The Union of Myanmar
Rehabilitation and Reconstruction Sub-committee

No.

OUTLINE DESIGN STUDY REPORT
ON
THE PROJECT FOR CONSTRUCTION OF PRIMARY SCHOOL-CUM-CYCLONE SHELTERS IN THE AREA AFFECTED BY CYCLONE "NARGIS"
IN
THE UNION OF MYANMAR

FINAL REPORT

AUGUST 2009

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

YACHIYO ENGINEERING CO., LTD

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PREFACE

In response to a request from the Government of the Union of Myanmar, the Government of Japan decided to conduct an outline design study on the Project for Construction of Primary School -cum- Cyclone Shelters in the Area affected by Cyclone “Nargis” in the Union of Myanmar and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to The Union of Myanmar a study team from 21st February to 1st May 2009.

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

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

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

August, 2009

Izumi Takashima
Vice-President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

August, 2009

We are pleased to submit to you the outline design study report on the Project for Construction of Primary School -cum- Cyclone Shelters in the Area affected by Cyclone “Nargis” in the Union of Myanmar.

This study was conducted by Yachiyo Engineering Co., Ltd., under a contract to JICA, during the period from January 2009 to July 2009. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of the Union of Myanmar and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

Very truly yours,

Naoyuki Minami

Chief Consultant,
Outline Design Study Team
on the Project for Construction of Primary School
-cum- Cyclone Shelters
in the Area affected by Cyclone “Nargis”
in the Union of Myanmar

Yachiyo Engineering Co., Ltd.

SUMMARY

(1) Overview of the Country

Myanmar is located in South Asia between north latitude 10°~27° and east longitude 92°~111°; it shares borders with India and Bangladesh to the west, with China to the northeast and with Thailand to the southeast, while the southern side of the country faces onto the Andaman Sea. The national land area is about 678,500 km^2 and the population is 53.2 million (2004).

Mt. Hkakabo Razi, the highest mountain in Myanmar with an elevation of 5,881 m, rises in the northernmost corner of the country. A vast plain stretches from north to south in the central area and is flanked by mountain ranges to the east and west. The eastern state border of Rakhine State lying to the western end of the central plain is marked by the Rakhine Mountain Range which stretches from the Assam Region in India to the natural border between India and Myanmar and further to Rakhine State after traversing Chin State. The plain lying between the Rakhine Mountain Range and the west coast of Myanmar along the Bay of Bengal is known for rice production. This area is, however, prone to damage by cyclones which rage in the Indian Ocean.

(2) Background of the Requested Project and Outline of Development

The Union of Myanmar (hereinafter referred to as “Myanmar”) was hit by Nargis, a powerful tropical cyclone, on 2nd through 4th May, 2008 and suffered huge damage, totalling an estimated US$ 4 billion with some 140,000 people killed or missing. Many buildings, including some 4,000 primary school buildings, collapsed in the disaster area stretching from the Ayeyarwady (Irawadi) Delta to Yangon. The Government of Japan swiftly reacted to the disaster and provided urgent and continual assistance, including the supply of emergency aid goods and the dispatch of a Japan Disaster Relief Medical Team, in collaboration with international aid organizations. In the aftermath of the disaster, a project formulation study (disaster prevention) was conducted in August 2008 based on the judgment that there was a strong need for Japanese assistance for the disaster prevention sector, in turn based on the findings of a field survey conducted by the JICA Myanmar Office. In November, 2008, the Preparatory (Needs Assessment) Study was conducted, confirming that the rebuilding of primary school buildings was very slow in the coastal area and that the rebuilding of collapsed primary school buildings as buildings capable of functioning as shelters to protect human lives from strong winds and storm surge caused by cyclones is extremely urgent. The Minutes for this Study confirmed the request by the Government of Myanmar regarding the construction of primary schools cum cyclone shelters. The formal letter of request with an attached list of candidate schools (20 primary candidates and 10 secondary candidates) was submitted on 6th February, 2009. The list of candidate schools has been subsequently modified to 21 primary candidates and 11 secondary candidates. It has been stated that partial funding by the government budget or a NGO may be available for four schools. Furthermore Ah Si Gyi School was declined and new Htaw Paing School was added with high priority.

(3) Outline of the Study Findings and Contents of the Project

In response to the request, the Government of Japan decided to implement an Outline Design Study on the Programme for Improvement of Solid Waste Management in Dhaka City toward the Low Carbon Society in the People’s Republic of Bangladesh, and consigned implementation of this to JICA. The

Outline Design Study Team was dispatched to Bangladesh from August to December 2008, during which time it held discussions with officials in the Bangladeshi government and implemented field surveys. Following its return to Japan, the Study Team continued its work, later returned to Bangladesh to explain and discuss the Draft Summary of the Outline Design Study, and compiled the results of this into the report in hand.

The Project aims to strengthen the waste collection and transportation capacity of DCC, and to reduce emissions of greenhouse gases in waste collection and transportation in Dhaka City.

After the Outline Study Team returned to Japan, the basic components of the Project based on the site surveys and results of discussions with the Bangladeshi side were compiled as follows.

Outline of the Project Facilities (Architectural)

Building	Structural Particulars	Contents of Facilities	Total Building Area		
			Floor area per building	Number of building	Total
Primary School cum Cyclone Shelter	- Structure: reinforced concrete structure - Raised floor, 2-story, with attic - Walls: brick/block, mortar finish, painted - Floors: concrete, trowel finish - Sanitary installations : rainwater holding tank, septic tanks, infiltration pits	Classrooms, teachers' room, toilets	359.4 ～ 802.5 ㎡	20	Average 415.83 ㎡
		Total	㎡	20	8,316.6 ㎡

Outline of Project Facilities (Furniture)

Item	Structural Particulars	Contents of Facilities	Quantity	Remarks
Furniture	Two seater desk and bench for pupils: wood Teacher's desk and chair: wood Locker : steel Meeting table and chairs: wood	Two seater desk and bench for pupils, Teacher's desk and chair, Locker, Meeting table and chair	1,540 77 20 20 80	40 pupils for one classroom

(4) Project Implementation Schedule and Cost Estimation

In the event where the Project is implemented under the Government of Japan's Grant Aid for Disaster Prevention and Reconstruction program, the rough project cost is estimated as 1 billion 178 million yen (958 million yen on the Japanese side and 220 million yen on the Bangladeshi side). The major scope of works on the Bangladeshi side will be preparation of the construction site, demolition and removal of obstructions, bearing of taxes, bearing of bank commission fees and so on, and the project implementation schedule from the tender to completion of works will be approximately 21 months.

Summary of Project Facilities and Number of Refugees

Town ship	No.	School/Village Name	Village Tract	Number of Pupils	Number of classroom			Floor Area		Capacity		
								Total		Area*		Refugee
					GF	1F	Total	(㎡)	(sq.feet)	Capacity	(sq.feet)	0.25㎡/p
Labutta	13	PPS-Mi Kyaung Ai	Sa Lu Seik	300	4	4	(8)	598.2㎡	6,438.9	468.36㎡	5,041.4	1,873
	11	PPS-Chan Thar Gone	Pyin Ah Lan	256	3	3	(6)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627
	3	PPS-Hlwa Zar	Hlwa Zar	215	2	3	(5)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627
	17	BEPS-Tha Pyu Gone	Tha Byu Gone	154	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	14	PPS-Thin Gan Lay	Sin Chae Yar	142	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	12	BEPS-Ma Khan Pon	Pyin Ah Lan	133	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	4	PPS-Zin Pyune Gone	Hlwa Zar	116	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	2	BEPS-Shwe Gone	Da Ni Seik	105	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	5	PPS-Kwa Kwa Lay	Hlwa Zar	96	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	15	BEPS-Ye Kyaw Wa	Tel Pin Kine	91	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	16	BEPS-Chaung Gyi	Tha Byu Gone	70	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	6	BEPS-Kyar Chaung	Kone Gyi	50	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	8	BEPS-Tha Pyay Chaing	Kone Gyi	19	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
				1,747	16	**30**	**(46)**	**5,208.8㎡**	**56,066.7**	**3,913.56㎡**	**42,125.2**	**15,654**
Bogale	28	BEPS-Ka Tha Hmyin	Daunt Gyi	494	6	6	(12)	802.5㎡	8,638.4	642.70㎡	6,918.0	2,571
	33	BEPS-Htaw Paing	Set San	269	4	3	(7)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627
	31	BEPS-Ti Tant	Set San	157	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	22	BEPS-Kyat Taujung Chaung	(Kyan Nyo Ghi) Kyun Htei	74	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	18	BEPS-Sat Kyun	Kyen Chaung Gyi	71	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	26	BEPS-Thar Yar Kone	Ma Gu	65	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
	20	BEPS-Pan Phu Ywa Ma	Kyen Chaung Gyi	55	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053
				1,185	12	**19**	**(31)**	**3,107.8㎡**	**33,452.3**	**2,365.30㎡**	**25,459.9**	**9,461**
Total				**2,932**	28	**49**	**(77)**	**8,316.6㎡**	**89,519.0**	**6,278.86㎡**	**67,585.1**	**25,115**

(5) Verification of Project Validity

The responsible agency for the Project is the Rehabilitation and Reconstruction Sub-Committee (RRSC), the members of which consist of representatives of the Ministry of Social Welfare, Relief and Resettlement (MoSWERR).

The agency to operate and maintain the facilities is the Ministry of Education (MoE).

The major effects anticipated as a result of Project implementation are as follows.

1) Direct Effects

Improvement of the educational environment

◊ The primary school buildings which were destroyed by Cyclone Nargis will be reconstructed at 20 project sites, vastly improving the educational environment for 2,932 pupils.

◊ The newly constructed facilities at the project sites will act as shelters for some 25,000 people

2) Indirect Effects

Increased number of people who can be evacuated to cyclone shelters

◊ The new facilities will contribute to improvement of the school enrolment rate and the level of education.

◊ The risk of a cyclone disaster will be reduced in the project areas, giving local residents peace of mind.

Thus, since the Project can be expected to realize sufficient beneficial effects and will not entail any problems in maintenance, the implementation of the Project under grant aid of the Government of Japan is judged to be appropriate.

Moreover, in order to realize the more efficient and effective implementation of the Project, it is necessary to establish the operation and maintenance setup, secure and appropriately assign personnel without delay, and secure an appropriate budget for operation and maintenance.

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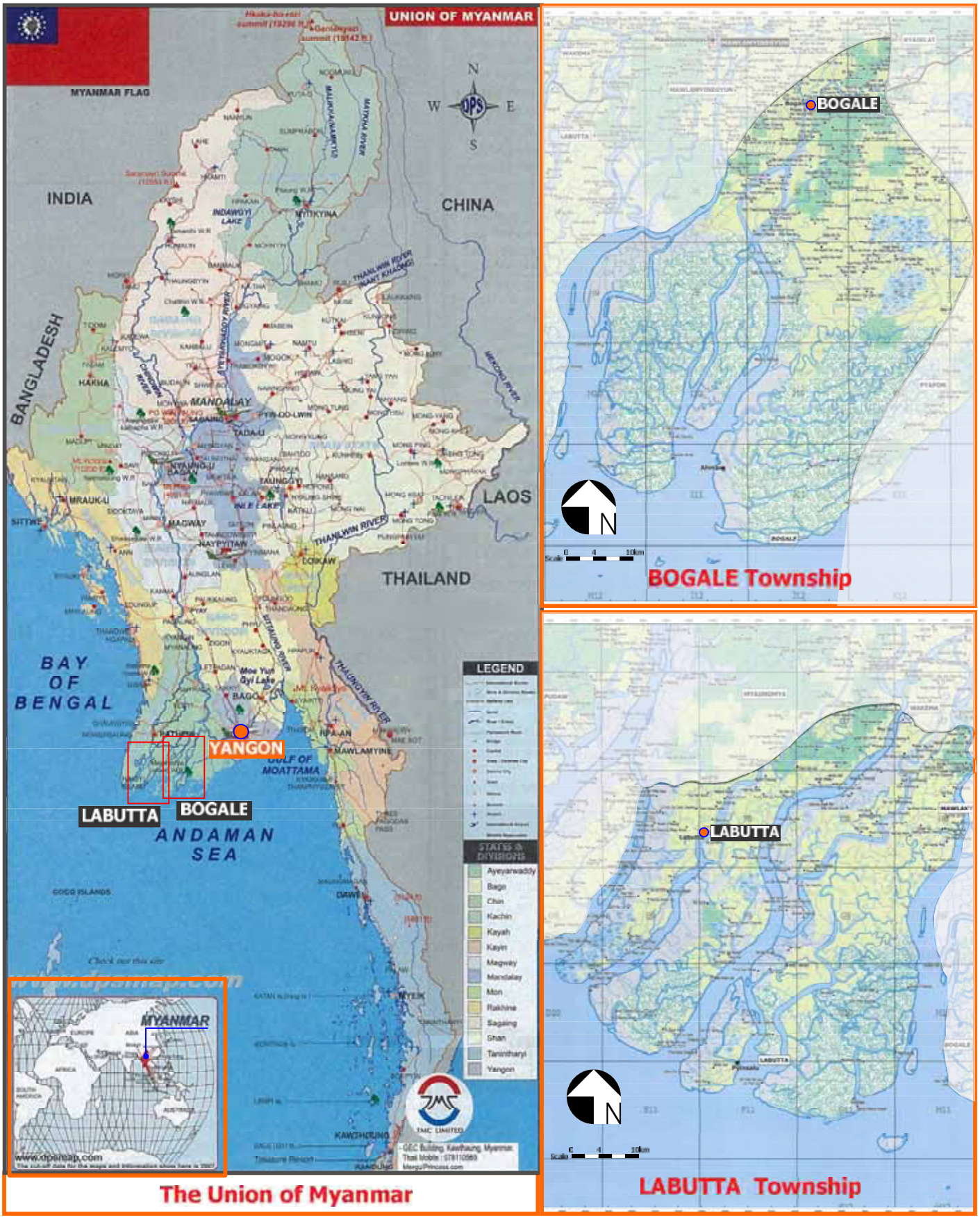
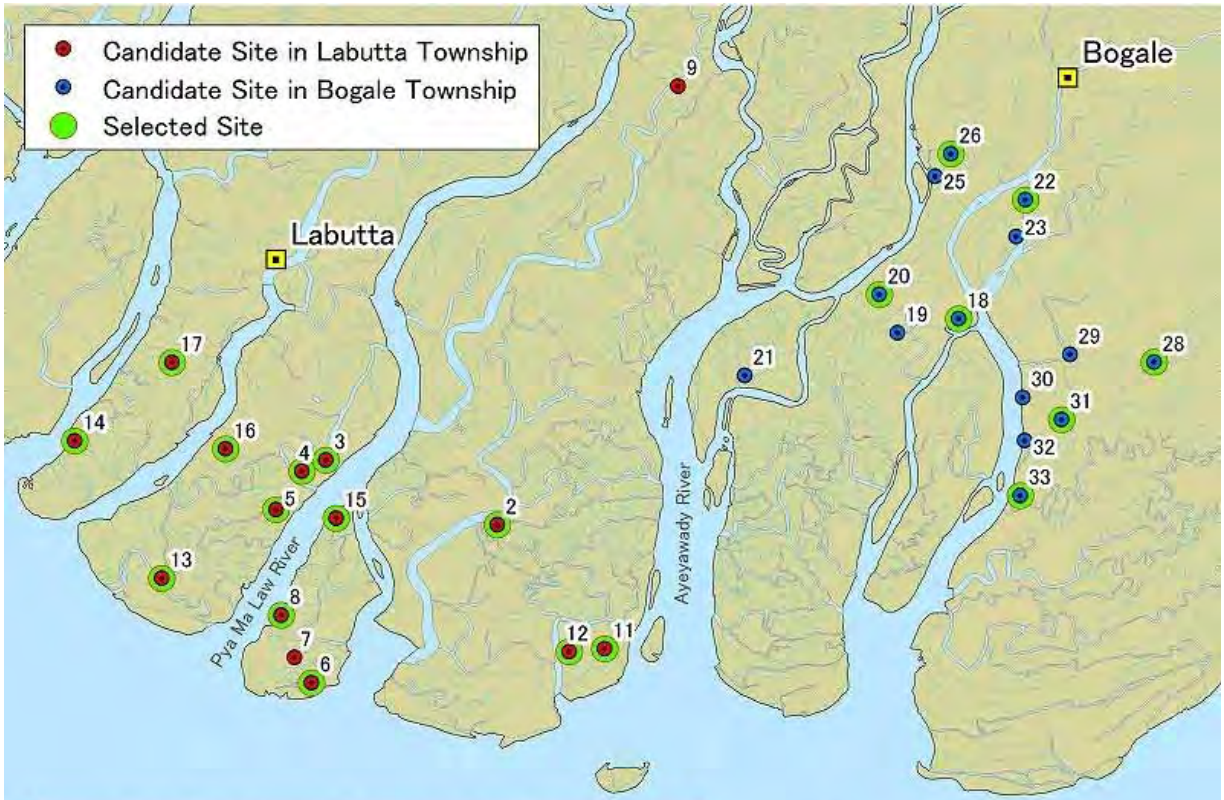
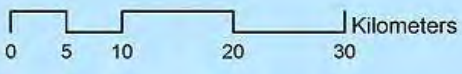


Location Map of Study Site



Labutta Township			Bogale Township		
No.	Name of School	Remark	No.	Name of School	Remark
1	BEPS-Daunk Chaung	Canceled	18	BEPS-Sat Kyun	
2	BEPS-Shwe Gone		19	BEPS-La Mu Oat Ka Lay	
3	PPS-Hlwa Zar		20	BEPS-Pan Phu Ywar Ma	
4	PPS-Zin Pyune Gone		21	BEPS-Kyun Thar Yar	
5	PPS-Kwa Kwa Lay		22	BEPS-Kyat Taung Chaung	
6	BEPS-Kyar Chaung		23	BEPS-Ywar Thar Yar	
7	BEPS-Nat Thet		24	BEPS-La Tar Chaung	Canceled
8	BEPS-Tha Pyay Chaing		25	BEPS-Poe Laung Ywar Ma	
9	BEPS-Aung Tha Pyay		26	BEPS-Thar Yar Kone	
10	BEPS-Wah Taw Gone	Canceled	27	BEPS-Ma Gu (1) Kyawat	Canceled
11	PPS-Chan Thar Gone		28	BEPS-Ka Tha Hmyin	
12	BEPS-Ma Khan Pon		29	BEPS-Ah Lan Oke	
13	PPS-Mi Kyaung Ai		30	BEPS-Thu Kha Wa Di Myit Tan	
14	PPS-Thin Gan Lay		31	BEPS-Ti Tant	
15	BEPS-Ye Kyaw Wa		32	BEPS-Ah Si Gyi	
16	BEPS-Chaung Gyi		33	BEPS-Htaw Paing	
17	BEPS-Tha Pyu Gone				



4 Classroom Type

12 Classroom Type

Photo-1:
Overview of a flat site. Temporary classroom has only roof sheet without walls.
(Labutta No.4-Zin Pyune Gone)

Photo-2:
Construction site. Temporary classrooms shall be reconstructed with rigid and safe structure.
(Labutta No.17-Tha Pyu Gone)

Photo-3:
Only roof was repaired temporarily.
(Labutta No.4-Zin Pyune Gone)

Photo-4:
Remain of foundation of old classroom after complete collapse by Nargis.
(Bogale No.18-Sat Kyun)

Photo-5:
Temporary classroom: Education environment is bad and not safe for cyclone etc.
(Labutta No.3-Hlwa Zar)

Photo -6:
Temporary classroom: shabby wooden or bamboo frame structure covered with plastic sheet.
(Labutta No.2-Shwe Gone)

Photo -7:
Congested classroom of poor condition.
(Bogale No.22-Kyat Taujung Chaung)

Photo -8:
Lack of school furniture (desks, chairs etc.)
(Labutta No.12-Ma Khan Pon)

Photo -9:
Temporary toilet. Unsanitary condition.
(Labutta No.14-Thin Gan Lay)

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Access road to the site with bad condition.
(Labutta No.12-Ma Khan Pon)

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Unpaved road in a village. In rainy season, road condition becomes bad and transportation of construction materials and equipment will get difficult.
(Labutta No.15-Ye Kyaw Wa)

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ABBREVIATIONS

Abbreviations	English	Japanese
A/A	: (Procurement) Agent Agreement	調達代理機関契約
ASEAN	: Association of Southeast Asian Nations	東南アジア諸国連合
B/A	: Banking Arrangement	銀行取極
DBE - 1	: Department of Basic Education – No.1	基礎教育第１局
DMH	: Department of Meteorology and Hydrology	気象水文局
DSW	: Department of Social Welfare	社会福祉局
EFA	: Education for All	万人のための教育
E/N	: Exchange of Notes	交換公文
EU	: European Union	欧州連合
G/A	: Grant Agreement	無償資金協力合意書
IFRC	: International Federation of Red Cross and Red Crescent Societies	国際赤十字・赤新月社連盟
JBIC	: Japan Bank for International Cooperation	国際協力銀行
JICA	: Japan International Cooperation Agency	独立行政法人国際協力機構
JICS	: Japan International Cooperation System	財団法人日本国際協力システム
MES	: Myanmar Engineering Society	ミャンマー技術協会
MIMU	: Myanmar Information Management Unit	ミャンマー情報管理ユニット
MoE	: Ministry of Education	教育省
MoSWERR	: Ministry of Social Welfare, Relief and Resettlement	社会福祉救済復興省
NDPCC	: National Natural Disaster Preparedness Central Committee	国家自然災害防災中央委員会
NGO	: Non-Governmental Organization	非政府組織
NRC	: Norwegian Refugee Council	ノルウェー難民委員会
PDC	: Peace and Development Council	平和開発委員会
PONJA	: Post-Nargis Joint Assessment	ナルギス被害合同調査
PONREP	: Post-Nargis Recovery and Preparedness Plan	ナルギス復旧復興計画
TCG	: Tripartite Core Group	３者復興コアグループ
UN	: United Nations	国際連合
UNDP	: United Nations Development Programme	国際連合開発計画
UN-HABITAT	: United Nations Human Settlements Programme	国際連合人間居住計画（ハビタット）
UNICEF	: United Nations Children's Fund	国際連合児童基金（ユニセフ）
UNOCHA	: UN Office for the Coordination of Humanitarian Affairs	国連人道問題調整事務所
UNOSAT	: UN Institute for Training and Research (UNITAR) Operational Satellite Applications Programme	国際連合衛星画像利用プログラム
WASH	: Water, Sanitation and Hygiene	給排水・衛生プログラム
WFP	: World Food Programme	世界食糧計画

CHAPTER 1 BACKGROUND OF THE PROJECT

1.1 Background and Outline of the Project

The Union of Myanmar (hereinafter referred to as “Myanmar”) was hit by Nargis, a powerful tropical cyclone, on 2nd through 4th May, 2008 and suffered huge damage, totalling an estimated US$ 4 billion with some 140,000 people killed or missing. Many buildings, including some 4,000 primary school buildings, collapsed in the disaster area stretching from the Ayeyarwady (Irawadi) Delta to Yangon. The Government of Japan swiftly reacted to the disaster and provided urgent and continual assistance, including the supply of emergency aid goods and the dispatch of a Japan Disaster Relief Medical Team, in collaboration with international aid organizations. In the aftermath of the disaster, a project formulation study (disaster prevention) was conducted in August 2008 based on the judgment that there was a strong need for Japanese assistance for the disaster prevention sector, in turn based on the findings of a field survey conducted by the JICA Myanmar Office. In November, 2008, the Preparatory (Needs Assessment) Study was conducted, confirming that the rebuilding of primary school buildings was very slow in the coastal area and that the rebuilding of collapsed primary school buildings as buildings capable of functioning as shelters to protect human lives from strong winds and storm surge caused by cyclones is extremely urgent. The Minutes for this Study confirmed the request by the Government of Myanmar regarding the construction of primary schools cum cyclone shelters. The formal letter of request with an attached list of candidate schools (20 primary candidates and 10 secondary candidates) was submitted on 6th February, 2009. The list of candidate schools has been subsequently modified to 21 primary candidates and 11 secondary candidates. It has been stated that partial funding by the government budget or a NGO may be available for four schools. Furthermore Ah Si Gyi School was declined and new Htaw Paing School was added with high priority.

