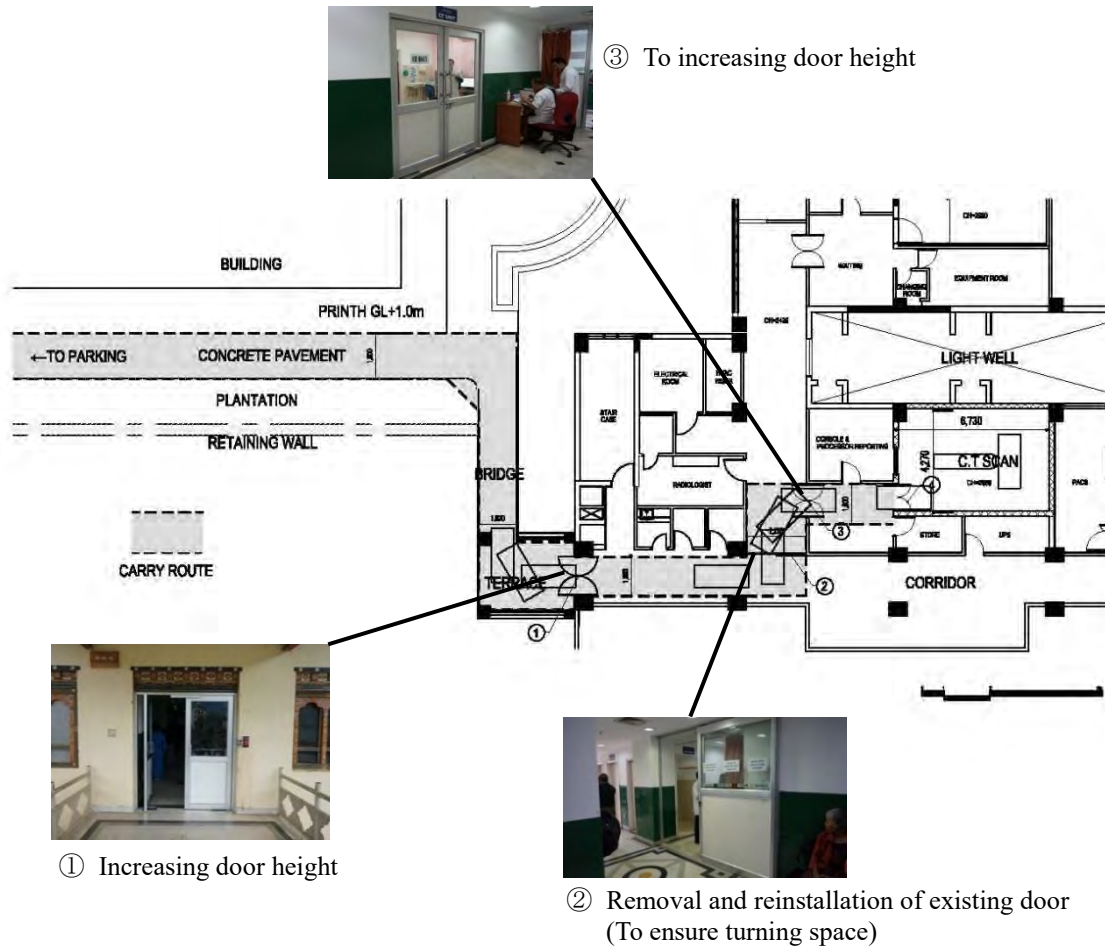
This physical work shall be undertaken at the expense of the Bhutan side, but the steel radiation-shielding doors and radiation protection boards shall be provided by the Japan side in the scope of the project, because these materials are difficult to obtain in Bhutan.

2-2-3 Outline Design Drawing

The location of the installation of main radiological equipment and the relevant physical work is shown in the following drawings.

(1) JDWNRH

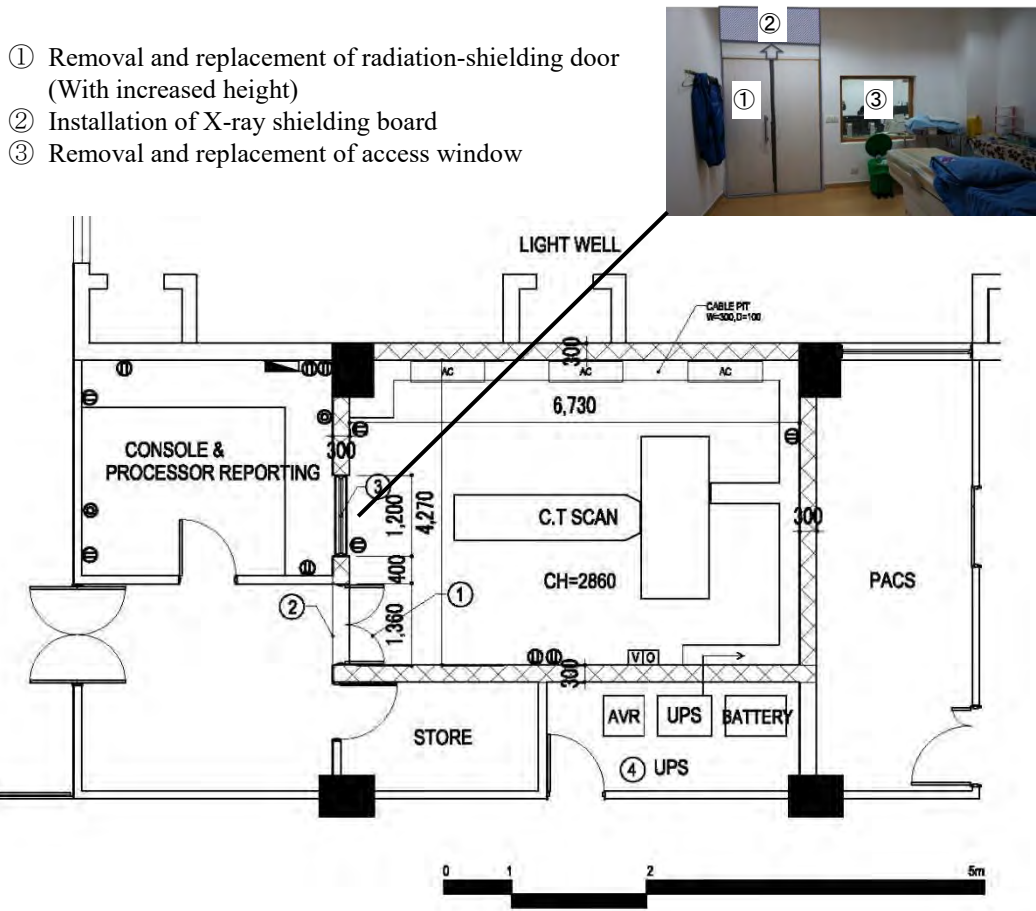
➤ CT



RENOVATION WORKS (EXPANSION OF DOOR OPENING)

NO	TYPE	EXISTING SIZE		REPLACED DOOR SIZE	
		WIDE	HEIGHT	WIDE	HEIGHT
①	ALUMINIUM DOOR (DOUBLE LEAF)	1,500	2,000	1,500	2,100
②	ALUMINIUM DOOR (SLIDING)	1,280	2,400	REMOVAL AND REATTACHED	
③	ALUMINIUM DOOR (DOUBLE LEAF, FREE SWING)	1,350	2,000	1350	2,100
④	X-RAY SHIELD DOOR (DOUBLE LEAF)	1,360	2,000	1,360	2,100

Figure 2-1 Securing the spaces to carry in the equipment (JDWNRH)



LEGEND (EXISTING FACILITIES)

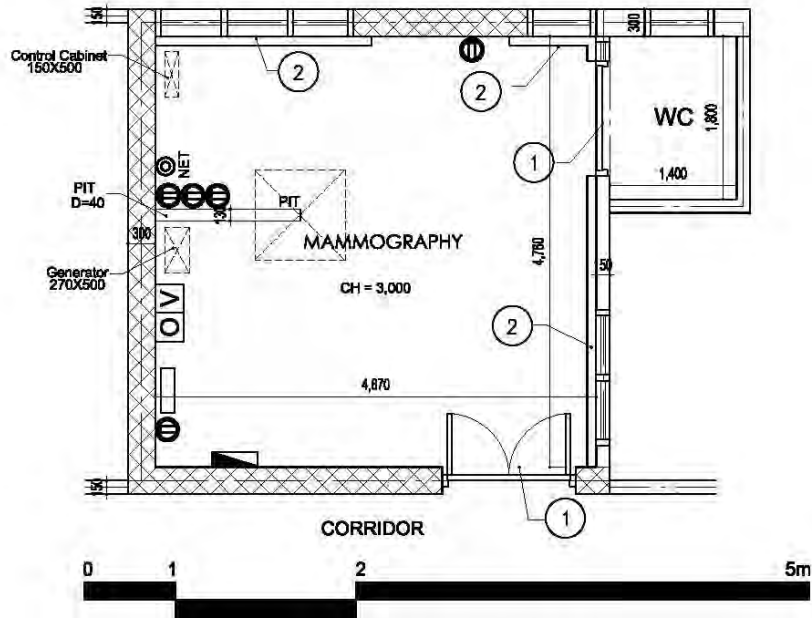
Ⓜ	RECEPTACLE	▬	MCCB
Ⓜ	RECEPTACLE (250V 20A)	∇	VACCUUM
Ⓜ	LAN	A	COMPRESSED AIR
Ⓜ	TELEPHONE	O	OXYGEN
● S	SWITCH		

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, 2.0mm LEAD LINING STEEL FRAME
②	WIDEN UPPER WALL OF DOOR WAY (TO SECURE X-RAY PROTECTION)	300mm THICKNESS BRICK AND CEMENT PLASTER WALL UP TO CONCRETE SLAB OF UPPER FLOOR (EXISTING 180mm), OR Pb=1.0mm LEAD BOARD BACKING ON THE EXISTING WALL
③	REPLACE PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSIT GLASS 2.0mm LEAD LINING STEEL FRAME
④	INCREASE POWER SUPPLY	3PHASE 440V 150KVA EXCLUSIVE USE (EXISTING 125KVA)

Figure 2-2 Floor plan of CT room (JDWNRH)

➤ Digital Mammography



LEGEND (EXISTING FACILITIES)

①	RECEPTACLE	▬	MCCB
②	RECEPTACLE (250V 20A)		
⊙	LAN	V	VACCUM
⊕	TELEPHONE	A	COMPRESSED AIR
● s	SWITCH	O	OXYGEN

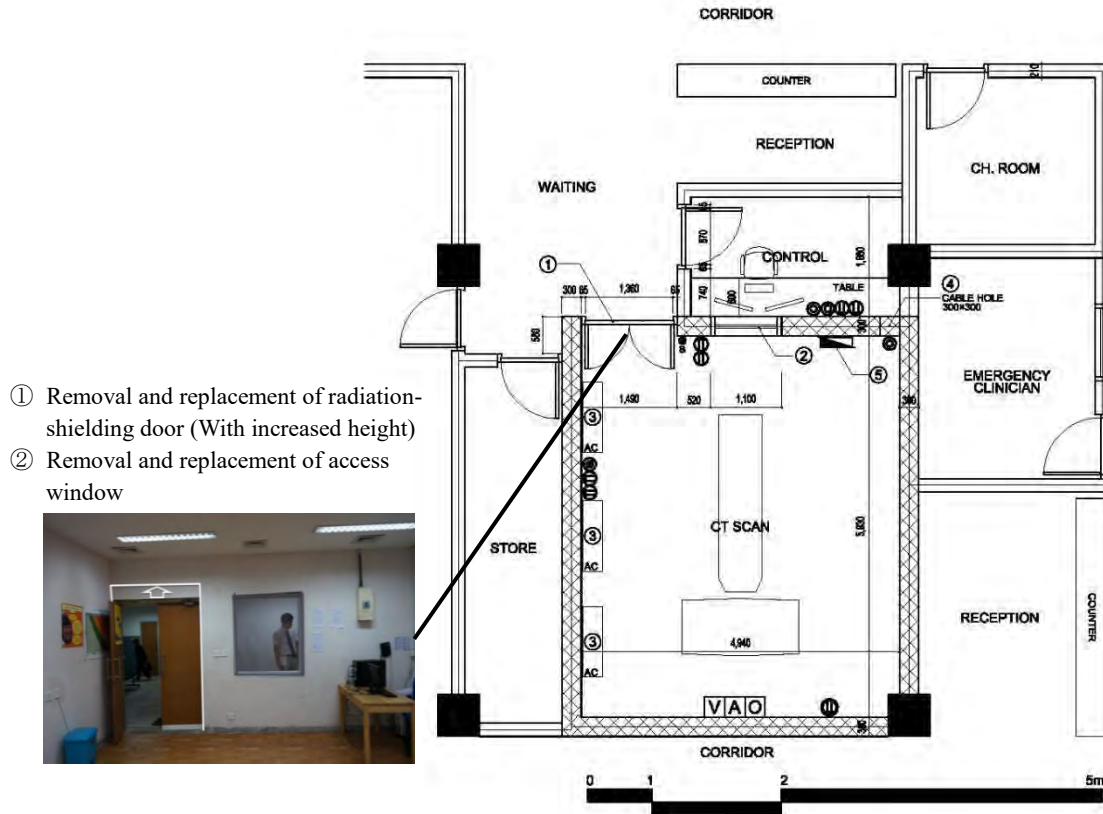
REQUIRED SPECIFICATION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD DOOR (REPLACING)	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,470mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
②	RADIATION SHIELDING OF WINDOWS AND OTHER OPENINGS	SEALING WITH Pb =2.0mm LEAD COMPOSITE BOARD

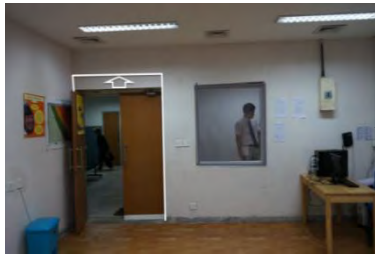
Figure 2-3 Floor plan of Mammography room (JDWNRH)

(2) Mongar Eastern Regional Referral Hospital (MERRH)

➤ CT



- ① Removal and replacement of radiation-shielding door (With increased height)
- ② Removal and replacement of access window



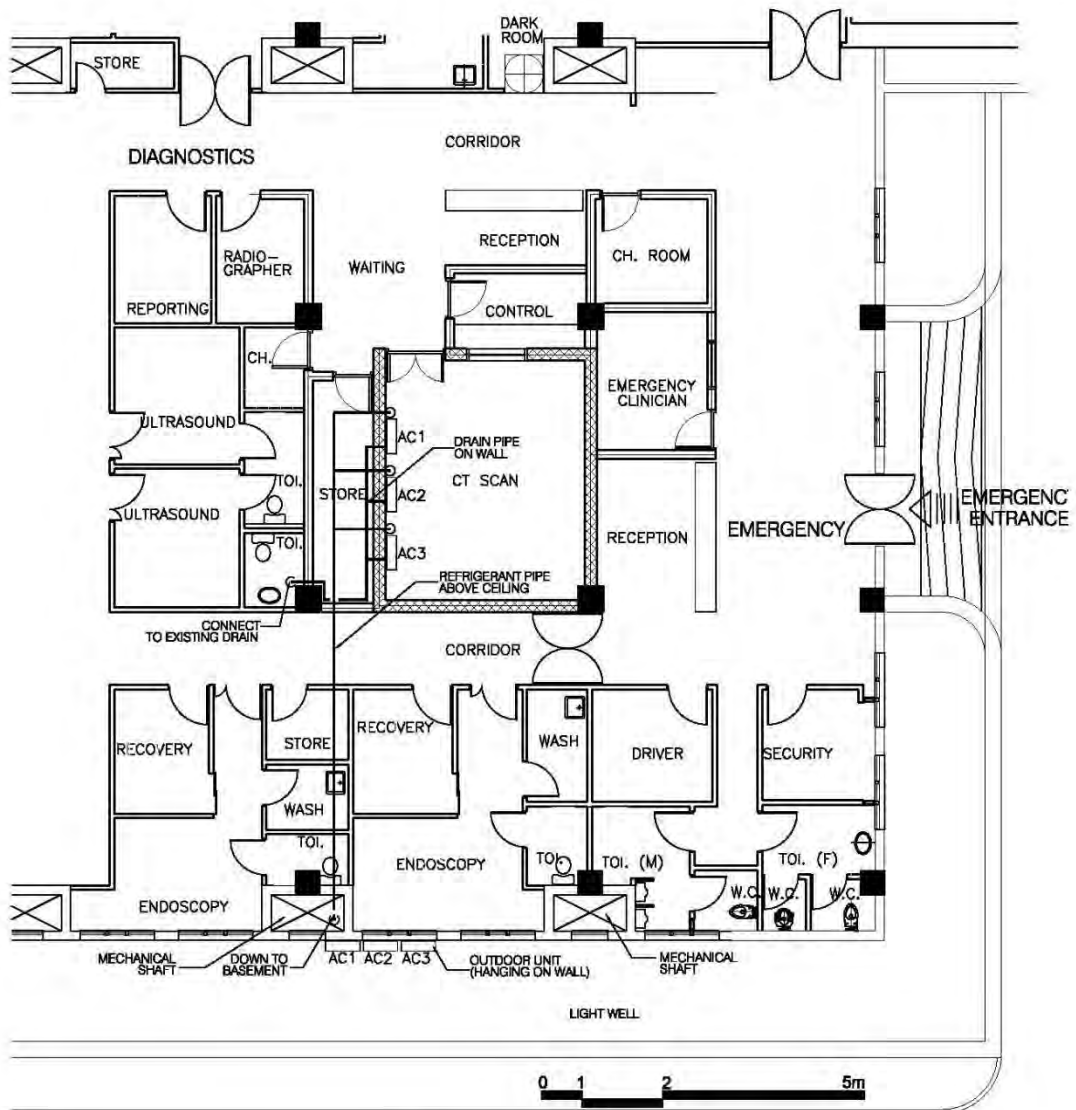
LEGEND (EXISTING FACILITIES)

Ⓜ	RECEPTACLE	▬	MCCB 400V 45kw
Ⓜ	RECEPTACLE (250V 20A)		
Ⓛ	LAN	V	VACCUM
Ⓣ	TELEPHONE	A	COMPRESSED AIR
● s	SWITCH	O	OXYGEN

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
②	INSTALL PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 1,100mm WIDTH, 1,200mm HEIGHT, 2.0mm LEAD LINING STEEL DOOR
③	INSTALL COOLING AC UNIT	TEMPERATURE 18~26°C, MOISTURE 30~60%, COOLING CAPACITY 4.0kw x3NOs WITH DRAIN AND REFRIGENT PIPING
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	INCREASE POWER SUPPLY	3PHASE 415V 75KVA EXCLUSIVE USE (EXISTING 51KVA)

Figure 2-4 Floor plan of CT room (MERRH)



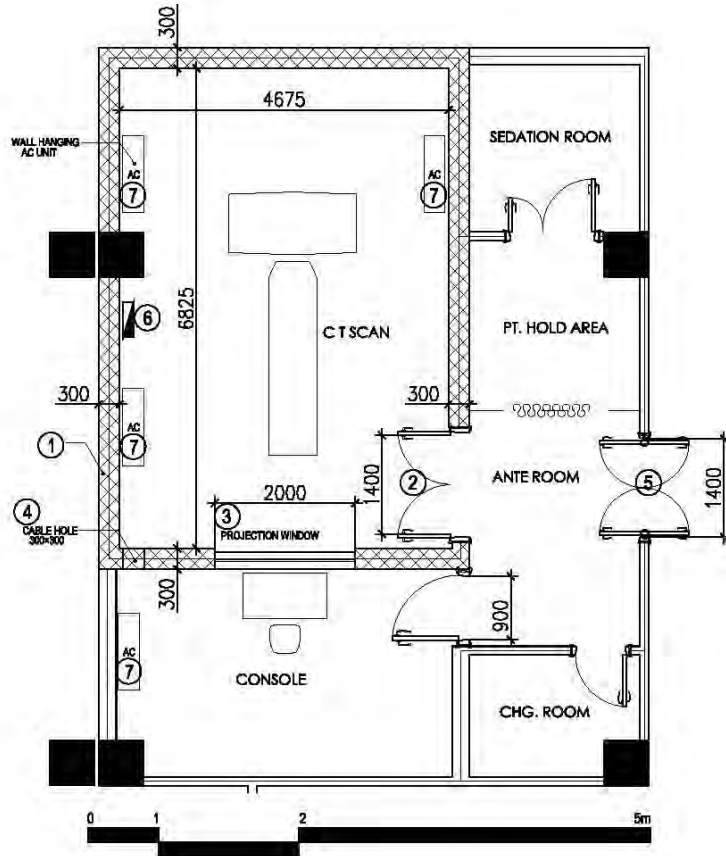
SPECIFICATION

EQP. No.	EQUIPMENT	ABILITY	VOLTAGE	POWER (KW)	NO
AC1	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
AC2	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
AC3	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
REFRIGERANT PIPING	PIPES : COPPER PIPE FITTINGS : WELDING JOINT				
DRAIN PIPING	PIPES : POLYVINYL CHLORIDE PIPE(VP) FITTINGS : PVC FITTINGS (DRAINAGE TYPE)				

Figure 2-5 AC unit & piping of CT room (MERRH)

(3) Gelephu Central Regional Referral Hospital (GRRH)

➤ CT

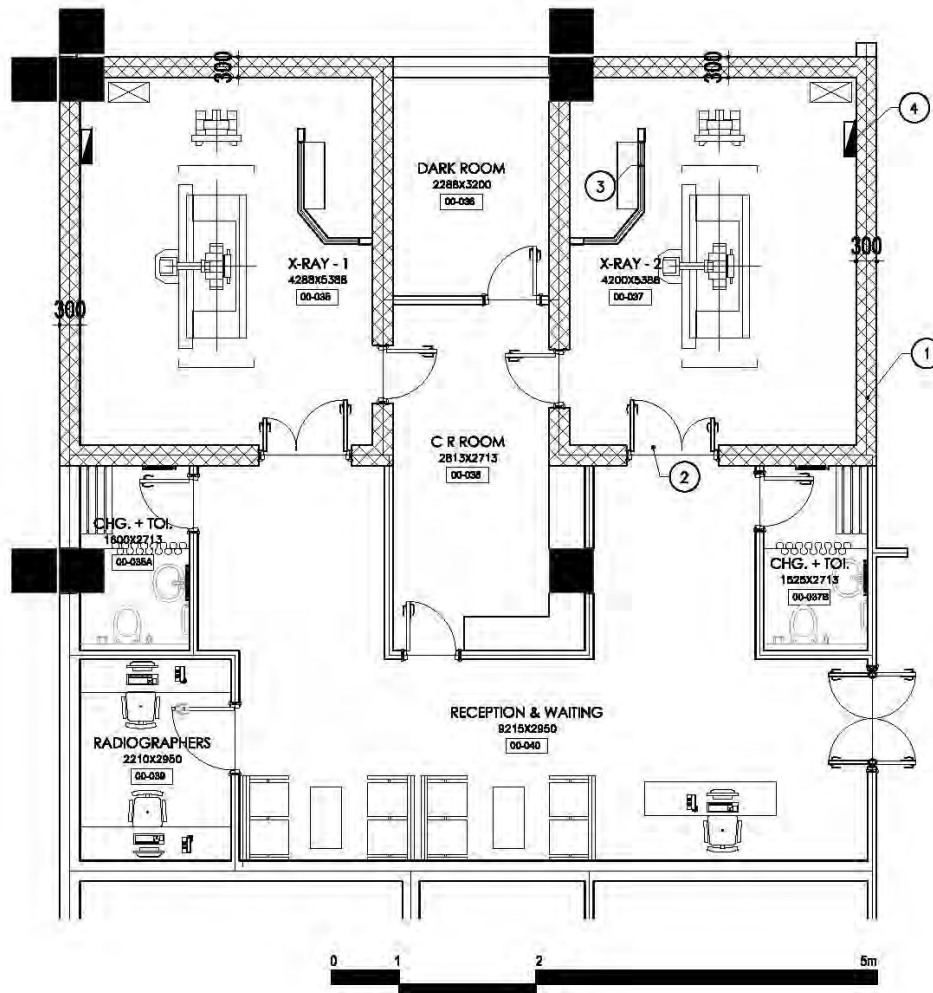


REQUIRED SPECIFICATION FOR CONSTRUCTION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD STRUCTURE	THE WALLS SHALL BE MORTAR-FINISHED BRICK AT LEAST 30 cm THICK. THE UPPER FLOOR SLABS SHALL BE 18 cm-THICK CONCRETE. OR RADIATION-SHIELDING MEASURES EQUIVALENT TO THAT SHALL BE TAKEN.
②	X-RAY SHIELD DOOR	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,400mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
③	PROTECTION WINDOW	Pb ≈2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 2,000mm WIDTH, 900mm HEIGHT, WINDOW FRAME SHALL BE COVERED WITH 2.0mm LEAD
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	ACCESS DOOR	NOT LESS THAN 1,400mm WIDTH OR 2,100mm HEIGHT
⑥	POWER DISTRIBUTION BOARD	3 PHASE 3 WIRE, 380~480V, 50/60Hz, VOLTAGE FLUCTUATION LESS THAN ±5%, CAPACITY 75KVA, EARTHING LESS THAN 10Ω
⑦	COOLING AC UNIT	TEMPERATURE 18~26°C, MOISTURE 30~60%, COOLING CAPACITY 4.0kw x 4NOs

Figure 2-6 Floor plan of CT room (GRRH)

➤ General Digital X-ray Apparatus



REQUIRED SPECIFICATION FOR CONSTRUCTION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD STRUCTURE	THE WALLS SHALL BE MORTAR-FINISHED BRICK AT LEAST 30 cm THICK. THE UPPER FLOOR SLABS SHALL BE 18 cm-THICK CONCRETE: OR RADIATION-SHIELDING MEASURES EQUIVALENT TO THAT SHALL BE TAKEN.
②	X-RAY SHIELD DOOR	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,400mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
③	PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 2,000mm WIDTH, 900mm HEIGHT, WINDOW FRAME SHALL BE COVERED WITH 2.0mm LEAD
④	POWER SUPPLY	3 PHASE, 400~480V, 50/60Hz, VOLTAGE FLUCTUATION LESS THAN ±10%, MAX OUTPUT 40KW ,CAPACITY50KVA

Figure 2-7 Floor plan of General Digital X-ray room (GCRRH)

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The project will be implemented in accordance with Japan's Grant Aid Scheme. After the approval of the cabinet of the government of Japan, an E/N on the project will be concluded between the governments of Japan and Bhutan, and a G/A will be concluded between the government of Bhutan and the Japan International Cooperation Agency (JICA).

