Bangladesh

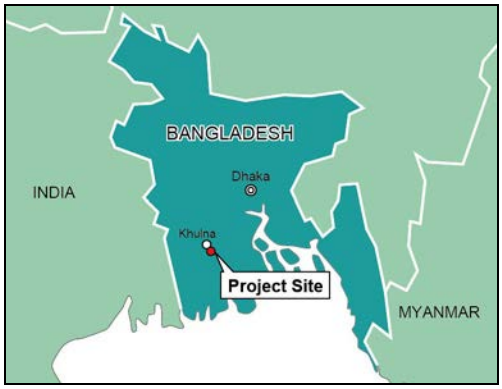
Ex-Post Evaluation of Japanese ODA Loan
"Rupsha Bridge Construction Project"

External Evaluator: Nobuyuki Kobayashi, OPMAC Corporation

0. Summary

The project has been relevant to the development plans of Bangladesh and has been meaningful in terms of the country's development needs. Difficult construction works required longer time than the plan due to the treatment of soft soil were but changes in the technical specifications and construction methods limited the delay to a short period only. In tandem with the reduction of cargo handling at Mongla port, traffic demand grew less than it had been forecasted. For this reason, the traffic volume at the time of the ex-post evaluation remained at almost 50% of the forecast. Serious damage which could negatively affect the incidence of the project effect was not observed in the site survey. However, in long run, the tight maintenance budget of the executing agency and insufficient experience in the supervision of the maintenance works for long bridges are issues for sustainability. In light of the above, this project is evaluated to be partially satisfactory.

1. Project Description



Project Location

The Rupsha Bridge

1.1 Background

Bangladesh is located in a delta region facing the Bay of Bengal in South Asia and its territory is divided by many rivers. Ferry crossings on the trunk roads linking major cities prevented the smooth flow of traffic. The Bangladesh government has made efforts to construct bridges for the elimination of ferry crossings on major corridors. At the beginning of the 2000s, the Meghna Bridge and the Meghna-Gumti Bridge on the Dhaka-Chittagong Corridor and the Jamuna Bridge on the Dhaka-Northwest Corridor were completed and the Paksey Bridge on the Northwest- Khulna Corridor was under construction. Japan supported these efforts of the Bangladesh government through the provision of official development assistance loans (Yen loans) and grant aid.

The Port of Mongla, the second biggest port in Bangladesh in terms of cargo handling tonnage, is located approximately 40km south from the largest city in the southwest region Khulna. At the beginning of the 2000s, a ferry service was used for river crossing at the Rupsha River and this was a major factor in preventing the smooth flow of traffic to the port. As a bridge over the Rupsha River would enable land transport from the Capital city Dhaka to Mongla Port via the Jamuna Bridge and the Paksey Bridge, it was expected that this would

improve the convenience of the port.

This is the background to the plan for a bridge over the Rupsha River. JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)/ (Phase 2)" carried out a feasibility study, design, and technological assessment at detailed level. It resulted in the provision of an ODA loan for the construction of the Rupsha Bridge[1].

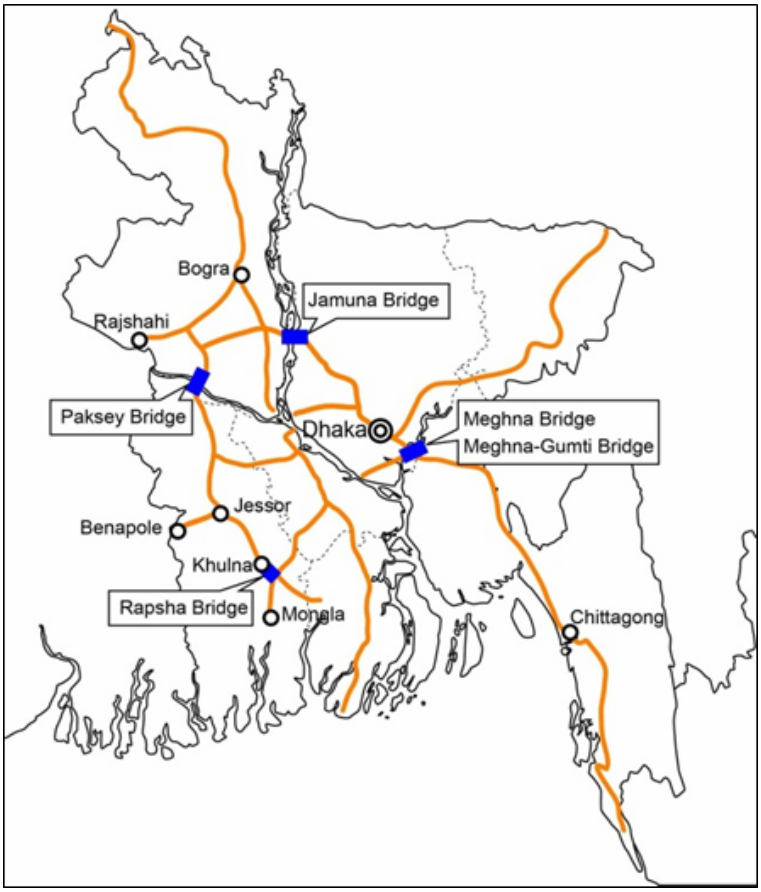


Figure 1: Major Bridges in Bangladesh

1.2 Project Outline

The objective of this project is to ensure smooth traffic across the Rupsha River by constructing a bridge over the river in the southern part of Khulna, thereby contributing to the regional development of the southwest part of Bangladesh and the convenient use of Mongla port.

Loan Approved Amount/ Disbursed Amount	8,300million yen / 7,966 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	August 2000 / March 2001
Terms and Conditions	Civil Work, etc.: Interest Rate 1.0%, Repayment Period: 30 years (Grace Period: 10 years), General untied

[1] The Rupsha Briged was named as the Khan Jahan Ali Bridge when it was completed. This report uses the name Rupsha Bridge in all sections in order to maintain consistency and prevent confusion.

