7/IX

PEOPLE'S REPUBLIC OF BANGLADESH

STUDY REPORT
ON
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT

ACCESS HIGHWAY

(FIRST STAGE)

MARCH 1975

JAPAN INTERNATIONAL COOPERATION AGENCY

MITSUI CONSULTANTS COMPANY LTD

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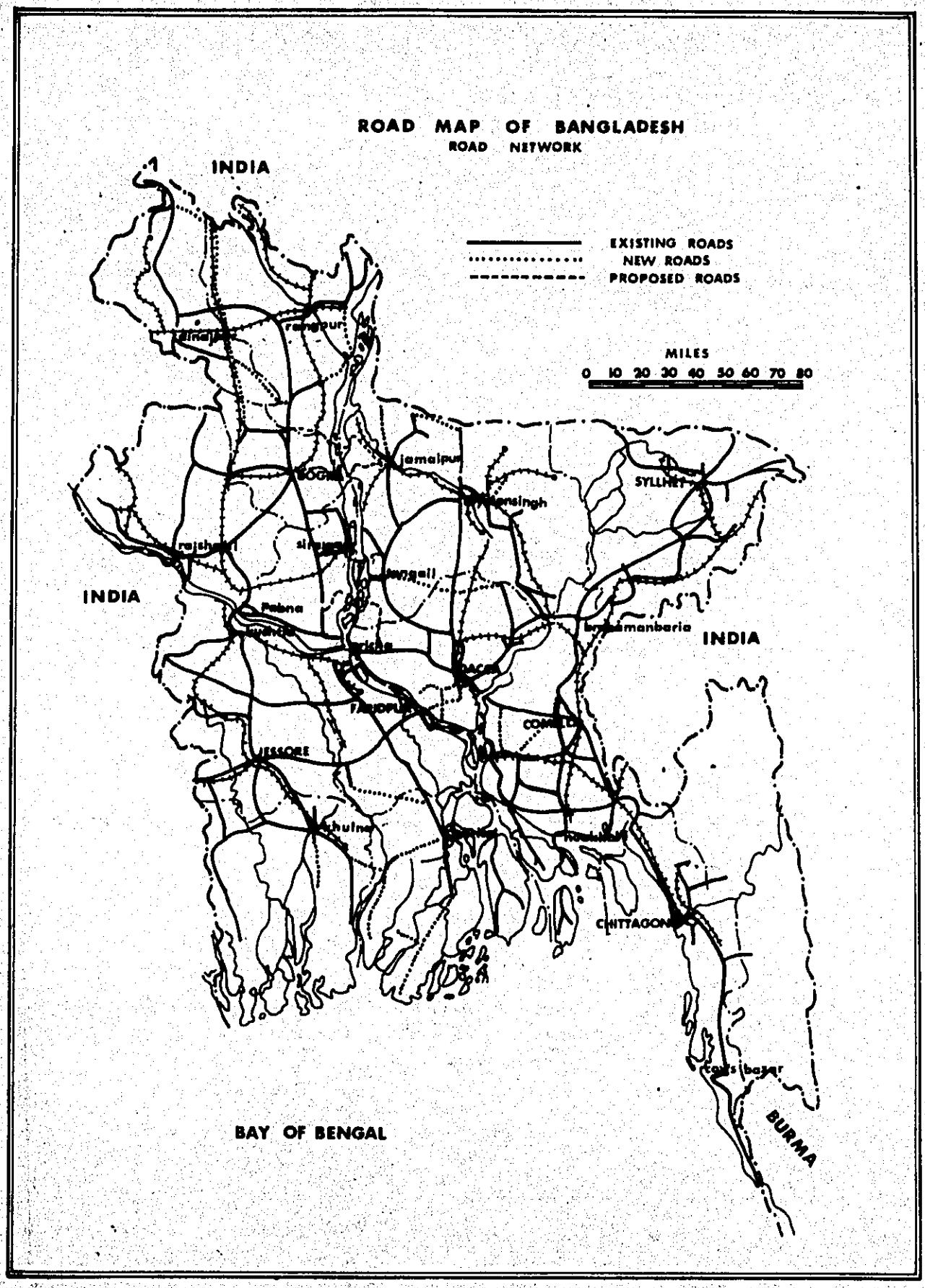

ROAD MAP OF BANGLADESH
ROAD NETWORK
INDIA
EXISTING ROADS
NEW ROADS
PROPOSED ROADS
MILES
0 10 20 30 40 50 60 70 80
rangpur
jamalpur
SYLLHET
INDIA
Pabna
INDIA
JESSORE
CHITTAGONG
BAY OF BENGAL
BURMA

C O N T E N T

ABBREVIATION AND UNIT

MOC	Ministry of Communications
MFCWRP	Ministry of Flood Control, Water Resources and Power
BWDB	Bangladesh Water Development Board
BIWTA	Bangladesh Inland Transport Authority
SOB (GTS)	Survey of Bangladesh
Bangladesh	The Peoples Republic of Bangladesh
Jamuna River	The Brahmaputra-Jamuna River
R & H	Roads and Highways Directorate
WAPDA	Water and Power Development Authority
JICA	Japan International Cooperation Agency
OTCA	Former name of JICA
Prefeasibility Report	Prefeasibility Report on Jumuna River Bridge Construction Project prepared by the Japanese Government Study Team for the Overseas Technical Cooperation Agency, Japan, March 1973
Inception Report	Inception Report on Feasibility Study for Jamuna River Bridge Construction Project submitted by the Overseas Technical Cooperation Agency, Japan
DHWL	Design high water level
GL	Ground level
WL	Water level
HWL	High water level
LWL	Low water level
PWD	Public Works Department
RL	Reduced level
PH	Proposed height

TO CONVERT	TO	Multiply by	
inches (in.)	millimeters (mm)		25.40
iches (in.)	centimeters (cm)		2.540
inches (in.)	meters (m)		0.0254
feet (ft)	meters (m)		0.305
miles (mi)	kilometers (km)		1.61
yards (yd)	meters (m)		0.91
square inches (sq in)	square centimeters (cm^2)		6.45
square feet (sq ft)	square meters (m^2)		0.093
square yards (sq yd)	square meters (m^2)		0.836
acres (ac)	square meters (m^2)		4047.
square miles (sq mi)	square kilometers (km^2)		2.59
cubic inches (cu in.)	cubic centimeters (cm^3)		16.4
cubic feet (cu ft.)	cubic meters (m^3)		0.028
cubic yards (cu yd)	cubic meters (m^3)		0.765
pounds (lb)	kilograms (kg)		0.453
tons (ton)	kilograms (kg)		907.2
one pound force (lbf)	newtons (N)		4.45
one kilogram force (kgf)	newtons (N)		9.81
pounds per square foot (pst)	newtons per square meter (N/m^2)		47.9
pounds per square inch (psi)	kilonewtons per square meter (KN/m^2)		6.9
gallons (gal)	cubic meters (m^3)		0.0038
gallons (gal)	liter (c/m^3)		3.8
acre-feet (ac-fe)	cubic - meters (m^3)		1233.
gallons per minuts (gpm)	cubic meter/minute (m^3/min)		0.0038
gallons per second (gps)	cubic meter/second		0.00063
TAKA (TK)	YEN		36

SUMMARY

SUMMARY

1 The Principal Purpose of the New Highway Link

The existing Aricha-Nagarbari road ferry is only the highway link between the northern district of Bangladesh with Dacca and other eastern district of Bangladesh. As this ferry is too much congested, road communication between the eastern part and the western part has not been efficient. Therefore it is necessary to connect the eastern part with the western part by new highway link and bridge across the Jamuna river.

2 Project Area

General

Generally the ground slope towards South, and most of the land of the project area lie between the 20ft and 60ft contours above the SOB level. The land to the west of the Jamuna is generally higher than the eastern part of the project area.

Geology

The project area is entirely a part of Bengal Basin subsidence which is filled by alluvium gradually deposited by the Jamuna and their numerous tributaries in the quarternary geological age. The alluvial deposits typically range from silt and clay to sand. The entire alluvial deposits in the Basin comprise Pleistocene and recent sediments. The Jamuna sediments are characterised by a higher percentage of fine materials and a typical red-brown colour. The project area consists of the flood plains of the Jamuna, the Ganges, their numerous tributaries and distributaries.

Climate

Climatically, the country has two distinct seasons, a dry season from October to May and a wet season from June to September. Over 80% of the annual rainfall occurs during the wet monsoon or rainy season when flood invariably does. The normal annual rainfall varies

from approximately 70 in. to 80 in. at the project area. In addition the project area is subject the high flood of the Jamuna. The recent maximum flood occured in the year 1970. This year, most of the principal rivers crossed the danger marks.

3 Progress of working

The access highway study team has carried out the field survey, collected useful data and exchanged opinions with R & H engineers during a period from January 18, 1974 to February 22, 1974 in People's Republic of Bangladesh.
The existing road map is shown in Fig.1-1. the table of inventory of existing approach road facilities is shown in Table.1-1.

In addition, the study team has compiled the report of Japanese version about the above survey which the study team had submitted to Japanese International Cooperation Agency (former "O.T.C.A.").
Some additional discussion and reviews among the study teams have resulted in compiling progress study report of English version for Tokyo Meeting.

In order to compile the Interim Report, the access highway study team, after the Tokyo Meeting, has revised the study report as much as possible according to suggestion of Mr. Shafiullah.

4 Purpose of the Access Highway Study

The Japanese Preliminary Survey Team Proposed the four bridge sites along the Jamuna river, namely, Bahadurabad, Gabargaon, Sirajganj and Nagarbari.

This study has designed and made an estimate of capital cost of access road at every four proposed site to connect the Jamuna bridge with the existing all-weather road, including Tangail-Bhuapur-Gopalgonj and Sirajanj-Hatikampul Roads, on the right and left side of the Jamuna.

However, without the sufficient result of data analysis the economic and traffic study team could not brought any decision regarding the number of lanes required according to design hour volume forecasting.
The study team has, therefore, planned the phasing and estimated the capital cost, for the highway construction for the two-lane (each eleven feet wide) undivided highway which will be extended to a four-lane divided highway in the future.

The Government of the People's Republic of Bangladesh shall take an appropriate actions to reserve sufficient land for two additional lane for the future extension on the other side of the borrow pit and the highway: The typical cross section is shown in Fig.2-1 and geometric design standards show in Table 2-1.

5 Definition of Access Highway

The definition of access highway by the study team corresponds to the all-weather road including Tangail-Bhuapur-Gopalgonj and Sirajganj-Hatikampul roads, on the both sides of the Jamuna to approach road of the Jamuna Bridge.

6 Outline of Horizontal Alignment

Taking account of the result of the field survey and regional speciality of Bangladesh in to consideration, the study team has planned Horizontal Alignment, giving priority to the (1) retention of existing road facilities and the (2) selection of river stability crossing sites at tributaries and distributaries according to the principle that (3) access highway must be straight. The proposed alignment passed through principal villages because of the above mentioned.

Besides, there are many marshes in the project area. Therefor the access highway study team has designed the route with detours and meanders so as to dodge the marshes on the left sides of Bahadurabad and Gabargaon. Each proposed horizontal alignment is shown in Fig.4-5,8,11,14,

7 Outline of Vertical Alignment

Decision making in Design High Flood Level (D.H.F.L.) is required prior to the design of vertical alignment. Regarding the decision of D.H.F.L., for the left side, the study team has adopted the maximum flood height which was recorded last in July, 1970. And it is also said that 1970 recorded the largest numbers of flood in the recent years.

In relation to the right side, on the other hand, study team has decided on the figures by the hearings at sites for Bahadurabad (Gobindganj)

and Gabargaon (Bogra) sites, and the study team has decided the D.H.F.L., which is from the Stream Gaging Data for Right Embankment Project at Sirajganj (Ulapara) and Nagarbari (Bagabari) sites. The whole alignment will be built with a minimum free-board of three feet above D.H.F.L.

The data of 1974 were unavailable for our study this time, therefor, the study team has been preparing D.H.F.L., in accordance with the data of 1970. Upon geting the latest data of 1974, the study team will study further in detail.

Each proposed Vertical Alignment is shown in Fig. 4-6, 9, 12, 15.

8 Elevation

Every land elevation described in this report is in terms of the great trigonometrical survey (G.T.S.) datum of the Survey of Bangladesh.

To bring a G.T.S. datum in terms of PWD datum, 1.509 feet is to be added.

9 Design of Structures

The study team has prepared for the site selection for long bridges which are longer than 100m after the study of the data collected at sites and 1:50,000 photo-mosaic map.

In relation to spillway and a bridge opening shorter than 100m, the study team have adopted the value of 4% of opening ratio of the structure to total road length, the data of which is from the inventory of existing spillway and bridge openings for kaliganga Aricha Road, which is only all-weather road in Bangladesh at a right angle to the Jamuna.

The calculated figure is shown in Table 3-1.

10 Outline of Road Structure

The access highway study team have carried out the road structure design referring to Geometric Design Standards of Rural Road in Bangladesh.

However, more integrated investigation and detail design will be required in the future for the purpose of the design of total pavement thickness and embankment side slope.

The adopted pavement section is shown in Fig. 2-2.

11. Technical Aspect

The recommend accèes highway has a large number of river and canal crossing. The access highway study team suggests that a considerable portion of the total opening should be closed or reduced in accordance with detail investigation of drainage.

The construction should be divided into two works at least, one for the road and the other for the bridge in pursuit of better result. Any topographic survey and soil investigation have not been carried out in this study. The above works will have to be done for the detail design.

	Total Length of Emb't	Total Length of Bridge 100m< L	Total Length of Spillway & Bridge Openings 100m> L
Bahadurabad site	64 km	600m	2,700m
Gabargaon site	61.5km	1,000m	2,600m
Sirajganj site	28.5km	-	1,190m
Nagarbari site	32.5km	1,200m	1,400m

12. Construction Cost

The estimated construction cost has included the cost of bridge and spillway.

Proposed Site	Rough Estimate of Construction Cost 100 million yen
Bahadurabad site	82
Gabargaon site	92
Sirajganj site*	101
Nagarbari site	59

* Cost of Sirajganj are based on closing the upper one of the offtakes the Dhaleswari River.

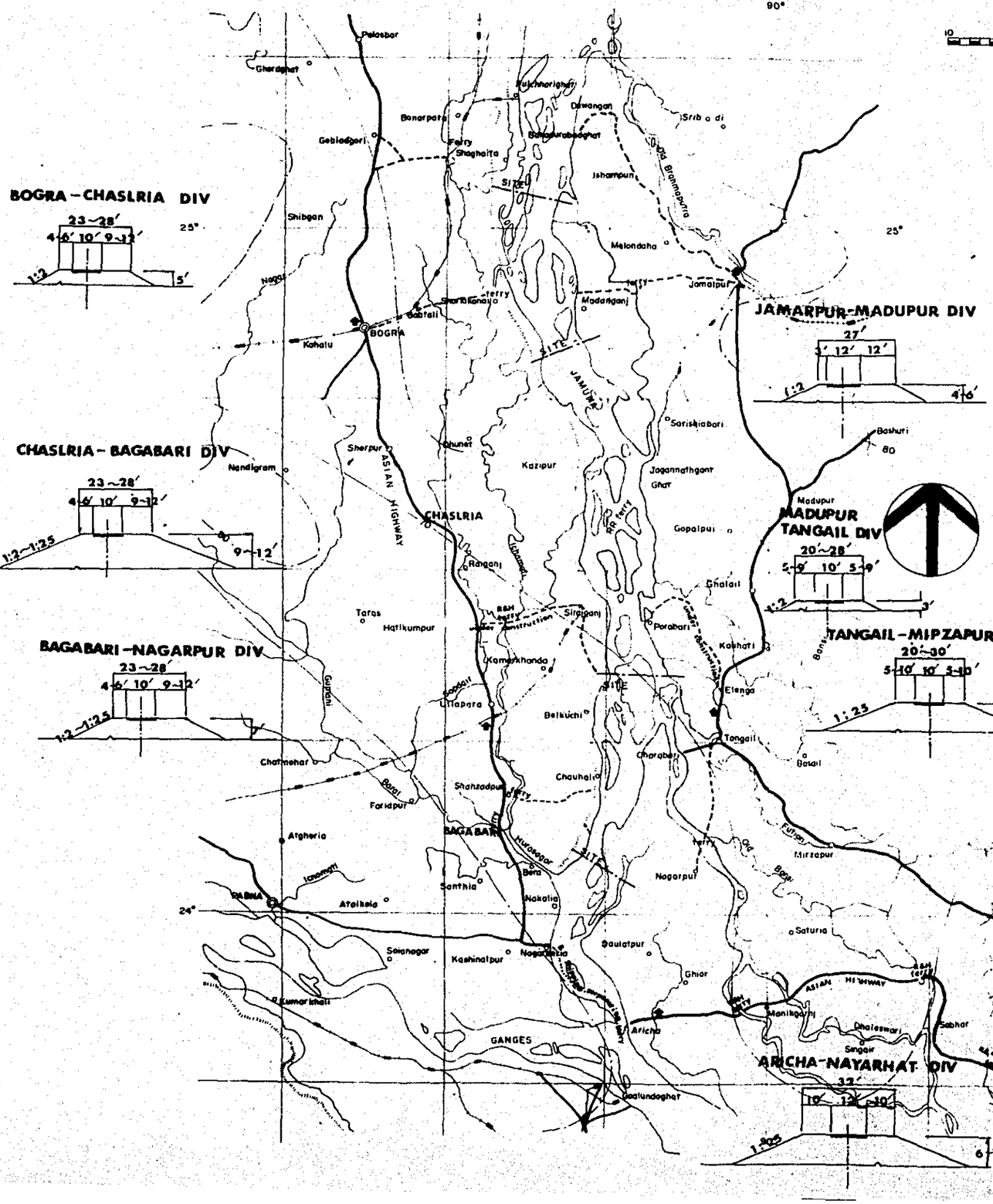
13. Members Engaged in the Access Highway Study

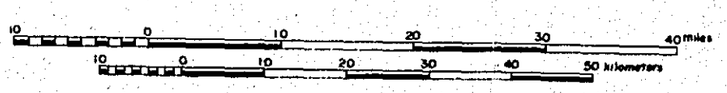
Kunimura Nagashima	Team Leader	Highway Engineer
Harumi Nishikawa	Member	id,.
Kunio Ohashi	Member	id,.

CHAPTER 1 RECONNAISSANCE

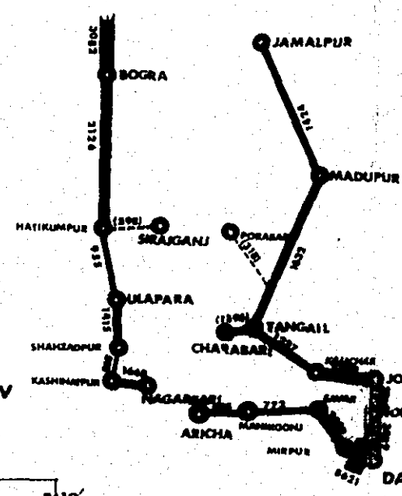
Fig. 1-1

ROAD MAP OF PROJECT AREA

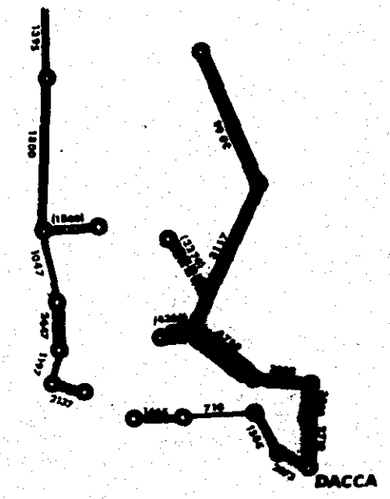




AVERAGE DAILY PASSENGER CAR EQUIVALENTS
R&H DIRECTORATE 1972–1973



AVERAGE DAILY PEDESTRIAN TRAFFIC ON R&H ROADS
R&H DIRECTORATE 1972–1973



- ★ Provincial Headquarters
- ◉ Divisional Headquarters
- ◎ District Headquarters
- ○ Subdivision or Thana Headquarters smaller towns and villages
- Railroads
- Embankment
- All Weather Road
- 80 Annual Rainfall (in inches)
- Existing Road
- SITE Proposed Site
- R&H Rest House

1-2. Inventory of Existing Roads and Facilities

(1) ALL-WEATHER ROAD

1) DACCA-ARICHA. SECTION (ASIAN HIGHWAY ROUTE A-1, ROUTE-2)

Asian Highway Routes A-1 and A-2 constitute this Section. Work is under way improving and widening to 2-lane pavement about 90 kilometers. Most of it runs over paddy fields except for a hilly portion on the Dacca side of Nayarhat.

Three R & H ferries now operate within this Section at Buriganga, Bangsh and Kaliganga river but at each of the above sites the bridge construction is progressing under U.S. Aid.

At Mirpur the road crosses the Buriganga by a 1-lane truss bridge but this bridge has been used only by light vehicles, while heavy duty vehicles use the R & H ferry.

2) NAGARBARI - SHAZADPUR - ULLAPARA. SECTION

A Section of about 50 kilometers, a portion of Asian Highway Route A-2 (395 kilometer from Tetsuria on the Indian border to Nagarbari). This is a 1-lane paved road. This area is in the vicinity of the confluence of the Ganges and the Jamuna and the road runs on several meters of high embankment.

One R & H ferry operates at the Bangari within this Section.

3) ULAPARA - BOGRA - GOBINDGANJ SECTION

This Section of about 100 kilometer is also a portion of Asian Highway Route A-2 and has 1-lane pavement for most of its extension. Around Bogra, however, it has a paved width of about 2-lanes. From Ulapara to Sherpur the high embankment continues but from there the road runs over rolling terrain.

Within this Section the bridges has damaged during the Second India-Pakistani War were particularly noticeable. Those bridges have been replaced by Bailey Bridges but they are still deemed to be the bottle neck to traffic.

4) NAYARHAT - KALIAKUR BYPASS

This road, which was constructed in 1972, runs over rolling terrain for the most part with fair horizontal alignment. It has one paved lane but at the portion around the structures it actually has a 2-lane paved width.

5) DACCA - JOYDEBPUR. SECTION

This road runs about 30 kilometers, from Dacca to Joydebpur. It has a 4-lane divided highway Section for about 6 kilometers from the point of intersection with the railway near Dacca Airport to where it again intersects with the railroad near the New Kurmitola Dacca Airport.
This Section is topographically hilly.

From Tongithe roadway becomes a individed 2-lane.road up to Joydebpur.

Most of this Section is on a low embankment.

6) JOYDEBPUR - TANGAIL. SECTION

Joydebpur - Tangail Section is 1 lane, paved and about 60 kilometers in length.

From Joydebpur to Mirzapur the road runs over rolling terrain for about 25 kilometers and from Mirgapur to Tangail the embankment Section continues for about 35 kilometers. Conspicuous within this embankment Section are the bridges has damaged during the Second India-Pakistani War and the sharply curved portion with poor horizontal and vertical alignment between Kaliakur and Karatia.

7) TANGAIL - JAMALPUR. SECTION

This Section, from Tangail to Jamalpur via Madhupur, about 85 kilometers in length, is a road with the poor horizontal alignment that does not permit comfortable driving and safe overtaking. There is hilly terrain around Tangail but the rest of the road passes paddy fields for the most part.

The broad shoulder on the left toward Jamalpur, made wider than the other side for the use by ox-cart, is a characteristic of this 1-lane paved road.

(2) EXISTING ACCESS ROAD TO JAMUNA

L) Left Side

L-1) JAMALPUR - BHADURABAD. SECTION

The existing road from Jamalpur to Bhadurabad, railway ghat, is about 40 kilometers in length.

This road runs almost keep parallel to the Jamalpur - Bhadurabad Railway and the Brahmaputra, also called Old Jamuna. There are four railway stations between Jamalpur and Bhadurabad and the road is paved with brick near the stations, but most of the rest is kacha road.

The driving time by jeep for this Section was three and a half hours.

L-2) JAMALPUR - GABARGAON. SECTION

This existing approach road is about 30 kilometers in length and it runs almost straight westward from Jamalpur to Gabargaon.

During the rainy season two private ferries has been operated within this Section. They are merely contrivances consisting of two barges bound together with bamboo platform laid between and which can hardly carry a jeep. During investigation of this Section the jeep was trapped in an ox-cart rut from which it was freed with much difficulty with the help of its winch.

The driving time by jeep for this Section was three hours.

L-3) ELENGA - GOPALGONJ. SECTION (T. B. G. Road)

The approximately 25 kilometers of this road from Elenga to the left bank of the Jamuna via Bhuapur, is now under reconstruction. The initial section of 19 kilometers from Elenga to Bhuapur consists of improvement and widening of the existing road and the 6 kilometer form Bhuapur to the left bank of the Jamuna is new road construction.

a) The Aricha - Nagarbari Road Ferry Ghat is the only existing highway link between Dacca and northern districts of the country. Nevertheless the present overcrowded ferry can no longer function as an effective link between the northern districts. A new road ferry ghat which would be able to navigate to the north of Aricha during dry season is therefore required.

b) On the right side there is a under reconstruction road between Hatikampul on the Asian Highway and Sirajgani where there is a passenger ferry ghat at present. On the left side also there is a under reconstruction road between Elenga, about 8 kilometers to the north of Tangail on Tangail - Mymensing Road, and Bhuapur. Not much new road construction is therefore needed for the both routes. Between Gopalganj and Sirajgani the ferry can operate even during the dry season.

Under the above circumstances and in compliance with requirements the T.B.G. Road, Sirajgani - Hatikampul Route was planned as a highway link between Dacca and northern districts. The Gopalgonj Road Ferry Ghat was planned at first for use during the rainy and dry seasons but the plan was later changed on 27th January in 1974 to make it available for the dry season only.

L-4) TANGAIL - CHARABARI. SECTION

This Section is about 4.5 kilometers from Tangail to Charabari where there is a rainy season ferry ghat at present.

Work on this Section is now under way by R & H for improvement and widening. On January 27 R & H changed the road ferry ghat for the rainy season, which was first planned for Gopalgonj, to Charabari.

L-5) TANGAIL - NAGARPUR. SECTION (NAGARBARI SITE)

The existing road is about 20 kilometers from Tangail to Nagarpur. Two private ferries operate in this Section.

The road is 1-lane and paved with brick for about 6 kilometers from Tangail to the first ferry but most of the rest of the section is kacha road. This initial Section now has heavier ox-cart traffic and horse-cart traffic than other approach roads on the left side. The first ferry site from Tangail is in shallow water that a jeep could drive through.

The second ferry is located on the Dhaleswari river, about 1 kilometer wide, with a steep right bank and a sand beach on the left bank. Its width in the dry season is reduced to about 100 meters. The section from Nagarpur to the left bank of the Jamuna was not passable by jeep due to the erosion of the road.

The driving time between Tangail and Nagarpur was three hours.

R) Right Side

R-1) GOBINDGANJ - BAHADURABAD SITE

This exsting road is about 30 kilometers, from Gobindganj, about 30 kilometers to the north of Bogra, to Shaghatta, of which the last Section of 10 kilometers was not passable by jeep due to erosion of the existing road. For about 17 kilometers from Gobindganj to Gapalpur, where there is a sugar mill, the road is 1-lane and paved with concrete but some cracks were observed.

The last Section from Capalpur onward about 4 kilometers of kacha road was covered, using a private ferry on the way, but the investigation had to be stopped there. It was learned that thenceforth up to the right bank of the Jamuna the road embankment and four bridges were destroyed by flood.

R-2) BOGRA - SHARIKANDI. SECTION

From Bogra to the private ferry site of Shariakandi, about 20 kilometers, the road passes over comparatively rolling terrain.

For 9 kilometer from Bogra to Gabtali, the road is 1-lane, paved with brick and runs parallel to the railway. At present a light public bus is operating between Bogra and Gabtali. From Gabtali to Shariakandi, 10 kilometers, the route is a kacha road.

The driving time by jeep from Bogra to Shariakandi was one and a half hours.

R-3)

a) HATIKAMPUL - SIRAJGANJ TOWN. SECTION

About 17 kilometers of roadway from Hatikampul on the Asian Highway to Sirajganj is now under construction. At present the R & H ferry and a private ferry operate at a point 5 kilometers from Hatikampul.

The driving time by jeep from Hatikampul to Sirajganj was one and a half hours.

b) SIRAJGANJ TOWN - SIRAJGANJ SITE. SECTION

This Section extends from Sirajganj straight southward for about 12 kilometers to the right bank. For about 9 kilometers from Sirajganj the road is 1-lane, paved with concrete. Thenceforth kacha road extends for 3 kilometers to the Right Embankment of the Jamuna. On the latter route there was the Hurasagar river with 100 meters of dried basin.

The driving time by jeep from Shiraganj to the right bank was 45 minutes.

R-4) SHAHADPUR - SHAHADPUR (NAGARBARI SITE)

From Shahadpur to the Right Embankment of the Jamuna the length of the road is 14 kilometers and from the Right Embankment to the right bank of the Jamuna the length is 16 kilometers. Both are kacha roads totalling 16 kilometers in length.

The shortest route has mentioned on the topographic map of 1:50,000 scale, from Shahadpur to the Right Embankment, has a private ferry only on the Karatoya river but none on other tributary. The route was changed on the way and point on the Right Embankment 5 kilometers to the north of the original objective was reached. The crest width of Right Embankment is considerably wide. Therefore it is considered possible to drive from Sirajganj to Nagarbari site through this right bank crest.

The driving time by jeep from Shahadpur to Nagarbari site was two and a half hours.

Table. 1-1 INVENTORY OF ROAD FACILITIES

EXISTING APPROACH ROADS

ROUTE & SECTION	DISTANCE	ALL-WEATHER ROAD		FAIR WEATHER JEEPABLE	NO ACCESS	STRUCTURE		FERRY CLOSSING	FORD	LINIOR-METER-OF-SPILLWAY OPENING-PER-KILOMETER
		1 LANE PAVEMENT	GRAVEL SURFACED			BOX- CUL	SPILLWAY BRIDGE			
BAHADURABAD SITE										
JAMALPUR — BAHADURABAD	42.0km			42.0km		6	9		1	$\frac{89^m}{42.0^{km}} = 0.002$
GOBINDGANJ —BAHADURABAD SITE	20.0km	16.5km		3.5km		3	7	PRIVATE 1		$\frac{92^m}{16.5^{km}} = 0.006$
GABARGAON SITE										
JAMALPUR — GABARGAON	32.5km			32.5km		4	2	PRIVATE 2		$\frac{22.5^m}{32.5^{km}} = 0.001$
BOGRA —GABARGAON SITE	20.5km	BRICK 9.2km		11.3km			17	PRIVATE 1	1	$\frac{313^m}{20.5^{km}} = 0.015$
SERAJGANJ SITE										
ELENGA — GOPALGONJ	26.0km			UNDER CONST 19.0km	7.0km	5	12		2	$\frac{358^m}{19.0^{km}}$ INCLUDING TWO FORDS $= 0.019$
TANGAIL — CHARABARI	6.0km	1.6km		UNDER CONST 4.4km			5			$\frac{75^m}{6.0^{km}} = 0.013$
HATIKAMPUL—SIRAJGANJ	17.0km			UNDER CONST 17.0km		6	4	R&H 1	4	$\frac{92^m}{17.0^{km}} = 0.005$
SIRAJGANJ—SIRAJGANJ	13.8km	9.0km	2.8km		RIGHT EMB'T 2.0km				1	$\frac{24^m}{11.8^{km}} = 0.002$
NAGARBARI SITE										
TANGAIL— NAGARPUR (NAGARBARI SITE)	19.5km	BRICK 5.8km		13.7km				PRIVATE 1		$\frac{264^m}{19.5^{km}} = 0.013$
ULAPARA — NAGARBARI SITE	21.0km			16.0km	RIGHT EMB'T 5.0km	2	7	PRIVATE 1	8	$\frac{111^m}{16.0^{km}} = 0.007$

CHAPTER 2 ROAD DESIGN

CHAPTER 2

ROAD DESIGN

2-1 GEOMETRIC DESIGN STANDARDS

The access highway study team have to carry out the design and capital cost estimate without the future design hourly volume forecasting, because the economic and traffic study team at this stage could not brought any decision as to the number of lanes required according to the future design hourly volume forecasting.

In modern practices single-lane roads are not considered appropriate for inclusion as a part of rural highway system. At least two lanes for traffic movement, one in each direction, is the minimum highway installation normally provided. The decision to provide a 2-lane highway should not be made only by the demand and capacity requirements alone. Therefore, at least one travel lane in each direction for safety (mostly in rainy season), convenience, and tolerable operating conditions is required for the minimum level of service requirements. The capacity and service volumes of 2-lane highway are expressed in total vehicles per hour, regardless of the distribution of traffic by direction.

Secondly overtaking and passing maneuvers must be done on the traffic lane normally occupied by opposing traffic.

As far as the maintenance of a desired speed requires passing maneuvers, the volume of traffics plus the highway geometrics, which establish available passing sight distance, have much more signigicant effects on operation speeds than in the case of multi-lane roads.

Therefore, whenever service volumes are considered for 2-lane roads, the corresponding range in available passing sight distance (1,500 ft or greater) must also be considered.

The width of roadway on 2-lane highways-taking traffic volume, design speed, character of terrain, and economy in to consideration may vary from 26ft (18-foot pavement carriageway plus 4-foot shoulders).

to about 44ft (24-foot pavement carriageway plus 10-foot shoulders).

From a standpoint of driver's convenience, operation, and safety, it is desirable to construct 2-lane highways with 12-foot lanes and with usable shoulders of 10-foot wide. The "usable"width of shoulder can be used when a driver makes an emergency stop.

In accordance with the above mentioned, the access highway study team has adopted the geometric standards to primary roads which has been established by R&H directorate in Bangladesh.

The geometric design standards for the proposed roads is shown in Table. 2-1.

The entire proposed road will have 22-foot flexible pavement, each 11-foot wide carriageway, and will be designed for 18000 pound axle loading, with 8-foot brickpaved shoulders, on a 40 feet embankment, 3'-0" minimum above high food level.

