PEOPLE'S REPUBLIC OF BANGLADESH

JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT

FEASIBILITY STUDY REPORT

VOLUME IV

RAILWAY LINKS

AUGUST 1976

JAPAN INTERNATIONAL COOPERATION AGENCY

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VOLUME	I	SUMMARY AND CONCLUSIONS
VOLUME	II	RIVER CONTROL
VOLUME	III	BRIDGE
VOLUME	IV	RAILWAY LINKS
VOLUME	V	ROAD LINKS
VOLUME	VI	GEOLOGY AND STONE MATERIAL
VOLUME	VII	TRAFFIC AND ECONOMIC BENEFITS
VOLUME	VIII	OVERALL CONSTRUCTION PLAN AND ECONOMIC EVALUATION

ABBREVIATIONS, DEFINITIONS AND UNITS

MOC	Ministry of Communications
MFCWRP	Ministry of Flood Control, Water Resources and Power
BWDB	Bangladesh Water Development Board
BIWTA	Bangladesh Inland Water Transport Authority
SOB	Survey of Bangladesh
Bangladesh	The People's Republic of Bangladesh
Jamuna River	The Brahmaputra-Jamuna River
Prefeasibility Report	Prefeasibility Report on Jamuna River Bridge Construction Project prepared by the Japanese Government Study Team for the Overseas Technical Cooperation Agency, Japan in 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
m	Meter
s, sec	Second
cm	Centimeter
km	Kilometer
cms	Cubic Meter per Second
kg	Kilogram
t, ton	Ton (Metric)
f, ft	Foot

cfs	Cubic Foot per Second
in	Inch
yd	Yard
mi	Mile
ac	Acre
hr	Hour
yr	Year
lb	Pound
sq	Square
cu	Cubic
max	Maximum
min	Minimum
B	Width
H	Water Depth
I	Slope
R	Mean Water Depth
W	Water Width
L, l	Length
A	Water Area
Q	Discharge
v	Velocity
n	Coefficient of Roughness

1 in. = 2.54 cm

1 ft. = 0.305 m

1 yd. = 0.914 m

1 mi. = 1.609 km = 5.280 ft.

1 sq. ft. = 0.0929 m^2

1 cu. ft. = 0.0283 cub.m.

1 cfs. = 0.0283 m^3/s

1 ac. = 0.4 ha. = 0.004 sq.km

CONTENTS

ABBREVIATIONS, DEFINITIONS AND UNITS	ii
CONTENTS	iv
CONTENTS OF FIGURES	vi
CONTENTS OF TABLES	vi
CHAPTER I GENERAL	1
1. Purposes and Outline of Survey	1
2. Site Investigation	1
3. Antecedents of Survey	2
CHAPTER II POLICIES FOR RAILWAY PLANNING	4
1. Outline	4
2. Gage	4
3. Track, Single or Double	5
4. Train Services and Station Intervals	5
5. Fixed Points and Length of Line	8
6. Levels	10
7. Gradients and Curves	10
CHAPTER III COMPARISON STUDY OF FOUR PROPOSED ROUTES	11
1. Selection of Route	11
2. Outline of the Four Candidate Bridge Sites and Related Routes	11
2.1. No. 1 route (Bahadurabad)	11
2.2. No. 2 route (Gabargaon)	11
2.3. No. 3 route (Sirajganj)	12
2.4. No. 4 route (Nagarbari)	13
3. Decision of Optimal Route	13
CHAPTER IV RAILWAY CONSTRUCTION PLAN	19
1. Design Load	19
2. Train Speed	19
3. Land and Earthwork	19
4. Bridges A (Major Bridges)	19
5. Bridges B (Minor Bridges)	24

6. Track 24
7. Stations 27
7.1. Functions and classification of stations 27
7.2. Location of station 27
7.3. Layout of station 28
8. Signalling and Safety Facilities 35
9. Outline of Construction Design Criteria 35
10. Outline of Track 35

CHAPTER V IMPLEMENTATION PLAN 38

1. Outline 38
2. Work Schedule 39

CHAPTER VI CONSTRUCTION COST 45

1. Rough Estimate of Construction Cost 45
2. Maintenance Cost 58

CHAPTER VII CARGO TRANSSHIPPING YARD AS AN INTERFACE BETWEEN BROAD AND METER GAGE TRACKS 60

APPENDIX A RECORD OF DISCUSSION AT TOKYO MEETING (1)

APPENDIX B GENERAL PLAN OF RAILWAY LINKS (Figure) (5)

APPENDIX C RAILWAY HORIZONTAL ALIGNMENT (Figure) (9)

APPENDIX D RAILWAY VERTICAL ALIGNMENT (Figure) (13)

APPENDIX E DESIGN OF BRIDGES (9 Figures) (17)

CONTENTS OF FIGURES

Fig. 4-1	BROAD GAGE STANDARD LOADINGS OF 1926
Fig. 4-2	TYPICAL CROSS SECTION OF RAILWAY EARTHWORK
Fig. 4-3	TYPICAL CROSS SECTION OF RAILWAY TRACK
Fig. 4-4	RAILWAY STATION YARD
Fig. 7-1	SKELTON OF TRANSSHIPPING YARD

CONTENTS OF TABLES

Table 3-1	SUMMARY OF ACCESS RAILWAY LINES
Table 3-2	ROUGH ESTIMATE OF RAILWAY CONSTRUCTION COSTS
Table 3-3	CONSTRUCTION COSTS
Table 4-1	TABLE OF RIGHT-OF-WAYS
Table 4-2	TABLE OF EARTHWORK UP TO FORMATION
Table 4-3	BRIDGES (A) (MAJOR BRIDGES)
Table 4-4	BRIDGES (B) (MINOR BRIDGES)
Table 4-5	TYPICAL RAIL STATION FACILITIES
Table 4-6	RAILWAY STATIONS
Table 4-7	GRADIENT ABSTRACT
Table 4-8	CURVE ABSTRACT

CHAPTER I

GENERAL

1. Purposes and Outline of Survey.

The Jamuna River dividing Bangladesh between east and west is a large river having several kilometers of width over which no bridge has ever been crossed. Such being the circumstances, the River still is leaving the East and West behind in terms of cultural and material exchange, though a trickle convenience of ferry is available which with the onset of the rainy season is forced to stop. The Jamuna River has long been standing in the way of the growth of domestic industry in Bangladesh.

To overcome this bleak situation, we have investigated the feasibility of a bridge construction under the Jamuna River Bridge Construction Project for the purpose of providing communications with which to prompt the progress of domestic industry in the People's Republic of Bangladesh.

Along with the Jamuna River Bridge Construction Project, or more precisely as a link thereof in order to fully exploit the potentialities of the Jamuna River Bridge, a railway system has been planned to connect the East and West from an existing railway to Capital Dacca via the Jamuna River Bridge and key areas on the left of the Jamuna River.

This projected railway system is hereinafter called "Railway Links."

This Railway Links Survey Report focuses on a new, broad-gage, single-track railway having an aggregate length of some 130 km to be run from Salap Station on the existing Ishurdi-Sirajganj Line in the west of Bangladesh to Capital Dacca by way of Sirajganj (sited for the Jamuna River Bridge Construction), Jamuna River Bridge and Tangail on the left of the River, and deals with the findings of field survey for the construction of the Railway Links, policies of Railway Links planning, examination of alternative routes, transit capacity, design criteria, construction schedule, estimate of costs for construction and maintenance, and so forth.

2. Site Investigation.

The Railway Team undertook for a period of some 40 days from mid-January, 1974, an inventory survey of those existing railways in Bangladesh which are considered to have much to do with the Jamuna River Bridge Construction Project, and found that the track and structures were generally lowly and destitute of care. This was particularly the case with the main track and sideline tracks in the premises of each station.

It was also noticed that most of station layouts and harnessing were disagreeable from the viewpoint of operation and maintenance; for example, use of double slip switch was noticed.

The Team visited the cargo transshipping yard of Santahar Station to find it operating less effectively while idling away most of its cargo handling potentialities.

The existing lines, whether of broad gage or meter gage, are, for the most part, of the single track type, and have much carrying capacity in reserve. With the possible increase of transportation volume in future, the train frequency could be increased up to a total of something like 100 in ups and downs if automatic signal devices for single track and well-equipped through type stations were provided. The introduction of the CTC (centralized traffic control) system which is capable of handling train dispatching and signalling collectively and integratively will contribute much toward the modernization of railway transportation.

Also, the electrification of railway system will go a long way toward the reinforcement of transportation and modernization of motive power. Bangladesh is expected to have an abundance of natural gas resources. With the development of thermal power generation, railway electrification which produces high efficiency in motive power will be hopefully promoted.

3. Antecedents of Survey.

(1) The Railway Team stayed in Bangladesh about 40 days from mid-January, 1974, during which they took stock of the various aspects of railway system in Bangladesh, including the existing conditions of railways, topographic features and endemicity, through a reconnaissance survey of the areas proposed for the planned access railway lines. During their stay in Bangladesh, the Team visited the Chittagong Railway Headquarters and had productive discussion with the competent officers concerned over the status quo and future of the Bangladesh railway system.

(2) After return home, the Team elaborated a new railway plan on a 1:50,000 topographical map according to the site survey data to locate four routes to be linked to the four Jamuna River Bridge Sites-elect. In July, 1974, alternative plans and engineering criteria were roughly made up and submitted as the Progress Study Report.

(3) Toward the end of August, 1974, the competent officers in charge of the Jamuna River Bridge Construction Project came to Japan. In early September, they had a meeting at Tokyo for about one week to discuss with their Japanese counterpart over the aforesaid Progress Study Report. Those parts of the proceedings at the Tokyo Meeting which are connected with the proposed railway links are summarized in the Appendix of this text.

(4) The Japanese counterpart reexamined the investigation results according to the results of the Tokyo Meeting and modified the plan to some extent by making much account of what is purported on the part of Bangladesh. The results were thus incorporated into a report titled "Access Railway Study Report (First Stage)."

(5) In Dec., 1974, a Japanese survey mission carried the Access Railway Study Report (First Stage) with them to Bangladesh and held a Dacca meeting.

At the meeting, Sirajganj was elected the bridge site. The mission immediately determined the center of the bridge and related surveying work at site.

(6) Entering 1975, the plan has been worked up according to the results of surveying, and the results are submitted herewith to the People's Republic of Bangladesh as a final report.

The most important items decided upon concerning the Railway Links are summarized below.

(1) The railway to be of broad-gage, single-track type.

(2) The connecting station in the eastern area to be Dacca Station, and not Tungi Station.

CHAPTER II

POLICIES FOR RAILWAY PLANNING

1. Outline.

From the viewpoint of transportation, operation and maintenance, the Railway Links should be regarded as an extension rather than independent of the existing railways. Naturally, the standards to be applied to the new construction must be the same with the existing railways. Not only these, but must the opinions of Bangladesh railway experts as well as future railway plans such as reconstruction and improvements of the existing lines be prized.

2. Gage.

The Jamuna River divides the Bangladesh railway into two different systems. On her west is a mixed system of broad gage (5'6") and meter gage (1.00 m) and on her east is the meter gage only.

The connecting operation in the mixed system in the west is undertaken by the transshipping yards at Santahar and Parbatipur. With the completion of the Jamuna Bridge, the two railway networks in the east and west are to be integrated into a single one.

Naturally, it gives rise to the problem of what size of the gage be selected for the proposed Railway Links.

The Bangladesh Railway seemingly inclines to believe in the unification into the broad gage system for its future and to reconstruct the meter gage into the broad one.

The broad gage far excels the meter gage in transit capacity, speed, stability and in other various points, and has also advantages of international acceptance. Those stations and transshipping facilities which are designed for connecting the different systems have already shown themselves every evil of transportation hardships. Such ineffective stations and facilities should no longer be installed, but rather should the new plan presuppose the principle that the new railway from the west to Dacca can run on the same gage without interruption.

As regards the route to be connected to the Jamuna Bridge at Sirajganj, a new line should preferably be branched off from the Ishurdi-Sirajganj Line to provide a seamless line to the west. Based on this principle, the Railway Links have been designed to assume the broad gage (5'6").

From what it is told, by the way, the Bangladesh is considering as a link of its future improvement plan an installation of entrepot facilities at Kamalupur in Dacca for the purpose of interconnecting the broad and meter gages.

3. Track - Single or Double.

The choice between single and double track for the Railway Links is not so simple. It permits of no simple computation or hasty conclusion. The growth of traffic volume is interwined with the population growth, economic growth, the way the regional development and industrial development will follow, kinds of communications, and other various factors. From the macroscopic viewpoint of the traffic survey, however, even the single-track system seems likely to answer the needs even in the far distant future, if station intervals are adjusted.

By way of precaution, however, it is suggested that an ample space be spared for additional installations for ease of making up for the hard-to-predict increase of traffic volume in the remote future.

The train services on the new Railway Links can be increased by additional installation of through-type stations at places other than on the Jamuna Bridge or partial installation of double track lines as the topographic conditions are in favour of such installations. Considering the difficulties involved in its construction, the Jamuna Bridge Section may well have its substructure provided with an ample space for additional installation of double-track lines for the future.

But this will need huge sums of money for the construction.

And, it will be too much for all it is good for the people at the end of the coming ten decades. Considering these and other various factors, it is decided to employ the single-track system for all the sections including Jamuna Bridge.

4. Trains Services and Station Intervals.

According to its stochastical survey results concerning traffic volume of passengers and cargo across the Jamuna River, the Economic and Traffic survey team have estimated the required train services for the year 2020 as follows.

Passenger train

Number of passengers per car	:	70
Number of cars per train	:	20
Number of passengers per train	:	1,400 (= 70 × 20)
Number of working days per year	:	365

Freight train

Load per freight car	:	20 tons
Number of freight cars per train	:	60

Loading factor : 80%

Number of working days per year : 365

Type of train	Annual number of services	Daily number of services	Target year
Passenger	13,870	38	2020
Freight	7,665	21	2020
Total	21,535	59	

Assuming that 59 trains are operated a day, the required average station interval is determined as follows.

$$N = (1,440/(t + s)) \times f$$

Where, N: traffic capacity, 59 services,

S: signalling and blocking time, 3 min.,

t: average speed between adjacent stations, 54 km/hr, and

f: traffic utility factor, 0.5.

Thus, the station interval is calculated at 8.2 km. By making an allowance for busy seasons, it is set at 6.0 km.

Passenger train

Year : 2020

Annual number of passengers : 19,160,000

Daily number of train services : approx. 38 (= 52,493 ÷ (20 cars × 70 persons))

Freight train

Year : 2020

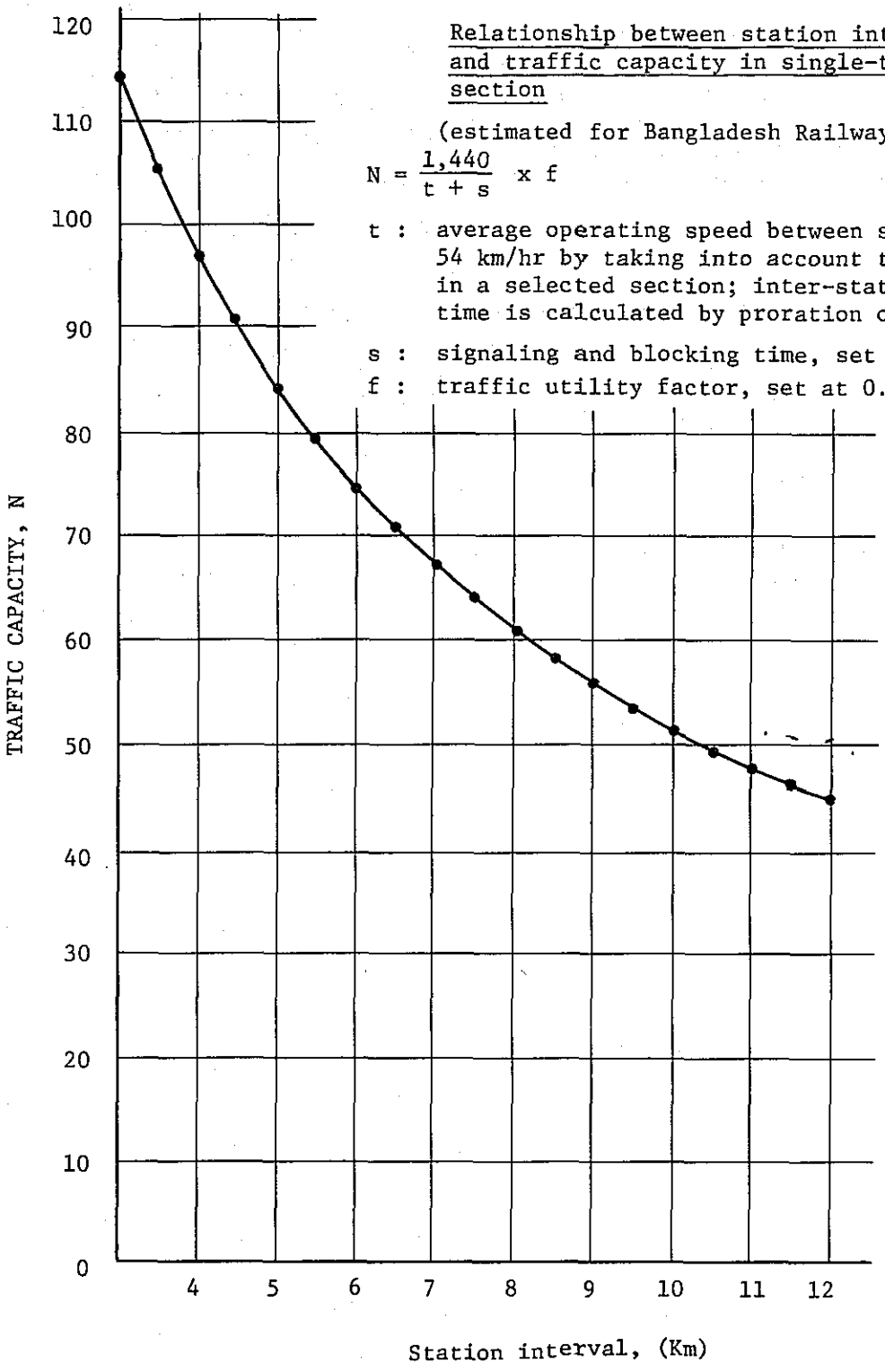
Annual cargo volume handled : 7,212,000 tons

Daily cargo volume : 19,758 tons (= 7,212,000 ÷ 365)

Daily number of train services : 21 (= 19,758 tons ÷ (60 cars × 20 tons 0.8))

Number of services per day of passenger and freight trains,

38 + 21 = 59 services



Relationship between station interval and traffic capacity in single-track section

(estimated for Bangladesh Railway)

$$N = \frac{1,440}{t + s} \times f$$

t : average operating speed between stations, set at 54 km/hr by taking into account the achievements in a selected section; inter-station operating time is calculated by proration of distance.

s : signaling and blocking time, set at 3 min.

f : traffic utility factor, set at 0.5

5. Fixed Points and Length of Line.

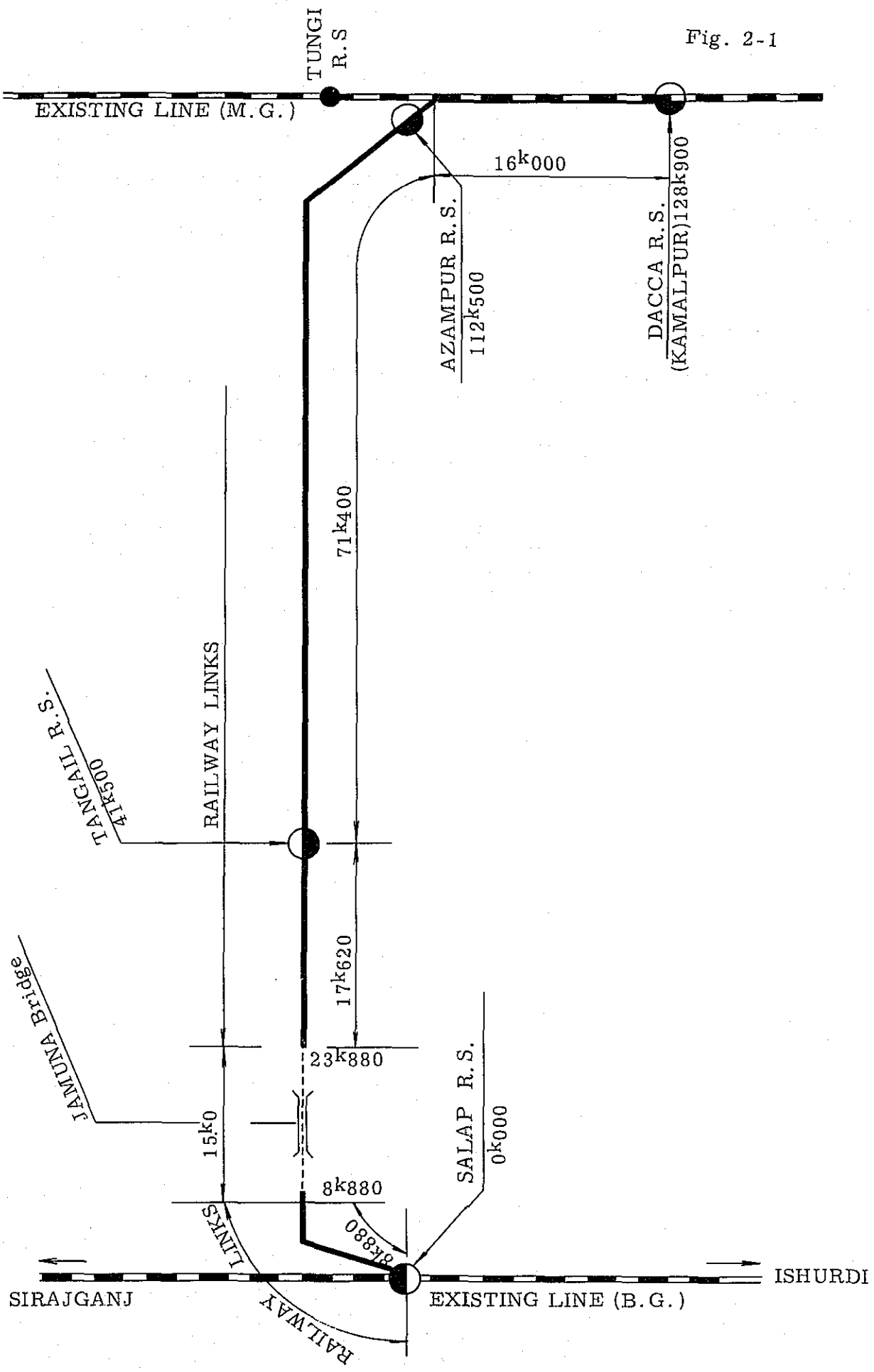
Each access railway starts from 0 km 000 m at the center of the proposed branching station on the west of the River of the existing railway and terminates with the center of the proposed connecting station on the east of the River of another existing railway.

Namely, the access railway originates from the center of Salap Station on the Ishurdi-Sirajganj Line with that center as 0 km 000 m, reaches the approach on the right bank of Jamuna Bridge at 8 km 880 m, comes to the end of the approach on the lest bank at 23 km 880 m. This 15 km section is to be covered by the bridge construction, and is to be subtracted from the aggregate length of the access railway. The access railway ends at the center of Dacca Station with a total mileage of 128 km 900 m from the starting point at Salap Station.

Aggregate length of new railway line	:	128 km 900 m
Net length of access railway	:	113 km 900 m (= 128 km 900 m - 15 km 000 m)

Refer to Fig. 2-1.

Fig. 2-1


TUNGI R.S
EXISTING LINE (M.G.)
16k000
AZAMPUR R.S.
112k500
DACCA R.S.
(KAMALPUR)128k900
71k400
RAILWAY LINKS
TANGAIL R.S.
41k500
17k620
JAMUNA Bridge
23k880
15k0
SALAP R.S.
0k000
8k880
8k880
LINKS
RAILWAY
SIRAJGANJ
EXISTING LINE (B.G.)
ISHURDI

6. Levels.

The levels appearing in this text and those in the railway profile are based on the G.T.S. Units (Great Trigonometrical Survey). The relationship between P.W.D. and G.T.S. is expressed by the following formula.

G.T.S. = P.W.D. — 1.5 ft.

7. Gradients and Curves.

The steepest gradient adopted for the new line is 5‰ (1/200) for the ordinary sections and 2.5‰ (1/400) for station sections.

The approaches of Jamuna Bridge form a hump extending over several kilometers, and the gradient for them is moderated at 1/300 in consideration of the performance of locomotives and others.

The minimum radius of curvature is set at 1,000 m which is judged best in the light of topography, operation and maintenance, provided that the section between Azampur and Dacca which is to run parallel with the existing line will have curvatures of 600 m and 350 m at one place each.

CHAPTER III

COMPARISON STUDY OF FOUR PROPOSED ROUTES

1. Selection of Route.

The route and its aggregate length vary with the bridge site if emphasis is placed on attaining the shortcut for tying the east and west railway networks.

As a result of surveys and investigations conducted in 1974, the bridge is sited at Sirajganj. Aside from the final siting of the bridge, the following routes have been on the list of candidacy and put to comparison study only from the Railway Links' point of view.

These are No. 1 site (Bahadurabad), No. 2 site (Gabargaon), No. 3 site (Sirajganj) and No.4 site (Nagarbari), from north to south. Respective routes of new lines, calling places, alignment, transportation, operation, maintenance, considerations to the future plan on the part of Bangladesh Railway, construction costs have been compared to rate the candidate sites.

2. Outline of the Four Candidate Bridge Sites and Related Routes.

2.1. No. 1 route (Bahadurabad).

This route is the northermost among the four. It is about 38 km (24 miles) long, originating from Velurpara Station on the existing Santahar-Bonarpara Line (meter gage) on the right of the Jamuna River, running eastward parallel to the existing line about 4 km, crossing the Bangali River after turning to the right and reaching Jamuna Bridge at point 17 km. The route continues almost straight as far as point 32 km and terminates at Durmat Station on the existing Bahadurabad-Jamalpur Line (meter gage) on the left of the River.

Since the proposed link is of the broad gage type, it will be necessary in future to reconstruct the existing line from Durmat all the way to Dacca via Jamalpur into a broad gage one. In this comparative study, however, this gage broadening project is omitted as one of the future improvements to be borne by the Bangladesh Railway, but the costs for the gage widening should be counted as one of the factors for route comparison.

The existing line on the right of the River is also of the meter gage type, and a broad gage line is to be constructed alongside it from Velurpara Station through to Santahar Station. The aggregate length of this extension is about 62 km (39 miles).

2.2. No. 2 route (Gabargaon).

This route diverges from Bogra Station on the existing Santahar-Bonarpara Line (meter gage) on the right of the Jamuna River, crossing the Karatoya River, turning to the east at point 3 km and running straight as far as point 20 km and reaching Jamuna River Bridge at

point 30 km after crossing the Bangali River. At point 48 km, the route crosses the Jhinai River, turns to the left at point 54 km and terminates with Jafar Shafee Station on the existing Jamalpur-Jagannathganj Line (meter gage) on the left of the River, going through a total of about 55 km (34 miles).

As is the case with No. 1 route, this route has its bridge site close to the existing meter gage lines on both sides of the Jamuna River, and a good number of transshipping facilities are required of perforce unless the existing lines are broadened.

Smooth and speedy conveyance of goods from the east to the west and from the west to the east is one of the essentials for which the Jamuna River Bridge Construction Project is imagjned. Adding unmanageable transshipping facilities further will not make a difference as they will possibly hamper the efficiency of railway operation.

It is therefore required to construct a uniform, stepless gage line from the west to Dacca with no installation of transshipping facilities in between.

On the right of the River, a broad gage line will be constructed 55 km (34 miles) along the existing meter gage line from Bogra all the way to Santahar.

On the left, the terminating station will be Jafar Shafee where Bangladesh Railway will take over the broad gage line through to Dacca in future.

2.3. No. 3 route (Sirajganj).

This route diverges from Salap Station on the existing Ishurdi-Sirajganj Line (broad gage), runs eastward and reaches the Jamuna River at point 13 km after crossing the Harasagar River. From there, it extends to the Dhaleswari River at point 23 km and runs down far to Tangail City at 42 km point where a new station will be built. Since the Dhaleswari River is expected to be cofferdammed in the upper reaches, the route will cross on the cofferdam.

The route runs further down, crosses the Lohajang and the Futjani, turns to the east, and then reaches Mirzapur at point 67 km. The route proceeds eastward, approaches the existing main highway in a comparatively arid area, and reaches the Turag River at point 96 km by way of Kalikair. After striding over the Turag River, the route goes far down, crosses the Tungi River and terminates with Azampur Station which will be located on the existing railway line between Dacca and Tungi, to the north of the proposed airport complex. The total track length will be about 114 km (71 miles).

According to the plans of the Bangladesh Government, a broad gage line will be constructed to cover the extension between Azampur through to Dacca and a transshipment yard at New Dacca Station (Kamalpur).

With this route, the broad-gage through-transportation will be covered from the west all the way to Dacca.

2.4. No. 4 route (Nagarbari).

This is the southernmost among the four. Like No. 3 route, this route diverges from Gooakhara Station on the existing Ishurdi-Sirajganj Line (broad gage) on the right of the River, turns to the right in a while, runs almost straight as far as point 30 km, crosses the Baral River, and reaches Jamuna River at point 41 km. The route crosses the Dhaleswari River by bridge, runs eastward, crosses the Bansi River and the Turag River, and finally reaches Azampur Station between Dacca and Tungi. The location of Azampur Station and the connection system are all the same as No. 3 route. The total track length will be 120 km (75 miles), the longest among the four access railways.

3. Decision of Optimal Route.

The four routes discussed above are compared in Table 3-1. Each of the stations from which No. 1 route and No. 2 route diverge is of the meter gage, and it is required to install a broad gage line along the existing line up to Santahar Station in order to do the mission of broad gage railway.

The construction costs of respective routes including these additional lines are compared in Table 3-2. No. 1 route is most inexpensive, followed by No. 2 route, No. 3 route and No. 4 route in turn.

In order to convey goods to Dacca without going through any trans-shipping facilities, gage widening improvement is to be implemented for No. 1 and No.2 route from the respective terminating stations of Durmat and Jafar-Shafee up to Tungi via Jamalpur and Mymensingh. The aggregate length of the gage widening improvement amounts to 124 km for each of these two routes, and the cost per km of improvement is roughly estimated at 4,000,000 taka, given that such improvement will cost half the new installation. Namely, the total improvement cost is,

4,000,000 taka × 124 km = 496,000,000 taka.

With all the improvement costs counted, the construction costs for the routes from the existing broad gage stations in the west to Tungi Station are compared in Table 3-3. As is clear from Table 3-3, No. 3 route (Sirajganj) is found most economical.

The findings of the above comparison study are one of the many elements that have finalized the optimal route. Surprisingly enough, however, this Sirajganj route has also been picked up as best by generalizing all-in and all-out conditions including the results of investigations relating to rivers and bridges.

The report submitted here deals with the modification of plan for the Sirajganj route due to the surveying and establishment of bridge axis in 1974 and also with the revision of design consequent upon the flood recording survey in 1974.

For the comparison of the four routes, refer to "General Plan of Railway Links" in the Appendix B.

Table 3-1 SUMMARY OF ACCESS RAILWAY LINES

Site Number & Nomination	No. 1 Bahadurabad	No. 2 Gabargaon	No. 3 Sirajganj	No. 4 Nagarbari
Originating Station and its Location	Velurpara on Santahar-Bonarpara Line	Bogra on Santahar-Bonarpara Line	Salap on Ishurdi-Sirajganj Line	Gooakhara on Ishurdi-Sirajganj Line
Terminating Station and its Location	Durmat on Jamalpur - Bahadurabad Line	Jafar Shafee on Jamalpur - Jagannathganj Line	Azampur (or Tungi) on Dacca - Tungi Line	Azampur (or Tungi) on Dacca - Tungi Line
Total Length of Line (Km)	38 (24 miles)	55 (34 miles)	114 (71 miles)	120 (75 miles)
Gage	Broad (5' - 6") 1,676 m	Broad (5' - 6") 1,676 m	Broad (5' - 6") 1,676 m	Broad (5' - 6") 1,676 m
Number of Tracks	Single	Single	Single	Single
Major Station	--	--	Tangail Station	--
Number of Minor Stations	3	5	11	12
Allowable Maximum Gradient	5/1,000	5/1,000	5/1,000	5/1,000
Minimum Curve (meters)	R = 1,000	R = 1,000	R = 1,000	R = 1,000
Bridge Running Length (m) Class A: L ≧ 100 m	500 (1,640f)	1,050 (3,450f)	1,300 (4,270f)	3,050 (10,000f)
Bridge Running Length (m) Class B: L < 100 m	270 (890f)	180 (590f)	360 (1,180f)	360 (1,180f)
Earthwork up to Formtion (m^3)	2,100,000	3,300,000	5,400,000	6,400,000
Area of Land Acquisition (m^2)	2,400,000	3,500,000	6,400,000	7,200,000
Length of New Broad Gage Line alongside the Existing Meter Gage	62 km (39 miles) Station: Velurpara to Santahar	40 km (25 miles) Station: Bogra to Santahar	18 km (11.3 miles) Station: Azampur (or Tungi) to Dacca (Kamalpur)	18 km (11.3 miles) Station: Azampur (or Tungi) to Dacca (Kamalpur)

Table 3-2 ROUGH ESTIMATE OF RAILWAY CONSTRUCTION COSTS

unit: Thousand Taka

Category	No. 1 route BAHADURABAD	No. 2 route GABARGAON	No. 3 route SIRAJGANJ	No. 4 route NAGARBARI	
Earth work	207,000	238,000	270,000	320,000	incl. right-of-ways
Bridge	78,000	73,000	99,000	153,000	incl. spillways
Track	244,000	227,000	273,000	280,000	Rails, sleepers and ballast
Operating	198,000	189,000	242,000	250,000	incl. stations, buildings, lighting facilities, power facilities, communications facilities, signalling and other safety gears and appurtenances
Total	727,000	727,000	884,000	1,003,000	
Aggregate length	63^{mi} (100km)	59^{mi} (95km)	71^{mi} (114km)	75^{mi} (120km)	

Table 3-3 CONSTRUCTION COSTS

	New Line		Additional line/parallel to existing line		Gage widening		Total	
	Aggregate length(km)	Construction cost(10^3Tk)	Aggregate length(km)	Construction cost(10^3Tk)	Aggregate length(km)	Construction cost(10^3Tk)	Aggregate length(km)	Construction cost(10^3Tk)
No. 1 route	38	314,000	62	413,000	124	496,000	224	1,223,000
No. 2 route	55	467,000	40	260,000	124	496,000	219	1,223,000
No. 3 route	114	884,000	-	-	-	-	114	884,000
No. 4 route	120	1,003,000	-	-	-	-	120	1,003,000

CHAPTER IV

RAILWAY CONSTRUCTION PLAN

1. Design Load.

The design load for the bridge design will conform to "Broad Gage Standard Loadings of 1926" already accepted in Bangladesh. (See Fig. 4-1).

2. Train Speed.

The train speed for the plan is determined as follows according to the results of fact-finding survey in Bangladesh.

Max. train speed	:	96 km/hr (60 miles/hr)
Average train speed	:	54 km/hr (34 miles/hr)

3. Land and Earthwork.

The right-of-way for earthwork design is specified in Fig. 4-2, "TYPICAL CROSS-SECTION OF RAILWAY EARTHWORK." It will have a borrow pit on one side only for the purpose of banking for double tracks in the future.

The width of fill subgrade will be 20'00" and the top fill subgrade will be 3'00" or more above H.W.L. The vertical alignment is so selected as to satisfy these requirements. The slope of the fill subgrade will be moderated to be smaller than 1:2, and at the same time will be protected with quality clay covered with turf against scouring by flood water.

4. Bridge A (Major Bridges).

The bridges of 100 m or more in span planned for the Railway Links are 9 all told. Their navigation clearance is determined according to the data available from BIWTA (Bangladesh Inland Water Transport Authority) and also in consideration of the sizes of respective rivers, channel widths of nearby bridges, etc.

The bridges planned for access railways are of medium-span size, and their superstructure will be made of prestressed concrete in an economic type; and, the employment of locally available materials and participation of local contractors will be fully taken into account. Similarly, the substructure will be designed to be an iron-reinforced concrete T-shaped pier. The pier footing will be embedded below the existing river bed level in order to provide against scouring.

Although the spanning should in principle be determined at once to keep the required navigation clearance and to minimize the overall construction cost, the minimum necessary spanning for the required navigation clearance is found to be most economical as insitu anchoring is applied for the foundation work.