	Consulting Services: Interest Rate 0.75%, Repayment Period: 40 years (Grace Period: 10 years), General untied
Borrower / Executing Agency	The President of the People's Republic of Bangladesh / Roads and Highways Department
Final Disbursement Date	July 2008
Main Contractor (Over 1 billion yen)	Shimizu Corporation (Japan)・Italian-Thai Development Public Company Limited (Thailand) (JV)
Main Consultant (Over 100 million yen)	Pacific Consultants International (Japan)
Feasibility Studies, etc.	"The Study on Construction of the Bridge over the River Rupsha (Phase 1)" JICA, March 1999, "The Study on Construction of the Bridge over the River Rupsha (Phase 2)" JICA, March 2000
Related Projects	None

2. Outline of the Evaluation Study

2.1 External Evaluator

Nobuyuki Kobayashi, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: December 2010 – November 2011
Duration of the Field Study: February 21 – March 16, 2011, July 2 – July 14, 2011

2.3 Constraints during the Evaluation Study

In order to assess the quality of the soil tests related to this project, several interviews with the executing agency, the consultant for project supervision, and the contractor for civil works were conducted. Due to a lack of necessary technical knowledge, however, this issue was difficult to evaluate. An interview with resettled residents could not be conducted because monitoring of resettled residents was not carried out and this made it difficult to find out the location of resettlement place. For this reason, the assessment of land acquisition is based on the information provided by the executing agency.

3. Results of the Evaluation (Overall Rating: C[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Relevance with the Development Plan of Bangladesh

The national development strategy at the time of the appraisal was the Fifth Fiver Year Plan (FY1997/98 - FY2001/22)[4]. The plan selected 14 policies as key elements in the transport sector strategy. These priority policies included the development of five major corridors[5] and

[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ② Fair, ① Low
[4] The fiscal year of the Bangladesh government starts in July and ends in July of a next year.
[5] Dhaka-Chittagong Corridor, Dhaka-Northwest Corridor, Dhaka-Khulna Corridor, Dhaka-Sylhet Corridor, and Northwest-Khulna Corridor

the strengthening of the linkage between Dhaka and two major ports (Chittagong port and Mongla port). The plan referred to the construction of bridges on the section between the Northwest and Mongla as prioritized investment. In addition, investment allocation under the Fifth Five Year Plan paid attention to balanced regional development and investment in the coastal area, including the southwest region. Prioritized investment in the southwest region included the development of network infrastructure, such as in electricity, transport, and telecommunications. As the Rupsha River prevented efficient road transport between Khulna and Mongla port and as it divided the southwest region into two sections, the construction of the Rupsha Bridge would contribute to the strengthening of the regional transport network.

The national development strategy at the time of the ex-post evaluation was the National Strategy for Accelerated Poverty Reduction II (NSAPRII), which included the construction of Padma Bridge as part of the development strategy for the transport sector. Through NSAPRII it was intended that transport between the eastern region and the western region would be made smoother by bridging the Padma River, aiming at the improvement of access from Dhaka to Khulna /Mongla port. Furthermore, NSAPRII saw the development gap in Bangladesh as a major development issue and urged that development resources such as investment should be preferably allocated to the Khula Division as the underdeveloped area.

This project was relevant to the development strategies in Bangladesh at both the times of the appraisal and the ex-post evaluation. The construction of the Rupsha Bridge was in line with the investment strategy of the Fifth Five Year Plan at the time of the appraisal. At the time of the ex-post evaluation, the national development strategy has led to greater efficiency in east-west traffic. In addition, investment in the southwest region, an underdeveloped area, is still regarded as a priority policy of the national development strategy.

3.1.2 Relevance with the Development Needs of Bangladesh

At the time of the appraisal, more efficient road transport between Mongla port and Khulna by the bridging the Rupsha River was expected to facilitate trade not only in Bangladesh but also in the landlocked countries of Nepal and Bhutan. In addition, traffic crossing the river poured into the urban area of Khunla City through the existing road network. In the southern area of Khulna City, ferry crossing caused traffic jams which had become an issue for urban transport. There was a significant necessity to solve this problem by a reduction in the traffic using ferries and flowing into the urban area of Khulna City, the countermeasure which the construction of the Rupsha Bridge could achieve.

At the time of the ex-post evaluation, the Bangladesh government, the Nepal government and the Bhutan government were continuing to discuss the further utilization of Mongla port. Furthermore, an intergovernmental agreement on the Asian Highway (AH) Network[6], to which Bangladesh was a party, was signed in 2004. Based on this agreement, the development of AH is on-going in Bangladesh. The development of AH has progressed since the 1950s but member countries have accelerated efforts after the signing of the intergovernmental agreement. The road section between Khulna and Mongla is part of AH41 and is connected to AH1 and AH2 which cross Bangladesh in an east-west direction. Facilitating access to Mongla port continues to be essential for the improvement of regional transport. The development need for a smooth crossing over the Rupsha River still remains.

Table 1: Population under the lower poverty line

Unit: %

Division	2000	2005
Bangladesh	34.3	25.1
Barisal Division	34.7	35.6
Chittagong Division	27.5	16.1
Dhaka Division	34.5	19.9
Khulna Division	32.3	31.6
Rajshahi Division	42.7	34.5
Sylhet Division	26.7	20.8

Source: Bangladesh Bureau of Statistics "Report of the Household Income and Expenditure Survey 2005"

[6] The Asian Highway is an international road network with a length of approximately 140,000 km which runs through 32 countries.

The poverty rate in the Khulna division was substantially higher than the national average in 2005, though it showed a marginal improvement between 2000 and 2005. In terms of the stimulus of the regional economy and income generation through employment creation, the investment in the region was quite meaningful.

3.1.3 Relevance with Japan's ODA Policy

Japan's Official Development Assistance (ODA) Charter, the preceding charter, which was approved in 1992, referred to the close relationship between Japan and Asia in terms of history, geography, politics, and economy, and placed a special emphasis on assistance to the Asian region. The charter defined infrastructure as a basic condition of social and economic development and prioritized assistance in infrastructure investment. The Country Assistance Strategy for Bangladesh of 2000 saw the region between Dhaka and Khulna/Mongla Port as a centre for growth and included support for the development of economic infrastructure. In 1999, the Japan Bank for International Cooperation approved the Medium-Term Strategy for Overseas Economic Cooperation Operation which also put special emphasis on the Asian region and on economic and social infrastructure to support economic growth.

