CHAPTER 4 NEW KARNAPHULI RIVER ROAD PROJECT

4.1 Objective of the Project

Karnaphuli River Road is composed to be a part of Chittagong City Ring Road. The starting point of Karnaphuli River Road is a place at the ending point of the Outer Ring Road in the northeastern part in the city. Thereafter, the road runs south on the right bank and heads for the estuary. Finally, the ending point is the place at the neighborhood of the intersection between Double Mooring Road and Sheki Mujib Road. The total length of the road is about 13.02km.

The route of Karnaphuli River Road is proposed in JBIC Pilot study of 2006 and in CDA Master Plan like that of Costal Road. (See Figure 3.1-1). Difference of the 2 plans is that, JBIC Pilot Study proposes the widening and improvement of the existing road continuing from Capital Dredging Section.

This road has a role on smooth traffic flow from the central city to the northeastern part and the left side area of Karnaphuli River.

Therefore, access roads to the approach roads to Kalurgahat Bridge and the under construction 3rd Karnaphuli Bridge are planned. And in Capital Dredging Project Section this road is planned to construct on the land which is developed by the project.

At present there is no embankment at the right side of Karnaphuli River between Karlurgahat Bridge and 3rd Karnaphuli Bridge. In this project embankment-cum-road will be constructed at this section for preventing the flood at the northeastern area of Chittagong City.

Therefore, in this chapter, the route of Karnaphuli River Road is finalized and proposed in this SAPROF study. Road structure along with the embankment shape are proposed guided by the high water level of Karnaphuli River in the past record as the road between Kalurgahat Bridge and 3rd Karnaphuli Bridge will be developed as the embankment-cum-road for flood prevention. On the other hand, since other sections in the road are developed as ordinary roads, structure of these sections are proposes as road on the flat ground.

Based on the design policy mentioned above, preliminary design is carried out, scope of the project is fixed, and project cost is estimated. Environment impact assessment and economical evaluation concerning this project implementation are also referred in this chapter.

4.2 Scope of the Project

4.2.1 Route Selection and Evaluation

1) Procedure of Route Selection

For selecting the route of Karnaphuli River Road, the same way is followed as for the route of the Costal Main Road shown in Chapter 3.3.1.

2) Sectionalize Karnaphuli River Road

The road is mainly divided into four sections as shown in Figure 4.2-1. A state of those sections is as follows.

Section-1 (Outer Ring Road Connecting Section): The road needs to connect to the Outer Ring Road because it becomes a part of Chittagong City Ring Road. Therefore, the starting point of the road is the ending point of Outer Ring Road. However, all of route of Outer Ring Road is not yet been fixed, and the starting point of the road is at about 400m upstream from Karlurgahat Bridge decided by CDA Master Plan. So, the section between the starting point of the route and the intersection with Karlurgahat Bridge is designated as Section-1.

Section-2 (Karnaphuli Embankment Section): Route between two intersections with Karlurgahat Bridge and 3rd Karnaphuli Bridge is to be Section-2. The road runs parallel with Karnaphuli River and close to the residential land development project by CDA is the only one control point. In this section, the road is developed as an embankment-cum-road as the flood countermeasure.

Section-3 (Capital Dredging Section): The road from 3rd Karnaphuli Bridge to the existing road along Capital Dredging Project becomes Section-3. The road is constructed on the land developed by Capital Dredging Project. By the way, the construction method of revetment work in the project was examined for considering more economical work by BRTC/BUET (Bureau of Research, Testing and Consultation/Bangladesh University of Engineering and Technology) consigned by CPA (Chittagong Port Authority). The project design was completed, and DPP (Development Project Proposal) of the project was submitted to MOS (Ministry of Shipping) on November 2008. Therefore, the route of the road is decided according to the route which is shown in the drawing, obtained from CPA, which shows the sheet pile method for a revetment.

Section-4 (Existing Road Widening and Improvement Section): The ending point of the road in Capital Dredging Project is connected with the existing road. It is necessary to widen and improve this connected existing road to deal with the much traffic from Section-3. So, Section-4 involves carrying out widening and improvement of the existing road.

3) Expected Function and Design Policy satisfied with the Expected Function

Like the Costal Main Road, Karnaphuli River Road forms a part of Chittagong City Ring Road. A role of the ring road is to prevent the concentration of the traffic in the central city by allowing the flow of traffic, which has not the destination of central city, on the ring road. Moreover, Karnaphuli River Road has to be equipped with flood prevention facilities to protect the city from high water level of Karbnaphuli River. Then, expected functions of Karnaphuli River Road are mentioned below.

- To ease the traffic congestion of the central city by the road as the bypass from the northeastern side of Karnaphuli River to airports and EPZ in the southern part of the city.
- To play a role as the bypass that doesn't let vehicles concentrate to the central city, because the road is a part of Chittagong City Ring Road.
- To protect Chittagong City from the high water level occurred during cyclone as the road is a continuous embankment-cum-road from Kalurghat to Hafiz Nagar on the right side of Karbnaphuli River.

Some requested countermeasures to satisfy the above-mentioned expected functions of Karnaphuli River Road are as follows.

- In northern part of the city, it is necessary to lead vehicles toward the southern part of the city coming from the east side of Karnaphuli River direction into the road / southern part without entering the central city. Similarly, it is necessary to lead vehicles toward the western part of the city into Outer Ring Road without entering the central city.
- It is necessary that the vehicle toward the southern part of the city from northern or the central city area doesn't pass the congested trunk roads, and use the road.
- Eastern area of Chittagong City is protected from high water level occurred during cyclone by the newly constructed embankment-cum-road.

The design policy for Karnaphuli River Road decided by above-mentioned reasons is as follows.

- The road connects Outer Ring Road and the other existing roads for connecting the northern part of the city and southern part of the city along Karnaphuli River.
- Similarly, the embankment up to northern part of the city is newly constructed and the east side of Chittagong City is protected from high water level occurred during cyclone.

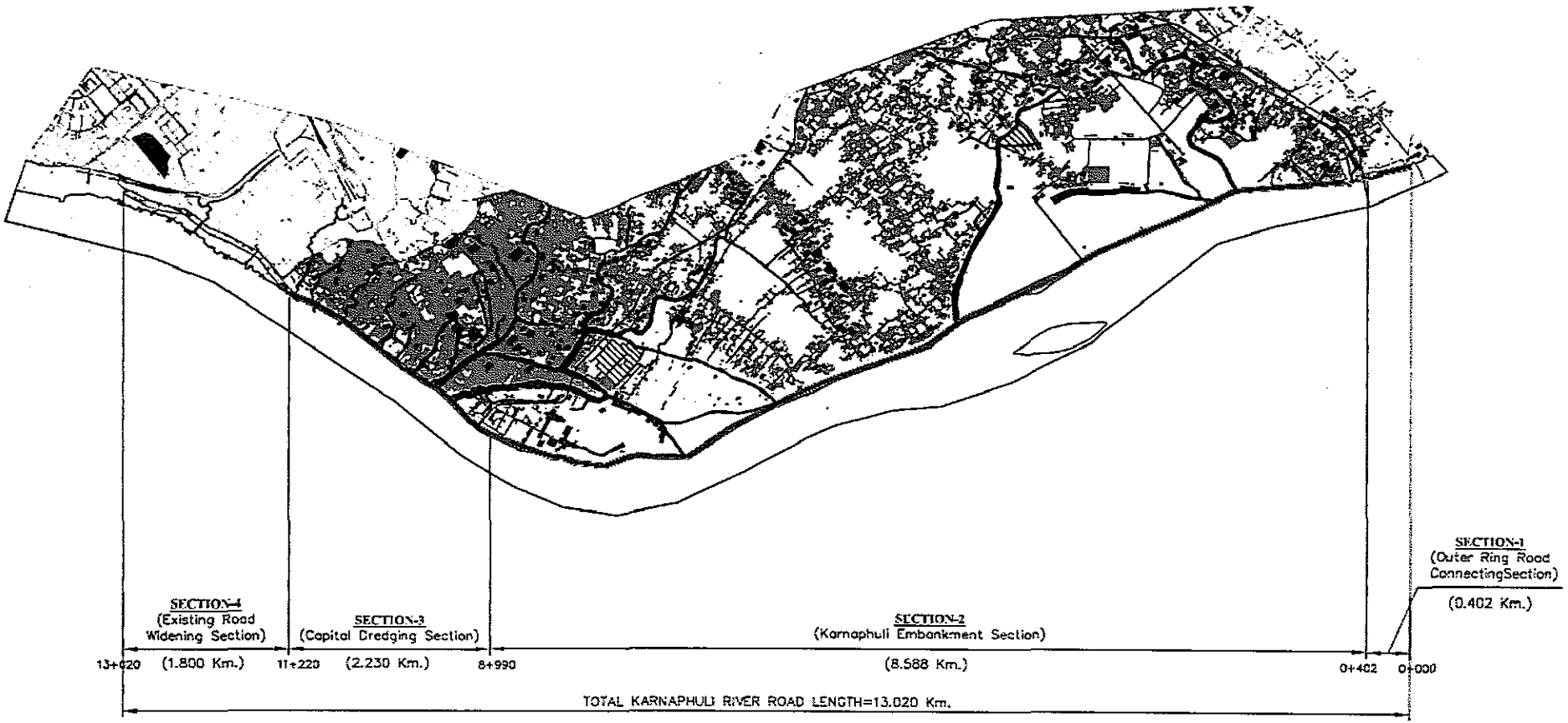


Figure 4.2-1 Karnaphuli River Road Route Map

4) Route Selection for Karnaphuli River Road

Basically, route of the road follows the alignment of Karnaphuli River and it will be fixed by examining the following subjects / points.

- The beginning point of the project.
- The ending point of the project.
- Control points for route selection (Which area the road passes through and what kind of roads are connected to the road?)

(1) Beginning point of the Project

Outer Ring Road and this road are composed as the northern and eastern sections of Chittagong City Ring Road respectively. Then, these two roads should be connected as to form a perfect circular shape. Therefore, the ending point of Outer Ring Road becomes the starting point of the project. Incidentally, sections of DT Road - Bayazid Bostami Road and Oxygen – Quish in Outer Ring Road are under construction or nearing completion, and the construction of the eastern section from the intersection of Kaptai Road is not progressed at present. The development plan of the eastern section from the intersection of Kaptai Road in Outer Ring Road is shown in Table 4.2-1 according to the CDA Master Plan. Actual beginning point of the project can be decided by fixing the route of eastern section from the intersection of Kaptai Road of Outer Ring Road. Then, the route will be fixed in the F/S executed in 2009. Therefore, in this study the ending point of Outer Ring Road is quoted from CDA Master Plan as the reference.

Table 4.2-1 Development Plan of the Eastern Section from the Intersection of Kaptai Road in Outer Ring Road

No.	Stage	Detailed Information
1	Present Condition	At present there is no road and barren paddy land as well as some marshy land. Very settlement is there, which are mainly temporary semi pucca and katcha structures.
2	F/S Stage	From July 2009 for 3 months (Hopefully)
3	Basic Design Stage	After finishing the F/S, CDA will carry out basic design of this section. Construction of this section is defined as first priority project in the Detailed Area Plan for Chittagong Metropolitan Master Plan,
4	Implementation (Land acquisition) & Detailed Design Stage	CDA will initiate land acquisition process after getting approval from the Government. For getting approval from the Government it may take 3 months i.e. Jan 2010 to March 2010 (safety factor another 3 months). It is to be mentioned that land acquisition process and detailed design activities may run simultaneously.
5	Implementation Stage (Constriction work)	About Year July 2010 - June 2012

Source: CDA

i) Application for Approval of the project of this section

- CDA will prepare the DPP of the project and will send to the Ministry of Housing and Public Works (MHPW).
- MHPW will send DPP to Planning Commission. IMED will evaluate the project.
- If Planning Commission approved the project, DPP will send back to MHPW.
- In the case CDA own funded project, MHPW will send DPP to the Ministry of Finance (MOF) and MOF will seek for liquidity certificate from CDA.
- In case of GOB funded project, MOF will send DPP for ECNEC meeting. After approval from ECNEC, it means that the Government has given full clearance.

ii) Procedure of Land Acquisition

- For land acquisition it will be sent to the Ministry of Land (MOL) for their clearance. MOL will guide DC (District Commissioner) officer, and DC office will guide LA (Land Acquisition office) regarding land acquisition.

(2) Ending Point of the Project

The Ending point of the road terminates at the end of Section-3 in CDA Master Plan. On the other hand, JBIC Pilot Study is proposing inclusion of Section-4, which is an existing road, to connect with the terminal point of Section-3 and the trunk roads in the central city are widened and improved. In the result of the site survey of this SAPROF, the width of the existing road doesn't satisfy with the trunk roads of the city, and there is no chance of generating traffic in Section-3. Section-4 is needed to include in Karnaphuli River Road Construction Project in order to satisfy the traffic demand in this project. Finally, the neighborhood of the intersection between Double Moorung Road and Sheki Mujib Road is proposed as the ending point of the project.

(3) Control Points for Route Selection

i) Control Points in Section-1

The road in Section-1 is about 440 m long along the bank of Karnaphuli River. There are two control points in this section, connecting point of Outer Ring Road and approach road of Karlurgahat Bridge. At the intersection between the road and Karlurgahat Bridge, the road passes under the bridge and access road is needed to connect the approach road of Karlurgahat Bridge.

ii) Control Points in Section-2

Section-2 is only to run simply along the right bank on Karnaphuli River. There is a residential land development project of CDA in close vicinity to the proposed route of the road, but it doesn't influence the ROW of the road. Therefore, there is no control point where it needs to adjust on route selection specially.

Also, the road needs connection with the approach road of the under construction 3rd Karnaphuli Bridge. As, the road passes under 3rd Karnaphuli Bridge, access road is needed to construct to connect the approach road of 3rd Karnaphuli Bridge in the same way in Section-1,

iii) Control Points in Section-3

A route of the road should be adjusted with Capital Dredging Project over the whole area of Section-3. The obtained drawing (See Appendix 4.2-1) of Capital Dredging Project from CPA, in which sheet pile revetment is adopted, provides the basic idea for selecting the route in Section-3 on this SAPROF. The outline of the project based on DPP obtained from CPA is shown in Table 4.2-2.

Table 4.2-2Table 4.2-2 Outline of Capital Dredging Project

No.	Items	Details
1	Project Title	Bank protection work and capital dredging in Karnaphuli River from Sadarghat Jetty to 3rd Karnaphuli Bridg
2	Sponsoring Ministry	Ministry of Shipping
3	Executing Agency	Chittagong Port Authority
4	Objective of the Project	The project aims at carrying out Capital Dredging and providing bank protection in the Karnaphuli Channel from Sadarghat Jetty to 3rd Karnaphuli Bridge to ensure the navigability of the channel.
6	Location of the Project	Division: Chittagong District: Chittagong Upazila: Sadar
7	Construction Work	Dredging Works / Bank Protection Works / Filling and Compaction / Concrete Works / Reinforcement/ Steel Piling Works / Brick Works / Fender and Bollard Works
	Finance	Chittagong Port Authority Self Finance
8	Estimated Cost of the Project	Total: 41172.00 Lakh Taka
9	Project Implementation Period	Date of Commencement: January 2009 Date of Completion: December 2011

Source: CPA

iv) Control Points in Section-4

The existing road will be widened and improved in Section-4. A route is persistently fixed according to the existing road alignment. Therefore, relocation of the shops,

which are located side by side on both sides of the existing road, are unavoidable with widening of the existing road. However, important facilities, as control points, that cannot be moved are not existed in Section-4.

(4) Intersection Plan

Two approach roads of Kalurgahat Bridge and 3rd Karnaphuli Bridge are only trunk roads to connect with the road other than the starting and the ending points. The connection plans with Kalurgahat Bridge Access Road is shown in Figure 4.2-2 as an example.

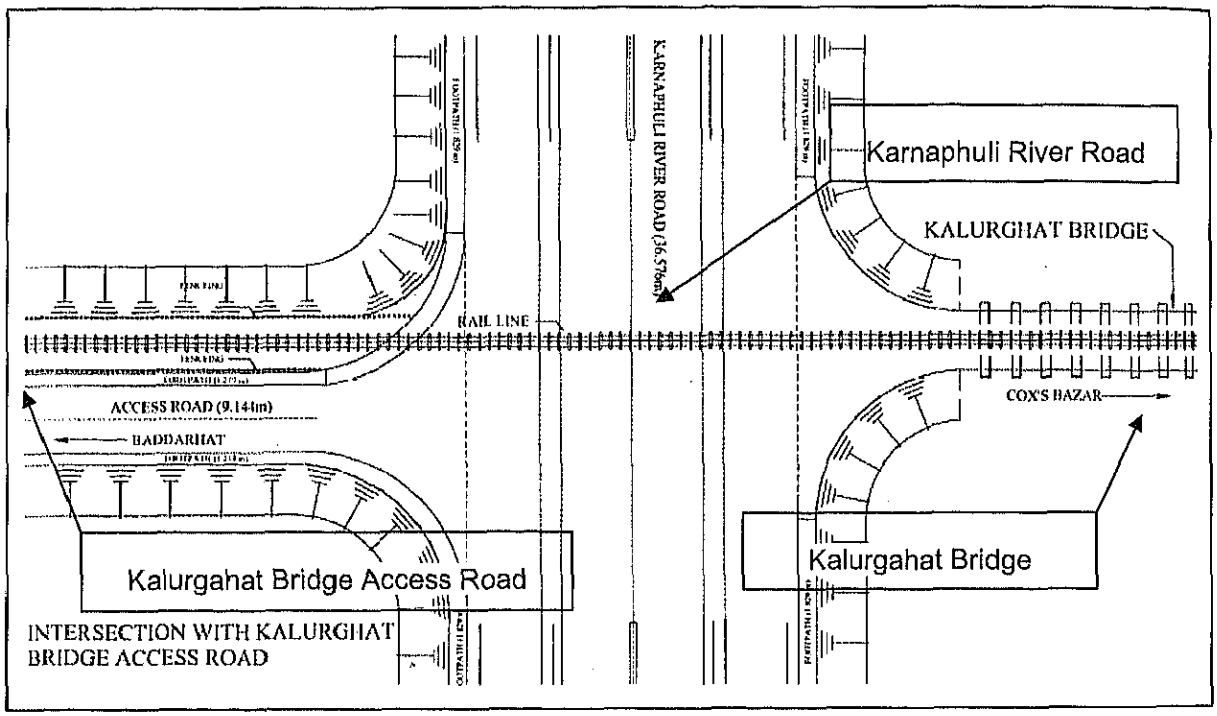
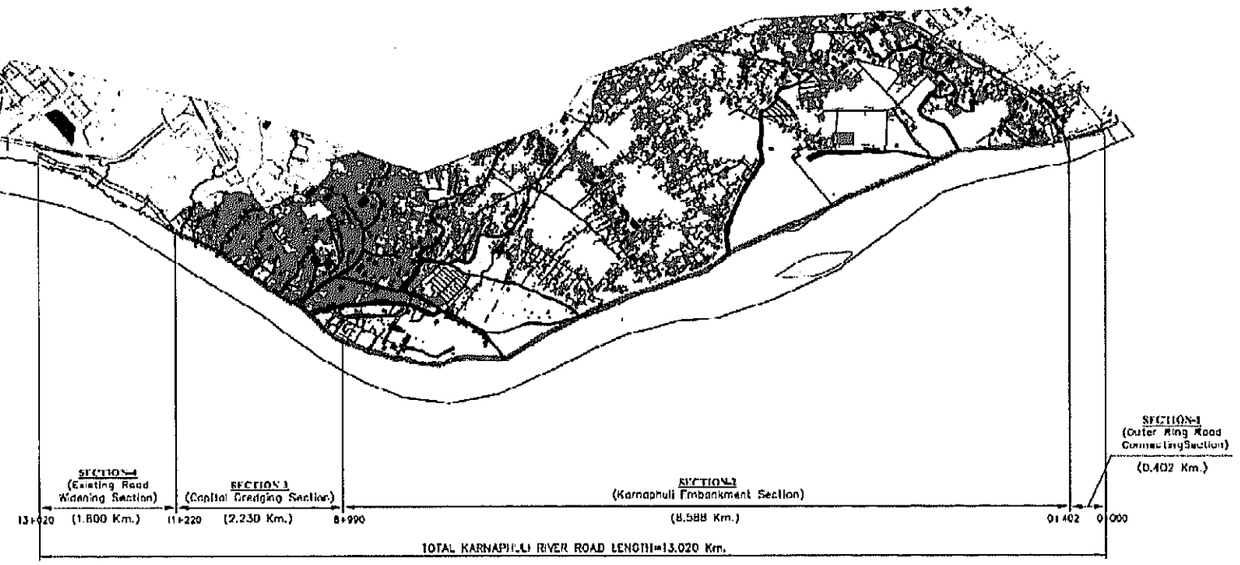


Figure 4.2-2 Intersection between Karnaphuli River Road and Kalurgahat Bridge Access Road

(5) Result of Route Selection, and Evaluation

As mentioned above, the comparative study is not necessary for route selection over the whole section of the road. An overview of route in each section, fixed in this SAPROF, is shown in Table 4.2-3.

Table 4.2-3 Outline of Karnaphuli River Road

	Section-4 Existing Road widening and Improvement Section	Section-3 Capital Dredging Section	Section-2 Karnaphuli Embankment section	Section-1 Outer Ring Road Connecting Section
Route Map				
Length	1.955km	2.2401km	8.570km	0.444km
Outline of Construction	☐The road is developed as urban trunk road ☐Number of lane is four.	☐The road in this section is developed as urban trunk road using the land constructed by Capital Dredging Project ☐Number of lane is four.	☐The road is developed as the countermeasure for a flood from Karnaphuli River. ☐Number of lane is four.	☐The road is developed for linking between Outer Ring Road and the Section-2 of the River Road ☐Number of lane is four.
Feature of Section	☐A lot of stores stand side by side along the existing road. ☐Since the existing road has only 2 lanes, widening to 4 lanes is needed. ☐A lot of stores are needed to relocate for widening the existing road.	☐It is needed to adjust the plan of Capital Dredging Project ☐The plan of Capital Dredging Project was finalized, and DPP of the project was submitted on November 2008. ☐The road is constructed on the land which is completed with Capital Dredging Project.	☐The road is constructed along the right side of Karnaphuli River. ☐There are a lot of rivers and canals across the road, and bridges is needed to cross these rivers and canals. ☐A huge amount of sand for embankment -cum-road is necessary.	☐The road becomes the embankment -cum-road basically, but shape of this section is not perfect shape of the embankment -cum-road because the distance is too short.
Control Points	☐Route of this section follows the existing road	☐The plan of Capital Dredging Project	☐Approach road to Karnaphuli No.3 Bridge to connect the River Road	☐Approach road to Karlurgahat Bridge and Outer Ring Road to connect the River Road
Utilization	☐The road connects with Sheki Mojib Road as the major urban road in the city, and the road contributes to ease the traffic congestion in the city to lead the traffic to the River Road.	☐The route is decided by the land use plan based on the Capital Dredging Project policy. ☐The road plays an important role as major trunk road in the area where is made by Capital Dredging Project.	☐The road contributes to ease the traffic congestion in the city by linking between two bridges which makes the traffic flow more smoothly.	☐The road contributes to ease the traffic congestion in the city because it links Outer ring Road and Karnaphuli River Road. Traffic can directly heads to the eastern side of the Karnaphuli River without heading to the central city.
Social Environmental	☐It is necessary to relocate many stores and houses.	☐The road construction will start after the completion of Capital Dredging Project. Therefore, there is not problems such as relocation of houses.	☐According to the proposed route, there is a few houses and buildings needed to relocation.	☐It is necessary to relocate several stores and houses.
Natural Environment	☐Nothing	☐These subjects regarding to the natural environment in this section will be solved in Capital Dredging Project.	☐It is necessary to take the countermeasure for preventing outflow of the sand from the embankment to river.	☐It is necessary to take the countermeasure for preventing outflow of the sand from the embankment to river.
Economical Efficiency	☐The cost for widening and improving the existing road is needed. ☐The cost for re-settlement stores and houses are needed.	☐The road is constructed on the land by Capital Dredging, therefore the construction cost is very economical.	☐The cost for construction the embankment-cum -road is needed.	☐The cost for construction the embankment-cum -road is needed.
Evaluation	☐In order to connect Sheki Mojib Road this route is suitable. However, it is needed to examine more as the ring road of the city	☐Route is decided by Capital Dredging Project. Then, finalization of the route has to adjust with the finalized the project design	☐This route is suitable for the embankment -cum-road	☐It is needed to wait until the ending point of outer ring road decided as the beginning point of the road.

4.2.2 Road Cross Section

1) Design Criteria for the Karnaphuli River Road

Design criteria for structure of the road and the embankment should be decided as follows.

- Road structure: Number of lanes, carriage way width and ROW of the road
- Disaster Prevention Facilities: Height, width and slope gradient of the embankment

(1) Road Structure

The estimated traffic volume which becomes the condition to fix the road structure of the road is shown in Table 4.2-4. And the design speed, the road standard and the number of lanes based on this traffic volume are also mentioned in the same Table. And the primary road criterion in CDA Master Plan is adopted as the urban road standard for the road based on the discussion with CDA.

Table 4.2-4 Design Condition of Karnaphuli River Road

No.	Section	Designed Daily Traffic Volume (year 2030) veh./ 24 hours	Design Speed (km/hour)	Road Cross-Section Standards	No. of Lane
1	Section-1	38,800	80	CDA Primary Road	4
2	Section-2	38,800	80	CDA Primary Road	4
3	Section-3	58,200	80	CDA Primary Road	4
4	Section-4	58,200	80	CDA Primary Road	4

Source: Study Team

(2) Disaster Prevention Facilities

i) Proposed Height of the Embankment-cum -Road

The most important function of the embankment is to protect the land behind the embankment from the flood.

In order to secure this function, it is necessary to secure the embankment height that exceed the planned/calculated high water level based on the calculation using the value of 50 years probability. Generally, height of the embankment is fixed by the following

Proposed height of the embankment = planned/calculated high water level + extra height

7.40m is the planned/calculated high water level of 50 years probability by the statistical processing in the maximum water level observation records in 1986 - 2006 at the water level observatory of CPA near Kalurgahat Bridge. And 1.0m is decided as the extra height.

Therefore, proposed height of the embankment= +7.40m+1.0m=+8.40m

ii) Width of the Embankment-cum-Road

3.0 m and over is needed as the width of the embankment to secure the stability of it. In case of the embankment-cum-road, the width follows the criterion of the road standard.

iii) Slope Gradient of the Embankment-cum -Road

To secure the stability of the embankment from dead load of the embankment and running water on the slope, 1:2 is adopted as the slope gradient.

2) Typical Cross Section

Basically, the cross section of the road is decided by the point of views based on above-mentioned design criteria for the road. Karnaphuli River Road is divided into four sections, and the cross section in each section depends on the condition that the road is constructed. Typical cross sections are shown in Separate Volume (Drawings) for each section according to the ideas mentioned below.

Section-1 (Outer Ring Road Connecting Section): Basically, the cross section of Section-1 is the same with Section-2 as the embankment-cum-road. However, the distance of Section-1 is short, and the road passes in front of the abutment under Karlurgahat Bridge. Then, the shape of cross section of Section-1 is gradually changed to the shape under the bridge.

Section-2 (Karnaphuli Embankment Section): The road in Section-2 is constructed as the road with disaster prevention facilities along Karnaphuli River. Then, the distance between the road center and the edge of the river is secured about 40m and the height of the road is kept 8.40m from MSL as mentioned above. In this way, the road structure in Section-2 becomes the shape as the embankment-cum-road.

Section-3 (Capital Dredging Section): In Section-3, the road is constructed at the section of Capital Dredging Project of CPA. Then, the planned height of the road is needed to adjust with the planned height of the land which is developed by Capital Dredging Project. Therefore, the cross section of the road is different from that of Section-2 and doesn't take the shape as the embankment. Since the design of Capital Dredging Project was finalized, the shape of the road is considered to pile up the thickness of designed pavement layers. Finally, the shape of the road is needed to adjust with the land use plan by Capital Dredging Project.

Section-4 (Existing Road Widening and Improvement Section): The road in Section-4 is constructed by widening and improvement of the existing road. Then, the road is adjusted to the condition of surrounding area. Therefore, the road is constructed as ordinary urban road and not the embankment-cum-road like Section-2.

4.2.3 Disaster Prevention over Flooding

1) River Embankment

The function of the embankment is to protect the hinterland against inundation resulting from the flood. Considering this function, it is necessary to ensure that the design high water level (with a return period of 50 years) should not exceed the embankment crown.

a. Design Crown Height of the Embankment

Generally, the crown height of the embankment is determined by the formula with a consideration mentioned below,

- A stochastic method is applied to process the observation record of the maximum water level during the 1986-2006 period gained at the water level observatory at the Karnaphuli bridge point, whereby the water level with a return period of 50 years is obtained, the flood record is shown below,

Table 4.2-5 Annual Maximum Tide Level from 1986 to 2006

Year	Annual Maximum Tide Level $X_{m,N}$
1986	4.50
1987	6.08
1988	4.95
1989	3.90
1990	4.45
1991	5.30
1992	3.95
1993	6.82
1994	3.98
1995	4.50
1996	4.42
1997	6.00
1998	4.17
2002	5.04
2003	6.30
2004	5.19
2005	3.85
2006	3.35

- Tide level with a return period of N years

Table 4.2-6 Result of Calculating the Probability Value

Result of calculating the probability value		Weibull distribution k = 1.50					
Reproduction period Rp (year)	2	10	20	30	40	50	100
Probability of nonexceedance P	0.5000	0.9000	0.9500	0.9667	0.9750	0.9800	0.9900
Normalization variable	0.7830	1.7440	2.0780	2.2620	2.3870	2.4830	2.7680
Probability value x	4.62	6.19	6.74	7.04	7.24	7.40	7.86

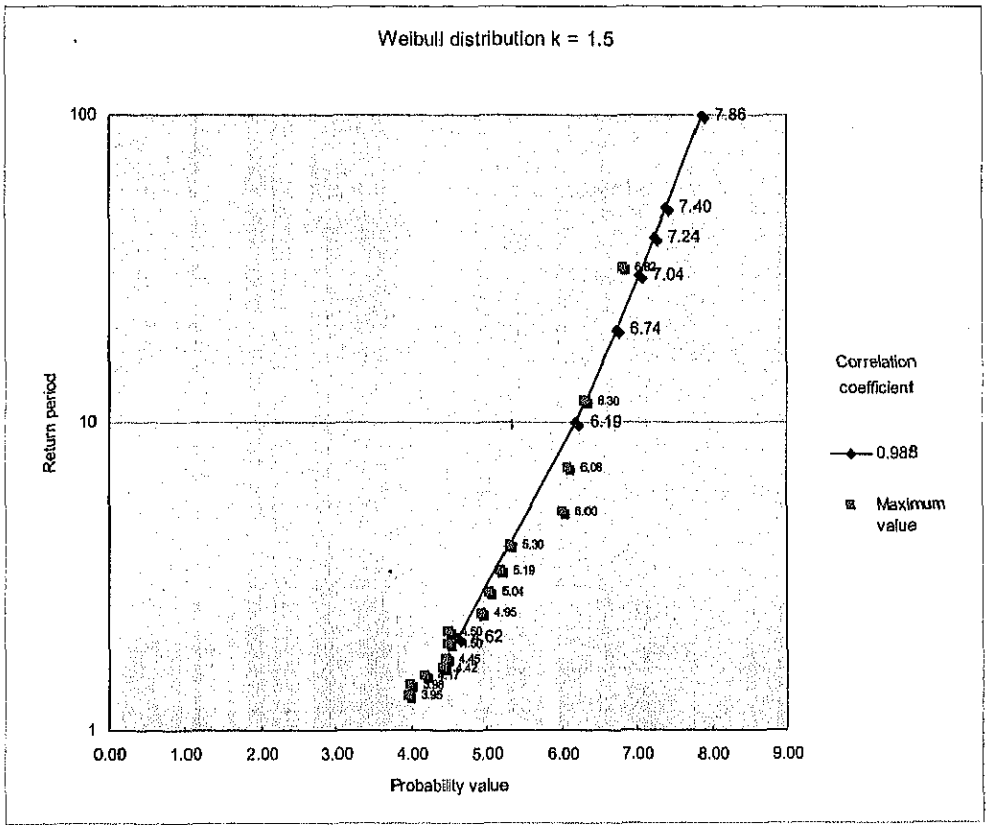


Figure 4.2-3 Result of Calculating the Probability Value

Thus,

Design crown height of embankment = design high water level + free board

where the design high water level: + 7.40 meters

Free board:

The free board is set to be of 2.0 meters assumed from the design high water flow rate of 10,000m3/sec or higher.

Thus,

Embankment Crown Height = + 7.40m + 2.0m = + 9.40m

b. Embankment Crown Width

The crown width is set to be of 7.0 meters or more, assumed from the design high water flow rate of 10,000m3/sec or higher. In case of that the crown is also used as the road, the width shall be designed with harmonization of the road design and road function.

c. Embankment Slope Inclination

To ensure stability of the embankment against water flow and self-weight, the embankment slope shall be designed to be of 1:2.

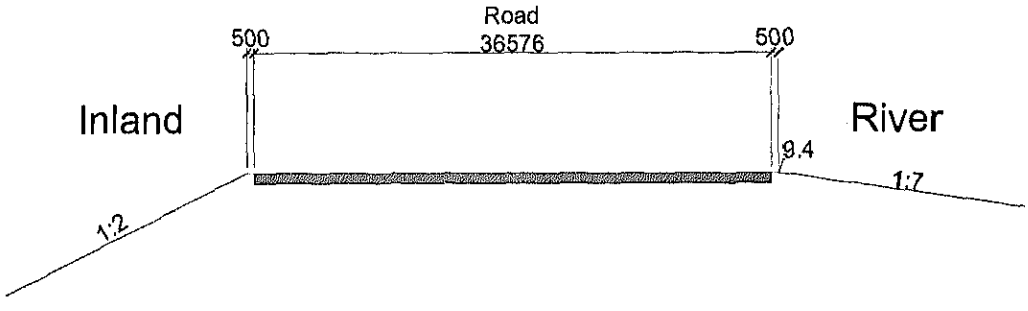


Figure 4.2-4 Cross Sectional View of Proposed Embankment

4.3 Project Cost and Financial Plan

4.3.1 Project Cost

1) Results of Civil Work Cost Estimate

(1) Civil Works Cost Estimation

Earth and pavement works' cost added to the structures cost comes up as the whole construction cost and are shown in Table 4.3-2. There is no much difference between this per km cost and the per km cost in the past construction projects of CDA in the chapter 3.4-1. Therefore, these calculated construction cost can be judged as appropriate.

i) Cost Estimation on Earth and Pavement Works

Calculated construction cost on earth and pavement works for Karnaphuli River Road Construction Project is shown in Appendix 4.3-1. This cost is estimated in the same way as Costal Road Construction Project estimation. By the way, in this design the topographic survey only carried out instead of the route survey, and the volume of cumulative fill is calculated by the results of the survey for the embankment-cum-road. On the other hand, quantity of material for bridge construction in this project is quoted from the typical bridge design in the past because the soil survey was not carried out and the precise bridge design cannot be drawn up in this study. Thereupon, each item on the construction cost is calculated very roughly. Then, the construction cost of this project should be estimated by the accurate quantities based on the detailed route survey and soil survey during the detailed design period.

ii) Cost Estimation on Structures

There are rivers and waterways in the road as listed in Table 4.3-1. Therefore, bridges and culverts/sluice gates are planned to construct as shown in Table 4.3-3 and Table 4.3-4 respectively. And the construction cost of bridges and culverts/sluice gates are calculated based on two lists. Quantity on the structure construction is quoted from the same scale of the structures in the past works and unit priced of each items for cost estimation are adapted from the RHD schedule on April 2008 in a similar manner to Costal Road cost estimation. Calculated construction cost on structures is shown in Table 4.3-2.

Table 4.3-1 List of Rivers and Canals and Location of Proposed Bridges and Culverts

Sl No.	Road Section	Chainage	Width	Length	Width	Vent	Existing Structure	Bottom Level in M (MSL)	Design Top Level in M (MSL)	Top to Bottom Difference (M)	Proposed Bridge	Proposed Culvert
1	Section-2	0+510 km	19.60m				Canal	-0.625	9.40	10.03	L = 20 m	
2		0+554 km	7.50m				Canal	0.084	9.40	9.32	L=10 m	
3		0+852 km	19.00m				Canal	-0.379	9.40	9.78	L = 20 m	
4		1+575 km	42.20m				Canal	-1.929	9.40	11.33	L = 40 m	
5		1+750 km	34.90m				Canal	-0.964	9.40	10.36	L = 30 m	
6		2+570 km	32.00m				Canal	-1.234	9.40	10.63	L = 30 m	
7		4+350 km	94.50m				Canal	-0.517	9.40	9.92	L = 90 m (30mx30mx3)	
8		5+100 km	15.52m				Canal	0.412	9.40	8.99	L=15 m	
9		5+377 km	27.80m				Canal	-0.558	9.40	9.96	L = 30 m	
10		6+687 km	12.00m				Canal	0.421	9.40	8.98	L=12 m	
11		7+030 km	23.70m				Canal	0.025	9.40	9.38	L = 25 m	
12		7+959 km	29.50m				Canal	-0.125	9.40	9.53	L = 30 m	
13	Section-3	9+230 km	63.70m				Canal	-1.121	7.00	8.12	L = 60 m (20mx20mx3)	
14		9+500 km	51.30m				Canal	-1.236	7.00	8.24	L=50m (25mx25mx2)	
15		9+750 km	15.60m				Nala	0.235	7.00	6.77	L=16 m	
16		10+000 km	38.00m				Canal	-0.820	7.00	7.82	L = 40 m	
17		10+112 km	9.60m				Drain	1.633	7.00	5.37		4.5 X 4. 5 Culvert
18		10+541 km	10.50m				Drain	0.394	7.00	6.61		4.5 X 4. 5 Culvert
19		10+908 km	10.00m				Canal	-0.658	7.00	7.66	L=10 m	
20		11+037 km	18.00 m				Nala	0.000	7.00	7.00	L = 20 m	
21	Section-4	11+558 km		6.78m	6.10m	1	Box Cul.	2.145	7.00	4.86		4.5 X 4. 5 Culvert
22		11+865 km		4.20m	9.64m	1	Box Cul.	2.313	7.00	4.69		4.5 X 4. 5 Culvert
23		12+106 km		6.70m	5.40m	1	Box Cul.	-0.499	7.00	7.50		4.5 X 4. 5 Culvert

Source: Study Team

b) Scope of Civil Works

The outline of the construction work, based on the above-mentioned design conditions, is shown in Appendix 4.3-3(1). Furthermore, the outline of the construction work divided for each Section is shown in Appendix 4.3-3(2).

