

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF COMMUNICATIONS

THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH

THE STUDY
ON
CONSTRUCTION OF THE BRIDGE OVER THE RIVER RUPSA
IN KHULNA
(Phase 2)

FINAL REPORT
VOLUME I: MAIN REPORT



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MARCH 2000

PACIFIC CONSULTANTS INTERNATIONAL
JAPAN OVERSEAS CONSULTANTS

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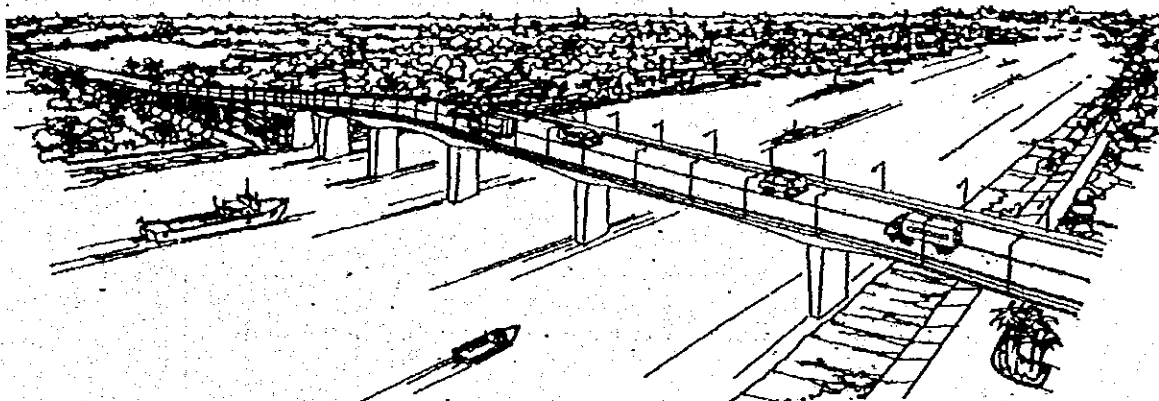
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The following foreign exchange rate is applied in the study:

US\$1.00 = 110.00 Yen = 48.60 Taka (as of August 1999)

PREFACE

In response to a request from the Government of the People's Republic of Bangladesh, the Government of Japan decided to conduct the Phase 2 study on the Construction of the Bridge over the River Rupsa and entrusted the study to the Japan International Cooperation Agency.

JICA selected and dispatched a study team headed by Mr. Kenji Maruoka of Pacific Consultants International, consisting of Pacific Consultants International and Japan Overseas Consultants to Bangladesh, three times between June 1999 and March 2000. In addition, JICA set up an advisory committee headed by Dr. Yuzo Akatsuka, Professor/Dean of Faculty of Regional Development Studies, Toyo University to examine the study from specialist and technical points of view.

The team held discussions with the officials concerned of the Government of Bangladesh and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

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

March 2000



Kimio Fujita

President

Japan International Cooperation Agency

March 2000

Mr. Kimio Fujita
President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

We are pleased to submit herewith the Final Report of "The Study on Construction of the Bridge over the River Rupsa in Khulna (Phase 2)" in the People's Republic of Bangladesh.

The report contains the results of study which was carried out by Pacific Consultants International in association with Japan Overseas Consultants between June 1999 and March 2000. The report consists of three volumes of Summary, Main Report, Appendix, Drawings and Draft Tender Documents.

The Summary briefly illustrates the findings of the whole study. The Main Report consists of 14 chapters and presents traffic demand forecast, engineering designs, environmental impact assessments, economic and financial analysis and conclusion and recommendations for the project implementation. It recommends that the institutional arrangement for project implementation should be taken as soon as possible.

The Draft Tender Documents comprise draft pre-qualification, draft tender documents and technical reports, and they are prepared based on the design at a detailed level.

We wish to express grateful acknowledgment to the personnel of your Agency, Ministry of Foreign Affairs, Advisory Committee, Ministry of Transport, Ministry of Construction and Embassy of Japan in Bangladesh, and also to officials of the Ministry of Communications, Government of Bangladesh for their assistance extended to the Study Team. The Study Team sincerely hopes that the results of the Study will contribute to the development of road network in Bangladesh.

