No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR RENOVATION
OF
TECHNICAL SCHOOL FOR MEDICAL CARE
IN
THE KINGDOM OF CAMBODIA

JULY 2004

JAPAN INTERNATIONAL COOPERATION AGENCY

PACIFIC CONSULTANTS INTERNATIONAL

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PREFACE

In response to a request from the Government of the Kingdom of Cambodia, the Government of Japan decided to conduct a basic design study on the Project for Renovation of Technical School for Medical Care and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Cambodia a study team from 11 February to 9 March 2004 and from 23 May to 6 June 2004.

The team held discussions with the officials concerned of the Government of the Kingdom of Cambodia, and conducted a field survey at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Cambodia in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the Kingdom of Cambodia for their close cooperation extended to the teams.

July 2004

Yasuo MATSUI
Vice-President
Japan International Cooperation Agency

July 2004

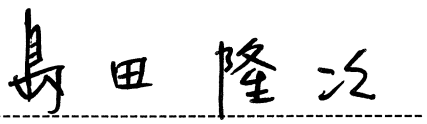
LETTER OF TRANSMITTAL

We are pleased to submit to you the Basic Design Study Report on the Project for Renovation of Technical School for Medical Care in the Kingdom of Cambodia.

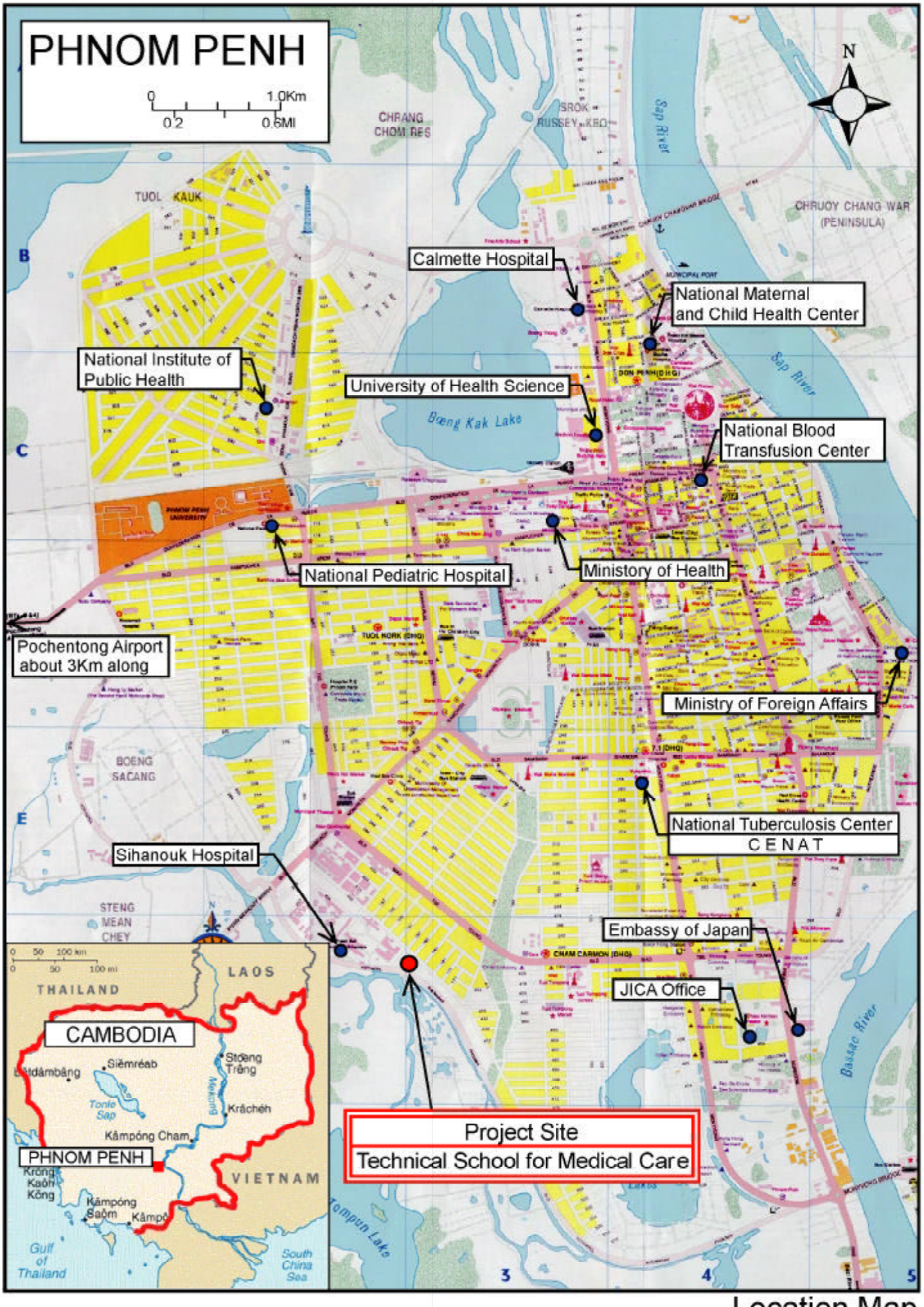
This study was conducted by Pacific Consultants International, under a contract to JICA, during the period from February 2004 to July 2004. In conducting the study, we have examined the feasibility and rationale of the Project with due consideration to the present situation of Cambodia and formulated the most appropriate basic design for the Project under Japan's Grant Aid scheme.

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

Very truly yours,



Takatsugu Shimada
Chief Consultant,
Basic Design Study Team on
The Project for Renovation of
Technical School for Medical Care
in the Kingdom of Cambodia
Pacific Consultants International

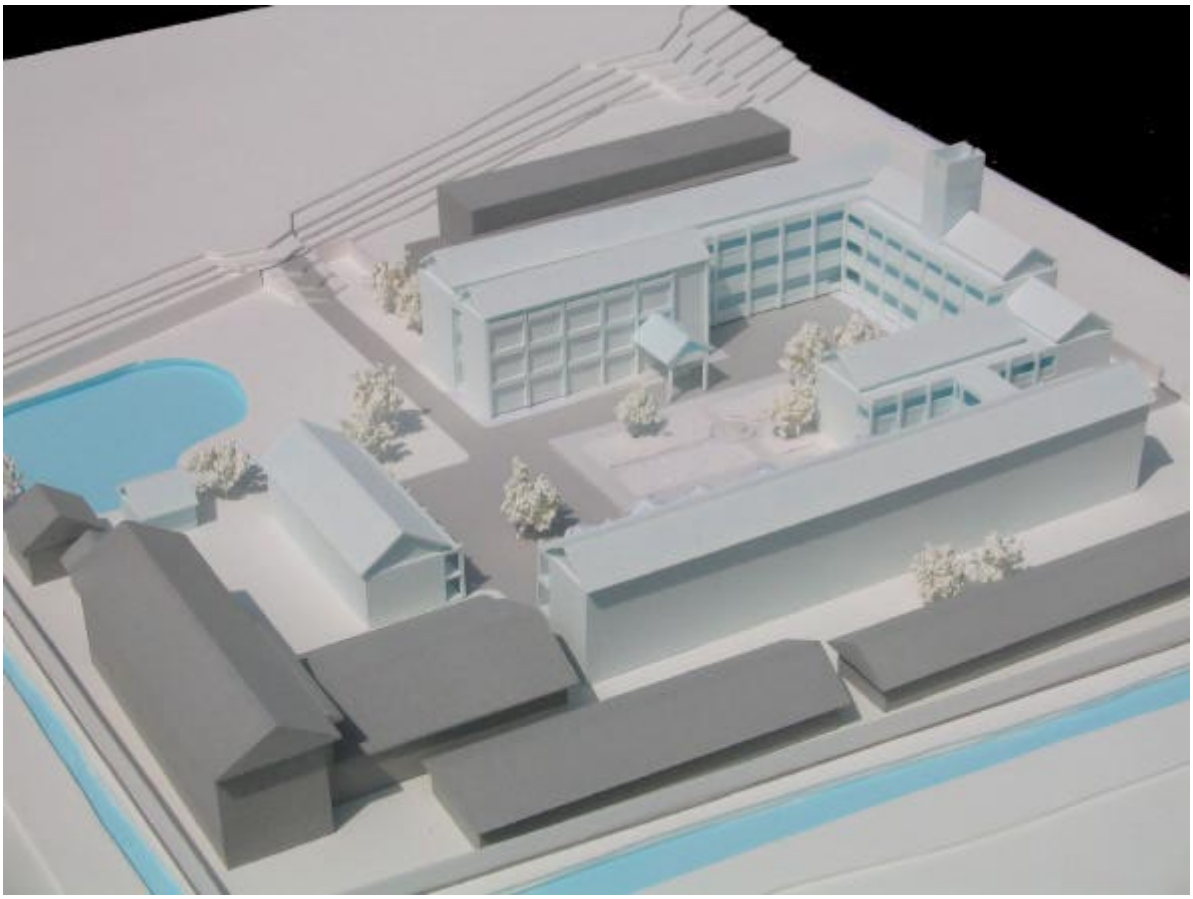


Location Map

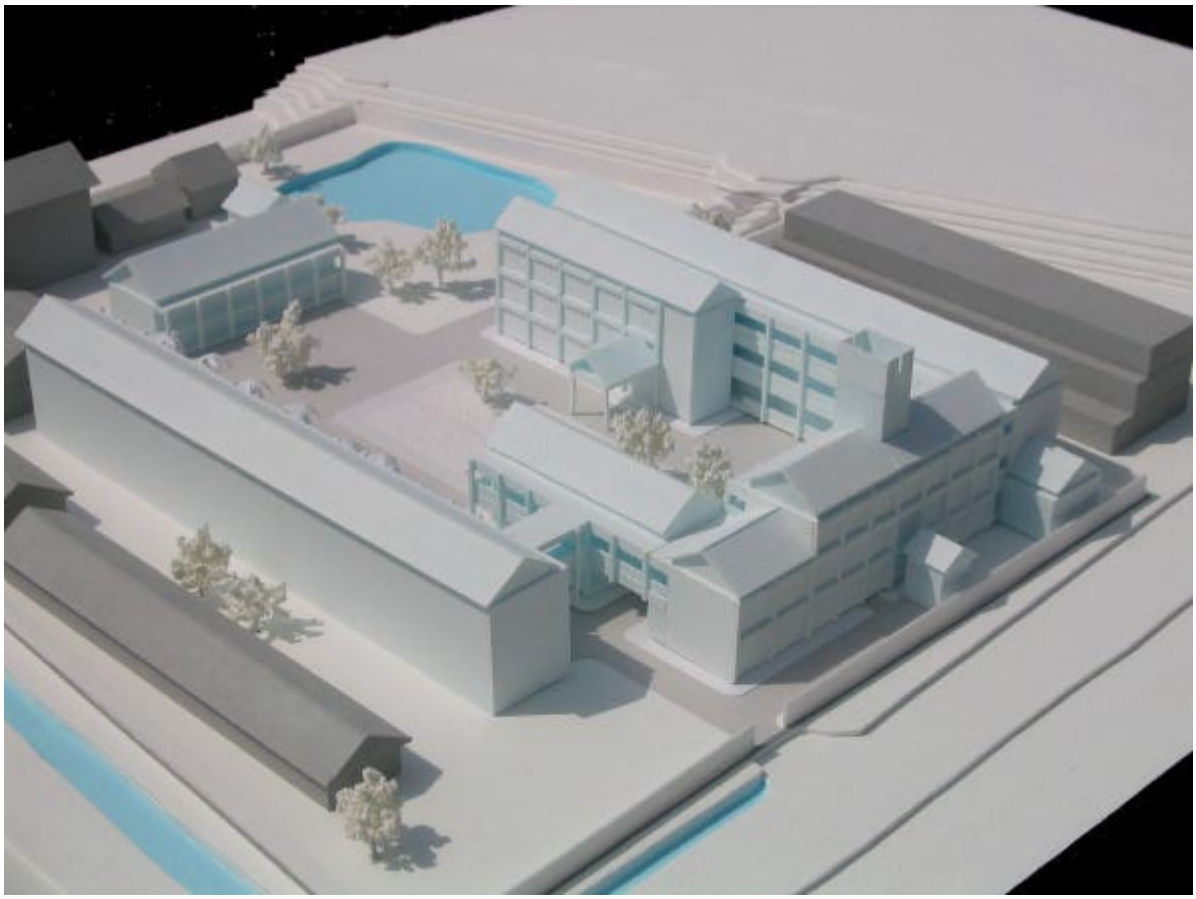
THE PROJECT FOR RENOVATION OF
TECHNICAL SCHOOL FOR MEDICAL CARE
IN THE KINGDOM OF CAMBODIA

PACIFIC CONSULTANTS INTERNATIONAL

Perspective



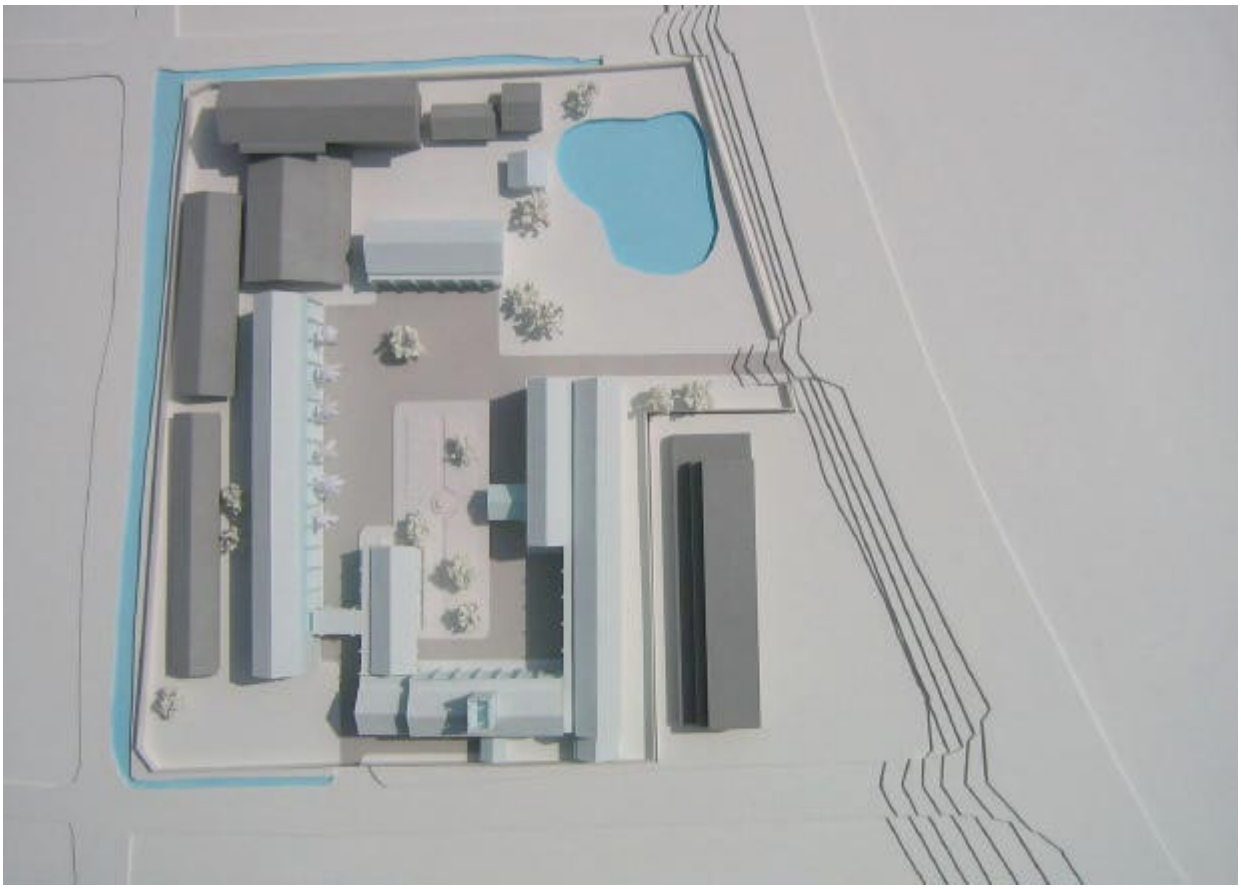
Northeast View



Northwest View

Model Photos 1

Southeast View



Top View

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ABBREVIATIONS

ADB	Asian Development Bank
A/P	Authorization to Pay
ASEAN	Association of South East Asian Nations
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.
ASTEM	American Society of Testing and Materials
B/A	Banking Arrangement
B/D	Basic Design
BOD	Biochemical Oxygen Demand
BS	British Standards
CDC	Council for the Development of Cambodia
CENAT	National Center for Tuberculosis and Leprosy Control
CPA	Complementary Package of Activities
D/D	Detailed Design
DOTS	Directly Observed Treatment, Short-course
E/N	Exchange of Notes
EDC	Electricite du Cambodge
FRP	Fiber Reinforced Plastic
GDP	Gross Domestic Product
GNI	Gross National Income
GOC	The Government of the Kingdom of Cambodia
GOJ	The Government of Japan
GTZ	Die Deutsche Gesellschaft für Technische Zusammenarbeit
HIV	Human Immunodeficiency virus
AIDS	Acquired Immunodeficiency Syndrome
RH	Referral Hospital
HRD	Human Resources Development (Department)
HSSP	Health Sector Support Project
JASS	Japanese Architectural Standard Specifications
JICA	Japan International Cooperation Agency
JIS	Japanese Industrial Standards
LPG	Liquefied Petroleum Gas
MCH	Maternal and Child Health (Center)
M/D	Minutes of Discussions
MDF	Main Distributing Frame
M/M	Minutes of Meetings
MOEF	Ministry of Economy and Finance
MOH	Ministry of Health
MOPT	Ministry of Posts & Telecommunications
MPA	Minimum Package of Activities
ODA	Official Development Assistance

PABX	Private Automatic Branch Exchange
PPWSA	Phnom Penh Water Supply Authority
PTSD	Post-Traumatic Stress Disorder
R/D	Record of Discussions
RTC	Regional Training Center
TCP	Technical Cooperation Project
TSMC	Technical School for Medical Care
UHS	University of Health Science
UNTAC	United Nations Transitional Authority in Cambodia
UPS	Uninterrupted Power Supply
WB	World Bank
WHO	World Health Organization

SUMMARY

SUMMARY

The economy in the Kingdom of Cambodia (hereinafter referred to as "Cambodia) dropped off in 1970s due to the long civil war and disorder, which devastated the country and affected the means of production such as agricultural facilities etc., loss of technical experts and intellectuals, decreasing numbers of working population, and so on. Thereafter, in 1980s, the economy showed some signs of recovery by receiving support from the Eastern Nations and shifted to the market economy in 1990s, and Cambodia strived for rebuilding of its devastated nation, despite falling into many difficulties, through democratization support by United Nations Transitional Authority in Cambodia (UNTAC) and other support from the international communities.

