Table 4.7.1 Approximate Quantities of Major Items

Descriptions	Unit	Quantities
Cutting	cu. m	184,600
Filling	cu. m	75,700
Concrete	cu. m	14,500
Reinforcement Bar	tons	1,300
Gabions	cu. m	9,200
Stone Masonry	sq. m	6,900
Graveled Surface	sq. m	42,900
Penetration Macadam Surface	sq. m	9,800
Concrete Surface for Causeways	sq. m	10,200
Drainage Ditches	m	12,400

4.8 Maintenance Work

4.8.1 General

The scope of work to be carried out by HMG covers the maintenance with some improvements of existing roads, except the stretches under construction. The main work will be composed of:

- Removal of landslide deposits on the road.
- Removal of debris flow deposits on the causeways after being hand over.
- Removal of sediment materials in the drainage ditches and culverts.
- Regular maintenance of on- and off-road work.
- Repair of slope protection.
- Other maintenance works, as needed.

4.8.2 Scope of Maintenance Work and Work Quantities

Required road maintenance work will mostly be to remove earth and rock deposited on the road by landslides and at the causeways after being handed over. Also, the rehabilitation and repair of the road is to include reconstruction of worn structures, replacement of expansion joints on bridges and slope stabilization work. All of this is

classified in terms of both manpower and mechanized maintenance work, discussed as follows:

A. Removal of Earth and Rock by Landslides

This work will consist of removing, loading, hauling and dumping of earth and rocks deposited on the road by landslides. This is expected to occur mostly between Kamara bridge and Sindhuli Bazar due to the existing conditions of topography. Required work volume is estimated based on currently available data as follows.

37.0 km times 700 m^3/km/year = 25,900 m^3/year, say 26,000 m^3/year

B. Removal of Sediment Materials at Causeways

This work will require the excavation, dozing, loading, hauling and dumping of the sediment materials at 17 causeway locations. The required work volume is estimated at 17,000 m^3/year with the condition that the sediment volume is 250 m^3/place and is to be carried out four times per year at each of the 17 causeways as shown below:

250 m^3/place x 17 places x 4 times/year = 17,000 m^3/year

C. Removal of Sediment Materials in the Drainage Ditches and Culverts

It is difficult to estimate the required work volume (quantitatively) for the drainage ditches and culverts; however, the amount and type of equipment to be provided to meet the needs for maintaining the 37.0 km of road length should be adequate to remove all sediment materials in the drainage ditches and culverts.

D. Regular Maintenance of On- & Off-Road Work

This work comprises: 1) replacement and compaction of gravel, 2) surface grading and 3) maintenance of road structures. The work to be performed is gathering and screening of gravel, hauling and dumping of gravel along the road's surface, spreading and compaction.

As noted above, it is difficult to estimate the required work volume quantitatively; however, the equipment to be provided to meet the needs for maintaining the 37.0 km of road length should be adequate to perform the required repair/rehabilitation work.

4.8.3 Selection of Maintenance Equipment

The required maintenance equipment is classified in accordance with the stipulated maintenance work mentioned above and is listed as follows:

- Earthmoving Equipment.
- Concrete Production Equipment.
- Lifting Equipment.
- Roadway Equipment.

Many kinds of equipment and tools are necessary for the repair shops which are planned to be located at Bardibas and Sindhuli Bazar. Procurement of spare parts are planned for two years of operation.

Maintenance equipment was selected taking into consideration the following factors:

- To meet all of the different types of required maintenance work for Section I.
- To repair the equipment by the trained DOR maintenance staff.
- A readily available supply of spare parts and tools.

A. Earthmoving Equipment

Bulldozer	:	For removal of earth and rock deposited on the road by means of one bulldozer with 14-ton capacity. This is to be allocated to Bardibas.
Backhoes	:	For removal of earth and rock deposited on the road as well as sediment at 17 causeways and drainage ditches along the road using a backhoe with a 0.6 m^3 of bucket capacity that is allocated to Bardibas.

Wheel Type Loader : For removing earth, clay, rock and other materials on the road and sediment at 17 causeways by two wheel type loaders with 1.4 m^3 bucket capacity. They will be allocated to Bardibas.

Crawler Type Loader : For removing earth and rock deposited on the road by means of one crawler loader with a 1.5 m^3 bucket capacity. It will be allocated to Bardibas.

Dump Trucks : For hauling deposited and sedimented materials using Three dump trucks, each with an 8-ton capacity. They will be allocated to Bardibas.

Vibratory Rollers : For compaction of surfacing materials by a vibratory roller with a 4-ton capacity. This will be allocated to Bardibas.

B. Concrete Production Equipment

Concrete Mixers : For production of concrete at the work site for re-construction of structures by means of a portable type concrete mixer (0.3 m^3 capacity). They will be allocated to Bardibas .

C. Lifting Equipment

Truck Crane : For handling heavy cargo and materials by means of a truck crane having a 5.0-ton lifting capacity that will be allocated to Bardibas.

D. Roadway Equipment

Motor Grader : For grading work along 37.0 km of road by means of a motor grader having a 2.8 m blade width. This will be allocated to Bardibas.

Plate Compactors : For compaction work along 37.0 km of road by means of Three 80 kg vibratory plate compactors. These will be allocated to Bardibas .

E. Repair Shop Equipment and Tools

Power Supply : To generate and supply electric power for the repair shop, a diesel engine generator with 50/60 kVA generating capacity will be procured for the maintenance/repair shop at Bardibas.

Equipment and Tools : To repair the maintenance equipment by means of standard type of equipment and tools for the repair shop at Bardibas.

F. Spare Parts

Spare parts (mainly fast-moving ones) are to be procured for two years of operations.

4.8.4 Required Maintenance and Repair Shop Equipment to be Supplied by GOJ

The types of maintenance and repair shop equipment to be supplied by GOJ are summarized below in Table 4.8.1 and Table 4.8.2, respectively.

Table 4.8.1 List of Maintenance Equipment at Bardibas for Section I

Equipment	Capacity	Total
Bulldozer	14.0 t	1
Backhoe	0.6 m^3	1
Wheel Loaders	1.4 m^3	2
Crawler Loader	1.5 m^3	1
Dump Trucks	8.0 t	3
Vibratory Roller	4.0 t	1
Truck Crane	5.0 t	1
Motor Grader	2.8 m	1
Plate Compactors	80 kg	3
Diesel Generator	50/60 kVA	1
4-Wheel Jeep	2/5 Passenger 350/150 kg	1
Pickup Trucks	1 t	2
Repair Shop Equipment & Tools	-	1 lot
Spare Parts	-	1 lot

Table 4.8.2 List of Equipment & Tools for DOR Repair Shop at Bardibas

Equipment/Tools	Bardibas
Gas Welding Set	1
Arc Welding Set	1
Gear Puller	1
Drilling Machine	1
Electric Grinder	1
Portable Air Compressor	1
Vices	2
Chain Block	1
Hydraulic Jack	1
Compression Gauge	1
Revolution Indicator	1
Thickness Gauge	1
Hydraulic Meter	1
Current Meter	1
Voltage Meter	1
Tool Sets for Vehicle Repair	2
Tool Sets for Repair or Construction Equipment	2
Tool Set for Tire Repair	1
Battery Charger	1

4.9 Implementation Program

4.9.1 Construction Principles

The following construction principles will apply:

- The construction work is to be undertaken by a Japanese contractor.

- The implementation program shall be divided into a detailed design stage and a construction stage with an adequate interval in between for the land/house acquisition tendering and other matters.

- Upon being constructed and after handing over the maintenance responsibility for the bridges, approach roads, and causeways will be transferred to DOR.

- HMG shall maintain the road and related facilities using the equipment supplied by GOJ.

4.9.2 Special Considerations for the Construction Plan

For the construction of the nine bridges including their approach roads and the 17 causeways, the following shall be taken into consideration:

- Since the Project site is located far from Kathmandu, there will be a lack of adequate facilities such as electric power, water supply, telecommunications and lodgings.

- The bridge construction sites are divided in about 27-km segments, with PC girder fabrication yards being required for each bridge site.

- The contractor's central concrete mixing plant and rock crushing plant must be adequate for the required concrete volume.

Taking the above into account, the construction plan will be made under following working conditions:

- To construct the base camp composed of the concrete mixing plant, rock crushing plant, workshop, contractor's office/lodgings, laboratory and consultant's office/lodgings near the center of the Project site.

- To construct the girder fabrication yards and contractor's field offices for the bridges.

- To prepare a sufficient communication systems connecting the sites and Kathmandu, the sites and Japan (by satellite) and from site to site.

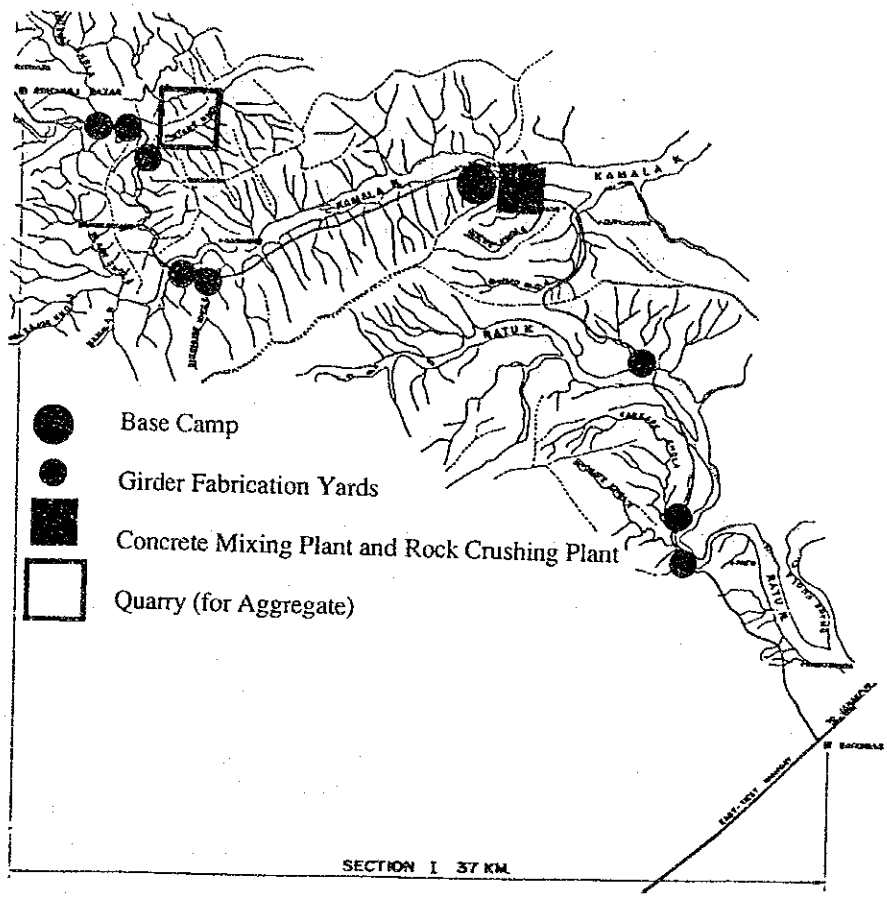


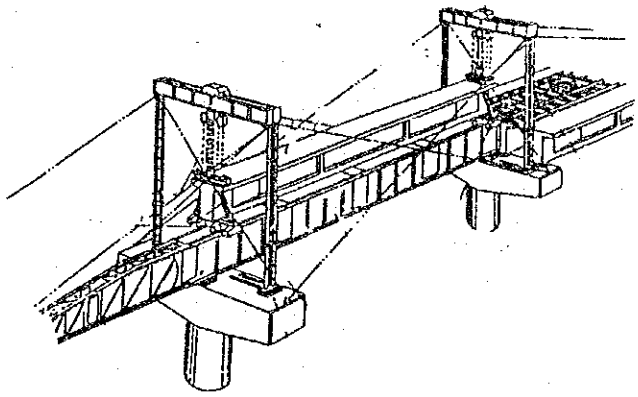
Figure 4.9.1 Location of Work Facilities

4.9.3 Bridge Construction Methods

The erection of the bridge PC girders will require the use of proven methods and experts, as discussed in the following sub-sections.

A. Erection

Considering the site conditions, and from an economical viewpoint, two erection methods have been selected for the bridges in Section I. These are the erection girder method and truck crane method as shown in Figures 4.9.2 and 4.9.3, respectively. It is planned that the truck crane method will be applied for Ratu Bridge while the erection girder method will be applied for the other bridges.



Figures 4.9.2 Erection Girder Method

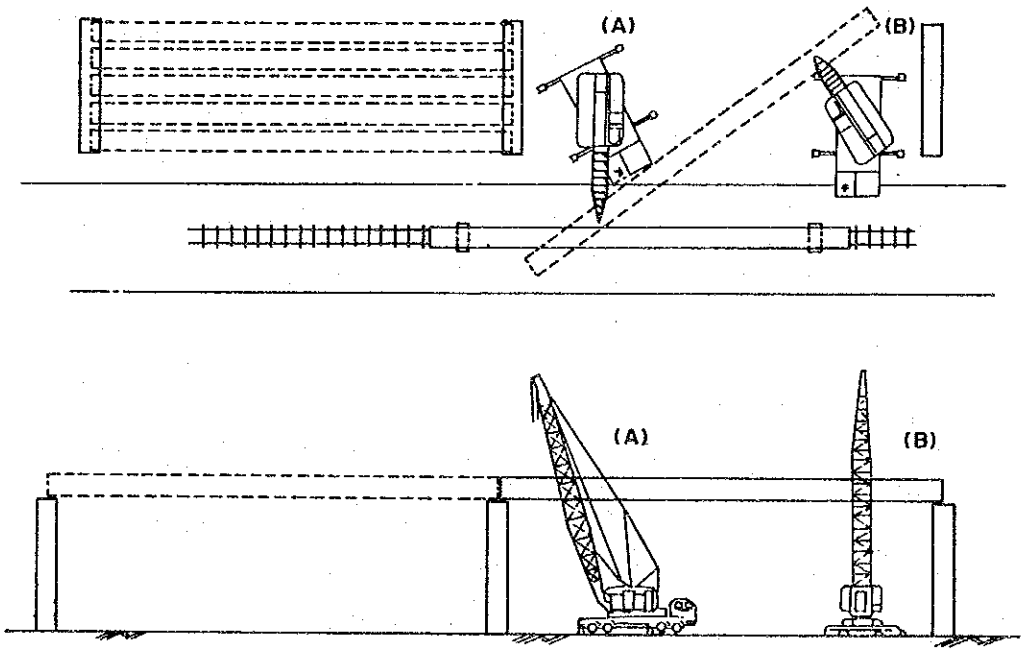


Figure 4.9.3 Truck Crane Method

B. Necessity of Experts

Production and erection of PC girders require well trained experts. Since the bridge sites are located quite a distance from Kathmandu with few experts available in Nepal, they will have to be dispatched from Japan at the required time for the purpose of operating special equipment and performing related work for erecting the girders.

4.9.4 Special Considerations for Project Implementation

The following considerations have been taken into account for formulating the implementation of the Project.

- As floods often take place from June to September, work in the river is dangerous. This will require that all work be limited to land-based operations for safety purposes during the flood season. Therefore, the commencement of the Project should be before October so as to use the full dry season profitably.

- Land acquisition for the permanent work items should be carried out by HMG prior to the commencement of the Project. In this regard, the detailed design including the centerline survey should be completed about six months before the commencement of the construction work.

- As construction of the approach roads will undoubtedly interfere with the existing traffic, where possible the construction of these roads should be carried out in the dry season since most of the vehicles can then safety utilize the riverbeds as detours.

4.9.5 Consulting Services for the Detailed Design and Construction Supervision

Immediately after the Exchange of Notes (E/N), the contract for Engineering Consulting Services should be signed. These Services will cover the design, cost estimate, tender/contract documents, tendering, and construction supervision. The required Japanese staff and their responsibilities concerning the Services is outlined as follows:

A. Team Leader

Responsible for all aspects of the Consulting Services.

B. Road Engineer

Responsible for the detailed design of the roads, and the supervision of road construction.

C. Superstructure Engineer

Responsible for the detailed design of the superstructure, and the supervision of its construction.

D. Substructure Engineer

Responsible for the detailed design of the substructure, and the supervision of the substructure construction.

E. River Structure Engineer

Responsible for the detailed design of the causeways during the detailed design stage.

F. Construction Planner/Cost Estimator

Responsible for the preparation of the detailed implementation schedule and Project cost estimate during the detailed design stage.

G. Contract Specialist

Responsible for the preparation of tender, contract and related documents during the detailed design stage.

H. Survey Engineer

Responsible for the topographic and other survey work.

I. Resident Engineer

To reside in Nepal and will supervise the construction work.

J. Materials Engineer

Responsible for the control/advice of specified material quality and strength for the road and structures during construction.

4.9.6 Procurement Plan for Materials and Equipment

The plan for procuring construction materials and construction equipment is presented below.

A. Construction Materials

(1) Normal Portland Cement

Normal Portland cement is manufactured in Nepal, but there is not always enough capacity. Therefore, some part of the normal Portland cement will probably have to be imported from other countries.

(2) High-early Strength Cement

Since high-early strength cement is not manufactured in Nepal, it should be imported from Japan or other countries.

(3) Reinforcement Bars

Indian-made reinforcement bars are sold in the local market, but the maximum size available is only 25 mm. As a result, rebar exceeding 25 mmϕ will not be used.

(4) Timber and Plywood

Timber and plywood having a water-proof treatment for use in making concrete forms are available in the local market.

(5) Concrete Hume Pipe

Concrete hume pipe is available in Janakpur.

(6) Crushed Stone, Sand, Ready Mixed Concrete and Asphalt mixture

As crushed stone and sand for use in producing such items as ready-mix concrete, asphalt mixture and base course materials, etc. are

not available in the local market, they will have to be produced by the Contractor.

(7) Fill Materials for Road Construction

Materials used as fill when constructing the approach roads will be obtained from nearby borrow areas approved by the Consultant.

(8) Petrol, Oil, Lubricants and Asphalt

The prices of petrol, oil, lubricants and asphalt are regulated by the Government and their prices are fairly consistent in Nepal. Suppliers can transport these items to the sites if the demand is large enough.

(9) Galvanized Steel Wire

Galvanized steel wire for gabions is available in the local market.

(10) Special Construction Materials

PC cable, PC anchors, concrete admixtures, bridge expansion joints and similar items will be imported from Japan.

B. Construction Equipment

Most of the construction equipment available in Nepal is old and it is difficult to obtain spare parts quickly in the case of breakdown. Some items of equipment can probably be rented from the larger construction companies when it is not in use, but there is no assurance that it will always be available. Therefore, it was decided that all needed construction equipment should be brought in from Japan by the Contractor

4.9.7 Implementation Schedule

The implementation schedule for the detailed engineering design and construction of the nine bridges, the approach roads and 17 causeways is depicted below in Figure 4.9.4.

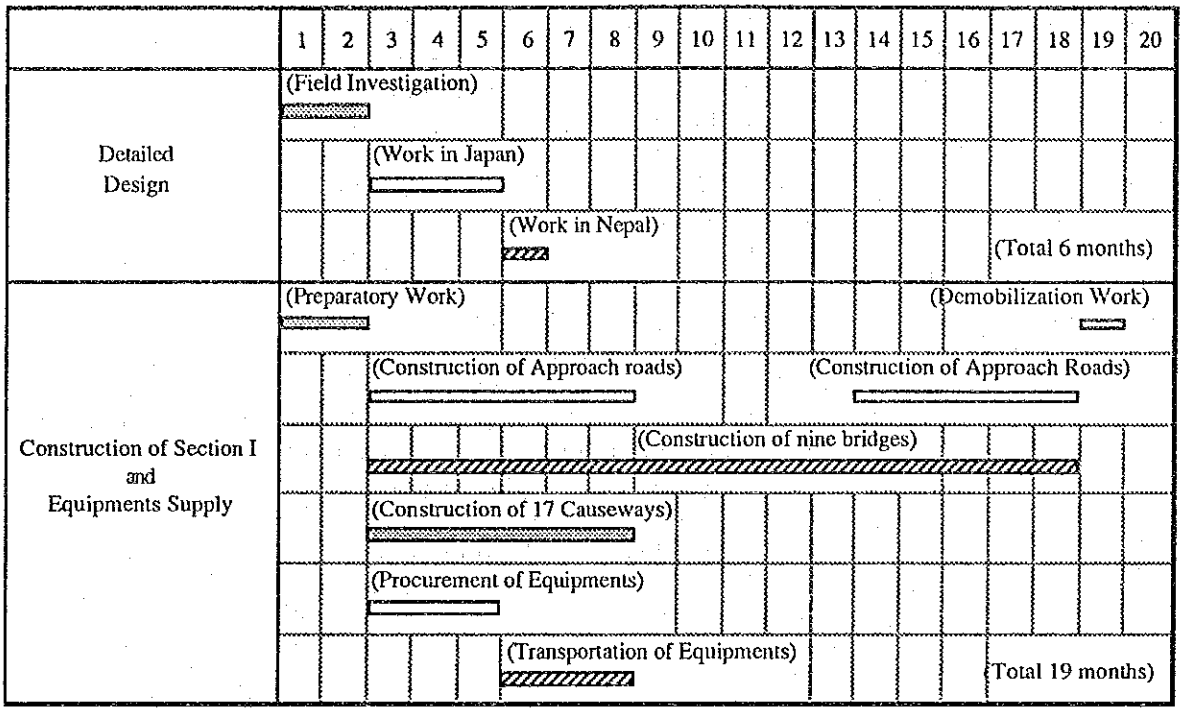


Figure 4.9.4 Tentative Implementation Schedule

The total implementation period is broadly divided into three stages as described below.

A. Contract with the Consultant and the Detailed Design

After signing the contract with the selected a Japanese firm, the detailed design will be carried out by the Consultant including the preparation of the tender/contract documents, drawings and cost estimate. The direct contract system currently in use by DOR will be applied to obtain the Consultant.

B. Prequalification, Tendering and Contract with the Contractor

After discussion with and approval by JICA pertaining to evaluation of the items for the prequalification (P/Q) of tenderers for the construction work, the P/Q activities will be carried out in Japan by the Consultant on behalf of HMG to select the qualified tenderers.

In the tendering operation, the principle of general competitive bidding will be applied to select a Japanese contractor for the construction work. Evaluation of the tenders and selection of the contractor will be performed in Japan by representatives of HMG and the Consultant in the presence of JICA officials. Negotiations with the selected contractor and signing of the contract will be also be done in Japan. The direct contract system currently in use by DOR will be applied to obtain the Contractor.

Parallel to the signing of the contract, HMG will conclude a banking arrangement with an authorized foreign exchange bank in Japan to open accounts for the purpose of receiving the funds granted by GOJ, and making payments to the Japanese consultant and contractor. This banking arrangement will serve as the basis for HMG to issue the Authorization to Pay (A/P) that is indispensable for use by the Japanese consultant as well as for use by the Japanese contractor who will have to obtain export licences for equipment and materials.

Such banking arrangement will also be used to receive payments as stipulated in the contract terms and should be concluded within one month after the signing of the E/N. It is noted that the Japanese consultant and contractor will able to carry out their contract responsibilities only after receiving the verified contract and A/P.

The next step is a verification to be conducted by GOJ. Verification means to examine whether the contents of contracts conform to the provisions of the E/N, which is requisite for the contract to be effective.

C. Construction Work

The construction work will basically consist of the approach roads, causeways, foundations and substructures for the bridges, production and erection of PC girders, bridge surfacing work, river protection and ancillary work. The construction is estimated to take about 19 months to complete.

4.9.8 Scope of Work

The work to be executed by the Japanese side and Nepal side is summarized below, together with the required undertakings by HMG.

A. Scope of Work to be Executed by the Japanese Side

(1) Consulting services for the design, prequalification, tendering and construction supervision services.

(2) Construction of nine bridges; namely, the Bhozate Bridge, Karkare Bridge, Gangate Bridge, Ratu Bridge, Sindhuse Bridge, Kamara Bridge, Phittang Bridge, Buka Bridge and Gadeuli Bridge.

(3) Construction of the approach roads for the above nine bridges.

(4) Construction of 17 causeways.

(5) Provision of equipment for maintenance of the road from Bardibas to Sindhuli Bazar and tools for the Bardibas repair shop that will be needed to keep such equipment in operation.

B. Scope of Work to be Executed by DOR

(1) To perform maintenance of the road, drainage ditches and bridges from Bardibas to Sindhuli Bazar using equipment provided by Japanese Grant Aid.

(2) To perform improvement of selected segments of the road.

(3) To staff and operate the repair shop.

C. Undertaking by HMG and DOR

(1) Provision of necessary land for construction of the bridges, approach roads and causeways.

(2) Demolition and/or removal of any impediments within the above mentioned land.

(3) Organizing and financing the maintenance activities that will be needed for Section I.

(4) Arranging for exemption of tax for all imported construction equipment and materials provided by the Japanese Grand Aid.

(5) Exemption of income tax for expatriates.

The expenditures to be borne by HMG in connection with the implementation of the Project is estimated as shown below:

(Unit: Mil. NRs.)

1)	Land Acquisition and House Compensation Cost	10.9
2)	DOR Administration Cost	1.9
3)	Maintenance Cost	13.4
Total		26.2

CHAPTER 5 SUMMARY OF MAIN POINTS AND CONCLUSION FOR THE PROJECT (SECTION I)

CHAPTER 5 SUMMARY OF MAIN POINTS AND CONCLUSION FOR THE PROJECT (SECTION I)

5.1 Summary of Main Points of the Project (Section I)

Sindhuli District, having a population of about 130,000, has only one road connecting it to the East-West Highway. The road has been constructed by DOR using equipment provided in 1982 by the Japanese Grant Aid Program; however its service level is extremely low because of a lack of bridges and paved surface.

The lack of bridges and the problem of natural disasters such as landslides cause road blockages which isolate the District during the rainy season thus placing serious hardships on the villagers.

The Project (Section I) consists of the construction of nine bridges with approach roads and 17 causeways in order to make the existing road/traffic conditions safe, especially during the rainy season. This will ensure an adequate transportation line for hauling subsistence commodities and agricultural produce between the East - West Highway and Sindhuli Bazar

Such improvements will not only provide safety for the villagers in Sindhuli District and Ramechhap District, they will also allow the linkage of farms around the Districts and market centres thereby intensifying regional economic gains.

DOR can carry out the maintenance of the Project after its completion because of its strengthened maintenance capability that is included as a part of the Project and due to a lesser requirement for maintaining concrete bridges as compared to steel bridges.

The objectives of the Sindhuli Road Project are consistent with the objectives of the road transport development called for in the Eighth Plan. Also the effects of the Project (Section I) mentioned above fully agree with the policies of the Eighth Plan such as consolidation of regional integration.

The main environmental impact will be that of land acquisition and demolition of some (not many) houses.

The construction period of about 19 month's is considered to be reasonable.

5.2 Conclusion

Based on the findings of the Basic Design Report included herein, the Project (Section I) should be implemented under the Japanese Grant Aid Program with the starting date to begin at the earliest possible time.

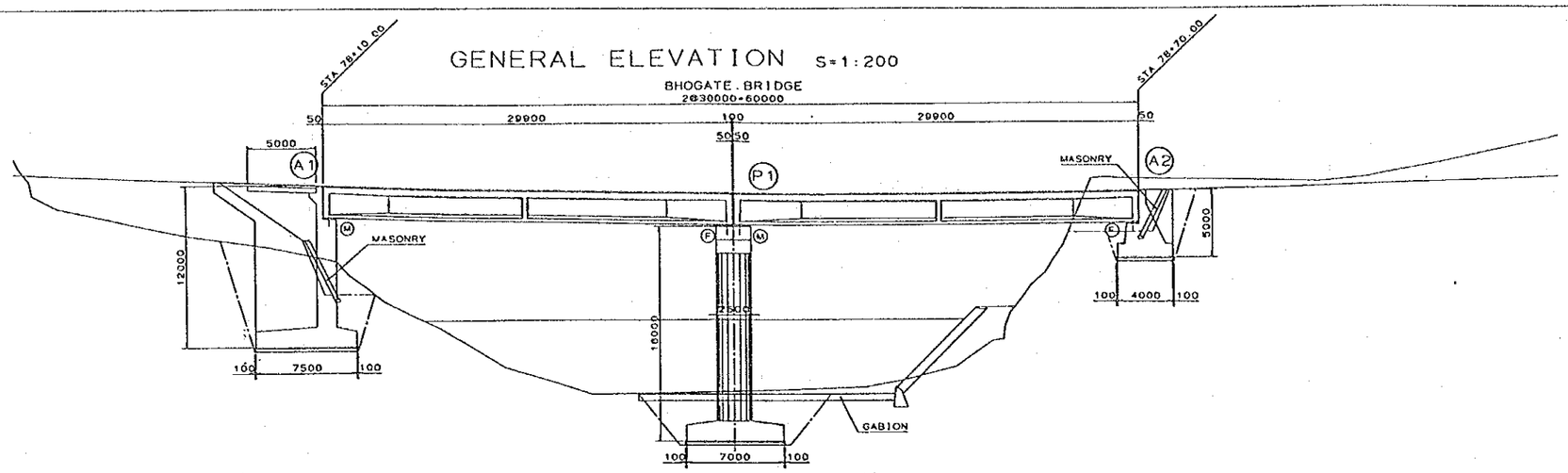
In order to ensure the smooth progress of the Project (Section I), it is recommended DOR undertake the following:

- To establish an efficient organization for implementing the Project.
- To obtain the required land and pay an adequate amount of compensation to the residents and land owners that will be affected by the Project.
- To limit the use of borrow areas (for fill, sand and boulders) near the bridges so that scoring of the riverbed will be avoided.
- To carry out the maintenance and improvement operations planned for Section I.
- To carry out the site inspection immediately after rain and remove any deposits at the causeways.

