

**THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF FOOD AND DISASTER MANAGEMENT**

**PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR THE IMPROVEMENT
OF THE CAPACITY OF PUBLIC FOOD STORAGE
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH**

JANUARY 2012

**JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
KOKUSAI KOGYO CO., LTD.**

Preface

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey on the Project for the Improvement of the Capacity of Public food Storage in the People's Republic of Bangladesh, and organized a survey team headed by Mr. Yukio KATAYANAGI of KOKUSAI KOGYO Co., Ltd. between October 2010 and January 2012.

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

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

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

January, 2012

Teruyoshi KUMASHIRO
Director General,
Rural Development Department
Japan International Cooperation Agency

Summary

1. Background of the Project

The People's Republic of Bangladesh (hereinafter referred to as "Bangladesh") has a land area of 144,000 sq. km, and a population of 146.6 million in 2007. In 2001, about 89.7% of the population is Islamic with the rest of the population comprised of Hindu, Buddhist, and Christian minorities. Bangladesh has a tropical monsoonal climate. The country is prone to periodic cyclones and has a rainy season between May and October. Monthly maximum rainfall is recorded in June and July, and highest temperature is recorded between March and June.

In 2010, GDP per capita is USD 684. The services sector contributed 49.7% of the GDP and employed 37.4% of the population, while the agricultural sector accounted for 20.6% of the GDP and employed 48.1% of the population and the industrial sector accounted for 29.7% of the GDP and employed 14.6% of the population.

In fact, the Government of Bangladesh (hereinafter referred to as "GOB") owns food storage with a capacity of total 1.54 million Mt. The GOB made an unofficial request to Japan to establish rice silo in order to strengthen food storage capacity and to ensure stable distribution. Under such circumstances, the preparatory study was carried out from June to July 2009 by Japan International Cooperation Agency (hereinafter referred to as "JICA"), for fact finding on the candidates of the project.

Through the series of discussion with concerned GOB officials, major findings of the preparatory study team are as follows.

- GOB has a plan to strengthen food storage with a capacity of total 3 million Mt by 2015, and has a specific plan to establish food storage with a total capacity of 0.784 million Mt. However, food storage is estimated to be lacking after the completion of specific planned project.
- Based on unofficial request proposed by the GOB, the preparatory study team reviewed and compared the potential of project sites, Dinajipur (Dinajipur District), Postagora (Dhaka City) and Santahar (Bogra District), and type of storage facility including required area for the construction and frequency of fumigation. As a result of the preparatory study, the team gave presentation that silo type storage is suited to flat storage, and Santahar is considered to be best for project site.

2. Result of the Survey and Contents of the Project

Under such circumstances, official request was proposed by the GOB to establish rice silo storage in Santahar. The Government of Japan (hereinafter referred to as "GOJ") has decided to conduct the Preparatory Survey, considering that it seems to be technically and economically difficult for the GOB to construct rice silos, because this project to construct rice silos is the first case in Bangladesh.

JICA dispatched the Preparatory Survey Team (hereinafter referred to as "Team") to Bangladesh over a period between October 9, 2010 and November 27, 2010 for the 1st field survey. The Team had

discussions with GOB officials and conducted a field survey. During analysis in Japan after 1st field survey, the Project has executed a technical comparison among silo type requested by GOB, and two types of warehouse, namely, 1) common warehouse in Bangladesh not equipped with air conditioning machines, and 2) multistoried warehouse equipped with air conditioning machines, which is possible to maintain grain quality and is common in Japan.

As a result of the comparison on rice logistics in Bangladesh, required skills and technology to control quality of rice for long term storage, adaptation in an emergency and so on, multistoried warehouse equipped with air conditioning machines is considered most appropriate in Bangladesh.

Considering the result of analysis in Japan after 1st field survey, 2nd and 3rd field surveys were conducted over a period between January 4, 2011 and January 21, 2011, and April 24, 2011 and May 21, 2011. During 3rd field survey, the type of the food storage has been changed from a silo to a multistoried warehouse and both Japan and Bangladeshi sides confirmed to precede the Preparatory Survey for a multistoried warehouse.

Summary of Japanese Assistance

Items	Contents
1) Facility	Multistoried warehouse equipped with air conditioning machine
2) Equipment	Forklifts
	Pallets
	Monitoring equipment (Grain moisture meter, Thermometer for grain, Thermo hygrometer)
3) Soft components (Technical assistance)	Technical support and capacity building

The Team examined the appropriateness of the construction of new facilities, the procurement of equipment and technical assistance; it then concluded its plan and specifications. The representatives from the Team visited Bangladesh to explain the Draft Preparatory Survey Report from October 12 to October 19, 2011.

Summary of planned facility, equipment and technical assistance is shown in the table below.

Summary of Planned Facility

Room name		Utilization	Floor size (sq.m)
Multistoried Warehouse (Ground floor)	Storage Room	To be used for pallet storage	4,446
	Platform	To be used for unloading rice bags from trucks to pallets and loading from pallets to trucks. It shall be located along storage room for forklift handling, unloading and loading.	1,164
	Staircase, corridor		64
	Sub total		5,674
Multistoried Warehouse (1st floor)	Storage Room	To be used for pallet storage	4,446
	Platform	To be located along storage room for forklift handling	1,080
	Staircase, corridor		64
	Sub total		5,590
Multistoried Warehouse Total			11,264
Truck Yard	Truck Yard on Ground Floor	To be used for truck parking and turnaround	1,174
	Platform on 1st Floor	To be located at the center of the building for unloading and loading	632
Truck Yard Total			1,806
Slope	Elevated section	To be used for trucks access. To include Equipment Storage and Pump Room.	366
	Access Slope	To be constructed on earth embankment	*817
Slope Total			1,183
Electric Room		To install sub station and distribution board	107
Total			14,360

*Area occupied by access slope

Summary of Planned Equipment

Equipment		Quantity	Purpose
Forklift		4 units	To be used for handling the pallets between platform and storage rooms. To be used for stacking the pallets in storage rooms.
Plastic Pallet		26000 units	To be used for loading of rice bags on pallets and pallets storage.
Equipment for Monitoring	Grain Moisture Meter	4 units	To be used for monitoring grain moisture.
	Thermometer for Grain	4 units	To be used for monitoring grain temperature.
	Thermo hygrometer	4 units	To be used for monitoring temperature and relative humidity in storage rooms.

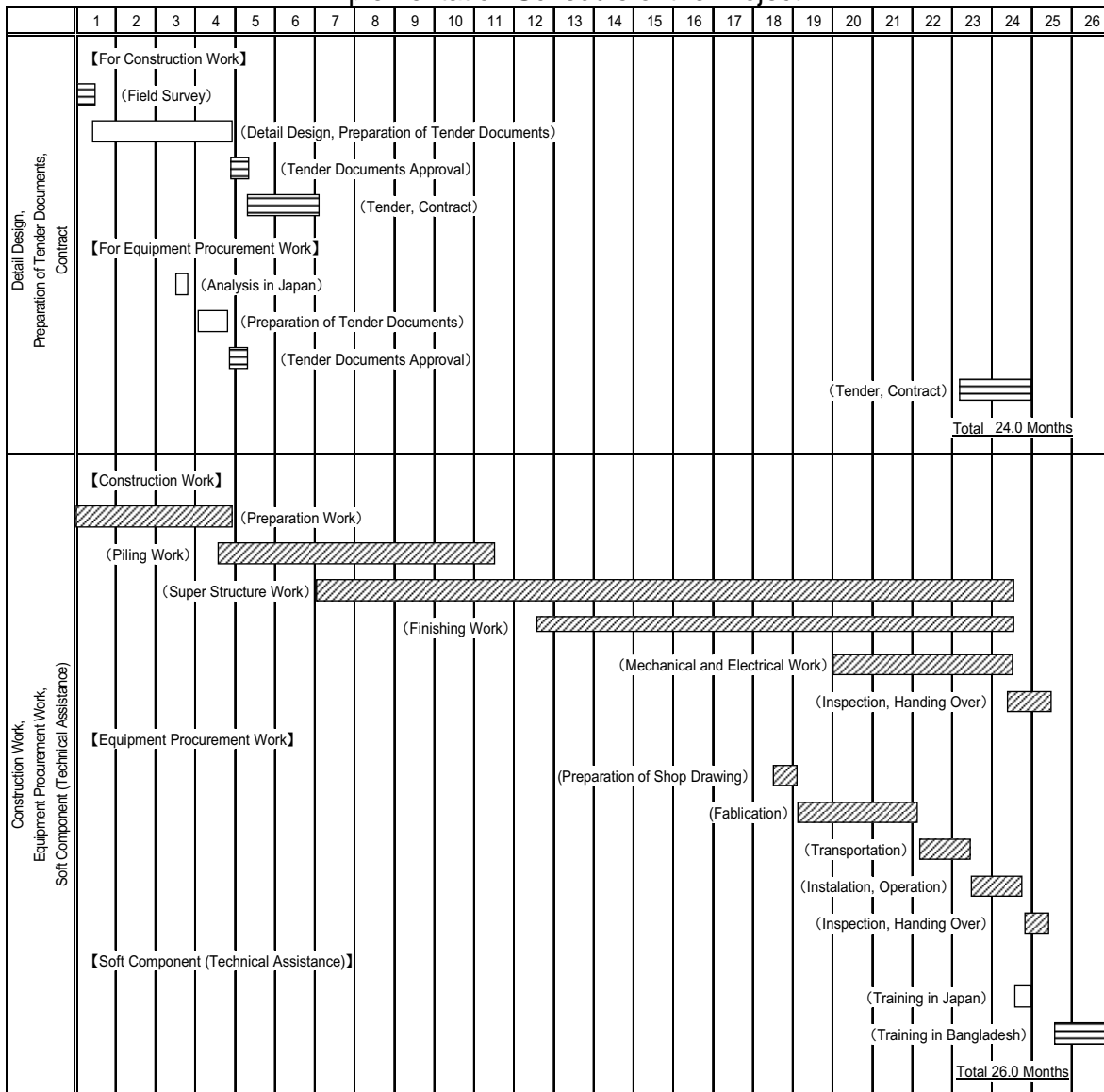
Summary of Technical Assistance

Output	Objectively verifiable indicator
Improvement of warehouse management and inventory management	Understanding of warehouse management and inventory management
	Implementation of first in – first out
Establishment of storage skills and technology using pallets and forklift	Implementation of rice bag loading on pallets and stacking of pallets
	Implementation of smooth carrying in and distribution of rice using forklift
	Implementation of rotation of pallets with rice bags in the storage room
Establishment of skills and technology to operate and maintain air conditioning machines	Understanding of skills and technology to operate and maintain air conditioning machines
	Implementation of monitoring of grain moisture, grain temperature, air temperature and relative humidity in storage room

3. Implementation Schedule

The implementation schedule of the Project is shown in the table below.

Implementation Schedule of the Project



4. Project Evaluation

In the point of view listed below, it can be judged that relevance of the Project is high.

- The Project is conforming to Bangladeshi national development policy.
- Profitability of the Project is low because the Project is contributing public food distribution system in Bangladesh.
- Target group of the Project is the general populace, including those in poverty.
- The Project is contributing food security and it is required to be implemented urgently.
- The Project has needs and advantages to be implemented using established skills and technology in Japan.
- The Project components are possible to be operated and maintained by the Bangladeshi side without excessive high skills and technology.
- The Project is possible to be implemented conforming to Japan's Grant Aid scheme without particular difficulty
- The Project is expected to contribute to adaptation to climate change.
- The Project is conforming with the "Country Assistance Program for Bangladesh" by GOJ

Considering actual distribution results, quantitative effectiveness of the Project can be expected as follows.

Quantitative Effectiveness of the Project

Objectively Verifiable Indicators	Baseline (Year of 2011)	Target (Year of 2017)
Capacity of public food storage in Rajshahi Division	420,350 Mt	446,090 Mt
Storage capacity of food aid to those in poverty (for 1 year / 1 household)	1,168,000 households	1,239,000 households
Storage capacity of food aid to those affected by natural disasters (for 1 time/ 1 person)	42,035,000 persons	44,609,000 persons

Besides the above, it is expected for qualitative effectiveness by the Project that, 1) modernized warehouse management system including pallets storage system using forklift and air conditioning machine is established, 2) grain condition is improved with the storage in the air conditioned warehouse, and 3) safe food in good quality is distributed smoothly.

As mentioned above, the Project is expected to contribute to food security in Bangladesh through Public Food Distribution System (PFDS). It is judged the relevance of the Project is high and the Project is expected to be effective.

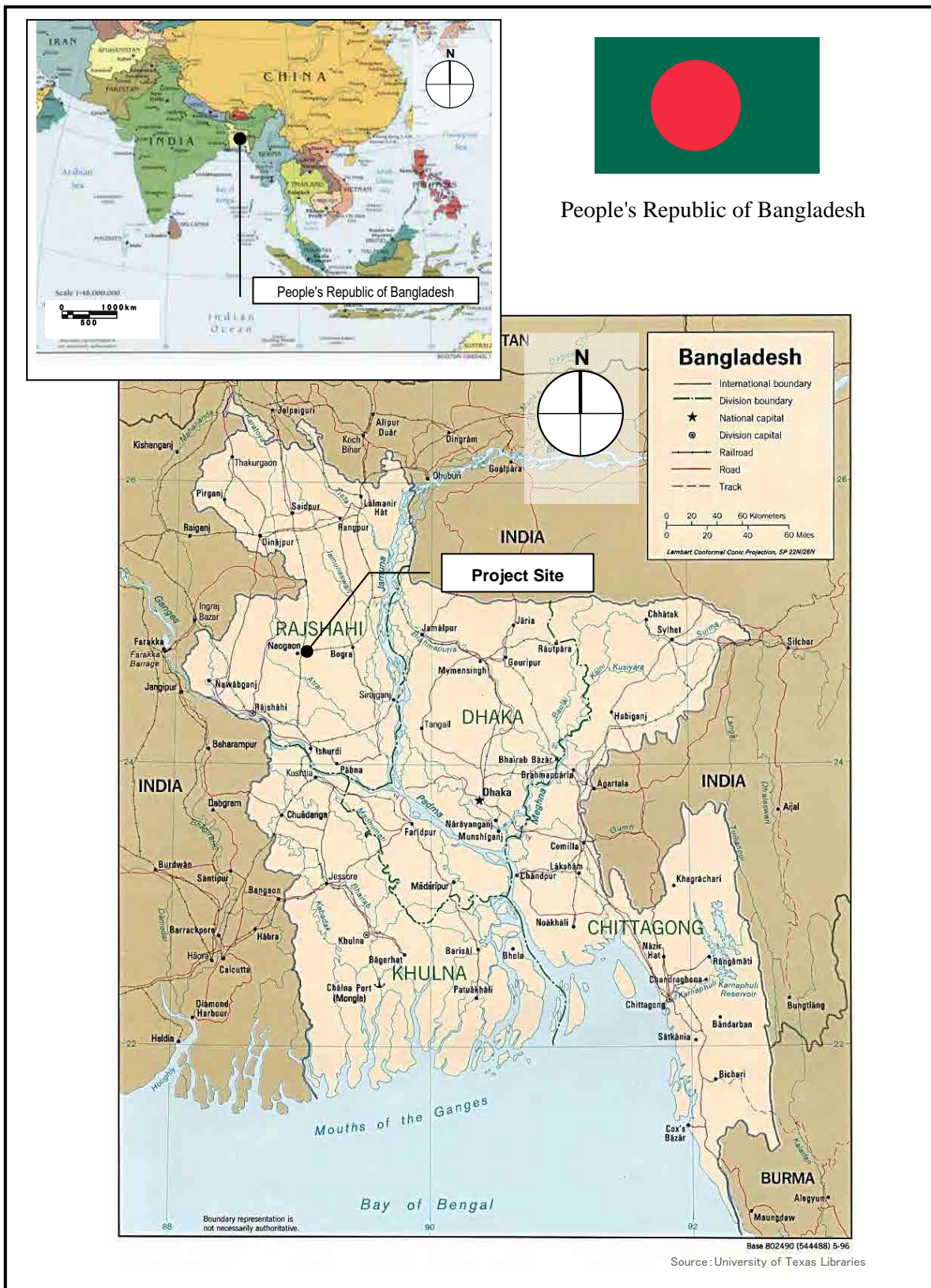
Contents

Preface	
Summary	
Contents	
Location Map / Perspective	
List of Figures & Tables	
Abbreviations	
Chapter 1.	Background of the Project..... 1-1
1-1	Background of Grant Aid..... 1-1
1-2	Natural Conditions..... 1-12
1-3	Environmental and Social Considerations 1-21
Chapter 2.	Contents of the Project 2-1
2-1	Basic Concept of the Project..... 2-1
2-2	Outline Design of the Japanese Assistance 2-4
2-2-1	Design Policy 2-4
2-2-2	Basic Plan (Construction Plan / Equipment Plan)..... 2-8
2-2-3	Outline Design Drawing..... 2-15
2-2-4	Implementation Plan..... 2-25
2-2-4-1	Implementation Policy 2-25
2-2-4-2	Implementation Conditions..... 2-28
2-2-4-3	Scope of Works..... 2-29
2-2-4-4	Consultant Supervision 2-31
2-2-4-5	Quality Control Plan 2-33
2-2-4-6	Procurement Plan 2-35
2-2-4-7	Operational Guidance Plan 2-36
2-2-4-8	Soft Component (Technical Assistance) Plan..... 2-36
2-2-4-9	Implementation Schedule..... 2-36
2-3	Obligations of Recipient Country 2-37
2-4	Project Operation Plan 2-39
2-5	Project Cost Estimation 2-40
2-5-1	Initial Cost Estimation..... 2-40
2-5-2	Operation and Maintenance Cost 2-40
2-6	Other Relevant Issues 2-42

Chapter 3.	Project Evaluation.....	3-1
3-1	Recommendations	3-1
3-2	Project Evaluation	3-2

[Appendices]

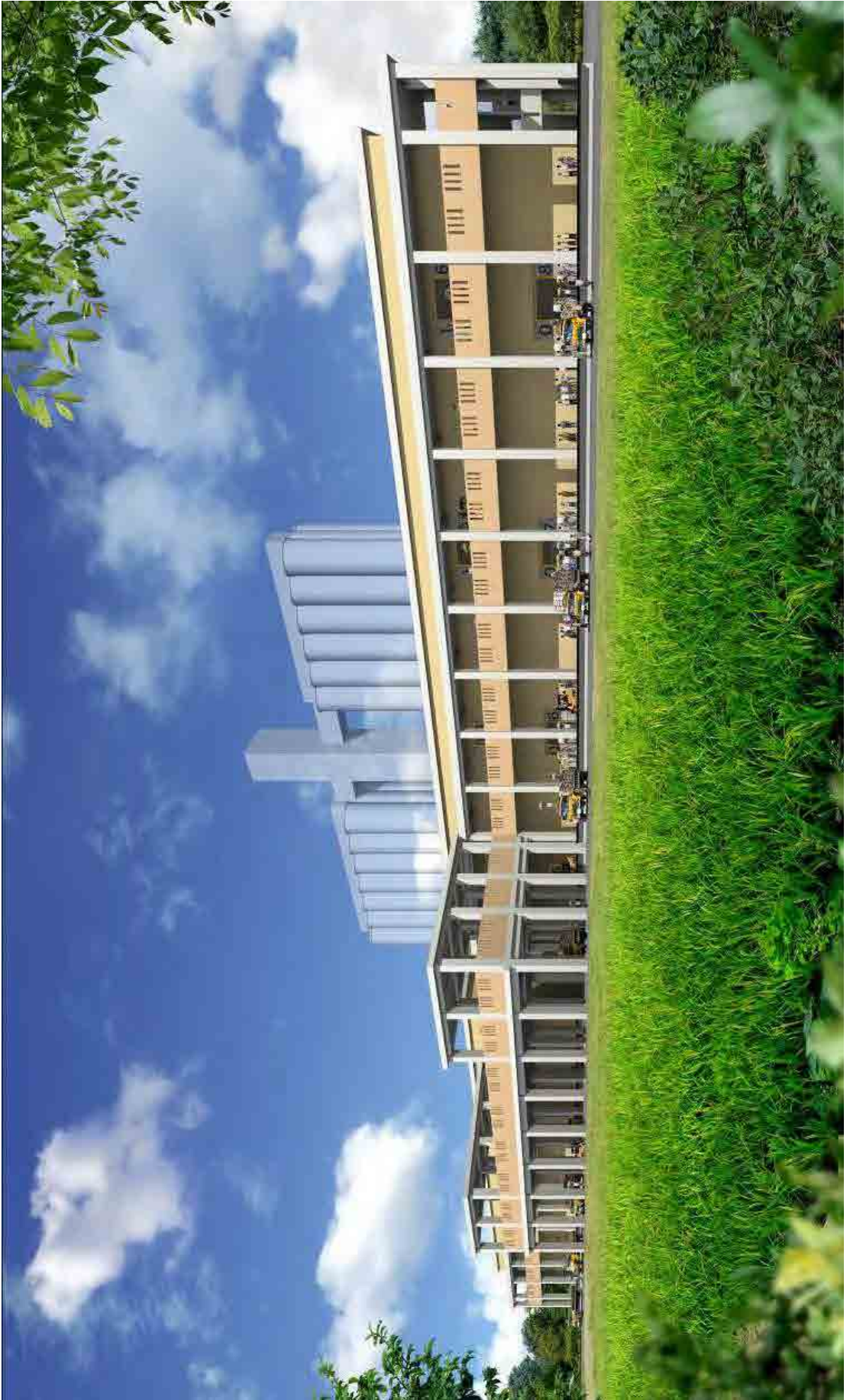
1. Member List of the Study Team
2. Study Schedule
3. List of Parties Concerned in the Recipient Country
4. Minutes of Meetings
5. Soft Component (Technical Assistance) Plan
6. References
7. Other Relevant Data



PREPARATORY SURVEY

ON THE PROJECT FOR THE IMPROVEMENT OF THE CAPACITY OF PUBLIC FOOD STORAGE

Location Map



Perspective

List of Figures & Tables

Table 1-1: Original Request and Japanese Assistance (Draft) (1st Field Survey).....	1-2
Table 1-2: Internal Procurement Policy for Rice in Bangladesh	1-6
Table 1-3: Necessary Period for Receiving	1-6
Table 1-4: Necessary Period for Discharging.....	1-7
Table 1-5: Technical Comparison by Type of Facility.....	1-7
Table 1-6: Japanese Assistance (Draft) (3rd Field Survey).....	1-9
Table 1-7: Daily Rainfall at Bogra (mm)	1-12
Table 1-8: Summary of Cyclones.....	1-15
Table 1-9: Summary of Tornado	1-16
Table 1-10: Summary of Earthquake in and around Bangladesh (1918-2010)	1-16
Table 1-11: Magnitude of Earthquake in and around Bangladesh (1918-2010)	1-17
Table 2-1: Plan to Establish Food Storage Facilities in 6th Five Year Plan (2011-2015).....	2-1
Table 2-2: Distribution through PFDS	2-2
Table 2-3: Scope of Works by Japanese Assistance.....	2-4
Table 2-4: Summary of Planned Facilities	2-9
Table 2-5: Comparison Table of Methods and Materials for Warehouse	2-12
Table 2-6: Table of External Finishing.....	2-13
Table 2-7: Table of Internal Finishing.....	2-13
Table 2-8: Summary of Equipment	2-14
Table 2-9: Storage Capacity of the Project (Mt)	2-15
Table 2-10: Outline Design Drawings.....	2-15
Table 2-11: Scope of Works to Be Borne by Japan and Bangladesh	2-30
Table 2-12: Dispatching of the Consultant for Construction Works	2-31
Table 2-13: Personnel Dispatching by the Contractor.....	2-32
Table 2-14: Dispatching of the Consultant for Equipment Procurement Works.....	2-33
Table 2-15: Items of Quality Controls and Methods of Major Works	2-35
Table 2-16: Implementation Schedule of the Project	2-37
Table 2-17: Approximate Estimation of the Costs Borne by the Bangladeshi Side.....	2-40
Table 2-18: Approximate Estimation of Operation and Maintenance Costs.....	2-41
Table 3-1: Precondition to Implement the Project.....	3-1
Table 3-2: Quantitative Effectiveness of the Project.....	3-3

Figure 1-1: Monthly Rainfall.....	1-12
Figure 1-2: Yearly Rainfall.....	1-13
Figure 1-3: Air Temperature.....	1-13
Figure 1-4: Wind Speed.....	1-14
Figure 1-5: Highest Wind Speed Range (Number of Days) for 1 Year.....	1-14
Figure 1-6: Average Relative Humidity	1-14
Figure 1-7: Location of Boring Test.....	1-18
Figure 1-8: Result of Standard Penetration Test.....	1-19
Figure 1-9: Geological Columnar Section	1-20
Figure 2-1: Outline of the Project.....	2-3
Figure 2-2: Layout Image of the Project.....	2-8
Figure 2-3: Storage Room Image.....	2-14
Figure 2-4: Site Plan	2-17
Figure 2-5: Ground Floor Plan.....	2-18
Figure 2-6: 1st Floor Plan	2-19
Figure 2-7: Elevation – 1	2-20
Figure 2-8: Elevation - 2.....	2-21
Figure 2-9: Section	2-22
Figure 2-10: Ground Floor Equipment Layout Plan.....	2-23
Figure 2-11: 1st Floor Equipment Layout Plan	2-24
Figure 2-12: The Roles of the Concerned Parties.....	2-26
Figure 2-13: Transport Plan for Construction Materials.....	2-36
Figure 2-14: Transport Plan for Pallets.....	2-36
Figure 2-15: Organization Chart for Operation and Maintenance of the Project	2-39

Abbreviations

ADB	Asian Development Bank
B/A	Banking Arrangement
BDT	Bangladeshi Taka
BH	Bore Hole
BM	Bench Mark
BNBC	Bangladesh National Building Code
CP	WFP Country Programme
CSD	Central Storage Depot
DG Food	Directorate General of Food
DPP	Development Project Proposal
DRGA	Debt Relief Grant Assistance
ECNEC	Executive Committee for National Economic Council
E/N	Exchange of Notes
EP	Essential Priorities
FAO	Food and Agriculture Organization of the United Nations
FPMU	Food Planning Monitoring Unit
FAAD	Food Assistance and Development
FFE	Food for Education
FFT	Food for Training
FFW	Food for Work
G/A	Grant Agreements
GDP	Gross Domestic Product
GL	Ground Level
GOB	The Government of Bangladesh
GOJ	The Government of Japan
GR	Gratuitous Relief
JDCF	Japan Debt Cancellation Fund
JICA	Japan International Cooperation Agency
LEI	Large Employment Industries
LPG	Liquefied Petroleum Gas
LSD	Local Supply Depot
MDG	Millennium Development Goal
MD	Minutes of Discussions
Mt	Metric Ton
MoFDM	Ministry of Food and Disaster Management
OMS	Open Market Sales
OP	Other Priorities
PC	Personal Computer
PFDS	Public Food Distribution System
PQ	Pre-Qualification
PRSP	Poverty Reduction Strategy Paper

Abbreviations

TR	Test Relief
UNDP	United Nations Development Programme
USAID	United State Agency for International Development
USD	U.S. Dollar
VAT	Value-Added Tax
VGf	Vulnerable Group Feeding
VGD	Vulnerable Group Development
WFP	World Food Programme

Chapter1 Background of the Project

Chapter 1. Background of the Project

1-1 Background of Grant Aid

1-1-1 Background of Preparatory Survey

In the People's Republic of Bangladesh (hereinafter referred to as "Bangladesh"), wet paddy rice growing including dual cropping is very popular. However, agricultural conditions are very weak against both floods and dry weather. In addition, natural disasters including cyclones and tornados are one factor that causes fluctuation of the amount of agricultural products.

