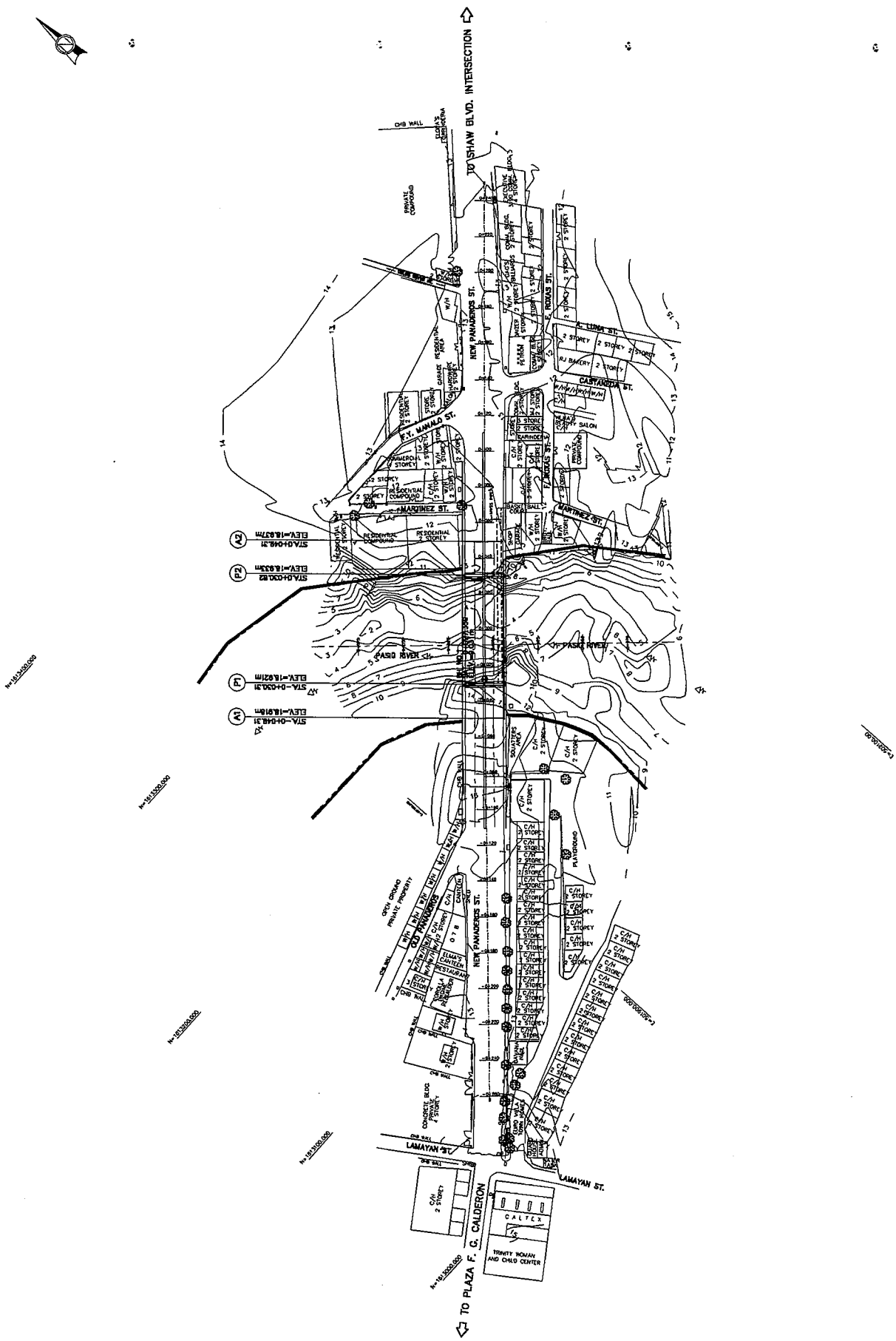
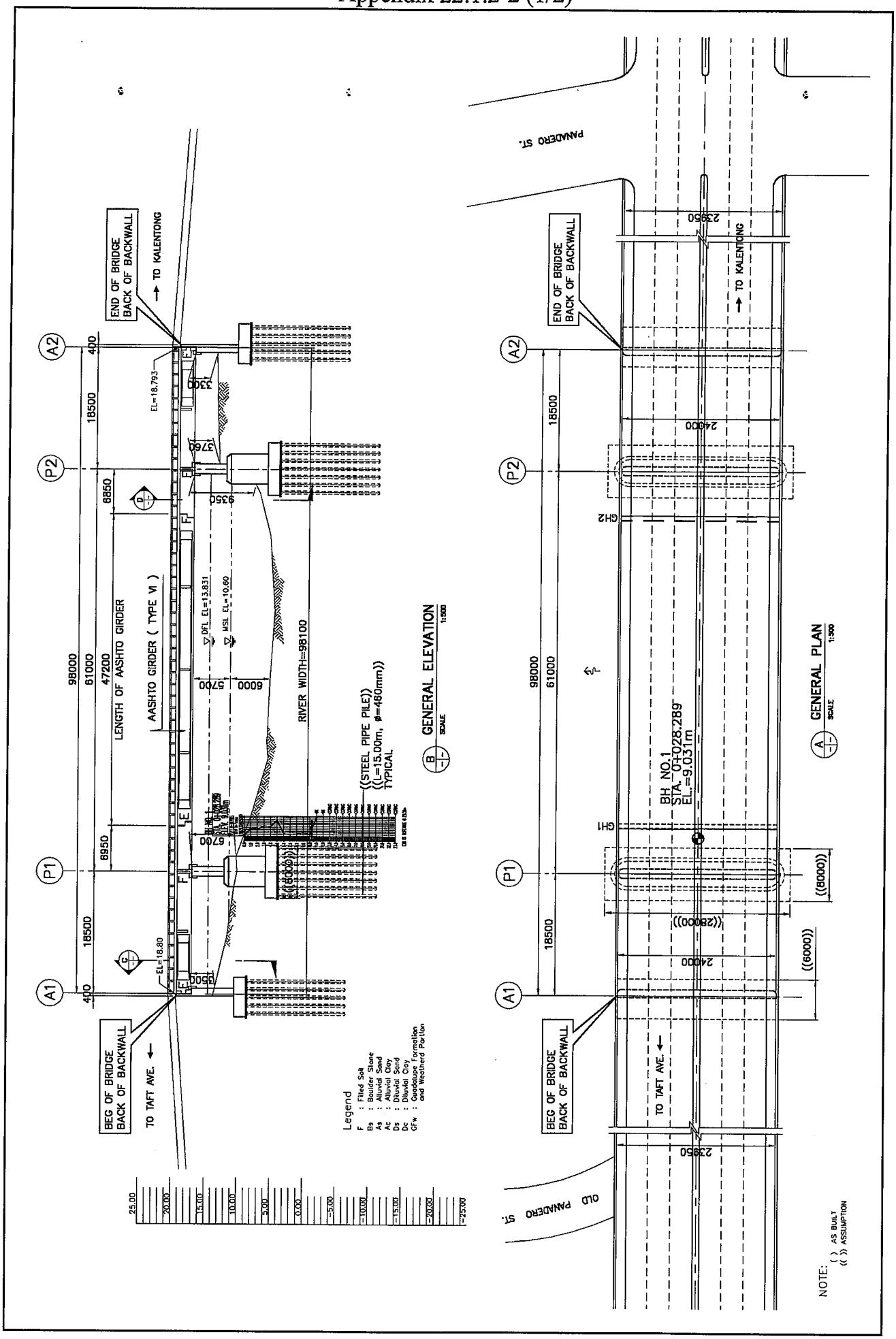
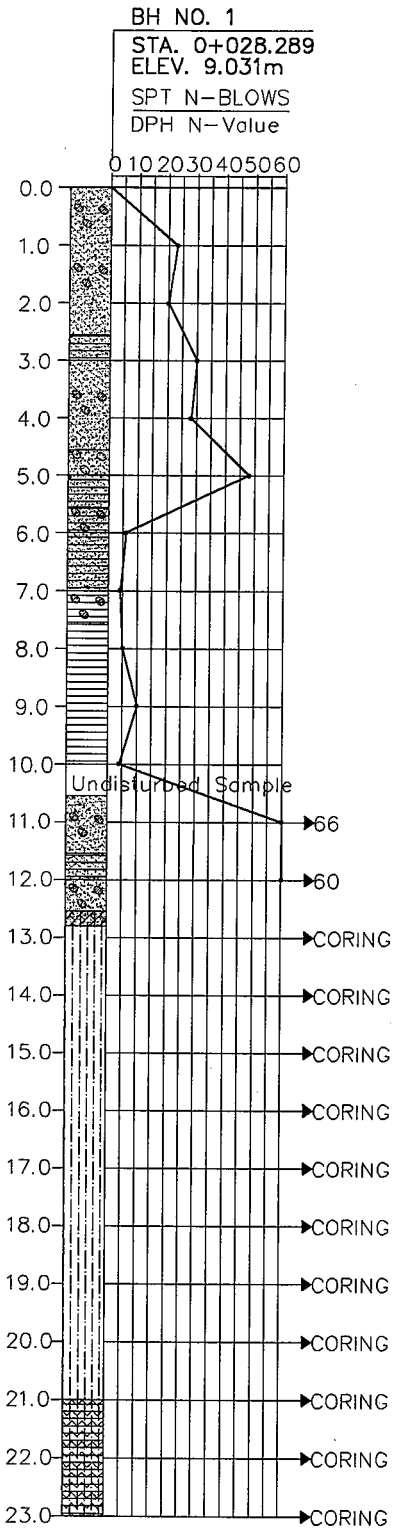
CHAPTER 22

FEASIBILITY STUDY OF LAMBINGAN BRIDGE REHABILITATION PLAN

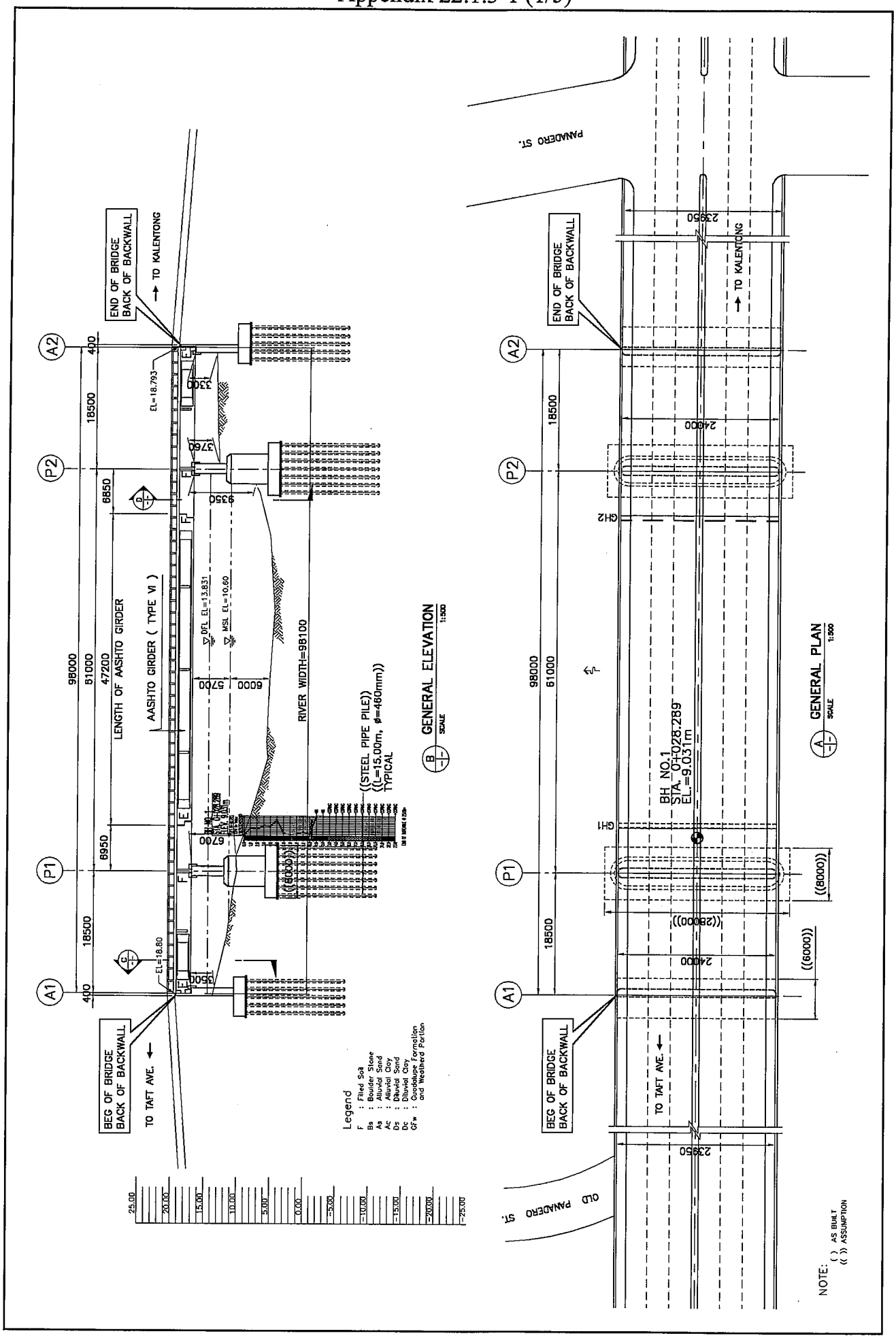


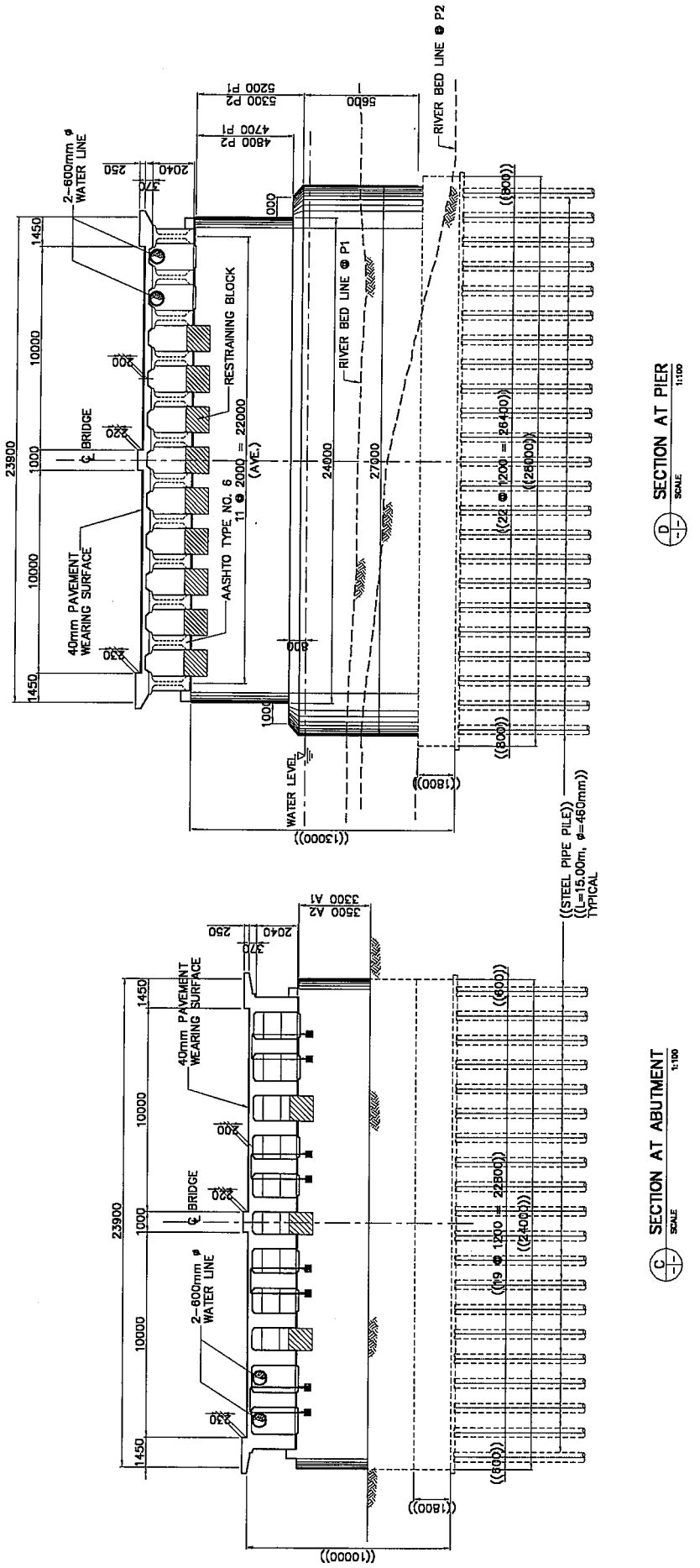
TOPOGRAPHIC SURVEY OF LAMBINGAN BRIDGE

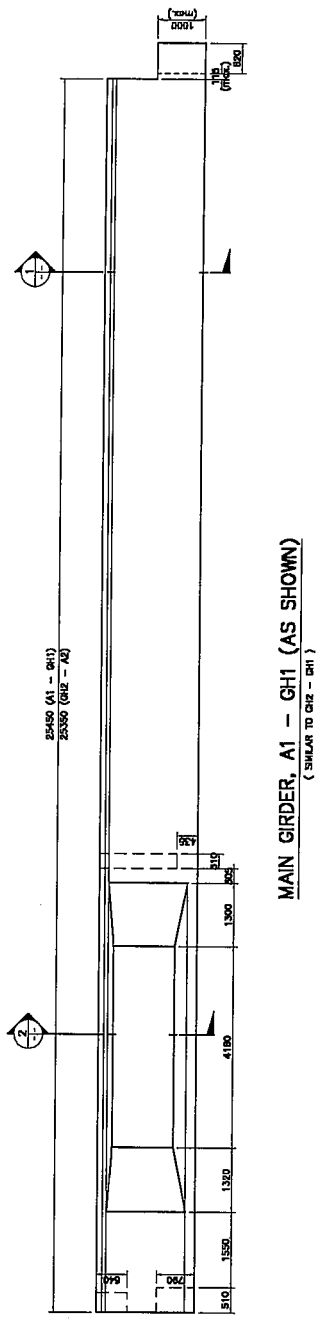

GENERAL ELEVATION
SCALE 1:500
GENERAL PLAN
SCALE 1:500
END OF BRIDGE
BACK OF BACKWALL
BEG OF BRIDGE
BACK OF BACKWALL
TO KALENTONG
TO TAFT AVE.
PANADERO ST.
OLD PANADERO ST.
A1
P1
P2
A2
98000
61000
47200
18500
8850
6950
400
LENGTH OF AASHTO GIRDER
AASHTO GIRDER (TYPE VI)
RIVER WIDTH=98100
DFL EL=13.831
MSL EL=10.60
EL=18.793
EL=18.80
((STEEL PIPE PILE))
((L=15.00m, ø=480mm))
TYPICAL
BH NO.1
STA. 0+028.289
EL.=9.031m
GH1
GH2
((8000))
((28000))
((6000))
24000
23950
NOTE:
( ) AS BUILT
(( )) ASSUMPTION
Legend
F : Filled Soil
Bs : Boulder Stone
As : Alluvial Sand
Ac : Alluvial Clay
Dc : Diluvial Clay
Dc : Diluvial Clay
GFw : Guadalupe Formation and Weathered Portion



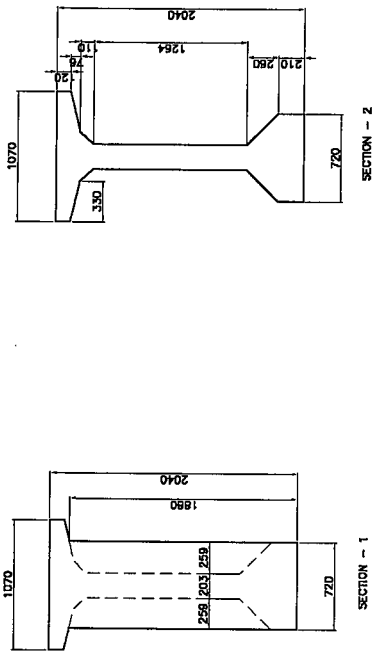
END OF BOREHOLE @ 23.00m


END OF BRIDGE
BACK OF BACKWALL
TO KALENTONG
BEG OF BRIDGE
BACK OF BACKWALL
TO TAFT AVE.
A2
P2
P1
A1
98000
61000
47200
LENGTH OF AASHTO GIRDER
AASHTO GIRDER (TYPE VI)
RIVER WIDTH=9B100
((STEEL PIPE PILE))
((L=15.00m, ø=480mm))
TYPICAL
GENERAL ELEVATION
SCALE
GENERAL PLAN
SCALE
PANADERO ST.
OLD PANADERO ST.
BH NO.1
STA. OH-028.289
EL.=9.031m
GH1
GH2
Legend
F : Filled Soil
Bs : Boulder Stone
As : Alluvial Sand
Ac : Alluvial Clay
Ds : Diluvial Sand
Dc : Diluvial Clay
GFw : Guadalupe Formation and Weathered Portion
NOTE:
( ) AS BUILT
(( )) ASSUMPTION

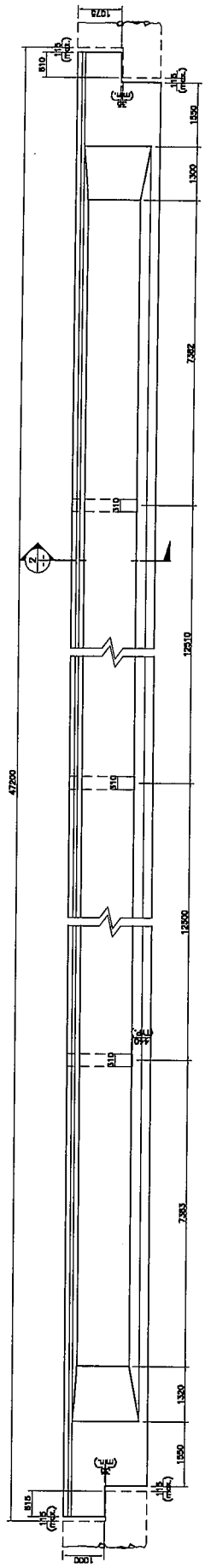

RIVER BED LINE @ P2
RIVER BED LINE @ P1
2-600mm ø WATER LINE
RESTRAINING BLOCK
AASHTO TYPE NO. 6
11 @ 2000 = 22000 (AVE.)
BRIDGE
40mm PAVEMENT WEARING SURFACE
WATER LEVEL
((STEEL PIPE PILE))
((L=15.00m, ø=460mm))
TYPICAL
D SECTION AT PIER
SCALE 1:100
C SECTION AT ABUTMENT
SCALE 1:100
NOTE:
( ) AS BUILT
(( )) ASSUMPTION