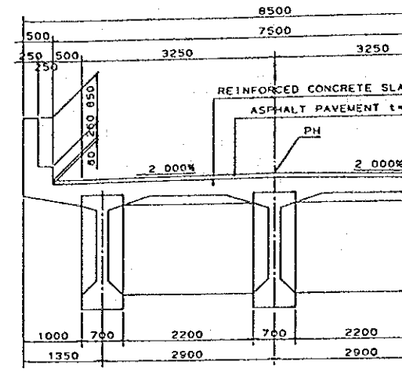
APPENDIX A

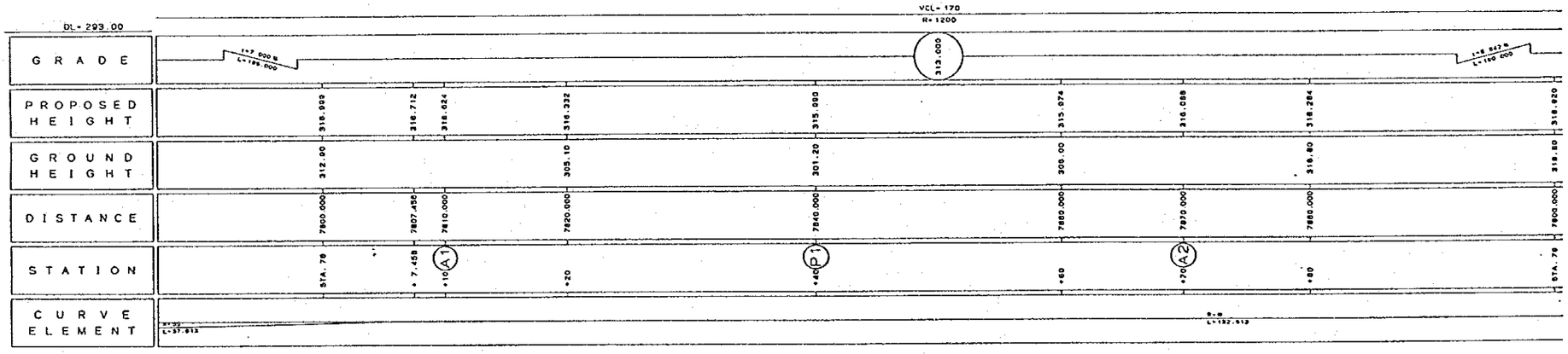
THE DRAWINGS

GENERAL ELEVATION S=1:200

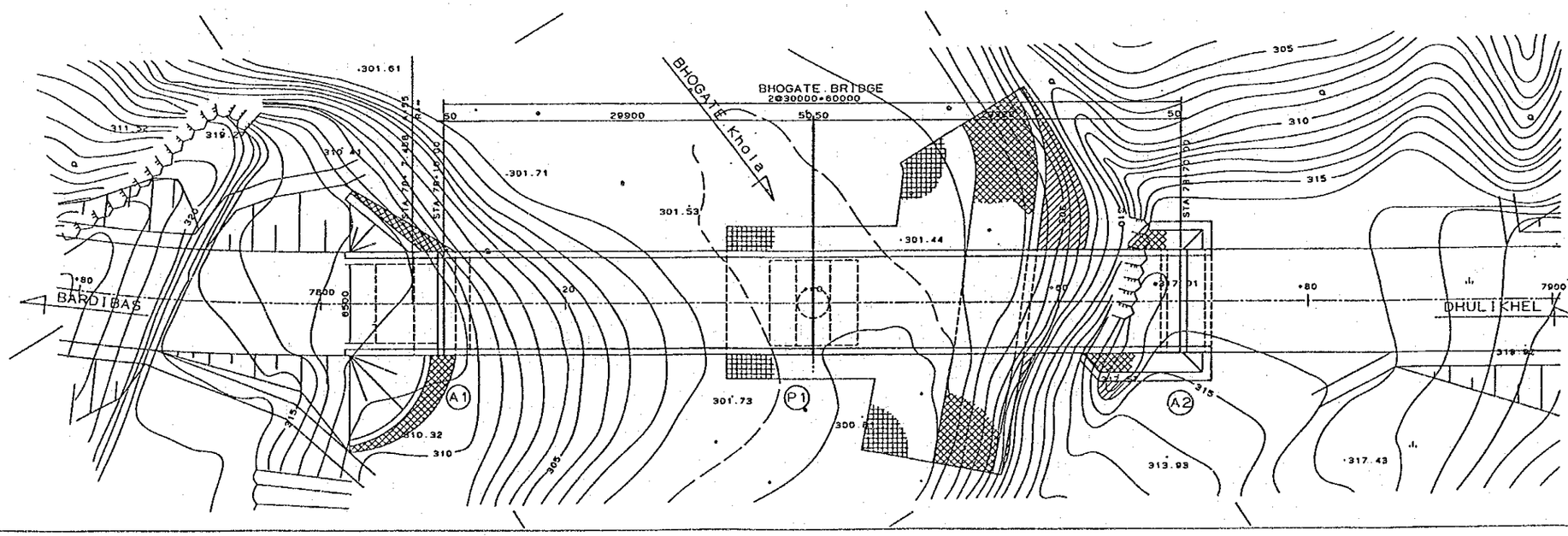


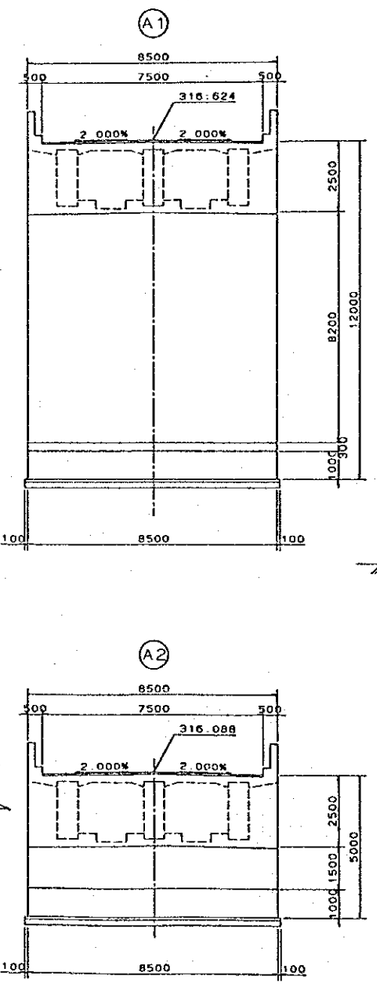
CROSS SECTION S=1

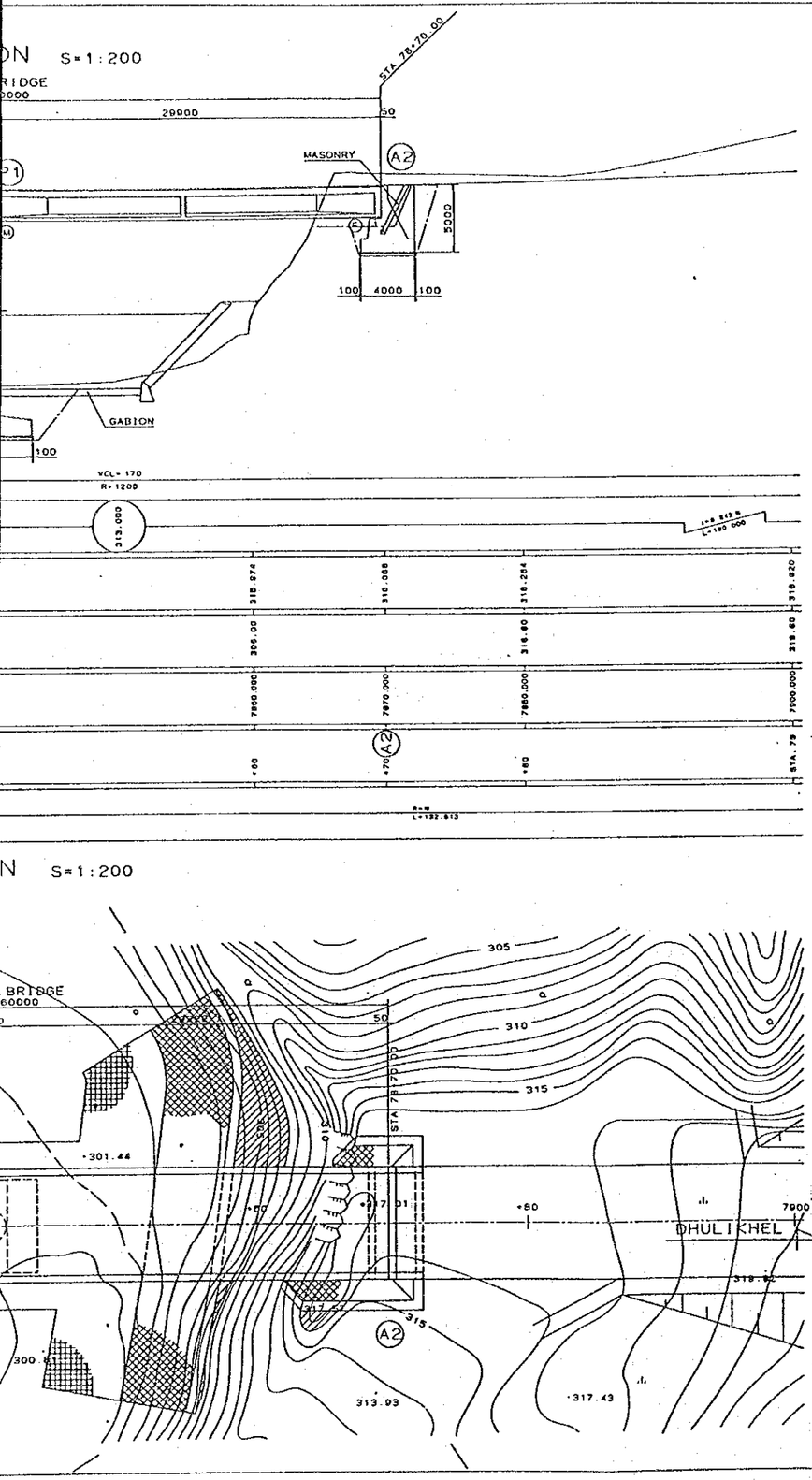




GENERAL PLAN S=1:200







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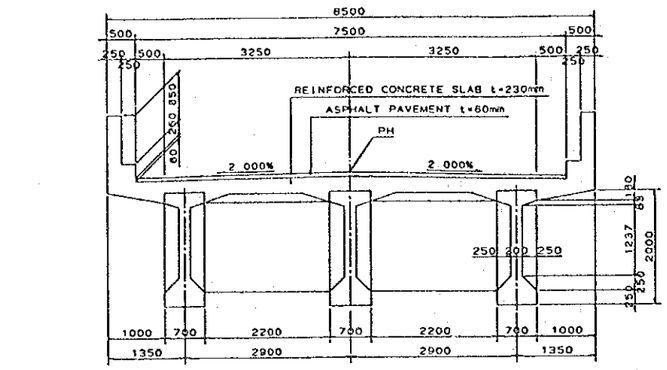
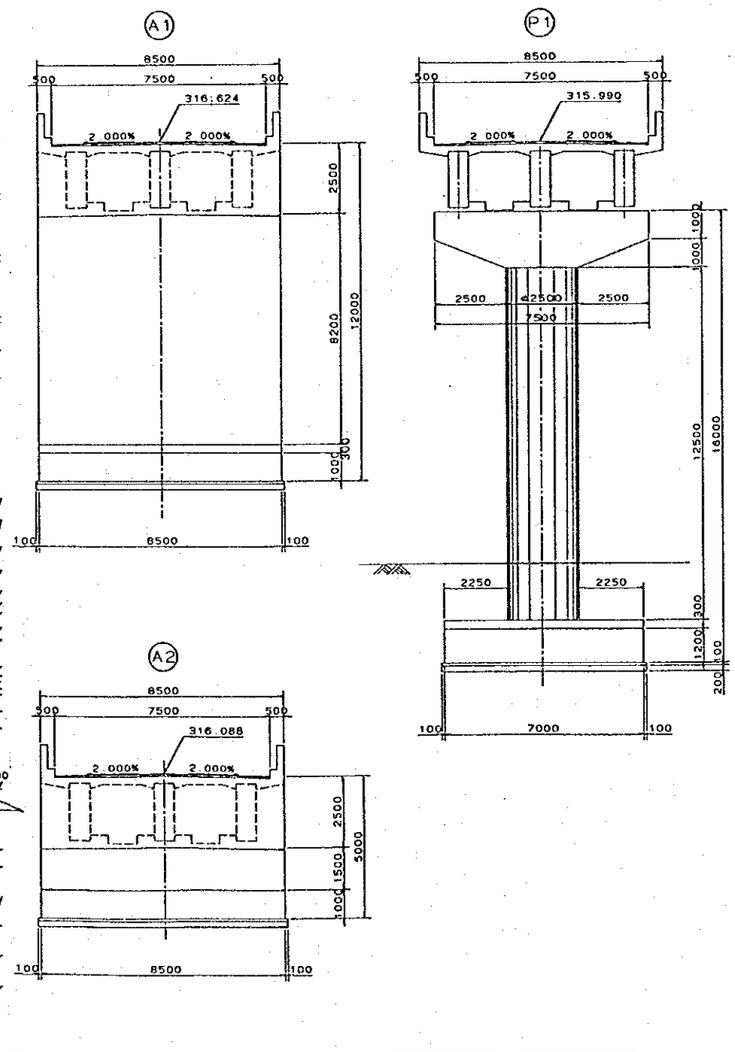




DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=60.00m
SPAN	S=30.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=-7.000%~6.842%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	24.88	74.65	149.30	
CAST IN PLACE	kg/cm² σck=300	m³	——	10.61	21.22	
CONCRETE	kg/cm² σck=240	m³	——	86.18	172.36	
FORM						
GIRDER		m²	158.04	474.13	948.26	
CAST IN PLACE		m²	——	541.76	1083.52	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	1309.67	3929.00	7858.00	
CROSS BEAM	12φ5	kgf	——	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	2000.00	11000.00	22000.00	
	φ16~φ25	kgf	2466.67	20400.00	40800.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	——	6	12	
EXPANSION JOINT		m	——	——	22.50	
DRAIN		n	——	2	4	
PAVEMENT		m²	——	224.30	448.60	
ERECTION		tf	62.21	186.63	373.25	

SUBSTRUCTURE

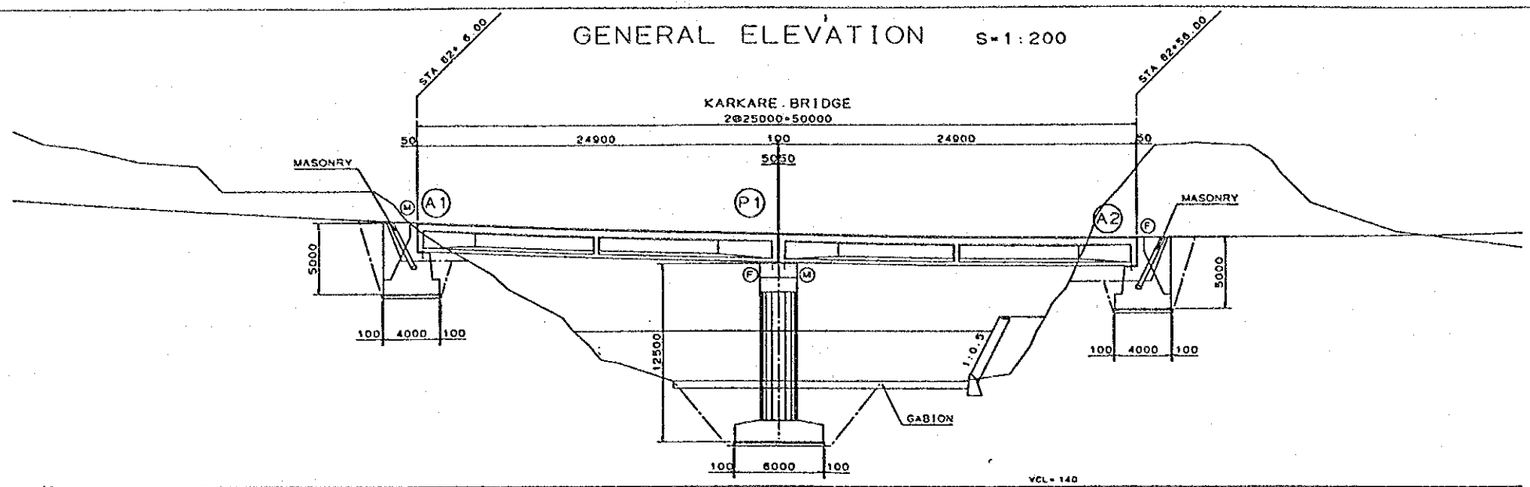
ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULAR CLAY	m³	——	579.7	——	
	MEDIUM SOUND ROCK	m³	718.2	——	359.6	
CONCRETE	σck=240kg/cm²	m³	297.8	161.6	89.8	
FORM	REGULAR	m²	515.9	36.5	144.6	
	CURVE	m²	——	98.2	——	
REINFORCEMENT BAR	φ13	kgf	700.0	400.0	——	
	φ16~φ25	kgf	35700.0	22000.0	2100.0	

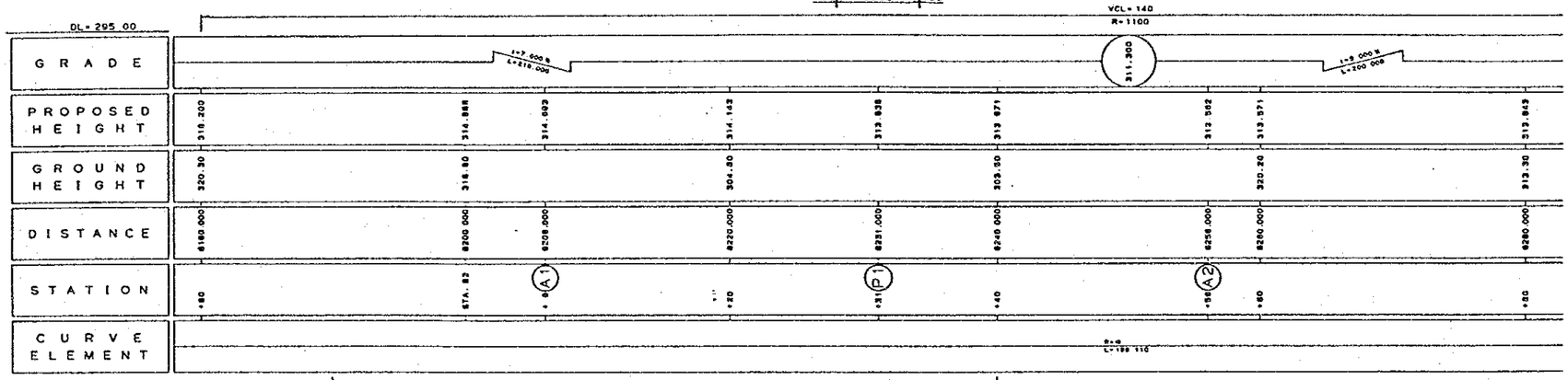
RIVER-PROTECTION

ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	——	186.3	186.3	
EMBANKMENT		m³	——	114.0	114.0	
FOUNDATION		m	——	——	——	STONE MASONRY
		m	——	20.5	20.5	STONE PITCHING
STONE MASONRY		m²	——	——	——	
STONE PITCHING		m²	——	118.8	118.8	
MAT GABIONS		m³	——	306.0	306.0	

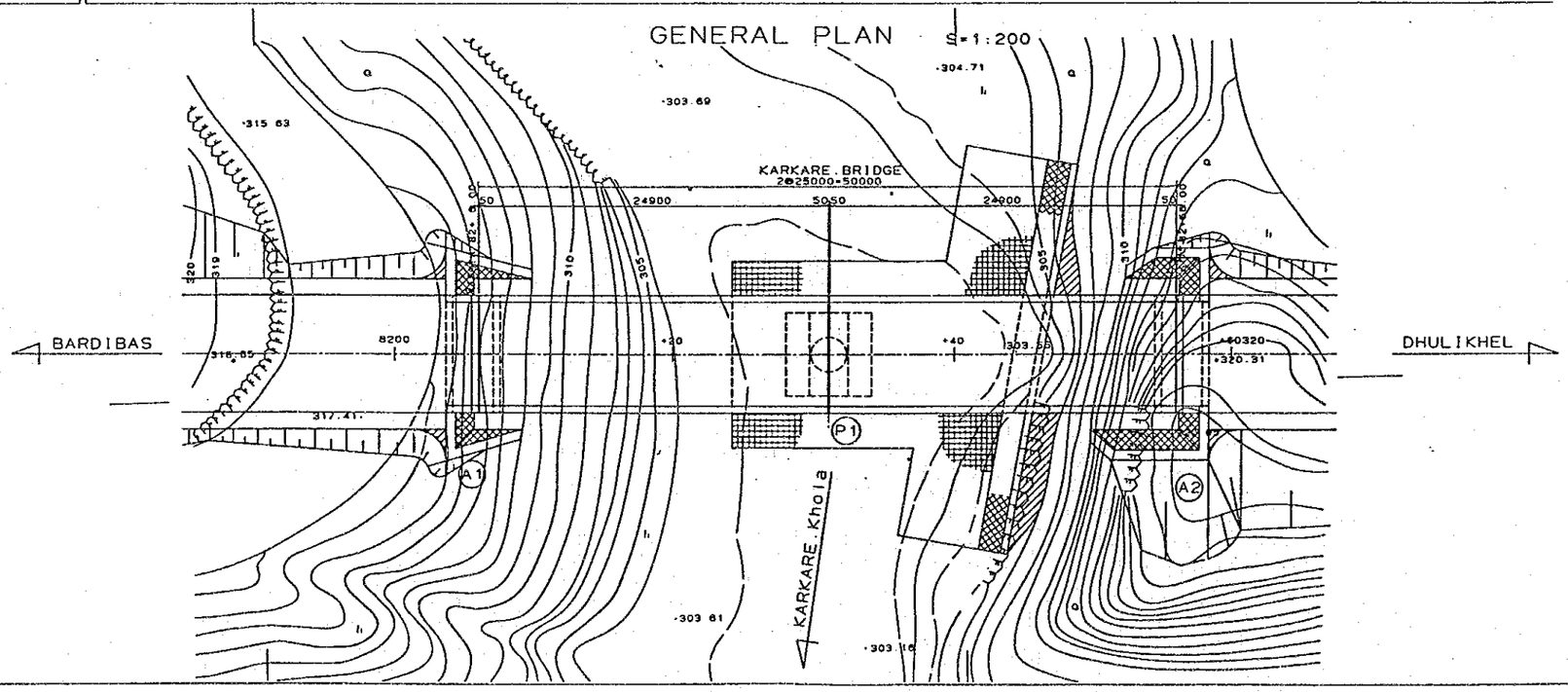
Figure 4.6.1 General Plan of Bhogate Bridge

GENERAL ELEVATION S=1:200





GENERAL PLAN S=1:200



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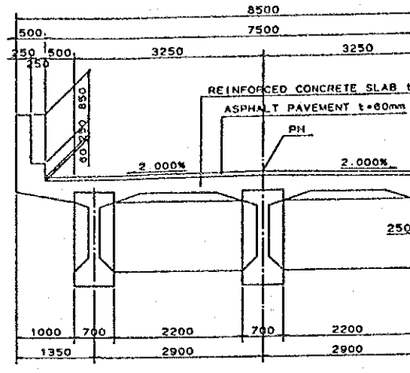
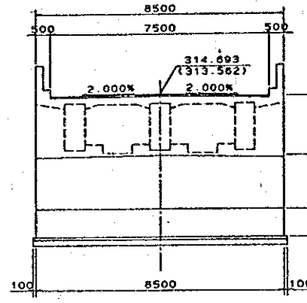


A1 (A2)



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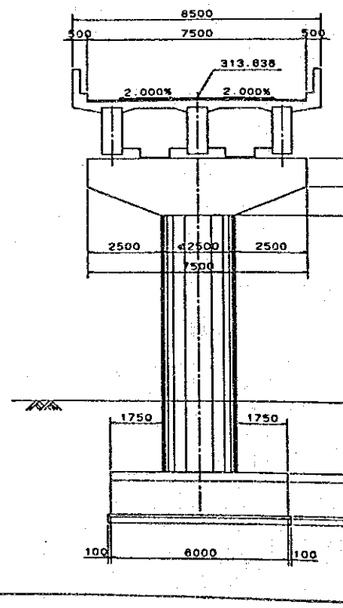

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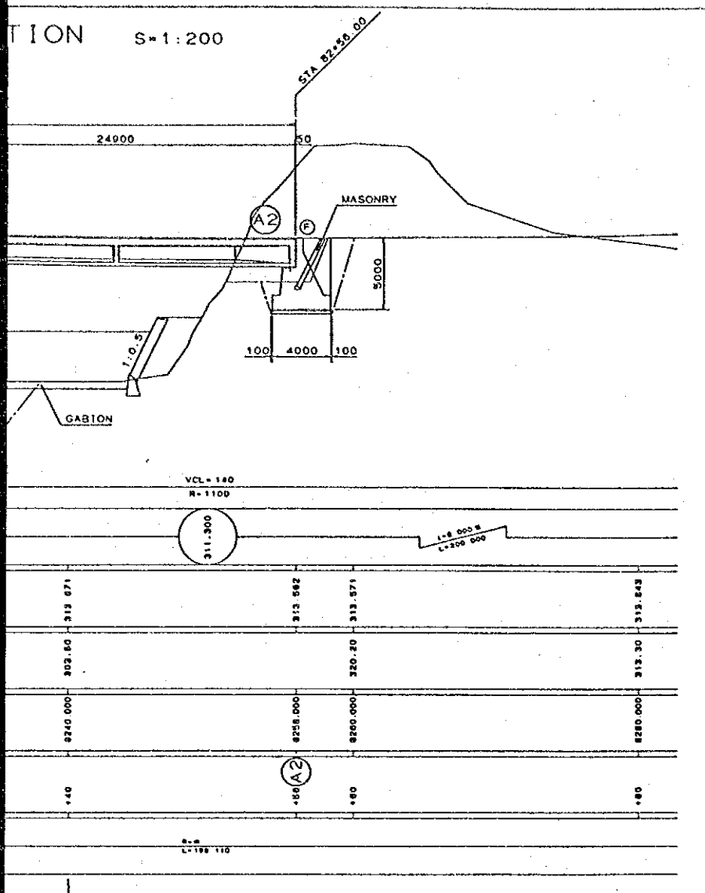