Poverty reduction impact has been realized in long term view in Bangladesh, however, almost half of the people in Bangladesh are considered to be living under the poverty line. The Government of Bangladesh (hereinafter referred to as "GOB") has targeted to reduce the number of people living in poverty by 2015, in United Nations Millennium Development Goals (hereinafter referred to as "MDG"), and to realize its MDGs by setting food security as an important policy issue to secure sufficient food production and access to food by all of its people, including those in poverty. However, it is reported that 40% of the population, as many as 146.6 million, are not able to access sufficient food due to poverty. To improve this situation, food is distributed to those in need through the Public Food Distribution System (hereinafter referred to as "PFDS"). PFDS is a provision for demand and distribution adjustment, market price stability, ensuring a buying price from farmers, and distribution to areas damaged by natural disasters through storage, transport and distribution of both domestic and imported agricultural products.

Besides, strengthening of public food procurement and construction of food storage are promoted in Poverty Reduction Strategy Paper (herein after referred to as "PRSP"¹). In fact, the GOB owns food storage with a capacity of total 1.54 million ton. The GOB made an unofficial request to Japan to establish rice silo in order to strengthen food storage capacity and to ensure stable distribution. Under such circumstances, the preparatory study was carried out from June to July 2009 by Japan International Cooperation Agency (hereinafter referred to as "JICA"), for fact finding on the candidates of the project. Through the series of discussion with concerned GOB officials, major findings of the preparatory study team are as follows.

- GOB has a plan to strengthen food storage with a capacity of total 3 million Mt by 2015, and has a specific plan to establish food storage with a capacity of total 0.784 million Mt. However, food storage is estimated to be lacking after the completion of specific planned project.
- Based on unofficial request proposed by the GOB, the preparatory study team reviewed and compared the potential of project sites, Dinajipur (Dinajipur District), Postagora (Dhaka City) and

¹ General Economic Division, Planning Commission, GOB, 2005

Titled : "Unlocking the Potential: National Strategy for Accelerated Poverty Reduction"

Santahar (Bogra District), and type of storage facility including required area for the construction and frequency of fumigation. As a result of the preparatory study, the team gave presentation that silo type storage is suited to flat storage, and Santahar is considered to be best for project site.

Under such circumstances, official request was proposed by the GOB to establish rice silo storage in Santahar. The Government of Japan (hereinafter referred to as “GOJ”) has decided to conduct the Preparatory Survey, considering that it seems to be technically and economically difficult for the GOB to construct rice silos, because this project to construct rice silos is the first case in Bangladesh.

1-1-2 1st Field Survey

1st field survey of the Preparatory Survey was conducted from October to November 2010. During 1st field survey, the Preparatory Survey had reconfirmed that project purpose is strengthening food storage capacity targeting on ensuring food security by construction of rice silo. The items desired by GOB are shown in the table below.

- After the series of discussions with the Team, silo storage with a maximum capacity of 50,000 Mt and associated facilities were desired by GOB. Both sides confirmed that GOB desired the silo with the capacity 50,000 Mt, considering that this is the first rice silo in Bangladesh. GOB explained that the capacity is so important that GOB will bear the costs for the items such as office building, railway and road construction etc. GOB understood that the ultimate capacity of the silo is determined by the result of the Preparatory Survey and the cabinet approval of GOJ.
- Conveyors, elevators were considered as building equipment and listed in the scope of construction works in 1st field survey, although these are requested in the scope of equipment procurement in the original request.
- Directorate General of Food (hereinafter referred to as “DG food”) has an experience that silo facility was not possible to be operated due to failure of small parts of equipment. Therefore, GOB desired to procure at least one set of spare parts for each piece of equipment.
- GOB desired technical assistance (soft component) for operation and maintenance of facilities and equipment.

Table 1-1: Original Request and Japanese Assistance (Draft) (1st Field Survey)

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Remarks
1) Facility		
10 grain storage silos Each having 10,000 Mt capacity	Grain storage silos with capacity 50,000 Mt or less	
—	Intake chain conveyor system	
—	Belt and bucket elevator	
—	Loading chain and flight conveyor	
—	Bulk weigh system (hopper scale)	
—	Unloading chain and flight conveyor system	

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Remarks
—	Electric motors	
—	Silo accessories	
—	Aeration system	
—	Temperature, Silo monitoring system	
—	Silo sweep auger	
—	Silo discharge gate packages	
—	Bagging system	
—	Packing and loading	
—	Stores and spares	
Approach road and side development including water supply, sanitation and piling	—	To be covered by GOB
Development of railway infrastructure	—	To be covered by GOB
Inspection bungalow and office building	Office building	
2) Equipment		
Intake chain conveyor system	—	Categorized as facility
Belt and bucket elevator	—	Categorized as facility
Loading chain and flight conveyor	—	Categorized as facility
Bulk weigh system (hopper scale)	—	Categorized as facility
Unloading chain and flight conveyor system	—	Categorized as facility
Electric motors	—	Categorized as facility
Silo accessories	—	Categorized as facility
Aeration system	—	Categorized as facility
Temperature, Silo monitoring system	—	Categorized as facility
Silo sweep auger	—	Categorized as facility
Silo discharge gate packages	—	Categorized as facility
Electric 3 way bulb	—	N/A
Electric 2 way bulb	—	N/A
Bagging system	—	Categorized as facility
Packing and loading	—	Categorized as facility
Shipping documents	—	N/A
Stores and spares	—	Categorized as facility
Training	—	Categorized as Soft Component
3) Soft components (Technical assistance)		
Foundation	—	Categorized as the Others
Erection	—	Categorized as the Others
Commission	—	Categorized as the Others
Custom duties, VAT	—	Categorized as the Others
Freight	—	Categorized as the Others
Insurance	—	Categorized as the Others

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Remarks
Physical and price contingency	—	Categorized as the Others
Manpower including revenue expenditure etc.	—	Categorized as the Others
—	Training	
4) Design/Supervision		
Consultants	—	Categorized as the Others
5) Others		
—	Foundation	Included in facility construction
—	Erection	Included in facility construction
—	Commission (workout)	To be covered by GOB
—	Custom duties, VAT	To be covered by GOB
—	Freight	Included in Japan's grant aid scheme
—	Insurance	Included in Japan's grant aid scheme
—	Physical and price contingency	N/A
	Consultants	Included in Japan's grant aid scheme
—	Manpower including revenue expenditure etc. (for operation and maintenance)	Included in Japan's grant aid scheme

1-1-3 Analysis in Japan after 1st Field Survey

Analysis in Japan after 1st field survey was concluded to the evaluation mentioned below.

(1) Storage Capacity

As a result of a rough estimation, construction cost of a concrete silo type storage facility with a capacity of 50,000 Mt, which consists of silos, machine building, receiving yard and shipping yard, is estimated to be 3.7 billion Japanese yen. The construction cost of a steel silo type storage facility is estimated to be 5.0 billion Japanese yen. Ultimate capacity is required to be reduced considering budget limitations of the Project.

(2) Parboiled Rice Logistics in Bangladesh

Bulk logistics is not established for rice in Bangladesh. At existing central storage depots (hereinafter referred to as “CSD”) and local supply depots (hereinafter referred to as “LSD”), rice is received, stocked and discharged in bags.

Silo type storage facility is appropriate to bulk transportation. Receiving in bulk makes it possible to save time and contribute to reduce labor costs. However, unpacking at the time of receiving and repacking at the time of discharging are required in silos in Bangladesh, considering present rice logistics. Unpacking and repacking causes extra labor and bag material costs. Accordingly, silo type storage facility is not considered adequate to save time and to reduce labor costs.

(3) Storage Skills, Technology and Experience

In Japan, husked and milled rice are packed in bags and stocked in warehouses equipped with air conditioning machines. Necessary skills and technology for rice storage in warehouses have been established and possible to be used in Bangladesh.

On the other hand, there are no actual examples to stock husked and milled rice in silos in Japan. Stocking parboiled rice in silo seems possible considering actual examples in Thailand. However, stocking in Thailand is targeting only for a short term, and silo facility seems not adaptable to rotation to control grain moisture. Therefore, to realize stocking parboiled rice in silo for long term in Bangladesh, it is necessary to establish skills and technology to control grain moisture by silo rotation, which is adequate to the economic and natural conditions (temperature, humidity) in Bangladesh.

To establish rice storage, natural condition shall be carefully considered. Besides, husked rice is not desired to be stored in silo except short term storage nor mixing of rice in silo, though paddy is possible to be stored for long term by setting of adequate drying machine even in tropical climate. (Source: Report on post harvest treatment of grain in developing countries / Association for International Cooperation of Agriculture & Forestry (Japan))

(4) Storage of Paddy, Husked and Milled Rice in Bangladesh

In Bangladesh, paddy is stocked by farm producer after harvesting by themselves. In the case that paddy was stocked in high moisture without drying process and/or with slight drying process in farming area, paddy is possible to hold harmful fungal, bacteria, insects and their eggs. Such possibility is getting higher when the paddy is getting wet during packing process in farming area and/or handling.

Considering the above, it is crucial requirement to dry the paddy with the moisture of 14% or less according to the standard mentioned in “Internal Procurement Policy for Rice in Bangladesh” shown in the table below, and to fumigate arbitrarily.

In general, moisture of paddy in Bangladesh shows 18 -30 % (average: 25%), which is higher than that of Japan. Unfortunately, drying condition is not appropriate because most farm producers do not have drying machines.

It is possible to dry wet paddy during storage in silos without unevenness drying and body crack, if internal moisture of paddy is going out of rice husk gradually. However, it is required to operate drying machine with high costs when paddy moisture is much higher. Besides, in the view of quality assurance, wet paddy is possible to become moldy during storage in silos.

Additionally, wet paddy is easy to be oxidized through the process below: 1) Internal moisture of paddy is going out of paddy surface by capillary movement. 2) With moisture movement, solute component of paddy is going out of paddy surface. 3) Solute component is deposited at paddy surface and become easy to be oxidized.

It is generally known that wet paddy is easy to become yellowed rice and/or chalky rice. Chalky rice is considered certain factor of quality loss because chalky rice generates broken rice and /or waste rice.

Considering current situation regarding paddy and rice in Bangladesh, paddy is considered not appropriate to stock in silos, because it is difficult to maintain appropriate moisture by farm producer and/or broker.

Table 1-2: Internal Procurement Policy for Rice in Bangladesh

Item	Parboiled Rice	White Rice	Paddy
1. Moisture	14% or less	14% or less	14% or less
2. Broken rice (large)	8% or less	12% or less	
3. Broken rice (small)	2% or less	8% or less	
4. Variety interfusion	8% or less	8% or less	8% or less
5. Damaged rice	1% or less	1% or less	2% or less
6. Dead rice	1% or less	1% or less	0.5% or less
7. Discolored rice	1% or less	1% or less	
8. Paddy interfusion	1/kg or less	2/kg or less	
9. Foreign materials	0.3% or less	0.3% or less	0.5% or less
10. Chalky rice	—	1% or less	
11. Non-parboiled	1% or less	—	
12. Milling	Excellent	Excellent	

(Source : MoFDM)

(5) Receiving Amount

Parboiled rice is transported to CSD and LSD in 85 kg and/or 50 kg bags by rice millers using trucks. Bag size has started to be changed from 85 to 50 kg in conformity with the standard specified by International Labor Organization. Existing CSDs are receiving 500-700 Mt /day during peak season. Unit receiving amount is estimated to be 80 Mt /hour considering receiving for 9 hours per day. In general, 15-20 Mt rice is transported by one truck, despite a maximum carrying capacity of a truck being specified as 7 Mt. 4 to 5 trucks per hour are supposed to be carried into CSD.

Besides, existing wheat silo at Santahar is available to receive 900 Mt /day. Almost all wheat is transported by train both in bulk and in bags.

Parboiled rice is supposed to be packed in bags, transported by trucks owned/hired by millers to the Project site, considering that the Project site is located in the rice basket. Therefore, receiving amount at the Project site is estimated to be 700 Mt at peak.

Table 1-3: Necessary Period for Receiving

Receiving amount/day	Necessary Period for Receiving (Month : based on 20 working day/month)		
	Storage capacity 50,000 Mt	20,000 Mt	15,000 Mt
500 Mt	100 days (5.00 months)	40 days (2.00 months)	30 days (1.50 months)
700 Mt	72 days (3.60 months)	29 days (1.45 months)	22 days (1.10 months)
900 Mt	56 days (2.80 months)	23 days (1.15 months)	17 days (0.85 months)

(Source : Preparatory Survey Team)

(6) Discharging Amount

In the case of a warehouse, it is possible to discharge the same unit amount as is received. Thus, it is

supposed that 700 Mt is possible to be discharged at peak in 9 working hours.

In the case of a silo, packing including stuffing into bags, sealing the bags and transportation to shipping yard, is required at the time of discharging from silos. Generally, one packing machine is possible to pack 5 Mt /hour (50 kg * 100 bags/ hour). In the case that operating 5 packing machines for 24 hours, discharging amount will be 600 Mt /day.

Table 1-4: Necessary Period for Discharging

Discharging amount/hour (Discharging amount/24 hours)	Necessary period for discharging (Month : based on 30 working day/month)		
	Storage capacity 50,000 Mt	20,000 Mt	15,000 Mt
5 Mt/hour (120 Mt/day)	417 days (13.89 months)	167 days (5.56 months)	125 days (4.17 months)
25 Mt/hour (600 Mt/day)	84 days (2.78 months)	34 days (1.11 months)	25 days (0.83 months)

(Source : Preparatory Survey Team)

(7) Technical Comparison

Maximizing storage capacity is required to contribute to the Project purpose, with consideration of local skills and technology, and present logistics system. Accordingly, the Project has executed a technical comparison among silo type requested by GOB, and two types of warehouse, namely, 1) common flat warehouse in Bangladesh not equipped with air conditioning machines, and 2) multistoried warehouse equipped with air conditioning machines, which is possible to maintain grain quality and is common in Japan.

As a result of the comparison, multistoried warehouse equipped with air conditioning machine is considered most appropriate in Bangladesh. The result of comparison is shown in the table below. It shows that multistoried warehouse has advantage in comprehensive evaluation.

Table 1-5: Technical Comparison by Type of Facility

Item	Silo		Multistoried warehouse (with air conditioning machine)		Flat warehouse (similar to existing warehouse)	
Aspect						
Storage type	Storage for unpacked material		Storage for packed material		Storage for packed material	
Site condition						
Required area	Required area is smallest.	A	Required area is larger than silo, but smaller than flat warehouse	B	Required area is largest.	C
Required facility foundation	Facility weight is heaviest. Pile foundation is required.	C	Facility weight is heavier than flat warehouse and lighter than silo.	B	Facility weight is smallest. (In principle no need pile foundation)	A
Quality control						
Fumigation	Frequent fumigation is not required since it is an airtight facility. However, Long period is required for fumigation work as each stock silo volume is very big.	A	More frequent fumigation is required than silos as it only has a certain level of air tightness.	B	The most frequent fumigation is required since it is not an airtight facility.	C
Long term storage	Grain can be stored for long term when moisture is controlled appropriately as it is airtight facility.	A	Grain can be stored for long term when moisture is controlled appropriately. (Moisture is controlled by air conditioning machine.)	A	Grain cannot be stored for long term since storage moisture is not able to be controlled.	C

Item	Silo		Multistoried warehouse (with air conditioning machine)		Flat warehouse (similar to existing warehouse)	
Management	Quantity management can be organized with bulk volume in one time. It is not able to carry out divisional management.	B	Quantity management can be organized even for small amount (divisional management).	A	Quantity management can be organized even for small amount (divisional management). Frequent quality control management are required for moisture control.	C
Logistics						
Adaptation to Bag	Unpacking and re-packing works are required.	C	It is possible to store and discharge bag directly.	A	It is possible to store and discharge bag directly.	A
Adaptation in emergency case	Time and energy is required for bagging.	C	Material can be moved quickly as it is stored in bags.	A	Material can be moved quickly as it is stored in bags.	A
Requirement for Construction						
Cost per unit volume	High	C	Moderate	B	Small	A
Construction Technique	Very high technique is required. Special contractor from other country is also required.	C	Some high techniques are required for construction works.	B	Special technology is not required.	A
Material and equipment	Carrier equipment is required to be imported. (Steel sheet is also needed to be imported if steel silo is constructed)	B	Construction material including concrete can be procured locally.	A	Construction material including concrete can be procured locally.	A
Construction machinery	Heavy crane is required for construction works.	C	Special machinery is not required	A	Special machinery is not required.	A
Construction period	Longest.	C	Moderate.	B	Moderate.	B
Requirement for Operation and maintenance						
Labor cost	A certain volume of labor is required for unpacking and repacking works.	C	The least labor is required.	A	The most labor is required as it is required for receiving and discharging.	C
Equipment other than facility	Periodical maintenance is required for carrier equipment.	C	Periodical maintenance is required for air conditioning machine and carrier equipment. Maintenance cost for equipment is lower than silo facility.	B	Operation and maintenance cost is low as repairing for equipment is not required.	A
Operation cost	Operational cost is highest as it uses much more electricity.	C	Operational cost is moderate.	B	Operation cost is lowest.	A
Comprehensive evaluation	C		A		B	

(A: Excellent, B: Normal, C: Not excellent, Source : Preparatory Survey Team)

1-1-4 2nd and 3rd Field Survey

Considering the result of analysis in Japan after 1st field survey, 2nd and 3rd field survey were conducted. During 3rd field survey, the type of the food storage has been changed from a silo to a multistoried warehouse and both Japan and Bangladeshi sides confirmed to precede the Preparatory Survey for a multistoried warehouse.

Bangladeshi side has understood effectiveness of modernized multistoried warehouse. Both sides have confirmed basic policy of the Project as follows.

- The warehouse shall be equipped with air conditioning machines to control the relative humidity (dehumidifier) and moisture content of stored parboiled rice.
- Parboiled rice packed in 50 kg bags shall be stored in the warehouse using pallets.

- Packed parboiled rice on pallet from unloading area to storing area and/or from storing area to loading area shall be handled by forklift. Besides, manpower is required for unloading from truck to pallet and/or loading from pallet to truck.
- The warehouse shall be used for PFDS to strengthen the food security and food safety, as well as distribution in times of emergency.
- Forklifts, pallets and equipment such as to monitor grain temperature, grain moisture, storage temperature and relative humidity in storage rooms shall be procured, by the Japan Side.
- Technical support and capacity building of concerned staff for operation and maintenance of the modernized multistoried warehouse and forklift system shall be implemented around the starting stage of operation.

