NO.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR PROVISION
OF
PORTABLE STEEL BRIDGES
ON
UPAZILAAND UNION ROADS
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

AUGUST 2005

JAPAN INTERNATIONAL COOPERATION AGENCY

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JR
05-107

Preface

In response to a request from the Government of the People's Republic of Bangladesh, the Government of Japan decided to conduct a basic design study on the Project for Provision of Portable Steel Bridges on Upazila and Union Roads and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Bangladesh a study team from January 8 to March 11, 2005 and from April 9 to May 1, 2005.

The team held discussions with the officials concerned of the Government of the People's Republic of Bangladesh, and conducted field studies at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Bangladesh from May 31 to June 6, 2005 in order to discuss a draft basic design, and as this result, the present report was finalized.

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

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of Bangladesh for their close cooperation extended to the team.

August, 2005

Seiji Kojima
Vice President
Japan International Cooperation Agency

August, 2005

Letter of Transmittal

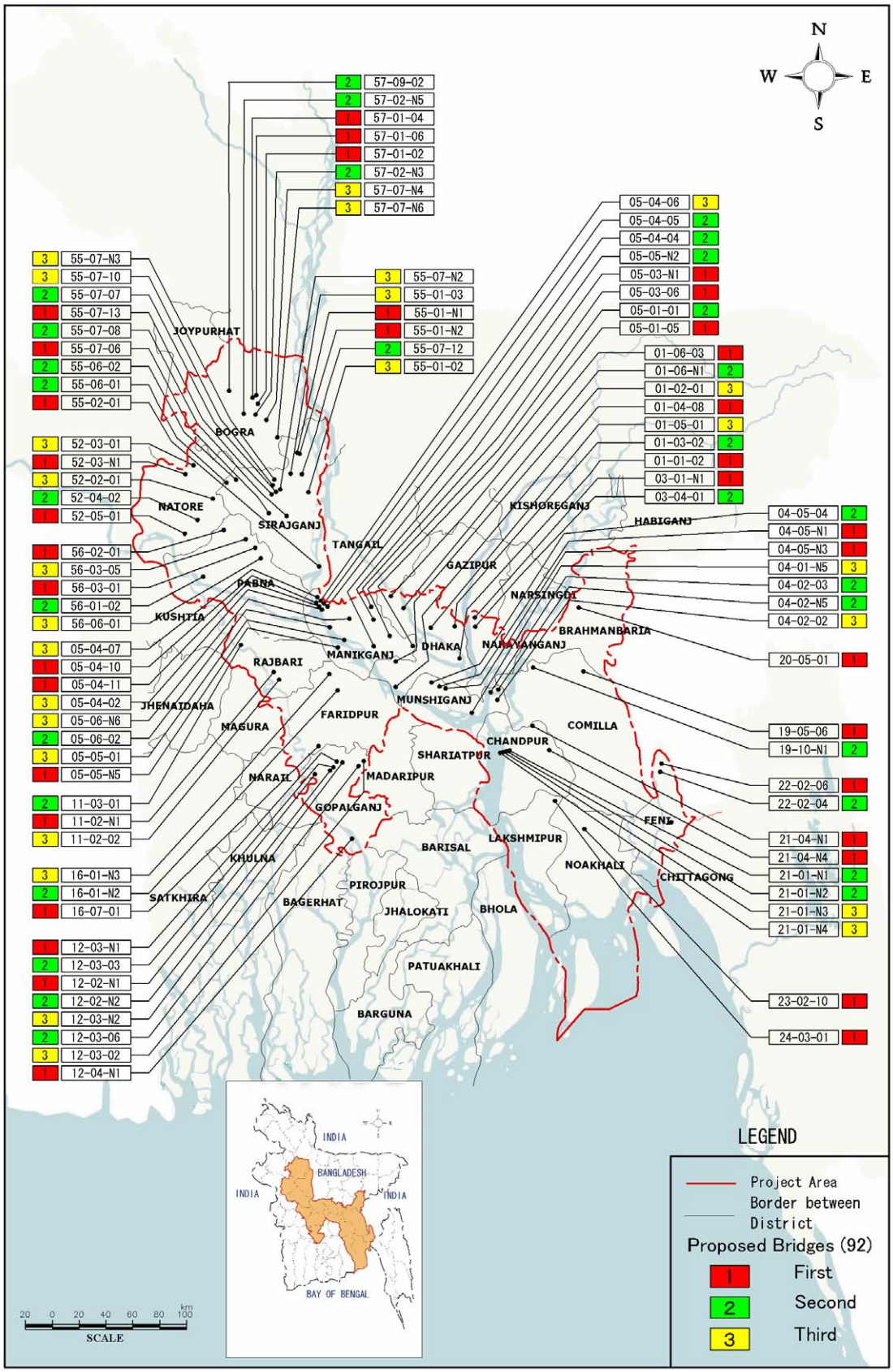
We are pleased to submit to you the basic design study report on the Project for Provision of Portable Steel Bridges on Upazila and Union Roads in the People's Republic of Bangladesh.

This study was conducted by Katahira & Engineers International, under a contract to JICA, during the period from December, 2004 to August, 2005. In conducting the study, we have examined the feasibility and rationale of the project, with due consideration to the present situation of Bangladesh, and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

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

Very truly yours,

Kazuyuki HIRAOKA
Chief Consultant,
Basic Design Study Team on the Project for
Provision of Portable Steel Bridges for Upazila
And Union Roads
Katahira & Engineers International



Location Map

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Abbreviation

AASHTO	:	American Association of State Highway and Transportation Officials
A D B	:	Asian Development Bank
B W D B	:	Bangladesh Water Development Board
DANIDA	:	Danish International Development Agency
I D B	:	Islamic Development Association
J B I C	:	Japan Bank for International Cooperation
J I C A	:	Japan International Cooperation Agency
J I S	:	Japanese Industrial Standard
L G E D	:	Local Government Engineering Department
N H W L	:	Normal High Water Level
R H D	:	Roads and Highways Department
R I D P	:	Rural Infrastructure Development Project
R T I P	:	Rural Transportation Improvement Project
S H W L	:	Standard High Water Level
S W M C	:	Surface Water Modeling Center
U S A I D	:	Unites States Agency for International Development
W B	:	World Bank (International Development Association)

Summary

The People's Republic of Bangladesh is the low-lying and riverine country, located in the alluvial delta plains of the major rivers (Ganges, Brahmaputra and Meghna rivers). Bangladesh has a tropical monsoon climate. Two seasons of monsoon season (April-September) and dry season (October-March) are recognized. The Area is about 148,000 sq. km and mostly flat as less 9 m above sea level. The heavy rainfall in the monsoon season comes at a time when major rivers are bringing in large volume of water from their upper catchments where the annual rainfalls are more than 10,000 mm. The areas more than 20% of the country are flooded and submerged in the monsoon season. The flooding is significant and occurs frequently at the Project Areas.

The Bangladesh's population is estimated 130 million (density=835 person/km^2). Main sector is agriculture that products are rice (single most important product), jute, wheat and etc. Major industries are textiles, garments, processed foods and etc. A vast majority of population (about 80%) live in the rural areas. It is estimated that around 50% of the population live in below poverty line and considered to be one of the less developed countries in the world.

In Bangladesh, the modal share of the road in these surface transport-roads, railways and inland waterway is 72% for passengers and 65% for fright. Thus, the road transport plays a dominant role in transport system and is very important to improve the road network for vitalizing the socio-economic activities in Bangladesh.

Under such situation, the government set out as one of the objectives of the Fifth Five Year Plan 1997-2002 the development of infrastructure needed to promote socio-economic growth particularly in the private sector. And the government has been implementing various projects for rural infrastructure developments such as roads, bridges, growth centers, irrigations, drainages and flood control facilities and employment generation programs etc. About 60% of financial outlay for rural development in the Fifth Five Year Plan was allocated to rural infrastructure development, as an important strategy for the reduction of rural poverty.

Despite of sustained efforts, the rural areas remain poor and undeveloped. Rural road is still undeveloped and lack of bridges crossing numerous creeks and small rivers is a big constraint to continuous passage in many road sections. Such is the present condition in Bangladesh. The government formulated Three Year Rolling Investment Program its development strategies being poverty alleviation and addresses the development of rural infrastructure such as roads, bridges as one of the strategies of the said Plan for rural development. The Government aims to accelerate development of the roads in rural areas keeping with the goals of national development plans.

In due consideration of the poor infrastructure for transportation which is serious constraint to overall development of the rural areas, the Government of Bangladesh made the request 3 times to the Government of Japan for grant aid for provision of portable steel bridge materials. In reply to the requests, the Government of Japan supplied the materials through LGED for 74 bridges in 1994-1996, as Phase-1 and 80 bridges in 2001-2002, as Phase-2 and through RHD for 76 bridges in 2002-2004. However, there still remain thousands of gaps on important rural roads where bridges are to be constructed / reconstructed urgently. In order to pursue the systematic implementation of the bridge construction for rural development, the Government of Bangladesh through LGED requested the Government of Japan to conduct the Master Plan Study for Portable Steel Bridge Construction on Feeder and Rural Roads in Bangladesh. The study started and completed in 2002.

The Government of Bangladesh made a request to the Government of Japan for grant aid for provision of portable steel bridge materials for 147 bridges with a total length of 7,585m, which are evaluated to have highest socio-economic effect in the Master Plan Study.

In response to a request from the Government of Bangladesh, the Government of Japan decided to conduct a basic design study on the Project for Provision of Portable Steel Bridges on Upazila and Union Roads and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to Bangladesh a study team from January 8 to March 11, 2005 and from April 9 to May 1, 2005. The team held discussions with the officials concerned of the Government of Bangladesh, and conducted field studies at the study area. After the team returned to Japan, basing on the field survey, the necessity of the project, socio-economic effect and appropriateness were studied. The optimized basic design and implementation plan were made and proposed with the Project Bridge. Then, a mission was sent to Bangladesh from May 31 to June 6, 2005 in order to discuss a draft basic design.

Finally proposed plan is outlined as follows:

- Type of Bridge : Steel Truss through Bridge
- Design Live Load : HS-20 for Upazila Road
  HS-15 for Union Road, Village-A Road, Village-B Road
- Effective Width : 3.350m, 1 Lane
- Span Length : 10m, 15m, 20m, 25m and 30m (5 types)
- Deck type : Steel Deck
- Rust Prevention : Zinc Hot Dip Galvanizing
- Scope of Works : Shown in the table below

The detail of finalizing the Project Bridge is described as the follows;

① After discussion with the Team, LGED requested that the 34 bridges already constructed/under construction and committed to be constructed shall be excluded from the list of Study (147 bridges), and highly prioritized 34 bridges shall be added into the study list.

② After the field survey, duplicated 9 bridges were excluded and 138 bridges were to be further studied.

③ The 138 bridges were evaluated on their engineering viability and socio-economic viability in accordance with the evaluation criteria shown in the Table. The 46 bridges were excluded from the list and 92 Bridges were selected to as the Project Bridge. The proposed plan is shown below.

Table Evaluation Criteria for Engineering and Socio-economic Viability

Criteria for Disqualification of Bridge			Disqualified Bridge	
No	Criteria	Condition	No. of Bridges	Total Length (m)
1	Site survey	Bridge length ＞ 150.0 m	2	570
2	Site survey	Water depth at a position of a pier in dry season＞1.200 m	25	1,900
3	The bridge priority by Master Plan's Evaluation method	Priority B or C	19	845
Total			46	3,315

District	Candidate Bridge（138 Bridges）									
	Project Bridge（92 Bridges）								Disqualified Bridge（46 Bridges）	
	Phase 1		Phase 2		Phase 3		Total			
	Nos.	Length	Nos.	Length	Nos.	Length	Nos.	Length	Nos.	Length
Dhaka	3	120 m	2	135 m	2	60 m	7	315 m	3	250 m
Narayanganj	1	45 m	1	40 m	-		2	85 m	3	225 m
Munishiganj	2	60 m	3	165 m	2	95 m	7	320 m	4	280 m
Manikganj	6	295 m	5	200 m	5	345 m	16	840 m	3	455 m
Rajburi	1	50 m	1	105 m	1	50 m	3	205 m	-	
Gopalganj	3	115 m	3	155 m	2	95 m	8	365 m	-	
Faridpur	1	75 m	1	35 m	1	60 m	3	170 m	6	240 m
Comilla	1	30 m	1	90 m	-		2	120 m	3	170 m
B' Baria	1	75 m	-		-		1	75 m	1	90 m
Chandpur	2	45 m	2	45 m	2	50 m	6	140 m	1	125 m
Feni	1	50 m	1	60 m	−		2	110 m	6	245 m
Noakhali	1	20 m	-		-		1	20 m	4	175 m
Lakshmipur	1	20 m	-		-		1	20 m	2	170 m
Natore	2	110 m	1	35 m	2	195 m	5	340 m	-	
Sirajganj	5	245 m	5	290 m	5	255 m	15	790 m	5	590 m
Pabna	2	140 m	1	100 m	2	165 m	5	405 m	-	
Bogra	3	185 m	3	220 m	2	130 m	8	535 m	5	300 m
Total（17 District）	**36**	**1,680 m**	**30**	**1,675 m**	**26**	**1,500 m**	**92**	**4,855 m**	**46**	**3,315 m**
New	33	1,605 m	30	1,675 m	25	1,465 m	88	4,745 m	-	-
Re-Const.	3	75 m	-	−	1	35 m	4	110 m	-	-

The undertakings by Japan is procurement and fabrication of the steel materials for superstructure of the portable steel bridges and transportation of the bridge materials to the designated stockyard. The undertakings by Bangladesh side is design and construction of the bridge substructures, approach roads and incidental structures and erection of superstructure of the bridges including their transportation from the stockyard to the sites.
Soft components will not be carried-out.

If the project is implemented under the Japan's grant aid, it is planned to be implemented in three phases and the periods for detailed design and procurement are estimated at 7 months and 8 months respectively at each phase. The total project cost is roughly estimated at 4,012 Million Yen consisting of 1,971 Million Yen and 2,041 Million Yen to be borne by the Japanese Government and Bangladesh Government respectively.

The system, personnel and budget of the Government of Bangladesh for construction, operation and maintenance of the facilities after completion are considered to be well arranged and no problem is expected.

Direct beneficiaries of the Project are the population residing in the 17 districts, amounting to about 3.0 million.

Major effects of the Project are as follows:

(1) Direct Effects

- By constructing bridges, transport means will be secured at 88 gaps.
- By re-constructing bridges, safe and stable year-round passage will be ensured at 4 bridges that car cannot go through due to the damages caused by floods.

(2) In-direct Effects

- Provision of Safe and Stable Transport Means
  The problem of the existing bridges such as absence of bridges, impassability for vehicles, serving only for pedestrians, insufficient loading capacity, etc. will be solved and safe and stable transport means will be secured.
- Increase of Transport Capacity
  Transport Capacity will be remarkably increased since large vehicle can pass.
- Savings in Transport Cost
  Transport Cost will be reduced resulting from improvement of transport efficiency since large vehicle can pass.
- Expansion of the area where vehicle is passable and reachable
  The zone where vehicle is passable and reachable will be expanded 1,190km^2 in area with new bridges to be constructed.

- Improvement of inhabitant's Convenience
  Daily life of inhabitants in commuting, attending school, shopping, going to hospital, visiting mosque and etc. will be improved by providing year-round safe and stable means for passage.

The project will produce many effects as mentioned above and improve inhabitant's daily life and economic activities in rural areas. Furthermore, the project will contribute the development of Bangladesh economy in broad view. It is appropriate to implement the project under the Japan's Grant Aid.

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CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

Bangladesh is one of the most densely populated countries of the world and a vast majority of population (about 77%) live in the rural areas. Poverty is widespread in the country and more so in the rural areas. It is estimated that around 50% of the population live in below poverty line and about half of them is considered to be the hard-core poor. The economy of Bangladesh is basically agrarian contributing about fifty five percent to Gross Domestic Product and employing over seventy percent of the country's entire labor force.

Rural infrastructure of the country consists of mainly Upazila Roads, Union Roads, Growth Centers, markets and Water ways etc.

For socio-economic development of the country as a whole, reduction of rural poverty is an essential condition. Toward that end, Rural Development & Institutes sector of the GOB aims at increasing income through development of rural infrastructure including improvement of marketing network and productive employment generation in the rural areas to boost up economic activities.

Rural development which aimed at improving the quality of life of rural people has thus gained a very high priority for economic relative to the over all welfare of the entire nation. The attention of the GOB is much focused on introducing programs aimed at boosting up agricultural production with other production oriented programs in order to augment the purchasing power of the rural people. Proper marketing of the agricultural products is none the less important to protect the farmer's interest in receiving increased ex-farm price of the perishable commodities. Aiming at reduction of rural poverty, the GOB has been implementing various projects including development of the rural infrastructure such as growth centers, roads, bridges and culverts connecting such centers, small irrigation and food control related infrastructure, employment generation programs, etc.

About 60% of financial outlay for rural development in the Three Year Rolling Plan (2003-2005) is allocated to rural infrastructure development, as an important strategy for the reduction of rural poverty.

Through national trunk roads have been improved to some extent but the rural access is still underdeveloped and cannot ensure year-round transportation in many areas.

Lack of bridges crossing numerous creeks and small rivers is a big constraint to continuous passability in many road sections.

Furthermore, flood causes damage almost every year to road structures and many road sections become impassable during rainy season and thereby hampers rural economic development.

In due consideration of the poor infrastructure for transportation which is a serious constraint to overall development of the rural areas, the GOB through LGED formulated the Portable Steel Bridge Construction Project and requested the Government of Japan to assist in its implementation.

In response, the Government of Japan conducted a Basic Design Study on the Project for Procurement of Portable Steel Bridge in 1993 and supplied the bridge superstructure materials for 74 bridges in 1994-1996, as Phase-1.

The Basic Design Study of the Phase-2 Project started in October 1999 and 80 bridges were selected. The implementation of the Phase-2 was completed within FY 2004.

However, there still remain thousands of gaps on important rural roads where bridges are to be constructed / reconstructed urgently. About 70,000 gaps where box culverts and pipe culverts are to be constructed are estimated.

In order to pursue the systematic implementation of the bridge construction for rural development purpose, it is of urgent necessity to investigate the present condition of the existing bridges / gaps and formulate a master plan.

Under such situation, the GOB through LGED requested the Government of Japan to conduct the Master Plan Study for Portable Steel Bridge Construction on Feeder and Rural Roads in Bangladesh.

In response to the request, the Government of Japan decided to conduct the study and entrusted the implementation of the study to the Japan International Cooperation Agency (JICA).

The study started in the middle of February 2002 and completed in early October 2002. In the master plan study, the country is divided into 15 zones. The zones are prioritized and classified into four groups : priorities 1 to 4.

On the other hand, project bridges are also prioritized and divided into three groups: priorities A to C.

Combining zone priority and bridge priority, the project bridges are divided into 12 groups. The combined priority is indicated such as 1A (zone priority 1 and bridge priority A), 1B, 1c and so forth. The GOB made a request to the Government of Japan for grant aid for provision of portable steel bridge materials for 147 bridges under priority group 1A.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Contents of the Project

2-1 Basic Concept of the Project

(1) Project Goals and Objectives

The Government of Bangladesh has formulated the national development plan and set out its development goals and objectives as simply presented below:

- Alleviation of poverty
- Generation of employment opportunities
- Attainment of food production beyond the self-sufficiency level
- Promotion of industries to produce high-value added products
- Human resources development
- Development of infrastructure, utilities and other services
- Achievement of a lower population growth rate
- Strengthening of country's scientific and technological base
- Protection and preservation of environment
- Closing gender gap
- Establishment of better social justice
- Improvement in the quality of life of the rural population
- Transformation of the rural socio-economic structure
- Putting in place effective local government institutions

Emphasis has been given to the development of transport infrastructure (roads, bridges and etc.) in rural area, which are directly related to poverty reduction and human development issues.

In response to a request from the Government of Bangladesh, the Project aims to contribute to the attainment of the goals set out in the development plan.

The overall goal and objective of the Project are as follows:

- Overall goal:
  - Improvement in the quality of life the rural population
  - Vitalization of socio-economic activities
  - Alleviation of poverty
  - Generation of employment opportunities
  - Development of infrastructure

- Project objectives:
  - Securing year-round transport means at the Project area
  - Improving human movement and physical distribution

(2) Basic Concept of the Project

The Project aims to provide the portable steel bridge materials for 17 districts of central and eastern area of the Bangladesh and to construct the bridges urgently in order to promote the socio-economic development of the Project area.

It is requested to evaluate this Project with its appropriateness and necessity for the Japanese Grant Aid Project.

The following effect is expected with implementing the Project. The socio-economic development and poverty alleviation will be promoted around the Project area. (It is estimated that direct beneficiaries of the Project are 30 million residents in the 17 districts.)

a) By constructing bridges, transport means will be secured at 88 gaps,
b) By re-constructing bridges safe and stable year-round passage will be ensured at 4 bridges.

