10.1.3 Interchanges

(1) General

The Study Team defined two types of interchanges based on their function. A system interchange connects two access controlled highways with each other to maintain high mobility and safety, while a service interchange connects an access controlled highway to an ordinary road where it may allow the stopping of traffic by traffic signals according to volume of traffic. Accordingly, a system interchange is suitable to apply high standards and the construction scale will be larger than a service interchange. The basic types of interchanges for the Study and its salient features are shown in Figure 10.1.5.

(2) Location of Interchange

Figure 10.1.6 and Table 10.1.6 show the location and list of interchanges on SHTRR respectively.

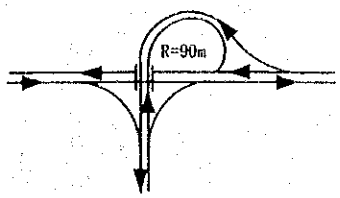
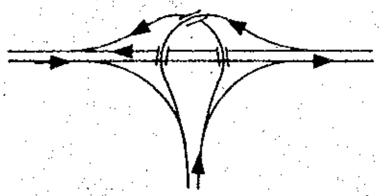
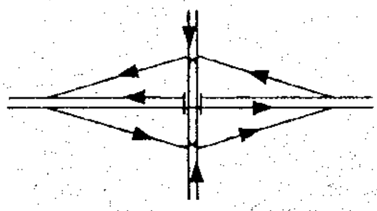
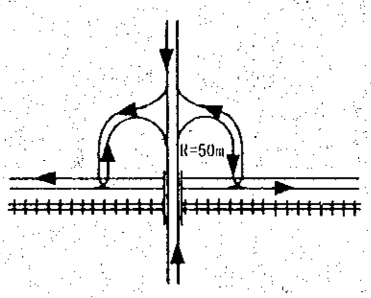
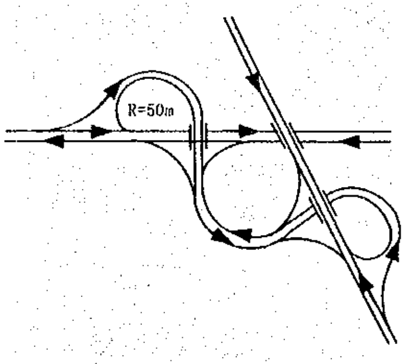
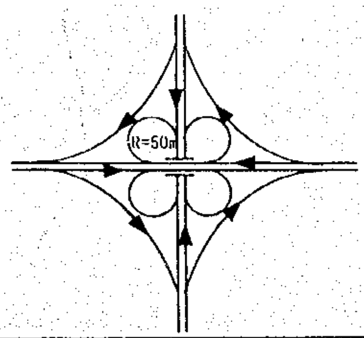
Table 10.1.4 List of Interchanges

Name of IC	Category of IC	Type of IC	Connecting Road
NH-1 IC	Service IC	Half Cloverleaf	NH-1
New NH-1 IC	System IC	Y-Type	New NH-1
2-Dyke Road IC	Service IC	Half Diamond	Branches of Dyke Roads
NH-5 IC	Service IC	Half Cloverleaf	NH-5

Half cloverleaf type NH-1 IC was planned in the vicinity of Linh Dam lake to connect NH-1 with the through travelled way of SHTRR. To develop single-exit design to facilitate access to and egress from SHTRR, a collector-distributor road was planned for full length of the interchange as shown in Figure 10.1.7.

Y-type interchange was proposed at the new NH-1 IC to be located 3 km east of existing NH-1 IC, which becomes the terminus of the southern section of new NH-1 and connects to the through travelled way of SHTRR.

At the intersection of SHTRR with the two dyke roads it is proposed that a half diamond interchange is constructed to allow access to and from each dyke road.

	Layout Configuration	Salient Features	Construction Cost Index	Land Area (ha)
SYSTEM INTERCHANGE		Single Structure Trumpet A simple structure commonly used for 3-leg intersection. Requires a large area which is influenced by the minimum curve radius due to design speed.	1.00	15.4
SYSTEM INTERCHANGE		Three Structures Y-Type Two double jug-handle configuration usually applies where the crossing road is of considerable importance too. Requires the use of three structures thereby reducing land area	1.06	10.6
SERVICE INTERCHANGE		Diamond Turning movements on minor road may be controlled by signals, and therefore the capacity for turning traffic is small. Traffic detour distance is shortest.	1.00	4.0
SERVICE INTERCHANGE		Half Cloverleaf Its two loop ramps configuration is readily adaptable to allow free movement in predominant direction. Turning movements on minor road may be controlled by signals.	1.05	5.1
SERVICE INTERCHANGE		Double Trumpet Loop ramps occur at two points. All turning movements pass through one point. There is weaving traffic but toll gates can be located at a single point. No signalisation is necessary.	1.56	7.5
SERVICE INTERCHANGE		Full Cloverleaf Its four loop ramps configuration allows free movement in all directions. There are two entrances and two exits on throughway. Weaving occurs between loop ramps.	1.29	6.8

Notes;

1) In the case of service interchange and system interchange, cost index is the relative cost of other interchange types when compared to diamond type taken as 1.00; in the case of system interchange, the cost of other interchange type is compared to that of single structure trumpet (R=90m) when the latter cost index is taken to 1.00.

2) All interchanges are compared on equal basis with regards to all factors influencing the construction of interchange on flat terrain.