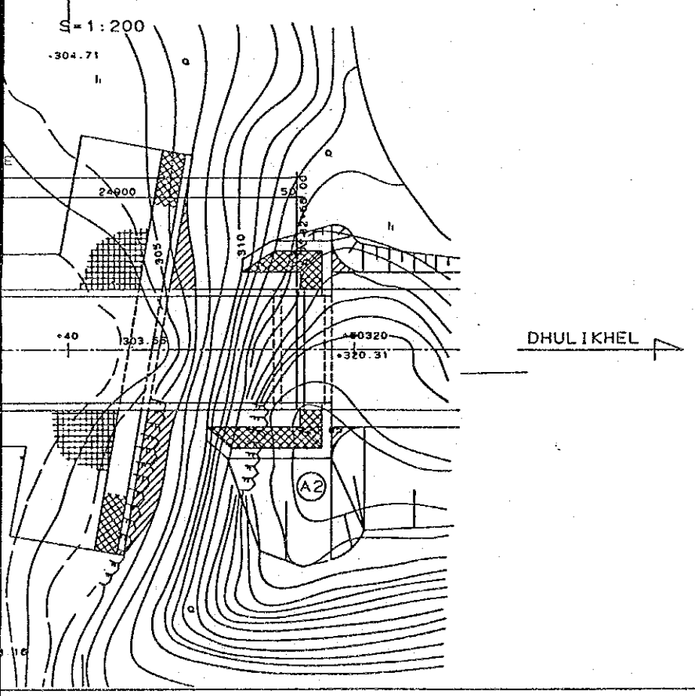

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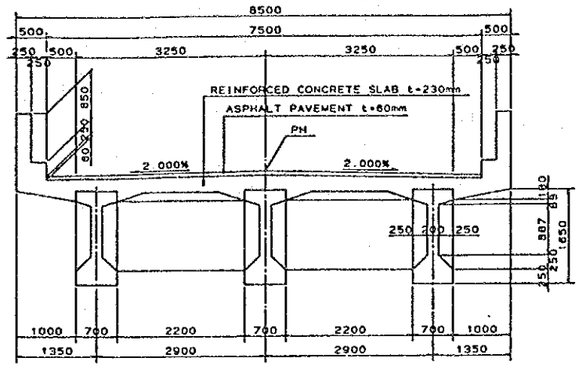
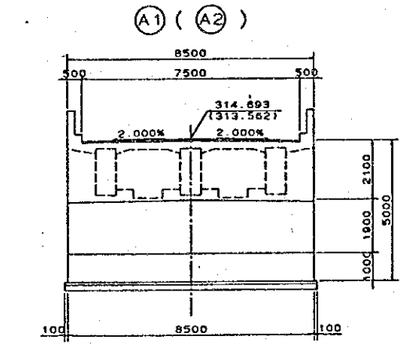
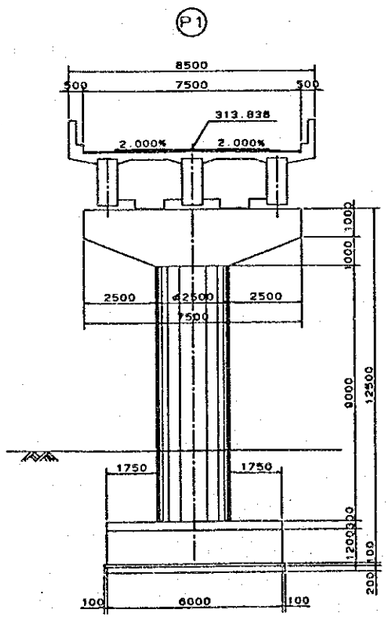






DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=50.00m
SPAN	S=25.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=-7.000%~6.000%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	18.23	54.69	109.38	
CAST IN PLACE	kg/cm² σck=300	m³	———	7.90	15.80	
CONCRETE	kg/cm² σck=240	m³	———	71.76	472.92	
FORM						
GIRDER		m²	113.90	341.69	683.38	
CAST IN PLACE		m²	———	451.63	903.26	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	872.60	2617.80	5236.00	
CROSS BEAM	12φ 5	kgf	———	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	1466.67	8300.00	16600.00	
	φ16~φ25	kgf	1800.00	16300.00	32600.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	———	6	12	
EXPANSION JOINT		m	———	———	22.50	
DRAIN		n	———	2	4	
PAVEMENT		m²	———	186.80	373.60	
ERECTION		tf	45.58	136.73	273.45	

SUBSTRUCTURE

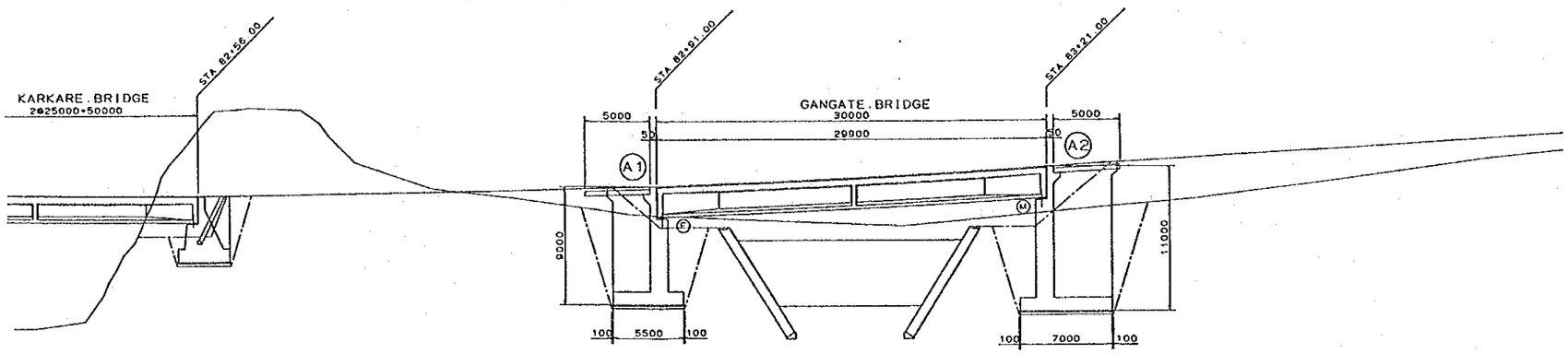
ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULARCLAY	m³	———	570.0	———	
	MEDIUM SOUND ROCK	m³	264.9	———	332.6	
CONCRETE	σck-240kg/cm²	m³	91.3	130.7	91.3	
FORM	REGULAR	m²	134.2	32.6	134.2	
	CURVE	m²	———	70.7	———	
REINFORCEMENT BAR	φ13	kgf	———	400.0	———	
	φ16~φ25	kgf	1800.0	17800.0	1800.0	

RIVER-PROTECTION

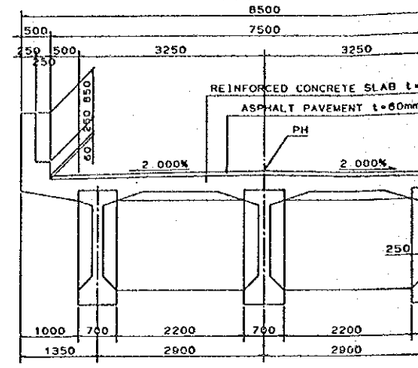
ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	———	182.0	182.0	
EMBANKMENT		m³	———	135.7	135.7	
FOUNDATION		m	———	29.0	29.0	STONE MASONRY
		m	———	———	———	STONE PITCHING
STONE MASONRY		m³	———	125.8	125.8	
STONE PITCHING		m²	———	———	———	
MAT GABIONS		m³	———	306.0	306.0	

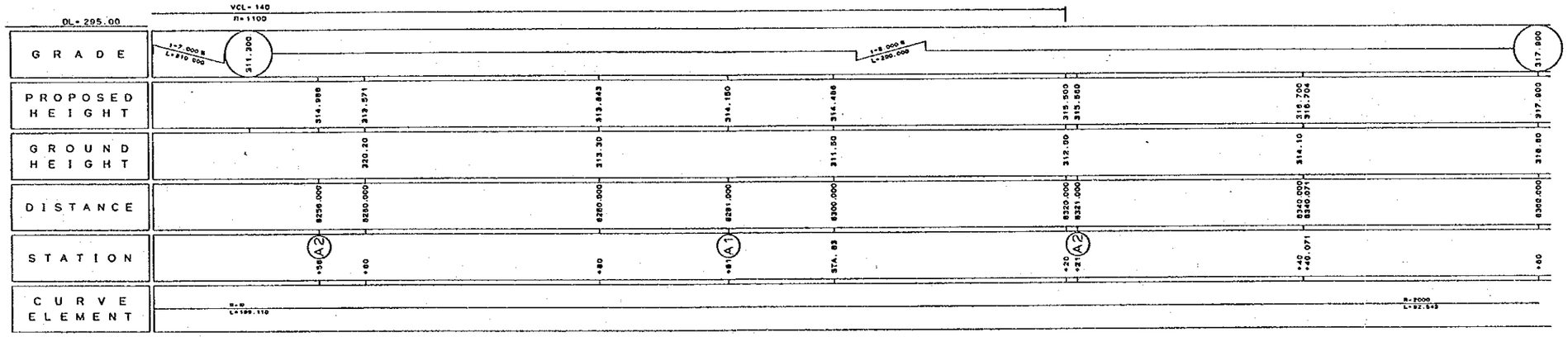
Figure 4.6.2 General Plan of Karkare Bridge

GENERAL ELEVATION S=1:200

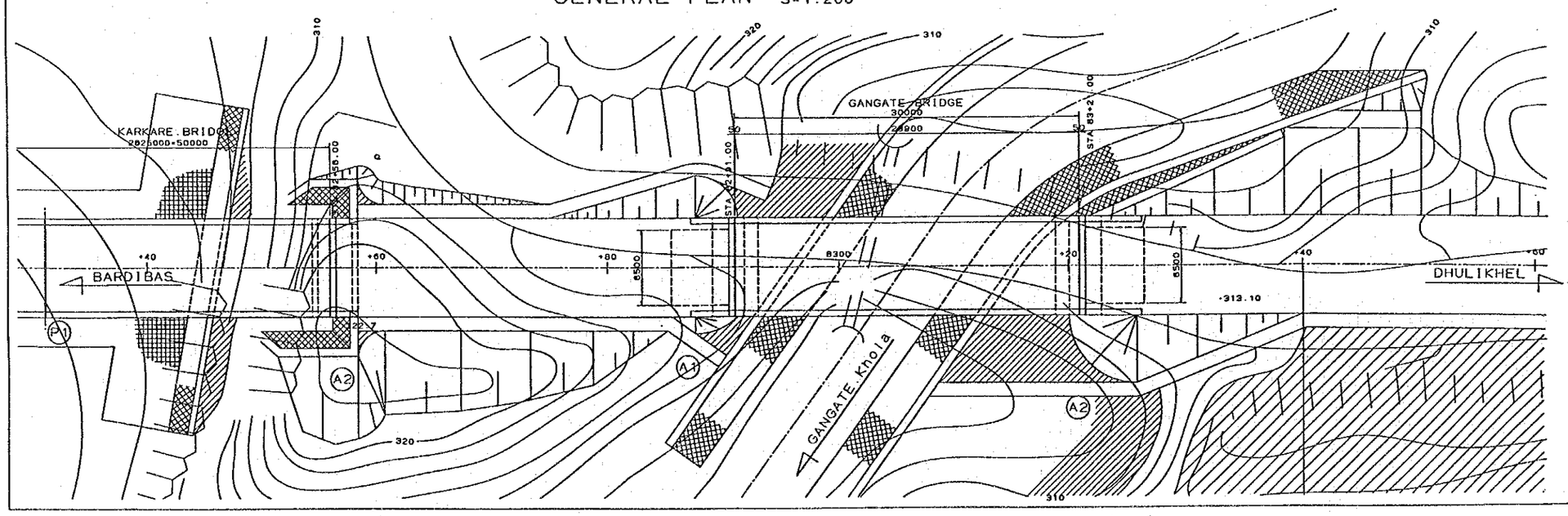


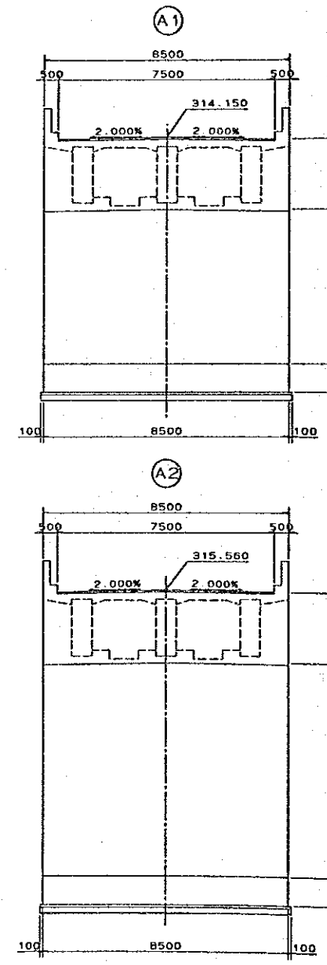
CROSS SECTION S=1:50



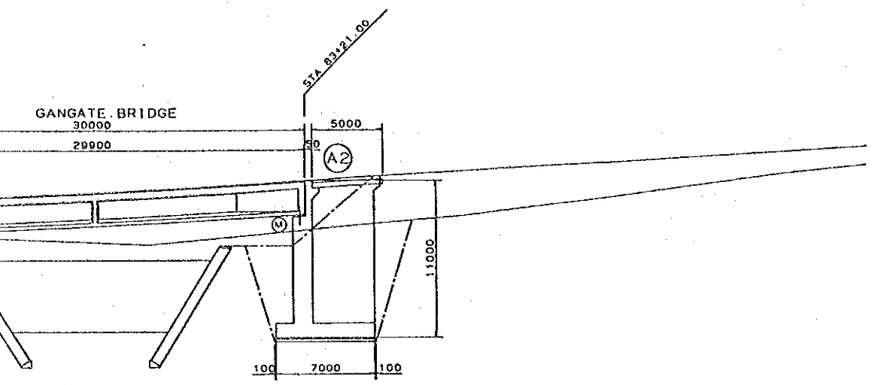


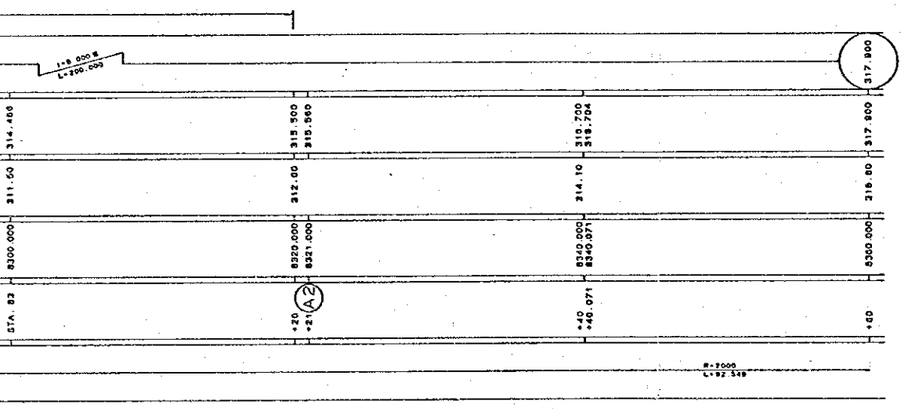
GENERAL PLAN S=1:200





S=1:200





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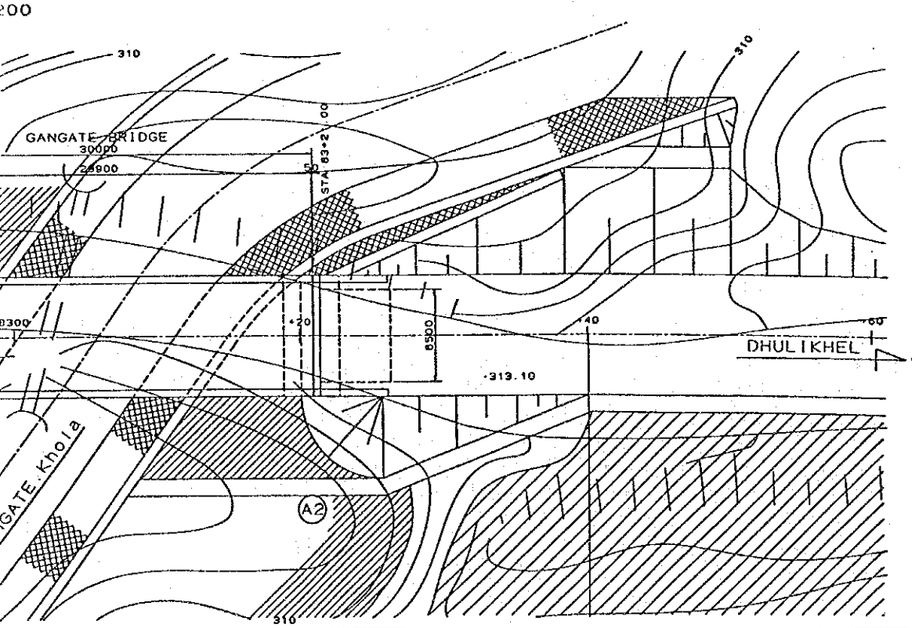

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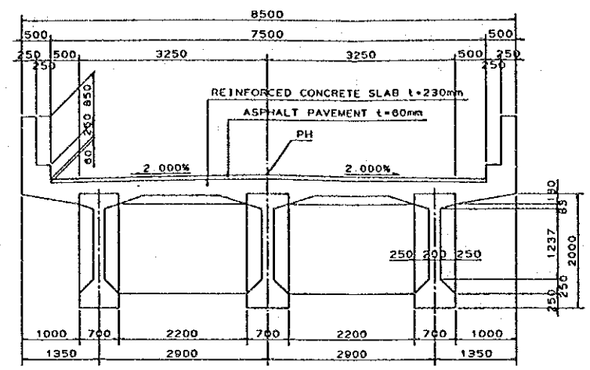
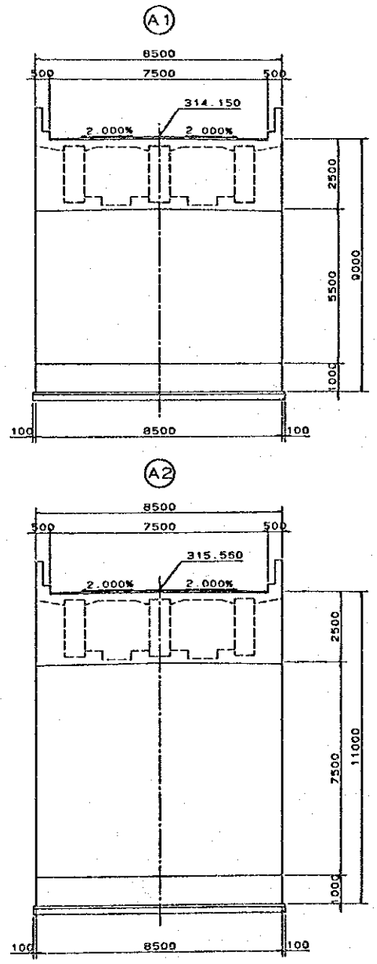




DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=30.00m
SPAN	S=30.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Cn=0.18
ANGLE OF SKEW	90° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=6.000%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	σck=350 kg/cm²	m³	24.88	74.65	74.65	
CAST IN PLACE	σck=300 kg/cm²	m³	——	10.61	10.61	
CONCRETE	σck=240 kg/cm²	m³	——	86.18	86.18	
FORM						
GIRDER		m²	158.04	474.13	474.13	
CAST IN PLACE		m²	——	541.76	541.76	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	1309.67	3929.00	3929.00	
CROSS BEAM	12φ S	kgf	——	70.60	70.60	
REINFORCEMENT BAR						
	φ13	kgf	2000.00	11000.00	11000.00	
	φ16~φ25	kgf	2466.67	20400.00	20400.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	——	6	6	
EXPANSION JOINT		m	——	——	15.00	
DRAIN		n	——	2	2	
PAVEMENT		m²	——	224.30	224.30	
ERECTION		tf	62.21	186.63	186.63	

SUBSTRUCTURE

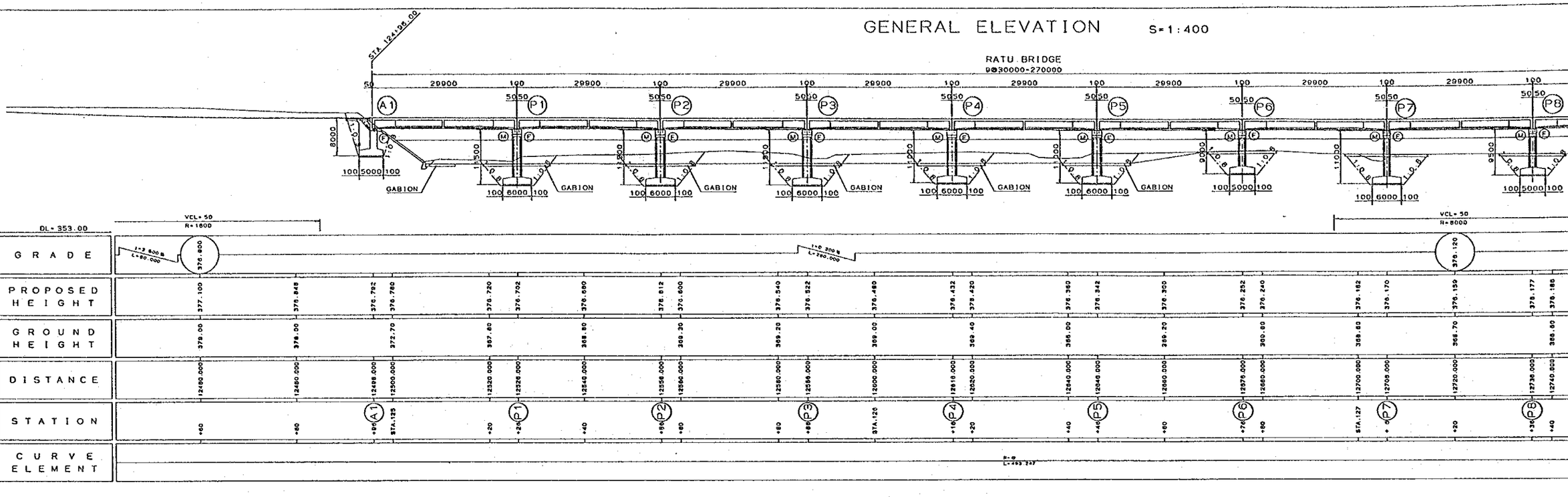
ITEM	CLASS	UNIT	A - 1	A - 2	REMARKS
EXCAVATION	REGULARCLAY	m³	——	——	
	MEDIUM SOUND ROCK	m³	250.8	161.8	
CONCRETE	σck=240kg/cm²	m³	99.6	134.7	
FORM	REGULAR	m²	189.9	289.0	
	CURVE	m²	——	——	
REINFORCEMENT BAR	φ13	kgf	200.0	300.0	
	φ16~φ25	kgf	11700.0	16500.0	

RIVER-PROTECTION

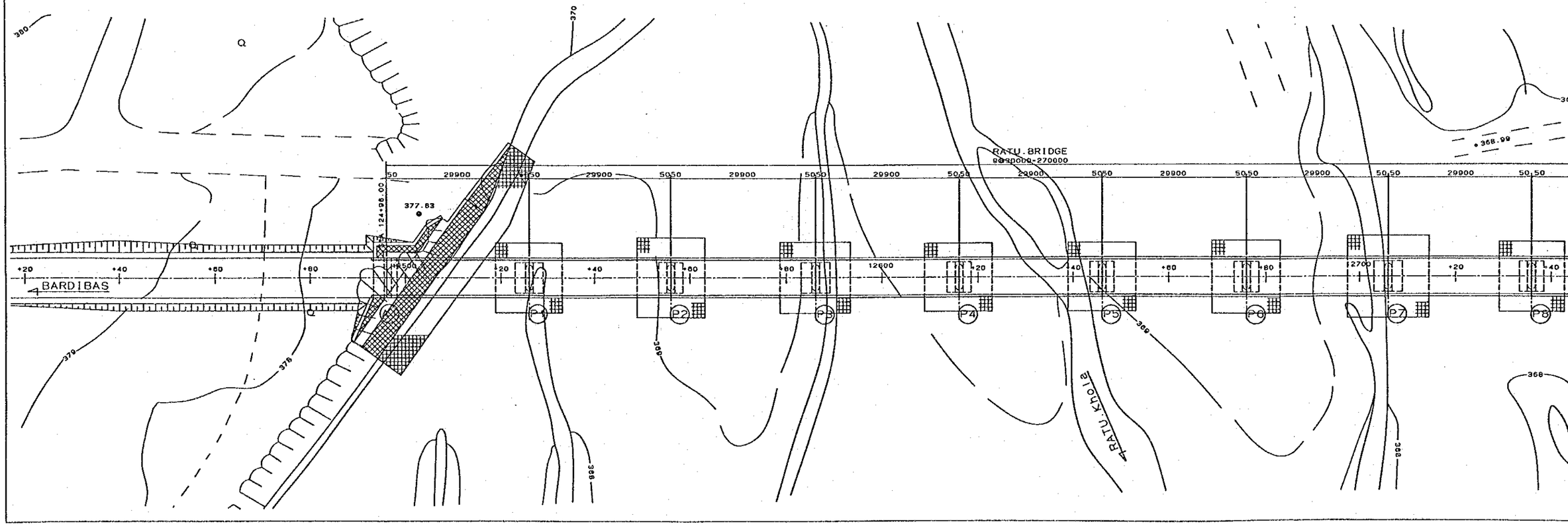
ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	——	——	1848.1	
EMBANKMENT		m³	——	——	1947.0	
FOUNDATION		m	47.0	79.0	126.0	STONE MASONRY
		m	——	——	——	STONE PITCHING
STONE MASONRY		m³	——	——	834.8	
STONE PITCHING		m²	——	——	——	
MAT GABIONS		m³	——	——	567.0	

