

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR CONSTRUCTING MEGHNA-GUMTI BRIDGE
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH

NOVEMBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

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マイクロ
フィルム作成

P R E F A C E

In response to a request from the Government of the People's Republic of Bangladesh, the Government of Japan has decided to conduct a Basic Design Study on the Project for Constructing Meghna-Gumti Bridge and entrusted the study to the Japan International Cooperation Agency (JICA).

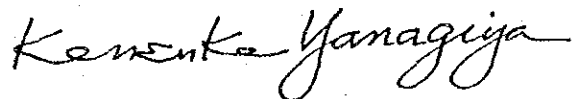
JICA sent to Bangladesh a survey team headed by Mr. Masaaki Tatsumi, Director, First Division, Design Department, the Honshu-Shikoku Bridge Authority from May 17 to June 30, 1990.

The team exchanged views with the officials concerned of the Government of Bangladesh and conducted a field survey at project site. After the team returned to Japan, further studies were made. Then a mission was sent to Bangladesh in order to discuss a draft report and the present report was prepared.

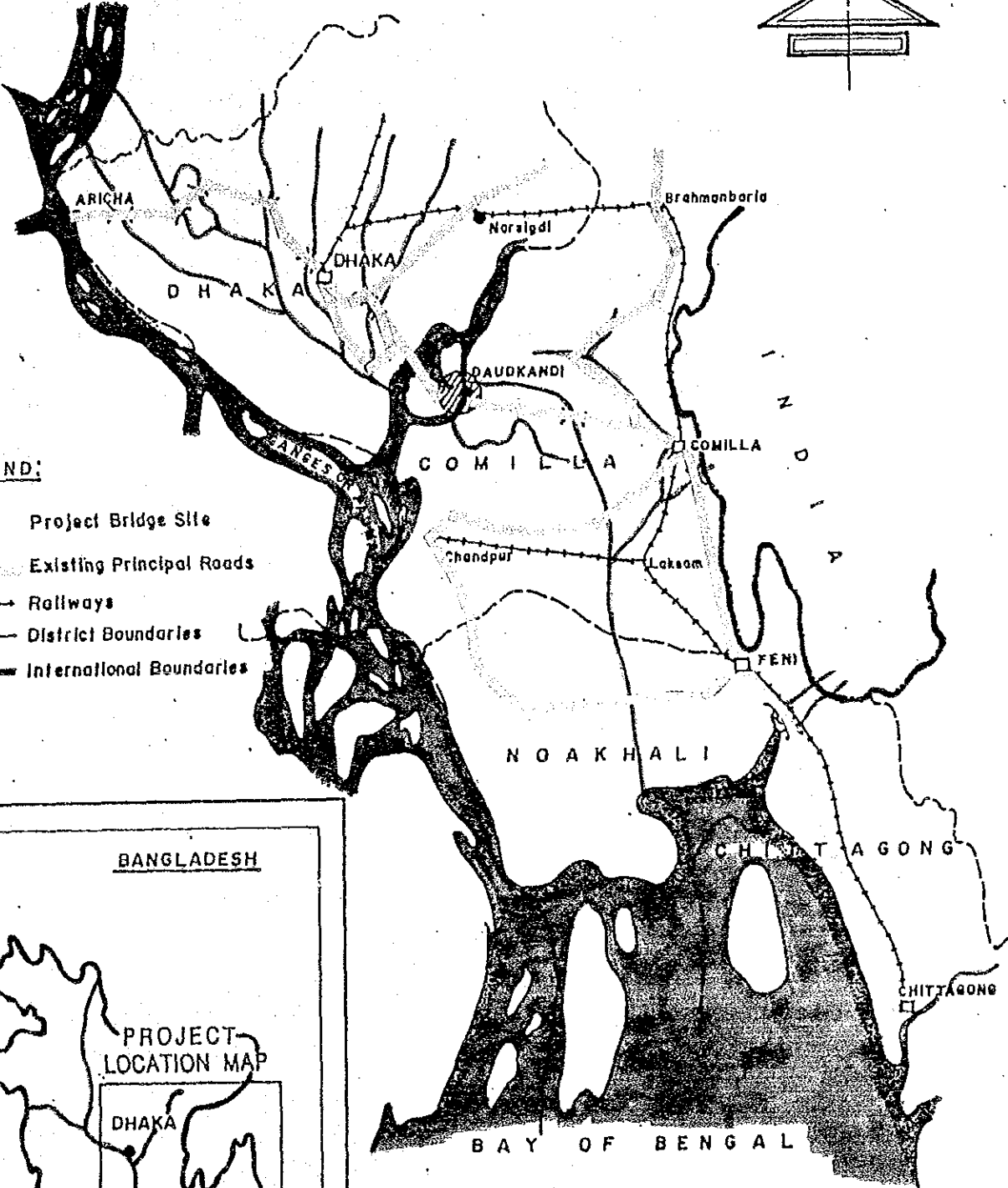
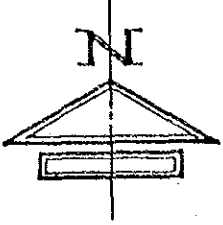
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of Bangladesh for their close cooperation extended to the team.






November 1990

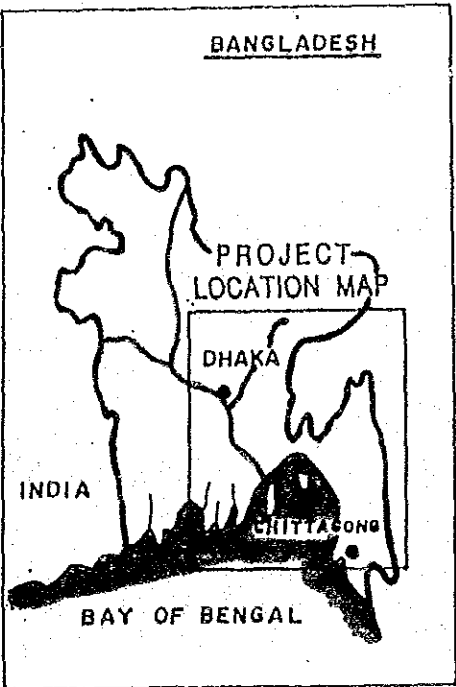


Kensuke Yanagiya
President
Japan International Cooperation Agency



LEGEND:

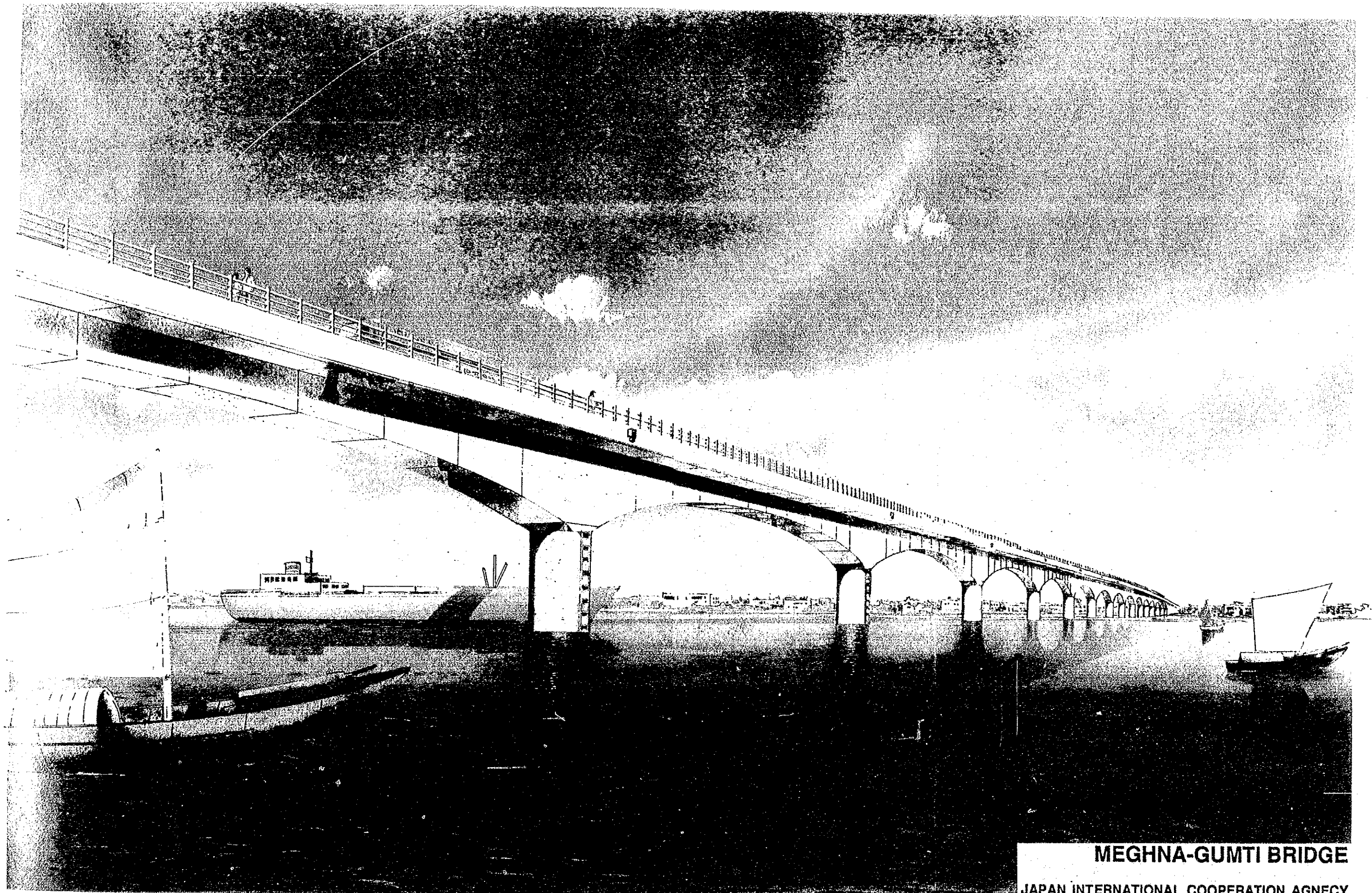
-  Project Bridge Site
-  Existing Principal Roads
-  Railways
-  District Boundaries
-  International Boundaries



PROJECT LOCATION MAP



SCALE



MEGHNA-GUMTI BRIDGE

JAPAN INTERNATIONAL COOPERATION AGENCY

PERSPECTIVE SKETCH OF MEGHNA-GUMTI BRIDGE



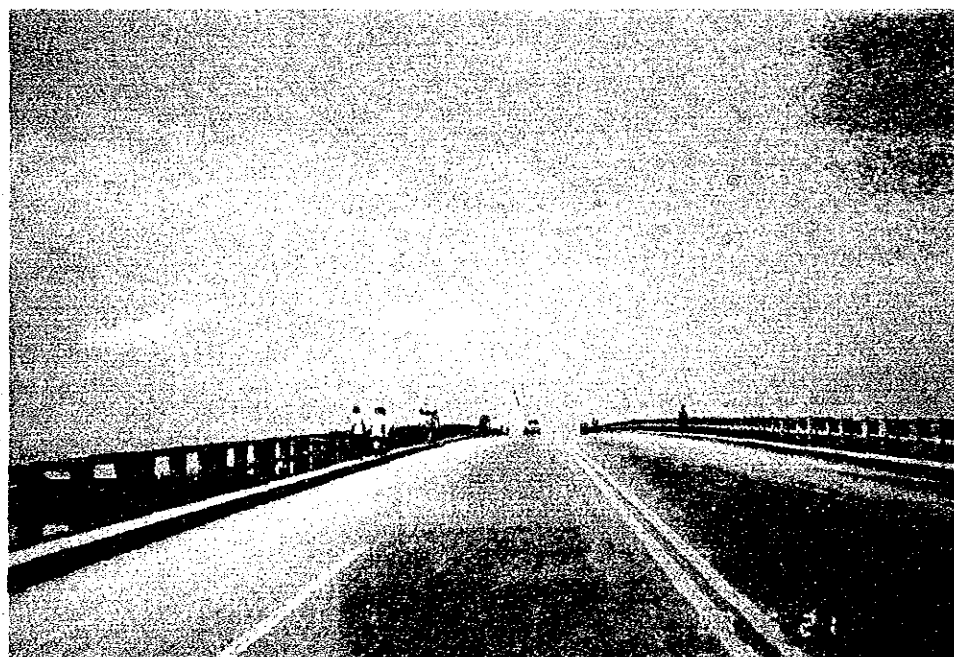
Dhaka - Chittagong National Road
(Between Dhaka and Sitalakhya Bridge)