Figure 10.1.5 Basic Types of Interchange

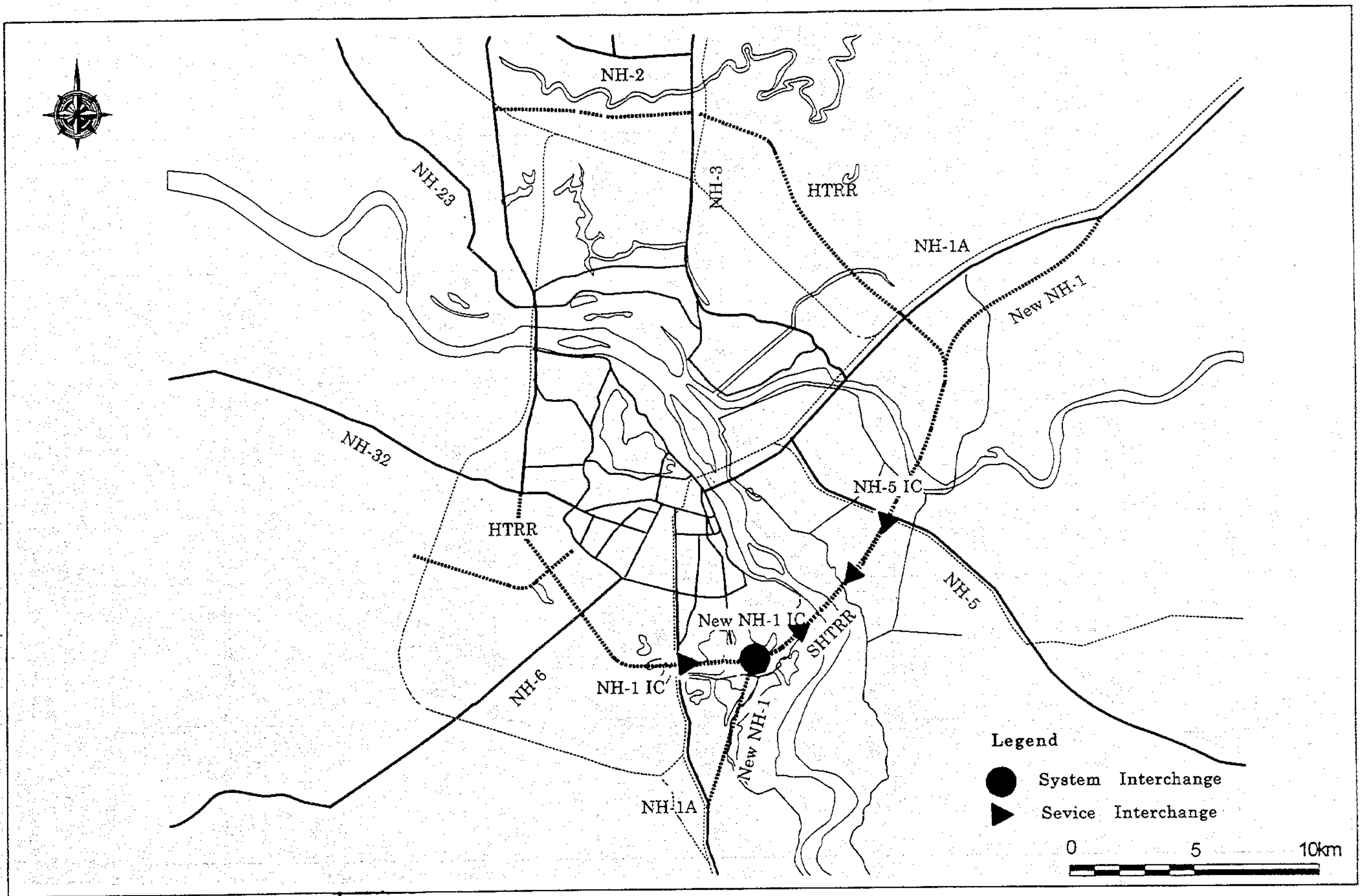


Figure 10.1.6 Location of Interchanges on SHTRR

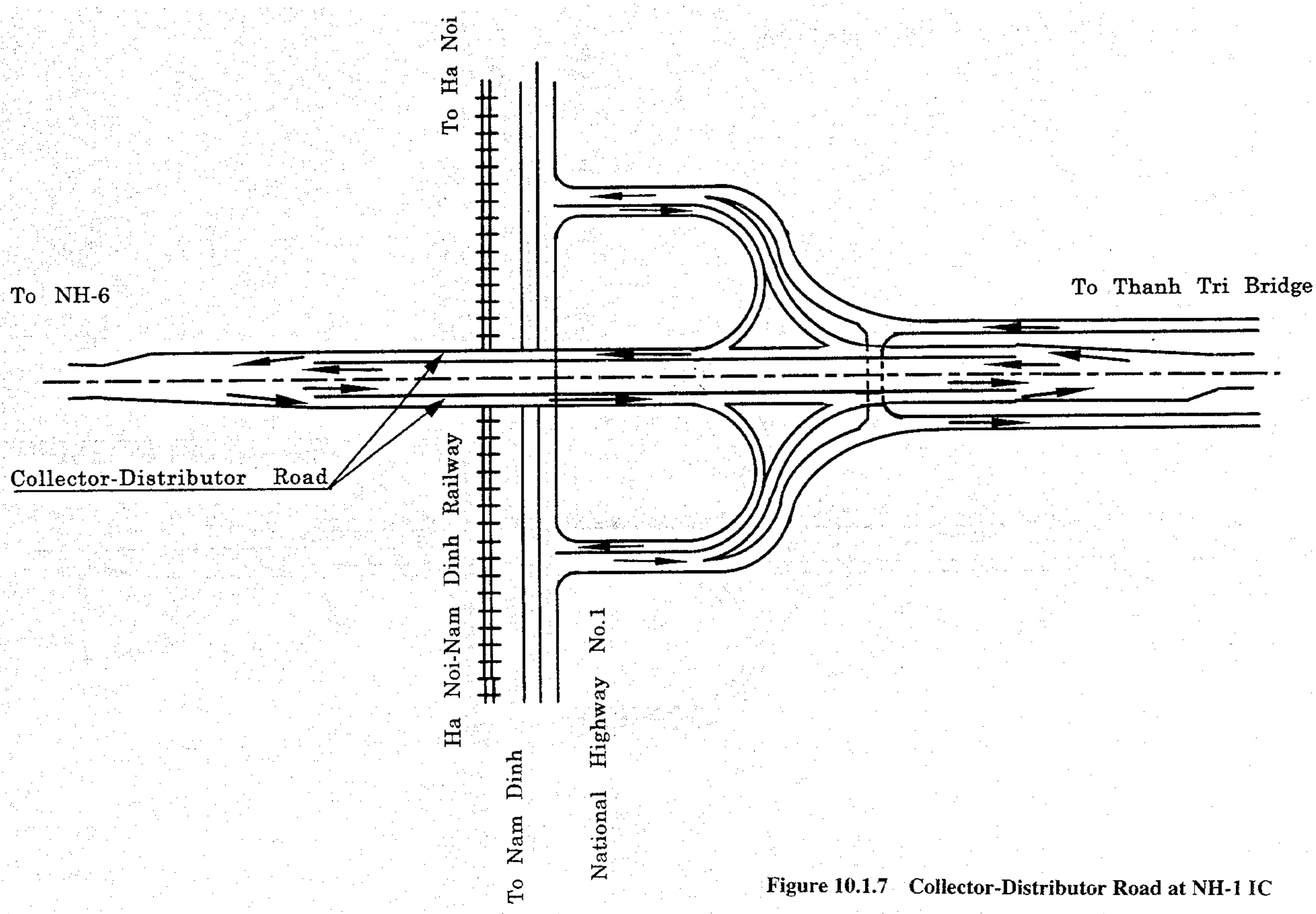


Figure 10.1.7 Collector-Distributor Road at NH-1 IC

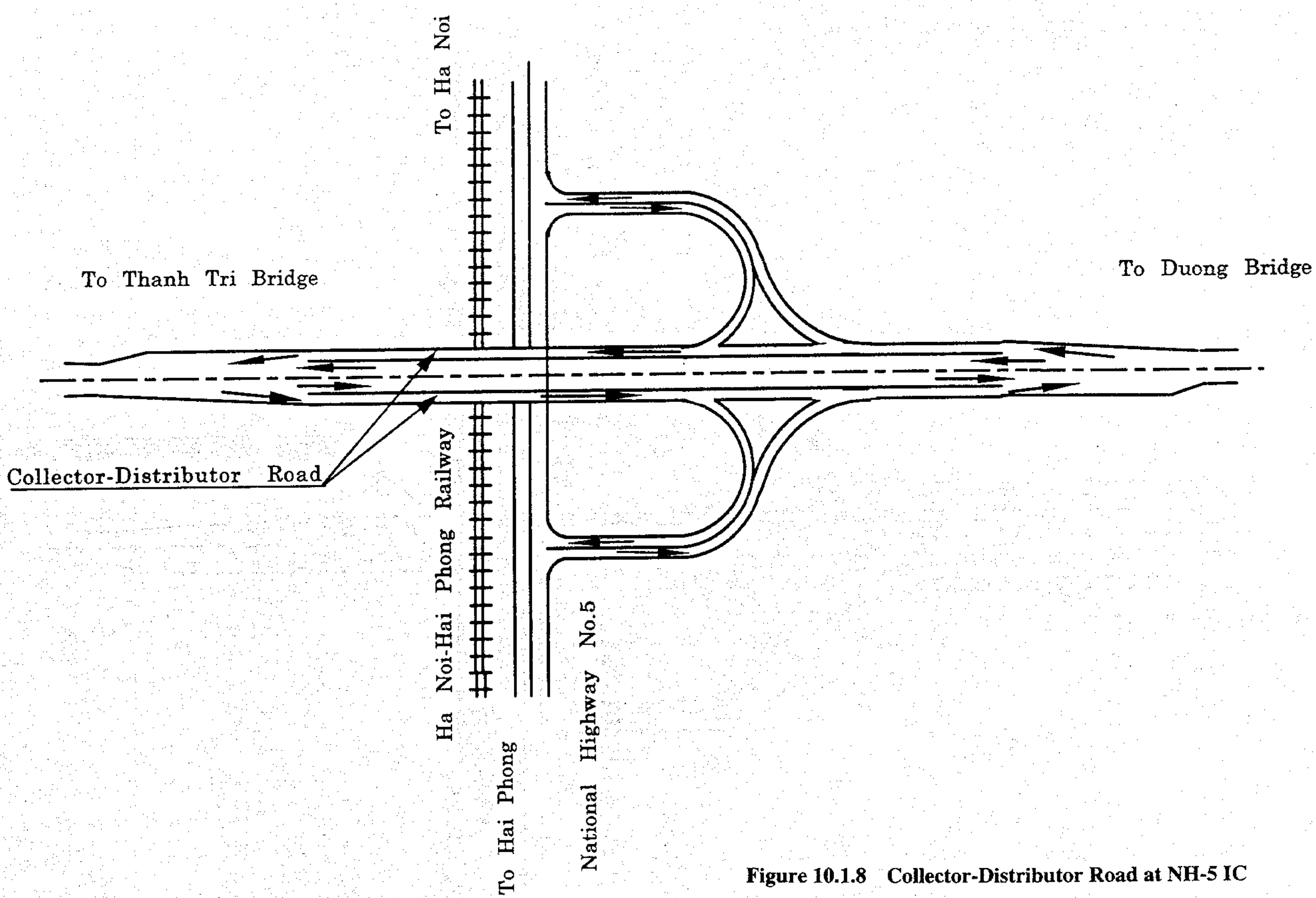


Figure 10.1.8 Collector-Distributor Road at NH-5 IC

Half cloverleaf type NH-5 IC was planned at the beginning point of the northern section of New NH-1 to connect NH-5 with the through travelled way of SHTRR. To develop single-exit design to facilitate access to and egress from SHTRR, a collector-distributor road was provided for full length of the interchange as shown in Figure 10.1.8.

A railway runs adjacent to both intersection points of SHTRR with NH-1 (Phap Van) and NH-5 (Sai Dong). SHTRR was planned to fly over NH-1 and NH-5 as well as the railway.

10.1.4 Location of Toll Plaza

A barrier type toll plaza was planned on the throughway of SHTRR to levy a toll from stretch users. Location of toll plaza was planned in between Gia Lam dyke road and NH-5 IC. The construction of approximately 200m long toll plaza was planned at about Sta. 11+100.

However, the traffic using the interchanges at the dyke locations may not travel through this toll plaza. Therefore, the Study Team proposes the planning of minor toll plazas on the ramps of interchanges.

10.1.5 Countermeasures against Community Severance

(1) Practical Solution against Community Severance

Full access controlled highway might bring adverse effect to adjacent area, especially disrupting community in urban area, without any countermeasures. Even if frontage roads are provided in both sides of access controlled highway, it is very necessary for local people to cross the highway within appropriate distance. For example, route bus users on one way controlled frontage road need pedestrian access across the highway under/over pass to access the opposite frontage road.

Practical solutions against community severance brought by access controlled highway are as follows;

- Provision of open space by grade separation structures such as bridges and flyovers;
- Installation of underpass facilities such as box culvert; and
- Construction of overpass facilities such as pedestrian overpass.

These facilities are not always planned for preventing the severing of the adjacent community, but minimise disruption of the wider community. Cyclist box culvert and pedestrian overpass are supplementary to other facilities.

(2) Location of Facilities

Table 10.1.5 gives the list of facilities for keeping community access across SHTRR.

Table 10.1.5 List of Facilities

No.	Station	Type of Facilities	Remark	District
1	0+830	Flyover	Existing Road	Thanh Tri
2	1+680	Drainage Box Culvert	Water Way	Thanh Tri
3	1+900	Flyover	U-turn Facility	Thanh Tri
4	2+625	River Bridge	Water Way	Thanh Tri
5	3+050	Vehicular Box Culvert	U-turn Facility	Thanh Tri
6	3+350	Pedestrian Box Culvert	Existing Road	Thanh Tri
7	3+770	Vehicular Box Culvert	U-turn Facility	Thanh Tri
8	4+370	Vehicular Box Culvert	U-turn Facility	Thanh Tri
9	4+900	Pedestrian Box Culvert	Existing Road	Thanh Tri
10	5+580	Pedestrian Box Culvert	For Pagoda	Thanh Tri
11	5+815	Vehicular Box Culvert	Existing Road	Thanh Tri
12	5+830	Drainage Box Culvert	Water Way	Thnah Tri
13	6+300	Drainage Box Culvert	Water Way	Thanh Tri
14	6+465	Flyover	Existing Road	Thanh Tri
15	10+300	Drainage Box Culvert	Water Way	Gia Lam
16	10+860	Pedestrian Box Culvert	Existing Road	Gia Lam
17	11+475	Drainage Box Culvert	Water Way	Gia Lam
18	11+490	Vehicular Box Culvert	Existing Road	Gia Lam
19	12+000	Pedestrian Box Culvert	Existing Road	Gia Lam
20	12+285	Flyover	Existing Road	Gia Lam
21	12+750	Drainage Box Culvert	Water Way	Gia Lam
22	12+930	Flyover	Existing Road	Gia Lam

10.1.6 Consideration to Future Railway Development

A railway development plan for Hanoi has been drawn up and has been approved by the Government, but neither definitive plans nor an implementation schedule are defined at present.

SHTRR will run parallel to a future railway on either side of the Thanh Tri bridge, and existing Hanoi - Hai Phong railway is planned to be relocated to the north-east as shown in Figure 10.1.9.

SHTRR route has been located in Thanh Tri area to keep minimum 60m from primary controlling points such a future railway (Figure 10.1.10).

The plan of new Hanoi - Hai Phong railway may affect the selection of interchange type of NH-5 IC. However, since the forecasted traffic demand warrants stage construction according to increase of traffic, the proposed half-cloverleaf type interchange does remain viable.

10.2 Preliminary Design of SHTRR

10.2.1 Plans and Profiles

Plans and Profiles are prepared along the selected route to the scales of 1:5,000 horizontal and 1:1,000 vertical. The basic data used in controlling the design has been topographic maps, aerial photos and the information obtained from the topographic survey. See Volume IV Drawings for plans and profiles.

10.2.2 Project Limits on SHTRR

SHTRR will be implemented in the near future to coordinate relevant projects. Such relevant projects are as follows:

- The western section of Hanoi Ring Road No.3 by the BOT (Build Operate Transfer) scheme;
- The southern section of New NH-1 by the assistance of World Bank; and
- The northern section of New NH-1 by the assistance of Asian Development Bank.

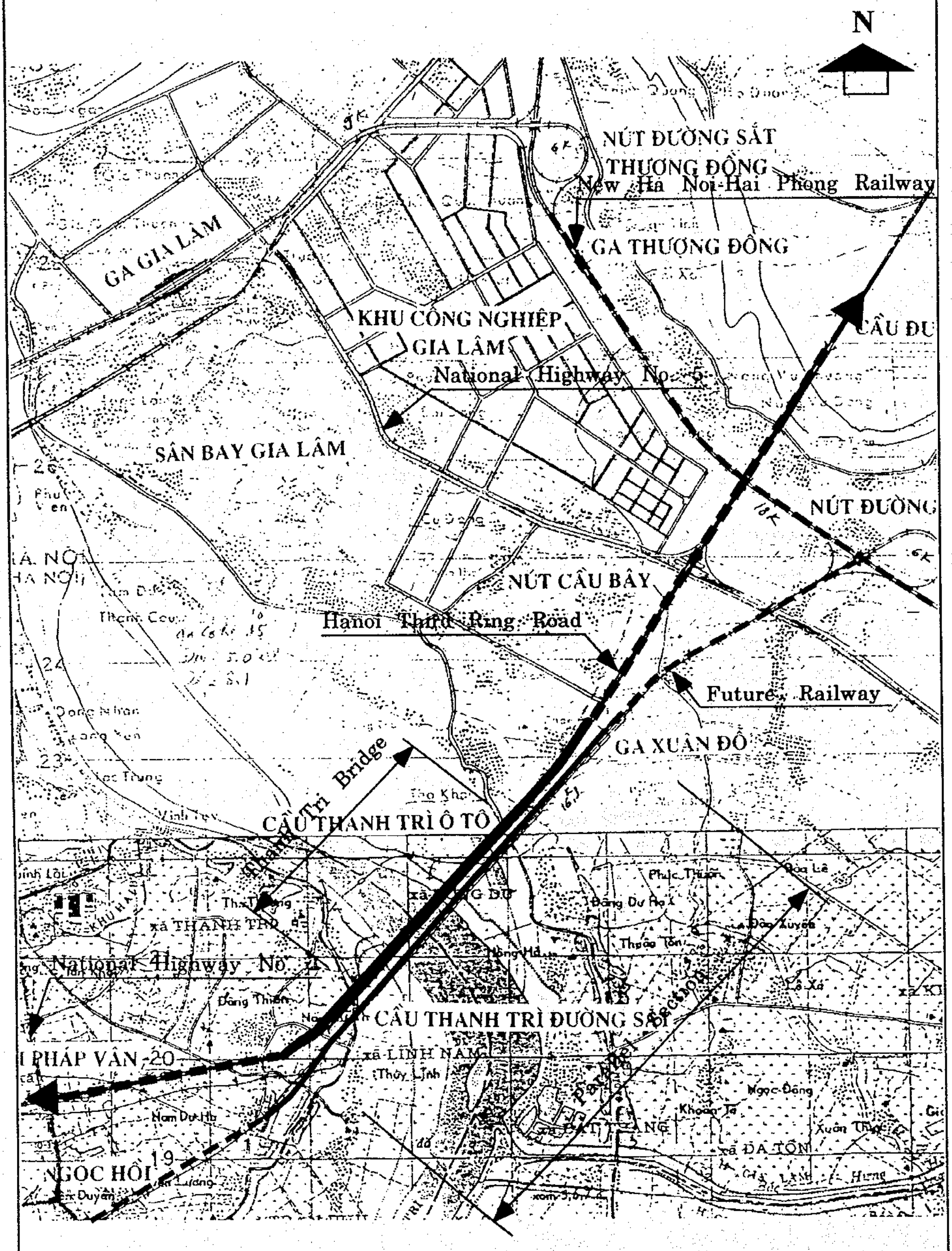
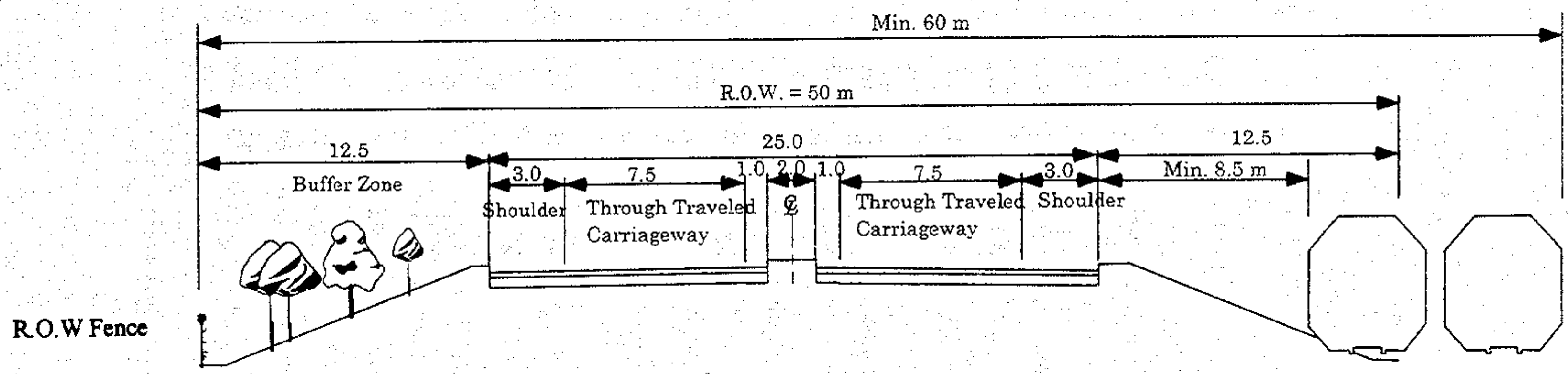


Figure 10.1.9 Location of Planned Railway parallel to SHTRR



Through Traveled Carriageway with Buffer Zone (At the parallel section to Future Railway)

Figure 10.1.10 Typical Cross Sections for SHTRR

Although these three road development projects are financed from different funds they will be connected to SHTRR at the final stage by interchanges. At present it is difficult to clearly define the project limits as these projects are individually implemented.