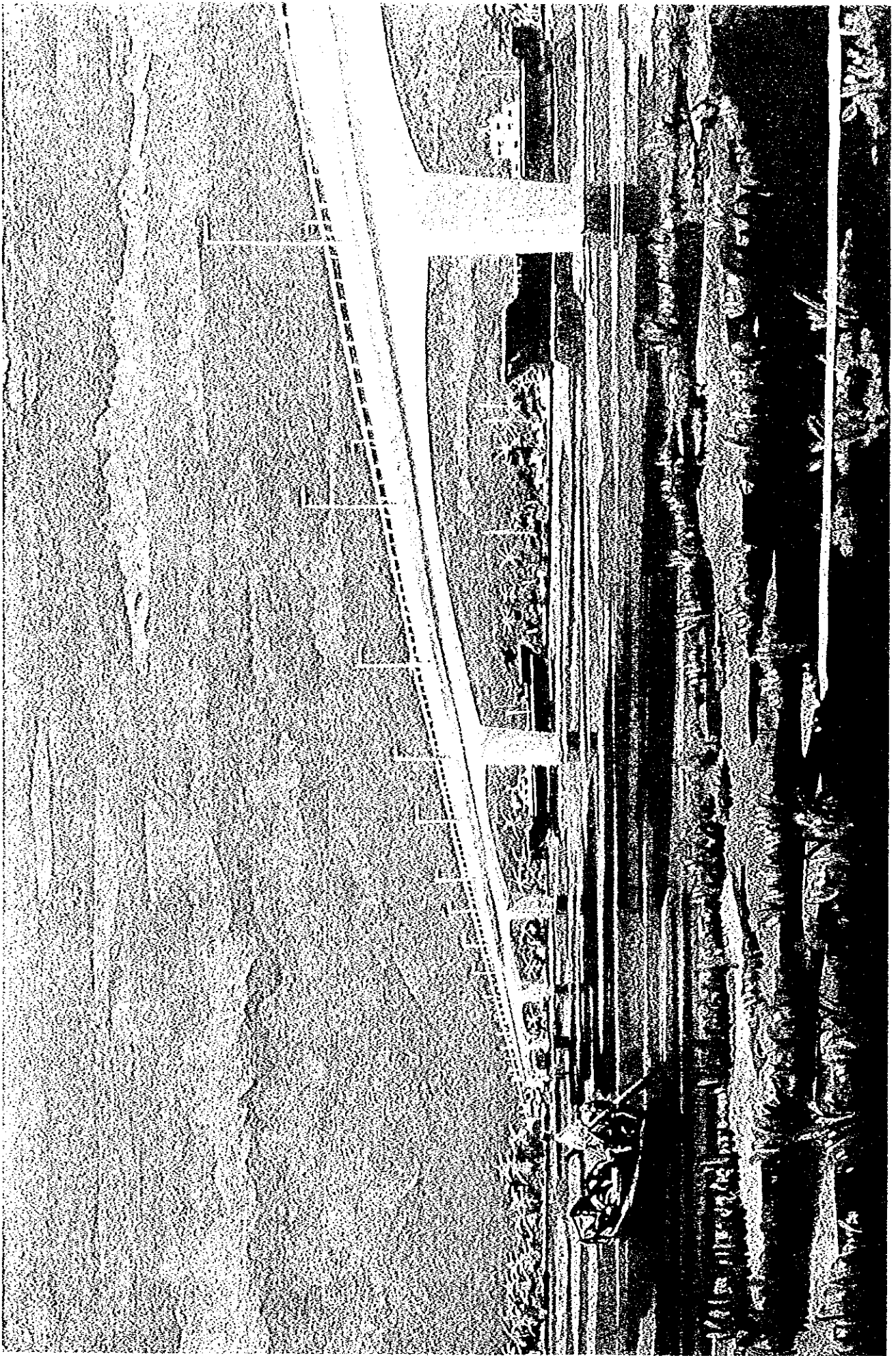
Yours faithfully,



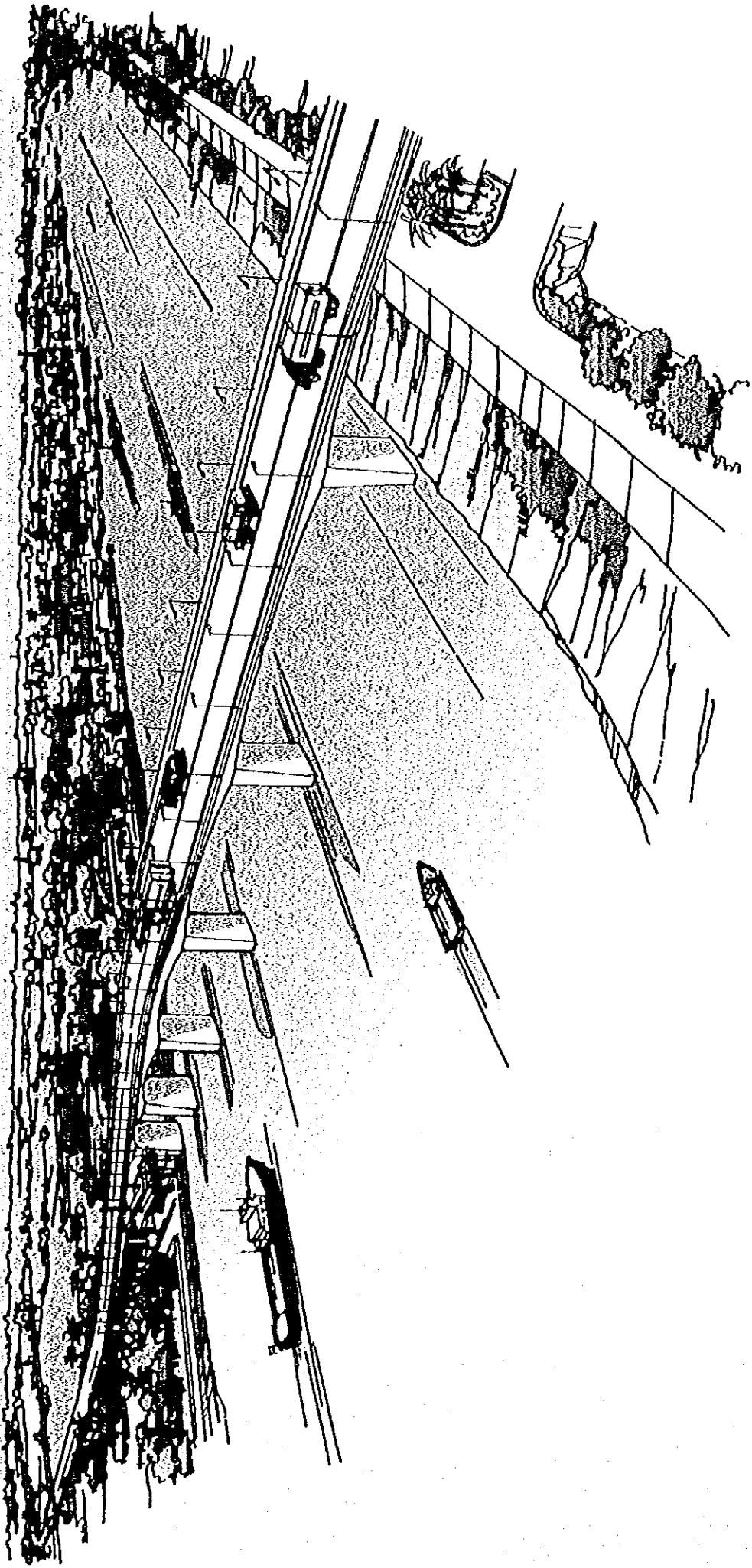
Kenji Maruoka

Team Leader