Figure 4.6.3 General Plan of Gangate Bridge

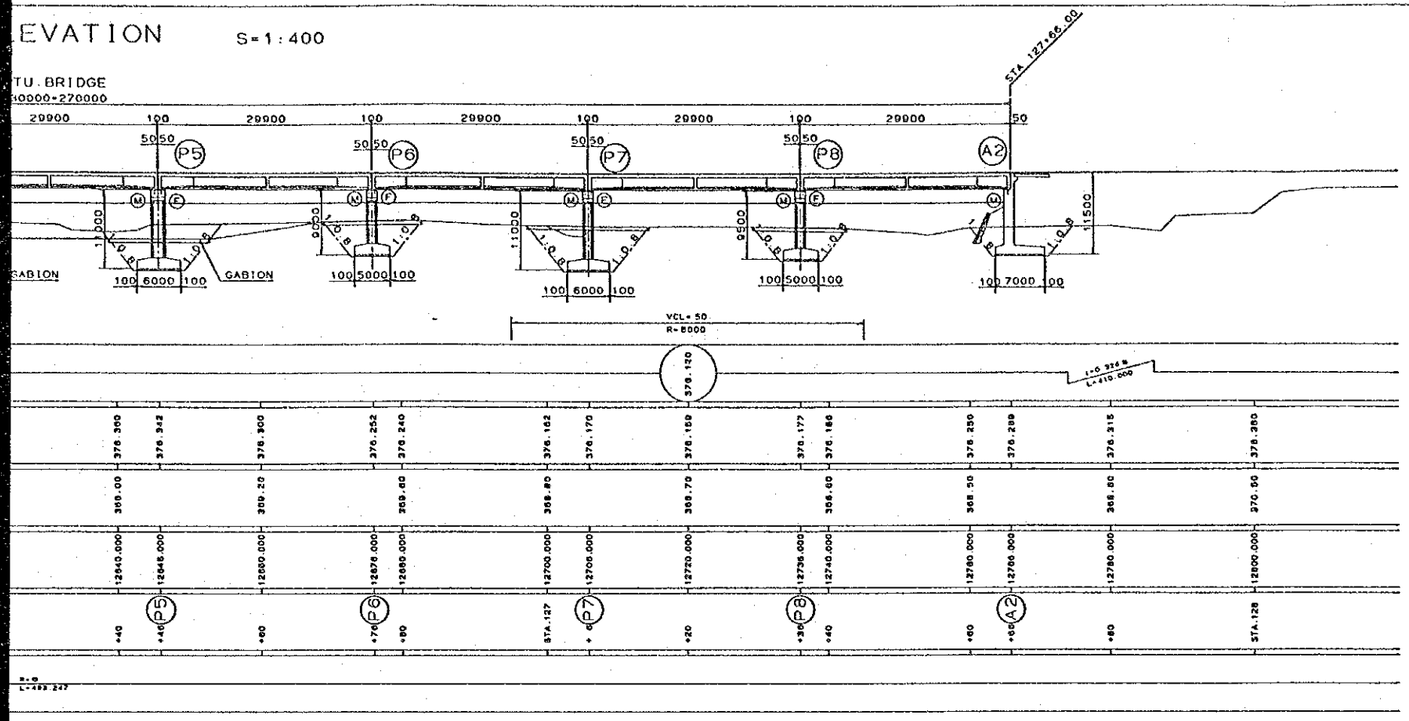
GENERAL ELEVATION S=1:400



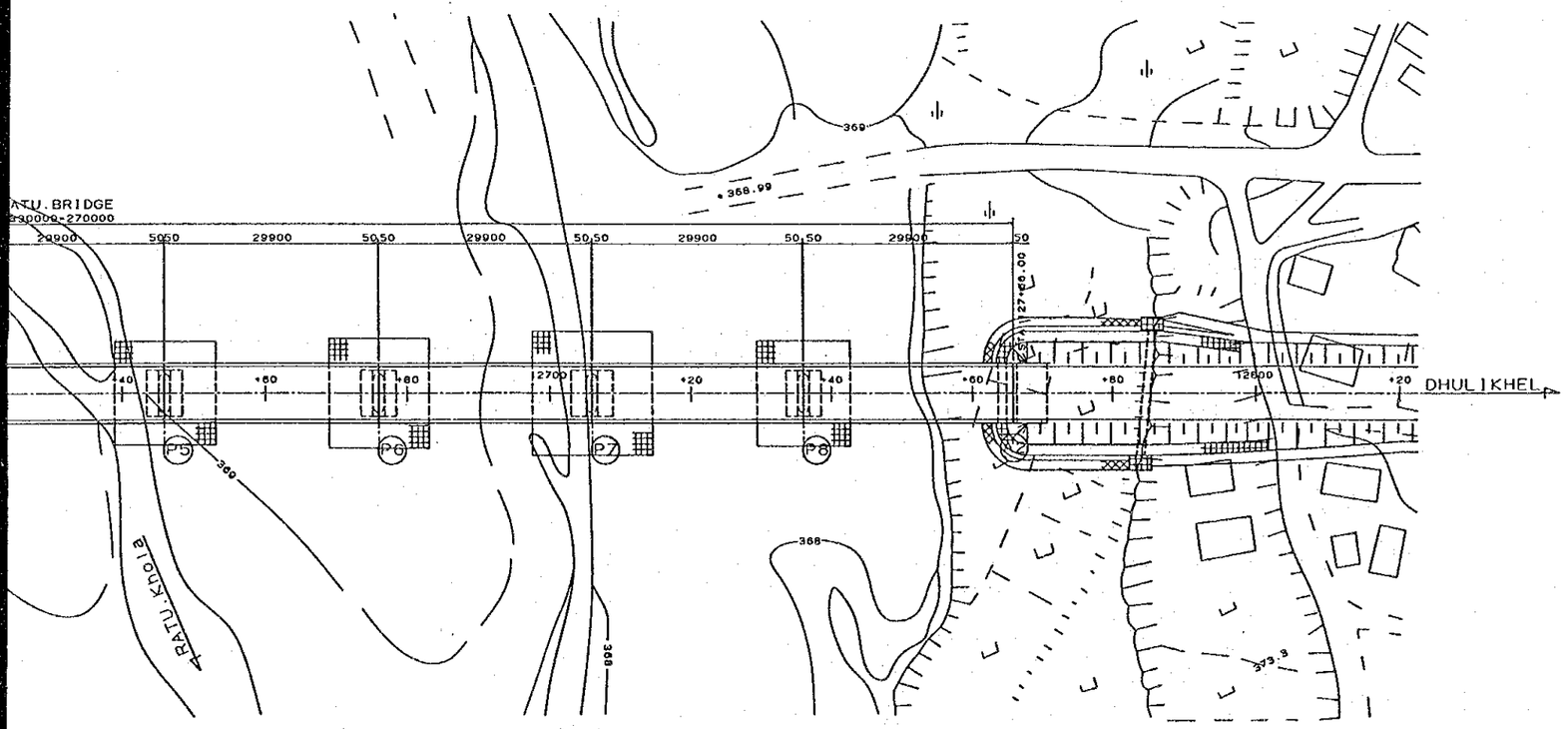
GENERAL PLAN S=1:400



EVATION S=1:400



LAN S=1:400



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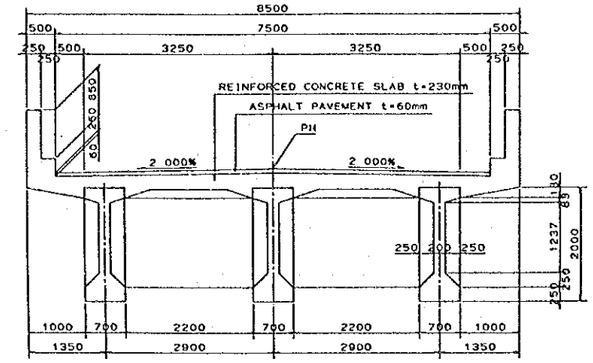
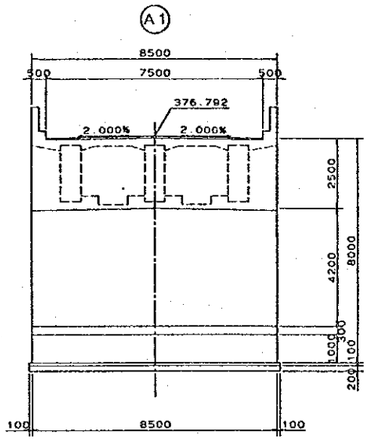
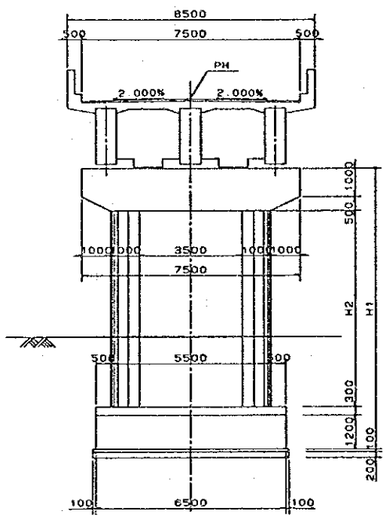
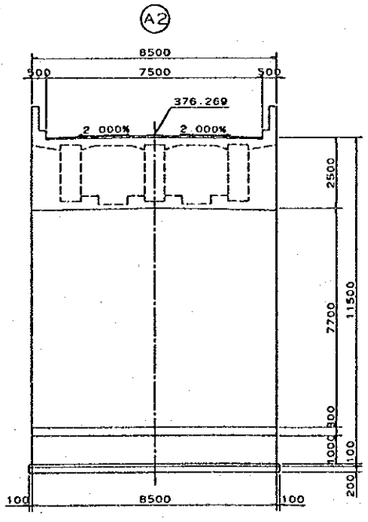


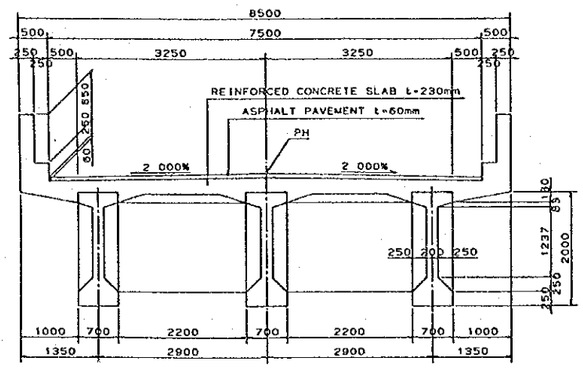


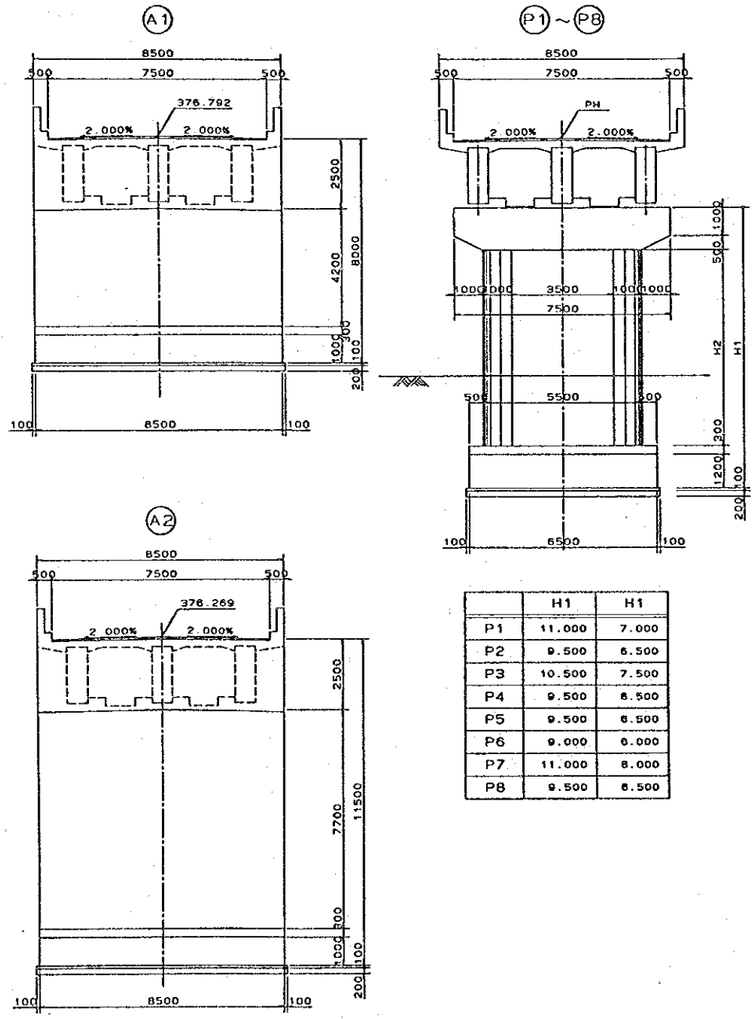




	H1	H1
P1	11.000	7.000
P2	9.500	6.500
P3	10.500	7.500
P4	9.500	6.500
P5	9.500	6.500
P6	9.000	8.000
P7	11.000	8.000
P8	9.500	6.500

CROSS SECTION S=1:50





	H1	H1
P1	11.000	7.000
P2	9.500	6.500
P3	10.500	7.500
P4	9.500	6.500
P5	9.500	6.500
P6	9.000	6.000
P7	11.000	8.000
P8	9.500	6.500

DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=180.00m
SPAN	S=30.00m
WIDTH	w= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	i=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90°00'00"
RADIUS OF CURVATURE	R=∞
LONGITUDINAL SLOPE	i=-0.300%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	σck=350 kg/cm²	m³	24.88	74.65	671.85	
CAST IN PLACE	σck=300 kg/cm²	m³	———	10.61	95.49	
CONCRETE	σck=240 kg/cm²	m³	———	86.18	775.62	
FORM						
GIRDER		m²	158.04	474.13	4267.17	
CAST IN PLACE		m²	———	541.76	4875.84	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	1309.67	3929.00	35361.00	
CROSS BEAM	12φ5	kgf	———	70.60	635.40	
REINFORCEMENT BAR						
	φ13	kgf	2000.00	11000.00	99000.00	
	φ16~φ25	kgf	2466.67	20400.00	183600.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	———	6	54	
EXPANSION JOINT		m	———	———	75.00	
DRAIN		n	———	2	18	
PAVEMENT		m²	———	224.30	2018.70	
ERECTION		tf	62.21	186.63	1679.63	

SUBSTRUCTURE

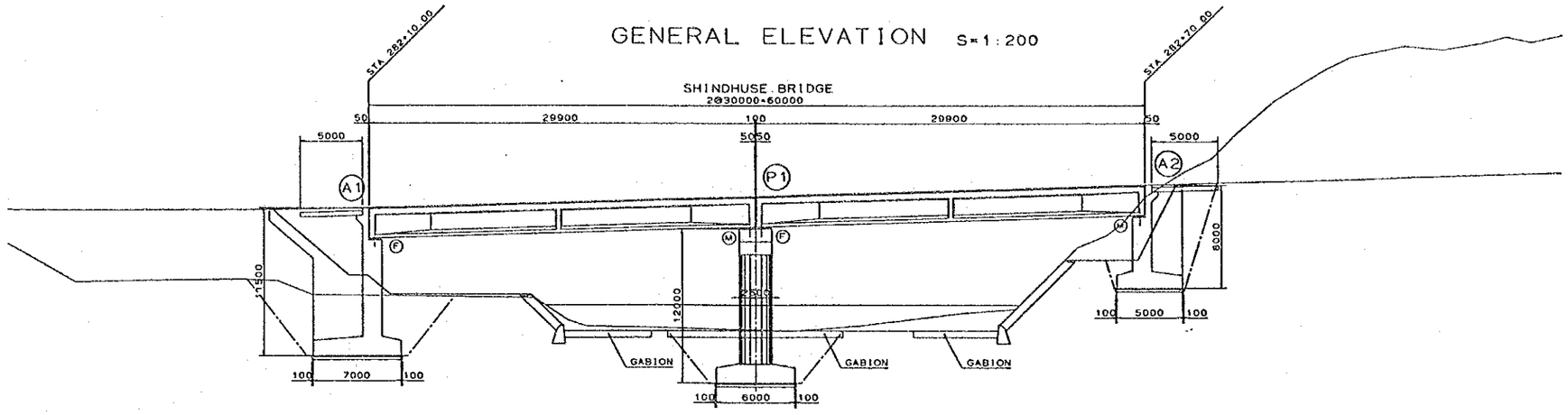
ITEM	CLASS	UNIT	A-1	P-1	P-2	P-3	P-4	P-5	P-6	P-7	P-8	A-2	REMARKS
EXCAVATION	REGULARCLAY	m³	———	756.1	1161.6	861.2	1097.1	807.6	508.5	659.1	508.1	662.5	
	MEDIUM SOUND ROCK	m³	530.4	———	———	———	———	———	———	———	———	———	
CONCRETE	σck=240kg/cm²	m³	145.6	162.5	162.5	162.5	157.4	157.4	128.4	157.4	133.4	285.5	
FORM	REGULAR	m²	247.9	121.7	121.7	121.7	118.2	118.2	103.7	118.2	107.2	493.6	
	CURVE	m²	———	53.4	53.4	53.4	50.3	50.3	37.7	50.3	40.8	———	
REINFORCEMENT BAR	φ13	kgf	300.0	400.0	400.0	400.0	400.0	400.0	300.0	400.0	300.0	700.0	
	φ16~φ25	kgf	16500.0	19100.0	19100.0	19100.0	18400.0	18400.0	14900.0	18400.0	15600.0	33900.0	

RIVER-PROTECTION

ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	———	56.9	56.9	
EMBANKMENT		m³	———	———	———	
FOUNDATION		m	47.5	———	47.5	STONE MASONRY
		m	———	26.5	26.5	STONE PITCHING
STONE MASONRY		m³	234.8	———	234.8	
STONE PITCHING		m²	85.5	203.2	288.7	
MAT GABIONS		m³	171.0	159.0	330.0	

Figure 4.6.4 General Plan of Ratu Bridge

GENERAL ELEVATION S=1:200

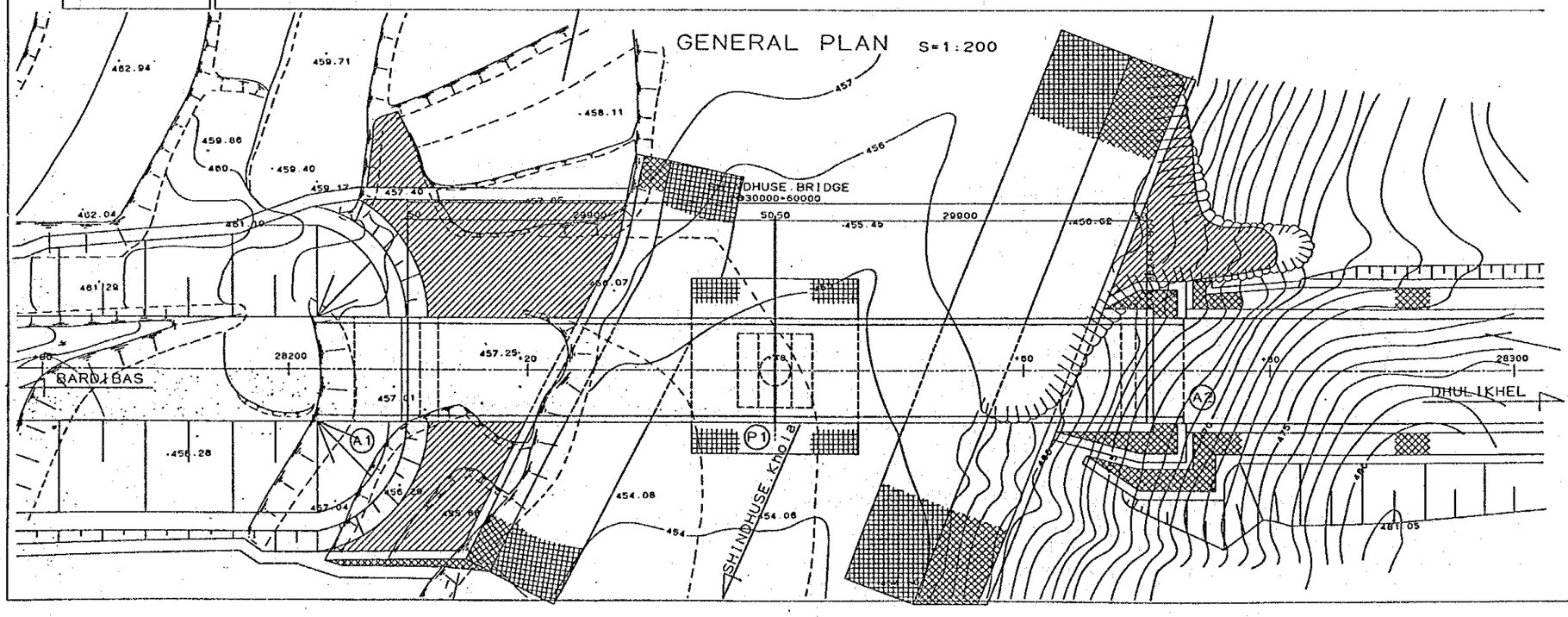


DL= 445.00

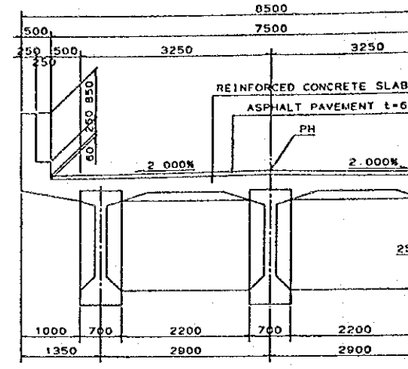
VCL= 60
R=750

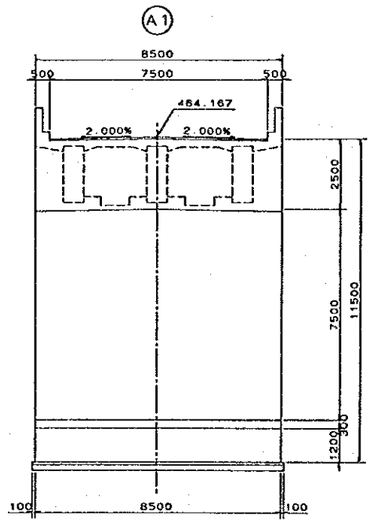
GRADE	L=9 000 m, L=170 000
PROPOSED HEIGHT	464.000 · 464.167 · 464.450 · 465.050 · 465.650 · 465.950 · 466.250 · 466.850
GROUND HEIGHT	458.80 · 457.25 · 454.70 · 456.30 · 472.50 · 477.10
DISTANCE	28200.000 · 28210.000 · 28220.000 · 28240.000 · 28260.000 · 28270.000 · 28280.000 · 28300.000
STATION	STA.282 · +10 · A1 · +20 · +40 · P1 · +60 · +70 · A2 · +80 · STA.283
CURVE ELEMENT	R=∞ L=341.072

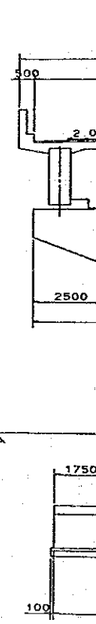
GENERAL PLAN S=1:200

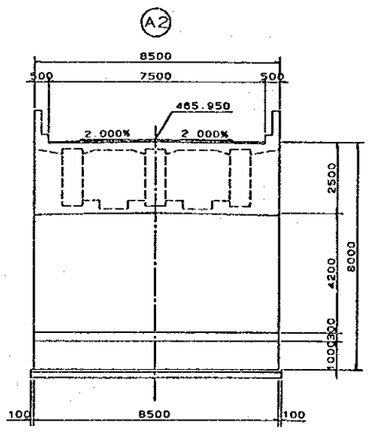


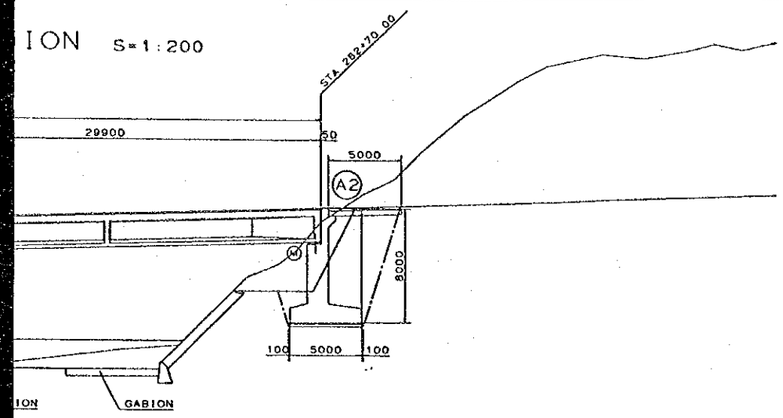
CROSS SECTION S=1:5

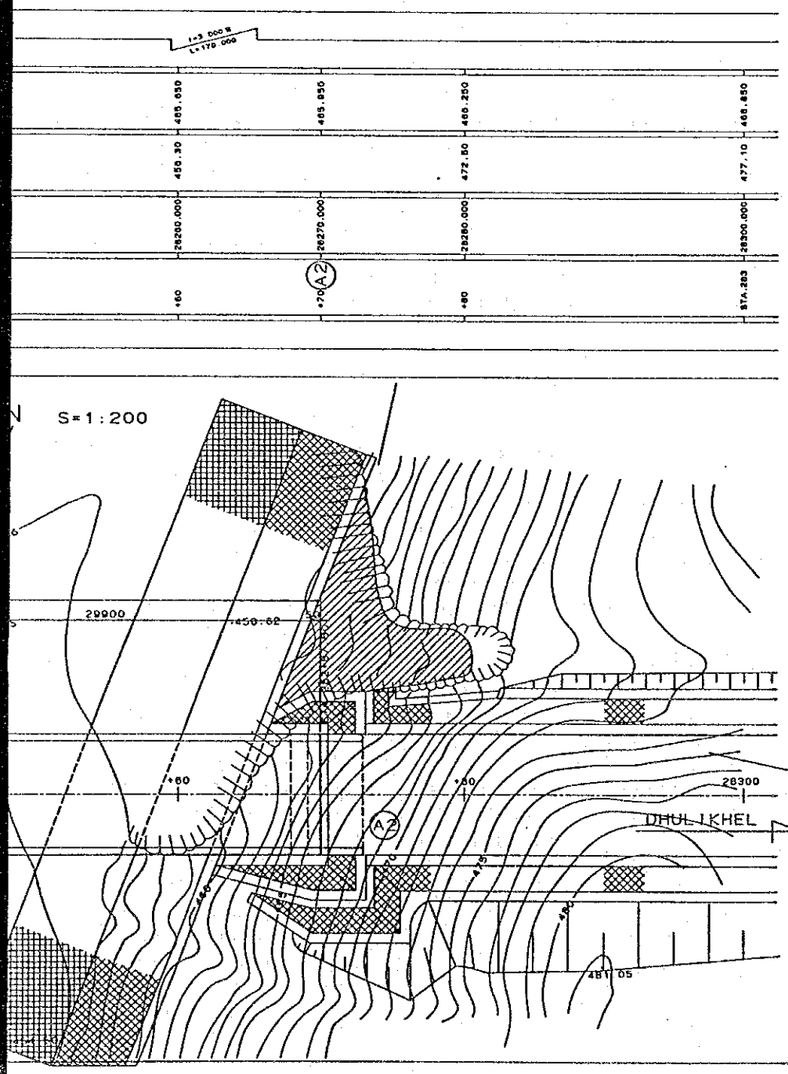




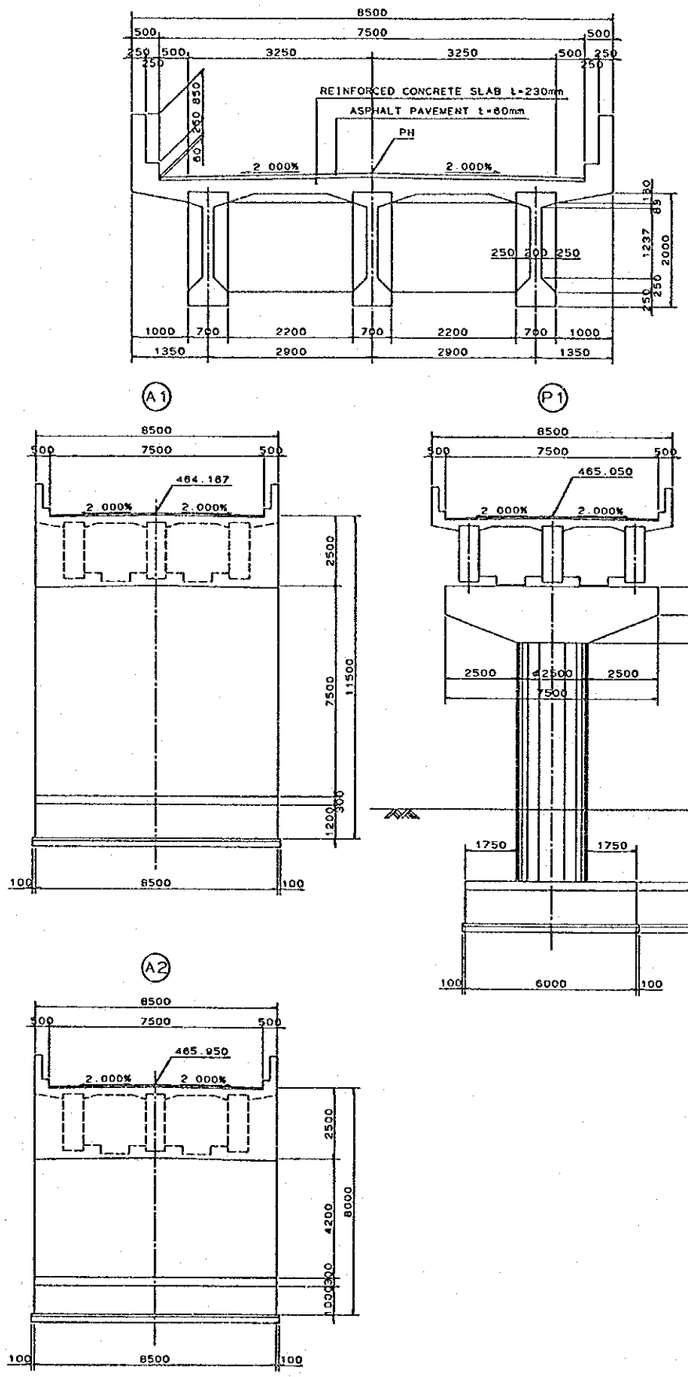








CROSS SECTION S=1:50



DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=60.00m
SPAN	S=30.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (T-L-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	00° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=3.000%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	24.88	74.65	149.30	
CAST IN PLACE	kg/cm² σck=300	m³	———	10.61	21.22	
CONCRETE	kg/cm² σck=240	m³	———	86.18	172.36	
FORM						
GIRDER		m²	158.04	474.13	948.26	
CAST IN PLACE		m²	———	541.76	1083.52	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	1309.67	3929.00	7858.00	
CROSS BEAM	12φ 5	kgf	———	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	2000.00	11000.00	22000.00	
	φ16~φ25	kgf	2486.67	20400.00	40800.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	———	6	12	
EXPANSION JOINT		m	———	———	22.50	
DRAIN		n	———	2	4	
PAVEMENT		m²	———	224.30	448.60	
ERECTION		tf	62.21	186.63	373.25	

