Ministry of Education, Youth and Sport
Kingdom of Cambodia

Preparatory Survey Report for the Project for the Construction of Teacher Education Colleges in the Kingdom of Cambodia

November, 2017

Japan International Cooperation Agency (JICA)

Mohri, Architect & Associates, Inc.
INTEM Consulting, Inc.

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Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on “the Project for the Construction of Teacher Education Colleges in the Kingdom of Cambodia” and entrust the said survey to the consortium of Mohri, Architect & Associations, Inc. and INTEM Consulting, Inc.

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

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

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

November, 2017

Akiko Kumagai
Director General,
Human Development Department
Japan International Cooperation Agency

Summary

1. Overview of the country

Kingdom of Cambodia has been experiencing the conspicuous economic development in recent years, despite that it had remained as one of the poorest countries in Asia for a long period even after the end of civil war in 1990. The population is around 14.67 million by the government population census conducted in March, 2013. More than 60 % of them are younger than 30, which means that "the population bonus (the status that the ratio of working-age population increase exceeds the rate of total population expansion)" could be expected. The 97.05 % of the population is Khmer and most of them are reverent Buddhist. The country area is 181,000 km^2 and the middle and southern part of the country is the fertile plain belonging to the Mekong river system. Cambodia belongs to the tropical monsoon climate. The rainy season is from June to October and the dry season is from November to May.

The economy of Cambodia maintains a course of stable economic growth at the exceeding 7.0 % of yearly growth rate since 2011[1]. Per capita GDP reached at 1,145USD in 2015[2] and World Bank upgraded Cambodia from lower income country to lower middle income country[3]. The breakdown of the industry based on the ratio of GDP is the agriculture 28.6 %, industry 29.8 % and service 41.5 %[4], although the agriculture sector occupies around 65 % based on the population[5]. Cambodia is aiming at the further economic growth by the introduction of foreign direct investment and planning to eliminate the tariff by 2018 in line with the framework of ASEAN Economic Community established in December, 2015. While the economy is steadily growing, limited opportunity for education and income gap has been left as a bottleneck of the growth.

2. Background and outline of the Project

The modern system of teacher's training in Cambodia started as an irregular short-term training to cope with an overwhelming shortage of teachers during the reconstruction period since 1980s. After that, Provincial Teacher Training Centers (PTTC) and Regional Teacher Training Centers (RTTC) had been gradually established in various areas and the current system of "12+2 year-system", which requires the 2-year teacher training after the completion of higher

[1] Ministry of Foreign Affairs of Japan, "Japan-Cambodia Relations (Basic Data)" (http://www.mofa.go.jp/region/asia-paci/cambodia/data.html)
[2] IMF, World Economic Outlook Database (estimation, in 2015)
[3] World Bank, Cambodia Economic Update; Improving Macroeconomic and Financial Resilience, 2016
[4] World Bank national accounts data (in 2015)
[5] FAO, Food and Agriculture Policy Decision Analysis "Country Fact Sheet on Food and Agriculture Policy Trends, April 2014"

secondary education, was introduced in 1998. Under the system, the number of teacher increased to 88,313 in 2014 from 66,982 in 1998[6], which has significantly contributed to the spread of basic education. In recent years, however, the low quality of basic education caused by the lack of teaching knowledge and practical ability of teaching has been recognized as one of the challenges to be overcome drastically. In this context, the Government of Cambodia committed in the "Cambodia National Development Plan 2014-2018" issued in 2014 to securing the human resources necessary to upgrade Cambodia to a high-middle-income country by 2030. In addition, the Ministry of Education, Youth and Sport (MoEYS) mentioned in the “Education Strategic Plan (2014-2018)” issued in 2014 that teachers are an important factor that affects the quality of education. Moreover, the “Teacher Policy Action Plan (2015-2020)” aims to extend the current two-year teacher training course to four years, and to open Teacher Education Collage (TEC) in Phnom Penh and Battambang by 2018 as a first step.

Japan International Cooperation Agency (JICA) has been implementing technical cooperation in the fields of math and science education, higher education, and vocational training since 2000 and has contributed to the human resource development in Cambodia. Additionally, JICA has made technical input in the process of making significant policies, including the “Teacher Policy (TP) (2013)” and “Teacher Policy Action Plan (TPAP) (2015-2020)”. Against this backdrop, the minister of MoEYS requested JICA to assist in the human resource development for industrialization in the education sector through the establishment of TEC, the strengthening of engineering faculties, and the establishment of technical high schools based on “the Industrial Development Policy (IDP): 2015-2025” in July, 2015. In response to the request, JICA conducted the “Data Collection Survey on Human Resource Development for Industrialisation in the Education Sector in the Kingdom of Cambodia” from February to July in 2016. And also, JICA commenced “The Project for Establishing Foundations for Teacher Education College (E-TEC)” from January 2017.

Based on these backgrounds, the Royal Government of Cambodia requested to the Government of Japan a grant aid project to construct facilities and to procure equipment for Phnom Penh TEC and Battambang TEC, which will be established for contributing to improvement of teachers’ quality in Cambodia.

3. Summary of the survey and contents of the Project

In response to the request, JICA carried out Field Survey I from 12th December, 2016 to 24th January, 2017, Field Survey I-2 from 8th March, 2017 to 17th March, 2017 and Field Survey I-3 from 16th May to 20th May, 2017. Following the analysis in Japan, the survey to explain the draft report of the Project (Field Survey II) was executed from 27th August to 2nd September,

[6] Educational Statistics and Indicators 2015

2017. Based upon the request, the survey results and a series of discussions with the Cambodian side, the Project plan was drawn up as follows;

3-1. Student capacity of a TEC

According to the initial request by the Cambodian side, the student capacity of one TEC is 2,000 including the students of pre-primary course and in-service course. However, such factors were identified in the meeting with the Cambodian side as (1) pre-primary teacher training course is not institutionalized so far, and to make a 4-year course in 2018 is not realistic, (2) in-service teacher training course shall be organized during the long vacation and/or the weekends, therefore facilities specific for conducting the course are not necessary. Thus, this Project covers facilities and equipment just for "primary teacher training" and "lower secondary teacher training". For those courses, the student capacity in one TEC is 1,360 in total for 4 grades. (240 students x 4 years in the primary course and 100 students x 4 years in the lower secondary course.)

3-2. Project sites

This Project will provide facilities and equipment necessary for upgrading the existing 2-year course teacher training centers (PTTC for primary education teacher training and RTTC for lower secondary teacher training) in Phnom Peng and Battambang to the 4-year TECs.

Facilities and equipment for Phnom Penh TEC will be provided in a single site where the existing Phnom Penh PTTC/RTTC is located. On the other, Battambang TEC will have two separate premises a distance of 1.5km apart, which are currently used as the PTTC and RTTC respectively, while the TEC will be operated as an integrated college. As the existing buildings of current Battambang PTTC are rather newly constructed and the area has no space for new construction, the new facility will be constructed only in the current RTTC premise by the Project. The current PTTC will be utilized as the G-1 campus, while the current RTTC will be utilized as the G-2-4 campus.

3-3. Plan for Building Facilities and Equipment

Facilities and equipment covered by the Project is shown in the following table.

Summary of Facilities and Equipment to be provided by the Project

Item	Phnom Penh TEC		Battambang TEC	
Facilities (by function)				
Special lecture room block	(PE[7]) Science lab, Music room, Art room and Preparation room for each		(PE) Science lab, Music room, Art room and Preparation room for each	
	(LSE[8]) Chemistry lab, Biology lab and Preparation room for each		(LSE) Chemistry lab, Biology lab, Music room, Art room and Preparation room for each	
	(PE and LSE) Home economics room, ICT room, Storage and Toilet		(PE and LSE) Home economics room, ICT room, Storage and Toilet	
Academic block	Auditorium, Storage, and Toilet		Auditorium, Lecture room, Research room, Department office, Storage and Toilet	
Administration block	Director's room, Vice director's room, Advisor and secretary room, Admin. Office (admin. and human resource), Admin. Office (finance and planning), Admin. Office (academic, student affairs, relation and job), Archive room, Meeting room, First-aid room, Storage and Toilet		Director's room, Vice director's room, Advisor and secretary room, Admin. Office (admin. and human resource), Admin. Office (finance and planning), Admin. Office (academic, student affairs, relation and job), Archive room, Meeting room, First-aid room, Storage and Toilet	
Library block	Library (incl. Self-study space), ICT room for self-study, Library office, Storage and Toilet		Library (incl. Self-study space), ICT room for self-study, Library office, Storage and Toilet	
Assembly hall	Hall, Stage, Control room, Locker room, Storage and Toilet		Hall, Stage, Control room, Locker room, Storage and Toilet	
Dormitory			Dormitory room, Kitchen, Shower room and Toilet	
Facilities (by building)	PN-1 Special lecture room bldg.	1,709.60 m^2	BRN-1 Special lec./academic bldg.	3,086.40 m^2
	PN-2 Admin. bldg.	2,045.14 m^2	BRN-2 Admin. bldg.	3.026.90 m^2
	PN-3 Library bldg.	1,352.25 m^2	BRN-3 Library bldg.	1,958.02 m^2
	PN-4 Assembly hall	1,661.42 m^2	BRN-4 Assembly hall	1,398.73 m^2
	Others (conn. bridge, etc.)	10.00 m^2	BRN-5 Dormitory bldg.	2,239.45 m^2
			Others (conn. bridge, etc.)	22.80 m^2
Total floor area	6,778.41 m^2		11,732.30 m^2	
Equipment (by function)				
Special lecture room block	(PE) Science lab, Mathematics lab, Social science room, Music room and Art room		(PE) Science lab, Mathematics lab, Social Science room, Music room and Art room	

[7] PE: for Primary Education Course
[8] LSE: for Lower Secondary Education Course

	(LSE) Mathematics lab, Physics lab, Chemistry lab, Biology lab, Earth science lab, Social Science room, Music room and Art room	(LSE) Mathematics lab, Physics lab, Chemistry lab, Biology lab, Earth science lab, Social Science room, Music room and Art room
	(PE and LSE) ICT room, Home economics room, Workshop	(PE and LSE) ICT room, Home economics room, Workshop
Academic block	(Auditorium) Sound equipment, Projector (Lecture rom) Projector (Department office) Computer network system	(Auditorium) Sound equipment, Projector (Lecture rom) Projector (Department office) Computer network system
Administration block	(First-aid room) Equipment for first aid	(First-aid room) Equipment for first aid
Library block	(Library) Computer network system, etc.	(Library) Computer network system, etc.
Assembly hall	Sound equipment, Projector, Sporting equipment, etc.	Sound equipment, Projector, Sporting equipment, etc.
Dormitory		

3-4. Soft component

Initially, the soft component was included in the request of Cambodian side. However, JICA Project named "Establishing Foundations for Teacher Education College : E-TEC) " has been implemented to assist the establishment of TEC from January 2017. In the Project, the instruction for the maintenance and operation of equipment by the procurement company is scheduled to be held. Therefore, it was agreed between Cambodia and Japan sides that the soft component would not be implemented in the Project.

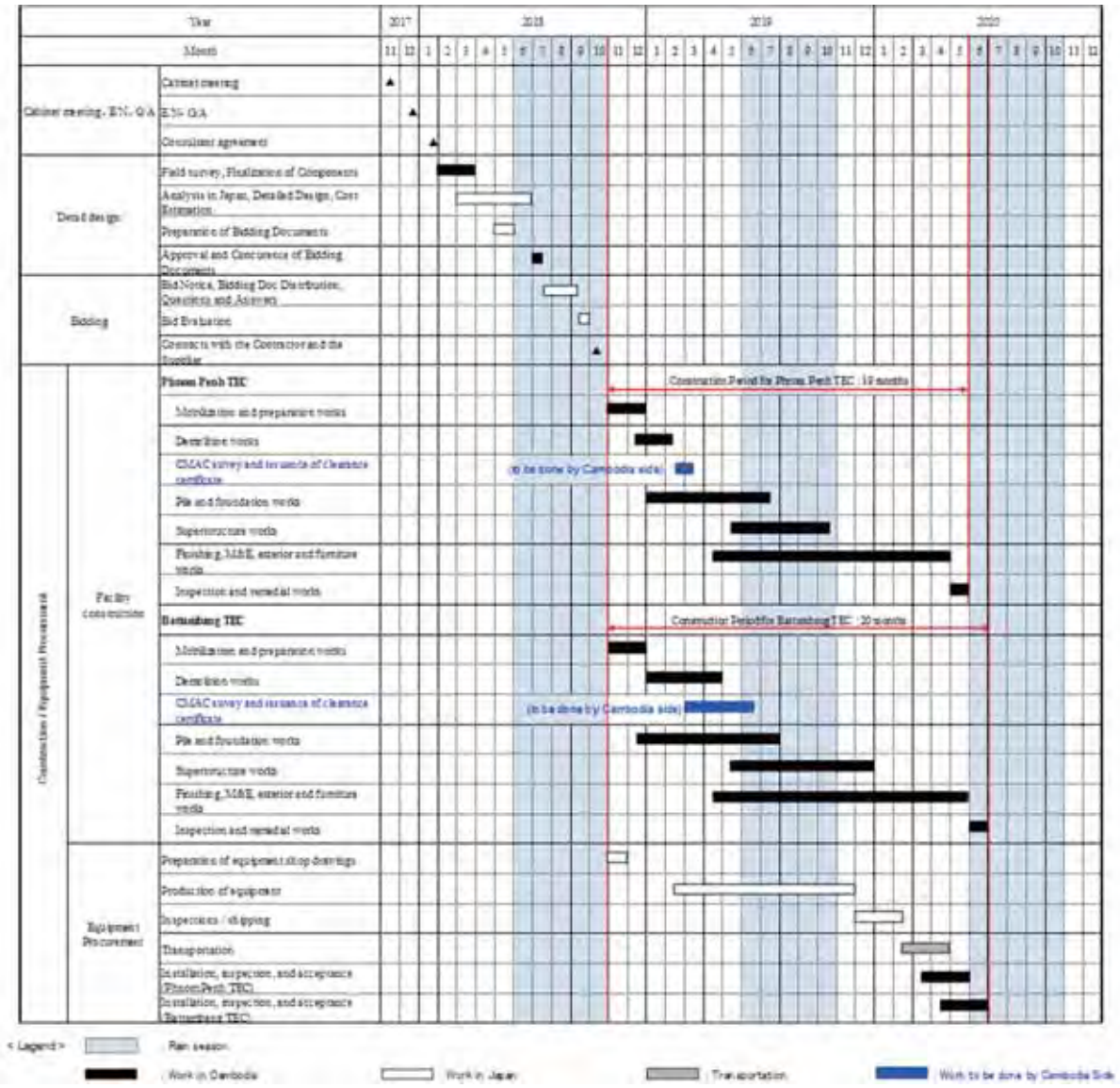
3-5. Implementation schedule and cost estimation

After the approval by the Cabinet of the Government of Japan, the Exchange of Notes (E/N) and the Grant Agreement (G/A) will be signed between the Cambodia and Japan sides. Then, the consultant agreement will be signed based on the E/N and the G/A. Through the detailed design and the bidding stages, the contracts with the Contractor and the Supplier will be made.

The period needed for the detailed design (from the filed survey to the approval and concurrence of the bidding documents) is estimated as 5.5 months, and the bidding (from the bid notice to the contracts with the Contractor and the Supplier) is 3.5 months. While the number of bidding/contract lots for construction works is set as one, the construction periods for Phnom Penh TEC and Battambang TEC are set as 19.0 months and 20.0 months respectively, based on the volume of construction works thereof.

The provisional Project implementation schedule, on the premise that the Cabinet approval of the Government of Japan is given in November 2017, is shown in the next table.

Project Implementation Schedule (Provisional)



The cost to be borne by Cambodian side is estimated as 168,000 USD.

4. Project evaluation

4-1. Relevance

The direct beneficiaries of the Project are the student of TECs (240 for the course of primary education and 100 for the course of lower-secondary education per year.). Additionally, as the quality of teachers becomes higher through the education at TECs, the quality of primary and lower-secondary education becomes higher, which contribute to the whole nation in the middle and long term.

In Cambodia, under the development plan of education sector, “Education Policy Action Plan

(ESP): 2014-2018", "Teacher Policy Action Plan (TPAP)" was drawn and is being promoted. On the other, the assistance to basic education, which contributes to the enhancement of basic academic skills and ability for teamwork, including the upgrade of teacher training capacity, is regarded as an important part of Japanese assistance policy for industrial human resource development in Cambodia. Thus, the Project complies with both of Cambodian development and Japanese assistance policies.

Additionally, in parallel with the Project, the Japanese technical cooperation (E-TEC) is being implemented for assisting the establishment of TECs. The high effectiveness of assistance can be expected through the synergy between two projects. Japan has implemented the grant aid projects for the construction of primary and lower-secondary schools and the technical cooperation for the enhancement of teaching ability of teachers in Cambodia. The Project will effectively contribute the achievement of overall objective of the Project by working with the outcomes of these past projects.

For all these reasons, the relevance of implementing the Project by Japanese Grant aid is high.

4-2. Effectiveness

The Project is expected to bring the following outcomes.

(1) Quantitative Outcomes

Indicators for the Quantitative Results of the Project

Indicator	Baseline data (Year 2017)	Target value (Year 2023: 3 years after the completion)
The number of students in 4-year degree courses for primary and lower secondary teacher education (students/year)[9]	0	2,720[10]

(2) Qualitative Outcomes

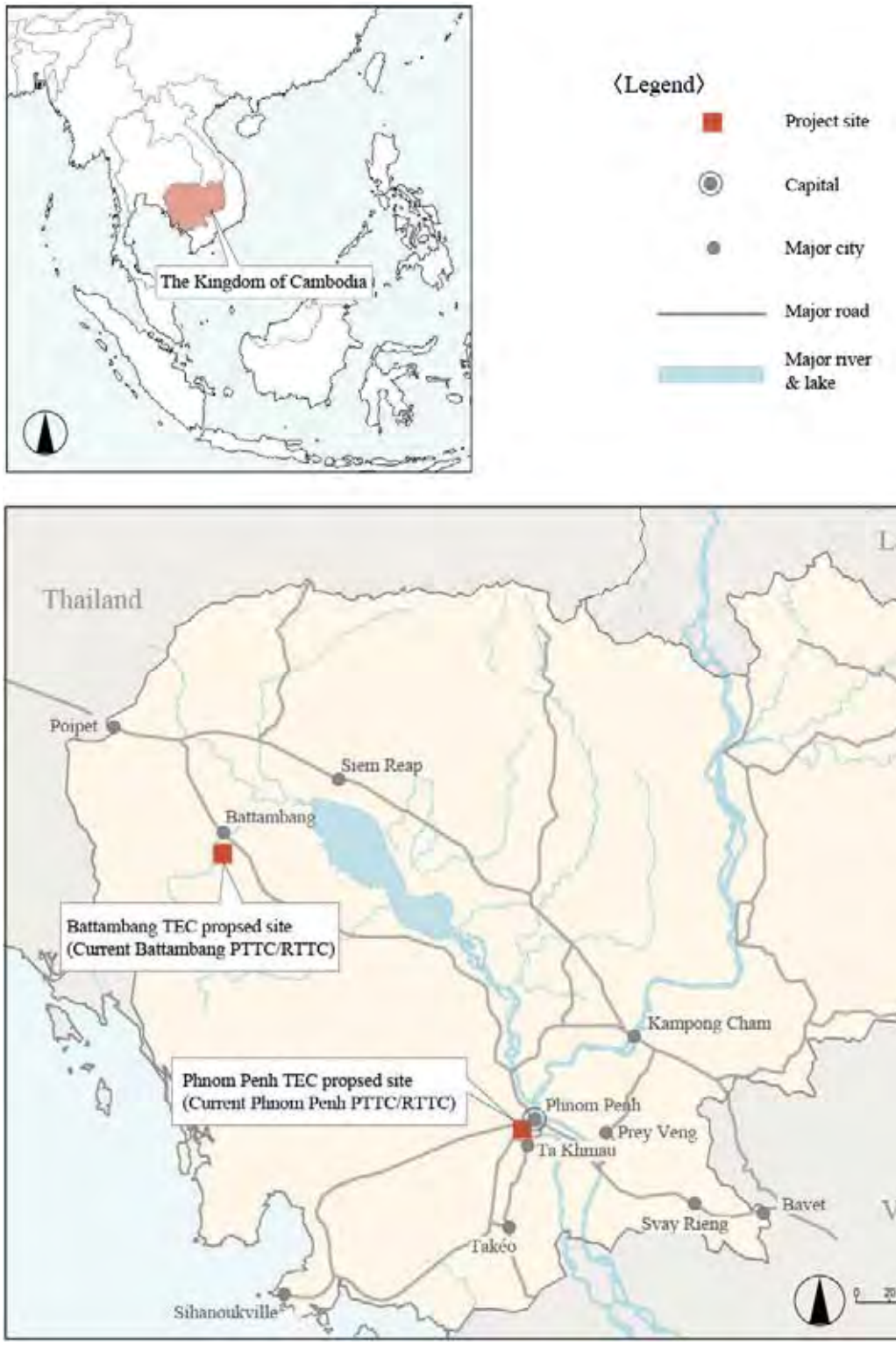
- The Project will contribute to the quality of teachers in both primary and lower secondary schools.

[9] While the quantitative indicator for the Project was set as "the number of degree holders from Phnom Penh TEC and Battambang TEC" in the Minutes of Discussions singed on August 31,2017, it is reconsidered and corrected as "the number of students in 4-year degree courses for primary and lower secondary teacher education".

[10] (Primary teacher education course 240 students/year + lower secondary teacher education course 100 students/year) x 4 grades x 2 TECs = 2,720 students

Contents

Appendices



TEC :Teacher Education College

RTTC : Regional Teacher Training Centre

PTTC : Provincial Teacher Training Centre

Location Map

Perspective for Phnom Penh Teacher Education College

Perspective for Battambang Teacher Education College

List of Tables and Figures

Abbreviations

A/P	Authorization to Pay
ASEAN	Association of South-East Asian Nations
B/A	Banking Arrangement
CDC	Council of Development of Cambodia
CDPF	Cambodia Capacity Development Partnership Fund
CMAC	Cambodian Mine Action Centre
CTD	Committee for Teacher Development
DAC	Development Assistance Committee
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
ESP	Education Policy Action Plan
E-TEC	The Project for Establishing Foundation for Teacher Education College
EU	European Union
FAO	Food and Agriculture Organization
G/A	Grant Agreement
GDCE	General Department of Customs and Excise
GDP	Gross Domestic Product
GDT	General Department of Taxation
HED	Higher Education Development
ICT	Information Communication Technology
IDP	Industrial Development Policy
IEE	Initial Environmental Examination
IMF	International Monetary Fund
INSET	In-service Training
JDS	The Project for Human Resource Development Scholarship
JICA	Japan International Cooperation Agency
KHR	Cambodian Riel
LED	Light Emitting Diode
LSE	Lower Secondary Education
MEF	Ministry of Economy and Finance
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MOC	Ministry of Commerce
MoEYS	Ministry of Education, Youth, and Sport
OECD	Organisation for Economic Co-operation and Development
PE	Primary Education
POE	Provincial Offices of Education
PRESET	Pre-service Training

PTTC	Provincial Teacher Training Centre
RTTC	Regional Teacher Training Centre
SIDA	Swedish International Development Cooperation Agency
TEC	Teacher Education College
TP	Teacher Policy
TPAP	Teacher Policy Action Plan
TTD	Teacher Training Department
UNICEF	United Nations Children's Fund
UXO	Unexploded Ordnance
VAT	Value Added Tax

CHAPTER 1 BACKGROUND OF THE PROJECT

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1 - 1 Background of the Grant Aid

In the Kingdom of Cambodia, the modern teacher training system was initiated with irregular short term training courses in order to solve the overwhelming lack of teachers during the civil war recovery period in the 1980s. After that, Provincial Teacher Training Centres (PTTC) and Regional Teacher Training Centres (RTTC) have opened nationwide as official teacher training institutes. Though the admission conditions and training period changed with times, the current system of "12 + 2 grades" or "two-year teacher training course after high school graduation" was established in 1998. Thereafter, the number of primary and secondary education teachers trained under this system increased from 66,982 in 1998 to 88,818 in 2014[1], and this increase has significantly contributed to the spread of basic education. However, in recent years, a low quality of basic education resulting from the lack of educational knowledge and of practical teaching skills has become a problem and therefore drastic improvement is necessary. In this context, the Government of Cambodia committed in the "Cambodia National Development Plan 2014-2018" issued in 2014 to securing the human resources necessary to upgrade Cambodia to a high-middle-income country by 2030. In addition, the Ministry of Education, Youth and Sport (MoEYS) mentioned in the "Education Strategic Plan (2014-2018)" issued in 2014 that teachers are an important factor that affects the quality of education. Moreover, the "Teacher Policy Action Plan (2015-2020)" aims to extend the current two-year teacher training course to four years, and to open Teacher Education Collage (TEC) in Phnom Penh and Battambang by 2018 as a first step.

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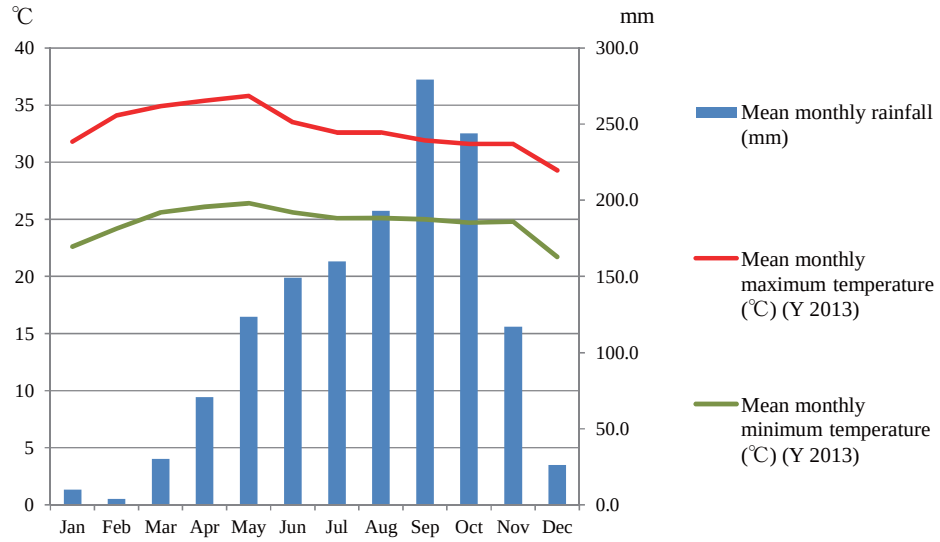
Based on these backgrounds, the Royal Government of Cambodia requested to the Government of Japan a grant aid project to construct facilities and to procure equipment for Phnom Penh TEC and Battambang TEC, which will be established for contributing to improvement of teachers' quality in Cambodia.

[1] MoEYS, Education Statistics and Indicators 2014-2015

1 - 2 Natural Conditions

(1) Climatic Conditions

Phnom Penh and Battambang, where the Project sites are located, belong to the tropical monsoon climate zone having a distinct rainy season and dry seasons. The rainy season runs for approximately for 5 months from June to October, and in particular, September and October have high rainfall - likely over 250 mm/month. The air temperature is high throughout the year, and the mean annual temperature is 27 degrees Celsius. The hottest month of the year is April, which is just before the start of the rainy season, with a mean maximum temperature of 35 degrees Celsius.



(Source: Prepared by the study team referring to the Japan Meteorological Agency's web site)

Figure 1-1 Climate Data of Phnom Penh

(2) Geographical Conditions

1) Phnom Penh TEC

Phnom Penh TEC site is located near the Tonle Sap River, approximately 4 km to the west of the centre of Phnom Penh city. The site is about 73,500 m^2 of nearly trapezoidal shaped land which runs approximately 360-400m in the east-west direction and 170-220m in the south-north directions. The site does not face the main road (street No.271) but is connected by an access road approximately 6m wide and 170m long. The site is flat and fenced all along the boundary lines, and surrounded by a hospital, a primary school, shops, houses and other buildings around the site.

While Phnom Penh has a high potential risk of flooding due to its geographical conditions, the severity and frequency of flooding have been mitigated by the rapid improvement of the public drainage systems of Phnom Penh Capital City. However, it is still possible to flood up to 15cm from the ground level when it is raining severely.

2) Battambang TEC

Battambang TEC site is located at the centre of Battambang city and is approximately 25,000m^2 in area, composed of two plots (the east plot and the west plot), facing National Highway No. 5 and street No.213. The east plot is nearly trapezoidal shaped land, which runs approximately 190-220m in the east-west direction and 100m in the north-south direction. Although the west plot was originally a rectangular shape of approximately 80m in the east-west direction and 120m in the north-south direction, the usable land is L-shaped because a part of the plot has been occupied by residents. The site is flat and fenced all along with the boundary lines. While the east plot is surrounded by roads all around, the west plot faces the roads on the east and south sides and faces shops, parking lots and other buildings on the west and north sides.

Battambang is a city prone to a high risk of flooding owing to its geographical features. Battambang TEC site is located along National Highway No. 5, which is affected by flooding almost every year, and has experienced severe flooding disasters in 2011 and 2013, when water levels rose 60-70cm from the ground level.

(3) Geological Conditions

Phnom Penh located in the swampy plains of the Mekong River has developed as an important city of river traffic. Battambang located along the Sangker River, which is connected to the Tonle Sap Lake, is one of the most popular rice-growing areas. In the context of such geographies, the geological conditions of both cities are generally weak. The results of soil investigations at each site are summarized below.

1) Phnom Penh TEC Site

Six (6) boreholes, each 30m deep, were drilled for soil investigation tests. The tests were conducted at the following two separate areas; ① two boreholes (BH1-BH2) around the existing meeting hall to be demolished where an assembly hall will be constructed by the Project, and ② four boreholes (BH3-BH6) at the open space where the other buildings (a special lecture room building, an administration building and a library building) will be constructed by the Project. The test results of one borehole from each of the two separate areas are summarized below. The detailed results of all the boreholes for Phnom Penh TEC site are shown in Appendix 6-a hereinafter.

Table 1-1 Results of Soil Investigation (Phnom Penh TEC Site)

Layer	Soil classification	①BH2		②BH4	
		Depth	N value	Depth	N value
1st layer	Lean clay with sand	Ground surface~8.5m	8~35	Ground surface~11.5m	0~6
2nd layer	Dense silty sand	8.5m～11.5m	22~36	11.5m~13.5m	16~20
3rd layer	Hard sandy lean clay	11.5m~13.5m	33	13.5m~14.5m	41
4th layer	Dense to very dense silty sand	13.5m~28.0m	43~ over 50	14.5m~27.5m	33~ over 50
5th layer	Hard sandy lean clay	28.0m~30.0m	over 50	27.5m~30.0m	34~ over 50
Groundwater level (rain season)		3.5m from ground surface			

2) Battambang TEC Site

Six (6) boreholes, each 30m deep, were drilled for soil investigation tests. The tests were conducted at the following two separate areas; ① four boreholes (BH1-BH4) in the east plot where a special lecture and academic building, an administration building, a library building, and an assembly hall will be constructed by the Project, and ② two boreholes (BH5-BH6) in the west plot where a dormitory building will be constructed by the Project. The test results of one borehole from each of the two separate areas are summarized below. The detailed results of all the boreholes for Battambang TEC site are shown in Appendix 6-b hereinafter.

Table 1-2 Results of Soil Investigation (Battambang TEC Site)

Layer	Soil classification	①BH1		②BH6	
		Depth	N value	Depth	N value
1st layer	Fat clay	Ground surface~8.6m	7~13	Ground surface~7.5m	3~10
2nd layer	Stiff to hard lean clay	8.6m~12.0m	16~19	7.5m~14.0m	11~13
		12.0m~22.0m	25~34	14.0m~20.0m	17~23
		22.0m~30.0m	45~ over 50	21.0m~0.0m	29~45
Groundwater level (rain season)		1.5m from ground surface			

1 - 3 Social and Environmental Consideration

Environmental administration in Cambodia is conducted in compliance with “Law on Environmental Protection and Natural Resources Management, 1996”, and environmental and social considerations are required for development activities accordingly. In addition, “Sub-decree on Environmental Impact Assessment Process, No. 72 ANRK.BK, 1999” stipulates the procedures of Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA).

The construction activities under this Project will be conducted only within the sites of existing teacher training centres, and it will not involve the involuntary relocation of local residents and will have no negative impacts to ecosystems, hydrological phenomena, geographies, geologies, and so on. Thus, this Project is categorized as “C”, which is likely to have minimal or little adverse impact on the environment and society, according to “JICA Guidelines for Environmental and Social Consideration”.

In addition, Article 2 of sub-decree No.72 stipulates “This sub-decree hereby applies to every proposed and ongoing project(s) and activities, either by private, joint-venture or state government, ministry institutions of which are described in the annex of this sub-decree, except a special case, where a project will be approved by the Royal Government”. Hence, it was confirmed that this Project will be exempted from IEE/EIA process through the discussions with MoEYS.

CHAPTER 2 CONTENTS OF THE PROJECT

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2 - 1 Basic Concept of the Project

2 - 1 - 1 Overall Goal and Project Objectives

The overall objective of the Project is to improve the quality of primary and lower secondary education in Cambodia, while the project objective is to improve the teacher training program and to improve teachers trained in TEC by upgrading facilities and equipment to meet the requirement for the 4-year course TEC.

2 - 1 - 2 Outline of the Project

To attain the above mentioned objectives, the Project will construct TEC facilities and procure equipment in Phnom Penh and Battambang to meet the requirement for the 4-year course TEC.

In planning TEC facilities and equipment, usable rooms and equipment in existing PTTCs/RTTCs are deducted from facilities and equipment necessary to meet the requirement for the 4-year course TEC. Only facilities and equipment which are not in existing PTTCs/RTTCs are provided by the Project.

Facilities and equipment covered by the Project is shown in Table 2-1.

Table 2-1 Summary of Facilities and Equipment to be provided by the Project

Item	Phnom Penh TEC	Battambang TEC
Facilities (by function)		
Special lecture room block	(PE[2]) Science lab, Music room, Art room and Preparation room for each	(PE) Science lab, Music room, Art room and Preparation room for each
	(LSE[3]) Chemistry lab, Biology lab and Preparation room for each	(LSE) Chemistry lab, Biology lab, Music room, Art room and Preparation room for each
	(PE and LSE) Home economics room, ICT room, Storage and Toilet	(PE and LSE) Home economics room, ICT room, Storage and Toilet
Academic block	Auditorium, Storage, and Toilet	Auditorium, Lecture room, Research room, Department office, Storage and Toilet
Administration block	Director's room, Vice director's room, Advisor and secretary room, Admin. Office (admin. and human resource), Admin. Office (finance and planning), Admin. Office (academic, student affairs, relation and job), Archive room, Meeting room, First-aid room, Storage and Toilet	Director's room, Vice director's room, Advisor and secretary room, Admin. Office (admin. and human resource), Admin. Office (finance and planning), Admin. Office (academic, student affairs, relation and job), Archive room, Meeting room, First-aid room, Storage and Toilet
Library block	Library (incl. Self-study space), ICT room	Library (incl. Self-study space), ICT room

[2] PE: for Primary Education Course
[3] LSE: for Lower Secondary Education Course

	for self-study, Library office, Storage and Toilet		for self-study, Library office, Storage and Toilet	
Assembly hall	Hall, Stage, Control room, Locker room, Storage and Toilet		Hall, Stage, Control room, Locker room, Storage and Toilet	
Dormitory			Dormitory room, Kitchen, Shower room and Toilet	
Facilities (by building)	PN-1 Special lecture room bldg.	1,709.60 m^2	BRN-1 Special lec./academic bldg.	3,086.40 m^2
	PN-2 Admin. bldg.	2,045.14 m^2	BRN-2 Admin. bldg.	3.026.90 m^2
	PN-3 Library bldg.	1,352.25 m^2	BRN-3 Library bldg.	1,958.02 m^2
	PN-4 Assembly hall	1,661.42 m^2	BRN-4 Assembly hall	1,398.73 m^2
	Others (conn. bridge, etc.)	10.00 m^2	BRN-5 Dormitory bldg.	2,239.45 m^2
			Others (conn. bridge, etc.)	22.80 m^2
Total floor area	6,778.41 m^2		11,732.30 m^2	
Equipment (by function)				
Special lecture room block	(PE) Science lab, Mathematics lab, Social science room, Music room and Art room		(PE) Science lab, Mathematics lab, Social Science room, Music room and Art room	
	(LSE) Mathematics lab, Physics lab, Chemistry lab, Biology lab, Earth science lab, Social Science room, Music room and Art room		(LSE) Mathematics lab, Physics lab, Chemistry lab, Biology lab, Earth science lab, Social Science room, Music room and Art room	
	(PE and LSE) ICT room, Home economics room, Workshop		(PE and LSE) ICT room, Home economics room, Workshop	
Academic block	(Auditorium) Sound equipment, Projector (Lecture rom) Projector (Department office) Computer network system		(Auditorium) Sound equipment, Projector (Lecture rom) Projector (Department office) Computer network system	
Administration block	(First-aid room) Equipment for first aid		(First-aid room) Equipment for first aid	
Library block	(Library) Computer network system, etc.		(Library) Computer network system, etc.	
Assembly hall	Sound equipment, Projector, Sporting equipment, etc.		Sound equipment, Projector, Sporting equipment, etc.	
Dormitory				

2 - 2 Outline Design of the Japanese Assistance

2 - 2 - 1 Design Policy

2 - 2 - 1 - 1 Basic Policy

(1) Project Sites

This Project will provide facilities and equipment necessary for upgrading the existing two-year course teacher training centres (PTTC for primary education teacher training and RTTC for lower

secondary teacher training) in Phnom Penh and Battambang.

Facilities and equipment for Phnom Penh TEC will be provided in a single site where the existing Phnom Penh PTTC/RTTC is located.

Meanwhile, Battambang TEC will have two separate premises a distance of 1.5 km apart, which are currently used as the existing PTTC/RTTC respectively. The current Battambang PTTC has no space for new construction, because the existing buildings are in good condition, and fully occupy the premises. Thus the Project will construct new buildings only in the current RTTC premises. The current PTTC will be utilized as the G-1 campus while the current RTTC will be utilized as the G-2-4 campus. This decision is made because the existing facilities in the current PTTC can be suitable for the G-1, which are basically programmed for foundation courses, and because the facilities in the current RTTC can be improved by the Project to meet the functional requirements for G-2-4, which are mainly programmed for major courses.

(2) Teacher Training Courses covered by the Project

According to the initial request by Cambodian side, TEC shall open following 4 courses namely "Pre-primary teacher training", "Primary teacher training", "Lower secondary teacher training", and "In-service teacher training".

After the discussion in the field survey, following points are confirmed.

① Pre-primary teacher training course is not institutionalized so far, and to make a 4-year course in 2018 is not realistic.

② In-service teacher training course shall be organized for long vacation and weekends, therefore facilities specific for the course are not necessary.

Thus, this project covers facilities and equipment for "primary teacher training" and "Lower secondary teacher training".

(3) Setting the Student Capacity of One TEC

In the initial request for the Project by the Cambodian side, the student capacity per TEC was set to 2,000, which includes 100 students × 4 years in the pre-primary course, 250 students × 4 years in the primary course, 100 students × 4 years in the lower secondary course and 100 to 200 students × 1 or 2 years in the in-service course.

However, as described above in "(2) Teacher Training Courses covered by the Project", this Project covers "Primary teacher training" and "Lower secondary teacher training". For those courses, the student capacity in one TEC is 1,360 in total for 4 grades. (240 students[4] × 4 years in the primary course and 100 students × 4 years in the lower secondary course)

Comparison between the capacity of the initial request and the capacity set by the Project is shown in Table 2-2.