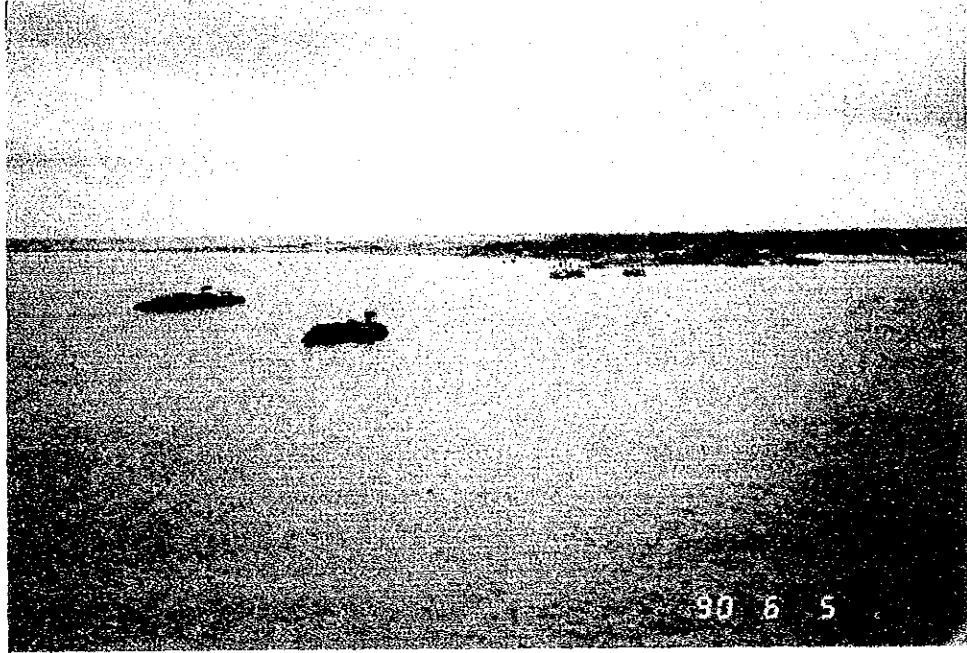
Dhaka - Chittagong National Road
(Between Dhaka and Sitalakhya Bridge)



Dhaka - Chittagong National Road
(Narrow 2-Lane 2-Way Road beyond Sitalakhya)



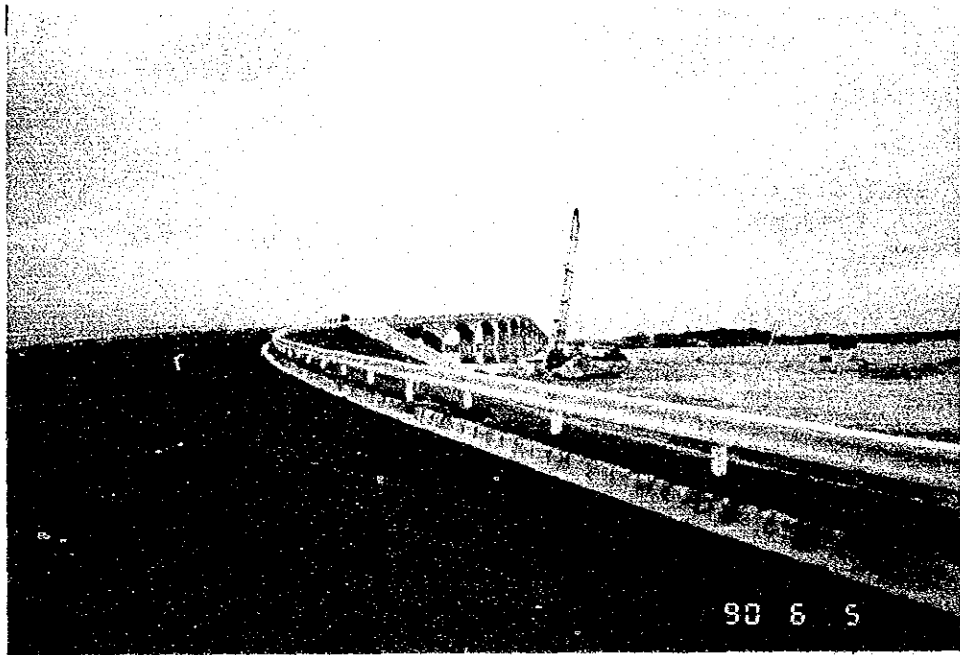
Sitalakhya Bridge
(Approximately 14km from Dhaka,
Urbanisation is Rapid in the Region)



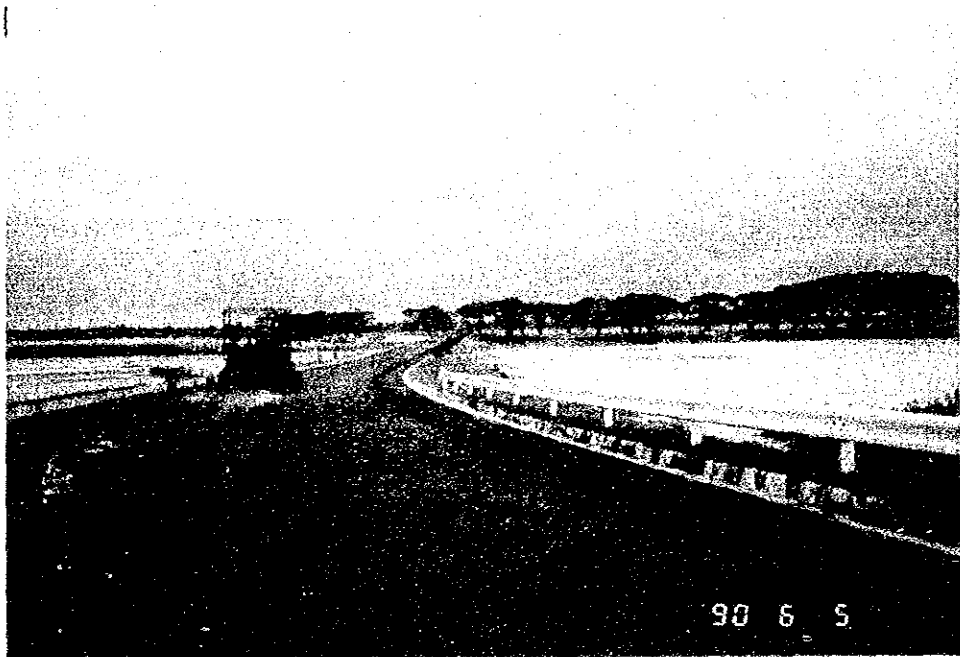
Meghna River Ferry Crossing



Dhaka - Chittagong National Road
(Meghna Bridge 29km Approx. from Dhaka,
Road Leading to Ferry Ghauts and New Approach Road)