SUBSTRUCTURE

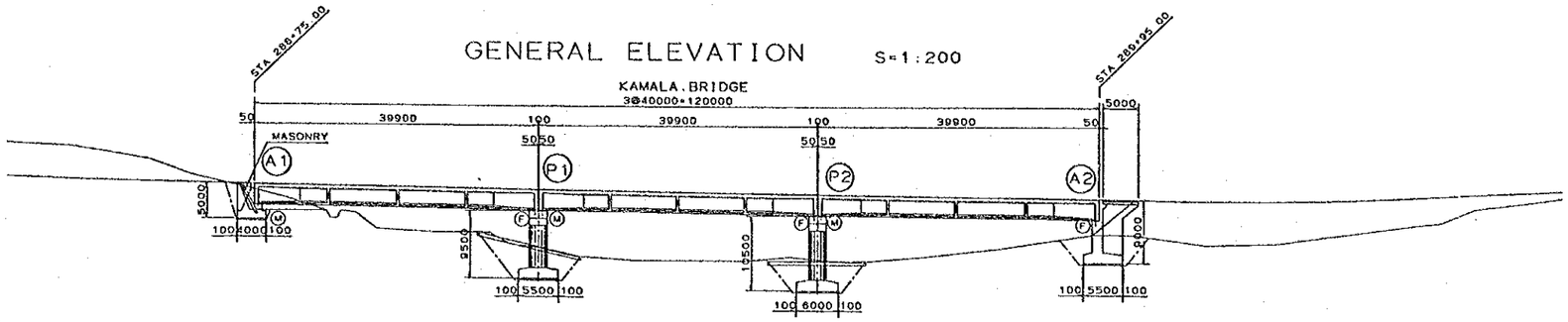
ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULAR CLAY	m³	516.0	508.1	———	
	MEDIUM SOLIND ROCK	m³	———	———	693.0	
CONCRETE	σck=240<s/cm²	m³	281.9	162.5	145.5	
FORM	REGULAR	m²	498.0	121.7	247.1	
	CURVE	m²	———	53.4	———	
REINFORCEMENT BAR	φ13	kgf	700.0	400.0	300.0	
	φ16~φ25	kgf	33800.0	19100.0	16500.0	

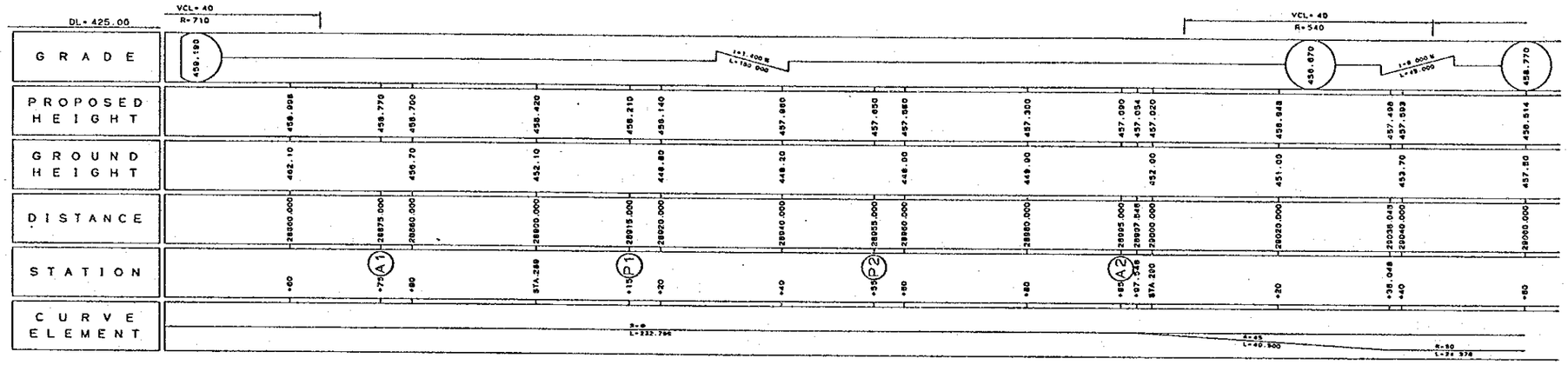
RIVER-PROTECTION

ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	362.6	509.3	871.9	
EMBANKMENT		m³	96.2	244.9	341.1	
FOUNDATION		m	———	———	———	STONE MASONRY
		m	37.0	48.5	85.5	STONE PITCHING
STONE MASONRY		m³	———	———	———	
STONE PITCHING		m³	146.5	192.0	338.5	
MAT GABIONS		m³	222.0	482.5	704.5	

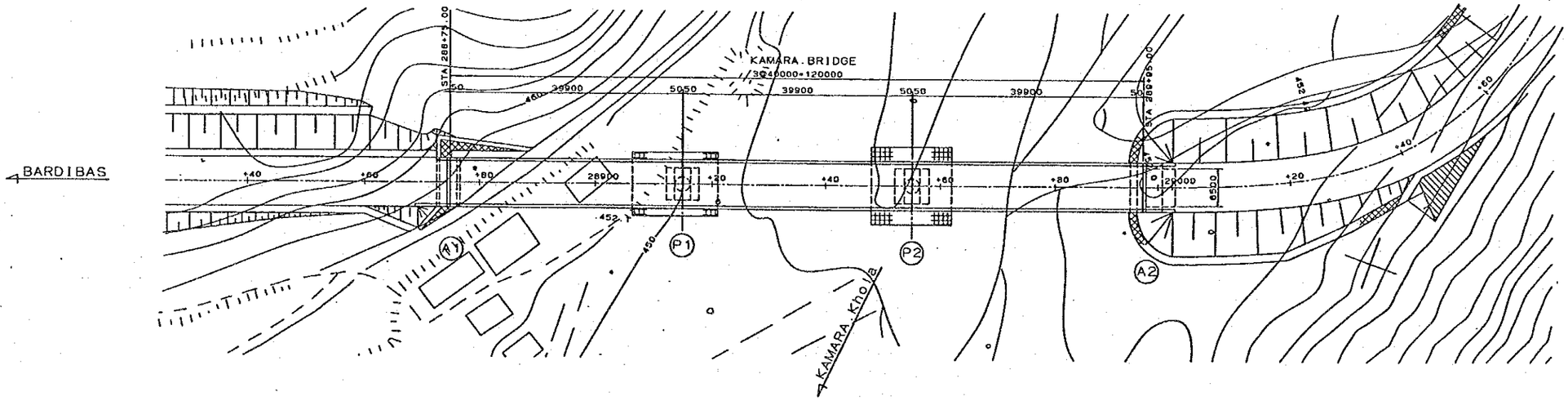
Figure 4.6.5 General Plan of Shindhuse Bridge

GENERAL ELEVATION S=1:200





GENERAL PLAN S=1:200



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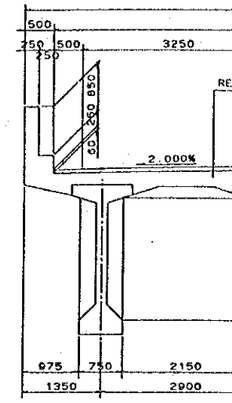

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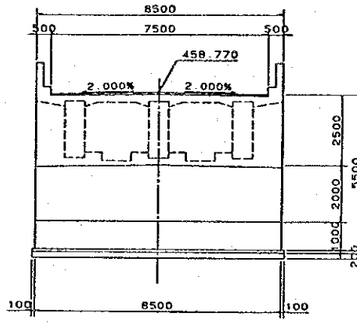

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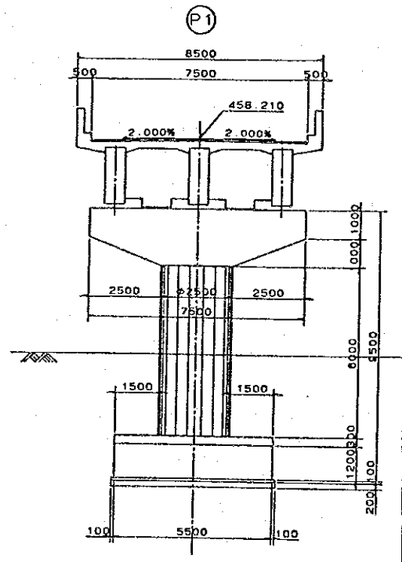

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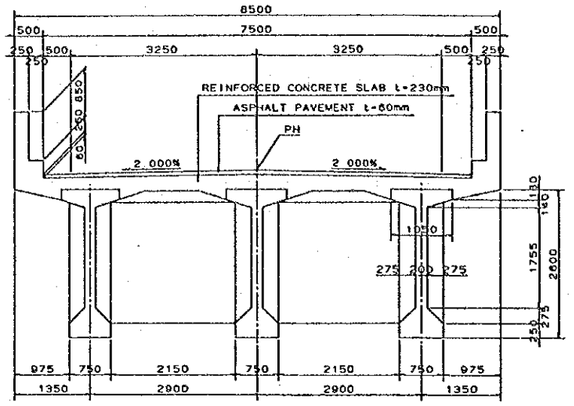
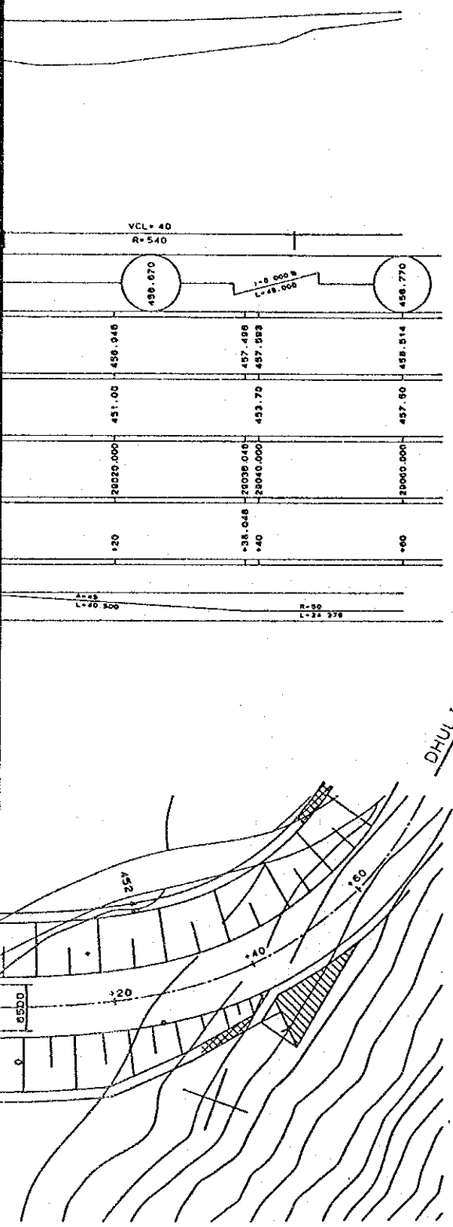
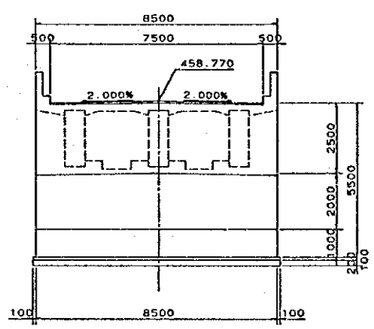
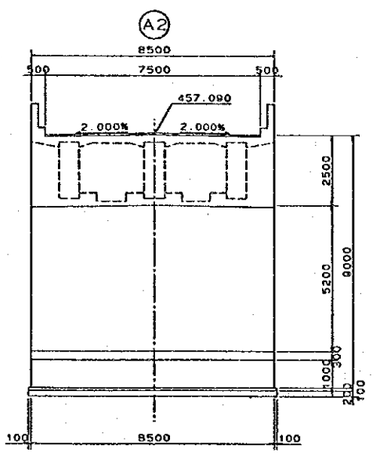
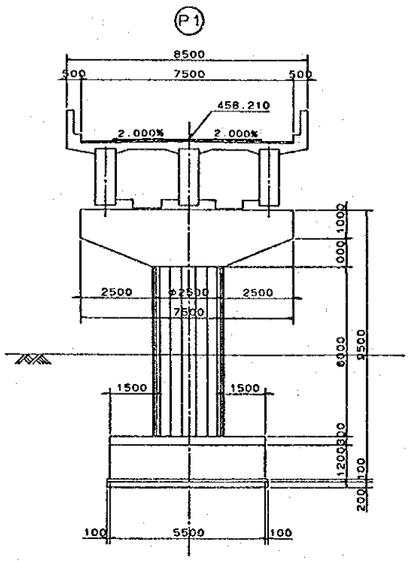
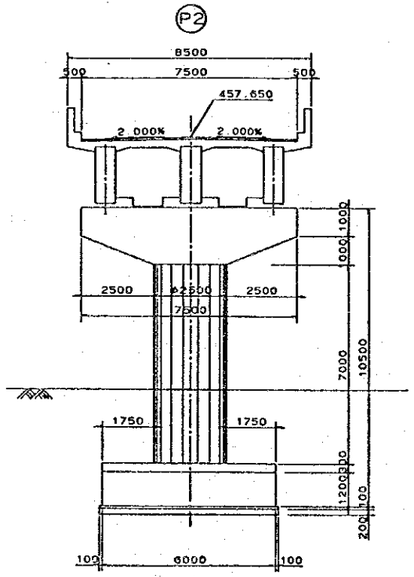












DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=120.00m
SPAN	S=30.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=-1.400%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	49.66	148.97	446.91	
CAST IN PLACE	kg/cm² σck=300	m³	———	20.41	61.23	
CONCRETE	kg/cm² σck=240	m³	———	118.41	355.23	
FORM						
GIRDER		m²	284.93	854.79	2564.36	
CAST IN PLACE		m²	———	720.22	2160.65	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	2451.75	7355.30	22066.00	
CROSS BEAM	12φ 5	kgf	———	117.70	352.98	
REINFORCEMENT BAR						
	φ13	kgf	4033.33	19900.00	59700.00	
	φ16~φ25	kgf	4900.00	32800.00	98400.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	———	6	18	
EXPANSION JOINT		m	———	———	30.00	
DRAIN		n	———	2	6	
PAVEMENT		m²	———	299.30	897.75	
ERECTION		tf	124.15	372.44	1117.32	

SUBSTRUCTURE

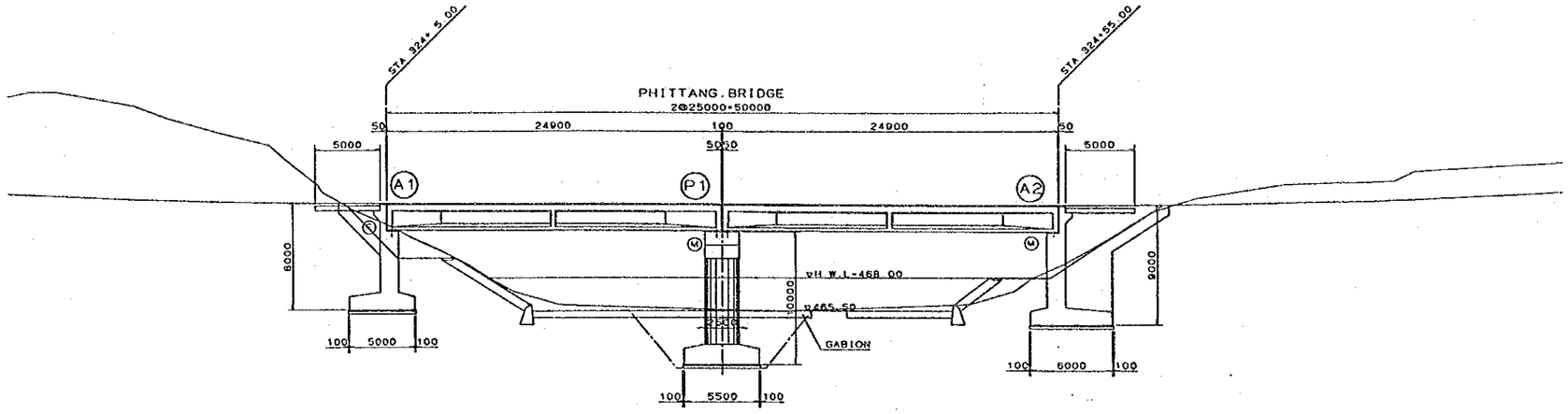
ITEM	CLASS	UNIT	A - 1	P - 1	P - 2	A - 2	REMARKS
EXCAVATION	REGULARCLAY	m³	———	478.5	525.1	480.0	
	MEDIUM SOUND ROCK	m³	350.0	———	———	———	
CONCRETE	σck=240kg/cm²	m³	88.7	103.8	116.6	210.4	
FORM	REGULAR	m²	146.1	28.9	31.4	400.7	
	CURVE	m²	———	47.1	55.0	———	
REINFORCEMENT BAR	φ13	kgf	———	300.0	300.0	500.0	
	φ16~φ25	kgf	2100.0	14300.0	15700.0	25000.0	

RIVER-PROTECTION

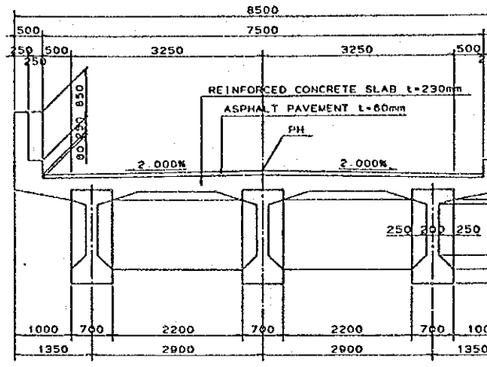
ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	A REMARKS
EXCAVATION		m³	120.0	———	120.0	
EMBANKMENT		m³	———	———	———	
FOUNDATION		m	———	———	———	STONE MASONRY
		m	20.0	———	20.0	STONE PITCHING
STONE MASONRY		m³	———	———	———	
STONE PITCHING		m²	127.3	———	127.3	
MAT GABIONS		m³	233.0	———	233.0	

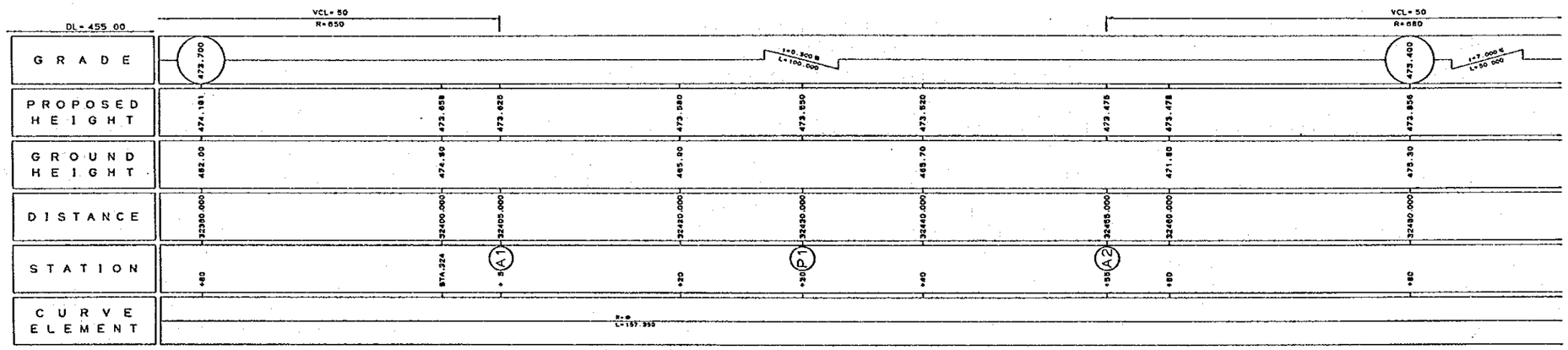
Figure 4.6.6 General Plan of Kamara Bridge

GENERAL ELEVATION S=1:200



CROSS SECTION S=1:50





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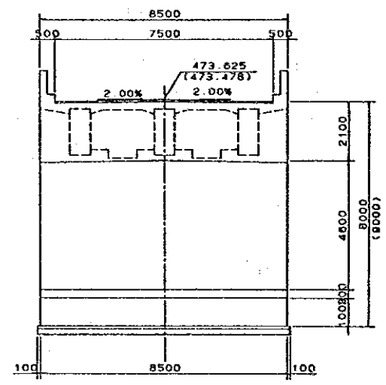

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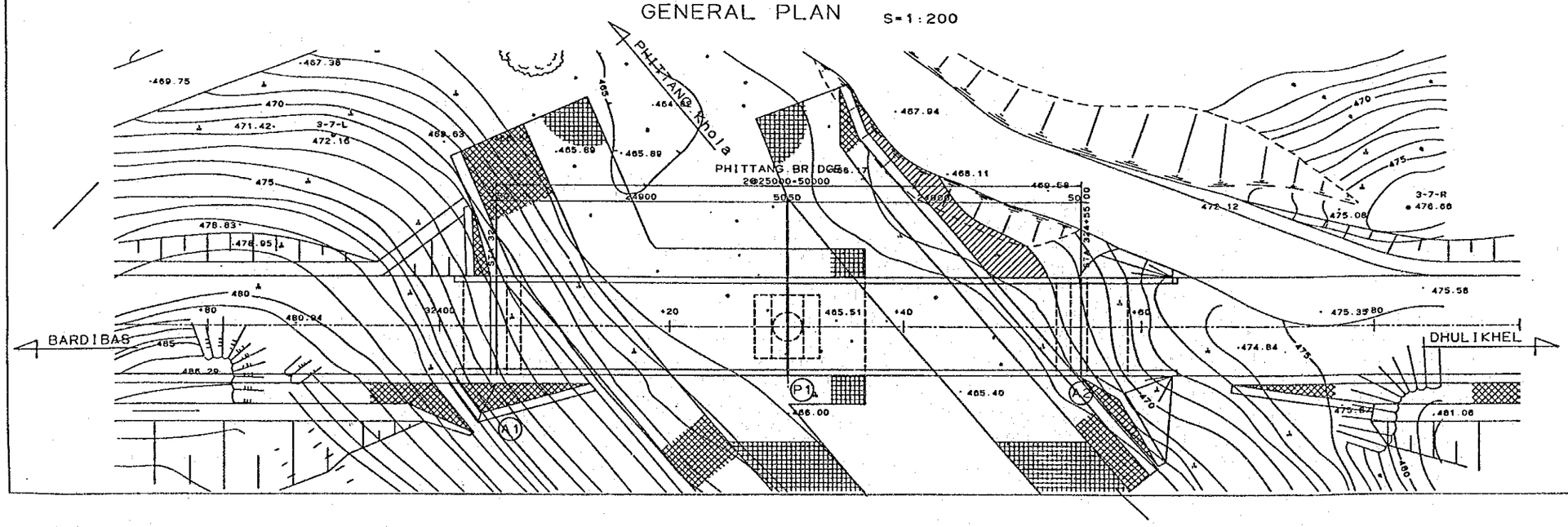

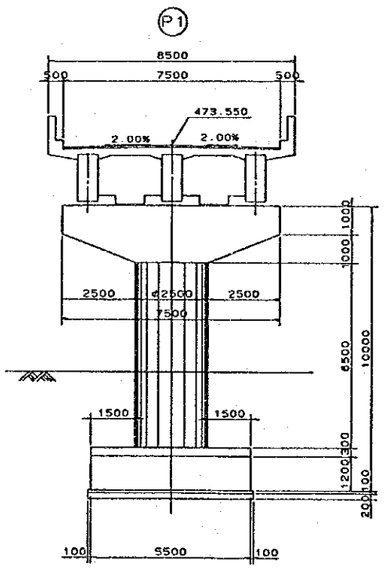

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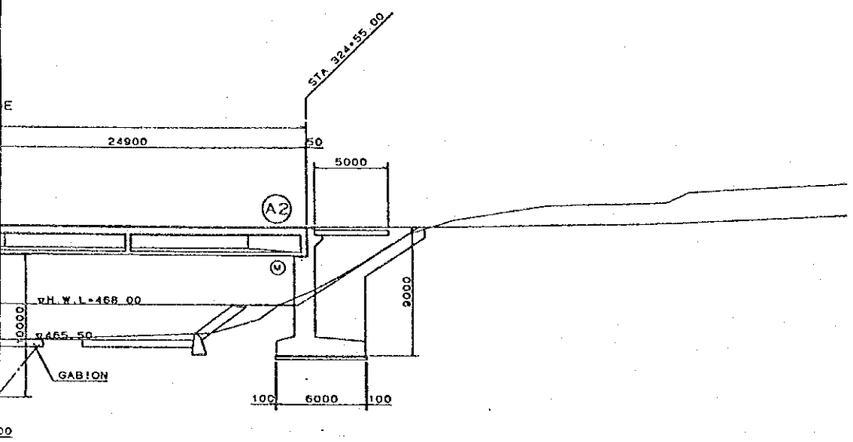

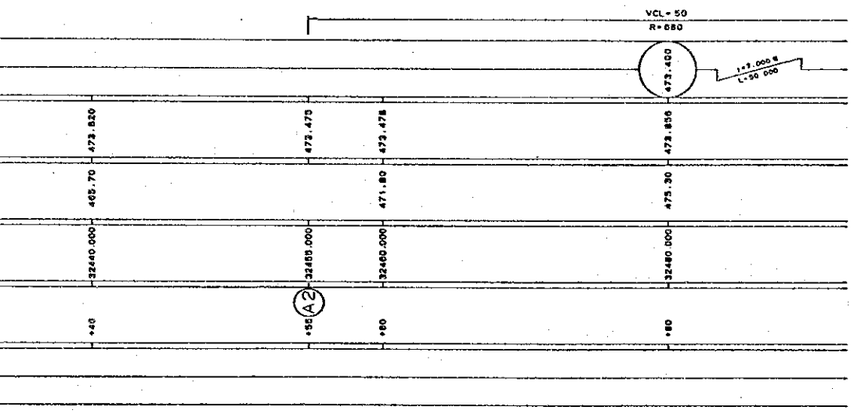

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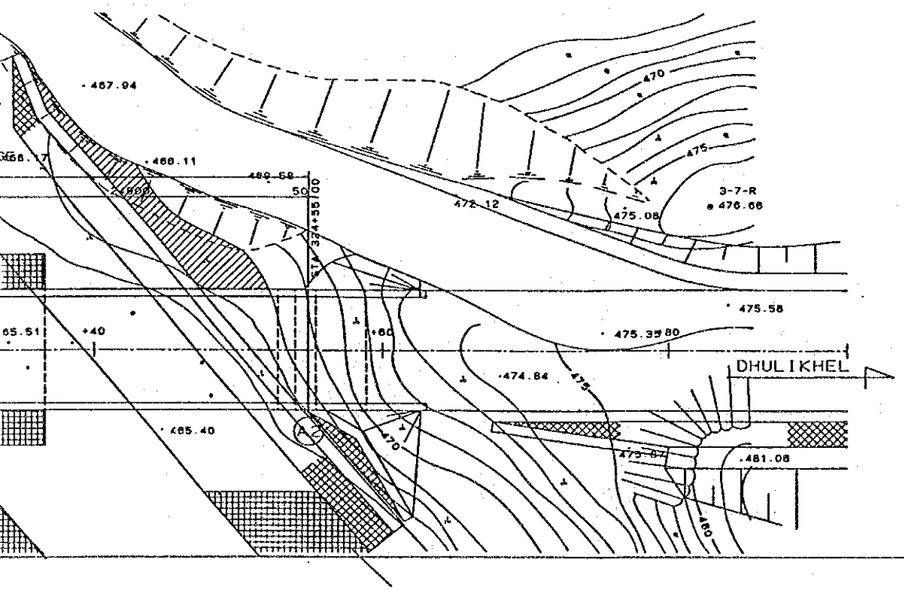
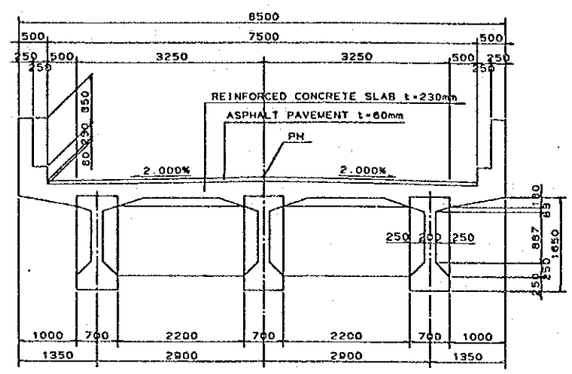


CROSS SECTION S=1:50



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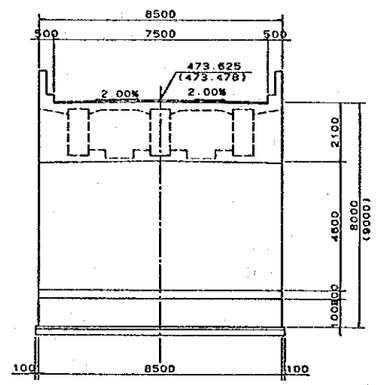

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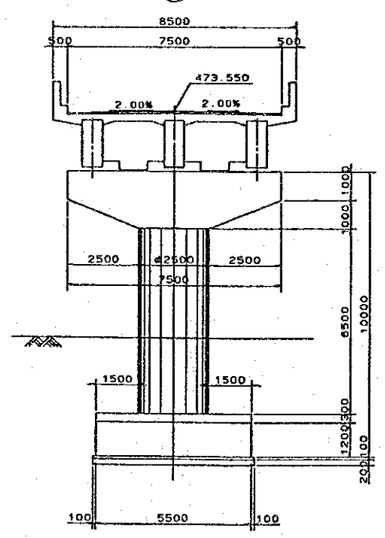


DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=50.00m
SPAN	S=25.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.16
ANGLE OF SKEW	90° 00' 00"
RADIUS OF CURVATURE	R= ∞
LONGITUDINAL SLOPE	I=-0.300%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	18.23	54.69	109.38	
CAST IN PLACE	kg/cm² σck=300	m³	———	7.90	15.80	
CONCRETE	kg/cm² σck=240	m³	———	71.76	472.92	
FORM						
GIRDER		m²	113.90	341.69	683.38	
CAST IN PLACE		m²	———	451.63	903.26	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	572.60	2617.80	5236.00	
CROSS BEAM	12φ5	kgf	———	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	1456.67	8300.00	16600.00	
	φ16~φ25	kgf	1600.00	16300.00	32600.00	
SHOE (LAMINATED RUBBER)	FIX.MOV	n	———	6	12	
EXPANSION JOINT		m	———	———	22.50	
DRAIN		n	———	2	4	
PAVEMENT		m²	———	186.80	373.60	
ERECTION		tf	45.58	136.73	273.45	

SUBSTRUCTURE

ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULAR CLAY	m³	———	478.5	852.0	
	MEDIUM SOUND ROCK	m³	550.0	———	———	
CONCRETE	σck=240<kg/cm²	m³	155.6	106.2	222.7	
FORM	REGULAR	m²	292.0	28.9	409.4	
	CURVE	m²	———	51.1	———	
REINFORCEMENT BAR	φ13	kgf	400.0	300.0	500.0	
	φ16~φ25	kgf	17900.0	14700.0	26400.0	

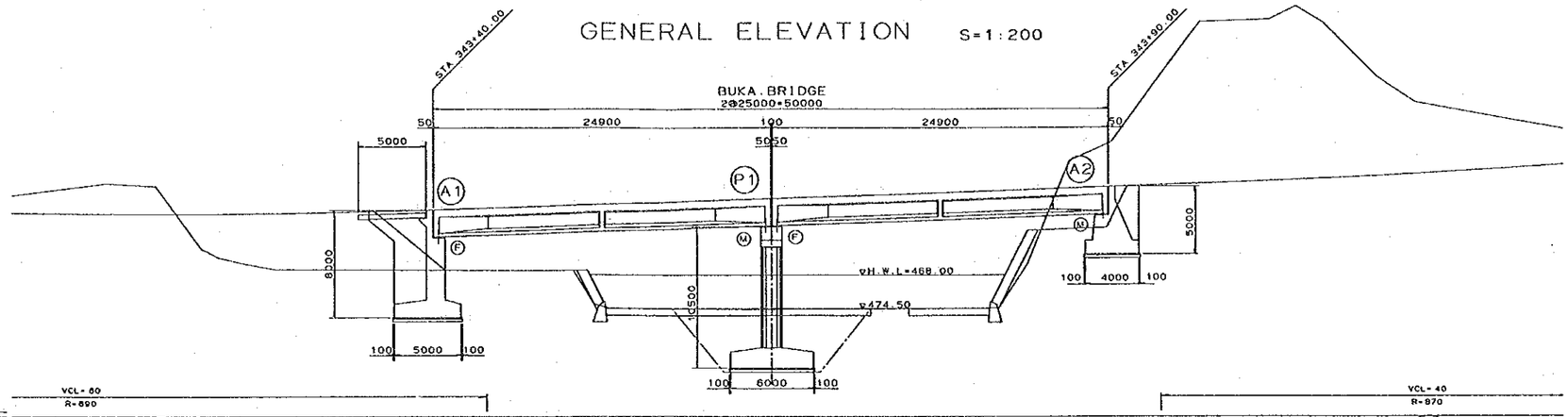
RIVER-PROTECTION

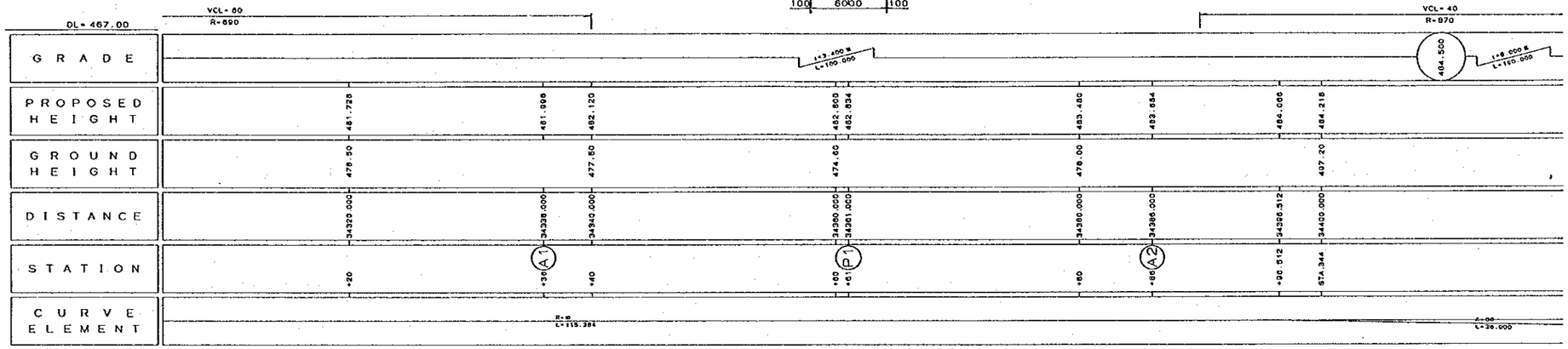
ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	243.6	476.0	719.6	
EMBANKMENT		m³	61.9	———	61.9	
FOUNDATION		m	———	———	———	STONE MASONRY
		m	43.5	40.0	83.5	STONE PITCHING
STONE MASONRY		m³	———	———	———	
STONE PITCHING		m²	180.6	281.2	461.8	
MAT GABIONS		m²	———	663.8	663.8	

Figure 4.6.7 General Plan of Phittang Bridge

8

GENERAL ELEVATION S=1:200





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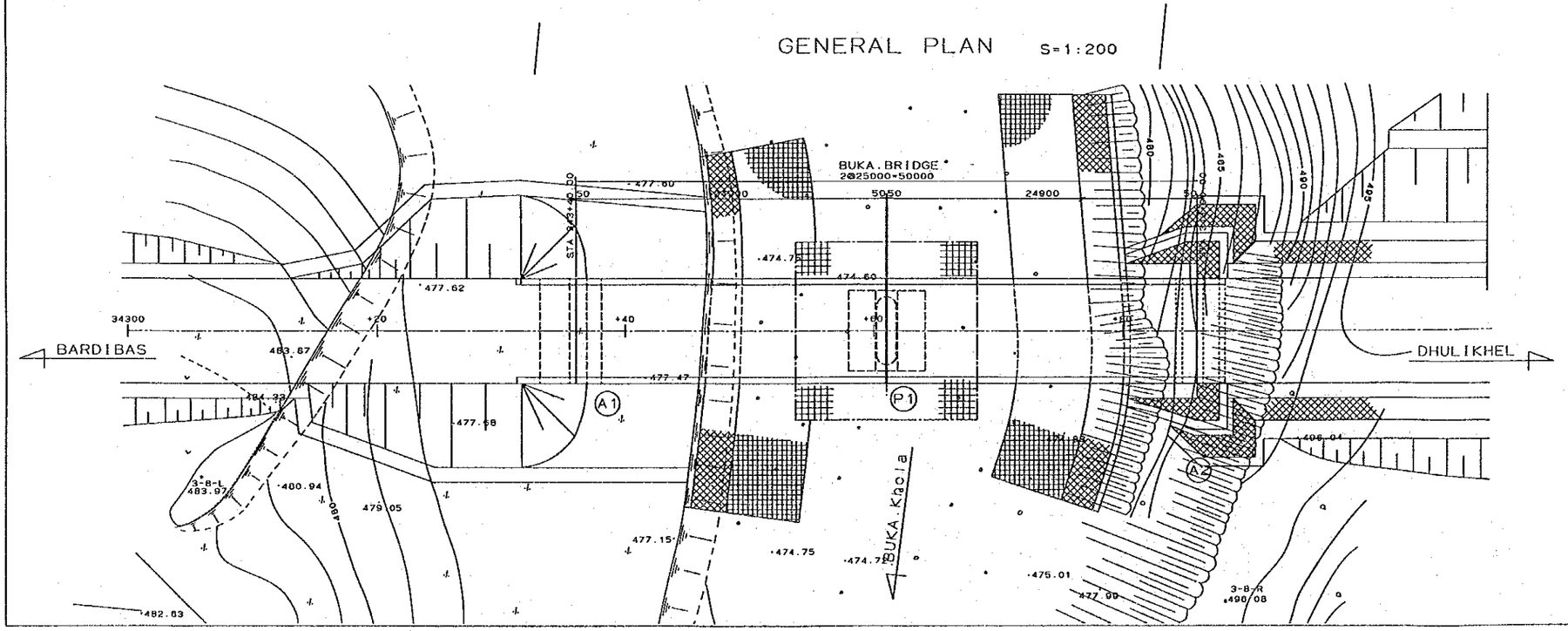

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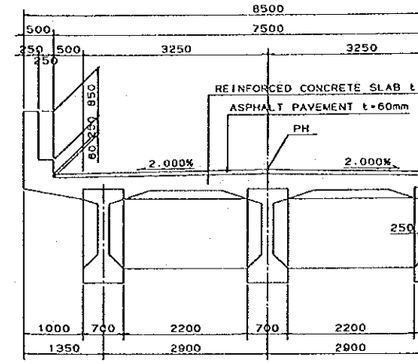
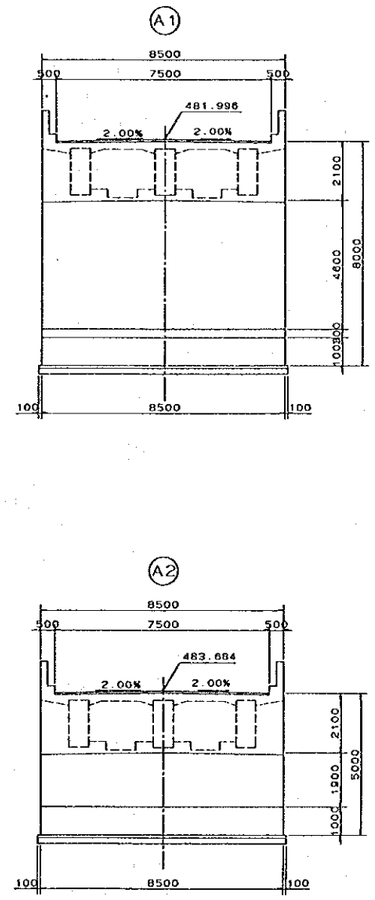
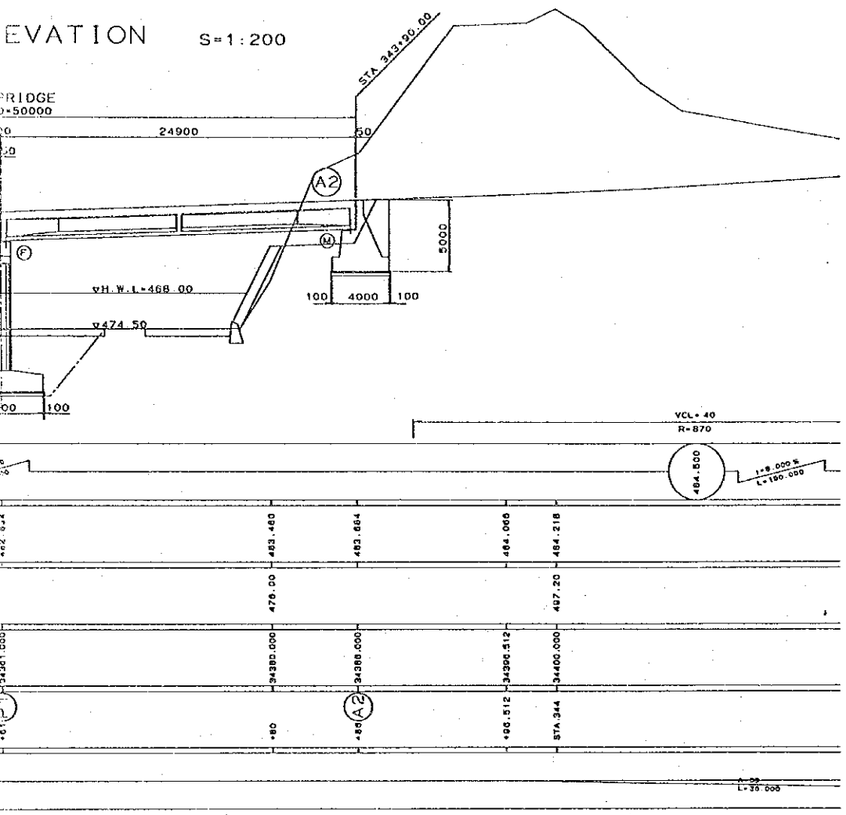
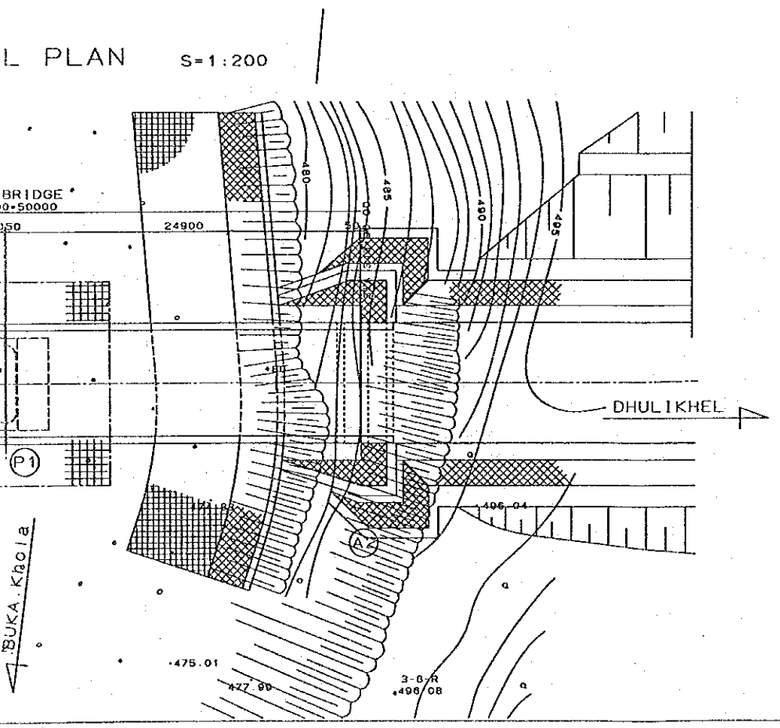
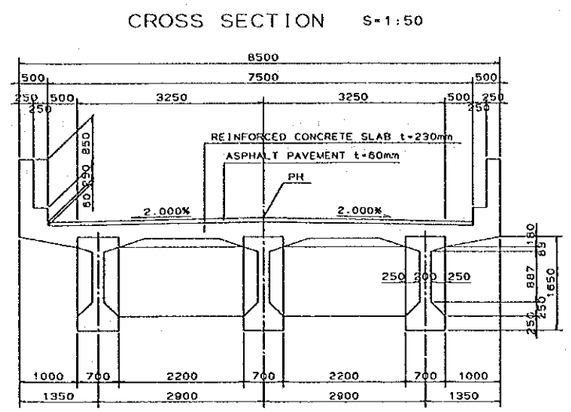
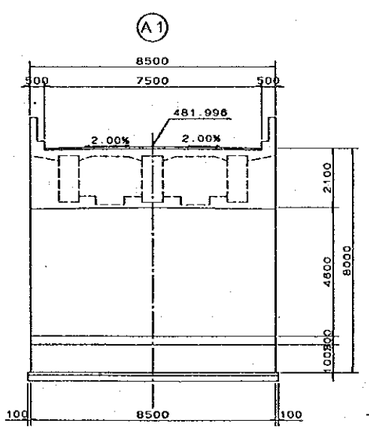


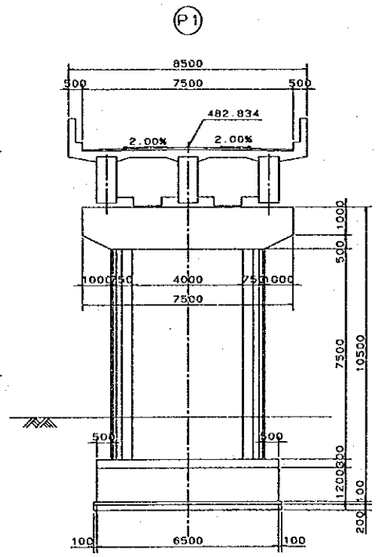


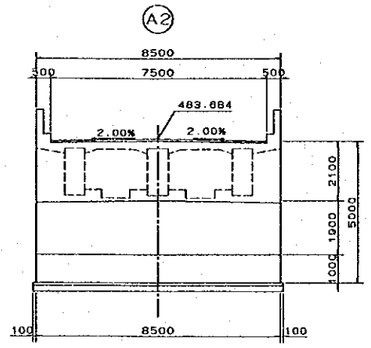












DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=50.00m
SPAN	S=25.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90°00'00"
RADIUS OF CURVATURE	R=∞
LONGITUDINAL SLOPE	I=3.400%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	18.23	54.69	109.38	
CAST IN PLACE	kg/cm² σck=300	m³	——	7.90	15.80	
CONCRETE	kg/cm² σck=240	m³	——	71.76	472.92	
FORM						
GIRDER		m²	113.90	341.69	683.38	
CAST IN PLACE		m²	——	451.63	903.26	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	872.60	2617.80	5236.00	
CROSS BEAM	12φ 5	kgf	——	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	1466.67	8300.00	16600.00	
	φ16~φ25	kgf	1800.00	16300.00	32600.00	
SHOE (LAMINATED LUBBER)	FIX.MOV	n	——	6	12	
EXPANSION JOINT		m	——	——	22.50	
DRAIN		n	——	2	4	
PAVEMENT		m²	——	186.80	373.60	
ERECTION		tf	45.58	136.73	273.45	

SUBSTRUCTURE

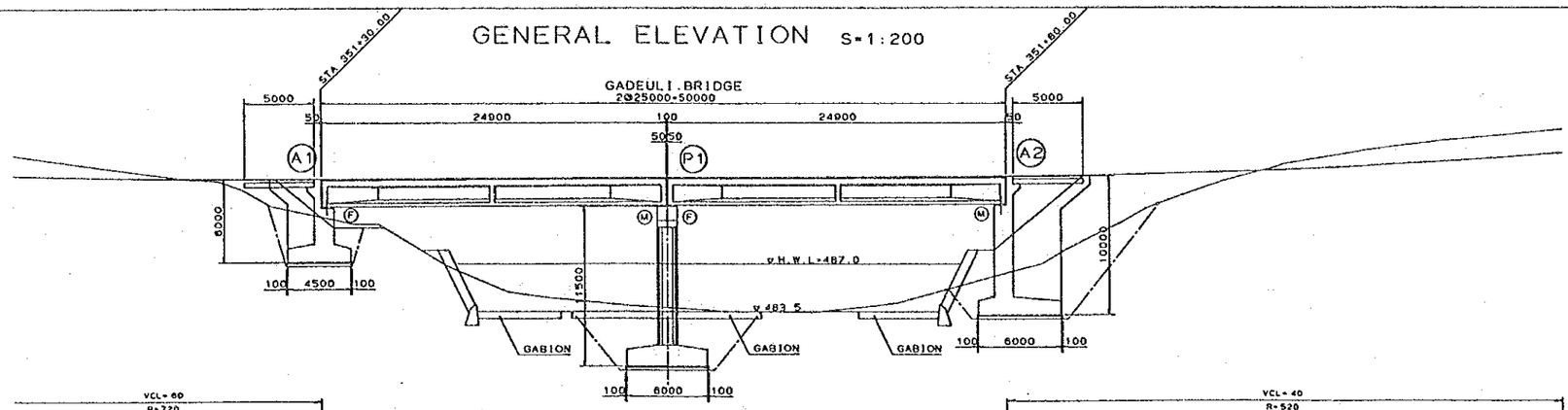
ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULARCLAY	m³	276.0	570.0	——	
	MEDIUM SOUND ROCK	m³	——	——	375.0	
CONCRETE	σck=240kg/cm²	m³	149.3	128.7	90.7	
FORM	REGULAR	m²	270.8	119.8	146.4	
	CURVE	m²	——	35.3	——	
REINFORCEMENT BAR	φ13	kgf	300.0	300.0	——	
	φ16~φ25	kgf	17000.0	14500.0	2100.0	

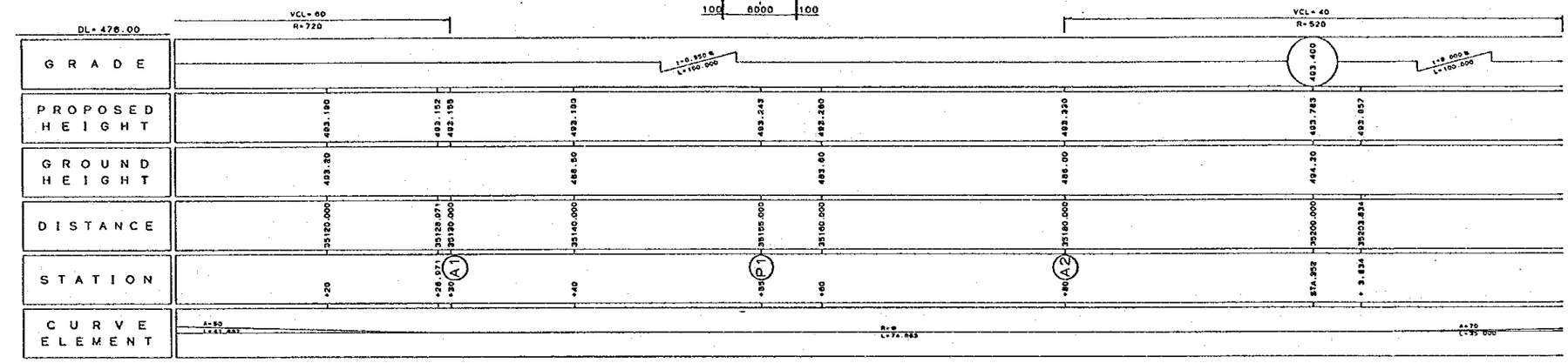
RIVER-PROTECTION

ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	201.0	113.9	314.9	
EMBANKMENT		m³	——	25.1	25.1	
FOUNDATION		m	30.0	33.5	63.5	STONE MASONRY
		m	——	——	——	STONE PITCHING
STONE MASONRY		m³	117.4	243.4	360.8	
STONE PITCHING		m²	——	——	——	
MAT GABIONS		m³	382.5	201.0	583.5	

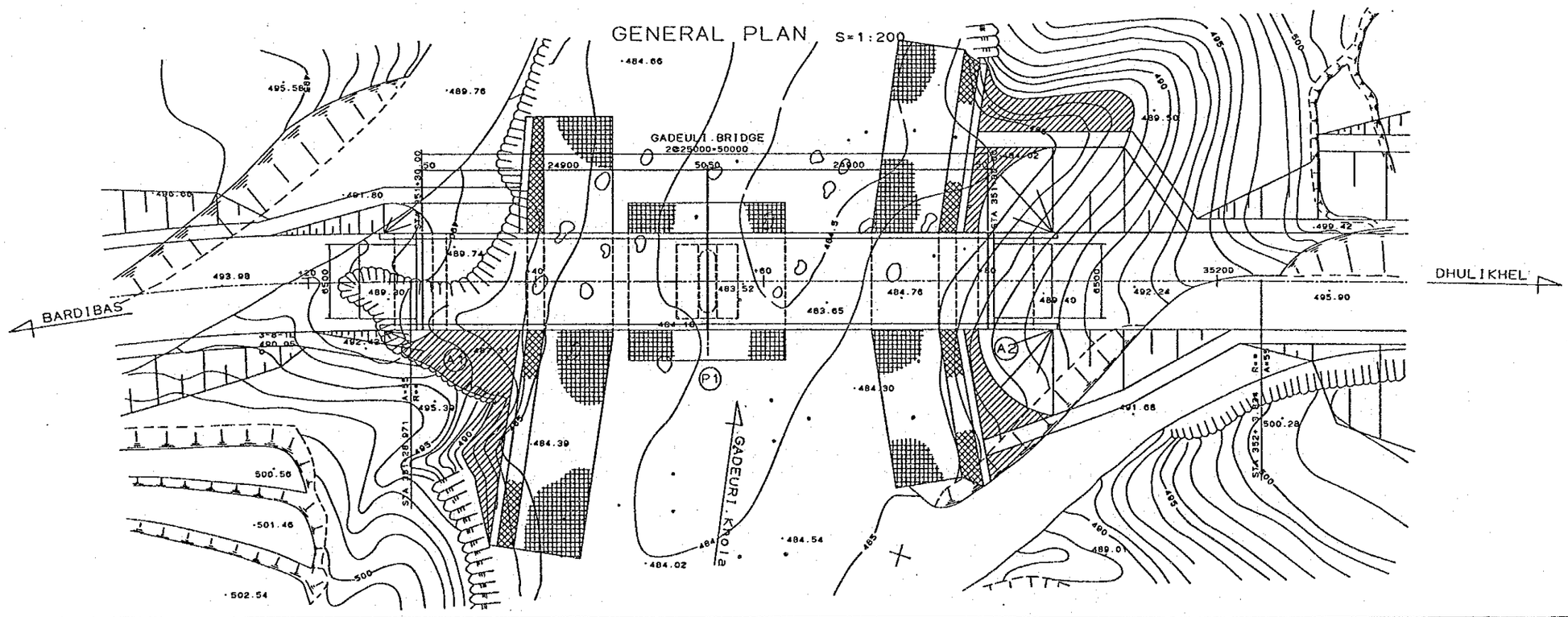
Figure 4.6.8 General Plan of Buka Bridge