For the purpose of economic evaluation of SHTRR, the following works were included within the project limits in case of NH-1, New NH-1 and NH-5 interchanges.

(1) NH-1 IC to Connect the Western Section of Hanoi Ring Road No.3 and NH-1

- Land acquisition and resettlement costs related to loop ramps of half-cloverleaf type interchange;
- Grade separation structure over NH-1;
- Earthworks of NH-1 IC;
- Pavement works on two ramps towards SHTRR;
- Vehicular box culvert for U-turn facility at STA. 1+220; and
- Frontage roads and signalized at-grade intersections.

(2) New NH-1 IC to Connect the Southern Section of New NH-1

- Half costs of land acquisition and resettlement costs related to Y-type interchange;
- Two grade separation rampways from the SHTRR to New NH-1; and
- Two rampways egress from SHTRR to New NH-1.

(3) NH-5 IC to Connect the Northern Section of New NH-1 and NH-5

- All the costs of land acquisition and resettlement costs related to loop ramps of half-cloverleaf type interchange;
- Grade separation structure over NH-5;
- Earthworks of NH-5 IC;
- Pavement works on four ramps towards both SHTRR and New NH-1;
- Reconstruction costs of New NH-1 such as structures over irrigation channels; and
- Signalized at-grade intersections.

10.3 Preliminary Pavement Design

10.3.1 Design Conditions

The pavement layers and their thickness should be determined based on the following factors governing the design (flexible pavement design):

- Traffic;
- Roadbed soil;
- Materials of construction; and
- Environment

In most of the prevailing pavement design guides, traffic is expressed in terms of the cumulative single axle loads of 8,200 kg (18-kip), over the design life of the road. The number of commercial vehicles, in particular, heavy vehicles such as buses and trucks.

The strength of subgrade will govern the thickness design of pavement. Commonly the strength is expressed by California Bearing Ratio (CBR) value determined by laboratory testing. A CBR value of 6.0% is adopted in the computation of pavement thicknesses.

As for the pavement surface, except for the toll plaza area where portland cement concrete pavement will be used, asphalt concrete was employed in the pavement design. There are three types of materials suitable for the base course, i.e., asphalt treated base course, cement treated base course and stabilized aggregate base course. Asphalt treated base course (ATB) and stabilized aggregate base course were applied in this study. Crusher-run aggregate was used as the subbase course material.

Two main environmental factors were considered with regard to pavement performance and pavement structure design; specifically, these are temperature and rainfall.

10.3.2 Design Features

Based on the above discussion, "AASHTO Guide for Design of Pavement Structures" (1972 and 1986) was used to determine the thickness of the pavement layers. The design condition is presented as follows:

- Pavement type : Flexible design
- Design life : 10 years
- Serviceability loss : 2.5

(1) Equivalent 18-kip Single Axle Loads (ESAL)

$\frac{(16{,}000 + 46{,}000)}{2}$ vehicle/day x 365 day/year x 10 year = 113.1 million vehicle

ESAL = 113.1 million x 0.725 x ½ x 0.8 = 32.8 million

(2) Required Structural Number (SN)

Adopt CBR = 6% and serviceability loss = 2.5
Required SN = 5.4

(3) Adopted Thickness Design

Pavement Component	Thickness in Inches	Structural Layer Coefficient	SN
AC Surface	1.97 (5cm)	0.44	0.87
AC Binder	1.97 (5cm)	0.44	0.87
ATB	3.94 (10cm)	0.34	1.34
Stabilized Aggregate Base	5.91 (15cm)	0.14	0.83
Subbase	13.79 (35cm)	0.11	1.52
Total			5.43

CHAPTER 11

PRELIMINARY ENGINEERING DESIGN OF BRIDGE

CHAPTER 11 PRELIMINARY ENGINEERING DESIGN OF BRIDGE

11.1 Introduction

The preliminary design for the bridge structures has been divided into the following categories;

(i) river crossing
(ii) interchange structure
(iii) flyover
(iv) drainage and other bridges

In this chapter, the preliminary design regarding the four above-mentioned categories was conducted.

For the river crossing, the preliminary design on the bridge types was carried out which were selected as the recommended alternatives both the Main Bridge and the Approach Bridge in Chapter 9.

For the interchange structure, flyover and other bridges, the preliminary design was conducted referring to the results of the study on the river crossing.

11.2 River Crossing

11.2.1 Main Bridge

(1) Superstructure

- Prestressed Concrete Box Girder

The span arrangement of the bridge is 80 + 4 x 130 + 80 giving an overall length of 680 metres, which gives sufficient clearance for the navigational requirements. To ease construction the Study Team has separated the cross section to form two individual and unconnected box sections, one for each carriageway. The overall depth at the pier and mid span is 7.0 and 2.8 metres giving a span/depth ratio of 18.5 and 46.4 respectively.
The calculations show that a force of approximately CGS unit of prestress/

carriageway is required at each pier to resist the dead weight cantilever construction and applied live loading. A summary of the stress history at the pier and mid span is shown in Table 11.2.1.

The overall layout and cross section of the bridge is shown in Figure 11.2.1 and 11.2.2.

(2) Substructure/Foundation

1) Pier

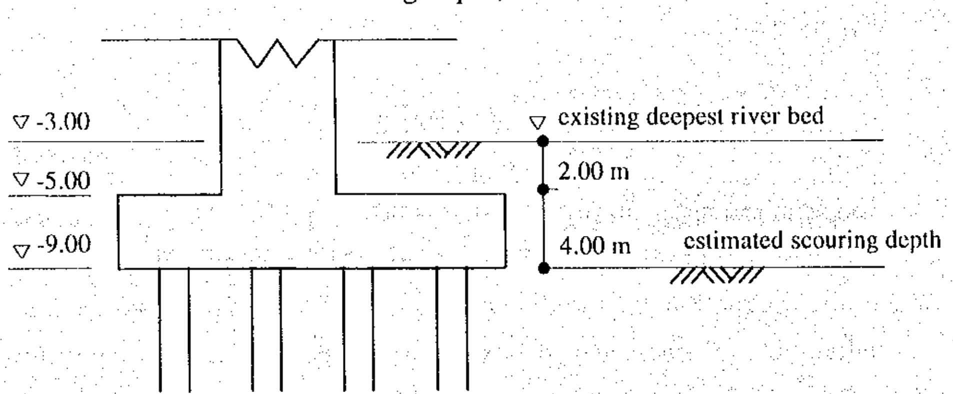
The dimensions of the pier were determined from the analysis. The preliminary design was conducted based on the following consideration.

- The pier consists of pier head, column and footing with pile foundation.

- Column is an elliptical shape and hollow type in order to reduce the concrete volume.

- The dimensions are determined according to the pile arrangement. Its vertical position is planned analysing the scour depth which is mentioned in Chapter 5. In the deepest river bed the relationship between structure and the river conditions are shown below.

  - existing deepest river bed; approximately -3.00 m
  - height of footing; 4.00 m
  - estimated scouring depth; 6.00 m



When the scour occurs up to the estimated depth, the pile foundation is still in the soil layer.

Table 11.2.1 Results of Analysis (1)

Bridge Type	**Balanced Cantilever**			Wt of Concrete =	24	kN/m^3
Span	130	metres				

	Pier Section			**Mid Span**	
	Depth of Section	7.00		Depth of Section	2.80
Web	Width of Web	0.75	Web	Width of Web	0.3
	y-web	3.75		y-web	1.45
Top Flange	Width	15.8	Top Flange	Width	15.8
	Depth	0.3		Depth	0.3
	y	6.85		y	2.65
Btm Flange	Width	8.0	Btm Flange	Width	8.0
	Depth	0.8		Depth	0.4
	y	0.4		y	0.2
Area of Section		20.74	Area of Section		9.95
y-bar		3.4466	y-bar		1.6418
Inertia		147.096	Inertia		12.508

Pier Section

Dead Load				Prestressing		
Bending Moment (kNm)	=	626032.33		Force (kN)	=	221000
top fibre stress (N/mm^2)	=	-15.12		eccentricity (m	=	3.403
btm fibre stress (N/mm^2)	=	14.67		top fibre stress (N/mm^2)	=	28.83
Superdead				btm fibre stress (N/mm^2)	=	-6.97
Bending Moment (kNm)	=	93520.424		stress(c)	=	10.66
top fibre stress (N/mm^2)	=	-2.26				
btm fibre stress (N/mm^2)	=	2.19				
Live Loading	(HS 20-44)*1.25					
Intensity of Lane Loading (kN/m)	=	11.9				
Bending Moment (kNm)	=	147608.61				
top fibre stress (N/mm^2)	=	-3.57				
btm fibre stress (N/mm^2)	=	3.46				

Mid Span Section

Dead Load						
Bending Moment (kNm)	=	15000		Force (kN)	=	54000
top fibre stress (N/mm^2)	=	1.39		eccentricity (m	=	1.442
btm fibre stress (N/mm^2)	=	-1.97		top fibre stress (N/mm^2)	=	-1.78
Superdead				btm fibre stress (N/mm^2)	=	15.65
Bending Moment (kNm)	=	16326.977		stress(c)	=	5.43
top fibre stress (N/mm^2)	=	1.51				
btm fibre stress (N/mm^2)	=	-2.14				
Live Loading						
Bending Moment (kNm)	=	38732.254				
top fibre stress (N/mm^2)	=	3.59				
btm fibre stress (N/mm^2)	=	-5.08				

note : width of deck allows 4 lanes of traffic

Table 11.2.2 Results of Analysis (2)

Pier Section **Span = 130m**

	ft N/mm^2	fc N/mm^2	fb N/mm^2
Dead Load	-15.12	-14.48	14.67
Prestress	28.83	28.06	-6.97
	13.70	13.57	7.70
	(16)		(-1)
Losses (30%)	-8.65		2.09
	5.05		9.79
Superdead	-2.26		2.19
	2.80		11.98
Live Loading (Comb 1)	-3.57		3.46
	-0.77		15.44
	(-3.2)		(16)
Live Loading (Comb1A)	-3.57		3.46
	-4.34		18.90
	(-4.8)		(24)

( ) permissible stress

Mid Span Section

	ft N/mm^2	fc N/mm^2	fb N/mm^2
Dead Load + Continuity	1.39	-1.73	-1.97
Prestress	-1.78	14.40	15.65
	-0.39	12.67	13.68
	(-1)		(16)
Losses (30%)	0.53		-4.69
	0.14		8.98
Superdead	1.51		-2.14
	1.65		6.84
Live Loading (Comb 1)	3.59		-5.08
	5.24		1.76
	(16)		(-3.2)
Live Loading (Comb1A)	3.59		-5.08
	8.83		-3.33
	(24)		(-4.8)

( ) permissible stress

- Concrete; δ_{28} = 290 kg/m²

Allowable stress;

	Normal stage (kg/m²)	Seismic stage (kg/m²)
• Flexure extreme compressive fiber stress	95	140
• Axial compressive stress	70	105

- Reinforcing Bar (SD 295A)

Allowable tensile stress;	1,800	2,700

The dimensions of the pier are shown in Figure 11.2.1 and 11.2.2 including the pile foundation.

2) Pile Foundation

The preliminary design was carried out regarding cast-in-situ concrete pile ø2,000 selected in Chapter 9.

(a) Bearing stratum for foundation

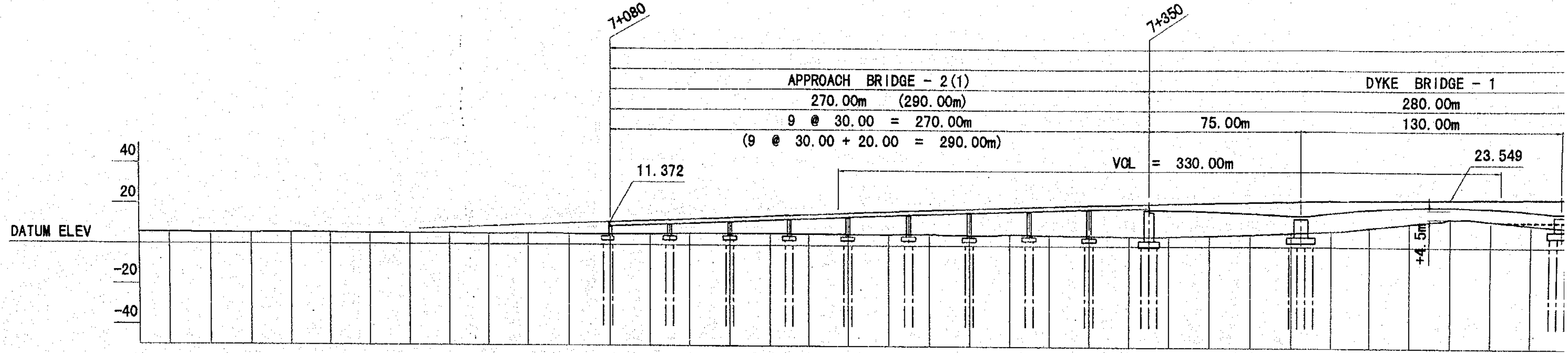
According to the soil investigation of Thanh Tri bridge area, the bearing stratum for foundation (N-value>50) appears on the elevation from -33 m to -43 m.

