Bangladesh

Jamuna Multipurpose Bridge Project

Report date: March 2001
Field survey: July 2000

1. Project Profile and Japan's ODA Loan

Site Map: About 100 km northwest of Dhaka

Jamuna Multipurpose Bridge

1.1. Background

The Jamuna, one of the three largest rivers in Bangladesh, runs from north to south through central Bangladesh, dividing the country to the east and west. At the time of appraisal, ferries, which were the only means of crossing the river, were operated on two sections in the project area, one upstream, one downstream. The operation of ferries, however, was influenced by the weather and moreover, a one-way trip took more than two hours. Furthermore, since the water level and width of the river changed significantly between the dry and rainy seasons, it was difficult to expand and improve the existing ferry facilities, and goods vehicles, which accounted for more than 60% of all cross-river traffic, were required to wait an average of 36 hours before boarding. Moreover, the volume of traffic crossing the Jamuna was expected to grow at an average annual rate of more than 6% during the period up to 1998 and by more than 5% per annum after 1999.

As described above, the Jamuna formed a bottleneck in east-west traffic, hindering the transport of agricultural products grown in the granaries in the west to the consumption centers in the east. In addition, regions in the west were prevented from benefiting from infrastructure, including gas, electricity and communications, which were concentrated in eastern Bangladesh and had been left underdeveloped. Under these circumstances, a plan to construct a bridge across the Jamuna had been the earnest wish of the nation since Bangladesh became independent in 1971.

1.2. Objectives

The objective of the project was to build a four-lane multipurpose bridge to accommodate power cables, railway lines, communications facilities and gas pipelines,

thus solving transport problems by meeting growing east-west traffic volume, as well as contributing to economic development in the country by revitalizing business activities in western districts to eliminate the disparities between the two regions.

1.3. Project Scope

The project involved (1) the construction of a multipurpose bridge (four lanes; approximately 4.8 km long), (2) construction of approach roads (16 km on the eastern side and 14 km on the western side), (3) implementation of river control work (bank protection work for approximately 2.2 km on both sides and (4) management consulting services covering supervision of and progress management for the above-mentioned civil engineering work, and the training of executing agency personnel in operation and maintenance. The project was jointly financed by the World Bank, Asian Development Bank (ADB) and JBIC, each putting up the equivalent of US$200 million. The remaining US$96 million was financed by the Bangladeshi government.

1.4. Borrower/Executing Agency

The People's Republic of Bangladesh/The Jamuna Multipurpose Bridge Authority (JMBA)

1.5. Outline of Loan Agreement

Loan amount/Loan disbursed amount	¥21.562 billion/¥21.290 billion
Exchange of notes/Loan agreement	March 1994/June 1994
Terms and conditions	Interest Rate: 1.0%, Repayment Period (Grace Period): 30 years (10 years), General untied
Final disbursement date	August 2000

2. Results and Evaluation

2.1. Relevance

Given the traffic conditions and economic disparities between eastern and western regions at the time of project planning, the project, which targeted the elimination of the bottleneck to east-west traffic, and the activation of economic exchanges between the two regions to correct existing disparities, thus contributing to economic development in Bangladesh was necessary and relevant. In addition, the Bangladeshi government had given high priority to the construction of the multipurpose bridge, allocating and managing the budgets for the project under its annual development plan, and collecting a special tax to fund the bridge. Meanwhile, infrastructure projects (gas pipelines, power cables and railway tracks) are being installed along the bridge and are on its use and other projects are steadily being promoted mainly in western districts, and the project continues to maintain its relevance.

2.2. Efficiency

(2.2.1.) Project Cost

In June 2000, the final project cost was estimated at US$753.7 million*. This estimated cost was 8.3% higher than the US$696 million planned at the time of appraisal. The actual Japan's ODA loan disbursement totaled ¥21.29 billion, 1.3% lower than the ¥21.562 billion initially approved, and there was no major difference between the two figures.

*This figure represents the estimated final cost based on cost items envisaged at the time of appraisal. JBMA added taxes, exchange rate losses, interest arising during construction, and other expenses (quoted in local currency), and if these expenses are included, the total project cost is forecast to be approximately US$950 million.

(2.2.2.) Implementation Schedule

At the time of appraisal, the project was scheduled to be completed in November 1997, but was completed in June 1998, seven months behind schedule. However, the bridge was opened to traffic in June 1998 as planned.