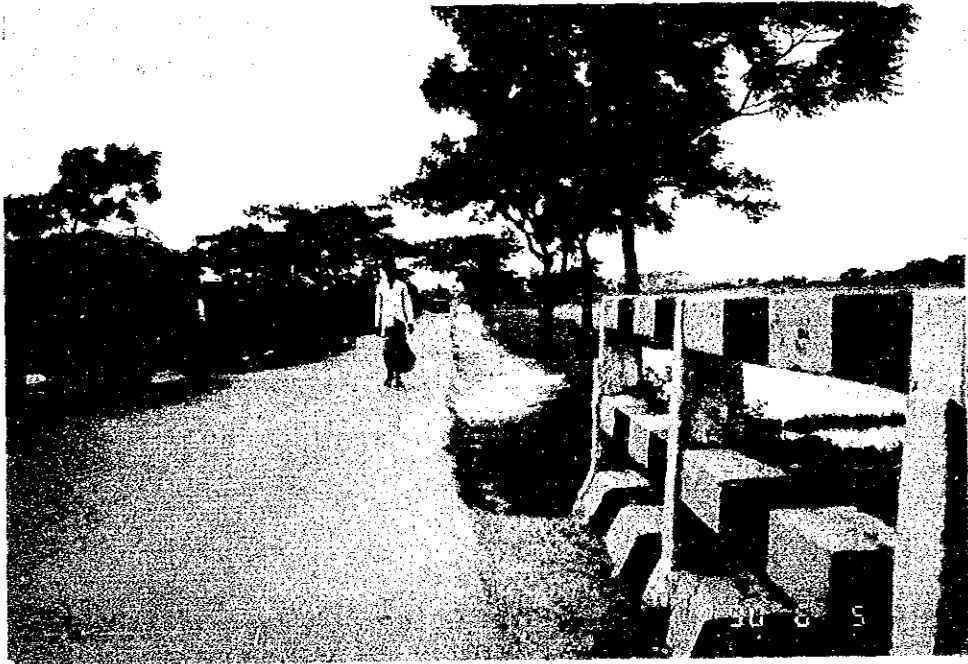
Meghna Bridge
(Comilla Side, Final Stage of Construction)



Meghna Brige
(Dhaka Side, Final Stage of Construction)



Queue of Truck at Meghna River Feery Crossing
(Same Queue, Viewing Back)



Queue of Truck at Meghna River Ferry Crossing
(Comilla Side Ferry Ghauts Approximately 1km Ahead)