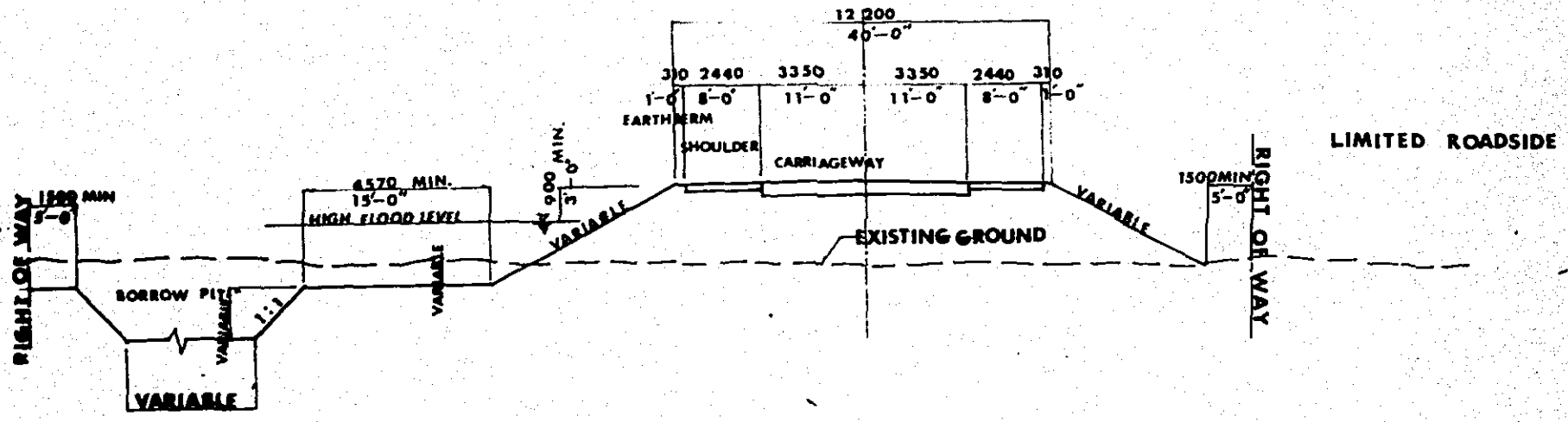
For future extension, the Government of the People's Republic of Bangladesh shall take an appropriate actions to reserve sufficient land for two additonal lane for the future extension on the other side of the borrowpit and the road.

Table. 2-1 GEOMETRIC DESIGN STANDARDS

		2-LANE TWO-WAY HIGHWAY
ROADBED		12.200m (40'-0")
LANE		3.355m (11'-0")
SHOULDER		2.440m (8'-0")
EARTHBERM		0.305m (1'-0")
DESIGN SPEEDS	RURAL	96.5 km (60mph)
	URBAN	80.5 km (50mph)
RUNNING SPEEDS	RURAL	72.5 km (45mph)
	URBAN	64.5 km (40mph)
RADIUS OF CURVATURE	60mph	350m (1,146')
	50mph	230m (754')
GRADES		3.0 % MAX
PASSING SIGHT DISTANCE	60mph	610m (2,000')
	50mph	520m (1,700')
STOPPING SIGHT DISTANCE	60mph	145m (475')
	50mph	107m (350')
SUPERELEVATION		8.0 % MAX

2-2 TYPICAL CROSS SECTION

Fig 2-1



2-3 Embankment Height

It is recommended that the whole alignment will be built with a minimum free-board of three feet above design high flood level. This is considered necessary because the maximum benefits to be derived from the road can be realised if it is passable throughout the year. In other words, three feet free-board has been provided to retain the moisture content of the subgrade at an allowable value by preventing saturation during the flood season, and spillway opening have been provided to preventing the rapid deterioration of the pavement and embankment.

2-4 Embankment Side Slope

Any soil investigation have not been carried out in this study. On the other hand, 1:2 embankment side slope is standard for roads in Bangladesh. For the purpose of the capital cost estimate, therefore, 1:2 embankment side slope have been adopted for all proposed roads. However, more integrared investigation and detail design will be required in the future for the purpose of the design of embankment side slope.

2-5 Embankment Side Slope Protection

Turfing will be required to maintain the normal height embankment side slope without sloughing. Enchased brick rivetment in high approaches of bridge and spillway will be required to keep embankment side slope from sloughing and erosion at brige abutment.

2-6 Earth Work

The soil in Bangladesh vary from sandy clay to silty clay. They are usually not good for embankment materials and have a low quality in stabilization. Road embankment and bridge approaches will be constructed by spreading and compacting the borrowed earth. The ground surface of all embankment borrowpits and embankment foundation should, therefore, stripped to remove organic materials. However,

where a bad soil is encounted the top layer of subgrade of 2 feet in thickness is adequately mixed up with sand and duly compacted. Earth moving and compacting equipment will be used in conjunction with headbasket labor to distribute the embankment materials and ensure a uniform embankment section. A limited amount of moisture control will be achived by use of compaction equipment.

2-7 Embankment Settlement

For the purpose of capital cost estimate, embankment earth work quantities have been increased by 10% to allow for settlement.

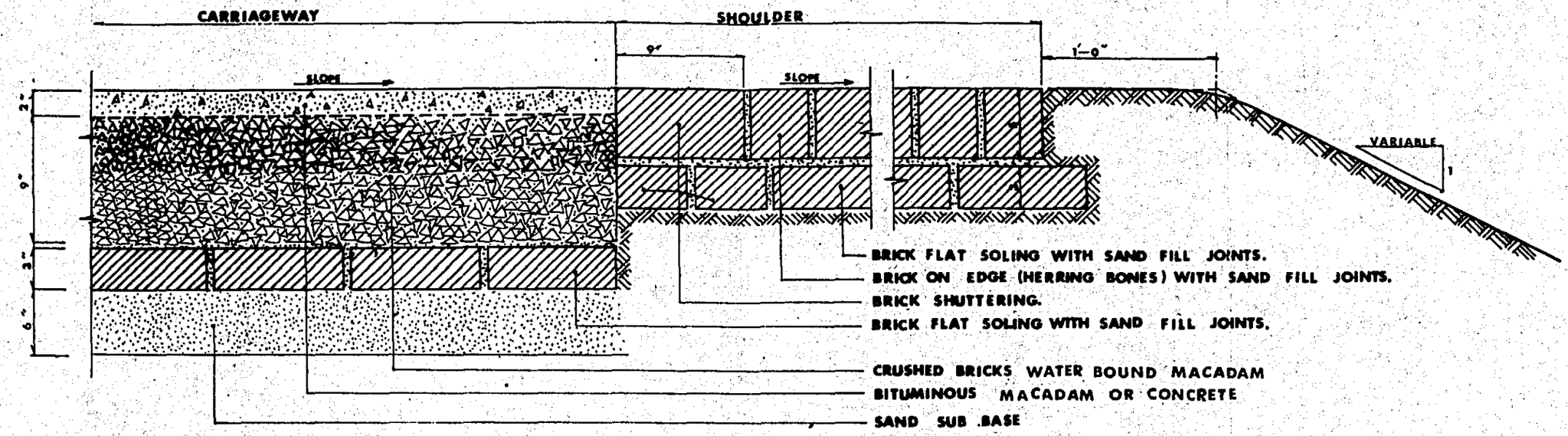
2-8 Type of Pavement

From practical experience in this country, a flexible pavement is considered best to insure against any possible settlement of the embankment.

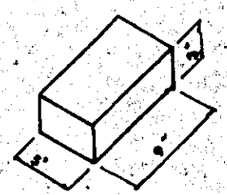
2-9 Pavement Design

From practical experience in this country, it has been observed that a 3 inch layer of brick flat soling under a 9 inch crushed brick water bound macadum, with a 2 inch bituminous macadam or concrete surface, total thickness of 14 inches. suits for this Project Area condition. Above pavement section has been recommended by the experience of the road engineers of this country. The sub-base is provided for the distribution of the load on the sub-grade and it also works as drainage. The access highway study team has adopted the value of sub-bace of 6 inches, it is minimum value for drainage. The typical pavement section is shown in Fig. 2-2.

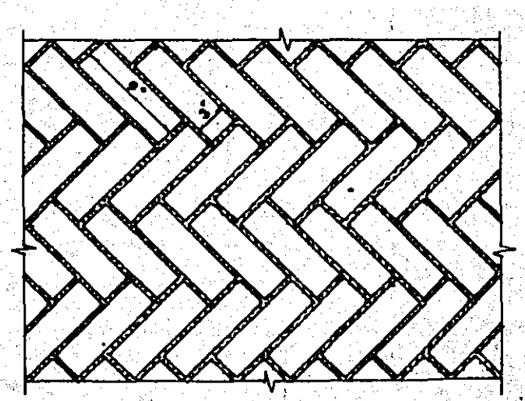
Fig. 2-2 **TYPICAL PAVEMENT SECTION**



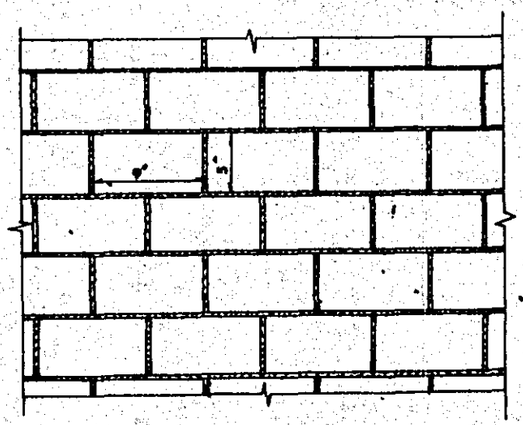
BRICK APPROX. WT. 8 LBS.



BRICK ON EDGE (HERRING BONE)



BRICK FLAT SOLING



CHAPTER 3 STRUCTURE DESIGN

CHAPTER 3

STRUCTURE DESIGN

3-1. Bridge and Spillway Opening

Any topographic survey and inland waterway investigation have not been carried out in this study. Therefore, the study team has been divided the structure design into two type of structure design, one for the bridge longer than 100 m and other for the spillway and a bridge shorter than 100 m, becouse of the accuracy of 1:50,000 Photo-mosaic and Topographic map.

The study team has prepared for the site selection for long bridge which are linger than 100 m after the study data collected at site and 1:50,000 photo-mosaic map. In relation to spillway and a bridge opening shorter than 100 m, the study team has adopted the value of 4% of opening ratio "linear-meter-of-spillway-and-bridge-shorter-than-100 m-opening-per-kilometer" of the structure to total raod length, the data of which is from the inventory Aricha-Kaliganga Road, which is only all-weather road in Bangladesh at a right angle to the Jamuna. The calculated figure is shown in Table 3-1.

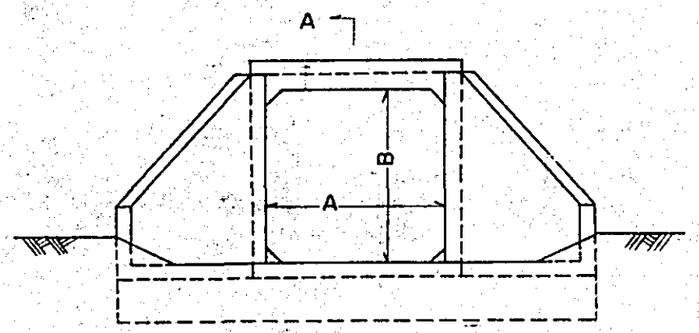
Table. 3-1 LIST OF SPILLWAY & BRIDGE OPENINGS

KALIGANGA RIVER — ARICHA ROAD

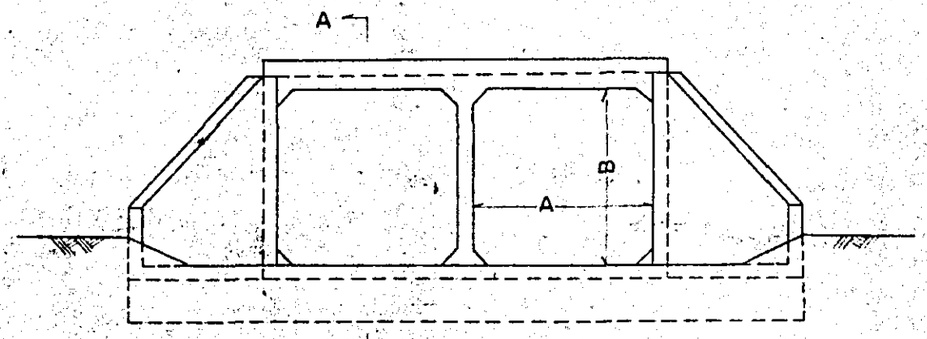
DISTANCE	EXISTING & PROPOSED STRUCTURE LENGTH	
	SPILLWAY & BRIDGE L < 100 m	REMARKS
0 – 1.6km	FERRY CROSSING	666.0m UNDER CONSTRUCTION KALIGANGA BRIDGE
〃	18.3m TEE — BM	
1.6 – 3.2km	24.4m 2 SPAN TEE — BM	
3.2 – 4.8km	36.6m 3 SPAN TEE — BM	
〃	24.4m MULTI-SPAN BOX CUL	
〃	90.0m	PROPOSED SINGLE UNIT "OVERLAND FLOW"
4.8 – 6.4km	24.4m 2 SPAN TEE — BM	
〃	30.5m MULTI-SPAN BOX CUL	
6.4 – 8.0km	18.3m TEE — BM	
8.0 – 9.6km	50.0m 3 SPAN TEE — BM	PROPOSED SINGLE UNIT "OVERLAND FLOW"
〃	90.0m	
9.6 – 11.2km	18.3m TEE — BM	
〃	36.6m MULTI-SPAN BOX CUL	
11.2 – 12.8km	50.0m 3 SPAN TEE — BM	
12.8 – 14.4km	18.3m TEE — BM	
14.4 – 16.0km	50.0m 3 SPAN TEE — BM	
16.0 – 17.6km	42.7m MULTI-SPAN BOX CUL	
〃	18.3m TEE — BM	
17.6 – 19.2km	30.0m MULTI-SPAN BOX CUL	
〃	50.0m 3 SPAN TEE — BM	
〃	24.3m MULTI-SPAN BOX CUL	
TOTAL	745.4m	

$$\frac{745.4\ m}{19.2\ km} = 0.039 \fallingdotseq 4\ \%$$

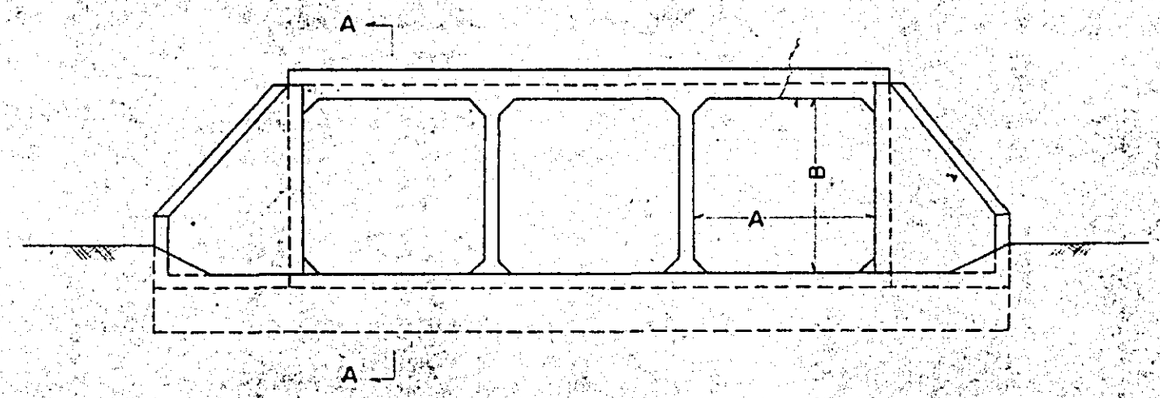
1-BOX CULVERT



2-BOX CULVERT

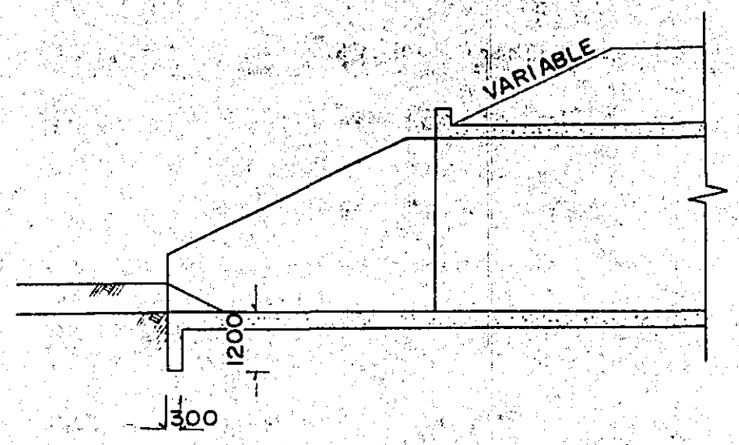


3-BOX CULVERT



SIZES (A X B)m
3.6 X 3.6
3.6 X 3.0
3.6 X 2.4
3.0 X 3.0
3.0 X 2.4
2.4 X 2.4
2.4 X 1.8
1.8 X 1.8

SECTION A-A



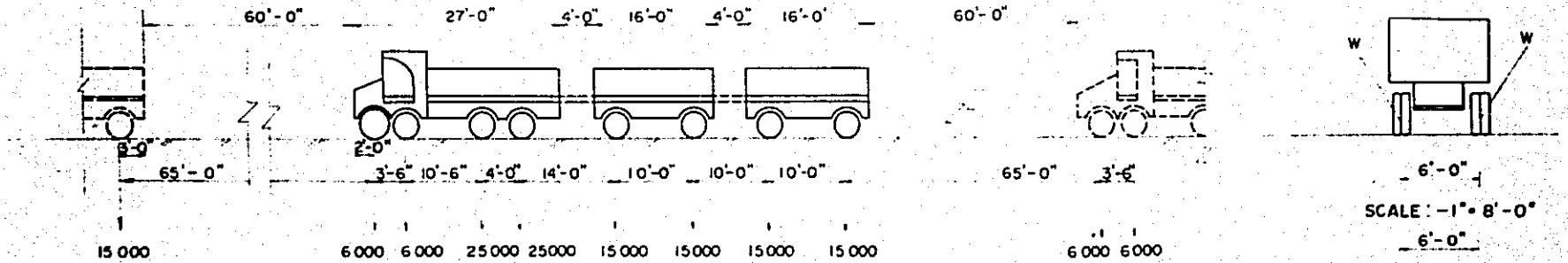
NOTES.

SPECIFICATION : I. R. C. STANDARD SPECIFICATION FOR HIGHWAY BRIDGES

LIVE LOAD I. R. C. CLASS 'A'

JPPAN INTERNATIONAL COOPERATION AGENCY	
PEOPIE'S REPUBLIC OF BANGLADESHI	
JAMUNA RIVER BRIDGE PROJECT	
BOX- CULVERT FOR SPILLWAY	
Drawn	Date
Approved	Date
MITSUI CONSULTANTS CO. LTD.	Fig 3-1

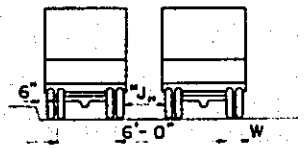
Fig. 3-2 IRC STANDARD VEHICLE CLASS 'A'



SCALE : - 1" = 12'-0"

SCALE : - 1" = 8'-0"

IMPACT FACTOR I I.R.C = $\frac{15}{L+20}$ ≯ 50 PERCENT



LIMITING POSITION OF STANDARD TRUCK-TRAIN LOADING WITH REFERENCE TO A TRAFIC LANE
(FOR ground corpact area and value of "J" see table I and 2)

CLASS OF LOADING	AXLE LOAD (Lbs)	GROUND CONTACT AREA (ft²) B	W
"A"	25 000	10	20
	15 000	8	15
	6 000	6	8
"B"	15000	8	15
	9 000	6	12
	3600	5	7

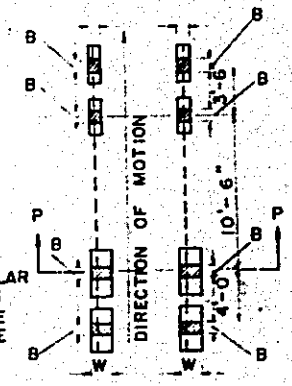
TABLE I

NOTE. CLASS "B" LOADING WILL HAVE SIMILAR SPECIFICATIONS TO CLASS "A" LOADING WITH THE ONLY DEFFERENCE THAT THE AXLE LOADS OF CLASS "B" SHALL BE 60 % OF CLASS "A"

CLEAR ROAD WIDTH	"J"
15'-6" or Less	0
16'-6" and 17'-0"	Increasing uniformly from 0 to 1'-6"
18'-0" to 24'-0"	Increasing uniformly from 1'-6" to 4'-0"
Above 24'-0"	4'-0"

TABLE 2

LOADING CLASS "A" FOR HIGHWAY BRIDGES



SCALE :-1" = 8'-0"

CHAPTER 4 PROPOSED ALIGNMENT

CHAPTER 4

PROPOSED ALIGNMENT

4-1. Horizontal Alignment

(1) Route Location of the Access Highway

1) The Route Location of access highway by the study team corresponds to the all-weather road including Tangail-Bhuapur-Gopalgonj and Sirajganj-Hatikampul roads, on the both sides of the Jamuna to approach road of the proposed Jamuna Bridge.

All-weather Road on Left Side	Proposed Bridge site	All-weather Road on Righ Side
Jamapul-Madhupur Road	Bahadurabad Site	Nagarbari-Saidpur Road (Asian Highway A-2)
Jamapul-Madhupur Road	Gabargaon Site	Nagarbari-Saidpur Road
Tangil-Bhuapur-Gopalgonj Road	Sirajganj Site	Sirajganj-Hatikumpul Road
Dacca-Anicha Road (Asian Highway A-1, A-2)	Nagarbari Site	Nagarbari-Saidpur Road

2) Taking account of the result of the field survey and regional speciality of Bangladesh in to consideration, the study team has planned Horizontal Alignment, giving priority to the (1) retention of existing road facilities and the (2) selection of river stability crossing sites at tributaries and distributaries according to the principle that (3) access highway must be straight. The proposed alignment passed through principal villages because of the above mentioned.

Besides, there are many marshes in the project area. Therefor the access highway study team has designed the route with detours and meanders so as to dodge the marshes on the left sides of Bahadurabad and Gabargaon.

(2) Proposed Route

Access Highway Type B: Dist. bew. guide banks 4.2 km
Type C: Dist. bew. guide banks 5.2 - 5.6 kg

1) Bahadurabad Site B = 67,500 m, C = 67,000 m

Right side B, C = 25,000 m

The proposed route follows the existing Kacha road, improving and widening the section from Kamar on the Asian Highway to Shahapur where there is a sugar mill at present, and the existing brick road for the section from Shahapur to Mahimaganj. Thereafter it turns south following the existing road from Gobaripara to Muhammadpur, which will be widened and improved, eliminating the present heavy erosion. The route to the bridge site was planned as above.

Left Side B = 42,500 m, C = 42,000 m

From Jamalpur to northwest up to Dharmakara the proposed Highway was planned on the left side of Jamalpur - Bahadurabad Railway and in parallel thereto and to Old Jamuna. Westward from Dharmakara to Ghilabari the present route will be followed, improving and widening the existing Kacha road.
The new alignment was planned from Ghilabari south to the proposed bridge site at Rajapur.

Due to the low and marshy ground in this area, it was necessary to lead the route in a large round-about curve to the north.

Proposed Access Highway Route Location is shown in Fig. 4-5.

2) Gabargaon Site B, C = 65,100 m

Right side B, C = 31,100 m

The proposed route followed the existing brick road from Bogra on the Asian Highway eastward to Gabtali, and the present Kacha road from Gabtali to Phurbari improving and widening them.
The new alignment was planned from Phurbari southeast to the proposed bridge site at Chandanbaisa.

Left side B, C = 34,000 m

The proposed route goes westward from Kochagar, about 5 kilometer to the south of Jamalpur, crossing the Chatal River, up to the proposed bridge site. As there are many marshes and river crossings in this area, like the left bank area of Bahadurabad, almost the whole route is new construction except for a portion between Kochgar and the Chatal River where the existing Kacha road is improved and widened.

Proposed Access Highway Route Location is shown in Fig. 4-8.

3) Sirajganj Site B, C = 29,750 m

Right side B, C = 15,500 m

From Hatikumrul on the Asian Highway to Slalkal, the Hatikumrul-Sirajganj Highway, now under re-construction for completion in 1978 is wholly used. From Slalkol the new road was planned toward southeast, passing the railway and bypassing Sirajganj Town, up to Banbaria. From Banbaria the route turns southward following the existing partly paved 1-lane road, widening it, up to Tengrail. From Tengrail the new alignment follows the shortest route to the proposed bridge site.

Left side B, C = 14,250 m

New road construction goes westward straight from Elenga on the Tangail - Bhuapur - Gopalgonj Road, crossing the Dhalesward River, to the proposed bridge site.

Proposed Access Highway Route Location is shown in Fig. 4-11.

4) Nagarbari Site B, C = 35,250 m

Right side B, C = 6,500 m

To northeast from Bangram on the Asian Highway to the Hurasagar River, the existing road was followed and widened, and henceforth the new alignment follows the shortest route to the proposed bridge site.

Left side B, C = 28,750 m

The proposed route starts from Mahadebpur, about 10 kilometer from Aricha on the Dacca-Aricha Road, and extends northwards to Tebaria, widening and improving the existing Kacha road now badly eroded. From there on the new alignment was planned to go westward from Tebaria to the proposed bridge site via Haparikatra.

Proposed Access Highway Route Location is shown in Fig. 4-14.

4-2. Vertical Alignment

(1) Decision Making in Design High Flood Level

The flood height is of vital importance for planning of the highway in Bangladesh.

Left side

The study team has adopted the maximum flood height from the Jamuna river section survey which was recorded last in July, 1970. And it is also said taht 1970 recorded the largest number of flood in the recent years.

Left side D.H.F.L. is shown in Fig. 4-1.

Right side

The study team has decided on the figures by the hearing at sites and Nagarbari-Saidpur Road height for Bahadurabad (Gobindganj) and Gabargaon (Bogra) sites, because of the Nagarbari-Saidpur Road has not been built with a minimum free board above height flood level, and the study team has decided the D.H.F.L., which is from the Stream Gauging Data and 100 year probability for Right Enbankment Project at Sirajgnaj (Ullapala gauge) and Nagarbari (Bagabari gauge) sites.

Sirajganj: The 100 year elevation at Ullapala was used as the design water profile for Right Embankment. Therefor, the study team has adopted the above figure for Sirajganj site.

Nagarbari: The 100 year elevation at Bagabari was not used directly in establishment of design water profile for Right Embankment. On the other hand, the highest record was observed on August 15, 1955 and was equal to 1970 jamuna Record. Therefor, the study team has adopted the figure of 1955 for Nagarbari site.

Right side D.H.F.L. is shown in Fig. 4-3.

(2) Feed Board

The whole alignment will be built with a minimum free board of three feet above D.H.F.L.

(3) Navigation Clearance

Classified waterway's clearance is determined by local requirement and need. BIWTA has set the clearance classification, but the waterways which the proposed alignment would cross have not been officially classified.

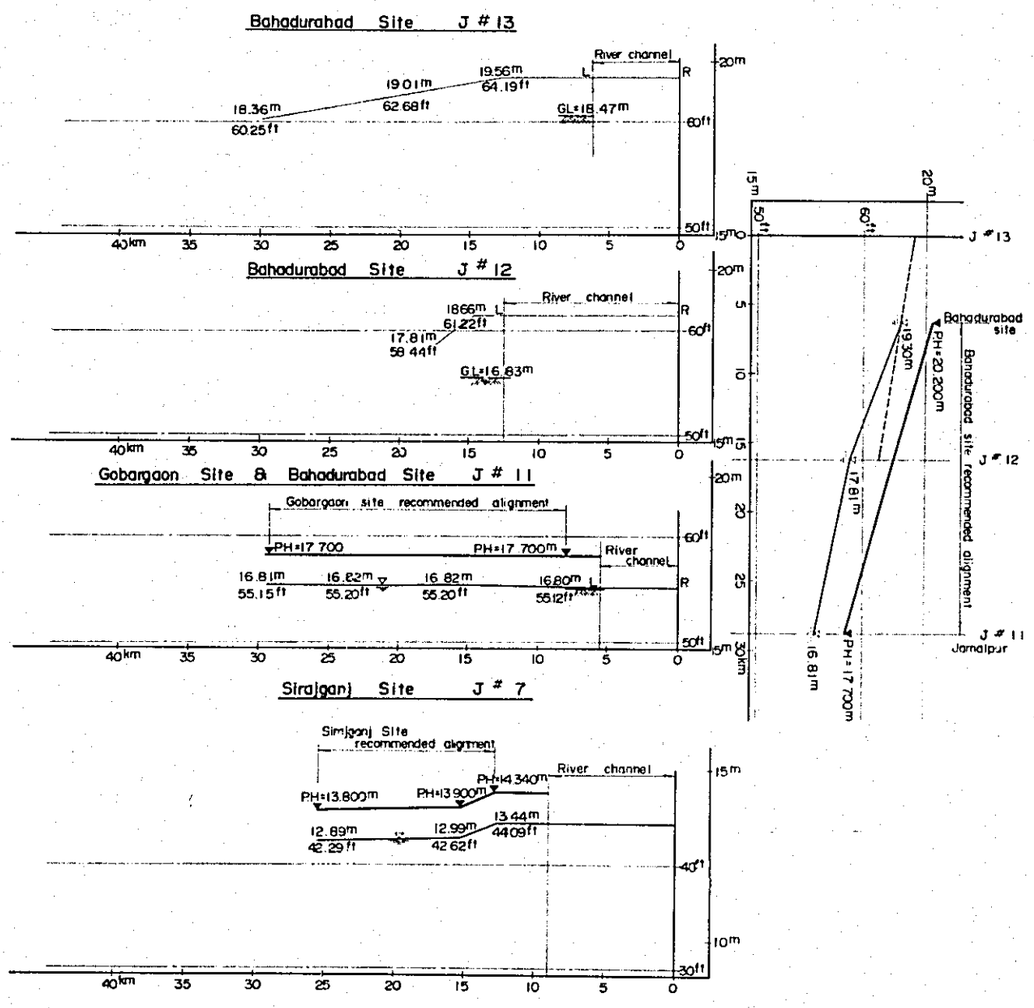
For the purpose of capital cost estimate, the highway study team has determined navigation clearance classification, for waterways that were not classified, from NEDECO report and BIWTA's clearance classification method.

The determined clearance classification is shown in Table 4-1.

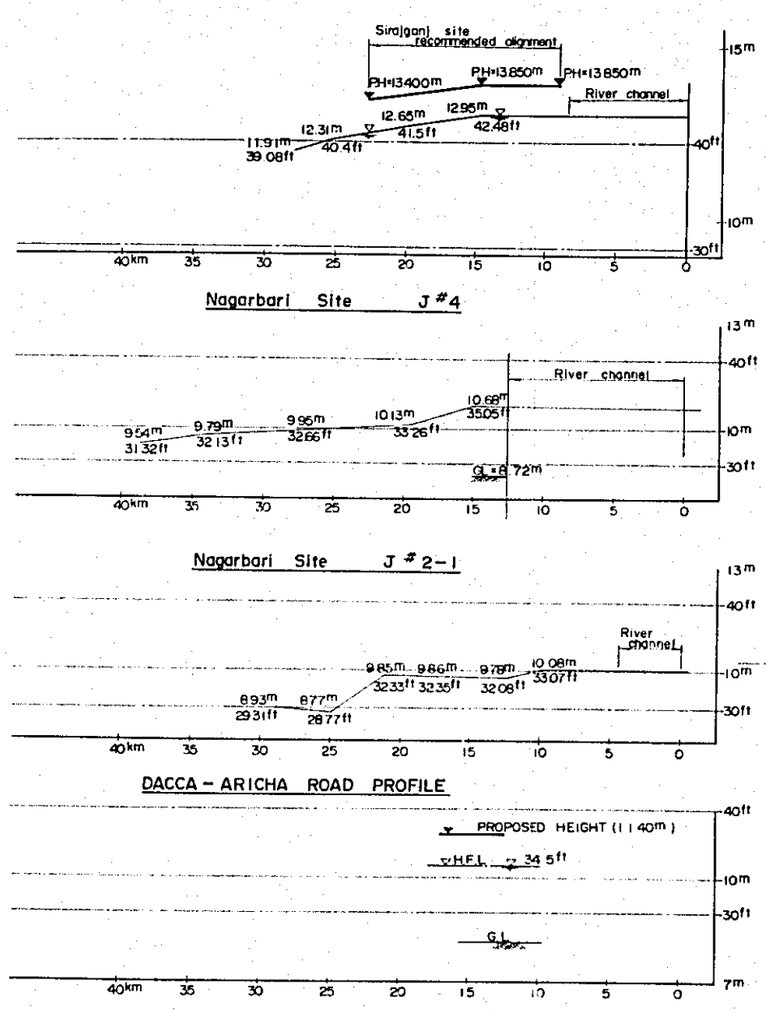
Fig.4-1 Determination of Left Side High Flood Levels.

Left Side Inland High Water Level (July. Aug. 1970)

Note : All elevation in this table refer to S.O.B. datum.