Fig. 4-1 BROAD GAUGE STANDARD LOADINGS OF 1926

AXIAL LOAD OF 22.5 TONS

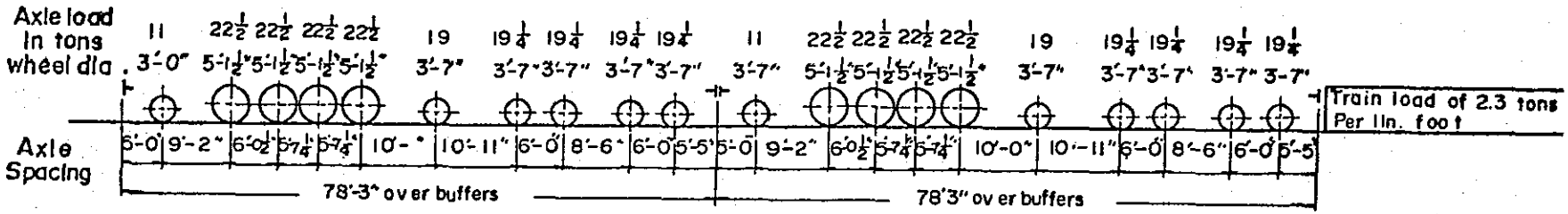
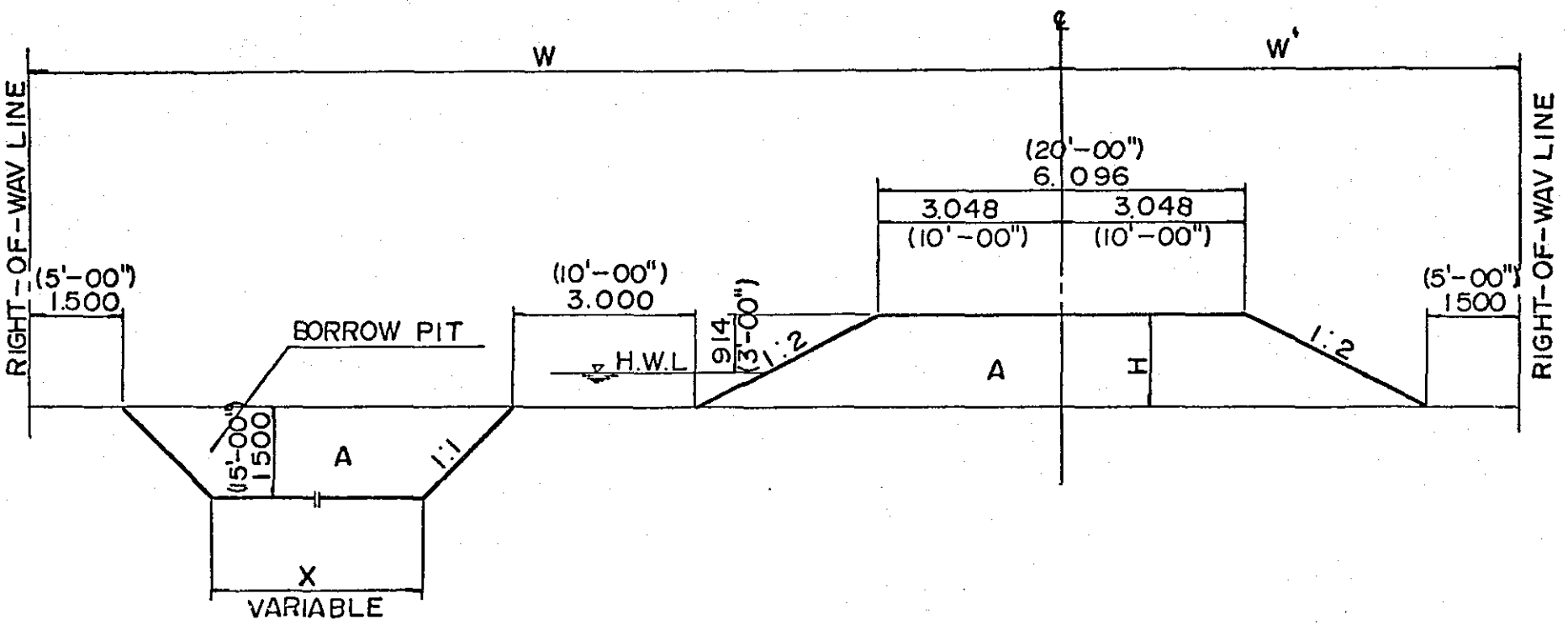


Fig.4-2 TYPICAL CROSS SECTION OF RAIL WAY EARTHWORK

Scale 1/100



RIGHT-OF-WAY = W+W'

Table 4-1 TABLE OF RIGHT-OF-WAYS

No.	Main line section		Location Km of station	Right-of-way			Remarks
				Main line 1,000m^2	Station 1,000m^2	Total 1,000m^2	
1	0^K ∿		0^K		31.2	31.2	
2		8^K880	7^K,500	491.4	43.6	535.0	
3	8^K880∿		13,380	-	-	-	excl. 15.0 km of graded approach section, Jamuna Bridge
4		23,880	19,380	-	-	-	
5	23^K,880∿	30^K,000	25,300	438.9	43.6	482.5	
6	30,000∿	35,000	31,000	313.5	31.2	344.7	
7	35,000∿	41,000	35,500	338.4	31.2	369.6	
8	41,000∿	47,000	41,500	355.3	62.5	417.8	
9	47,000∿	52,000	47,500	267.7	31.2	298.9	
10	52,000∿	57,000	52,500	250.4	31.2	281.6	
11	57,000∿	62,000	57,500	297.6	43.6	341.2	
12	62,000∿	67,000	62,500	363.4	31.2	394.6	
13	67,000∿	72,000	67,500	535.0	43.6	578.6	
14	72,000∿	75,000	72,500	249.2	31.2	280.4	
15	75,000∿	81,000	76,000	264.9	31.2	296.1	
16	81,000∿	87,000	82,000	272.8	43.6	316.4	
17	87,000∿	93,000	88,000	165.0	31.2	196.2	
18	93,000∿	99,000	94,000	457.5	31.2	488.7	
19	99,000∿	105,000	100,000	323.1	31.2	354.3	
20	105,000∿	112,00	106,000	506.7	31.2	537.9	
21	112,000∿	116,000	112,500	226.5	43.6	270.1	
22	116,000∿	123,000	116,700	243.0	31.2	274.2	
23	123,000∿	128,900	123,500	172.1	31.2	203.3	
24			128,900		62.5	62.5	
	Total			6,532.4	823.4	7,355.8	

Table 4-2 TABLE OF EARTHWORK UP TO FORMATION

No.	Main line section		Location Km of station	Earthwork up to formation			Remarks
				Main line 1,000m³	Station 1,000m³	Total 1,000m³	
1	0K ∿		0		83.5	83.5	
2		8K880	7,500	321.4	158.6	480.0	
3	8K880∿		13,380	-	-	-	excl. 15.0 km of graded approach section, Jamuna Bridge
4		23K880	19,380	-	-	-	
5	23K880∿	30K000	25,300	321.3	119.7	441.0	
6	30,000∿	35,000	31,000	229.5	87.0	316.5	
7	35,000∿	41,000	35,500	232.2	87.0	319.2	
8	41,000∿	47,000	41,500	220.5	157.9	378.4	
9	47,000∿	52,000	47,500	177.3	71.6	248.9	
10	52,000∿	57,000	52,500	257.7	76.8	334.5	
11	57,000∿	62,000	57,500	211.7	105.8	317.5	
12	62,000∿	67,000	62,500	287.8	102.5	390.3	
13	67,000∿	72,000	67,500	555.3	151.4	706.7	
14	72,000∿	75,000	72,500	211.4	140.8	352.2	
15	75,000∿	81,000	76,000	1,144.6	102.5	1,247.1	
16	81,000∿	87,000	82,000	155.2	130.3	235.5	
17	87,000∿	93,000	88,000	48.6	30.6	79.2	
18	93,000∿	99,000	94,000	396.6	30.6	427.2	
19	99,000∿	105,000	100,000	215.3	78.6	293.9	
20	105,000∿	112,000	106,000	418.7	92.1	510.8	
21	112,000∿	116,000	112,500	157.7	70.5	228.2	
22	116,000∿	123,000	116,700	107.2	46.0	153.2	
23	123,000∿	128,000	123,500	56.4	25.6	82.0	
24			128,900		71.5	71.5	
	Total			5,726.4	2,020.9	7,747.3	

The overall lengths, navigation clearances, spanning and types of the nine bridges planned for the access railways are shown in Table 4-3.

The construction work will be carried out primarily in the dry season. Even in the dry season, the foundation work at those places which are expected to have a considerably large depth may have to count on islanding work. The superstructure will be prepared at a girder production yard at site, and will be erected by means of erection girder.

5. Bridges B (Minor Bridges).

Of the bridges for the Railway Links, those measuring less than 100 m in length, and spillway bridges are distinguished as minor bridges from major bridges explained under item 5. They are listed in Table 4-4.

In the flooded area, the aggregate length of minor bridges is not less than 4% of the aggregate length of railway line.

The construction, type and construction method will be in accordance with the bridges (A), depending on the spanning.

6. Track.

The rail will be 90 lbs./yard, and the sleeper will be wooden. The roadbed will be crushed stone ballast. This new line is to be operated at a higher speed than the others, and the main line alone (excl. siding) will use tieplate and anticreep device.

	Ballasted section		Non-ballasted section
	Main line	Siding	Jamuna Bridge
Rail	90Lb/YARD	90LB/YARD	90LB/YARD
Sleeper	Wooden (9'×5"×10")	Wooden (9'×5"×10")	Wooden (10'×8"×10")
Number of sleepers	1375T/Km	1375T/Km	1900T/Km
Tieplate	ease	nil	ease
Anti-creep device	ease	nil	nil
Ballast	Crushed stone, $1.6m^3/m$	Crushed stone, $1.4m^3/m$	-

The non-ballasted section on Jamuna Bridge will have guard rails, spacing strips and footboards will be provided.

Table 4-3 BRIDGES (A) (MAJOR BRIDGES)

No.	Location point, km	Spanning	Running length	Height about F.L.	H.W.L.	Girder clearance	Superstructure	Navigation clearance (f.t)	
1	$8^{K}750^{M}$	5×20^{m}	100^{m}	15.50^{m}	11.84^{m}	2.50^{m}	Prestressed Concrete girder	HURASAGAR	60' × 6'
2	44,700	5 × 20	100	14.00	10.18	3.40	"	LOHAJANG	"
3	54,950	7 × 20	160	13.50	9.42	2.40	"	FUTJANI	"
4	68,250	5 × 20	100	13.00	9.12	2.80	"	BANSI	"
5	77,900	3 × 33	100	15.70	8.98	4.30	"		100' × 12'
6	79,350	5 × 33	165	"	8.92	4.60	"		"
7	81,100	5 × 33	165	"	8.85	4.70	"		"
8	96,600	7 × 33	231	15.00	7.99	4.30	"	TURAG	"
9	110,300	7 × 33	231	13.50	6.66	4.40	"	TUNGI	"
	Total		1,352m						

Table 4-4 BRIDGES (B) (MINOR BRIDGES)

Section	Location point, km	Spanning	Length overall	Remarks
OK ∿ 8K880	1,400	1 × 15m	15m	
ℓ = 8K880m	3,150	2 × 20	40	
Flooded area	5,100	1 × 15	15	
	8,400	2 × 15	30	
		Spill way	255	
		Sub total	355m	4% of aggregate length of railway line
23K880m ∿ 81K400m	33,000	3 × 20	60	
ℓ = 57K520m	58,800	2 × 20	40	
Flooded area	63,400	3 × 20	60	
	67,100	3 × 20	60	
	71,600	3 × 20	60	
	73,800	3 × 20	60	
	75,800	2 × 15	30	
	76,400	4 × 20	80	
	78,900	2 × 15	30	
	79,900	2 × 15	30	
		Spill way	1,790	
		Sub total	2,300m	4% of aggregate length of railway line
81K400m ∿ 128K900m	96,800	2 × 15	30	
ℓ = 47K500m	103,600	2 × 15	30	
Non-flooded area		Spill way	480	
		Sub total	540	1.1% of aggregate length of railway line
	Total		3,195m	2.8% of aggregate length of railway line

A typical cross-section of general railway track is given in Fig. 4-3.

7. Stations.

7.1. Functions and classification of stations.

The stations are classified by function into the following four. Their standard types are arranged to meet the actual conditions in consideration of local demography and industrial conditions.

(1) Station, class A.

Two sidings will be prepared, and the passenger platform will be of the four-sided island system. The station will handle shunting, passing-by of trains, carrying of passengers, and cargo. Tangail and Dacca will be of this type.

(2) Station, class B.

A siding will be located in the center, and the passenger platform will be of the two-opposed one-sided system. The station will handle shunting and passing-by of trains, and carrying of passengers and cargo. Azampur and five other stations will be of this type.

(3) Station, class C.

This station will be designed for passengers only, and will handle passing-by of trains. The passenger platform will be of the two-opposed one-sided system. Cargo will not be handled. Fourteen stations other than those under classes A and B will come under this type.

(4) Block station.

This handles passing-by of trains only, and is unmanned. Neither passengers nor cargo is handled. The signalling will be of automatic, remote CTC system. The block station will be installed one each on front and back of Jamuna River and on the high embankment.

Principal particulars of each class of station are shown in Table 4-5, "TYPICAL RAILWAY STATION FACILITIES."

7.2. Location of station.

Effort has been made so as to locate the station at as flat a place as possible. But, two block stations on the approaches of Jamuna Bridge and one other station are forced to be on a 2.5‰ grade (1/400). All other stations are on a level place.

All the stations are located in a straight line and not in a curved section. The stations are allocated with interval set at 6.0 km as standard.

7.3. Layout of station.

A typical layout of station is illustrated in Fig. 4-4. The effective length of the station is set at 700 m as determined by the number of cars per freight train. The center-to-center distance between tracks is set at 4.3 m pursuant to the Bangladesh Railway's Standards.

The numbers of point and crossing are 16#, 12# and 8#, and safety siding is provided as circumstances so demand.

Fig.4-3 TYPICAL CROSS SECTION OF RAIL WAY TRACK

SCALE 1/50

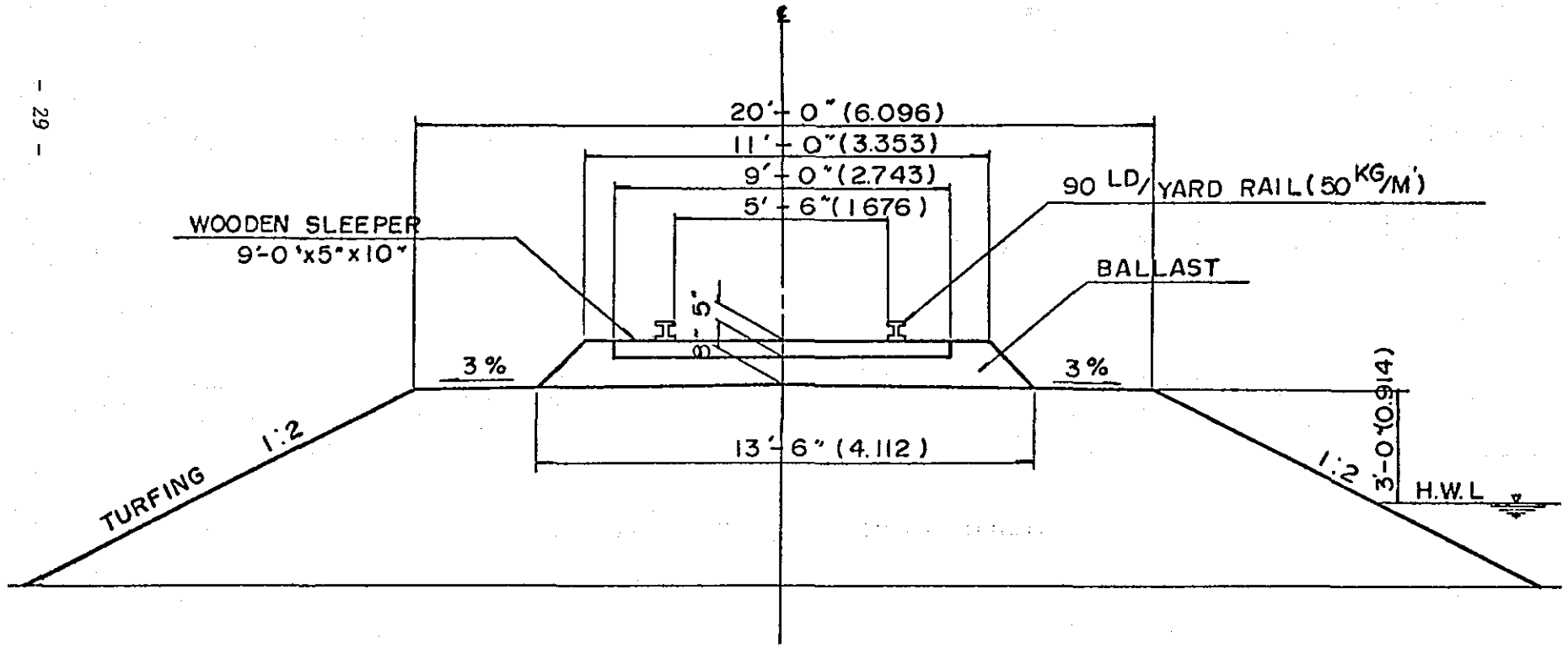


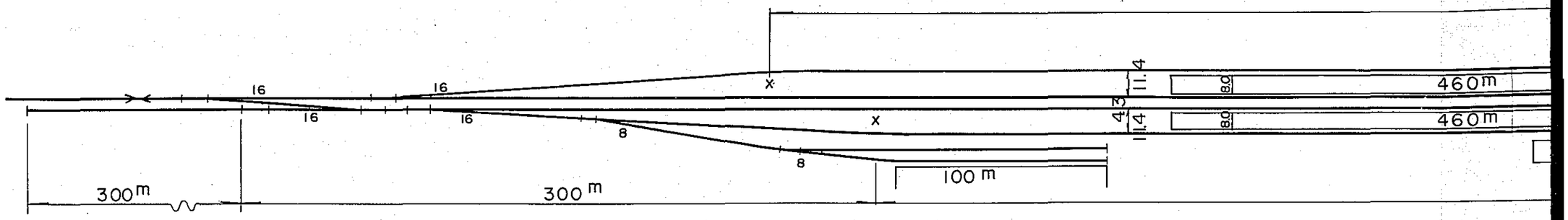
Table 4-5 TYPICAL RAILWAY STATION FACILITIES

Class	Aggregate length	Formation, area	Aggregate length of siding	Point and crossing					Passenger platform	Cargo platform	Main building	Remarks
				8 #	12#	16#	Continuous rail point	Total				
A	1,600m	62,528m^2	4,290m	2	5	2	1	10	4 sides × 460m	1 × 100m	800m^2	2 places: Tangail R.S. and one other
B	1,360m	43,560m^2	2,560m	2	3	2		7	2 sides × 460m	1 × 60m	600m^2	6 places: Azampur R.S. and five others
C	920m	31,225m^2	955m		1	1	1	3	2 sides × 460m	-	400m^2	14 places: 14 other stations
Block Station	920m		955m		1	1	1	3	-	-	-	2 places on the approaches

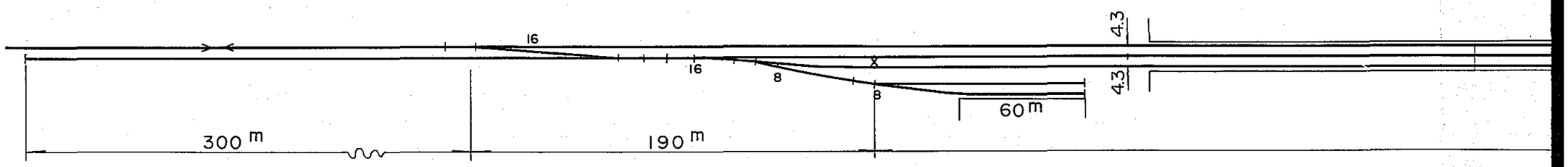
Table 4-6 RAILWAY STATIONS

No.	Location point, km	Name of station	Interval	Class	Height of earth-full	Grade	Aggregate length of siding	Remarks
	km							
1	0,000	Salap		C	2.7m	L	955m	Existing stations
2	7,500	Dhopa Kandi	7,500m	B	4.5	L	2,560	
3	13,380	(Block Station)	5,880		16.8	2.5‰	955	Block station
4	19,380	(")	6,000		16.2	"	955	- " -
5	25,300	Durgapur	5,920	B	3.4	L	2,560	
6	31,000	Bara Basalia	5,700	C	3.4	"	955	
7	35,500	Rasulpur	4,500	C	3.4	"	955	
8	41,500	Tangail	6,000	A	3.0	"	4,290	
9	47,500	Pathrail	6,000	C	2.8	"	955	
10	52,500	Delduar	5,000	C	3.0	"	955	
11	57,500	Jamurki	5,000	B	3.0	"	2,560	
12	62,500	Ichail	5,000	C	4.0	"	955	
13	67,500	Mirzapur	5,000	B	4.3	"	2,560	
14	72,500	Gorai	5,000	C	5.5	"	955	
15	76,000	Gazaria	3,500	C	4.0	2.5‰	955	
16	82,000	Kalia Kair	6,000	B	3.7	L	2,560	
17	88,000	Chandara	6,000	C	1.2	"	955	
18	94,000	Baimat	6,000	C	1.2	"	955	
19	100,000	Chandpar	6,000	C	3.2	"	955	
20	106,000	Khartail	6,000	C	3.6	"	955	
21	112,500	Azampur	6,500	B	2.0	"	2,560	
22	116,700	Dacca cantt	4,200	C	1.8	"	955	Existing station
23	123,500	Tejgaon	6,800	C	1.0	"	955	- " -
24	128,900	Dacca (Kamalpur)	5,400	A	1.2	"	4,290	- " -

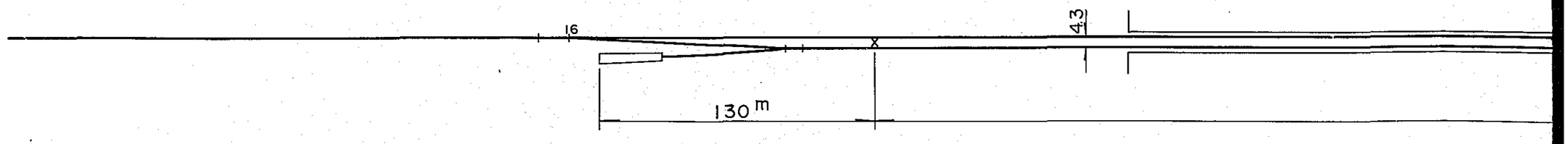
RAILWAY STATION YAR



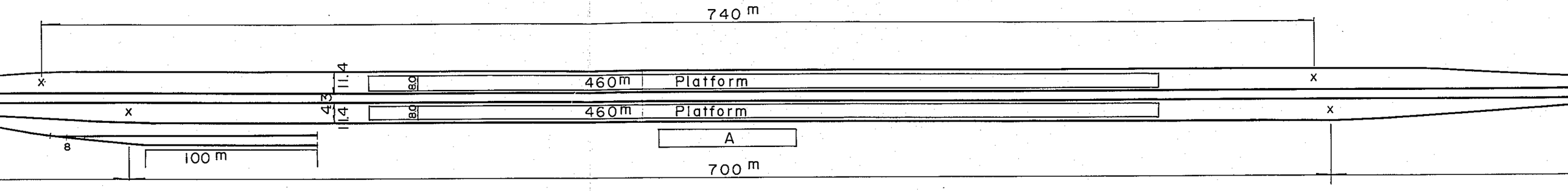
RAILWAY STATION YAR



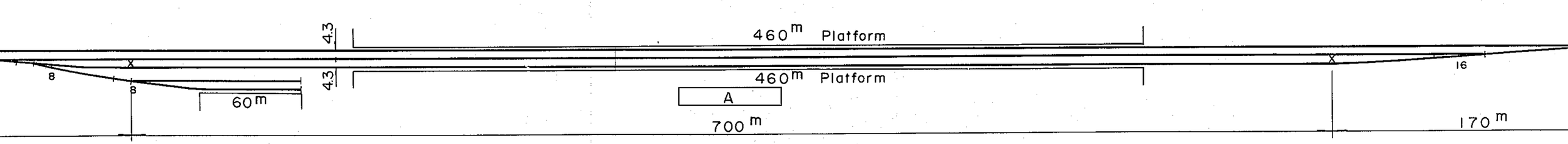
RAILWAY STATION YAR



RAILWAY STATION YARD Ⓐ CLASS (ℓ = 1 600 m)



RAILWAY STATION YARD Ⓑ CLASS (ℓ = 1 360 m)



RAILWAY STATION YARD Ⓒ CLASS (ℓ = 920 m)

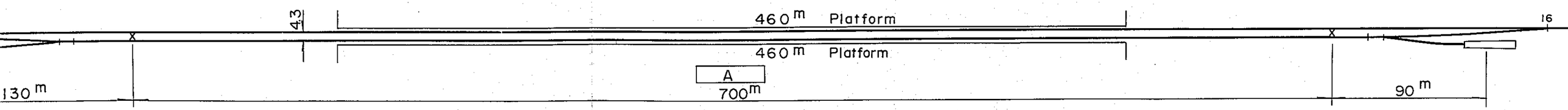
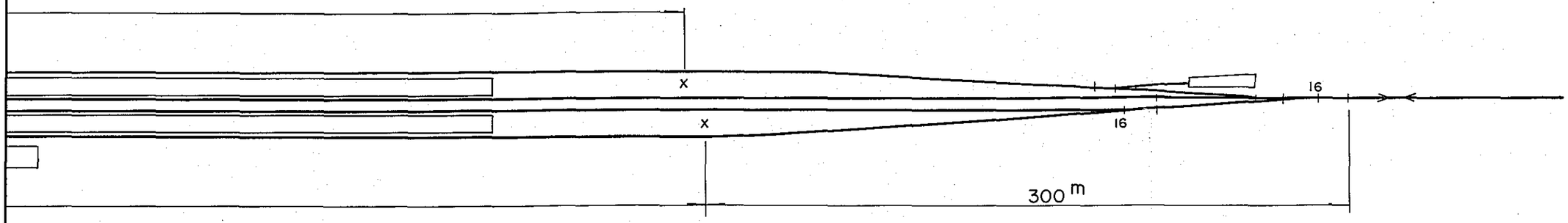
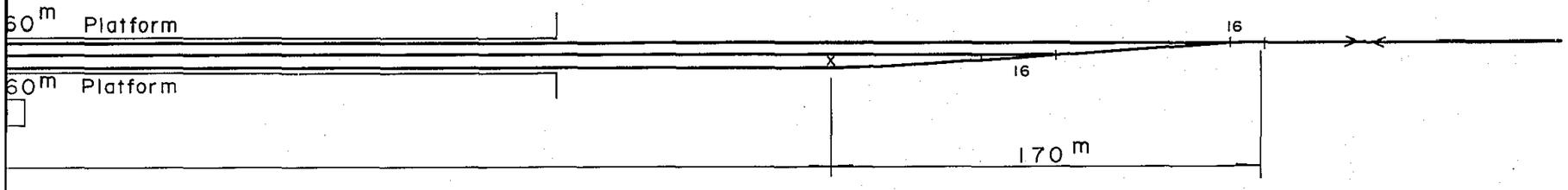


Fig. 4—4

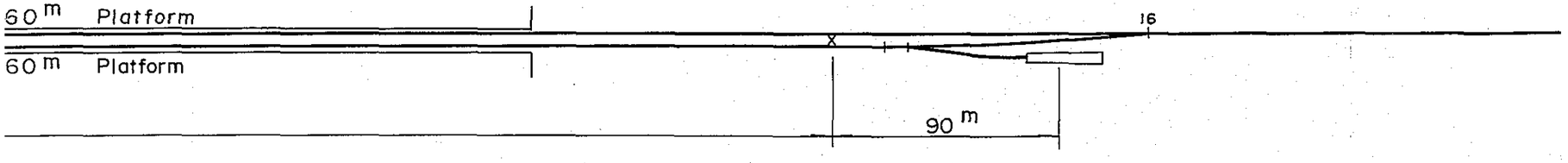
CLASS (ℓ = 1 600 m)



CLASS (ℓ = 1 360 m)



CLASS (ℓ = 920 m)



8. Signalling and Safety Facilities.

So far, the train dispatching has been undertaken at the central dispatching station, while each station has also handled signalling on its own. The dispatching and signalling should however be an inseparable integral whole. Namely, if both are handled at one station by a single dispatcher, the signalling of any desired local station can also be controlled. In this new line, CTC (centralized train control) system will be adopted for the purpose integrating train dispatching and signalling services and thus saving signalling staff in the intermediary stations.

9. Outline of Construction Design Criteria.

Gage	:	Broad (5'6")
Track	:	Single
Curvature	:	1,000 m in minimum radius, R, as standard
Gradient	:	5‰ (1/200) max.(for short section only)
Datum level	:	G.T.S. unit
Top of fill subgrade	:	over 3'00" above H.W.L.
Design load	:	Axial load of 22.5 tons in accordance with "Broad Gage Standard Loadings of 1926"
Train speed	:	Max., 96 km/hr (60 miles/hr) Balance, 54 km/hr (34 miles/hr)
Track structure	:	Rail, 90 lbs./yard (45 kg/m) Sleeper, wooden Ballast base, crushed stone
Station	:	Center-to-center distance between tracks, 14-00. Max. grade, 2.5‰ (1/400) Signal system, CTC in principle Effective line length, 700 m

10. Outline of Track.

Aggregate length	:	128.9 km { Jamuna Bridge and approaches, 15.0 km { Railway Links, 113.9 km
Originating point	:	Center of Salap Station
Terminating point	:	Center of Dacca Station
Number of stations	:	22 (incl. 2 block stations, but excl. 2 connecting stations - Dacca and Salap)
Aggregate length of bridge	:	Jamuna Bridge, 4.750 km Other major bridges, A, 1.352 km Minor bridges, 3.195 km

Station interval	:	6.0 km as standard
Max. height of formation	:	29.54 m (at Jamuna Bridge)
Table of curvatures	:	Refer to Table 4-8.
Table of gradients	:	Refer to Table 4-7.

Table 4-7 GRADIENT ABSTRACT

Length : 128.9 km

Gradient	No. of each	Length	Percentage of total length of line	Longest continuous length of grade	Remarks
		k m	%	k m	
5 ‰ ($\frac{1}{200}$)	5	3,400	2.6	1,100	
3.3‰ ($\frac{1}{300}$)	2	7,025	5.5	3,680	
3 ‰ ($\frac{1}{330}$)	2	1,000	0.8	500	
2.5‰ ($\frac{1}{400}$)	3	4,280	3.3	1,880	
2 ‰ ($\frac{1}{500}$)	7	5,400	4.2	1,200	
1 ‰ ($\frac{1}{1000}$)	2	2,000	1.6	1,000	
LEVEL	20	105,759	82.0	12,000	
TOTAL	41	128,900	100.0	—	
STEEPEST GRADE		5‰ ($\frac{1}{200}$)			

Table 4-8 CURVE ABSTRACT

km
Length : 128.9

Radius of curvature	No. of each	Length	Percentage of total length of line	Longest continuous length of curvature	Remarks
		k m	%	k m	
R = 2,000m	13	12,450	9.67	1,950	
R = 1,500m	1	300	0.23	300	
R = 1,000m	2	1,300	1.01	900	
R = 600m	1	850	0.66	850	Alongside the existing meter gage.
R = 350m	1	550	0.43	550	- do -
Total	18	15,450	12.00	—	

CHAPTER V

IMPLEMENTATION PLAN

1. Outline.

It is not until the Jamuna River Bridge Construction Project is completed that the east and the west of Bangladesh are tied up by communications, trade and culture into unity. Among other bridges, Jamuna Bridge will take the longest construction period. In order to commission the access railway as early as possible after completion of the Bridge, the railway construction work will be promoted in parallel with the construction of the Jamuna Bridge.

What governs the construction period of the Railway Links is the track laying work which requires quantities of heavy materials and supplies such as rails and ballast.

Near each of the connecting stations on the east and west will a logistics base handling such heavy materials and supplies be set (one near Salap St. on the west and one near Tungi St. on the east), and rails and crushed stone and other materials will be sent forward toward Jamuna Bridge from each base while constructing the track.

In order to promote the Jamuna Bridge Construction Project, a huge amount of stone must be collected near each base because it is indispensable for river work, bridge work and base construction work. The stone will be transported from India by rail, and a construction materials railway must be constructed from Salap to the approach on the right of the Jamuna beforehand in order to run stone freighters up to the site.

For this reason, the earthwork, bridging and track laying for the section, 0 km - 8 km 880 m will be completed in an early stage for expediting the supply of materials and equipment to the Jamuna Bridge construction site.

When the Jamuna Bridge work has been completed, this section will be repaired and adjusted for commissioning, and will be connected on Jamuna Bridge to the line extended from the east to complete the line for one-through commissioning.

In the east region, the extension from Jamuna Bridge to Dacca is no less than 100 km. It is therefore imperative to locate logistics based at places (3 to 4 along the route) in order to cut the haulage of huge volumes of ballast materials necessary for track laying. Transportation of materials to bases will be by truck. Assuming that the progress of track laying is 300 m per day on the average, the western region will complete the earthwork and bridge construction work in about a year. In the eastern region, the track laying alone will take some 14 months (106 km).

In order to complete the Railway Links as early as possible, the eastern line will have to complete earthwork, bridging and culvert

work to an extent that the track formation will have been well secured at least before the western line is completed.

To achieve this, it will be mandatory to divide the eastern route into say 8 work sections as shown in the separate work schedule and to enter upon the earth work and bridge construction of each simultaneously. According to this work schedule, the earth work and bridge construction will be completed in 33 months after inauguration, except western route. If the preliminary period for detailed surveying and design is taken into account as necessary before starting construction work, the total construction period will be about 3 years and a half.

The installation work for electrical, telecommunication, signalling, safety and station-oriented facilities which are all necessary for railway operations, as well as trial run will prompted within that period, along with the main civil engineering work.

2. Work Schedule.

Main railway construction work, including earth-moving work, bridge construction, track laying, will follow the schedule shown on a separate sheet. The underlying principles of the construction work are as follows.

(1) Work during rainy season.

The four months from June to September fall upon the rainy season. Both banks, that is, Salap Station (0 km) to around Kalikair (84 km) on the left, will be flooded, inhibiting earth work and bridge substructure construction work. Namely, such work will be started at the end of the rainy season and completed before entering the next raining season.

(2) Earth work and bridge construction work.

Except Jamuna Bridge and its approaches, an example of earth work and bridge construction is shown below. The eastern route is divided into 8 blocks, each block being executed independently in order to complete all the blocks in advance of track laying. Namely, the four blocks east of 70 km point alone will be set about after the end of the rainy season of the 12th year, and at the end of the rainy season of the 13th year the four blocks west of 70 km point will be launched upon.

The earth work and bridge substructure work cannot be made in the flooded areas in the rainy season, but the superstructure work (PC girder erection) will be pushed forward even during rainy season.

(3) Track laying work.

The logistics bases near Salap Station and Azampur Station must keep in stock track laying materials, rails, sleepers and crushed stone transported by freighters by the existing rail during the period of earth work and bridge construction work.

Also, the points 45 km, 60 km and 85 km, will have ballast collectint bases to which ballast will be transported by trucks except during rainy season in order to supply required amount of ballast during track

laying work. The track laying will progress at a rate of 300 m per day on the average for the ordinary section. In the Jamuna Bridge section, however, the sleeper installation will take much more time than in other places, and if the daily progress is set at 80 m, the Jamuna Bridge section alone will take something like 2 months. For othe bridges, the same rate of progress as with the ordinary section will be achieved as they are of the ballasted type to be constructed on PC girders or iron-reinforced concrete girders.

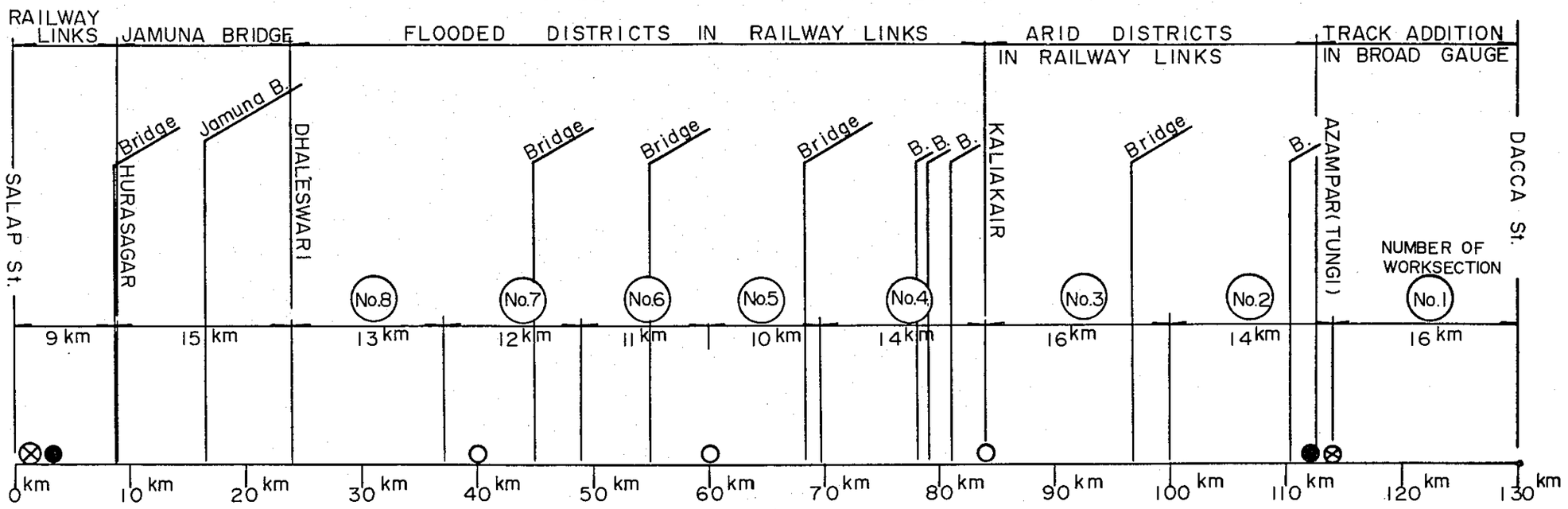
(4) Work for ancillary facilities necessary for railway operations.

Ancillary facilities installation work for each station, including station layout, platform, water supply, bunkerage, station building, accommodation facilities, machine shop for maintenance, lighting, power, telecommunications, signalling and safety equipment, will be carried out along with the principal track laying work, and will be completed in time with the completion of the track. After completion of the railway track, 1 to 2 months of period will be spared for the track maintenance which is to be continued until the commissioning operation is started, as well as for the trial run.

