

CHAPTER 5 ENVIRONMENTAL IMPACT ASSESSMENT

5.1 Objectives and Methodology

- (1) For planning the proposed construction of the Bridge, actual conditions of environment items for each of three alternative routes including roads were surveyed and Environmental Impact Assessment (EIA) was carried out. A supplement survey was also undertaken for resettlement issue on Route 1 which was decided as the optimum route. Interviewers were dispatched to all the households on the road alignment and social baseline surveys were carried out by the use of survey sheets and the collected data were analyzed.
- (2) Environment Clearance application is obligated for this Project by Environmental policy and laws of Bangladesh, because bridges over 100 m. and national highway projects belong to the 4th category called "Red Category" in accordance with the Environment Conservation Act (1995) and the Environment Conservation Rule (1997) enacted based thereupon. This application should be submitted by RHD Khulna Division Office to Khulna Office of Department of Environment (DOE), the Ministry of Environment and Forestry. This application should be attached with a feasibility study report, IEE-EIA reports and Mauza maps for lands intended to be used for the project.

5.2 Social and Natural Conditions of the Project Area

(1) Social Conditions of the Project Area

Khulna is the third largest metropolitan city in Bangladesh with a population of nearly one million in 1998. The old town, with half of the population of Khulna City, is characterized by narrow lanes along rivers and tightly packed housing ranging from two to three storied buildings to poorly serviced squatter slums.

The percentage of persons engaged in agriculture is found very insignificant in Khulna City Corporation where 97.2 percent are engaged in non-agriculture sector.

The physical environmental factors, particularly the presence of rivers and ponds and the nature of the topography largely determine the patterns of rural settlement. In Khulna region, rural settlement differs from area to area. Most typical homesteads have independent enclosed courtyards, generally rectangular in shape with dwelling units on three or even all four sides. The courtyard forms an essential and integral part of the rural homestead and performs several functions.

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It is used as outdoor living or sitting space for adults, mainly women, as children's play space, and as space for drying field crops, clothes, utensils etc. Ponds also form an essential element of rural settlements in some areas of Bangladesh and serve multi-purpose activities mainly bathing, washing and fishing. Tree species growing on homestead platforms include fruits, fuel wood timber and horticultural species. The size of the homestead area varies from 140 m² to 600 m² and are consisted of 4 to 6 families with a total member of 8 to 20. What is the most important in this living form is that it has very strong bondage among the members of immediate kin who live together on the same homestead or in close proximity.

(2) Natural Conditions of the Project Area

The city area of Khulna is situated on narrow and slightly high natural levee, which was naturally made on south-north direction along the both sides of the River. In general, the ground of natural levee is good on sandy soil. However, the back swamp outside such levee is located on soft ground and development in east-west direction of the town is hindered thereby making a boundary.

The Routes 1, 2 and 3 neither passe over any natural forest nor that any forest exists in the adjacent areas. The embankment and the bridge pass through several distinctly different ecosystems, e.g. rural homesteads, agricultural land, swampland on alluvial younger materials and urban area consisting of residential, commercial, industrial and recreational areas. The rural homesteads are found scattered throughout the flood plain area. These are situated on man made platforms and are usually densely covered by different tree species in rural and suburban areas. The agricultural lands in flood plain area are tidally flooded and possess a narrow range of aquatic biodiversities and weed species. Perennial water bodies surrounded by a swampy land occur locally within the area. The flood plain soils are coarse to fine loamy to clayey in basis.

5.3 Environmental Impact Assessment

(1) Overall Evaluation of Environmental Impacts

Table 5.3.1 shows general comparison of three alternative routes:

Table 5.3.1 General Comparison of Three Alternative Routes

	Route 1	Route 2	Route 3
Location	About 2.6 km south of Rupsa Ferry Ghat	About 2 km south of Rupsa Ferry Ghat	About 1 km south of Rupsa Ferry Ghat
Pass through character of the Route	Passing through Rural Area	Passing through Peri-Urban Area in the vicinity of west bank of the Rupsa River	Passing through Urban Area in the vicinity of west bank of the Rupsa River
Number of Household and Population Affected	53 households (2 kutchha houses) 242 persons	114 households (No kutchha house) 523 persons	325 households (49 kutchha houses) 1,557 persons
Land Area for ROW	398,908m ²	338,400m ²	295,200m ²
State of Land Use	Agriculture 89% Commercial & Industrial 1% Residential 3% Shrimp Gher 4% Others 3%	Agriculture 71% Residential 21% Swamp 3% Shrimp Gher 2% Others 3%	Residential 44% Agriculture 41% Commercial & Industrial 7% Pond 5% Others 3%
Percentage of Indigenous Population in/near the Route	4%	3%	8%
Percentage of Population Mainly Engaged in Agriculture	None	None	0.2%
Number of Schools	0	0	1 (Primary School)
Number of Mosques	0	0	1

Overall environmental impacts on each proposed route are summarized and presented in Table 5.3.2 and Route 1 can be adjudged as having less negative impact than the other two routes.

Table 5.3.2 Summary of Environmental Impacts on Proposed Routes

No.	Environmental Item	Description	Route 1		Route 2		Route 3		Remarks
			Construction Stage	Operation Stage	Construction Stage	Operation Stage	Construction Stage	Operation Stage	
Socio-economic Environment	1. Resettlement	Resettlement due to land occupancy (transfer of rights of residence/land ownership)	○	○	△	△	▲	▲	Households affected: R1-53, R2-114, R3-348
	2. Economic Activities	Loss of bases of economic activities, such as land, and change of economic structure	○	○	△	△	▲	▲	Farm land and nursery ponds
	3. Traffic and Public Facilities	Impacts on schools, hospitals and present traffic conditions, such as the increase of traffic congestion and accidents	○	○	△	△	▲	▲	Transport/Waterway should be secured on embankment section. Traffic conditions will be improved.
	4. Split of Communities	Community split due to interruption of area traffic	○	○	△	△	▲	▲	One primary school and one mosque exist on Route 3.
	5. Cultural Property	Damage to or loss of the value of churches, temples, shrines, archaeological remains or other cultural assets	○	○	○	○	△	△	
	6. Water Rights and Rights of Common	Obstruction of fishing rights, water rights, rights of common	○	○	○	○	○	○	
	7. Public Health Condition	Deterioration of public health and sanitary conditions due to generation of garbage and the increase of vermin	○	○	○	○	△	△	Water will be stagnated if waterway is blocked by embankment.
	8. Waste	Generation of construction and demolition waste, debris and logs	△	○	△	○	△	○	Impacts during construction.
	9. Hazards (Risk)	Increase in risk of landslides, cave-ins and accidents	○	○	○	○	○	○	Waterway shall be supplied adequately.
	10. Topography and Geology	Changes of valuable topography and geology due to excavation or filling work	○	○	○	○	○	○	
Natural Environment	11. Soil Erosion	Topsoil erosion by rainfall after reclamation and vegetation removal	△	△	△	△	△	△	Ponds and puddles will be made by excavation for embanking materials.
	12. Groundwater	Change of distribution of groundwater by large-scale excavation	○	○	○	○	○	○	
	13. Hydrological Situation	Changes of river discharge and riverbed condition due to landfill and drainage inflow	○	○	○	○	○	○	
	14. Coastal Zone	Coastal erosion and sedimentation due to landfill or change in marine condition	○	○	○	○	○	○	
	15. Fauna and Flora	Obstruction of breeding and extinction of species due to changes of habitat conditions	○	○	○	○	○	○	
	16. Meteorology	Changes of temperature, precipitation, wind, etc. due to large-scale land reclamation and building construction	○	○	○	○	○	○	
	17. Landscape	Deterioration of aesthetic harmony by structures	○	○	○	○	○	○	
	18. Air Pollution	Pollution caused by exhaust gas or toxic gas from vehicles and factories	△	○	△	△	▲	▲	Generated during construction and by traffic after construction.
	19. Water Pollution	Pollution by inflow of silt, sand and effluent into rivers and groundwater	△	○	△	△	△	○	"
	20. Soil Contamination	Contamination of soil by dust and chemicals, such as herbicides	△	○	△	△	△	○	"
Pollution	21. Noise and Vibration	Noise and vibration generated by vehicles	△	○	△	△	▲	▲	"
	22. Land Subsidence	Deformation of land and land subsidence due to the lowering of groundwater table	○	○	○	○	○	○	Where organic soil layer develop under embankment section.
	23. Offensive Odor	Generation of exhaust gas and offensive odor by facility construction and operation	○	○	○	△	△	△	Generated during construction and by traffic after construction.

○ No negative impact expected, ○ Less impact expected, △ Some negative impact expected, ▲ Serious impact expected

Table 5.3.3 presents section-wise data of affected households on Route 1. The highest concentration of affected households and population is found in Section 3 at Labon Chara Area on Route 1 at the west bank of the Rupsa River.