Left Side Inland High Water Level (July. Aug. 1970)

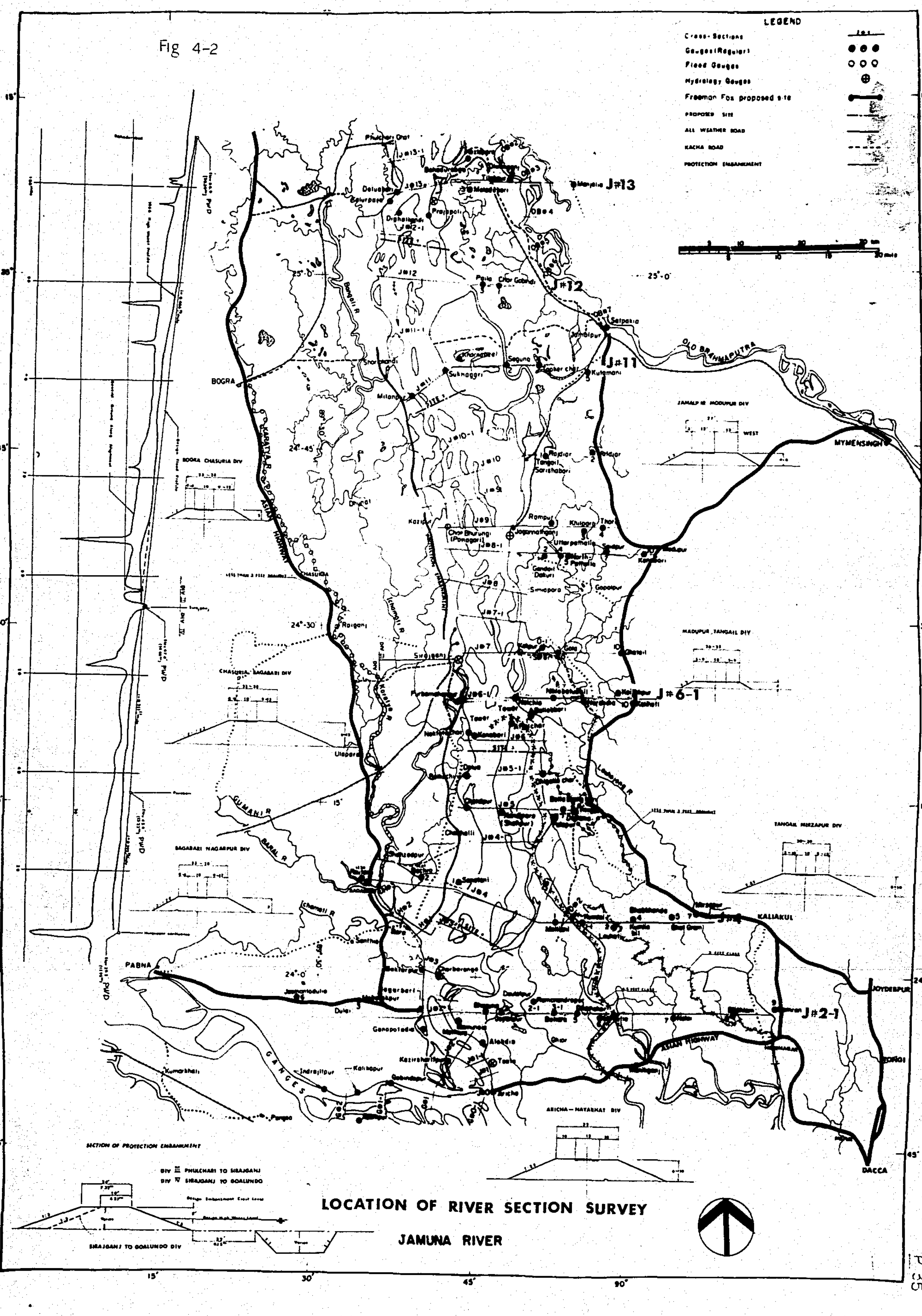


LEGEND

▽ Determined high flood level.

▼ PH Determined recommended road links proposed height.
(Embankment crest height)

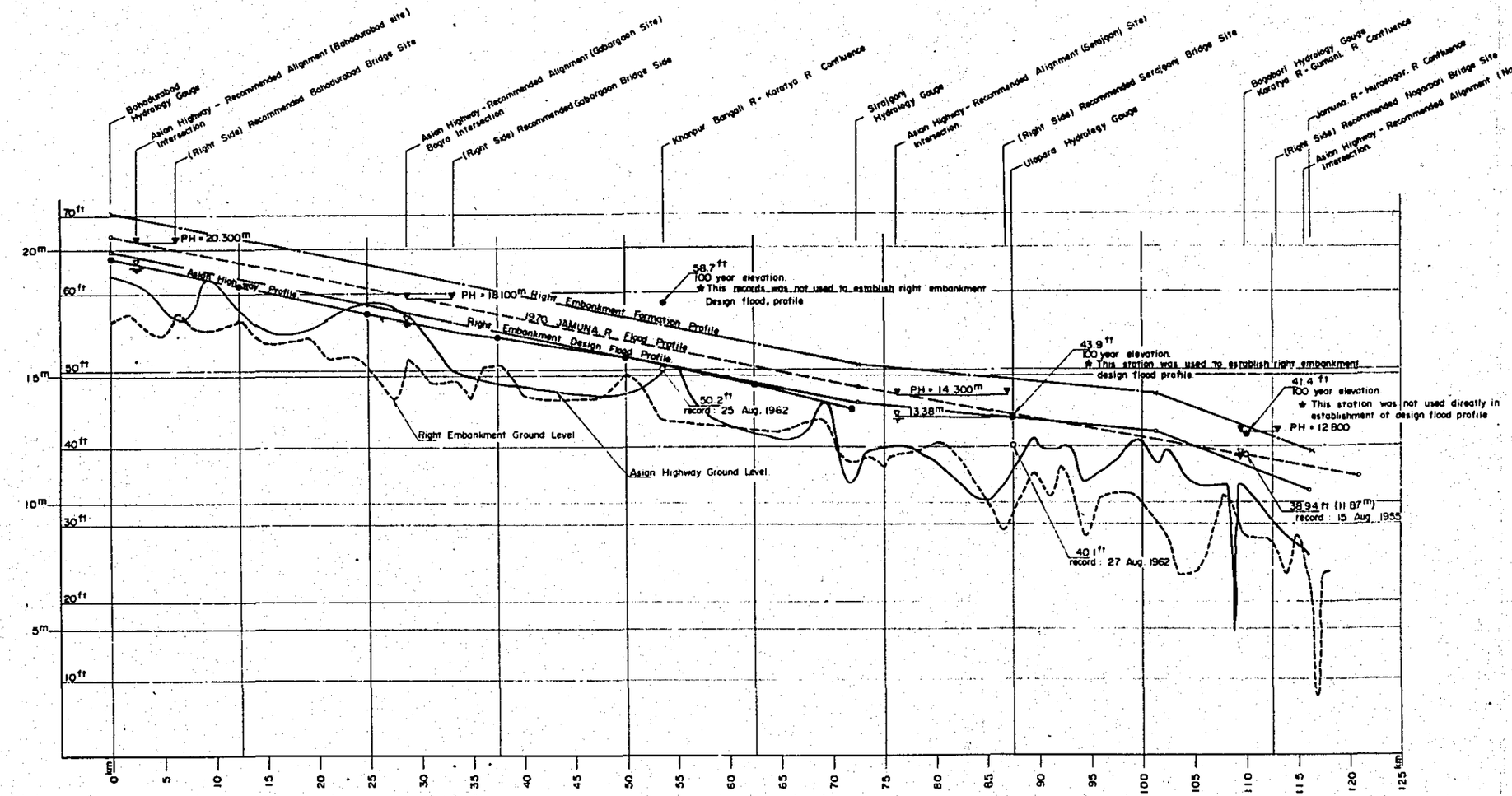
Fig 4-2



LOCATION OF RIVER SECTION SURVEY

JAMUNA RIVER

Fig.4-3 Determination of Right Side High Flood Levels



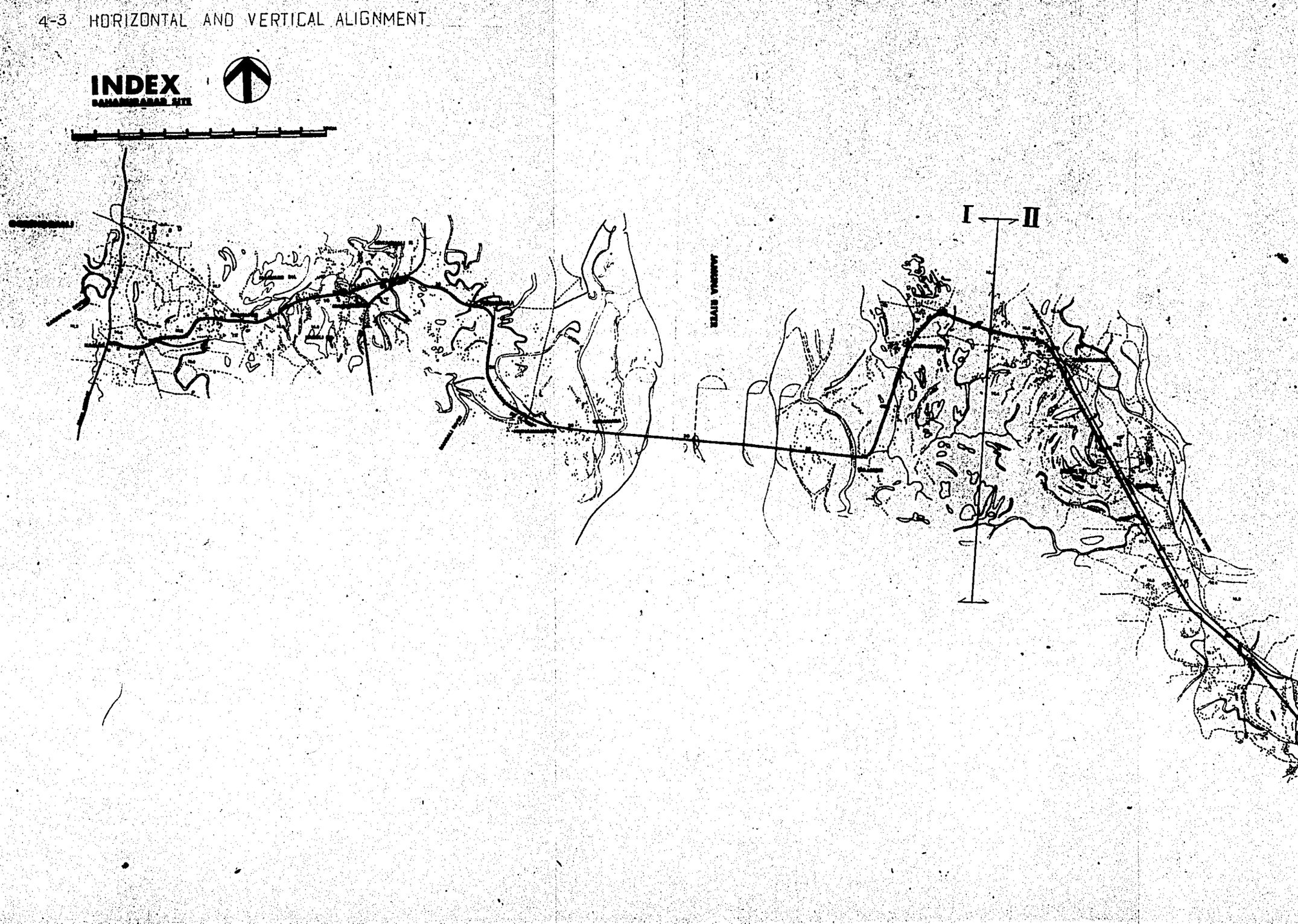
Note : All elevation in this table refer to S.O.B. datum.

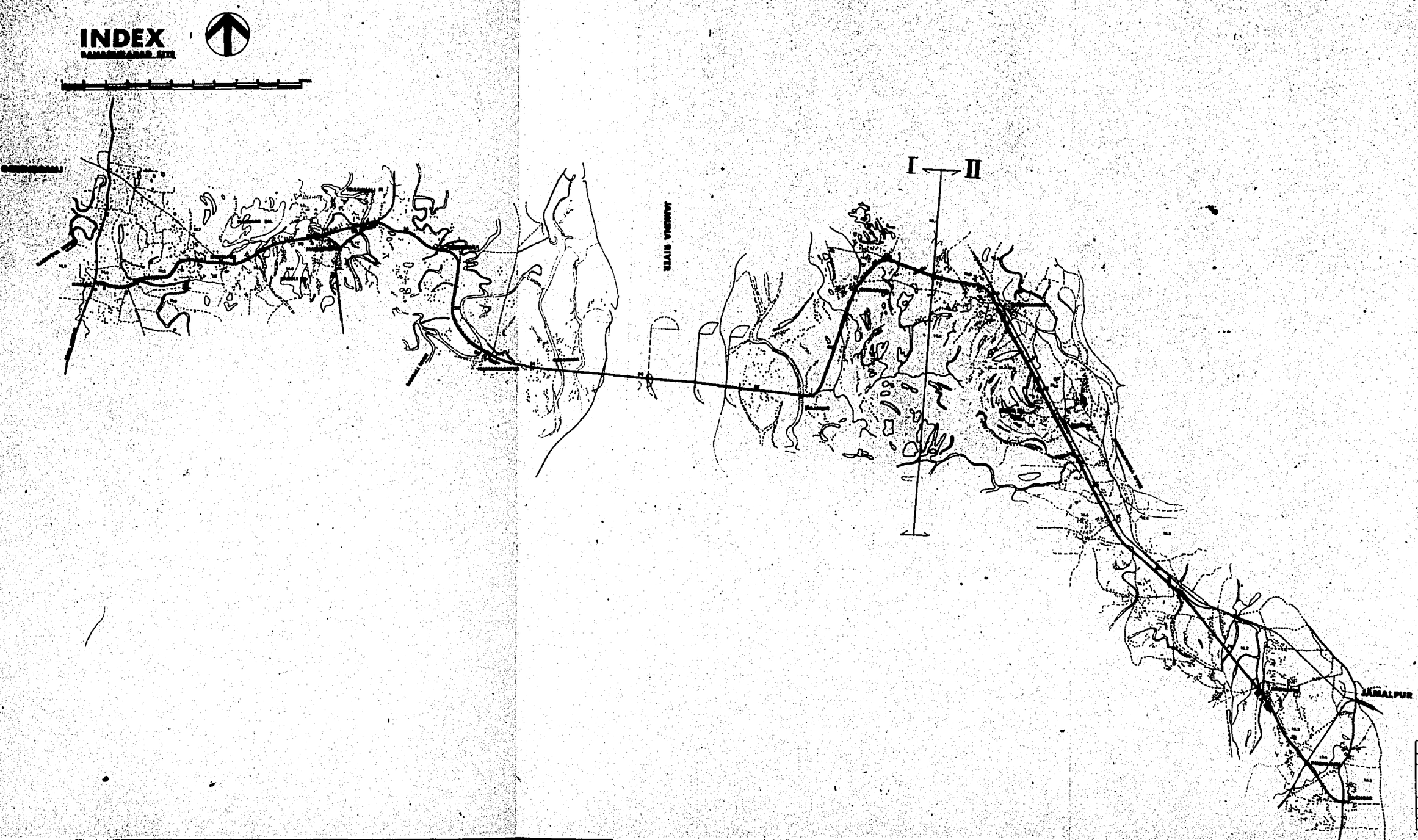
LEGEND

- High water record.
- 100 year elevation.
- Right embankment formation profile.
- 1970 Jamuna river flood profile
- Right embankment design flood profile.
- Asian highway formation profile.
- Determined high flood level.
- PH Determined recommended road links proposed height. (embankment crest height)
- Asian highway ground level.
- Right embankment ground level.

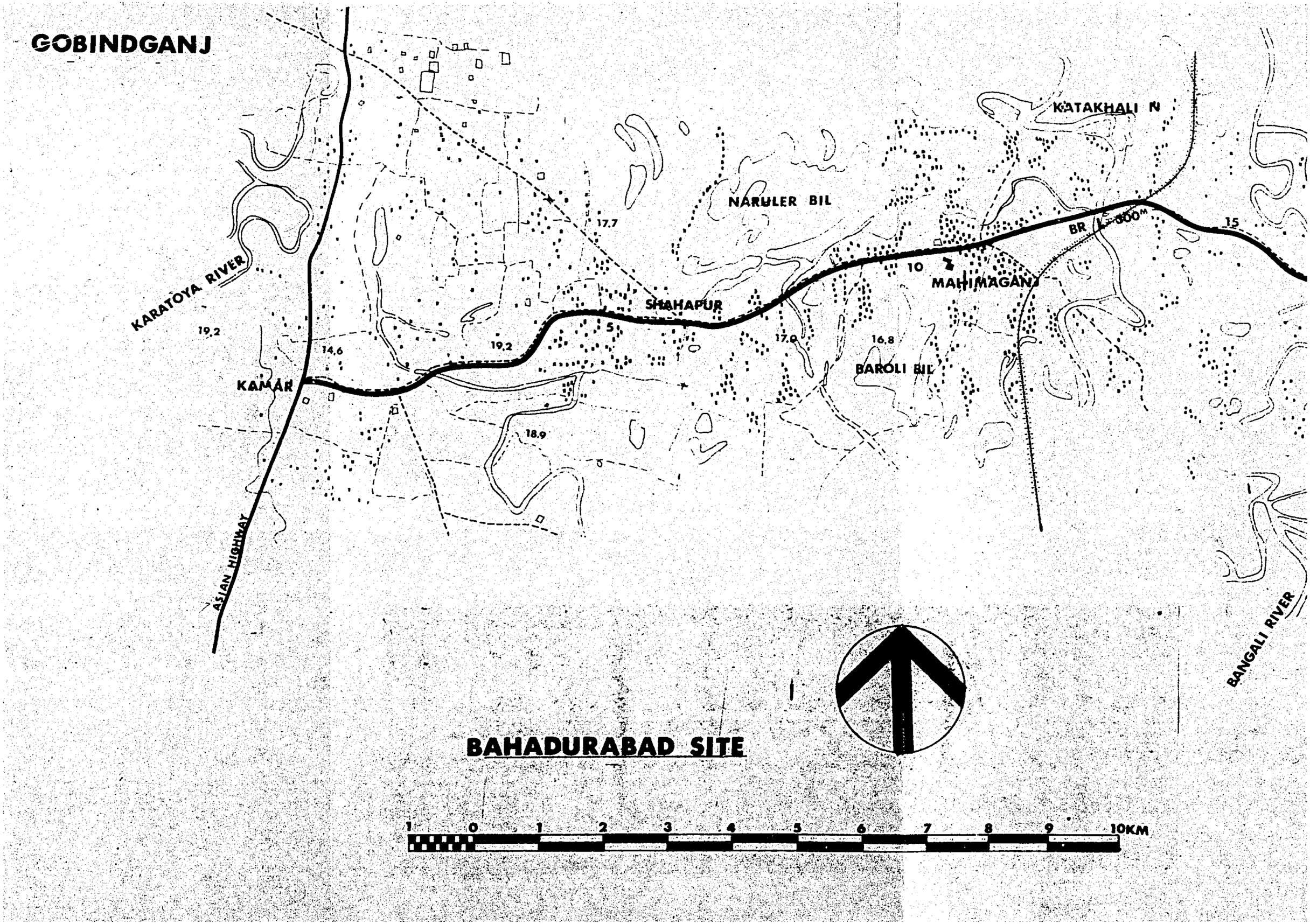
Table 4-1 CLEARANCE CLASSIFICATION

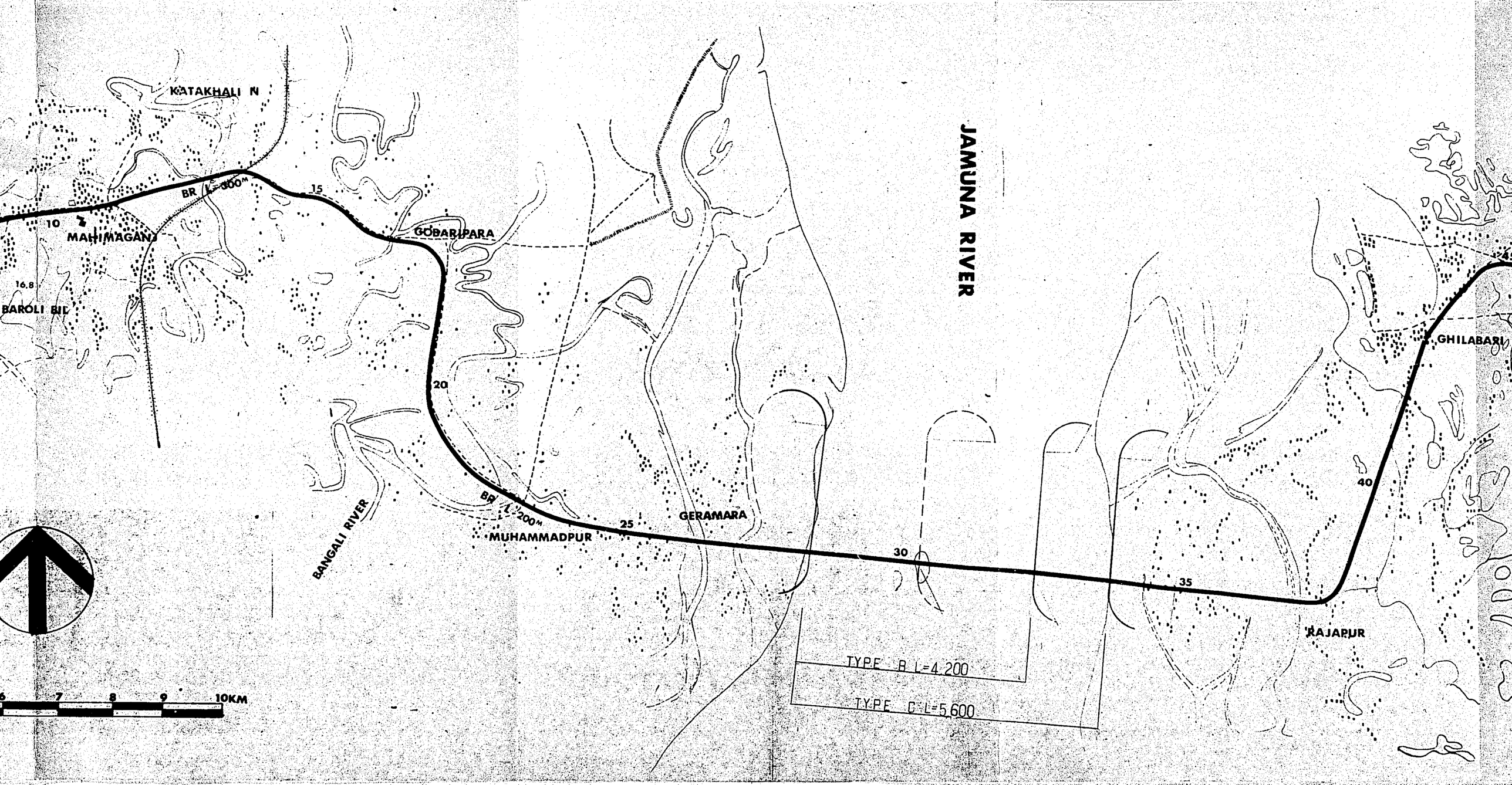
WATERWAY TRAFFIC DESCRIPTION	CLASS	VERTICAL CLEARANCE ON H.F.L.	RECOMMENDED CLASSIFICATION
LARGEST VESSELS - RIVER STEAMERS 6^{feet} DRAUGHT - GROUP	A	40^{feet}	
LARGEST VESSELS - CARGO BARGES & CARGO SAIL BOATS 4.5^{feet} DRAUGHT - GROUP	B	25^{feet}	HURASAGAR RIVER
LARGEST VESSELS - COUNTRY BOATS 3^{feet} DRAUGHT - GROUP	C	12^{feet}	BANGALI RIVER KARATOYA RIVER CHATAL RIVER
	OTHER	6^{feet}	OTHER MINOR CHANNELS

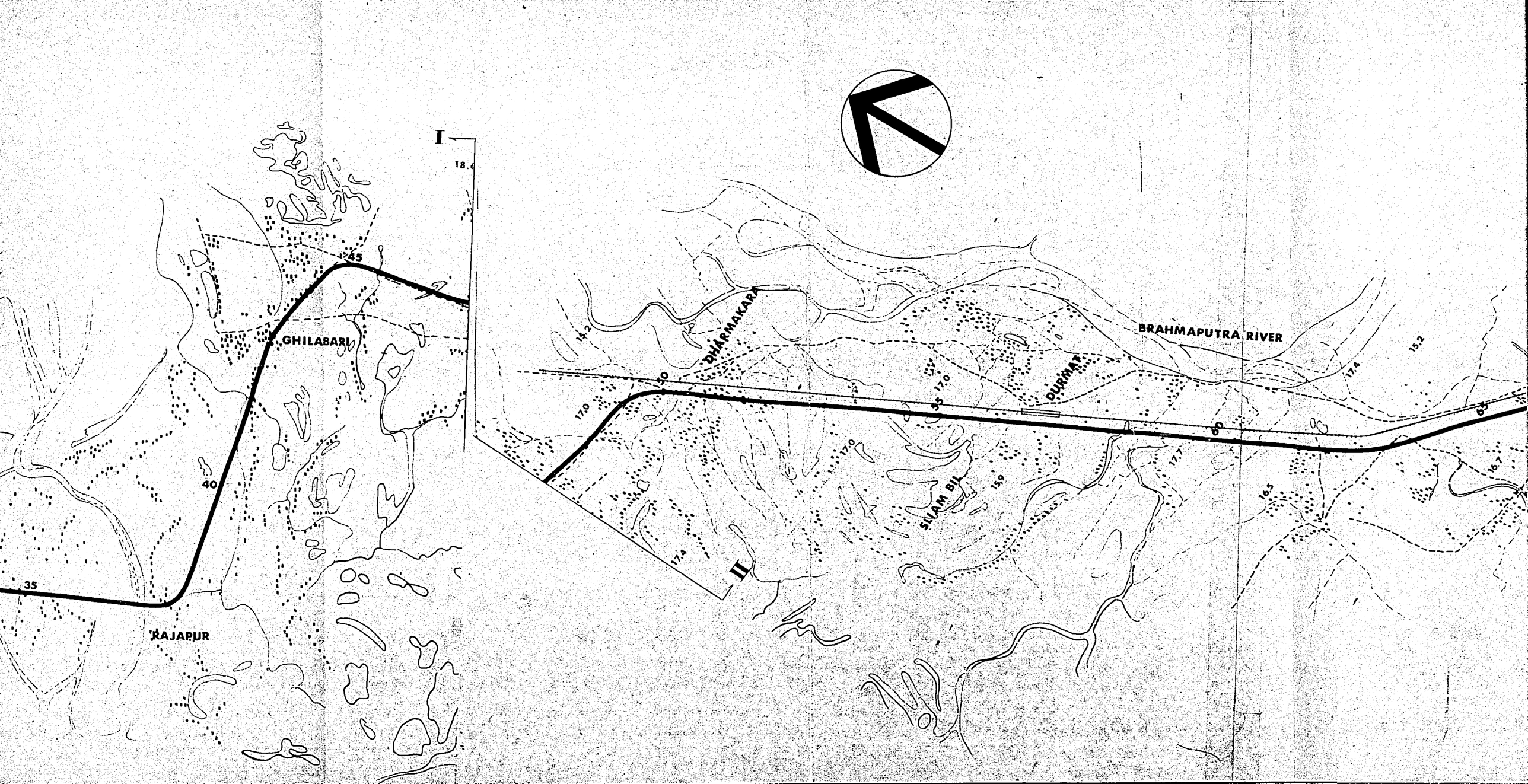

INDEX
I
II
JAMUNA RIVER
JAMALPUR



JAPAN INTERNATIONAL COOPERATION AGENCY	
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE PROJECT SAHARABAD SITE ACCESS ROAD HORIZONTAL ALIGNMENT	
Drawn	Date
Approved	Date
NIPPON CONSULTANTS CO., LTD.	No.4-4


GOBINDGANJ
KARATOYA RIVER
KAMAR
ASIAN HIGHWAY
19.2
14.6
19.2
18.9
17.7
SHAHAPUR
5
NARULER BIL
17.0
16.8
BAROLI BIL
KATAKHALI N
10
MAHIMAGANJ
BR
L=300M
15
BANGALI RIVER
BAHADURABAD SITE
1 0 1 2 3 4 5 6 7 8 9 10KM


KATAKHALI N
BR L=300M
10
MAHIMAGANJ
15
GOBARIPARA
16.8
BAROLI BIL
20
BR L=200M
BANGALI RIVER
MUHAMMADPUR
25
GERAMARA
JAMUNA RIVER
30
35
GHILABARI
40
RAJAPUR
TYPE B L=4,200
TYPE C L=5,600
6
7
8
9
10KM


I
II
GHILABARI
RAJAPUR
DHARMAKARA
DURMAT
SUAM BIL
BRAHMAPUTRA RIVER
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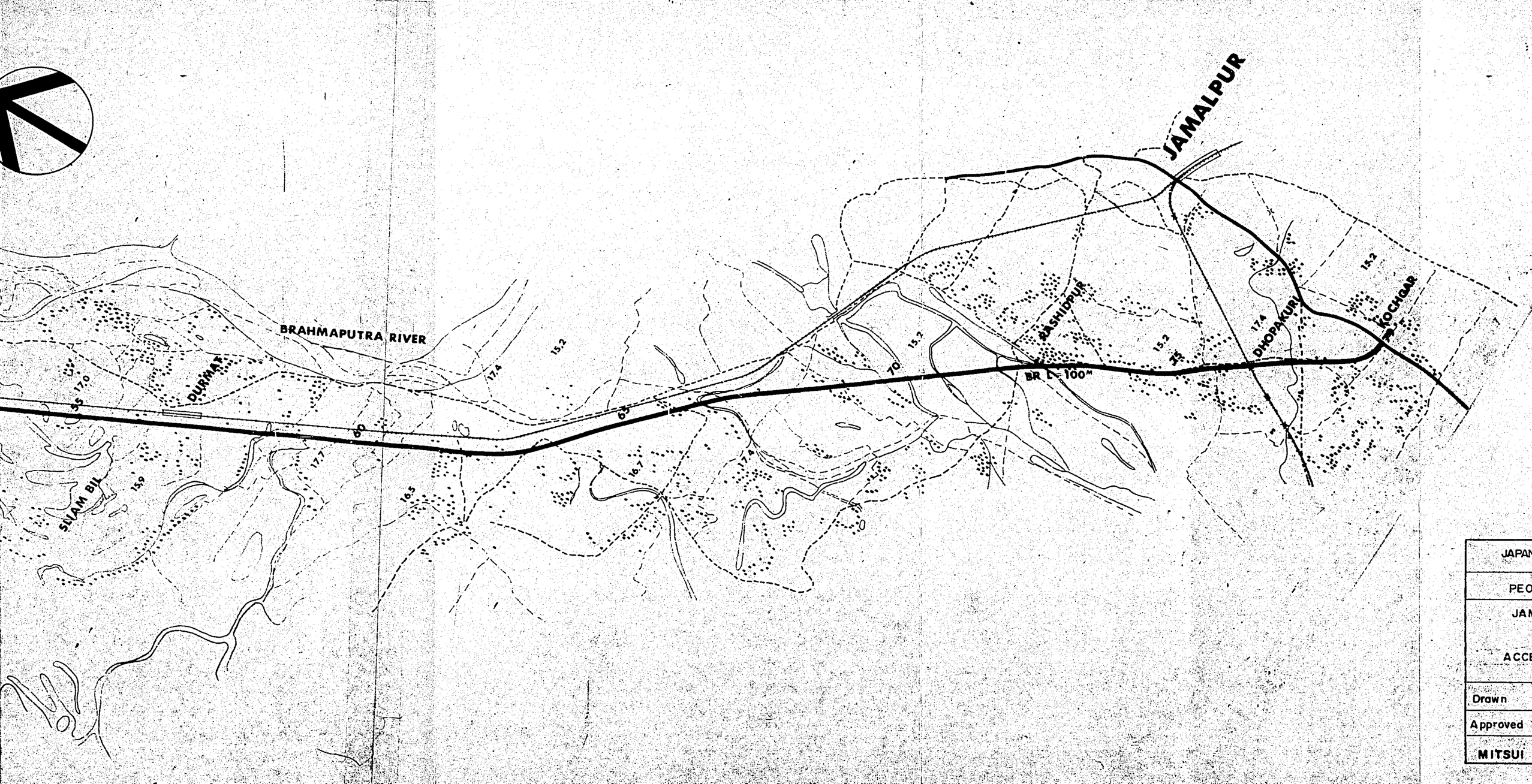
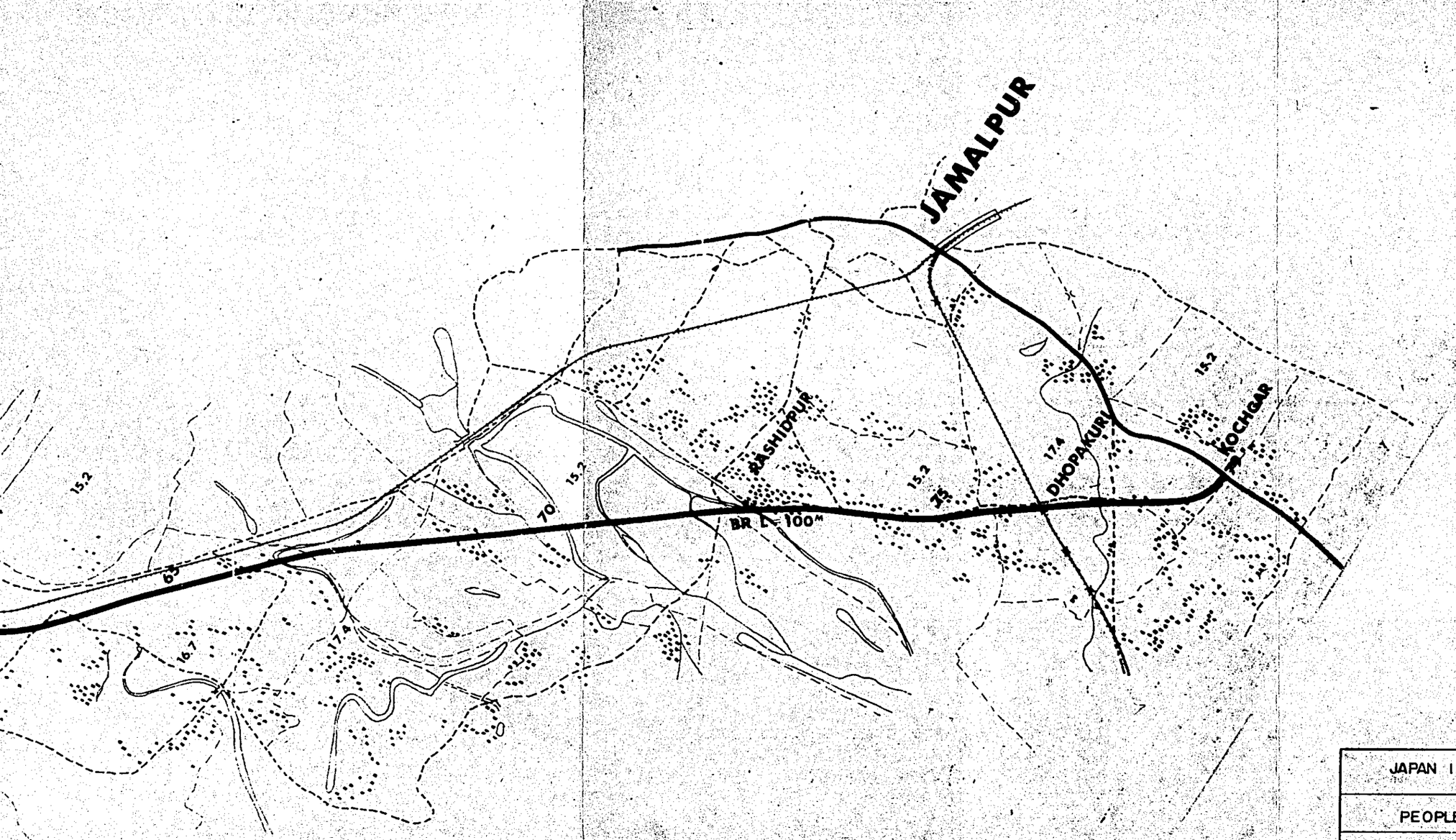
17.0
15.2
17.4
13.9
16.5
16.7



