CHAPTER 5 ALTERNATIVE ANALYSIS

5.1 Project Justification

Priority in national strategy

To achieve an average GDP growth rate of 7 percent per annum, the transport sector growth rate is projected to increase by 7.5 percent per annum. It is required to accommodate the increased domestic traffic volume as well as the future traffic volume from the Asian Highway and Trans-Asia Railway as indicated in the Sixth Five Year Plan (2011-2015). In the plan, importance is mainly concentrated on five main corridors: Dhaka-Chittagong, Dhaka-Northwest, Dhaka-Khulna, Dhaka-Sylhet and Khulna-Northwest with special emphasis on Dhaka-Chittagong, Dhaka-Northwest and Khulna-Northwest arterial corridors. The two sea ports will be further developed and linked to Dhaka.

Other transportation modes

Although there are other modes of transport, such as railway and in land water transport as shown Figure 5.1 and are being reinforced to upgrade to ease the present overburden of road transport, they are still weak in the views of capacity and reliability compared road transport with many points to improve.

Figure 5.1 Modes of Mass Transportation

Other routes

From Chittagong to Dhaka, only one route is available presently although other routes are being studied their realization is far future.

Issues in NH-1

The purpose of the present project is to link Dhaka with Chittagong through a fully access-controlled expressway. However the condition of 3 key bridges, Kanchpur Bridge, Meghna Bridge and Gumti Bridge on NH-1 are in problem such as damaged hinges, scouring of pier, narrow widths etc, becoming a bottle neck.

As a conclusion of above discussion, not only repair the present damaged bridges but also enlarge the bridge width by the construction of 3 new bridges are required.
The 'without project scenario' will cause heavy congestion, as a result, social losses such as traffic accidents, environmental deterioration and increase of travelling time will be accelerated.

5.2 Route Selection

For 3 bridges sites respectively, 3 alternative routes, namely Route A, Route B and Route C were proposed to compare their feasibilities in terms of :

- Convenient to road users
- Impact on Socio- environment
- Impact on natural environment
- Obstacle Object (steel towers, water pipe, gas pipe)
- Construction condition
- Project cost

The characteristics of Route A, B and C in each of the three bridges are described as below:

Kanchpur Bridge

Route A: Next to existing bridge (down stream); fairly low resettlement; no land acquisition; fairly low impacts to economic activities; good construction condition; low project cost.

Route B: Next to existing bridge (down stream); fairly high resettlement; land acquisition occurs; low impacts to economic activities; fairly bad construction condition; high project cost.

Route C: Next to existing bridge (up stream); fairly high resettlement; land acquisition occurs; high impacts to economic activities; good construction condition; low project cost.

Meghna Bridge

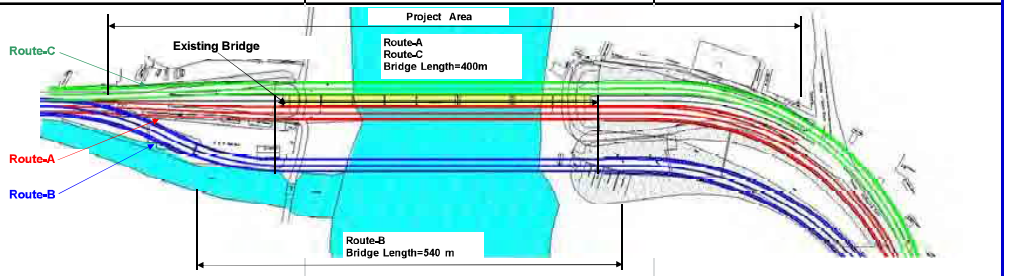
Route A: Next to existing bridge (up stream); low resettlement; land acquisition occurs; low impacts to economic activities; good construction condition; low project cost.

Route B: Secure distance of 250m upstream near old ferry route; high resettlement; no land acquisition; high impacts to economic activities; bad construction condition; high project cost.
Route C:Secure distance of 250m upstream of shifted ferry route Minimize resettlement issue(Ctg. side) on Alignment B; fairly high resettlement; no land acquisition; high impacts to economic activities; normal construction condition; high project cost.

Gumti Bridge
Route A: Next to existing bridge (down stream); fairly low resettlement; no land acquisition; low impacts to economic activities; good construction condition; low project cost.
Route B: Route that secures distance from existing bridge (downstream); high resettlement; no land acquisition; high impacts to economic activities; normal construction condition; slightly high project cost.
Route C: Next to existing bridge (upstream); fairly low resettlement; land acquisition occurs ; normal impacts to economic activities; good construction condition; low project cost.