[4] Based on the discussion in the field survey, student capacity is adjusted to 240. (number of student in one class is 30 and there are 8 classes in one grade)

Table 2-2 Capacity set by the Project (in one TEC)

Training Course		Initial Request	Capacity set by the Project
Pre-primary Education	4-year course	100 students/Grade	―
Primary Education	4-year course	250 students/Grade	240 students/Grade
Lower secondary Education	4-year course	100 students/Grade	100 students/Grade
In-service Training	1 to 2-year course	100 students/Grade	―
Total number of students		2,000 students	1,360 students

TP (2013) and TPAP (2015-2020) stipulate that one of the priority issues is to attract competent persons into the teaching profession and to train them to have a 4-year degree equivalent to a bachelor's degree. In connection with this, TPAP mentions "one of the most urgent tasks for pre-service and in-service provision is to ensure opportunities for as many teachers as possible to reach the new BA equivalency".

Phnom Penh TEC and Battambang TEC, whose facilities and equipment will be expanded and improved by the Project, are the first TECs to be established in Cambodia based on its teacher policies aiming at the improvement of education quality in the country. These TECs are expected to be core institutions for providing the 4-year degree courses and for allocating high quality teachers to schools nation-wide. Thus, the setting of the capacity for the TECs which will be covered by the Project is examined by taking into account the current situation of teacher quality, the teacher demand projection, and the actual numbers of students trained by the current PTTCs/RTTCs. Under the current system of teacher training, admissions to PTTCs/RTTCs are regionally constrained. However, it has already been decided that the two newly established TECs will admit students nation-wide. Therefore, the rationale for setting the capacity for the Project is examined based on the relevant data at the national level.

1) Need for High Quality Teacher Education

As indicated in Table 2-3, the ratio of teachers having degrees equivalent to or higher than a bachelor's degree among in-service teachers in 2016/17 remains 37% in secondary education[5] and only 8% in primary education. The fact illustrates the need for high quality teachers, who have degrees equivalent to or higher than bachelor's degrees, at both primary and secondary education levels. In particular, the need for improving teacher quality at the primary education level is obviously high. While the incumbent teachers are retrained to have degree qualifications through in-service (INSET) trainings, under the current circumstances, with no access to 4-year teacher education courses, TPAP reported that the annual increase rate in the number of teachers in the teaching profession with degree qualifications is approximately 2%.

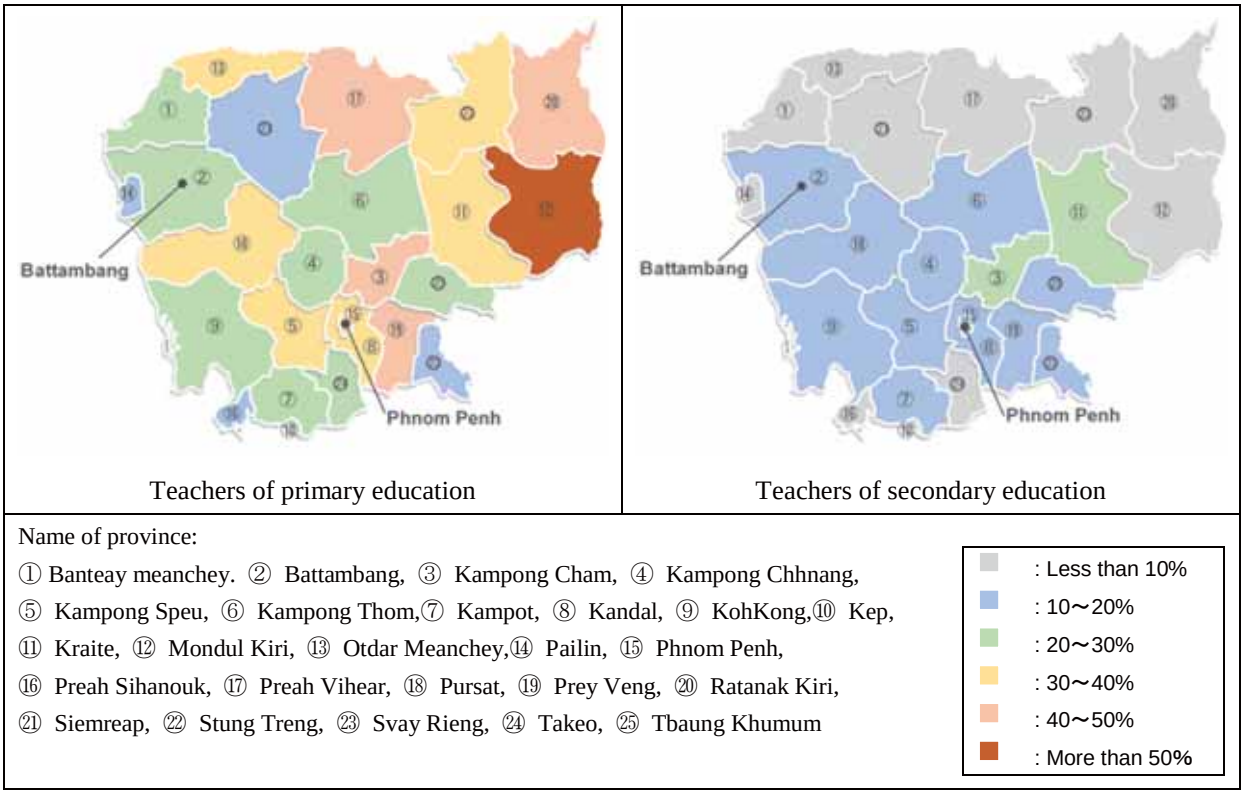
[5] As there are many integrated secondary schools in Cambodia, which cover both lower and higher secondary education, it is hard to distinguish the number of teachers between lower secondary education and higher secondary education in the statistics of MoEYS. The data mentioned in the text, therefore, refers to secondary education as a whole including both lower and higher secondary education.

Table 2-3 Educational Backgrounds of In-service Teachers (2016/17)

Educational backgrounds	Primary education teacher		Secondary education teacher	
	Number	Ratio	Number	Ratio
Primary education	1,104	2.40%	494	1.20%
Lower secondary education	12,521	27.21%	5,084	12.36%
Higher secondary education	28,701	62.38%	20,305	49.38%
Sub-total No. of teachers without degrees	42,326	92.00%	25,883	62.94%
Bachelor's degree	3,585	7.79%	14,231	34.61%
Master's degree	95	0.21%	995	2.42%
Doctoral degree	3	0.01%	12	0.03%
Sub-total No. of teachers with degrees	3,683	8.00%	15,238	37.06%
Total	46,009	100.0%	41,121	100.0%

(Source: Prepared by the survey team based on MoEYS Education Statistics and Indicators 2016-2017)

Figure 2-1 shows the percentages of teachers by province who completed only primary or secondary education. As previously mentioned, the improvement of teacher quality is more urgently required in primary education almost nationwide. While the number of degree holders in primary and lower secondary education need to be increased through both pre-service training (PRESET) and INSET, it is assumed that larger numbers of high quality teachers educated by PRESET will be deployed to primary schools, for improving the quality of primary education of the country.



(Source: Prepared by the survey team based on MoEYS Education Statistics and Indicators 2016-2017)

Figure 2-1 Ratio of In-service Teachers in Primary and Secondary Education who only completed Primary or Lower Secondary Schools

2) Actual Number of Admissions to Current PTTCs/RTTCs and Teacher Demand Projection

Table 2-4 shows the number of admissions to each PTTC/RTTC and the teacher demand projections (according to the "*Mid-Term Review Report in 2016 of the Education Strategic Plan 2014-2018 and Projection to 2020*") in the 2 years after admission. The highlighted lines of the following table are for PTTCs/RTTCs of Phnom Penh and Battambang, which are to be upgraded to TECs and are covered by the Project.

The number of admissions to each PTTC/RTTC varies year by year and school by school, and the increase and decrease rates are unequal. This mainly owes to the fact that the number of teachers to be trained is determined not based on the projected demand for teachers, but based on the demand surveyed at the school level and compiled at the regional level. In some years, the number of teachers to be trained was adjusted following governmental decisions. Meanwhile, in only the recent two years (2015 and 2016), the number of admissions to PTTCs/RTTCs seemed comparable to the projected number of teachers in 2017 and 2018, respectively, after the end of the 2-year teacher training courses.

Table 2-4 Number of Admissions to PTTCs/RTTCs and Teacher Demand Projections

Name of PTTC/RTTC	2011	2012	2013	2014	2015	2016	Annual Average
Teacher demand projection in primary education (2 years after admission)	--	--	--	(2016)	(2017)	(2018)	
	--	--	--	1,776	1,776	1,776	1,776
Sub-total of PTTCs	1,955	2,205	2,340	3,084	1,690	1,513	2,131
Phnom Penh	**65**	**80**	**90**	**90**	**53**	**86**	**77**
Kandal	110	160	170	200	137	81	143
Takeo	100	100	115	200	168	70	126
Kampong Chnnang	80	100	100	180	63	62	98
Kampot	70	60	60	100	107	53	75
Kampong Cham	190	220	275	260	132	160	206
Krate	70	60	60	100	42	54	64
Steng Treng	160	170	165	160	76	97	138
Preah Vihear	85	90	90	80	33	83	77
Svay Rieng	60	60	60	80	103	45	68
Prey Veng	160	185	180	320	144	110	183
Banteay Meanchey	90	105	115	124	71	74	97
Battambang	**190**	**215**	**220**	**320**	**113**	**143**	**200**
Pursat	60	70	90	100	45	45	68
Kampong Thom	100	115	120	190	84	81	115
Preah Sihanouk	50	60	50	30	22	35	41
Siem Reap	245	265	290	390	223	181	266
Kampong Speu	70	90	90	160	74	53	90
Teacher demand projection in lower secondary education (2 years after admission)	--	--	--	(2016)	(2017)	(2018)	
	--	--	--	1,193	753	644	863
Sub-total of RTTCs	1,366	1,251	919	793	0	768	850
Phnom Penh	**215**	**185**	**117**	**99**	**0**	**112**	**121**
Battambang	**327**	**318**	**222**	**195**	**0**	**78**	**190**
Kandal	238	224	178	153	0	190	164

Takeo	189	170	131	87	0	174	125
Prey Veng	175	156	96	98	0	69	99
Kampong Cham	222	198	175	161	0	145	150
Total number of demand of teaching staff in primary and lower secondary education (2 years after admission)	--	--	--	(2016)	(2017)	(2018)	
	--	--	--	2,969	2,529	2,420	2,639
Total admissions of PTTCs/RTTCs	3,321	3,456	3,259	3,877	1,690	2,281	2,981

(Source: Prepared by the survey team based on the data provided by Teacher Training Department of MoEYS and *Mid-Term Review Report in 2016 of the Education Strategic Plan 2014-2018 and Projection to 2020*)

As shown in the above table, the supply (equal to admissions in 2016) and the projected demand in 2018 seem consistent to a certain extent. Thus, the data of year 2016 is extracted and used for the analysis of the number of trained teachers after the establishment of TECs, and the analysis is made at the national level as shown in Table 2-5. While the projected number of primary education teachers is fixed for the 5-year period (2016-2020), the projected number of lower secondary education teachers fluctuates largely every year. In case of lower secondary education, therefore, the average of the 5-year period is used for the analysis. Additionally, as the policy regarding the upgrade of the 16 PTTCs and 4 RTTCs other than the ones in Phnom Penh and Battambang has not been clearly decided[6], the analysis is made based on the assumption that the PRESET teacher training courses for primary and lower secondary education will be provided at 2 TECs, 16 PTTCs and 4 RTTCs for the time being.

Table 2-5 Estimation of Number of Trained Teachers in TECs and PTTCs/RTTCs

Education level	Demand projection (Average of 2016-2020)	Number of teachers trained in TECs[7]	Number of teachers trained in PTTCs/RTTCs (2016)[8]	Total
Primary education	1,776	480	1,284	1,764
Lower secondary education	1,221[9]	200	578	778

(Source: Prepared by the survey team based on the data provided by Teacher Training Department of MoEYS and *Mid-Term Review Report in 2016 of the Education Strategic Plan 2014-2018 and Projection to 2020*)

As for primary education, the total number of teacher students trained in TECs and PTTCs is calculated as almost the same as the number in the demand projection. In short, if 2 TECs train 480 teachers annually and 16 PTTCs keep training a similar number of teacher students as in 2016, the total number of teachers produced from TECs and PTTCs will meet with the projected demand. Considering this, it is understood that the TEC capacity set for the primary teacher education course, 240 students per year per TEC, is appropriate.

[6] In the discussion with MoEYS during Field Survey II conducted in August 2017, MoEYS explained that the policy for establishment of TECs other than Phnom Penh and Battambang TECs is still under discussion.
[7] The total number of teachers trained in 2 TECs in Phnom Penh and Battambang.
[8] The total number of admissions in 16 PTTCs and 4 RTTCs excepting Phnom Penh PTTC/RTTC and Battambang PTTC/RTTC in 2016.
[9] The average of demand prediction for new teachers from 2016 to 2020 shown in the *Mid-Term Review Report in 2016 of the Education Strategic Plan 2014-2018 and Projection to 2020.* (The minimum is 644 in 2018 and the maximum is 2,158 in 2020.)

Regarding secondary education, the total number of teacher students trained in TECs and RTTCs is calculated as 778 students, including 200 students from TECs and 578 students from RTTCs (actual number of admissions to RTTCs in 2016), against the projected demand of 1,221 teachers. However, based on the fact that most of the RTTCs have trained around 200 students per year, it is estimated that about 1,000 teachers can be produced from 2 TECs and 4 RTTCs annually. Thus, it is also understood that the TEC capacity set for lower secondary teacher education course, 100 students per year per TEC, is reasonable.

As a result of the said analysis taking into account the current situation of teachers' quality, the teacher demand projection, and the actual numbers of teachers trained in the current PTTCs/RTTCs, there is justification to set the capacity for a TEC at 240 students/year for primary teacher courses and 100 students/year for lower secondary teacher courses.

(4) Rooms to be furnished for New TEC

The types and numbers of rooms to be furnished for the new TECs are discussed and determined based on the request from the Cambodian side. The necessity and validity of such rooms are examined within the curriculum framework and the legislations relevant to the establishment of TECs and in keeping with the JICA's technical cooperation project, namely E-TEC. The rooms to be furnished for a TEC are listed in the following table.

Table 2-6 List of Rooms to be Furnished for a TEC

Block (Function)	Name of room	Seating capacity	Number of rooms	Remarks
Special lecture room block	Science laboratory	30	2	for Primary Education course
	Math/physics laboratory	30	1	for Lower Secondary Education course
	Chemistry laboratory	30	1	for Lower Secondary Education course
	Biology laboratory	30	1	for Lower Secondary Education course
	Earth science laboratory	30	1	for Lower Secondary Education course
	Music room (large)	60	1	for Primary Education course
	Music room (small)	30	1	for Lower Secondary Education course
	Art room (large)	60	1	for Primary Education course
	Art room (small)	30	1	for Lower Secondary Education course
	Workshop	30	2	for assembling teaching materials (for both primary and Lower Secondary Education)
	Home economics room	30	1	for cooking and sewing (for both primary and Lower Secondary Education)
	ICT room	30	4	incl. language laboratory (for both Primary and Lower Secondary Education)
Academic block	Auditorium	120	2	lecture theatre
	Lecture room	30	36	
	Research room	15~20	6	
	Department office	10	9	for each department
Administration block	Director's room	--	1	
	Vice director's room	--	4	

	Advisor and secretary room	5	1	
	Admin. Office (admin. and human resource)	10	1	
	Admin. Office (finance and planning)	10	1	
	Admin. Office (academic, student affairs, relation and job)	15	1	
	Archive room	--	1	
	Meeting room (large)	30	1	
	Meeting room (small)	15	2	
	First-aid room	--	1	
Library	Library	--	1	incl. self-study space for 100 seats
	ICT room for self-study	30	1	
	Library office	5	1	
Assembly hall	Assembly hall	500～600	1	incl. stage, hall, changing room, storage, toilets, and chairs
Dormitory	Dormitory room	16	36	only for Battambang TEC

The validity of the number of lecture room, which belongs to the academic block included in Table 2-6 is verified by calculating the lecture hours per week based on the subjects and the number of credits stated in the TEC curriculum framework[10], while setting the occupancy rate of each room at 60 %[11]. Two Auditoriums per TEC will be prepared regardless of the occupancy rate, as they are expected to be used for activities other than academic works scheduled in the curriculum. Every special lecture room required by the curriculum will be also provided regardless of the occupancy rate in view of the necessity of performing lectures and practicums for specialized fields.

As described later, while Phnom Penh TEC will have one single campus, Battambang TEC will be divided into two campus areas. Therefore, the calculation method of rooms for Battambang TEC is different from Phnom Penh TEC. Regarding the campus area for the G-2-4, which will be improved by the Project, the number of lecture rooms is calculated based on the occupancy rate referencing the number of student and curriculum of those grades. The kind and number of special lecture room are decided based on the requirements by curriculum by those grades.

Regarding rooms of the administration block, as mentioned in "2-4 Project Operation Plan", 52 staff of the block, including a director, per TEC are going to be allocated (see Table 2-25). Based on this staff allocation plan, the kind and number of rooms originally stated in the request from the Cambodian side is validated and the plan will comply with that original request.

[10] This curriculum framework was confirmed by the Secretary of State of MoEYS in April 2017, while the corrections in Khmer are being made for its official issuance.

[11] In general, the occupancy rate of lecture room of university varies widely and there is no reference value. On the other hand, the average rate is 58.6% (FY 2014) according to "the final report towards preparation of 5 years plan for facility planning of universities" prepared by the advisory council of the Japanese Ministry of Education, Culture, Sports, Science and Technology, dated on March 28, 2016. It has also been pointed out that time schedule generation becomes difficult if the occupancy rate is over 60% according to the facility plan for the prefectural university of Miyagi, dated on June 28, 2010. Referencing these, the occupancy rate is set to 60% in this Project.

(5) Existing Facilities Utilization Plan and Facility Components of the Project

The facility components of the Project are determined in consideration of the rooms required for the new TECs as well as the usable existing facilities of the current PTTCs/RTTCs. The existing facilities utilization plan of each TEC was studied in Japan based on the findings gained through the field survey I[12], and then confirmed with the Cambodian side through discussions and site visits during the field survey I-2[13]. Consequently, the facility components of each TEC to be provided by the Project are settled. The following tables show the facility components of the Project and the existing facilities utilization plan of Phnom Penh and Battambang TECs.

[12] Field Survey I was conducted from December 12, 2016 to January 24, 2017.
[13] Field Survey I-2 was conducted from March 8 to 17, 2017.

Table 2-7 Existing Facilities and Facility Components of the Project for Phnom Penh TEC

Block (Function)		Special lecture room block												Academic block				Administration block									Library			Assembly hall	Dormitory	
Name of rooms		Science laboratory	Math/physics laboratory	Chemistry laboratory	Biology laboratory	Earth science laboratory	Music room (large)	Music room (small)	Art room (large)	Art room (small)	Workshop	Home economics room	ICT room	Auditorium	Lecture room	Research room	Department office	Director's room	Vice director's room	Advisor and secretary room	(Admini and human resource) Administration office	(Finance and planning) Administration office	(Academic, student affairs, relation and job) Administration office	Archive room	Meeting room (large)	Meeting room (small)	First-aid room	(Include self-study space) Library	ICT room for self-study	Library office	(Include hall and stage) Assembly hall	Dormitory room	
Phnom Penh TEC , The total number of required rooms		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**4**	**2**	**36**	**6**	**9**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	N/A	
New buildings for this proposal																																**New buildings Total floor area**
PN-1	Special lecture room building	2		1	1		1		1			1																				1,709.60 m2
PN-2	Administration building													2				1	4	1	1	1	1	1	1	2	1					2,045.14 m2
PN-3	Library building												4															1	1	1			1,352.25 m2
PN-4	Assembly hall																													1		1,661.42 m2
New buildings The total number of rooms		**2**	**0**	**1**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**1**	**4**	**2**	**0**	**0**	**0**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	N/A	(Conn. bridge)
Existing buildings																																10.00 m2
PE-1	Special lecture room building		2			1																										**6,778.41 m2**
PE-2	Academic building														6	1	1															
PE-3	Academic building														6	1	1															
PE-4	Academic building														6	1	1															
PE-5	Academic building														8	1	4															
PE-6	Academic building														6	1	1															
PE-7	Special lecture room building							1		1	2																					
PE-8	Academic building														2	1	1															
PE-11～PE-17： Dormitory building, canteen/kiosk, adjoining facilities for toilet building																																
Existing buildings The total number of rooms		**0**	**2**	**0**	**0**	**1**	**0**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**34**	**6**	**9**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
The total number of rooms		**2**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**4**	**2**	**34**	**6**	**9**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	N/A	
			(※1)												(※2)																		

<Notes>

※1： In consideration of the existing service utilities of PE-1, the existing rooms in PE-1will be utilized as labs which do not require water supply. Consequently, the two rooms will be utilized as the math laboratory and the physics laboratory respectively.

※2： Two out of 34 lecture rooms in the existing building are required to contain more than 60 people. Therefore, the number of rooms is calculated as total 36 in total (32 rooms that contain 30 people + 2 rooms x 2 to account for the capacity of 60 people = 36 rooms).

Table 2-8 Existing Facilities and Facility Components of the Project for Battambang TEC

Block (Function)		Special lecture room block												Academic block				Administration block									Library			Assembly hall	Dormitory	
Name of rooms		Science laboratory	Math/physics laboratory	Chemistry laboratory	Biology laboratory	Earth science laboratory	Music room (large)	Music room (small)	Art room (large)	Art room (small)	Workshop	Home economics room	ICT room	Auditorium	Lecture room	Research room	Department office	Director's room	Vice director's room	Advisor and secretary room	(Admin and human resource) Administration office	(Finance and planning) Administration office	(Academic, student affairs, relation and job) Administration office	Archive room	Meeting room (large)	Meeting room (small)	First-aid room	(Include self-study space) Library	ICT room for self-study	Library office	(Include hall and stage) Assembly hall	Dormitory room	
Battambang TEC, The number of required rooms		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**4**	**2**	**36**	**6**	**9**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**36**	
New buildings for this proposal																																	**New buildings Total floor area**
BRN-1	Special lecture & academic building	2		1	1		1	1	1	1		1			14																		3,086.40 m2
BRN-2	Administration building															6	9	1	4	1	1	1	1	1	1	2	1						3,026.90 m2
BRN-3	Library building												4	2														1	1	1			1,958.02 m2
BRN-4	Assembly hall																														1		1,398.73 m2
BRN-5	Dormitory building																															16	2,239.45 m2
New buildings The total number of rooms		**2**	**0**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**0**	**1**	**4**	**2**	**14**	**6**	**9**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**16**	(Conn. bridge)
Existing buildings																																	22.80 m2
BRE-2	Memorial building（※1）																																**11,732.30 m2**
BRE-3	Attached secondary school building（※2）																																
BRE-4	Academic building														10																		
BRE-6	Special lecture room building		1			1																											
BRE-8	Staff dormitory（※3）										2																						
BRE-10	Dormitory building (male)																															4	
BRE-7, 15-22： Canteen/kiosk, and adjoining facilities for toilet building																																	
Existing buildings The total number of rooms		**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	
The total number of rooms		**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**4**	**2**	**24**	**6**	**9**	**1**	**4**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**20**	

（※4） （※5）

<Notes>

※1： Building BRE-2 is currently the administration building, constructed in 1965. The building will not function as part of the TEC facilities due to its progressive deterioration, but will remain as the memorial building as per the request of the Cambodia side.

※2： Due to aging of the current old affiliated secondary school (BRE-5), the current academic building (BRE-3) will be transformed to the new affiliated secondary school.

※3： The current female dormitory building (BRE-8) will be transformed to the dormitory building for teachers, but 2 rooms of the building on the ground floor will be used as workshops.

※4： TEC G-1 students, who mostly take foundation courses, will use existing buildings in PTTC site which is 1.5km away. The students from the 2nd to 4th year will use facilities in this proposed site. The required number of lecture rooms for the latter students are caliculated as 24.

※5： Due to the restriction on the operating cost and the site condition, the number of the dormitory rooms were adjusted.

(6) Priorities of Facility Components

The priorities of facility components by function and by room type were confirmed through a series of discussions during the field surveys, taking into account possible component adjustment due to limitation of the Project budget (see Table 2-9 and Table 2-10).

Table 2-9 Priority of Facility Components for Phnom Penh TEC

Priority by function	Block (Function)	Priority by room		
		Priority A[14]	Priority B[15]	Priority C[16]
1	Special lecture room block	Science lab, Chemistry lab, Biology lab, Music room (large), Art room (large), Home economics room, ICT room	—	Math/physics lab, Earth science lab, Music room (small), Art room (small), Workshop
2	Academic block	Auditorium	—	Lecture room, Research room, Department office
3	Administration block	All rooms	—	—
4	Library	All rooms	—	—
5	Assembly hall	—	All rooms	—

Table 2-10 Priority of Facility Components for Battambang TEC

Priority by function	Block (Function)	Priority ranking of each room		
		Priority A	Priority B	Priority C
1	Special lecture room block	<For G-2-4[17]> Science laboratory, Chemistry laboratory, Biology laboratory, Music room (large) (small), Art room (large) (small), Home economics room, ICT room	—	<For G-2-4> Math/physics laboratory, Earth science laboratory, Workshop
		—	—	<For G-1[18]> Science laboratory, Music room, Workshop
2	Academic block	<For G-2-4> Auditorium, Lecture room (14 rooms), Research room, Department office	—	<For G-2-4> Lecture room (10 rooms)
		—	—	<For G-1> Lecture room (18 rooms), Department office
3	Administration block	<For G-2-4> all rooms	—	—
		—	—	<For G-1> Director's room, Vice director's room, Department office

[14] Priority A: To be provided by the Project with high priority, for the reasons of no available buildings or no usable buildings due to aging.
[15] Priority B: Considered to be provided by the Project, if the Project budget allows, as the existing buildings cannot be fully functioned as TEC facilities or as the existing buildings better be reconstructed due to aging. If not, the existing rooms will be utilized.
[16] Priority C: Not to be provided by the Project, since the existing rooms are available.
[17] New buildings to be constructed by the Project and the existing buildings within the current RTTC site of Battambang (the Project site for Battambang TEC) will be utilized for G 2-4.
[18] The existing buildings within the current PTTC site of Battambang will be utilized for G-1.

4	Library	<For G-2-4> all rooms	—	—
		—	—	<For G-1> Library (include Self-study space
5	Assembly block	—	<For G-2-4> all rooms	—
		—	—	—
6	Dormitory	—	<For G-2-4> Dormitory (16 dorm. rooms and other necessary rooms)	<For G-2-4> Male dormitory (4 rooms), Department office
		—	—	<For G-1> Female dormitory (8 rooms)

(7) Existing Building Demolition for Reconstruction

Serval existing buildings of various ages are located in the two Project sites, and open spaces in the sites are not enough for new construction of all the buildings planned for the Project. Thus, some of the aged buildings are to be demolished to allow construction of new buildings in the same places.

Through the discussions during the field surveys, MoEYS explained that the governmental process to obtain the necessary budget for the building demolition works may take at least two years (there was a case that took five years in the past) due to the long procedure within the Ministry of Economy and Finance (MEF), which includes evaluation, budgeting and procurement of contractor(s) stages. It would mean that the Project cannot be commenced until the first half of 2019 at the earliest, and that there is a risk of further delay depending on the governmental procedures, if the demolition works are to be undertaken by the Cambodian side. In summary, this factor would be a serious risk in terms of smooth implementation of the Project.

The construction works under this Project are planned to commence in November 2018 aiming for inauguration of TEC operations by using the new facilities and equipment from November 2020. Thus, it is necessary that the demolition works needed for reconstruction will be done by Japanese side in order to attain the planned project schedule and to maintain smooth implementation of the Project.

As for the other aged buildings located in places which will not interfere with the construction works of the Project, they will not be planned as part of the TEC facilities, and the decision whether to demolish or not will be reasonably made by the Cambodian side. Such possible demolition works are not to be classified as obligation of the Cambodian side under the Project.

Table 2-11 Existing Building to be demolished by the Project

Item	Phnom Penh (1 building)	Battambang (7 buildings)				
Bldg. ID	PE-10	BRE-1	BRE-5	BRE-9, 11	BRE-12, 13	BRE-14
Building name	Meeting hall	Admin./class room building	Affiliated LS school	Dormitory building	Toilet	Kiosk
Building age	28 years	52 years	51 years	32 years	(Unknown)	(Unknown)
Number of buildings	1	1	1	2	2	1
Number of stories	1 story	4 stories	3 stories	2 stories	1 story	1 story
Total floor area	815 m^2	1,716 m^2	1,854 m^2	144m^2/bldg.	12.5 m^2/ bldg.	12.5 m^2
Roof	Cement tile Wooden truss	Flat roof	Metal sheet Wooden truss	Metal sheet Wooden truss	Metal sheet	Metal sheet
Column/beam	Reinforced concrete	Reinforced concrete	Reinforced concrete Wooden structure (only 2nd floor)	Reinforced concrete Wooden structure (only 1st level)	Reinforced concrete	Steel structure
Foundation	Independent foundation	Independent foundation	Independent foundation	Independent foundation	Independent foundation Pit	Independent foundation
Wall	Bricks + Mortar	Bricks + Mortar	Bricks + Mortar Wooden structure (only 2nd floor)	Bricks + Mortar Wooden structure (only 1st floor)	Bricks + Mortar	Bricks + Mortar
Ceiling	Wood	Contact ceiling	Contact ceiling Suspended ceiling (only 2nd floor)	Contact ceiling Suspended ceiling (only 1st floor)	―	―
Floor	Concrete slab + tile	Concrete slab + tile	Concrete slab + tile	Concrete slab + tile	Concrete slab + tile	Slab on grade
Door/Windows	Wood	Wood	Wood	Wood	Wood	Wood
Furniture	Wood	Wood, Metal	Wood, Metal	Wood	―	―

(8) Equipment Planning

The final requested equipment list is the list of equipment and facilities necessary for learning at primary and lower secondary school level. TEC students must master the operational methods to cultivate a deep understanding of such basic equipment during the teacher training course, which will result in high quality teachers in the future. Therefore, the relevance of this Project is very high. During studies in Japan, the Consultant analysed the appropriateness of each equipment and finalized the equipment list, taking into consideration the operation and maintenance conditions of existing equipment, the differences between the planned construction sites, and the facility component plan, obtained during the site survey period.

The equipment planning policy is summarized below.

Table 2-12 Equipment Planning Policy

Name Laboratory	Equipment Planning Policy
Science (primary)	- Plan basic equipment for science class - Due to class activity, DC ammeter and pulley are added
Mathematics (primary)	- Plan basic equipment for mathematics class - Exclude equipment for which students can make alternatives to use
Social science (primary)	- Replace obsolete maps and globes (no-English labels) - Plan English version for easy understanding
Mathematics (lower secondary)	- Plan basic equipment for mathematics - Exclude equipment for which students can make alternatives to use
Physics (lower secondary)	- Replace obsolete and frequently used equipment - Plan solid and appropriate laboratory table for physical experiment
Chemistry (lower secondary)	- Plan basic equipment for chemistry experiment - Replace inadequate items for chemistry experiment - Plan solid and appropriate laboratory table for chemistry experiment
Biology (lower secondary)	- Plan basic equipment for biology experiment - Replace inadequate items (no-English labels) - Plan solid and appropriate laboratory table for biology experiment
Earth science (lower secondary)	- Plan basic equipment for earth science experiment - Plan equipment with English labels - Plan solid and relevant laboratory table for earth science experiment
Social science (lower secondary)	- Replace obsolete maps and globes (no-English labels) - Plan English version for easy understanding
Music (primary)	- Plan basic musical instrument at primary level
Music (lower secondary)	- Plan basic musical instrument at lower secondary level
Art (primary)	- Plan basic art equipment at primary level
Art (lower secondary)	- Plan basic art equipment at lower secondary level
Workshop	- Plan basic equipment necessary for development and creation of teaching materials
Home economics	- Plan basic equipment for cooking and sewing practice - Plan work table (dual function for cooking and sewing)
ICT	- Plan suitable system for computer practice - Plan a similar system to the current structure
ICT (Library)	- Plan basic equipment for making reports and self-study - Plan a similar system to the current structure
Assembly hall	- Plan suitable sound equipment and projector for ceremonies and seminars
Physical education	- Plan basic equipment for physical education
First-aid	- Plan basic equipment for first-aid - Exclude procurement of medicine and drugs
Auditorium	- Plan suitable sound equipment and projector for ceremonies and seminars
Department office	- Plan computer system suitable for material development and test production

2 - 2 - 1 - 2 Policy for Natural Conditions

(1) Climatic Conditions

Phnom Penh and Battambang, where the Project sites are located, belong to the tropical monsoon climate zone having a distinct rain season and dry season. The rainy season runs for approximately

for 5 months from June to October, and in particular, September and October have high rainfall - likely over 250 mm/month. The air temperature is high throughout the year, and the mean annual temperature is 27 degrees Celsius. The hottest month of the year is April, which is just before the start of the rainy season, with a mean maximum temperature of 35 degrees Celsius.

To cope with the climatic conditions of high temperature and high humidity in the tropical monsoon climate zone, a comfortable room environment will be maintained by insulating buildings and by considering the sectional plan of buildings. In addition, natural ventilation and sunlight will be adopted in principle to maintain a comfortable room environment, while adoption of mechanical ventilation and air conditioners will be considered depending on the type of usage and capacity of rooms.

The details of architectural, electrical and mechanical considerations are described in "2-2-2-1 (2) Architectural Plan" hereunder.

(2) Geological Conditions

Phnom Penh located in the swampy plains of the Mekong River has developed as an important city of river traffic, and Battambang located along the Sangker River which is connected to the Tonle Sap Lake is one of the most popular rice-growing area. In the context of such geographies, the geological conditions of both cities are generally weak. Thus, appropriate designs for piles and foundations are considered based on the results of the soil tests.

(3) Flooding

Phnom Penh and Battambang encounter a high risk of flooding due to their geographical conditions. Battambang TEC site, in particular, is located along National Highway No.5 which is repeatedly affected by flooding almost every year. Battambang TEC site experienced severe flooding disasters in 2011 and 2013, and water levels rose 60-70 cm from the ground level at that time. As for Phnom Penh TEC site, the severity and frequency of flooding are mitigated because of rapid improvement of the public drainage systems of Phnom Penh Capital City, however it is still possible to flood up to 15 cm from the ground level when it is raining severely.

Against these backdrops, the ground floor level of the new buildings for Phnom Penh TEC will be set at 50 cm from the ground level. As for Battambang TEC, the ground around the new buildings will be raised by 70 cm from the current ground level, while the ground floor level of the new buildings will be set at 100 cm from the current ground level.

2 - 2 - 1 - 3 Policy for Social Conditions

(1) UXO and Landmine Clearance

The situation of landmines and UXO in Cambodia is roughly classified as resulting from two facts; (1) UXOs resulting from the bombing of the Ho Chi Minh route by the USA army during the Vietnam War from 1960 to 1975, (affected area in Cambodia: the eastern and southern parts of the country), and (2) landmines being buried by the Khmer Rouge who were driven to the border to the Thailand

border during the Cambodia War from 1970 to 1990, (affected area in Cambodia: the northern and western parts of the country). In the context of these facts, it is understood that the major risk in Phnom Penh is UXOs bombed in 1960-1975, and that the risk in Battambang is landmines buried in 1970-1990.

In the sites of Phnom Penh TEC and Battambang TEC, the Cambodian Mine Action Centre (CMAC) conducted detection surveys and issued clearance certificates for the proposed construction areas of the Project. However, additional detection survey is needed for Battambang TEC site. Thus, the Cambodian side is requested to conduct it prior to bidding (by June 2018), and it is agreed and confirmed on the Minutes of Discussions signed during the field survey II[19].

Even though the clearance certificates cover all the proposed construction areas, the land under the existing buildings and the paved areas cannot technically be detected. According to the CMAC units in Phnom Penh and Battambang, nothing has been reported to CMAC regarding UXOs and landmines from the two sites so far. Additionally, the CMAC units explained that they have never experienced a case of discovery of landmines underneath existing buildings. However, with the utmost consideration to safety, it is determined that CMAC detections will be conducted by the Cambodian side during temporary suspension of construction works in the designated areas after the demolition works done by the Project. The detailed procedure of detection surveys after demolition will be described in "2-2-4-2 Implementation Conditions" hereunder.

(2) Land Ownership

The sites of Phnom Penh TEC and Battambang TEC are lands belonging to the current PTTCs/RTTCs. Thus, there is no issue of acquisition of the Project sites, and the land ownership certificates for the major parts of the Project sites were submitted to Japanese side. As for the missing documents (for the access road of Phnom Peng TEC site and the dormitory zone (the west plot) of Battambang TEC site), it is agreed and confirmed that the Cambodian side will submit to the Japanese side by the end of 2017 on the Minutes of Discussions of the field survey II.

(3) Accessible Design Considerations

Taking into account the use of the TEC facilities by people with disabilities, ramps from the ground level to the ground floor level will be constructed for all TEC facilities to be built by this Project. The rooms which will be used by students are generally allocated on the lower floors. While elevators will be needed to maintain full accessibility of the buildings, this Project will, in considerations of the challenges for operation and maintenance of elevators, provide only elevator shafts for future installation of elevators. In the meantime, a connecting bridge between each neighbouring building will be provided by the Project, and it will bring easy access to the users on the upper floor levels (basically on the 1st floor level, but on the 1st and 2nd floor levels at some buildings) of neighbouring buildings.

[19] Signed on August 31, 2017.

(4) Gender Considerations

The following gender considerations are made for the facility planning of the Project.

- The same numbers of toilets and showers are planned for male and female facilities, on the premise that the number of male and female users of the TEC are equal.
- Toilets for male and female users of each building are located in areas reasonably separated to avoiding overlapping access to both facilities. This arrangement will keep make male students away from female toilets.
- The dormitory for Battambang TEC is planned for the use of male students or female students only. While the decision regarding "for male" or "for female" will be made by MoEYS later, the dormitory building is designed taking into account the possibility of being a "female dormitory".
  - Steel grill doors will be provided at the entrances of staircases to prevent entry of outsiders including members of the opposite sex.
  - Insides of shower rooms and baths will not be visible from common areas, such as corridors and staircases, by means of partition walls and/or floor layout arrangement.
  - Each dormitory room will have a balcony, and laundry can be hung in a way that is not visible.

2 - 2 - 1 - 4 Policy for Local Industries of Construction and Procurement

(1) Construction

1) Construction Materials

There are many importer and supplier of construction materials in Cambodia, especially in big cities, such as Phnom Penh and Battambang, thus a variety of construction materials imported from neighbouring Asian countries are available in Cambodia. Concrete aggregates, cement, and wood are domestically produced and available in domestic markets. As for steel products, the ones produced in factories of neighbouring countries, such as Thailand and Vietnam, which have received technical assistance from European countries or Japan, are available in domestic markets, and such products with a specified level of quality can be procured in Cambodia. Though construction machines and temporary materials and equipment can be leased, most construction companies, except for small-scale companies, have their own. Therefore, the facilities to be covered by the Project are designed with the policy to utilize locally available materials and equipment to the maximum extent, except for some special equipment for electrical and mechanical services.