The Project area is located at following 17 districts.

01. Dhaka	02. Narayanganj	03. Munshiganj	04. Manikganj	05. Rajbari
06. Gopalganj	07. Faridpur	08. Comilla	09. B-Baria	10. Chandpur
11. Feni	12. Noakhali	13. Laxmipur	14. Natore	15. Sirajganj
16. Pabna	17. Bogra			

2-2 Basic Design of the Requested Assistance

2-2-1 Design Policy

2-2-1-1 Basic Policy of the Project Bridges

(1) Policy of Evaluation Criteria for the Project Bridges

1) Evaluation Criteria for the Project Bridges

The Project aims to provide the portable steel bridge materials for the highest prioritized by "Master Plan Study for Portable Steel Bridge Construction of Feeder and Rural Roads in Bangladesh (2002)" entrusted to the Local Consultant by JICA.

The 147 bridges were requested originally. The 34 bridges already constructed/under construction/committed to be constructed were excluded from the scope of study. It elapsed after "Master Plan Study", the additional 34-bridges higher prioritized with condition changed were requested and accepted to include in the scope of Study at M/D.

After field survey, 9-bridges were disqualified due to the project's duplication. The Study Bridges by districts are shown on Table 2.2.1-1 and Disqualified Bridges and Fund are shown on Table 2.2.1-2.

Table 2.2.1-1 Study Bridges

District	Original Request	At M/D		Field Survey Bridge	After Field Survey	Candidate
		Disqualified Bridge	Additional Bridge		Disqualified Bridge	
Dhaka	**13**	0	0	**13**	- 3	**10**
Narayanganj	**7**	- 5	+ 3	**5**	0	**5**
Munshiganj	**10**	- 2	+ 3	**11**	0	**11**
Manikganj	**17**	- 1	+ 4	**20**	- 1	**19**
Rajbari	**3**	0	0	**3**	0	**3**
Gopalganj	**8**	0	0	**8**	0	**8**
Faridpur	**4**	- 2	+ 7	**9**	0	**9**
Comilla	**9**	- 8	+ 4	**5**	0	**5**
B-Baria	**2**	- 1	+ 1	**2**	0	**2**
Chandpur	**9**	- 1	0	**8**	- 1	**7**
Feni	**6**	- 4	+ 6	**8**	0	**8**
Noakhali	**7**	- 1	0	**6**	- 1	**5**
Laxmipur	**2**	0	+ 1	**3**	0	**3**
Natore	**5**	0	0	**5**	0	**5**
Sirajganj	**22**	- 1	0	**21**	- 1	**20**
Pabna	**3**	- 1	+ 5	**7**	- 2	**5**
Bogra	**20**	- 7	0	**13**	0	**13**
Total	**147**	-34	+34	**147**	- 9	**138**

Table 2.2.1-2 Disqualified Bridges and Funds

District	Bridge ID	Bridge Length (m) (by Master Plan)	Contents of the Project		
			Project Name	Funds	Complete Year
Dhaka	01-04-02	75	LGED→RHD (Under Construction)	GOB	2005
	01-04-03	60	LGED→RHD (Under Construction)	GOB	2005
	01-04-07	40	LGED→RHD (Under Planning)	GOB	2006
Narayanganj	03-01-N2	30	Light Bridge Project	GOB	2004
	03-03-01	30	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	03-03-02	60	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	03-03-03	20	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	03-03-04	30	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
Munshiganj	04-05-N2	30	Rural Transportation Improvement Project (RTIP)	WB	2005
	04-06-01	35	Food For Work Program	Local Fund (Zila Parishad)	2005
Manikganj	05-05-N6	25	2nd Small Scale Water Resouce Development Project (2nd SSWRRDP)	ADB	2007
	05-06-N1	30	Rural Transportation Improvement Project (RTIP)	WB	2007
Faridpur	16-07-02	25	Rural Development Project-24 (RDP-24)	JBIC	2004
	16-07-N1	20	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2004
Comilla	19-02-09	50	Greater Comilla Project	IDB	2007
	19-03-12	75	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2006
	19-04-05	30	Priority Bridge Construction Project	GOB	2003
	19-04-06	30	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	19-05-03	35	Rural Transportation Improvement Project (RTIP)	WB	2007
	19-07-02	110	Portable Steel Bridge Project	Netherlands	2005
	19-08-01	120	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	19-10-02	110	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
B-Baria	20-05-05	75	Greater Comilla Project	IDB	2007
Chandpur	21-03-04	40	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2007
	21-03-05	15	Priority Bridge Construction Project	GOB	2007
Feni	22-02-10	20	Food For Work Program (FFWP)	USAID	2004
	22-03-01	60	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2004
	22-04-01	25	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	22-05-05	20	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2003
Noakhali	23-01-06	50	Priority Bridge Construction Project	GOB	2005
	23-05-01	75	Greater Noakhali Project	IDB	2007
Sirajganj	55-02-02	65	Complete	GOB	2005
	55-04-02	120	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2006
Pabna	56-02-10	90	Rural Transportation Improvement Project (RTIP)	WB	2006
	56-03-03	150	Portable Steel Bridge Project	Netherlands	2005
	56-08-N1	95	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2006
Bogra	57-01-N1	80	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	57-01-N2	40	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
	57-07-01	40	Rural Transportation Improvement Project (RTIP)	WB	2006
	57-07-N2	55	LGED→RHD (Under Planning)	—	—
	57-07-N3	35	LGED→RHD (Under Planning)	—	—
	57-08-N2	75	Greater Bogra Rajshali Pabna Project (GPRPP)	GOB	2004
	57-10-01	85	Rural Infrastructure Development Project (RIDP)	GOB (PMC)	2005
合計	43 橋	2,380			

Abbreviation

GOB : Government of Bangladesh
PMC : Primimister Commited Project
WB : World Bank (International Development Association)
ADB : Asian Development Bank
JBIC : Japan Bank for International Cooperation
IDB : Islamic Development Bank
USAID : United States Agency for International Development

The Study Bridges has been evaluated by Evaluation Criteria for Disqualification of Bridges shown on Table 2.2.1-3 and Evaluation Criteria for Prioritization of Bridge shown on Table 2.2.1-4.

Table 2.2.1-3 Evaluation Criteria for Disqualification of Bridge

Description		Reason
1	Bridge Length exceeds 150m.	The bridge built with the Project is 1 lane bridge of the effective width 3.350m. A rickshaw and rickshaw / sedan car and rickshaw can pass each other on the bridge but sedan car and sedan car / sedan car and truck can not pass each other. When vehicles enter in the bridge, driver must confirm whether his vehicle is passable or not. The driver can not confirm at bridge exceeds 150m long.
2	The water depth exceeds 1.2m in dry season at a position of the pier.	The temporary cofferdam is required for pier construction. The cofferdam is usually made for sand-bugged. Sand-bugged cofferdam can be applied for 1.2m water depth at maximum. Steel sheet pile cofferdam is required for over 1.2m water depth. It is very difficult to procure either a steel sheet or driving equipment.

Evaluation Criteria for Prioritization of Bridge

Basing on the Master Plan Study, the Project has been requested. The re-evaluation of the bridge priority carried out with the method used for the Master Plan Study to secure the consistency of evaluation.

This method evaluates bridge with two aspects. The one is engineering factors (necessity/urgency of bridge construction), the other is socioeconomic factors (effect of bridge construction). So, high evaluation score is given to the bridge where it can get the above evaluation scores of both aspects to a certain extents as well.

Table 2.2.1-4 Evaluation Criteria for Prioritization of Bridge

A Bridge Prioritization Process	− Engineering evaluation score and a socio-economic evaluation score are calculated ①Engineering evaluation score: Valuation of necessity/urgency of bridge construction, the score of the following Ia, Ib, Ic and Id in total. ②Socioeconomic evaluation score: Evaluation of the effect of bridge construction, the point of the following IIa, IIb, IIc and IId in total
	− Bridge priority is decided with the following conditions from the engineering evaluation score and the socioeconomic evaluation score ・Bridge priority A: More than engineering evaluation score 63 and more than socioeconomic evaluation score 53. ・Bridge priority B: More than engineering evaluation score 50 and more than socioeconomic evaluation score 40. ・Bridge priority C: When priority isn't reached to B.

	Item	Condition	Score
①Engineering Evaluation Point	Ia. Road Class	Upazila Road Union Road Village Road A Village Road B	20 13 7 0
	Ib. The conditions of existing bridge	There is no existing bridge that vehicles can go through There is existing bridge that vehicles can go through	40 0
	Ic. The conditions of approach road	The good conditioned paved road The poor conditioned paved road Earth road	30 20 0
	Id. The conditions of a detour	No detour A detour (detouring distance over 2km) A detour (detouring distance less 2km)	10 5 0

	Item	Evaluation Score Calculated-Formula	Highest Score
②Socioeconomic Evaluation Score	IIa. Beneficial population	0.001 x P x Bridge length coefficient Here, P = influence area population (Max. 30,000)	30
	IIb. Vehicles traffic demand	0.1 x V x Bridge length coefficient Here, V = passenger car + trucks + buses) + (motorcycle + rickshaw + auto-rickshaw + animal tractor) /2 (Max. 200)	20
	IIc. Pedestrian demand	0.01 x Pd x Bridge length coefficient Here, Pd = the number of pedestrians (Max. 2,000)	20
	IId. Number of public facilities in influence area	1.0 x Pf x Bridge length coefficient Here, Pf = the number of public facilities in influence area (Max. 30)	30
	Here : Bridge length coefficient = 1.0 (bridge head ≦ 30m) 0.9 (30m< bridge length ≦ 75m) 0.7 (75m< bridge length ≦125m) 0.5 (125m<bridge length)		

2) The selection of the Project Bridge

The selection of the Project Bridge was made based on the above criteria with the following step.

Step 1: The bridge is disqualified and picked off which doesn't conform to the Project (refer to Table 2.2.1-4.).

Step 2: Re-evaluation was made for the bridges with the data and information obtained by Field Survey and the bridges of Priority B and C were disqualified.

Step 3: As the result of evaluation, the 46 bridges were disqualified, which is shown in the Table 2.2.1-5. Furthermore, the role, needs of the bridge is specially reconfirmed as to the site conditions, and the Project Bridges were decided, and that is shown in the Table 2.2.1-6 Project Bridge List (92 bridges).

Table 2.2.1-5 Bridges Disqualified for the Project

Criteria for Disqualification of Bridge			Disqualified Bridge	
No	Criteria	Condition	No. of Bridges	Total Length (m)
1	Site survey	Bridge length ＞ 150.0 m	2	570
2	Site survey	Water depth at a position of a pier in dry season＞1.200 m	25	1,900
3	The bridge priority by Master Plan's Evaluation method	Priority B or C	19	845
Total			46	3,315

Table 2.2.1-6 Disqualified Bridge List（46 Bridges）

Condition	District	Bridge ID	Length(m)	Water Depth at Dry Season (m)	Evaluation Result		
					Engineering Score	Socioeconomic Score	Priority *
Length ＞150m	Manikganj	05-06-N4	270	0.00	63	50	X1
	Sirajganj	55-07-04	300	0.00	63	50	X1
	Sub-total	2 Bridges	570				
Water Depth at Pier in Dry Season ＞1.200m	Dhaka	01-02-06	75	7.60	70	62	X2
	Dhaka	01-02-07	75	1.40	57	61	X2
	Dhaka	01-03-01	100	2.20	83	63	X2
	Narayanganj	03-02-04	100	1.40	70	42	X2
	Munshiganj	04-05-02	100	2.60	100	70	X2
	Munshiganj	04-05-03	105	7.10	63	69	X2
	Manikganj	05-06-N2	60	2.30	63	80	X2
	Faridpur	16-05-02	75	5.90	50	54	X2
	Comilla	19-09-N1	105	2.10	63	64	X2
	B-Baria	20-04-N3	90	1.60	93	49	X2
	Chandpur	21-05-02	125	3.80	93	70	X2
	Feni	22-02-01	40	1.70	87	77	X2
	Feni	22-05-06	80	2.00	87	67	X2
	Feni	22-05-07	65	2.80	87	90	X2
	Noakhali	23-02-02	40	1.60	87	90	X2
	Noakhali	23-02-04	45	1.40	87	90	X2
	Noakhali	23-02-05	40	1.70	63	90	X2
	Noakhali	23-02-06	50	1.80	93	90	X2
	Laxmipur	24-01-02	40	1.50	50	90	X2
	Laxmipur	24-02-01	130	4.50	63	50	X2
	Sirajganj	55-06-03	60	2.90	100	90	X2
	Sirajganj	55-08-01	125	7.40	93	70	X2
	Bogra	57-02-N4	40	3.00	70	90	X2
	Bogra	57-03-N2	60	2.80	57	86	X2
	Bogra	57-05-01	75	1.80	70	90	X2
	Sub-total	25 Bridges	1,900				
Priority B or C	Narayanganj	03-01-N3	30	0.00	50	74	B
	Narayanganj	03-02-06	95	1.10	83	41	B
	Munshiganj	04-02-N1	50	0.50	57	72	B
	Munshiganj	04-04-01	25	0.00	57	56	B
	Manikganj	05-04-03	125	0.20	70	52	B
	Faridpur	16-01-N1	40	0.00	50	55	B
	Faridpur	16-01-N4	30	0.00	57	93	B
	Faridpur	16-01-N7	30	0.00	45	78	C
	Faridpur	16-02-05	40	1.20	53	79	B
	Faridpur	16-06-01	25	0.00	57	86	B
	Comilla	19-04-07	40	1.20	57	90	B
	Comilla	19-06-03	25	0.00	53	91	B
	Feni	22-01-01	20	0.00	50	100	B
	Feni	22-01-03	20	0.00	50	90	B
	Feni	22-01-07	20	0.00	50	100	B
	Sirajganj	55-07-02	40	0.20	63	52	B
	Sirajganj	55-07-09	65	1.10	63	52	B
	Bogra	57-03-N3	75	0.60	57	90	B
	Bogra	57-05-04	50	0.30	57	90	B
	Sub-total	19 Bridges	845				
Total		**46 Bridges**	**3,315**				

*) The priority is X1 for Disqualified Bridges with condition of bridge length.
The priority is X2 for Disqualified Bridges with condition of Water depth at pier in dry season.

Table 2.2.1-7 Project Bridge List (92 Bridges)

No.	District	Serial No.	Bridge ID	Road No.	Length (m)
1	Dhaka	1	01-01-02	326383042	30
2	Dhaka	2	01-02-01	326622013	30
3	Dhaka	3	01-03-02	326733097	75
4	Dhaka	4	01-04-08	326182008	60
5	Dhaka	5	01-05-01	326723001	30
6	Dhaka	6	01-06-03	326142021	30
7	Dhaka	7	01-06-N1	326143020	60
8	Narayanganj	1	03-01-N1	367583038	45
9	Narayanganj	2	03-04-01	367683041	40
10	Munshiganj	1	04-01-N5	359563011	60
11	Munshiganj	2	04-02-02	359243012	35
12	Munshiganj	3	04-02-03	359242003	30
13	Munshiganj	4	04-02-N5	359242003	30
14	Munshiganj	5	04-05-04	359743035	105
15	Munshiganj	6	04-05-N1	359742007	30
16	Munshiganj	7	04-05-N3	359742007	30
17	Manikganj	1	05-01-01	356823025	55
18	Manikganj	2	05-01-05	356822005	60
19	Manikganj	3	05-03-06	356703005	65
20	Manikganj	4	05-03-N1	356703037	30
21	Manikganj	5	05-04-02	356102005	115
22	Manikganj	6	05-04-04	356102002	50
23	Manikganj	7	05-04-05	356102002	30
24	Manikganj	8	05-04-06	356102002	50
25	Manikganj	9	05-04-07	356102002	40
26	Manikganj	10	05-04-10	356102003	80
27	Manikganj	11	05-04-11	356102003	40
28	Manikganj	12	05-05-01	356283025	50
29	Manikganj	13	05-05-N2	356282002	40
30	Manikganj	14	05-05-N5	356283009	20
31	Manikganj	15	05-06-02	356223004	25
32	Manikganj	16	05-06-N6	356223014	90
33	Rajbari	1	11-02-02	382073015	50
34	Rajbari	2	11-02-N1	382072011	50
35	Rajbari	3	11-03-01	382733014	105
36	Gopalgonj	1	12-02-N1	345432001	50
37	Gopalgonj	2	12-02-N2	345434009	55
38	Gopalgonj	3	12-03-02	345583020	55
39	Gopalgonj	4	12-03-03	345584005	50
40	Gopalgonj	5	12-03-06	345582011	50
41	Gopalgonj	6	12-03-N1	345583008	40
42	Gopalgonj	7	12-03-N2	345583008	40
43	Gopalgonj	8	12-04-N1	345913011	25
44	Faridpur	1	16-01-N2	329473031	35
45	Faridpur	2	16-01-N3	329473015	60
46	Faridpur	3	16-07-01	329842010	75
47	Comilla	1	19-05-06	419813011	30
48	Comilla	2	19-10-N1	419543022	90
49	B-Baria	1	20-05-01	412852002	75
50	Chandpur	1	21-01-N1	413013002	25
51	Chandpur	2	21-01-N2	413013002	20
52	Chandpur	3	21-01-N3	413013002	30
53	Chandpur	4	21-01-N4	413013002	20
54	Chandpur	5	21-04-N1	413584003	25
55	Chandpur	6	21-04-N4	413583023	20
56	Feni	1	22-02-04	430514002	60
57	Feni	2	22-02-06	430513004	50
58	Noakhali	1	23-02-10	475074087	20
59	Laxmipur	1	24-03-01	451653025	20
60	Natore	1	52-02-01	169414054	105
61	Natore	2	52-03-01	169912004	90
62	Natore	3	52-03-N1	169913025	45
63	Natore	4	52-04-02	169153001	35
64	Natore	5	52-05-01	169443004	65
65	Sirajgani	1	55-01-02	188783066	80
66	Sirajgani	2	55-01-03	188783004	25
67	Sirajgani	3	55-01-N1	188783003	50
68	Sirajgani	4	55-01-N2	188783003	45
69	Sirajgani	5	55-02-01	188272002	25
70	Sirajgani	6	55-06-01	188893003	65
71	Sirajgani	7	55-06-02	188893003	60
72	Sirajgani	8	55-07-06	188943006	60
73	Sirajgani	9	55-07-07	188943060	75
74	Sirajgani	10	55-07-08	188943059	65
75	Sirajgani	11	55-07-10	188943038	60
76	Sirajgani	12	55-07-12	188943063	25
77	Sirajgani	13	55-07-13	188943024	65
78	Sirajgani	14	55-07-N2	188943038	40
79	Sirajgani	15	55-07-N3	188943009	50
80	Pabna	1	56-01-02	176552028	100
81	Pabna	2	56-02-01	176223017	65
82	Pabna	3	56-03-01	176332001	75
83	Pabna	4	56-03-05	176332005	90
84	Pabna	5	56-06-01	176723078	75
85	Bogra	1	57-01-02	110962014	65
86	Bogra	2	57-01-04	110963017	60
87	Bogra	3	57-01-06	110204106	60
88	Bogra	4	57-02-N3	110882007	50
89	Bogra	5	57-02-N5	110883046	105
90	Bogra	6	57-07-N4	110273024	50
91	Bogra	7	57-07-N6	110273055	80
92	Bogra	8	57-09-02	110332011	65

3) Phasing of the Project Bridge

It is agreed by the Bangladesh side that the Project Bridges will be completed within 2 yeas after the handing over Portable Steel Bridge material to generate effect in early stage. Taking account of budget allocation, magnitude of the Project, construction period and etc., the Project is carried out with 3 phases.

The bridge of higher evaluation score in total is ranked higher order of priority. The 2 plans of phasing shown in the Table 2.2.1-8 is proposed. The 2nd plan is selected for phasing since distribution of the bridges to the districts well-balanced, and it could obtain the consent of LGED.

Table 2.2.1-8 Plan of Phasing

	Phasing method	Characteristics	Decision
1st Plan	To select the bridges simply in order of higher evaluation score.	The bridges are unevenly distributed to the districts at each phase.	-
2nd Plan	To select the bridges in order of higher evaluation score within district level to balance the numbers at each phase. The bridges are evenly distributed to the districts at each phase.	But, in case that the Project Bridge is only one at the district, the bridge shall be phase 1 bridge. In case that the Project Bridge is 2, the bridges shall be phase 1 bridge and phase 2 bridge.	Accepted

The number and total length of the Project Bridges at each phase are shown in the Table 2.2.1-9. The evaluation scores of each bridge are shown in Table 2.2.1-10.