Table 5.3.3 Number of Affected Households, Commercial and Industrial Establishments along the Route-1

Name of Section	No. of House holds	Commercial/Shrimp Gher Establishment	Industrial establishment	Community facilities	Population		
					Population	Male	Female
Section-1. Satkhira road to Hatia river ; 1850m	9	-	1	-	39	20	19
Section-2 Hatia River to Khatra Khal ; 3415m	-	1	-	-	0	0	0
Section-3. Kharta Khal to west bank of Rupsa River ; 1055m	43	-	-	-	198	101	97
Section-4 East bank of Rupsa to Jabusa Road ; 1674m	1	1	-	-	5	4	1
Section-5. Jabusa Road to Khulna Mongla Road ; 1529m	-	7	-	-	0	0	0
Total	53	9	1	-	242	125	117

(2) Impacts During Construction Stage

The following impacts are expected along the optimum Route 1 during construction stage:

1) Social Environment

The construction of the bridge with approach roads will require considerable amount of land area. So, the primary impact of the project will be made on land with agricultural, residential, shrimp gher and industrial/commercial characters.

The implementation of the project will displace 53 households in Route-1 from their present place of residence and they are to be relocated elsewhere. So the impact due to the loss of residence cannot be ignored but this loss has been considered least among the three alternative routes. Meantime, the RoW acquisition for the project is not affecting any major industry or commerce except one newly built rice mill at the starting point.

During relocation to new places, normally these people will lose some workdays consequently some loss of income, which cannot be ignored under the involuntary displacement. Moreover, the people to be relocated during implementation of the project will be affected temporarily due to displacement from residence.

Most of the affected people are likely to be relocated in the same village or on the residual land. No serious impact is expected in this regard. However, in Labon Chara area at the west bank of the Rupsa river, construction of high embankment road and interruption of existing road may have significant impacts during and after construction by inconvenience caused in daily activities of inhabitants, which shall have profound effect on their economic activity.

Some negative impact is expected in transportation system of the area during construction in both land and navigation. On the other hand, the implementation of the project will have positive impact on employment of the people. The people of the area are expecting to get additional employment opportunity in different activities of the project.

2) Natural Environment

The surface water drainage is usually disrupted by all major earthworks such as access roads, diversion roads, stockpiles that may have to be built during the construction of the Rupsa bridge and road embankment. The embankment may hold water back during the floods or after heavy shower that usually flow through as thick sheet of water across the flooded land causing drainage congestion.

Agricultural land, homesteads, other real estates and roads on the river sides would be flooded under such condition causing hardship and economic loss to the people living in the project area. On the contrary, farmers of basin areas region would also be affected due to lack of availability of water in time for agricultural practices. This may affect the cropping pattern in the down slope areas of floodplain affected by the Rupsa Bridge Project. However, all these if at all happen will affect only a narrow belt along the newly constructed road embankment near the Khulna City.

The project site after taking soil for embankment material will become ponds and puddles. Excavation plan should be made carefully considering best utilization of such lands. PAPs, for instance, may be encouraged to practice aquaculture in the borrow pits dug within or outside RoW.

3) Pollution

a) Air Pollution and Offensive Odor

During construction period, impacts on air quality is anticipated by exhaust gas from construction equipment and vehicles, and dust generated by earthwork. Of course, exhaust gas becomes continuous source of air pollution, once the operation starts and the degree of pollution shall increase as traffic volume does in future. If the gradient of slope is larger, the concentration of exhaust gas from running vehicles will be higher.

However, dust shall be a real problem during earthwork of embankment. Warm temperatures and the presence of heavy traffic on the roads supply fostered conditions to create a high level dust in the atmosphere.

It affects not only public health but also the yield of crops harvested. Compensations even may be inevitable to the peoples for the value of lost production. If hauling of embankment material is made through residential areas, dust shall create serious problem.

b) Water Pollution

The inhabitants in the area rely their drinking water on wells. River water is used for irrigation widely. Flush out of dust and oils in rains during construction and from the road surface in operation stage may affect the quality of water.

c) Noise and Vibration

Operation of equipment and vehicles during construction and after completion generates certain degree of noise and vibration.

The inhabitants located close to the work area and the hauling route will be affected mostly during construction. Noise and vibration are inevitable but minimal in operation stage, unless traffic volume may

increase drastically. Especially, operation by noise and vibration at nighttime shall disturb sound sleep of the people living nearby. Therefore, some restriction and countermeasure shall be taken during construction period.

(3) Impact after Construction (Operation Stage)

The following impacts are expected along the optimum Route 1 during construction stage:

1) Social Environment

Completion of the project will improve the communication network of the region. This improvement in communication will pave the way for development of opportunities in other sectors such as commerce/business and industry. Increase in the above activities will bring some positive impact in the area. After construction of the bridge, social facilities like education, health, sanitation etc. will improve to some extent. People will be careful about these things when their economic conditions improve. The high embankment of the connecting roads on both sides of the project shall disrupt movement of cattle and agricultural machinery. This will cause certain inconvenience especially to those farmers whose lands lie on both sides of the highway embankment.

2) Natural Environment

Trees and plantation may increase, after the construction of the bridges, due to planned roadside plantation on the approach road.

3) Pollution

Monitoring of water quality parameters should be continued and any probable adverse effect will be identified. Data obtained during pre-project and during-construction period will be compared with the after-construction data (impact) and mitigation measures should be suggested accordingly.

Air quality determination during pre-project and during-construction period will facilitate comparative evaluation as to whether commissioning of the bridge has caused any direct or indirect effect on aerial environment in and around the bridge site. It is expected that mechanized transport movement,

commercial and industrial activity will steadily increase resulting in emission of high concentration of SMP, NO_x, SO_x, CO etc. Baseline and during-construction data on these parameters when compared with that of the after-construction monitoring, will quantitatively reveal as to whether any significant administrative/legal measures are warranted to minimize air pollution. It is well known that the main source of air pollution in Dhaka is the two-stroke engine vehicles (TSEVs), commonly known as scooters and temps used by public. These TSEVs are also widely used in Khulna area and 20% of traffic volumes expected in the forecast is assumed to be of this type, having serious effect on air quality in future. However, these solutions need to be combined with social mobilization.

Labon Chara Area at the west bank of the Rupsa River has the highest concentration of population along the route. The area is anticipated to be the most affected one on air and noise by increased traffic in future.

(4) Social Cost Estimation

For the economic analysis for Feasibility Study, the following cost items are counted as social cost and presented in Table 5.3.4.

Information on the quantities and numbers of affected land, structures and trees have been collected through socio-economic survey. The price of affected land was calculated through consultation with the local people and officials concerned.

Miscellaneous costs were estimated after taking into consideration experiences in different resettlement projects such as Jamuna Multipurpose Bridge project, Third Road Improvement Project, Rupsa Bridge project Phase 1, etc, and also through field survey and consultation with the people concerned. The costs include transfer costs, resettlement allowance, compensation for income loss and standing crops, additional assistance for female headed households, and administrative costs, hiring of implementing NGOs and monitoring of the implementation arrangements.

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Table 5.3.4 Social Costs by Route

Compensation Items	Route-1			Route-2			Route-3		
	Quantity / No. (in Sqm.)	Value (per sqm. In Tk.)	Total Value	Quantity / No. (in Sqm.)	Value (per sqm. In Tk.)	Total Value	Quantity / No. (in Sqm.)	Value (per sqm. In Tk.)	Total Value
1. Land									
a. Agriculture	354,931	375	133,099,125	240,433	500	120,216,500	121,120	600	72,672,000
b. Residential	11,620	430	4,996,600	71,605	575	41,172,875	129,150	625	80,718,750
c. Commercial	2,423	475	1,150,925	3,316	625	2,072,500	7,764	750	5,823,000
d. Industrial	2,150	475	1,021,250			0	12,782	750	9,586,500
e. Pond	6,232	375	2,337,000	7,005	575	4,027,875	13,668	600	8,200,800
f. Shrimp Gher	15,040	400	6,016,000	7,318	500	3,659,000	5,461	550	3,003,550
g. Low Land	6,512	350	2,279,200	8,663	400	3,465,200	5,255	450	2,364,750
Sub-Total of 1.	398,908		150,900,100	338,340		174,613,950	295,200		182,369,350
2. Structure									
a. Dwelling houses									
i. Pucca	193.6	5,790	1,120,944			0	1,820.7	5,845	10,641,992
ii) Semi pucca	139.9	2,802	392,000	926.8	1,875	1,737,750	3,095.7	2,100	6,500,970
iii) Kutcha	1,194.7	725	866,158	2,340.6	625	1,462,875	3,739.5	1,005	3,758,198
b. Kitchen	192.2	475	91,295	325.9	360	117,324	733.4	1,850	1,356,790
c. Latrine	41.2	2,457	101,228	105.0	1,960	205,800	390.7	3,255	1,271,729
d. Cowshed	52.4	706	36,994	122.1	195	23,810	109.6	345	37,812
e. Commercial	656.4	1,590	1,043,676	15.0	1,000	15,000	189.0	465	87,885
f. Others	1,092.9	945	1,032,791	64.9	310	20,119	560.0	495	277,200
Sub-Total of 2.	3,563		4,685,086	3,900		3,582,678	10,074		23,932,576
3. Trees									
a. Timber	1,452	650	943,800	1,089	315	343,035	948	1,925	1,824,900
b. Fruit	2,668	350	933,800	1,180	438	516,840	2,113	775	1,637,575
c. Fire wood	1,714	175	299,950	1,743	15	26,145	1,381	55	75,955
Sub-Total of 3.	5,834		2,177,550	4,012		886,020	4,442		3,538,430
Total (1.+2.+3.)			157,762,736			179,082,648			209,840,356
4. Miscellaneous			45,800,500			35,954,700			58,760,000
Grand Total			203,563,236			215,037,348			268,600,356

Note: Miscellaneous for Route-1 includes additional land acquisition cost related to variation of Right-of-Way more than 36m due to selection of desirable road embankment structure.