1.2 Natural Conditions

(1) Topography

Mt. Hkakabo Razi, the highest mountain in Myanmar with an elevation of 5,881 m, rises in the northernmost corner of the country. A vast plain stretches from north to south in the central area and is flanked by mountain ranges to the east and west. The eastern state border of Rakhine State lying to the western end of the central plain is marked by the Rakhine Mountain Range which stretches from the Assam Region in India to the natural border between India and Myanmar and further to Rakhine State after traversing Chin State. The plain lying between the Rakhine Mountain Range and the west coast of Myanmar along the Bay of Bengal is known for rice production. This area is, however, prone to damage by cyclones which rage in the Indian Ocean.

To the east of the central plain lies Shan State, most of which consists of highlands spreading from China.

Ayeyarwady (Irawadi) River is a great river running through a long, narrow central plain between the Rakhine Mountain Range and the Shan Highlands. This river is formed by the merger of two rivers originating in China and India at a point to the north of Myitkyina, the capital of Kachin State. It has a length of 2,100 km and widens to some 300 km, forming a vast dealt before emptying into the Andaman Sea. Thanlwin (Salween) River originating in Yunnan Province in China runs to the east of Ayeyarwady River and empties into the Gulf of Martaban at a point located to the south of Mawlamyine, the third largest city in Myanmar. The total national land area of 680,000 km^2 is approximately 1.8 times larger than that of Japan.

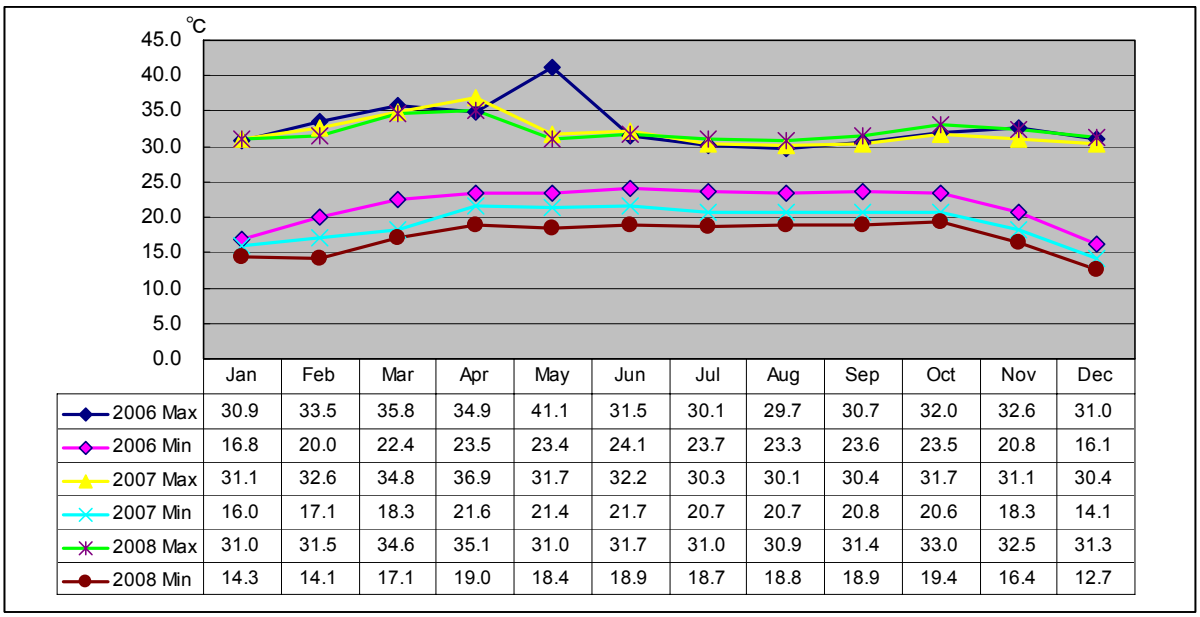
Because of the fertile soil, rice is popularly cultivated in the delta area and Myanmar is the biggest rice exporting country in the world. The country is rich in natural resources and large quantities of wood, such as teak, and natural gas are exported.

(2) Climate

Most of Myanmar belongs to the torrid zone and is strongly affected by monsoons. There are three seasons, i.e. hot season (March - May), rainy season (June - October) and dry season (November - February). In the hot season, it is not unusual for the temperature to exceed 40°C. In contrast, the rainy season is more bearable although it rains almost every day as most of the annual rainfall (approximately 3,000 mm in Yangon) occurs during this season. The dry season is the most comfortable season of the year with dry air, pleasant breeze and cool temperatures. The temperature drops in the morning and the evening, sometimes to below 15°C.

The rainfall pattern is similar throughout the country except in the Central Highlands (Upper Myanmar) which is called the dry zone because of the distinctively low level of annual rainfall. The amount of rainfall in the dry zone is quite low even in the rainy season and hardly any rain is observed in the dry season and hot season (annual rainfall of approximately 500 - 700 mm). According to one theory, a huge amount of bricks was required to meet the demand for the construction rush of pagodas in the Pagan Kingdom and the resulting indiscriminate felling of trees to obtain firewood changed the climate. Meanwhile, as the temperature is greatly affected by the elevation, it drops to a fairly low level in the mountainous areas of Kachin, Chin and Shan States during the dry season.

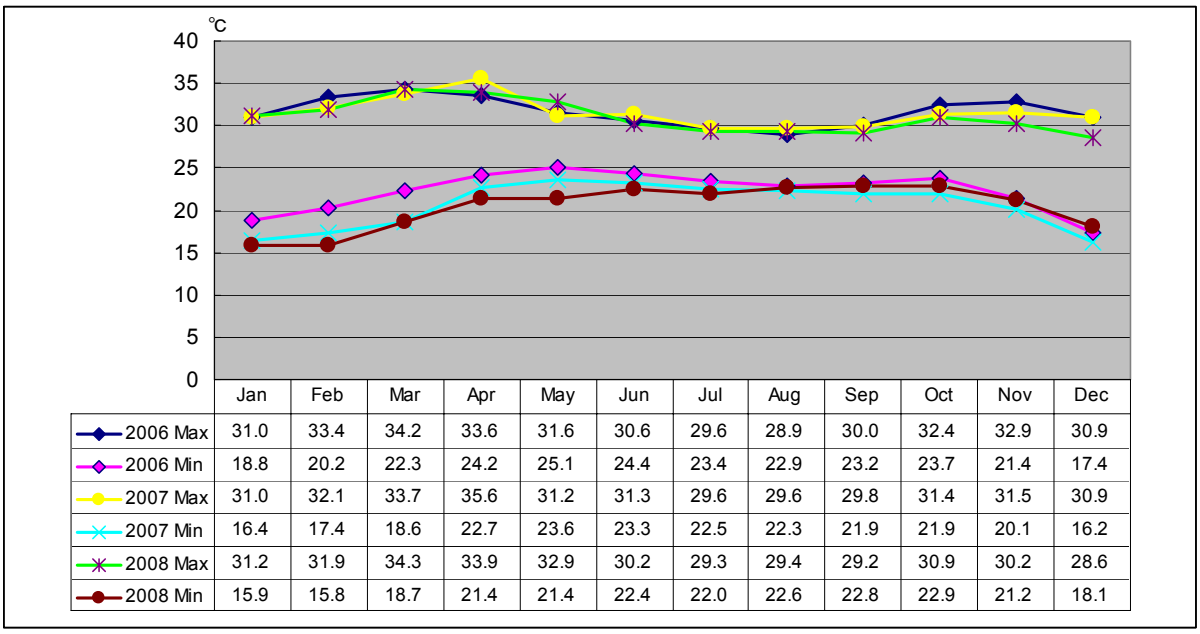
Meteorological data for the last three years for the project areas is given in Fig. 1-1 through Fig. 1-4.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006 Max	30.9	33.5	35.8	34.9	41.1	31.5	30.1	29.7	30.7	32.0	32.6	31.0
2006 Min	16.8	20.0	22.4	23.5	23.4	24.1	23.7	23.3	23.6	23.5	20.8	16.1
2007 Max	31.1	32.6	34.8	36.9	31.7	32.2	30.3	30.1	30.4	31.7	31.1	30.4
2007 Min	16.0	17.1	18.3	21.6	21.4	21.7	20.7	20.7	20.8	20.6	18.3	14.1
2008 Max	31.0	31.5	34.6	35.1	31.0	31.7	31.0	30.9	31.4	33.0	32.5	31.3
2008 Min	14.3	14.1	17.1	19.0	18.4	18.9	18.7	18.8	18.9	19.4	16.4	12.7

Source: Department of Meteorology and Hydrology, Ministry of Transport

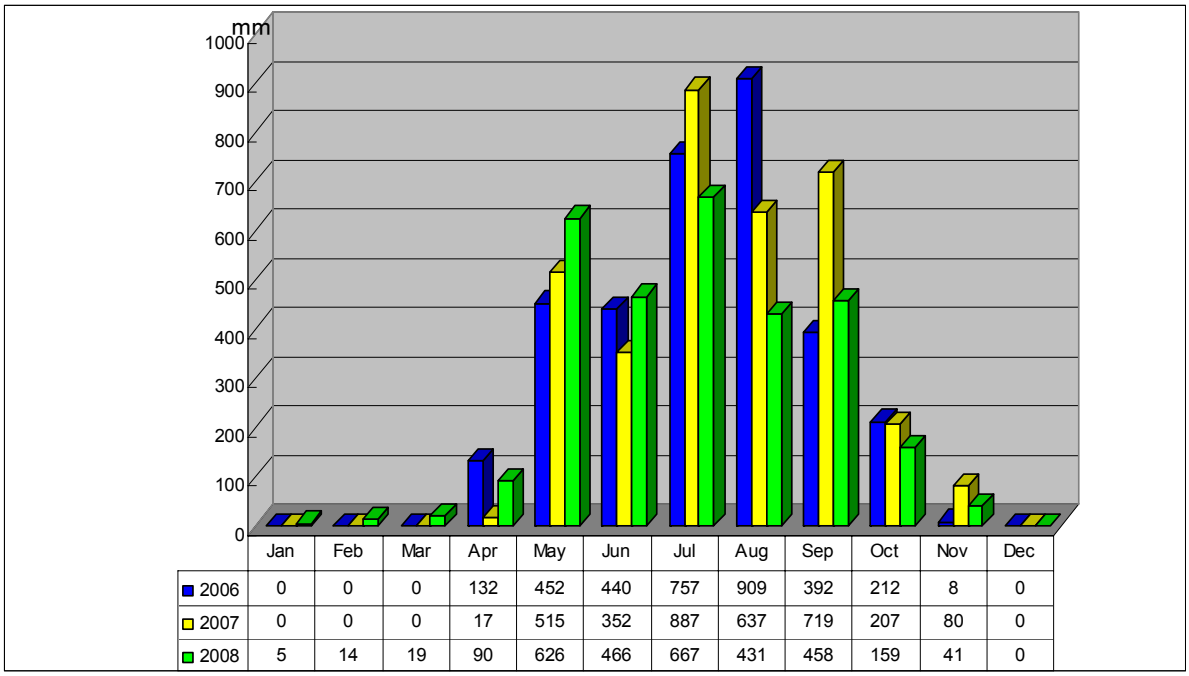
Fig. 1-1 Maximum and Minimum Temperatures at Labutta Township
(Observation Site: Myaungnya)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006 Max	31.0	33.4	34.2	33.6	31.6	30.6	29.6	28.9	30.0	32.4	32.9	30.9
2006 Min	18.8	20.2	22.3	24.2	25.1	24.4	23.4	22.9	23.2	23.7	21.4	17.4
2007 Max	31.0	32.1	33.7	35.6	31.2	31.3	29.6	29.6	29.8	31.4	31.5	30.9
2007 Min	16.4	17.4	18.6	22.7	23.6	23.3	22.5	22.3	21.9	21.9	20.1	16.2
2008 Max	31.2	31.9	34.3	33.9	32.9	30.2	29.3	29.4	29.2	30.9	30.2	28.6
2008 Min	15.9	15.8	18.7	21.4	21.4	22.4	22.0	22.6	22.8	22.9	21.2	18.1

Source: Department of Meteorology and Hydrology, Ministry of Transport

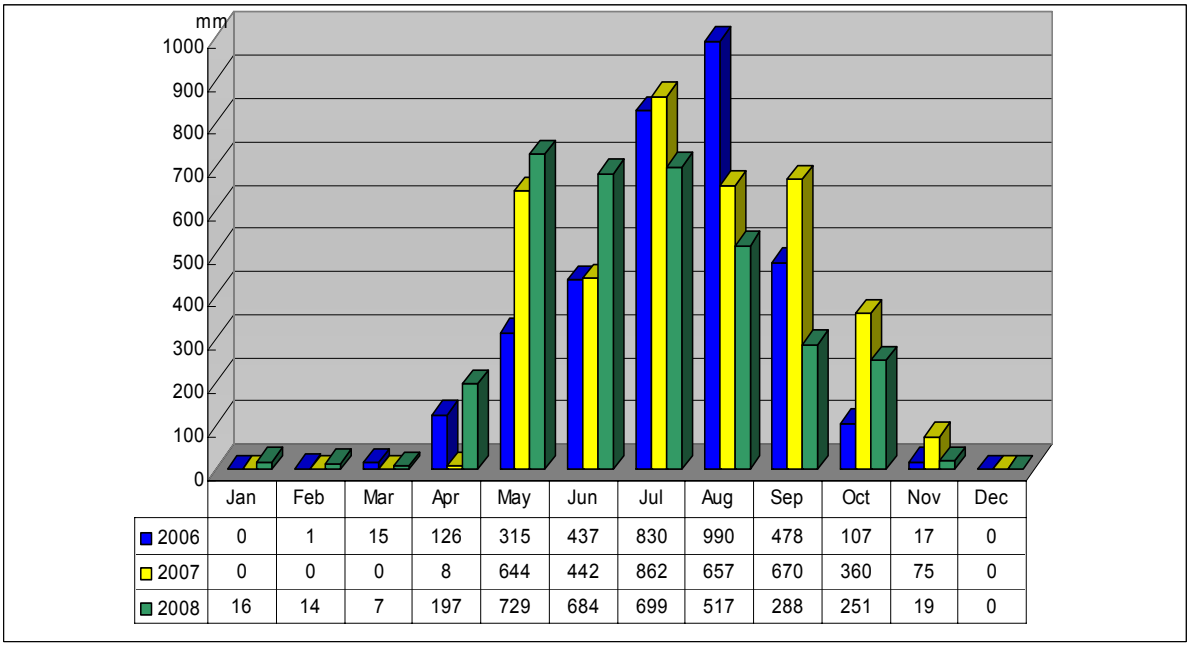
Fig. 1-2 Maximum and Minimum Temperatures at Bogale Township
(Observation Site: Phyapon)



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	0	0	0	132	452	440	757	909	392	212	8	0
2007	0	0	0	17	515	352	887	637	719	207	80	0
2008	5	14	19	90	626	466	667	431	458	159	41	0

Source: Department of Meteorology and Hydrology, Ministry of Transport)

Fig. 1-3 Monthly Rainfall at Labutta Township (Observation Site: Myaungnya)

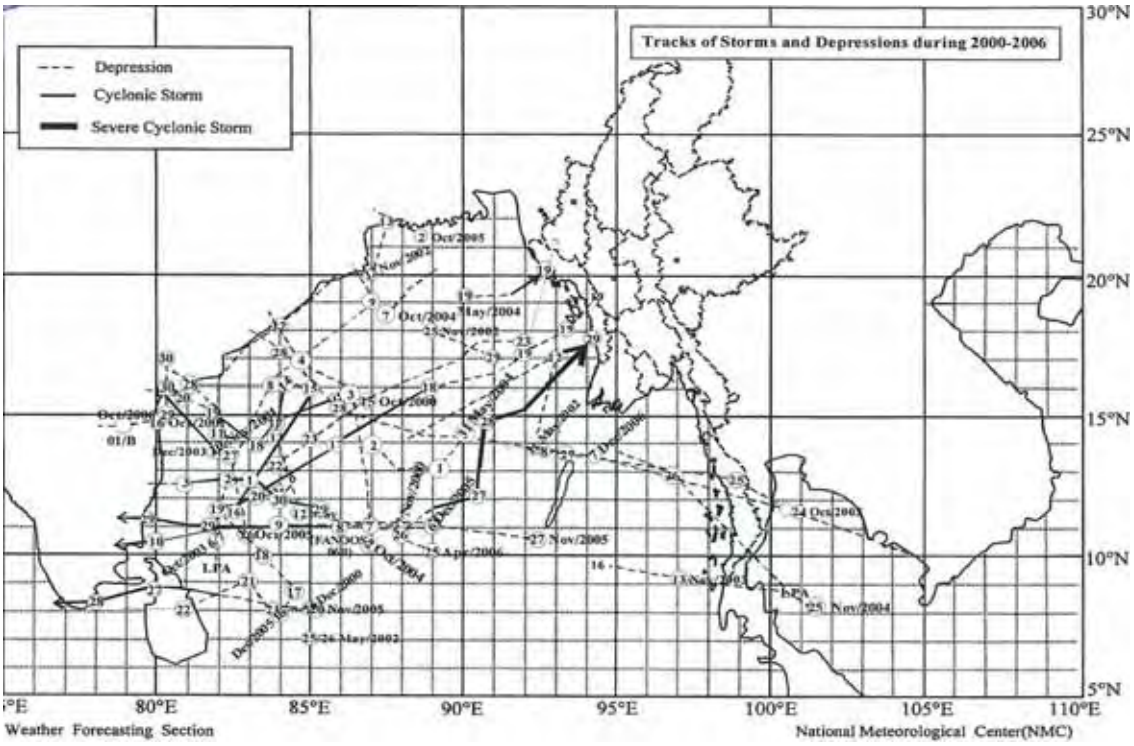


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	0	1	15	126	315	437	830	990	478	107	17	0
2007	0	0	0	8	644	442	862	657	670	360	75	0
2008	16	14	7	197	729	684	699	517	288	251	19	0

Source: Department of Meteorology and Hydrology, Ministry of Transport)

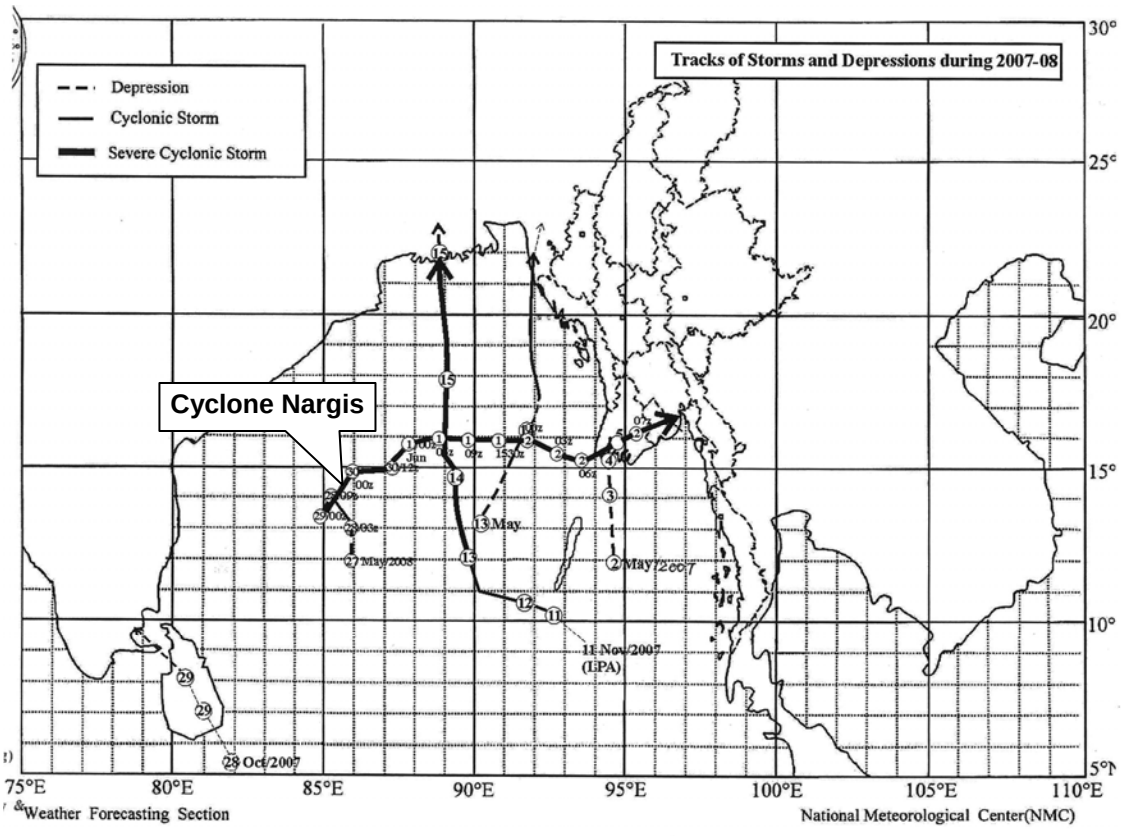
Fig. 1-4 Monthly Rainfall at Bogale Township (Observation Site: Phyapon)

Cyclones which form in the Bay of Bengal from April to May and from October to December usually head towards the northeast-northwest on course to hit Bangladesh and the northeastern part of India. Because of this, not many cyclones hit Myanmar. When cyclone damage does occur in Myanmar, it is usually in the northern coastal area along the Bay of Bengal. Areas facing the Andaman Sea are relatively immune to cyclone damage.



