REPORT AND RECOMMENDATION

OF THE

PRESIDENT

TO THE

BOARD OF DIRECTORS

ON A

PROPOSED LOAN

TO THE

PEOPLE'S REPUBLIC OF BANGLADESH

FOR THE

JAMUNA BRIDGE PROJECT

February 1994

CURRENCY EQUIVALENTS
(as of 31 January 1994)

Currency Unit	-	Taka (Tk)
Tk 1.0	=	$0.0249
$1.00	=	Tk 40.07

(a) The Taka is pegged to a basket of six currencies with the US dollar as the intervention currency.

(b) Calculations in this report have been made using a rate of $1.00 = Tk 39.80, the rate prevailing during Project appraisal.

ABBREVIATIONS

A-D	-	Aricha-Daulatdia
A-N	-	Aricha-Nagarbari
BIWTA	-	Bangladesh Inalnd Water Transport Administration
BIWTC	-	Bangladesh Inland Water Transport Corporation
BR	-	Bangladesh Railway
BRAC	-	Bangladesh Rural Advancement Committee
B-S	-	Bhuapur-Sirajganj
CSC	-	Construction Supervision Consultant
DC	-	Deputy Commissioner
EAP	-	Environmental Action Plan
GRC	-	Grievances Redress Committee
IDA	-	International Development Associaiton (an affiliate of the World Bank)
JMBA	-	Jamuna Multipurpose Bridge Authority
LUMP	-	Land Use Master Plan
MC	-	Management Consultant
ODA	-	Overseas Development Administration (UK)
OECF	-	Overseas Economic Cooperation Fund (Japan)
PAPs	-	Project-Affected Persons
PoE	-	Panel of Experts
RAP	-	Resettlement Action Plan
RMP	-	Road Master Plan
ROIP	-	Road Overlay and Improvement Project
RRAP	-	Revised Resettlement Action Plan
RU	-	Resettlement Unit
TYRIP	-	Three Year Rolling Investment Program
VOC	-	Vehicle Operating Cost
VRW	-	Village Resettlement Worker

NOTES

(i) The fiscal year (FY) of the Government ends on 30 June.

(ii) In this Report, "$" refers to US dollars.

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LOAN AND PROJECT SUMMARY

Borrower	:	People's Republic of Bangladesh
Project Outline	:	A bridge with necessary river training works and road approaches across the Jamuna River will be constructed under the Project. The bridge will have four road lanes and has been designed to carry an electric power interconnector, a natural gas pipeline, telecommunication cables and a meter gauge railway in the future.
Classification	:	Economic growth
Rationale	:	The Jamuna River physically divides Bangladesh into two halves, the east and the west, but so far it has not been possible to construct a permanent linkage across the river because of the extremely high investment cost, mainly due to the complex characteristics of the river. In the absence of a fixed crossing, economic development of the country, particularly in the western part, as well as national integration, have been constrained. At present, transportation of passengers and freight across the river is by ferries and to a lesser extent by launches and manuall operated boats, but such services are grossly inadequate in both capacity and service level. A major investment will be required to provide a service level comparable with a bridge, but even then an improved ferry system will not be an all-weather multipurpose facility. Very high priority has therefore been given by the Government to the construction of a bridge that will provide for cross-Jamuna transportation of passengers and freight. The proposed bridge, by linking the eastern and the western parts of the country, will stimulate economic growth and promote the integration of the country.
Objectives and Scope	:	The main objective of the Project is to connect the eastern and western parts of the country, and thus help stimulate economic growth by facilitating cross-Jamuna transportation of passengers and freight. The Project will also permit the transmission of electricity, natural gas, telecommunications and railway more economically and efficiently when needed. The Project provides for the construction of a fixed crossing over the Jamuna River, about 7 kilometers (km) south of Sirajganj. It consists of (i) construction of a bridge, about 4.8 km long and 18.5 meters (m) wide; (ii) construction of two guide bunds of about 2.2 km each in

length to regulate the river flow at the bridge site; (iii) construction of the east and west road approaches; (iv) measures to mitigate the Project's impacts on the environment including implementation of a resettlement plan; and (v) consultant services for Project management, construction supervision and training in operation and maintenance of the bridge.

Cost Estimate : The total cost of the Project is estimated at $696 million equivalent, with a foreign exchange cost of $509 million. The cost estimates are based on actual bid prices and provide for necessary physical and price contingencies.

Financing Plan : The Project is proposed to be co-financed by the Bank, the International Development Association (IDA) and the Overseas Economic Cooperation Fund (OECF), Japan, with equal shares of $200 million equivalent each on a joint financing basis. The remaining Project cost of $96 million equivalent will be provided by the Government. In addition, the Government has agreed to establish an emergency fund of $10 million equivalent to meet force majeure.

Table 1: Financing Plan
($ million)

	Source of Finance				
Component	ADB	IDA	OECF	Government	Total
Civil Works	185.07	190.30	190.30	43.50	609.17
Consultant Services	9.70	9.70	9.70	-	29.10
Others	5.23 [a]	-	-	52.50	57.73
Total	**200.00**	**200.00**	**200.00**	**96.00**	**696.00**

[a] Service charges on the Bank loan.

Loan Amount and Terms : The equivalent in various currencies of SDR 145.607 million ($200.0 million equivalent) from the Bank's Special Funds resources with an amortization period of 40 years, including a grace period of 10 years, and a service charge of 1 per cent per annum

Relending Terms : The loan proceeds will be relent to the Jamuna Multipurpose Bridge Authority (JMBA) on terms not lower than those to the Borrower.

Period of Utilization	:	Until 30 June 1999
Executing Agency and Implementation Arrangements	:	JMBA, which was established by the Government specifically for the construction of the bridge, will be the Executing Agency for the Project. The Executive Director of JMBA will be responsible for Project implementation. He will be supported by appropriate local staff and assisted by management consultants as the employer and by the supervision consultants in the implementation of civil works. Given the complex technical nature of the Project, it is also proposed to continue with the services of the Panel of Experts (PoE), who have been providing technical assistance in the preparation of the Project, to advise JMBA at critical stages of construction. Further,to ensure regular monitoring of the implementation of the civil works, it is proposed to establish a committee consisting of senior staff from the co-financiers' resident offices in Dhaka.
Procurement	:	Civil works will be carried out through four contracts: (i) main bridge, (ii) river training works, (iii) east road approach, and (iv) west road approach. Bids have been received for all packages following international competitive bidding procedures in accordance with the Bank's *Guidelines for Procurement* and have been evaluated. The Government is in the process of awarding the river training works contract, to avail of the 1994 work season, under advance procurement action approved by the Bank and the co-financiers. The other contracts are proposed to be awarded after the Project is approved by the Boards of the respective co-financiers.
Consulting Services	:	About 830 person-months of international experts and 1,740 person-months of domestic experts will be needed for construction supervision and Project management. In view of the complex technical nature of the Project and their experience with the Project, the Government proposes to engage the consultants responsible for design as the supervision consultants by direct negotiations. The management consultants will be engaged in accordance with the Bank's *Guidelines on the Use of Consultants.*
Estimated Project Completion Date	:	30 June 1998

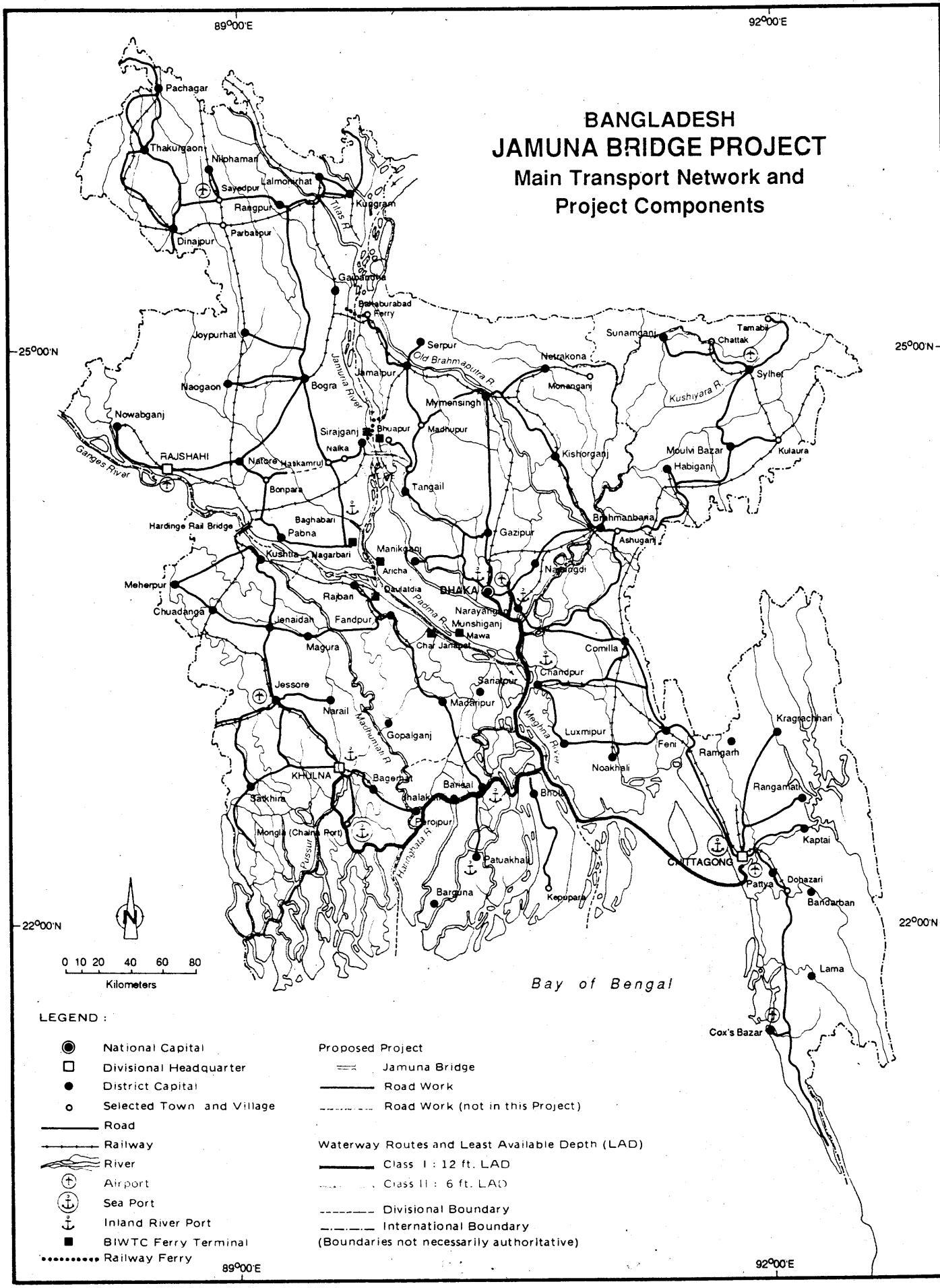
Project Benefits and Beneficiaries : The Project will generate multifaceted benefits by providing a permanent all-weather linkage across the Jamuna River. Based on quantifiable benefits from road traffic and from carrying the power interconnector, the Project is estimated to have an economic internal rate of return of about 15 per cent. Nonquantifiable benefits are substantial and include more efficient interregional trade, and economic and social development resulting from the integration of the country. The Project will bring about structural improvement in the economy through creation of a more efficient transportation and communication system. It will stimulate economic growth in the less developed and relatively isolated northwestern region, which has about 27 million people. The direct beneficiaries will be the bridge users, including passengers crossing the river, freight operators, manufacturers, farmers and consumers from both sides of the river, who will benefit from improved market access and reduced transport costs.

Project Risks : Concern has been expressed about the stability of the future river course and whether the planned river training works will be adequate to contain any shifting in the river course. All the studies, tests and designs that were carried out by the consultants and reviewed by the PoE indicate that the guide bunds to be constructed will, with a high probability, be able to prevent shifting of the river. The river training works have been designed using the latest river engineering techniques. However, there is a risk of liquefaction of part of the guide bunds. Since such damage will be localized, it can be contained and repaired. The risk of structural failure of the bridge is considered negligible.

The main implementation risks are delays in Project execution caused by (i) natural disasters, (ii) Government procedures, and (iii) cost overruns. The effects of usual natural disasters have been built into the design and risks on such account have been minimized. Procedural risks will be addressed by (i) making special arrangements for disbursement of both foreign and local expenditures on the basis of the Engineer's signature; (ii) having management consultants to advise JMBA as the employer for purposes of construction; (iii) reaching agreement with the Government to enhance the powers and authority of JMBA to be able to cope with day-to-day operations; (iv) designing a Resettlement Action Plan with community participation, and close monitoring of its implementation; and (v) establishing a committee of senior staff from the

co-financiers' resident offices in Dhaka to monitor implementation regularly. The risk of cost overruns, which may be caused mainly by natural disasters, cannot be quantified at this time. Cost estimates, however, have been based on actual bid prices.

The main maintenance risk is the capability of JMBA to operate and maintain the bridge and river training works after their construction. To reduce this risk, maintenance of the river training works, which is critical to the bridge's safety, has been included for a period of six years after construction in the related contract, and the management consultants will be required to train JMBA staff in the operation and maintenance of the bridge.


BANGLADESH
JAMUNA BRIDGE PROJECT
Main Transport Network and
Project Components
89°00'E
92°00'E
25°00'N
22°00'N
Pachagar
Thakurgaon
Nilphamari
Lalmonirhat
Sayedpur
Rangpur
Kurigram
Dinajpur
Parbatipur
Tista R.
Gaibandha
Bahaburabad Ferry
Joypurhat
Serpur
Old Brahmaputra R.
Jamalpur
Jamuna River
Naogaon
Bogra
Nowabganj
Sirajganj
Bhuapur
Madhupur
Mymensingh
Ganges River
RAJSHAHI
Nalka
Natore
Hatikamrul
Tangail
Bonpara
Hardinge Rail Bridge
Baghabari
Pabna
Kushtia
Nagarbari
Manikganj
Aricha
Meherpur
Daulatdia
Rajbari
DHAKA
Padma R.
Chuadanga
Jenaidah
Fandpur
Narayanganj
Munshiganj
Mawa
Char Janajat
Magura
Jessore
Narail
Madaripur
Gopalganj
Madhumati R.
KHULNA
Bagerhat
Satkhira
Barisal
Bhola
Mongla (Chalna Port)
Pussur
Barguna
Patuakhali
Hariphala R.
Sunamganj
Tamabil
Chattak
Netrakona
Sylhet
Moulvi Bazar
Kishorganj
Habiganj
Kulaura
Kushiyara R.
Brahmanbaria
Gazipur
Ashuganj
Narsingdi
Comilla
Chandpur
Shariatpur
Meghna River
Luxmipur
Feni
Ramgarh
Noakhali
Kragnachhari
Rangamati
Kaptai
CHITTAGONG
Pattya
Dohazari
Bandarban
Lama
Cox's Bazar
Kepupara
Bay of Bengal
N
0 10 20 40 60 80
Kilometers
LEGEND :
National Capital
Divisional Headquarter
District Capital
Selected Town and Village
Road
Railway
River
Airport
Sea Port
Inland River Port
BIWTC Ferry Terminal
Railway Ferry
Proposed Project
Jamuna Bridge
Road Work
Road Work (not in this Project)
Waterway Routes and Least Available Depth (LAD)
Class I : 12 ft. LAD
Class II : 6 ft. LAD
Divisional Boundary
International Boundary
(Boundaries not necessarily authoritative)

I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on a proposed loan to the People's Republic of Bangladesh for the Jamuna Bridge Project. The Project is proposed to be financed with co-financing in equal amounts from the Bank, the International Development Association (IDA) and the Overseas Economic Cooperation Fund (OECF), Japan.

II. INTRODUCTION

2. The Jamuna River is at present crossable by ferries (three road and two railway ferries) (see Map on page vii) and to a lesser extent by launches and manually operated boats. The ferry services are grossly inadequate in both capacity and service level. Waiting time is long, and crossing is difficult and even dangerous during the monsoon period which extends from May to October. The construction of a bridge across the Jamuna River that will provide a permanent all-weather multipurpose linkage between the east and the west, and thus facilitate closer economic integration and reduction of regional disparities, has been a high national priority for some time. This has, however, not materialized so far because of the high cost, primarily because of the width of the river, its flow volume, depth, uncertainty of its course and other technical complexities.

3. A pre-investment study, comprising a feasibility study and design preparation, was undertaken by the Government in 1985, financed by United Nations Development Programme (UNDP) with IDA acting as the Executing Agency. The findings of the feasibility study were presented to the aid agencies by the Government in June 1988; IDA, OECF and the Bank expressed interest in co-financing the Project. In view of the differing procurement eligibility criteria of the potential financiers, to determine the interest of internationally reputed contractors and consortia to bid for civil works and to ascertain their eligibility under the Bank's guidelines, pending further processing, prequalification of contractors was undertaken, which was completed in April 1990. Reputed contractors applied for prequalification, but since some contractors from nonmember countries of the Bank also met the prequalification criteria, it was not possible at that stage to reach any understanding on financing and implementation arrangements.

4. Fact-Finding of the Project was undertaken by a Joint Mission of IDA, OECF and the Bank from 30 July to 17 August 1990. After Fact-Finding, however, IDA considered it necessary to re-examine the Project's economic viability and its macroeconomic affordability to Bangladesh, before further processing. These were satisfactorily established in early 1992. A separate study on affordability undertaken by OECF subsequently also reached the same conclusion. Processing of the Project resumed in April 1992. Because of the lapse of considerable time since the original prequalification exercise, new prequalification of contractors was carried out. During the second round of prequalification, reputed contractors/consortia from only the Bank's member countries qualified, leaving the option open for joint or parallel financing, and it was decided to invite bids from prequalified contractors. In the meantime, an environmental impact assessment and an action plan for resettlement of people affected by the proposed Project were prepared, which provided a good basis for the co-financiers to fully examine the environmental and resettlement aspects of the Project.

5. Following receipt of bids from prequalified contractors, a Joint Mission from IDA and the Bank appraised the Project from 6 to 20 September 1993.[1] During this period, OECF fielded its Fact-Finding Team, which participated in the Joint Mission. OECF further sent a technical team in early December 1993 to Bangladesh to re-examine some engineering aspects of the Project and the resettlement and environmental issues. In the meantime, IDA conducted negotiations with the Government from 29 November to 2 December 1993, with the proviso that negotiations would be completed only when the Bank and OECF had successfully completed their negotiations. Formal negotiations for the proposed Project were held in Dhaka between the Bank and representatives of the Government on 12-13 January 1994. OECF is expected to conduct its negotiations in March 1994. This report is based on the project preparatory work carried out by consultants under the pre-investment study, the views of the Panel of Experts (PoE),[2] and the Joint Appraisal Mission's findings and its discussions with the Government and related nongovernment organizations (NGOs) and beneficiaries.

III. BACKGROUND

A. General

6. The Jamuna River physically divides Bangladesh into the eastern and western halves. The eastern part includes Dhaka and Chittagong Divisions, and the western part consists of Rajshahi and Khulna Divisions (see Map on page vii). The east is relatively more developed because of its access to the capital, Dhaka, and to the outside market through Chittagong port, and it has established itself as the industrial and commercial center of the country. The west has fertile agricultural land with higher average yield for major crops than the rest of the country. In this area, agriculture is the dominant sector of the economy and has high potential for further development.

7. Trans-Jamuna freight movement, which at present is through ferries, launches and manually operated boats, consists mostly of agricultural produce going from the west to the east, particularly to the Dhaka and Chittagong areas, for consumption in these urban markets and partly for processing and exports; from the east to the west, the movement of goods comprises mainly industrial products, such as agricultural inputs (fertilizers), petroleum products, cement, steel, manufactured consumer goods and imported items. The comparative economic advantages of both sides, however, have not been fully utilized because of the high transport cost of crossing the river due to frequent long delays at ferry terminals. The economic development of the west, and particularly of the northwest, has lagged behind because of its isolation from the economic center in the east. There is an urgent need to substantially reduce transportation costs and remove the uncertainties and risks in delivery of goods and services and develop the small-scale and informal sectors in the northwest.

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[1] The Bank appraisal team consisted of B.K. Gupta (Senior Project Engineer/Mission Chief), E. Brotoisworo (Environmental Specialist), G. Chen (Project Economist), P. Daltrop (Counsel), Y. Hirosato (Project Specialist- Resettlement) and D. Singh (Senior Programs Officer).

[2] The PoE, consisting of seven highly qualified experts of international eminence in their respective fields of expertise, was engaged by IDA to oversee the consultants' work and advise the Government on Project design and procurement.

B. The Transport Sector[1]

1. General

8. The demand for transport in Bangladesh has grown rapidly since the mid-1970s, averaging about 8 per cent per annum for passengers and 6 per cent per annum for freight, compared with an annual gross domestic product (GDP) growth rate of around 4 per cent. These relatively high transport growth rates are expected to continue as the country progresses in the direction of a more market-oriented economy. The transport system is served by three major modes: roads, inland water transport and railways. Road transport is by far the most dominant mode, accounting for about 70 per cent of passenger movement and about 60 per cent of freight traffic. Railways and inland water transport account for about 15 per cent each of passenger traffic and approximately 10 per cent and 30 per cent, respectively, of freight. The railways remain particularly competitive for trans-Jamuna long haul traffic. Civil aviation has a relatively minor share of the domestic passenger and freight traffic. These relative shares by different modes are expected to continue in the foreseeable future. The Government's transport development strategy is to concentrate on the arterial corridors linking the country's two seaports (Chittagong and Mongla) to Dhaka and the four Divisions. The main arterial corridor is Chittagong-Dhaka-Northwest. In this corridor, the link across the Jamuna River, which is at present by two railway ferries and two road ferries, is grossly inadequate in both capacity and service level. The absence of a fixed crossing over the Jamuna River constitutes a major bottleneck to the country's transport.

9. Investment in the transport sector has not kept pace with the demand. An effective strategic approach to physical works with institutional development and policy reforms is needed for the efficient utilization of resources. Over the past few years the Government, with assistance from aid agencies, including the Bank, has taken several important steps to strengthen transport planning and policy analysis capabilities and to build up road, road transport and railway institutions. These include the Intermodal Transport Study[2] by the Bank, the Bangladesh Transport Sector Study by IDA, and — with Bank assistance — the preparation of the Road Master Plan (RMP) for the principal network[3] and the organizational reforms of the Bangladesh Railway (BR).[4] The Government is committed to follow RMP recommendations substantially in planning future road investments and maintenance expenditures. This will facilitate optimal use of road funds and allocation of sufficient funds for road maintenance. The BR's organizational reforms are aimed at realizing a break-even level against working expenses.

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1 A Board Information Paper entitled "Economic Review and Bank Operations, Bangladesh: Development Constraints and Challenges" was circulated to the Board of Directors on 9 September 1992.

2 TA No. 567-BAN, for $358,000, approved on 9 January 1984 with financing from UNDP.

3 TA No. 1053-BAN: Road Master Plan, for $2.06 million, approved on 24 October 1988 with financing from UNDP.

4 TA No. 1819-BAN: Organizational Reform of Bangladesh Railway, for $1.5 million, approved on 24 December 1992.

2. Roads

10. Bangladesh's road system is fairly well developed and comprises about 13,700 km of main roads catering to arterial movements, and 22,200 km of local roads connecting population centers and markets. In addition, there is a network of farm-to-market roads of about 13,000 km, which are mainly low standard earth roads passable only a few months in a year. The main network accounts for about 90 per cent of the motorized road transport. Construction and maintenance of this network is the responsibility of the Roads and Road Transport Division of the Ministry of Communications, which is assisted by the Roads and Highways Department in administration of roads and by the Bangladesh Road Transport Authority in road transport matters.

11. With the Jamuna River effectively separating the country into eastern and western halves, the road network has developed more along the north-south axis. The main network is about evenly divided between the eastern and western parts of the country and is considered adequate in extent, but the condition is not fully satisfactory. About 8,200 km (60 per cent) of the main network is bitumen paved, but less than 10 per cent has a pavement width greater than 6 m. Of the local road network, only about 15 per cent is paved. The network is also disadvantaged by the presence of a large number of rivers, which are currently served by ferries only at a number of important crossings. Despite the lack of a fixed crossing on the Jamuna River, the poor condition of the network and ferry services at a number of river crossings, road traffic has increased at a rate of about 10 per cent per annum, and, at present, traffic on the arterial main network ranges from 1000 to 4000 vehicles per day (vpd), with trucks and buses consisting of 70 to 80 per cent of the traffic.