Project completion was delayed because the process of choosing a contractor to be responsible for bank protection work was delayed, which meant that the construction work for the bridge and the elevated sections of approach roads started in October 1994 instead of April 1994. The implementation schedule spanned 44 months as compared to the 43 months predicted at the planning stage, indicating that construction work was implemented almost as planned.

2.3. Effectiveness

(2.3.1.) Traffic Volume

Table 1 compares the traffic volume planned at the time of appraisal and the actual traffic volume by vehicle type. Actual traffic volumes for both buses and cars/light vehicles/motorcycles in 1999 were far larger than the planned figures, achieving a 115.4% and 209.3% increase, respectively, and the overall traffic volume for the year was also 29.7% larger than the planned value*. This is probably because the short and fixed time for crossing the river produced far greater volumes of traffic than predicted.

* As described later, the traffic volume for the Jamuna Bridge fluctuates between the rainy and dry seasons. Due to the unavailability of data for the entire year, it is necessary to note that the average daily traffic volume for the bridge in 1998, when more data were obtained during the rainy season, appears smaller than it actually was and that that in 2000, when more data were obtained during the dry season, appears larger.

Table 1 Comparison of Predicted/Actual Average Daily Traffic Volume for the Bridge

Indicator			1998[*1] (Project completion date)		1999		2000[*2]	
Goods vehicle[*3] (Units/day)	Plan	Actual	1,093	645	1,253	891	1,365	1,361
	Achievement ratio [*5]		59.0%		71.1%		99.7%	
Bus [*4] (Units/day)	Plan	Actual	340	660	383	825	414	1,192
	Achievement ratio		194.1%		215.4%		287.9%	
Car/light vehicle and motorcycle (Units/day)	Plan	Actual	196	773	227	702	247	893
	Achievement ratio		394.3%		309.3%		361.5%	
Total (Units/day)	Plan	Actual	1,630	2,079	1,865	2,418	2,025	3,445
	Achievement ratio		127.5%		129.7%		170.1%	

[*1] Figures represent those for the period from June, when the bridge was opened to traffic, to December.

[*2] Figures represent those for the period from January to June.

[*3] Figures for actual results are the totals for light, medium and heavy goods vehicles from the vehicle classification schedule for tolls.

[*4] Figures for buses are the totals for small and large buses from the vehicle classification schedule for tolls.

[*5] The achievement ratio was obtained by dividing the actual traffic volume by that predicted at the time of appraisal.

Source: JMBA materials

In 1998 and 1999, the traffic volume for goods vehicles dropped below that predicted at the time of planning. One reason for this was that the toll of 1,000 taka* for goods vehicles was relatively higher than the ferry fare of approximately 700 taka (see Table 2). Another reason was that on the National Route No. 4 (N4), which links the Jamuna Bridge with the capital city of Dhaka, there were places where the traffic flow was not smooth due to the work being conducted to widen the road that started in 1998**, while the ferry service for the Aricha-Nagarbari sector, which is connected to Dhaka by N5, was more convenient. A third reason was that

Figure 1 The Location of the Jamuna Multipurpose Bridge

the waiting time for goods vehicles using the ferry service, which had been 12 to 48 hours, was shortened with the opening of the bridge.

However, the traffic volume for goods vehicles has been increasing every year, and the volume of goods vehicles that use the Jamuna Bridge is expected to grow further in 2002, when the construction work for widening the road that links the bridge with Dhaka is completed.

* This is the toll for medium-sized goods vehicles, which account for approximately 93% of all goods vehicles.

** This is a project for improving the existing national route, an access road to the Jamuna Bridge from the Dhaka area. The project is financed by ADB and JBIC. The work to widen the road involves removing the existing surface followed by resurfacing. Therefore, sections of road that are under construction are not paved and passable sections are extremely limited due to construction vehicles and construction equipment hindering smooth passage at certain locations.