5.4 Mitigation Measures and Environment Monitoring Plan

(1) General

The provisions and concerns regarding the negative environmental impacts by the project should be initiated during preparation of tender documents. Because, several of the mitigation measures are to be accomplished by the prospective contractor who might prepare the bridge as well as the connecting highway embankments on both sides of the Rupsa Bridge. However, the main activities of Monitoring Plan shall be carried out concurrently with the bridge and connecting road construction activities. Environmental management will also be involved to a lesser extent during the pre-construction phase and to a greater extent during the operational phase.

(2) Pre-Construction and Construction Stage

Loss of land can be mitigated by payment of adequate cash compensation to Projected Affected Persons (PAP) at specified rates and also buying of soil from non-agriculture land outside RoW area. The unused lands and borrow pits within RoW should be released to PAPs. Loss of field crops can be mitigated by building the access roads, storage sites, workers camp and other construction related activities within RoW area, paying compensation of crop loss caused to PAPs and leasing back the rehabilitated agriculture land progressively to the farmers.

Loss of trees on homesteads shall be compensated by paying cash and by planting of site specific tree seedling on embankment sides as per the prescription of BFD (Bangladesh Forest Department), distributing seedling or propagating specific timber trees, fruit trees and multipurpose tree specimen (MPTS) and planting mulberry along the highway embankment.

Crop loss caused by embankment erosion, siltation and dust blowing along wind direction should be compensated in cash and embankment sides should be carpeted with suitable productive grass sap and the embankment top should be watered regularly to avoid wind blowing.

Health care and disease contamination at construction site, workers camp and in adjacent areas can be minimized or avoided by arranging hygienic disposal of human waste, solid waste at campsite, using insect killers and preventive inoculations and arranging safe drinking water in workers camp.

(3) Operation Stage

Vegetation of the RoW and adjacent area shall be controlled by planting specific tree species on road sides, homesteads and wasteland, and cleaning the noxious plant species periodically from borrow pits and RoW area.

Discouraging construction of roadside slum, settlement and commercial structures shall mitigate the cumulative loss of agriculture land. This can be done by the collective and collaborative efforts of GOB, NGOs, and local volunteers.

Traffic hazards and accidents can be minimized by installing proper traffic signs, regulating speed limits, enforcing traffic regulation and developing traffic awareness amongst the people.

(4) Environmental Enhancement

RHD and other agencies for pursuing the efforts undertaken to mitigate the environmental impacts during the construction and operation stages shall adopt planned approach during operation phase. Skill, experience and reputation of several local NGOs can be utilized for implementation of the environmental enhancement programs.

(5) Monitoring

A monitoring program at the project site may be initiated based on primary data and results of the current EIA study. Areas particularly important for this purpose are:

1) Monitoring activities in resettlement operation

- Information campaign and consultation with the PAPs
- Status of land acquisition and compensation payments
- Compensation for lost structures and assets
- Relocation of PAPs
- Payment of Income Restoration Assistance

2) Social impact of the project in the region

3) Silting of the local river channels and water ways that may consequently block drainage and cause water logged conditions in low lying areas

- 4) Monitoring of susceptible pollution parameters like water, air, noise and surface soil characteristics;
- 5) Pollution of the open water system by petroleum products leaked or released from mechanized boats and ships;
- 6) Release of solid and liquid industrial wastes and discharges of sewerage and solid wastes from the site and workers camp.
- 7) Aquatic biodiversities in open water bodies.

These can be done either by employing full-time Environmental Monitors by RHD or engaging local NGOs.

CHAPTER 6 RESETTLEMENT ACTION PLAN AND LANDSCAPE CONSERVATION PLAN

6.1 Resettlement Action Plan on Three Routes

6.1.1 Project Affected Area

Site investigation survey was carried out all along the three (3) routes to obtain the information on social conditions and land use of the area for Bypass Routes from the view points of social and environmental issues related to land acquisition and compensation of project sites. Through the three route alternatives of 36-meter width, there exist number of homesteads, which sometimes consists of kin family group households within same property that has to be recognized as affected, cluster formation. In most of the cases, property of these homesteads will be affected partly but very few cases in total.

6.1.2 Homesteads Affected by Three Route Alternatives

Each proposed route area has been surveyed for affected households and persons lived in. The results of the survey are presented in Tables 6.1.1 through 6.1.4, indicating the intentions of project affected persons which need to be taken into consideration while formulating the resettlement plan.

Table 6.1.1 Affected Households and Persons within 36 Meter Width

Route No.	Affected Households	Affected persons	Nos. of cluster (Homestead)	Nos. of household within cluster
Route 1	53	242	29	53
Route 2	114	520	42	116
Route 3	348	1,560	126	348

Table 6.1.2 Tendency of Householder's Wishes for Compensation Options

Option	Route 1		Route 2		Route 3	
	Household Nos.	Percentage	Household Nos.	Percentage	Household Nos.	Percentage
1: Cash	46	86.7%	65	57.0%	257	79.1%
2: Land for substitute land	3	5.7%	15	13.2%	33	10.2%
3: House lot	2	3.8%	6	5.3%	16	4.9%
4: House in resettlement site	2	3.8%	22	19.2%	19	5.8%
5: Others	0	0.0%	6	5.3%	0	0.0%
Total	53	100.0%	114	100.0%	325	100.0%

Table 6.1.3 Area Wished to Stay for Resettlement Option

Area wished to stay	Route 1		Route 2		Route 3	
	Household Nos.	Percentage	Household Nos.	Percentage	Household Nos.	Percentage
1: Within same village	37	69.8%	59	51.7%	176	54.2%
2: In Thana area	2	3.8%	6	5.3%	23	7.1%
3: Neighboring village	12	22.6%	9	7.9%	66	20.3%
4: In Khulna town	1	1.9%	12	10.5%	41	12.6%
5: Outside of Khulna district	1	1.9%	5	4.4%	6	1.8%
6: Not known yet	0	0.0%	23	20.2%	13	4.0%
Total	53	100.0%	114	100.0%	325	100.0%

Table 6.1.4 Intentions for Spending the Cash Compensation

Spend intendance	Route 1		Route 2		Route 3	
	Household Nos.	Percentage	Household Nos.	Percentage	Household Nos.	Percentage
1: Buying land	35	66.0%	52	45.6%	200	61.5%
2: Investment in business	14	26.4%	14	12.3%	62	19.1%
3: Building new house	2	3.8%	35	30.7%	16	4.9%
4: Renovation/Repairing of house	0	0.0%	0	0.0%	1	0.3%
5: Repay loan	2	3.8%	5	4.4%	23	7.1%
6: Others	0	0.0%	8	7.0%	23	7.1%
Total	53	100.0%	114	100.0%	325	100.0%

6.1.3 Presumed Resettlement Options

Considering the available compensation options and preferred area to stay, the following tendencies can be clarified.

- 1) Quite high tendency of the cash compensation option (86.7% for Route 1, 57.0% for Route 2, 79.1% for Route 3) is to be desired for the affected households.
- 2) The number of households and their preference for having the land, house lot and house in resettlement site as compensation option for each three routes may be clarified as objectives of resettlement plan. Following number of households need to be considered for inclusion of their wishes in the resettlement plan.

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- Route 1: 7 households –13.2%
(Total number of affected households numbers: 53)
- Route 2: 43 households –37.7%
(Total number of affected households numbers: 114)
- Route 3: 68 households –20.97%
(Total number of affected households numbers: 325)

3) Regarding the preferred area for settlement, majority of the people wished to stay within same village, followed by the Thana area, neighboring village and in the Khulna town. Following are the objective householders, wish to stay near original household location.

- Route 1: 98.1% of householders
- Route 2: 75.4% of householders
- Route 3: 94.2% of householders

6.1.4 Extent of Affected Homestead Area and the Number of Households

Table 6.1.5 shows the average number of households in the homestead and average area available for household in each Route.