12. The number of registered motorized vehicles was close to 300,000 in 1992. Of the registered vehicles, trucks and buses account for about 16 per cent; cars, taxis and jeeps, 26 per cent; and autorickshaws, motorcycles and others, 58 per cent. Truck utilization rates are relatively low (about 45,000 km per annum), partly because of delays at the numerous ferry crossings, the worst cases being the Jamuna River crossings, where delays can be as much as two to three days. A program of construction of bridges to replace ferries is under way, including the bridge across the Jamuna River proposed under the present Project. This is expected to alleviate the problem. Excessive truck axle loads, a problem in many developing countries resulting in significant damage to the road network, are not a problem in Bangladesh. Passenger transport is mostly by bus. Buses operate with high load factors, and there is frequent overloading. Largely because of concerns raised by the Bank and other aid agencies, the Government has initiated action in regard to deregulating bus services, liberalizing licensing of vehicle assembly plants, and reducing import duties on spares and locally assembled vehicles, all of which is expected to improve the quality of bus services. Further, the Government, with assistance from the Bank,[1] is in the process of strengthening the enforcement of road transport regulations. This, together with the establishment of vehicle inspection centers at the four Divisional headquarters proposed under the Road Overlay and Improvement Project (ROIP),[2] is expected to improve road safety in Bangladesh. Road revenue in the past had significantly exceeded the budgetary allocation for maintenance and is expected to be sufficient

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[1] TA No. 896-BAN: Institutional Support for Road and Road Transport Development, for $1.2 million, approved on 27 August 1987 with financing from UNDP.

[2] Loan No. 1287-BAN(SF), for $68 million, approved on 9 December 1993.

to meet the maintenance allocation recommended by RMP.

3. Railways

13. The rail network has developed, like roads, more along the north-south axis, because of the Jamuna River, and consists of 925 km of broad gauge and 443 km of meter gauge (MG) track on the west of the Jamuna and 1379 km of MG track on the east. Transportation across the Jamuna is by a ferry at Bahadurabad for freight wagons and passengers and another at Sirajganj for passengers only. These crossings are often disrupted by floods, siltation and shifting of river banks.

14. Rail transport, fully public owned and operated by BR, was the dominant mode of transport in the past. However its market position has eroded over the past two decades because of the development of road haulage and bus services, and because BR's management has largely failed to counter the challenge. Traffic on the railway declined substantially in the 1980s, from about 90 million passengers and 3 million tons of freight in 1983 to about 50 million passengers and 2.5 million tons of freight in 1992, while the country's population grew by 20 per cent during this period. This among other aspects has led to the severe deterioration of BR's financial situation. The Government recognizes the competitive role the railway can have for long-haul traffic, particularly across Jamuna, and is making all efforts to transform BR into a financially viable entity. To this end, the Government has formulated with Bank assistance[1] a Railway Recovery Program, which includes tariff adjustments and improved collections, replacement of open-ended subsidies with explicit subsidies for uneconomic but essential services, labor force reduction, organizational restructuring, rationalization of services and facilities and sale of surplus assets. There has been a good progress on these aspects during 1993 and the momentum is continuing.

4. The Jamuna Ferry System

15. Transportation services across the Jamuna River are at present provided by several operators. Passenger transport is by the Bangladesh Inland Water Transport Corporation (BIWTC) and BR ferries, and by privately owned launches and manually operated boats. Freight transport services are provided by BIWTC, by BR and by some privately owned barges. The most important of these services along the Jamuna Bridge Corridor (Chittagong-Dhaka-Northwest) are provided by BIWTC through two ferry routes: Aricha-Nagarbari (A-N) and Bhuapur-Sirajganj (B-S). Another important ferry service is on the Aricha-Daulatdia route, also run by BIWTC, which connects the east to the southwest. Traffic on this route will, however, not be significantly affected by the proposed Jamuna bridge. Across the Jamuna, BR carries about 25 per cent of the freight and 10 per cent of the passenger traffic, and barges carry about 20 per cent of the freight. Even though launches carry a significant portion of passenger traffic (42 per cent), their services are offered mainly on the east-southwest route (Aricha-Daulatdia). Past traffic data show a substantial growth of traffic across the Jamuna River (for details see Chapter V). During 1986-1993, the annual average growth of traffic on the bridge corridor was estimated at about 7.5 per cent, with growth for buses, light vehicles and trucks accounting for 9.9 per cent, 7.0 per cent and 7.3 per cent, respectively.

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[1] TA No. 1819-BAN (see footnote 4, page 3).

16. The services at these crossings face numerous problems that threaten the stability of the inter-regional transportation system as a whole. The width of the Jamuna varies significantly, from about 4 km in some places in winter to 30 km in summer, and the difference between low and high water is as much as 8 m. Since the location of deep waters varies several times every year according to the amount of siltation or scouring, pontoons (or "ferry terminals") have to be moved from time to time along the river banks, requiring frequent reconstruction of access roads and other facilities to suit these changes. The channel locations and depths also vary from season to season, making navigation difficult. The navigation channels used by the ferries silt up continuously, reducing their depth and width, and also change course frequently. The whole ferry system has reached capacity limits imposed by the river, in addition to inherent managerial problems; has not been able to cope with the increasing demand of cross-Jamuna traffic for the last several years; and will not be able to do so in the future without major improvement and investment in the system. For a more detailed description of the ferry system, see Appendix 1.

5. The Government's Transport Development Strategy and Plans

17. Poverty reduction through promotion of economic growth is a key component of the Government's development strategy. Recognizing the strong linkage between economic growth and the provision of transport infrastructure, the Government gives high priority to the provision of a more reliable transport system, including removal of major interregional transport barriers like the lack of a fixed Jamuna River crossing. Through provision of adequate transport infrastructure, the strategy aims at promoting export-oriented industrial growth; developing the northwest, which is rich in resources but isolated from the economic center of the east by the Jamuna River; and integrating the eastern and western parts of the country. To implement this sectoral strategy, the Government's stated objectives for transport in the Fourth Five Year Plan (FY 1990/91 - FY 1994/95) are: complete ongoing projects, maximize utilization of the existing transport network, improve access ro rural areas, ensure economic modal split through appropriate pricing policies, encourage fuel economy, improve passenger safety and comfort through better maintenance and regulations, and encourage increased private participation.

18. The FFYP places particular emphasis on economic justification of projects and a balanced development of the overall transport network and has identified the following priority areas for investment: development of an arterial corridor linking the two seaports, Chittagong and Mongla, to Dhaka and the four Divisions, by the construction of the Jamuna Bridge; implementation of the recommendations of the RMP with priority on periodic maintenance and rehabilitation; maintenance and completion of missing structures on priority rural roads; and improvement of substandard ferry operations on the road network. In addition, the FFYP emphasize on improving BR's performance and harnessing its economic potential.

19. Construction of the Jamuna Bridge Project will be a key action in implementing the Government's sectoral strategy. Another key action which the Government has embarked upon to implement its sectoral strategy is the extensive program of periodic maintenance (overlays and sealcoats) covering both the eastern and western road networks, together with upgrading, rehabilitation and construction of priority road sections and strengthening of related

institutions.[1] The Three Year Rolling Investment Plan (FY 1992/93 - FY 1994/95) provides about Tk 24,320 million for roads and another Tk 12,800 million for the Jamuna Bridge.[2]

C. External Assistance to the Transport Sector

20. Assistance to the transport sector has been provided mainly by IDA and the Bank.[3] The main objective of the external assistance is to provide development of an efficient and cost-effective transport system by supporting an integrated program of physical works, institutional development and policy reforms. Rationalization and prioritization of sectoral investments (particularly to ensure adequate attention to maintenance and rehabilitation), strengthening of related institutions and improvement of infrastructure are key elements of external assistance to the transport sector.

21. The focus of external assistance to the transport sector has been largely on the road subsector. Road development in the past generally followed a piecemeal approach of pursuing individual road schemes. Following coordinated efforts of the Bank and other aid agencies in the mid-1980s, preparation of RMP, consolidation of road transport matters, strengthening of RHD's road planning and maintenance management capabilities, and streamlining of Government procedures for decision making were undertaken by the Government in the late 1980s and early 1990s, mainly with Bank assistance.[4] During this period, because of concerns raised by the Bank and other aid agencies, the Government also increased the maintenance allocation threefold. As a result of these steps by the Government, significant improvement is being noticed in road and road transport operations. The Government's commitment in 1992 to follow substantially the RMP's recommendations for future road development and maintenance is expected to help improve road and road transport operations. To sustain these efforts in the future, following the completion of RMP, a series of meetings were held by the Bank, IDA, OECF and ODA with the Government, and a coordinated extensive program of periodic maintenance and institutional development is being financed by

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1 The Bank-financed ROIP provides for the implementation of a two-year time slice (FY 1994/95-FY 1995/96) of the Overlays and Sealcoats Program (FY 1994/95-FY 1998/99) and the improvement of high priority road sections of the eastern network. IDA's proposed Second Road Rehabilitation and Maintenance Project includes a similar program for the western network. OECF proposes to finance the improvement and rehabilitation of the Ashuganj-Sylhet-Tamabil road. The development of road and road transport institutions is proposed by the Overseas Development Administration (ODA), United Kingdom.

2 For the construction of Jamuna Bridge the Government has been collecting since February 1983 specific charges and levies to meet the local costs of bridge construction. The collection as of 1 September 1983 was about Tk 4,500 million.

3 Bank assistance to the transport sector to date has included seven construction loans for main roads, four for railways, two for rural roads and one for ports, and ten project preparatory and 12 advisory and operational technical assistance projects. IDA has thus far provided four credits for roads, three for inland waterways, one for ports and seven for multisectoral operations. In addition, assistance has been provided by OECF, ODA and People's Republic of China for construction of bridges.

4 See footnote 3, page 3 and footnote 1, page 4; to assist the Government in streamlining its procedures for project implementation, the Bank provided the services of an international expert (staff consultant) in construction management in mid-1991.

these agencies.

D. Lessons Learned

22. With the exception of the recently approved ROIP, under the road projects financed by the Bank in the past,[1] significant delays were experienced in preconstruction activities such as selection of consultants, prequalification of contractors, invitation and evaluation of bids, and award of contracts, as well as in some cases during construction because of poor performance of contractors. Based on the experience with past projects, the following actions are considered desirable:

(i) Preconstruction activities such as selection of consultants for detailed engineering and/or construction supervision, and invitation and evaluation of bids for civil works contracts should be completed prior to Board consideration;

(ii) Prequalification of contractors and shortlisting of consultants should be carried out following strict criteria so that only contractors/consultants with substantial experience are prequalified/shortlisted. Further, so that only competent contractors participate in bidding, bids should be received following a two-envelope system, with separate technical and financial proposals; and the financial proposals should be considered of only those contractors whose technical proposals have passed the specified thresholds; and

(iii) Contracts should not provide for horizontal splitting of civil works but should include all work items in a given section so that delays arising from coordination problems are minimized.

23. Under the Project, start-up activities are well underway and the delays experienced under the past projects are not expected to occur. Only contractors with substantial experience have been prequalified; bid evaluation has been completed; and it is proposed to retain the consultants who carried out detailed engineering, for construction supervision.

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[1] These are: Loan No. 298-BAN(SF): Khulna-Mongla Road, for $15.0 million, approved on 10 May 1977; Loan No. 767-BAN(SF): Feeder Roads Improvement Project, for $58.0 million, approved on 5 December 1985; Loan No. 839-BAN(SF): Road Improvement Project, for $137.5 million, approved on 27 August 1987; and Loan 1287-BAN(SF): Road Overlay and Improvement Project, for $68 million, approved on 9 December 1993, financed to help economic development; and Loan No. 892-BAN(SF): Flood Damage Rehabilitation Project, for $40 million, approved on 30 June 1988; Loan No. 967-BAN(SF): Second Flood Damage Rehabilitation Project, for $80 million, approved on 24 August 1989 and Loan No. 1149-BAN(SF): Cyclone Damaged Road Reconstruction Project, for $28.8 million, approved on 19 December 1991, financed to assist rehabilitation after disasters.

E. The Bank's Transport Sector Strategy

24. Poverty reduction constitutes the cornerstone of the Bank's operational strategy for Bangladesh. The Bank's strategic priority, in line with the Government's development objectives, therefore focuses on the acceleration of GDP growth. Since road and rail transport will continue to be the main mechanism for improving national, social and economic integration, the Bank's emphasis, among other aspects, is on the development of road and rail infrastructure and related institutions. The Bank's strategy for roads is aimed at reducing transport costs through an integrated program of physical works, institutional development and policy reforms. Road rehabilitation/maintenance and improvement of high priority road sections in the arterial corridors, construction of the Jamuna bridge, and development of road and road transport institutions are the Bank's main vehicles for investment in the road sector. This is consistent with the Government's development strategy for roads (see para. 18) and the Bank-assisted RMP, recently completed. The thrust of the Bank's strategy for railways is to support the Government's efforts to improve BR's performance and to harness its economic potential, which lies in long-haul traffic.

25. In the Chittagong-Dhaka-Northwest main arterial corridor, the absence of a fixed crossing over the Jamuna River is a major bottleneck. The construction of the Jamuna bridge under the present Project will strengthen the northwest's linkage to the rest of the country and support the arterial corridor development strategy. Although the Jamuna bridge will not reduce poverty directly, it will have important indirect benefits for the poor. By improving access to the large markets to the east of the Jamuna, the bridge will stimulate economic growth in the northwest, from which poor families will benefit. Furthermore, the bridge will facilitate the provision of transport and other public services such as education, health and disaster relief in the northwest.

F. Policy Dialogue

26. The Bank has been conducting policy dialogue with the Government on transport issues on a continuous basis in cooperation with other aid agencies, in particular the World Bank. The main thrust of the dialogue has been directed at assisting the Government to maximize benefits from limited resources and to improve the efficiency of road and railway transport. In the past, the major issues in the road subsector were the proliferation of road projects with poor budgetary control, planning and prioritization. These have been addressed with the preparation of RMP and the Government's commitment to follow substantially its recommendations for road development and maintenance. So that the RMP meets its objectives, it is important that it is regularly updated based on the latest road conditions and traffic. This aspect, together with the allocation of matching maintenance expenditure, has been the focus of the Bank's discussion with the Government. The Government, under the ROIP, has agreed to strengthen the road planning and maintenance, to carry out road maintenance based on the RMP recommendations and to provide allocation for maintenance accordingly.

27. Another aspect of the dialogue deals with the poor performance of BR. Bank has emphasized to the Government that, until BR's financial viability is restored, support cannot be given to constructing a railway on the proposed Jamuna bridge. BR's large deficit and the high level of direct and indirect government subsidies constitute probably the single biggest institutional issue confronting the Government in the transport sector. The problems can be attributed in large part to Government policies that deny BR managers real control over key

issues affecting their financial performance, such as tariffs, staffing, salary scales and investment plans. In an effort to arrest this deteriorating trend and restructure BR, the Government has begun to implement key elements of the Railway Recovery Program formulated with the Bank's support (see para. 14). The restructuring of BR aims at restoring its financial viability and making it capable of competing with other transport modes in terms of cost and quality of service. Since BR will be particularly competitive for trans-Jamuna long-haul traffic, to help support the Government's efforts to revitalize BR, the proposed bridge will be constructed with flexibility to accommodate a meter gauge railway on the bridge in the future.[1]

28. A further aspect of dialogue concerns the policy of cost recovery through user charges. Both the Bank and the Government agree as a general policy to recover the cost of constructing and maintaining the proposed bridge through charges levied on users. The level of charges should, however, be appropriately determined so as not to deter the project benefits from accruing to likely users. The Government under the proposed Project has, therefore, decided to levy tolls on the bridge. This policy is supported by the co-financiers, since the forecast traffic volume on the bridge is high and is expected to double in seven to eight years, and the bridge users are willing to pay for using the bridge. The bridge tolls will initially be set at a level slightly lower than the current ferry charges, but adequate to recover the operation and maintenance (O&M) costs, so that the traffic using the bridge will not be discouraged. Tariffs will be increased gradually, so that the cost of construction is also recovered.

IV. THE PROJECT

A. Rationale

29. The present ferry services across the Jamuna River are of poor quality and are subject to many interruptions involving delays of up to two days for freight traffic. Although truck waiting times have increased significantly, ferry operators have been able to provide only minor improvements and a few additional ferries to cope with the demand. Further increase in the capacity to provide a satisfactory level of service to future traffic will require major improvements and considerable investment, by way of construction of river training works to provide stable ferry terminal facilities and improved channels, and the provision of modern ferries and efficient management. Even then, an improved ferry situation will not be equal to a bridge, as a bridge will be all-weather, multipurpose and less management intensive.

30. The proposed bridge, through provision of a fixed road link across the Jamuna River, will eliminate a major physical barrier to trans-Jamuna passengers and freight. It will also facilitate trans-Jamuna crossing of an electric power interconnector, telecommunication cables, a gas pipeline and a railway at a minimal cost.[2] These improvements will bring about a structural change in the regional economy and promote new trade and economic growth in the country. The bridge will stimulate agricultural production in the isolated northwest, which

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[1] Provision for a meter gauge railway on the bridge has been considered appropriate because of the existence of meter gauge system on both sides of the Jamuna River.

[2] For example, compared with a stand-alone power interconnector, the construction of which is estimated at $125 million, the cost of transmission of electric power using the bridge will be only about $5 million.

presently produces marketable surpluses of rice, spices, jute, sugar, fruits and vegetables. With reduction in transport cost, removal of uncertainty and delays, and more efficient access to the large market in the east, farmers in the northwest will receive better prices for their produce; cropping patterns will change in favor of high-value vegetables and fruits by both intensive cultivation and partial switch from other crops; and these will lead to increase in farmers' income. Likewise, the bridge will enable more efficient flow of industrial goods from the east to the west. As the bridge will serve as a strategic link integrating the two parts of the country, the influence areas will be not only the adjacent areas of the bridge but essentially the whole country. The construction of a bridge across the Jamuna River has, therefore, been given very high priority by the Government.

B. Objectives

31. The main objective of the Project is to connect the eastern and western parts of the country, separated by the Jamuna River, and thus help stimulate economic growth by facilitating the transportation of passengers and freight and the transmission of electricity, natural gas and telecommunications across the Jamuna River more economically and efficiently. In addition, the Project will have provision to include a railway connection between the east and the west in a cost-effective manner in the future.

C. Scope

32. The Project envisions construction of a fixed crossing over the Jamuna River, about 7 km south of Sirajganj, with provision for four road lanes, and capable of supporting an electric power interconnector, telecommunication cables, a gas pipeline and a meter gauge railway. The Project consists of:

(i) construction of a bridge about 4.8 km long and 18.5 m wide to carry initially four road lanes with sidewalks; the bridge will also be capable of supporting an electric interconnector, a gas pipeline, telecommunication facilities and a meter gauge railway;

(ii) construction of two viaducts,[1] about 128 m each, connecting the bridge to the approach roads;

(iii) construction of two guide bunds, about 2.2 km each, and a flood protection bund on the east bank to regulate the river at the selected site;

(iv) construction of two approach roads, about 16 km to the east, and 14 km to the west; the approach roads will have a two-lane single carriageway

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[1] Construction of viaducts, guide bunds and long approach roads has become necessary because of the braided nature of the Jamuna River, which has a width of about 4 km in winter and as much as 30 km in summer and a depth difference of as much as 8 m between low and high water. In the case of a braided river, continuous shifting of channels takes place, and at any point along its course neither the overall width of the river nor its location will stay the same for a long time, unless it is forced to do so through river training works.

with paved shoulders and provision for dualling;

(v) measures to mitigate the Project's impacts on the environment;

(vi) implementation of the Resettlement Action Plan (RAP) for Project- affected persons (PAPs); and

(vii) consultant services for Project management, construction supervision and training of Government staff in O&M of the bridge.

D. Project Description

33. *Bridge construction*. The bridge is designed using innovative but proven offshore drilling technique and will be constructed on steel piles, about 2.5-3.0 m in diameter and about 70-90 m long, with about 100-m spans. The use of this innovative technique will result in substantial savings in construction cost. Foundations for the bridge have been designed to carry a meter gauge railway, which can be provided when necessary by reducing mainly the sidewalk width, relocating the roadways and strengthening the deck by prestressed cables. The design provides for ducts for such cables.

34. *Viaduct construction*. The two viaducts will be constructed on reinforced concrete piles with the superstructure having a proper slope to connect with the approach roads.

35. *Guide bunds*. The guide bunds will be constructed from dredged material with appropriate side slopes. On technical considerations the eastern guide bund will be constructed first and the western guide bund will be built 4.8 km from the eastern one. The Project provides for an additional bridge length of 500 m (to a total bridge length of 5.3 km) to facilitate construction of the western bund on the flood plain. If the flood plain at the time of construction of the western bund is further away, it will be cost effective to build it in the river about 4.8 km away from the eastern one. The Project cost provides for the cost of the extra bridge length or building the guide bund in the river. In addition, a flood protection bund will be needed on the eastern bank, which is included under the Project.[1]

36. The river training works have been designed using state-of-the-art river engineering and physical/mathematical modelling. All the studies, tests and designs that were carried out by the consultants and reviewed by the PoE indicate that the guide bunds as designed should, with high probability, be able to prevent shifting of the river.

37. *Approach roads*: The surplus dredged material from the guide bunds will be used in the construction of the approach roads and bridge end facilities areas. This will be supplemented by earth from borrow pits along the approach road embankment. The bridge-end facilities areas are designed to conform to the Land Use Master Plan (LUMP) for the areas around the bridge.

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[1] A flood protection bund on the western bank already exists. It needs rehabilitation which will be carried by the Government, financed from its own resources.

38. *Environmental mitigation measures*: Environmental studies have been completed regarding (i) resettlement, (ii) closure of the Dhaleswari Intake, (iii) the LUMP for the areas around the bridge, (iv) fisheries, and (v) wildlife. Mitigation measures and environmental monitoring requirements have been identified and will be implemented under the Project (see paras. 59-60).

39. *Resettlement and Rehabilitation*: Based on the resettlement studies carried out, about 77,000 PAPs will need to be resettled. The Project provides for the resettlement of these PAPs (see paras. 61-66).

40. *Consultant Services*: Consultant services will cover project management and construction supervision. The services will also provide for the training required for Government staff to operate the bridge and toll booths and to control development around the bridge as well as to monitor changes in the Jamuna River that may affect the bridge (e.g., erosion and accretion of the banks).

E. Technical Justification

41. The Project is based on pre-investment studies carried out with the assistance of consultants during 1985-1989, with IDA acting as the Executing Agency and financing by UNDP. The initial emphasis of the study was on the river configuration and the selection of the site, which, in this case, was complex given the braided nature of the Jamuna River, its large discharge, the presence of fine silty micaceous sand in the river bed and the area being seismically active. Following estimation of the average annual flood discharge (65,000 cubic meters per second -- m^3/s -- and a 100-year flood discharge (91,000 m^3/s), extensive studies were carried out by the consultants using satellite imagery, river geomorphological modelling, and hydraulic physical and mathematical modelling to determine the optimum site for the proposed bridge. From ten sites studied, the one about 7 km south of Sirajganj was selected where "hard points" exist on either bank, as a result of which, although the bank lines have continuously wandered at most locations, the river has been very stable for the last 200 years. In-depth studies for the selected site were carried out to determine the optimum bridge length and the length of the required river training embankments, which formed the basis for the design of the Project. General information on the design adopted for the river training works is given in Appendix 2.