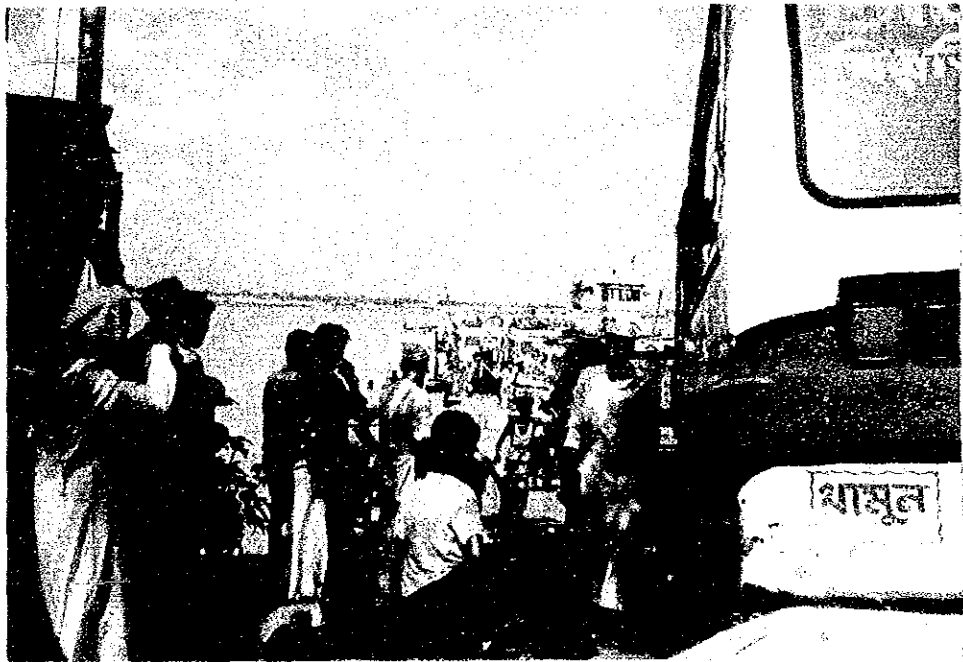
Queue of Truck and Traffic Accident



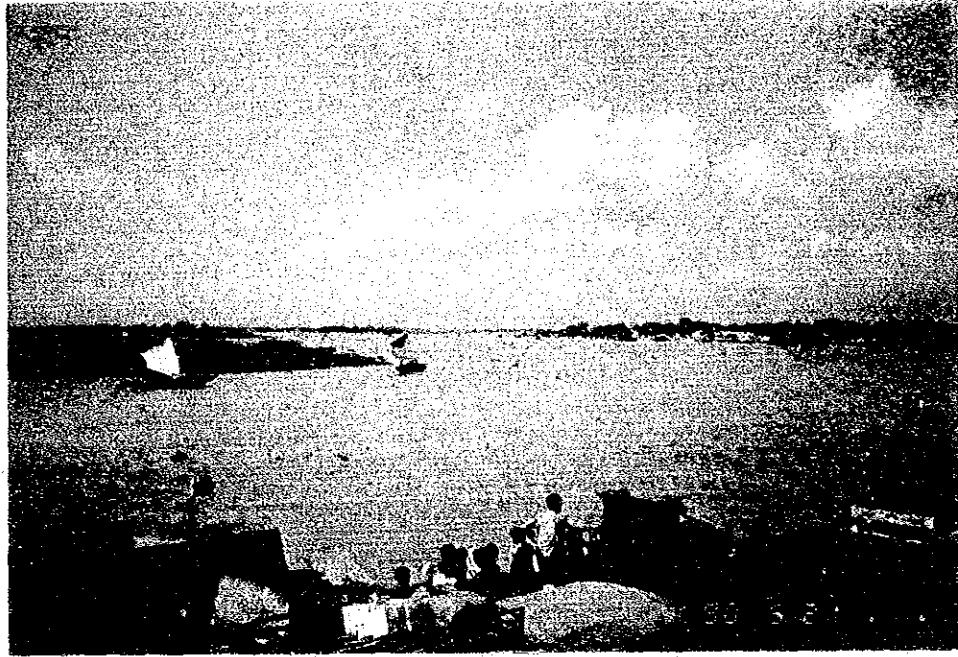
Queue of Truck and Traffic Accident



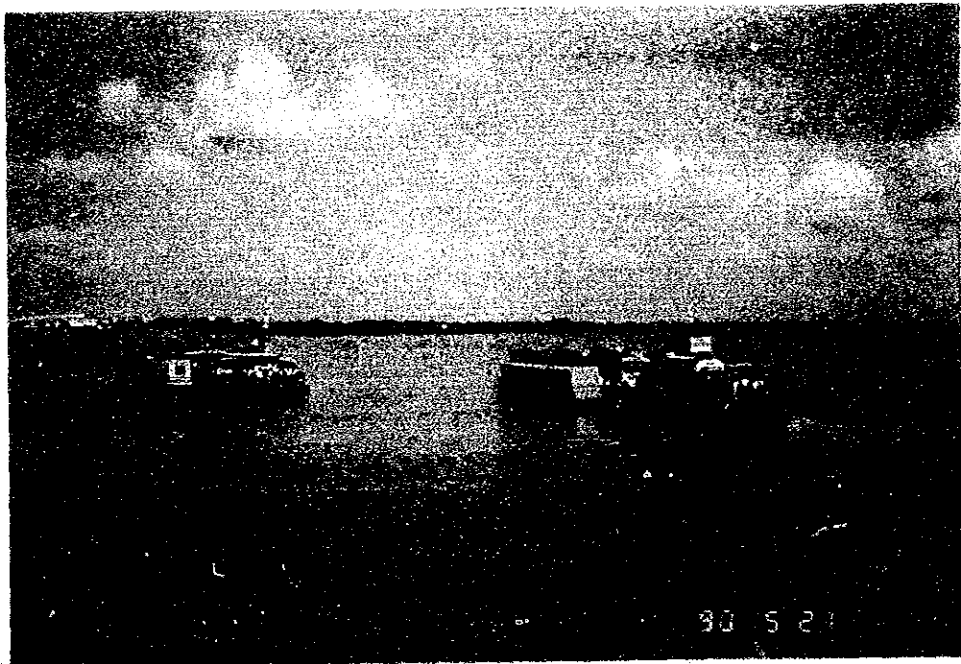
Meghna - Gumti River Ferry Crossing
(Departure from Dhaka Side Ghauts)



Meghna - Gumti River Ferry Crossing
(Roll On at Dhaka Side Ghauts)



Site of Meghna - Gumti Bridge Construction
(Proposed Meghna - Gumti Bridge Centreline Hits the Char)



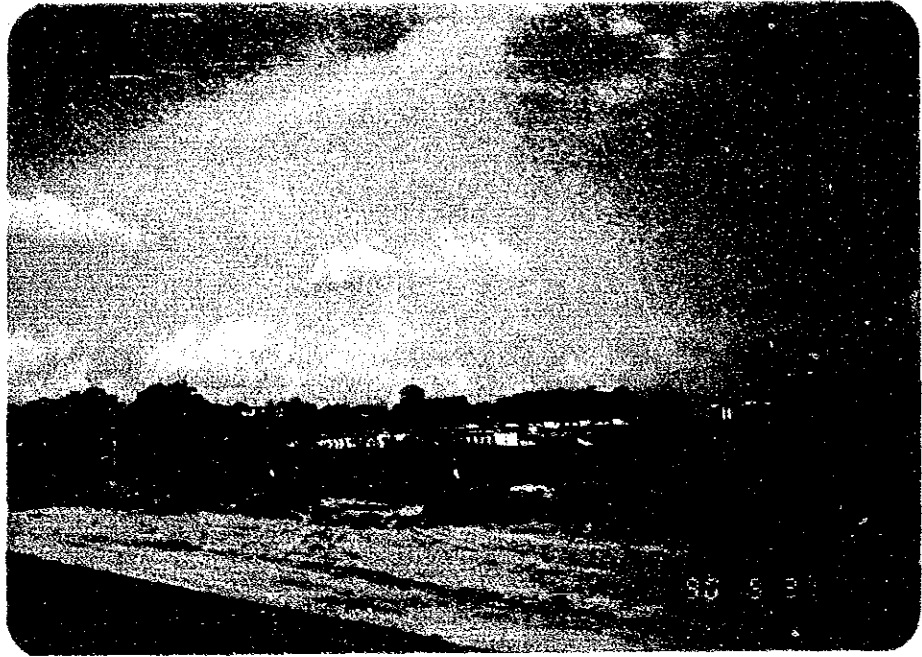
Site of Meghna - Gumti Bridge Construction
(Proposed Meghna - Gumti Bridge Centreline Situates
About 150m Upstream of Present Ferry Course)



Dhaka - Chittagong National Road
(Road Improvement is Completed in Chandina Bypass)



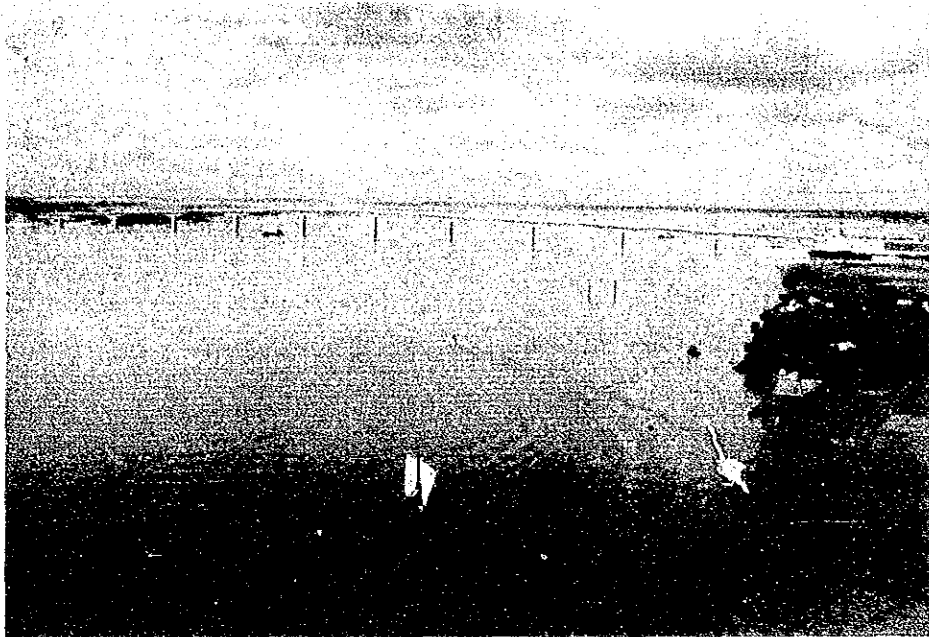
Dhaka - Chittagong National Road
(Near the End of Approach Road at Comilla Side,
Completion of Road Improvement is Scheduled in Mid 1991)