Table 4.3-2 Civil Works Cost

	Items	Section	Quantity	Cost[1] (BDT)	Unit Price (BDT/m)	Rem arks
1	Earth Work Pavement Work Incidental	Section-1	402m	110,718,859	275,420	
		Section-2	8,588m	2,420,008,530	281,790	
		Section-3	2,230m	600,385,484	269,231	
		Section-4	1,800m	452,845,889	251,581	
	Sub Total		13,020	3,583,958,762	275,266	
2	Bridge Work		20,080m2	1,514,939,479	75,445	
3	Culvert Work		5unit	27,305,850	5,461,170	
	Sub Total			1,542,245,329		
	Total			5,126,204,091		
4	General & Site Facilities			256,310,205		
5	Others (Disaster Prevention Facility etc.)			256,310,205		
	Sub total			512,620,409		
	Grand Total			5,638,824,500		
	Grand Total(Without Tax)			5,159,524,418		
			Yen	8,048,858,091		

Source: Study Team

BDT=Yen 1.56

[1] :This is the cost after deduction of TAX(4.0%) and VAT(4.5%).

Table 4.3-3 List of Bridges

Section	No.	Crossing Rivers / Canals	Type of Bridge	No. Lanes	Length (m)	Width (m)
Section-2	1	Canal	I Shape PC Girder Bridge(20 * 1 Span)	4	20.00	36.576
	2	Canal	-ditto- (10 * 1 Span)	4	10.00	-ditto-
	3	Canal	-ditto- (20 * 1 Span)	4	20.00	-ditto-
	4	Canal	-ditto- (40 * 1 Span)	4	40.00	-ditto-
	5	Canal	-ditto- (30 * 1 Span)	4	30.00	-ditto-
	6	Canal	-ditto- (30 * 1 Span)	4	30.00	-ditto-
	7	Canal	-ditto- (30 * 3 Span)	4	90.00	-ditto-
	8	Canal	-ditto- (15 * 1 Span)	4	15.00	-ditto-
	9	Canal	-ditto- (30 * 1 Span)	4	30.00	-ditto-
	10	Canal	-ditto- (12 * 1 Span)	4	12.00	-ditto-
	11	Canal	-ditto- (25 * 1 Span)	4	25.00	-ditto-
	12	Canal	-ditto- (30 * 1 Span)	4	30.00	-ditto-
Section-3	13	Canal	-ditto- (30 * 2 Span)	4	60.00	-ditto-
	14	Canal	-ditto- (25 * 2 Span)	4	50.00	-ditto-
	15	Nala	-ditto- (16 * 1 Span)	4	16.00	-ditto-
	16	Canal	-ditto- (40 * 1 Span)	4	40.00	-ditto-
	17	Canal	-ditto- (10 * 1 Span)	4	10.00	-ditto-
	18	Nala	-ditto- (20 * 1 Span)	4	20.00	-ditto-

Source: Study Team

Table 4.3-4 List of Culverts

	Section	No. of Rivers / Canals	No. of Existing Culverts	No. of New Culverts	Remarks
1	Section-1	0	0	0	
2	Section-2	12	0	0	
3	Section-3	8	0	2	
4	Section-4	3	3	0	
	Total	23	3	2	

Source: Study Team

2) Consulting Services Cost Estimation

Presently, CDA hasn't any idea about the scope of consulting service for Karnaphuli River Road Construction Project. Therefore, proposed items of consulting service for Costal Road Construction Project shall be applied in this road project and they are as follows.

- Detailed design and preparing the tender documents (including the route survey, geological and soil investigation)
- Supervision of tender procedure
- Supervision of construction works

And the calculated ration of consulting service cost among the whole project cost for Costal Road Construction Project shall be applied to calculate the ration of consulting service cost on Karnaphuli River Road Construction Project. The result of the calculation is shown in Table 4.3-5

Table 4.3-5 Consulting Services Cost

	Road	Civil Works		Consulting Services		Total	
		Cost(Yen)	Ratio	Cost(Yen)	Ratio	Cost(Yen)	Ratio
1	Costal Road	7,260,136,176	89.77%	827,306,480	10.23%	8,087,442,656	100.00%
	Foreign			632,450,000	76.45%		
	Local			194,856,480	23.55%		
2	Karnaphuli River Road	8,048,858,091	89.77%	**917,182,859**	**10.23%**	8,966,040,950	100.00%
	Foreign			**701,157,689**	**76.45%**		
	Local			**216,025,171**	**23.55%**		

Source: Study Team

4.3.2 Financial Plan

Construction cost for Karnapuli River Road Construction Project has been estimated based on the preliminary design in this SAPROF. The unit cost analysis was conducted in accordance with the same with Chapter 3.4.2. Then, Karnapuli River Road Construction Project Cost, shown in Table 4.3-6, is prepared on the basis of the calculation of construction cost and consulting services cost in above Chapter 4.3.1.

Table 4.3-6 Karnaphuli River Road Construction Project Cost

	Foreign Portion	Local Portion	Total
	(Yen)	(BDT)	(Yen)
(1)Construction Cost	1,767,825,568	4,026,302,899	8,048,858,091
(2)=(1)×Ratio of Price Escalation	5%	0%	—
	88,391,278	0	88,391,278
(3)=((1)+(2)) × Ratio of Contingency	5%	5%	—
	92,810,842	201,315,145	406,862,468
Sub total (4)=(1)+(2)+(3)	1,949,027,689	4,227,618,044	8,544,111,837
(5)Consulting Service Cost	701,157,689	138,477,674	917,182,860
(6)ROW and Compensation	—	—	—
(7)=((4)+(5)+(6))×Ratio of General Administrative Expenses	0%	5%	—
	—	303,246,625	473,064,735
(8)= ((4)+(5)+(6)+(7)) × Ratio of TAX	30%	10%	—
	795,055,613	466,934,234	1,523,473,019
Total	3,445,240,991	5,136,276,577	11,457,832,451

Source: Study Team

BDT=Yen 1.56

4.4 Environmental and Social Consideration

4.4.1 Extent of Displacement

The New Karnaphuli River Road Project is located in the old part of Chittagong city on the river Karnaphuli and covers 4 sections. The total length of the Karnaphuli River Road is about 13 km and divided in to four sections. The road starts from Kalurghat Bridge and continues up to Shaik Mujib Road. The sections with name of roads are as follows:

- Section- 1: 0+000-0+402 from Kalurghat to Kalurghat Bridge
- Section-2: 0+402-8+990 from Kalurghat Bridge - Shah Amanat Bridge
- Section- 3: 8+990-11+220 from Shah Amanat Bridge to Sadarghat Road (Capital Dredging Section)
- Section-4: 11+220 - 13+020 from Sadarghat Road to Sheik Mujib Road

Length of the road, average width and area under the RoW and location of the RoW by chainage of sections are shown in Table 4.4-1 It is observed that section 1 and 2 is in the river side. Section 3 is the area dredged by Chittagong Port Authority (CPA). These areas are very adjacent to the river and capital dredged area and not along any road. On the other hand section 4 is also in the river side but this area is a stretch of land with 30 m width from the central line of the existing Sadarghat Road to Shaik Mujib Road which is 1,800 m long.

Table 4.4-1 Area of the RoW by Section with Length and Average Width of the Road

Section	Start Point	End Point	Length(m)	Average Width (m)	RoW Area (sq m)	Remarks
Section 1	*0+000*	*0+402*	*402*	*83.0*	*33,366*	River side
Section 2	0+402	0+700	298	83.0	24,743	River side
	0+700	1+410	710	81.5	57,865	River side
	1+410	2+110	700	83.3	58,310	River side
	2+110	2+810	700	79.0	55,300	River side
	2+810	3+510	700	80.0	56,000	River side
	3+510	4+210	700	77.0	53,900	River side
	4+210	4+900	690	77.0	53,130	River side
	4+900	5+590	690	83.0	57,270	River side
	5+590	6+300	710	78.0	55,380	River side
	6+300	7+022	722	84.0	60,648	River side
	7+022	7+680	658	84.0	55,272	River side
	7+680	8+370	690	81.5	56,235	River side
	8+370	8+990	620	80.0	49,600	River side
	Sub-total		*8,588*		*693,644*	

Section	Start Point	End Point	Length(m)	Average Width (m)	RoW Area (sq m)	Remarks
Section 3	8+990	9+060	70	36.6	2,562	CPA (Capital Dredging)
	9+060	9+770	710	36.6	25,986	CPA (Capital Dredging)
	9+770	10+480	710	36.6	25,986	CPA (Capital Dredging)
	10+480	11+170	690	36.6	25,256	CPA (Capital Dredging)
	11+170	11+220	50	36.6	1,830	CPA (Capital Dredging)
	Sub-total		2,230		*81,618*	
Section 4	11+220	13+020	1,800	30.0	54,000	Expansion of Existing Road
Total			**13,020**		**862,628**	

For this project total area to be acquired is 862,628 sq. m, and majority (693,644 sq. m) is in the section 2 which constitute 80.41% of the total area in the RoW. On the other hand section 4 contains only 54,000 sq. m area and constitutes only 6.26% of the area covered by the RoW.

The area needed for the RoW of this road is owned by various types of government organizations as well as there are private owners. Ownership of the land on this RoW by section is shown in the Table 4.4-2 It is observed that more than half (57.37%) of the land is privately owned followed by CPA and Bangladesh Railway (BR). Only negligible percentage of land is owned by Bangladesh Inland Water Transport Corporation (BIWTC) (0.94%) and Jute Ministry (0.87%). All the land of the section-1 is owned by BR. Majority portion (68.30%) of land in section-2 is privately owned followed by CPA (28.13%) and BR (0.57%). As section-3 is the area which is being developed by capital dredging by CPA, the whole area is owned by CPA. On the other hand, land in section-4 has mixed ownership status. BR does not own any land in this section and highest portion is privately owned (39%) followed by CPA (32%), BIWTC (15%) and Jute Ministry (14%).

Table 4.4-2 Ownership Status of the Land in the RoW by Section

Section	Start Point	End Point	Land owners (Govt. Organization/Private) in sq. m					Total Area sq. m
			BR area	CPA	Private	BIWTC	Jute Ministry	
Section 1	*0+000*	*0+402*	***33366 (100%)***					**33366 (100%)**
Section 2	0+402	0+700	24734 (100%)					24734 (100%)
	0+700	1+410		57865 (100%)				57865 (100%)
	1+410	2+110		57143.8 (98%)	1166.2 (02%)			58310 (100%)
	2+110	2+810		55300 (100%)				55300 (100%)
	2+810	3+510			56000 (100%)			56000 (100%)
	3+510	4+210			53900 (100%)			53900 (100%)
	4+210	4+900			53130 (100%)			53130 (100%)
	4+900	5+590			57270 (100%)			57270 (100%)
	5+590	6+300			55380 (100%)			55380 (100%)
	6+300	7+022			60648 (100%)			60648 (100%)
	7+022	7+680			55272 (100%)			55272 (100%)
	7+680	8+370			56235 (100%)			56235 (100%)
	8+370	8+990		24800 (50%)	24800 (50%)			49600 (100%)
	Sub-total		***24734 (3.67%)***	***195108.8 (28.13%)***	***4738014.2 (68.30%)***			***693644 (100%)***
Section 3	8+990	9+060		2562 (100%)				2562 (100%)
	9+060	9+770		25986 (100%)				25986 (100%)
	9+770	10+480		25986 (100%)				25986 (100%)
	10+480	11+170		25254 (100%)				25254 (100%)
	11+170	11+220		1830 (100%)				1830 (100%)
	Sub-total			*81618 (100%)*				81618 (100%)
Section 4	11+220	13+020		**17280 (32%)**	**21060 (39%)**	**8100 (15%)**	**7560 (14%)**	**54000 (100%)**
Total			**58100 (6.74%)**	**294007 (34.08%)**	**494861 (57.37%)**	**8100 (0.94%)**	**7560 (0.87%)**	**862628 (100%)**

According to GoB Land acquisition Ordinance (LA) landownership and land price is determined by following the Mauza (revenue unit) boundary. Table 4.4-3 presents the name of mouzas through which the RoW runs with average price by land type. The RoW runs through 6 mouzas namely Mohara, Balirhat, Sujakatgor, Firingi Bazar, Purba Madar Bari and Goshail Dhanga. Land type by mouzas is noticeable in section-1, 2 and 3, these are either vita (high land) or agriculture. On the other hand land type of total area in section-4 is identified as commercial and existing road. Land price appears to be highest

in section-4 followed by section-3, 1 and 2. It is remarkable that agriculture land type is only observed in part of section 3 and land price of agriculture land is lowest among all.

Table 4.4-3 Mouza covered, Land type and Land price on the RoW by Section

Section	Start Point	End Point	Mouza	Land Type	Land Price per ha
Section 1	*0+000*	*0+402*	*Mohara*	*Vita*	51164321
Section 2	0+402	0+700	Mohara	Vita	51164321
	0+700	1+410	Mohara	Vita	51164321
	1+410	2+110	Mohara	Vita	51164321
	2+110	2+810	Mohara	Vita	51164321
	2+810	3+510	Mohara	Vita	51164321
	3+510	4+210	Mohara	Vita	51164321
	4+210	4+900	Mohara	Vita	51164321
	4+900	5+590	Balirhat	Agriculture	26964249
	5+590	6+300	Balirhat	Agriculture	26964249
	6+300	7+022	Balirhat	Agriculture	23465000
	7+022	7+680	Balirhat	Agriculture	23465000
	7+680	8+370	Balirhat	Agriculture	23465000
	8+370	8+990	Balirhat	Agriculture	23465000
	Sub-total				
Section 3	8+990	9+060	Sujakatgor	Vita	182162500
	9+060	9+770	Sujakatgor	Vita	182162500
	9+770	10+480	Sujakatgor	Vita	182162500
	10+480	11+170	Firingi Bazar	Vita	104975000
	11+170	11+220	Firingi Bazar	Vita	104975000
	Sub-total				
Section 4	11+220	13+020	Purba Madar Bari, Goshail Dhanga	Commercial Land, Road	360,208,374.5
Total					

It is mentioned earlier that only section-4 is located along the existing road and it was decided by the study team to conduct census survey in section 4 (11+220 - 13+020 from Sadarghat Road to Sheik Mujib Road) only. That is 1.8 km long and 30 m wide from central line of the existing road towards the river. Following part of this chapter presents the socio-economic profile of the affected Households (HHs) on the basis of this survey report. As a result all the information presented in the following part of the chapter is on

the HHs located on the RoW of only section-4 of this Karnaphuli River Road Project. Detail Socio-economic information of section-1, 2 and 3 has not been presented here in this chapter as census survey has not been conducted in these sections.

In total 349 households (HHs) are going to be affected. Among the affected HHs only 12 own land in the area and other 337 HHs will lose other properties but not the land. As survey area is from the central line of the road towards the river side, all the affected HHs identified by this survey is from the river side.

There are three wards (lowest administrative unit of Chittagong City Corporation) under section 4 of this project (surveyed area). Like any other city the river port located in this area was the principal entry point to the city and established as market, gradually become the whole sale market and trading place of the city and over time city expanded. The survey was conducted 30 m towards the riverside from the central line of the road shown by the engineers of the SAPROF team. This area is mostly a commercial area with large number of CBEs of different type. As this area is located on the bank of the river, most of the land is owned by different government organizations like CPA, BIWTC and Jute Ministry. Among the affected structures 75% are the rental business (Table 4.4-4). It indicates most of the affected units are CBEs and mostly own and run by the tenant of the structure.

Table 4.4-4 Distribution of Affected Households by Wards

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Household Category	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Households on Govt. Land	03	3.70	00	00	02	1.13	05	1.43
Structure on Private Land (Res.& CBEs)	04	4.94	00	00	05	2.82	09	2.58
Structure, Trees on Private Land	01	1.23	01	1.10	00	00	02	0.57
CBEs on Govt. Land	16	19.8	14	15.4	23	13.0	53	15.2
Rental Residence	02	2.47	01	1.10	03	1.69	06	1.72
Rental Business	50	61.7	74	81.3	141	79.7	265	75.9
Others (Company, Bank, and Somity etc.)	04	4.94	01	1.10	03	1.69	08	2.29
Common Property Resources	01	1.23	00	00	00	00	01	0.29
Total	**81**	**100**	**91**	**100**	**177**	**100**	**349**	**100**

The census was conducted on all the affected units and has been identified as individual household who would be affected. Except 2 out of 348, all are headed by male person. Majority (88%) of the affected HHs is Muslims and rest is Hindus by religion (Table 4.4-5 and Table 4.4-6).

Table 4.4-5 Distribution of affected Households Head by sex by Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Headed by	No	%	No	%	No	%	No	%
Male	79	98.8	91	100	176	99.4	346	99.4
Female	01	01.25	00	00	01	0.56	02	0.57
Total	80	100	91	100	177	100	348	100

Table 4.4-6 Distribution of Households by Religion

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Religion	No	%	No	%	No	%	No	%
Islam	65	81.3	86	94.5	155	87.6	306	87.9
Hindu	15	18.8	05	5.49	22	12.4	42	12.1
Total	**80**	**100**	**91**	**100**	**177**	**100**	**348**	**100**

Like any other commercial area, this project area is dominated by male population (55%) (Table 4.4-7). It needs to be mentioned here that not necessarily all these HH (family) members are living the project area, but the CBE, the principal source living is located and affected by the project.

Table 4.4-7 Distribution of Household Population by Sex

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Headed by	No	%	No	%	No	%	No	%
Male	1253	54.8	00	00	00	00	1253	54.8
Female	1032	45.2	00	00	00	00	1032	45.2
Total	**2285**	**100**	**00**	**00**	**00**	**00**	**2285**	**100**

Average HH size of these affected households is 6.6. This is very high in comparison to the national average. It is remarkable that about 9 percent of the affected HH is single member HH (Table 4.4-8). About 35% are within the range of 3-6. Extended family is still

a tradition of the people of Chittagong and all or most of the active members are involved with family business.

Table 4.4-8 Household Size By Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Household size	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
01	07	8.75	11	12.1	12	6.78	30	8.62
02	01	1.25	02	2.20	08	4.52	11	3.16
03	05	6.25	04	4.40	12	6.78	21	6.03
04	08	10.0	06	6.59	15	8.47	29	8.33
05	11	13.8	11	12.1	34	19.2	56	16.1
06	08	10.0	18	19.8	26	14.7	52	14.9
07	11	13.8	11	12.1	11	6.21	33	9.48
08	05	6.25	08	8.79	16	9.04	29	8.33
09	07	8.75	04	4.40	05	2.82	16	4.60
10	04	5.00	09	9.89	07	3.95	20	5.75
11	02	2.50	02	2.20	03	1.69	07	2.01
12	02	2.50	02	2.20	09	5.08	13	3.74
More than 12	09	11.3	03	3.30	19	10.7	31	8.91
Total	**80**	**100**	**91**	**100**	**177**	**100**	**348**	**100**

More than 83 percent of the HH heads are literate. Among the literate persons majority of them have higher secondary level of education. About 11 percent of the affected HH heads have graduate or post graduation degree (Table 4.4-9). This indicates they do not only contribute to the economy of Chittagong but they are also educated enough to handle better business and implementation of this project will facilitate them more.

Table 4.4-9 Level of Education of Head Of Households by Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Level of Education	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Illiterate	12	14.8	17	18.7	30	17.0	59	16.9
Literate but below Primary	02	2.47	06	6.59	10	5.65	18	5.16
Primary	04	4.94	18	19.8	17	9.60	39	11.2
Secondary	43	53.1	36	39.6	75	42.4	154	44.1

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Level of Education	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Higher Secondary	06	7.41	05	5.49	28	15.8	39	11.2
Graduation	11	13.6	06	6.59	12	6.78	29	8.31
Post Graduation	03	3.70	02	2.20	04	2.26	09	2.58
Others	00	00	01	1.10	01	0.56	02	057
Total	**81**	**100**	**91**	**100**	**177**	**100**	**349**	**100**

Business is the principal occupation of the majority affected HHs (89.4%). About 7 percent of the affected Household head identified them as retired or jobless or old person but they own property on the RoW (Table 4.4-10). About 2 percent of the affected HH head's occupation has been identified as service. Other occupations identified by the affected HH heads are Agriculture, Household work, Labor, Doctor and others.

Table 4.4-10 Principal Occupation of Head of the Households by Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Principal Occupation	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Agriculture	00	0.00	01	1.10	00	00	01	0.29
Business	67	83.8	83	91.2	161	91.0	311	89.4
Service	04	5.00	00	00	02	1.13	06	1.72
Household Work	00	0.00	00	00	01	0.56	01	0.29
Labor	02	2.50	00	00	00	00	02	0.57
Doctor	01	1.25	00	00	00	00	01	0.29
Retired/Old age/jobless	04	5.00	07	7.69	13	7.34	24	6.90
Others (Care taker, cobbler etc.)	02	2.50	00	00	00	00	02	0.57
Total	**80**	**100**	**91**	**100**	**177**	**100**	**348**	**100**

Annual income of about 90% of these affected HHs have income of more than Tk 300,000 on the other hand about 10 percent of them have income within the range of 30,000 . It indicates the affected HHs is from different level of income group. Income and expenditure as mentioned by the respondents are very close (Table 4.4-11 and Table 4.4-12).

Table 4.4-11 Annual Income of the Households

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Income (Tk)	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
0-15,000	04	4.94	10	11.0	16	9.04	30	8.60
15,001-30,000	00	00	01	1.10	01	0.56	02	0.57
30,001-45,000	01	1.23	06	6.59	06	3.39	13	3.72
45,001-60,000	05	6.17	08	8.79	15	8.47	28	8.02
60,001-75,000	01	1.23	08	8.79	06	3.39	15	4.30
75,001-90,000	03	3.70	04	4.40	03	1.69	10	2.87
90,001-105,000	05	6.17	05	5.49	11	6.21	21	6.02
105,001-120,00	06	7.41	19	20.9	16	9.04	41	11.8
105,001-135,000	00	00	02	2.20	00	00	02	0.57
135,001-150,000	04	1.94	02	2.20	09	5.08	15	4.30
150,001-165,000	00	00	00	00	00	00	00	00
165,001-180,000	12	14.8	04	4.40	08	4.52	24	6.88
180,001-195,000	00	00	00	00	00	00	00	00
195,001-210,000	00	00	00	00	01	0.56	01	0.29
210,001-225,000	00	00	01	1.10	02	1.13	03	0.86
225,001-240,000	09	11.1	06	6.59	20	11.3	35	10.0
240,001- 255,000	00	00	00	00	00	00	00	00
255,000-270,000	00	00	00	00	01	0.56	01	0.29
270,001- 290,000	00	00	00	00	00	00	00	00
290,001- 305,000	07	8.64	01	1.10	8	4.52	16	4.58
>= 305,001	24	29.6	14	15.4	54	30.5	92	26.4
Total	**81**	**100**	**91**	**100**	**177**	**100**	**349**	**100**

Table 4.4-12 Annual Expenditure of the Households

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Income (Tk)	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
0-15,000	04	4.94	12	13.2	16	9.04	32	9.17
15,001-30,000	00	00	01	1.10	01	0.56	02	0.57
30,001-45,000	01	1.23	07	7.69	05	2.82	13	3.72
45,001-60,000	05	6.17	08	8.79	16	9.04	29	8.31
60,001-75,000	01	1.23	07	7.69	08	4.52	16	4.58

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Income (Tk)	No	%	No	%	No	%	No	%
75,001-90,000	02	2.47	05	5.49	07	3.95	14	4.01
90,001-105,000	07	8.64	08	8.79	07	3.95	22	6.30
105,001-120,00	07	8.64	16	17.6	15	8.47	38	10.9
105,001-135,000	02	2.47	03	3.30	00	00	05	1.43
135,001-150,000	02	2.47	00	00	10	5.65	12	3.44
150,001-165,000	00	00	03	3.30	01	0.56	04	1.15
165,001-180,000	15	18.5	02	2.20	12	6.78	29	8.31
180,001-195,000	00	00	00	00	00	00	00	00
195,001-210,000	00	00	00	00	01	0.56	01	0.29
210,001-225,000	03	3.70	02	2.20	05	2.82	10	2.87
225,001-240,000	06	7.41	05	5.49	16	9.04	27	7.74
240,001- 255,000	00	00	00	00	00	00	00	00
255,000-270,000	01	1.23	00	00	01	0.56	02	0.57
270,001- 290,000	00	00	00	00	01	0.56	01	0.29
290,001- 305,000	09	11.1	04	4.40	06	3.39	19	5.44
>= 305,001	16	19.8	08	8.79	49	27.7	73	20.9
Total	**81**	**100**	**91**	**100**	**177**	**100**	**349**	**100**

Based on the poverty level measured on the basis on income and expenditure as mentioned in section 3.10, it is found that more than 42 percent of the male headed affected HH are identified as not poor. On the other hand more than 20 percent have been found as hard core poor (Table 4.4-13). These poor HH would need especial attention during implementation of the project. Contrary to that out of two female headed household one belong to hard core poor group and other as not poor (Table 4.4-14).

Table 4.4-13 Poverty Level of Male Headed Households by Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Poverty Level	No	%	No	%	No	%	No	%
Hard Core Poor	10	12.7	25	27.5	37	21.0	72	20.8
Absolute Poor	15	19.0	36	39.6	36	20.5	87	25.1
Poor	15	19.0	08	8.79	17	9.66	40	11.6
Non Poor	39	49.4	22	24.2	86	48.9	147	42.5

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Poverty Level	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Total	***79***	***100***	***91***	***100***	***176***	***100***	**346**	**100**

Table 4.4-14 Poverty Level of Female Headed Households by Ward

Ward	Ward No. 28		Ward No. 29		Ward No. 30		Total	
Poverty Level	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Hard Core Poor	00	00	00	00	01	100	01	50.0
Absolute Poor	00	00	00	00	00	00	00	00
Poor	00	00	00	00	00	00	00	00
Non Poor	01	100	00	00	00	00	01	50.0
Total	**01**	**100**	**00**	**00**	**100**	**100**	**02**	**100**

4.5 Operational and Effect Indicators and Economic Evaluation

4.5.1 Selection of Operation and Effect Indicators

The following operational and effect indicators were selected for this evaluation. The indicators are the same as those used to evaluate the Coastal Road Project and were chosen on the basis of guidelines given in the "Project Operation and Effect Indicator Reference" (second edition, October 2002), as well as consultations with the Project executor.

Table 4.5-1 Operational and Effect Indicators Selected

Category	Indicator	Index Preparation Guide	Survey Points
Operational	Annual Average Daily Traffic (units per 12 hours)	Investigate the extent of traffic transfer from existing roads to the Project Road.	Representative spots along the Project Road and Arakan Road
Effect	Same as above	Same as above	Same as above
	Travel time reduction (hours per year)	Investigate the amount of time it takes to travel between two specified spots and calculate the reduction in travel time on an annual basis.	Between Kalurghat Bridge and CDA
	Increase in average travel speed	Use the above survey results to calculate average travel speed.	Same as above
	Traffic stoppages due to natural disasters (days per year)	To be used as an indicator of the extent to which the Project Road fulfills its disaster prevention function. (No Before-After comparison is possible, as there are currently no roads along the planned route of the Project Road.)	Investigate by individual Project Road sections.

Source: Study Team

Table 4.5-2 Baseline Data for Coastal Road Project

Indicator	Baseline Data	Survey Point (or Section)
12-hours Traffic Count	15,275 vehicle/12 hours (Non-motorized vehicle is excluded.)	Arakan Road Counted on 11Oct., 2005
Travel Time	Morning: 34' 33" Afternoon: 42' 02" Evening: 58' 56"	Kalughat Bridge to CDA (11 km) Surveyed on from 17 to 18 Oct., 2005
Travel Speed	Morning: 19.1 km/h Afternoon: 15.7 km/h Evening: 11.2 km/h	Kalughat Bridge to CDA

Source: The Study Team

4.5.2 Future Traffic Volume Estimate

Table 4.5-3 shows projected volumes of traffic on the Karnaphuli River Road in 2030. The figures given in the table are based on a simpler method of future traffic estimation than the OD-based estimation given in Figure 2.4-1.

Traffic on the Karnaphuli River Road is expected to consist primarily of traffic diverted from the Arakan Road, which enters the City center from the north, and the CDA Avenue, which enters the City center from the east, crossing the Shah Amanat Bridge along the way. For this reason, the future traffic estimation given below is based on the expected volume of traffic to be diverted from the two roads. The diversion rates were determined on the basis of the Shortest Path Method, which analyzes alternative routes and identifies the routes most likely to be taken by travelers heading toward a given destination. The projected volumes of traffic to be diverted to the Karnaphuli River Road were then calculated based on the diversion rates.

Table 4.5-3 Future Traffic Volume of the Karnaphuli River Road

Project Section	12 hour Traffic			24 hour Traffic
	High Assumption	Low Assumption	Average	Average
Kalughat Br.- Shah Amant Br.	25,755	20,158	23,000	32,400
Shah Amant Br.- Sheik Mujib Road	38,789	30,359	34,600	48,700

Source: The Study Team

4.5.3 Economic Evaluation

1) Methodology of Evaluation

This section discusses the procedures and results of an economic evaluation of the Karnaphuli River Road Project conducted by the Study to assess Project feasibility. The methodology of the evaluation is the same as that of the economic evaluation of the Coastal Road Project, which methodology is discussed in Section 3.11 above.

2) Evaluation Period

The following timeframes are assumed for the Project: March 2010 to August 2010 for detailed engineering; 3 years from mid 2011 for the construction period; project completion in mid 2014; and service commencement in mid 2014. The economic evaluation period is 20 years from service commencement, namely the period up to 2034.

3) Project Costs

(1) Construction Costs

The table below lists the various costs entailed in the construction of the Project Road, namely the costs for construction work, contingency, land acquisition and resident resettlement. The costs are based on 2008 prices. Economic costs do not include taxes and other transfer costs, and no price contingency is included.

Table 4.5-4 Construction Costs of the Project (million TK)

	Economic Costs
Construction Costs	5,159.5
Other Costs and Contingency	1,152.0
Land Acquisition & Resettlement Costs	631.2
Total	6,942.7

Source: Study Team

(2) Maintenance Costs

The Project entails both embankment maintenance costs and highway maintenance costs. The costs of each are based on separate calculations of the costs of regular maintenance to be carried out annually and that of periodic maintenance to be carried out at a lower frequency. (Note: Highway maintenance will be carried out by the CDA, while embankment maintenance will be carried out by the BWDB.)

A. Road Maintenance Costs

Table 4.5-5 Road Maintenance Costs (unit: 1,000TK)

Item	Periodical Maintenance	Regular Maintenance
Major Items	Resurfacing	Regular maintenance
Frequency	15 years	Every year
Economic Costs	353.7 (256.5)	27.1

Source: Study Team

B. Embankment Maintenance Costs

Table 4.5-6 Embankment Maintenance Costs (unit: 1,000TK)

Item	Periodical Maintenance	Regular Maintenance
Major Items	-	Regular maintenance
Frequency	-	Every year
Economic Costs	-	1.77

Source: Study Team

(3) Annual Investment of the Project

The Project, including detailed engineering, pre-construction and construction, is assumed in this economic evaluation to commence in 2010 and be completed in mid 2014. Annual investments required during this period are shown in Table 4.5-7.

Table 4.5-7 Annual Investments of the Project (unit: million TK)

	Investment Rate	Economic Investment
2010	8.69	603.3
2011	8.57	595.0
2012	23.87	1,657.2
2013	40.32	2,799.3
2014	18.43	1,279.6
2015	0.12	8.3
Total	100.00	6,942.7

Source: Study Team

4) Project Benefits

Benefits to be generated by the Project are believed to be those listed below. Of these, the benefits that can be quantified easily and to a high degree of accuracy are (1) and (2), both of which are generally used in economic evaluations of projects. For these reasons, the two benefits are quantified in the economic evaluation discussed here.

(1) Cost savings due to reductions in travel distance and time
(2) Savings in fuel and repair costs due to smoother pavement
(3) Damage to cargoes
(4) Fewer accidents
(5) Less damage from cyclones and the like due to stronger embankment

Specifically, travel speeds and total travel times applicable to future road networks for the With-Project and Without-Project cases were obtained and converted to monetary values by multiplying with VOC and TTC. To calculate Benefit (2), individual links of the above networks were given IRI values, which indicate pavement smoothness, and the VOC applicable to the IRI value was used to calculate operating cost.

It should be noted that benefit (5) is an important consideration in relation to this Project. While it cannot be quantified in a reliable manner, the Study attempted a tentative quantification using a simplified method

In the estimation, the value of production to be protected by the embankment reinforcement were established as the damage reduction target, and the length of time that production activity is assumed to be suspended due to a 1991-level cyclone, determined on the basis of an interview survey, was established as the damage reduction period. Furthermore, the return period for 1991-level cyclones was established as 40 years, as indicated in the 1993 Design Report of the BWDB (see Figure 3.2-3).

Table 4.5-8 Estimation of Cyclone Damage Reduction

Damage Reduction Target	Annual Production (million Taka/year)	Damage Reduction Period	Damage Reduction Value
GDP of regions where the Project will realize damage reduction	64,796 million Taka (2008) 385,492 million Taka (2030)	1.5 month	8,100 million Taka (2008) 48,187 million Taka (2030)

Source: the Study Team

5) Results of Economic Evaluation

As shown in Table 4.5-9, all the cases evaluated had an EIRR of more than 12.0%, which means that the Project is feasible. The B/C was 1.86 in the Basic Case and at least 1.52 among the cases for sensitivity analysis, indicating that the Project is highly superior.

Table 4.5-9 Results of Economic Evaluation

Evaluation Case	EIRR (%)	NPV (million TK)	B/C
Basic Case	20.0	3,751	1.86
Costs +10% Case	18.6	3,315	1.69
Traffic -10% Case	18.5	2,940	1.67
Costs +10% & Traffic -10%	17.2	2,503	1.52

Source: Study Team

Table 4.5-10 Cash Flow

(million TK)

	Cost			Benefit			Balance
	Investment.	O/M	Subtotal	VOC+TTC	Cyclone Damage Reduction	Subtotal	
2008							
2009							
2010	603.3		603.3				-603.3
2011	595.0		595.0				-595.0
2012	1,657.2		1,657.2				-1,657.2
2013	2,799.3		2,799.3				-2,799.3
2014	1,279.6		1,279.6				-1,279.6
2015	8.3	28.9	37.2	1,099.3	357.8	1,457.1	1,419.9
2016		28.9	28.9	1,158.6	387.9	1,546.5	1,517.6
2017		28.9	28.9	1,221.6	420.7	1,642.3	1,613.4
2018		28.9	28.9	1,287.8	456.1	1,743.9	1,715.0
2019		28.9	28.9	1,357.7	494.6	1,852.3	1,823.4
2020		28.9	28.9	1,431.4	536.3	1,967.7	1,938.8
2021		28.9	28.9	1,496.1	581.5	2,077.6	2,048.7
2022		28.9	28.9	1,564.0	630.5	2,194.5	2,165.6
2023		28.9	28.9	1,635.0	683.7	2,318.7	2,289.8
2024		28.9	28.9	1,709.0	741.4	2,450.4	2,421.5
2025		28.9	28.9	1,786.4	803.9	2,590.3	2,561.4
2026		28.9	28.9	1,867.6	871.7	2,739.3	2,710.4
2027		28.9	28.9	1,952.3	945.2	2,897.5	2,868.6
2028		382.6	382.6	2,041.2	1,024.9	3,066.1	2,683.5
2029		285.4	285.4	2,134.1	1,111.3	3,245.4	2,960.0
2030		14.6	14.6	2,231.1	1,205.0	3,436.1	3,421.5
2031		14.6	14.6	2,332.7	1,306.6	3,639.3	3,624.7
2032		14.6	14.6	2,438.9	1,416.8	3,855.7	3,841.1
2033		28.9	28.9	2,550.0	1,536.3	4,086.3	4,057.4
2034		28.9	28.9	1,333.1	1,665.8	2,998.9	2,970.0
Total	6,942.7	1,145.3	8,088.0	34,627.9	17,177.9	51,805.8	43,717.8

Source: The Study Team

CHAPTER 5 RECOMMENDATION/SUGGESTION ON PROJECT IMPLEMENTATION AND MANAGEMENT

5.1 Project Implementation Scenario

The EIRR of the Coastal Road Project and that of the Karnaphuli River Road Project both exceed 12% by a large margin, as discussed in Sections 3.11 and 4.5. They are both favorable projects, and the construction of the Roads is assessed to be feasible. It should be noted that the ultimate objective of the Coastal Road and Karnaphuli River Road Projects is to realize the construction of the Chittagong City Ring Road, which is the most important component of the City's future network. The three projects comprising the Ring Road---namely the Coastal Road, the Karnaphuli River Road, and the Outer Ring Road---should be implemented surely and steadily.

Furthermore, in terms of protection against cyclones and other natural disasters, the Coastal Road-cum-embankment will serve to shield the Bay of Bengal from storm tides, while the Karnaphuli River Road-cum-embankment will serve as protection against disasters originating from the Karnaphuli River. The construction of both Roads is necessary in terms of protecting Chittagong City from disasters.

Scenario for Steady Implementation

In view of the foregoing, the Coastal Road and Karnaphuli River Road Projects should be implemented within an early timeframe. At the same time, a staged construction is believed to be the most practical in consideration of the limited finances and the burden on the project executor in carrying out the Projects. In this case, higher priority should be given to the Coastal Road Project, since it will provide direct benefits to the Chittagong and Karnaphuli EPZs, Chittagong Port and the Chittagong International Airport, which are anticipated to serve as the Bangladeshi economy's engines of growth. In other words, it is believed more practical to implement the Project in stages, with the Coastal Road constructed at Stage 1 and the Karnaphuli River Road constructed at Stage 2.

Construction of Northern Extension Section

The Northern Extension Section, running from Feeder Road 3 of the Coastal Road to Fauzderhat, is also an important component of the Chittagong City Ring Road and should desirably be constructed within an early timeframe. However, the Section is recommended for construction at the above-mentioned Stage 2. In other words, the recommended construction of the Coastal Road at Stage 1 does not include this section.

- The four-laning of the Dhaka-Chittagong Highway is currently under way with the RHD as the executing agency. With the completion of the four-laning, traffic congestion on the Dhaka-Chittagong Highway will be eliminated for the time being

(see 2.4.3).

- It is necessary to ascertain traffic volume trends on the Port Access Road and otherwise determine to what extent the road is being used.
- The current plan is for the Northern Extension Section to run along the coast in an alignment parallel to the Port Access Road. However, alternative schemes should be studied further and the current plan adjusted as necessary. A potential alternative is the scheme of merging the Section with the Port Access Road for greater investment efficiency (where the merged part would be provided with four lanes; see 3.3.1).

5.2 Recommendations for Pre-Construction and Construction Phases

5.2.1 Creation of a Project Implementation Unit (PIU)

It is recommended that a Project Implementation Unit (PIU) be established inside the CDA to comprehensively carry out tasks and activities at the pre-construction and construction phases. In addition to engineering and construction supervision, the PIU would be in charge of environmental management and resident resettlement assistance and would be given the experts necessary for fulfilling those functions. As the Project executor, the CDA would provide the experts necessary for fulfilling the PIU's functions by reassigning experts from the existing Town Planning and Engineering Divisions. It would be also expected that the consultants hired in the project will transfer necessary skills in various fields, including road engineering, road construction, embankment engineering, environmental monitoring and management, and resident resettlement, to create a setup for carrying out the construction project.

It should be noted that the Project entails the resettlement of a large number of residents, as well as numerous tasks of considerable volumes pertaining to the required social considerations. For the smooth progress of the Project, it is recommended that social development NGOs be contracted collectively to assist resettlement and post-resettlement activities and to serve as the Project's point of contact with the local residents at the day-to-day level.