Then, a Japanese consultancy company recommended by JICA will conclude a consultancy service contract with MOH, and the contract will become effective with the approval of JICA. The consultant will implement the tender-related work and the supervision of procurement work of the project in accordance with the contract.

A Japanese supplier selected in the tender will procure the equipment under the procurement contract concluded with MOH, which will also become effective after approval by JICA. The supplier will procure, transport and install the equipment, provide technical guidance on the operation and maintenance of all the equipment and prepare technical documents such as manuals, required for maintenance of the equipment after procurement and a list of the manufacturers and agents for the equipment.

2-2-4-2 Implementation Conditions

In Bhutan, the Gross National Happiness Commission (GNHC) takes charge of assistance from abroad. Accordingly, GNHC signs E/N, G/A and the Banking Arrangement (B/A) for Japan's grant aid, and issues the Authorization to Pay (A/P) based on B/A.

According to the guidelines of the Ministry of Finance (MOF) of Bhutan, all taxes for equipment and materials in the bilateral assistance project should be exempted. The department of revenue and customs in MOF of Bhutan will issue the certificate of tax exemption for the project in accordance with E/N and G/A on the project. In addition, taxes for maintenance contracts in the project shall also be exempted. MOH will prepare and submit the necessary documents to MOF, and obtain the certificate of tax exemption at the request of the supplier.

2-2-4-3 Scope of Works

(1) Scope of Works on Procurement

- The government of Japan
 - 1) Procurement of the equipment
 - 2) Marine and land transportation of the equipment to the target hospitals
 - 3) Installation of the equipment
 - 4) Adjustment and test operation of the equipment, and technical training on operation, daily inspection and maintenance

- 5) Implementation of soft component
- 6) Maintenance of the radiological equipment

➤ The government of Bhutan

- 1) Providing documents and information required for transportation, installation of the equipment
- 2) Acquisition of permits required for import of the equipment
- 3) Improvement of the room in which the procured equipment is installed
- 4) Securing the locations for unloading the procured equipment
- 5) Providing the sites for the storage of the procured equipment prior to its installation
- 6) Securing the route to carry in the procured equipment
- 7) Removal of existing equipment and repair of the rooms after removal

(2) Scope of Works on Renovation of Facilities

While the renovation work necessary for the installation of the radiological equipment shall be the responsibility of the Bhutan side, the Japan side will supply the materials as shown below.

1) JDWNRH

➤ CT

Renovation work items	Bhutan	Japan
Removal of existing CT (Existing equipment to be relocated to Emergency Department)	○	-
Securing the route to carry in the equipment ● Removal and replacement of existing door (Increasing door height) ● Removal and reinstallation of existing door (To ensure turning space)	○	-
Removal and replacement of radiation-shielding door ● Door height to be increased to 2.1 m ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Physical work)	○ (Provision of radiation-shielding door and doorframe)
Removal and replacement of access window ● Lead glass with Pb equivalence of 2.0 mm ● Frame to be of steel with 2.0 mm lead plate	○ (Physical work)	○ (Provision of lead glass and frame)
Upgrading of radiation-shielding wall above the door ● Attachment of X-ray shielding board (Pb equivalency 1.0 mm) over section of wall that is 18 cm thick	○ (Physical work)	○ (Provision of X-ray shielding board)
Increase of power supply capacity (150 kVA)	○	○ (Provision of UPS)
Other incidental work necessary for installation of the equipment	○	-

➤ Digital Mammography

Renovation work items	Bhutan	Japan
Removal of existing X-ray equipment (Existing equipment to be relocated to Emergency Department)	○	-
Removal and replacement of radiation-shielding door ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Installation work)	○ (Provision of radiation-shielding door and doorframe)
Radiation shielding of windows and other openings ● Sealing with X-ray shielding board (Pb equivalency 2.0 mm)	○ (Installation work)	○ (Provision of X-ray shielding board)
Other incidental work necessary for installation of the equipment	○	-

2) Mongar Eastern Regional Referral Hospital

➤ CT

Renovation work items	Bhutan	Japan
Removal and replacement of radiation-shielding door ● Door height to be increased to 2.1 m ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Installation work)	○ (Provision of radiation-shielding door and doorframe)
Removal and replacement of access window ● Lead glass with Pb equivalence of 2.0 mm ● Frame to be steel with 2.0 mm lead plate	○ (Installation work)	○ (Provision of lead glass and frame)
Increase of power supply capacity (75 kVA)	○	○ (Provision of UPS)
Installation of room cooler units ● 3 units with cooling capacity of 4.0 kw ● Outdoor units to be installed in dry area of basement ● Includes laying of refrigerant pipes and drains	○ (Installation work)	○ (Provision of 3 room cooler units)
Other construction work/incidental work necessary for installation of the equipment	○	-

3) Gelephu Central Regional Referral Hospital

The buildings are currently under construction, and preparation of various rooms, facilities and routes to carry in the equipment shall be the responsibility of the Bhutan side. Uninterruptible power supplies (UPS) for the equipment shall be supplied by the Japan side.

➤ CT

Renovation work items	Bhutan	Japan
<u>Structure of room</u> The walls shall be mortar-finished brick at least 30 cm thick. The upper floor slabs shall be 18 cm-thick concrete: or radiation-shielding measures equivalent to that shall be taken.	○	-
<u>Radiation-shielding door</u> The entryway door and doorframe shall both have lead lining of at least 2.0 mm. The doorway shall have an effective width of 1.4 m and an effective height of at least 2.1 m.	○	-
<u>Access window</u> The window shall have radiation-shielding glass with a Pb equivalency of at least 2.0 mm, and the window frame shall also be protected with lead plate at least 2.0 mm thick.	○	-

<u>Cable opening</u> A cable penetration opening measuring 300 mm × 300 mm shall be made in the partition wall between the control room and the imaging room, and the opening shall be sealed on both sides with lead plate at least 2.0 mm thick.	○	-
<u>Size of doors</u> All doors leading from the entrance to the building to the CT room shall have an effective width of 1.4 m and an effective height of at least 2.1 m.	○	-
<u>Power supply</u> A dedicated electrical panel (MCCB) supplying 3-phase, 3-wire 380 – 480V with a capacity of at least 75 kVA shall be installed in either the CT imaging room or the control room.	○	○ (Provision of UPS)
<u>Cooling system</u> Separately from the normal air conditioning system, a dedicated cooling unit shall be installed that is appropriate for the amount of heat generated by the equipment to be installed. (To maintain temperatures of 18 - 26° C, humidity of 30 - 60%) when the equipment is in operation.)	○	-

➤ **General Digital X-ray Apparatus**

Renovation work items	Bhutan	Japan
<u>Structure of room</u> The walls shall be mortar-finished brick at least 30 cm thick. The upper floor slabs shall be 15cm-thick concrete or radiation-shielding measures equivalent to that shall be taken.	○	-
<u>Radiation-shielding door</u> The entryway door and doorframe shall both have lead lining of at least 2.0 mm. The doorway shall have an effective width of 1.2 m and an effective height of at least 2.1 m.	○	-
<u>Shielding plate</u> Shielding performance shall be Pb equivalency of at least 2.0 mm	○	-
<u>Power supply</u> 3-phase, 400 – 480V, 50/60Hz, Voltage fluctuation less than ±10%, Max output 40 kw, Capacity 50 kVA	○	○ (Provision of UPS)

2-2-4-4 Consultant Supervision

After completing the tender-related work to select a supplier of the equipment, the consultant will supervise the equipment procurement by the supplier. The focus of supervision of the procurement work should be on verification of conformity of the procured equipment to the contract documents, pre-shipment inspection of the products and packing conditions, confirmation of the state of marine and land transportation/customs clearance, and final reception of the equipment at the target hospitals.

Moreover, the consultant should always make every effort to monitor the progress of each process of the project and inform the relevant organizations of the two countries of such progress, and provide appropriate advice and instruction to both the implementation agency in Bhutan and the equipment supplier. The consultant will conduct on-the-spot supervision until the end of the project.

2-2-4-5 Procurement Plan

(1) Procurement Sources

In the project, Japanese products will be procured in principle. However, there is a possibility that products from third countries will also be considered for procurement for competitive bidding.

In Bhutan, almost all medical equipment, its consumables and spare parts are purchased from agencies in India, and engineers are dispatched from India when the equipment needs to be repaired. Considering these conditions, CMC for the radiological equipment shall include the supply of spare parts. The equipment that requires CMC and/or the regular supply of consumables and spare parts shall be procured from manufacturers whose agents are located in Bhutan or India.

(2) Transportation Route

The equipment to be procured in Japan will be shipped from the port of Yokohama to the port of Kolkata in India and transported by truck from the port of Kolkata to Phuentsholing in Bhutan. After all the equipment has cleared customs in Phuentsholing, the equipment will be transported to each facility by truck.

The border between India and Bhutan has three border posts in Phuentsholing, Gelephu and Samdrup Jongkhar. Customs clearance of products not made in India is available only at Phuentsholing, and after Phuentsholing, trucks can drive through territory in north India again and go into Bhutan through another border post. However, the availability of these border posts is sometimes influenced by the security situation in India.

All the equipment procured in the project shall be brought to Phuentsholing first. After customs clearance there, they will be delivered to JDWNRH, MERRH and GCRRH, respectively. The trucks going to MERRH and GCRRH drive into Indian territory again after customs clearance, and enter Bhutan at Samdrup Jongkhar or Gelephu. The exact transportation route should be determined carefully considering the security situation and road conditions at the time of delivery to the sites.

It takes approximately 40 days for transportation from the port of Yokohama to each hospital including customs clearance.

2-2-4-6 Operational Guidance Plan

After installation of the equipment, initial setting, adjustment, test operation and functional inspection shall be done by engineers of the manufacturers. In addition, the engineers will conduct technical training for health staff of the target hospitals on the basic operation, replacement of consumables, daily inspection and maintenance of the equipment.

The equipment are mainly sophisticated radiological apparatus, and their operation, especially of CT, are complicated. Moreover, those Japanese products may be new to the health staff of target hospitals. Consequently, sufficient guidance on operation shall be given to the users for the smooth and appropriate use of the equipment. As for the equipment with CMC, the outline of the maintenance contract and ways to contact the manufacturers or their agents shall be explained to the hospital staff as well.

2-2-4-7 Soft Component Plan

The number of patients with NCDs has increased year by year and heart diseases have become a leading cause of death in Bhutan. However, currently, most of the patients with heart diseases are transferred to hospitals in India because the diagnosis and treatment of heart diseases are not available in Bhutan. Considering this situation, it was decided that a 64-slice CT, which has the function of a cardiac CT scan, shall be procured for JDWNRH in the project.

The health staff in JDWNRH basically can conduct CT examinations for most diseases except for heart disease, since the 16-slice CT has been used in the hospital thus far. The 64-slice CT, first installed in Bhutan in this project, is very new to them and they need to obtain specialist knowledge and skills for cardiac CT scan and image diagnosis with the new CT. Accordingly, the project includes clinical training on patient management and image analysis of heart diseases as a soft component of the grant aid project.

A Japanese doctor and a radiological technologist who are acquainted with cardiac CT scans will be dispatched as training instructors targeting about 30 participants including cardiologists, radiologists, radio-technologists, radio-technicians and CT nurses. The participants will be invited not only from JDWNRH but also regional referral hospitals in order to improve a system for providing diagnosis and follow-ups for patients with heart diseases throughout the whole country. In advance of the installation, a three-day training course will be held, and after installation, two batches of five-day training courses will be conducted.

2-2-4-8 Implementation Schedule

The implementation schedule of the project consists of three stages: tender-related work, equipment procurement/installation and maintenance service. Figure 2-8 shows the implementing processes of the project after the conclusion of G/A. It is expected to take five months for tender-related work and 12 months for procurement and installation. Since there is a four-year CMC for the radiological equipment after a one-year warranty period, the entire implementation schedule shall be completed in five years after the installation of the equipment.

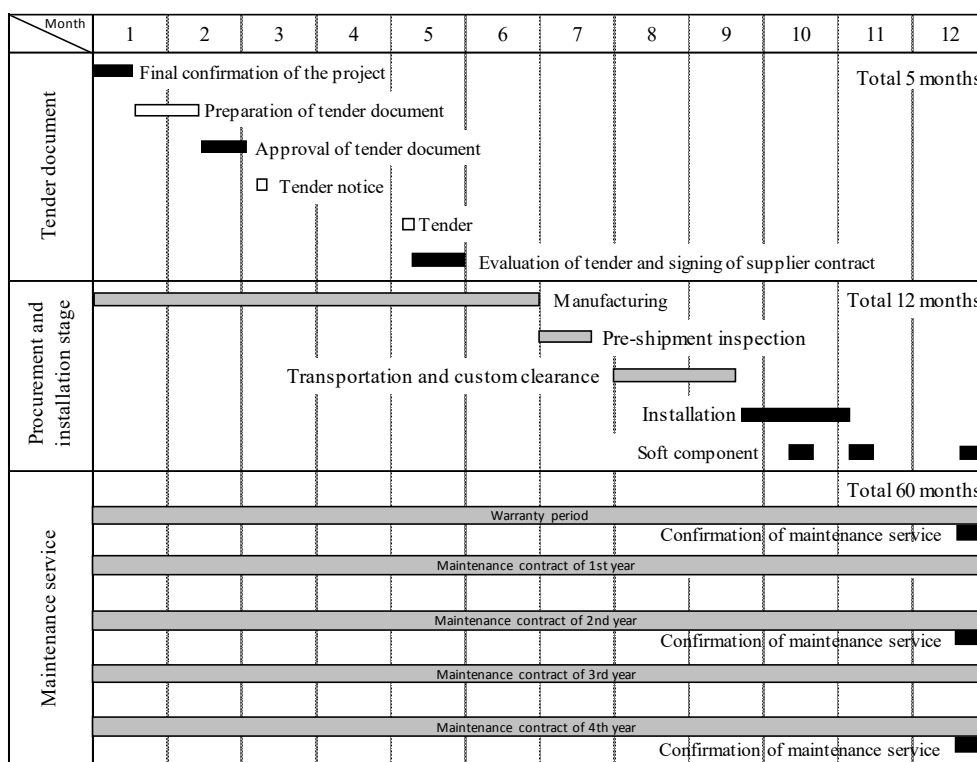


Figure 2-8 Implementation schedule of the project

2-3 Obligations of Recipient Country

The responsibilities of the Bhutan side in the implementation of the project are described in "2-2-4-3 Scope of Works". The following work shall be undertaken by MOH in association with relevant ministries and the target hospitals.

- Facilitation of signing B/A and issuing A/P
- Facilitation of issuing any other official documents indispensable for the implementation
- Facilitation of procedures for customs clearance and tax exemption for the equipment and maintenance services
- Completion of the building construction of GCRRH before the installation of the equipment
- Implementation of other physical work necessary for and after the installation of the equipment
- Allocation of personnel to correctly use the equipment
- Allocation of budget for operation and maintenance of the equipment
- Assurance of convenience and safety to consultant and supplier of the equipment
- Waiver of customs and other various taxes for the supplier and its employees

The cost of physical work to be borne by the Bhutan side is shown in the following table. The cost includes that for removal and/or relocating of existing equipment and material for the work such as concrete.

Expenses borne by Bhutan for Repair / Extension / Renovation work

Contents of physical works	Expenditure (BTN)
JDWNRH Preparation of the CT room and the space to carry in the equipment	850,000
JDWNRH Preparation of the Mammography room	70,000
MERRH Preparation of the CT room	1,580,000
Total	2,500,000

2-4 Project Operation Plan

2-4-1 Human Resources Allocation

As of 2015, there are 251 doctors in Bhutan, and seven of them are radiologists. Only radiologists can read CT and MRI images and write the results in reports to send to the specialists. Radio-technologists and radio-technicians also work at radiology unit of the hospitals. At present, a bachelor's degree for radio-technologists is not available domestically; however, the Kesar Gyalpo University of Medical Sciences, the sole medical university in Bhutan, provides a training course for radio-technicians. Radio-technologists who graduated from universities abroad can operate all kinds of radiological apparatus such as MRI, CT, X-ray and ultrasound, and radio-technicians who have completed a two- or three-year training course in the country usually operate one type of apparatus. Radiologists and technicians who have completed the training on use of mammography have already been allocated to JDWNRH. A CT nurse has a role in managing infusion, patient condition and others during CT examination.

Human resources allocation at all health facilities is decided by MOH. Table 2-4 shows the current and planned personnel for the radiological equipment procured in the project. These staff members are expected to be secured before the installation of the equipment.

Table 2-4 Plan of human resources allocation for use of the equipment procured

Category	JDWNRH		MERRH		GCRRH	
	Current	Plan	Current	Plan	Current	Plan
1. Radiologist	5	4	0	1	0	1
2. Radio-technologist	2	3	1	2	1	2
3. Radio-technician	4	6	0	2	0	2
4. X-Ray Technician	16	16	3	3	4	4
5. CT Nurse	1	2	0	1	0	1
6. Mammography Technician	2	2				

Current: As of December 2016, Plan: At the time of installation

2-4-2 Maintenance of Medical Equipment

In Bhutan, the medical equipment of all 48 health facilities of MOH is maintained with an inventory by the Bio Medical Engineering Division (BMED) of MOH. Table 2-5 shows human resources allocation for maintenance of medical equipment at present. Biomedical engineers and technicians are allocated to the regional referral hospitals, and they maintain and repair the equipment of health facilities in the respective regions. They will also carry out daily checks of the equipment procured in the project.

When a problem occurs with complicated equipment such as radiological equipment, the facilities request an agent in India to send their engineer because few agents exist in Bhutan. Consequently, MOH concludes a maintenance contract, CMC or an annual maintenance contract (AMC), with a manufacturer for such equipment.

A CMC covers several years and includes unlimited on-call support, which is relatively expensive. An AMC covers a single year and includes the cost for dispatch of engineers, although it does not include the cost for necessary spare parts. Since the MOH guideline requires at least a five-year contract for important equipment, a four-year CMC in addition to a one-year warranty period for the equipment shall be included in the project.

Table 2-5 Human resources allocation for maintenance of medical equipment

Category	BMED	JDWNRH	MERRH	GCRRH
Bio Medical Engineer	5	1	0	0
Assistant/Bio Medical Junior Engineer	2	1	1	0
Bio Medical Technician	2	2	0	1
Basic Operator	0	1	0	0

The figures are as of November, 2016

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

Expenses borne by Bhutan is estimated as shown below.

(1) Expenses borne by Bhutan

Items	Expense (BTN)
Expenses borne by Bhutan for Repair / Extension / Renovation work	2,500,000 (4.3 million yen)
Others (Commission)	700,000 (1.2 million yen)
Total	3,200,000 (5.5 million yen)

(2) Estimation conditions

- ① Time of estimation : September, 2016
- ② Exchange rate : US\$ 1 = 104.59 yen
INR 1 = 1.70 yen
BTN 1 = 1.70 yen
- ③ Implementation period : The period is shown in Figure 2-8
- ④ Other : To be estimated in accordance with the Japan's Grant Aid scheme

2-5-2 Operation and Maintenance Cost

Table 2-6 shows the budgets of the health sector in Bhutan and target hospitals; these budgets have been increasing year by year. According to the recent National Budget, some 500 million BTN is annually allocated for the procurement of essential medicine and medical equipment.

Table 2-6 Health budget (Unit : Million BTN)

	2013-14	2014-15	2014-16
Health Budget			
Total amount of health budget	3,139	3,206	3,934
Health expenditure (% of general budget)	7.94%	7.94%	7.76%
Essential medicine and medical equipment	--	514	550
Budget of target hospitals			
JDWNRH	560	890	993
MERRH	113	124	132
GCRRH	81	104	104

Source : National Budget 2013-14, 2014-15, 2015-16, Ministry of Finance, Bhutan
Questionnaire of the field survey

The cost to be borne by the Bhutan side is approximate 3.2 million BTN as described in "2-5-1 Initial Cost Estimation", and this is thought to not be difficult for the Bhutan side. The annual cost for consumables for the equipment is estimated at some five million BTN. Because the cost is less than one percent of the budget for essential medicines and equipment appropriated into the annual health budget, it is also thought to be manageable for the Bhutan side within the framework of the current budget.

The equipment to be procured in the project shall be maintained appropriately by the Bhutan side even after the end of the five-year CMC period covered by the project. On the assumption that the budget increase trend will continue, the amount for maintenance of the equipment can be arranged during the five-year period covered by the project.

Accordingly, implementation of the project causes no serious problems regarding the financial aspects of operation and maintenance.

Chapter 3 Project Evaluation

Chapter 3 Project Evaluation

3-1 Preconditions

The responsibilities of the Bhutan side described in “2-3 Obligations of Recipient Country” shall be fulfilled for the implementation of the project. Especially, the construction of the new GCRRH building, which has been conducted under the responsibility of the Bhutan side, shall be completed in advance to the installation of the equipment procured in the project. It is a precondition for the smooth implementation of the entire project. Accordingly, MOH is requested to report to the JICA Bhutan Office on the monthly progress of construction work of the building.

It also important that the necessary measures shall be taken by the government of Bhutan for customs clearance and tax-exemption for the equipment and maintenance services during the transportation stage of the equipment.

3-2 Necessary Inputs by Recipient Country

The following inputs should be made by the Bhutan side.

- Allocation of personnel to adequately use and maintain the equipment
- Implementation of physical preparation before and/or necessary renovation after installation of the equipment
- Continuous supply of consumables for the equipment
- Allocation of budget for maintenance of the radiological equipment after the end of the five-year CMC period covered by the project
- Continuous education for health staff to effectively use and maintain the equipment

3-3 Important Assumptions

The following assumptions are important for the smooth implementation and sustainable effect of the project.

- The transportation and installation of the equipment will be implemented without any obstructions such as landslides and road collapses in the rainy season, frozen roads in winter, security problems in the areas on the Indian border.
- Electricity, road conditions and infrastructure of the project sites will be maintained without any serious problems.

- Business of prospective manufacturers and their agents in Bhutan and/or India will be continued and their maintenance services will not be suspended.

3-4 Project Evaluation

3-4-1 Relevance

The project provides medical equipment needed for diagnosis of NCDs, injuries and others for the national and regional referral hospitals to strengthen the diagnostic services of those hospitals with the objective of improving access to quality health services. The purpose of the project is consistent with the target of the health sector in the current five-year plan. The effort by the government of Bhutan to achieve equitable access to quality health services shall be continued so that the effect of the project contributes to the achievement of UHC.

In addition, the purpose of the project corresponds to the policy of Japanese cooperation with Bhutan, which supports sustainable economic growth through correcting the disparity between urban and rural areas. The project is thought to be adequate assistance under the Japanese grant in the health sector of Bhutan following past grant aid projects.

At present, a CT examination is only available at JDWNRH. Patients have to go to hospitals in India when they need examinations and treatment for heart diseases, breast cancer and others which require more advanced equipment and skills. It is an urgent matter to strengthen diagnostic services in both national and regional referral hospitals to reduce the physical and financial burden of transportation on patients. It is expected that introducing the medical equipment to the target hospitals enables early diagnosis and treatment for NCDs, injuries and others in each region and reduces the burden on patients. The whole nation, especially the poor in rural areas, will benefit from the project.

For these reasons, it is justified that the relevance of the implementation of the project is high.

3-4-2 Effectiveness

By introducing the medical equipment needed for diagnosis of NCDs, injuries and others in the project, diagnostic services of national and regional referral hospitals will be improved. The following effects can be expected.

1) Quantitative effects

	Indicators	Baseline (2015)	Target* (2021)
1	Number of days for which use of CT is suspended in JDWNRH (days/year)	16	2
2	Number of CT examinations in JDWNRH (cases/year)	3,782	5,000
3	Number of CT examinations in MERRH (cases/year)	0	1,500
4	Number of CT examinations in GCRRH (cases/year)	0	1,500

*Target year is set as 3 years after completion of equipment procurement

The basis for calculation of baseline and target figures of the quantitative effects are as follows:

	Baseline (2015)	Target (2021)
1	<p>The baseline figure is based on the log-book of maintenance and examination records of CT in 2015 in JDWNRH.</p> <p>Sunday is not included in the figure because CT examinations are conducted only in emergency cases.</p>	<p>It will be expected that CT examination is basically available every day because there will be two CTs in JDWNRH.</p> <p>Considering the possibility of malfunction of both CTs, target shall be set as 2 days, which is necessary time for engineers to come from India and repair.</p>
2	<p>The baseline figure is based on examination records of CT in 2015 in JDWNRH.</p>	<p>It is assumed that the number of CT examinations was 4,000 cases in 2015 if failures of CT did not occur.</p> <p>Existing CT shall be moved to Emergency Dept., and it is assumed that 3 CT examinations per day will be performed for emergency patients.</p> <p>Emergency: 3 cases × 365 days = 1,095 cases/year 4,000 (New CT) + 1,000 (Existing CT) = 5,000 cases/year</p> <p>It is expected that about 5,000 cases of CT examinations will be performed annually.</p>
3	<p>The baseline figure is “0” because of first time installation of CT.</p>	<p>The number of in-patients referred for CT examination was 190 in 2015.</p> <p>Also, it is assumed that 3 out-patients were referred for CT examinations per day.</p> <p>Out-patients: 3 cases × 365 days = 1,095 cases/year 190 (in-patients) + 1,095 (out-patients) = 1,285 cases/year</p> <p>It is expected that the number of CT examinations will increase up to 1,500 cases annually.</p>
4	<p>The baseline figure is “0” because of first time installation of CT.</p>	<p>The number of in-patients referred for CT examination was 305 in 2015.</p> <p>Also, it is assumed that 3 out-patients were referred for CT examinations per day.</p> <p>Out-patients: 3 cases × 365 days = 1,095 cases/year 305 (in-patients) + 1,095 (out-patients) = 1,285 cases/year</p> <p>It is expected that the number of CT examinations will increase up to 1,500 cases annually.</p>

2) Qualitative effects

- ① Improvement of health services at target hospitals by enabling early diagnosis and treatment
- ② Alleviation of burden on patients by reducing waiting time and/or travel time for CT examination with availability of CT examination at regional referral hospitals
- ③ Improvement of skills of health staff by introducing sophisticated equipment for diagnosis

Appendices

- 1. Member List of the Survey**
- 2. Survey Schedule**
- 3. List of Parties Concerned in the Recipient Country**
- 4. Minutes of Discussions**
- 5. Soft Component Plan**

Appendix 1. Member List of the Survey

(1) Preparatory Survey (August 13 – September 11, 2016)

Mr. Tatsuya Ashida	Team Leader Advisor, Health Team 4, Human Development Dept., JICA
Dr. Ryota Sakamoto	Technical Advisor Associate Professor, Center for Southeast Asian Studies Kyoto Univ.
Mr. Yukihiro Kondo	Cooperation Planning Health Team 4, Human Development Dept., JICA
Mr. Kazuhiro Abe	Project Manager/Equipment Planning International Techno Center Co., Ltd.
Ms. Yuko Suzuki	Equipment Planning International Techno Center Co., Ltd.
Mr. Kota Yoshifuji	Procurement & Cost Planning International Techno Center Co., Ltd.
Ms. Haruko Shimomura	Facility Planning K.I.T.O Architects & Engineers Inc.
Mr. Koichi Suzuki	Facility Planning K.I.T.O Architects & Engineers Inc.