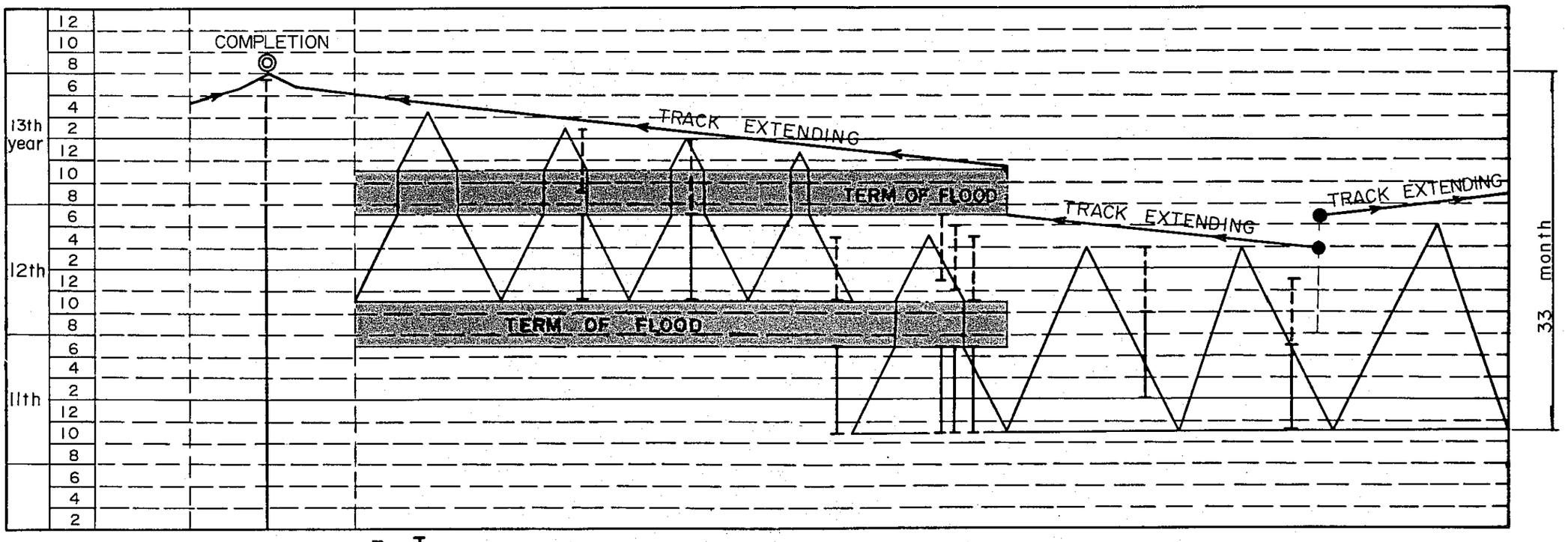
TIME SCHEDULE OF RAILWAY LINKS

CLASSIFICATION OF CONSTRUCTION	From 1st year to 10th year	11th year						12th year						13th year										REMARKS
		2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	2	4	6	8	10	12	
CONSTRUCTION OF JAMUNA RIVER BRIDGE																										JAMUNA BRIDGE
RAILWAY CONSTRUCTION																										RAILWAY LINKS
ITEMS FIELD SURVEY & DESIGN																										
EARTH WORK	H																									
BRIDGE	H																									
TRACK	H																									
POWER SUPPLY TELECOMMUNICATION & SIGNALLING																										
STATION & YARD																										
TEST RUNNING																										

TIME SCHEDULE OF RAILWAY LINKS



※ NOTES



REMAKS

TRACK 300 m/day — SUPERSTRUCTURE

EARTH WORK OR OTHERS — SUBSTRUCTURE

● STORAGE OF TRACK MATERIAL

⊗ STORAGE OF BALLAST FROM TRAIN

○ STORAGE OF BALLAST FROM TRUCK

※ NOTES : Constructions of earth work , bridges, and track extension in this section must be completed by the end of 4th. year in order to use a transportation of materials for Jamuna Bridge construction.

CHAPTER VI

CONSTRUCTION COST

1. Rough Estimate of Construction Cost.

   1) Name : Railway Links, Sirajganj Route

   2) Coverage : Salap Station - Dacca Station

   3) Aggregate length : 113.9 km

   4) Principal calling places : Jamuna Bridge, Tangail, Mirzapur, Azampur

   5) Construction cost :

1 US$ = 13 Tk

Total construction cost	Cost per km
686,610,000 Tk	6,028,000 Tk

   6) Foreign currency required:

Total, Taka	Domestic currency		Foreign currency	
	%	Taka	%	US$
686,610,000	62	423,516,000	38	20,238,000

Note: The net aggregate length of the extension between Salap and Dacca is 138.9 km, but the 15 km section of Jamuna Bridge and its approaches is excluded. The railway construction cost for this section is posted as an account for the bridge section. See relevant text.

ROUGH ESTIMATE OF CONSTRUCTION COST

Broad-Gage, Single-Track
Coverage : Salap-Dacca, 113.9 km in aggregate length

	DESCRIPTION	UNIT	Q'TY	UNIT PRICE	AMOUNT	REMARKS
				Tk	Tk	
1	Preliminary Expenses	km	113.9	750	85,425	
2	Land	$10^3 \times m^2$	7,356	8,160	60,024,960	incl. compensation for relocation of existing housing, ect.
3	Formation	$10^3 \times m^3$	7,747	10,640	82,428,080	covering up to finish
4	Bridge (A)	m	1,352	50,050	67,667,600	more than 100m in aggregate length
5	Bridge (B)	m	3,195	46,550	148,727,250	bridges other than above
6	Permanent way (Main Line)	km	113.9	1,026,000	116,861,400	incl. ballast, staff, etc.
7	Permanent way (Sidings)	km	37.3	1,038,000	38,717,400	incl. ballast, switches, etc.
8	Station & Buildings	nos	22	2,200,000	48,400,000	incl. station building, operations facilities, works, and accommodations.
9	Electric Lighting Power & Telecommunication	km	113.9	300,000	34,170,000	
10	Signalling	km	113.9	556,000	63,328,400	CTC facilities
11	Equipment	km	113.9	30,000	3,417,000	incl. equipment for maintenance
12	General Charges	km	113.9	200,000	22,780,000	incl. remunerations for managerial staff, etc.
	Total				686,607,515	≒ 686,610,000

6,028,000 Tk per km

BREAKDOWN OF FOREIGN AND DOMESTIC CURRENCIES REQUIRED

1 US$ = 13 Taka

	DESCRIPTION	UNIT	UNIT PRICE Taka	DOMESTIC CURRENCY %	DOMESTIC CURRENCY Taka	FOREIGN CURRENCY %	FOREIGN CURRENCY US$	MATERIALS REQUIRING FOREIGN CURRENCIES
1	Preliminary Expenses	km	750	100	750	-	-	
2	Land	$10^3 \times m^2$	8,160	100	8,160	-	-	
3	Formation	$10^3 \times m^3$	10,640	100	10,640	-	-	
4	Bridge (A)	m	50,050	49	24,417	51	1,972	
5	Bridge (B)	m	46,550	49	22,708	51	1,834	
6	Permanent way (Main Line)	km	1,026,000	38	390,000	62	48,923	Rails, appendages, and sleepers
7	Permanent way (Sidings)	km	1,038,000	39	405,000	61	48,692	Rails, appendages, points, sleepers
8	Station & Buildings	nos	2,200,000	90	1,980,000	10	16,923	
9	Electric Lighting Power & Telecommunication	km	300,000	70	210,000	30	6,923	
10	Signalling	km	556,000	35	195,000	65	27,769	Cables, C.T.C.facilities
11	Equipment	km	30,000	100	30,000	-	-	
12	General Charges	km	200,000	100	200,000	-	-	

BREAKDOWN OF CONSTRUCTION COST
BETWEEN DOMESTIC AND FOREIGN CURRENCIES

1 US$ = 13 Taka

	DESCRIPTION	UNIT	Q'TY	DOMESTIC CURRENCY (Taka)		FOREIGN CURRENCY (US$)	
				UNIT PRICE	AMOUNT	UNIT PRICE	AMOUNT
1	Preliminary Expenses	km	113.9	750	85,425	-	-
2	Land	$10^3 \times m^2$	7,356	8,160	60,024,960	-	-
3	Formation	$10^3 \times m^3$	7,747	10,640	82,428,080	-	-
4	Bridge (A)	m	1,352	24,417	33,011,784	1,972	2,666,144
5	Bridge (B)	m	3,195	22,708	72,552,060	1,834	5,859,630
6	Permanent way (Main Line)	km	113.9	390,000	44,421,000	48,923	5.572,330
7	Permanent way (Sidings)	km	37.3	405,000	15,106,500	48,692	1,816,212
8	Station & Buildings	nos	22	1,980,000	43,560,000	16,923	372,306
9	Electric Lighting Power & Tele-communication	km	113.9	210,000	23,919,000	6,923	788,530
10	Signalling	km	113.9	195,000	22,210,500	27,769	3,162,889
11	Equipment	km	113.9	30,000	3,417,000	-	-
12	General Charges	km	113.9	200,000	22,780,000	-	-
	Total				423,516,309		20,238,041

YEARLY OUTLAY TABLE OF DOMESTIC AND
FOREIGN CURRENCIES FOR CONSTRUCTION WORK

1US$ = 13 Tk

Year	Domestic currency		Foreign currency		Total	
	Amount (Tk)	%	Amount US$	%	Amount (Tk)	%
1st	-		-		-	
2nd	-		-		-	
3rd	27,138,000	6.4	1,284,000	6.3	43,830,000	6.4
4th	-		-		-	
5th	-		-		-	
6th	-		-		-	
7th	-		-		-	
8th	-		-		-	
9th	-		-		-	
10th	-		-		-	
11th	33,043,000	7.6	-		33,043,000	4.8
12th	133,420,000	31.5	4,890,000	24.2	196,990,000	28.6
13th	94,553,000	22.5	5,344,000	26.4	164,025,000	24.0
14th	135.362,000	32.0	8,720,000	43.1	248,722,000	36.2
Total	423,516,000	100	20,238,000	100	686,610,000	100

YEARLY OUTLAY TABLE OF DOMESTIC AND
FOREIGN CURRENCIES FOR CONSTRUCTION WORK (EXCL. TAXES)

1US$ = 13 Tk

Year	Domestic currency		Foreign currency		Total	
	Amount (Tk)	%	Amount (US$)	%	Amount (Tk)	%
1st	-		-		-	
2nd	-		-		-	
3rd	26,505,000	6.4	1,170,000	6.4	41,715,000	6.4
4th	-		-		-	
5th	-		-		-	
6th	-		-		-	
7th	-		-		-	
8th	-		-		-	
9th	-		-		-	
10th	-		-		-	
11th	32,924,000	8.0	-		32,924,000	5.1
12th	130,153,000	31.6	4,890,000	26.7	193,731,000	29.8
13th	91,998,000	22.3	4,674,000	25.5	152,757,000	23.5
14th	130,630,000	31.7	7,562,000	41.4	228,929,000	35.2
Total	412,210,000	100	18,296,000	100	650,057,000	100

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION WO

	CATEGORY	UNIT	TOTAL QUANTITY	FINANCIAL COST		2RD YEAR				10TH YEAR				11TH YEAR				1	
				DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY
1	Preliminary Expenses	km	113.9	750	-	7.8	8.9	6,675	-	92.2	105.0	78,750	-	-	-	-	-	-	-
2	Land	10^3m^2	7,356.0	8,160	-	7.8	574.0	4,683,840	-	53	3,900	31,824,000	-	39.2	2,882	23,517,120	-	-	-
3	Formation	10^3m^3	7,747.0	10,640	-	7.8	604.0	6,426,560	-	-	-	-	-	53	4,106	43,687,840	-	39.2	3,037
4	Bridge (A)	m	1,352	24,417	1,972	7.5	100	2,441,700	197,200	-	-	-	-	73	992	24,221,664	1,956,224	19.5	260
5	Bridge (B)	m	3,195	22,708	1,834	11.1	355	8,061,340	651,070	-	-	-	-	50	1,600	36,332,800	2,934,400	38.9	1,240
6	Track (Main line)	km	113.9	390,000	48,923	7.8	8.9	3,471,000	435,415	-	-	-	-	-	-	-	-	39.5	45.0
7	Track (Siding)	km	37.3	405,000	48,692	-	-	-	-	-	-	-	-	-	-	-	-	20	7.3
8	Station and buildings	site	22	1,980,000	16,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Lighting, power & tele-communication	km	113.9	210,000	6,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Signalling and safety gears	km	113.9	195,000	27,769	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Equipment	km	113.9	30,000	-	7.8	8.9	267,000	-	-	-	-	-	32.2	36.7	1,101,000	-	30	34.2
12	General Charges	km	113.9	200,000	-	7.8	8.9	1,780,000	-	5	5.7	1,140,000	-	20	22.8	4,560,000	-	27.2	31.0
	Total							Tk 27,138,115	$ 1,283,685			Tk 33,042,750	-			Tk 133,420,424	$ 4,890,624		94
	Percentage of outlay %							6.4	6.3			7.6	0			31.5	24.2		
								6.4				4.8				28.6			

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION WORK

	10TH YEAR				11TH YEAR				12TH YEAR				13TH YEAR				TOTAL			
¥T	%	Q'TY	AMOUNT		%	Q'TY	AMOUNT		%	Q'TY	AMOUNT		%	Q'TY	AMOUNT		%	Q'TY	AMOUNT	
FOREIGN CURRENCY $			DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $			DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $			DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $			DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $			DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $
-	92.2	105.0	78,750	-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	85,425	-
-	53	3,900	31,824,000	-	39.2	2,882	23,517,120	-	-	-	-	-	-	-	-	-	100	7,356	60,024,960	-
-	-	-	-	-	53	4,106	43,687,840	-	39.2	3,037	32,313,680	-	-	-	-	-	100	7,747	82,428,080	-
197,200	-	-	-	-	73	992	24,221,664	1,956,224	19.5	260	6,348,420	512,720	-	-	-	-	100	1,352	33,011,784	2,666,144
651,070	-	-	-	-	50	1,600	36,332,800	2,934,400	38.9	1,240	28,157,920	2,274,160	-	-	-	-	100	3,195	72,552,060	5,859,630
435,415	-	-	-	-	-	-	-	-	39.5	45.0	17,550,000	2,201,535	52.7	60.0	23,400,000	2,935,380	100	113.9	44,421,000	5,572,330
-	-	-	-	-	-	-	-	-	20	7.3	2,956,500	355,452	80	30.0	12,150,000	1,460,760	100	37.3	15,106,500	1,816,212
-	-	-	-	-	-	-	-	-	-	-	-	-	100	22	43,560,000	372,306	100	22	43,560,000	372,306
-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	23,919,000	788,530	100	113.9	23,919,000	788,530
-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	22,210,000	3,162,889	100	113.9	22,210,500	3,162,889
-	-	-	-	-	32.2	36.7	1,101,000	-	30	34.2	1,026,000	-	30	34.1	1,023,000	-	100	113.9	3,417,000	-
-	5	5.7	1,140,000	-	20	22.8	4,560,000	-	27.2	31.0	6,200,000	-	40	45.5	9,100,000	-	100	113.9	22,780,000	-
$ 1,283,685			Tk 33,042,750	-			Tk 133,420,424	$ 4,890,624			Tk 94,552,520	$ 5,343,867			Tk 135,362,000	$ 8,719,865			Tk 423,516,309	$ 20,238,041 (263,094,533) T.K
6.3			7.6	0			31.5	24.2			22.5	26.4			32.0	43.1			686,610,842 T.K	
4			4.8				28.6				24.0				36.2				100%	100%

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION WORK (EXCL. TAXES)

	CATEGORY	UNIT	TOTAL QUANTITY	UNIT PRICE EXCL. TAXES		2RD YEAR				10TH YEAR				11TH YEAR				12TH YEAR			
				DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT FOREIGN CURRENCY $	%	Q'TY	AMOUNT DOMESTIC CURRENCY Tk	AMOUNT F C
1	Preliminary Expenses	km	113.9	705	-	7.8	8.9	6,275	-	92.2	105	74,025	-	-	-	-	-	-	-	-	
2	Land	10^3m^2	7,356.0	8,160	-	7.8	574.0	4,683,840	-	53	3,900	31,824,000	-	39.2	2,882	23,517,120	-	-	-	-	
3	Formation	10^3m^3	7,747.0	10,258	-	7.8	604.0	6,195,832	-	-	-	-	-	53	4,106	42,119,348	-	39.2	3,037	31,153,546	
4	Bridge (A)	m	1,352	23,914	1,972	7.5	100	2,391,400	197,200	-	-	-	-	73	902	23,722,688	1,956,224	19.5	260	6,217,640	
5	Bridge (B)	m	3,195	22,243	1,834	11.1	355	7,896,265	651,070	-	-	-	-	50	1,600	35,588,800	2,934,400	38.9	1,240	27,581,320	2,
6	Track (Main line)	km	113.9	389,000	36,154	7.8	8.9	3,462,100	321,771	-	-	-	-	-	-	-	-	39.5	45.0	17,505,000	1,
7	Track (Siding)	km	37.3	402,000	35,615	-	-	-	-	-	-	-	-	-	-	-	-	20	7.3	2,934,600	
8	Station and buildings	site	22	1,925,000	16,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
9	Lighting, power & tele-communication	km	113.9	199,500	6,923	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10	Signalling and safety	km	113.9	183,880	27,769	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
11	Equipment	km	113.9	30,000	-	7.8	8.9	267,000	-	-	-	-	-	32.2	36.7	1,101,000	-	30	34.2	1,026,000	
12	General Charges	km	113.9	180,000	-	7.8	8.9	1,602,000	-	5	5.7	1,026,000	-	20	22.8	4,104,000	-	27.2	31.0	5,580,000	
	Total							26,504,712	1,170,041			32,924,025	-			130,152,056	4,890,624			91,998,106	4,
	Percentage of outlay %							6.4	6.4			8.0				31.6	26.7			22.3	
								6.4				5.0				29.8				23.5	

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION WORK (EXCL. TAXES)

D YEAR		10TH YEAR				11TH YEAR				12TH YEAR				13TH YEAR				TOTAL			
AMOUNT				AMOUNT				AMOUNT				AMOUNT				AMOUNT				AMOUNT	
OMESTIC URRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $	%	Q'TY	DOMESTIC CURRENCY Tk	FOREIGN CURRENCY $
6,275	-	92.2	105	74,025	-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	80,300	-
,683,840	-	53	3,900	31,824,000	-	39.2	2,882	23,517,120	-	-	-	-	-	-	-	-	-	100	7,356	60,024,960	-
,195,832	-	-	-	-	-	53	4,106	42,119,348	-	39.2	3,037	31,153,546	-	-	-	-	-	100	7,747	79,468,726	-
,391,400	197,200	-	-	-	-	73	902	23,722,688	1,956,224	19.5	260	6,217,640	512,720	-	-	-	-	100	1,352	32,331,728	2,666,144
,896,265	651,070	-	-	-	-	50	1,600	35,588,800	2,934,400	38.9	1,240	27,581,320	2,274,160	-	-	-	-	100	3,195	71,066,385	5,859,630
,462,100	321,771	-	-	-	-	-	-	-	-	39.5	45.0	17,505,000	1,626,930	52.7	60.0	23,340,000	2,169,240	100	113.9	44,307,100	4,117,941
-	-	-	-	-	-	-	-	-	-	20	7.3	2,934,600	259,990	80	30.0	12,060,000	1,068,450	100	37.3	14,994,600	1,328,440
-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	22	42,350,000	372,306	100	22	42,350,000	372,306
-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	22,723,050	788,530	100	113.9	22,723,050	788,530
-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	20,943,932	3,162,889	100	113.9	20,943,932	3,162,889
267,000	-	-	-	-	-	32.2	36.7	1,101,000	-	30	34.2	1,026,000	-	30	34.1	1,023,000	-	100	113.9	3,417,000	-
,602,000	-	5	5.7	1,026,000	-	20	22.8	4,104,000	-	27.2	31.0	5,580,000	-	40	45.5	8,190,000	-	100	113.9	20,502,000	-
,504,712	1,170,041			32,924,025	-			130,152,056	4,890,624			91,998,106	4,673,800			130,629,982	7,561,415			412,209,781	18,295,880
6.4	6.4			8.0				31.6	26.7			22.3	25.5			31.7	41.4			100%	100%
6.4				5.0				29.8				23.5				35.3				100%	

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION

	CATEGORY	UNIT	TOTAL QUANTITY	UNIT PRICE (Tk) INCL. TAXES	UNIT PRICE (Tk) EXCL. TAXES	2RD YEAR %	2RD YEAR Q'TY	2RD YEAR AMOUNT (Tk) INCL. TAXES	2RD YEAR AMOUNT (Tk) EXCL. TAXES	10TH YEAR %	10TH YEAR Q'TY	10TH YEAR AMOUNT (Tk) INCL. TAXES	10TH YEAR AMOUNT (Tk) EXCL. TAXES	11TH YEAR %	11TH YEAR Q'TY	11TH YEAR AMOUNT (Tk) INCL. TAXES	11TH YEAR AMOUNT (Tk) EXCL. TAXES	1 %	1 Q'TY
1	Preliminary Expenses	km	113.9	750	705	7.8	8.9	6,675	6,275	92.2	105.0	78,750	74,027	-	-	-	-	-	-
2	Land	10^3m^2	7,356.0	8,160	8,160	7.8	574.0	4,683,840	4,683,840	53	3,900	31,824,000	31,824,000	39.2	2,882	23,517,120	23,517,120	-	-
3	Formation	10^3m^3	7,747.0	10,640	10,258	7.8	604.0	6,426,560	6,195,832	-	-	-	-	53	4,106	43,687,840	42,119,348	39.2	3,037
4	Bridge (A)	m	1,352	50,050	49,550	7.5	100	5,005,000	4,955,000	-	-	-	-	73	992	49,649,600	49,153,600	19.5	260
5	Bridge (B)	m	3,195	46,550	46,085	11.1	355	16,525,250	16,360,175	-	-	-	-	50	1,600	74,480,000	73,736,000	38.9	1,240
6	Track (Main line)	km	113.9	1,026,000	859,000	7.8	8.9	9,131,400	7,645,100	-	-	-	-	-	-	-	-	39.5	45.0
7	Track (Siding)	km	37.3	1,038,000	865,000	-	-	-	-	-	-	-	-	-	-	-	-	20	7.3
8	Station and buildings	site	22	2,200,000	2,145,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Lighting, power & tele-communication	km	113.9	300,000	289,500	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Signalling and safety gears	km	113.9	556,000	544,880	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Equipment	km	113.9	30,000	30,000	7.8	8.9	267,000	267,000	-	-	-	-	32.2	36.7	1,101,000	1,101,000	30	34.2
12	General Charges	km	113.9	200,000	180,000	7.8	8.9	1,780,000	1,602,000	5	5.7	1,140,000	1,026,000	20	22.8	4,560,000	4,104,000	27.2	31.0
	Total							43,825,725	41,715,222			33,042,750	32,924,025			196,995,560	193,731,068		1
	Percentage of outlay %							6.4	6.4			4.8	5.1			28.6	29.8		

BREAKDOWN OF ANNUAL OUTLAY OF DOMESTIC AND FOREIGN CURRENCIES FOR CONSTRUCTION WORK

T (Tk)	10TH YEAR				11TH YEAR				12TH YEAR				13TH YEAR				TOTAL			
			AMOUNT (Tk)				AMOUNT (Tk)				AMOUNT (Tk)				AMOUNT (Tk)				AMOUNT (Tk)	
EXCL. TAXES	%	Q'TY	INCL. TAXES	EXCL. TAXES	%	Q'TY	INCL. TAXES	EXCL. TAXES	%	Q'TY	INCL. TAXES	EXCL. TAXES	%	Q'TY	INCL. TAXES	EXCL. TAXES	%	Q'TY	INCL. TAXES	EXCL. TAXES
6,275	92.2	105.0	78,750	74,027	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	85,425	80,300
4,683,840	53	3,900	31,824,000	31,824,000	39.2	2,882	23,517,120	23,517,120	-	-	-	-	-	-	-	-	100	7,356	60,024,960	60,024,960
6,195,832	-	-	-	-	53	4,106	43,687,840	42,119,348	39.2	3,037	32,313,680	31,153,546	-	-	-	-	100	7,747	82,428,080	79,468,726
4,955,000	-	-	-	-	73	992	49,649,600	49,153,600	19.5	260	13,013,000	12,883,000	-	-	-	-	100	1,352	67,667,600	66,991,600
16,360,175	-	-	-	-	50	1,600	74,480,000	73,736,000	38.9	1,240	57,722,000	57,145,400	-	-	-	-	100	3,195	148,727,250	147,241,575
7,645,100	-	-	-	-	-	-	-	-	39.5	45.0	46,170,000	38,655,000	52.7	60.0	61,560,000	51,540,000	100	113.9	116,861,400	97,840,100
-	-	-	-	-	-	-	-	-	20	7.3	7,577,400	6,314,500	80	30.0	31,140,000	25,950,000	100	37.3	38,717,400	32,264,500
-	-	-	-	-	-	-	-	-	-	-	-	-	100	22	48,400,000	47,190,000	100	22	48,400,000	47,190,000
-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	34,170,000	32,974,050	100	113.9	34,170,000	32,974,050
-	-	-	-	-	-	-	-	-	-	-	-	-	100	113.9	63,328,400	62,061,832	100	113.9	63,328,400	62,061,832
267,000	-	-	-	-	32.2	36.7	1,101,000	1,101,000	30	34.2	1,026,000	1,026,000	30	34.1	1,023,000	1,023,000	100	113.9	3,417,000	3,417,000
1,602,000	5	5.7	1,140,000	1,026,000	20	22.8	4,560,000	4,104,000	27.2	31.0	6,200,000	5,580,000	40	45.5	9,100,000	8,190,000	100	113.9	22,780,000	20,502,000
41,715,222			33,042,750	32,924,025			196,995,560	193,731,068			164,022,080	152,757,446			248,721,400	228,928,882			686,607,515	550,056,643
6.4			4.8	5.1			28.6	29.8			24.0	23.5			36.2	35.2			100	100

LIST OF STATION EQUIPMENT AND APPURTENANCES

Category	A 2 stations	B 6 stations	C 14 stations	Total 22 stations
Siding	4,290m × 2	2,560 × 6	955 × 14	
	8,580m	15,360m	13,370m	37,310m
Switch 16#	2 sets × 2	2 sets × 6	1 set × 14	
	4	12	14	30 sets
Switch 12#	5 sets × 2	3 sets × 6	1 set × 14	
	10	18	14	42 sets
Switch 8#	3 sets × 2	2 sets × 6	1 set × 14	
	6	12	14	32 sets
Complete set of station ancillary facilities	Tk 5,000,000 × 2	Tk 2,300,000 × 6	Tk 1,800,000 × 14	
	10,000,000	13,800,000	25,200,000	Tk 49,000,000
				49,000,000 ÷ 22
			Cost per station	= 2,200,000

2. Maintenance Cost.

The Annual Railway Links Maintenance Cost

Class	Unit	Extension of Railway	The annual maintenance cost (per Km)	Total Amount	Description
Maintenance Cost (incl. Tax)	Km	128.9	Tk 104,000	Tk 13,405,600	
ITEM					
Earthwork			7,904		Labour cost, materials & maintenance tool cost
Bridge			4,472		ditto
Track			61,776		Labour cost, rail, sleeper, make-up ballast & maintenance tool cost
Station and buildings			6,240		Labour cost and materials
Power and telecommunications			6,968		ditto
Signalling and safety gears			14,144		ditto
Administrative			2,496		Others
Total			104,000		

Maintenance Cost (except Tax)	Km	128.9	Tk 90,638	Tk 11,683,238	
ITEM					
Earthwork			7,412		
Bridge			4,283		
Track			51,412		Rail 40 % tax Sleeper 25 % tax
Station and buildings			5,956		
Power and telecommunications			6,590		
Signalling and safety gears			12,716		
Administrative			2,269		
Total			90,638		

Classification of Local Currency and Foreign Currency

Class		Annual maintenance cost as extension 128.9 Km	Annual maintenance cost per 1 Km	Classification	
				Local currency	Foreing currency
		Tk		Tk	US$
Maintenance Cost	A.	13,405,600		10,024,037	260,120
	B.	11,683,238		8,301,676	260,120
ITEM					
Earthwork	A.		7,904	7,904	0
	B.		7,412	7,412	0
Bridge	A.		4,472	4,472	0
	B.		4,283	4,283	0
Track	A.		61,776	37,778	1,846
	B.		51,472	27,418	1,846
Station and buildings	A.		6,240	6,240	0
	B.		5,956	5,956	0
Power and tele-communications	A.		6,968	6,968	0
	B.		6,590	6,590	0
Signalling and safety gears	A.		14,144	11,908	172
	B		12,716	10,476	172
Administrative	A.		2,496	2,496	0
	B.		2,269	2,269	0
Total	A.		104,000	77,766	2,018
	B.		90,638	64,404	2,018

Note: A. include tax

B. except tax

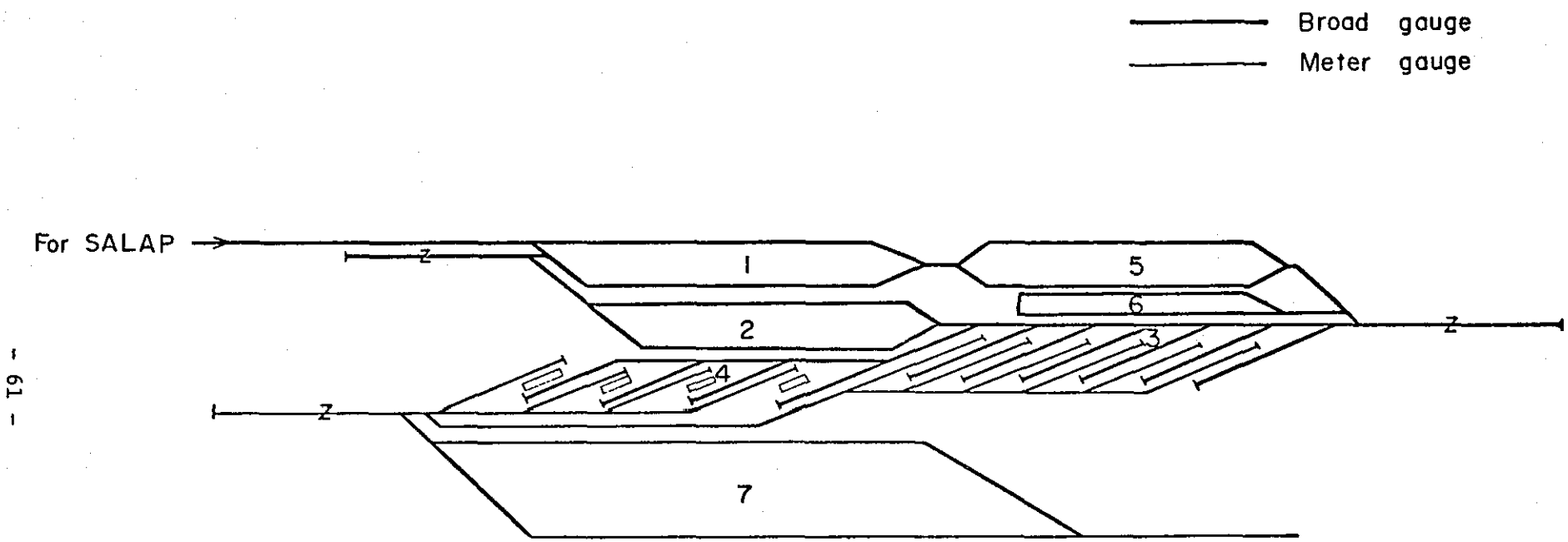
CHAPTER VII

CARGO TRANSSHIPPING YARD AS AN INTERFACE BETWEEN BROAD AND METER GAGE TRACKS

The new line to cross Jamuna River Bridge is to run on a broad gage track from Salap Station on the existing line on the right of the Jamuna River all the way to Dacca. In Dacca, it is to be joined to the existing meter gage track. Accordingly, it is necessary to install a cargo transshipping yard as an interface between broad and meter gage tracks.

In Bangladesh now, there is Santahar Yard to the right of the Jamuna for interfacing the broad and meter gages. The new interfacing yard will be of the same type. Its schematic diagram is shown in Fig. 7-1. It shows a rough idea only, and the detailed track layout and number of lanes are omitted. It will be modified to meet specific conditions of the site. The yard will not be of the automatic type.

Fig.7-1 SKELETON OF TRANSSHIPPING YARD



1 : Arriving & deperting track group,
2 : Sorting track group.
3 : Transshipping track group in open air.
4 Transshipping track group under shed.
5 : Composing track group
6 : Storage track group
7 : Existing marshalling yard of meter gauge
Z : Turn-out track

APPENDICES

APPENDIX A

RECORD OF DISCUSSION

AT

TOKYO MEETING

FOR

JAMUNA BRIDGE PROJECT, BANGLADESH

PART VI: RAILWAY

SEPTEMBER, 1974

1. Route Location.

B: Generally agreed. However, during the succeeding step it shall be studied for river crossing, embankment over low laying marshy lands, blockade of water way, highest flood level, connecting places of commercial importance, etc.

J: Due attention will be paid.

B: The reduction of the number of transshipment yards at way side place will be desirable from the point of view of rail operational efficiency.

A uniform gage track line from the west through to Dacca will be wished to be maintained.

For this purpose the existing meter gage line will have to be widened to broad gage if one of sites No. 1 and 2 is decided. All railway lines are to be taken to Dacca which is a terminal station.

J: Due consideration will be given to the transshipment facilities when the final route is decided, together with the volume of transportation and the improvement plans of the existing rail lines.

2. Double Track.

B: The cross-sectional space for the future provision of double track from proposed single track shall be kept.

J: The traffic study has been and will be conducted.

With the results of the study, double track plan will carefully be elaborated, taking into consideration distances between station, required daily carrying capacity of the line, etc. If the traffic study results reveal the necessity of double track in later years the possibility of a double track in later years the possibility of a double track bridge which requires a huge amount of construction cost, will be fully considered in connection with the bridge structure.

B. Traffic will be projected for long future and provision will be kept in foundation and substructure of the bridge for putting in double track in the super-structure in some future days if economic study and traffic operation justify it.

J: Full consideration will be given.

3. Gradient of Bridge Access.

B. The gradient 1 in 200 shall be flattened from the point of the train motive power. One in 300 or 400 is desirable.

J: Generally accepted. However, we will study more about this with the distance between stations and the location of station, etc.

4. Provision for Railway Study.

B: Second stage, study of access railway line may be conducted according to provision of Code of Practice for Engineering Department of Bangladesh Railway.

J: Agreed.

5. Structures and Earthwork.

B: For embankment on Railway links, soil test, spillway bridges, flood openings, freeboard over normal flood level, etc. should have some considerations as those for road links.

In case of a future double track, provision should be kept for borrow pits on one side only.

J: Agreed.