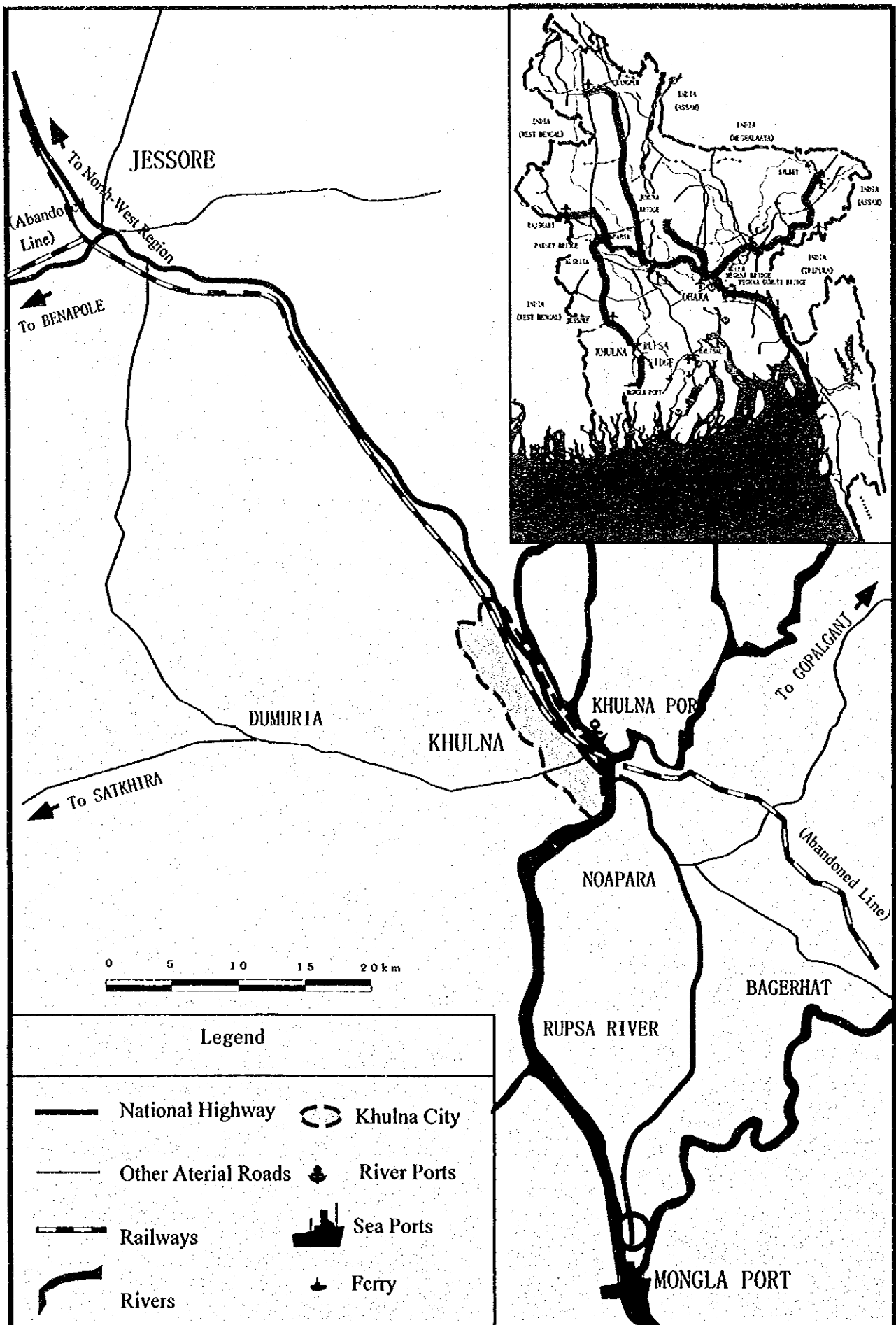
The Study on Construction of the Bridge over the
River Rupsa in Khulna (Phase 2)