Table 6.1.5 Average Number of Households in the Homestead and Average Household Area

Item	Route 1	Route 2	Route 3
Number of homesteads in sampling area	15	19	27
Area of homestead in sampling area	8,998m ²	9,416m ²	13,114m ²
Average homestead area in sampling area	600m ²	496m ²	487m ²
Affected area within 36-m width in sampling area	6,300m ²	7,164m ²	8,856m ²
Affected area ratio to the area of homestead in sampling area	70.00%	76.10%	67.50%
Total number of affected homesteads through the Route	29	42	126
Total number of affected households through the Route	53	114	348
Average number of households per homestead through the Route	1.83	2.71	2.76
Average area per household	118.9m ²	139.1m ²	118.8m ²

6.1.5 Formulation of the Resettlement Plan for the Affected Households

(1) Required Resettlement Area

Presumed area required for the resettlement of the affected households is shown in Table 6.1.6.

Table 6.1.6 Required Resettlement Area for each Route

Items	Route 1	Route 2	Route 3
Number of households for resettlement option	7	43	68
Average area per household	119 m ²	139 m ²	119 m ²
Total net area required for resettlement	833 m ²	5,977 m ²	8,092 m ²
Infrastructure space (road and alley etc. 15%)	125 m ²	895 m ²	1,215 m ²
Gross area needed for resettlement site	960 m ²	6,900 m ²	9,300 m ²

(2) Resettlement plan module

The resettlement plan and module shall be in conformation with linear pattern type distribution which currently exist in the Khulna vicinity. However the resettlement plan module should take into consideration the scale of development and projected increase in number of households in order to meet future development realities. Figs. 6.1.1 and Fig. 6.1.2 indicate typical plan module for each of 3 Routes.

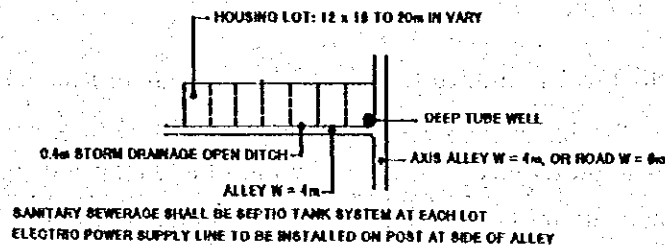


Fig. 6.1.1 Resettlement Plan Module for the Route 1

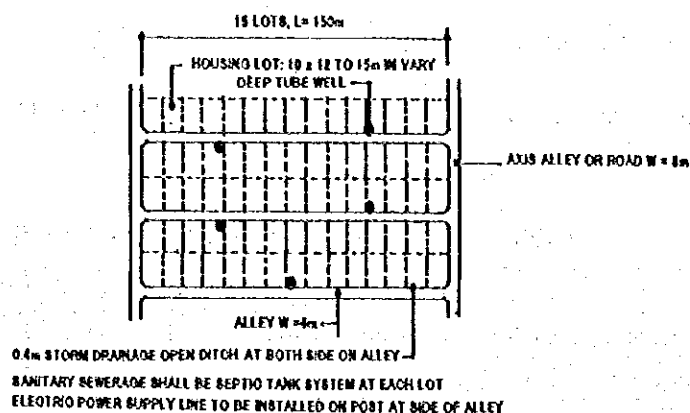


Fig. 6.1.2 Resettlement Plan Module for the Route 2 and Route 3

6.1.6 Issues to be Considered before Resettlement

- 1) Resettlement scale reality: Considering the practical realities, development of resettlement sites for small number of households as in the case of route 1 is not practical by public sector. In this case it is better to let the affected householders to choose individual housing lot location with satisfactory scale of cash compensation. Resettlement site development for the scale more than 50 house lots would be practical from the view point of practical development.
- 2) Landless householders account for 38% to 55% of the total affected householders, while the average size of the land owned by the affected people varies from 1,100 m² to 2,000 m² through the three Routes.

6.2 Resettlement Action Plan

The scope of resettlement is limited to only 53 households in Route-1. Of the households under Route-1 who would need relocation, majority said that they would remain within the "same village". The preference is to remain within the vicinity of the present residence to enable the PAPs cultivation of residual land, and to maintain kinship and other social ties.

1) Concerns About Land Acquisition and Resettlement

41.5% of the PAPs of Route-1 expressed concerns on fair compensation for lost properties, followed by timely payment of compensation 34.0%, for the assets.

2) Planning Relocation Options/Strategies

Majority of the respondents clearly expressed their opinion in favor of on-site "relocation" with in the same village. Only a few affected households in Route-1, expressed preference for relocation to resettlement site. As such, it is not desirable to develop a resettlement site. In that case, NGOs will assist those PAPs to find out replacement land in the area.

3) Gender Issues in Resettlement

Women's economic participation in the household is expected to remain unaffected due to on-site relocation. Among the affected households of the Route 1, women head 4 households. These households may need additional assistance and help for relocation.

4) Resettlers / Host Relations

The resettlement strategies in the Project preclude any resettler-host conflict. Therefore, no conflict or tension is anticipated. If required, NGO will conduct meetings with local villagers to avoid any conflict.

5) Occupational Preference in Post-Relocation Period

In order to restore lost income and livelihoods, the PAPs indicated high preference of the same occupation as before in case of resettlement.

6) Income Restoration Assistance and Allowances for Lost Income

The RAP has provision for allowance for lost income for a period of 90 days due to dislocation and relocation. The primary objective of this additional assistance is to allow the displaced PAPs to relocate and settle in.

7) Employment opportunity in the Project

The implementation of the project will require a huge unskilled labour daily. And further, many commercial opportunities will develop during and after the construction of the bridge. Thus, the construction work will greatly benefit the PAPs and will help restore their income and livelihoods.

6.3 Recommendation for Resettlement

(1) Community Participation and Implementation of Resettlement Plan

a) Steps to Ensure Community Participation

Following steps will be taken to keep the PAPs informed about the land acquisition plan, compensation policy and entitlements associated with relocation and restoration of income.

- i) Provision of information displays in Bangladesh in project sites and affected areas.
- ii) Preparation and distribution of leaflets outlining the resettlement policy and compensation packages for the PAPs in the Project.
- iii) Formulation of Resettlement Advisory Committee.
- iv) PAPs' involvement in the Grievances Redress Committee to review and resolve any dispute concerning compensation and other resettlement benefits.
- v) Continuous on-site consultation during the implementation stage to ensure that the PAPs receive their due entitlements.

b) Resettlement Organization and Framework

For the construction of the Rupsha Bridge, Project Director of RBP, will be responsible for coordinating and monitoring the project activities. RHD fully recognizes the complexity of the resettlement management and operations and lack of personnel within the Rupsa Bridge Project with any relevant experience. RHD will hire an experienced NGO to implement the resettlement action plan.

The selected NGO will also work in close cooperation with the DC office in Khulna in the delivery of all land, structure, and crop-related compensation. Involvement of NGOs in resettlement projects have shown to be very positive in terms of transparency, consultation, institutional strengthening, safeguarding rights of the disadvantaged people and long-term sustainability of resettlement activities.

c) Recommended Procedures for NGO Selection

RHD may consult with the Association of Development Agencies in Bangladesh (ADAB) in the recruitment of the NGO for the special tasks. The Project Consultants may suggest a list of some experienced NGOs and this list may be submitted to ADAB for review and/or additions for short listing and approval by the RHD.

The NGO to be selected for the tasks must have proven experience in resettlement planning and implementation. A local NGO or an NGO with local field office in Khulna region would be in a better position to carry out the tasks because of local presence.

(2) Monitoring and Evaluation

a) Monitoring and Evaluation in Resettlement Operations

Monitoring and evaluation (M&E) are critical activities in resettlement operations. Resettlement monitoring is a continuous process of data collection, analysis and reporting about the progress of work against set objectives.

b) Internal and External Monitoring

The internal monitoring will deal with all aspects of land acquisition and resettlement. The Project management office, particularly the Head of Social Development Unit (SDU), will be responsible to monitor the progress of resettlement activities.

The benchmark for project level monitoring will come from land acquisition and the census survey.

External monitoring involves review of resettlement implementation, verification of the results of internal monitoring in the field, and consultation with PAPs, officials, and community leaders for preparing review reports.

The external monitoring will commence in the first quarter of the Project implementation and shall continue through the implementation of the Project.

c) Time Frame and Reporting Requirements

During the implementation phase, the Head of SDU, will prepare monthly reports on the progress of resettlement activities and forward copies of the reports to the Donor. Field officials shall devise a format for resettlement implementation monitoring for monthly monitoring and data collection. RHD will prepare a final report at the end of the Project activity. The report should provide evidence whether adverse effects of the Project have been mitigated adequately or at least pre-project standard of living and income have been restored as a result of the resettlement plan.