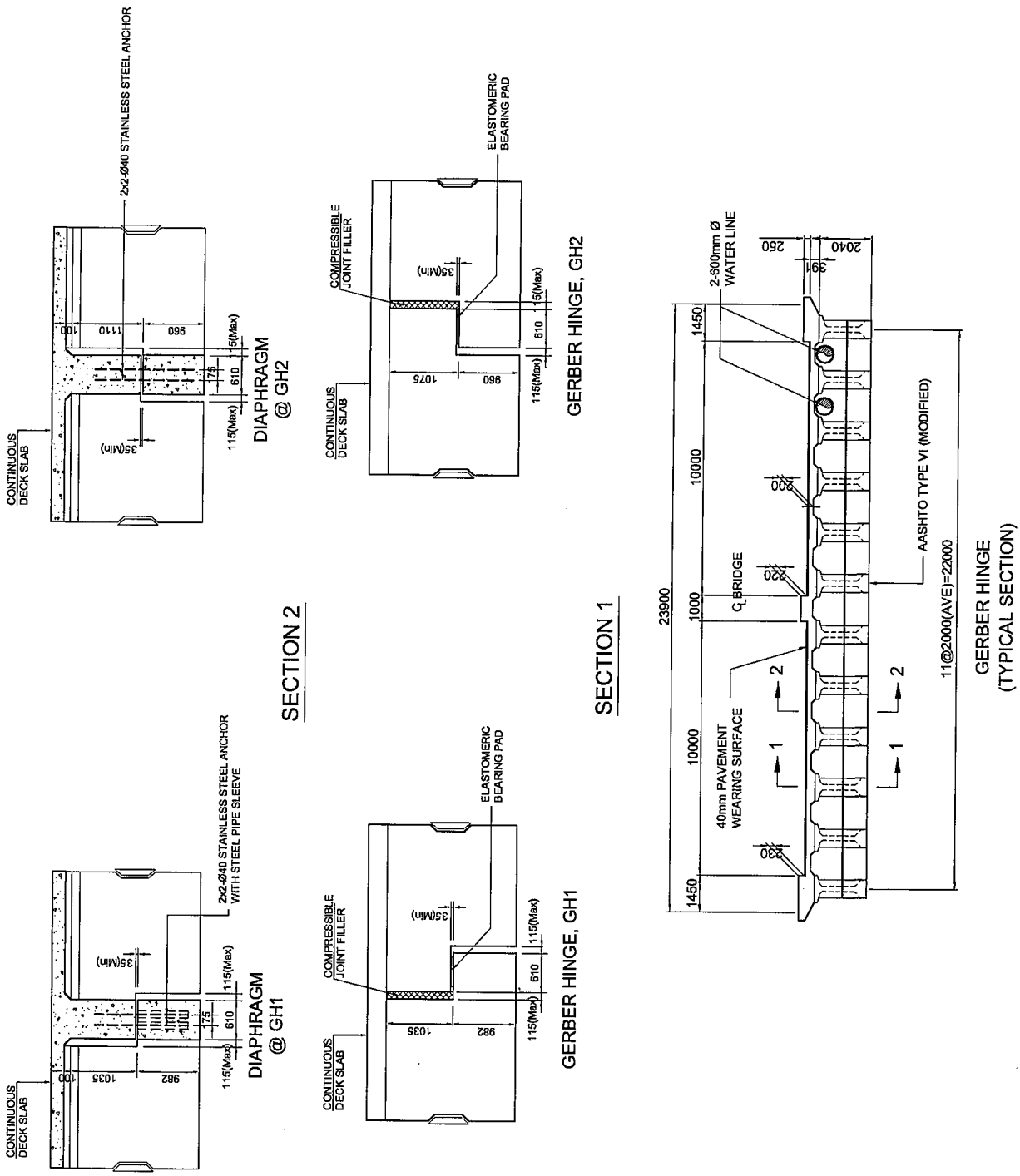
MAIN GIRDER, A1 – GH1 (AS SHOWN)
(SIMILAR TO GH2 – GH1)

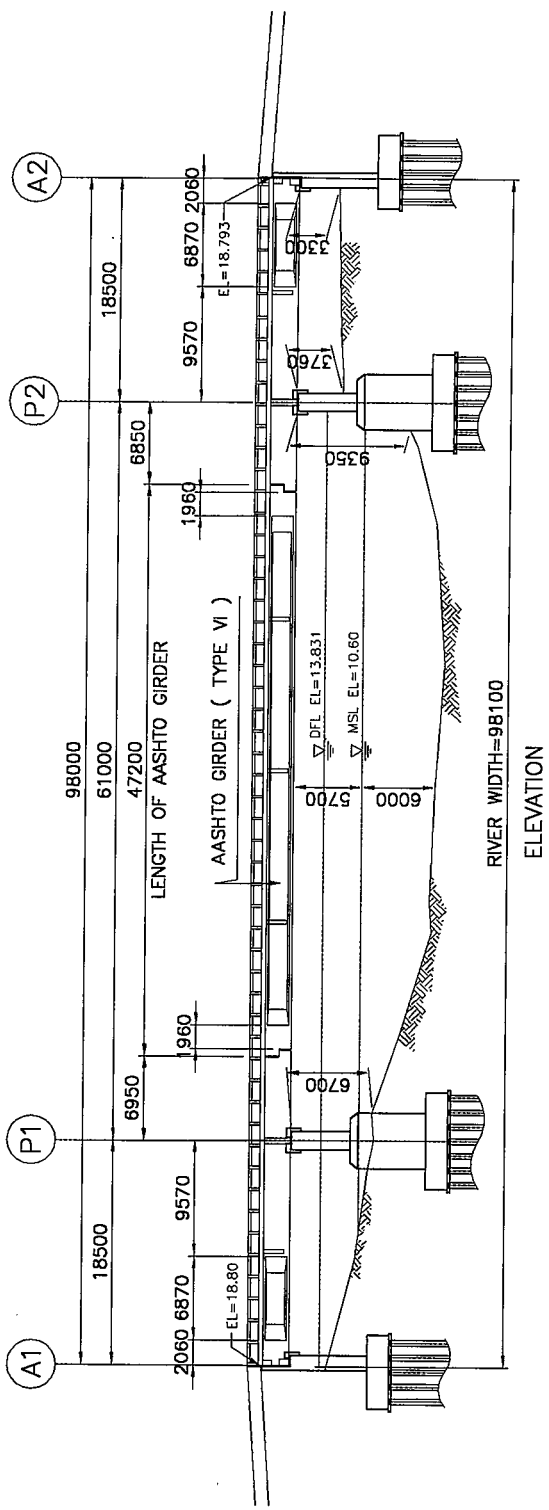


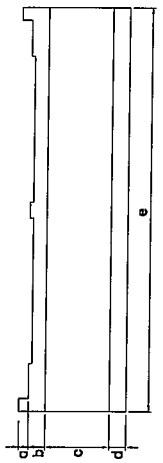
TYPE – VI GIRDER DETAILS

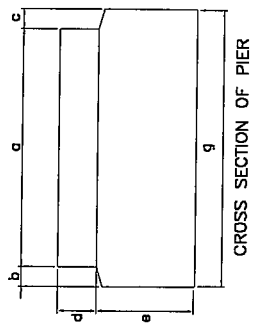


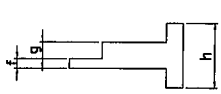
MAIN GIRDER, GH1 – GH2 (AS SHOWN)

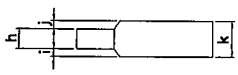

2x2-Ø40 STAINLESS STEEL ANCHOR
CONTINUOUS DECK SLAB
35(Min)
115(Max)
610
175
960
110
100
DIAPHRAGM @ GH2
SECTION 2
2x2-Ø40 STAINLESS STEEL ANCHOR WITH STEEL PIPE SLEEVE
982
1035
DIAPHRAGM @ GH1
ELASTOMERIC BEARING PAD
COMPRESSIBLE JOINT FILLER
1075
GERBER HINGE, GH2
SECTION 1
GERBER HINGE, GH1
2-600mm Ø WATER LINE
1450
10000
1000
23900
40mm PAVEMENT WEARING SURFACE
℄ BRIDGE
AASHTO TYPE VI (MODIFIED)
11@2000(AVE)=22000
2040
260
GERBER HINGE (TYPICAL SECTION)











Foundation

Dimension (m)	Type	Scale	Number
A1	((PILE))	-	-
P1	((PILE))	-	-
P2	((PILE))	-	-
A2	((PILE))	-	-

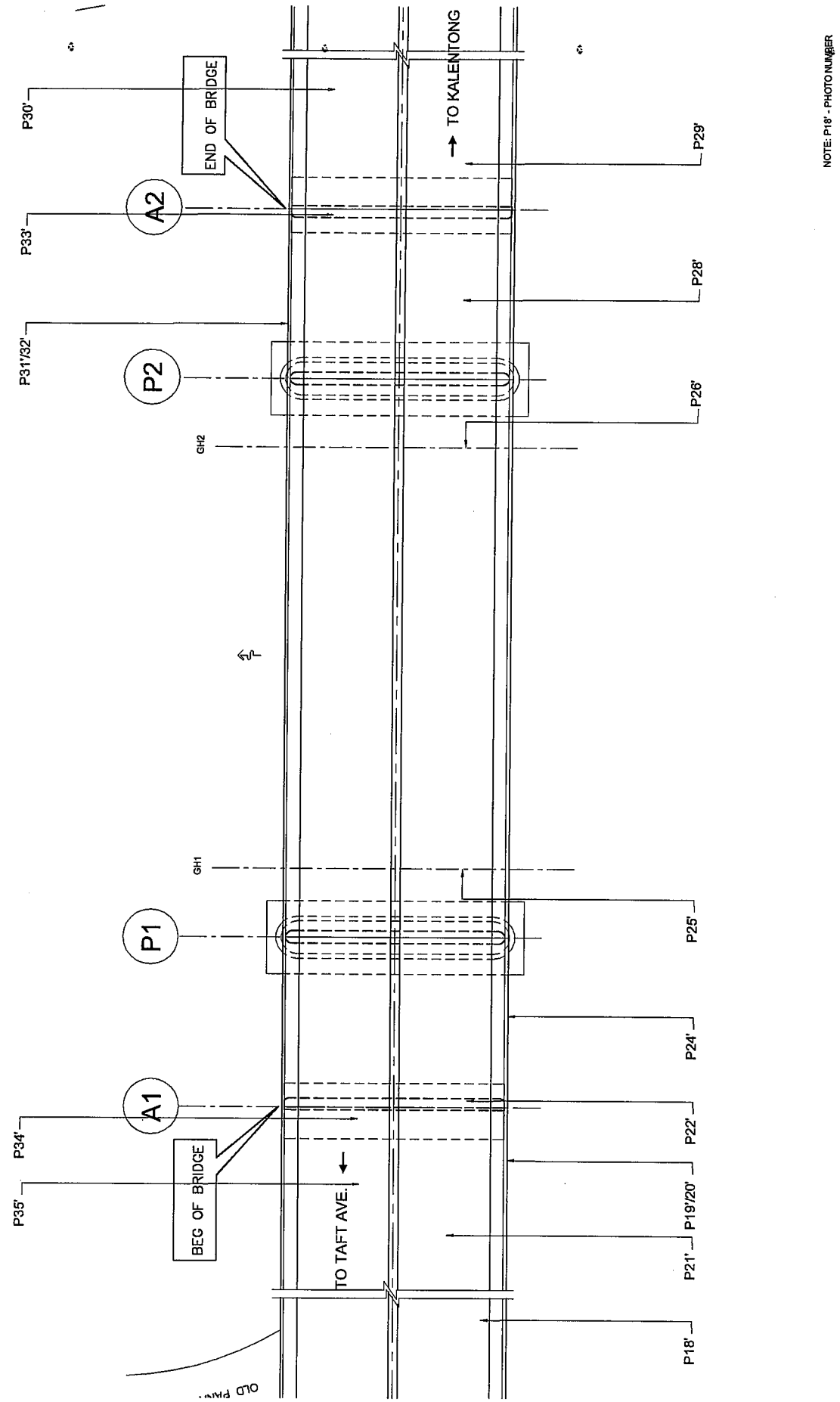
Pier

Dimension (m)	P1	P2
a	24.00	24.00
b	1.50	1.50
c	1.50	1.50
d	4.70	4.80
e	NOT ACCESSIBLE	
f	-	-
g	27.00	27.00
h	1.50	1.50
i	1.50	1.50
j	1.50	1.50
k	4.50	4.50

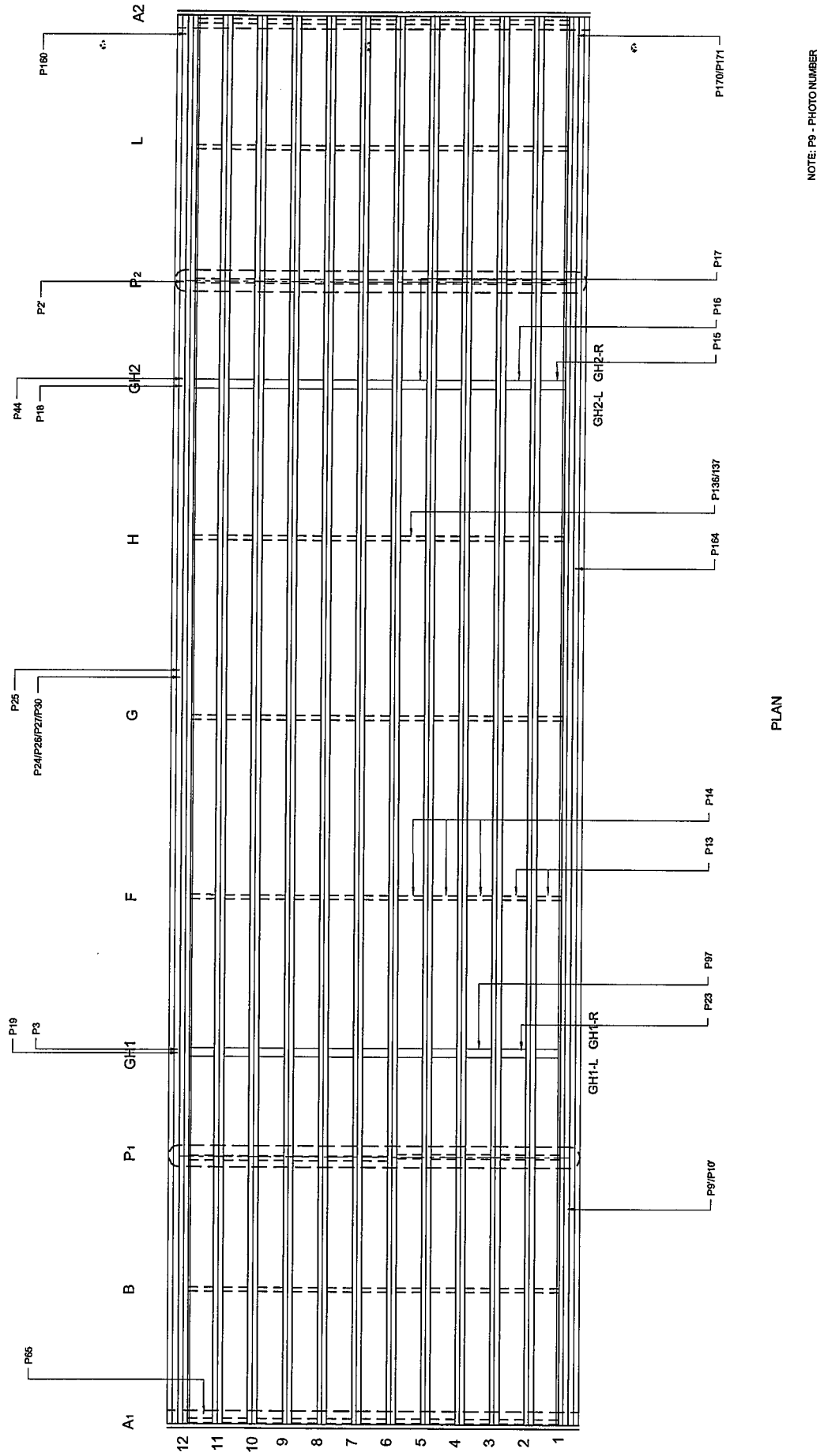
NOTE: ( ) AS BUILT
(( )) ASSUMPTION

Abutment

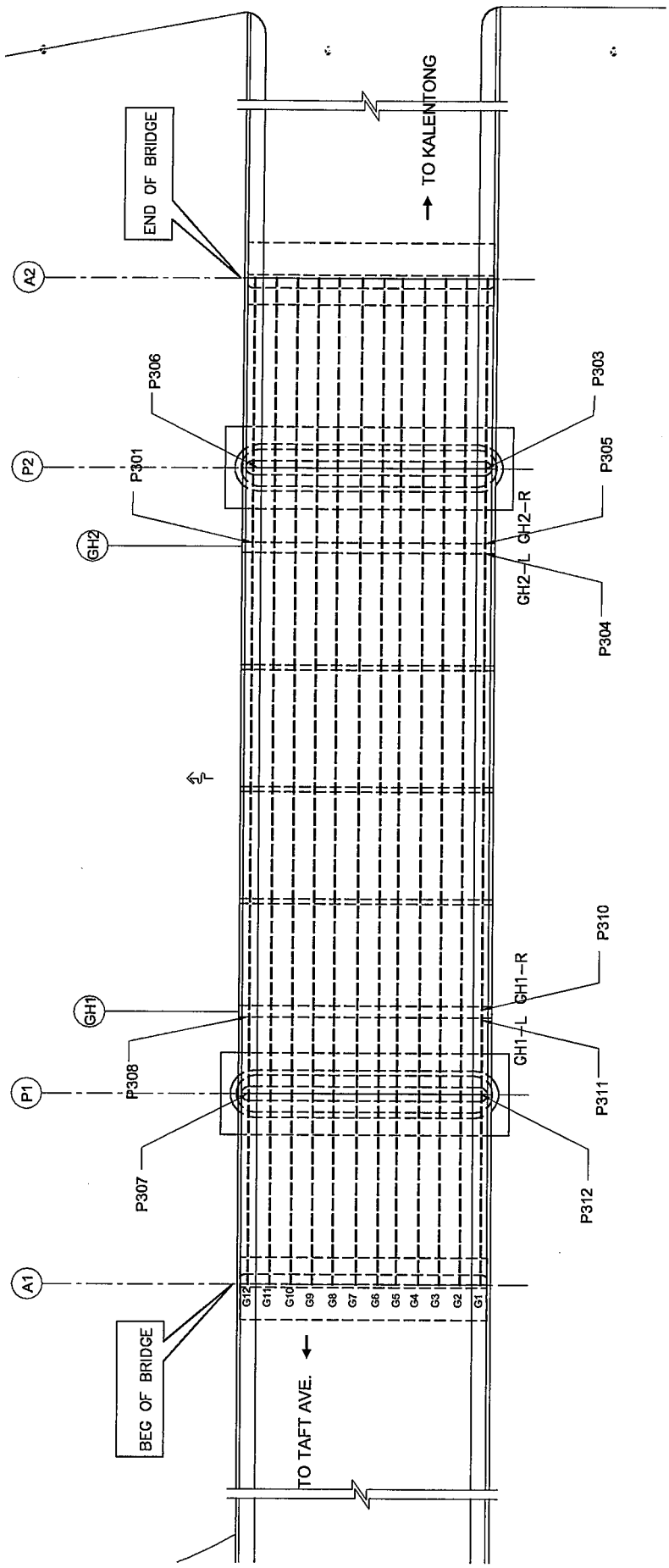
Dimension (m)	A1	A2
a	-	-
b	-	-
c	NOT ACCESSIBLE	
d	NOT ACCESSIBLE	
e	NOT ACCESSIBLE	
f	0.30	0.30
g	0.96	0.90
h	NOT ACCESSIBLE	