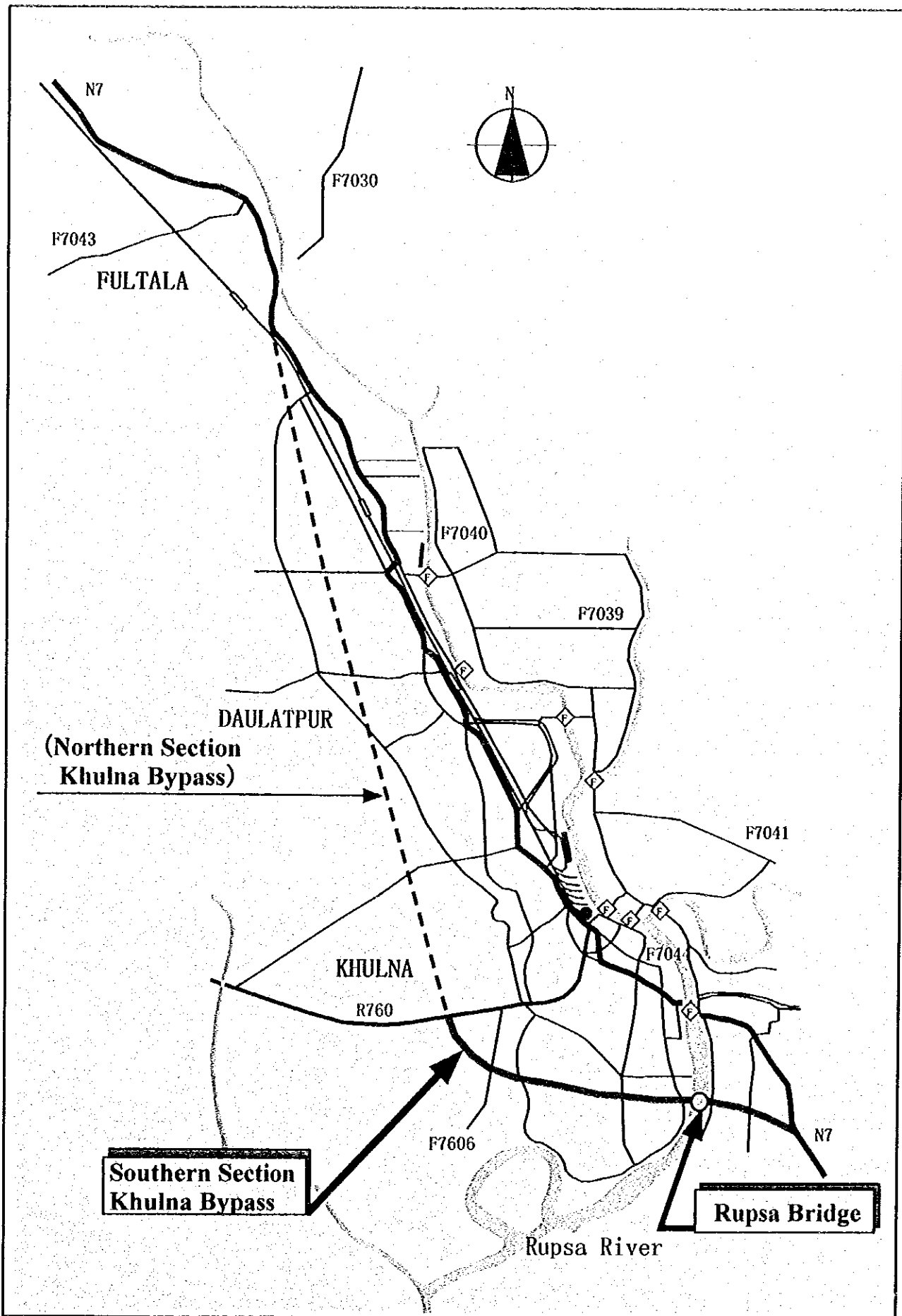
Rupsa Bridge, overlooking Khulna City



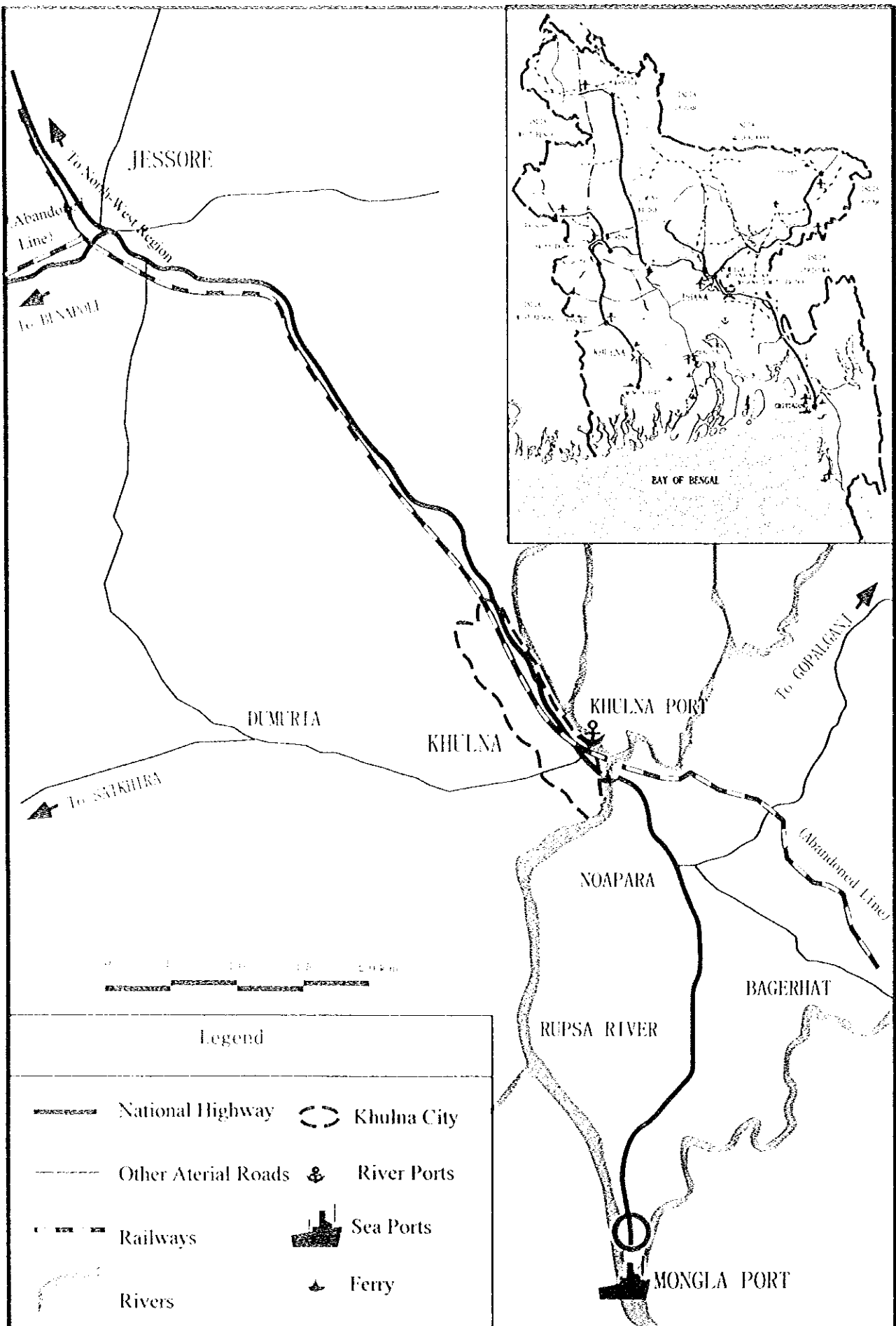
Rupsa Bridge, view from east bank



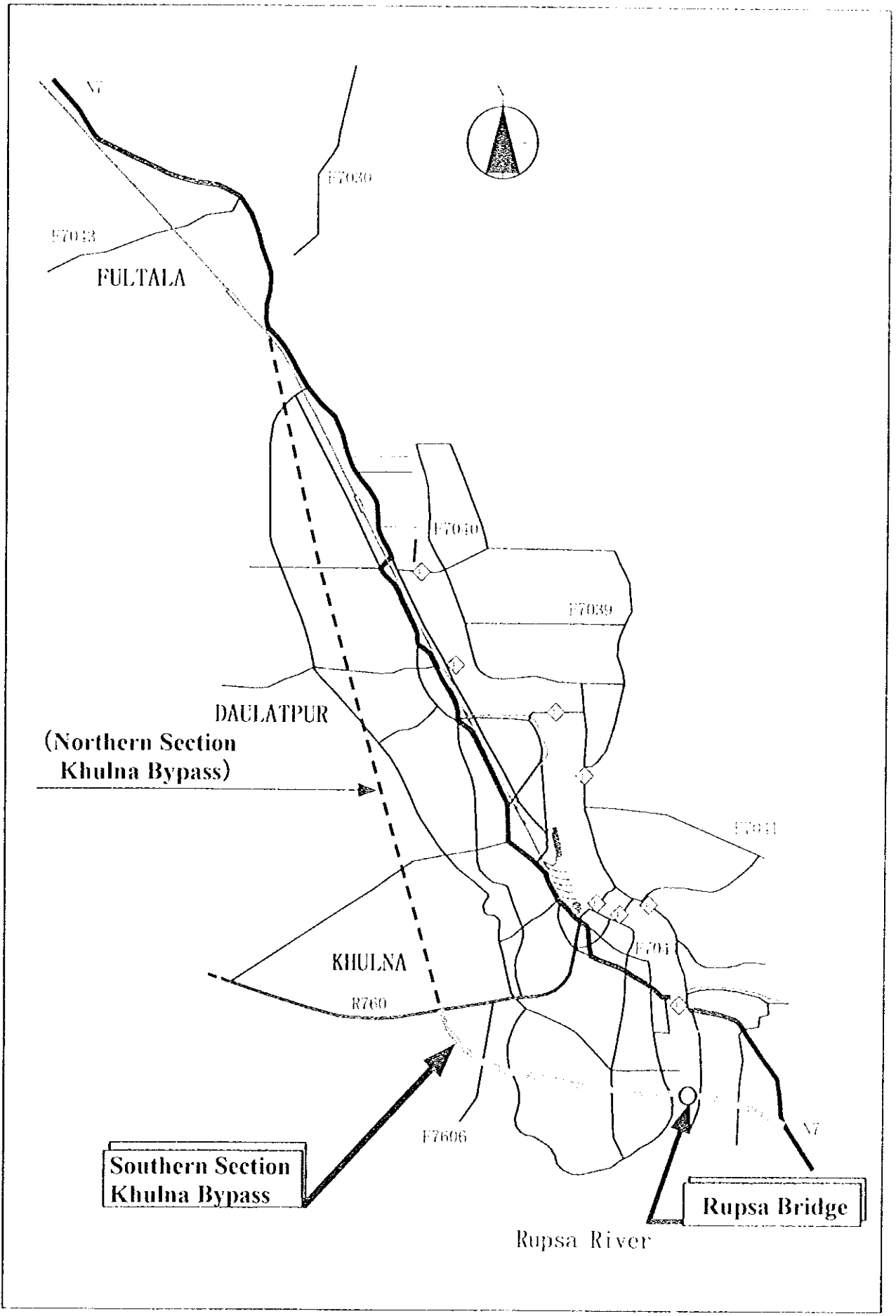
Map of the Study Area



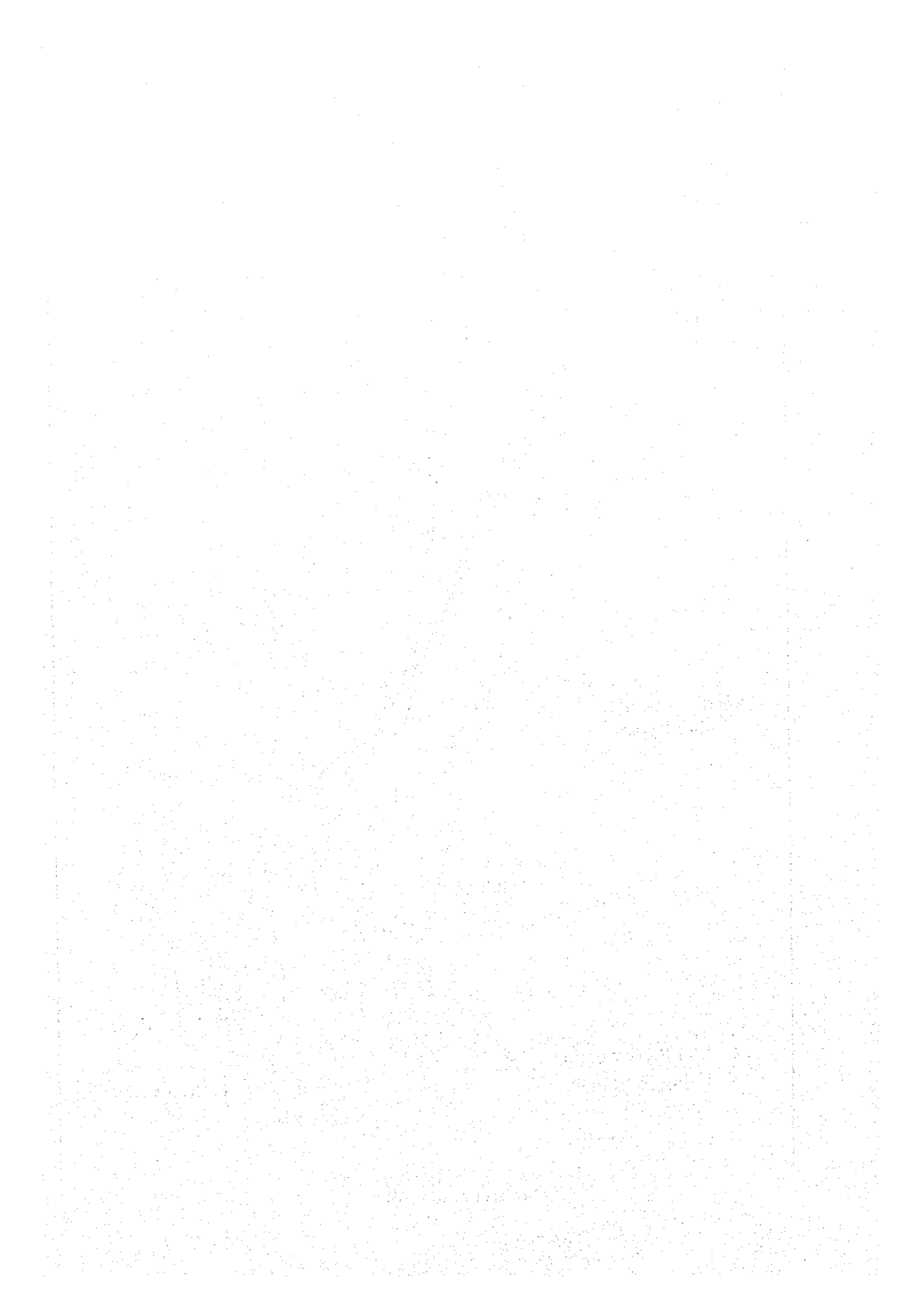
Project Location Map



Map of the Study Area



Project Location Map



DEFINITIONS AND ABBREVIATIONS

(1) Agencies

ADB	Asian Development Bank
BIWTA	Bangladesh Inland Water Transport Authority
BR	Bangladesh Railways
CPA	Chittagong Port Authority
DOE	Department of Environment, Ministry of Environment and Forestry
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
JMB	Jamuna Multipurpose Bridge
KCC	Khulna City Corporation
KDA	Khulna Development Authority
KFAED	Kuwait Fund for Arab Economic Development
LGED	Local Government Engineering Department, Ministry of Local Government, Rural Development and Co-operatives
MOC	Ministry of Communications
MPA	Mongla Port Authority
NBR	National Bureau of Revenue
NDF	Norway Development Fund
RHD	Roads and Highways Department, Ministry of Communications
WB	World Bank

(2) Technical Terms and others

SFYP	5 th Five Year Plan