For each item in each comparison is described by the list. (Refer to Table 5.1, 5.2, 5.3)

Table 5.1 Comparison of the road alignment at Kanchpur Bridge site

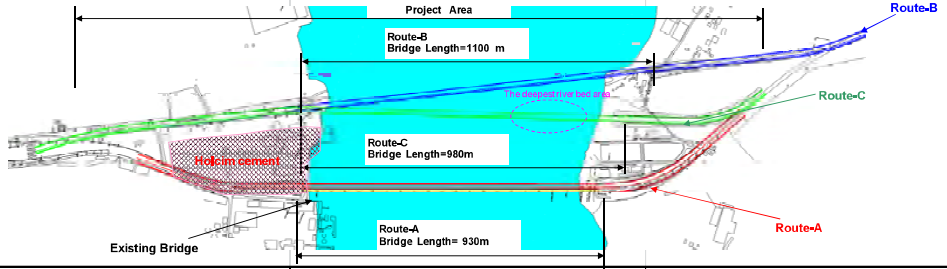
Kanchpur Bridge		Route A		Route B		Route C	
Route							
Summary		Next to existing bridge(down stream)		Route that secures distance from existing bridge (down stream)		Next to existing bridge(up stream)	
① Convenient to road user		No specific problem	◎	Two intersections are needed at the point of connecting existing road, so it's lower safe	△	No specific problem	◎
Impact on Socio-environment	② Resettlement	45 structure (15 houses, 20 shops,10 stalls)	◎	60 structure (40 houses, 20 shops)	○	60 structure (30 houses, 30 shops)	○
	③ Public facility	No	◎	Mosque relocation	△	No	◎
	④ Land acquisition (area, landowner)	0 m2	◎	5,000 m2	△	2,000 m2	△
	⑤ Traffic safety for vessels	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Negligible (one foundation combined with both bridge)	◎
	⑥ Economic activities (sand unloading, ferry terminal operation, factory etc)	20 shops, 10 stalls 30 Sand loading/unloading workers	○	20 shops 30 Sand loading/unloading workers	◎	30 shops 60 Sand loading/unloading workers	△
Impact on natural environment	⑦ Ecosystem	Some impacts to natural fauna and flora during construction	○	Some impacts to natural fauna and flora during construction	○	Some impacts to natural fauna and flora during construction	○
	⑧ Hydrological conditions	Slightly (enlarge scoring if some foundation will be conbined)	○	Negligible (scoring will be same around existing bridge)	◎	Slightly (enlarge scoring if some foundation will be conbined)	○
	⑨ noise / air pollution	Moderate impact since some houses are remained along new accesses	○	Moderate impact since some houses are remained along new accesses	○	Moderate impact since some houses are remained along new accesses	○
	⑩ River flow	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Negligible (one foundation combined with both bridge)	◎
	⑪ Landscape	Negligible (two bridges are close)	◎	Slightly (two bridges are separated)	○	Negligible (two bridges are close)	◎
⑫ Obstacle Object (steel towers, water pipe, gas pipe)		No specific problem	◎	No specific problem	◎	No specific problem	◎
⑬ Construction condition		Construction period is shorter comparing to Route B Bridge Length: 400m Earthwork : 47,000m3	◎	Construction period is the longest Bridge Length: 540m Earthwork : 102,000m3	△	Construction period is shorter comparing to Route B Bridge Length: 400m Earthwork : 35,000m3	◎
⑭ Project cost		Cheap	◎	Expensive	△	Cheap	◎
Evaluation		◎		△		○	

Legend ◎ : Excellent, ○ : Good, △ : Poor

Note: Number of structure within the proposed alignment were counted and rouded up based on the number of roofs identified through Google maps and site reconnaissance made

In the Census survey, number of actual affected households of Route A is 231 households, which include one household with several rentees per one structure. It is estimated 5.1 households per one structure on an average. Based on such estimation, that of Route B and C is both 308 households. It is therefore Route A is the most feasible due that number affected households is the smallest compared with the other plans.