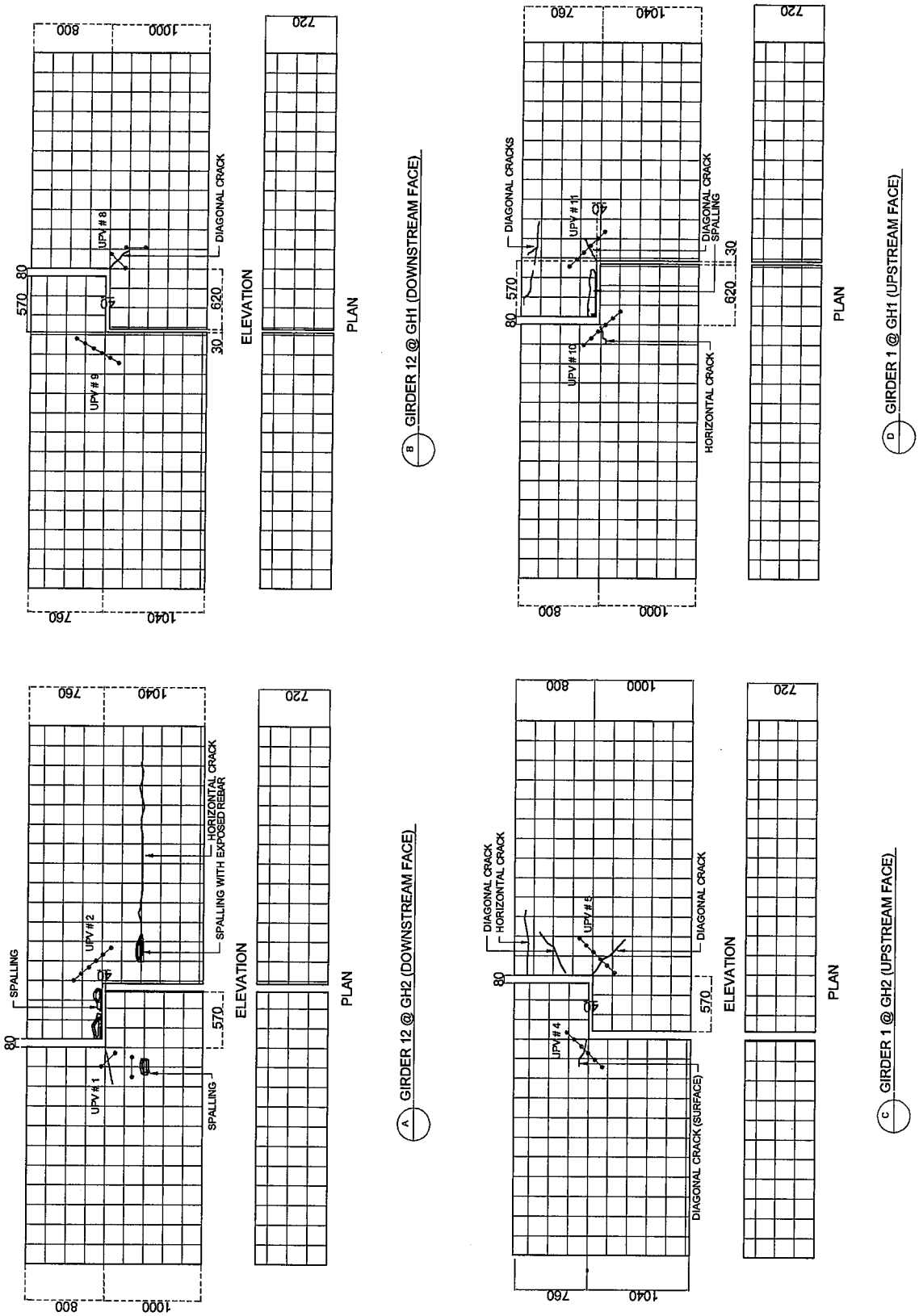
MAPPING OF DAMAGE ON ROAD DECK LEVEL



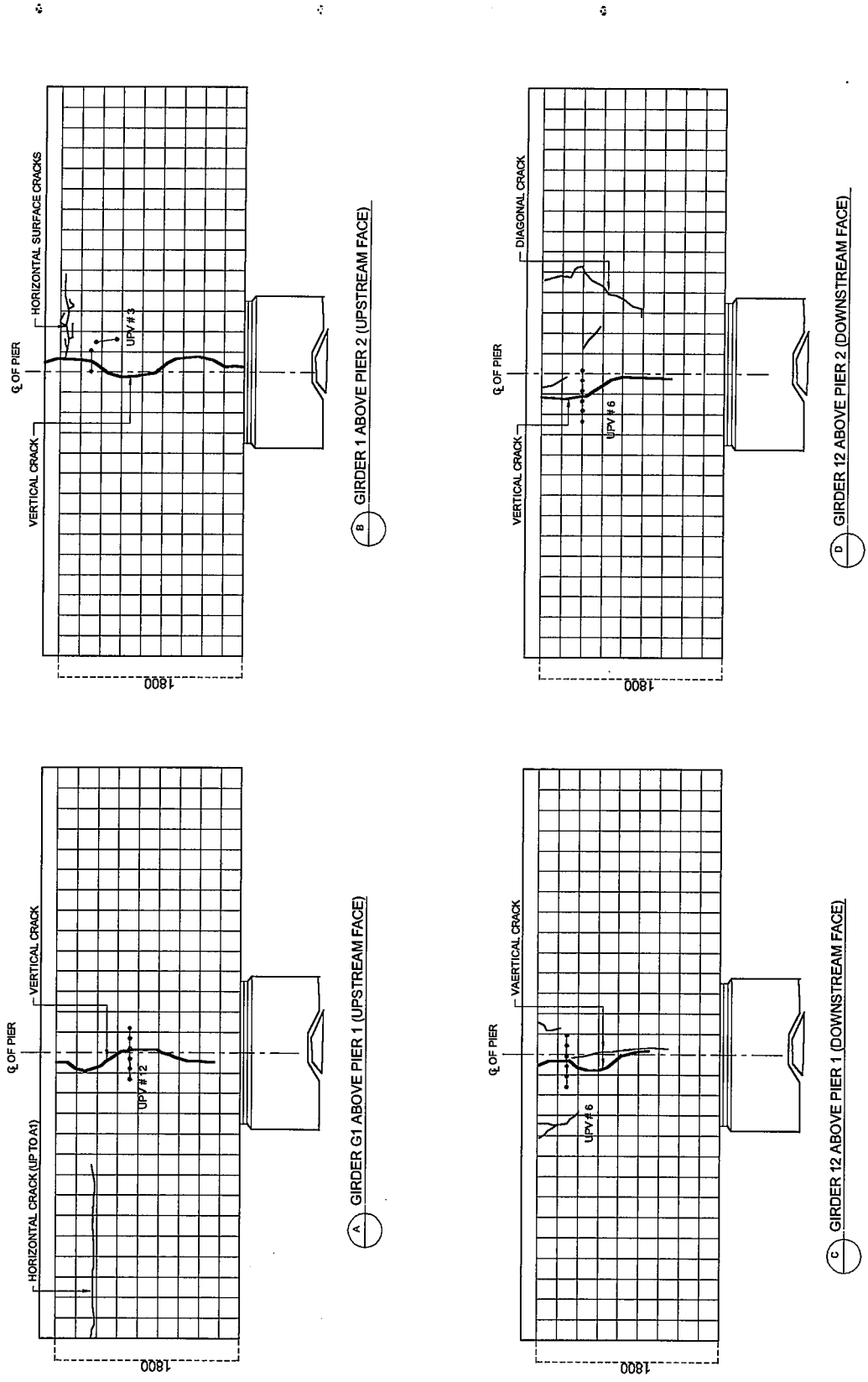
MAPPING OF DAMAGE ON BELOW DECK LEVEL



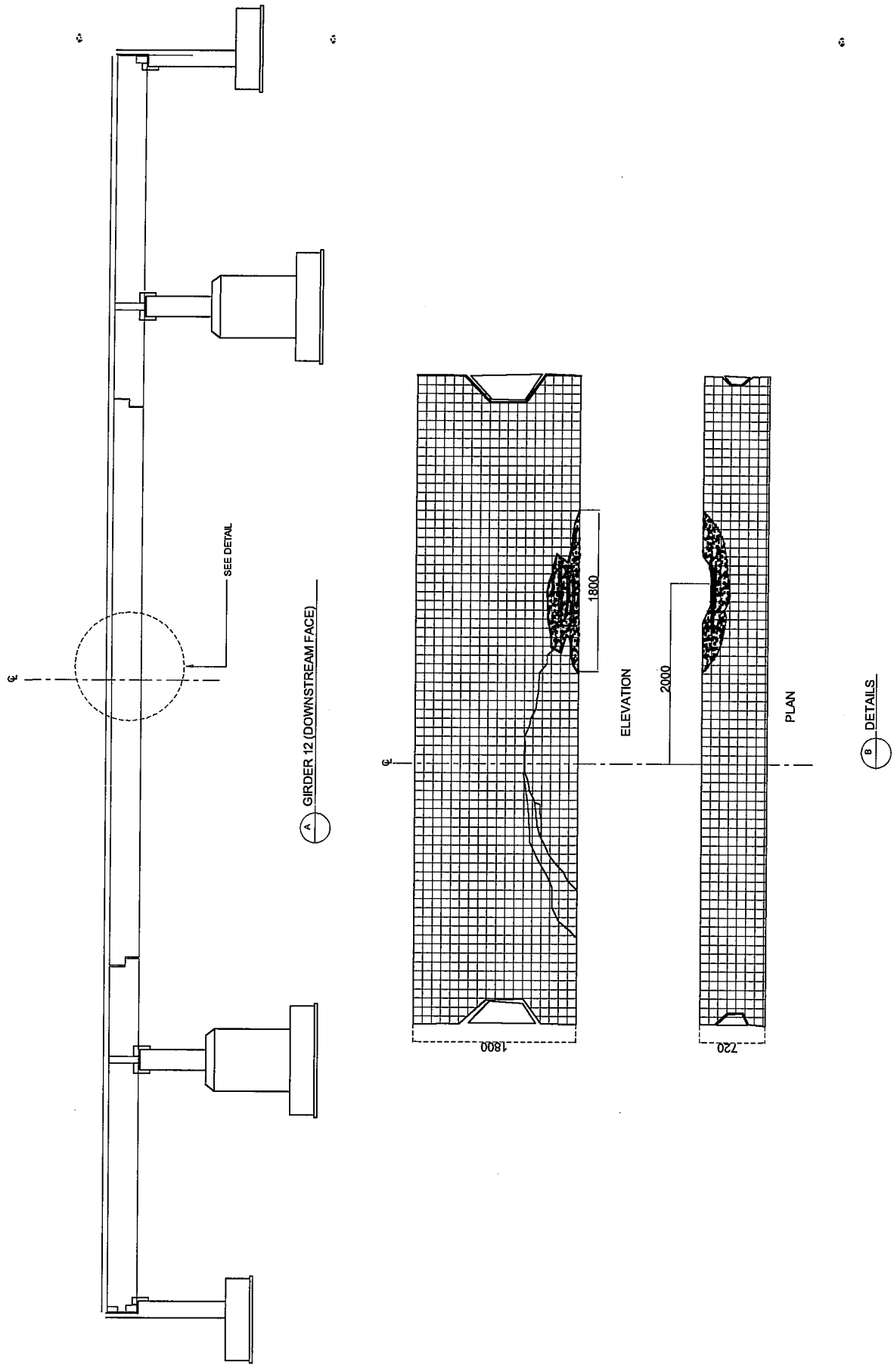
MAPPING OF DAMAGE ON GERBER HINGE AND ABOVE PIER



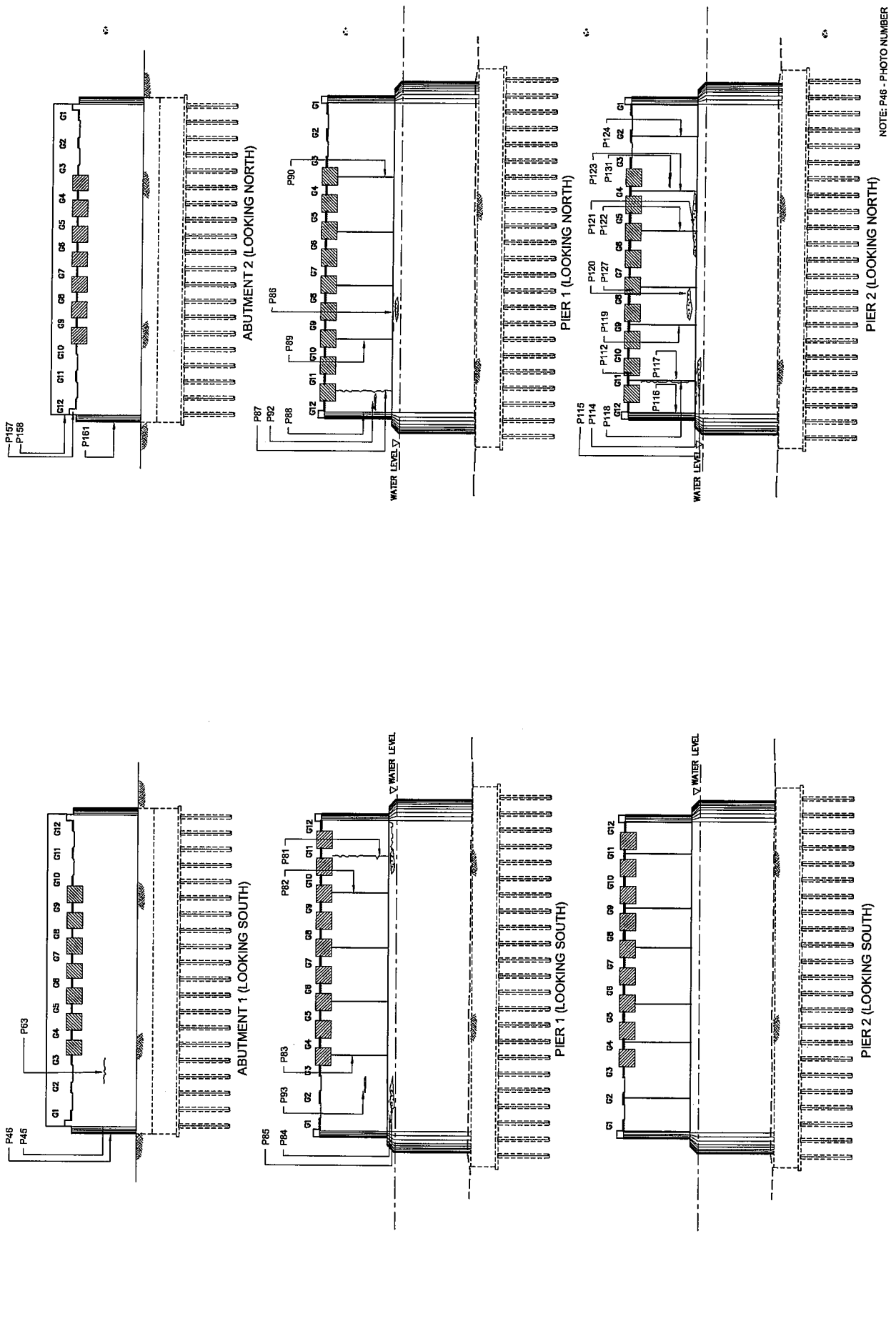
MAPPING OF DAMAGE ON BELOW DECK LEVEL (GERBER HINGE)



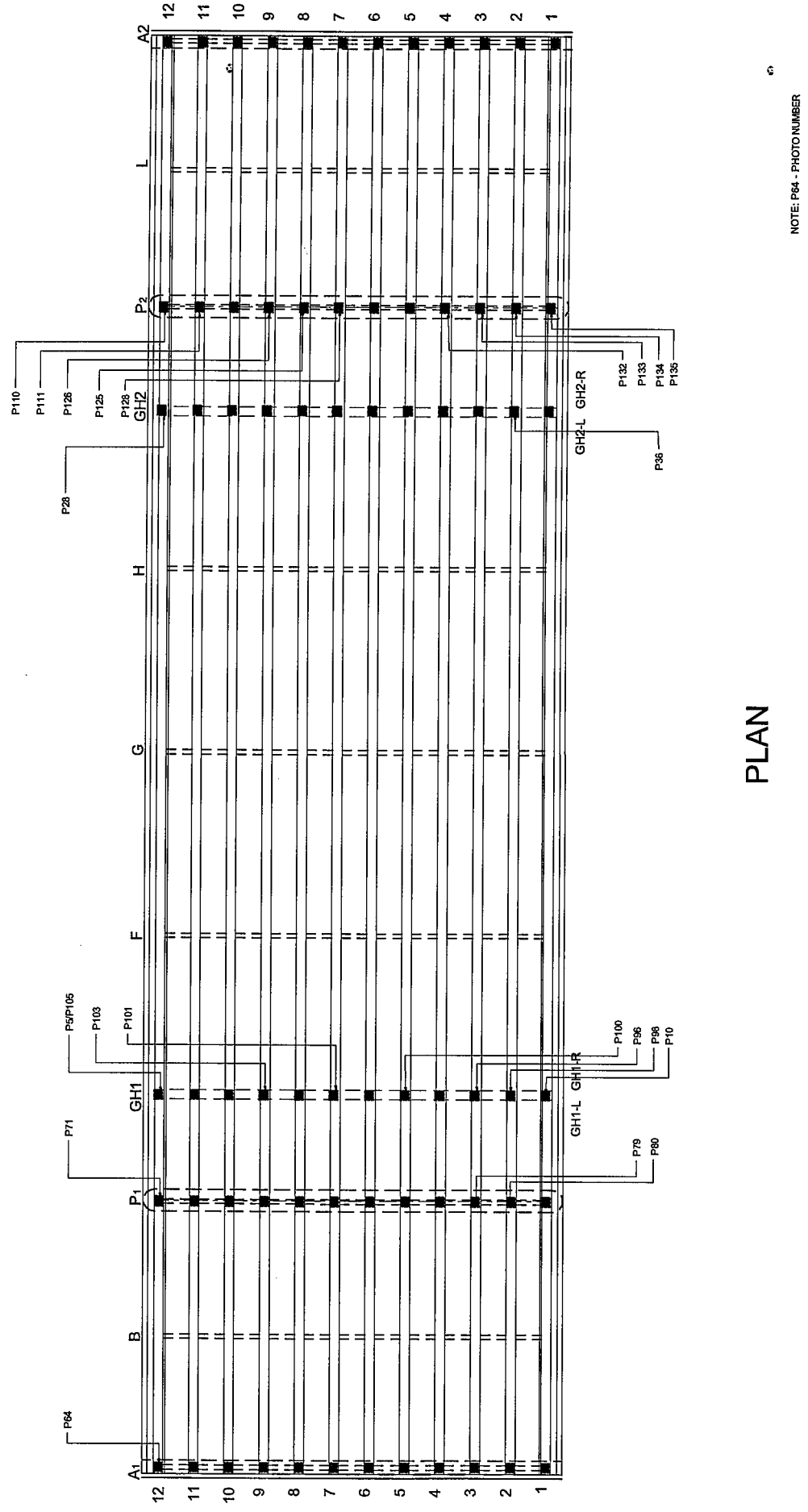
MAPPING OF DAMAGE ON BELOW DECK LEVEL (ABOVE PIER)



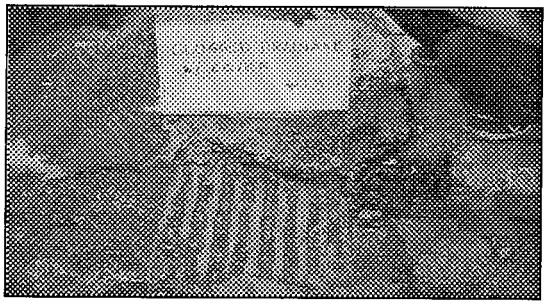
MAPPING OF DAMAGE ON BELOW DECK LEVEL (GIRDER G12 @ SPAN 2)



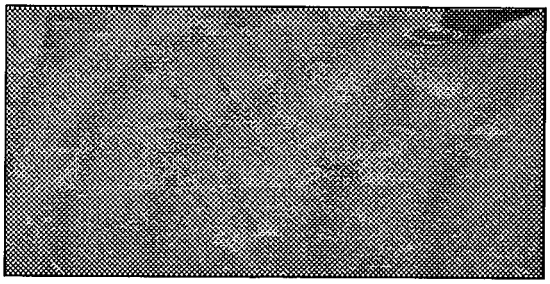
MAPPING OF DAMAGE ON SUBSTRUCTURE



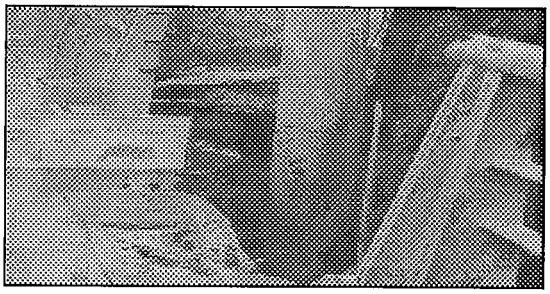
MAPPING OF DAMAGE ON SUBSTRUCTURE (BEARING PADS)



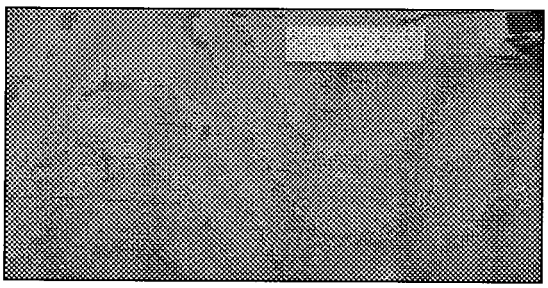
DAMAGE	TYPE	CLOGGED	
	EVALUATION	X	-
		Y	HIGH
		Z	-
	RATING	II	
	DAMAGE CONDITION	W/ COVER TYP. FOR 2DRAINAGE ON BOTH SIDES	
DRAINAGE INLET	VIEW	PHOTO FILENAME	
APPROACH SLAB RIGHT SIDE FACING NORTH	DOWN	P18'	



DAMAGE	TYPE	CRACK OF ASPHALT PAVEMENT	
	EVALUATION	X	-
		Y	LOW
		Z	-
	RATING	IV	
	DAMAGE CONDITION	t<5mm	
ASPHALT PAVEMENT	VIEW	PHOTO FILENAME	
APPROACH SLAB @ RIGHT SIDE FACING NORTH	NORTH	P21'	

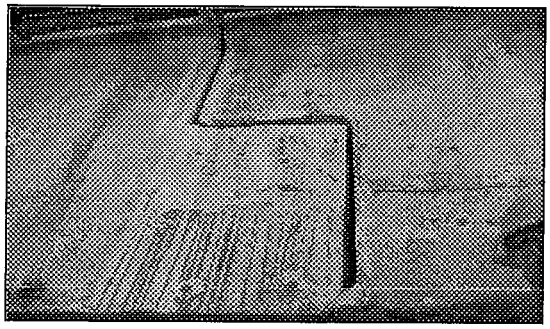


DAMAGE	TYPE	MISSING	
	EVALUATION	X	-
		Y	HIGH
		Z	-
	RATING	II	
	DAMAGE CONDITION	DUE TO VEHICLE COLLISION	
RAILING	VIEW	PHOTO FILENAME	
APPROACH SLAB @ RIGHT SIDE FACING NORTH	NORTH EAST	P19'	



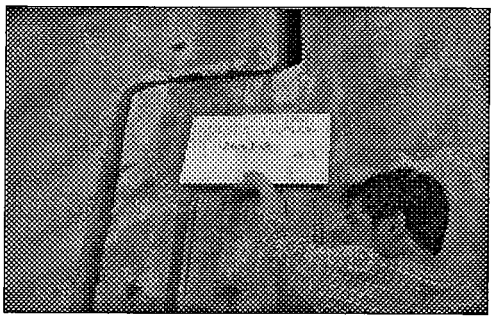
DAMAGE	TYPE	CRACK	
	EVALUATION	X	-
		Y	LOW
		Z	-
	RATING	IV	
	DAMAGE CONDITION	t<5mm AREA = 12sq.m.	
ASPHALT SURFACE	VIEW	PHOTO FILENAME	
APPROACH SLAB @ A1 (LEFT SIDE FACING NORTH)	NORTH	P34'	

DAMAGE	TYPE	POTHOLES	
	EVALUATION	X	-
		Y	LOW
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	AREA = 10sq.m. DIA.>350mm DEPTH = 40mm	
ASPHALT SURFACE	VIEW	PHOTO FILENAME	
APPROACH SLAB OF A1 (LEFT SIDE FACING NORTH)	SOUTH	P35'	

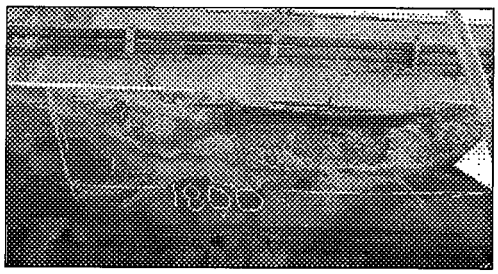


DAMAGE	TYPE	ABNORMAL JOINT GAP	
	EVALUATION	X	-
		Y	HIGH
		Z	-
	RATING	II	
	DAMAGE CONDITION	W=25-40mm REMARKABLE CONSTRICTED EXPANSION	
JOINT GAP	VIEW	PHOTO FILENAME	
G12, GERBER HINGE 2 L	UPSTREAM	P19	

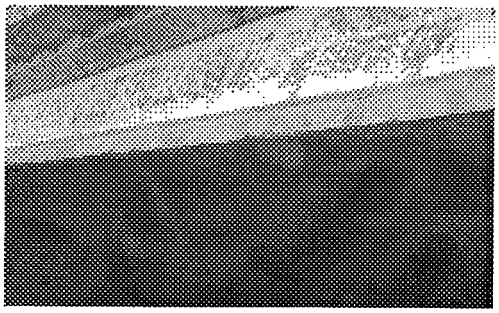
CLOSE-UP VISUAL INSPECTION OF DAMAGE (LAMBINGAN BRIDGE)



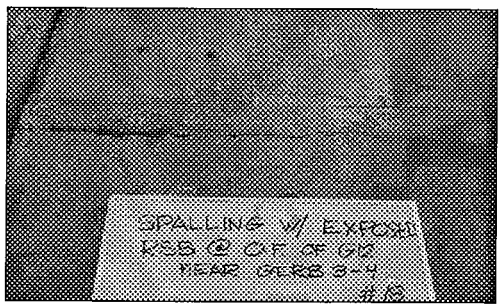
DAMAGE	TYPE	CRACKS	
	EVALUATION	X	HIGH
		Y	HIGH
		Z	LOW
	RATING	II	
	DAMAGE CONDITION	t=0.2mm,spacing=150 3CRAKCS ONLY HAIRLINE/SURFACE CRACKS NOT CRITICAL	
GERBER HINGE	VIEW	PHOTO FILENAME	
OUTSIDE FACE G12, GERBER HINGE 1 R	UPSTREAM	P3	



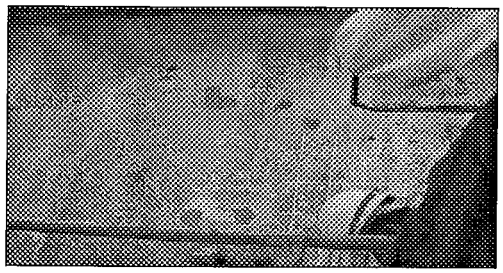
DAMAGE	TYPE	SPALLING WITH EXPOSED REBARS	
	EVALUATION	X	-
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	L=1800mm,W=400mm, A=0.72sq.m.	
GIRDER	VIEW	PHOTO FILENAME	
DOWNSTREAM FACE OF G12 @ CENTER OF SPAN 2	UPSTREAM	P27	