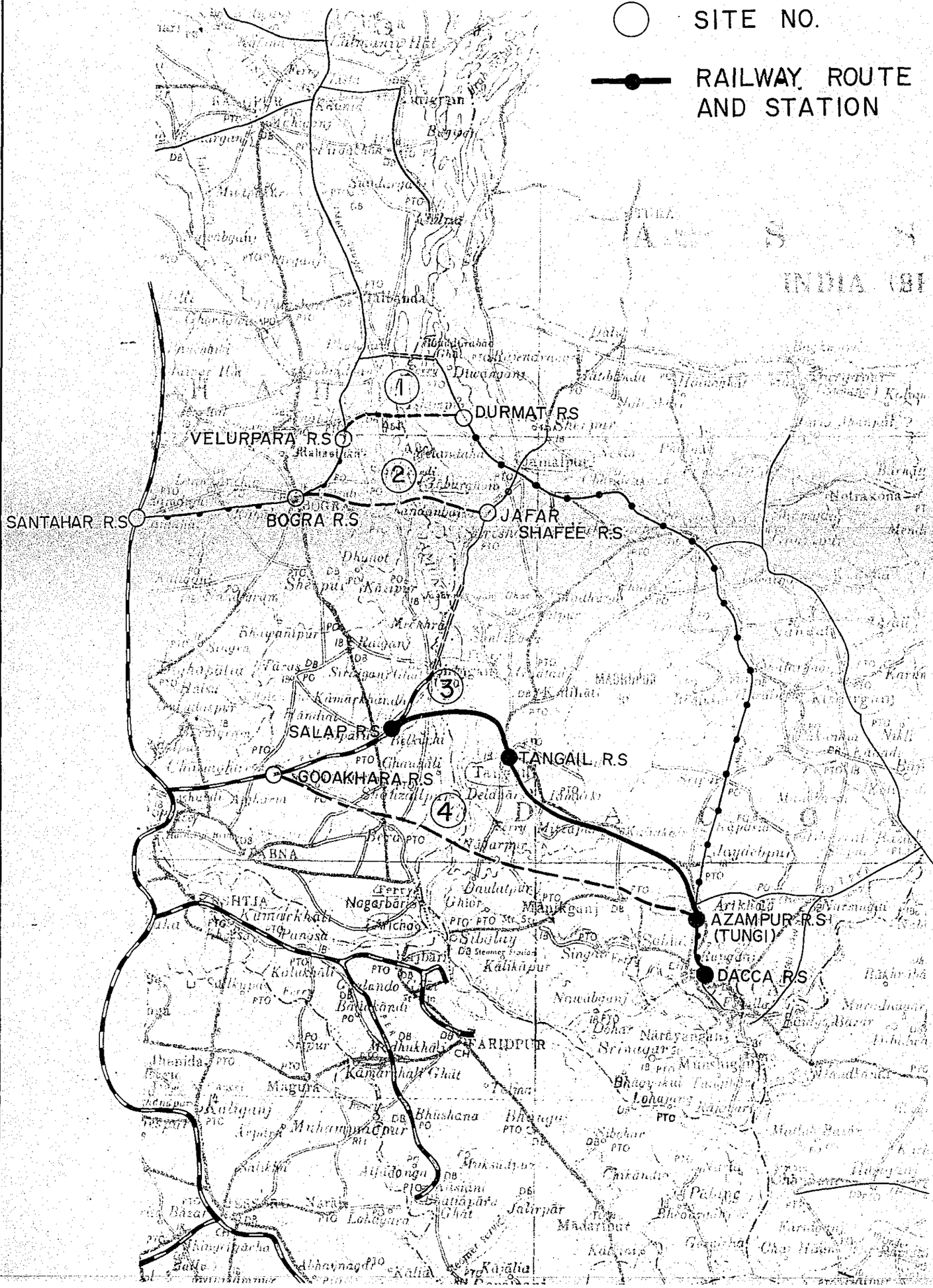
APPENDIX B

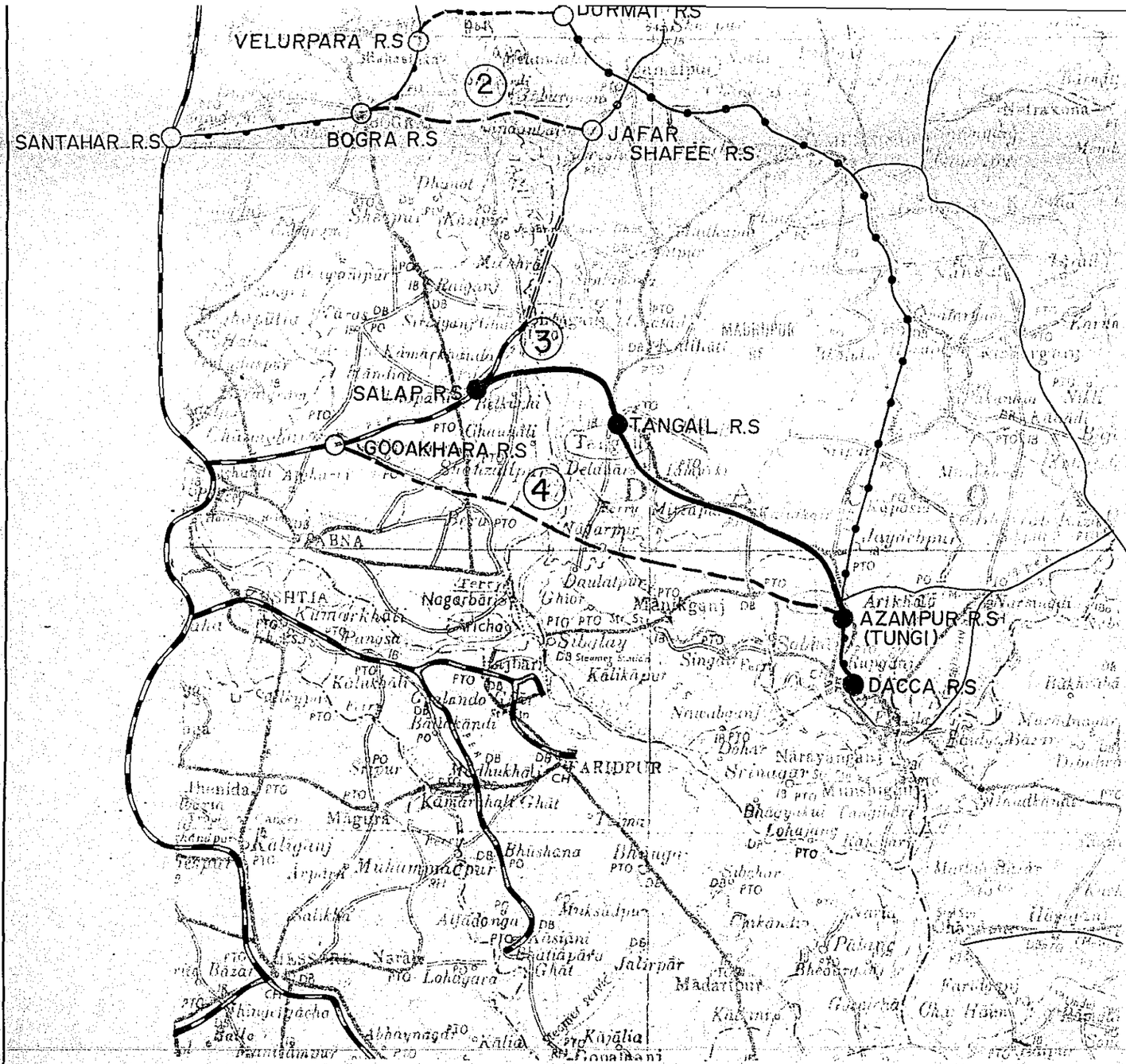
GENERAL PLAN OF RAILWAY LINKS

(Figure)

BANGLADESH

SHOWING COMMUNICATIONS





1967

Scale 1:1,000,000 (1 Inch to 15.783 miles)

Miles to 0 10 20 30 40 50 60 70 80 90 Miles

Kilometres to 5 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 Kilometres

PEOPLE'S REPUBLIC BANGLADESH	
JAMUNA RIVER BRIDGE PROJECT	
VOLUME IV RAILWAY LINKS	
GENERAL PLAN OF RAILWAY LINKS	
JAPAN INTERNATIONAL COOPERATION AGENCY	
PACIFIC CONSULTANTS INTERNATIONAL	
Scale 1/1 000 000	Date
Drawn	
Approved	DRW. NO.

1 — RAILWAY LINKS FOR SIRAJGANJ SITE.

2 — NEW BROAD GAUGE LINE ALONGSIDE THE EXISTING METER GAUGE.

3 — ANOTHER PROPOSED ROUTE.

4 — GUAGE WIDENING INTO BROAD GAUGE.

5 — NEW BROAD GAUGE LINE ALONGSIDE THE EXISTING METER GAUGE IN PROPOSED ROUTE.

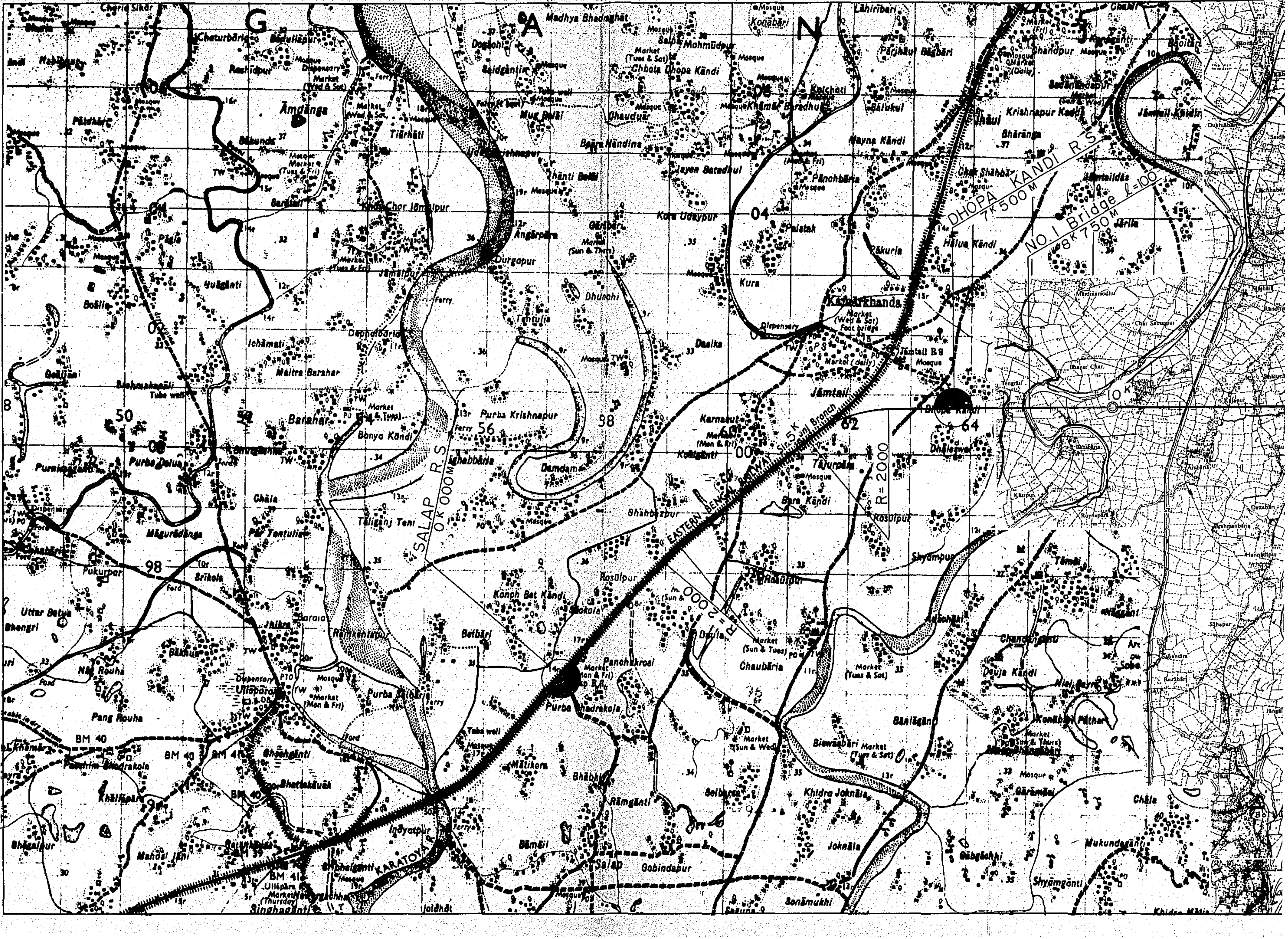
6 — EXISTING BROAD GAUGE.

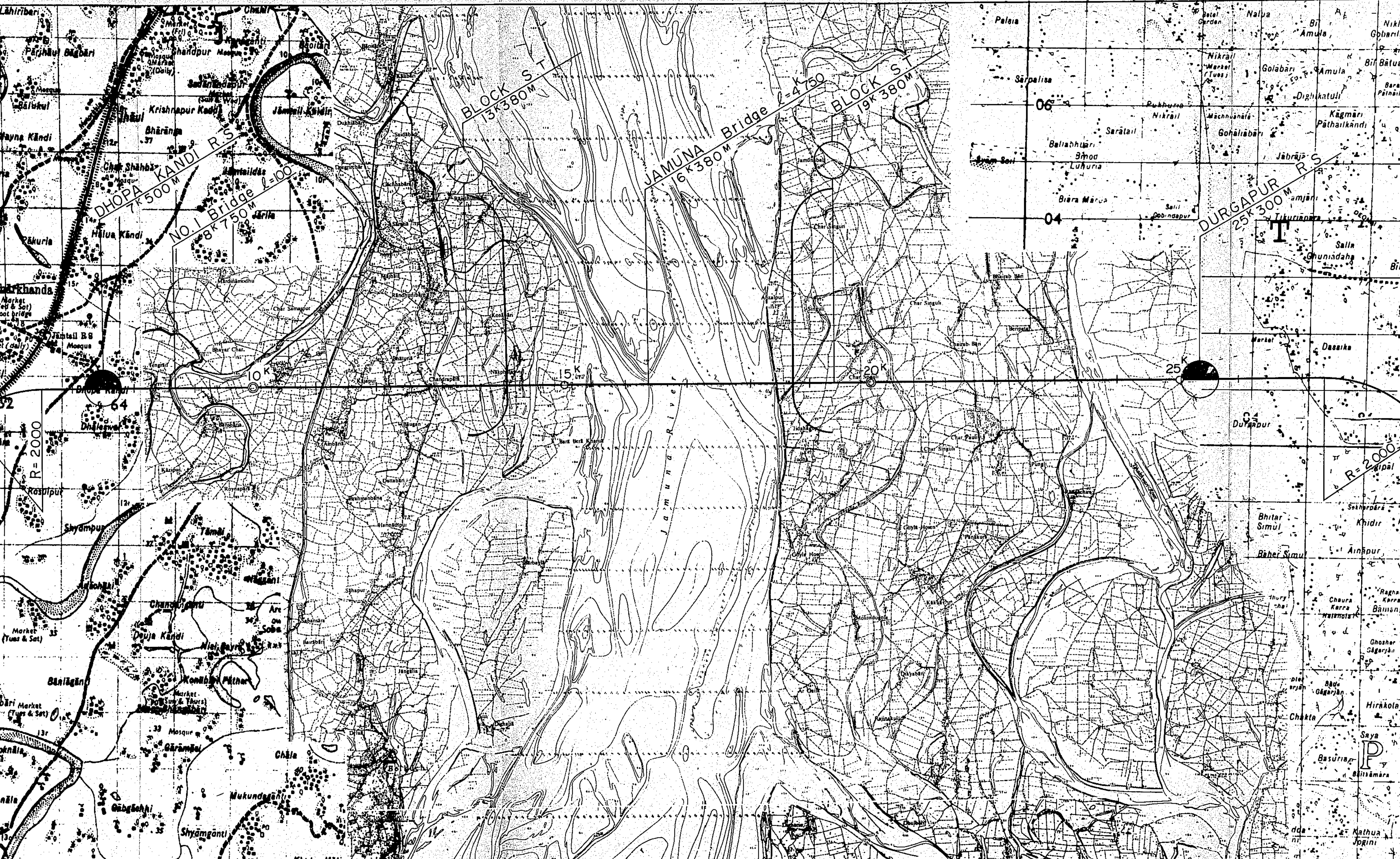
7 — EXISTING METER GAUGE.

APPENDIX C

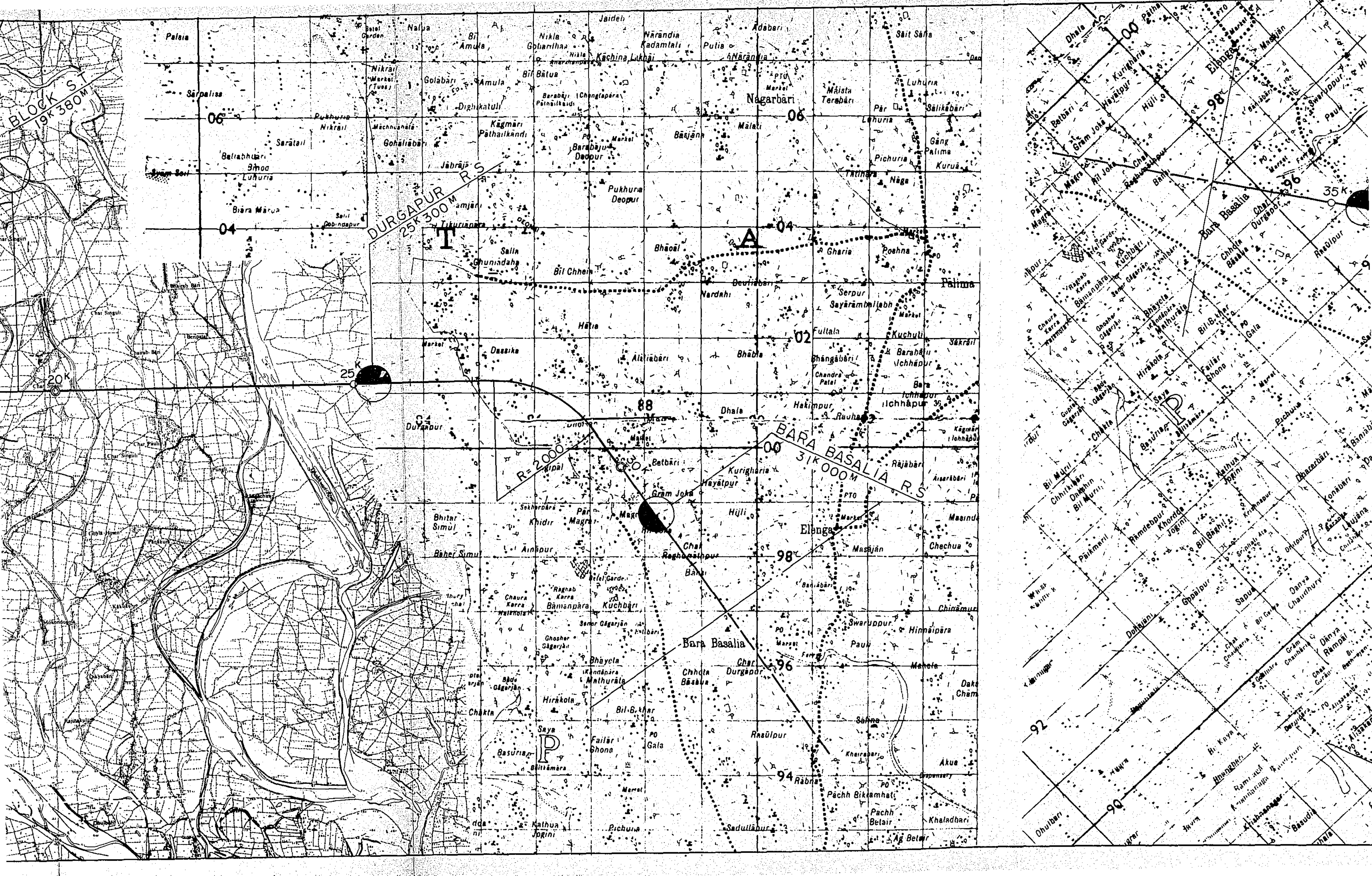
RAILWAY HORIZONTAL ALIGNMENT

(Figure)

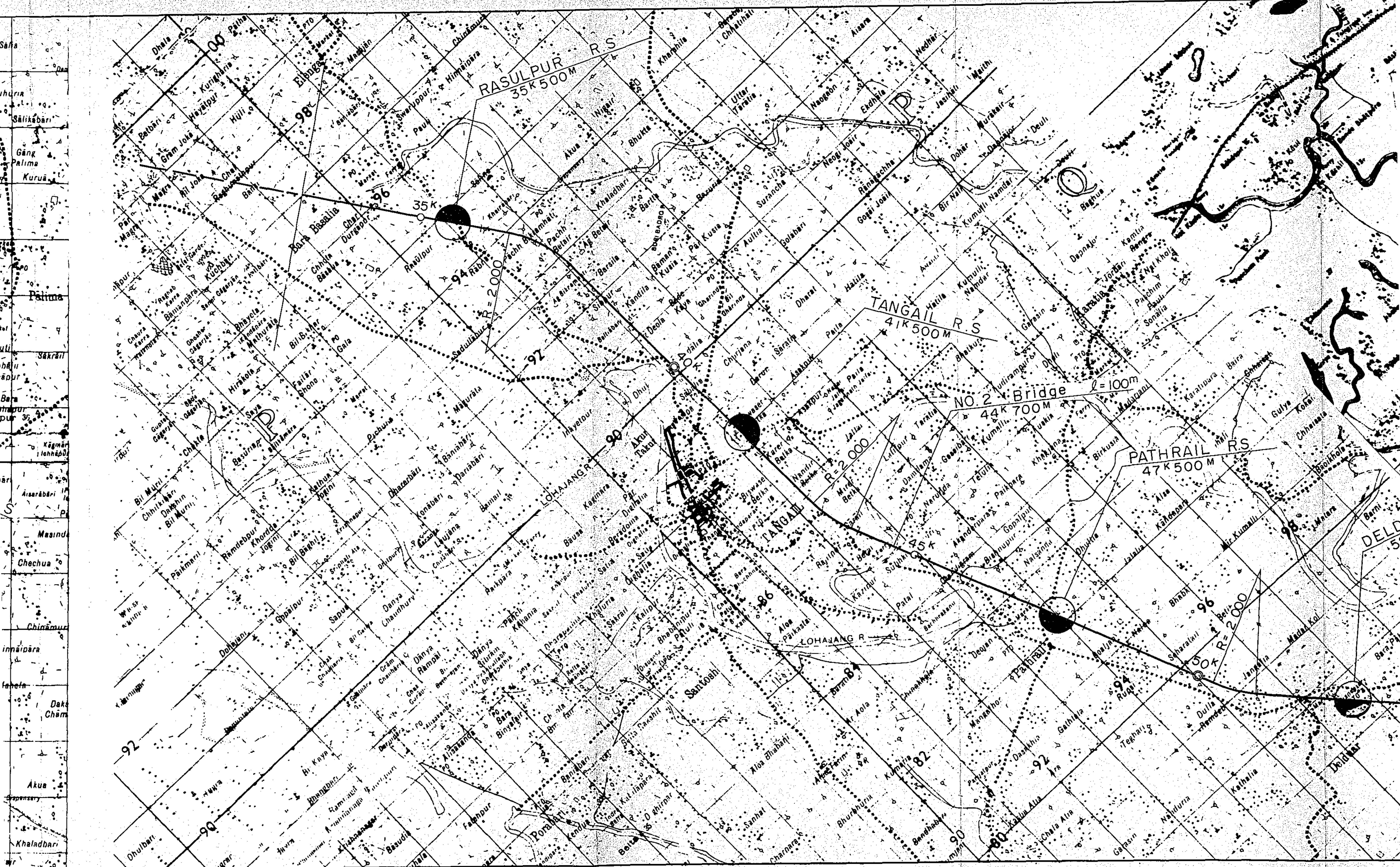

G
A
N
Madhya Bhadraghat
Konabari
Lahiribari
Chaturbaria
Rashidpur
Mahmudpur
Chhota Dhopa Kandi
Parjhaul
Bagbari
Chandpur
Amdanga
Kalchari
Khamar Baradhul
Balikul
Krishnapur Kadai
Jamtail Kaidin
Tiarhati
Mug Bhai
Ghauduar
Bara Handina
Jayen Batadhul
Mayna Kandi
Bharanga
Panchbaria
Chak Shahbaz
Jamtaildas
DHOPA KANDI R.S
7K 500M
NO.1 Bridge ℓ=100
8K 750M
Angarpara
Durgapur
Jamalpur
Kora Udaypur
04
Paistak
Pakuria
Halua Kandi
Jarila
Kura
Dhunchi
Kamarkhanda
Market (Wed & Sat)
Foot bridge
Jamtail R.S
Dispensary
Ichamati
Maitra Barahar
Tentulia
Daslia
Jamtail
Dhopa Kandi
10K
Barahar
Purba Krishnapur
Bonya Kandi
Karnasut
60
62
64
50
56
58
00
98
Purba Delua
SALAP R.S
0K 000M
Dhaleswar
Damdama
Tajurpara
R = 2000
Bara Kandi
Chala
Par Tentulia
Taliganj Teni
Shahbazpur
EASTERN BENGAL RAILWAY Sir.5K Jamtail Branch
Rasulpur
Shyampur
Pukuria
Srikola
Uttar Batua
Konch Bet Kandi
Rasulpur
R=2000
Tamai
Baraia
Ramkantapur
Belbari
Sachola
Market (Sun & Tues)
Chaubaria
Chandangati
Ullapara
Pang Rouha
Purba Salaria
Purba Bhadrakola
Panchakrosi
Market (Tues & Sat)
Dauja Kandi
BM 40
BM 41
Pashchim Bhadrakola
Bhatakauak
Matikora
Bhabki
Biswasbari
Banlagari
Kenabari Pathar
Khalimpur
Ramganti
Salbaria
Khidra Joknala
Chala
Inayatpur
Bhagalpur
Mahdal Jahi
BM 39
Bamail
Joknala
Mukundaganti
KARATOYA
Salap
Gobindapur
Shyamganti
Ullapara
Singhaganti
Joldhat
Sonamukhi
Khidra Matia

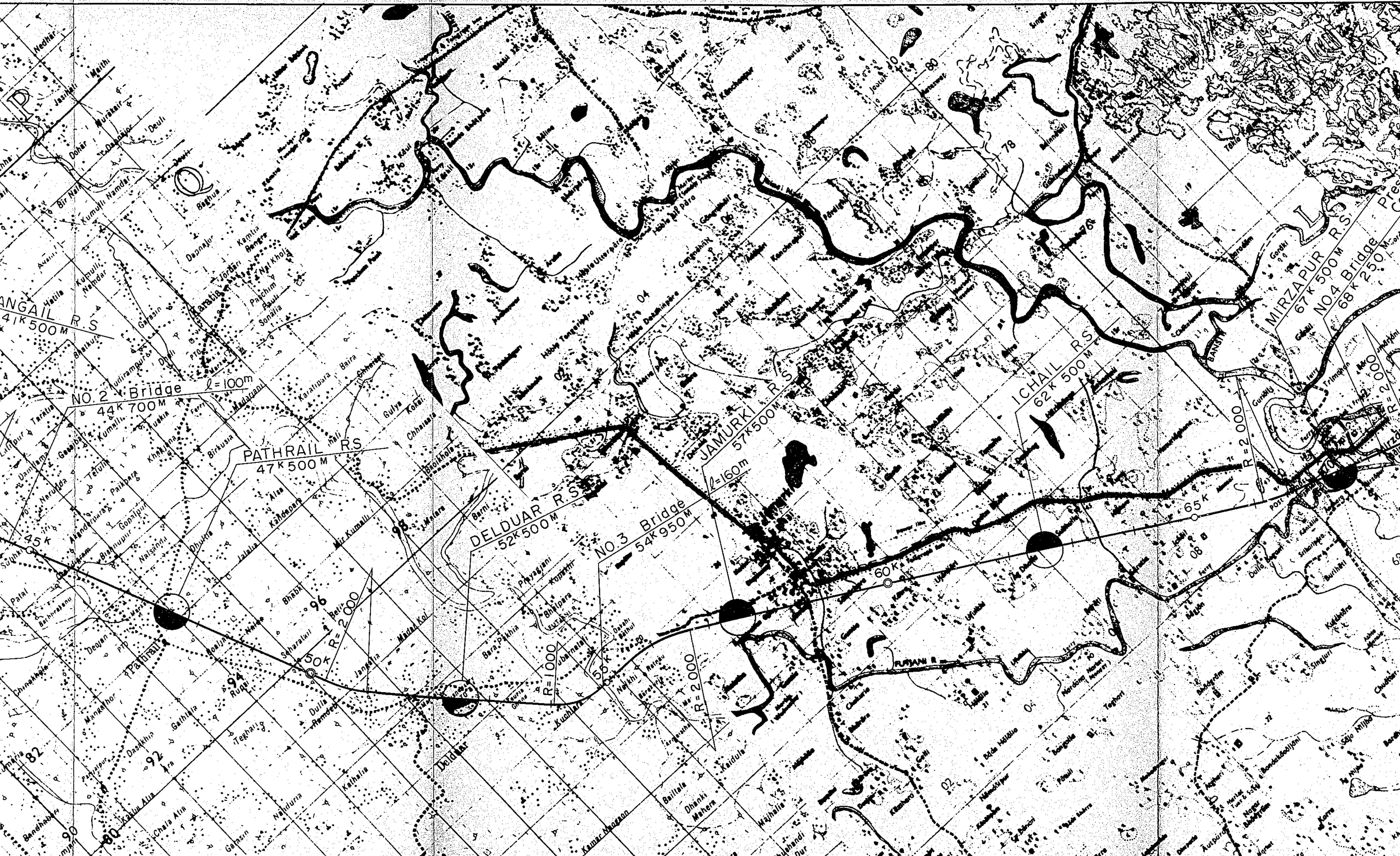


DHOPA KANDI R.S
7K500M
NO.1 Bridge ℓ=100
8K750M
BLOCK ST
13K380M
JAMUNA Bridge ℓ=4750
16K380M
BLOCK ST
19K380M
DURGAPUR R.S
25K300M
R=2000
R=2000
10K
15K
20K
25K
Jamuna River
Dhopa Kandi
Durgapur

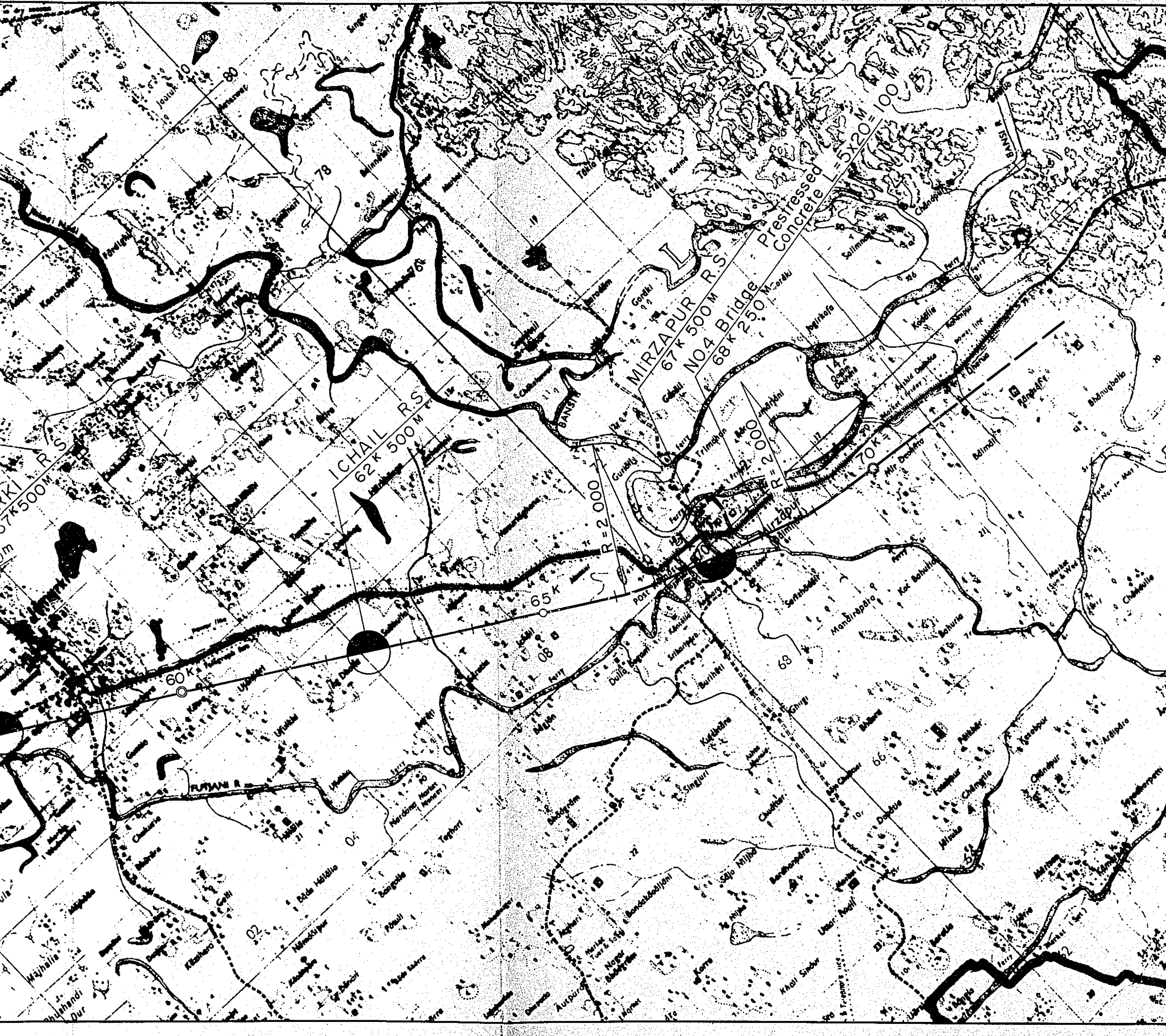


BLOCK ST
19K 380M
DURGAPUR R.S
25K 300M
BARA BASALIA R.S
31K 000M
R=2000
20K
25K
30K
35K
T
A
P
Palsia
Nalua
Bi Amula
Nikla Goharidhar
Jaideb
Nārāndia Kadamtali
Pulia
Ādābari
Sāit Sāna
Kāchina Lukhāi
Nārāndia
Sarpalisa
Nikrail Market (Tues)
Golabari
Amula
Bil Bātua
Māista Terabari
Luhuria
Nagarbari
Dighikatuli
Pār
Sālikābari
Pukhuria Nikrail
Kāgmari Pāthailkandi
Baraba ju Deopur
Bāsjāni
Mālati
Gāng Palima
Sarātail
Gohalirbari
Pichuria
Kuruā
Beltabhuari
Jābrājār
Tatinara
Nāga
Pukhuria Deopur
Bāra Mārua
Salli Gobindapur
Tikuriapara
Salla Ghunmadaha
Bil Chhein
Bhaosi
Gharia
Poshna
Beulia bari
Nardahi
Pālima
Serpur
Sayārāmballabh
Hātia
Fultala
Dassika
Āltiabāri
Bhabla
Bhāngābāri
Kuchuti
Barahāli Ichhāpur
Sakrail
Chandra Patel
Bara Ichhāpur
Ichhāpur
Durgapur
Dhala
Hakimpur
Rauha
Kāgmari Ichhāpur
Betbāri
Kurigharia
Hayātpur
Rājābāri
Aisarābāri
Gram Joka
Hijli
Elenga
Bhitar Simul
Khidir
Pār Magra
Masinda
Bāher Simul
Ainapur
Chak Raghonathpur
Masājān
Chechua
Bārni
Raghab Karra
Bāmanpāra
Kuchbāri
Chaura Karra
Swaruppur
Hinnaipāra
Chinamura
Ghosher Gāgarjān
Bara Basālia
Pauli
Bhaycla
Kandapara Mathurāla
Char Durgāpur
Chhota Bāsālia
Mahela
Bāde Gāgarjān
Hirākola
Chākta
Bil Bākhar
Saya
Basuria
Bāliāmāra
Failār Ghono
Gala
Rasūlpur
Sāfina
Khairabari
Ākua
Rābna
Pāchh Bikramhati
Pachh Betair
Khaladbari
Kathua Jogini
Pichuria
Sadullāpur
Āg Betair
Dhala
Patha
Hijli
Kuriqharia
Hayatpur
Betbāri
Makra
Bil Joka
Chak Raghonathpur
Barni
Bara Basalia
Char Durgapur
Rasulpur
Chhota Basalia
Bil Bakhar
Hirakola
Failar Ghono
Bil Muril
Chhitkibari
Dokshin Bil Muril
Ramdebpur
Khordo Jogini
Kathua Jogini
Gopalpur
Sapua
Danya Chaudhury
Pichuria
Dharerbari
Konabari
Laujana
Dohajani
Bil Bāghil
Krishnapur
Danya Rampal
Ohulbari
Ramanui
Krishnanagar
Basudi
06
04
02
00
98
96
94
92
90
88


RASULPUR R.S
35K500M
35K
TANGAIL R.S
41K500M
40K
NO.2 Bridge l=100m
44K700M
45K
PATHRAIL R.S
47K500M
50K
R=2,000
R=2,000
R=2,000
TANGAIL
LOHAJANG R.
LOHAJANG R
Rasulpur
Pathrail
Santoshi
Pālima