Source: National Meteorological Center (NMC)

Fig. 1-5 Tracks of Storms and Depressions in 2000 - 2006



Source: National Meteorological Center (NMC)

Fig. 1-6 Tracks of Storms and Depressions in 2007 - 2008

A cyclone which forms in the Bay of Bengal usually heads towards the northeast-northwest. In the case of Cyclone Nargis, however, this cyclone headed north-northeast for a while after its formation but then changed course towards the east in the early morning of 1st May, 2008, subsequently landing in the Ayeyarwady Delta. After landing, Cyclone Nargis moved east in the delta along the coastline. As it moved inland, the prevailing anti-clockwise wind caused a storm surge along the coast. This storm surge deeply penetrated the vast, flat delta area, causing massive damage to this defenceless area.

(3) Earthquakes

While no massive earthquake damage has been recorded in Myanmar, the seismic factor is relatively high in the central to northwestern parts of the country. The Bay of Bengal is the most prominent area for hypocenters and 28 earthquakes were observed in the Bay of Bengal in the three months from January to March, 2008. The earthquake intensity is 3.6 - 4.6 on the Richter Scale and neither tsunami nor physical damage due to earthquakes have been recorded.

The project sites are located in areas with the lowest likelihood of a strong earthquake and the horizontal load factor is 0.1 - 0.15 g.

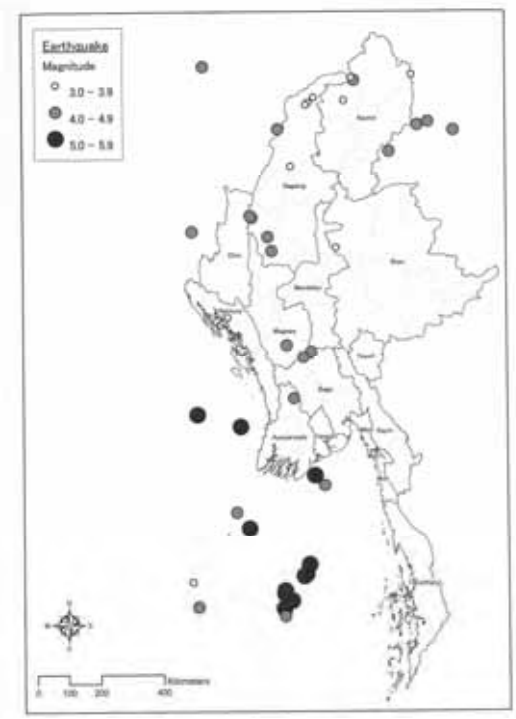
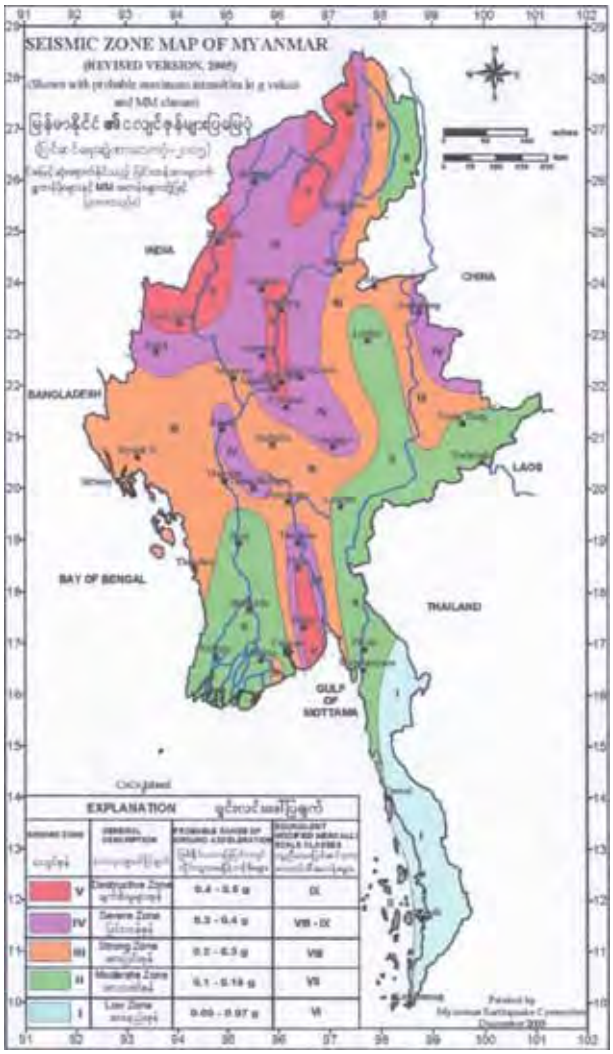


Fig. 1-8 Distribution of Epicenters of Past Earthquakes



Earthquake Zone		Horizontal Load Factor
Red	V	0.4 - 0.5 g
Purple	IV	0.3 - 0.4 g
Orange	III	0.2 - 0.3 g
Green	II	0.1 - 0.15 g
Blue	I	0.05 - 0.07 g

Source: Myanmar Engineering Society (MES)

Fig. 1-7 Earthquake Zones in Myanmar

CHAPTER 2 CONTENTS OF THE PROJECT

2.1 Basic Concept of the Project

2.1.1 Superior Goal and Project Goals

(1) Superior Plan

The Post-Nargis Recovery and Preparedness Plan (PONREPP) is a medium-term recovery plan covering the three year period from January, 2009 to December, 2011. It provides a broad overview of the state of recovery in the disaster-hit areas and the framework for the smooth transition from the emergency assistance phase to the medium to long-term reconstruction phase. The PONREPP consists of individual recovery plans for eight sectors: (i) livelihoods, (ii) shelter and permanent settlement, (iii) education and training, (iv) health, (v) water, sanitation and hygiene, (vi) disaster risk reduction, (vii) environment and (viii) protection of vulnerable groups.

In the face of 1,400 totally destroyed and 2,600 partially damaged schools, the educational facility reconstruction plan aims at the reconstruction of 300 schools by April, 2010, 500 schools by April, 2011 and a further 400 totally destroyed schools by the end of 2011.

(2) Current Conditions and Problems in the Target Sector

Cyclone Nargis is said to have totally destroyed 1,400 schools and partially destroyed 2,600 schools in Myanmar. Of the 266 damaged schools in Labutta Township, no rehabilitation / reconstruction budget or assistance plan is in place for 61 schools. In Bogale Township, the respective figures are 381 and 113. The need for the construction and rebuilding of these schools is extremely high in both townships. In particular, 20 schools of which the reconstruction priority is judged to be high by the Outline Design Study are located in coastal and other areas devastated by storm surge and the recovery efforts in their villages has been slow. Given this situation, the provision of disaster-resistant classrooms through the construction of primary school cum cyclone shelters is urgently necessary to ensure both the safety of children and their families and an improved physical environment for primary education.

Table 2-1 Situation of Damage and Restoration of Primary Schools (as of February, 2009)

(Unit: school)

Situation of Damage	Township			
	Labutta		Bogale	
(1) Totally destroyed	204	266	313	381
(2) Partially destroyed	18		68	
(3) Roof damaged	44			
Situation of Restoration	Labutta		Bogale	
(1) Restored	66	266	68	381
(2) Restoration/reconstruction budget or assistance plan in place	139		200	
(3) Restoration/reconstruction budget or assistance plan not in place	61		113	

Note: In the case of schools with more than one building, when part of the school is restored but no restoration/reconstruction budget or assistance plan is in place, the situation of restoration at these schools is classified under (3).

2.1.2 Objectives of the Project

The Project aims at the construction of new primary school buildings which also function as shelters at the time of a cyclone in two townships (Labutta and Bogale), both of which were devastated by Cyclone Nargis, to improve the physical environment for primary education in these townships and also to mitigate any future damage by natural disasters to the lives of the residents.

< Superior Goal >

Disaster prevention facilities will be provided in the target areas of the Project which were hit by the cyclone disaster.

< Project Objectives >

The physical environment for primary education in the target areas of the Project will be improved and shelters for residents at the time of a cyclone will be made available. (To reduce future risks caused by cyclones and create safe learning space in the Program sites)

< Output of the Project>

Primary schools which can also function as shelters at the time of a cyclone will be constructed in the target areas of the Project. (To construct primary school-cum-cyclone shelters in the Project sites)

< Indicators for Project Achievement >

- Increase of the number of pupils studying in safe and adequate classrooms
- Increase of the number of people who can be evacuated at the time of a cyclone warning
- Increase of the number of primary schools and classrooms which can function as shelters

2.1.3 Outline of the Project

(1) Contents of the Request to Japan

- Construction of 20 primary schools which can function as shelters in the cyclone disaster-hit areas
- Provision of desks, chairs, water supply system and others

(2) Planned Undertaking by the Recipient Country

- Provision of building plots
- Payment of bank commission fees

2.2 Outline Design of the Requested Japanese Assistance

2.2.1 Design Policy

2.2.1.1 Basic Concept

(1) Study Schools

While the request to study the possibility of Japanese assistance under the Project was originally made for 32 schools, four schools have been dropped because of confirmation of the rebuilding of these schools by another donor or the self-help efforts of the Government of Myanmar. Afterwards Ah Si Gyi School would be rebuilt by the Government of Myanmar and Htaw Paing School was added with high priority. Accordingly, the number of schools to be studied is 29 [15 in Labutta and 14 in Bogale (20 primary candidates and 9 secondary candidates)].

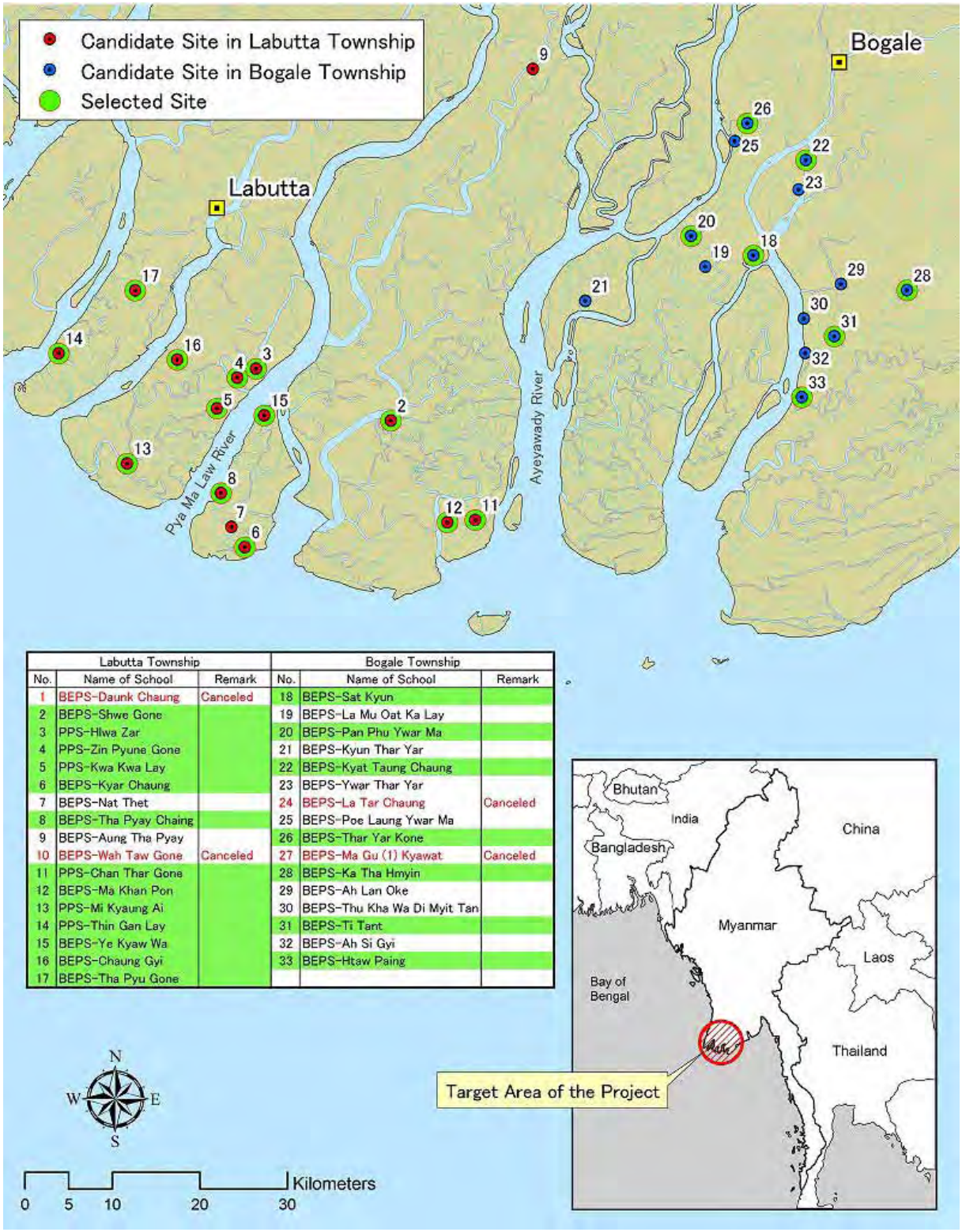
(2) Criteria for the Selection of the Target Schools

All of the 29 schools (sites) were severely damaged by Cyclone Nargis and teaching is currently conducted in simple and crowded temporary facilities due to the lack of permanent classrooms, making the construction of a strong and safe building essential. The original list of 28 schools has been narrowed down to 20 schools based on the selection criteria shown in Table 2-2.

Table 2-2 Selection Criteria and Schools Dropped from the Scope of the Project

No.	Selection Criteria	Site Dropped Due to Failure to Meet the Criteria
1	Government school with the land owned by the government	No. 21 community school and the land is personally owned
2	Extensively damaged by Cyclone Nargis (surge height of more than three feet with some fatalities)	No. 9 (surge height of two feet and no fatalities (although the building of No. 9 school collapsed, no villagers lost their lives)
3	Availability of land of a sufficient size for the construction of a new building	-
4	No plan by the Myanmar government or another donor to construct a similar permanent school building in the vicinity	-
5	Possibility of access to the site by vehicle or boat for the transportation of construction materials	-
6	Existence of a local PTA which can maintain the new facility	-
7	Quite large number of residents in the vicinity for which the provision of a shelter will be highly beneficial (local population of 300 or more)	Nos. 7, 23 and 30 (less than 300)
8	50 pupils or more	No. 7 (between No. 7 and No. 8), Nos. 19, 23, 25 and 30 (less than 50)
	Priority is given to schools with more pupils	No. 29 (No. 29 is the smallest among Nos. 29, 31 and 32)
9	Priority given to Labutta over Bogale and to primary candidates over secondary candidates as proposed by the Myanmar side	

The construction priority for the 20 selected schools will be given to those in Labutta and also to those with a larger number of pupils as shown in Table 2-3.



Labutta Township			Bogale Township		
No.	Name of School	Remark	No.	Name of School	Remark
1	BEPS-Daunk Chaung	Canceled	18	BEPS-Sat Kyun	
2	BEPS-Shwe Gone		19	BEPS-La Mu Oat Ka Lay	
3	PPS-Hlwa Zar		20	BEPS-Pan Phu Ywar Ma	
4	PPS-Zin Pyune Gone		21	BEPS-Kyun Thar Yar	
5	PPS-Kwa Kwa Lay		22	BEPS-Kyat Taung Chaung	
6	BEPS-Kyar Chaung		23	BEPS-Ywar Thar Yar	
7	BEPS-Nat Thet		24	BEPS-La Tar Chaung	Canceled
8	BEPS-Tha Pyay Chaing		25	BEPS-Poe Laung Ywar Ma	
9	BEPS-Aung Tha Pyay		26	BEPS-Thar Yar Kone	
10	BEPS-Wah Taw Gone	Canceled	27	BEPS-Ma Gu (1) Kyawat	Canceled
11	PPS-Chan Thar Gone		28	BEPS-Ka Tha Hmyin	
12	BEPS-Ma Khan Pon		29	BEPS-Ah Lan Oke	
13	PPS-Mi Kyaung Ai		30	BEPS-Thu Kha Wa Di Myit Tan	
14	PPS-Thin Gan Lay		31	BEPS-Ti Tant	
15	BEPS-Ye Kyaw Wa		32	BEPS-Ah Si Gyi	
16	BEPS-Chaung Gyi		33	BEPS-Htaw Paing	
17	BEPS-Tha Pyu Gone				

Fig. 2-1 Locations of the Study Schools

Table 2-3 Outline of the Subject Schools of the Study

No.		Name of School	Village Tract	No.of Household	Population	**No. of Pupil**	No. of Pupils of selected sites	No. of Teachers	Surge Height of NARGIS (feet)	Maximum Flood (feet)	Casualties by Nargis	Type of School	Land Owner	Risk of Surge	Remarks
1		*BEPS-Daunk Chaung*	*Da Ni Seik*	*canceled*											Government Plan in 2008/09
2		BEPS-Shwe Gone	Da Ni Seik	215	633	**105**	**105**	3	8	0	259	G	G	H	Damage was large.
3		PPS-Hlwa Zar	Hlwa Zar	300	1436	**215**	**215**	7	17	0	149	G	G	H	Population is increasing.
4		PPS-Zin Pyune Gone	Hlwa Zar	285	1300	**116**	**116**	5	8	1	114	G	G	H	Damage was large.
5		PPS-Kwa Kwa Lay	Hlwa Zar	158	530	**96**	**96**	6	13	2	486	G	G	H	Damage was large.
6		BEPS-Kyar Chaung	Kone Gyi		301	**50**	**50**	3	12	2	310	G	G	H	Population is increasing.
7		BEPS-Nat Thet	Kone Gyi		227	**39**		4	9	0	250	G	G	H	No. 7 and 8 are both small size. The risk, damage and population of No. 8 is larger than No.7.
8		BEPS-Tha Pyay Chaing	Kone Gyi	120	420	**19**	**19**	4	12	0.5	430	G	G	H	
9	*Labutta*	BEPS-Aung Tha Pyay	Kyun Chaung		414	**69**		2	2	6	-	G	G	**L**	Smaller risk of cyclone surge
10		*BEPS-Wah Taw Gone*	*Pyin Ah Lan*	*canceled*											Government Plan in 2008/09
11		PPS-Chan Thar Gone	Pyin Ah Lan		1175	**256**	**256**	5	5	0.4	4	G	G	H	Damage was large.
12		BEPS-Ma Khan Pon	Pyin Ah Lan	116	586	**133**	**133**	3	3	0	2	G	G	H	Damage was large.
13		PPS-Mi Kyaung Ai	Sa Lu Seik	334	1520	**300**	**300**	8	7	0	700	G	G	H	Damage was large.
14		PPS-Thin Gan Lay	Sin Chae Yar	238	947	**142**	**142**	6	6	0	300	G	G	H	Damage was large.
15		BEPS-Ye Kyaw Wa	Tel Pin Kine		623	**91**	**91**	5	12	0	724	G	G	H	Damage was large.
16		BEPS-Chaung Gyi	Tha Byu Gone		506	**70**	**70**	4	18	0	540	G	G	H	Damage was large.
17		BEPS-Tha Pyu Gone	Tha Byu Gone	264	1088	**154**	**154**	3	4	2	21	G	G	H	Damage was large.
18		BEPS-Sat Kyun	Kyen Chaung Gyi	160	610	**71**	**71**	2	10	2	250	G	G	H	Damage was large.
19		BEPS-La Mu Oat Ka Lay	Kyen Chaung Gyi	70	307	**19**		1	15	6	600	G	G	H	Branch school. Number of pupils is small.
20		BEPS-Pan Phu Ywar Ma	Kyen Chaung Gyi	168	624	**55**	**55**	3	12	3	451	G	G	H	Damage was large.
21		BEPS-Kyun Thar Yar	Kyun Thar Yar	102	456	**62**		3	12	2	800	**A**	**P**	H	Affiliated Community School. The site is owned by private.
22		BEPS-Kyat Taung Chaung	(Kyan Nyo Ghi) Kyun Hteik	149	554	**74**	**74**	2	7	0	111	G	G	H	Damage was large.
23		BEPS-Ywar Thar Yar	(Kyan Nyo Ghi) Kyun Hteik	62	232	**38**		2	12	8	74	G	G	H	Number of pupils is small.
24		*BEPS-La Tar Chaung*	*(Kyan Nyo Ghi) Kyun Hteik*	*canceled*											World Vision Plan
25		BEPS-Poe Laung Ywar Ma	Ma Gu	95	372	**41**		3	8	0.5	89	G	G	H	Number of pupils is small.
26		BEPS-Thar Yar Kone	Ma Gu	118	536	**65**	**65**	3	6	0	20	G	G	H	Damage was large.
27		*BEPS-Ma Gu (1) Kyawat*	*Ma Gu*	*canceled*											World Vision Plan
28		BEPS-Ka Tha Hmyin	Daunt Gyi	751	4117	**494**	**494**	9	5	2	11	G	G	M	Damage was large.
29		BEPS-Ah Lan Oke	Set San	122	400	**57**		3	7	0	156	G	G	M	Comparatively lower risk of cyclone surge. Number of pupil is small. Houses are dispersed.
30		BEPS-Thu Kha Wa Di Myit Tan	Set San	44	171	**35**		2	7	0	90	G	G	M	Size is small. Comparatively lower risk of cyclone surge.
31		BEPS-Ti Tant	Set San	128	766	**157**	**157**	4	4	0	8	G	G	M	Comparatively lower risk of cyclone surge. Number of pupil is larger than No.29.
32		BEPS-Ah Si Gyi	Set San	412	2930	**216**		5	4	0	50	G	G	M	Government Plan. Comparatively lower risk of cyclone surge and small number of pupil than No.33
33		BEPS-Htaw Paing	Set San	290	1420	**269**	**269**	5	6	1	54	G	G	M	Comparatively lower risk of cyclone surge. Number of pupil is larger than No.29.
			Total	4,701	25,201	3,508	2,932	115			7,032				

G: Government, A: Affiliated Community, P: Private
Risk of surge: H: High, M: Medium, L: Low

(3) Outline Design

1) Design Policy

The facilities to be constructed under the Project will normally function as primary schools but will function as shelters when the area is hit by a cyclone. The facility scale is determined based on the assumption that combined classes with single shift teaching, which is the common practice in Myanmar, will be held while taking the current number of pupils into consideration.

2) Contents and Scale

The facilities will consist of general classrooms, a teachers' room and toilets. The required number of classrooms and toilets are calculated based on the current number of pupils. At some schools, several former pupils were killed by Cyclone Nargis and it is unlikely that the previous number of pupils will be quickly restored at these schools. The number of pupils per classroom is set at 40 based on the relevant standards of the Myanmar Ministry of Education and the UNICEF.

The classroom size is determined based on 0.893 m^2/pupil, the MoSWERR standard, as follows.

6.1 m (20 feet) x 6.1 m (20 feet) = 37.16 m^2 (0.929 m^2/pupil)

The number of toilet booths is determined taking the expected number of evacuees into consideration with a minimum of one booth for boys and one booth for girls per two classrooms.