B/C	Cost Benefit Ratio
BITSS	Bangladesh Integrated Transport System Study
CBD	Central Business District
EAM	Equilibrium Assignment Method
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EPZ	Export Processing Zone
EQS	Environmental Quality Standards
FDI	Foreign Direct Investment

FIRR	Financial Internal Rate of Return
G/A	Generated/Attracted
GDP	Gross Domestic Product
Ghat	Platform to the water's edge
ICB	International Competitive Bidding
IEE	Initial Environmental Examination
IRR	Internal Rate of Return
ISIE	Initial Social Impact Examination
LCB	Local Competitive Bidding
LPG	Liquefied Petroleum Gas
MMT	Multi Modal Terminal
MPADP	Mongla Port Area Development Project
N.P.V	Net Present Value
NGO	Non Governmental Organization
O & M	Operation and Maintenance
OD	Origin and Destination
PAPs	Project Affected Persons
PC	Prestressed Concrete
PCU or pcu	Passenger Car Unit
RIP-III	Third Road Improvement Project
ROW	Right-of-Way
SIA	Social Impact Assessment
SPM	Suspended Particulate Matter
SPT	Standard Penetration Test
STRADA	System for Traffic Demand Analysis developed by JICA
Tk	Taka
Zila	Administrative sub-unit of Division and group of Thanas