The most noticeable health problems of Cambodia surveyed in 2000 are indicated in the infant mortality rate of 95 per 1000 live births, and the maternal mortality rate at 437 deaths per 100,000 live births. The mortality rates are higher than the neighboring countries including Vietnam, Thailand, and Laos. And, it becomes a most important health problem in Cambodia to take necessary measures against infectious diseases such as tuberculosis, HIV/AIDS, malaria, diarrhea, and acute respiratory infections. On the other hand, Cambodia's long civil war destroyed the educational system and health care service system very severely and caused large shortage of medical personnel. There were 487 doctors in 1975 but only 43 doctors and 342 nurses left in the whole country after the civil war (sometime in 1991). Although the education system for doctors and co-medicals resumed in 1980, it is expected to improve the quality of medical education and increase the number of health workers.

The Government of the Kingdom of Cambodia (GOC) launched the First Socio-Economic Development Plan 1996 – 2000 and the Second Socio-Economic Development Plan 2001-2005 so as to upgrade medical worker's knowledge and skill through strengthening the education system so that more effective health care services will be provided for the Cambodian citizens. The GOC also launched the Health Workforce Development Plan 1996-2005 for human resources development, aiming to promote upgrading the knowledge and skill of the laboratory technicians and to introduce training course for X-ray technicians, a training course which is not currently available in the country. Furthermore, the Health Sector Strategic Plan 2003-2007 has been launched aiming to reform the national health care services in Cambodia.

The target school for the Project; namely, Technical School for Medical Care (TSMC) was established in 1950 as a first training school for nurses and midwives in Cambodia followed by the Laboratory Technology Course which was started in 1970. In 1987, Physiotherapy Course was also started in order to deal with disabled person without limbs, which were mainly caused by detonation of landmines placed during Cambodia's long civil war. And, it is expected to add an X-ray Technology

Course at TSMC as a regular basic training course, which is expected to open on October 2006. The addition of X-ray Technology Course is quite important as the said new course is aiming to train X-ray technicians, who will be essential to enhance the capability of medical diagnosis and treatment areas. Furthermore, TSMC plays a important role for providing in-service trainings for nurses working in nation-wide such as chief nurse training, psychiatric nurse and anesthetic nurse training, and so on. However, the existing facilities at TSMC are relatively small and deteriorating rapidly and the educational equipment currently available is in short supply as well, and therefore, TSMC is unable to provide the education and training satisfactorily.

Based on the preceding actual circumstances, in July 2001, GOC submitted an application for Japan's Grant Aid for the renovation and upgrading of the facilities and educational equipments at TSMC to the Government of Japan (GOJ) in order to solve the problems of the shortage of co-medicals and to improve the quality thereof.

Then, Japan International Cooperation Agency (JICA) entrusted by GOJ dispatched a Basic Survey Mission to the Kingdom of Cambodia aiming to collect basic data, as to the current situation of the co-medicals and its education system in Cambodia, from relevant institutions and/or agencies and to discuss with Ministry of Health (MOH) as to the possibility of the cooperation in future.

Based on the results of the Basic Survey, JICA commenced the reviewing of the implementation of the Technical Cooperation; namely, the Project for Human Resource Development for Co-medicals (hereinafter referred to as "the Technical Cooperation Project"), and dispatched a First Feasibility Study Mission and a Second Feasibility Study Mission in September 2002 and in March 2003 respectively. Based on the results of the said feasibility studies, a Record of Discussions (R/D) was signed between Cambodian side and Japanese side and commenced the implementation of the Technical Cooperation in September 2003, the project of which will continue until September 2008. And, at the same time, the Second Feasibility Study was conducted, a Preliminary Study was conducted to review an appropriateness of renovating and upgrading the facilities and educational equipments at TSMC and to determine its scope of the works for Japan's Grant Aid Assistance, taking the collaboration with the said Technical Cooperation Project into account.

And, based on the results of the said Preliminary Study, JICA dispatched a Basic Design Study Team (hereinafter referred to as "the Team") on the Project for Renovation of Technical School for Medical Care (hereinafter referred to as "the Project") to the Kingdom of Cambodia and conducted field survey at the study area including the project site from 11th of February to 9th of March 2004. The Team held discussions with the officials concerned of GOC and collected various relevant data and information. Through analysis in Japan, the Team prepared and proposed Basic Design and Implementation Schedule after reviewing and studying the contents of the facilities and equipments

and its scale and preparing a rough cost estimate. Based on the said Basic Design and Implementation Schedule proposed by the Team, JICA dispatched the Draft Report Explanation Team to the Kingdom of Cambodia from 23rd of May to 6th of June 2004 to explain to and to discuss with the officials concerned of GOC as to the Basic Design and Implementation Schedule which GOC agreed to in principle.

The purpose of the Project is "to improve education quality for co-medicals". And, the Project will be implemented for the renovation of the existing facilities, the construction of new facilities and the procurement of the educational equipment at TSMC for the purpose of training co-medicals in order to solve the problems of the shortage of co-medicals and to improve the quality thereof. The implementation of the Project will fulfill a shortage of co-medicals and will improve the technical quality of co-medicals, and will improve the quality of overall health care services in Cambodia as well.

The policy for the Basic Design for the Project was made giving a consideration to the natural and social conditions in Cambodia, maintenance and management capability of the Implementation Agency, and the collaboration with the Technical Cooperation Project.

Finally agreed summary of the Basic Design for the Project is shown below.

＜FACILITY＞

Work	Building Name	Department / Course	Major Rooms	Floor Area (m^2)
New Construction Work	Main Building	Administration	Director, Deputy Directors, Secretary, Administration Office, Technical Office, Meeting Rooms, Storage	497.92
		X-ray Technology Course	Classrooms, X-ray Rooms, Control Room, Dark Room, Storage, Staff Room, Maintenance Workshop, General Laboratory	398.19
		Laboratory Technology Course	Classrooms, General Laboratory, Clinical Laboratories, Sterilizing / Preparation Room, Staff Room, Visiting Lectures' Room, Storage, Changing Rooms	508.83
		Midwifery Course	Classroom, Practical Training Room, Staff Room, Storage	154.08
		Physiotherapy Course	Classrooms, Practical Training Room, Staff Room, Storage	430.64
		Special Program	Classrooms, Storage	165.04
		Others	Dining Hall, Kitchen, Sundry Shop, JICA Project Office, Library, Pantry, Electrical/Generator Room, Pump Room, Toilets, Toilet for Disabled, Corridors, etc.	1,885.67
		Floor Area for Main Building		4,040.37
	Total Floor Area for New Construction			4,040.37
Renovation Work	Nursing Course Building	Nursing Course	Classrooms, Practical Training Rooms, Preparation Rooms, Staff Room, Visiting Lecturers' Room, Changing Rooms	1,90.00
		Others	Counseling Room, Infirmary, Storage, Toilets, Corridors, etc.	806.21
		Floor Area for Nursing Course Building		1,896.21
	Seminar House	Post-basic Course	Seminar Rooms, Training Room, Storage	216.72
		Others	Students Association, Continuing Education Office, Teaching Materials Production Room, Night watchmen's Duty Room, Bookshop, Toilets, Storage, etc.	292.32
		Floor Area for Seminar House		509.40
	Toilet	Toilet	Male and Female Toilet	27.00
	Total Floor Area for Renovation Work			2,432.25
Grand Total Floor Area				6,472.62

＜EQUIPMENT＞

Course	Purpose	Major Equipment
Nursing / Midwifery	Equipment to learn body structure and training simulators to assist delivery and to learn injection	Human anatomical model Human skeleton model Delivery simulator Injection simulator
Physiotherapy	Equipment to replace obsolete ones and to learn basic anatomy and physiology	Wheel chair Skeleton model Joint model
Lab Technology	Equipment to be used in hematology / biochemistry and bacteriology / parasitology	Electronic balance Haematocrit centrifuge Binocular microscope Teaching microscope Deep freezer
X-ray Technology	Equipment requested by CPA3 and to learn principle of X-ray imaging, X-ray imaging system, film processing, basic anatomy and physiology	General X-ray system Mobile X-ray system Automatic film processor Manual film processor Accessories for X-ray system Ultrasound diagnostic system Cranial phantom for X-ray Joint phantom for X-ray
(Common)	Equipment to produce teaching materials and to present in classrooms or meeting rooms	LCD projector Digital video camera Computer Scanner Visual presenter

In case of implementing the Project described above by Japan's Grant Aid Assistance, it is assumed that the total implementation period would be approx. 19 months i.e. 6 months for detailed design and tender, and 13 months for the construction and renovation works. And, total cost for the Project is estimated at approx. 792 Million Japanese Yen of which Japan side and Cambodian side will share 782 Million Japanese Yen and 10 Million Japanese Yen respectively.

The Responsible Agency for the Project is the Directorate General of Ministry of Health, and the Implementing Agency is TSMC, which consists of one of the four faculties considered for the University of Health Science (UHS).

UHS became autonomy in October 2002, and therefore, TSMC which is one of the faculties of UHS shall also be treated the same. However, in the "Medium Term Expenditure Framework 2003-2007 for the Ministry of Health" and its supplementary document "Program Budget Fiscal Year 2002-2006 Program / Sub-program for the Ministry of Health", MOH allowed estimated expenditures for UHS and TSMC up to the year 2007, and it is expected that MOH will extend the necessary financial supports to TSMC even after the year 2007. And, it seems that the expenses to be incurred for

leasing temporary facilities required during the construction and renovation of the Project and the expenses deemed necessary for the maintenance and management of the facilities and equipments after the completion of the Project are allowed for in the budget planned for the year up to 2007 which is being prepared by TSMC. Therefore, it is assumed that the necessary budget required for the implementation of the Project and the expenses deemed necessary for the maintenance and management of the facilities and equipments after the completion of the Project will be secured.

Effects that can be anticipated from the implementation of the Project are as follows:

(1) Direct Effects

1) Although classrooms and practical training rooms for each course at TSMC are relatively small and deteriorating, the learning environment would be greatly improved and upgraded, as an appropriate size of the facilities, and its scale would be broadened by the Project.

2) It would be much easier to implement an education and practical training curriculum for each course as planned, because an appropriate size and number of classrooms and practical training rooms would be provided by the Project. And, consequently, overall education quality for co-medicals would be improved and upgraded.

3) Quality in education and practical training at TSMC would be improved and upgraded, as the Project would provide appropriate and substantial educational equipments.

4) The first X-ray technology course in Cambodia would be established at TSMC as the necessary facilities and equipments would be provided by the Project, and thus, it would be possible to train X-ray technicians.

5) It would be much easier to schedule and organize post-basic and post-graduate education programs intended for working nurses nation-wide, such as for chief nurse, psychiatric nurse, anesthetic nurse, and so on, as appropriate size and number of classrooms and seminar rooms would be provided by the Project.

6) By improving and upgrading the facilities and educational equipments at TSMC by the Project, the Technical Cooperation Project would smoothly and effectively be implemented.

(2) In-direct Effects

1) The Project will fulfill a shortage of co-medicals at public health-care institutions such as hospitals, health centers, etc. And, consequently, the implementation system of appropriate health-care services will be improved.

2) Quality of the health-care services provided at the public and private health-care institutions will be improved, as it is expected to increase the number of well-qualified co-medicals.

3) By increasing the number of well-qualified X-ray technicians, it is expected to enhance the capability of medical diagnosis and treatment.

4) Health in general of the people in Cambodia will be promoted by improving implementation of appropriate health care services. This will be a result of improving the overall quality of co-medicals.

It is judged that the implementation of the Project is appropriate in view of the effects it will achieve as described above and considering the maintenance and management structure after the implementation of the Project. Therefore, it is concluded that the implementation of the Project by Japan's Grant Aid Assistance is quite appropriate.

Finally, it is recommended to pay attention to the following necessary factors in order to implement the Project effectively and efficiently.

(1) Promotion and Strengthening of Education System for Co-medicals

In order to realize the purpose of the Project which is "to improve education quality for co-medicals", it is considered to be necessary to promote and strengthen the education system for co-medicals at TSMC by Cambodian side.

To be specific, Cambodian side should further grapple with the followings:

1) To secure quality of the students at the time of new enrollment.

2) To conduct classes including practical trainings as scheduled by full-time teachers and/or lecturers by increasing the numbers thereof.

3) To feedback the results of improvements by monitoring thereof.

4) To secure necessary budgets for operation and maintenance continuously.

(2) Strengthening of Collaboration with Cooperation Project

In order to take advantage of facilities and equipment to be improved and/or provided by the Project to have maximum practical use, it is essential to strengthen collaboration with the Technical Cooperation Project, which was started in September 2003 and scheduled to complete in September 2008. And, for the said collaboration, it is inevitable to receive support in operation and maintenance from MOH and UHS.

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BACKGROUND OF THE PROJECT

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(1) Background of the Request

The target school for the Project; namely, Technical School for Medical Care (TSMC) was established in 1950 as a first training school for nurses and midwives in Cambodia followed by the Laboratory Technology Course which was started in 1970. In 1987, Physiotherapy Course was also incorporated in order to deal with disabled person without limbs, which were mainly caused by detonation of land mines placed during Cambodia's long civil war. At present, Nursing Course, Physiotherapist Course and Laboratory Technology Course as the basic education and Midwifery Course as the post-basic education are available regularly at TSMC. It is also expected to add X-ray Technology Course at TSMC as a regular course additional to the basic education. This addition of X-ray Technology Course is quite important as the said new course is aiming to train X-ray technicians, which will be essential to enhance the capability of medical diagnosis and treatment areas.

TSMC is the only educational institution that trains the laboratory technicians, physiotherapists and X-ray technicians (new course expected to be opened). In addition to that, TSMC plays a important role for providing in-service training for nurses working in nation-wide such as chief nurse training, psychiatric nurse and anesthetic nurse training, and so on. Therefore, it is assumed that the upgrading of the educational and training facilities for TSMC would lead to enhance medical care service in Cambodia. However, the existing facilities at TSMC are relatively small and deteriorating rapidly and the educational equipment currently available is in short supply as well.

Based on the preceding actual circumstances, the Government of the Kingdom of Cambodia (GOC) made a request to the Government of Japan (GOJ) for dispatching short-term experts in the field of co-medical. And, in respond to the said request made by GOC, Japan International Cooperation Agency (JICA), entrusted by GOJ, dispatched a radiology expert and a clinical laboratory expert from February to March in 2001 and from November 2001 to February 2002 respectively. Then, in July 2001, GOC submitted an Application Form for Japan's Grant Aid Assistance to GOJ requesting to renovate and to upgrade the facilities and educational equipment at TSMC and also requested a technical cooperation project in August 2001. Then, in November 2001, JICA dispatched a Basic Survey Mission to the Kingdom of Cambodia aiming to collect basic data, as to the current situation of the co-medicals and its education system in Cambodia, from relevant institutions and/or agencies and to discuss with Ministry of Health (MOH) as to the possibility of the cooperation in the future.

In response to the request for the technical cooperation project made by GOC, JICA dispatched a First Feasibility Study Mission and the Second Feasibility Study Mission in September 2002 and in March 2003 respectively. Based on the results of the said feasibility studies, a Record of Discussions (R/D) was signed between Cambodian side and Japanese side and thereafter commenced the implementation of the Project for Human Resource Development of Co-medicals (hereinafter referred to as "the Technical Cooperation Project") in September 2003, the project of which will continue until September 2008. And, at the same time the Second Feasibility Study which was conducted, a Preliminary Study was conducted to review the appropriateness of renovating and upgrading the facilities and educational equipment at TSMC and to determine its scope of the works for Japan's Grant Aid Assistance, taking into account the collaboration with the Technical Cooperation Project.

And, based on the results of the said Preliminary Study, JICA entrusted by GOJ dispatched a Basic Design Study Team (hereinafter referred to as "the Team") on the Project for Renovation of Technical School for Medical Care (hereinafter referred to as "the Project") to the Kingdom of Cambodia and conducted field survey at the study area including the project site from 11th of February to 9th of March 2004. The Team held discussions with the officials concerned of GOC and collected various relevant data and information. Through analysis in Japan, the Team prepared and proposed Basic Design and Implementation Schedule described in a Draft Report of the Basic Design Study for the Project after reviewing and studying the contents of the facilities and equipments and also its scale and prepared a rough cost estimate. Based on the said Basic Design and Implementation Schedule proposed by the Team, JICA dispatched the Draft Report Explanation Team to the Kingdom of Cambodia from 23rd of May to 6th of June 2004 to explain to and to discuss with the officials concerned of GOC in regard to the Basic Design and Implementation Schedule which GOC agreed to in principle.