As the structural body of the ground floor may be damaged when the walls are subject to a strong storm surge caused by a cyclone, the classroom spaces are designed as pilotis (open space with pillars only) or with hollow block walls. A floor height of 3.6 m is uniformly adopted regardless of the expected surge height to allow the use of this space for various purposes.

The basic configuration of the building to be constructed is as follows.

Ground floor : classroom space except at two classroom schools
First floor : classrooms (0.93 m^2/pupil), teacher's room and toilets

The scale and shelter capacity of the planned primary schools under the Project are shown in Table 2-5.

All items of school furniture will be locally produced and procured and are included in the scope of the building work. Blackboards are included in the scope of the finishing work. Each classroom will be furnished with suitable desks and seating for 40 pupils and one teacher. The teachers' room will primarily function as the head teacher's office and will be provided with a head teacher's desk and chair, a locker for the storage of books and teaching materials and a meeting table with four chairs.

Table 2-4 Outline of School Furniture

Type of Furniture	Room	Quantity
Two seater desks and benches for pupils	Classroom	20 sets per classroom
Teacher's desk and chair	Classroom	One set
Head teacher's desk and chair	Teachers' room	One set
Locker for the storage of books and teaching materials	Teachers' room	One
Meeting table with chairs	Teachers' room	One table and four chairs

Table 2-5 Total Floor Area and Shelter Capacity of Each Selected School

No.	Priority by Consul-tant	Town ship	No.	School/Village Name	Village Tract	Number of Pupils	Number of classroom			Floor Area		Capacity			Total Population
							Total			Total		Area*		Refugee	
							GF	1F	Total	(㎡)	(sq.feet)	Capacity	(sq.feet)	0.25㎡/p	
L01	1	Labutta	13	PPS-Mi Kyaung Ai	Sa Lu Seik	300	4	4	(8)	598.2㎡	6,438.9	468.36㎡	5,041.4	1,873	1,520
L02	2		11	PPS-Chan Thar Gone	Pyin Ah Lan	256	3	3	(6)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627	1,175
L03	3		3	PPS-Hlwa Zar	Hlwa Zar	215	2	3	(5)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627	1,436
L04	4		17	BEPS-Tha Pyu Gone	Tha Byu Gone	154	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	1,088
L05	5		14	PPS-Thin Gan Lay	Sin Chae Yar	142	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	947
L06	6		12	BEPS-Ma Khan Pon	Pyin Ah Lan	133	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	586
L07	7		4	PPS-Zin Pyune Gone	Hlwa Zar	116	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	1,300
L08	8		2	BEPS-Shwe Gone	Da Ni Seik	105	1	2	(3)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	633
L09	9		5	PPS-Kwa Kwa Lay	Hlwa Zar	96	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	530
L10	10		15	BEPS-Ye Kyaw Wa	Tel Pin Kine	91	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	623
L11	11		16	BEPS-Chaung Gyi	Tha Byu Gone	70	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	506
L12	12		6	BEPS-Kyar Chaung	Kone Gyi	50	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	301
L13	13		8	BEPS-Tha Pyay Chaing	Kone Gyi	19	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	420
						1,747	16	**30**	**(46)**	**5,208.8㎡**	**56,066.7**	**3,913.56㎡**	**42,125.2**	**15,654**	**11,065**
B01	14	Bogale	28	BEPS-Ka Tha Hmyin	Daunt Gyi	494	6	6	(12)	802.5㎡	8,638.4	642.70㎡	6,918.0	2,571	4,117
B02	15		33	BEPS-Htaw Paing	Set San	269	4	3	(7)	508.1㎡	5,469.6	406.70㎡	4,377.7	1,627	2,930
B03	16		31	BEPS-Ti Tant	Set San	157	2	2	(4)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	766
B04	17		22	BEPS-Kyat Taujung Chaung	(Kyan Nyo Ghi) Kyun Htei	74	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	554
B05	18		18	BEPS-Sat Kyun	Kyen Chaung Gyi	71	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	610
B06	19		26	BEPS-Thar Yar Kone	Ma Gu	65	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	536
B07	20		20	BEPS-Pan Phu Ywa Ma	Kyen Chaung Gyi	55	0	2	(2)	359.4㎡	3,868.9	263.18㎡	2,832.8	1,053	624
						1,185	12	**19**	**(31)**	**3,107.8㎡**	**33,452.3**	**2,365.30㎡**	**25,459.9**	**9,461**	**10,137**
Total						**2,932**	28	**49**	**(77)**	**8,316.6㎡**	**89,519.0**	**6,278.86㎡**	**67,585.1**	**25,115**	**21,202**

* Toilet and water tank area etc. are excluded from the total floor area.

*The school(s) of the lowest priority may not be constructed depending on the tender result.

2.2.1.2 Design Concept Regarding the Natural Conditions

The natural conditions of the project sites demand the following considerations in terms of the design.

- The roofs will be made of reinforced concrete slabs in consideration of the need to avoid damage by strong winds caused by a cyclone and to provide adequate shelter at the time of a cyclone.
- The design floor level for the ground floor is 3 feet (0.91 m) above the ground to avoid inundation of the building with a flood level during the rainy season.

2.2.1.3 Design Concept Regarding the Socioeconomic Conditions

As agriculture and fisheries provide the livelihoods in the subject areas of the Project, local people are classified as poor because of the low level of cash income. The necessary consideration will be given to minimizing the maintenance cost, including the adoption of durable materials and finishing used locally in general.

2.2.1.4 Design Concept Regarding the Local Construction Industry, Local Contractors and Local Materials

(1) Basic Concept

In Myanmar, most building materials, including imported materials, can be procured locally. As the construction work under the Project does not require procurement from Japan or a third country, all materials to be used for the construction work under the Project will be procured in Myanmar. In the case of the selection of common construction methods (wooden structure, brick masonry and RC concrete frame) in Myanmar, the bulk supply of building materials of a certain quality can be secured locally. The locations of the selected schools (sites) for the Project indicate that access by land from the centre of the township or Yangon is extremely difficult. The common means of transportation to these sites is either ferry or boat. All building materials for the Project will, therefore, be transported by either ferry or boat. The main building materials to be used for the construction work under the Project are described below.

◊ Myanmar has five cement factories which are run by the government and three cement factories which are run by private enterprises. Because of the absence of a cement factory near the project sites, cement made in Myanmar or Thailand will be transported from Yangon to each site. The Outline Design Study Team found no problems regarding the quality or suppliable quantity of cement made in either Myanmar or Thailand.

◊ Although there is a government-owned reinforcing bar factory, at most building sites in urban areas, imported reinforcing bars (from Russia, China and India, etc.) are used. Accordingly, the reinforcing bars to be procured under the Project will be those which can be easily procured in the market and of which the quality and suppliable quantity are satisfactory. Given the use of a ferry/boat as the principal means of transportation to the construction sites, the delivery of reinforcing bars specially produced to meet the required specifications to each site is preferable.

◊ As the procurement of ready-mixed concrete is difficult outside Yangon and other cities, concrete will be prepared on site using a simple mixer driven by an engine. Fine and coarse aggregates can be procured locally as these are excavated from rivers near Bogale Township. Prior to their use, however, a preliminary test will be necessary to ensure the acceptable level of salinity and grain distribution of these materials.

◊ Even though the project sites are near a river, it is difficult to obtain water with few impurities to make concrete. For this reason, water will be arranged in the township at the time of the construction work and will be transported by boat to each site. Prior to the use of this water, inspection will be conducted to check the water quality in terms of the level of salinity, etc.

(2) Design Concept Regarding the Transportation of Materials and Geographical Characteristics

The target sites of the Project were the most severely damaged by Cyclone Nargis and are concentrated in the delta facing the Andaman Sea in southern Myanmar. Rivers of various sizes make land access to most of these sites very difficult. Accordingly, transportation by boat will be necessary and the landing of the materials will have to rely on manual transportation.

Some of the sites are 1 - 3 km away from the nearest landing place on a river. However, transportation in small quantities will be possible in the dry season with the help of villagers as tractors towing a small trailer can travel on the roads. Because of the lack of a suitable landing facility at or near each site, it will be necessary to include the cost of constructing a temporary jetty and access road in the construction cost.

(3) Securing of Material Storage Areas

The climate of Myanmar means that the period from June to October is the monsoon season and downpours can inundate some areas to a water depth of 50 - 90 cm. As it will be difficult to complete the structural work before the start of the rainy season in June, special attention should be paid to the delivery schedule of such materials as cement, aggregates, reinforcing bars and

form materials. At the same time, banking should be conducted to a satisfactory height and area capable of avoiding inundation as a storage area for the building materials.

(4) Use of Local Contractors

Even though hardly any major domestic or foreign private sector investment has been made in Yangon and other cities in recent years, the government buildings in the new administrative capital of Nay Pyi Taw, Yangon International Airport, high-rise hotels, flats and shopping centers built earlier suggest that local construction companies in Myanmar have a certain technical level and construction capability. In the aftermath of Cyclone Nargis, many primary schools, shelters and health care facilities have been constructed or are in the process of construction under reconstruction/rehabilitation projects of the Government of Myanmar, international aid organizations and NGOs. All of this work is undertaken by construction companies based in Yangon. There are some 30 relatively large and medium-size construction companies in Yangon. Although there are many smaller construction companies, their use for the Project is likely to pose problems in terms of the scale of the work, finance and technical capability. While there are construction companies in the townships of Labutta and Bogale which suffered the severest damage by Cyclone Nargis, these companies are small and lack experience of conducting the work ordered by an international aid organization. Their technical capability is insufficient to conduct the required work for the Project. Accordingly, large or medium-size construction companies based in Yangon will be used as subcontractors and 20 tenders will be held on the basis of one site-one lot. These companies may participate in more than one tender within their business size and capacity but will only be allowed to win tenders within their physical capability to complete the work on time and at the required quality.

(5) Use of Local Labour

Much construction work has been conducted in Myanmar in the past in both the public and private sectors and, more recently, is being conducted under reconstruction/rehabilitation projects to redress the cyclone damage. Local workers are, therefore, inferred to have a certain level of skill and experience. However, the remote locations of the project sites mean that it is difficult to recruit skilled workers who are very familiar with the anticipated construction work under the Project. Because of this, it will be necessary for the subcontractors to recruit skilled workers in Yangon or the township and to dispatch them to individual sites. The dispatch of engineers to supervise the quality, schedule and other vital aspects of the construction work will also be necessary. The recruitment of simple manual workers from among farmers and fishermen in the neighbourhood of each project site or nearby villages will be possible.

(6) Use of Local Consultant

While not many general consultancy companies exist in Myanmar, many small consultancy companies exist locally and it will be possible to appoint engineers with some knowledge and ability required for on-site supervision. However, Japanese consultant will be used for the Project to provide strict technical guidance/supervision to meet the required quality and schedule of the work.

2.2.1.5 Design Concept Regarding the Maintenance Capability of the Implementation Body

The implementation body responsible for the construction of facilities under the Project will be the Rehabilitation and Reconstruction Sub-Committee led by the Ministry of Social Welfare, Relief and Resettlement (MoSWERR). After the completion of the construction work, the Ministry of Education will be responsible for education at and the maintenance of the new facilities. When the facilities are handed over to the Myanmar side, it will be necessary to provide information on the facility operation and maintenance methods to enhance the relevant capability of the Myanmar side.

2.2.1.6 Design Concept Regarding the Grade of the Facilities

The facilities will be constructed with a grade which enables the performance of the required functions and which meets the minimum required level of durability based on the standard design adopted by the Ministry of Education, Ministry of Construction and Ministry of Science and Technology in Myanmar. The structure will be a reinforced concrete structure which is commonly used in Myanmar and the finishing specifications will include mortar trowel work for the floors, mortar trowel work and painting for the brick walls and mortar trowel work and painting for the ceilings, all of which are commonly used in Myanmar.

2.2.1.7 Design Concept Regarding the Construction and Procurement Methods and Work Schedule

The concept regarding the construction and procurement methods and work schedule is explained below.

- The construction work should commence as soon as possible after the rainy season.
- When the work schedule is prepared, the difficulty of delivering the building materials to the sites and the substantial decline of the work efficiency during the rainy season should be taken into careful consideration.

- As other similar projects are expected to commence or recommence en-masse after the end of the rainy season, appropriate guidance on the early and systematic procurement of the building materials should be provided for the subcontractors.

- A common local construction method should be selected along with the use of building materials which can be locally procured.

2.2.2 Architectural Planning

2.2.2.1 Layout Plan

All of the school sites are located on farming land which is slightly away from the village center and the site boundaries are not clearly established. Part of the assumed school premises is used for farming at many sites. The school premises are generally large and there is sufficient space for the construction of a new school building. The land is generally flat and none of the sites will require the removal of existing facilities which obstruct the construction of a new building. Some of the sites are densely covered by shrubs and weeds, the removal of which will be required. Banking should be considered at some sites where the elevation is lower than the surrounding ground.

2.2.2.2 Building Plan and Design

(1) Basic Concept

The facilities to be constructed will normally function as primary schools and will also function as shelters (disaster prevention facilities) at the time of a cyclone. The scale of each building will be determined in consideration of the current number of pupils based on the standard practice for primary education in Myanmar of a single shift and combined classes.

(2) Design Guidelines

The design guidelines listed in Table 2-6 are adopted in Myanmar.

Table 2-6 Design Guidelines in Myanmar

	Design Standards/Guidelines	Governing Body
1	Guidelines and Procedure for School Building Project, Post-Cyclone Nargis	Ministry of Social Welfare, Relief and Resettlement (MoSWERR)
2	Guidelines for Design of Cyclone Shelters	Myanmar Engineering Society (MES)
3	Guidelines for Design of Important Structures	Myanmar Engineering Society (MES)
4	Guidelines for Design of Residential Structures, July, 2008	Myanmar Engineering Society (MES)

While the design documents of consultants and construction companies based in Myanmar and engaged in construction work must be examined by the MES, foreign donors are exempt from this requirement. While building projects for post-Nargis reconstruction must be accepted by the MoSWERR, no technical examination is involved in the acceptance procedure.

(3) Outline of Existing Design Guidelines

The Guidelines and Procedure for School Building Project, Post-Cyclone Nargis and its comparison with the design specifications adopted for the Project are summarised in Table 2-7.

Table 2-7 Comparison Between the MoSWERR Guidelines and the Design Specifications for the Project

		MoSWERR Guidelines	Project	Grant Aid Cyclone Shelter Project in Bangladesh (2008)
Classroom	Area	• Primary school 50 pupils/class 20' x 24' (6.1 m x 8.4 m = 44.59 m^2) 9.6 sqft/pupil (0.89 m^2/pupil)	• Primary school 40 pupils/class 22' x 18' ~ 29' x 15' (36.71m^2 ~ 40.35m^2), 9.9 ~ 10.88 sqft/pupil (=0.91 ~ 1.00 m^2/pupil)	• Primary school 50 pupils/class 6.1 m x 5.45 m = 33.25 m^2 0.665 m^2/pupil
		• Middle or high school 50 pupils/class 30' x 24' (9.15 m x 8.4 m = 76.9 m^2) 14.4 sqft/pupil (1.54 m^2/pupil)	Not applicable	Not applicable
	Height	12' (3.66 m)	12' (3.66 m)	3.3 m
Desks and Chairs		Not specified	Pupils: 20 sets of two seater desks and chairs Teacher: 1 set of desk and chair	Pupils: 25 sets of two seater desks and chairs Teacher: 1 set of desk and chair
Other Rooms		• Primary school One library and one clinic • Middle/high school One library, one clinic and one laboratory	Teachers' room cum clinic cum library 240 ~ 320 sqft (22 - 30 m^2) Furniture: one set of desk and chair, one locker and one table with four chairs	Teachers' room: 6.1 m x 5.45 m Warehouse: 3.25 m x 4.6 m x 2 9.6 x 4.5 m (middle corridor)
Corridor Width		Not specified	Minimum internal dimensions: 6' (1.83 m)	Internal dimensions: 2.5 m (side corridor type) or 3 m (middle corridor type)
Stairs		• With railing • Effective width not specified	Minimum internal dimensions: 6' (1.8 m) Walled stairs	Internal dimensions: 1.9 m Walled stairs
Toilets		Number of booths not specified	Per two classrooms: One booth for boys One booth for girls Septic tank and infiltration tank	Per three classrooms: Two booths for boys Two booths for girls Septic tank and infiltration tank
Water Supply		Rainwater collection tank (RWCT) Waste water treatment (in accordance with UNICEF standards)	Installation of Rainwater collection tank (RWCT) No borehole due to the lack of a confirmed groundwater vein and/or poor water quality	Installation of a borehole equipped with a hand pump at sites where good quality groundwater is available
Electrical Installations		Not specified	Not installed	Not installed
Calculation of Shelter Capacity		Based on 10 sqft/person (0.929 m^2/person)	the maximum capacity is calculated based on 2.68sqft/person (0.25 m^2/person)	Based on 0.25 m^2/person but only 50% of the stair area is considered to be effective for shelter purposes
Ground Floor Level		Minimum requirement: 3.28 ft (1.0 m) above the maximum flood level	GL +1' (0.91 m)	GL +0.9 m
First Floor Level		GL +22'6" (6.86 m) in the Design Parameters	GL +15' (4.5 m)	GL +4.2 m
Seismic Load		Horizontal seismic load factor: 0.15	Horizontal seismic load factor: 0.15	Horizontal seismic load factor: 0.05
Wind Load		Withstand at least 80 mph (35.8 m/sec) wind speed	Withstand at least 125 mph (55.9 m/sec) wind speed (MES standard)	Withstand at least 260 km (72.2 m/sec)
Floor Finish		Classroom: concrete with wooden planks Wet area: ceramic tiles	Classroom: cast-in-concrete with mortar steel trowel finish	Classroom: cast-in-concrete with mortar steel trowel finish
Door Dimensions		Entrance: double doors 3' x 2 (0.9 m x 2) Other rooms: 3' wide (0.91 m)	Entrance: none Classroom Door: 3' (0.91m) wide, 6.6' (2.04m) high	Entrance: none Door width: 1 m

('': feet; ": inches; sqft: square feet)

(4) Building Plan

1) Building Plans of Other Donors

The UNICEF, UNHABITAT, a domestic NGO and others are implementing their own plans to construct multi-purpose cyclone shelters in Myanmar. The characteristics of these plans are described next.

① Cyclone Shelter Plan of Metta Foundation (NGO in Myanmar)

One classroom for 50 pupils and another classroom for combined classes are located on the first floor while the ground floor has a pilotis construction. The height is 12 feet (3.66 m) for both the ground floor and the first floor. The roof top is also planned as a space to accommodate evacuees at the time of a disaster. While the corridor width is 8 feet (2.44 m), the stair width of 4 feet (1.22 m) is very narrow.

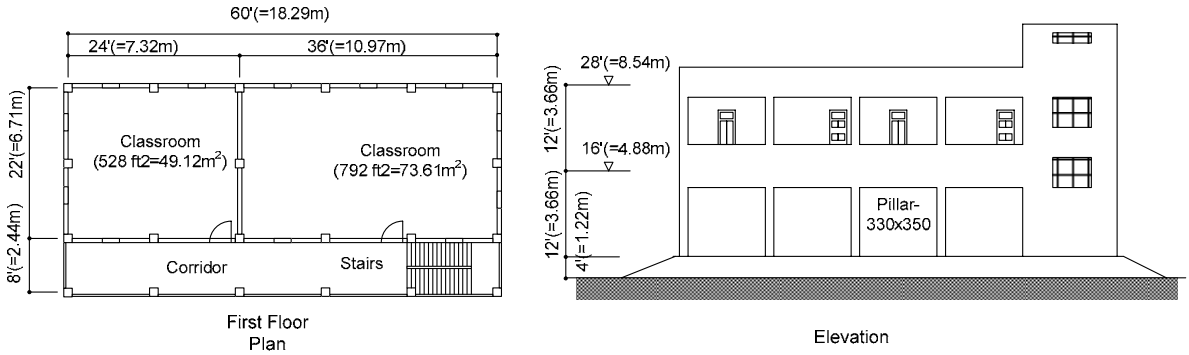


Fig. 2-2 Cyclone Shelter Plan of the Metta Foundation (Example)

② Cyclone Shelter Plan of the Department of Public Works

The Department of Public Works plans to construct multi-purpose cyclone shelters which normally function as clinics, etc. Three building sizes are available to shelter 300, 500 and 1,000 evacuees respectively based on an octagonal floor plan. The ground floor has a pilotis construction. The building to shelter 1,000 evacuees consists of three floors while the other two buildings consist of two floors. One shelter capable of accommodating 500 evacuees is currently under construction at Pyinsalu located at the tip of the delta in Labutta Township. Because of the soft ground, pile foundations are adopted for this shelter.

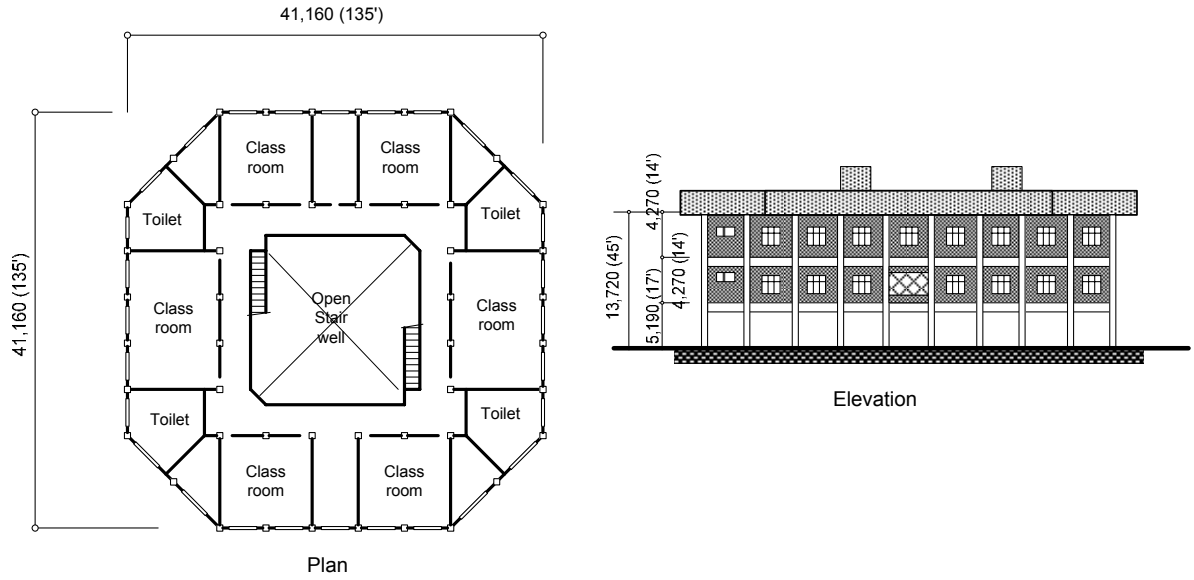


Fig. 2-3 Cyclone Shelter Plan of the Department of Public Works (Example)

③ Cyclone Shelter Plan of the UNICEF

The primary schools (cum cyclone shelters) of the UNICEF are characterized by a high floor construction where the first floor is 7 - 12.5 feet (2.1 - 3.8 m) above the ground depending on the expected storm surge height in a specific area. The ceiling height of the classrooms is 3.8 m. The roof is made of steel sheets and the roof top space is not considered to be shelter space. The classrooms have a floor area of approximately 33.5 m^2 to accommodate 35 - 40 pupils and the floor area of some 0.83 m^2 per pupil is smaller than the corresponding Myanmar standard. Schools with larger classrooms are also planned. Toilets are not included in the building plan as it is believed that they will be located outdoors. Because of the light weight construction of the superstructure, the foundations are supported by wooden piles, resulting in an economical design. However, there is concern in regard to the strength of the roof structure when it is exposed to strong wind pressure during a storm.