F. Cost Estimates

42. The total cost of the Project is estimated at $696 million equivalent, with a foreign exchange component of $509 million. The cost estimates are based on actual bid prices obtained under international competitive bidding. The estimates provide for necessary physical and price contingencies.[1] Project cost estimates are summarized in Table 1 and detailed in Appendix 3. The costs exclude customs duties and taxes, which the Government has agreed

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[1] Price contingencies for local costs have been estimated assuming a general increase of 6 per cent per annum instead of the 3.1 per cent increase per annum assumed for the foreign exchange component and required to be adopted for the local costs according to Bank practice. This has been done following IDA's practice so that the Project cost estimates are consistent with those of IDA and OECF, which are co-financiers of the Project.

either not to levy or to pay directly.[1]

Table 1: Summary of Project Cost Estimates ($ million)

Component	Foreign Exchange	Local Currency	Total
Contract 1			
Main Bridge	178.97	41.43	220.40
Contract 2			
River Training	207.20	36.85	244.05
Contracts 3 & 4			
Approach Roads	26.18	26.72	52.90
Consultant Services	22.68	4.32	27.00
Others	0.00	52.50	52.50
Total Base Cost	435.03	161.82	596.85
Contingencies			
Physical	45.33	10.87	56.20
Price	28.64	14.31	42.95
Grand Total	**509.00**	**187.00**	**696.00**

G. Financing Plan

43. It is proposed that the Bank finance the Project with cofinancing from IDA and OECF in equal amounts of $200 million each on a joint financing basis. The total financing from the three cofinanciers will represent about 86 per cent of the total cost of the Project.[2] The proposed funding will meet the entire foreign exchange cost of the Project and part of the local currency cost. The local cost financing from co-financiers will cover the entire local currency cost of consultant services and will meet part of the local currency cost of civil works. The Government has agreed to meet the remaining local currency cost of the Project from its own resources. In addition, the Government has agreed to establish an emergency fund of $10 million equivalent to cover force majeure. The proposed loan of $200 million from the Bank will be on standard Asian Development Fund terms and will have an amortization period of 40 years, including a grace period of 10 years, and a service charge of 1 per cent per annum. The IDA credit and OECF loan will be made on standard IDA and OECF terms, respectively. The Bank loan of $200 million will cover a foreign exchange cost of about $172.90 million equivalent (civil

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[1] The cost estimates also do not include service or interest charges on the loans/credit from the co-financiers to be consistent with IDA which, unlike the Bank, does not pay such charges from its credit.

[2] If customs duties and taxes and service charges on the Bank loan are included, the Project cost would total about $800 million and the funding from co-financiers would be about 75 per cent of the Project cost.

works, $159.52 million; consultant services, $8.15 million; and service charges, $5.23 million equivalent) and a local currency cost of about $27.10 million equivalent. The Borrower will be the People's Republic of Bangladesh.

Table 2: Financing Plan
($ million)

Item	ADB	IDA	OECF	Government	Total
Civil Works	185.07	190.30	190.30	43.50	**609.17**
Consultant Services	9.70	9.70	9.70	-	**29.10**
Others	5.23[a]	-	-	52.50	**57.73**
Total	**200.00**	**200.00**	**200.00**	**96.00**	**696.00**

[a] Service charges on the Bank loan.

H. Implementation Arrangements

1. Executing Agency and Implementation Arrangements

44. The Project will be implemented by the Jamuna Multipurpose Bridge Authority (JMBA) as the Executing Agency. JMBA was specifically established in 1985 in the Ministry of Communications by the Government for the construction of the Jamuna bridge. It is staffed by senior professional staff and is considered capable of carrying out the main Government functions related to the Project. International consultants will be responsible for construction supervision. In addition, international management consultants will be engaged to assist JMBA as employer. Further, given the complex technical nature of the Project, PoE will continue to provide guidance in the fields of bridge and river training engineering and construction management, and supervise the Project at least bi-annually starting from the date of effectiveness. As an additional measure to monitor the progress of Project implementation regularly, a committee composed of senior staff from the resident offices of the Bank, World Bank and OECF in Dhaka will be established. JMBA's organizational structure, together with its interrelationships with the supervision consultants, management consultants and PoE, is shown in Appendix 4.

45. The Project will involve joint financing among the Bank, IDA and OECF, and since under joint financing arrangements, the most efficient implementation can be achieved with one agency in charge of day-to-day project administration, it is proposed that IDA act as the lead agency for the administration of the Project. To this end, IDA proposes to engage a senior engineer, experienced in preparation and administration of similar complex projects, to supervise the Project on a regular basis. The project administration arrangements will include provision for the Bank to be consulted on all major issues such as any major change in scope or implementation arrangements, extension of loan closing dates, and noncompliance with loan covenants, and for the Bank to participate in project administration missions (also see para. 47).

2. Lending and Re-lending

46. The proceeds of the proposed Bank loan will be re-lent by the Government to JMBA, under a subsidiary loan agreement to be entered into between the Borrower and JMBA on terms and conditions that will be approved by the Bank and include, inter alia, that the proceeds of the loan will be re-lent at an interest rate not lower than 1 per cent per annum for a term of 40 years, including a grace period of 10 years, with the Borrower bearing the foreign exchange risk.[1] A study on the level and structure of tolls and other charges to be levied on the bridge will be carried out by the management consultants and is expected to be completed by 31 December 1996, in accordance with methodology satisfactory to the co-financiers. Based on the results of the study, the Government may, in consultation with the Bank, increase the re-lending rate to JMBA, which may go up to 2 per cent.[2] The Government will further review and, if appropriate and agreed to by the Bank, increase the re-lending rate after bridge opening, in light of traffic increases and additional revenues generated from other users on the bridge.

3. Project Reviews

47. Given the large size and complex technical nature of the Project and that it is being jointly financed by three institutions with differing procedures for project administration, it is essential that Project implementation be closely monitored. Day-to-day coordination problems will be minimized with IDA acting as the lead agency for administration. In addition to reviews by IDA every four months and normal consultations among the co-financiers, joint reviews by the Bank, IDA and OECF together with the PoE, JMBA and the Government will be undertaken every year before the beginning of the monsoon season, that is about May, to take stock of work completed, review contractors' workplans for the next work season, and settle any outstanding or anticipated problems. A mid-term review will be carried out in 1996, which will cover, among other aspects, the performance of JMBA and the contractors in implementing the Project; the availability of the counterpart funding from the Government and the adequacy of its budgetary allocations for the Project; the implementation of the Resettlement Action Plan, the Environmental Action Plan (EAP) and the Bridge End Facilities Land Use Plan and the identification of measures necessary to expedite Project implementation.

4. Project Preparation and Procurement

48. Project preparation has been nearly completed, including receipt of bids for all contracts. Bids were invited under international competitive bidding procedures on 1 September 1992 after prequalification of contractors. Contract 1, the main bridge, was subjected to a two-stage bidding process. Technical proposals were evaluated in the first stage, and price proposals from bidders with technically acceptable designs were received on 30 June 1993. Prices for contract 2 (River Training Works) were first received on 1 February 1993. These were substantially higher than the engineer's estimate. After a slight modification of the conditions

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[1] The onlending rates by the other co-financiers are expected to equal their own terms to the Borrower.

[2] Based on the preliminary estimates prepared by the co-financiers, an increase in the re-lending rate beyond the proposed levels will require tolls to be increased to a level significantly higher than the present ferry charges and will discourage the traffic from using the bridge.

of contract and specifications, without affecting the design quality, bids were reinvited and received on 30 June 1993. Negotiations with the lowest bidder are under way and are expected to be completed soon. The flood embankment on the east side is under construction financed by the Government. The construction on the western flood embankment, which needs rehabilitation, is proposed to be taken up soon by the Government, financed from its own funds.

5. Implementation Schedule

49. The contracts for civil works are expected to be awarded in March 1994. Construction is expected to start in October 1994, with completion scheduled for mid-1998. The construction schedule and other project activities are presented in Appendix 5. The schedule provides for five work seasons, which is considered adequate given the substantial experience of the contractors.

6. Consultant Services

50. It is estimated that about 830 person-months of international experts and 1,740 person-months of domestic experts will be needed for construction supervision and management of the Project. Broad terms of reference for the supervision consultants are given in Appendix 6, and those for the management consultants in Appendix 7. The Government proposes to engage the supervision consultants by direct negotiations with the present design consultants. The Government proposal is supported by the PoE in view of the complex technical nature of the Project and has been accepted by IDA and OECF. The proposal is in accordance with the Bank's *Guidelines on the Use of Consultants* and is therefore supported. The management consultants will be engaged following the Bank's guidelines.

7. Disbursements and Retroactive Financing

51. The disbursement/audit mechanisms will follow disbursement/audit guidelines of the respective co-financiers. Cross effectiveness of the credit/loan agreements of the three co-financing institutions will be required for disbursements. The credit/loan agreements will also contain cross-default provisions.

52. Construction of each of the guide bunds on technical considerations must be substantially completed in one working season, which in Bangladesh is from October to May. For construction on the eastern guide bund, which for technical reasons has to be taken up first, to start in October 1994 and to be substantially completed by April 1995, it is necessary that the contractor completes mobilization by mid-1994, and to do so the mobilization advance will need to be paid in early 1994. Retroactive financing of $60 million for the river training works contract has accordingly been requested by the Government. The Bank's share of retroactive financing will be $20 million, or 10 per cent of the proposed Bank loan.

8. Operation and Maintenance

53. According to the present JMBA ordinance, JMBA was established for the construction of the bridge only. The Government now also intends to make JMBA responsible for O&M of the bridge after its completion and to empower it to collect tolls and to implement the Bridge End Facilities Land Use Plan. The Government will provide adequate initial working capital to enable JMBA to assume O&M of the bridge. The Government has agreed to amend

JMBA's ordinance to this effect within one year of loan effectiveness.

54. The river training works will require adequate maintenance, especially during the early years of their completion. Provision has therefore been made under the river training works contract for the maintenance of the guide bunds by the contractor for six years after the completion of the Project. The contract also provides for extending this maintenance period by an additional five years (11 years in total) if required. The equipment required for the maintenance of the bridge will be supplied by the bridge contractor as part of the contract. In addition, the contractor will be responsible for training JMBA staff in the use of the equipment as part of the contract.

55. The funds for O&M of the bridge will be obtained through tolls levied on the bridge. This is consistent with the cost recovery policy pursued by the Government in the transport sector, and is supported by the Bank. As substantial traffic volumes will be diverted to the bridge from the current ferry system, preliminary financial projections show that the bridge will generate sufficient revenues at a moderate toll level, in comparison with the current ferry tariffs, to cover the costs of O&M of the bridge (see paras. 71-72 for details).

56. JMBA staff will need training in bridge maintenance, devising and eventually operating suitable collecting and security systems; and implementing commercially oriented financial accounting, costing and budgetary systems. The Government has agreed to review with the co-financiers, not later than 31 December 1995, the arrangements for the training of JMBA staff to be assigned for bridge O&M.

9. Benefit Monitoring and Evaluation

57. JMBA has agreed to establish a benefit monitoring and evaluation system acceptable to the Bank. This will be prepared by JMBA with the assistance of the Project consultants. It will include, among other aspects, the monitoring of river hydrology and changes in river configuration, and taking remedial measures in a timely manner.

10. Reports, Accounts and Audit

58. JMBA will maintain adequate records and will provide quarterly progress reports on implementation to the co-financiers. JMBA will also maintain Project accounts in English. JMBA's audited annual financial statements will be sent to the co-financiers within six months of the end of the financial year to which they relate. The Government has agreed to submit to each co-financier a Project Completion Report, in a form satisfactory to each co-financier, within four months of physical completion of the Project.

I. Environmental and Social Measures

1. Environment[1]

59. A series of separate and successive studies on the environmental aspects of the Project have been undertaken during Project preparation. These studies constitute a comprehensive assessment of the environmental impacts that may arise during the construction and O&M phases of the bridge. It is apparent that several key positive and negative impacts will arise from the Project. Positive impacts include, inter alia, (i) increased opportunities for employment (both long-term and short-term) in a rural area of underemployment; (ii) opportunities to diversify income-generating activities; and (iii) improved flooding characteristics on the eastern bank, which will offer opportunities to increase agricultural production. Negative impacts that are likely to arise mainly because of closure of the Dhaleswari River northern intake include (i) reduction in fish production (500 tons per annum) because of a reduction in available fish habitat; (ii) increased erosion of rainfed agricultural land because of overbank spill from the Jamuna to the Upper Dhaleswari River basin; and (iii) disruption to navigation activities in the Dhaleswari, which will increase journey times on existing routes. During the construction phase, it is also likely that there will be some disturbance to roosting and breeding of birds that inhabit the Project area. To maximize the Project's positive impacts and prevent or mitigate negative impacts, JMBA will implement the EAP that has been prepared in consultation with the co-financiers.[2] The EAP includes, inter alia, the following key impact monitoring, management and benefit enhancing measures:

(i) a compensatory fisheries development program, which comprises pond fish culture, training and fisheries management; these measures will yield 500 tons of fish per annum;

(ii) environmental guidelines for construction-related activities, to be prepared by the management consultants to minimize/prevent impacts caused by pollution, noise and wildlife disturbance, etc.;

(iii) a wildlife action plan, which will inventory the fauna of the Project area, monitor and mitigate Project impact, increase environmental awareness and potentially lead to the establishment of reserve areas for the bird population;

(iv) Land Use Master Plan and Bridge End Facilities Land Use Plan, which will give rise to environmentally acceptable economic and urban development associated with the bridge;

(v) monitoring of groundwater levels in the eastern area of the bridge; and

(vi) technical assistance to PAPs where and when appropriate to (i) adjust cropping patterns in relation to the modified flooding regime, (ii) enhance

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[1] A Summary of Environmental Impact Assessment was circulated to the Board on 14 September 1993.

[2] The EAP is attached as Appendix 8.

fisheries production in the affected area, and (iii) provide practical advice on deep-setting of shallow tube wells.

60. JMBA has agreed to establish an Environmental Unit, which will be responsible for implementing the above measures. The unit will be supervised and guided by an Environmental Management Committee, which will continue to function for at least three years after bridge construction is completed. The Committee will include representatives from at least two NGOs. JMBA will establish a framework for the EAP to be executed with the active involvement of the Environmental Unit, Environmental Management Committee, supervision and management consultants, and construction contractors. Details of this framework and the results of regular discussions among the parties will be communicated to the co-financiers. It was agreed by the Government that the LUMP and, more importantly, the Bridge End Facilities Land Use Plan will be adhered to and that illegal development will be strictly monitored and controlled.

2. Resettlement and Rehabilitation

61. Construction of the envisaged 4.8 km long bridge will not entail any land acquisition or resettlement. Construction of two guide bunds, eastern flood embankment and approach roads on the east and west banks of the Jamuna River and strengthening of hard points will, however, require land acquisition and resettlement in the districts of Tangail and Sirajganj. As the ecological conditions in the river have been changing, the exact location of each of the guide bunds will be finalized only between April and October of the year of construction. For the first construction season to begin in April 1994, approximately 850 hectares (ha) of land in Tangail District on the east bank will have to be handed over to the contractor. Taking possession of these 850 ha will lead to the resettlement of approximately 17,000 persons.

62. The Bangladesh Rural Advancement Committee (BRAC), a NGO, carried out a socioeconomic survey of the affected people in the Tangail and Sirajganj Districts from 17 October to 27 December 1992. The number of PAPs, according to the survey, is 11,945 households or, on the basis of 6.4 persons per household, 77,220 persons. The survey revealed that about 39,000 persons (6,000 households) will lose land and/or properties to JMBA; another 37,800 persons (5,900 households) dependent on the acquired area for making their living will also be affected. Of the nonlandowning persons, 42 per cent are farm workers.

63. A compensation and rehabilitation policy matrix was prepared by the Government and submitted to the co-financiers as part of the Revised Resettlement Action Plan (RRAP) (October 1993).[1] The policy has been approved by the co-financier. The RRAP envisages that the standard of living of PAPs should be improved or at least maintained. The cash compensation for the land acquired will correspond to its full replacement value. The Government has also proposed a mechanism for compensation of land at replacement value, allowing PAPs to purchase new land, mainly through self-relocation. The ceiling for compensation is to reflect the current market price of better quality land. This mechanism has been approved by the co-financiers on the condition that an effective grievance mechanism is instituted. The RRAP ensures that the PAPs benefit from the Project. Among the PAPs, there

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[1] The RRAP is attached as Appendix 9.

is a strong demand for the bridge, and many expect to improve their livelihood through the Project even if it means displacement. Based on the field checks, it appeared that the majority of PAPs would be satisfied by the proposed compensation package. Furthermore, to mitigate system failures, if any, corrective measures have been built in, such as monitoring and review mechanisms, grievance redress committees and physical provisions such as for homestead failures, etc.

64. The proposed schedule of construction will require the resettlement of an estimated 17,000 persons by 1 September 1994 at the latest. Of these, approximately 7,000 people will have to be relocated before 1 April 1994, when the river training works contractor will have to be given possession of the area for the construction of the eastern guide bund. All the actions for the acquisition of the total 850 ha of land and the resettlement of the 17,000 PAPs will be required to be completed by 1 September 1994.

65. As a condition of loan negotiations, JMBA was required to (i) submit an acceptable RAP to the Bank, (ii) enter into a contract with the implementing NGO, (iii) enter into a contract for technical assistance for implementation of the RRAP with individual consultants identified (two expatriates and three nationals), (iv) enter into a contract with consultants for developing and implementing a management information system, and (v) have all proposed staff of the Resettlement Unit take up their positions. These conditions were met by JMBA before loan negotiations. In addition, JMBA has completed substantially the identification cards for all PAPs whose land will be acquired in 1994, made arrangements to establish a land registration cell, and finalized the policy issues and remedial actions for the PAPs evicted because of construction of the eastern flood embankment.

66. Further, the Government will ensure before loan effectivity that most PAPs will have completed the purchase of replacement homestead land using the mechanisms outlined in the RRAP. The Government has assured that it has taken all necessary action required for implementing or causing to be implemented the RRAP as well as the EAP.

J. Project Risks

67. The Project entails some significant technical, implementation and maintenance risks, which have been addressed adequately.

68. *Technical Risks*: The bridge has been designed using innovative offshore drilling technique. It is a proven technique and the risk of structural failure is considered negligible. The river training works are designed using the latest river engineering techniques. Nevertheless, there is a risk of liquefaction of part of the guide bunds through earthquakes exceeding the design parameters. However, such damage will be localized, and it can be contained and repaired. During construction, a major earthquake can cause damage to the guide bunds and to the spans being erected but which had not been fully post-tensioned. The cost of repair of such damage is not expected to exceed $10 million. In addition to meeting counterpart funding for the Project, the Government has agreed to establish an emergency fund of $10 million to cover such force majeure. Concern has been expressed about the stability of the future river course and whether the planned river training works will be able to contain any shifting in the river course. All the studies, tests and designs that were carried out by the consultants and reviewed by the PoE indicate that the guide bunds as designed will, with high probability, be able to prevent shifting of the river. Even in the unlikely event of a shift in the

river's course, it would occur over an extended period during which remedial action can be taken. Moreover, there are other investments as well that will be placed at risk by such a change, and hence it is reasonable to assume that appropriate remedial action will be taken in a timely manner.

69. *Implementation Risks*: The main implementation risks are delays in Project execution caused by (i) natural disasters, (ii) Government procedures, and (iii) cost overruns. The probable effects of usual natural disasters have been considered in the design, and risks on such account have been minimized. Procedural risks have been addressed by (i) making special arrangements for disbursement of both foreign exchange and local currency expenditures on the basis of the Engineer's signature; (ii) having a management consultant to advise JMBA as the employer for construction purposes; (iii) reaching agreement with the Government to enhance the powers and authority of JMBA to enable it to cope with the daily issues; (iv) designing the RRAP with community participation, and monitoring the implementation of the RRAP closely; and (v) establishing a committee of senior staff from the co-financiers' resident offices in Dhaka to monitor implementation regularly. The risk of cost overruns, which will be mainly due to natural disasters, cannot be quantified at this time. The Government has agreed to cover cost overruns, if any, from its resources.

70. *Maintenance Risk*: The main risk is the capability of JMBA to operate and maintain the bridge, river training and the road approaches after their construction. To reduce this risk, the maintenance of the guide bunds, which is critical to the bridge's safety, has been included in the river training works for a period of six years, with provision for extension by five years after completion of the bunds; and the bridge contract provides for the supply of equipment for the O&M of the bridge and training of JMBA staff in such tasks.

V. PROJECT JUSTIFICATION

A. Financial Analysis

71. The Government has decided to pursue a policy of cost recovery from bridge users. Tolls and other charges (such as charges on power transmission through the interconnector to be constructed on the bridge) will be levied on bridge users. As the bridge is expected to be open to traffic in mid-1998, the Government has agreed to establish the structure and level of tolls and other charges on the bridge by 30 June 1997. JMBA, with assistance from the management consultants provided under the Project, will undertake a study to this end in accordance with methodology acceptable to the Bank. One of the key requirements for determining toll levels is that tolls will be set at a minimum and acceptable (to users) level so as not to discourage traffic from using the bridge. The Government has therefore agreed to keep the bridge toll levels in the initial years of operation below the current Aricha-Nagarbari ferry tariffs. Based on the projected bridge traffic, revenue and expenditure forecasts have been estimated for JMBA taking into account its future debt-service obligations and the re-lending rate from the Government to JMBA. The projections indicate that initial bridge toll levels, set at the same levels as the current ferry tariff for trucks, and at one half of the current ferry

tariffs for buses and light vehicles[1], will generate sufficient funds to meet the Government's debt-servicing obligation and all operating expenses. Such toll levels would be acceptable to bridge users, as the bridge would be highly superior to the existing ferry system for river crossing in terms of increased comfort level, elimination of waiting time for trucks and elimination of negative weather influence.

72. Based on the results of the aforesaid study the Government may, in consultation with the Bank, increase the re-lending rate, which may go up to 2 per cent. Any further increase in the re-lending rate to JMBA, if considered necessary by the Government, will be done in consultation with the Bank, in light of traffic increases and additional revenues generated from the other users of the bridge (also see para. 46).

B. Economic Analysis

1. Introduction

73. The proposed bridge will generate multifaceted benefits by eliminating a physical barrier that divides the country into two halves. As some of the benefits are difficult to quantify, the estimation of economic internal rates of return (EIRRs) in the present analysis has been carried out on the basis of the quantifiable benefits from road traffic and the power interconnector.

74. The economic costs and benefits of the Project have been examined with reference to two alternatives: (i) the *current ferry situation*, which will be continued with only marginal improvement; (ii) an *improved ferry system* with major investments in river training, port facilities, navigation channels, dredging and new ferry vessels so that it will be as close in efficiency as possible to the bridge, with minimum vehicle waiting time. The scenario of bridge versus current ferry situation is treated as the base case in the present analysis. The case of an improved ferry system is also studied to present a notional alternative to the proposed bridge in improving the efficiency of carrying an increasing volume of traffic across the Jamuna River.

75. As the bridge is designed for 100 years, the Project life of the bridge, for economic evaluation purposes, is assumed to be 50 years after its planned opening to traffic in mid-1998. Benefits beyond the first 50 years have been ignored, as has the salvage value at the end of 50 years. All Project-related cost and benefit streams are expressed in mid-1993 prices. Costs of all imported and tradable inputs are estimated at border prices, and the standard conversion factor applied for the local cost component is 0.89.

2. Costs

76. The total financial cost of the Project (based on bid prices), including consultant services, land acquisition, resettlement, environmental mitigation measures, and physical and price contingencies, is estimated at $696 million. After adjusting these costs (excluding price contingencies) by applying the standard conversion factor to the local cost component and using border prices for foreign exchange costs, the total economic cost of the Project is

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[1] The current ferry tariffs are about Tk 270 per light vehicle, Tk 740 per truck and Tk 1500 per full-loaded bus.

estimated at $626.6 million. The annual average economic O&M cost of the bridge is estimated at $3.1 million, which includes expenses associated with toll collection and the maintenance cost of the river training works.

77. The cost of improving the current ferry service under the notional alternative of an improved ferry system (assuming the bridge is not constructed) is also estimated based on studies carried out by consultants and the PoE. It has been found that a significant capacity increase in the current ferry system is possible only with substantial investment in river training works and other facilities. To improve the ferry system to meet the current and future demand for river crossing, it was estimated that the capital cost could reach $406 million; in addition, other costs will be necessary for channel dredging and O&M of terminals and shipyards. The economic cost of the improved ferry system was derived in a similar manner as that of the bridge.

3. Traffic Projections

78. Past traffic growth data have been obtained from a 1986 origin and destination survey, and from the official register on ferry crossing vehicles maintained by BIWTC. After appropriate adjustments, the estimated base year (1993) annual average daily traffic on the two relevant crossing channels (Aricha-Nagarbari and Bhuapur-Sirajganj), which the bridge will carry, is estimated as 271 buses, 140 light vehicles and 770 trucks. The annual average growth rate of traffic on the bridge corridor was about 7.5 per cent during 1986-1993. On the basis of past traffic growth trends, taking account of population and per capita GDP growth as well as estimated income elasticity of demand for transport services, the traffic growth rates from 1993 to 1998 were estimated at 6.6 per cent for buses and trucks, and 8.2 per cent for light vehicles. Based on these traffic data, the normal traffic in the bridge-opening year of 1998 was projected for the three categories of vehicles according to the estimated growth rates. From 1998 to 2025, all traffic was projected to grow at 5 per cent per annum, and thereafter traffic volume was assumed to be frozen for the remainder of the Project life.