(2) Explanation of Draft Final Report (November 26 – December 4, 2016)

Mr. Kozo Watanabe	Team Leader Deputy Director General, Human Development Dept., JICA
Mr. Masato Matsuno	Cooperation Planning Health Team 4, Human Development Dept., JICA
Mr. Kazuhiro Abe	Project Manager/Equipment Planning International Techno Center Co., Ltd.
Ms. Yuko Suzuki	Equipment Planning International Techno Center Co., Ltd.
Ms. Haruko Shimomura	Facility Planning K.I.T.O Architects & Engineers Inc.

Appendix 2. Survey Schedule

(1) Preparatory Survey (August 13 – September 11, 2016)

			JICA team			Consultant team				
			Leader	Technical Advisor	Cooperation planning	Project Manager/ Equipment Planning	Equipment Planning	Procurement & cost planning	Facility Planning	Facility Planning
			Mr. Tatsuya ASHIDA	Dr. Ryota SAKAMOTO	Mr. Yukihiko KONDO	Mr. Kazuhiro ABE	Ms. Yuko SUZUKI	Mr. Kota YOSHIFUJII	Ms. Haruko SHIMOMURA	Mr. Koichi SUZUKI
1	2016/8/13	Sat				Tokyo → Bangkok				
2	2016/8/14	Sun				Bangkok → Paro				
3	2016/8/15	Mon				[Thimphu]	09:00- Meeting with JICA Bhutan 09:30- Meeting with JDWNRH 12:00- Courtesy call to Hon. Secretary/MOH 14:30- Meeting with GNHC			
4	2016/8/16	Tue					09:00- Meeting with Dept. of Revenue and Customs/MOF 10:00- Survey on JDWNRH 14:30- Courtesy call to the President of JDWNRH			
5	2016/8/17	Wed					(AM) Survey on agents and Meeting with MOH 14:30- Meeting with the President of KGUMSB (Medical Univ.)			
6	2016/8/18	Thu				[Paro]	Survey on Dist. Hospital/BHU II	[Thimphu]	Survey on JDWNRH and Medical Univ. Meeting with Local Constructors	
7	2016/8/19	Fri				[Thimphu]	09:30- Meeting with Dept. of Medical Supplies and Health Infrastructure 12:00- Meeting with Health Care and Diagnostics Div. Survey on JDWNRH, Health Help Center and Traditional Medicine			
8	2016/8/20	Sat				Documentation				
9	2016/8/21	Sun				Thimphu → Gelephu				
10	2016/8/22	Mon				[Gelephu]	Survey on Gelephu Central Regional Referral Hospital (GCRRH) Survey on New building under construction Meeting with Medical Superintendent and Medical staffs of GCRRH			
11	2016/8/23	Tue								Tokyo → Bangkok
12	2016/8/24	Wed								Bangkok → Paro
13	2016/8/25	Thu					Gelephu → Thimphu			
14	2016/8/26	Fri				[Thimphu]	Meeting with Health Infrastructure Div. and Biomedical Engineering Div. Survey on JDWNRH			
15	2016/8/27	Sat				Team meeting				
16	2016/8/28	Sun				Tokyo → Bangkok Bangkok → Paro	Team meeting	Paro → Kolkata	Paro → Bangkok	Same as Project Manager
17	2016/8/29	Mon				[Thimphu]	Courtesy call to MOH	Thimphu → Trongsa	Survey on agents	Bangkok → Tokyo
18	2016/8/30	Tue					Thimphu → Trongsa	Trongsa → Mongar		
19	2016/8/31	Wed					Trongsa → Mongar		Kolkata → Paro	
20	2016/9/1	Thu				[Mongar]			[Thimphu]	
21	2016/9/2	Fri					Survey on Mongar Eastern Regional Referral Hospital (MERRH) Meeting with Medical Superintendent and Medical staffs of MERRH		Meeting with agents Survey on JDWNRH	
22	2016/9/3	Sat					Mongar → Trongsa			
23	2016/9/4	Sun	Tokyo → Bangkok Bangkok → Paro				Trongsa → Thimphu		Documentation	
24	2016/9/5	Mon				[Thimphu]	09:00- Meeting with JICA Bhutan 10:30- Meeting with MOH (PM) Survey on JDWNRH / Team Meeting			
25	2016/9/6	Tue					10:00- Roundtable meeting of stakeholders (JICA, MOH, GNHC, JDWNRH, etc.) (PM) Survey on JDWNRH / MOF			
26	2016/9/7	Wed					(AM) Survey on JDWNRH (PM) Team meeting (* Dr. Sakamoto to leave for Bangkok at 13:30)			
27	2016/9/8	Thu					12:00- Confirmation of M/D with Hon. Secretary/MOH 14:00- Meeting with JICA Bhutan (PM) Survey on JDWNRH			
28	2016/9/9	Fri				Paro → Delhi (Embassy of Japan in India)		Documentation		
29	2016/9/10	Sat					Deli → Tokyo	Paro → Bangkok		Paro → Bangkok
30	2016/9/11	Sun						Bangkok → Tokyo		Bangkok → Tokyo

(2) Explanation of Draft Final Report (November 26 – December 4, 2016)

			JICA team		Consultant team				
			Leader	Cooperation planning	Project Manager/ Equipment Planning	Equipment Planning	Facility Planning		
			Mr. Kozo WATANABE	Mr. Masato MATSUNO	Mr. Kazuhiro ABE	Ms. Yuko SUZUKI	Ms. Haruko SHIMOMURA		
1	2016/11/26	Sat				Tokyo → Bangkok			
2	2016/11/27	Sun				Bangkok → Paro			
3	2016/11/28	Mon				[Thimphu]	9:00- Meeting with JICA Bhutan 10:00- Roundtable meeting of stakeholders (JICA, MOH, JDWNRH, etc.) 12:00- Meeting with JDWNRH 14:00- Meeting with GNHC and Health Infrastructure Div.		
4	2016/11/29	Tue				Thimphu → Gelephu	[Thimphu]	Meeting with BMED	Same as Project Manager
5	2016/11/30	Wed				[Gelephu]	Meeting with GCRRH Confirm the progress of construction of new		Meeting with JDWNRH
6	2016/12/1	Thu					Gelephu → Thimphu		Meeting with JDWNRH
7	2016/12/2	Fri				[Thimphu]	10:00- Discussion of contents of MD 14:00- Signing of MD 17:30- Meeting with JICA Bhutan		
8	2016/12/3	Sat					Paro → Bangkok		
9	2016/12/4	Sun					Bangkok → Tokyo		

Appendix 3. List of Parties Concerned in the Recipient Country

Prime Minister of Royal Government of Bhutan

Mr. Tshering Tobgay

Ministry of Health of Royal Government of Bhutan

Dr. Tandin Wangchuk	Minister
Dr. Ugen Dophu	Secretary
Dr. Pandup Tshering	Director of Department of Medical Services
Mr. Tandin Dorji	Chief of Healthcare & Diagnostic Division
Mr. Yenten Jamtsho	Dy. Chief of Healthcare & Diagnostic Division
Mr. Sonam Jamtsho	Director of Department of Medical Supplies & Health Infrastructure
Mr. Tashi Penjore	Chief Engineer of Biomedical Engineering Division
Mr. Tsheten Dorji	Chief Engineer of Health Infrastructure Development Division
Ms. Soira Sonam Tamang	Dy. Executive Engineer of Biomedical Engineering Division
Mr. Gyembo	Program officer of Health Infrastructure Development Division
Mr. Sonam Wangda	Program officer of Healthcare & Diagnostic Division
Mr. Karma Jurmin	Program officer of Healthcare & Diagnostic Division
Mr. Pema Yangzom	Program officer of Healthcare & Diagnostic Division
Ms. Thinley Wangmo	Budget Assistant of Administration & Finance Division

Ministry of Finance of Royal Government of Bhutan

Mr. Yonten Namgyel	Director of Department of Revenue and Custom
Mr. Choki Gyeltshen	Chief of Sales Tax Division
Ms. Yeshey Seldon	Joint Collector of Department of Revenue and Custom

Gross National Happiness Commission

Mr. Rinchen Wangdi	Chief of Gross National Happiness Commission
Ms. Kuenzang Lham Sangey	Dy. Chief of Gross National Happiness Commission

Jigme Dorji Wangchuck National Referral Hospital

Mr. Lhab Dorji	President
Dr. Gosar Pemba	Medical Superintendent
Mr. Tandin Dorji	Chief of Radiology Unit
Dr. Nidup	Radiologist
Dr. Deki Choden	Radiologist
Dr. Dechen Nidup	Radiologist
Dr. Yeshey Penjore	Cardiologist
Mr. Pema Jigme	Radio-Technologist
Mr. Deepak Kumar Samal	Biomedical Engineer
Mr. Karma Tenzin	Electrician
Mr. Tshewang Norbu	Revenue Officer
Mr. Uttam Sharma	Accounts Officer
Mr. A.N. Acharya	Chief accountants
Mr. Ugyen Penjore	Medical Record Officer

Mongar Eastern Regional Referral Hospital

Dr. Sonam Gyamtsho	Medical Superintendent
Mr. Tshering Dorji	District Health Officer
Mr. Phuntsho Norbu	Nursing Superintendent
Dr. Sonam Tshering	General Surgeon
Dr. Mahesh Gurung	Cardiologist
Dr. Tulsi Ram Sharma	Pediatric
Dr. Santiram Dhakal	Orthopedic Surgeon
Dr. Phuntsho Dorji	Ophthalmology
Dr. Jigme Sherab	General Duty Medical Officer
Dr. Pradhan Nepal	General Duty Dental Surgeon

Ms. Sonam Choki	Radio-Technologist
Mr. Nima Wangchuk	Emergency Room Incharge
Mr. Dhan Ray Limbu	Electrical Technician
Mr. Ugyen Wangdi	Electrical Technician
Mr. Tshering Dorji	Radio-Technician

Gelephu Central Reginal Referral Hospital

Dr. Tapas Gurung	Medical Superintendent
Dr. Tshering Penjore	Administrative Officer
Mr. Amber Gurung	Nursing Superintendent
Mr. Palden Lepcha	Medical Record officer
Dr. Prabhat Pradhan	Surgeon
Dr. Sunanda Pradhan	Internal Medicine
Dr. Nidup Gyeltshen	Obstetrician and Gynecologist
Dr. Mindu Dukpa	Ophthalmology
Dr. Umesh Pradhan	General Duty Medical Officer
Dr. Tshewang Lhamo	General Duty Medical Officer
Dr. Sherub Wangdi	General Duty Medical Officer
Mr. Tek Bdr. Chhetri	Pharmacy
Mr. Jampel Dorji	Project Manager/Electical Engineer
Mr. Nagendra Gurung	Electrical Engineer
Mr. Ugyen Namtuel	Electrical Engineer
Ms. Sonam Choden	Radio-Technologist
Mr. Yeshi Lhamo	Biomedical Technician
Ms. Ugyen Dukpa	Biomedical Technician
Mr. Jigme Dukpa	Clinical Officer
Ms. Tsheltrim zangmo	Assistant Financial Officer

Dzongkhag Hospital Paro

Dr. Yowaan Thapa Chief Medical Officer

Khesar Gvelpo University of Medical Science of Bhutan

Dr. Kinzang P. Tshering President

Mr. Tashi Rabgay Assistant Program Officer

Health Help Center

Mr. Yenten Choki Norbu Paramedics

Mr. Samgay Karpo Information & Communication Technology Technical

Mr. Bikash Gurung Information & Communication Technology Technical

JICA Bhutan Office

Mr. Koji Yamada Chief Representative

Mr. Sho Takano Representative

Ms. Kazumi Shimaoka Project Formulation Advisor

Mr. Kinley Dorji Chief Program Officer

Appendix 4. Minutes of Discussions
(1) Preparatory Survey

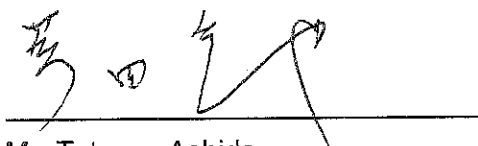
**Minutes of Discussions
on the Preparatory Survey for the Project for
Improvement of Medical Equipment
at the National and Regional Referral Hospitals**

In response to the request from the Kingdom of Bhutan (hereinafter referred to as "Bhutan"), the Government of Japan (hereinafter referred to as "Japan") decided to conduct a Preparatory Survey for the Project for Improvement of Medical Equipment at the National and Regional Referral Hospitals (hereinafter referred to as "the Project"), and entrusted the Preparatory Survey to Japan International Cooperation Agency (hereinafter referred to as "JICA").

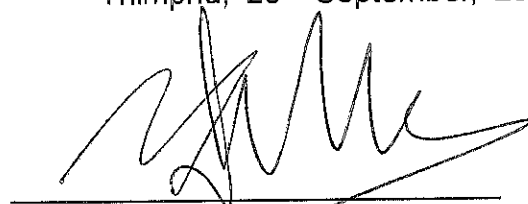
JICA sent the Preparatory Survey Team for the Outline Design (hereinafter referred to as "the Team") to Bhutan.

The Team held a series of discussions with the officials concerned of Bhutan and conducted a field survey in the Project area. In the course of the discussions, Bhutan and the Team have confirmed the main items described in the attached sheets. The Team will proceed to further works and prepare the Preparatory Survey Report.

Thimphu, 20th September, 2016



Mr. Tatsuya Ashida
Leader, Preparatory Survey Team
Japan International Cooperation Agency



Dr. Ugen Dophu
Health Secretary
Ministry of Health



(Witness)
Mr. Rinchen Wangdi
Chief Program Coordinator
Development Cooperation
Gross National Happiness Commission

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance the diagnostic services to be provided by the National and Regional Referral Hospitals and improve the access to medical services for population living in the eastern and central region of Bhutan through procurement of medical equipment.

2. Title of the Preparatory Survey

The Bhutan side and the Team confirmed the title of the Preparatory Survey as "the Preparatory Survey for Improvement of Medical Equipment at the National and Regional Referral Hospitals".

3. Project Site

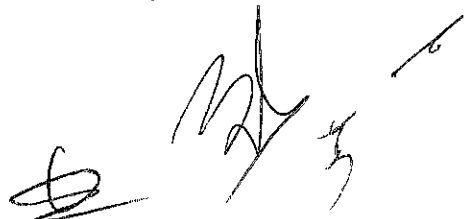
The Bhutan side and the Team confirmed that the sites of the Project are Jigme Dorji Wangchuk National Referral Hospital (hereinafter referred to as "JDWNRH") in Thimphu, Gelephu Central Regional Referral Hospital (hereinafter referred to as "GCRRH"), Mongar Eastern Regional Referral Hospital (hereinafter referred to as "MERRH") which are shown in Annex 1.

4. Executing Agency

The Bhutan side and the Team confirmed the executing agency is the Ministry of Health (hereinafter referred to as "MoH"), which would be the agency to coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex 2.

5. Items Requested by Bhutan

5-1. As a result of discussions, the Bhutan side and the Team confirmed that the items requested by Bhutan are in Annex 3. Equipment necessary for Bhutan is requested to Japan based on 3 criteria, which are "Needs of an equipment", "Availability of personnel and budget for maintenance", and "Difficulty of purchasing an equipment by Bhutan's own budget". The Bhutan side and the Team discussed priorities based on the criteria and agreed that a list of equipment to be requested to Japan's Grant Aid is suitable.



5-2. The Team will assess the appropriateness of the above requested items through the survey and will report findings to Japan. The final components of the Project would be decided by Japan.

6. Japan's Grant Scheme

The Bhutan side understands the Japan's Grant Scheme and its procedures as described in Annex 4, 5 and 6, and necessary measures to be taken by the Bhutan side for smooth implementation of the Project, as a condition for the Japan's Grant to be implemented.

7. Undertakings by Bhutan and Japan

The Bhutan side and the Team confirmed the undertakings described in Annex 7. The Bhutan side assured to take necessary measures for the smooth implementation of the Project. Contents of Annex 7 will be updated as the Preparatory Survey progresses, and will finally be the Attachment to the Grant Agreement.

8. Monitoring during the Implementation

The Project will be monitored every 3 months by the executing agency using the Project Monitoring Report (PMR), as per attached in Annex 8.

9. Schedule of the Survey

9-1. The Team will prepare the draft Preparatory Survey Report in English and dispatch a mission to Bhutan in order to explain its contents around December 2016.

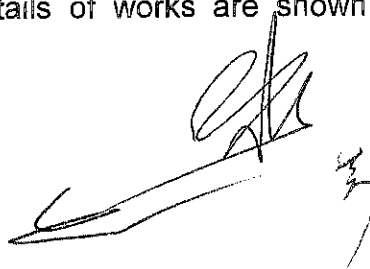
9-2. If the contents of the draft Preparatory Survey Report is accepted in principle and the undertakings are fully agreed by the Bhutan side, the Team will complete the final report in English and send it to Bhutan around first half of 2017.

9-3. The above schedule is tentative and subject to change.

10. Other Relevant Issues

10-1. Repair/Expansion/Renovation Works for Facilities

The Bhutan side agreed to repair/expand/renovate facilities for the smooth implementation of the Project. Details of works are shown in Annex 9.

A handwritten signature in black ink, appearing to be 'AKA', is written over a horizontal line. To the right of the signature is a small, stylized scribble or mark.

10-2. Operation and Maintenance of the Equipment

a) Importance of Operation and Maintenance

The Team explained the importance of operation and maintenance of the equipment under the Project considering that proper asset management is necessary to secure the life-span of the equipment and to reduce its maintenance cost. The Bhutan side agreed to secure enough budgets necessary for appropriate operation and maintenance of the equipment.

b) Maintenance Contracts on Major Equipment

The Team explained that the importance of the routine maintenance and maintenance service of major equipment such as CT. Keeping this in view, the Bhutan side and the Team agreed to consider inclusion of maintenance service contracts into the Project to the major equipment that needs frequent maintenance.

10-3. Allocation of Human Resources

The Bhutan side agreed to secure sufficient personnel for the utilization of the medical equipment to be provided. Plan for the allocation is shown in Annex 10.

10-4. Soft Components

The Bhutan side and the Team agreed on the necessity of technical assistance as soft components of the Project, which will be provided by Japan's grant aid as soft component, for the maximum utilization of the equipment.

Annex 1. Project Site

Annex 2. Organization Chart

Annex 3. Requested Items

Annex 4. Japan's Grant Aid

Annex 5. Flow Chart of Japan's Grant Aid Procedures

Annex 6. Financial Flow of Japan's Grant Aid

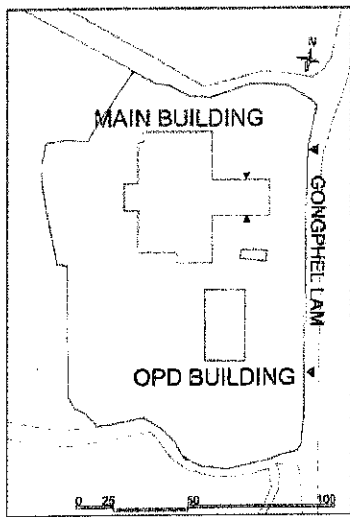
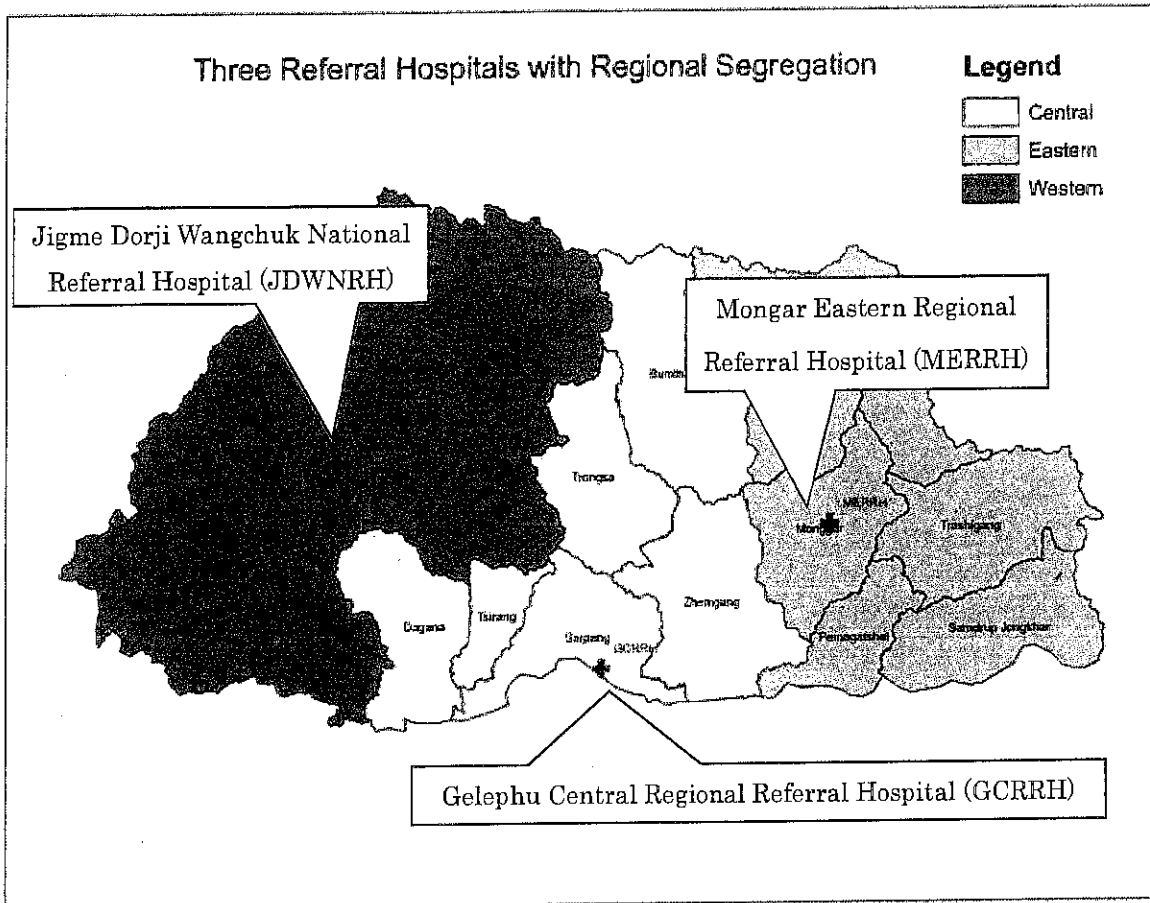
Annex 7. Major Undertakings to be taken by Each Government

Annex 8. Project Monitoring Report (Template, Main Clause)

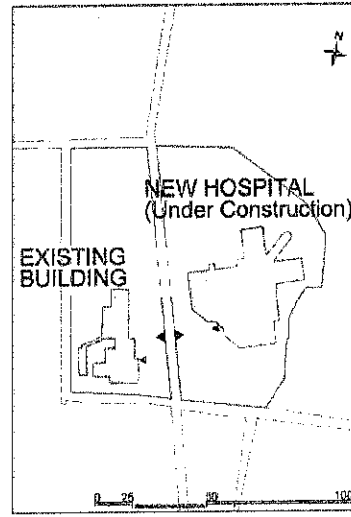
Annex 9. Renovation plan of CT scan rooms

Annex 10. Plan of Human Resource Allocation

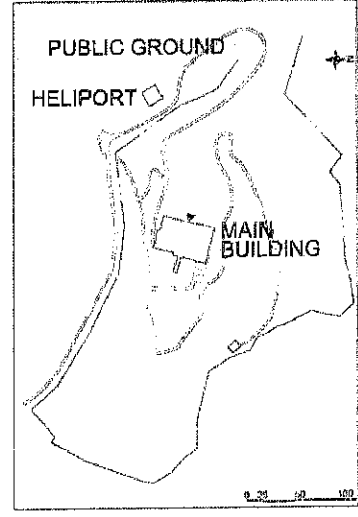
Annex 1. Project Site



JDWNRH

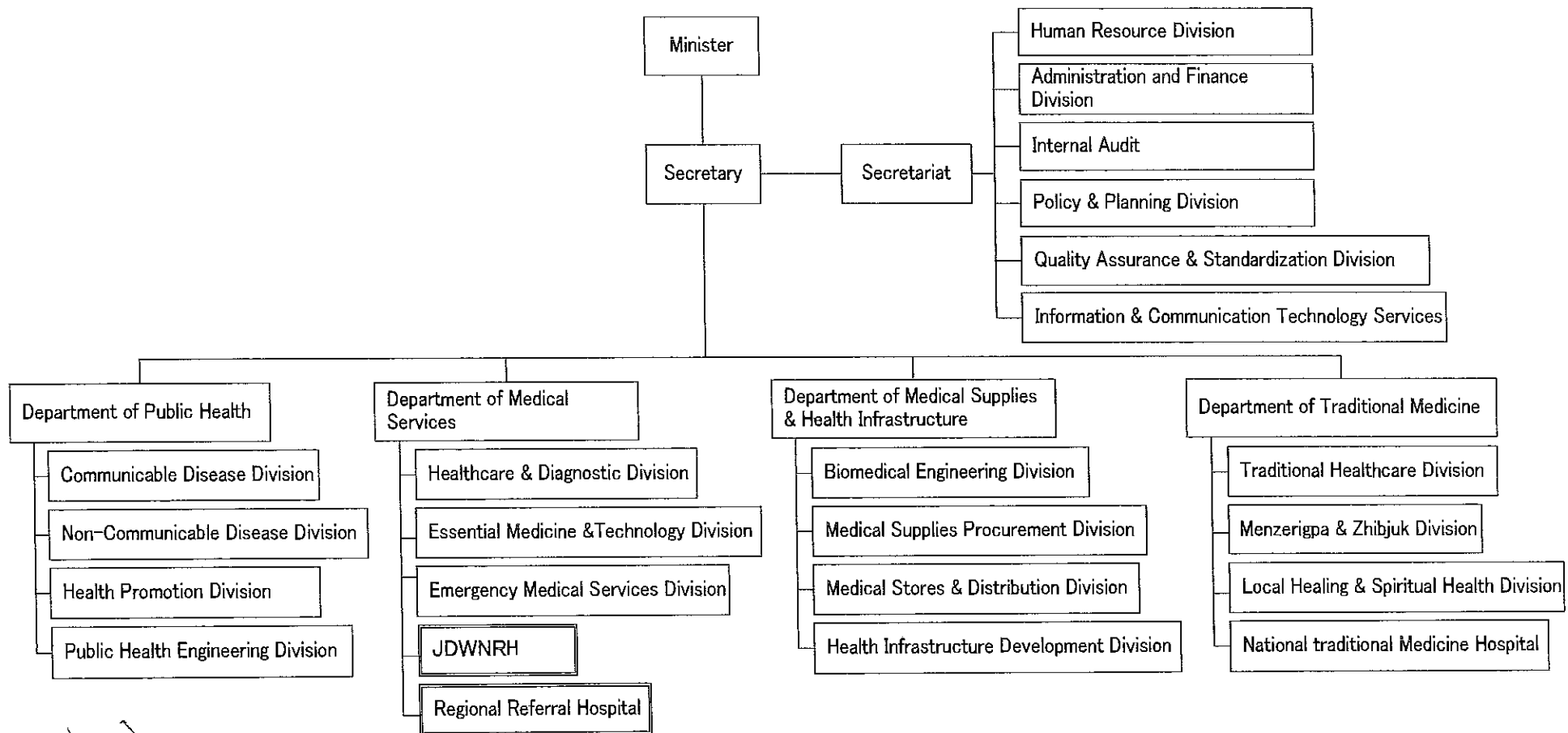


GCRRH



MERRH

Annex 2. Organization Chart of the Ministry of Health



Annex 3. Requested Items

No.	Description	Quantity	JDWNRH	GCRRH	MERRH	Priority
1	CT (64 Slices)	1	1	0	0	A
2	Comprehensive maintenance contract	1	1	0	0	A
3	CT (16 Slices)	2	0	1	1	A
4	Comprehensive maintenance contract	2	0	1	1	A
5	MRI	1	1	0	0	B
6	Comprehensive maintenance contract	1	1	0	0	B
7	C-ARM	3	1	1	1	C
8	Angiography	1	1	0	0	C
9	Ultrasound 3D	3	1	1	1	C
10	Portable Ultrasound	1	0	0	1	C
11	Digital X-ray Apparatus	1	0	1	0	B
12	Comprehensive maintenance contract	1	0	1	0	B
13	Portable X-ray (Digital)	1	1	0	0	C
14	Mammography	1	1	0	0	B
15	Comprehensive maintenance contract	1	1	0	0	B
16	Fiberscope	1	0	0	1	C
17	Spirometer	1	0	0	1	B
18	Blood gas analyzer	1	0	0	1	C
19	Holter ECG	5	0	0	5	B

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Annex 4. Japan's Grant Aid

The Japan's Grant Aid is non-reimbursable fund provided to Bhutan to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Japan's Grant Aid is not supplied through the donation of materials as such.