GENERAL ELEVATION S=1:200

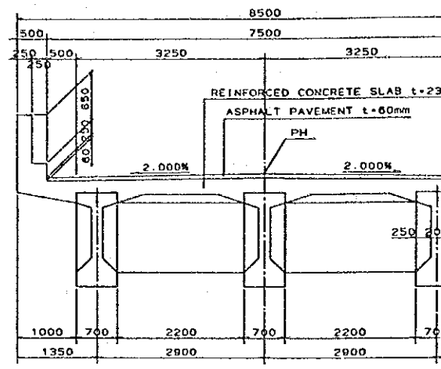


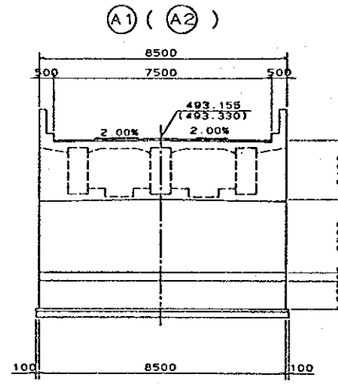


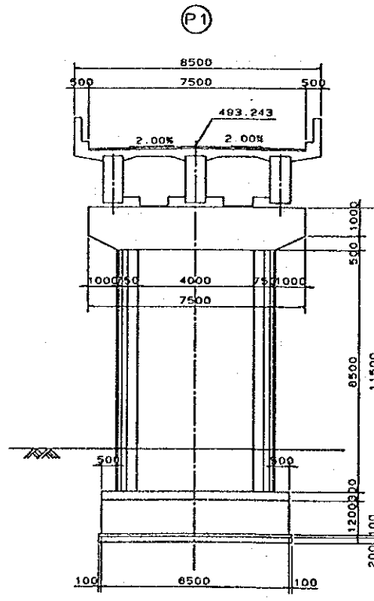
GENERAL PLAN S=1:200

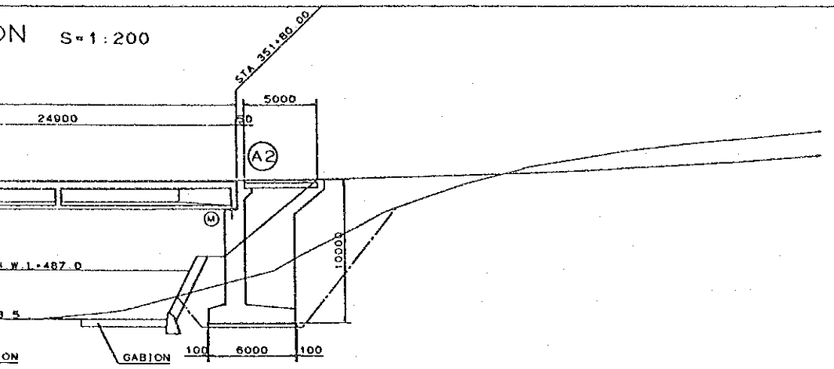


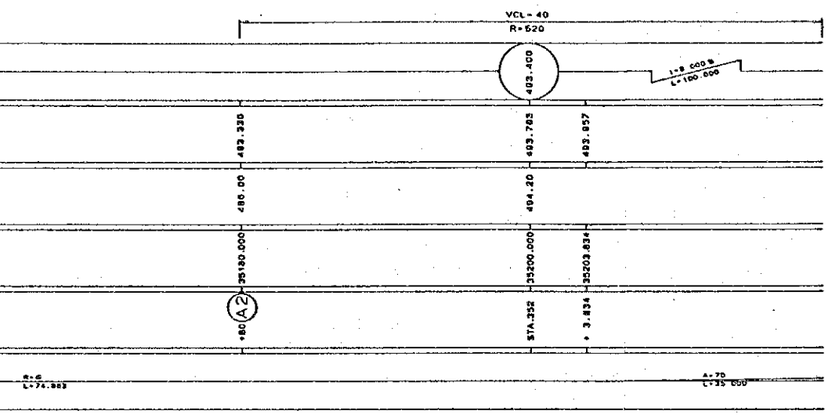
CROSS SECTION S=1:50

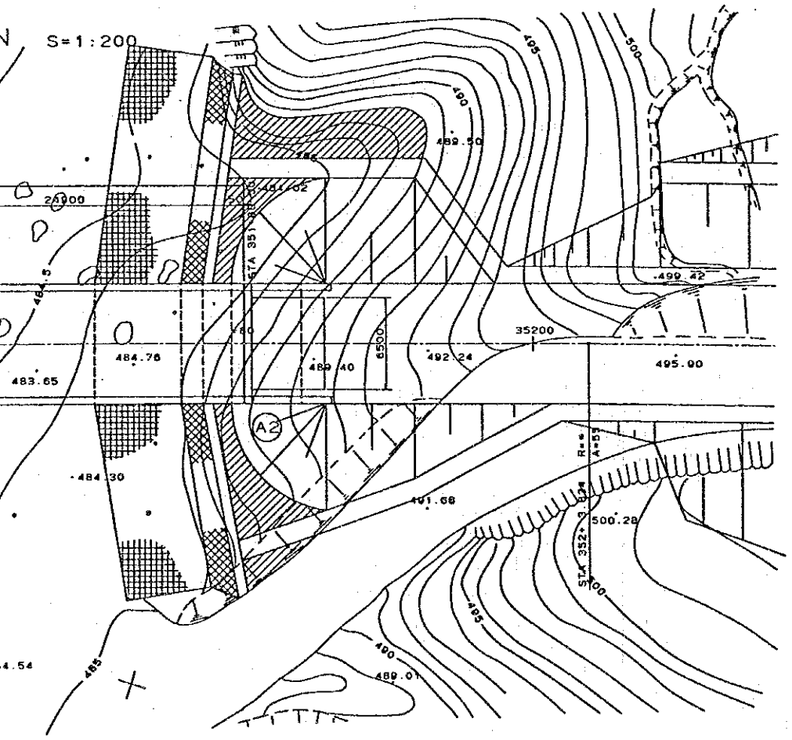






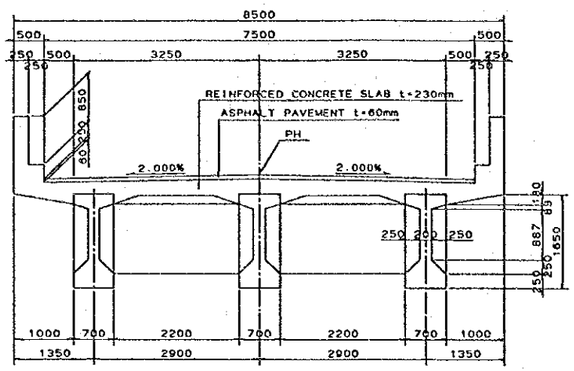


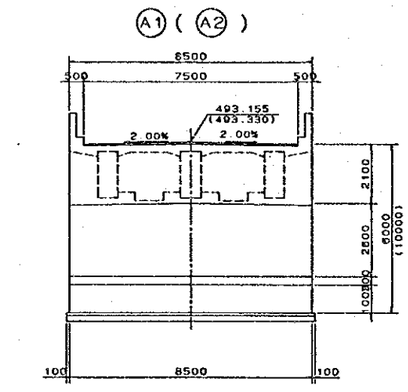


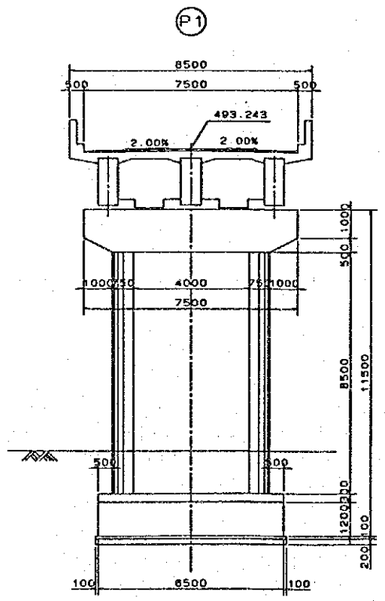


DHULIKHEL

CROSS SECTION S=1:50







DESIGN CONDITION

TOTAL BRIDGE LENGTH	L=50.00m
SPAN	S=25.00m
WIDTH	W= 7.50m
LIVE LOAD	A-TYPE LIVE LOAD (TL-25)
IMPACT COEFFICIENT	I=10/(25+L)
SEISMIC COEFFICIENT	Kh=0.18
ANGLE OF SKEW	90°00'00"
RADIUS OF CURVATURE	R=∞
LONGITUDINAL SLOPE	I=0.350%

SUPERSTRUCTURE

ITEM	CLASS	UNIT	PER GIRDER	PER SPAN	PER BRIDGE	REMARKS
CONCRETE						
GIRDER	kg/cm² σck=350	m³	18.23	54.69	109.38	
CAST IN PLACE	kg/cm² σck=300	m³	———	7.90	15.80	
CONCRETE	kg/cm² σck=240	m³	———	71.76	472.92	
FORM						
GIRDER		m²	113.90	341.69	683.38	
CAST IN PLACE		m²	———	451.63	903.26	
PRESTRESSING CABLE						
GIRDER	12T12.4	kgf	872.60	2617.80	5236.00	
CROSS BEAM	12φ 5	kgf	———	70.60	141.20	
REINFORCEMENT BAR						
	φ13	kgf	1466.67	8300.00	16600.00	
	φ16~φ25	kgf	1800.00	16300.00	32600.00	
SHOE (LAMINATED LUBBER)	FIX.MOV	n	———	6	12	
EXPANSION JOINT		m	———	———	22.50	
DRAIN		n	———	2	4	
PAVEMENT		m²	———	186.80	373.60	
ERECTION		tf	45.58	136.73	273.45	

SUBSTRUCTURE

ITEM	CLASS	UNIT	A - 1	P - 1	A - 2	REMARKS
EXCAVATION	REGULARCLAY	m³	235.2	508.1	———	
	MEDIUM SOUND ROCK	m³	———	———	562.5	
CONCRETE	σck=240kg/cm²	m³	110.5	136.5	218.4	
FORM	REGULAR	m²	192.6	127.8	374.9	
	CURVE	m²	———	40.1	———	
REINFORCEMENT BAR	φ13	kgf	200.0	300.0	500.0	
	φ16~φ25	kgf	12000.0	15500.0	25800.0	

GARD-BANK-STRUCTURE

ITEM	CLASS	UNIT	RIGHT BANK	LEFT BANK	TOTAL	REMARKS
EXCAVATION		m³	679.4	335.4	1014.8	
EMBANKMENT		m³	23.7	148.2	171.9	
FOUNDATION		m³	39.5	39.0	78.5	STONE MASONRY
		m³	———	———	———	STONE PITCHING
STONE MASONRY		m³	220.8	218.0	438.8	
STONE PITCHING		m³	———	———	———	
MAT GABIONS		m³	237.0	234.0	471.0	

Figure 4.6.9 General Plan of Gadeuli Bridge

PROFILE SCALE V=1: 200 H=1: 1000

BHOGATE BRIDGE 2•30•60.0

B P STA. 76•30.00

M P STA. 80•40.00

STA 78•10.00

STA 78•70.00

330.00

320.00

310.00

DL= 300.00

V=1: 200

H=1: 1000

VCL= 170 R= 1200

VCL= 50 R= 780

VCL= 120 R= 870

GRADE.	325.800 326.050 +1.7.508 % L=199.000 313.000 +1.6.842 % L=180.000 326.000 +1.7.000 % L=210.000
PROPOSED HEIGHT.	326.076 326.056 326.044 325.265 324.900 323.800 322.819 322.100 320.700 320.172 318.350 318.034 317.052 316.698 316.712 316.332 315.980 315.074 315.264 316.920 317.881 319.155 319.163 320.528 321.566 321.695 323.032 323.709 323.824 323.877 323.968
GROUND HEIGHT.	327.50 327.10 327.00 326.85 326.75 326.85 326.50 326.35 326.20 324.20 327.00 323.80 312.90 305.10 301.20 306.00 310.80 318.00 321.50 322.20 323.10 323.80 324.70 325.20 325.80 326.20 326.70
ACCUMULATED DISTANCE.	7580.000 7580.000 7600.000 7605.742 7620.000 7640.000 7640.850 7680.000 7694.517 7700.000 7700.725 7720.000 7740.000 7747.838 7760.000 7769.646 7780.000 7800.000 7807.458 7820.000 7840.000 7860.000 7880.000 7900.000 7920.000 7940.000 7940.071 7960.000 7975.228 7980.000 8000.000 8020.000 8040.000 8060.000 8080.000
DISTANCE.	20.000 20.000 20.000 5.742 14.258 20.000 0.850 19.150 14.517 5.483 20.000 8.725 10.275 20.000 7.838 12.162 9.646 10.354 20.000 7.458 12.542 20.000 20.000 20.000 20.000 20.000 0.071 19.929 15.228 4.772 20.000 20.000 20.000 20.000 20.000
STATION.	+00 +00 STA.76 +20 +40 +00 +80 STA.77 +20 +40 +00 +80 STA.78 +20 +40 +00 +80 STA.79 +20 +40 +60 +80 STA.80 +20 +40 +60 +80
CURVE ELEMENT.	R=∞ L=297.358 A=95 L=99.498 R=120 L=33.337 A=95 L=99.498 A=50 L=37.618 R=80 L=22.109 A=35 L=37.819 R=∞ L=132.618 A=75 L=221.736 R=180 L=36.574 R=180 L=135.574
SUPERELEVATION.	1/114 1/221 1/221 1/221 1/100 1/100 1/117

TYPICAL CROSS SECTION

STA. 79•
GR=323.
PH=321

7500
500 3250 325
700
4.000% 4.00
GRAVEL

DL 320.0

PLAN SCALE 1:1000

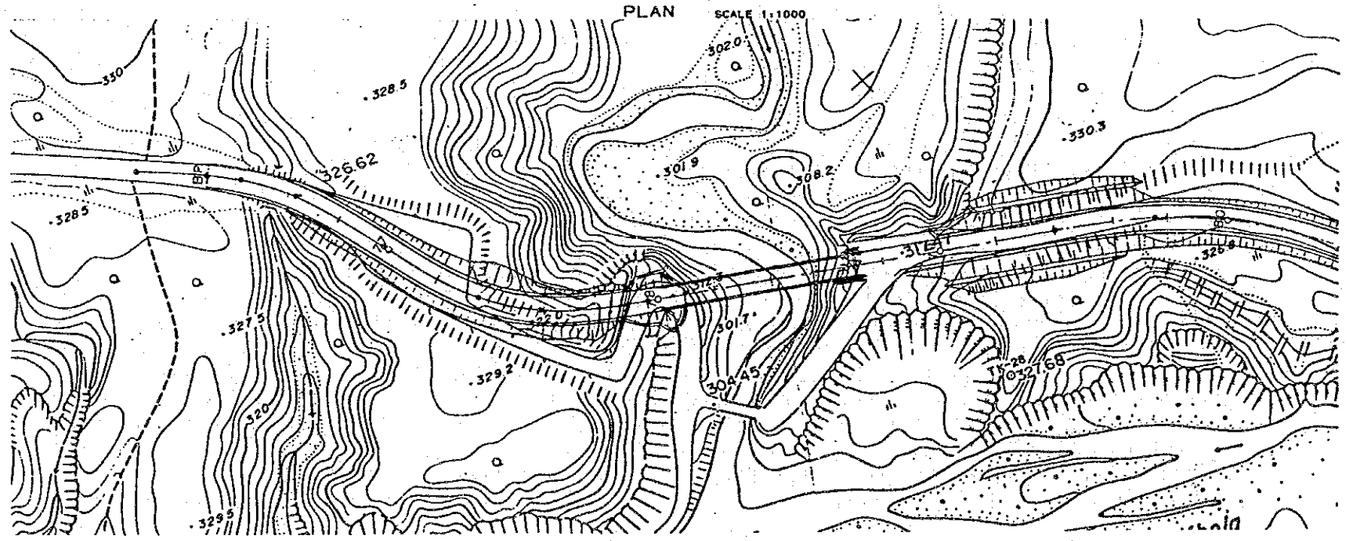
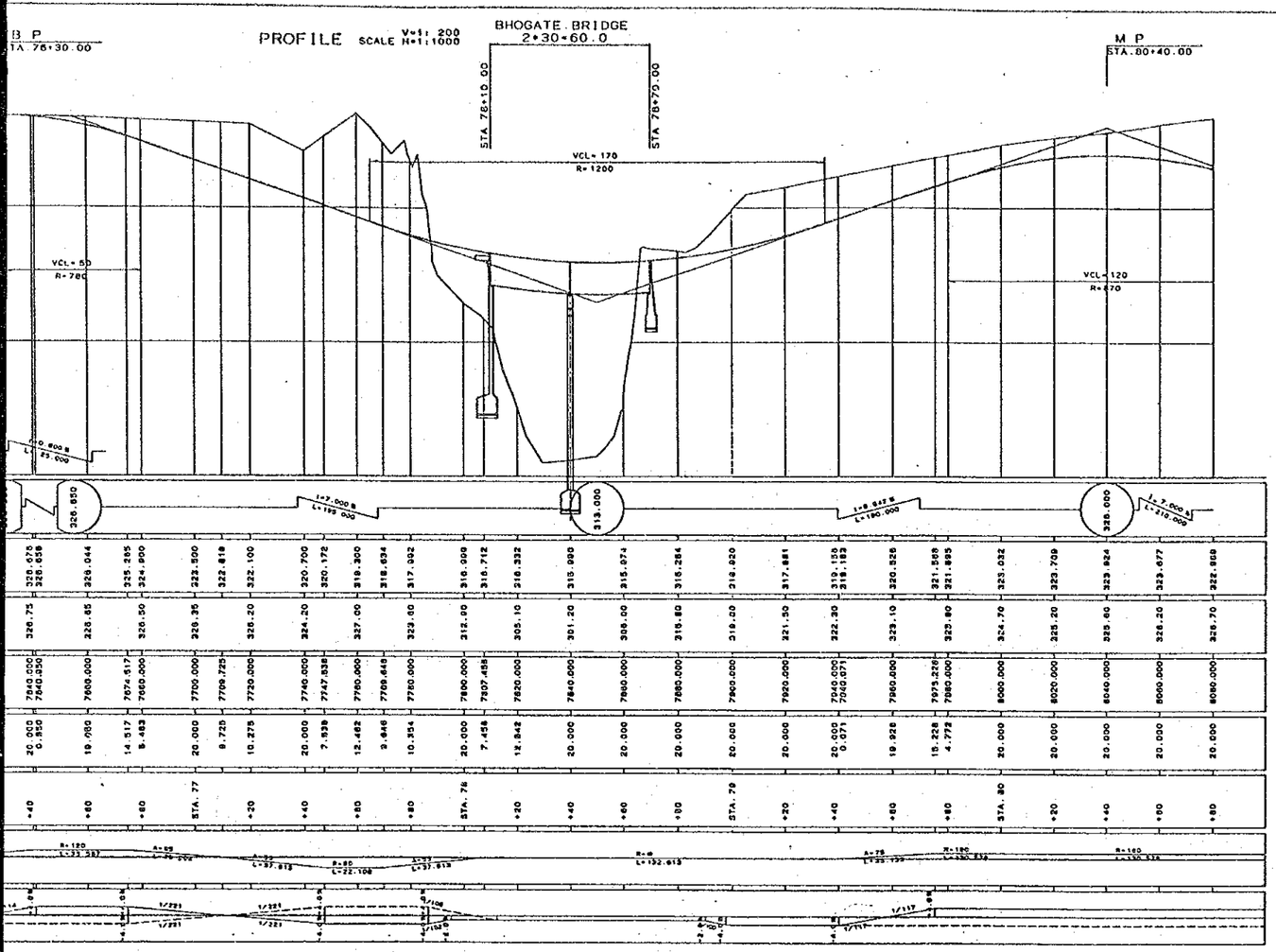
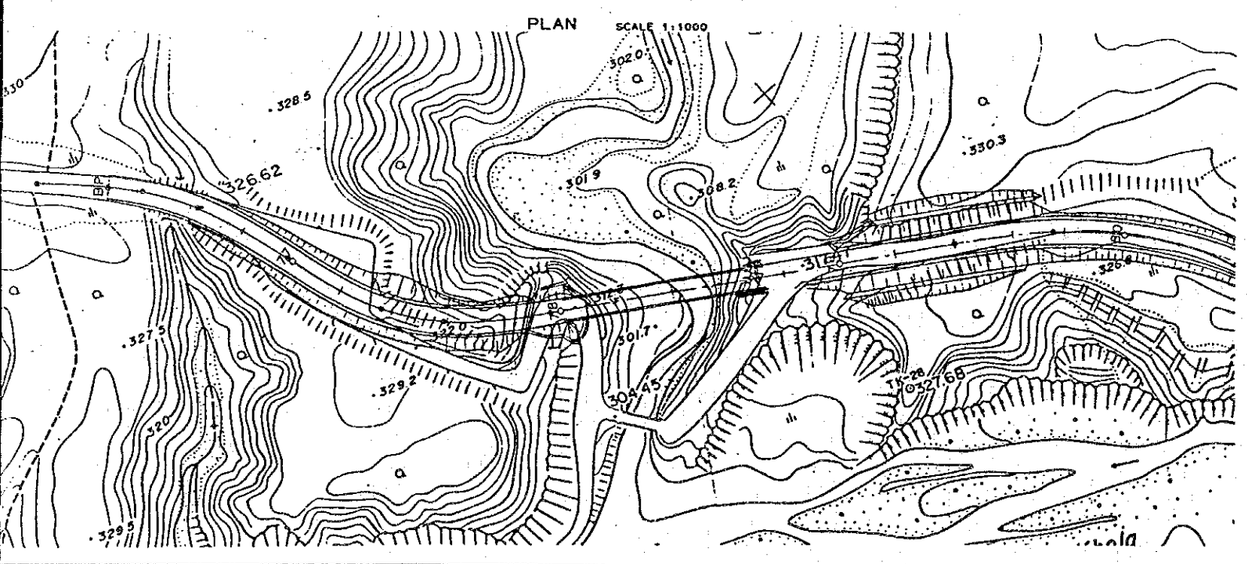


Figure 4.6.10 Plan





TYPICAL CROSS SECTION SCALE 1:200

STA. 79+80
GH=323.90
PH=321.895

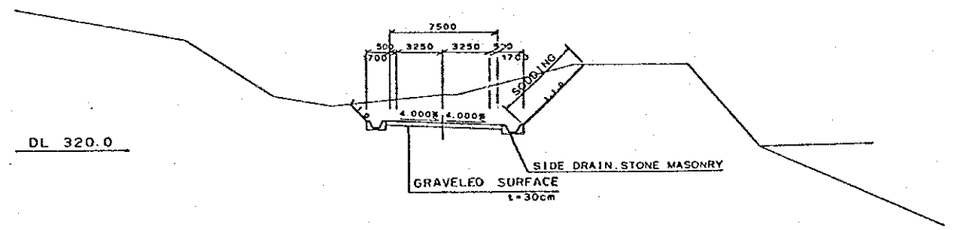
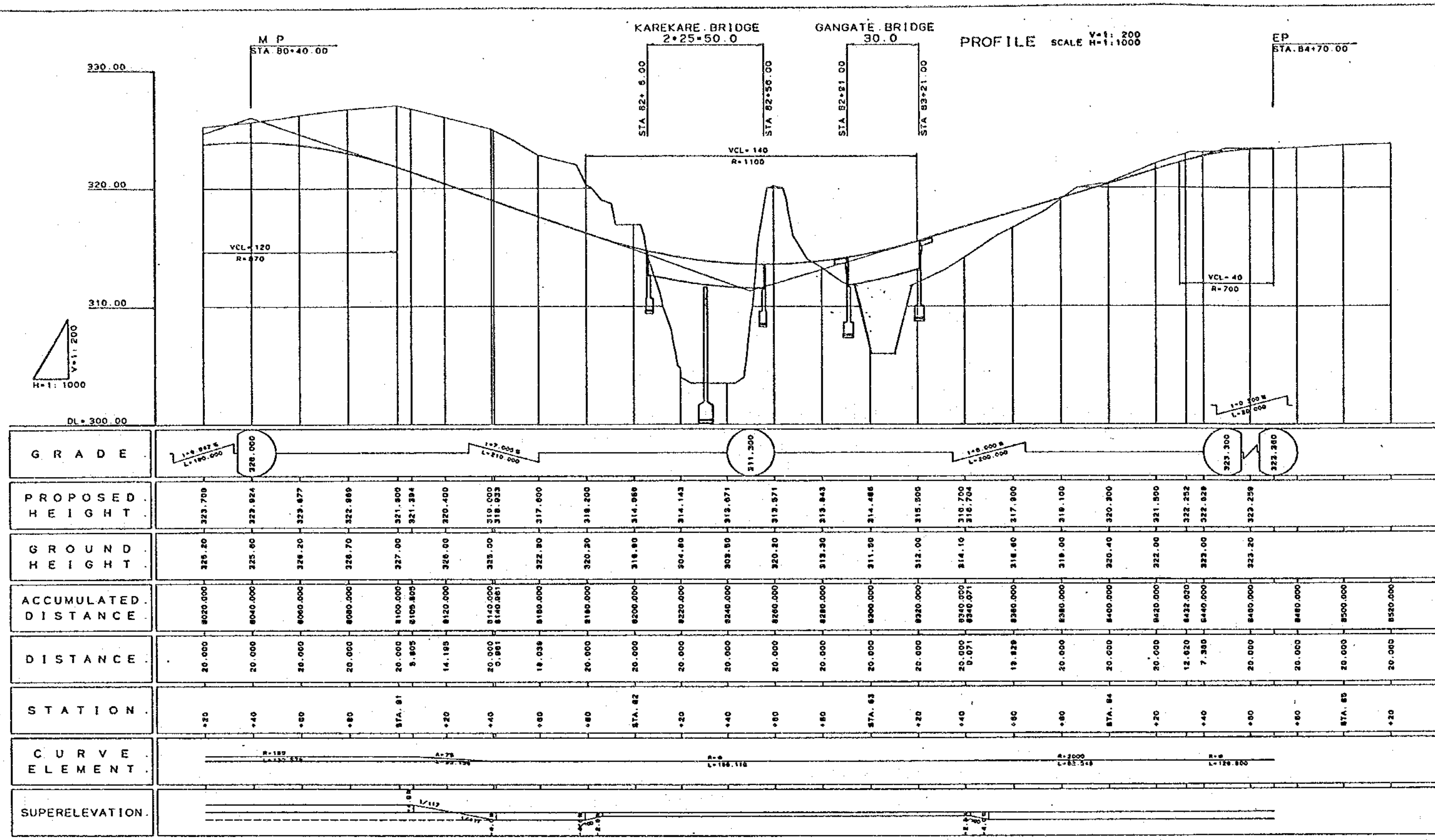
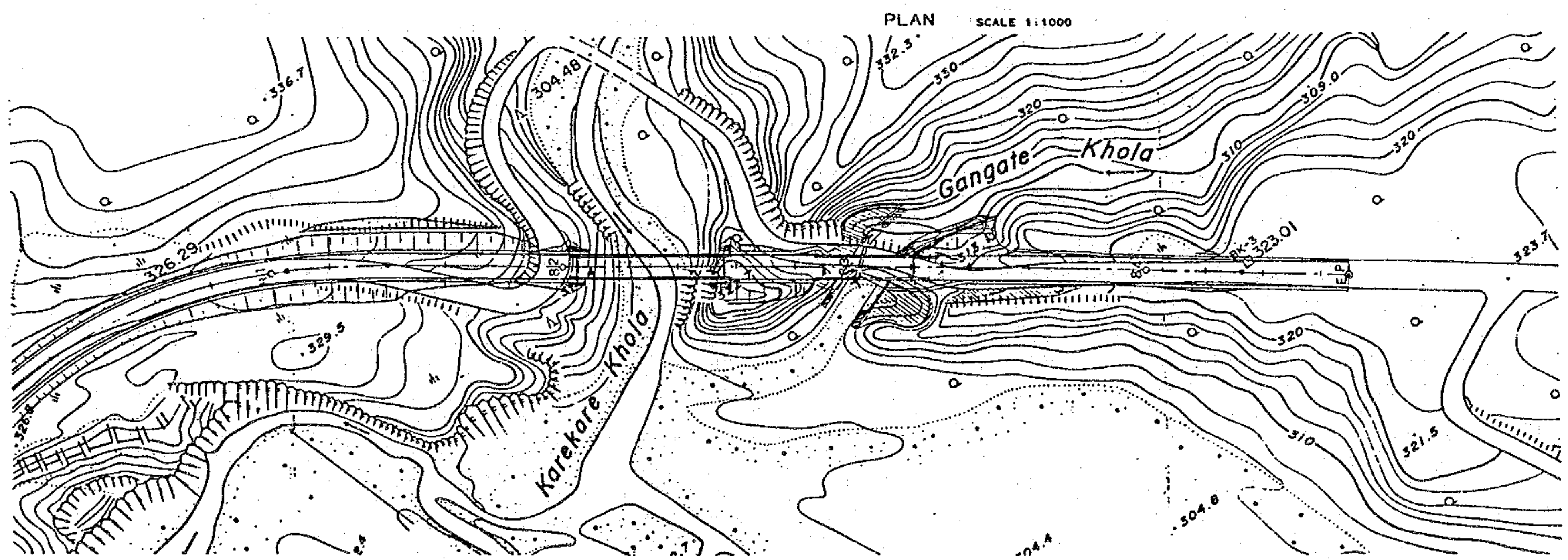