PROJECT SUMMARY

1. COUNTRY	The People's Republic of Bangladesh
2. NAME OF STUDY	The Study on Construction of the Bridge over the River Rupsa in Khulna (Phase 2)
3. COUNTERPART AGENCY	Roads and Highways Department, Ministry of Communications
4. OBJECTIVE OF STUDY	To conduct the feasibility study for the Southern Section of Khulna Bypass including Rupsa Bridge
1. STUDY AREA	Khulna City and its Surrounding
2. ECONOMIC FRAMEWORK	5.0 % p.a.(1996/97 - 2014/15)
3. TRAFFIC DEMAND FORECAST	Traffic Demand on the Bridge (2015) 11,100 veh./day (18,500 PCU/DAY)
4. OUTLINE OF FEASIBILITY STUDY AND ENGINEERING DESIGN	
(1) Feasibility Study and Design at a Preliminary Level (June 1999 to October 1999)	
<ul style="list-style-type: none"> • Major design elements in association with design criteria, route location, bridge structure type and area of river revetment were studied along the selected scheme of Khulna Bypass in Phase 1. • The economic analysis shows EIRR of 26.2% on the base case (VOC + 15% TTC). • In the financial analysis, the existing ferry tolls were applied to the new bridge. The estimated FIRR marks 2.4% after 25 years of toll operations (year 2029) and full cost recovery is reached in case of JBIC ODA Loan. • In the course of Phase 2 Study, EIA & SIA report was prepared based on IEE & ISIE in accordance with the environmental policy and laws of Bangladesh. The EIA and SIA concluded that there are no substantial or irreversible adverse environmental and social impacts arising from the Project. 	
(2) Design at a Detailed Level (November 1999 to February 2000)	
<ul style="list-style-type: none"> • Alternative Route-1 was selected to minimize adverse social impacts. • The typical cross section comprises undivided 2-lane with sidewalks and lanes for slow-moving vehicles at both sides. • Rupsa Bridge: L=1,360m W=16.0m <ol style="list-style-type: none"> 1) Rupsa Main Bridge (16m effective width) : Superstructure: 7-span PC Box Girder with span length of 70m + 5@100m + 70m = 640m : Substructure: RC Bored Piles and Pile-cap on water level 2) Rupsa Approach Bridge (16m effective width) : Superstructure: Standard PC I-girder composite with RC deck slab 2 x 12 @30m = 720m : Substructure: RC Bored Piles 3) River Revetment : 50m x 150m wide river revetment on the East Bank 4) Pier Protection : at piers of Rupsa Bridge in the water against scouring • Approach road: L=8,679m (West section L=5,880m, East section L=2,799m) <ol style="list-style-type: none"> 1) Typical Cross section : Roadway Width : 21.5m : Through Traveled Way: 2x6m (Through traveled lane 3.5m, Slow-moving track 2.5m) : Median: 5.5m : Inner Shoulder : 1.0m (part of median) : Outer Shoulder : 2.0m (used for sidewalk) 2) Canal Bridge: Hatia Br. (L=90m W=2x9m), Molonghata Br. (L=30m W=2x9m) Superstructure: Standard PC I-girder composite with RC deck slab :Hatia Br.: 3 x 30m = 90m, Molonghata Br.: 1 x 30m = 30m Substructure: RC Bored Piles 3) Box Culvert : Nine (9) locations • Related Facilities <ol style="list-style-type: none"> 1) At-grade Intersections : Six (6) locations 2) Toll Plaza : Barrier type toll gates of five booths for fast-moving vehicles and four booths for slow-moving vehicles 3) Bus Bay : Two (2) locations 4) Staircases with Slope for Bicycle Pulling : Both sides and both ends of Rupsa Bridge • The land acquisition plan, draft pre-qualification documents, draft tender documents and cost estimates were prepared for the project implementation. RHD as the executing agency for the Project has submitted the environment clearance application to DOE based on the EIA & SIA report prepared by the Study. 	
5. ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENTS	
The EIA and SIA were conducted along the selected route and it revealed that the land acquisition for the route would require relocating 53 households. It is confirmed that neither public facilities/cultural heritages nor vulnerable flora and fauna are affected by the land acquisition for the selected route.	
6. CONSTRUCTION PLANNING AND COST ESTIMATES	
The construction of Main Bridge is to be one of the major components for Rupsa Bridge Construction Project because of its scale and technical difficulties, and the Approach Bridges are also to be another because of voluminous fabrications of standard I-girder. The scheme of single contract package is evaluated superior from all aspects. The project cost is estimated 4.12 billion taka at August 1999 prices.	
7. CONCLUSION AND RECOMMENDATIONS	
It is concluded that the Study reveals high feasibility for the project implementation. It may be concluded that the institutional arrangement for project implementation should be taken without interruption.	

OUTLINE OF THE STUDY

The Study on Construction of the Bridge over the River Rupsa in Khulna (Phase 2)

- Study Period : June, 1999 - March, 2000
- Counterpart Agency : Roads and Highways Department (RHD), Ministry of Communications

1. Background of the Study

Khulna City, the 3rd biggest city and the hub of commerce and administration in the southwestern region, is located 150km far from Dhaka having 600,000 population (1991). Major agricultural products in Khulna and its surroundings are paddy rice, jute, sugar cane and prawn. The Rupsa River disrupts the urbanized area that has been developed along National Highway No. 7 and Rupsa Ferry is only one transport means to connect the east to the west. Since the incremental congestion of the ferry terminal at Rupsa ghat increases transport costs as well as aggravating the severance of the local community, the scheme of bridge construction is deemed a drastic measure to improve the situation.

Mongla Port, as the 2nd international port in Bangladesh, is located 40km south from Khulna City. Khulna-Mongla Road will have no river interruption after Rupsa Bridge is completed, and accordingly Rupsa Bridge is expected to play an expanded role in future to cope with incremental freight traffic and further transit cargo movement to the landlocked counties of Nepal and Bhutan.

The Government of Bangladesh and the Japan International Cooperation Agency (JICA) have agreed to the Scope of Work in March 1999 to conduct Phase 2 of the Study on Construction of the Bridge over the River Rupsa in Khulna (hereinafter referred to as "the Study") based on the findings and recommendations prepared under Phase 1 in close cooperation with the Government of Bangladesh.

2. Study Objectives

The objectives of the Study are as follows;

- (1) to conduct the feasibility study for the construction of a road bridge over the river Rupsa including its approaches and the Southern Section of Khulna Bypass from Khulna-Satkhira Road to Khulna-Mongla Road; and
- (2) to pursue technology transfer to Bangladesh counterpart personnel in the course of the Study.

3. Study Area

The study area covers the location of Rupsa Bridge to be in 1 – 3 km south of existing ferry crossing point, the Southern Section of Khulna Bypass in Khulna and resettlement site, if any.

4. Target Year

The target year of the plan is the year 2015 which accords with that of the studies implemented by the World Bank.

5. Outline of the Study

The Study was conducted regarding the Southern Section of Khulna Bypass including Rupsa Bridge in accordance with the agreed scope of work.

5.1 Socio-Economic Framework

During recent years Bangladesh has achieved a GDP growth rate of about 4% per annum. Based on the Fifth Five-Year Plan (5FYP) GDP is projected to grow at an average annual rate of 7% over the five-year period ending 2001/02. This forecast now looks optimistic, given the recent severe floods in Bangladesh and the possibility of some fallout from the ongoing economic crisis in nearby East Asia.

The population growth rate in Bangladesh is expected to continue to decline, to an average annual rate of around 1.37% during the 5FYP (123.8 million population in 1996/97 increasing to 132.5 million by 2001/02, 147.1 million by 2010 and 166.5 million by 2020).

The motorized vehicle ownership is forecasted based on the growth of GDP to be 584,000 vehicles (1997/98) up to 1,558,000 vehicles (2014/15).

5.2 Traffic Demand Forecast and Typical Cross Sections

The future OD tables are subdivided into more detailed traffic zones in the study area, and the future traffic is assigned on more detailed road network than that of Phase 1 Study to examine necessary improvement of connecting roads. Additional traffic survey was conducted to supplement traffic survey data obtained in Phase 1 Study.

- 1) Totaling 35 traffic zones were established in Bangladesh; subdivided are four zones of Khulna City in Phase 1 to eleven zones in Phase 2. Based on total traffic demand (control total) derived within the national transport plan forecasted by “Bangladesh Integrated Transport System Study (BITSS)”, this study applied future increases

between 1997/98 and 2014/15 of 2.54 times for passenger demand, and 2.75 for freight demand.