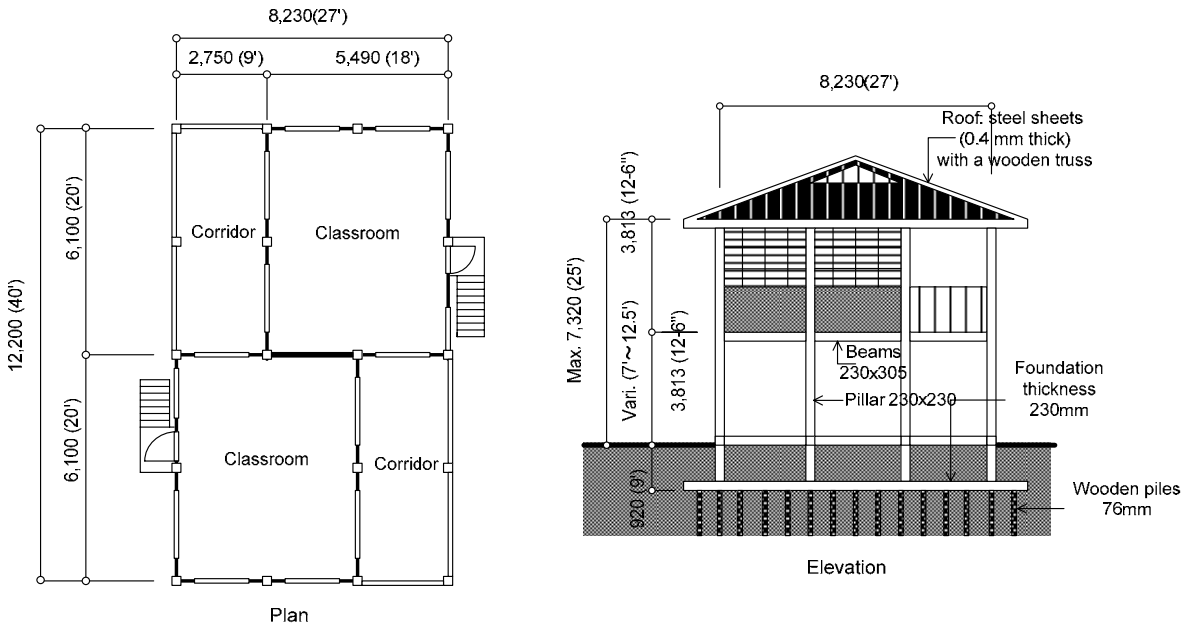


Fig. 2-4 Primary School (Cyclone Shelter) Plan of the UNICEF (Example)

2) Floor Planning Under the Project

The primary school (cum cyclone shelter) buildings to be constructed under the Project are planned as described below through consultations with the MoSWERR, Ministry of Education and MES of Myanmar while referring to the building plans of other donors described above.

① Classroom and Teachers' Room

The MoSWERR standards for primary schools set a classroom size of 20' x 24' (6.09 m x 7.31 m = 44.51 m^2) to accommodate 50 pupils (0.89 m^2 per pupil). Given the fact that the target primary school sites of the Project are located in remote areas with a low population density, the application of the Ministry of Education and UNICEF standard of 40 pupils per class is believed to be appropriate. Consequently, the classroom floor area is set at 6.70m x 5.48m (22' x 18') ~ 8.83m x 4.57m (29' x 15'). However, the classroom will have a rectangular shape so that it can be divided into two areas by a simple partition to accommodate combined lower grade classes with a small number of pupils each. This design is also economical

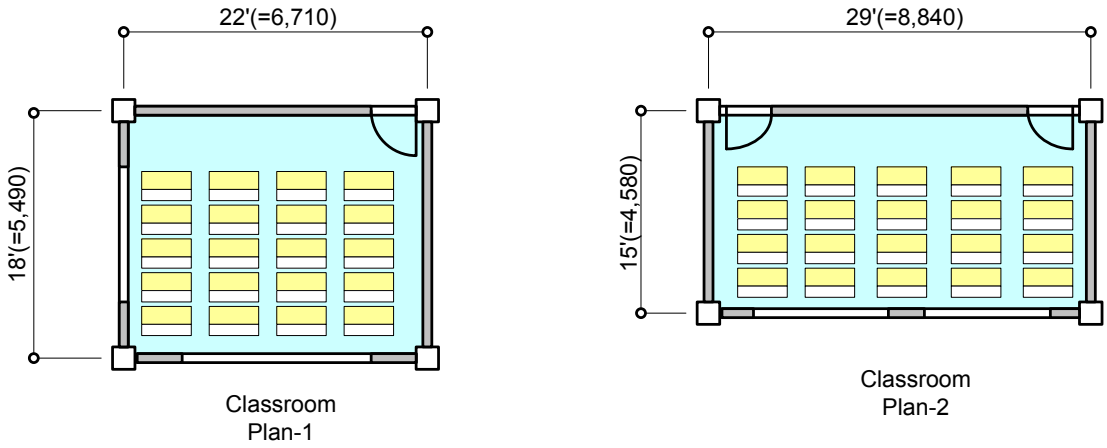


Fig. 2-5 Classroom Plan for the Project

Desks and chairs to seat 40 pupils will be provided for each classroom. The teachers' room will also function as the head teacher's office and a teacher's desk and chair will be provided as well as a locker for the storage of books and textbooks and a meeting table with four chairs. There is no official guideline for the size of a teachers' room and the current design secures 21.1 m^2 ~ 28.5 m^2 (3.1 m^2 per teacher) given the expected number of teachers of 2 - 9 depending on the school.

② Toilet

There is no official guideline for the number of toilet booths. The introduction of a minimum of one booth each for boys and girls per two classrooms on the first floor is planned under the Project. As additional toilet facilities are available outdoors, this should constitute a sufficient number of booths. The location of the toilet on the first floor makes it usable at the time of emergency evacuation and its damage by surge can be avoided.

③ Building Height

The building height is determined in view of the flood level during the rainy season (May - October) and the estimated surge height at the time of a cyclone. The 20 selected schools are located in either "a high risk area" defined as an area subject to a surge height of 6 - 12 feet (1.88 - 3.66 m) or "a hazard area" defined as an area subject to a surge height of 12 feet or higher on the risk map of the MES. Interviews with local residents found that the likely surge height is 4 - 18 feet (1.22 m - 5.49 m) with a flood level during the rainy season of some 0 - 2 feet (0 - 60 cm) at most sites. In consideration of these conditions, the design floor level for the ground floor is 3 feet (0.91 m) above the ground to avoid inundation of the building during the rainy season.

The design floor level of the first floor is 15 feet (4.57 m) in view of the expected surge height of 6 - 15 feet (1.83 m - 4.57 m) at the time of a cyclone. The design ceiling height of the ground floor is 12 feet (3.66 m), enabling use of the space as a classroom or for other purposes. The design ceiling height of the first floor is 12 feet (3.66 m) as required by the corresponding Myanmar standard. The roof top will have a concrete base so that the space can be used as a shelter at the time of a disaster. In this way, the new primary school cum cyclone shelters to be constructed under the Project will be able to protect human lives from Nargis-size cyclones.

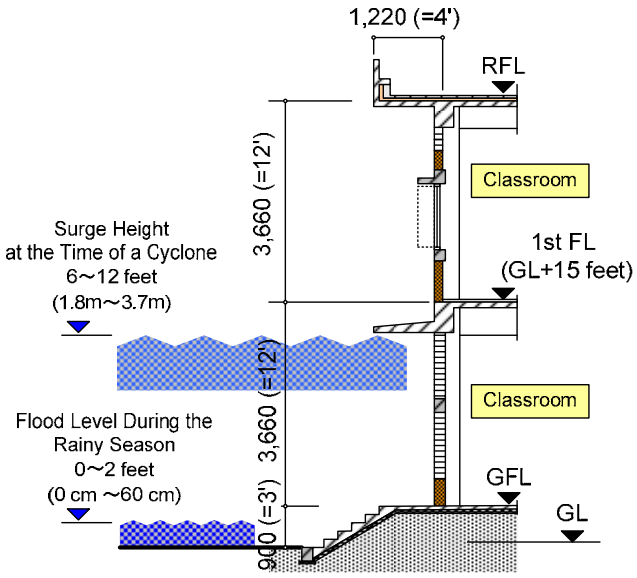


Fig. 2-6 Conceptual Cross-Section

④ Floor Plan for the Rooms

Each planned primary school building under the Project consists of classrooms, toilet and teachers' room. For the floor planning, the following considerations are made to achieve an efficient and economical layout of these rooms.

(a) Common spaces, such as the stairs and corridor, are placed together in the centre of the building to minimize both the walking distance to each room and the overall floor area.

(b) A combination of rectangular shaped classrooms is employed to achieve an efficient floor plan.

(c) The ground floor is also used as classroom space at schools with three or more classrooms.

(d) The floor plan is designed to minimize the actual building area to reduce the overall construction cost.

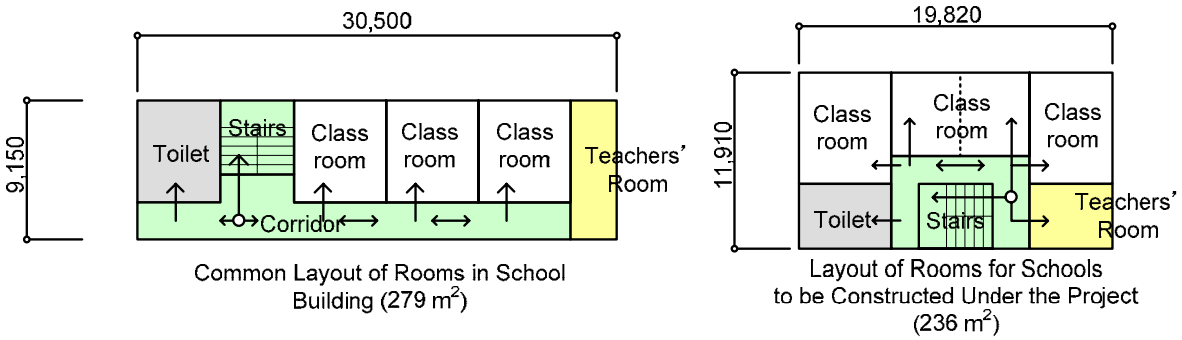


Fig. 2-7 Conceptual Floor Plan Under the Project

⑤ Important Points for the Introduction of Ground Floor Classroom

The Project aims at constructing primary school buildings which function as shelters at the time of a disaster. Because of less frequent disasters in Myanmar and the use of the first floor and roof top spaces for emergency evacuation, it is decided to allocate a classroom(s) in some schools to ensure the effective use of the available space during normal times. To avoid structural damage by the water pressure of a storm surge, durable hollow blocks will be used for the ground floor walls as these can reduce the water pressure, maintain the air permeability and natural lighting and be easily procured in the local market. The dimensions of these blocks are 240 mm x 200 mm x 230 mm. Because of the deep voids, the incursion of rainwater into the classroom can be avoided.

⑥ Floor Plan by Number of Classrooms

(a) Classification of Schools by Number of Classrooms

The 20 selected primary schools for construction under the Project are classified into different types based on the planned number of classrooms as shown in Table 2-8.

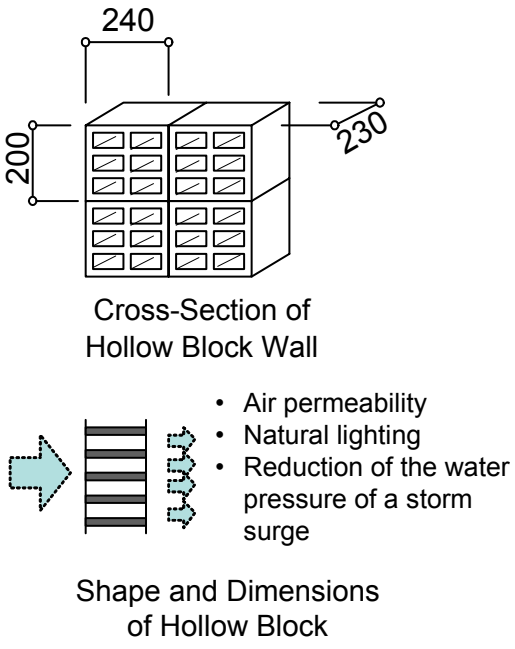


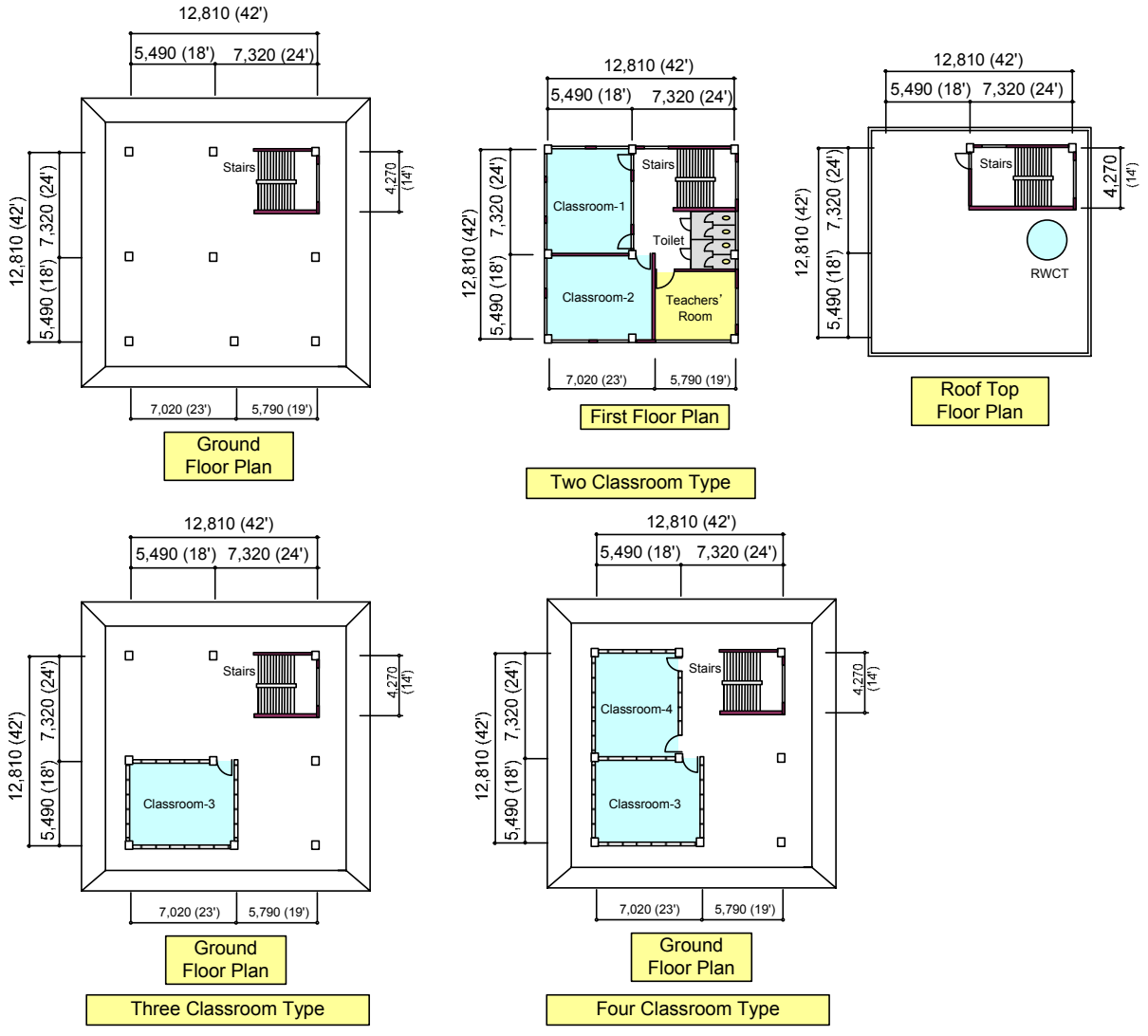
Table 2-8 Types of Schools by Number of Classrooms

Type	No. of Classrooms on Ground Floor	No. of Classrooms on First Floor	No. of Relevant Schools
Two Classroom Type	0	2	9
Three Classroom Type	1	2	3
Four Classroom Type	2	2	3
Five Classroom Type	2	3	2
Six Classroom Type	3	3	1
Eight Classroom Type	4	4	1
Twelve Classroom Type	6	6	1
Total			20

Note: As classrooms on the first floor are sufficient at nine schools, the ground floor of these schools will have a pilotis construction without a classroom.

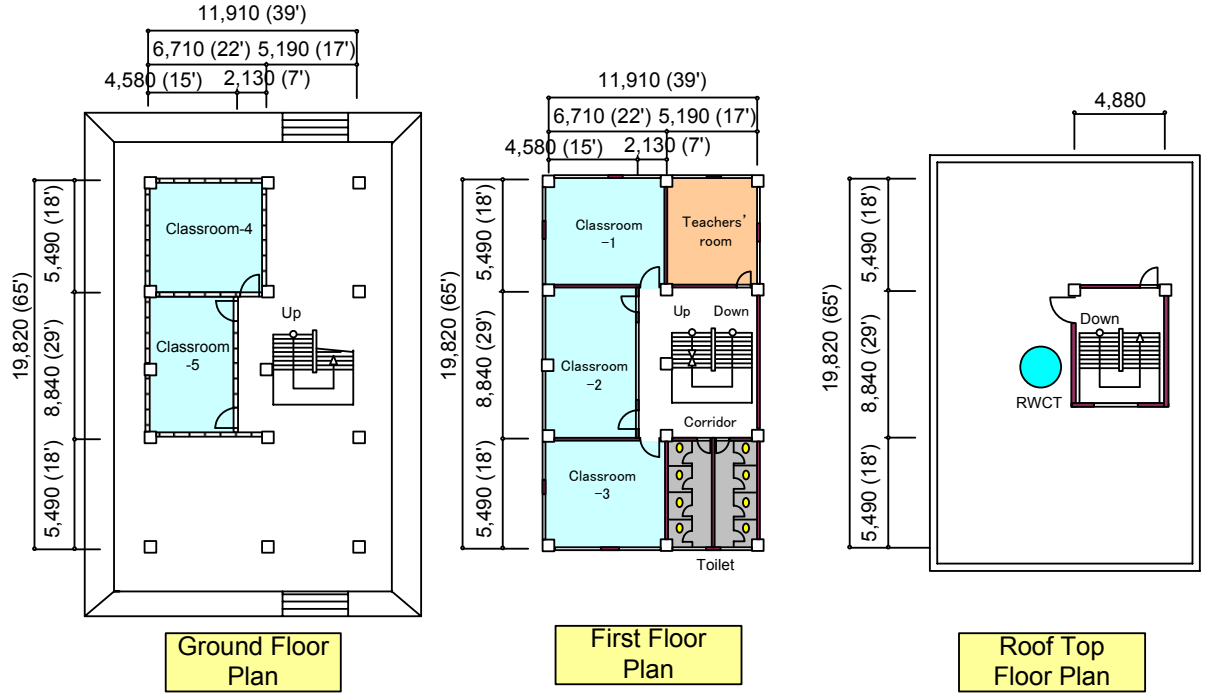
(b) Two Classroom Type (Three Classroom Type and Four Classroom Type)

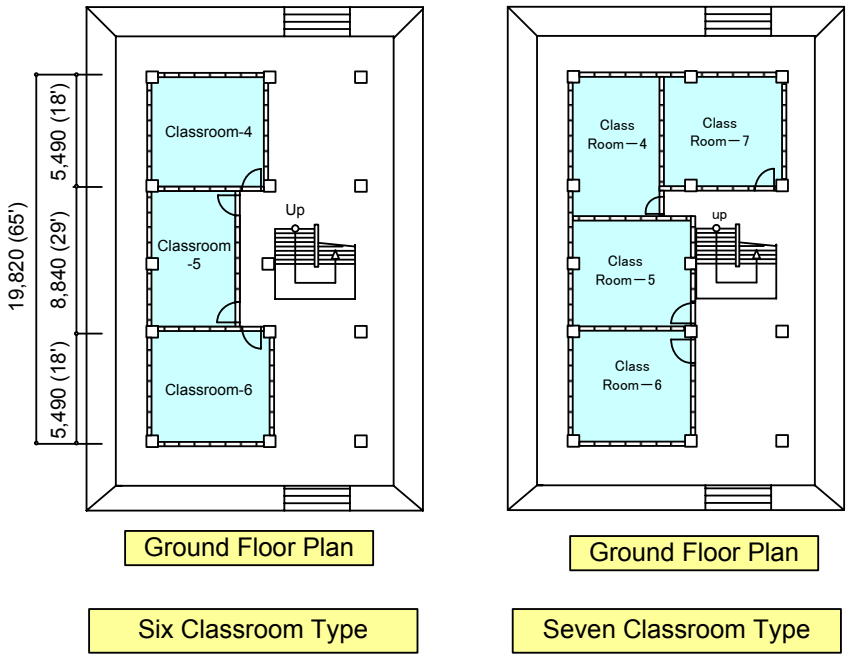
The same floor plan is used for two, three and four classroom type schools. These schools are distinguished from one another based on the number of classrooms on the ground floor.