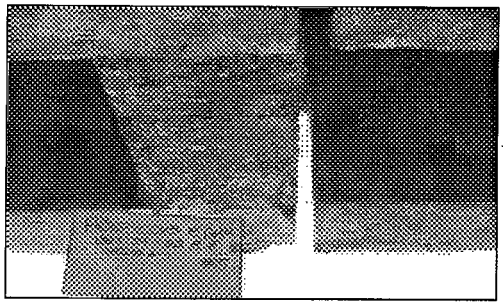
DAMAGE	TYPE	SPALLING	
	EVALUATION	X	-
		Y	LOW
		Z	LOW
	RATING	IV	
	DAMAGE CONDITION	L=100mm,w=100mm,A=0.01sq.m. TYP. FOR ALL GIRDERS @ SPAN 2 (due to vessel collision)	
BOTTOM FLANGE	VIEW	PHOTO FILENAME	
G1 @ CENTER OF SPAN 2	UP	P164	



DAMAGE	TYPE	SPALLING WITH EXPOSED REBAR	
	EVALUATION	X	-
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	DUE TO INSUFFICIENCY CONCRETE COVER,2.0x0.1=0.2sq.	
OUTSIDE FACE OF GIRDER @ END BLOCK	VIEW	PHOTO FILENAME	
G12 NEAR GERBER HINGE GH2	EAST	P18	

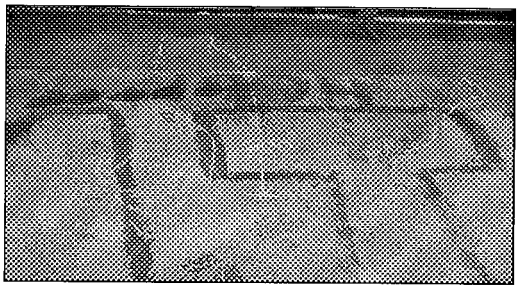


DAMAGE	TYPE	DIAGONAL CRACKS	
	EVALUATION	X	HIGH
		Y	HIGH
		Z	LOW
	RATING	II	
	DAMAGE CONDITION	t=0.2mm, SPACING > 500 cm	
OUTSIDE FACE OF GIRDER	VIEW	PHOTO FILENAME	
G12, GERBER HINGE GH2-L	UPSTREAM	P44	

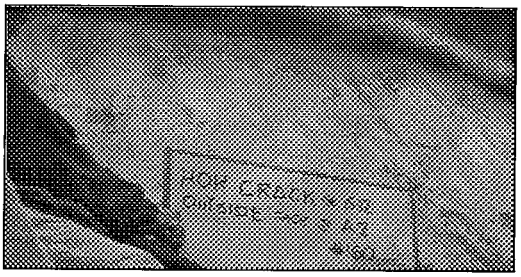


DAMAGE	TYPE	HONEYCOMB	
	EVALUATION	X	-
		Y	LOW
		Z	HIGH
	RATING	III	
	DAMAGE CONDITION	DUE TO CONSTRUCTION FAULTS A=0.78sq.m.	
BOTTOM OF DIAPHRAGM	VIEW	PHOTO FILENAME	
BETWEEN G1, G2 @ GERBER HINGE GH2-L	UP(UPSTREAM)	P15	

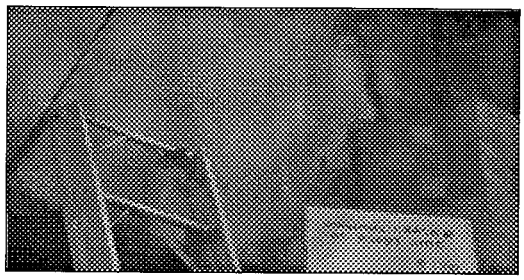
CLOSE-UP VISUAL INSPECTION OF DAMAGE (LAMBINGAN BRIDGE)



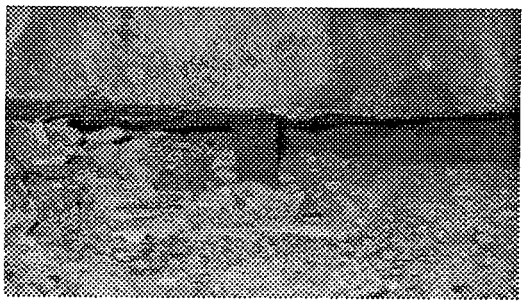
DAMAGE	TYPE	CRACK	
	EVALUATION	X	HIGH
		Y	MEDIUM
		Z	HIGH
	RATING	III	
	DAMAGE CONDITION	t = 0.15 mm, spacing + 200 mm	
GIRDER	VIEW	PHOTO FILENAME	
DOWNSTREAM FACE OF G12 @ PIER 2	UPSTREAM	P2'	



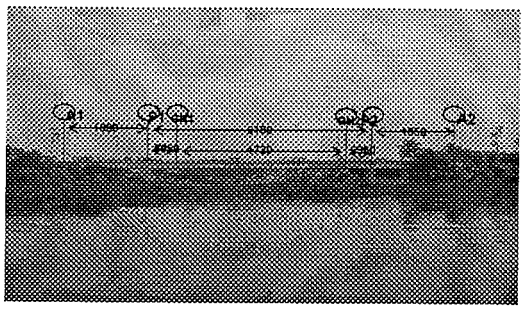
DAMAGE	TYPE	HORIZONTAL CRACKS	
	EVALUATION	X	HIGH
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	l=4300,t=2mm,d+<5 spacing = 150 mm	
GIRDER G12	VIEW	PHOTO FILENAME	
OUTSIDE FACE NEAR A2 (DUE TO ANCHORAGE)	EAST	P160	



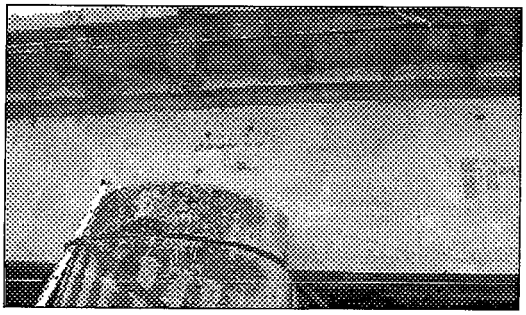
DAMAGE	TYPE	HORIZONTAL CRACKS	
	EVALUATION	X	HIGH
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	L=1000,t=0.5mm, spacing = 200 mm	
END BLOCK @ GIRDER	VIEW	PHOTO FILENAME	
G1 @ A2	EAST	P170	



DAMAGE	TYPE	CORROSION	
	EVALUATION	X	-
		Y	LOW
		Z	HIGH
	RATING	II	
	REMARKS	Surface rust. Scale shows entire diameter of anchor bars 2- ϕ36 bars/diaphragm	
UPLIFT DEVICE ANCHOR BAR	VIEW	PHOTO FILENAME	
DIAPHRAGM @ ABUTMENT A1 (TYP.)	SOUTH	P36b	

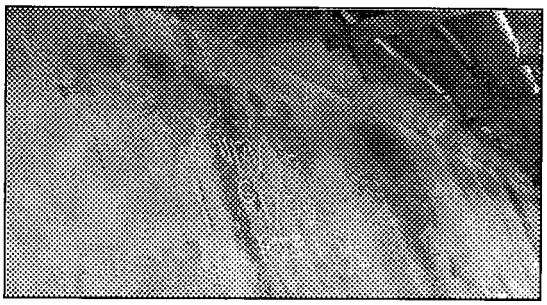


DAMAGE	TYPE	ABNORMAL DEFLECTION	
	EVALUATION	X	-
		Y	HIGH
		Z	-
	RATING	II	
	REMARKS	Deflection has occurred at outer span due to uplift at abutments	
SPAN PROPORTION INAPPROPRIATE	VIEW	PHOTO FILENAME	
SPAN S1 S2 S3	DOWNSTREAM	P7"	

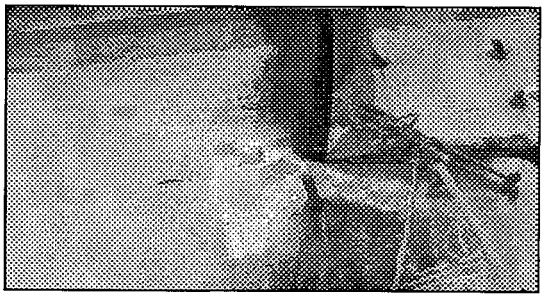


DAMAGE	TYPE	VERTICAL CRACK	
	EVALUATION	X	HIGH
		Y	HIGH
		Z	LOW
	RATING	II	
	DAMAGE CONDITION	L=1600mm,w=0.3mm,d=134mm N = 1 (UPV 12)	
ABOVE PIER	VIEW	PHOTO FILENAME	
GIRDER G1 @ PIER 1	DOWNSTREAM	P312	

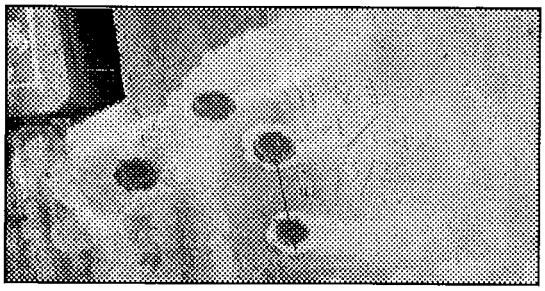
CLOSE-UP VISUAL INSPECTION OF DAMAGE (LAMBINGAN BRIDGE)



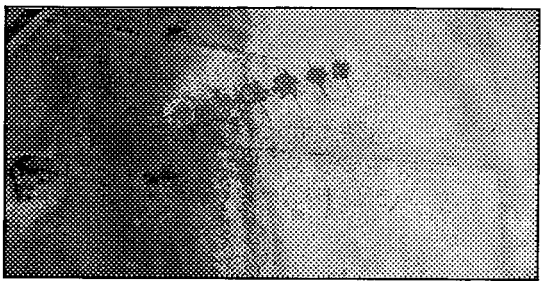
DAMAGE	TYPE	VERTICAL CRACK
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L=1200mm,w=0.4mm,d=180mm, N=1 (UPV 7)
ABOVE PIER	VIEW	PHOTO FILENAME
GIRDER G12 @ PIER 1	UPSTREAM	P307



DAMAGE	TYPE	DIAGONAL CRACK
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L+250mm,w+0.3mm,d=20mm, N=1 (UPV 11)
GERBER HINGE	VIEW	PHOTO FILENAME
GIRDER G1 @ GH1-L	DOWNSTREAM	P311



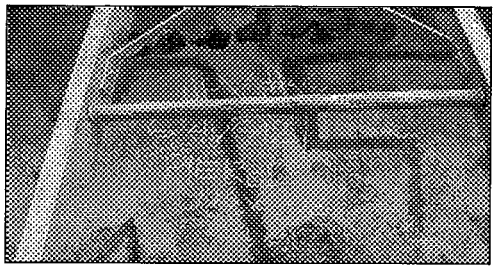
DAMAGE	TYPE	DIAGONAL
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L=280mm,w=0.2mm,d=91mm N=1 (UPV 8)
GERBER HINGE	VIEW	PHOTO FILENAME
GIRDER G12 @ GH1-R	UPSTREAM	P308



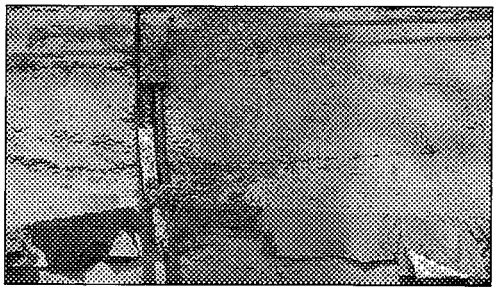
DAMAGE	TYPE	DIAGONAL CRACK
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L=400mm,w=0.215mm,d=64mm N=1 (UPV 5)
GERBER HINGE	VIEW	PHOTO FILENAME
GIRDER G1 @ GH2-R	DOWNSTREAM	P305

DAMAGE	TYPE	DIAGONAL CRACK
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L=350mm,w=0.2mm,d=56mm N=1 (UPV 1)
GERBER HINGE	VIEW	PHOTO FILENAME
GIRDER G12 @ GH2-L	UPSTREAM	P301

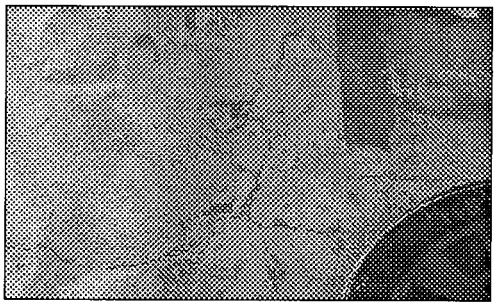
DAMAGE	TYPE	VERTICAL CRACK
	EVALUATION	X HIGH
		Y HIGH
		Z LOW
	RATING	II
	DAMAGE CONDITION	L=1200mm,w=0.15mm, d=29mm N=1 (UPV 6)
ABOVE PIER	VIEW	PHOTO FILENAME
GIRDER G12 @ P2	DOWNSTREAM	P303



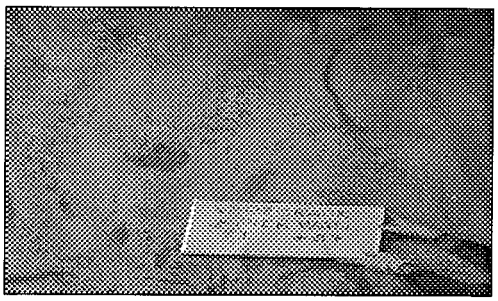
DAMAGE	TYPE	VERTICAL CRAK	
	EVALUATION	X	HIGH
		Y	MEDIUM
		Z	LOW
	RATING	II	
	DAMAGE CONDITION	L=1200mm,w=0.15mm, d=29mm N=1 (UPV 6)	
ABOVE PIER	VIEW	PHOTO FILENAME	
GIRDER G12 @ P2	DOWNSTREAM	P306	



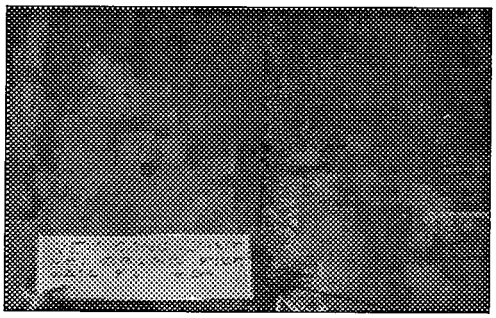
DAMAGE	TYPE	SPALLING WITH EXPOSED REBARS	
	EVALUATION	X	-
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	A=1.2sq.m., DUE TO INSUFFICIENT COVER TO STEEL BARS	
ABUTMENT WALL	VIEW	PHOTO FILENAME	
LEFT SIDE, ABUTMENT A1	WEST	P46	



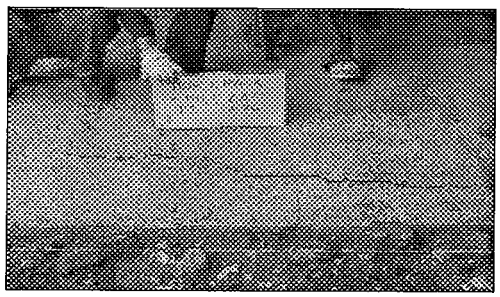
DAMAGE	TYPE	CRACKS	
	EVALUATION	X	LOW
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	t_{max}=1mm, spacing=200mmSURFACE CRACKS DUE TO SHRINKAGE & TEMPARATURE	
ABUTMENT WALL	VIEW	PHOTO FILENAME	
LEFT SIDE, ABUTMENT A1	SOUTH	P45	



DAMAGE	TYPE	VERTICAL CRACKS	
	EVALUATION	X	LOW
		Y	HIGH
		Z	HIGH
	RATING	II	
	DAMAGE CONDITION	L=TOP TO BOTTOM,t=0.533mm,d=10mm,spacing=3--mm(TYP. FROM G10-G12,N=NUMEROUS)	
PIER WALL	VIEW	PHOTO FILENAME	
PIER P1 BETWEEN G11-G12	NORTH	P87	

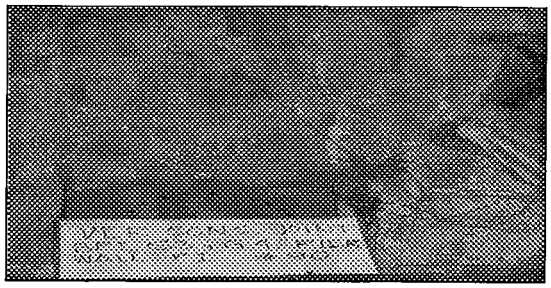


DAMAGE	TYPE	CRACK	
	EVALUATION	X	LOW
		Y	HIGH
		Z	LOW
	RATING	III	
	DAMAGE CONDITION	VERTICAL CONSTRUCTION JOINT (L=4800,t=10(max.),d=(THROUGH),spacing>500mm	
PIER WALL (P1)	VIEW	PHOTO FILENAME	
BETWEEN G9-G10	MORTH	P89	



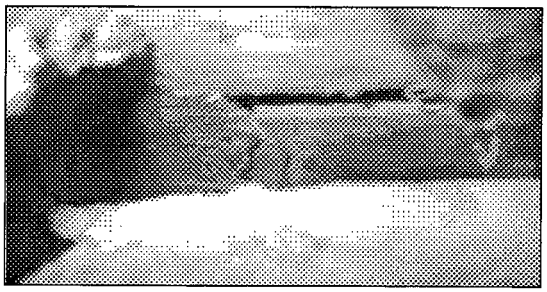
DAMAGE	TYPE	CRACK	
	EVALUATION	X	LOW
		Y	HIGH
		Z	LOW
	RATING	III	
	DAMAGE CONDITION	L=4000,t=5(MAX.),d>90,spacing>1000mm	
PILE CAP	VIEW	PHOTO FILENAME	
PIER 1	NORTH	P86	

CLOSE-UP VISUAL INSPECTION OF DAMAGE (LAMBINGAN BRIDGE)



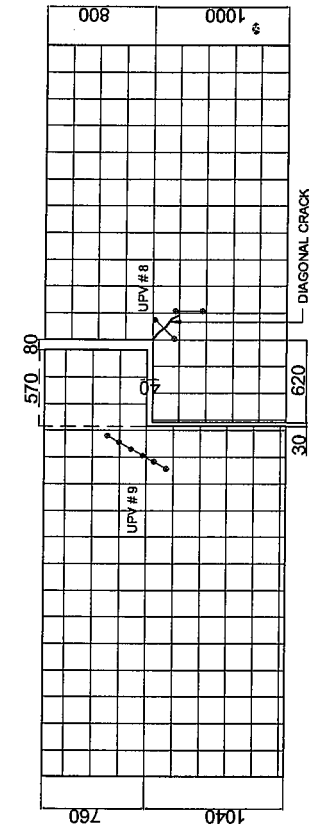
DAMAGE	TYPE	CRACK	
	EVALUATION	X	LOW
		Y	HIGH
		Z	LOW
	RATING	III	
	DAMAGE CONDITION	VERTICAL CONSTRUCTION JOINT, L=4800mm, t=5mm	
PIER WALL (P1)	VIEW	PHOTO FILENAME	
BETWEEN G3-G4	NORTH	P90	

DAMAGE	TYPE	MOVEMENT	
	EVALUATION	X	-
		Y	HIGH
		Z	-
	RATING	II	
	DAMAGE CONDITION	ABNORMAL MOVEMENT OF BEARING	
BEARING PAD	VIEW	PHOTO FILENAME	
OUTSIDE FACE G1, GERBER HINGE 1	WEST	P10	

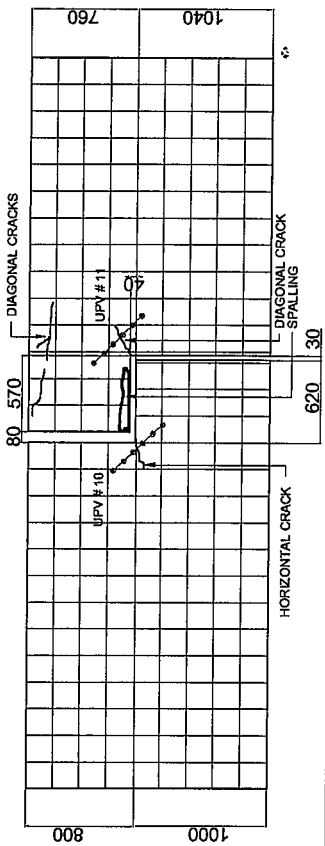


DAMAGE	TYPE	MISSING	
	EVALUATION	X	-
		Y	LOW
		Z	-
	RATING	III	
	DAMAGE CONDITION	ABNORMAL MOVEMENT OF BEARING	
BEARING PAD	VIEW	PHOTO FILENAME	
GIRDER G2 @ GERBER HIMGE 1		P98	

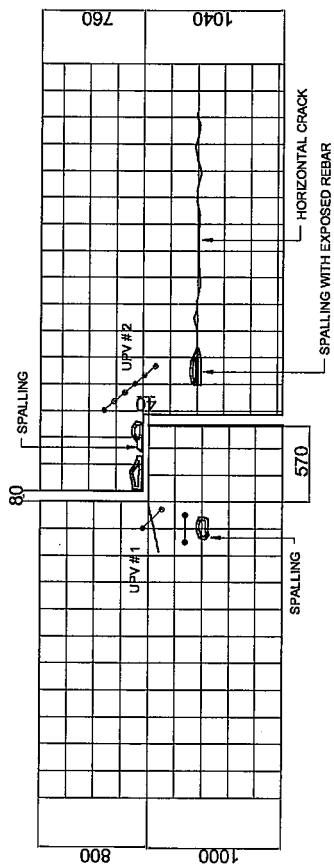
CLOSE-UP VISUAL INSPECTION OF DAMAGE (LAMBINGAN BRIDGE)



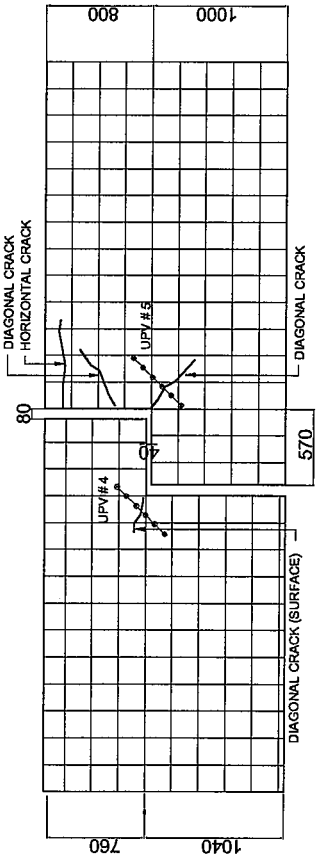
TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 8	GH1-L, G12	DS	DIAGONAL	91	0.2	280
UPV # 9	GH1-R, G12	DS	NONE EVIDENT	-	-	-



TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 10	GH1-L, G1	US	HORIZONTAL	20	0.15	200
UPV # 11	GH1-R, G1	US	DIAGONAL	20	0.15	250