Additionally, the PIU will be responsible for supervising committees (GRCs) to receive and deal with resident complaints at the ward level and for overseeing the re-commissioned services of survey agencies conducting measurements of air quality, water quality, noise, and ecosystem conditions.

5.2.2 Permanent Setup of Social Environmental Unit (SEU)

In proceeding with the land acquisition and resettlement in compliance with the Donor's Guidelines, a permanent setup of a SEU, not just established for the project implementation period, is essential.

It is recommended that CDA to secure SEU's institutional sustainability and to accumulate social-and-environmental expertise and experiences within CDA's permanent organization, which shall undertake such professional tasks as; valuation of assets on market price, payment of the gap between market price and the registered price, compensation payment for the non-title holders, assistance to the relocated in rehabilitating livelihood, assistance to the socially vulnerable, and maintain social-and environmental monitoring activity, even after the project completion.

5.2.3 Detailed Engineering

The main focus of the SAPROF was to study the best routes for the Main Road and Feeder Roads and to study the embankment structures. Accordingly, at the detailed engineering stage, the needs of the local communities should desirably be reflected to a greater degree in the detailed designs for the Project Roads, including designs for traffic safety facilities, lighting facilities, incidental road facilities, and drainage facilities.

5.2.4 Drainage Designs

Drainage is a major problem in Chittagong and an important technical issue at the detailed engineering stage. There is the case of the Port Access Road built by the RHD: after the road was completed, drainage from low lands worsened from before. If the construction of the Project Roads stimulates development in the surrounding areas in the future, discharge volumes will increase further, necessitating the provision of greater-capacity drainage facilities. Accordingly, one of the technical issues to be addressed at the detailed engineering stage will be to determine the extent of development that is likely to occur.

5.2.5 Environmental Aspects

1) Points to Note Concerning Dredged Materials

As structural fill for the construction of embankments, dredged material is a highly promising option. As the source of dredged material is currently unknown, it is not possible at this time to make a definite prediction of the contamination level of the dredged material or the impact on the natural environment in and around the source.

However, it can be said that the following studies and monitoring activities should desirably be carried out when dredging for fill material:

Environmental Impact at Source of Dredged Material

- Once the source of dredged material is selected, organize all information concerning the surrounding environment, carry out impact assessments, and review protection measures.
- Make sure to ascertain the habitats of valuable shellfish, seaweeds, and the like, as lower organisms and marine plants are likely to be affected greatly by debris build-up.

Environmental Impact at Embankment Site

- Carry out soil environment surveys once every 5,000 m^3 or so to check the contamination level of the dredged material. Also implement monitoring surveys of well water, which can also be affected.
- Depending on the state of contamination, review the possibility of using an embankment construction method where the contaminated soil is sealed off with a waterproof sheet.

2) Environmental Management Plan

Concerning the environmental management plan (EMP), it is necessary to create an EMP implementation setup to ensure that residents' views are fully reflected in the plans and measures. It is also necessary to carry out adequate monitoring surveys in order to discover any adverse impacts as early as possible, thereby minimizing the impact of the Project on the environment.

Specifically, it is recommended that a permanent Environmental Management Unit, including residents, wards and other local governments, and construction contractors, be established as part of the Project Implementation Unit (PIU)setup during the construction period (an Environmental Manager to be designated inside CDA). The Environmental Management Unit will implement matters pertaining to environmental management, including the following:

i) Hold monthly meetings to review the results of periodic monitoring carried out in compliance with JICA environmental guidelines and take actions as necessary, regardless of whether there are any reports on environmental anomalies.

ii)Take note of any resident requests received through the support desk established within the CDA for hearing complaints and inquiries concerning resettlement and environmental issues. Also take note of various requests received from residents slated for resettlement, through the support desks established in individual wards. Review the complaints and inquiries at the monthly meetings and have the person in charge of resettlements (CRO), to be designated inside the CDA, take appropriate actions.

iii)Send regular reports to JICA concerning environmental monitoring results.

5.2.6 Social Environmental Aspects

1) Compensation of Land Price Differences

In the project, provision of administratively set compensation and an automatic 50 percent solatium was replaced with land-purchase committees guaranteeing supplemental compensation sufficient to purchase replacement land form a wiling seller, indentified by the displaced person. Therefore it is strongly recommended that GoB to see to it this fact and take serious measures to faithfully undertake payment of aforementioned value to the titleholders, with a special enactment by GoB to afford such payment.

2) Compensation for Non-title Holders

It is understood that the non-title holders are not eligible for any means of compensation. However, the SAPROF report recommends compensations for those non-title holders, including costs of providing relocation sites, assets restoration costs, and livelihood rehabilitation. Therefore GoB shall agree to afford such compensations to the non-title holders affected by the proposed project, by enactment of a special purpose law to realize it.

3) ID Card Issuance

It is strongly recommended that CDA to take immediate action to issue ID Cards to all the non-title holders, whose names and household attributes are identified by the SAPROF Study. It is important from the viewpoint of avoiding further inflow of uninvited settlers to the proposed sites. It shall be accompanied by a public notice at respective WARD Offices.

4) Setting Detail Plan for Resettlement Sites

It is strongly recommended that CDA to take immediate action to establish a detail plan to secure land areas demarcated for resettlement, inclusive of site plan, modality of land

ownership, plan of providing life-supporting infrastructure, implementation schedule and the budget.

5) Preparation of Mouza Maps

By following the legal framework of Bangladesh, CDA needs to prepare the area of proposed land demarcated with red ink on the mouza maps.

5.3 Recommendations for Post-Construction Phase

5.3.1 Road Maintenance and Management

Road maintenance/management after service commencement is one of the major issues of this Project. The CDA has little experience in road maintenance and management and has only a limited quantity of the necessary equipment and supplies. While the CDA has plans to rely on outsourcing for road maintenance and management, the problem remains of how to supervise or evaluate the work being done when they have little experience in the area.

1) Maintenance Management Organization

While the road maintenance management organization to be newly established will be involved primarily in management, it is essential that it have the following three functions: (1) patrol and monitoring of maintenance, quality control (2) contract management, and (3) data management and plan formulation. Coordination should be ensured among the three functions. One of the main tasks of road maintenance is ensuring good pavement condition, and one of the biggest causes of pavement damage is the passage of overloaded vehicles. At present there are no weighbridges in Chittagong City, and overloading is not being regulated. As the CDA cannot introduce new traffic regulations and controls on its own and must communicate and coordinate with the RHD and CCC to do so, it should desirably make effective use of the Maintenance Management Committee (MMC) proposed as part of the maintenance management setup when seeking to introduce regulations pertinent to road maintenance and management.

2) Capacity Building for Quality Control

In order to ensure the efficiency of maintenance management operations, quality control of even small tasks cannot be ignored. From this standpoint, there is a strong need for technical cooperation concerning quality control. Such cooperation can be effectively carried out through on-the-job training (OJT) during project implementation. Accordingly, the possibility of adding an OJT program to the construction supervision to be conducted by the consultant should be considered.

3) Improvement of Data Management

Awareness of the importance of maintenance and management has heightened in recent years, and all donors are carrying out technical cooperation in this area. In Bangladesh, the DFID is carrying out such cooperation. Most of the technical cooperation activities are focused on improving management efficiency, in other words, ensuring optimum budget allocation, and the objectives are to prioritize road maintenance and management tasks and create an efficient maintenance management system by carrying out surveys of traffic volumes, pavement conditions (International Roughness Index (IRI)) and other basic attributes and analyzing the results. Although the CDA does not have many roads to manage, it should improve its data management systems in order to enable more efficient maintenance and management.

5.3.2 Drainage Facility Maintenance and Management

Site reconnaissance conducted by the SAPROF found that sluice gates, as well as drainage facilities connected to them, are not being adequately maintained. The channels contain waste and refuse, which are obstructing the drainage facility cross sections and undermining the drainage function. One of the major reasons for this is low awareness among local residents. While it goes without saying that public agencies should improve their maintenance and management activities, efforts should also be made to develop a sense of ownership among the residents toward public facilities.

5.3.3 Resident Participation in Community Disaster Prevention

For disaster prevention at the local community level, "soft" measures such as resident-participated management are as important as "hard" measures such as embankment construction. While such soft measures should be carried out under the leadership of the BWDB, it may also be a good idea for BWDP and CPP to work in collaboration in this area, as volunteer-based disaster prevention activities centering on the CPP are quite active in Bangladesh. In addition, consideration should be given to adding disaster drills to the curriculum for disaster prevention education at schools and other institutions.

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JICA Special Assistance for Project Formation (SAPROF) for Chittagong City Ring Road Project

Executive Summary of Final Report

JICA SAPROF Study Team
(Nippon Engineering Consultants and Japan Engineering Consultants JV)

1

Table of Contents for the FR Presentation

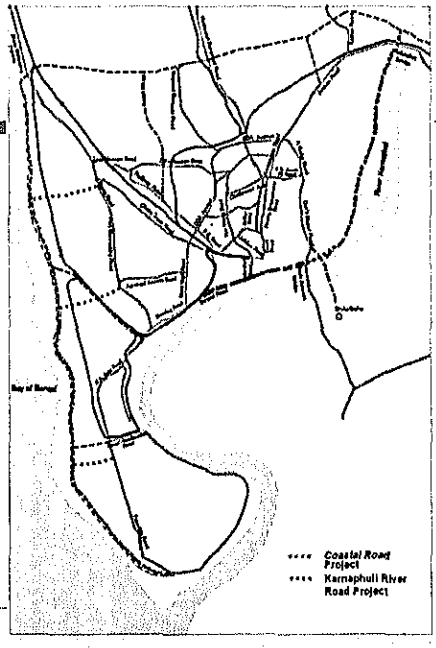
2

1. Study Framework of SAPROF
1.1 TOR of the Study

1. Review the current situation and problems for the road sector in Chittagong
2. Analyze Coastal Road and Embankment Strengthening Project
3. Analyze Karnaphuli River Road and Flood Protection Construction Project
4. Analyze the environmental and social consideration and assist resettlement and land acquisition plan

3

1.2 Project Roads



4

2. Key Roles of the Project Roads

■ Questionnaire to Concerned Agencies

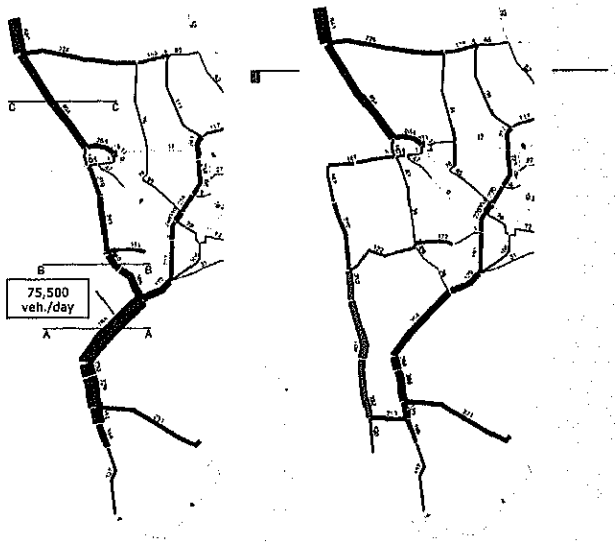
All seven agencies evaluated highly the roles to be fulfilled by the Coastal Road and the Karnaphuli River Road. Of the roles expected to be played by the Roads, strong expectations were expressed toward "alleviation of traffic congestion" and "disaster prevention".

	Question 2-3 a) Coastal Road						Question 2-3 b) Karnaphuli River Road					
	1	2	3	4	5	Average Score	1	2	3	4	5	Average Score
To divert traffic from existing roads	3	1	1	0	1	2.2	4	0	2	0	0	1.7
To alleviate traffic congestion in the city	2	2	2	0	0	2.0	1	4	1	0	0	2.0
To prevent disaster	1	2	3	0	0	2.3	1	2	2	1	0	2.5
To enhance land use and urbanization	0	0	0	4	2	4.3	0	0	0	3	3	4.5
To enhance tourism attraction	0	1	0	2	3	4.2	0	0	1	2	3	4.3

5

■ To Divert Traffic from Existing Roads

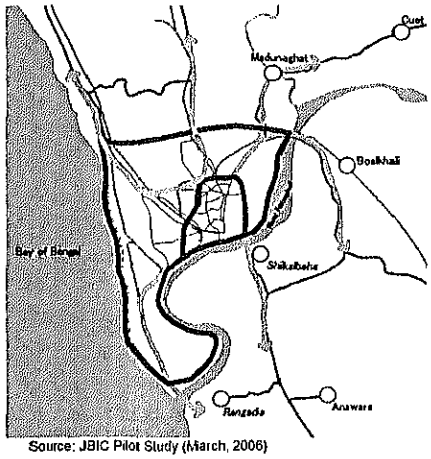
100 veh./day



6

Formulate Future Trunk Road Network

The Coastal Road and the Karnaphuli River Road are positioned as highly important components of Chittagong's road network system.



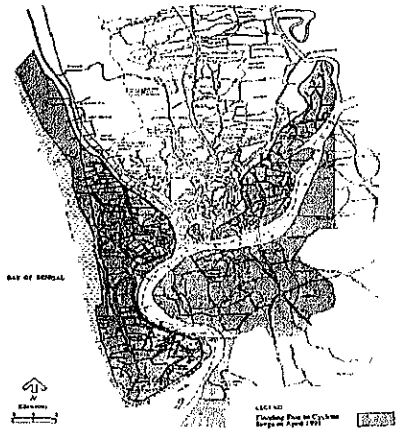
Source: JBIC Pilot Study (March, 2006)

Protection from Disasters

The infrastructure sector and productive sector suffered by far large amount of damages by disasters.

Year	No. of Deaths
1876	100,000
1897	175,000
1970	200,000
1991	138882

Sector	Damage by Sidr (million Taka)
Social	5,934
Infrastructure	73,194
Productive	33,817
Cross-Cutting	420
Total	115,569



Source: Chittagong Metropolitan Master Plan, 1995

Close Related Projects

The Coastal Project and the Karnaphuli Project should be well coordinated with related projects in earlier time.

A. Coastal Road Project

1. 4-Laning of Dhaka Chittagong National Highway Project
2. Chittagong- Fauzdarhat- Muhuriganji Seashore Road Construction Project
3. Chittagong Outer Ring Road Construction Project
4. Port Access Toll Road Project
5. Coastal Embankment Rehabilitation Project (Stage-II)
6. Expansion of Chittagong-EPZ and Karnaphuli EPZ Project

B. Karnaphuli River Road Project

1. Capital Dredging Project
2. 3rd Karnaphuli Bridge Construction Project

A. Coastal Road Project

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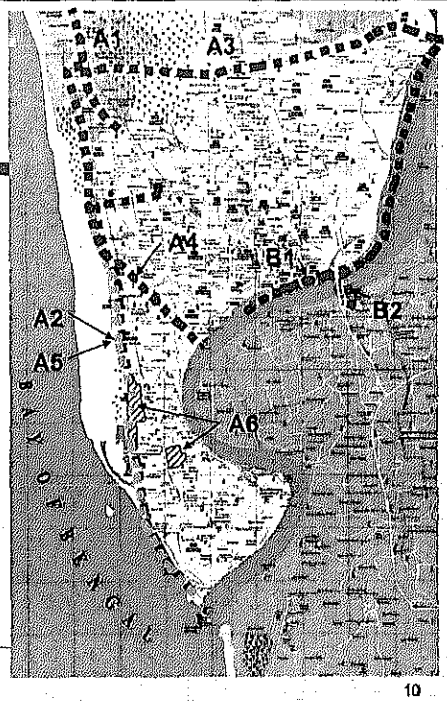
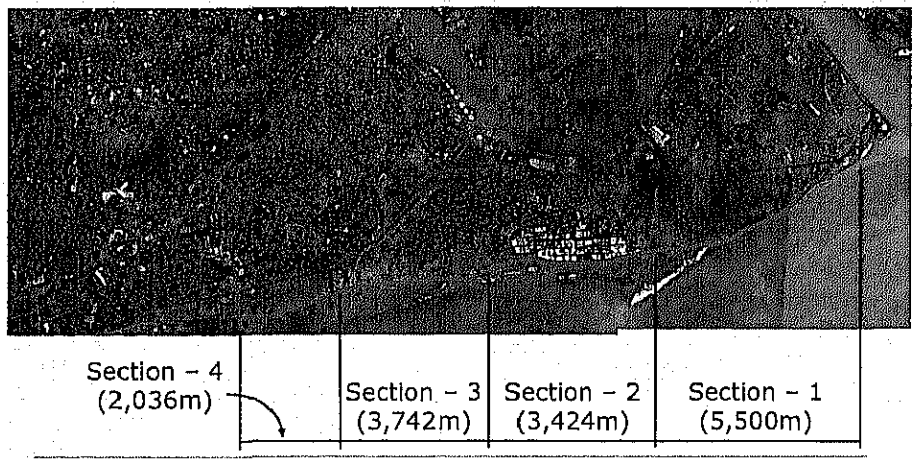
B. Karnaphuli River Road Project

1. Capital Dredging Project
2. 3rd Karnaphuli Bridge Construction Project



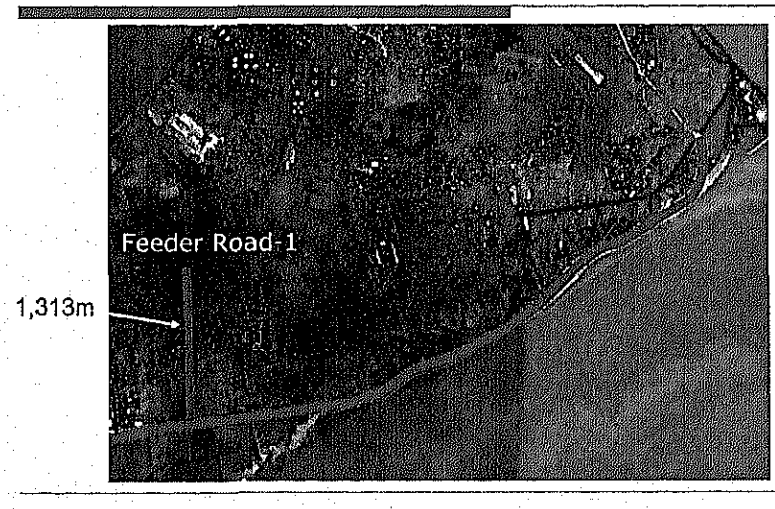
3. Project Design (Coastal Road Project)

Section-1=5,500 m Section-2=3,424 m Section-3=3,742 m
Section-4=2,036 m Total=14,702 m



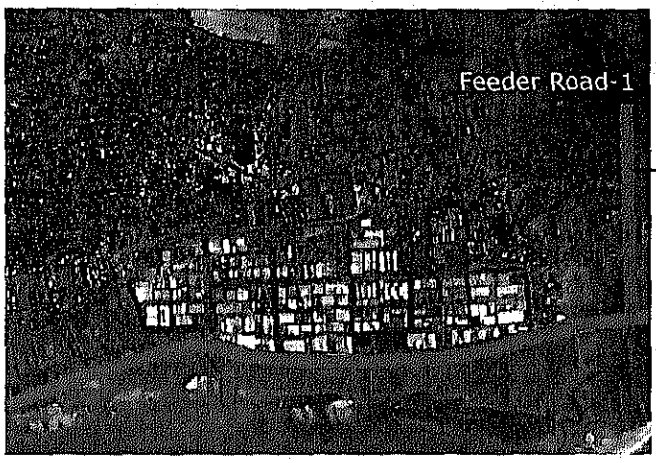
11

■ Section-1 (Beach-side Section)

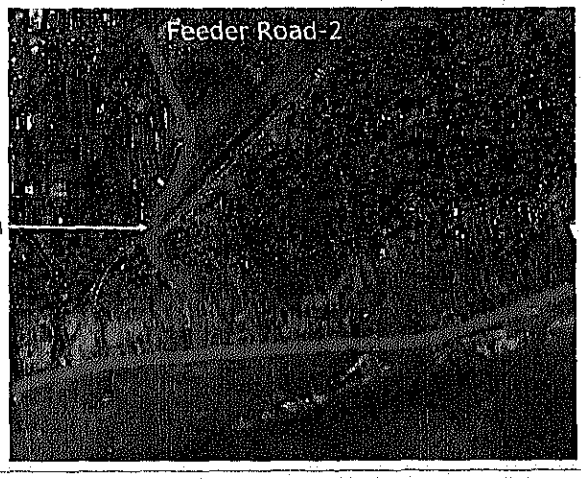


12

Section-2 (EPZ Section)



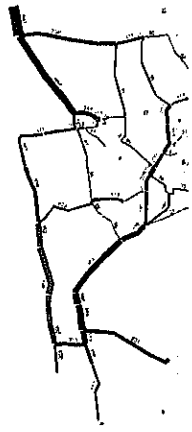
Section-3 (Tidal Section)



Section-4 (Toll Road Parallel Section)

Number of Lanes in each Section

	High	Low	No. of Lanes
Section-1	12,000	9,200	2
Section-2	40,100	31,400	4
Section-3	35,200	27,600	4
Section-4	23,000	18,100	4
Feeder-1	21,300	17,000	4
Feeder-2	12,200	9,500	4
Feeder-3	16,700	13,100	4



Northern Extension Section

The northern extension section is necessary to be open to public around 2020 from future traffic estimation.

☐Construction Option

A. No construction

(Feeder-3 road is used as a main road tentatively.)

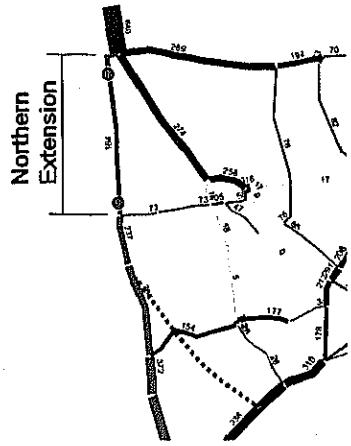
B. Constructed singly

(No join with Port Access Road)

C. Join to Port Access Road

C-1: Join near Feeder-3

C-2: Join near end point



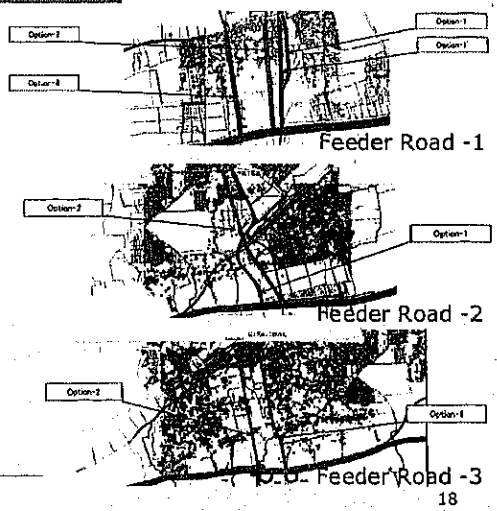
17

Selection of Routes of Feeder Roads

The routes of feeder roads are selected through comparative study by the Study Team

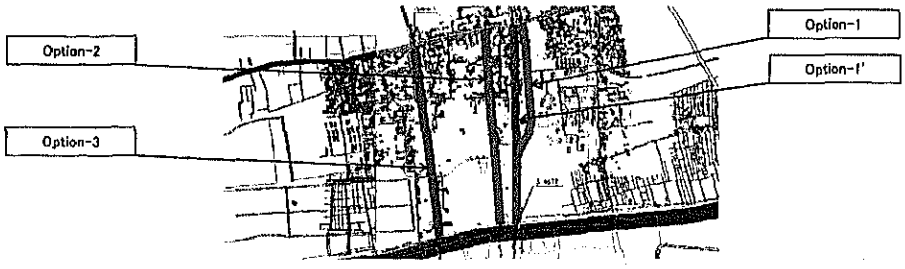
☐ Items to evaluate route options for feeder roads

1. Social Environment
2. Natural Environment
3. Civil Engineering
4. Transport Function
5. Project Cost



18

Feeder Road -1

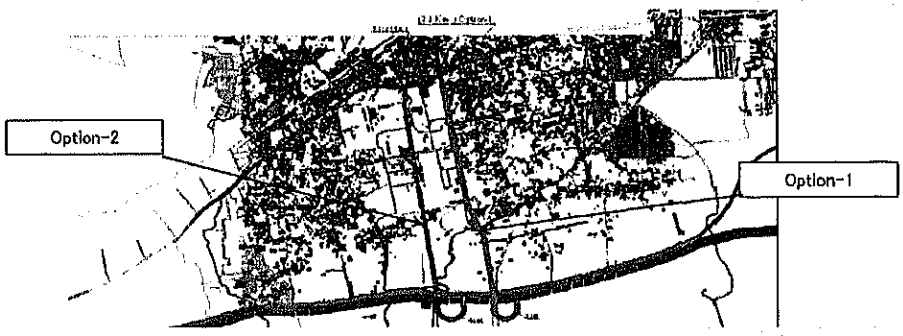


Selected Option: Option-1'

Feeder Road –2

Selected Option: Option-1

Feeder Road –3

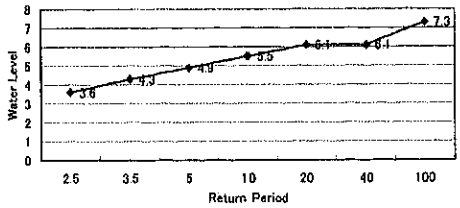


Selected Option: Option-1

Embankment Design

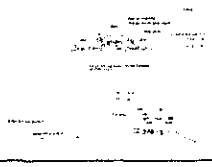
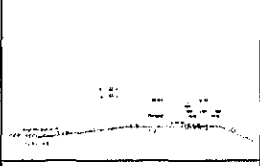
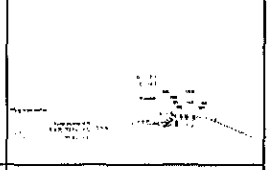
The embankment design was reviewed and analyzed. Comparative study was carried to set embankment structure types.

1. Design Target: Return period = 50 years
2. Design High Water Level: 6.7m based on "the Coastal Embankment Rehabilitation Project, Phase II"
3. Design Wave Height: 4.0 m
4. Slope: 1:7 (seaward slope), 1:2 (landward slope)
5. Green Gas Effect: Introducing as a marginal height



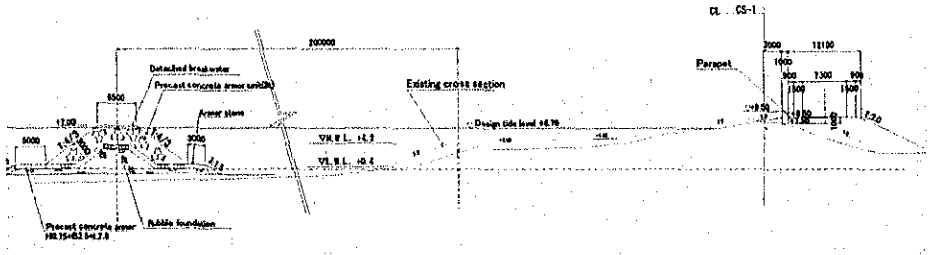
Comparative Study on Structure Type (1)

Section-1 (Start point – 05K+500, Beachside Section)

	Type1	Type2	Type3
Cross Sectional view			
Workability	3	1	2
Usage	1	1	2
Social Environment	1	2	2
Natural Environment	2	1	1
Economy	1,220,000 TK/m 2	250,000TK/m 1	250,000TK/m 1
Evaluation	3	1	2

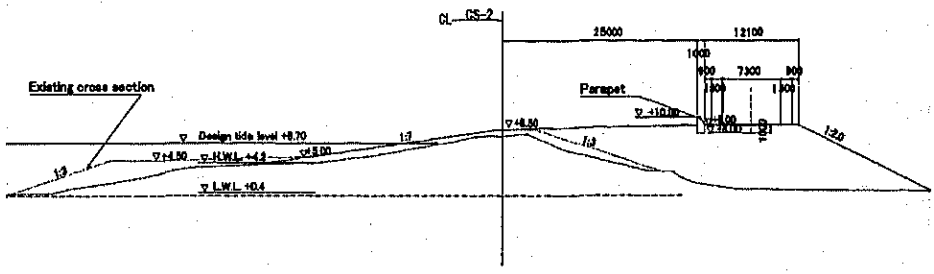
Type(2)⇒

Type-1 (Cross Section)



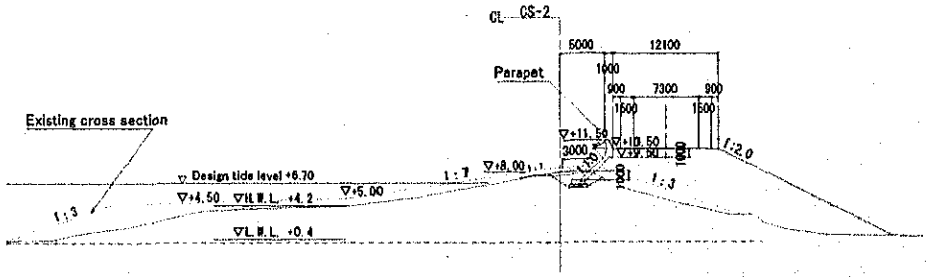
Back

Type-2 (Cross Section)



Back

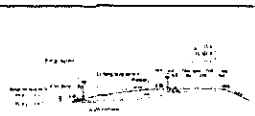
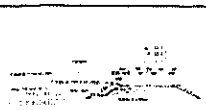
Type-3 (Cross Section)



Back

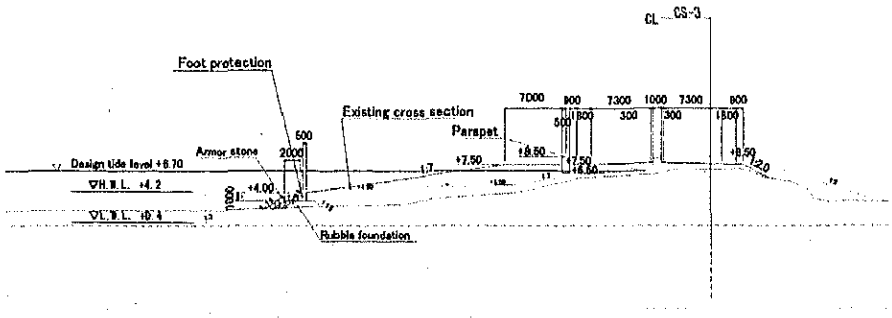
Comparative Study on Structure Type (2)

Other Section (05K+500– End point)

	Type1	Type2	Type3
Cross Sectional view			
Workability	1	3	2
Usage	1	2	3
Social Environment	3	2	1
Natural Environment	3	2	1
Economy	240,000 TK/m 1	450,000TK/m 3	260,000TK/m 2
Evaluation	1	3	2

31⇒ 27

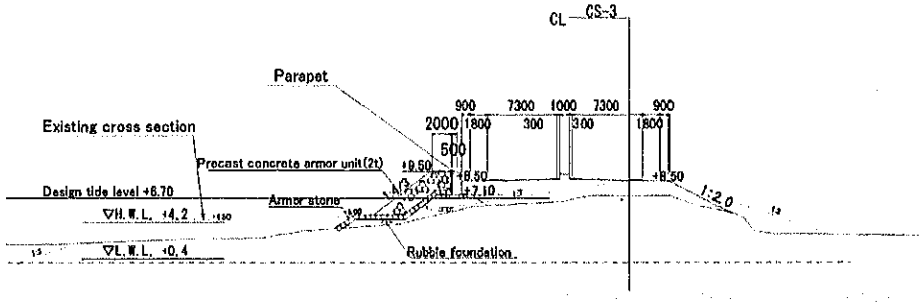
Type-1 (Cross Section)



Back

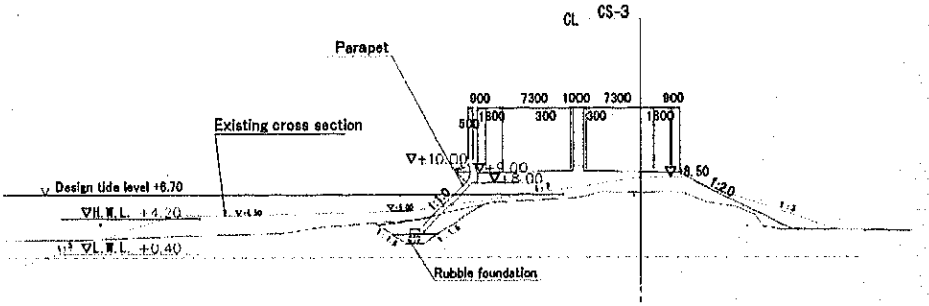
28

Type-2 (Cross Section)



Back

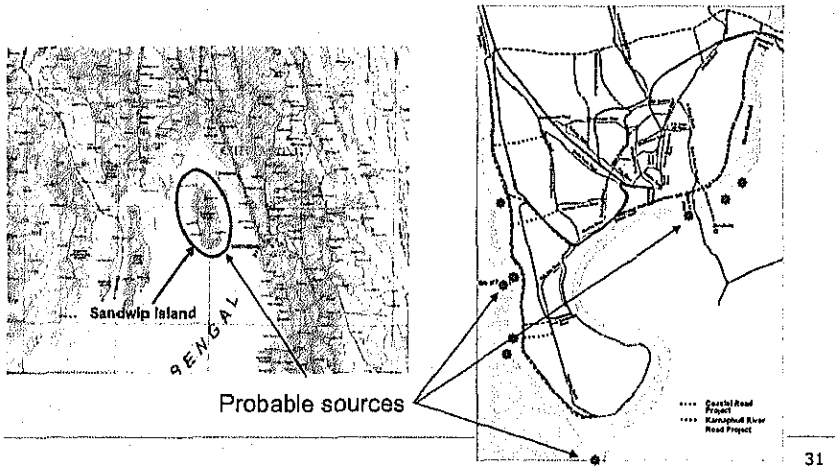
Type-3 (Cross Section)



Back

Securing Filling Material for Embankment Construction

The total embankment earth volume is estimated to be approximately 2,800,000 cubic meters. Most probable sources are from sea and/or river nearby the Project area because the Chittagong hill is prohibited to collect the materials.



31

4.Project Implementation

Economic Evaluation

- ✓ The base year for Project cost-benefit calculations is 2008.
- ✓ The discount rate is 12%, and no inflation is considered.
- ✓ The scenarios for sensitivity analyses are (a) investment costs: increase 10%, (b) the volume of future traffic forecast: decreases 10%, and (c) the case where both the preceding cases occur simultaneously.

Evaluation Case	EIRR (%)	NPV (million TK)	B/C
Basic Case	23.8	7,434	2.54
Costs +10% Case	22.4	6,951	2.31
Traffic -10% Case	22.2	6,208	2.28
Costs +10% & Traffic -10%	20.9	5,724	2.08

32

Outline of the Coastal Road Construction Project

Items		Quantities
Outline		
1)	Project Distance	21,593m (Main Road: 2 lane-6,236m / 4 lane-8,466m Feeder Road: 4 lane-6,648m / 4+2 lane-243m)
2)	No. of Lanes and Width of Carriageway & Shoulder	Main Road: 2 lane-12.10m / 4 lane-21.60m Feeder Road: 4 lane-18.29m / 4+2 lane-30.48m
Type of Works		
1)	Earth Works	Soil Volume: 2,809,506m3
2)	Pavement Works	Pavement Volume: 179,740m3
3)	Bridge Works	Bridge: 8 bridges
4)	Culvert works	Culvert: 18 culverts(new), 6 culverts(existing)
5)	Drainage Works	Total Distance: 55,306m
6)	Disaster Prevention Works	Concrete wall at roadside, Sluice gates of culverts

33

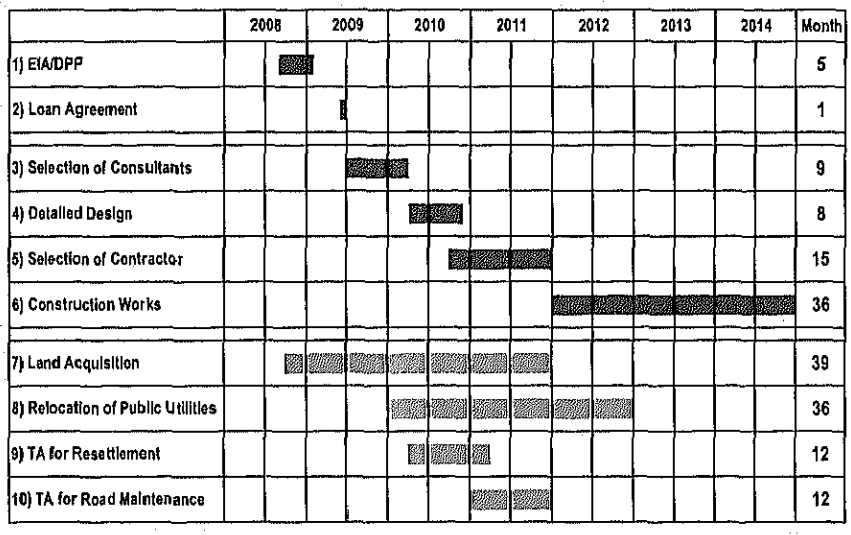
Construction, Land Acquisition &Resettlement Costs

	Foreign	Local	Total
Construction Cost	286	4,368	4,654
Public Utilities Relocation		18	18
Contingency/Price Escalation	29	219	248
Sub Total	315	4,605	4,920
Consulting Service Cost	447	194	641
Administrative Expense		275	275
Tax	229	507	736
Total	991	5,581	6,572
Land Acquisition & Resettlement		2,167	2,167

Million Taka

34

Construction Schedule



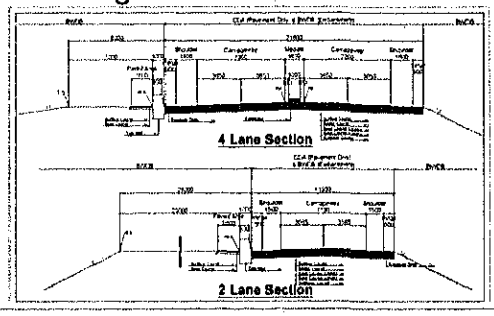
Relocation of Public Utilities

Public Utilities should been checked for smooth relocation during construction period.