(2) Outline of the Request and Major Components

The request made by GOC for the Project consists of the renovation and new construction of the facilities and the procurement of the educational equipment for TSMC. The summary of the requested facilities and equipment are as shown in Table 1-1 and Table 1-2 herein below:

Table 1-1 Requested Facilities for the Project

Name of Courses	Facilities
Nursing	Classroom, Practical Training Room, Staff Room, Storage
Physiotherapy	Classroom, Practical Training Room, Staff Room, Storage
Laboratory Technology	Classroom, Laboratory, Preparation Room, Sterilization Room, Staff Room, Storage
Midwifery	Classroom, Practical Training Room, Staff Room, Storage
X-ray Technology	Classroom, X-ray Room/ Operation Room/ Dark Room, Laboratory, Staff Room, Storage
Special Program/ Short Course	Classroom, Practical Training Room, Visiting Tutors' Room, Storage
Others	Library, Administration Office, Meeting Room, Student Association Room, Bookshop, Cafeteria, Garage, Guard House, Generator House

Table 1-2 Requested Equipment for the Project

Location and Purpose	Major Equipment Requested
Nursing / Midwifery Course	No equipment requested in the Application
Laboratory Technology Course	Spectrophotometer, Automatic blood cell counter, Centrifuge, Incubator, Autoclave, Water distiller, Electronic balance, Hematocrit centrifuge, Binocular microscope, Clean bench, Electrophoresis analyzer, Glassware, Micropipette set, Ultrasonic cleaner, Pipette cleaner, Blood gas analyzer, etc.
Physiotherapy Course	Rotary wrist machine, Wrist roll, Shoulder wheel, Training mat, Mat platform, Tilt Table, Parallel bar, Posture training mirror, Curb block, Quadriceps Table, Ultrasound therapy device, Microwave therapy device, Low frequency therapy device, Ultraviolet and infrared lamp, Paraffin bath, Whirlpool bath, etc.
X-ray Technology Course	General X-ray diagnostic system, Mobile X-ray diagnostic system, Automatic X-ray film processor, Manual X-ray film processor, X-ray film viewer, X-ray film dryer, Ultrasound scanner, Electrocardiograph, etc
Production of teaching materials and presentation	TV system, Wireless meeting room system, LCD projector, Screen, Digital video camera, Video tape editing system, Computer system, etc.

CHAPTER 2

CONTENTS OF THE PROJECT

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Basic Concept of the Project

2-1-1 Overall Goal and Project Purpose

GOC launched the First Socio-Economic Development Plan 1996-2000 and the Second Socio-Economic Development Plan 2001-2005 aiming to upgrade the knowledge and skill of co-medicals through strengthening the education system so that more effective health care services will be provided for the Cambodian citizens. GOC also launched the Health Workforce Development Plan 1996-2005 for human resources development, aiming to promote upgrading the knowledge and skill of the laboratory technicians and to introduce training X-ray technicians, a training course which is not currently available in Cambodia. Furthermore, the Health Sector Strategic Plan 2003 – 2007 has been launched aiming to reform the national health care services in Cambodia.

In 1950, the first nursing and midwifery school was established and in 1970, the laboratory technology educational program was started. In 1987, Physiotherapy Course was also started in order to deal with disabled person without limbs, which were mainly caused by detonation of landmines placed during Cambodia's long civil war. And, it is expected to add X-ray Technology Course at TSMC as a regular basic training course. This addition of X-ray Technology Course is quite important as the said new course is aiming to train X-ray technicians, who will be essential to enhance the capability of medical diagnosis and treatment areas.

TSMC is the only educational institution in Cambodia that trains the laboratory technicians, physiotherapists and X-ray technicians (expected to be started). In addition to that, TSMC plays a important role for providing in-service trainings for nurses working in nation-wide such as chief nurse training, psychiatric nurse and anesthetic nurse training, and so on. Therefore, it is assumed that the upgrading of the educational and training facilities for TSMC would benefit the people in Cambodia.

Most importantly, the main project purpose is to improve the education quality for co-medicals by improving the facilities and equipment at TSMC. By implementing the Project, the technical quality of co-medicals would be greatly improve, and at the same time, the Project will fulfill a shortage of co-medicals and the implementation system of appropriate health-care services in Cambodia will be improved as well.

2-1-2 Outline of the Project

The project will assist TSMC in reaching its goal of improving the quality of medical personnel and providing better health care for the Cambodians. The project includes the renovation of existing building, the construction of a new building and the procurement of the educational equipment. This is expected to provide a better environment for the students to undertake their studies. The framework of the Project is as shown in Table 2-1 here in below:

Table 2-1 Project Framework

Overall Goal	To improve technical quality of co-medicals
Project Purpose	To improve education quality for co-medicals
Output	Upgraded facilities for TSMC
Activities	Renovation and construction of buildings and procurement of educational equipment for TSMC

The Responsible Agency for the Project is the Directorate General of Ministry of Health (DG/MOH), and the Implementing Agency is TSMC.

2-1-3 Examination of the Contents of the Request

2-1-3-1 Facility

As for the contents of the requested facilities, it was agreed in principle with Cambodian side as shown in Table 2-2 here in below, the contents of which was finalized through the discussions and examinations during the Basic Design Study, and described in the Minutes of Discussions (M/D) signed between the Cambodian side and the Japanese side on 24th of February 2004.

Table 2-2 Requested Facilities for the Project

Name of Courses	Facilities
Nursing	Classroom, Practical Training Room, Staff Room, Storage
Physiotherapy	Classroom, Practical Training Room, Staff Room, Storage
Laboratory Technology	Classroom, General Laboratory / Clinical Laboratory, Preparation Room, Sterilization Room, Staff Room, Storage
Midwifery	Classroom, Practical Training Room, Staff Room, Storage
X-ray Technology	Classroom, X-ray Maintenance Workshop, General Laboratory, Staff Room, Control Room / Dark Room / X-ray Room, Storage
Special Program / Short Program	Classroom, Practical Training Room, Visiting Lecturers' Room, Storage
Others	Library, Administration Office, Meeting Room, Student Association Room, Bookshop, Cafeteria, Garage, Guard House, Generator House

(1) Study on the target school

As for the facility plan, the Cambodian side requested the improvement of educational facilities at TSMC such as the classrooms and practical training rooms in the Application Form submitted to GOJ. The Team studied the appropriateness and necessity in accordance with the said request through the discussion with MOH, TSMC and the Technical Cooperation Project. The summary of the existing facilities, facilities requested in the Grant Aid Application, facilities requested during the Basic Design Study and facilities to be considered for the Project as shown in Annex-1 of M/D dated 24th of February 2004 is as shown in Table 2-3.

Points of the discussions and studies regarding the facilities are enumerated as follows:

(2) Study on the facility contents

As shown in Table 2-3, garage and guardhouse were included in the Application Form submitted by the Cambodian side beside the education and administration related facilities. The Basic Design Team explained that the Japan's Grant Aid Assistance would not cover such facilities because of the restraint in the project budget, and MOH and TSMC understood and agreed to exclude such facilities.

(3) Study on the necessary facilities and number of rooms

Necessary facilities and the number of classrooms and practical training rooms were confirmed based on the future plan for TSMC with regard to the planned courses, planned annual intake for each course, and the number of classrooms, etc., as well as the condition of the existing facilities through the discussions with MOH and TSMC.

Although the education related necessary facilities are mainly classrooms and practical training rooms, necessity of renovation and new construction was studied giving a consideration to the conditions of the existing facilities. The results of the study are as shown in Table 2-3, which was agreed by the Cambodian side.

(4) Confirmation of the conditions of the existing facilities and study on the necessity and possibility of renovating the existing facilities

In parallel with the study on the required facilities, necessity and possibility of renovation of the existing facilities were studied based on the field inspections, as TSMC contains many existing facilities, such as classroom building, administration building, practical training building, hall with dormitory, and so on. And, facilities to be newly constructed or renovated were studied; with

consideration given to re-arrangement of the functional layout plan i.e. zoning, as well as the maximum use of the existing facilities.

Although the understanding of the Cambodian side was that all of the necessary facilities would be newly constructed, the Cambodian side agreed that the existing facilities of which can be used would be renovated and the rest of the necessary facilities will be newly constructed by the explanation made by the Team in this regard.

Table 2-3 Summary of Requested Facilities

1. Existing Facilities	General Classroom for: ・Nursing Course ・Physiotherapy Course ・Laboratory Technology Course ・Midwifery Course ・Special Program ・Short Program Director's Office Deputy Director's Office	Practical Training Room for: ・Nursing Course ・Physiotherapy Course ・Laboratory Technology Course ・Midwifery Course Administration Office Technical Office Staff Room for each Course Library	Meeting Room Storage Sterilizing (Preparation) Room Students Association Room Secretary's Office Bookshop / Cafeteria Garage Guard House Generator House
2. Facilities Requested in the Grant Aid Application made in July 2001	21 General Classroom for: ・Nursing Course (9) ・Physiotherapy Course (3) ・Laboratory Technology Course (2) ・Midwifery Course (1) ・X-ray Technology Course (2) ・Special Program (3) ・Short Program (1) Director's Office Deputy Director's Office (2)	14 Practical Training Room for: ・Nursing Course (6) ・Physiotherapy Course (2) ・Laboratory Technology Course (2) ・Midwifery Course (2) ・X-ray Technology Course (2) Administration Office Technical Office Staff Room for each Course Library	Meeting Room (2) Storage for each Course Sterilizing (Preparation) Room (1) Students Association Room (1) Secretary's Office (1) Bookshop / Cafeteria Visiting Lecturers' Office (1) Garage Guard House Generator House
3. Facilities Requested During Basic Design Study by TSMC	22 General Classroom for: ・Nursing Course (9) ・Physiotherapy Course (3) ・Laboratory Technology Course (2) ・Midwifery Course (1) ・X-ray Technology Course (3) ・Special Program (3) ・Short Program (1) Director's Office Deputy Director's Office (2) Administration Office	19 Practical Training Room for: ・Nursing Course (6) ・Physiotherapy Course (2) ・Laboratory Technology Course (2) ・Midwifery Course (2) ・X-ray Technology Course (3) ・General Training Laboratory (2) ・X-ray General Laboratory (1) ・X-ray Maintenance Workshop (1) Technical Office Staff Room for each Course	Library Meeting Room (2) Storage for each Course Sterilizing (Preparation) Room (1) Students Association Room (1) Secretary's Office (1) Bookshop / Cafeteria Visiting Lecturers' Office (1) Garage Guard House Generator House
4. Facilities to be Considered as shown in Annex-1 of M/D dated 24/FEB/2004	**Nursing Course** ・General Classroom ・Practical Training Room ・Staff Room ・Storage **Physiotherapy Course** ・General Classroom ・Practical Training Room ・Staff Room ・Storage **Midwifery Course** ・General Classroom ・Practical Training Room ・Staff Room ・Storage	**Laboratory Technology Course** ・General Classroom ・Laboratory ・Preparation Room ・Sterilizing Room ・Staff Room ・Storage **X-ray Technology Course** ・General Classroom ・X-ray Maintenance Workshop ・General Laboratory ・Staff Room ・Storage	**Special / Short Program** ・General Classroom ・Practical Training Room ・Visiting Lecturers' Office ・Storage **Others** ・Library ・Administration Office ・Meeting Room ・Students Association Room ・Bookshop / Cafeteria ・Garage ・Guard House ・Generator House

2-1-3-2 Equipment

All health workers including co-medicals provide medical practice by sharing their knowledge of basic science and medical subjects such as physics, chemistry, biology, mathematics, anatomy and physiology. And, more importantly, based on their wide array of knowledge, they provide health and medical care services with the additional expertise such as nursing, biochemical analysis, physiotherapy, radiography and so forth.

Therefore, well-organized curriculum aiming at mastering related subjects efficiently is indispensable for the training of co-medicals. To effectively train co-medicals, providing various kinds of educational and training equipment are extremely important and thus it is necessary not only to renovate and/or construct buildings furnished with sufficient infrastructure but also to secure necessary equipment for facilitating their study.

The following Table 2-4 shows major equipment corresponding to each course and for common use necessary for teaching and training that were requested by Cambodian side in the Application Form for Japan's Grant Aid Assistance.

Table 2-4 Summary of Requested Major Equipment

Course	Requested Major Equipment
Nursing / Midwifery	No equipment requested in the Application.
Laboratory Technology	Spectrophotometer, Automatic blood cell counter, Centrifuge, Incubator, Autoclave, Water distiller, Electronic balance, Hematocrit centrifuge, Binocular microscope, Clean bench, Electrophoresis analyzer, Glassware, Micropipette set, Ultrasonic cleaner, Pipette cleaner, Blood gas analyzer, etc.
Physiotherapy	Rotary wrist machine, Wrist roll, Shoulder wheel, Training mat, Mat platform, Tilt Table, Parallel bar, Posture training mirror, Curb block, Quadriceps Table, Ultrasound therapy device, Microwave therapy device, Low frequency therapy device, Ultraviolet and infrared lamp, Paraffin bath, Whirlpool bath, etc.
X-ray Technology	General X-ray diagnostic system, Mobile X-ray diagnostic system, Automatic X-ray film processor, Manual X-ray film processor, X-ray film viewer, X-ray film dryer, Ultrasound scanner, Electrocardiograph, etc
Equipment for production of teaching materials and presentation	TV system, Wireless meeting room system, LCD projector, Screen, Digital video camera, Video tape editing system, Computer system, etc.

For essential medical knowledge for training co-medicals, particularly in regard to human body structure and its functions, it is most effective to use anatomical models and such images as X-ray, ultrasound and so on. Also, it is very important for them to receive hands-on practice using artificial models and simulators. However, in reality, the number of equipment and models available at TSMC for lecture and hands-on practice is limited and/or outdated. Also as there are few textbooks and reference books written in the Khmer language, lectures are often given utilizing

conventional audio-visual equipment, e.g. Over Head Projector (OHP). However, equipments for producing teaching materials and visual aid for presenting teaching materials at lecture are also extremely in short supply and outdated. In order to resolve those problems, the list of requested equipment is, we believe, generally appropriate.

On the other hand, the equipment plan has to be implemented giving a consideration to the fact that some existing equipment for the courses other than X-ray Technology Course can still be utilized, that the equipment provided or planned to be provided by the other donors for each course will vary, and most importantly that the Technical Cooperation Project is currently planning to procure some equipment for each course at TSMC.

Thus, based on the original Application for Japan's Grant Aid Assistance requested by Cambodian side made in July 2001, discussions were held among MOH, TSMC, and the Team during the Basic Design Study. The final and agreed list of the Requested Equipment was attached to M/D dated 24th of February 2004 and the equipment was planned as described in **Section 2-2-2-8**, by coordinating with the Architectural and Facility Plans.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Project Background

(1) Views of Cooperation Target

The cooperation target for The Project is TSMC of which is an educational institution that provides knowledge and skill to the co-medicals in Cambodia.

At present, there is an education system for medical doctor, dentist, pharmacist, midwife, nurse, laboratory technician, physiotherapist, and dental hygienist in Cambodia. Basic education for co-medicals is conducted at three faculties at UHS i.e. Medical Science, Dentistry, and Pharmacy, and three courses at TSMC i.e. Nursing Course, Physiotherapy Course and Laboratory Technology Course, as well as at courses available at four Regional Training Centers (RTC) i.e. Nursing Course and Dental Hygienist Course. Furthermore, post-basic education for midwife, anesthetic nurse and psychiatric nurse is conducted at TSMC.

An education overview and background of each course, which is currently available and will be available at TSMC, are described as follow:

1) Education for the Nurse and Midwife

For twenty years before the UNTAC, the nursing education system in Cambodia had been unstable. In the 1979 and 80's, a temporary system was practiced where the requirement was to have 10 years of primary education to get into nursing school. The nurses that graduated from the school who became the primary nurse, worked mainly for the rural medical services and they had played an important role for improving the medical services at rural areas.

At present, the nurses with three different education levels are working together at local medical and health care institutions. The first level is a nurse that has only a few months of training. The second level is a nurse that has six years of primary education and then two and a half years of nursing education. The third level is a nurse that has ten years of primary education and then three years of nursing education.

Base on the preceding circumstances, after 1992, a promotion course was established aiming to improve the quality of the primary nurses and to train them as secondary nurses, and at the same time, it started from 1997 to give out the license as "Registered Nurse" for those who completed three years of education. At present, the training course for the nurses is available at each RTC in four other provinces i.e. Battambaug, Kompongchan, Kanpot, and Stungtreng, in addition to the one available at TSMC. And, in order to help lower the high maternal mortality rate, training of more midwives is implemented at each RTC so that the deliveries are supported by medical specialists i.e. midwives, and the live birth rate will be enhanced as well. And, in order to do so, a secondary midwifery course is opened for primary midwives aiming to improve their knowledge and skill. However, number of students for most needed midwifery course, even compared with the nursing course, is quite low in recent years. In case of TSMC, actual enrollment was less than planned intake of 20. As for the training of nurse and midwives, all students for midwifery course and a half of the students for nursing course will be given a scholarship in accordance with Human Resources Development Plan prepared by MOH, although scholarship students are later expected to work in the local community or rural area. However, notably many of them look for the work in the Capital, Phnom Penh. MOH is trying to solve the imbalance in manpower supply between the cities and local communities, but their efforts are not too effective at present.

2) Education for the Laboratory Technician

TSMC is the only education institution in Cambodia for laboratory technician, which takes two years to complete. This course was first opened in 1970 and was a three-year course at that time. It was reopened in 1981 after the civil war and, in 1990; it became a new two-year course when a new curriculum was introduced with support of France. According to

Complementary Package of Activities (CPA) and Minimum Package of Activities (MPA), each Referral Hospital should have more than two laboratory technicians, however, it seems quite difficult to meet such requirement, if their placement at local hospitals were considered, as a total number of trained laboratory technicians after UNTAC is only around 370. The laboratory technicians are considered quite important for medical diagnosis and treatment, and therefore, it is deemed necessary to train laboratory technicians with high quality by strengthening the provisions of the educational equipment.

Note: The Service Package of which is based on the Health Service Plan 1996 Amendment of Medical Health Structure (Health Sector Reform).
CPA (Complementary Package of Activities) is comprehensive service package. There are 3 CPA ranks and hospitals are ranked according to their size, number of inpatients beds and types of operation performed.
MPA (Minimum Package of Activities) is basic services for Health Centers and Health Posts. They request to have mainly Midwives and Nurses.

Work Cited: "Complementary Package of Activities" Guidelines for the Referral Hospital for 2003-2007, Version I (Feb., 2003).