79. Induced traffic would be generated due to the substantial transport cost reduction perceived from bridge construction or ferry improvement by passengers and by the freight transport sector. The base year (1998) induced traffic was estimated based on the price elasticity of demand for transportation services. The induced traffic was assumed to build up gradually over a period of eight years (1998-2005) as economic activities will take time to adjust to the existence of the bridge. The growth of induced traffic is estimated to be the same as that of normal traffic.

4. Economic Benefits

80. The principal sources of economic benefits from the Project are (i) savings in vehicle operating costs (VOCs) for vehicles using the bridge in comparison with VOCs for the current ferry system; (ii) value of time saved (resulting from elimination of waiting time) for freight traffic, which is reflected in reduction in inventory costs, losses and damages (especially to perishable agricultural goods), and value of time saved for passenger traffic; (iii) benefits from avoiding the substantial investment needed (approximately $115 million) for a stand-alone power interconnector in the absence of the bridge; (iv) savings in the cost of dredging of ferry channels incurred in the absence of the bridge; and (v) environmental protection benefits resulting from the river training works associated with bridge construction.

81. Among these expected benefits, traffic benefits dominate: they account for almost 90 per cent of the total Project benefits. Traffic benefits are derived from freight and passenger traffic diverted from the current ferries and from induced traffic. Traffic benefits are divided into the three categories of vehicles studied: buses, light vehicles and trucks.

5. EIRR Estimation and Sensitivity Analysis

82. The economic analysis of the Project has been carried out on the basis of a "with" the bridge and the "without" bridge situations, i.e., the scenario of the bridge versus the current ferry situation. The alternative of an improved ferry system was also studied, and an EIRR was estimated for such a system versus the current ferry system, after which an analysis was carried out to estimate the EIRR of the bridge versus the improved ferry scenario.

83. Taking into account the assumptions described above, and using the Project cost and traffic demand data, the Project presents an EIRR of 14.5 per cent when compared with the current ferry system. The investment in the improved ferry project itself yields an EIRR of 13.0 per cent, and the analysis of the bridge versus an improved ferry results in an EIRR of 15.5 per cent.

84. Sensitivity analyses on the economic viability of the Project were carried out by assuming various adverse scenarios. In the base case of the bridge vs. the current ferry, (i) a cost overrun of 20 per cent or a traffic benefit reduction of 20 per cent will reduce the EIRR to 13.0 per cent; (ii) the EIRR will fall by one percentage point if the benefits of the power interconnector are excluded from the Project benefit stream; (iii) a one- year delay in completion of the bridge (i.e., the bridge opens to traffic in mid-1999) will reduce the EIRR to 14.0 per cent; and (iv) if the bridge tolls are set at twice the level as the current ferry tariffs (instead of the same level as the current tariffs assumed in the base case), the EIRR will go down to 14.1 per cent.

85. A summary of the economic evaluation is presented in Table 3, and an abstract of the details of the analyses presented in the background paper on Project economics is attached as Appendix 10.

86. The economic analyses of the Project conclude that the bridge investment is economically viable. The analyses also indicate that, even though the bridge requires a higher investment, it will also result in higher economic rates of return. Although the EIRR of an improved ferry scenario is more than 12 per cent, the bridge is an all-season river crossing facility, unlike the improved ferry system. The risk of a system breakdown once the bridge is built is practically nil, whereas even with the improved ferry it is a real risk. Moreover, given the unstable nature of the river, there is a capacity limitation on ferry improvements to accommodate increasing traffic. In addition, waiting time cannot be completely eliminated by improving the ferry system. The bridge is also a multipurpose facility capable of carrying a power interconnector, telecommunication lines, gas pipeline and a railway in the future.

Table 3: Summary of Economic and Sensitivity Analyses
EIRR (per cent)

Comparison	Base Case	Scenario: Without Power Intercon-nector	Scenario: With Link Road	Scenario: Cost (+20%)	Scenario: Traffic Benefit (-20%)	Scenario: Cost (+20%) Benefit (-20%)	Scenario: One Year Delay in Bridge Opening
Bridge vs. Current Ferry	14.51	13.53	14.70	12.94	13.30	11.54	14.01
Improved Ferry vs. Current Ferry	13.01	-	-	11.70	11.04	9.91	12.56
Bridge vs. Improved Ferry	15.45	13.10	15.84	11.91	14.38	10.99	15.18

6. Nonquantifiable Benefits

87. In addition to the quantifiable economic benefits from the bridge, there are substantial nonquantifiable economic benefits. The bridge will be a strategic link integrating the country and promoting more efficient interregional trade and economic and social development. The current high opportunity cost of freight traffic crossing the river has effectively created a "barrier" to trade crossing the river, incurring heavy economic losses to the economy on both sides of the river. Elimination of the "barrier" by constructing the bridge will lead to a more efficient flow of goods and services within the country, and consequently will generate substantial benefits to the economy.

88. The northwestern region of the country has fertile agricultural land with higher average yields of major crops than the rest of the country, and it is supplying the eastern region with surplus agricultural products, albeit at high transport costs because of the river crossing. Construction of the bridge will substantially lower the overall transport costs, which will stimulate agricultural production in the northwest. Furthermore, once the bridge is built, there will be a more efficient flow of industrial products from the east to the northwest such as steel, fertilizer and machinery, which would further promote the economic integration of the two regions, and ultimately the economic and social advancement of the country. A bridge will also have the potential for serving subregional transport between Bangladesh and India. During the monsoon season, crossing by launches and boats can become dangerous and each year several cases of launch and boat sinking are reported with loss of human lives. These economic benefits, however, are difficult to quantify and are not included in the estimation of EIRRs.

C. Macroeconomic Affordability

89. The proposed bridge is a costly project in a relatively poor country. Consequently, there has been concern whether the investment will crowd out other important investments such as those on primary education, health and family planning. The analysis in the 1991 Country Economic Memorandum of the World Bank entitled *Managing Public Resources for Higher Growth*, which was presented to the Aid Group Meeting in May 1991, concluded that all the Government's high-priority objectives, including the Jamuna bridge, were affordable provided that there was a strong revenue mobilization effort through fundamental tax reform and a program for prioritization of public expenditures. A separate study by OECF to this end also confirmed this.

90. In the last two years, the Government has initiated, with the support of the World Bank's Public Resource Management Adjustment Credit, a far-reaching program to raise additional revenues and to improve the allocation of funds, particularly through the TYRIP. The cornerstone of the tax reforms has been the introduction of a value-added tax in July 1991, which, together with concurrent fiscal reforms in the income tax system and in scaling down of subsidies to public enterprises, has yielded substantial additional revenues. As a result, Bangladesh's macroeconomic situation has improved significantly since the early 1990s: public savings rose and the current account deficit declined. Government savings (defined as total revenue less current expenditures and the food account deficit), which were Tk 4.6 billion in FY 1989/90, rose to Tk 25.2 billion in FY 1992/93. The current account deficit fell from $1.5 billion to $0.4 billion during the same period, while foreign exchange reserves rose from $0.6 billion (less than two months of imports) to $2.1 billion (more than six months of imports). Moreover, fiscal stabilization was accompanied by a tightening of monetary policy as the rate of growth of money supply declined from 17 per cent in FY 1989/90 to around 10 per cent in FY 1992/93. This, together with a sharp decline in the price of rice, led to a fall in the inflation rate from 10 per cent in FY 1989/90 to less than 2 per cent in FY 1992/93.

91. The Government's project prioritization exercise has resulted in ensuring adequate funding for high-priority projects, notably in the social sectors and infrastructure. The structure of the Annual Development Program has changed significantly since FY 1989/90, with the share of industry in total public investment falling from 7 per cent to 2.5 per cent, while the shares of education and health rose from 5.9 per cent and 2.7 per cent to 9.2 per cent and 3.4 per cent, respectively. There has also been a major increase in investment allocations for the natural gas sector to address various project implementation problems resulting from local funding constraints. Concurrently, through annual pruning exercises, lower priority projects have been deferred, dropped or scaled back.

92. The satisfactory progress made since the early 1990s, if sustained, should allow expenditures under the Jamuna Bridge Project to be accommodated without crowding out expenditures on priority programs in other sectors. A continuation of sound fiscal policies would ensure the availability of the required local funds. The $96 million (Tk 3.8 billion) that the Government would be contributing to the Project, over a five-year period, is only 3 per cent of its revenue in FY 1992/93. The Government's largest contribution of Tk 1.6 billion to the Project, expected to occur in FY 1994/95, is only 2.6 per cent of the total taka allocation for public investment in FY 1994/95 according to the TYRIP. In addition, Jamuna bridge taxes levied during FY 1984/85-1991/92 have already generated over $100 million equivalent of local funds, which is sufficient to pay for the local cost of the Project to be met by the Government. Overall, the continuation of the recent fiscal and monetary policies, the annual exercise of project prioritization, and the Jamuna bridge special funds already collected would ensure that the Jamuna Bridge Project is affordable to the country.

VI. ASSURANCES

A. Specific Assurances

93. The Government has given the following assurances, in addition to the standard assurances, which have been incorporated in the legal documents:

(i) *Jamuna Multipurpose Bridge Authority*

(a) Within one year of loan effectiveness, the Government will empower JMBA to operate and maintain the bridge, implement the Bridge End Facilities Land Use Plan and collect tolls (para. 53).

(b) The Government will provide adequate initial working capital to enable JMBA to assume O&M of the bridge. JMBA will prepare by 31 December 1996 a study of the tariff structure for the bridge and financial policies for JMBA. By 30 June 1997, JMBA will propose to the co-financiers a fee structure for use of the bridge that will be sufficient to cover full O&M as well as the amount by which debt-service requirements exceed depreciation (paras. 53 and 71).

(ii) *Emergency Fund*: The Government will establish a bridge emergency fund of $10 million equivalent (para. 68).

(iii) *Resettlement and Rehabilitation*: JMBA will carry out the agreed Resettlement Action Plan with the assistance of its Resettlement Unit and a NGO (paras. 65 and 66). Detailed covenants have been included in the legal documents to regulate the procedures for resettlement and the institutional arrangements for the Resettlement Unit.

(iv) *Environmental Action Plan*: JMBA will establish the Environmental Unit, for the implementation of the EAP (para. 60).

(v) *Staffing and Training*: The Government will ensure that JMBA maintains effective management during Project implementation and subsequent O&M of the Project. A training program will be prepared for JMBA staff not later than 31 December 1995 (para. 56).

B. Conditions of Loan Effectiveness

94. Effectiveness of the IDA and OECF loan agreements will be conditions for effectiveness of the Bank's loan agreement. In order to accomplish this (i) subsidiary agreement for re-lending must be finalized, (ii) contracts relating to construction supervision, Project management and monitoring of implementation of the RRAP and EAP must be signed, (iii) substantial progress must be made in the purchase of replacement land for resettlement, and (iv) all necessary governmental actions required to implement the RAP and EAP must be taken. In addition, the Government's approval of Project Proformas for the Project as a whole, including the RAP and EAP, will be conditions for effectiveness.

VII. RECOMMENDATION

95. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Bank and recommend that the Board approve the loan in various currencies equivalent to Special Drawing Rights one hundred forty-five million six hundred seven thousand (SDR 145,607,000) to the People's Republic of Bangladesh for the Jamuna Bridge Project, with a service charge at the rate of 1 per cent per annum and with an amortization period of 40 years, including a grace period of 10 years and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan and Project Agreements presented to the Board.

MITSUO SATO
President

10 February 1994

APPENDIXES

THE FERRY SYSTEM

A. Introduction

1. Transportation services across the Jamuna River are presently provided by several agencies. Passenger transport is carried out by the Bangladesh Inland Water Transport Corporation (BIWTC) and the Bangladesh Railway (BR) ferries, and by privately owned launches and manually operated boats. Freight transport services are offered by BIWTC, BR and some privately-owned barges.

2. The most important of these services for the east-northwest connection (on the proposed Jamuna Bridge Corridor) are those provided by the BITWC ferries, through two ferry routes (Aricha-Nagarbari (A-N), 22 km; and the much less used Bhuapur-Sirajganj (B-S), 18 km). The Aricha-Daulatdia (A-D) ferry route, also run by BITWC, connects the east to southwest, and traffic on this route will not be significantly affected by the proposed bridge. BR carries only about 25 per cent of the freight and 10 per cent of the total passenger flow across the Jamuna, and barges transport about 20 per cent of the total freight traffic across. Although launches carry a significant portion of the passenger traffic across the Jamuna, their services are offered mainly on the east-southwest crossings (A-D). During recent months, after the addition of two ferries on the A-N route in FY 1992/93, no organized launch services have been operating on the A-N route as passengers shifted to the safer ferries. Some launch traffic operates on the B-S route during the months the ferry system on that route remains closed. The services provided by each system, as well as their relevance to the Jamuna Bridge Project, are summarized in the Table at page 5. Bridge traffic projections made in the Project economic evaluation are based on diversion from A-N and B-S ferry routes and its traffic growth, as well as new induced traffic. The projections exclude potential diversion from rail ferries, launches and barges as a conservative assumption.

B. The BITWC Ferry System

3. BITWC is a publicly-owned entity that provides inland waterway transport services in Bangladesh. Ferry operations across the Jamuna have grown to be the most important activity within BITWC, generating 70 per cent of its turnover.

4. These services are provided by BITWC on four routes, which handles about 41 per cent of the passenger traffic and 54 per cent of the freight across the river in 1990: A-N, north of the Padma; A-D, south of Padma; B-S, north of the Padma and near the stipulated bridge crossing; and Mawa-Kwrakand, south of Dhaka. About 54 per cent of the total traffic along these routes goes through A-N. A-D is responsible for 38 per cent and B-S for 8 per cent of the total traffic. Insignificant amounts are moved through Mawa-Kwrakand. A-N and B-S are the only northwest-east ferry routes on the Jamuna Bridge Corridor (i.e., will be directly affected by the proposed bridge); of this, B-S is closed for four to five months because of erosion and other river-related problems and is much less used. During FY 1992/93, the average daily traffic carried by BITWC on the Jamuna Bridge Corridor (i.e., A-N and B-S routes, both ways) consisted of about 700 trucks, 270 buses (mostly carrying long-distance passengers) and 140 light vehicles (passenger cars, jeeps, etc.) totaling about 1,110 vehicles. Ferry traffic on these routes increased by 17 per cent during FY 1992/93 over the previous year. (For details see Appendix 10).

(Reference in text: page 6, para. 16)

5. All the ferry terminals are jointly managed and operated by BITWC, the Bangladesh Inland Water Transport Administration (BIWTA) and the Truck Drivers Association. Each terminal consists of one or more landing stations, or pontoons, and a parking area for trucks, buses and light vehicles that are waiting for the services. At Aricha, a large parking area with direct approach to the landing stations has been developed by BIWTA just behind the riverbank. At Nagarbari and Daulatdia the parking facilities are more limited, and at the two other routes they are nonexistent.

6. Ferry loading and unloading operations are performed via a floating landing station, connected to the ferry and to a temporary road by two ramps. Two different types of landing stations have been used to provide these services: flattop pontoons, which belong to BIWTA and are used for normal mooring and side load operations, and pontoons, owned by BIWTC, and used to moor ferries for loading and unloading via hydraulically operated ramps. In early 1993, Aricha had four ferries and one flattop pontoons, Nagarbari two pontoons, Daulatdia one and one or two flattop pontoon, and other terminals had one or two flattop pontoon.

7. During the same period, the BIWTC fleet dedicated to the Jamuna crossing comprised two barges pushed by tugboats, with capacity for 14 trucks each, and 22 ferries, including six small to medium ferries with capacity varying from 2 to 5 trucks, eight large K-type ferries with side ramp and capacity for 12-14 trucks each; and ten ferries (supplied under financial assistance from Danish International Development Agency [DANIDA]) with nominal rated capacity for 27 trucks each (or 24 buses). Eight DANIDA ferries were built and delivered, two each in 1981, 1985, 1988 and 1989; two additional ferries were added during 1992. The K-type ferries were all built in the 1960s.

8. Currently, only the DANIDA ferries serve the A-N route. The A-D route is regularly served by K-type series, but ferries are also used in periods of heavy traffic. The B-S route is served by three K-type and two medium size ferries, and the Mawa-Kwrakand route operates two small ferries.

9. Stowing of ferries is supervised by BIWTC, but the Bus and Truck Association and the police have taken over the actual stowing process, being effectively in control of the parking areas. From October 1992 the system of giving serial numbers according to the order of arrival to mark their position in the queue has been introduced, which has improved queue management to some extent; however, lack of discipline, queue jumping and traffic jams are still a common feature. BIWTC practices a differential queuing system which gives priority to passenger vehicles. As a consequence, waiting time for buses (usually carrying long-distance passengers) and light vehicles normally does not exceed one to four hours, whereas for trucks an average wait of 30-40 hours is usual and it may extend to three to four days because of weather-related or other problems. Some early priority is allowed for perishable goods vehicles but this is not effectively enforced, particularly when these vehicles come in large numbers. Giving buses and light vehicles equal priority would slightly reduce truck waiting time, but is considered not practicable or desirable since the scheduled long-distance buses (which predominate this preference category) should be given early transit, as this is the only convenient and affordable way for passenger transport between northwest-east.

10. The ferries and the ferry ports operate 21 hours a day, with no loading/unloading operations taking place between 3 a.m. and 6 a.m. Based on data collected from the logbook of the newest ferry in June 1993, the round trip between Aricha-Nagarbari-Aricha averaged six and a half hours, consisting of about one hour each for loading and unloading at each point, four hours cruising time and half to one hour delay in some trips.

C. Problems Faced by the Ferry System

11. The services provided at these crossings face numerous problems, which threaten the stability of the inter-regional transportation system, and therefore the economic development of the country as a whole. During the monsoon season, more than 600 billion cubic meters of water flow through the Jamuna River, bringing with it about 600 million tons of silt. Consequently, the river's width in some places varies from 4 km in winter to 30 km in summer, and the difference between low and high waters reaches 8 m. Since the location where the deep waters are available varies several times every year, according to the amount of siltation or scouring, the pontoons (the "ferry terminals") have to be moved from time to time along the riverbanks, requiring frequent reconstruction of the access roads and other facilities to suit these changes. The channel locations and depths also vary from season to season, making navigation difficult. The navigation channels used by the ferries silt up, continuously reducing their depth and width, and change course frequently.

12. Severe bank erosions affect all ferry terminals during the monsoon season, frequently swallowing up large areas of access roads and parking facilities, and the crude bank protection constructed by BIWTA has not prevented such damage. These problems, in addition to the heavy rainfall and rapid river current, make berthing and unberthing difficult, and often result in ferry operations being suspended for several days. Both A-N and the B-S crossings are hindered by numerous shoals and by the changes in the navigable channels. Ferries occasionally run into ground; during the dry season, this may happen two to three times daily.

13. Navigation channels are often too narrow. The almost constant traffic pressure has forced BIWTC to extend the A-N and A-D ferry services to include night operations. However, night navigation through shoal areas is very difficult and dangerous, and the ferries lack adequate facilities to make night operations safe, relying on sighting bamboo markers by searchlight.

14. The level of the maintenance services provided to the fleet is of very low standard. The general condition of all the small and medium size ferries is poor. All but two K-type ferries cannot be rehabilitated and are kept in operation only because of the demand pressures.

15. The BIWTC's shipyard (at Narayanganj, 85 km south of Aricha), is in extremely poor condition. No maintenance has been carried out at it since its construction 50 years ago, and it lacks tools or skilled labor. The main available repair facility capable of docking ferries is a floating dock, that leaves only about 45 cm clearance on each side of the ferry, which is too small for adequate hull maintenance and repair. Moreover, lack of adequate spare parts delays repair services. The main slipway is virtually useless, and the only operating facility is a second slipway, which lacks hauling power and is being hampered by siltation and by the lack of working space during the monsoon season. The availability of ferries remains low (70-75 per cent) for these reasons.

16. The capacity of the ferry system is severely restricted by (i) the river's turbulence; (ii) erosion, siltation, and shifting channels; and (iii) complex management problems that constrain provision of timely and adequate dredging, port relocation, ferry operation, ferry maintenance, and orderly queue system for waiting vehicles. River related constraints make it very difficult for the ferry system to attain full capacity without extensive investment in the river training works to provide stable port facilities and improved channels, and without highly efficient management of all the total system.

GENERAL INFORMATION ON THE DESIGN AND CONSTRUCTION OF RIVER TRAINING WORKS

A. The Guide Bunds

1. At the selected bridge site (see Map on page 4 of this Appendix), the present width of the Jamuna River (from bank to bank) is approximately 6.5 km, while the distance between the existing flood embankments is approximately 12 km. The distance between riverbanks is more than the minimum distance required to ensure that a major flood passing the bridge site does not result in unacceptable backwater effects upstream of the bridge. It will be more economical and expeditious to construct the guide bunds on and in the flood plains of the Jamuna. In view of the tendency of the Jamuna to erode its eastern bank at the bridge site, it has been considered advantageous to construct the eastern guide bund first. This will also facilitate the access to the site by road from Dhaka for transport of personnel and materials.

2. A guide bund will be formed by dredging a trench in the flood plain, at sufficient distance from the riverbank. The slope of the trench will then be covered with a protective revetment, strong enough to withstand current and wave forces that can be expected once the strip of land (buffer zone) separating the trench and the river has been eroded. Since early 1987 the width between riverbanks at the bridge site has increased by approximately 3 km. This implies that, when the guide bunds are constructed in the flood plain, the bridge will be unnecessarily long. For this reason, it was proposed in 1989 to construct one of the guide bunds "in the river," that is on the river side of the flood plain. Studies by the Consultants revealed that one guide bund could be constructed "in the river" if shoals and/or shallow channels are present where the guide bunds are to be constructed.

3. In late 1993 the river did not have shoals and/or narrow channels at the bridge site, but the river configuration offered an alternative for the construction of the western guide bund on an island in the middle of the river. This approach would have three main consequences: (i) the scope of temporary works necessary to create a protected working environment would be rather limited; (ii) the distance between the guide bunds could be reduced to within the target range; (iii) the western river channel would have to be closed after the start of the construction works for the western guide bund. The tender documents have been adapted to reflect the present river configuration.

4. The final location of the first guide bund will be determined by the construction supervision consultants. Depending on the erosion of the buffer zone occurring until the works commence on site, the location of this guide bund may have to be shifted, and areas to be reclaimed will have to be relocated. The location of the second guide bund will be determined shortly after the peak of the flood has passed during the hydrological cycle, preceding its construction. The guide bund is to be substantially completed while the water in the river is below the level of the flood plains. The guide bund slopes formed during the dredging operation will have to be protected by revetments. Materials for protection against scour below the deepest dredged level have to be provided and placed.

B. Slope Protection near Bhuapur

5. East of the Bhuapur ferry terminal the existing riverbank/flood embankment has to be reshaped and protected against erosion by currents and waves. Works in this area will have

to be carried out in less sheltered conditions than anticipated for the construction of the guide bund. However, this is not expected to impose serious problems for the construction of the protective revetment near Bhuapur, as currents and waves will be moderate, particularly during the winter (approximately December till March). Moreover, no substantial dredging work will be required with a view to install the slope protection to a considerable depth.

C. Dredging and Reclamation

6. For the construction of the guide bunds, large quantities of soil will have to be dredged. The soil consists mainly of sandy silt (upper layers), and silty sand and fine sand (lower layers). Dredged soil from the construction trenches will as much as possible be used for reclaiming areas for the bridge-end facilities, adjacent areas, and access embankments and roads. A substantial quantity of dredged soil may be required for the temporary works for the guide bund island, leading to a shortage of soil for reclaiming the areas for the bridge-end facilities, etc. Additional soil will have to be dredged to compensate for the deficit.

D. Closure of the River Channels

1. Location of main closure

7. The closure can, in principle, be located anywhere between the island and the western riverbank, but will preferably be within the northern and southern perimeters of the bridge-end facilities area. Another location will only be attractive if it offered obvious advantages, for instance in terms of costs, logistics or materials required. After consultation with the Contractor, the Supervision Consultants will determine the position of the closure.