Table 5.2 Comparison of the road alignment at Meghna Bridge site

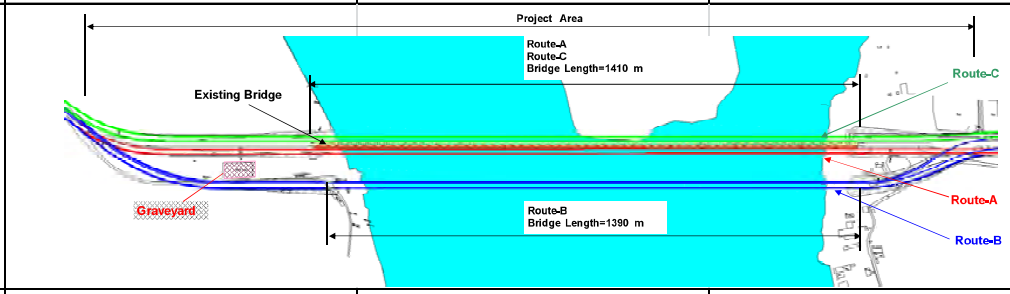
Meghna Bridge		Route A		Route B		Route C	
Route							
Summary		Next to existing bridge(up stream)		Secure distance of 250m upstream near old ferry route		Secure distance of 250m upstream of shifted ferry route Minimize resettlement issue (Ctg. side) on Alignment B	
① Convenient to road user		No specific problem	◎	No specific problem	◎	No specific problem	◎
Impact on Socio-environment	② Resettlement	10 structure (5 houses, 5 shops)	◎	250 structure (90 houses, 150 shops, 10 stalls)	△	60 structure (10 houses, 50 shops)	△
	③ Public facility	No	◎	Mosque relocation	△	No	◎
	④ Land acquisition (area, landowner)	15m from Holcim Cement boundary (RHD will agree with Holcim Cement)	◎	0 m2	◎	0 m2	◎
	⑤ Traffic safety for vessels	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Slightly (two foundations are separated)	○
	⑥ Economic activities (sand unloading, ferry terminal operation, factory etc)	5 shops Fishery	◎	150 shops 50 Sand loading/unloading workers Fishery	△	50 shops 30 Sand loading/inloading workers Fishery	△
Impact on natural environment	⑦ Ecosystem	Small Plantation Some impacts to natural fauna and flora during construction	△	Many roadside trees shall be cut	△	Many roadside trees shall be cut	△
	⑧ Hydrological conditions	Slightly (enlarge scoring if some foundation in main channel will be combined, but bank erosion will be little)	○	Slightly (new bridge inpact is small, but scoring around existing bridge will be large by protection)	○	Worst (new bridge scoring will be large because new route is on the deepest river bed, and existing bridge is needed	△
	⑨ noise / air pollution	Negligible impact since few houses remaind along new access on Chittagon side	◎	Severe impact since many houses remaind along new accesses A school is located near the new access	△	Svevere impact since many houses remaind along new accesses A school is located near the new access	△
	⑩ River flow	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Slightly (two foundations are separated)	○
	⑪ Landscape	Negligible (two bridges are close)	◎	Slightly (two bridges are separated ,loss of road side trees)	○	Slightly (two bridges are separated ,loss of road side trees)	○
⑫ Obstacle Object (steel towers, water pipe, gas pipe)		No specific problem	◎	No specific problem	◎	No specific problem	◎
⑬ Construction condition		Construction period is the shortest Bridge Length: 930m Earthwork : 39,000m3	◎	Construction period is the longest Bridge Length: 1,100m Earthwork : 84,000m3	△	Construction period is shorter comparing to Route B Bridge Length: 980m Earthwork : 128,000m3	○
⑭ Project cost		Cheap	◎	Expensive	△	Expensive	△
Evaluation		◎		△		○	

Legend ◎ : Excellent, ○ : Good, △ : Poor

Note: Number of structure within the proposed alignment were counted and rouded up based on the number of roofs identified through Google maps and site reconnaissance made

In the Census survey, number of actual affected households of Route A is 19 households, which include one household with several rentees per one structure. It is estimated 1.9 households per one structure on an average. Based on such estimation, that of Route B and C is both 475 households and 114 households, respectively. It is therefore Route A is the most feasible due that number affected households is the smallest compared with the other plans.