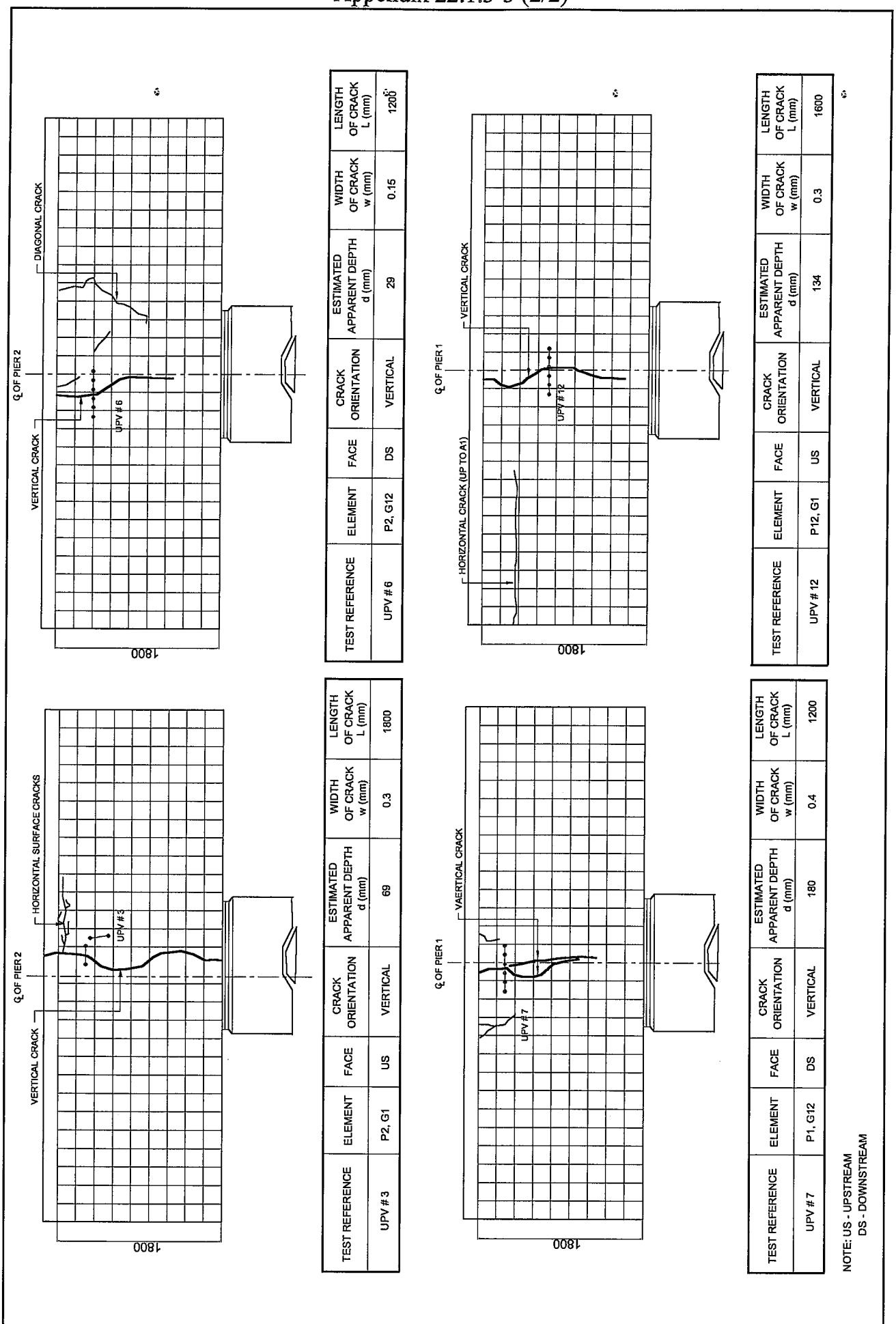
TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 1	GH2-R, G12	DS	DIAGONAL	56	0.2	350
UPV # 2	GH2-L, G12	DS	NONE EVIDENT	-	-	-



TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 4	GH2-L, G1	US	DIAGONAL	22	0.1	200
UPV # 5	GH2-R, G1	US	DIAGONAL	64	0.25	400

NOTE: US - UPSTREAM
DS - DOWNSTREAM

SUMMARY OF RESULTS FOR UPV OF GERBER HINGE



TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 6	P2, G12	DS	VERTICAL	29	0.15	1200

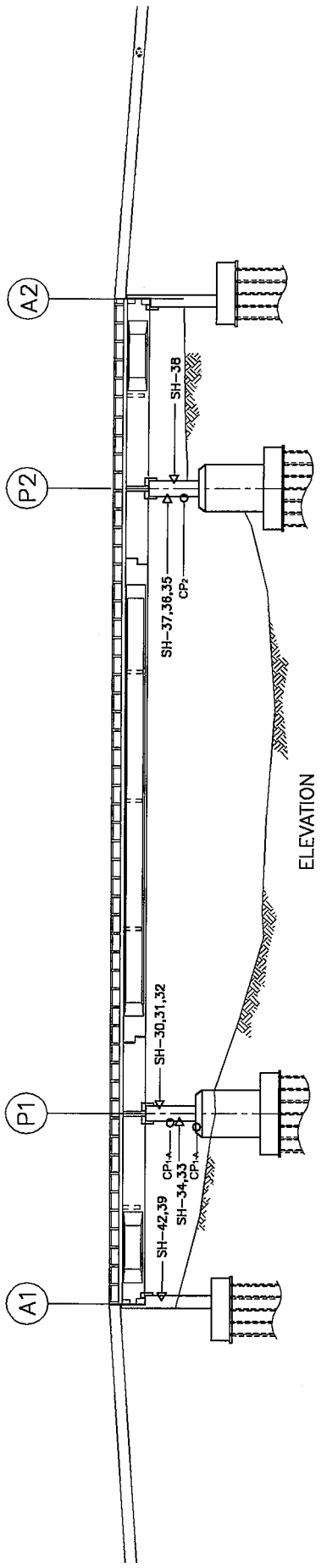
TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 12	P12, G1	US	VERTICAL	134	0.3	1600

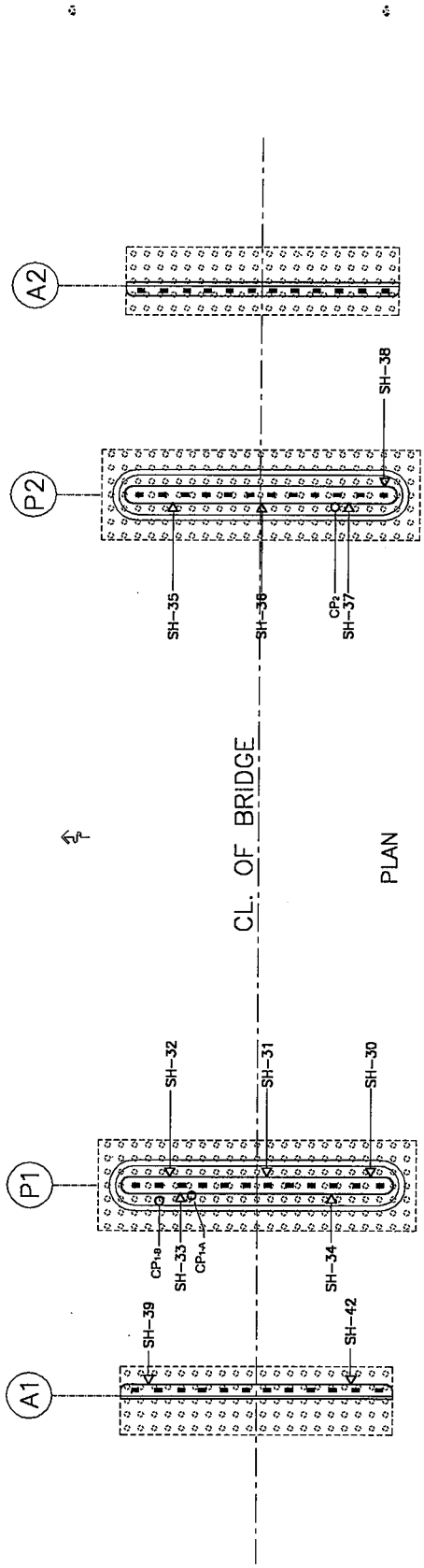
TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 3	P2, G1	US	VERTICAL	69	0.3	1800

TEST REFERENCE	ELEMENT	FACE	CRACK ORIENTATION	ESTIMATED APPARENT DEPTH d (mm)	WIDTH OF CRACK w (mm)	LENGTH OF CRACK L (mm)
UPV # 7	P1, G12	DS	VERTICAL	180	0.4	1200

NOTE: US - UPSTREAM
DS - DOWNSTREAM

SUMMARY OF RESULTS FOR UPV ABOVE PIER





LABORATORY TEST ON CONCRETE SAMPLE

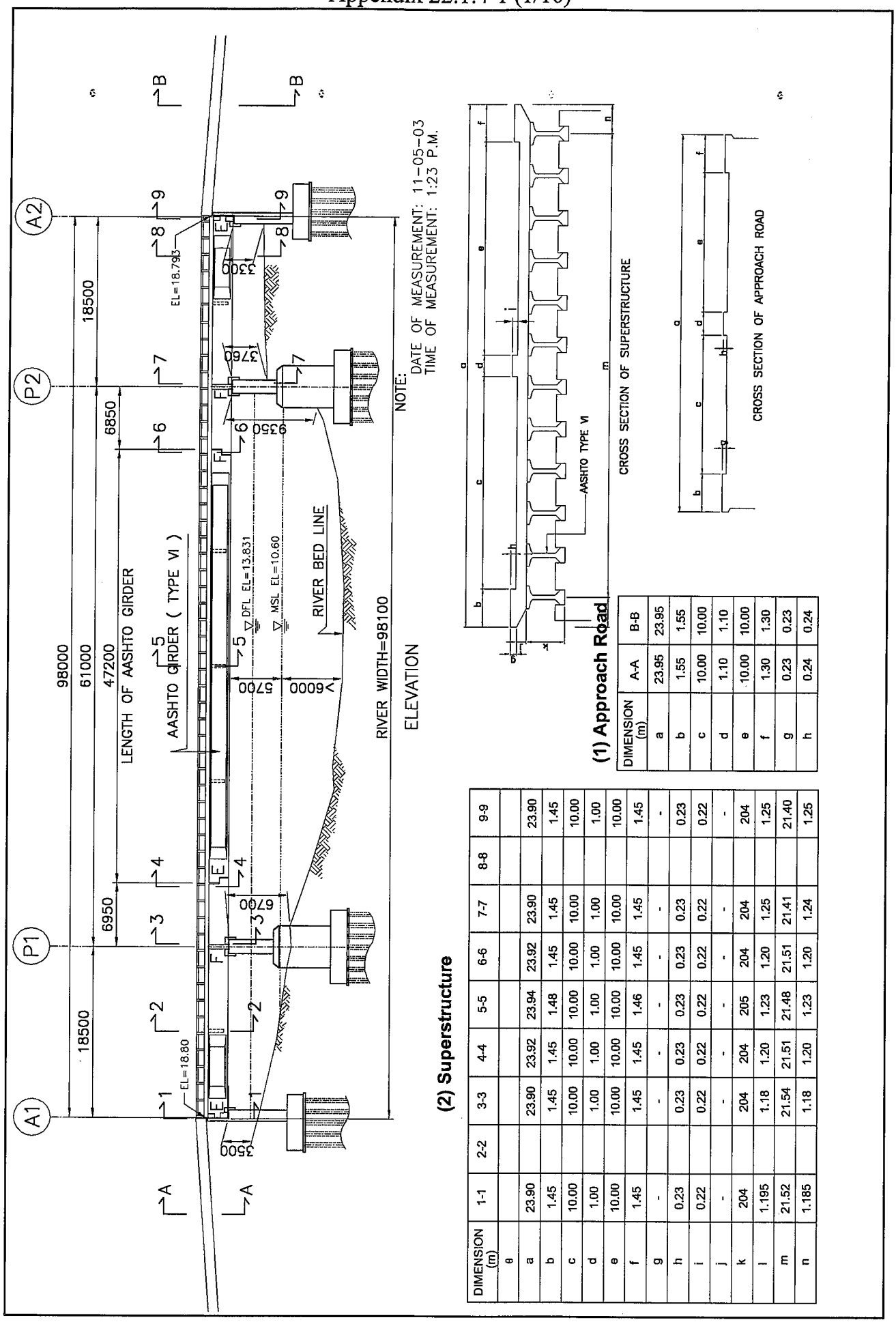
	TEST LOCATION		
	CP_{1-A}	CP_{1-B}	CP_2
COMPRESSIVE STRENGTH (MPa)	20.2	17.8	22.6
ALKALI-SILICA REACTION (PETROGRAPHIC ANALYSIS)	QUITE STRONG	QUITE STRONG	NEGLIGIBLE
CHLORIDE CONTENT (CHLORIDE TEST)	NONE	NONE	NONE
CARBONATION DEPTH (mm) (PHENOLPTHALEIN TEST)	0	0	13
CORE LENGTH (mm) ORIENTATION[3]	350 h	380 v	390 h

IN-SITU NON-DESTRUCTIVE TEST OF CONCRETE

	TEST LOCATION												
	SH-42	SH-39	SH-34	SH-33	SH-30	SH-31	SH-32	SH-37	SH-36	SH-35	SH-38	SH-16	
HAMMER ORIENTATION[1]	H	H	H	H	H	H	H	H	H	H	H	H	H
REBOUND NUMBER, R	39	37	28	26	34	31	33	36	25	28	32	39	h
CALIBRATED COMPRESSIVE STRENGTH[2] kg/cm²	312	288	168	144	248	208	232	272	136	168	216	390	

1 H - HORIZONTAL
2 CALIBRATED CUBE COMPRESSIVE STRENGTH AT THE SURFACE CONCRETE.
3 h - HORIZONTAL v - VERTICAL
O LOCATION OF IN-SITU AND LABORATORY TEST
Δ LOCATION OF HAMMER TEST

SUMMARY OF NON-DESTRUCTIVE RESULTS FOR SUBSTRUCTURE



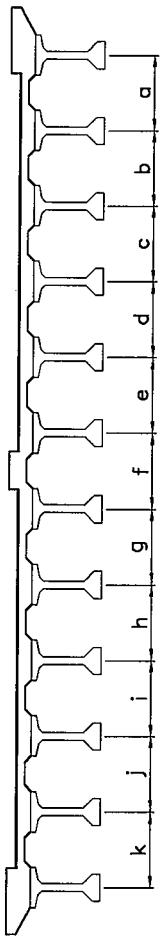
(1) Approach Road

DIMENSION (m)	A-A	B-B
a	23.95	23.95
b	1.55	1.55
c	10.00	10.00
d	1.10	1.10
e	10.00	10.00
f	1.30	1.30
g	0.23	0.23
h	0.24	0.24

(2) Superstructure

DIMENSION (m)	1-1	2-2	3-3	4-4	5-5	6-6	7-7	8-8	9-9
θ									
a	23.90		23.90	23.92	23.94	23.92	23.90		23.90
b	1.45		1.45	1.45	1.48	1.45	1.45		1.45
c	10.00		10.00	10.00	10.00	10.00	10.00		10.00
d	1.00		1.00	1.00	1.00	1.00	1.00		1.00
e	10.00		10.00	10.00	10.00	10.00	10.00		10.00
f	1.45		1.45	1.45	1.46	1.45	1.45		1.45
g	-		-	-	-	-	-		-
h	0.23		0.23	0.23	0.23	0.23	0.23		0.23
i	0.22		0.22	0.22	0.22	0.22	0.22		0.22
j	-		-	-	-	-	-		-
k	204		204	204	205	204	204		204
l	1.195		1.18	1.20	1.23	1.20	1.25		1.25
m	21.52		21.54	21.51	21.48	21.51	21.41		21.40
n	1.185		1.18	1.20	1.23	1.20	1.24		1.25

SHAPES AND DIMENSIONS
ROAD DECK AND APPROACH ROAD



CROSS SECTION A-A

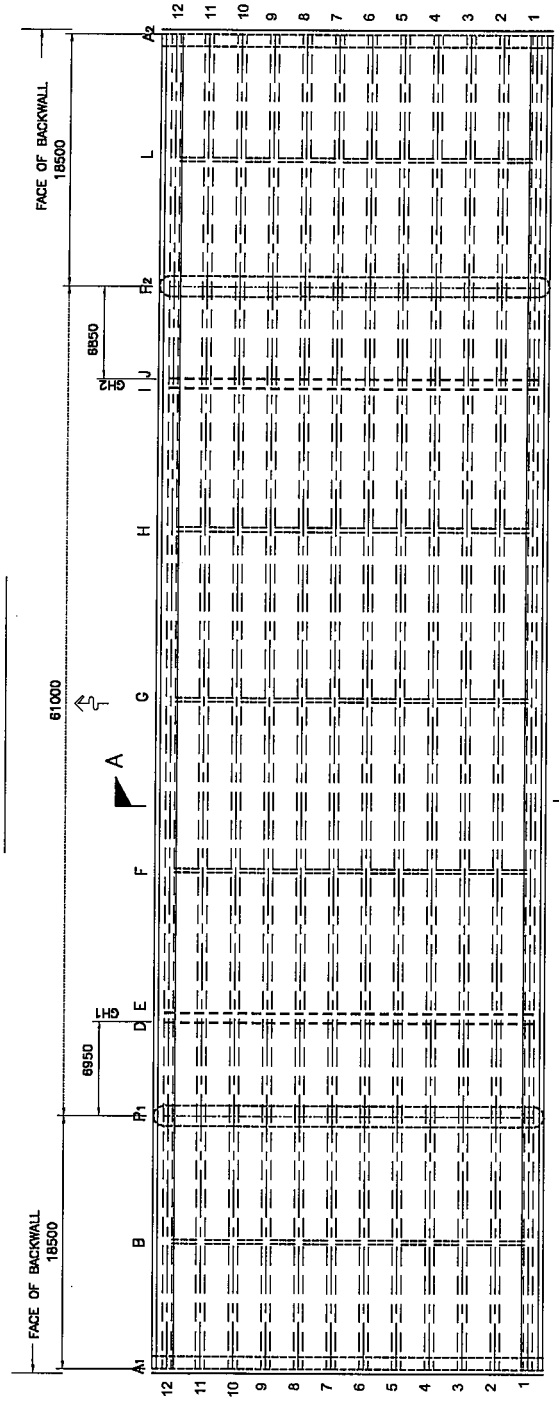
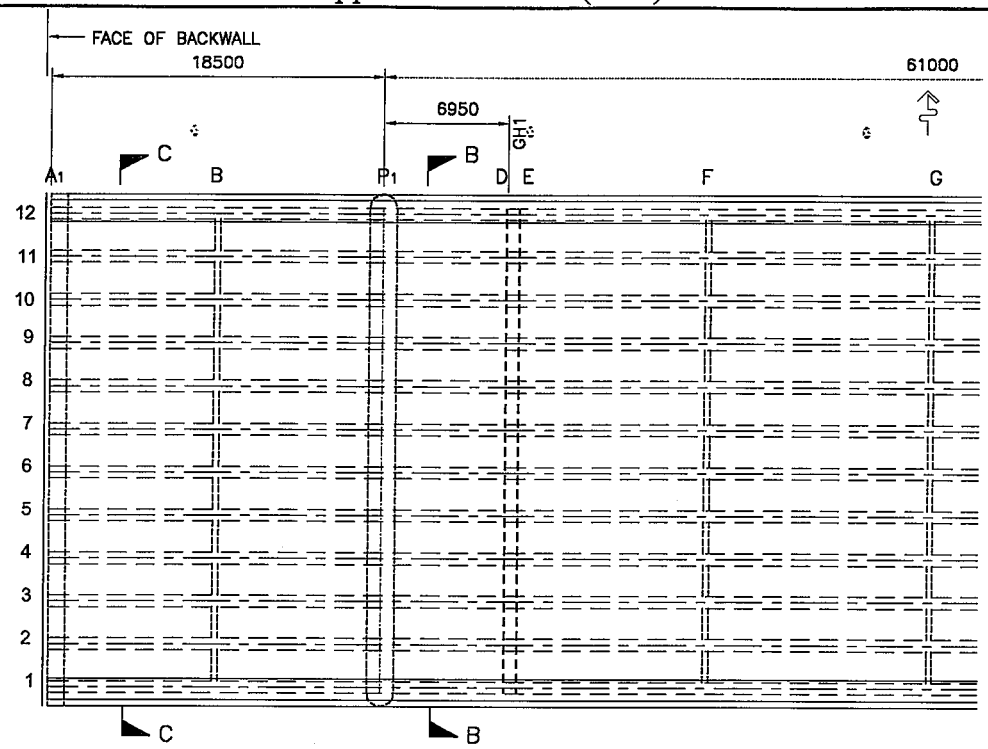
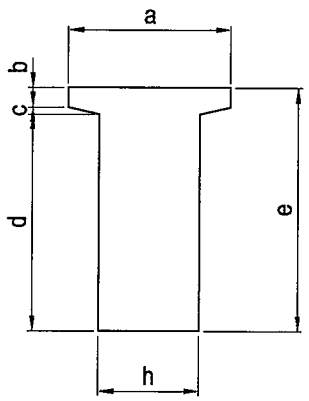


TABLE OF GIRDER SPACING

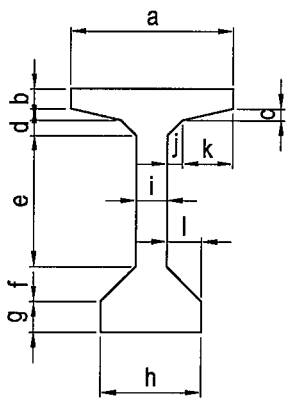
GRID	DIMENSION (cm)											
	k	j	i	h	g	f	e	d	c	b	a
A	202	203	184	193	194	186	194	193	193	204	206
B	203	203	184	194	194	187	193	193	193	204	206
C	200	198	188	195	193	189	195	188	189	204	202
D	200	199	187	194	194	188	195	188	189	204	202

SHAPES AND DIMENSIONS
BELOW ROAD DECK - GIRDER SPACING





CROSS SECTION B-B

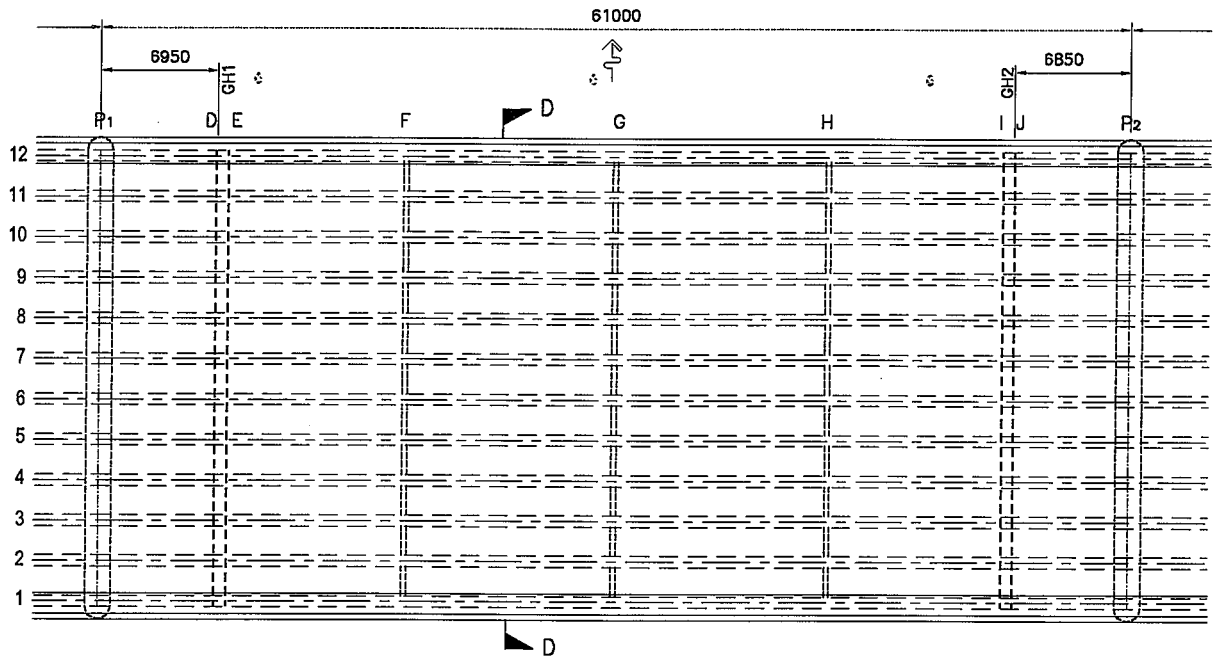


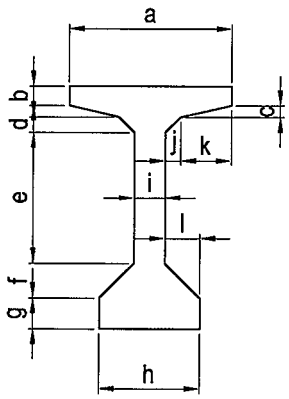
CROSS SECTION C-C

TABLE OF CANTILEVER GIRDER (SECTION B-B)