2) Building Codes and Building Permit

Laws, acts and codes relevant to construction equivalent to the "Building Standard Laws of Japan" are not legislated in Cambodia, and it is determined that structural and other design can be made on the basis of the standards of other countries, such as Japan and the UK. As for building permits,

MoEYS issued a letter, signed by the Minister of MoEYS, which states that MoEYS allows construction of TEC facilities within the current PTTCs/RTTCs of Phnom Penh and Battambang premises. While MoEYS explained that the Project will be exempted from building permits procedures by the letter, MoEYS confirmed that the Cambodian side will conduct necessary procedures to obtain building permits if required due to change of laws and regulations.

3) Equipment

The planned equipment involves Japanese products and third country goods, which need after-sales services provide by the local agents and/or distributers in Cambodia. Considering the presence of Japan's Grant Aid Project and sustainable equipment use, the Consultant consciously made a plan of procurement from Japan. In expanding the scope of procurement to a third country, the elements and factors such as versatility and after-sales service were considered essential to avoid easy selection of equipment based only on low price. Thus, the quality of equipment will be ensured by putting in place certain restrictions, such as a limitation of products from only DAC or OECD member countries.

Currently Japanese manufacturers have their factories in ASEAN countries and/or China. In the case that the Japanese manufacturers have responsibility for their product quality and sell their products in the Japanese market under the same name, acceptance of such countries as the country of origin will be considered.

The transportation plan for the equipment to be procured from Japan and third countries will consist of sea transportation to Sihanouk Port in Cambodia and land transportation from the port to TEC Phnom Penh and TEC Battambang. This route is considered as the first priority. The transportation schedule from the Sihanouk Port to both TECs will be managed in accordance with the timing of construction works and/or school activities and lectures.

2 - 2 - 1 - 5 Policy for Employing Local Firms (Consultants and Contractors)

(1) Consultants

There are dozens of civil engineering consultants in Phnom Penh. While most of them are individual consultants, there are some consulting companies with high-level capabilities, who have enough experience and staff to manage to handle the requirements of foreign donors. Thus, it is possible to conduct design and supervision works by employing such local resources.

(2) Construction Companies

The construction companies in Cambodia need the following legal registrations.

① Company registration: Ministry of Land Management, Urban Planning and Construction (MLMUPC)
② Patent registration: General Department of Taxation, MEF
③ Value Added Tax (VAT) registration: General Department of Taxation, MEF
④ Company registration: General Department of Public Procurement, MEF
⑤ Commercial registration: Ministry of Commerce (MOC)

There are about 200 construction companies in Cambodia, however, the ones with sufficient technical capacities in terms of quality control and schedule management are ten to twenty companies only. In addition, approximately ten Japanese affiliated construction companies (including project based offices without a locally incorporated company and/or sales branch) are in Cambodia.

(3) Manufactures and Engineers for Equipment

The existence of local manufacturers that would produce equipment at the same quality as Japanese manufacturer was not discovered. On the other hand, Japanese manufacturers and other manufacturers (with headquarters registered in DAC and/or OECD member countries) have many local agents and/or sales agents with local engineering staff. With the conclusion that it is possible to provide services equivalent to those in Japan, these local engineers will be employed for the installation works and initial operation training of the procured equipment.

2 - 2 - 1 - 6 Policy for Operation and Maintenance

The existing PTTCs/RTTCs are being run as teacher training centres under Provincial Offices of Education (POE), and their operation and maintenance costs are covered by the provincial budgets. In contrast, the new TECs will be established as higher educational institutions and be operated and maintained by the national budgets of MoEYS. The legislation arrangements for the establishment of TECs are currently in process. As for allocation of TEC staff, it has been stipulated by the Sub-decree[21] for the establishment of TECs, dated on May 22, 2017, that the staff of the existing PTTCs/RTTCs will be continuously employed for the new TEC for a while.

The Directorate General of Education is responsible for the quality of education at TECs, and the Teacher Training Department (TTD) manages the process of establishing TECs. Meanwhile, the Project will be implemented for the purpose of contributing to the upgrade of the current PTTC/RTTC, which is overseen by TTD, to TEC as a higher educational institution. In this regard, the Directorate General of Higher Education will oversee TECs as higher educational institutions[22].

2 - 2 - 1 - 7 Policy for Grade Setting of Building Facilities and Equipment

(1) Building Facilities

The two TECs to be expanded by the Project will be established as the first TECs in Cambodia and are being recognized as a model case of TEC. Therefore, appropriate grade of building design will be adopted for the Project in consideration of the future TEC building design as well as necessary functions for 4-year teacher education courses.

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[21] Sub-decree No.72 dated May 22, 2017 “Sub-decree on Upgrading and Merging Regional Teacher Training Center and Provincial Teacher Training Center in Phnom Penh to become Teacher Education College in Battambang” , and Sub-decree No.73 dated May 22, 2017 “ (the same as the above mentioned) in Phnom Penh”

[22] Confirmed on the Minutes of Discussion signed on August 31, 2017.

The buildings to be covered by the Project are designed with consideration of aspects of the climatic conditions (high humidity and long rain season), the natural conditions (geological and geographical conditions), and the environmental and social conditions around the planned buildings. The considerations of ease of maintenance and healthy/safe school environment are also taken into account in building design. Each room of the new buildings will have appropriate spatial composition and finishing, and appropriate grades of electrical and mechanical services will be employed to maintain a comfortable room environment. Furthermore, as for the architectural considerations, the appearance and finishing of the building façades are designed in harmony with the neighbouring environment and landscapes, and thus the presence as a Japanese grant aid project is also maintained in the building design.

(2) Equipment

Planned equipment is basic educational equipment for primary and lower secondary schools. Such equipment is necessary for the students to accumulate their experiences of experimentation and to study and develop effective teaching method at TEC. There is no equipment which requires complicated operation and maintenance. Because the grade of equipment is the same as the ones at primary and lower secondary schools, the students will use easily by following manuals and operational training from lecturers. Regarding equipment requiring consumables and/or periodic inspections/maintenance, the Consultant carefully analysed whether such equipment will be appropriately utilized, based on the results of the site surveys regarding the existence of local agents and distributors in Cambodia or neighbouring countries, the procurement route of consumables and so forth.

2 - 2 - 1 - 8 Policy for Methods and Schedule of Construction and Procurement

(1) Construction

This Project is to construct TEC facilities at the two sites of Phnom Penh and Battambang, which are approximately 300 km (6 hours by car) away from one another. In order to attain the earliest inauguration of the new TEC campuses, the construction works at both sites are scheduled to be conducted in parallel.

It is essential to consider the temporary work plans and the construction work schedule, since the Project will have to be implemented under special conditions, such as the demolition of the existing buildings, the partial suspensions of the construction works after demolition to allow the UXO and landmine detection survey to be done by the Cambodian side, and TEC operation within the same premises during the construction period. (The details will be described in “2-2-4-2 Implementation Conditions” and “2-2-4-8 Implementation Schedule” hereunder.)

A reinforced concrete structure, which is common and can be constructed by general construction workers in Cambodia, is adopted for the structures of the buildings to be constructed by the Project, because it is difficult to secure a sufficient number of skilled workers in the country. Even for the finishing works of the interior and exterior, materials and methods are selected in consideration of

conventional construction methods that general workers are familiar with. In addition, for the piling works, a less-noisy method that does not disturb the neighbourhood will be adopted for the Project.

(2) Equipment

The construction schedules and their completion dates at both sites are different. The current usage of existing buildings and subjects (laboratories) to be offered are different between Phnom Penh and Battambang as well. Under these circumstances, the locations for unpacking of wooden boxes, travelling routes of equipment inside/outside buildings, working times and utility conditions are also different. Therefore, it is necessary to manage the above works and arrangements differently and separately. In addition, at the existing buildings at the two TECs, the technical cooperation project (E-TEC) is to be implemented. With the coordination with E-TEC, the installation work schedule and timing of handing-over will be considered and managed in order to encourage effective use of procured equipment at the two TECs.

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

2 - 2 - 2 - 1 Basic Plan for Building Facilities

(1) Site Layout Plan

1) Phnom Penh TEC

Phnom Penh TEC site is 73,500 m^2, and various types and scales of facilities for the current PTTC/RTTC and the affiliated lower secondary school are located in it.

① TEC Master Plan including Utilization of Existing Facilities

While the existing buildings on the premises are of different ages and conditions, most of the buildings, except for the meeting hall (PE-10, see Figure 2-2) and the library at the north-east corner (PE-9), are generally in good conditions and usable. Therefore, it has been decided to utilize the existing buildings to the maximum extent, and to construct new buildings to complement the missing functions, in order to consolidate the full functions of a TEC.

The existing buildings do not generally have special building services, and thus, the rooms in the existing buildings will be utilized as certain types of special lecture rooms, ordinary lecture rooms, research rooms and department offices, which do not require special building services. In particular, all required number of ordinary lecture rooms, research rooms and department offices will be covered by the existing buildings. In the meantime, the new work of the Project will cover the various types of special lecture rooms (excluding some rooms to be covered by the existing buildings[23]), administration block rooms, a library and an assembly hall. The existing facilities utilization plan and the facility components of the Project for Phnom Penh TEC are as shown in Table 2-7 above.

[23] Math laboratory, Physics laboratory, Earth science laboratory, Music room (small), Art room (small), and Workshops

② Site Layout Plan of New Buildings to be constructed by the Project

Special lecture room building (PN-1, see Figure 2-3), Administration building (PN-2) and Library (PN-3) are to be located on the open space at the south-west corner of the premises near the main gate, and Assembly hall (PN-4) is to be located on the vacant space after demolition of the existing meeting hall. The current PTTC/RTTC site layout and the proposed TEC site layout of Phnom Penh are shown on the following page.

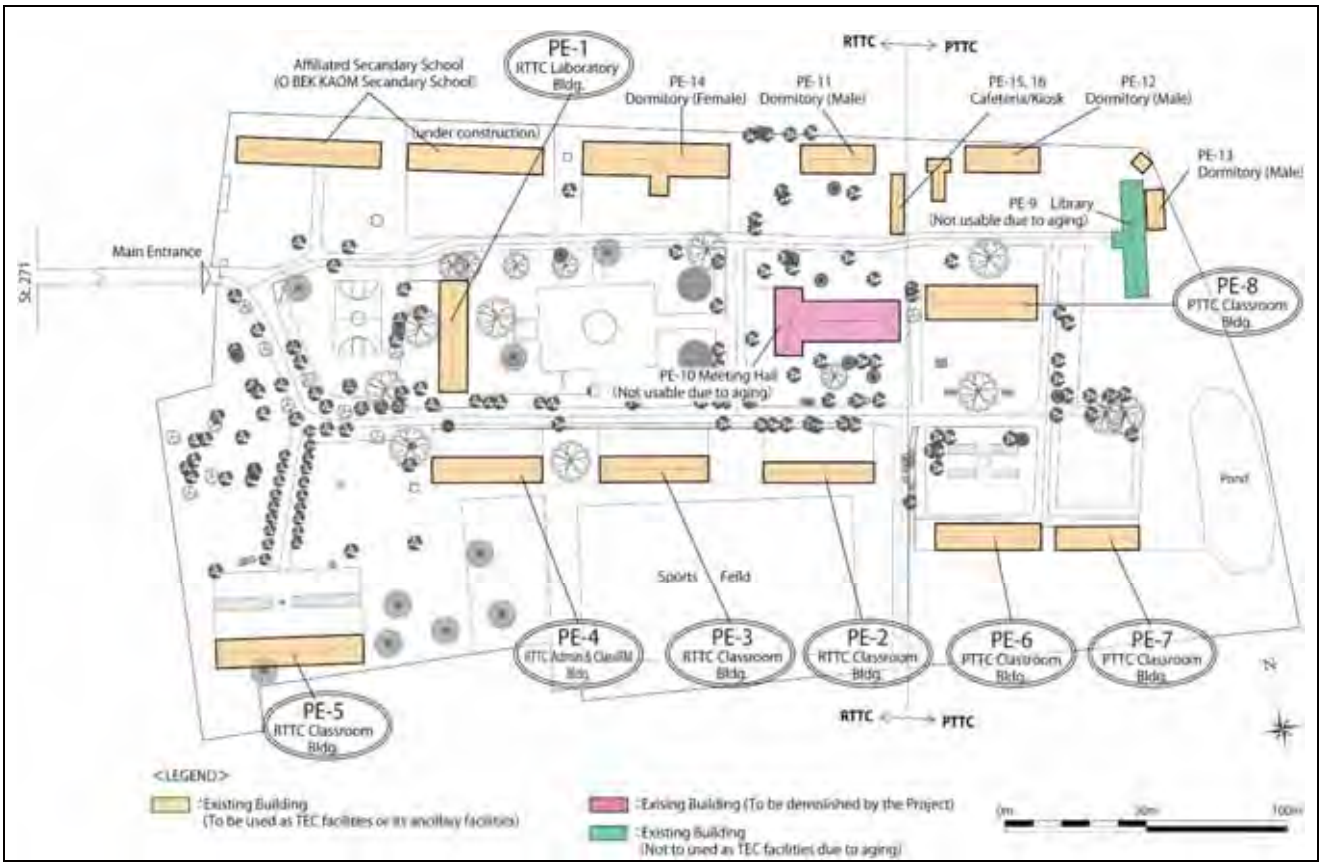

Figure 2-2 Current Site Layout of Phnom Penh PTTC/RTTC

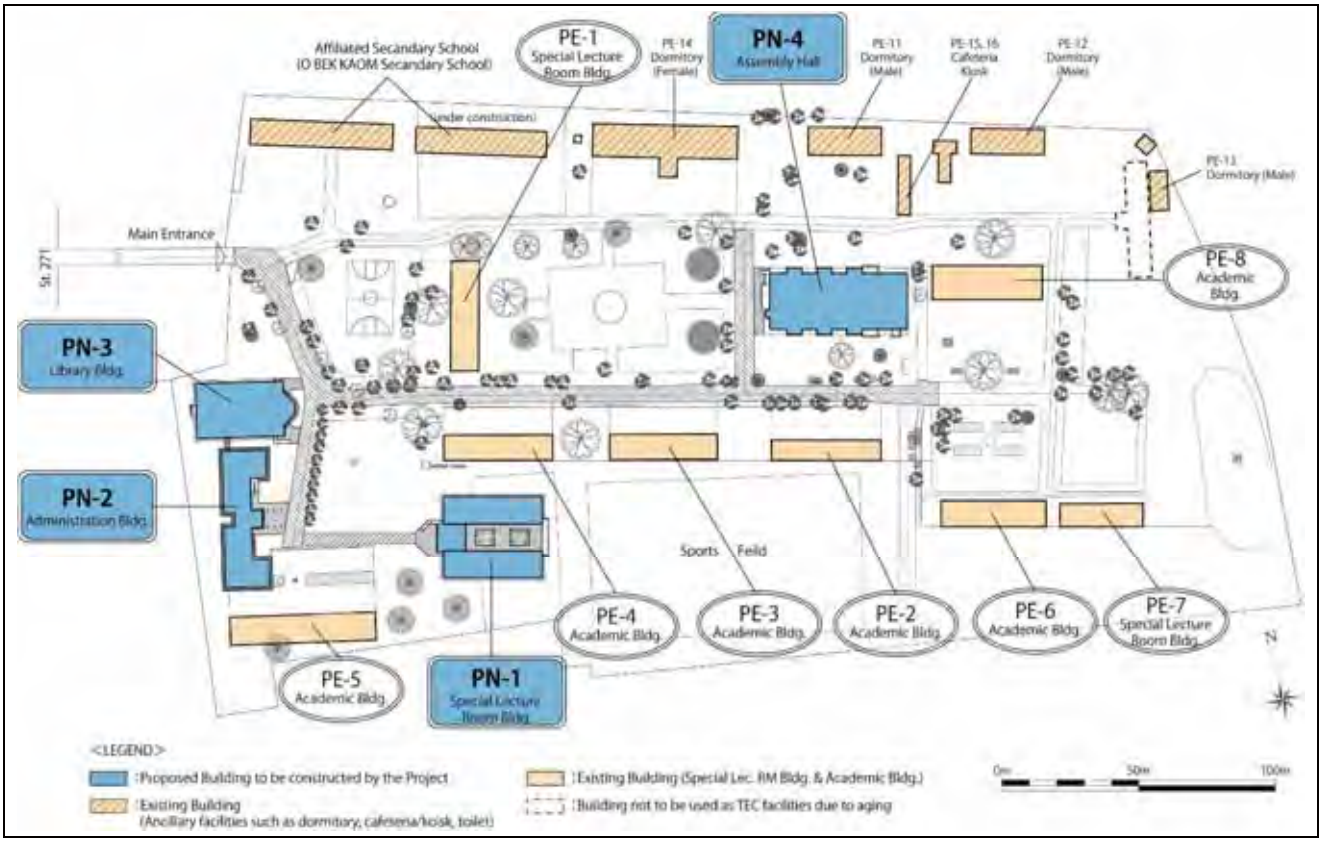

Figure 2-3 Proposed Site Layout for Phnom Penh TEC

2) Battambang TEC

In Battambang TEC, as described above, the facilities in the two separate sites of the current PTTC/RTTC are 1.5 km away from one another and will be utilized and operated as a single TEC.

The current PTTC is approximately 12,000 m^2. It is located at the southern side of Battambang University, and contains classroom buildings, a laboratory building, an administration building, and dormitories. The existing buildings in the current PTTC site are relatively new, and there is no space for new construction in the site.

In the meantime, the current RTTC is approximately 25,000 m^2 composed of two plots (the east plot: approx. 21,000 m^2 and the west plot: approx. 4,000m^2), facing National Highway No.5 and street No.213. The existing classroom buildings, laboratory building, administration buildings, meeting hall and dormitories for female are located in the east plot, and the dormitories for male are located in the west plot. Part of the west plot cannot be utilized for new TEC building construction because it is illegally occupied by people. There are several buildings not usable due to age and condition in the current RTTC site (BRE-1, 2, 5, 9 and 11, see Figure 2-4).

Against these backdrops, the facility construction by the Project will be conducted only in the current RTTC site. Taking into account the available but limited functions and services of the current PTTC site, it is to be utilized as the campus for G-1, which is basically programmed for foundation courses, and the current RTTC site, where the Project will improve the facilities, is planned as the campus for G-2-4, which is mainly programmed for major courses.

① TEC Master Plan including Utilization of Existing Facilities (for the Campus for G-2-4)

Among the existing buildings in the current RTTC site, the buildings deemed unusable, except for BRE-2[24], will be demolished and new buildings will be constructed by the Project.

Because the usable existing buildings do not have special building services in general, the rooms in those buildings are to be utilized as certain types of special lecture rooms and ordinary lecture rooms, which do not require special building services.

In the meantime, the various types of special lecture rooms (excluding some rooms to be covered by the existing buildings[25]), ordinary lecture rooms (to compensate for the shortage of rooms), administration block rooms, a library and an assembly hall will be provided by the Project in the east plot. A dormitory will be constructed in the west plot. The existing facilities utilization plan and the facility components of the Project for Battambang TEC are as shown in Table 2-8 above.

② Site Layout Plan of New Buildings to be constructed by the Project

The east plot is planned as the main campus zone, and the west plot as the dormitory zone. The open space at the south side of the main campus (approximately 35 m from the boundary), along street No.213, will remain as a green area as per the strong request from the Cambodian side. The current RTTC site layout and the proposed TEC site layout of Battambang are shown on the following page.

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[24] BRE-2 building is currently the administration building, constructed in 1965. The building will not function as a TEC facility due to its progressive deterioration, but will remain as a memorial building as per the request of the Cambodia side.

[25] Math/Physics laboratory, Earth science laboratory and Workshops

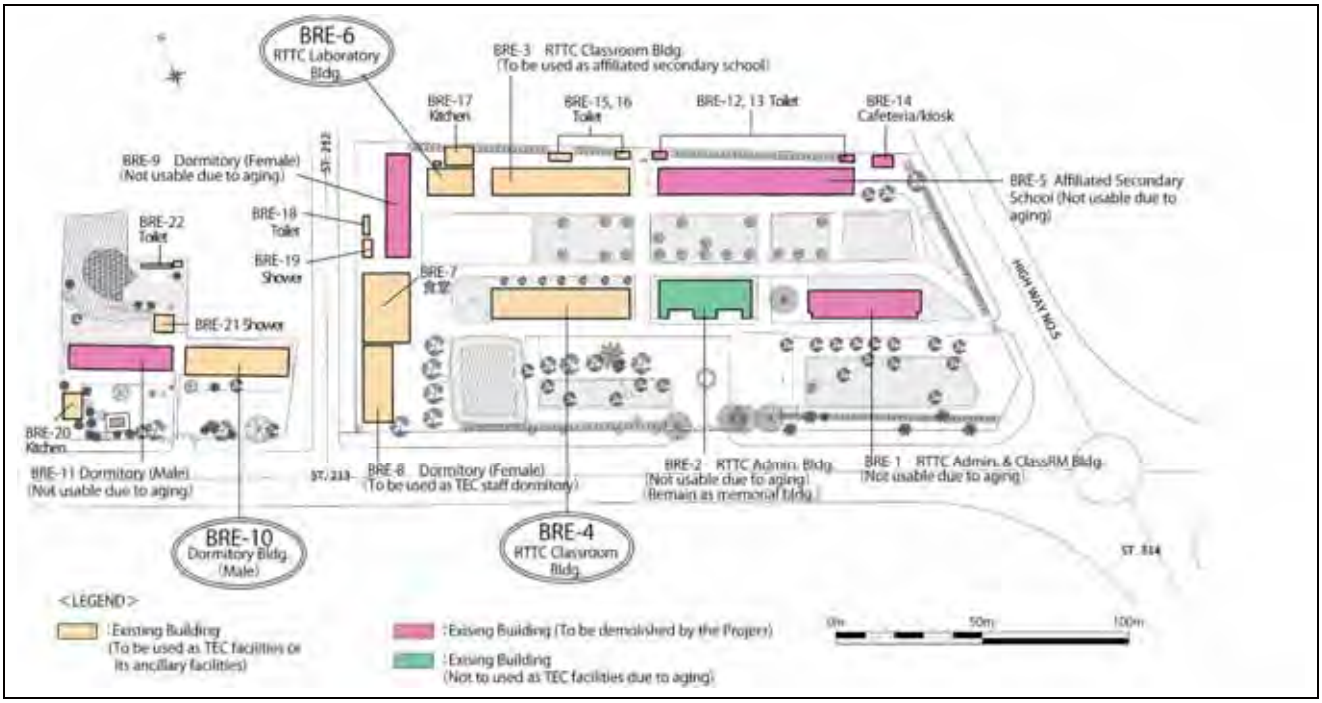


Figure 2-4 Current Site Layout of Battambang PTTC/RTTC

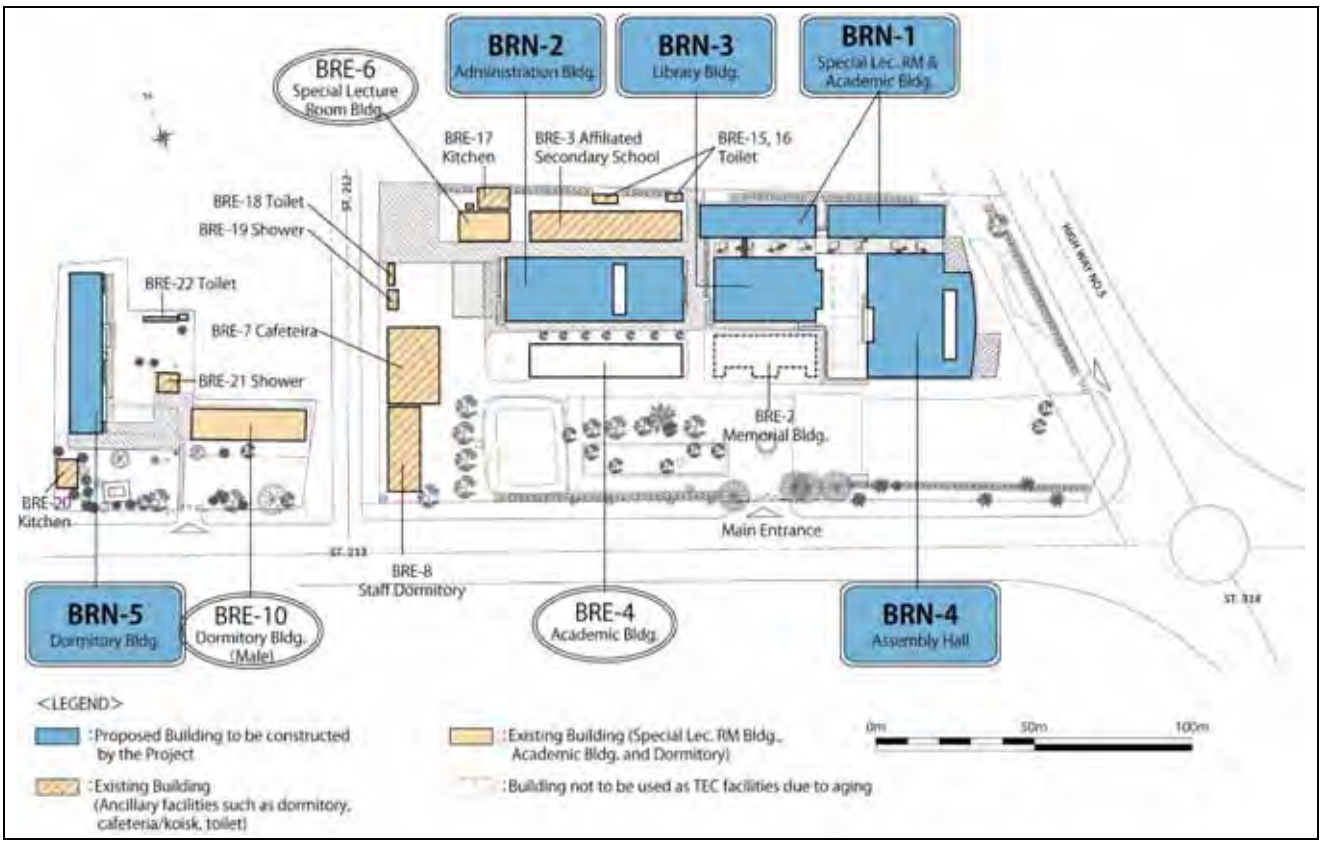


Figure 2-5 Proposed Site Layout for Battambang TEC

(2) Architectural Plan

1) Floor Plan

The floor plans by room and/or block provided by this Project are described below. The explanations regarding reused rooms from existing buildings are omitted.

① Special Lecture Room Block

a. Science Laboratory, Chemistry Laboratory, and Biology Laboratory

The size of each laboratory is 96 m^2 (8m x 12m). Inside each laboratory, 4 sets of 8-seat laboratory tables, to accommodate 30 students, and a demonstration table for lecturers are procured by the equipment component of the Project, so that experiments can be held in the laboratories. Two exits/entrances are provided in each laboratory, and windows are installed on the south and the north walls. Each laboratory has a preparation room of $32m^2$.

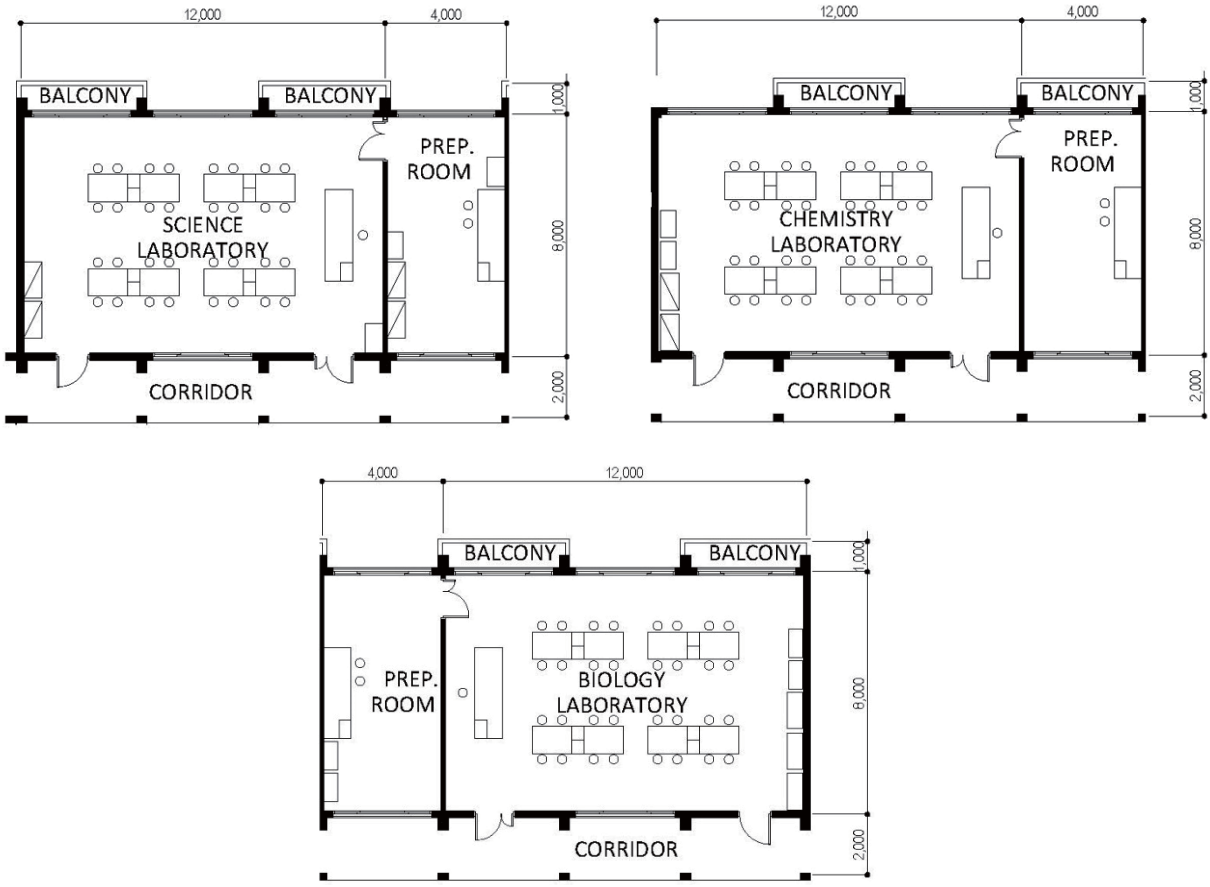


Figure 2-6 Floor Plans of Science, Chemistry, Biology Laboratories and Preparation Rooms

b. Music Room

The size of the music room (large) is 128 m^2 (8m x 16m) with 60 student seats. The size of the music room (small) is 96 m^2 with 30 student seats. Both large and small rooms are planned to be equipped with 2-seat electronic pianos for students and another one for lecturers. Since each TEC already owns a certain number of electronic pianos, the remaining number of electronic pianos will be

procured by the equipment component of this Project. Two exits/entrances are provided in each room, and windows are installed on the south and the north walls. The size of preparation room is 32m^2.

For Phnom Penh TEC, only a music room (large) will be newly provided, because one of the existing buildings is planned to be transformed into a music room (small).

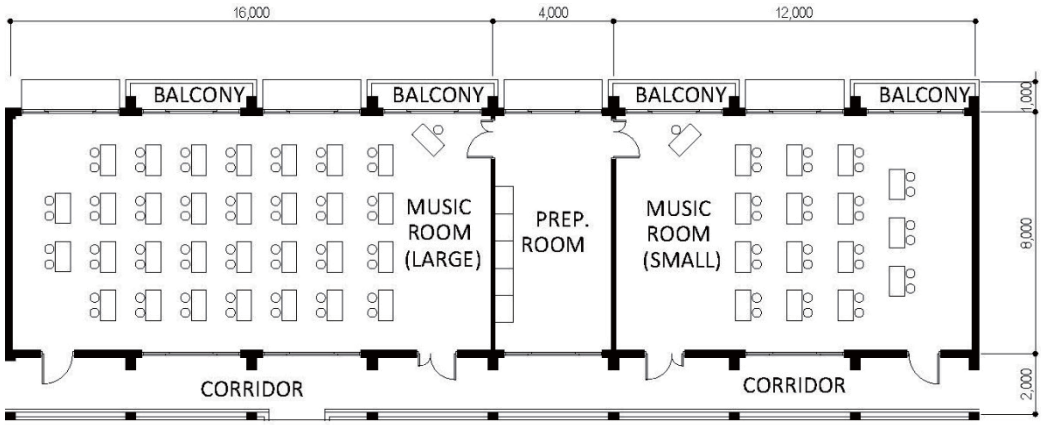


Figure 2-7 Floor Plan of Music Room (large), Music Room (small), and Preparation Room

c. Art Room

The size of the art room (large) is 128 m^2 (8m x 16) with 60 student seats. The size of the art room (small) is 96 m^2 (8m x 12m), with 30 student seats. Inside the room, 6-seat tables, and a demonstration table for lecturers, all with sinks, are procured and installed by the equipment component of this Project. Two exits/entrances are provided, and windows are installed on the south and the north walls in each room. Each room has a preparation room (Phnom Penh TEC: 16m^2, Battambang TEC: 32 m^2 -shared with large and small art rooms).

For Phnom Penh TEC, only an art room (large) will be newly provided, because one of the existing buildings is planned to be transformed into an art room (small).

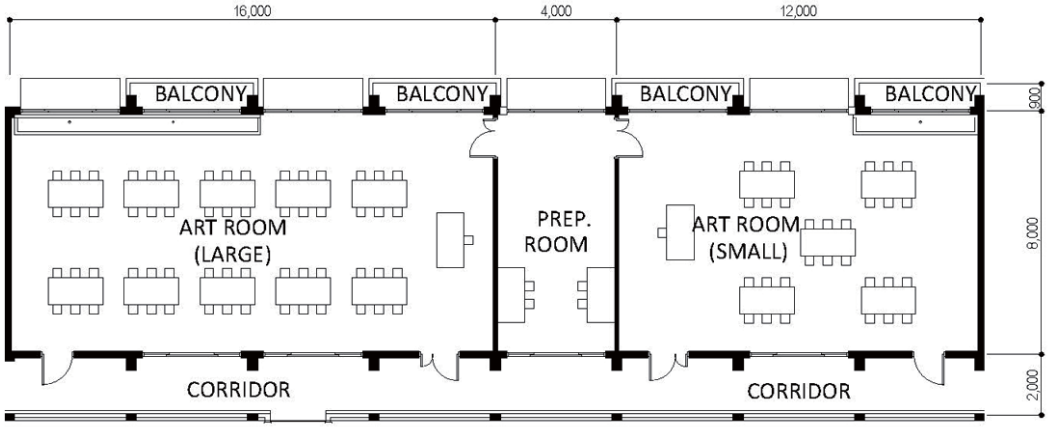


Figure 2-8 Floor Plan of Art Room (large), Art Room (small), and Preparation Room

d. Home Economics Room

The size of the room is 96m^2 (8m x 12m) with 30 student seats. Inside the room, 5 sets of 6-seat tables, and a demonstration table for lecturers are procured and installed by the equipment component of the Project. Two exits/entrances are provided, and windows are installed on the south and the north walls. A preparation room (Phnom Penh TEC: 16m^2, Battambang TEC: 32m^2) is adjacent to the home economics room.

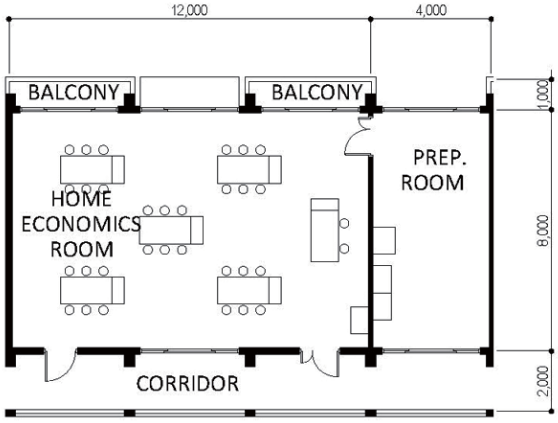


Figure 2-9 Floor Plan of Home Economics Room and Preparation Room

e. ICT Room

The size of the room is 80 m^2 (8m x 10m). To accommodate 30 students in each room, 16 sets of 2-seat computer desks and a lecturer's desk are procured and installed by the equipment component of the Project. ICT rooms are located in the library building taking into account the need for consolidating information and communication facilities and mutual access between the ICT rooms, the ICT room for self-study and the library.

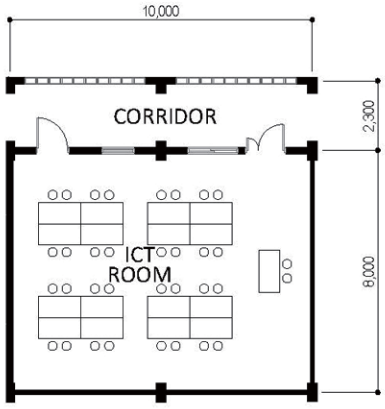
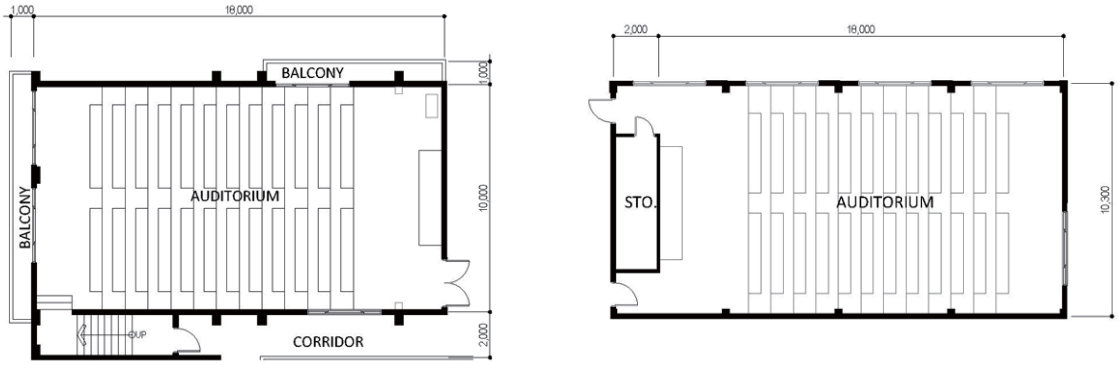


Figure 2-10 Floor Plan of ICT Room

② Academic Block

a. Auditorium

The size of the room is 180 m^2 (18m x 10m) in a theatre style to accommodate 120 students. Lecture theatre seats with writing desks are installed in the auditorium. Two exits/entrances are provided.