JAPAN	
PEOPL	
JAMU	
ACCES	
Drawn	
Approved	
MITSUI C	



JAPAN INTERNATIONAL COOPERATION AGENCY	
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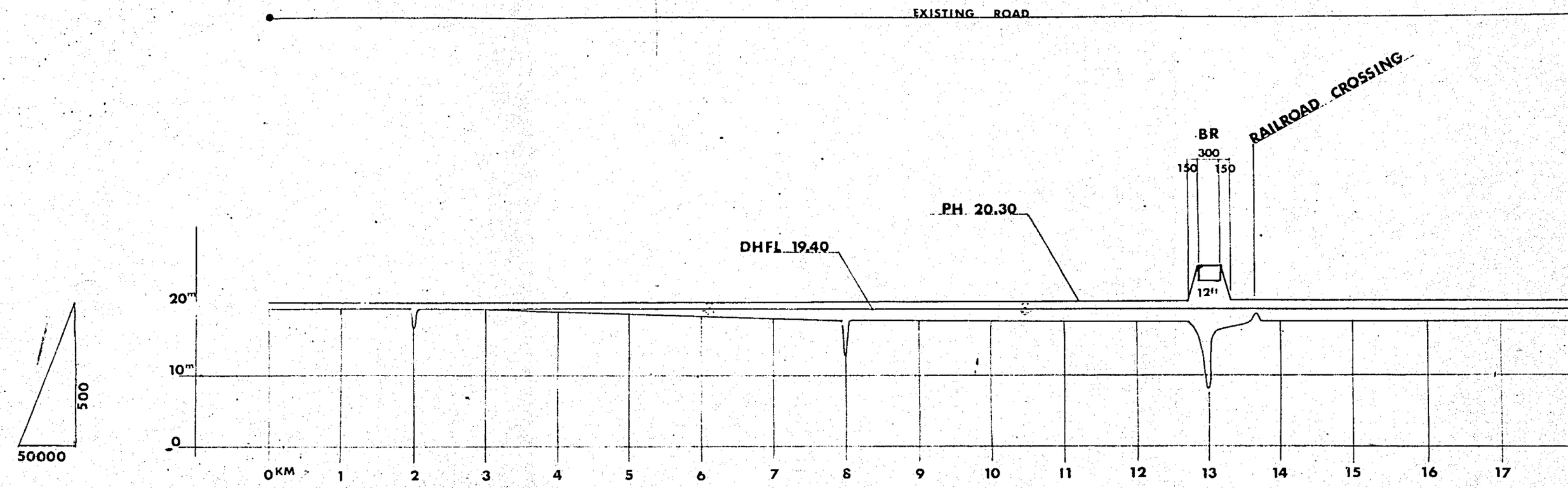
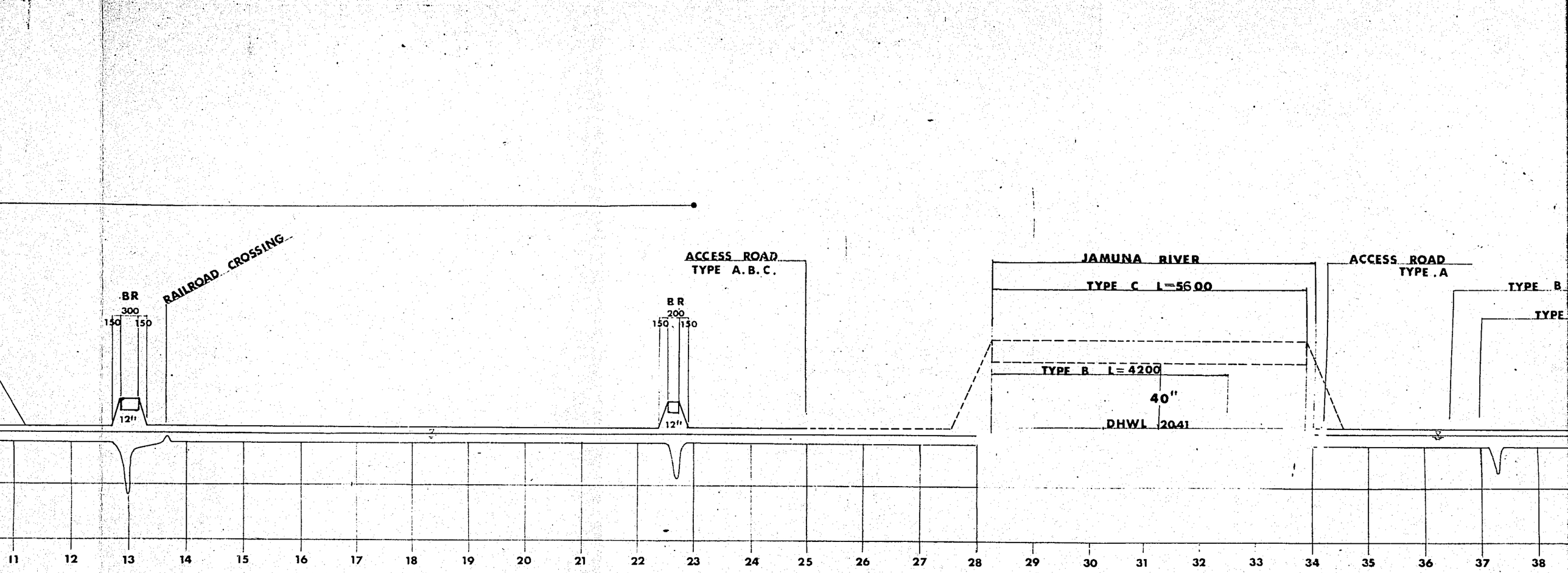
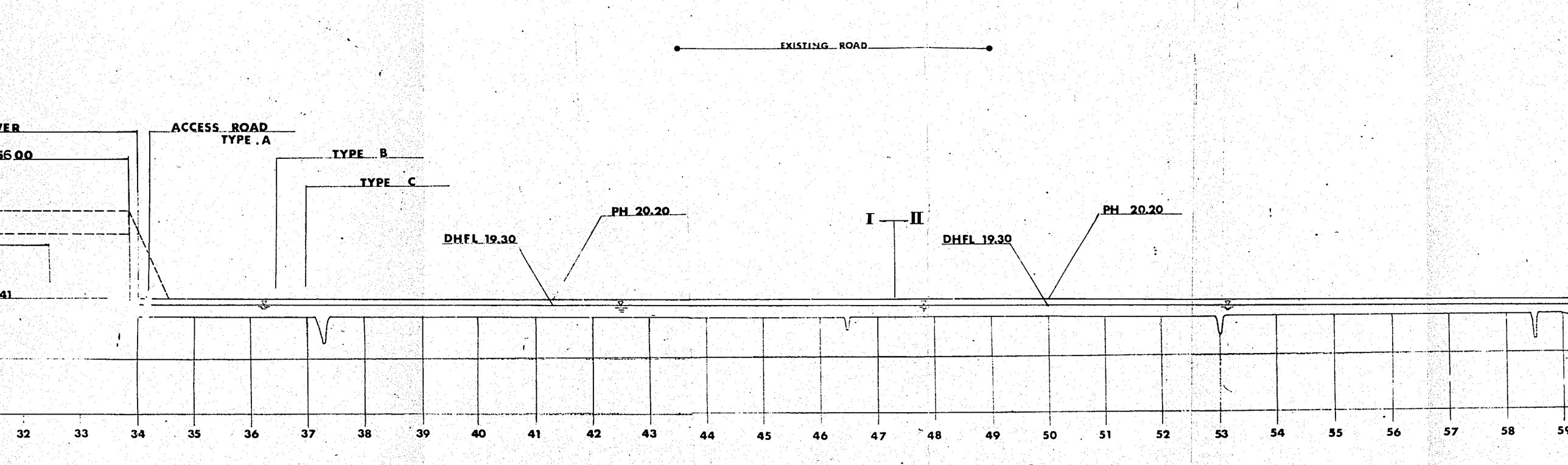
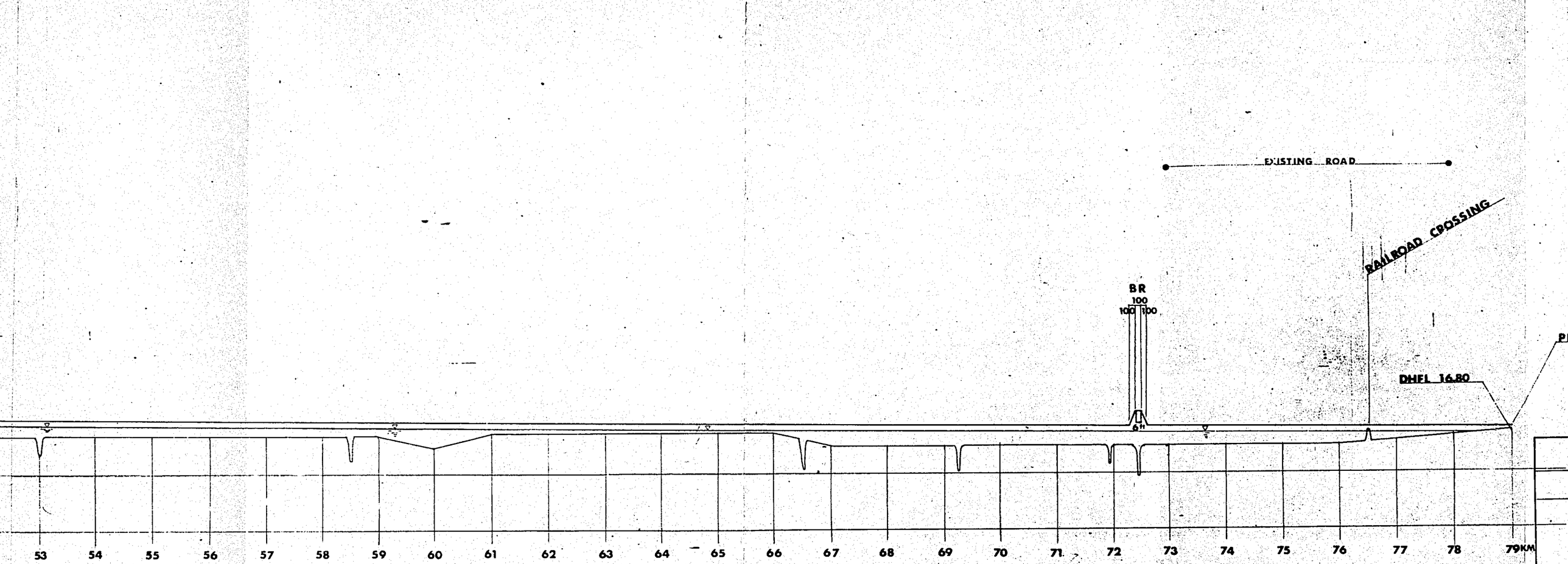
JAMUNA RIVER BRIDGE PROJECT BAHADURABAD SITE ACCESS ROAD HORIZONTAL ALIGNMENT	
Drawn	Date
Approved	Date
MITSUI CONSULTANTS CO., LTD.	Fig 4-5

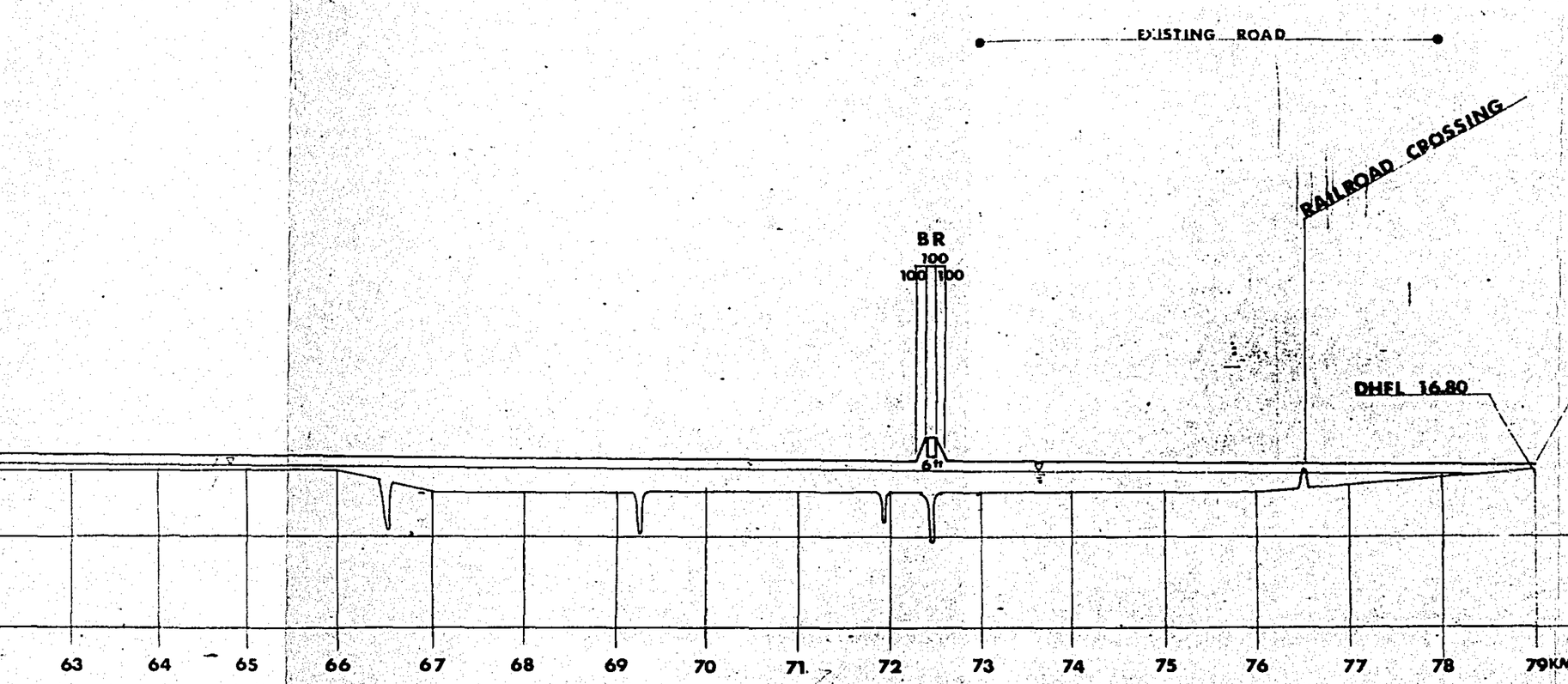
BAHADURABAD SITE




BR
300
150
150
12"
RAILROAD CROSSING
ACCESS ROAD
TYPE A.B.C.
BR
200
150
150
12"
JAMUNA RIVER
TYPE C L=5600
TYPE B L=4200
40"
DHWL 20.41
ACCESS ROAD
TYPE . A
TYPE B
TYPE
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38


EXISTING ROAD
ACCESS ROAD
TYPE . A
TYPE B
TYPE C
DHFL 19.30
PH 20.20
I
II
DHFL 19.30
PH 20.20
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58


EXISTING ROAD
RAILROAD CROSSING
BR
100
100 100
DHFL 16.80
6m
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79KM



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MITSUI CONSULTANTS CO., LTD.	Fig 4-6

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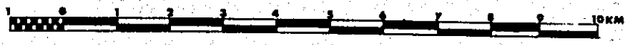
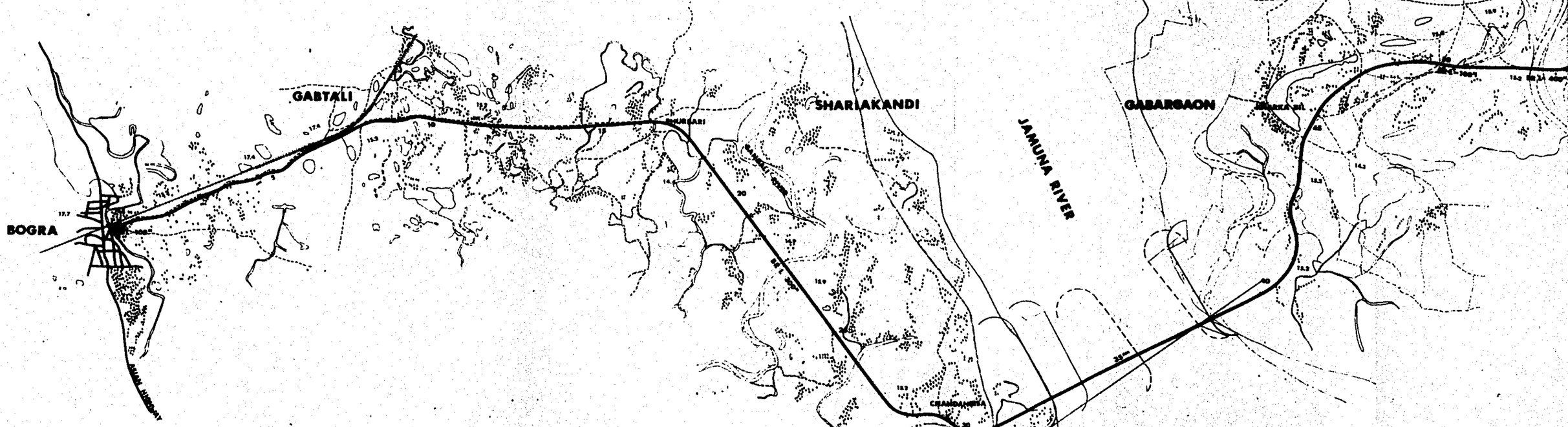
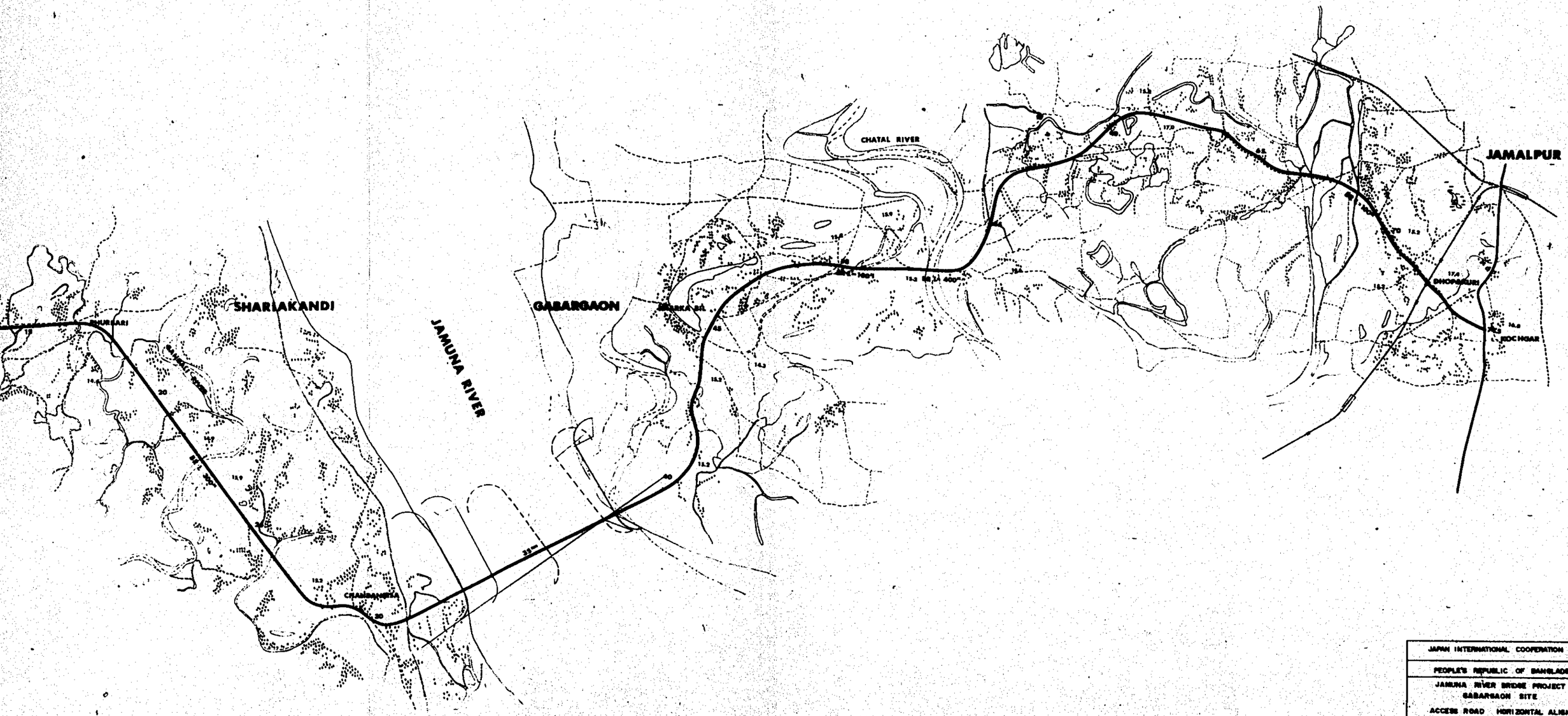
GABARGAON - SITE







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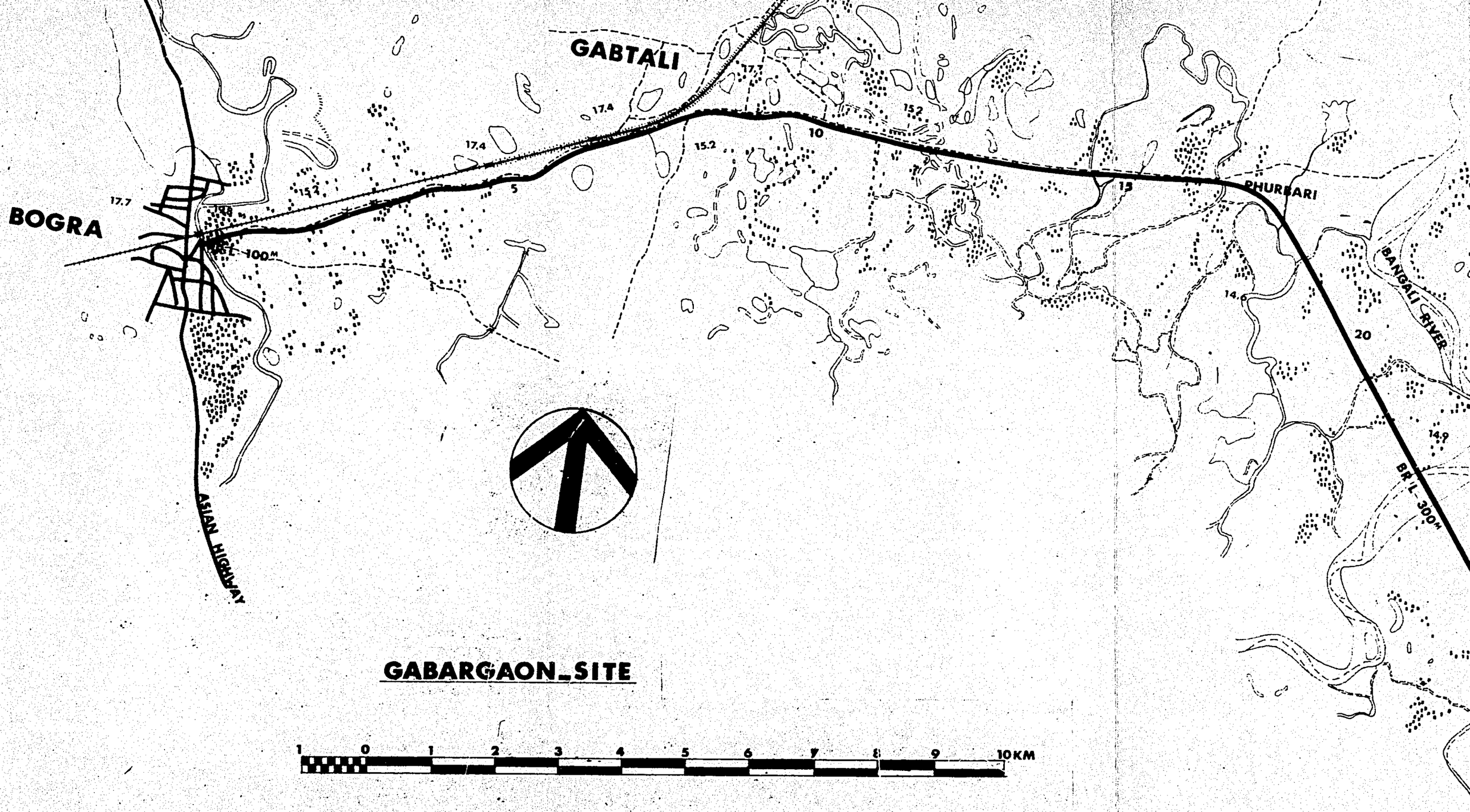
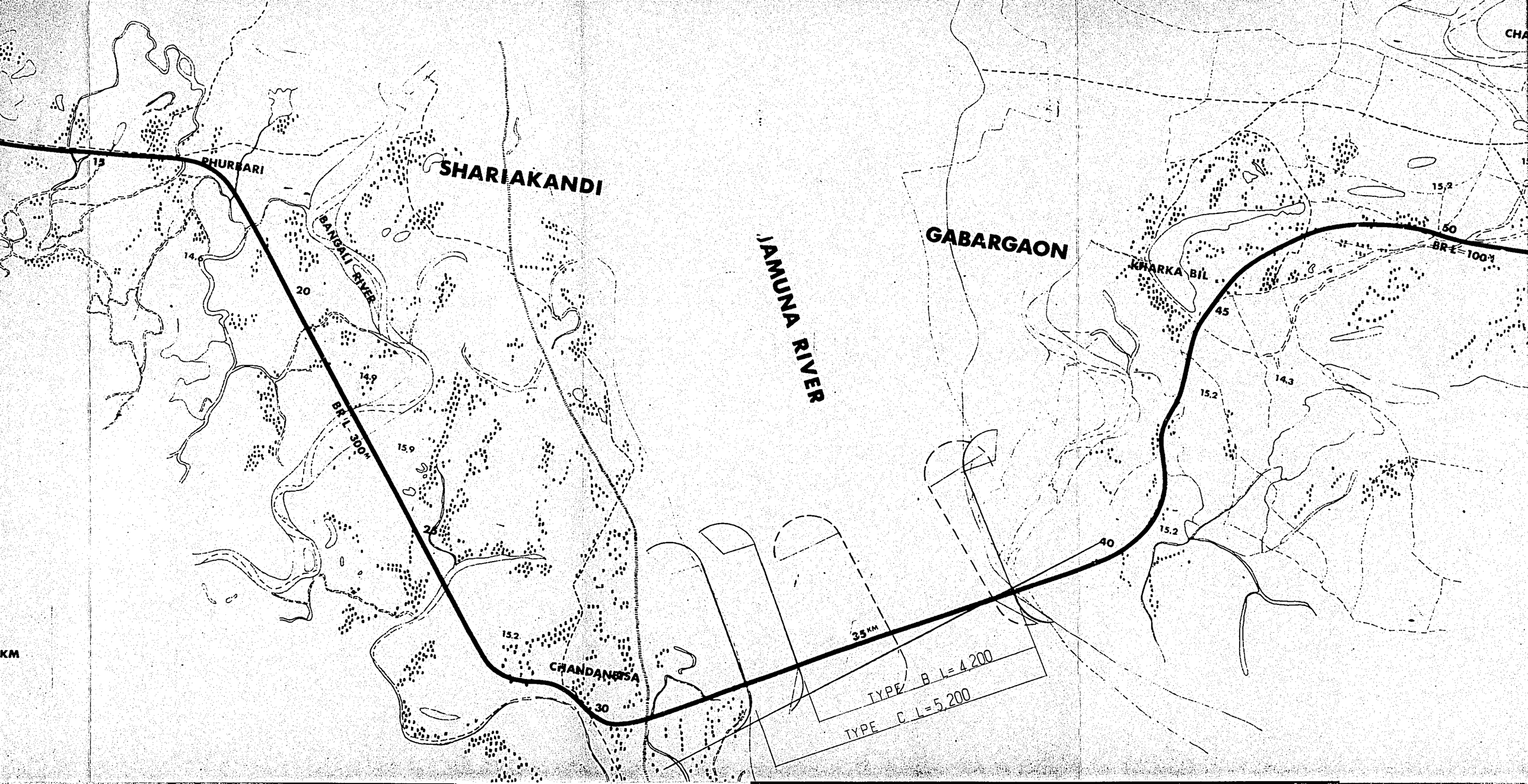
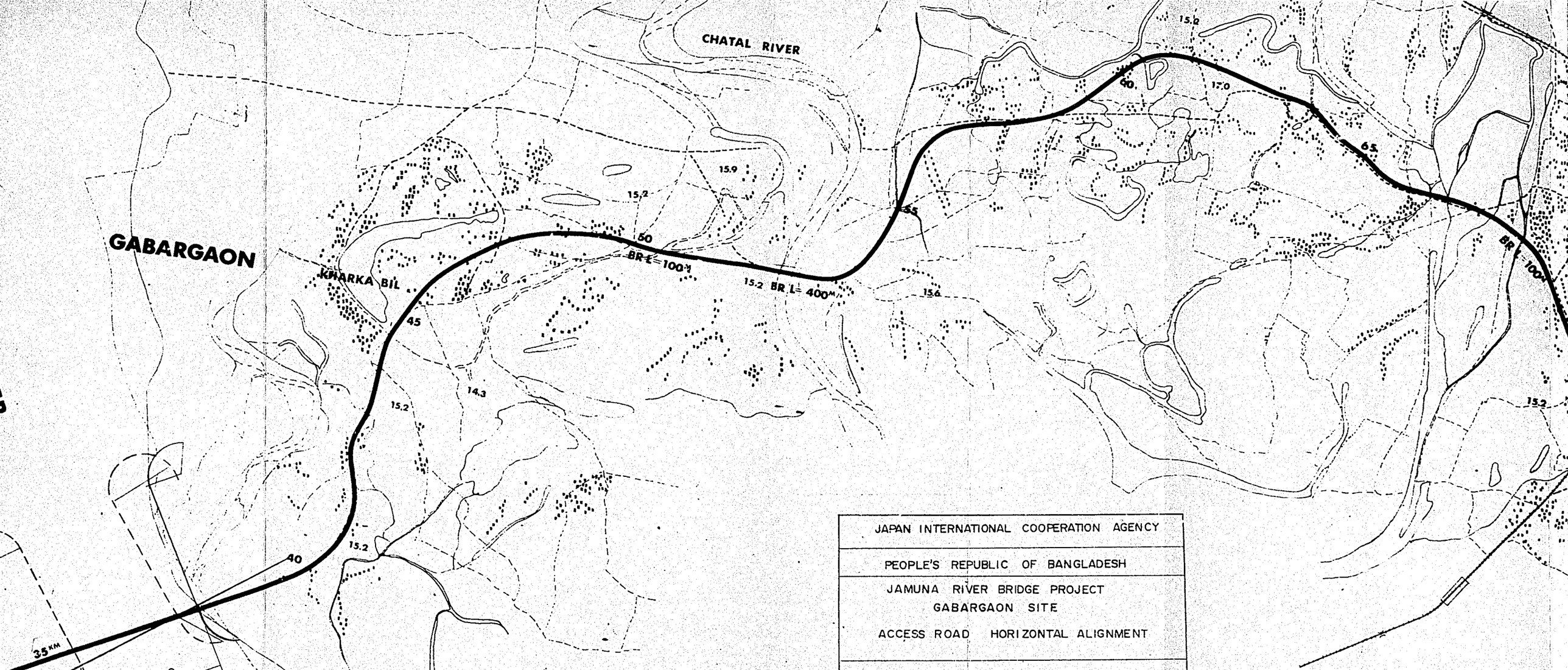

GABTALI
BOGRA
PHURBARI
BANGALI RIVER
ASIAN HIGHWAY
BR'L-300M
100M
17.7
17.4
15.2
14.6
14.9
5
10
15
20
GABARGAON_SITE
1 0 1 2 3 4 5 6 7 8 9 10KM


PHURBARI
SHARIAKANDI
BANGALI RIVER
JAMUNA RIVER
GABARGAON
KHARKA BIL
CHANDANBISA
BR L=300M
BR L=100M
TYPE B L=4,200
TYPE C L=5,200
35 KM
KM