This project assisted infrastructure development in the Asian region by constructing a bridge over the Rupsha River, which prevented efficient transportation in the Dhaka–Khulna Corridor. At the time of the appraisal, Japanese ODA policy placed importance on assistance to Asian countries, in particular in terms of infrastructure development in the region between Dhaka and Khulna / Mongla Port. Thus, the project was considered to be highly relevant to Japan's ODA policy.

The Rupsha Bridge is one of the longest bridges in Bangladesh today. At the Japan-Bangladesh Summit Meeting in November 2010, Prime Minister Hasina mentioned the bridge as an example of Japanese ODA in Bangladesh. This project was meaningful not only in terms of improving traffic conditions but also in strengthening the bilateral relationship.

This project has been highly relevant with the country's development plan and development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

The plan and actual results for the output of this project are shown as follows:

Table 2: Project Output

Plan (at the time of the appraisal)	Actual (at the time of ex-post evaluation)
(1) Civil Works 1) Rupsha Main Bridge: Length 1,360m, Wide 16m 2) River Revetment: East Side 150m 3) Approach Roads: West section 5,880m, East Section 2,799m 4) Canal Bridges: 2 Bridges 5) Related Facilities: 1 Toll Plaza and 2 Bus Bays (2) Consulting Services International: 222 M/M National: 639 M/M Scope: Tendering Assistance, Detailed Design Review, Construction Supervision, Environmental Monitoring etc.	(1) Civil Works 1) Same as planned 2) River revetment 145m, Protection by stones 37m 3) Same as planned 4) Same as planned 5) Same as planned (2) Consulting Services International: 249.9 M/M National: 689 M/M Scope: Same as planned

Source: Project Completion Report, RHD

The output of this project was almost as planned, though there were modifications in technical specifications. As the load bearing capacity of piles was insufficient due to soft soil, additional works such as grouting under and around the piles were implemented to the piling work. In order to reduce the time for the procurement of consulting services, the executing agency selected consultants to provide services, including construction supervision, by direct appointment. The consultants who had conducted the feasibility study, the detailed design, and tendering assistance also carried out construction supervision[7].

3.2.2 Project Inputs

3.2.2.1 Project Cost

While the planned cost was JPY 10,549 million, the actual cost was JPY 12,151 million. The project cost was slightly higher than planned (115% of the original plan). This increase in the project cost was due to the cost of civil works, inflation of material costs, and taxes and duties paid to the Bangladesh government which were not an eligible portion for the ODA loan. The increase in the cost of the civil works was caused by several reasons such as additional works for piling and soil treatment for the construction of two small bridges on the approach roads.

3.2.2.2 Project Period

The project period was slightly longer than planned (119% of the original plan)[8]. Due to soft soil, difficulties in construction work resulted in a longer period for civil works. However, the delay was reduced through changes in technical specifications and construction methods. In order to shorten a delay in a construction period, technical specifications of piles were changed. The diameter of piles was reduced from 2500mm to 900mm but the number of piles increased to 16 units. The change in the diameter of pile allowed the use of pile driver which required less time for installation by easier setup.

Table 3: Project Period

	Plan (at the time of the appraisal)	Actual (at the time of the ex-post evaluation)
L/A Signing	March 2001	March 2001
Consulting Services	July 2000 – September 2004[9]	June 2000 -June 2006
Procurement of Main Contracts	September 2000 – March 2001	June 2000 - April 2001
Civil Works	March 2001- September 2004	May 2001 - May 2005
Project Completion (Project Period)	September 2004 (43 months)	May 2005 (51 months)

Source: Appraisal Documents, RHD

Prior to the implementation of the project, a soil test was carried out as a part of JICA's "A Study on the Construction of a Bridge over the River Rupsha (Phase 2)". The contractor for the civil work conducted an additional soil test after the commencement of the project. According to the consultant for construction supervision, estimating the firmness of ground soil only with soil tests in the feasibility study had limitations in its accuracy[10]. For this reason, a load test to determine pile length was deliberately included at the planning stage. The initial load test

[7] Prior to the implementation of this project, JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)/ (Phase 2)" conducted the feasibility study and detailed design.

[8] The commencement of the project is defined as the L/A signing. The completion of project is defined as the end of civil works.

[9] The Bangladesh government employed the consultants before the L/A signing. As the appraisal documents do not explicitly set an end for consulting services, the end of consulting service is defined as the end of civil works.

[10] According to the consultant for construction supervision, N-value, an indicator to show the firmness of ground, might be overestimated because the stratum which was expected to have higher surface friction was in a deeper area.

resulted in deeper sinking and revealed that the piles did not have sufficient load bearing capacity and so additional works were added to the piling works as aforementioned.

Both project cost and project period slightly exceeded the plan, therefore efficiency of the project is fair.

3.3 Effectiveness[11] (Rating: ②)

3.3.1 Quantitative Effects

Since the project supported the construction of a new bridge, not only traffic volume but also time savings were regarded as project outcomes to be assessed. While the target level for traffic volume was set at the time of the appraisal, in the first year after opening (FY2005/06), this reached approximately 40% of the target level. The above rating was determined, given that traffic volume increased after FY2006/07 with accompanying time savings attained as planned.

3.3.1.1 Results from Operation and Effect Indicators

(1) Traffic Volume

Since the northern section of the Khulna Bypass[12], which was connected to the Rupsha Bridge, was incomplete, the traffic volume for the first year after opening was approximately 40% of the target level. However, traffic volume showed an upward trend after the completion of the bypass road. Compared with the forecast in the Economic Internal Rate of Return, traffic volume at the time of the ex-post evaluation remained at almost 50%. ing) in FY 2009/10[13].