6.4 Landscape Plan

Landscape plan shall be expected to enhance and reinforce the natural environment along Route-1 in harmony with existing conditions. Introducing landscaping into focus area is brought to enhance the functions of potential node of traffic flow as well as community transition and core area.

(1) The Rupsa bridge; bridge Staircase

Balcony adjoined staircase is tend to be a symbolic monument of the bridge project, pair of the stair case shall be installed at both ends of main section of Rupsa Bridge. The followings are the major functions of the staircase, and Fig. 6.3.1 shows the dimensions of the staircase.

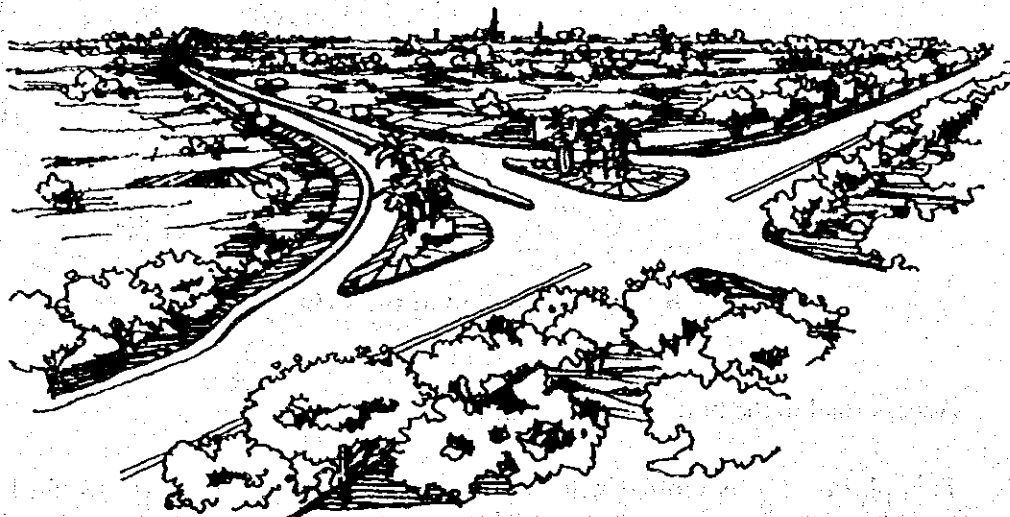
Function of the staircase:

- Community pedestrian's easy and safety access to the bridge top from the dike road access way.
- Convenience for bicycle users to pull up and down on sloped lane in the staircase for meeting with present and future bicycle use tendency.
- Landing areas of the staircase as to be used view observation balcony for points of interest.
- Top landing area, as a balcony shall be adjacent with the pedestrian sidewalk of the bridge.
- Whole silhouette of the staircase with column post is to be a symbolic monument of the Bridge.

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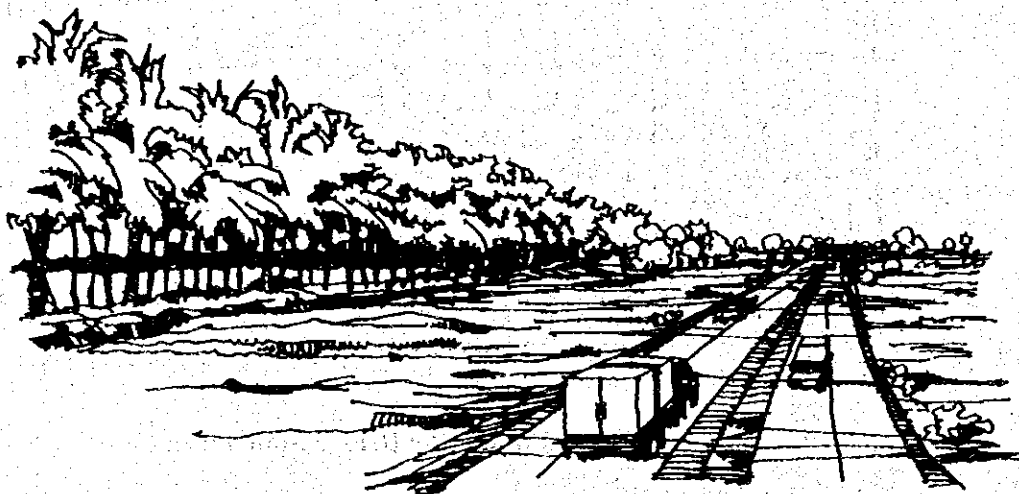
(3) Road Intersections

Visual identification of the road intersection shall be quite essential for the motor vehicle drivers as well as local people. For grading and aesthetic landscape identification, partial mound creation would be performed on a slight variation of the ground level and it would make an atmosphere of amicable sense of arrival for the motor vehicle drivers.



(4) Vicinity point at Palm row grove planted area

Location where Southern Section of Khulna Bypass is passed through is one of the most significant potential places, where palm grove with row vegetation; as an existing natural environmental resources and homestead heritage at border of Laban Chara and Harintana. For conservation of the existing palm grove, minimum removal of affected coconut palms would be necessary.



CHAPTER 7 IMPLEMENTATION SCHEDULE AND PROJECT COST

7.1 General

The construction planning is to be studied for the establishment of construction method so as to meet technical requirements based on the selected plans of route location and bridge type. While a construction time schedule is to be estimated on the assumption that the project should be implemented based on the proposed construction planning and the recommended scheme of contract package. Furthermore, these two elements of construction planning and scheme of contract package have close relationship with each other and the construction cost estimates are to be made in consequence of these two elements.

7.2 Implementation Plan

7.2.1 Single Contract Package

The scheme of single contract package is evaluated superior yet suitable from the following aspects:

1) **Construction Practicality**

The single package has technical soundness and steady construction practicality to complete the construction period of 42 months with the economical justification.

2) **Construction Period**

It is well balanced and reasonable for the scheme of single contract package that the most expensive contract section of the Rupsa Bridge becomes critical and crucial for the construction planning.

3) **Construction Economy**

The highest efficiency and the least number of equipment as well as the smallest construction yards surely result in the most economical way.

4) **Social Impacts**

It surely contributes to minimize adverse social impacts to adjacent inhabited area that well balanced yet reasonable construction planning be made.

7.2.2 Time Requirements

(1) Review of Technical Design

It may take ten (10) months after contracting with a supervisory consultant to complete a review of the technical design even though a professional consultant familiar with the technical design as well as Bangladeshi conditions be procured and advanced technology such as computer aided design (CAD) and global positioning system (GPS) be fully utilized.

(2) Land Acquisition

The consummation of land acquisition always becomes crucial in a road project, and it fully depends upon the allocation of required funds and the competence of executing agency.

It is likely possible that some section of future ROW will be able to proceed land acquisition in process of time when a review of the technical design is under way.

Under such circumstances, it may take twelve (12) months to complete land acquisition in a whole stretch of project road.

(3) Tendering Process

After the completion of design review, it usually requires sufficient time to consummate due procedure to select a responsible and bona fide contractor through an international competitive bidding. However, it is possible to execute them simultaneously while land acquisition is under way.

It may take six (6) months to complete tendering process from the completion of design review.

(4) Construction Time Schedule

Since construction activities require many preparatory works, an elaborated construction planning is vital for smooth execution.

It may take forty two (42) months to complete construction of bridge and road, referring to the construction planning.

The project implementation time schedule is prepared as shown in Fig. 7.2.1.

Major Items	YR 1999				YR2000				YR 2001				YR 2002				YR 2003				YR 2004				YR 2005			
	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Technical Design (JICA Phase 2 Study)	■																											
Review of Technical Design					■																							
Land Acquisition & Compensation					■																							
Tendering									■																			
Construction									■				■				■				■							
Operation																					➔							

Fig. 7.2.1 Project Implementation Schedule

7.3 Project Cost Estimates

7.3.1 Criteria for Cost Estimates

The construction cost of the Southern Section of Khulna Bypass including Rupsa Bridge is estimated as a financial cost based on the results of preliminary engineering design and a subsequent quantity take-off of the main work items. The estimate takes into consideration the prevailing market conditions and construction practices in Khulna as well as in Bangladesh, the study on construction planning, method and package, and the duration of the construction period.

The basic premises in estimating the project cost are as follows:

- 1) It is assumed that all construction works will be executed by general contractors to be employed by RHD with contractors being selected by international competitive bidding (ICB).
- 2) The unit price of each cost component is determined based on the economic conditions prevailing in August 1999.
- 3) For the construction works, Bangladeshi taxes and duties on imported equipment and materials (tax percentage depending on type/kind of equipment and materials) is included in the estimates. However, it shall exempt from tax, duties and other charges on equipment, machinery and other materials which will be brought into Bangladesh for the construction work and taken out of Bangladesh after the work.