Phnom Penh TEC Auditorium　　Battambang TEC Auditorium

Figure 2-11 Floor Plans of Auditoriums

b. Lecture Room

Because some of the existing buildings are planned to be transformed into lecture rooms for Phnom Penh TEC, only Battambang TEC will receive newly provided lecture rooms. The size of the room is 64 m^2 (8m x 8m) with 30 student seats. A lecturer's desk and chair is installed in each lecture room. Two exists/entrances are provided, and windows are installed on the south and the north walls in each room.

c. Research Room

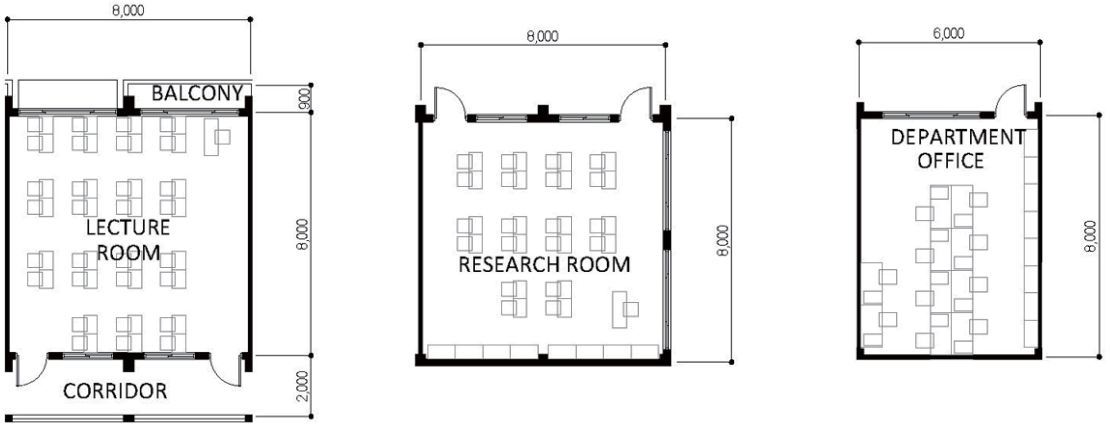
Because the existing facilities are planned to be transformed into research rooms for Phnom Penh TEC, only Battambang TEC will receive newly provided research rooms. The size of the research room is 64 m^2 (8m x 8m) to accommodate 15 to 20 students. A lecturer's desk and chair is installed in each research room. Two exists/entrances are provided, and windows are installed on the south and the north walls.

d. Department Office

Because the existing facilities are planned to be transformed into department offices for Phnom Penh TEC, only Battambang TEC will receive newly provided department offices. Considering the zoning based on function, the department offices are to be located in the administration block. There are two sizes of offices: has two kinds in 64 m^2 (8m x 8m) and 48 m^2 (8m x 6m) to accommodate 10 lecturers/researchers each, adjusted to the floor plan of the administration building. 10 sets of lecturer's desks and chairs are to be procured for each office. Two exists/entrances for 64 m^2 type and one for 48 m^2 type are provided, and windows are installed on either the south or the north walls

depending on the floor plan.

The capacity of each office is set at 10 based on the initial request from Cambodian side, and it was confirmed in the Technical Notes[26] and the Technical Notes No. 2[27] resulting from the series of discussions during the field surveys. On the other hand, as described in "2-4-1 (4) Recruitment of Lecturers and Staff" hereunder, the number of lecturers and researchers in each department is tentatively planned as 10 to 13 full-time lecturers/researchers and 0-20 part-time or contract-based ones, while the final number of the lecturers/researchers have not been confirmed yet. Under present conditions, the Project will provide each department office with a capacity of 10 people, which is the minimum number of full-time lecturers/researchers for a department.



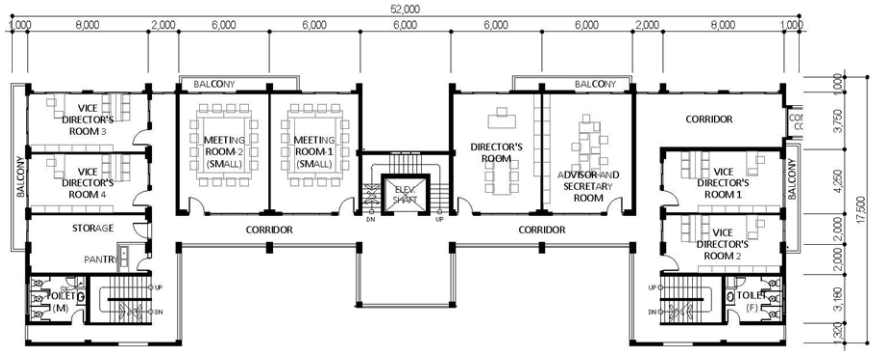
Academic block Research Room Department Office (small)

Figure 2-12 Floor Plans of Lecture Room, Research Room, and Department Office (small)

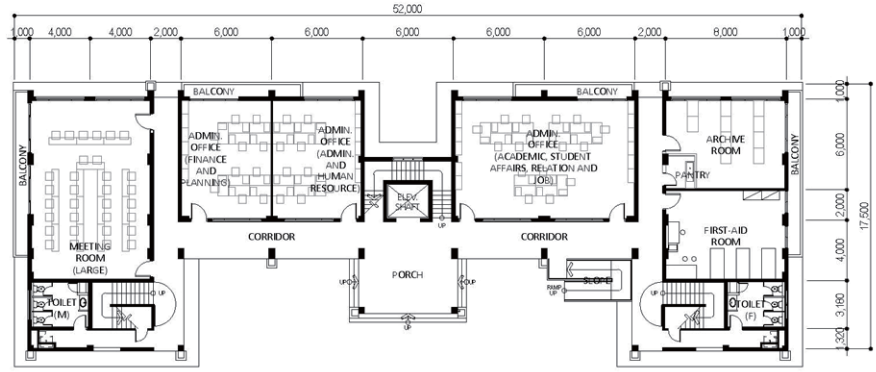
③ Administration Block

The administration block consists of a director's room, four vice director's rooms, an advisor and secretary room, three administration offices, an archive room, meeting rooms (large x 1 and small x 2), and a first-aid room. Phnom Penh TEC locates the administration block on the ground floor and 1st floor of its administration building. Battambang TEC has its administration block in the west block of the ground floor and 1st floor of its administration building.

[26] Technical Notes: signed on January 13, 2017.
[27] Technical Notes No.2: signed on March 16, 2017.

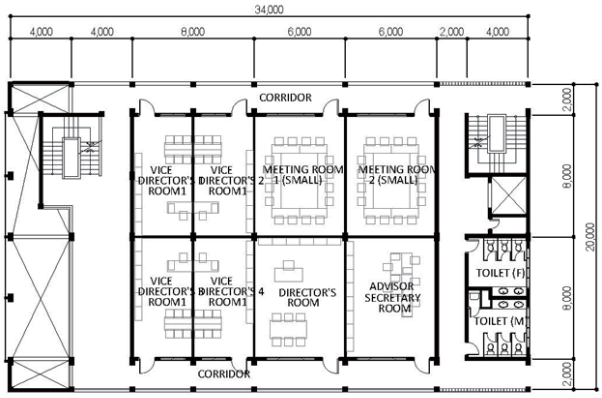


(1st Floor)

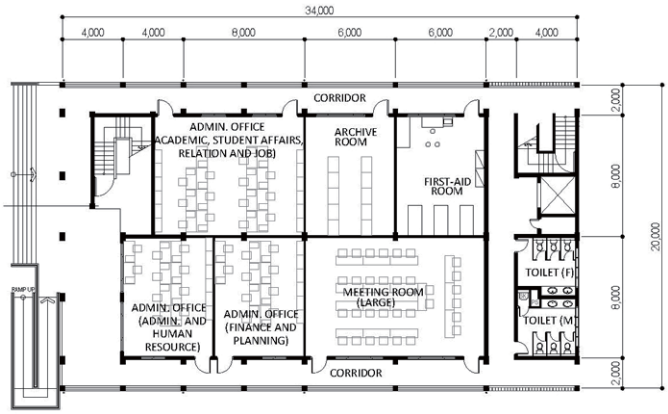


(Ground Floor)

Figure 2-13 Floor Plans of Administration Block (Phnom Penh TEC)



(1st Floor)



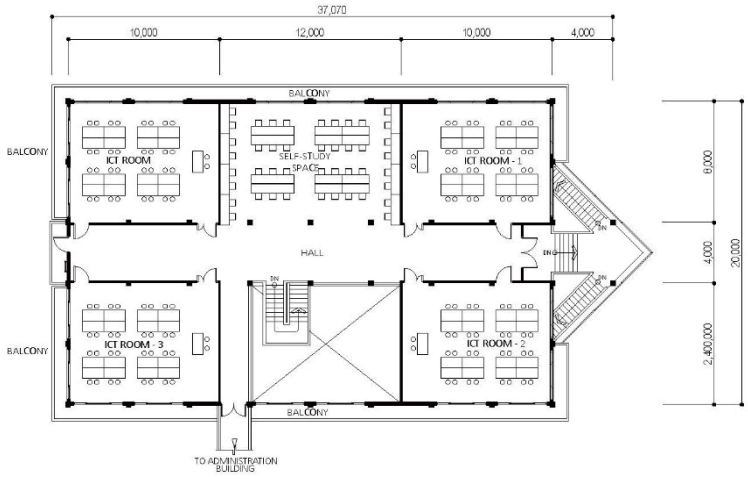
(Ground Floor)

Figure 2-14 Floor Plans of Administration Block (Battambang TEC)

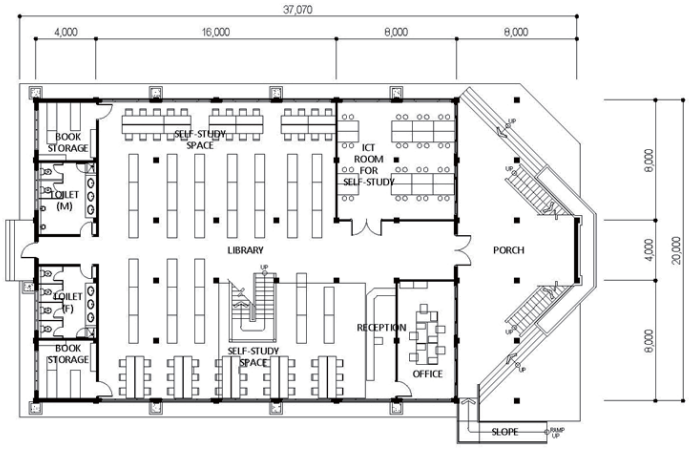
④ Library

The library building of Phnom Penh TEC consists of a library, an ICT room for self-study and a library office on the ground floor, and self-study spaces with 100 student seats located on the ground floor and the 1st floor, which are connected through an atrium space. The library room has bookshelves, the self-study spaces have reading desks/chairs, the ICT rooms for self-study has desks/chairs for 30 students, and the library office has desks/chairs and racks.

The library building of Battambang TEC consists of a library room with self-study space for 100 students, an ICT room for self-study, and a library office on the ground floor. The library room is provided with bookshelves, and the self-study spaces include reading desks/chairs. The ICT room for self-study has desks/chairs for 30 students, and the library office has desks/chairs and racks.



(1st Floor)



(Ground Floor)

Figure 2-15 Floor Plans of Library (Phnom Penh TEC)

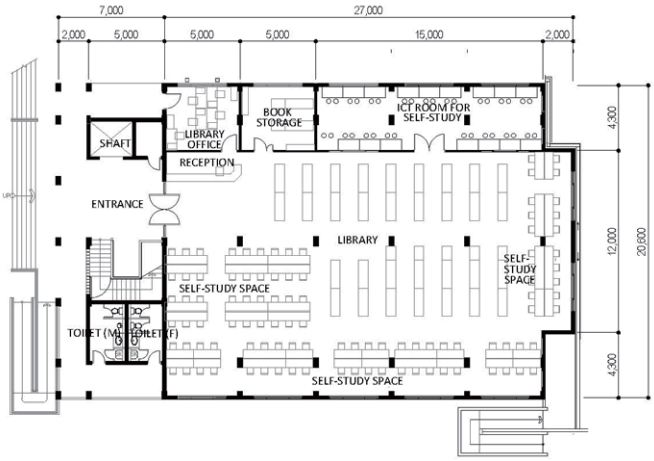


Figure 2-16　Floor Plan of Library (Battambang TEC)

⑤ Assembly Hall

The assembly hall is a facility that provides functional space for conventions and sports events. The size of the hall is set to be 33m x 20m (660 m^2) with 600 seats for conventions, and is sufficient for playing basketball inside.　A stage, a waiting room, locker rooms, and shower rooms are also provided.　The suspended basketball goals are fixed as the facility component, while the badminton/volleyball nets are to be procured under the equipment component of the Project.

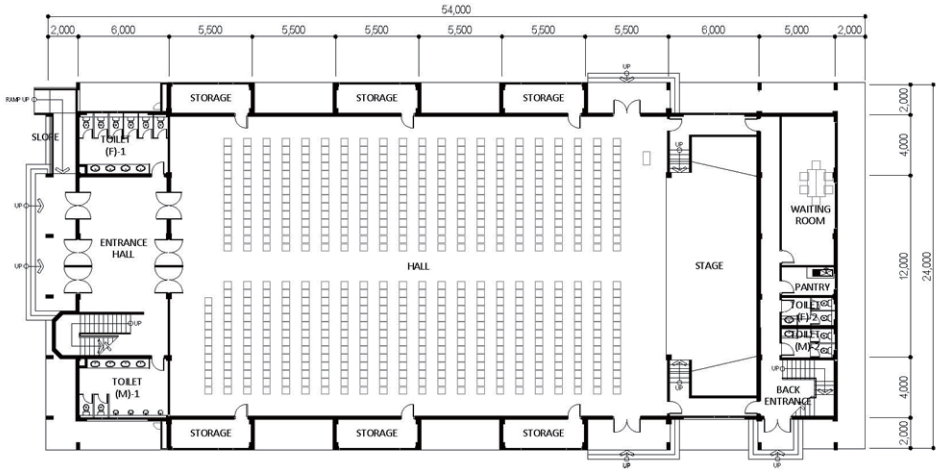


Figure 2-17　Ground Floor Plan of Assembly Hall (Phnom Penh TEC)

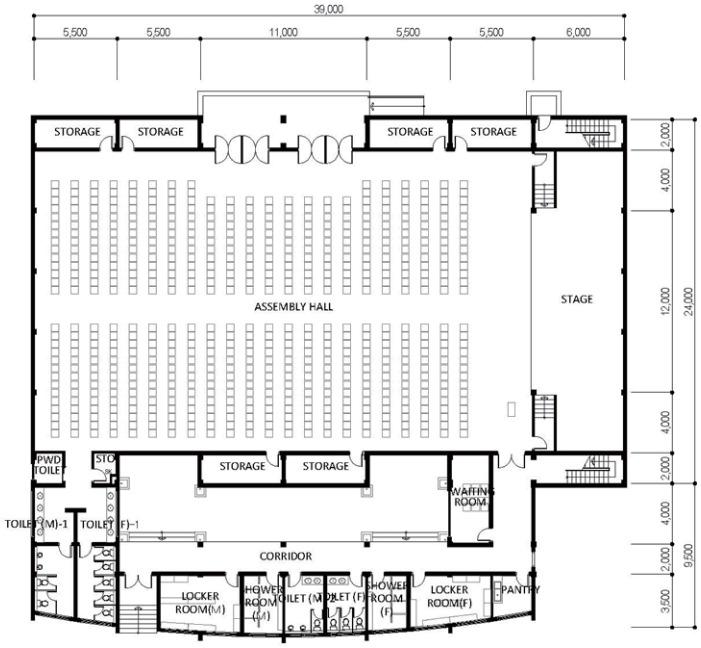
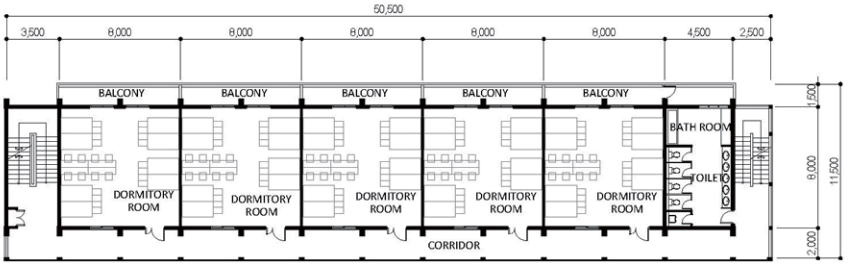


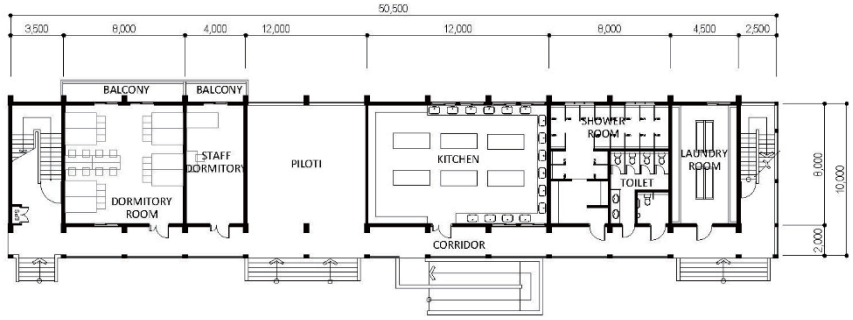
Figure 2-18　Ground Floor Plan of Assembly Hall (Battambang TEC)

⑥ Dormitory

A dormitory building is planned for Battambang TEC only. The building is planned as a four-storey building with 16 dormitory rooms (a capacity of 256 students) and common spaces. 8 sets of two bed bunks, 8 sets of tables/chairs (each one shared by 2 students), and clothes hanging racks for each student are provided inside the dormitory room. The building has toilets and a bath room on each floor. A kitchen, a shower room, a laundry room and a staff dormitory room are located on the ground floor. Although the Cambodian side will eventually decide whether the building will be used either for male or female students, the building is designed for the use of only one group based on the gender considerations, social habits, and customs in Cambodia.



(1st to 3rd Floor Plan)



(Ground Floor Plan)

Figure 2-19　Floor Plans of Dormitory

2) Cross-Section

The basic principles of designing the cross-section are as follows.

- Considering the viable constructive areas and the effective use of the sites, the planned facilities are 2 to 4 storey structures except the assembly halls.
- As a countermeasure for flooding, the ground floor level of the Phnom Penh TEC is set at 50 cm above ground level, and the Battambang TEC is set at 100 cm.
- The floor-to-floor height for each building is set to be 3.5 m. The use of a suspended ceiling system is determined based on the functions of the rooms, the presence of air conditioning and so on. The ceiling height of rooms with a suspended ceiling is 2.5m to 2.6m, while the ones with contact ceiling is 3.3m in general.
- Sloped roofs finished with aluminium-galvanized steel roofing sheets or cement tiles are used. Insulation is to be applied underneath the roofing materials, and the attic spaces between the ceiling and the sloped roof is enclosed for the sake of heat insulation and noise reduction.
- To mitigate the entrance of oblique sun light, and to lower the thermal load of the air-conditioning, balconies and eaves are effectively located and louvers are installed outside windows.

3) Structural Plan

① Type of structure

The buildings have a reinforced concrete frame structure, and the exterior walls and partition walls are infilled with brick. The roof is constructed with a reinforced concrete strut/purlin frame structure underplayed with a steel frame, in principle. However, for auditoriums and assembly halls where long span roof structures is needed, a steel structure (sloped steel beams or steel truss structure) is adopted in considerations of the structural design.

A structural slab is adopted for the ground floor, because of the weak subsoil conditions of both sites and because the floor level will be raised 0.5 to 1.0 m above the ground level as a measure against flooding. However, the arena area of the assembly hall is slab on grade applied onto improved ground by using shallow cement-soil mixing methods, in consideration of the cost reduction resulting from the omission of structural slab and piles in this area.

② Foundation

As a result of the weak subsoil conditions, all buildings are constructed on a pile structure. Based on the soil tests, piles 18m and 27m in length will be used for Phnom Penh TEC and Battambang TEC, respectively. The piling method is cast-in-place for both sites (likely employing reverse circulation drilling methods. Pile diameter: 500mm and 600mm).

Table 2-13 Summary of Piles for the Proposed Buildings

Site	Building ID / building name	Pile length		Pile diameter	
		18m	27m	500 ㎜	600 ㎜
Phnom Penh TEC	PN-1 Special lecture room building	●		●	●
	PN-2 Administration building	●		●	●
	PN-3 Library building	●		●	
	PN-4 Assembly hall	●		●	
Battambang TEC	BRN-1 Special lecture & academic building		●	●	●
	BRN-2 Administration building		●	●	●
	BRN-3 Library building		●	●	●
	BRN-4 Assembly building		●	●	
	BRN-5 Dormitory building		●	●	●

③ Design Forces

Since Cambodia does not experience earthquakes, seismic design force is not considered. On the other hand, since Cambodia is hit by monsoon and typhoon, the wind load is set to be 74.5 mph (equivalent to 34m/s: the same as Tokyo).

④ Structural Materials

The design strengths of materials for structural design are as follows.

- Concrete : fc24
- Reinforcing bar : D10-D20：390N/mm^2, R6-R8：235N/mm^2
- Structural Steel : 235 N/mm^2

⑤ Design Loads

The design loads are as follows.

- Roof/eaves : 1000N/m^2
- Auditorium, special lecture rooms : 3000N/m^2
- Library building : 4500N/m^2 (Loading for corridors was chosen after comparing the Structural Guideline of Tokyo at 3900N/m^2 and the corridor load of 4500N/m^2)
- Administration offices : 2900N/m^2 (Article 85 of Order for Enforcement of the Building Standards Law of Japan, “offices”)
- Assembly hall : 3500N/m^2（Article 85 of Order for Enforcement of the Building Standards Law of Japan, “meeting hall”）
- Corridor : 4500N/m^2
- Stairs : 3000N/m^2

4) Building Service Plan

① Electrical System

a. Substation

Both sites are planned to receive the medium voltage (22kV) power supply (by underground cable

for Phnom Penh TEC and overhead cable for Battambang TEC) from the main line along the frontal main roads. Incoming medium voltage power will be transformed down to low voltage (220/380V) at the substation (cubicle) of each site, and it will be distributed to each building through underground cables. The design electrical capacity is 550 kVA for Phnom Penh TEC and 1075 kVA for Battambang TEC. The design electrical capacity for each building is as follows.

Table 2-14 Design Electrical Capacity for Each Building

Facilities	Phnom Penh TEC (kVA)	Battambang TEC (kVA)
Special lecture room building	125	—
Special lecture & academic building	—	300
Administration building	175	300
Library building	125	175
Assembly building	125	125
Dormitory building	—	175

b. Trunk Cable System

Low voltage trunk cables are drawn from the exterior walls of each building, and distributed through the building corridors by using cable rack system.

c. Lighting System

In principle, lighting equipment is direct-mounted. LED base lights are used in the lecture rooms and the administration rooms. LED ceiling lights are used for the wet rooms and corridor areas. LED high ceiling lights are used in the assembly hall, however bulb lifting devices for maintenance are not provided. The illuminance values set for the major rooms are as follows.

Table 2-15 Illuminance Values of Major Rooms

Room	Illuminance (lux)
Lecture room, Special lecture room	200 (at desk surface)
Library	200 (at desk surface)
Administration building (office)	200 (at desk surface)
Assembly hall (hall)	300 (at floor surface)
Dormitory building (dormitory room)	200 (at floor surface)

In addition, evacuation guide lights will be installed at the exits/entrances of assembly halls and auditoriums.

d. Socket System

The appropriate number of sockets are installed according to the use and function of each room and common space. The tables for the laboratories, which are procured and installed under the

equipment component of the Project, have built-in sockets. The Contractor engaged for the facility component will install the electrical cables up to floor boxes at the positions of such tables, and the Supplier for the equipment component will connect the cable to the sockets mounted in the tables. Furthermore, because the offices and ICT rooms have many distribution cables, several wiring boxes are installed in the floor for easy layout changes.

e. Communication System

The communication system (LAN and telephone) will be provided to the rooms depending on the functions and use thereof. The equipment of the LAN system is installed in an office in the administration building, and access points and communication outlets are provided in the other rooms. The telephone system is installed in the same way as the LAN system. Because the offices and ICT rooms have many distribution cables, several wiring boxes are installed in the floor for later layout adjustment. Wiring for the TV system is run from cable TV.

f. Fire Alarm System

Heat sensors for the fire alarm system are installed in each laboratory and home economics room of special lecture room building. If a fire is detected, emergency lights and bells will operate. This system is built into the indoor fire hydrant system, described in a later section.

g. Broadcasting System

Although the broadcasting system equipment for the assembly halls are procured by the equipment component of the Project, the speakers are installed by the Contractor engaged for the facility component of the Project.

h. Lightning Protection System

Considering the building layouts within the sites, lightning rods are installed at 3 buildings in Phnom Penh TEC, and 2 buildings in Battambang TEC. The lightning conductors are installed on the roof top of each building.

② Mechanical System

a. Air conditioning and Ventilation System

(Air Conditioning System)

The air conditioning systems are installed in the rooms that need to be airtight and temperature control for the special lecture room block, the academic block, the administration block and the libraries. Air-cooled separate type air conditioners are adopted for the Project. In terms of maintenance, an outdoor and an indoor unit is installed as a pair, and the indoor unit is suspended from the ceiling. For the lecture rooms, the research rooms, the waiting rooms of the assembly halls and the dormitory rooms, ceiling fans are installed instead of an air conditioner.

(Ventilation System)

The ventilation systems are provided in the laboratories, the art rooms, and the home economics room of the special lecture room block, the archive room of the administration block, the first-aid room of the administration block, the kitchen of the dormitory, and wet rooms such as toilets and shower rooms of each building. Wall mounted ventilation fans are adopted in general. The duct ventilation system is installed for rooms which do not have an exterior wall.

b. Water Supply and Drainage System

A water tank and its built-in pump unit are installed for the water supply system, and connected to the existing water supply pipes. Although water is fed by the pump from the water tank to each building, an elevated water tank is installed on the roof level for buildings which have water supply outlets installed above 2nd floor.

The grey water and sewage water are separately drained inside each building, and merge outside the building within the site. The drained water is naturally treated through septic tanks placed on each site, flows through the drain channels, then drain off the site.

The volume of water supply is calculated based on the designed water volume as shown below.

- General facilities: 20 litres/ person・days (lecturers), 15 litres/ person・days (students)
- Dormitory building: 50 litres/ person・days (lecturers, students)

c. Fire Extinguishing System

Indoor fire hydrant systems are installed in an area covering the laboratories, the home economics room of the special lecture room building, and the kitchen of the dormitory. An underground fire cistern, fire pump, and roof-top fire supplement water tank are installed for the special lecture room building. As for the dormitory, the kitchen is the only the room requiring fire extinguishing systems, a packaged fire hydrant is to be installed.

d. Elevator System

While installation of elevators was discussed as a way to maintain full accessibility of the buildings, it was determined that operation and maintenance of elevators is a challenge at the present situation. If the proper operation and maintenance are not carried out, serious accidents may occur. Hence, this Project provides only elevator shafts to allow future installation of elevators by the Cambodian side when a proper operation and maintenance structure is established along with an adequate budget.

The following able indicates the summary of major service systems.

Table 2-16 Summary of Service Systems

Block	Name of room	Water supply system	Drainage system	Air-conditioning sytem	Ventilation system	Ceiling fan	Lighting system	Socket system	Telephone system	LAN system	Acoustic (broadcast) system	TV system	Emergency exit sign	Fire alarm system	Indoor fire hydrant system
Special lecture room block	Science laboratory	●	●	●	●		●	●						●	●
	Chemistry laboratory	●	●	●	●		●	●						●	●
	Biology laboratory	●	●	●	●		●	●						●	●
	Music room			●			●	●							
	Art room	●	●	●	●		●	●							
	Home economics room	●	●	●	●		●	●						●	●
	ICT room			●			●	●		●					
Academic block	Auditorium			●			●	●					●		
	Lecture room					●	●	●							
	Research room					●	●	●	●	●		●			
	Department office			●			●	●	●	●		●			
Administration block	Director's room			●			●	●	●	●		●			
	Vice director's room			●			●	●	●	●		●			
	Advisor and secretary room			●			●	●	●	●		●			
	Admin. Office			●			●	●	●	●		●			
	Archive room				●		●	●							
	Meeting room			●			●	●	●	●		●			
	First-aid room	●	●	●	●		●	●	●	●		●			
Library	Self-study space			●			●	●							
	ICT room for self-study			●			●	●		●					
	Library reception			●			●	●	●	●					
	Book storage				●		●	●							
Assembly hall	Hall						●	●			●		●		
	Stage						●	●							
	Waiting room					●	●	●							
	Locker room						●	●							
	Shower room	●	●		●		●	●							
Dormitory	Dormitory room					●	●	●							
	Kitchen	●	●		●		●	●						●	●
	Shower room	●	●		●		●	●							
	Laundry room	●	●		●		●	●							

5) Construction Materials

The new buildings to be covered by this Project are generally designed to be constructed by using locally available building materials. Table 2-17 indicates the building material schedule for each building of Phnom Penh TEC and Battambang TEC.

6) Furniture

Table 2-18 indicates the list of furniture to be equipped by the Project.

Table 2-17 Building Material Schedule

Element \ Bld. number / Name	PN-1	PN-2	PN-3	PN-4	BRN-1	BRN-2	BRN-3	BRN-4	BRN-5
	Special lecture room building	Administration building	Library building	Assembly hall	Special lecture & academic building	Administration building	Library building	Assembly hall	Dormitory
Major structure									
Number of levels	2	3	2	1 (partially have 2F)	4	3	3	1(partially have 2F)	4
Roof	Reinforced concrete with roof truss, steel rafter/purlin	Steel truss, steel purlin	Reinforced concrete with roof truss, steel rafter/purlin	Steel beam structure	Reinforced concrete with roof truss, steel rafter	Reinforced concrete with roof truss, steel rafter	Steel truss	Steel beam structure	Reinforced concrete with roof truss, steel rafter/purlin
Wall	Brick masonry	Brick masonry	Brick masonry	Brick masonry	Brick masonry	Brick masonry	Brick masonry	Brick masonry	Brick masonry
Column/beam	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete	Reinforced concrete
Foundation	Pile (length 18m)	Pile (length 18m)	Pile (length 18m)	Pile (length 18m)	Pile (length 27m)	Pile (length 27m)	Pile (length 27m)	Pile (length 27m)	Pile (length 27m)
Exterior finish									
Roof	Cement tile roofing	Cement tile roofing	Cement tile roofing	Metal corrugated sheet roofing	Metal corrugated sheet roofing	Metal corrugated sheet roofing	Metal corrugated sheet roofing	Metal corrugated sheet roofing	Cement tile roofing
Wall	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor	Plaster wall, paint finish, and stone finish only on the ground floor
Fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture
Floor	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)
Interior finish									
Contact ceiling	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish	Concrete surface repair, paint finish
Suspended ceiling	T bar suspended grid frame General room: rock wool acoustic board Music room: acoustic porous board	T bar suspended grid frame General room: rock wool acoustic board	T bar suspended grid frame General room: rock wool acoustic board	Fiber glass board	T bar suspended grid frame General room: rock wool acoustic board Music room: acoustic porous board	T bar suspended grid frame General room: rock wool acoustic board	T bar suspended grid frame General room: rock wool acoustic board	Fiber glass board	Cement board
Wall (general)	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish	Plaster wall, paint finish
Wall (wet room)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)	Ceramic tile (200 x 200)
Fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture	Aluminum fixture
Floor (general)	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Hall: thick film elastic urethane resin floor Stage: Floor paint finish GF & others: Floor tile (300 x 300) 1F: PVC Sheet	Floor tile (300 x 300)	Floor tile (300 x 300)	Floor tile (300 x 300)	Hall: thick film elastic urethane resin floor Stage: Floor paint finish GF & others: Floor tile (300 x 300) 1F: PVC Sheet	Floor tile (300 x 300)
Floor (wet room)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)	Floor tile (200 x 200)

Table 2-18 List of Furniture

Blocks	Name of rooms	List of furniture/supplies ( ) is the quantity for 1 room	Remarks (Equipment)
Special lecture room block	Science laboratory		Laboratory tables/chairs, cabinet
	Chemistry laboratory		Same as above
	Biology laboratory		Same as above
	Music room (large) (small)		Electronic piano/chairs, cabinets
	Preparation room		
	Art room (large) (small)		Art tables/chairs
	Preparation room		
	Home economics room		Home economics tables/chairs
	Preparation room		
	ICT room		PC desks/chairs
Academic block	Auditorium	Desks and chair for auditorium (3seats x 40)	
	Lecture room	Student's desk/chair (30), lecturer's desk/chair (1)	
	Research room	Student's desk/chair (20), lecturer's desk/chair (1) Open cabinet (8)	
	Department office	Office desk/chair (10), open cabinet (2), double door cabinet (3), glass door cabinet (3)	
Administration block	Director's room	Office desk/chair (1), double door cabinet (4), glass door cabinet (2), meeting table (2), chair (6)	
	Vice director's room	Office desk/chair (1), double door cabinet (3), glass door cabinet (3), meeting table (2), chair (6)	
	Advisor and secretary room	Office desk/chair (5), open cabinet (2), double door cabinet (3), glass door cabinet (3)	
	Admin. Office (admin. and human resource)	Office desk/chair (10), open cabinet (2), double door cabinet (2), glass door cabinet (2)	
	Admin. Office (finance and planning)	Office desk/chair (10), open cabinet (2), double door cabinet (2), glass door cabinet (2)	
	Admin. Office (academic, student affairs, relation and job)	Office desk/chair (15), open cabinet (4), double door cabinet (4), glass door cabinet (4)	
	Archive room	Rack (10)	
	Meeting room (large)	Meeting table (16), chair (32)	
	Meeting room (small)	Meeting table (8), chair (16)	
	First-aid room		Desk/chair, bed, etc.
Library	Library	Bookshelves, reading desk/chair (100 seats)	
	Book storage	Bookshelves	
	ICT room for self-study		PC desk/chair
	Library office	Office desk/chair (5), double door cabinet (1), glass door cabinet (1)	
Assembly hall	Hall/stage	Chair (600), stage (1)	
	Waiting room	Meeting table (2), chair (6)	
	Locker room	Locker (4), bench (4)	
	Control room	Meeting table (1), chair (1)	
Dormitory	Dormitory room	Double bunk bed (8), hanger rack (16), desk/chair (8 seats)	

2 - 2 - 2 - 2 Basic Plan for Equipment

(1) Examination of Requested Equipment

In considering the equipment planned to be procured in this Project, the Consultant carefully examined each item according to the following equipment selection criteria and the above-mentioned equipment planning policy.

[Equipment Selection Criteria]

① Conformity to curriculum and syllabus in future plan
② Conformity with the number of students and the number of classes designed by the Cambodian government
③ Conformity to maintenance and management system and budgetary provision in current or future plan
④ Not seeking advanced technology
⑤ Capability of purchasing spare-parts and consumables with self-budget in the future (avoidance of obstacles for sustainability)
⑥ Not becoming obsolete quickly
⑦ Not having short durability
⑧ Not used for administration department

Based on the criteria above, each equipment was evaluated with the following five-point allocation.

[Evaluation Criteria and Point]

5 point: No problem
4 point: Generally no problem
3 point: Relevance is recognized, with some minor concerns
2 point: Many concerns (minor and major)
1 point: No relevance

For the comprehensive evaluation of each item of equipment, the above evaluation points for all items were summed up and those at 90% (36 points) out of a full score (40 points) were adopted. To avoid overlap with existing equipment, the planned quantity was calculated by deducting the quantity of existing usable items. The evaluation results are summarized in “Appendix 7 Equipment Relevance Evaluation Table”.

(2) Planned Equipment

The relevance of requested equipment had was examined by the above criteria. The items that are classified as one category were combined as one group. Finally 163 items are counted as reasonable. The planned equipment is summarized below.