Pile lengths shall be approximately L = 32 - 35 m for the Main Bridge and L = 35 - 38 m for the Approach Bridge and other bridges which will reach to the bearing stratum (N-value>50).

Maximum allowable vertical loads (Ra) were calculated based on the soil investigation results.

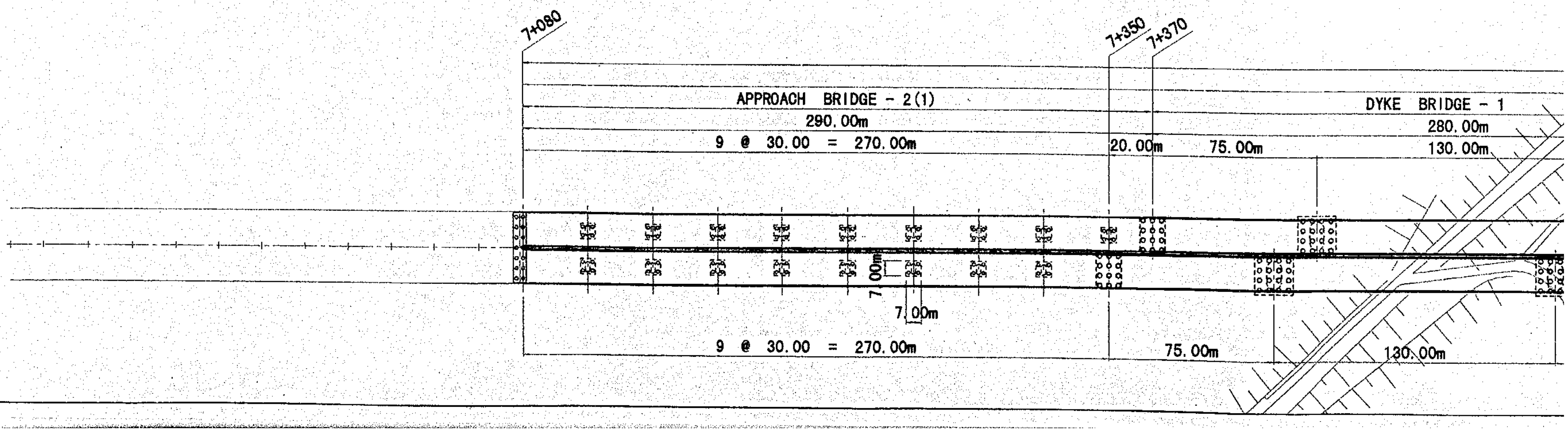
	Diameter (mm)	Ra (t/pile)
- cast-in-situ concrete pile	ø2,000	1,000

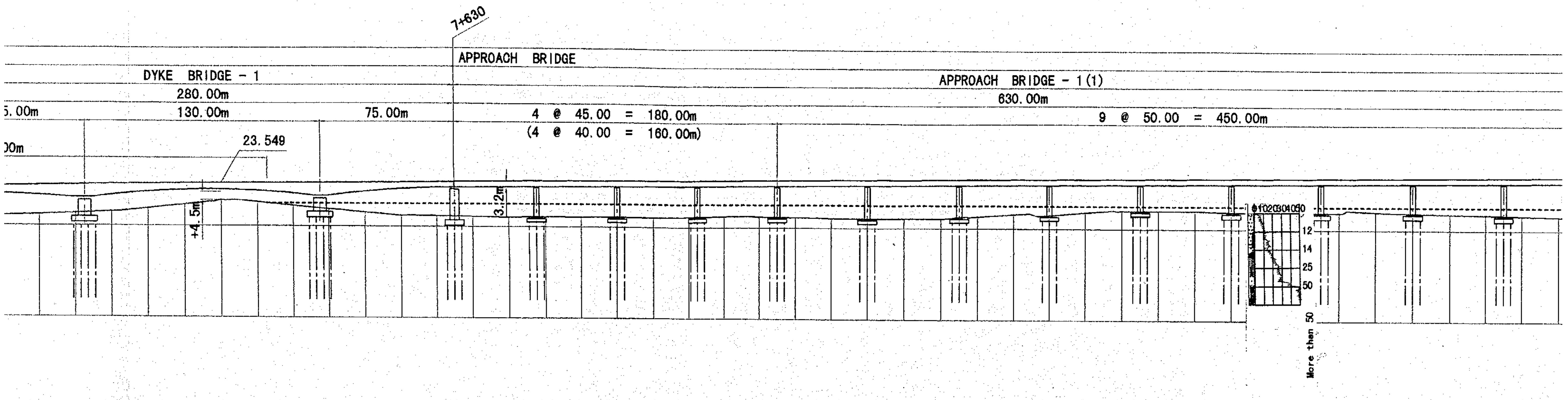
The results are shown in Figure 11.2.2.



GRADE												11.372						
ELEVATION												11.372	12.172	12.972	13.772	14.572	15.372	16.171
GROUND HEIGHT	5.55	5.53	5.50	5.52	5.52	5.47	5.42	5.40	5.34	5.42	5.23	5.19	5.30	5.71	5.70	5.65	5.59	5.50
STATION	6+860	6+880	6+900	6+920	6+940	6+960	6+980	7+000	7+020	7+040	7+060	7+080	7+100	7+120	7+140	7+160	7+180	7+200

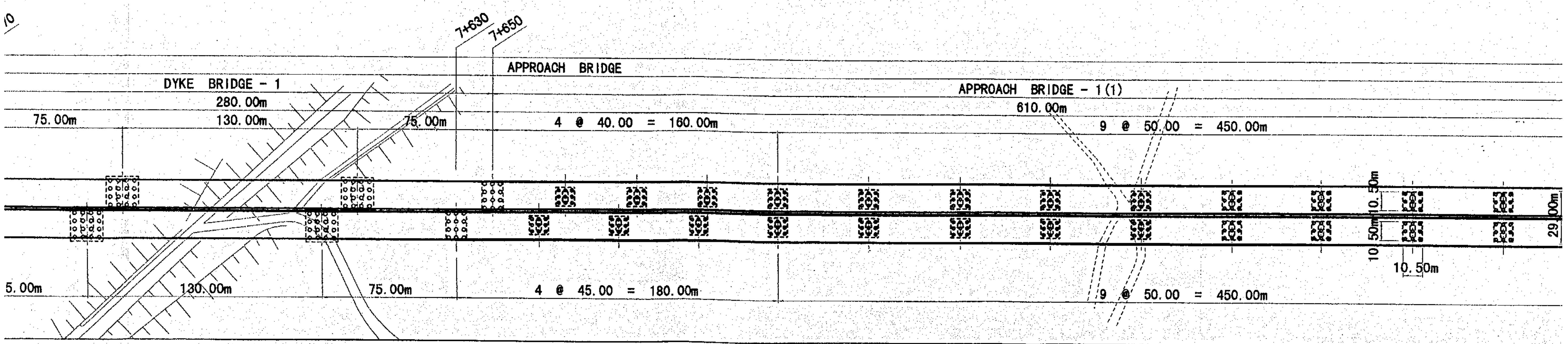
GRADE	i=4.00% L=280.00m							22.572										
ELEVATION	16.941	17.672	18.362	19.013	19.624	20.196	20.727	21.219	21.671	22.084	22.456	22.789	23.082	23.335	23.549	23.723	23.868	24.012
GROUND HEIGHT	5.57	5.63	5.12	5.68	5.20	5.00	4.79	4.91	5.45	6.00	6.79	7.57	9.39	11.55	14.01	13.00	11.17	9.47
STATION	7+220	7+240	7+260	7+280	7+300	7+320	7+340	7+360	7+380	7+400	7+420	7+440	7+460	7+480	7+500	7+520	7+540	



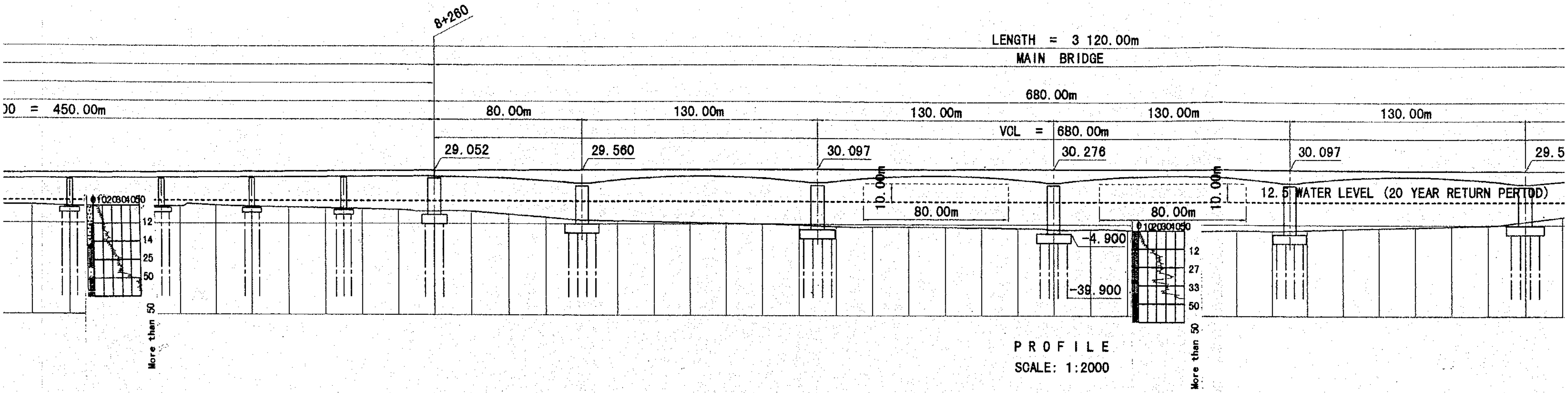


i=0.72%
L=1 240.00m

7+400	22.084	6.00
7+420	22.456	6.79
7+440	22.789	7.57
7+460	23.082	9.39
7+480	23.335	11.55
7+500	23.549	14.01
7+520	23.723	13.00
7+540	23.868	11.17
7+560	24.012	9.47
7+580	24.156	7.73
7+600	24.300	6.00
7+620	24.444	5.79
7+640	24.588	5.49
7+660	24.733	5.14
7+680	24.876	5.37
7+700	25.020	5.30
7+720	25.164	5.35
7+740	25.308	5.27
7+760	25.452	5.60
7+780	25.596	6.05
7+800	25.740	6.00
7+820	25.884	5.70
7+840	26.028	5.40
7+860	26.172	5.29
7+880	26.316	5.25
7+900	26.460	5.20
7+920	26.604	6.46
7+940	26.748	7.83
7+960	26.892	7.44
7+980	27.036	8.94
8+000	27.180	10.00
8+020	27.324	10.00
8+040	27.468	10.00
8+060	27.612	9.27
8+080	27.756	9.29
8+100	27.900	9.30
8+120	28.044	9.27
8+140	28.188	9.87
8+160	28.332	9.32
8+180	28.476	8.91
8+200	28.620	8.50
8+220	28.764	8.06
8+240	28.908	7.63



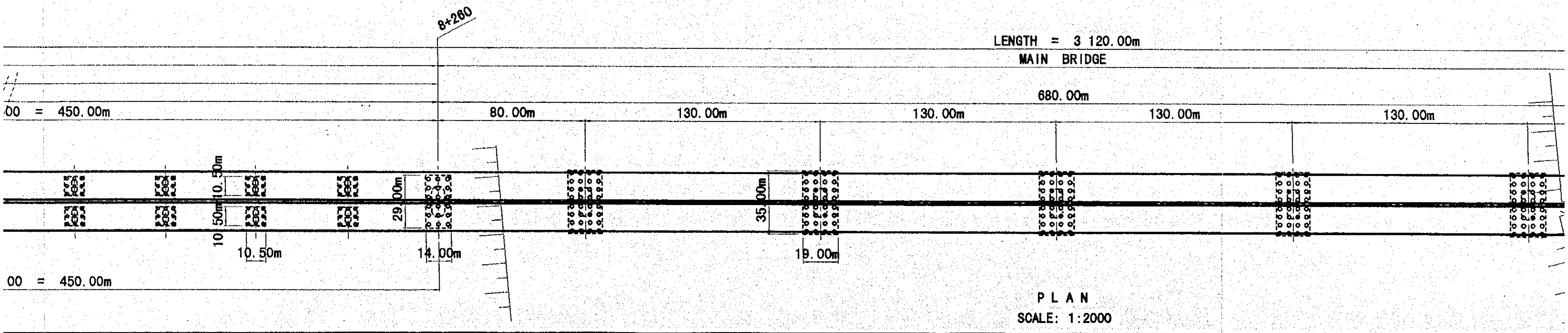
GENERAL VIEW



PROFILE
SCALE: 1:2000

31.500

8+040	27.468	10.00
8+060	27.612	9.27
8+080	27.756	9.29
8+100	27.900	9.30
8+120	28.044	9.27
8+140	28.188	9.87
8+160	28.332	9.32
8+180	28.476	8.91
8+200	28.620	8.50
8+220	28.764	8.06
8+240	28.908	7.63
8+260	29.052	6.86
8+280	29.192	6.74
8+300	29.323	5.14
8+320	29.446	3.55
8+340	29.560	1.95
8+360	29.666	1.65
8+380	29.764	1.28
8+400	29.852	0.91
8+420	29.933	0.54
8+440	30.005	0.17
8+460	30.068	-0.45
8+480	30.124	-1.15
8+500	30.170	-1.40
8+520	30.208	-1.35
8+540	30.238	-1.42
8+560	30.259	-1.76
8+580	30.272	-2.14
8+600	30.276	-2.90
8+620	30.272	-2.66
8+640	30.259	-3.01
8+660	30.238	-2.93
8+680	30.208	-3.56
8+700	30.170	-3.20
8+720	30.124	-3.31
8+740	30.068	-2.89
8+760	30.005	-2.35
8+780	29.933	-1.85
8+800	29.852	-1.34
8+820	29.764	-0.84
8+840	29.666	-0.34
8+860	29.560	1.70
8+880	29.446	4.25