Table 5.3 Comparison of the road alignment at Gumti Bridge site

Gumti Bridge		Route A		Route B		Route C	
Route							
Summary		Next to existing bridge(down stream)		Route that secures distance from existing bridge(down stream)		Next to existing bridge(up stream)	
① Convenient to road user		No specific problem	◎	No specific problem	◎	No specific problem	◎
Impact on Socio-environment	② Resettlement	20 structure (5 houses, 15 shops)	◎	80 structure (40 houses, 40 shops)	△	20 structure (20 shops)	◎
	③ Public facility	No	◎	No	◎	No	◎
	④ Land acquisition (area, landowner)	0 m2	◎	0 m2	◎	32,000m2	△
	⑤ Traffic safety for vessels	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Negligible (one foundation combined with both bridge)	◎
	⑥ Economic activities (sand unloading, ferry terminal operation, factory etc)	15 shops 100 sand loading/unloading workers cultivating farm on sand bars Fishery	◎	40 shops 100 sand loading/unloading workers Fishery	△	20 shops 100 sand loading/unloading workers cultivating farm on sand bars Fishery	○
Impact on natural environment	⑦ Ecosystem	Some impacts to natural fauna and flora during construction	○	Some impacts to natural fauna and flora during construction	○	Some impacts to natural fauna and flora during construction	○
	⑧ Hydrological conditions	Slightly (enlarge scoring if some foundation will be combined)	○	Negligible (scoring will be same around existing bridge)	◎	Slightly (enlarge scoring if some foundation will be combined)	○
	⑨ noise / air pollution	No impact since no house remained along new access	◎	Moderate impact since several houses remained along new access	○	Negligible impact since few houses remained along new access	◎
	⑩ River flow	Negligible (one foundation combined with both bridge)	◎	Slightly (two foundations are separated)	○	Negligible (one foundation combined with both bridge)	◎
	⑪ Landscape	Negligible (two bridges are close)	◎	Slightly (two bridges are separated)	○	Negligible (two bridges are close)	◎
⑫ Obstacle Object (steel towers, water pipe, gas pipe)		No specific problem	◎	No specific problem	◎	No specific problem	◎
⑬ Construction condition		Construction period is shorter comparing to Route B Bridge Length: 1,410m Earthwork : 33,000m3	◎	Construction period is the longest Bridge Length: 1,390m Earthwork : 41,000m3	○	Construction period is shorter comparing to Route B Bridge Length: 1,410m Earthwork : 33,000m3	◎
⑭ Project cost		Cheap	◎	Slightly expensive	○	Cheap	◎
Evaluation		◎		△		○	

Legend ◎ : Excellent, ○ : Good, △ : Poor

Note: Number of structure within the proposed alignment were counted and rouded up based on the number of roofs identified through Google maps and site reconnaissance made

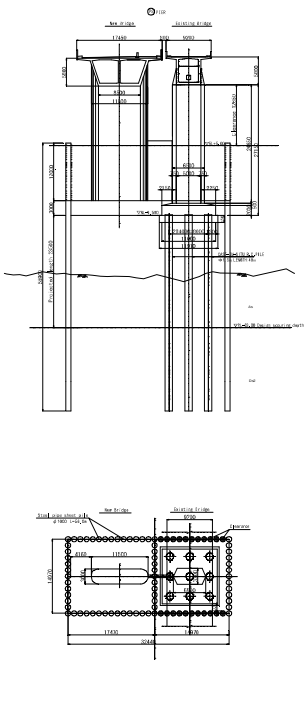
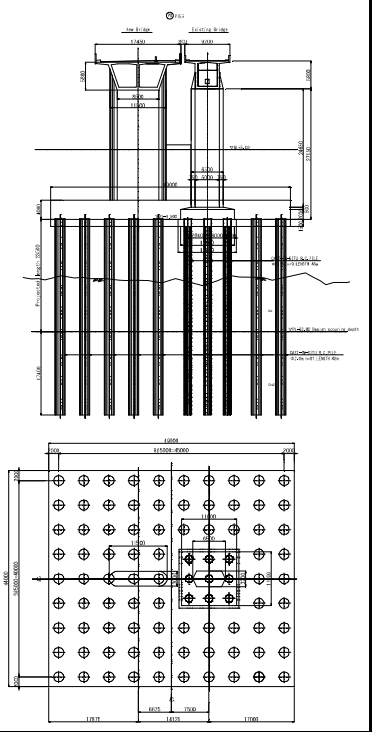
In the Census survey, number of actual affected households of Route A is 24 households, which include one household with several rentees per one structure. It is estimated 1.2 households per one structure on an average. Based on such estimation, that of Route B and C is both 96 households and 24 households, respectively. It is therefore Route A is the most feasible due that number affected households is the smallest compared with the other plans.

5.3 Selection of Foundation type and Bridge type of the 2nd bridges

5.3.1 Selection of Steel Pipe Sheet Pile Foundation

The comparison of the Steel Pipe Sheet Pile Foundation (SPSP) and concrete pile foundation in case of Meghna Bridge, both of which are capable of resisting new seismic forces after scouring of design depth was conducted regarding the necessity of cofferdams, construction period, foundation size and construction cost. The SPSP foundation was then selected based on the comparison results shown in Table 5.4.