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- 4) The unit price of each work item includes the labor cost, equipment cost, material cost and the contractor's overhead and profit (11%), consisting of 5% for overhead and 6% for profit.
- 5) A physical contingency of 10% of the construction cost has been added.
- 6) The cost is split into foreign currency and local currency portions, both indicated in Taka. Foreign currency and local currency portions of the unit cost of each work item are estimated based on the classifications of net imported items.
- 7) Foreign and local currency portions are quoted in Taka. Foreign costs may be converted into foreign currency using exchange rates applicable in August 1999: $US\$1.00 = \text{¥}110 = \text{Tk. } 48.6$.

7.3.2 Project Cost Estimates

(1) Direct Construction Cost

The direct construction cost is estimated based on the base cost and additional General & Preliminary Items of 10% of the base cost, which consists of mobilization and demobilization cost, site laboratory, engineer's transport, personnel, and other contractual & specified requirements.

(2) Physical Contingency

The physical contingency of 10% of Direct Construction Cost is estimated in addition to Direct Construction Cost to obtain Construction Cost.

(3) Land Acquisition and Property Compensation Costs

Land acquisition and property compensation costs are estimated based on the field investigations on affected area along the selected route to acquire land and to compensate affected properties such as homesteads, trees, rights of fishing/farming/common, costs for resettlement and so forth.

(4) Engineering & Supervisory Services

The engineering & supervisory services cost is estimated separately from the construction cost. The cost of the services is estimated in accordance with the scope of work for the consulting services.

(5) Estimated Project Cost

The total project costs including physical contingency are shown in Table 7.3.1 for the Southern Section of Khulna Bypass including Rupsa Bridge.

Table 7.3.1 Summary of Cost Estimate and the Cost Breakdown

ROUTE : ALT-1 Urban Structure Scheme L=10.039 km
BRIDGE : OPT-1 PC Box Girder Bridge 7-Span Option

AT AUGUST 1999 PRICES

Description	Financial Cost (Million Taka)		
	Foreign Component	Local Component	Total
1. Direct Construction Cost	2,007.8	1,236.1	3,243.9
1) General	182.5	112.4	294.9
2) Earthwork	16.8	145.6	162.4
3) Drainage	66.6	56.2	122.8
4) Bank & Pier Protection	45.7	43.7	89.5
5) Pavement	268.3	215.7	484.0
6) Bridge	1,367.8	632.8	2,000.6
7) Incidental Work	56.4	23.2	79.6
8) Toll Facilities	3.5	6.5	10.0
2. Physical Contingency (10% of 1.)	200.8	123.6	324.4
3. Construction Cost (total of 1. & 2.)	2,208.6	1,359.7	3,568.3
4. Land Acquisition and Compensation	0.0	203.6	203.6
5. ES & SS Services *1	255.3	94.8	350.0
Total of (3.+4.+5.)	2,463.8	1,658.1	4,121.9

Description	Financial Cost (Million Taka)		
	Foreign Component	Local Eligible to JBIC	Local Component
1. Direct Construction Cost	2,007.8	1,236.1	3,243.9
2. Physical Contingency (10% of 1.)	200.8	123.6	324.4
3. Construction Cost	2,208.6	997.5	3,568.3
4. Land Acquisition and Compensation	0.0	0.0	203.6
Su-total	2,208.6	997.5	3,771.9
5. ES & SS Services *1	255.3	42.3	350.0
Total of (3.+4.+5.)	2,463.8	1,039.8	4,121.9

Note:

*1: The cost of ES & SS Services includes Contingency (10%).

CHAPTER 8 ECONOMIC EVALUATION AND FINANCIAL ANALYSIS

8.1 Project Scenarios

The "Without the Project (Case 0)" scenario was assumed as follows: the Rupsa ferry service would remain open; 17 km long Northern Section of Khulna Bypass (NSKB) which is scheduled to be developed by the KDA is considered to be a stand-alone committed project which would be completed by the year 2005; and other roads in the Project area would be developed in accordance with Road Network proposed by KDA Master Plan which spans the period to 2015. Under the scenario of Case 0, the maximum number of motorized vehicles crossing the river by ferry would be about 5,000 vehicles per day assuming a round-the-clock operation (24 hours). Beyond this limit, motorized vehicles would have to make relatively long detours to avoid the ferry.

The "With the Project (Case 1)" scenario was assumed as follows: the Rupsa ferry service would remain open but only for passengers and non-motorized vehicles; the construction of the Rupsa Bridge and 10 km long Southern Section of Khulna Bypass (SSKB), which would connect with the NSKB to form an overall bypass solution; and the development of other roads in the Project area based on Road Network to 2015 of KDA Master Plan. Under Case 1, RHD would not operate the ferry service.

8.2 Economic Benefits

Under the umbrella of the UK's Department for International Development, RHD is receiving long term technical assistance (TA). The TA program is known as the Institutional Development Component (IDC). Among other things, IDC/RHD have recently developed a set of recommended national Travel Time Cost (TTC)s and Vehicle Operating Cost (VOC)s (TTC Final Report E7, September 1998 and VOC Final Report E6, December 1998).

IDC/RHD's recommended economic TTCs for FY 1998/99 are as follows:

Table 8.2.1 Economic Travel Time Costs for FY 1998/99

Vehicle	Occupancy	TTC per passenger Tk./hour	TTC per vehicle Tk./hour
Bus	47.1	12.5	588.6
Car	3.2	28.2	90.2
Auto Rickshaw	2.0	12.5	25.0
Motor Cycle	1.5	12.5	18.8

Note: economic costs reflect conversion by 0.8.

IDC/RHD's recommended economic VOCs for FY 1998/99 are as follows:

Table 8.2.2 Economic Vehicle Operating Costs for FY 1998/99

Vehicle	IRI 3 Tk./km	IRI 4 Tk./km
Truck	10.88	11.58
Bus	13.92	14.17
Car	5.50	5.80
Motor Cycle	1.71	1.79
Auto Rickshaw	3.43	3.59

VOC economic costs were derived based on border prices; local taxes where known were excluded; and local labor and materials were converted by 0.8 except where the local tax on materials was known. The above figures for motor cycles and auto rickshaws were drawn from the ongoing RIP III ADB project since IDC/RHD do not yet have VOCs for these two categories. However, by the early part of the year 2000 IDC/RHD expect to have VOCs for motor cycles and auto rickshaws based on HDM IV (the existing VOCs are based on HDM III which does not cover motor cycles and auto rickshaws).

8.3 Economic Analysis

In the economic analysis, the vehicle operating costs for trucks, buses and cars are based on the figures recently developed by IDC/RHD (FY 1998/99 prices expressed in economic terms). For Case 0, the international roughness index was assumed as "IRI 4", while for Case 1, the assumption was "IRI 3". VOCs for auto-rickshaws and motor cycles were drawn from the ongoing RIP III ADB project. For TTCs, the recent figures developed by IDC/RHD were the starting point. To reflect the inherent difficulties in valuing non work time, only 15 per cent of IDC/RHD's TTCs were used in the economic analysis. 15 per cent is considered to be the working time component of total TTCs (85 per cent is non work time). Travelling to/from work is treated as non work time.

Base case	EIRR 26.2%
VOC benefits only	EIRR 19.4%
Costs increased by 10%	EIRR 24.4%
Benefits decreased by 10%	EIRR 24.2%
Costs increased by 10% and benefits decreased by 10%	EIRR 22.6%
Vehicles crossing bridge in 2005	6,243 per day
Vehicles crossing bridge in 2010	8,282 per day
Vehicles crossing bridge in 2015	11,094 per day

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8.4 Financial Analysis

8.4.1 Concept of Toll Bridge

When a new bridge with a length of less than 1,500 m replaces an existing ferry, RHD's policy is that the ferry tolls should be applied to the new bridge. In the financial analysis, this approach has been adopted (i.e., the bridge tolls in the above table are the same as the ferry tolls).

In the FIRR analysis, the assumed tolls are as follows:

	Tk. per crossing
Truck	88
Bus	38
Car	19
Auto-rickshaw	13
Motor Cycle	5

8.4.2 Results of Financial Analysis

Financial analysis was conducted for Case 1. The results are summarized below.

Base case - after 25 years of toll operations (year 2029)	FIRR 2.4%
Annual toll revenue	88.0 Tk. million in 2005, rising to 159.3 Tk. million by 2015
Cost of routine maintenance (annual)	6.0 Tk. million
Cost of periodic maintenance (every 7 years)	10.2 Tk. million

The resulting estimated FIRR of 2.4% appears low but full cost recovery is reached. Also, the annual toll revenue streams greatly exceed maintenance requirements. The traffic levels used in the economic analysis were also used in the financial analysis because the existing ferry tolls were applied to the Bridge. In estimating the FIRR, tolls were kept constant in real terms (i.e., real increases in toll rates were not assumed). The capital cost used in the Base Case FIRR analysis only covers the main bridge and not whole stretch of the SSKB. This reflects that tolls would only be levied for crossing the Bridge.