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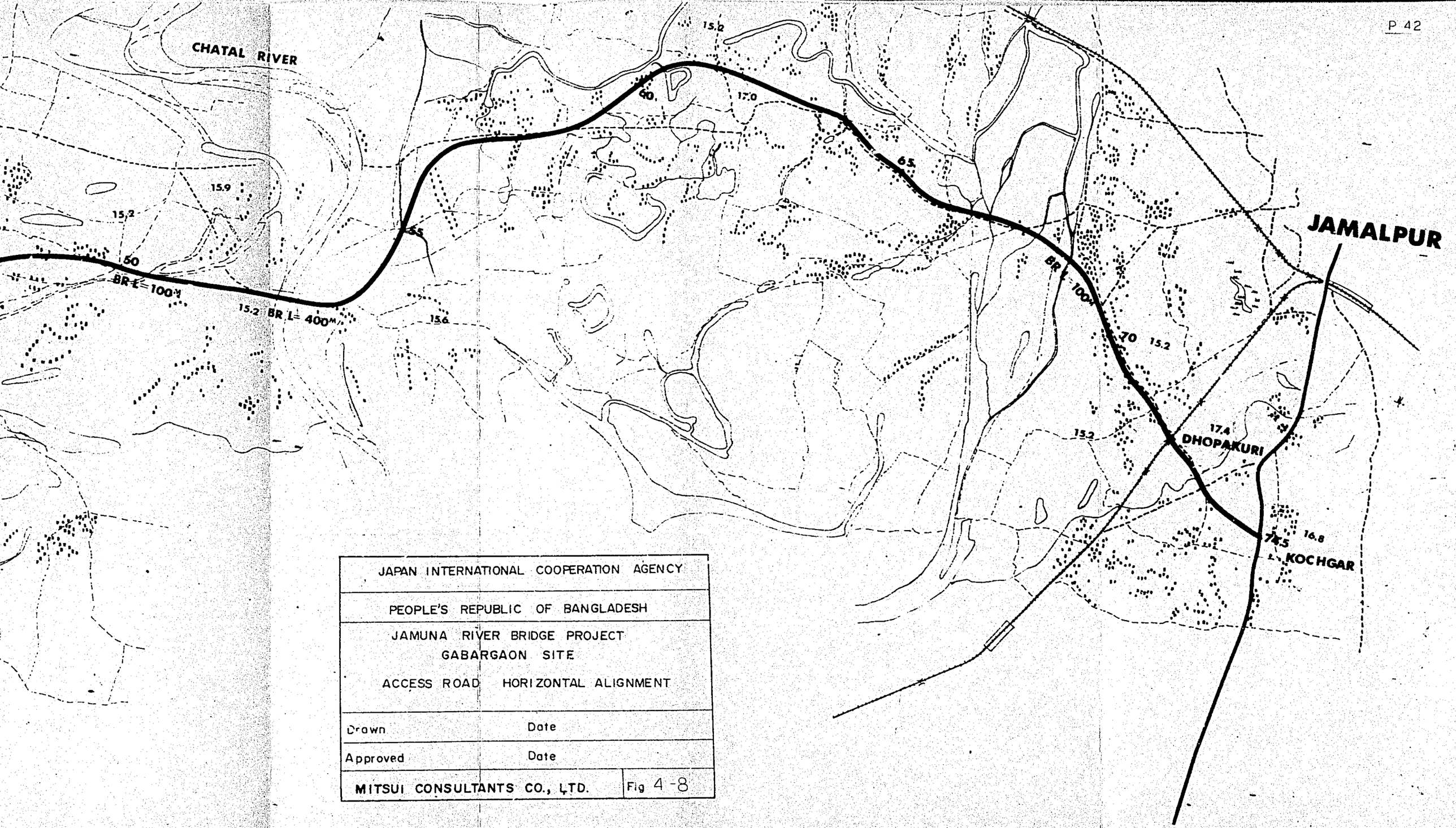
MITSUI CONSULTANTS CO., LTD.	Fig 4-8



JAPAN INTERNATIONAL COOPERATION AGENCY	
PEOPLE'S REPUBLIC OF BANGLADESH	
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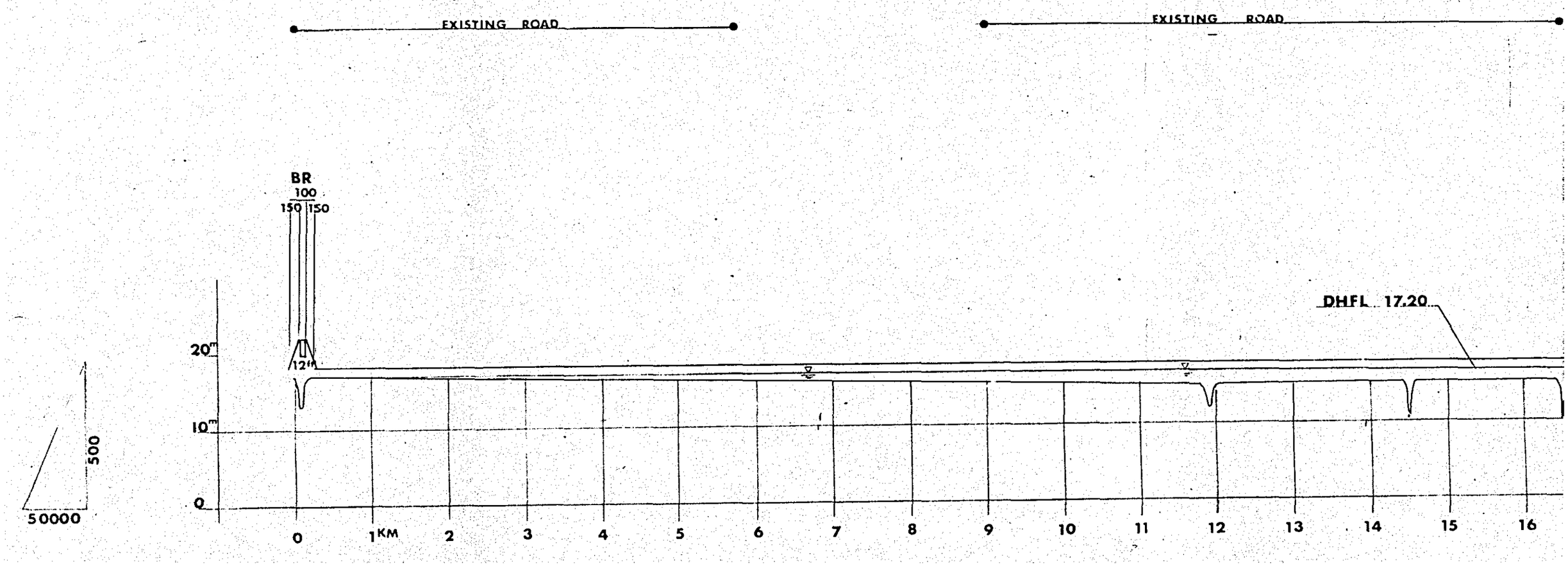
MITSUI CONSULTANTS CO., LTD.	Fig 4-8

GABARGAON SITE



ROAD

CESS ROAD
TYPE A

PE B.C.

EXISTING ROAD

JAMUNA RIVER

TYPE C L-5200

TYPE B L-4200

40"

DHWL 18.99

ACCESS ROAD
TYPE A.B.C.

DHFL 16.80

PH 17.70

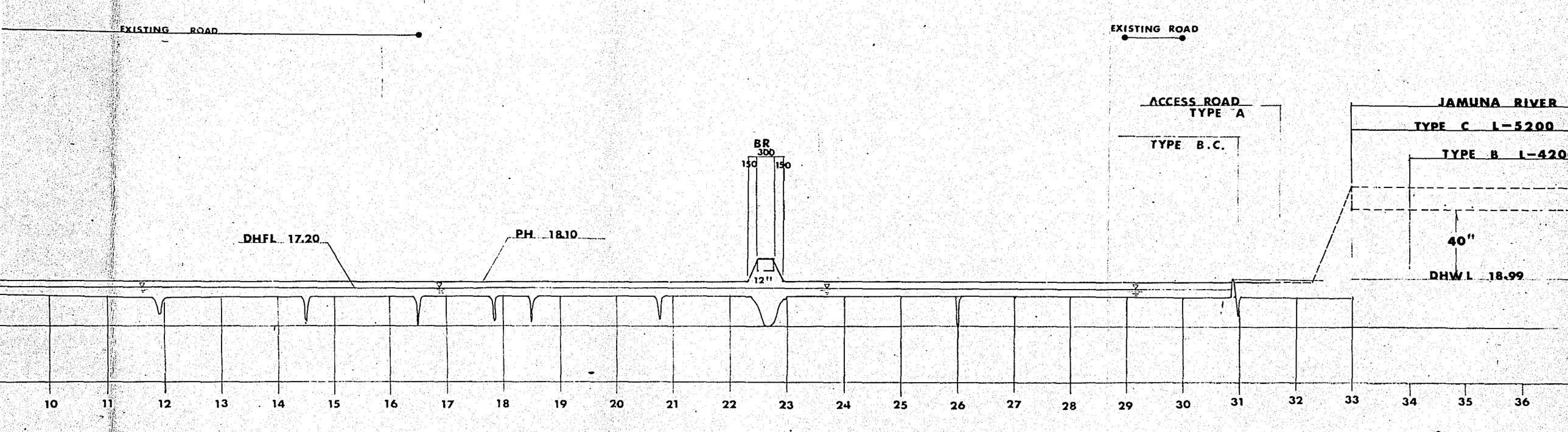
BR
100
100 100

BR
400
150 150

6ft

12ft

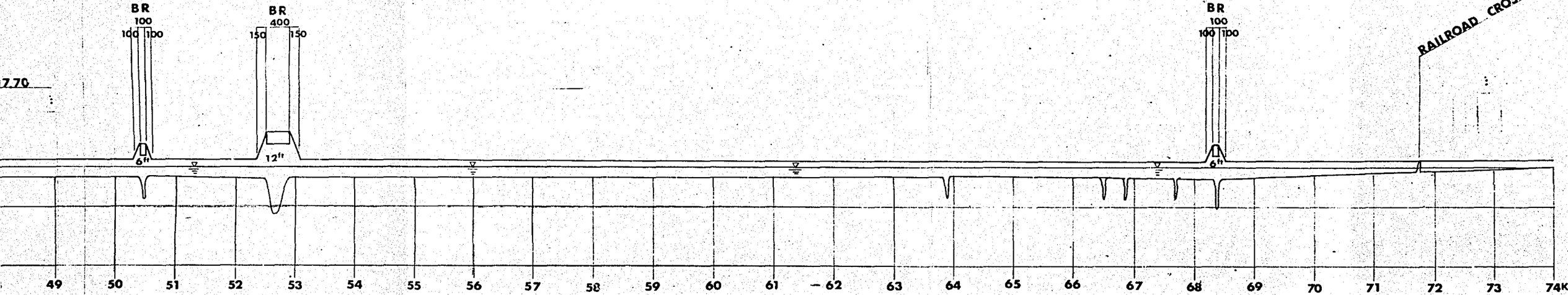
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57

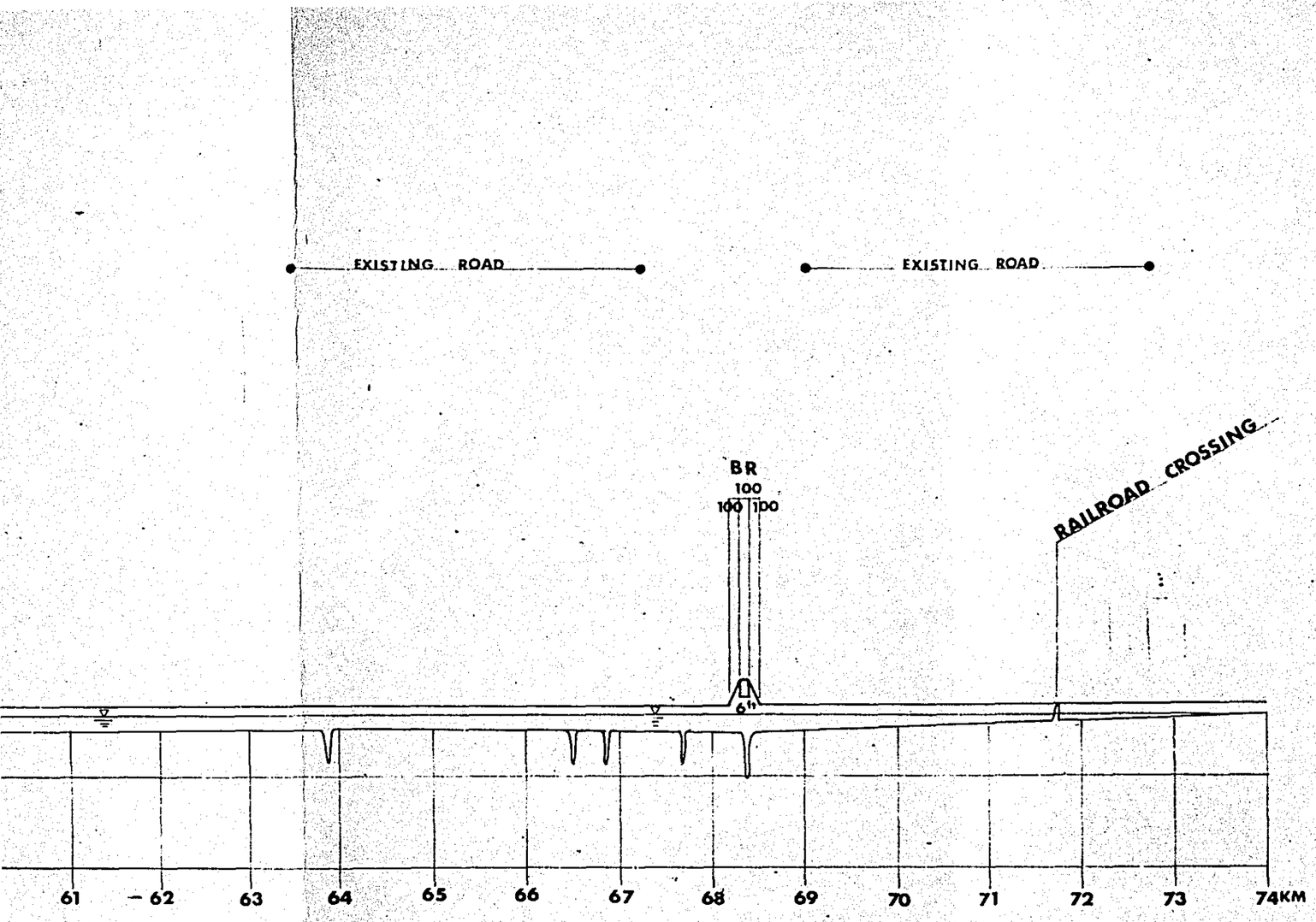

EXISTING ROAD
EXISTING ROAD
ACCESS ROAD
TYPE A
TYPE B.C.
JAMUNA RIVER
TYPE C L-5200
TYPE B L-420
BR
300
150
150
12"
DHFL 17.20
PH 18.10
40"
DHWL 18.99
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36

EXISTING ROAD

EXISTING ROAD

EXISTING ROAD





JAPAN INTERNATIONAL COOPERATION AGENCY	
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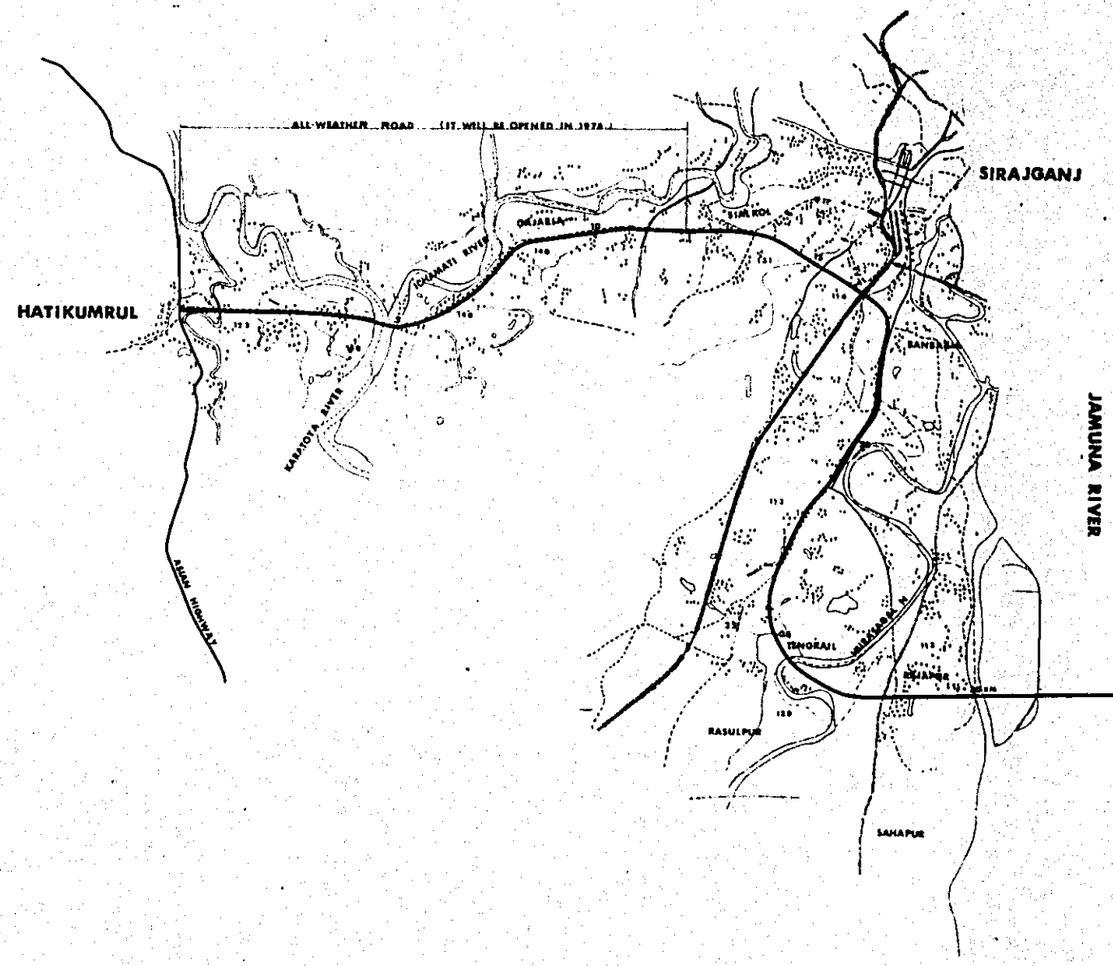

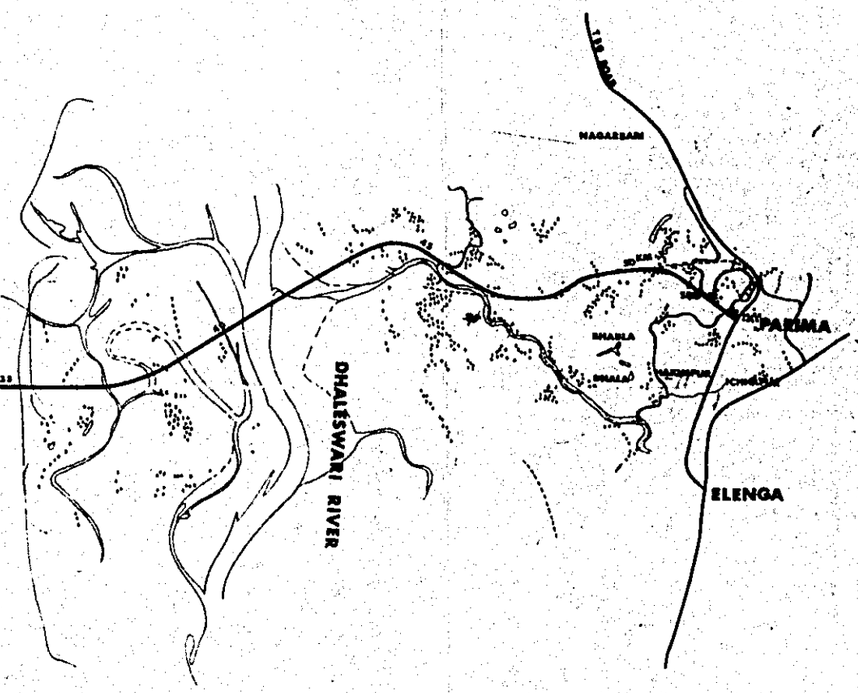

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SIRAJGANJ SITE

JAPAN INTERNATIONAL COOPERATION AGENCY	
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE PROJECT SIRAJGANJ SITE ACCES ROAD VERTICAL ALIGNMENT	
Drawn	Date
Approved	Date
MITSUI CONSULTANTS CO., LTD	Fig 4-10

ALL-WEATHER ROAD (IT WILL BE OPENED IN 1978)

HATIKUMRUL

SIRAJG

CHAMATI RIVER

GAJARIA

SIAL KOL

BANBARIA

KARATOYA RIVER

ASIAN HIGHWAY

TENGRAIL

HURASAGAL N

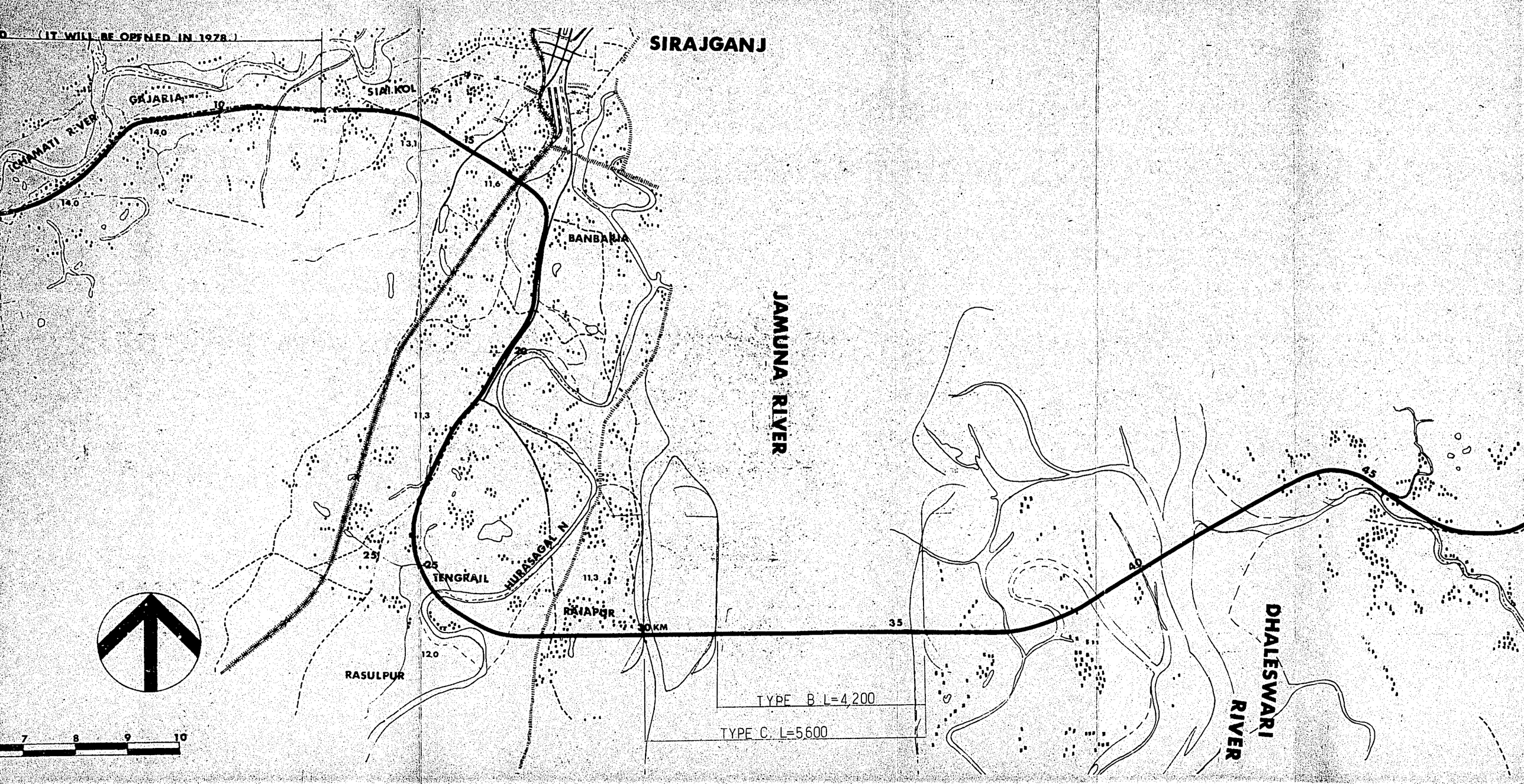
RAIAPUR

RASULPUR

30 KM

SIRAJGANJ SITE

0 1 2 3 4 5 6 7 8 9 10


(IT WILL BE OPENED IN 1978.)
SIRAJGANJ
SIRAJKOL
GAJARIA
ICHAMATI RIVER
BANBARIA
JAMUNA RIVER
TENGRAIL
HURASAGAL N
RAIAPUR
RASULPUR
DHALESWARI RIVER
10
14.0
13.1
15
11.6
14.0
20
11.3
25
25
11.3
30 KM
35
40
45
12.0
TYPE B L=4,200
TYPE C L=5,600
7
8
9
10

JAPAN INTERNATIONAL COOPERATION AGENCY	
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE PROJECT SIRAJGANJ SITE ACCES ROAD VERTICAL ALIGNMENT	
Drawn Date	
Approved Date	
MITSUI CONSULTANTS CO., LTD.	Fig 4-11

SIRAJGANJ

JAMUNA RIVER

TBG ROAD

NAGARBARI

35

40

45

50 KM

SERI

PARIMA

BHABLA

DHALA

HAKIMPUR

ICHHAPUR

ELENGA

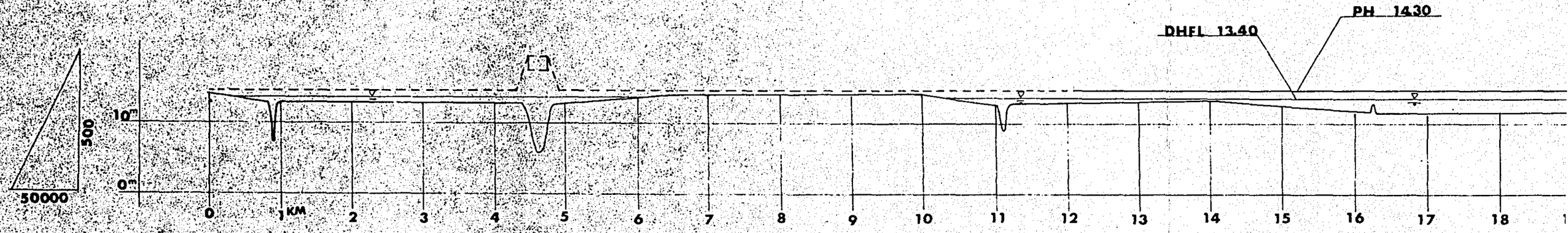
DHALESWARI RIVER

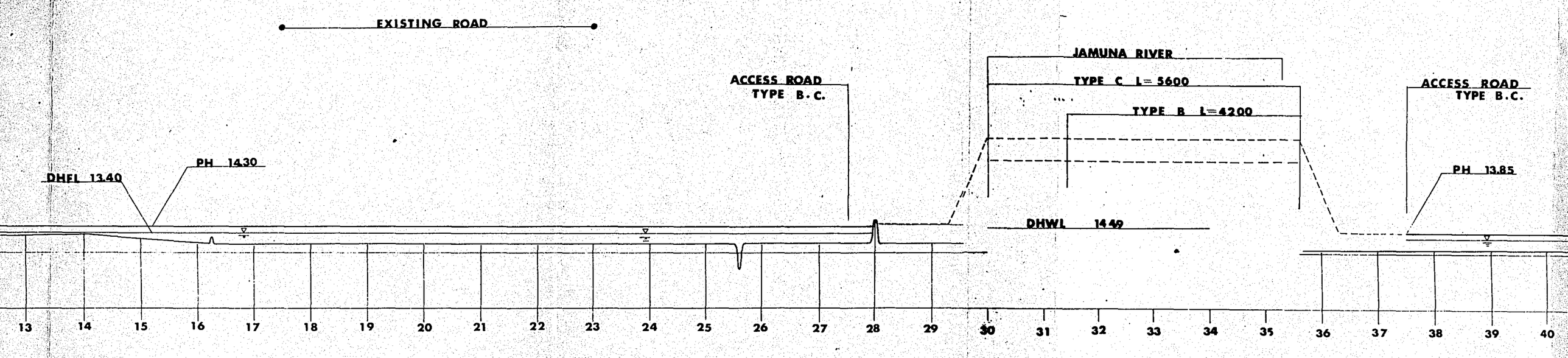
TYPE B L=4,200

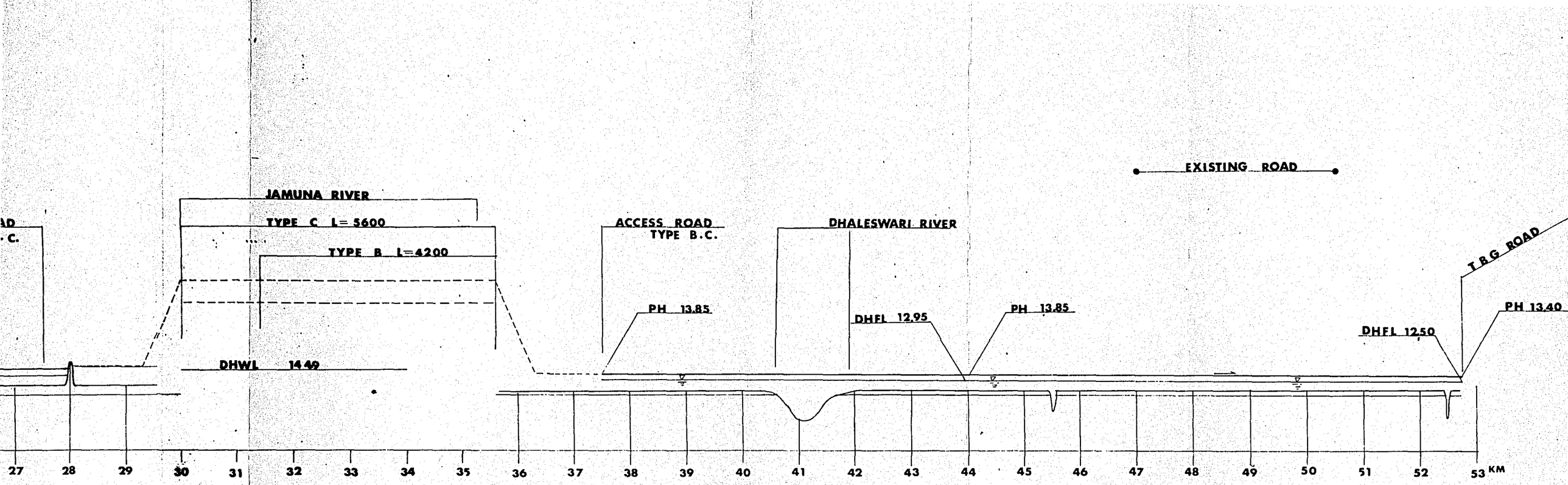
TYPE C L=5,600

SIRAJGANJ SITE
TYPE B.C.

ALL-WEATHER ROAD (IT WILL BE OPENED IN 1978)




EXISTING ROAD
ACCESS ROAD
TYPE B.C.
JAMUNA RIVER
TYPE C L= 5600
TYPE B L=4200
ACCESS ROAD
TYPE B.C.
PH 14.30
DHFL 13.40
PH 13.85
DHWL 14.49
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40


AD
C.
JAMUNA RIVER
TYPE C L= 5600
TYPE B L=4200
DHWL 14.49
ACCESS ROAD
TYPE B.C.
PH 13.85
DHALESWARI RIVER
DHFL 12.95
PH 13.85
EXISTING ROAD
DHFL 12.50
T.R.G. ROAD
PH 13.40
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53 KM

EXISTING ROAD

CESS ROAD
TYPE B.C.