2. Closure Method

8. The closure method will depend on the difference in water levels occurring upstream of the closure dam during the closure operation, particularly during the final stages of the closure. For the closure of a river channel (in a system with multiple channels) the head difference is almost entirely governed by the water level gradient along the river and the length of the island separating river channels. Investigations by the Consultants have revealed that sand cannot be used alone to close the channel because of rapid currents during the final stages of the closure. The head difference immediately after closure of the river channel should not exceed 0.80 m. For the final stages, other materials such as rock or filled geotextile bags, will be required. Depending upon the current velocity and scour potential during the closure operation, the riverbed will have to be protected.

F. Other Salient Technical Aspects

9. Since the tender designs were finalized, the main channel of the Jamuna has taken a diagonal southeasterly direction from its location off Sirajganj, to the extent that it is eroding the bank at the eastern guide bund's location. Meanwhile, the western secondary channel appears to have diminished, which will make its closure easier. One more flood season will be completed before construction of the eastern guide bund will commence. Assuming that the present conditions remain without substantial change during the 1994 monsoon, two adjustments can be made. One is to move the eastern guide bund about 700 m north and 300 m east, with appropriate adjustment to the approach road. This will require additional land acquisition and resettlement. The other solution is to place a substantial quantity of sand at the southern end so that the guide bund may be constructed in the flood plain. There is adequate provision in the tender documents to accommodate either option.

10. A major earthquake during construction of a guide bund can cause temporary sand slopes of the dredged basin to slump and the completed embankment to settle and will disrupt the above-water paved slopes. A major earthquake during erection of the bridge superstructure can severely damage spans being erected that had not been fully post-tensioned, or cause them to collapse. However, the completed portions of the bridge will suffer, at most, minor damage to the bearings and expansion joints, etc. Rebuilding of the damaged span or spans will delay completion 1 to 3 months. The cost of repairs of such damage has been estimated at $10 million. After completion of construction, an earthquake with energy 5 times that of the design event will cause only minor damage to the bridge. It will cause embankment to slump 1-2 m, and will disrupt slope paving.

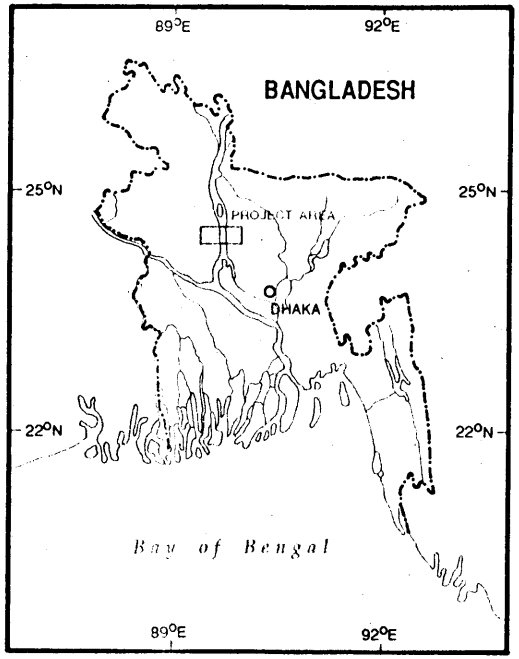
11. Episodic floods have also been addressed. For example, a flood level occurring during construction experienced only once per century, will not significantly affect a completed bund. Changes in channelization can occur. The flood will widen the distance between banks by the promoting secondary channels between the islands. Provision has been made within the contracts to accommodate such eventualities. After the bridge is completed, such a flood anytime will raise the level of the river by about 1 m, including backwater effects caused by the bridge. Overtopping of upstream flood embankments will probably occur flooding the adjoining land as happening at present during high floods, but more extensively. River velocities through the bridge opening will increase, which will result in additional scouring and deepening the channel. The design of the bridge contemplates such deepening. However, the increased velocities around the upper noses of the guide bunds will cause local erosion and damage to the stone, which, along with the falling apron, will have to be replenished.

12. The probability that one of the above events will occur during construction is only 1 in 16 or 6 per cent. The probability that either of these two events will occur during the next 100 years is only 20 per cent. These probabilities are within the limits set for reliability of major bridges worldwide.

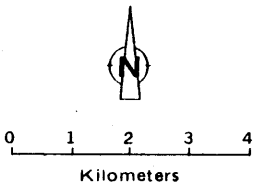
13. A report by the Flood Action Plan Engineer and map made available to the Consultants showed the bank lines of the Jamuna River since 1765. Although the bank lines have continuously wandered up to 5 km at most locations, at Sirajganj and Bhuapur (the only stable locations) the river has been very stable, showing no appreciable changes for the last 228 years. This confirms the selection of the bridge site. The details of the proposed river training system were further explored in depth by the PoE. The consensus was that the present tender design is essentially correct and adequately conservative but that, a moderate additional contingency should be provided to take care of adjustments in location in case the river moves prior to completion of the bridge.

14. A new northern channel to the Dhalaswari River was examined as a means of mitigating the effects of closing the present northern entrance. Such a channel is feasible, at minimal cost, if it is found to be necessary and desirable.

15. A detailed study by the PoE confirmed that the allowance for maintaining the river training system, as presently proposed, is adequate. The required stockpile of 41,000 cubic meters of rock should be continually replenished as it is used for maintenance and repair, with the costs thereof to be considered as part of maintenance.



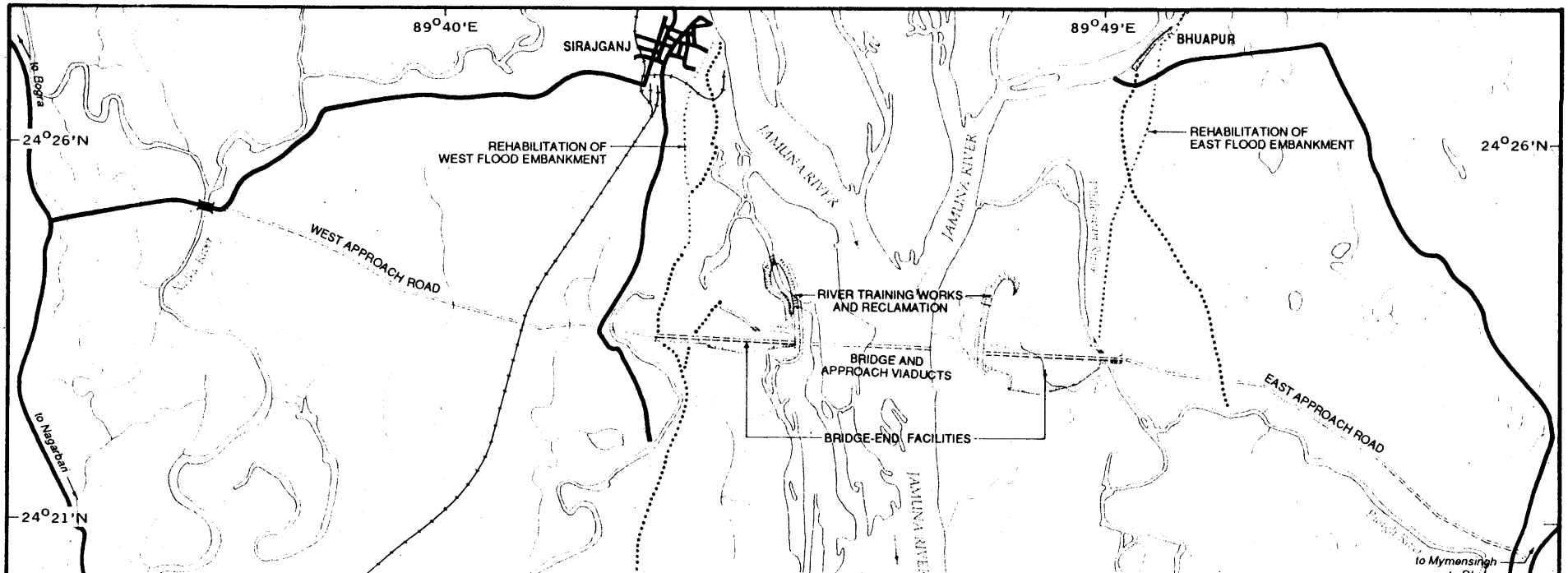
BANGLADESH
JAMUNA BRIDGE PROJECT
Location and Construction Components



LEGEND :

- River Training Work
- Bridge and Approach Viaduct
- Flood Embankment
- Road Approach
- Existing Flood Embankment
- Main Road
- Railway
- River
- International Boundary

(Boundaries not necessarily authoritative)

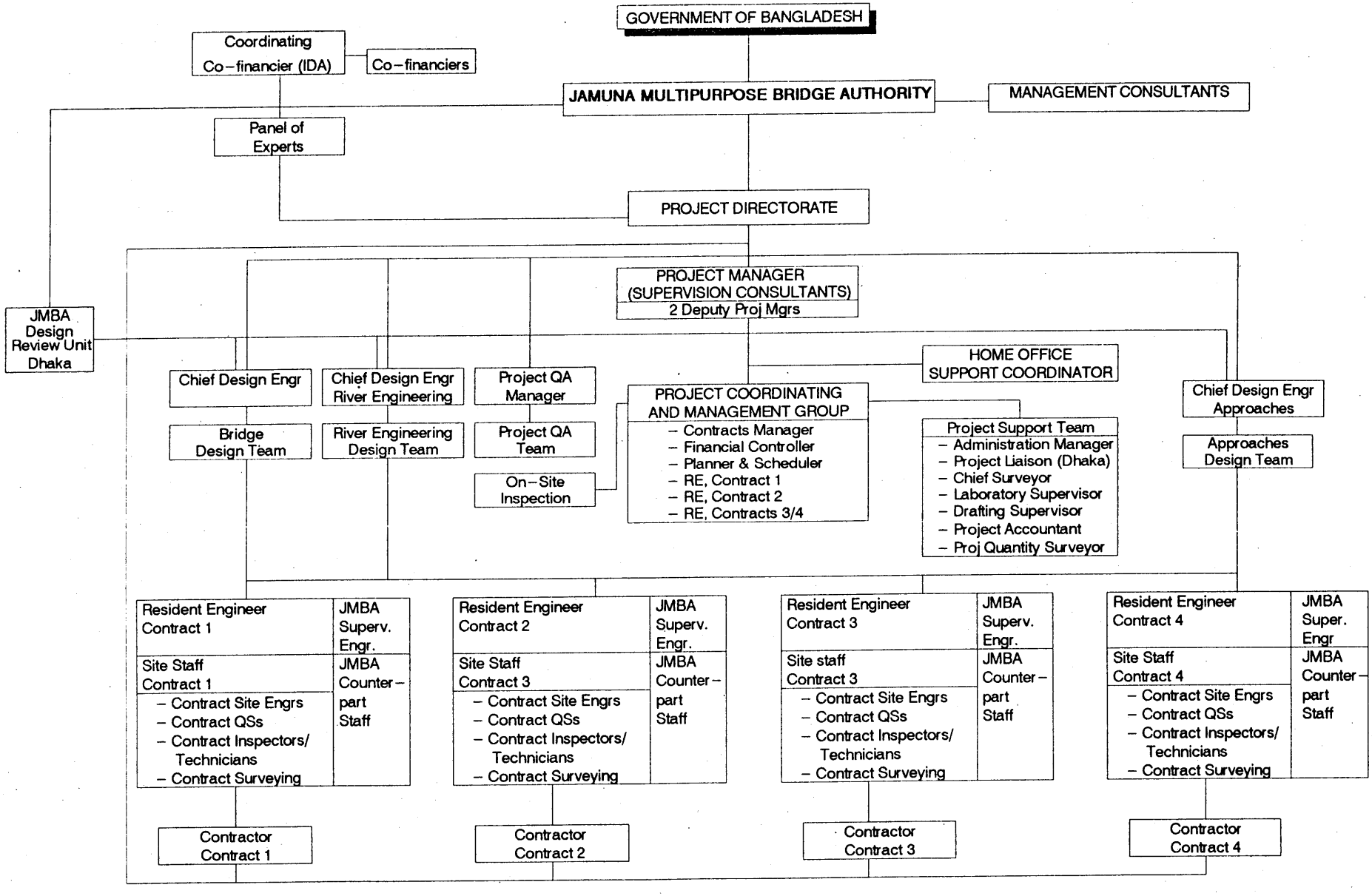


COST ESTIMATES AND BUDGETING
($ million)

Component	Project Cost			1994			1995			1996			1997		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total
	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)
A. Main Bridge															
CONTRACT 1															
Base Cost	178.96	41.44	220.40												
Allocated Contingency: Piles & Spans	15.10	3.50	18.60												
Unallocated Physical Contingency and Dayworks	6.82	1.58	8.40												
Subtotal: Contract 1 Tender Sum	200.89	46.51	247.40	74.93	17.35	92.28	76.14	17.83	93.97	38.77	8.98	47.75	11.05	2.56	13.61
Price Contingency	12.28	5.53	17.80	2.32	1.04	3.36	4.80	2.12	6.91	3.72	1.71	5.43	1.44	0.67	2.10
B. River Training Works															
CONTRACT 2															
Base Cost	207.20	36.85	244.05												
Allocated Contingency: Additional dredging 3.5															
Channel closure 8.4															
Temp works 2.0															
Sirajganj 2.5	13.84	2.46	16.30												
Unallocated Contingency	7.47	1.33	8.80												
Subtotal: Contract 2 Tender Sum	228.51	40.64	269.15	90.03	16.01	106.05	89.80	15.97	105.78	48.67	8.66	57.33	0.00	0.00	0.00
Price Contingency	13.12	4.52	17.64	2.79	0.96	3.75	5.66	1.92	7.57	4.67	1.64	6.32	0.00	0.00	0.00
C. Approach Roads															
CONTRACT 3															
Base Cost	13.71	13.99	27.70												
Physical Contingency	1.04	1.06	2.10												
Subtotal: Contract 3 Tender Sum	14.75	15.05	29.80	4.74	4.83	9.57	7.08	7.22	14.30	2.94	2.99	5.93	0.00	0.00	0.00
Price Contingency	0.87	1.73	2.60	0.15	0.29	0.44	0.45	0.67	1.12	0.28	0.57	0.85	0.00	0.00	0.00
CONTRACT 4															
Base Cost	12.47	12.73	25.20												
Physical Contingency	0.99	1.01	2.00												
Subtotal: Contract 4 Tender Sum	13.46	13.74	27.20	4.32	4.41	8.73	6.46	6.59	13.06	2.68	2.73	5.41	0.00	0.00	0.00
Price Contingency	0.80	1.58	2.37	0.13	0.26	0.40	0.41	0.79	1.20	0.26	0.52	0.78	0.00	0.00	0.00
D. Technical Assistance															
Engineering Supervision/Man. Consultants	21.00	4.00	25.00												
CONTRACT 7	0.42	0.08	0.50												
Panel of Experts	1.26	0.24	1.50												
Subtotal: Technical Assistance	50.40	33.38	27.00	4.54	0.86	5.40	11.34	2.16	13.50	4.99	0.95	5.94	1.81	0.35	2.16
Price Contingency	1.57	0.58	2.15	0.14	0.05	0.19	0.71	0.26	0.97	0.48	0.18	0.66	0.24	0.09	0.33
E. Others															
Land acquisition (Incl. contingency)	0.00	20.00	20.00												
CONTRACT 7 (Incl. contingency)	0.00	5.50	5.50												
Resettlement (Incl. contingency)	0.00	21.00	21.00												
Environment	0.00	6.00	6.00												
Subtotal: Others	0.00	52.50	52.50	0.00	46.50	46.50	0.00	2.00	2.00	0.00	2.00	2.00	0.00	2.00	2.00
Total Base Cost	435.03	161.82	596.85												
Total Physical Contingencies	45.33	10.87	56.20												
Total Price Contingencies	28.64	14.31	42.95												
GRAND TOTALS	**509.00**	**187.00**	***696.00***	**184.09**	**92.57**	***276.66***	**202.85**	**57.53**	***260.38***	**107.46**	**30.93**	***138.40***	**14.54**	**5.66**	***20.20***

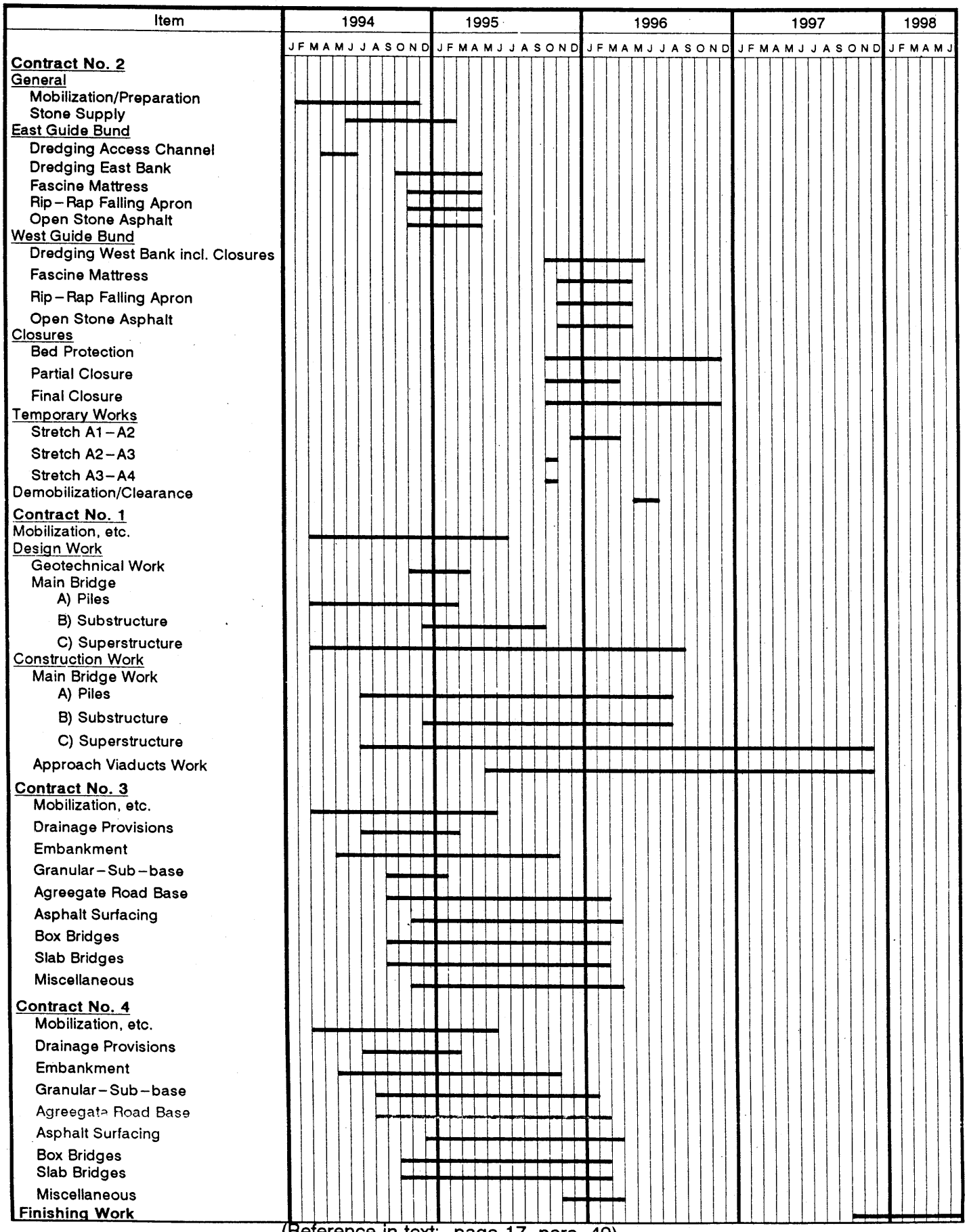
(Reference in text: page 13, para. 42)

JMBA ORGANIZATION AND PROJECT SUPERVISION ARRANGEMENTS



(Reference in text: page 15, para. 44)

IMPLEMENTATION SCHEDULE



(Reference in text: page 17, para. 49)

BROAD TERMS OF REFERENCE
CONSTRUCTION SUPERVISION CONSULTANTS

A. Objectives

1. The construction supervision consultants (CSC) will ensure that the construction of the Project is implemented in an economical and efficient manner consistent with internationally accepted standards and practices and accomplishes the specified requirements of the Jamuna Multipurpose Bridge Authority (JMBA), which is the Executing Agency for the Project.

B. Scope of Services

2. The CSC will provide all the services required of the Engineer, except those duties retained by the Employer. The CSC will be assisted by the management consultant (MC). The services required from CSC will comprise:

(i) *Construction Supervision*: The Project will be built under four major and two small contracts. The major contracts are (a) Contract 1: Bridge and Approach Viaducts, (b) Contract 2: River Training works, (c) Contract 3: East Road Approach; and (d) Contract 4: West Road Approach. The two small contracts are for (a) the procurement of operation and maintenance (O&M) equipment for JMBA, and (b) bank protection works south of Sirajganj hard point and rehabilitation of the west bank flood embankment. The supervision will, in general, be carried out by the resident engineers assisted by a number of site engineers. Their tasks will include:

(a) issuing of design drawings, specifications and instructions for contracts 2, 3 and 4, and review of design drawings, shop drawings, etc., for contract 1;
(b) supervision of surveys, setting out and site investigations;
(c) inspection/testing of materials and manufactured components of the temporary and permanent works;
(d) checking of sources of materials and machinery proposed for use in the temporary or permanent works;
(e) checking of day-to-day shop drawings;
(f) checking of construction/erection schemes;
(g) site inspections of the works;
(h) interim measurement of the works for contracts 2, 3 and 4;
(i) direction of any emergency measures;
(j) evaluations of and recommendations concerning conditions such as river channel changes, soil characteristics changes, and anomalous behavior of piling (including physical model testing), and coordination with JMBA and its consultants;

(k) recommendations concerning corrective measures for construction and unintended behavior of constructed elements, e.g., excessive settlement;

(l) maintenance of up-to-date records of river morphology from 20 km upstream to 5 km downstream;

(m) a study of the erosion that may occur due to over flow south of the bridge between the Jamuna and Dhaleswari rivers (the study shall include as necessary, topographic surveys; hydrologic analysis; landuse and land ownership surveys; and forecast of erosion locations, magnitudes and impacts (physical, social and economic) and recommendations and action plans for preventing, controlling and investigating erosion impacts and for compensating affected people);

(n) a study of the effects of the Project on drainage upstream of the approach embankments in the flood plains at both banks, and proposals for remedial measures to be taken; and

(o) accomplishment of the required environmental protection measures during Project implementation.

(ii) *Certification*: Prepare interim payment certificates for contracts 1 to 4 and process them for payment, and prepare Completion Certificates and Maintenance Certificates and submit them to JMBA.

(iii) *Quality Assurance*: Establish a documented quality system and procedure, including a quality plan, in order to implement quality assurance on the contract supervision services, and audit the contractors' quality systems. CSC will be required to report periodically to JMBA on the implementation of the quality control and quality assurance procedures.

(iv) *Operation and Maintenance (O&M)*: Manage and coordinate the taking over and successful start of the Project operation and maintenance by:

(a) describing JMBA staff duties, other than those required for financial commercial accounting or administrative activities and for which job descriptions will be prepared by MC;

(b) training JMBA staff, specifically including bridge, river training and road engineers and inspectors but excluding staff to be trained by MC;

(c) checking and approving of O&M manuals submitted by the contractors;

(d) establishing and defining an overall O&M program;

(e) handing over "as-built drawings" as may be required;

(f) periodically reviewing the quality control and assurance records, tests and reports, including spot checks, to ensure that the plan is being properly implemented and the discrepancies have been corrected (CSC will bring any serious discrepancies to the attention of JMBA); and

(g) establishing and defining the overall environmental protection measures required to mitigate negative impacts (i.e., disposal of waste materials) of maintaining the bridge and ancillary facilities.