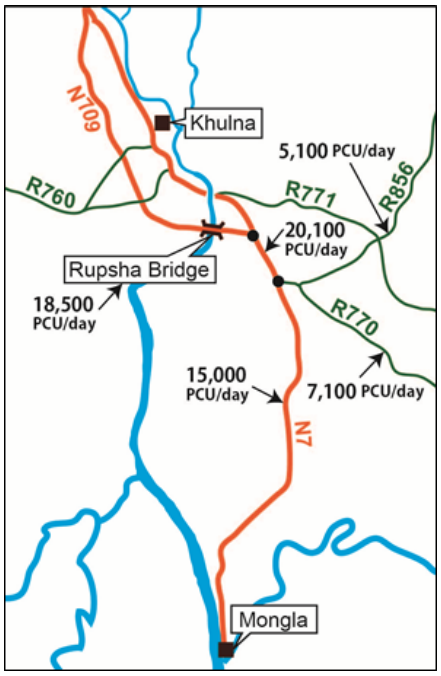


Figure 2:Traffic Distribution (2015 Forecast)

One factor which explains why traffic volume did not meet the forecast at the time of the appraisal is that cargo handling at Mongla port, in particular cargo handling at the jetties, was below forecast[14]. The forecasted traffic distribution for 2015 shows that traffic in the section starting from or ending at Mongla port significantly affects the traffic volume on the Rupsha Bridge (see Figure 2)[15]. While cargo handing at Mongla port was 2.87 million tons in FY1997/98, the forecast at the time of the appraisal suggested that it would reach 5.81 million tons in 2015. The actual figure for cargo handling at Mongla port in FY 2009/10, however, recorded only 1.65 million tons. Assuming the containerization of cargo, the forecast for cargo handling at jetties should increase from 0.16 million tons (6% of total cargo handling) in FY 1997/98 to 2.13 million tons (37% of total cargo handling) in 2015. The actual cargo handling at jetties was 0.22 million tons (13% of total cargo handlAt the time of the ex-post evaluation, the construction of a long bridge over the Padma River was planned. After

[11] For the judgment for Effectiveness, the findings in Impact are also taken into consideration in the rating.
[12] The northern section of the Khulna Bypass was constructed by RHD.
[13] Based on the interview at Mongla Port Authority
[14] The ex-post evaluation report on the Paksey Bridge Construction Project (I)/(II) in Bangladesh mentioned that the traffic volume between Khulna/Mongla and the northwest was relatively small and that the stagnation of Mongla port was one of the reasons behind a slower growth of the traffic between Mongla and the Northwest.
[15] The forecast was prepared in JICA's "The Study on Construction of the Bridge over the River Rupsha (Phase 1)." PCU (Passenger Car Unit) shows traffic volumes when all vehicle types are translated into passenger car equivalent.

completion, which is planned for 2016, the bridge will contribute to an increase in traffic volume between Dhaka and Khulna. A further increase in traffic volume on the Rupha Bridge is also expected.

Table 4: Traffic volume per day (plan and actual)

Plan		Actual		Actual/Plan
Year	Traffic Volume	Year	Traffic Volume	%
2005	6,243	2005/06	2,552	40.9%
2006	6,606	2006/07	3,024	45.8%
2007	6,990	2007/08	3,930	56.2%
2008	7,396	2008/09	4,007	54.2%
2009	7,827	2009/10	3,913	50.0%

Source: Appraisal documents, RHD

Photo 1: Vehicles on the Rupsha Bridge

Compared with the forecast at the time of the appraisal, traffic volumes for buses and auto rickshaws accounted for smaller portions of the total traffic than expected. On the other hand, the portion of motor cycles was larger. The use of motorcycle as an individual mode of transport had become more prevalent than before. Although the ferry service on National Highway No. 7 was terminated after the completion of the project as planned, boats for pedestrians and bicycles are still operating. Users of the bus terminal for long and medium-distance buses on the east side of the Rupsha River still use the boats. This may also explain why the traffic volumes of buses and auto rickshaws do not reach the forecast.

Table 5: Traffic per day by type of vehicles (Planned and Actual)

- Planned

	Motor Cycles		Auto Rickshaws		Cars		Buses		Trucks	
Year	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%
2005	664	10.6%	1409	22.6%	627	10.0%	2060	33.0%	1484	23.8%
2006	701	10.6%	1486	22.5%	661	10.0%	2173	32.9%	1585	24.0%
2007	739	10.6%	1568	22.4%	697	10.0%	2293	32.8%	1693	24.2%
2008	780	10.5%	1654	22.4%	736	10.0%	2419	32.7%	1808	24.4%
2009	823	10.5%	1745	22.3%	776	9.9%	2552	32.6%	1931	24.7%

- Actual

	Motor Cycles		Auto Rickshaws		Cars		Buss		Trucks	
Year	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%	Vehicles	%
2005/06	819	32.1%	83	3.3%	309	12.1%	757	29.7%	583	23%
2006/07	1028	34.0%	109	3.6%	348	11.5%	891	29.5%	647	21%
2007/08	1509	38.4%	159	4.0%	393	10.0%	1103	28.1%	765	19%
2008/09	1543	38.5%	172	4.3%	388	9.7%	1104	27.6%	799	20%
2009/10	1568	40.1%	223	5.7%	362	9.3%	980	25.0%	774	20%

Source: Appraisal documents, RHD

• Planned

• Actual

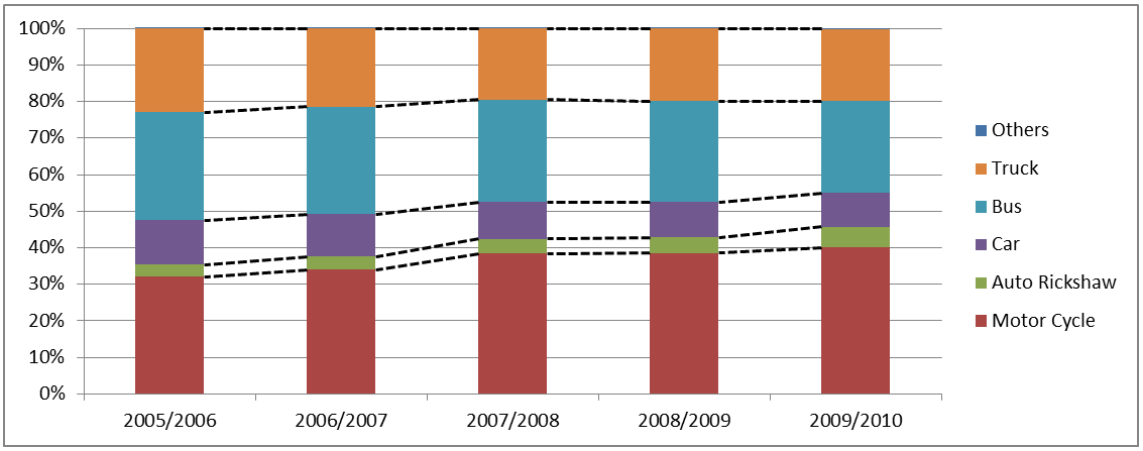


Figure 2: Percentage of total traffic by types of vehicle (Planned and Actual)