3) Education for the Physiotherapist

TSMC is also the only education institution in Cambodia for physiotherapist, which takes three years to complete. It was started in 1989, but was actually started after a new curriculum was introduced in 1991. Thus, the course has a short history in Cambodia. After the UNTAC, only 110 students have graduated from the course. The number of physiotherapist placed in Referral Hospitals up to the year 2003 was very low. The doctors' recognition for the necessity of physiotherapist is also very low, and therefore, only a few placement requests for physiotherapists are made to MOH from Referral Hospitals.

Because of the situations described above, it is necessary not only the training of physiotherapist but also public relations activities and promotion thereof. At the National Rehabilitation Center in Phnom Penh, there are many people that were disabled by the civil war and landmines. There are also many inborn malformations, brain paralysis, and limb paralysis that needs physical rehabilitation. Patients at all the local hospitals in the countryside are waiting for physiotherapists to be placed, and thus, there will a great demand for them.

4) Education for the X-ray Technician

At present, the Technical Cooperation Project is planning to and providing technical support for the establishment of X-ray Technical Course at TSMC. There are eight licensed X-ray technicians throughout the country who were trained in Hungary, Belgium, and Germany. There are also some doctors who had 6-9 months training at Calmette Hospital, CENAT, and private hospitals such as Hope, and there are a few nurses who are trained as X-ray technicians

and are actually working as the X-ray technicians. And, as a result, a total of 118 co-medicals who were trained as X-ray technician but are not licensed are conducting the X-ray examinations without license or qualification at the Referral Hospitals in each province. The breakdown thereof is 43 doctors of whom 12 are medical assistants and 73 nurses of which 11 are primary nurses. However, considering the specialty of the X-ray examination, the need for qualified X-ray technicians is great and the demand is expected to increase rapidly.

Work Cited: JICA Education Project of Medical Health Workers: X-ray technicians Report (Jul. 2003).

In order to deal with the various problems in the health sector based on the preceding actual circumstances, MOH launched the Health Sector Strategic Plan 2003-2007 (HSSP) in August 2002 aiming to reform the national health care services for the people in Cambodia; especially, the improvement of the health of mothers and children, and aiming to reduce the poverty and to enhance socio-economy as well. Essential strategies to achieve such aims are as follow:

1) To further improve the access to the health care service for poor and socially weak people and its coverage area through the planning of placement of the health care facilities.

2) To strengthen and enhance the quality of health care service through the implementation of MPA at the health centers nation-wide.

3) To strengthen the services at hospitals trough the implementation of CPA, especially in the obstetrical department and pediatric department.

Based on the afore-mentioned national program in Cambodia, JICA commenced the Technical Cooperation Project on September 2003 aiming to produce able co-medicals at public institution for training co-medicals, the Technical Cooperation project of which will continue for five (5) years until September 2008. The project includes improvement of the school management, education standards, curriculums, and the opening of X-ray Technology Course at TSMC. Giving a consideration of collaboration with on-going Technical Cooperation Project, the implementation of the Project seems in good timing and it is quite obvious that the implementation of the Project will definitely contribute for the improvement of the technical quality of co-medicals.

(2) Appropriateness of Selection of the Target School

In the Health Workforce Development Plan 1996-2005, the importance of the training the co-medicals is emphasized aiming to reduce the poverty and to enhance the socio-economy through the development of the field of medical and health care services. The Health Workforce Development Plan especially stated the importance of educating future medical personnel and

developing the fundamental health care services. The demand for Physiotherapists, Laboratory Technicians, X-ray Technicians, and other essential personnel is already high and growing. TSMC has the experience, history and know-how for the Medical Health Education Courses. The Health Workforce Development Plan also tries to increase the number of co-medical staff that has licenses higher than the secondary school license. TSMC is working for post-basic educational courses, training, and supporting of Mental Health Care Nurses, Anesthesia Nurses, and other Medical Specialist. TSMC is also trying to train teachers at four RTC and also try to train middle level nurses to become leaders. The students that finish the courses are expected to become leaders at each of the local hospitals to provide medical and health support for the surrounding areas. Most of the students that have graduated from TSMC have already been hired and are working at national hospitals or other public health institutions and/or facilities and have started to contribute to the health care of the areas they are in (Refer to APPENDIX-8).

And, as for the training of co-medicals other than nurse and midwife, TSMC is the only institution in the country that provides the necessary training, and therefore, strengthening of the educational facilities and provisions of the educational equipment at TSMC will enhance health care services indirectly and will benefits the people in Cambodia. Thus, it is judged to be appropriate to support TSMC.

Giving a consideration to the above, it is judged to be appropriate to renovate the existing facilities and to construct a new facility at TSMC as well as to procure the educational equipment by the Project, as it will enhance the quality of technical education in Cambodia.

(3) Appropriateness of the Scale of the Project

Things to be considered for the scope of the works for the Project are 1) intake capacity at TSMC, 2) contents of the education, and 3) educational materials and equipments.

1) Intake capacity (Refer to Table 2-5: Annual Intake Capacity)

In the nursing course, those that receive a regular nurse's license or a primary nurse's license have a chance to further their education by getting into the secondary nursing course. At one time in 1996, there were as much as 400 students, where usually there are about 110 students. After 2003, the school had a capacity of about 120 students. The midwifery course has 20 students every six months. The needs for laboratory technicians and physiotherapists will increase, thus, it is believed that the capacity to train 40 students annually is deemed reasonable giving a consideration of the fact that TSMC is the only institution that trains the laboratory technicians and physiotherapists. The X-ray Technology course to train 20

students is also appropriate, because it is a newly planned course with limited number of teachers and facilities.

Table 2-5 Annual Intake Capacity

Education Program	Scholarship	Paying	Total
Nursing course	60	60	120
Physiotherapy course	20	20	40
Lab technology course	20	20	40
Midwifery course*	20	0	20
X-ray technology course	20	0	20

* Indicate a half yearly intake

2) Ccontents of the Education

As for the educational effects at TSMC, it is quite important to teach and train students along with an appropriate educational policy set on what kind of the skill level TSMC expects the students to have at the time of completing each course. Curriculum should reflect the said educational policy, and compulsory subjects deemed necessary to become specialist in selected fields should at least be covered. Our field survey of TSMC indicated that the curriculum and educational goals are satisfactory. Basic subjects are taught and subjects that train the student to become a specialist are also satisfactory. But the quality of teachers is also quite important factor, and the quality education cannot be provided unless sufficient and necessary numbers of well-qualified teachers are secured. The teacher / student ratio at TSMC needs better management and control.

3) Educational materials and equipments

Giving a consideration to the fact that the kind of educational equipment and the numbers thereof and the learning environment would reflect the students' motivation to study, the scope of the supply of the educational equipment considered to be supplied for the Project is deemed minimum to retain an appropriate educational quality.

For the verification of the appropriateness of the above-mentioned 1) intake capacity, the graphs and tables for the balance of supply and demand as shown in the APPENDIX-6 were used for reviewing and analyzing. And, as a result, it was judged that there would be a sufficient demand and the supply would not exceed the expected demand.

Conditions given for the reviewing and analyzing demand are as follows:

a) In the "Second Economic Development Plan 2001 – 2005", it stated that the first priority was given to support the medical system and to upgrade human resources because of its

great effect upon society. They set a goal to reestablish the medical health care and primary care systems and to upgrade and establish 68 referral hospitals and 942 health centers in Cambodia. However, according to the Health Coverage Plan, only 812 health centers are established, which is not enough to cover every 10,000 people as required in MPA. According MPA, each health center should have two nurses and two midwives, but the conditions right now are that 50 – 60% thereof are primary nurses or primary midwives and many health centers have only one primary nurse or one primary midwife. With the increase in the number of health centers, the number of required nurses and midwives will also increase. Furthermore, MOH is considering to establish a small-scale health center called "Health Post" for the under-populated area throughout the country, and therefore, demand for the nurses and midwives would further be increased.

b) There are 8 national hospitals and 68 referral hospitals. Although it depends on the number of beds, each referral hospital should have co-medical staff of more than 20 nurses, 5 laboratory technicians and a physiotherapist, and an X-ray technician as based on CPA rules and by what MOH education officials stated. However, many of the referral hospitals do not have sufficient number of laboratory technician, as required by CPA rules. And, as for the physiotherapist, of the 24 provinces, 12 provinces have none at all. The hospitals' staff request made in 2004 included 27 physiotherapist, and 110 laboratory technicians of which 71 were to be from the primary level. But the requirement has not been fulfilled.

c) There is no institution in Cambodia that teaches and trains X-ray technicians. There are only 8 X-ray technicians, who were trained overseas, such as Belgium, Germany, and Hong Kong (as of the year 2003). As for the placement at the referral hospitals, 7 X-ray technicians are placed at the referral hospital in Phnom Penh and, as for the rest of the referral hospitals, nursing staff operate X-ray equipment under the supervision of the doctors who were given 6 to 9 month training as X-ray technician. According to the findings during the Basic Design Study, ADB is planned to install an X-ray equipment at least at each referral hospital. Therefore, the need for the establishment of the X-ray technology course to train X-ray technicians is urgent and the demand will definitely be quite great.

d) It is assumed that the demand for co-medical staff for health-related NGOs and private hospitals and clinics will be increased. For example, the number of private health care facilities in Phnom Penh alone is increasing at the rate of 7.4%. The graduates from TSMC may find a job at such private health care facilities.

However, MOH employ the co-medical staff such as graduates from TSMC through the examination for civil servant annually based on the number of staff requested by each medical institution, and MOH has no mid-term and long-term plan as to the employment of co-medical staff. Therefore, it is strongly recommended that MOH should have an appropriate employment schedule to be prepared based on the planned placement of the co-medical staff in the future.

And, with regard to the supply of educational equipment and upgrading of learning environment, continuing education is also to be considered. Although TSMC had been active as the central medical institution for providing higher education for the co-medical staff throughout the country having programs for continuing education, there was no appropriate classroom or seminar room for the said continuing education. Thus, it is appropriate to provide classrooms and/or seminar rooms for the continuing education for the Project.

Furthermore, it is quite important to secure required number of teaching staff for an X-ray technology course, which is newly set up at TSMC. Considering the situation in Cambodia, the proportion of the visiting lecturer will be quite high thus the chance for no class will also be quite high. Therefore, it is important to secure sufficient number of the permanent teaching staff prior to the scheduled opening of the newly constructed and renovated facilities at TSMC in 2006.

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

2-2-2-1 Policy for Construction Plan

(1) Points to be Considered

1) The contents of the requested facilities by Cambodian side for the Project is summarized in the ANNEX-1 of the Minutes of Discussions dated 24 February 2004 which was prepared based on confirmation of the conditions of the existing buildings and the necessity of new facilities. The basic design of the facilities shall be reviewed and studied based on the contents of the said ANNEX-1.

2) Necessary rooms and its numbers and scale were fixed after reviewing and studying the contents of the above-mentioned ANNEX-1. In particular, the size and basic layout for desks, chairs, tables, etc of the classroom and practical training room for Nursing Course and Laboratory Technology Course were reviewed and studied through the discussions with JICA experts.

3) Existing classroom building and the proposed new building shall be connected with an easy and smooth line of flow so as to function as one educational facility, and the facility zoning and its flow planning were reviewed from this point of view. It is planned to connect the existing classroom building and the proposed new building with a connecting corridor in the air.

4) Although there are many existing facilities at TSMC other than the ones to be renovated under the Project, such existing facilities shall also be included for the planning of the fire-fighting system and sewerage treatment system, giving a consideration of fire prevention and environmental protection of TSMC as a whole.

5) The demolition of the existing facilities required for the renovation work requires close supervision by the Consultant. Therefore, the demolition and removal works shall be included in the scope of works for the Project.

6) There are no Building Code describing building standards and structural design standards. These are not officially established yet in Cambodia, although its draft is currently being prepared. Therefore, the structural design standards of the Architectural Institute of Japan (AIJ) shall be referred to for the structural analysis method and structural design method for the Project.

7) Prior to reviewing and fixing the necessary rooms and its numbers and scale, the Basic Design Team visited the following similar facilities, one of which was under construction, in Cambodia:

   a) Secondary School Teacher Training Project in Science and Mathematics (STEPSAM)
   b) National Center for TB and Leprosy Control (CENAT)
   c) Maternal and Child Hospital (MCH)
   d) Royal University of Agriculture
   e) The National Cambodia-Korea Vocational Training School (under construction)

The above-mentioned similar facilities shall be referred to for further reviewing and studying for the Basic Design of the facilities.

(2) Basic Policy

1) Consideration of Function in terms of Curriculum and Activities in TSMC

Facility planning, including the determination of its scale i.e. floor area shall be confirmed after careful study and understanding of the curriculum, flow of students, staff, goods and

information, characteristics of the medical equipment to be used and conditions of its placement. From this point of view, the basic design of the facility shall be made considering function and efficiency so as to improve quality of education both in the classroom and in the practical training room.

2) Durability

a) Structural design criteria shall be set carefully through the field survey of the natural conditions and confirmation of the soil bearing conditions by conducting topographic survey and soil test including boring test, so as not to propose excessive structural design or structurally weak design.

b) Foundation design shall be carefully studied taking the results of the soil investigation and the field survey records of the existing buildings, as the foundation structure would have a great influence on durability of the entire building. As for the super-structure, the rational structural design by adopting "Reinforced Concrete Frame Structure" in principle should be considered for the durability of the building.

c) Roof shape shall be designed considering rainfall during rainy season in Cambodia. And, some measures i.e. provision of canopy, louver, etc shall be considered in order to shade rainfall onto external wall. At the same time, natural ventilation and lighting should also be considered.

3) Economical

a) Rational facility planning by adopting economical standard module shall be considered for the Basic Design.

b) Window opening shall be as wide as practically allows, so as to enable the taking in of sufficient natural lighting and ventilation, and consequently in order to lower the running cost for lighting, air-conditioning, mechanical ventilation, etc.

c) As for the procurement of the construction equipment and materials and construction methods, it is planned to procure locally and/or from neighboring third countries, and to adopt local conventional construction methods so as to lower the construction cost. Furthermore, as for the finishing materials, it is planned to use maintenance-free materials as practical as possible so as to lower the maintenance cost to be incurred after handing-over of the Project.

d) Although facility planning shall be made based upon the above-mentioned basic policies, attention shall also be paid to the quality control in construction planning, as the said quality control is one of the important factors of the Project.

(3) Basic Design Policy

1) Study of Floor Plan

The floor plan for each room was reviewed and studied taking a planned course and the total annual new enrollment i.e. annual intake for each planned course at TSMC into account and made accordingly. As for the number of students per classroom, it is set to be 40 in principle (20 for Midwifery Course semi-annually and X-ray Technology Course annually). Refer to Paragraph 2-3 Basic Design Drawing, for the proposed floor plan for each room.

And, as for the floor area for each practical training room, it was reviewed and studied taking similar facilities both in Japan and Cambodia into account and through various discussions with JICA experts at TSMC.

2) Study of Renovation Work

In regards to the renovation of the existing buildings for the Project, it was planned that the existing classroom building, administration building and toilet building located nearby the said administration building shall be subject for the renovation for the Project. The results of concrete strength test conducted by using Schmidt Hammer indicate that these buildings were proved to be structurally sound. Refer to APPENDIX-9 for the summary of the said test results.

It is planned to renovate the existing classroom building solely for Nursing Course, having classrooms, practical training rooms, and other necessary rooms. And, as for the existing administration building, it is planned to renovate solely for continuing education, having seminar rooms, room for students association, etc.

Proposed renovation work mainly consists of internal and external finishing works. However, it is planned to install new steel roof trusses with new roof coverings for all existing buildings to be renovated, as deterioration of the existing roof trusses are quite evident and water leakage from roof slabs became serious problems in the aspect of the maintenance. Furthermore, installation of the suspended ceilings shall be considered, as it is inevitable to re-new all electrical, plumbing and mechanical installations for the said existing buildings, and fire-fighting system and alarm system shall be planned for entire facilities including other existing facilities at TSMC.

(4) Study for the Necessary Rooms

Planned course and total annual new enrollment i.e. annual intake for each planned course and the number of necessary rooms for the subject school (TSMC) was confirmed with MOE and TSMC during the Basic Design Study, summary of which is as shown in Table 2-7 on the following page. And, the necessary number of the classroom and other rooms being prepared is also shown in Table 2-6 herein below. Options of 1) renovation of the existing building or 2) new construction has been carefully selected for each necessary room based on the results of the investigations of the existing buildings, selection of which is also summarized in the Table 2-6.

Table 2-6 Summary of the Necessary Rooms

Name of Course	Number of Students	Number of necessary rooms	Options	
			Renovation	New construction
1. Nursing	120 / Grade	Classroom: 9 Training Room: 3 Staff Room: 2	Classroom: 9 Training Room: 3 Staff Room: 2	Classroom: - Training Room: - Staff Room: -
2. Physiotherapy	40 / Grade	Classroom: 3 Training Room: 1 Staff Room: 1	Classroom: - Training Room: - Staff Room: -	Classroom: 3 Training Room: 1 Staff Room: 1
3. Lab. Technology	40 / Grade	Classroom: 2 Training Room: 3 Staff Room: 1	Classroom: - Training Room: - Staff Room: -	Classroom: 2 Training Room: 3 Staff Room: 1
4. Midwifery	20 / Group	Classroom: 2 Training Room: 1 Staff Room: 1	Classroom: - Training Room: - Staff Room: -	Classroom: 2 Training Room: 1 Staff Room: 1
5. X-ray Technology	20 / Grade	Classroom: 3 Training Room: 4 Staff Room: 1	Classroom: - Training Room: - Staff Room: -	Classroom: 3 Training Room: 4 Staff Room: 1

* Indicate half yearly intake i.e. 2 groups per year.