8.4.3 Cash Flow Analysis

To provide a picture of the extent to which bridge toll revenues would cover total project costs (Rupsa Bridge and SSKB), a cash flow analysis was conducted. The terms of the proposed financing from the donor are not yet known. However, for the purpose of

preparing the cash flow analysis the assumed terms are: a loan to cover 85% of total project costs (the balance of 15% is an equity contribution from the Bangladesh Government); an interest rate of 1%; and a repayment period of 30 years including a grace period of 10 years (i.e., 10 years grace plus 20 years repayment).

	Cumulative cash 2000 - 2029 (Tk. Million)
Toll Revenues	3,558.2
1. Loan repayments	3,372.9
2. Interest expenses	570.1
3. O/M expenses (routine and periodic)	289.5
Cash Deficit as of 2029	674.3 (= 20% of loan repayments)

The cash flow analysis is in real terms and indicates that tolls revenues (same as FIRR Base Case) would be sufficient to cover interest and O/M expenses and about 80% of loan repayments. In interpreting the cash flow picture it is important to consider that the tolls are only for the main bridge while the three expense items cover the total project (Rupsa Bridge and SSKB).

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

9.1 Technical Soundness

Technical risks of the Project have been minimized to the extent possible by having a series of technical designs at a different level by each study phase based on various engineering site surveys, full-scaled natural condition surveys and social and environmental surveys. Technical designs and associated cost estimates were carried out by two-phase study undertaken by JICA in the period of 1998 to 2000. Emphases were put on route selection against adverse social impacts, type of superstructure against design wind, foundation design against sub-surface soil conditions, river revetment against erosion and pier protection against scouring. In the course of these studies, land acquisition plan was prepared based on topographic survey along the selected route and due procedure to acquire future Road Right-of-Way is in process.

Accordingly, soundness for the Project is warranted from all technical aspects.

9.2 Financial and Economic Feasibility

Major quantifiable benefits accruing from the Project consist of savings in transport costs for present and future traffic in and around Khulna, especially at Rupsa Ferry. Benefits from generated and attracted traffic in the socio-economic framework are included in the economic evaluation. The annual traffic growth rate during the planning period is forecasted as 9% for buses, cars and motorcycles and 11% for trucks. The base EIRR for the Project is 26.4%, with various sensitivity scenarios ranging from 19% to 24%.

When a new bridge with a length of less than 1,500 m replaces an existing ferry, RHD's policy is that the ferry tolls should be applied to the new bridge. In the financial analysis, this approach has been adopted and the resulting estimated FIRR (for Rupsa Bridge only) of 2.4% appears low but full cost recovery is reached. The cash flow analysis (for the SSKB including Rupsa Bridge) is in real terms and indicates that tolls revenues would be sufficient to cover interest and O/M expenses and about 80% of loan repayments.

9.3 Social Justification

The Rupsa River severs the Southwestern region of Bangladesh and disrupts community of Khulna Division with 12.7 million population in regional as well as Khulna Former District with 5.3 million in local, and it causes serious traffic congestion at Rupsa Ferry. The bridge construction is deemed a drastic measure to improve such adverse social situation.

In the course of these studies, EIA & SIA report was prepared based on IEE & ISIE in accordance with the environmental policy and laws of Bangladesh as well as environmental guidelines of international cooperation institutions including JICA and JBIC. RHD as the executing agency for the Project has submitted the environment clearance application to DOE based on the EIA & SIA report, and due procedure is in process to obtain Environmental Clearance Certificate. Therefore, it is obvious that social justification for the Project will be confirmed officially in a short time.

9.4 Conclusion

The EIA and SIA concluded that there are no substantial or irreversible adverse environmental and social impacts arising from the Project.

The Project will realize strategic corridors by non-river interruption in terms of regional context and will relieve traffic congestion at present Rupsa Ferry drastically as well as alleviate other local traffic bottlenecks on National Highway No. 7. The Project will also strengthen Khulna-Mongla Road so as to stimulate Mongla Port to induce incremental demand of domestic freight as well as transit cargo to Nepal and other landlocked countries. This transformation will bring considerable degrees of both direct and indirect benefits in Khulna as well as the southwestern region of the country, especially by minimizing transport constraints and reducing transport costs.

The Project has been given high priority in the Fifth Five-Year Plan (1997 – 2002) and both its technical and economical feasibilities have been confirmed in the course of JICA studies. The technical design and prequalification/tender documents for the Project are scheduled to be approved by the Government of Bangladesh in March 2000.

It may be concluded that the institutional arrangement for project implementation should be taken without interruption.

9.5 Recommendations

The following recommendations are made for the implementation of the project:

- 1) It is vital that the northern section of Khulna Bypass should be implemented to meet the implementation time schedule of the southern section of Khulna Bypass.
- 2) It is quite important that the development within and along the proposed Right-of-Way should be effectively controlled to facilitate the land acquisition process.
- 3) RHD Khulna Zone should immediately commence due procedure for land acquisition, and simultaneously try to get BWDB's consent for the construction of river revetment,

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pier protection in the Rupsa River and the installation of bridges and box culverts to canals, branches and tributaries.

- 4) It is necessary for RHD to procure a consultant for supervisory services that may review the technical design to hold a professional liability. Since tender documents have close relation to the design, the procurement of consultant should be made prior to starting the pre-qualification process for contractors.
- 5) The Multi Modal Terminal that it was formulated as the proposed transport masterplan during Phase 1 Study may be required together with the implementation of Rupsa Bridge to accommodate increase cargo throughput of Mongla Port up to 2015.
- 6) It is desirable that connecting roads will be improved to meet the implementation time schedule of the southern section of Khulna Bypass and a city planning road will be developed accordingly.
- 7) Existing Rupsa Ferry will be closed after opening of the Rupsa Bridge. However, existing ferry terminals should be utilized effectively as follows:
 - to transfer existing facilities to Khulna City Corporation (KCC) to accommodate non-motorized traffic.
 - to build bus terminals at present ferry terminals and to provide circumferential bus services between two terminals through Rupsa Bridge.

JICA Secretariat, Advisory Committee and Study Team

JICA Secretariat Members

- | | | |
|-------------------------|---|--|
| 1) Mr. Takao KAJIBARA | : | Director, First Social Development Study Division |
| 2) Mr. Hidenori KUMAGAI | : | Deputy Director, First Social Development Study Division |
| 3) Mr. Nobuo IWAI | : | Staff, First Social Development Study Division |

JICA Advisory Committee Members

- | | | |
|------------------------|---|---|
| 1) Dr. Yuzo AKATSUKA | : | Chairperson, Professor/Dean Toyo University |
| 2) Mr. Ikuo YAMADA | : | Honshu-Shikoku Bridge Authority |
| 3) Mr. Kenji NOMURA | : | Japan Highway Public Corporation |
| 4) Mr. Takeo MATSUZAWA | : | Japan Bank for International Cooperation |
| 5) Mr. Kenji KURODA | : | Japan Bank for International Cooperation |

JICA Study Team Members

- | | | |
|-------------------------------|---|---|
| 1) Mr. Kenji MARUOKA | : | Team Leader / Road Planner/Document Specialist |
| 2) Mr. Takashi CHUJO | : | Deputy Team Leader/Bridge Planner |
| 3) Mr. Jiro KOYAMA | : | Bridge Engineer (Superstructure 1) |
| 4) Mr. Yukihiko INOUE | : | Bridge Engineer (Substructure 1) |
| 5) Mr. AMIR MALIK FAEIZ | : | Bridge Engineer (Substructure 2) |
| 6) Mr. Tomoaki TAKEUCHI | : | Highway Engineer |
| 7) Mr. Takashi INOUE | : | River Engineer |
| 8) Mr. Kenji MORITA | : | River Facilities Engineer |
| 9) Mr. Tsutomu KUDO | : | Traffic Engineer |
| 10) Mr. John SPURR | : | Economic Analyst |
| 11) Mr. Hiroki KAWAHARA | : | Geodetic Engineer |
| 12) Mr. Yutaka KOMATSU | : | Geotechnical Engineer |
| 13) Mr. Hiroshi TANAKA | : | Resettlement Planner / Landscape Specialist |
| 14) Mr. Yoshitoshi KOBAYASHI | : | Environmental Specialist |
| 15) Mr. Toshinari KOBAYASHI | : | Construction Planning Specialist / Cost Estimator |
| 16) Mr. Yoshikazu WAKABAYASHI | : | Coordinator |