Table 2-19 Final Equipment List

Item #		Equipment Name	Planned Quantity		
			Phnom Penh	Battambang	Total
Science, primary					
1	PSC-1	Scale balance	16	16	32
2	PSC-2	Electronic balance	8	9	17
3	PSC-3	DC ammeter	3	9	12
4	PSC-4	DC voltmeter	5	9	14
5	PSC-5	Magnetizing coil	1	1	2
6	PSC-6	Astronomical telescope	1	0	1
7	PSC-7	Tripartite model	0	1	1
8	PSC-8	Binoculars	9	9	18
9	PSC-9	Pendulum apparatus	9	9	18
10	PSC-10	Instrument shelter	1	1	2
11	PSC-11	Experimental lever	16	16	32
12	PSC-12	Air extraction kit	16	16	32
13	PSC-13	Microscope	6	3	9
14	PSC-14	Binocular stereomicroscope	12	16	28
15	PSC-15	Chemical locker	1	1	2
16	PSC-16	Iron support	4	9	13
17	PSC-17	DC power supply	9	9	18
18	PSC-18	Specimen set	2	2	4
19	PSC-19	Arm joint model	1	1	2
20	PSC-20	Skeleton model of human body	1	1	2
21	PSC-21	Anatomical model of human body	0	1	1
22	PSC-22	Eyeball model	1	1	2
23	PSC-23	Ear model	1	1	2
24	PSC-24	Glass tool set	5	4	9
25	PSC-25	Experimental tool set	9	9	18
26	PSC-26	Laboratory table (Biology) for student with stool	8	8	16
27	PSC-27	Laboratory table (Biology) for lecturer with stool	2	2	4
28	PSC-28	Laboratory table (General Science) for student with stool	0	8	8
29	PSC-29	Laboratory table (General Science) for lecturer with stool	0	2	2
30	PSC-30	Pulley	10	6	16
31	PSC-31	Laptop computer	2	2	4
32	PSC-32	Projector	2	2	4
33	PSC-33	Cabinet set	2	2	4
Mathematics, primary					
34	PMA-1	Plotting blackboard	1	1	2
35	PMA-2	Calculation practice card for demonstration	0	1	1
36	PMA-3	Tape for explanation	1	1	2
37	PMA-4	Number line sheet	1	1	2
38	PMA-5	Explanation kit for superficial measure of triangle and tetragon	1	1	2
39	PMA-6	Weight set	1	1	2
40	PMA-7	Explanation kit for polygon	1	1	2
41	PMA-8	Explanation kit for sum of the internal angles	1	1	2
42	PMA-9	Diagram congruity model	9	9	18
43	PMA-10	Study kit for volume	9	9	18
44	PMA-11	Liter square/measure	9	9	18
45	PMA-12	Cabinet set	1	1	2
Social Science, primary					
46	PSO-1	Map and globe set	1	1	2

Item #		Equipment Name	Planned Quantity		
			Phnom Penh	Battambang	Total
Mathematics, lower secondary					
47	LMA-1	Plotting blackboard	1	1	2
48	LMA-2	Development model of formula	1	1	2
49	LMA-3	Diagram congruity model	9	9	18
50	LMA-4	Plane parallel study apparatus	9	9	18
51	LMA-5	Solid model	9	9	18
52	LMA-6	Three dimensional model	9	9	18
53	LMA-7	Pythagorean theorem experiment kit	9	9	18
Physics, lower secondary					
54	LPH-1	Experimental apparatus of slope	9	9	18
55	LPH-2	Dynamic movement apparatus	1	1	2
56	LPH-3	Pulley	1	1	2
57	LPH-4	Experimental lever	9	5	14
58	LPH-5	Vacuum apparatus set	1	0	1
59	LPH-6	Experimental apparatus for dynamics (slope)	1	1	2
60	LPH-7	Semiconductor laser	0	1	1
61	LPH-8	Optical bench and experimental apparatus	1	1	2
62	LPH-9	School Oscilloscope	1	1	2
63	LPH-10	Resonant apparatus in the air column	1	1	2
64	LPH-11	Primary and secondary coils	9	9	18
65	LPH-12	DC AC power supply	9	9	18
66	LPH-13	Instrument set for electrical current and magnetic field	1	1	2
67	LPH-15	Experimental apparatus for dynamics	9	9	18
68	LPH-16	Collision balls	1	1	2
69	LPH-17	Experimental apparatus for energy conversion	1	1	2
70	LPH-18	Laboratory table (Physics) for student with stool	6	0	6
71	LPH-19	Laboratory table (Physics) for lecturer with stool	1	0	1
72	LPH-20	Laptop computer	1	1	2
73	LPH-21	Projector	1	1	2
74	LPH-22	Cabinet set	1	1	2
Chemistry, lower secondary					
75	LCH-1	Electronic balance	9	9	18
76	LCH-2	Magnetic stirrer	9	9	18
77	LCH-3	Chemical locker	2	2	4
78	LCH-4	Refrigerator-Freezer	1	1	2
79	LCH-5	Iron support	9	9	18
80	LCH-6	Glass tool set	3	3	6
81	LCH-7	Experimental tool set	9	9	18
82	LCH-8	Laboratory table (Chemistry) for student with stool	4	4	8
83	LCH-9	Laboratory table (Chemistry) for lecturer with stool	1	1	2
84	LCH-10	Laptop computer	1	1	2
85	LCH-11	Projector	1	1	2
86	LCH-12	Cabinet set	1	1	2
87	LCH-13	Distillator	1	1	2
Biology, lower secondary					
88	LBI-1	Mendel's laws experiment machine	9	9	18
89	LBI-2	Microscope	16	0	16
90	LBI-3	Binocular stereomicroscope	16	10	26
91	LBI-4	Magnifying mirror with polarization	9	9	18
92	LBI-5	Digital camera system for microscope	1	1	2
93	LBI-6	Microscope cabinet	2	2	4

Item #		Equipment Name	Planned Quantity		
			Phnom Penh	Battambang	Total
94	LBI-7	Laboratory wagon	2	2	4
95	LBI-8	Cylinder microtome	2	2	4
96	LBI-9	Magnifier for field	1	1	2
97	LBI-10	Skeleton of vertebrates	1	1	2
98	LBI-11	Anatomy of (in)vertebrate specimens	1	1	2
99	LBI-12	Cell division model	1	1	2
100	LBI-13	Skeleton and organ structure model set A	1	0	1
101	LBI-14	Skeleton and organ structure model set B	0	1	1
102	LBI-15	Laboratory table (Biology) for student with stool	4	4	8
103	LBI-16	Laboratory table (Biology) for lecturer with stool	1	1	2
104	LBI-17	Laptop computer	1	1	2
105	LBI-18	Projector	1	1	2
106	LBI-19	Cabinet set	1	1	2
Earth Science, lower secondary					
107	LEA-1	Tripartite model	1	1	2
108	LEA-2	Transparent celestial globe	1	0	1
109	LEA-3	Rain gauge	1	1	2
110	LEA-4	Specimens set of rock, mineral and fossil	1	1	2
111	LEA-5	Laboratory table (Earth Science) for student with stool	4	0	4
112	LEA-6	Laboratory table (Earth Science) for lecturer with stool	1	0	1
113	LEA-7	Laptop computer	1	1	2
114	LEA-8	Projector	1	1	2
115	LEA-9	Cabinet set	1	1	2
Social Science, lower secondary					
116	LSO-1	Map and globe set	1	1	2
Music, primary					
117	PMU-1	Electronic piano for primary education	23	21	44
118	PMU-2	Music instrument set for primary education	1	1	2
119	PMU-3	CD radio-cassette recorder for primary education	1	1	2
120	PMU-4	Cabinet set for primary education (Music)	1	1	2
Music, lower secondary					
121	LMU-1	Electronic piano for lower secondary education	13	7	20
122	LMU-2	Music instrument set for lower secondary education	1	1	2
123	LMU-3	CD radio-cassette recorder for lower secondary education	1	1	2
124	LMU-4	Cabinet set for lower secondary education	1	1	2
Art, primary					
125	PAT-1	Drawing board for primary education	61	61	122
126	PAT-2	Art desk for student with stool for primary education	12	12	24
127	PAT-3	Art desk for lecturer with stool for primary education	1	1	2
Art, lower secondary					
128	LAT-1	Drawing board for lower secondary education	31	31	62
129	LAT-2	Art desk for student with stool for lower secondary education	6	6	12
130	LAT-3	Art desk for lecturer with stool for lower secondary education	1	1	2

Item #		Equipment Name	Planned Quantity		
			Phnom Penh	Battambang	Total
Workshop					
131	WOK-1	Processing tool set for woodwork	4	4	8
132	WOK-2	Fabricating equipment for woodwork	4	4	8
133	WOK-3	Worktable with stool	0	2	2
134	WOK-4	Cabinet set	1	1	2
Home Economics					
135	HOE-1	Refrigerator	1	1	2
136	HOE-2	Utensil set	6	6	12
137	HOE-3	Tableware set	31	31	62
138	HOE-4	Sewing machine	6	6	12
139	HOE-5	Sewing kit	31	31	62
140	HOE-6	Torso set	1	1	2
141	HOE-7	Iron	6	6	12
142	HOE-8	Cooking/Clothing table for student	5	5	10
143	HOE-9	Cooking/Clothing table for lecturer	1	1	2
144	HOE-10	Cabinet set for Home Economics	1	1	2
ICT					
145	ICT-1	Computer network system for ICT Lab	2	2	4
146	ICT-2	Laptop computer	4	4	8
147	ICT-3	Computer desk and chair set	4	4	8
148	ICT-4	Printer	4	4	8
149	ICT-5	Projector	4	4	8
Library (ICT for Self-study)					
150	LIB-1	Computer network system for library	1	1	2
151	LIB-2	Computer desk and chair set	1	1	2
152	LIB-3	Printer	2	2	4
Assembly Hall					
153	ASB-1	Sound equipment set	1	1	2
154	ASB-2	Projector	1	1	2
155	ASB-3	White board	2	2	4
Physical Education					
156	PHS-1	Sports equipment set	1	1	2
157	PHS-2	Ball set	1	1	2
First-Aid					
158	FIA-1	Equipment for dispensary room	1	1	2
Auditorium					
159	AUD-1	Projector	2	1	3
160	AUD-2	Sound equipment set	2	2	4
Lecture Room					
161	LEC-1	Projector	12	11	23
162	LEC-2	Screen	12	12	24
Academic Department					
163	ACD-1	Computer network system for department office	9	9	18

(3) Operation and Maintenance Plan

Most of the requested equipment are simple structures and have low frequency for repair. The equipment, however, requires routine maintenance for continuous usage. Therefore, basic operation and maintenance will be instructed to users during the initial operation training.

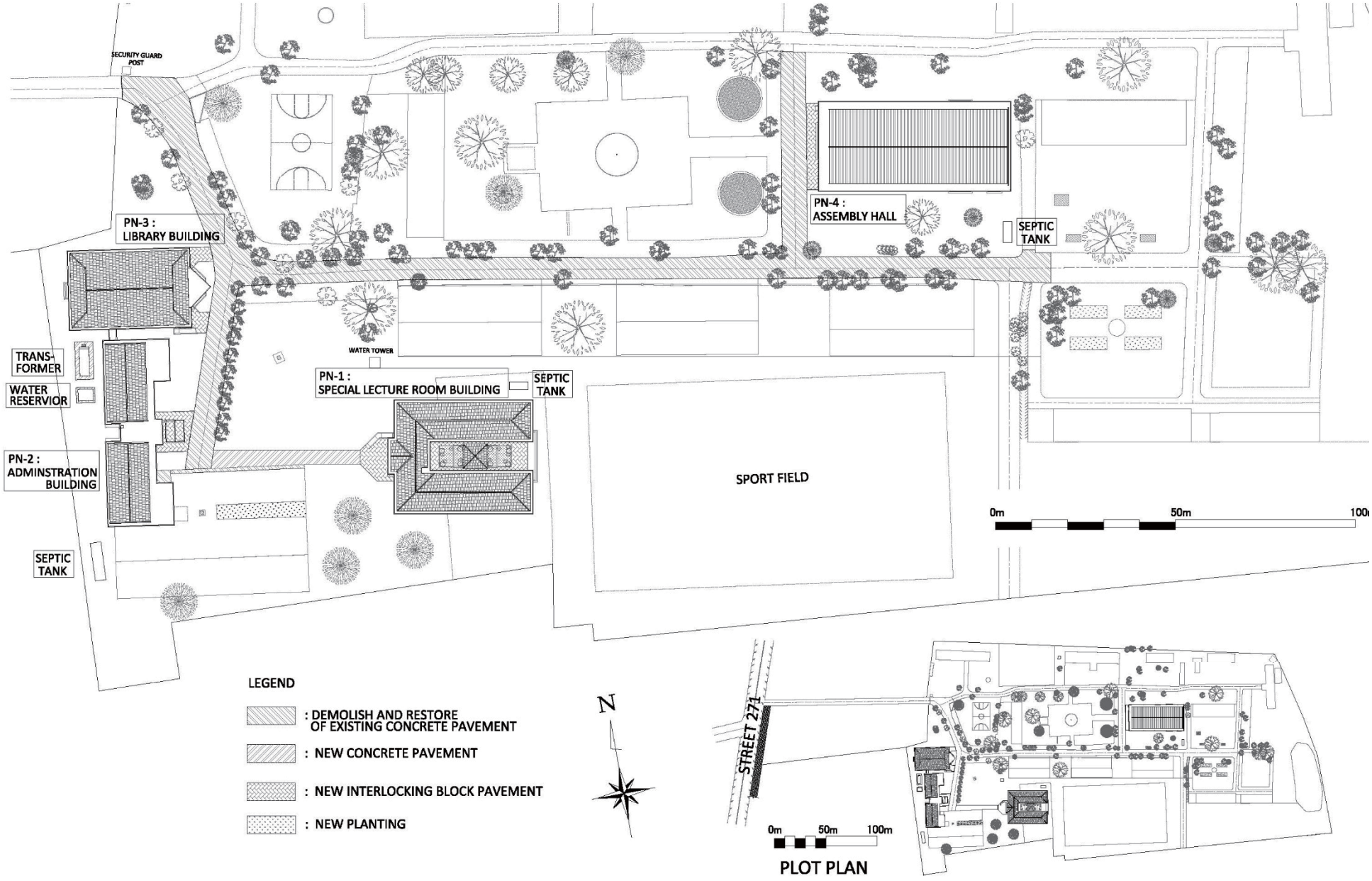
2 - 2 - 3 Outline Design Drawing

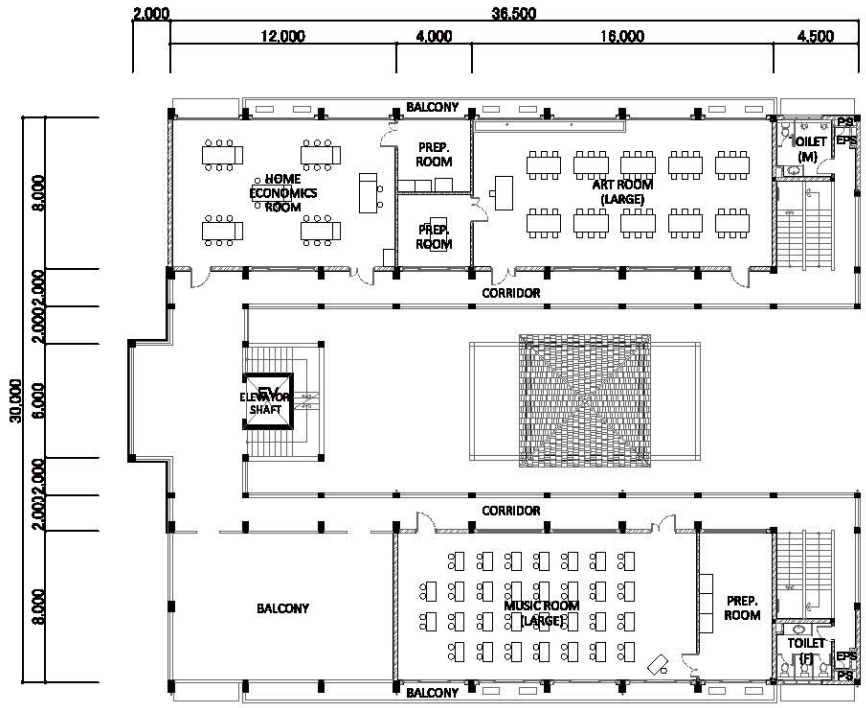
The outline design drawings for the Project are listed below.

Table 2-20 List of Outline Design Drawings

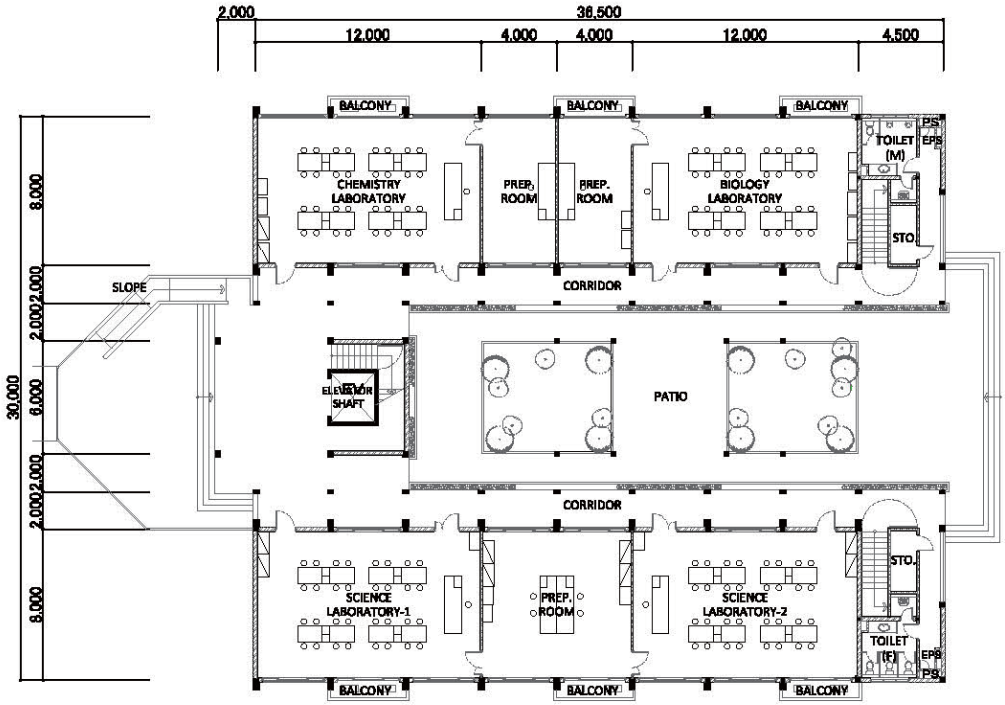
Building number	Building name	List of drawings	Page number
Phnom Penh Teacher Education College			
―	Phnom Penh Teacher Education College	Site plan	2-51
PN-1	Special lecture room building	Floor plan	2-52
		Elevation, section	2-53
PN-2	Administration building	Floor plan	2-54
		Elevation, section	2-55
PN-3	Library building	Floor plan	2-56
		Elevation, section	2-57
PN-4	Assembly hall	Floor plan	2-58
		Elevation, section	2-59
Battambang Teacher Education College			
―	Battambang Teacher Education College	Site plan	2-61
BRN-1	Special room & academic building	Floor plan	2-62
		Elevation, section	2-63
BRN-2	Administration building	Floor plan	2-64
		Elevation, section	2-65
BRN-3	Library building	Floor plan	2-66
		Elevation, section	2-67
BRN-4	Assembly hall	Floor plan	2-68
		Elevation, section	2-69
BRN-5	Dormitory building	Floor plan	2-70
		Elevation, section	2-71

PHNOM PENH TEC LAYOUT PLAN & EXTERNAL WORK PLAN

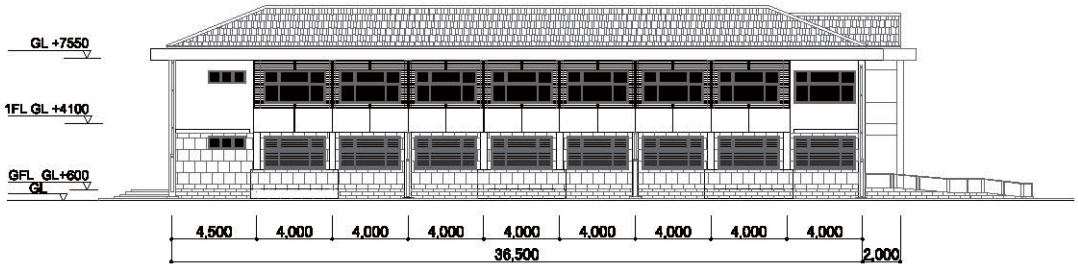




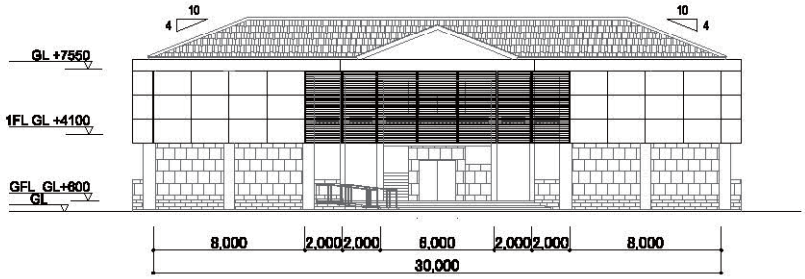
1ST FLOOR PLAN



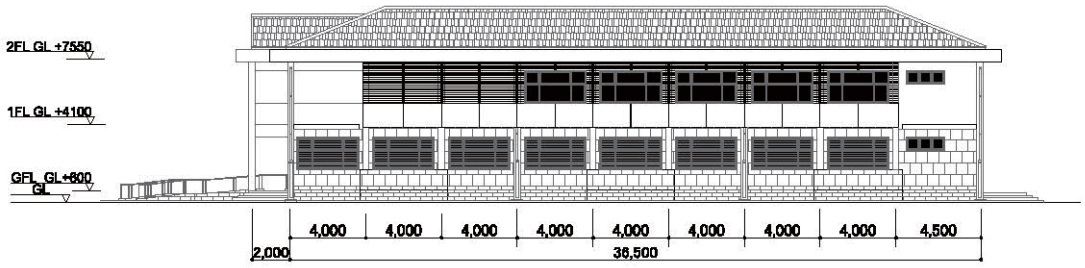
GROUND FLOOR PLAN



NORTH ELEVATION



WEST ELEVATION



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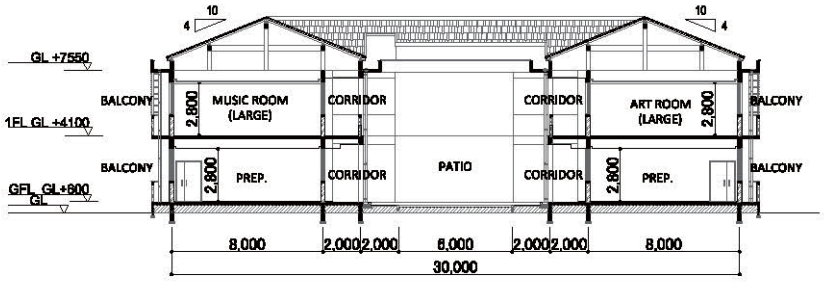

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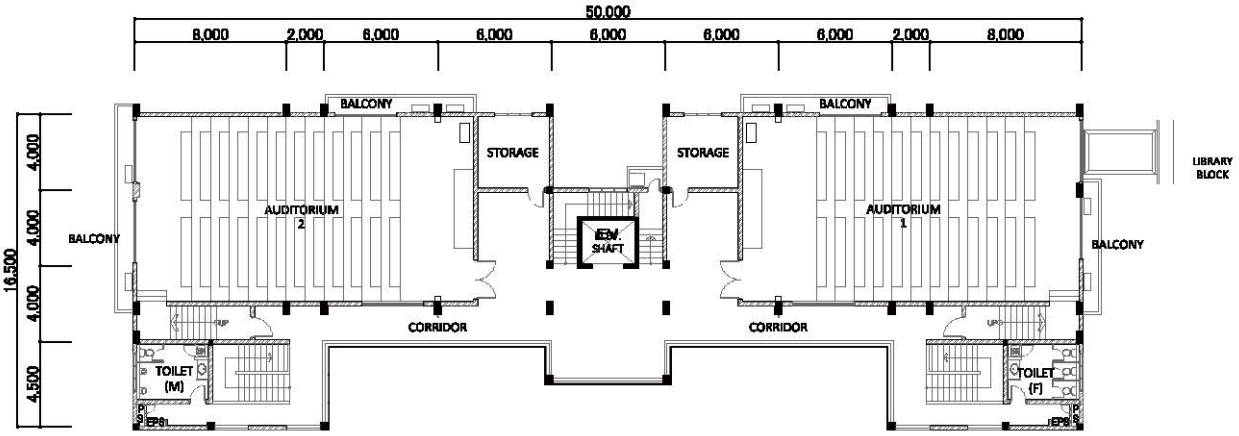

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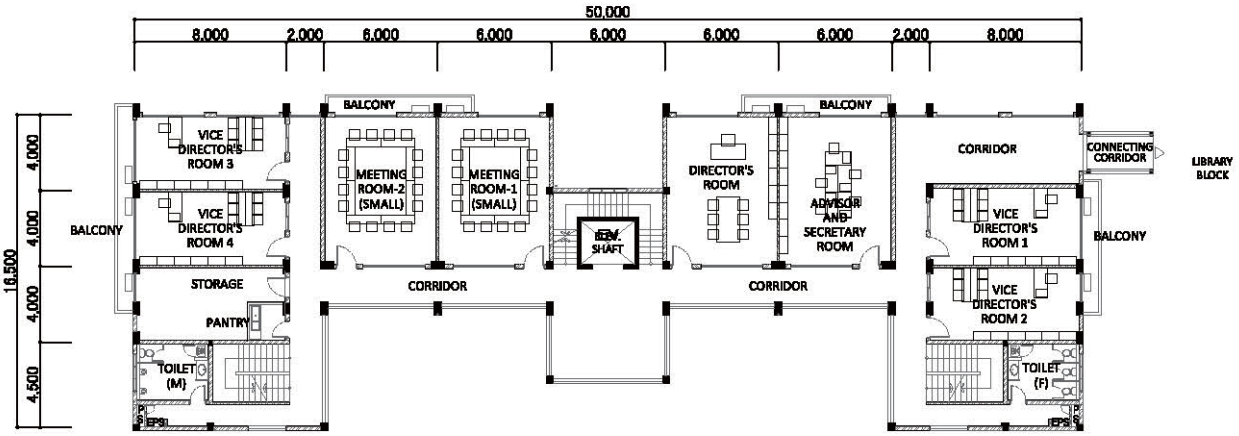

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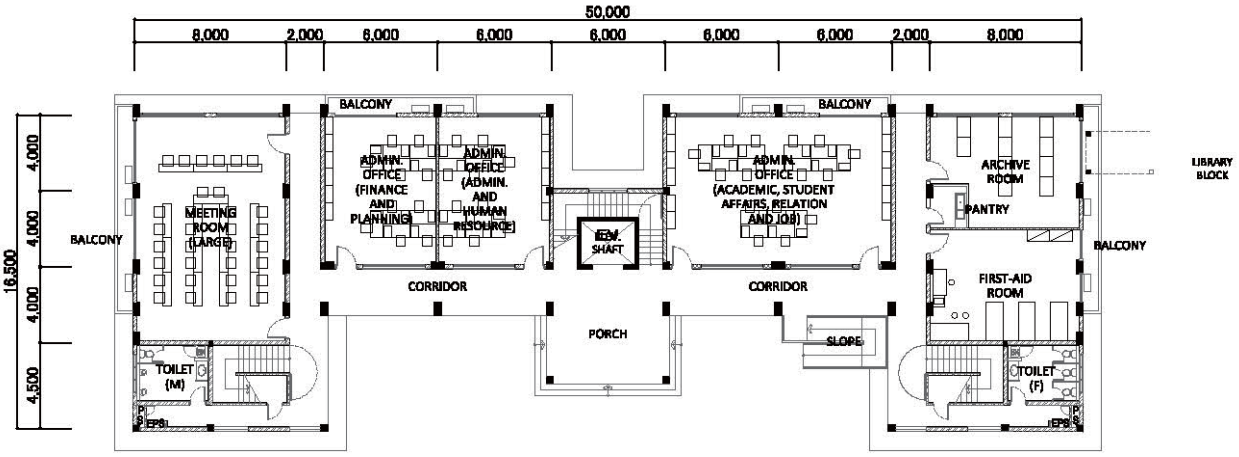

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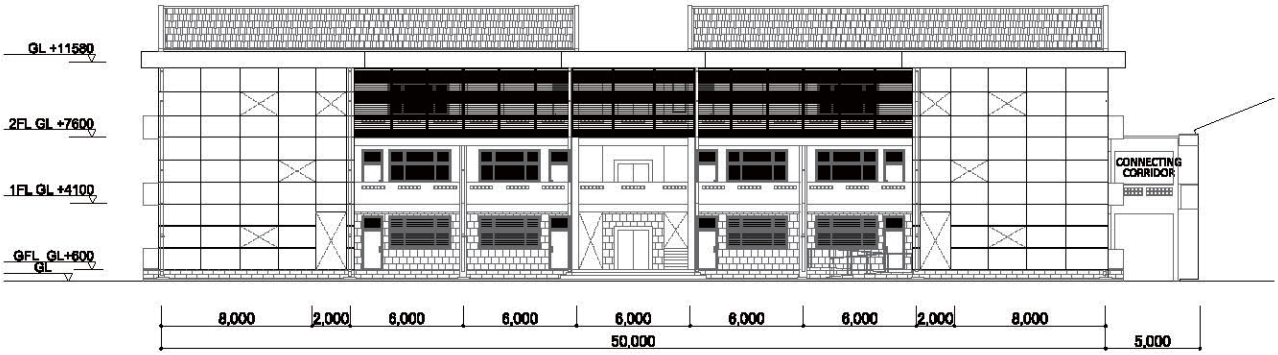

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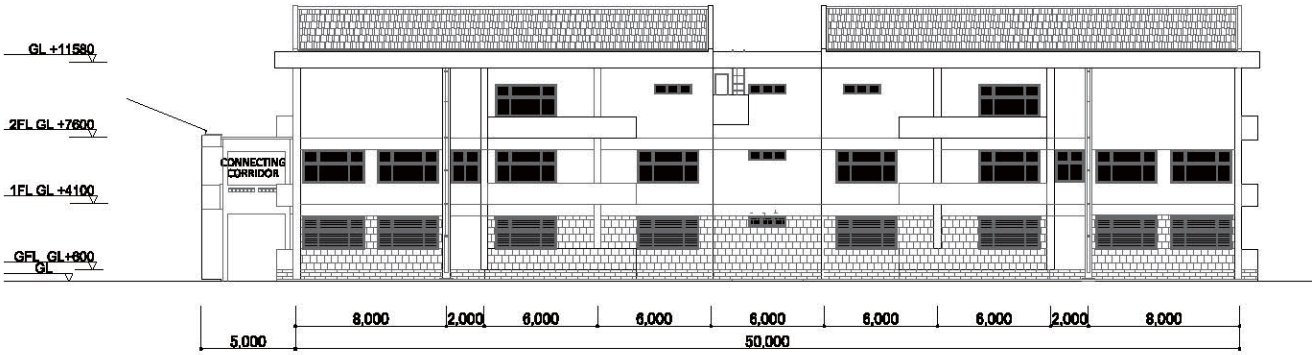

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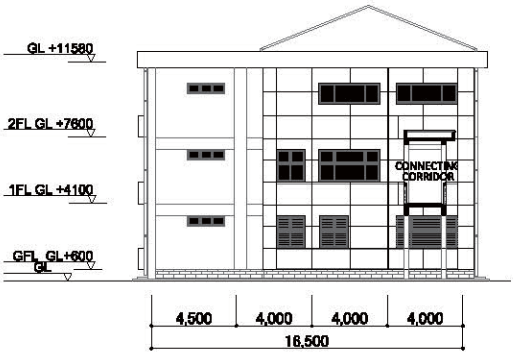

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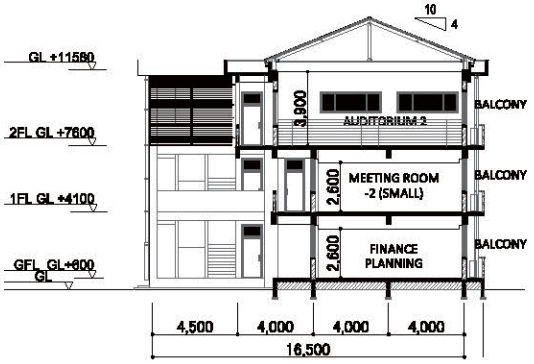

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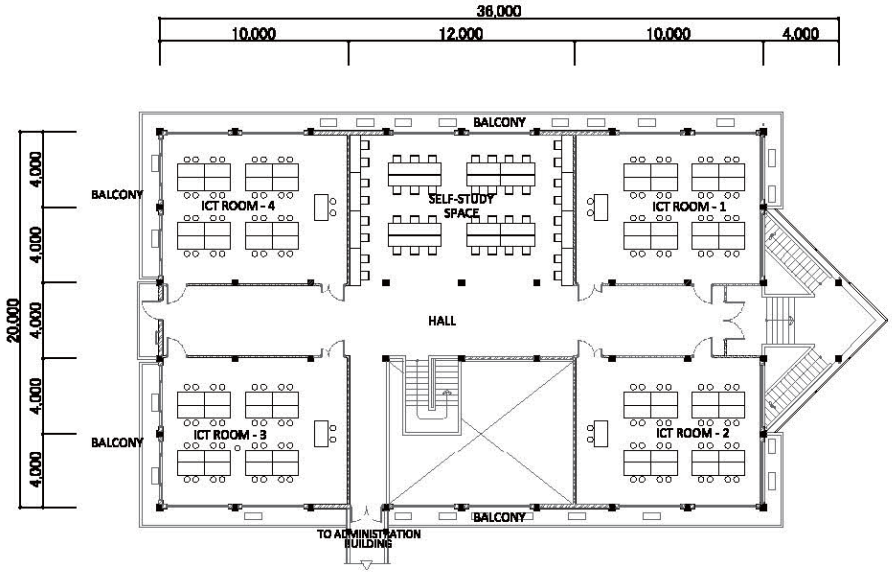

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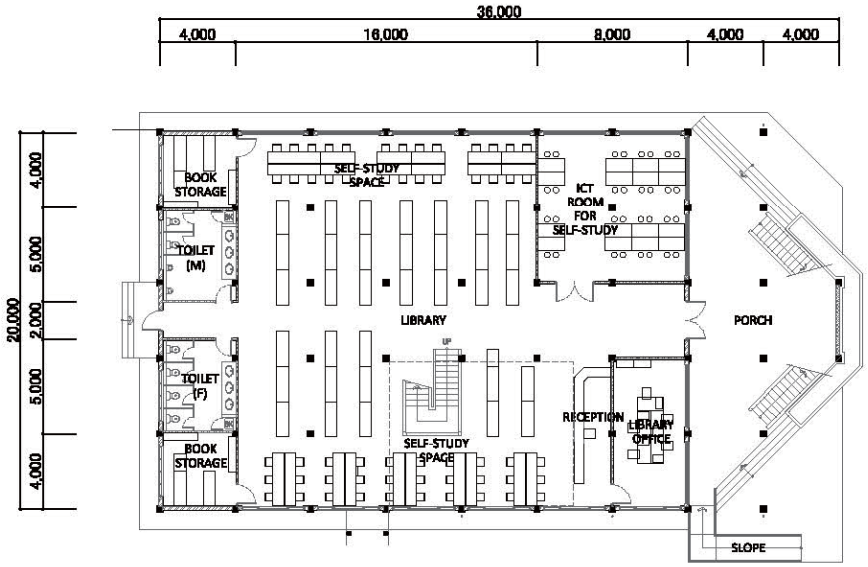

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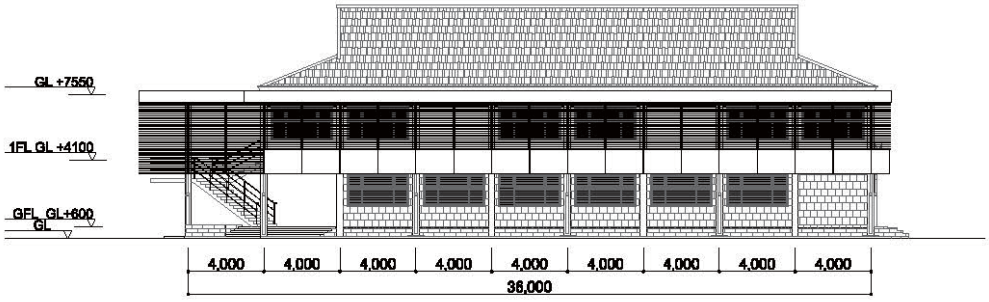

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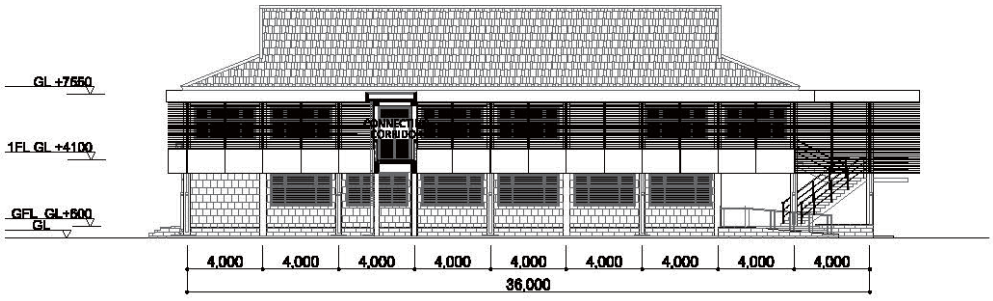

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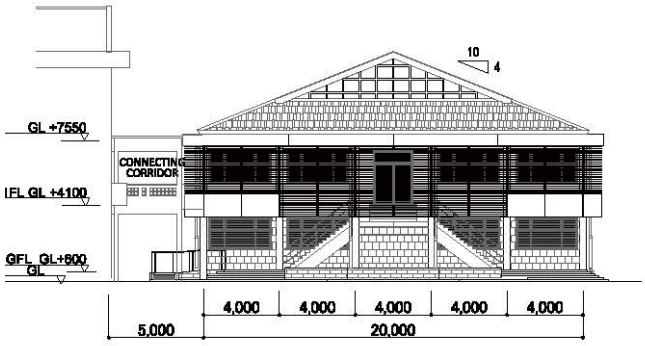

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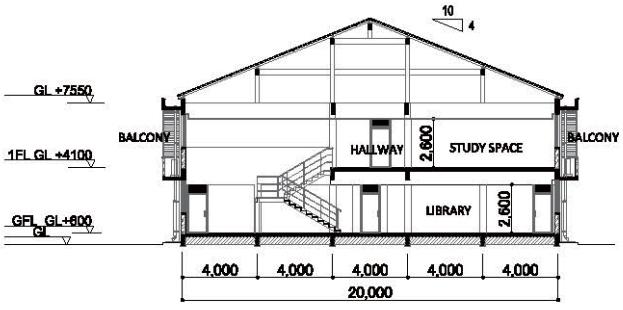

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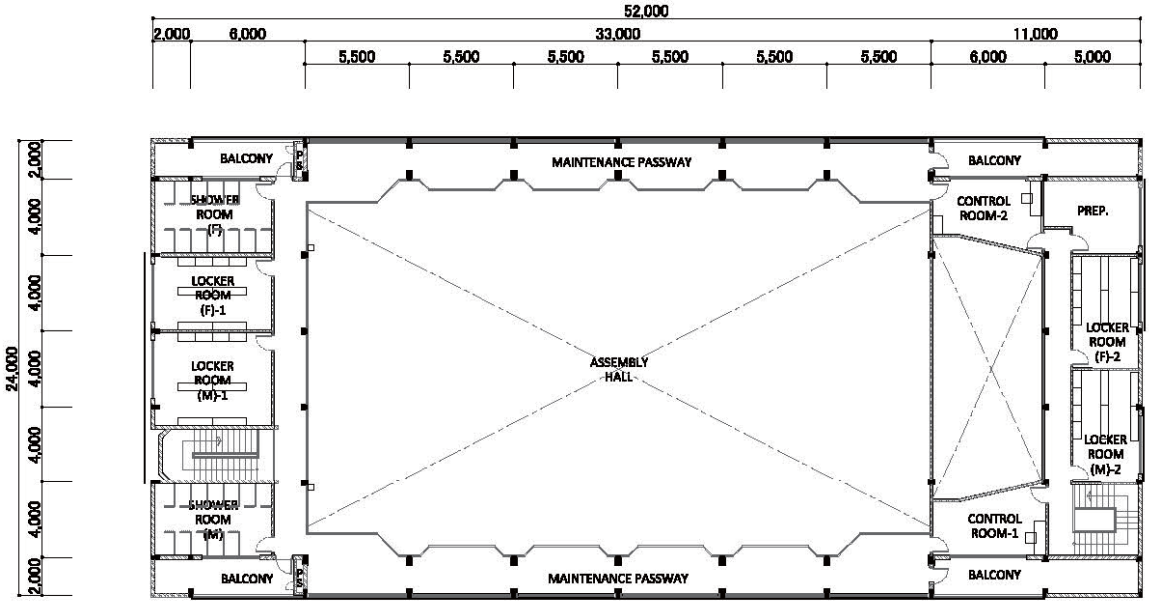

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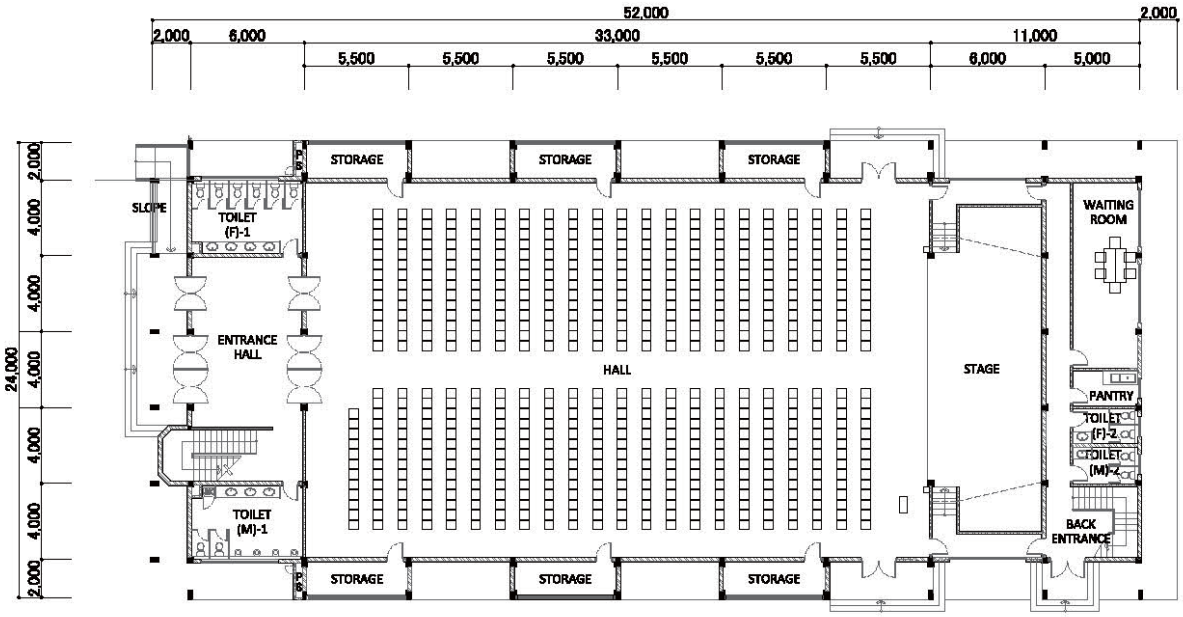