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the government of Japan (hereinafter referred to as the "GOJ"), JICA has become the executing agency of the Japan's Grant Aid for Projects for construction of facilities, purchase of equipment, etc.

1. Grant Procedures

The Japan's Grant Aid is supplied through following procedures:

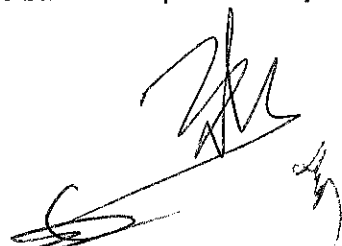
- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and Bhutan
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and Bhutan
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of Bhutan necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Japan's Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.



- Estimation of costs of the Project.

The contents of the original request by Bhutan are not necessarily approved in their initial form as the contents of the Japan's Grant Aid project. The Outline Design of the Project is confirmed based on the Guidelines of the Japan's Grant Aid scheme.

JICA requests the government of Bhutan to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of Bhutan which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of Bhutan based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) Consulting firm(s). JICA selects (a) Firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. The Japan's Grant Aid Scheme

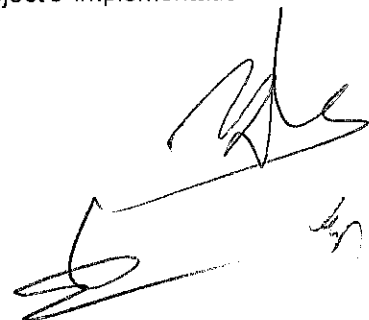
(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of Bhutan to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of Bhutan to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of Bhutan, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to Bhutan to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

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Under the Japan's Grant Aid, in principle, Japanese products and services including transport or those of Bhutan are to be purchased. The Japan's Grant Aid may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(4) Necessity of "Verification"

The Government of Bhutan or its designated authority will conclude contracts denominated in Japanese Yen with Japanese nationals, in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of Bhutan

In the implementation of the Japan's Grant Aid Project, Bhutan is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of Bhutan to exempt all customs duties, internal taxes and other fiscal levies such as value added tax (hereinafter referred to as "VAT"), commercial tax, income tax, corporate tax, resident tax, fuel tax, but not limited, which may be imposed in Bhutan with respect to the supply of the products and services under the verified contract, since the Japan's Grant Aid fund comes from the Japanese taxpayers.

(6) "Proper Use"

The Government of Bhutan is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Japan's Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japan's Grant Aid.

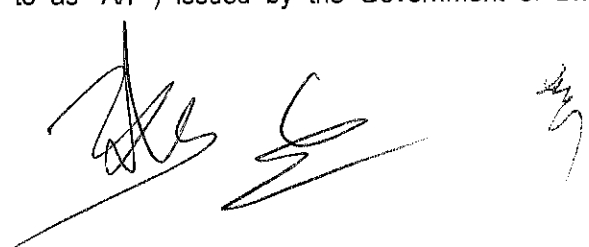
(7) "Export and Re-export"

The products purchased under the Japan's Grant Aid should not be exported or re-exported from Bhutan.

(8) Banking Arrangements (B/A)

a) The Government of Bhutan or its designated authority should open an account under the name of the Government of Bhutan in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Japan's Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of Bhutan or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (hereinafter referred to as "A/P") issued by the Government of Bhutan or its

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designated authority.

(9) Authorization to Pay

The Government of Bhutan should bear an advising commission of A/P and Payment Commissions paid to the Bank.

(10) Environmental and Social Considerations

The Government of Bhutan must carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of Bhutan and JICA Guidelines for Environmental and Social Consideration (April, 2010) .

(11) Monitoring

The Government of Bhutan must take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and must regularly report to JICA about its status by using the Project Monitoring Report (PMR).

(12) Safety Measures

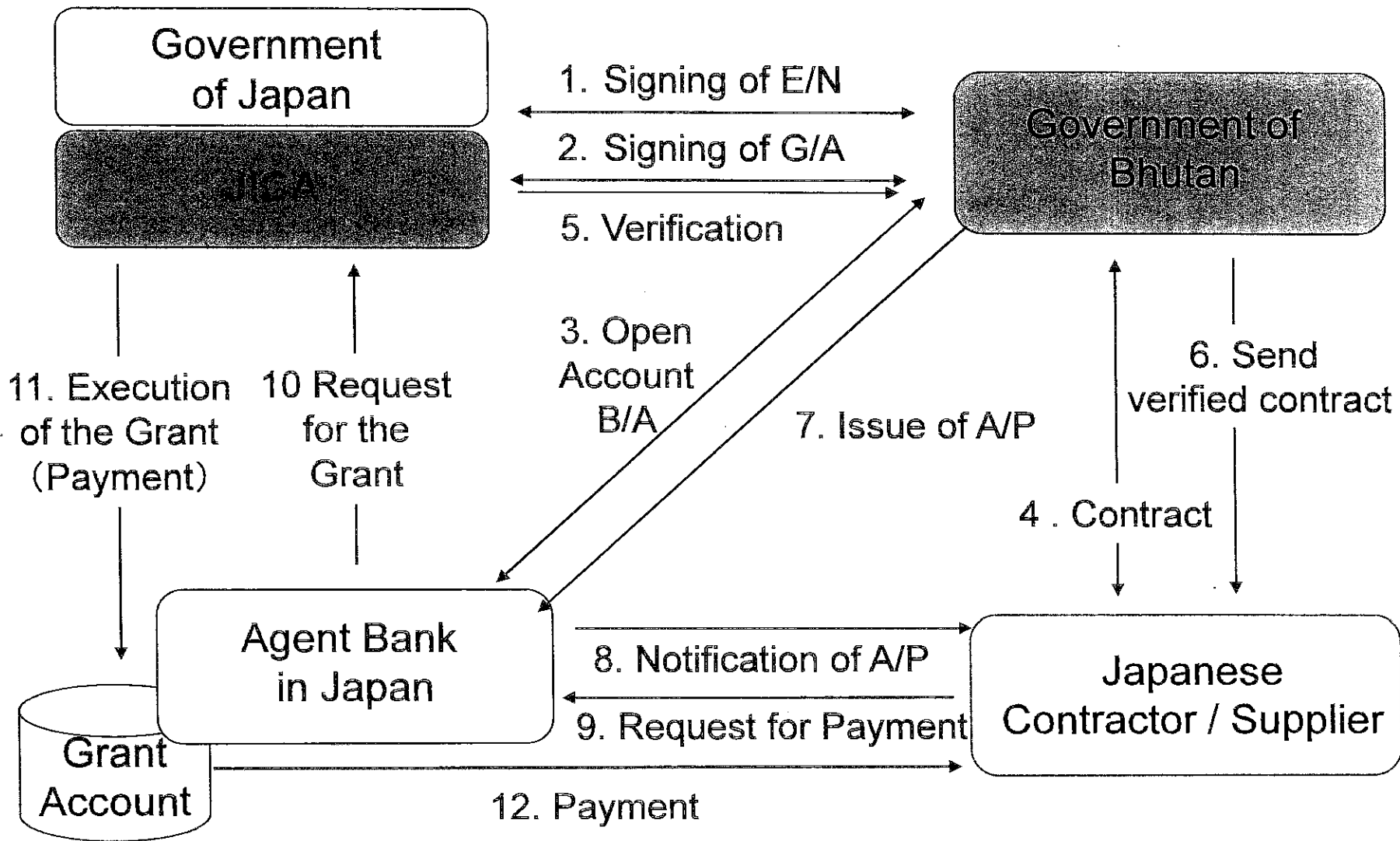
The Government of Bhutan must ensure that the safety is highly observed during the implementation of the Project.



Annex 5. Flow Chart of Japan's Grant Aid Procedures

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contract	Others
Application							
Project Formulation & Preparation	Preparatory Survey						
Appraisal & Approval							
Implementation	<p>(E/N: Exchange of Notes) (G/A: Grant Agreement) (A/P: Authorization to Pay)</p>						
Evaluation & Follow up							

Annex 6. Financial Flow of Japan's Grant Aid



E/N: Exchange of Notes, G/A: Grant Agreement, B/A: Banking Arrangement, A/P: Authorization to Pay,

Annex 7. Major Undertakings to be Taken by Each Government

Major Undertakings to be Taken by Bhutan

1. Before the Tender

NO	Items	Deadline	In charge	Cost	Ref.
1	To take necessary measures to open Bank Account (Banking Arrangement (B/A))				
	1) To bear the necessary commission charges with Bank Account if required.	Within 1 month after receiving B/A from the Bank	GNHC		
	2) To take necessary procedures among government organizations and Agent Bank in Bhutan to open Bank Account (Banking Arrangement (B/A))	Within 1 month after receiving B/A from the Bank	GNHC		

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost	Ref.
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A				
	1) Advising commission of A/P	Within 1 month after the verification of the contract	MOH/ GNHC		
	2) Payment commission for A/P	Every payment	MOH/ GNHC		
2	To ensure prompt unloading and customs clearance in recipient country				
	1) Tax exemption and customs clearance of the products	During the Project	MOH		
	2) To take necessary arrangement for internal transportation to the project site	During the Project	MOH		
3	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	During the Project	MOH		
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; (especially sales tax, income tax and customs)	During the Project	MOH		
5	To bear all the expenses, other than those to be borne by the Grant Aid, if any.	During the Project	MOH		
6	To provide and repair/expand/renovate facilities for; the distribution of electricity, X-ray protection, and others		JDWNRH /GRRH/ MERRH MOH		
	1) Electricity To relocate electrical lines and exchange the transformers to increase the power receiving capacity.	Before installation of the equipment			
	2) X-ray Protection To take necessary measures for the protection of X-ray.	Before installation of the equipment			
	3) Others				
	To complete Expansion Work at GRRH for the installment of equipment.	Before installation of the equipment			
	To secure the carry-in route of the equipment	Before installation of the equipment			
	To install the air-conditioners if necessary	Before installation of the equipment			
7	To assign all necessary staff with appropriate skills and experiences for operation and maintenance of new equipment provided under the Grant Aid (EX: CT-technicians, Radiologists, Biomedical Engineers etc)	Before installation of the equipment	MOH		
8	To dispose the existing equipment and secure spaces for daily operation.	During the Project	JDWNRH /GRRH/ MERRH		

Jigme Dorji Wangchuk National Referral Hospital (JDWNRH), Gelephu Central Regional Referral Hospital (GRRH)
Mongar Eastern Regional Referral Hospital (MERRH), Gross National Happiness Commission (GNHC), Ministry of Health (MOH)

3. After the Project

NO	Items	Deadline	In charge	Cost	Ref.
1	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid by: 1) Allocation of sufficient budget and personnel for operation and maintenance 2) Training of staff on the specialized medical services for the full use of the equipment 3) Contracting with agents for major equipment.	After completion of the procurement	JDWNRH/GCRRH/MERRH/MOH		
2	To appoint and retain sufficient staff with appropriate skills and experiences for operation and maintenance of new equipment provided under the Grant Aid	After completion of the procurement	MOH,		

(B/A: Banking Arrangement, A/P: Authorization to pay, N/A: Not Applicable)

Major Undertakings to be Covered by the Japan's Grant Aid

No	Items	Deadline	Cost Estimated (Million Japanese Yen)*
1	1) To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Ocean (Air) transportation of the products from Japan (the third country) to the recipient country	During the Project	
	b) Transportation from the port of disembarkation to the project site	During the Project	
	2) To provide equipment with installation, commissioning and training	During the Project	
2	To implement detailed design, tender support if any (Consultant)	During the Project	
3	Technical assistance as soft components, which will be provided by Japan's grant aid, for proper operation and preventive maintenance of the equipment.	During the Project	
	Total		

*: The cost estimates are provisional. This is subject to the approval of the Government of Japan.

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Annex 8. Project Monitoring Report (Template, Main Clause)

<p><u>Project Monitoring Report</u> on <u>Project Name</u> <u>Grant Agreement No. XXXXXXX</u> 20XX, Month</p>

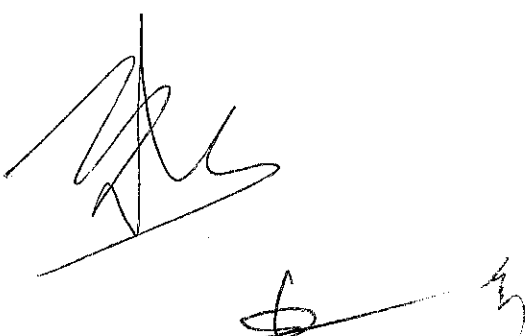
Organization Information

Authority (Signer of the G/A)	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Implementing Agency	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Responsible Agency	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
Project Title	
E/N	Signed date: _____ Duration: _____
G/A	Signed date: _____ Duration: _____

1



1: Project Description

1-1 Project Objective

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1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

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1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr)	Target (Yr)
Qualitative Effect		

2: Project Implementation

2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	Original: (M/D) Attachment(s):Map	Actual: (PMR) Attachment(s):Map

Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D) 'Soft component' shall be included in 'Items'.	(M/D)	(PMR) Please state not only the most updated schedule but also other past revisions chronologically. All change of design shall be recorded regardless of its degree.

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Upgrading of the Kukum Highway	length 20km, single lane (3.47m*2), path(1.25m*2) Concrete Pavement 200mm (motor lane only)	length 20km, single lane (3.47m*2), path(1.00m*2) Concrete Pavement 200m m (motor lane only)
2. Replacement of Old Mataniko Bridge	Bridge length 40m, Width 9.5m, path(1.00m*2), compound steel box-girder bridge, Inverted T type-abutment spread foundation	Ditto

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Outpatient Department	RC, Double Story Ground floor: Consultation room 6 Reception Satellite Lab. Pharmacy, etc 1 st floor: Consultation room 5 Dental Clinic 2	RC, Double Story Ground floor: Consultation room 5 ditto
2. Operation Theatre, Casualty Unit, Maternity Ward	RC, Double Storey Ground Floor: Operation room 2 Casualty Unit 1 st Floor: Maternity Ward 50 beds	ditto Maternity Ward 60 beds

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Primary and Secondary Surveillance Radars at Chittagong Int'l Airport	i) OSR/SSR 1 set ii) RDP 1 set iii) VHF Transmitters 2 sets	Ditto
2. Access Control System for Dhaka Int'l Airport	1 set	Ditto
3. Doppler VOR/DME at Saidpur Airport	1 set	Ditto
4. Aerodrome Simulator for Civil Aviation Training Center	1 set	Ditto

5. Baggage Inspection System for Dhaka Int'l Airport	i) Hold Baggage Xray Inspectin system 7sets ii) Hold Baggage Explosive Trace Detecting System 7sets iii) Cabin Baggage Xray Inspection System 2sets	Ditto
6. Airport Fire Fighting Vehicles for Dhaka Int'l Airport	2 sets	3 sets

2-1-2 Reason(s) for the modification if there have been any.

(PMR)

2-2 Implementation Schedule

2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D]	(M/D)		(PMR) As of (Date of Revision)
'Soft component' shall be stated in the column of 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Project Completion Date*			

*Project Completion was defined as _____ at the time of G/A.

(Sample)Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval	11/2015	-	-
E/N	12/2015	1/2016	24/1/2016
G/A	12/2015	1/2016	24/1/2016
Detailed Design	12/2015-4/2016	1/2016-5/2016	Amended 13/3/2017 1/2016-5/2016
Tender Notice	5/2016	5/2016	1/6/2016
Tender	6/2016	6/2016	15/7/2016
(Lot1) Construction Period	7/2016-11/2018	7/2016-11/2018	8/8/2016-30/11/2018
(Lot2) Installarion of Equipement	7/2016-6/2018	7/2016-6/2018	6/8/2016-30/60/2017
Project Completion Date	11/2018	11/2018	30/11/2018

Defect Liability Period	11/2019	11/2019	30/11/2019
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*Project Completion was defined as Check-out of Construction work at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

2-3 Undertakings by each Government

2-3-1 Major Undertakings
See Attachment 2.

2-3-2 Activities
See Attachment 3.

2-3-3 Report on RD
See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

	Items		Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction Facilities (or Equipment)	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design - Procurement Management - Construction Supervision			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

Table 2-4-1b Comparison of Original and Actual Cost by the Government of XX

	Items		Cost (Million USD)	
	Original	Actual	Original	Actual
				Please state not only the most updated schedule but also other past revisions chronologically.

Total		
-------	--	--

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = (local currency)

(Sample)Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items	Cost (Million Yen)			
	Original	Actual	Original ^(1,2)	Actual
Construction Facilities	1. Outpatient Department 2. Operation Theatre, Casualty Unit, Maternity Ward	Ditto Ditto	1,169.5	1,035.0
Equipment	1) Primary and Secondary Surveillance Radars at Chittagong Int'l Airport 2) Access Control System for Dhaka Int'l Airport 3) Doppler VOR/DME at Saidpur Airport 4) Aerodrome Simulator for Civil Aviation Training Center 5) Baggage Inspection System for Dhaka Int'l Airport 6) Airport Fire Fighting Vehicles for Dhaka Int'l Airport	Ditto	2,374.6	2,110.0
Consulting Services	- Detailed design - Procurement Management - Construction Supervision - Soft Component	Ditto	0.87	0.87
Total			3544.97	3145.87

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 99.93 Yen

(Sample)Table 2-4-1b Comparison of Original and Actual Cost by the Government of Bangladesh

Items	Cost (1,000 Taka)			
	Original	Actual	Original ^(1,2)	Actual
Dhaka International Airport	Modification of software of existing Rader Data Processing System	Ditto	8,000	9,240
	Provision of a partition, lighting, air conditioning and electric power supply at transfer hold baggage check point	Ditto	5,000	2,453
	Replacement of five doors in the international passenger terminal building	Ditto	4,000	5,340
Chittagong Int'l Airport	Preparation of the radar site including felling of trees, clearing and grabbing	Ditto	5,000	3,400
Total			22,000	20,433

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 0.887 Bangladesh Taka (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: (M/D)
Actual, if changed: (PMR)

2-6 Environmental and Social Impacts

- The results of environmental monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- The results of social monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

3: Operation and Maintenance (O&M)

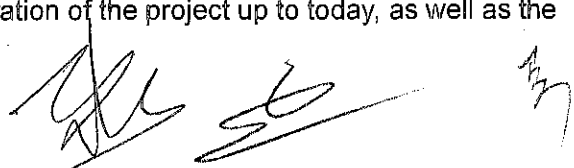
3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number, qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

Original: (M/D)
Actual: (PMR)

3-2 O&M Cost and Budget

- The actual annual O&M cost for the duration of the project up to today, as well as the

7 

annual O&M budget.

Original: (M/D)

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): (M/D)	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

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5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation
Please describe your overall evaluation on the project.

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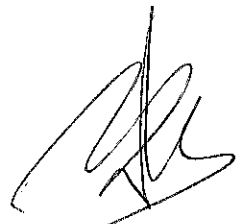
5-2 Lessons Learnt and Recommendations
Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

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5-3 Monitoring Plan for the Indicators for Post-Evaluation
Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

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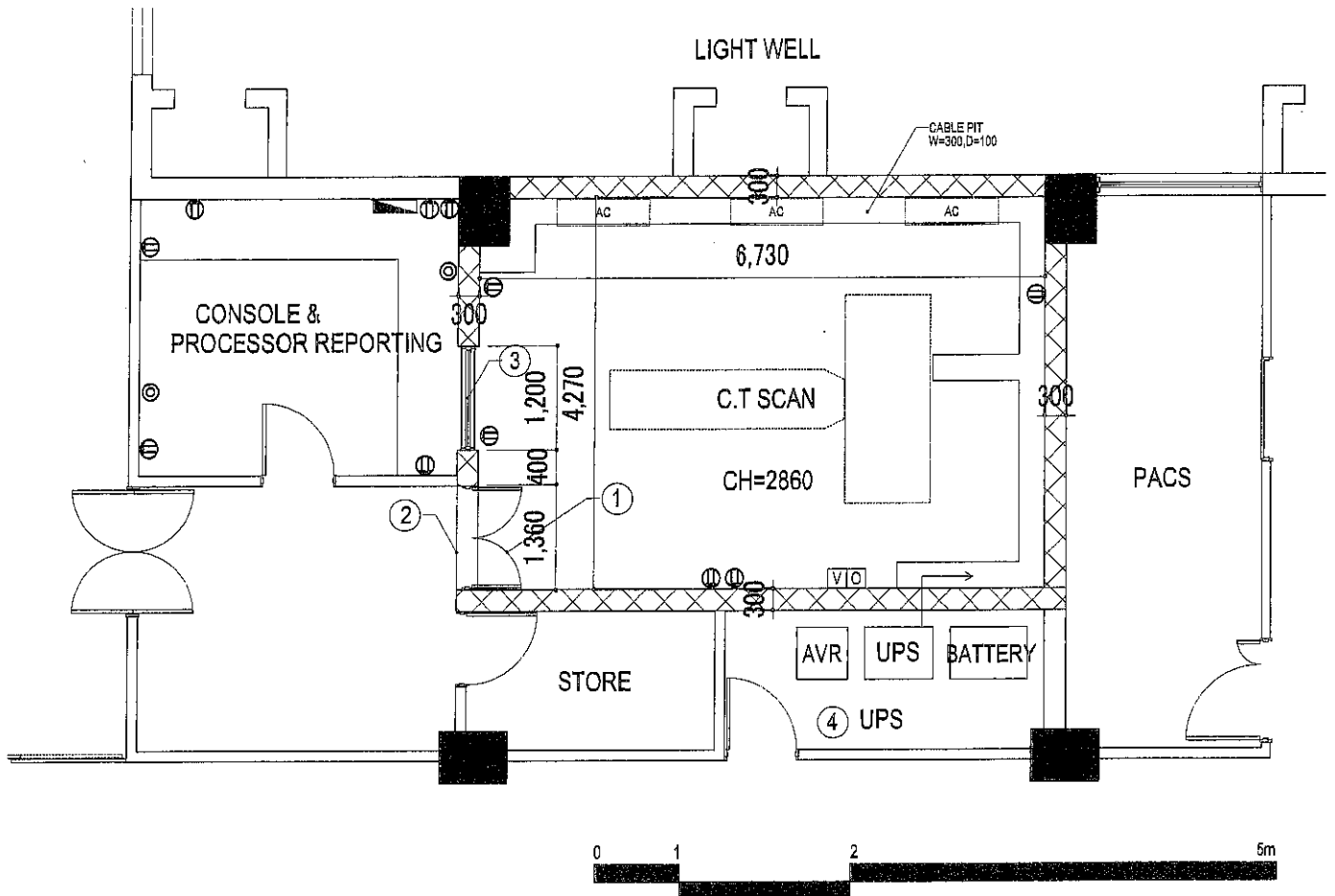


Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Final Report Only)

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Annex 9. Renovation Plan of CT Scan Rooms



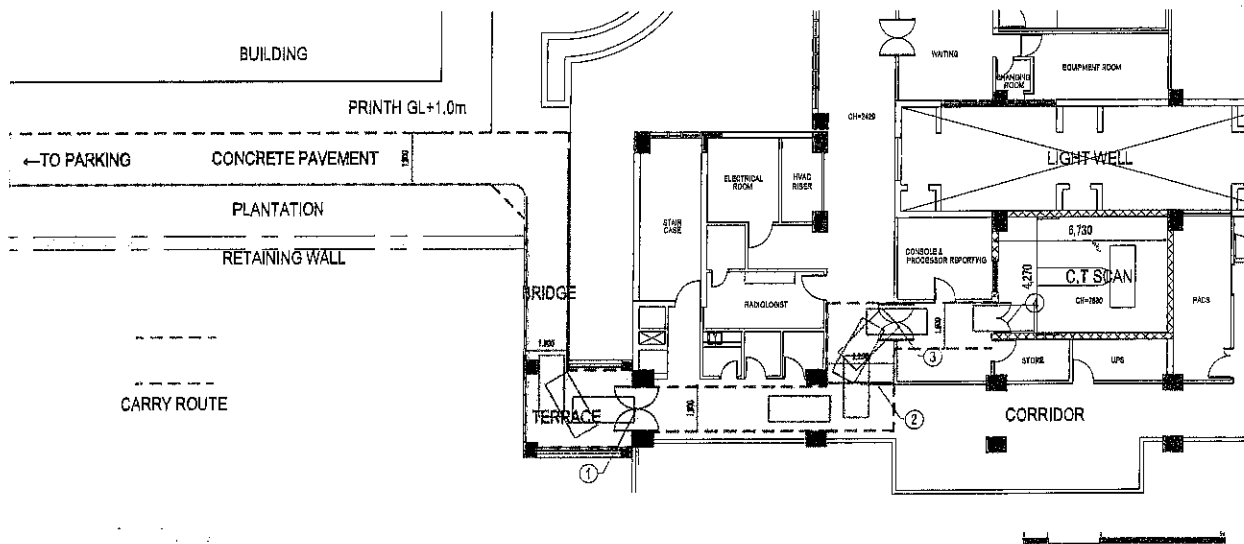
LEGEND (EXISTING FACILITIES)