Table 2.2.1-9 Number and Total Length of the Project Bridges

District	Phase 1		Phase 2		Phase 3		Phase 1～Phase 3		Disqualified Bridge	
	No.	Length	No.	Length	No.	Length	No.	Length	No.	Length
Dhaka	3	120 m	2	135 m	2	60 m	7	315 m	3	250 m
Narayanganj	1	45 m	1	40 m	-		2	85 m	3	225 m
Munshiganj	2	60 m	3	165 m	2	95 m	7	320 m	4	280 m
Manikganj	6	295 m	5	200 m	5	345 m	16	840 m	3	455 m
Rajbari	1	50 m	1	105 m	1	50 m	3	205 m	-	
Gopalgonj	3	115 m	3	155 m	2	95 m	8	365 m	-	
Faridpur	1	75 m	1	35 m	1	60 m	3	170 m	6	240 m
Comilla	1	30 m	1	90 m	-		2	120 m	3	170 m
B-Baria	1	75 m	-		-		1	75 m	1	90 m
Chandpur	2	45 m	2	45 m	2	50 m	6	140 m	1	125 m
Feni	1	50 m	1	60 m	-		2	110 m	6	245 m
Noakhali	1	20 m	-		-		1	20 m	4	175 m
Laxmipur	1	20 m	-		-		1	20 m	2	170 m
Natore	2	110 m	1	35 m	2	195 m	5	340 m	-	
Sirajganj	5	245 m	5	290 m	5	255 m	15	790 m	5	590 m
Pabna	2	140 m	1	100 m	2	165 m	5	405 m	-	
Bogra	3	185 m	3	220 m	2	130 m	8	535 m	5	300 m
Total	**36**	**1,680 m**	**30**	**1,675 m**	**26**	**1,500 m**	**92**	**4,855 m**	**46**	**3,315 m**

Table 2.2.1-10 Phase of the Project Bridges

District	Br. ID	Road No.	L(m)	Eng. Score	Socio Eco Score	Total	Priority	Phase		
								P-1	P-2	P-3
Dhaka	01-01-02	326383042	30	93	86	179	A	○		
	01-04-08	326182008	60	90	81	171	A	○		
	01-06-03	326142021	30	90	67	157	A	○		
	01-06-N1	326143020	60	93	64	157	A		○	
	01-03-02	326733097	75	83	60	143	A		○	
	01-05-01	326723001	30	63	65	128	A			○
	01-02-01	326622013	30	70	54	124	A			○
Narayanganj	03-01-N1	367583038	45	93	78	171	A	○		
	03-04-01	367683041	40	78	71	149	A		○	
Munshiganj	04-05-N3	359742007	30	70	90	160	A	○		
	04-05-N1	359742007	30	70	85	155	A	○		
	04-02-03	359242003	30	70	66	136	A		○	
	04-05-04	359743035	105	63	70	133	A		○	
	04-02-N5	359242003	30	70	62	132	A		○	
	04-01-N5	359563011	60	63	64	127	A			○
	04-02-02	359243012	35	63	53	116	A			○
Manikganj	05-01-05	356822005	60	100	83	183	A	○		
	05-04-11	356102003	40	100	69	169	A	○		
	05-03-N1	356703037	30	63	93	156	A	○		
	05-05-N5	356283009	20	63	93	156	A	○		
	05-04-10	356102003	80	100	55	155	A	○		
	05-03-06	356703005	65	63	90	153	A	○		
	05-05-N2	356282002	40	70	82	152	A		○	
	05-01-01	356823025	55	63	88	151	A		○	
	05-04-05	356102002	30	70	74	144	A		○	
	05-06-02	356223004	25	63	79	142	A		○	
	05-05-01	356283025	50	63	78	141	A			○
	05-04-07	356102002	40	70	69	139	A			○
	05-04-06	356102002	50	70	68	138	A			○
	05-04-04	356102002	50	70	66	136	A		○*	
	05-06-N6	356223014	90	63	69	132	A			○
	05-04-02	356102005	115	70	61	131	A			○
Rajbari	11-02-N1	382072011	50	70	90	160	A	○		
	11-03-01	382733014	105	93	63	156	A		○	
	11-02-02	382073015	50	63	75	138	A			○
Gopalgonj	12-02-N1	345432001	50	100	90	190	A	○		
	12-04-N1	345913011	25	93	88	181	A	○		
	12-03-N1	345583008	40	93	87	180	A	○		
	12-02-N2	345434009	55	87	86	173	A		○	
	12-03-03	345584005	50	87	76	163	A		○	
	12-03-06	345582011	50	70	85	155	A		○	
	12-03-N2	345583008	40	63	90	153	A			○
	12-03-02	345583020	55	63	74	137	A			○
Faridpur	16-07-01	329842010	75	100	80	180	A	○		
	16-01-N2	329473031	35	93	85	178	A		○	
	16-01-N3	329473015	60	63	78	141	A			○
Comilla	19-05-06	419813011	30	93	100	193	A	○		
	19-10-N1	419543022	90	63	53	116	A		○	

District	Br. ID	Road No.	L(m)	Eng. Score	Socio Eco Score	Total	Priority	Phase		
								Ph-1	Ph-2	Ph-3
B-Bari	20-05-01	412852002	75	90	64	154	A	○		
Chandpur	21-04-N1	413584003	25	87	90	177	A	○		
	21-04-N4	413583023	20	63	100	163	A	○		
	21-01-N2	413013002	20	63	100	163	A		○	
	21-01-N1	413013002	25	63	92	155	A		○	
	21-01-N3	413013002	30	63	92	155	A			○
	21-01-N4	413013002	20	63	85	148	A			○
Feni	22-02-06	430513004	50	93	77	170	A	○		
	22-02-04	430514002	60	87	81	168	A		○	
Noakhali	23-02-10	475074087	20	87	85	172	A	○		
Laxmipur	24-03-01	451653025	20	93	84	177	A	○		
Natore	52-03-N1	169913025	45	93	90	183	A	○		
	52-05-01	169443004	65	93	90	183	A	○		
	52-04-02	169153001	35	93	90	183	A		○	
	52-03-01	169912004	90	100	70	170	A			○
	52-02-01	169414054	105	87	70	157	A			○
Sirajganj	55-01-N1	188783003	50	93	90	183	A	○		
	55-01-N2	188783003	45	93	88	181	A	○		
	55-02-01	188272002	25	70	100	170	A	○		
	55-07-06	188943006	60	93	76	169	A	○		
	55-07-13	188943024	65	83	76	159	A	○		
	55-07-07	188943060	75	63	90	153	A		○	
	55-07-08	188943059	65	63	90	153	A		○	
	55-06-01	188893003	65	63	86	149	A		○	
	55-06-02	188893003	60	63	86	149	A		○	
	55-07-12	188943063	25	63	85	148	A		○	
	55-07-N3	188943009	50	63	85	148	A			○
	55-07-10	188943038	60	63	81	144	A			○
	55-07-N2	188943038	40	63	78	141	A			○
	55-01-02	188783066	80	63	70	133	A			○
	55-01-03	188783004	25	63	65	128	A			○
Pabna	56-03-01	176332001	75	100	90	190	A	○		
	56-02-01	176223017	65	88	90	178	A	○		
	56-01-02	176552028	100	100	70	170	A		○	
	56-06-01	176723078	75	63	90	153	A			○
	56-03-05	176332005	90	70	68	138	A			○
Bogra	57-01-02	110962014	65	100	87	187	A	○		
	57-01-04	110963017	60	93	90	183	A	○		
	57-01-06	110204106	60	77	90	167	A	○		
	57-02-N5	110883046	105	93	70	163	A		○	
	57-02-N3	110882007	50	70	90	160	A		○	
	57-09-02	110332011	65	70	90	160	A		○	
	57-07-N4	110273024	50	63	90	153	A			○
	57-07-N6	110273055	80	63	67	130	A			○

(2) Policy for Selecting a Superstructure Type

An element to take into consideration for selecting a superstructure type is as follows from the viewpoint of bridge superstructure material supply project.

Constructability : Manual erection can be made. (maximum member weight 250kg)

Durability : The bridge shall have a durability as a permanent structure and be maintained easily.

Economical	:	Overall bridge construction cost shall be economical, which contain bridge fabrication costs and substructure cost and maintenance cost.
Vertical alignment	:	Bridge height shall be low as long as possible.

The following bridge type is selected as the most suitable superstructure which satisfies the above considerations. Since same bridge type was selected for the both Phase 1 and Phase 2 project under LGED, it is appropriate to select steel truss through bridge (pony truss bridge) as the Project Bridges.

Superstructure type	:	Steel truss through bridge (pony truss bridge)
Bridge deck type	:	Steel deck
Member connection	:	Friction grip joints with high strength bolt & nut (most reliable and popular)
Rust prevention on steel members	:	Zinc hot dip galvanizing

(3) Design Standard

1) Applied Standard

The following LGED's standards shall be applied as the design standard. But, as for the items which are not prescribed by these standards, the design specification issued by Japan Road Association is applied.

- Road bridge design standard : AASHOTO Standard Specifications for Highway Bridges and 17th 2002
- The standard design of the bridge : ROAD STRUCTURES MANUAL (PART B) LGED and 1989

2) Applied Design Standard

a. Design Load

- Dead load : steel beam, a hand rail and a safety recess for pedestrian
- Live load : shown in Table 2.2.1-11

  The roads of the Bangladesh is being classified by seven classes as shown in the Table 2.2.1-11. The Project Bridges are constructed in the roads of four classes of Upazila, Union, Village A and B which is under jurisdiction of LGED. HS-15 was used as the

design live load for a past portable steel bridge projects of LGED, and HS-20 is applied for RHD jurisdiction road.

However, in recent years, truck loads is so increased that HS-20 is decided to apply for the bridge in Upazila Road. Therefore, a design live load is applied to the Project Bridges as shown in the Table 2.2.1-11. And, as for the issue of other donors as well, it will confirm that it is a policy to change to HS-20 in the same way with LGED from now on.

Table 2.2.1-11 Road Classification and Applied Design Live Load

Organization		Road Class		Design Live Load	
		Old Name	New Name	HS-15	HS-20
-	RHD	National Highway	National Highway	－	○
		Regional Highway	Regional Highway	－	○
		Feeder Road A	Zila Road	－	○
◎	LGED	Feeder Road B	Upazila Road	×	○
		Rural Road 1	Union Road	○	×
		Rural Road 2	Village Road A	○	×
		Rural Road 3	Village Road B	○	×

- Impact load : AASHTO Section 3.8. to be referred.
- Temperature : It is set at ± 10℃ in consideration of the local condition.
- Wind load : AASHTO Section 3.15. to be referred.

b. Design Strength

The lower limit value of the design strength of the concrete which is usually used and the yield point lower limit value of the strength of the reinforcement are shown in the following.

Abutment・Pier

- Concrete design strength: Fc = 21 N/mm^2
- Re-bar yield strength Fy = 295 N/mm^2

c. Physical Properties of Steel Material

A steel material used shall be most popular, and economical rolled steels for general structure (JIS G3101 and SS400). But, the rolled steel material for welded structure (JIS G3106 and SM490Y) shall be used for upper code of truss which needs the higher strength.

The mechanical properties of the steel material is shown in the Table 2.2.1-12 here.

Table 2.2.1-12 Physical Properties of Steel Material

Standard Designation	Type	Mark	Yield Point (N／mm^2)			Tensile Strength (N／mm^2)
			t ≦16	16＜ t ≦40	40＜ t ≦75	
JIS G 3101	2	SS 400	245 more	235 more	215 more	400～510
JIS G 3106	3	SM 490Y	365 more	355 more	335 more	490～610
Bolt / Nuts	Sets of high strength hexagon bolts/nuts for friction grip joints M22 (F8T)					

d. Rust Prevention for the Steel Members

For Rust prevention for the steel members, C1 paint system is applied recently in Japan. This is, modified epoxy resin paint is applied for 1st and 2nd coat and polyurethane resin paint is applied for finishing coat. But, a coating system such as C1 has life in 20-40 years against the rust, and a repair painting should be necessary in the period in about 30 years.

But, the repair and maintenance painting which uses epoxy resin paint and polyurethane resin paint, is difficult in terms of techniques and procurement. Hot dip galvanizing (expected life 50 years) is applied for rust prevention and is specified below.

- Working standard in the galvanizing process: JIS H 9124
- The amount of coating : HDZ55 (with the steel material to use under the critical corrosion environment, beyond coating quantity 550g/ ㎡) of the JIS H 8641
- The friction coefficient of the contact surface of jointed material : over 0.4

e. The geometric Design of the Approach Road

- Cross Section : It is fitted to the existent road in principle.
- Minimum curve radius : Feeder road B:15m (design speed 20km /h)
  Other roads : It isn't specially prescribed.
- Maximum slope: 6%

(4) Bridge Width

The effective width of the bridge was 3.35m for the past projects. There was a request to increase for effective width of the ride from 3.35m to 3.670m. The effective width 3.350m was decided to be unchanged after the review and examination.

The effective width of the bridge of other donors is also 3.350m. There is no hindrance in passing of the large buses and the trucks with 3.350m effective width.

- For the long bridge, a pedestrian protection measures is provided as mentioned later.
- When effective width is increased, sections and length of members must be bigger and longer. And bigger bridge members not only rise the cost but also interfere manual erection of the bridge.

(5) Position and Length of a Bridge

The overall data and information such as river alignment, flood level, normal water level, velocity, discharge volume and geotechnical condition, topographical condition and constructability) obtained with field survey river were taken into consideration, for deciding bridge length and span. And, it paid attention to the following point as well.

The regards to the transport condition and manual erection of the portable steel bridge superstructure was made. Maximum span length shall be 30m. And, it paid attention to the following point as well.

- Abutments and piers constructed in the river or canal, shall be planned not disturb the flow of flood.
- It is a design principle that abutment shall be located outer side of the intersection point of flood water level and river levee. But, at the Project Bridge location where the river levee is not constructed, the position of abutments shall decided with care.
- Span length should be decided not to obstruct flowing down objects taking the river conditions and the geographical features in consideration.

The Decision of the Bridge Length

Length of the Project Bridges was decided with not only the above points but also the followings.

- Width between the abutments is fully secured against the flood flow, the freeboard of the beam shall be kept.
- A bridge length shall be reasonably minimized.
- Positioning of abutment shall be selected to prevent scouring and over-turning and washing-away of the abutment from flood.

Span Composition

Span composition shall be made in accordance with following criteria.

- Applicable span length shall be 10m, 15m, 20m, 25m and 30m. But the application of span length 10m and 30m is made only the case unavoidable to use 10m and 30m. Application space 10m is uneconomical, and the erection of 30m span bridge is difficult because of complex structure.

- The middle part of the river or canal is utilized for navigation in Bangladesh. In case of 2 span bridge, different span length shall be applied not to locate the pier in the middle of river. And the difference between each span shall be 10m and more.
- The number of span is reduced as less as possible to reduce the number of piers as well. In case a bridge length is in more than 70m, span 25m is applied in principal, and combination of 25m and 20m span is applied.

Basing on the above criteria, the standard spanning of bridges is shown in the Table 2.2.1-13.

Table 2.2.1-13 Standard Spanning

Length	Spanning	Length	Spanning	Length	Spanning
15m	(1) 1x15m	65m	(3) 20m+25m+20m	115m	(5) 20m+3x25m+20m
20m	(1) 1x20m	70m	(3) 20m+2x25m	120m	(5) 20m+4x25m
25m	(1) 1x25m	75m	(3) 3x25m	125m	(5) 5x25m
30m	(1) 1x30m	80m	(4) 4x20m	130m	(6) 2x20m+2x25m+2x20m
35m	(2) 10m+25m	85m	(4) 2x20m+25m+20m	135m	(6) 2x20m+3x25m+20m
40m	(2) 15m+25m	90m	(4) 20m+2x25m+20m	140m	(6) 20m+4x25m+20m
45m	(3) 3x15m	95m	(4) 20m+3x25m	145m	(6) 20m+5x25m
50m	(3) 15m+20m+15m	100m	(4) 4x25m	150m	(6) 6x25m
55m	(3) 15m+2x20m	105m	(5) 2x20m+25m+2x20m		
60m	(3) 3x20m	110m	(5) 2x20m+2x25m+20m		

Note: ( ) Figure is the number of spans.

(6) The Decision of Height of a Bridge

Deck level of a bridge is the Normal High Water Level (N.H.W.L) plus Navigation height plus bridge structure height at lowest. The Normal High Water Level is average flood water level which returns every 2 or 3 year. But, the past maximum flood water level is applied when the past maximum flood (H.F.W.L) is higher than the level of N.H.W.L plus Navigation Height.

N.H.W.L adopted the design is decided from the data and information obtained by site survey. Finally N.H.W.L is verified from a result of hydrology analysis.

(7) Substructure Design

Substructure design accord to the followings:

- Substructure of the Project Bridges shall be designed in accordance with the Bridge Designers' Handbook of LGED, and the topographic survey and the geotechnical investigation (boring) result are fully examined, and utilized.
- The type of the abutment and the pier shall accord to the standard design of the Bangladesh.
- Abutment Footing shall designed with enough cover.

- The cover of pier footing shall be 1.5m or more, and protection work shall be designed at place where it has possibility of scouring.
- Abutment shall be constructed at the position without erosion. A concrete block river bank protection shall be designed at the location where there is possibility of erosion, scouring and collapse of approach embankment.

(8) River Bank Protection and Road

Bank Protection : A concrete block bank protection shall be constructed at the location where there is the possibility of the erosion on river bank. (Slope gradient 1:1.5)

Approach road : Width and composition to be fitted with the existent road, and paving may be asphalt paving as standard. Longitudinal gradient to be less than 6%, and the slope of the embankment is 1:1.8.

2-2-1-2 Policy of the Nature

Elevation of beam soffit was decided based on the hydrological analysis. The procedure for determination of beam soffit is shown in the Figure 2.2.1-1.

The study area divided into five hydrological regions: Northeast (NE), Southeast Region (SE), North Central Region (NC), Southwest Region (SW/SC) and Eastern Hill Region (EH/CA) as shown in Figure 2.2.1-1.

According to flood pattern of waterway, bridges are divided into two categories: bridge on river and bridges in catchment. The elevation of girder soffit of each category is decided as follows;

- Bridge on the river: Elevation of girder soffit $\geqq$ SHWL + Navigation clearance
  where,
  SHWL (Standard High Water Level) = water level for flood run-off of 10-year return period,
  Navigation clearance = 1.5-3.3m depending on the size of boat passing (mostly 1.0m)

- Bridge in catchment: Elevation of girder soffit $\geqq$ NHWL + Navigation clearance
  where,
  NHWL (Normal High Water Level) = high water level which may occur every year,

Navigation clearance = 1.0m in principle, 0.6m in special case where necessary to avoid making the approach road elevation too high, and 1.5-3.3m in case large-sized boats pass

Procedure for Determination of Elevation of Girder Soffit is flow-charted in Figure 2.2.1-1 and Hydrological Regional Map are shown in “Appendices 6-3”.

With due regards to the characteristics of natural condition such as climate, geology, geomorphology and hydrology, both water levels obtained by hydrological analysis and the past highest water levels gained through Field Survey are checked. And Girder Soffit Elevation is determined carefully.

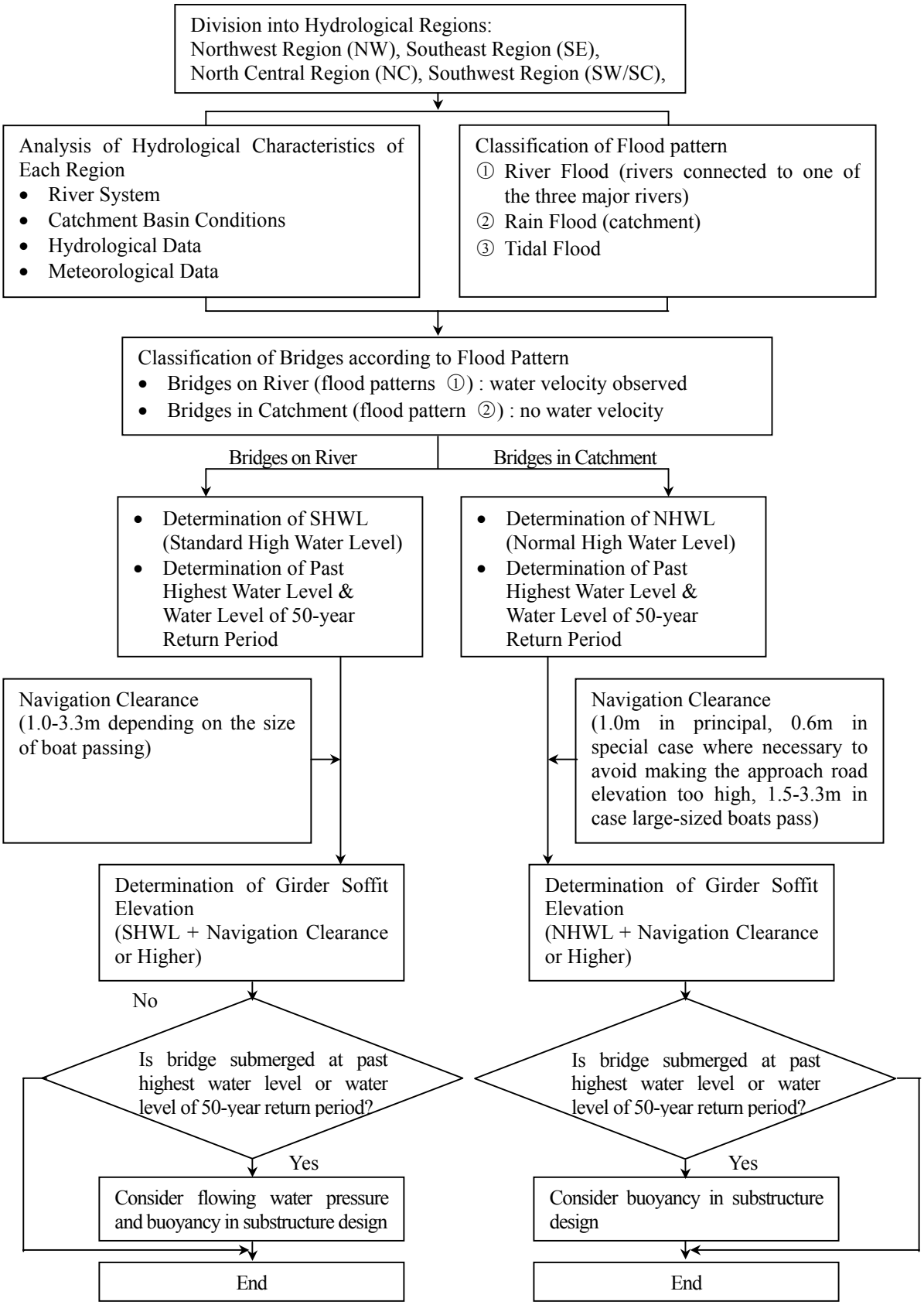


Figure 2.2.1-1 Procedure for Determination of Elevation of Girder Soffit

The various water levels are estimated as follows:

SHWL and water level of 50-year return period for bridges on river

① Water level – flow rate curve (H-Q curve) is drawn based on the water velocity measured during the site survey and the river cross section prepared by the topographic survey.