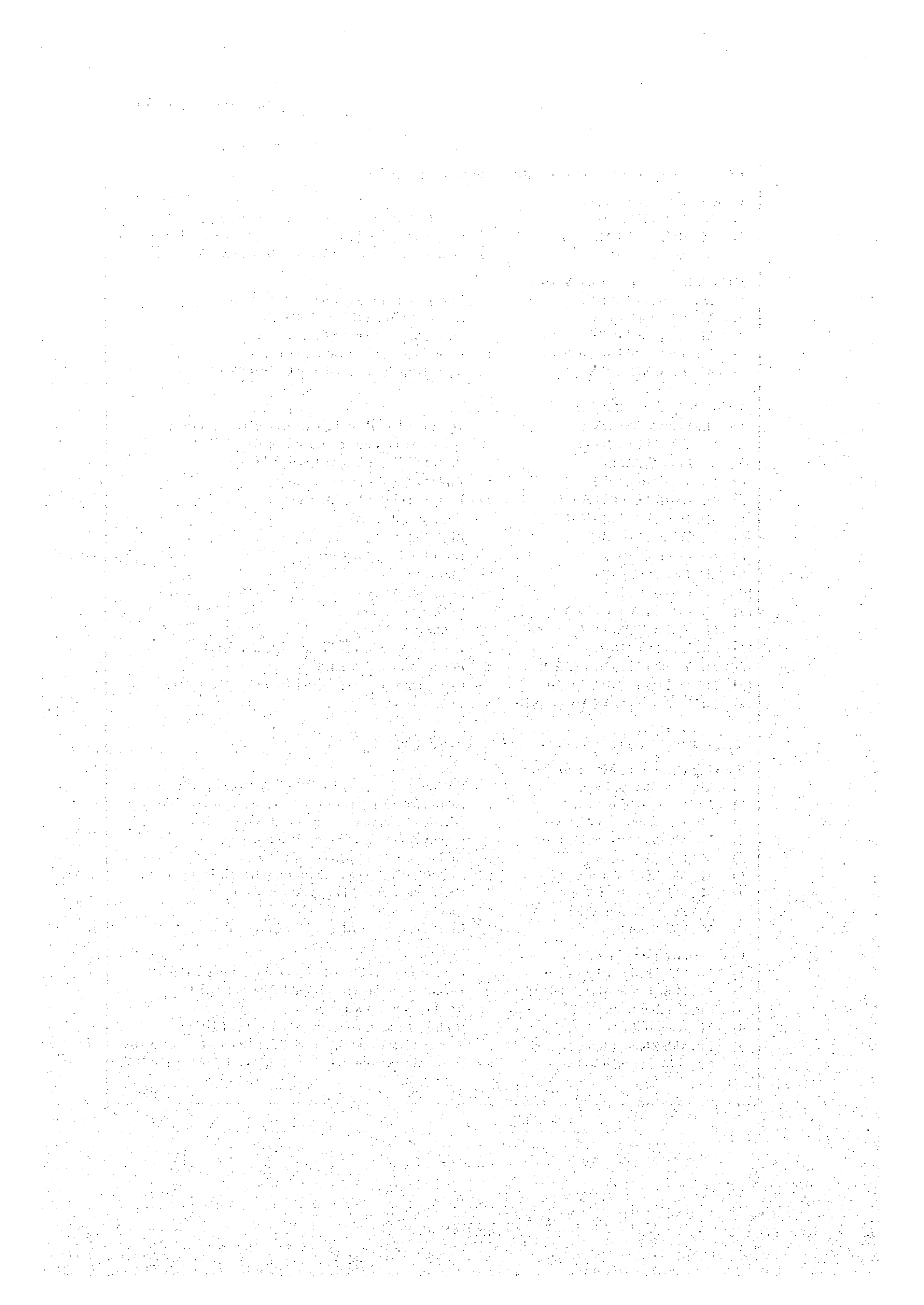
Bangladeshi Steering Committee and Counterpart Team

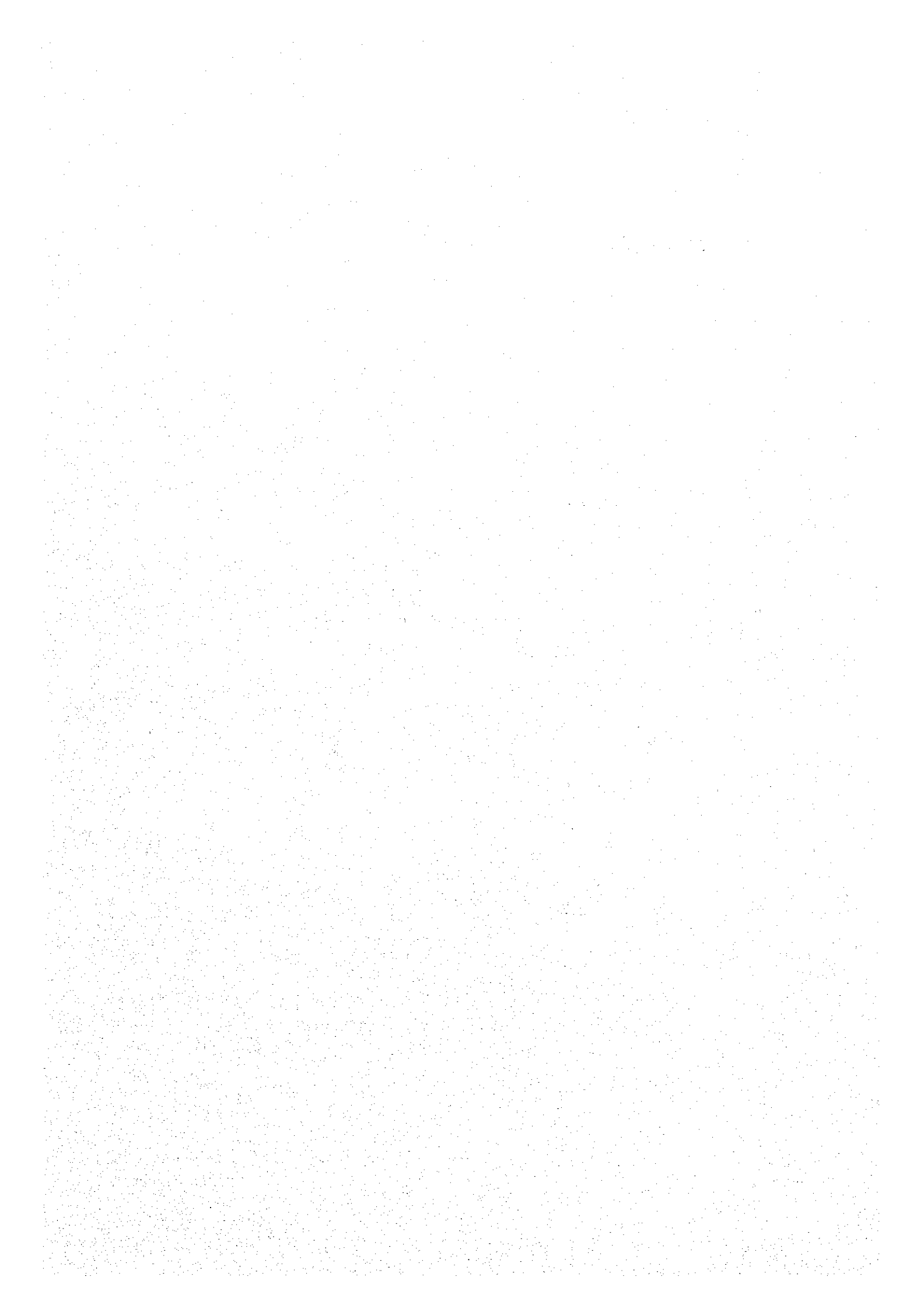
Steering Committee Members

- | | | |
|------------------------------|---|---|
| 1) Mr. Syed Rezaul Hayat | : | Chairperson, Secretary of Roads & Railways Division |
| 2) Mr. Sohel Ahmed | : | Additional Secretary of Economic Relations Division |
| 3) Mr. SK. Mainuddin Ahmed | : | Division Chief of Planing Commission |
| 4) Mr. Mia Mohammed Mostaque | : | Deputy Secretary of Ministry of Shipping |
| 5) Mr. Md. Abdus Sattar | : | Additional Chief Engineer of RHD |
| 6) Mr. Md. Syed Ahmed | : | Additional Director General/I of Bangladesh Railway |
| 7) Mr. Md. Safiullah Khan | : | Chief Engineer of Mongla Port Authority |
| 8) Mr. Pervez Anwar Khan | : | Chief Engineer of BIWTA |
| 9) Mr. Liakat Ali Sarif | : | Chief Engineer of Khulna City Corporation |

Counterpart Team Members

- | | | |
|-----------------------------------|---|--|
| 1) Mr. Md. Sheikh Rabiul Islam | : | Coordinator, Additional Chief Engineer of RHD Khulna |
| 2) Mr. Moiz Uddin Ahmed Jaigirder | : | Team Leader, Superintendent Engineer of RHD |
| 3) Mr. Habibur Rahman | : | Road Engineer, Executive Engineer of RHD |
| 4) Mr. Ashraf-ul-Islam | : | Bridge Engineer, Executive Engineer of RHD |
| 5) Mr. Md. Khalilur Rahman | : | Regional Development Specialist, Planning Officer, KDA |
| 6) Mr. G.M. Masudur Rahman | : | Regional Development Specialist, Assist. Engineer, KDA |





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