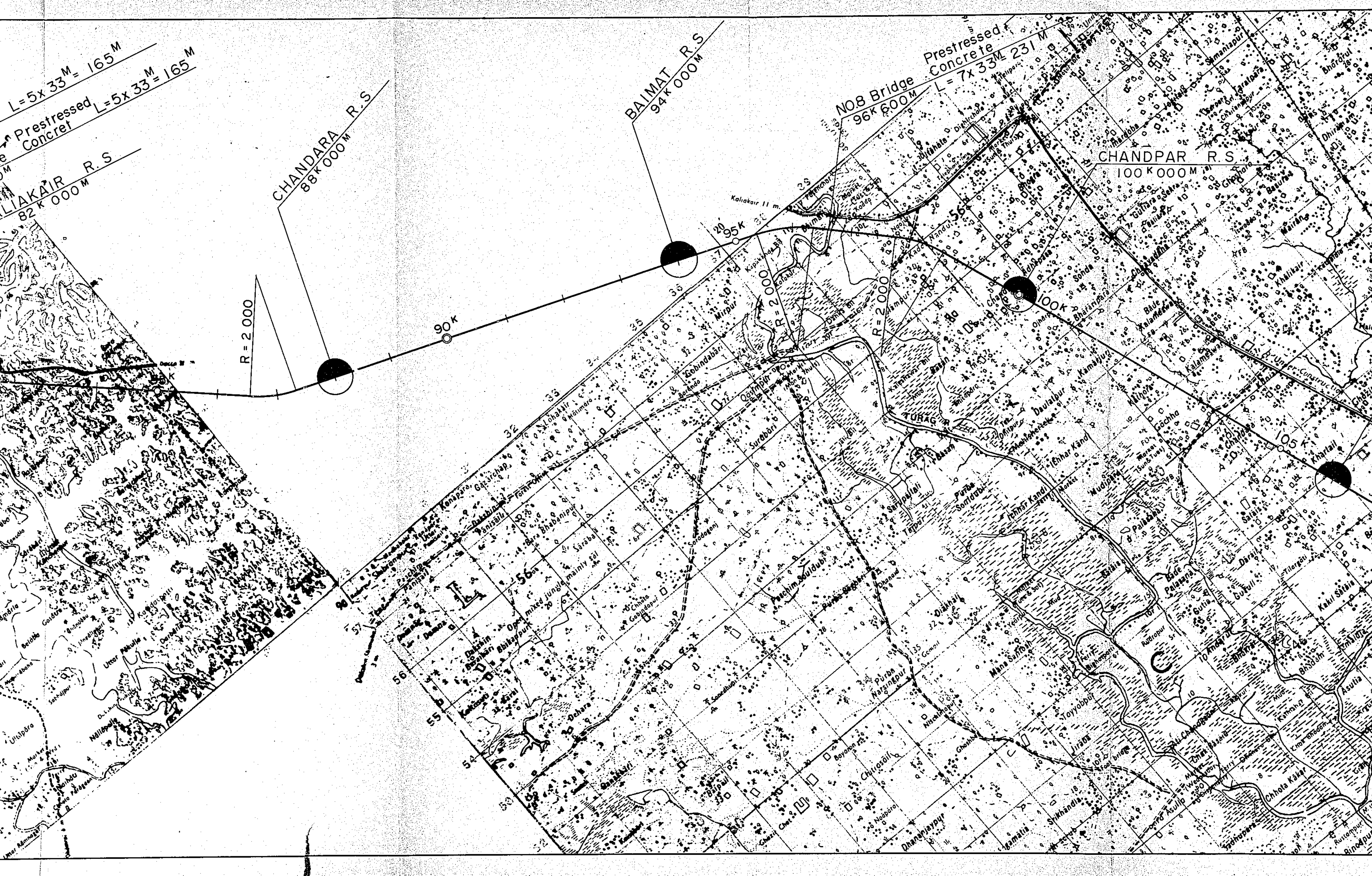


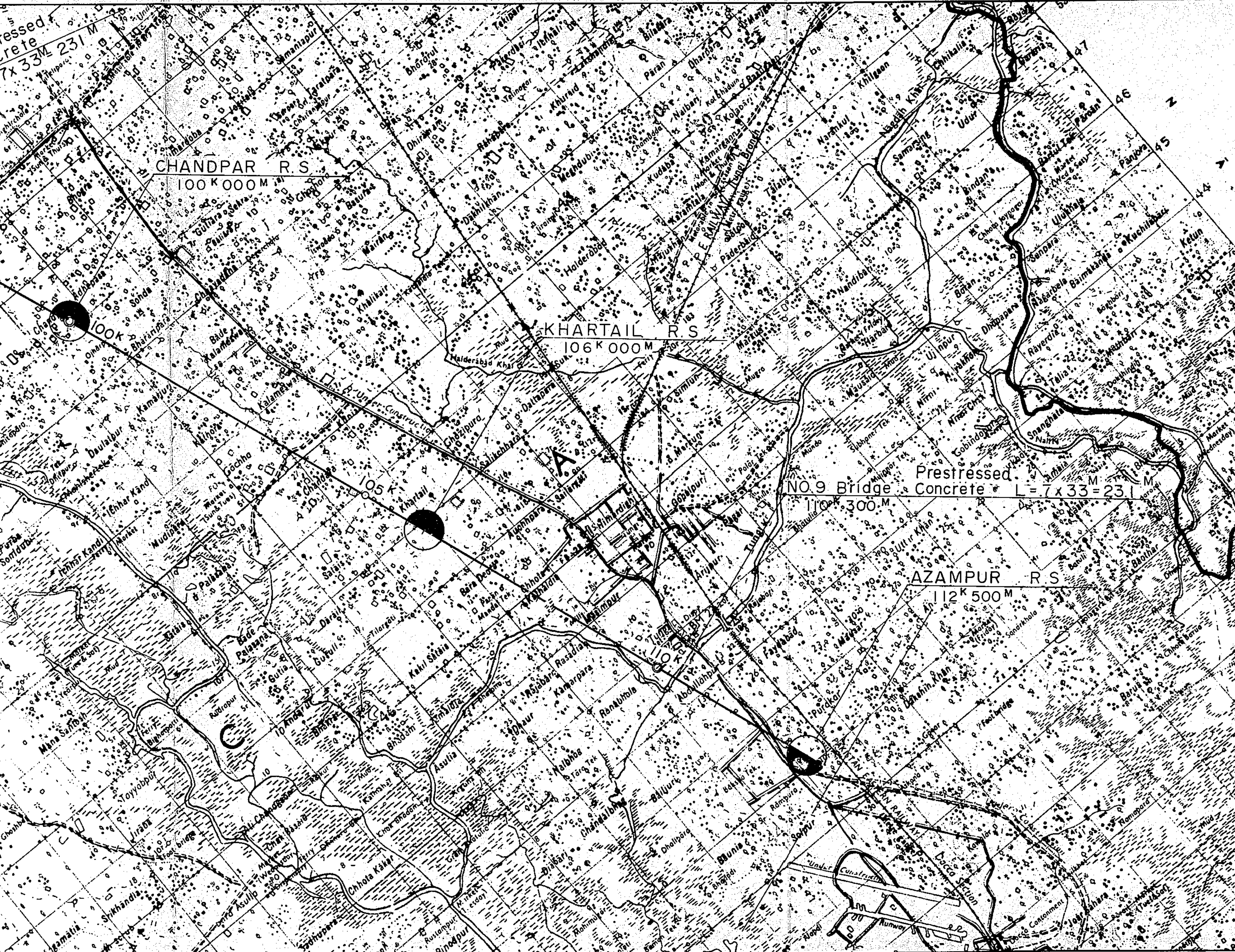
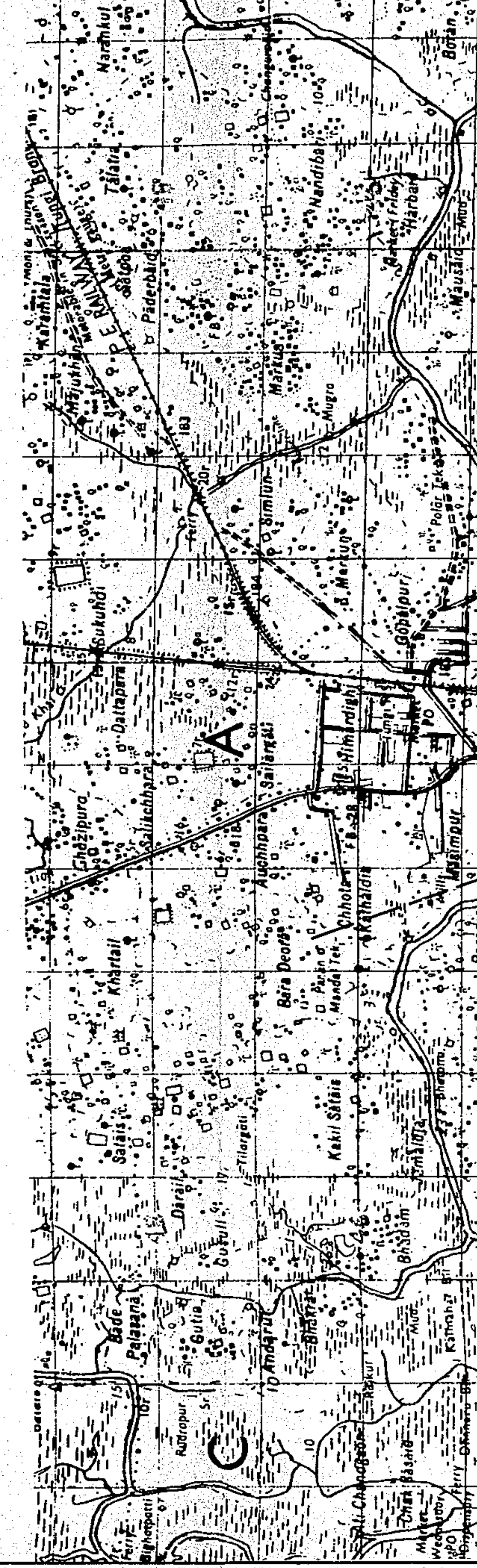
NO.2 Bridge
l=100m
44K700M
PATHRAIL R.S.
47K500M
DELDUAR R.S.
52K500M
NO.3 Bridge
54K950M
JAMURKI R.S.
57K500M
l=160m
ICHAIL R.S.
62K500M
MIRZAPUR R.S.
67K500M
NO.4 Bridge
68K250M
R=2000
R=1000
45K
50K
55K
60K
65K

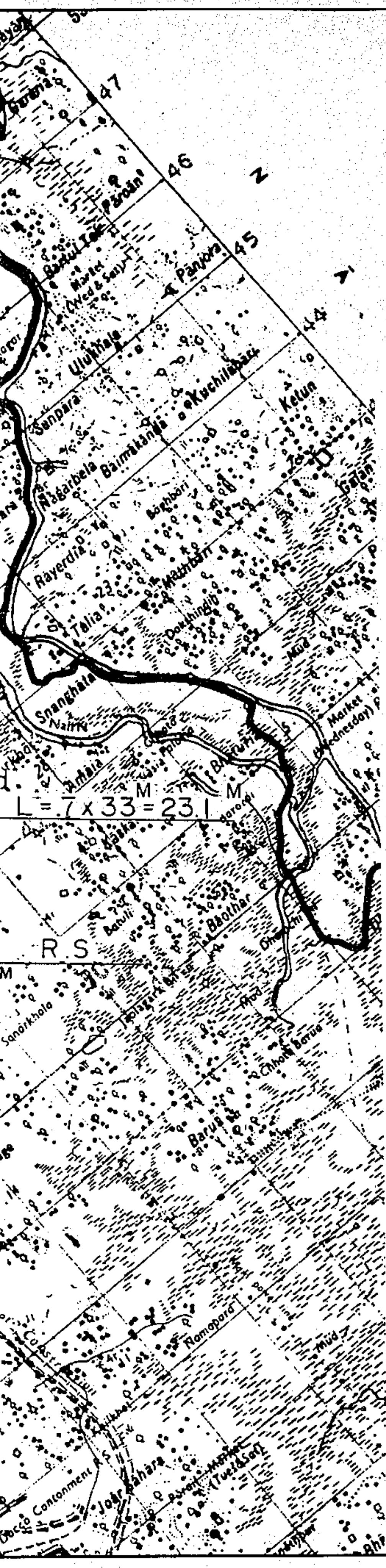

MIRZAPUR R.S.
67 K 500 M
NO.4 Bridge
68 K 250 M
Prestressed
Concrete L=5X20=100 M
ICHAIL R.S.
62 K 500 M
R=2 000
65 K
60 K
70 K
Mirzapur

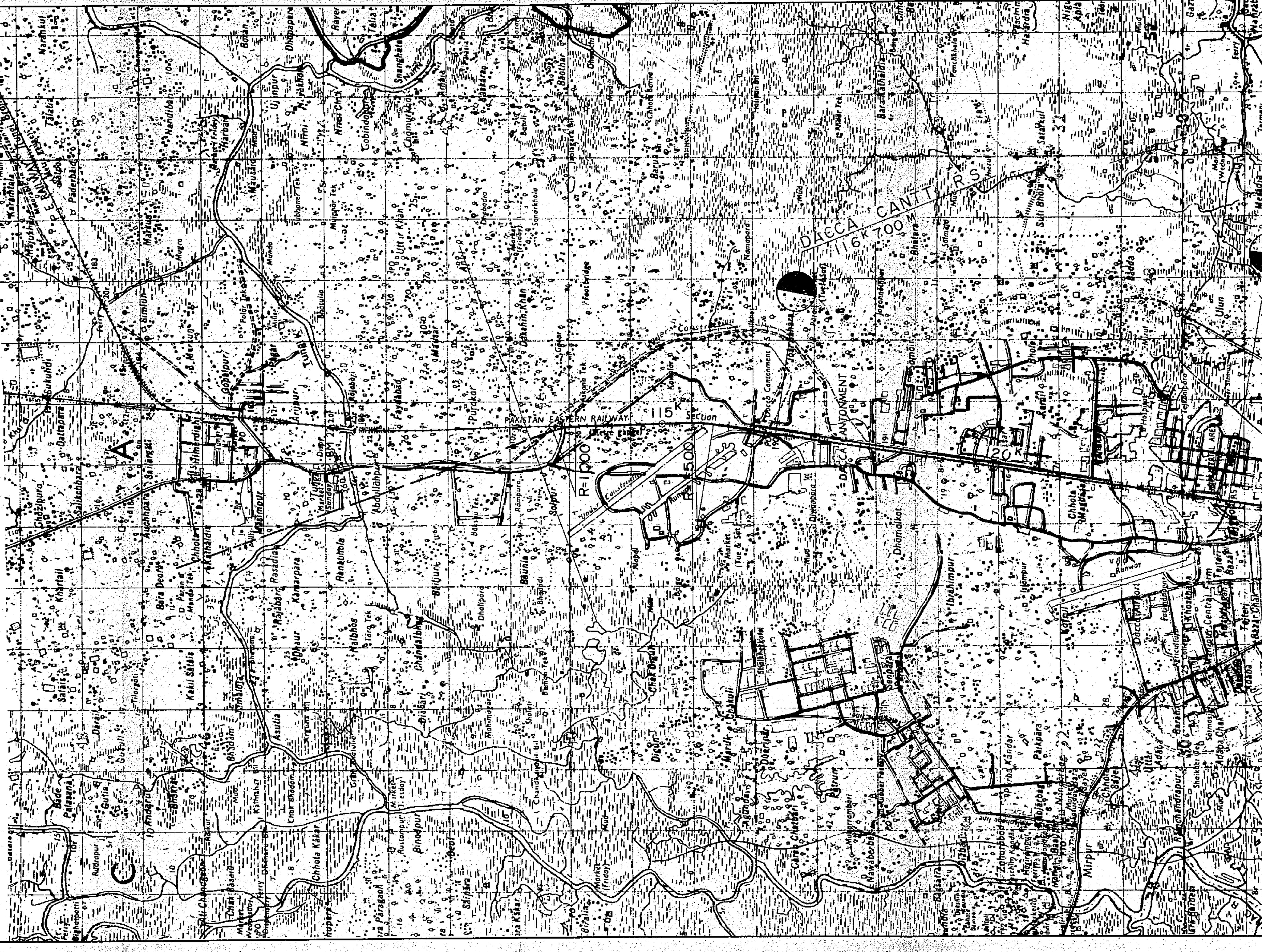

GORAI R.S.
72 K 500 M
Mirzapur

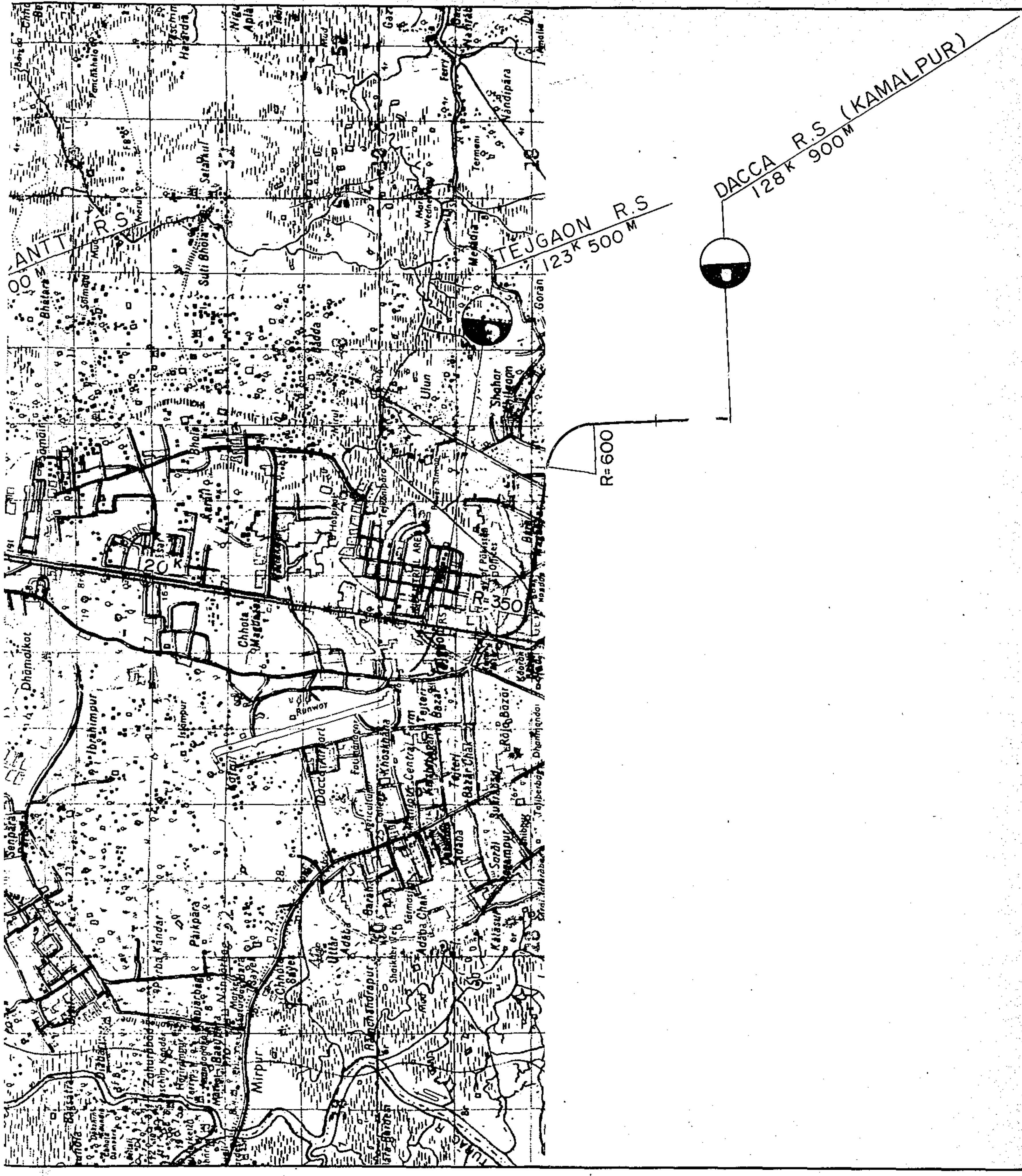
GORAI R.S
72K 500M
GAZARIA R.S
76K 000M
NO5 Bridge
77K 900M
Prestressed Concrete L=3x33.3M=100M
NO.6 Bridge
79K 350M
Prestressed Concrete L=5x33M=165M
NO.7 Bridge
81K 100M
Prestressed Concrete L=5x33M=165M
KALIAKAIR R.S
82K 000M
CHANDARA R.S
88K 000M
R=2000
R=2000
75K
80K
90K


L=5x 33M = 165M
Prestressed
Concret
L=5x 33M = 165M
LIAKAIR R.S
82K 000M
CHANDARA R.S
88K 000M
BAIMAT R.S
94K 000M
NO.8 Bridge
96K 600M
Prestressed
Concrete
L = 7x 33M = 231M
CHANDPAR R.S
100K 000M
R = 2000
R = 2000
R = 2000
90K
95K
100K
105K
TURAG


CHANDPAR R.S
100K000M
KHARTAIL R.S
106K000M
Prestressed
NO.9 Bridge Concrete L=7x33=231M
110K300M
AZAMPUR R.S
112K500M
100K
105K
110K



L = 7 x 33 = 231 M
R S


DACCA CANTT R.S.
116 K 700 M
PAKISTAN EASTERN RAILWAY
115 K
Section
R=1500
1500
20 K
DACCA
CANTONMENT
A
C



G.T.S DATUM LEVEL

PEOPLE'S REPUBLIC BANGLADESH

JAMUNA RIVER BRIDGE PROJECT

VOLUME IV RAILWAY LINKS

RAILWAY HORIZONTAL ALIGNMENT

JAPAN INTERNATIONAL COOPERATION AGENCY

PACIFIC CONSULTANTS INTERNATIONAL

Scale 1/50 000	Date
Drawn	DRW. NO.
Approved	

APPENDIX D

RAILWAY VERTICAL ALIGNMENT

(Figure)

RAILWAY LINKS

SARAP R.S
0K 000M

DHOPA KANDI R.S
7K 500M

8K 880M

NO.1 BRIDGE
8K 750

G.T.S DATUM LEVEL

40
30
20
10
0

1 : 800
1:50 000

5K 700M
6K 900M
9K 435M

GRADES	13.10	L			13.10	2	15.50	L		15.50
HEIGHT OF BANK	2.70	2.70	2.70	2.40	2.40	2.40	2.70	4.50	4.50	1.50
FORMATION LEVEL	13.10	13.10	13.10	13.10	13.10	13.10	13.70	15.50	15.50	15.50
GROUND LEVEL	10.40	10.40	10.40	10.70	10.70	10.70	11.00	11.00	11.00	14.00
K. METER AGE	0K	1	2	3	4	5	6	7	8	9
CURVES			R = 2 000				R = 2 000			

RAILWAY LINKS

JAMUNA BRIDGE (LENGTH 15KM 000

DHOPA KANDI R.S
7K 500M

8K 880M

NO.1 BRIDGE 5x20M=100M
8K 750M

BLOCK S.T
13K 380M

JAMUNA BRIDGE ℓ=4K750
16K 380M

BLOCK S.T
19K 380M

23K 880M

D.H.W.L = 14.80m

5K700M
6K900M
9K435M
12K780M
13K980M
18K780M
19K980M
23K660M

L	13.10	2	15.50	L	15.50	3.3	26.54	2.5	29.54	L	29.54	2.5	26.54	3.3	14.40								
2.70	2.40	2.40	2.40	2.70	4.50	4.50	1.50	4.36	8.66	11.96	16.09	17.54							16.99	15.48	12.18	7.88	5.58	3.40
13.10	13.10	13.10	13.10	13.70	15.50	15.50	15.50	17.36	20.66	23.96	27.09	29.54	29.54	29.54	29.54	29.54	29.54	28.99	26.48	23.18	19.88	16.58	14.40	
10.40	10.70	10.70	10.70	11.00	11.00	11.00	14.00	13.00	12.00	12.00	11.00	12.00	12.00	5.50	2.00	1.30	12.00	11.00	11.00	12.00	11.00	11.00		
2	3	4	5	6	7	8	9	10K	11	12	13	14	15	16	17	18	19	20K	21	22	23	24		

R = 2 000

R = 2 000

RAILWAY LINKS

BRIDGE $\ell = 4750^{M}$ 380^{M}

BLOCK S.T 19^{K} 380^{M}

23^{K} 880^{M}

DURGAPUR R.S 25^{K} 300^{M}

BARA BASALIA R.S 31^{K} 000^{M}

RASUL PUR R.S 35^{K} 500^{M}

18^{K} 780^{M} 19^{K} 980^{M} 23^{K} 660^{M} 36^{K} 000^{M} 36^{K} 700^{M}

29.54 2.5 26.54 3.3 14.40 L 14.40 2 13.00

	16.99	15.48	12.18	7.88	5.58	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.40	3.00	3.00	3.00	3.00
29.54	28.99	26.48	23.18	19.88	16.58	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	14.40	13.00	13.00	13.00	13.00
1.30	12.00	11.00	11.00	12.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	10.00	10.00	10.00	10.00

18 19 20^{K} 21 22 23 24 25 26 27 28 29 30^{K} 31 32 33 34 35 36 37 38 39 4

R = 2 000

R = 2 000

SASALIA R.S
^{K} 000^{M}

RASUL PUR R.S
35^{K} 500^{M}

TANGALL R.S
41^{K} 500^{M}

NO.2 BRIDGE 5 x 20^{M} = 100^{M}
44^{K} 700^{M}

PATH RAIL R.S
47^{K} 500^{M}

DELDUAR R.S
52^{K} 500^{M}

HW.L=10.18

36^{K} 000^{M} 36^{K} 700^{M} 44^{K} 100^{M} 44^{K} 600^{M} 44^{K} 800^{M} 45^{K} 800^{M} 54^{K} 300^{M}

14.40 2 13.00 L 13.00 2 14.00 14.00 2 12.00 L 12.00

3.40	3.40	3.40	3.40	3.40	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.80	2.50	2.70	2.90	3.00	3.00	3.00	3.00	3.00	3.30
14.40	14.40	14.40	14.40	14.40	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.60	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
11.00	11.00	11.00	11.00	11.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	9.30	9.80	9.50	9.30	9.10	9.00	9.00	9.00	9.00	8.70

32 33 34 35 36 37 38 39 40^{K} 41 42 43 44 45 46 47 48 49 50^{K} 51 52 53 54

R= 2 000 R= 2 000 R= 2 000 R= 1

5 x 20 M = 100 M

PATH RAIL R.S
47K 500M

DELDUAR R.S
52K 500M

NO.3 BRIDGE 8 x 20 M = 160 M
54K 950M

JAMURKI R.S
57K 500M

ICHAIL R.S
62K 500M

MIRZAPUR
67K 500

NO. 4
6

HWL 9.42

54K 300M
54K 800M
55K 100M
55K 600M
66K 400M
66K 900M
68K 400M
68K 900M

L

12.00 CH 13.50 CH 13.50 CH 12.00

L

12.00 2 13.00

L

13.00 2

2.70	2.90	3.00	3.00	3.00	3.00	3.00	3.30	5.50	3.80	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.50	4.20				
12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	13.50	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	13.00	13.00				
9.30	9.10	9.00	9.00	9.00	9.00	9.00	8.70	8.00	8.20	9.00	9.00	9.00	8.50	8.00	8.00	8.00	8.00	8.00	8.00	8.50	8.80				
47	48	49	50K	51	52	53	54	55	56	57	58	59	60K	61	62	63	64	65	66	67	68				

R = 2 000 R = 1 000 R = 2 000 R = 2 000 R

ICHAIL R.S
62K 500M

MIRZAPUR R.S
67K 500M

NO. 4 BRIDGE 5x20M=100M
68K 250M

GORAI R.S
72K 500M

GAZARIA R.S
76K 000M

NO.5 BRIDGE 3x33M=100M
77K 900M

NO.6 BRIDGE 5x33M=165M
79K 350M

KALIAKAIR R.S
82K 000M

NO.7 BRIDGE 5x33M=165M
81K 100M

HW.L=8.98

66K 400M | 66K 900M | 68K 400M | 68K 900M | 77K 000M | 77K 740M | 81K 200M | 83K 080M

12.00 2 13.00 L 13.00 2 12.00 L 12.00 5 15.70 L 15.70 2.5 11.00

4.70	4.00	4.00	4.00	4.00	4.50	4.20	4.30	7.00	7.10	7.00	4.00	4.00	4.00	4.00	4.00	10.00	9.20	9.20	9.00	3.70	1.20	1.20
12.00	12.00	12.00	12.00	12.00	13.00	13.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	15.70	15.70	15.70	15.70	13.50	11.00	11.00
8.00	8.00	8.00	8.00	8.00	8.50	8.80	7.70	5.00	4.90	5.00	8.00	8.00	8.00	8.00	8.00	5.70	6.50	6.50	6.70	9.80	9.80	9.80

62 63 64 65 66 67 68 69 70K 71 72 73 74 75 76 77 78 79 80K 81 82 83 84

R= 2 000 R=2 000 R = 2 000

NO.5 BRIDGE 3x33^{M}=100^{M}
77^{K} 900^{M}

NO.6 BRIDGE 5x33^{M}=165^{M}
79^{K} 350^{M}

KALIAKAIR R.S
82^{K} 000^{M}

NO.7 BRIDGE 5x33^{M}=165^{M}
81^{K} 100^{M}

CHANDARA R.S
88^{K} 000^{M}

BAIMAT R.S
94^{K} 000^{M}

NO.8 BRIDGE 7x33^{M}=231^{M}
96^{K} 600^{M}

CH

HW.L=8.98

HWL=7.99

81^{K} 200^{M}

83^{K} 080^{M}

95^{K} 600^{M}

96^{K} 400^{M}

96^{K} 800^{M}

97^{K} 400^{M}

15.70 L 15.70 2.5 11.00 L 11.00 5 15.00 L 15.00 5 12.00 L

10.00	9.20	9.20	9.00	3.70	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	7.00	7.80	5.00	3.20	3.20
15.70	15.70	15.70	15.70	13.50	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00	13.00	14.00	12.00	12.00	12.00
5.70	6.50	6.50	6.70	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	6.00	6.20	7.00	8.80	8.80

78 79 80^{K} 81 82 83 84 85 86 87 88 89 90^{K} 91 92 93 94 95 96 97 98 99 100^{K}

R=2 000 R=2 000 R=2 000

BAIMAT R.S
94K 000M

NO.8 BRIDGE 7x33M=231M
96K 600M

CHANDRAR R.S
100K 000M

KHARTAIL R.S
106K 000M

NO.9 BRIDGE 7x33M=231M
110K 300M

AZAMPUR R.S
112K 500M

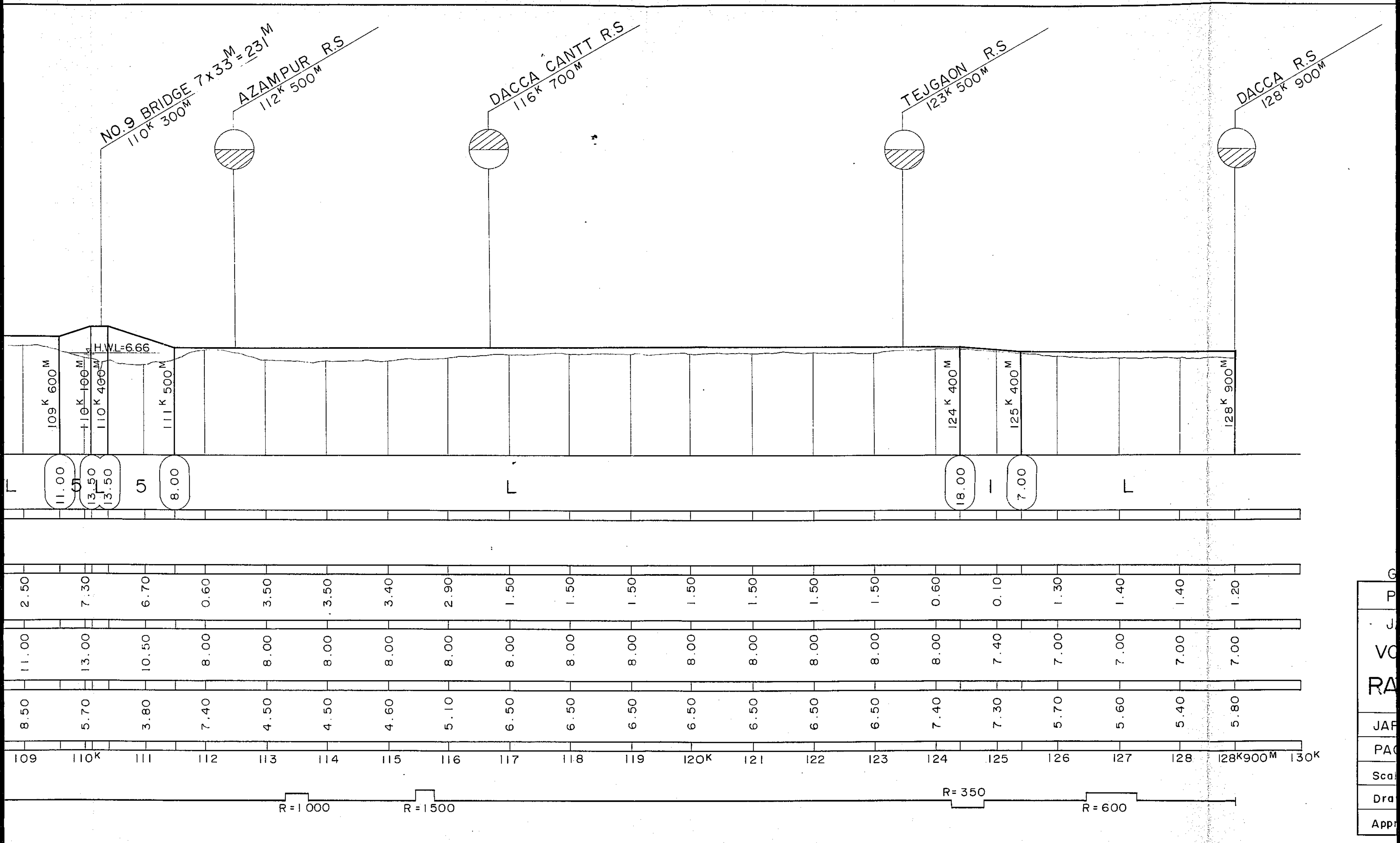
H.W.L=7.99

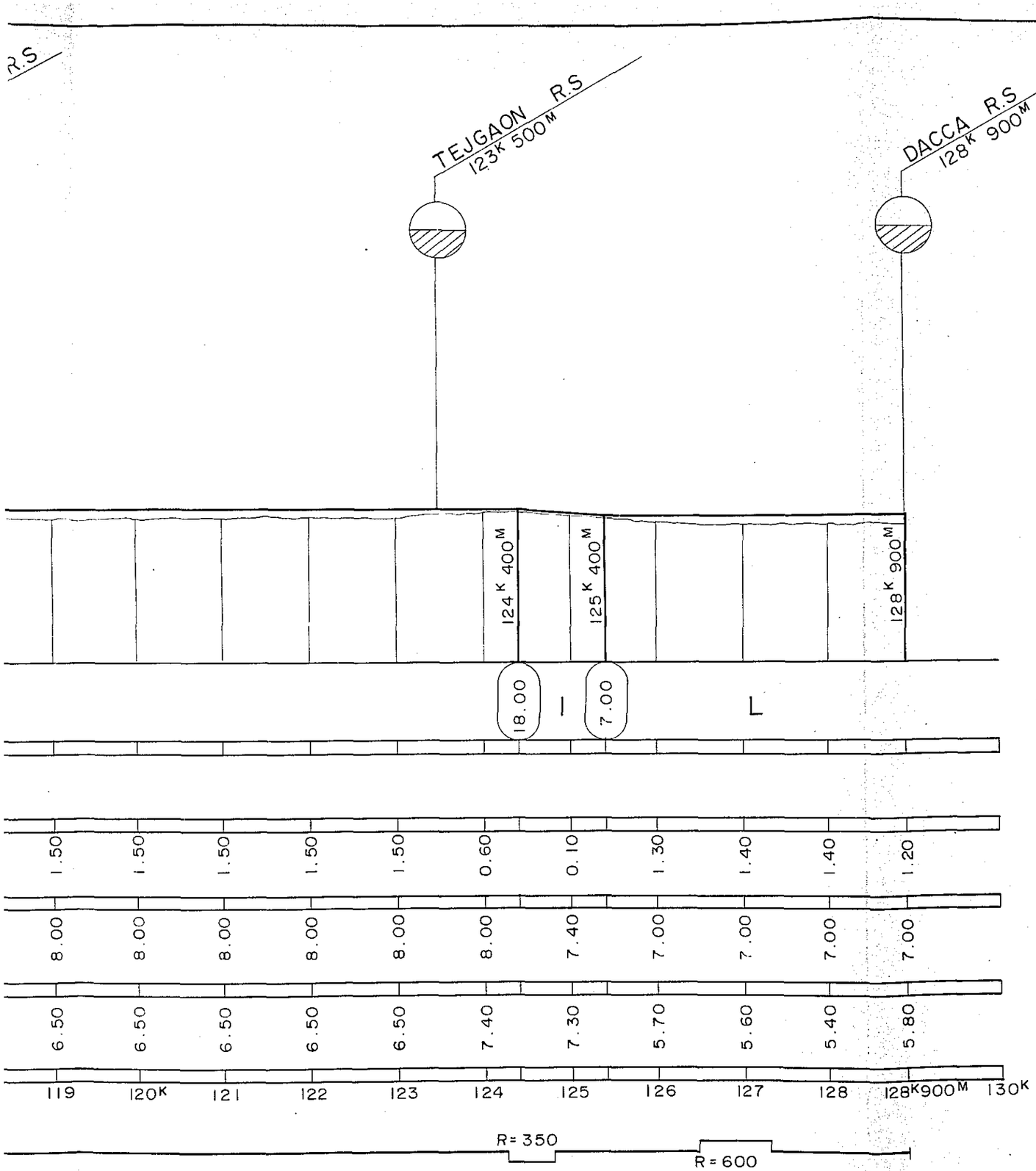
H.W.L=6.66

	95K 600M	96K 400M	96K 800M	97K 400M	101K 000M	102K 000M	107K 000M	108K 000M	109K 600M	110K 100M	110K 400M	111K 500M
	11.00	15.00	15.00	12.00	12.00	10.00	10.00	11.00	11.00	13.50	13.50	8.00
	5	L	5		L	2	L	1	L	5	L	5
	1.20	1.20	7.00	7.80	5.00	3.20	3.20	3.20	2.40	2.40	3.60	3.60	3.60	3.60	2.50	2.50	7.30	6.70	0.60	3.50	3.50	3.40
	11.00	11.00	13.00	14.00	12.00	12.00	12.00	12.00	10.00	10.00	10.00	10.00	10.00	10.00	11.00	11.00	13.00	10.50	8.00	8.00	8.00	8.00
	9.80	9.80	6.00	6.20	7.00	8.80	8.80	8.80	7.60	7.60	6.40	6.40	6.40	6.40	8.50	8.50	5.70	3.80	7.40	4.50	4.50	4.60

94 95 96 97 98 99 100K 101 102 103 104 105 106 107 108 109 110K 111 112 113 114 115

R = 2 000 R = 2 000 R = 1 000 R = 150


NO.9 BRIDGE 7x33M=231M
110K 300M
AZAMPUR R.S
112K 500M
DACCA CANTT R.S
116K 700M
TEJGAON R.S
123K 500M
DACCA R.S
128K 900M
H.W.L=6.66
109K 600M
110K 100M
110K 400M
111K 500M
124K 400M
125K 400M
128K 900M
L
11.00
5
13.50
L
13.50
5
8.00
L
18.00
I
7.00
L
2.50 7.30 6.70 0.60 3.50 3.50 3.40 2.90 1.50 1.50 1.50 1.50 1.50 1.50 1.50 0.60 0.10 1.30 1.40 1.40 1.20
11.00 13.00 10.50 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 8.00 7.40 7.00 7.00 7.00 7.00
8.50 5.70 3.80 7.40 4.50 4.50 4.60 5.10 6.50 6.50 6.50 6.50 6.50 6.50 6.50 7.40 7.30 5.70 5.60 5.40 5.80
109 110K 111 112 113 114 115 116 117 118 119 120K 121 122 123 124 125 126 127 128 128K900M 130K
R=1000
R=1500
R=350
R=600
P
J
VC
RA
JAF
PAC
Sca
Dra
Appr



G.T.S DATUM LEVEL

PEOPLES REPUBLIC BANGLADESH	
JAMUNA RIVER BRIDGE PROJECT	
VOLUME IV RAILWAY LINKS	
RAILWAY VERTICAL ALIGNMENT	
JAPAN INTERNATIONAL COOPERATION AGENCY	
PACIFIC CONSULTANTS INTERNATIONAL	
Scale V= 1/800 H= 1/50 000	Date
Drawn	DRW NO.
Approved	