GIRDER	DIMENSION (cm)											
	a	b	c	d	e	f	g	h	i	j	k	l
12	107	13	12	179	204			72				
11	107	13	11	180	204			72				
10	107	13	13	180	206			72				
9	107	11	10	187	208			72				
8	107	11	10	187	208			72				
7	107	11	10	187	208			72				
6	107	11	10	186	207			72				
5	107	12	10	187	209			72				
4	107	12	11	186	209			72				
3	107	13	11	180	204			72				
2	107	13	11	180	204			72				
1	107	13	11	180	204			72				

SHAPES AND DIMENSIONS
BELOW ROAD DECK, CANTILEVER GIRDER (SOUTH)

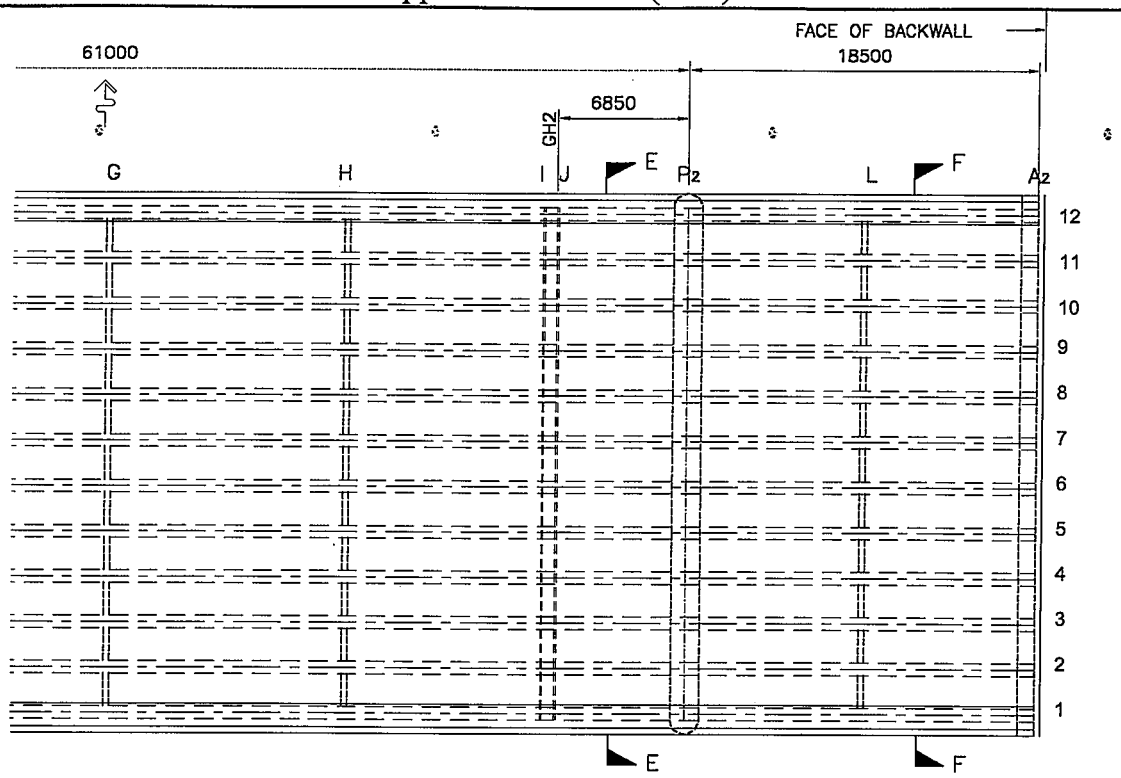


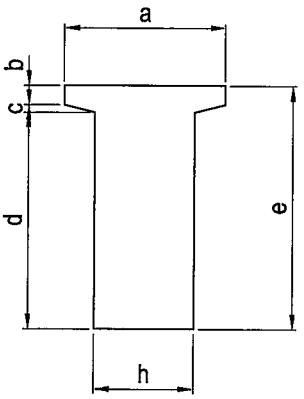


CROSS SECTION D-D

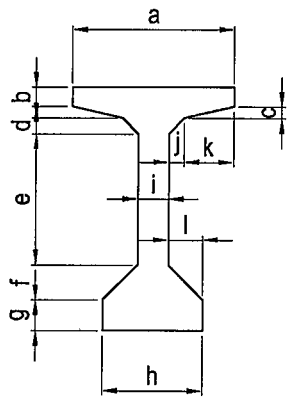
TABLE OF SUSPENDED GIRDER (SECTION D-D)

GIRDER	DIMENSION (cm)											
	a	b	c	d	e	f	g	h	i	j	k	l
12	107	12	7	11	127	27	21	72	20.30	10	33	26
11	107	12	7	11	127	26	21	72	20.30	10	33	26
10	107	10	7	11	127	26	21	72	20.30	10	33	26
9	107	10	7	10	127	26	21	72	20.30	10	33	26
8	107	10	7	10	127	27	21	72	20.30	10	33	26
7	107	10	7	10	127	26	21	72	20.30	10	33	26
6	107	10	7	10	126	26	21	72	20.30	10	33	26
5	107	11	7	10	127	26	20	72	20.30	10	33	26
4	107	11	7	11	126	27	21	72	20.30	10	33	26
3	107	12	7	12	127	26	21	72	20.30	10	33	26
2	107	12	7	11	126	26	21	72	20.30	10	33	26
1	107	12	7	11	127	27	21	72	20.30	10	33	26





CROSS SECTION E-E



CROSS SECTION F-F

TABLE OF CANTILEVER GIRDER (SECTION E-E)

GIRDER	DIMENSION (cm)											
	a	b	c	d	e	f	g	h	i	j	k	l
12	107	17	11	180	208			72				
11	107	17	11	180	208			72				
10	107	17	11	180	208			73				
9	107	12	6	186	204			72				
8	107	12	5	187	204			72				
7	107	12	5	187	204			72				
6	107	12	5	187	204			72				
5	107	14	5	187	206			72				
4	107	14	10	182	206			71				
3	107	17	11	180	208			72				
2	107	16	11	180	207			72				
1	107	17	11	180	208			72				

SHAPES AND DIMENSIONS
BELOW ROAD DECK - CANTILEVER GIRDER (NORTH)

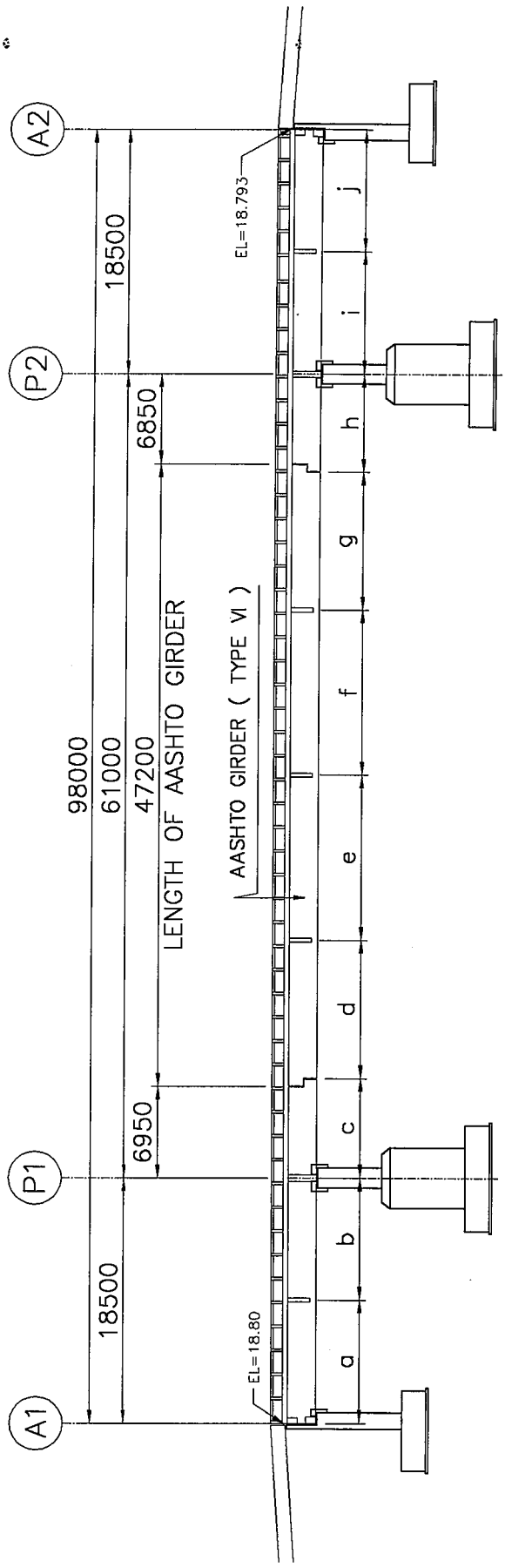
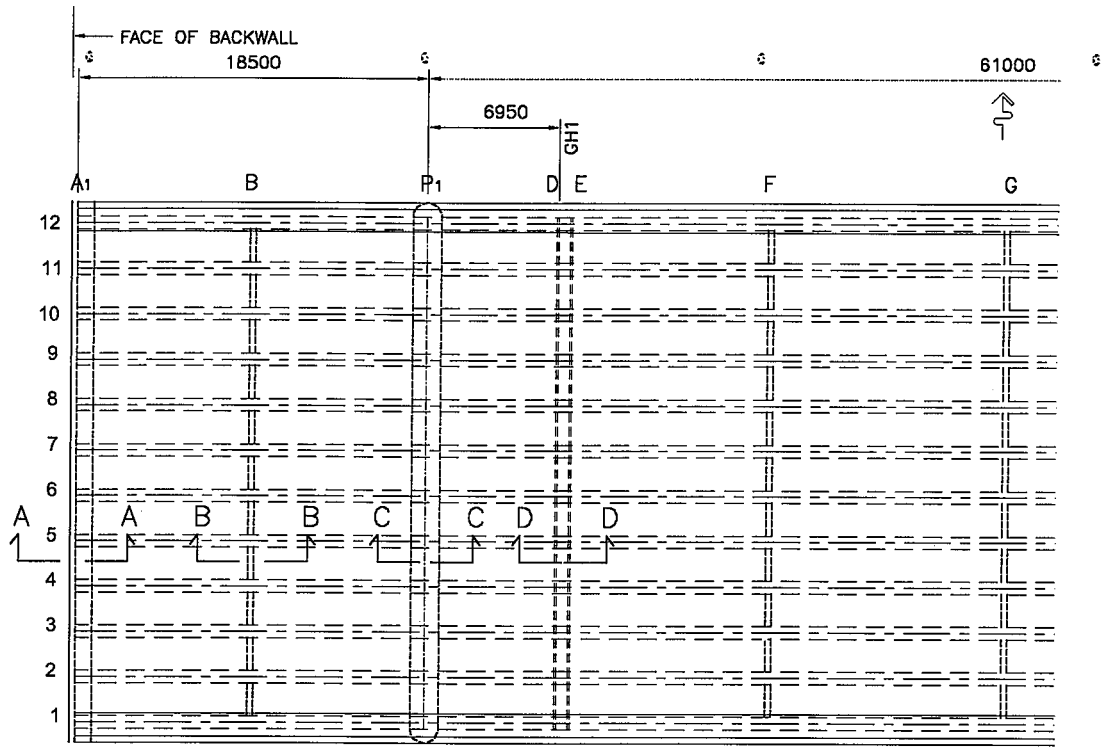
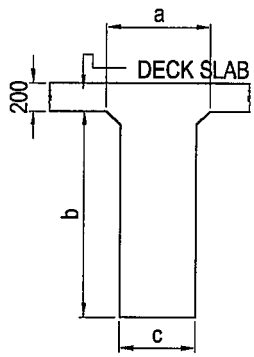


TABLE OF DIAPHRAGM SPACING

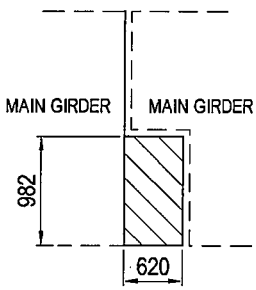
	DIMENSION (mm)
a	9300
b	9200
c	7560
d	10500
e	12500
f	12510
g	10470
h	7460
i	9300
j	9200

SHAPES AND DIMENSIONS
BELOW ROAD DECK - DIAPHRAGM SPACING





CROSS SECTION A-A TO C-C

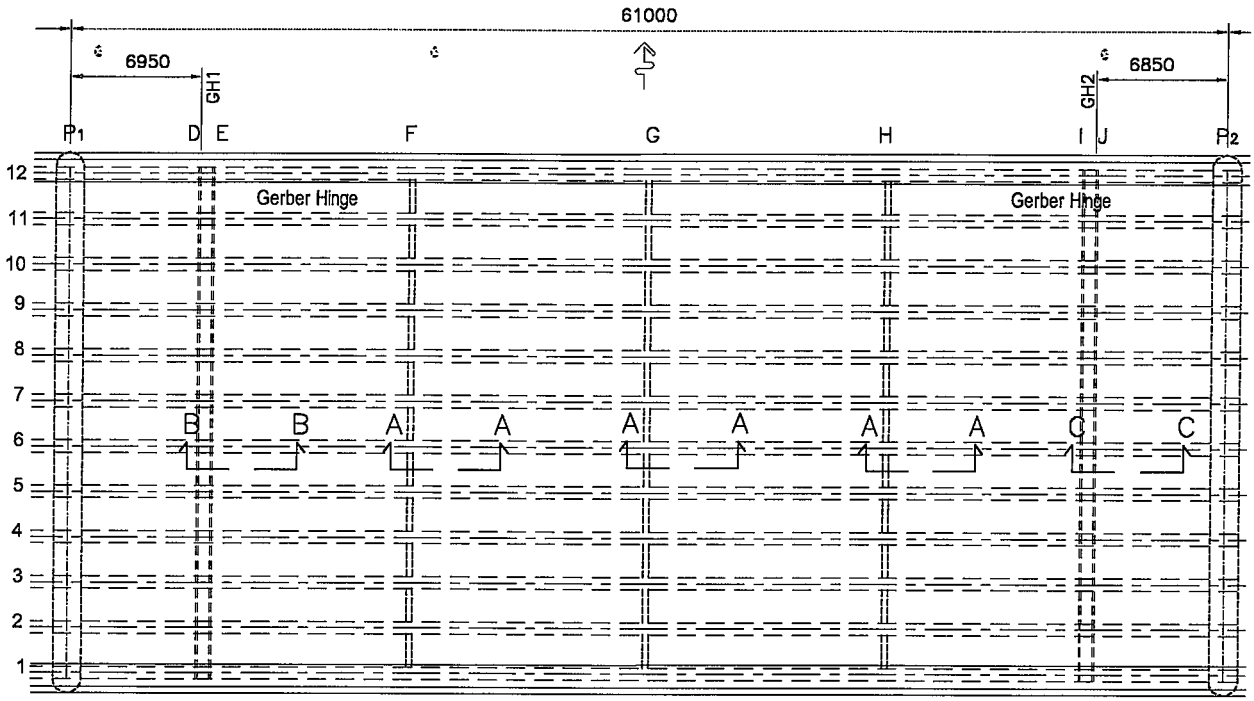


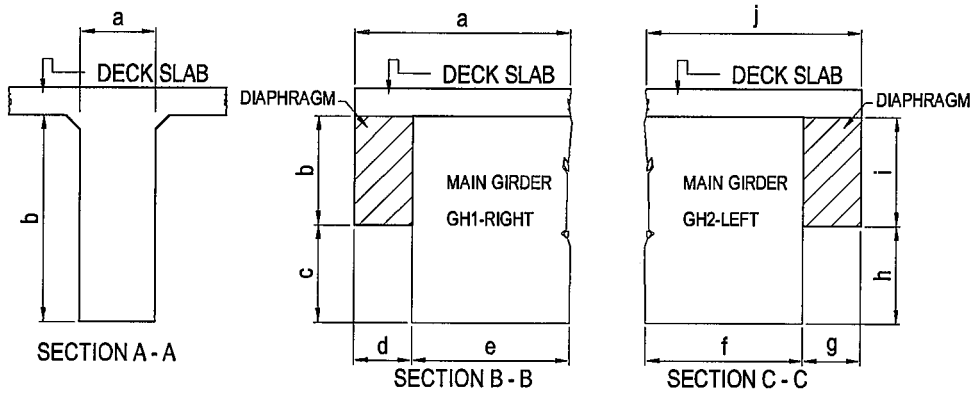
CROSS SECTION D-D

SECTION	GRID	DIMENSION (mm)		
		a	b	c
A - A	A_1	410	2060	410
B - B	B	310	1530	310
C - C	P_1	500	2060	500
D - D	D	-	-	-

GERBER HINGE GH1-LEFT (DIAPHRAGM 1)

SHAPES AND DIMENSIONS
BELOW ROAD DECK - GIRDER HINGE (G1)

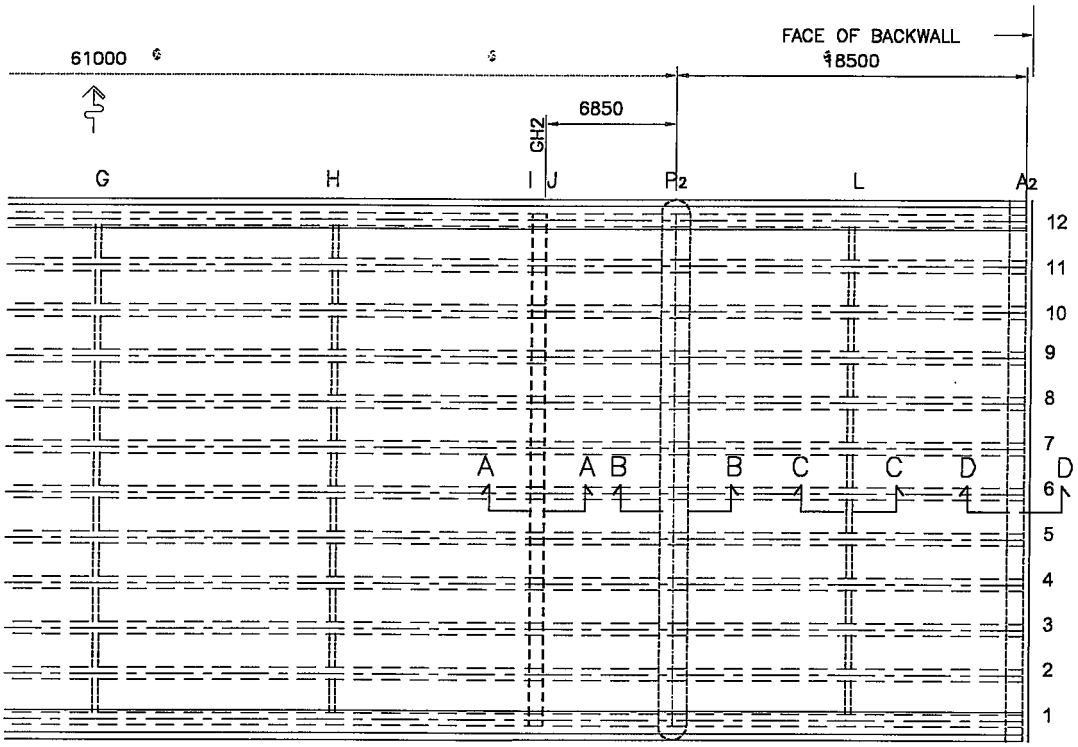


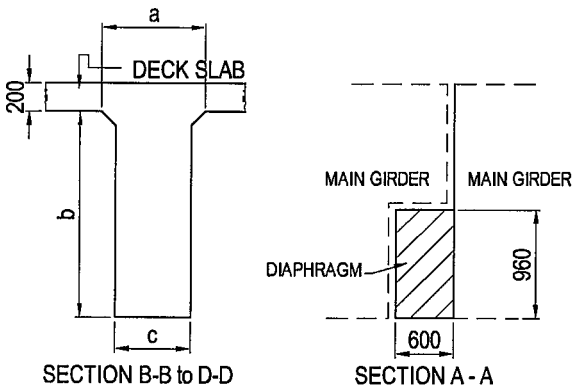


SECTION	GRID	DIMENSION (mm)									
		a	b	c	d	e	f	g	h	i	j
B - B	E	615	1000	-	615	-	-	-	-	-	-
A - A	F	310	1700	-	-	-	-	-	-	-	-
A - A	G	310	1700	-	-	-	-	-	-	-	-
A - A	H	310	1700	-	-	-	-	-	-	-	-
C - C	I	-	-	-	-	-	-	530	-	1075	530

GERBER HINGE GH1, GH2 (DIAPHRAGM 2)

SHAPES AND DIMENSIONS
BELOW ROAD DECK - GIRDER HINGE (G2, G3)