PLAN
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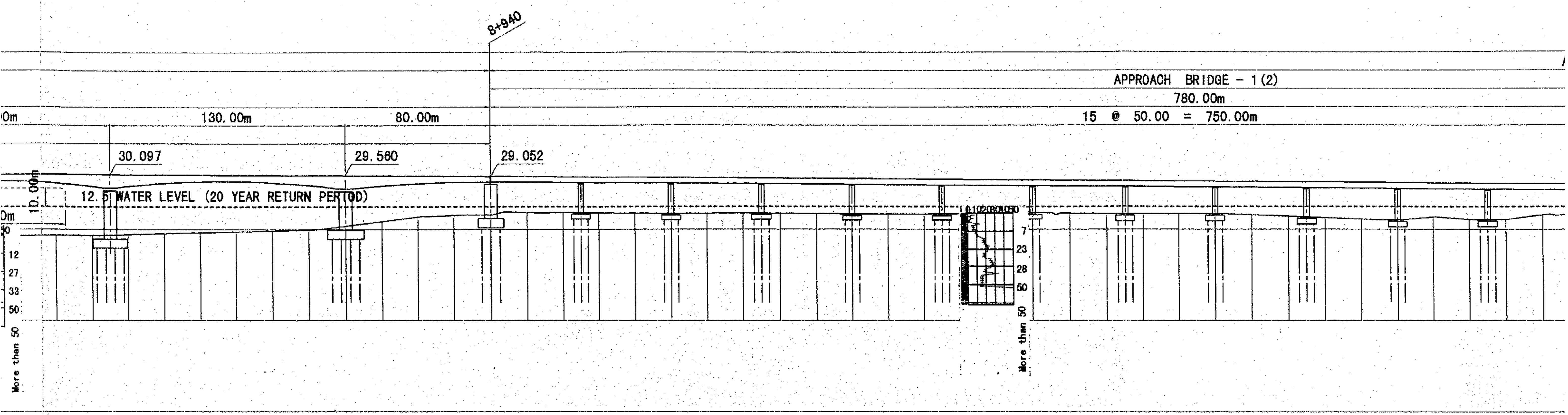
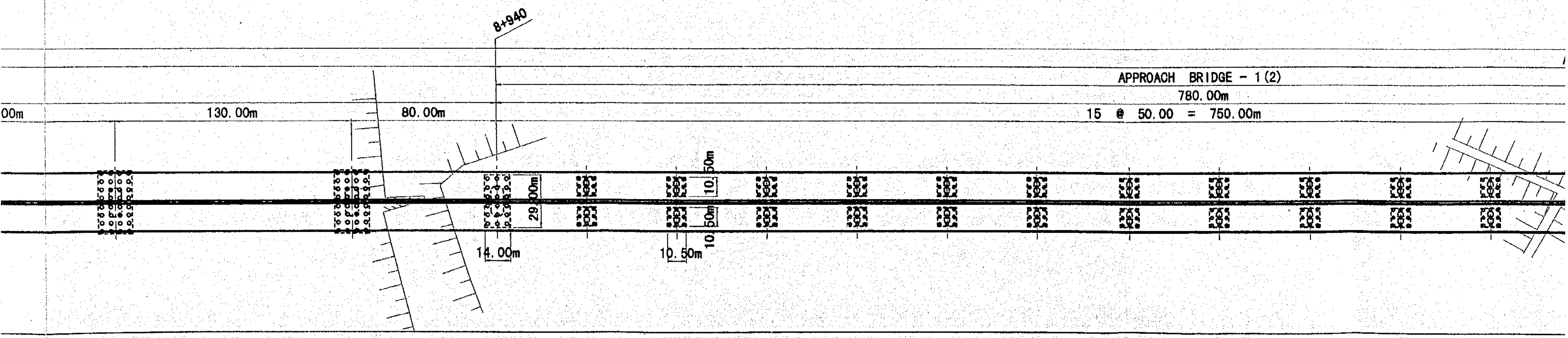
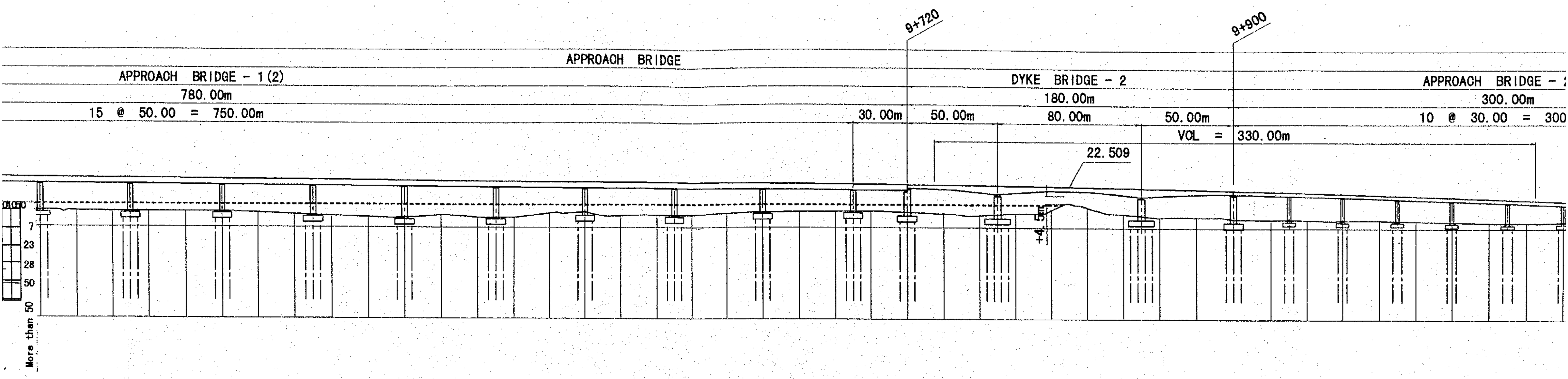
EW



i=0.72%
L=1 300.00m

8+680	30.208	-3.56
8+700	30.170	-3.20
8+720	30.124	-3.31
8+740	30.068	-2.89
8+760	30.005	-2.35
8+780	29.933	-1.85
8+800	29.852	-1.34
8+820	29.764	-0.84
8+840	29.666	-0.34
8+860	29.560	1.70
8+880	29.446	4.25
8+900	29.323	6.80
8+920	29.192	7.65
8+940	29.052	8.03
8+960	28.908	9.17
8+980	28.764	9.12
9+000	28.620	9.00
9+020	28.476	8.79
9+040	28.332	8.63
9+060	28.188	8.71
9+080	28.044	8.79
9+100	27.900	8.60
9+120	27.756	8.49
9+140	27.612	8.38
9+160	27.468	8.30
9+180	27.324	8.33
9+200	27.180	8.40
9+220	27.036	8.63
9+240	26.892	8.86
9+260	26.748	8.83
9+280	26.604	8.59
9+300	26.460	8.50
9+320	26.316	8.53
9+340	26.172	8.52
9+360	26.028	7.90
9+380	25.884	7.10
9+400	25.740	6.30
9+420	25.596	5.54
9+440	25.452	5.29
9+460	25.308	6.73
9+480	25.164	5.54
9+500	25.020	5.40
9+520	24.876	7.75





i=0.72%
L=1 300.00m

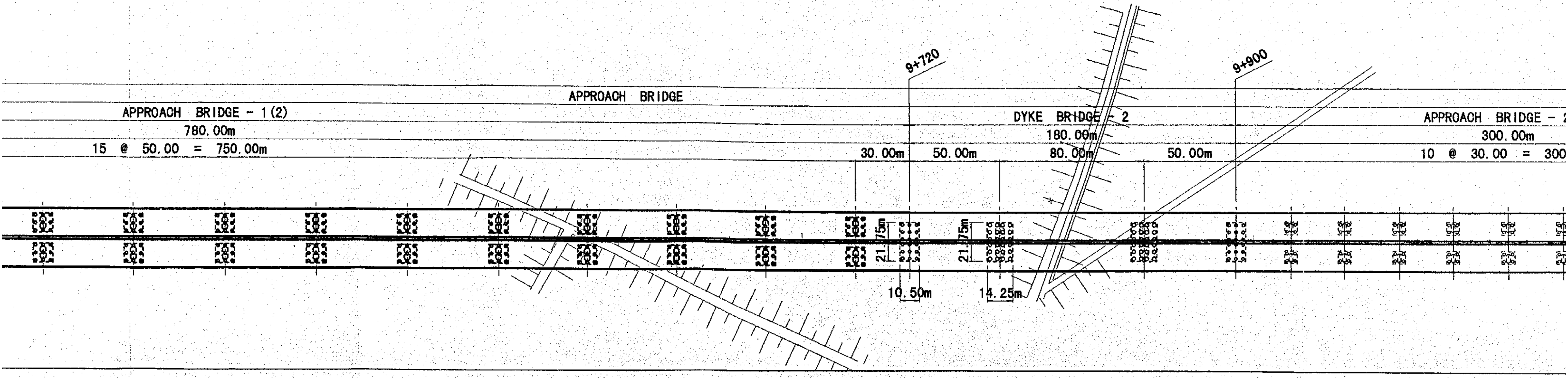
22.140

i=4.00%
L=300.00m

	9+220	9+240	9+260	9+280	9+300	9+320	9+340	9+360	9+380	9+400	9+420	9+440	9+460	9+480	9+500
		26.892	26.748	26.604	26.460	26.316	26.172	26.028	25.884	25.740	25.596	25.452	25.308	25.164	25.020
		8.86	8.83	8.59	8.50	8.53	8.52	7.90	7.10	6.30	5.54	5.29	6.73	5.54	5.40

	9+520	9+540	9+560	9+580	9+600	9+620	9+640	9+660	9+680	9+700	9+720	9+740	9+760	9+780	9+800
	24.876	24.732	24.588	24.444	24.300	24.156	24.012	23.868	23.724	23.580	23.436	23.291	23.117	22.903	22.650
	7.75	8.41	6.32	6.60	6.70	7.55	8.30	8.49	8.70	8.90	8.29	7.60	6.57	7.75	9.59

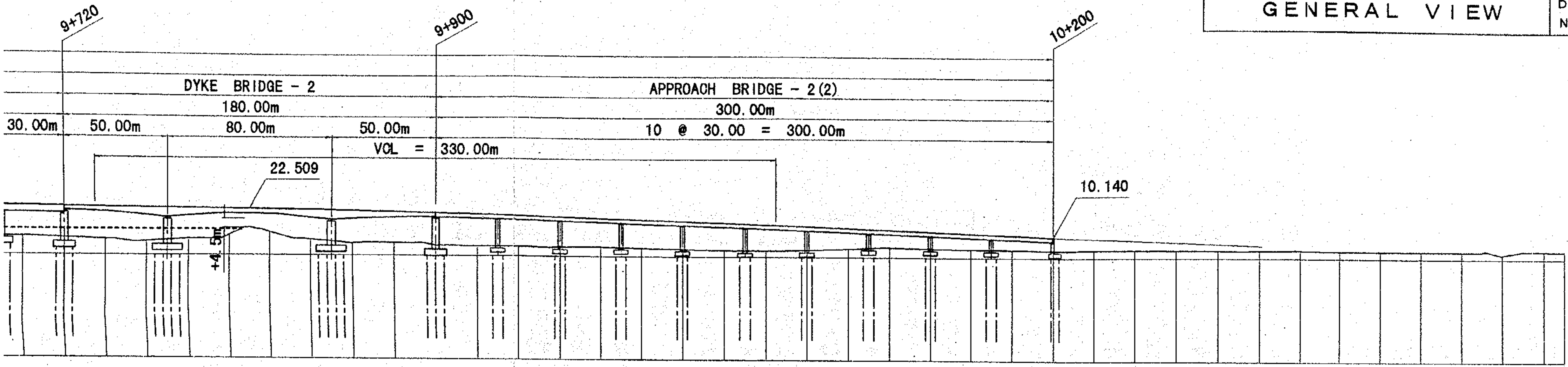
	9+820	9+840	9+860	9+880	9+900	9+920	9+940	9+960	9+980	10+000	10+020	10+040	10+060	10+080
	22.357	22.024	21.652	21.239	20.787	20.295	19.764	19.192	18.581	17.930	17.239	16.509	15.739	14.940
	11.28	7.51	5.81	6.00	5.00	4.82	4.62	4.41	4.60	4.10	3.68	3.22	3.11	3.43



THE FEASIBILITY STYDY ON
THANH TRI BRIDGE AND THE SOUTHERN SECTION
OF RING ROAD NO.3 IN HANOI

GENERAL VIEW

DWG NO.