DHALESWARI RIVER

T.B.G. ROAD

PH 13.85

DHFL 12.95

PH 13.85

DHFL 12.50

PH 13.40

38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 KM

JAPAN INTERNATIONAL COOPERATION AGENCY

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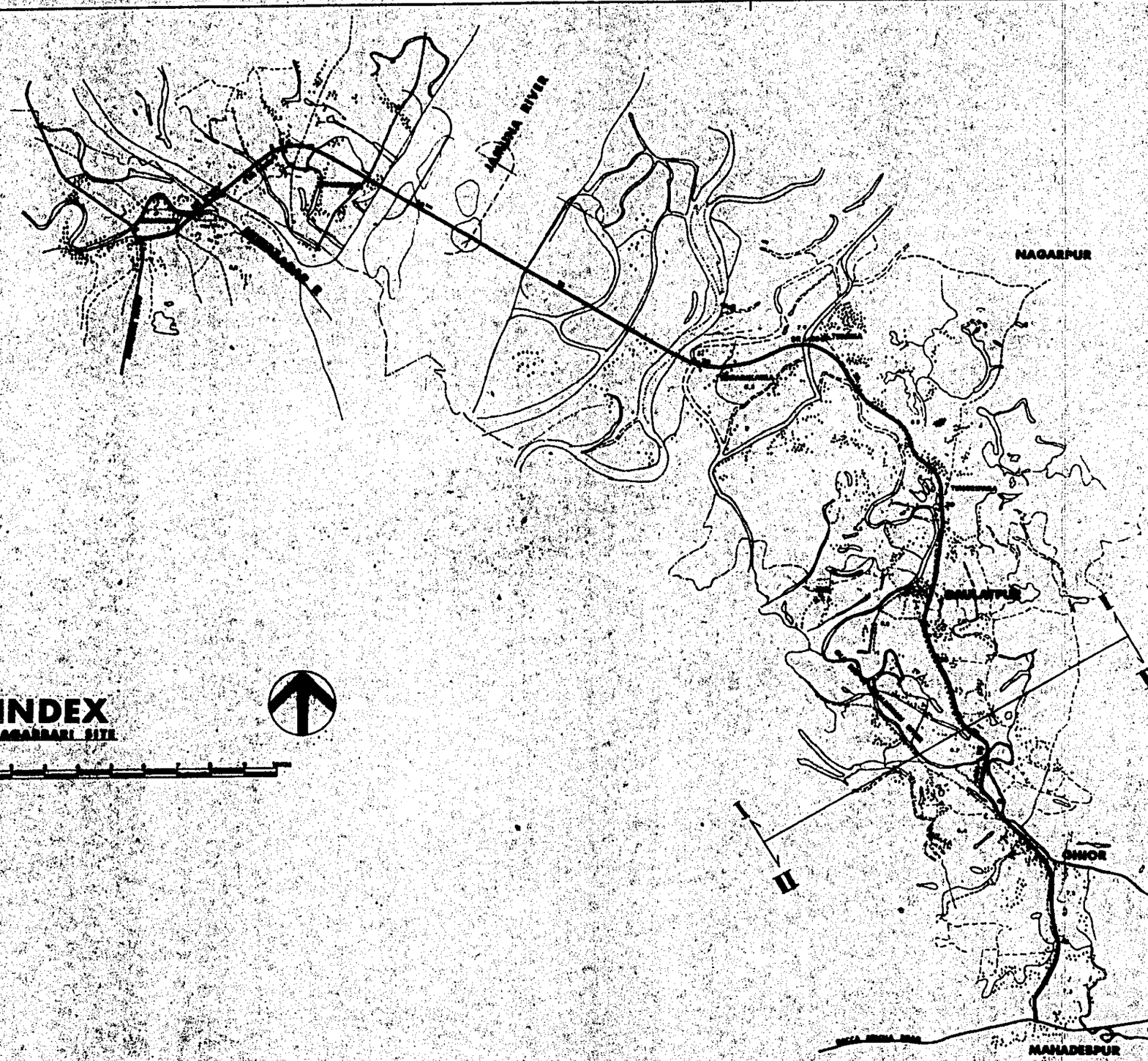
JAMUNA RIVER BRIDGE PROJECT
SIRAJGANJ SITE

ACCESS ROAD VERTICAL ALIGNMENT

Drawn	Date
Approved	Date
MITSUI CONSULTANTS CO., LTD.	Fig. 4-12

P-47



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NAGARBARI SITE

JAPAN INTERNATIONAL COOPERATION AGENCY

PEOPLE'S REPUBLIC OF BANGLADESH

JAMUNA RIVER BRIDGE PROJECT

NAGARBARI SITE

ACCESS ROAD HORIZONTAL ALIGNMENT

Drawn Date

Approved Date

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JAMUNA RIVER

10 KM

15

TYPE B L=4,200

TYPE C L=5,200

SHARISPUR

BR L-300M

BR L-600M

BANGRAM

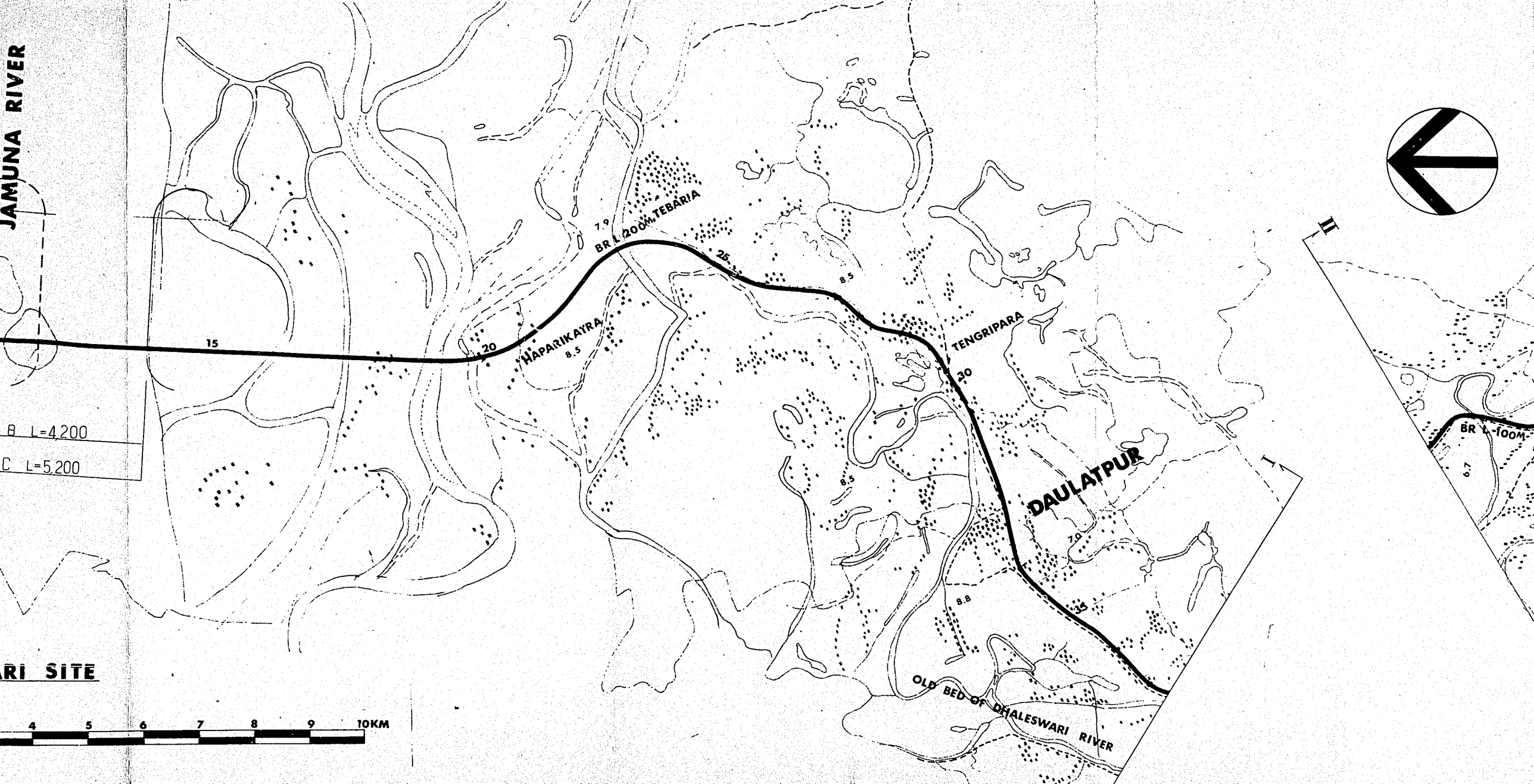
HURASAGAR R

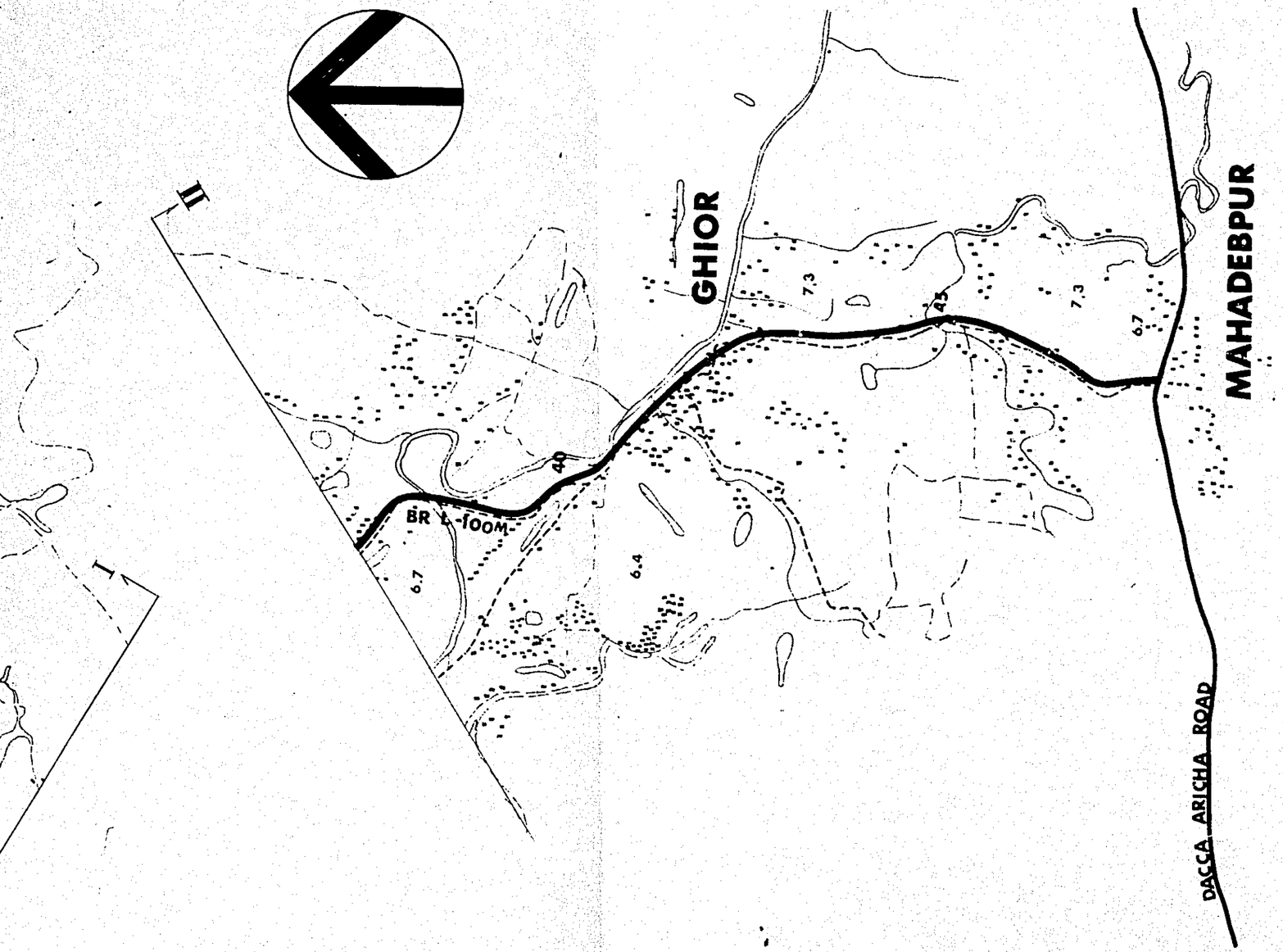
ASIAN HIGHWAY

88

NAGARBARI SITE

1 0 1 2 3 4 5 6 7 8 9 10KM


JAMUNA RIVER
B L=4,200
C L=5,200
15
20
HAPARIKAYRA
8.5
7.9
BR L 200M. TEBARIA
25
8.5
TENGRIPARA
30
8.5
DAULATPUR
7.0
8.8
35
OLD BED OF DHALESWARI RIVER
II
I
BR L-100M-
6.7
ARI SITE
4
5
6
7
8
9
10KM



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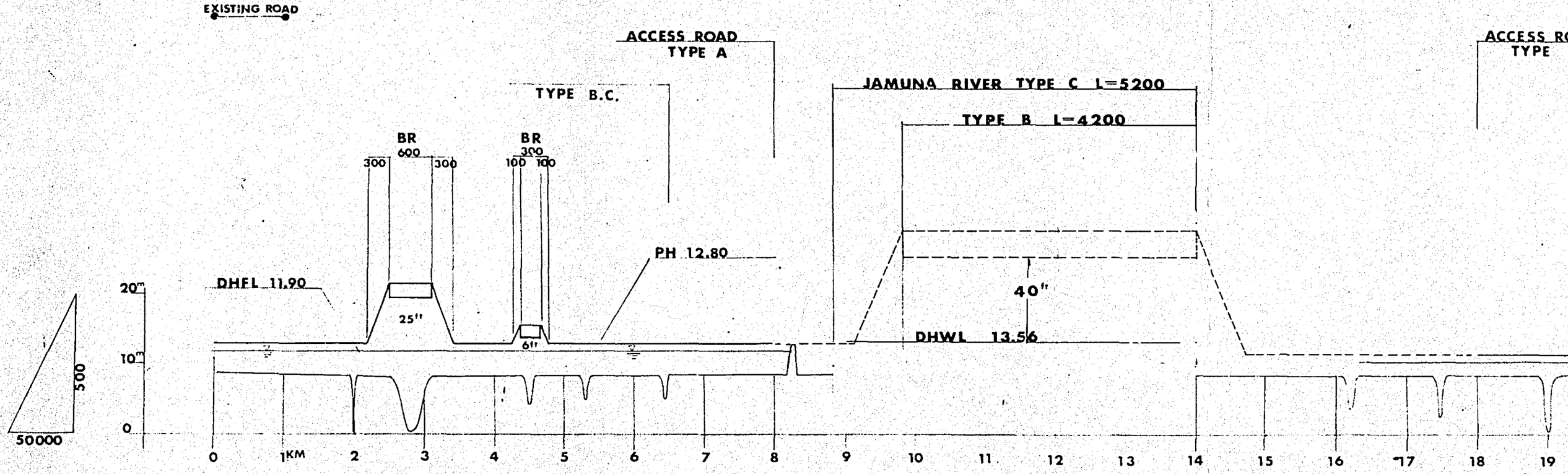
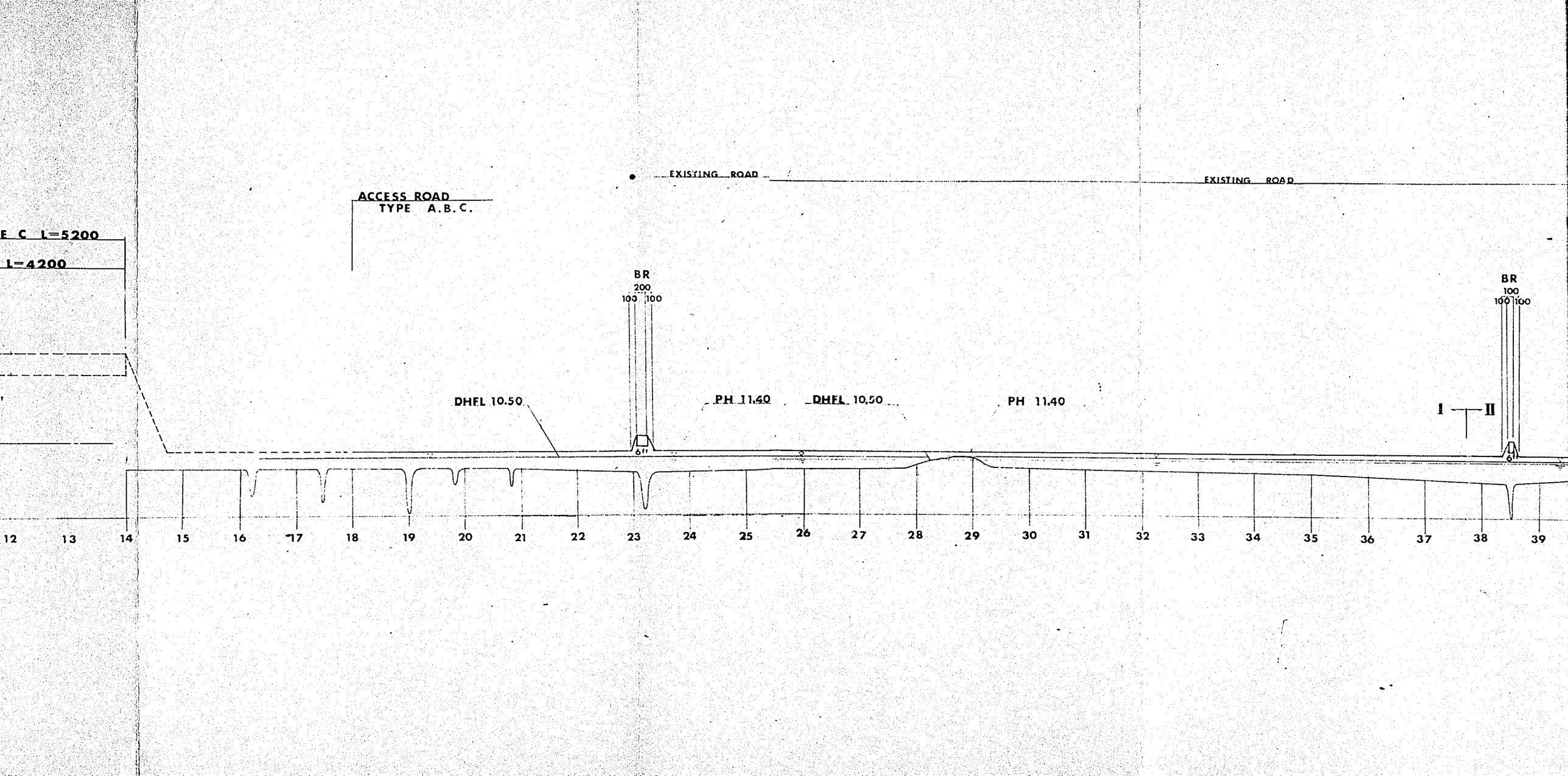
NAGARBARI SITE




E C L=5200
L=4200
ACCESS ROAD
TYPE A.B.C.
EXISTING ROAD
EXISTING ROAD
BR
200
100 100
BR
100
100 100
DHEL 10.50
PH 11.40
DHEL 10.50
PH 11.40
I
II
12
13
14
15
16
17
18
19
20
21
22
23
24
25
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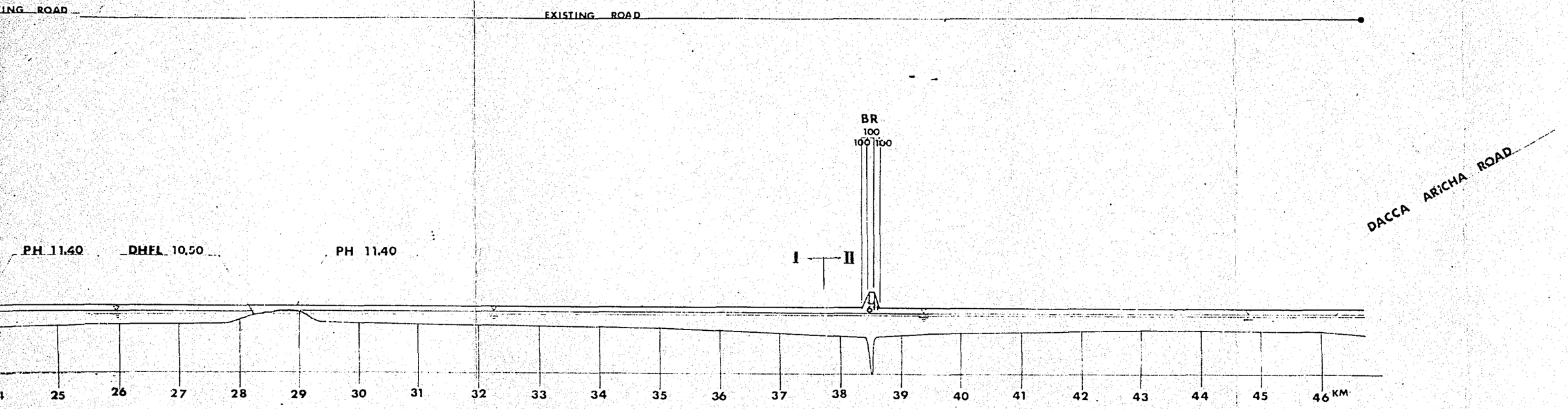
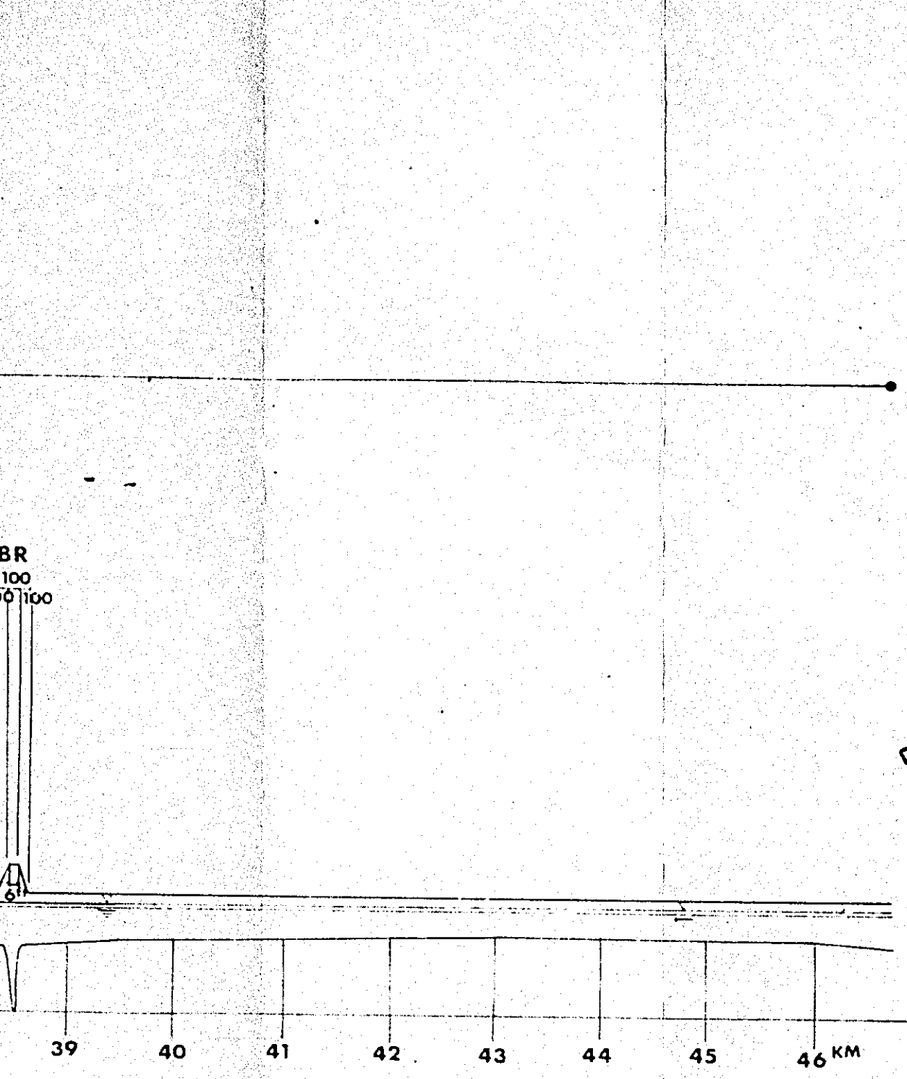
29
30
31
32
33
34
35
36
37
38
39


LING ROAD
EXISTING ROAD
BR
100
100 100
DACCA ARICHA ROAD
PH 11.40
DHFL 10.50
PH 11.40
I
II
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46 KM



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Approved	Date
MITSUI CONSULTANTS CO., LTD.	Fig 4-15

4-4. RELATION TO EXISTING ROADS

Fig. 4-16 ROAD MAP OF PROJECT AREA

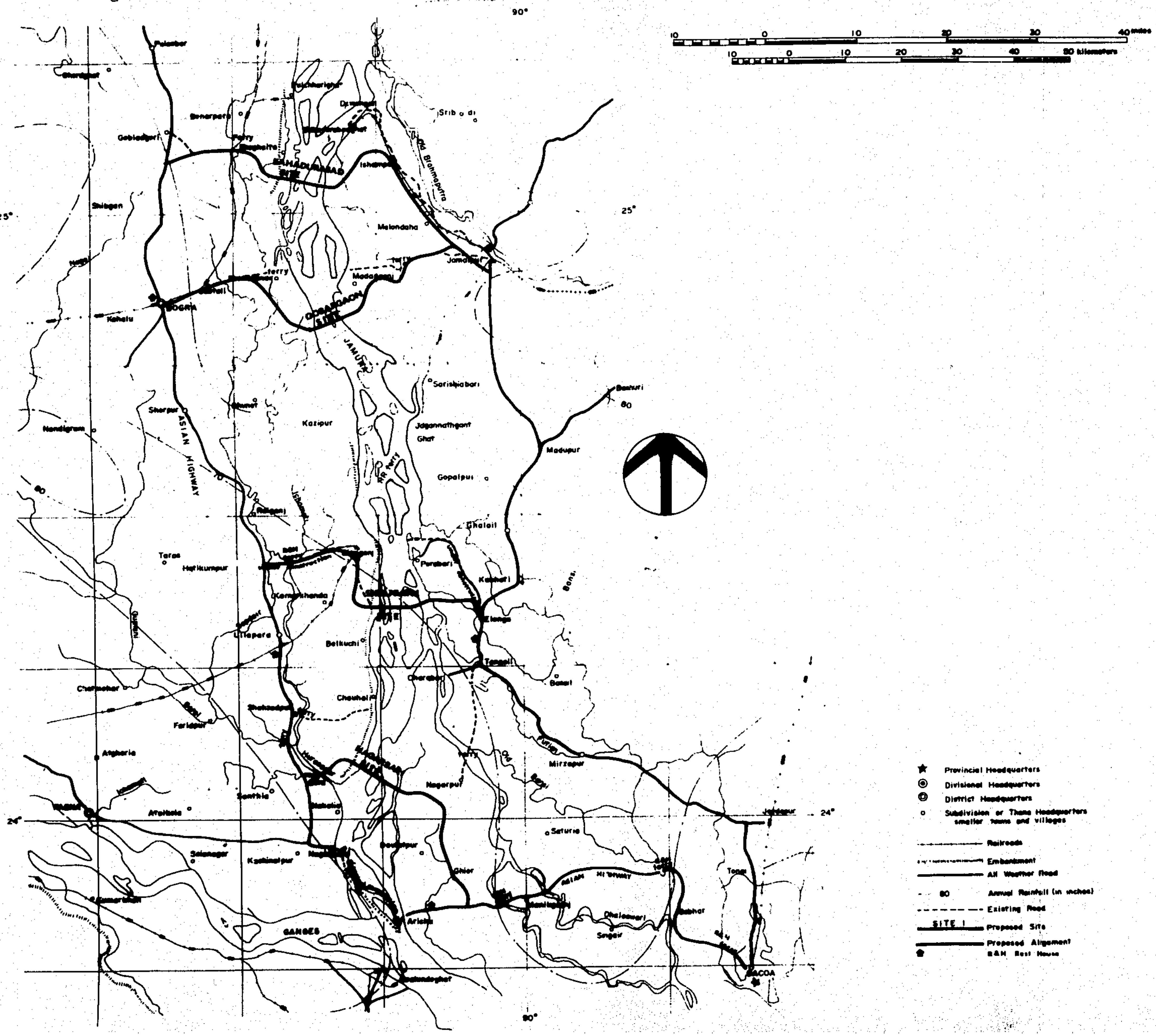
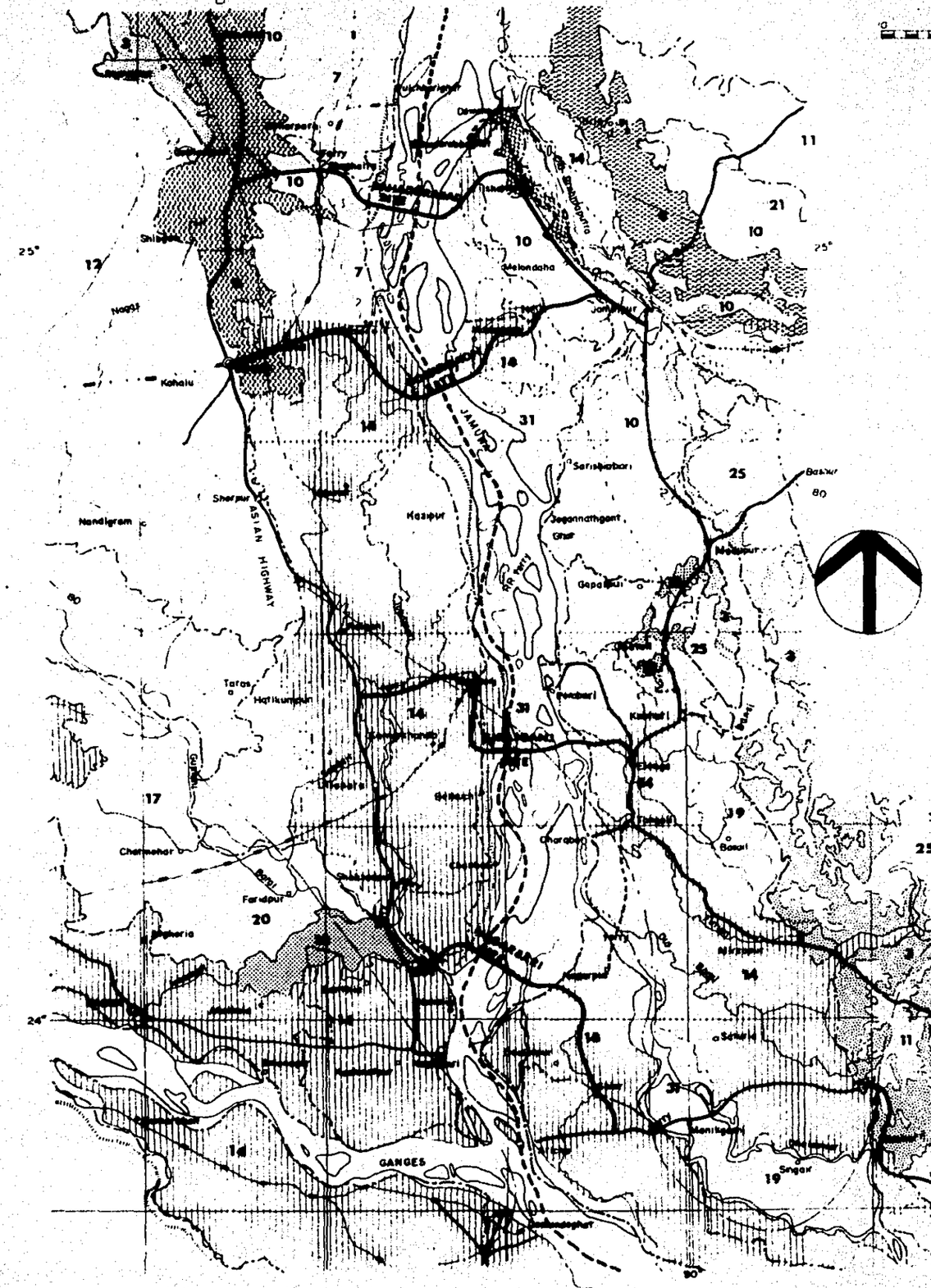


Fig. 4-17 **LAND USE OF PROJECT AREA**



MAINLY AUS RICE ROTATIONS

crop rotation symbols	MAIN LAND USE	SECONDARY LAND USE	OTHER LAND USE
3	Aus (part maize)—fallow (part rabi crops) on well drained land	Transplanted aman — fallow on poorly drained land	Deepwater aman— fallow; aus transplanted aman fallow

MAINLY TRANSPLANTED AMAN RICE ROTATIONS

4	Aus (part jute) — transplanted aman fallow	Aus (part jute) rabi crops (part fallow) on high ridges	
10	Aus (part jute) transplanted aman fallow on poorly drained land	Mixed aus and deepwater aman fallow in basins	Bare in basins
11	Aus transplanted aman fallow	Transplanted aman fallow	

MAINLY BROADCAST (DEEPWATER) AMAN RICE ROTATIONS

14	Mixed aus and deepwater aman rabi crops	Deepwater aman — fallow in basins	Aus (part jute) transplanted aman fallow; aus rabi crops on highest ridges
16	Deepwater aman fallow part rabi crops	Mixed aus and deepwater aman rabi crops (part fallow)	Aus (part jute) rabi crops on ridges
18	Deepwater aman rabi crops	Deepwater aman fallow	Bare fallow in basins
19	Deepwater aman fallow	Mixed aus and deepwater aman fallow on ridges	Bare in basin centers
20	Deepwater aman fallow		

MAINLY BORO RICE ROTATIONS

21	Bare	Grassland	
25	Forest	Aus transplanted aman fallow in valleys	
31	Pioneer grassland	Bare alluvium	Cultivated land (aus, deepwater aman, transplanted aman, millet, chenna or other rabi crops on old forest areas)

NOTES

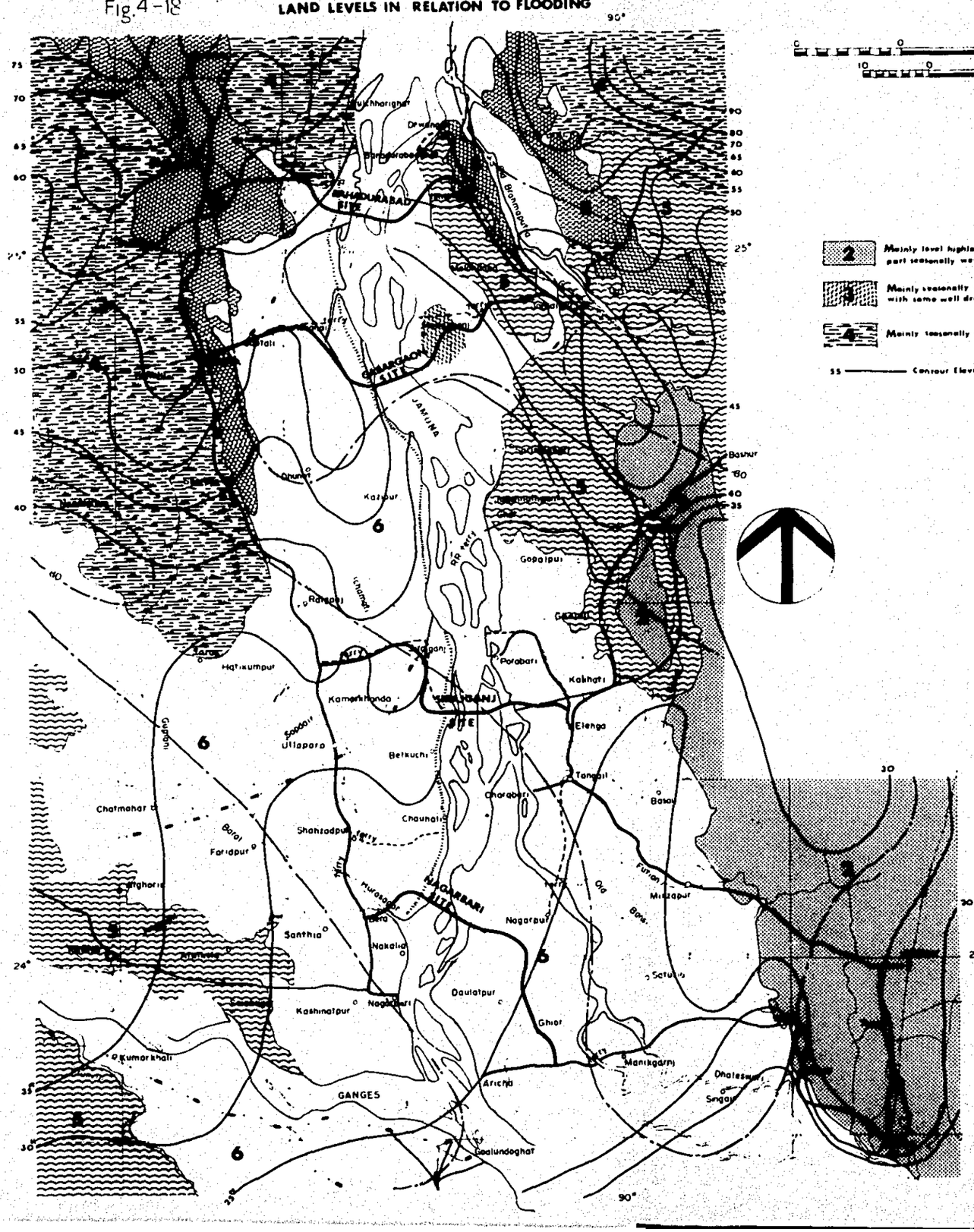
The land use indicated generally occupies 60-80 percent of the unit. Areas under homestead land, water and minor crop rotations are not referred to.