No	Kind of Utilities	Name of Organizations	Estimated Period of Relocation (M: month)
1	High Voltage Power Line (Over 132Kv)	PGCB: Power Grid Company of Bangladesh	Application Procedure: 6-12 M Relocation Work: 12-24 M
2	Electric Distribution Line (Under 33Kv)	PDB: Power Development Board	Application Procedure: 6-12 M Relocation Work: 3-6 M
3	Water Pipe Line	WASA: Water Supply and Sanitation Authority	-ditto-
4	Telephone Line	BTTB: Bangladesh Telephone and Telegraph Board	-ditto-
5	Gas Pipe Line	Bakhrabad Gas Company, Chittagong	-ditto-

Maintenance Issues

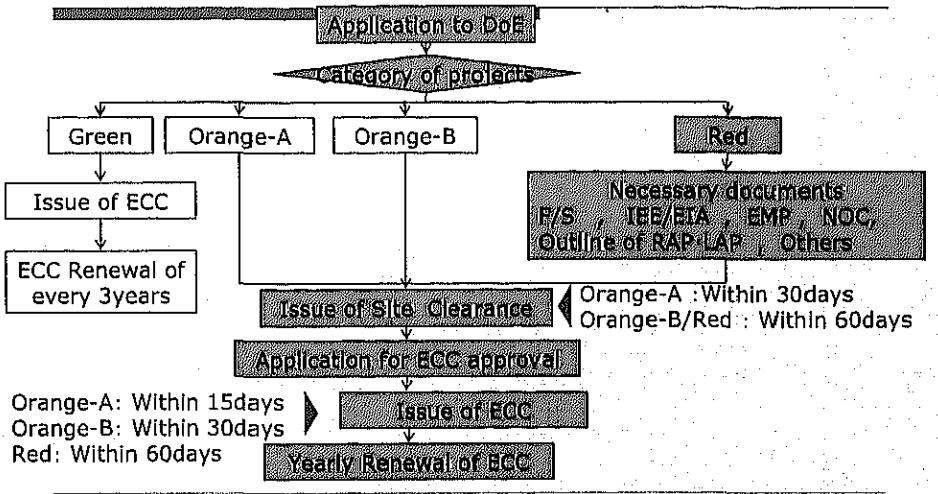
- ✓ Clear institutional demarcation on responsibility for road & embankment structures
- ✓ Capacity building for engineers
- ✓ Set up Maintenance Management Committee



37

5. Natural Environment

Procedure of EIA



38

Present Environemnt
Natural Environment

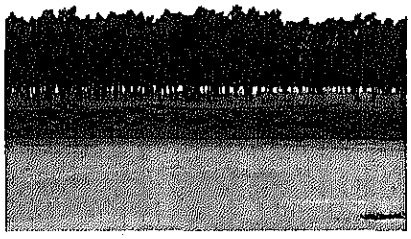
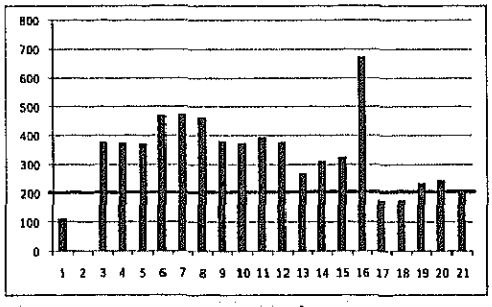


Photo-1 Mangrove forest
A Precious mangrove forest spreads along the seashore beside the project.

Photo-2 Seashore with rich nature
Precious nature such as the swampy area of bird hidernaculum remains on the seashore.

39

Present Environemnt
Air Pollution



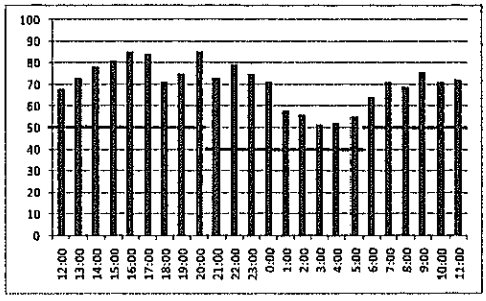
Graf-1 : SPM(μg/m^3) in Chittagong
Source:DoE Date(2006-2008)

Photo-3 :
Roads inside of Chittagong

SPM largely exceeds the limit value of Environmental Standard.

40

Present Environemnt Noise & Water Pollution



Graf-2 : Noise Level(dB) of Feeder Road-2

Noise level largely exceeds the limit value of the Environmental Standards.

Photo-4 : Rivers inside of Chittagong

The river is heavily polluted due to the raw wast water discharge from the houses.

Environmental Impact and Mitigation Measures Checklist

Environmental element	Before the counter measure: During construction(1)	Before the counter measure: After completion(2)	After the counter measure: During construction(1)	After the counter measure: After completion(2)
Air pollution	★★	★	★	★
Surface water pollution	★★	★	★	★
Groundwater pollution	★★★	★★★	★	★
Noise	★★	★★	★	★
Vibration	★★	★	★	★
Soil	★★★	★★★	★	★
Coastal ecosystems	★★	★	★	—
Aquatic flora and fauna in water	★★	★	★	—
Land-based flora and fauna	★★	★	★	—
Land acquisition	★★	—	—	—
Resettlement	★★	—	—	—
Jobs and employment	★★	★★★	—	—
Health and hygiene	★★	—	★	—

mitigation measures

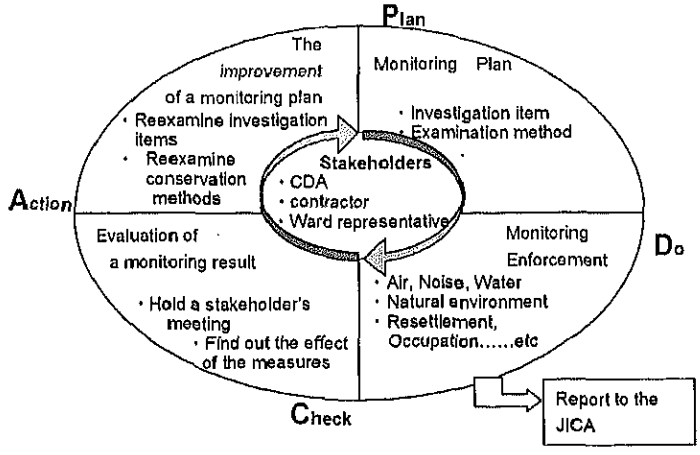
Major Mitigation Measures

Environmental element	Main Conservation s
Air pollution	Observation through regular watering
Surface water pollution	Implement treatment
Groundwater pollution	Polluted dredged is unusable
Noise	Erected a noise barrier
Vibration	Construction vehicles will run at a slow pace
Soil	Usage of polluted dredged soil
Geographical features	Build a guard at the base of the base of the slope to stop sediment runoff. Use waterproof sheeting when it rains.
Geology	Stabilize soft ground
Aquatic flora and fauna in water	Erect a fence to hide the flora and fauna
Land-based flora and fauna	Erect a fence to hide the flora and fauna
Land acquisition	Implement according to LAP
Resettlement	Implement according to LAP
Jobs and employment	Implement according to RAP
Health and hygiene	Inform the local hospitals. Circulate prevention methods. Distribute vaccines.

Others : The monitoring system is needed during construction and after the completion.

43

Environmental Management Plan
EMP PDCA cycle



44

6. Social Environment

Key Findings of the Census &Socio-Economic Survey

The Affected House Holds are concentrated in Section 1 & 2.

Type of Loss/Items	Section-1 & 2	Section-3 & 4	Feeder Road	Total
Losing land, structures & properties	84	5	9	98
Losing properties	10	1	0	11
Squatter housing (owned)	601	38	54	693
Squatter housing (rental)	420	76	167	663
Losing commercial & business properties	578	70	105	753
Common property resources affected	18	2	1	21
Total	1,711	192	336	2,239

45

Number of Affected Persons

Almost all persons to be displaced illegally stay along the Project.

Type of Loss/Items	Affected Units	Affected Persons	Displaced	Impacted but not displaced
Losing land, structures & properties	98	812	812	
Losing properties	11	98		98
Squatter housing (owned)	693	4,019	4,019	
Squatter housing (rental)	663	3,858	3,858	
Losing commercial & business properties	753	4,731		4,731
Common property resources affected	21	N/A		
Total	2,239	13,518	8,689	4,829

46

Land to be needed for the Project

Note: Land (11.0 ha) for 3 resettlement sites are included in the Table.

	Agriculture & Others	Home Stead	Highland Embankment	Road	Total
Land to be acquired					
Private	22.0	7.2	1.5		30.7
BR	1.6	1.2			2.8
CPA		0.2			0.2
NA	0.8				0.8
Subtotal	24.4	8.6	1.5	0	34.5
Land to be used but do not to be acquired					
CDA				4.3	4.3
BWDB	37.3		30.5		67.8
Total	61.7	8.6	32.0	4.3	106.6

47

Compensation and Entitlement Matrix

Type of Loss	Entitlement (Compensation Package)
1. Loss of agriculture land, pond etc.	- Replacement value & additional grant to cover market value, refund of duty
2. Loss of homestead/ residential/ commercial plot (legal owner)	- Ditto - Relocation facilities at resettlement site
3. Loss of trees and other properties	- Cash compensation
4. Loss of residential/ commercial structure (legal title holder)	- Replacement value of structure - Relocation in resettlement site
5. Loss of residential/ commercial structure (informal settlers)	- Ditto
6. Loss of business	- Business restoration grant
7. Poor & vulnerable households	- Cash grant & income generation program

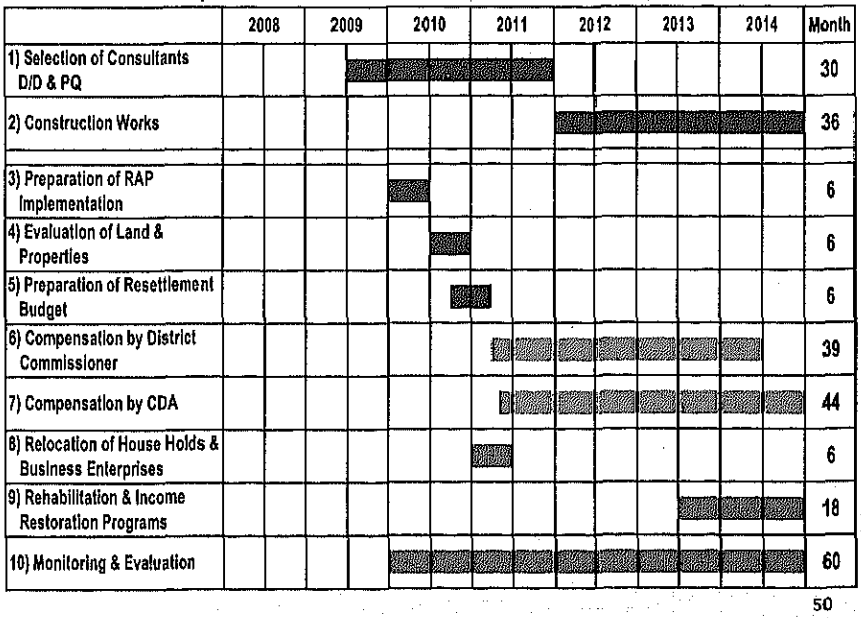
48

Land Acquisition and Resettlement Budgets

Item	Quantity	Amounts Million Taka
Land to be acquired	23.5 ha	839
Properties compensation		482
Grant and allowance		136
Resettlement sites for residents	9.8 ha	529
Resettlement site for business	1.2 ha	73
Administrative & contingency		108
Total		2,167

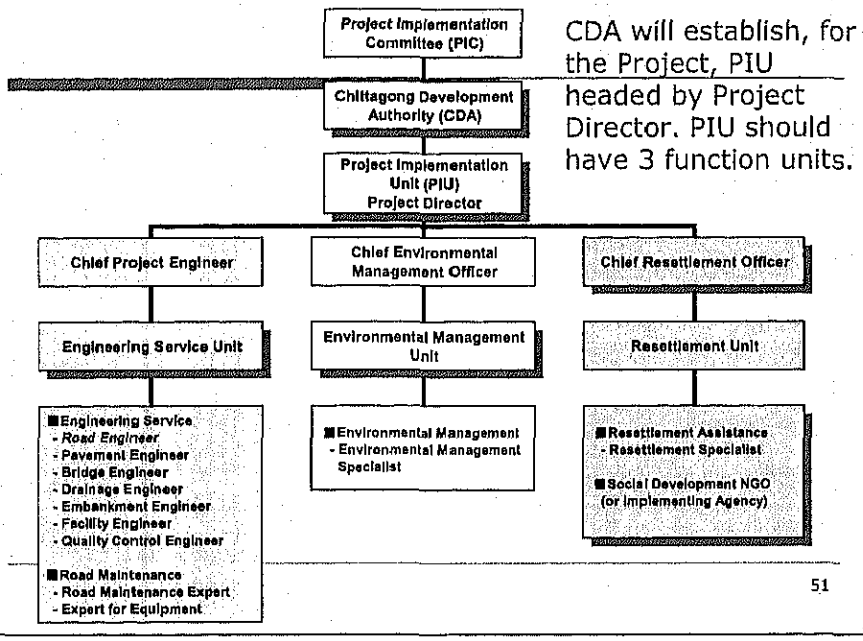
49

RAP Implementation Schedule



50

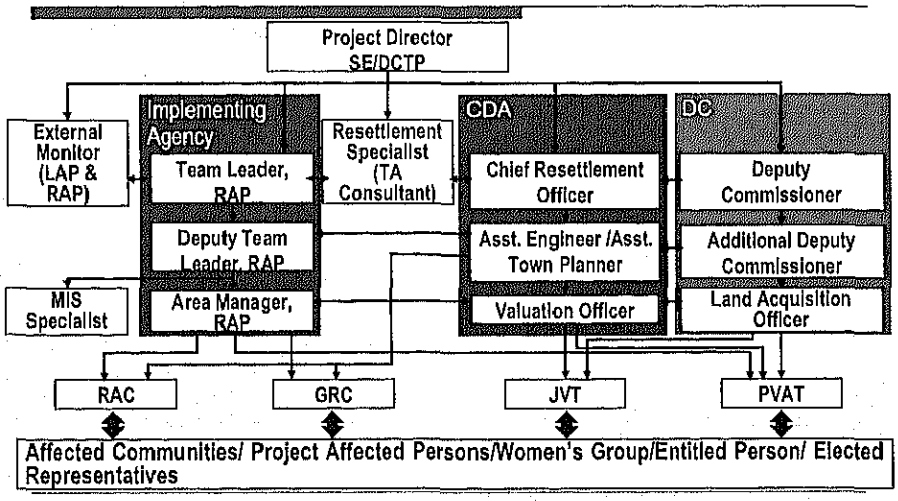
7. Institutional Set Up for the Project



CDA will establish, for the Project, PIU headed by Project Director. PIU should have 3 function units.

51

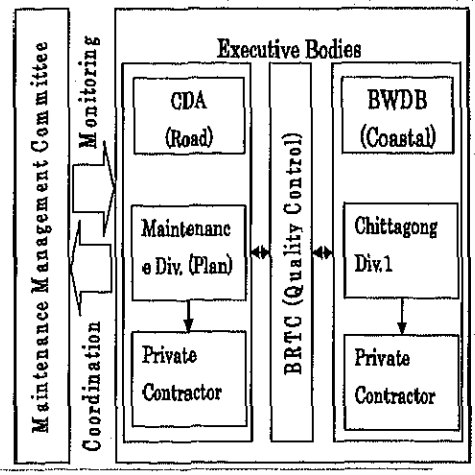
Detail Structure of Resettlement Unit



52

Maintenance Management Committee

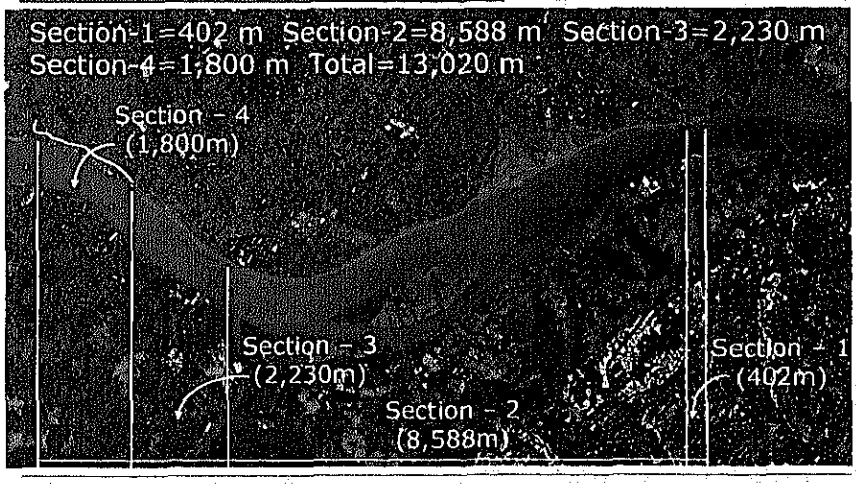
- CDA chairman as Chairman of the Committee
- Engineer of the BWDB
- Engineer of the CCC
- Engineer of the CDA
- 2 Representatives for the concerned wards
- Engineer of the Ministry of Public Works
- Authority of Bureau of Research, Testing and Consultancy (BRTC), Department of Civil Engineering Chittagong University of Engineering and Technology
- Authority of Traffic Police



53

8. Karnaphuli River Road Project

The Project Routes and Sections

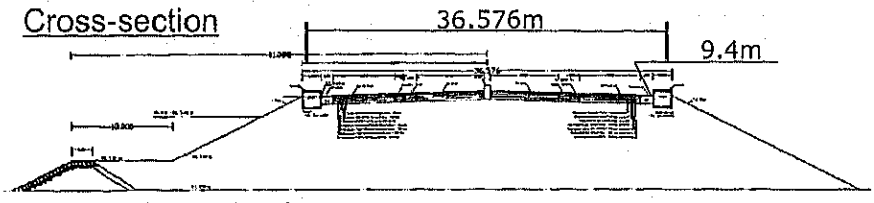


54

Outline of the Karnaphuli River Road Project

Karnaphuli River Road has multi-functions like (1) Ring Road, (2) flood prevention & (3) enhancing land development.

Cross-section



Economic Evaluation

Evaluation Case	EIRR (%)	NPV (million TK)	B/C
Basic Case	16.0	1,611	1.37
Costs +10% Case	14.7	1,177	1.23
Traffic -10% Case	14.6	1,016	1.23
Costs +10% & Traffic -10%	13.4	581	1.12

55

Outline of Karnaphuli River Road Construction Project

	Items	Quantities
Outline		
1)	Project Distance	4 lane-13,020m
2)	No. of Lanes and Width of Carriageway & Shoulder	4 lane-36.576m
Type of Works		
1)	Earth Works	*Soil Volume:* 5,255,397m3
2)	Pavement Works	*Pavement Volume:* 235,967m3
3)	Bridge Works	*Bridge:* 18 bridges
4)	Culvert works	*Culvert:* 3 culverts(new), 2 culverts(existing)
5)	Drainage Works	*Total Distance:* 26,040m
6)	Disaster Prevention Works	*Sluice gates of culverts* etc.

56

Costruction Costs

	Foreign	Local	Total
Construction Cost	1,133	4,026	5,159
Contingency/Price Escalation	652	201	853
Sub-Total	1,785	4,227	6,012
Consulting Service Cost	543	140	683
Administrative Expense		218	218
Tax	698	459	1,157
Total	3,026	5,044	8,070

Million Taka

57

9. Recommendation

1. Set up Project Implementing Unit as early as possible.
2. Enough and intensive Capacity Building for resettlement & maintenance
3. Securing appropriate Budgets for the big Project
4. Well Coordination with central government and concerned agencies
5. Securing Resettlement Sites at vicinity of the Project

Thank you for your kind attention!

End

59

Appendix

Appendix 2.3-1 Traffic Counts on M. A. Aziz Road

Daily Traffic Count Data

Survey Date : 25-06-2008 Weather : Sunny

Road Name : M.A. Aziz Road Traffic Direction : To Salt Gola From : Patenga

Station: C (Miler Matha) Supervisor : Tanjib Hossian Surveyor : Rashed, Sabuj, Motin, Razib, Sadad, Monir

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Total	9 Non-Motor Vehicle	Grand Total
7.00-7.30	76	11	251	126	39	70	359	932	239	1171
7.30-8.00	81	14	227	131	22	122	408	1005	211	1216
8.00-8.30	82	19	226	100	33	171	489	1120	248	1368
8.30-9.00	58	10	128	88	17	131	368	800	246	1046
9.00-9.30	51	38	144	84	33	97	373	820	288	1108
9.30-10.00	79	41	134	63	26	106	411	860	284	1144
10.00-10.30	113	18	111	50	27	102	408	829	328	1157
10.30-11.00	146	30	132	73	45	150	450	1026	280	1306
11.00-11.30	169	54	122	76	39	143	443	1046	322	1368
11.30-12.00	190	23	114	88	35	102	444	996	315	1311
12.00-12.30	154	30	120	79	60	109	449	1001	378	1379
12.30-13.00	198	25	99	67	98	116	409	1012	313	1325
13.00-13.30	228	34	119	88	40	151	554	1214	284	1498
13.30-14.00	161	27	122	85	25	94	338	852	218	1070
14.00-14.30	133	15	101	98	30	90	306	773	185	958
14.30-15.00	133	43	92	82	24	72	307	753	201	954
15.00-15.30	183	45	119	114	30	104	530	1125	251	1376
15.30-16.00	166	35	117	121	28	94	489	1050	306	1356
16.00-16.30	192	32	139	126	66	130	570	1255	360	1615
16.30-17.00	177	17	132	119	63	96	535	1139	316	1455
17.00-17.30	166	25	133	111	73	102	579	1189	403	1592
17.30-18.00	123	31	162	103	69	140	476	1104	367	1471
18.00-18.30	155	29	169	120	61	119	496	1149	391	1540
18.30-19.00	126	24	186	115	57	121	459	1088	462	1550
Total	**3340**	**670**	**3399**	**2307**	**1040**	**2732**	**10650**	**24138**	**7196**	**31334**

Daily Traffic Count Data

Survey Date : 25-06-2008 Weather : Sunny

Road Name : M.A. Aziz Road Traffic Direction : To Salt Gola From : Patenga

Station: Miler Matha Supervisor : Md. Kamrul Hassan Surveyor : Al-Amin, Mahabub, Kais, Habib

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Total	9 Non-Motor Vehicle	Grand Total
19.00-19.30	140	43	187	161	47	171	488	1237	400	1637
19.30-20.00	87	20	109	82	30	109	421	858	292	1150
20.00-20.30	122	17	171	101	49	114	429	1003	340	1343
20.30-21.00	74	15	129	89	40	143	453	943	361	1304
21.00-21.30	109	31	136	75	29	83	317	780	169	949
21.30-22.00	71	6	106	61	22	74	269	609	137	746
22.00-22.30	94	11	122	59	23	92	317	718	183	901
22.30-23.00	73	5	94	43	15	57	243	530	94	624
23.00-23.30	101	3	97	28	16	46	214	505	89	594
23.30-24.00	49	0	43	25	8	24	95	244	28	272
24.00-0.30	36	2	25	7	8	19	63	160	39	199
0.30-1.00	53	3	6	3	9	10	70	154	42	196
1.00-1.30	43	1	4	2	3	6	43	102	32	134
1.30-2.00	33	0	4	5	0	6	43	91	14	105
2.00-2.30	54	2	4	5	6	10	53	134	27	161
2.30-3.00	27	2	3	4	3	1	16	56	8	64
3.00-3.30	33	2	1	3	0	2	22	63	18	81
3.30-4.00	32	3	1	7	0	5	13	61	9	70
4.00-4.30	32	2	3	4	0	1	27	69	23	92
4.30-5.00	22	2	10	7	16	7	44	108	31	139
5.00-5.30	40	4	27	17	3	5	44	140	42	182
5.30-6.00	56	3	54	44	1	15	97	270	46	316
6.00-6.30	51	6	86	54	16	11	124	348	45	393
6.30-7.00	69	4	226	103	21	31	183	637	138	775
Total	**1501**	**187**	**1648**	**989**	**365**	**1042**	**4088**	**9820**	**2607**	**12427**

Source: Study Team

Appendix 2.3-2 Incoming and Outgoing Traffic Counts at Chittagong EPZ and Chittagong International Airport

Daily Traffic Count Data

Survey Date : 23-06-2008 Weather : Sunny

Road Name : CEPZ Connecting Road Traffic Direction : Both Direction From :

Station: Entry/Exit Point of CEPZ Road Supervisor : Tanjib Hossian/Kamrul Hassan Surveyor : Rashed, Sabuj, Al-Amin, Mahabub

Time	1	2	3	4	5	6	7	8	9	Grand Total
	Truck	Small Truck	Bus	Microbus	Jeep/Utility Vehicle	Car	Three Wheeler	Total	Non-Motor Vehicle	
7.00-7.30	17	1	325	83	5	30	217	678	483	1161
7.30-8.00	19	1	265	100	12	40	498	935	689	1624
8.00-8.30	36	0	205	83	10	82	527	943	204	1147
8.30-9.00	26	4	17	74	15	47	224	407	166	573
9.00-9.30	29	8	9	85	5	50	244	430	149	579
9.30-10.00	46	13	4	94	13	55	221	446	188	634
10.00-10.30	36	14	7	105	22	73	190	447	145	592
10.30-11.00	28	23	0	95	13	57	175	391	100	491
11.00-11.30	31	26	10	103	15	49	189	423	122	545
11.30-12.00	49	21	22	100	11	74	165	442	134	576
12.00-12.30	47	18	58	112	14	60	171	480	133	613
12.30-13.00	53	19	2	85	10	46	156	371	118	489
13.00-13.30	85	10	5	125	16	44	167	452	108	560
13.30-14.00	39	6	17	72	18	38	113	303	74	377
14.00-14.30	56	9	11	86	25	46	182	415	99	514
14.30-15.00	76	5	14	86	12	47	140	380	69	449
15.00-15.30	62	13	23	78	41	50	129	396	88	484
15.30-16.00	62	6	41	109	19	40	133	410	64	474
16.00-16.30	78	7	60	117	45	41	125	473	62	535
16.30-17.00	74	13	86	77	32	56	128	466	78	544
17.00-17.30	87	11	90	92	28	61	135	504	102	606
17.30-18.00	72	6	88	79	31	38	97	411	113	524
18.00-18.30	87	11	124	111	30	48	95	506	144	650
18.30-19.00	38	7	170	90	26	33	87	451	93	544
Total	1233	252	1653	2241	468	1205	4508	11560	3725	15285

Daily Traffic Count Data

Survey Date : 24-06-2008 Weather : Sunny

Road Name : Airport Road Traffic Direction : Both Direction From :

Station: Near Airport Supervisor : Md. Kamrul Hassan Surveyor : Nayan, Amanat, Al-Amin, Kais, Monir, Sadad, Motin

Time	1	2	3	4	5	6	7	8	9	Grand Total
	Truck	Small Truck	Bus	Microbus	Jeep/Utility Vehicle	Car	Three Wheeler	Total	Non-Motor Vehicle	
7.00-7.30	1	0	0	49	2	22	53	127	0	127
7.30-8.00	0	0	0	29	8	30	49	116		116
8.00-8.30	0	0	0	56	7	54	64	181	0	181
8.30-9.00	0	0	0	34	4	18	62	118	0	118
9.00-9.30	2	0	2	46	2	19	55	126	0	126
9.30-10.00	1	0	0	34	1	6	53	95	0	95
10.00-10.30	4	0	0	38	3	16	64	125	1	126
10.30-11.00	3	0	0	46	2	9	49	109	1	110
11.00-11.30	3	2	2	46	7	34	108	202	0	202
11.30-12.00	7	0	1	34	2	31	48	123	0	123
12.00-12.30	4	0	0	15	8	14	56	97	0	97
12.30-13.00	3	1	0	22	3	18	45	92	0	92
13.00-13.30	1	2	0	18	3	11	36	71	3	74
13.30-14.00	0	2	2	16	2	13	44	79	6	85
14.00-14.30	2	2	1	18	4	9	56	92	3	95
14.30-15.00	3	0	0	33	3	21	51	111	7	118
15.00-15.30	6	2	0	32	6	18	43	107	2	109
15.30-16.00	3	0	0	12	7	22	48	92	4	96
16.00-16.30	5	0	0	17	8	35	50	115	4	119
16.30-17.00	5	5	0	26	7	17	24	84	10	94
17.00-17.30	3	0	1	27	9	26	26	92	11	103
17.30-18.00	1	3	0	17	6	25	21	73	5	78
18.00-18.30	1	2	0	18	3	20	22	66	5	71
18.30-19.00	2	1	0	26	20	39	21	109	6	115
Total	60	22	9	709	127	527	1148	2602	68	2670

Source: Study Team

Appendix 2.3-3

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 27-08-2008 Weather : Cloudy

Road Name : Dhaka-Chittagong Highway Traffic Direction : From Dhaka To : Chittagong.

Station: City Gate Supervisor : Babu Surveyor : Titu, Hasan, Robin

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	56	4	41	21	12	24	60	35	253
7.30-8.00	27	8	38	15	15	27	101	67	298
8.00-8.30	55	5	32	11	17	12	95	63	290
8.30-9.00	48	10	33	13	9	15	94	89	311
9.00-9.30	22	5	40	9	15	22	99	111	323
9.30-10.00	38	8	36	10	7	21	175	140	435
10.00-10.30	63	1	35	11	18	26	151	106	411
10.30-11.00	55	4	28	14	30	29	174	100	434
11.00-11.30	56	7	32	12	29	17	153	76	382
11.30-12.00	72	6	30	26	18	31	138	94	415
12.00-12.30	53	0	29	20	15	24	174	74	389
12.30-13.00	58	6	52	12	12	45	196	82	463
13.00-13.30	56	8	31	17	17	24	168	61	382
13.30-14.00	40	5	54	16	23	26	140	73	377
14.00-14.30	49	1	35	15	22	20	177	67	386
14.30-15.00	44	8	51	16	24	24	155	94	416
15.00-15.30	49	2	34	20	21	19	148	70	363
15.30-16.00	52	7	53	13	18	37	154	77	411
16.00-16.30	50	2	43	21	29	29	172	71	417
16.30-17.00	49	5	38	12	15	24	144	84	371
17.00-17.30	48	5	43	37	25	24	177	99	458
17.30-18.00	52	7	43	25	26	46	214	84	497
18.00-18.30	35	6	23	24	14	23	149	83	357
18.30-19.00	41	6	20	16	28	35	144	89	379
Total	1168	126	894	406	459	624	3552	1989	9218

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 31-08-2008 Weather : Sunny

Road Name : Dhaka-Chittagong Highway Traffic Direction : From Chittagong To : Dhaka

Station: City Gate Supervisor : Babu Surveyor : Titu, Robin, Hasan

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	23	6	33	7	11	9	60	41	190
7.30-8.00	22	3	38	17	18	14	71	69	252
8.00-8.30	20	3	42	25	15	24	110	97	336
8.30-9.00	26	8	43	33	17	30	139	129	425
9.00-9.30	29	2	49	28	13	31	169	163	484
9.30-10.00	24	9	46	17	17	41	199	170	523
10.00-10.30	32	8	48	17	10	31	209	155	510
10.30-11.00	37	8	51	19	20	20	165	164	484
11.00-11.30	53	10	48	20	34	50	200	177	592
11.30-12.00	26	9	34	12	20	27	145	100	373
12.00-12.30	28	4	36	22	23	33	244	143	533
12.30-13.00	31	7	43	15	27	35	202	106	466
13.00-13.30	23	7	29	17	14	31	168	91	380
13.30-14.00	53	18	53	19	22	19	202	100	486
14.00-14.30	29	18	36	8	29	54	212	113	499
14.30-15.00	46	16	46	20	23	26	142	88	407
15.00-15.30	55	13	47	30	26	43	202	85	501
15.30-16.00	43	8	41	19	33	48	197	113	502
16.00-16.30	64	12	50	26	23	27	177	133	512
16.30-17.00	48	6	39	23	17	44	242	121	540
17.00-17.30	58	5	41	20	26	42	201	114	507
17.30-18.00	69	13	41	26	25	40	166	140	520
18.00-18.30	54	6	30	28	14	38	167	106	443
18.30-19.00	61	10	30	32	18	36	169	100	456
Total	954	209	994	500	495	793	4158	2818	10921

Appendix 2.3-4

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 01-09-2008 Weather : Sunny

Road Name : Arakan Road Traffic Direction : From Chittagong To : Cox's Bazar

Station: Near (West) Kaptai Road Starting Point Supervisor : Rashed Surveyor : Raihan, Samrat, Rashed

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	6	2	80	3	6	9	58	21	185
7.30-8.00	10	3	87	4	1	4	96	58	263
8.00-8.30	11	7	69	16	2	20	162	132	419
8.30-9.00	7	2	51	14	2	19	185	109	389
9.00-9.30	9	5	42	12	5	12	146	103	334
9.30-10.00	7	5	44	22	8	13	239	154	492
10.00-10.30	6	9	49	12	6	19	215	146	462
10.30-11.00	1	4	56	10	2	14	221	123	431
11.00-11.30	11	9	48	9	3	19	271	177	547
11.30-12.00	12	9	46	13	2	13	244	156	495
12.00-12.30	7	7	39	16	12	10	279	187	557
12.30-13.00	13	3	40	33	4	13	250	144	500
13.00-13.30	14	5	30	25	14	9	265	149	511
13.30-14.00	15	7	41	11	12	18	320	182	606
14.00-14.30	13	5	44	11	6	9	260	121	469
14.30-15.00	12	6	44	6	10	20	281	136	515
15.00-15.30	12	7	56	12	7	20	332	135	581
15.30-16.00	15	7	42	12	10	17	226	108	437
16.00-16.30	28	6	47	12	3	16	256	152	520
16.30-17.00	20	12	62	15	10	20	346	226	711
17.00-17.30	22	25	82	14	8	14	330	248	743
17.30-18.00	17	9	31	8	2	11	290	312	680
18.00-18.30	8	14	39	7	4	14	280	259	625
18.30-19.00	12	16	40	9	8	18	260	298	661
Total	288	184	1209	306	147	351	5812	3836	12133

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 01-09-2008 Weather : Sunny

Road Name : Arakan Road Traffic Direction : From Cox's Bazar To : Chittagong

Station: Near (West) Kaptai Road Starting Point Supervisor : Titu Surveyor : Babu, Mostafa, Sajal

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	8	2	77	9	6	7	89	89	287
7.30-8.00	5	2	98	17	2	11	138	186	459
8.00-8.30	3	3	62	9	2	21	315	327	742
8.30-9.00	6	4	53	14	1	5	170	184	437
9.00-9.30	6	2	50	4	5	9	233	177	486
9.30-10.00	4	4	45	6	5	13	168	175	420
10.00-10.30	11	3	36	11	12	18	228	93	412
10.30-11.00	4	0	47	4	3	15	190	119	382
11.00-11.30	8	4	50	5	6	16	274	229	592
11.30-12.00	4	1	46	9	8	16	223	159	466
12.00-12.30	6	1	54	18	6	14	281	160	540
12.30-13.00	12	1	45	13	10	10	233	166	490
13.00-13.30	9	2	40	11	2	8	244	127	443
13.30-14.00	8	0	44	6	10	5	186	101	360
14.00-14.30	9	5	42	18	2	14	186	127	403
14.30-15.00	7	9	58	5	10	7	193	80	369
15.00-15.30	5	6	40	8	10	17	235	113	434
15.30-16.00	18	2	44	16	6	21	207	124	438
16.00-16.30	11	7	49	25	7	7	226	112	444
16.30-17.00	14	6	40	5	16	26	192	82	381
17.00-17.30	12	4	64	17	10	7	282	148	544
17.30-18.00	20	2	48	10	5	23	226	155	489
18.00-18.30	37	14	77	24	8	30	236	165	591
18.30-19.00	41	7	85	17	9	19	277	141	596
Total	268	91	1294	281	161	339	5232	3539	11205

Appendix 2.3-5

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 01-09-2008 Weather : Sunny

Road Name : Chittagong-Cox's Bazar Road Traffic Direction : From Chittagong To : Cox's Bazar

Station: Shah Amanat Bridge Supervisor : Shibly Surveyor : Hasan, Masum, Shanu

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	3	1	17	7	6	4	32	30	100
7.30-8.00	0	4	32	17	5	4	39	43	144
8.00-8.30	2	10	41	25	12	7	56	55	208
8.30-9.00	1	2	28	24	20	15	51	57	198
9.00-9.30	1	6	32	20	17	15	53	52	196
9.30-10.00	4	4	32	21	20	15	79	75	250
10.00-10.30	2	10	33	30	15	11	96	91	288
10.30-11.00	2	8	29	27	17	11	83	87	264
11.00-11.30	2	10	37	24	15	10	80	83	261
11.30-12.00	2	8	38	22	11	15	85	91	272
12.00-12.30	3	8	36	21	12	11	93	95	279
12.30-13.00	5	7	27	26	12	7	87	69	240
13.00-13.30	5	13	37	20	16	17	107	105	320
13.30-14.00	5	6	31	20	8	6	100	107	283
14.00-14.30	0	8	28	25	8	10	117	91	287
14.30-15.00	2	10	32	32	15	6	111	98	306
15.00-15.30	2	13	33	29	18	14	117	132	358
15.30-16.00	0	5	38	27	12	14	150	137	383
16.00-16.30	2	1	43	43	13	12	144	111	369
16.30-17.00	1	2	53	40	20	9	112	81	318
17.00-17.30	2	3	31	27	17	11	129	111	331
17.30-18.00	4	10	37	31	15	11	127	120	355
18.00-18.30	4	7	31	20	13	6	117	98	296
18.30-19.00	1	4	30	19	10	9	110	98	281
Total	55	160	806	597	327	250	2275	2117	6587

Chittagong City Ring Road Project Under JBIC SAPROF Study

Daily Traffic Count Data

Survey Date : 01-09-2008 Weather : Sunny

Road Name : Chittagong-Cox's Bazar Road Traffic Direction : From Cox's Bazar To : Chittagong

Station: Shah Amanat Bridge Supervisor : Shibly Surveyor : Robin, Shammi, Srabon

Time	1 Truck	2 Small Truck	3 Bus	4 Microbus	5 Jeep/Utility Vehicle	6 Car	7 Three Wheeler	8 Non-Motor Vehicle	Total
7.00-7.30	0	1	19	16	4	3	39	34	116
7.30-8.00	2	6	34	19	12	4	53	73	203
8.00-8.30	1	2	39	19	13	3	46	95	218
8.30-9.00	1	0	33	30	20	4	54	98	240
9.00-9.30	0	3	48	37	15	6	90	100	299
9.30-10.00	2	5	33	32	20	13	74	115	294
10.00-10.30	1	4	43	36	11	4	96	108	303
10.30-11.00	3	5	41	26	26	10	98	120	329
11.00-11.30	5	4	37	25	16	12	88	82	269
11.30-12.00	6	8	35	23	14	9	98	87	280
12.00-12.30	4	8	36	24	18	13	99	69	271
12.30-13.00	5	9	43	21	12	9	114	87	300
13.00-13.30	4	14	58	29	17	14	104	92	332
13.30-14.00	11	9	30	24	9	8	89	66	246
14.00-14.30	4	6	38	29	7	10	81	74	249
14.30-15.00	4	14	58	29	17	14	104	87	327
15.00-15.30	5	9	34	27	11	12	92	51	241
15.30-16.00	8	6	30	28	15	11	100	65	263
16.00-16.30	4	6	28	28	22	9	95	96	288
16.30-17.00	3	8	23	20	15	8	141	110	328
17.00-17.30	4	9	39	26	16	13	117	90	314
17.30-18.00	8	10	40	32	16	20	155	111	392
18.00-18.30	8	11	31	19	18	18	137	159	401
18.30-19.00	7	9	50	16	14	21	159	138	414
Total	100	166	900	615	358	248	2323	2207	6917

Appendix 2.3-6 Origin – Destination Survey Sheet

Vehicle Origin-Destination Survey Format

Name of Road ..... Survey Location ..... Sheet No .....
Interviewer ..... Supervisor ..... Date .....