i=4.00%
L=300.00m
22.140
10.140

Station	Design level	Ground level
9+700	23.580	3.90
9+720	23.436	8.29
9+740	23.291	7.60
9+760	23.117	6.57
9+780	22.903	7.75
9+800	22.650	9.59
9+820	22.357	11.28
9+840	22.024	7.51
9+860	21.652	5.81
9+880	21.239	6.00
9+900	20.787	5.00
9+920	20.295	4.82
9+940	19.764	4.62
9+960	19.192	4.41
9+980	18.581	4.60
10+000	17.930	4.10
10+020	17.239	3.68
10+040	16.509	3.22
10+060	15.739	3.11
10+080	14.940	3.43
10+100	14.140	4.00
10+120	13.340	4.84
10+140	12.540	4.41
10+160	11.740	4.12
10+180	10.940	3.89
10+200	10.140	3.64
10+220		3.70
10+240		3.77
10+260		3.79
10+280		3.66
10+300		3.70
10+320		3.80
10+340		3.61
10+360		3.55
10+380		3.54
10+400		3.50
10+420		2.11
10+440		3.87

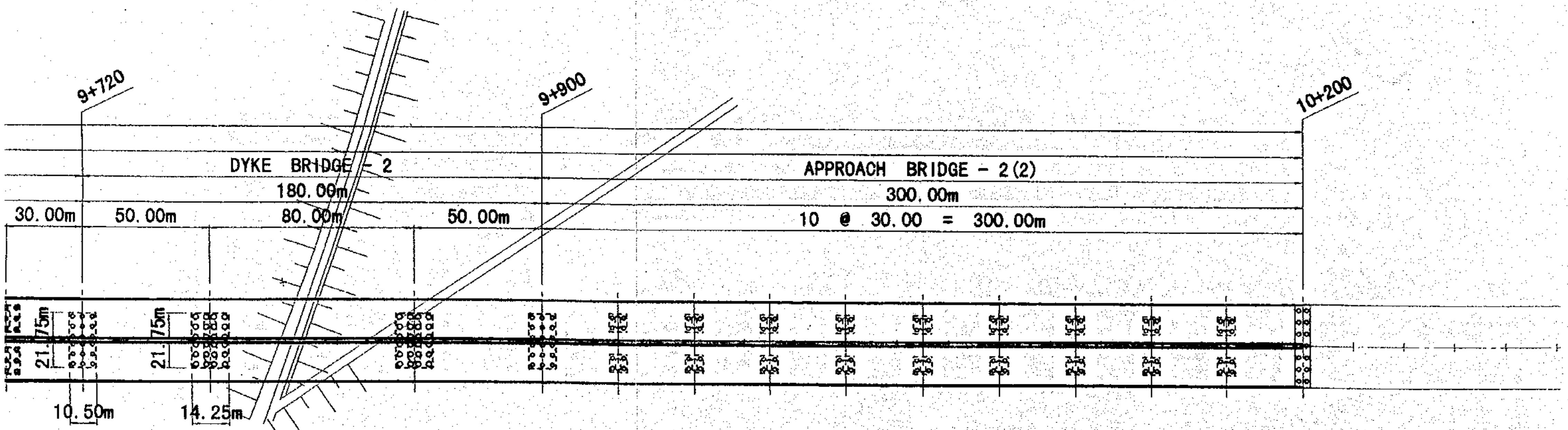
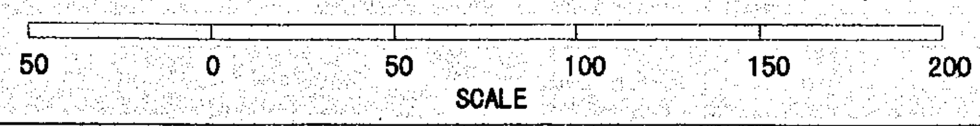


Fig. 11.2.1 General View



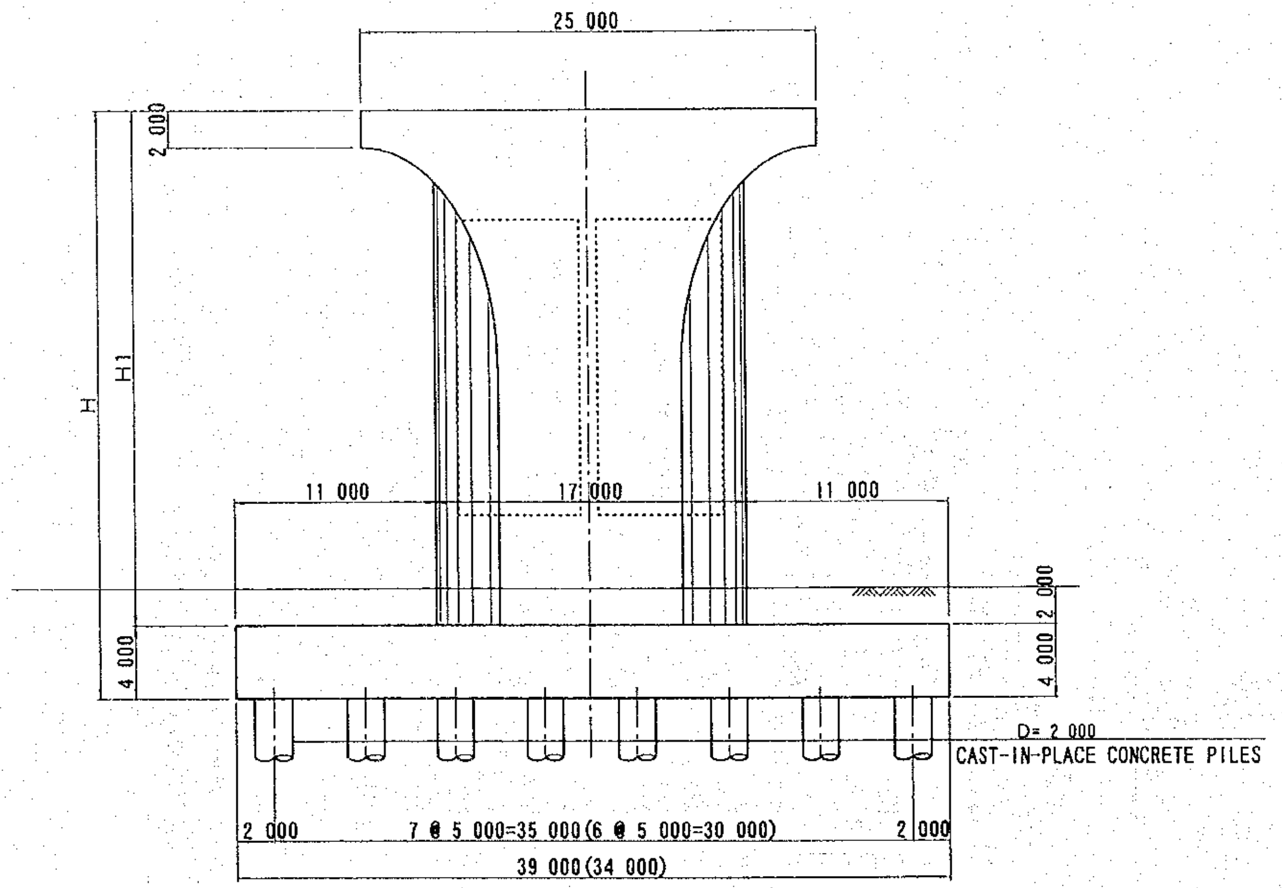
THE FEASIBILITY STYDY ON
THANH TRI BRIDGE AND THE SOUTHERN SECTION
OF RING ROAD NO. 3 IN HANOI

SUBSTRUCTURE FOUNDATION

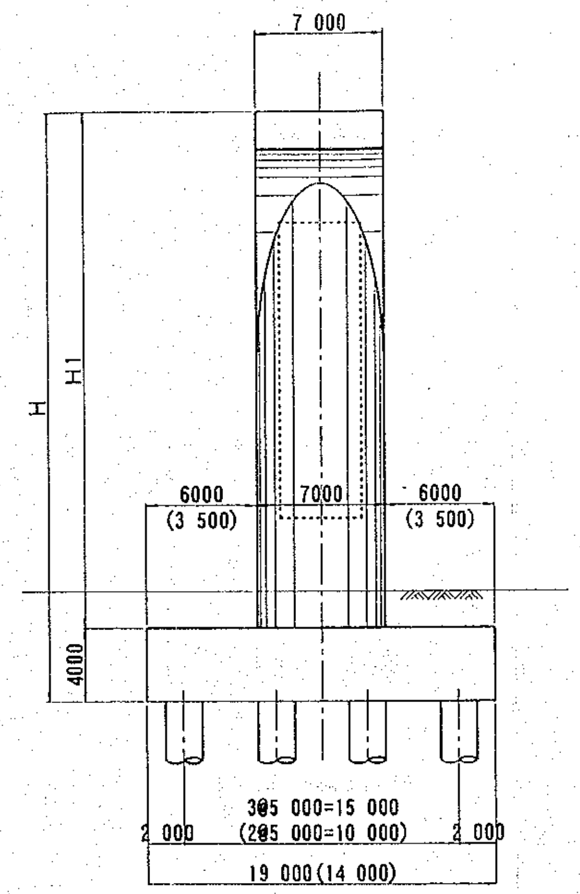
MAIN BRIDGE

SUBSTRUCTURE FOUNDATION SCALE: 1:400

CROSS SECTION



PROFILE



	H	H1
P 1	24, 100	20, 100
P 2	25, 000	21, 000
P 3	28, 200	24, 200
P 4	30, 500	26, 500
P 5	30, 500	26, 500
P 6	25, 200	21, 200
P 7	23, 000	19, 000

( ) P_1 AND P_7

PLAN

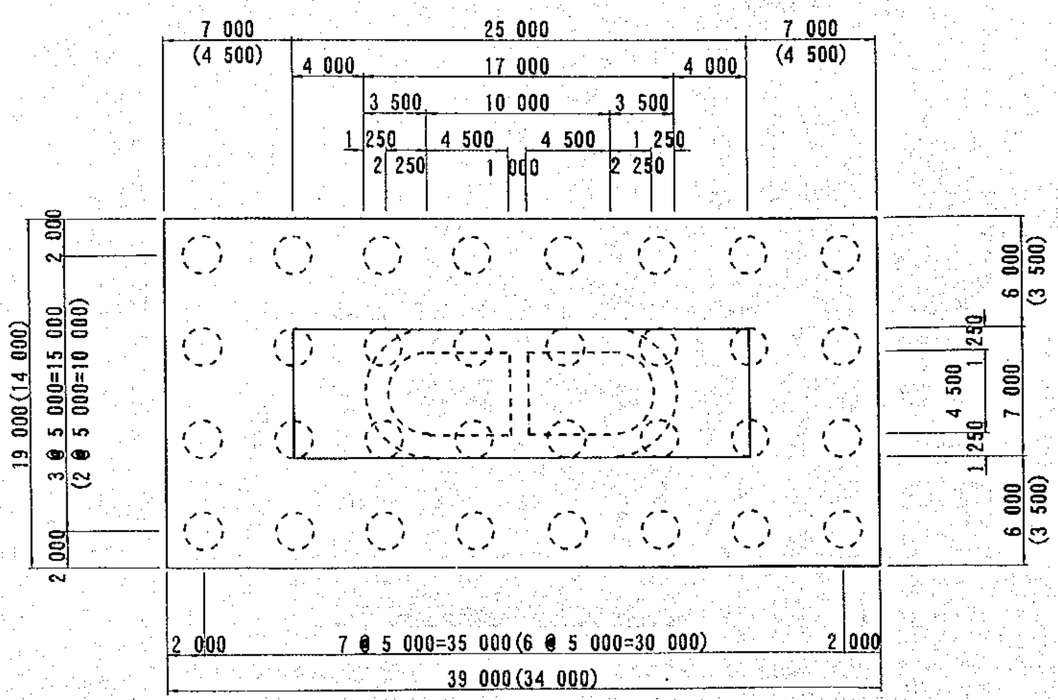


Figure 11.2.2 Substructure / Foundation

11.2.2 Approach Bridge

The structural types of the Approach Bridge were selected in Chapter 9 as follows.

Approach Bridge (1)	PC Continuous Box Girder Bridge with 50 m span length	
Approach Bridge (2)	PC Simple Girder Bridge with 30 m span length	
Dyke Bridge	PC Continuous Box Girder Bridge	
	Hanoi side;	75 m + 130 m + 75 m
	Gia Lam side;	50 m + 80 m + 50 m

(1) Superstructure

1) Approach Bridge (1)

There are many technical data on the PC box girder bridge based on previous experience. Based on past experience, the dimensions of the superstructure were determined indicated in Figure 11.2.1.

2) Approach Bridge (2)

The bridge type was determined as same procedure as Approach Bridge (1), and referring to the execution in Vietnam.

3) Dyke Bridge

The bridge types were determined as same procedure as Approach Bridge (1).

(2) Substructure/Foundation

1) Pier

Approach Bridge (1) gains access to the Main Bridge, therefore, it is better to adopt the same shape of pier type considering the continuity and the hydrological conditions of the site. The pier is separated in both Hanoi and Gia Lam direction.

The piers were located inside of the flood area, however, were not located in the normal water course of the River. In dry season, the footings of the pier are situated above the water level even though these are in the water in rainy season.

2) Abutment

Adversed T-shape is adopted as shown in Figure 11.2.5.

3) Foundation

Cast-in-situ concrete pile ø1,500 is adopted as shown in Figures 11.2.3, 11.2.4.