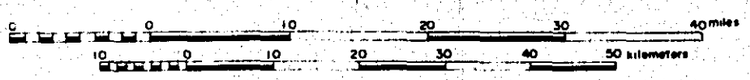
Land use in this country is generally intensive, involving rotations of two or more crops per year on the same piece of land. It is also finely adjusted to environmental conditions, especially to land levels in relation to flooding.

Aus rice is grown in the monsoon season. Broadcast (deepwater) aman is generally sown in March-April, lengthens as it does up to 5-20 feet as the flood water rises, and is mainly harvested in November after floodwater recedes.

- ★ Provincial Headquarters
- ● Divisional Headquarters
- ◎ District Headquarters
- · Subdivision or Thana Headquarters smaller towns and villages
- Railroads
- Embankment
- All Weather Road
- 80 Annual Rainfall (in inches)
- Existing Road
- SITE I Proposed Site
- Proposed Alignment

Fig. 4-18 **LAND LEVELS IN RELATION TO FLOODING**





Land Levels in Relation to Flooding

- 2 — Mainly level highland, part well drained, part seasonally wet or shallowly flooded
- 3 — Mainly seasonally wet/shallowly flooded land in basins
- 1 — Mainly seasonally wet or shallowly flooded land with some well drained floodplain ridges
- 6 — Mainly deeply flooded land
- 4 — Mainly seasonally wet or shallowly flooded land
- 55 ——— Contour Elevation Shown with Reference to GTS (in feet)

- Provincial Headquarters
- Divisional Headquarters
- District Headquarters
- Subdivision or Thana Headquarters smaller towns and villages
- Railroads
- Embankment
- All Weather Road
- 80 — Annual Rainfall (in inches)
- Existing Road
- SITE I — Proposed Site
- Proposed Alignment

Fig 4-19 **POPULATION MAP OF PROJECT AREA**

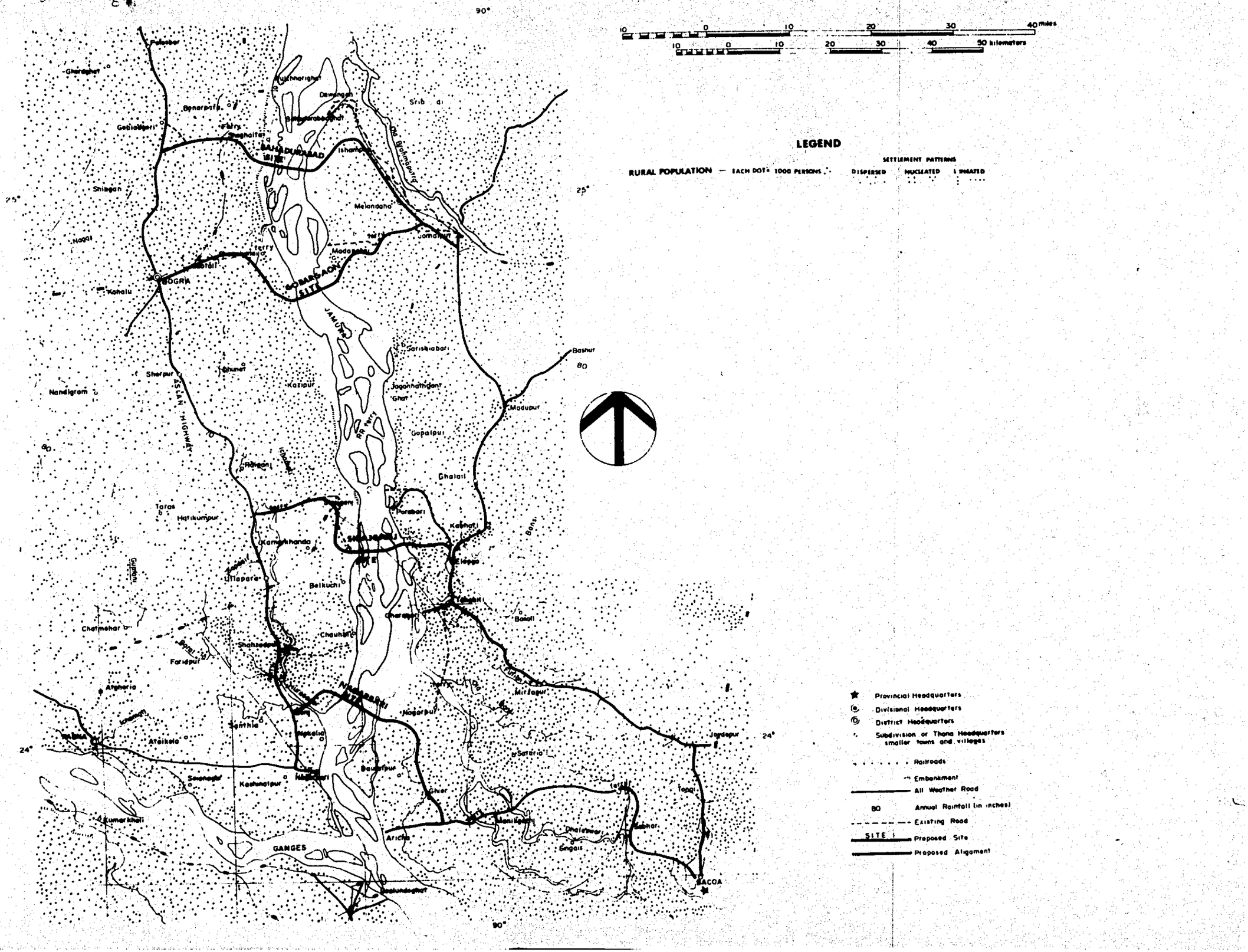
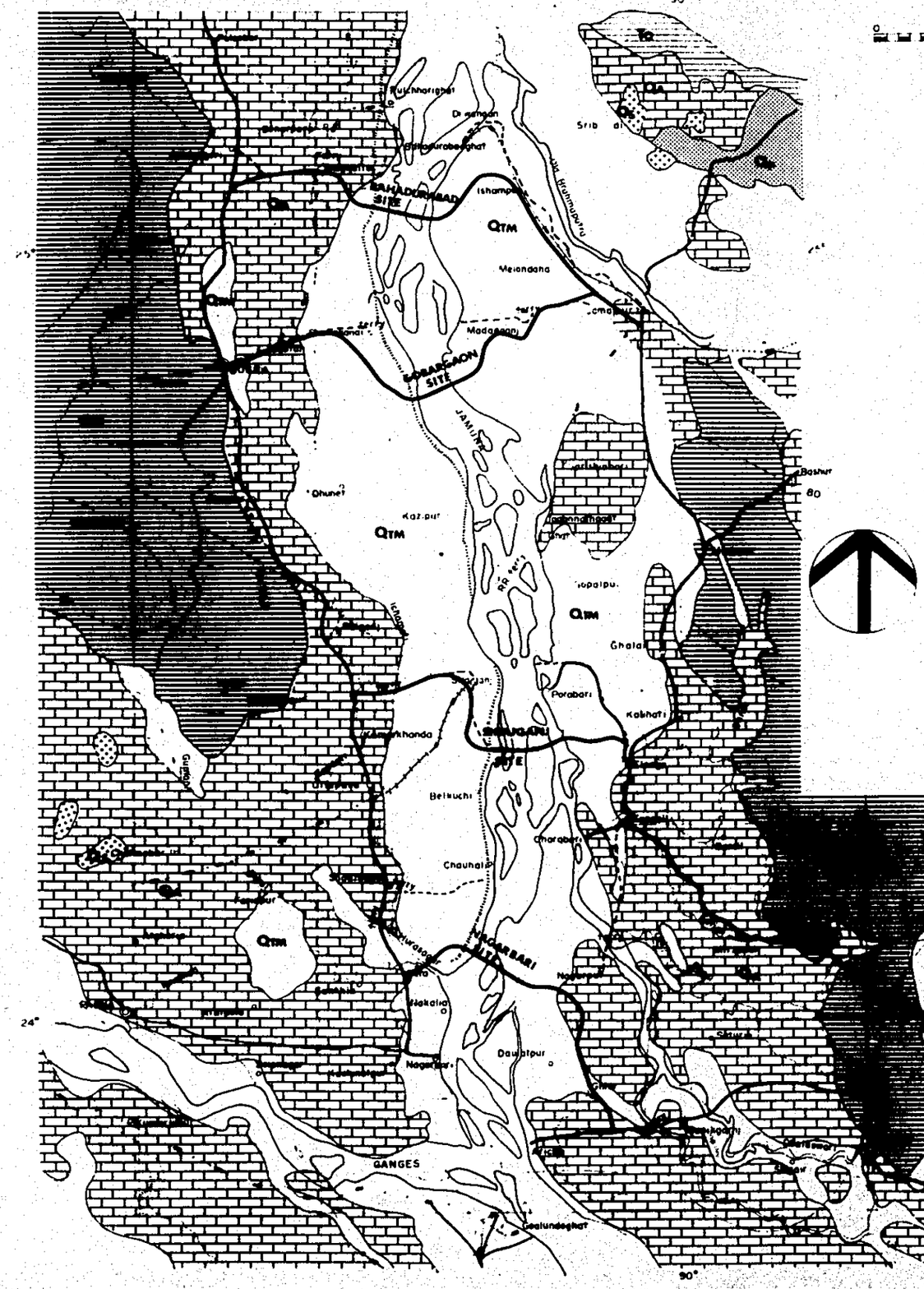


Fig. 4-20 **GEOLOGICAL MAP OF PROJECT AREA**



0 10 20 30 40 miles

10 0 10 20 30 40 50 kilometers

GEOLOGICAL EXPLANATION

Qs | Qd | Qds | Qtm

Qs. Swamp deposits

Qd. Deltaic deposits

Qds. Swamp and deltaic deposits, undifferentiated

Qtm. Terrace and meander deposits, including swamp deposits in some areas

Piedmont Deposits

Detritus material derived from the highlands of India and Burma and deposited in gentle slopes to the south and west

Intersteam deposit

Silt, sand, and gravel deposits at a slightly higher altitud than adjacent flood plain and low level terrace deposits

Older alluvial deposits

Madhupur Clay; mostly red and orange clay deposits at a slightly higher altitude than intersteam deposits (Qis) and having an incised dendritic draining pattern; generally not subject to seasonal flooding possibly equivalent to the Dupi Tila formation

TQ

Pleistocene and Pliocene sedimentary rocks

- Provincial Headquarters
- Divisional Headquarters
- District Headquarters
- Subdivision or Thana Headquarters smaller towns and villages
- Railroads
- Embankment
- All Weather Road
- 80 Annual Rainfall (in inches)
- Existing Road
- SITE Proposed Site
- Proposed Alignment

CHAPTER 5 CONSTRUCTION ROUGH COST ESTIMATE

Table 5-1 Construction Rough Cost Estimate

B: Dist. bew. guide banks 4.2 km
C: Dist. bew. guide banks 5.2 - 5.6 km

unit: 100 million Yen
(million Taka)

Site \ Article		Total Length of Approach Highway km (mile)	Earthwork & Land Acquisition Yen (Taka)	Bridge L 100m Yen (Taka)	Bridge & Spillway L 100m Yen (Taka)	Dhaleswari River Causeway Yen (Taka)	Pavement Work Yen (Taka)	Miscella-neous Yen (Taka)	Total Amount Yen (Taka)
Bahadurabad site	B	67.500 (43.3)	27.9 (77.5)	5.8 (16.1)	27.0 (75.0)		19.3 (53.6)	2.0 (5.6)	82.0 (227.8)
	C	67.000 (41.6)	27.6 (76.6)	5.8 (16.1)	26.8 (74.4)		19.1 (53.1)	2.0 (5.6)	81.3 (225.8)
Gabargaon site	B	65.100 (40.4)	30.4 (84.4)	15.3 (42.5)	26.0 (72.2)		18.5 (51.4)	2.0 (5.6)	92.2 (256.1)
	C	65.100 (40.4)	30.4 (84.4)	15.3 (42.5)	26.0 (72.2)		18.5 (51.4)	2.0 (5.6)	92.2 (256.1)
Sirajganj site	B	29.750 (18.5)	16.8 (46.7)		11.9 (33.1)	63.0 (175.0)	8.6 (23.9)	0.9 (2.5)	101.2 (281.1)
	C	29.750 (18.5)	16.8 (46.7)		11.9 (33.1)	63.0 (175.0)	8.6 (23.9)	0.9 (2.5)	101.2 (281.1)
Nagarbari site	B	35.250 (21.9)	14.5 (40.3)	19.4 (53.9)	14.1 (39.2)		9.8 (27.2)	1.1 (3.0)	58.9 (163.6)
	C	35.250 (21.9)	14.5 (40.3)	19.4 (53.9)	14.1 (39.2)		9.8 (27.2)	1.1 (3.0)	58.9 (163.6)

Table 5-2 Total Length unit: m

		B Type of Access Highway			C Type of Access Highway			Bridge length (longer than 100m length)
		Access Highway	Embankment	Structure	Access Highway	Embankment	Structure	
Bahadurabad site	Right side	25,000	23,520	1,480	25,000	23,520	1,480	500
	Left side	42,500	40,680	1,820	42,000	40,200	1,800	100
	Total	67,500	64,200	3,300	67,000	63,720	3,280	600
Gabargaon site	Right side	31,100	29,460	1,640	31,100	29,460	1,640	400
	Left side	34,000	32,040	1,960	34,000	32,040	1,960	600
	Total	65,100	61,500	3,600	65,100	61,500	3,600	1,000
Sirajganj site	Right side	15,500	14,880	620	15,500	14,880	620	-
	Left side	14,250	13,680	570	14,250	13,680	570	-
	Total	29,750	28,560	1,190	29,750	28,560	1,190	-
Nagarbari site	Right side	6,500	5,340	1,160	6,500	5,340	1,160	900
	Left side	28,750	27,300	1,450	28,750	27,300	1,450	300
	Total	35,250	32,640	2,610	35,250	32,640	2,610	1,200

Construction Cost — BAHADURABAD SITE — Unit: 1,000 Yen

Item	Unit Cost	B. Type Access Road (Bridge Length 4.2km)		C. Type Access Road (Bridge Length: 5.6km)		Remarks
		Quantity	Cost	Quantity	Cost	
Total Length of the Access Road		67,500		67,000		
Total Length of the Embankment		64,200		63,720		
Total Length of the Bridge (Longer than 100 m Length)	970,000 yen/m	600	580,000	600	580,000	
Total Length of Spillway & Bridge (Shorter than 100 m Length)	1,000,000 yen/m	2,700	2,700,000	2,680	2,680,000	Total road length x 4%
Borrowed Earth in Embankment & Shoulder (A)	800 yen/m^3	2,860,044	2,288,035	2,829,420	2,263,536	10% Allowance
Borrowed Earth in Bridge Approaches (B)	1,200 yen/m^3	109,450	131,340	109,450	131,340	id,.
Slope Protection on Normal Height Embankment (A)	50 yen/m^2	718,600	35,930	712,400	35,620	
Slope Protection on Bridge Approaches (B)	2,000 yen/m^2	35,930	71,860	35,620	71,240	
Pavement Work	30,000 yen/m	64,200	1,926,000	63,720	1,911,160	
Cost of Miscellaneous	3,000 yen/m	67,500	202,500	67,000	201,000	
Construction Cost			7,935,665		7,873,896	
Contingency						
Land Acquisition & Compensation	100 yen/m^2	2,650,880	265,088	2,625,520	262,552	
Total Construction Cost			8,200,753		8,136,448	

Construction Cost — GABARGAON SITE — Unit: 1,000 yen

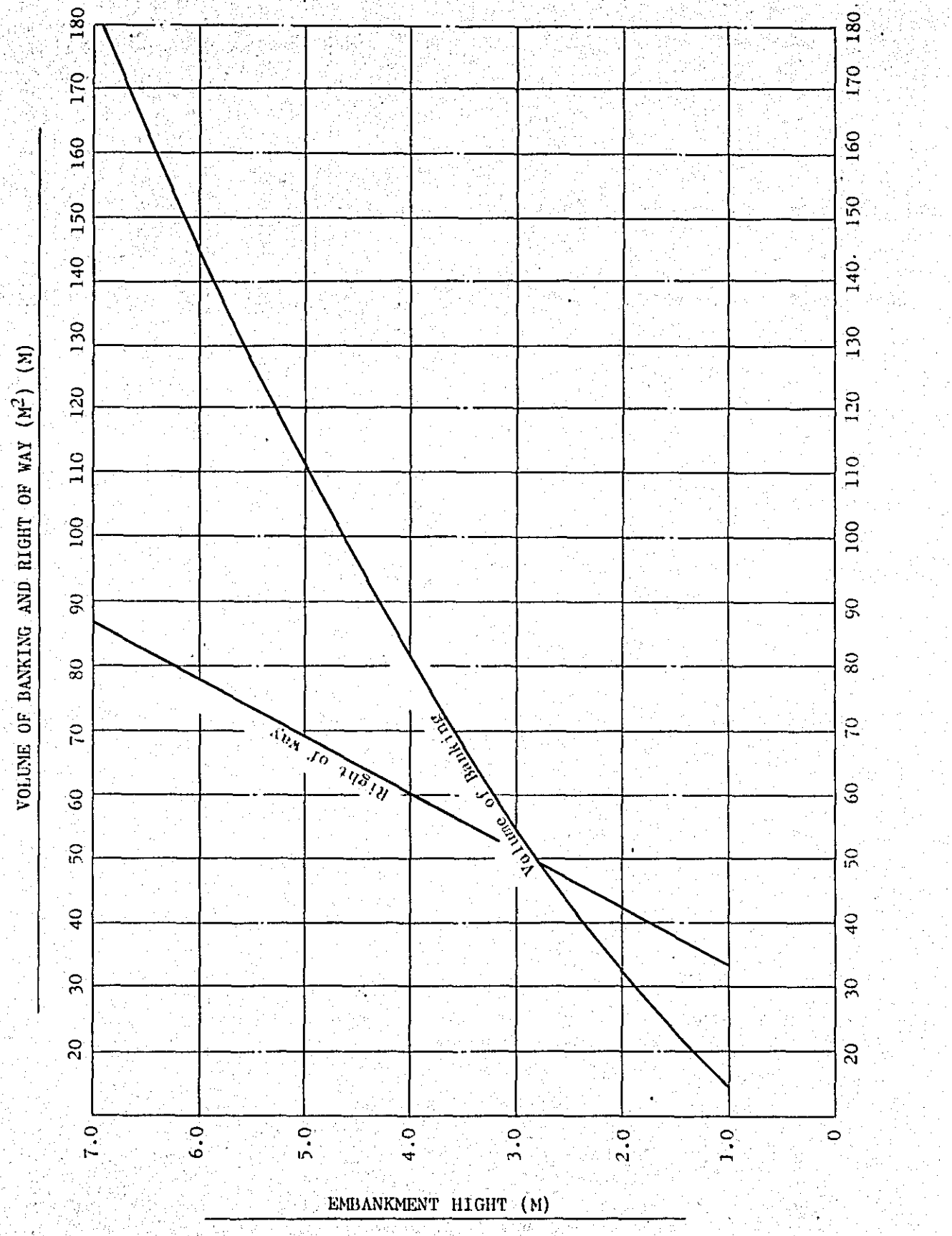
Item	Unit Cost	B. Type Access Road (Bridge Length 4.2km)		C. Type Access Road (Bridge Length 5.2km)		Remarks
		Quantity	Cost	Quantity	Cost	
Total Length of the Access Road		65,100		65,100		
Total Length of the Embankment		61,500		61,500		
Total Length of the Bridge (Longer than 100 m Length)	1,530,000 yen/m	1,000	1,530,000	1,000	1,530,000	
Total Length of Spillway & Bridge (Shorter than 100 m Length)	1,000,000 yen/m	2,600	2,600,000	2,600	2,600,000	Total road length x 4%
Borrowed Earth in Embankment & Shoulder (A)	800 yen/m^3	3,036,528	2,429,222	3,036,528	2,429,222	*10% Allowance
Borrowed Earth in Bridge Approaches (B)	1,200 yen/m^3	155,232	186,278	155,232	186,278	id,.
Slope Protection on Normal Height Embankment (A)	50 yen/m^2	759,720	37,986	759,720	37,986	
Slope Protection on Bridge Approaches (B)	2,000 yen/m^2	37,987	75,974	37,987	75,974	
Pavement Work	30,000 yen/m	61,500	1,845,000	61,500	1,845,000	
Cost of Miscellaneous	3,000 yen/m	65,100	195,300	65,100	195,300	
Construction Cost			8,899,760		8,899,760	
Contingency						
Land Acquisition & Compensation	100 yen/m^2	3,118,150	311,815	3,118,150	311,815	
Total Construction Cost			9,211,575		9,211,575	

Construction Cost — SIRAJGANJ SITE — Unit: 1,000 Yen

Item	Unit Cost	B. Type Access Road (Bridge Length 4.2 km)		C. Type Access Road (Bridge Length 5.6 km)		Remarks
		Quantity	Cost	Quantity	Cost	
Total Length of the Access Road		29,750		29,750		
Total Length of the Embankment		28,560		28,560		
Total Length of the Bridge (Longer than 100 m Length)						
Total Length of Spillway & Bridge (Shorter than 100 m Length)	1,000,000 yen/m	1,190	1,190,000	1,190	1,190,000	Total road length x 4%
Borrowed Earth in Embankment & Shoulder (A)	800 yen/m^3	1,734,018	1,387,214	1,734,018	1,387,214	*10% Allowance
Borrowed Earth in Bridge Approaches (B)	1,200 yen/m^3					id,.
Slope Protection on Normal Height Embankment (A)	50 yen/m^2	401,500	20,075	401,500	20,075	
Slope Protection on Bridge Approaches (B)	2,000 yen/m^2	20,075	40,150	20,075	40,150	
Pavement Work	30,000 yen/m	28,560	856,800	28,560	856,800	
Cost of Miscellaneous	3,000 yen/m	29,750	89,250	29,750	89,250	
Construction Cost			3,583,489		3,583,489	
Contingency						
Land Acquisition & Compensation	100 yen/m^2	2,311,720	231,172	2,311,720	231,172	
Dhaleswari River Cause way Cost			6,300,000		6,300,000	
Total Construction Cost			10,114,661		10,114,661	

Construction Cost — NAGARBARI SITE — Unit: 1,000 yen

Item	Unit Cost	B. Type Access Road (Bridge Length 4.2km)		C. Type Access Road (Bridge Length 5.2km)		Remarks
		Quantity	Cost	Quantity	Cost	
Total Length of the Access Road		35,250		35,250		
Total Length of the Embankment		32,640		32,640		
Total Length of the Bridge (Longer than 100 m Length)	1,620,000 yen/m	1,200	1,940,000	1,200	1,940,000	
Total Length of Spillway & Bridge (Shorter than 100 m Length)	1,000,000 yen/m	1,410	1,410,000	1,410	1,410,000	Total Load Length x 4%
Borrowed Earth in Embankment & Shoulder (A)	800 yen/m^3	1,386,320	1,109,056	1,386,320	1,109,056	10% Allowance
Borrowed Earth in Bridge Approaches (B)	1,200 yen/m^3	158,248	189,898	158,248	189,898	id,.
Slope Protection on Normal Height Embankment (A)	50 yen/m^2	321,600	16,080	321,600	16,080	
Slope Protection on Bridge Approaches (B)	2,000 yen/m^2	16,080	32,160	16,080	32,160	
Pavement Work	30,000 yen/m	32,640	979,200	32,640	979,200	
Cost of Miscellaneous	3,000 yen/m	35,250	105,750	35,250	105,750	
Construction Cost			5,782,144		5,782,144	
Contingency						
Land Acquisition & Compensation	100 yen/m^2	1,049,630	104,963	1,049,630	104,963	
Total Construction Cost			5,887,107		5,887,107	


VOLUME OF BANKING AND RIGHT OF WAY (M²) (M)
EMBANKMENT HIGHT (M)
Right of way
Volume of Bank line
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
170
180

APPENDICES

APPENDIX 1

B I B L I O G R A P H Y

1	Faridpur--Jhenida Jessore--Khulna Roads Economic and Engineering Feasibility Report, Volume I	Lowis Berger Inc., USA	Aug.1963
2	id., Volume II	Lowis Berger Inc., USA	Aug.1963
3	Dacca--Aricha Road Economic and Engineering Feasibility Report, Volume I	Amman & Whitney International Ltd., USA	Sept.1963
4	id., Volume II	Amman & Whitney International Ltd., USA	Sept.1963
5	Khulna--Mongla Road Economic and Engineering Feasibility Study, Volume I	Bangladesh Consultants Ltd.	Dec.1972
6	id., Volume II	Bangladesh Consultants Ltd.	Dec.1972
7	Brahmaputra (Jamuna) River Crossing Feasibility Study Stage One	Freeman, Fox and Partners	
8	Surveys of Inland Waterways and Ports 1963-1967, General Report	NEDECO, Holland	July 1967
9	id., Investigation of Waterways	NEDECO, Holland	July 1967
10	Bangladesh Transport Survey Inventory of Trnsport Facilities 3 Roads	The Economist Intelligence Unit Ltd. in association with Scott Wilson Kirkpatrik	Aug.1973
11	Report on Investigations for Jessore--Madhukhali Road Construction Project	Government of Japan	Sept.1969
12	Brahmaputra Flood Embankment Project Phulchari to Serajganj Definite Project Report	WAPDA. Leedshell-Deleuw Engineers	Nov.1965
13	Annual Report on Flood in Bangladesh for 1970	WAPDA	
14	id., for 1971	WAPDA	
15	Ground Water Investigation for 1970	WAPDA	
16	Traffic Survey for 1968-69 and 1972-73	R & H Directorate	
17	Tangail--Bhuapur--Gopalgonj Road, Skim Report	R & H Directorate	
18	Serajganj--Hatikamrul Road, Skim Report	R & H Directorate	

19	Serajganj--Kazipur Road, Skim Report	R & H Directorate
20	Tangail--Charabari Road, Skim Report	R & H Directorate
21	The First Five Year Plan 1974-78	Government of Bangladesh
22	Specification for Road Structure and Earth Work (Road Specification)	R & H Planning Division
23	Geometric Design Standards of Rural Roads in Bangladesh	R & H Planning Division

APPENDIX 2
GEOMETRIC DESIGN STANDARDS OF RURAL ROADS IN BANGLADESH

1. Basic Principles.

The terrain of Bangladesh is mostly flat excepting some hilly areas in the east and south eastern part of the country. The plains get innundated by monsoon floods necessitating construction of high roadway embankments. These conditions greatly influence the design standards of roads in this country. Uniform application of design standards is most desirable here. In road planning the aim is to apply the minimum standards on short range basis since high level of standards the country cannot afford at this stage.

2. Classification of roads.

The road system has been classified into three different categories in consideration of traffic service and importance. These classifications are as under:-

(a) Primary roads:-

Roads connecting the district HQs with the Metropolis come under this category. These roads have 40'ft wide roadway embankment and 22'ft wide hard crest with or without brick paved shoulders.

(b) Secondary roads:-

Roads connecting Sub-divisional HQs with district HQs or primary roads come under this category. The secondary roads have 32'ft wide roadway embankment and 18' ft wide pavement.

(c) Feeder roads-

Roads connecting business centres, industrial centres, places of importance inaccessible areas etc. with primary and secondary roads come under this category. Feeder roads have 24'ft. wide roadway embankment and 12'ft wide pavement.

3. Design speeds.

The design speed is 60 MPH for rural areas, 50 MPH for Urban and 40 MPH in special cases where existing structures control.

contd.....page....2....

4. Running speeds.

The running speeds are 45 MPH, 40 MPH and 34 MPH corresponding to design speeds, of 60 MPH, 50 MPH and 40 MPH respectively.

5. Radius of curvature.

The radic of curvature are 1,146 ft, 754 ft and 430 ft corresponding to design speeds of 60 MPH, 50 MPH and 40 MPH respectively.

6. Max. Degree of curvature.

The max ^{m} degrees of curvature corresponding to the above noted radic of curvature are 5.0^{o}, 7.6^{o} and 12.4^{o}.

7. Grades.

The grades provided to roads varry from 0% to 3.0% max^{m}

8. Passing sight distance.

Passing sight distances provided to roads are 2,000 ft., 1700 ft and 1,300 ft corresponding to design speeds of 60 MPH, 50 MPH and 40 MPH respectively.

9. Stopping sight distance.

The following stopping sight distances are provided assuming height of eye as 44 inches and height of object as 4 inches.

475 ft for design speed of 60 MPH
350 " " " 50 MPH
40 " " " 40 MPH

10. Cross Stope — ¼ " inch both ways with parabolic crown.

11. Extra with on curves.

Over 11^{o} only.

For 60 MPH - not rgd.
50 MPH - not required
40 MPH- 2'ft for R(520'ft)

12. Superelevation.

1. inch in one foot (e= 0.8) max m

No ,crown for the stated design speeds.

13. Embankment side slopes.

2 in 1

14. Embankment slope protection.

Turfing in normal cases and encased brick rivetment in high approaches of bridges and culverts.

Soil stabilisation Methods.

The soils in Bangladesh very from sandy clay to silty clay. These soils usually ~~from a~~ form a good embankment material and do not usually require stabilisation. However, where a bad soil is encountered the top layer of sub-grade of 2'ft in thickness is adequately mixed up with sand and duly compacted.

২৬/২/৭৪-

Superintending Engineer (R&H),
Road Planning Circle, Dacca.