Table 2 A Comparison of Bridge Tolls and Ferry Fares

	Goods vehicle			Bus		Car/light vehicle and motorcycle	
	Light	Medium	Heavy	Small	Large	Motorcycle	Car/light vehicle
Tolls for the Jamuna Bridge	750	1,000	1,250	550	800	30	400
Ferry fares	705.5			1,346.7		29	290.9

Source: JMBA materials

* Goods vehicle: Light (5 tons or less), medium (5-8 tons) and heavy (8 tons or more)
Bus: Small (29 seats or less) and large (30 seats or more)

A look at a line graph of the seasonal fluctuations in the traffic volume for the Jamuna Bridge (see Figure 3) shows that the overall traffic volume tends to increase during the dry season when the water level of the river declines thereby hindering the operation of ferries. Many goods vehicles, which usually prefer to use the ferry, alter their route, depending on the availability of the ferry service.

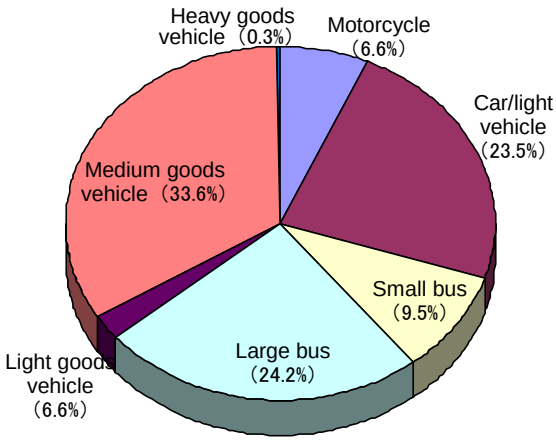

Figure 2 Percentages of Traffic Volumes by Vehicle Type

High values were recorded for cars/light vehicles, motorcycles and buses immediately after the bridge was opened to traffic, because many people visited the bridge for the purpose of sightseeing.

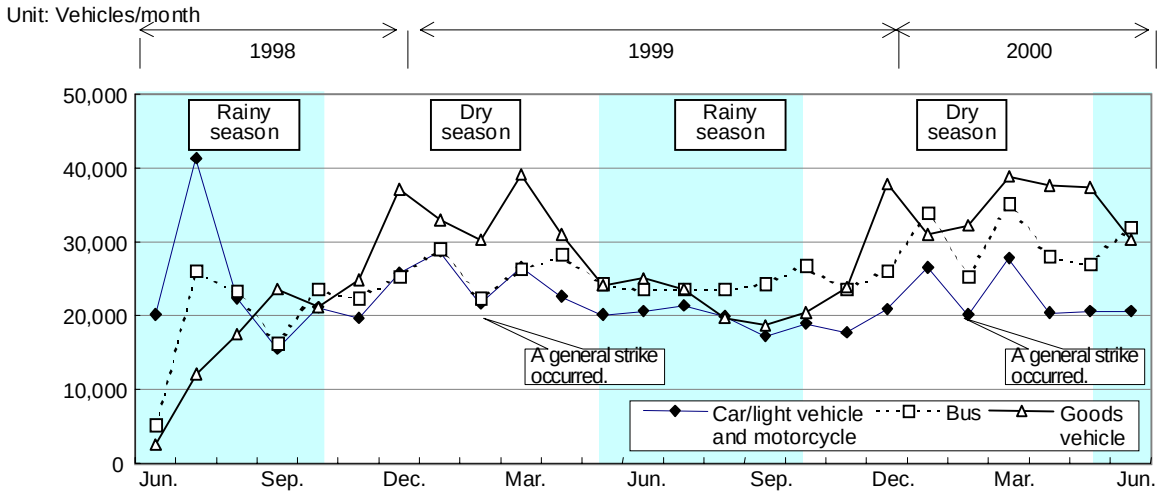

Figure 3 Seasonal Changes in Traffic Volumes for the Jamuna Bridge by Vehicle Type

(2.3.2.) Reduction in the Time Required to Cross the River

Before the Jamuna Bridge was constructed, ferries were the only means of crossing the Jamuna, which divides Bangladesh to the east and west. The survey[*1] conducted before the bridge was opened to traffic indicated that the waiting time for the Aricha-Nagarbari, 75km downstream from the bridge, and that for the Sirajganj-Bhuapur[*2], 7km upstream, were 12-48 hours and 8-12 hours, respectively, with the time required to cross the river by ferry being about two and half hours on both sections. By contrast, the Jamuna Bridge enabled vehicles to cross the river in just 12-18 minutes.

[*1] The survey was executed during January through February 1997 by management consultants employed by JMBA.

[*2] The ferry service for the sector was discontinued with the opening of the bridge.