11.3 Interchange Structure

11.3.1 Superstructure

Three interchanges were proposed over the length of the project which require bridge structure;

(i) interchange with the existing National Highway No. 1
(ii) interchange with the new National Highway No. 1
(iii) interchange with National Highway No. 5

1) National Highway No. 1 and No. 5

The Study Team proposes that the deck structures are formed from precast beam of spans 30 to 40 metres, cross sections are shown in Figures 11.3.1 and 11.3.2. The width of the deck in 18.8 metres to allow for acceleration and deceleration lanes and the overall length between abutments are 340 metres for NH-1 and 450 metres for NH-5, respectively.

2) New National Highway No. 1

The main carriageway traverses the site at grade. Ramp A and B shown in Volume IV; Drawings require elevated flyover to allow a grade separated junction. The lengths of the flyover between abutments are: Ramp A-405 metres; Ramp B-180 metres.

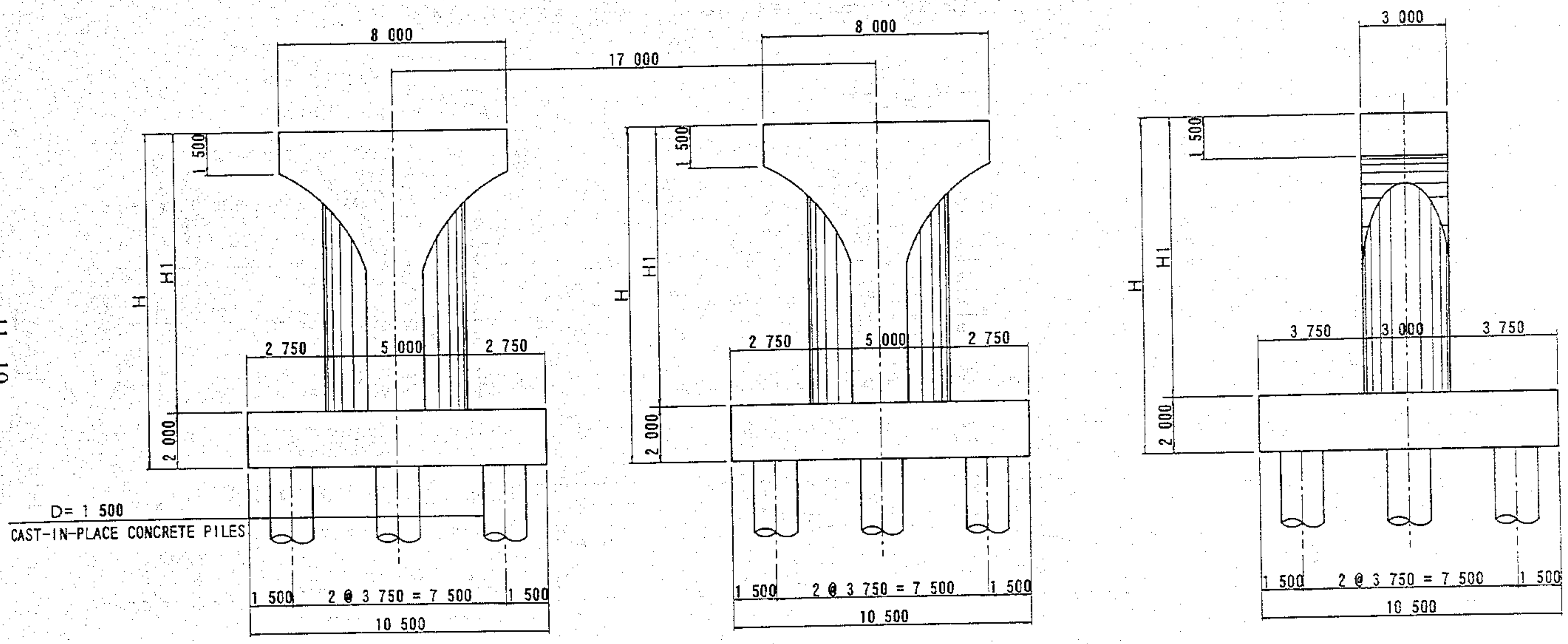


Figure 11.2.3 Substructure / Foundation for Approach Bridge (1)

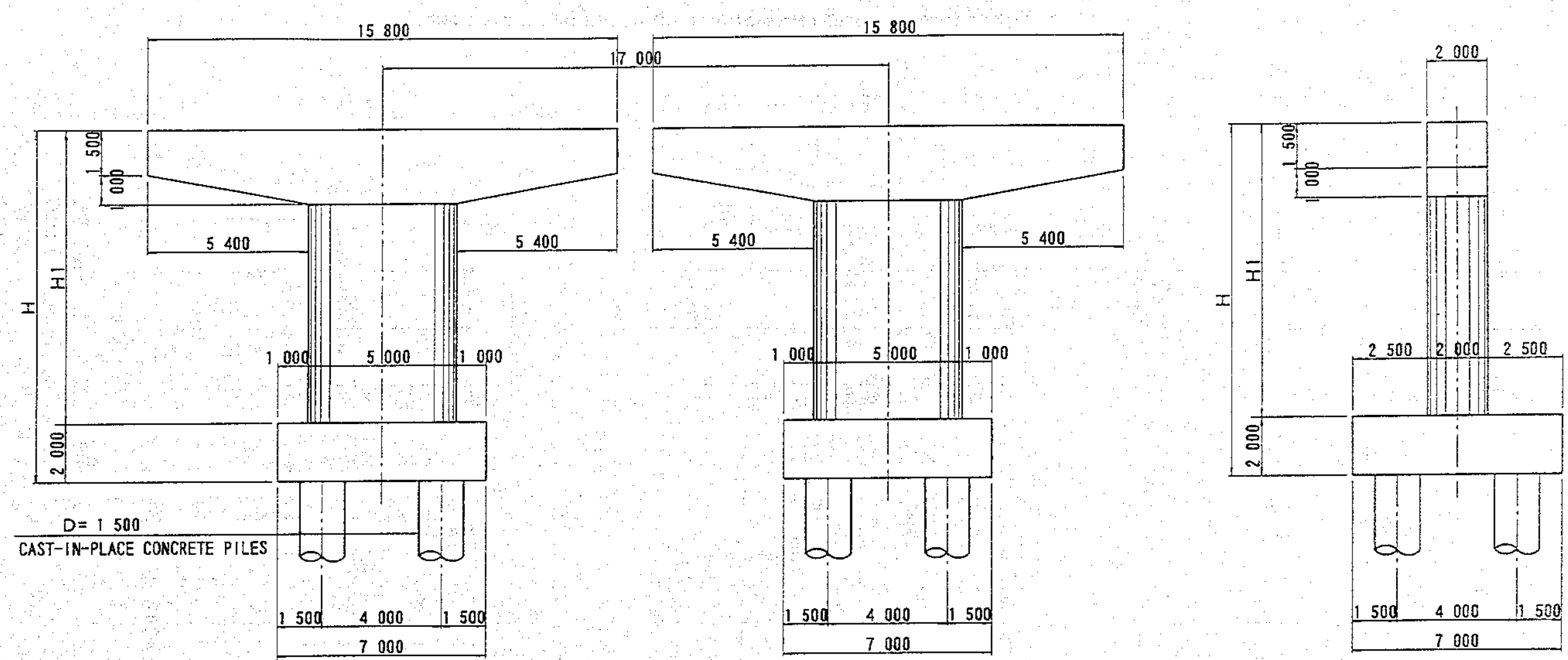


Figure 11.2.4 Substructure / Foundation for Approach Bridge (2)

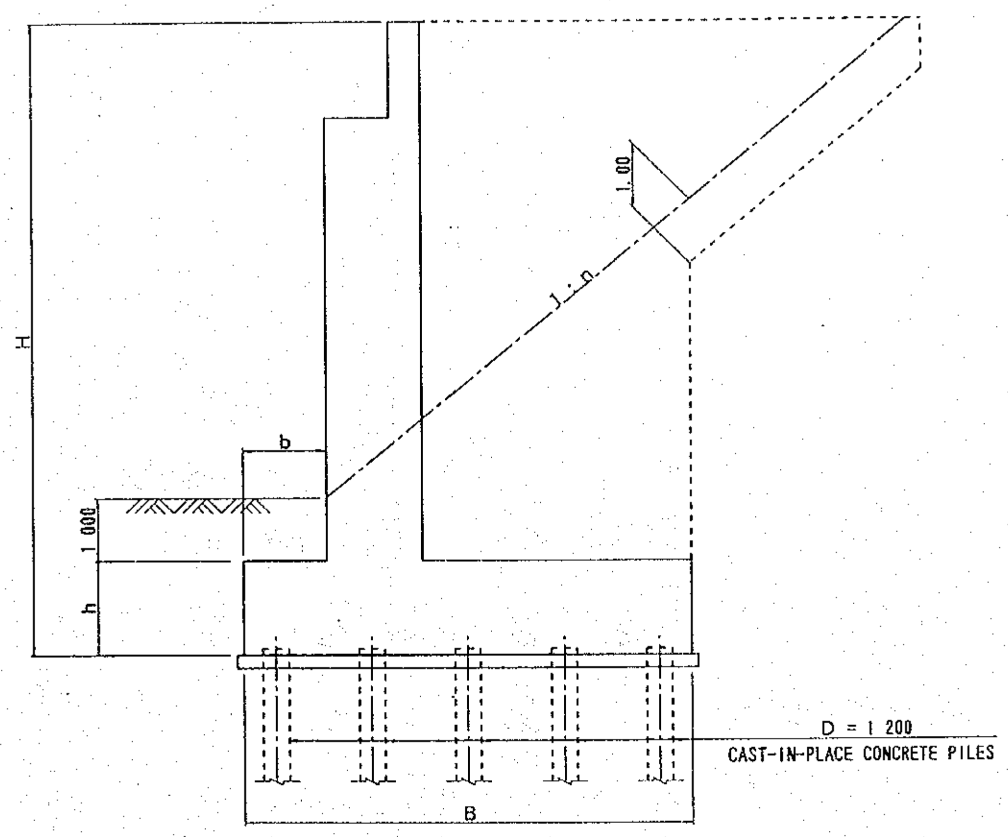


Figure 11.2.5 Abutment

The plan curvature of the ramps requires a cross section to be able to resist both flexion and torsional moments. The optimum cross section will be either a steel or concrete box girder. However, the decision for the material choice will depend on the time of construction. A concrete solution would be the most economical, should the ramps be constructed at the same time as SHTRR, where as a steel solution would result in less disruption should be ramp be built in a later period. A cross section of the ramp by concrete solution is shown in Figure 11.3.3.

11.3.2 Substructure

The type of piers, abutments and foundation refer to Approach Bridge (2). The cross sections are shown in Volume IV; Drawings.

THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM THANG LONG PROJECTS MANAGEMENT UNIT, MINISTRY OF TRANSPORT				
PROJECT	FEASIBILITY STUDY FOR THANH TRI BRIDGE AND SOUTHERN SECTION OF RING ROAD No.3 IN HA NOI			
CONSULTANT	PACIFIC CONSULTANTS INTERNATIONAL			
	DESIGNED BY	CHECKED BY	APPROVED BY	
NAME				
SIGNATURE				
DATE				