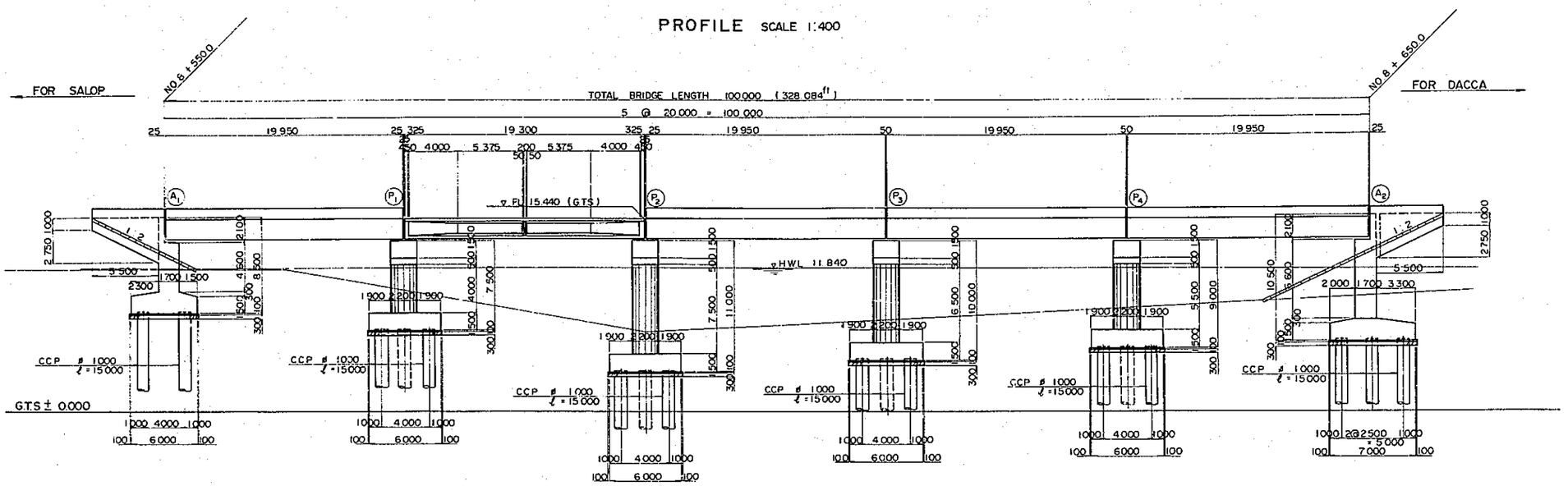
APPENDIX E

DESIGN OF BRIDGES

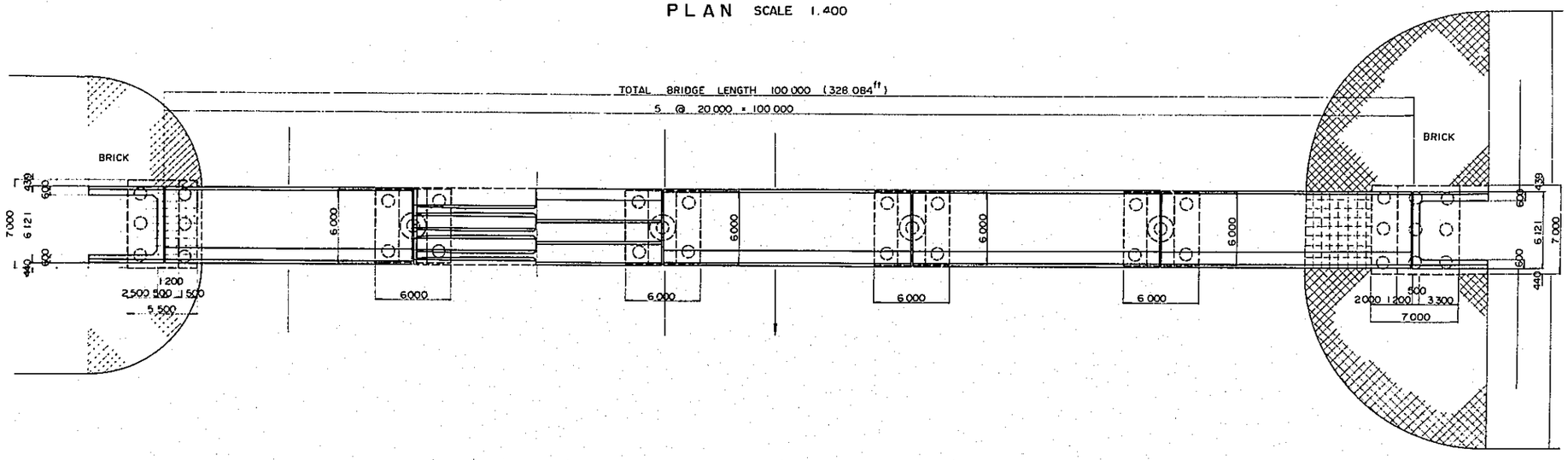
(9 Figures)

RAILWAY BRIDGE NO. 1

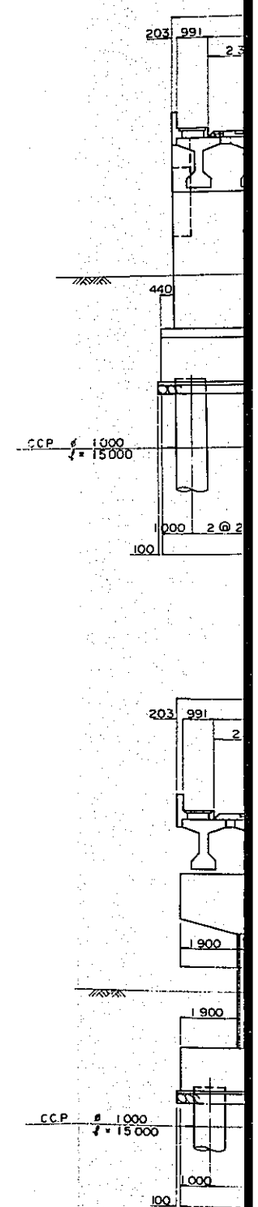
PROFILE SCALE 1:400



PLAN SCALE 1.400

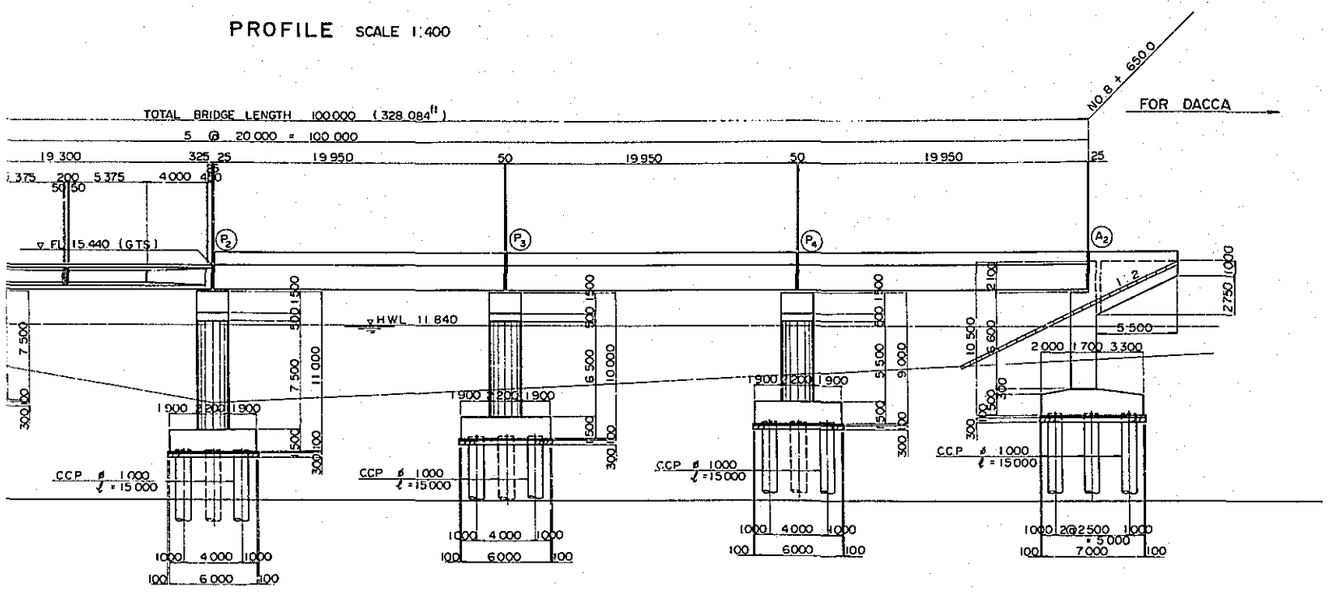


CROSS SE

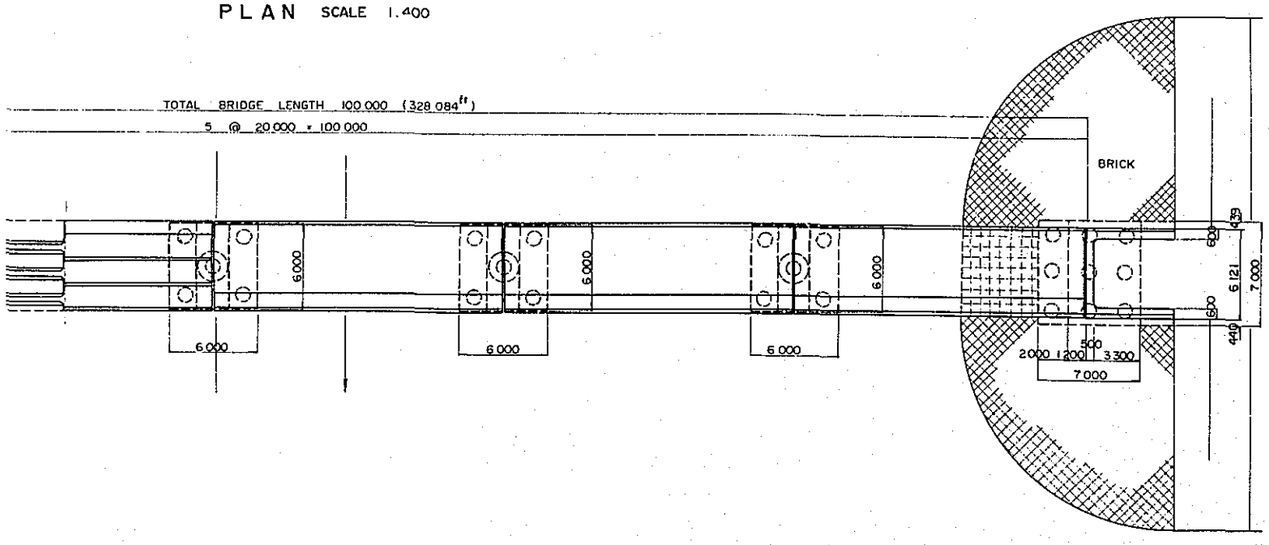


RAILWAY BRIDGE NO. 1

PROFILE SCALE 1:400



PLAN SCALE 1.400



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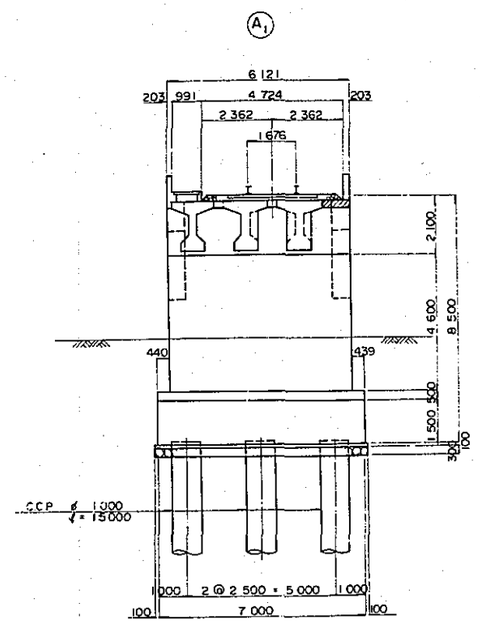
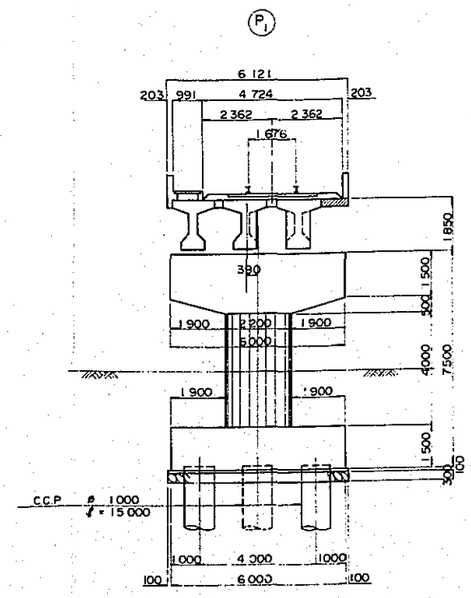
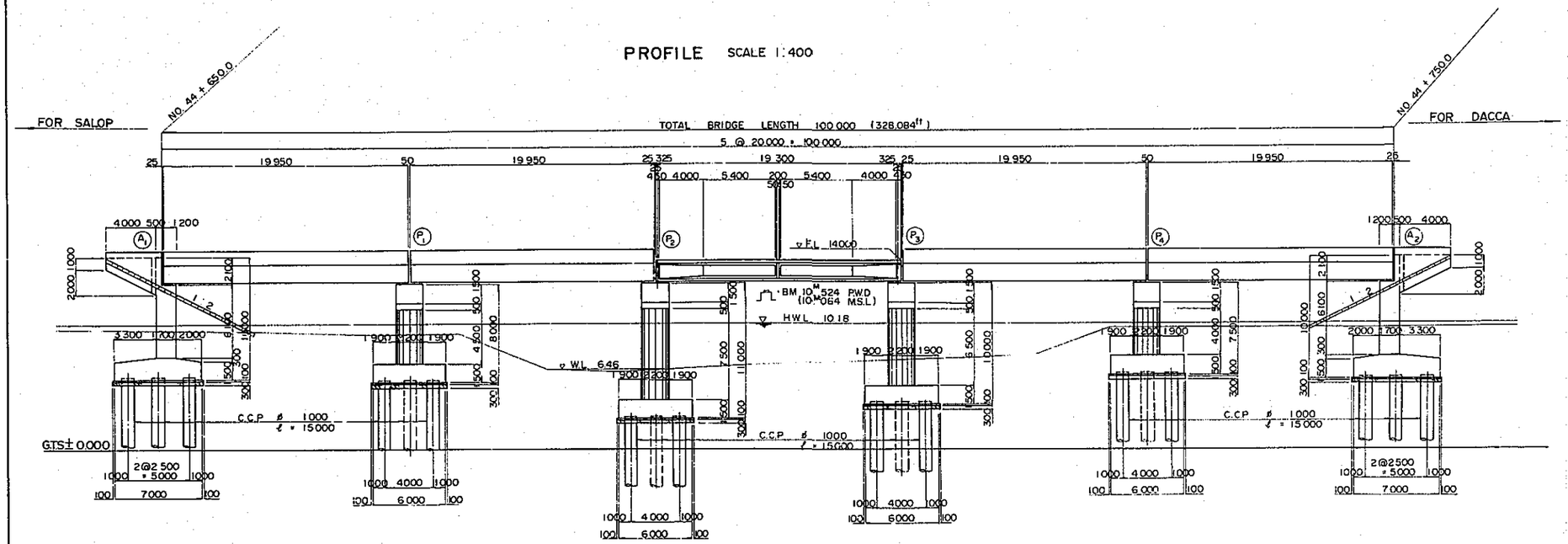




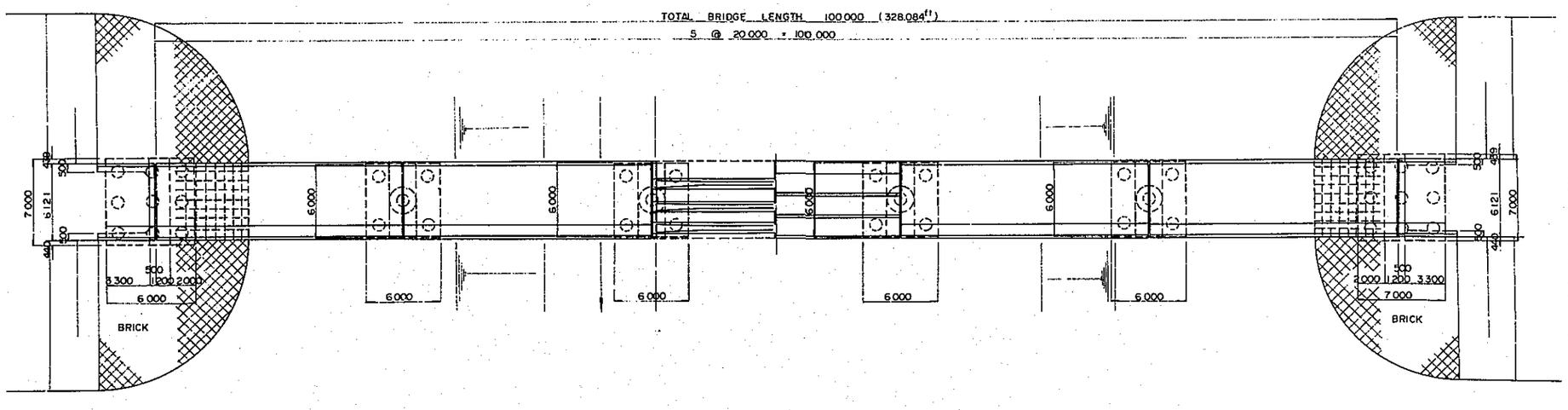
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME IV RAILWAY LINKS RAILWAY BRIDGE NO. 1	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1:400, 200	Date
Drawn Y. Nakabayashi Approved K. Tezuka	DRW. NO. 1

RAILWAY BRIDGE NO.2

PROFILE SCALE 1:400

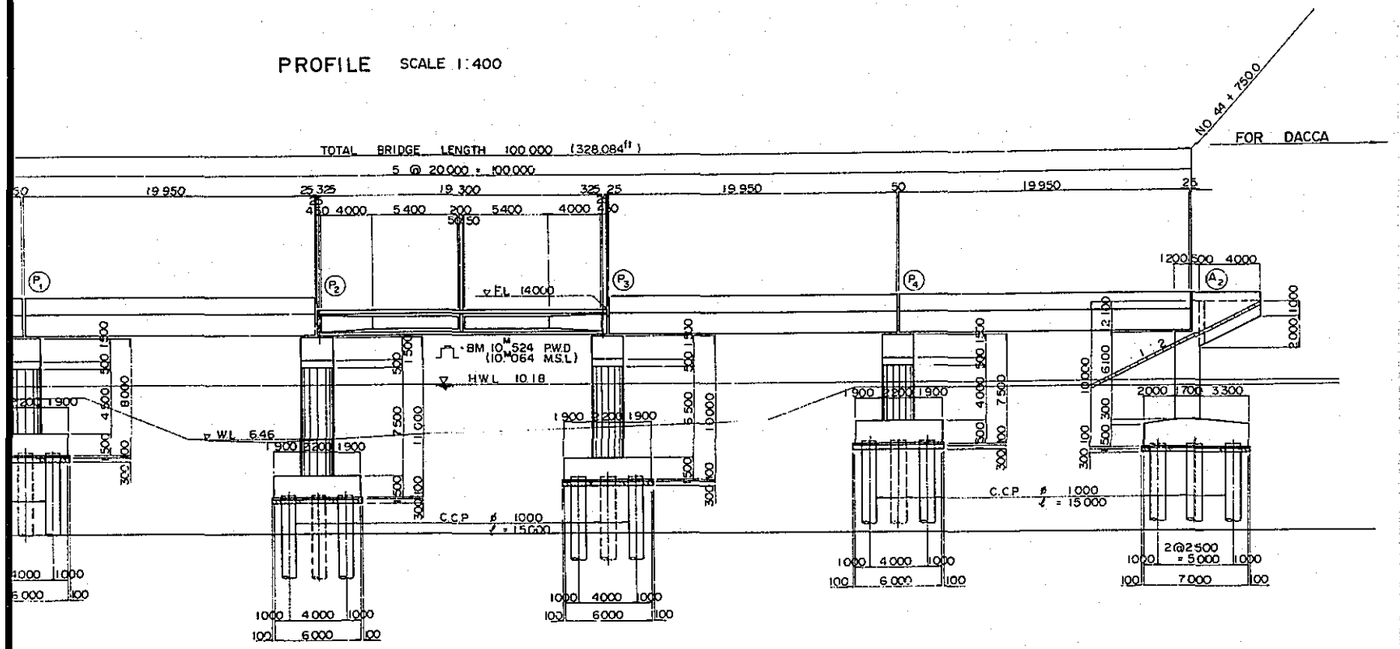


PLAN SCALE 1:400



RAILWAY BRIDGE NO.2

PROFILE SCALE 1:400



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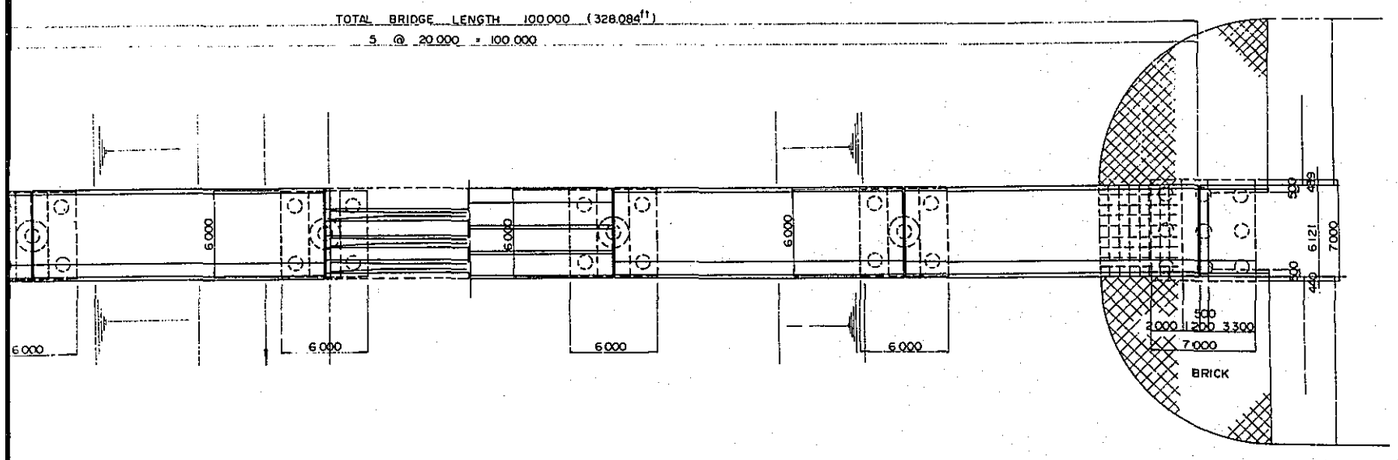

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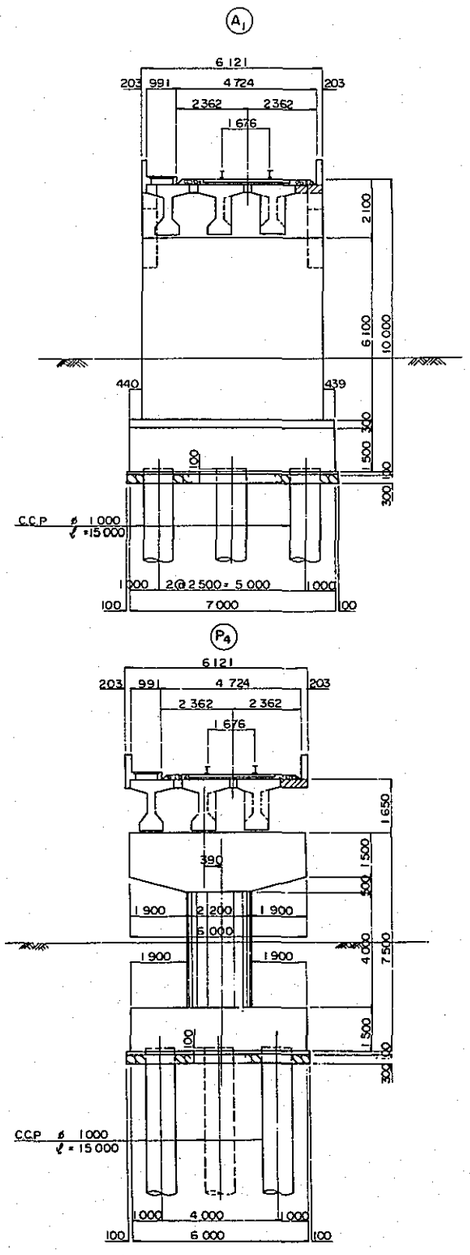
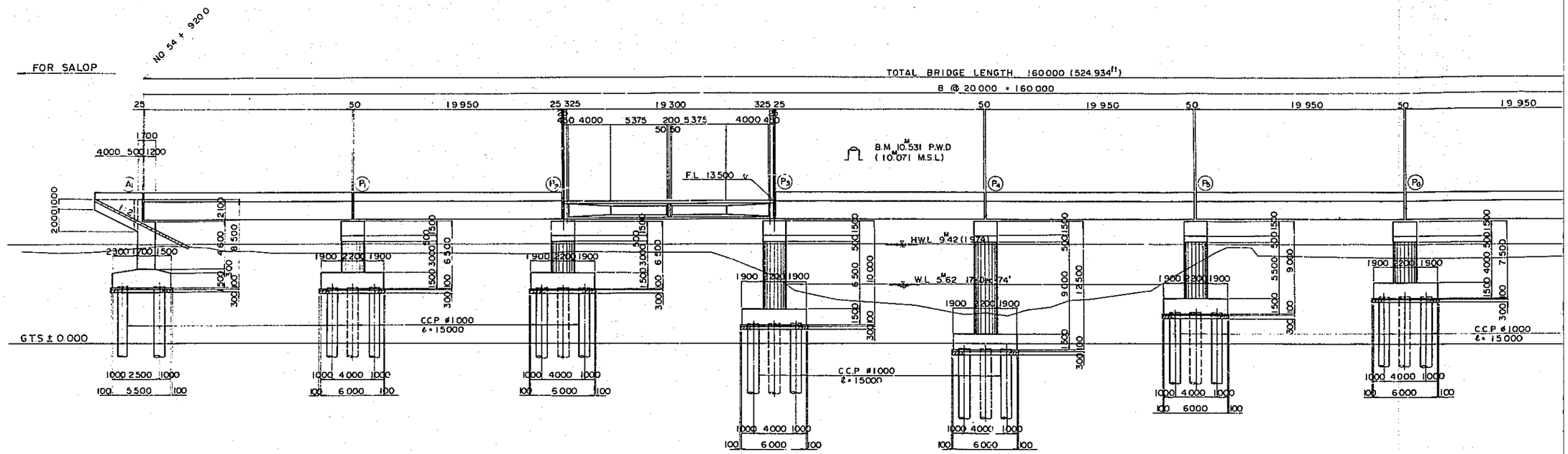


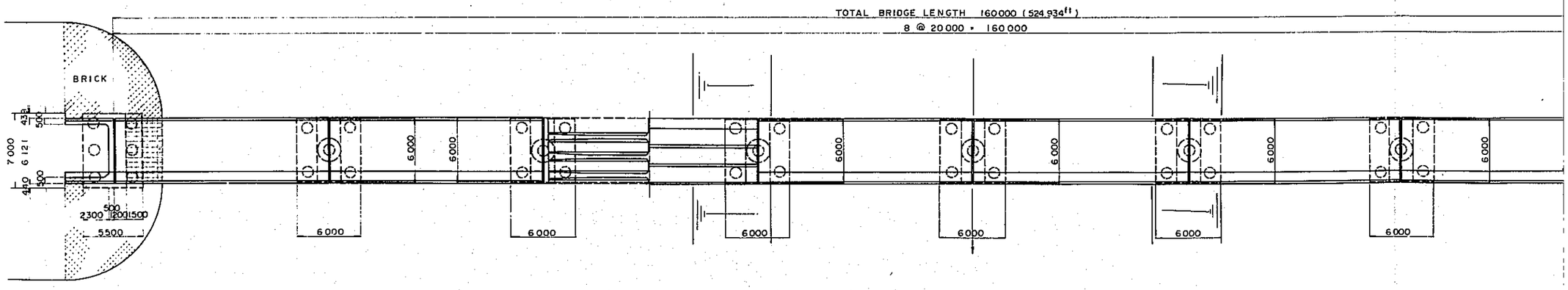
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME IV RAILWAY LINKS RAILWAY BRIDGE NO. 2	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1: 400, 200	Date
Drawn Y. Wakabayashi	DRW. NO. 2
Approved K. Tezuka	

RAILWAY BRIDGE NO.3

PROFILE SCALE 1:400



PLAN SCALE 1:400



;E NO.3

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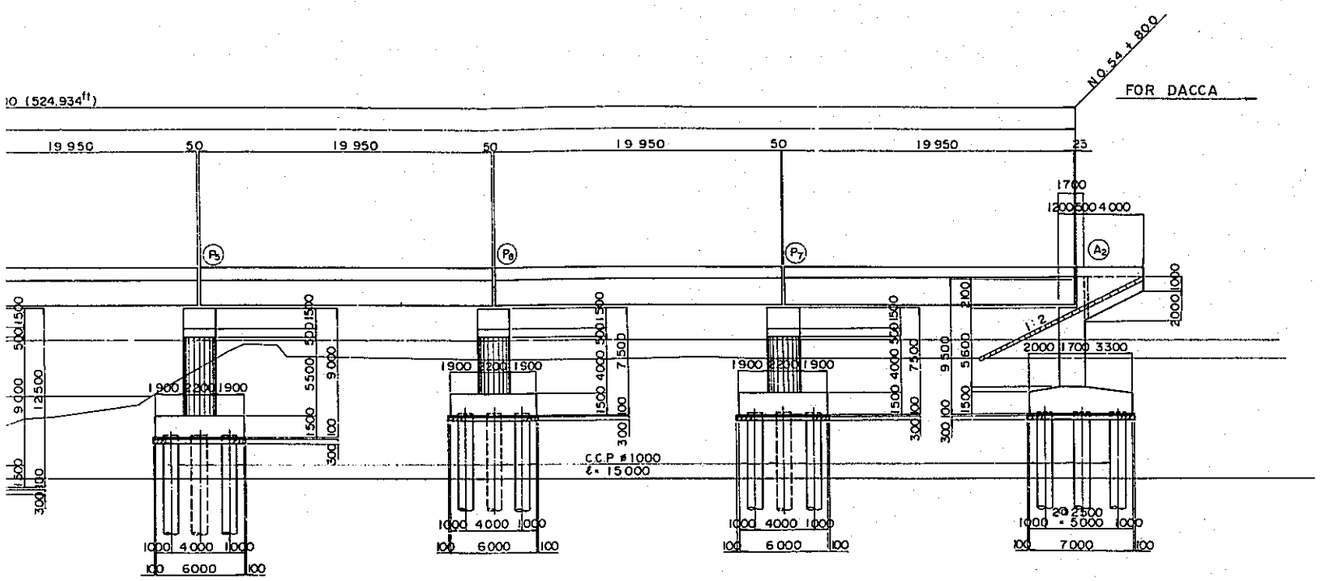

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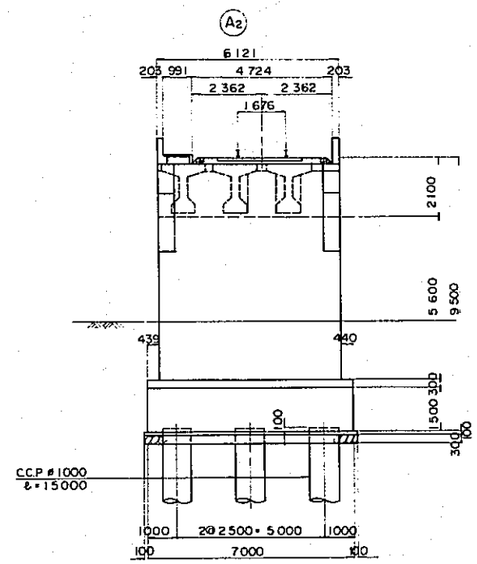

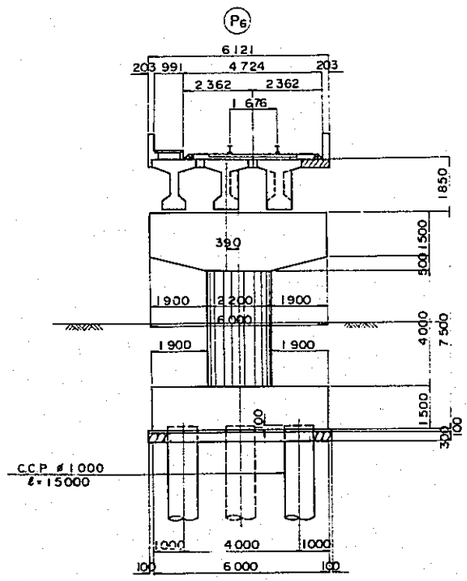

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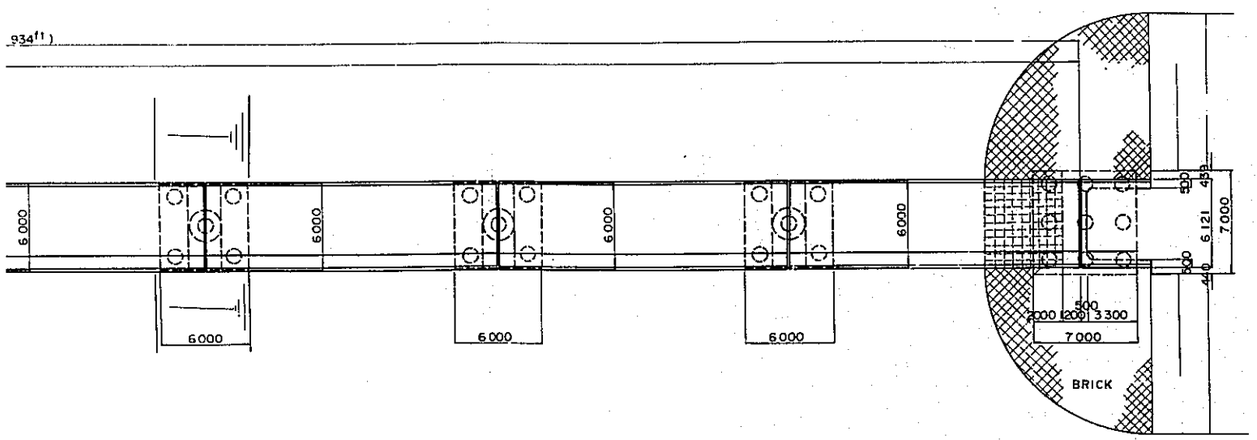
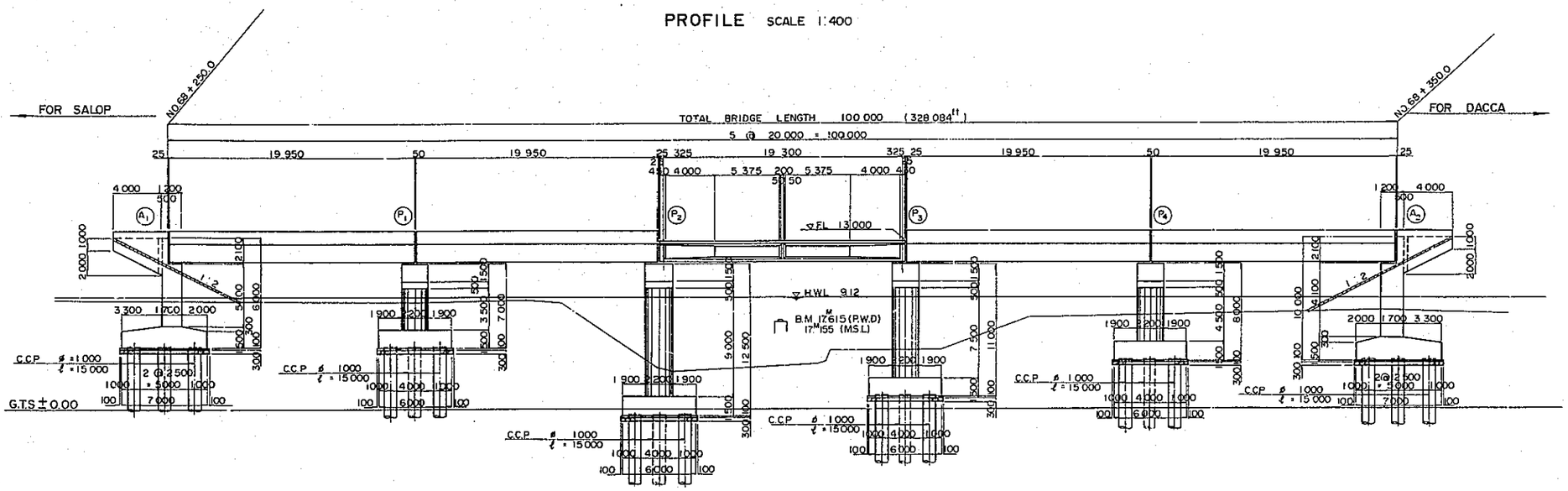


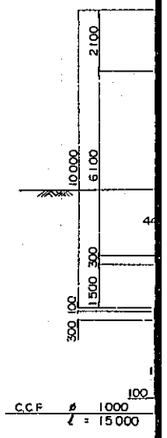
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME Ⅳ RAILWAY LINKS RAILWAY BRIDGE NO. 3	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400, 200	Date
Drawn Y. Wakabayashi	DRW. NO. 3
Approved K. Tezuka	