Table 2-7 Annual Intake for Each Course and Number of Necessary Rooms

	No. of Students	2003	2004	2005	2006	2007	2008
					Completion of Renovation (Expected)		
Nursing		III 3classes					
intake 2001	100	II 3classes	III 3classes				
intake 2002	210	I 4classes	II 4classes	III 4classes			
intake 2003	119		I 3classes	II 3classes	III 3classes		
intake 2004	120			I 3classes	II 3classes	III 3classes	
intake 2005	120				I 3classes	II 3classes	III 3classes
intake 2006	120					I 3classes	II 3classes III
intake 2007	120						I 3classes II
intake 2008	120						I
Total No. of Class		**10**	**10**	**10**	**9**	**9**	**9** **9**
No. of Class Rooms		**9**	**9**	**9**	**9**	**9**	**9** **9**
No. of Practice Rooms		**3**	**3**	**3**	**3**	**3**	**3** **3**
Physiotherapy		III 1class					
intake 2001	14	II 1class	III 1class				
intake 2002	16	I 1class	II 1class	III 1class			
intake 2003	25		I 1class	II 1class	III 1class		
intake 2004	40			I 1class	II 1class	III 1class	
intake 2005	40				I 1class	II 1class	III 1class
intake 2006	40					I 1class	II 1class III
intake 2007	40						I 1class II
intake 2008	40						I
Total No. of Class		**3**	**3**	**3**	**3**	**3**	**3** **3**
No. of Class Rooms		**3**	**3**	**3**	**3**	**3**	**3** **3**
No. of Practice Rooms		**1**	**1**	**1**	**1**	**1**	**1** **1**
Lab. Technology							
intake 2001	0						
intake 2002	54	I 1classes	II 1classes				
intake 2003	36		I 1classes	II 1classes			
intake 2004	40			I 1classes	II 1classes		
intake 2005	40				I 1classes	II 1classes	
intake 2006	40					I 1classes	II 1classes
intake 2007	40						I 1classes II
intake 2008	40						I
Total No. of Class		**1**	**2**	**2**	**2**	**2**	**2** **2**
No. of Class Rooms		**2**	**2**	**2**	**2**	**2**	**2** **2**
No. of Practice Rooms		**3**	**3**	**3**	**3**	**3**	**3** **3**
Midwifery							
intake 2002 2nd Admission	0						
intake 2003 1st Admission	0						
intake 2003 2nd Admission	18		I 1class				
intake 2004 1st Admission	20			I 1class			
intake 2004 2nd Admission	20			I 1class			
intake 2005 1st Admission	20				I 1class		
intake 2005 2nd Admission	20				I 1class		
intake 2006 1st Admission	20					I 1class	
intake 2006 2nd Admission	20					I 1class	
intake 2007 1st Admission	20						I 1class
intake 2007 2nd Admission	20						I 1class
intake 2008 1st Admission	20						I 1class
intake 2008 2nd Admission	20						I
Total No. of Class		**0**	**1** **2**	**2** **2**	**2** **2**	**2** **2**	**2** **2** **2**
No. of Class Rooms		**1**	**1** **1**	**1** **1**	**1** **1**	**1** **1**	**1** **1** **1**
No. of Practice Rooms		**1**	**1** **1**	**1** **1**	**1** **1**	**1** **1**	**1** **1** **1**
X-Ray Technology							
intake 2006	20					I 1class	II 1class III
intake 2007	20						I 1class II
intake 2008	20						I
Total No. of Class		**0**	**0**	**0**	**0**	**1**	**2** **3**
No. of Class Rooms		**0**	**0**	**0**	**0**	**3**	**3** **3**
No. of X-ray Rooms		**0**	**0**	**0**	**0**	**2**	**2** **2**
No. of Workshop Rooms		**0**	**0**	**0**	**0**	**2**	**2** **2**

(5) Study for the Size of Each Room

Calculation of floor area of each room was made based on the results of discussions with TSMC including JICA experts being assigned to TSMC as well as the results of the study of the other similar facilities constructed and/or being constructed in Cambodia.

1) Classroom

Number of students per classroom for Physiotherapy Course and Laboratory Technology Course shall be set to 40. The size of the classroom, which would be provided in the new building, shall be 8m x 10m (floor area: 80m^2 i.e. 2.0m^2/student). Currently, 40-50 students are learning in each classroom of the size of 7m x 8m i.e. 1.12-1.4m^2/student, thus the learning environment would be improved appropriately.

The number of students per classroom for Midwifery Course and X-ray Technology Course shall be set to 20 and the size of the classroom, which would be provided in the new building, shall be 8m x 5m (floor area: 40m^2 i.e. 2.0m^2/stident).

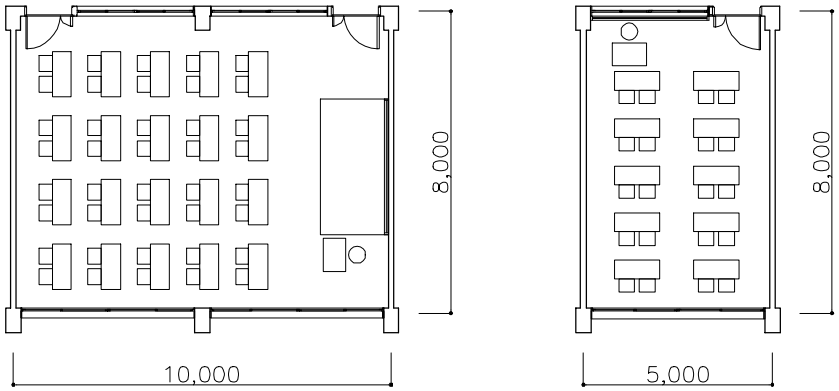

Fig. 2-1 Floor Plan for Classroom

As for the classrooms for Nursing course, it shall be planned to have appropriate floor area for 40 students by removing the existing partitions. And, the size of the classroom for Nursing Course, which would be provided in the existing building, shall be 7m x 10m (floor area: 70m^2 i.e. 1.75m^2/student) due to structural limitation. However, the leaning environment would also be improved appropriately, as 40-50 students are currently learning in each classroom of the size of 7m x 8m i.e. 1.12-1.4m^2/student.

2) Practical Training Room

In the practical training room for Nursing Course, varies for each course, the students shall be trained through demonstrations given by the teacher/lecturer using educational equipment such as patient beds and other instruments.

In the Project, it is assumed that the training for Nursing Course would be conducted at 10 students per bed considering the current situations of nursing education in Cambodia. Thus, four (4) patient beds shall be placed in each practical training room, as 40 students would be trained at the time. Base on the preceding assumptions, the size of each practical training room for Nursing Course shall be 7m x 12m (floor area: 84m^2 i.e. 2.1m^2/student)

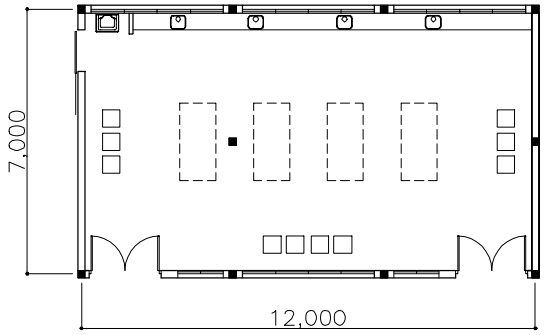

Fig. 2-2 Floor Plan for Nursing Course Practical Training Room

As for the practical training room for the Laboratory Technology Course, it shall be clinical laboratory equipped with laboratory table having a sink for the use of 20 students at the time i.e. a half of the class, and the size of which shall be 8m x 12.5m (floor area: 100m^2 i.e. 5.0m^2/student). However, general laboratory planned for the Laboratory Technology Course shall be for the use of 40 students at the time, and the size of which shall be 8m x 10m (floor area: 80m^2 i.e. 2.0m^2/student).

Sinks shall be provided in each practical training room so as to enable students to practice washing hands, operation of medical equipment, and so on. It is also planned to equip the sinks with hot water supply at the practical training rooms for the Nursing Course and Midwifery so as to enable to practice cleaning and rinsing. Furthermore, the preparation room shall be provided adjacent to each practical training room, which would maximize the usable space for the practical training room, as any and all unused equipment would be kept in the adjacent preparation room.

3) Library

Floor area for the existing library is insufficient compared to the total number of students in TSMC, especially reading and/or self-study space. Therefore, it is planned to provide sufficient number of the reading and/or self-study tables in addition to bookshelves, as providing sufficient reading and/or self-study space in the library is quite important.

It is planned to provide closed book storage with hand-operated integrated bookshelves, in order to protect damageable and precious books, as those books tend to be easily damaged due to humid and dust in the climate of Cambodia.

Furthermore, a reference room of which shall be enabled to equip with computer(s) in the future and the necessary piping work for the wiring in the future giving a consideration to the future Internet access.

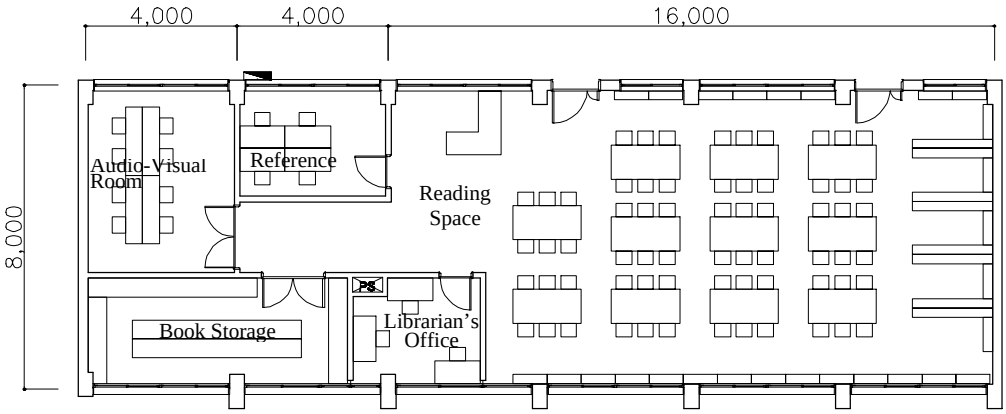

Fig. 2-3 Floor Plan for Library

(6) Necessary Rooms and Floor Area

Summary of the necessary rooms and floor area for each room which was prepared based on the results of the discussions held with the Cambodian side during the Basic Design Study is as shown herein below.

Table 2-8 Necessary Rooms and Floor Area

Name of Room	Requested by Cambodia				Analysis by JICA Project Team				Planned by Basic Design Study Team						Remarks
	No. of Students	No. of Rooms	Room Area	Area/ Student	No. of Students	No. of Rooms	Room Area	Area/ Student	No. of Students	No. of Rooms	Room Area	Area/ Student	Desk	Chair	
1. Nursing Course															
Practical Training Room	20	6	60m2	3.00	40	3	112m2	2.80	40	3	84m2	2.10	-	30	Existing Classrm Bldg.
Classroom	40	9	64m2	1.60	40	9	88m2	2.20	40	9	70m2	1.75	180	360	Existing Classrm Bldg.
Staff Room	17	1	77m2	4.53	10	1	44m2	4.40	10	1	48m2	4.80	-	-	Existing Classrm Bldg.
2. Physiotherapy Course															
Practical Training Room	40	2	74m2	1.85	40	1	* not specified		40	1	160m2	4.00	-	-	
Classroom	40	3	64m2	1.60	40	3	88m2	2.20	40	3	80m2	2.00	60	120	
Staff Room	4	1	28m2	7.00	4	1	20m2	5.00	4	1	30m2	7.50	-	-	
3. Lab. Technology Course															
General Laboratory		* not requested			20	1	96m2	4.80	40	1	80m2	2.00	20	40	
Biochem/ Hemato Lab	20	1	74m2	3.70	20	1	112m2	5.60	20	1	100m2	5.00	-	20	
Bacterio/ Parasito Lab	20	1	74m2	3.70	20	1	112m2	5.60	20	1	100m2	5.00	-	20	
Preparation Room		1				1	48m2			1	40m2		-	-	
Classroom	40	2	74m2	1.85	40	3	88m2	2.20	40	2	80m2	2.00	40	80	
Staff Room	5	1	35m2	7.20	10	1	44m2	4.40	8	1	30m2	3.75	-	-	
4. Midwifery Course															
Practical Training Room	20	2	60m2		20	1	60m2	3.00	20	1	64m2	3.20	-	10	
Classroom	20	1	74m2		20	1	44m2	2.20	20	1	40m2	2.00	10	20	
Staff Room	5	1	35m2		10	1	44m2	4.40	7	1	40m2	5.71	-	-	
5. X-Ray Technology Course															
General Laboratory					20	1	80m2	4.00	20	1	64m2	4.00	-	20	
Maintenance Workshop					20	1	50m2	2.50	20	1	48m2	2.40	-	20	
X-ray Room					10	2	40m2	4.00	10	2	30m2	3.00	-	-	
Control Room					10	2	15m2	1.50	20	1	30m2	1.50	-	-	
Dark Room					20	1	80m2	4.00	10	1	24m2	2.40	-	-	
Classroom					20	3	44m2	2.20	20	3	40m2	2.00	30	60	
Staff Room						1	* not specified		6	1	40m2	6.67	-		
6. Others															
Special Course Classroom	30	3	40m2	1.33					30	3	48m2	1.60	90	90	
Short-Term Course CR	30	1	40m2	1.33					20	3	35m2	1.75	60	60	Existing Adm. Bldg.
Library	90	1	171m2	1.90					66	1	130m2	1.97	66	80	
Reference Room, Book Storage, etc.											62m2		-	-	

Notes:

1. Floor area for laboratory at STEPSAM is 114m^2, i.e. 2.32m^2/student (number of student: 48).
2. Floor area for mathematics classroom at STEPSAM is 86m^2, i.e. 2.15m^2/student (number of student: 40).
3. Floor area for general classroom and practical training room for technical school in Japan are usually in the range of 1.8 – 2.2m^2/student and 2.6 – 6.3m^2/student, respectively.

Table 2-9 Summary of Floor Area

Work	Name of Building	Name of Course/ Zone	Name of Room	Floor Area (m2)		Number of Room	Remarks
				Each Room	Total		
New Construction Work	**Main Building**	Administration	Director	54.07		1	Incl. Storage
			Secretary	14.90		1	
			Deputy Directors	57.32		2	
			Administration	60.00		1	
			Accounting Office	29.80		1	
			Technical Office	60.00		1	
			Meeting Room	156.16		2	
			Storage	65.67	497.92		
		X-ray Technology Course	General Classroom	120.00		3	
			Control Room	30.00		1	
			X-ray Room	60.00		2	
			Dark Room	30.00		1	
			Maintenance Workshop	48.60		1	
			General Laboratory	64.40		1	
			Staff Room	40.00		1	
			Storage	5.19	398.19		
		Laboratory Technology Course	General Classroom	160.00		2	
			General Laboratory	81.71		1	
			Clinical Laboratory	136.64		2	
			Preparation Room	40.00		1	* Sterilizing Room
			Staff Room	30.00		1	
			Visiting Lecturers	22.50		1	
			Changing Room	30.48		2	* Male and Female
			Storage	7.50	508.83		
		Midwifery Course	General Classroom	39.44		1	
			Practical Training	64.00		1	
			Staff Room	40.64		1	
			Storage	10.00	154.08		
		Physiotherapy Course	General Classroom	240.00		3	80m2×3 Rooms
			Practical Training	145.64		1	
			Staff Room	30.00		1	
			Storage	15.00	430.64		
		Special Program	General Classroom	144.64		3	
			Storage	20.40	165.04		
		Others	Dining Hall	127.56		1	
			Kitchen	57.29		1	Rest room, storage, etc.
			Sundry Shop	28.02		1	
			JICA Project Office	81.71		1	Meeting room, etc.
			Library	193.20		1	Librarians' office, etc.
			Pantry	19.02		2	
			Electrical/Generator Room	47.92		1	
			Pump Room	16.00		1	
			Common Space	1,314.95	1,885.67		Corridor, toilet, etc.
	Total Floor Area for New Construction				**4,040.37**		
Renovation Work	**Nursing Course Building**	Nursing Course	General Classroom	630.00		9	
			Practical Training	252.00		3	
			Preparation Room	84.00		3	
			Staff Room	48.00		1	
			Visiting Lecturer	28.00		1	
			Changing Room	48.00	1,090.00	2	* Male and Female
		Others	Infirmary	42.00		1	
			Counselling	42.00		1	
			Storage	62.00			
			Common Space	660.21	806.21		Corridor, toilet, etc.
		Sub-total (1)			1,896.21		
	Seminar House	Short Program	Seminar Room	105.84		3	
			Training Room	93.24		1	Incl. Storage
			Storage	17.64	216.72		
		Others	Students Association	35.28		1	
			Continuing Education	35.28		1	
			Teaching Materials	35.28		1	
			Nightwatchmen	17.64		1	
			Bookshop	35.28		1	Incl. Storage
			Common Space	133.56	292.32		Corridor, toilet, storage, etc.
		Sub-total (2)			509.04		
	Toilet Building	Toilet	Male Toilet	11.70			
			Female Toilet	15.30			
		Sub-total (3)			27.00		
	Total Floor Area for Renovation Work				**2,432.25**		

Grand Total	**6,472.62**

***** Except for the rooms at administration zone, all necessary furniture such as desks, chairs, bookshelves, etc would be provided by the Project.

2-2-2-2 Policy for Equipment Plan

(1) Acquisition of Basic Medical Knowledge

It is essential for health workers or co-medicals to understand human body structure and function. And, to learn anatomy and physiology, various kinds of model of human body, organs, bone structure and so on are important in the on-going courses for nurses, midwives, laboratory technicians, physiotherapist and newly planned X-ray technicians.

(2) Acquisition of Specialized Knowledge and Skill

To learn efficiently and effectively the specialized knowledge and skill of each course, various kinds of hands-on practice equipment such as microscopes for hematological or bacteriological training in the clinical laboratories for the Laboratory Technical Course and beds and simulators for students training in the Nursing Course are indispensable. Thus, plan is made so that hematological clinical laboratory and bacteriological clinical laboratory are equipped with approximately 10 microscopes respectively.

(3) Teaching Materials Production and Audio-visual Equipment

There are only limited textbooks and reference books written in Khmer in Cambodia. Therefore, devices or equipment to produce teaching materials and to present them to students in an effective manner during lectures are useful in improving the efficiency of education. Therefore, equipment planning is made so that high quality teaching materials can be created and presented by using recent digital technology such as digital cameras and computers.