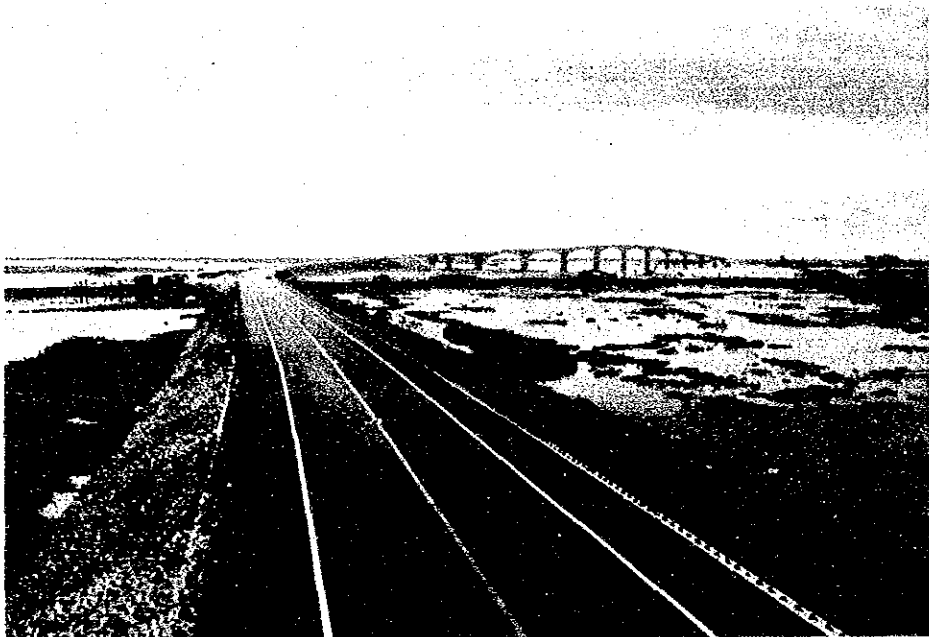
Dhaka - Chittagong National Road
(Road Improvement is Ongoing Near Comilla)



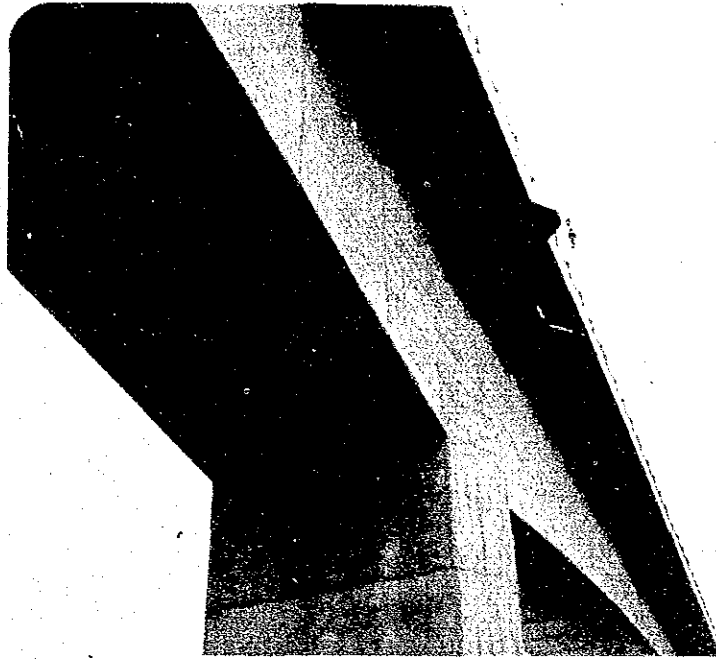
Dhaka - Chittagong National Road
(Road Improvement is Ongoing Near Comilla)



Meghna Bridge



Meghna Bridge
(Viewed from Comilla Side)



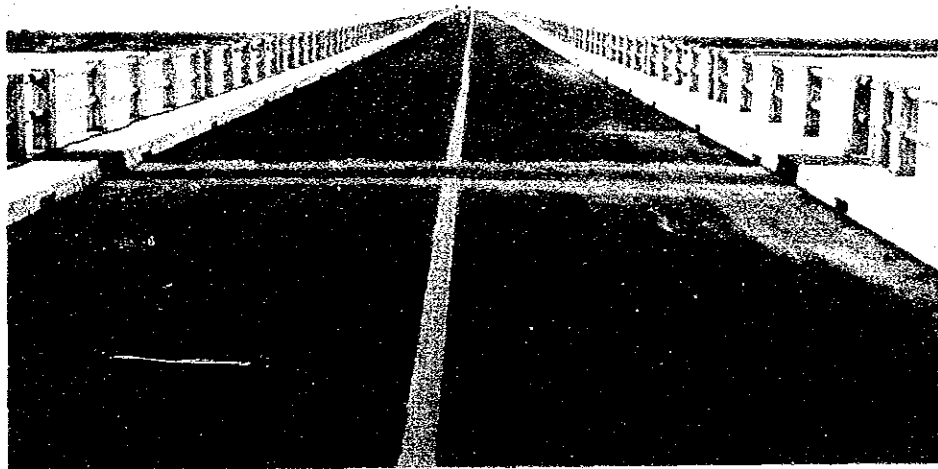
Meghna Bridge
(Use of Wide Girder has Achieved an Aesthetic Grace
which Blends Well with Pier Column)



Meghna Bridge
(Viewed from Meghna Side Abutment)



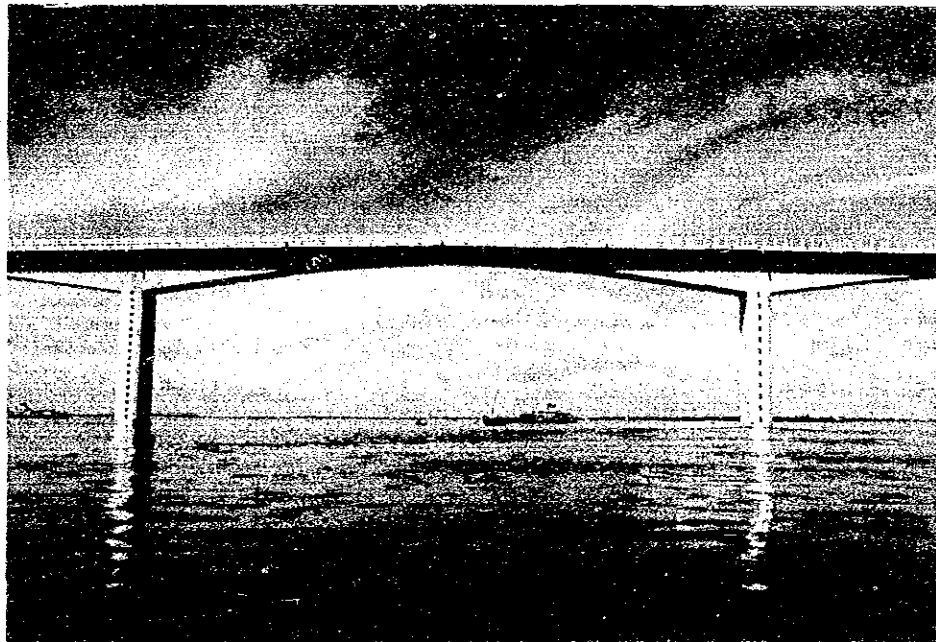
Meghna Bridge
(Dhaka Side Approach Road)