Ⓛ	RECEPTACLE	▬	MCCB
ⓁⓁ	RECEPTACLE (250V 20A)		
Ⓛ	LAN	V	VACCUM
Ⓛ	TELEPHONE	A	COMPRESSED AIR
Ⓛ S	SWITCH	O	OXYGEN

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, 2.0mm LEAD LINING STEEL FRAME
②	WIDEN UPPER WALL OF DOOR WAY (TO SECURE X-RAY PROTECTION)	300mm THICKNESS BRICK AND CEMENT PLASTER WALL UP TO CONCRETE SLAB OF UPPER FLOOR (EXISTING 180mm), OR Pb=1.0mm LEAD BOARD BACKING ON THE EXISTING WALL
③	REPLACE PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSIT GLASS 2.0mm LEAD LINING STEEL FRAME
④	INCREASE POWER SUPPLY	3PHASE 440V 150KVA EXCLUSIVE USE (EXISTING 125KVA)




THIMPHU JDWNRH CT SCAN ROOM RENOVATION PLAN

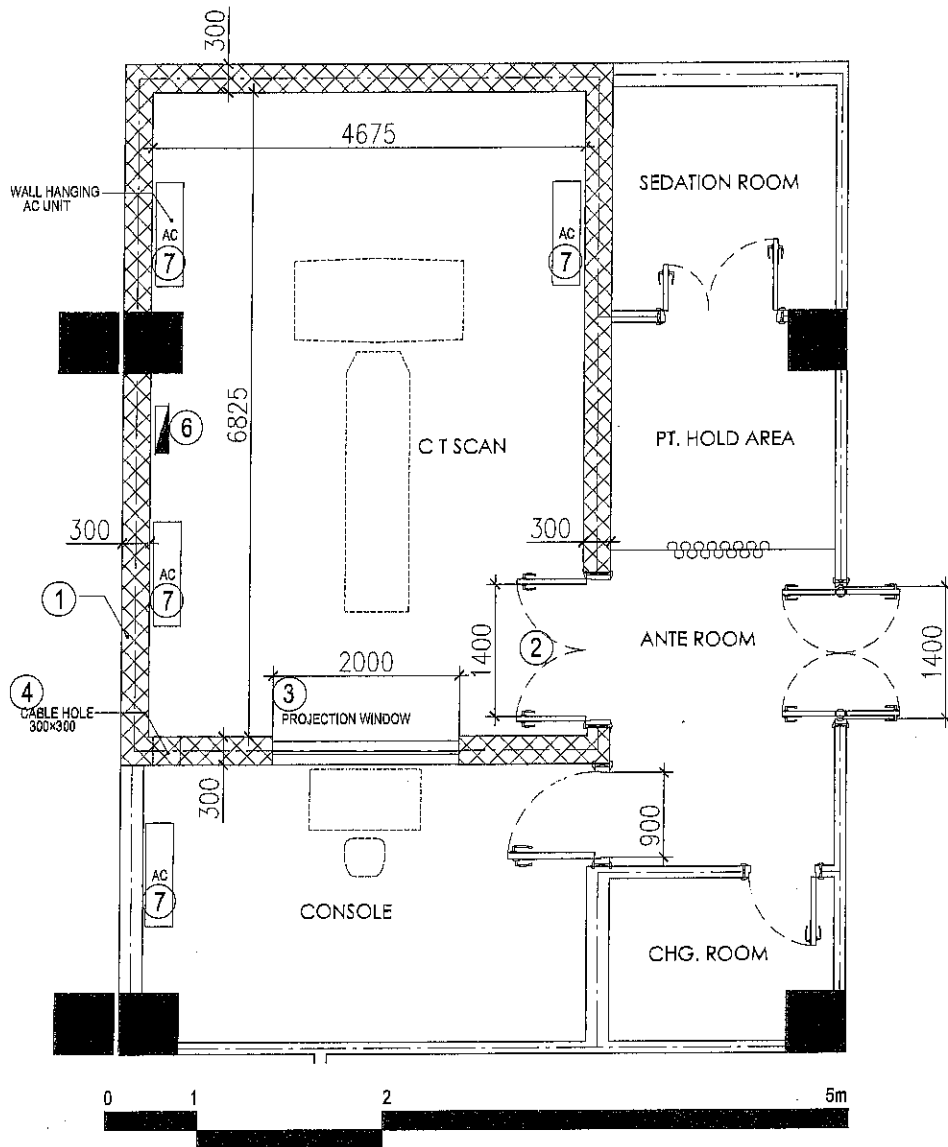


RENOVATION WORKS (EXPANSION OF DOOR OPENING)

NO	TYPE	EXISTING SIZE		REPLACED DOOR SIZE	
		WIDE	HEIGHT	WIDE	HEIGHT
①	ALUMINIUM DOOR (DOUBLE LEAF)	1,500	2,000	1,500	2,100
②	ALUMINIUM DOOR (SLIDING)	1,290	2,400	REMOVAL AND REATTACHED	
③	ALUMINIUM DOOR (DOUBLE LEAF, FREE SWING)	1,350	2,000	1,350	2,100
④	X-RAY SHIELD DOOR (DOUBLE LEAF)	1,360	2,000	1,360	2,100

THIMPHU JDWRNH CT SCAN CARRY - IN/OUT PLAN

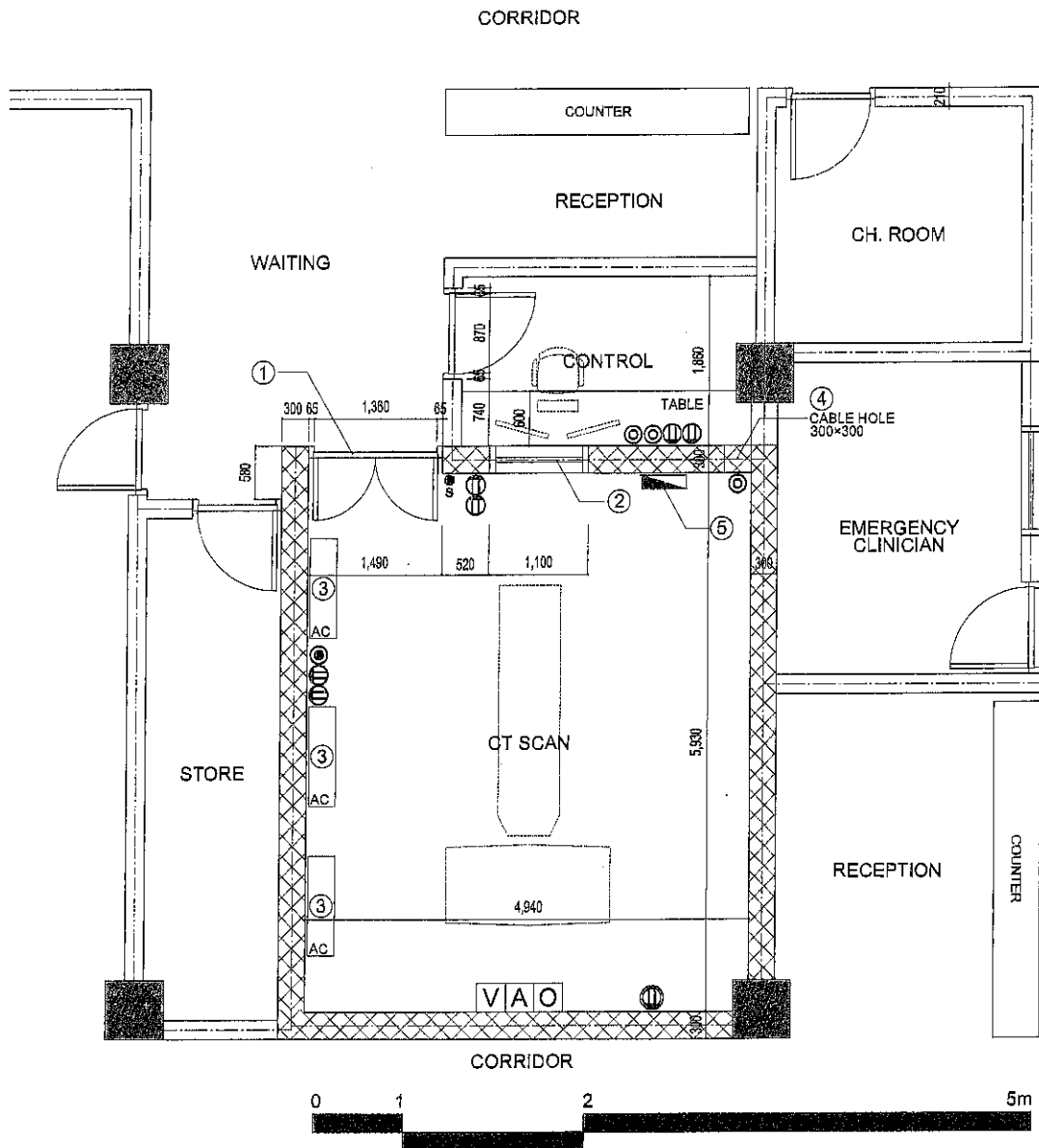






REQUIRED SPECIFICATION FOR CONSTRUCTION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD STRUCTURE	300mm THICKNESS BRICK AND CEMENT PLASTER WALL 180mm THICKNESS CONCRETE SLAB (UPPER FLOOR)
②	X-RAY SHIELD DOOR	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,400mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
③	PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 2,000mm WIDTH, 900mm HEIGHT, WINDOW FRAME SHALL BE COVERED WITH 2.0mm LEAD
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	ACCESS DOOR	NOT LESS THAN 1,400mm WIDTH OR 2,100mm HEIGHT
⑥	POWER DISTRIBUTION BOARD	3 PHASE, 3 WIRE, 380~480V, 50/60Hz, VOLTAGE FLUCTUATION LESS THAN ±5%, CAPACITY 75KVA, EARTHING LESS THAN 10Ω
⑦	COOLING AC UNIT	TEMPERATURE 18~26°C, MOISTURE 30~60%, COOLING CAPACITY 4.0kw x 4NOs

**GELEPHU CRRH
CT SCAN ROOM PLAN**



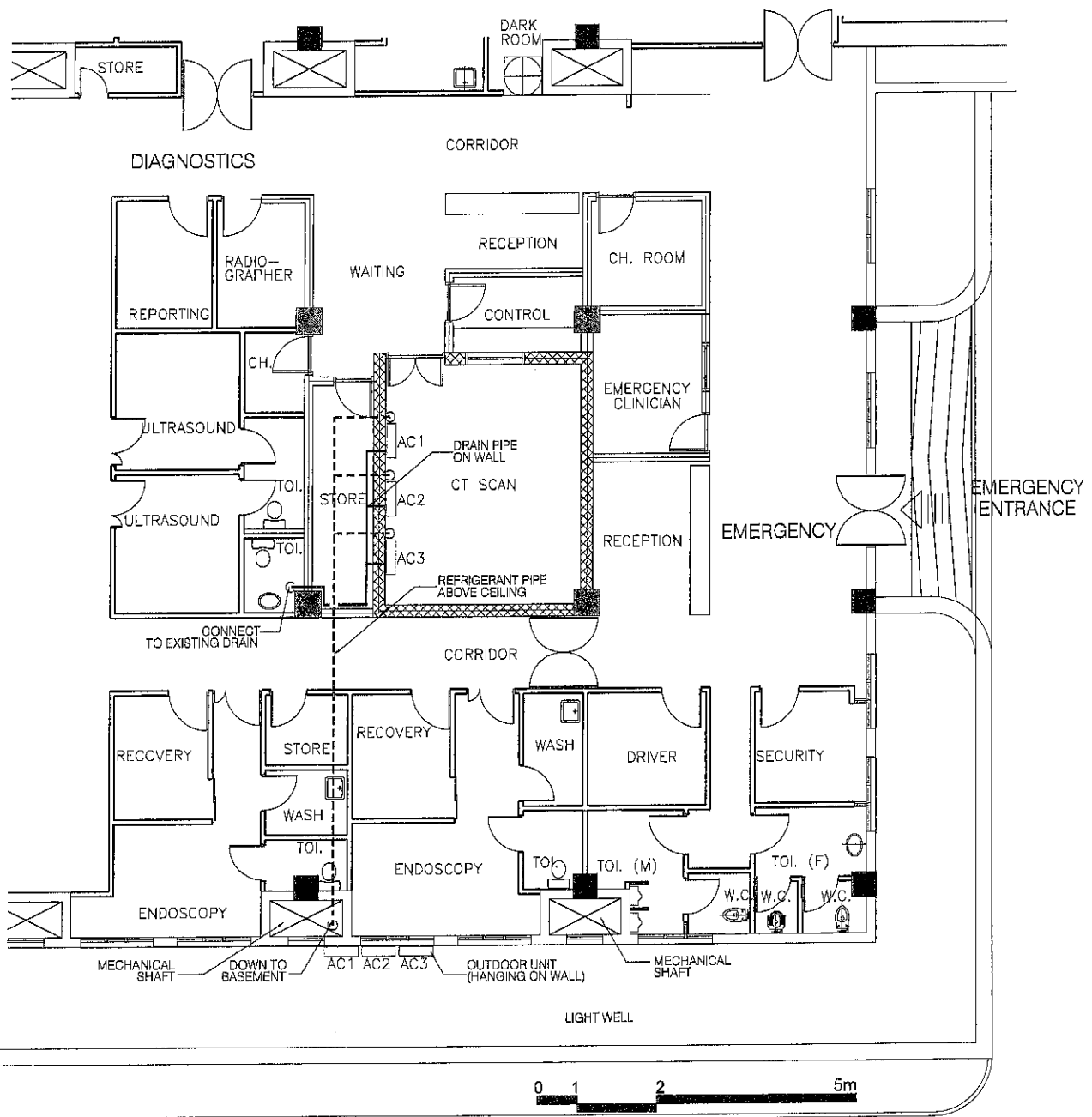
LEGEND (EXISTING FACILITIES)

Ⓜ	RECEPTACLE	▬	MCCB 400V 45kw
Ⓜ	RECEPTACLE (250V 20A)		
Ⓛ	LAN	∇	VACCUM
Ⓣ	TELEPHONE	A	COMPRESSED AIR
● S	SWITCH	□	OXYGEN

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
②	INSTALL PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 1,100mm WIDTH, 1,200mm HEIGHT, 2.0mm LEAD LINING STEEL DOOR
③	INSTALL COOLING AC UNIT	TEMPERATURE 18-28°C, MOISTURE 30-60%, COOLING CAPACITY 4.0kw x3NOs WITH DRAIN AND REFRIGENT PIPING
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	INCREASE POWER SUPPLY	3PHASE 415V 75KVA EXCUSIVE USE (EXISTING 51KVA)

**MONGAR ERRH
CT SCAN ROOM RENOVATION PLAN**



SPECIFICATION

EQP. No.	EQUIPMENT	ABILITY	VOLTAGE	POWER (KW)	NO
AC1	Packaged Air Conditioner Wall Mount Type	Cooling capacity = 4.0 KW	1Ø 230V	1.5	1
AC2	Packaged Air Conditioner Wall Mount Type	Cooling capacity = 4.0 KW	1Ø 230V	1.5	1
AC3	Packaged Air Conditioner Wall Mount Type	Cooling capacity = 4.0 KW	1Ø 230V	1.5	1
REFRIGERANT PIPING	PIPES : COPPER PIPE FITTINGS : WELDING JOINT				
DRAIN PIPING	PIPES : POLYVINYL CHLORIDE PIPE(VP) FITTINGS : PVC FITTINGS (DRAINAGE TYPE)				

**MONGAR ERRH
AC UNIT AND PIPING PLAN**

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Demarcations of the Renovation Works

JDWNRH

Items	Bhutan	Japan
To remove existing CT	✓	
To secure carry-in/out route	✓	
To enlarge / Install X-ray shield doors	✓ (installment work)	✓ (materials supply)
To replace protection window	✓ (installment work)	✓ (materials supply)
To increase power supply (150KVA)	✓	✓ (AVR, UPS if needed)
Other necessary infrastructural works	✓	

GCRRH

Items	Bhutan	Japan
Building construction including electricity, HVAC, and plumbing work necessary for CT installment	✓	*

*AVR, UPS will be provided by Japan if needed

MERRH

Items	Bhutan	Japan
To enlarge / Install X-ray shield doors	✓ (installment work)	✓ (materials supply)
To install protection window	✓ (installment work)	✓ (materials supply)
To increase power supply (75KVA)	✓	✓ (AVR, UPS if needed)
To install cooling AC Units	✓ (installment work)	✓ (materials supply)
Other necessary infrastructural works	✓	




Annex 10. Plan of Human Resource Allocation

Existing: As of 2016, Plan: As of 2018

Categories	JDWNRH		MERRH		GCRRH	
	Existing	Plan	Existing	Plan	Existing	Plan
1. Radiologist	4	4	0	1	0	1
2. Radio-Technologist	2	2	1	2	1	2
3. CT Technician	4	4	0	1	0	1
4. X-ray Technician	1	1	3	3	4	4
5. CT Nurse	1	1	0	1	0	1
6. Mammography Technician	2	2	-	-	-	-

*Planned figures are minimum numbers of allocation.

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Appendix 4. Minutes of Discussions
(2) Explanation of Draft Final Report

**Minutes of Discussions
on the Preparatory Survey for
the Project for Improvement of Medical Equipment
at the National and Regional Referral Hospitals
(Explanation on Draft Preparatory Survey Report)**

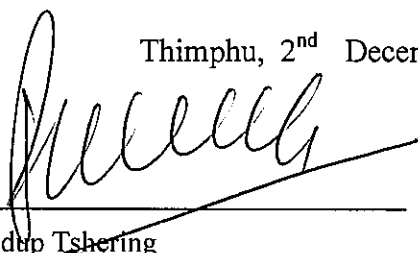
On the basis of the discussions with the the Government of Bhutan (hereinafter referred to as "Bhutan") from August 13 to September 11, 2016 during a field survey, and the subsequent technical examination of the results in Japan, the Japan International Cooperation Agency (hereinafter referred to as "JICA") prepared a draft Preparatory Survey Report (hereinafter referred to as "the Draft Report") on the Project for Improvement of Medical Equipment at the National and Regional Referral Hospitals (hereinafter referred to as "the Project").

In order to explain the Draft Report and to consult with the concerned officials of the Bhutan side on its contents, JICA sent to Bhutan the Preparatory Survey Team for the explanation of the Draft Report (hereinafter referred to as "the Team"), headed by Kozo WATANABE, Deputy Director General, Health Group 2, Human Development Department, JICA, and is scheduled to stay in Bhutan from November 27 to December 4, 2016. As a result of the discussions, the Bhutan side and the Team confirmed the main items described in the attached sheets.

Thimphu, 2nd December, 2016



Mr. Kozo WATANABE
Leader, The Preparatory Survey Team
Japan International Cooperation Agency



Dr. Pandup Tshering
Director
Department of Medical Services
Ministry of Health



(Witness)
Mr. Rinchen Wangdi
Chief Program Coordinator
Development Cooperation
Gross National Happiness Commission

ATTACHMENT

1. Objective of the Project

The objective of the Project is to enhance the diagnostic services for Non-Communicable Diseases, injuries and others to be provided by the National and Regional Referral Hospitals and improve the access to medical services for population, especially those living in the eastern and central region of Bhutan through procurement of medical equipment.

2. Title of the Preparatory Survey

The Bhutan side and the Team confirmed the title of the Preparatory Survey as “the Preparatory Survey for Improvement of Medical Equipment at the National and Regional Referral Hospitals”.

3. Project Site

The Bhutan side and the Team confirmed that the sites of the Project are Jigme Dorji Wangchuk National Referral Hospital (hereinafter referred to as “JDWNRH”) in Thimphu, Gelephu Central Regional Referral Hospital (hereinafter referred to as “GCRRH”), and Mongar Eastern Regional Referral Hospital (hereinafter referred to as “MERRH”) which are shown in Annex 1.

4. Executing Agency

The Bhutan side and the Team confirmed the executing agency is the Ministry of Health, which would be the agency to coordinate with all the relevant agencies to ensure smooth implementation of the Project and ensure that the undertakings are taken by relevant agencies properly and on time. The organization charts are shown in Annex 2.

5. Final Request

After the discussions with the Team, the items described in Annex 3 were finally requested by the Bhutan side.

6. Contents of the Draft Report

After the explanation of the contents of the Draft Report by the Team, the Bhutan side agreed in principle to its contents.

7. Cost Estimation

The Bhutan side and the Team confirmed that the Project cost estimation described in the Draft Report was provisional and would be examined further by the Government of Japan for its final approval.

8. Confidentiality of the Cost Estimation and Specifications

The Bhutan side and the Team confirmed that the Project cost estimation and technical specifications in the Draft Report should never be duplicated or disclosed to any third parties until all the contracts of the Project are concluded.

9. Japan's Grant Aid Scheme

The Bhutan side understands the Japan's Grant Scheme and its procedures as described in Annex 4, 5 and 6, and necessary measures to be taken by the Bhutan side for smooth implementation of the Project, as a condition for the Japan's Grant to be implemented.

10. Project Implementation Schedule

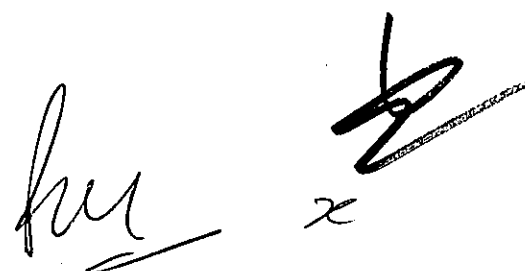
The Team explained to the Bhutan side that the expected implementation schedule is as attached in Annex 7.

11. Expected Outcomes and Indicators

The Bhutan side and the Team agreed that key indicators for expected outcomes are as follows. The Bhutan side has responsibility to monitor the progress of the indicators and achieve the target in year 2021.

[Quantitative Effect]

	Indicators	Baseline Data	Target
1	Reduction of the number of days for which use of CT is suspended in JDWNRH	16 days/year	2 days/year
2	Increase in the number of CT examinations in JDWNRH	3,782 cases/year	5,000 cases/year
3	Increase in the number of CT examinations in GCRRH	0 case/year	1,500 cases/year
4	Increase in the number of CT examinations in MERRH	0 case/year	1,500 cases/year



[Qualitative Effect]

1. Improvement of provision of health services at target hospitals by enabling early diagnosis and treatment
2. Reduction waiting time and/or travel time for CT examination by providing it at regional referral hospitals
3. Improvement of training for health staff at JDWNRH by introducing sophisticated equipment for diagnosis

12. Technical Assistance (“Soft Component” of the Project)

Considering the sustainable operation and maintenance of the provided medical equipment, following technical assistance is planned to be provided under the Project. The Bhutan side confirmed to deploy necessary number of counterparts who are appropriate and competent in terms of its purpose of the technical assistance as described in the Draft Report.

13. Undertakings by the Bhutan Side and to be Covered by the Grant Aid

The Bhutan side and the Team confirmed the undertakings described in Annex 8. The Bhutan side assured to take necessary measures for the smooth implementation of the Project. Contents of Annex 8 will be updated as the Preparatory Survey progresses, and will finally be the Attachment to the Grant Agreement.

14. Monitoring during the Implementation

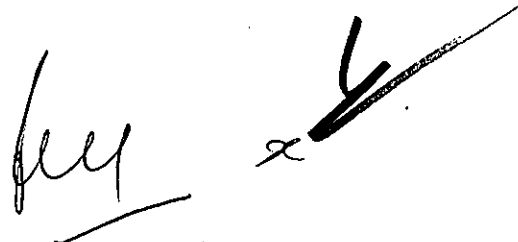
The Project will be monitored and reported every 3 months by the executing agency using the Project Monitoring Report (PMR), as per attached in Annex 9.

15. Ex-Post Evaluation

JICA will conduct ex-post evaluation 3 years after the project completion with respect to five evaluation criteria (Relevance, Effectiveness, Efficiency, Impact and Sustainability) of the Project. Results of the evaluation will be publicized. The Bhutan side is required to provide necessary support including information necessary for the evaluation of the Project.

16. Schedule of the Study

The Team will complete the Final Report of the Preparatory Survey in accordance with the confirmed items and send it to the Bhutan side around February 2017



17. Other Relevant Issues

17-1. Renovation/Expansion Works for Facilities

a) Policy of Renovation/Expansion Works

The Bhutan side agreed to complete renovation/expansion works for facilities shown as follows before the installation of equipment in accordance with the detail design shown in Annex 10. The cost of the works will be borne by the Bhutan side, except for some materials and equipment provided by the Project.

- i) Renovation works of the CT and mammography rooms in JDWNRH,
- ii) Renovation works of the CT room in MERRH
- iii) Expansion works of GCRRH

b) Report of the Plan and Progress/Completion of the Works

The Bhutan side assured to report to JICA on the plan, progress and completion of the above mentioned works in following ways.

- i) For renovation works of JDWNRH and MERRH, the Ministry of Health will report to JICA every 3 months since the start of implementation of the Project on the plan and progress/completion of the works using the Project Monitoring Report (PMR) as per attached in Annex 9.
- ii) For expansion works of GCRRH, the Ministry of Health will report to JICA every month since the signing of the Minutes of Discussion on the progress/completion of overall works and works for CT room and Digital X-ray room. The monthly report for CT room and Digital X-ray room will include the physical progress rate and pictures of the site.

17-2. Allocation of Human Resources for Utilization

The Bhutan side agreed to secure sufficient personnel for the utilization of the medical equipment to be provided. Plan for the allocation is shown in Annex 11.

17-3. Maintenance of the Equipment

a) Importance of Maintenance

The Team explained the importance of maintenance of the equipment under the Project considering that proper asset management is necessary to secure the life-span of the equipment and to reduce its maintenance cost.

b) Budget allocation for Maintenance

The Bhutan side agreed to secure enough budgets necessary for appropriate operation and maintenance of the equipment including the additional purchase of consumables described in Annex 12.

c) Allocation of Human Resources for Maintenance

The Bhutan side agreed to secure sufficient personnel for the maintenance of the medical equipment to be provided. The allocation at present is shown in Annex 13.

d) Maintenance Contracts on Major Equipment

The Bhutan side and the Team agreed that the Project includes a four-year Comprehensive Maintenance Contract (hereinafter referred to as "CMC") in addition to a one-year warranty for major equipment. The Bhutan side agreed to have responsibility on maintenance after the period of the warranty and CMC.