② By SWMC (Surface Water Modeling Center), the whole country is divided into 48 catchment basins as shown in Appendix 7 and the flood frequency analysis is made for each basin. Based on the analysis results, the probability flood run-off (Qp) at the bridge site is obtained from the following equation:

$$Q_p = C \times Q_{SWMC}$$

Where, Q_p = probability flood run-off at the bridge site

Q_{SWMC} = probability flood run-off prepared by SWMC in the basin covering the bridge site

C = adjustment factor for the bridge site, obtained from the following equation:

$$C = \sqrt{Q_{00}} \,/\, \sqrt{Q_{1.1}}$$

Q_{00} = flow rate at the bridge site, surveyed in September 2000

$Q_{1.1}$ = flood run-off of 1.1-year return period by SWMC in the corresponding basin

③ SHWL and water level of 50-year return period are estimated applying Q_p's of 10-year and 50-year return periods obtained in ② to the H-Q curve obtained in ①, respectively.

NHWL for bridges in catchment

NHWL is obtained from hearing at site.

Water level of 50-year return period for bridges in catchment

When water level reaches the NHWL in the catchment area, the area is inundated all around and ground surface is saturated. There is no place where water is drained. Under such situation, excess rainfall after reaching the NHWL is assumed to be added to the NHWL. On this assumption, water level of 50-year return period is estimated from the following equation:

$$HWL_{50} = NHWL + (R_{50} - R_{1.1})$$

Where, HWL_{50} = water level of 50-year return period

NHWL = normal high water level

R_{50} = rainfall of 50-year return period in the corresponding hydrological region

$R_{1.1}$ = rainfall of 1.1-year return period in the corresponding hydrological region

Past highest water level for both bridges on river and bridges in catchment

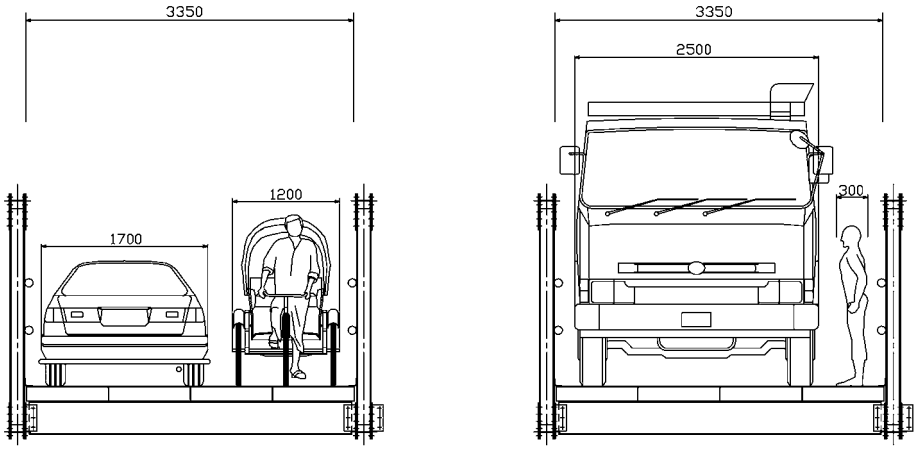
They are obtained from hearing at Field Survey.

2-2-1-3 Social and Environmental Consideration

The characteristics of the traffic in rural areas of Bangladesh are many pedestrians and rickshaws, a few busses and trucks.

The road standard section of LGED is a roadway (paving): 3.66m + shoulder: 1.88m, and the width of the portable steel bridge by other donors is 3.35m (11 feet). The Project Bridges are designed with the width of 3.350m, too. Sedan car and Rickshaw can pass each other on the bridge. When large vehicle like buses and trucks pass the bridge, the pedestrian on the bridge must let them pass by the deck side as shown in Figure 2.2.1-2.

Attention is especially necessary to the passage of the large buses, trucks when pedestrian puts an umbrella in the rainy day or has baggage in both hands. Because of this, provision of safety recess is examined from the viewpoint of the pedestrian protection. From the viewpoint of the pedestrian protection, safety recess shall be provided.



Car and Rickshaw Truck and Pedestrian

Figure 2.2.1-2 Passing Each Other on the PSB

2-2-1-4 Policy of the Supply and Transportation

The Project is provision of Portable Steel Bridge materials will be fabricated outside of Bangladesh. Special consideration on supply and transportation of materials is not be required.

2-2-1-5 Participation of Local Companies and Engineers/Workers

The provision of portable steel bridge materials is to be supplied by Japanese supplier. But other project activities (designing and construction of sub-structure, approach road, river bank

protection and superstructure erection) is undertaken by Local Consultants and Contractors and engineers/workers under the supervision of LGED.

2-2-1-6 Consideration on Implementing Agencies Abilities

LGED, the implementation agency of the Project successfully completed the both Japanese Bridge Grant Aid Projects Phase-1 and Phase-2 in the past. At the implementation of the past projects, LGED ordered the Local Consultants to design, tender and supervise the projects and awarded the Local Contractors to construct the substructures, approach roads and river bank protections. LGED awarded the special Contractors for the erection of portable steel bridge materials provided by Japanese Grant Aid.

Furthermore, LGED completed many road and bridge projects under foreign aids. LGED has annual budget as shown on the Table 2.2.1-14. Hence, it is noted that LGED has experience and abilities to manage the Project.

Table 2.2.1-14 Budget of LGED for the Past Three Years（2002－2005）

（Unit : Million Taka (1Taka = 1.72 Yen)）

Year		2002－2003*1		2003－2004*1		2004－2005*1	
		Ordinary Budget	Development Budget	Ordinary Budget	Development Budget	Ordinary Budget	Development Budget
Cost Total		**26,352.4**		**28,987.6**		**30,972.0**	
		19,418.0	**6,934.4**	**21,705.3**	**7,282.3**	**23,478.6**	**7,493.4**
＜Item＞							
A.	Road･Bridge Construction	**5,259.6**	**6,007.4**	**6,142.5**	**6,250.3**	**7,832.3**	**6,405.8**
	Roads	3,576.5	4,085.1	4,176.9	4,250.0	6,067.1	4,962.0
	Bridges	1,683.1	1,922.3	1,965.6	2,000.3	1,765.2	1,443.8
B.	Maintenance	**1,650.0**	**0.0**	**2,000.0**	**0.0**	**2,630.0**	**0.0**
C.	Others	**12,508.4**	**927.0**	**13,562.8**	**1,032.0**	**13,016.3**	**1,087.6**

・ 1 Taka = 1.72 Yen (1／12／2004～31／5／2005 : Average)
・ ＊1 : 1.July～30.June

A superintending Engineer in Head Quarter of LGED is responsible for the maintenance of roads, bridges and other facilities, and a considerable sum of the budget for the maintenance is allocated annually. After completion of the Project, the Project Bridges are expected to be well-maintained by LGED.

2-2-1-7 Policy in Selection of the Grade of Bridge Materials

The Grade of Bridge Material is selected in accordance with the policies already described and it is the same grade aided by other donors.

2-2-1-8 Consideration on Erection Method/Procurement/Phasing and Project Period

(1) Erection Method

The 2-Manual Erection Methods were applied for the past 2 projects. The one is “All Staging Method” and the other is “Draw Erection Method with Semi-Staging”. Both manual Erection Methods do not require special equipment, expert and high skilled workers.

Based on the previous result in the past 2 projects, the 2-manual erection methods is to be applied for the Project.

(2) Procurement

The procurement of the portable steel bridge material shall be optimized taking account the following items.

- Quality assurance
- Cost performance
- Reliability of delivery by due date

(3) Phasing and Project Period

The Project is to be implemented with 3 phasing consist of 3-single Fiscal Year Components, taking the following points into consideration.

- Viability of the Projects
- Production capability of the Bridge Fabricator
- Allocation of the Project Budget

Including verification period of Tender Documents and Contract Approval required in the Bangladesh, the most probable Project period is as follows;

- Design and tendering: 7.0 months
- Provision of the bridge material: 8.0 months

2-2-2 Basic Plan

2-2-2-1 Location of Bridge

Bridge Locations should be in accordance with the road plan of LGED and the engineering view point. LGED and the Basic Design Study Team agreed the location of bridges at the sites.

The most of the Project Bridges located just on the alignment of the existing road. But location was changed at following case.

- The Bridge and Approach center lines crossed at right angle each other and it is difficult for car to turn into the bridges and turn out to the approach road.
- The intersection angle of the river and bridge center linen is too small. (about less than 70°)

The bridge length was decided so as to be minimum on condition that abutments are placed behind the intersections of design high water level and river banks. But, it was so planned that a bridge length might be the multiple of 5m in reason to standardize a superstructure member. And, the elevation height of the Bridge Decks is determined based on the Hydrological Analysis.

The result of the Hydrological Analysis is shown on the Table 2.2.2-1.

Table 2.2.2-1 Hydrological Analysis (1/2)

No.	District	Bridge ID	Catchment Area No.	Probability Rainfall (mm) (April～September)		Normal High Water Level	Navigation Clearance	NHWL + NC	50-year return Period Water Level	Past Highest Water Level	Girder Soffit Elevation	Deck Surface Elevation
				1.1-year	50-year	NHWL (m)	NC (m)	(m)	(m)	(m)	(m)	(m)
1	Dhaka	01-01-02	NC-17	1,464	3,196	11.16	1.5	**12.66**	**12.89**	**12.36**	12.66	13.26
2		01-02-01	NC-16	1,464	3,196	10.26	1.0	**11.26**	**11.99**	**11.25**	11.26	11.86
3		01-03-02	NC-16	1,464	3,196	12.47	2.0	**14.47**	**14.20**	**13.79**	14.47	15.07
4		01-04-08	NC-16	1,464	3,196	10.17	2.0	**12.17**	**11.90**	**11.45**	12.17	12.77
5		01-05-01	NC-17	1,464	3,196	12.69	0.6	**13.29**	**14.42**	**14.09**	14.09	14.69
6		01-06-03	NC-16	1,464	3,196	10.38	1.0	**11.38**	**12.11**	**12.25**	12.25	12.85
7		01-06-N1	NC-16	1,464	3,196	12.31	1.0	**13.31**	**14.05**	**14.08**	14.08	14.68
8	Narayanganj	03-01-N1	NC-18	1,464	3,196	7.42	0.6	**8.02**	**9.15**	**9.44**	9.44	10.04
9		03-04-01	NC-11	1,464	3,196	8.81	2.0	**10.81**	**10.54**	**10.26**	10.81	11.41
10	Munishiganj	04-01-N5	NC-16	1,464	3,196	9.75	1.5	**11.25**	**11.48**	**10.64**	11.25	11.85
11		04-02-02	NC-10	1,464	3,196	9.20	0.6	**9.80**	**10.93**	**11.12**	11.12	11.72
12		04-02-03	NC-10	1,464	3,196	9.34	0.6	**9.94**	**11.07**	**11.54**	11.54	12.14
13		04-02-N5	NC-10	1,464	3,196	11.06	0.6	**11.66**	**12.79**	**12.64**	12.64	13.24
14		04-05-04	NC-16	1,464	3,196	9.13	1.5	**10.63**	**10.87**	**10.37**	10.63	11.23
15		04-05-N1	NC-16	1,464	3,196	8.80	1.0	**9.80**	**10.53**	**10.27**	10.27	10.87
16		04-05-N3	NC-16	1,464	3,196	8.80	1.0	**9.80**	**10.53**	**9.97**	9.97	10.57
17	Manikganj	05-01-01	NC-16	1,464	3,196	8.76	2.0	**10.76**	**10.49**	**10.42**	10.76	11.36
18		05-01-05	NC-16	1,464	3,196	7.10	1.5	**8.60**	**8.83**	**9.22**	9.22	9.82
19		05-03-06	NC-13	1,316	2,360	8.02	1.0	**9.02**	**9.07**	**9.88**	9.88	10.48
20		05-03-N1	NC-13	1,316	2,360	9.07	1.0	**10.07**	**10.11**	**10.21**	10.21	10.81
21		05-04-02	NC-13	1,316	2,360	7.84	2.0	**9.84**	**8.88**	**9.61**	9.84	10.44
22		05-04-04	NC-13	1,316	2,360	9.31	1.0	**10.31**	**10.35**	**10.20**	10.31	10.91
23		05-04-05	NC-13	1,316	2,360	9.67	1.0	**10.67**	**10.71**	**10.56**	10.67	11.27
24		05-04-06	NC-13	1,316	2,360	7.88	1.0	**8.88**	**8.93**	**8.53**	8.88	9.48
25		05-04-07	NC-13	1,316	2,360	9.33	1.5	**10.83**	**10.37**	**10.43**	10.83	11.43
26		05-04-10	NC-13	1,316	2,360	8.66	1.5	**10.16**	**9.70**	**10.39**	10.39	10.99
27		05-04-11	NC-13	1,316	2,360	7.78	1.0	**8.78**	**8.83**	**9.66**	9.66	10.26
28		05-05-01	NC-16	1,316	2,360	7.93	1.0	**8.93**	**8.97**	**9.57**	9.57	10.17
29		05-05-N2	NC-16	1,316	2,360	9.38	1.5	**10.88**	**10.43**	**11.24**	11.24	11.84
30		05-05-N5	NC-16	1,316	2,360	7.95	1.0	**8.95**	**8.99**	**9.83**	9.83	10.43
31		05-06-02	NC-13	1,316	2,360	8.13	1.5	**9.63**	**9.18**	**10.22**	10.22	10.82
32		05-06-N6	NC-13	1,316	2,360	9.67	2.0	**11.67**	**10.71**	**10.56**	11.67	12.27
33	Rajburi	11-02-02	SW-11	1,316	2,360	8.43	1.8	**10.23**	**9.48**	**9.85**	10.23	10.83
34		11-02-N1	SW-11	1,316	2,360	9.03	1.0	**10.03**	**10.08**	**10.03**	10.03	10.63
35		11-03-01	SW-11	1,316	2,360	9.40	0.8	**10.20**	**10.45**	**10.90**	10.90	11.50
36	Gopalganj	12-02-N1	SW-12	1,316	2,360	7.82	2.5	**10.32**	**8.87**	**8.66**	10.32	10.92
37		12-02-N2	SW-12	1,316	2,360	9.22	2.8	**11.97**	**10.26**	**10.22**	11.97	12.57
38		12-03-02	SW-12	1,316	2,360	9.51	3.0	**12.51**	**10.56**	**11.10**	12.51	13.11
39		12-03-03	SW-12	1,316	2,360	9.06	1.8	**10.81**	**10.10**	**10.47**	10.81	11.41
40		12-03-06	SW-12	1,316	2,360	8.40	3.0	**11.40**	**9.45**	**9.91**	11.40	12.00
41		12-03-N1	SW-12	1,316	2,360	8.64	1.5	**10.14**	**9.68**	**9.25**	10.14	10.74
42		12-03-N2	SW-12	1,316	2,360	7.89	1.5	**9.39**	**8.93**	**9.37**	9.39	9.99
43		12-04-N1	SW-16	1,316	2,360	8.53	1.0	**9.53**	**9.57**	**10.04**	10.04	10.64
44	Chandpur	16-01-N2	SW-1	1,316	2,360	7.87	1.0	**8.87**	**8.92**	**10.04**	10.04	10.64
45		16-01-N3	SW-1	1,316	2,360	9.68	1.0	**10.68**	**10.72**	**11.55**	11.55	12.15
46		16-07-01	SW-16	1,316	2,360	7.79	1.8	**9.59**	**8.84**	**10.04**	10.04	10.64
47	Comila	19-05-06	SE-5	1,316	2,360	10.94	1.5	**12.44**	**11.98**	**12.63**	12.63	13.23
48		19-10-N1	SE-5	1,316	2,360	10.01	2.0	**12.01**	**11.05**	**11.39**	12.01	12.61
49	B'Baria	20-05-01	SE-22	1,464	3,196	10.14	1.5	**11.64**	**11.87**	**12.10**	12.10	12.70

Table 2.2.2-1 Hydrological Analysis (2/2)