Meghna Bridge
(View of Birdge Surface)



Meghna Bridge
(Installation of Navigation Light)



Meghna Bridge
(Gauge Showing Navigation Clearance)

SUMMARY

Dhaka, the capital and centre of the political and economic activities of Bangladesh, and Chittagong, the second largest city and the centre of industry with the nation's largest port, belong to the Southeastern Economic Region which is the most populated and important region in Bangladesh. The biggest bottleneck on the Dhaka-Chittagong Highway has been the ferry crossings at Meghna River and at Meghna-Gumti River.

The Government of the People's Republic of Bangladesh (the "Government") planned to construct bridges to eliminate these bottlenecks and requested the Government of Japan in 1983 to conduct a Feasibility Study for the Meghna and Meghna-Gumti Bridges Construction Project. In response to this request, the Government of Japan decided to undertake the feasibility study and entrusted it to the Japan International Cooperation Agency ("JICA").

The results of the study confirmed the feasibility of the construction of these bridges on technical, economic and social grounds and the government of Japan extended Grant Aid for construction of the Meghna Bridge. Construction started in April, 1987 and is presently in the final construction stages with completion scheduled for the end of March 1991.

After completing the Meghna Bridge construction, the only remaining bottleneck on the Dhaka-Chittagong Highway is the Meghna-Gumti River ferry crossing. The Government has requested the Government of Japan for the construction of Meghna-Gumti Bridge on a Grant Aid Assistance basis. In response to the request of the Government, the Government of Japan decided to conduct a basic design study on the project for constructing the Meghna-Gumti Bridge (hereinafter referred to as the "Project"), and entrusted the study to JICA. JICA sent a Study Team to carry out the Study from May 17 to June 30, 1990. The Study Team had a series of discussions on the Project with the Government officials concerned. The major point of understanding reached is:

- The main objective of the Project is to construct a bridge over the Meghna-Gumti River to provide uninterrupted road transport between

Dhaka and Chittagong. This will contribute toward the enhancement of the nation's economic activities.

The Study Team discussed with RHD, the location of the bridge and access road, width of the bridge (and in particular the necessity of an additional central lane of 2.5 m over the bridge.); and the height clearance of 7.5 m to provide clearance for river vessels.

The study team carried out the following field surveys:

- Topographic Survey
- Soundings along the Proposed Bridge Centreline
- 24-Hour Traffic Count Survey at Project Site
- Hydrological Study
- Understanding of Existing Construction Environment
- Establishment of Bridge Structure Scheme
- Clarification of Maintenance after the Construction,

The results of the field surveys and initial studies conducted in Bangladesh were used to prepare a basic design in Japan. The result of the field survey and the basic design is:

- River courses of the Meghna Branch and Gumti Tributary have been stable without erosion of riverbanks near the proposed construction site. Accordingly, the construction site should be located as in the F/S.
- The design high and low water levels of the Meghna-Gumti River are +6.65 m and +0.64 m respectively (100-year return period), with a flood discharge of approximately 12,400 m³/s. 7.5 m of clearance under the bridge must be kept for the navigation on a basis of 5.25 m average water level.
- The bearing strata for piled foundations is identified at elevations of approximately -60 m near the Dhaka side riverbank and approximately -70 m near the Comilla side riverbank.

- The horizontal alignment of the bridge is straight and the vertical alignment of the bridge is determined by consideration of the passage of boat traffic during the flood season. (see Figure in S-6)
- Since 3 lanes, including an additional central lane of 2.5 m width over the bridge, may be more dangerous to traffic by head-on collisions, 2 lanes is adopted as a result of discussions. In case of traffic accident, damaged vehicles should be moved by recovery vehicles so as not to disturb other traffic.
- Bridge length is finally determined to be 1,410 m by moving the Comilla side Abutments nearer to the present riverbank. This is 70 m length shorter than the F/S, because the river course of the Meghna Gumti River is stable and Comilla side of Gumti Tributary is accumulating material.
- The Adopted span arrangement of the bridge is $52.5 \text{ m} + (87.0 \text{ m} \times 15) + 52.5 \text{ m} = 1,410 \text{ m}$.
- The navigation channel clearance of 75 m width and 7.5 m height was adopted for both the Meghna Branch and the Gumti Tributary.
- Proposed construction period of 58 months is F/S in the shortened to 50 months because foundation piles, piers and Abutments can be executed in the rainy season.
- The outline of design features of the bridge structure is as follows:
 - 1) Bridge Center Line : Based on the selected route of the F/S, the bridge site is determined to be 150 m in the upstream direction from the existing Meghna Gumti Ferry Gatt.
 - 2) Bridge Length : 1,410 metre
 - 3) Type of Bridge Structure : Superstructure and piers are to be concrete as recommended in the F/S
 - a. Superstructure : Prestressed concrete box girder (cast-in-place) by cantilevered construction. Centre-hinge type
 - b. Abutments : Buttress type

- c. Piers : Circular column type, 16 piers
- d. Foundation Piles : Cast-in-place reinforced concrete piles by reverse circulation drill method
- 4) Number of Lanes and Lane Width : 2 x 3.6 metres
- 5) Sidewalk Width : 1.0 metre sidewalk on both sides
- 6) Live Load : AASHTO STANDARD HS20-44 (MS18)
- 7) Design Seismic Coefficient : $K_h = 0.05$

- The outline of design features of the approach road is as follows:

- 1) Approach Road Length : 870 metre for Dhaka side and 470 metre for Comilla side
- 2) Pavement : Asphalt pavement
- 3) Number of Lanes and Lane Width : 2 x (3.35 metres + 0.30 metre side strip)
- 4) Shoulder Width : 1.95 metres
- 5) Pavement Design Standard : BS Road Note No.29

- Equipment requested to be provided: Two 25 tonne recovery vehicles.

Although Bangladesh has sufficient numbers of labours, and operators who can drive construction machinery with adequate technical capability, there is no company with enough equipment in the civil engineering industry because building construction is the major field. Accordingly, almost all equipment for this project and construction materials except cement, aggregate, reinforcing bars and asphalt are to be procured from Japan.