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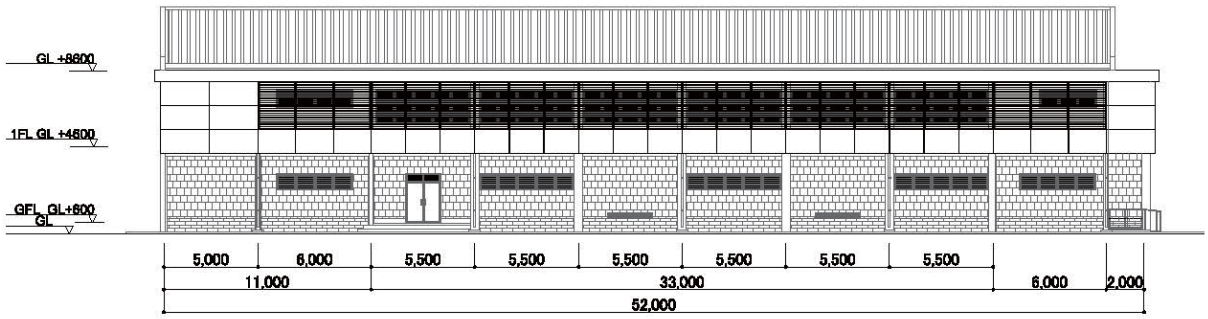

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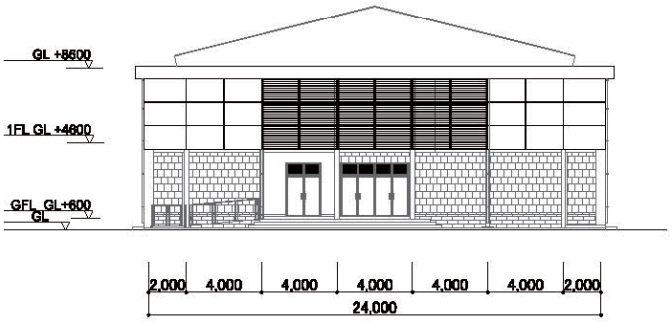

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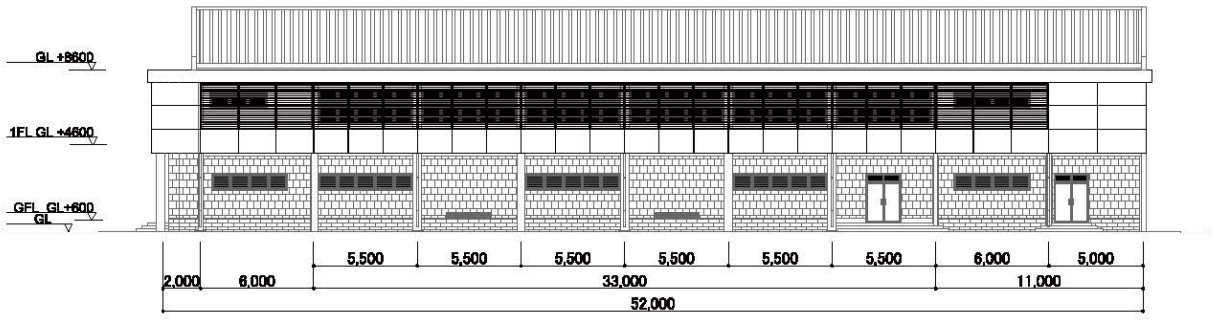

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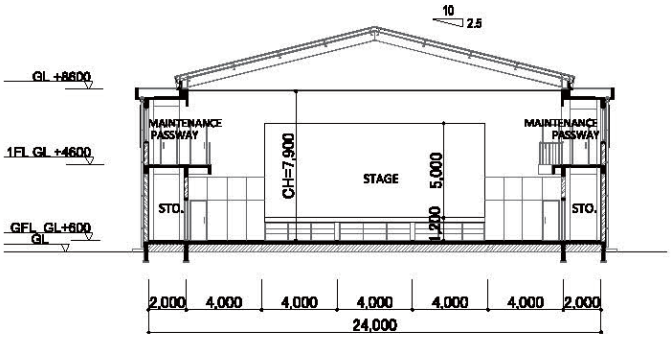
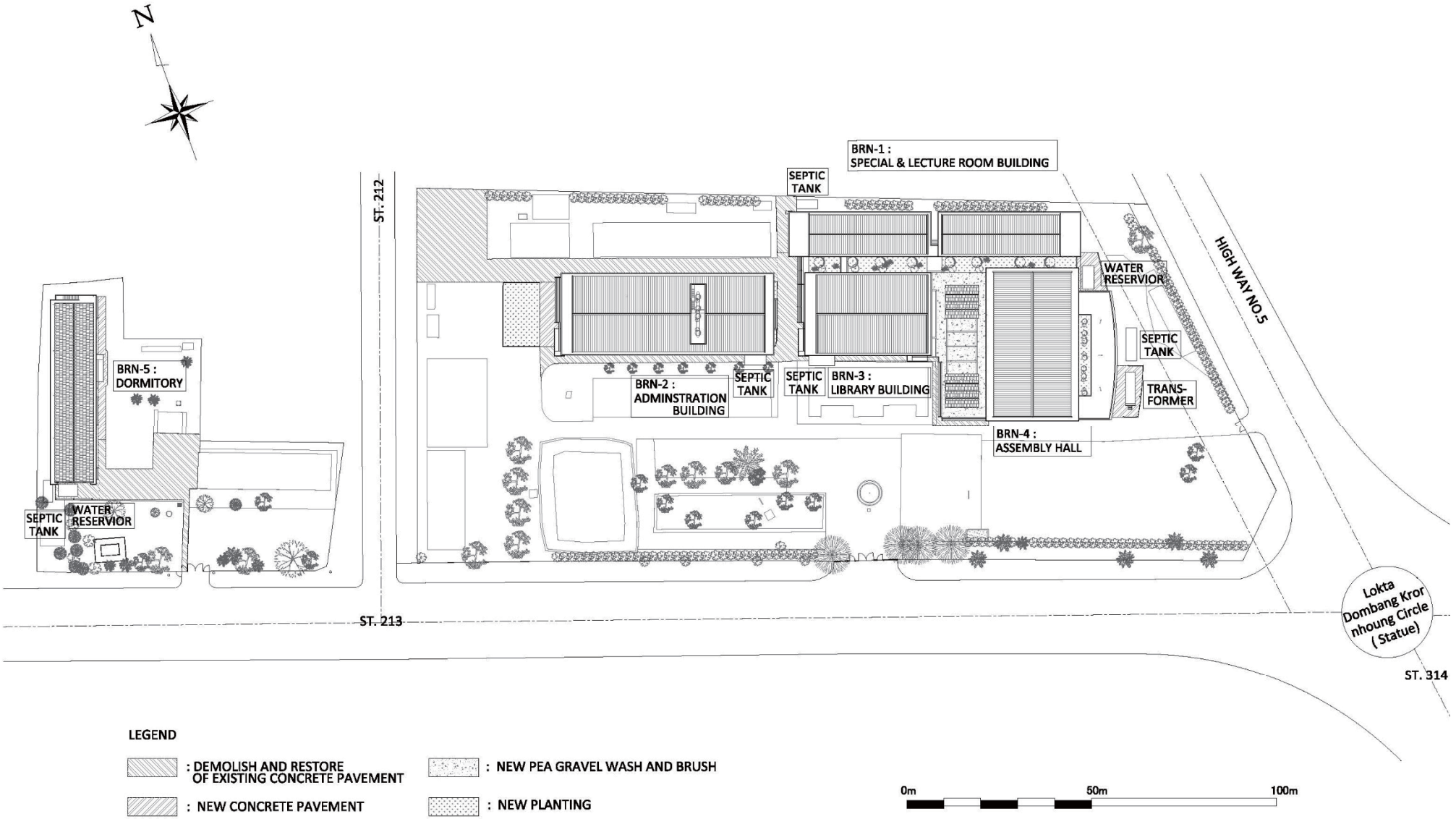
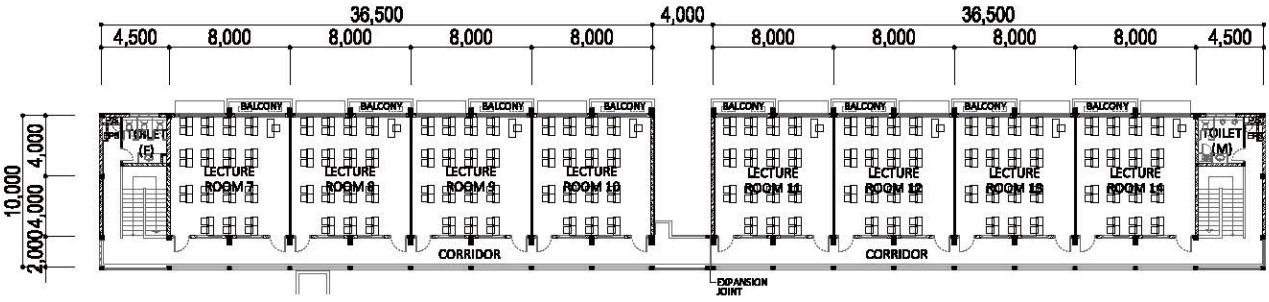


SECTION

BATTAMBANG TEC LAYOUT PLAN & EXTERNAL WORK PLAN





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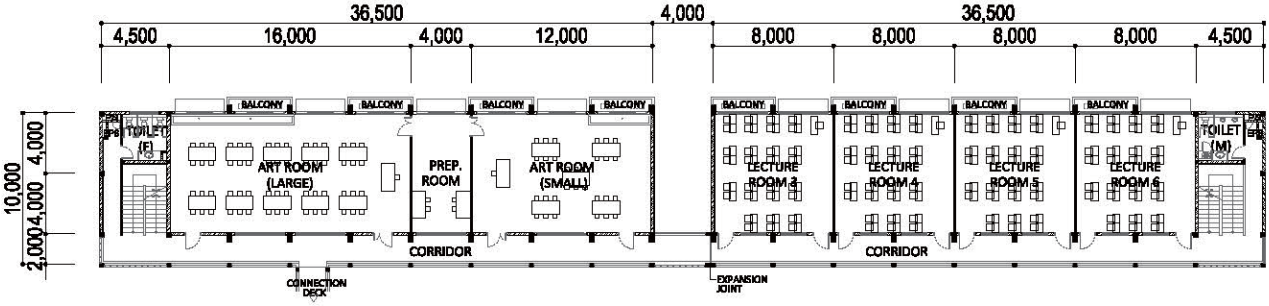

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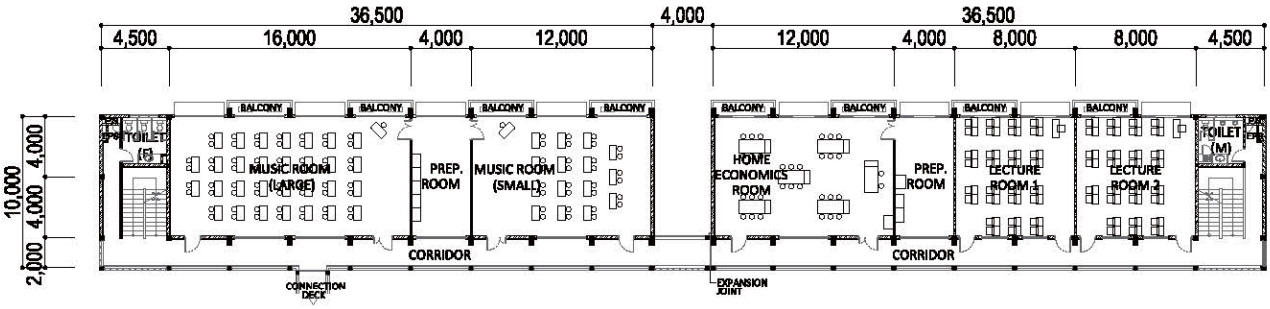

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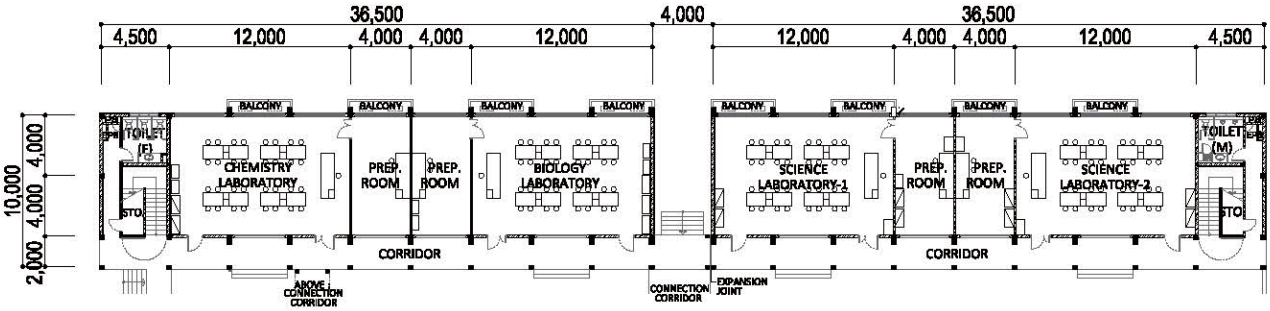

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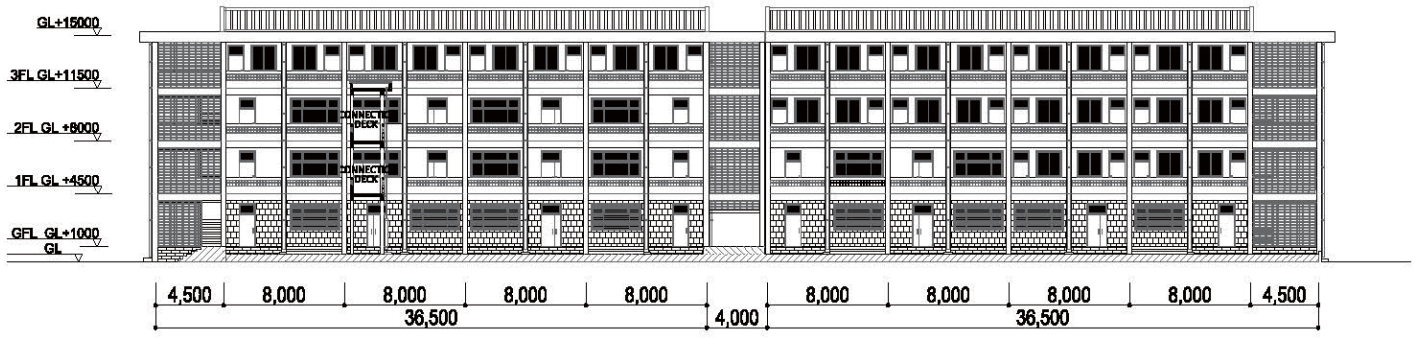

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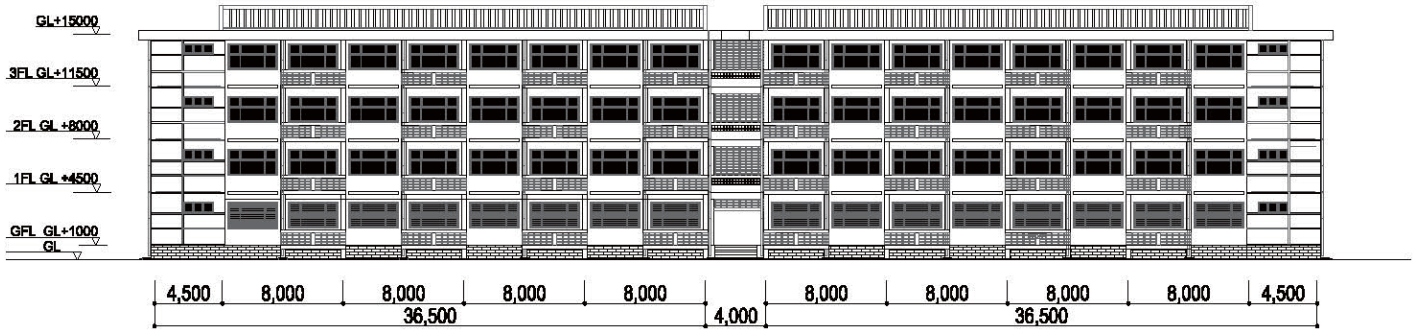

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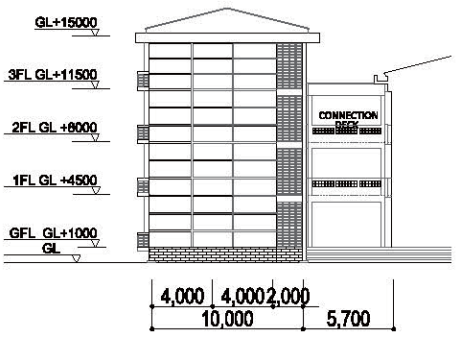

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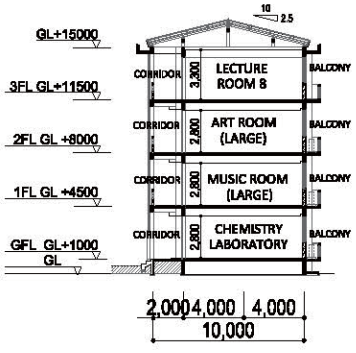

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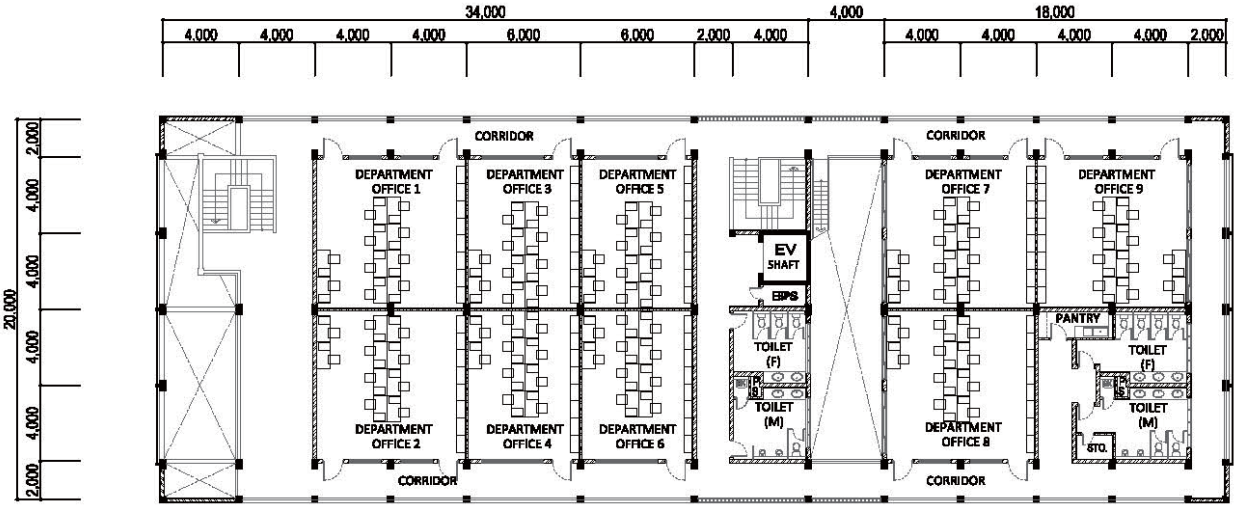

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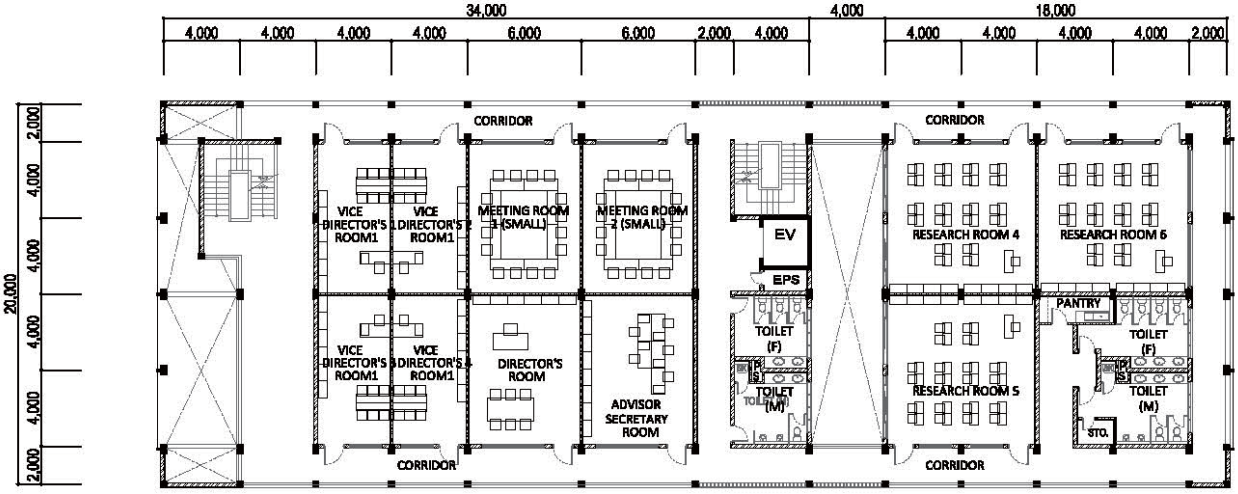

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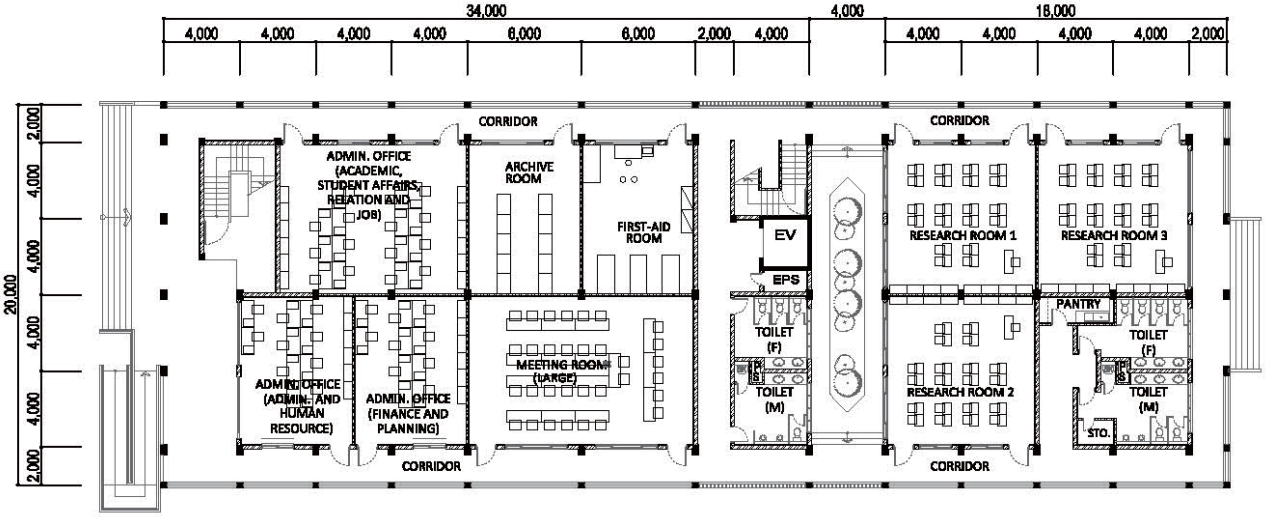

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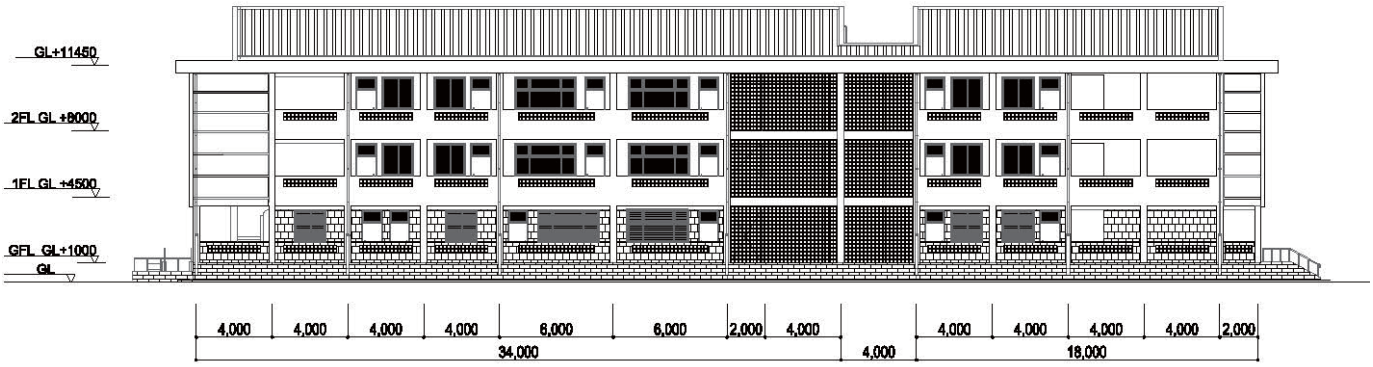

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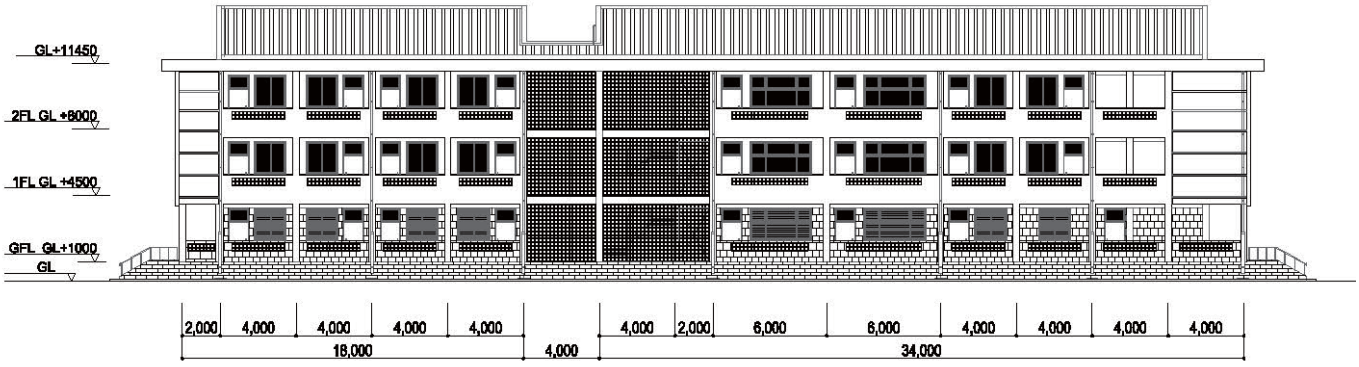

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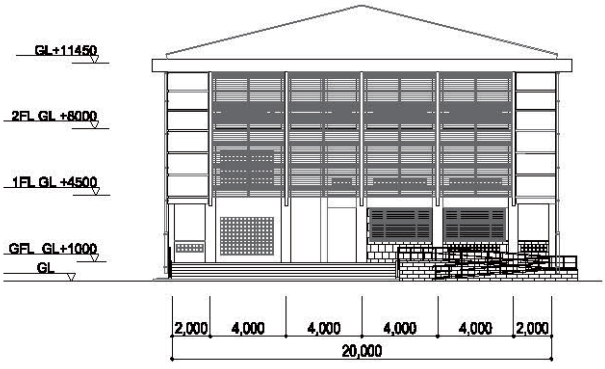

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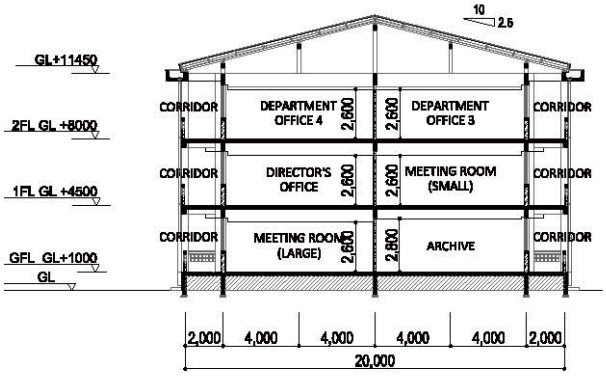

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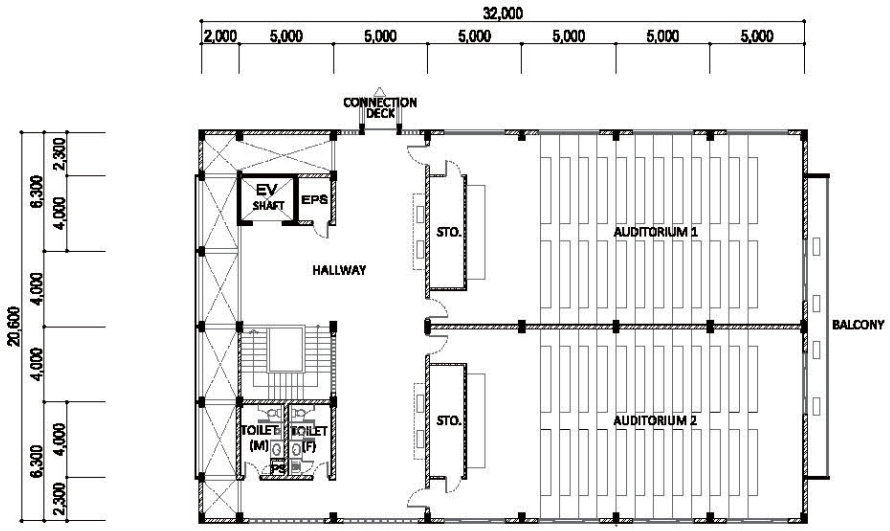

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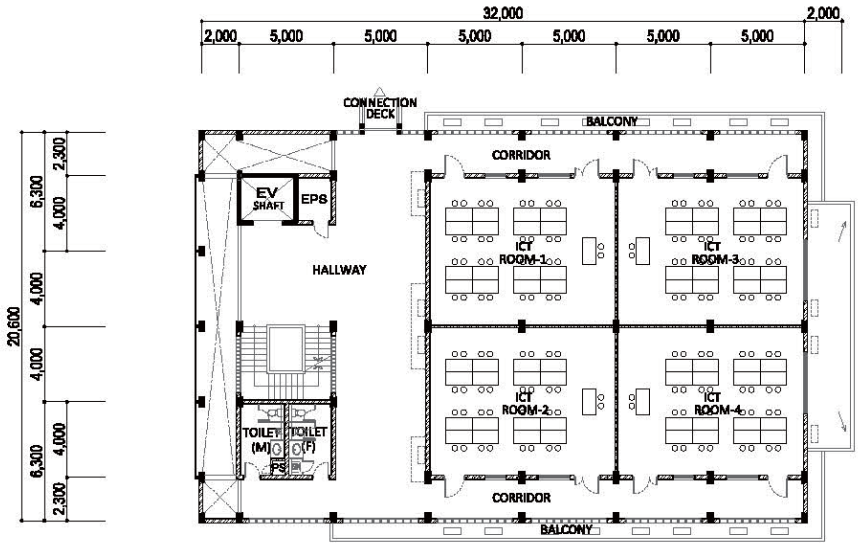

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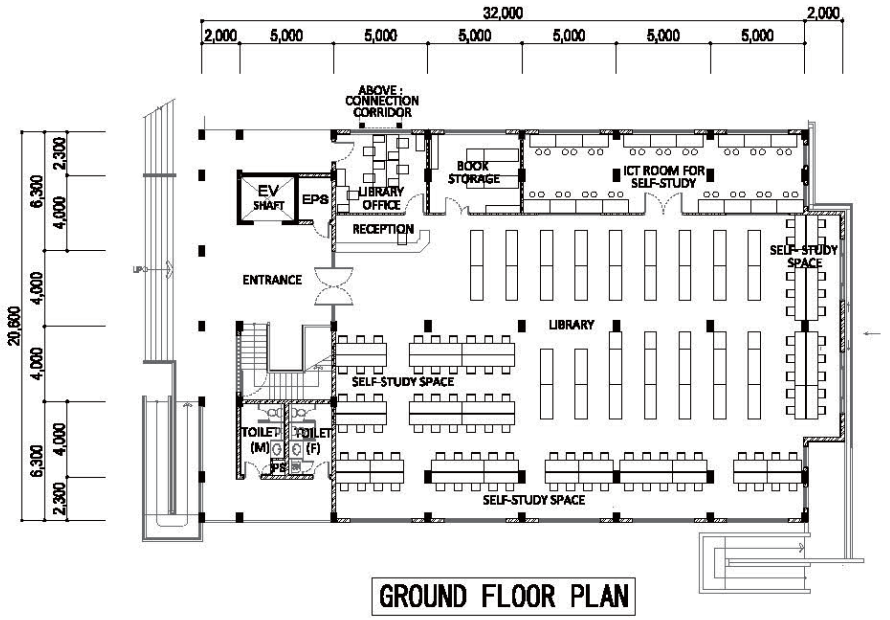

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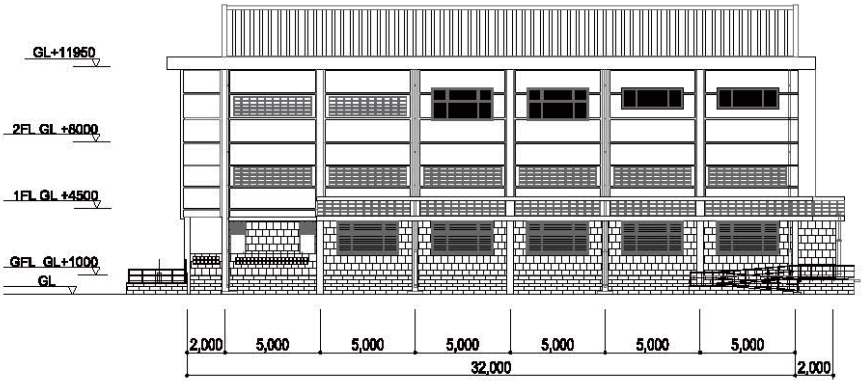

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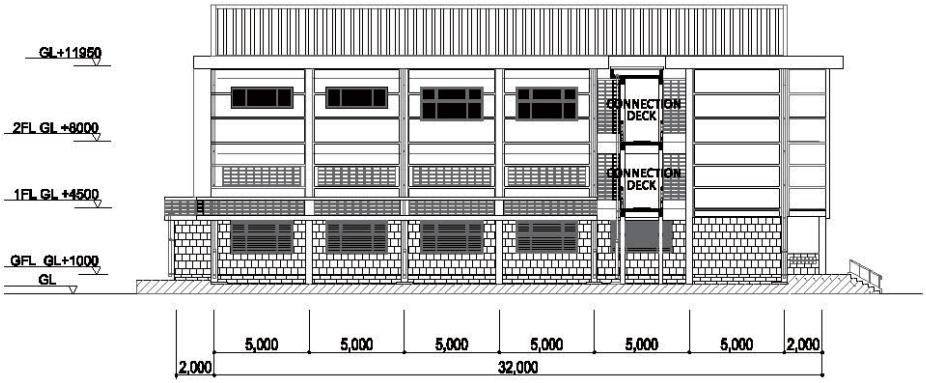

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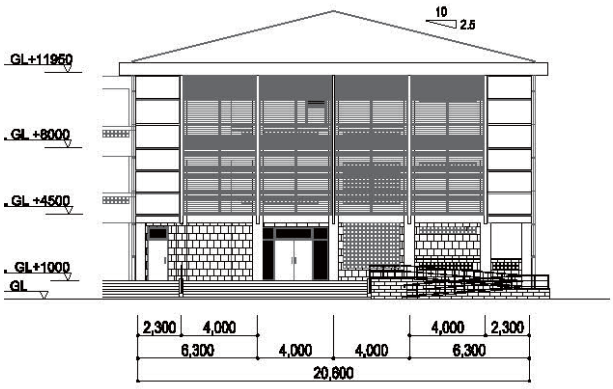

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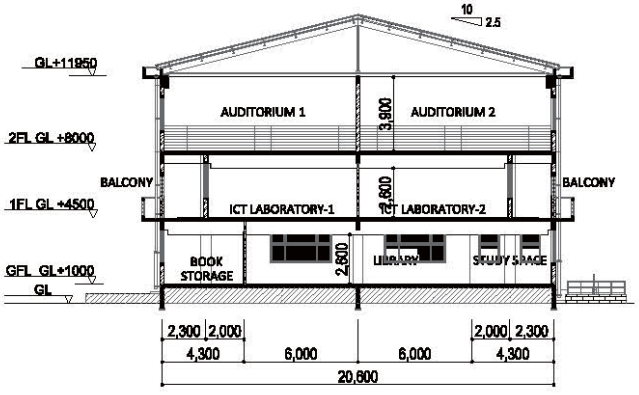

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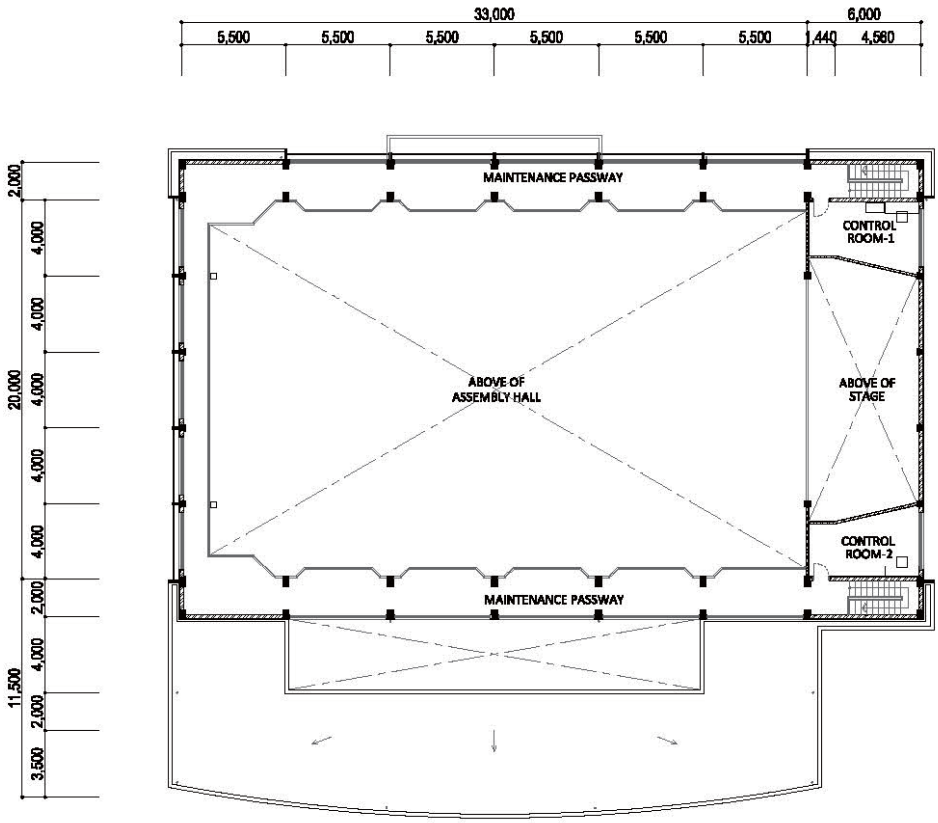