Table 1-6: Japanese Assistance (Draft) (3rd Field Survey)

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Japanese Assistance (Draft) (3rd Field Survey)	Remarks
1) Facility			
10 grain storage silos Each having 10,000 Mt capacity	Grain storage silos with capacity 50,000 Mt or less	Multistoried warehouse	
—	Intake chain conveyor system	—	
—	Belt and bucket elevator	—	
—	Loading chain and flight conveyor	—	
—	Bulk weigh system (hopper scale)	—	
—	Unloading chain and flight conveyor system	—	
—	Electric motors	—	
—	Silo accessories	—	
—	Aeration system	—	
—	Temperature, Silo monitoring system	—	
—	Silo sweep auger	—	
—	Silo discharge gate packages	—	
—	Bagging system	—	
—	Packing and loading	—	
—	Stores and spares	—	
Approach road and side development including water supply, sanitation and piling	—	—	To be covered by GOB
Development of railway infrastructure	—	—	To be covered by GOB

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Japanese Assistance (Draft) (3rd Field Survey)	Remarks
Inspection bungalow and office building	Office building	—	To be covered by GOB
2) Equipment			
Intake chain conveyor system	—	Forklifts	
Belt and bucket elevator	—	Pallets	
Loading chain and flight conveyor	—	Monitoring equipment	
Bulk weigh system (hopper scale)	—	—	
Unloading chain and flight conveyor system	—	—	
Electric motors	—	—	
Silo accessories	—	—	
Aeration system	—	—	
Temperature, Silo monitoring system	—	—	
Silo sweep auger	—	—	
Silo discharge gate packages	—	—	
Electric 3 way bulb	—	—	
Electric 2 way bulb	—	—	
Bagging system	—	—	
Packing and loading	—	—	
Shipping documents	—	—	
Stores and spares	—	—	
Training	—	—	
3) Soft components (Technical assistance)			
Foundation	—	—	
Erection	—	—	
Commission	—	—	
Custom duties, VAT	—	—	
Freight	—	—	
Insurance	—	—	
Physical and price contingency	—	—	
Manpower including revenue expenditure etc.	—	—	
—	Training	Technical support and capacity building	
4) Design/Supervision			
Consultants	—	—	Included in Japan's grant aid scheme

Original request (July 2009)	Japanese Assistance (Draft) (1st Field Survey)	Japanese Assistance (Draft) (3rd Field Survey)	Remarks
5) Others			
—	Foundation	—	Included in facility construction
—	Erection	—	Included in facility construction
—	Commission (workout)	—	To be covered by GOB
—	Custom duties, VAT	—	To be covered by GOB
—	Freight	—	Included in Japan's grant aid scheme
—	Insurance	—	Included in Japan's grant aid scheme
—	Physical and price contingency	—	N/A
	Consultants	—	Included in Japan's grant aid scheme
—	Manpower including revenue expenditure etc.(for operation and maintenance)	—	To be covered by GOB

1-2 Natural Conditions

(1) Meteorological Condition

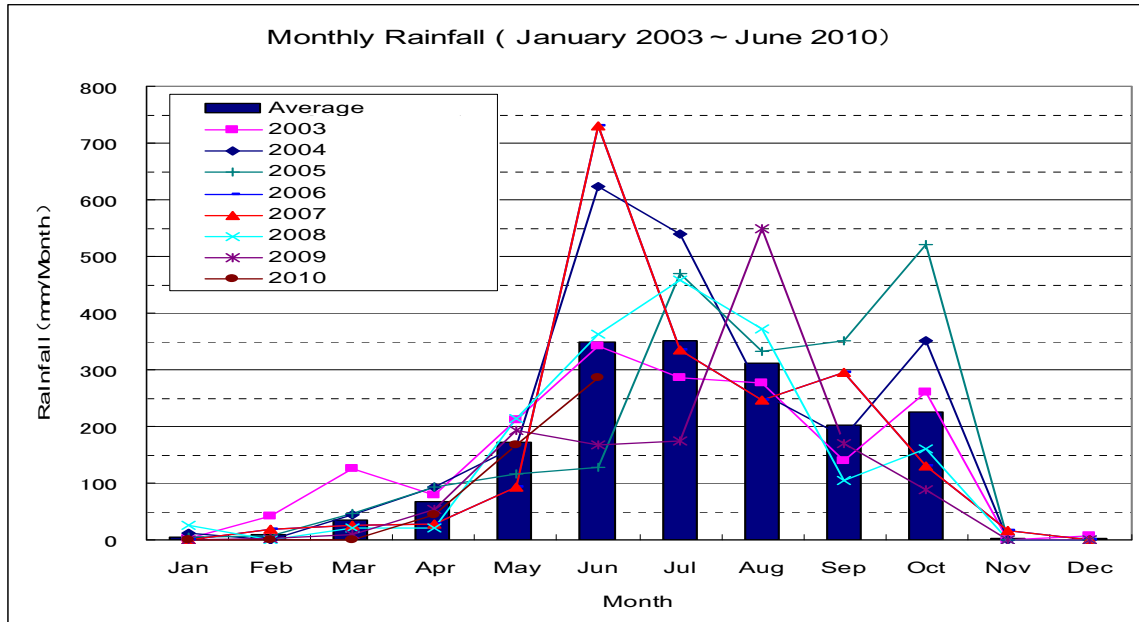
1) Rainfall

Bangladesh is belonging to tropical monsoonal climate. Its season is divided into rainy season (May to October) and dry season (November to April). Monthly maximum rainfall is recorded between June and July. Rainfall data at Bogra is recorded in the table below.

Table 1-7: Daily Rainfall at Bogra (mm)

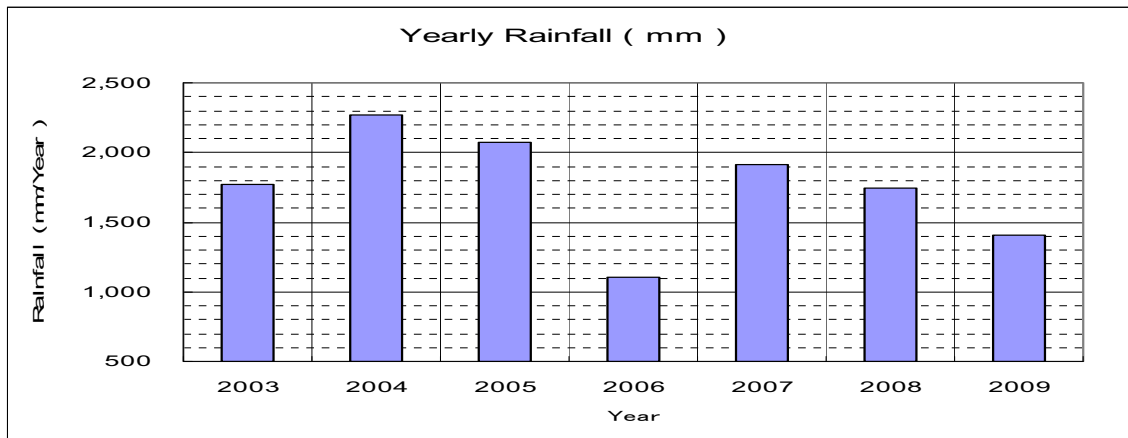
Month	Day	Daily Rainfall (mm)																															Total (mm/mth)	More than 10mm (days/mth)
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
Average (2003-2010)	Jan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	1.0	2.2	0.0	0.1	0.0	0.0	0.1	1.7	0.0	5.4	0
	Feb	1.4	0.0	0.0	0.0	0.3	0.0	0.7	0.0	0.1	1.2	1.5	0.3	0.9	0.5	0.0	0.0	0.2	0.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0
	Mar	1.6	0.0	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	3.7	0.0	0.3	0.1	0.0	0.0	0.9	5.7	0.0	0.0	0.0	0.3	4.2	0.6	1.3	0.0	0.0	3.4	3.2	5.5	35.6	0
	Apr	0.0	0.2	2.5	0.0	0.1	0.0	2.6	0.2	5.3	0.3	1.3	0.0	2.5	1.6	1.6	0.0	3.0	1.9	5.5	2.5	8.7	1.7	10.0	1.8	2.4	0.8	0.2	0.0	5.5	6.6	68.2	1	
	May	1.6	5.5	4.0	2.6	8.1	2.6	1.4	6.3	0.0	7.6	3.9	10.2	2.6	1.1	0.3	0.0	4.3	10.8	4.1	7.6	14.0	18.9	2.7	14.9	10.8	5.2	3.8	3.6	2.1	4.2	8.0	172.4	6
	Jun	20.1	7.6	6.4	18.1	11.8	9.0	5.9	11.8	23.1	28.1	11.5	2.8	11.7	7.8	12.2	10.6	9.6	10.5	9.2	4.6	9.6	18.7	9.5	15.4	12.2	6.1	3.3	20.1	15.1	6.8	349.3	16	
	Jul	18.7	8.6	7.1	7.0	7.9	8.6	13.3	14.9	7.8	2.5	5.4	19.9	25.6	9.5	10.9	16.4	1.6	21.4	25.9	9.5	15.7	6.1	12.6	5.7	4.5	6.8	9.4	26.3	9.2	3.6	7.6	350.1	12
	Aug	7.9	7.3	8.9	10.3	2.8	8.0	8.9	0.3	17.6	17.8	7.0	21.6	16.3	12.4	17.1	7.6	16.6	13.4	32.4	1.5	4.8	4.3	6.1	7.8	13.8	3.6	5.8	18.5	0.3	6.2	4.1	311.0	12
	Sep	2.6	6.3	7.1	3.3	6.7	18.2	18.4	5.8	17.1	4.6	5.7	0.7	6.6	3.3	5.0	4.8	1.5	4.7	4.1	8.8	25.6	15.6	3.7	3.7	0.7	1.1	4.1	3.9	9.0	0.6	203.3	5	
	Oct	0.7	28.0	11.5	12.1	13.6	16.5	26.0	9.4	27.4	0.1	2.9	4.4	0.3	5.7	0.5	0.0	0.0	5.4	6.1	6.4	8.7	16.0	3.9	0.0	0.7	14.9	4.5	0.0	0.0	0.0	225.6	9	
	Nov	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.5	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0	
	Dec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.2	0	
Total																																1,733.3	61	

(Source: Bangladesh Meteorological Department)



(Source: Bangladesh Meteorological Department)

Figure 1-1: Monthly Rainfall

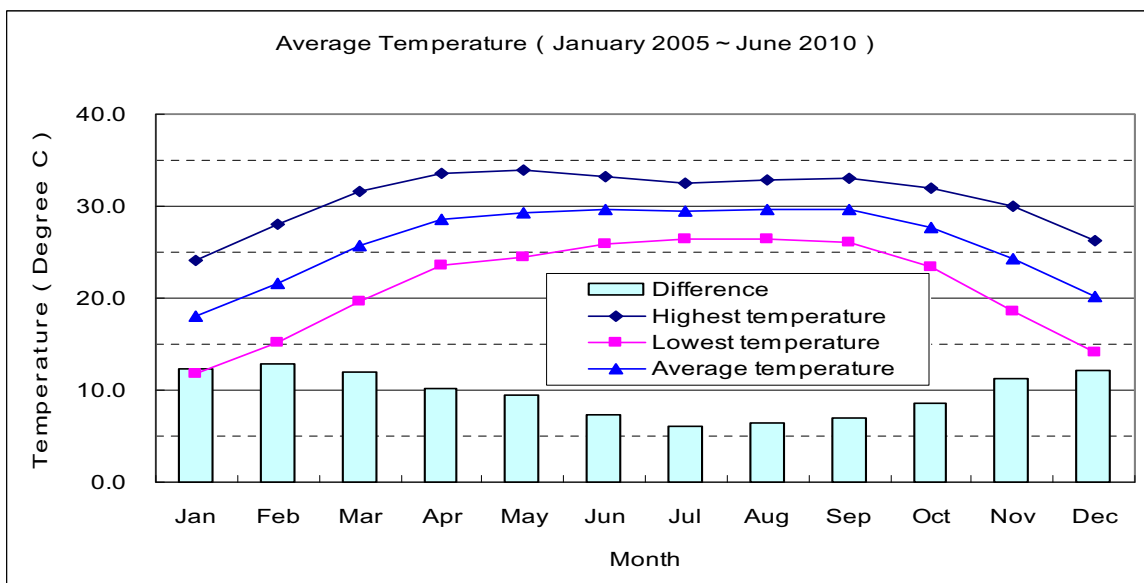


(Source: Bangladesh Meteorological Department)

Figure 1-2: Yearly Rainfall

2) Air Temperature

Air temperature is fairly constant from March through October. Highest temperature is between April and May. Air temperature is dropping and daily temperature range then gets smaller until July. Air temperature data at Bogra is recorded in the table below.



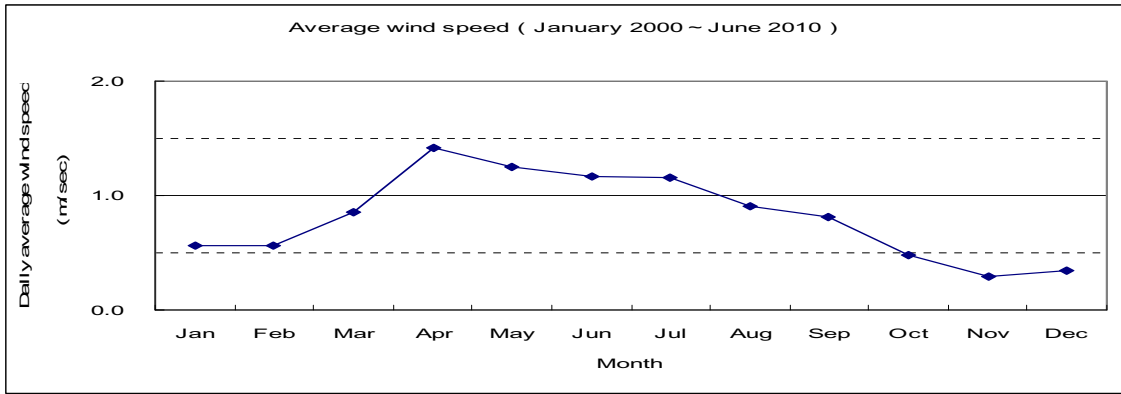
(Source: Bangladesh Meteorological Department)

Figure 1-3: Air Temperature

3) Wind Speed

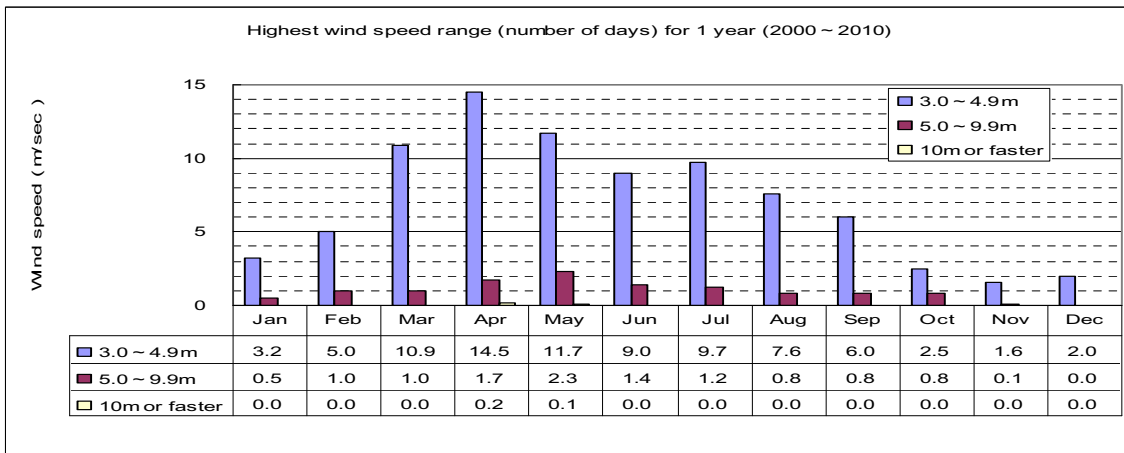
Bengal Bay coast is often damaged by cyclones. On the other hand, strong wind with the speed of 10m/s or faster was recorded 3 days only in last decade (2000-2010) around the Project site.

Wind speed data at Bogra is recorded in the table below.



(Source: Bangladesh Meteorological Department)

Figure 1-4: Wind Speed

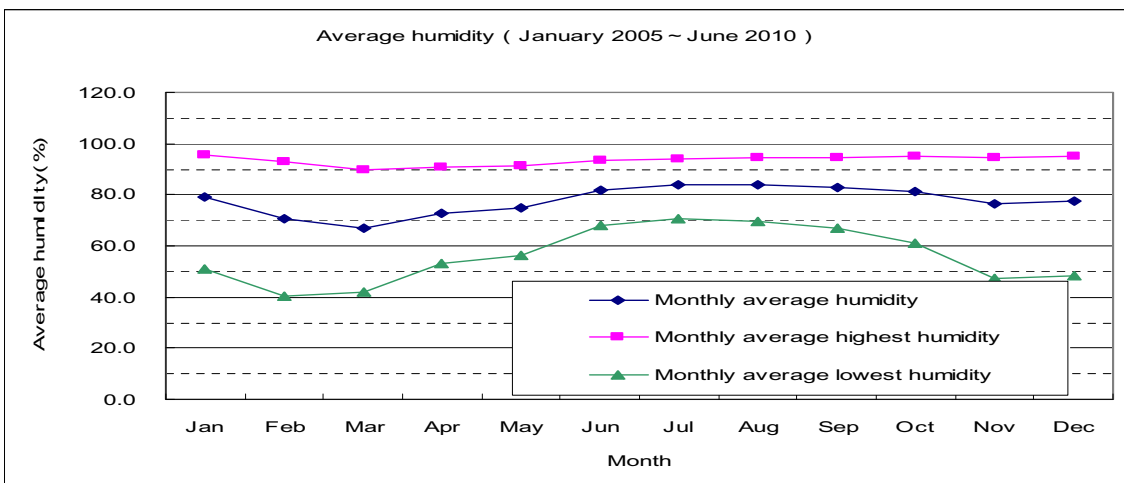


(Source: Preparatory Survey Team)

Figure 1-5: Highest Wind Speed Range (Number of Days) for 1 Year

4) Humidity

Humidity level is high all through the year in Bangladesh. Average highest relative humidity in Bogra is 90% or over all through the year.



(Source: Preparatory Survey Team)

Figure 1-6: Average Relative Humidity

(2) Natural Disaster

1) Cyclone

Every year, several cyclones strike coastal areas of Bangladesh. Cyclones cause severe damage by strong winds and heavy rains. Besides, coastal areas will be damaged by storm surges caused by cyclones that occur during spring and high tides.

Table 1-8: Summary of Cyclones

Date (DD/MM/YY)	Situation	Place	Highest wind speed (km/hr)	Highest raised height of tide(ft)	Atmosphere (mbs)
11.10.60	Severe Cyclonic Storm	Chittagong	160	15	-
31.10.60	Severe Cyclonic Storm	Chittagong	193	20	-
09.05.61	Severe Cyclonic Storm	Chittagong	160	8-10	-
30.05.61	Severe Cyclonic Storm	Chittagong (Near Feni)	160	6-15	-
28.05.63	Severe Cyclonic Storm	Chittagong- Cox's Bazar	209	8-12	-
11.05.65	Severe Cyclonic Storm	Chittagong-Barisal Coast	160	12	-
05.11.65	Severe Cyclonic Storm	Chittagong	160	8-12	-
15.12.65	Severe Cyclonic Storm	Cox's Bazar	210	8-12	-
01.11.66	Severe Cyclonic Storm	Chittagong	120	20-22	-
23.10.70	Severe Cyclonic Storm of Hurricane	Khulna-Barisal	163	Moderate	-
12.11.70	Severe Cyclonic Storm with a core of hurricane wind	Chittagong	224	10-33	-
28.11.74	Severe Cyclonic Storm	Cox's Bazar	163	9-17	-
10.12.81	Cyclonic Storm	Khulna	120	7-15	989
15.10.83	Cyclonic Storm	Chittagong	93	-	995
	Severe Cyclonic Storm	Cox's Bazar	136	5	986
24.05.85	Severe Cyclonic Storm	Chittagong	154	15	982
29.11.88	Severe Cyclonic Storm with a core of hurricane wind	Khulna	160	2-14.5	983
18.12.90	Cyclonic Storm (crossed as a depression)	Cox's Bazar Coast	115	5-7	995
29.04.91	Severe Cyclonic Storm with a core of hurricane wind	Chittagong	225	12-22	940
02.05.94	Severe Cyclonic Storm with a core of hurricane wind	Cox's Bazar-Teknaf Coast	278	5-6	948
25.11.95	Severe Cyclonic Storm	Cox's Bazar	140	10	998
19.05.97	Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	232	15	965
27.09.97	Severe Cyclonic Storm with a core of hurricane wind	Sitakundu	150	10-15	-
20.05.98	Severe Cyclonic Storm with core of hurricane winds	Chittagong Coast near Sitakunda	173	3	-
28.10.00	Cyclonic Storm	Sundarban, Coast near,	83	-	-
12.11.02	Cyclonic Storm	Sundarban, Coast near, Raimangal River	65-85	5-7	998
19.05.04	Cyclonic Storm	Cox's, Bazar, Coast between Teknaf and Akyab	65-90	2-4	990
15.11.07	Severe Cyclonic Storm with core of hurricane winds (SIDR)	Khulna-Barisal Coast near Baleshwar river	223	15-20	942

(Source: Bangladesh Meteorological Department)

2) Tornado

Tornado is formulated at the time of changing of seasons from dry season to rainy season. Disaster area is mainly located in Bengal Bay coast.

Table 1-9: Summary of Tornado

Date (DD/MM/YY)	Place	Area of devastation (sq. km)	Duration (Minutes)	Highest wind speed (km/hr)	People killed	Number of injured	Loss of property (Million BDT)
14/04/69	Demra	155.5-168.4	5-7	644	922	16,511	40-45
17/08/73	Manikganj	20.7	8-10	322	100	1,000	10
10/04/74	Faridpur	25.9-39.9	12-15	242	46	Innumerable	Several
11/04/74	Bogra	25.9-31.1	10-15	242	28	75	10
09/05/76	Narayanganj	2.59	1-2	242	1	42	Several
01/04/77	Faridpur	51.8	2-3	322	500	6,000	12
26/04/89	Manikganj (Saturia)	150.2	Several minutes	388-419	526	Innumerable	Several
20/04/90	Sirajganj	77.7	40	193	29	2,000	-
07/05/91	Gazipur	-	Several minutes	298	46	400	-
18/05/91	Gouranadi	207.2	Several minutes	251	17	400	-
08/05/95	Lowhajang	-	Several minutes	250	34	several hundreds	-
13/05/96	Tangail	16 unions	5-8	320-400	570	30,000	-

(Source: Bangladesh Meteorological Department)

3) Earthquake

Much serious damage by earthquakes has not been recorded in Bangladesh. Damage has occurred in limited area around seismic center.

Table 1-10: Summary of Earthquake in and around Bangladesh (1918-2010)

Date (DD/MM/YY)	Seismic center				Magnitude in Richter's scale	Date (DD/MM/YY)	Seismic center				Magnitude in Richter's scale	Date (DD/MM/YY)	Seismic center				Magnitude in Richter's scale
	Latitude (N)		Longitude (E)				Latitude (N)		Longitude (E)				Latitude (N)		Longitude (E)		
	Deg.	Mts.	Deg.	Mts.			Deg.	Mts.	Deg.	Mts.			Deg.	Mts.	Deg.	Mts.	
08-07-1918	24	30	91	0	7.6	11-08-2007	26	27	89	24	4.9	27-02-2009	20	29	89	31	4.8
09-09-1923	25	18	91	0	7.1	31-08-2007	23	4	90	45	3.9	14-04-2009	24	9	91	29	3.7
02-09-1930	25	30	90	0	7.1	19-09-2007	25	18	90	59	4.6	19-04-2009	25	37	91	28	3.4
24-03-1932	25	0	90	0	7.4	13-03-2008	27	46	91	0	4.5	25-04-2009	26	24	91	42	4.1
27-03-1932	24	30	92	0	7.4	20-03-2008	24	42	90	38	4.4	05-05-2009	26	32	89	1	3.4
09-11-1932	26	30	92	0	7.4	09-05-2008	23	51	91	47	3.6	15-05-2009	25	36	91	56	3.0
06-03-1933	26	0	90	30	7.6	24-05-2008	27	59	89	15	3.2	26-06-2009	23	15	91	10	3.7
21-05-1935	28	48	89	18	6.3	29-05-2008	26	24	91	46	4.9	13-07-2009	26	9	89	39	4.5
21-01-1941	27	0	92	0	6.8	05-07-2008	26	7	91	39	5.1	21-09-2009	27	40	91	36	6.4
23-02-1954	28	30	91	30	6.5	06-07-2008	26	56	88	46	4.0	21-09-2009	27	21	91	28	4.9
22-02-1959	28	30	91	30	5.7	20-09-2008	23	50	91	7	4.8	21-09-2009	27	20	91	13	4.7
18-02-1964	27	30	91	6	5.6	20-09-2008	23	19	90	50	3.3	21-09-2009	27	43	91	14	4.6
06-11-1965	27	12	91	36	4.8	20-09-2008	23	41	91	3	4.6	21-09-2009	27	31	91	25	4.4
06-09-1967	24	6	91	42	5.0	20-09-2008	23	33	91	1	4.8	22-09-2009	27	30	91	25	3.9
15-09-1967	27	24	91	48	5.8	20-09-2008	23	48	91	6	4.3	23-09-2009	26	15	89	24	4.3
14-11-1967	25	0	91	30	5.1	21-09-2008	23	28	90	56	3.0	30-10-2009	27	29	91	36	5.2
27-12-1968	24	6	91	36	5.2	21-09-2008	23	48	91	3	2.9	30-10-2009	26	40	90	1	4.2
05-11-1969	27	42	90	12	5.0	21-09-2008	23	19	90	56	2.8	08-11-2009	26	43	88	10	4.6
25-07-1970	25	42	88	30	5.2	26-09-2008	24	25	90	24	3.3	18-11-2009	27	35	90	1	4.4
28-08-1970	24	42	91	42	4.9	26-09-2008	23	25	89	54	3.1	19-11-2009	26	3	90	53	3.9
02-02-1971	23	48	91	48	5.4	01-10-2008	24	23	90	13	3.5	15-12-2009	21	42	91	56	3.4
31-10-1971	26	12	90	42	4.6	04-10-2008	24	24	90	20	2.8	31-12-2009	27	31	91	15	5.4
06-11-1972	27	0	88	42	4.8	09-11-2008	26	32	88	21	3.6	10-03-2010	24	50	90	38	4.1
21-09-1974	25	42	90	54	4.7	19-11-2008	24	17	90	47	4.1	12-06-2010	23	59	91	24	4.0
23-06-1976	21	24	88	42	5.3	19-11-2008	24	27	90	25	4.0	21-07-2010	27	12	91	10	4.5
21-05-1984	23	42	91	30	5.3	19-12-2008	21	0	90	43	4.4	31-07-2010	23	9	90	36	3.7
30-09-1984	25	24	91	30	5.4	25-12-2008	27	4	88	15	4.5	10-09-2010	23	9	90	29	3.6
03-05-2007	25	40	91	0	4.1	05-01-2009	27	22	90	53	4.8	10-09-2010	23	14	90	45	4.8
08-05-2007	25	21	90	10	3.6	06-01-2009	24	11	89	25	4.7	11-09-2010	25	52	90	39	5.2
18-05-2007	28	5	90	12	4.7	29-01-2009	23	33	88	54	3.6	15-09-2010	23	12	90	40	3.9
20-05-2007	27	15	88	44	5.3	09-02-2009	23	58	91	21	3.1	21-09-2010	24	48	94	45	4.4
25-06-2007	22	57	91	52	2.8	16-02-2009	26	15	90	1	4.0						