(2) Travel Time for River Crossing

The Rupsha Bridge has sufficient capacity, given the forecast traffic volume at the time of the ex-post evaluation. The travel time for river crossing decreased almost as planned. Interviews with long-distance bus operators and a truck driver union also confirmed the reduction in the travel time for river crossing[16]. The travel time including waiting time for a ferry was 30 minutes under usual traffic and 2 hours at peak time before the opening of the Rupsha Bridge. At the time of the ex-post evaluation, the travel time to pass the Rupsha was 2.5 minutes and the travel time for river crossing was substantially reduced.

Table 6: Travel Time for Crossing the Rupsha River

Actual (2001)	Target (2005)	Actual (2010)
(Ferry crossing) Approx. 30 min. 2 hours at peak time	(Passing through the Rupsha Bridge) Approx. 2 min.	(Passing through the Rupsha Bridge) 2.5 min.

Source: Appraisal documents, RHD

[16] Interviewed with the Mongla Export Processing Zone (EPZ) Office, a truck drivers' union, five long-distance bus operators and one private enterprise in order to find out about changes in regional transportation after the opening of the Rupsha Bridge.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

(1) Financial Inter Rate of Return (FIRR)

As a result of the recalculation at the time of the ex-post evaluation, FIRR is a negative number and below the plan (2.4%). Project costs increased. As traffic volumes, except that of motorcycles, did not reach the forecast, the actual toll revenue is below the original forecast. O&M costs became almost threefold of the assumptions at the time of the appraisal and this is one of the factors to decrease FIRR. If one assumes that toll fees increase 1.5 times of the assumptions in the ex-post evaluation, FIRR turns positive.

Table 7: Assumptions for the calculation of FIRR

	At the time of the appraisal	At the time of the ex-post evaluation
Costs	Project costs (only bridge), and O&M costs	Project costs (only bridge[17]) and O&M costs (FY05/06 - FY09/10:actual data, FY10/11 - FY29/30: forecasted by RHD - 2% increase per annum)
Benefits	Toll revenue from the bridge	Toll revenue from the bridge (toll revenue FY05/06-FY10/11: actual data, toll fees after FY11/12: the same assumption as in the appraisal, traffic volume for FY10/11-FY14/15: forecasted by RHD, traffic volume for FY15/16 - FY29/30: estimated by growth rate until FY14/15)
Project Life	Until 2029 (25 years after completion)	Until FY29/30 (25 years after completion)

Source: Appraisal documents, RHD

(2) Economic Internal Rate of Return (EIRR)

As a result of the recalculation at the time of the ex-post evaluation, EIRR is 0.8% and below the plan (26.2%)[18]. Higher project costs, an increase in O&M costs, and smaller volume of traffic did not allow EIRR to reach the forecasted level at the time of the appraisal as these factors did so in FIRR. Because of the difficulty in estimating unit costs for vehicle operating costs and unit costs for travel time costs, the same assumptions are used for this recalculation. The calculation assumes the project life of this project to be 16 years after completion. If the same assumption as for FIRR (Project life: 25 years) is used, the result of EIRR improves to 5.1%.

Table 8: Assumptions for the calculation of EIRR

	At the time of the appraisal	At the time of the ex-post evaluation
Costs	Project Cost (Bypass roads and Bridges) and O&M costs	Project Cost (Bypass roads and Bridges) and O&M costs (FY05/06- FY09/10): actual data, FY10/11- FY29/30: forecasted by RHD - an increase 2% per annum)
Benefits	Reduction in vehicle operating costs and benefits from reduction in travel time	Reduction in vehicle operating costs (unit costs for vehicle operating costs is the same data as at appraisal) and benefits from reduction in travel time (unit costs for travel time costs is the same data as at appraisal). The same assumptions for traffic volume were used for the estimation of benefits.
Project Life	Until 2020 (16 years after completion)	Until FY20/21 (16 years after completion)

Source: Appraisal documents, RHD

[17] For a fair comparison with the calculation at appraisal, the same assumption (bridge only) is used. However, it is desirable that all project costs for the computation of FIRR are included.

[18] For EIRR, both unit costs for vehicle operating costs and unit costs for travel time costs are the same data as at appraisal). The benefits reflect a change in traffic volume only. Because of incomplete updates in benefits, the results of EIRR are not used in the determination of the rating.

3.3.2 Qualitative Effects

(1) Resolving the Problem of Traffic Jams Caused by Traffic Waiting for Ferry Boats

The completion of the Rupsha Bridge allowed the termination of ferry service on National Highway No.7 and this resolved the traffic jams nearby the ferry terminal. According to residents, traffic jams at the ferry crossing sometime reached an intersection several hundred meters away and caused traffic congestion. At the time of the ex-post evaluation, the site survey found that there was no traffic jams, though buses were passing by and waiting for passengers near the ghat on the Khulna side (the west side of the Rupsha River) as boats for pedestrians and bicycles were still under operation.

(2) Larger Trucks and a Decrease in Logistics Costs

The interview at the truck drivers' union revealed that the ferry crossing had limited the weight of trucks and that drivers were able to use heavier trucks after the construction of the Rupsha Bridge. Interviewees at the cement factory near Mongla port stated that the travel time to Khulna had decreased from 2 hours to 1 hour after the completion of the bridge and that logistics costs had declined by approximately 40%. This decrease in logistics costs was due to reductions in fuel costs and labour costs attended by the reduction in travel time.

This project has somewhat achieved its objectives, therefore its effectiveness is fair.