Annex 1. Project Site

Annex 2. Organization Chart of the Ministry of Health

Annex 3. Equipment List

Annex 4. Japan's Grant Aid

Annex 5. Flow Chart of Japan's Grant Aid Procedures

Annex 6. Financial Flow of Japan's Grant Aid

Annex 7. Implementation Schedule

Annex 8. Major Undertakings to be Taken by Each Government

Annex 9. Project Monitoring Report (Template, Main Clause)

Annex 10. Renovation Plan and Scope of Work

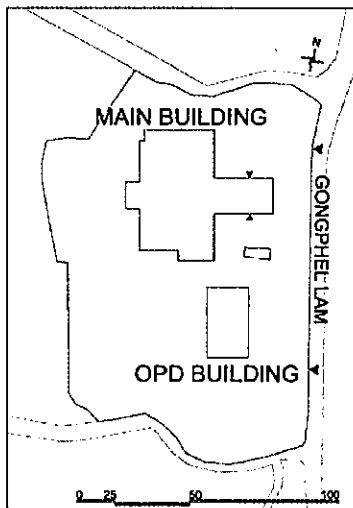
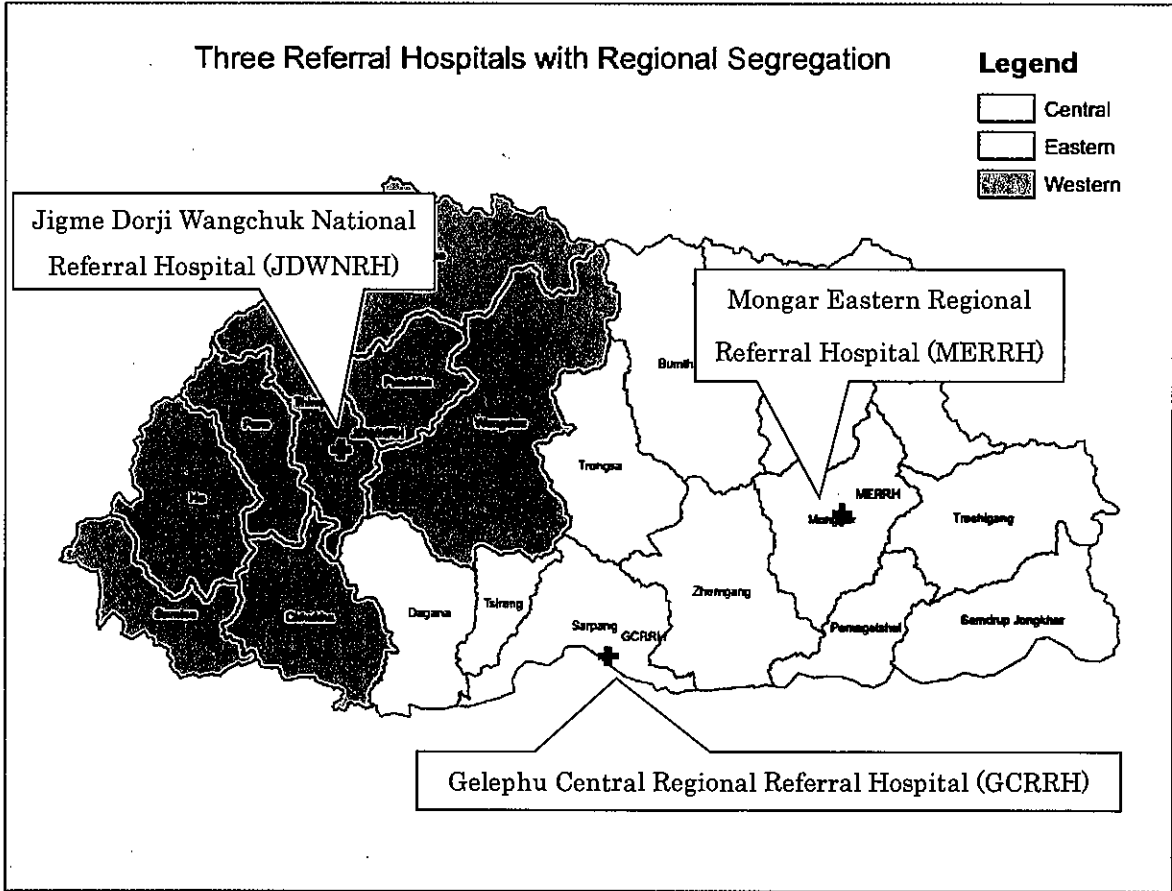
Annex 11. Plan of Human Resource Allocation for Utilization

Annex 12. List of Consumables

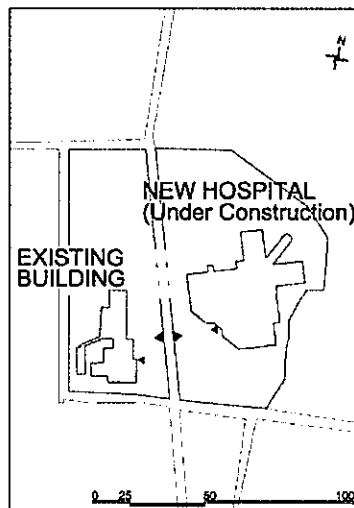
Annex 13. Human Resources Allocation for Maintenance

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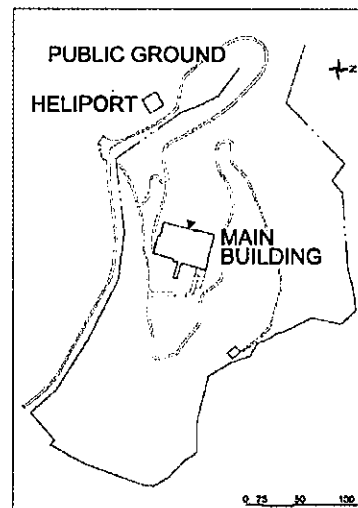
Annex 1. Project Site



JDWNRH

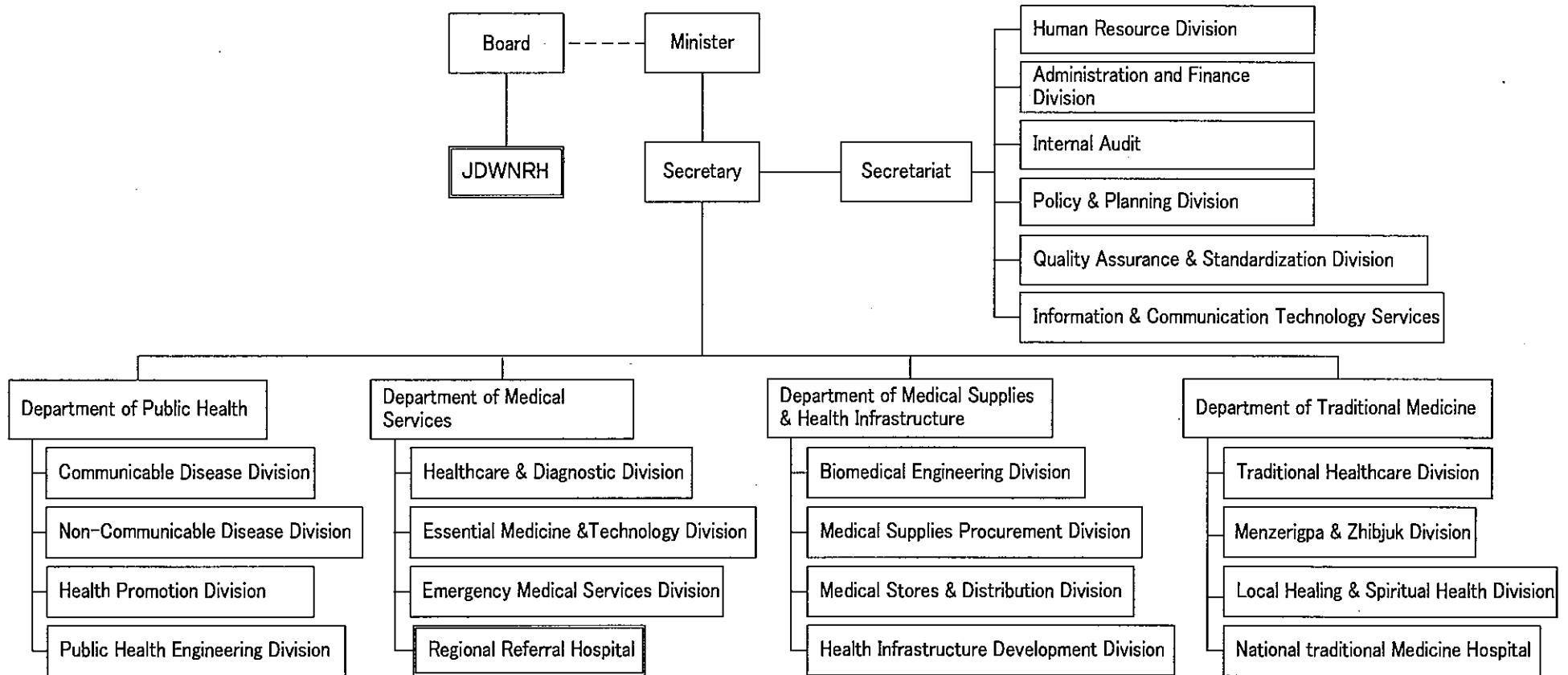


GCRRH



MERRH

Annex 2. Organization Chart of the Ministry of Health





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Annex 3. Equipment List

No.	Items	Quantity	JDWNRH	GCRRH	MERRH	CMC
1	CT (64 Slice)	1	1	0	0	✓
2	CT (16 Slice)	2	0	1	1	✓
3	General X-Ray Apparatus	1	0	1	0	✓
4	Mammography	1	1	0	0	✓
5	Spirometer	1	0	0	1	
6	ECG Holter System	1	0	0	1	

*CMC: Comprehensive Maintenance Contract

 
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Annex 4. Japan's Grant Aid

The Japan's Grant Aid is non-reimbursable fund provided to Bhutan to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Japan's Grant Aid is not supplied through the donation of materials as such.

Based on a JICA law which was entered into effect on October 1, 2008 and the decision of the government of Japan (hereinafter referred to as the "GOJ"), JICA has become the executing agency of the Japan's Grant Aid for Projects for construction of facilities, purchase of equipment, etc.

1. Grant Procedures

The Japan's Grant Aid is supplied through following procedures:

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and Bhutan
- Grant Agreement (hereinafter referred to as "the G/A")
 - Agreement concluded between JICA and Bhutan
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of Bhutan necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Japan's Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.



- Estimation of costs of the Project.

The contents of the original request by Bhutan are not necessarily approved in their initial form as the contents of the Japan's Grant Aid project. The Outline Design of the Project is confirmed based on the Guidelines of the Japan's Grant Aid scheme.

JICA requests the government of Bhutan to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of Bhutan which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of Bhutan based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) Consulting firm(s). JICA selects (a) Firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. The Japan's Grant Aid Scheme

(1) The E/N and the G/A

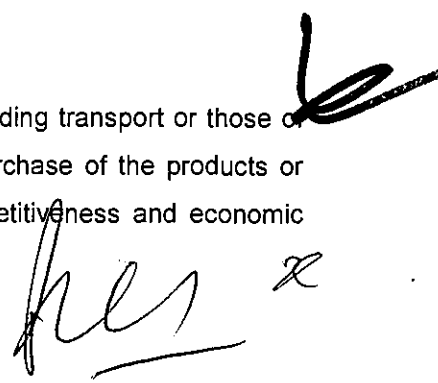
After the Project is approved by the Cabinet of Japan, the Exchange of Notes (hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of Bhutan to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of Bhutan to define the necessary articles, in accordance with the E/N, to implement the Project, such as payment conditions, responsibilities of the Government of Bhutan, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to Bhutan to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japan's Grant Aid, in principle, Japanese products and services including transport or those of Bhutan are to be purchased. The Japan's Grant Aid may be used for the purchase of the products or services of a third country, if necessary, taking into account the quality, competitiveness and economic

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rationality of products and services necessary for achieving the objective of the Project. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals", in principle.

(4) Necessity of "Verification"

The Government of Bhutan or its designated authority will conclude contracts denominated in Japanese Yen with Japanese nationals, in principle. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of Bhutan

In the implementation of the Japan's Grant Aid Project, Bhutan is required to undertake such necessary measures as Annex. The Japanese Government requests the Government of Bhutan to exempt all customs duties, internal taxes and other fiscal levies such as value added tax (hereinafter referred to as "VAT"), commercial tax, income tax, corporate tax, resident tax, fuel tax, but not limited, which may be imposed in Bhutan with respect to the supply of the products and services under the verified contract, since the Japan's Grant Aid fund comes from the Japanese taxpayers.

(6) "Proper Use"

The Government of Bhutan is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Japan's Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Japan's Grant Aid.

(7) "Export and Re-export"

The products purchased under the Japan's Grant Aid should not be exported or re-exported from Bhutan.

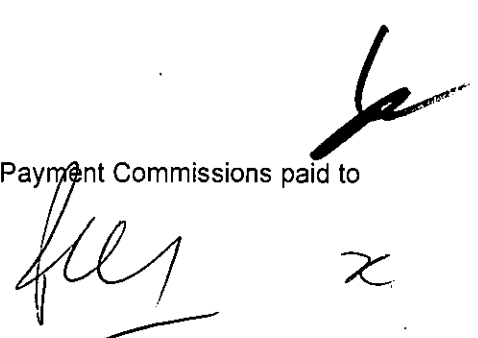
(8) Banking Arrangements (B/A)

a) The Government of Bhutan or its designated authority should open an account under the name of the Government of Bhutan in a bank in Japan (hereinafter referred to as "the Bank"), in principle. JICA will execute the Japan's Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of Bhutan or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (hereinafter referred to as "A/P") issued by the Government of Bhutan or its designated authority.

(9) Authorization to Pay

The Government of Bhutan should bear an advising commission of A/P and Payment Commissions paid to the Bank.

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(10) Environmental and Social Considerations

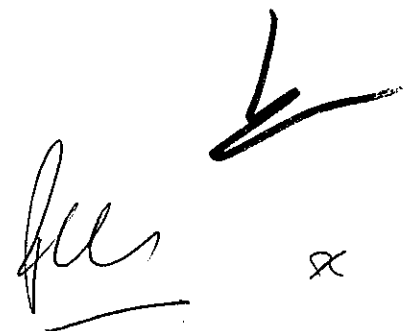
The Government of Bhutan must carefully consider environmental and social impacts by the Project and must comply with the environmental regulations of Bhutan and JICA Guidelines for Environmental and Social Consideration (April, 2010) .

(11) Monitoring

The Government of Bhutan must take their initiative to carefully monitor the progress of the Project in order to ensure its smooth implementation as part of their responsibility in the G/A, and must regularly report to JICA about its status by using the Project Monitoring Report (PMR).

(12) Safety Measures

The Government of Bhutan must ensure that the safety is highly observed during the implementation of the Project.



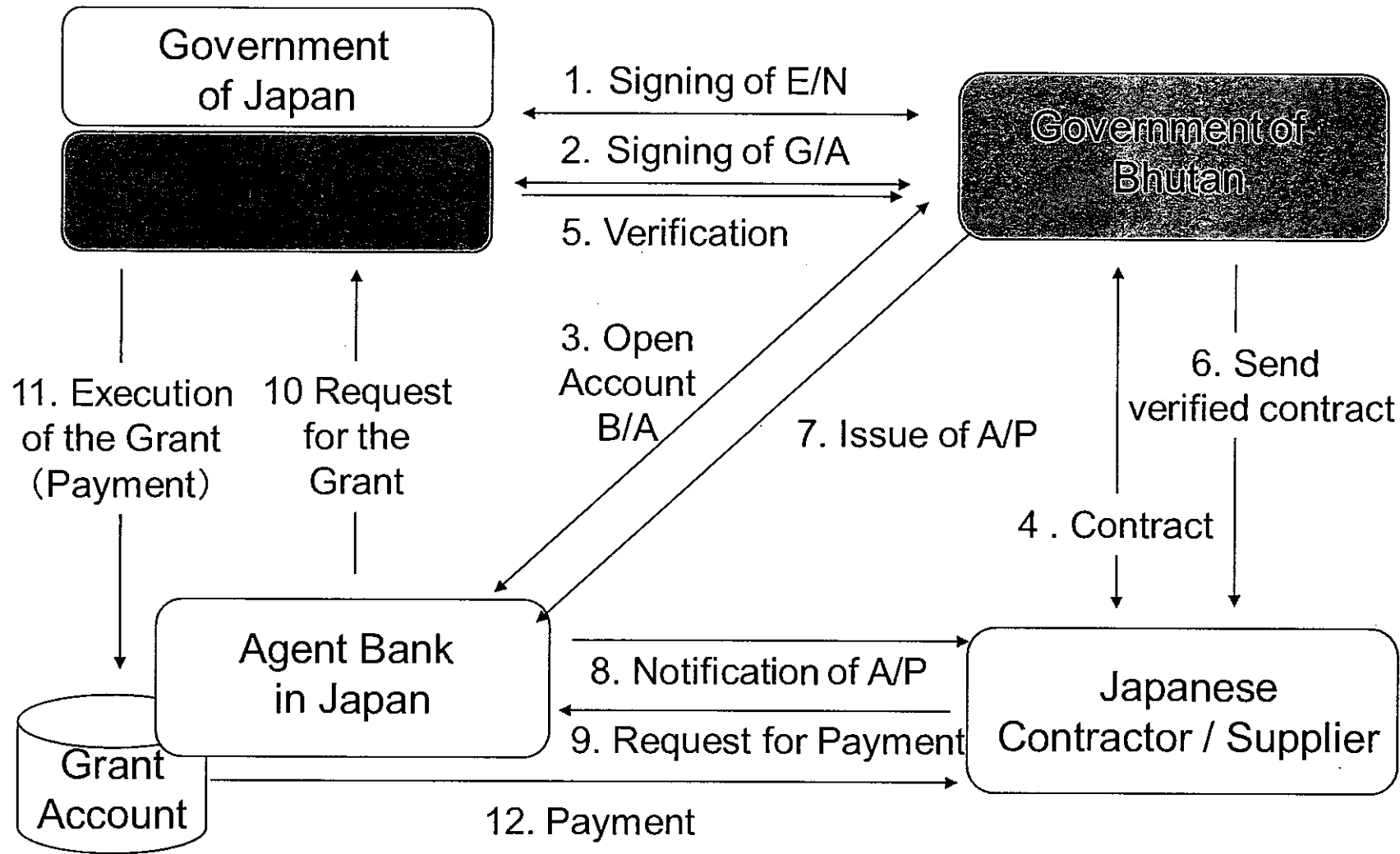
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Annex 5. Flow Chart of Japan's Grant Aid Procedures

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contract	Others
Application							
Project Formulation & Preparation	Preparatory Survey						
Appraisal & Approval							
Implementation	<p>(E/N: Exchange of Notes) (G/A: Grant Agreement) (A/P: Authorization to Pay)</p>						
Evaluation & Follow up							

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Annex 6. Organization Chart of the Ministry of Health



E/N: Exchange of Notes, G/A: Grant Agreement,
 B/A: Banking Arrangement, A/P: Authorization to Pay,

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Annex 7. Implementation Schedule

Month	1	2	3	4	5	6	7	8	9	10	11	12
Tender document	Final confirmation of the project										Total 5 months	
	Preparation of tender document											
	Approval of tender document											
	Tender notice											
	Tender				Evaluation of tender and signing of supplier contract							
Procurement and installation stage	Manufacturing									Total 12 months		
	Pre-shipment inspection											
	Transportation and custom clearance								Installation			
	Soft component											
Maintenance service	Total 60 months											
	Warranty period											
	Confirmation of maintenance service											
	Maintenance contract of 1st year											
	Maintenance contract of 2nd year											
	Confirmation of maintenance service											
	Maintenance contract of 3rd year											
	Maintenance contract of 4th year											
	Confirmation of maintenance service											

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Annex 8. Major Undertakings to be Taken by Each Government

Major Undertakings to be Taken by Bhutan

*GNHC: Gross National Happiness Commission, *MOH: Ministry of Health, *JDWNRH: Jigme Dorji Wangchuk National Referral Hospital, *GRRH: Gelephu Central Regional Referral Hospital, *MERRH: Mongar Eastern Regional Referral Hospital

1. Before the Tender

NO	Items	Deadline	In charge	Cost (BTN)
1	To take necessary measures to open Bank Account (Banking Arrangement (B/A))			
	1) To bear the necessary commission charges with Bank Account if required	Within 1 month after receiving B/A from the Bank	GNHC	XX**
	2) To take necessary procedures among government organizations and Agent Bank in Bhutan to open Bank Account (B/A)	Within 1 month after receiving B/A from the Bank	GNHC	-

2. During the Project Implementation

NO	Items	Deadline	In charge	Cost (BTN)
1	To bear the following commissions to a bank of Japan for the banking services based upon the B/A			
	1) Advising commission of Authorization to Pay (A/P)	Within 1 month after the verification of the contract	MOH/ GNHC	XX**
	2) Payment commission for A/P	Every payment	MOH/ GNHC	XX**
2	To ensure prompt unloading and customs clearance in recipient country			
	1) Tax exemption and customs clearance of the products	During the Project	MOH	-
	2) To take necessary arrangement for internal transportation to the project site	During the Project	MOH	-
3	To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services under the verified contract such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work	During the Project	MOH	-
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the Products and/or the Services be exempted; (especially sales tax, income tax and customs)	During the Project	MOH	-
5	To bear all the expenses, other than those to be borne by the Grant Aid, if any.	During the Project	MOH	-
6	To provide and repair/expand/renovate facilities including distributions of electricity, X-ray protection, establishment of carry-in route and others.			
	1) Renovation works of the CT room in JDWNRH	Before installation of the equipment	JDWNRH MOH	0.85M
	2) Renovation works of the Mammography rooms in JDWNRH	Before installation of the equipment	JDWNRH MOH	0.07M
	3) Renovation works of the CT room in MERRH	Before installation of the equipment	MERRH MOH	1.58M
	4) Expansion works at GRRH.	Before installation of the equipment	GRRH MOH	-
7	To assign all necessary staff with appropriate skills and experiences for operation and maintenance of new equipment provided under the Grant Aid (EX: CT-technicians, Radiologists, Biomedical Engineers etc)	Before installation of the equipment	MOH	-
8	To dispose the existing equipment and secure spaces for daily operation.	During the Project	JDWNRH/ GRRH/ MERRH	-

**The total amount of B/A and commission of A/P is estimated to be approximately 0.7M BTN (0.24% of the total project cost based on the cost estimation of the previous project).

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3. After the Project

NO	Items	Deadline	In charge	Cost (BTN)
1	To appoint and retain sufficient staff with appropriate skills and experiences for utilization of equipment provided under the Grant Aid	After completion of the procurement	MOH	
2	To take necessary measures to maintain properly and effectively the equipment provided under the Grant Aid			
	1) Budget allocation including the additional purchase of consumables	After completion of the procurement	JDWNRH/ GRRH/ MERRH MOH	5M
	2) Allocation of human resources for maintenance	After completion of the procurement	JDWNRH/ GRRH/ MERRH MOH	-
	3) Contracting with agents for major equipment (or an equivalent measures)	After a five-year contract borne by the Project expires	JDWNRH/ GRRH/ MERRH MOH	-

Major Undertakings to be Covered by the Japan's Grant Aid

No	Items	Deadline	Cost Estimated (Million Japanese Yen)*
1	1) To ensure prompt unloading and customs clearance at the port of disembarkation in recipient country		
	a) Ocean (Air) transportation of the products from Japan (the third country) to the recipient country	During the Project	
	b) Transportation from the port of disembarkation to the project site	During the Project	
	2) To provide equipment with installation, commissioning and training	During the Project	
	3) To provide comprehensive maintenance services for the radiological equipment	During the Project	
2	To implement detailed design, tender support if any (Consultant)	During the Project	
3	Technical assistance as soft components, which will be provided by Japan's grant aid, for proper operation and preventive maintenance of the equipment.	During the Project	
	Total		

*; The cost estimates are provisional. This is subject to the approval of the Government of Japan.



 2

Annex 9. Project Monitoring Report (Template, Main Clause)

<p><u>Project Monitoring Report</u> on <u>Project Name</u> <i>Grant Agreement No. <u>XXXXXXXX</u></i> 20XX, Month</p>

Organization Information

Authority (Signer of the G/A)	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Implementing Agency	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____
Responsible Agency	Person in Charge _____ _____ (Division) _____ Contacts Address: _____ Phone/FAX: _____ Email: _____

Outline of Grant Agreement:

Source of Finance	Government of Japan: Not exceeding JPY _____ mil. Government of (_____): _____
Project Title	
E/N	Signed date: Duration:
G/A	Signed date: Duration:

free

1: Project Description

1-1 Project Objective

--

1-2 Necessity and Priority of the Project

- Consistency with development policy, sector plan, national/regional development plans and demand of target group and the recipient country.

--

1-3 Effectiveness and the indicators

- Effectiveness by the project

Quantitative Effect (Operation and Effect indicators)		
Indicators	Original (Yr)	Target (Yr)
Qualitative Effect		

2: Project Implementation

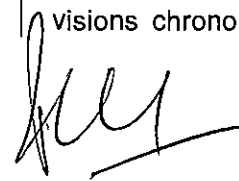
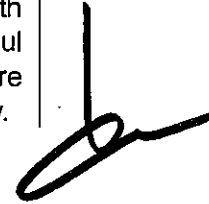
2-1 Project Scope

Table 2-1-1a: Comparison of Original and Actual Location

Location	Original: (M/D) Attachment(s):Map	Actual: (PMR) Attachment(s):Map
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Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
(M/D)	(M/D)	(PMR)
Please state not only the most updated schedule but also other past revisions chronologically.		



 ze

'Soft component' shall be included in 'Items'.	All change of design shall be recorded regardless of its degree.
--	--

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Upgrading of the Kukum Highway	length 20km, single lane (3.47m*2), path(1.25m*2) Concrete Pavement 200mm (motor lane only)	length 20km, single lane (3.47m*2), path(1.00m*2) Concrete Pavement 200mm (motor lane only)
2. Replacement of Old Mataniko Bridge	Bridge length 40m, Width 9.5m, path(1.00m*2), compound steel box-girder bridge, Inverted T type-abutment spread foundation	Ditto

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Outpatient Department	RC, Double Story Ground floor: Consultation room 6 Reception Satellite Lab. Pharmacy, etc 1 st floor: Consultation room 5 Dental Clinic 2	RC, Double Story Ground floor: Consultation room 5 ditto
2. Operation Theatre, Casualty Unit, Maternity Ward	RC, Double Storey Ground Floor: Operation room 2 Casualty Unit 1 st Floor: Maternity Ward 50 beds	ditto Maternity Ward 60 beds

(Sample)Table 2-1-1b: Comparison of Original and Actual Scope

Items	Original	Actual
1. Primary and Secondary Surveillance Radars at Chittagong Int'l Airport	i) OSR/SSR 1 set ii) RDP 1 set iii) VHF Transmitters 2 sets	Ditto
2. Access Control System for Dhaka Int'l Airport	1 set	Ditto
3. Doppler VOR/DME at Saidpur Airport	1 set	Ditto
4. Aerodrome Simulator for Civil Aviation Training Center	1 set	Ditto



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5. Baggage Inspection System for Dhaka Int'l Airport	i) Hold Baggage Xray Inspectin system 7sets ii) Hold Baggage Explosive Trace Detecting System 7sets iii) Cabin Baggage Xray Inspection System 2sets	Ditto
6. Airport Fire Fighting Vehicles for Dhaka Int'l Airport	2 sets	3 sets

2-1-2 Reason(s) for the modification if there have been any.