(4) Equipment for Nursing / Midwifery Courses

In the Application Form for Japan's Grant Aid Assistance submitted by GOC to GOJ, only the equipment for X-ray Technology Course, Laboratory Technology Course, Physiotherapy Course and the equipment for teaching materials production and presentation were included. And, no equipment for Nursing Course and Midwifery Course was requested. Therefore, it needs to be addressed and confirmed considering the plan of the Technical Cooperation Project, existing equipment, other donors' activities and so forth.

(5) Equipment for X-ray Technology Course

Equipment plan for the newly planned X-ray Technology Course is to be made so that the current problems encountered with X-ray equipment operating in medical and health care institutions in Cambodia can be improved as much as possible through the education of the X-ray technology at

TSMC, and giving a consideration to the future plan proposed by the Technical Cooperation Project as well as the proposed annual intake for the Course. Also, CPA, which is a guideline for Referral Hospitals in Cambodia, is to be considered for equipment planning.

(6) Equipment for Physiological Function Tests

Ultrasound diagnostic equipment was included in the original list of requested equipment for X-ray Technology Course. It is generally recognized that the ultrasound diagnostic equipment has become increasingly important equipment thanks to minimal adverse effects as compared to the X-ray equipment, which uses ionizing radiation. However, the general trend is to train specialists in the operation of ultrasound equipment, such as the ultrasonographer. Since the equipment is used at the departments of internal medicine and/or OB/GYN in most hospitals, it is needed to confirm whether or not this new imaging field should be included in the X-ray Technology Course.

Although an electrocardiograph (ECG) was also included in the original list of requested equipment for X-ray Technology Course, the necessity of this equipment has to be investigated more closely from the viewpoint of curriculum and educational purposes, because the clinical technologist usually operates such equipment as part of physiological tests.

(7) Collaboration with Technical Cooperation Project and Architectural and Utility Plan

The equipment plan has to be collaborated with the Technical Cooperation Project. Therefore, the original list of requested equipment in the Application for Japan's Grant Aid Assistance needs a major modification in order to coordinate with the future plan being made by the on-going Technical Cooperation Project. Furthermore, equipment plan has to be harmonized with architectural and utility plan for the Project. And, planned X-ray diagnostic equipment and film processor for new X-ray Technology Course, in particular, requires radiation-protected wall, door and window against radiation hazards as well as supply of electricity and water. Those facilities will be provided in coordination with the architectural and utility plans.

2-2-2-3 Site Layout Plan

The site layout plan for the Project was based on the analysis of the entire composition of the facility, giving full consideration to the site conditions of TSMC, such as the natural conditions, the condition of the existing facilities and the surrounding area. Results of the physical inspection of the existing facilities are also considered for the new site layout plan. In overall, the new site layout is planned on the basis of the following policies:

(1) Considering the existing building layout, it is planned to use the existing gate located at south-west side of the site along Trunk Road No. 271 for main approach and the other existing

gate located at north-west side of the site along Trunk Road No. 187 for service approach, although it has to be relocated.

(2) It is planned to provide vehicle traffic flow and parking area around garden court, giving consideration to easy flow of the vehicles within the site.

(3) Zoning plan for each necessary room shall be made considering characteristic of each available course and other departments, and layout plan for all the necessary rooms shall be made so as to enable cooperation and easy access between each zone.

(4) The existing classroom building shall be renovated for the sole use of Nursing Course as "Nursing Course Building" considering the kind of the necessary rooms and scale thereof.

(5) All necessary rooms for other than Nursing Course i.e. Physiotherapy Course, Laboratory Technology Course, Midwifery Course and X-ray Technology Course shall be housed in the new building which shall be built at where the existing storage building currently occupies. And, the connecting corridor shall be provided between the new building and the existing classroom building so that the both buildings for the educational zone would function as one facility.

(6) Classrooms for Special Course and meeting rooms together with various necessary rooms for administration department and library shall also be housed in the new building so as to let the said new building function as "Main Building" in TSMC so that the education and training for each course would effectively be conducted.

(7) Existing administration building shall be renovated as "Seminar House" to house seminar rooms for Short Course, etc., and consequently, garden court would softly be surrounded with education related facilities of Main Block, Nursing Course Block and Continuing Education Block with a sense of unity.

(8) Existing dormitory is currently being used as classrooms for short course and special course due to the shortage of classroom, in the other words; dormitory is currently not available for the students. However, the said existing dormitory shall be used for original purpose, since sufficient classrooms would be provided by the Project.

(9) The site layout of the facilities shall be designed with consideration of the climate in Cambodia, in order to incorporate good ventilation and natural lighting throughout the year. Sufficient open area at the south of the garden court shall be provided in order to secure appropriate ventilation environment, as wind blows from the direction of between south-west and south-east throughout the year in Phnom Penh.

2-2-2-4 Architectural Designs

(1) Floor Plan

In preparation of floor plan, the calculated floor area for each necessary room and function thereof and zoning plan of which was reviewed and studied for the preparation of the aforementioned site layout plan are considered. And, each facility is planned on the basis of the following criteria:

1) Floor Plan for each building

a) Main Building (New Construction)

Main Block shall be a 3-story building in order to layout all the allocated zones effectively within the limited space of the project site. Relationship of floor-to-floor zoning plan shall be as shown in Fig. 2-4 through Fig. 2-6.

Administration zone having staff rooms and various offices necessary for the administration and management of the school shall be placed at south-end of the Main Block on the ground and first floors. Common meeting zone shall be placed directly above the administration zone on the second floor so as to enable to provide easy access and flow between the administration zone and common meeting zone.

X-ray technology course zone shall be placed on the ground floor considering the safety at the time of hauling of the mobile-type X-ray equipment. Zone for each course shall compactly be grouped in order to heighten convenience of the facilities and at the same time to minimize the flow distance and the scale of the building consequently.

b) Nursing Course Building (Renovation)

Each grade of Nursing Course shall be allocated to one floor thus whole building shall become Nursing Course zone. The Main Block from Nursing Course Block can easily be accessed through connecting corridor so that the Nursing Course students can easily access to the library, dining hall, administration offices, etc housed in the Main Block. And, students at the Main Block can easily access to the counseling room and infirmary housed in the Nursing Course Block.

c) Seminar House (Renovation)

The existing administration building shall be renovated for the sole use of continuing education zone having seminar rooms for Short Course Program, which attract many participants from the outside of TSMC. As the activities in this zone would be quite

different from other courses available in TSMC, no connecting corridor would be provided.

d) Toilet Building (Renovation)

The existing toilet building located in the vicinity of the existing administration building shall be renovated as common toilet for the visitors in conformity with other renovation work

2) Layout of Classroom, Practical Training Room and Library shall be carefully reviewed considering coordination with equipment planning, although the standardized floor plans would be prepared as described in **Section 2-2-2-1**.

3) It shall be planned to aim to reduce construction costs by putting the column spacing in order and coordinating the above-mentioned standardized floor plans with standard structural dimensions in Cambodia.

4) It shall be planned to secure comfortable room environment with maximum use of natural lighting and ventilation giving consideration to the climate in the project site.

Table 2-10 Facilities and Zoning

Facilities	Type	Zones / Rooms
Main Building	New Construction	Administration, Project Office Physiotherapy, Lab Technology, Midwifery, X-ray Technology, Special Program Library, Dining Room, Meeting Room
Nursing Course Building	Renovation	Nursing Infirmary, Counseling Room
Seminar House	Renovation	In-Service Training Student Association
Toilet Building	Renovation	Toilet

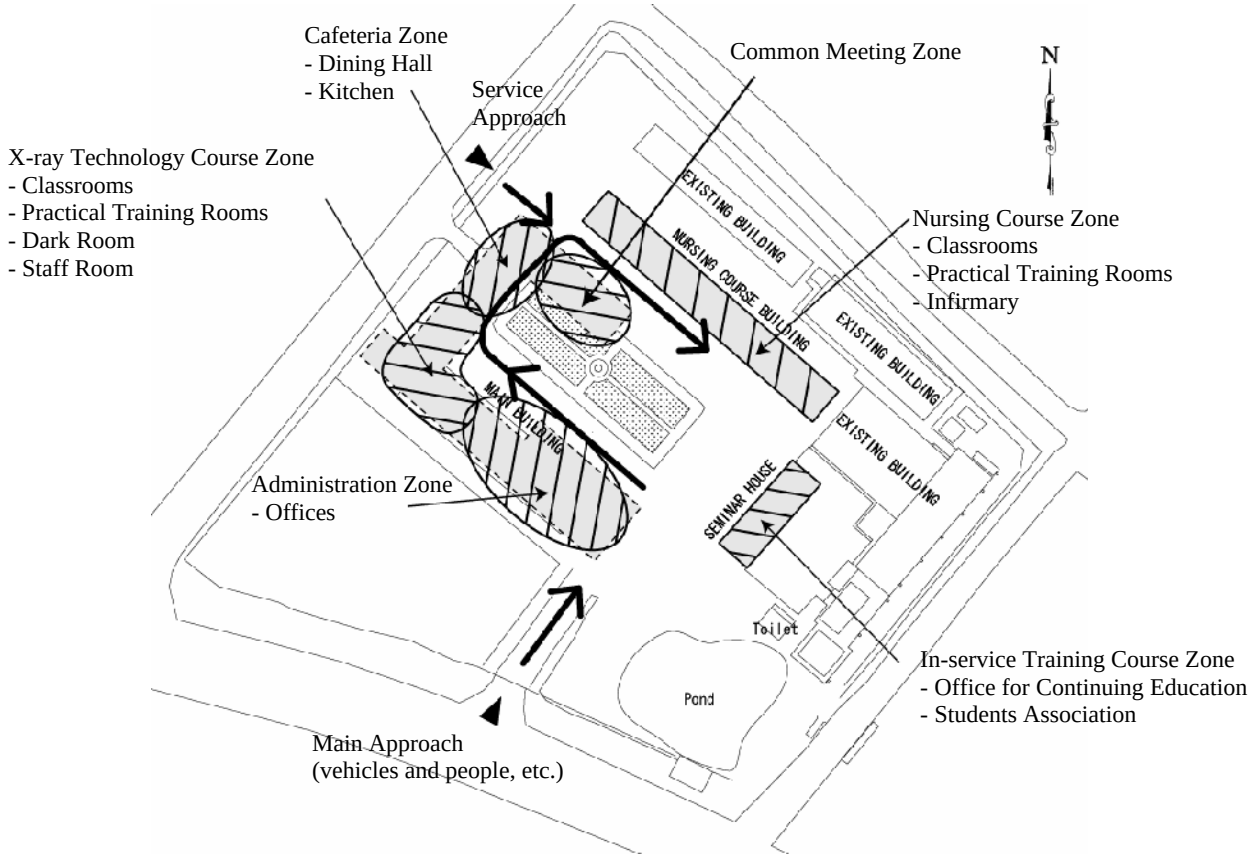

Fig. 2-4 Ground Floor Zoning

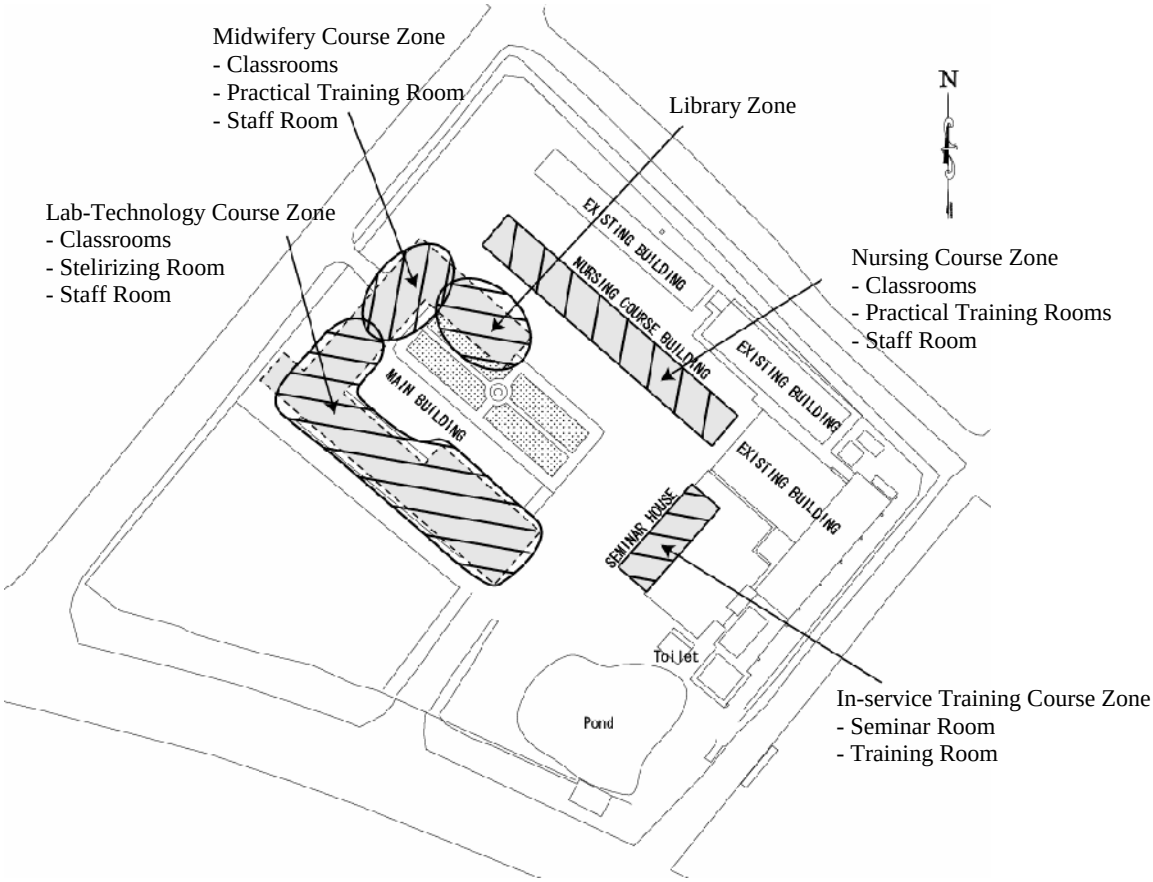

Fig. 2-5 First Floor Zoning

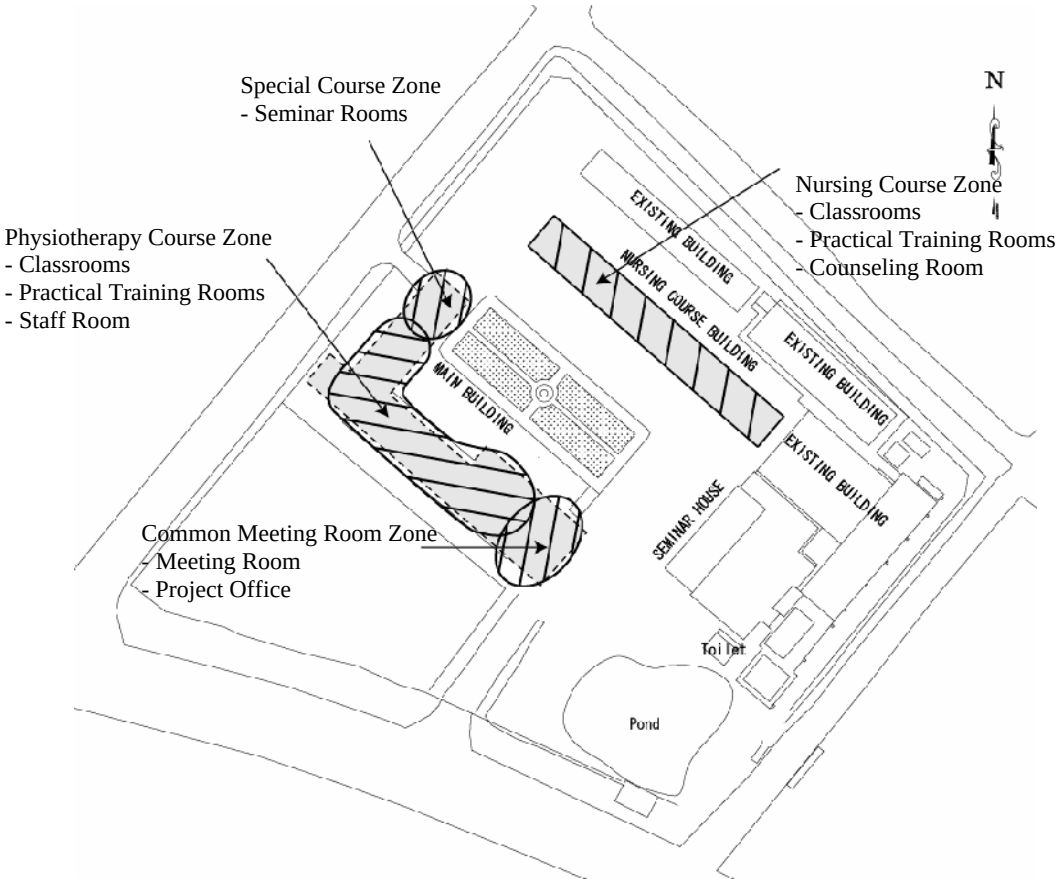

Fig. 2-6 Second Floor Zoning

(2) Cross-Sectional Plan

Cambodia is located in the temperate monsoon zone and, therefore, it is hot and humid. Consequently, it is the essential issue for the building design to secure the natural ventilation and to mitigate severe sunlight. For planning of cross-section of the building, the following policies are considered:

1) The site ground level and floor heights of the existing buildings shall be taken into consideration in order to determine the floor level and cross section of the new building i.e. Main Building, giving considerations to the topographic conditions of the project site.

2) The level of the ground floor of the new building i.e. Main Building having X-ray equipment to be installed shall be raised i.e. 600mm above designed ground level in order to prevent water infiltration and radiant heat from the ground. Furthermore, the ground floor level of the machine room and pump room shall be raised further in order to avoid the danger of the equipment being submerged.