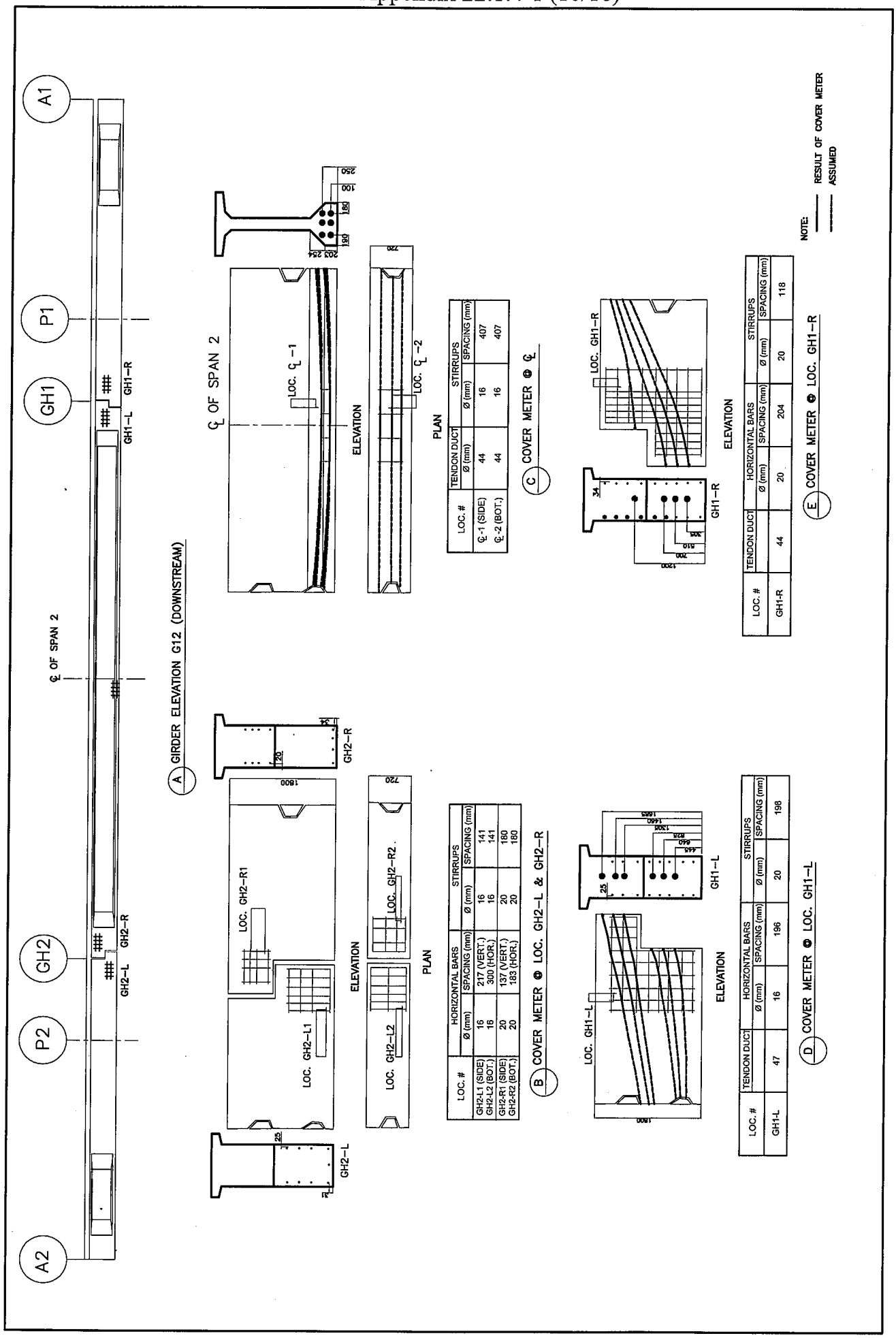




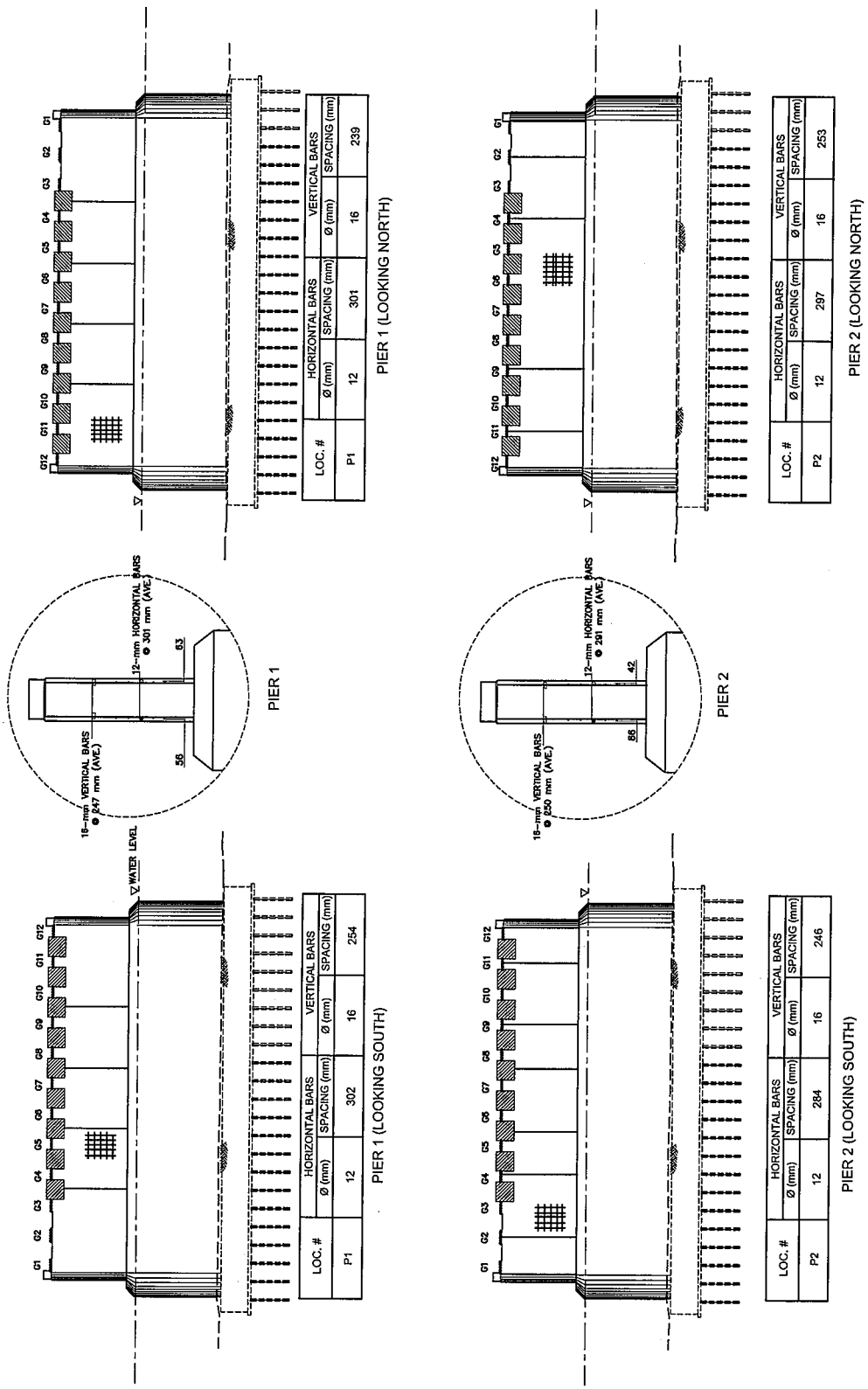
SECTION	GRID	DIMENSION (mm)		
		a	b	c
A - A	J	-	-	-
B - B	P_2	500	2060	500
C - C	L	310	1530	310
D - D	A_2	"NOT ACCESSIBLE"		

GERBER HINGE GH2-RIGHT (DIAPHRAGM 3)

SHAPES AND DIMENSIONS
BELOW ROAD DECK - GIRDER HINGE (G4)



SUMMARY OF RESULTS FOR COVERMETER MAIN GIRDER



LOC. #	HORIZONTAL BARS		VERTICAL BARS	
	Ø (mm)	SPACING (mm)	Ø (mm)	SPACING (mm)
P1	12	301	16	239

LOC. #	HORIZONTAL BARS		VERTICAL BARS	
	Ø (mm)	SPACING (mm)	Ø (mm)	SPACING (mm)
P1	12	302	16	254

LOC. #	HORIZONTAL BARS		VERTICAL BARS	
	Ø (mm)	SPACING (mm)	Ø (mm)	SPACING (mm)
P2	12	297	16	253

LOC. #	HORIZONTAL BARS		VERTICAL BARS	
	Ø (mm)	SPACING (mm)	Ø (mm)	SPACING (mm)
P2	12	284	16	246

SUMMARY OF RESULTS FOR COVERMETER PIER

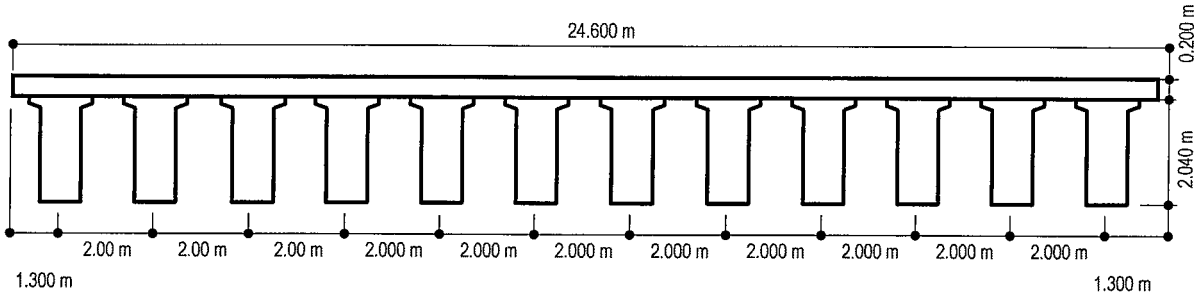
A. TYPE VI AASHTO GIRDERS

1.0 MATERIAL SPECIFICATIONS

Modulus of elasticity of prestressed concrete girder, E_c (fc' = 35.0 Mpa) = 27983.06 Mpa
Modulus of elasticity of reinforced concrete slab, E_{cs} (fc' = 21.0 Mpa) = 21675.58 Mpa
Modular ratio, $n = E_{cs} / E_c$ = 0.774597

2.0 WHOLE SUPERSTRUCTURE

2.1 END BLOCK / SOLID PORTION



2.1.1 Properties of Girder

Area of Girder = 1.518 m^2
Centroid of Girder = 1.051 m
Dimension of Haunch : 50 mm

2.1.2 For I_X

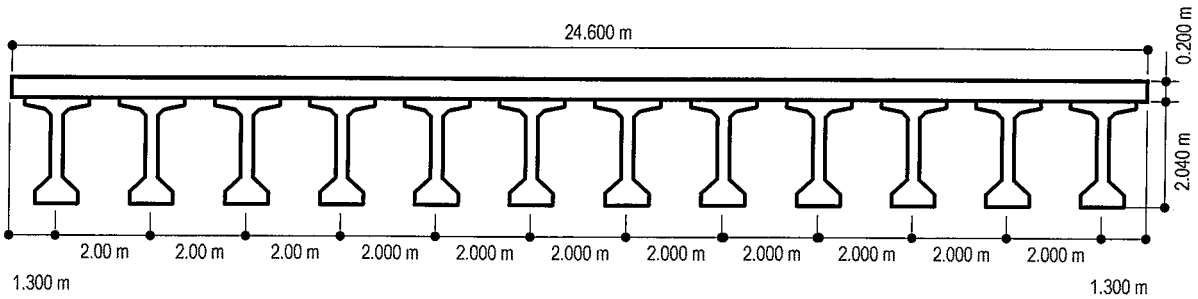
Girder : No. of girders x I_{X-X} = 12 × 0.008 = 0.097 m^4
Slab : $nbt^3 / 3$ = 0.775 × 24.600 × 0.200^3 ÷ 3 = 0.051 m^4
Total = **0.148 m^4**

2.1.3 For I_Y

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
A	1.518	23.300	35.369	11.000	183.678	0.06702	183.745
B	1.518	21.300	32.333	9.000	122.958	0.06702	123.025
C	1.518	19.300	29.297	7.000	74.382	0.06702	74.449
D	1.518	17.300	26.261	5.000	37.950	0.06702	38.017
E	1.518	15.300	23.225	3.000	13.662	0.06702	13.729
F	1.518	13.300	20.189	1.000	1.518	0.06702	1.585
G	1.518	11.300	17.153	1.000	1.518	0.06702	1.585
H	1.518	9.300	14.117	3.000	13.662	0.06702	13.729
I	1.518	7.300	11.081	5.000	37.950	0.06702	38.017
J	1.518	5.300	8.045	7.000	74.382	0.06702	74.449
K	1.518	3.300	5.009	9.000	122.958	0.06702	123.025
L	1.518	1.300	1.973	11.000	183.678	0.06702	183.745
E	3.811	12.300	46.875	0.000	0.000	115.314	115.314
Total	22.027		270.932				**984.414**

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
A	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
B	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
C	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
D	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
E	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
F	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
G	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
H	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
I	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
J	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
K	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
L	1.518	1.051	1.595	0.188	0.054	0.55200	0.606
E	3.811	2.140	8.156	0.901	3.091	0.01270	3.104
Total	22.027		27.301				**10.374**

2.2 MID-SECTION (TYPICAL SECTION)



2.2.1 Properties of Girder

Area of Girder = 0.743 m^2

Centroid of Girder = 1.044 m

Dimension of Haunch : 50 mm

2.2.2 For I_X

Girder : No. of girders x I_{X-X} = 12 × 0.008 = 0.097 m^4

Slab : $nbt^3 / 3$ = 0.775 × 24.600 × 0.200^3 ÷ 3 = 0.051 m^4

Total = **0.148 m^4**

2.2.3 For I_Y

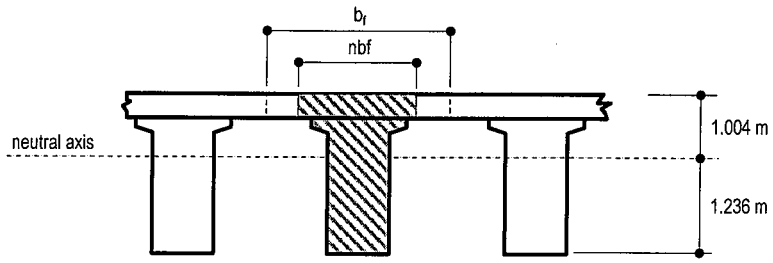
Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
A	0.743	23.300	17.323	11.000	89.960	0.026	89.986
B	0.743	21.300	15.836	9.000	60.221	0.026	60.247
C	0.743	19.300	14.349	7.000	36.430	0.026	36.456
D	0.743	17.300	12.862	5.000	18.587	0.026	18.613
E	0.743	15.300	11.375	3.000	6.691	0.026	6.717
F	0.743	13.300	9.888	1.000	0.743	0.026	0.769
G	0.743	11.300	8.401	1.000	0.743	0.026	0.769
H	0.743	9.300	6.914	3.000	6.691	0.026	6.717
I	0.743	7.300	5.427	5.000	18.587	0.026	18.613
J	0.743	5.300	3.940	7.000	36.430	0.026	36.456
K	0.743	3.300	2.453	9.000	60.221	0.026	60.247
L	0.743	1.300	0.967	11.000	89.960	0.026	89.986
E	3.811	12.300	46.875	0.000	0.000	115.314	115.314
Total	12.733		156.612				**540.889**

2.2.4 For I_Z

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
A	0.743	1.044	0.776	0.328	0.080	0.406	0.486
B	0.743	1.044	0.776	0.328	0.080	0.406	0.486
C	0.743	1.044	0.776	0.328	0.080	0.406	0.486
D	0.743	1.044	0.776	0.328	0.080	0.406	0.486
E	0.743	1.044	0.776	0.328	0.080	0.406	0.486
F	0.743	1.044	0.776	0.328	0.080	0.406	0.486
G	0.743	1.044	0.776	0.328	0.080	0.406	0.486
H	0.743	1.044	0.776	0.328	0.080	0.406	0.486
I	0.743	1.044	0.776	0.328	0.080	0.406	0.486
J	0.743	1.044	0.776	0.328	0.080	0.406	0.486
K	0.743	1.044	0.776	0.328	0.080	0.406	0.486
L	0.743	1.044	0.776	0.328	0.080	0.406	0.486
E	3.811	2.140	8.156	0.768	2.247	0.013	2.259
Total	12.733		17.472				**8.090**

3.0 ONE GIRDER PROPERTY

3.1 INTERIOR GIRDER (END BLOCK)



Effective flange width, b_f : (minimum)

a) 1/4 span length	=	18.500	÷	4			=	4.625 m
b) Center-to-center spacing of girder	=	2.000					=	2.000 m
c) Web width + 12 times slab thickness	=	1.067	+	12	×	0.200	=	3.467 m
						Use b_f	=	**2.000 m**

3.1.1 Properties of Girder

Girder	:					=	1.518 m^2
Slab	:	$b_f t$ =	2.000	×	0.200	=	0.400 m^2
Haunch	:					=	0.043 m^2

3.1.2 For I_X

Girder	:							=	0.008 m^4
Slab	:	$nb_f t^3 / 3$ =	0.775	×	2.000	×	0.200^3 ÷ 3	=	0.004 m^4
							Total	=	**0.012 m^4**

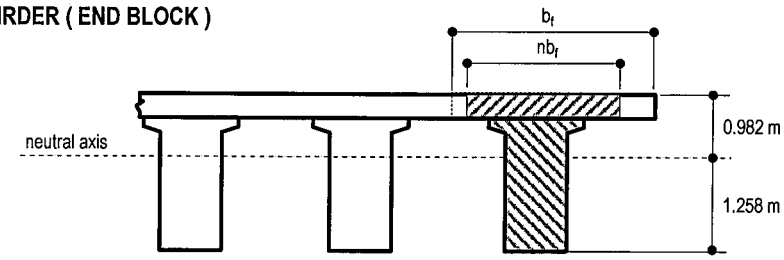
3.1.3 For I_Y

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
Girder	1.518	1.000	1.518	0.000	0.000	0.067	0.067
Slab	0.310	1.000	0.310	0.000	0.000	0.062	0.062
Total	1.828		1.828				**0.129**

3.1.4 For I_Z

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
Girder	1.518	1.051	1.595	0.185	0.052	0.552	0.604
Slab	0.310	2.140	0.663	0.904	0.253	0.001	0.254
Total	1.828		2.258				**0.858**

3.2 EXTERIOR GIRDER (END BLOCK)



Effective flange width, b_f : (minimum)

a) 1/4 span length	=	18.500	÷	4			=	4.625 m
b) 1/2 girder spacing + length of cantilever	=	1.000	+	1.300			=	2.300 m
c) Web width + 12 times slab thickness	=	1.067	+	12	×	0.200	=	3.467 m
						Use b_f	=	**2.300 m**

3.2.1 Properties of Girder

Girder	:					=	1.518 m^2
Slab	:	$b_f t$ =	2.300	×	0.200	=	0.460 m^2
Haunch	:					=	0.043 m^2

3.2.2 For I_X

Girder : = 0.008 m^4

Slab : $nb_ft^3 / 3$ = 0.775 × 2.300 × 0.200^3 ÷ 3 = 0.005 m^4

Total = **0.013 m^4**

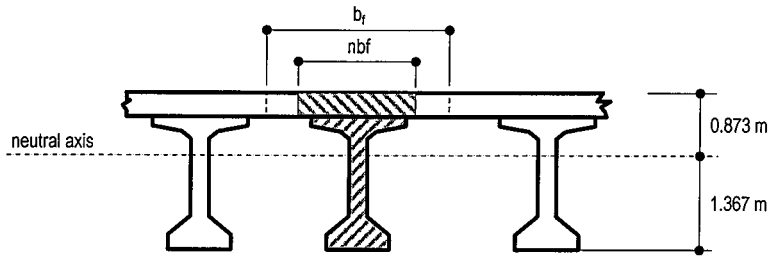
3.2.3 For I_Y

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
Girder	1.518	1.300	1.973	0.029	0.001	0.067	0.068
Slab	0.356	1.150	0.410	0.121	0.005	0.094	0.100
Total	1.874		2.383				**0.168**

3.2.4 For I_Z

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
Girder	1.518	1.051	1.595	0.207	0.065	0.552	0.617
Slab	0.356	2.140	0.763	0.882	0.277	0.001	0.278
Total	1.874		2.358				**0.895**

3.3 INTERIOR GIRDER (MIDSPAN SECTION)



Effective flange width, b_f : (minimum)

a) 1/4 span length = 18.500 ÷ 4 = 4.625 m

b) Center-to-center spacing of girder = 2.000 = 2.000 m

c) Web width + 12 times slab thickness = 1.067 + 12 × 0.200 = 3.467 m

Use b_f = 2.000 m

3.3.1 Properties of Girder

Girder : = 0.743 m^2

Slab : b_ft = 2.000 × 0.200 = 0.400 m^2

Haunch : = 0.043 m^2

3.3.2 For I_X

Girder : = 0.008 m^4

Slab : $nb_ft^3 / 3$ = 0.775 × 2.000 × 0.200^3 ÷ 3 = 0.004 m^4

Total = **0.012 m^4**

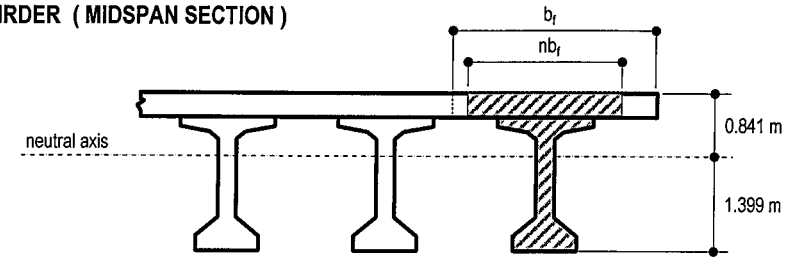
3.3.3 For I_Y

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
Girder	0.743	1.000	0.743	0.000	0.000	0.026	0.026
Slab	0.310	1.000	0.310	0.000	0.000	0.062	0.062
Total	1.053		1.053				**0.088**

3.3.4 For I_Z

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
Girder	0.743	1.044	0.776	0.322	0.077	0.406	0.483
Slab	0.310	2.140	0.663	0.773	0.185	0.001	0.186
Total	1.053		1.439				**0.670**

3.4 EXTERIOR GIRDER (MIDSPAN SECTION)



Effective flange width, b_f : (minimum)

a) 1/4 span length	=	18.500	÷	4			=	4.625 m
b) 1/2 girder spacing + length of cantilever	=	1.000	+	1.300			=	2.300 m
c) Web width + 12 times slab thickness	=	1.067	+	12	×	0.200	=	3.467 m
						Use b_f	=	**2.300 m**

3.4.1 Properties of Girder

Girder	:						=	0.743 m^2
Slab	:	$b_f t$ =	2.300	×	0.200		=	0.460 m^2
Haunch	:						=	0.043 m^2