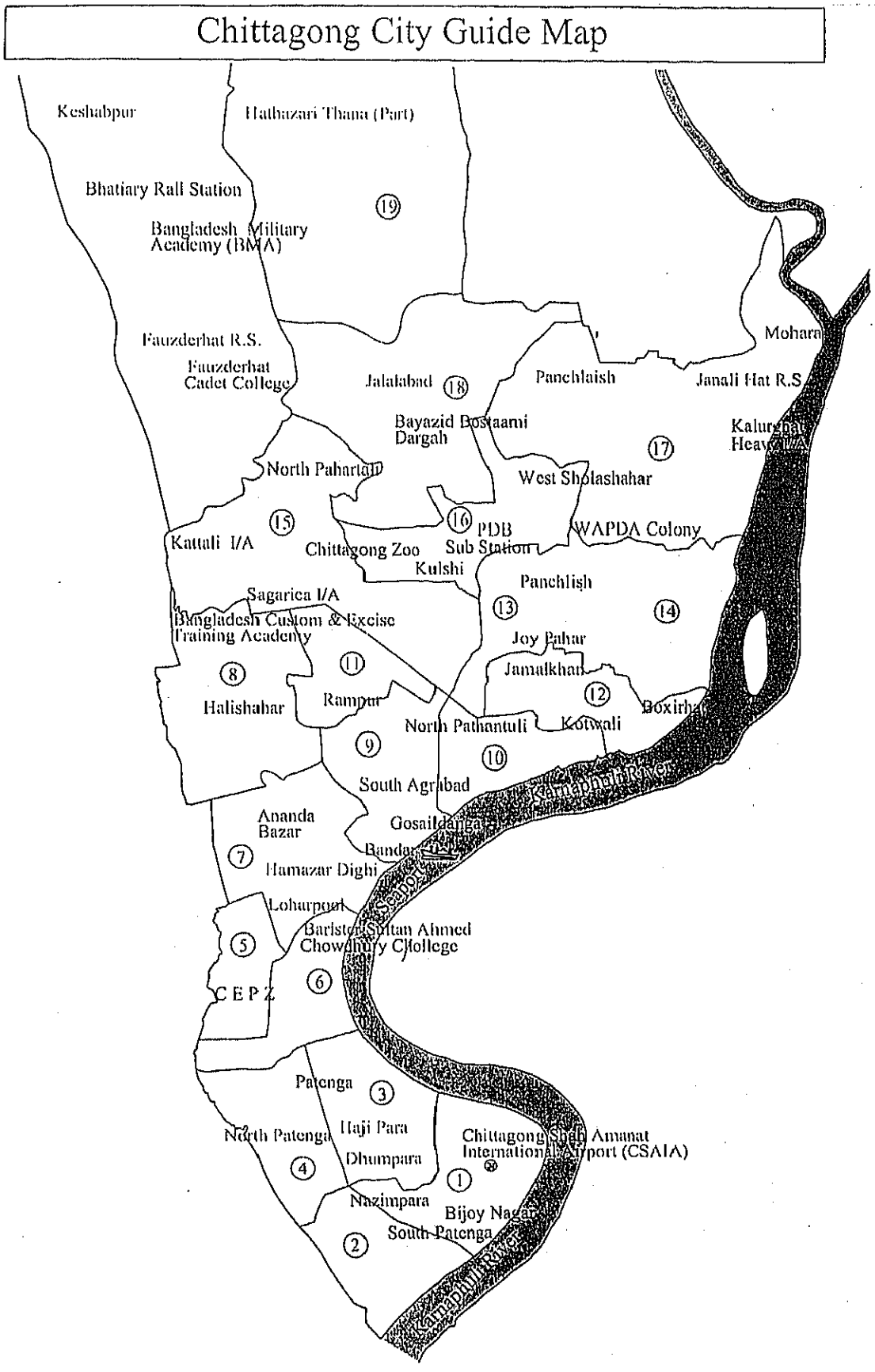
SL. No.	Time	Vehicle Class[a]	Origin		Destination		Purpose of Journey[b]	No. of Passengers	Commodity Categories[c]
			Place/Thana	District	Place/Thana	District			

a. Vehicle Class : 1 Truck 2. Small Truck 3. Bus 4. Micro Bus
5. Jeep/Utility Vehicle 6. Car 7. Three Wheeler 8. Non-motorized Vehicle

b. Purpose of Journey : 1. Work 2. Business 3. Official Tour 4. Personal Tour
5. Social 6. Shopping 7. Medical 8. Transport of Commodities
9. Commuter 10. Other (Specify)

c. Commodity Class : 1. Agricultural Products (rice, corn, wheat, vegetable, fruit etc.) 2. Forest Products (Log, timber, plywood etc.)
3. Fisheries Products (fresh fish, frozen fish, fish food) 4. Mineral Products (coal, iron, salt etc.)
5. Construction Material Metals (MS road, CI sheets, GP sheets etc). 6. Petroleum Products (diesel, petrol, octane etc.)
7. Construction Material (sand, gravel, stone, brick, asphalt, re-rolling bar, etc.)
8. Grocery (flour, sugar, edible oil, etc.) 9. Machinery and Equipment 10. Electronic Goods (radio, TV, fridge etc.)
11. Consumer Goods (cloth, garments, shoes, etc) 12. Jute and Jute Goods
13. Hide, Skin and Leather 14. Other Goods (Specify)

Appendix 2.3-7 Zone Map of Origin – Destination Survey



Appendix 2.3-8 Zone List of Origin – Destination Survey

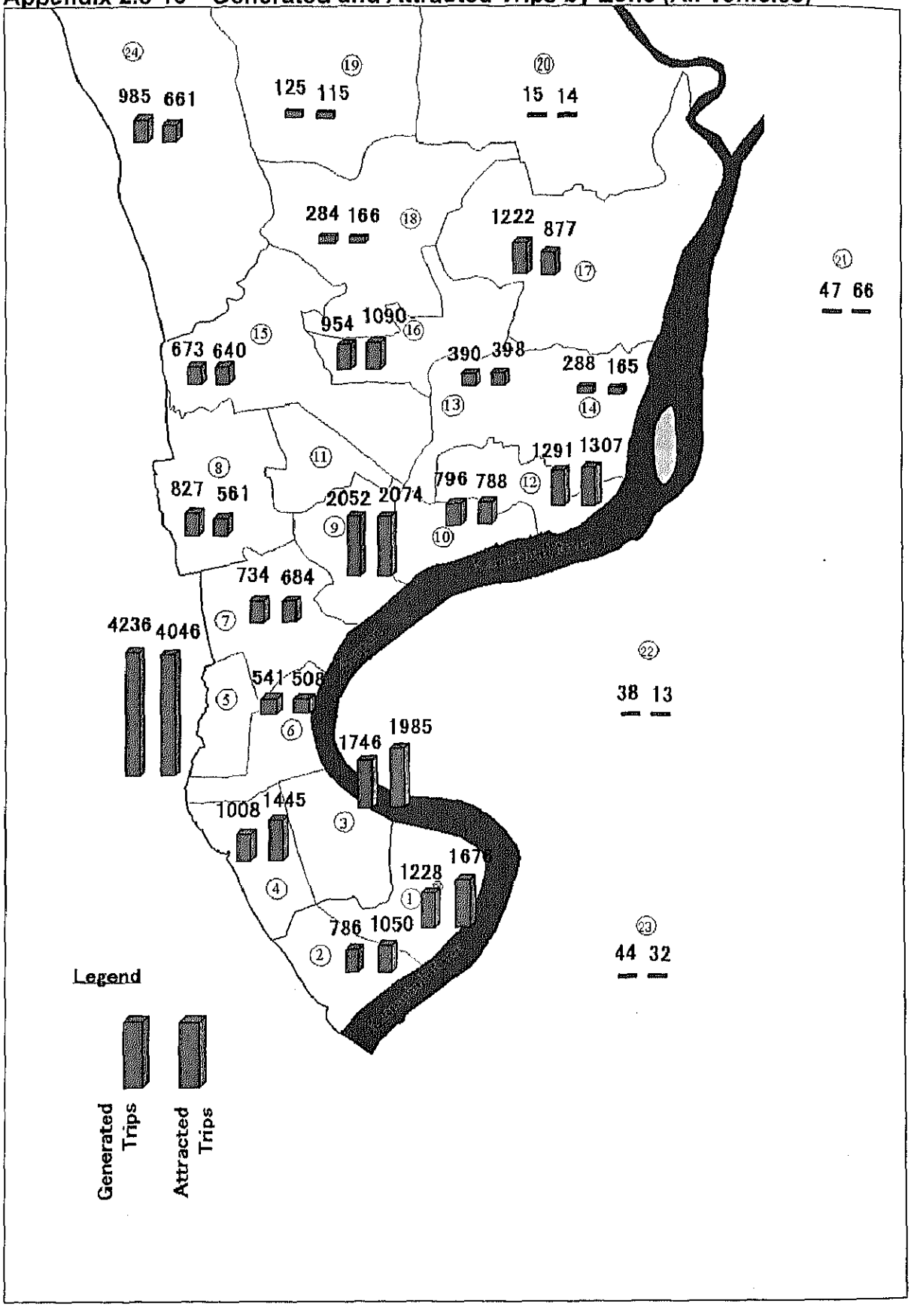
PROPOSED ZONING OF CHITTAGONG CITY AND AREAS BEYOND THE CITY

Zone No.	Wards Included	Popular Places or Facilities
A. Chittagong City		
1	Ward 41 (South Patenga)	Chittagong International Airport
2	South Patenga (West)	Patenga Naval Academy, Patenga Sea Beach
3	North Patenga (East)	Patenga Industrial Area, Patenga
4	Ward 40, North Patenga (West)	Patenga Combined Res. Area
5	Ward 39, South Halishahar (West)	Chittagong EPZ (CEPZ)
6	South Halishahar (East)	Navy Colony, Barister Sultan Ahmed College
7	Ward 37, 38, South Middle Halishahar	Ananda Bazar, Yasin Mistrir Haat, Natun Bazar
8	Ward 11, 26; North Halishahar	Halishahar Thana, Residential Area, Chittagong Divisional Stadium
9	Ward 24, 27, 36; North and South Agrabad	Double Mooring Thana, Residential Area, WAPDA School and College
10	Ward 23, 28, 29, 30, 31, 33, 34, North Pathantuli, Pathantuli, Firingi Bazar, etc.	Hotel Agrabad, Bangladesh Betar, Chittagong Rail Station, Kadamtali Bus Terminal, etc.
11	Ward 12, 25, Pahartali, Lalkhan Bazar, Rampur, etc.	Hazi Camp, Hazrat Shah Sufi Monirullah Mazar Sharif, Dhaka Trunk Road
12	Ward 19, 20, 21, 22, 32, Jamal Khan, Enayet Bazar, Anderkilla, etc.	Dewan Bazar, Kotwali Thana, Ctg. Helipad, Enayet Bazar
13	Ward 15, 16, Panchlaish, Chawk Bazar, etc.	Chawk Bazar, Joy Pahar, Chittagong Govt. College, Panchlaish Thana
14	Ward 06, 17, 18, Bakalia, East Sholashahar, etc.	Shaha Amanat Bridge on Karnafuly River, Bakalia Thana.
15	Ward 09, 10, Pahartali, Kattali, Sagarica, etc.	Foy's Lake, Sagarica Industrial Area, Kattali Industrial Area, Pahartali Thana
16	Ward 07, 08, Khulshi, Shulokbahar, etc.	Holy Crescent Hospital, Sholoshahar Railway Station, Khulshi Thana
17	Ward 03, 04, 05, Chandgaon, Panchlaish, Mohara, etc.	Chandgaon Bus Terminal, Kalurghat Heavy Industrial Area, Chandgaon Residential Area, Chandgaon Thana, Kalurghat Rail Cum Road Bridge over Kanarfuly River
18	Ward 02, Bayazid Bostami, Jalalabad, etc.	BSCIC Shilpa Nagar, Bayazid Bostami Dargah, Cantonment Public School and College, Bayazid Bostami Thana
19	Ward 01, Hathazari Thana, etc.	Chittagong Cantonment, Cantonment Railway Station, Chowdhury Haat Railway Station, Hathazari Thana (Part), Nachni Khola Forest, South Pahartali, etc.
B. Areas Outside Chittagong City		
20	Khagrachhari District Areas	-
21	Rangamati District Areas	-
22	Bandarban District Areas	-
23	Cox's Bazar District Areas	-
24	Feni, Noakhali, Comilla, Chandpur, Sylhet, Dhaka Areas and Beyond	-

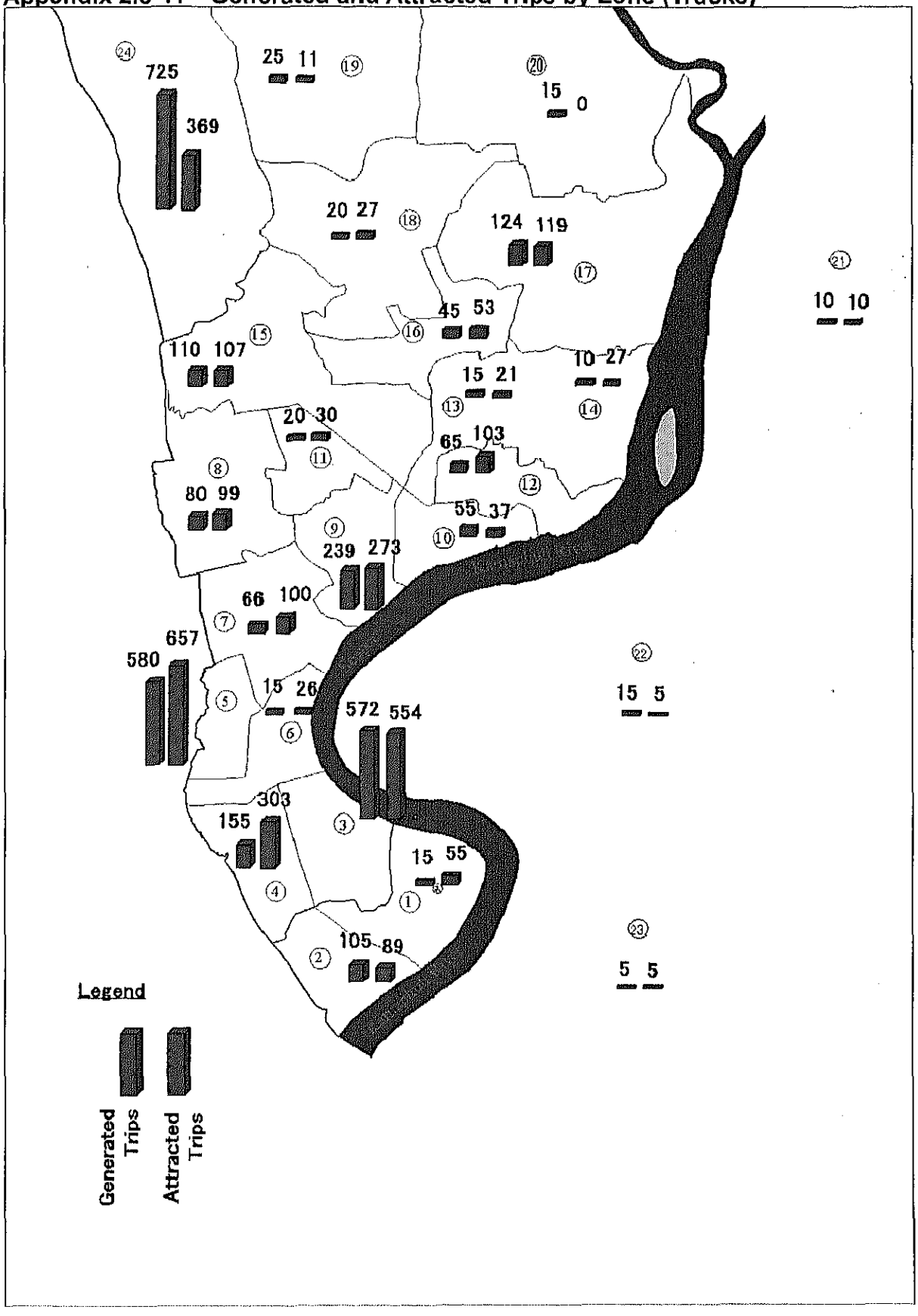
Appendix 2.3-9 O-D Table (All Vehicles)

O\D	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	99	Total
1	0	0	0	0	38	0	14	55	153	105	0	165	57	15	65	113	132	21	68	8	56	0	21	121	21	1228
2	6	5	25	5	76	0	6	39	32	50	11	152	13	15	35	47	225	0	0	0	0	0	0	44	0	786
3	17	5	0	18	6	8	59	37	241	120	24	281	121	40	163	197	134	11	11	0	5	13	5	188	42	1746
4	0	6	11	0	29	5	11	77	179	73	57	147	39	11	105	65	85	11	0	0	0	0	0	78	19	1008
5	53	6	48	27	202	32	262	267	1018	286	130	393	136	84	221	580	215	56	19	0	5	0	0	196	0	4236
6	0	6	28	10	37	0	30	19	127	71	24	65	21	0	27	19	45	0	0	0	0	0	0	6	6	541
7	23	17	43	84	216	22	39	13	72	47	26	34	11	0	13	26	24	5	0	6	0	0	0	13	0	734
8	132	37	146	93	313	44	5	16	16	0	0	0	0	0	6	19	0	0	0	0	0	0	0	0	0	827
9	171	121	321	269	876	104	87	5	32	11	0	13	0	0	0	13	11	6	0	0	0	0	6	0	6	2052
10	98	122	98	150	218	45	43	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	5	0	796
11	64	32	18	35	120	55	22	0	17	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	374
12	196	111	254	183	402	54	39	12	17	6	0	11	0	0	0	0	0	6	0	0	0	0	0	0	0	1291
13	54	38	85	36	115	32	6	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	390
14	35	88	36	23	84	6	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	288
15	140	71	70	78	208	38	10	0	35	0	6	0	0	0	0	11	6	0	0	0	0	0	0	0	0	673
16	171	43	133	97	423	30	28	0	24	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	954
17	217	225	265	163	270	11	12	6	31	6	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	1222
18	51	22	53	28	86	6	11	0	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	284
19	66	16	10	0	17	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	125
20	0	0	0	0	5	5	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	15
21	29	0	5	0	5	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47
22	22	0	5	0	6	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	38
23	31	0	5	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44
24	100	68	321	146	294	0	0	15	5	0	11	20	0	0	5	0	0	0	0	0	0	0	0	0	0	985
99	0	11	5	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	32
Total	1676	1050	1985	1445	4046	508	684	561	2074	788	300	1307	398	165	640	1090	877	116	115	14	66	13	32	661	105	20716

Appendix 2.3-10 Generated and Attracted Trips by Zone (All Vehicles)



Appendix 2.3-11 Generated and Attracted Trips by Zone (Trucks)



QUESTIONNAIRE
Concerning the Construction of the Chittagong City Ring Road

The Special Assistance for Project Formation for the Chittagong City Ring Road Project, organized with the financial support of the Japan Bank for International Cooperation (JBIC), is currently carrying out a study concerning the potential construction of the Coastal Road and the Karnaphuli River Road described in Appendixes 1 and 2. This questionnaire was prepared to obtain the views of Chittagong's local government agencies and private corporations concerning the necessity for these two new roads and the likely impacts of their construction.

Please answer the questions below and return the completed questionnaire to us at your earliest convenience. For your information, responses to this questionnaire will be used solely for the purposes of the above-mentioned JBIC study. Furthermore, please be assured that no mention will be made in the questionnaire results of the specific names of the government agencies and private corporations responding to this questionnaire.

Coastal Road Outline (see Appendix 1 for further details)
The planned route of the Coastal Road runs from Patenga Sea Beach at the mouth of the Karnaphuli River to Pahartali (or Fouzderhat), running along the existing coastal embankment. Access roads linking the Coastal Road with the M.A. Aziz Road in the vicinity of the Chittagong EPZ, the Agrabad Access Road in the Halishahar District, and the Dhaka-Chittagong Highway at Pahartali (or Fouzderhat) are also planned. The Road will form a part of the Chittagong City Ring Road.

Karnaphuli River Road Outline (see Appendix 2 for further details)
The planned route of the Karnaphuli River Road starts from the Kalurghat Bridge area, intersects the New Shah Amanat Bridge along the way, and ends at the intersection between the Sheik Mujib Road and the Double Mooring Road in the Agrabad District. The route runs more or less along the western bank of the Karnaphuli River. The Road will also form a part of the Chittagong City Ring Road.

Date of response: _____
Name of your organization: _____

Please answer the **QUESTIONS** below.

1. Chittagong City Ring Road

1-1 **QUESTION:** Do you know about the Chittagong City Ring Road plan? *Please place a ✓ mark in the appropriate box below.*
☐ Yes, very well ☐ Yes, a little ☐ No

1-2 **QUESTION:** The Chittagong City Ring Road will consist of the Coastal Road, the Karnaphuli River Road, the Outer Ring Road and other roads. The idea is to encircle the city's built-up area in order to alleviate traffic congestion in the city. Do you think this plan/concept is a good one? *Please place a ✓ mark in the appropriate box below.*
☐ Yes ☐ Not very much ☐ No ☐ Don't know

2. Roles and Benefits of Coastal Road and Karnaphuli River Road Construction Projects

2-1 Expectations toward Project Road Construction
QUESTION: If the Project Roads are built, do you think they will fulfill their expected roles?

a. Coastal Road: ☐ Yes, very much ☐ Yes, a little ☐ No ☐ Don't know
Please place a ✓ mark in the appropriate box above and cite your reasons below.
Why is that? _____

b. Karnaphuli River Road: ☐ Yes, very much ☐ Yes, a little ☐ No ☐ Don't know
Please place a ✓ mark in the appropriate box above and cite your reasons below.
Why is that? _____

2-2 Benefits of Project Road Construction
QUESTION: If the Project Roads are built, what benefits will they provide?

a. Coastal Road: _____

b. Karnaphuli River Road: _____

2-3 **QUESTION:** For which functions should the Project Roads be designed to perform in order to fulfill their expected roles?

a. Coastal Road:
☐ To divert traffic from existing roads
☐ To alleviate traffic congestion in the city
☐ To prevent disaster
☐ To enhance land use and urbanization
☐ To enhance tourism attractions
☐ Others (please specify) _____
(Please put your priority serial numbers in the above boxes)

b. Karnaphuli River Road:
☐ To divert traffic from existing roads
☐ To alleviate traffic congestion in the city
☐ To prevent disaster
☐ To enhance land use and urbanization
☐ To enhance tourism attractions
☐ Others (please specify) _____
(Please put your priority serial numbers in the above boxes)

3. Coordination with Other Development Plans

3-1 **QUESTION:** Coordination with what other **road development plans** is important in the construction of the Project Roads? *Please cite below the names of the road development plans and the points on which coordination should be achieved.*

a. Coastal Road
Road development plan: _____
Coordination points: _____

b. Karnaphuli River Road
Road development plan: _____
Coordination points: _____

3-2 **QUESTION:** Coordination with what **urban development plans** is important in the construction of the Project Roads? *Please cite below the names of the urban development plans and the points on which coordination should be achieved.*

a. Coastal Road
Urban development plan: _____
Coordination points: _____

b. Karnaphuli River Road
Urban development plan: _____
Coordination points: _____

3-3 **QUESTION:** Coordination with **disaster prevention plans and seaport development plans** is also considered important in the Project Road construction. Please cite any disaster prevention plans or seaport development plans that should be taken into consideration, and describe the points on which coordinated should be achieved.

a. Coastal Road
Disaster prevention/seaport development plans: _____
Coordination points: _____

b. Karnaphuli River Road
Disaster prevention/seaport development plans: _____
Coordination points: _____

4. Project Road Facilities and Systems

Diverse measures can be thought of concerning the Project Road facilities and systems. Please answer the following questions to help us determine the best measures to be adopted for the Project Road facilities and systems.

4-1 **QUESTION:** Aesthetic considerations are important when designing a highway. What specific measures should be adopted concerning the aesthetic designs of the Project Roads?

a. Coastal Road: _____
_____

b. Karnaphuli River Road: _____
_____

4-2 **QUESTION:** Measures for preventing traffic accidents must be given careful consideration when designing a highway. What specific accident prevention measures do you think are important for the Project Roads to have?

a. Coastal Road: _____
_____

b. Karnaphuli River Road: _____
_____

4-3 **QUESTION:** The Project Roads will be built along either a river or a seacoast and therefore must be provided with disaster prevention measures against high tides and flooding. What specific disaster prevention systems should the Project Roads have?

a. Coastal Road: _____
_____

b. Karnaphuli River Road: _____
_____

5. If you have any other views or comments concerning the Project Road construction, please elaborate below.

_____
_____

Thank you very much for your cooperation.

JBIC Special Assistance for Project Formation (SAPROF) for
Chittagong City Ring Road Project
Team Leader: Kazuhiro Hasegawa (Mob: 01732-353137)

QUESTIONNAIRE
Concerning the Construction of the Chittagong City Ring Road

The Special Assistance for Project Formation (SAPROF[1]) for the Chittagong City Ring Road Project, organized with the financial support of the Japan Bank for International Cooperation (JBIC[2]), is currently carrying out a study concerning the potential construction of the Coastal Road and the Kamaphuli River Road described in Appendix. This questionnaire was prepared to obtain the views of Chittagong's local government agencies and private corporations concerning the necessity for these two new roads and the likely impacts of their construction.

Please answer the questions below and return the completed questionnaire to us at your earliest convenience. For your information, responses to this questionnaire will be used solely for the purposes of the above-mentioned *JBIC study. Furthermore, please be assured that no mention will be made in the* questionnaire results of the specific names of the government agencies and private corporations responding to this questionnaire.

Coastal Road Outline (see Appendix for further details)

The planned route of the Coastal Road runs from Patenga Sea Beach at the mouth of the Kamaphuli River to Pahartali, running along the existing coastal embankment. Access roads linking the Coastal Road with the M.A. Aziz Road in the vicinity of the Chittagong EPZ; the Agrabad Access Road in the Halishahar District; and the Dhaka-Chittagong Highway at Pahartali are also planned. The Road will form a part of the Chittagong City Ring Road. The Coastal Road Project aims to strengthen existing embankment for disaster prevention in the road section along the Bay of Bengal.

Kamaphuli River Road Outline (see Appendix for further details)

The planned route of the Kamaphuli River Road starts from the Kalurghat Bridge area, intersects the New Shah Amanat Bridge along the way, and ends at the intersection between the Sheik Mujib Road and the Double Mooring Road in the Agrabad District. The route runs more or less along the western bank of the Kamaphuli River. The Road will also form a part of the Chittagong City Ring Road. The Kamaphuli River Road Project also aims to strengthen existing embankment for disaster prevention in the road section along the River.

Date of response:_____

Name of your corporation: _____

Please answer the QUESTIONS below.

[1]SAPROF: Studies conducted to review the contents of developing country projects on which the JBIC has received a formal or tentative request for Japanese ODA.
[2]JBIC: The Japan Bank for International Cooperation is a Japanese governmental financing institution that provides loans and other assistance to developing countries to promote their socio-economic development and growth, thereby contributing to the stability of the international financial order.

1. Road Conditions in Chittagong Metropolitan Area

1-1 **QUESTION:** Are there spots or areas in the Chittagong Metropolitan Area where road transport conditions are unsatisfactory (congested, hazardous, etc.)? *Please place a ✓ mark in the appropriate box below.*

☐ *Yes, many* ☐ *Yes, a few* ☐ *No*

1-2 **QUESTION:** *Please answer the following question if you answered "yes, many" or "yes, a few" to Question 1-1 above:* Which spots/areas do you feel have unsatisfactory road transport conditions? *Please specify below, giving road and area names.*

_____

1-3 **QUESTION:** Where and what types of roads should be constructed in the Chittagong Metropolitan Area in the future?

_____

_____

2. Chittagong City Ring Road

One of the roads currently being planned for Chittagong is the Chittagong City Ring Road. Please answer the following questions concerning this road:

2-1 **QUESTION:** Do you know about the Chittagong City Ring Road plan? *Please place a ✓ mark in the appropriate box below.*

☐ Yes, very well ☐ Yes, a little ☐ No

2-2 **QUESTION:** The Chittagong City Ring Road will consist of the Coastal Road, the Kamaphuli River Road, the Outer Ring Road and other roads. The idea is to encircle the city's built-up area in order to alleviate traffic congestion in the city. Is this road necessary? *Please place a ✓ mark in the appropriate box below.*

☐ Yes ☐ No ☐ Don't know

2-3 **QUESTION:** Do you think the plans (including concept) for the Chittagong City Ring Road are appropriate? *Please place a ✓ mark in the appropriate box below.*

☐ Yes ☐ Not very much ☐ No ☐ Don't know

- ☐ To divert traffic from existing roads
- ☐ To alleviate traffic congestion in the city
- ☐ To prevent disaster
- ☐ To enhance land use and urbanization
- ☐ To enhance tourism attractions
- ☐ Others (please specify) _____

c. **QUESTION:** If the Kamaphuli River Road is built, what benefits will it bring to your company and/or communities in Chittagong?

(company): _____

(communities): _____

d. **QUESTION:** If the Kamaphuli River Road is built, what adverse impacts (environmental or otherwise) will it have on your company and/or communities in Chittagong?

(company): _____

(communities): _____

3. Roles and Benefits of Coastal Road and Karnaphuli River Road Construction Projects

3-1 Coastal Road Construction Project

The Coastal Road, to be built along the Bay of Bengal (see Appendix), will help alleviate congestion on existing routes that provide access to central Chittagong from the Chittagong and Kamaphuli EPZs, the *Chittagong International Airport, and Chittagong Port.* It will also strengthen the existing embankment along the bay to help prevent damages from cyclones and other natural disasters.

a. **QUESTION:** Do you think the Coastal Road is necessary? *Please place a ✓ mark in the appropriate box below.*

☐ Yes ☐ No ☐ Don't know

b. **QUESTION:** If the Coastal Road is built, what roles should it fulfill? *Please enter appropriate numbers in the boxes below to indicate the order of importance of the roles to be fulfilled (starting with 1 as the most important).*

- ☐ To divert traffic from existing roads
- ☐ To alleviate traffic congestion in the city
- ☐ To prevent disaster
- ☐ To enhance land use and urbanization
- ☐ To enhance tourism attractions
- ☐ Others (please specify) _____

c. **QUESTION:** If the Coastal Road is built, what benefits will it bring to your company and/or *communities in Chittagong?*

(company): _____

(communities): _____

d. **QUESTION:** If the Coastal Road is built, what adverse impacts (environmental or otherwise) will it have on your company and/or communities in Chittagong?

(company): _____

(communities): _____

3-2 Kamaphuli River Road Construction Project

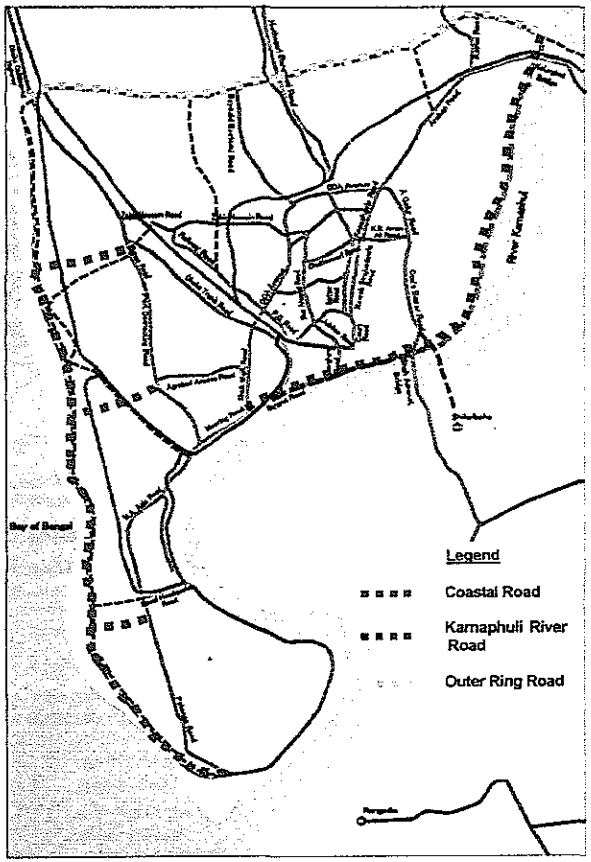
The Kamaphuli River Road, to be constructed along the Kamaphuli River (see Appendix), will alleviate congestion in the central urbanized area. The riverside embankment to be built in conjunction with the road will help prevent flooding and other natural disasters. The road is also anticipated to stimulate urban development in nearby areas.

a. **QUESTION:** Do you think the Kamaphuli River Road is necessary? *Please place a ✓ mark in the appropriate box below.*

☐ Yes ☐ No ☐ Don't know

b. **QUESTION:** If the Kamaphuli River Road is built, what roles should it fulfill? *Please enter appropriate numbers in the boxes below to indicate the order of importance of the roles to be fulfilled (starting with 1 as the most important).*

Appendix Coastal Road and Karnaphuli River Road Project



4. **Project Road Facilities and Systems**

Diverse measures can be thought of concerning the Project Road facilities and systems. Please answer the following questions to help us determine the best measures to be adopted for the Project Road facilities and systems.

4-1 **QUESTION:** Aesthetic considerations are important when designing a highway. What specific measures should be adopted concerning the aesthetic designs of the Project Roads?

a. Coastal Road: _____

_____

b. Karnaphuli River Road: _____

_____

4-2 **QUESTION:** Measures for preventing traffic accidents must be given careful consideration when designing a highway. What specific accident prevention measures do you think are important for the Project Roads to have?

a. Coastal Road: _____

_____

b. Karnaphuli River Road: _____

_____

4-3 **QUESTION:** The Project Roads will be built along either a river or a seacoast and therefore must be provided with disaster prevention measures against high tides and flooding. What specific disaster prevention systems should the Project Roads have?

a. Coastal Road: _____

_____

b. Karnaphuli River Road: _____

_____

5. **If you have any other views or comments concerning the Project Road construction, please elaborate below.**

_____

_____

Thank you very much for your cooperation.

JBIC Special Assistance for Project Formation (SAPROF)
for
Chittagong City Ring Road Project in CDA Office in Chittagong
Team Leader: Kazuhiro Hasegawa

Appendix 3.2-1 Results of Site Investigation

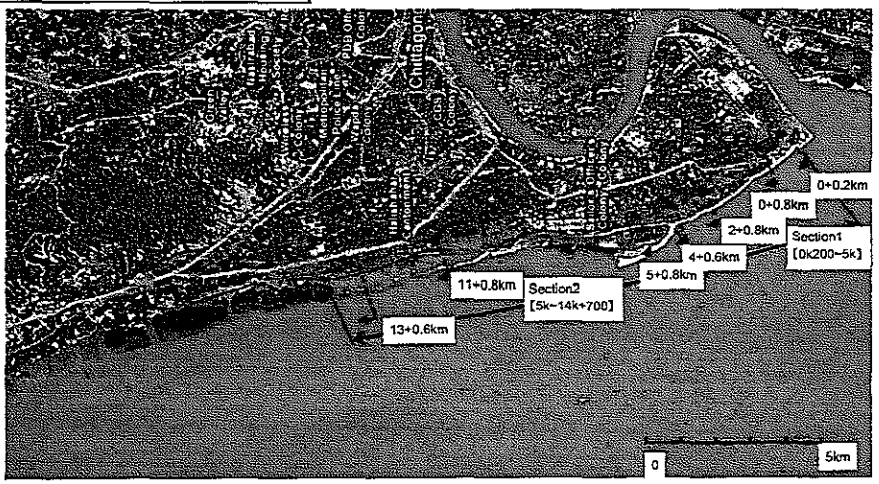
Sheet 3.2.1(a) Result of Investigation (1-1)

Coast Name	Chittagong Beach	Area Name	Around 0+0.2km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki
Plan								Institutional Situation	
								Outline of Embankment	Institutional Extends
									Type of Embankment: Gentle Slope-Type
									Date of Construction: 1996
								Physical Conditions	Coastal Accretion, Erosion: Accretion and Erosion
									Ground height at rear: Low
									Protective Population: N/A
								Existing Structure	Foundation Works: Concrete Block
									Seaward Slope Pavement: Planting Treatment
									Parapet: Nil
Cross Section									

Sheet 3.2-1 (a) Result of Investigation (1-2)

Coast Name	Chittagong Beach	Area Name	Around 0+0.2km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Location Map



Photo

1. Armoring Work on Crown

2. Seaward Slope Pavement

3. Seaward Slope Pavement

Institutional Condition

1.No pavement is provided for armoring work

2.Planting treatment is provided for seaward slope pavement

3.No serious problems are observed.