(PMR)

2-2 Implementation Schedule
2-2-1 Implementation Schedule

Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
[M/D] 'Soft component' shall be stated in the column of 'Items'. Project Completion Date*	(M/D)		(PMR) As of (Date of Revision) Please state not only the most updated schedule but also other past revisions chronologically.

*Project Completion was defined as _____ at the time of G/A.

(Sample)Table 2-2-1: Comparison of Original and Actual Schedule

Items	Original		Actual
	DOD	G/A	
Cabinet Approval	11/2015	-	-
E/N	12/2015	1/2016	24/1/2016
G/A	12/2015	1/2016	24/1/2016 Amended 13/3/2017
Detailed Design	12/2015-4/2016	1/2016-5/2016	1/2016-5/2016
Tender Notice	5/2016	5/2016	1/6/2016
Tender	6/2016	6/2016	15/7/2016
(Lot1) Construction Period	7/2016-11/2018	7/2016-11/2018	8/8/2016-30/11/2018
(Lot2) Installation of Equipment	7/2016-6/2018	7/2016-6/2018	6/8/2016-30/6/2017
Project Completion Date	11/2018	11/2018	30/11/2018

Defect Liability Period	11/2019	11/2019	30/11/2019
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*Project Completion was defined as Check-out of Construction work at the time of G/A.

2-2-2 Reasons for any changes of the schedule, and their effects on the project.

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2-3 Undertakings by each Government

2-3-1 Major Undertakings

See Attachment 2.

2-3-2 Activities

See Attachment 3.

2-3-3 Report on RD

See Attachment 4.

2-4 Project Cost

2-4-1 Project Cost

Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

	Items		Cost (Million Yen)	
	Original	Actual	Original	Actual
Construction Facilities (or Equipment)	'Soft component' shall be included in 'Items'.			Please state not only the most updated schedule but also other past revisions chronologically.
Consulting Services	- Detailed design - Procurement Management - Construction Supervision			
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = Yen

Table 2-4-1b Comparison of Original and Actual Cost by the Government of XX

	Items		Cost (Million USD)	
	Original	Actual	Original	Actual
				Please state not only the most updated schedule but also other past

xx

				revisions chronologically.
Total				

Note: 1) Date of estimation:
2) Exchange rate: 1 US Dollar = (local currency)

(Sample)Table 2-4-1a Comparison of Original and Actual Cost by the Government of Japan
(Confidential until the Tender)

Items			Cost (Million Yen)	
	Original	Actual	Original ^(1),2)	Actual
Construction Facilities	1. Outpatient Department 2. Operation Theatre, Casualty Unit, Maternity Ward	Ditto Ditto	1,169.5	1,035.0
Equipment	1) Primary and Secondary Surveillance Radars at Chittagong Int'l Airport 2) Access Control System for Dhaka Int'l Airport 3) Doppler VOR/DME at Saidpur Airport 4) Aerodrome Simulator for Civil Aviation Training Center 5) Baggage Inspection System for Dhaka Int'l Airport 6) Airport Fire Fighting Vehicles for Dhaka Int'l Airport	Ditto	2,374.6	2,110.0
Consulting Services	- Detailed design - Procurement Management - Construction Supervision - Soft Component	Ditto	0.87	0.87
Total			3544.97	3145.87

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 99.93 Yen

(Sample)Table 2-4-1b Comparison of Original and Actual Cost by the Government of
Bangladesh

Items			Cost (1,000 Taka)	
	Original	Actual	Original ^(1),2)	Actual
Dhaka International Airport	Modification of software of existing Rader Data Processing System	Ditto	8,000	9,240
	Provision of a partition, lighting, air conditioning and electric power supply at transfer hold baggage check point	Ditto	5,000	2,453
	Replacement of five doors in the international passenger terminal building	Ditto	4,000	5,340

x



Chittagong Int'l Airport	Preparation of the radar site including felling of trees, clearing and grabbing	Ditto	5,000	3,400
Total			22,000	20,433

Note: 1) Date of estimation: October, 2014
2) Exchange rate: 1 US Dollar = 0.887 Bangladesh Taka (local currency)

2-4-2 Reason(s) for the wide gap between the original and actual, if there have been any, the remedies you have taken, and their results.

(PMR)

2-5 Organizations for Implementation

2-5-1 Executing Agency:

- Organization's role, financial position, capacity, cost recovery etc,
- Organization Chart including the unit in charge of the implementation and number of employees.

Original: (M/D)
Actual, if changed: (PMR)

2-6 Environmental and Social Impacts

- The results of environmental monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- The results of social monitoring as attached in Attachment 5 in accordance with Schedule 4 of the Grant Agreement.
- Information on the disclosed results of environmental and social monitoring to local stakeholders, whenever applicable.

3: Operation and Maintenance (O&M)

3-1 O&M and Management

- Organization chart of O&M
- Operational and maintenance system (structure and the number, qualification and skill of staff or other conditions necessary to maintain the outputs and benefits of the project soundly, such as manuals, facilities and equipment for maintenance, and spare part stocks etc)

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Original: (M/D)
Actual: (PMR)

3-2 O&M Cost and Budget

- The actual annual O&M cost for the duration of the project up to today, as well as the annual O&M budget.

Original: (M/D)

4: Precautions (Risk Management)

- Risks and issues, if any, which may affect the project implementation, outcome, sustainability and planned countermeasures to be adapted are below.

Original Issues and Countermeasure(s): (M/D)	
Potential Project Risks	Assessment
1.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
2.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L
	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
3.	Probability: H/M/L
(Description of Risk)	Impact: H/M/L

	Analysis of Probability and Impact:
	Mitigation Measures:
	Action during the Implementation:
	Contingency Plan (if applicable):
Actual issues and Countermeasure(s)	
(PMR)	

5: Evaluation at Project Completion and Monitoring Plan

5-1 Overall evaluation

Please describe your overall evaluation on the project.

5-2 Lessons Learnt and Recommendations

Please raise any lessons learned from the project experience, which might be valuable for the future assistance or similar type of projects, as well as any recommendations, which might be beneficial for better realization of the project effect, impact and assurance of sustainability.

5-3 Monitoring Plan for the Indicators for Post-Evaluation

Please describe monitoring methods, section(s)/department(s) in charge of monitoring, frequency, the term to monitor the indicators stipulated in 1-3.

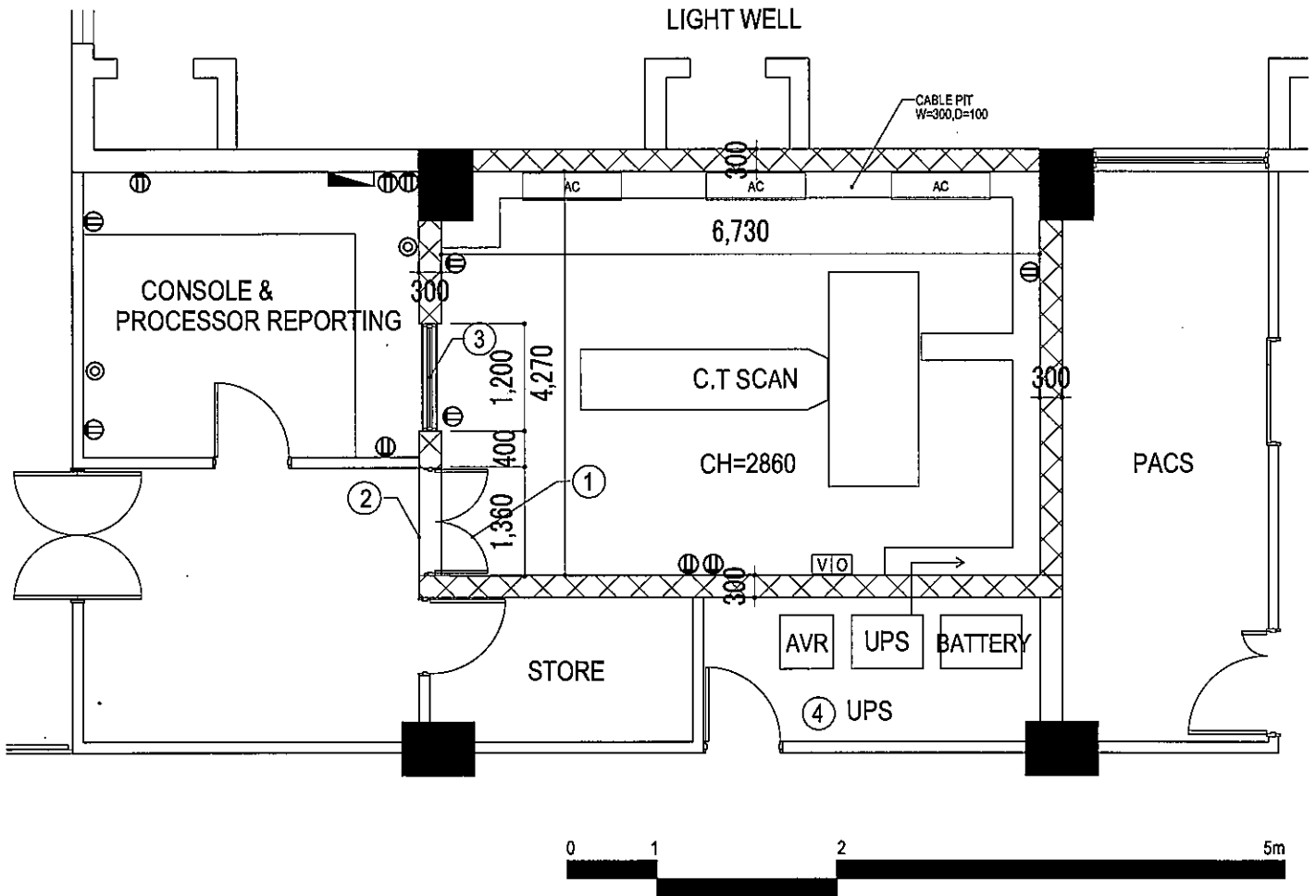
Attachment

1. Project Location Map
2. Undertakings to be taken by each Government
3. Monthly Report
4. Report on RD
5. Environmental Monitoring Form / Social Monitoring Form
6. Monitoring sheet on price of specified materials (Quarterly)
7. Report on Proportion of Procurement (Recipient Country, Japan and Third Countries)
(Final Report Only)

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Annex 10. Renovation Plan and Scope of Work

1. Renovation Plan



LEGEND (EXISTING FACILITIES)

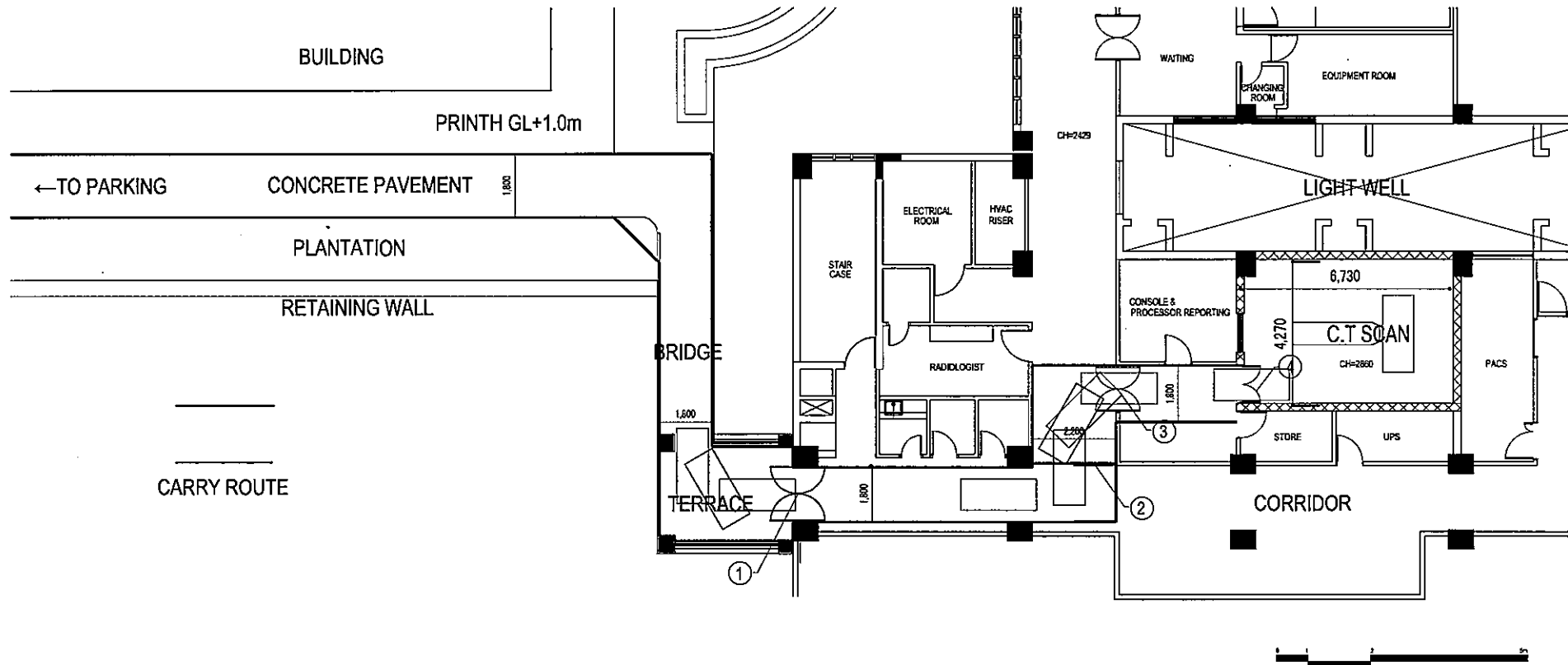
Ⓜ	RECEPTACLE	▬	MCCB
Ⓜ	RECEPTACLE (250V 20A)		
Ⓛ	LAN	∇	VACCUM
Ⓣ	TELEPHONE	A	COMPRESSED AIR
● s	SWITCH	□	OXYGEN

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, 2.0mm LEAD LINING STEEL FRAME
②	WIDEN UPPER WALL OF DOOR WAY (TO SECURE X-RAY PROTECTION)	300mm THICKNESS BRICK AND CEMENT PLASTER WALL UP TO CONCRETE SLAB OF UPPER FLOOR (EXISTING 180mm), OR Pb=1.0mm LEAD BOARD BACKING ON THE EXISTING WALL
③	REPLACE PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSIT GLASS 2.0mm LEAD LINING STEEL FRAME
④	INCREASE POWER SUPPLY	3PHASE 440V 150KVA EXCLUSIVE USE (EXISTING 125KVA)

FLOOR PLAN OF CT ROOM (JDWNRH)

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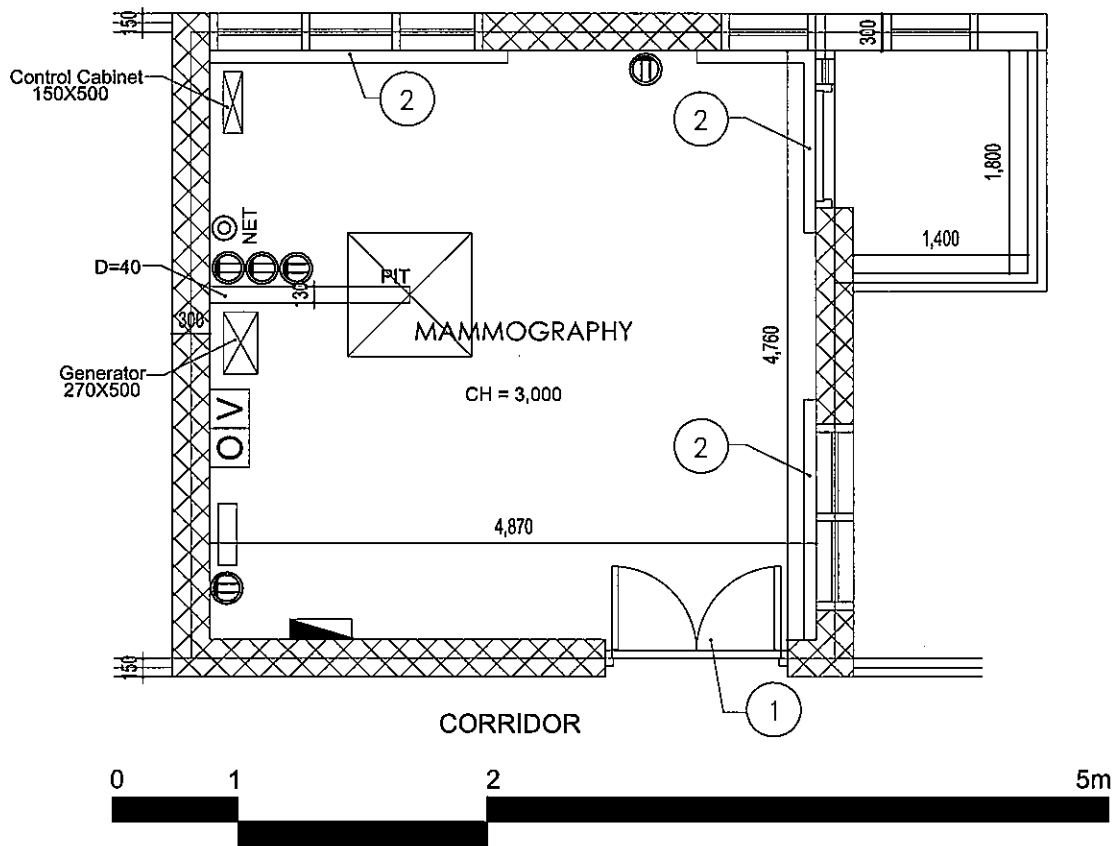


RENOVATION WORKS (EXPANSION OF DOOR OPENING)

NO	TYPE	EXISTING SIZE		REPLACED DOOR SIZE	
		WIDE	HEIGHT	WIDE	HEIGHT
①	ALUMINIUM DOOR (DOUBLE LEAF)	1,500	2,000	1,500	2,100
②	ALUMINIUM DOOR (SLIDING)	1,290	2,400	REMOVAL AND REATTACHED	
③	ALUMINIUM DOOR (DOUBLE LEAF, FREE SWING)	1,350	2,000	1350	2,100
④	X-RAY SHIELD DOOR (DOUBLE LEAF)	1,360	2,000	1,360	2,100

SECURING THE SPACES TO CARRY IN THE EQUIPMENT(JDWNRH)

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LEGEND (EXISTING FACILITIES)

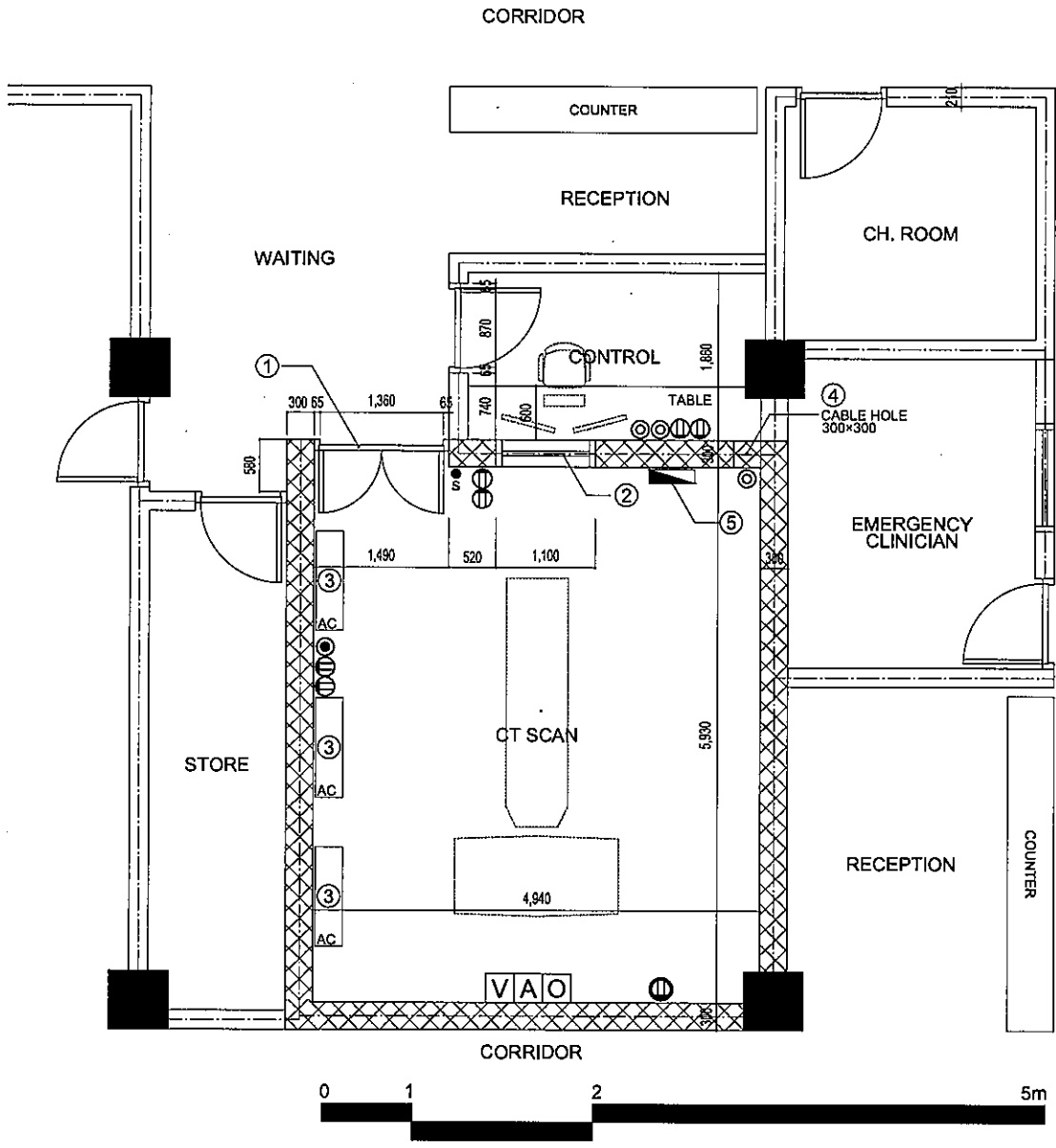
Ⓜ	RECEPTACLE	▬	MCCB
Ⓜ	RECEPTACLE (250V 20A)		
Ⓞ	LAN	V	VACCUM
Ⓞ	TELEPHONE	A	COMPRESSED AIR
● s	SWITCH	O	OXYGEN

REQUIRED SPECIFICATION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD DOOR (REPLACING)	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,470mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
②	RADIATION SHIELDING OF WINDOWS AND OTHER OPENINGS	SEALING WITH Pb =2.0mm LEAD COMPOSITE BOARD

**FLOOR PLAN OF
MAMMOGRAPHY ROOM (JDWNRH)**

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LEGEND (EXISTING FACILITIES)

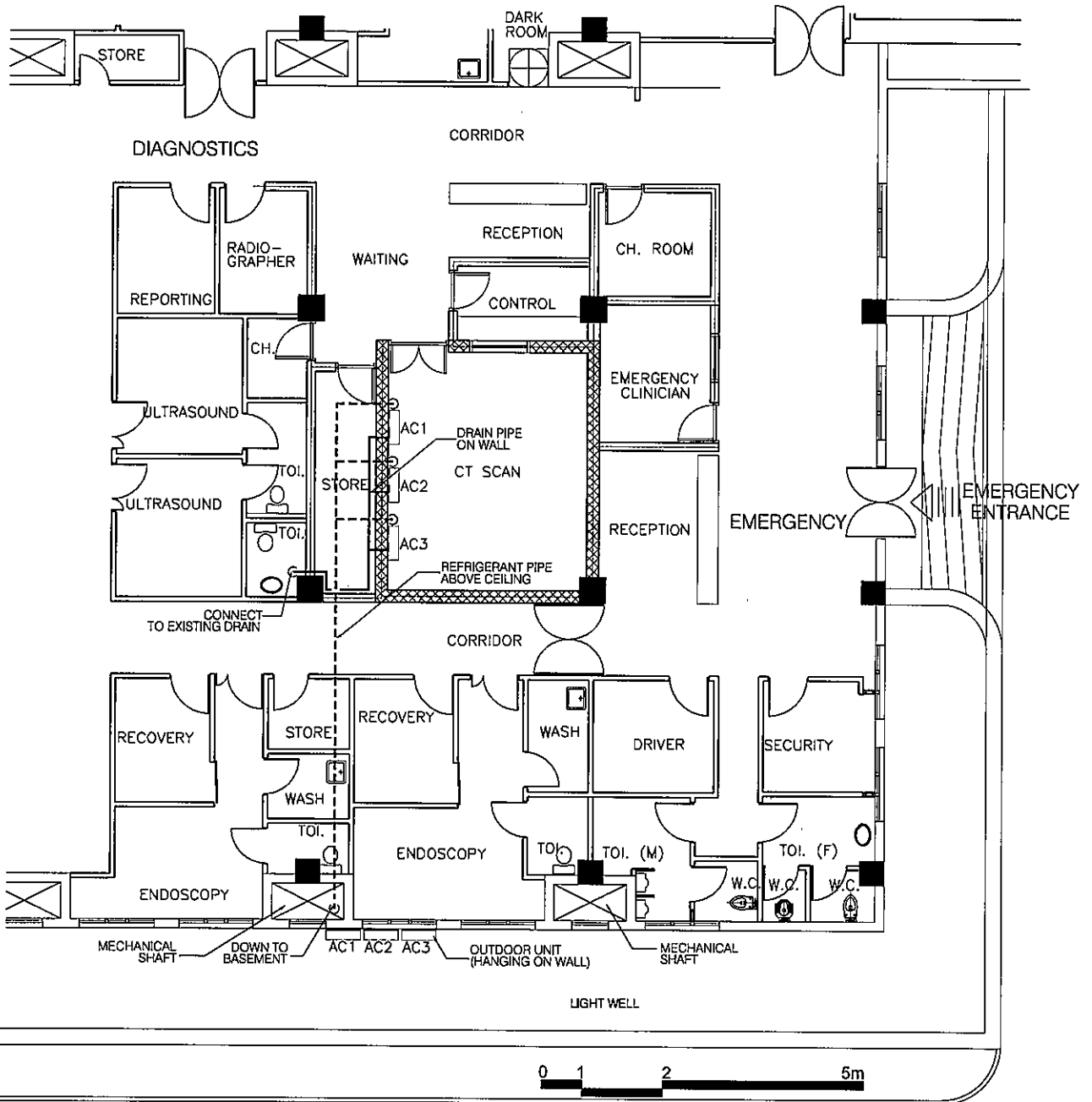
Ⓜ	RECEPTACLE	▬	MCCB 400V 45kw
Ⓜ	RECEPTACLE (250V 20A)		
Ⓞ	LAN	∇	VACCUM
Ⓞ	TELEPHONE	Ⓐ	COMPRESSED AIR
● s	SWITCH	Ⓞ	OXYGEN