3.4 Impact

3.4.1 Intended Impacts

(1) Impact on Local Residents' Livelihood and Living Environment

In order to understand the project effects, focus group discussion (FGD) sessions with Khulna side (West bank) residents and Rupsha side (East Bank) residents were carried out. Voting was held after opinions on the discussion topic were drawn out in order to quantify qualitative opinions. Outlines of the FGD sessions are as follows:

- Location: Khulna City
- Date/Time: Khulna side residents - March 2, 2011, Rupsha side residents - March 3, 2011
- Participants: Khulna side residents - 9 participants (7 male and 2 female), Rupsha side residents - 8 participants (6 male and 2 female)
- Discussion topic: "How has the project changed your life?"
- Voting method: After consolidating to five (or so) opinions, each participant cast three votes. (Multiple votes for the same opinion were allowed if the voter strongly agreed)

As the result of voting, the Khulna side residents supported the opinion that "Social problems have arisen" most of all, while the Rupsha side residents most of all agreed that "Travel became easier". The Khulna side residents lived in the urban area of Khulna City and had relatively few chances to cross the river. The Khulna side residents pointed out negative effects such as traffic accidents and the lack of parking space, recognizing fewer direct benefits from the improvement in transport. On the other hand, the Rupsha side residents recognized improvements in transport as the Rupsha Bridge had enabled the smooth flow of traffic from the eastern bank to the urban area of Khulna City. Some Rupsha side residents highly valued the convenience of the Rupsha Bridge as they commuted to factories built on the Khulna side. Both Khulna side and Rupsha side residents supported the opinion that the "Scope of business is expanded" but the Khulna side residents supported this more strongly. The appreciation of land prices and an increase in the number of pedestrians has significantly improved the business environment for Khulna side residents. A few participants pointed out silting on inland

waterways[19] and a decrease in the amount of fish caught as impacts on the natural environment.

Table 9: Results of Focus Group Discussion

Khulna side (West bank) residents			Rupsha side (East Bank) residents		
Rank	Opinion	Vote	Rank	Opinion	Vote
1	Social problems have arisen.	15	1	Travel became easier	8
2	Scope of business is expanded	7	2	The bridge became a tourist spot	5
3	Travel became easier	3	3	Scope of business is expanded	4
4	Environmental problems have arisen	2	4	Employment opportunities increased	4
	Total	27	5	Environmental problems have arisen.	3
				Total	24

(2) Cargo Handling at Mongla port

Cargo handling at Mongla port decreased by approximately 40% from FY2000/01 to FY2009/10. Mongla port, as a river port, requires a long approach from the Bay of Bengal and insufficient dredging had made the anchoring of larger vessels difficult. Moreover, the export of jute, a major export item, decreased during the same period. As a result, the downward trend of cargo handling continued until FY2007/08. Since the Bangladesh government implemented the policy that a certain portion of grain import should be made via Mongla port at the time of the export evaluation, cargo handling at Mongla port was recovering.

Table 10: Cargo handling at Mongla port

Year	Ship calls	Cargo handling (ton)
2000/2001	313	2,766,461
2001/2002	268	2,252,880
2002/2003	291	1,800,516
2003/2004	446	1,494,231
2004/2005	455	1,476,172
2005/2006	385	1,482,644
2006/2007	193	914,375
2007/2008	128	722,834
2008/2009	151	1,137,826
2009/2010	190	1,649,283

Source: Mongla Port Authority

An interview with the Mongla Port Authority revealed that approximately 90% of export/import cargo was transported by inland waterway. A relatively small portion of land transport became a factor in preventing the incidence of project effects.

As stated in "3.3.2 Qualitative Effects", logistic conditions improved. Nevertheless, ship calls and cargo handling at Mongla port were affected by factors other than the implementation of this project. It can be seen that external conditions such as insufficient dredging by the port authority, a reduction of jute export, and the dependency on inland waterways prevented this project from generating its project effects.

3.4.2 Other Impacts

(1) Impacts on the Natural Environment

The consultant for construction supervision conducted environmental monitoring during the project implementation period and submitted the results to the executing agency. The executing agency shared the information on environmental monitoring with JICA when it was requested to do so. According to the executing agency, residents complained about dust from an asphalt plant. The design of the chimney was modified but it did not effectively prevent dust. After project completion, environmental monitoring was not conducted. At the FGD sessions, a few mentioned that the amount of fish caught had decreased. However, the causality between these incidents and the construction of the bridged was not confirmed as detailed studies had not

[19] A few people mentioned that the construction of the bridge affected silting on the riverbed and prevented the smooth operation of inland waterways. However, other factors such as insufficient dredging of waterways might explain the negative effect on inland waterways.

been conducted.

(2) Land Acquisition and Resettlement

Both the area of acquired land and the number of relocated households are higher than the plan. While the area of acquired land was 774,500m^2, the number of relocated households was 94 households. The reasons for these changes were that the design change for frontage roads required additional land and that it was difficult to identify appropriate land owners because of unreliable land registration. The increase in the amount of acquired land prolonged the period needed for land acquisition. Cash compensation was paid to land owners and resettlement to alternative land was not carried out.

Table 11: Land Acquisition and the Number of relocated households

	Plan	Actual
Acquired land (unit: m^2)	755,000	774,500
Number of relocated households	53	94

Source: RHD

RHD employed a NGO in order to obtain support for the review of the land acquisition plan, budgeting for land acquisition, and payment of compensation. Cash compensation to land owners was in accordance with Bangladesh regulations in principle but the amount paid was 150% of the average value of land in the vicinity of the project site (government price). When the market price was far above the government price, additional payment was allowed. Because of several problems such inaccurate land titling and inappropriate preparation of documents, it took more time to identify proper land owners. For this reason, compensations were paid after the commencement of civil works in some cases. The executing agency decided that land acquisition had involved no problems as the NGO had identified land owners and paid an adequate amount of compensation to them.