Table 5.4 Foundation retrofitting

		Steel pipe sheet pile foundation (SPSP)		Concrete pile foundation	
Image					
Structural aspect					
	Record	A little	△	A little	△
	Foundation scale	Small in size	◎	Large in size	△
Construction aspect					
	Cofferdam	Not required	◎	Required (cofferdam by Steel pipe sheet pile)	△
	Navigation clearance	Adequate	△	Adequate	△
	Construction period	Six months (Only Steel pipe sheet pile)	◎	Over one year (RC pile + Steel pipe sheet pile)	△
Natural environment					
	Effect on acquatic environment	Small (foundation is small)	◎	Large (foundation is large)	△
	River bed scouring	Small (foundation is small)	◎	Large (foundation is large)	△
Cost		1.00	◎	2.56	△
Evaluation		◎		△	

Legend: ◎excellent, ○good, △poor

Consequently, SPSP foundations have been adopted for most of the foundations in the 3 bridges. In general the SPSP has less impact on the environment compared to the other types of foundation because the amount of the excavated soil to be disposed is much less than in the conventional piled foundation.

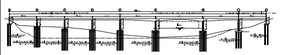
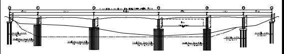
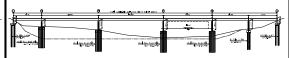
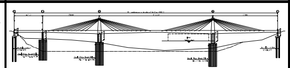
5.3.2 Selection of Continuous Steel Narrow Box Girder with Weathering Steel

For Kanchpur bridge, the comparison of PC box girder, continuous steel narrow box girder with weathering steel and PC extradosed type was conducted regarding structural performance, constructability, maintenance, landscape, environmental impact and lifecycle cost, while for Meghna and Gumti bridges, the PC box girder with corrugated steel web was added to the comparison. The continuous steel narrow box girder with weathering steel was selected for 2nd Kanchpur, Meghna and Gumti Bridges based on the comparison results shown in Table 5.5 to 5.7.

In general, the weathering steel adopted for the steel narrow box girder type in the 3 bridges has less negative impact on the environment compared to the conventional steel for the reasons listed below:

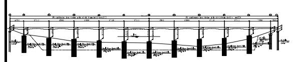
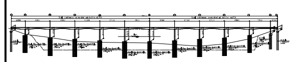
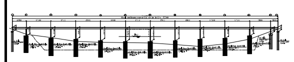
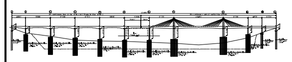
- As the corrosion protective coating is not required, no paint will be used.
- There will be no negative impact on the environment arising from scattered paint.
- There will be no repainting works which otherwise are required every 25 years.

Table 5.5 Bridge type evaluation for 2nd Kanchpur Bridge

Bridge type			Option-1			Option-2			Option-3			Option-4		
			PC T-beam bridge + PC box girder bridge			Continuous PC box girder bridge			Continuous steel narrow box girder bridge with weathering steel			PC extradosed bridge		
Bridge shape														
Strctural performance	Record of usage		Many	◎	◎	Many	◎	◎	Not many	△	○	Many	◎	◎
	Durability	Durability of floor slab	Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎	
	Earthquake resistance	Weight of superstructure	moderate	○		moderate	○		advantageous	◎		moderate	○	
Constructability	Construction method	Difficulty level of constructuction	normal	○	○	normal	○	○	normal	○	○	slightly difficult	△	△
	Quality control	Difficulty level of quality control	normal	○		normal	○		normal	○		slightly difficult (Camber adjustemnt)	△	
	Construction period		3.0 years	○		3.0 years	○		2.5 years	◎		3.5 years	△	
Maintenance	Painting / Carbonation	Necessity of painting / Surface treatment	Painting once in 30 years	○	○	Painting once in 30 years	○	◎	Surface treatment once in 50 years	◎	◎	Painting once in 30 years	○	○
	Maintenace	Intermidiate joint numbers	1 point	○		Nothing	◎		Nothing	◎		Nothing	◎	
		Pier with bearings	5 points	△		Nothing	◎		5 points	△		1 point	○	
	Cable	replacement of cable sheath	Not required	◎		Not required	◎		Not required	◎		replacement once in 75 years	△	
Landscape	Aesthetic view		Straight + Slender arch shape	○	○	Slender arch shape	○	○	Straight	○	○	Monumental appearance	◎	◎
Environmental impact	River Hydrology	Depends on no. of bridge piers in riverbed	7 piers	△	○	5 piers	○	○	5 piers	○	○	3 piers	◎	◎
	Scouring	number of piers in main stream	2 piers	○		2 piers	○		2 piers	○		1 pier	◎	
	Periodic maintenance	No.and conditions of expansion joints	3 points	○		2 points	◎		2 points	◎		2 points	◎	
Life cycle cost (Construction cost, Maintenance cost)			1.01	◎		1.04	○		1.00	◎		1.32	△	
Evaluation			2			3			1			4		