Sheet 3.2-1(b) Result of Investigation (1-1)

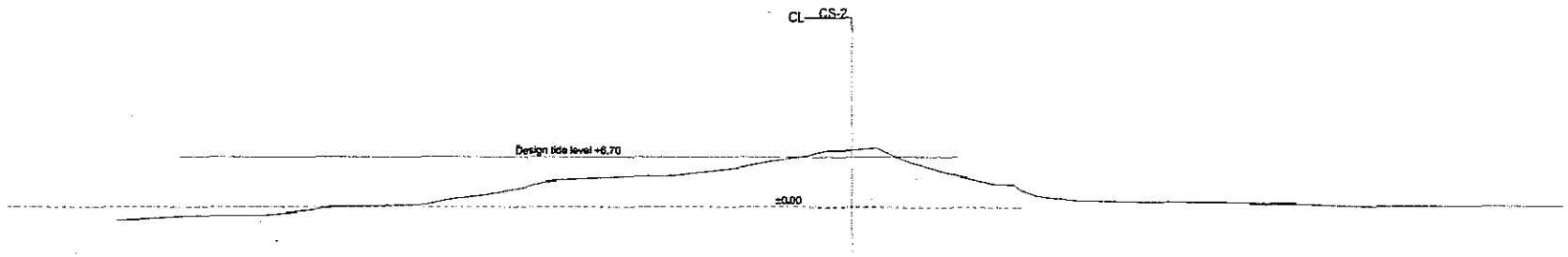
Coast Name	Chittagong Beach	Area Name	Around 0+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Plan

Institutional Situation

Outline of Embankment	Institutional Extends	
	Type of Embankment	Gentle Slope-Type
	Date of Construction	1996
Physical Conditions	Coastal accumulation or Erosion	accretion and erosion
	Ground Height at Rear	Low
	Protective Population	N/A
Existing Structure	Foundation Works	Concrete Block
	Seaward Slope Pavement	Planting Treatment
	Parapet	Nil

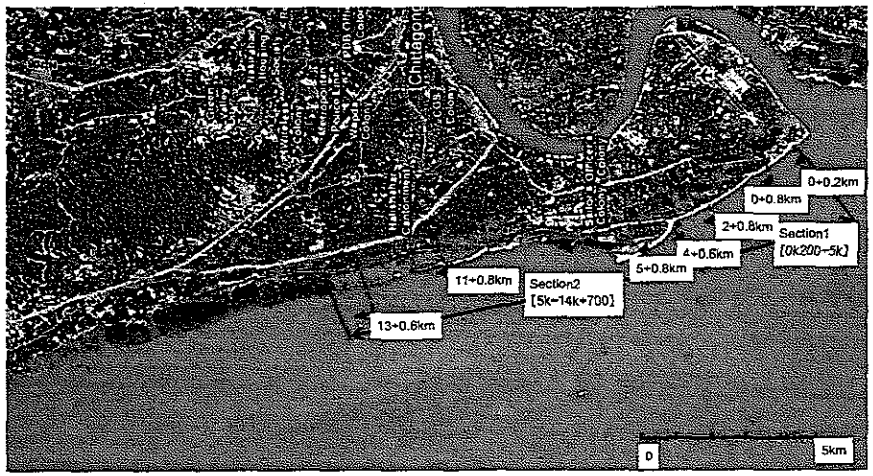
Cross Section



Sheet 3.2-1(b) Result of Investigation (1-2)

Coast Name	Chittagong Beac	Area Name	Around 0+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Location Map

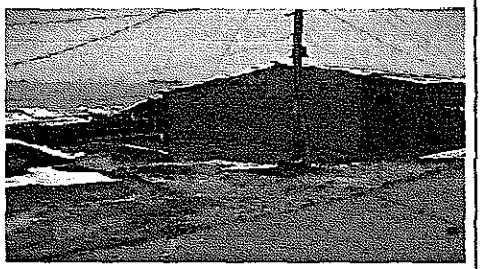


Institutional Condition

1. No pavement is provided for armoring work
2. Planting treatment is provided for seaward slope pavement
3. Kiosks are located on seaward slope pavement
4. Concrete block is provided for foot protection work.
5. No serious ploblems are observed

Photo

1. Armoring Work on



2. Seaward Slope

3. Kiosk

4. Kiosk

5. Foot Protection Works (High Water)

6. Foot Protection Works(Low Water)

Sheet 3.2-1(c) Result of Investigation (1-1)

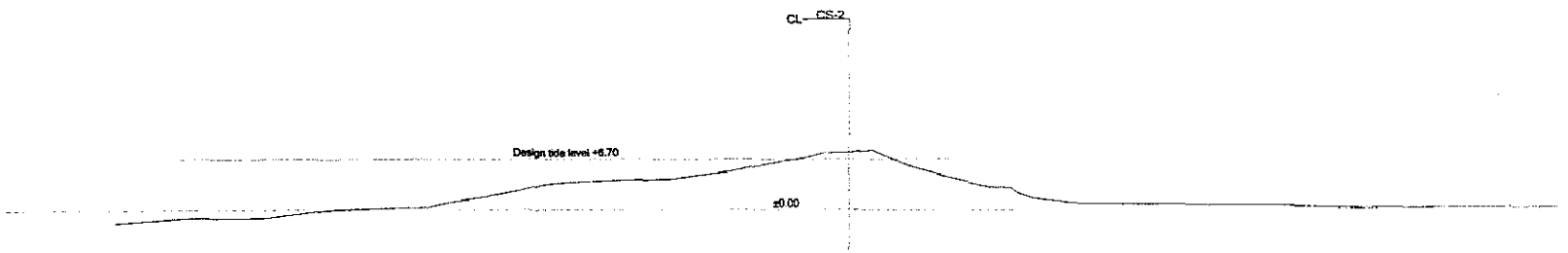
Coast Name	Chittagong Beach	Area Name	Around 2+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Plan

Institutional situation

Outline of Embankment	Institution Extends	
	Type of Embankment	Gentle Slope-Type
	Date of Construction	1996
Physical Conditions	Coastal Accumulation or Erosion	Accretion and Erosion
	Ground Height at Rear	Low
	Protective Population	N/A
Existing Structure	Foundation Works	Concrete Block
	Seaward Slope Pavement	Planting Treatment
	Parapet	Nil

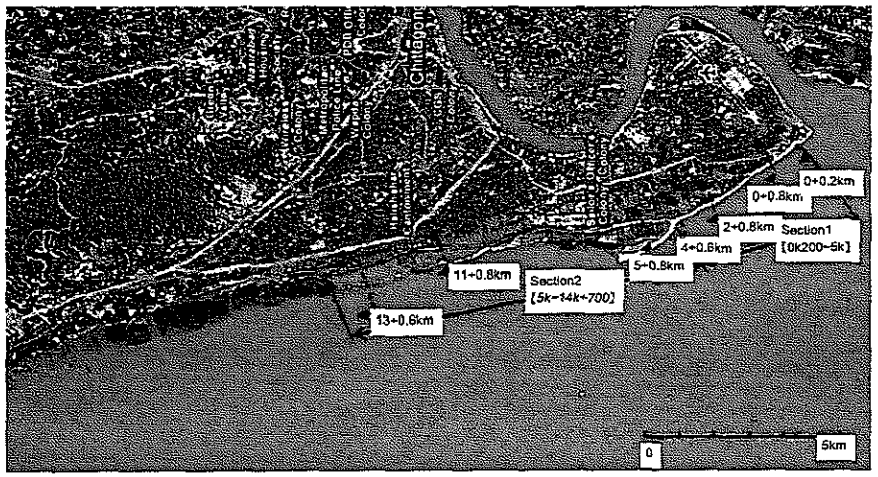
Cross Section



Sheet 3.2-1 (c) Result of Investigation (1-2)

Coast Name	Chittagong Coast	Area Name	Around 2+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

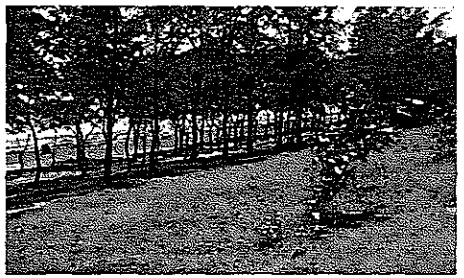
Location Map



Institutional Condition

1. Planting Treatment is provided for seaward slope pavement.
2. No pavement is provided for armoring work on crown.
3. Planting treatment is provided for seaward slope pavement.(wood)
4. Planting treatment is provided for landward slope pavement.(wood)
5. Concrete block is provided for foot protection work.
6. No serious damages are observed.

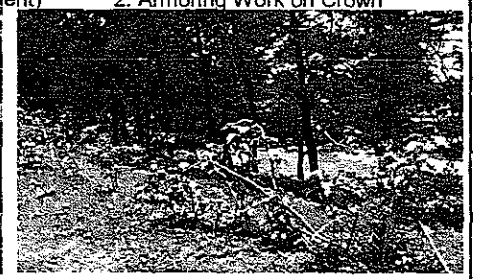
Photo



1.Seaward Slope Pavement (Planting Treatment)

2. Armoring Work on Crown

3. Seaward Slope Pavement(woods)



4. Landward Slope Pavement (wood)

5. Foot Protection Work (Low Water)

6. Foot Protection Works (Low Water)

Sheet 3.2-1(d) Result of Investigation (1-1)

Coast Name	*Chittagong Beach*	*Area Name*	*Around 4+0.6km*	*Institution Name*	*Embankment*	*Date of Investigation*	2008.6.24	Surveyor	Mr. Makoto Suzuki

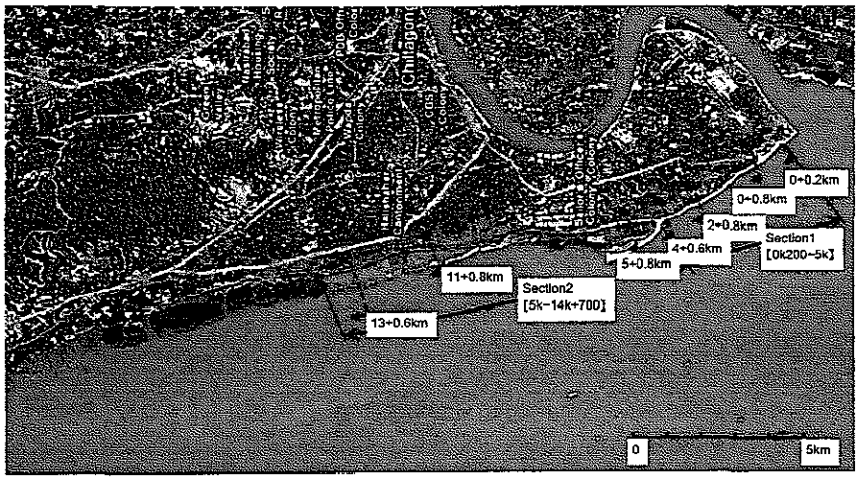
Plan	Institutional Situation		
	Outline of Embankment	Institutional Extends	
		Type of Embankment	Gentle Slope-Type
		Date of Construction	1996
	around conditions	Coastal Accumulation or Erosion	Accretion and Erosion
		Ground Height at Rear	Low
		Protective Population	
	Existing Structure	*Foundation Works*	*Concrete Block*
		Seaward Slope Pavemer	Planting Treatmen
		Parapet	Nil

Cross Section

Sheet 3.2-1(d) Result of Investigation (1-2)

Coast Name	Chittagong Beach	Area Name	Around 4+0.6km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Location Map



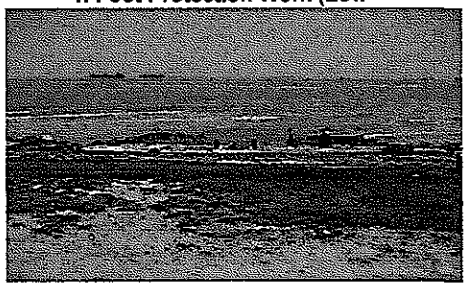
Institutional Condition

1. Concrete block is provided for foot protection work
2. Planting treatment is provided for seaward slope pavement
3. Drain is protected by concrete block.
4. Some concrete blocks are scattered on the beach

Photo

1. Foot Protection Work (Low

2. Foot Protection Works (Low Water)



3. Seaward Slope Pavement and Drain

Sheet 3.2-1(e) Result of Investigation (1-1)

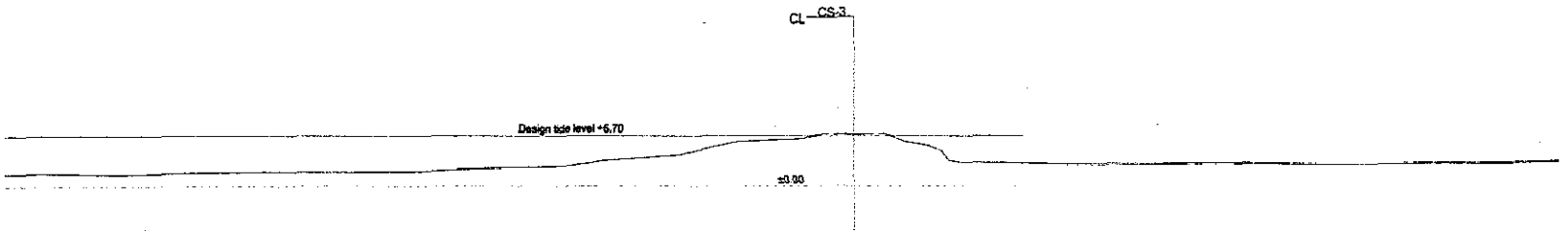
Coast Name	Chittagong Beach	Area Name	Around 5+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Plan

Institutional Situation

Outline of Embankment	Institution Extends	
	Type of Embankment	Gentle Slope-Type
	Date of Construction	1996
Physical Conditions	Coastal Accumulation or Erosion	Accretion and Erosion
	Ground Height at Rear	Low
	Protective Population	N/A
Existing Structure	Foundation Work	Concrete Block
	Seaward Slope Paveme	Planting Treatment
	Parapet	Nil

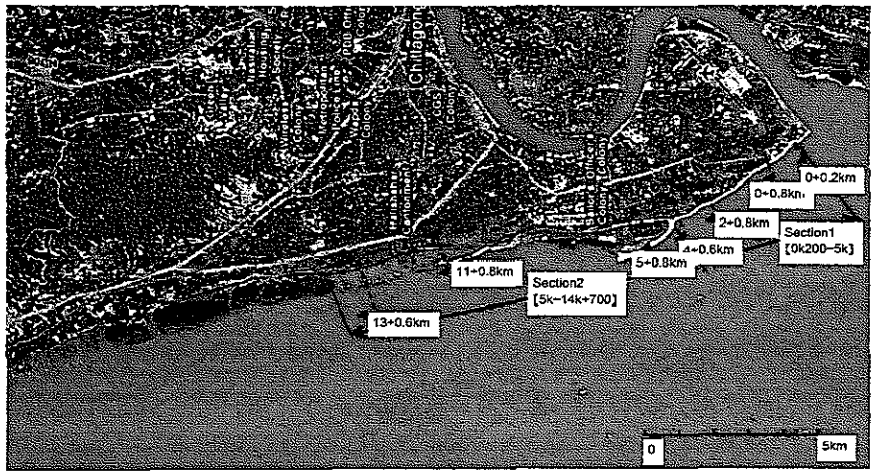
Cross Section



Sheet 3.2-1(e) Result of Investigation (1-2)

Coast Name	Chittagong Beach	Area Name	Around 5+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

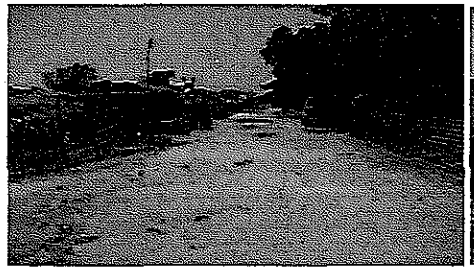
Location Map



Institutional Condition

1. Pavement is provided for armoring work on crown
2. Some houses are located illegally on the seaward slope pavement.
3. Planting treatment is provided for landward slope pavement

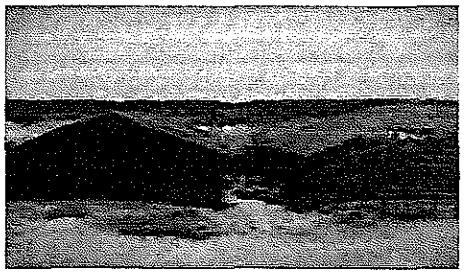
Photo



1. Armoring Work on Crown

2. Seaward Slope Pavement (Houses occupy land

3. Landward Slope Pavement (wood)



4. Seaward Slope Pavement (Houses occupy land

Sheet 3.2-1(f) Result of Investigation (1-1)

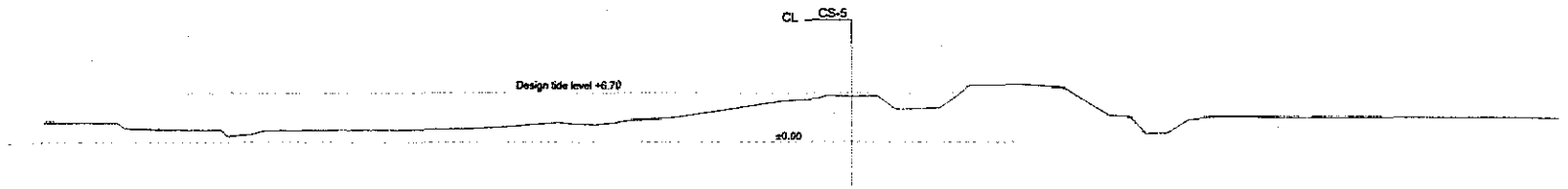
Coast Name	Chittagong Beach	Area Name	Around 11+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Plan

Institutional Situation

Outline of Embankment	Institution Extends	
	Type of Embankment	Gentle Slope-Type
	Date of Construction	1996
Physical Conditions	Coastal Accumulation or	Accretion and Erosion
	Ground Height at Rea	Low
	protective population	
Existing Structure	foundation works	Concrete Block
	seaward slope pavem	Planting Treatment
	parapet	Nil

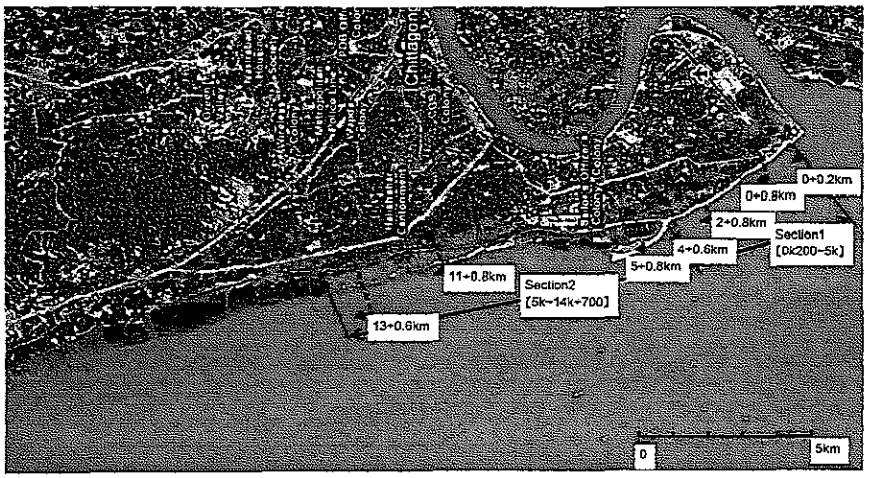
Cross Section



Sheet 3.2-1(f) Result of Investigation (1-2)

Coast Name	Chittagong Beach	Area Name	Around 11+0.8km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Location Map

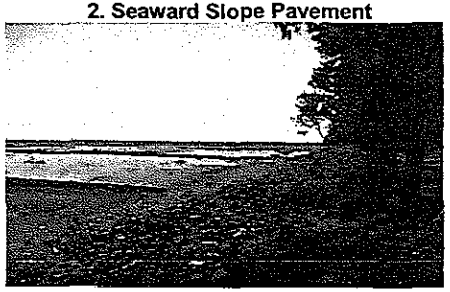


Photo

1.Seaward Slope

2. Seaward Slope Pavement

3. Armoring Work on Crown



4. Foot Protection Work

Institutional Condition

1. Planting treatment is provided for seaward slope pavement (wood).
2. No pavement is provided for armoring work
3. Gabion is placed as foot protection work
4. Planting treatment is provided for landward slope pavement(wood).
5. Tideland exists in front of the embankment.
6. No serious problems are observed.

Sheet 3.2-1(g) Result of Investigation (1-1)

Coast Name	Chittagong Beach	Area Name	Around 13+0.6km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

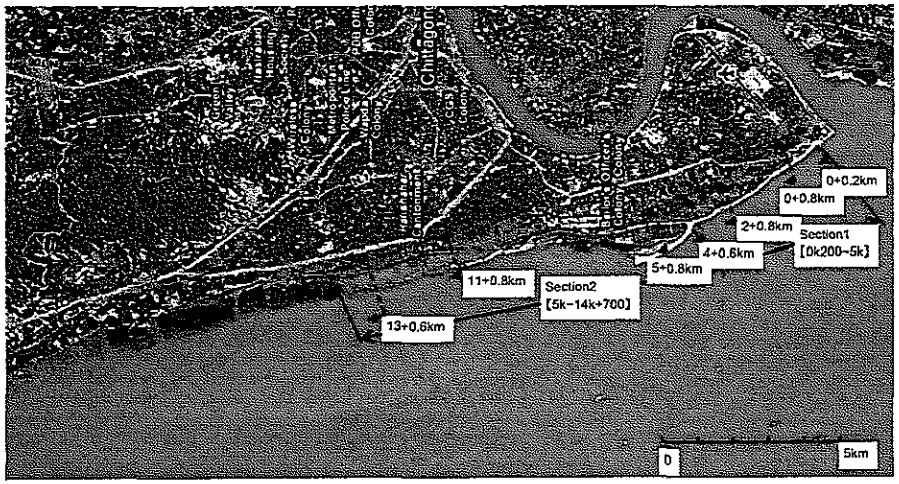
Plan	Institutional Situation		
	Outline of Embankment	Institution Extends	
		Type of Embankment	Gentle Slope-Type
		Date of Construction	1996
	Physical Conditions	Coastal Accumulation or Erosion	Accretion and Erosion
		Ground Height at Rear	Low
		Protective Population	N/A
	Existing Structure	Foundation Work	Concrete Block
		Seaward Slope Pavemen	Planting Treatment
		Parapet	Nil

Cross Section

Sheet 3.2-1(g) Result of Investigation (1-2)

Coast Name	Chittagong Beach	Area Name	Around 13+0.6km	Institution Name	Embankment	Date of Investigation	2008.6.24	Surveyor	Mr. Makoto Suzuki

Location Map



Institutional Condition

1. No pavement is provided for armoring work on crown on the section next to the toll road.

2. Some houses exist in front of the embankment.

3. Planting treatment is provided for seaward slope pavement (woods)

4. Existing water-course connects to the sea

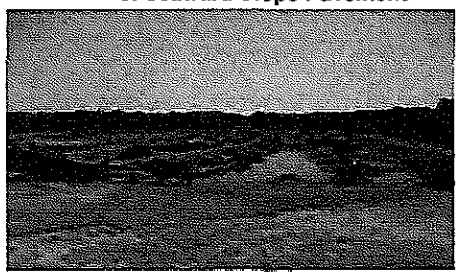
Photo

1. Armoring Work on Crown

2. Armoring Work on Crown

3. Seaward Slope Pavement

4. Seaward Slope Pavement



5. Water-Course

Appendix 3.2-2 Reference to the Design Wave Water Level and Wave

Coastal Embankment Rehabilitation Project,Phase2(DESIGN REPORT May 1993)
Based on Table 3.4: Cyclonic Surge Frequencies after [1], the high tide level with a return period of 50 years was calculated by interpolation, whereby the design water level (design tide level= = +6.70m was obtained.

Return Period (Years)	2.5	3.5	5	10	20	40	100
Water level (m PWD)	3.6	4.3	4.9	5.5	6.1	6.1	7.3

Table 3.4 : Cyclonic Surge Frequencies after [1]

Coastal Embankment Rehabilitation Project,Phase2(DESIGN REPORT May 1993)
Based on Table 3.6 Approximate near shore Significant Wave Heights, the significant wave height = 4.0m and Significant wave period = 9.0 sec were obtained by extrapolation.
Design conditions
(Calculation was made) according to:
water depth on the front of the embankment = - 1.0 m
design water level (Design tide level)=+6.70m, and
water depth = +6.70- (-1.00) = 7.70m.

Water Depth (m)	1.0	2.0	3.0	4.0	5.0	6.0
Nearshore Significant Wave Height (m)	0.8	1.50	2.10	2.70	3.3	3.6
Nearshore Significant Wave Period (s)	7	8	8.5	9	9	9

Table 3.6 Approximate Nearshore Significant Wave Heights

Appendix 3.2-3 Reference to the Estimating the Offshore Wave Height Equivalent

1) *Design conditions*

Design high tide level HHWL= +6.70m

Water depth for installation -1.00m

Water depth h= +6.70m - (-1.00m) =7.70 m

Offshore wave height equivalent H0'= 4.21m (Assuming)

Period T0= 9.00 sec

Offshore wavelength equivalent L0= 126.36m

Design wave $H_{1/3}$in= 4.00m

2) Offshore wave height equivalent

Design wave $H_{1/3}$	*Period T0* (sec)	*Water depth h(m)*	Offshore wave length L0(m)	*h/H0'*	*H0'/L0*	*Shoaling coefficient Ks**	$H_{1/3}/H0'$ Inside the breaker zone	*Offshore wave height equivalent H0'*
4.00	9.00	7.70	126.36	1.83	0.033	Inside the breaker zone	0.95	4.21

$H_{1/3}/H0'$= 0.95

H0'=$H_{1/3}$/ 0.95

= 4.00 / 0.95= 4.21 m

Assuming that the sea bottom slope 1/m = 1/100

$H_{1/3}$ = Ks×H0' is obtained from Fig. 4.3.12 (e).

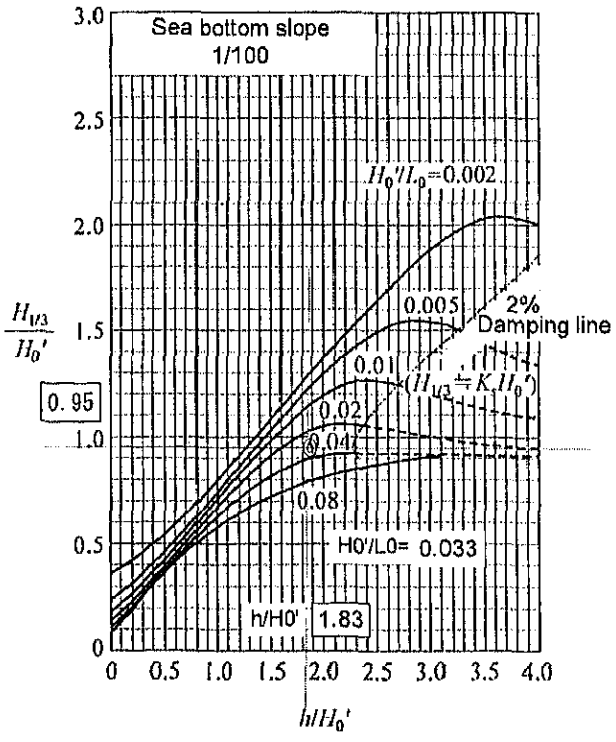


Fig. 4.3.12 (e) Calculation of significant wave height inside the breaker zone

Appendix3.3-1 Control Points of Feeder Road-2

	Objects	Contents
1	A lot of shops in the vicinity of the intersection with Port Connecting Road	• Route is selected nearly same with the current state of this area, permanent buildings are avoided, and temporary buildings are affected.
2	A mosque in the BR land after crossing a canal	• BR agrees to move the mosque.
3	Lands for widening are all properties of BR	• BR agrees with widening of the road into the BR property (vacant land).
4	A grave of a famous religionist in the BR land located in the middle of Halishahar Road	• Though a family maintains this grave, one of the member of the family said that the move of the grave is OK at the site meeting. One group of people from the family came to CDA next day and requested to avoid the movement of the grave. Then, the route passing through the either side of the grave is selected. This route is desirable for minimizing the land acquisition from BR property and similar type of road route with graves at the maiden islands is seen well in the trunk roads in Chittagong city.
5	A yard of cargo railway in the existing road corner	• BR requested that route should not affect the railway yard in spite of several wagons are derailed and left there for long time. On the other hand, BR allows using the vacant land located opposite side of the railway yard for the road.
6	Public Technical Institution is located adjoining the BR vacant land	• Route doesn't affect it so much, though the edge of the institution ground is cut across.
7	Main line of cargo railway	• BR doesn't demand a fly over to cross the cargo railway line that has only 12 numbers of cargo trains in both ways in each day. In case of a fly over crosses Port Access Road as well as the cargo railway, the fly over continues from Port Access Road to cargo railway and thus the length of the fly over becomes very long, and the route might affect the Technical Institute ground widely.
8	Port Access Road and a high–voltage power line	• Feeder Road-2 crosses Port Access Road, and, in addition, a high-voltage power line stretches over them. The height of a high-voltage power line is about 15m from the ground at the point of crossing. It is to be judged whether transfer or elevation the power line is necessary of not after checking the interrelation of each height of them. The procedure and the period for these works are to be confirmed to the power company.
9	Old railway land after crossing Port Access Road	• Approval to use old railway land for Feeder Road-2 was obtained from BR. Consequently, selecting a route using old railway land doesn't affect a lot of houses.

Appendix3.3-2 List of Rivers and Canals of the Coastal Road Construction Project

Section	No	Ch	Existing River / Channel		Existing Structure					Proposed Structure					Bridge / Culvert Type
			Type of River /Channel	Distance of River / Channe	Bridge		Culvert			Bridge		Culvert			
					Width	Length	Width	Height	Length	Width	Length	Width	Height	Length	
				m	m	m	m	m	m	m	m	m	m	m	
Section-1	1	2+925	Channel	3.5			3.5		36.9			3.5			
	2	4+034	Channel	2.0			2.0		37.1			2.0			
	3	5+494	Channel	2.0			2.0		37.2			2.0			1
Section-2	4	8+175	Channel	2.7			2.7		37.2			2.7			1
Section-3	5	9+776	Channel	2.3			2.3		22.4			2.3			1
	6	12+280	Channel	2.8			2.8		22.4			2.8			1
Feeder Road 1	7	0+032	Channel/Khal	7.0								4.0	4.0		2 - 4.0 X 4.0
	8	0+613	Channel	9.0								4.0	4.0		3 - 4.0 X 4.0
	9	0+730	Low lying Land	70.0								4.0	4.0		3 - 4.0 X 4.0
Feeder Road 2	10	0+038	Borrow Pit	27.0						18.29	20.0				1 - 20m span
	11	1+130	Low lying Land/Channel	4.0								4.0	4.0		1 - 4.0 X 4.0
	12	2+515	Channel	20.0		15.0				19.29	20.0				1 - 20m span
Feeder Road 3	13	0+040	Ditch	6.0								4.5	4.5		1 - 4.5 X 4.5
	14	0+200	Ditch/Low Lying Land	250.0								4.5	4.5		2 - 4.5 X 4.5
	15	0+950	Channel	4.0								2.0	2.0		2 - 2.0 X 2.0
	16	1+065	Channel	15.0								2.5	2.5		6 - 2.5 X 2.5
	17	1+852	Channel	4.0			4.0	1.25				2.0	2.0		2 - 2.0 X 2.0
	18	2+540	Channel	4.0			4.0	1.6				2.0	2.0		2 - 2.0 X 2.0

Source: Study Team

Appendix3.3-3

Outline of the Coastal Road Construction Project

Items		Quantities	
Outline			
1)	Project Distance	21,593m (*Main Road:* 2 lane-6,236m / 4 lane-8,466m *Feeder Road:* 4 lane-6,648m / 4+2 lane-243m)	
2)	No. of Lanes and Width of Carriageway & Shoulder	*Main Road:* 2 lane-12.10m / 4 lane-21.60m *Feeder Road:* 4 lane-18.29m / 4+2 lane-30.48m	
Type of Works			
1)	Earth Works	Soil Volume	2,809,506m3
2)	Pavement Works	Pavement Volume	179,740m3
3)	Bridge Works (Number of Bridges)	Feeder Road-2	3 bridges
		Feeder Road-3	1 bridge
4)	Culvert works (Number of Culverts)	Section-1	New: 2 existing: 3
		Section-2	New: 2 existing: 1
		Section-3	New: 2 existing: 2
		Section-4	New: 2 existing: 0
		Feeder Road-1	New: 3
		Feeder Road-2	New: 1
		Feeder Road-3	New: 6
5)	Drainage Works (Total Distance of Concrete Side Ditch/U-Drain)	Section-1	16,500m
		Section-2	10,272m
		Section-3	11,226m
		Section-4	6,108m
		Feeder Road-1	2,400m
		Feeder Road-2	4,40m
		Feeder Road-3	4,886m
6)	Disaster Prevention Works	Concrete wall at roadside	14,702m
		Sluice gates of culvert	14 unit

Source: Study Team

Appendix3.3-4

Outline of the Coastal Road Construction Project by Section and Feeder Roads

Section	Road Type	Chainage	Distance (km)	Embankment Type	No. Lanes	RoadWidth (m)	Earth Volume (m3)	No. & Length of Bridge	No. of Culvert
Main Road									
Section 1	ES		(0.211)	A	–	(4.0)	45,305	–	–
	NR	0+00 – 0+420	0.420	A	2	12.10	76,238	–	–
	ECR	0+420 – 5+500	5.080	A	2	12.10	1,245,148	–	–
	Total		5.500	–	–	–	1,336,691	0	2(3)
Section 2	ECR	5+500 – 8+924	3.424	B	4	21.60	–	–	–
	Total		3.424	–	–	–	335,508	0	2(1)
Section 3	ECR	8+924 – 12+666	3.742	B	4	21.60	–	–	–
	Total		3.742	–	–	–	586,808	0	2(2)
Section 4	ECR	12+666 – 14+702	2.036	B	4	21.60	–	–	–
	Total		2.036	–	–	–	323,189	0	2(0)
Sub Total			14.702	–	–	–	2,582,196	0	8(6)
Feeder Road									
Feeder Road-1	NR	–	1.000	–	4	18.29	41,922	0	3
	W+R	–	0.313	–	4	18.29	13,974	0	0
	Total		1.313				55,896	0	3
Feeder Road-2	NR	–	1.200	–	4	18.29	39,127	2-360m	3
	W+R	–	1.379	–	4	18.29	55,896	1-20m	
	Total		2.579				95,023	3-380m	1
Feeder Road-3	NR	–	1.350	–	4	18.29	15,837	1-560m	4
	W+R	–	1,406	–	4	18.29	60,554	0	2
	R	–	0.243	–	4+2	30.48	0	0	-
	Total		2.999			–	76,391	1-560m	6
Sub Total			6.891			–	227,310	4-940m	10
Total			21.593			–	2,809,506	4-940m	18 (6)

Road Type: ES: Existing Embankment Strengthen, NR: New Road, ECR: Embankment-Cum-Road (Widening Existing Embankment), W+R: Widening and Rehabilitation Road, R: Rehabilitation Road

No. of Culvert: No.of Newly construction Culvert (No. of Existing Culvert) Source: Study Team

Appendix3.3-5

Consulting Services Cost Estimate

US $ = yen 107
BDT = yen 1.56

	Unit	Q'ty.	Foreign Portion (Yen)		Local Portion BDT		Combined Total
			Rate	Amount ('000)	Rate	Amount ('000)	('000) Yen
A Remuneration							
1 Professional (A)	M/M	245	2,500,000	612,500			612,500.000
2 Professional (B)	M/M	344		0	200,000	68,800	107,328.000
3 Supporting Staffs	M/M	48		0	50,000	2,400	3,744.000
Subtotal of A				612,500		71,200	723,572.000
B Direct Cost							
1 Topographical Survey	BDH	1			3,000,000	3,000	4,680.000
2 Geotechnical Investigation	BDH	1			1,000,000	1,000	1,560.000
3 International Airfare	BDT/M	57	350,000	19,950		0	19,950.000
4 Domestic Airfare		0		0	0	0	0.000
5 Domestic Travel	BDT/M	114		0	14,000	1,596	2,489.760
6 Accommodation Allowance	Month	245		0	70,000	17,150	26,754.000
	Month	344		0	35,000	12,040	18,782.400
	Month	48		0	1,500	72	112.320
7 Vehicle Rental	BDTH/M/Veh	171		0	70,000	11,970	18,673.200
8 Office Rental	BDT/M	57		0	70,000	3,990	6,224.400
9 International Communications	BDT/M	57		0	70,000	3,990	6,224.400
10 Domestic Communications	BDT/M	57		0	20,000	1,140	1,778.400
11 Office Supply	BDT/M	57		0	20,000	1,140	1,778.400
12 Office Furniture and Equipmen	BDH	1		0	500,000	500	780.000
13 Report Preparation	BMDH	4		0	30,000	120	187.200
Subtotal of B				19,950		53,708	103,734.480
Total				632,450		124,908	827,306.480

Basic Cost	632,450,000		124,908,000		827,306,480
Price Escalation	5.0%		0.0%		
	31,622,500		0		31,622,500
Contingency	5.0%		5.0%		
	33,203,625		6,245,400		42,946,449
Total	697,276,125		131,153,400		901,875,429

Appendix 3.3-6 Manning Schedule for the Consulting Services

					1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	Position	2010												2011												2012											
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Task Name: Detail Design																																					
A-1	Project Manager (Road)				1	1	1	1	1	1	1	1																									
A-2	Procurement-Administration										1	1																									
A-3	Senior Road Engineer-2							1	1	1	1	1																									
A-4	Senior Embankment Engineer				1	1	1																														
A-5	Senior Bridge Engineer				1	1	1	1	1	1	1	1																									
A-6	Senior Facilities Engineer								1	1	1																										
A-7	Environmental Management Specialist				1		1																														
B-1	Engineer for Road Design-1				1	1	1	1	1	1	1	1																									
B-2	Engineer for Road Design-2				1	1	1	1	1	1	1	1																									
B-3	Engineer for Structure Design-1				1	1	1	1	1	1	1	1																									
B-4	Engineer for Structure Design-2				1	1	1	1	1	1	1	1																									
B-5	Engineer for Facilities Engineer								1	1	1																										
B-6	Environmental Management Specialist				1		1	1	1																												
C-1	Cost Estimater-1				1	1	1	1	1	1	1	1																									
C-2	Cost Estimater-2				1	1	1	1	1	1	1	1																									
C-3	Draftsman-1				1	1	1	1	1	1	1	1																									
C-4	Draftsman-2				1	1	1	1	1	1	1	1																									
C-5	Draftsman-3				1	1	1	1	1	1	1	1																									
C-6	Draftsman-4				1	1	1	1	1	1	1	1																									
	Total of Pro-A	31												0												0											
	Total of Pro-B	39												0												0											
	Total of Pro-C	48												0												0											
Task Name: Tender Assistance																																					
Pro-A																																					
A-1	Project Manager (Road)												1	1	1	1	1	1	1	1	1	1	1	1	1												
A-2	Procurement-Administration												1	1	1	1	1	1	1	1	1	1	1	1	1												
	Total of Pro-A	2												24												0											
Task Name: Construction Supervision																																					
A-1	Project Manager (Road)																									1	1	1	1	1	1	1	1	1	1	1	1
A-4	Senior Embankment Engineer																									1	1										
A-5	Senior Bridge Engineer																									1	1	1	1	1	1	1	1	1	1	1	1
A-8	Senior Pavement Engineer																																				
A-6	Senior Facilities Engineer																																				
A-7	Environmental Management Specialist																									1											1
A-9	Senior Quality Control Engineer																									1	1	1	1	1	1	1	1	1	1	1	1
B-7	Expert for Soil Works																									1	1	1	1	1	1	1	1	1	1	1	1
B-8	Expert for Geotechnical Work																									1	1	1	1	1	1	1	1	1	1	1	1
B-9	Expert for Hydraulic Work																									1	1	1	1	1	1	1	1	1	1	1	1
B-10	Engineer for Structure																									1	1	1	1	1	1	1	1	1	1	1	1
B-11	Expert for Pavement																																				
B-12	Engineer for Facilitates & Equipment																																				
B-13	Environmental Management Specialist																									1	1	1	1	1	1		1	1	1		1
B-14	Expert for Quality Control																									1	1	1	1	1	1	1	1	1	1	1	1
	Total of Pro-A	0												0												40											
	Total of Pro-B	0												0												70											
Task Name: Resettlement Assistance																																					
A-10	Resettlement Specialist - 1			1		1		1						1			1		1							1			1		1						
B-15	Resettlement Specialist - 2			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1	1		1	1	1	1		1
	Total of Pro-A	3												3												3											
	Total of Pro-B	10												12												8											
	Total of Pro-C																																				
Task Name: Training of Road Maintenance																																					
A-12	Expert for Road Maitenance-1													1	1	1	1	1	1	1	1	1	1	1	1												
A-13	Expert for Road Maitenance-2																1	1	1				1	1	1												
A-14	Expert for Equipment on Road Maintenance													1	1	1				1	1	1															
B-16	Expert for Road Maintenance													1	1	1	1	1	1	1	1	1	1	1	1												
B-17	Expert for Road Maintenance													1	1	1	1	1	1	1	1	1	1	1	1												
	Total of Pro-A	0												24												0											
	Total of Pro-B	0												24												0											
	Total of Pro-A	36												51												43											
	Total of Pro-B	49												36												78											
	Total of Pro-C	48												0												0											