(2.3.3.) Economic Internal Rate of Return (EIRR)

The EIRR calculated at the time of appraisal was 14.9%. Recalculations based on the total project cost (not final) and the actual traffic volume, indicated that the EIRR was 14.7%. As the traffic volume increased substantially, it was expected that the EIRR based on the same assumptions as used at the time of appraisal would exceed initial predictions. However, since the benefit of reducing the cost for the construction of interconnected power cables, which were included at the time of appraisal, were excluded (because the power cables had not started to be used for service), the EIRR was actually almost identical to predictions, however.

Preconditions for EIRR recalculations[*1]

Project life: 50 years

Costs: Total project cost (actual), as well as operation and maintenance costs

(predicted at appraisal)[*2]

Benefits[*3]: Effect of time and cost savings for basic and induced traffic (traffic benefit[*4])

Environment-related benefits

Dredging cost reduction benefits

Profits from the sale of existing ferry facilities

[*1] Items used were identical to those employed at appraisal, except for the benefit of reducing the cost for the construction of interconnected power cables.

[*2] Operation and maintenance costs include the costs for the purchase and renewal of equipment, emergency operation and maintenance costs, etc., in addition to annual consignment fees paid to contracted service providers, which amount to US$2.4 million. Due to a lack of sufficient information, however, costs predicted at the time of appraisal (US$3.36 million/year on average) were used.

[*3] It is assumed that benefits from the project include the benefit of reducing railway construction costs. This benefit, however, is not taken into consideration in the calculation and therefore is excluded from EIRR recalculation because there were no plans to construct a railway at the time of appraisal and also because it was not possible to obtain necessary data.

[*4] Based on the value of benefits calculated using network analysis at the time of appraisal, traffic benefits were recalculated according to the ratio of the initially predicted traffic volume to the actual volume.

2.4. Impact

(2.4.1.) Revitalization of Economic Activities Due to Smoother Distribution

As described above, since the traffic volume for the Jamuna Bridge has exceeded predictions, the bridge is contributing to reducing the time required to transport agricultural products from granaries in the northwest to areas in eastern Bangladesh, the center of consumption. Currently, agricultural and regional development plans are being implemented in the northwest. Specifically, in accordance with ADB's agricultural development plan for the area, roads to this region are being built with financial assistance provided by ADB and the International Development Association. Furthermore, it is expected that when the construction of a railway using the tracks laid along the bridge is completed in 2002 with financial assistance from ADB, the movement of people and goods will become more vigorous.

(2.4.2.) Construction of Basic Infrastructure to Reduce East-West Disparities

The area of the country west of the Jamuna is less developed than that to the east and has been prevented from benefiting from infrastructure, including gas, electricity and communications, which are concentrated in eastern regions. East-west regions have been connected by a network of public utilities as the result of the installation of 232kV power cables, gas pipelines 750 mm in diameter and telephone cables along the bridge.

(2.4.3.) Effects on the Social Environment

In constructing the bridge, a total of 2,680 ha of land was acquired to construct river control embankments on both sides of the river, and approach roads, and to provide for the possible effects of erosion due to the modification of the course of the river. Under the project, local residents were compensated for the loss of their homes, land and other properties due to the land acquisition conducted by JMBA. From the initial planning stage, the executing agency attached significance to the fact that the project would affect many of the local residents and carefully developed a relocation plan. This relocation plan adopted the concept included in the World Bank's Operational Directive 4.30 (Policy on Involuntary Resettlement) and was more vigilant than any resident relocation plans executed in Bangladesh to date. Examples included enacting a new law to allow for more compensation to be awarded to local residents than in the past, and the payment of damages even to illegal settlers, as well as implementing large-scale land development for relocated residents. In addition, in order to ensure smooth relocation and compensation, JBIC established the Co-financiers' Monitoring Committee in conjunction with the World Bank and ADB to monitor progress.

The results of two surveys conducted by the Committee confirmed that the land acquisition had direct and indirect negative effects on residents from 15,728 households. Of these residents, those who were confirmed as being directly affected received compensation money. As of May 2000, 62.65% of the compensation plans had been completed with compensation continued even today (for details, see the results of the impact assessment on the relocation of local residents, which was carried out separately).