- 2) The total cargo at Mongla Port in 2015, excluding that to/from Nepal, is projected at 5,800 thousand tons. The estimated volume of the Nepalese cargo handled at Mongla Port in 2015 is 400 thousand tons including 41 thousand TEUs of containers. The total cargo volume handled at the jetty, all of which is to be transshipped by road transport, will reach more than 2,125 thousand tons. Port related land traffic is defined as that generated from the port area, which covers the public jetty, cement factories, a planned LPG distribution depot, a planned EPZ, and port administration facilities. While currently the number of trucks generated from Mongla Port is not so large, the future land traffic is projected to reach approximately 5 thousand trips a day
- 3) Latent demand for the Rupsa Ferry is presently indicated by much shuttle service to the Rupsa Ferry ghat. It is predicted that traffic flow pattern will greatly change in the future with the construction of a bridge nearby. The latent traffic demand for Rupsa River crossing that will arise upon the construction of the bridge can be forecasted on the basis of Origin-Destination studies of the existing situation.

	(trips/day)			
	Khulna from Rupsa		Rupsa from Khulna	
	1998	2015	1998	2015
Autorickshaw	455	1,373	352	1,062
Bus	296	847	260	745

Source: Study Team

- 4) The traffic demand passing the Rupsa Bridge is forecasted about 11,100 vehicles/day (about 18,500 pcu/day) as the heaviest traffic volume on the Southern section of Khulna Bypass, and its average trip length is 53.8 km. Accordingly, undivided 2-lane highway was warranted by traffic capacity analysis.
- 5) The cross section of undivided 2-lane with sidewalks was the basis for the Study. However, Rupsa Bridge is located in the urbanized area of Khulna and major users are expected local commuters. It is necessary to deliberate transport means for citizens such as auto-rickshaws and motorcycles, and accordingly separated lanes for slow-moving vehicles were added to accommodate commuters as well as contribute traffic safety and steady flow of traffic.

5.3 Outline of Feasibility Study and Engineering Design

Natural condition surveys such as topographic survey, soil investigations and hydrological survey were carried out to supplement the results of engineering site surveys obtained in Phase 1. Engineering study was conducted in two phases based on these survey results.

5.3.1 Feasibility Study and Design at a Preliminary Level (June 1999 to October 1999)

Major design elements in association with design criteria, route location, bridge structure type and area of river revetment were studied along the selected scheme of Khulna Bypass in Phase 1. The design at a preliminary level, cost estimates and economic/financial analyses were made for the project evaluation. The economic analysis shows EIRR of 26.2% on the base case (VOC + 15% TTC). In the financial analysis, the existing ferry tolls were applied to the new bridge. The estimated FIRR marks 2.4% after 25 years of toll operations (year 2029) and full cost recovery is reached in case of JBIC ODA Loan. The study results of economic/financial analyses reveal high feasibility of the project.

In the course of Phase 2 Study, 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 institutions including JICA and JBIC. The EIA and SIA concluded that there are no substantial or irreversible adverse environmental and social impacts arising from the Project.

5.3.2 Design at a Detailed Level (November 1999 to February 2000)

The design at a detailed level was carried out based on topographic maps and results of soil investigations. The land acquisition plan and draft tender documents were also prepared for the institutional arrangement for the project implementation. RIID as the executing agency for the Project has submitted the environment clearance application to DOE based on the EIA & SIA report.

The Southern Section of Khulna Bypass is of 10,039m long, comprising the following components:

(1) Rupsa Bridge: L=1,360m W =16.0m

1) Rupsa Main Bridge (16m effective width)

Superstructure : 7-span PC Box Girder with span length of
70m + 5@100m + 70m = 640m

Substructure : RC Bored Piles and Pile-cap on water level

2) Rupsa Approach Bridge (Viaduct : 16m effective width)

Superstructure : Standard PC I-girder composite with RC deck slab,
2 x 12 @30m = 720m

Substructure : RC Bored Piles

3) River Revetment : 50m x 150m wide river revetment on the East Bank

4) Pier Protection : at piers of Rupsa Bridge in the water against scouring

(2) Approach road: L=8,679m (West section L=5,880m, East section L=2,799m)

1) Typical Cross section

Roadway Width : 21.5m

Through Traveled Way : 2 x 6m

(Through traveled lane 3.5m, Slow-moving track 2.5m)

Median : 5.5m

Inner Shoulder : 1.0m (part of median)

Outer Shoulder : 2.0m (used for sidewalk)

2) Canal Bridge: Hatia Br. (L=90m W=2x9m), Molonghata Br. (L=30m W=2x9m)

Superstructure : Standard PC I-girder composite with RC deck slab

Hatia Br.: 3 x 30m = 90m,

Molonghata Br.: 1 x 30m = 30m

Substructure : RC Bored Piles

3) Box Culvert : Nine (9) locations

(3) Related Facilities

Following facilities are to be constructed related to the Southern Section of Khulna Bypass:

1) At-grade Intersections : Six (6) locations

2) Toll Plaza : Barrier type toll gates of five booths for fast-moving vehicles and four booths for slow-moving vehicles

3) Bus Bay : Two (2) locations

4) Staircases with Slope : Both sides and both ends of Rupsa Bridge for Bicycle Pulling

5.4 Major Design Specifications

- (1) The design speed for through traveled way is 60km/h and the vertical and horizontal alignments have maximum grade of 3% and minimum horizontal curve radius of 600m. The lowest elevation of road surface is determined so as to keep subgrade above the flood level of 1.9 PWD.
- (2) The service roads are provided at both sides of Rupsa Bridge approach roads to connect dike roads along the Rupsa River. The location of toll plaza is selected to levy tolls from all vehicles on Rupsa Bridge, including traffic access to/egress from dike roads.
- (3) At-grade intersections are designed to be channelized by auxiliary lanes. Bus bays are provided at far side nearby intersections with Batiaghata and Jabusa.
- (4) RC Bored Piles are selected from the viewpoints of construction cost and practicality against soil condition. The foundation of Rupsa Main Bridge is designed six bored piles of 2.5m diameter with maximum length of 75m, while that of Rupsa Approach Bridge and other canal bridges is eight bored piles of 0.9m diameter with the range of 30m to 50m. The position of pile-cap is selected on the water due to its superiority of cheaper construction cost, shorter construction period and lesser effect against scouring. The design wind of 75m/sec governed required number of piles.
- (5) The superstructure of Rupsa Main Bridge is selected as PC Box Girder type by the balanced cantilever cast-insitu segmental method from the viewpoints of construction cost and practicality, while that of Rupsa Approach Bridge and other canal bridges are PC I-girder composited with RC deck slab.
Since 200 PC I-girders should be fabricated within a certain period, a full-equipped fabrication yard is required to produce PC I-girders systematically.
- (6) The navigation clearance for the Hatia River is kept the same (3.5m) as that of Garamari Bridge on Khulna-Satkhira Road. Accordingly, the embankment at the abutment of Hatia Bridge is 5.2m high. Surcharge together with counterweight fill is required on embankment to stabilize subsurface soil. The resulting Right-of-Way requires 80m wide.
- (7) Neither guide bank nor a kind of river training works, whose basic objective is to constrict waterway, is required at the selected bridge location. However, it is planned to construct 50m x 150m revetment on the east bank as a slope protection measure because there is a possibility for small-scale slope erosion of which the causes are the wind, the waves generated by winds shipping vessels, apart from river flow velocity.