(Source: Bangladesh Meteorological Department)

Table 1-11: Magnitude of Earthquake in and around Bangladesh (1918-2010)

Year	Magnitude in Richter's scale								Total	Highest tremor
	Unknown	0 - 3.00	3.00 - 3.99	4.00 - 4.99	5.00 - 5.99	6.00 - 6.99	7.00 - 7.99	8.00 -		
1918							1		1	7.6
1923							1		1	7.1
1927						1			1	6.5
1930							2		2	7.1
1932							5		5	7.4
1933							1		1	7.6
1934						1		1	2	8.3
1935						3			3	6.5
1936							2		2	7.5
1938						3	1		4	7.2
1940						1			1	6.5
1941					1	3			4	6.8
1943							1		1	7.2
1954						1	1		2	7.4
1955						1			1	6.8
1956						3			3	6.3
1957						2			2	6.8
1958						1			1	6.4
1959					1	1			2	6.1
1960					1				1	5.7
1963				5	7				12	5.6
1964				4	3	4			11	6.7
1965				1	5				6	5.9
1966				3	4				7	5.7
1967				4	8				12	5.8
1968				2	2				4	5.2
1969		2		3	6				11	5.9
1970				4	6	1			11	6.5
1971				6	5				11	5.5
1972	1			6	2				9	5.0
1973				6	5				11	5.3
1974			2	9	1				12	5.1
1975				4	4	1			9	6.5
1976	2		1	8	1				12	5.3
1977	1				1				2	5.6
1978	3								3	
1979	3								3	
1980	3					1			4	6.0
1982	2								2	
1983	3								3	
1984	1				4				5	5.6
1985	9								9	
1986	5								5	
1987	5								5	
1988	6								6	
1989	24								24	
1990	8								8	
1991	4			2	2				8	5.3
1992	7			12	6				25	5.8
1993	6		1	10	2	1			20	6.3
1994	4			2	3	2			11	6.2
1995	6			3	2	1			12	6.4
1996	7								7	
1997		11	1	1	3			1	17	8.5
1998		9		1					10	4.9
1999	21								21	
2000	14	3	4	6	3				30	5.5
2001	3	2	13	16	4				38	5.5
2002	2	4	16	23	3				48	5.5
2003	1	2	6	5	5				19	5.8
2004			3	8			1		12	7.4
2005		2	10	8	5				25	5.6
2006		1	4	8	3				16	5.9
2007		7	21	19	33	42	11	1	134	8.5
2008		7	16	55	158	73	13		322	7.7
2009			19	37	105	56	12		229	7.9
Total	151	50	117	281	404	203	52	3	1,261	

(Source: Bangladesh Meteorological Department)

(3) Topographical Condition

Topographic survey was conducted by re-consignment with a survey company in Bangladesh, in order to investigate appropriateness of the site and to grasp exact geological condition to establish adequate layout plan.

Project site have been found that it is basically flat. Therefore, large scale construction work including cutting and/or filling the land is not required.

(4) Geological Condition

Geological survey was conducted by re-consignment with a survey company in Bangladesh, in order to establish adequate structural plan.

Bangladesh is located in Alpine-Himalayan belt. Geological province of Bangladesh is designated as mountainous land, diluvia tableland, alluvial tableland and alluvial plain field. Almost of all country is located in alluvial plain field, which is created of alluvial fan, back marsh and delta.

Alluvial formation is formulated by silt and clay. Thickness of alluvial formation of Bangladesh is approximately 50 m. Soil texture of alluvial formation vary widely both vertical and horizontal direction, therefore, characteristic features, density and consistency of soil vary widely too. The variety of soil is created by changing of flow channel caused by complicated river developing.

Surface of ground in the Project site is alluvial formation. Soil condition of Project site is found as follows by geological survey; from surface to 7 m under surface: filled clay mixed with silt, from 7 m under surface to 13-14m under surface: soft sand, 13m under surface or deeper: stiff sand. N value is recorded 50 or over at 16 m under surface or deeper. Location of boring test, result of standard penetration test and geological columnar section are shown as below.

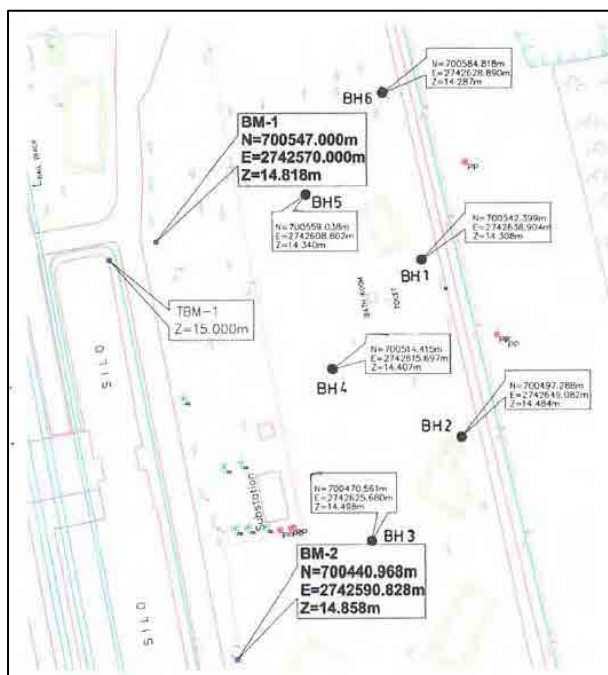


Figure 1-7: Location of Boring Test

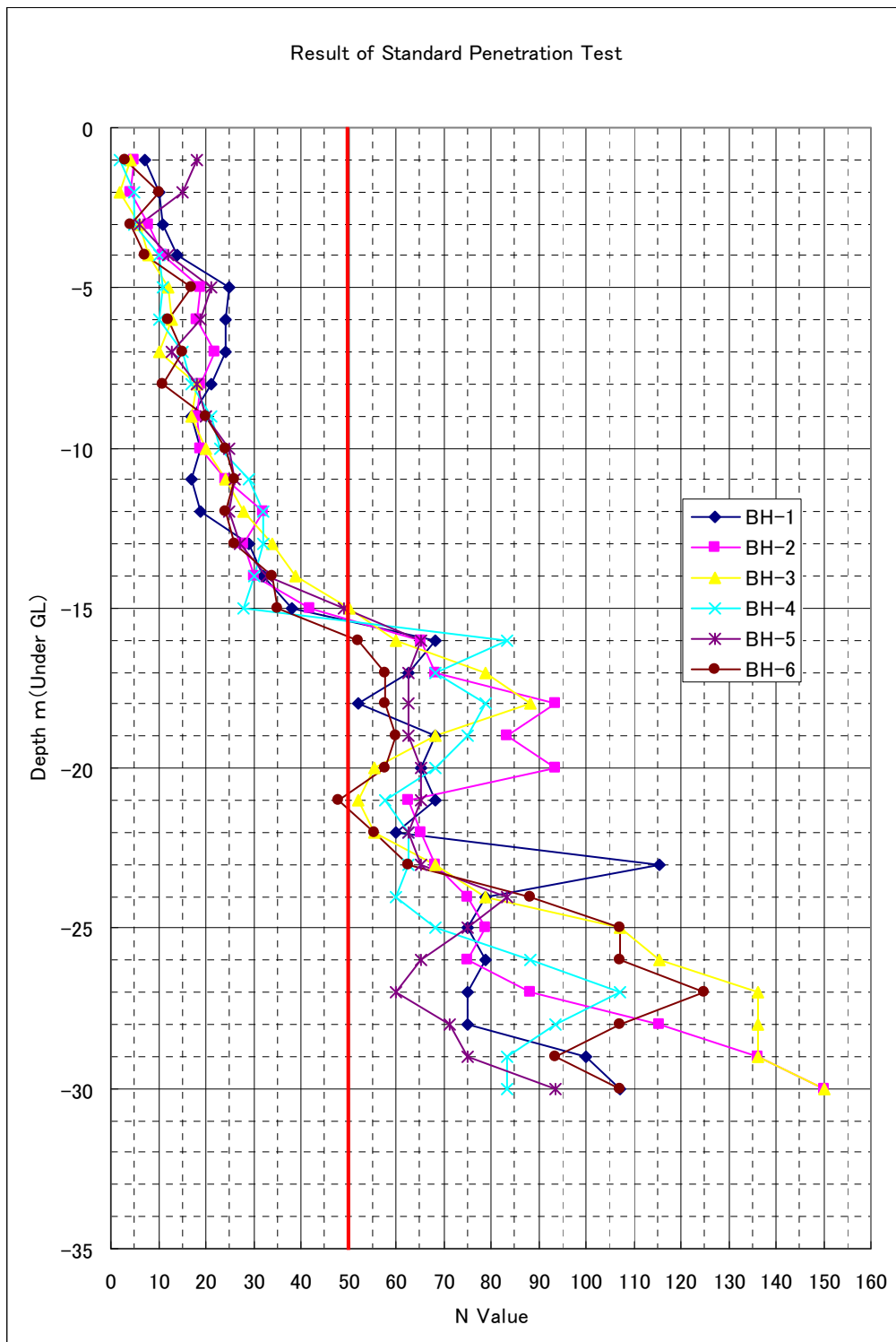


Figure 1-8: Result of Standard Penetration Test

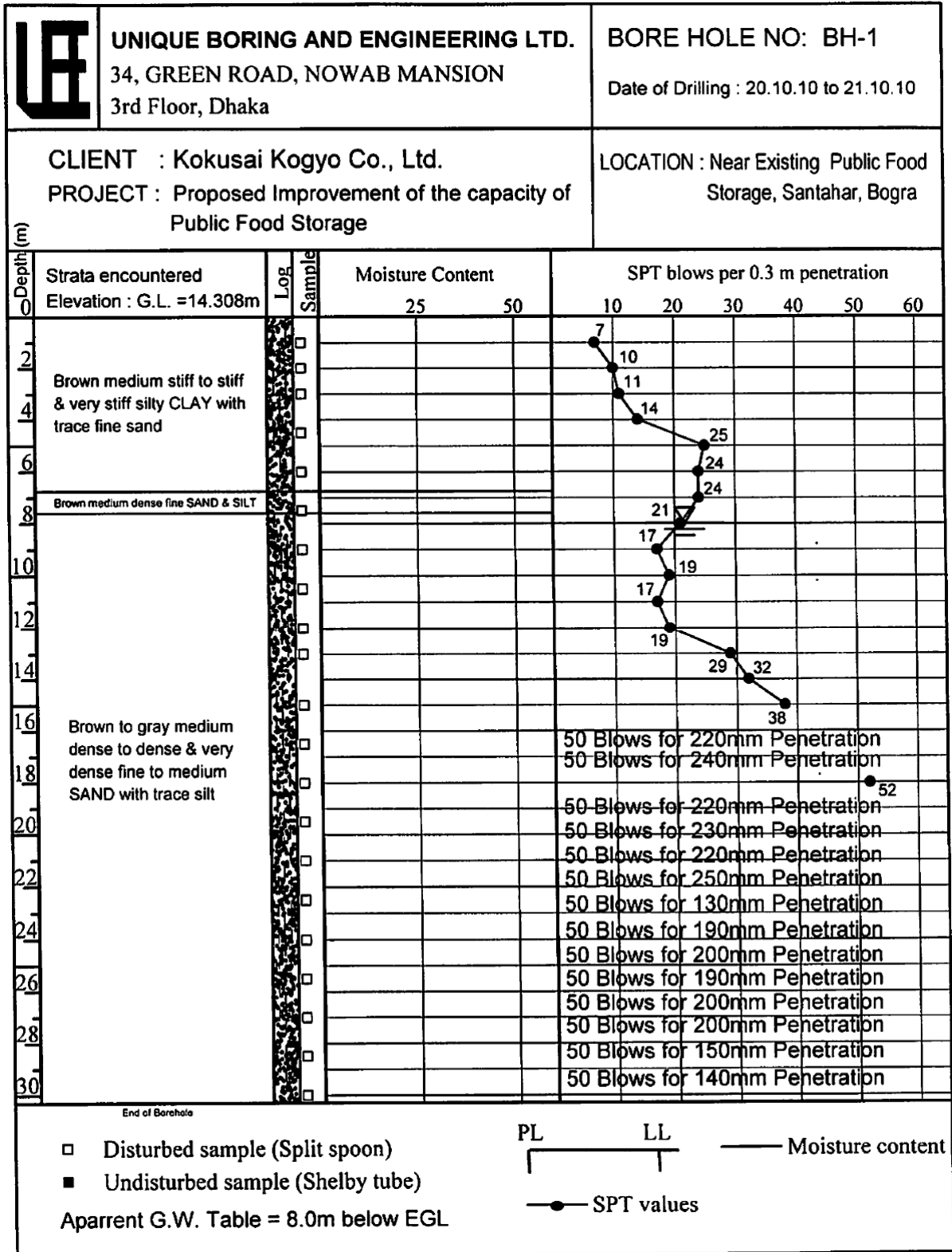


Figure 1-9: Geological Columnar Section

1-3 Environmental and Social Considerations

(1) Points of Concern to Implement the Project

Construction works and equipment procurement of the Project are planned to be implemented in Santahar Silo Premises only. Undesirable impact to environment and society by the Project are considered minimum or nothing. The Project is categorized C in the “guideline for environmental and social consideration” issued by JICA.

(2) Future Construction of the Railway

Both meter gauge and wide gauge railways are connected into Project site and used for existing wheat silo. Railway for construction area have been constructed and already removed, therefore, additional railway is required for construction area of the Project, if necessary. The Project shall consider future railway construction considering that GOB have an idea to construct railway in the medium and long term, though there is no concrete plan to construct railway.

For construction of railway, resident transfer is required because 10 facilities and at least 26 residents have been confirmed along existing road at the proposed railway construction area. Existing road and surroundings area are owned by GOB. Residents have recognized that they are living temporary at the area owned by GOB and shall transfer if ordered.

Necessary arrangement shall be taken by Bangladeshi side for Environmental and Social Consideration by following Bangladesh Environmental Conservation Act, 1995.

Chapter2 Contents of the Project

Chapter 2. Contents of the Project

2-1 Basic Concept of the Project

(1) Overall Goal and Project Purpose

GOB has targeted to reduce the number of people living in poverty by 2015, in United Nations Millennium Development Goals (MDGs), and to realize its MDGs by setting food security as an important policy issue to secure sufficient food production and access to food by all of its people, including those in poverty. Additionally, the importance of food security is highlighted in PRSP, as well as strengthening of public food distribution and construction of food storage facilities are promoted based on recognition to overcome the weakness against food insecurity when natural disasters occur. Besides, necessity to improve the capacity of public food storage is emphasized in National Food Policy and its action plan in Bangladesh.

DG Food has a plan to establish food storage facilities with the total capacity of 784,000 Mt in their 6th Five Year Plan (2011-2015). Total capacity of food storage managed by DG Food is 1,540,000 Mt only on March 2010, and is considered to be improved up to 3,000,000 Mt until the year of 2015. As shown in the table below, the project to establish food storage with a total capacity of 379,000 Mt has been approved by Executive Committee of the National Economic Council (hereinafter referred to as “ECNEC”).

Table 2-1: Plan to Establish Food Storage Facilities in 6th Five Year Plan (2011-2015)

	Project name	Item	Amount(Mt)	Period	Financial source	Remarks
1	Improvement of food security network in the northern region (Rajshahi Division)	Flat warehouse	110,000	Jul. 2009 to Jun. 2011	DRGA-CF	Approved by ECNEC
2	Improvement of food security network in the coastal region (Khulna and Barisal Division)	Wheat Silo	50,000	Jan. 2010 to Dec. 2013	JDCF	Approved by ECNEC
3	Improvement of food security network throughout Bangladesh	Flat warehouse	135,000	Jul. 2010 to Jun. 2013	GOB	Approved by ECNEC
4	Improvement of food security network in the Chittagong port area	Flat warehouse	84,000	Jul. 2010 to Jun. 2012	GOB	Approved by ECNEC
5	Ensure longer and safe storage facility for creating national buffer stock in the country	Rice silo	100,000	(Under study)	(Under study)	(Under study)
6	Improvement of food security network throughout the country	Flat warehouse	105,000	(Under study)	(Under study)	(Under study)
7	Ensure longer and safe storage facility creating national buffer stock in the country	Rice silo	100,000	(Under study)	(Under study)	(Under study)
8	Ensure longer and safe storage facility creating national buffer stock in the country	Rice silo	100,000	(Under study)	(Under study)	(Under study)
9	To implement e-governance system for Directorate General of Food and ICT based food management system	—	—	(Under study)	(Under study)	(Under study)
	Total		784,000			

(Source: Directorate General of Food)

In Bangladesh, food is distributed through PFDS. PFDS is a provision for distribution to those in poverty who lack food, distribution to areas damaged by natural disaster, ensuring a buying price from farmers to enhance domestic production, demand and distribution adjustment, and market price stability.

A break-down of PFDS distribution channels is shown in the table below. Distribution to Open Market Sales (hereinafter referred to as “OMS”), Food for Work (hereinafter referred to as “FFW”), Vulnerable Group Feeding (hereinafter referred to as “VGF”), and Vulnerable Group Development (hereinafter referred to as “VGD”) are relatively high.

Table 2-2: Distribution through PFDS

PFDS Channel		2005-2006		2006-2007		2007-2008		2008-2009		2009-2010	
		Distribution	%	Distribution	%	Distribution	%	Distribution	%	Distribution	%
Monetized	Essential Priorities	145,563	14%	153,501	12%	11,631	12%	133,341	8%	151,946	12%
	Other Priorities	11,276	1%	11,491	1%	1,170	1%	17,076	1%	16,672	1%
	Large Employment Industries	0	0%	5,861	0%	988	1%	10,007	1%	9,742	1%
	Open Market Sales	18,317	2%	408,011	32%	34,593	35%	194,454	11%	259,429	20%
	Garments	0	0%	0	0%	0	0%	0	0%	43,048	3%
	Fair Price	0	0%	0	0%	0	0%	0	0%	6,091	0%
	Others	50,981	5%	0	0%	0	0%	21	0%	67	0%
	Sub total	226,137	22%	578,864	45%	48,382	50%	354,899	20%	486,995	37%
Non-Monetized	Food for Work	227,390	23%	122,474	10%	6,821	7%	362,281	21%	263,356	20%
	Vulnerable Group Development	167,637	17%	116,588	9%	16,122	17%	136,900	8%	66,761	5%
	Test Relief	173,775	17%	148,513	12%	8,675	9%	257,806	15%	163,316	13%
	Gratuitous Relief	32,355	3%	31,704	2%	394	0%	46,546	3%	36,991	3%
	Vulnerable Group Feeding	127,591	13%	230,329	18%	12,144	12%	507,169	29%	248,286	19%
	Hill Tracts/Others	53,145	5%	59,359	5%	5,119	5%	91,657	5%	38,763	3%
	Sub total	781,893	78%	708,967	55%	49,275	50%	1,402,359	80%	817,473	63%
Total		1,008,030	100%	1,287,831	100%	97,657	100%	1,757,258	100%	1,304,468	100%

(Source: Directorate General of Food)

Storing sufficient amount of food is required in Bangladesh in order to strengthen food storage capacity and to ensure stable distribution to those in poverty and affected by disasters.

The purpose of the Project is “to establish food storage facility to ensure food quality for long term in Santahar, Rajshahi Division located in the grain belt of Bangladesh”. And the overall goal of the Project is “to improve the capacity of food storage and to realize food security in times of emergency”.

(2) Outline of the Project

To achieve the above purpose, the Project shall include construction of food storage facility, procurement of required equipment, and establish the system to store and distribute parboiled rice without quality deterioration. In the Project, Japan’s Grant Aid shall cover construction of warehouse, procurement of equipment required for operation of warehouse and technical assistance (soft component) to realize sound and sustainable operation and maintenance.

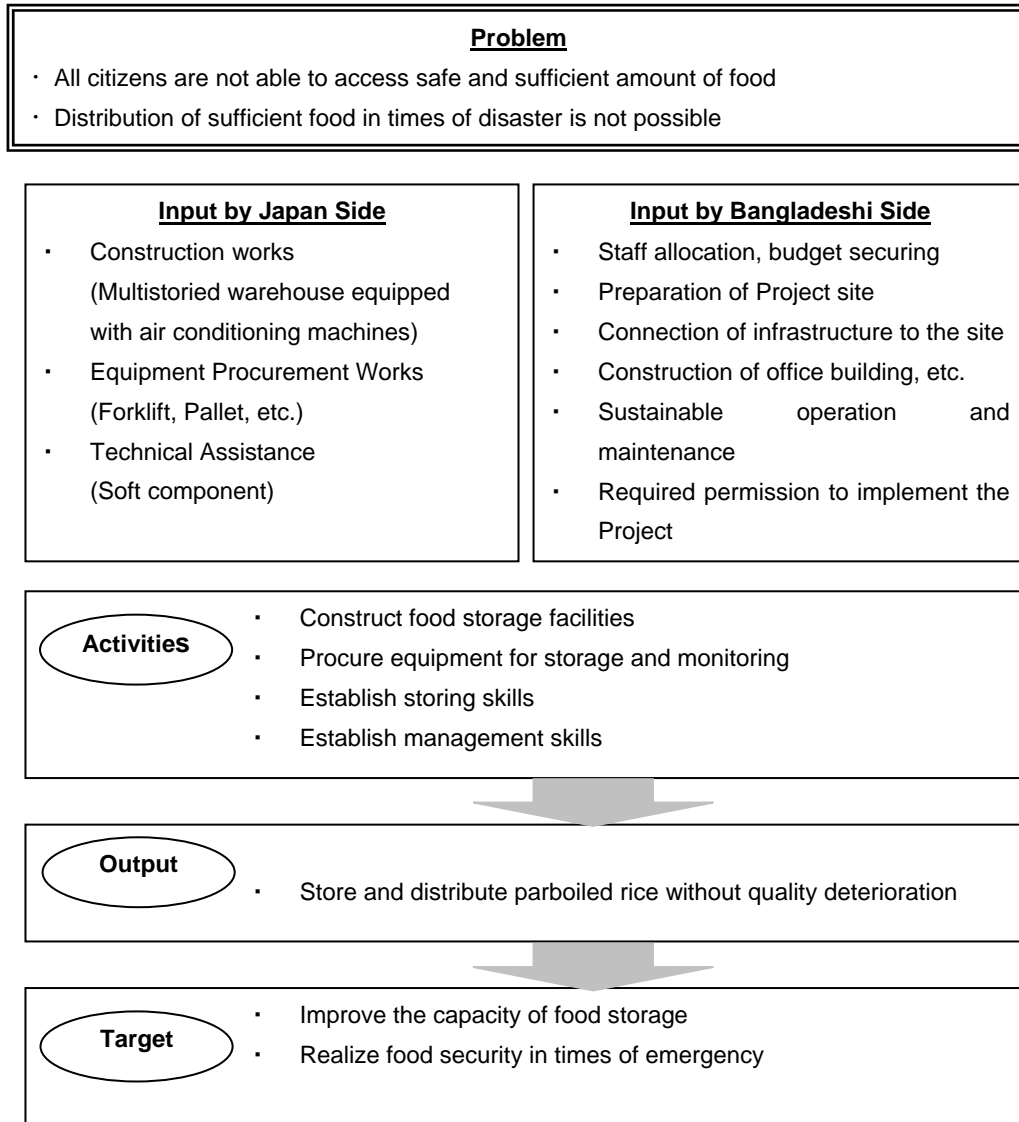


Figure 2-1: Outline of the Project

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy

(1) Contents of the Project

For wheat storing, DG Food have experiences to store in flat warehouse, as well as in silo type storage facilities. On the other hand, for rice storing they have experiences to store only in flat warehouse without any air conditioning machine.