(c) Five Classroom Type (Six Classroom Type)

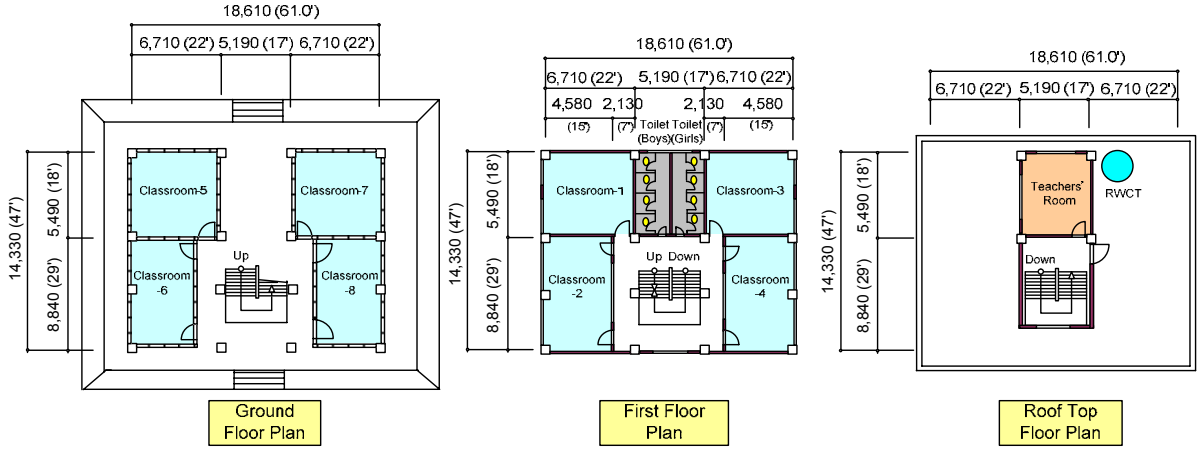
The same floor plan is used for five and six classroom type schools. The first floor has three classrooms while the ground floor is allocated two or three classrooms. A toilet is only provided on the first floor. The stairs and corridor are located at the centre of the building to enable the shortest walking distance to each classroom.

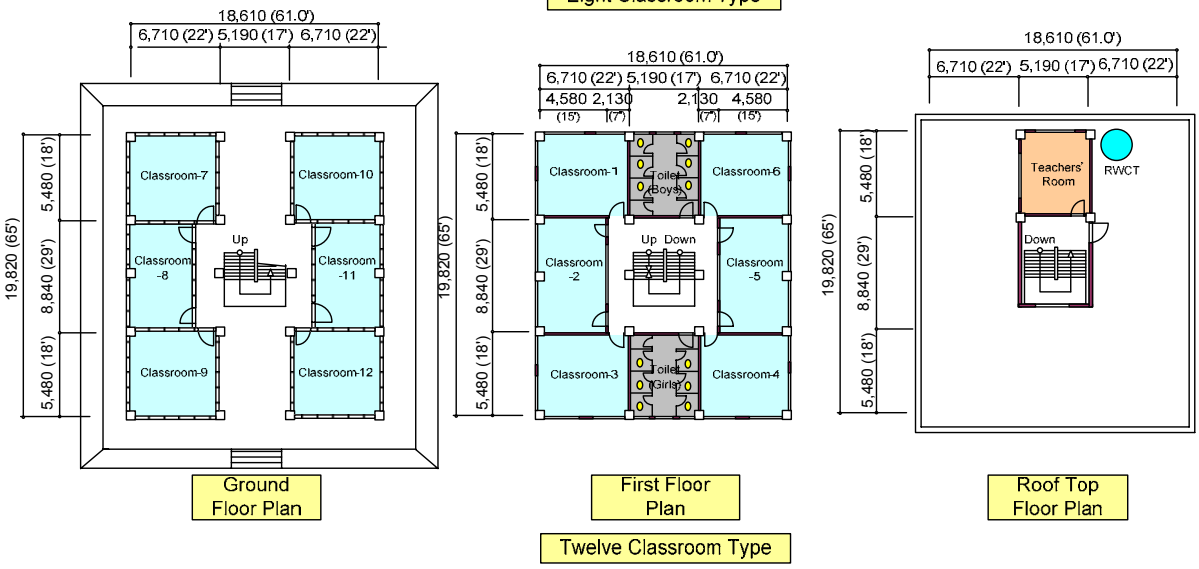




(d) Eight Classroom Type and Twelve Classroom Type

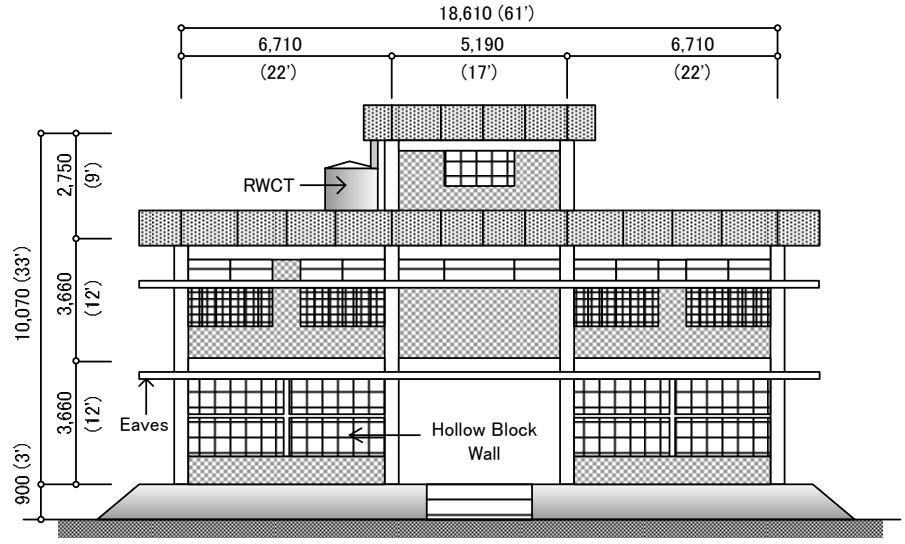
In the case of the eight classroom type, four classrooms each are planned for the ground floor and first floor. With the twelve classroom type, six classrooms each are planned for the ground floor and first floor. The teachers' room is planned for the roof top floor utilizing the pillars of the stairs.





⑦ Elevation

The elevation plan is prepared based on the height plan. As a ground floor classroom(s) is introduced at 11 of the 20 target schools, concrete eaves immediately above the openings (window sections) are designed to avoid direct sun during the dry season and the incursion of rainwater during the rainy season. Window glass is not used to avoid the danger posed by easily breakable glass and also to avoid a high maintenance cost. The windows have wooden grid frame with small glass tiles for lighting and strength against strong wind.



Elevation
Twelve Classroom Type

⑧ Finishing Plan

The finishings listed in Table 2-9 are adopted for the planned school cum cyclone shelter buildings taking the corresponding local specifications into consideration.

Table 2-9 Finishings

Room	Floor	Walls	Ceiling
Classroom / Teachers' Room / Corridor	Concrete floor with mortar trowel finish	Ground floor: hollow block masonry with paint finish First floor: solid block masonry with mortar trowel work and paint finish	Mortar steel trowel finish and paint
Toilet	As above	Same as the first floor walls	Mortar steel trowel finish and paint
Roof	Concrete floor with levelled mortar and waterproof sheeting; top concrete layer to hold the sheeting and to form a drainage slope	-	-
External Finish	Concrete with mortar steel trowel finish	Concrete with mortar steel trowel finish and paint for the pillars, beams and eaves	-

⑨ Furniture

Based on the standards adopted by the Ministry of Education, the following furniture specifications are adopted.

Table 2-10 Furniture Specifications

Type of Furniture	Specifications
Two Seater Desk and Bench for Pupils	Wooden top and frame
Desk and Chair for Teachers	Wooden top and frame
Locker for Teachers	Steel locker with four shelves

(5) Draft Structural Plan and Foundation Plan

1) Overview

◊ The planned buildings are primary school buildings with a shelter function and people will be evacuated to the first and roof top floors at the type of a cyclone. Normally, the first floor will be used as a primary school.

◊ A reinforced concrete (RC) structure is adopted to withstand strong wind pressure as well as surge pressure caused by a cyclone and also to withstand fire.

◊ A salt-resistant structure and specifications are considered as the planned construction sites are located in coastal areas.

2) Applicable Standards

As Myanmar does not have its own standards, the American Concrete Institute (ACI) standards are basically used as the structural design standards for concrete buildings. Japanese standards will also be used for the Project where necessary. In Yangon, a building permit is issued on the basis of the signature of an expert, but not applicable in Ayeyarwady Division.

3) Types of Building Structures

There are principally two types of building structures, i.e. RC structure and steel structure. As the planned buildings will also act as shelters, they must be strong enough to withstand storms and earthquakes. They must also be durable and salt-resistant to possible tsunami, salt wind from the sea and other external conditions. A steel structure is less resistant to salt damage due to the exposure of the structural steel. The wind pressure caused by an assumed wind velocity of 55 m/sec is equivalent to the wind pressure produced by Typhoon Isewan which is the basis for the wind load standard in Japan. The window frames and finishing materials for the building exterior must, therefore, have a certain level of local robustness. For these reasons, a RC frame structure with brick walls is employed. The external windows will have wooden grid frame with small glass tiles.

As classrooms are located on the first floor, pillars with a suitable span are introduced to create classroom spaces. The stairs have an effective width of 6 feet (1.83 m) and a landing

length of 6 feet (1.83 m). In view of the building's normal use as a primary school, the step width (going) and height (rise) are basically set at 25 cm (10 inches) and 15 cm (8 inches) respectively.

The bricks forming the external walls and partition walls cannot maintain their strength and/or may suffer from cracks when they cover a large area and, therefore, wall studs and supporting beams (beams on top of the masonry walls) will be introduced to support the brick walls. The foundations are supported by rigid underground piles to enhance the overall rigidity of the structure in order to mitigate any adverse effects of uneven subsidence.

4) Building Materials

The building materials to be used for the structure are locally procurable materials to meet the following specifications.

Concrete	Un-Reinforced Concrete	Reinforced Concrete
	28 day strength: fc' = 15 N/mm^2	28 day strength: fc' = 21 N/mm^2
Reinforcing Bars	Standards	Tensile Strength
	ASTM A615 M	fy = 415 N/mm^2

5) Design Load

Live Load

The MES standards adopt a large live load in consideration of the concentrated load produced by a large number of evacuees at the time of a disaster. However, evacuation is only a short-lasting phenomenon and the adoption of this live load as the design load results in uneconomical large structural dimensions. Japanese design standards are, therefore, used to determine the live load.

Area		Live Load		
		MES Standards	Adopted Value Based on Japanese Standards	
		Common	For Design of Floor, Pillars, Beams and Foundations	For Calculation of Seismic Load
1	Classroom; Teachers' Room; Roof Top	125 lb/ft2 (610 kg/m^2)	60.0 lb/ft2 (293 kg/m^2)	30.0 lg/ft2 (146 kg/m^2)
2	Corridor; Passageway; Stairs	150 lb/ft2 (732 kg/m^2)	70.0 lb/ft2 (342 kg/m^2)	35.0 lb/ft2 (170 kg/m^2)

Wind Load

The relevant MES standard (wind pressure: 125.0 miles/hr = 55.9 m/sec) is adopted.

Seismic Load

The relevant MES standard (horizontal load factor at the time of an earthquake = 0.15 g) is adopted.

6) Salt Damage Prevention Measures for Structures

As mentioned earlier, measures to prevent salt damage to structures are necessary in view of the site conditions which include frequent floods and tsunamis. The surface of the reinforcing bars embedded in the concrete of the reinforced concrete structure is coated by a thin oxide film which protects the bars from corrosion by passivating them. However, the infiltration of carbon dioxide gas and other acidic substances in the atmosphere gradually destroys the alkalinity of concrete, resulting in the corrosion of the reinforcing bars. Moreover, if chlorides above a certain level are present in cast-in-place concrete, corrosion of the reinforcing bars is accelerated by chloride ions. The adoption of appropriate salt damage prevention measures for the concrete structures is, therefore, extremely important. The effective methods to prevent or to slow down salt damage are listed in Table 2-11. Methods ① through ③ are believed to be realistic measures in view of the conditions of the project sites.

Table 2-11 Salt Damage Prevention Measures for Structures

No.	Method	Remarks
①	**Conduct the measurement of chlorides as an important quality control item during execution. As the control criteria, the level of chloride ions should be 0.3~0.6kg/m^3 or less. This level can be determined by a measuring device or by a Quantab (chloride test strip).**	**Can be done on the project sites.**
②	**With the use of concrete with low slump (no more than 55% water cement), the unit cement density increases, thereby enabling uniformly dense concrete to be made and enhancing the resistance to the chemical substances of salt and corrosion of the reinforcing bars in concrete.**	**Can be done on the project sites.**
③	**Securing the covering thickness over reinforcing bars.**	**Can be done on the project sites.**
④	Protection of the structure through coating of the surface (waterproof effect). As a waterproofing agent, asphalt paint is effective.	Higher cost and not usual practice.
⑤	Use of an appropriate antirust agent.	Can be done on the project sites, but control is difficult.
⑥	Possible use of acid-resistant cement (blast furnace cement, moderate-heat Portland cement or fly-ash cement) but it is difficult to procure these types of cement in Myanmar.	Cannot be done on the project sites.
⑦	Use reinforcing bars, such as galvanized steel iron bars, resin coated bars and others, that have been specially treated for corrosion	As the procurement and management of the materials are difficult, this is not a realistic option for the project sites.

7) Foundation Plan

The unit load of the planned building, which is the basis for selection of the foundation type, will be approximately 4 t/m^2. The ground conditions at the project sites are

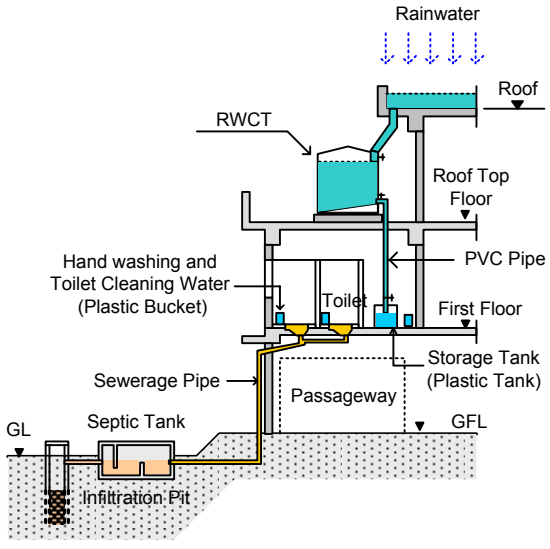
generally poor. Spread foundations will be selected in case the soil bearing capacity is more than 5 t/m^2 and consolidation settlement is not more than 15cm, and pile foundations will be adopted in case the soil bearing capacity is not more than 5 t/m^2.

For pile foundations, the bearing ground should have an N value of no less than 20 and a strata thickness of no less than 5 m. The bearing capacity of the piles will be set as the sum of the bearing capacity at the tip and the frictional force. If no bearing ground is available, friction piles to utilize the frictional force around the piles will be used.

(6) Building Services Plan (Collection of Rainwater, Water Supply and Septic Tank)

The introduction of the building services listed in the table below is provisionally planned for the Project.

No.	Item	Description
1	Water Supply System	No water supply system will be installed as none of the project sites are served by the municipal water supply system. A borehole will not be constructed as neither a reliable source nor quantity of groundwater has been confirmed.
2	Collection of Rainwater	A rainwater collection tank will be installed on the roof top to facilitate the use of rainwater for the toilet. This water will be used for the cleaning of the toilet and washing of hands.
3	Septic Tank	A septic tank and infiltration pit will be introduced on the ground to treat raw sewage from the toilet on the first floor.
4	Electrical Installations	Most of the project sites are not electrified. As there is no plan to use the building at night, a lighting system is not required. Therefore, no electrical installations are introduced to make the building maintenance simpler and easier.



Conceptual Drawing for Rainwater Use and Sewage Treatment

2.2.3 Implementation Plan

2.2.3.1 Implementation Policy

The employment of local contractors to implement the work is possible under this scheme. It will, therefore, be necessary to strengthen the work supervision and technical guidance by the Japanese consultant in order to ensure proper quality control, schedule control and safety management.

(1) Implementation Setup

Following the signing of the Exchange of Notes (E/N) and G/A concerning the grant aid, the Government of Myanmar will consign the procurement agent to select a supervisory consultant and contractors. The selected supervisory consultant and contractors will sign binding contracts with the procurement agent and implement their respective work.

1) Responsible Implementing Body

The body responsible for the implementation of the Project is the Rehabilitation and Reconstruction Sub-Committee (RRSC), the members of which consist of representatives of the Ministry of Social Welfare, Relief and Resettlement (MoSWERR), which is coordinating rehabilitation and reconstruction projects and work in the aftermath of Cyclone Nargis, and other government ministries. Meanwhile, the Ministry of Education (MoE) is responsible for the deployment of teachers at each school and preparation of the curriculum, school management and maintenance.

The Project will be implemented under the Grant Aid Scheme for Disaster Prevention and Reconstruction based on the Agent Agreement to be signed by the RRSC on the Myanmar side and the Japanese procurement agent. A consultative committee will be established with representatives of the Myanmar side and the Japanese side (EoJ, JICA and the procurement agent) to discuss issues which require adjustment and confirmation at a government level. The RRSC, JICA Myanmar Office and procurement agent will form a working group to check the work progress and to discuss the technical issues. The project implementation setup is shown in Fig. 2-9.

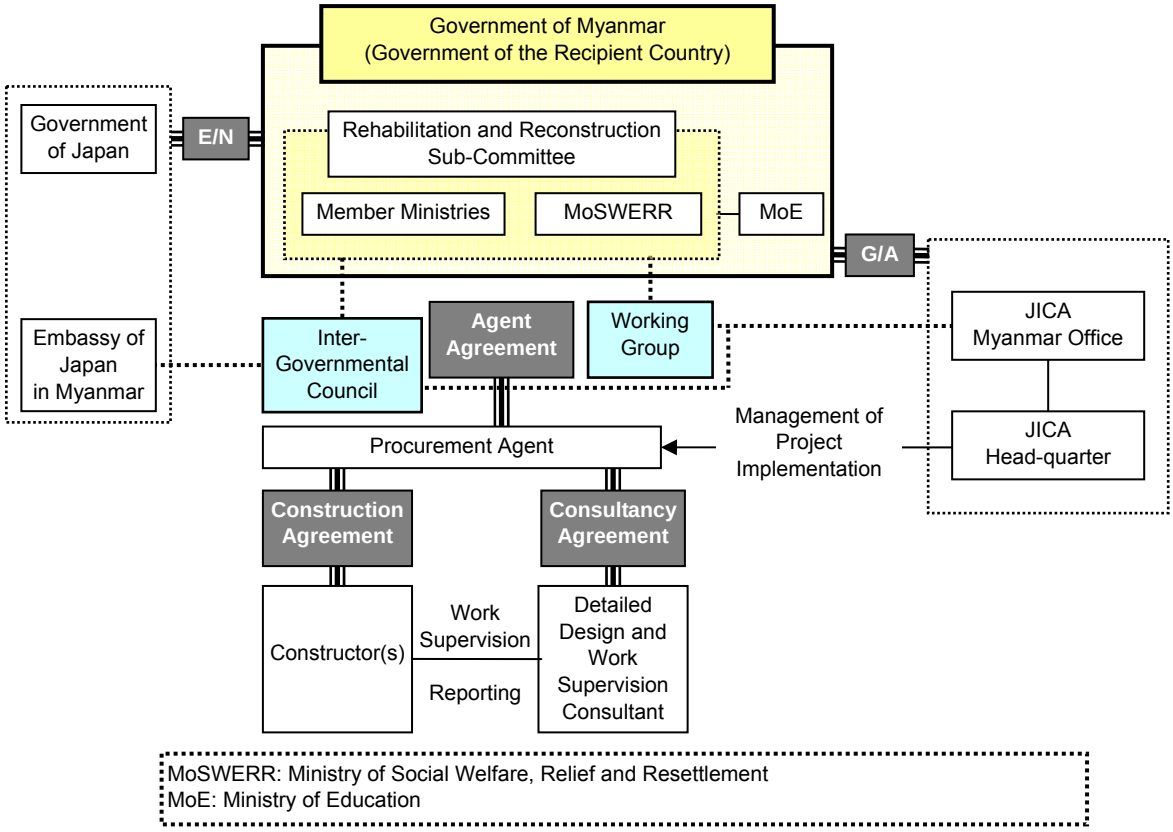


Fig. 2-9 Project Implementation Setup

2) Procurement Agent

① Work of the Procurement Agent

The procurement agent will act as the agent for the project implementing body and will conduct comprehensive supervision with a view to the appropriate and smooth implementation of all components of the main contract. The procurement agent will also prepare the pre-qualification (PQ) and tender documents, execute the tender and provide general work supervision through the construction period.

② Implementation Setup

The project implementation setup of the procurement agent is described below.