Figure 4.6.10 Plan and Profile of Approach Road for Bhogate Bridge





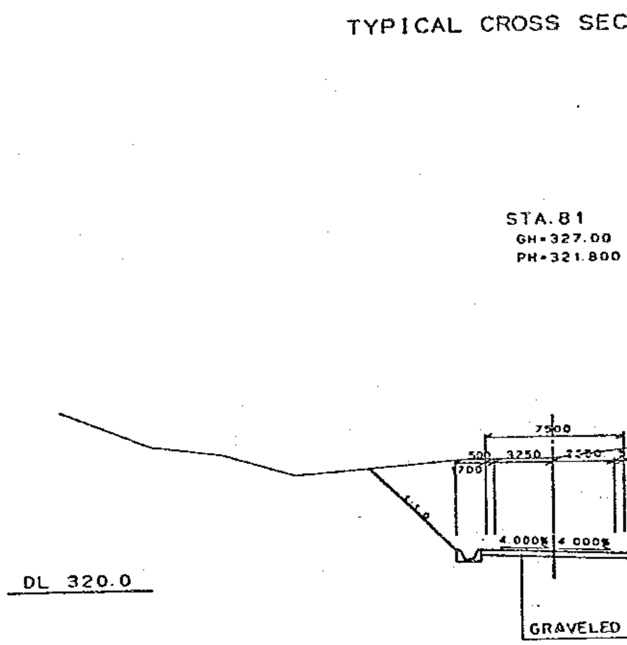
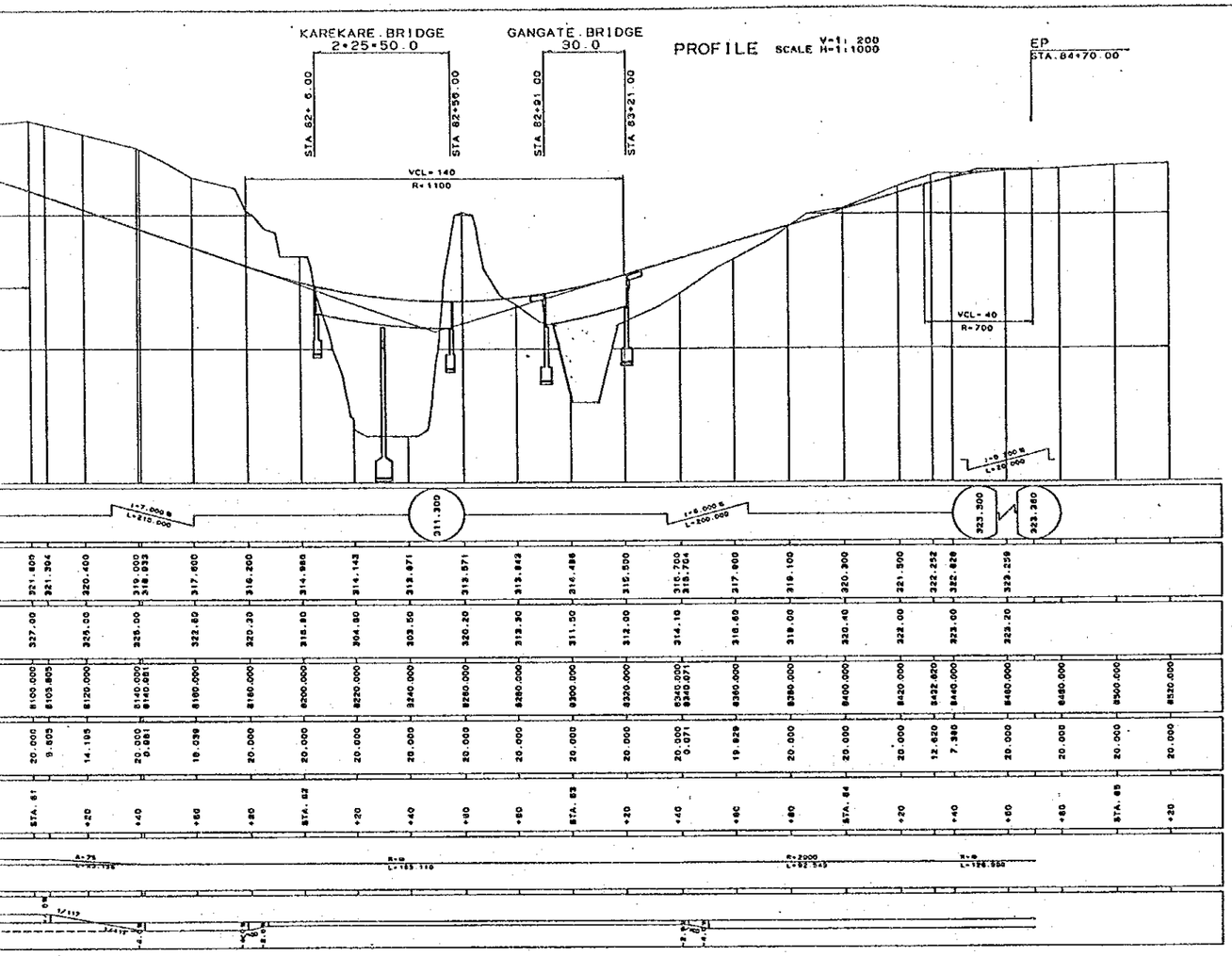
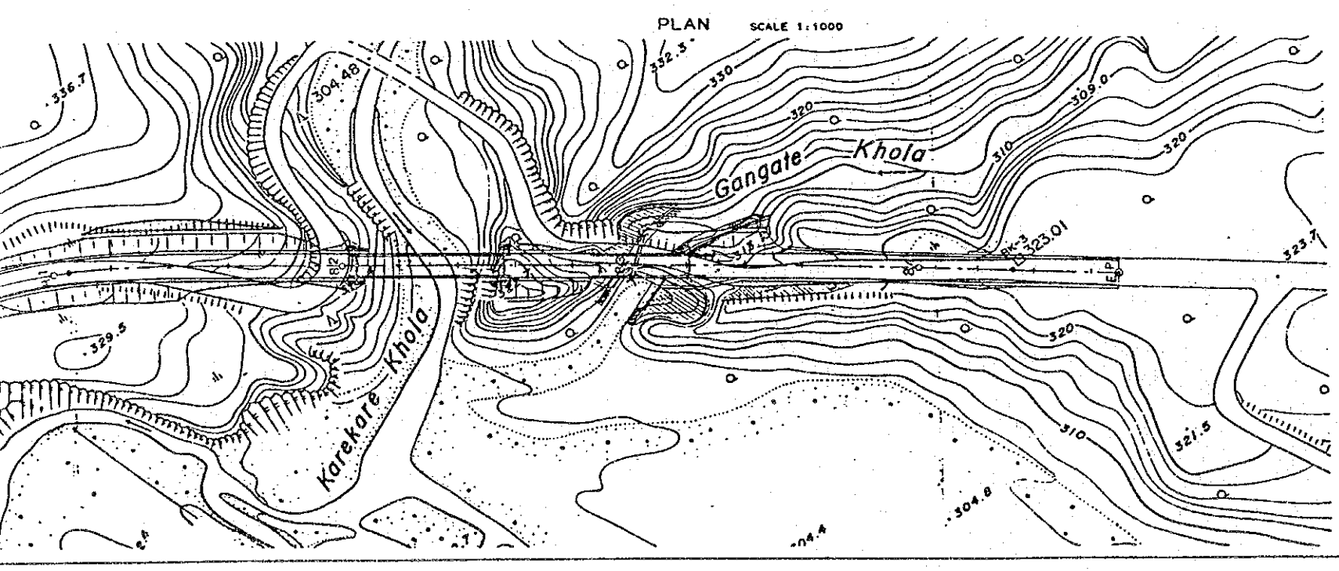


Figure 4.6.11 Plan





TYPICAL CROSS SECTION SCALE 1:200

STA.81
GH=327.00
PH=321.800

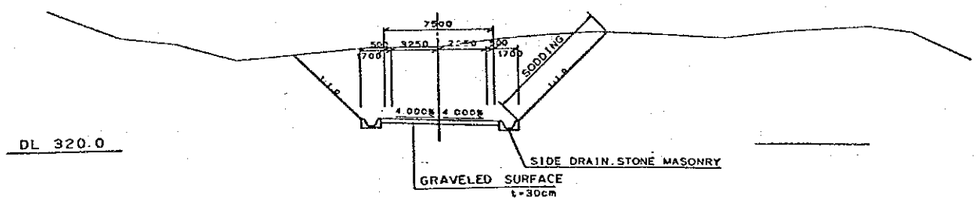
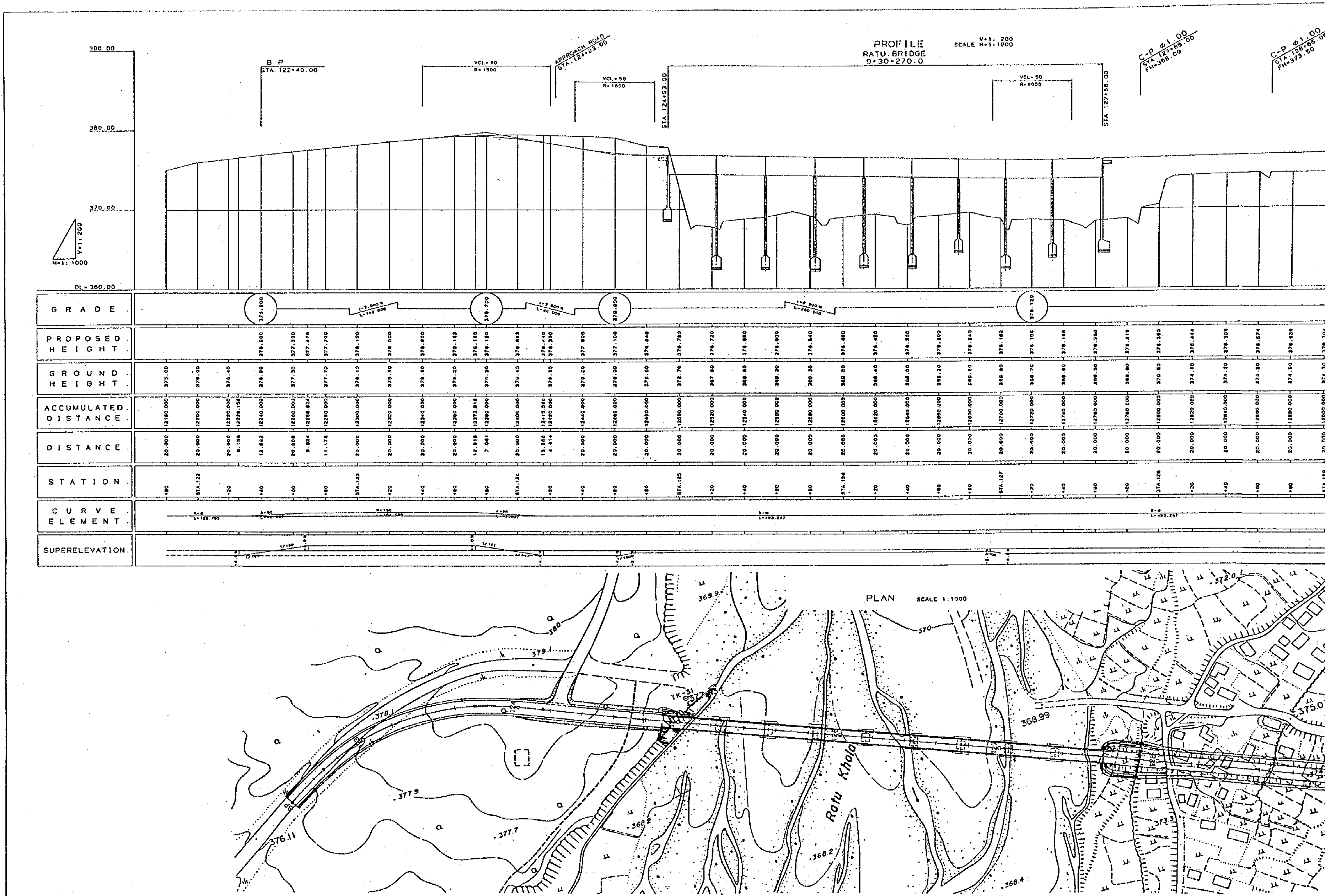
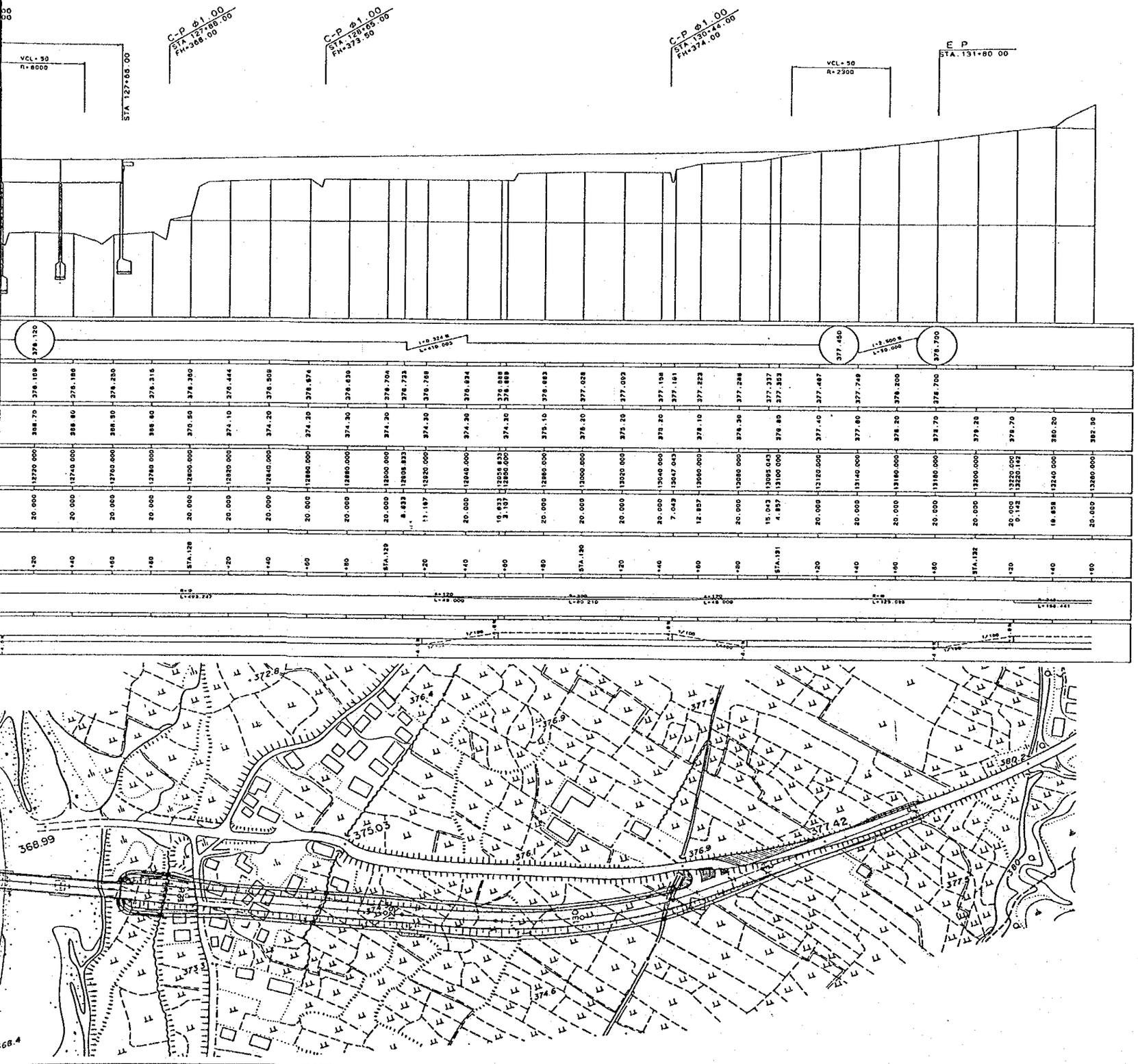


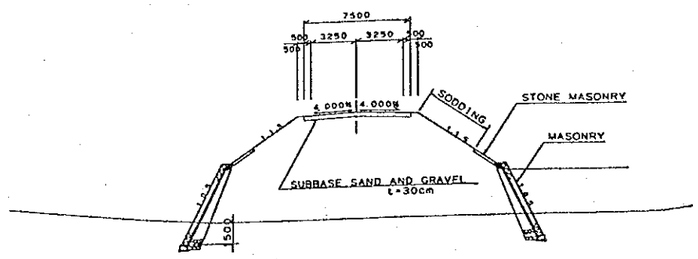
Figure 4.6.11 Plan and Profile of Approach Road for Karkare Bridge


PROFILE
SCALE V=1:200 H=1:1000
RATU BRIDGE
9@30=270.0
B P
STA.122+40.00
APPROACH ROAD
STA.124+23.00
STA.124+93.00
STA.127+66.00
C-P φ1.00
STA.127+88.00
FH=368.00
C-P φ1.00
STA.128+65.00
FH=373.50
390.00
380.00
370.00
DL=360.00
V=1:200
H=1:1000
GRADE
PROPOSED HEIGHT
GROUND HEIGHT
ACCUMULATED DISTANCE
DISTANCE
STATION
CURVE ELEMENT
SUPERELEVATION
PLAN
SCALE 1:1000
Ratu Khola
TK-31
368.99
375.0
369.9
379.1
378.1
377.9
377.7
376.11
368.2
368.4
373.3
372.8



TYPICAL CROSS SECTION SCALE 1:200

STA. 127+80
GH=366.80
PH=376.315



STA. 129+80
GH=375.10
PH=376.963

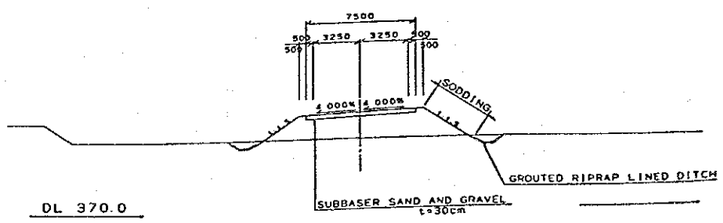
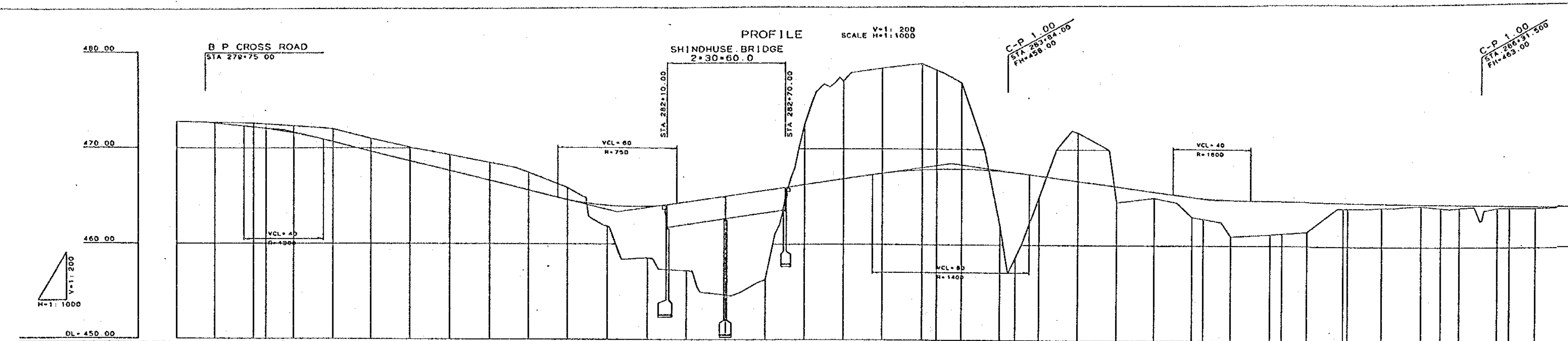


Figure 4.6.12 Plan and Profile of Approach Road for Ratu Bridge

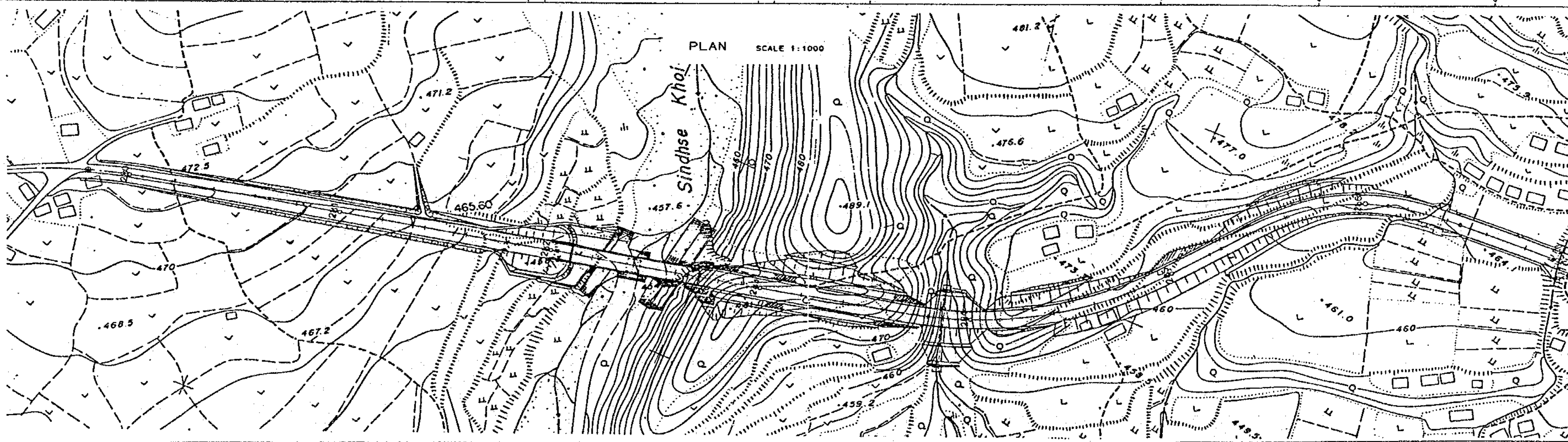


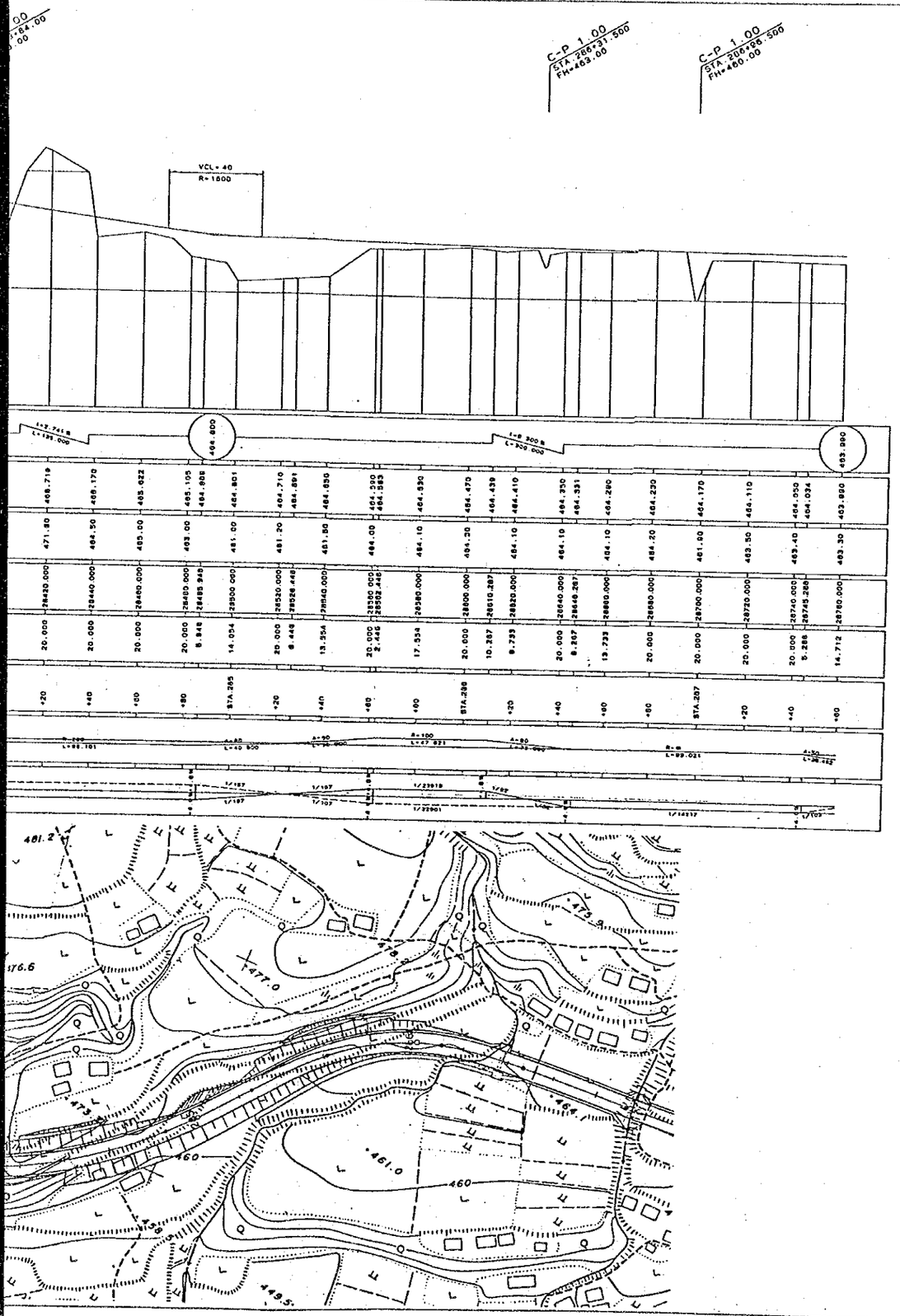
GRADE: 472.700 — i=2.000% L=40.000 — 471.600 — i=5.000% L=170.000 — 463.400 — i=3.000% L=175.000 — 468.500 — i=2.741% L=135.000 — 464.800 — i=0.300% L=300.000

STATION	DISTANCE	ACCUMULATED DISTANCE	GROUND HEIGHT	PROPOSED HEIGHT
STA 279+60	20.000	27960.000	472.75	
+80	20.000	27980.000	472.70	472.600
STA 280	20.000	28000.000	472.60	472.191
	6.273	28006.273		472.027
+20	13.727	28020.000	472.30	471.560
+40	20.000	28040.000	472.00	470.650
+60	20.000	28060.000	471.00	469.650
+80	20.000	28080.000	470.10	468.650
STA 281	20.000	28100.000	468.30	467.650
+20	20.000	28120.000	468.50	466.650
+40	20.000	28140.000	467.50	465.650
+60	20.000	28160.000	465.90	464.867
+80	20.000	28180.000	461.90	464.067
STA 282	20.000	28200.000	458.80	464.000
+20	20.000	28220.000	457.25	464.450
+40	20.000	28240.000	454.70	465.050
+60	20.000	28260.000	458.30	465.650
+80	20.000	28280.000	472.80	466.250
STA 283	20.000	28300.000	477.10	466.850
+20	20.000	28320.000	476.50	467.441
+40	20.000	28340.000	479.00	467.828
	7.345	28347.345		467.895
+60	12.655	28360.000	477.00	467.923
+80	20.000	28380.000	482.00	467.734
	7.845	28387.845		467.561
STA 284	12.155	28400.000	485.90	467.287
+20	20.000	28420.000	471.80	466.710
+40	20.000	28440.000	464.50	466.170
+60	20.000	28460.000	465.00	465.622
+80	20.000	28480.000	463.00	465.105
	5.946	28485.946		464.989
STA 285	14.054	28500.000	461.00	464.801
+20	20.000	28520.000	461.20	464.710
	6.446	28526.446		464.691
+40	13.554	28540.000	461.80	464.650
+60	20.000	28560.000	464.00	464.590
	2.446	28562.446		464.583
+80	17.554	28580.000	464.10	464.530
STA 286	20.000	28600.000	464.30	464.470
	10.267	28610.267		464.438
+20	9.733	28620.000	464.10	464.410
+40	20.000	28640.000	464.10	464.350
	6.207	28646.207		464.331
+60	13.733	28660.000	464.10	464.280
+80	20.000	28680.000	464.20	464.230

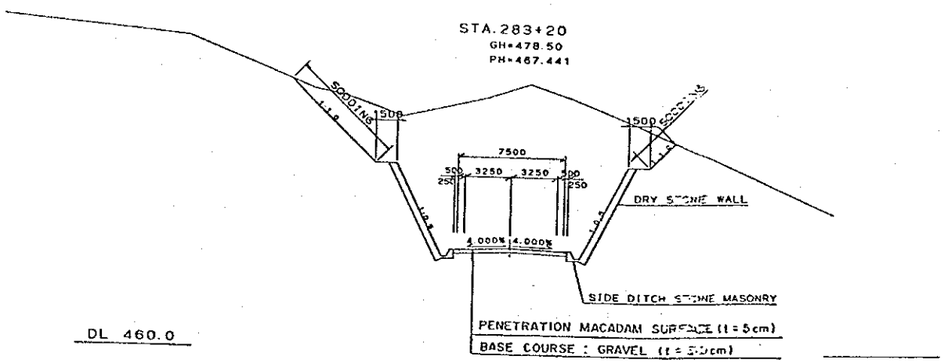
CURVE ELEMENT: R=240 — A=80 L=40.500 — R=200 — A=50 — R=100 — A=60

SUPERELEVATION: 1/197 — 1/197 — 1/22919 — 1/22081 — 1/92





TYPICAL CROSS SECTION SCALE 1:200



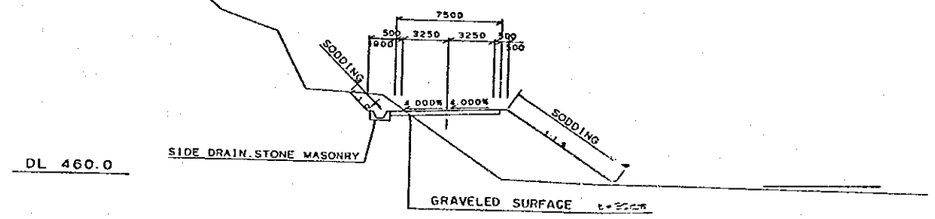


Figure 4.6.13 Plan and Profile of Approach Road for Shindhuse Bridge

PROFILE SCALE V=1: 200 H=1: 1000

PLAN SCALE 1:1000

GRADE	
PROPOSED HEIGHT	
GROUND HEIGHT	
ACCUMULATED DISTANCE	
DISTANCE	
STATION	
CURVE ELEMENT	
SUPERELEVATION	