The camp site is revetted by dredging the river bed to prevent the site from flooding in the rainy season, as was done for Meghna bridge project. Compared with construction of Meghna bridge project, this project differs by the construction of the piled foundations and substructure in the sand bar during the rainy season. The following three matters must have particular attention paid to them during execution:

- Construction of pier columns in the "dry" by the construction of cofferdam and pump drainage inside the cofferdam
- Execution of concrete piling at the site by the reverse circulation drill method
- Quality control for the construction of Cantilever Erection Method and Hinge Construction

Mechanized batching plant and automatic production controls must be employed for this work which requires high accuracy and speed due to the strict limitation of the construction period. This project has 6 months for the detailed design and 50 months for construction.

The influence area of the Project covers the entire area of Southeastern Economic Region, which is the most populated and important in Bangladesh. The Dhaka-Chittagong Highway runs through the region and is the country's most important highway. The region's population and GRP occupy approximately 30% (based on the 1981 census) and 32% (based on 1987-88 records) of the Bangladesh total figures. The land transport demand of Bangladesh originates mainly in Dhaka and Chittagong. The shares in freight transport volumes by truck in these two cities are 50% (Dhaka) and 30% (Chittagong) respectively (based on a 1985 study). The Dakka-Chittagong Highway on which this project is located, has biggest share in both number of passengers and amount of cargo, and is the most important road in Bangladesh in terms of economic activity. This project, accordingly, contributes not only to the surrounding area of the project but also activates the whole of Bangladesh.

- The feasibility study on Meghna, Meghna-Gumti bridges construction (March, 1985, JICA) revealed the following economic indicators. These are considered to be appropriate in the present situation, in the light of the result of traffic count survey conducted by the Study Team.

As the result of this detailed design plan, present assumptions for economic analysis, traffic demand forecast, are still the same as that of the F/S 5 years ago. And, the result of the traffic survey by the study team indicates that the actual increase of the traffic demand is higher than

expected. From those points of view, the economic analysis is still effective at present.

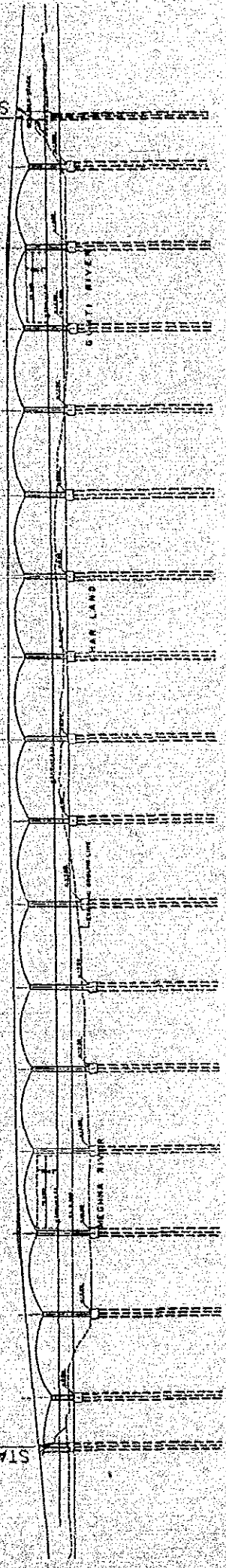
The realisation of Meghna and Meghna-Gumti Bridges will create immeasurably large indirect benefits. It will overcome the inconvenience of the time-consuming ferry crossing and provide uninterrupted road transport and contribute to development along the region traversed, and will invite investments and hence increase employment opportunities.

- The realisation of the Meghna and Meghna-Gumti Bridges together with the betterment of Dhaka-Chittagong Highway by ADB financing will reduce travel time by half, which at present, is 12 hours. It contributes to promoting foreign direct investment through reduction in travel time and traffic costs.
- Large numbers of people and construction materials from the surrounding area will be employed for this project following that of the Meghna bridge project. From these points of view, this project is significant for grant aid and should be implemented soon.

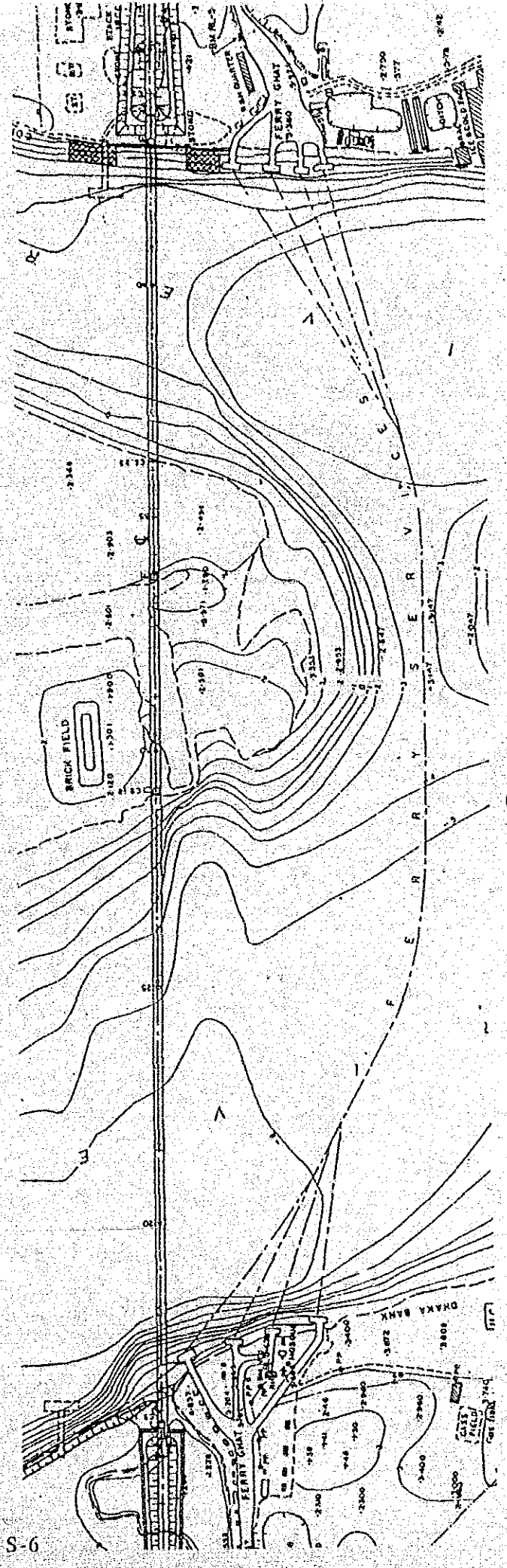
BRIDGE LENGTH L=1410 M

STA 43+30

STA 15+20



PROFILE



PLAN

9-5