(2.4.4.) Effects on the Natural Environment

In 1994, the Bangladesh University of Engineering & Technology developed an environmental action plan with the aim of reducing the effects of the project on the natural environment around the Jamuna Bridge during the construction and post-project periods.

In accordance with the action plan, JMBA's Environmental Unit adopted measures to reduce the effects of the project on the environment, paid compensation to local residents and helped improve the lives of local residents with the cooperation of non-governmental organizations. Under the project, in addition to compensating residents who were directly affected by relocation, vocational training was provided to local residents who might be indirectly affected by the project due to the changes in the social conditions and natural environment. This training included guidance in developing and managing fish culture ponds. Moreover, efforts to compensate local residents and assist in improving their lives through the promotion of sanitary practices, agricultural guidance and other activities are continuing even today.

Field surveys of animals, fish, insects and plants were conducted during 1990 through 1992 prior to the construction of the bridge. The results of post-project surveys based on the environmental action plan indicate that the project has had no serious effects on existing animals and plants.

2.5. Sustainability

(2.5.1.) Operation and Maintenance Structure

For the first five years, operation of the bridge, collection of the tolls and maintenance of all the works is being undertaken by a contractor under JMBA's supervision. The contractor JOMAC (short for Jamuna Operation and Maintenance Company) is a joint venture company that was selected through international competitive bidding, comprising companies from South Africa, from the UK, and the local firm of contractors, and has a total of 352 employees. The operations consigned to JOMAC cover routine operation and maintenance, including the collection of tolls, traffic control, guarding surrounding areas and protection of the bridge, approach roads and embankments. If large-scale regular maintenance work is required or serious problems occur with bridge facilities due to floods or other disasters, however, JMBA will be directly engaged in maintenance work.

Three JMBA engineers are stationed on the east side of the bridge where the JOMAC office is located. They inspect the condition of bridge maintenance and bank erosion and report the results to JMBA's chief engineer. If there are any problems, JMBA informs JOMAC of its recommendations and the measures to be taken.

(2.5.2.) Operation and Maintenance Budgets

Annual operation and maintenance fees paid to JOMAC total approximately US$2.4 million and accounted for about 20% of the 597 million taka (approx. US$12 million*) collected as tolls in 1999. The tolls are set so that toll revenues can cover operation and maintenance costs as well as construction costs, and since the traffic volume for the bridge has exceeded initial predictions, revenues are increasing. In addition, the government has decided to give priority to budgetary allocations to the operation and maintenance of the bridge, so no particular problems exist in this respect (currently, toll fee revenues go to the national treasury first and are then separately appropriated as operation and maintenance budgets).

* The exchange rate is US$1.00 = 49.65 taka applicable on December 1, 1999.

(2.5.3.) Sustainability

The South African and British companies in the JOMAC conglomerate have abundant experience in the operation and maintenance of large bridges on an international scale, and thus there are no particular problems in this respect. In

addition, technology transfer to the local contractor, the remaining member of the international consortium, is progressing smoothly through practical exercise and training.

However, no decisions have been made on the operation and maintenance structure for the period after 2003, when the contract with JOMAC expires, though JMBA plans to consign operation and maintenance work to the private sector and it will be necessary to pay close attention to future developments.

Comparison of Original and Actual Results

Item	Plan	Actual
1. Project scope	(1) Construction of the bridge Approx. 4.8 km, four lanes	Same as left
	(2) Construction of approach roads 16 km on the east side, connected to national route No.4	Same as left
	14 km on the west side, connected to national route No.5	Same as left
	(3) Implementation of river control work Construction of 2.2-km river control embankments on both banks	3.07 km for the east bank and 3.26 km for the west bank*
	Construction of flood prevention embankments on the east side	1.7 km
	(4) Consulting services: 2,570 M/M	Same as left
2. Implementation schedule	April 1994 to November 1997 (43 months)	October 1994 to June 1998 (44 months)
3. Project cost		
Foreign currency	US$600 million	-
Local currency	US$96 million	-
Total	US$696 million	US$753.7 million
ODA loan portion	¥21.562 billion	¥21.29 billion
Exchange rate	US$1.00 = ¥107.81 (1994)	

* Since the shape of embankments undergo remarkable changes due to erosion and sedimentation, the location for river control work was determined and river control designs conducted in parallel with the construction of the bridge. As a result, the final distance for river control work was slightly extended as compared to the initial plan.