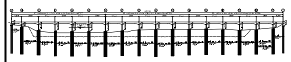
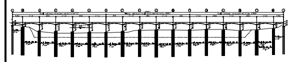
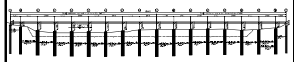
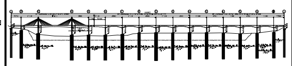
Legend: ◎ Excellent, ○ Good, △ Poor

Table 5.6 Bridge type evaluation for 2nd Meghna Bridge

Bridge type			Option-1			Option-2			Option-3			Option-4		
			PC box girder bridge			PC box girder bridge with corrugated steel web			Continuous steel narrow box girder bridge with weathering steel			PC extradosed bridge + PC box girder bridge		
Bridge shape														
Strctural performance	Record of usage		Many	◎	◎	Few	○	○	Not many	△	○	Many	◎	◎
	Durability	Durability of floor slab	Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎	
	Earthquake resistance	Weight of superstraucture	moderate	○		slightly advantageous	○		advantage	◎		moderate	○	
Constructability	Construction method	Difficulty level of constructuction	normal	○	○	slightly difficult	△	○	normal	○	○	slightly difficult	△	△
	Quality control	Difficulty level of quality control	normal	○		normal	○		normal	○		slightly difficult (Camber adjustemnt)	△	
	Construction period		4 years	○		4 years	○		3 years	◎		4 years	○	
Maintenance	Painting / Carbonation	Necessity of painting / Surface treatment	Painting once in 30 years	○	○	Painting once in 30 years	○	○	Surface treatment once in 50 years	◎	◎	Painting once in 30 years	○	○
	Maintenace	Intermidiate joint numbers	1 points	○		1 points	○		Nothing	◎		1 points	○	
		Pier with bearings	2 points	○		2 points	○		11 points	△		3 points	○	
	Cable	replacement of cable sheath	Not required	◎		Not required	◎		Not required	◎		replacement once in 75 years	△	
Landscape	Aesthetic view		Slender arch shape	○	○	Slender arch shape	○	○	Straight	○	○	Monumental appearance	◎	◎
Environmental impact	River Hydrology	Depends on no. of bridge piers in riverbed	11 piers	○	○	11 piers	○	○	11 piers	○	○	10 piers	◎	◎
	Scouring	number of pier in main stream	5 piers	○		5 piers	○		5 piers	○		4 piers	◎	
	Periodic maintenance	No.and conditions of expansion joints	3 Points	○		3 Points	○		2 Points	◎		3 Points	○	
Life cycle cost (Construction cost, Maintenance cost)			1.01	◎		1.00	◎		1.00	◎		1.15	△	
Evaluation			2			3			1			4		

Legend: ◎ Excellent, ○ Good, △ Poor

Table 5.7 Bridge type evaluation for 2nd Gumti Bridge

Bridge type			Option-1			Option-2			Option-3			Option-4		
			PC box girder bridge			PC box girder bridge with corrugated steel web			Steel narrow box girder bridge with weathering steel			PC extradosed bridge + PC box girder bridge		
Bridge shape														
Strctural performance	Record of usage		Many	◎	◎	Few	○	○	Not many	△	○	Many	◎	◎
	Durability	Durability of floor slab	Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎		Enough (PC floor slab)	◎	
	Earthquake resistance	Weight of superstructure	moderate	○		slightly advantageous	○		advantageois	◎		moderate	○	
Constructability	Construction method	Difficulty level of constructuction	normal	○	○	slightly difficult	△	○	normal	○	◎	slightly difficult	△	△
	Quality control	Difficulty level of quality control	normal	○		normal	○		normal	○		slightly difficult (Camber adjustemnt)	△	
	Construction period		4 years	○		4 years	○		3 years	◎		4 years	○	
Maintenance	Painting / Carbonation	Necessity of painting / Surface treatment	Painting once in 30 years	○	◎	Painting once in 30 years	○	◎	Surface treatment once in a 50 years	◎	◎	Painting once in 30 years	○	○
	Maintenace	Intermidiate joint numbers	2 points	○		2 points	○		1 point	◎		2 points	○	
		Pier with bearings	2 points	◎		2 points	◎		16 points	△		4 points	○	
	Cable	replacement of cable sheath	Not required	◎		Not required	◎		Not required	◎		replacement once in 75years.	△	
Landscape	Aesthetic view		Slende arch shape	○	○	Slende arch shape	○	○	Straight	○	○	Monumental appearance	◎	◎
Environmental impact	River Hydrology	Depends on no. of bridge pier in riverbed	16 piers	○	○	16 piers	○	○	16 piers	○	○	15 piers	◎	◎
	Scouring	number of piers in main stream	6 piers	○		6 piers	○		6 piers	○		5 piers	◎	
	Periodic maintenance	No.and conditions of expansion joints	4 points	◎		4 points	◎		4 points	◎		4 points	◎	
Life cycle cost (Construction cost, Maintenance cost)			1.00	◎		1.01	◎		1.00	◎		1.06	△	
Evaluation			2			3			1			4		