RAILWAY BRIDGE NO. 4

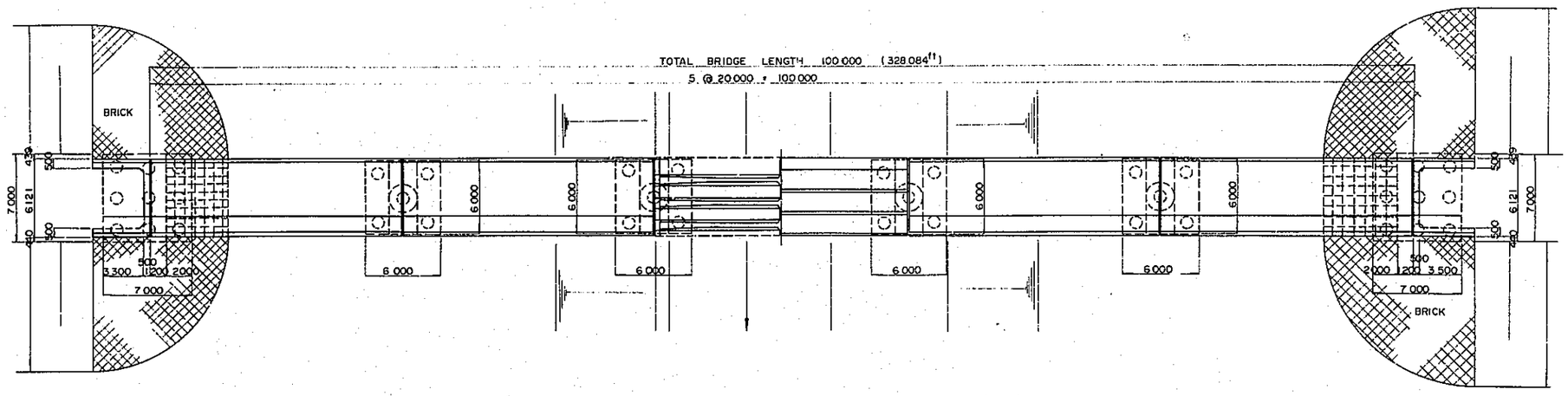
PROFILE SCALE 1:400

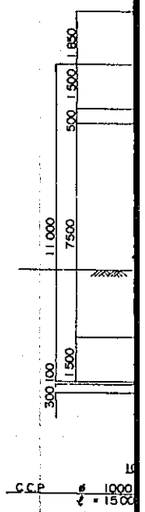


CROSS



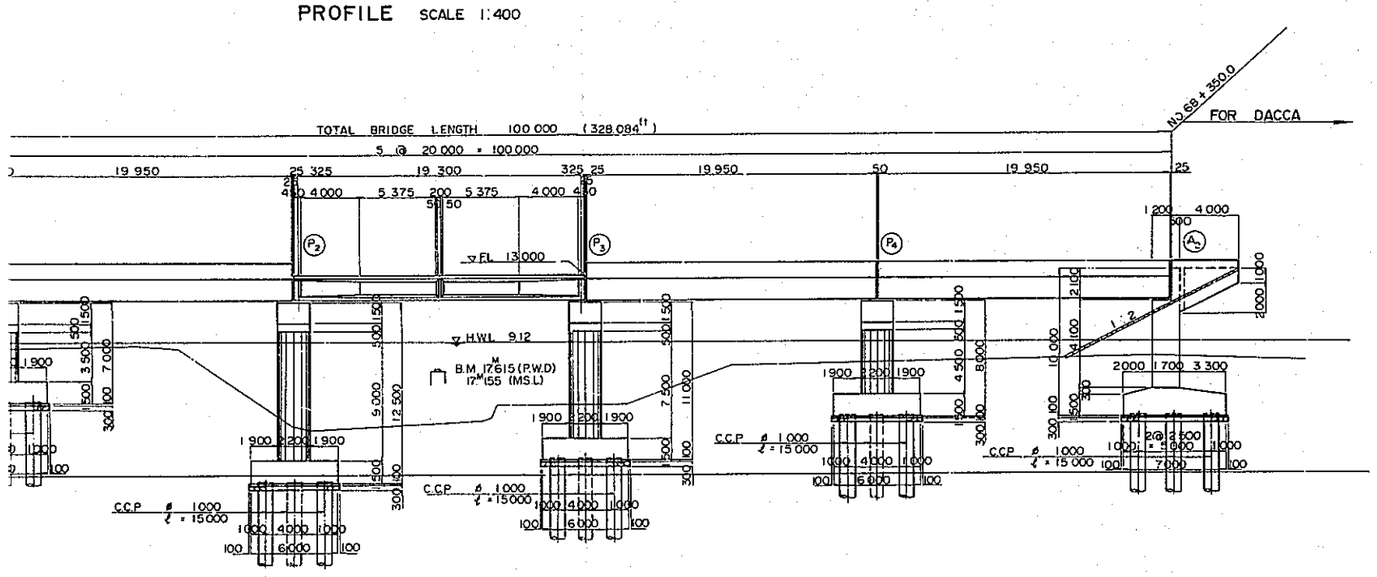
PLAN SCALE 1:400



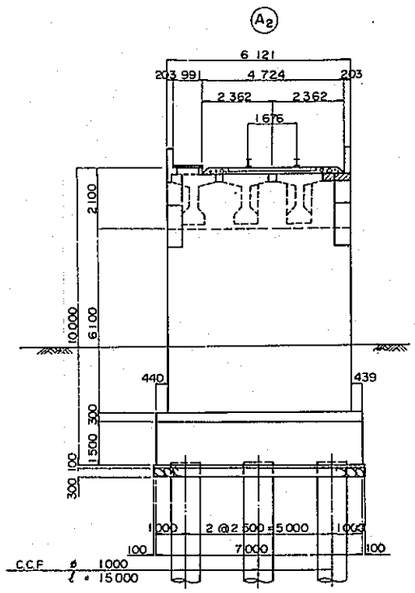


RAILWAY BRIDGE NO.4

PROFILE SCALE 1:400



CROSS SECTION SCALE 1:200



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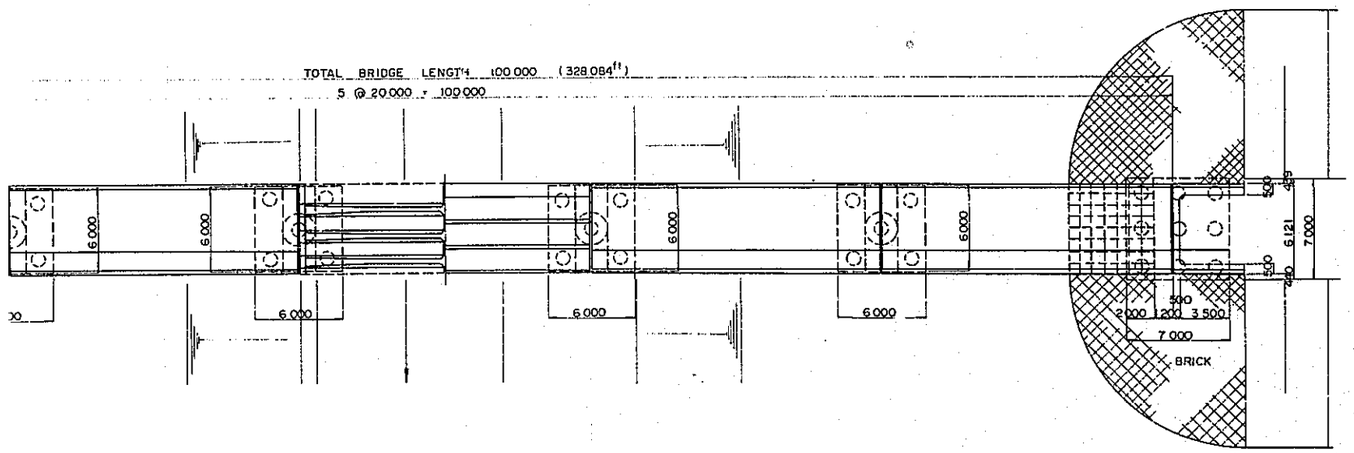
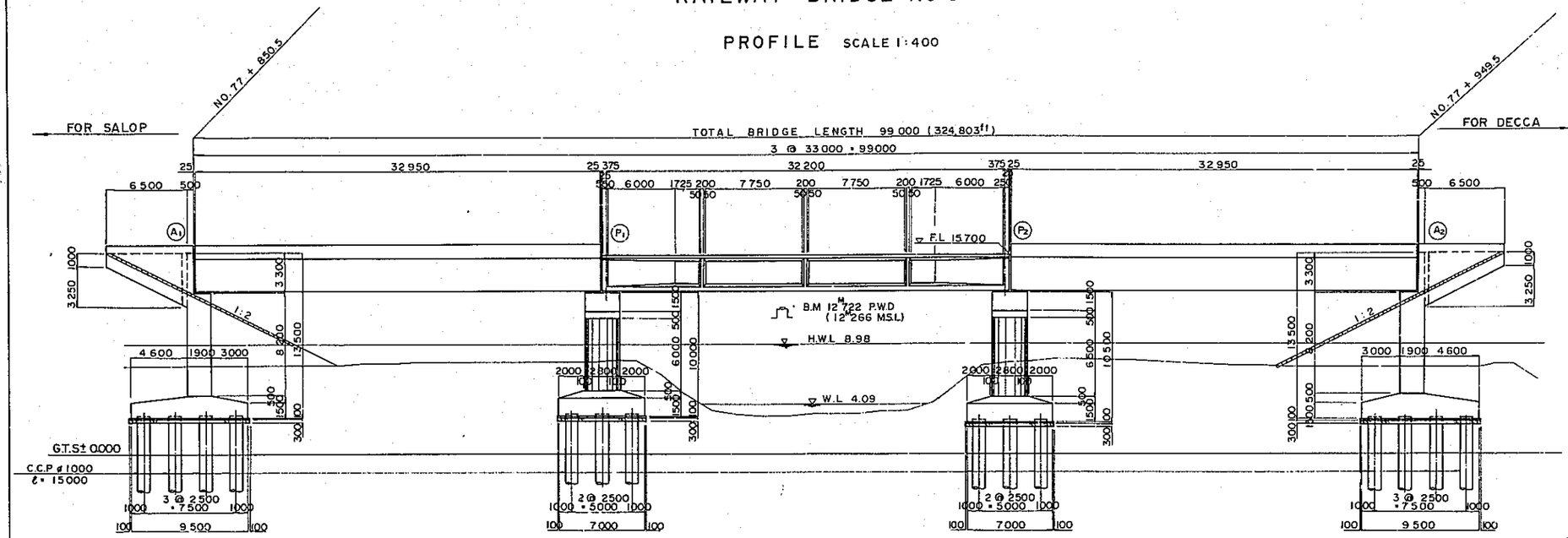


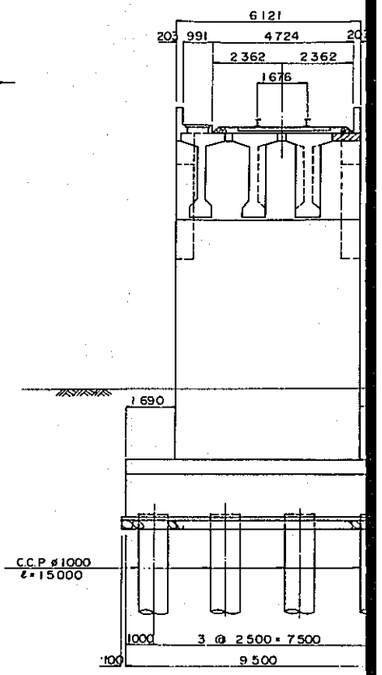
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME V RAILWAY LINKS RAILWAY BRIDGE NO. 4	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400 , 200	Date
Drawn Y. Wakabayashi Approved K. Tezuka	DRW. NO. 4

RAILWAY BRIDGE NO. 5

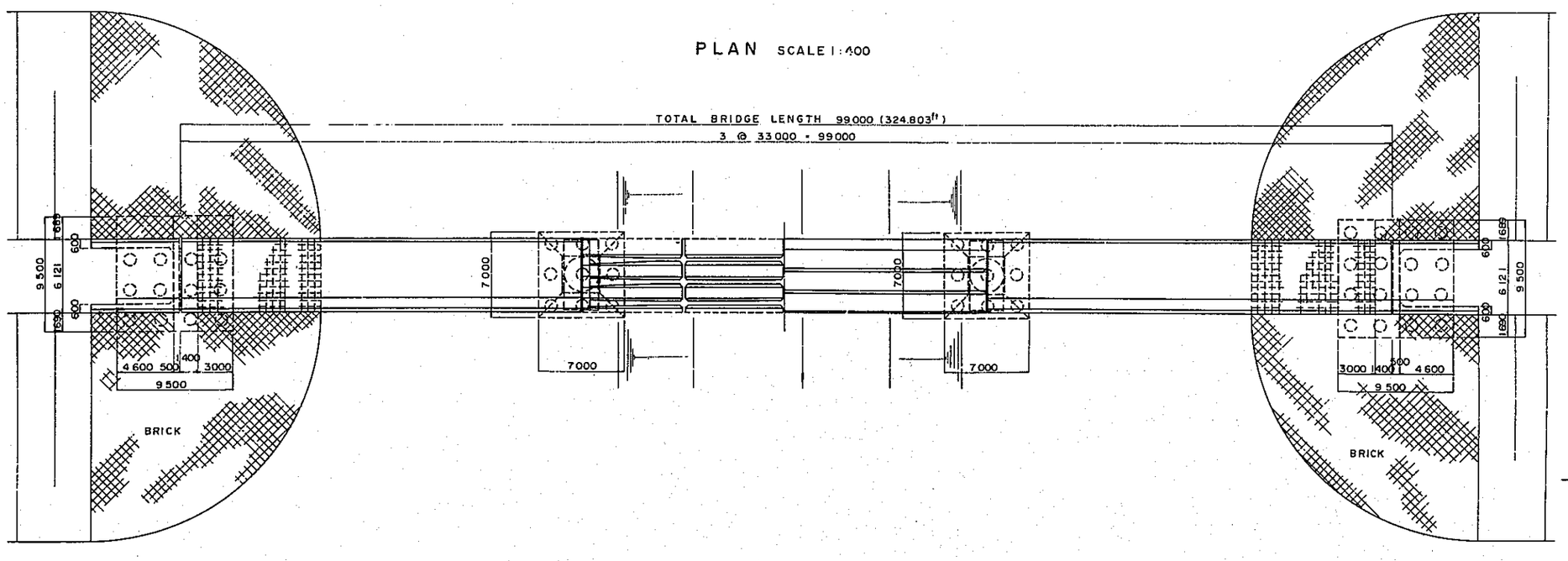
PROFILE SCALE 1:400

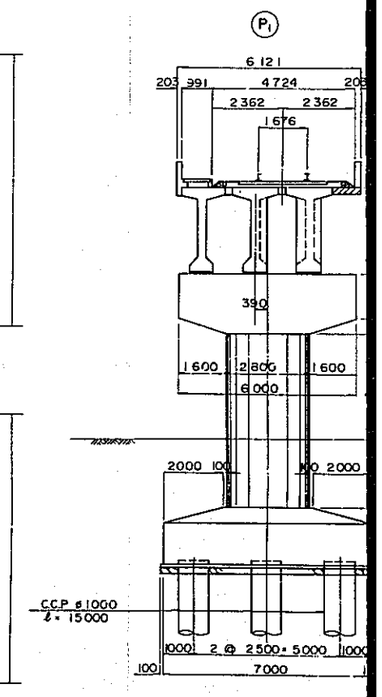


CROSS SECTION SCALE



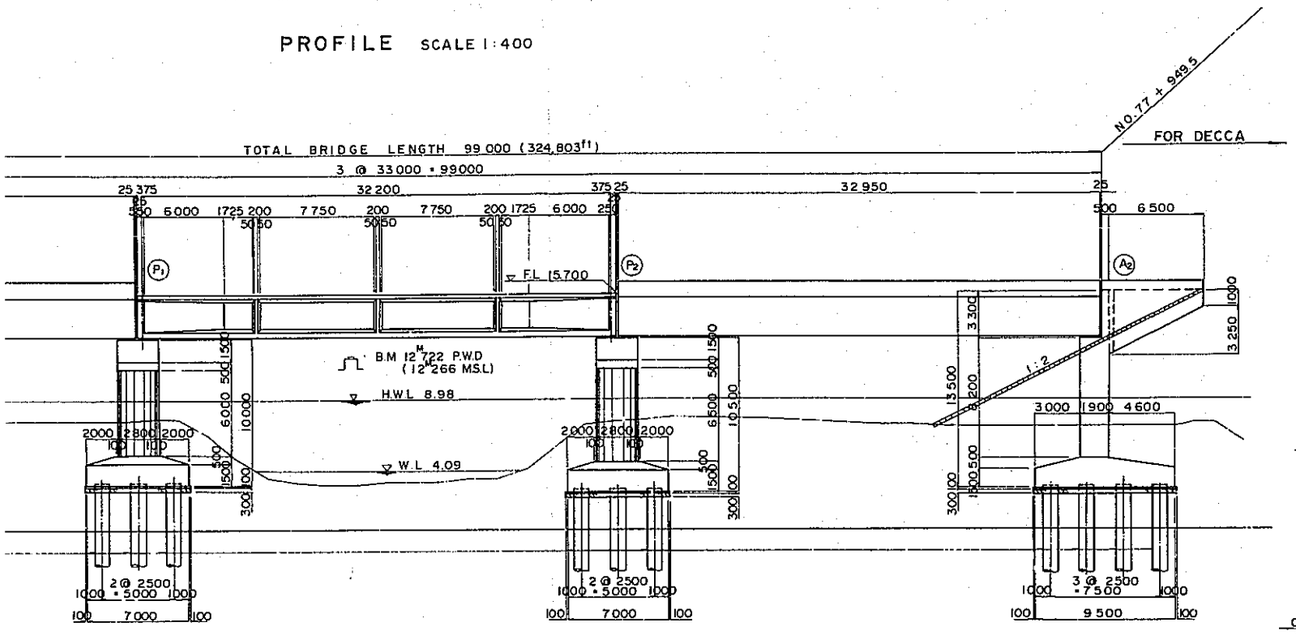
PLAN SCALE 1:400



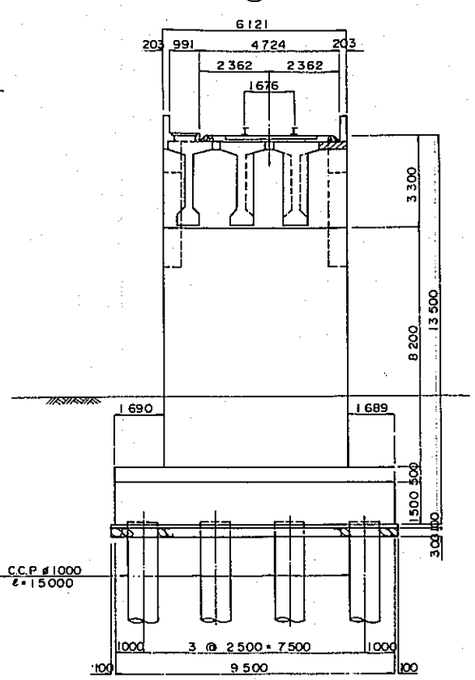


RAILWAY BRIDGE NO. 5

PROFILE SCALE 1:400



CROSS SECTION SCALE 1:200



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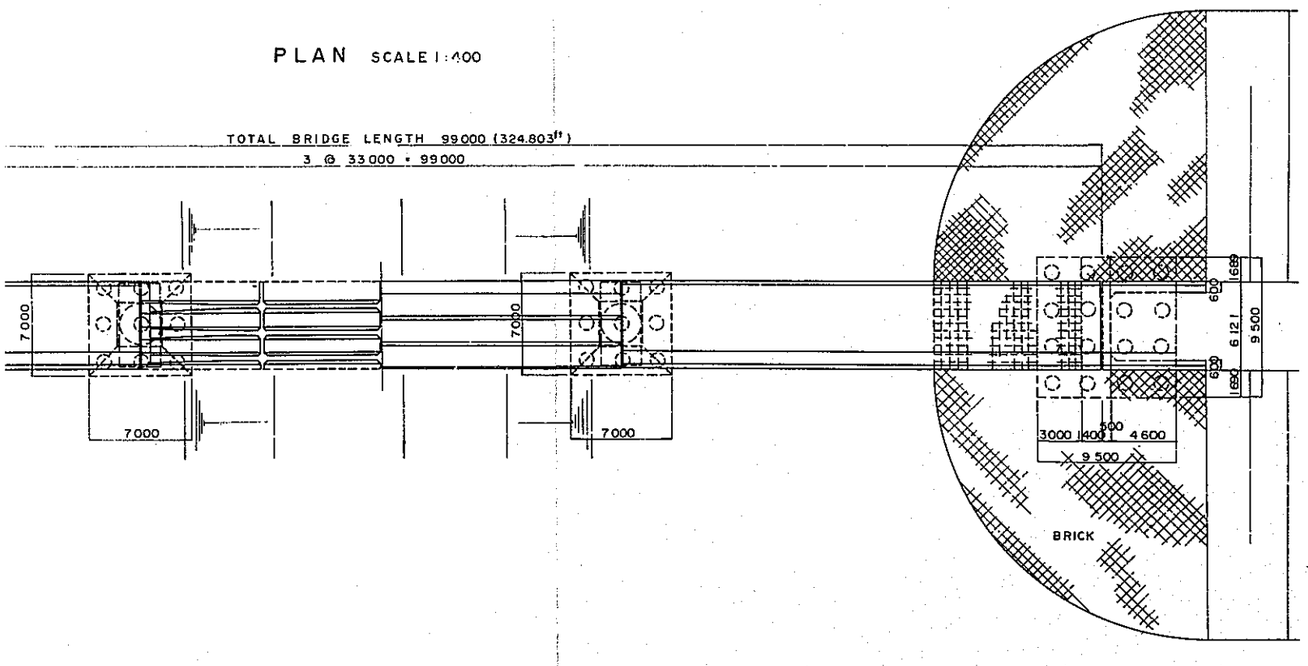
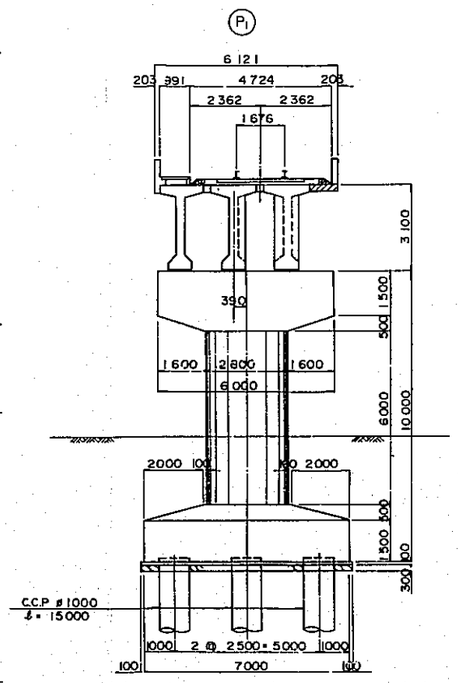
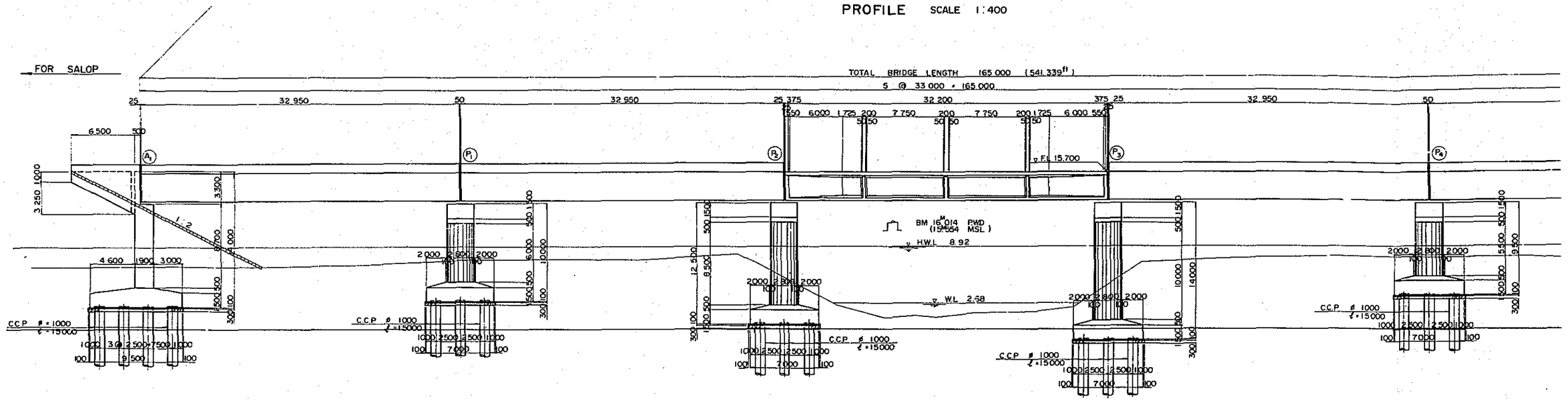




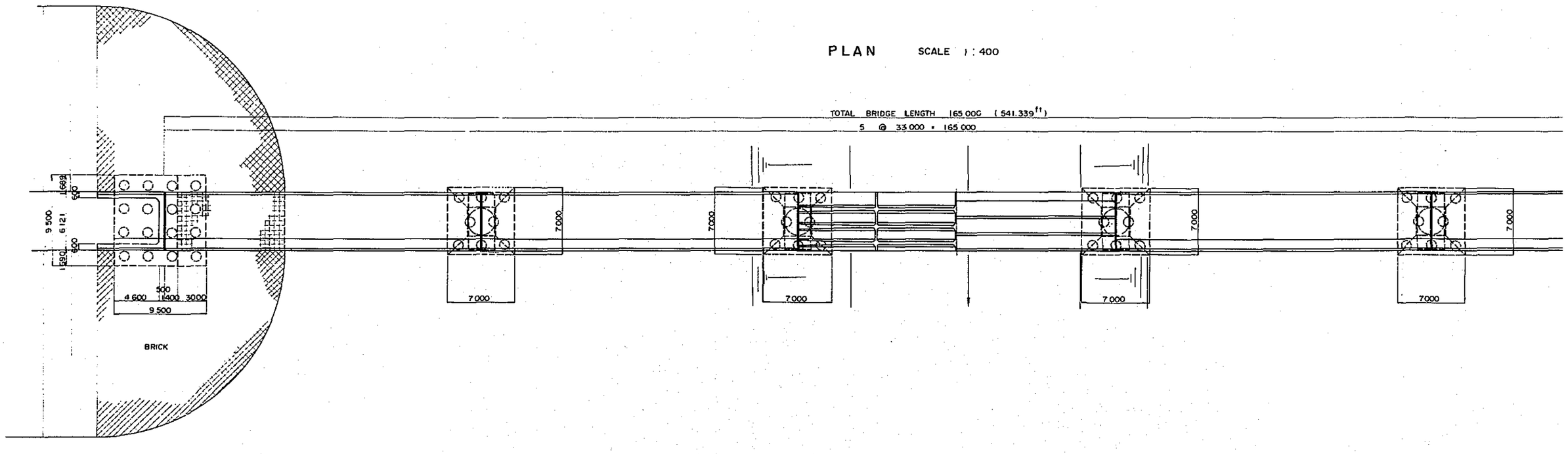
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME IV RAILWAY LINKS RAILWAY BRIDGE NO. 5	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400 , 200	Date
Drawn Y. Wakabayashi Approved K. Tezuka	DRW. NO. 5

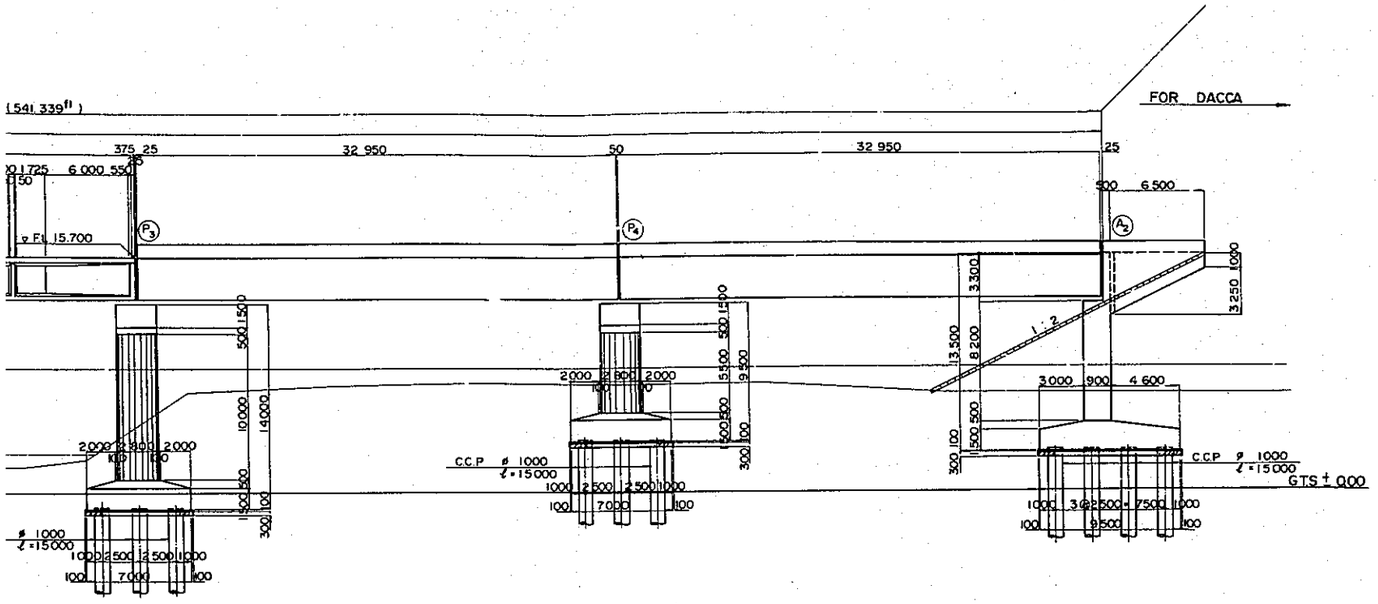
RAILWAY BRIDGE NO. 6

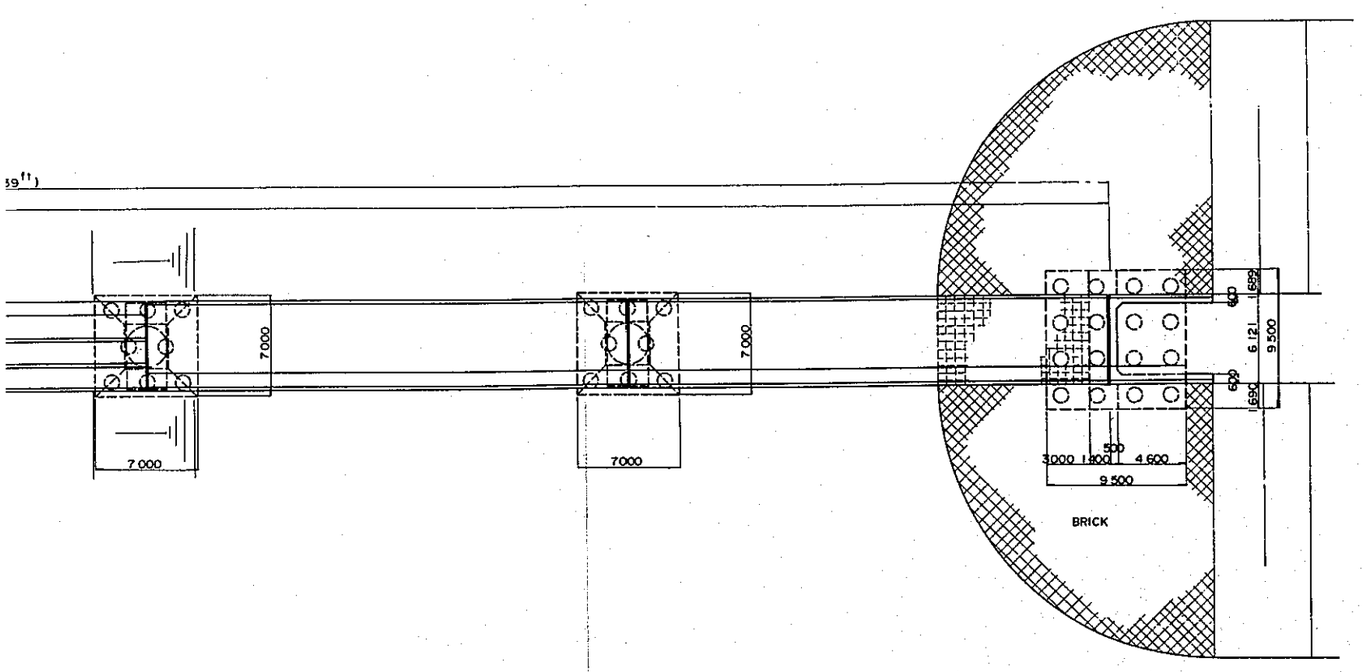
PROFILE SCALE 1:400



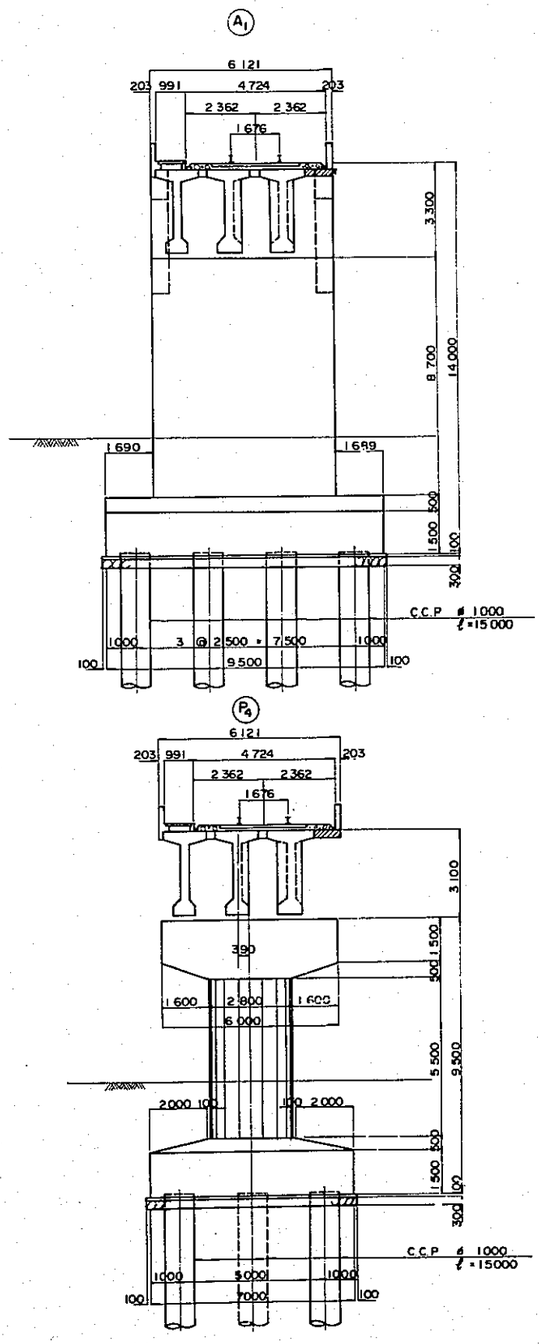
PLAN SCALE 1:400







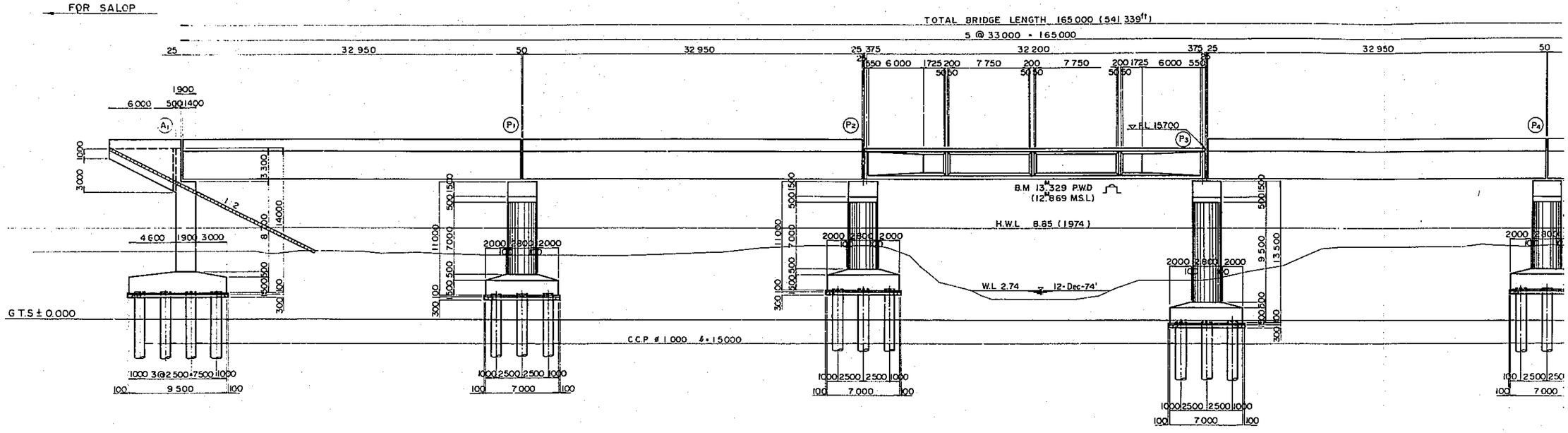
CROSS SECTION SCALE 1 : 200



PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME Ⅳ RAILWAY LINKS RAILWAY BRIDGE NO. 6	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400 , 200	Date
Drawn Y. Wakabayashi	DRW. NO. 6
Approved K. Tezuka	