3) The roof shall be adequately sloped to provide speedy discharge of the rainfall. And, at the same time, insulation effects of the roof space will reduce the total heat load of the building.

4) Deep eaves and canopies and louvers shall be provided to protect rooms from severe direct sunlight and intense rainfall.

5) Adequate window openings shall be designed so as to facilitate natural room ventilation and to provide balanced natural lighting, and also to reduce the running cost for the electrical lighting and equipment.

6) Harmonization of the environment of the surrounding area and the existing facilities within the project site shall be considered.

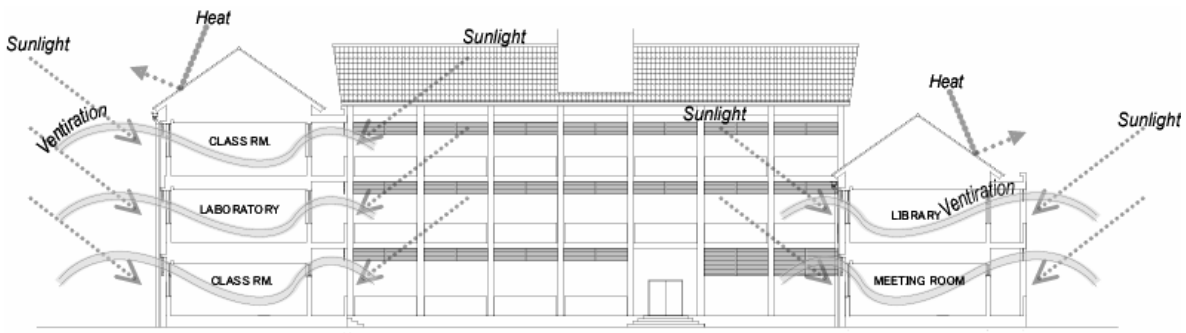

Fig. 2-7 Cross-Sectional Elevation

(3) Cost Reducing Measures

Various cost reduction factors such as cost performance, maintenance cost, etc shall be considered on the basis of the following policies in the course of design works for the new facilities and renovation works. And, at the same time, it shall be considered that the reduction of the initial cost should not increase the maintenance cost.

1) The overall size of the facility is rationalized so as to enhance the utilization rate of the rooms and to promote the effective use of room layout, utilities and equipment.

2) The standardization of space shall be considered, giving full consideration to economical column spacing and the basic module of each room in Cambodia

3) In principle, natural ventilation and lighting shall be applied as practical as possible by contriving floor plan and cross-sectional plan, and air-conditioning and mechanical ventilation and artificial lighting shall be minimized to reduce maintenance costs as well as the initial cost.

4) Construction equipment and materials shall be procured locally as practical as possible and local conventional construction method shall be effectively used so as to reduce the costs for construction and maintenance and so as to make the most of the local skills and technologies.

5) In the long-term view of the Project, together with the consideration of the maintenance costs of the facilities, the finishing materials of which would be easy to maintain shall be selected as practical as possible considering its cost performance.

2-2-2-5 Structural Plan

(1) Basic Policy

The structural plan for the Project should be formulated after a full review of the existing site conditions and considering the results of the soil investigation. The structure shall be designed to prevent serious defects such as cracks caused by structural member deflection and ground settlement, etc. Additionally, the building shall have sufficient factor of safety and to have durability against earthquakes, strong winds, etc. Consideration should also be given to local construction methods, materials and to facilitate maintenance.

(2) Standard for Structural Design

The building code of Cambodia is improving its local original standards. Generally, the construction standards follow the Building Standards Law of Japan, and the analysis method and design of structure shall refer to the structure design standard of the Architectural Institute of Japan

(AIJ) as required. In addition, the material standards shall follow the Japanese Industrial Standards (JIS), the American Society For Testing and Materials (ASTM) and British Standards (BS).

(3) Construction Method and Material

1) The superstructure is to be reinforced concrete and the walls are of brick, which are economical and widely used materials in Cambodia. Although the walls are based on brick structure, the horizontal rigidity of a building is increased by reinforced concrete walls, which are superficially arranged to provide sufficient lateral stability. And, although the superstructure up to roof girders shall be reinforced concrete, some reinforced concrete roof slabs shall also be provided appropriately so as to enhance horizontal rigidity. In Cambodia, in order to raise sound insulation and air tightness, the outer walls are built with double brick masonry and partition walls are built with single brick masonry.

2) There are three ready-mixed concrete plants in Phnom Penh city and the products from two plants (Thai and Chinese managed) has been used for Japan's Grant Aid projects without any problems reported in the past. As for the reinforcing steels bars, the products that are made in Thailand, Vietnam and China are available in Phnom. And, except the products made in China, mill certificates (mill sheets) complied with JIS, ASTM, BS, etc can easily be obtained.

3) As for the steel roof trusses, it is impossible to procure in Cambodia as no one can provide necessary shop drawings and manufacture accordingly. Therefore, it is planned to procure from neighboring countries such as Thailand, Malaysia, Singapore, Vietnam, etc., and transported to and assembled in Cambodia.

(4) Soil Conditions and Foundation Design

The results of the soil investigations indicate that sub-strata from ground level to a depth of 1.50 meters are topsoil, the layers from 1.50m to 7.00m are mixtures of silty clay and clay (N value is 4～11), the layers from 7.00m to 10.50m are sand (N value is 17～31), the layers from 10.50m to 22.50m are mixtures of sand and clay, and the layers more or over 22.50m are solid sand and clay (N value is 31～95). In order to design a three-story building, it is assumed that the foundation will require friction piles which support facilitates over sandy clay (N value is 20 over) at the depth below 13.00m from ground. And, it is planned to use PC piles with pneumatic hammer method, as the PC piles have been proved to be safe in the use of the other Japan's Grant Aid projects in the past.

From the result of soil investigation, it is assumed that allowable design pile load would be around 460kN (square pile 350x350, pile depth 13.0m) or 555kN (square pile 400x400, pile depth 13.0m). However, the detail of the pile foundation shall be finally determined upon completion of the final design of the superstructure.

(5) Earthquake-resistant Design

Although there is no record of earthquake in Cambodia, a base shear coefficient adopted for the Project shall be a half of the value set in the Building Standards Law of Japan i.e. (Co=0.1), considering similar Japan's Grant Aid projects in neighboring countries as for reference.

(6) Wind-resistant Design

In wind-resistant design, the calculation shall be made based on Japanese Standards, and the wind speed is assumed as 30 m/sec.

(7) Materials

The structural materials to be used for the Project is shown in Table 2-11 herein below:

Table 2-11 Specification of Structural Materials

Concrete	From footing to first floor	Concrete strength 21N/mm^2*
	From first floor Column and Wall to Roof	Concrete strength 24N/mm^2*
Reinforcement	Round steel bar	ϕ6-ϕ9
	Deformed bar SD295A	D10-D16
	Deformed bar SD345	D19-D25
Steel	Shape steel, Steel plate	SS400, SSC400

*Note: Minimum compressive strength by cylinder test @ 28days

2-2-2-6 Utility Plan

It should be considered that this facility is for the Medical Care School. Facility planning and equipment planning should be coordinated so that each facility, such as laboratory, workshop and so on, can be operated effectively. Consideration should also be given to the condition of existing infrastructure (electric power, water supply and drainage, etc.). Most importantly, operational and maintenance system costs need to be considered in regard to economic compatibility.

(1) Basic Concept

1) The following items need to be considered for the utility plan.

   a) Building planning should consider the number of persons using the facility based on the educational curriculum. It is important that the practical training room reviews the demonstration & practice educational experiments, which are likely to be conducted. These can then be coordinated with facility and equipment planning for effective use of facilities.

   b) As there will be many demonstrations & practice with educational experiment and equipment, consideration should be given to the consistency and/or interface with facility and equipment plans and reduce problems with proper piping and electricity distribution.

2) In order to clarify the scope of the work to be borne by the Japanese and Cambodian project participants, the facility plan should be prepared so that existing facilities at the Project site are not affected. New facilities for the Project should be independent of the existing facilities. In addition, the function of existing facilities and new facilities to be built by the Project should be clarified. Most importantly, new facilities should function together with existing facilities.

3) From the viewpoint of easy procurement of spare parts, easy facility maintenance and repair, and easy facility operation and management, equipment and materials for the Project should be locally available products.

4) The codes and standards used for materials, design, etc., should basically be relevant codes and standards in Cambodia. If there are no applicable codes and standards in Cambodia, other internationally recognized codes and standards should be applied.

5) As low utility costs are very important for facility maintenance and operation, the facility plan should take into consideration energy saving measures.

(2) Water Supply and Sewerage System

1) Water supply system

   The existing water supply system for TSMC comes from PPWSA (Phnom Penh Water Authority) city water main. We are planning to provide a new water receiver tank for the new Main Building. New water supply piping will branch from the existing pipeline at the point of the existing water meter. The new water supply system will be composed of a water receiver tank made from FRP panels, lift pumps and an elevated water tank. The water will

be distributed to sanitary fixtures, kitchen, etc in the new Main Building and the renovated building. The water supply system will also distribute irrigation water for landscape. On the other hand, we plan to keep the existing water supply system as it is.

The capacity of water receiver tank will be equal to half the amount of one day's water consumption requirement.

Estimated water demand per day

Occupants;	Full-time Staffs	59 persons
	Part-time Staffs	25 persons
	Students	660 persons
	Total	744 persons
Unit water consumption;	Staff;	100 liters/person/day
	Student and Visitor;	70 liters/person/day

Water demand is calculated based on the occupancy and the above unit water consumption rate as follows:

Staffs	84 persons	× 100 liters/person/day	=	8,400 liters/day
Students	660 persons	× 70 liters/person/day	=	46,200 liters/day
	Total			54,600 liters/day

Irrigation water for the court yard and the rest of the project site is additional to the above figure:

5mm/day × 1,200m^2 = 6,000 liters/day

Total flushing water demand; 54,600 liters/day＋6,000 liters/day=60,600 liters/day

→ 61m^3/day

2) Sewerage System

Considering an environmental aspect of TSMC as a whole, it is planned to provide two sewerage water treatment plants (STPs); one for new Main Building and Nursing Course Building and another one for Seminar House, Toilet Building and other existing buildings. The wastewater generated from TSMC will be treated by the STP, and then be discharged to the existing sewage canal surrounding the compound of TSMC. According to the requirements of Ministry of Environment, design quality of effluent water from the STP is set to be less than BOD (Biological Oxygen Demand) 80ppm so as to prevent the adjacent environment from pollution. The design flow rate of the STP is planned as follows;

Capacity of the STP-1;	Quality of treated water;	Less than BOD 80ppm
	Design Flow Rate;	3.8m^3/day

Capacity of the STP-2; Quality of treated water; Less than BOD 80ppm
Design Flow Rate; $20m^3$/day

Chemical waste generated from experimental apparatus in laboratories should be collected at laboratory sinks. And, wastewater from X-ray film developing equipment should also be collected and not disposed of in the STP.

Rainwater from the buildings and pavement will be collected and be disappeared by soaking into the soil as much as possible and/or be collected and discharged to the existing sewage canal.

3) Plumbing Fixtures

Most of the water closets equipped in the existing TSMC are Asian type. But ones for the staff are Western type. In regard to urinals, Cambodia side requested Muslim type. Therefore we are planning to provide TSMC with both Western type closets with flush valve for staff, Asian type ones for student and Muslim type urinals.

4) Hot Water Supply System

We were requested to provide hot water supply system in Nursing Practical Training Room and Midwifery Practical Training Room. It is planned to install electric water heater in each room to supply hot water.

5) Liquefied Petroleum Gas (LPG)

It is planned to provide LPG central supply system for kitchen equipment.

6) Fire Fighting Facilities

In order to provide, protection for TSMC against fire, indoor and outdoor hydrant system as well as fire extinguishers shall be provided. The hydrant system will be installed so as to protect all the existing facilities at TSMC and in accordance with the Japanese fire code since Cambodian fire code is not officially established yet.

7) Kitchen Equipment

Kitchen equipment required mainly for cooking local foods of approximately 400 meals per day shall be provided for the kitchen planned in the new Main Building.

(3) Air conditioning and Ventilation Work

1) Air-conditioning System

Phnom Penh City is located near the equator at latitude of 11° north and altitude of approximately 11 meters above sea level. The climate is hot and humid throughout the year. According to the air conditioning design standard for ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc.), the outdoor design condition should be as follows,

Outdoor: Dry Bulb 36°C, Wet Bulb 28°C, Daily Range 11°C
(ASHRAE Fundamentals 1997: at Phnom Penh)

In light of using the existing buildings, we are planning to install air conditioning system (A/C system) in the following rooms; X-ray Room, X-ray Operation Room, Darkroom, Laboratory, Library, staff room, and Administration Office so as to maintain appropriate indoor condition. Since other rooms could obtain natural ventilation and effective sunshade, they won't be provided with A/C system. Split type air conditioners will be used for individual type air conditioning system.

2) Ventilation System

We are planning to provide pantry, lavatories, X-ray Room, X-ray Operation Room, Darkroom, Laboratory, electrical room and pump rooms with mechanical ventilation systems to eliminate odor, heat and humidity. According to the Japanese standard of the Ministry of Land, Infrastructure and Transport and the ASHRAE standard, the recommended standard of mechanical ventilation is shown in Table 2-11,

Table 2-12 Design Standard of Mechanical Ventilation

Room	Method of Ventilation	Unit Air Flow Rate	Remarks
Storage	Exhaust only	5 changes/hour	
X-ray room, Control room	Exhaust and Supply	5 changes/hour	
Office, Training room	Exhaust or Supply only	5 changes/hour	
Toilet	Exhaust only	10 changes/hour	
Kitchen	Exhaust only	10 changes/hour	Depend on gas consumption
Pump room, Electrical/Generator room	Exhaust only	5 changes/hour	
Laboratory	Exhaust and Supply	5 changes/hour	

(4) Electrical Works

1) Power Supply System

In the existing TSMC, a low voltage power supply line (3ϕ 4W, 380V/220V) is led-in by the Electricite de Cambodge (EDC). The low voltage power is distributed from the existing distribution panel room to all facilities. Based on the site survey and discussions with EDC through the Basic Design Study, we concluded to change the distribution point to the new building. Thereafter, EDC accepted to newly distribute low voltage power to TSMC from the existing substation near TSMC and to install a demand meter for TSMC.

Furthermore, it was confirmed that Cambodian side should be responsible for the installation work of this low voltage power cable from the EDC's substation to watt-hour meter installed in the compound of TSMC.

Table 2-13 The Estimated Power Load

Description	Load Density (VA/m^2)	Floor Area (m^2)	Total Load (KVA)	Remarks
Lighting and Small Appliance For the Existing Facilities	30	4,500	135	
Lighting and Small Appliance For the new Facilities	45	4,000	180	
Air conditioning Equipment	250	1,050	312	
X-ray Equipment	30 KVA/set	1 set	30	
Plumbing Equipment			10	
Total			667	

Thus, the estimated power load is approximately 667 KVA.

Assuming that demand factor is 35%, the estimated power demand is calculated as follow,

$$667KVA \quad x \quad 0.35 \quad = \quad 233KVA \rightarrow \quad 250KVA$$

Based on the result of discussions held with the engineers at the EDC and TSMC, the condition of power supply in Phnom Penh by EDC is still not stable. Therefore, we concluded that a stand-by generator should be provided for TSMC. Some non-robust equipment such as computers should be provided individually with Uninterrupted Power Supply units (UPS) by equipment work.

2) Stand-by Generator

The condition of power supply in Phnom Penh by EDC becomes improved. Frequency of power outrage was improving fewer then before. However, power supply by EDC is still not

stable and we have to provide back-up emergency power supply to the hydrant pump in accordance with Fire Code. Though TSMC will keep the generator donated by others, we concluded to provide a new generator since there is not assurance of proper running of the existing generator. We will prepare change over circuits from duty to emergency drive, in order to effectively utilize the stand-by power.

The capacity of the generator is estimated around 60KVA, as back-up emergency power supply only, to the hydrant pump.

A. Type: Indoor package type diesel driven generator
Low noise and radiator cooling system
B. Capacity: 3 Phase 4 Wire 380V/220V 50Hz 60KVA
C. Fuel: Diesel oil (10 hours running)
D. Quantity: 1 (one) number

3) Main Feeder Wiring System

It is planned to distribute the power from the receiving panel in the electrical room to each distribution board. The cabling and power distribution should be as follows;

A. Wiring Method: Cable ladder. Conduit piping
B. Power Distribution Main Feeder: 3ϕ 4W 380V/220V
For lighting and small appliance 1ϕ 2W 220V
For power 3ϕ 3W 380V

4) Lighting System

Every room, entrance hall and corridor will be equipped with fluorescent lamps since it will reduce energy consumption and fluorescent lamps are easy to maintain. The lighting intensity level to be adopted is based on international standards and JIS (Japanese Industrial Standards) as follows;

Table 2-14 Standard of Lighting Intensity Level

Room	Lighting Intensity (lux)
Class room	200
Laboratory, Practical Training room	300
Meeting room, Library	300
Staff room, Administration office	300
Corridor, Stair case	30
Toilet, Storage	30

The X-ray room will be equipped with lighting fixture control switch. Exit lights and emergency light with battery power should be installed at every staircase and corridor.

5) Telephone System

It is planned to provide TSMC with a telephone system including a Private Automatic Branch Exchanger (PABX), 21 extension telephones and necessary cabling work. Through the discussion with the Cambodian side, it was confirmed that the Cambodian side should be responsible for the following items;

a) Application and subscription fee for 10 new telephone trunk lines by Ministry of Post & Telecommunication (MOPT)

b) Expense for the installation of in-coming power line from exterior city source to the Main Distribution Panel to be provided by the Project

6) Public Address System

Public address system will be provided so as to enable to make announcements for students and staff in TSMC. It is planned to equip the speakers in every room and common public areas of the new building, renovated ones and existing ones. An amplifier with a chime machine will be equipped in the administration office of the new Main Building. And we are planning to equip an outdoor type clock on the wall at the penthouse of the new Main Building edifice.