Domestic rice is handled in bags, because bulk transportation system is not established in Bangladesh. And thus, distribution to consumer shall be handled in bags. Accordingly, to realize speedy and smooth distribution in times of emergency, storing in bags is considered more efficient than storing in bulk. To contribute speedy dispatch from storage facilities, rice bags shall be stocked in pallets. Forklift is possible to shorten the time required to handle stocked rice from storage room to platform (truck loading area).

It is effective to rotate the pallet for equalization of moisture contents in storage area, because air condition is different between top and bottom, and between centre and the end of storage room. Accordingly, the Project is going on pallet storage system. Additionally, the Project includes air conditioning machine to realize long term storage without quality deterioration.

It is first case to install forklift, pallet and air conditioning machine for storage facilities contributing PFDS in Bangladesh. Considering the fact, Japanese assistance shall cover construction of storage facilities and procurement of necessary equipment, as well as soft component aiming at quality maintenance and long term storage by transferring established skills and technology in Japan.

Table 2-3: Scope of Works by Japanese Assistance

Scope of Works by Japanese Assistance
(1) Construction of Facilities
Multistoried Warehouse equipped with air conditioning machines (Storage room, Platform, Access slope, Truck yard)
(2) Equipment Procurement
Forklifts, Pallets, Equipment for monitoring (Grain Moisture Meter, Thermometer for Grain, Thermo hygrometer)
(3) Soft Component
Warehouse management including inventory management for pallet storage system
Rice bags loading on the pallets and pallets stacking using forklift
Operation of air conditioning machine to maintain grain moisture in good condition.

(2) The Scale of the Project

Bangladeshi side had requested to construct silos by the Project with the capacity of maximum 50,000 Mt at 1st field survey. At 3rd field survey, considering the present situation mentioned above, both Japan and Bangladeshi sides finally agreed to construct a multistoried warehouse with a capacity of

25,000 Mt.

However, addressing food security is urgent issue for Bangladesh considering inflation of food prices, and Bangladeshi side has strong intent to secure storage capacity as much as possible by the Project. Food storage capacity seems to be going short of demand in the future as shown in 6th 5 year plan. Accordingly, the Project shall secure maximum capacity within budget by reduction of the construction cost, equipment cost and so on.

2-2-1-2 Policy on Natural Conditions

It is hot and humid throughout the year in the Project site. The Project will install dehumidifier to control relative humidity in storage rooms. Additionally, to avoid increase of temperature in storage room by the operation of dehumidifier, the Project will install air conditioning machine to control temperature in storage room. Air conditioning machine will be planned to install individual type to ease the operation and maintenance.

Lightening system is required to avoid frequent lightening strikes in the rainy season.

Earthquake damages have been rarely recorded, because crustal activity is weak in Bangladesh. On the other hand, the Project shall be planned in seismic safety because the Project shall consider the fact that structural regulation has been established in Bangladesh, and the Project is desirable to maintain properly even in times of emergency.

2-2-1-3 Policy on Socioeconomic Conditions

Electric power failure is caused often in Bangladesh. Electrification is behind especially in rural areas, and potential electrical demand is supposed to be very high. It is supposed that electric condition is getting worse in the future because it is very difficult to improve electric power generation and supply in a short time.

It is essential to minimize the use of electricity to reduce operation cost of the Project. Accordingly, the Project will install ventilation system to reduce operation cost and to realize proper condition in the storage room without air conditioning machine, when it is not hot and humid.

It is desirable to operate the Project facility and equipment in times of disaster, the Project shall install electric generator for lighting fixture in storage room and battery type forklift operation.

Most common religion in Bangladesh is Muslim. Considering that there is existing mosque in the Project site, the Project shall not construct mosque.

2-2-1-4 Policy on Construction and Equipment Procurement

(1) Permission, Law and Regulation to Implement the Project

In terms of construction standards in Bangladesh, the Project shall follow Bangladesh National Building Code (hereinafter referred to as “BNBC”) in principal.

To achieve construction permission, Project owner shall submit application documents and drawings including site plan, building plan and elevation drawings to Santahar Municipality. It takes 1 week to

achieve construction permission after submission of application. Drawings drawn by foreign engineers including Japanese architect are available for application. Drawings are possible to be shown in meter scale, though drawings in inch and/or feet scale are popular in Bangladesh.

(2) Code, Standard and Construction Method in Building Design

Building design shall be executed based on the principal that construction material shall be procured according to Bangladesh Standard, British Standard, Bureau of Indian Standard and/or American Society for Testing and Materials.

(3) Procurement of Construction Materials and Equipment

Major construction materials including cement, reinforcement bar, pipes and so on are possible to be procured in domestic market. Therefore, the Project shall procure such materials in Bangladesh.

For overseas procurement, truck transportation and rail transportation after landing at Chittagong and Mongla are possible.

2-2-1-5 Policy for Uses of Local Contractors

The Project is possible to be constructed using a Bangladeshi construction company according to Japan's Grant Aid scheme, because most construction work does not require special skills or technology.

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

Operation and maintenance plan after completion of the Project shall be planned by DG Food, the Ministry of Food and Disaster Management (hereinafter referred to as "MoFDM"). DG Food has vast experience to operate and maintain CSD consisting of many warehouses. Facilities in CSD are well operated and maintained, without leaving unrepaired. Considering their experience in the past, DG Food seems to be able to operate and maintain the Project facilities consisting of many storage rooms. On the other hand, the Project is the first case for DG Food to install air conditioning machine to control temperature and humidity. Proper storage for long term can be realized by adequate control of storage room air. Considering that the Project is the first case, technical assistance (soft component) shall be implemented to develop skills and technology to operate air conditioning machine. Besides, pallet storage system using forklift and pallets is the first case for DG Food, technical assistance shall be considered.

2-2-1-7 Policy on Construction and Equipment Grade

(1) Building Construction

In order to ensure the sustainability and independent development of the Project, the Project shall be planned targeting easy maintenance. The facilities concerned with PFDS have been relatively well operated and maintained. Thus, the grade of Project facilities shall be same as them. Besides, it is required to ensure air tightness to install air conditioning machine, doors shall be higher grade. The Project shall consider reducing operation cost by having manually opened doors.

(2) Equipment Procurement

Electronic controlled equipment are not popular in Bangladesh. They have risks to be broken by frequent power failure and/or voltage fracture. Thus, equipment for monitoring including grain moisture meter, thermometer for grain, and thermo hygrometer shall be planned to be operated manually and simple structure.

2-2-1-8 Policy on Technical Method / Procurement Method and Implementation Term

(1) Building Construction

Special technical methods are not required for construction works of the Project.

During the rainy season, some construction works become difficult to be executed and easily get behind schedule. For planning of work schedule for piling works, foundation works and so on, actual operation ratio during rainy season shall be reduced to secure construction quality.

Project site is centrally located. The Project facilities shall be most functional if they are built together at one location. Considering all of the above, it is not appropriate to divide construction work into lots, and/or construction parts.

(2) Equipment Procurement

Pallets made in Bangladesh are able to be procured, however, the quality of pallets is not stable and supply amount is not sufficient because of a short history in their manufacture. Besides, forklift and equipment for monitoring are not able to be procured in Bangladesh, though the agent in Bangladesh is able to import from overseas and supply them. Accordingly, both procurement in Japan and Bangladesh will be investigated considering the result of comparative study of costs, appropriateness and quality.

It is essential to procure the equipment in good season, because there is not sufficient place to stock forklifts and pallets around the Project site. The Project shall consider adequate procurement schedule considering the above.

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

(1) Layout Plan

The Project facilities shall be constructed in the Project site located in Santahar silo premises, Adamdighi Upazila, Bogra District, Rajshahi Division, which is owned by Food Division, the Ministry of Food and Disaster Management, Bangladesh. Existing wheat silo in the Project site is possible to be accessed from north side of the site by foot or by truck. The Project facilities shall be planned to be accessed in the same way as the wheat silos. The Project shall also consider layout plan in order to ensure access by rail, because a railway is proposed to be constructed in the future, although a concrete plan to construct the railway does not exist. Construction area in the Project site is located on the eastern side of the wheat silos. Warehouse shall be planned in line, not in parallel due to the shape of the construction area. Besides, traffic line of truck shall be planned in order to use existing weighing scale. Residents, trees and other existing facilities shall be removed by GOB prior to the commencement of construction of warehouse.

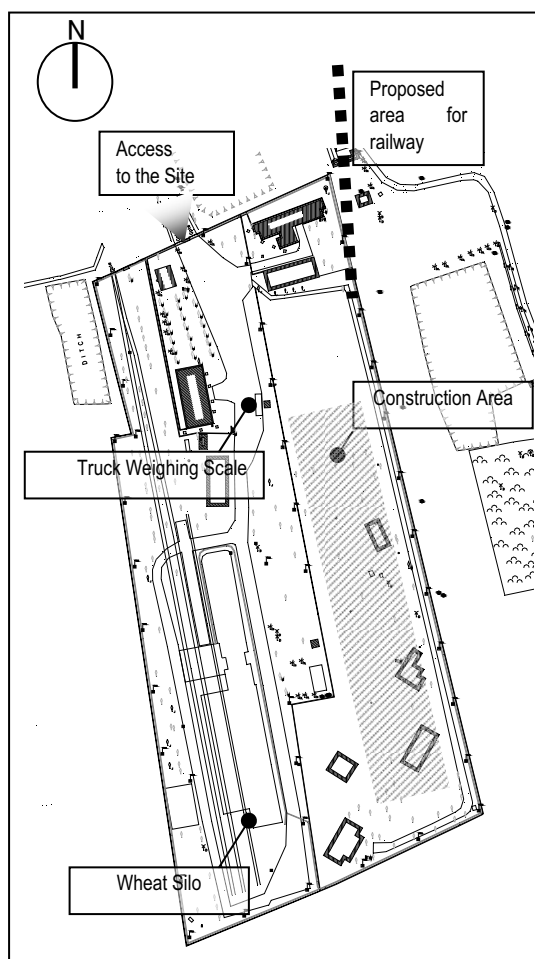


Figure 2-2: Layout Image of the Project

(2) Building Plan

1) Architectural Plan

To secure maximum storage capacity within the limited budget of Japan's Grant Aid, the input to the Project covered by Japan side shall consist of bare essential facilities. In particular, Japan side shall cover construction of a multistoried warehouse building that consists of storage rooms equipped with air conditioning machines, access slope for trucks to access the first floor, truck yard for unloading rice bags from trucks to pallets and for loading from pallets to trucks, electric room and so on. On the other hand, management office and rest house for workers shall be covered by Bangladeshi side.

In general, platform shall be planned to be located along storage rooms in order to shorten the distance from platform to storage rooms for smooth handling between platform and storage rooms.

However, the Project shall minimize truck yard volume, by locating platform in the center of the warehouse building on the 1st floor. Unloading and loading shall be implemented on the platform located in the center of the warehouse, and handling between platform and storage rooms shall be implemented by forklift.

The size of each storage room shall be designated to realize efficient storage considering pallet size and pallet loading of 50 kg rice bags.

Table 2-4: Summary of Planned Facilities

Room name		Utilization	Floor size (sq.m)
Multistoried Warehouse (Ground floor)	Storage Room	To be used for pallet storage	4,446
	Platform	To be used for unloading rice bags from trucks to pallets and loading from pallets to trucks. It shall be located along storage room for forklift handling, unloading and loading	1,164
	Staircase, corridor		64
	Sub total		5,674
Multistoried Warehouse (1st floor)	Storage Room	To be used for pallet storage	4,446
	Platform	To be located along storage room for forklift handling	1,080
	Staircase, corridor		64
	Sub total		5,590
Multistoried Warehouse Total			11,264
Truck Yard	Truck Yard on Ground Floor	To be used for truck parking and turnaround	1,174
	Platform on 1st Floor	To be located at the center of the building for unloading and loading	632
Truck Yard Total			1,806
Slope	Elevated section	To be used for trucks access. To include Equipment Storage and Pump Room.	366
	Access Slope	To be constructed on earth embankment	*817
Slope Total			1,183
Electric Room		To install sub station and distribution board	107
Total			14,360

*Area occupied by access slope

2) Section Plan

Lifting and lowering device and/or access slope for trucks are required for multistoried warehouse. In the case of lifting and lowering device, securing electric power, and operation cost and periodical inspection fee shall be considered to handle rice bags from downstairs to upstairs, and/or from upstairs to downstairs. In addition, such possibility shall be considered that smooth receiving and dispatching might be disturbed if the number of devices are lacking, because handling material would be concentrated around the devices.

In the case of access slope, operation cost shall not be required to transport rice bags from

downstairs to upstairs, and/or from upstairs to downstairs except truck transportation fee. Smooth receiving and dispatching are possible by direct access of trucks to upstairs. Thus, it is sufficient to construct access slope instead of lifting and lowering device for the Project.

The maximum slope is designated 1:8 or slower according to BNBC. However, the Project shall consider overloaded trucks and plan to establish access slope with 1:10 recommended by the Ministry of Housing and Public Works.

Ceiling height shall be planned in order to secure the height for 5 pallets stacking with aeration space. In times of emergency, additional rice bags can be stored by hand in the aeration space. For storage rooms upstairs, ceiling board shall be installed in order to minimize operation cost of air conditioning machine preventing from hot air and/or radiation from roofs caused by sunlight.

3) Structural Plan

The Project shall adopt the Rahmen (rigid frame) structure with column and beams made by reinforced concrete for the construction. In terms of the roof of multistoried warehouse, the Project plans flat roof with reinforced concrete. As for its foundation, the Project uses cast-in-place concrete piles generally adopted in Bangladesh, because soil condition of the Project site has been recognized as not sturdy down to 16 m below the surface.

The Project shall determine wind load and seismic load of facilities based on structural statement in Japan using concerned coefficient defined in Bangladeshi standard.

4) Building Equipment Plan

a) Air Conditioning Machine

It is essential to minimize the operation cost of air conditioning machine for reduction of operation cost of the facilities. On the other hand, it is supposed that quality deterioration by hot and humid air and insect damage will be occurred because the air in the facilities depends on natural conditions, when the air conditioning machine is not installed. Considering the above, the Project shall plan to control the air by air conditioning machine to avoid quality deterioration and insect damage, and to realize long term storage.

In Japan, there are actual examples to store brown rice (husked and not milled rice) for long term, and it is recommended to maintain air condition at a temperature of 15 deg C and 60 % relative humidity. It is known that fungus growth is depending on temperature, thus recommended temperature seems to be defined to avoid fungus growth. In Bangladesh, the possibility of fungus growth seems low because fungus has been destroyed by parboiling process. Therefore, quality deterioration of parboiled rice seems possible to be improved by controlling humidity only. Accordingly, the Project plans air conditioning machine to control humidity (dehumidifier). Additionally, the Project plans air conditioning machine to control temperature to avoid heat increasing of room temperature by heat flush from a series of dehumidifiers.

To minimize operation cost of air conditioning machine, the Project shall plan separate storage

rooms in order to operate these machines separately depending on the storage volume in the warehouse.

b) Electrical Power Supply

There is existing electric power supply system in the Project site. However, electric capacity of the system is not enough for Project implementation. Thus, the Project plans to establish additional power supply system including additional high voltage line (11 kV), sub station and distribution system.

In Bangladesh, electric power failures occur often. The Project shall install electric generator for lighting and forklift battery necessary for dispatching from the warehouse in order to realize food distribution in an emergency. The Project includes meter, breaker, transformer, generator and distribution board for power supply system.

c) Lighting Fixture

The Project shall principally plan to install fluorescent lights because they are generally used in Bangladesh and they can be maintained with low cost. The Project shall ensure illuminating levels according to recommended levels in Bangladeshi standard.

d) Fire Prevention Equipment

Bangladeshi regulations concerned with fire prevention are going to be revised in late 2011 or early 2012. According to the revised regulations, the Project shall install a sprinkler system, and fire alarms and distinguishers.

e) Lightning Protection System

There are frequent thunder storms around the Project site, especially during the rainy season. The Project shall install lightning protection system because there are no high buildings except the wheat silos around the site and it is necessary to avoid damage to equipment such as air conditioning machines.

f) Water Supply System

The Project shall install a water tank and pumping system for sprinkler system.

g) Drainage System

The Project shall plan a drainage system around the multistoried warehouse in order to disperse evacuate rain water.

5) Construction Material Plan

The Project shall contribute PFDS in Bangladesh. It is essential to reduce operation and maintenance cost of facilities to secure maximum amount of food. Accordingly, in terms of construction material selection for the Project, the Project shall introduce materials and methods generally adopted in Bangladesh, while taking into account the ease of their operation and

maintenance, weather conditions, and climate.

a) Roofing Material

The Project shall adopt reinforced concrete for roof, because it has advantages such as heat insulation and weather proofing. Construction methods for reinforced concrete are generally used, and it does not require special skills or technology.

The Project shall adopt water proofing paint to ease their maintenance in the future.

b) External Wall Material

The Project shall adopt reinforced concrete walls, with paints on external concrete.

c) Internal Wall Material

The Project shall adopt reinforced concrete walls with a wooden lattice framework—that maintains a ventilation space between the stacked rice and walls—in the storage rooms.

d) Ceiling Material

The Project shall plan ceiling board on the 1st floor to avoid heat radiation from roof structure and to secure a space for ventilation. The Project shall adopt silicate calcium boards because they are durable in humid weather.

e) Flooring Material

The Project shall install hardener material on concrete for storage rooms, platform and truck yard to improve ablation resistance and dust prevention.

f) Doors & Windows

The Project shall install thermal insulation door to improve air tightness and heat insulation.

Table 2-5: Comparison Table of Methods and Materials for Warehouse

Member	Example of Similar Facilities	Design for Project	Reason for Adoption
Roofing	Concrete	Reinforced concrete	They have advantage for heat insulation, noise reduction and weather proofing
	Corrugated slate		
	Metal sheet		
External Wall	Concrete	Reinforced concrete	They exhibit low water absorption. They have advantage for quake resistance and durability.
	Brick masonry		
Internal Wall	Concrete	Reinforced concrete, wooden lattice framework	They have advantage for quake resistance and durability.
	Brick masonry		
Ceiling	Silicate calcium board	Silicate calcium board	They are durable in humid weather.
	Gypsum board		
Flooring	Concrete	Reinforced concrete, hardener finish	To improve ablation resistance and dust prevention
Doors	Steel door	Thermal insulation door	To improve air tightness and heat insulation

Table 2-6: Table of External Finishing

Building	Item	External Finishing
Multistoried warehouse	Roof	Reinforced concrete slab, water proofing paint
	External wall	Reinforced concrete, paint finish
	Platform floor	Reinforced concrete, hardener finish
	Doors and windows	Thermal insulation door, aluminum sash
Truck yard	Roof	Reinforced concrete slab, water proofing paint
	Column, Beam	Reinforced concrete, paint finish
Slope	External wall	Reinforced concrete, paint finish
	Column, Beam	Reinforced concrete, paint finish
	Access slope	Reinforced concrete

Table 2-7: Table of Internal Finishing

Room	Floor	Wall	Skirting	Ceiling
Storage room	Reinforced concrete, hardener finish	Reinforced concrete, Wooden lattice framework	Reinforced concrete, hardener finish	Silicate calcium board, Concrete slab
Equipment storage	Reinforced concrete, hardener finish	Reinforced concrete	Reinforced concrete, hardener finish	Concrete slab
Pump room	Reinforced concrete, hardener finish	Reinforced concrete	Reinforced concrete, hardener finish	Concrete slab

(3) Equipment Plan

1) Overall Plan

The Project shall procure the equipment necessary for storage and distribution of packed parboiled rice in multistoried warehouse. In particular, the Project shall procure forklifts and pellets in order to store the rice using a pallet storage system. Besides, to realize long term storage in warehouse, it is essential to grasp condition of stored grain. The Project shall procure the equipment for monitoring such as moisture meter, thermometer for grain, and thermo hygrometer.

2) Equipment Plan

a) Forklift

Concerning with drive system of forklift, battery motor and diesel/gasoline engine can be selected. The project shall procure forklift with battery motor drive system considering that they have advantages for the Project because exhaust fumes are not desirable inside the food storage rooms.

b) Plastic Pallet

Concerning with pallet materials, wooden pallets and plastic pallets can be selected. Wooden pallets are generally not used for food storage because wooden chips and/or flakes can be mixed into food. On the other hand, plastic pallets have advantages such as their strength and they can

withstand high loads and do not chip or flake. Accordingly, the Project shall procure plastic pallets.

c) Equipment for Monitoring

The Project shall procure grain moisture meter, thermometer for grain and thermo hygrometer. Grain moisture meter is used in existing food warehouse in Bangladesh. Besides, thermometer for grain and thermo hygrometer does not require special techniques or skills. Therefore, the equipment seems to be utilized without any difficulty.

Table 2-8: Summary of Equipment

Equipment	Specification	Quantity	Purpose
Forklift	1. Battery powered 2. Lifting capacity : 2000 kg or more 3. Maximum lifting height : 5500 mm or more	4 units	To be used for handling the pallets between platform and storage rooms. To be used for stacking the pallets in storage rooms.
Plastic Pallet	1. Size : 1200X1000X150mm 2. Racking : 1000 kg or more 3. Static : 5000 kg or more	26000 units	To be used for loading of rice bags on pallets and pallets storage.
Equipment for Monitoring			
Grain Moisture Meter	1. Range : 11~20% 2. Display : Digital, English	4 units	To be used for monitoring grain moisture.
Thermometer for Grain	1. Range: 0~50°C 2. Type: Bimetal	4 units	To be used for monitoring grain temperature.
Thermo hygrometer	1. Temperature Range : 0~50°C 2. RH Range : 20~99% 3. Display : Digital, English	4 units	To be used for monitoring temperature and relative humidity in storage rooms.

(4) Storage Plan

1) Storage Amount of the Pallet

Each layer will consist of 3 bags of parboiled rice. 6 layers of rice bags will be loaded on the pallet. Accordingly, 18 bags with the weight of 900 kg will be loaded on each pallet.

2) Storage Room Plan

A, B, C and D types of storage blocks will be formulated in storage rooms depending on the situation.

a) Storage in Normal Times

It is desired to secure passage for forklift to realize inventory management by first in – first out. In

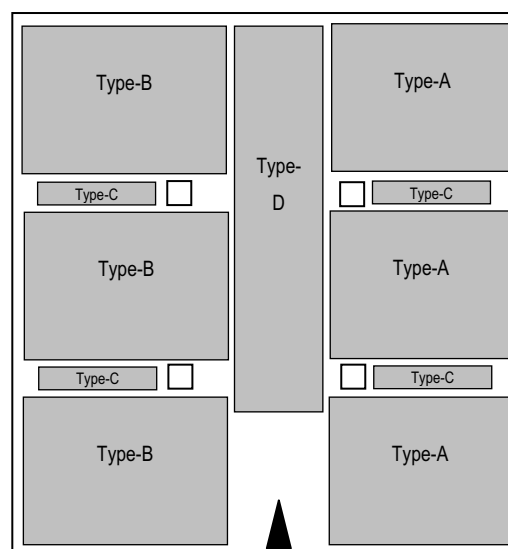


Figure 2-3: Storage Room Image

normal times, rice on pallets can be stored in type A, B and C. Total storage capacity in this case will be 19,512 Mt.

b) Storage in Emergency

In emergency case, passage can be used for storage. In this case, rice on pallets can be stored in type A, B, C, as well as type D. Total storage capacity in this case will be 23,400 Mt. However, it is impossible to manage the inventory by first in – first out method.

c) Maximum Storage Capacity

Additional rice bags are possible to be loaded on the top of pallets. Total storage capacity in this case will be 25,740 Mt. However, it is impossible to secure air space for ventilation beyond the top of pallets.