(3) Traffic Accidents

After the opening of the bridge, traffic accidents where vehicles hit a fence dividing non-motorized vehicles from motorized vehicles occurred frequently. Based on an inquiry conducted by the executing agency, it was found that the improvement of approach roads allowed a higher speed of vehicles while the width of carriage way suddenly became narrower with the fence at the curve. It was concluded that these factors had caused the accidents where vehicles hit the fence. After FY2009/10, the police cracked down violations of traffic rules more severely and at night an O&M contractor[20] guided traffic at black spots where accidents were prone to occur. As a result, the number of accidents started to decline. At the time of the ex-post evaluation, reflectors were sited at road sides for the prevention of accidents at night. For a further reduction in accidents, the executing agency planned to implement improvement works such as the extension of the fence and the shortening of traffic islands in order carriage ways not to become narrower suddenly.

Table 12: Traffic Accidents on the Rupsha Bridge*

Year	Number of Accidents	Number of Injuries	Number of Deaths
2005/2006	18	9	7
2006/2007	35	24	11
2007/2008	41	55	7
2008/2009	42	86	7
2009/2010	16	10	3

Source: RHD

Note: * Including approach roads

[20] Routine maintenance of the Rupsha Bridge was outsourced to a private company. See “3.5.1 Structural Aspects of Operation and Maintenance” for further details.

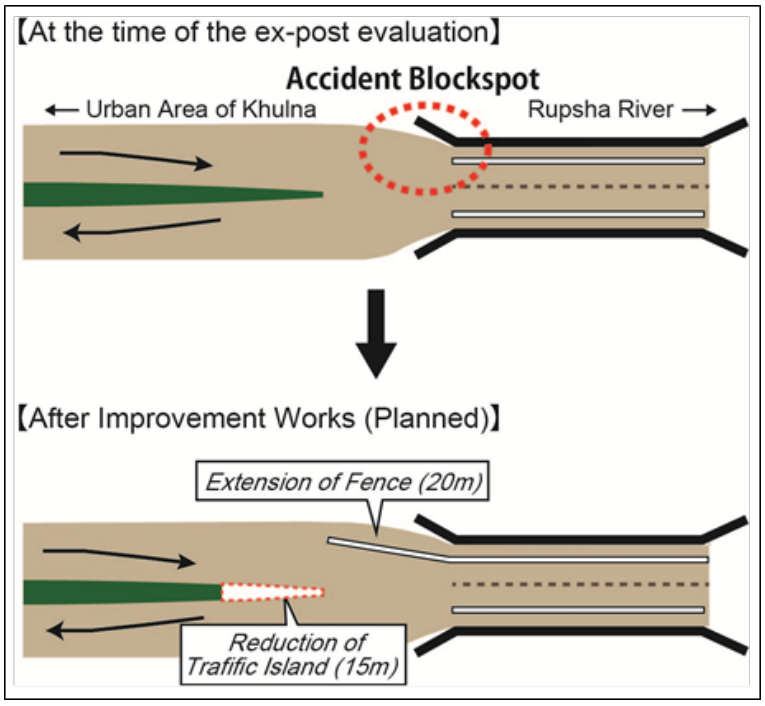


Figure 3: Accident Blackspot on the Rupsha Bridge

(4) Impact on Local Residents through the Termination of the Ferry Service

The ferry service on National Highway No.7 was no longer being operated at the time of the ex-post evaluation. Although it was planned that shuttle buses would be operated at the time of the appraisal, the operation of buses had not started. The Ministry of Communications (MoC) decided that the operation of shuttle buses was not appropriate as the fee charged by boats was cheaper than the bus fares and so bus services were unlikely to have enough users. Nevertheless, the operation of boats allowed pedestrians and cycles to cross the river. Thus, the termination of the ferry service did not negatively affect the mobility of local residents.

The construction of the Rupsha Bridge presumably contributed to an improvement in the livelihood of local residents. A few residents referred to a possible effect on the natural environment but the causality between these incidents and the Rupsha Bridge has not been proved. The executing agency concluded that land acquisition was conducted properly.

3.5 Sustainability (Rating: ②)

3.5.1 Structural Aspects of Operation and Maintenance

The responsibility for operation maintenance was clearly defined. Under the supervision of the MoC, RHD was in charge of the maintenance of the Rupsha Bridge and the approach roads together with toll collection for the bridge. RHD carried out routine maintenance by outsourcing this type of maintenance to the O&M contractor. While RHD periodically inspected the bridge as part of its contract management, the O&M contractor was directly in charge of the implementation of routine maintenance including inspection and repair of road surface, cleaning, and the inspection and replacement of road lights and vessel guiding lamps. The O&M contractor, which was NEA-TEC JV[21] at the time of the ex-post evaluation, was selected by

[21] Joint venture between EFCON AG (Austria), National Civil Engineers Limited (Bangladesh), Asian Traffic Technologies Ltd. (Bangladesh)

tender. There was no significant change in the number of staff at the O&M contractor. In 2010 there were 117 maintenance staff, out of which 95 employees were directly engaged in operation and maintenance. Periodic maintenance was not outsourced and RHD assume direct responsibility of this type of maintenance.

3.5.2 Technical Aspects of Operation and Maintenance

As for the collection of tolls, a computer system to record numbers of vehicles was sited at the toll plaza. Based on the comparison of toll revenue and actual traffic, efforts to minimize leakages in toll collection took place. One of the JV members had developed and supplied a toll collection system in other countries and had a sufficient technical capacity in toll collection system. At the beginning of the O&M outsourcing, the O&M contractor trained the employees engaged in O&M for toll collection. It can be concluded that the O&M contractor had the appropriate technical capacity for toll collection.

It is a reasonable judgement that that the activities for routine maintenance such as inspection and light repair did not require advanced technical capability. At the beginning of the O&M outsourcing, the O&M contractors trained its employees for routine maintenance. It can be concluded that the O&M contractor had the appropriate technical capacity for routine maintenance.

There were an issue in the maintenance of long bridges. RHD did not have a sufficient training budget and could not assign bridge specialists to maintenance. There were unexpected damage at bridges on trunk roads after maintenance works[22] and this suggested an issue in the supervision for the quality of maintenance works in long bridges.