Protection work against scouring is required at six piers in the water among totaling eight piers of Rupsa Main Bridge.

- (8) Water level in Rupsa is greatly influenced by tide in Bay of Bengal and the flood of the Ganges river and the Garai river which are upstream rivers, do not have any direct influence on Rupsa river. Accordingly, no seasonal constraint for construction planning is considered but emphasis is put on securing traffic safety for water transport during construction period and procurement and transportation plans of necessary construction equipment and materials.

5.5 Environmental and Social Impact Assessments

The EIA and SIA were conducted along the selected route and it revealed that the land acquisition for the route would require relocating 53 households.

- 1) Almost all of the affected households are located in the residential area adjacent to the west bank of the Rupsa River.
- 2) Of the households under the selected route who would need relocation, majority clearly expressed their opinion in favor of on-site relocation within the same village.
- 3) Nearly 90% of affected households desired cash compensation, while only eleven households wished having the land, house lot and house in resettlement site.

Considering the practical realities of resettlement site development by public sector, it is better to let the affected households to choose individual housing lot location with satisfactory scale of cash compensation. It is confirmed that the executing agency has firm policy to acquire land without any problems in this case.

It is confirmed that neither public facilities/cultural heritages nor vulnerable flora and fauna are affected by the land acquisition for the selected route.

5.6 Construction Planning and Cost Estimates

The construction of Main Bridge is to be one of the major components for Rupsa Bridge Construction Project because of its scale and technical difficulties, and the Approach Bridges are also to be another because of voluminous fabrications of standard I-girder. The construction planning is studied as a whole to cover these major works and three construction sections are deliberated from the viewpoints of dominant work components and accessibility. The scheme of single contract package is evaluated superior from reasons of (i) suiting methods of access to work components, land access for earthwork and pavement and riverine

access for bridge works and (ii) sharing heavy construction equipment in order to ensure quality of work as well as to keep substantial progress.

Two types of cost estimates were carried out, namely for the feasibility study based on the design at a preliminary level and for the tendering based on the design at a detailed level. The costs for the feasibility study was referred for the purpose of funding arrangement because no major design element was changed in the period of design at a detailed level. The project cost is estimated 4.12 billion taka at August 1999 prices.

5.7 Project Implementation Plan

The project implementation plan is made, consisting of 10 months of design review, 12 months of land acquisition, 6 months of tendering and 42 months of construction. Five-year implementation time schedule is set as a whole.

The project of Rupsa Bridge Construction will follow a general flow concept of project implementation on the assumption that the project should be implemented under JBIC ODA Loan proceeds. To avoid delays in project implementation, it will be necessary for RHD and other concerned government agencies to pay close attention to the numerous project processing steps of both the Bangladesh side and an international lending agency. The budget for land acquisition and property compensation should be allocated earlier because of the required fund at the first year and non-eligible portion of the lending agency.

5.8 Maintenance and Operation Plan

Rupsa Bridge is designated to replace the existing ferry and the present ferry tolls should be applied to the new bridge. The cash flow analysis is in real terms and indicates that tolls revenues would be sufficient to cover interest and O/M expenses.

Given the economic importance of the Project, it is envisaged that annual budgets for routine and periodic maintenance will be specifically allocated to the Project (i.e., dedicated) rather than being part of a zonal/block budget allocation. It is proposed that routine maintenance should be funded from the Revenue budget while periodic maintenance should be under an ADP allocation.

5.9 Conclusion and Recommendations

It is concluded that the Study reveals high feasibility for the project implementation. It is obvious that (i) technical soundness is warranted from all technical aspects, (ii) neither substantial nor irreversible adverse environmental and social impacts arise from the project,

(iii) route is selected to minimize adverse social impacts as well as to make realistic resettlement plan and (iv) economic and financial analyses show high feasibility of the project.

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

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, 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 was proposed in the transport masterplan during Phase 1 Study may be required together with the implementation of Rupsa Bridge to accommodate expected increase in 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 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 as shown in the Appendix.



The starting point is designated and clearly marked up on Khulna-Sathkira Road by KDA at 150 m toward Sathkira from the western corner of Weather Office under Meteorological Department.



The route is planned to connect with Batiaghta Road (F7606) at Sta.1+800 which is the feeder road in the district.



The route is planned to pass through open spaces from Sta. 2+000 to Sta. 5+100 such as paddy land and coconut farm.



The route will cross Laban Chara Main Road (Western Dyke Road) by a grade separation structure because the approach bridge of the Rupsa Bridge is planned to become the elevated viaduct so as to secure the navigation clearance of the Rupsa River at Sta.6+400.



The route is planned to connect with Jabusa Road at Sta.8+600 which is the feeder road in the district.



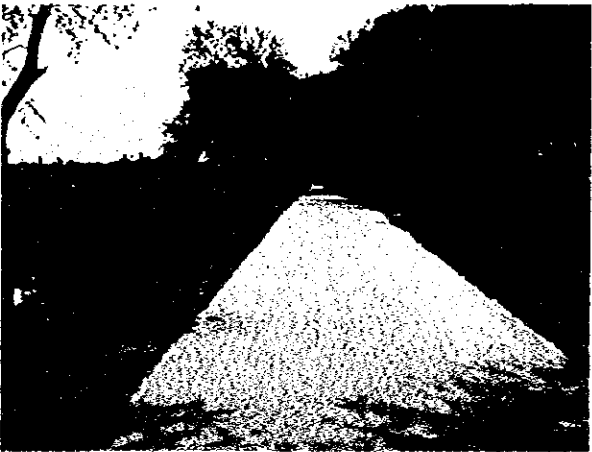
The route is planned to connect to Khulna-Mongla Road (NH-7) at existing at-grade intersection in Teelok area where Kudir 5m wide road of Bat Tala Sarak exists to lead to Abdul Wadud Memorial Hospital.



The route will cross Laban Chara Main Road (Western Dyke Road) by a grade separation structure because the elevation of approach road is too high to connect directly.



It is so inhabited area in Amitala that the route will affect a cluster of homesteads and it will be required to be relocated in groups.



The route is planned to connect to Khulna-Mongla Road (NH-7) in Amda Bad area where it is approximately 1.0km far from the existing intersection between NH-7 and Jabusa Road.

The route is planned to divert from Alternative-2 at Sta.3+900 to run eastward in the built-up area of the southern part of Khulna City.



The route is planned to avert primary controls such as mosque, primary school and cemetery in Matia Khali area. However, it is inevitable to demolish a densely inhabited area, and it is necessary to relocate on large scale.



The route continues to pass through residential area to keep distance from Khulna Shipyard, and will run to cross Rupsa Stand Road (Western Dyke Road) by a grade separation structure.



**THE STUDY ON
CONSTRUCTION OF THE BRIDGE OVER THE RIVER RUPSA
IN KHIULNA
(Phase 2)
FINAL REPORT
Vol. I: MAIN REPORT**

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