RAILWAY BRIDGE NO.7

PROFILE SCALE 1:400



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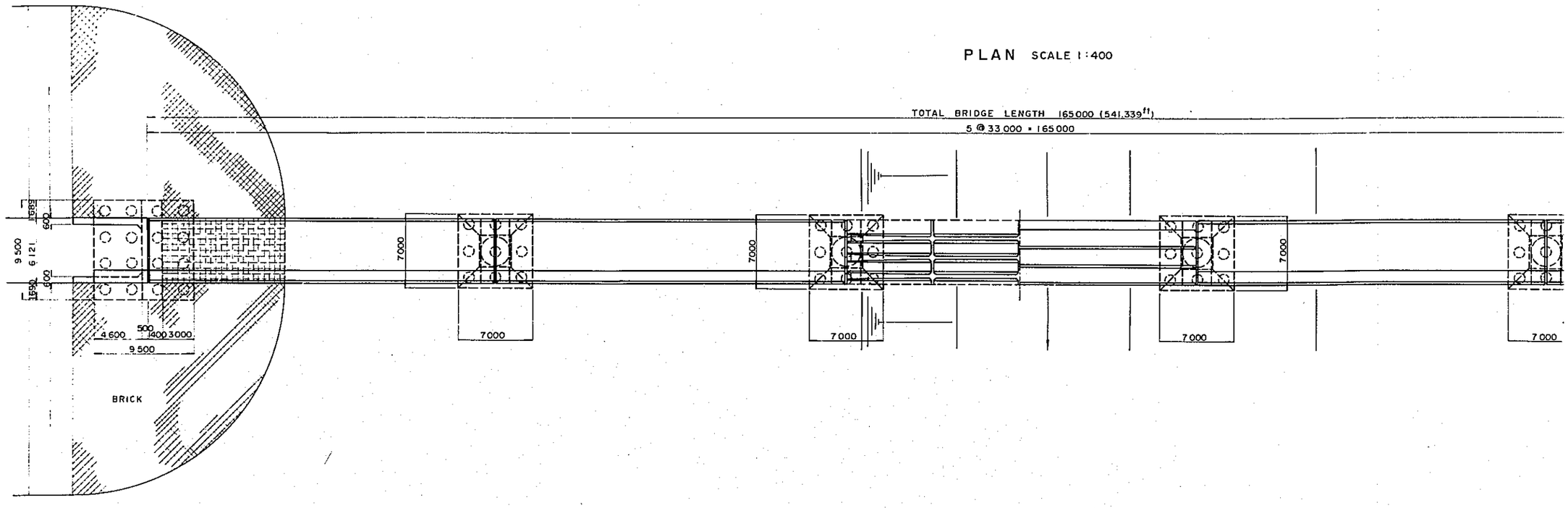
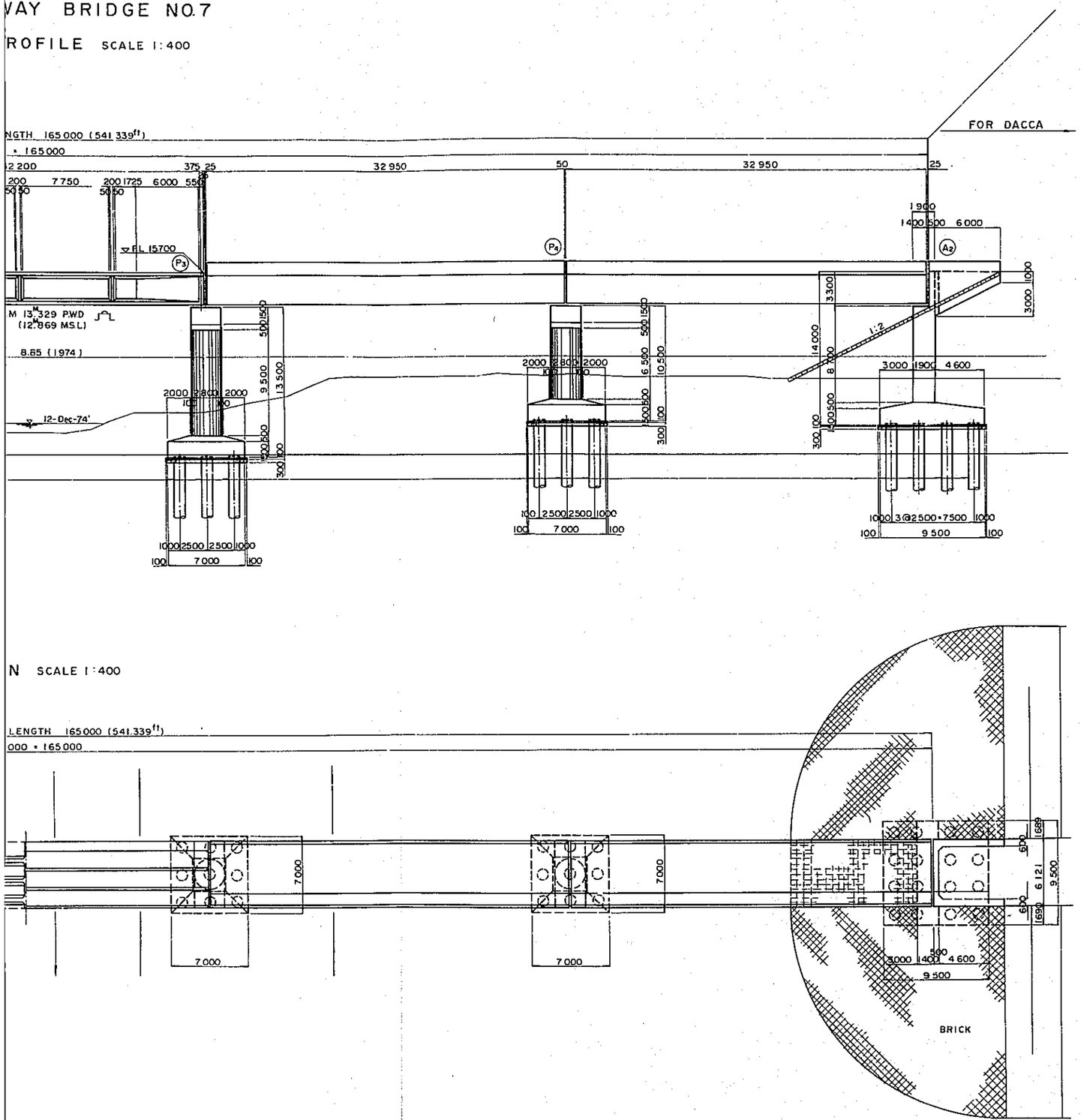


VAY BRIDGE NO.7

ROFILE SCALE 1:400



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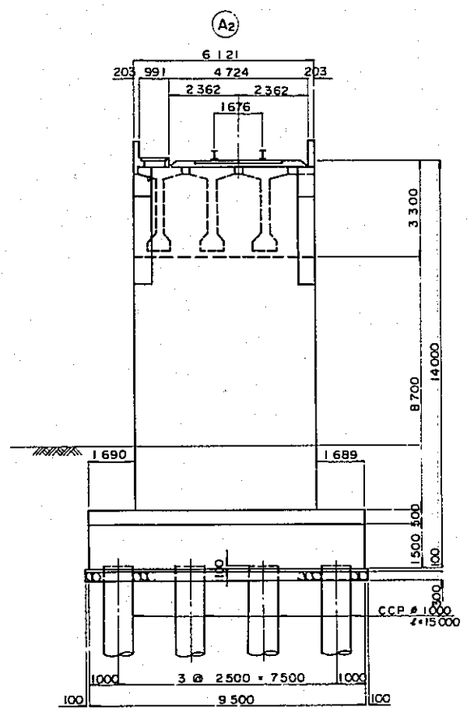
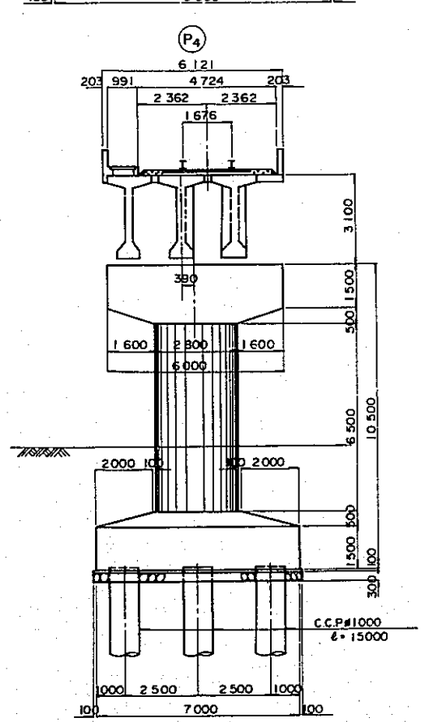


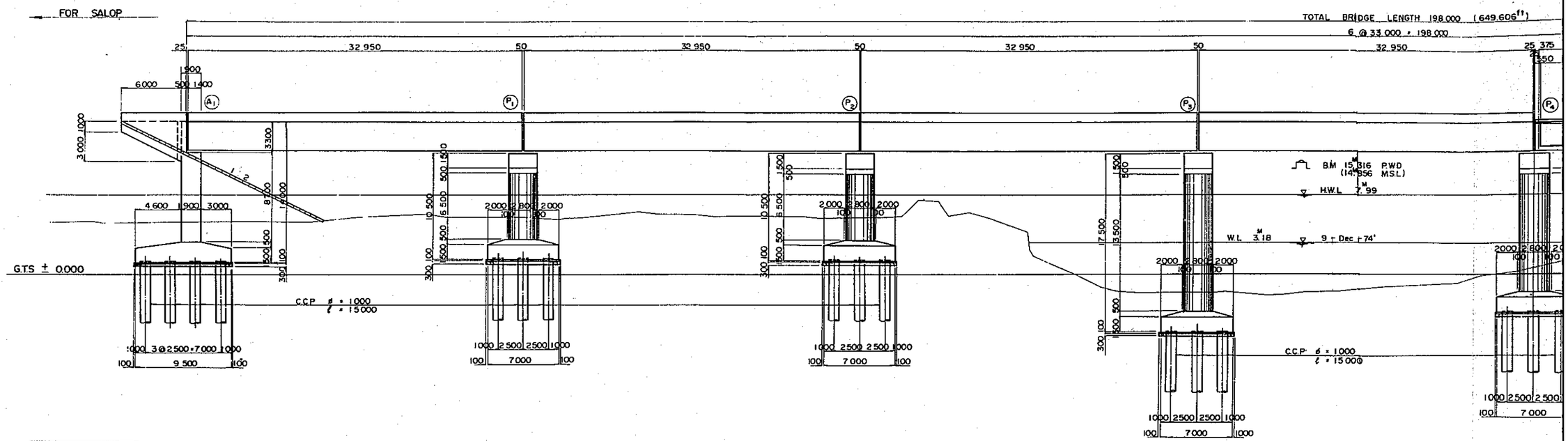


N SCALE 1:400

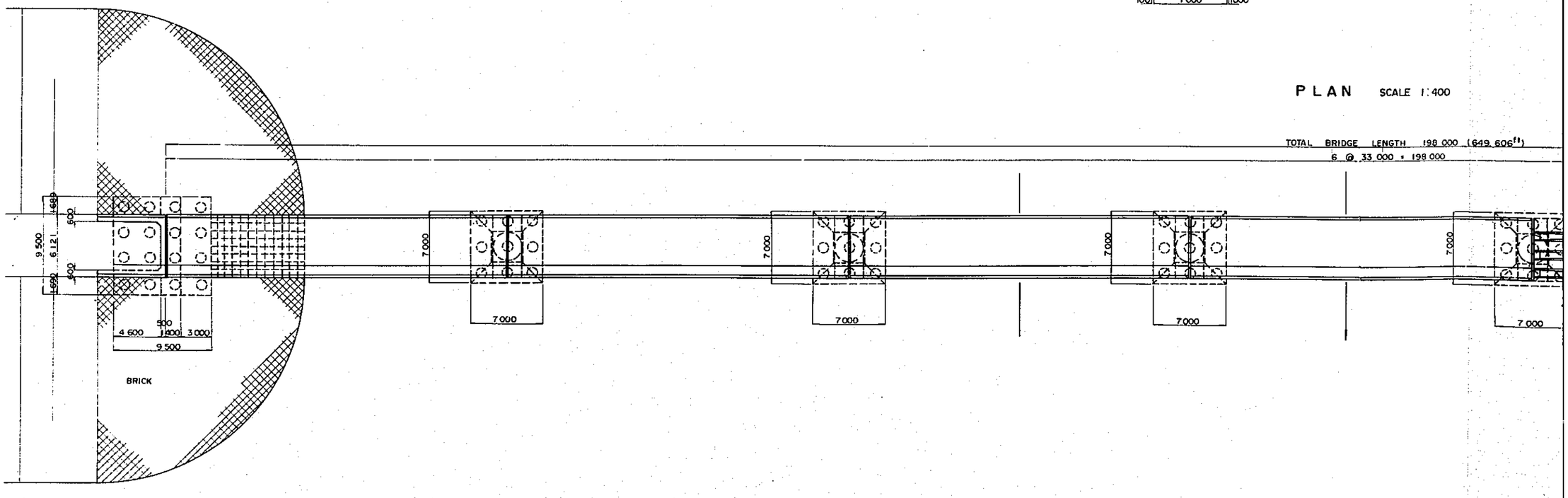
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME Ⅳ RAILWAY LINKS RAILWAY BRIDGE NO.7	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1:400, 200	Date
Drawn Y. Nakabayashi Approved K. Tezuka	DRW. NO. 7

RAILWAY BRIDGE NO.8

PROFILE SCALE 1:400

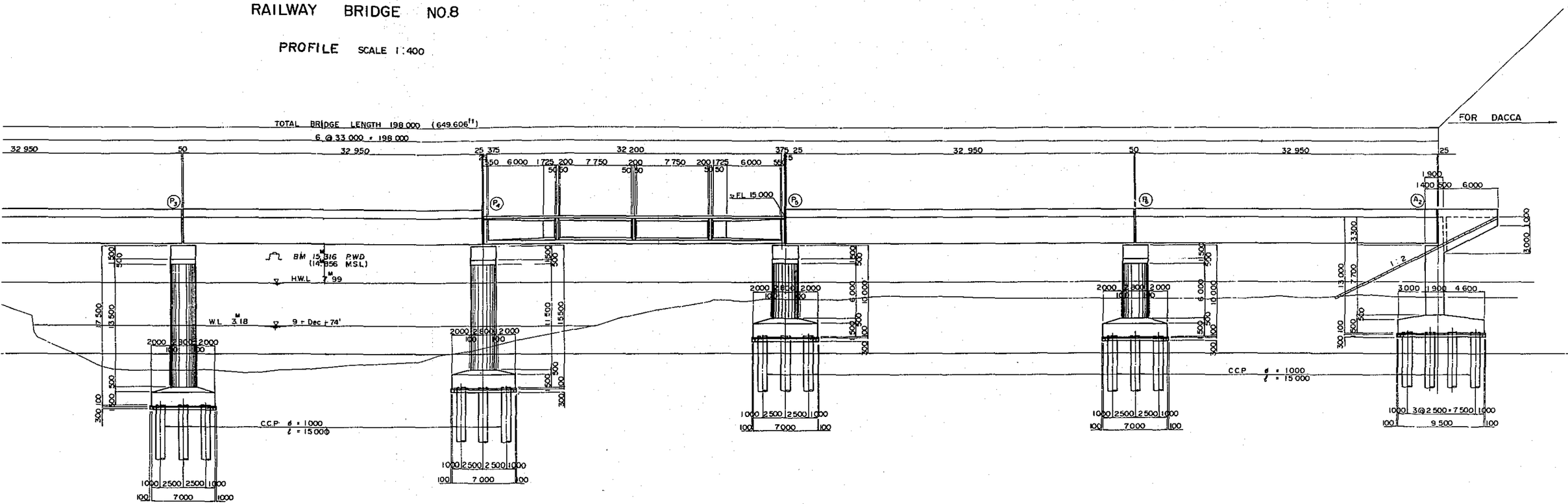


PLAN SCALE 1:400

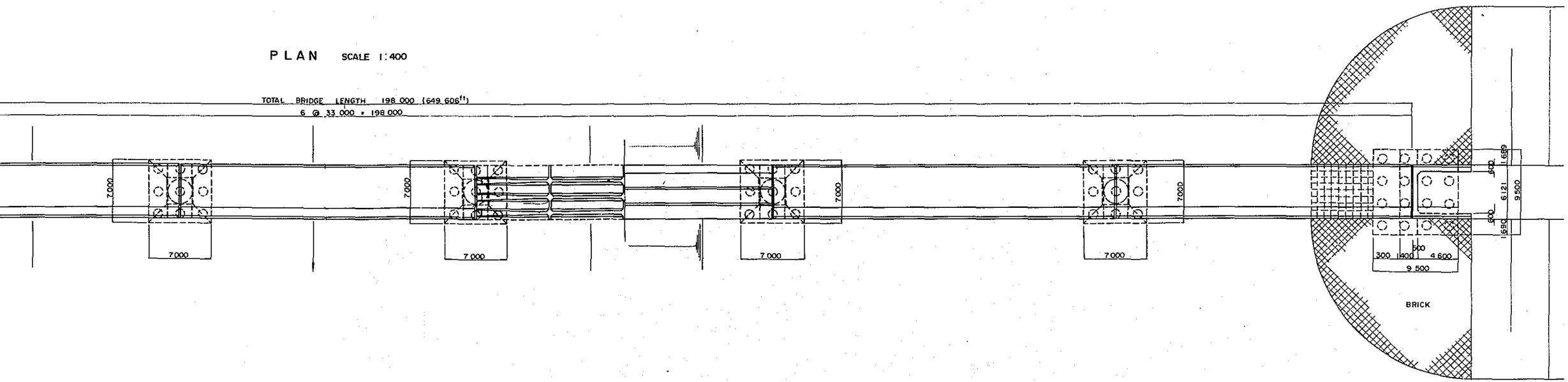


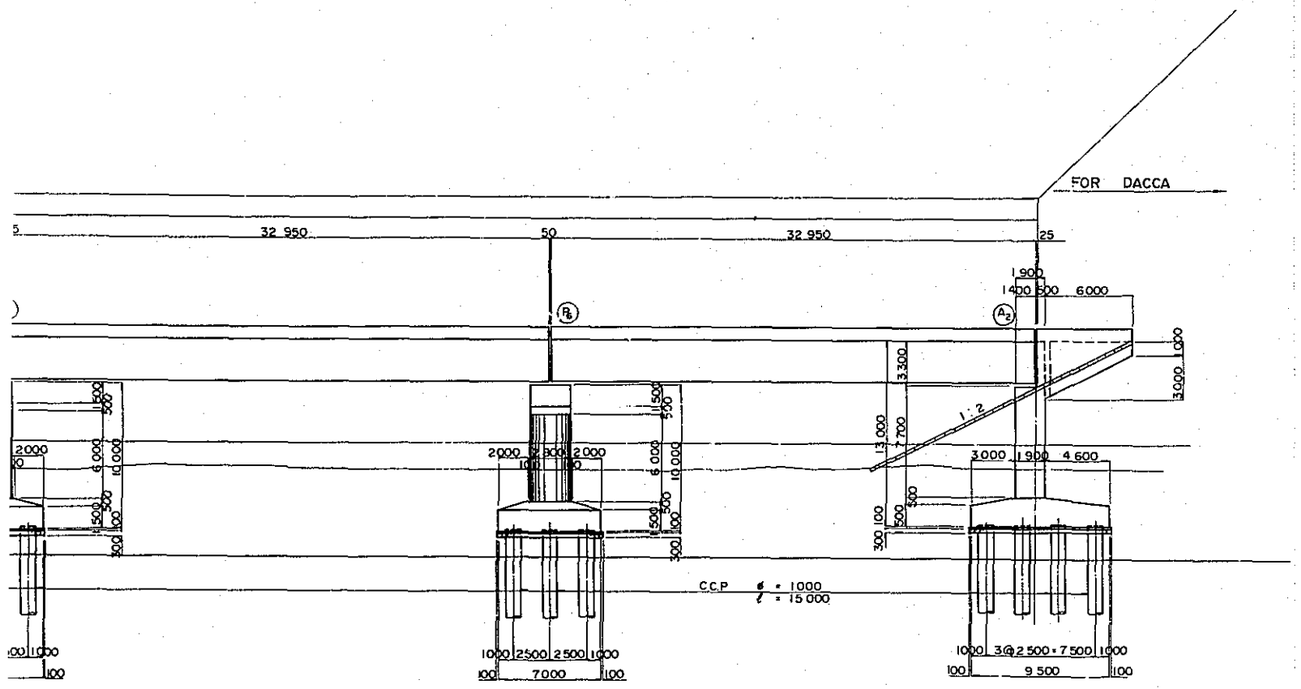
RAILWAY BRIDGE NO.8

PROFILE SCALE 1:400

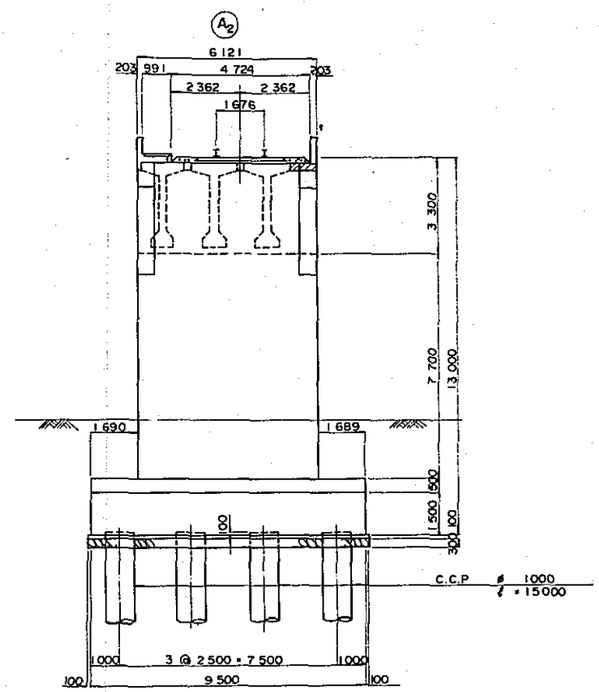


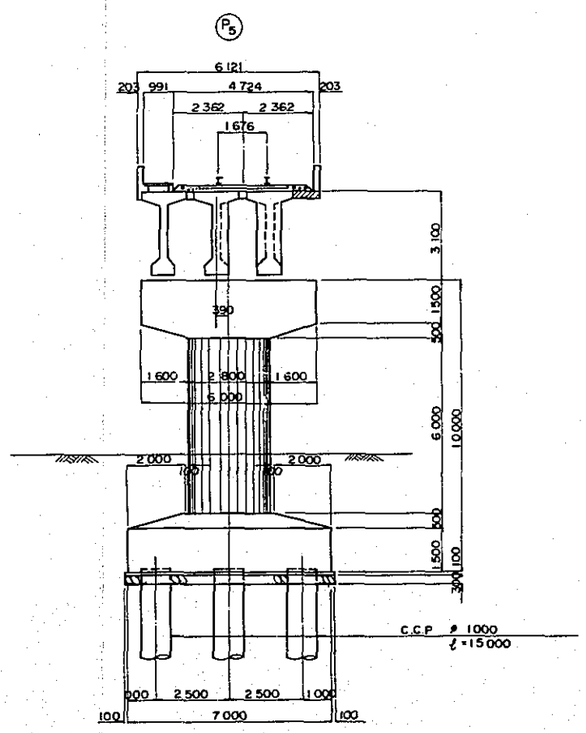
PLAN SCALE 1:400





CROSS SECTION SCALE 1:200

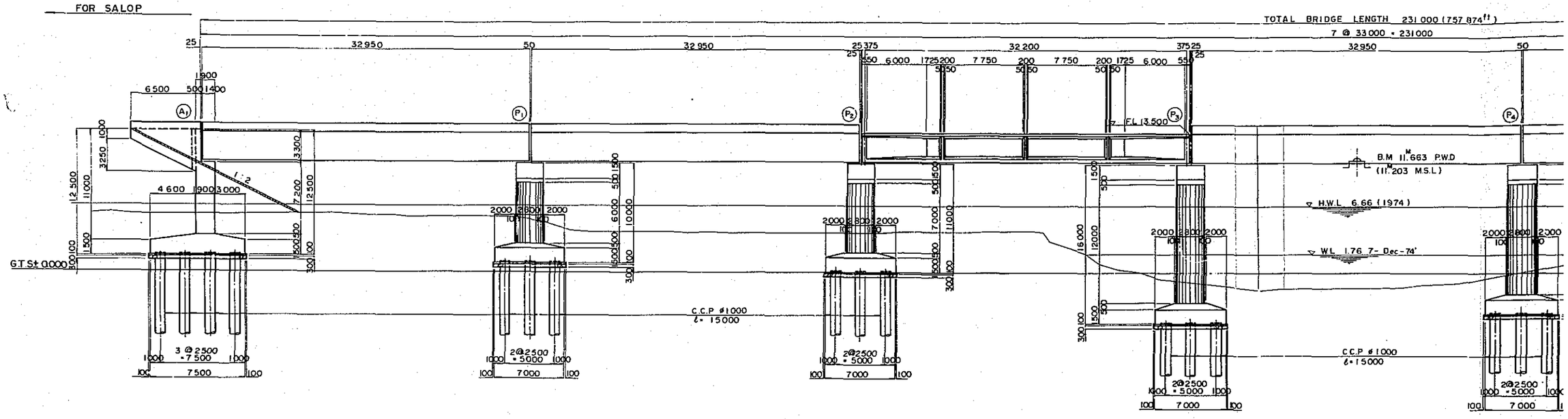




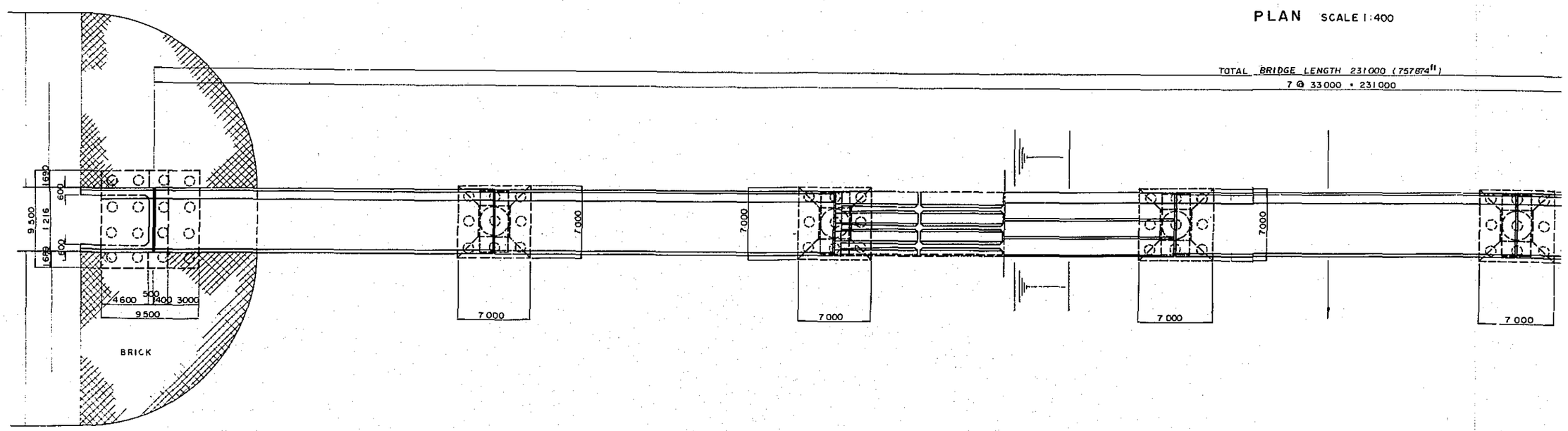
PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME Ⅳ RAILWAY LINKS RAILWAY BRIDGE NO. 8	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400 , 200	Date
Drawn K. Wakabayashi	DRW. NO. 8
Approved K. Tezuka	

RAILWAY BRIDGE NO.9

PROFILE SCALE 1:400

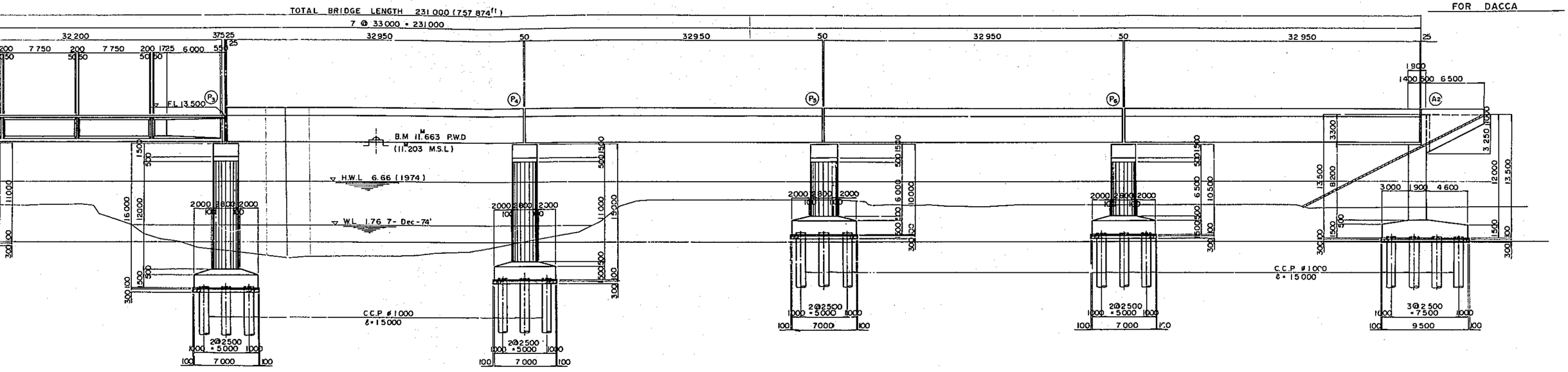


PLAN SCALE 1:400

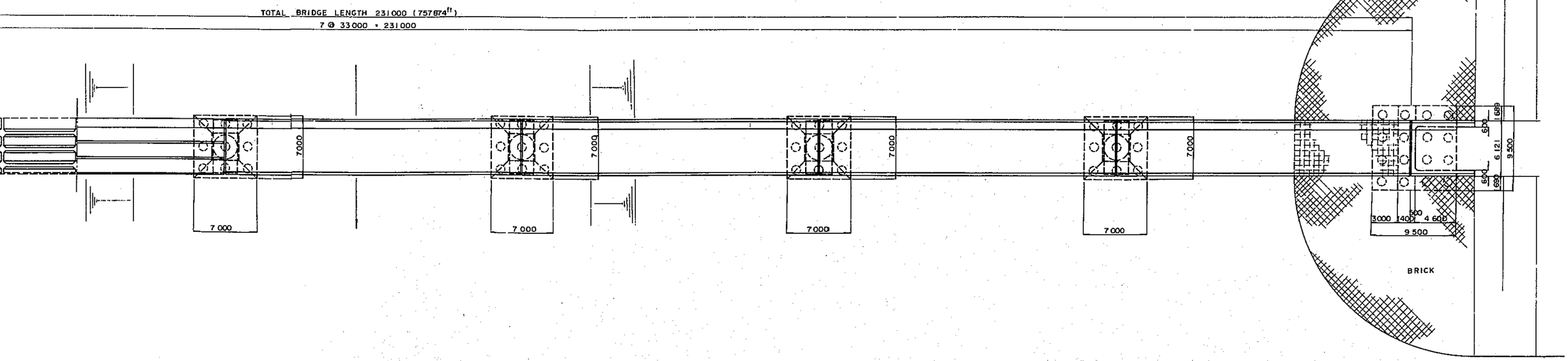


RAILWAY BRIDGE NO.9

PROFILE SCALE 1:400

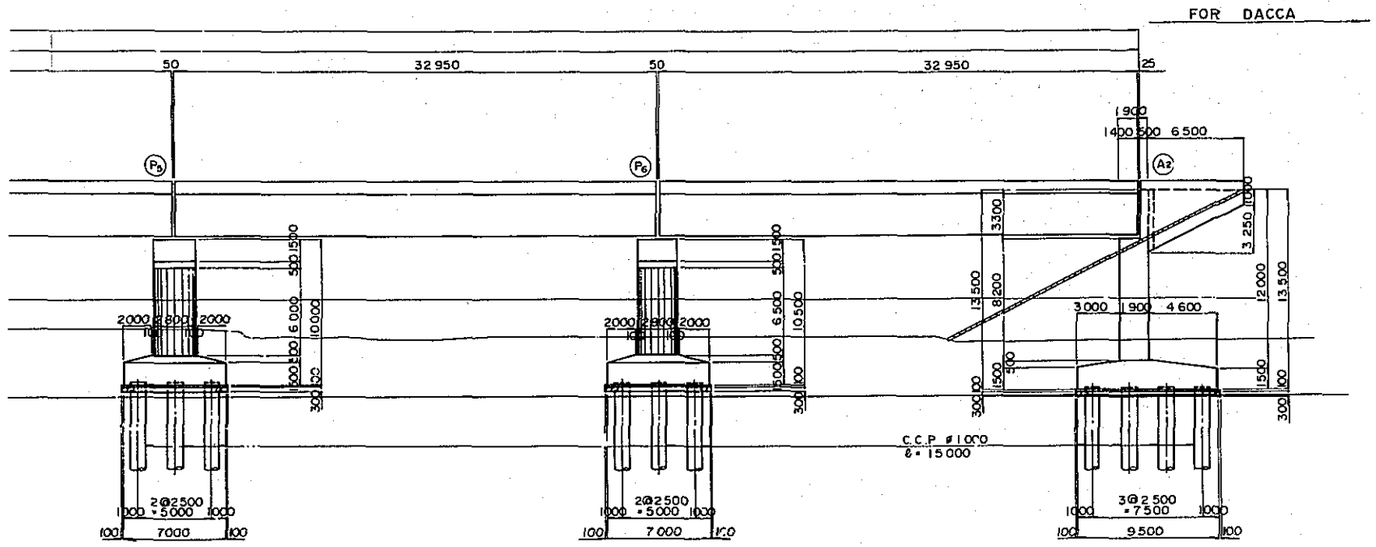


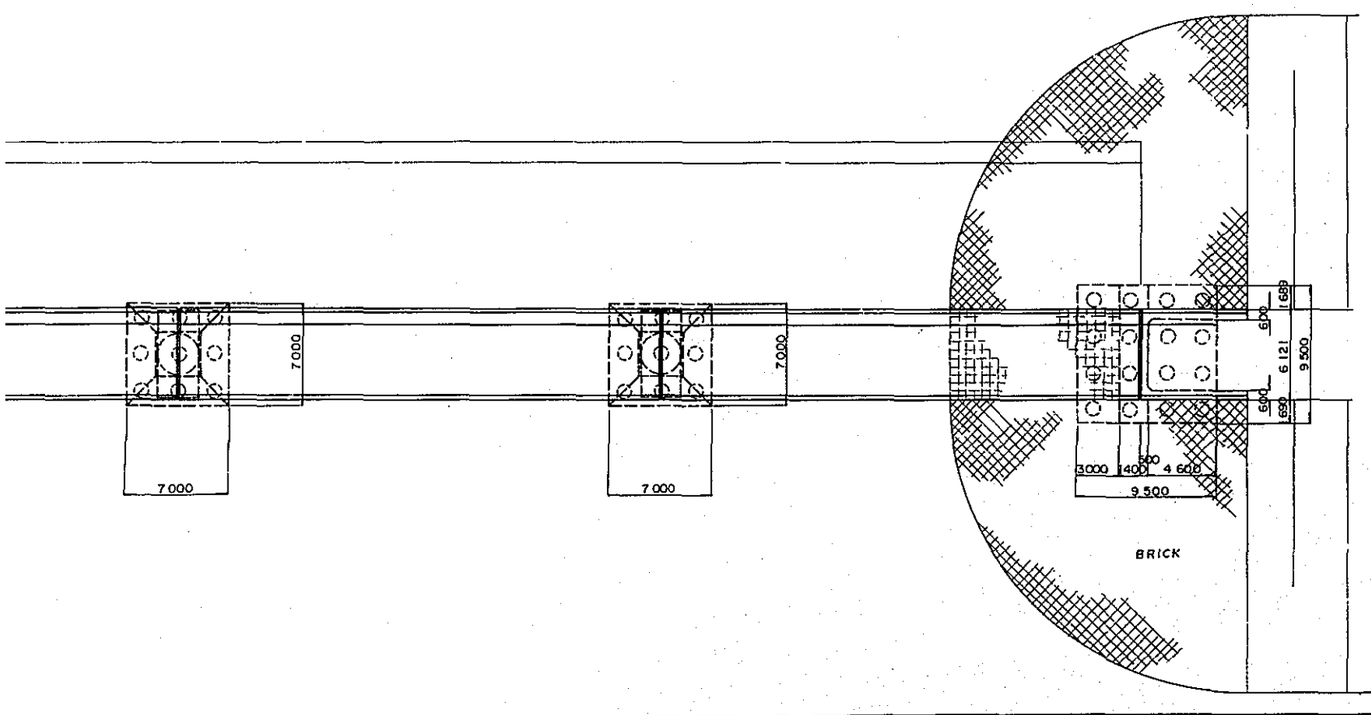
PLAN SCALE 1:400



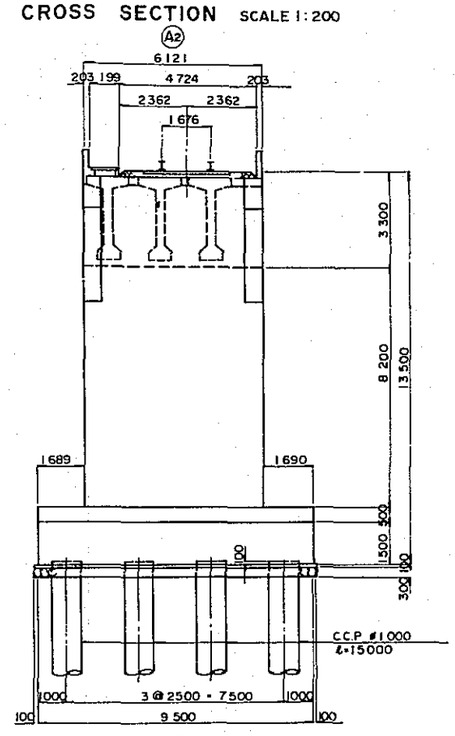
CROSS

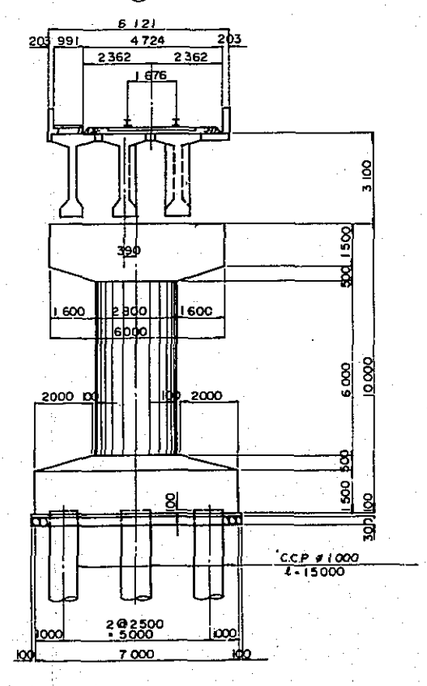
FOR DACCA





CROSS SECTION SCALE 1:200





PEOPLE'S REPUBLIC OF BANGLADESH	
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT	
VOLUME Ⅳ RAILWAY LINKS	
RAILWAY BRIDGE NO. 9	
JAPAN INTERNATIONAL COOPERATION AGENCY	
JAPAN BRIDGE & STRUCTURE INSTITUTE, INC.	
Scale 1 : 400 , 200	Date
Drawn Y. Wakabayashi	DRW.NO. 9
Approved K. Izuka	