Table 2-9: Storage Capacity of the Project (Mt)

	Storage Capacity/Storage Block				Storage Capacity/Storage Room				Storage Capacity of the Warehouse (16 storage rooms)	
	No. of pallets	Capacity	Additional No. of bags	Additional Capacity	No. of pallets	Capacity	Additional No. of bags	Additional Capacity	Normal Time	Additional Capacity
Type A	200	180.0	360	18.0	600	540.0	1,080	54.0	8,640.0	864.0
Type B	225	202.5	405	20.3	675	607.5	1,215	60.8	9,720.0	972.0
Type C	20	18.0	36	1.8	80	72.0	144	7.2	1,152.0	115.2
Type D	270	243.0	486	24.3	270	243.0	486	24.3	3,888.0	388.8
Total					1625	1462.5	2,925	146.3		25,740.0

2-2-3 Outline Design Drawing

The following pages present the outline design drawings of the facilities and layout plans of equipment by the Project.

Table 2-10: Outline Design Drawings

No.	Drawing Title
1	Site Plan
2	Ground Floor Plan
3	1st Floor Plan
4	Elevation - 1
5	Elevation - 2
6	Section
7	Ground Floor Equipment Layout Plan
8	1st Floor Equipment Layout Plan

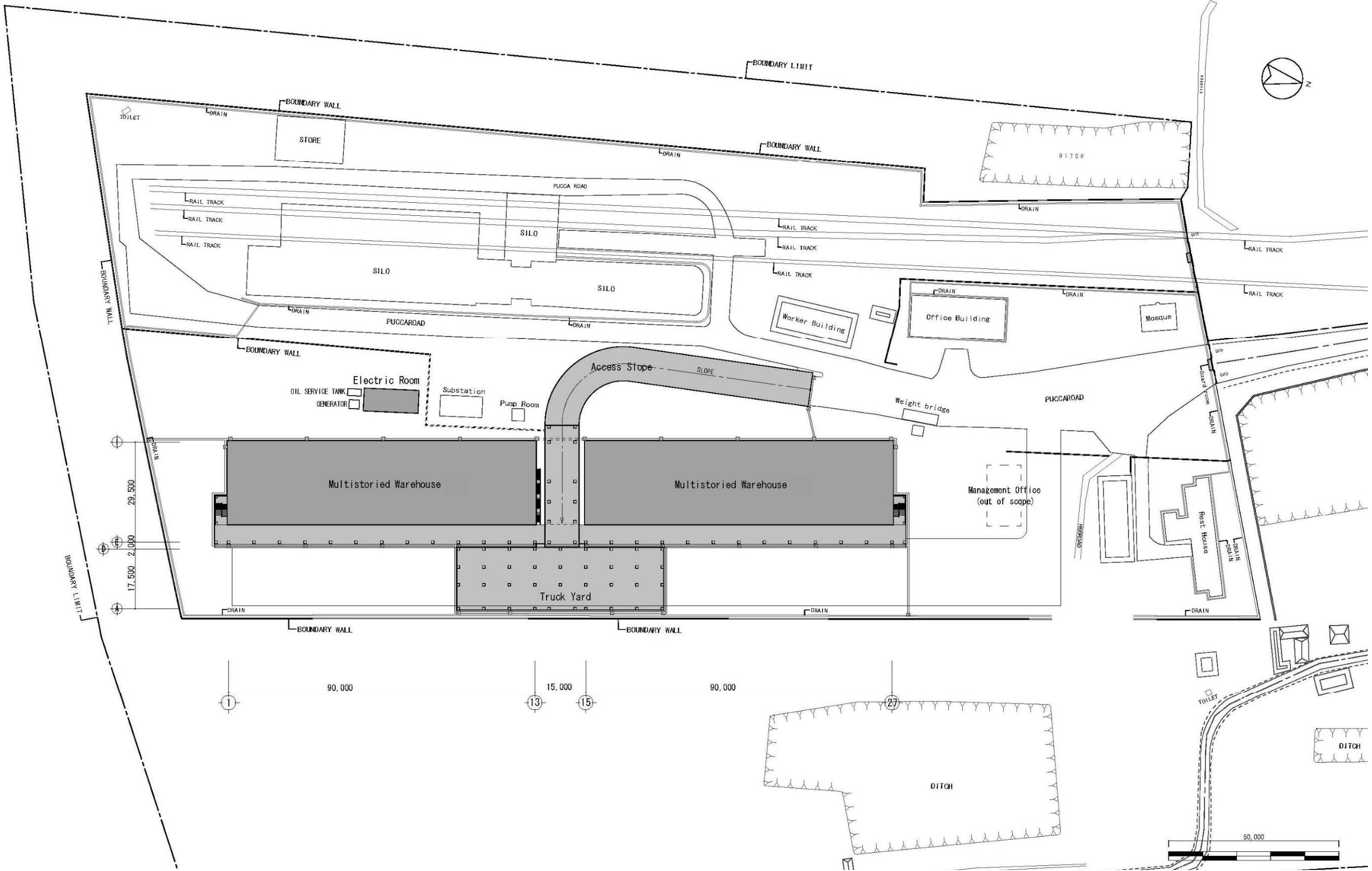


Figure 2-4: Site Plan

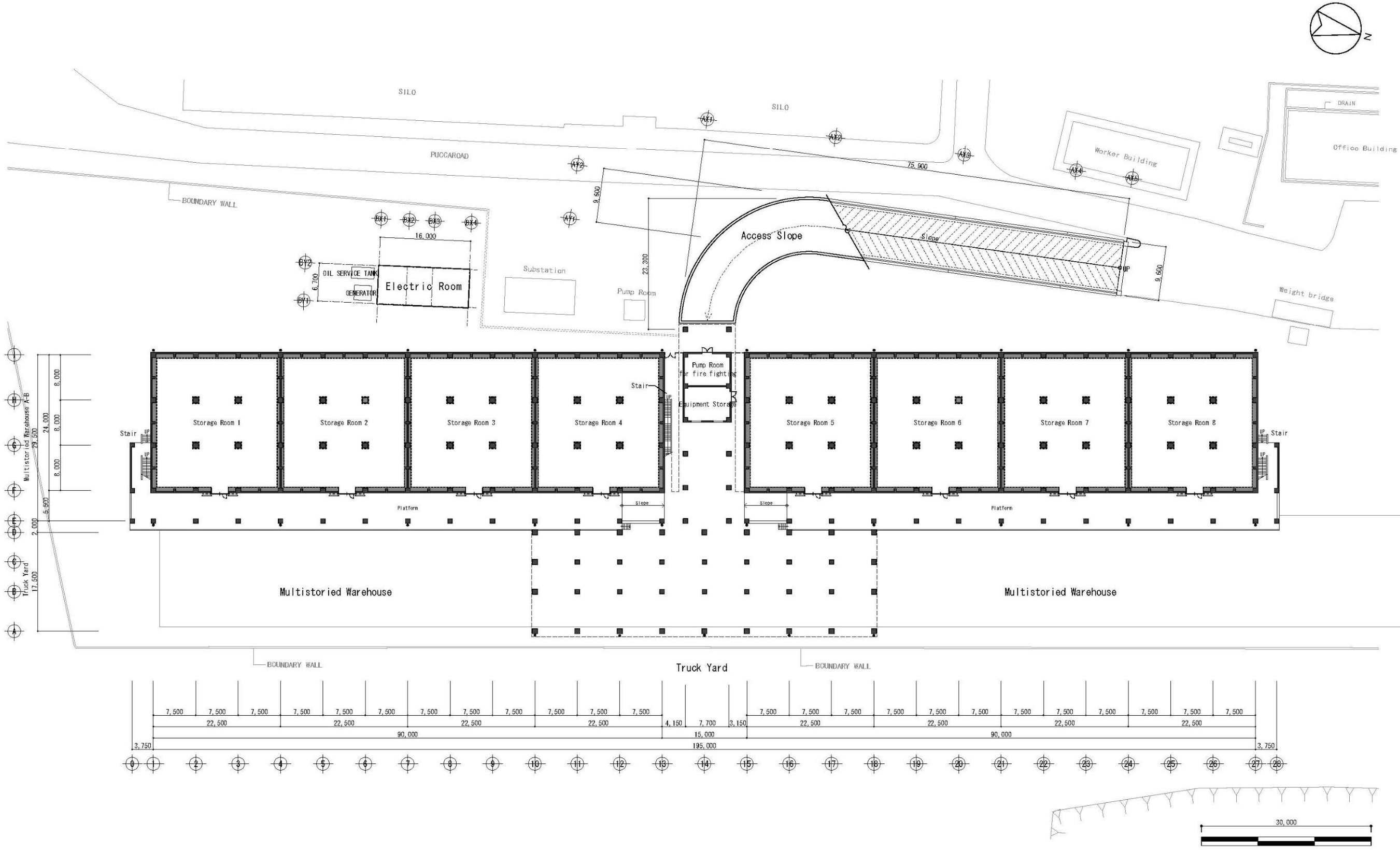


Figure 2-5: Ground Floor Plan

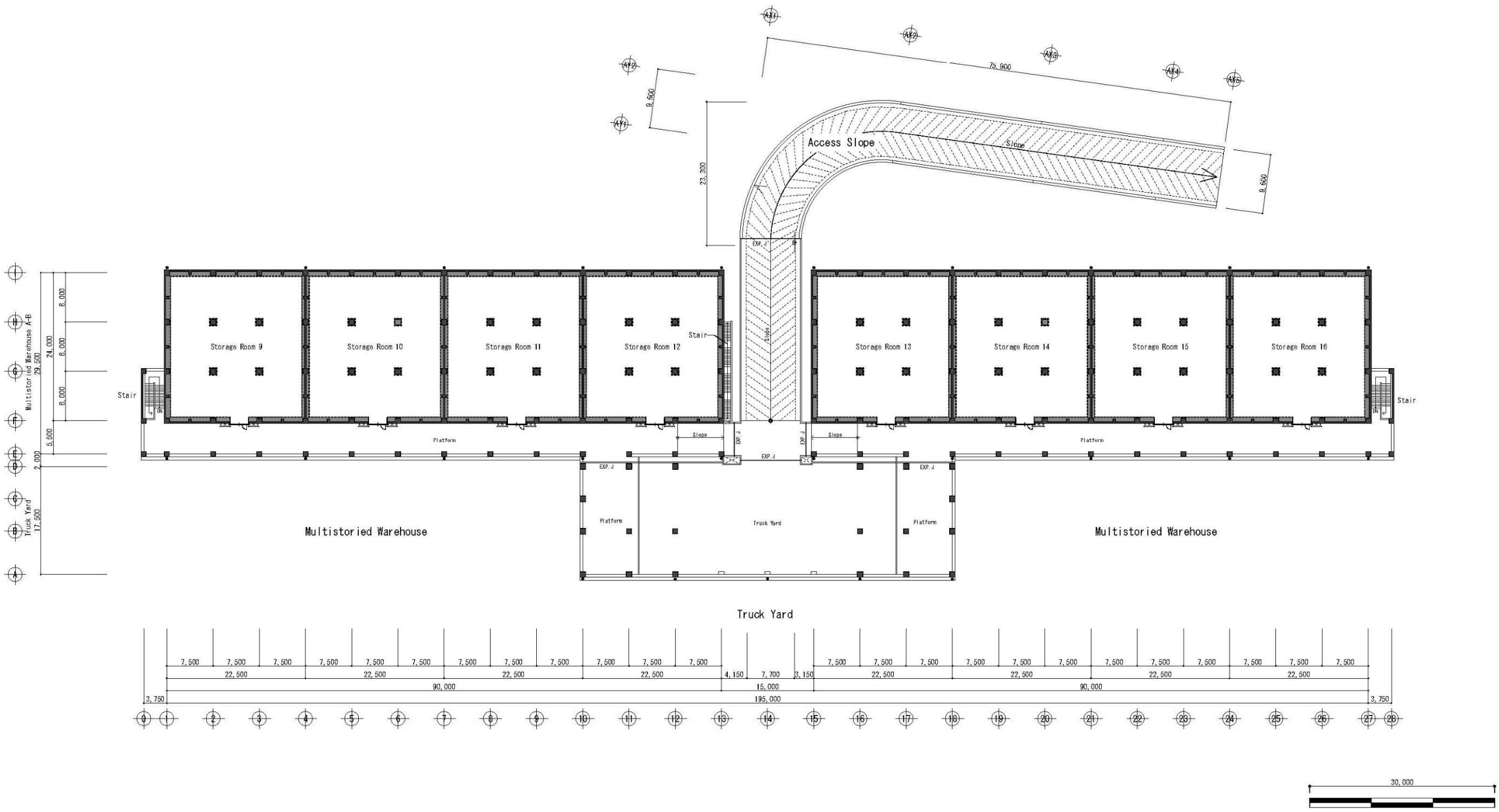
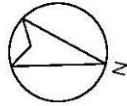
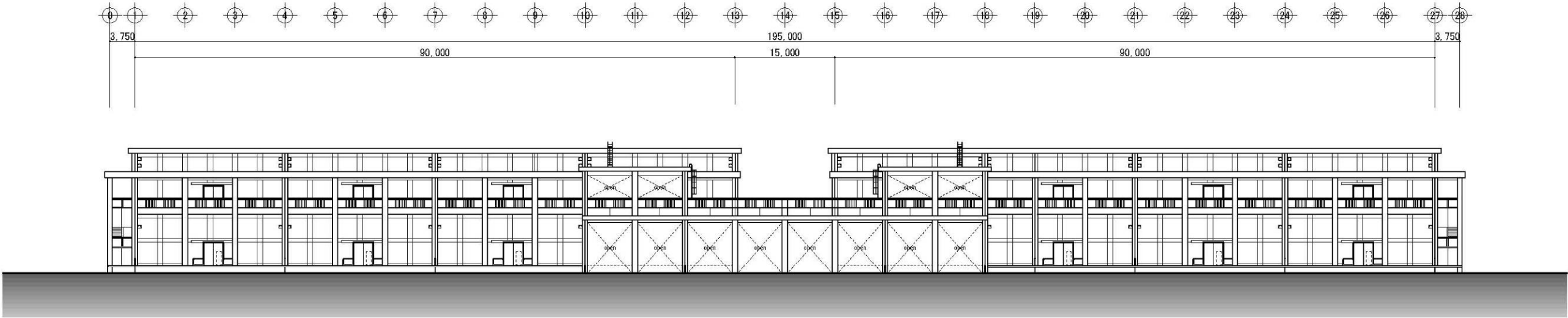
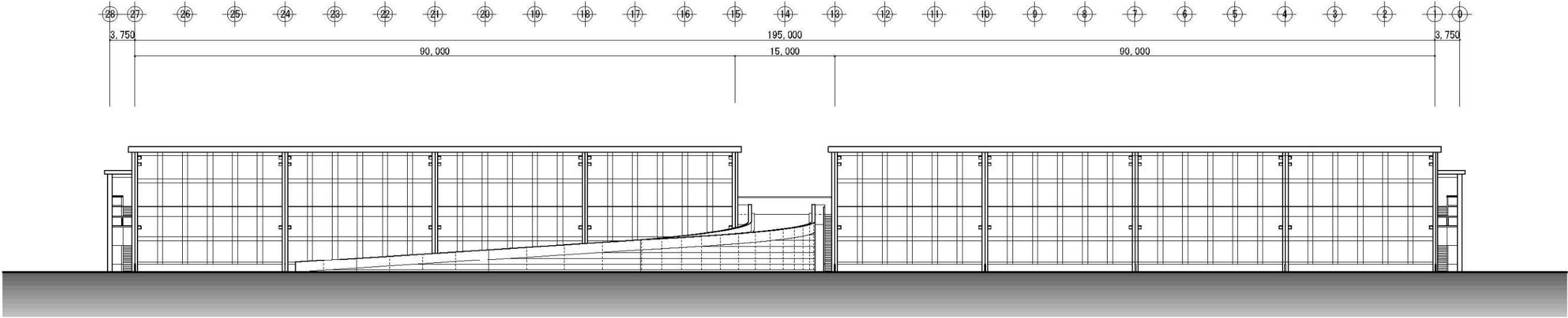


Figure 2-6: 1st Floor Plan



East Side Elevation



West Side Elevation

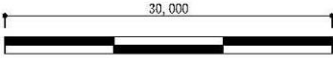
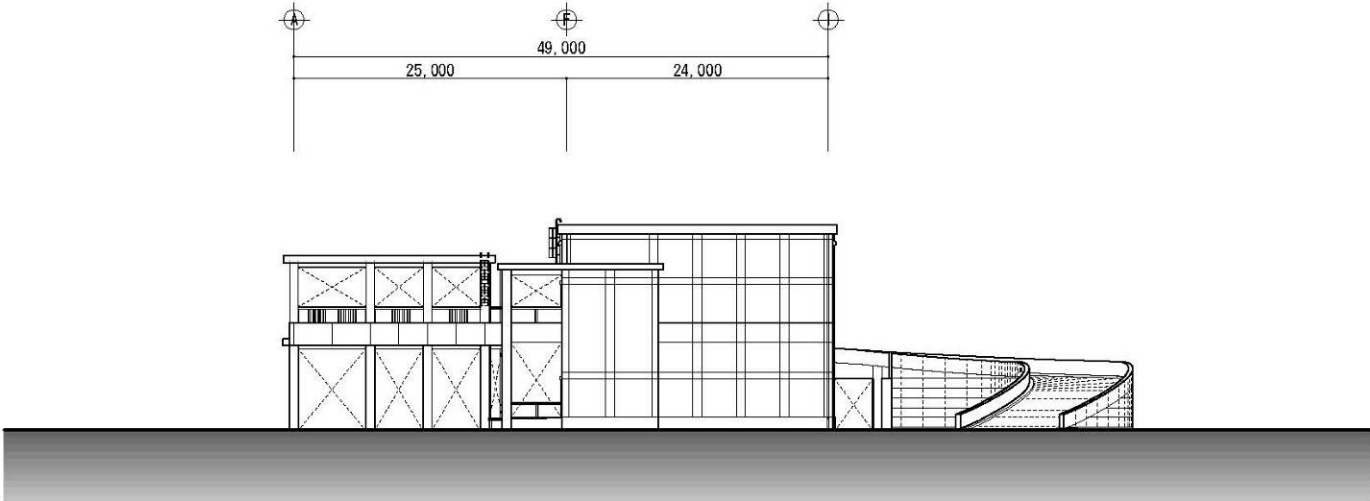
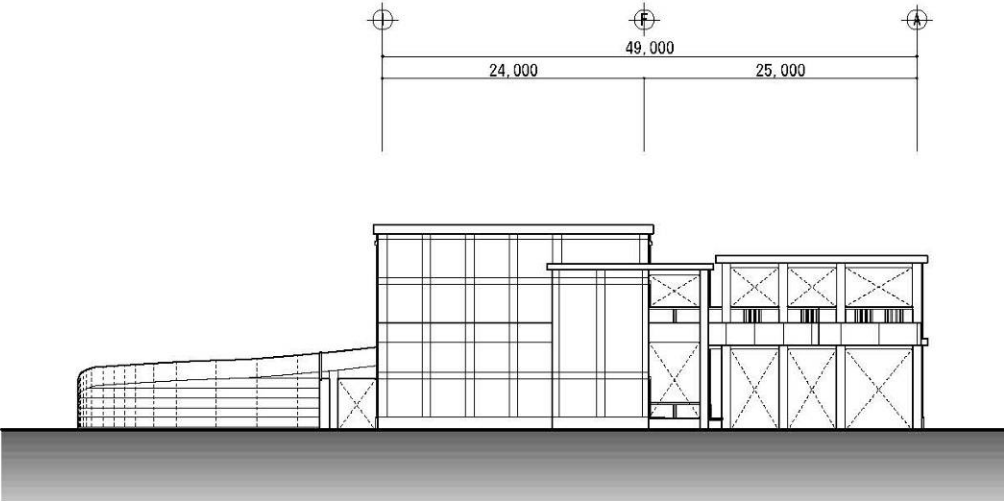


Figure 2-7: Elevation – 1



North Side Elevation



South Side Elevation

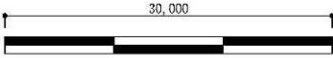


Figure 2-8: Elevation - 2

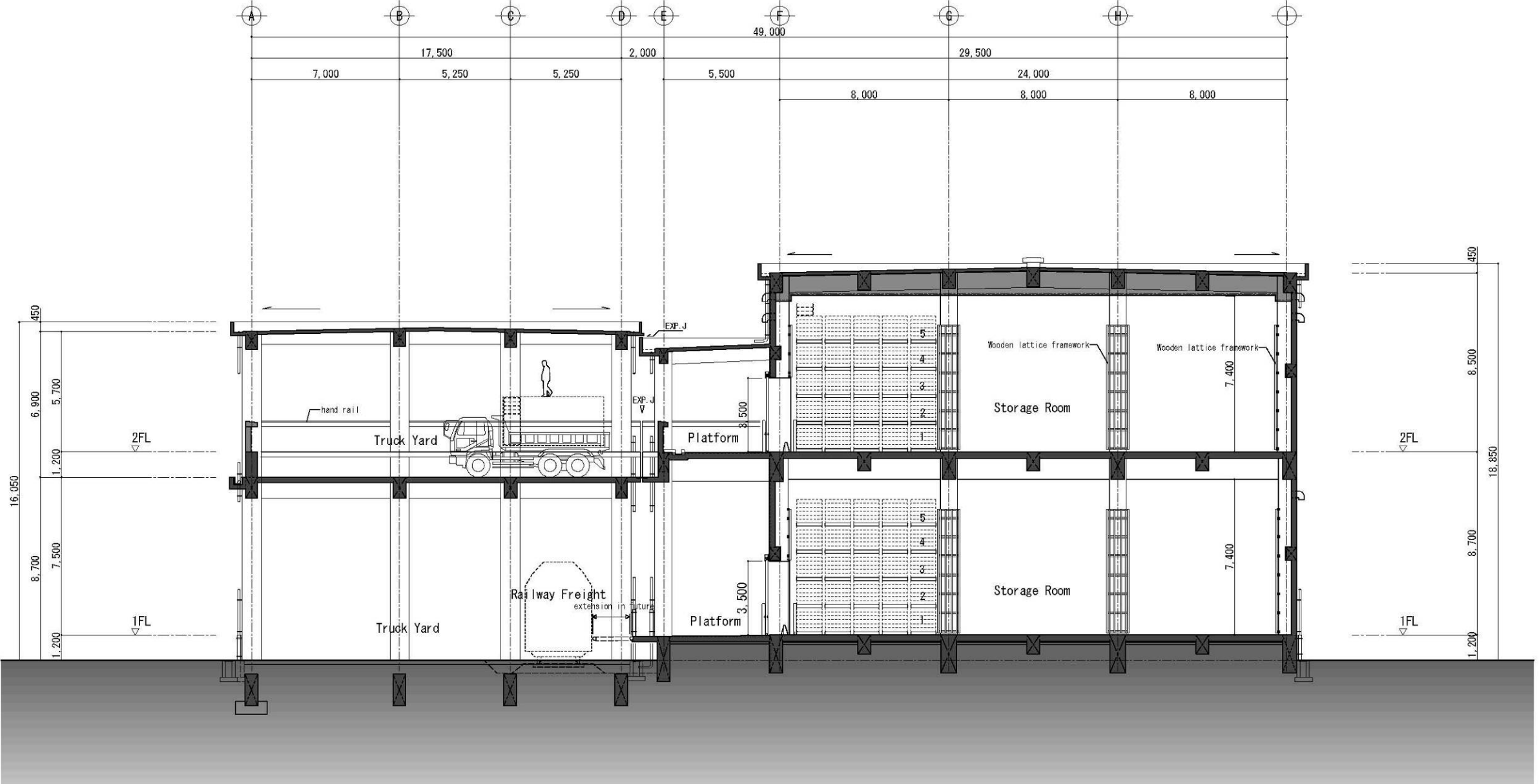


Figure 2-9: Section

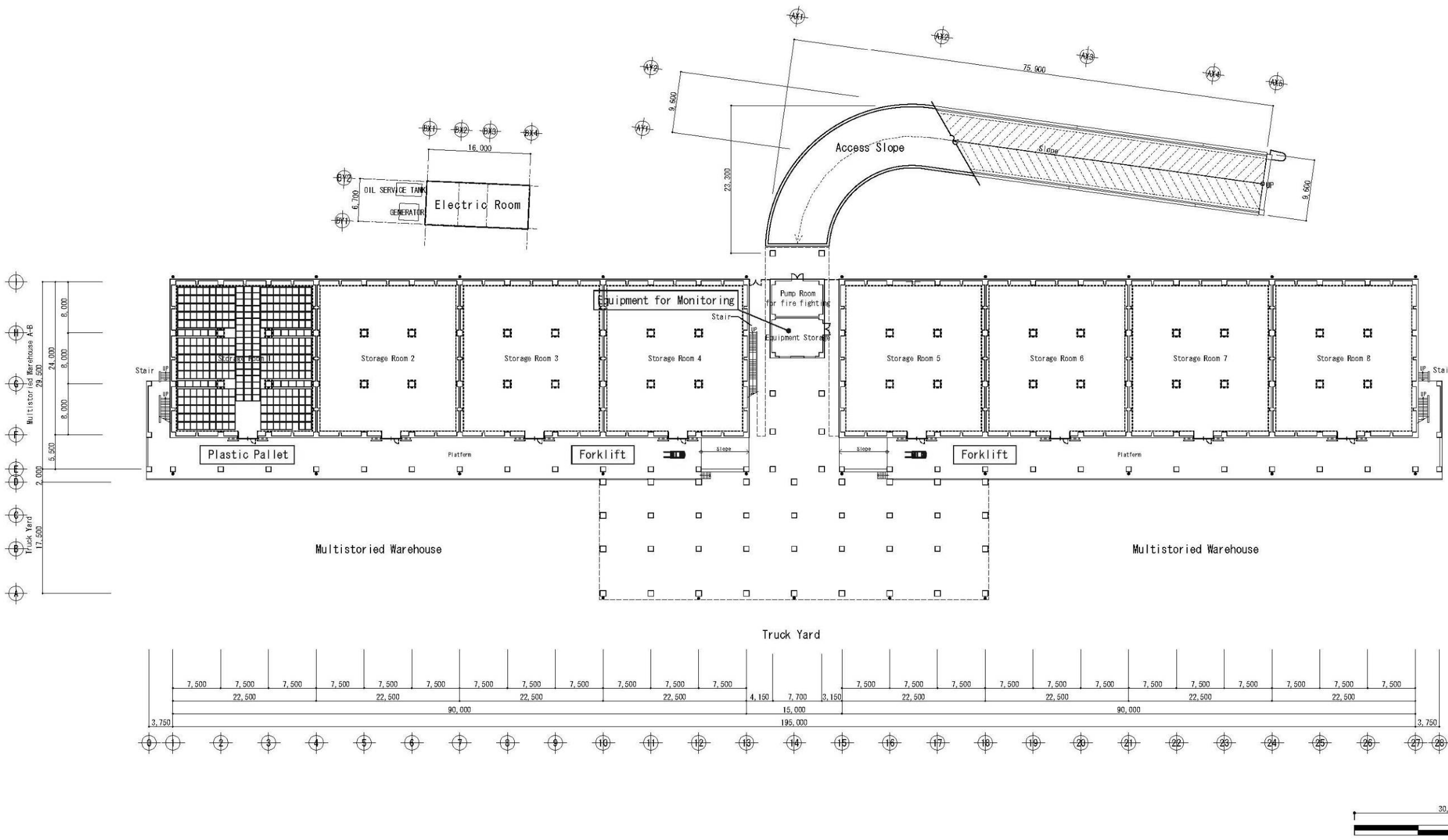
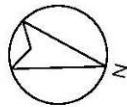