7) LAN（Local Area Network）System

It is planned to provide only embedded conduit pipes in the walls and ceilings for the LAN system. This conduit piping will be useful for connecting the wiring network to operate LAN system in the future.

8) Fire Alarm System

A manual fire alarm system will be provided. Combination panels that consist of an alarm bell, an indicator lamp and a push button in each alarm area will be installed. And, it is also planned to equip the same system for the existing buildings not included for the renovation works. The fire control panel is to be installed in the administration office of the new Main Building.

9) Lightning Protection System

Lightning protection system will be provided to prevent serious damage to the building structure and electrical facilities. It is planned to install lightning protection system at the new Main Building only.

(5) Garbage and Waste Disposal

The inflammable waste is collected 4 times per month by public organization. It is planned to leave as it is for the Project. As for the medical solid and liquid waste, it is planned to dispose them by teaming up with another medical institutions.

As for the medical wastes created by laboratory practice, etc., it is supposed be burnt and the remains are supposed be buried underground. However, it is not done so all the time, which is not a good practice for the school training co-medicals such as TSMC. And, therefore, it was suggested to dispose such medical wastes in coordination with other medical institutions and was agreed to by TSMC.

2-2-2-7 Construction Plan

(1) Basic Policy

The building material plan shall be formulated based on the following basic policy in consideration of the climatic conditions, local culture, local construction method and materials, construction period and construction cost, etc.

1) The local procurement of construction materials shall be considered to reduce construction costs and shorten the construction period. However, the quality and supply capacity in Cambodia should be confirmed.

2) The maintenance and operational costs shall be reduced by the building design considering the adaptation to the local climate, resistance against climate and the selection of materials that are easy to maintain.

3) Function of Technical School for Medical Care and activity plan in each room should be taken into consideration when the materials are to be selected.

4) Selection and determination of building materials shall be based on the detailed studies of local construction method and procurements.

(2) Selection of Building Material

Building material plan is formulated according to the above-mentioned policy, referring to the analysis of materials used for the similar facilities. Materials for structural works and some finishing works can be procured in Cambodia, however, most of the finishing materials come from neighboring countries such as Thailand.

The policy for selection of materials in regard to the Project is to adopt local materials, which are acceptable in quality and supply in Cambodia, considering harmony with the existing buildings.

The selection of materials for the Project will aim at maximizing the adoption of local construction methods and selection of local materials. In reference to the surveys and studies of materials of existing buildings and similar projects, it is considered that this policy will enable proper selection and procurement of building materials under the scheme of Japan's Grant Aid assistance:

1) Structural Materials

The typical local construction method and materials, which are reinforced concrete for main frames with brick walls, will be adopted for this Project.

2) Exterior Finishing

a) Exterior Walls

Exterior wall finishing planned will be mainly washed-terrazzo. It is necessary to consider the adoption of quality material for easy maintenance and endurance.

In order to avoid the degeneration of paint coating and cracks, the quality of plastering work should be maintained by the careful work. Quality of plaster works and paint works shall be controlled by quality assurance inspections.

b) Roofs

Asbestos-free fiber reinforced cement roofing tile will be adopted for the new building and renovation work which is supported by ridged light weight steel frame roof structure taking into consideration the durability and to avoid sound transmission from heavy rain and heat absorption from strong sunlight and also maintenance. Also the appearance of the roof tile will match the existing buildings and surrounding landscape. For the renovation work, reinforcing and restructuring the roof frame is considered to adopt the above-mentioned roof.

c) Windows and Doors

Windows and doors for renovation and construction works, wooden doors, wooden windows, or jalousies are adopted in consideration to the existing ones.

Ventilation system for TSMC is planned with ceiling mounted fan units and natural ventilation. Therefore, doors and windows with louvers and ventilation blocks are

adopted. And, the security grille will be installed on the windows of each room on 1st floor.

d) Aluminum Louvers

Aluminum louvers are planned to place along the corridors to protect the rooms from direct sunlight and intense rainfall and to incorporate good ventilation and natural lighting throughout the year. Although aluminum louvers are commonly used in Cambodia, the quality and durability should be considered by careful selection.

3) Interior Finishing

a) Floors

Porcelain tile, generally used and available in Cambodia, will be adopted for floor finishing for classrooms and demonstration Rooms.

b) Walls

Painting on mortar base will be adopted as the finishing materials for interior walls. This is generally used in Cambodia and used for the existing facilities. As such, quality of plaster works and paint works shall be controlled during installation as well as for the exterior walls.

c) Ceiling

Suspended ceiling using rock wool acoustic boards will be mainly used. Fiber reinforced cement board is also used for some areas, such as toilet and corridors.

(3) Proposed Major Materials

The criteria for building materials have been analyzed. Based on the results, main materials proposed are as follows:

Table 2-15 Major Finish Materials

New Construction		Main Building						
Structure		Reinforced Concrete Wall: Brick						
Floor Height		4,200mm and 3,800mm						
Exterior Finish	Roof	Roof tile (Asbestos-free Fiber Reinforced Cement Roofing)						
	Plancier	Fiber Reinforced Cement Board, Epoxy Resin Paint						
	Wall	Exterior Wall: Mortar Trowel, Washed Terrazzo, Epoxy Resin Paint Louvers: Aluminum						
	Windows Doors	Aluminum (Float Glass)						
Interior Finish	Room	X-ray Rm.	Classrm.	Library	Prep. Room	Corridor	Toilet	Stairs
	Floor	Mortar bed porcelain tile 300x300 (Non-slip type)	Mortar bed porcelain tile 300x300 (Non-slip type)	Mortar bed porcelain tile 300x300 (Non-slip type)	Mortar bed porcelain tile 300x300 (Non-slip type)	Mortar bed terracotta tile 300x300	Mortar bed porcelain tile 100x100 (Non-slip type)	Mortar bed porcelain tile 300x300 (Non-slip type)
	Wall	Mortar bed Emulsion paint	Mortar bed Emulsion paint	Mortar bed Emulsion paint	Mortar bed Emulsion paint	Mortar bed Acrylic-urethane resin paint	Mortar bed ceramic tile 100x100	Mortar bed Acrylic-urethane resin paint
	Ceiling	Rock-wool Acoustic Board (t=16) Suspension system (T-runner)	Rock-wool Acoustic Board (t=16) Suspension system (T-runner)	Rock-wool Acoustic Board (t=16) Suspension system (T-runner)	Rock-wool Acoustic Board (t=16) Suspension system (T-runner)	Fiber reinforced cement board (t=6) VP (LGS)	Fiber reinforced cement board (t=6) VP (LGS)	Fiber reinforced cement board (t=6) VP (LGS)
Ceiling Height		3,000	3,000	3,000	3,000	3,000	2,400	3,000

Renovation		Nursing Course Building, Seminar House, Toilet Building		
Structure		Reinforced Concrete Wall: Brick		
Floor Height		3,600 mm		
Exterior Finish	Roof	Roof tile (Asbestos-free Fiber Reinforced Cement Roofing)		
	Plancier			
	Wall	Exterior Wall: Mortar Trowel, Washed Terrazzo, Epoxy Resin Paint Louvers: Aluminum		
	Windows Doors	Aluminum (Float Glass)		
Interior Finish	Room	Class Room	Corridor	Toilet
	Floor	Mortar bed porcelain tile 300x300 (Non-slip type)	Mortar bed terracotta tile 300x300	Mortar bed porcelain tile 100x100 (Non-slip type)
	Wall	Mortar bed Emulsion paint (EP)	Mortar bed Acrylic-urethane resin paint	Mortar bed Porcelain tile 100 x 100
	Ceiling	Rock-wool Acoustic Board (t=16) Suspension system (T-runner)	Fiber reinforced cement board (t=6) VP	Fiber reinforced cement board (t=6) Vinyl paint (LGS)
Ceiling Height		2,800	3,000	2,400

2-2-2-8 Equipment Plan

Equipment list with priority attached to the Minutes of Discussions dated 24th of February 2004 was formulated with consideration of the existing equipment owned by each course, the actual situation of equipment in urban and rural health facilities, the supporting plan of other donors, the interview results of JICA Expert, the procurement plan of Technical Cooperation Project and so forth. Also, quantity of each equipment and rough specifications are discussed and drafted. Quantity is planned in accordance with the allocations, to course, to classroom, to practice room, or to a group of 10 students.

There is no visible supporting plan for TSMC, a sole training institution for co-medicals in Cambodia, from major other donors such as WHO, ADB, French Cooperation, and GTZ. Since GOJ has disclosed the possibility of supporting TSMC, there will be no overlapping support plan by the major donors.

(1) Equipment Plan for Existing Courses

The followings are equipment plan for each existing course at TSMC.

1) Nursing / Midwifery Courses

As described, there was no requested equipment for nursing and midwifery courses in the Cambodian Application for Grant Aid. Preliminary Study Report also indicated that the nursing and midwifery courses are rather well equipped with by the support of ADB.

Technical Cooperation Project is also planning to procure some equipment for nurse training that includes patient beds, manikins for nurse training, resuscitation simulators, urethral catheterization simulators and so forth. Considering the advice given by JICA Expert, and avoiding the overlap with existing equipment and planned equipment by other projects, such essential and minimal equipment as injection simulators, infant height and weight scale is planned.

2) Physiotherapy Course

Clinical facilities usually give patients a massage and a muscle strengthening exercise for upper and lower extremities when physiotherapeutic procedure is needed, and thus only little rehabilitation equipment is used. In Calmette Hospital, for instance, two physiotherapists are working in the outpatient department using a simple treatment bed and a magnetic treatment bed. In Sihanouk Hospital, physiotherapists help patient's bending and stretching exercises or give patients a massage on a conventional bed. Physiotherapists also perform a

thermo-therapy using infrared lamp or a neural stimulation therapy using low frequency electric current for paralysis treatment.

Various advanced equipment for rehabilitation are listed as the original list of requested equipment in the Application for Grant Aid. However, it is informed that there are very few urgent equipment in need since some equipment exists already and is planned for procurement through the Technical Cooperation Project.

Thus, a skeleton model and wrist, elbow, and knee joint models are planned in order for physiotherapy course students to facilitate learning fundamental human anatomy and mechanism of joints.

Existing equipment includes two overhead frames for building muscle strength, a number of treatment beds, a posture correction mirror and so on. A body-position-transforming treatment bed, a platform with mat and an exercise (training) mat are planned to procure through Technical Cooperation Project. Since all of those equipment as well as walk training and muscle strength training require ample space at the time of exercise and practice, the physiotherapy equipment plan is coordinated with architectural plan so that optimal space will be assured for the future expandability of practice room.

There is no plan to dispatch a long-term expert at this time in this field but a limited-term expert may be dispatched. And he/she may plan to procure the needed equipment for this course through the Technical Cooperation Project based on his/her experience and revised curriculum.

3) Laboratory Technology Course

Similar to other courses, the Technical Cooperation Project is planning to procure some essential equipment and consumables for the Lab Technology Course. The procurement plan includes sterilizer, spectrophotometer, centrifuge, water distiller, incubator, autoclave, pH meter, glassware and so forth. Therefore, equipment plan of this project is formulated to avoid overlapping as much as possible.

As for binocular microscopes, trainings in a hematology and biochemistry laboratory and a bacteriology and parasitology laboratory are conducted using 18 microscopes donated by MSF in around 1990 and 5 microscopes recently-supplied by Cambodian MOH. But due to the fact that the older ones can only be used with outer light source, the quality of microscopic image is not clear enough, which hinders the efficiency of training. In order to ease this

problem, 15 microscopes are planned in this project so that 10 microscopes can be allocated in each room.

(2) Equipment Plan for X-ray Technology Course

Since the establishment of X-ray Technology Course is newly planned, for which curriculum is under formulation, there is no existing equipment that can be used in this new course. It is planned that TSMC will be equipped with X-ray diagnostic system and relevant devices so that students can learn the basic procedures of X-ray imaging, safety aspects of ionizing radiation, the technical aspects of X-ray diagnostic system and so forth. Clinical practice that is not available on real patients at the TSMC will be given in the neighboring medical facilities such as Sihanouk Hospital.

A workshop organized for establishment of new X-ray Technology course at the TSMC was held under auspices of MOH and JICA during Basic Design Study. Participants were radiologists, X-ray technicians, policy makers and other stakeholders from MOH, donors, Calmette Hospital, CENAT, and other hospitals and facilities.

Among many issues pointed out in the workshop, it is noted that current problems are shortage of radiologists and X-ray technicians in number, no formal training given to most of the current operators of X-ray diagnostic system, lack of knowledge regarding radiation safety both in installation and operation of equipment. The preliminary plan of curriculum for X-ray Technology Course at TSMC and the procedure to award certificate to X-ray technician was explained by MOH. According to this plan, the course will be 3 years (not 2 years as originally planned) for newly enrolled students. In-service training will be given to the nurses or medical assistants who have been working as X-ray technicians and there will be a route available for them to obtain a diploma. Further, in order to solve the shortage problem of instructors, financial support to study in Thailand for one year and English study in Cambodia will be planned by MOH as a package.

The formulation of curriculum for X-ray Technology Course and in-service training course is in progress, and a variety of subjects such as Basic anatomy and physiology, Basic X-ray technology, Basic darkroom technology, Patient positioning, Radiation measurement, Radiation protection and so on is being explored. New intake of X-ray Technology Course students (max 20 students) at TSMC will start after the facilities are completed. But the in-service training may start as soon as possible, with clinical hands-on practice at near-by hospitals.

It is informed through interview that health workers who operate X-ray equipment appear to be lacking in knowledge in regard to safety against ionizing radiation. Thus, operators and patients may have been exposed to unnecessary radiation. Therefore, it is of most importance to recruit

competent instructors who can teach basic physics regarding ionizing radiation, radiation measurement, radiation protection and safety and other related basics.

The X-ray Technology Course at TSMC does not have plan to train ultrasonographers or ultrasound technicians, since it is determined in Cambodia that the ultrasound diagnostic equipment is to be operated and images are to be read and diagnosed by medical doctors. An ultrasound diagnostic system, however, is included in the equipment plan from the viewpoint that the equipment is useful to teach body structure and tissue characteristics of organs. The equipment will still require a knowledgeable instructor who is familiar well with human anatomy as well as ultrasound images. Since all health workers including nurses have to understand the body structure and tissue, it is agreed to install the ultrasound diagnostic equipment in the school infirmary.

Electrocardiograph (ECG) is also included in the requested equipment for X-ray Technology Course but neither X-ray Technology Course nor Laboratory Technology Course have plans to train clinical lab technicians who performs such physiological function tests as ECG tests, EEG tests, pulmonary function tests, and ultrasound tests. As for ECG tests in the clinical facilities, it is better that nurses or medical assistants who get on-the-job training carry out the ECG tests under directions of medical doctors and that the ECG reading and diagnosis is done by medical doctor.

In 2003, the MOH developed a guideline for referral hospitals, called Complementary Package of Activities (CPA). The guideline for the highest-level referral hospitals, CPA3, describes the equipment and the basic specifications, which need to be equipped in the referral hospital. In the guideline, both general-purpose X-ray diagnostic system and mobile X-ray system are recommended for CPA3 referral hospitals. Therefore, those two different kinds of X-ray system are planned in this project.

There are many other tools, devices and accessories in the medical X-ray field for the education of the X-ray technology, X-ray system operation, periodical maintenance, and radiation and other parameter measurements. Those devices may be planned when needed through the Technical Cooperation Project.

(3) Common Equipment

There are only limited number of textbooks and technical books written in Khmer. In addition to this situation, it is a transient time when the education of major foreign language in Cambodia has been changing from French to English and it is hard to say that the English textbooks and reference books furnished in libraries are utilized more than expected. Thus, it is of importance for teachers in health worker training to produce teaching materials in Khmer and to use them for presentation in the classroom and/or to distribute resume of lecture to the students.

Most equipment used for production and presentation of teaching materials can be shared among staff of all courses. This equipment includes computers with peripherals, digital cameras, digital video cameras and LCD projectors for presentation at lectures or for production and distribution of résumé of lectures to students. In learning medical science, such pictures as anatomical chart, graphs, figures and tables play an important role. Furthermore, digital camera and digital video camera can be used for recording scenes of hospital practice in order to show the image to students prior to clinical practice. It should be noted that this kind of equipment might be more efficiently managed if teachers of all related courses share the equipment.

(4) Desks, Tables and Chairs

Number of desks, tables and chairs for students and teachers used in classrooms, workshop, offices, staff rooms and a dining room are planned as shown below in accordance with the number of students, teachers and/or other staff planned or estimated.

Table 2-16 Summary of Planned Desks, Tables and Chairs

Location	Desk / Table (unit)	Chair (unit)
Meeting Rooms, etc.	63	126
Staff room, etc.	75	75
Classroom (for teachers)	19	20
Classroom (for students)	340	730
Dining Room	12	96
Workshop / Laboratory	13	48

(5) Major Planned Equipment

Planned major equipment is shown in the following table and the detailed list of planned equipment, its quantity and rough specifications are shown in the APPENDIX-12.

Table 2-17 Summary of Planned Major Equipment

Course	Purpose	Major Equipment
Nursing / Midwifery	Equipment to learn body structure and training simulators to assist delivery and to learn injection	Human anatomical model Human skeleton model Delivery simulator Injection simulator
Physiotherapy	Equipment to replace obsolete ones and to learn basic anatomy and physiology	Wheel chair Skeleton model Joint model
Lab Technology	Equipment to be used in hematology / biochemistry and bacteriology / parasitology	Electronic balance Haematocrit centrifuge Binocular microscope Teaching microscope Deep freezer
X-ray Technology	Equipment requested by CPA3 and to learn principle of X-ray imaging, X-ray imaging system, film processing, basic anatomy and physiology	General X-ray system Mobile X-ray system Automatic film processor Manual film processor Accessories for X-ray system Ultrasound diagnostic system Cranial phantom for X-ray Joint phantom for X-ray
(Common)	Equipment to produce teaching materials and to present in classrooms or meeting rooms	LCD projector Digital video camera Computer Scanner Visual presenter