3.5.3 Financial Aspects of Operation and Maintenance

While the road master plan, which was prepared by the Bangladesh government, assumed that the required total budget for routine and periodic maintenance would be 12. 2 billion taka per annum, the actual budget allocation was almost half the required amount. RHD faced constraints in its maintenance budget. The actual O&M budget for the Rupsha Bridge was used for payment to the O&M contractor, paying for routine maintenance and toll collection. As aforementioned in “3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)”, O&M costs substantially surpassed the estimation at the time of the appraisal. Since the opening of the bridge in 2005, the costs of periodic maintenance had not been included in the O&M budget. As for periodic maintenance of the Rupsha Bridge constructed by this project, the appraisal assumed this type of maintenance every seven years. As only six years had passed since the completion of the bridge, budget for periodic maintenance had not been since project completion.

Table 13: O&M Budget

Unit: million taka

Year	RHD’s O&M budget	The requited O&M budget for the Rupsha Bridge	The actual O&M budget for the Rupsha Bridge
2007/2008	6,178.21	45.60	42.95
2008/2009	5,143.84	40.13	40.73
2009/2010	6,094.74	40.13	37.73

Source: Project Completion Report, RHD

Since toll revenue is a part of the general budget for the Bangladesh government, RHD was not able to directly allocate the revenue to maintenance activities. Toll charges were set before

[22] According to the O&M contractor, at the Meghuna Bridge and the Meghuna-Gumti Bridge, expansion joints which were supposed to last for more than 10 years were broken within 2 years after their replacement. Given the negative effect on the life of the bridge body, early repair work was appropriate. However, the damage remained unrepaired for more than a year.

the opening of the bridge in March 2005. Since then, they have not been revised. As toll charges were set so that there could be no substantial increase from ferry tariffs, they were relatively inexpensive in comparison with those for Meghuna Bridge / Meghuna-Gumti Bridge and the Paksey Bridge. This comparison shows that pricing of tolls may not have prevented the use of the Rupsha Bridge.

Table 14: Toll charges for major types of vehicles

Unit: Taka

	Rupsha Bridge	Meghuna Bridge Meghuna-Gumti Bridge	Paksey Bridge
Motor Cycles	5	10	10
Cars	30	50	50
Buses	150	150	215
Trucks	150	400	215

Source: RHD

3.5.4 Current Status of Operation and Maintenance

No serious damage negatively affecting the incidence of the project effects was observed during the site survey. There was no damage in the expansion joints and scouring was not found.

Cracks appeared on the piers (MP2 and MP7) during project implementation. According to the executing agency, the cracks were narrow hair cracks and within RHD's standards. The contractor for civil works periodically inspected the cracks even after the completion of civil works and conducted painting and water proofing work on the piles at the beginning of 2011.

The site survey showed that routine maintenance was properly implemented. According to the O&M contractor, RHD routinely inspected the bridge (Surface 5-6 times annually and bridge body twice annually) as a part of contract management for routine maintenance. As neither RHD nor the O&M contractor had a bridge inspection vehicle, binoculars were used for inspection of the bridge body.

As aforementioned in "3.5.3 Financial Aspects of Operation and Maintenance", periodic maintenance had not been implemented for the period from the project completion to the ex-post evaluation because it did not reach the number of years which the appraisal assumed for this type of maintenance.

Some problems have been observed in terms of the technical and financial aspects, therefore sustainability of the project effect is fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The project has been relevant to the development plans of Bangladesh and has been meaningful in terms of the country's development needs. Difficult construction works required longer time than the plan due to the treatment of soft soil were but changes in the technical specifications and construction methods limited the delay to a short period only. In tandem with the reduction of cargo handling at Mongla port, traffic demand grew less than it had been forecasted. For this reason, the traffic volume at the time of the ex-post evaluation remained at almost 50% of the forecast. Serious damage which could negatively affect the incidence of the project effect was not observed in the site survey. However, in long run, the tight maintenance budget of the executing agency and insufficient experience in the supervision of the maintenance works for long bridges are issues for sustainability.

In light of the above, this project is evaluated to be partially satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None

4.2.2 Recommendations to JICA

None

4.3 Lessons Learned

(To assess countermeasures for traffic accidents)

Traffic accidents on the Rupsha Bridges remained at notable level from the opening to FY2009/10. Khulna side residents regarded the increase in traffic accidents as a social problem. Since the increase in traffic accidents after the completion of the bridge was not foreseen at the time of the appraisal, measures for the prevention of traffic accidents were not assessed. Traffic accidents frequently occurred where there were several contributing factors (an increase in traffic speed, curved carriageway, and narrower road width with fence). During the project formation and implementation stages, it is desirable that measures to prevent traffic accidents (such as a traffic safety campaign for drivers, traffic safety education for local residents, and the assessment of road design and warning signs) are assessed from several different aspects.

(To assess the assumptions for forecasting traffic volume)

The forecast for traffic volume on the Rupsha Bridge assumed an increase in cargo handling at the jetties in Mongla port. This in turn assumed both an increase in cargo handing at Mongla port and containerization stimulating a shift from inland waterways to land transport. As these assumptions were not fully met, this severely affected traffic volume. In the case that a forecast for traffic volume is based on important assumptions, it is desirable to estimate how non-attainment of assumptions would affect traffic volume and to use the estimate for sensitivity analysis in the calculation of IRR and assessment of countermeasures.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1.Project Outputs	(1) Civil Works 1) Rupsha Main Bridge Length 1,360 m, Wide 16 m 2) River Revetment East Side 150 m 3) Approach Roads West section 5,880 m East Section 2,799 m 4) Canal Bridges 2 Bridges 5) Related Facilities 1 Toll Plaza and 2 Bus Bays (2) Consulting Services International: 222 M/M National: 639 M/M	(1) Civil Works 1) Same as planned 2) River revetment 145 m Protection by stones 37m 3) Same as planned 4) Same as planned 5) Same as planned (2) Consulting Services International: 249.9 M/M National: 689 M/M
2.Project Period	March 2001 – September 2004 (43 months)	March 2001 – May 2005 (51 months)
3.Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 8,045 million yen 2,504 million yen (1,160 million Taka) 10,549 million yen 8,300 million yen 1 Taka = 2.16 yen (As of May 2000)	 7,766 million yen 4,385 million yen (2,160 million Taka) 12,151 million yen 7,966 million yen 1 Taka = 2.03 yen (Average between January 2001 and December 2005)