No.	District	Bridge ID	Catchment Area No.	Probability Rainfall(mm) (April～September)		Normal High Water Level	Navigation Clearance	NHWL + NC	50-year return Period Water Level	Past Highest Water Level	Girder Soffit Elevation	Deck Surface Elevation
				1.1-year	50-year	NHWL (m)	NC (m)	(m)	(m)	(m)	(m)	(m)
50	Chandpur	21-01-N1	SE-1	1,316	2,360	10.49	1.2	**11.69**	**11.54**	**11.34**	11.69	12.29
51		21-01-N2	SE-1	1,316	2,360	9.39	1.6	**10.99**	**10.43**	**9.59**	10.99	11.59
52		21-01-N3	SE-2	1,930	2,380	10.35	1.0	**11.35**	**10.80**	**11.26**	11.35	11.95
53		21-01-N4	SE-2	1,930	2,380	10.13	0.6	**10.73**	**10.58**	**10.79**	10.79	11.39
54		21-04-N1	SE-1	1,316	2,360	9.67	1.0	**10.67**	**10.71**	**10.25**	10.67	11.27
55		21-04-N4	SE-1	1,316	2,360	9.38	1.0	**10.38**	**10.43**	**10.44**	10.44	11.04
56	Feni	22-02-04	SE-6	1,316	2,360	10.92	0.6	**11.52**	**11.97**	**12.12**	12.12	12.72
57		22-02-06	SE-6	1,316	2,360	8.57	0.6	**9.17**	**9.61**	**9.80**	9.80	10.40
58	Noakhali	23-02-10	SE-13	1,930	2,380	9.00	0.6	**9.60**	**9.45**	**10.19**	10.19	10.79
59	Laxmipur	24-03-01	SE-11	1,930	2,380	9.35	0.6	**9.95**	**9.80**	**9.78**	9.95	10.55
60	Natore	52-02-01	NW-6	1,316	2,360	10.02	2.5	**12.52**	**11.06**	**10.68**	12.52	13.12
61		52-03-01	NW-8	1,316	2,360	9.26	1.5	**10.76**	**10.30**	**10.35**	10.76	11.36
62		52-03-N1	NW-8	1,316	2,360	9.05	1.0	**10.05**	**10.10**	**9.47**	10.05	10.65
63		52-04-02	NW-6	1,316	2,360	7.24	1.0	**8.24**	**8.28**	**8.26**	8.26	8.86
64		52-05-01	NW-6	1,316	2,360	6.79	1.5	**8.29**	**7.83**	**9.32**	9.32	9.92
65	Sirajganj	55-01-02	NW-3	1,316	2,360	10.10	2.0	**12.10**	**11.14**	**10.94**	12.10	12.70
66		55-01-03	NW-3	1,316	2,360	13.29	0.6	**13.89**	**14.33**	**14.43**	14.43	15.03
67		55-01-N1	NW-3	1,316	2,360	12.97	1.0	**13.97**	**14.02**	**13.32**	13.97	14.57
68		55-01-N2	NW-3	1,316	2,360	10.73	1.5	**12.23**	**11.77**	**11.47**	12.23	12.83
69		55-02-01	NW-10	1,316	2,360	9.78	1.5	**11.28**	**10.82**	**10.45**	11.28	11.88
70		55-06-01	NW-11	1,219	2,783	9.69	1.5	**11.19**	**11.25**	**12.32**	12.32	12.92
71		55-06-02	NW-3	1,316	2,360	12.04	1.0	**13.04**	**13.08**	**13.26**	13.26	13.86
72		55-07-06	NW-3	1,316	2,360	10.31	2.0	**12.31**	**11.35**	**11.03**	12.31	12.91
73		55-07-07	NW-3	1,316	2,360	11.13	1.5	**12.63**	**12.17**	**11.84**	12.63	13.23
74		55-07-08	NW-4	1,316	2,360	10.04	2.0	**12.04**	**11.09**	**10.50**	12.04	12.64
75		55-07-10	NW-4	1,316	2,360	9.03	2.0	**11.03**	**10.07**	**10.15**	11.03	11.63
76		55-07-12	NW-3	1,316	2,360	10.04	1.0	**11.04**	**11.08**	**10.56**	11.04	11.64
77		55-07-13	NW-4	1,316	2,360	10.85	2.0	**12.85**	**11.90**	**11.52**	12.85	13.45
78		55-07-N2	NW-3	1,316	2,360	10.26	1.5	**11.76**	**11.30**	**10.86**	11.76	12.36
79		55-07-N3	NW-4	1,316	2,360	9.98	2.0	**11.98**	**11.02**	**10.71**	11.98	12.58
80	Pabna	56-01-02	NW-10	1,316	2,360	10.29	2.0	**12.29**	**11.33**	**11.15**	12.29	12.89
81		56-02-01	NW-10	1,316	2,360	9.23	1.5	**10.73**	**10.27**	**10.10**	10.73	11.33
82		56-03-01	NW-10	1,316	2,360	9.34	1.0	**10.34**	**10.39**	**9.90**	10.34	10.94
83		56-03-05	NW-10	1,316	2,360	10.31	1.0	**11.31**	**11.36**	**10.94**	11.31	11.91
84		56-06-01	NW-10	1,316	2,360	8.38	1.5	**9.88**	**9.42**	**9.38**	9.88	10.48
85	Bogra	57-01-02	NW-1	1,316	2,360	7.27	1.3	**8.52**	**8.32**	**8.84**	8.84	9.44
86		57-01-04	NW-1	1,316	2,360	8.01	1.0	**9.01**	**9.05**	**10.56**	10.56	11.16
87		57-01-06	NW-1	1,316	2,360	8.35	1.5	**9.85**	**9.40**	**10.49**	10.49	11.09
88		57-02-N3	NW-3	1,316	2,360	9.45	1.0	**10.45**	**10.49**	**10.64**	10.64	11.24
89		57-02-N5	NW-1	1,316	2,360	6.49	2.5	**8.99**	**7.54**	**8.23**	8.99	9.59
90		57-07-N4	NW-3	1,316	2,360	7.81	2.0	**9.81**	**8.85**	**10.42**	10.42	11.02
91		57-07-N6	NW-3	1,316	2,360	9.20	2.0	**11.20**	**10.25**	**11.60**	11.60	12.20
92		57-09-02	NW-1	1,316	2,360	5.82	2.0	**7.82**	**6.86**	**7.48**	7.82	8.42

2-2-2-2 Environmental and Social Consideration (Safety Recess for Pedestrian)

From the view point of pedestrian protection, taking account of the escaping distance of the pedestrian, the safety recess shall be provided for the bridge with higher frequency that large vehicle and pedestrians pass each other.

The structure of Safety Recess shall be as simple as Photograph 2.2.2-1, and designed in accordance with the design guidelines (plan) of steel road bridge belongings : Ministry of Construction of Japan, Aug. 1998. Position of Safety Recess is shown in Figure 2.2.2-2. The provision of Safety Recess is summarized in Table 2.2.2-2.

Criteria for Provision of Safety Recess

- Upazila road : the bridge exceeds 50m
- Union, Village-A and Village-B road : the bridge exceeds 80m

Photograph 2.2.2-1 Safety Recess provided by the Bangladesh
(the Project Phase 1, Bridge Length = 115m)

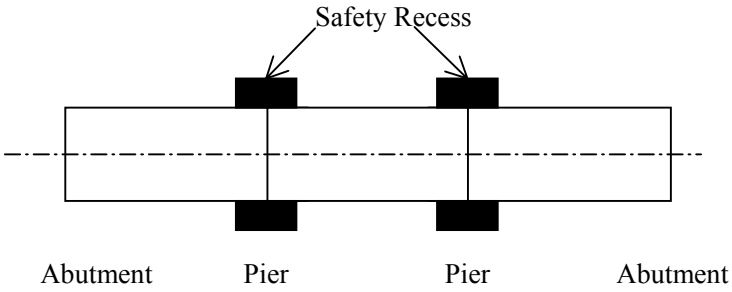


Figure 2.2.2-1 Position of Safety Recess

Table 2.2.2-2 Safety Recess

Road Class	Br. Length L(m)	Position	The area (㎡) taking	Accommodation Capacity (person/area)
Upazila	L>50m	At Piers （both side）	1.300×1.01＝1.31 ㎡	5
Union	L>80m			
Village-A				
Village-B				

2-2-2-3 Design of Superstructure

Superstructure design was carried out based on the design condition shown in 2-2-1, and past three portable steel bridge projects (RHD 1 and LGED 2 projects).

In the Basic Design Study, the safety recess for pedestrian was designed with care. It is followed the improvements made in the Phase 2. With reference to the Field Survey, it shifts a pier to the position of shallow water so as to construct the pier easier. Table 2.2.2-3 shows the bridges out of standard spanning.

Table 2.2.2-3 Bridges out of Standard Spanning

District	Bridge ID	Length	(Nos. of Span) Spanning	Remarks	
				Const. Term	Water Depth at Pier in Dry Season
Manikganj	05-04-10	80m	(4) 2x15m+2x25m	Term 1	0m
Rajbari	11-03-01	105m	(5) 3x20m+25m+20m	Term 2	0m
Bogra	57-07-N6	80m	(4) 15m+2x25m+15m	Term 3	0m

The results of design analysis are shown in Table 2.2.2-4.
The Basic Dimensions of the Project Bridges are shown in Table 2.2.2-5～7.
And the Structure Drawings and Details are shown in Figure 2.2.3-1～6.

Table 2.2.2-4　Results of Design Analysis (1/2)

Live Load = HS-15／HS-20　Span Length 10m

Members			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-150 × 150 × 7 ×10	H-150 × 150 × 7 ×10	H-150 × 150 × 7 ×10	H-150 × 150 × 7 ×10
Material Designation			SM490Y	SS400	SS400	SS400
Property	Radius of Gyration of Area (cm)		3.77	3.77	3.77	3.77
	Area (cm^2)		39.65	39.65	39.65	39.65
Normal Force (ton)			Since the same members are used for 10 and 20m Span Bridges, Design Calculation may be omitted. (The member is same as the one of Span 20m)			
Axial Stress (kgf／cm^2)	Actual Stress	HS-15				
		HS-20				
	Allowable Stress					

Live Load = HS-15／HS-20　Span Length 15m

Members			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-150×150×7×10	H-150×150×7×10	H-150×150×7×10	H-150 × 150 × 7 ×10
Material Designation			SM490Y	SS400	SS400	SS400
Property	Radius of Gyration of Area (cm)		3.77	3.77	3.77	3.77
	Area (cm^2)		39.65	39.65	39.65	39.65
Normal Force (ton)			Since the same members are used for 10 and 20m Span Bridges, Design Calculation may be omitted. (Minimum Flange width of H-shape steel shall be 150mm because at least, 2 lines of HTB is required for jointing.)			
Axial Stress (kgf／cm^2)	Actual Stress	HS-15				
		HS-20				
	Allowable Stress					

Live Load = HS-15／HS-20　Span Length 20m

Members			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-150×150×7×10	H-150×150×7×10	H-150×150×7×10	H-150 × 150 × 7 ×10
Material Designation			SM490Y	SS400	SS400	SS400
Property	Radius of Gyration of Area (cm)		3.77	3.77	3.77	3.77
	Area (cm^2)		39.65	39.65	39.65	39.65
Normal Force (ton)			40.7	40.7	15.7	10.6
Axial Stress (kgf／cm^2)	Actual Stress	HS-15	-----	-----	-----	-----
		HS-20	997	1,318	386	263
	Allowable Stress		1,270	1,320	858	1,320

Live Load = HS-15　Span Length 25m

Members			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-150×150×7×10	H-150×150×7×10	H-150×150×7×10	H-150 × 150 × 7 ×10
Material Designation			SM490YA	SS400	SS400	SS400
Property	Radius of Gyration of Area (cm)		3.77	3.77	3.77	3.77
	Area (cm^2)		39.65	39.65	39.65	39.65
Normal Force (ton)			43.3	43.3	26.1	8.1
Axial Stress (kgf／cm^2)	Actual Stress	HS-15	1,092	1,092	658	204
		HS-20	------	------	------	------
	Allowable Stress		1,270	1,320	882	1,320

Table 2.2.2-4 Results of Design Analysis (2/2)

Live Load = HS-20 Span Length 25m

Members			First Panel			
			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-150×150×7×10	H-150×150×7×10	H-150×150×7×10	H-150×150×7×10
Material Designation			SM490YA	SM490Y	SS400	SS400
Property	Radius of Gyration of Area (cm)		3.77	3.77	3.77	3.77
	Area (cm^2)		39.65	39.65	39.65	39.65
Normal Force (ton)			45.8	45.8	17.2	10.7
Axial Stress (kgf/cm^2)	Actual Stress	HS-15	------	------	------	------
		HS-20	1,155	1,526	435	270
	Allowable Stress		1,270	1,980	858	1,320

Members			Second Panel			
			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-175×175×7.5×11	H-175×175×7.5×11	H-175×175×7.5×11	H-175×175×7.5×11
Material Designation			SM490YA	SM490YA	SS400	SS400
Property	Radius of Gyration of Area (cm)		4.37	4.37	4.37	4.37
	Area (cm^2)		51.42	51.42	51.42	51.42
Normal Force (ton)			54.5	54.5	------	------
Axial Stress (kgf/cm^2)	Actual Stress	HS-15	------	------	------	------
		HS-20	1,060	1,416	------	------
	Allowable Stress		1,387	1,980	------	------

Live Load = HS-20 Span Length 30m

Members			First Panel			
			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-175×175×7.5×11	H-175×175×7.5×11	H-175×175×7.5×11	H-175×175×7.5×11
Material Designation			SM490YA	SM490YA	SS400	SS400
Property	Radius of Gyration of Area (cm)		4.37	4.37	4.37	4.37
	Area (cm^2)		51.42	51.42	51.42	51.42
Normal Force (ton)			64.4	54.4	------	------
Axial Stress (kgf/cm^2)	Actual Stress	HS-15	------	------	------	------
		HS-20	1,252	1,672	------	------
	Allowable Stress		1,387	1,980	------	------

Members			Second Panel			
			Upper Cord	Lower Cord	Diagonal	Vertical
Section			H-200×200×8×12	H-200×200×8×12	H-200×200×8×12	H-200×200×8×12
Material Designation			SM490YA	SM490YA	SS400	SS400
Property	Radius of Gyration of Area (cm)		5.02	5.02	5.02	5.02
	Area (cm^2)		63.53	63.53	63.53	63.53
Normal Force (ton)			72.4	72.4	18.2	10.7
Axial Stress (kgf/cm^2)	Actual Stress	HS-15	------	------	------	------
		HS-20	1,462	1,509	460	270
	Allowable Stress		1,462	1,980	858	1,320

Table 2.2.2-5 Basic Dimensions of the Project Bridges (Phase 1) (1/4)

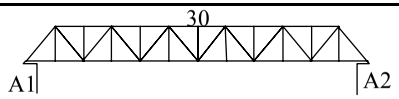
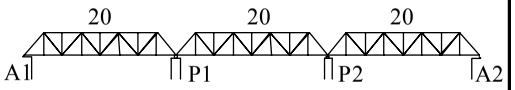
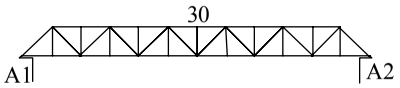
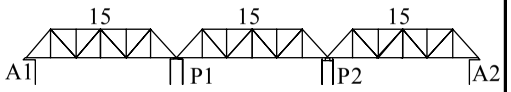
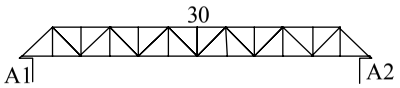
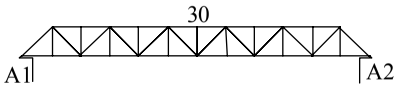
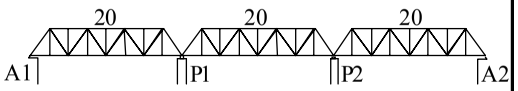
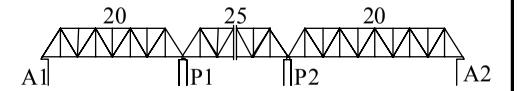
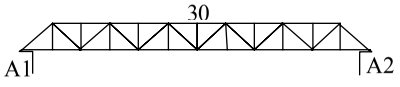
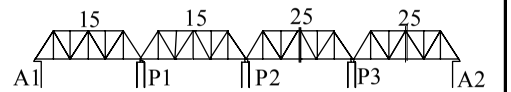
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
1	Dhaka	01-01-02	326383042		30.00	27.732	A1: 5.5 - A2: 6.0	A1: 8.0 × 12 - A2: 8.0 × 12	A1: 70.0 A2: 70.0	A1: 230 A2: 210	Phase 1	HS-20	
2	Dhaka	01-04-08	326182008 Upazila		60.00	48.306	A1: 5.0 P1,2: 6.5 A2: 5.0	A1: 8.0 × 10 P1,2: 10.0 × 6 A2: 8.0 × 10	A1: 50.0 A2: 40.0	A1: 50 A2: 140	Phase 1	HS-20	Safety Recess : 4
3	Dhaka	01-06-03	326142021 Upazila		30.00	27.732	A1: 5.0 - A2: 5.0	A1: 8.0 × 10 - A2: 8.0 × 10	A1: 40.0 A2: 50.0	A1: 60 A2: 50	Phase 1	HS-20	
4	Narayanganj	03-01-N1	367583038		45.00	36.387	A1: 3.5 P1,2: 3.8 A2: 3.5	A1: 8.0 × 10 P : 10.0 × 3 A2: 8.0 × 10	A1: 0.0 A2: 0.0	A1: 110 A2: 100	Phase 1	HS-20	
5	Munshiganj	04-05-N1	359742007 Upazila		30.00	27.732	A1: 4.0 - A2: 3.0	A1: 8.0 × 8 - A2: 8.0 × 6	A1: 55.0 A2: 40.0	A1: 70 A2: 70	Phase 1	HS-20	
6	Munshiganj	04-05-N3	359742007 Upazila		30.00	27.732	A1: 5.0 - A2: 5.0	A1: 8.0 × 10 - A2: 8.0 × 10	A1: 55.0 A2: 55.0	A1: 80 A2: 90	Phase 1	HS-20	
7	Manikganj	05-01-05	356822005 Upazila		60.00	48.306	A1: 3.0 P1,2: 6.0 A2: 2.5	A1: 8.0 × 6 P : 10.0 × 3 A2: 8.0 × 6	A1: 40.0 A2: 40.0	A1: 40 A2: 20	Phase 1	HS-20	Safety Recess : 4
8	Manikganj	05-03-06	356703005		65.00	52.279	A1: 4.0 P1,2: 4.0 A2: 3.0	A1: 8.0 × 8 P1,2: 10.0 × 3 A2: 8.0 × 6	A1: 40.0 A2: 30.0	A1: 60 A2: 100	Phase 1	HS-15	
9	Manikganj	05-03-N1	356703037		30.00	27.732	A1: 2.5 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 25.0 A2: 25.0	A1: 80 A2: 40	Phase 1	HS-20	
10	Manikganj	05-04-10	356102003 Upazila		80.00	67.068	A1: 2.5 P1-3: 4.0 A2: 2.5	A1: 8.0 × 6 P1-3: 10.0 × 3 A2: 8.0 × 6	A1: 15.0 A2: 25.0	A1: 40 A2: 120	Phase 1	HS-20	Safety Recess : 6

Table 2.2.2-5 Basic Dimensions of the Project Bridges (Phase 1) (2/4)

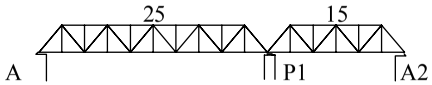
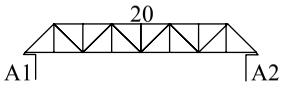
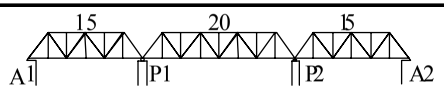
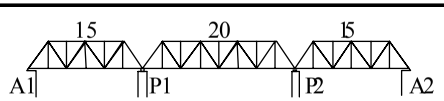
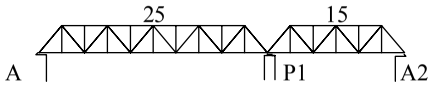
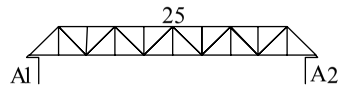
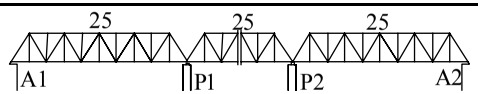
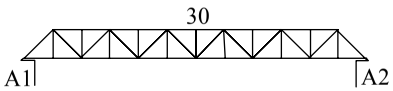
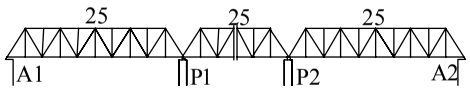
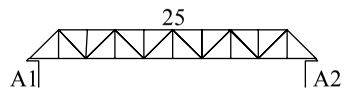
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
11	Manikganj	05-04-11	356102003 Upazila		40.00	33.534	A1: 3.0 P1: 3.6 A2: 3.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 6	A1: 15.0 A2: 20.0	A1: 70 A2: 60	Phase 1	HS-20	
12	Manikganj	05-05-N5	356283009		20.00	16.102	A1: 2.0 - A2: 2.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 45.0 A2: 45.0	A1: 110 A2: 80	Phase 1	HS-20	
13	Rajbari	11-02-N1	382072011 Upazila		50.00	40.360	A1: 2.5 P1,2: 4.0 A2: 2.5	A1: 8.0 × 6 P1,2: 10.0 × 3 A2: 8.0 × 6	A1: 10.0 A2: 10.0	A1: 40 A2: 50	Phase 1	HS-20	
14	Gopalgonj	12-02-N1	345432001 Upazila		50.00	40.360	A1: 3.0 P1,2: 6.0 A2: 3.0	A1: 8.0 × 6 P2: 10.0 × 3 A2: 8.0 × 10	A1: 40.0 A2: 0.0	A1: 140 A2: 220	Phase 1	HS-20	
15	Gopalgonj	12-03-N1	345583008		40.00	32.204	A1: 3.0 P1: 4.0 A2: 3.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 6	A1: 45.0 A2: 55.0	A1: 80 A2: 70	Phase 1	HS-15	
16	Gopalgonj	12-04-N1	345913011		25.00	20.075	A1: 2.5 - A2: 2.5	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 25.0 A2: 25.0	A1: 100 A2: 50	Phase 1	HS-15	
17	Faridpur	16-07-01	329842010 Upazila		75.00	64.215	A1: 3.0 P1: 4.0 P2: 3.0 A2: 3.0	A1: 8.0 × 10 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 10	A1: 0.0 A2: 0.0	A1: 150 A2: 130	Phase 1	HS-20	Safety Recess : 4
18	Comilla	19-05-06	419813011		30.00	27.732	A1: 3.0 - A2: 3.0	A1: 8.0 × 9 - A2: 8.0 × 10	A1: 0.0 A2: 0.0	A1: 210 A2: 180	Phase 1	HS-20	
19	B.Baria	20-05-01	412852002 Upazila		75.00	64.215	A1: 5.0 P1: 6.0 P2: 5.0 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 6 P2: 10.0 × 6 A2: 8.0 × 10	A1: 60.0 A2: 60.0	A1: 230 A2: 140	Phase 1	HS-20	Safety Recess : 4
20	Chandpur	21-04-N1	413584003		25.00	20.075	A1: 3.0 - A2: 3.5	A1: 8.0 × 6 - A2: 8.0 × 10	A1: 40.0 A2: 0.0	A1: 130 A2: 180	Phase 1	HS-15	

Table 2.2.2-5 Basic Dimensions of the Project Bridges (Phase 1) (3/4)