C. Reports

3. The CSC will help JMBA and MC prepare periodic progress reports (quarterly, annual summary reports and Project completion report) for JMBA and the co-financiers. The periodic progress reports will summarize the status of the construction contracts (schedule, budget, actual and/or potential problems and delays). They should be submitted within 30 days of the reported period and should include information on: (a) principal work accomplished during the period covered by the report; (b) comparison of actual progress with the original schedule estimated for construction and procurement, and with the schedule agreed upon with the contractors and suppliers; (c) actual or contemplated major deviations and reasons therefor from original plans or schedules, other than changes that require prior consultation with JMBA (contemplated changes should be reported to JMBA immediately and be included in the subsequent progress report); (d) the development of cost estimates and expenditures and the availability of funds to meet the cost of the Project; (e) conditions that would significantly affect construction schedules or the cost of the Project; and (f) progress made in training. The annual summary reports, which are required for JMBA to report to the Government and to co-financiers, will present the information required for such reports and will be more financial than technical. The Project completion report which will be submitted within three months of the substantial completion of the Project, will be in accordance with the rules and regulations of the funding agencies.

BROAD TERMS OF REFERENCE
MANAGEMENT CONSULTANTS

A. Objectives

1. The main objective of the services to be provided by the management consultants (MC), is to assist the Jamuna Multipurpose Bridge Authority (JMBA) in its duties as the Employer in the management of civil works construction and to ensure that the environment, land-use and resettlement plans are satisfactorily carried out. The MC will also assist JMBA in preparation for its role as future operator of the bridge.

B. Scope of Services

2. The scope of the services to be provided by the MC shall include the management of the various construction contracts and the environment, resettlement and land-use plans by:

(i) monitoring progress and updating overall project planning as reported to the Employer by the Construction Supervision Consultant, who will be the "Engineer";

(ii) controlling the budget, including maintenance of detailed records of payments for civil works and consultant contracts;

(iii) setting up and implementing a financial commercial accounting system for JMBA, including cash flow projections for the funding organizations;

(iv) reviewing periodic progress reports submitted by the Engineer, preparing other reports as required by JMBA and proposing Project coordination/liaison meetings as needed;

(v) assisting JMBA in processing interim and final payments and issuing necessary certificates, including the maintenance certificates, in accordance with the conditions of contracts;

(vi) periodically reviewing the quality control and assurance records, tests and reports, including spot checks, to ensure that the civil works are being properly implemented and the discrepancies have been corrected (the MC will bring any serious discrepancies to the attention of the JMBA);

(vii) supervising the implementation of the Environmental Action Plan, including monitoring and management requirements, in relation to the land-use master plan, the fisheries and wild life plans, and other environmental issues;

(viii) supervision of the implementation of the Resettlement Action Plan, including any monitoring and management requirements;

(Reference in text: page 17; para. 50)

(ix) advising JMBA on possible measures for improving efficiency and reducing the total Project costs;

(x) maintaining and reviewing the daily records held by JMBA, as produced by the contractor through the Engineer, on work progress, labor, equipment, major construction materials at site, work accomplished, weather, river conditions, accidents, and any other events affecting Project cost or implementation schedule; and advising JMBA on measures necessary to overcome bottlenecks;

(xi) assisting JMBA in settling all contractual disputes;

(xii) carrying out a study, by 31 December 1996, to determine the level and structure of tolls and other charges to be levied by JMBA on the users: the toll should help the Government to pursue its policy of cost recovery without discouraging the potential clients from using the bridge; and

(xiii) assisting JMBA in the management and coordination of taking over and successfully starting the operation and maintenance of the Project by extending the financial commercial accounting system.

C. Reports

3. The MC will prepare, in collaboration with JMBA and the Engineer, periodic progress reports (quarterly), annual summary reports and the Project completion report for submission to JMBA and the various co-financing organizations involved. The periodic progress reports will summarize the status of the construction contracts (schedule, budget, actual and/or potential problems and delays). The reports will be illustrated by with photographs, graphs and tables that enable interested parties to obtain an up-to-date picture of the stage of completion of the Project as well as of progress achieved during the report period. They should be submitted within 30 days of the end of the reported period and should include information on (a) principal work accomplishment during the period covered by the report; (b) comparison of actual progress with the original estimated schedule of construction and procurement, and with the schedule agreed upon with the contractors and suppliers; (c) actual or contemplated major deviations and reasons thereof from original plans or schedules, other than changes that require prior consultation with JMBA (such contemplated changes should be reported to JMBA immediately and also should be included in the subsequent progress report); (d) the development of cost estimates and expenditures and the availability of funds to meet the cost of the project; (e) conditions that would significantly affect construction schedules or the cost of the project; (f) progress made on training; (g) progress made on environmental issues; and (h) progress made on resettlement. The annual summary reports, which are required for JMBA to report to the Government and to financing organizations, will present the kind of information for such reports and will be more financial than technical. The Project completion report, which will be submitted within three months of the substantial completion of the project, and will be in accordance with the rules and regulations of the funding agencies.

ENVIRONMENTAL ACTION PLAN

1. The Environmental Action Plan (EAP) addresses the range of potential environmental impacts that may arise through the Project. The plan considers both short-term construction-related impacts and longer term impacts during the operation and maintenance of the bridge. It outlines both impact monitoring and management actions and has nine components.[1]

A. Environmental Management of the Construction Phase

2. Environmental guidelines will be prepared by the Jamuna Multipurpose Bridge Authority (JMBA), assisted by the Management Consultants, prior to the commencement of major construction activities. The guidelines will address as a minimum: (i) water supply for about 1,500 people at the construction camp and bridge end facilities, and water supply and sanitation for new settlements for about 20,000 people; (ii) disposal of sanitary, solid and construction wastes (including surplus spoil); (iv) minimizing disturbance to wildlife; (v) environmental health and safety; (vi) accident and spill contingency plans; and (vii) management of construction noise. The Construction Supervision Consultants will ensure that all environmental matters are attended to in accordance with these guidelines and the environment-related provisions under civil works contracts.

B. Wildlife Monitoring and Conservation

3. The Wildlife Action Plan will be implemented over a three-year period with a follow-up post construction impact evaluation in the sixth year. The three-year plan has the following components: (i) regular baseline monitoring of the fauna and flora of the Project area, (ii) identification and demarcation of sensitive areas that might be significantly impacted by construction activities, (iii) study of the ecology and reproductive behavior of the spotbill duck, (iv) identification and establishment of protected areas for the breeding and roosting of resident and migratory birds, (v) habitat improvement through planting vegetation, and (vi) an environmental multimedia awareness program to support the protection of natural habitats and the wildlife. The total estimated cost is $100,000.

C. Mitigation of Fisheries Impacts

4. The Fisheries Mitigation Action Plan has three components. (i) By developing pondfish culture, it will replace the estimated 500 tons/year of fish harvest lost by closure of the northern Dhaleswari River intake. The pondfish will be cultured in about 200 hectares (ha) of derelict and cultivable ponds in the impact area (estimated cost $1.163 million), (ii) A reserve fund will be made available to NGOs working in the area to provide Project-affected persons (PAPs) with alternate employment training, skills development and fixed and working capital requirements for fish culture and other activities ($1.27 million), (iii) Fisheries monitoring activities of the Directorate of Fisheries will be strengthened in the affected area in Tangail District ($567,000).

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[1] Relevant study reports, namely: Land Use Master Plan, Dhaleswari Closure Mitigation Study, Fisheries Action Plan, Wildlife Preservation Action Plan, and Environmental Management Action Plan, are in Project files.

(Reference in text: page 19, para.59)

5. The JMBA will be responsible for the overall management of the Plan and the recruitment of NGOs. The district and thana level fisheries officers will provide technical assistance where and when required. The estimated total cost is $3 million.

D. Land-Use Management

6. The JMBA will: (i) manage the development at the bridge ends in accordance with the Bridge End Facilities Land Use Plan; (ii) ensure that water supply, sanitation and waste disposal are environmentally acceptable, (iii) ultimately transfer the administration of services within the resettlement sites to the district authorities; (iv) collaborate with relevant government agencies in the execution of the Land-Use Master Plan, which addresses sustainable development in the vicinity of the bridge. The estimated cost is $20,000.

E. Promoting Changes in Cropping Patterns

7. The JMBA will seek to maximize the agricultural benefits that arise from closing the northern intake of the Dhaleswari River by: (i) providing technical assistance (training and demonstration plots) to farmers through NGOs to facilitate the necessary adjustments to cropping patterns in about 49,000 ha of the upper Dhaleswari basin ($20,000), (ii) further technical support through short-term consultancy by the Bangladesh Agricultural University of Mymensingh ($10,000) and the Department of Agricultural Extension before closing the Dhaleswari, (iii) providing credit facilities to farmers for adjustments in cropping patterns over a three-year period ($60,000), and (iv) gauging changes in agricultural production through a yearly, three-year monitoring program, commencing in 1996 ($30,000). The total estimated cost is $120,000.

F. Monitoring and Management of Water Resources

8. The Project will support: (i) monitoring of groundwater levels through existing automatic water level recording wells in the district of Tangail; (ii) technical advice and guidance to farmers and well owners affected by falling groundwater levels; (iii) monitoring of possible erosion losses in the area between the Dhaleswari and the Jamuna River following closure of the Dhaleswari intake, and making funds available for appropriate mitigation measures such as channel deepening, temporary embankments of spurs and gauges, ($1.0 million); (iv) a study, during construction, of drainage congestion near the eastern guide bund and the embanked road and devising of appropriate mitigation measures if required; (v) monitoring of changes in land types and associated cropping patterns for two years ($30,000); (vi) monthly monitoring druing dry season of water quality in residual water bodies that are isolated by the closure of the northern Dhaleswari intake with respect to its use for domestic purposes ($30,000); (vii) dissemination of appropriate environmental health information to affected persons through the existing health services and NGOs ($30,000). The estimated total cost is $1,090,000.

G. Other Environmental Issues

9. The closure of the northern intake of the Dhaleswari River will disrupt minor river navigation for three months per year and will affect boat owners (about 250 families). Training and credit will be provided to boatmen who wish to pursue job alternatives or re-locate to other rivers (estimated cost $65,000). A survey will be carried out by an NGO to determine the number and their socioeconomic conditions ($5,000). The total estimated cost is $70,000.

10. The improved flood characteristics of the upper Dhaleswari and reclaimed areas, and berms of new access roads present opportunities for social forestry programs that will improve the availability of fruit, fodder and fuelwood. Social forestry will be undertaken through the services of appropriate NGOs, the Forestry Department and contractors over a three-year period, commencing mid-1995 ($150,000).

H. Institutional Aspects of EAP Implementation

11. The JMBA will be responsible for implementing the EAP. An Environmental Unit will be established and staffed by three graduate level officers, three technicians and support staff. A local EAP consultant will be engaged to develop detailed components of the EAP for implementation and to establish the Environmental Unit. Training will be provided to the unit by appropriate agencies such as the Bangladesh University of Engineering and Technology, the Bangladesh Center for Advanced Studies and the Management Consultants through on the job activities. These agencies will provide technical support during the initial two years of the unit's operation. A prime role of the Unit will be to supervise studies and activities undertaken by NGOs and other agencies (the total estimated cost is $100,000).

12. The Environmental Unit will exist for at least six years. It will be advised, guided and supervised by the existing Environmental Management Committee, which will also continue for at least six years. It will comprise related agencies and institutions, viz: the JMBA, Ministry of Environment and Forests, Bangladesh University of Engineering and Technology, Faculty of Biological Sciences University of Dhaka, Bangladesh Water Development Board, Water and Aquatic Resources Planning Organization, Bangladesh Rural Development Board, Bangladesh Consultants Limited, Bangladesh Rural Advancement Committee, Bangladesh Center for Advanced Studies, and National Institute for Preventive and Social Medicine.

13. During the construction phase of the Project, JMBA will be assisted in implementing the EAP by the Management Consultants.

I. Costs and Contingencies

14. The EAP components and the estimated costs are:

	($ '000)
Wildlife monitoring and conservation	100
Fisheries action plan	3,000
Land-use management	20
Promoting changes in cropping patterns	120
Monitoring and managing water and land resources and mitigating erosion impact	1,090
Loss of river traffic	70
Social forestry	150
Institutional support	100
Contingencies	1,350
Grand Total	**6,000**

J. Implementation Schedule

Preparation of detailed EAP components	Nov 93 to Dec 93 (completed)
Recruitment of EAP staff	Jan 94 to Mar 94
Establishment of Environmental Unit	Mar 94
Preparation of Environmental Guidelines (Construction)	Mar 94 to May 94
Wildlife Action Plan (Implementation)	Apr 94 to Feb 97
Fisheries Action Plan (Implementation)	Sep 94 to Sep 98
Fisheries survey of ponds	Sep 94
Changes in cropping patterns	Jun 95
Monitoring and management of water resources	Mar 95
Survey of affected boatmen	Apr 95
Water quality monitoring	Apr 94

REVISED RESETTLEMENT ACTION PLAN

A. Introduction

1. The total area affected by the Project is estimated at about 2,724 hectares (ha) and the total number of Project-affected persons (PAPs) at 77,220. This is inclusive of approximately 953 ha on the east end of the bridge, where the civil works construction will begin in April 1994, and where an estimated 17,000 persons will be affected by land acquisition by 1 September 1994. Of these, approximately 7,000 people will have to be relocated before 1 April 1994. In agreement with the co-financiers, the Revised Resettlement Action Plan (RRAP), prepared by the Jamuna Multipurpose Bridge Authority (JMBA) in October 1993,[1] aims foremost at the resettlement of these persons. This is required in connection with the construction of the eastern guide bund (Contract 2).

B. Objectives and Framework of Operationalization

2. The main objective of the proposed resettlement and rehabilitation plan is to minimize involuntary resettlement. Since some displacement is unavoidable, resettlement plans will be developed with the following objectives:

(i) Displaced persons should be: (a) compensated for their losses at full replacement cost; (b) assisted with the move and supported during the transition period in the resettlement site; and (c) assisted in their efforts to improve their former living standards, income earning capacity, and production levels, or at least to restore them. Particular attention should be given to the needs of the poorest groups to be resettled.

(ii) Community participation in planning and implementing resettlement should be encouraged. Appropriate patterns of social organization will be established and existing social and cultural institutions of resettlers and their hosts will be supported and used.

(iii) Resettlers should be integrated socially and economically into host communities in such a way that host communities also benefit from the Project. Consultation between resettlers and host communities is to be realized.

(iv) Land, alternative sources of income, skill training, housing, infrastructure and other compensation should be provided to the PAPs who have usufruct or customary rights to the land or other resources taken for the Project. Absence of (legal) title to land should not bar compensation to those deriving an income from or living on the land.

3. For implementing the objectives, the following framework has been agreed upon between JMBA and the co-financiers:

(i) During the planning and design of all Project components, such as location of the bridge, alignment of approach roads, lay out of guide bunds, etc., the effects of

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[1] The Original and Revised Resettlement Action Plans are in the Project files.

homestead, agricultural land and other income loss has been taken into account. For example, approach roads have been routed around and land acquisition boundaries required for engineering purposes were refined to meet field resettlement constraints. Because of the Jamuna River meanders, it is only possible to determine the exact location of the guide bunds immediately before construction. To avoid extremely costly potential claims by contractors for delays due to unresolved resettlement problems, and at the same time to ensure that resettlers have sufficient time to prepare themselves for resettlement, more area will be acquired than may eventually be used. Surplus land will be redistributed among PAPs.

(ii) The Plan ensures that both PAPs and hosts should benefit from the Project. Among the PAPs there is a strong demand for the bridge, because many PAPs expect to improve their livelihood through JMBA even if it means displacement. Field checks indicate that people are less worried about being displaced than about receiving the appropriate entitlement in time or in full. The entitlement packages allow for replacement value to compensate losses and for incentives that serve as a bonus on evacuation from the area and successful resettlement elsewhere. To mitigate system failures on any details not covered, corrective mechanisms are built in, such as the monitoring and review mechanism, grievances redress committees (GRCs) and physical provisions such as for homestead failures, etc.

(iii) The initial socioeconomic survey is being updated for the Project-affected area. This provides a sufficient base to identify all entitled persons. Village, union and religious leaders will be consulted during the survey to identify PAPs. The PAPs and potential host communities are informed through surveys, ongoing land acquisition exercises or other means that they are likely to be affected. Information campaigns will be executed in PAP and host areas. These will communicate the entitlement policy approved by the Government, and will allow villagers to express their concerns and make suggestions as to the implementation of the policy. The resettlement strategy is based on encouraging PAPs to resettle on their own initiative and according to their choice, by providing necessary financial and institutional support. Participation of the people is in-built in this strategy. The entitlement packages also allow for a fair amount of choice by PAPs. During the implementation, JMBA will interact actively with the population through the information campaign, village resettlement workers (VRWs) and GRCs. Grievances can be appealed to the GRC, directly or through village leaders and/or NGOs. Next to routine monitoring and remedial action, a future post-resettlement monitoring/evaluation survey is planned to investigate to what extent the rehabilitation of PAPs has been achieved in order to determine further remedial action needed.

(iv) By having an incentive-driven system, it is assumed that PAPs and host communities share a mutual interest in their successful integration. Where this system fails, alternative action is planned to accommodate the homestead failures in resettlement sites. Such small resettlement sites are accompanied by facilities that benefit the host communities.

(v) PAP categories have been identified and an entitlement policy has been designed to accommodate their specific requirements. Categories eligible for entitlement

also include squatters, uthulis[1] and tenant/farm workers and/or wage earners. Economically weak categories are likely to benefit more in relative terms than others.

C. Entitlement Policy

1. Policy

4. Project-affected households depend on a variety of sources such as farmland, tenant farming, wage labor, trading, etc., for their livelihood. Often a single household may rely on more than one means of livelihood through the properties and work of its several individual members. A large number of households suffer different kinds of losses in the process of relocation, which the entitlement policy takes into consideration by linking the entitlement to types of losses and to individuals. This will ensure that households are compensated according to their losses irrespective of their social composition.

2. Basic Definitions

5. A PAP is defined as a person who owns property, lives and/or earns a living in the area to be acquired for the construction of the Project at the time of Section 3 Notification under the Land Acquisition Law or at the time of the Bangladesh Rural Advancement Committee (BRAC) socioeconomic survey of January 1993 (whichever is later).

6. A household is defined as all persons living and eating together (sharing the same kitchen and cooking food together as a single family unit). The psychoeconomic survey carried out by BRAC is based on the same definition and hence will be used as the basic record for identifying the household unit. There may be one or more persons in a household who are entitled to a resettlement benefits. Each entitlement has a corresponding definition of an entitled person. Entitlement to replacement of land or cash grants and credits in lieu of replacement land is based on legal ownership. In the case of joint title deed, the replacement land or cash grants and credits in lieu of replacement land will be given to the joint holders (i.e., joint holders will be treated as one unit). In the case of uthulis and squatters who do not own land but are entitled to a homestead plot (or grant to purchase land), the entitled person is the head of the household as recorded in the BRAC survey. In the case of house or building construction grants, the entitled person is the legal owner of the structure, (one who received the compensation under the law) when legal ownership is established. In the case of uthulis and squatters who do not normally own the land on which the structure is constructed, the entitled person is the head of the household as recorded in the BRAC survey.

7. Maintenance grants and vocational training are provided to persons affected by the loss of wage earning opportunities, rented land or shared cropped farm. This entitlement is to the affected individual (above the age of 13), and the criteria of entitlement is loss of primary occupation or primary source of income as reported by the BRAC psychoeconomic survey. In a household with more than one adult, each additional person affected by loss of the primary source of income is entitled to maintenance grants and vocational training assistance. However, domestic help, casual employees and persons not usually residing with or dependent upon the PAP household are not eligible for resettlement benefits.

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[1] People who have been displaced by flood or similar causes. They do not own a homestead, but usually live on land provided by relatives and friends.

8. Indirectly affected persons are those whose primary source of income was dependent on areas acquired for the Project, but do not own property in those areas and are not normally residing in those areas. Their eligibility status will be determined through (i) socioeconomic survey records, and (ii) an affidavit confirming their status jointly signed by the PAP, his/her employer, and a member of the the Union Parishad (an elected body) of the respective village.

3. Entitlement Package

(a) Loss of Farm Land

9. All PAPs affected by loss of farm land are entitled to a monetary package adequate to buy an equal area of replacement land. This package includes, in addition to the compensation under the Land Acquisition Law, a cash grant to meet the difference between the compensation and the replacement value of an equivalent area of land. However, PAPs whose per capita holding was less than 600 square meters (sq m) before acquisition can use the credit facilities arranged by JMBA to increase their per capita holding (inclusive of residual land) up to 600 sq m. This concession is specifically intended to give PAPs at the low end of the economy a stronger resource base (according to the psychoeconomic survey, the mean average landholding in the Project area is approximately 480 sq m). PAPs who lose land are also eligible for an additional credit, up to 50 per cent of the total compensation for purchase of land. This facility is primarily to safeguard PAPs who are, for various reasons such as the need to repay debts, unable to put in their share of money (compensation money received earlier). Commercial interest rates will be charged to discourage misuse of the credit facilities. This facility, however, will not be available to PAPs whose per capita residual holding is more than 1,320 sq m.

(b) Loss of Homestead

10. All PAPs who have lost their normal place of residence (land and structure owned or otherwise occupied) to Project works are entitled to equivalent replacement homestead land. Such PAPs will not be removed from their place of residence until a replacement homestead is provided for by themselves or by JMBA in a resettlement site. Households that lose 100 sq m or more of homestead land are eligible for a cash grant adequate to make up the difference between the compensation and the replacement cost of an equal area of homestead or, if they fail to acquire a homestead before the specified date, for a plot of approximately equal area (subject to a maximum of 300 sq m) at a resettlement site. The plots at the resettlement site will be valued at the same price as the replacement homestead land. Households that owned less than 100 sq m of homestead and lose all or most of the area will be provided with a minimum homestead of 100 sq m, either through private land purchase or at the resettlement site. The difference between the total compensation money received for homestead and the cost of replacement homestead plot of 100 sq m will be considered as a grant. Households that do not own a homestead but lose their place of residence (uthulis and squatters) will be given a homestead plot of 100 sq m either through purchase of private land or at the resettlement site. In case of private land purchase, the PAP will receive a cash grant equal to the predetermined replacement value of a 100 sq m homestead plot. The cash grant, however, is made only against purchase of a plot.

(c) Loss of Residential and Commercial Structures

11. PAPs affected by loss of residential structures are entitled to a transfer and house construction grant of Tk 7,000. This will be paid in two installments: Tk 2,000 at the time of

relocation, and Tk 5,000 after the PAP has identified a homestead and has left the Project area. PAPs are allowed to take all salvageable materials from their old structure(s). In the case of commercial buildings, the scale of assistance is (i) dismantling and removal assistance equal to 15 per cent of the compensation under the law; and (ii) a building construction grant of Tk 25 per sq ft of floor area. PAPs who are displaced from a rented/occupied commercial premise are entitled to a moving/transfer grant of Tk 2,000.

(d) Loss of Rented Land, Shared Cropped Farm, Wage Labor or Employment

12. Persons affected by such losses are entitled to a one-time maintenance grant of Tk 3,600 and to vocational training at Project cost. After the vocational training, they will be helped to find employment or to obtain institutional credit for starting a suitable production or service activity. Alternatively, these PAPs are entitled to 600 sq m of land, the cost of which is considered equivalent to the cost of vocational training. Landless tenant farmers and farm laborers residing within areas acquired for the Project will be offered, as an alternative option, a cash grant adequate to buy 600 sq m of land. The cost of 600 sq m land is considered equal to the cost of vocational training. This grant will be paid only against purchase of land.

E. Implementation Strategy

1. Entitlement Data Management System

13. Before the present entitlement policy can be applied, it is necessary to determine who the entitled people are and what they are entitled to. The records available for determining this matter are limited to the PAP households surveyed by BRAC and the land acquisition records. Reconciling these two sets of information is a major task. That more than one person in a household may be eligible for one or more entitlement under the resettlement policy makes this all the more difficult. For efficient management of information related to entitlement, a fully computerized data management system will be developed. The system will have two basic components.

(i) For each household, all information required for implementing the entitlement, monitoring and subsequent evaluation will be maintained at JMBA-Resettlement Unit (RU), with offices at the headquarters and in the field. The information will also be used to produce individual household file and identification (ID) cards, and periodic monitoring reports. The computer facility and the programs will be designed and managed by consultants appointed by JMBA. The data and program currently available with BRAC will be transferred to the computer facility at JMBA-RU. A fully operational facility has been established. The Special Land Acquisition Office attached to JMBA will draw out all relevant land acquisition information associated with the Project from records available at the Deputy Commissioner's (DCs) office. The Special Land Acquisition Office will reorganize the data according to the requirements of auditors and the computer data processing needs. The reconciliation of information from BRAC and DC's office has been completed.