Figure 2-10: Ground Floor Equipment Layout Plan

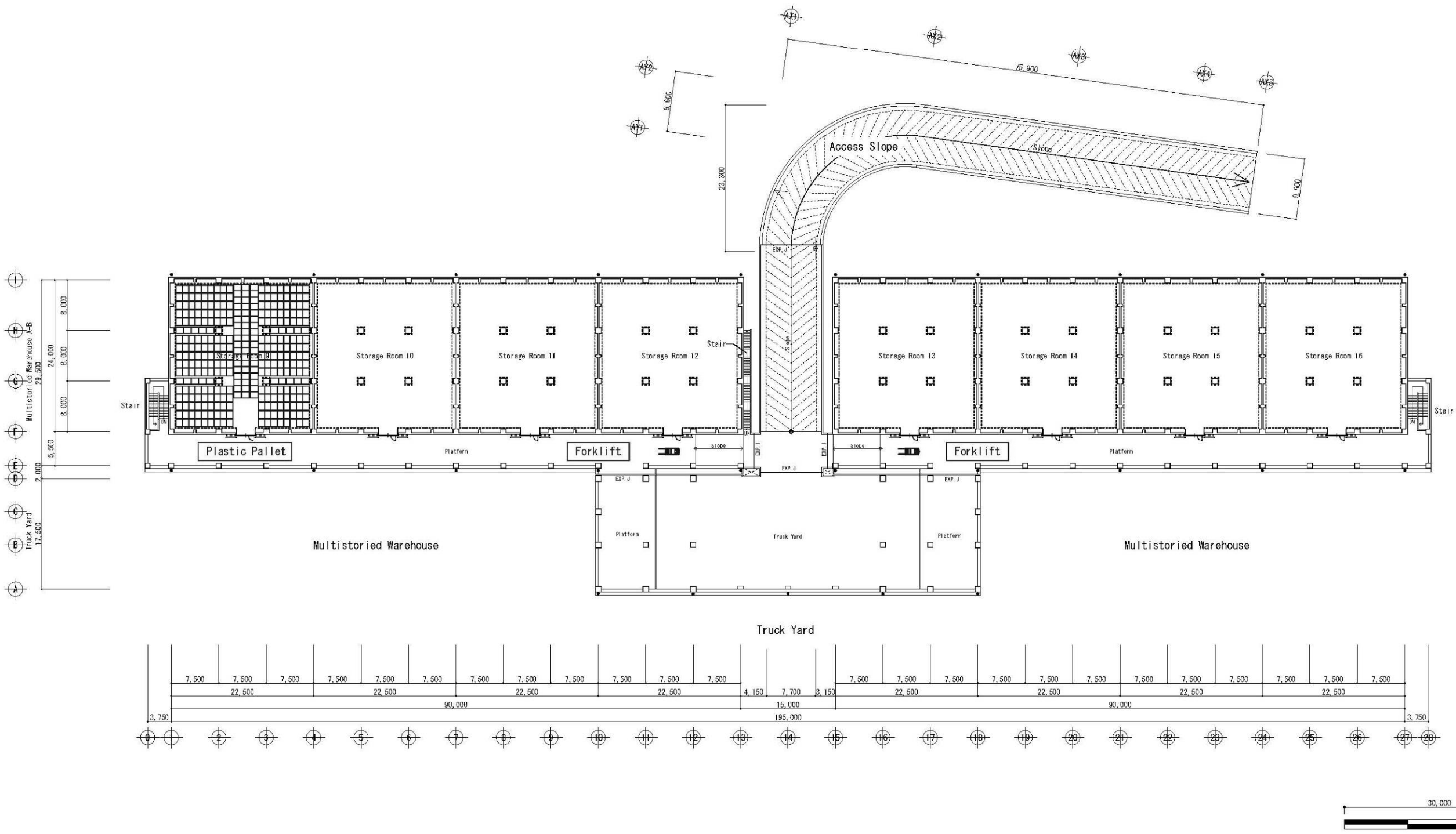
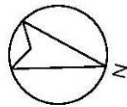


Figure 2-11: 1st Floor Equipment Layout Plan

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

(1) Basic Policy

The Project shall be implemented in accordance with the scheme of the Japanese Grant Aid. The Grant Aid shall be used for the procurement of the products and services for the Project which is agreed upon in the Exchange of Notes (hereinafter referred to as the “E/N”) between the Government of Japan and the Government of Bangladesh.

Following the E/N, the Grant Agreement (hereinafter referred to as the “G/A”) of the Project shall be concluded between the Government of Bangladesh and JICA. The application of Grant Aid to a particular project funded by the Grant will be stipulated in the G/A.

The rights and obligations of the Government of Bangladesh and the providers of the products and services for the Project are governed by the tender documents, and by the contracts signed by the Government of Bangladesh with the providers of the products and services.

The roles of the concerned parties, including the Government of Japan, JICA, consultants and contractors in relation to the implementation of the Project under the Grant Aid are understood as follows.

- 1) the Government of Japan decides the Grant be extended to the Government of Bangladesh in accordance with the relevant laws and regulations of Japan.
- 2) JICA extends the Grant to the Government of Bangladesh in accordance with the relevant laws and regulations of Japan and within the scope of the E/N and pays serious attention to ensure the accountability on proper and effective use of the Grant for the Project.
- 3) the Government of Bangladesh is the recipient of the Grant, and is responsible for the execution of the Project. As the client or the buyer, the Government of Bangladesh conducts the procurement of the products and services necessary for the Project implementation using the Grant provided by JICA.
- 4) the Consultant is the firm who renders services to the Government of Bangladesh with regard to designing, cost estimating, tendering and supervising the procurement and the construction works for the Project in accordance with the contract with the Government of Bangladesh; and
- 5) the Contractor is the firm who provides the products and services necessary for the Project in accordance with the contract with the Government of Bangladesh.

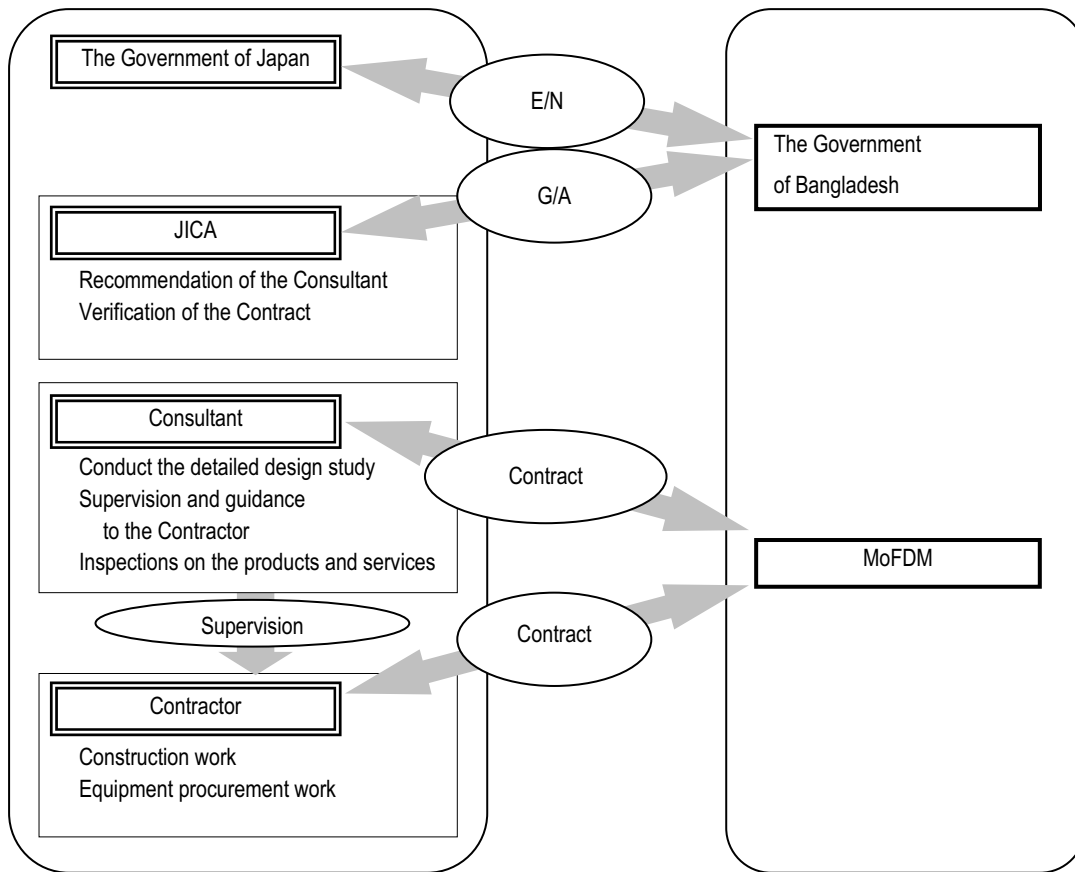


Figure 2-12: The Roles of the Concerned Parties

(2) Implementing Organization of the Bangladeshi Side

The executing agency of the Bangladeshi side for the Project is MoFDM and implementing agency is DG Food, MoFDM. For the smooth progress of the Project, it shall be necessary to contact and consult closely among the Consultant, the Contractors and concerned agency/organization of the Bangladeshi side. Accordingly, the Bangladeshi side shall need to assign responsible persons in charge of the Project. Responsible persons shall understand the roles and duties of the Project and to implement Bangladeshi obligations including the construction of infrastructure without any delay.

(3) Consultant

The Consultant of the Project shall conclude a contract regarding services for detail design study, tendering and construction/procurement supervising works with MoFDM, the Government of Bangladesh. In accordance with Japan’s Grant Aid scheme, the consultant shall form a project team in order to design and supervise the correct progress of the construction works, following the prescriptions made at the point of outline design. The service contents of each step shall be as follows.

1) Services before the tender

The Consultant shall review the survey results produced by the Preparatory Survey of the Project, and the Consultant shall indemnify against the consistency in the services.

2) Services in the tender stage

The Consultant shall execute the following services in the tender stage of the Project;

- Compiling service of the tender documents
- Supporting service of the tender
- Supporting for preparing service of answers to the question and amendment drafts regarding the tender
- Supporting for producing service of the implementation of technical evaluation and evaluation tables / evaluation reports
- Service of the evaluation of tender prices, production of evaluation tables / evaluation reports and determination of the first negotiable contractor of the tender
- Supporting service of the contact negotiations of the Project

3) Services in the stages of construction / procurement supervising works

The Project shall need to dispatch Japanese technicians to Bangladesh to ensure the construction qualities of the Project. Besides, the Project shall be an integrated assistance including equipment procurement and soft component. Therefore, the Project shall place a full-time stationed consultant in Bangladesh for coordinating works among concerned persons of the Bangladeshi side and the contractor's side, and also for supervising works of the implementation stage of the Project.

The consultant shall supervise the contractors in order to execute contracts concerning the Project adequately and smoothly. The consultant supervision for the Project shall aim to supervise whether or not the construction and the procurement are being implemented correctly, while ensuring a level of quality prescribed in documents such as specifications and design drawings in the contracts of the Project. It shall also confirm whether or not qualities, standards and actual concrete shapes are different from those prescribed in the contracts of the Project. In addition, it shall also supervise whether or not the contractors are controlling and storing documents concerning their working records such as quality control data, photos and equipment procurement adequately. Besides, the consultant shall visit each manufacturing place if necessary, in order to prevent discrepancies after delivering the materials and equipment and when they are assembled.

(4) Contractors

According to the Japan's Grant Aid scheme, Japanese contractors who are selected through a bidding procedure will implement the construction works and equipment procurement works for the Project. Even after the building and the equipment are handed over, it is still necessary to contact the contractor regarding after-sale services, repair and maintenance. Thus, the Contractor shall make arrangements for the above services.

1) Necessity of Engineer Dispatch

The construction works in the Project includes material and equipment procurement, transportation

and construction, which requires coordination between the parties concerned. Also, it is necessary to dispatch a chief engineer from Japan to manage and supervise construction, including the schedule, quality, and safety. This person will also arrange and manage the schedule of local construction workers, in order to make a most effective use of them under the Project.

2) Policy Concerning the Construction Works

Effective use of local materials and methods shall be considered a high priority in the Project for the smooth implementation and cost reduction.

3) Policy for Equipment Procurement

As equipment which requires special skills for operation and maintenance would disturb sustainability of the Project, it must be universal and available on the market.

2-2-4-2 Implementation Conditions

(1) Construction Condition

It is possible to hire general engineers and workers and to procure general construction materials, equipment and machines around the Project site. On the other hand, there are no concrete production plants around the site, it is necessary to procure job-mixed concrete. Besides, the Project shall need to carry out advance preparations carefully for procurements because there is a limited supply of reinforcing bars and thermal insulation doors which are not common in Bangladesh.

To avoid delays to these material procurements, it is desired to prepare systems for their orders in the early stage of the commencement of construction works. Thus, on the consideration of the production terms of materials to be used for the Project, it shall be important to urge the construction contractor of the Project to start their advance preparations for the procurement of the materials and equipment.

(2) Procurement Condition

It is required to clean and organize the storage and the place of equipment installation by the Project before delivery of equipment to encourage the smooth commencement of the soft component. Therefore, on the consideration of the production terms of equipment to be procured for the Project, it shall be important to urge the procurement contractor of the Project to start their advance preparations for the procurement of equipment.

(3) Safety Measures

At construction sites, it is necessary to consider safety measures for construction workers. The construction works will involve work in high places such as roofing, so there is a possibility of falling accidents. Consequently, the Project will need to prepare concrete measures to ensure worker safety, such as the wearing of helmets and safety shoes, and prohibiting work going up-and-down.

2-2-4-3 Scope of Works

(1) Scope of Works for Construction

1) Preparation of the Project Site

At the Project site, there are existing wheat silo facilities. There are no obstacles to own and use the site for the construction. However, because there are fences, residents—who work at the wheat silos—for silo works and trees at the construction site, the Bangladeshi side shall be responsible for their removal and land reclaiming.

2) Infrastructure

a) Electric Power

The Bangladeshi side shall be responsible for wiring works of electric power cables with 11 kV up to transformer. The Grant Aid shall cover installation of transformer, distribution to the facilities in the Project site and wiring inside the facilities.

b) Water Supply

The Bangladeshi side shall be responsible to supply water to the water tank planned in the Project.

c) Drainage

The Project shall plan drainage from around the facilities to existing drainage in order to disperse rain water.

d) Furniture and Equipment

The Bangladeshi side shall be responsible to install all furniture including shelves, tables and chairs, as well as chemicals, sheet and equipment for fumigation.

3) Application for Permission

a) Construction Permission

The Bangladeshi side shall be responsible to submit the application for construction permission. The Japan side shall cover to prepare drawings only.

b) Fire Services

The Bangladeshi side shall be responsible to submit the application for fire services. The Japan side shall cover to prepare drawings only.

(2) Scope of Works for Equipment Procurement and Installation

1) Delivery to the Site

All equipment to be procured in the Project shall be delivered to the Project site. Delivery shall be implemented by the Japan side.

2) Installation

After completion of delivery of forklifts, initial operation guidance shall be implemented by Japan

the side.

(3) Scope of Works for the Project

Scope of works is shown below.

Table 2-11: Scope of Works to Be Borne by Japan and Bangladesh

Works	Japan	Bangladesh
1. Securing of the Project site, Removal of the existing facilities and trees at the Project site, Leveling of the site		○
2. Construction		
(1-1) Construction of multistoried warehouse	○	
(1-2) Construction of management office and other facilities except the warehouse		○
(2) Installation of gates and fences at the Project site		○
(3) Arrangement of parking areas		○
(4) Arrangement of access road inside the Project site		○
(5) Arrangement of access road to the Project site		○
(6) Arrangement of railway inside the Project site		○
(7) Arrangement of railway to the Project site		○
3. Infrastructure		
(1) Electric power		
1) Distributing main power lines to the Project site		○
2) Installation of transformer at the Project site, Arrangement of truck lines, lighting/outlets, emergency power supply	○	
(2) Water Supply		
1) Water supply to the water tank		○
2) Installation of water tank, piping works inside the building	○	
(3) Drainage		
1) Main drainage line		○
2) Construction of drainage for rain water inside the Project site	○	
(4) Furniture and equipment		○
4. Transportation, Customs clearance		
(1) Marine transportation of the Products	○	
(2) Tax exemption and customs clearance of the products at the port of disembarkation		○
(3) Internal transportation from the port of disembarkation to the Project site	○	
5. Exemption of customs duties, internal taxes and other fiscal levies		○
6. To accord Japanese nationals for their entry into Bangladesh and stay therein		○
7. Proper and effective use of facilities and equipment of the Project		○
8. Other necessary procedures and expenses for the project		○
9. Banking Arrangement, Authorization to pay		
(1) Advising commission of A/P		○
(2) Payment commission		○
10. Procedures concerning environmental and social consideration		○

2-2-4-4 Consultant Supervision

(1) Basic Concept

Since the Project shall be an integrated assistance project including facility construction, equipment procurement and soft component, it shall be important to complete each work within the prescribed schedules in accordance with each of their operation plans in order for the observance of the whole schedule of the Project. Moreover, it shall also be important to always grasp the working progress of items to be borne by the Bangladeshi side that are vital to the smooth progress of the whole schedule.

The Project shall include various types of works such as material and equipment procurement work, temporary work, foundation work, structural work, mechanical work, finishing work and so on. The consultant shall execute their supervising work in collaboration with the implementing organization of the Project.

(2) Consultant Supervision Plan for Construction Works

1) Dispatching of the Consultant

As regards the consultant supervision of the Project, the consultant shall assign a stationed supervisor who has experienced construction supervising works abroad. The consultant shall also dispatch the engineer properly in accordance with the capacities and contents of the construction work of the Project as described in the following table.

Table 2-12: Dispatching of the Consultant for Construction Works

Consultant	Working Contents	Timing (Total Term)
Project Manager	Supervision of the whole project, attendance at the commencement, final completion of the Project, etc.	When necessary (1.0 M/M)
Stationed Supervisor (Resident Consultant)	Supervision of the whole construction work, negotiation and consultation with organizations concerned with the Project, confirmation of design / shop drawings and specifications.	During the Project implementation (24.5M/M)
Architectural Engineer	Supervision of finishing work.	When necessary (0.5 M/M)
Structural Engineer	Supervision of foundation and structural work.	When necessary (0.5 M/M)
Mechanical and Electrical Engineer	Supervision of piping, electric systems / wiring, air conditioning works	When necessary (1.0 M/M)

2) Construction Management by the Contractor

In order to ensure the quality of the building and that deadlines are met, it is desirable for the work to be managed by a Japanese engineer. Therefore, a well experienced Japanese engineer shall be stationed at the construction site for the whole period of construction. Mechanical and electrical engineer shall be also dispatched according to the progress.

Other necessary engineers shall be hired locally. During the construction period, the Japanese engineers are expected to transfer their construction skills and technology to Bangladeshi engineers.

Considering the scale of the construction in this Project, at least the engineers listed below shall be necessary.

Table 2-13: Personnel Dispatching by the Contractor

Contractor	Working Contents	Timing (Total Term)
Director (Site Representative)	Manage the whole work, obtain approval, manage procurement of material, equipment and accessories, manage workers, and site works	During the Project implementation (24.5 M/M)
Technical Chiefs	Manage construction work, obtain approval, manage procurement of material, equipment and accessories, and manage laborers	When necessary (20.0 M/M)
Mechanical and Electrical Chief	Manage mechanical and electrical work	When necessary (4.5 M/M)
Administrator	Manage procurement of material, equipment and accessories, workers, and do the accounting	During the Project implementation (24.5 M/M)

3) Schedule Control

The consultant shall compare the implementation progress of the construction to be planned at the time of their contracts with those to be carried out actually in order for the observance of deadlines prescribed in the contracts signed by the contractors of the Project. The consultant shall encourage the contractor to keep strictly to the schedule and request the contractor to submit proposed measures and implement these against the issues when schedule delays are predicted, in order that the construction and equipment delivery can be completed on time. The items to be compared with the schedule are as follows.

- Overall progress (progress of the material and equipment procurement, and construction work)
- Material and equipment delivery (material, equipment and accessories for construction)
- Temporary work and provision of construction machines (accordingly)
- The number of engineers, technicians, general workers, etc.

4) Quality Control and Inspection of Actual Shape

The consultant shall supervise whether or not the facilities to be constructed by the Project and its construction materials meet the required quality and actual shapes as per the contract documents. If the consultant finds any issues with the quality or faults in the contractor's workmanship in the process of their confirming and inspecting work, the consultant shall require the contractors to correct, change and modify them immediately. The items to be controlled are as follows.

- Examine shop drawings and specifications of construction work
- Examine shop drawings and specifications of accessories and fixtures
- Attendance to the production place of the material and equipment or examine the inspection results

- Examine plans and methods of equipment installation
- Inspect and confirm performance and actual shape

5) Safety Control

By discussing and cooperating with the responsible persons of the contractors for safety control, the consultant shall supervise the contractors to prevent from industrial accidents, injuries and accidents to third persons at the Project site during the implementation term. Important points for the safety control at the site shall be as follows.