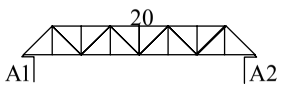
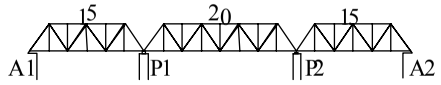
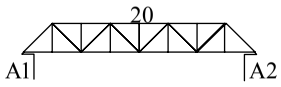
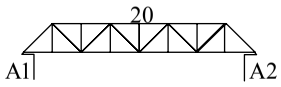
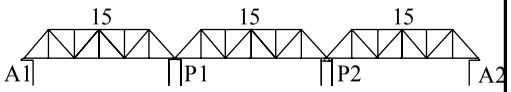
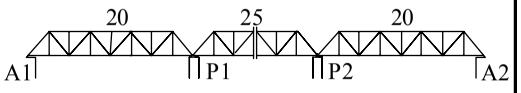
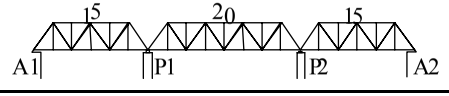
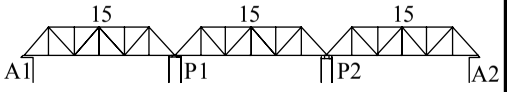
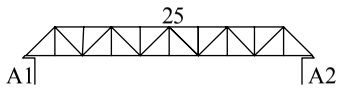
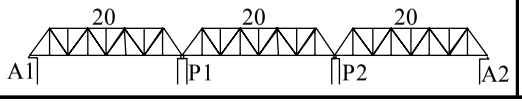
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
21	Chandpur	21-04-N4	413583023		20.00	16.102	A1: 2.0 - A2: 2.0	A1: 8.0 × 3 - A2: 8.0 × 3	A1: 35.0 A2: 35.0	A1: 40 A2: 50	Phase 1	HS-20	
22	Feni	22-02-06	430513004		50.00	40.360	A1: 2.5 P1: 3.5 P2: 4.0 A2: 2.5	A1: 8.0 × 6 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 6	A1: 25.0 A2: 20.0	A1: 100 A2: 80	Phase 1	HS-20	
23	Noakhali	23-02-10	475074087		20.00	16.102	A1: 2.0 - A2: 2.0	A1: 8.0 × 3 - A2: 8.0 × 3	A1: 0.0 A2: 30.0	A1: 70 A2: 30	Phase 1	HS-20	
24	Laxmipur	24-03-01	451653025		20.00	16.102	A1: 2.0 - A2: 2.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 30.0 A2: 30.0	A1: 0 A2: 0	Phase 1	HS-20	
25	Natore	52-03-N1	169913025		45.00	36.387	A1: 3.0 P1: 4.5 P2: 4.0 A2: 3.0	A1: 8.0 × 10 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 6	A1: 0.0 A2: 35.0	A1: 170 A2: 70	Phase 1	HS-20	
26	Natore	52-05-01	169443004		65.00	52.279	A1: 3.0 P1: 4.5 P2: 3.0 A2: 4.0	A1: 8.0 × 6 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 8	A1: 10.0 A2: 30.0	A1: 160 A2: 60	Phase 1	HS-15	
27	Sirajganj	55-01-N1	188783003		50.00	40.360	A1: 4.0 P1,2: 5.5 A2: 6.0	A1: 8.0 × 8 P1,2: 10.0 × 3 A2: 8.0 × 12	A1: 55.0 A2: 55.0	A1: 140 A2: 200	Phase 1	HS-15	
28	Sirajganj	55-01-N2	188783003		45.00	36.387	A1: 6.0 P1: 5.0 P2: 5.5 A2: 6.0	A1: 8.0 × 12 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 12	A1: 45.0 A2: 45.0	A1: 180 A2: 230	Phase 1	HS-15	
29	Sirajganj	55-02-01	188272002 Upazila		25.00	21.405	A1: 4.0 - A2: 4.0	A1: 8.0 × 8 - A2: 8.0 × 8	A1: 50.0 A2: 70.0	A1: 100 A2: 180	Phase 1	HS-20	
30	Sirajganj	55-07-06	188943006		60.00	48.306	A1: 5.0 P1: 6.5 P2: 7.0 A2: 6.0	A1: 8.0 × 10 P1: 10.0 × 6 P2: 10.0 × 6 A2: 8.0 × 10	A1: 20.0 A2: 55.0	A1: 120 A2: 120	Phase 1	HS-20	

Table 2.2.2-5 Basic Dimensions of the Project Bridges (Phase 1) (4/4)

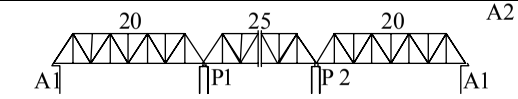
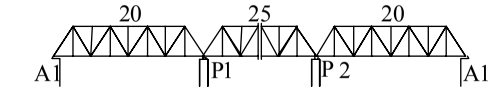
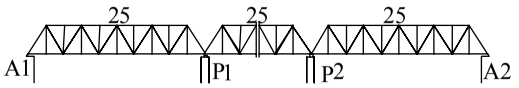
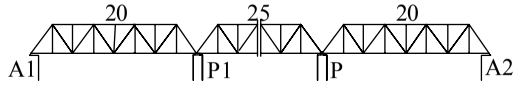
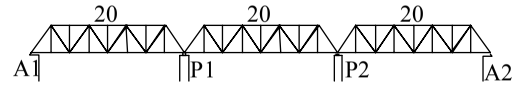
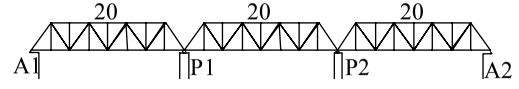
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
31	Sirajganj	55-07-13	188943024		65.00	52.279	A1: 7.0 P1: 6.5 P2: 8.5 A2: 7.0	A1: 10.0 × 16 P1: 12.0 × 6 P2: 12.0 × 6 A2: 8.0 × 16	A1: 80.0 A2: 90.0	A1: 250 A2: 490	Phase 1	HS-15	
32	Pabna	56-02-01	176223017		65.00	52.279	A1: 4.0 P1: 3.0 P2: 4.5 A2: 4.0	A1: 8.0 × 8 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 8	A1: 30.0 A2: 0.0	A1: 60 A2: 70	Phase 1	HS-15	
33	Pabna	56-03-01	176332001 Upazila		75.00	64.215	A1: 4.0 P1: 8.5 P2: 7.5 A2: 4.0	A1: 8.0 × 8 P1: 11.0 × 6 P2: 11.0 × 6 A2: 8.0 × 8	A1: 55.0 A2: 25.0	A1: 280 A2: 270	Phase 1	HS-20	Safety Recess : 4
34	Bogra	57-01-02	110962014 Upazila		65.00	53.609	A1: 4.0 P1: 5.0 P2: 6.0 A2: 3.0	A1: 8.0 × 8 P1: 10.0 × 3 P2: 11.0 × 6 A2: 8.0 × 6	A1: 190.0 A2: 190.0	A1: 150 A2: 90	Phase 1	HS-20	Safety Recess : 4
35	Bogra	57-01-04	110963017		60.00	48.306	A1: 6.0 P1,2: 5.5 A2: 6.0	A1: 8.0 × 12 P1,2: 10.0 × 3 A2: 8.0 × 12	A1: 190.0 A2: 190.0	A1: 160 A2: 160	Phase 1	HS-20	
36	Bogra	57-01-06	110204106		60.00	48.306	A1: 4.0 P1,2: 5.0 A2: 3.0	A1: 8.0 × 8 P1,2: 10.5 × 3 A2: 8.0 × 6	A1: 220.0 A2: 220.0	A1: 130 A2: 90	Phase 1	HS-20	

Table 2.2.2-6 Basic Dimensions of the Project Bridges (Phase 2) (1/3)

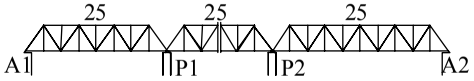
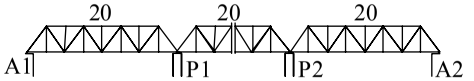
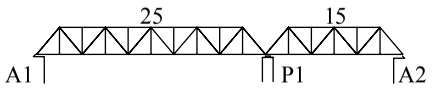
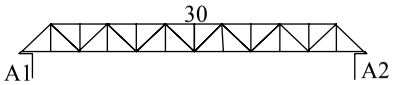
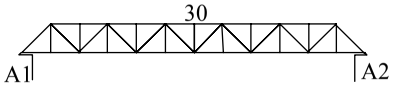
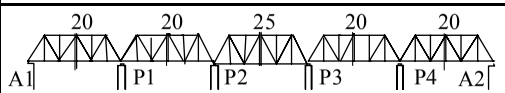
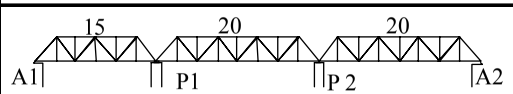
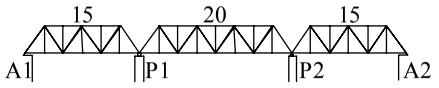
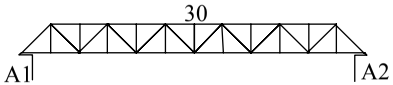
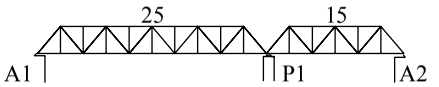
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
37	Dhaka	01-03-02	326733097		75.00	60.225	A1: 6.0 P1,2: 6.5 A2: 6.0	A1: 8.0 × 12 P1,2: 12.0 × 6 A2: 8.0 × 12	A1: 90.0 A2: 108.0	A1: 230 A2: 180	Phase 2	HS-15	
38	Dhaka	01-06-N1	326143020		60.00	48.306	A1: 6.0 P1,2: 6.5 A2: 4.0	A1: 8.0 × 12 P1,2: 12.0 × 6 A2: 8.0 × 8	A1: 45.0 A2: 43.0	A1: 130 A2: 90	Phase 2	HS-20	
39	Narayanganj	03-04-01	367683041		40.00	32.204	A1: 3.0 P1: 5.5 A2: 4.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 8	A1: 40.0 A2: 40.0	A1: 50 A2: 30	Phase 2	HS-15	
40	Munshiganj	04-02-03	359242003 Upazila		30.00	27.732	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 50.0 A2: 0.0	A1: 220 A2: 300	Phase 2	HS-20	
41	Munshiganj	04-02-N5	359242003 Upazila		30.00	27.732	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 48.0 A2: 50.0	A1: 130 A2: 110	Phase 2	HS-20	
42	Munshiganj	04-05-04	359743035		105.00	84.483	A1: 5.0 P1-4: 6.5 A2: 3.0	A1: 10.0 × 12 P1-4: 10.0 × 6 A2: 10.0 × 12	A1: 40.0 A2: 38.0	A1: 240 A2: 110	Phase 2	HS-15	Safety Recess : 8
43	Manikganj	05-01-01	356823025		55.00	44.333	A1: 5.0 P1 : 4.0 P2 : 5.5 A2: 3.0	A1: 8.0 × 10 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 6	A1: 45.0 A2: 43.0	A1: 140 A2: 280	Phase 2	HS-15	
44	Manikganj	05-04-04	356102002 Upazila		50.00	40.360	A1: 4.0 P1: 3.0 P2: 4.0 A2: 4.0	A1: 8.0 × 8 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 8	A1: 60.0 A2: 28.0	A1: 140 A2: 120	Phase 2	HS-20	
45	Manikganj	05-04-05	356102002 Upazila		30.00	27.732	A1: 3.0 - A2: 4.0	A1: 8.0 × 6 - A2: 8.0 × 8	A1: 30.0 A2: 35.0	A1: 90 A2: 70	Phase 2	HS-20	
46	Manikganj	05-05-N2	356282002 Upazila		40.00	33.534	A1: 3.0 P1: 4.5 A2: 3.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 6	A1: 65.0 A2: 73.0	A1: 50 A2: 170	Phase 2	HS-20	

Table 2.2.2-6 Basic Dimensions of the Project Bridges (Phase 2) (2/3)

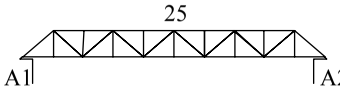
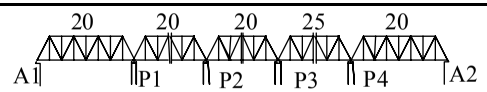
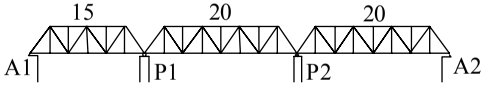
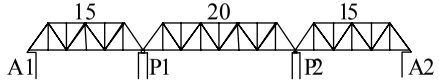
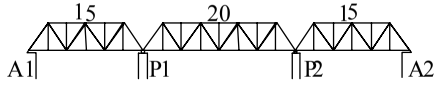
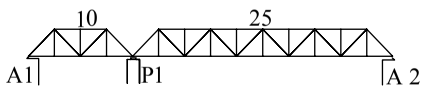
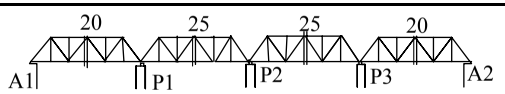
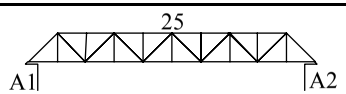
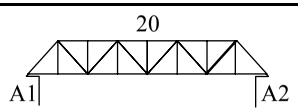
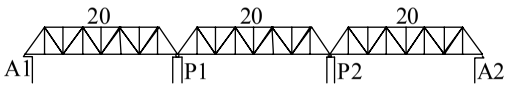
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
47	Manikganj	05-06-02	356223004		25.00	20.075	A1: 4.0 - A2: 4.0	A1: 8.0 × 8 - A2: 8.0 × 8	A1: 35.0 A2: 35.0	A1: 100 A2: 80	Phase 2	HS-15	
48	Rajbari	11-03-01	382733014		105.00	84.483	A1: 4.0 P1,2: 3.0 P3,4: 4.5 A2: 4.0	A1: 8.0 × 8 P1,2: 10.0 × 6 P3,4: 10.0 × 6 A2: 8.0 × 8	A1: 25.0 A2: 50.0	A1: 310 A2: 180	Phase 2	HS-15	Safety Recess : 8
49	Gopalgonj	12-02-N2	345434009		55.00	44.333	A1: 4.0 P1: 5.0 P2: 5.5 A2: 5.0	A1: 8.0 × 8 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 10	A1: 20.0 A2: 60.0	A1: 0 A2: 180	Phase 2	HS-15	
50	Gopalgonj	12-03-03	345584005		50.00	40.360	A1: 4.0 P1,2: 5.5 A2: 4.0	A1: 8.0 × 8 P1,2: 10.0 × 3 A2: 8.0 × 8	A1: 51.0 A2: 45.0	A1: 180 A2: 120	Phase 2	HS-20	
51	Gopalgonj	12-03-06	345582011 Upazila		50.00	40.360	A1: 3.0 P1,2: 6.5 A2: 3.0	A1: 8.0 × 6 P1,2: 12.0 × 6 A2: 8.0 × 6	A1: 45.0 A2: 50.0	A1: 80 A2: 70	Phase 2	HS-20	
52	Faridpur	16-01-N2	329473031		35.00	28.240	A1: 3.0 P1: 4.0 A2: 3.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 6	A1: 28.0 A2: 28.0	A1: 70 A2: 60	Phase 2	HS-15	
53	Comilla	19-10-N1	419543022		90.00	72.354	A1: 4.0 P1-3: 6.5 A2: 3.0	A1: 8.0 × 8 P1-3: 10.0 × 6 A2: 8.0 × 6	A1: 42.0 A2: 57.0	A1: 200 A2: 90	Phase 2	HS-15	Safety Recess : 6
54	Chandpur	21-01-N1	413013002		25.00	20.075	A1: 3.0 - A2: 3.0	A1: 8.0 × 8 - A2: 8.0 × 6	A1: 0.0 A2: 35.0	A1: 180 A2: 220	Phase 2	HS-15	
55	Chandpur	21-01-N2	413013002		20.00	16.102	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 50.0 A2: 0.0	A1: 0 A2: 0	Phase 2	HS-15	
56	Feni	22-02-04	430514002		60.00	48.306	A1: 4.0 P1,2: 5.0 A2: 3.0	A1: 8.0 × 8 P1,2: 10.0 × 3 A2: 8.0 × 6	A1: 45.0 A2: 40.0	A1: 90 A2: 70	Phase 2	HS-15	

Table 2.2.2-6 Basic Dimensions of the Project Bridges (Phase 2) (3/3)

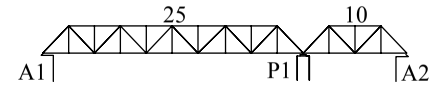
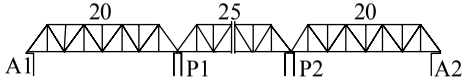
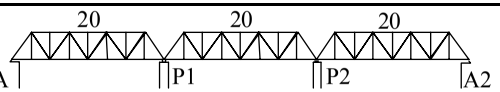
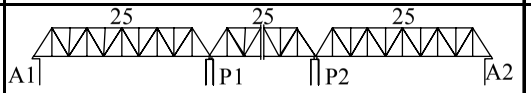
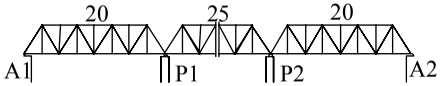
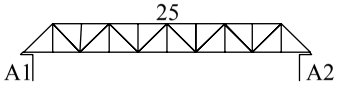
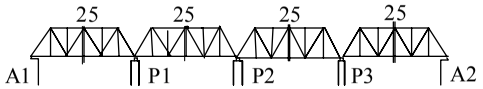
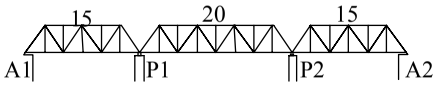
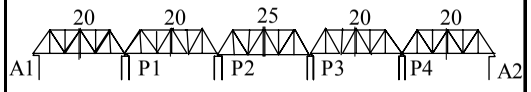
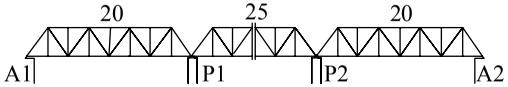
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure Length (m)	Super-structure Weight (ton)	Sub-structure Abutment/Pier H (m)	Sub-structure Foundation Pile Diameter (m)	Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
57	Natore	52-04-02	169153001		35.00	28.240	A1: 3.0 P1: 3.0 A2: 3.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 6	A1: 0.0 A2: 0.0	A1: 80 A2: 80	Phase 2	HS-15	
58	Sirajganj	55-06-01	188893003		65.00	52.279	A1: 6.0 P1: 5.5 P2: 4.0 A2: 5.0	A1: 8.0 × 12 P1: 10.0 × 6 P2: 10.0 × 6 A2: 8.0 × 10	A1: 45.0 A2: 40.0	A1: 240 A2: 220	Phase 2	HS-15	
59	Sirajganj	55-06-02	188893003		60.00	48.306	A1: 5.0 P1,2: 4.0 A2: 5.0	A1: 8.0 × 10 P1,2: 10.0 × 3 A2: 8.0 × 10	A1: 63.0 A2: 70.0	A1: 170 A2: 190	Phase 2	HS-15	
60	Sirajganj	55-07-07	188943060		75.00	60.225	A1: 4.0 P1,2: 6.5 A2: 4.0	A1: 8.0 × 8 P1,2: 12.0 × 6 A2: 8.0 × 8	A1: 47.0 A2: 48.0	A1: 150 A2: 220	Phase 2	HS-15	
61	Sirajganj	55-07-08	188943059		65.00	52.279	A1: 6.0 P1,2: 6.5 A2: 6.0	A1: 8.0 × 12 P1,2: 12.0 × 6 A2: 8.0 × 12	A1: 60.0 A2: 55.0	A1: 210 A2: 120	Phase 2	HS-15	
62	Sirajganj	55-07-12	188943063		25.00	20.075	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 65.0 A2: 60.0	A1: 130 A2: 130	Phase 2	HS-15	
63	Pabna	56-01-02	176552028 Upazila		100.00	85.620	A1: 5.0 P1,3: 4.5 P2: 5.0 A2: 5.0	A1: 8.0 × 10 P1,3: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 10	A1: 43.0 A2: 45.0	A1: 190 A2: 190	Phase 2	HS-20	Safety Recess : 6
64	Bogra	57-02-N3	110882007 Upazila		50.00	40.360	A1: 3.0 P1,2: 4.0 A2: 3.0	A1: 8.0 × 6 P1,2: 10.0 × 3 A2: 8.0 × 6	A1: 30.0 A2: 40.0	A1: 80 A2: 100	Phase 2	HS-20	
65	Bogra	57-02-N5	110883046		105.00	84.483	A1: 5.0 P1: 5.5 P2,3: 6.5 P4: 4.0 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 3 P2,3: 10.0 × 6 P4: 10.0 × 3 A2: 8.0 × 10	A1: 40.0 A2: 35.0	A1: 90 A2: 90	Phase 2	HS-15	
66	Bogra	57-09-02	110332011 Upzilla		65.00	53.609	A1: 3.0 P1: 6.5 P2: 4.0 A2: 3.0	A1: 8.0 × 6 P1: 12.0 × 6 P2: 10.0 × 3 A2: 8.0 × 6	A1: 50.0 A2: 35.0	A1: 190 A2: 140	Phase 2	HS-20	Safety Recess : 4