(ii) Household file and ID cards will be prepared for each household. This will have details of loss and entitlement, and other basic information regarding the family's resettlement. The information will be periodically updated to reflect the progress of implementing the entitlement package,

and the updated information will be passed on to the central computer facilities. Field workers will be trained to prepare and maintain the household files. Copies of the files will be maintained at the field RU.

14. A fully operational household file and ID card system is in place for the affected households who will be removed in 1994. The system will be integrated with the overall management information system for resettlement.

2. Information Campaign

15. The resettlement program will start with a public campaign to explain the resettlement policy and plan to PAPs, and to solicit their cooperation.

(i) JMBA has produced a booklet explaining the resettlement entitlement policy, procedures and program in simple language, and has distributed it widely in the areas affected by the east bridge facilities. The booklet will also explain what the PAPs are expected to do to avail of their entitlement. PAPs will also be asked to register with the RU-East. VRWs will hold meetings in affected villages to explain the policy and plan to PAPs.

(ii) GRC and/or VRWs attached to RU-East held a series of meetings in the affected villages to explain the resettlement program and to answer queries regarding the program between 15 December 1993 and 31 January 1994.

(iii) About 60 VRWs have been recruited by a NGO associated with the Project for implementing the resettlement program, and will be trained in resettlement-related activities They will contact every affected household to provide information regarding specific entitlements to each household, to distribute household files and ID cards, and to verify the correctness of information contained in the household files.

(iv) Each affected household will be given a household file and ID card and a separate ID card for each person entitled to compensation. The individual ID cards contain details of the individual's specific entitlement.

(v) JMBA will seek the assistance of village leaders, religious leaders and other influential persons to solicit participation of the PAPs.

3. Making Replacement Farm and Homestead Lands Available

16. PAPs will be provided with financial assistance to purchase replacement farm and homestead lands of their choice. Field RUs and NGOs will facilitate this process by providing all necessary institutional support to PAPs.

4. Replacement Value

17. The prevailing realistic market price for three or four standard types of farm and/or homestead land will be determined through a land market survey. Based on the findings of the survey, the statistical mean average price of double cropped paddy land will be determined and this value will be used as maximum allowable replacement value by JMBA. A PAP can opt for a larger area of lower priced land or smaller area of a higher priced land. This maximum

allowable replacement land value for each affected subdistrict will be fixed by JMBA. The price so determined will be applicable only to PAPs affected by the east bridge end facilities. Replacement values for other phases will be determined at a later stage.

5. Identification of Replacement Land

18. Two measures are proposed for speedy identification of replacement farm and homestead lands.

(a) Identification by PAPs

19. PAPs will be asked, through an information campaign, to identify lands of their choice and to enter into provisional agreements with willing landowners. The present schedule provides for PAPs to convey the details of the land they have identified to RU-East (i) by 28 February 1994 for homestead land, and (ii) by 30 September 1994 for farmland.

(b) Encouraging Landowners

20. DC and local political leaders will visit possible host villages and will encourage land owners to sell lands to PAPs at reasonable rates and to accept them as settlers. Information gathered through this meeting (names of villages, available lands, names of prospective sellers, etc.) will be conveyed to PAPs through field RUs. The RU-East will use all possible formal and informal communication channels to transfer information and to bring PAPs and prospective sellers together, including (i) periodic posting of information on available lands at public places in affected areas, (ii) public announcements after Friday prayer gatherings, and (iii) regular village visits by VRWs.

6. Procedures for Payment of Privately Purchased Lands

21. The money for the replacement farm and homestead lands comes from three sources:

(i) Compensation under the law (awarded under the old or revised land acquisition laws) has already been wholly or partly paid in most cases. This amount is the PAP's share of the cost of replacement land. The PAPs are expected to make a down payment of this amount when the land is purchased.

(ii) Additional cash grant, to cover the difference between compensation and the official price fixed for the replacement farm or homestead land, will be made available by JMBA at the time of purchase. The grant is paid only against purchase of land.

(iii) Institutional credit will cover (a) up to 50 per cent (or 75 per cent for homestead land) of the total compensation received by a PAP who is unable to place the down payment, and (b) the cost of purchasing additional land required a PAP's total per capita farmland up to 600 sq m. The Krishi Bank or any other financial institution designated by the Government will make this commercial credit available to the PAP at the time of land purchase.

22. Efficient management of the land purchase strategy will require (i) assessing each entitlement of each PAP (compensation down payment, cash grant and two credit components); (ii) developing an efficient money transfer system to the seller of replacement land after verifying and certifying the transaction; (iii) finalizing an agreement between JMBA and the Government and designated financial institutions for making credit available to PAPs; and (iv) making the collateral funds available to the financial institutions. Computerized PAP household files and ID cards will have, among other things, exact information on the amount of funds a person is entitled to from the different sources and the amount of down payment needed before other payments can be received. Copies of this household file will be given to the credit institutions and PAPs. The PAP will be asked to open an escrow account at a designated financial institution and to deposit at least 50 per cent of the compensation money in the account (compensation due to the PAP will be deposited directly to this account). JMBA will credit the additional grant due to the PAP to this account immediately after the PAP deposits at least 50 per cent of the compensation money. The loan applications for the amount eligible to the PAP will then be processed and the amount will be transferred to the account. The money will be released to the land seller after JMBA certifies the land transaction between the PAP and the land seller. The schedule for completing these activities for the east bridge end is:

(i) opening of escrow accounts by PAPs by 15 February 1994;
(ii) transferring of additional grants to escrow accounts by JMBA by 28 February 1994; and
(iii) processing and sanctioning of loans by banks by 31 March 1994.

23. The JMBA has already entered into a formal contractual agreement with the Krishi Bank and other suitable financial institutions in the area to provide loans to the PAPs for purchase of land. The agreement covers, among other things, the financial aspects of the manpower and logistical requirements for administering large number of loans within short time span. In addition, JMBA will transfer an amount to the Krishi Bank (and other designated banks) as the collateral for loans to PAPs by 28 February 1994. These schedules are being followed satisfactorily.

7. Land Transaction: Verification and Registration

24. As soon as a land deal is provisionally finalized between the PAP and land seller, the land revenue officer attached to GRC may be requested to assist and verify all legal requirements regarding ownership rights, encumbrances, measurements and other matters related to the land. The officer will also advise the PAP whether the price agreed is reasonable when compared with the predetermined market price. The land revenue officer will accordingly approve the deal or, in the event of legal ambiguities, advise the PAP to identify another parcel of land. Any dispute arising out of this procedure will be brought to the GRC for adjudication.

8. Additional Measures

25. In principle, JMBA cannot guarantee to provide replacement land to PAPs affected by loss of farmland, but only to provide financial and institutional assistance to purchase land from the private market. However, JMBA will take the following measures to ensure effective implementation of this measure:

(i) Several GRCs will be formed for affected areas. The three-member committees will include representatives of JMBA, implementing NGOs, and the Union (a locally elected body). Decisions will be made through majority vote. GRCs have already been established.

(ii) To facilitate speedy registration of the large number of land transactions, a special land registration cell has been established in the Project area to deal exclusively with land transactions associated with the resettlement program. The cell may set up field camps if found necessary.

(iii) Some flexibility in "equal area" of replacement land will be allowed so that PAPs can buy slightly more or less (approximately 10 per cent variation) than the area of the land they are entitled to.

(iv) If the replacement value set through the market survey is found unrealistic during the implementation of the program, it will be revised by JMBA.

(v) A PAP household that is found unable to make the 50 per cent of compensation (75 per cent in the case of homestead land) as down payment for purchase of land, may be given additional credit as an exception. Such cases will be examined by the GRC and decided on a case by case basis.

(vi) If an affected household, which is entirely dependent on agriculture before acquisition (households with a per capita holding of 1,320 sq m or more) for some reason is unable to purchase private land, JMBA will make all efforts to provide such families with equivalent land. Part of the land that will become surplus after the completion of Project works will be reserved for this purpose.

(vii) Additional community facilities will be provided in host villages in order to stimulate integration and goodwill between settlers and host communities. The scale and nature of such facilities will be determined after taking into account the common needs of both settler and host communities and will be proportionate to the amount of land made available to the settlers by a particular host community.

(viii) A part (approximately 8 ha) of the land acquired for resettlement site on the eastern side of the river under the earlier resettlement plan will be developed to make plots available to households that are unable to purchase homestead plots elsewhere; households that are currently living on this land will not be displaced. Standard plots of 100 sq m and 150 sq m will be developed at this site and PAPs will be allotted one or more plots depending on their eligibility. Basic community facilities will be provided at the site (e.g., drinking water, access roads, and other facilities depending on the need). The proposed schedule for developing the resettlement site is progressing satisfactorily:

Layout design for the resettlement site	-	31 January 1994
Assessment of plot requirements	-	28 February 1994
Development and allotment of the plots	-	15 March 1994
Relocation and community facilities	-	1 April-31 May 1994

9. Evaluation and Relocation

26. All people living in the east bridge end area need to be evacuated by the end of March 1994 in order to make the land available for the contractors by 1 April 1994. This will put

considerable pressure on both JMBA-RUs as well as the PAPs. JMBA will have to ensure that all PAPs that will lose their houses are able to find an alternative location. The following incentives are proposed to encourage PAP households to vacate the lands:

(i) PAPs will be allowed to take away all salvageable materials of their houses and other structures free of cost. The Government will issue necessary administrative orders by 31 October 1993 (complied with).

(ii) PAPs will be given a lump sum grant of Tk 2,000 towards dismantling and transportation costs. This grant is paid only after the PAPs have vacated the affected areas.

(iii) Each PAP who loses his or her house will be given a house building assistance of Tk 5,000. This grant is conditional on the PAP (a) vacating the affected areas by the stipulated date; and (b) purchaseing a homestead plot or accepting one provided by JMBA.

27. If the 1 April 1994 deadline is missed, JMBA can decide to extend the deadline to PAPs who lose their homesteads and/or allow them to resettle at a resettlement site. If there are still homestead failures by the final deadline of 1 September 1994, remaining PAPs will only be forcibly evicted if alternative homesteads are provided by the JMBA at the resettlement site.

E. Redressing Grievances

28. Grievances and disputes that arise during implementation will be addressed through the following formal mechanisms:

1. Preliminary Verification

29. A preliminary list of PAPs and their entitlement will be prepared on the basis of land acquisition records and BRAC survey records. The ID cards will be based on the same records. When the ID cards are distributed, PAPs will be asked to bring any discrepancies contained in their ID cards to the notice of RU-East within 15 days through VRWs. Persons who feel that they have been wrongly excluded from the list of PAPs and hence have not received ID cards will be asked during the information campaign to bring their complaints to RU-East within 15 days. They will also be asked to submit relevant records as proof of their claims. The types of proof required to be submitted will include:

(i) copies of title deeds (khatian), compensation awards or mortgage deeds in the case of disputes related to legally-owned land;

(ii) in case of shared cropped or rented land, documentary evidence of the understanding between landowner and the tenant if there are any, otherwise an affidavit signed by the landowner and the tenant;

(iii) rent receipts in case of rented commercial premises;

(iv) for place of residence (in the case of squatters and uthulis), a voters list or official membership records with a cooperative or with Grameen Bank;

(v) in case of the wage employment, wage records or an affidavit signed by the employee and the employer.

The RU will review and verify the claims or complaints on the basis of existing records (BRAC survey, land acquisition records and the proofs submitted in support of the claim). If the RU is unable to decide or if the PAP is not satisfied with its decision, the case will be referred to GRC for further review.

2. Grievance Redressal Committee

30. The GRC will act, apart from providing the necessary institutional assistance at the village level, as a dispute or grievance resolving body. The Land Purchase Committee will have a member each representing JMBA, NGO and the Union Parishad. Two representatives of PAPs will be invited as observers. A revenue officer of the rank equivalent to Thana Revenue Officer (attached to JMBA) will provide technical assistance to GRC on matters related to acquisition, compensation and other land-related matters. The GRC will review cases referred to it by RU-East in the light of evidence submitted and will then hold a hearing of the case, normally in the village, within 15 days. The GRC will also consult village elders while taking a decision on matters referred to it. Under normal circumstances the decision of the GRC will be final and binding on all parties. An affected person who is still dissatisfied with decision may appeal to the regular institutions entrusted with grievance redressal, such as the DC's office or the court of law.

F. Vocational Training

1. Target Groups

31. In general, PAPs who do not have definite means of livelihood are eligible for vocational training; however, the program will be more specifically aimed at individuals and households who are landless and who were earlier dependent on wage labor or tenant farming/sharecropping, but may not be able to continue the same activity after relocation. Special focus groups will be women, educated youths and traditional artisans. Training in these skills will be mainly organized at existing training facilities such as industrial training institutes, existing workshops, or through informal apprenticeship with master mechanics. The target groups will be young with the required basic level of education and will be aimed at:

(i) upgrading of existing skills, which is targeted primarily at people who are currently engaged in a similar activity, many of whom will be women;

(ii) supplementary income generating activities, which are specifically aimed to provide additional income to the household and are not expected to provide full time employment; and

(iii) skills that are aimed at improving general quality of life and are not expected to bring direct economic benefits but can have significant impact on the life of PAPs.

2. Overall Management of the Program

32. The entire vocational training package will be contracted out to NGOs who have the experience and capacity to organize and to manage large-scale vocational training programs. The contracted NGOs are responsible for designing specific training modules, selecting the eligible trainees, and organizing and managing the training program according to a time schedule and budget agreed with JMBA. They are also responsible to liaise with credit institutions, arrange loans and develop tie-ups for supply of inputs and marketing.

3. Actions and Decisions by JMBA

33. The JMBA is expected to reach a contract agreement with selected NGO(s) on organization and management of vocational training program by 31 January 1994. The administrative and financial approval of the training modules and implementation plan is expected to be prepared by NGO(s) by March 1994. The Memorandum of Understanding with credit institutions to make loans available to the trained PAPs on priority basis is expected to be signed by 30 April 1994.

34. Apart from the preparation of the Revised Resettlement Action Plan, many actions have been taken simultaneously, such as recruiting staff for the RU, selecting agencies for audit, surveying the land market, reviewing resettlement sites, reviewing bridge end facilities, and updating the socioeconomic survey.

35. As a general approach, the JMBA RU proposes to contract work to NGOs and other organizations that are suited for these specific tasks. A participatory approach involving consultation with affected persons is envisaged in developing the resettlement sites. The process has begun and will be implemented by the RU according to the schedule indicated in paras. 19, 22, 23 and 25. During December 1993 and January 1994, the VRWs attached to the RU held a series of meetings in the affected villages to explain the resettlement program and to answer people's queries regarding the program.

ECONOMIC EVALUATION

A. Introduction

1. A detailed discussion of the Project's economic evaluation is presented in a background paper entitled "Jamuna Bridge Project - Economic Evaluation". The paper was jointly prepared by the project economists of the Bank and the World Bank for the Project, and the analysis and findings presented in it reflect the consensus on the Project's economic evaluation of the Bank, the World Bank and OECF. This Appendix is essentially an abstract of this background Paper.[1]

B. Present Traffic and Traffic Projection

2. Table 1 presents data on traffic crossing the Jamuna River by ferry over the period FY 1985/86-FY1992/93. The ferry routes on the Jamuna Bridge Corridor are the Aricha-Nagarbari (A-N) and Bhuapur-Sirajganj (B-S), which carry the northwest-east traffic as the bridge would do. Past traffic data show that the annual average growth rate of traffic on the bridge corridor is about 7.5 per cent.

1. Normal Traffic Projection

3. Only the road traffic now crossing the A-N and B-S ferry routes are considered the base traffic for traffic projections on the proposed bridge. Traffic diverted from rail, launches and barges, and road traffic from/to the southwest are not taken into account in the bridge traffic, as previous studies have shown that such diversion may not be significant.

4. On the basis of past traffic growth trends on the bridge corridor, normal traffic growth between 1993 and the bridge opening year of 1998 has been projected. This traffic growth projection is in line with the traffic forecast based on income elasticity of demand for transport services. Taking the past traffic growth trends and population and income growth into account, the traffic growth rates between 1993 and 1998 were projected at annual growth rates of 8.2 per cent for light vehicles and 6.6 per cent for buses and trucks. Necessary adjustments were then made to the projected 1998 traffic. After the planned opening of the bridge in 1998, a 5 per cent annual growth is assumed from 1998 to 2025, after which the traffic was assumed frozen for the remaining life of the Project.

2. Induced Traffic Projection

5. Induced traffic was projected using the concept of arc price elasticity of demand, where the "price" here refers to users' perceived cost of crossing the river. The price elasticities of demand for transport assumed in the projection were -1.0, -1.5 and -0.6 for light vehicles, buses, and trucks, respectively.

6. The following method was used for projection; taking the 1998 normal traffic estimates as the basis, the additional traffic is generated (induced) because of the reduction in users' perceived costs attained by the construction of the bridge or the improvements in the ferry system.

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[1] This Background Paper is in the Project files.

(Reference in text: page 25, para. 85)

Table 1: FERRY TRAFFIC DATA ON JAMUNA BRIDGE CORRIDOR (number of vehicles)

Vehicle Type/Route	1985/86	1989/90	1990/91	1991/92	1992/93	Annual Growth rate in %
Light Vehicles						
Aricha–Nagarbari	61	114	113	120	138	
Aricha–Daulatdia	87	122	116	124	122	
Bhuapur–Sirajganj	13	11	10	6	5	
Subtotal	**161**	**247**	**239**	**250**	**265**	**7.4%**
Buses						
Aricha–Nagarbari	167	199	212	217	270	
Aricha–Daulatdia	95	113	108	119	131	
Bhuapur–Sirajganj	3	4	1	1	3	
Subtotal	**265**	**316**	**321**	**337**	**404**	**6.2%**
Trucks						
Aricha–Nagarbari	317	521	551	541	648	
Aricha–Daulatdia	261	394	389	450	466	
Bhuapur–Sirajganj	111	114	115	68	54	
Subtotal	**689**	**1029**	**1055**	**1059**	**1168**	**7.8%**
Total Vehicles						
Aricha–Nagarbari	545	834	876	878	1056	
Aricha–Daulatdia	443	629	613	693	719	
Bhuapur–Sirajganj	127	129	126	75	62	
GRAND TOTAL	**1115**	**1592**	**1615**	**1646**	**1837**	**7.4%**
JAMUNA BRIDGE CORRIDOR (A–N + B–S)						
Light Vehicles	74	125	123	126	143	**9.9%**
Buses	170	203	213	218	273	**7.0%**
Trucks	428	635	666	609	702	**7.3%**
Total	**672**	**963**	**1002**	**953**	**1118**	**7.5%**

A–N: Aricha–Nagarbari
B–S: Bhuapur–Sirajganj

7. It was assumed that the expected induced traffic would require approximately eight years to build up. Therefore, the base year (1998) total induced traffic for all three types of vehicles was spread over the period between mid-1998 and 2005, starting with 20 per cent of the total volume, increasing to 40 per cent, 50 per cent, 60 per cent, 70 per cent, 80 per cent, 90 per cent and finally 100 per cent. A natural annual growth of 5 per cent was assumed for this traffic up to 2025, after which the traffic growth was kept constant up to the end of the Project's economic life.

3. Total Traffic Projection

8. The detailed traffic projections on the bridge are presented in Table 2. The traffic projection in annual average daily traffic shows that the 1998 traffic level will double over eight years, with an average compounded growth rate of about 8 per cent including normal and induced traffic. This level of traffic projection is modest, considering the major reduction in transport costs, the present transport uncertainties and the likely structural economic change that may follow.

Table 2: TRAFFIC PROJECTIONS (1993–2030)

	Trucks			Buses			Light Vehicles			Grand Total			Growth
	Normal	Induced	Total	Normal	Induced	Total	Normal	Induced	Total	Normal	Induced	Total	Rate
1993 a/	770			271			140					1181	
1998	988.00	105.40	1,093.40	314.00	26.20	340.20	176.00	20.40	196.40	1,478.00	152.00	1,630.00	–
1999	1,037.40	216.07	1,253.47	329.70	53.71	383.41	184.80	41.82	226.62	1,551.90	311.60	1,863.50	14.33%
2000	1,089.27	274.30	1,363.57	346.19	68.19	414.37	194.04	53.09	247.13	1,629.50	395.58	2,025.08	8.67%
2001	1,143.73	329.92	1,473.65	363.49	82.01	445.50	203.74	63.85	267.60	1,710.97	475.78	2,186.75	7.98%
2002	1,200.92	385.40	1,586.32	381.67	95.80	477.47	213.93	74.59	288.52	1,796.52	555.79	2,352.31	7.57%
2003	1,260.97	440.87	1,701.84	400.75	109.59	510.34	224.63	85.33	309.96	1,886.34	635.79	2,522.13	7.22%
2004	1,324.01	496.34	1,820.36	420.79	123.38	544.17	235.86	96.07	331.92	1,980.66	715.79	2,696.45	6.91%
2005	1,390.22	551.82	1,942.03	441.83	137.17	579.00	247.65	106.80	354.45	2,079.69	795.79	2,875.48	6.64%
2006	1,459.73	579.41	2,039.13	463.92	144.03	607.95	260.03	112.14	372.18	2,183.68	835.58	3,019.26	5.00%
2007	1,532.71	608.38	2,141.09	487.12	151.23	638.35	273.03	117.75	390.78	2,292.86	877.36	3,170.22	5.00%
2008	1,609.35	638.80	2,248.15	511.47	158.79	670.26	286.69	123.64	410.32	2,407.51	921.23	3,328.73	5.00%
2025	3,688.65	1,464.14	5,152.79	1,172.31	363.95	1,536.26	657.09	283.38	940.47	5,518.05	2,111.47	7,629.51	5.00%
2030	3,688.65	1,464.14	5,152.79	1,172.31	363.95	1,536.26	657.09	283.38	940.47	5,518.05	2,111.47	7,629.51	0.00%

Projected Traffic Growth Rates

	Trucks	Buses	Light Vehicle
1986–93 (Actual)	0.073	0.070	0.098
1993–1997	0.066	0.066	0.082
1998–2025	0.050	0.050	0.050
2026–2048	0.000	0.000	0.000

Base (1998) total Induced traffic

Trucks	527
Buses	131
Light Vehicles	102

1998's induced traffic are spread over a period of 8 years at 20%,40%,50%,60%,70%,80%,90% and 100%.

a/ 1993 traffic figures include + 10% correction to truck traffic reported by BIWTC.
It is assumed that only 50% of Pabna traffic will remain with current ferry after 1998.

C. The Improved Ferry Scenario

9. Assuming that the Jamuna bridge is not constructed, a complete restructuring of the ferry system needs to take place to meet the current and future demand for river crossing trips. The new system should have enough capacity to carry the expected traffic flows, adequate operation and maintenance (O&M) capabilities to provide customers with uninterrupted and high quality services, good and reliable shore facilities for fast loading and unloading, safe waterways with proper dredging and navigational markings for day and night operations, and dedicated management to handle ferry operations and maintenance adequately. The improved ferry capital, O&M costs included in this economic evaluation were based on results of the previous studies. These financial costs are converted into economic costs in the same manner as with the bridge Project cost.

10. A typical Jamuna ferry terminal would require the construction of a vehicle marshaling yard, with parking and service areas, bus station and miscellaneous buildings, plus river training works. Aricha and Nagarbari would be relocated to a more secure site, and Bhuapur and Sirajganj would remain at the proposed Jamuna bridge location. The required investment in these four terminals, including river training, totals $406.32 million.

11. The ferry channels would have to be widened and their number increased, but difficulties from frequent shifting of channels caused by the river's turbulence would continue. The Bhuapur-Sirajganj crossing would have to be deepened before the beginning of the improved system's operation to accommodate ferries. The required investment is estimated at $8.0 million. Since the Aricha-Nagarbari crossing cannot handle more than 12 ferries safely at the same time, two separate navigation channels parallel to the existing one would have to be dredged, one starting in 1999 and the other in 2016, to handle the increased number of ferries expected on that route. The cost of digging each one of these channels was estimated at $17.6 million. It is also estimated that an annual expenditure of $10 million in dredging would be required to maintain the navigability of the channels. In addition, there would be additional costs for acquiring new ferries.