RENOVATION WORKS

NO	ITEMS	SPECIFICATIONS
①	REPLACE/ENLARGE X-RAY SHIELD DOOR	2.0mm LEAD LINING STEEL DOOR, EFFECTIVE OPENING 1,360mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
②	INSTALL PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 1,100mm WIDTH, 1,200mm HEIGHT, 2.0mm LEAD LINING STEEL DOOR
③	INSTALL COOLING AC UNIT	TEMPERATURE 18~26°C, MOISTURE 30~60%, COOLING CAPACITY 4.0kw x3NOs WITH DRAIN AND REFRIGENT PIPING
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	INCREASE POWER SUPPLY	3PHASE 415V 75KVA EXCUSIVE USE (EXISTING 51KVA)

FLOOR PLAN OF CT ROOM (MERRH)

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SPECIFICATION

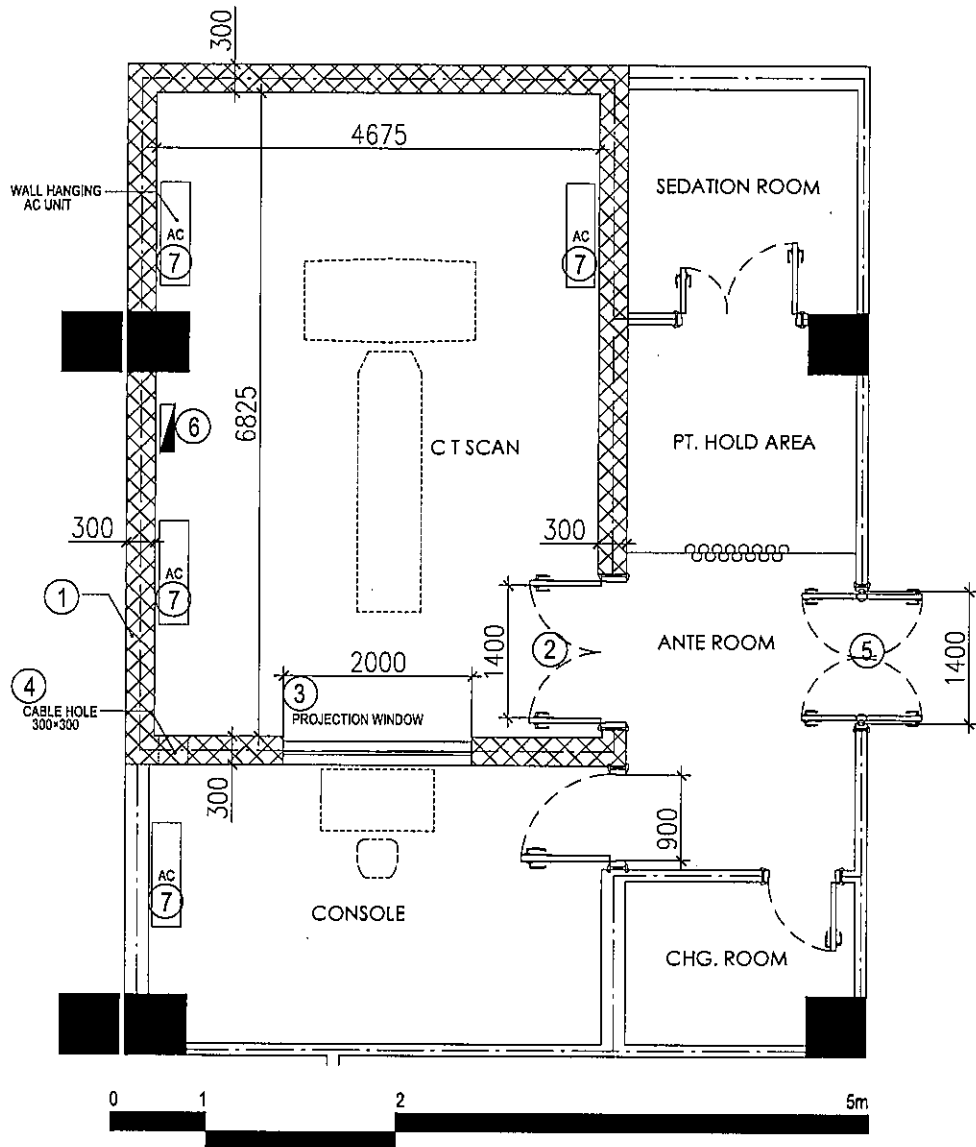
EQP. No.	EQUIPMENT	ABILITY	VOLTAGE	POWER (KW)	NO.
AC1	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
AC2	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
AC3	Packaged Air Conditioner Wall Mount Type	Cooling capacity =4.0 KW	1Ø 230V	1.5	1
REFRIGERANT PIPING	PIPES : COPPER PIPE FITTINGS : WELDING JOINT				
DRAIN PIPING	PIPES : POLYVINYL CHLORIDE PIPE(VP) FITTINGS : PVC FITTINGS (DRAINAGE TYPE)				

AC UNIT & PIPING OF CT ROOM (MERRH)

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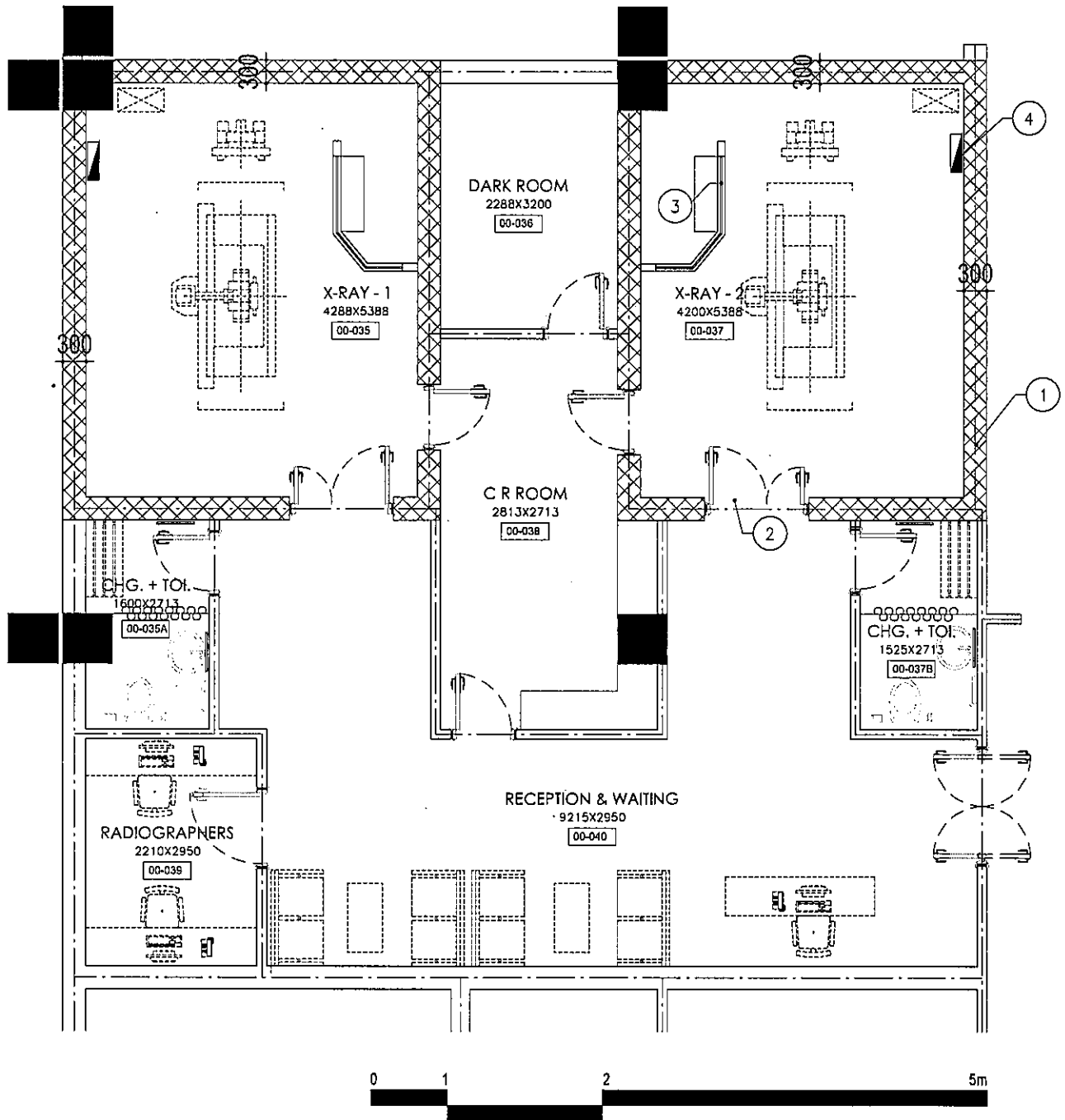


REQUIRED SPECIFICATION FOR CONSTRUCTION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD STRUCTURE	THE WALLS SHALL BE MORTAR-FINISHED BRICK AT LEAST 30 cm THICK. THE UPPER FLOOR SLABS SHALL BE 18 cm-THICK CONCRETE; OR RADIATION-SHIELDING MEASURES EQUIVALENT TO THAT SHALL BE TAKEN.
②	X-RAY SHIELD DOOR	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,400mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
③	PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 2,000mm WIDTH, 900mm HEIGHT, WINDOW FRAME SHALL BE COVERED WITH 2.0mm LEAD
④	CABLE HOLE	300mm X 300mm OPENING WITH 2.0mm LEAD PLATE COVERING ON BOTH SIDES
⑤	ACCESS DOOR	NOT LESS THAN 1,400mm WIDTH OR 2,100mm HEIGHT
⑥	POWER DISTRIBUTION BOARD	3 PHASE 3 WIRE, 380-480V, 50/60Hz, VOLTAGE FLUCTUATION LESS THAN $\pm 5\%$, CAPACITY 75KVA, EARTHING LESS THAN 10 Ω
⑦	COOLING AC UNIT	TEMPERATURE 18-26°C, MOISTURE 30-60%, COOLING CAPACITY 4.0kw x 4NOs

x

FLOOR PLAN OF CT ROOM (GCRRH)



REQUIRED SPECIFICATION FOR CONSTRUCTION

NO	ITEMS	SPECIFICATIONS
①	X-RAY SHIELD STRUCTURE	THE WALLS SHALL BE MORTAR-FINISHED BRICK AT LEAST 30 cm THICK. THE UPPER FLOOR SLABS SHALL BE 18 cm-THICK CONCRETE: OR RADIATION-SHIELDING MEASURES EQUIVALENT TO THAT SHALL BE TAKEN.
②	X-RAY SHIELD DOOR	2.0mm LEAD LINING DOOR, EFFECTIVE OPENING 1,400mm WIDTH, 2,100mm HEIGHT, DOOR FRAME SHALL BE COVERED WITH 2.0mm LEAD
③	PROTECTION WINDOW	Pb =2.0mm LEAD COMPOSITE GLASS, FRAME SIZE 2,000mm WIDTH, 900mm HEIGHT, WINDOW FRAME SHALL BE COVERED WITH 2.0mm LEAD
④	POWER SUPPLY	3 PHASE, 400~480V, 50/60Hz, VOLTAGE FLUCTUATION LESS THAN ±10%, MAX OUTPUT 40KW ,CAPACITY50KVA

FLOOR PLAN OF GENERAL DIGITAL X-RAY (GCRRH)

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2. Scope of Work on Renovation of Facilities

1) JDWNRH

➤ CT

Renovation work items	Bhutan	Japan
Removal of existing CT (Existing equipment to be relocated to Emergency Department)	○	-
Securing the route to carry in the equipment ● Removal and replacement of existing door (Increasing door height) ● Removal and reinstallation of existing door (To ensure turning space)	○	-
Removal and replacement of radiation-shielding door ● Door height to be increased to 2.1 m ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Physical work)	○ (Provision of radiation-shielding door and doorframe)
Removal and replacement of access window ● Lead glass with Pb equivalence of 2.0 mm ● Frame to be of steel with 2.0 mm lead plate	○ (Physical work)	○ (Provision of lead glass and frame)
Upgrading of radiation-shielding wall above the door ● Attachment of X-ray shielding board (Pb equivalency 1.0 mm) over section of wall that is 18 cm thick	○ (Physical work)	○ (Provision of X-ray shielding board)
Increase of power supply capacity (150 kVA)	○	○ (Provision of UPS)
Other incidental work necessary for installation of the equipment	○	-

➤ Digital mammography X-ray equipment

Renovation work items	Bhutan	Japan
Removal of existing X-ray equipment (Existing equipment to be relocated to Emergency Department)	○	-
Removal and replacement of radiation-shielding door ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Installation work)	○ (Provision of radiation-shielding door and doorframe)
Radiation shielding of windows and other openings ● Sealing with X-ray shielding board (Pb equivalency 2.0 mm)	○ (Installation work)	○ (Provision of X-ray shielding board)
Other incidental work necessary for installation of the equipment	○	-

2) Mongar Eastern Regional Referral Hospital

➤ CT

Renovation work items	Bhutan	Japan
Removal and replacement of radiation-shielding door ● Door height to be increased to 2.1 m ● Both door and doorframe to be made of steel and containing a 2.0 mm lead plate	○ (Installation work)	○ (Provision of radiation-shielding door and doorframe)
Removal and replacement of access window ● Lead glass with Pb equivalence of 2.0 mm ● Frame to be steel with 2.0 mm lead plate	○ (Installation work)	○ (Provision of lead glass and frame)
Increase of power supply capacity (75 kVA)	○	○ (Provision of UPS)

2

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Installation of room cooler units ● 3 units with cooling capacity of 4.0 kw ● Outdoor units to be installed in dry area of basement ● Includes laying of refrigerant pipes and drains	○ (Installation work)	○ (Provision of 3 room cooler units)
Other construction work/incidental work necessary for installation of the equipment	○	.

3) Gelephu Central Regional Referral Hospital

➤ CT

Renovation work items	Bhutan	Japan
<u>Structure of room</u> The walls shall be mortar-finished brick at least 30 cm thick. The upper floor slabs shall be 18 cm-thick concrete: or radiation-shielding measures equivalent to that shall be taken.	○	-
<u>Radiation-shielding door</u> The entryway door and doorframe shall both have lead lining of at least 2.0 mm. The doorway shall have an effective width of 1.4 m and an effective height of at least 2.1 m.	○	-
<u>Access window</u> The window shall have radiation-shielding glass with a Pb equivalency of at least 2.0 mm, and the window frame shall also be protected with lead plate at least 2.0 mm thick.	○	-
<u>Cable opening</u> A cable penetration opening measuring 300 mm × 300 mm shall be made in the partition wall between the control room and the imaging room, and the opening shall be sealed on both sides with lead plate at least 2.0 mm thick.	○	-
<u>Size of doors</u> All doors leading from the entrance to the building to the CT room shall have an effective width of 1.4 m and an effective height of at least 2.1 m.	○	-
<u>Power supply</u> A dedicated electrical panel (MCCB) supplying 3-phase, 3-wire 380 – 480V with a capacity of at least 75 kVA shall be installed in either the CT imaging room or the control room.	○	○ (Provision of UPS)
<u>Cooling system</u> Separately from the normal air conditioning system, a dedicated cooling unit shall be installed that is appropriate for the amount of heat generated by the equipment to be installed. (To maintain temperatures of 18 - 26° C, humidity of 30 - 60%) when the equipment is in operation.)	○	-

➤ General digital X-ray apparatus

Renovation work items	Bhutan	Japan
<u>Structure of room</u> The walls shall be mortar-finished brick at least 30 cm thick. The upper floor slabs shall be 15cm-thick concrete or radiation-shielding measures equivalent to that shall be taken.	○	-
<u>Radiation-shielding door</u> The entryway door and doorframe shall both have lead lining of at least 2.0 mm. The doorway shall have an effective width of 1.2 m and an effective height of at least 2.1 m.	○	-
<u>Shielding plate</u> Shielding performance shall be Pb equivalency of at least 2.0 mm	○	-
<u>Power supply</u> 3-phase, 400-480V, 50/60Hz, Voltage Fluctuation less than ±10%, Max Output 40kw, Capacity 50 kVA	○	○ (Provision of UPS)

✕

Annex 11. Plan of Human Resources Allocation for Utilization

Existing: As of 2016, Plan: At the time of installation

Categories	JDWNRH		MERRH		GCRRH	
	Existing	Plan	Existing	Plan	Existing	Plan
1. Radiologist	5	4	0	1	0	1
2. Radio-Technologist	2	3	1	2	1	2
3. CT Technician	4	6	0	2	0	2
4. X-ray Technician	16	16	3	3	4	4
5. CT Nurse	1	2	0	1	0	1
6. Mammography Technician	2	2	-	-	-	-

*Planned figures are minimum numbers of allocation.

2




Annex 12. List of Consumables

Equipment	Items	Unit Price (BTN)	Quantity	Amount (BTN)
CT (64 Slice)	Syringe (200 ml) Extension tube	3,556	200 sets	711,280
	ECG electrode	219	300 pcs	65,790
	Printer cartridge (black and color)	19,992	10 sets	199,920
CT (16 Slice)	Syringe (200 ml) Extension tube	3,556	200 sets×2 HPs=400 sets	1,422,560
	Printer cartridge (black and color)	19,992	10 sets×2 HPs=20 sets	399,840
General Digital X-ray Apparatus	Printer cartridge (black and color)	19,992	10 sets	199,920
Digital Mammography	Printer cartridge (black and color)	19,992	10 sets	199,920
Spirometer	Printer paper	2,550	10 rolls	25,500
	Disposal mouthpiece	27	200 pcs	5,440
	Spiro filter	425	100 pcs	42,500
	Flow sensor head	3,060	10 pcs	30,600
ECG Holter System	ECG electrode	219	300 pcs ×5 units = 1,500 pcs	328,950
	Printer cartridge (black and color)	19,992	10 sets	199,920
Total				3,832,140

*The above list shows consumables required for three months.

2

Annex 13. Human Resources Allocation for Maintenance

Category	BMED	JDWNRH	MERRH	GCRRH
Bio Medical Engineer	5	1	0	0
Assistant/Bio Medical Junior Engineer	2	1	1	0
Bio Medical Technician	2	2	0	1
Basic Operator	0	1	0	0

*The figures are as of November, 2016



x.

Appendix 5. Soft Component Plan

1. Background

The essential equipment needed for diagnosis of non-communicable diseases (NCDs), injuries and others, including computed tomographies (CTs), will be procured for national and regional referral hospitals in the project with the purpose of strengthening diagnostic services in those hospitals and improving access to quality health services.

In Bhutan, the number of patients with NCDs has increased year by year and heart diseases have become a leading cause of death in Bhutan. Most heart disease cases, however, are transferred to hospitals in India because the diagnosis and treatment of heart diseases are not available in Bhutan at present. In order to improve this situation, it was decided that a 64-slice CT, which has the function of a cardiac CT scan, shall be procured for Jigme Dorji Wangchuck National Referral Hospital (JDWRNH) in the project.

The health staff in JDWRNH basically can conduct examinations with CT for most diseases except for heart disease, since the 16-slice CT has been used in the hospital thus far. The 64-slice CT, first installed in Bhutan in this project, is very new to them, and they need to obtain special knowledge and skills for cardiac CT scans and image diagnosis with the new CT.

Accordingly, the project includes clinical training on patient management and image diagnosis of heart diseases as a soft component of the grant aid project.

2. Objectives

The image diagnosis and cardiac CT scans with a 64-slice CT will be appropriately performed in JDWRNH.

3. Expected outcomes and measurement of achievements

① Cardiac CT scan with a 64-slice CT can be conducted safely and appropriately at JDWRNH.

The achieved outcome will be measured with a check sheet to evaluate trainees' knowledge and skills of cardiac CT scans.

② Scanned cardiac images can be analyzed appropriately at JDWRNH.

The achieved outcome will be measured evaluating trainees' skills of image analyses based on actual images made by trainees.

③ Cardiac cases can be diagnosed accurately based on appropriate image analyses at JDWRNH.

The achieved outcome will be measured confirming diagnosis reports written by trainees.

The outcome of the introduction of a 64-slice CT to JDWRNH can be expected to contribute to progress and that diagnoses and treatment of heart diseases can be completed in the country in the future.

4. Input

(1) Target of the training

The health staff who use a 64-slice CT shown in table below will be trainees. They include not only staff of JDWRNH but also those of regional referral hospitals in order to improve total care and follow-ups of patients with heart diseases throughout the country.

	JDWRNH	MERRH*	GRRH**	
Radiologist	4	1	1	6
Cardiologist	1	1	1	3
Radio-technologist	2	2	2	6
CT-technician	4	1	1	6
X-ray Technician	1	3	4	8
CT Nurse	1	1	1	3
Total				32

*MERRH: Mongar Regional Referral Hospital

**GRRH: Gelephu Regional Referral Hospital

(2) Place of the training

The training will be held in JDWRNH and a lecture hall in Thimphu.

(3) Training period

A three-day training course will be held in advance to the installation of CT, and two batches of five-day training courses will be held after the installation.

At the preliminary training, the current situation of image analyses and CT examinations in Bhutan will be shared, a briefing of new CTs will be given, and details of the second and third training will be determined including the choice of image analyzing method to be adopted in JDWRNH. Trainees are requested to gain a basic understanding of cardiac CT scans, patient management and image analysis/reading before the second training using training materials made by instructors.

At the training after installation training, the trainees will learn practical operations of equipment, patient management and image analysis/reading. The later batch will be conducted two months after the former because the training will be more effective when it is repeated after a certain period of trainees practicing obtained skills.

(4) Contents of the training

➤ The preliminary training

	Place	Contents
Day 1	Lecture hall in Thimphu	- Explanation of the training outline - Skill check of CT examination and image analysis
Day 2	Lecture hall in Thimphu	- Explanation of new CT - Explanation and decision of method of image analysis Slab Maximum Intensity Projection Curved Multi Planner Reconstruction
Day 3	Lecture hall in Thimphu	- Lecture on method of image analysis/reading - Explanation of the 2 nd and 3 rd training - Explanation of training materials

➤ The training, batch-1

	Place	Contents
Day 1	Lecture hall in Thimphu	- Explanation of the training outline - Instructions for basic operation of CT
Day 2	Lecture hall in Thimphu	- Lecture on cardiac CT scan - Demonstration of cardiac CT scan
Day 3	JDWNRH	- Practice of cardiac CT scan
Day 4	Lecture hall in Thimphu JDWNRH	- Lecture on image analysis using a workstation - Practice of image analysis using a workstation
Day 5	Lecture hall in Thimphu	- Lecture on image reading - Summarize the training - Explanation of the 3 rd training

➤ The training, batch-2

	Place	Contents
Day 1	Lecture hall in Thimphu	- Recap the 2 nd training - Explanation of the training outline - Case study of patients with heart diseases
Day 2	Lecture hall in Thimphu JDWNRH	- Skill check of cardiac CT scan - Practical instructions for cardiac CT scan
Day 3	Lecture hall in Thimphu JDWNRH	- Skill check of image analysis/reading - Practical instructions for image analysis/reading
Day 4	Lecture hall in Thimphu	- Review lecture on cardiac CT scan and image analysis/reading - Question and response
Day 5	Lecture hall in Thimphu	- Evaluation of achievements - Summarize the training

5. Instructors

A Japanese cardiologist and a radiological technologist who are acquainted with cardiac CT scans will be dispatched as training instructors. Additionally, a Japanese nurse will be dispatched as a training coordinator.

(1) Training instructor 1 (Cardiologist)

- Advice on training materials
- Instructions for cardiac CT scan and patient management
- Instructions for image analysis/reading of heart diseases
- Evaluation of achievement of outcomes
- Preparation of training implementation report

(2) Training instructor 2 (Radiological technologist)

- Instructions for operation of CT
- Preparation of a procedure manual of cardiac CT scan
- Assistance for cardiac CT scan and patient management instructions
- Assistance for image analysis instructions
- Evaluation of achievement of outcomes
- Preparation of training implementation report

(3) Training coordinator (Nurse)

- Explanation of the outline of training
- Coordination of the training activities
- Development of training materials, a check sheet and a questionnaire
- Instructions for patient management during cardiac CT scan
- Evaluation of achievement of outcomes
- Report to JICA and other relevant organizations

6. Implementation Schedule of the soft component

	2018						
	Apr	May	Jun	Jul	Aug	Sep	
Installation of equipment		■	■				
Contents							
Explanation of the training outline			■				
Decision of method of image analysis			■				
Development of training materials			■				
Instruction for basic operation of CT				■			
Instruction for CT heart scan				■		■	
Instruction for patient management				■		■	
Instruction for image analysis				■		■	
Instruction for image reading				■		■	
Evaluation of achievement of outcomes						■	
Preparation of training implementation report							■
Instructors/coordinator							
Instructor 1 (Cardiologist)			■	■			■
Instructor 2 (Radiological technologist)				■			■
Training coordinator			■	■			■

7. Records and products

- ① Training materials
- ② List of participants
- ③ Evaluation check sheet and questionnaire
- ④ Training implementation report by instructors

8. Obligations of the Bhutan side

Trainees are health staff working in hospitals who have night and holiday shifts. Therefore, it is necessary to arrange their work schedules.

Because the procedure of the CT examination, patient care and method of analysis differ according to the condition of each patient, further practice and training are necessary for appropriate CT examinations and accurate diagnosis. A variety support initiatives by MOH to health staff shall be continued including other training in the country and abroad.