Table 2.2.2-7 Basic Dimensions of the Project Bridges (Phase 3) (1/3)

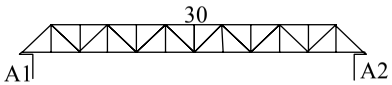
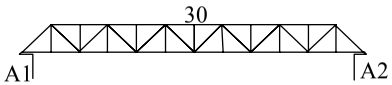
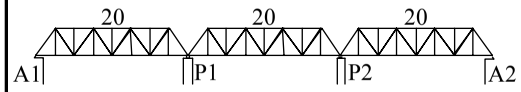
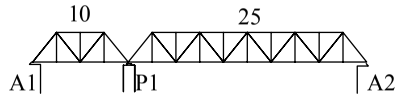
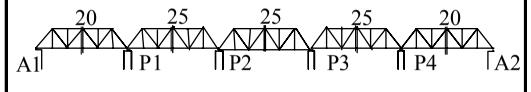
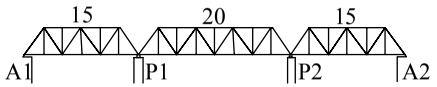
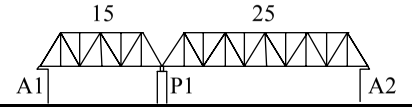
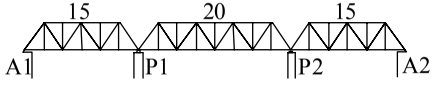
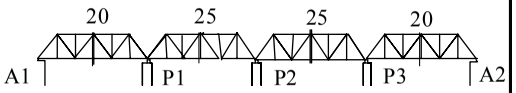
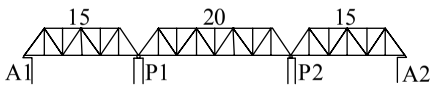
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure Length (m)	Super-structure Weight (ton)	Sub-structure Abutment/Pier H (m)	Sub-structure Foundation Pile Diameter (m)	Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
67	Dhaka	01-02-01	326622013 Upazila		30.00	27.732	A1: 5.0 - A2: 3.0	A1: 8.0 × 10 - A2: 8.0 × 6	A1: 40.0 A2: 45.0	A1: 110 A2: 70	Phase 3	HS-20	
68	Dhaka	01-05-01	326723001		30.00	27.732	A1: 5.0 - A2: 5.0	A1: 8.0 × 10 - A2: 8.0 × 10	A1: 45.0 A2: 45.0	A1: 190 A2: 190	Phase 3	HS-15	
69	Munshiganj	04-01-N5	359563011		60.00	48.306	A1: 5.0 P1: 6.5 P2: 5.5 A2: 5.0	A1: 8.0 × 10 P1: 12.0 × 6 P2: 12.0 × 6 A2: 8.0 × 10	A1: 55.0 A2: 35.0	A1: 180 A2: 130	Phase 3	HS-15	
70	Munshiganj	04-02-02	359243012		35.00	28.240	A1: 3.0 P1: 3.5 A2: 3.0	A1: 8.0 × 6 P1: 12.0 × 3 A2: 8.0 × 6	A1: 50.0 A2: 45.0	A1: 140 A2: 140	Phase 3	HS-15	
71	Manikganj	05-04-02	356102005 Upazila		115.00	96.419	A1: 3.0 P1,4: 4.5 P2,3: 9.0 A2: 5.0	A1: 8.0 × 6 P1,4: 10.0 × 3 P2,3: 14.0 × 6 A2: 8.0 × 10	A1: 20.0 A2: 35.0	A1: 50 A2: 170	Phase 3	HS-20	Safety Recess : 8
72	Manikganj	05-04-06	356102002 Upazila		50.00	40.360	A1: 4.0 P1,2: 3.0 A2: 4.0	A1: 8.0 × 8 P1,2: 10.0 × 3 A2: 8.0 × 8	A1: 40.0 A2: 60.0	A1: 110 A2: 80	Phase 3	HS-20	
73	Manikganj	05-04-07	356102002 Upazila		40.00	33.534	A1: 3.0 P1: 3.0 A2: 4.0	A1: 8.0 × 6 P1: 10.0 × 3 A2: 8.0 × 8	A1: 20.0 A2: 45.0	A1: 0 A2: 100	Phase 3	HS-20	
74	Manikganj	05-05-01	356283025		50.00	40.360	A1: 3.0 P1: 3.5 P2: 5.5 A2: 3.0	A1: 8.0 × 6 P1: 13.0 × 3 P2: 10.0 × 3 A2: 8.0 × 10	A1: 65.0 A2: 0.0	A1: 100 A2: 190	Phase 3	HS-15	
75	Manikganj	05-06-N6	356223014		90.00	72.354	A1: 5.0 P1: 8.5 P2,3: 8.0 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 6 P2,3: 12.0 × 6 A2: 8.0 × 10	A1: 40.0 A2: 30.0	A1: 0 A2: 70	Phase 3	HS-15	Safety Recess : 6
76	Rajbari	11-02-02	382073015		50.00	40.360	A1: 5.0 P1: 4.5 P2: 5.5 A2: 3.5	A1: 8.0 × 10 P1: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 10	A1: 25.0 A2: 25.0	A1: 160 A2: 200	Phase 3	HS-15	

Table 2.2.2-7 Basic Dimensions of the Project Bridges (Phase 3) (2/3)

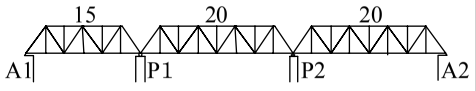
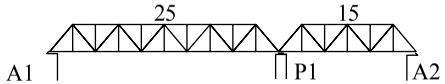
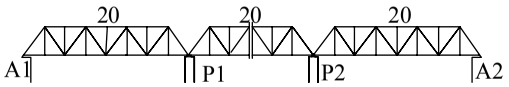
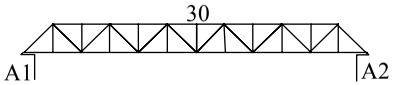
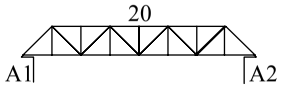
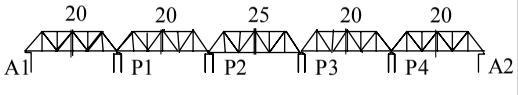
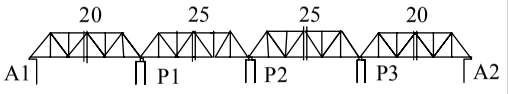
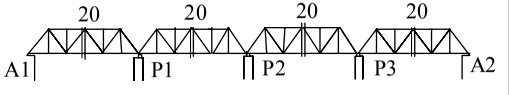
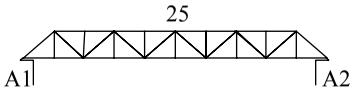
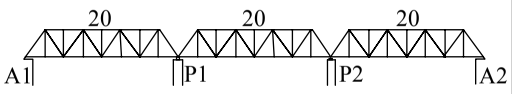
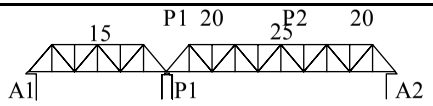
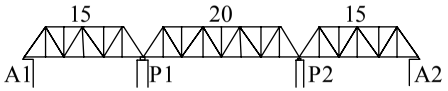
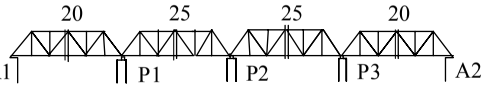
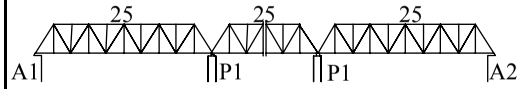
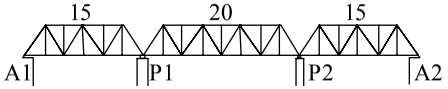
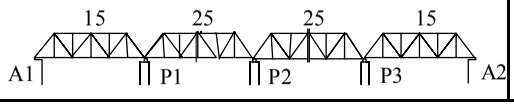
No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
77	Gopalgonj	12-03-02	345583020		55.00	44.333	A1: 4.0 P1: 6.0 P2: 6.5 A2: 4.0	A1: 8.0 × 8 P1: 12.0 × 6 P2: 12.0 × 6 A2: 8.0 × 8	A1: 65.0 A2: 60.0	A1: 150 A2: 140	Phase 3	HS-15	
78	Gopalgonj	12-03-N2	345583008		40.00	32.204	A1: 5.0 P1: 4.0 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 3 A2: 8.0 × 10	A1: 50.0 A2: 50.0	A1: 180 A2: 290	Phase 3	HS-15	
79	Faridpur	16-01-N3	329473015		60.00	48.306	A1: 5.0 P1: 4.5 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 3 A2: 8.0 × 10	A1: 35.0 A2: 40.0	A1: 140 A2: 100	Phase 3	HS-15	
80	Chandpur	21-01-N3	413013002		30.00	27.732	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 35.0 A2: 35.0	A1: 90 A2: 90	Phase 3	HS-15	
81	Chandpur	21-01-N4	413013002		20.00	16.102	A1: 3.0 - A2: 3.0	A1: 8.0 × 6 - A2: 8.0 × 6	A1: 30.0 A2: 30.0	A1: 110 A2: 110	Phase 3	HS-15	
82	Natore	52-02-01	169414054		105.00	84.483	A1: 4.0 P1,4: 5.5 P2,3: 8.5 A2: 5.0	A1: 8.0 × 8 P1,4: 10.0 × 3 P2,3: 13.0 × 6 A2: 8.0 × 10	A1: 60.0 A2: 55.0	A1: 80 A2: 110	Phase 3	HS-15	Safety Recess : 8
83	Natore	52-03-01	169912004 Upazila		90.00	75.014	A1: 3.0 P1,3: 5.5 P2: 6.0 A2: 3.0	A1: 8.0 × 6 P1,3: 10.0 × 3 P2: 10.0 × 3 A2: 8.0 × 6	A1: 50.0 A2: 35.0	A1: 0 A2: 0	Phase 3	HS-20	Safety Recess : 6
84	Sirajganj	55-01-02	188783066		80.00	64.408	A1: 5.0 P1: 5.5 P2,3: 4.5 A2: 5.0	A1: 8.0 × 10 P1: 10.0 × 3 P2,3: 10.0 × 3 A2: 8.0 × 10	A1: 60.0 A2: 60.0	A1: 60 A2: 90	Phase 3	HS-15	
85	Sirajganj	55-01-03	188783004		25.00	20.075	A1: 5.0 - A2: 5.0	A1: 8.0 × 10 - A2: 8.0 × 10	A1: 50.0 A2: 40.0	A1: 210 A2: 140	Phase 3	HS-15	
86	Sirajganj	55-07-10	188943038		60.00	48.306	A1: 5.0 P1: 6.5 P2: 8.5 A2: 5.0	A1: 8.0 × 10 P1: 12.0 × 6 P2: 12.0 × 6 A2: 8.0 × 10	A1: 50.0 A2: 70.0	A1: 90 A2: 110	Phase 3	HS-15	

Table 2.2.2-7 Basic Dimensions of the Project Bridges (Phase 3) (3/3)

No.	LGED Division	Bridge ID	Road No.	Side View	Super-structure		Sub-structure		Approach Road (m)	Revetment (m^2)	Phase	Live Load	Remarks
					Length (m)	Weight (ton)	Abutment/Pier H (m)	Foundation Pile Diameter (m)					
87	Sirajganj	55-07-N2	188943038		40.00	32.204	A1: 5.0 P1: 5.0 A2: 5.0	A1: 8.0 × 10 P1: 10.5 × 3 A2: 8.0 × 10	A1: 50.0 A2: 60.0	A1: 100 A2: 100	Phase 3	HS-15	
88	Sirajganj	55-07-N3	188943009		50.00	40.360	A1: 6.0 P1,2: 5.5 A2: 6.0	A1: 8.0 × 12 P1,2: 10.0 × 3 A2: 8.0 × 12	A1: 50.0 A2: 50.0	A1: 130 A2: 130	Phase 3	HS-15	
89	Pabna	56-03-05	176332005 Upazila		90.00	75.014	A1: 5.0 P1,2: 7.5 P3: 5.5 A2: 5.0	A1: 8.0 × 12 P1,2: 9.0 × 6 P3: 10.0 × 3 A2: 8.0 × 10	A1: 40.0 A2: 40.0	A1: 310 A2: 80	Phase 3	HS-20	Safety Recess : 6
90	Pabna	56-06-01	176723078		75.00	60.225	A1: 4.0 P1,2: 6.5 A2: 5.0	A1: 8.0 × 8 P1,2: 10.0 × 6 A2: 8.0 × 10	A1: 30.0 A2: 30.0	A1: 130 A2: 130	Phase 3	HS-15	
91	Bogra	57-07-N4	110273024		50.00	40.360	A1: 4.0 P1,2: 5.0 A2: 4.0	A1: 8.0 × 8 P1,2: 10.5 × 3 A2: 8.0 × 8	A1: 50.0 A2: 45.0	A1: 90 A2: 110	Phase 3	HS-15	
92	Bogra	57-07-N6	110273055		80.00	64.408	A1: 3.0 P1: 3.0 P2,3: 4.0 A2: 4.0	A1: 8.0 × 6 P1,2: 12.5 × 3 P3: 11.5 × 3 A2: 8.0 × 8	A1: 45.0 A2: 40.0	A1: 30 A2: 60	Phase 3	HS-15	

2-2-2-4 Design of Substructure, Revetment and Approach Road

(1) Substructure

Government of Bangladesh will construct Substructure. In the Report, the Standard type of Substructure is recommended. The following Standard type of substructure is shown in the LGED's Design Manual.

- Abutment: Invert T type abutment and box type abutment
- Piper: Pile bent type pier

Standard structure drawings of abutment and pier are shown in Drawing 2.2.2-2～4.

The Height of Abutment and Pier shall be made with drafting the General View Drawing in accordance with topographic survey and hydrological analysis. Footing shall have enough cover to prevent scouring. In case enough cover is not obtained, the abutment shall be protected with stone, concrete block, gabion etc.

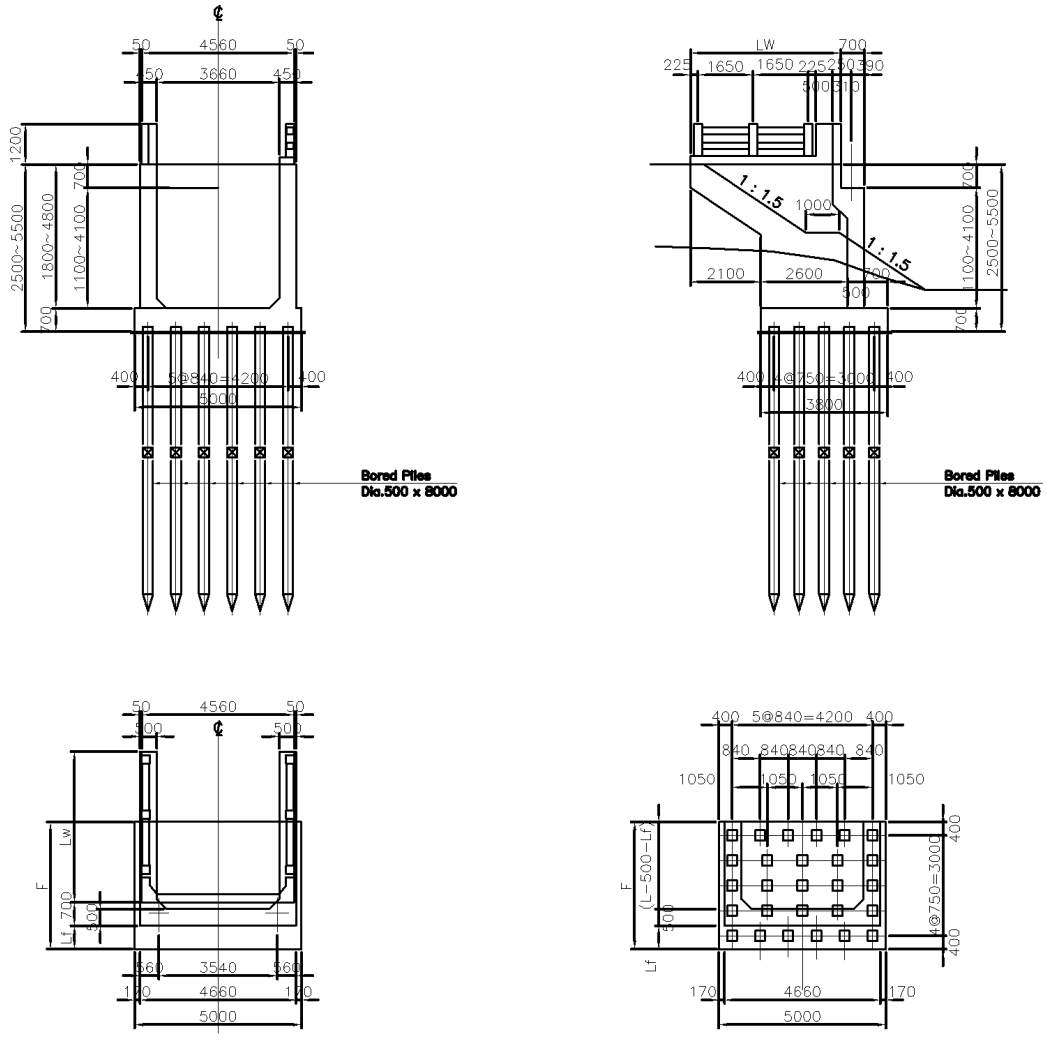
(2) Foundation

Government of Bangladesh also will construct foundations. In the Report, the Standard type of foundation is recommended. The following Standard type of substructure is shown in the LGED's Design Manual.

As for the geotechnical investigation, subsoil condition is silt at all bridge sites, and a pile is necessary for substructure. The Diesel Pile driver is not accessible at most of the site. Pile driving with drop hammer is practicable. The 0.3x0.3 section and 10 to 15m long pre-cast RC concrete pile is practicable for drop hammer.

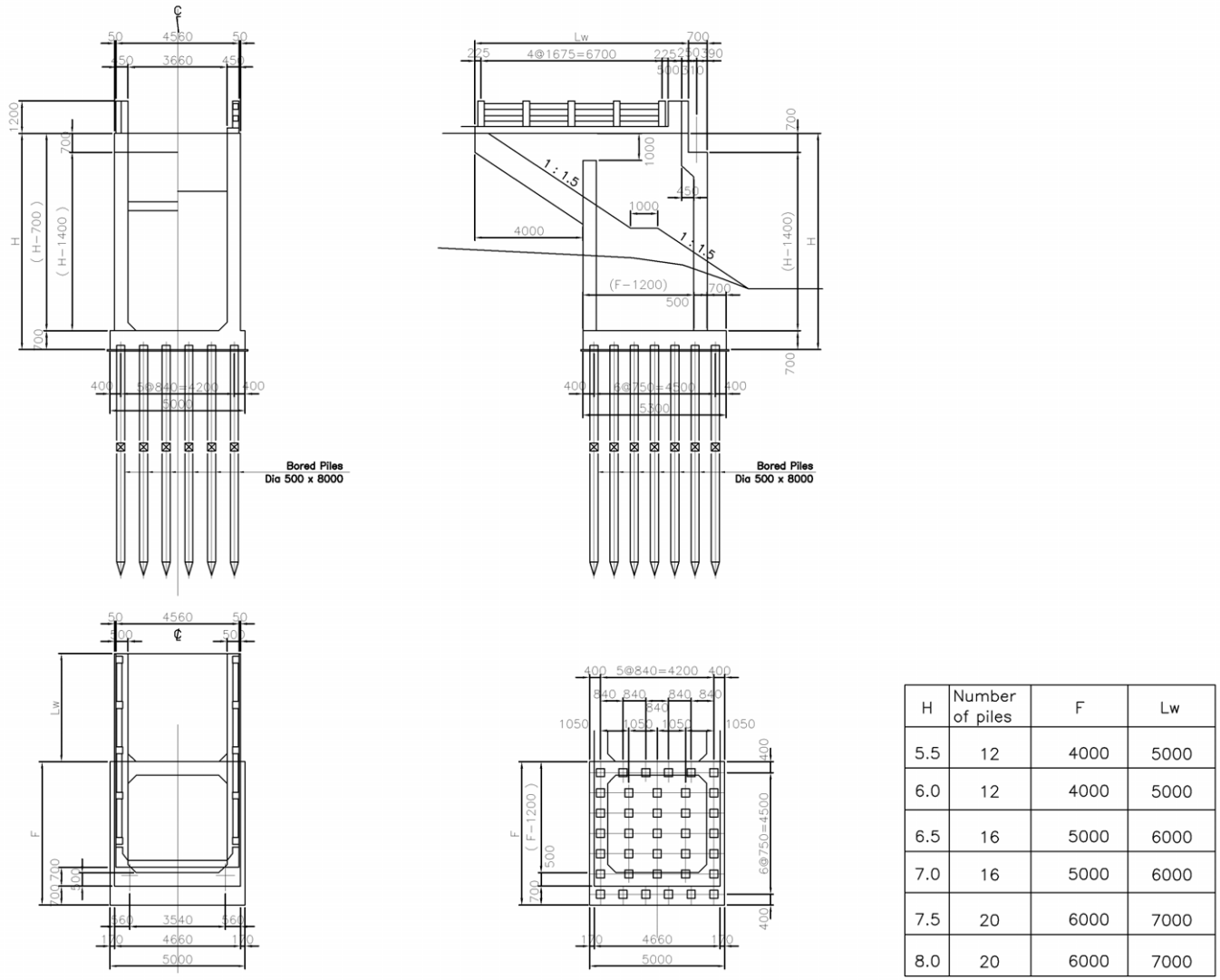
Bored pile is economical and popular in Bangladesh. ϕ 0.8m with length of 10～15m bored pile is common.