Legend: ◎ Excellent, ○ Good, △ Poor

CHAPTER 6 INITIAL ENVIRONMENTAL EXAMINATION

6.1 Screening

Screening is the step to categorize projects/activities based on degree of environmental impacts caused by the project.

The Project was classified as “Red” under regulation of Bangladesh and “A” according to the JICA Environmental Guidelines, and thus EIA is necessary to be conducted.

6.2 Scoping

The aim of scoping is to find out possible ecological/environmental and social impact caused by the implementation of proposed project and to determine Terms of Reference (TOR) for EIA. The results of screening are shown in Table 5.1. Impacts are rated in A, B, C and D. The definition of the rating is as follows.

Definition of the Rating:

A: Severe negative impact is predicted

B: Limited negative impacts can be predicted

C: Impact is unknown

D: Almost no negative impact is predicted

Table 6.1 Results of Scoping at Kanchpur Bridge Site

	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper ation	Before / During Construction	During Operation	
1	Involuntary resettlement	A	A	D	Loss of approximately 40 residential houses and small shops	-	Preparation of RAP Census Asset inventory
2	Local economics, such as employment, livelihood, etc.	A	A	D	Loss of approximately 20 small shops Some restrictions to sand carrying work	- (Local economy can be activated)	Socio-economical survey and group discussion
3	Land use and utilization of local resources	B	B	D	Impact on part of fishing place	-	Study of current land use
4	Social institutions such as social infrastructure and local decision-making institutions	D	D	D	-	-	-
5	Existing social infrastructures and services	D	D	D	-	-	-
6	Poor, indigenous, or ethnic people	A	A	D	Relocation of approximately 40 poor and landless families and small shops	-	Group discussion
7	Misdistribution of benefits and damages	B	B	B	Relocated families may become poorer while the remaining families can have the project benefit		Socio-economical survey and group discussion
8	Local conflicts of interest	B	B	B	Local conflicts may take place by the misdistribution of benefits and damages		Socio-economical survey and group discussion
9	Cultural heritage	D	D	D	Appeared to be no cultural heritage around	-	-
10	Accident	B	B	B	Construction accident during construction	Traffic accident	Study and analysis of construction accident during construction and traffic accident
11	Infectious diseases such as HIV/AIDS	B	B	C	Inflow of workers with HIV into camp	-	Study of present condition of HIV
12	Gender	B	B	C	Female laborers may be discriminated in wage at construction site	-	Study of present condition of gender gaps
13	Children's rights	B	B	C	Children's labor	-	Study of present condition of children's labor

	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper ation	Before / During Construction	During Operation	
14	Erosion and scouring	C	C	C	River bank erosion may be caused by installation of embankment road for construction and abutments		literature study and hearing study
15	River transportation	B	B	B	Construction vessels may obstacle passing vessels	New pier foundations may obstacle passing vessels	Study of the number of passing vessels and their passing direction Study of present condition of river traffic accident
16	Hydrology	B	B	B	Flood can be caused by installation of embankment road for construction and abutments		Hydrological analysis
17	Biota and Ecosystem	B	B	C	Impact on precious species	-	Hearing study
18	Global Warming	C	C	C	CO2 emission from construction equipment	An increase in CO2 emission from passing vehicles	Estimation of the amount of emission Prediction of the amount of emission
19	Air Pollution	B	B	C	Emission of air pollutant from construction equipment	An increase in emission of air pollutant from passing vehicles	Chemical analysis of air pollution Prediction of future density
20	Water Contamination	B	B	D	Release of construction turbid water without treatment into river Disturbance of river bottom by installation of pier foundation	-	Chemical analysis of present water quality Estimation and prediction of amount of suspended solid by installation of pier foundation
21	Soil Pollution	B	B	D	Leakage of asphalt and gasoline	-	Soil sampling and analysis for pollution Prediction of leakage in construction
22	Waste	B	B	D	Illegal dumping of construction solid waste	-	Prediction of amount of generated construction waste
23	Noise and Vibration	B	B	C	Noise and vibration of construction equipment	Noise and vibration of passing vehicles	Measurement of noise and vibration Prediction of future noise and vibration