		34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57													
	Position	2013												2014												2015												
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
Task Name: Detail Design																																						
A-1	Project Manager (Road)																																					8
A-2	Procurement-Administration																																					2
A-3	Senior Road Engineer-2																																					5
A-4	Senior Embankment Engineer																																					3
A-5	Senior Bridge Engineer																																					8
A-6	Senior Facilities Engineer																																					3
A-7	Environmental Management Specialist																																					2
B-1	Engineer for Road Design-1																																					8
B-2	Engineer for Road Design-2																																					8
B-3	Engineer for Structure Design-1																																					8
B-4	Engineer for Structure Design-2																																					8
B-5	Engineer for Facilities Engineer																																					3
B-6	Environmental Management Specialist																																					4
C-1	Cost Estimater-1																																					8
C-2	Cost Estimater-2																																					8
C-3	Draftsman-1																																					8
C-4	Draftsman-2																																					8
C-5	Draftsman-3																																					8
C-6	Draftsman-4																																					8
	Total of Pro-A	0												0												0												31
	Total of Pro-B	0												0												0												39
	Total of Pro-C	0												0												0												48
Task Name: Tender Assistance																																						
Pro-A																																						
A-1	Project Manager (Road)																																					13
A-2	Procurement-Administration																																					13
	Total of Pro-A	0												0												0												26
Task Name: Construction Supervision																																						
A-1	Project Manager (Road)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1			1			#			1	40
A-4	Senior Embankment Engineer	1	1																																			4
A-5	Senior Bridge Engineer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
A-8	Senior Pavement Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													22
A-6	Senior Facilities Engineer													1	1	1	1	1	1	1	1	1	1	1	1													12
A-7	Environmental Management Specialist																																					2
A-9	Senior Quality Control Engineer	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
B-7	Expert for Soil Works	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
B-8	Expert for Geotechnical Work	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
B-9	Expert for Hydraulic Work	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
B-10	Engineer for Structure	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
B-11	Expert for Pavement			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													22
B-12	Engineer for Facilitates & Equipment													1	1	1	1	1	1	1	1	1	1	1	1													12
B-13	Environmental Management Specialist	1	1						1	1	1		1	1	1								1	1	1													21
B-14	Expert for Quality Control	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													36
	Total of Pro-A	48												60												4												152
	Total of Pro-B	76												89												0												235
Task Name: Resettlement Assistance																																						
A-10	Resettlement Specialist - 1	1			1		1																															12
B-15	Resettlement Specialist - 2		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1		1					46
	Total of Pro-A	3												0												0												12
	Total of Pro-B	6												6												4												46
	Total of Pro-C																																					
Task Name: Training of Road Maintenance																																						
A-12	Expert for Road Maitenance-1																																					12
A-13	Expert for Road Maitenance-2																																					
A-14	Expert for Equipment on Road Maintenance																																					6
B-16	Expert for Road Maintenance																																					12
B-17	Expert for Road Maintenance																																					
	Total of Pro-A	0												0												0												24
	Total of Pro-B	0												0												0												24
	Total of Pro-A	51												60												4												245
	Total of Pro-B	82												95												4												344
	Total of Pro-C	0												0												0												48

Appendix 3.3-7 NGO Manning Schedule for the Resettlement Assistance

		Position	2010											2011											2012											2013											2014											2015											
			1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	
Task: Resettlement Assistance (Implementation Agency)																																																																					
N	1	Team Leader				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	60
N	2	Deputy Team Leader								1	1	1		1	1	1	1	1	1	1	1	1	1	1																																															15
N	3	Office Administrator						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																	36
N	4	MIS Manager						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1													45
N	5	Legal Advisor for GRC																1	1	1										1	1	1														1	1	1																			12
N	6	Area Manager				4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	216
N	7	Accounting Officer						1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	54
N	8	Field Worker						20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	15	15	15	15	15	15	15	15	15	15	15	15	15	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	825
N	9	Administrative Support				2	2	2	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	219
A		ManMonths Fee (Taka 1,000											6,486											11,862											9,762											8,034											5,994											960	
		Year	2010											2011											2012											2013											2014											2015											
		Month	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	1	2	3	4	5	6	7	8	9	#	#	#	
Out-of-pocket Expenses																																																																				
	1	Vehicles				1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	114
	2	Office Rent				1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	96
	3	PC and Equipment				1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	90
	4	Office Printing				1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	90
	5	ID Card Production											1																																																								1
	6	Production of PI Brocure											1																																																						1
	7	Communication/Consumables				1	1	1	4	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	120
B		Yearly Expenses (Taka 1,00											2,915											4,275											3,720											2,580											1,860											465	15,815
																																																																			0
C		**Sum of MM Fee and Direct**											9,401											16,137											13,482											10,614											7,854											1,425	58,913
																																																																			0
Development Budget Staff																																																																			0
		Resettlement Coordinator											260											260											260											260											260												1,300
		Total											**9,661**											**16,397**											**13,742**											**10,874**											**8,114**											**1,425**	**60,213**

Number of NGO Staff

N	1	Team Leader	9	12	12	12	12	3	60
N	2	Deputy Team Leader	3	12	0	0	0	0	15
N	3	Office Administrator	6	12	12	6	0	0	36
N	4	MIS Manager	6	12	12	12	3	0	45
N	5	Legal Advisor for GRC	0	3	3	3	3	0	12
N	6	Area Manager	36	48	48	48	36	0	216
N	7	Accounting Officer	6	12	12	12	12	0	54
N	8	Field Worker	120	240	180	135	120	30	825
N	9	Administrative Support	36	60	57	36	24	6	219
		Total	222	411	336	264	210	39	1,482

Appendix3.3-8 Cost Breakdown for Package

US $ = yen 107
BDT = yen 1.56

PACKAGE 1 : Costal Road Construction Project

Item	Unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			yen	BDT	yen	BDT	yen
1.General & Site Facilities	Ls	1.0		231,193,912		231,193,912	360,662,503
2.Main Road(except structure)							
(1) Section1			89,141,593	956,561,137	89,141,593	956,561,137	1,581,376,966
(a) Earth Work	Ls	1.0		692,298,185		692,298,185	1,079,985,168
(b) Pavement Work	Ls	1.0	89,141,593	83,320,820	89,141,593	83,320,820	219,122,072
(c) Incidential Work	Ls	1.0		180,942,132		180,942,132	282,269,726
(2) Section2			102,800,831	586,687,759	102,800,831	586,687,759	1,021,465,735
(a) Earth Work	Ls	1.0		212,616,905		212,616,905	331,682,372
(b) Pavement Work	Ls	1.0	102,800,831	99,713,160	102,800,831	99,713,160	258,353,392
(c) Incidential Work	Ls	1.0		276,557,674		276,557,674	431,429,971
(3) Section3			112,348,338	747,830,538	112,348,338	747,830,538	1,278,963,977
(a) Earth Work	Ls	1.0		337,027,196		337,027,196	525,762,426
(b) Pavement Work	Ls	1.0	112,348,338	108,973,925	112,348,338	108,973,925	282,347,661
(c) Incidential Work	Ls	1.0		301,829,416		301,829,416	470,853,889
(4) Section4			61,128,064	408,516,948	61,128,064	408,516,948	698,414,503
(a) Earth Work	Ls	1.0		185,064,748		185,064,748	288,701,007
(b) Pavement Work	Ls	1.0	61,128,064	59,292,066	61,128,064	59,292,066	153,623,687
(c) Incidential Work	Ls	1.0		164,160,134		164,160,134	256,089,808
2.Feeder Road (except structure)							
(1) Feeder Road 1			24,237,548	62,497,839	24,237,548	62,497,839	152,934,178
(a) Earth Work	Ls	1.0		51,080,040		51,080,040	79,684,862
(b) Pavement Work	Ls	1.0	24,237,548	23,671,644	24,237,548	23,671,644	61,165,312
(c) Incidential Work	Ls	1.0		7,746,156		7,746,156	12,084,003
(2) Feeder Road 2			43,765,141	129,757,161	43,765,141	129,757,161	246,186,313
(a) Earth Work	Ls	1.0		79,438,637		79,438,637	123,924,274
(b) Pavement Work	Ls	1.0	43,765,141	36,296,520	43,765,141	36,296,520	100,387,713
(c) Incidential Work	Ls	1.0		14,022,004		14,022,004	21,874,327
(3) Feeder Road 3			54,636,417	127,678,600	54,636,417	127,678,600	253,815,033
(a) Earth Work	Ls	1.0		67,920,601		67,920,601	105,956,138
(b) Pavement Work	Ls	1.0	54,636,417	43,855,665	54,636,417	43,855,665	123,051,254
(c) Incidential Work	Ls	1.0		15,902,335		15,902,335	24,807,642
3. Bridge							
(a) Feeder Road 2				486,808,133		486,808,133	759,420,688
Over Bridge				41,073,295		41,073,295	64,074,341
Foundation Work	Ls	1.0		13,733,038		13,733,038	21,423,539
Structure Work	Ls	1.0		27,340,257		27,340,257	42,650,801
Aproach Bridge(40m span)				273,130,959		273,130,959	426,084,296
Foundation Work	Ls	1.0		63,993,607		63,993,607	99,830,028
Structure Work	Ls	1.0		209,137,351		209,137,351	326,254,268
Retaining Wall				108,733,871		108,733,871	169,624,839
Structure Work	Ls	1.0		108,733,871		108,733,871	169,624,839
Bridge(2-1*20m span)				63,870,008		63,870,008	99,637,212
Foundation Work	Ls	1.0		20,669,985		20,669,985	32,245,176
Structure Work	Ls	1.0		43,200,023		43,200,023	67,392,036
(b) Feeder Road 3				575,921,338		575,921,338	898,437,287
Over Bridge				61,053,274		61,053,274	95,243,107
Foundation Work	Ls	1.0		20,529,130		20,529,130	32,025,442
Structure Work	Ls	1.0		40,524,144		40,524,144	63,217,665
Aproach Bridge(40m span)				446,909,394		446,909,394	697,178,655
Foundation Work	Ls	1.0		109,300,884		109,300,884	170,509,379
Structure Work	Ls	1.0		337,608,510		337,608,510	526,669,276
Approach Retaining Wall				67,958,670		67,958,670	106,015,525
Structure Work	Ls	1.0		67,958,670		67,958,670	106,015,525
4. Box Culvert Structure							
(a) Main Road				103,952,119		103,952,119	162,165,306
Existing Culvert Extension	Ls	1.0		44,550,908		44,550,908	69,499,417
New Culvert Construction	Ls	1.0		59,401,211		59,401,211	92,665,889
(b) Feeder Road				102,609,016		102,609,016	160,070,066
New Culvert Construction	Ls	1.0		102,609,016		102,609,016	160,070,066
4. Others							
Disaster Prevention Facilities etc.	Ls	1.0		231,193,912		231,193,912	360,662,503
Total					486,057,932	4,773,408,413	7,934,575,056
Total (exclusive of TAX(8.5%))					446,673,008	4,367,668,698	7,260,136,176
TAX(8.5%)					41,484,924	405,739,715	674,438,880

Appendix 3.3-9 Main Road Cost Estimation

Item Code	Item Description	Unit	Unit Price (BDT)		Section-1 From Ch.0+000 to Ch. 5+500			Section-2 From Ch.5+500 to Ch. 8+924			Section-3 From Ch.8+924 to Ch. 12+666			Section-4 From Ch.12+666 to Ch. 14+702			Total From Ch.0+000 to Ch. 14+702		
					Length(Km)	5.500		Length(Km)	3.424		Length(Km)	3.742		Length(Km)	2.036		Length(Km)	14.702	
					Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)	
			Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local
DIVISION-1 General and Site facilities																			
01/01/01	Protection of Temporary Roads, Structures etc	Lump Sum		68,284															
01/01/02	Maintain Temporary Structures & Equipment for the	day		607															
01/02/01	Supply, Erect and Remove Field Office for Engineer	Lump Sum		126,219															
01/02/02	Maintenance, Staffing, Security Cleaning of the Field	Month		6,081															
01/02/03	Provision of Office Equipment and Consumable	Month		6,011															
01/02/04	Provision, Maintenance and Removal of Sign Boards	Lump Sum		6,000															
01/02/05	Provision and Maintenance of Survey Equipment	Month		601															
01/02/06	Provision of Insurance for Engineer's Office, Furniture	Month		-															
01/02/07	Progress Photograph	Month		962															
01/03/01	Provide and Remove Site Laboratory & Equipment	Lump Sum		200,030															
01/03/02	Maintain Site Laboratory	Month		6,011															
01/03/03	Special or Additional Tests	Provisional		-															
01/04/01	Saloon Car 1200cc Capacity	Month		40,072															
01/04/02	Pick-up (Double Cab)	Month		45,000															
01/04/03	Four Wheel Drive Vehicle Min. 6 seats	Month		48,811															
01/04/04	Motor Cycle 125 cc	Month		2,699															
01/04/05	Motor Boat min 5m length	Month		10,018															
01/05/01	Relocation of Public Utilities	Provisional		-															
Subtotal																			
DIVISION-2 Earthwork																			
02/01/01	Clearing and Grubbing	Sq. metre		16	315,527		5,048,425	149,487		2,247,479	159,588		2,553,378	78,393		1,222,284	691,973		11,071,566
02/02/01	Roadway Excavation in Unsuitable Material	Cu metre		62	65,534		4,063,091	63,666		3,948,557	69,601		4,315,274	37,870		2,347,915	236,691		14,674,837
02/02/02	Roadway Excavation in suitable Material	Cu metre		62															
02/02/03	Roadway Excavation in Existing Pavement (not	Cu metre		99															
02/02/04	Roadway Excavation in Existing Reinforced Concrete	Cu metre		436															
02/04/01	Channel Excavation in Unsuitable material	Cu metre		63															
02/04/02	Channel Excavation in Suitable material	Cu metre		63															
02/05/01	Excavation and Backfill for Structures	Cu metre		188															
02/05/02	Concrete Backfill for Structures	Cu metre		5659															
02/05/03	Sand Backfill for Structures	Cu metre		755															
02/06/02	Embankment Fill from borrow pit in contractor's	Cu metre		475	1,336,662		634,928,589	335,508		159,366,239	586,808		278,733,770	323,189		153,514,634	2,582,195		1,226,543,232
02/06/03	Sand Backfill to Swamp	Cu metre		475	65,534		31,128,519	63,666		30,251,040	69,601		33,060,570	37,870		17,988,060	236,691		112,428,189
02/07/02	Preparation of Subgrade 300mm depth	Sq. metre		32	84,150		2,692,800	84,915		2,717,280	92,602		2,963,264	50,493		1,615,776	312,360		9,995,567
02/08/01	Improved Subgrade (F. M.=0.5)	Cu metre		627	21,038		13,190,513	21,229		13,310,458	23,290		14,546,651	12,623		7,914,746	78,090		48,962,367
02/10/01	Construction of Soil Earthen Shoulder	Cu metre		123	10,132		1,246,248	8,309		775,846	8,894		847,902	3,751		461,338	27,084		3,331,235
02/11/01	Construction Hard Shoulder	Cu metre		2695															
02/12/01	Subgrade Drains	Lin. Metre		154															
Subtotal							692,298,185			212,616,905			337,027,196			185,064,748			1,427,007,034
DIVISION-3 Pavement Work																			
03-02/01	Sub-Base	Cu. metre		2,800	11,330		31,724,000	13,559		37,965,312	14,818		41,491,296	8,063		22,575,168	47,770		133,755,776
03/03/01	Aggregate Base Type I	Cu. metre		3,389	8,498		28,798,028	10,169		34,463,590	11,114		37,664,465	6,047		20,493,012	35,827		121,419,194
03-03/02	Aggregate Base Type II	Cu. metre		2,683	8,498		22,798,793	10,169		27,284,176	11,114		29,818,164	6,047		16,223,686	35,827		96,125,022
03/05/01a	Bituminous Prime Coat (Plant Placed)	sq. metre	69		56,650	3,908,850		62,317	4,299,859		68,104	4,699,204		37,055	2,556,809		224,126	15,464,722	
03/07/01a	Bituminous Tack Coat (Plant work)	sq. metre	20		40,150	803,000		49,990	999,808		54,633	1,092,664		29,726	594,512		174,499	3,489,984	
03/10/01	Dense Bituminous Surfacing- Base Course (Plant	Cu. metre	9,456		3,399	32,276,904		3,739	35,505,629		4,088	38,803,183		2,223	21,112,571		13,449	127,698,258	
03/10/02	Dense Bituminous Surfacing- Wearing Course (Plant	Cu. metre	10,039		2,008	20,153,293		2,500	25,092,691		2,732	27,423,135		1,486	14,920,785		8,725	87,589,873	
Subtotal						57,142,047	83,320,820		65,897,988	99,713,180		72,018,185	108,873,925		39,184,656	59,292,066		234,242,837	351,299,992
DIVISION 5-Incidental																			
05/01/02	Concrete Slope Protection	sq. metre		2,005				17,120		35,352,800	18,710		38,636,150	10,180		21,021,700	46,010		95,010,650
05/01/03	Loose Stone Riprap Protection	cu. metre		2,905				34,240		99,467,200	37,420		108,705,100	20,360		59,145,800	92,020		267,318,100
05/01/04	Concrete Cut-Off Wall	cu. metre		10,880	9,625		104,816,250	8,560		93,218,400	9,355		101,875,950	5,060		55,430,100	32,630		355,340,700
05/02/02	Reinforced Concrete Culvert Pipe- Class B bedding	Lin. metre		1,422															
05/03/03	Concrete Side Ditch/U-drain	Lin. metre		1,977	16,500		32,620,500	10,272		20,307,744	11,226		22,193,802	6,108		12,075,516	44,106		87,197,562
05/04/01	Concrete Kerb (as detailed on the drawing)	Lin. metre		1,839															
05/05/01	Road Marking - Thermoplastic Material (indicare if	Sq. metre		848	1,155		979,440	1,438		1,219,492	1,572		1,332,751	855		725,142	5,020		4,256,824
05/07/02	Grass Turfing	Sq. metre		19	118,578		2,253,008	82,248		1,562,710	89,842		1,706,209	38,615		733,681	329,084		6,252,600
05/08/01	Guardrail	Lin. metre		7,200	5,500		39,600,000	3,424		24,652,800	3,742		26,942,400	2,036		14,659,200	14,702		105,854,400
05/09/02	Concrete Post	Number		1,558	300		467,400	350		545,300	200		311,600	175		272,650	1,025		1,596,950
05/10/01	Traffic Sign	Number		4,500	32		144,000	36		162,000	20		90,000	16		67,500	103		463,500
05/10/02	Sign Post	Number		1,923	32		61,536	36		69,228	20		38,460	15		28,845	103		198,069
Subtotal							180,942,132			276,557,674			301,829,416			164,160,134			923,389,356
	Total Foreign (BDT) Local (BDT)					57,142,047	956,561,137		65,897,988	588,887,759		72,018,185	747,930,538		39,184,656	408,516,948		234,242,837	2,701,796,381
	Total Foreign (Yen) Local (BDT)					89,141,593	956,561,137		102,800,831	588,887,759		112,348,338	747,930,538		61,126,064	408,516,948		365,416,825	2,701,796,381
	Foreign (BDT)+Local (BDT)					1,013,700,183			654,785,728			819,948,723			447,701,604			2,936,039,218	
	BDTton					184,309,670			191,234,149			219,093,721			219,892,733			199,703,309	

(BDT=1.58Yen)

Appendix 3.3-10 Feeder Road Cost Estimation

Item Code	Item Description	Unit	Unit Price (BDT)		Feeder Road - 1			Feeder Road - 2			Feeder Road - 3			Total		
					Length(Km)	1.313		Length(Km)	2.579		Length(Km)	2.999		Length(Km)	5.891	
					Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)	
			Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local
DIVISION- 1 General and Site facilities																
01/01/0	Protection of Temporary Roads, Structures etc	Lump Sum		53,284												
01/01/0	Maintain Temporary Structures & Equipment for the	day		807												
01/02/0	Supply, Erect and Remove Field Office for Engineer	Lump Sum		120,219												
01/02/0	Maintenance, Staffing, Security Cleaning of the Field	Month		8,001												
01/02/0	Provision of Office Equipment and Consumable	Month		6,011												
01/02/0	Provision, Maintenance and Removal of Sign	Lump Sum		6,000												
01/02/0	Provision and Maintenance of Survey Equipment	Month		601												
01/02/0	Provision of Insurance for Engineer's Office,	Month		-												
01/02/0	Progress Photograph	Month		962												
01/03/0	Provide and Remove Site Laboratory & Equipment	Lump Sum		200,030												
01/03/0	Maintain Site Laboratory,	Month		6,011												
01/03/0	Special or Additional Tests	Provisional Sum		-												
01/04/0	Saloon Car 1200cc Capacity	Month		40,072												
01/04/0	Pick-up (Double Cab)	Month		45,080												
01/04/0	Four Wheel Drive Vehicle Min. 6 seats.	Month		49,611												
01/04/0	Motor Cycle 125 cc	Month		2,999												
01/04/0	Motor Boat min 5m length	Month		10,018												
01/05/0	Relocation of Public Utilities	Provisional Sum		-												
Subtotal																
DIVISION- 2 Earthwork																
02/01/0	Clearing and Grubbing	Sq. metre		16	30,861		493,776	48,348		773,568	45,777		732,432	124,986		1,999,776
02/02/0	Roadway Excavation in Unsuitable Material	Cu metre		62	5,248		324,896	17,468		1,082,985	23,709		1,469,952	46,417		2,877,833
02/02/0	Roadway Excavation in suitable Material	Cu metre		62	1,545		95,790	5,150		319,300	5,018		311,126	11,713		726,216
02/02/0	Roadway Excavation in Existing Pavement (not	Cu metre		99	1,545		152,955	5,562		550,638	8,176		809,438	15,283		1,513,031
02/02/0	Roadway Excavation in Existing Reinforced	Cu metre		436	103		44,908	206		89,816	453		197,595	762		332,319
02/04/0	Channel Excavation in Unsuitable material	Cu metre		63	3600		226,800	6,000		378,000	19974		1,258,362	29,574		1,863,162
02/04/0	Channel Excavation in Suitable material	Cu metre		63	3,600		226,800	6,000		378,000	19,974		1,258,362	29,574		1,863,162
02/05/0	Excavation and Backfill for Structures	Cu metre		188												
02/05/0	Concrete Backfill for Structures	Cu metre		5655												
02/05/0	Sand Backfill for Structures	Cu metre		755												
02/06/0	Embankment Fill from borrow pit in contractor's	Cu metre		475	55,896		26,550,600	95,023		45,136,020	76,391		36,285,820	227,310		107,972,440
02/06/0	Sand Backfill to Swamp	Cu metre		475	36,682		17,423,831	46,813		22,236,128	34,586		16,428,184	118,080		56,088,143
02/07/0	Preparation of Subgrade 300mm depth	Sq. metre		32	27,948		894,336	42,854		1,371,315	46,380		1,484,170	117,182		3,749,822
02/08/0	Improved Subgrade (F. M.=0.5)	Cu metre		627	6,987		4,380,849	10,713		6,717,302	11,595		7,270,116	29,295		18,368,267
02/10/0	Construction of Soil Earthen Shoulder	Cu metre		123	2,150		264,499	3,297		405,565	3,374		415,043	8,822		1,085,108
02/11/0	Construction Hard Shoulder	Cu metre		2695												
02/12/0	Subgrade Drains	Lin. Metre		154												
Subtotal						-	51,080,040		-	79,438,637		-	67,920,601			198,439,278
DIVISION 3: Pavement Work																
03/02/01	Sub-Base	Cu. metre		2,800	3,219		9,012,864	4,936		13,819,725	5,964		16,697,833	14,118		39,530,422
03/03/01	Aggregate Base Type I	Cu. metre		3,389	2,414		8,181,588	3,702		12,545,102	4,473		15,157,756	10,589		35,884,446
03/03/02	Aggregate Base Type II	Cu. metre		2,683	2,414		6,477,191	3,702		9,931,693	4,473		12,000,076	10,589		28,408,961
03/06/01	Bituminous Prime Coat (Plant Placed)	sq. metre	69		16,094	1,110,514		24,678	1,702,788		29,462	2,032,865		70,234	4,846,166	
03/07/01	Bituminous Tack Coat (Plant work)	sq. metre	20		16,094	321,888		24,678	493,562		29,462	589,236		70,234	1,404,686	
03/10/01	Dense Bituminous Surfacing- Base Course (Plant	Cu. metre	9,496		805	7,641,627		1,475	14,009,639		1,849	17,554,556		4,129	39,205,815	
03/10/02	Dense Bituminous Surfacing- Wearing Course	Cu. metre	10,039		644	6,462,867		1,180	11,848,590		1,479	14,846,588		3,303	33,158,145	
Subtotal						16,536,890	23,671,644		28,054,578	36,295,520		35,023,344	43,855,565		78614811.81	103,823,828
DIVISION 6 Incidental																
06/01/0	Concrete Slope Protection	sq. metre		2,065												
06/01/0	Loose Stone Riprap Protection	cu. metre		2,905												
06/01/0	Concrete Cut-Off Wall	cu. metre		10,890												
06/02/0	Reinforced Concrete Culvert Pipe- Class B bedding	Lin. metre		1,422												
06/03/0	Concrete Side Ditch/U-drain	Lin. metre		1,977	2,400		4,744,800	4,400		8,698,800	4,886		9,659,622	11,686		23,103,222
06/04/0	Concrete Kerb (as detailed on the drawing)	Lin. metre		1,839	1,200		2,206,800	2,200		4,045,800	2,443		4,492,677	5,843		10,745,277
06/05/0	Road Marking - Thermoplastic Material (indicate if	Sq. metre		848	504		427,392	773		655,334	1,290		1,094,124	2,567		2,175,850
06/07/0	Grass Turfing	Sq. metre		19	11,700		222,300	22,800		433,200	19,467		369,873	53,967		1,025,373
06/08/0	Guardrail	Lin. metre		7,200												
06/09/0	Concrete Post	Number		1,558	60		93,480	80		124,640	130		202,540	270		420,660
06/10/0	Traffic Sign	Number		4,500	8		36,000	10		45,000	13		58,500	31		139,500
06/10/0	Sign Post	Number		1,923	8		15,384	10		19,230	13		24,999	31		59,613
Subtotal						0	7,746,156			14,022,004		0	15,902,335			37,670,495
	Total Foreign (BDT) Local (BDT)					16,536,890	82,497,839		28,054,578	129,757,161		35,023,344	127,678,600		78,614,812	339,933,601
	Total Foreign (Yen) Local (BDT)					24,237,548	82,497,839		43,765,141	129,757,161		54,636,417	127,678,600		122,639,105	339,933,601
	Foreign (BDT)+Local (BDT)					98,034,729			157,811,739			162,701,944			418,548,413	
	BDT/km					74,654,684			61,191,058			54,252,065			60,738,414	

(BDT=1.56Yen)

Appendix 3.3-11 Bridge Cost Estimation & Culvert Cost Estimation

DIVISION 4 (Foundation)

Item Code	Item Description	Unit	Unit Price(BDT)		Feeder Road-2												Feeder Road-1							
					Over Bridge (1*40m span)			Approach Bridge (2-6*25m span)			Approach Retaining Wall (2*80m)			Bridge (1*20m span)			Over Bridge (1-2*30m span)			Approach Bridge (2-10*25m span)			Approach Retaining Wall (2*50m)		
			Foreign	Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local
04/01/01c	Bored cast in place piles(dia 750 mm)	Lin. Metre		4,435	1,200.00		5,322,000	5,600.00		24,836,000	-		-	900.00		3,991,500	1,800.00		7,983,000	9,500.00		42,576,000			
04/01/01d	Bored cast in place piles(dia 900 mm)	Lin. Metre		6,567			-			-	-		-			-			-			-			
04/01/03	Mild Steel Reinforcing Bars	Tonne		80,040	103.33		8,270,183	482.19		38,594,187	-		-	77.49		6,202,837	154.99		12,405,275	826.61		66,161,464			
04/01/04	High Yield Deformed Steel Reinforcing Bars	Tonne		86,112			-			-	-		-			-			-			-			
04/01/05e	Permanent Steel Casing (6mm thick, dia 750mm)	Lin. Metre		9,589			-			-	-		-			-			-			-			
04/01/05f	Permanent Steel Casing (10mmm thick, dia 750mm)	Lin. Metre		18,122			-			-	-		-			-			-			-			
04/02/01b	Load Test on Cast in place pile (For 100 Ton)	Number		80,821			-			-	-		-			-			-			-			
04/02/01c	Load Test on Cast in place pile (For 200 Ton)	Number		140,855	1.00		140,855	4.00		563,420	-		-	1.00		140,855	1.00		140,855	4.00		563,420			
	Sub Total						13,733,038			63,993,607	-		-			10,334,992			20,529,130			109,390,884			

DIVISION 5 (Structures)

Item Code	Item Description	Unit	Unit Price(BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)		Quantity	Cost (BDT)	
			Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local		Foreign	Local
05/01/1	Single Layer Brick Flat Soling	Sq. metre		273	171.29		46,782	939.89		256,589	3,285.12		896,838	198.74		54,255	85.84		23,381	1,422.64		388,381	2,053.20		560,524		
05/01/02a	Concrete as detailed on Drawing (Class 10)	Cu. Metre		4,784	12.85		61,458	70.49		337,232	246.38		1,178,701	14.91		71,307	6.42		30,729	106.70		510,444	153.99		736,688		
05/01/02b	Concrete Class- 20 (Foundation)	Cu Metre		8,753			-			-			-			-			-			-			-		
05/01/02c	Concrete	Cu metre		8,324			-	-		-	4,248.68		35,349,185			-	-		-	-		-	2,652.18		22,083,228		
05/01/02d	Concrete	Cu.metre		10,203			-			-			-			-			-			-			-		
05/01/02e	Concrete	Cu.metre		8,619	174.80		1,506,601	1,311.00		11,299,509			-	94.60		815,357	418.60		3,607,913	2185.00		18,832,515			-		
05/01/02f	Concrete	Cu.metre		10,881			-	43.79		476,457			-	2.95		32,089	8.66		94,229	72.98		794,095			-		
05/01/02g	Concrete	Cu.metre		7,078			-			-			-			-			-			-			-		
05/01/02h	Concrete	Cu.metre		8,642	408.07		3,509,257	382.64		3,306,747			-	418.56		3,618,075	678.56		5,859,789	3,958.41		34,208,544			-		
05/01/02i	Concrete	Cu.metre		10,527	43.90		462,118	2,474.01		26,043,934			-	63.77		671,336	63.77		671,336	637.73		6,713,383			-		
05/02/02j	Concrete	Cu.metre		17,136	319.17		5,469,297	2,489.51		42,660,161			-	191.50		3,281,551	223.42		3,828,476	4,149.18		71,100,268			-		
05/02/01	Mild Steel	Tonne		80,040			-			-			-			-			-			-			-		
05/02/02	High Yield	Tonne		86,112	141.42		12,178,114	1,227.91		105,737,772	828.10		71,309,768	137.72		11,856,848	258.28		22,241,087	2,914.35		173,459,823	517.56		44,568,230		
05/02/03	Wire	Tonne		78,600			-			-			-			-			-			-			-		
05/03/01	Prestressi	Tonne		223,303	15.68		3,496,282	71.99		16,074,472			-	4.15		926,725	16.64		3,715,326	119.98		26,790,786			-		
05/04/01	Modificati	Cu. Metre		8,415			-			-			-			-			-			-			-		
05/04/02	Concrete Surface Repair Works (Superstructure)	Sq. metre		180			-			-			-			-			-			-			-		
05/04/03	Concrete Surface Repair Works (Substructure)	Sq. metre		240			-			-			-			-			-			-			-		
05/04/06	Anchor and Tie Bars	Tonne		1,893			-	2.40		4,063			-	0.20		309	0.40		677	4.00		6,772			-		
05/05/01	New and Extended Brickwork	Cu. Metre		4,263	80.00		341,040			-			-			-			-			-			-		
05/05/02	Brick Drainage Layer	Cu. Metre		2,075			-			-			-			-			-			-			-		
05/05/03	Replacement of defective Existing brick	Cu metre		6,095			-			-			-			-			-			-			-		
05/05/04	Repointing of Existing Brickwork Joint	Sq. metre		292			-			-			-			-			-			-			-		
05/06/01	Preparation and painting of Existing Structure	Sq. metre		337			-			-			-			-			-			-			-		
05/07/03	Supply and Fixing of Elastomeric Bearing	Number		0			-			-			-			-			-			-			-		
05/08/01	Expansion Joint Complete as detailed on the Drawing	Lin. Metre		1,593	36.60		58,304	256.20		408,127			-	36.60		58,304	18.30		29,152	366.00		583,038			-		
05/13/01(	Neoprene	Number		13,189	16.00		211,024	192.00		2,532,288			-	16.00		211,024	32.00		422,048	320.00		4,220,480			-		
05/13/01(	Neoprene	Number		15,497	-		-	-		-			-			-			-			-			-		
05/14/01(	Double	Lin. Metre		1,875	-		-	-		-			-			-			-			-			-		
2001/5/16	Dismantling of deck slab, thickness 175mm	Sq. metre		3,825	-		-	-		-			-			-			-			-			-		
	Sub Total						27,349,257			205,137,351			108,733,871			21,600,012			40,524,144			337,608,510			67,956,670		
	Grand Total						41,073,295			273,130,959			108,733,871			31,935,004			61,053,274			446,999,394			67,956,670		
	Area of Super Structure (Sq. meter)						752.00			5,467.00						366			1,097			9,145			-		
	Unit Cost (BDT/Sq. meter)						54,611			49,778						87,254			55,655			48,859					

There are two same size bridges in Feeder Road-2

Culvert Cost Estimation (Main Road)

	Description	Unit	Unit Price (BDT) Foreign	Unit Price (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local
1	Single Layer Brick Flat Soling	Sq. metre		273	1530.40		417,799
2	Concrete Class 10 (Blinding Concrete)	Cu. Metre		4,784	114.78		549,106
3	Concrete Class 20	Cu. Metre		8,324	1735.32		14,444,798
4	High Yield Reinforcement Bars	Tonne		86,112	338.39		29,139,205
	Existing Culvert Cost Total				6 Unit		44,550,908
	Existing Culvert Unit Cost						7,425,151
	New Construcsion Culvert Cost Total (Existing Culvert Unit Cost*8Unit)				8 Unit		59,401,211
	Total		-	-	14 Unit		103,952,119

Culvert Cost Estimation (Feeder Road)

	Description	Unit	Unit Price (BDT) Foreign	Unit Price (BDT) Local	Quantity	Cost (BDT) Foreign	Cost (BDT) Local
1	Single Layer Brick Flat Soling	Sq. metre		273	3608.34		984,532
2	Concrete Class 10 (Blinding Concrete)	Cu. Metre		4,784	270.48		1,293,956
3	Concrete Class 20	Cu. Metre		8,324	3994.71		33,251,977
4	High Yield Reinforcement Bars	Tonne		86,112	778.87		67,078,553
	New Construction Culvert Cost Total				12 Unit		102,609,016

Culvert Grand Total	206,561,135

Appendix3.3-12

Record of Past Road Construction Projects in CDA

No.	Name of the Project	Estimate Date	Length (km)	Width (m)	Estimate Construction Cost (Million BDT)	Unit Cost (Million BDT/km)
1	Widening & Improvement of Sirajud-doullah Road	May 2007	1.81	14.63	243.41	134.48
2	Costruction of Link Road from Oxgen Junction to kaptai Road	Jul 2005	6.10	7.32	136.28	22.34
3	Development & Widening of Kalurghat Road	Jul 2005	3.08	15.85	134.47	43.66
4	Widening & Improvement of Arakan Road	Jul 2003	3.18	14.63	103.12	32.43
5	Construction of Link Road from M.A. Hannan International airport Terminal to patenga Road	Jul 2000	4.68	14.63	277.65	59.33
6	Construction of Link Road from Dhaka Trunk Road to Baizid Bostami Road	Jul 1997	6.00	7.32	405.28	67.55

Source: Study Team

Appendix3.3-13

Record of Past Bridge Construction Projects in CDA

No.	Name of the Project	Estimate Date	Length (m)	Width (m)	Construction Cost (BDT)		Unit Cost (BDT/m2)
					Foundation Sub-Struc Super-Struc	Total	
1	Majapool Bridge	Jul 2008	40.00	16.70	23,805,421 1,802,375 40,074,960	65,682,756	98,327
2	Rail-Road Bridge	Jul 2008	320.00	9.00	75,650,200 63,417,500 115,062,500	254,130,200	88,240

Source: Study Team

Appendix3.3-14

Actual Market Price on Dredging Sand in Chittagong Area

No	Soil Type	Location/ Source	Assumed Available Quantity	Unit	Assessed Price at present BDT/ m3
1	Mostly sandy soil or sand of F.M. 0.6 to 1.2	Some/ several location between Shagarika to Khejurtala along sea side within sea beach.	300,000.00	Cu.m	275.00
2	Sand F.M 0.8 to 1.3	Karnophuly bed at upstream porition of Kalurghat bridge.	1,000,000.00	Cu.m	500.00
3	Sand F.M 0.6 to 1.3	Upstream of Karnophuly from Kalurghat bridge & other river flown to Karnophuly/ Sungo river mouth.	200,000.00	Cu.m	575.00
4	Silty, sandy/ Silty clayee/ Sandy clayee soil of PI 8 to 20	Some/ Several location between Shagarika to Khejurtala along sea side within sea beach.	500,000.00	Cu.m	275.00
5	Silty, sandy/ Silty clayee/ Sandy clayee soil of PI 8 to 20	Karnophuly river mouth	1,000,000.00	Cu.m	520.00

Note: Volume will be measured at final loading point of the materials during supplying to work spot.