INTERCHANGE BRIDGES AT NATIONAL HIGHWAY No.1 AND 5
CROSS SECTION

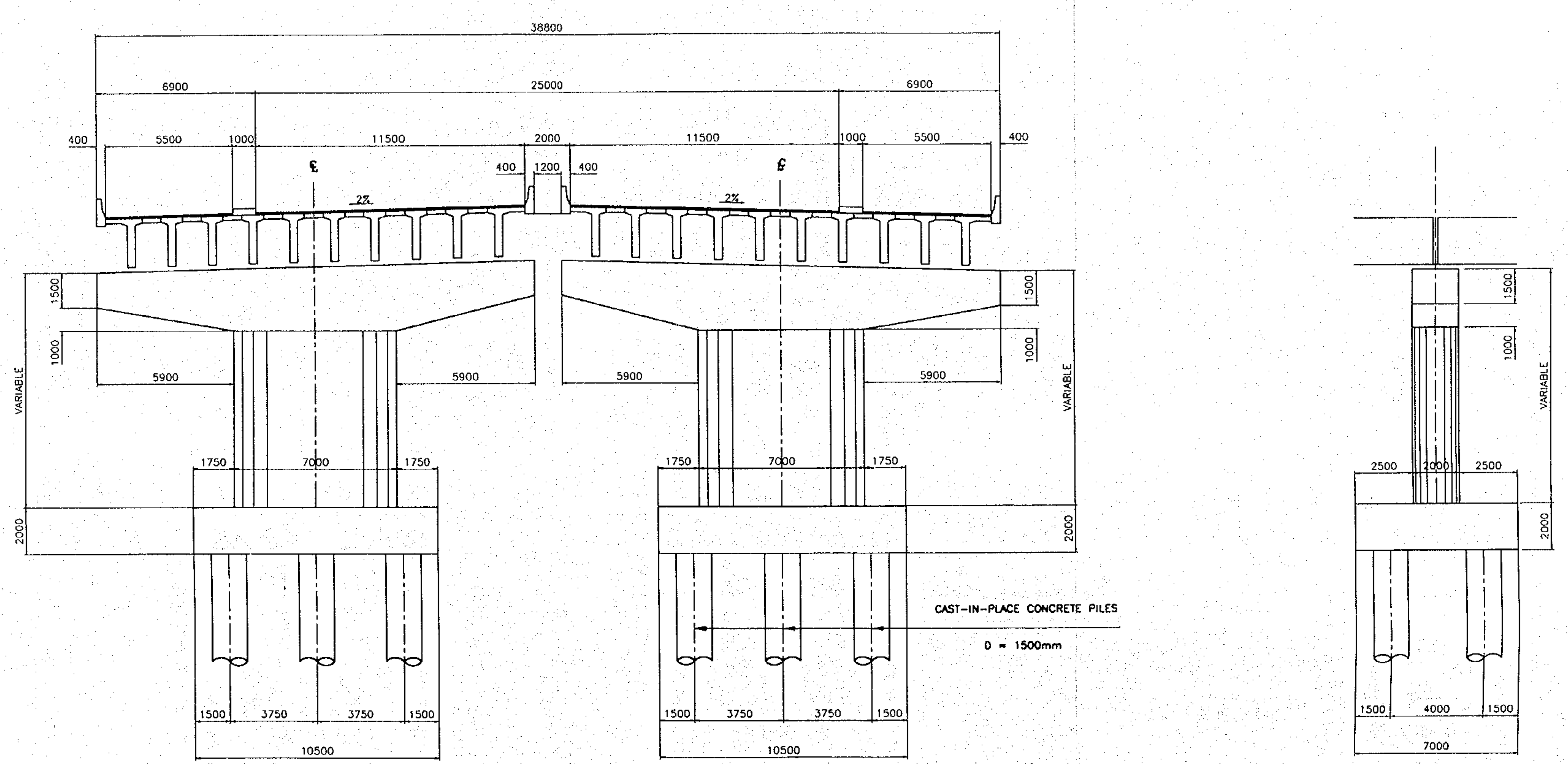


Figure 11.3.1

Drawn by Mr T.N.N

THE GOVERNMENT OF THE SOCIALIST REPUBLIC OF VIETNAM THANG LONG PROJECTS MANAGEMENT UNIT, MINISTRY OF TRANSPORT				
PROJECT	FEASIBILITY STUDY FOR THANH TRI BRIDGE AND SOUTHERN SECTION OF RING ROAD No.3 IN HA NOI			
CONSULTANT	PACIFIC CONSULTANTS INTERNATIONAL			
	DESIGNED BY	CHECKED BY	APPROVED BY	
NAME				
SIGNATURE				
DATE				

INTERCHANGE BRIDGES AT NATIONAL HIGHWAY No.1 AND 5

CROSS SECTION

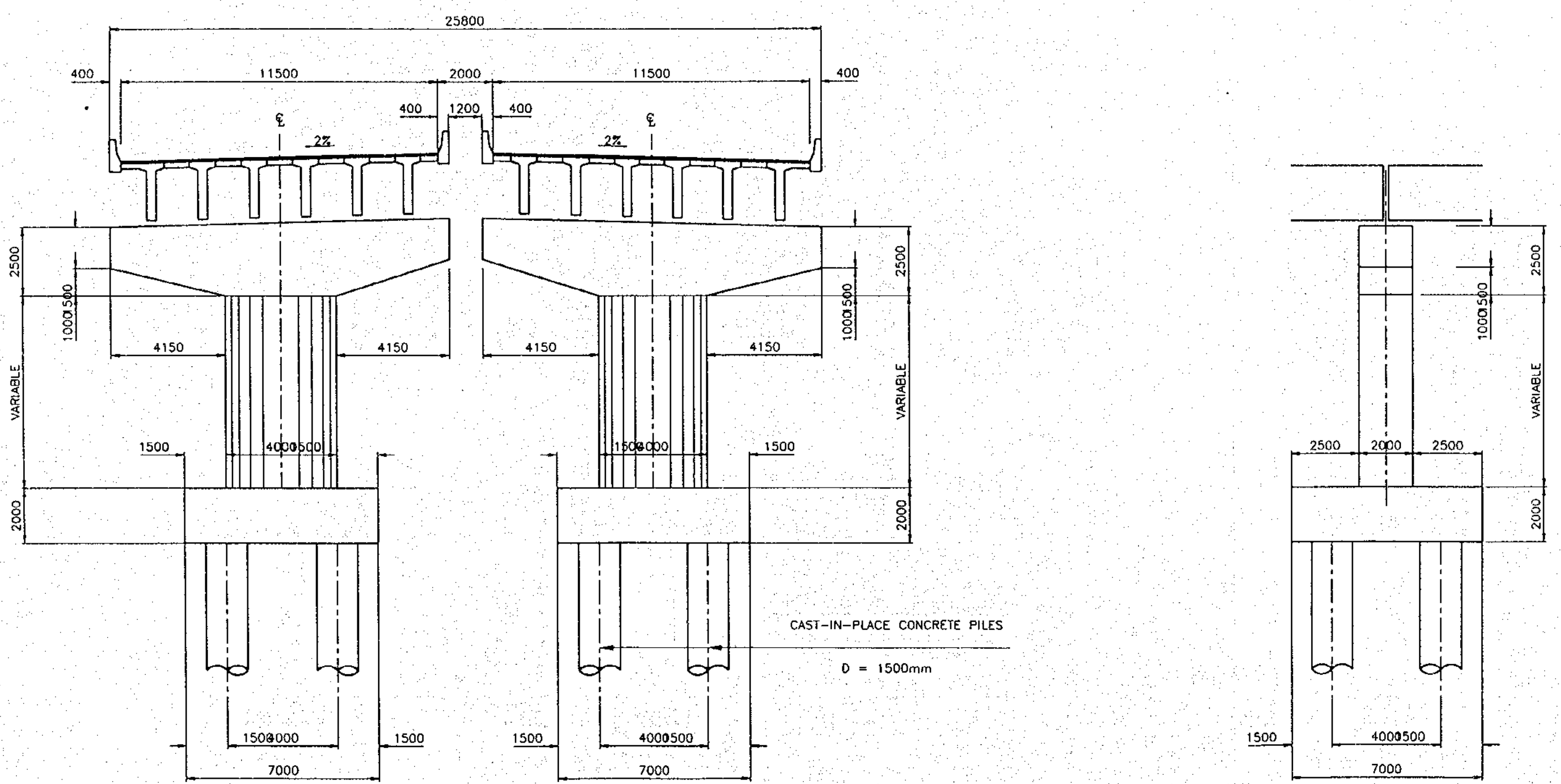


Figure 11.3.2

by Mr T.N.N

NEW NATIONAL HIGHWAY No.1 INTERCHANGE

Ramps A & B - CROSS SECTION

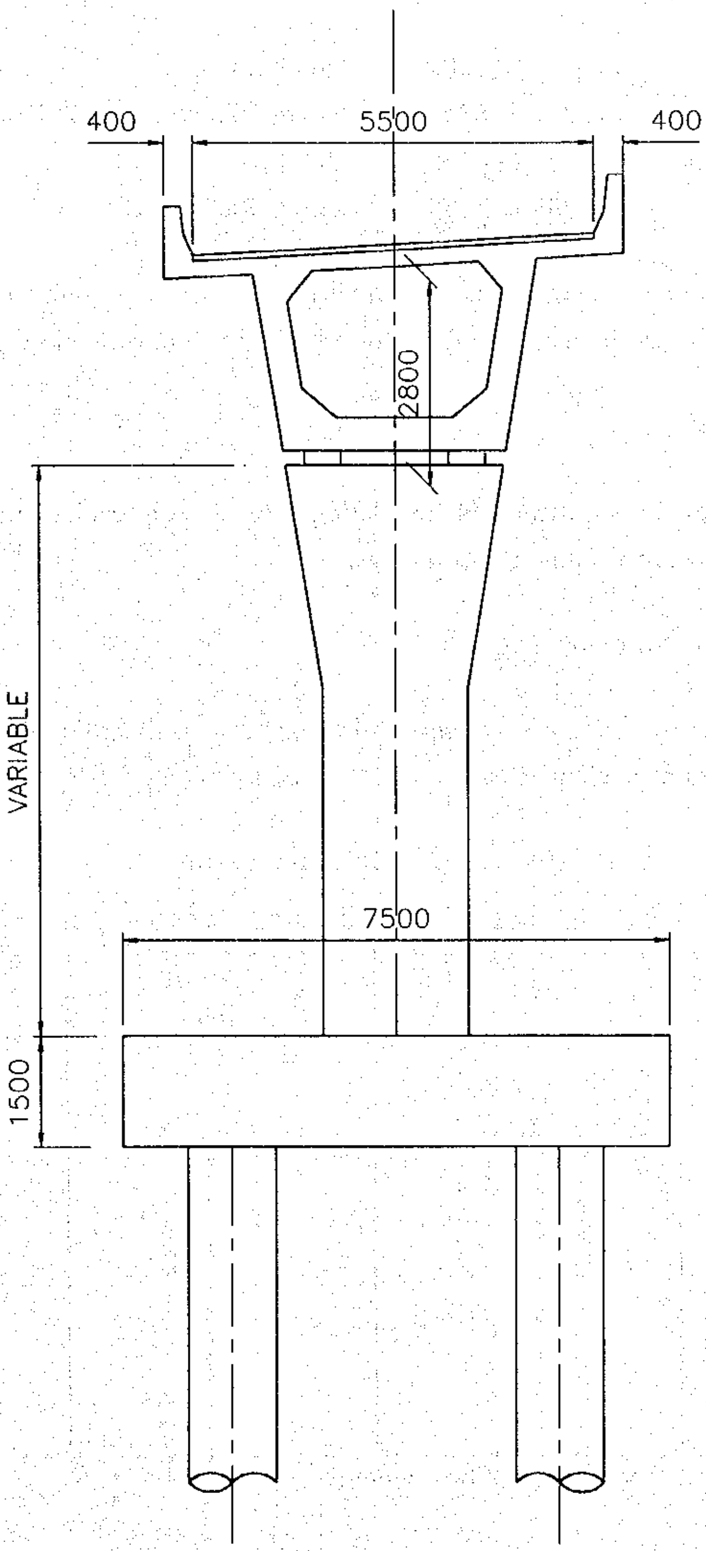


Figure 11.3.3

11.4 Flyover

11.4.1 Superstructure

The Study Team has identified four locations where bridge flyovers are required:

i)	chainage	1+900 - 2+140;	length 240 metres
ii)	chainage	2+625 - 2+685;	length 60 metres (River Bridge)
iii)	chainage	6+465 - 6+645;	length 180 metres
iv)	chainage	12+285 - 12+585;	length 300 metres

The cross section of the main carriageway bridge is shown in Figure 11.3.2 and the Study Team has used precast beams to allow for future widening if required.

11.4.2 Substructure

The type of piers, abutment and foundation refer to Approach Bridge (2). The cross section is shown in Volume IV; Drawings.

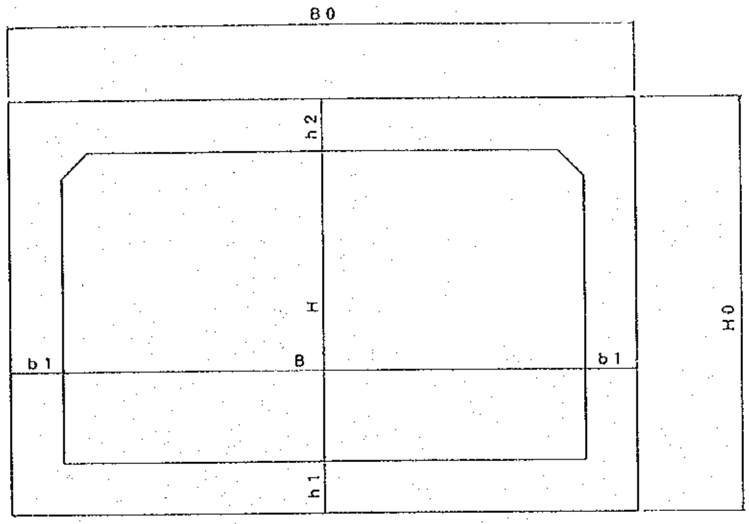
11.5 Drainage and Other Bridges

In Table 11.5.1 gives the assessment for drainage bridges based on the site inspections of the existing drainage channels and the proposed alignment.

Table 11.5.1 Drainage Facility

Chainage	Type of Box Culvert *	Diameter of Pipe (m)	Length (m)
1+680	C	-	70
2+410	-	0.8	75
5+830	A	-	85
6+300	D	-	160
10+300	C	-	110
10+460	-	1.0	65
10+840	-	0.8	65
11+220	-	1.0	10
11+475	D	-	65
11+675	-	1.5	70
11+870	-	1.5	75
11+935	-	1.5	65
12+750	D	-	60

* see Table 11.5.2 for details of box culvert.



	H	B	h1	h2	b1	H0	B0
TYPE-A	5 000	7 000	900	800	800	6 700	8 600
TYPE-B	3 000	2 000	450	350	350	3 800	2 700
TYPE-C	3 000	3 000	500	400	400	3 900	3 800
TYPE-D	5 000	5 000	700	600	600	6 300	6 200

DIMENSION LIST

Table 11.5.2 Box Culvert Details

The Study Team proposes that the box culvert solution is also used for the following locations for vehicular and pedestrian traffic as given in Table 11.5.3.

Table 11.5.3 Type of Box Culvert

Chainage	Type of Box Culvert *	Length (m)	Purpose
3+050	A	70	Vehicular
3+350	B	70	Pedestrian
3+770	A	70	Vehicular
4+370	A	70	Vehicular
4+900	B	85	Pedestrian
5+580	B	85	Pedestrian
5+815	A	85	Vehicular
10+860	B	65	Pedestrian
11+490	A	65	Vehicular
12+000	B	60	Pedestrian

* see Table 5.4 for details of box culvert.