	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper ation	Before / During Construction	During Operation	
24	Ground Subsidence	C	D	C		Ground subsidence of buildings and surrounding facilities	Study of current condition of soft ground distribution by boring
25	Offensive Odor	C	C	C	Odor from emitted gases by construction equipment and open burning of waste		Study of a cause and a resource of offensive odor
26	Bottom Sediment	C	C	D	-	-	Sampling and chemical analysis of bottom sediments
27	Landscape	C	C	C	View of bridges and embankments during construction	View of bridges and embankments during operation	Hearing from local residents

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Table 6.2 Results of scoping at Meghna Bridge Site

No.	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper-ation	Before / During Construction	DuringOperation	
1	Involuntary resettlement	A	A	D	Loss of approximately 400 residential houses and small shops	-	Census Asset inventory -
2	Local economics, such as employment, livelihood, etc.	A	A	D	Loss of approximately 200 small shops Some restrictions to sand carrying work	- (Local economy can be activated)	Socio-economical survey and group discussion
3	Land use and utilization of local resources	B	B	D	Impact on part of fishing place and timber industry	-	Study of current land use
4	Social institutions such as social infrastructure and local decision-making institutions	B	B	D	Construction impact on school	-	Study of location, influence and so forth

No.	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper-ation	Before / During Construction	DuringOperation	
5	Existing social infrastructures and services	B	B	D	Relocation of ferry terminal	-	Study of current condition of ferry use
6	Poor, indigenous, or ethnic people	A	A	D	Relocation of approximately 40 poor and landless families and small shops	-	Group discussion
7	Misdistribution of benefits and damages	B	B	B	Relocated families may become poorer while the remaining families can have the project benefit		Socio-economical survey and group discussion
8	Local conflicts of interest	B	B	B	Local conflicts may take place by the misdistribution of benefits and damages		Socio-economical survey and group discussion
9	Cultural heritage	D	D	D	Appeared to be no cultural heritage around	-	Appeared to be no cultural heritage around
10	Accident	B	B	B	Construction accident during construction	Traffic accident	Study and analysis of construction accident during construction and traffic accident
11	Infectious diseases such as HIV/AIDS	B	B	C	Inflow of workers with HIV into camp	-	Study of present condition of HIV
12	Gender	B	B	C	Female laborers may be discriminated in wage at construction site	-	Study of present condition of gender gaps
13	Children's rights	B	B	C	Children's labor	-	Study of present condition of children's labor
14	Erosion and scouring	A	C	A	Deep scour of river bottom around pier's foundations and river bank erosion may be caused by installation of embankment road for construction and abutments		Hydrological analysis
15	River transportation	B	B	B	Construction vessels may obstacle passing vessels	New pier foundations may obstacle passing vessels	Construction vessels may obstacle passing vessels
16	Hydrology	B	B	B	Flood can be caused by installation of embankment road for construction and abutments		Hydrological analysis for erosion and scouring
17	Biota and Ecosystem	B	B	C	Impact on precious species	-	Hearing study

No.	Item	Rating			Potential impact description		Study methodology
		Overall	Before / During Const-ruction	During Oper-ation	Before / During Construction	DuringOperation	
18	Global Warming	C	C	C	CO2 emission from construction equipment	An increase in CO2 emission from passing vehicles	Estimation of the amount of emission Prediction of the amount of emission
19	Air Pollution	B	B	C	Emission of air pollutant from construction equipment	An increase in emission of air pollutant from passing vehicles	Chemical analysis of air pollution Prediction of future density
20	Water Contamination	B	B	D	Release of construction turbid water without treatment into river Disturbance of river bottom by installation of pier foundation	-	Chemical analysis of present water quality Estimation and prediction of amount of suspended solid by installation of pier foundation
21	Soil Pollution	B	B	D	Leakage of asphalt and gasoline	-	Soil sampling and analysis for pollution Prediction of leakage in construction
22	Waste	B	B	D	Illegal dumping of construction solid waste	-	Prediction of amount of generated construction waste
23	Noise and Vibration	B	B	C	Noise and vibration of construction equipment	Noise and vibration of passing vehicles	Measurement of noise and vibration Prediction of future noise and vibration
24	Ground Subsidence	C	D	C		Ground subsidence of buildings and surrounding facilities	Study of current condition of soft ground distribution by boring
25	Odor	C	C	C	Odor from emitted gases by construction equipment and open burning of waste		Study of a cause and a resource of offensive odor
26	Bottom Sediment	C	C	D	-	-	Sampling and chemical analysis of bottom sediments
27	Landscape	C	C	C	View of bridges and embankments during construction	View of bridges and embankments during operation	Hearing from local residents