12. All the above mentioned capital, O&M costs were considered to be incremental to those of the current system. As such, they were integrally considered as project costs in the comparison between the improved and the current ferry system, and as benefits to the bridge in the incremental analysis.

D. Generalized Transport Costs and Benefits

13. It was assumed that implementation of the improved ferry system would significantly reduce the generalized costs of east-northwest inter-regional trips, generating additional surplus for current users and increasing the demand for river crossing services. Nevertheless, given the inherent characteristics of a ferry system, such as the requirement for intensive management, unavoidable waiting times and vulnerability to weather conditions, it was expected that the bridge would further reduce these generalized costs, increasing society's welfare level to a higher extent.

14. Assessing these benefits involves calculating the economic and users' perceived costs of trips across the Jamuna under the current situation, the improved ferry scenario and the bridge scenario, for both passengers and freight. Users' perceived costs in this system include financial operating costs of road-bound vehicles, ferry fares, bridge tolls and users' perceived value of time. Even though these may not represent the actual costs to the economy as a whole, they are the costs the users pay for, and consequently the ones on which they base their decisions. The economic costs in this analysis include economic O&M costs of the road-bound vehicles, the ferries and the bridge, as well as the social valuation of time-related costs for individuals and freight.

15. Vehicle operating costs can be divided into distance-related and time-related items. Long waiting times during a trip imply nonproductive use of the vehicles, the need for a larger fleet to produce a fixed amount of ton-km or passenger-km, and consequently higher time-related transport costs per unit carried, which are reflected in the high prices to the users. Reductions in waiting time allow for a more efficient use of the fleet, resulting in lower system economic costs, and eventually in lower prices to the users.

16. The assessment of the impacts of savings in vehicle operating costs due to the improvements in the ferry system and the construction of the bridge were based on the unit distance-related and time-related costs presented in Table 3, which were estimated considering the parameters and prices used for the Nalka-Bonpara Road Feasibility Study done recently in Bangladesh.

17. The toll to be charged for each category of vehicle to cross the bridge is assumed to be set equal to the current tariffs these vehicles would be charged in using the ferry. These tolls are sufficient to cover the bridge's economic O&M costs, and will generate additional revenue for debt servicing and repayment.

18. The economic and users' perceived value of the time saved on passengers trips were estimated based on the individuals' hourly income. This analysis assumes that business travelers' time is valued at 110 per cent of their hourly income, the time of the remaining economically active passengers at 50 per cent of their hourly income, and non-business travelers' time at 25 per cent of their hourly income. The hourly income for each one of these three groups was estimated according to the data available in the report of the Bangladesh Household Survey for 1985-86 and updated to 1993 prices level by both the consumer price index factor and by the annual growth rate of 1.7 per cent of per capita GDP, observed

between 1986 and 1993. The estimates of the value of time were obtained by assuming the proportion of individuals traveling for business, work-related, and nonbusiness purposes to be 26 per cent, 48 per cent and 26 per cent, respectively. This distribution was kept unchanged during the Project life. The results of these calculations represent the users' perceived value of time. The results used in the evaluation are presented in Table 4.

19. The time savings for trucks are reflected in items such as reduction in inventory costs, losses and damages. Given the unavailability of recent data to evaluate these indirect time-related costs, both the improved ferry and the bridge alternative economic and users' perceived costs were increased by 10 per cent to account for such effects.

E. Vehicle Waiting Time and Ferry Crossing Time

20. It is generally acknowledged that long truck waiting time at the ferry crossing points (particularly at Aricha and Nagarbari) is a major traffic bottleneck, increasing freight transport cost and creating uncertainty about delivery times. Many recent surveys have shown very high average waiting times. The RPT feasibility study in 1988 and an IDA fact- finding team in 1991 indicated an average truck waiting time of about 40 hours. Two independent traffic surveys conducted during April and July 1993 organized by the Transport Survey Wing of the Planning Commission under the UN-sponsored Bangladesh Transport Sector Study, also indicated waiting time in the range of 30-40 hours. Spot checks and extensive driver interviews by a World Bank team in June 1993, and by a Bank/OECF team in September 1993 confirmed the average waiting time of 30-40 hours.

21. In light of these surveys and studies, the economic analysis for the bridge Project conservatively assumes, in the absence of the bridge or improved ferry, a 36-hour average waiting time for trucks in the bridge-opening year of 1998. The waiting time for trucks would increase by 25 per cent (6 hours) from 2001 in the do-nothing situation, since the existing ferry system has already reached its physical limit of capacity. With regard to buses and light vehicles, because of the preferential queuing system, their waiting time for ferry crossing is assumed to be one hour under the existing ferry system.

22. The average operating time of a ferry during one trip is also conservatively assumed to be 2.5 hours, which includes berthing, loading and unloading, as well as crossing time. This operating time is assumed to apply to all types of vehicles and to remain unchanged under the improved ferry scenario.

23. Crossing the river on the Project bridge is assumed to entail no waiting time for all vehicles. Under the improved ferry scenario, however, a certain amount of waiting time will remain, because an improved ferry system will still be subject to the vagaries of weather and changes in the depth of crossing channels. It is assumed that 4 hours of average waiting time will remain for trucks, while average waiting time for buses and light vehicles will stay constant at one hour.

F. Benefits Estimation

24. The main benefits accrue to the Jamuna Bridge Project from its potential to reduce the generalized transportation costs for current and potential users of the existing system. Benefits also occurs from the significant reduction of investment required to provide the East-Northwest power interconnector, and from reduction of construction and maintenance required to protect the river bank in the vicinity of the bridge.

Table 3: Vehicle Operating Costs

	Light Vehicle		Bus		Truck	
	Financial	Economic	Financial	Economic	Financial	Economic
	(Taka in 1993 prices)					
Fuel	32175	22187	164703	118205	192848	13840
Oil	2195	2000	6966	6347	8708	793
Tire	5998	3523	29700	20917	44172	3021
Service/repair	23901	14340	272344	169841	157314	9823
Wages	0	0	94164	70455	74382	5833
Overhead	21850	11180	13800	12010	80500	7004
Depreciation	91350	38780	171150	94963	109390	8041
Interest	182017	77270	305126	169299	217962	16021
Total	359486	169280	1057953	662037	885276	64379
Total distance-related costs	109944	61440	559288	362791	457737	31499
Distance costs per km	4.23	2.36	12.71	8.25	8.32	5.7
Distance costs per pax km	2.11	1.18	0.26	0.17	0	
Distance costs per ton km	0	0	0	0	1.66	1.1
Total time-related costs	249542	107840	498665	299245	427539	32880
Time costs per hour	499.08	215.68	283.33	170.03	171.02	131.5
Time costs per pax hour	249.54	107.84	5.78	3.47	0	
Time costs per ton hour	0	0	0	0	34.2	26.3
Time costs per pax km	4.8	2.07	0.23	0.14	0	
Time costs per ton km	0	0	0	0	1.55	1.2

Table 4: Passengers Value of Time

Passengers	Average Hourly Income	Mark-up	Proportion	Shadow Price	Value (Tk/hour) Financial	Economic
By Light vehicle						
business	68.68	1.10	0.26	0.89	19.64	17.48
commuting	68.68	0.50	0.48	0.89	16.48	14.67
other	68.68	0.25	0.26	0.89	4.46	3.97
Total					**40.59**	**36.12**
By Bus, launch, foot						
business	28.63	1.10	0.26	0.89	8.19	7.29
commuting	24.08	0.50	0.48	0.89	5.78	5.14
other	24.08	0.25	0.26	0.89	1.57	1.39
Total					**15.53**	**13.82**

1. Traffic Benefits

25. The economic benefits for the full benefit analysis were estimated based on the difference between the total annual economic costs of the "without" and "with" project situations, where the latter refers to either the improved ferry system or the bridge. These costs include vehicle economic operating costs, ferry economic costs, and shadow-priced time valuation for passengers and freight, and bridge O&M costs.

26. The benefits associated with the traffic generated from the growth in population and per capita GDP were obtained by multiplying the unit economic cost differential for each vehicle category by the corresponding diverted traffic. The benefits associated with the traffic induced by either improvements in the ferry system or bridge construction result from substantial reduction (in the case of the improved ferry) or elimination (in the case of the bridge) of waiting time and reduction of overall transport cost. The induced traffic benefits were obtained by multiplying the unit economic cost differential for each category of vehicle by half of the total induced traffic.

27. As the Project life (for economic evaluation purposes) is assumed to be 50 years, consistent with assumed traffic growth, the benefits associated with traffic growth are projected to grow from 1998 until 2025 at an annual rate of 5 per cent. After 2025, all values are kept constant up to the 50th year of Project life. Moreover, the benefits associated with induced traffic in the planned bridge-opening year of 1998 were spread over the period mid-1998 to 2005, according to the ratios of spread assumed for the induced traffic to buildup.

2. Energy Sector Benefits

28. If the bridge Project is not implemented, the Bangladesh Power Development Board would need to construct a second power interconnector across the Jamuna. This would be done to serve the country's grid for the additional power generation capacity that is to be constructed during the intervening time period. Based on the previous studies, the economic costs of constructing the interconnector on a stand-alone basis are estimated at $114.5 million at 1993 prices, and the construction would take three years. With the bridge, costs of carrying the power interconnector are reduced to $6.2 million, of which $4.6 million is already included in the bid price of the bridge contract for pylons and brackets. The costs difference of $112.9 million, as well as the $2.2 million annual savings in maintenance costs of a stand alone power interconnector (about 2 per cent of the capital cost), were credited to the Project as a part of the benefit in the economic analysis. As the bridge is to be completed in 1998, the economic analysis conservatively assumes that construction of the power interconnector on the bridge would start in 1998.

3. Environmental Benefits

29. The Project will generate agricultural and land use benefits, some of which are positive, some negative. The positive effects consist of increased agricultural production during the monsoon season and the prevention of embankment erosion in some areas in the vicinity of the proposed bridge. The negative effects consist of temporary effects during construction, backwater effects, decreased agricultural production in the floodplain upstream, decreased agricultural production during the dry season, increased costs of keeping the navigational channel open, loss in fishery production and resettlement costs. Some costs will be incurred

during the implementation phase, but once the project is opened to traffic the positive elements will outweigh the negative ones and leave a small annual surplus of $2 million, based on the estimate of RPT.

4. Bridge-related Road Investments/Benefits

30. A 52-km road section connecting Nalka, Hatikamrul and Bonpara is currently in the preliminary planning stage and still not funded. Road construction is planned to start in the beginning of 1995 and end in the beginning of 1998, matching the proposed bridge schedule. This road is required to secure some of the traffic-related benefits attributed to the bridge, but its potential to divert and generate traffic is too low to justify the required investment economically if the bridge is not constructed. Therefore, its upgrading costs, as well as the consequent benefits, were attributed to the bridge Project as a benefit in the sensitivity analysis.

G. Economic Cost of the Bridge

31. The total economic cost of the Project was estimated at $626.6 million from the financial cost based on the June 1993 bid prices by applying a standard conversion factor of 0.89 to the local cost component and using border prices for foreign exchange costs. This total cost excludes price contingencies, taxes and duties, but includes physical contingencies, and bridge O&M costs. The implementation schedule starts in 1994 and finishes in mid-1998, and the annual distribution of economic cost based on the disbursement schedule of the Project is indicated in Table 5. All project related cost and benefit streams are expressed in mid-1993 prices.

Table 5: Jamuna Bridge Capital Costs ($ million)

Year	1994	1995	1996	1997	Total
Economic Capital Cost	258.63	236.71	121.51	9.80	626.65

H. Economic Return and Sensitivity Analysis

32. A summary of the economic evaluation result is presented in Table 6, and the details for the base case is shown in Table 7. Taking into account all the assumptions described above, the bridge Project presents an EIRR of 14.5 per cent when compared with the current ferry system (the base case); while the EIRR of the investment in the improved ferry project itself is 13.0 per cent, the incremental cost-benefit analysis of bridge versus improved ferry indicates an EIRR of 15.5 per cent.

Table 6: Economic Returns and Sensitivity Analyses - Summary EIRR (per cent)

Scenario	Base Case	Without Intercon.	With Link Road	Cost (+20%)	Traffic Benefit (-20%)	Cost (+20%) Benefit (-20%)
Bridge vs. Current Ferry	14.51	13.53	14.70	12.94	13.30	11.54
Improved Ferry vs. Current Ferry	13.01	-	-	11.70	11.04	9.91
Bridge vs. Improved Ferry	15.45	13.10	15.84	11.91	14.38	10.99

33. Sensitivity analyses on the economic viability of the Project were carried out by assuming various adverse scenarios. In the base case of bridge vs. current ferry, (i) a cost overrun of 20 per cent or a traffic benefit reduction of 20 per cent would reduce the EIRR of the bridge Project to 13.0 per cent; (ii) the EIRR would fall by one percentage point if the benefit of the power interconnector is excluded from the Project benefit stream; (iii) one year delay in completion of the bridge, i.e., the bridge opens to traffic in mid-1999, will reduce the EIRR to 14.0 per cent; and (iv) if the bridge tolls are set at twice the level as the current ferry tariffs (instead of the same as current tariffs assumed in the base case), the EIRR would go down to 14.1 per cent.

I. Nonquantifiable Economic Benefits

34. While the economic estimations show that the Jamuna bridge Project is economically viable, with an EIRR above 12 per cent, it should be emphasized that the economic impact in the present study is limited to the quantifiable economic benefits from road traffic and benefits of carrying the second power interconnector on the proposed bridge. The bridge Project also has many nonquantifiable economic benefits.

35. Since the river constitutes a major physical barrier dividing the country into two halves: east and northwest, the bridge would be a strategic link integrating the country and promoting more efficient inter-regional trade, as well as economic and social development of the country. The current high opportunity cost of freight traffic crossing the river has effectively created a "nontariff barrier" to trade crossing the river, incurring heavy economic "deadweight losses" to the economy on both sides of the river. Elimination of the "trade barrier" by constructing the bridge would lead to more efficient flows of goods and services within the country, and consequently would generate substantial consumer surpluses.

36. The northwest will greatly benefit from the bridge Project in both agriculture and industry. This region has fertile agricultural land with a higher average yield of major crops than the rest of the country, and it is supplying the eastern region with surplus agricultural products, despite the high transport cost of crossing the river. Construction of the bridge will substantially lower the overall transport cost of river crossing, which would stimulate agricultural production in the region. The positive effect of the bridge in the agriculture sector will be found not only in the increase of output but also in the increase of wages (of the farmers). The 1985/86 Labor Force Survey estimates show that the average daily wage of an agricultural laborer in the east, at Tk 31.50, is higher than the northwest's average daily wage of Tk 26.00. The increase of agricultural output in the northwestern region will raise the wage of the farmers in those areas and contribute to reducing the income gap between the east and the northwest. Moreover, once the bridge is built, there will be a more efficient flow of industrial products from the east supplying the northwest, such as steel, fertilizer and machinery. This will further promote the economic integration and growth of the two regions, and ultimately the economic and social advancement of the country.

37. Considering international trade with India, it is important to point out that Bangladesh will benefit from the Project because of easier access to imported commodities from India. At present, some of the imported materials from India cannot reach the east because of the physical division of the country by the Jamuna River. If the bridge is built, large quantities of imported materials from India will be transported to the eastern side, which will contribute to reducing the cost of industry. Further, if politically acceptable, Bangladesh will benefit by charging India for the transportation because India will also benefit from the bridge Project because of the more efficient transfer of their commodities from its eastern part (e.g., Assam) to Calcutta.

Table 7: Estimation of EIRR – Bridge vs Current Ferry

(Traffic benefits annual growth rate: 5%)

($ million)

Year	COSTS Bridge	BENEFITS: Ferry System Capital Costs	Dredging	Ferries	Direct Demand: Environ	Bus: Diverted	Bus: Induced	Light Vehicle: Diverted	Light Vehicle: Induced	Freight: Diverted	Freight: Induced	Other a/	Power Interconn.	Total	NET BENEFIT	SENSITIVITY ANALYSIS: Without Power Interconn.	With Road Link	Cost (+20%)	Traffic Benefit (−20%)	Cost (+20%) Benefit (−20%)
1994	258.63													0.00	−258.63	−258.63	−258.63	−310.36	−258.63	−310.36
1995	237.16													0.00	−237.16	−237.16	−237.16	−284.59	−237.16	−284.59
1996	121.96													0.00	−121.96	−121.96	−120.01	−146.35	−121.96	−146.35
1997	10.90													0.00	−10.90	−10.90	−8.96	−13.08	−10.90	−13.08
1998	7.03	0.00	2.00	10.00	−0.13	1.69	0.06	0.65	0.04	28.13	2.04	0.00	19.19	63.66	56.63	37.44	58.58	55.23	56.63	55.23
1999	2.69	0.00	2.00	0.00	2.00	3.46	0.17	1.33	0.13	57.66	6.21	0.00	73.39	146.35	143.66	70.27	145.60	143.66	129.87	129.87
2000	2.69	0.00	2.00	0.00	2.00	3.64	0.24	1.40	0.17	60.54	8.45	0.00	20.32	98.76	96.07	75.75	98.01	96.07	81.18	81.18
2001	3.99	0.00	2.00	0.00	2.00	3.82	0.30	1.47	0.21	63.57	10.60	9.80	2.21	95.98	91.99	89.77	93.93	91.99	75.99	75.99
2002	5.87	0.00	2.00	0.00	2.00	4.01	0.36	1.54	0.26	66.74	12.74	9.80	2.21	101.67	95.79	93.58	97.74	95.79	78.66	78.66
2003	4.59	0.00	2.00	0.00	2.00	4.21	0.42	1.62	0.30	70.08	14.88	9.80	2.21	107.53	102.93	100.72	104.88	102.93	84.63	84.63
2004	3.99	0.00	2.00	0.00	2.00	4.42	0.48	1.70	0.34	73.59	17.02	9.80	2.21	113.57	109.57	107.36	111.52	109.57	90.06	90.06
2005	4.15	0.00	2.00	0.00	2.00	4.64	0.59	1.79	0.43	77.26	21.20	9.80	2.21	121.93	117.78	115.57	119.73	117.78	96.60	96.60
2006	4.43	0.00	2.00	0.00	2.00	4.87	0.62	1.87	0.45	81.13	22.26	9.80	2.21	127.23	122.80	120.59	124.75	122.80	100.56	100.56
2007	5.62	0.00	2.00	0.00	2.00	5.12	0.65	1.97	0.47	85.18	23.37	9.80	2.21	132.79	127.17	124.96	129.11	127.17	103.81	103.81
2008	2.48	0.00	2.00	0.00	2.00	5.37	0.69	2.07	0.49	89.44	24.54	9.80	2.21	138.63	136.14	133.93	138.09	136.14	111.62	111.62
2009	1.58	0.00	2.00	0.00	2.00	5.64	0.72	2.17	0.52	93.92	25.77	9.80	2.21	144.76	143.18	140.97	145.12	143.18	117.43	117.43
2010	1.58	0.00	2.00	0.00	2.00	5.93	0.76	2.28	0.55	98.61	27.06	9.80	2.21	151.19	149.61	147.40	151.56	149.61	122.58	122.58
2011	2.88	0.00	2.00	0.00	2.00	6.22	0.80	2.39	0.57	103.54	28.41	9.80	2.21	157.95	155.07	152.86	157.02	155.07	126.69	126.69
2012	4.76	0.00	2.00	0.00	2.00	6.53	0.84	2.51	0.60	108.72	29.83	9.80	2.21	165.05	160.29	158.08	162.24	160.29	130.48	130.48
2013	3.48	0.00	2.00	0.00	2.00	6.86	0.88	2.64	0.63	114.16	31.32	9.80	2.21	172.50	169.02	166.81	170.96	169.02	137.72	137.72
2014	2.88	0.00	2.00	0.00	2.00	7.20	0.92	2.77	0.66	119.86	32.89	9.80	2.21	180.33	177.45	175.23	179.39	177.45	144.58	144.58
2015	3.04	0.00	2.00	0.00	2.00	7.56	0.97	2.91	0.70	125.86	34.53	9.80	2.21	188.54	185.50	183.29	187.45	185.50	151.00	151.00
2016	3.31	0.00	2.00	0.00	2.00	7.94	1.02	3.05	0.73	132.15	36.26	9.80	2.21	197.17	193.85	191.64	195.80	193.85	157.62	157.62
2017	4.51	0.00	2.00	0.00	2.00	8.34	1.07	3.21	0.77	138.76	38.07	9.80	2.21	206.22	201.72	199.51	203.66	201.72	163.68	163.68
2018	2.48	0.00	2.00	0.00	2.00	8.75	1.12	3.37	0.81	145.69	39.98	9.80	2.21	215.73	213.25	211.04	215.20	213.25	173.31	173.31
2019	1.58	0.00	2.00	0.00	2.00	9.19	1.18	3.54	0.85	152.98	41.98	9.80	2.21	225.72	224.14	221.93	226.09	224.14	182.20	182.20
2020	1.58	0.00	2.00	0.00	2.00	9.65	1.23	3.71	0.89	160.63	44.08	9.80	2.21	236.21	234.63	232.42	236.57	234.63	190.59	190.59
2021	2.88	0.00	2.00	0.00	2.00	10.13	1.30	3.90	0.93	168.66	46.28	9.80	2.21	247.22	244.34	242.12	246.28	244.34	198.10	198.10
2022	4.76	0.00	2.00	0.00	2.00	10.64	1.36	4.09	0.98	177.09	48.59	9.80	2.21	258.78	254.02	251.80	255.96	254.02	205.46	205.46
2023	3.48	0.00	2.00	0.00	2.00	11.17	1.43	4.30	1.03	185.95	51.02	9.80	2.21	270.91	267.43	265.22	269.38	267.43	216.45	216.45
2024	2.88	0.00	2.00	0.00	2.00	11.73	1.50	4.51	1.08	195.24	53.57	9.80	2.21	283.66	280.78	278.57	282.72	280.78	227.25	227.25
2025	3.04	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.00	291.79	295.95	294.00	237.80	237.80
2026	3.31	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	293.73	291.52	295.67	293.73	237.52	237.52
2027	4.51	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	292.53	290.32	294.48	292.53	236.33	236.33
2028	2.48	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.56	292.35	296.50	294.56	238.35	238.35
2029	1.58	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	295.46	293.25	297.41	295.46	239.26	239.26
2030	1.58	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	295.46	293.25	297.41	295.46	239.26	239.26
2031	2.88	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.16	291.95	296.11	294.16	237.96	237.96
2032	4.76	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	292.28	290.07	294.23	292.28	236.08	236.08
2033	3.48	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	293.56	291.35	295.50	293.56	237.35	237.35
2034	2.88	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.16	291.95	296.11	294.16	237.96	237.96
2035	3.04	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.00	291.79	295.95	294.00	237.80	237.80
2036	3.31	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	293.73	291.52	295.67	293.73	237.52	237.52
2037	6.16	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	290.88	288.67	292.83	290.88	234.68	234.68
2038	2.48	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.56	292.35	296.50	294.56	238.35	238.35
2039	1.58	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	295.46	293.25	297.41	295.46	239.26	239.26
2040	1.58	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	295.46	293.25	297.41	295.46	239.26	239.26
2041	2.88	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.16	291.95	296.11	294.16	237.96	237.96
2042	4.76	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	292.28	290.07	294.23	292.28	236.08	236.08
2043	3.48	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	293.56	291.35	295.50	293.56	237.35	237.35
2044	2.88	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.16	291.95	296.11	294.16	237.96	237.96
2045	3.04	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.00	291.79	295.95	294.00	237.80	237.80
2046	3.31	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	293.73	291.52	295.67	293.73	237.52	237.52
2047	4.51	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	292.53	290.32	294.48	292.53	236.33	236.33
2048	2.48	0.00	2.00	0.00	2.00	12.32	1.58	4.74	1.13	205.01	56.25	9.80	2.21	297.04	294.56	292.35	296.50	294.56	238.35	238.35
	799.82	0.00	102.00	10.00	100.07	474.42	59.47	182.47	42.77	7895.30	2123.05	470.40	219.05	11678.99	10879.17	10660.13	10982.29	10752.04	8730.20	8603.06
NPV 12%	534.7	0.0	10.6	5.7	9.4	26.7	2.9	10.3	2.1	443.6	102.9	36.8	65.6	716.3	181.6	116.0	194.5	78.0	67.6	−35.9
EIRR:															14.51%	13.53%	14.70%	12.94%	13.00%	11.54%