・Foundation : bored concrete pile (ϕ 500- Abutment)
bored concrete pile (ϕ 800- Piper)



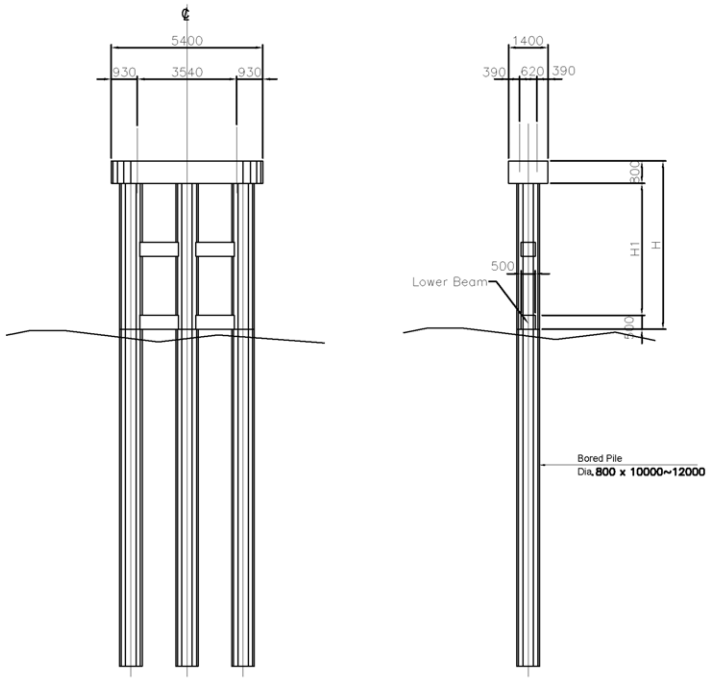
H	Number of piles	F	Lf	Lw
2.5	6	2300	500	2500
3.0	6	2300	700	2500
3.5	8	3000	700	3000
4.0	8	3000	700	3000
4.5	10	3500	700	4000
5.0	10	3500	700	4000

Figure 2.2.2-2 Invert T Type Abutment



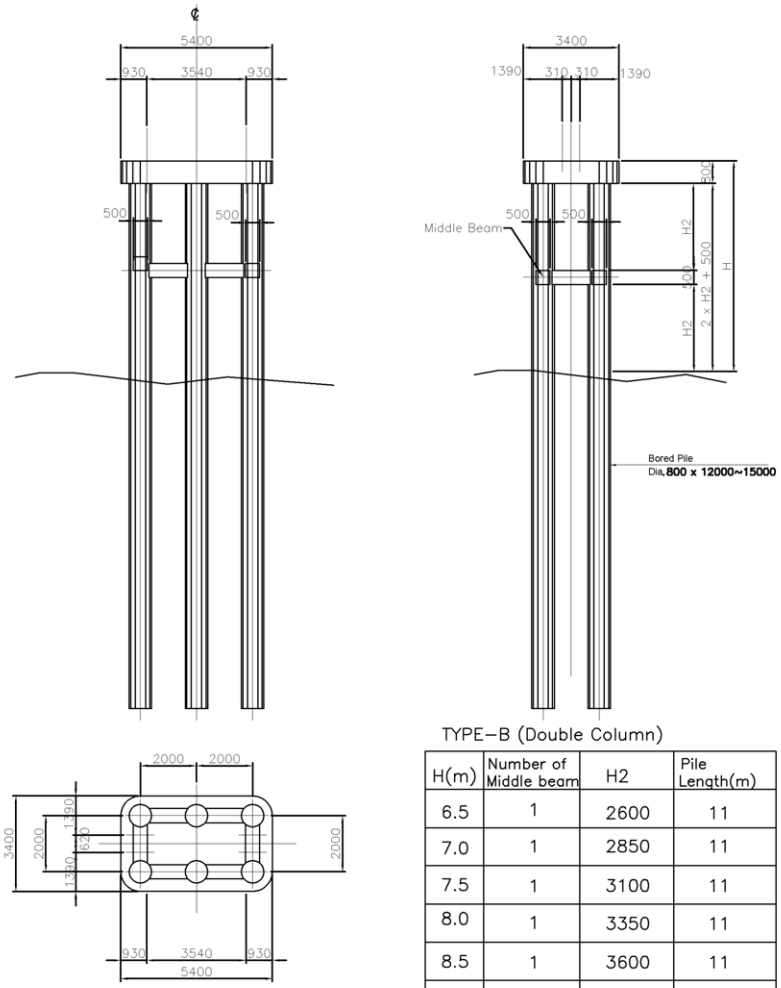
H	Number of piles	F	Lw
5.5	12	4000	5000
6.0	12	4000	5000
6.5	16	5000	6000
7.0	16	5000	6000
7.5	20	6000	7000
8.0	20	6000	7000

Figure 2.2.2-3 Box Type Abutment



TYPE–A (Singl Column)

H(m)	Number of Lower beam	H1	Pile Length(m)
3.5	0	2700	10
4.0	0	3200	10
4.5	1	3700	10
5.0	1	4200	10
5.5	1	4700	10
6.0	1	5200	10



TYPE–B (Double Column)

H(m)	Number of Middle beam	H2	Pile Length(m)
6.5	1	2600	11
7.0	1	2850	11
7.5	1	3100	11
8.0	1	3350	11
8.5	1	3600	11
9.0	1	3850	11
9.5	1	4100	12
10.0	1	4350	12

Figure 2.2.2-4 Pile Bent Pier

(3) Revetment

Revetment is also constructed by the Government of Bangladesh. The Standard Structure of Revetment is recommended.

- The stream velocity is not so fast with the speed of 0.3 to 1.0 m/sec. But erosion and scouring and so on is expected for the embankment around the abutment with flooding water, revetment 10m long at both upstream and downstream sides are provided.
- Pre-cast Concrete Block revetment is popular and recommendable. Crushed brick is obtainable and suitable for backfilling.
- Revetment foundation level shall be planned as river bed level or deeper where scouring is anticipated (embed depth is 0.6m or more).
- Backfilling of foundation and toe foot protection shall be compacted and finished carefully.

Standard Section of Revetment is shown in Figure 2.2.2-5.

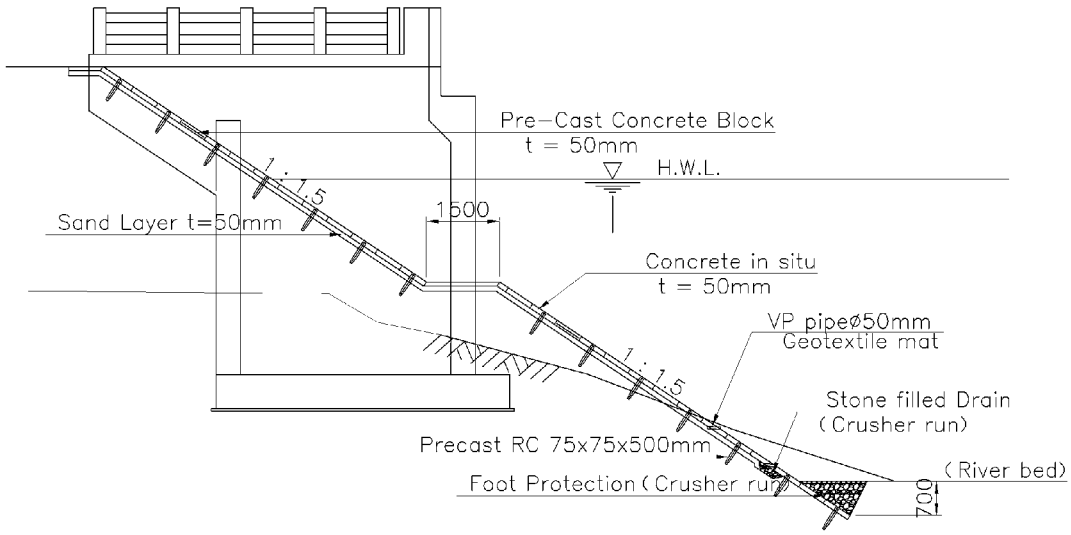


Figure 2.2.2-5 Standard Section of Revetment

(4) Approach Road

Following Standard structure of Approach Road is recommended.
Typical Cross Section is shown in Figure 2.2.2-6.

- Cross Section of the approach road is shown in Standard Design of Upazila Road is applied.

- As Approach Road is waiting zone for the passing vehicles, longitudinal gradient of the road is less 6% and sight distance shall be secured.
- In case of that right of way is not enough, application of retaining wall may be taken.

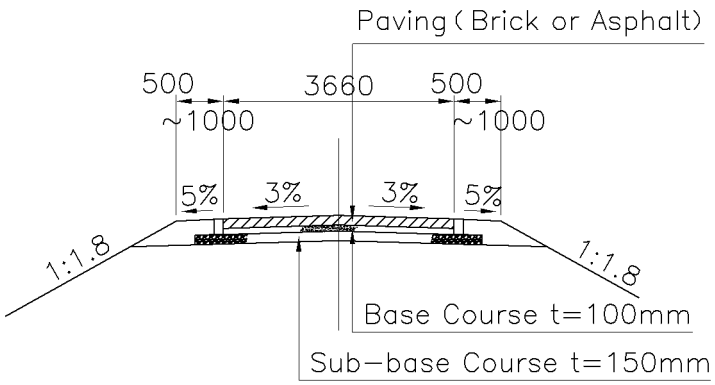


Figure 2.2.2-6 Typical Cross Section of Approach Road

2-2-2-5 Quantities of the Project Bridges

Material to be provided for the Project is shown Table 2.2.2-8 and the breakdown of the Steel Materials for the Project Bridges is shown in Table 2.2.2-9.

Table 2.2.2-8 Bill of Quantities

Description				Unit	Phase			
					1	2	3	Total
Number of bridges				Bridge	36	30	26	92
Super-structure	HS-15／HS-20	10m Truss		span	0	2	1	3
	HS-15／HS-20	15m Truss		span	21	12	16	49
	HS-15／HS-20	20m Truss		span	33	38	33	104
	HS-15	25m Truss		span	7	19	12	38
	HS-20	25m Truss		span	14	6	8	28
	HS-15／HS-20	30m Truss		span	6	3	3	12
	Total			span	81	80	73	234
	Safety Recess	1.0m×1.3m		Point	30	32	34	96
Sub-structure	Abut	Invert T type Abut	H=2.0m	each	8	0	1	9
			H=2.5m	each	10	0	0	10
			H=3.0m	each	20	27	13	60
			H=3.5m	each	3	0	0	3
			H=4.0m	each	12	16	10	38
			H=4.5m	each	0	0	1	1
			H=5.0m	each	10	9	23	42
		Box Type Abut	H=5.5m	each	1	0	0	1
			H=6.0m	each	6	8	4	18
			H=6.5m	each	0	0	0	0
			H=7.0m	each	2	0	0	2
		Sub-Total		each	72	60	52	184
	Pier	Pile Bent Pier	H=3.0m	each	3	4	4	11
			H=3.5m	each	4	0	2	6
			H=4.0m	each	11	12	4	27
			H=4.5m	each	3	5	5	13
			H=5.0m	each	5	6	4	15
			H=5.5m	each	5	3	8	16
			H=6.0m	each	6	2	5	13
			H=6.5m	each	4	18	5	27
			H=7.0m	each	1	0	1	2
			H=7.5m	each	1	0	2	3
			H=8.0m	each	1	0	1	2
			H=8.5m	each	0	0	2	2
			H=9.0m	each	1	0	2	3
			H=9.5m	each	0	0	0	0
			H=10.0m	each	0	0	2	2
		Sub-Total		each	45	50	47	142
	Founda-tion	RC Bored Pile	Φ500mm(Abutment)	each	403	472	451	1,326
			Φ800mm(Pier)	each	120	204	183	507
		Sub-Total		each	523	676	634	1,833
Inci-denta	Revetment			m^2	8,460	8,310	6,290	23,060
	Approach Road			m	3,415	2,583	2,255	8,253

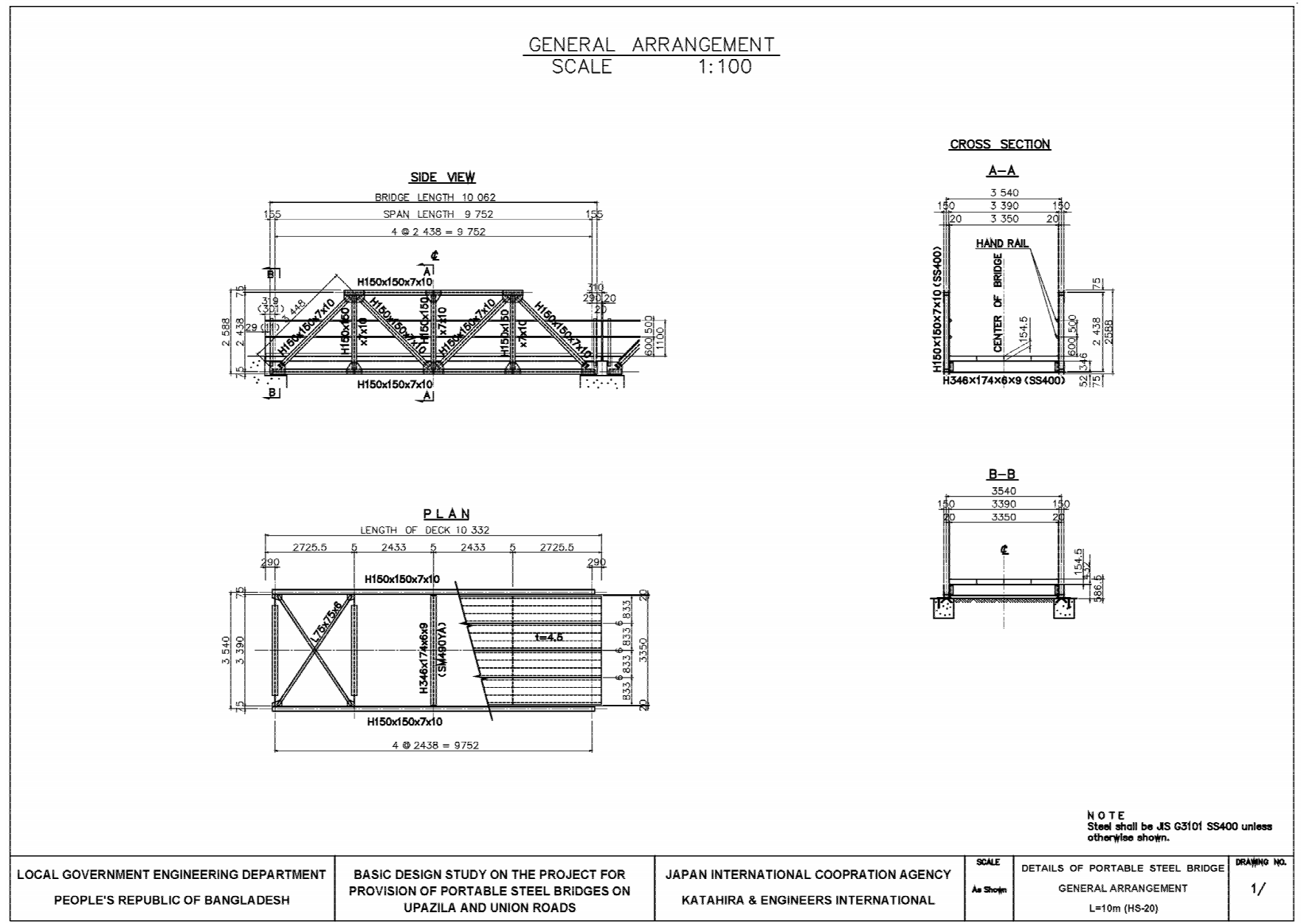
Table 2.2.2-9 Breakdown of Steel Materials

Item	Designation	Dimension	Span					
			10m HS-20	15m HS-20	20m HS-20	25m HS-15	25m HS-20	30m HS-20
Plate	SM490YA	t = 12					76	1,342
		t = 11					836	668
		t = 10					578	344
		Sub-total					1,490	2,354
	SM400A	t = 22					62	62
		t = 12					18	18
		t = 8					40	40
		t = 6					220	260
		小 計					340	380
	SS400	t = 22	62	62	62	62		
		t = 12	52	65	78	91	90	210
		t = 8	415	611	807	1,003	2	2
		t = 6	100	142	182	224	26	30
		Sub-total	629	880	1,129	1,380	118	242
	Sub-total (Plate)		629	880	1,129	1,380	1,948	2,976
H-Shape	SM490YA	346×174× 6× 9					1,524	1,793
		200×200× 8×12						1,936
		175×175×7.5×11					1,572	1,572
		150×150× 7×10	342	644	948	1,250	1,562	956
		150× 75× 5× 7					5,568	6,656
		Sub-total	342	644	948	1,250	10,226	12,913
	SS400	346×174× 6× 9	684	958	1,231	1,505		
		200×200× 8×12						2,262
		175×175×7.5×11					1,878	1,676
		150×150× 7×10	1,796	2,762	3,728	4,692	1,698	1,036
		150× 75× 5× 7	2,304	3,392	4,480	5,568		
		Sub-total	4,784	7,112	9,439	11,765	3,576	4,974
	Sub-total (H-Shape)		5,126	7,756	10,387	13,015	13,802	17,887
L	SS400	75×75× 6× 6	291	357	424	490	490	556
C.P.	SS400	t = 4.5	1,272	1,872	2,472	3,072	3,072	3,672
Pipe	STK400	φ42.7× 2.3	94	138	183	227	228	272
F. Bar	SS400	100× 6	240	360	480	600	600	720
R. Bar	SS400	φ16	6	6	6	6	6	6
Anch.Bolt	SS400	M24(1-W,2-N)	11	11	11	11	12	12
B/Nut	SS400	M24	3	3	3	3	4	4
		M16	8	11	15	19	100	118
	Sub-total (B/Nut)		11	14	18	22	104	122
HTB	F8T	M22	434	658	889	1,123	1,137	
		M16	49	74	99	124		1,503
	Sub-total (HTB)		483	732	988	1,247	1,137	1,503
U Bolt	SS400	32A Type C	2	3	4	5	6	6
Total			8,165	12,129	16,102	20,075	21,405	27,732

Phase	Description	Span					
		10m HS-20	15m HS-20	20m HS-20	25m HS-15	25m HS-20	30m HS-20
Phase 1	Unit		21	33	7	14	6
	Weight 【kg】		254,709	531,366	140,525	299,670	166,392
	Total 【kg】						1,392,662
Phase 2	Unit	2	5	40	19	6	3
	Weight 【kg】	16,330	60,645	644,080	381,425	128,430	83,196
	Total 【kg】						1,314,106
Phase 3	Unit	1	16	33	12	8	3
	Weight 【kg】	8,165	194,064	531,366	240,900	171,240	83,196
	Total 【kg】						1,228,931

2-2-3 Basic Design Drawing

Details of Portable Steel Bridge is shown in Drawing 2.2.3-1～6.



NOTE
Steel shall be JIS G3101 SS400 unless otherwise shown.

LOCAL GOVERNMENT ENGINEERING DEPARTMENT PEOPLE'S REPUBLIC OF BANGLADESH	BASIC DESIGN STUDY ON THE PROJECT FOR PROVISION OF PORTABLE STEEL BRIDGES ON UPAZILA AND UNION ROADS	JAPAN INTERNATIONAL COOPRATION AGENCY KATAHIRA & ENGINEERS INTERNATIONAL	SCALE As Shown	DETAILS OF PORTABLE STEEL BRIDGE GENERAL ARRANGEMENT L=10m (HS-20)	DRAWING NO. 1/

Figure 2.2.3-1 General Arrangement L = 10m (HS-20)