Source: Taher Brothers Ltd. In Chittagong

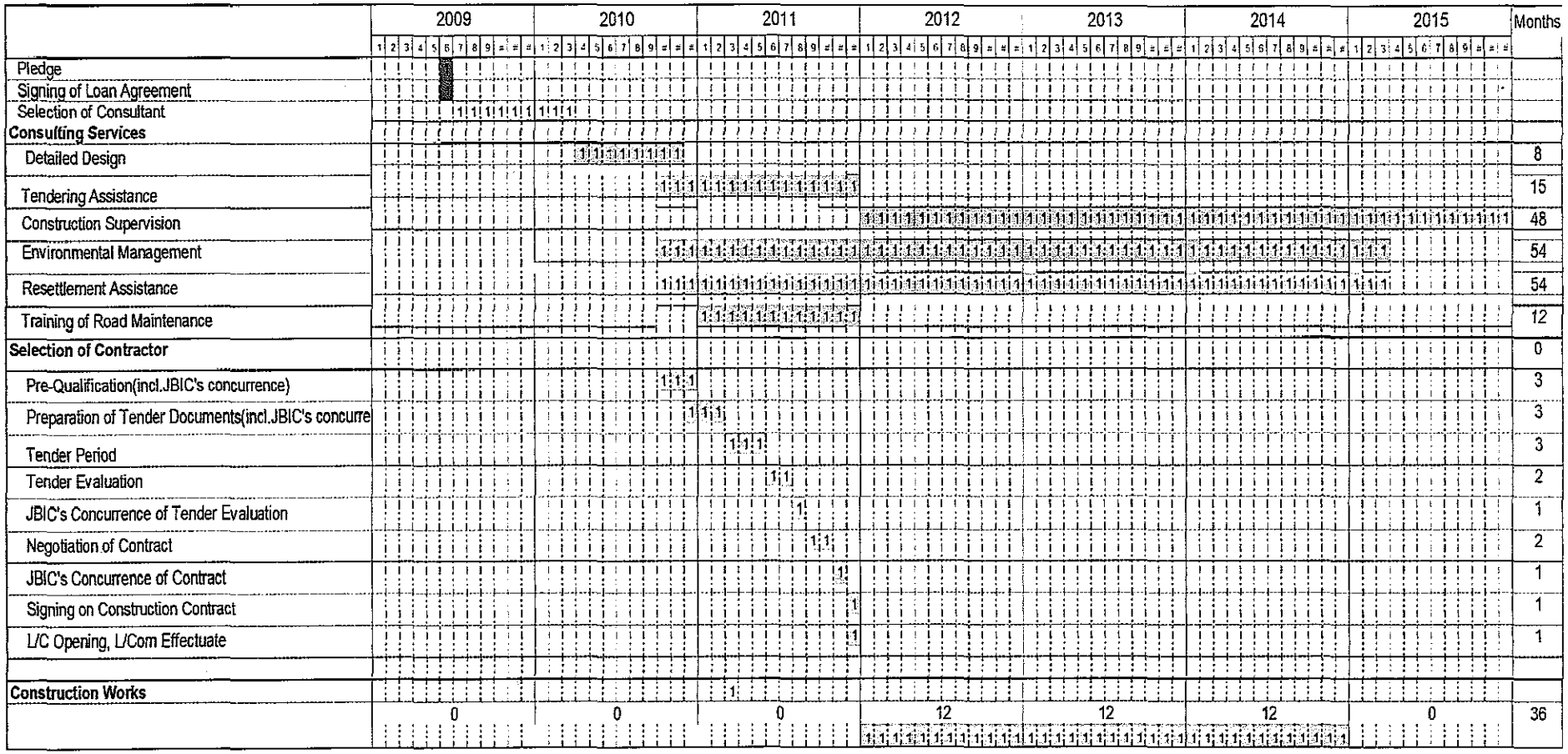
Appendix3.3-15

Recent Price Trend on Principal Materials

	Items of Materials	Unit	Market Price		Volatility (%)	Remarks
			Apr.2008	Aug.2008		
	Bitumen 80/100 Grade					
	Liquid	Per Ton	Tk. 33,000	Tk. 40,000	121%	ERL (Ex Factory)
	Liquid	Per Ton	Tk. 33,800	Tk. 43,000	127%	PHP (Ex Factory)
	Drum (150 Kg)	Per Drum	Tk. 6,500	Tk. 7,005	108%	ERL (Ex Factory)
	Mild Steel					
	40 Grade (8 mm)	Per Ton	Tk. 68,000	Tk. 61,000	90%	KSRM (Ex Factory)
	40 Grade (10 mm to Above)	Per Ton	Tk. 67,000	Tk. 59,500	89%	KSRM (Ex Factory)
	60 Grade (8 mm)	Per Ton	Tk. 72,000	Tk. 70,000	97%	KSRM (Ex Factory)
	60 Grade (10mm to 28mm)	Per Ton	Tk. 72,000	Tk. 69,200	96%	KSRM (Ex Factory)
	60 Grade (32 mm)	Per Ton	Tk. 72,000	Tk. 69,800	97%	KSRM (Ex Factory)
	60 Grade (8 mm)	Per Ton	Tk. 74,500	Tk. 70,500	95%	BSRM (Ex Factory)
	60 Grade (10 mm to Above)	Per Ton	Tk. 74,500	Tk. 70,000	94%	BSRM (Ex Factory)
	Cement					
	Ruby Cement	Per Bag (50 Kg)	Tk. 338	Tk. 360	107%	Ex Factory
	Confidence	Per Bag (50 Kg)	Tk. 342	Tk. 364	106%	Ex Factory
	Aramit	Per Bag (50 Kg)	Tk. 335	Tk. 355	106%	Ex Factory
	Royal	Per Bag (50 Kg)	Tk. 337	Tk. 350	104%	Ex Factory

Source: Taher Brothers Ltd. In Chittagong

Appendix 3.3-16 Implementation Schedule on the Consulting Services



Appendix3.3-17

Record of the Construction Period of Past Road Construction Projects in CDA

No.	Name of Projects	Construction Period (months)		Quantities of Projects		Efficiency in Projects	
				Earth Works (m3)	Pavement Works (m2)	Earth Works (m3/M)	Pavement Works (m2/M)
01	Kalurghat Road	June,05 –June,08	36	84,046	51,259	2,335	1,424
02	Arakan Road	June,03 – June,06	36	348,593	303,696	9,683	8,436
03	Oxygen-Kuaish Road	June,05 – June,07	24	160,281	61,316	6,678	2,554
04	Airport Road	June,00 – June,05	60	416,918	407,436	6,948	6,791
	Coastal Road	Jan, 12 – Dec, 14	36	2,809,506	387,320	78,042	10,759

Source: CDA

Appendix3.3-18

Utilization Record of Dredging Sand in Past CDA Projects

No.	Used Record in other Past Projects	Capacity of providing (m3)	Name of the Company (Dredging / Selling)
1	Kalpolok phase-1	313,238	M/s M.n. Alam Asha Construction M/s Abdus salam
2	Kalpolok phase-2	904,871	M/s Pacific Marina M/s M.n. Alam Asha Construction M/s Abdus salam M/s Alraji & Co.
3	"Chandrima" at Chandgaon R/A	114,527	M/s M.n. Alam Asha Construction M/s Abdus salam M/s Yunus Brothers M/s Didar Brothers M/s Anwar Hossen

Source: CDA

Appendix3.3-19

Procurement Condition of Pavement Materials in Chittagong Area

No.	Name of Materials	Place of Production	Name of the Selling Company	Remarks
1	Bitumen	Chittagong	ERI	Import from UAE, IRAN
2	Coarse Aggregate	Chittagong, Sylhet	Various Companies	
3	Stone chips	Chittagong, Sylhet	Yunus Co.	
4	Sand	Chittagong, Sylhet	M/s M.n. Alam Asha Construction M/s Abdus salam M/s Pacific Marina M/s Yunus Brothers M/s Didar Brothers M/s Anwar Hossen etc.	

Source: CDA

Appendix3.9-1

Bird Life International (February/2008)

http://www.birdlife.org/news/news/2008/02/sbs_myanmar.html

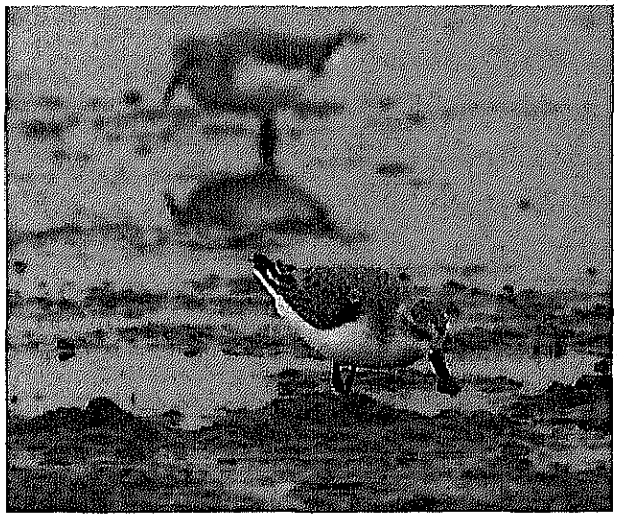
"...no birds have been seen this year at their traditional wintering sites in Bangladesh" —Evgeny Syroechkovskiy, Vice President of the Russian Bird Conservation Union

Wintering Spoon-billed Sandpipers found in Myanmar

14-02-2008

Sightings of 84 Spoon-billed Sandpipers *Eurynorhynchus pygmeus* at two coastal wetland sites in Myanmar have cast new light on the winter distribution of this Endangered species, and confirmed that these wetlands are of international importance for their biodiversity.

The known global population of Spoon-billed Sandpiper has plunged alarmingly in the last few years to only 200-300 pairs. "The number of breeding pairs in Chukotka, Siberia, fell by 50 percent between 2006 and 2007, and no birds have been seen this year at their traditional wintering sites in Bangladesh", says Evgeny Syroechkovskiy, Vice President of the Russian Bird Conservation Union (BirdLife in Russia).



Peter Ericsson

New wintering sites for Spoon-billed Sandpiper have been discovered in Myanmar.

Zoom In | Hi-Res

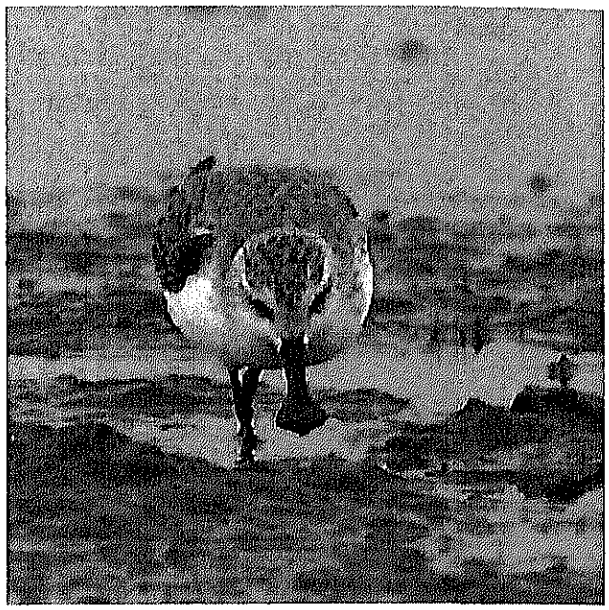
The Spoon-billed Sandpiper Recovery Team which found the birds included staff from Biodiversity and Nature Conservation Association (BANCA), Bird Life International's Partners in Russia and Thailand, and members of ArcCona Consulting (Cambridge, UK and Kiel, Germany) and the Japan Wetlands Action Network (JAWAN).

ArcCona's analysis of satellite images, combined with the experience of previous surveys in India, Bangladesh and Thailand, and with historical records of the species in Myanmar, suggested that potentially suitable habitats existed in the south-western state of Arakan (Rakhine) in the Bay of Bengal, and Martaban (Mottama) Bay near the Thai border.

"Thirty-five Spoon-billed Sandpipers were counted at one high-tide roost in Arakan, including one juvenile ringed at the breeding ground in Chukotka last summer. The team at Martaban found a total of 48 Spoon-billed Sandpiper, scattered over the huge mudflats of the bay but included a flock of 39 birds. The Arakan coast has never been surveyed before, and Martaban Bay only marginally in 2003," explained Christoph Zöckler of ArcCona Cambridge.

"...no birds have been seen this year at their traditional wintering sites in Bangladesh"

—Evgeny Syroechkovskiy, Vice President of the Russian Bird Conservation Union



Peter Ericsson

Despite this new find the species's future remains precarious

Zoom In | Hi-Res

"Our surveys have covered only a small section of the promising Arakan coast," Christoph Zöckler added. "Although small-scale reclamation of the mudflats for prawn ponds has been observed, the coastal zones are largely healthy ecosystems, which provide both crucial habitat for tens of thousands of arctic waders, and livelihoods for hundreds of thousands of people."

Htin Hla of BANCA said he was surprised and delighted by the findings. He said that BANCA will work with the international community to provide a more secure future for the species.

"This is an important piece of the jigsaw," said **Simba Chan, Senior Conservation Manager at BirdLife's Asia Division**. "If present trends continue, Spoon-billed Sandpiper faces extinction in the next few years. If we are to save the species, we need to identify and conserve not only its breeding sites, but its migration stopover sites and wintering grounds too."

The Arakan team also recorded Indian Skimmers, several pairs of Sarus Crane and a huge number of wintering Bar-headed Geese. At Martaban, an estimated 50,000 waders are believed to include globally significant numbers of Broad-billed sandpiper, Lesser Sand-plover and Pallas' Gull.

"This work provides further illustration of the global importance of Myanmar for biodiversity conservation" —Simba Chan, Senior Conservation Manager at BirdLife's Asia Division

Simba Chan added: "The coast of Myanmar is still relatively intact, but most of the tidal area along the eastern asia flyway is under very heavy development pressure. This work provides further illustration of the global importance of Myanmar for biodiversity conservation."

The surveys would not have been possible without the full support of the Ministry of Hotels and Tourism of Myanmar. The survey team logistics were managed in Myanmar by WATT (Wildbird Adventure Travel and Tours). The Main sponsor for the survey work is Keidanren Nature Conservation Fund. Additional contributions by the Royal Society for the Protection of Birds (BirdLife in the UK), Asia Bird Fund of BirdLife International, the Manfred Hermsen Foundation (Bremen) and private Russian sponsors.

The BirdLife International Partnership has been committed for a number of years to surveying and monitoring habitats in Myanmar. In the early 2000s The Wild Bird Society of Japan (BirdLife partner in Japan) assisted the Myanmar authorities to survey and compile a national wetland inventory. That helped Myanmar's ratification of the Ramsar Convention. The Ramsar Designated Moyingyi Wetland Wildlife Sanctuary is an inland wetland located close to the Martaban (Mottama) coast.

Those earlier surveys did not include the Arakan (Rahkine)

Appendix 3.9-2 JICA Environmental Checklist: 15. Roads and Railways (1)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1)EIA and Environmental Permits	① Have EIA reports been officially completed? ② Have EIA reports been approved by authorities of the host country's government? ③ Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? ④ In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country' s government?	① Report of IEE and EIA were completed.(support for IEE and EIA drafting is being provided through the project) ② IEE was submitted to DOE on 13th January 2009.EIA will be submitted to DOE. ③④ The plan is to submit the EIA for approval.
	(2)Explanation to the Public	① Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? ② Are proper responses made to comments from the public and regulatory authorities?	① Public meetings were held at the time of the IEE and EIA. ② The local project proponent will provide appropriate responses to comments received from residents and the regulatory authorities and, where deemed necessary, will carry out the requirements (note that the comments have already been reflected in the EIA).
2 Mitigation Measures	(1)Air Quality	① Is there a possibility that air pollutants emitted from various sources, such as vehicle traffic will affect ambient air quality? Does ambient air quality comply with the country's ambient air quality standards? ② Where industrial areas already exist near the route, is there a possibility that the project will make air pollution worse?	① SO2 and NOx predictions made following project consolidation demonstrate that local ambient air quality standards will be met. Specifically, the contribution to SO2 concentrations made by the road is marginal when compared with background concentrations, and it is unlikely that the existence of this project will have any significant impact on pollutant concentrations. SPM, PM10 and PM2.5 constitute the foremost concern; however, vehicles in Bangladesh are being converted to compressed natural gas (CNG) fuel and it is thought that the impact of the project road will be minimal. It will, however, be necessary to monitor pollutant concentrations both during construction and after completion and measures, such as watering, may need to be looked into depending on the results of the monitoring. ② The planned route passes through a number of industrial areas. However, since the project will not generate large volumes of atmospheric pollutants, it is unlikely that it will result in any deterioration in air quality.
	(2)Water Quality	① Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradatian in downstream water areas? ② Is there a possibility that surface runoff from roads will contaminate water sources, such as groundwater? ③ Do effluents from various facilities, such as stations and parking areas/service areas comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas that do not comply with the country's ambient water quality standards?	① It is possible that fillings and cuttings will generate turbidity. Foot protection works are to be undertaken on the seaward side of the section to be filled, and every effort is being made to avoid turbid water runoff into the ocean. The embankment slopes are to be planted when the road goes into service in an effort to mimimize turbid water runoff. ② It is unlikely that surface runoff from roads will result in any significant pollution of water sources. There are, however, concerns about the impact on local drinking water wells of rain-induced elution in the event that polluted dredged soil is used as the filling material. To this end, sampling surveys of dredged soil will need to be conducted and measures taken to ensure that polluted soil is not used. ③ The plans do not include parking areas, suggesting that the impact of effluent once the road goes into use will be minimal.

Appendix 3.9-2 JICA Environmental Checklist: 15. Roads and Railways (2)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(3)Noise and Vibration	① Do noise and vibrations from vehicle and train traffic comply with the country's standards?	① Under current circumstances, threshold limit values are being exceeded in certain places and at certain times of the day. It is thus possible that the increase in traffic resulting from the project will worsen noise and vibration levels. It may be necessary to investigate countermeasures, such as sound insulating walls and/or drainage pavement, depending on the circumstances.
3 Natural Environment	(1)Protected Are	① Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	① No protected areas have been identified along the planned route.
	(2)Ecosystem	① Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? ② Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? ③ If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? ④ Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock? ⑤ Is there a possibility that installation of roads will cause impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered? ⑥ In cases where the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?	① There are mudflats and mangrove forests along the coast, but they will not be directly altered by the project. There are concerns about sediment runoff during the construction of the embankment, but measures will be taken to minimize the impact by preventing the runoff of filling materials, etc. ② The habitats (wintering grounds) of a precious species requiring protection have been confirmed local to the project site, but the project will not directly impact upon (alter) these habitats. Nonetheless, measures will need to be taken to prevent the runoff of filling materials when construction is undertaken during the rainy season and appropriate countermeasures have already been looked into. ③ It is concluded that this project is unlikely to have a significant impact on the ecosystem. ④ It is concluded that this project is unlikely to result in the fragmentation of migration routes and/or habitats, etc. ⑤&⑥ Since the project road is to pass along the shore and through low-lying areas of the city, it is concluded that the impact of the project is unlikely to be significant. The only conceivable impact is that on banking material sources and efforts will be made to ensure tha
	(3)Hydrology	① Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	① The planned route will pass through a flood-prone area and it is thus possible that the construction of the embankment will have an impact on surface water flows. Since the project road will function as a levee, it will be necessary to incorporate an appropriate number of sluice (flood) gates, appropriately located, into the design and to investigate a flood management system.

Appendix 3.9-2 JICA Environmental Checklist: 15. Roads and Railways (3)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(4)Topography and Geology	① Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed? ② Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides? ③ Is there a possibility that soil runoff will result from cut and fill areas, waste soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?	①&② The planned route will pass through soft ground, but an appropriate method of construction was put forward at the design stage thus the impact will be minimal. ③ Due to the potential for soil runoff from banked areas, it will be necessary to explore appropriate measures to counter this problem at the detailed design stage.
4 Social Environment	(1)Resettlement	① Is involuntary resettlement eaused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? ② Is adequate explanation on relocation and compensation given to affected persons prior to resettlemeut? ③ Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? ④ Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, chlidren, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? ⑤ Are agreements with the affected persons obtained prior to resettlement? ⑥ Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? ⑦ Is a plan developed to monitor the impacts af resettlement?	① The project will involve involuntary resettlement. To this end, LAP and RAP are being compiled to minimize the impacts caused to those affected. ② Stakeholder meetings are to be convened. ③ A baseline survey on the social impact of resettlement is to be conducted and an appropriate RAP devised. ④ Due consideration will be given to the socially vulnerable in the RAP. ⑤ It will be necessary to find an appropriate means of forming a consensus with those residents who will be affected by the resettlement component. ⑥ An environment department is being set up at CDA, the local project proponent (Town Planner-2) ⑦It isplanned to monitor the impact of resettlement.
	(2)Living and Livelihood	① Where roads or railways are newly installed, is there a possibility that the project will affect the existing means af transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or nemployment? Are adequate measures eonsidered for preventing these impacts? ② Is there a passibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary? ③ Is there a possibility that diseases, including communicable diseases, such as HIV will be introduced due to immigration of workers associated with the projeot? Are adequate considerations given to public health, if necessary? ④ Is there a possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)? ⑤ Is there a possibility that roads and railways will cause impede the movement of inhabitants? ⑥ Is there a possibility that structures associated with roads (such as bridges) will cause a	①There are some inhabitants necessary to resettle by this project. RAP shall be created in order to minimise the impacts. ②It shall be planned to create RAP and timely confirm the anxieties by monitoring and then take measures in order to minimise the impacts to inhabitants necessary to resettle. ③ There is a possibility that diseases would be aroused at accommodation for project workers. It is necessary to take actions of prior notice to hospitals. ④It is expected to eliminate traffic jam in the future by this project. ⑤It is considered to design sections in order to avoid obstacles during detail design step. ⑥It is not expected because there is no plan to construct viaduct within residential area.

Appendix 3.9-2 JICA Environmental Checklist: 15. Roads and Railways (4)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
	(3)Heritage	① Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	① There are no heritage sites in the vicinity of the planned route.
	(4)Landscape	① Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	① There are no landscapes requiring particular consideration in the vicinity of the planned route.
	(5)Ethnic Minorities and Indigenous Peoples	① Where ethnic minorities and indigenous peoples are living in the rights-of-way, are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples? ② Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples?	①&② There are no ethnic minorities and/or indigenous people living near the planned route.
5 Others	(1)Impacts during Construction	① Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? ② If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? ③ If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? ④ If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	① Measures to ease pollution during construction will need to be devised. The contractor will need to take responsibility for investigating detailed mitigation measures at the schedule design stage. ② It is possible that construction work will have some impact on the natural environment. However, the contractor will need to take responsibility for investigating detailed mitigation measures at the schedule design stage. ③ The RAP is intended to ensure an appropriate resettlement process. ④ The EMP is intended to ensure that appropriate health and safety education is provided.
	(2)Monitoring	① Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? ② Are the items, methods and frequencies included in the monitoring program judged to be appropriate? ③ Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? ④ Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	① There are plans to implement a monitoring program; the details are contained within the EMP. ② At this time, those monitoring parameters deemed to be necessary have been selected. The addition of other monitoring parameters will need to be investigated at the stakeholder meetings that are to be held on a regular basis henceforth and due consideration given to the environment. ③ CDA, the local project proponent, has informed us that a department to handle environmental issues relating to this project is to be set up internally. This is organizationally viable, but due to the need for expert monitoring, it will be necessary to commission a natural and social environment consultant to undertake a survey. ④ No stipulations have been made as to how monitoring results are to be reported to the DoE. However, provision will need to be made for mandatory reporting to JICA.

Appendix 3.9-2 JICA Environmental Checklist: 15. Roads and Railways (5)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
6 Note	Reference to Checklist of Other Sectors	① Where necessary, pertinent items described in the Forestry Projects checklist should also be cheeked (e.g., projects including large areas of deforestation). ② Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	① The project (planned route) is not anticipated to include large areas of deforestation. ② No power transmission lines or distribution facilities are to be installed near the planned route.
	Note on Using Environmental Checklist	① If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the (ozone layer, or global warming).	① The project road is to be built along the coast and is thus likely to be severely affected by rising sea levels cause by climate change, etc. Due consideration was accordingly given to climate change and a design created to minimize its effects. The project will also contribute to relieving congestion in the city and to increasing average vehicle speed, which means that it has the potential to reduce carbon dioxide emissions.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.
*: This table format is modified from "Environmental Checklist" 15 Roads and Railways" in JBIC Environmental Guideline.

Report on

Reaction of Participants (Mostly CDA personals) of the Training program on Land Acquisition and Resettlement in CDA 4-5 December 2008

Two days training program on Land Acquisition, Resettlement and Rehabilitation of the Chittagong Ring Road was conducted by Dr. Hafza Khatun, Resettlement Specialist and SAPROF team member. CDA provided the logistics like venue, technical support like presentation facility, printing facilities of materials and food. The training was for two days 4 & 5th of December 2008. Sixteen modules have been presented through power point and rest items were discussed in detail with documents in hands of the participants. Most of the modules were distributed among the participants.

There were in total 28 participants, 2 were from BWDB, 2 from CC 1 PA 1 from Chittagong Metropolitan Police and rest were from CDA. CDA Chairman were present on and off in the whole program.

The attitude of the participants was positive towards the policy but they expressed to have legal power to handle that. Reaction of the participants by topic is given below:

Program Details

Event: Orientation/Training on LA & Resettlement issues of CCRRP

Duration 2 days

Venue: CDA Conference Room

Coordinator: Dr. Hafza Khatun, Resettlement Specialist

Course Program Day -1

Times		Module No	Activities/Topics
09.00	09.20		Registration
09.20	09.45		Inauguration and Welcome by Chairman, Chief Planner and other members of CDA
09.45	10.00		Personal Introduction
10.00	10.30	01	Course Introduction & Objectives
10.30	11.00	02	Philosophy and Principles of Resettlement
11.00	11.15		Tea Break
11.15	12.00	03	LA Ordinance and Resettlement

12.00	12.30	04	IR Experience in Bangladesh
12.30	12.45	05	CD viewing of BBP
12.45	13.45		Lunch and prayer break
13.45	14.30	06	Experience of BBP
14.30	14.45	07	Introduction of Social issues of CCRRP
14.45	15.15	08	Social Baseline Survey
15.15	15.25	09	CD Viewing the APs with ID numbers
15.25	16.00		Question and Answer
16.00			Tea

Course Program Day -2

Times			Activities/Topics
09.00	09.20		Registration
09.20	09.40	10	Socio-economic Aspects of the APs
09.40	10.30	11	Eligibility Policy and Entitlement Matrix
10.30	11.00	12	Payment Procedure of Compensation and Resettlement Assistance
11.00	11.15		Tea Break
11.15	11.30	13	Development of Resettlement Sites
11.30	12.00	14	Implementation Arrangements
12.00	12.45	15	Implementation Steps to be followed, relocation and re-establishment of Housings, CBEs, and CPRs
12.45	13.45		Lunch and prayer break
13.45	14.15	16	Income and Livelihood Restoration Strategy
14.15	14.45	17	Resettlement cost and budget
14.45	15.15	18	RAP Implementation Schedule
15.15	15.30	19	Monitoring and Evaluation
15.30	16.00		Question/Answer
16.00			Tea

1. **Philosophy and Principles of Resettlement**
   - Bangladeshi law does not permit to compensate the non titled person. So to compensate them the law need to be amended.
   - As Bangladesh has experience of resettling or compensating the non titled holders in donor funded project, CDA also can do it.
   - This type of compensation might encourage the illegal occupancy on other vacant land or land along any road or river.

2. **LA Ordinance and Resettlement**
   - It is true that it takes long time to complete the compensation process by following the LA ordinance
   - In many cases people do not take compensation money for this complicated process.
   - In most of the cases the compensation money remains far below than the real market price
   - Some times if people can manipulate the DC office in price fixation, they some times even get higher price than the reality
   - This LA ordinance needs to be more people friendly and simple.
   - Bangladesh should have its own resettlement policy
   - The affected people should be given appropriate compensation

3. **IR Experience in Bangladesh**
   - Experience in other donor funded projects are very optimistic
   - Participants asked many questions about the implementation arrangement of RAP of these projects like Jamuna Multipurpose Bridge Project (JMBA), Bhairab Bridge Project (BBP) and others.
   - Sustainability was questioned
   - Transparency about compensation mechanism and monitoring was questioned
   - Mechanism of approval procedure of Resettlement budget was discussed

4. **CD viewing of Bhairab Bridge Project (BBP)/ Experience of BBP**
   - During the training period, A video film was shown to share the resettlement and rehabilitation experience in Bhairab Bridge project. This film could make very positive impact on the participants
   - Participants enjoyed the CD and asked several questions regarding resettlement procedure
   - Chairman expressed his hope that CDA will do better than that of Bhairab Bridge Project in respect of Resettlement
   - CDA is very much in favor of providing special assistance to the vulnerable people
   - CDA expects that they will use the knowledge of lesson learnt from designing and implementation of the BBP

5. **Introduction of Social issues of CCRRP , Social Baseline Survey & CD Viewing the APs with ID numbers**
   - Project area is known to almost all the participants
   - Detail discussion took place on methodologies
   - Participants felt comfortable about the video filming of all the affected people with some ID number, so it would be easier to identify the affected people.

6. **Socio-economic Aspects of the APs**
   - CDA appreciated so detail analysis of the socials profile of the affected people
   - Some facts became more clear to the participants regarding social situation of the affected people
   - Occupation of this project area is very much influenced both way. Through exploiting water resource that is fishing as well as work in EPZ

7. **Eligibility Policy and Entitlement Matrix**
   - Participants asked several questions on reasons for fixation of rate of compensation
   - After explanation, they appreciated that
   - They appreciated the incorporation of safeguard issues in the matrix
   - CDA is ready to compensate the affected people as prescribed in the entitlement matrix

8. **Payment Procedure of Compensation and Resettlement Assistance**
   - Participants raised various types of question on the proposed compensation procedure
   - Most repeated questions were on legality of formation of committees like PVAT, GRC and RAC
   - How the IA (NGO) will be appointed and keep liaison with DC office through CDA
   - What would be the role of CDA here to expedite the compensation procedure process
   - All the steps to be followed in acquision and compensation for titled and non titled holders
   - Based on earlier discussion on experience in other donor funded projects, CDA expressed their willingness to implement this RAP by following the prescribed mechanism

9. **Development of Resettlement Sites**
   - All the proposed resettlement sites with nature has been shown in the map
   - CDA expressed ther positive view about development and establishment of these resettlement sites with all the infrastructure facilities proposed in the plan

- The allotment mechanism of the plots with all the conditions have got positive view from the CDA authority, specially the chairman
- Chairman even told that if possible they may provide better facilities to the resettlers.

10. Implementation Arrangements & Implementation Steps to be followed, relocation and Re-establishment of Housings, CBEs, and CPRs

- Implementation arrangement and tasks of concern position has been elaborated
- Main Organizational Arrangement for RAP implementation has been appreciated by CDA after detailed discussion of each persons responsibilities
- Participants were very much concerned about the timing, synchronization of all the activities mentioned in the design
- CDA Chairman thinks capacity of the CDA personals need to be enhanced to handle and manage this huge task
- CDA Chairman declared all sorts of cooperation will be extended to all concern agencies to implement this RAP

11. Income Livelihood Restoration Strategy

- Participants showed their concern in selection of appropriate training program for livelihood restoration of the APs'and their family members
- The program must be selected based on their capacity as well as local market demand
- They also showed their concern on sustainability of this program

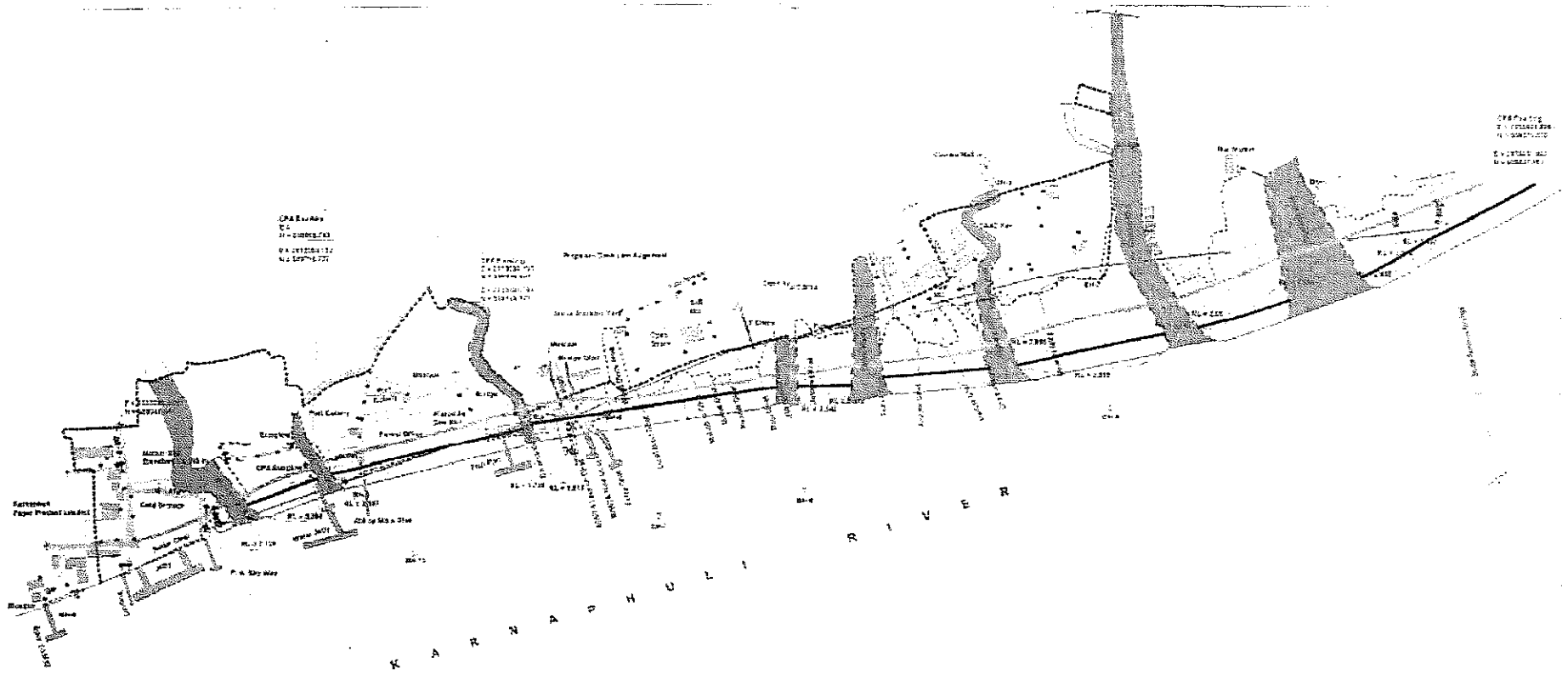
12. Resettlement cost and budget

- The Participants were not very optimistic about approval of this budget by the ministry
- On the other hand it was discussed that as this a donor funded project, so like any other donor funded project it will be approved by appropriate authority

13. RAP Implementation Schedule & Monitoring and Evaluation

- Expressed that strong monitoring is essential for fruitful and effective implementation of RAP
- Mid-term evaluation would help in improving the shortfall of RAP or implementation mechanism.

Appendix 4.2-1 Capital Dredging Project Drawing



LEGEND

- Light Post
- Electric Pole
- Bore Hole
- Bench Mark
- Reference Point
- Tube Well
- Tree

- Proposed Bank Line
- Existing Bank Line
- CPA Property Line
- Reference Line
- Low Bank Line
- Boundary Wall
- Fence
- Proposed Extension of Bank Line in Khal

- Reclaimed Land
- Proposed 120 Feet Road
- Khal
- Paved Road
- Semi Pucca Road
- Katcha Road
- Nala
- Pond

- Building
- Semi Pucca Shop
- Tin Shed House
- Tin Shed Shop
- Bounded Departmental Facility
- Bridge/Culvert
- Temporary Ghat
- RCC Ghat

Survey Map of Northern Bank of the River Karnafulli Between Sadarghat Area to Shah Amanat Bridge

100 50 0 100 200 Meter

Appendix 4.3-1 Civil Work Cost Estimate (Total) Karnaphuli River Road

Division	Description of Items	Karnaphuli River Road				Total Amount (Tk.)
		Section- 1	Section- 2	Section- 3	Section- 4	
DIVISION 1	*General & Site Facilities*					256,310,205
DIVISION 2	Earth work	27,127,398	695,245,166	142,030,652	82,854,974	947,258,189
DIVISION 3	Pavement work	29,843,961	637,562,036	176,396,169	142,382,558	986,184,724
DIVISION 4	Foundation work					476,927,243
DIVISION 5	Structures					1,065,318,085
DIVISION 6	Incidental	53,747,500	1,087,201,329	281,958,664	227,608,357	1,650,515,849
Others						256310204.5
						5,638,824,500
					Grand Total =	**5,638,824,500**
				Without Tax	91.50%	5,159,524,417
				Tax	8.50%	479,300,082

Appendix 4.3-2 List of Rivers and Canals of the Karnaphuli River Road Construction Project

Sl No.	Road Section	Chainage	Width	Length	Width	Vent	Existing Structure	Bottom Level in M (MSL)	Design Top Level in M (MSL)	Top to Bottom Difference (M)	Proposed Bridge	Proposed Culvert
1	Section-2	0+510 km	19.60m				Canal	-0.625	9.40	10.03	L = 20 m	
2		0+554 km	7.50m				Canal	0.084	9.40	9.32	L=10 m	
3		0+852 km	19.00m				Canal	-0.379	9.40	9.78	L = 20 m	
4		1+575 km	42.20m				Canal	-1.929	9.40	11.33	L = 40 m	
5		1+750 km	34.90m				Canal	-0.964	9.40	10.36	L = 30 m	
6		2+570 km	32.00m				Canal	-1.234	9.40	10.63	L = 30 m	
7		4+350 km	94.50m				Canal	-0.517	9.40	9.92	L = 90 m (30mx30mx3)	
8		5+100 km	15.52m				Canal	0.412	9.40	8.99	L=15 m	
9		5+377 km	27.80m				Canal	-0.558	9.40	9.96	L = 30 m	
10		6+687 km	12.00m				Canal	0.421	9.40	8.98	L=12 m	
11		7+030 km	23.70m				Canal	0.025	9.40	9.38	L = 25 m	
12		7+959 km	29.50m				Canal	-0.125	9.40	9.53	L = 30 m	
13	Section-3	9+230 km	63.70m				Canal	-1.121	7.00	8.12	L = 60 m (20mx20mx3)	
14		9+500 km	51.30m				Canal	-1.236	7.00	8.24	L=50m (25mx25mx2)	
15		9+750 km	15.60m				Nala	0.235	7.00	6.77	L=16 m	
16		10+000 km	38.00m				Canal	-0.820	7.00	7.82	L = 40 m	
17		10+112 km	9.60m				Drain	1.633	7.00	5.37		4.5 X 4. 5 Culvert
18		10+541 km	10.50m				Drain	0.394	7.00	6.61		4.5 X 4. 5 Culvert
19		10+908 km	10.00m				Canal	-0.658	7.00	7.66	L=10 m	
20		11+037 km	18.00 m				Nala	0.000	7.00	7.00	L = 20 m	
21	Section-4	11+558 km		6.78m	6.10m	1	Box Cul.	2.145	7.00	4.86		4.5 X 4. 5 Culvert
22		11+865 km		4.20m	9.64m	1	Box Cul.	2.313	7.00	4.69		4.5 X 4. 5 Culvert
23		12+106 km		6.70m	5.40m	1	Box Cul.	-0.499	7.00	7.50		4.5 X 4. 5 Culvert

Source: Study Team

Appendix 4.3-3(1)

Outline of the Karnaphuli River Road Construction Project

Items		Quantities	
Outline			
1)	Project Distance	4 lane-13,020m	
2)	No. of Lanes and Width of Carriageway & Shoulder	4 lane-36.576m	
Type of Works			
1)	Earth Works	Soil Volume	5,255,397m3
2)	Pavement Works	Pavement Volume	235,967m3
3)	Bridge Works (Number of Bridges)	Section-1	-
		Section-2	12-353m
		Section-3	6-196m
		Section-4	-
4)	Culvert works (Number of Culverts)	Section-1	-
		Section-2	-
		Section-3	New: 2
		Section-4	New: 3
5)	Drainage Works (Total Distance of Concrete *Side Ditch/U-Drain*)	Section-1	804m
		Section-2	17,176m
		Section-3	4,460m
		Section-4	3,600m
6)	Disaster Prevention Works	Sluice gates of culverts	-

Source: Study Team

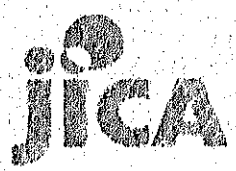
Appendix 4.3-3(2)

Outline of the Karnaphuli River Road Construction Project by Each Section

Section	Road Type	Chainage	Distance (km)	Embankment Type	No. Lanes	Road Width (m)	Earth Volume (m3)	No. & Length of Bridge	No. of Culvert
Section-1	NECR	0+000 – 0+402	0.402	Earth bank	4	36.576	147,438	0	0
Section-2	NECR	0+402 – 8+990	8.588	Earth bank	4	36.576	3,934,719	12-353	0
Section-3	NR	8+990 – 11+220	2.230	Sheet pile	4	36.576	765,910	6-196	2
Section-4	W+R	11+220 – 13+020	1.800	No bank	4	36.576	407,330	0	3
Total			13.020				5,255,397	18-549	5

Source: Study Team

Road Type: NR: New Road Construction, NECR: New Embankment-Cum-Road Construction, W+R: Widening and Rehabilitation Road, Source: Study Team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