Detailed Design Stage (Tender Stage)	Work Supervision Stage
As it is assumed that the tender for the project will be held in Myanmar, it is preferable for a field office of the procurement agent to be located in Yangon. The general supervisor will conduct spot supervision when the field office is opened and when the constructor agreement is signed and approved by the owner. A deputy supervisor will be permanently stationed in Myanmar and will be responsible for the preparation of the contract documents with construction companies, distribution of the tender documents and work related to the tender, evaluation and contract among the work relating to the procurement agent contract, banking arrangements, including the opening of an account, setting-up of the field office and preparation of the tender documents. As the number of tender lots is expected to be large because of the situation of the construction industry in Myanmar, an accounting officer and a clerk will be recruited locally. The Japanese consultant will provide technical assistance to provide appropriate answers to technical questions relating to the contents of the tender documents and to properly evaluate the technical parts of the proposals submitted by bidders. (See Fig. 2-10)	While the procurement agent will be responsible for the overall work supervision during the construction period, the Japanese consultant will be responsible for the supervision of technical issues. In effect, the procurement agent will mainly be responsible for fund management during the construction period. For this purpose, the Yangon Office will be maintained and the general supervisor will conduct the work ranging for witnessing of the commencement of the work, completion inspection and closure of the office. The deputy supervisor will be stationed permanently in Myanmar to conduct fund management and other work. An accounting officer and a clerk will be recruited locally to assist the deputy supervisor to ensure smooth fund management and other work. (See Fig. 2-11)

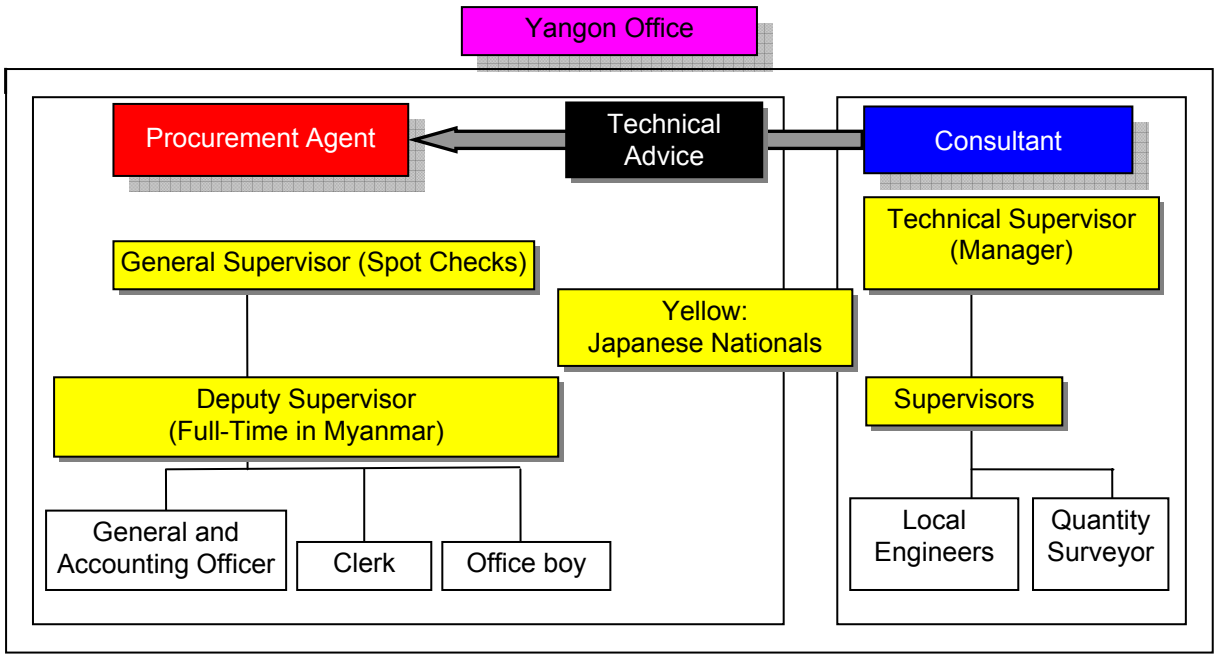


Fig. 2-10 Project Implementation Setup at the Time of Tender

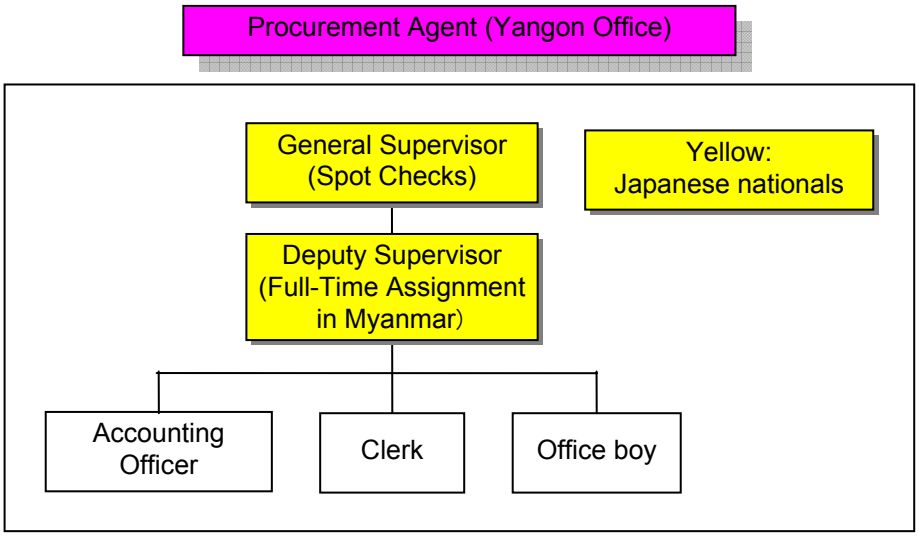


Fig. 2-11 Implementation Setup at the Time of Work Supervision

3) Work Supervision Consultant

① Description of the Work

The consultant will act as the work supervision consultant to (i) provide technical support for the tender to be organized and executed by the procurement agent and (ii) supervise the actual construction work. The work supervision by the consultant will involve not only supervision relating to the quality, schedule and safety of the work but also assessment of the monthly amount of completed work by each contractor to report the findings to the procurement agent.

② Work Implementation Setup

Detailed Design Stage (Tender Stage)	Work Supervision Stage
The office of the consultant will be located at the Yangon office of the procurement agent and will provide technical support for the tender-related work, including THE PQ. The head technical supervisor and technical supervisors will provide technical support as required at the time of the tender document preparation and approval and also at the timing of the signing of the contract and approval of the contract by the owner. Local engineers, etc. will be employed to assist the Japanese technical supervisors to ensure the smooth progress of the work. For answers to questions regarding the tender, etc., Japanese engineers will provide answers in Japan and the local work will be conducted by local engineers.	The 20 target schools of the Project are scattered in remote coastal areas of the two townships of Labutta and Bogale. It will be necessary to rely on speed boats or normal boats for access to the sites at the work supervision stage. The work implementation capability and technical capability of local construction companies cannot be said to be sufficient, making the deployment of Japanese technical supervisors and locally recruited technical supervisors necessary. A supervisory office will be set up in both Labutta and Bogale. The Labutta office will be responsible for the work supervision at 13 primary school cum cyclone shelter sites and also for liaisoning with the procurement agent. In view of the proper implementation of such work, a Japanese technical supervisor will be stationed at this office on a full-time basis and will be assisted by one chief engineer, 13 technical supervisors (one at each site), one quantity surveyor, one driver and one office boy which will be locally recruited to implement quality control, schedule control and safety management. As the volume of the work is expected to decline during the rainy season from June to October, the number of local technical supervisors will be halved from 13 to six in this period. In Bogale, one chief engineer, seven technical supervisors, one cost engineer, one driver and one office boy will be locally employed to conduct the work as in the case of Labutta Township. (See Fig. 2-12 - Setup for Consultant Work at the Work Supervision Stage)

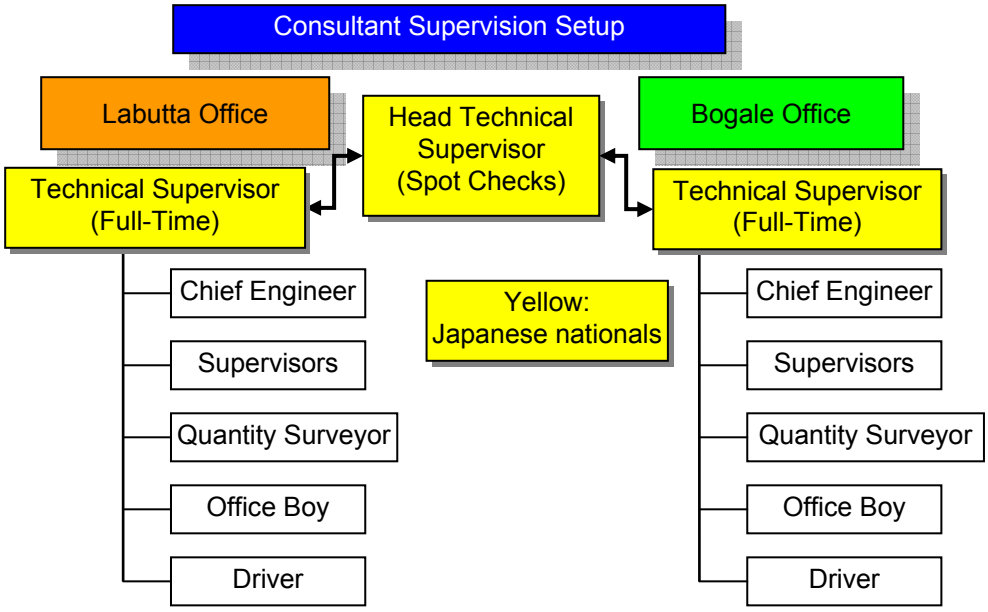


Fig. 2-12 Setup for Consultant Work at the Work Supervision Stage

4) Construction Companies (Contractors)

The construction companies (contractors) for the Project will be selected in accordance with the flow shown in Fig. 2-13.

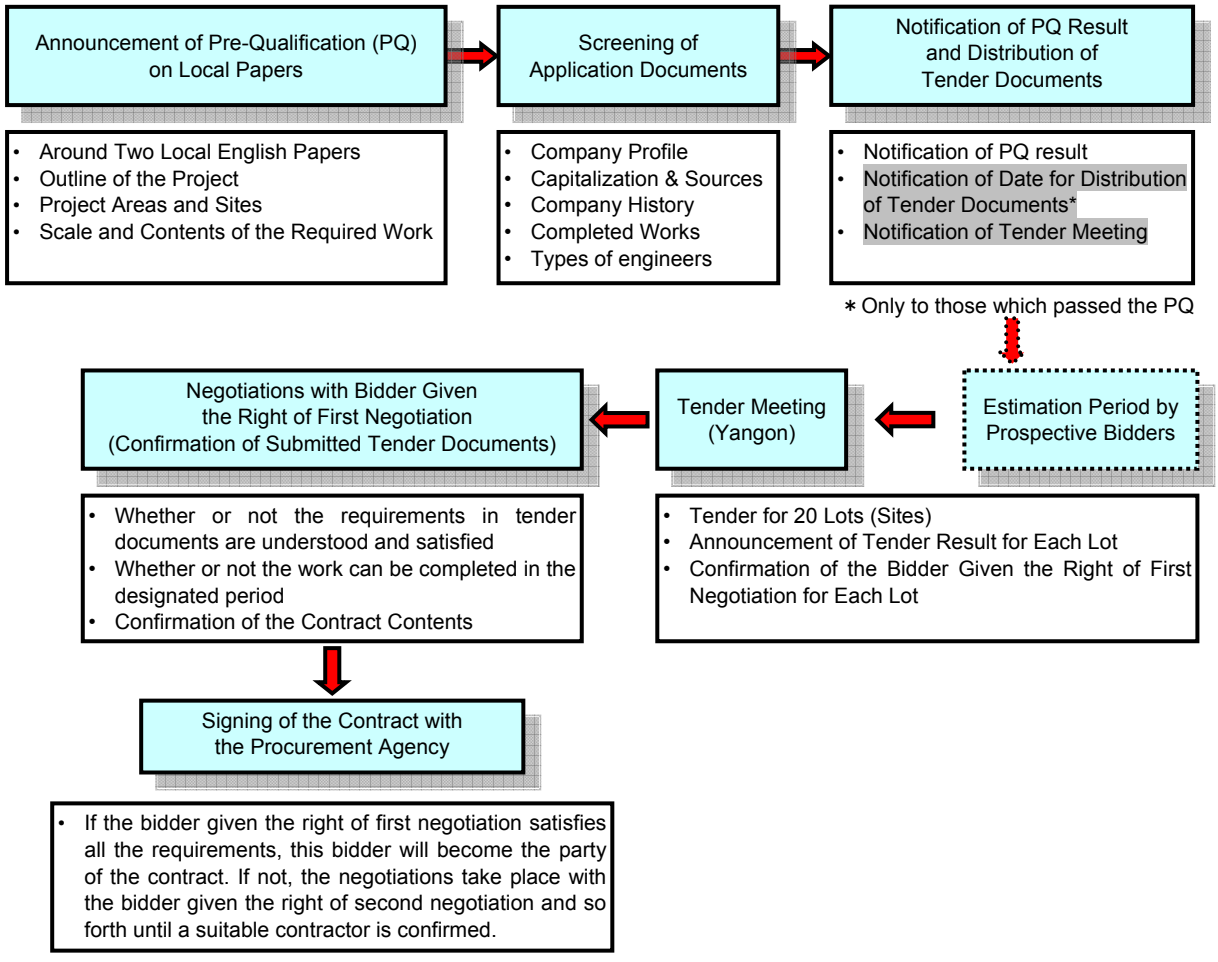


Fig. 2-13 Contractor Selection Flow

Local construction companies may bid for more than one site but cannot be selected for contracts beyond an acceptable level (past work performance) in view of their business size and past work performed.

(2) Work Execution

The basic principle for the planning of the buildings under the Project is the use of common local construction methods, building specifications and materials so that local construction companies can implement the work without difficulty. The actual contractors will be selected through general competitive bidding in which local construction companies will be allowed to participate.

In view of the many target schools (sites) and the fact that the project areas are located in the southern delta in Myanmar, the construction lots for bidding will be determined in an appropriate manner, taking the geographical characteristics of the sites and the capability of local construction companies into full consideration. In short, each site will comprise one lot. As there are 20 sites, there will be 20 lots for bidding. Construction companies will be allowed to bid for more than one lot within their capability. Medium to large construction companies based in Yangon are judged to be capable of simultaneously conducting the construction work at more than one site.

(3) Construction Work Supervision

The Project consists of the simultaneous construction of new primary schools which will also function as cyclone shelters in two townships, i.e. Labutta Township (13 schools) and Bogale Township (7 schools), under a single grant aid project. A reliable work supervision system is required to ensure quality control, schedule control and safety management at a certain acceptable level at all of the sites. The procurement agent will be responsible for the overall management of the Project while the Japanese consultant will be responsible for the technical aspects of work supervision.

(4) Ordering Method for Public Works in Myanmar

1) Tender and Work Contract Procedure

The announcement, tender and contract procedure for public works in Myanmar follow the rules for tender specified by individual ministries, etc. There are no special regulations or rules set by the Government of Myanmar. The tender for the Project will, therefore, be conducted in consideration of the announcement, tender and contract signing procedures adopted by various international aid organizations while also referring to actual examples of tenders for disaster rehabilitation support projects which have been implemented by the Government of Japan in recent years.

2) Contract Method

Common types of contracts for construction work in Myanmar are bill of quantities (BQ) contracts based on the quantity of work to be completed, lump sum contracts and cost plus fee contracts. The lump sum type of contract will be selected for the Project. In terms of the currency for the contract, the payment of foreign currency (US dollar contract) is desirable for the following reasons.

① If payment is made in local currency (kyats), the amount of US dollars to be transferred must be converted to kyats to pay the contractors in kyats. This means that the official exchange rate (US$ 1 = approximately 450 kyats) must be applied at the time of conversion. Because the actual exchange rate in the money market as of February, 2009 is approximately 1,000 kyats to one US dollar. In view of the discrepancy between the official rate and market rate, payment in local currency will more than double the contract amount in US dollars.

② Even though circulation of the US dollar is restricted in Myanmar, a special measure has been introduced to allow the opening of foreign currency bank accounts relating to foreign aid for rehabilitation and reconstruction from the Cyclone Nargis disaster. Under this measure, it is possible for Myanmar companies to receive payment in a foreign currency from Japan under the Project. The procurement agent must submit an application to open a foreign currency account to the MoSWERR for approval of such an account.

③ It is possible to make Project-related payments to construction companies, etc. which have a foreign currency account at the Myanmar Foreign Trade Bank (MFTB) or the Myanmar Investment and Commercial Bank (MICB).

2.2.3.2 Implementation Conditions

(1) Construction Sites

The primary school (cum cyclone shelter) construction work under the Project will take place in Labutta and Bogale townships in the southern delta area of Myanmar. Because the construction sites are separated by many rivers of various sizes, access by land to these sites for the delivery of construction machinery and materials will be difficult. In the rainy season from June to October in particular, the land near some sites is inundated. The actual construction work will, therefore, be implemented with special attention paid to the items described below.

1) Building Material Transportation Method

The positional relationship of the two townships in which the Project will take place is shown in Fig. 2-14 and will greatly affect the work supervision. The key areas of these two townships are the towns of Labutta and Bogale. Although the accommodation conditions are not ideal, it is possible to rent a house(s) to accommodate people working for the Project. Both Labutta and Bogale are linked to Yangon by mostly unpaved roads. It is some eight hours and some four hours by four-wheel drive vehicle to Labutta and Bogale respectively from Yangon. There are ferry and cargo ship links from Yangon to Labutta and Bogale. By ferry, it is some 19 hours to Labutta and 5 - 6 hours to Bogale. Most of the building materials for the Project will be transported by sea. As there is no road access to the individual project sites from either Labutta or Bogale, the materials will be transferred to a speed boat, normal boat or cargo ship at the port of Labutta or Bogale. In Labutta Township, the 13 project sites are widely scattered and it takes some six hours by normal boat (some two and half hours by speed boat) to reach the two most remote sites (Chang Thar Gone and Ma Khan Pon). In Bogale Township, there are seven project sites and it takes some three hours by normal boat to reach the most remote site (Ka Tha Hmyin). At some sites, a motorcycle is required for access from the jetty to the actual site.

The building materials will be transported from Port Yangon to the towns of Labutta and Bogale, the key areas of the two townships, by ferry, cargo ship or truck. From Labutta and Bogale, the materials will be delivered by river to the individual sites using a 3 - 5 ton class small boat. Given the lengthy transportation time, very careful preparation of the schedule plan is required.

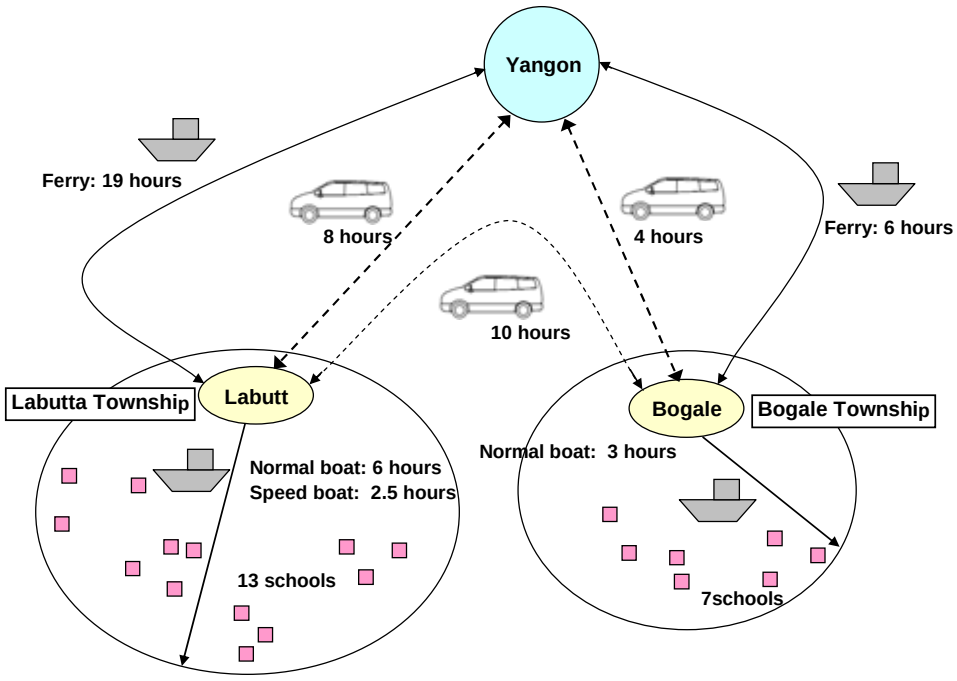


Fig. 2-14 Positional Relationship of the Project Sites

2) Improvement of Landing Site

The unloading of the materials at the township ports and project sites will be conducted manually. None of the sites currently have satisfactory landing facilities and the repair or rehabilitation of the existing jetties will be necessary. The cost of such work will, therefore, be included in the overall cost of the Project.

3) Timing of Transportation

As mentioned earlier, the rainy season usually affects the project sites from June to October. As transportation by sea or river can be adversely affected by high waves, the transportation timing must be carefully planned.

4) On-Site Storage of Building Materials

As the construction sites are located in their respective village areas, the erection of temporary fencing, etc. will be required to restrict unauthorized site access. Restricted access to the sites by third parties will be necessary from the viewpoint of safety as well as security (prevention of theft). Some sites can be inundated during the monsoon season from June to October, making careful planning of the delivery timing of such building materials as cement, aggregates, reinforcing bars and form materials essential. It will also be necessary to conduct banking work in a certain area to secure a safe storage space for the building materials.

(2) Contractors

The construction of primary schools, cyclone shelters and clinics as part of the reconstruction and rehabilitation efforts of the Government of Myanmar, international aid organizations and NGOs is being undertaken by local construction companies based in Yangon. There are some 30 medium to large construction companies based in Yangon which are capable of such work. Although there are many more smaller construction companies, these companies appear to have shortcomings in terms of their business scale, finance and construction capability. There are also construction companies in Labutta Township and Bogale Township, the two townships most severely damaged by Cyclone Nargis, but these companies are small and lack experience of working for international aid organizations. Their construction capability is also below the level required for the Project. Accordingly, it is judged that medium to large construction companies based in Yangon are likely to be selected as the contractors for the Project.

(3) Procurement of Materials

The building materials to be used for the Project are not special materials and can be procured in Myanmar, including some imported materials which are readily available in the local market.

Because the construction work will simultaneously start at all of the sites in October after the end of the rainy season, the systematic and early procurement of the materials will be required to avoid a supply shortage at individual sites.

Cement

There are five government-run cement factories in Myanmar along with three privately-run cement factories. Cement produced in Thailand is widely marketed to compensate for the supply shortage of domestically produced cement. The cement produced in Myanmar and the cement produced in Thailand are similar in terms of quality and price.

Reinforcing Bars

There is one reinforcing bar factory in Myanmar but the product quality is poor and the production volume is small. Accordingly, imported bars (made in India and China, etc.) are used at most construction sites.

Fine and Coarse Aggregates

These aggregates can be procured in various parts of Myanmar. For the Project, their procurement from rivers near Bogale will be convenient. They will be directly transported to each site by boat from the source.

(4) Safety Management

Most of the project sites are located either in a farming village or a fishing village and many local farmers and fishermen who are not familiar with construction work are likely to be recruited as labourers. In addition, it will not be easy to immediately transport anyone injured at a construction site to hospital, making safety management extremely important. A good safety management system must, therefore, be established as described below and the safety awareness of locally recruited labourers must be improved.

1) There is not sufficient means of telecommunication at any of the sites as ordinary mobile phones cannot be used. The site manager will be issued with a CDMA mobile phone and an emergency communication network incorporating Project-related organizations in Japan as well as Myanmar, hospitals and the police should be established and made known to all people concerned.

2) A morning assembly should be held so that everyone properly understands the details of the day's work and safety instructions prior to the commencement of the day's work.

3) When the day's work is finished, the site should be thoroughly patrolled to ensure that the scaffolding, supports, handrails and others are in a safe condition.

4) In the case of poor weather, the condition of the access road may deteriorate, leading to slips, falls or over-turning. The access road should be constantly checked to maintain it in good condition. In the case where the sea route is expected to face rough weather, delivery of the materials by sea should be suspended.

5) At many of the project sites, school lessons are expected to continue in temporary classrooms while the construction work is taking place. Temporary fencing should be erected to clearly separate the flow lines for school personnel (pupils, teachers and others) and those for construction personnel.

6) A first aid box must be available at each site office.

7) Many pupils are expected to be very curious about the work and guards should be deployed at important points.

2.2.3.3 Division of Work

The scope of the work to be undertaken by the Japanese side under the grant aid project and that of the implementing body on the Myanmar side is shown in Table 2-13.