APPENDIX 3

SURVEY SCHEDULE OF ACCESS ROAD STUDY TEAM

DATE		INVESTIGATION ROADS	KM	BASE	REMARKS
JAN	20 SUN			DACCA	
	21 MON			DACCA	
	22 TUE			DACCA	
	23 WED	DACCA-STARAKIYA.Br	80	DACCA	
	24 THU	DACCA-ARICHA	160	DACCA	
	25 FRI	DACCA-TANGAIL	200	DACCA	
	26 SAT	DACCA-TANGAIL (III	260	DACCA	TBG.ROAD
	27 SUN	DACCA-TANGAIL (IV	280	DACCA	NAGARPUR.CHARABARI
	28 MON			DACCA	
	29 TUE	DACCA-TANGAIL	100	TANGAIL	
	30 WED	TANGAIL-TBC-JAMALPUR	140	JAMALPUR	TBG.ROAD
	31 THU	JAMALPUR-BAHADURABAD (I	80	JAMALPUR	
FEB	1 FRI	JAMALPUR-GABARGAON (II	80	JAMALPUR	
	2 SAT	JAMALPUR-DACCA	100	DACCA	
	3 SUN			DACCA	
	4 MON			DACCA	
	5 TUE	DACCA-ULAPARA	140	ULAPARA	
	6 WED	ULAPARA-SHIRAJGANJ (III	80	ULAPARA	
	7 THU	ULAPARA-SITE(IV)-BOGRA	180	BOGRA	
	8 FRI			BOGRA	
	9 SAT	BOGRA-SHAGHATTA (I	140	BOGRA	
	10 SUN	BOGRA-SHARLAKANDI (II	80	BOGRA	
	11 MON	BOGRA-SHIRAJGANJ	100	SHIRAJ	
	12 TUE	SHIRAJ-SITE(III) (III	50	SHIRAJ	
	13 WED	SHIRAJ-GOPALGONJ (III	60	SHIRAJ	BY SPEED BOAT
	14 THU	SHIRAJ-ARICHA-DACCA	160	DACCA	SPEED BOAT & CAR
	15 FRI			DACCA	
	16 SAT			DACCA	
	17 SUN			DACCA	
	18 MON			DACCA	
	19 TUE			DACCA	
	20 WED			DACCA	
	21 THU			DACCA	
	22 FRI	DACCA-BANGKOK		BANGKOK	
	23 SAT			BANGKOK	
	24 SUN			BANGKOK	
	25 MON	BANGKOK-HONGKONG		BANGKOK	ECAFE
	26 TUE	HONGKONG-TOKYO		TOKYO	
	27 WED				

APPENDIX 4

VISITING RECORD

Mitsui Consultants Co., Ltd.
Mr. H. Nishikawa
Mr. K. Ohashi

Date (1974)	Time	Personnel	Position & Department
18 JAN	16:00	Mr. EBIHARA	JAMUNA OFFICE, DACCA
	17:30	Mr. HANDA	MITSUI & CO., LTD., DACCA
		Mr. KOBA	"
		Mr. KOGA	"
19 JAN	9:15	Mr. TEZUKA	BRIDGE STUDY TEAM
	10:30	Mr. KANEKO	EMBASSY OF JAPAN
	11:00	Mr. S.S. M. LUTFUL HAQ	JOINT SECRETARY (MINISTRY OF COMMUNICATION)
	18:00	Mr. A, HOSSAIN	EXECUTIVE ENGINEER (ROAD & HIGHWAY DIRECTORATE), DACCA COUNTERPART
22 JAN	10:30	Mr. SHAFIULLAH	DEPUTY CHIEF ENGINEER (R & H), DACCA
		Mr. A. HOSSAIN	COUNTERPART
	18:30	Mr. A. HOSSAIN	COUNTERPART
23 JAN	10:30	Mr. M. RAHMAN	CHIEF ENGINEER (R & H), DACCA
	14:00	Mr. KAIDO	OHBAYASHIGUMI (SITALAKIYA BRIDGE)
25 JAN	12:00	Mr. L. RAHMAN	EXECUTIVE ENGINEER (R & H), TANGAIL
		Mr. HAQ	SUBDIVISIONAL ENGINEER (R & H), TANGAIL
26 JAN	10:30-14:00	Mr. HAQ	
27 JAN	10:00-15:00	Mr. HAQ	
28 JAN	18:00	Mr. A. HOSSAIN	EXECUTIVE ENGINEER (R & H), DACCA
29 JAN	14:00	Mr. HAQ	SUBDIVISIONAL ENGINEER (R & H), TANGAIL
	17:00	Mr. L. RAHMAN	EXECUTIVE ENGINEER (R & H), TANGAIL
30 JAN	9:30-11:00	Mr. HAQ	SUBDIVISIONAL ENGINEER (R & H), TANGAIL
	10:30	Mr. T. MOLLA	ADDITIONAL CHIEF ENGINEER (R & H), TANGAIL
	16:00	Mr. B. BHUYAN	SUBDIVISIONAL ENGINEER (R & H), JAMALPUR
		Mr. A. ALI	SECTIONAL OFFICER (R & H), JAMALPUR
31 JAN	7:30-16:00	Mr. A. ALI	"
1 FEB	7:30-16:00	Mr. A. ALI	"
7 FEB	16:00	Mr. A. N. ATIQUEULLAH	SUBDIVISIONAL ENGINEER (R & H), BOGRA
8 FEB	9:00	Mr. HOSSAIN	SUBDIVISIONAL ENGINEER (R & H), BPGRA

Date	Time	Personnel	Position & Department
9 FEB	9:30	Mr. CHOUDHURY	EXECUTIVE ENGINEER (R & H), BOGRA
	13:00-16:00	Mr. A.N.ATIQUEULLAH	SUBDIVISIONAL ENGINEER (R & H), BOGRA
10 FEB	8:00-12:00	Mr. HOSSAIN	"
	16:00	Mr. ICHIJI	JAMUNA OFFICE, SIRAJGANJ
16 FEB	10:30	Mr. A. HOSSAIN	EXECUTIVE ENGINEER (R & H), DACCA
		Mr. K. CHOUDHURY	EXECUTIVE ENGINEER (R & H), DACCA
	11:30	Mr. M. M. HOSSAIN	SUPERINTENDING ENGINEER (R & H) ROAD DESIGN CIRCLE, DACCA
	12:00	Mr. HOSSAIN AHMED	SUPERINTENDING ENGINEER (R & H) ROAD PLANNING CIRCLE, DACCA
18 FEB	16:30	Mr. SHAFIULLAH	DEPUTY CHIEF ENGINEER (R & H), DACCA
	18:30	Mr. A. HOSSAIN	EXECUTIVE ENGINEER (R & H), DACCA
19 FEB	19:00	Mr. INOSE	
		Mr. SATO	
		Mr. NISHIMURA	STUDY TEAM
		Mr. KUNIHIRO	
		Mr. KOMADA	
21 FEB	10:30	Mr. INOSE	
		Mr. SATO	
		Mr. NISHIMURA	STUDY TEAM
		Mr. KUNIHIRO	
		Mr. KOMADA	
22 FEB	15:00	Mr. KANEKO	EMBASSY OF JAPAN
	16:00	Mr. HANDA	MITSUI & CO., LTD., DACCA
		Mr. HASE	"
		Mr. KOGA	"

APPENDIX 5

High Water Level in 1970

SOURCE WAPDA

Note: Elecation

All elevation in this table is in terms of the Survey of Bangladesh datum. To bring a SOB datum in terms of PWD datum, 1.509^{ft} (0.460^{m}) is to be added.

	Name of station	Gauge station NO	Gauge NO	High water level in 1970 (in meters)	Ground level cross to the River side (in meters)
1	Mangalia	J-13 (LB)	9	18.36	Left side = L
2	Tilakpur	"	6	19.10	Right side = R
3	Moradabab	"	3	19.56	J-13 L=18.47 R=18.74
4	Paila	J-12 (LB)	3	17.	J-12 L=16.83 R=16.98
5	Char Cobindi	"	1		
6	Kotamoni	J-11 (LB)	5	16.	J-11 L=15.72 R=15.43
7	Tooker Char	"	4	16.82	
8	Sequna	"	2	16.82	
9	Suknagari	"	1	16.79	
10	Naldiar	J-19 (LB)	2	15.05	J-10 L=15.26 R=14.34
11	Tangail Rajdior	"	1	15.56	
12	Thara	J-9 (LB)	4	13.89	J-9 L=13.00 R=14.08
13	Khilpara	"	3	14.19	
14	Rampur	"	1	14.77	
15	Konabari	J-8--(LB)	10	13.38	J-8-1 L=12.70 R=13.64
16	Sayedpur	"	7	13.70	
17	Pathalia	"	5	14.69	
18	Utler Pathalia	"	4	14.84	
19	Gondail Dakuri	"	2	14.33	
20	Birghatail	J-7 (LB)	10	12.88	J-7 L=12.47 R=12.56
21	Gala	"	5	12.98	

	Name of station	Gauge station NO	Gauge NO	High water level in 1970 (in meters)	Ground level cross to the River side (in meters)
22	Sarai	"	0-1	13.43	
23	Kalihati	J-6-1 (LB)	10	11.91	J-6-1 L=10.92 R=11.73
24	Kaijalipur	"	7	12.31	
25	Narandia	"	4	12.65	
26	Nikla Anar Khapara	"	1	12.95	
27	Dighnlia	J-5- (LB)	2	11.10	J-5 L=10.36 R=10.86
28	Belfabhangabari	"	1	11.19	
29	Mirjapur	J-4- (LB)	7	9.54	J-4 L=8.72 R=7.75
30	Bhatgram	"	5	9.79	
31	Bhabkanda	"	4	9.95	
32	Dharkumuli	"	1-1	11.59	
33	Law hati	"	2	10.13	
34	Mailjani	"	1	10.68	
35	Rowtara	J-4- (RB)	4	10.74	
36	Bachra		2	13.55	
37	Sonatani	J-4- (RB)	1	11.11	
38	Damran	J-2-1 (LB)	9	13.55	J-2-1 L=8.18
39	Kalampur	"	8	11.25	
40	Baranalia	"	7	11.13	
41	Mirkutia	"	6	8.93	
42	Dhamsher	"	5	8.77	
43	Bahara	"	3-1	9.85	
44	Ramchandrapur	"	2-1	9.86	
45	Jionpar	"	2	9.78	
46	Baghutia	"	1	10.08	
47	Jasamantadulia	J-2-1 (RB)	6	9.53	J-2-1 R=8.07

	Name of station	Gauge station NO	Gauge NO	High water level in 1970 (in meters)	Ground level cross to the River side (in meters)
48	Mobarakpur	"	3	10.58	
49					
50					

APPENDIX 6

RECORDS OF DISCUSSIONS
AT
TOKYO MEETING
FOR
HIGHWAY LINK

1. Route Location

J: The access road study team have prepared the alignment on a basis of giving priority to the retention of existing road facilities, the selection of river stability crossing site and avoiding marshes, according to principle that access road must be direct.

B: In addition to the above, we suggest taking account of geological and soil condition. And we also ask you to weight the other pavement methods comparatively in pavement design works.

At this stage, as the selection of the best site among the four proposed sites is very important, we will design according to your suggestions after the selection of site.

2. Vertical Alignment

J: In decision of design high flood level, the study team have adopted the maximum flood height which was recorded last in July, 1970 and which is also said the largest number in the recent years. Besides the whole alignment will be built with a minumum free-board of three feet above high flood level.

B: The flood discharge in 1970 recorded 2,700,000 cfs. However, you have adopted 3,100,000 cfs in design flood discharge for Jamuna River Bridge Construction Project. Therefore, you might adopt the data of 1954, 1970 and 1974.

The data of 1974 was unavailable for our study this time, therefore, we have been preparing design high flood level in accordance with the data of 1970. On getting the newest data of 1974, we will study in detail.

3. Bridge & Spillway Bridge

J: With relation to the length of bridges over the tributaties, we have prepared through the field survey and on photomosaic map. On the other hand, we have calculated and adopted the value 2% of opening ratio for the sillway bridge from inventory of existing spillway and bridge opening for Dacca-Aricha Road which identifies only all weather road in Bangladesh at a right angle to the Jamuna.

B: We are going to study wheather the value 2% is reasonable or not.

We believe that we have to identify the opening of spillways after the identification of design flood discharge of tributaries. However, on the basis of presumption of 2% we should try to investigate at the second stage in order to reach the full-satisfaction.

4. Road Section Composition

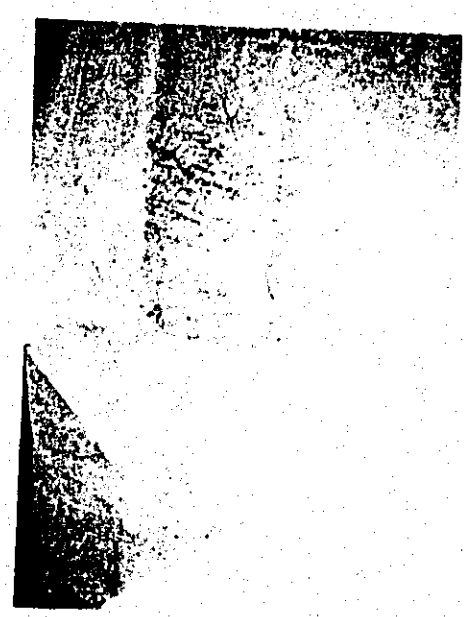
J: The heighway will have two lanes, each eleven feet wide. The right-of-way is of sufficient width to permit construction of two additional lanes when traffic warrant it.

B: You have deisgned the highway with borrow pits on both sides, but we suggest one side borrow pit as it is enough to function as cannal and to supply earth.

The Government of the People's Republic of Bangladesh shall take appropriate actions to reserve sufficient land for two additional lanes for future extension on the other side of the borrow pit and the road. None should be allowed any construction on such reserved land. It can only be used for agricultural purpose.. It is not necessary at this time to acquire this land. We will discuss the above mentioned with R&H at the second stage.

APPENDIX 7

TANGAIL- ELENGA - GOPALGONT(UNDER CONSTRUCTION ROAD)



ALIGNMENT

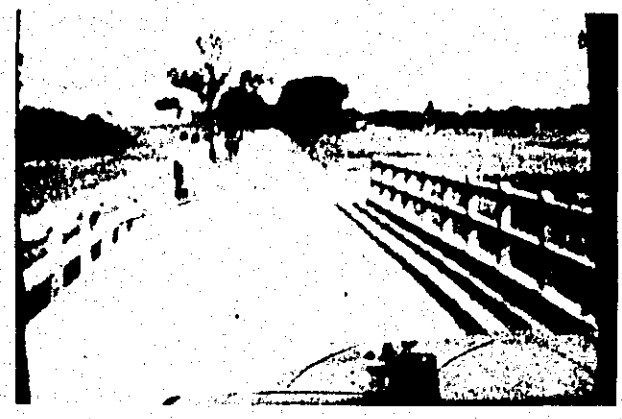
ELENGA INTERSECTION

BR 1 L - 20m

BR 2 L = 30 m

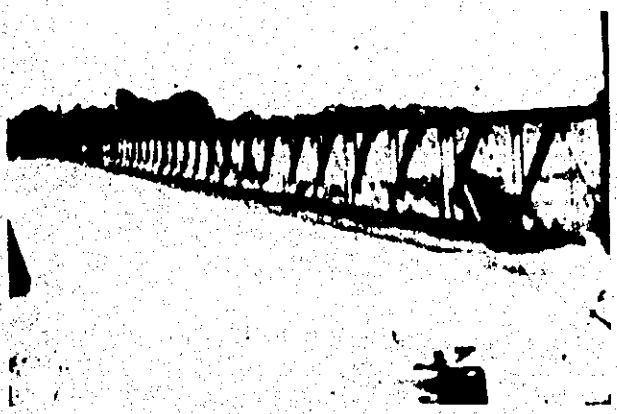
EARTH WORKS
(HEAD BASKET LABOR)

BORROW PIT



BR 3 L = 15 m

BR 4

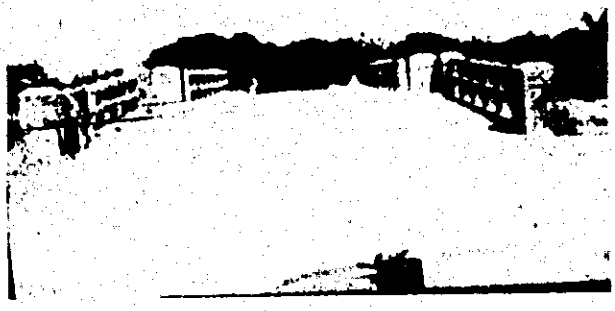


BR 4 L = 30 m

BR 4

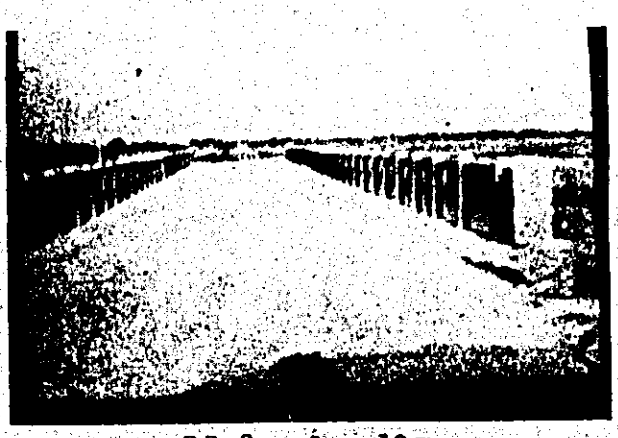
BR 5 L - 15 m

BR 6 L - 15 m



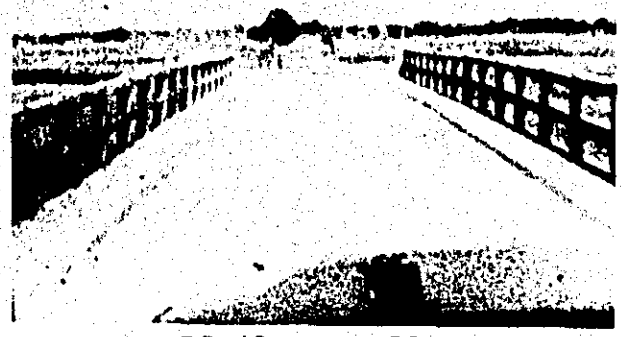
BR 7 L - 15 m

SHEEPSFOOT ROLLER



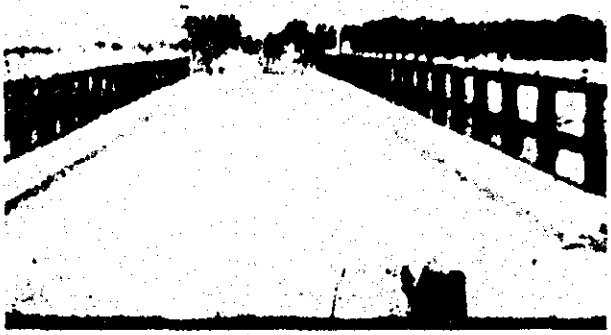
BR 8 L - 30 m

BR 9 L = 15 m



BR 10 L = 30 m

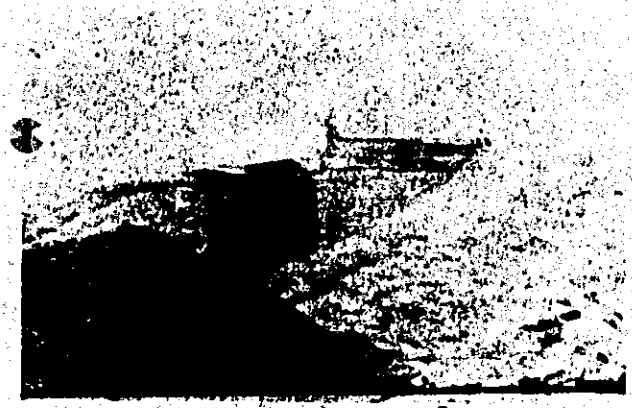
BR 11 L = 30 m



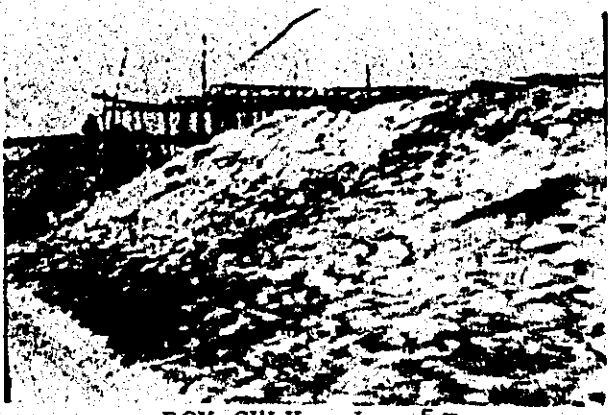
BR 12 L = 30 m

BOX CULV L = 5 m

FORD 1 L = 30 m
(SPILLWAY)



BOX CULV L - 5m



BOX CULV L - 5m

BOX CULV 4 L - 5m

TYPICAL EMBANKMENT & BORROW PIT

FORD(SPILLWAY) 2 L - 20m

BOX CULV 5 L - 3m

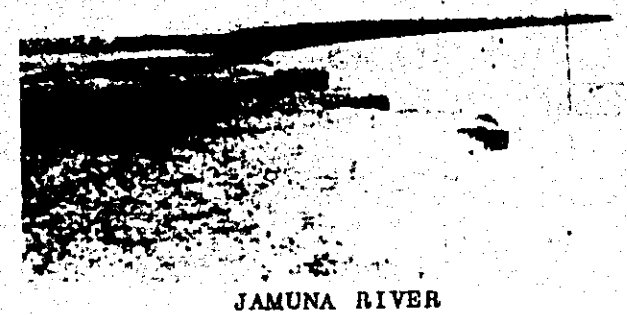
THE END OF THE EMBANKMENT

PROTECTION EMBANKMENT

FORD

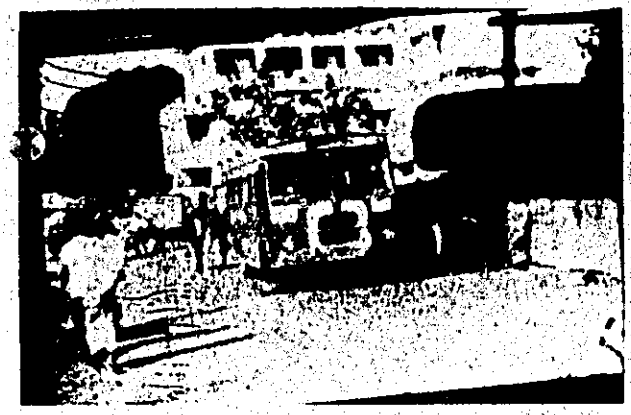
FORD

FORD



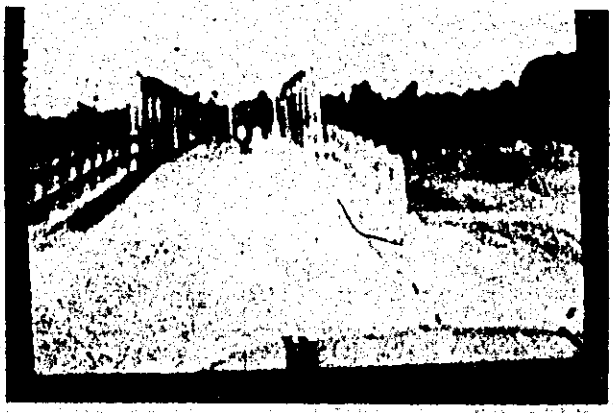
JAMUNA RIVER

TANGAIL – CHARABARI

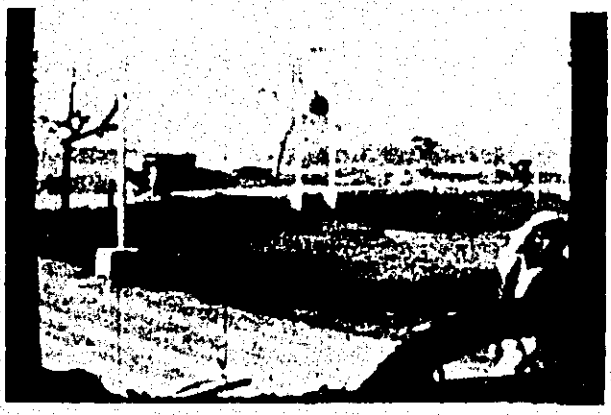


TANGAIL

TANGAIL



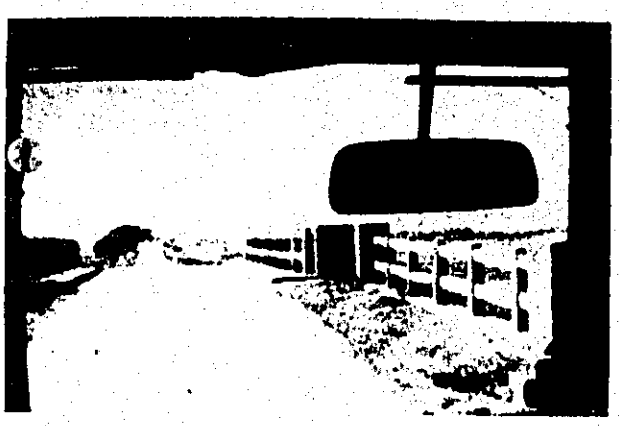
BR 1 L = 15m



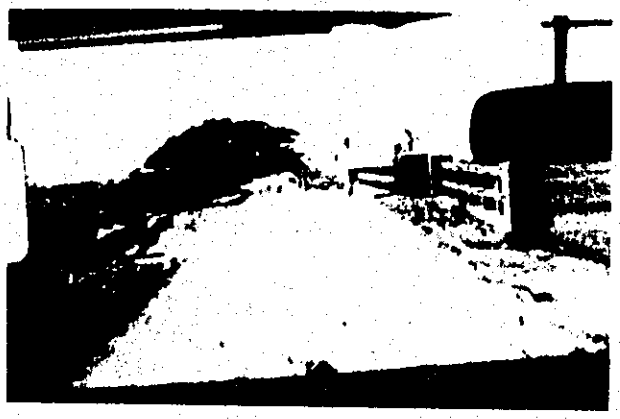
NAGARPUR CHARABARI
INTERSECTION

BR 2 L = 15m

BR 3 L = 15m



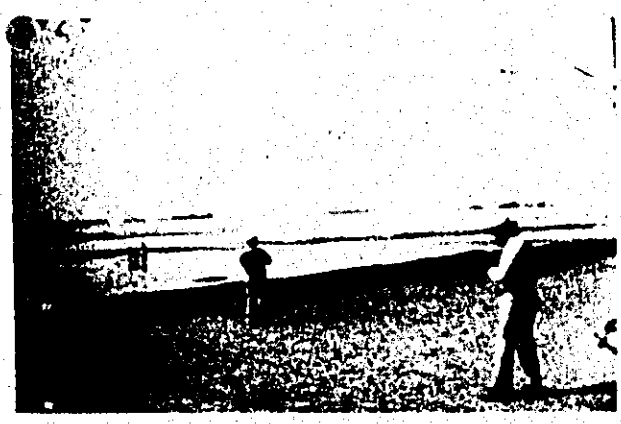
BR 4 L = 15 *m*



BR 5 L = 15 *m*

CARABARI

CARABARI

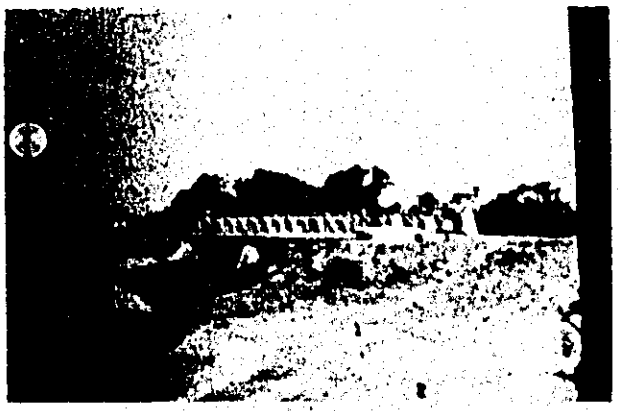


DHALESWARI RIVER

RIVER SIDE

APPENDIX 9

HATIKAMPUL – SERAJGANJ



ASIAN HIGHWAY

BR 1 L = 40 m

TYPICAL EMBANKMENT

BRICK PAVEMENT WORKS

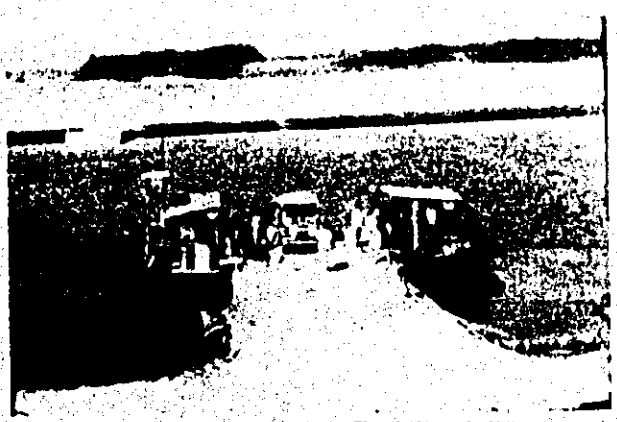
BOX CULV 1 – L = 5 m

BOX CULV

BOX CULV. 2 L - 5 m

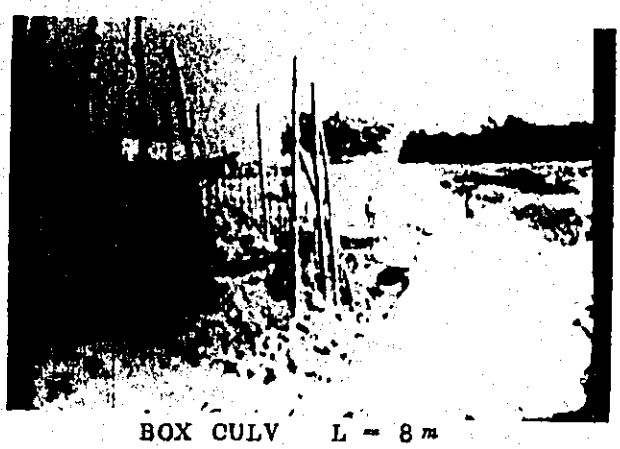
BOX CULV 3 L - 8 m

FORD (SPILLWAY)



KARATYA RIVER FERRY GHAT

BOX CULV 4 L - 5 m

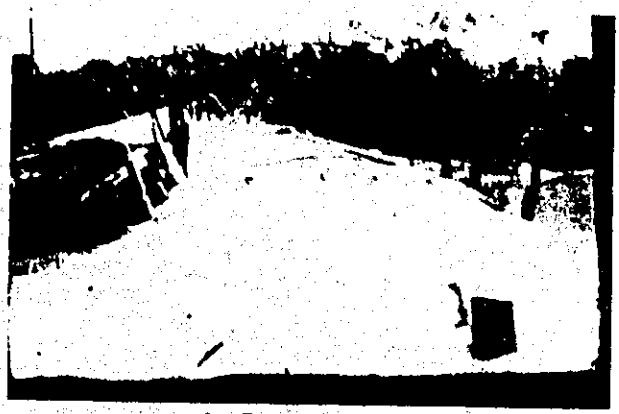


BOX CULV L - 8 m

BR 2 L - 6 m

FORD (SPILL WAY)

BOX CULV L - 5 m



BR 3 L - 10 m

SERAJGANJ – SERAJGANJ SITE

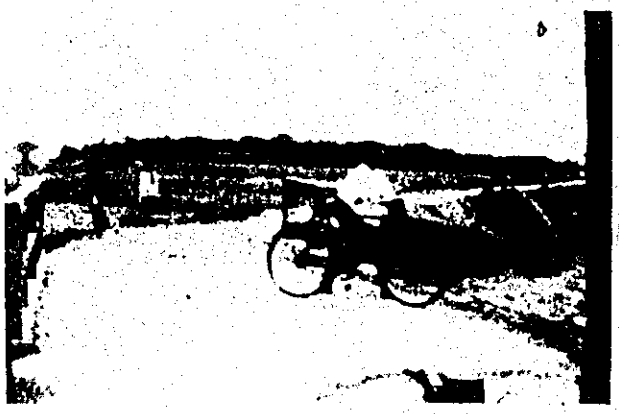
SIRAJGANJ

TYPICAL PAVEMENT ROAD

BR 1 L – 6m

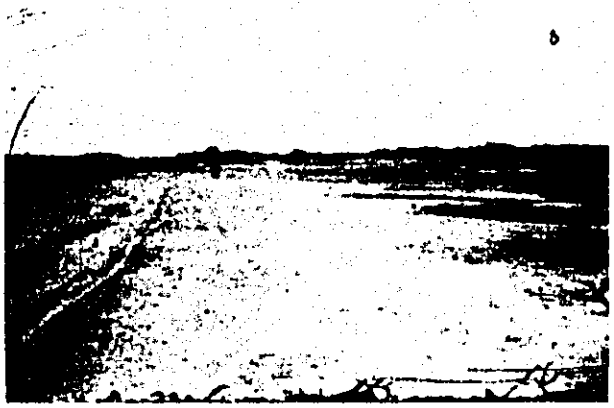
BR 2 L – 10m

HURASAGAR N.



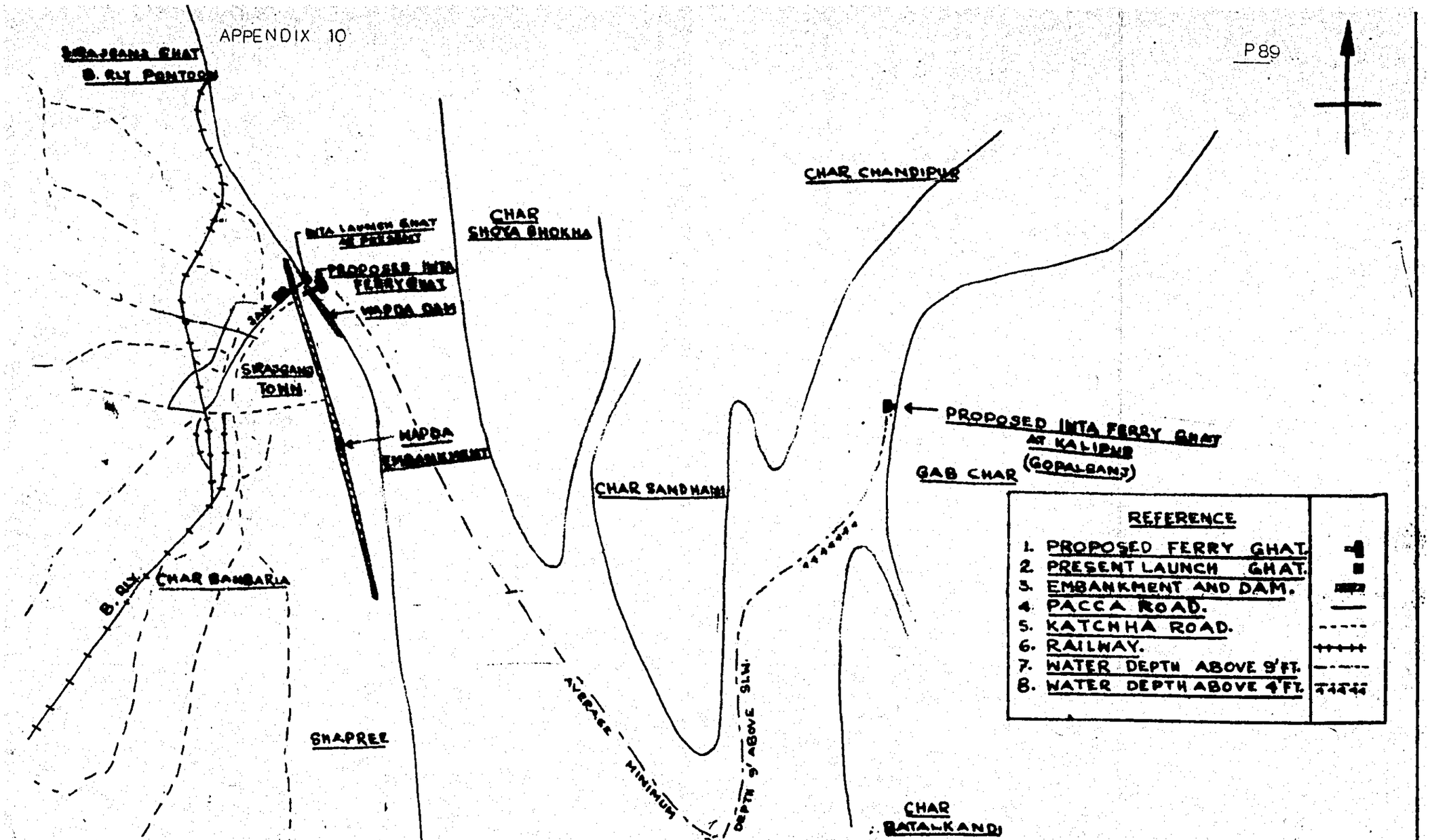
BR 3 L - 5m

BOX CULV L - 3m



HURASAGAR N

RIGHT EMBANKMENT



BANGLADESH
INLAND WATER TRANSPORT AUTHORITY

SITE PLAN SHOWING THE PROPOSED VEHICULAR FERRY SERVICE GHAT ON BOTH BANK OF RIVER JAMUNA TO CONNECT SIRAJGANJ-TANGAIL ROAD VIA BHUAPUR.

Scale 1:50,000	APPROVED BY	DRAWN BY
	(DEPUTY CHIEF ENGINEER)	(TECHNICAL ASSISTANT)