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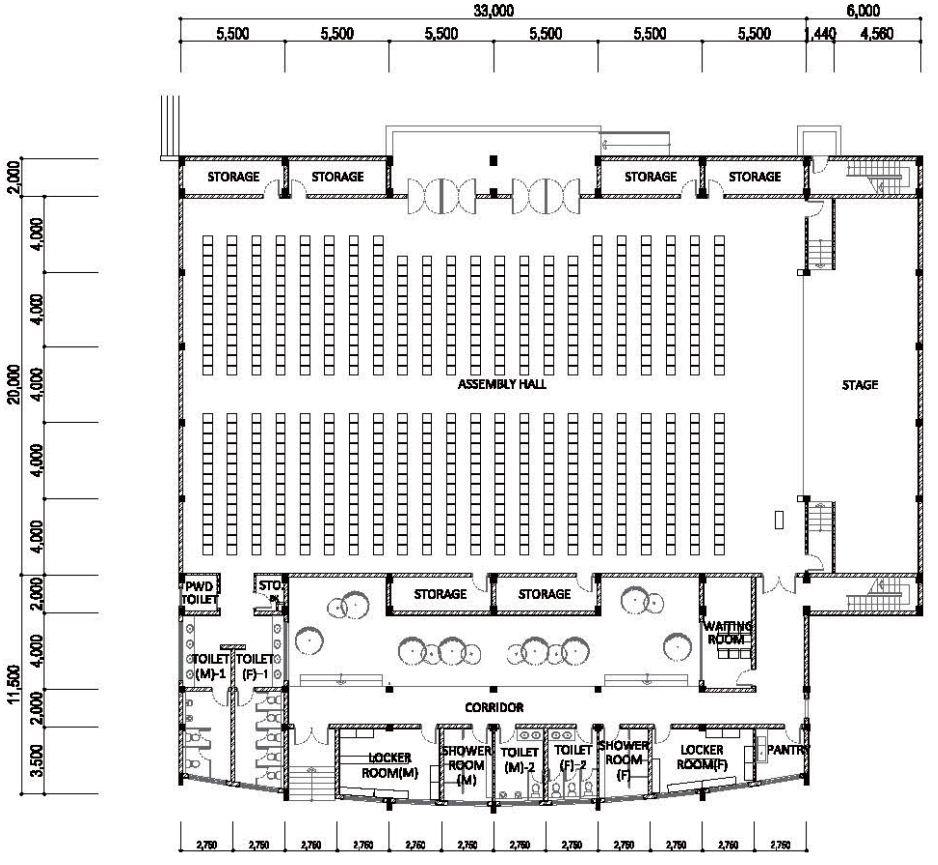

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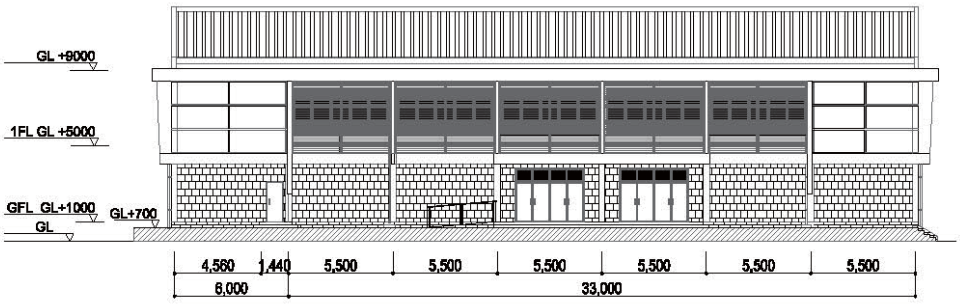

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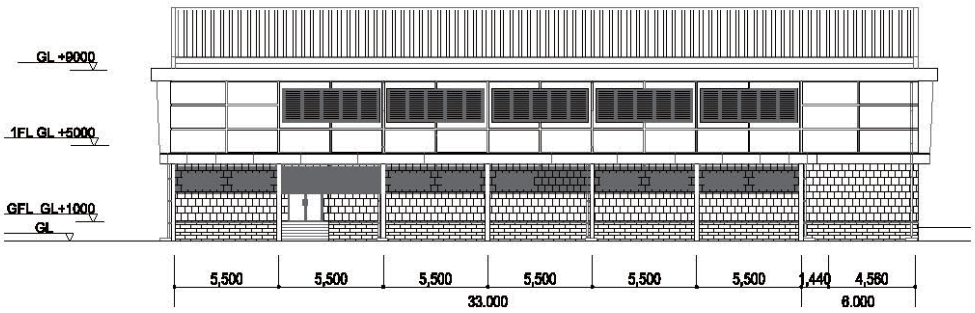

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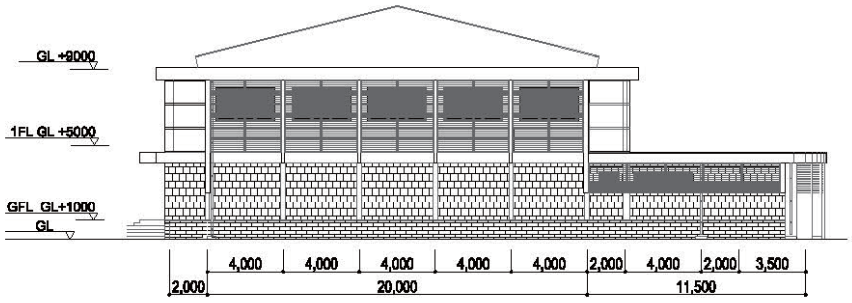

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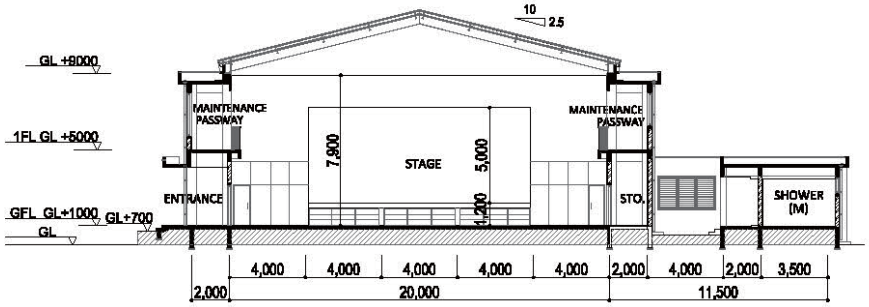

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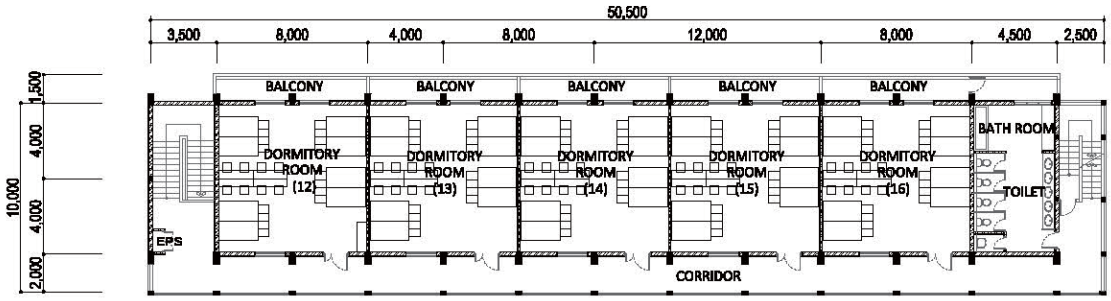

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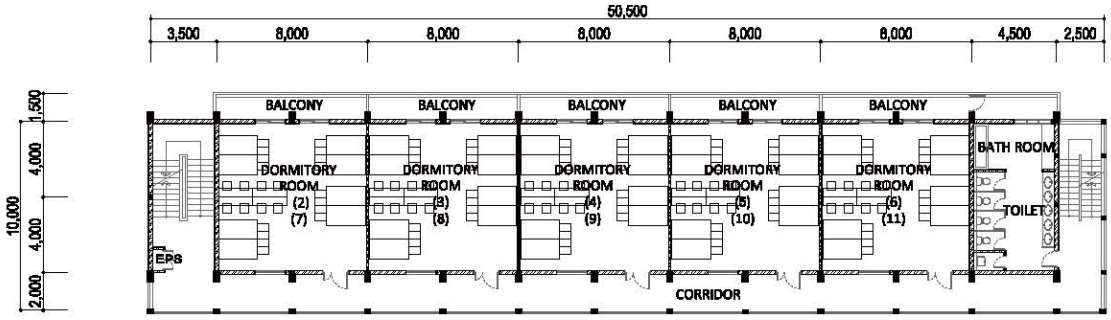
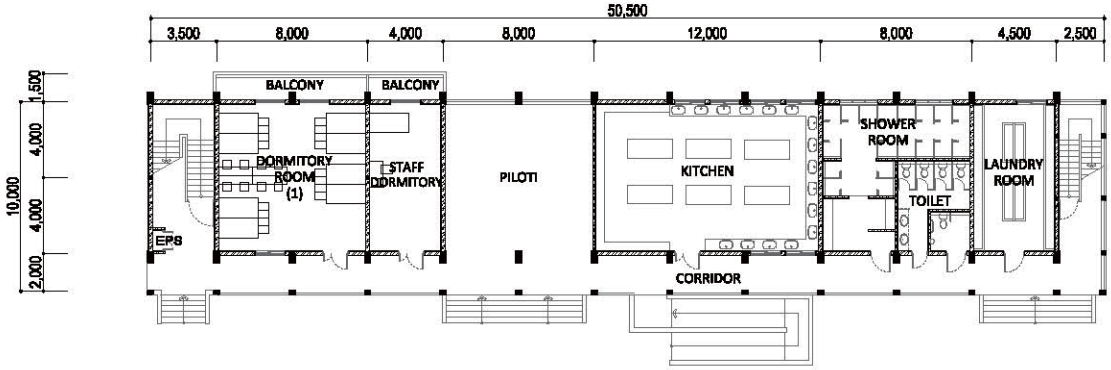
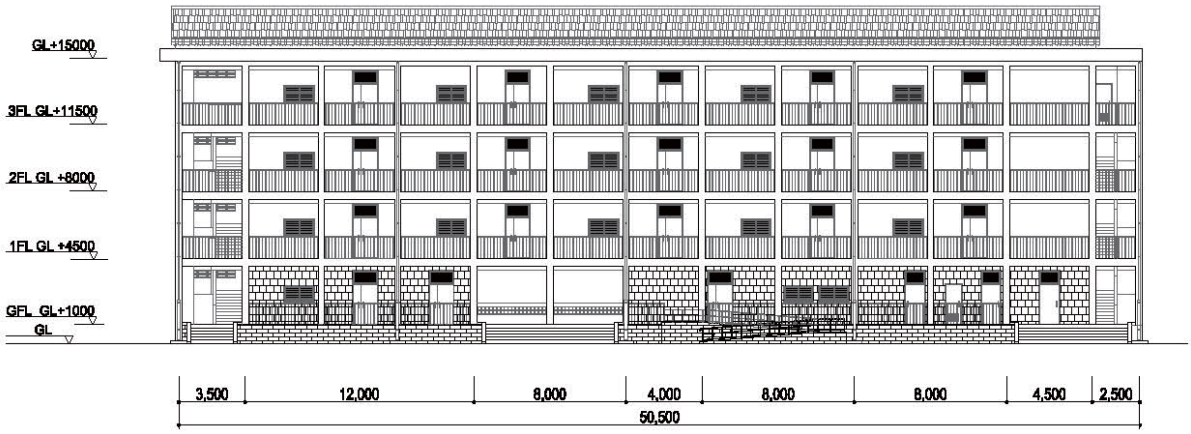


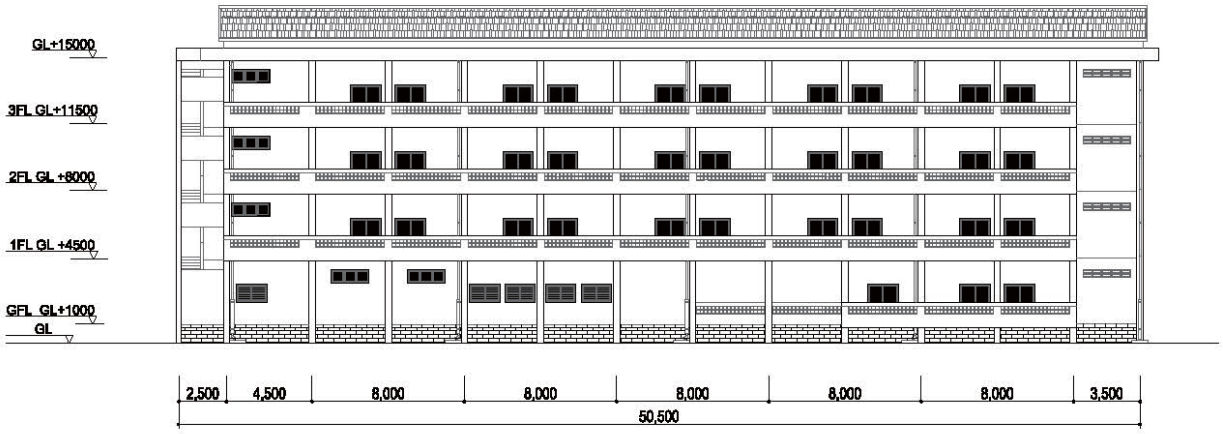
1ST & 2ND FLOOR PLAN



GROUND FLOOR PLAN



EAST ELEVATION



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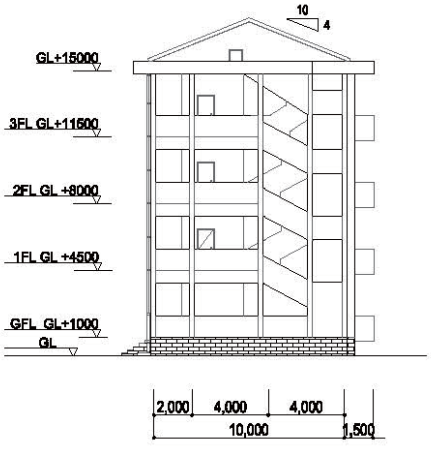

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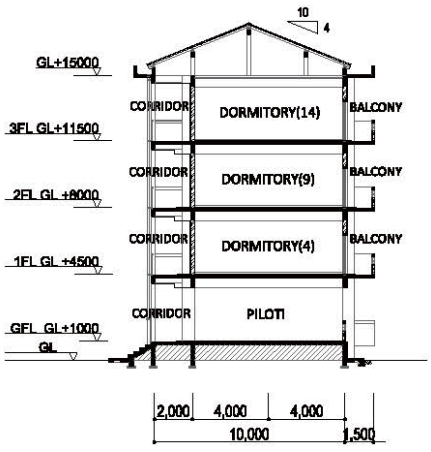


SECTION

2 - 2 - 4 Implementation Plan

2 - 2 - 4 - 1 Implementation Policy

This Project is to construct facilities and procure equipment for Phnom Penh TEC and Battambang TEC under the Japanese Grant scheme. An approval by the Cabinet of the Government of Japan is required for the implementation of the Project. After the approval, Exchange of Notes (E/N), between both the governments of Japan and Cambodia, and Grant Agreement (G/A), between JICA and the Government of Cambodia, will be signed for the Project.

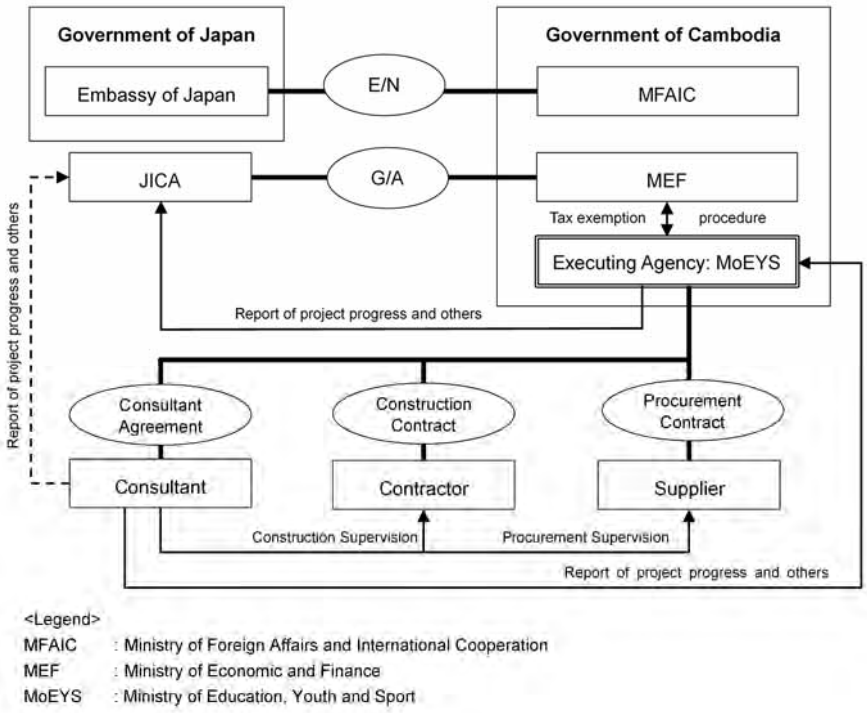


Figure 2-20 Project Implementation Organogram

(1) Executing Agency

The Executing Agency for the Project is MoEYS, and MoEYS will make contracts with the Consultant, the Contractor for construction, and the Supplier for equipment procurement for the Project. Furthermore, MoEYS is to be responsible for operation and maintenance of the facilities and the equipment provided by the Project.

(2) JICA

JICA will sign a G/A with the Government of Cambodia, and will review and monitor the Project for proper implementation in accordance with the Japanese Grant schemes.

(3) Consultant

After signing of E/N and G/A for the Project, the Executing Agency of the Project and a Consultant in Japan will sign an agreement for the consulting services. The Consultant will carry out the

following works.

a. Detailed Design Stage

Preparation of bidding documents, including detailed drawings and technical specifications, and assistance in obtaining necessary approvals for the bidding documents.

b. Bidding Stage

Assistance to the Executing Agency in the bidding and contractual procedures (including bid notices, bidding documents distribution, answers to questions from bidders, bid openings, bid evaluation, contracts with Contractor and the Supplier).

c. Construction and Procurement Stage

Supervisory works for building construction and equipment procurement (including installation, operational guidance and maintenance guidance of equipment).

d. One Year Inspection for Construction

Final inspections for the facilities constructed by the Project one year after the date of handing over.

Because the Project will implement construction works at the two sites of Phnom Penh and Battambang, which area a distance of 300 km (6 hours by car) away from each other, in parallel, the main office for the Consultant will be established in Phnom Penh, while two separate Consultant teams will be organized for both sites.

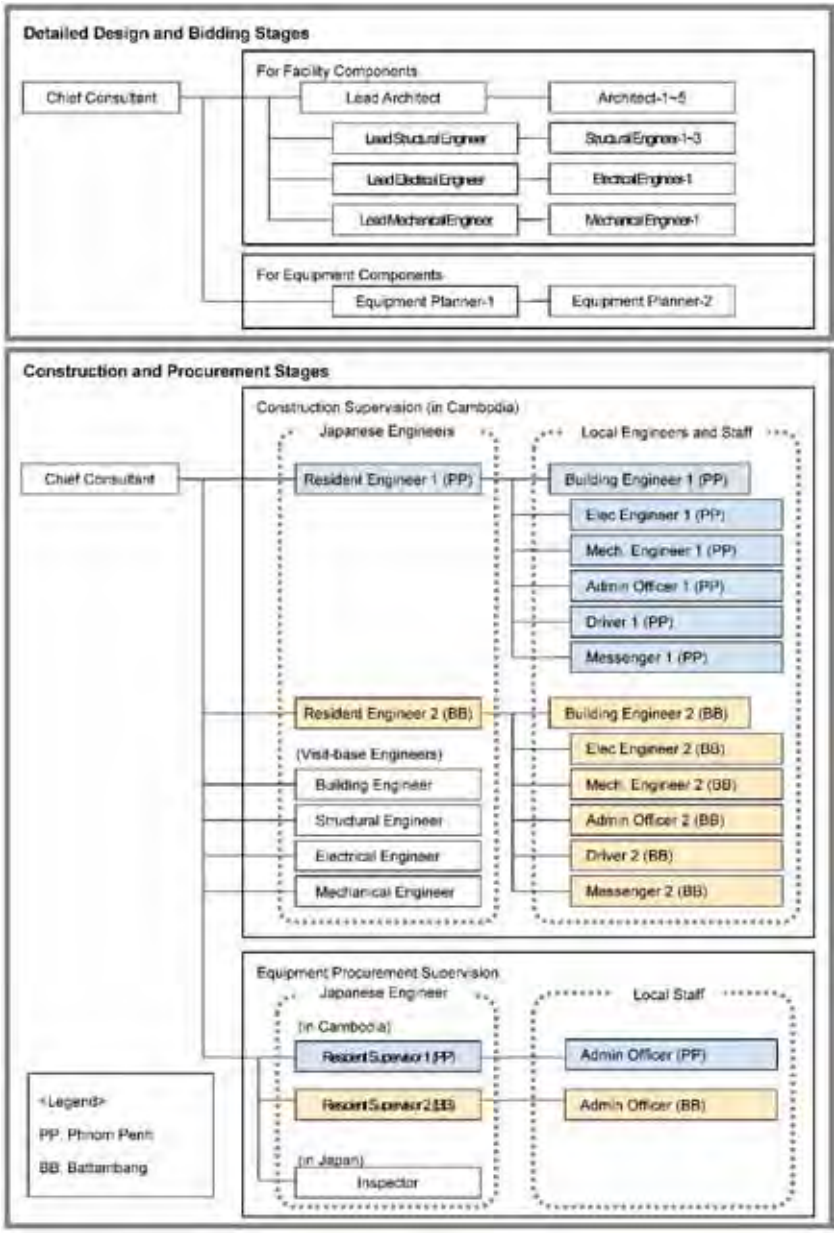


Figure 2-21 Proposed Project Organogram of the Consultant

(4) Contractor and Supplier

Complying with the Japanese Grant scheme, the Contractor for construction and the Supplier for equipment procurement will be selected through general competitive bidding opened to Japanese companies who satisfy the required eligibilities. The selected Contractor and Supplier will make contracts with the Executing Agency of the Cambodian side for a construction contract and an equipment procurement contract respectively. Then, the Contractor and the Supplier will conduct their works for facility construction and for equipment procurement in accordance with the contract documents.

As is the case of the Consultant, while the Contractor and the Supplier may have a main office in Phnom Penh, two teams for construction/procurement management of each site will be organized in order to maintain site activities at the two sites in parallel.

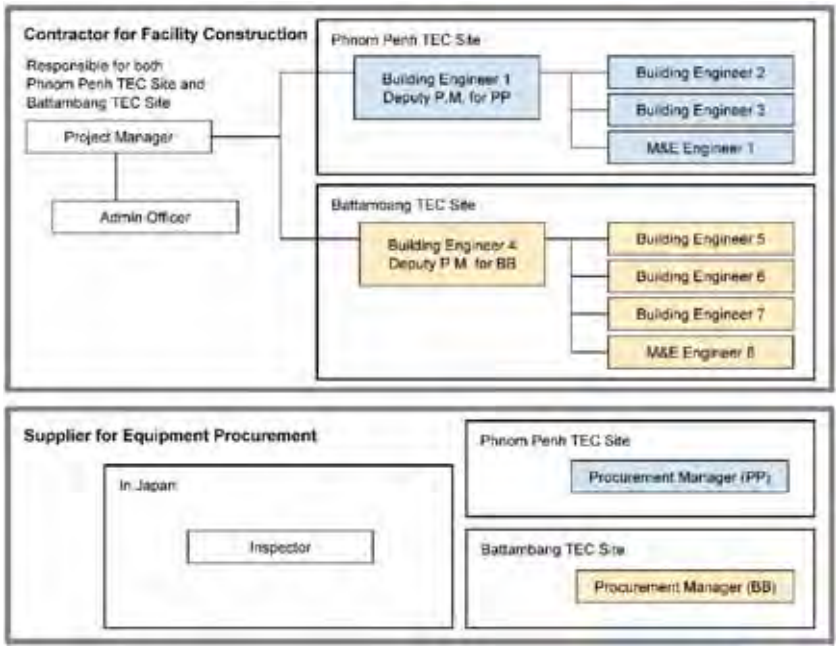


Figure 2-22 Proposed Project Organogram of the Contractor and the Supplier

2 - 2 - 4 - 2 Implementation Conditions

(1) Implementation Conditions on Construction

1) Considerations to TEC Operation during Construction Period

The construction works of this Project will be carried out in the same sites where the TECs continue to operate. Therefore, the areas for TEC operation, the areas for construction works (temporary fenced areas for construction), separation of traffic/pedestrian routes for the TEC users and the construction engineers/workers, and so on were discussed with MoEYS and confirmed in Technical Notes No.3[28]. Considerations to be made for each site are described below.

① Phnom Penh TEC

Phnom Penh TEC and its affiliated lower secondary school will operate within the same site during the construction period of the Project. Thus, it is essential to make proper safety control arrangements during the period.

In the present conditions, the narrow connecting road (approx. 6m in width and 170m in length) from the frontal main road to the campus area is the only access for the site. Though the south and east boundary lines face the roads, no sub-gates are provided along those lines because the south side is within the premises of the neighbouring hospital, and the east side is too far from the main road. As a result of discussions with MoEYS, it was confirmed that a temporary gate for TEC users will be provided around the north-east corner of the site by the Cambodian side, in order to separate the access

[28] Technical Notes No.3: signed on June 14, 2017.

ways of construction vehicles and TEC users. In the meantime, since the middle of the site is to be divided by the temporary construction road, a pair of gates and a guard man will be provided by the Project to allow for pedestrians' crossing.

Figure 2-23 Construction Area of the Project and Area for TEC Operation (Phnom Penh TEC)

② Battambang TEC

Battambang TEC consists of the Project site (the current RTTC site) and another site (the current PTTC site) which away 1.5 km away from each other. It was determined that Battambang TEC will be operated by using the existing facilities of the current PTTC site during the construction period, as a result of discussions with MoEYS. Furthermore, it was confirmed that the affiliated lower secondary school in the current RTTC site will be temporarily transferred out of the site. Thus, the Project site where the major facilities are to be constructed by the Project will be entirely used as the construction area for the Project. As for the dormitory zone, because one of the existing male dormitories will be continuously in use, the construction area for the Project will be separated by fencing.

In respect to the existing buildings that will remain within the Project site, it was discussed and confirmed with MoEYS that the major buildings, such as the classroom building, will be properly protected by fencing and sheets, and that the ancillary buildings, such as cafeteria and toilets, may be used as temporary facilities for the Contractor.

Figure 2-24 Construction Area of the Project and Area for TEC Operation (Battambang TEC)

2) Demolition of Existing Buildings and UXO/Landmine Detection after Demolition Works

As described in "2-2-1-1 (7)", this Project will demolish some existing aged buildings in order to secure space for reconstruction. Also, as described in "2-2-1-3 (1)", the construction works at the designated areas will be temporarily suspended after the demolition works are completed in order for UXO and landmine detection surveys of CMAC to be undertaken by the Cambodian side. The surveys are to be conducted to assure the safety of the sub-soil deeper than the foundations of the existing buildings.

As a result of discussions with MoEYS, the procedures of the temporary suspension of the construction works and the CMAC surveys during the construction period were confirmed in Technical Notes No.3.

- The schedule of detection shall be well coordinated by MoEYS and CMAC in order to avoid any delay.
- After completion of the demolition work by the Japanese side, the construction works within the designated areas will be temporarily suspended, while the construction works in other areas shall continue without temporary suspension.
- Immediately after temporary suspension, UXO/landmine detection will be conducted by CMAC, and the expected duration of the detection is 2-3 days. If any UXO or landmine is detected, the areas shall be properly cleared by CMAC.
- Clearance certificate shall be issued within one month from the date of suspension.
- Construction works by Japanese side will resume as soon as the site is cleared.

It is essential to make careful schedule coordination with Cambodian side, prior to implementation

of UXO/landmine detection surveys. As a delay of UXO/landmine detection survey will directly cause further delay of construction works, MoEYS will be requested to coordinate with CMAC for smooth implementation of the surveys and issuance of clearance certificates, once the dynamic work schedule for demolition works is determined.

3) Schedule and Quality Control at Two Separated Sites with a Distance of 300 km

The Project is to construct the TEC facilities at the two separated sites of Phnom Penh and Battambang, which are 300 km away from one another. Moreover, as described in "2-2-4-8 Implementation Schedule" hereunder, the construction works at both sites are scheduled to be conducted in parallel, in order to attain the earliest inauguration of the new TEC campuses.

Because of the long distance between the sites, and because both sites have large-scale construction components, it is assumed that the Contractor will employ at least 2 local construction companies as sub-contractors. Against this backdrop, it is essential to consider how to maintain and harmonize the construction schedules and the construction quality between the two sites.

As described in "2-2-4-1 (3) Consultant" and "2-2-4-1 (4) Contractor and Supplier", it is planned that the Consultant and the Contractor will organize one team for Phnom Penh TEC site and another for Battambang TEC site, while they will have their own main offices in Phnom Penh. Especially for the Contractor, it is planned that a project manager will be responsible for the overall construction management for both sites, and that one deputy project manager for each site will manage the schedule and construction quality of his or her site as well as those controls and harmonization between the two sites. However, further careful attention will be definitely needed during the construction period for the schedule and quality management.

4) Countermeasures to Flooding during Construction Period (Battambang TEC site)

The neighbouring area of Battambang TEC site tends to be affected by flooding during the late rain season of every year. The boundary of the site is fenced with a 70 cm high dwarf brick wall. Thus, those brick walls will be utilized to protect the construction areas from flooding during the construction period. In the case that severe flooding is forecast due to the global climate change etc., it is essential to consider prevention or mitigation measures against the negative impacts of flooding by obtaining as much relevant information as possible in advance.

5) Securing Construction Workers

There is a boom in construction in Cambodia, and demand for construction workers is high. Engineers and workers of neighbouring countries, such as Vietnam, are also employed for construction in Cambodia. Many workers leave construction sites to go home to celebrate their important seasonal events, such as the lunar New Year festival (Tet for Vietnam) in February, the Khmer New Year in April, the King's birthday in May, the ancestors day holidays in September and the water festival holidays in November. In addition, many of them tend to leave construction sites for farming in their home villages during the farming season from December to January. Hence, the construction schedule is to be managed and controlled, considering that the number of workers may be

less during such occasions.

(2) Implementation Conditions on Equipment

1) Schedule Management

Planned equipment will not require complicated installation work, but the quantity of equipment is large and there are two project sites (in addition, Battambang TEC has two separated sites). At each site new facilities and existing facilities are scheduled to have equipment installed. Even though the commencement of construction works at Phnom Penh TEC and Battambang TEC have been scheduled at the same time, their completion of construction works and renovation works of existing buildings will be different from each other.

Moreover, it is necessary to adjust and manage each installation work period flexibly in order to prevent interference to lectures at existing buildings at both TECs. In the case that one of the construction works is delayed unexpectedly, the installation works and handing-over at the other TEC will be conducted without waiting for such delays.

(3) Tax Exemption

The procedures for tax exemption in a Japanese Grant Aid Project are confirmed as follows, through the discussions with MEF. Meanwhile, careful attention needs to be paid to the practical procedure of tax exemption, because there was a case of VAT exemption which took approximately 5 months under a previous Japanese Grant Aid project.

1) Import Duty

Materials and equipment to be imported for the Project by Japanese Contractor(s) and Supplier(s) will be exempted from import duties by the following procedures. Standard duration of the following procedures is approximately 2.5 months.

① Submission of Master List from Japanese Contractor(s)/Supplier(s) to MoEYS
② Approval of Master List by MoEYS
③ Approval of Master List and Importation by Council of Development of Cambodia (CDC)
④ Response to Application for Non-taxable Supply by General Department of Taxation (GDT) of MEF
⑤ Issue of the Tax Exemption Letter by General Department of Customs and Excise (GDCE) of MEF
⑥ Submission of Tax Exemption Letter from Japanese Contractor(s)/Supplier(s) to Customs

2) VAT

VAT on materials procured in Cambodia and contract amounts between Japanese Contractor(s)/Supplier(s) and local sub-contractors/suppliers for the Project will be exempted by the following procedures. Japanese Contractor(s)/Supplier(s) shall submit the required documents (the list, tax identification numbers of supplying companies and photocopies of invoices for all the purchase of goods and services in Cambodia) to GDT on a monthly basis.

① Japanese Contractor(s)/Supplier(s) applies for Tax Exemption to MoEYS together with the Lists of Materials to be procured in Cambodia and Contract Documents between Japanese Contractor(s)/Supplier(s) and local companies
② MoEYS submits the application for Tax Exemption to GDT with submitted documents by Japanese Contractor(s)/Supplier(s)
③ GDT forwards it to MEF after the internal approval in GDT
④ GDT issues the Letter of Tax Exemption

3) Income Tax and Corporate Tax

Income tax of Japanese/international employees employed by Japanese Contractor(s)/Supplier(s) and corporate tax of Japanese Contractor(s)/Supplier(s) will be exempted.

2 - 2 - 4 - 3 Scope of Works

This Project will be implemented based on the mutual cooperation of Japan and Cambodia. For the implementation of the Project under the Japanese Grant scheme, the scope of works for both sides are as follows,

1) Japan Side

- Demolition of the existing buildings necessary for the Project implementation
- Construction of the planned facilities
- Procurement, installation, adjustment, operational guidance and maintenance guidance of the planned equipment

2) Cambodia Side

- Securing construction sites
  - Preparatory works (removal of trees, land clearance, disposal of dumped waste, removal of pavement, rerouting of service utilities, installation of a temporary gate at north-east corner of Phnom Penh TEC site, and others)
  - UXO/landmine detection surveys and issuance of clearance certificates for the areas where the existing buildings are demolished by the Japanese side
  - Securing alternative facility for temporarily transferring the affiliated lower secondary school in Battambang TEC site (the current Battambang RTTC site)
- New connection of medium voltage electric power (22 kV) to the sites
- Change of water supply contract (for Phnom Penh TEC only. To merge the separate contracts for the current PTTC/RTTC)
- New connection of optical fibre for internet
- Rehabilitation of water supply system for the science laboratories of the existing laboratory building in the G-1 campus of Battambang TEC (the current PTTC) necessary for installation of laboratory tables to be installed by the Project

Among the existing buildings to remain, the 5 academic buildings and the special lecture room building in Phnom Penh TEC are in usable conditions. However, the Cambodian intends to renovate the buildings' interior and exterior finishes. Because those buildings are functionally usable in their current conditions, it is determined that such renovation works are not part of the scope of the Cambodian side under this Project. The renovation works may be done by the Cambodian side in the future.

2 - 2 - 4 - 4 Consultant Supervision

As mentioned above, the Project is to implement large-scale facility construction and equipment procurement for the two sites which are 300 km away from one another. For smooth implementation of the Project under the Japanese Grant scheme and for successful completion within the given period, the Consultant will pay the utmost attention to the schedule and quality management of both sites, by giving appropriate instructions to the Contractor and the Supplier, and by coordinating with and between them. Furthermore, the Consultant will build a close relationship by reporting to the Executing Agency, enabling smooth and appropriate resolutions for any difficulties and challenges faced, and for encouraging the implementation of the undertakings to be done by the Cambodian side without any delay. By accomplishing the above, the Consultant will conduct the construction and procurement supervision for the Project by organizing the teams as described in "2-2-4-1 (3)".

2 - 2 - 4 - 5 Quality Control Plan

(1) Construction

The Contractor will submit method statements, shop drawings, material samples, etc. to the Consultant prior to each works, in accordance with the contract documents (including the technical specifications and the drawings). The Consultant will approve the submittals from the Contractor after careful check and examination. The Contractor will conduct various inspections to ensure compliance with the technical specifications and the method statements. The Consultant will be present at the inspections as needed, and will check the results of inspections submitted by the Contractor. The following table shows the major items of quality control for construction works.

Table 2-21 Major Quality Control Items (Provisional)

Work	Item	Method	Frequency
Piling works	Pile bearing capacity	Load test	No. of test piles, by pile diameter
	Pile integrity	Sonic test	One per building
		Concrete compressive strength test	As required
Earth works	Bottom of excavation	Checking bottom level, Visual inspection of soil condition	Upon completion of excavation
Reinforcement and form works	Re-bar materials	Verification of mill sheets or tensile test	Upon site delivery
	Re-bar arrangement	Visual inspection	Prior to concrete casting
	Formworks	Visual inspection	Prior to concrete casting
Concrete works	Materials	Verification of type of cement, grading, gravity, chloride quantity of aggregate	Upon determination of mix proportion
	Mix proportion	(Mix proportion) Verification of unit cement amount, unit water amount, aggregates volume, water-cement ratio, slump	Upon trial mix for each site
		(Compressive strength test on trial mix) Verification of slump, air content, concrete temperature, chloride quantity	
	Concrete quality (on delivery)	Verification of slump, air content, concrete temperature, chloride quantity	Per structural portion of each site Per design strength
	Concrete quality (on casting)	Compressive strength test	
	Concrete integrity (on de-shuttering)	Visual inspection on de-shuttering	
Structural steel works	Steel materials	Verification of shop drawings Material test and inspection	Prior to fabrication
		Visual inspection of accuracy of assembling and joints	Before or on site delivery
	Assembly accuracy	Visual inspection of assembly accuracy and joints	After assembly

(2) Equipment

Considering the presence of Japan's Grant Aid Project and sustainable equipment use, the Consultant consciously made a plan of procurement from Japan. In expanding the scope of procurement to a third country, elements and factors such as versatility and after-sales service were considered essential to avoid easy selection of equipment based only on low price. The quality of equipment will be ensured by putting in place certain restrictions, such as a limitation of products from only DAC or OECD member countries.

Additionally, many products have been manufactured in ASEAN countries, China and other developing countries. In the case that such products have been sold under the manufactures' responsibilities in terms of their quality and safety, and if their Head Offices are currently registered in Japan, DAC or OECD countries, acceptance of such countries as the country of origin will be considered.

The Consultant will check the design and layout plans, conduct pre-shipment inspections to confirm the consistency of equipment to be procured, the contents of the contract, and the quality of equipment.

2 - 2 - 4 - 6 Procurement Plan

(1) Construction

Almost all the construction materials can be procured in Cambodia. In respect of reinforcing steel bars, structural steel, metal products, finishing materials, materials for mechanical and electrical services and others, the products imported from neighbouring countries, such as Vietnam and Thailand, are to be locally procured. On the other hand, electrical equipment for substation (cubicle type) and water reservoir tanks made of FRP are planned to be imported from Japan due to the difficulties of procurement in Cambodia.

Table 2-22 Sources of Procurement of Major Construction Materials

Material	Source of Procurement			Remarks (country of origin)
	Local	Japan	Third country	
Materials for building works				
Portland cement	●			Thailand
Plaster	●			Thailand, Singapore
Concrete aggregate	●			
Deformed bar	●			Vietnam, China
Steel	●			Vietnam, China
Formwork	●			Vietnam, China
Concrete blocks	●			
Bricks	●			
Cement roof tiles	●			Thailand
Wood	●			Vietnam
Tiles	●			Thailand, Vietnam, Malaysia
Stone (Laterite stone)	●			
Stainless steel	●			China, Taiwan
Aluminium doors and windows	●			Thailand, Vietnam
Glass	●			Malaysia, Thailand, Indonesia
Paint	●			Thailand, Singapore
Materials for electrical works				
Substation (Cubicle type)		●		Japan
Switchboard	●			Thailand, Singapore
Cable	●			Thailand, Singapore, Korea
Lighting equipment	●			Thailand, Singapore, Korea
Light electrical equipment	●			Thailand, Singapore, Korea
Materials for plumbing works				
FRP water tank		●		Japan
Galvanized steel pipe	●			Thailand
Valve	●			Thailand, Japan
PVC pipe	●			Thailand
Sanitary ware	●			Thailand

(2) Equipment

The existence of local manufacturer that would produce equipment at the same quality as Japanese manufacturers was not discovered. On the other hand, Japanese manufacturers and other manufacturers which register their headquarters in DAC and/or OECD member countries have many local agents and/or distributers with local engineering staff. Therefore, the equipment procurement model will be planned based on the existence of such local agents and distributers in Cambodia.

Equipment procurement will also be designed in conformity with the quality control plan.

2 - 2 - 4 - 7 Initial Operation Training

The planned equipment is basic educational equipment for primary and lower secondary schools. Such equipment is necessary for the students to accumulate their experience of experimentation and to study and develop effective teaching methods at TEC. There is no equipment which requires complicated operation and maintenance. But operation training, including routine adjustment and maintenance, will be conducted for all users to keep equipment in good conditions. Since the equipment will be generally procured from the manufacturers that have local agents and/or distributers, the installation work, initial operation training and maintenance guidance will be performed by local engineers under the instruction of the procurement manager.