Table 2-13 Division of Work

No.	Item	Japan	Myanmar	Remarks
1	Securing of construction sites		●	
2	Leveling of construction sites and demolition work		●	
3	Installation of fences and gates		●	
4	Parking area work	N/A		
5	Road work			
	1) Inside the site	N/A		
	2) Outside the site (access road)		●	
6	Construction work	●		Blackboard installation
7	Electrical work, water supply work and drainage work			
	1) Electrical work			
	a. Transmission line work		N/A	
	b. Distribution work	N/A		
	c. Receiving panel and distribution panel work	N/A		
	2 Water supply work			
	a. City water (public water supply) work		N/A	
	b. Distribution pipe work and water tank work	N/A		Rainwater work (Japan)
	3 Drainage work			
	a. Sewage pipe work (sanitary sewage; rainwater)		N/A	
	b. Septic tank work	●		
	4 Furniture (desks and chairs)			
	a. Desks and chairs (teachers and pupils)	●		
	b. General furniture		N/A	
8	Bank account opening commission and A/P commission based on the B/A		●	
9	Customs procedures			
	1) Marine (air) transportation of the products from Japan to the recipient country	N/A		
	2) Tax exemption and custom clearance of the products at the port of disembarkation		N/A	
	3) Internal transportation in Myanmar from the port of disembarkation to the project sites	N/A	N/A	
10	Bearing of duties and taxes		N/A	
11	Maintenance		●	
12	Work costs not included in the grant aid		●	

Note: B/A : Banking Arrangement
● : Indicates the responsible party
N/A : Not applicable

2.2.3.4 Work Supervision Plan

(1) Local Consultant

Although the number of general consultancy companies operating in Myanmar is quite limited, there are many smaller consultancy companies. It is, therefore, possible to secure the services of engineers with certain technical capability to conduct the on-site supervision for the Project. However, because of the lack of quality control standards for consultancy companies, these engineers cannot be expected to have a high technical standard. In this situation, it will be necessary to use a Japanese consultancy company so that Japanese consultants can provide strict technical guidance to ensure the required quality control, schedule control and safety management system. At the beginning of the construction work, technical supervisors of local consultancy companies will participate in an orientation workshop to make them properly understand the key points and methods of work supervision, reasons for ensuring the work quality and how to complete the work supervision-related documents with a view to both uniformatising and strictly enforcing the work supervision method.

(2) Implementation Setup

1) Detailed Design Period (Tender Period)

The tender procedure will be implemented by the procurement agent. Because it will be necessary to answer technical queries about the contents of the tender documents and also to evaluate the technical propriety of the proposals and actual bids of the tenderers, a Japanese consultant(s) will provide assistance for the technical aspects of the tender procedure. For this purpose, a Japanese consultant will be dispatched to Myanmar in the early tender period and proposal evaluation period to provide technical assistance.

2) Work Supervision Period

During the construction period, the consultant will provide on-site guidance and technical guidance primarily featuring quality control, schedule control and safety management. The consultant will also report on the progress and contents of the ongoing and completed work to the procurement agent and relevant ministries of the Myanmar government. In the case of a technical problem, the consultant will hold discussions, conduct an examination and propose solutions.

3) Work Supervision Setup

A supervision office will be set up in Labutta and Bogale. The Labutta Office will not only supervise the primary school cum cyclone shelter construction work at the 13 sites in the township but will also act as the main liaison office in Labutta Township with the

procurement agent. In view of this, a Japanese technical supervisor will be permanently stationed at this office throughout the construction period and will be assisted by one chief engineer, 13 technical supervisors (one at each site), one cost estimator, one driver and one office boy, all of which will be recruited locally, for the proper implementation of quality control, schedule control and safety management. Similarly, the Bogale Office will supervise the primary school cum cyclone shelter construction work at the seven sites in the township and will also act as the main liaison office in Bogale Township with the procurement agent. A Japanese technical supervisor will be permanently stationed at this office throughout the construction period and will be assisted by one chief engineer, seven technical supervisors (one at each site), one cost estimate, one driver and one office boy, all of which will be recruited locally, for the proper implementation of quality control, schedule control and safety management.

2.2.3.5 Quality Control Plan

(1) Basic Concept

The consultant supervising the construction work will check the contents and progress of the work as well as the procurement of materials and will also verify the amount of work completed each month to be reported to the procurement agent to ensure the quality of the work and that the work itself is duly completed by the deadlines stipulated in the contracts. The consultant will also supervise and provide guidance for the contractors to ensure the safety of the site work.

There are no local laboratories in the two target townships to conduct the compressive strength test for concrete and tensile strength test for reinforcing bars and such tests must be conducted at the relevant facilities in Yangon. Because of the remote location of each site, however, such tests cannot be quickly arranged. In view of the special geographical circumstances of the target sites and the technical level of construction companies and workers in Myanmar, it will be necessary to install simple facilities to conduct the compressive strength test, etc. at each field office. Moreover, technical guidance for the personnel of the contractors at the project sites will be an important requirement. To meet such challenge, field workshops will be organized where possible to develop control standards based on the quality control standards in Japan and to transfer the relevant skills.

(2) Quality Control Items

The planned construction methods, building specifications and materials for the Project are commonly used in Myanmar and quality control will be conducted in the following manner.

1) Checking of the Working Drawings and Specifications of the Materials to be Used

The submission of working drawings prior to the commencement of the construction work will be a compulsory requirement for the contractors so that the contents of these drawings can be checked in advance. Equally, contractors will be required to submit the specifications and proof of purchase of the materials to be delivered to the construction sites so that their quality can be assured.

2) On-the-Spot Visits to Manufacturing/Production Sites or Checking of the Inspection Results

In regard to the building equipment and materials to be procured, visits will be made, if necessary, to the manufacturing or production factories to conduct on-the-spot checks of the material quality and product inspection certificates.

3) Control and Confirmation of the Completed Amount of Work and State of the Finish

Technical supervision and on-the-spot inspection will be conducted at the construction sites at the construction stage. The completed amounts of the work will be checked against the relevant working drawings.

4) Inspection Records

Work supervision instructions will be given to the locally recruited work supervisors. These supervisors will be required to keep inspection records for each structural member and each type of work conducted at every stage of the construction work for efficient work supervision without fail. The main quality control items are shown in Table 2-14.

Table 2-14 Main Quality Control Items

Type of Work	Management Item	Testing (Inspection) Method	Testing Frequency
Foundation work	Bearing capacity of the soil	Portable cone penetration test or Plate load test	One place of each (spread foundation)
	Pile supporting layer	Comparison between excavated soil and boring data; measuring	For each pile
	Pile bearing capacity test	Loading test	Test piles
Earth work	Degree of compaction	Visual inspection	Entire foundation base, soil filling
	Incoming sand quality inspection	Visual inspection	Quarry: 1 site
Form work	Completed amount	Dimensional inspection and photographs	All members
	Material inspection	Plate thickness, quality and deformation	All members
	Assembly inspection	Visual check (gaps, reinforcing material and spacers)	All members
Reinforcing bar work	Tensile strength	Tensile strength test	Once for each size and every 20t
	General quality	Mill sheet inspection	Once for each size
	Bar arrangement inspection	Number of bars, diameter, spacing, joint length, setting length and covering thickness	Prior to concrete placing at all points
Concrete work	Aggregate particle size	Sieve-analysis test	Once
	Test mixing	Blending, water-cement ratio, compressive strength, slump and salt content	Once
	Compressive strength	Compressive strength test	Once for casting day, 6 pieces each
	Slump	Slump test	Once for casting day
	Temperature	Temperature gauge	Each batch
	Water quality test	Salt concentration test by Quantab	Once for casting day
Brick work	Brick quality	Factory inspection	Once
Doors and windows	Quality of doors and windows	Visual inspection; measuring	When delivered
Furniture and fixtures	Quality of furniture and fixtures	Visual inspection; measuring	When delivered

(3) Schedule Control

In order to ensure that the contractors adhere to the delivery deadlines stipulated in their respective contracts, the consultant will compare the implementation schedule in each contract with the actual work progress every month. When a delay is predicted, the consultant will alert the contractor and request that the said contractor submit a plan to prevent the delay and implement the said plan to ensure that the construction work and delivery of the necessary equipment, etc. is duly completed by the agreed deadline. Comparison between the planned schedule and actual progress will be mainly conducted in the following manner.

- Confirmation of the amount of completed work
  (procurement state of building materials and state of work progress)
- Confirmation of the amount of delivered equipment and materials
  (construction machinery and fixtures)

- Confirmation of the progress of temporary work and preparation of construction machinery (according to necessity)
- Confirmation of the number of engineers, skilled workers and labourers

2.2.3.6 Procurement Plan

The procurement of the materials required for the implementation of the Project is included in the contract for the construction work. Accordingly, procurement under the Project will be conducted based on the contract between the procurement agent and each contractor. The contracted construction work will include the building work, sanitary installation work and procurement and installation of furniture. The field survey has concluded that all of the necessary materials can be procured in the local market.

All of the building materials to be used under the Project are common materials and their procurement in Myanmar (including imported materials which are readily available in Myanmar) is planned. Given the prospect of the uniform commencement of the construction work at all of the sites in October after the rainy season, the early procurement of the materials will be necessary to avoid a supply shortage at the sites. VAT (value-added tax) is not imposed on building materials in Myanmar and, therefore, it will be unnecessary to invoke the tax exemption procedure regarding the building materials.

The procurement sources of the building materials for the Project are listed in Table 2-15.

Table 2-15 Equipment and Material Procurement Sources

Item	Country of Origin			Remarks
	Myanmar	Japan	Third Country	
[Materials]				
Portland cement	○		○	Thailand etc.
Concrete aggregates	○			
Reinforcing bars	○		○	India, China, etc.
Concrete blocks	○			
Sintered bricks	○			
Timber and formwork	○			
General steel materials	○		○	India, etc.
Wooden fittings	○			
Paint	○		○	China, India, etc.
Temporary installation materials	○			
Furniture	○			
Waterproofing materials	○		○	Thailand etc.
Glass	○		○	Thailand etc.
Sanitary ware	○		○	Thailand etc.
Water supply and drainage pipes (including joint pipes)	○			
Water tank (PVC)	○			

2.2.3.7 Implementation Schedule

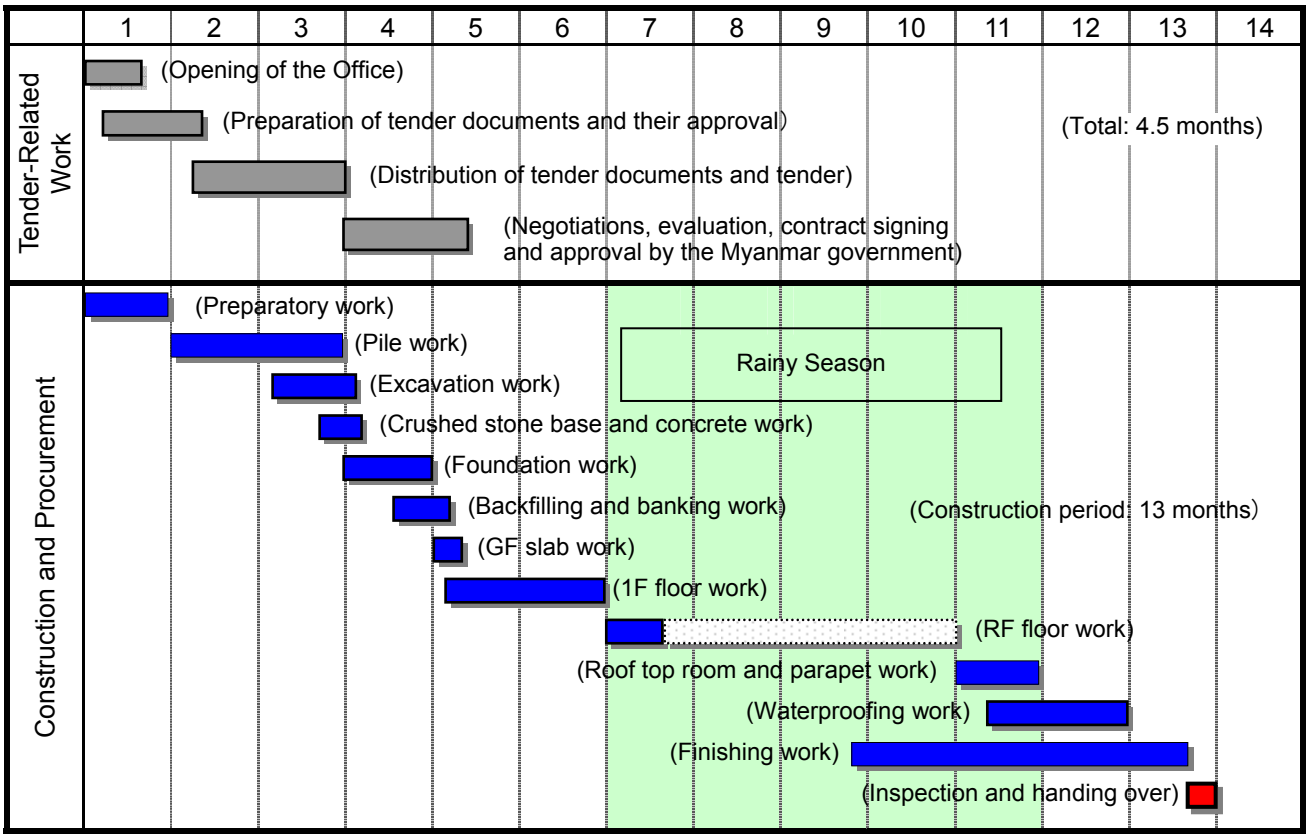
The implementation schedule for the Project after the signing of the E/N will include 4.5 months for the tender-related work and 13 months for construction and procurement.

The following tender-related works will be carried out for 4.5 months.

- Opening of the office 1.0 months
- Preparation and approval of the tender documents 1.0 months (simultaneously above)
- Public announcement in local English papers 0.5 months
- Public announcement of the PQ, distribution of the tender documents and tender 1.5 months
- Negotiations and evaluation 0.5 months
- Signing of the contracts and their approval by the Government of Myanmar 1.0 months

Approximately 13 months will be required to complete the construction work in consideration of the construction management capability of the contractors, time required for the delivery of the materials to the construction sites, work capability of the workers, rainy season from June to October, time required for piling work (bore piling), time required for waterproofing of the roof and other relevant matters. There is information that similar construction work can be completed in a shorter period in the case of projects of the Government of Myanmar, international aid organizations and NGOs even though the actual period largely depends on the scale and specifications of the facilities to be constructed. When these projects are compared to the Project, the much shorter construction period reflects different piling work, different building structure, different type and/or shape of the roof and difference in the roof top waterproofing specifications. Given the design contents and specifications adopted for the Project, construction period for this project is judged as reasonable.

Table 2-16 Project Implementation Schedule



(1) Important Points to Consider for Schedule Planning

1) Removal of Existing Buildings and Obstacles

None of the project sites will require the removal of existing buildings or obstacles and the ground is flat at all of the sites. However, it is believed that banking will be required at one school in Labutta Township and at three schools in Bogale Township as the ground level at these sites is lower than the ground level of the surrounding area.

2) Preparation Period

The preparation period is taken into consideration in the planned schedule shown in Table 2-16 to allow time for the procurement of the building materials, arrangement of labour, preparation of the schedule plan and working drawings, construction of building material storage facilities, workers' rest facilities, dormitories and site offices and checking of the sites and the surrounding areas.

3) Ground Work, Foundation Work and GF Slab Work

It is assumed that piling work using bore piles will be required at all of the sites. The number of piles required for the largest of the planned buildings (two stories, six classrooms

with a total floor area of some 802.53 m^2) is expected to be approximately 36 piles of φ50 cm. As one day's work is required for each pile, the piling work will take approximately 2 months to complete. To verify the bearing strength of the piles, it will be necessary to conduct the loading test after confirmation of the compressive strength of the 4 week concrete.

After completion of the piling work, the foundation work will commence and will follow the sequence of excavation, treatment of the pile heads, laying of gravel, blinding concrete, arrangement of the reinforcing bars and formwork, placement of the concrete, backfilling, banking and slab work for the ground floor (arrangement of the reinforcing bars and formwork and placement of the concrete). About 3 months will be required to complete all of the types of work mentioned above.

4) Structural Work for First Floor, Roof Top Floor and Roof Top Room

The reinforcing bar and framework arrangement and concrete placing, including that for the first floor, roof top floor and roof top room, will be conducted before and after the rainy season and will require approximately seven months to complete. Even though the work is not impossible during the rainy season, the work efficiency is likely to significantly decline. The schedule planning must take this decline of the work efficiency into consideration.

5) Roof Top Waterproofing

The waterproofing work for the roof top floor will commence after the completion of the concrete work for the roof top floor and construction of the parapet along the edge of the roof. As this work cannot be conducted during the rainy season, it will be conducted after the rainy season and is likely to constitute a major component of the critical path for the overall work schedule.

6) Rainy Season

It will be necessary to avoid rainy season for the delivery of the materials with the materials being delivered in advance. A temporary storage building will be required for the safe storage of the materials and measures to prevent the flooding of this building should be implemented.

7) Work Execution Capacity

It is believed that construction companies in Myanmar have a certain construction work execution capacity. Because the work under the Project will be conducted in fairly remote areas, it is likely that many local residents will be employed as labourers. The work

schedule must, therefore, take the likely poor construction work execution capacity of these labourers into consideration.

8) Decision on the Work Execution Period

The construction work execution period has been decided based on the construction work volume and execution capacity of local contractors as well as local labourers. For the planning of the work schedule for the Project, the largest primary school cum cyclone shelter building planned (two stories, six classrooms with a total floor area of some 793.25 m^2) is used to constitute the critical path. The estimated construction period required is approximately 13 months.

9) Other Important Point

Myanmar has public and government holidays totalling 23 days a year as shown in Table 2-17.

Table 2-17 National Holidays in Myanmar in 2010

No.	Name	Date	Duration (days)
National Holidays			
1.	Independence Day	4 Jan.	1
2.	Union Day	12 Feb.	1
3.	Peasants Day	2 Mar.	1
4.	Full Moon of Tabaung	21 Mar	1
5.	Tatmadaw Day	27 Mar	1
6.	Water Festival	13 ~16Apr.	4
7.	Myanmar New Year	17 ~21Apr.	5
8.	Labour Day	1 May.	1
9.	Full Moon of Kason	8 May.	1
10.	Beginning of Buddhist Lent	6 July.	1
11.	Martyrs' Day	19 July.	1
12.	End of Buddhist Lent	3 Oct.	1
13.	Trazaungdaing Festival	1 Nov.	1
14.	National Day	11 Nov.	1
15.	Kyain (Karen) New Year	16 Dec.	1
16.	Christmas	25 Dec.	1
	Total		23 days

2.3 Obligations of the Recipient Country

Following the signing of the E/N, the Myanmar side will perform the range of undertakings described next in cooperation with the responsible ministry for and implementing body of the Project.

2.3.1 General Matters

① Opening of an account with a Japanese bank to enable payments to be made to the procurement agent, consultant responsible for supervision of the construction work and contractors under Japan's grant aid scheme. The Myanmar side will be responsible for the payment of banking fees/commissions for the opening of the account and money transfers.

② Securing of swift landing and tax exemption for materials to be imported for the Project even though it is believed that the Project does not involve any imports using Japan's grant aid scheme

③ Affording Project-related personnel (Japanese nationals and third country nationals) such conveniences as may be necessary for their entry to Myanmar and their safe stay therein

④ Customs duties, domestic taxes and other levies relating to the Project which may be imposed in Myanmar shall be exempted or borne by Myanmar side.

⑤ Proper use and maintenance of the facilities rehabilitated with Japan's grant aid

⑥ Payment of all other expenses which are not covered by Japan's grant aid

2.3.2 Special Notes

① The Myanmar side must provide the land for material storage and temporary installations free of charge to the contractors.

② The Myanmar side must provide disposal sites for the surplus soil and construction waste free of charge to the contractors

③ It is believed that an environmental impact assessment (EIA) is unnecessary as all of the project sites are existing school sites based on the idea that the planned construction work under the Project is the restoration of the pre-disaster state.

④ The Myanmar side shall obtain permission for construction from the land owner or relevant organization at each site.

2.4 Operation and Maintenance Plan

The Project is construction of school buildings based on the present number of pupils. The present teachers are assigned by the Department of Basic Education No. (1) (DBE-1) and the school operation will be continued after completion of the new buildings. The DBE-1 has capability and power to operate the primary schools. The number of pupils per teacher is about 32 and it will be strengthened for the education in the completed buildings. The DBE-1 has allocation of national budget as recurrent budget for teachers' salaries and light repair, and capital budget and supplementary grant (budget) for construction and large repair.

In addition, every project school has PTA that is contributing to school operation and maintenance in cooperation of the community.

2.5 Project Cost Estimation

2.5.1 Project Cost Estimation

The total cost of the Project is estimated as 0.58 billion yen. However this amount does not indicate the aid limit given in the E/N and G/A.

2.5.2 Operation and Maintenance Cost

The estimated annual maintenance cost for the facilities to be constructed under the Project is shown in Table 2-18. As the total cost of 12,000,000 kyats a year only represents a tiny 0.1% of the annual facility and equipment expenditure of the Department of Basic Education-1 (DBE-1) of 12,310,997,000 kyats, this maintenance cost should not pose any financial problem for the Myanmar side.

Table 2-18 Annual Maintenance Cost

Item	Amount ('000 kyats/year)	Remarks
Maintenance of the septic tank	-	To be conducted by the PTA and the local community
Repainting and repair of the windows, doors and metalware, etc.	12,000	
Repair of the desks and benches	-	To be conducted by the PTA and the local community
Total	12,000	

The Project will only cover the construction of new school buildings (cum cyclone shelters) at existing school premises and the operating costs, including teacher salaries, will be met by the Government of Myanmar as is currently the case.

2.5.3 Responsibility and Cost borne by Recipient Country

The responsibility and the cost to be borne by the recipient country will be as follows:

Table 2-19 Responsibility and Cost borne by Recipient Country

Description	Cost (thousand Yen)	Remarks
Preparation and securing of the site	—	No monetary cost
Taxes	—	Not applicable
Payment for banking arrangement	300	
Total	300	

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3.1 Project Effects

The implementation of the Project is expected to produce various effects of which the principal effects are described in Table 3-1.

Table 3-1 Principal Project Effects

Current Situation and Problems	Remedial Measures Under the Project	Direct Effects and Extent of Improvement	Indirect Effects and Extent of Improvement
At all of the sites, the primary school building was destroyed by Cyclone Nargis. As the reconstruction process has been slow, many pupils are forced to receive lessons in dangerous temporary classrooms with poor conditions. No local cyclone shelters exist for evacuation in the target areas which are prone to cyclone damage, increasing the risk of a disaster when the areas are hit by a cyclone.	Construction of primary school buildings which also function as shelters at the time of a cyclone	<u>Improvement of the educational environment</u> ① The primary school buildings which were destroyed by Cyclone Nargis will be reconstructed at 20 project sites, vastly improving the educational environment for 2,932 pupils. ② The newly constructed facilities at the project sites will act as shelters for some 25,000 people.	<u>Increased number of people who can be evacuated to cyclone shelters</u> ① The new facilities will contribute to improvement of the school enrolment rate and the level of education. ② The risk of a cyclone disaster will be reduced in the project areas, giving local residents peace of mind.

3.2 Recommendations

In order to realise and sustain the project effects, it will be necessary for the Myanmar side to tackle the following issue.

- The prompt securing of the services of the required number of teachers and their adequate assignment to the project sites will be necessary to ensure that lessons are appropriately conducted after the handing over of the new school buildings to the Myanmar side.