- Formulation of safety control regulations and selection of responsible persons for safety controls
- Avoidance of accidents by the regular inspection of construction machines
- Formulation of the operational routes of vehicles for construction and transporting machines and thoroughness in their safe driving
- Setting of facilities and equipment for safety controls and their regular checks
- Welfare measures for construction workers and encouragement to take days off

(3) Consultant Supervision Plan for Equipment Procurement Works

1) Dispatching of the Consultant

The consultant shall dispatch the engineer properly as described in the following table.

Table 2-14: Dispatching of the Consultant for Equipment Procurement Works

Consultant	Working Contents	Timing (Total Term)
Procurement Supervisor	Procurement supervision, inspection of delivered equipment	When necessary (0.5 M/M)
Inspector	Confirmation of shop drawings and specifications, factory and shipping inspection	When necessary (0.2 M/M)

2) Specification, Quality and Quantity

The consultant shall supervise whether or not the equipment to be procured by the Project meets the specifications, quality and quantity required by the contract documents.

3) Installation of Equipment and Operational Training

The consultant shall supervise whether or not the equipment are possible to be delivered to the facility to be constructed. After delivery to the Project site, the consultant shall supervise operation training to be executed by the contractor.

2-2-4-5 Quality Control Plan

It is feasible to procure the materials, equipment and machines for the construction domestically. However, as Bangladesh has imported many goods from neighboring countries, the quality of them varies. Therefore, the specifications and performance of the materials, equipment and machines used for this Project require careful examinations before they are approved. For the quality control of

reinforcement bar, concrete, mortar etc., which will be processed at the construction site, must follow the rules specified in the construction method to be specified during implementation of the Project.

When concrete temperatures are high, there is a possibility of increased risk of slump declines and cracks by rapid vaporization of surface moisture on the concrete. Accordingly, the Project shall need to reduce the temperature of the concrete by considering the method of their in-site transporting, placing and curing works.

To examine concrete quality, the Project shall carry out the compressive strength test of concrete at public institutions in Bangladesh. In terms of reinforcement bars, the Project shall carry out their quality controls by confirming their inspection certificates. As for the tensile strength test of reinforcing bars, the Project shall carry out the test at public institutions.

To ensure the quality of the construction works, the Project shall need the following quality controls in terms of the major works of the construction.

Table 2-15: Items of Quality Controls and Methods of Major Works

Works	Item of Quality Control	Method of Quality Control
Temporary work	Locations of the permanent and temporary facilities, etc.	Staking out inspection, confirmation of benchmark
Earth work	Excavation	Confirmation of bearing stratum
Piling work	Cast in place concrete pile	Confirmation of position and bearing stratum
Reinforcement bar work	Material	Tensile strength test, confirmation of inspection certificate
	Arrangement	Confirmation of diameter, numbers, binding, etc.
Concrete work	Fresh concrete	Confirmation of slump, air content, temperature, etc.
	Concrete placement	Confirmation of placing situation
	Formwork	Visual inspection of forming
	Concrete strength	Confirmation of compressive strength test
Roofing work	Water leakage	Visual inspection, sprinkling inspection
Plastering work	Flatness, unevenness	Visual inspection of finishing
Door and window work	Installation	Visual inspection
Painting work	Surface finishing, color	Visual inspection
Electric power system work	Performance, operation	Confirmation of factory inspection result, operation test
Piping work	Bending, twist, support pitch	Visual inspection
Wiring work	Damage	Measurement of resistance value, visual inspection
Lightning work	Resistance value	Measurement of resistance value, visual inspection
Lighting work	Performance, operation	Visual inspection
Water supply work	Support pitch, water leakage	Water pressure test, visual inspection
Air conditioning work	Performance, operation	Operation test

2-2-4-6 Procurement Plan

(1) Procurement Method

The Construction materials to be used for the Project except for thermal insulation doors and disaster prevention equipment will be procured in Bangladesh.

In addition, pallets made in Bangladesh are able to be procured, however, considering the quality, supply amount and actual performance in Japan, pallets shall be planned to be procured in Japan. Besides, forklift and equipment for monitoring made in Bangladesh are not able to be procured, and they shall be planned to be procured in Japan.

(2) Consumable Goods and Spare Parts for the Equipment

Both consumable goods and spare parts for the equipment of the Project will not be procured. They can be procured by the agents in Bangladesh.

(3) Transport Plan

Concerning the equipment to be procured in Japan, it is necessary to be transported from Japan by air or sea. The cost of sea shipping is much cheaper than that of by the air, and there is enough time for shipping against required time of materials and equipment at the site. Accordingly, the Project will plan

to transport the procured equipment by sea.

It takes 10 – 20 days to transport materials and equipment from departure at the port in Japan to arriving at the port in Chittagong, Bangladesh. Customs clearance procedures will take 11 - 13 days in Chittagong. Continuously, it will take 3- 4 days for the construction materials to be transported from Chittagong to the Project site, and 30 days for pallets.



Figure 2-13: Transport Plan for Construction Materials



Figure 2-14: Transport Plan for Pallets

2-2-4-7 Operational Guidance Plan

The Project shall implement operation guidance for forklift in order to operate safely and properly. The contractor of equipment procurement shall train the forklift operator designated by the Bangladeshi side. Operation guidance shall include the operation and maintenance training for forklift and shall exclude pallets handling in the storage rooms and handling between storage rooms and platform where rice bags are loaded and unloaded.

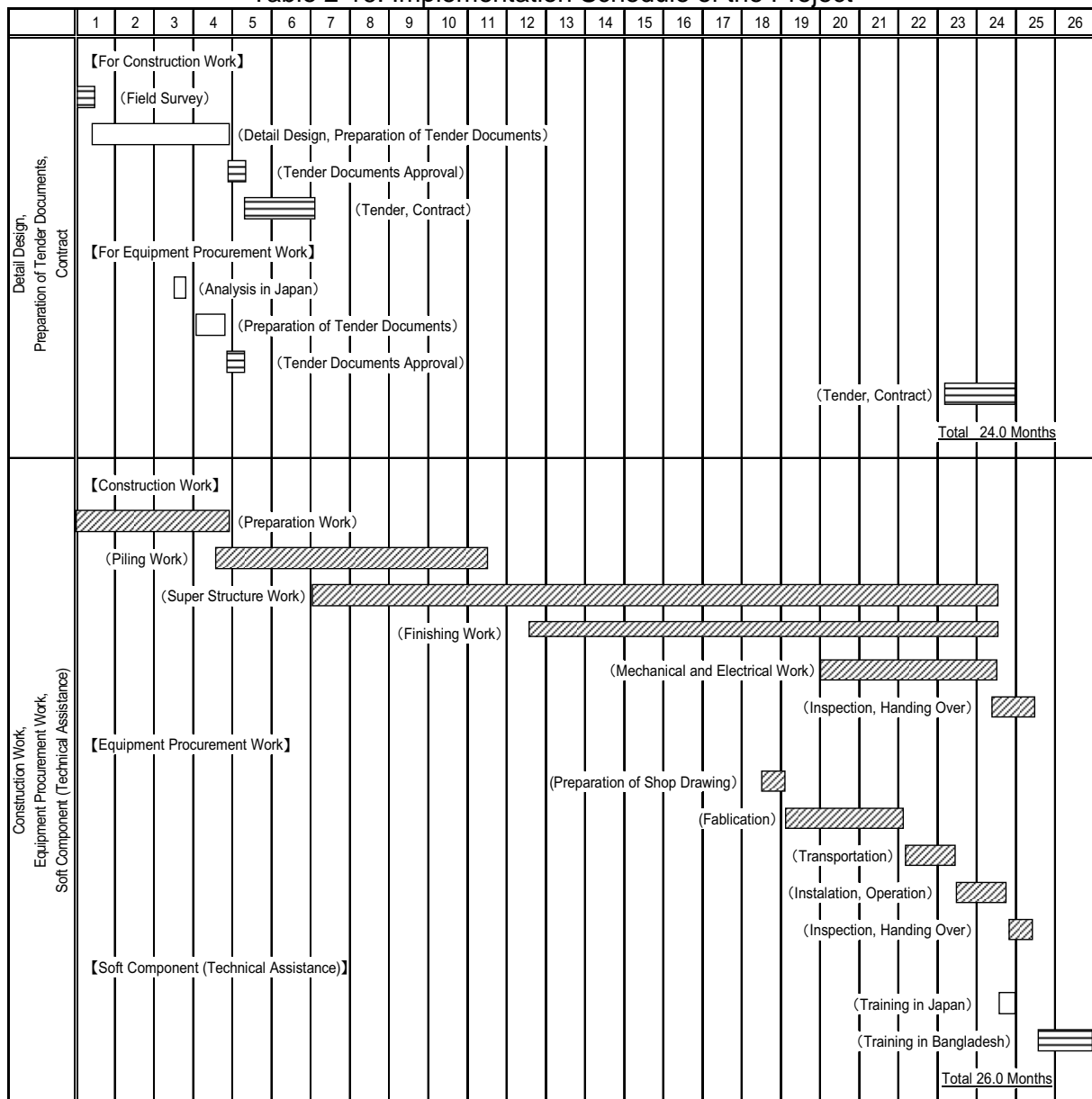
2-2-4-8 Soft Component (Technical Assistance) Plan

It is the first case for Bangladeshi food storage to install air conditioning machine and pallet storage system using forklift. Accordingly, soft component (technical assistance) is desired to be implemented in the Project to establish skills and technology for 1) adequate warehouse management including inventory management for the pallet storage system, 2) loading rice bags on pallets and stacking pallet using a forklift, and 3) proper and effective operation of air conditioning machines to maintain grain moisture in good condition. Soft component shall be implemented immediately after the completion of the construction works and equipment procurement works to support smooth operation and maintenance. Detail contents of soft component plan are shown in the appendix of this report.

2-2-4-9 Implementation Schedule

The implementation schedule of the Project is shown in the table below.

Table 2-16: Implementation Schedule of the Project



2-3 Obligations of Recipient Country

(1) General Items

In the implementation of Japan's Grant Aid Scheme, the Bangladeshi side is required to undertake certain measures as follows.

- 1) To ensure prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
- 2) To exempt from customs duties, internal taxes and other fiscal levies, this will be imposed in the recipient country with respect to the supply of the products and services under the verified contracts.
- 3) To accord the agent whose services may be required in connection with the supply of the products and services under the verified contracts, such facilities that may be necessary for their entry into the recipient country and stay therein for the performance of the work.
- 4) The recipient country is required to operate and maintain the facilities constructed and equipment purchased under the Grant Aid properly and effectively.
- 5) Assign the staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.
- 6) Bear the commissions paid to the bank for banking services based upon the B/A.

(2) Special Items for the Project

The following special items are required to be undertaken by the Bangladeshi side when carrying out the Project.

- 1) To submit the application for construction works, fire services and others related to the Project if any, and to obtain permission for these.
- 2) To prepare the land, remove fences, trees and other preparatory construction related to the Project.
- 3) To bring in power lines to Project site.
- 4) To secure water supply.
- 5) To secure the personnel who will be assigned to the Project, and to secure and dispatch the personnel for the technical assistance.
- 6) To procure furniture and equipment related to the Project.
- 7) To secure the budget to operate and maintain the facilities and equipment related to the Project.
- 8) To attend the beginning, mid term and completion inspection of the construction.
- 9) To attend equipment and materials inspection.

(3) Operability for Obligations of Recipient Country

The Project shall contribute food security in Bangladesh and it is highly prioritized. Staff and budget allocation plan in order to implement the Project shall be finalized at the time of approval of Development Project Proposal (hereinafter referred to as “DPP”) by ECNEC. The DPP for the Project seems possible to be approved considering the facts that draft DPP have been prepared by DG Food, MoFDM, and DPP concerning with food security in Bangladesh have been approved by ECNEC without any difficulty.

General and special items to be covered by the Bangladeshi side can be considered adequate because all items are designated according to Japan’s Grant Aid scheme.

2-4 Project Operation Plan

(1) Organization and staff Plan

Staff allocation for operation and maintenance of the facilities and equipment of the Project will be ensured at the time of approval of DPP by ECNEC. It is planned to allocate additional staff shown in the figure below.

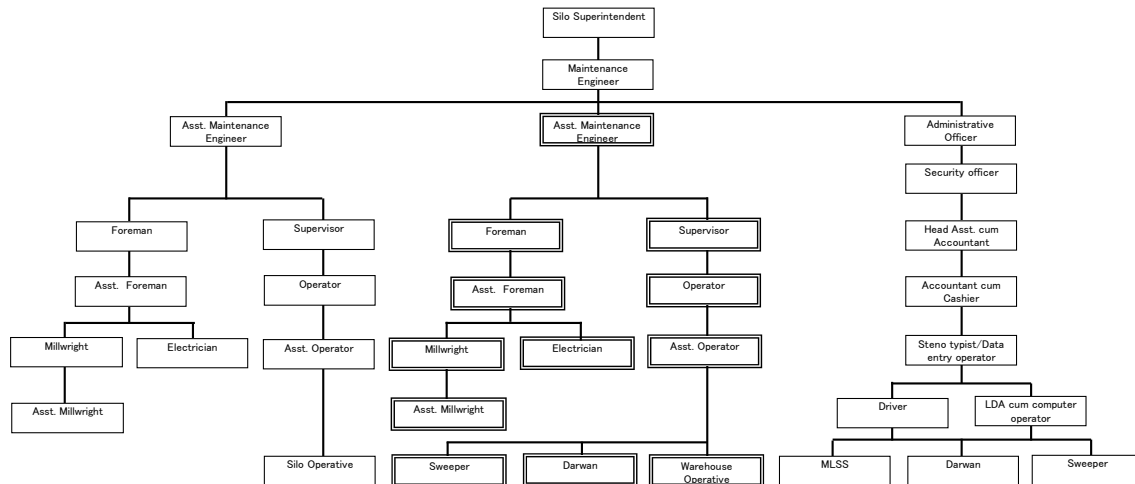


Figure 2-15: Organization Chart for Operation and Maintenance of the Project

DG Food seems possible to operate and maintain the facilities and equipment of the Project properly, because DG Food has experience operating and maintaining food warehouses in the past. By the way, to ensure effectiveness of the Project, it is strongly recommended to establish concrete organization for operation and maintenance of the Project.

(2) Budget

The budget necessary for operation and maintenance of the Project shall be secured by the budget of DG Food, MoFDM. To realize sustainability of the Project, it is strongly recommended to secure sufficient budget by the Bangladeshi side.

(3) Skills and Technology

The facilities and equipment of the Project have been planned based on the consideration regarding technical level for maintenance, procurement condition of spare parts and consumable parts, and necessary cost for operation and maintenance. Soft component included in the Project shall assist to use the items which are the first case in Bangladesh. However, it is strongly recommended for the Bangladeshi side to maintain an operation system, skills and technology to ensure the sustainability of the Project achievement.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

(1) Cost to be borne by the Bangladeshi Side

The costs to be borne by the Bangladeshi side are shown in the tables below. Those numbers have been estimated with the conditions mentioned below.

Table 2-17: Approximate Estimation of the Costs Borne by the Bangladeshi Side

Obligation of Bangladeshi side : BDT 529,200,000 (614 Million Yen)

Contents	Costs (thousand BDT)
Site ground leveling, Removal of fence, residents, trees, etc.	5,600
Construction of management office, rest house, etc.	9,000
Connecting electricity	10,000
Water supply to the tank	10,000
Pavement inside the Project site	7,900
Construction of railway	15,100
Furniture and equipment	2,000
Construction permission	100
Supposed Bank fees	1,000
Custom duties, internal taxes and other fiscal levies	468,500
Total	529,200

(2) Condition of Cost Estimation

1) Time of Cost Estimation

The Project cost was estimated in May 2011 when the 3rd field survey of the Preparatory Survey was completed.

2) Exchange Rate

The Project cost was calculated using average rate in six months from November 1, 2010 to April 30, 2011.

- USD 1=83.73 Yen
- BDT 1=1.160 Yen

3) Schedule

Schedule is shown in the implementation schedule in chapter 2-2-4-9.

4) Others

Project cost was estimated according to the Guideline of Japanese Grant Aid.

2-5-2 Operation and Maintenance Cost

Operation and maintenance cost of warehouse equipped with air conditioning machines is depending on the operation condition including time and target humidity/temperature of the air. The operation cost is

estimated to be BDT 4,600,000/year as electrical bill for air conditioning machines in the case that target relative humidity in the storage room is 70% or less without rising of air temperature by the operation of air conditioning machines located in the storage rooms.

Staff salaries, telephone charge, postal and stationary expenses are estimated based on actual expense of existing food storage in Bangladesh.

Estimated cost required for operation and maintenance is almost same as 1.2 % of total budget of DG Food, MoFDM, so it is judged that it will be able to secure the budget and that sufficient operation and maintenance can be implemented.

Table 2-18: Approximate Estimation of Operation and Maintenance Costs

Contents	Cost (thousand BDT/Year)	Calculation Base
Staff salaries (permanent)	2,700	Estimated based on actual expenses of existing food storage
Staff salaries (temporary)	800	Estimated based on actual expenses of existing food storage
Facilities maintenance cost	5,400	Estimated on the assumption requiring renewal 50% of the external painting, wooden lattice framework and air conditioning machines, every 10 years (5%/Year)
Line marking on the floor	400	Estimated on the assumption requiring repainting every year
Equipment maintenance cost	3,900	Estimated on the assumption requiring renewal 50% of the equipment every 10 years (5%/Year)
Electrical charge (For air conditioning)	4,600	Estimated on the assumption targeting with relative humidity of 70% for air conditioning machine
Electrical charge (For lighting, etc)	600	Estimated based on actual expenses of existing food storage
Telephone charge	90	Estimated based on actual expenses of existing food storage
Postal charge	40	Estimated based on actual expenses of existing food storage
Stationary charge	70	Estimated based on actual expenses of existing food storage
Others	2,300	Estimated based on actual expenses of existing food storage
Total	20,900	

In the case that 1 % of 25,000 Mt rice is damaged, the loss corresponds to a cost of BDT 4,845,000 based on average wholesale price: BDT 19.38 / kg from January 2009 to June 2009. Furthermore, 5 % corresponds to a cost of BDT 24,225,000 and 10% corresponds to a cost of BDT 48,450,000.

Electrical charge to operate air conditioning machines of the Project is estimated to be BDT 4,600,000, which corresponds to a cost of 0.9 % damaged rice of the total storage capacity of 25,000 Mt.

It is expected that loss will be reduced 0.9% or more by air conditioning. In this case, electrical charge is going to be less than the cost caused by the loss.

2-6 Other Relevant Issues

Other relevant issue affecting smooth implementation of the Project shall be considered as follows.

(1) Customs Clearance and Tax Exemption

The facilities to be constructed and the equipment to be procured by the Project shall be used to resolve an issue of urgency in Bangladesh. It is necessary to take care so that customs clearance and tax exemption procedures may be carried out promptly and implementation schedule may not be affected.

(2) Securing the Project Site

It is necessary to secure the Project site including leveling and removal of existing facilities located in construction area of the Project prior to the commencement of the construction works of the Project.

(3) Securing Safety in the Project Site

The construction works of the Project will be executed in the site where existing facilities are located. It is necessary to secure safety in the construction area, as well as neighboring areas and existing facilities in the Project site.

Chapter3 Project Evaluation

Chapter 3. Project Evaluation

3-1 Recommendations

3-1-1 Precondition to Implement the Project

For the smooth implementation of the Project, the Bangladeshi side shall take care of the preconditions listed in the table below. It is necessary to be implemented with certainty in an adequate timing.

Table 3-1: Precondition to Implement the Project

Contents	Timing
To Submit applications for construction works, fire services and others related to the Project if any, and to get those permission.	Prior to the commencement of construction works
To remove existing residents, walls, trees, etc. in the Project site	Prior to the commencement of construction works
To secure water supply	Prior to the commencement of construction works
To bring in power lines to the Project site	Before the completion of construction works
To secure the personnel who will be assigned to the Project, and to secure and dispatch the personnel for the technical assistance	Before implementation of soft component (technical assistance)
To procure furniture and equipment related to the Project	Before the completion of construction works and equipment procurement works
To secure the budget to operate and maintain the facilities and equipment related to the Project	Before the completion of construction works and equipment procurement works
To attend the beginning, mid term and completion of the construction inspection	Accordingly
To attend equipment and materials inspection	Accordingly

3-1-2 Preconditions to Achieve Project Purpose

For preconditions to achieve and sustain the Project effect, the Bangladeshi side shall solve the issues listed below.

(1) Establishment of Operation and Maintenance System

The Project will newly establish food storage facilities. It is necessary to establish a new operation and maintenance system to realize adequate and sustainable operation and maintenance of the facilities and equipment after the completion of the construction works and equipment procurement works of the Project.

(2) Receiving in Merchantable Quality

It is necessary to receive the parboiled rice in merchantable quality to realize long term storage without quality deterioration. Thus, only parboiled rice satisfying specified quality shall be stored in the warehouse. In particular, random inspection is desired to be executed at the time of receiving. Besides, for safety pallets loading, packing and bag condition are required to be inspected prior to loading on the pallets.

(3) Establishment of Skills and Technology

In Bangladesh, there are no examples and experience in operating and maintaining warehouses equipped with air conditioning machines. Technical assistance will assist to establish the skills and technology to operate and maintain the warehouse, but it shall be limited to the assistance at the beginning stage of operation of warehouse.

It is desired to reduce operation and maintenance cost in order to realize the sustainability of the Project. For the above, it is essential to minimize operation cost of air conditioning machine. After the completion of the Grant Aid, it is required to establish unique skills and technology conforming to Bangladeshi climate conditions through the actual experience to operate and maintain the warehouse equipped with air conditioning machine.

3-1-3 Important Assumptions to Achieve Project Purpose

It is pointed out for important assumption for the Project that: 1) Bangladeshi national policy concerning food security will not be changed, 2) necessary budget and staff will be secured to manage the facilities and equipment and 3) production volume of rice to be stored in the warehouse will not be reduced.

3-2 Project Evaluation

3-2-1 Relevance of the Project

In the point of view listed below, it can be judged that relevance of the Project is high.

- The Project is conforming to Bangladeshi national development policy.
- Profitability of the Project is low because the Project is contributing to public food distribution system in Bangladesh.
- Target group of the Project is the general populace, including those in poverty.
- The Project is contributing to food security and it is required to be implemented urgently.
- The Project has needs and advantages to be implemented using established skills and technology in Japan.
- The Project components are possible to be operated and maintained by the Bangladeshi side without excessive high skills and technology.
- The Project is possible to be implemented conforming to Japan's Grant Aid scheme without particular difficulty
- The Project is expected to contribute to adaptation to climate change.
- The Project is conforming with the "Country Assistance Program for Bangladesh" by GOJ

3-2-2 Effectiveness

The Project is expected to contribute to food security in Bangladesh through Public Food Distribution System (PFDS). Considering actual distribution results, quantitative effectiveness of the Project can be expected as follows.

Table 3-2: Quantitative Effectiveness of the Project

Objectively Verifiable Indicators	Baseline (Year of 2011)	Target (Year of 2017)
Capacity of public food storage in Rajshahi Division	420,350 Mt	446,090 Mt
Storage capacity of food aid to those in poverty (for 1 year / 1 household)	1,168,000 households	1,239,000 households
Storage capacity of food aid to those affected by natural disasters (for 1 time/ 1 person)	42,035,000 persons	44,609,000 persons

Calculation Base
Total storage capacity of the Project: 25,740 Mt of parboiled rice, inventory turns once a year
Capacity of public food storage in 2011: Silo: 25,000 Mt (1 silo), CSD: 71,650 Mt (3 CSD), LSD: 323,700 Mt (182 LSD)
Distribution of parboiled rice to those in poverty through the channel of Vulnerable Group Development (VGD) for 1 month: 30 kg / household (source: DG Food, MoFDM) Through the channel of VGD, rice is contributed for 18 months, and is contributed continuously after 18 months
Distribution of parboiled rice to those affected by disasters through the channel of Vulnerable Group Feeding (VGF) for 1 time: 10 kg / person (source: DG Food, MoFDM)

Besides the above, it is expected for qualitative effectiveness by the Project that, 1) modernized warehouse management system is established, 2) grain condition is improved with the storage in the air conditioned warehouse, 3) safe food in good quality is distributed smoothly.

3-2-3 Conclusion

It is judged that the relevance of the Project is high and the Project is expected to be effective.