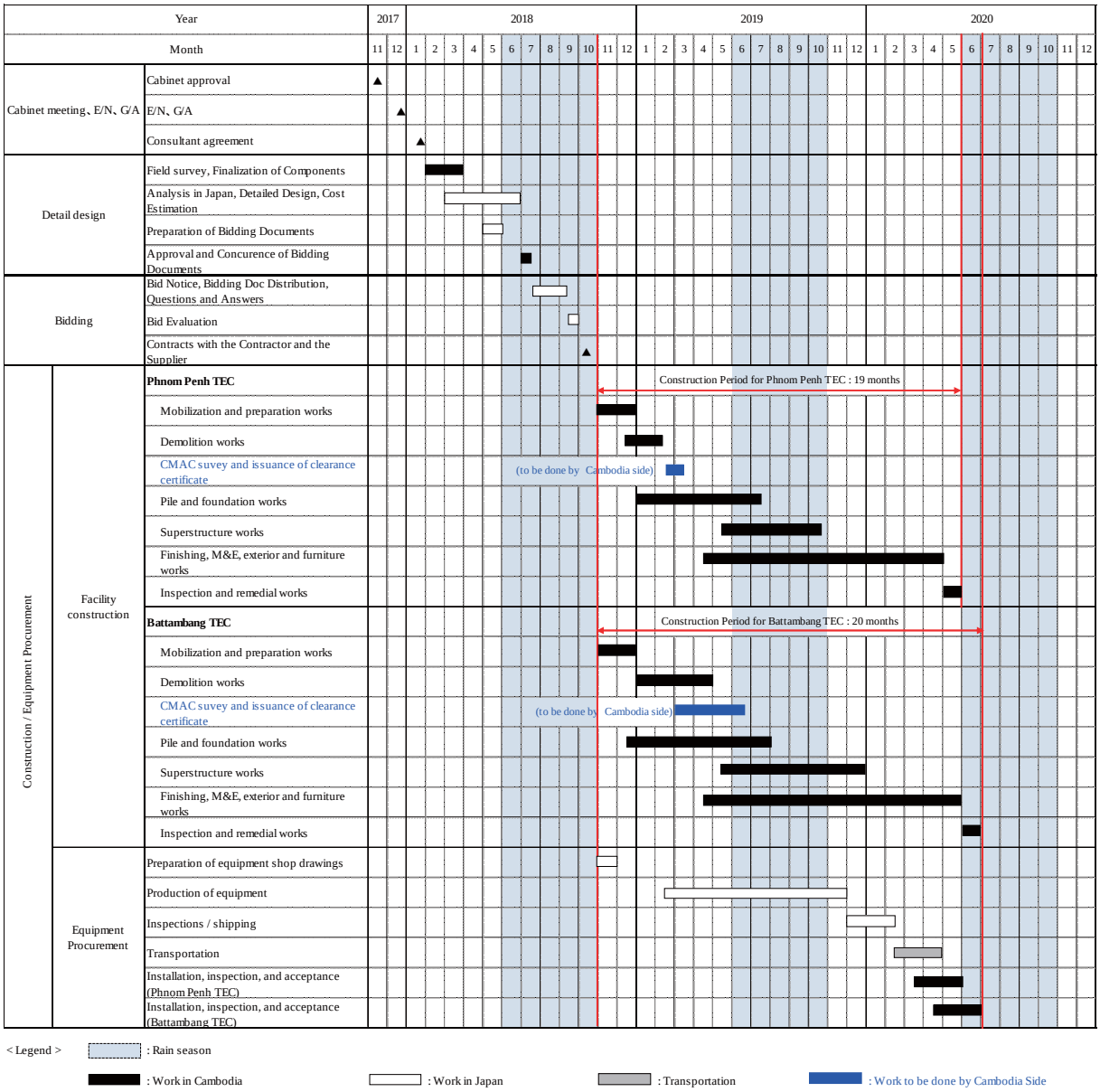
2 - 2 - 4 - 8 Implementation Schedule

After the approval by the Cabinet of the Government of Japan, the E/N and the G/A will be signed between the Cambodia and Japan sides. Then, the consultant agreement will be signed based on the E/N and the G/A. Through the detailed design and the bidding stages, the contracts with the Contractor and the Supplier will be made.

The period needed for the detailed design (from the filed survey to the approval and concurrence of the bidding documents) is estimated as 5.5 months, and the bidding (from the bid notice to the contracts with the Contractor and the Supplier) is 3.5 months. While the number of bidding/contract lots for construction works is set as one, the construction periods for Phnom Penh TEC and Battambang TEC are set as 19.0 months and 20.0 months, respectively, based on the volume of construction works thereof.

The provisional Project implementation schedule, on the premise that the Cabinet approval of the Government of Japan is given in November 2017, is shown below.

Table 2-23 Project Implementation Schedule (Provisional)



2 - 3 Obligations of Recipient Country

Specific obligations of the Cambodian side which will not be funded with the Grant for the Project are described below.

(1) Before Bidding

- To prepare budget for the Project for FY 2017 and onward.
- To open bank account (B/A).
- To issue A/P to a bank in Japan (the Agent Bank) for the payment to the consultant.
- To bear the following commissions to a bank in Japan for the banking services based upon the B/A.
  - Advising commission of A/P
  - Payment commission for A/P
- To approve IEE/EIA (conditions of approval should be fulfilled, if any) and secure the necessary budget for the implementation of IEE/EIA, if necessary.
- To secure and clear the lands (including preparatory works to remove obstacles which may impede the Project implementation).
  - Removal of trees
  - Land clearance
  - Disposal of dumped waste
  - Disposal of pavement
  - Transferring of statues
  - Rerouting of service utilities
  - Installation of a temporary gate at north-east corner of Phnom Penh TEC site, and others
- To obtain building permit and permit for demolition of the existing buildings, if necessary.
- To obtain the clearance certificate for UXO and landmines (To conduct the additional detection survey for the proposed construction areas of Battambang TEC which the previous survey did not cover.
- To secure alternative facility for temporarily transferring the affiliated lower secondary school in Battambang TEC site (the current Battambang RTTC site).
- To move and store necessary furniture and equipment from the designated buildings (PE-10 in Phnom Penh TEC and BRE-1, 5, 9, 11, 12, 13, 14 in Battambang TEC) which will be demolished by the Japanese side.
- To submit Project Monitoring Report (with the result of Detail Design).

(2) During the Project Implementation

- To issue A/P to a bank in Japan (the Agent Bank) for the payment to the Contractor(s) and Supplier(s).
- To bear the following commissions to a bank in Japan for the banking services based upon the B/A.
  - Advising commission of A/P
  - Payment commission for A/P
- To ensure prompt unloading and customs clearance at ports of disembarkation in recipient country and to assist the Supplier(s) with internal transportation therein.
- To accord Japanese nationals and/or physical persons of third countries whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the country of the Recipient and stay therein for the performance of their work.
- To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted.
- To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project.
- To conduct UXO/landmine detection surveys and issuance of clearance certificates for the areas where the existing buildings are demolished by the Japanese side for both Phnom Penh TEC site and Battambang TEC site.
- To rehabilitate water supply system for the science laboratories of the existing laboratory building in the G-1 campus of Battambang TEC (the current PTTC) necessary for installation of laboratory tables to be installed by the Project.
- To submit Project Monitoring Report and Project Completion Report
- To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities necessary for the implementation of the Project outside the site(s).
  - Change of water supply contract (for Phnom Penh TEC only. To merge the separate contracts for the current PTTC/RTTC)
  - New connection of medium voltage electric power (22 kV) to the sites
  - New connection of optical fibre for internet
  - Connection to public drainage system, if necessary
  - Other incidental facilities, if necessary

(3) After the Project

- To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid.
  - Allocation of maintenance cost
  - Operation and maintenance structure
  - Routine check/Periodic inspection
- To allocate lecturers and staff required for school management

2 - 4 Project Operation Plan

2 - 4 - 1 Operation Plan

Parallel to the Project, the technical cooperation of JICA named E-TEC is being carried out from January 2017 to December 2022 (planned). The cooperation project assists not only the development of educational contents, such as curriculum and syllabus, but also the development of the administration system of TEC. It is projected that the administration system of each TEC is going to be expanded steadily with the support of the technical cooperation project.

(1) Opening Schedule of TECs

Both Phnom Penh TEC and Battambang TEC are scheduled to open in November 2018. The completion of construction in Phnom Penh is in May 2020 and in Battambang is in June 2020, respectively. Even after TECs start, the existing facilities of PTTCs/RTTCs will be continuously used until the completion of construction.

(2) Operation System

As mentioned above, the legal arrangement for TEC establishment is in progress. The Directorate General of Education is responsible for the quality of education at TECs, and the TTD manages the process of establishing TECs. Meanwhile, the Project will be implemented for the purpose of contributing to the upgrade of the current PTTC/RTTC, which is overseen by TTD, to TEC as a higher educational institution. In this regard, the Directorate General of Higher Education will oversee TECs as higher educational institutions.

The selection of the directors and vice directors of TECs was conducted in October 2017[29], in preparation of the inaugurations of TECs scheduled in November 2018. The other teaching/management staff are planned to be selected in January 2018.

(3) Plan of Student Entrance

In 2018, the 1st year of TEC, only G-1 student will be accepted. The number of entrant grades will increase year by year and become full-scale in 2021. Although the existing PTTCs/RTTCs have accepted students from neighbouring prefectures and districts, coming TECs will accept students nationwide in the current plan.

[29] Though a director and four vice directors for Phnom Penh TEC were selected, only three vice directors for Battambang TEC were selected, so re-selection for a director and a vice director of the same will be advertised. One of the vice directors of Battambang TEC will be assigned as an acting director until the director is selected. The selected director and vice directors will join the training courses in Japan from November to December, 2017 by assistance from E-TEC.

Table 2-24 Number of Student of TEC (Per TEC)

Course	Grade/Year	2018.11～2019.6	2019.11～2020.6	2020.11～2021.6	2021.11～2022.6
Teacher training for primary school	G-1	240	240	240	240
	G-2	-	240	240	240
	G-3	-	-	240	240
	G-4	-	-	-	240
	Sub-total	240	480	720	960
Teacher training for secondary school	G-1	100	100	100	100
	G-2	-	100	100	100
	G-3	-	-	100	100
	G-4	-	-	-	100
	Sub-total	100	200	300	400
Total		340	680	1,020	1,360

(Source: The survey team)

The operation plan, mentioned from the next page onward, is based on the operation after the full range of grades is accepted.

(4) Recruitment of Lecturers and Staffs

MoEYS is considering the recruitment plan of lecturers and staff of TEC. As of July 2017, only the following points had been decided by the Sub-decree regarding TEC establishment issued as of 22nd May, 2017.

- TECs will keep employing the lecturers and staff of existing RTTCs and PTTCs for some time.
- 1 director, equivalent to the director of department at MoEYS, and 4 vice directors, equivalent to the vice director of department, will be assigned to each TEC.

As to other lecturers and staff, the PRESET[30] sub-committee, chaired by the Directorate General of Education, under the Committee for Teacher Development (CTD) is making a plan of personnel allocation as mentioned in Table 2-25, which has not been officially approved at this moment. (The plan is tentative and the actual allocation could change.)

Based on the tentative plan, 506 lecturers and staff are required to operate 2 TECs in total. On the other hand, as there are 232 trainers and staff at 4 existing RTTCs/PTTCs, the number of lecturers and staff which shall be newly recruited is calculated at 274.

[30] PRESET: Pre-service Training

Table 2-25 Plan of Allocation of Lecturers and Staff (Per TEC) (Draft)

Kind of work		Number of lecturers and staff	Plan of room usage		
			Name of room	Room capacity	Number of room
Administration	Director	1	Director's room	1	1
	Vice director	4	Vice director's room	1	4
	Secretary	2	Advisor and secretary's room	5	1
	Advisor to TEC director	3			
	Office chief (Administration and personnel)	1	Office room (Administration and personnel)	10	1
	Vice office chief (Administration and personnel)	2			
	Staff in administration (Administration and personnel)	7			
	Office chief (Planning and accounting)	1	Office room (Planning and accounting)	10	1
	Vice office chief (Planning and accounting)	2			
	Staff in administration (Planning and accounting)	7			
	Office chief (Academic, student affairs and public relations)	1	Office room (Academic, student affairs and public relations)	15	1
	Vice office chief (Academic, student affairs and public relations)	2			
	Staff in administration (Academic, student affairs and public relations)	12			
	First aid	1	First aid room	1	1
	Maintenance, guard, cleaning	6	--	--	--
Education	**Department chief**	**9**	Lecture room	10[31]	9
	Vice department chief	**18**			
	Lecturer (Full-time)	**57**			
	Lecturer (Part-time/contract)	**88**			
	Researcher	**16**			
	Lab Technician	6	Attached to each laboratory	--	--
	Lac Technician (ICT)	2	Attached to ICT room	--	--
	Librarian	1	Library office	5	1
	Assistant librarian	4			
Total		**253**			

(Source: Prepared by the survey team based on the data provided by MoEYS)

Table 2-26 Lecturers and Staff to be Newly Recruited (Per TEC)

(Unit: people)

Item	Phnom Penh TEC	Battambang TEC	Total
Required lectures and staff	253	253	506
Lecturers and staff of existing PTTCs/RTTCs[32]	128	104	232
Required lectures and staff additionally recruited	**125**	**149**	**274**

(Source: Prepared by the survey team based on the data provided by MoEYS)

[31] For planning, the tables and chairs for department chief and vice department chief are considered dedicated for the person and other tables and chairs are shared among the others.
[32] In the existing PTTCs/RTTCs, many staff are in charge of works in both administration and education in parallel.

The coloured cells in Table 2-25 refer to the number of lecturers and researchers who will be assigned in 9 departments. The breakdown of lecturers and researchers per TEC based on the tentative personnel allocation plan is shown in Table 2-27.

Table 2-27 Breakdown of Lecturers and Researchers (Per TEC) (Draft)

(Unit: people)

Department	Subject	Department chief	Vice department chief	Researcher	Lecturer		Total (Full-time)
		Full-time				Part-time, contract	
Research and development							
Curriculum development		1	2	8	0	0	11 (11)
Educational research		1	2	8	0	0	11 (11)
Natural Science							
Mathematics	Mathematics	1	2	0	8	12	23 (11)
Science	Physics, chemistry, biology and earth science	1	2	0	10	20	33 (13)
ICT	Pedagogy	1	2	0	4	0	11 (11)
	Subject			0	4	0	
Social Science							
Linguistics	Khmer	1	2	0	3	7	34 (11)
	English			0	3	10	
	French			0	2	6	
Social study development	History and geography	1	2	0	5	7	28 (11)
	Moral, civil rights and economics			0	3	10	
Philosophy and psychology	Philosophy and psychology	1	2	0	7	0	10 (10)
Art	Art	1	2	0	4	8	27 (11)
	Music			0	4	8	
Total		**9**	**18**	**16**	**57**	**88**	**188 (100)**

(Source: Prepared by the survey team based on the data provided by MoEYS)

TEC lecturers are required to have a master's degree or higher, which is specified as recruitment criteria when lecturers are newly recruited. Currently, among the trainers of existing PTTCs/RTTCs, only 26% have a master's degree or higher, thus the rest of them should be retrained to have a master's degree from now on. The assistance for their retraining has been already planned in TPAP[33]. In addition to this, JICA's training project/program, namely "The Project for Human Resource Development Scholarship (JDS)" and the training program "Improvement of Education Quality"[34] are to promote the TEC lecturers to study in Japan to earn master's degrees. It is also assumed that

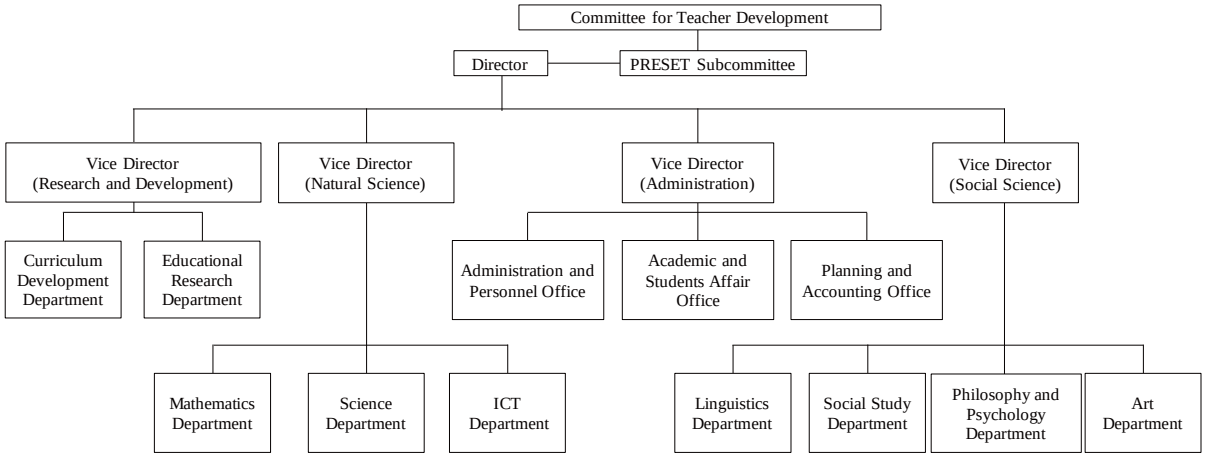
[33] In the 4.3.1.1 of TPAP, 50 bachelor's degree holders are planned to have master's degree for a year.
[34] The training program will be implemented in 4 batches from 2017 to 2023 for 20 teachers in total to obtain master's degrees.

MoEYS will continue the use of Cambodia Capacity Development Partnership Fund (CDPF) [35], which is funded by EU, SIDA[36] and UNICEF, to let the TEC lecturers enter a master's course, as it has executed the same policy with trainers of PTTCs/RTTCs so far.

Besides this, the strategic utilization of part-time and contract lecturers is equally important for improving the quality of TEC's education. Due to the upgrading of TEC as a higher education facility, the level of curriculum will become higher and new research fields could be added. It is planned that lecturers of higher education facilities in the country, such as the Royal University of Phnom Penh, will be invited to give lectures at TECs as part-time or contract lecturers.

(5) Organogram of TEC (Draft)

The TEC organogram drafted by the PRESET sub-committee, chaired by the Directorate General of Education, under the Committee for Teacher Development (CTD) is shown below.



(Source: Prepared by the survey team based on the data provided by MoEYS)

Figure 2-25 Organogram of TEC (Draft)

2 - 4 - 2 Maintenance Plan

As stated in the beginning of this chapter, the operation system of TEC is not yet fixed. However, it is presumed that in order to implement the variety of maintenance works, including daily cleaning, maintenance and repair of facilities, equipment and research instruments without problem, the number lecturers and staff described in "2-4-1 (4)" is necessary.

In existing PTTCs/RTTCs, in addition to the deployment of staff in charge of maintenance and repair, the green garden and pavement of paths in the campus has been funded by students' parents. The same donation is also expected at the new TECs.

[35] Capacity Development Partnership Fund
[36] Swedish International Development Cooperation Agency: SIDA

(1) Facility

In order to maintain the facilities introduced by the Project in good condition, regular maintenance is required. As shown in Table 2-25, each TEC plans to recruit six staff members for maintenance, cleaning and security. The maintenance and cleaning staff are going to be in charge of regular inspection, basic repair and cleaning of facilities and furniture.

In the existing PTTCs/RTTCs, 1 staff at Phnom Penh PTTC, 3 staff at Phnom Penh RTTC, 2 staff at Battambang PTTC, and 4 staff at RTTC are allocated as maintenance staff. It is projected that all of them will be continuously employed at the TECs. Although some additional staff are required to be hired complementarily, it can be said that the basics of the maintenance system will be established by the existing staff.

It is also noted that daily cleaning has been done well at the existing centres and a beautification effort has been undertaken in the whole facility area. In the newly established TECs, it is expected that the same cleaning and beautification activities will be practiced by a similar maintenance system.

The regular inspection of substation equipment and the cleaning of the water receiving tank, overhead water tank and septic tank shall be outsourced, and the outsourcing expenditure should be included in the maintenance budget.

(2) Equipment

The equipment to be procured under this Project does not require complicated or exceptional maintenance because they are usually used at primary and lower secondary school. As shown in Table 2-25, the laboratory technicians (6 staff per TEC) and ICT technicians (2 staff per TEC) will be allocated at each laboratory and ICT rooms respectively. These staff and lecturers will have the responsibility for equipment maintenance.

2 - 5 Project Cost Estimation

2 - 5 - 1 Initial Cost Estimation

(1) Cost to be borne by Cambodian side (168,000 USD) (Around 18.5mil JPY)

Table 2-28 Cost and Items to be borne by Cambodian Side

Item	Amount (USD)	Equivalent to JPY (Million JPY)
Cost for preparatory works; removal of trees, land levelling, land filling, removal and disposal of rubbish, removal of paving material, relocation of Buddhist statue, relocation of facility infrastructure, installation of temporary gate at Phnom Penh TEC etc.	97,000	10.7
Costs for issue of clearance certification and inspection of land mine and unexploded bomb	12,400	1.3
Securing the facility temporarily used by the affiliated lower secondary school (Current Battambang RTTC) at the new campus of Battambang TEC during the construction period	—	—
Cost for new connection of electricity (Medium voltage 22kV)	30,000	3.3
New connection of optical fibre for internet	—	—
Cost for connection of water supply at science laboratory in the Battambang TEC campus for the G-1 student (Current Battambang PTTC)	1,000	0.1
Bank transfer charge	27,600	3.1
Total	168,000	18.5

(2) Conditions of Estimation

① Time of estimation： January, 2017

② Exchange rate： 1 .00 USD = 110.41 JPY
1 KHR[37] = 0.0273 JPY

③ Implementation period： As per Table 2-23

④ Others： The rules of Japan's Grant Aid Scheme are applied in estimating the cost.

2 - 5 - 2 Operation and Maintenance Cost

2 - 5 - 2 - 1 Operation Cost

(1) Salary for Lecturers and Administration Staff

Salary for lecturers and administration staff assumedly varies depending on the type of employment

[37] Currency in Cambodia : Riel

(full-time, part-time, contract), years of experience and other conditions. As the details of the salary system has not become clear so far, the level of salary is tentatively estimated and the amount of salary is calculated based on the level as shown in Table 2-29.

Table 2-29 Estimated Salary for Lecturers and Staff (Per TEC)

(Unit price:1,000 Riel)

Position	Number of people	Salary level (estimate)	Salary (per person and year)	Total amount (per year)
TEC Director	1	MoEYS director level (decided)	18,186	18,186 (4,497 USD)
TEC vice director	4	MoEYS vice director level (decided)	16,986	67,944 (16,800 USD)
Advisor to TEC director	3	Based on the MoEYS director level	17,826	53,478 (13,223 USD)
Department chief	9	Based on the MoEYS director level	17,826	160,434 (39,669 USD)
Vice department chief	18	Based on the TEC department chief level	17,706	318,708 (78,804 USD)
Lecturer (Full-time)	57	The same as RTTC's lecturer level (The lowest level of category A3)	11,718	667,926 (165,152 USD)
Lecturer (Part-time/contract)	88	Half of lecturer (full-time)	5,859	515,592 (127,485 USD)
Other staff	67	The same as PTTC's lecturer level (Lecturer-cum-staff) (The lowest level of category B2)	10,560	707,520 (174,942 USD)
Maintenance, cleaning, handyman	6	Actual applied level at Battambang PTTC	6,000	36,000 (8,901 USD)
Total	253	-	-	2,545,788 (629,473 USD)

(2) Electricity Expense

Electricity expense for operating facilities constructed by the Project is preliminary calculated as follows.

Table 2-30 Electricity Expense (Preliminary calculation)

Item	Electricity capacity of new building	Actual load (50%)	Demand rate	Operation time/day	Operation days/year	Assumed electricity usage /year	Unit price[38] (Riel/kWh)	Amount of expense per year
Phnom Penh TEC	550 kVA	275 kVA	30%	7 hrs	180days	103,950 kWh	820	85,239 (k Riel) (21,076 USD)
Battambang TEC	1,075 kVA	1,075 kVA				203,175 kWh	750	152,381 (k Riel) (37,678 USD)
Total amount of expense per year								237,620 (k Riel) (58,754 USD)

(3) Water Expense

Water expense for operating the facilities constructed by the Project is preliminarily calculated as follows.

Table 2-31 Water Expense (Preliminary calculation)

Item	Building	Volume of usage /people/day	Number of people (Staff)	Number of people (Student)	Volume of usage/day	Total volume of usage/year (180days)	Unit price[39] (Riel/m³)	Amount of expense per year
Phnom Penh TEC	All	20L (Staff) 15L (Student)	188	1,360	24.16 m³	4,348.8 m³	1,030	4,480 (k Riel) (1,108 USD)
Battambang TEC	Except for dormitory		188	1,020	19.06 m³	5,743.8 m³	1,500	8,616 (k Riel) (2,130 USD)
	Dormitory	50L	1	256	12.85 m³			
Total amount of expense per year								13,096 (k Riel) (3,238 USD)

(4) Internet Expense

The internet expense amounts to 2,000 USD (8,088 k Riel) per TEC and 4,000 USD (16,176 k Riel) for 2 TECs on the assumption that the internet is supplied by the optical fibre in both of TECs.

2 - 5 - 2 - 2 Maintenance Cost

(1) Facility

The facilities constructed by the Project will not require the special maintenance at least for one year after delivery. The expected maintenance cost which might occur after that period is shown in Table 2-32.

[38] In the case of Cambodia, the electricity charge system differs from area to area. For Phnom Penh TEC, the unit price of government payment for any voltage power and for Battambang TEC, the estimated unit price of the contract for medium voltage power is applied respectively.

[39] The water charge system differs depending on the operating water supply authorities that have jurisdiction over the area.

Table 2-32 Estimated Maintenance Cost of Facilities

Item		Frequency	Cost per year (USD)		
			Phnom Penh TEC	Battambang TEC	Total
Re-paint	Outside	Once every 15 years	3,500.00	7,500.00	11,000.00
	Inside	Once every 15 years	2,700.00	4,400.00	7,100.00
	Steel fitting	Once every 10 years	500.00	800.00	1,300.00
Facility	Maintenance inspection/replacing consumables/cleaning etc.[40]	Once every 3 years	2,300.00	3,900.00	6,200.00
Total amount of expense per year			9,000.00 (36,398 k Riel)	16,600.00 (67,135 k Riel)	25,600.00 (103,533 k Riel)

(2) Equipment

The maintenance cost of equipment will be main expenses of consumables and spare parts. The expected costs are calculated as approximately USD21,000 (equivalent to 84,930,000 Riel) in total, which consists of USD10,500 (equivalent to 42,465,000 Riel) at each TEC, Phnom Penh and Battambang.

2 - 5 - 2 - 3 Total Amount of Operation and Maintenance Cost

As mentioned above, TEC is planned to open in November 2018. TTD of MoEYS has developed the 3-year budget plan of TEC and the budget of FY 2018 has been requested. The budget for FY 2018 is for the TECs' operation[41] at the existing PTTCs/RTTCs before the construction completion of new TECs by the Project.

[40] The cost includes the expenditures for regular inspection of substations and fire protection facility, inspection and replacing consumables of lighting fixtures, outlet and air-conditioner and cleaning of water receiving tank, overhead water tank and septic tank and other maintenance-related works.

[41] In 2018/2019 year, G2 students of the current PTTC/RTTC and G1 students of the new TEC will be educated at the same facilities of Phnom Penh and Battambang TECs. It is informed that the operation budget for the current PTTC/RTTC are secured as the provincial budgets.

Table 2-33 Budget of Operation and Maintenance of TEC (Draft)

(Unit price: k Riel)

	Phnom Penh TEC			Battambang TEC			Total (2 TEC)		
	2018	2019	2020	2018	2019	2020	2018	2019	2020
Personnel expences (lecturers and staff)	3,400,000	3,740,000	4,114,000	1,900,000	2,090,000	2,299,000	5,300,000	5,830,000	6,413,000
Student benefit	168,200	185,020	203,522	273,800	301,180	331,298	442,000	486,200	534,820
Operational expences	734,600	808,060	888,866	606,500	667,150	733,865	1,341,100	1,475,210	1,622,731
Utilities, communication cost	68,400	75,240	82,764	104,400	114,840	126,324	172,800	190,080	209,088
Consumption material for office use	79,900	87,890	96,679	76,720	84,392	92,831	156,620	172,282	189,510
Material/equipment for educational use	107,200	117,920	129,712	110,590	121,649	133,814	217,790	239,569	263,526
Travel cost	41,300	45,430	49,973	34,390	37,829	41,612	75,690	83,259	91,585
Operation/maintenance for vehicle	1,900	2,090	2,299	1,900	2,090	2,299	3,800	4,180	4,598
Maintenance/repair the facility	24,900	27,390	30,129	31,800	34,980	38,478	56,700	62,370	68,607
Others	411,000	452,100	497,310	246,700	271,370	298,507	657,700	723,470	795,817
Operation for dormitories	55,000	60,500	66,550	87,000	95,700	105,270	142,000	156,200	171,820
Total (in tounsand Riel)	4,357,800	4,793,580	5,272,938	2,867,300	3,154,030	3,469,433	7,225,100	7,947,610	8,742,371
Total (in USD)	1,077,974	1,185,772	1,304,349	709,274	780,202	858,222	1,787,248	1,965,973	2,162,571
Total (in thousand JPY)	118,968	130,865	143,951	78,277	86,105	94,716	197,245	216,970	238,667

(Source: TTD, MoEYS)

(1) Salary for Lecturers and Administration Staff

In comparison with the salary amount calculated in "2-5-2-1 (1)" [42], the personnel expenses included in the budge of FY 2020 as in Table 2-33 can fully cover the total salary amount of 2 TECs. It is assumed that MoEYS considers a sufficient amount of budget allocation for the personnel expenses.

Table 2-34 Estimated Salary of TEC Lectures/Staff and Budget of FY 2020 (Draft)

(Unit: k Riel)

Item	Phnom Penh TEC	Battambang TEC	Total
Estimated amount of salary (Table 2-29)	2,545,788	2,545,788	5,091,576 (1,258,946 USD)
Personnel expenses (lecturer and staff) in FY 2020 budget (Draft) (Table 2-33)	4,114,000	2,299,000	6,413,000 (1,585,680 USD)

(2) Utility and Communication Costs

The total amount of utility and communication costs estimated in "2-5-2-1 (2) ~ (4)" is rearranged in Table 2-35. The costs included in the table are cited from Table 2-33. The amount is calculated based on the assumption that TEC is operated at the existing PTTCs/RTTCs facilities and does not consider the operation and maintenance cost of the newly constructed facilities and equipment by the

[42] The estimation of the salary amount is as of FY 2021, when TEC comes into full-operation, and onward. Therefore, it is not precisely correct to compare with the budget of FY 2020.

Project. After the completion of construction of the Project in 2021, 98,527 k Riel for Phnom Penh TEC and 169,805 k Riel for Battambang TEC shall be included in the budget in addition to the utility and communication costs used when operating at the existing centres.

Table 2-35 Estimated Utility and Communication Costs and Budget of FY 2020 (Draft)

(Unit: k Riel)

Item	Phnom Penh TEC	Battambang TEC	Total
Electricity expense (Table 2-30)	85,239	152,381	237,620 (58,754 USD)
Water expense (Table 2-31)	4,480	8,616	13,096 (3,238 USD)
Internet expense	8,808	8,808	17,616 (4,000 USD)
The amount of utility and communication costs for the new facilities and equipment	**98,527**	**169,805**	**268,332 (65,992 USD)**
The amount of utility and communication costs for the existing facilities and equipment (Table 2-33)	82,764	126,324	209,088 (51,699 USD)
The estimated amount of utility and comm. costs necessary in FY 2021 and onward	**181,291**	**296,129**	**477,420 (117,691 USD)**

(3) Maintenance Cost of Facility and Equipment

The facility maintenance cost calculated in "2-5-2-2 (1)" and the maintenance cost included in the TEC operation and maintenance budget of FY 2020 (Table 2-33) are rearranged together in Table 2-36. As there is no corresponding item for equipment maintenance cost in the TEC budget, the cost is included as the total amount of the maintenance costs of facilities and equipment. As with the utility and communication cost, 78,863 k Riel for Phnom Penh TEC and 109,600 k Riel for Battambang TEC shall be included in the budget in addition to the necessary cost at the existing centres, after the completion of construction of the Project in 2021.

Table 2-36 Estimated Maintenance Costs and Budget of FY 2020 (Draft)

(Unit: k Riel)

Item	Phnom Penh TEC	Battambang TEC	Total
Maintenance cost of facility (Table 2-32)	36,398	67,135	103,533 (25,600 USD)
Maintenance cost of equipment	42,465	42,465	84,930 (21,000 USD)
The amount of maintenance cost for the new facilities and equipment	**78,863**	**109,600**	**188,463 (46,600 USD)**
The amount of maintenance cost for the existing facilities and equipment (Table 2-33)	30,129	38,478	68,607 (16,963 USD)
The estimated amount of maintenance cost necessary in FY 2021 and onward	**108,992**	**148,078**	**257,070 (63,563 USD)**

CHAPTER 3 PROJECT EVALUATION

Chapter 3 PROJECT EVALUATION

3 - 1 Preconditions

The followings are to be conducted by the Cambodian side as the preconditions for implementation of the Project.

① To secure and clear the lands (including preparatory works to remove obstacles which may impede the Project implementation).

② To conduct UXO/landmine detection surveys and issuance of clearance certificates.

- Before bidding: for the proposed construction areas of Battambang TEC which the previous survey did not cover.
- During the Project implementation: for the areas where the existing buildings are demolished by the Japanese side for both Phnom Penh TEC site and Battambang TEC site.

③ To secure alternative facility for temporarily transferring the affiliated lower secondary school in Battambang TEC site (the current Battambang RTTC site).

④ To move and store necessary furniture and equipment from the designated buildings which will be demolished by the Japanese side.

⑤ To obtain building permit and permit for demolition of the existing buildings, if necessary.

⑥ To approve IEE/EIA (conditions of approval should be fulfilled, if any) and secure the necessary budget for the implementation of IEE/EIA, if necessary.

⑦ To ensure prompt unloading and customs clearance at ports of disembarkation in Recipient country and to assist the Supplier(s) with internal transportation therein.

⑧ To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the country of the Recipient with respect to the purchase of the products and/or the services be exempted.

⑨ To provide new connection of medium voltage electric power (22 kV), to merge the separate contracts for water supply, and to provide new connection of optical fibre for internet.

⑩ To rehabilitate water supply system for the science laboratories of the existing laboratory building in the G-1 campus of Battambang TEC (the current PTTC) necessary for installation of laboratory tables to be installed by the Project.

3 - 2 Necessary Inputs by Recipient Country

The necessary inputs which shall be provided by the Cambodian side to make the Project outcome effective are as follows.

① To allocate necessary lecturers and staff to Phnom Penh TEC and Battambang TEC in order to operate the TECs as professional degree-granting (equivalent to a bachelor's degree) higher educational institutions.

② To operate educational programs, including the preparation of curriculum, syllabus, and

teaching materials, in order to educate an adequate number of students and to maintain educational quality.

③ To allocate the graduates of Phnom Penh TEC and Battambang TEC as teachers of primary and lower secondary schools nationwide in response to the demands by region as well as by specialty.

④ To secure necessary operational budget, including personnel costs and operation and maintenance costs for facilities and equipment, for Phnom Penh TEC and Battambang TEC.

⑤ To establish operation and maintenance systems for facilities and equipment at Phnom Penh TEC and Battambang TEC, and to conduct appropriate operation and maintenance activities for the same.

3 - 3 Important Assumptions

The external factors which are critical to ensure that the Project outcome is effective, but cannot be controlled by the Project activities, are as follows.

① There are no major changes of policies, deterioration of security, or natural disasters which may cause the cancellation or long delay of the Project.

② There are no sudden and unexpected price escalations according to economic circumstances, and the procurement of necessary materials and equipment is carried out as planned.

③ There are no major changes in the teacher management reform and in the regime of MoEYS to promote the reform, and the reform proceeds as planned.

3 - 4 Project Evaluation

3 - 4 - 1 Relevance

The Project proves to be relevant for Japanese Grant Aid, on account of the reasons mentioned below.

① The direct beneficiaries of the Project are the student of TECs (240 for the primary education course and 100 for the lower-secondary education course per year.). Additionally, as the quality of teachers becomes higher through the education at TECs, the quality of primary and lower-secondary education becomes higher, which contributes to the whole nation in the mid and long term.

② The education sector is positioned as one of 4 important strategies in the national development policy of “Rectangular Strategy: 2013-2018”, emphasizing the importance of “human resource development especially the skill training for the industrial sector through enhanced quality of education in all areas and at all levels…”. Also under the development plan of the education sector, “Education Policy Action Plan (ESP): 2014-2018”, TPAP was drawn up and is being

promoted. As the objective of the Project is to improve the teacher training program and to improve teachers trained in TEC by upgrading facilities and equipment to meet the requirement for the 4-year course TEC, the Project complies with the development strategy of Cambodia.

③ In the Japanese assistance policy for Cambodia, "Program for Human Resource Development for Industry" including the field of basic education is located in one of 4 main pillars of the policy, "Assistance for industrial development". According to the policy, Cambodia is under the severe competition with the emerging neighbor countries, such as Myanmar and Bangladesh and the quantity and quality improvement of human resource contributing to the industrial development is one of urgent issues. Thus, the policy makes much of the assistance for human resource development from basic education to higher/technical education to satisfy the demand of labor market. The Project aims to tackle the issue by quantitatively and qualitatively improving the teacher training capacity of basic education and complies with this Japanese assistance policy.

④ The improvement of educational quality is included in the promotion of social development, one of four pillars of the Japanese assistance policy for Cambodia. Specifically, "the lack of educational knowledge and practical teaching skills of teachers" is pointed out as an urgent challenge. The Project will provide the response measures and comply with the Japanese assistance policy.

⑤ In parallel with the Project, Japanese technical cooperation (E-TEC) is being implemented for assisting the establishment of TEC's operation and management system. By developing infrastructural development by Japanese Grant Aid along with the "soft" assistance, a high effectiveness of assistance can be expected through the synergy between the two projects. In addition to this, Japan has implemented the grant aid projects for the construction of primary and lower-secondary schools and the technical cooperation for the enhancement of teaching ability of teachers in Cambodia. The Project will effectively contribute to the achievement of the overall objective of the Project, to improve the quality of primary and lower secondary education in Cambodia, and to work with the outcomes of these past projects.

3 - 4 - 2 Effectiveness

The Project is expected to bring the following outcomes.

(1) Quantitative Outcomes

Table 3-1 Indicator for the Quantitative Results of the Project

Indicator	Baseline data (Year 2017)	Target value (Year 2023: 3 years after the completion)
The number of students in 4-year degree courses for primary and lower secondary teacher education (students/year)[43]	0	2,720[44]

(2) Qualitative Outcomes

- The Project will contribute to the quality of teachers in both primary and lower secondary schools.

According to the above considerations, it is assumed that the relevance and effectiveness of the Project is sufficiently high.

[43] While the quantitative indicator for the Project was set as "the number of degree holders from Phnom Penh TEC and Battambang TEC" in the Minutes of Discussions singed on August 31,2017, it is reconsidered and corrected as "the number of students in 4-year degree courses for primary and lower secondary teacher education".

[44] (Primary teacher education course 240 students/year + lower secondary teacher education course 100 students/year) x 4 grades x 2 TECs = 2,720 students