3.4.2 For I_X

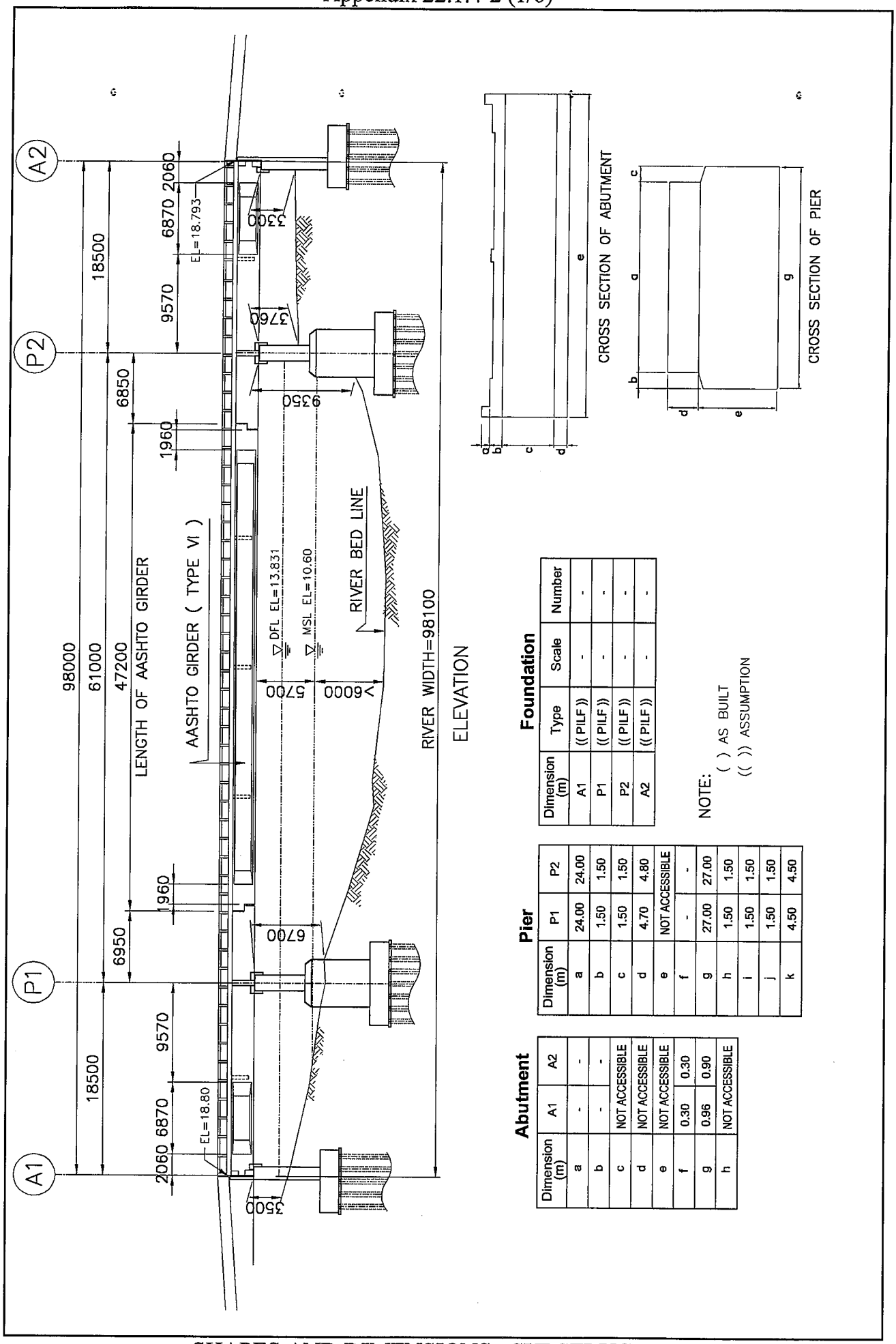
Girder	:								=	0.008 m^4
Slab	:	$nb_f t^3 / 3$ =	0.775	×	2.300	×	0.200^3	÷ 3	=	0.005 m^4
								Total	=	**0.013 m^4**

3.4.3 For I_Y

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Y-Y} (m^4)	$I_Y = I_{Y-Y} + Ad^2$ (m^4)
Girder	0.743	1.300	0.967	0.049	0.002	0.026	0.028
Slab	0.356	1.150	0.410	0.101	0.004	0.094	0.098
Total	1.100		1.376				**0.125**

3.4.4 For I_Z

Item	Area, A (m^2)	y (m)	Ay (m^3)	d (m)	Ad^2 (m^4)	I_{Z-Z} (m^4)	$I_Z = I_{Z-Z} + Ad^2$ (m^4)
Girder	0.743	1.044	0.776	0.355	0.094	0.406	0.500
Slab	0.356	2.140	0.763	0.741	0.196	0.001	0.197
Total	1.100		1.539				**0.696**



Foundation

Dimension (m)	Type	Scale	Number
A1	((PILF))	-	-
P1	((PILF))	-	-
P2	((PILF))	-	-
A2	((PILF))	-	-

Pier

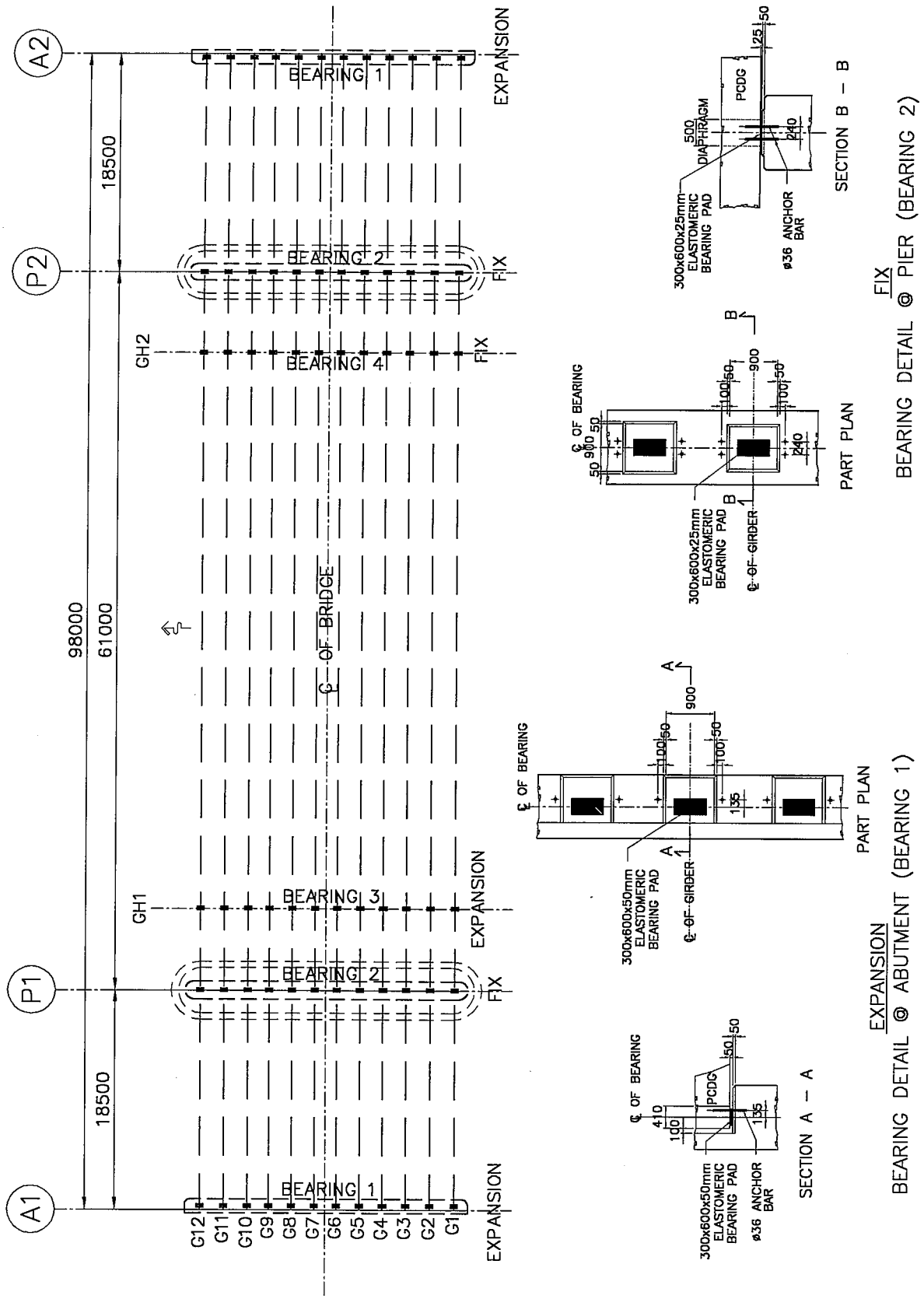
Dimension (m)	P1	P2
a	24.00	24.00
b	1.50	1.50
c	1.50	1.50
d	4.70	4.80
e	NOT ACCESSIBLE	
f	-	-
g	27.00	27.00
h	1.50	1.50
i	1.50	1.50
j	1.50	1.50
k	4.50	4.50

Abutment

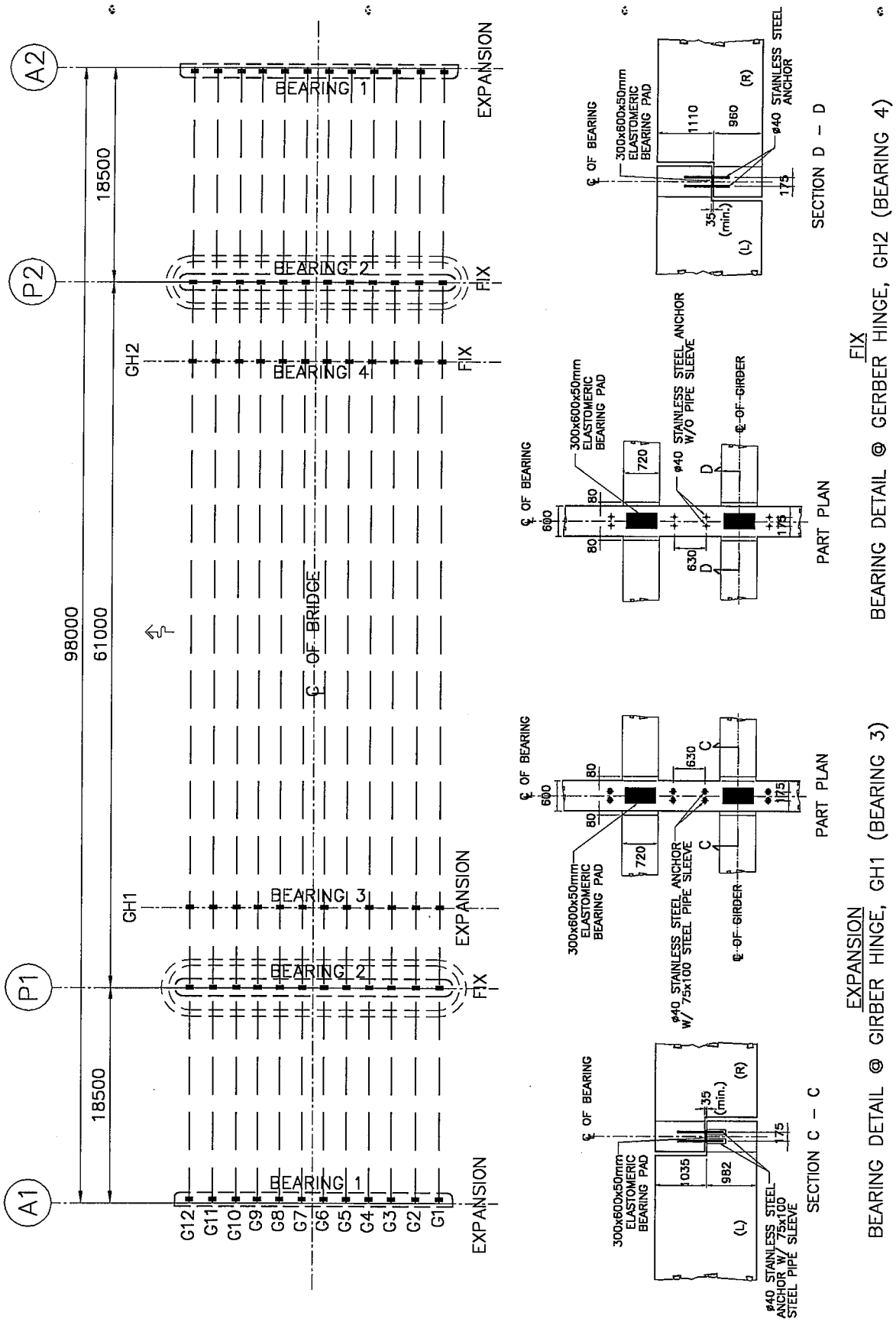
Dimension (m)	A1		A2
a	-		-
b	-		-
c	NOT ACCESSIBLE		
d	NOT ACCESSIBLE		
e	NOT ACCESSIBLE		
f	0.30	0.30	
g	0.96	0.90	
h	NOT ACCESSIBLE		

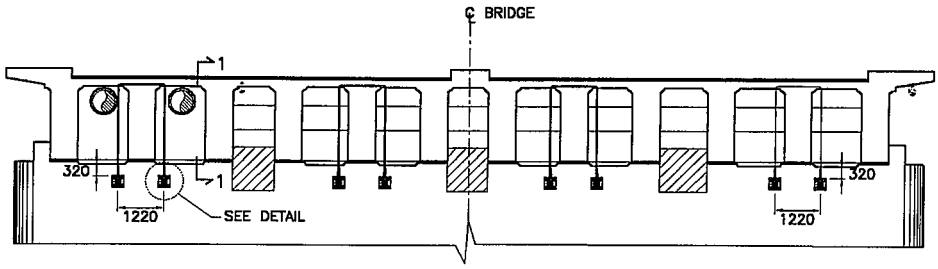
NOTE:
( ) AS BUILT
(( )) ASSUMPTION

SHAPES AND DIMENSIONS - SUBSTRUCTURE

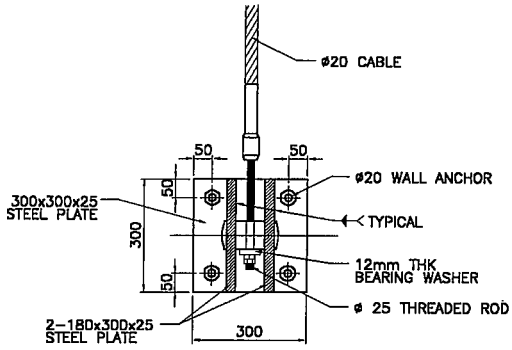


SHAPES AND DIMENSIONS - SUBSTRUCTURE BEARINGS

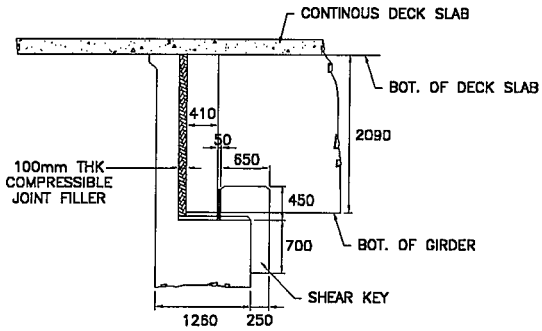

A1
P1
P2
A2
98000
61000
18500
18500
BEARING 1
BEARING 2
BEARING 3
BEARING 4
EXPANSION
FIX
GH1
GH2
℄ OF BRIDGE
G1
G2
G3
G4
G5
G6
G7
G8
G9
G10
G11
G12
℄ OF BEARING
300x600x50mm ELASTOMERIC BEARING PAD
ø40 STAINLESS STEEL ANCHOR W/ 75x100 STEEL PIPE SLEEVE
ø40 STAINLESS STEEL ANCHOR W/O PIPE SLEEVE
℄ OF GIRDER
SECTION C - C
SECTION D - D
PART PLAN
EXPANSION
FIX
BEARING DETAIL @ GIRBER HINGE, GH1 (BEARING 3)
BEARING DETAIL @ GERBER HINGE, GH2 (BEARING 4)



PLAN

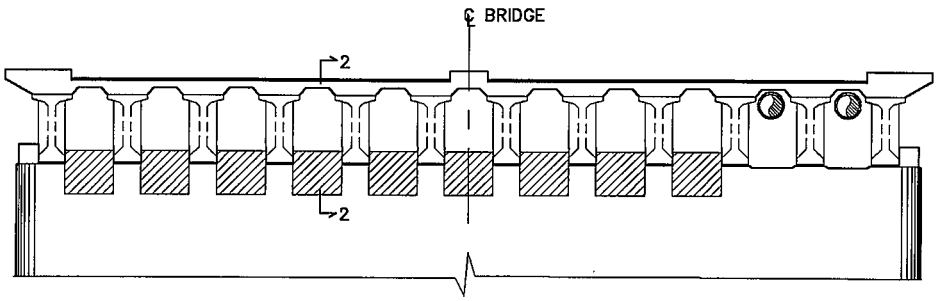


CABLE RESTRAINER DETAIL

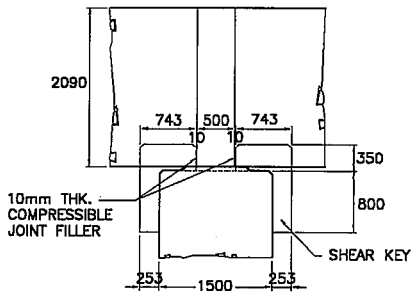


SECTION 1 – 1

ABUTMENT A1 (AS SHOWN)
SIMILAR ABUTMENT A2

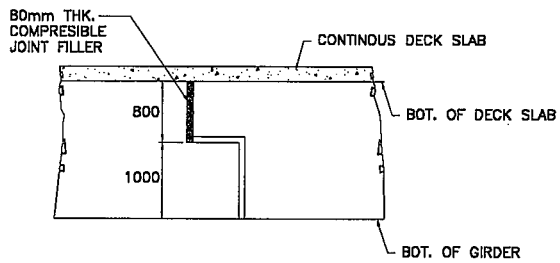


PLAN



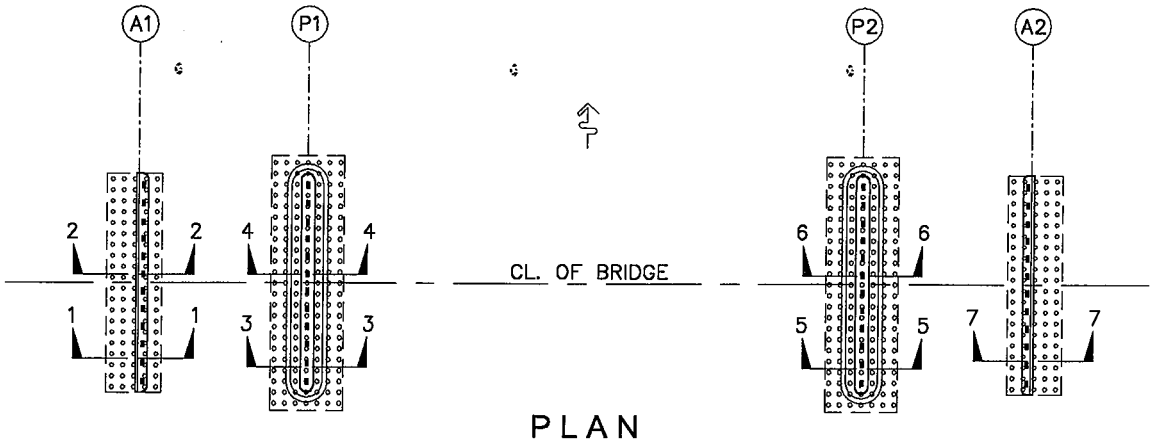
SECTION 2 – 2

PIER P1 & P2

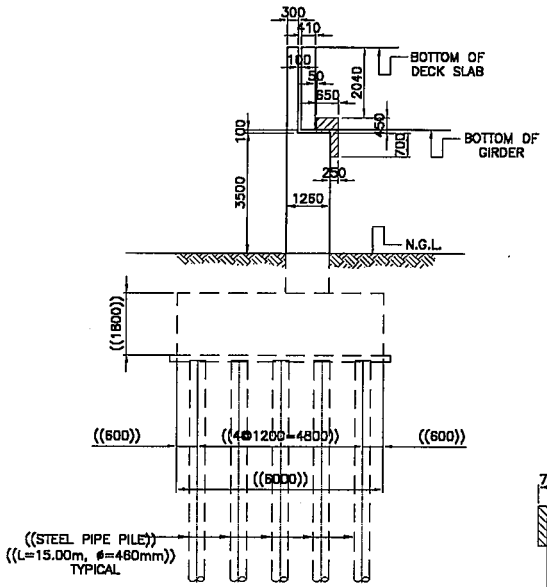


SECTION

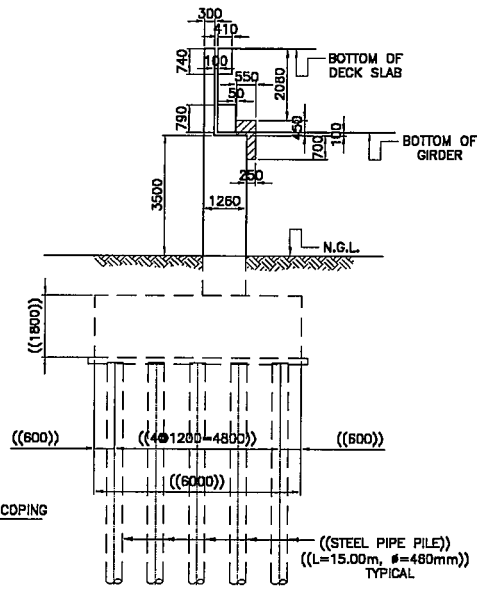
SECTION @ GERBER HINGE, GH1
(SIMILAR TO GERBER HINGE, GH2)



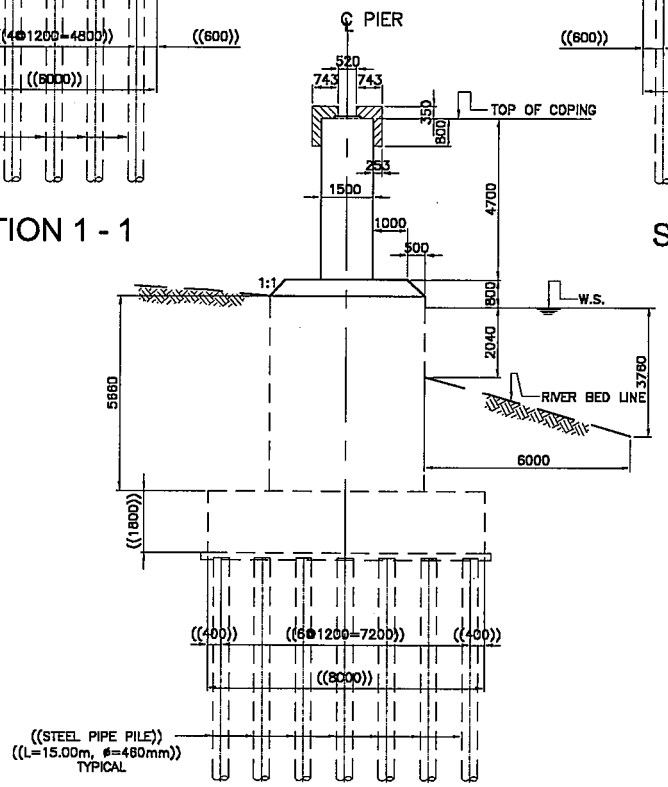
PLAN



SECTION 1 - 1

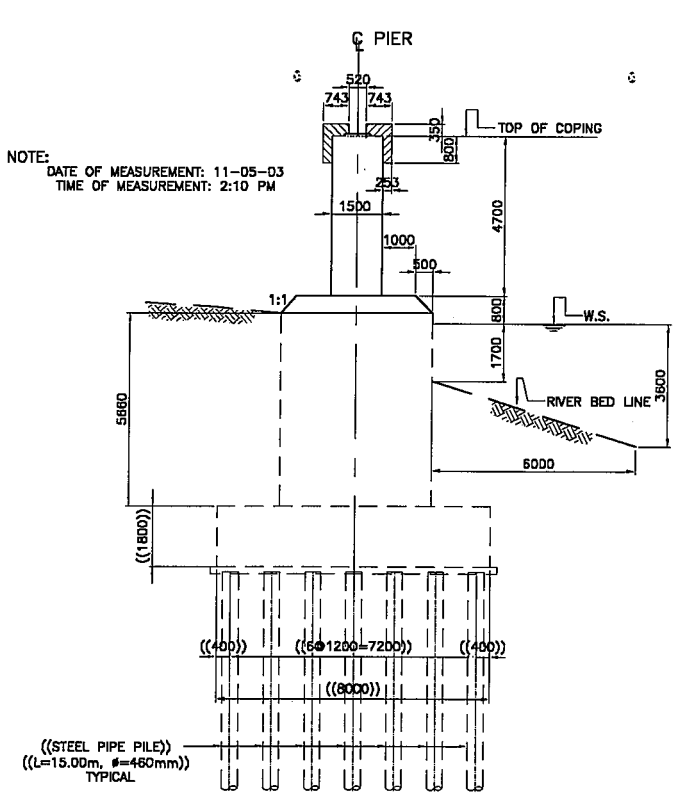


SECTION 2 - 2

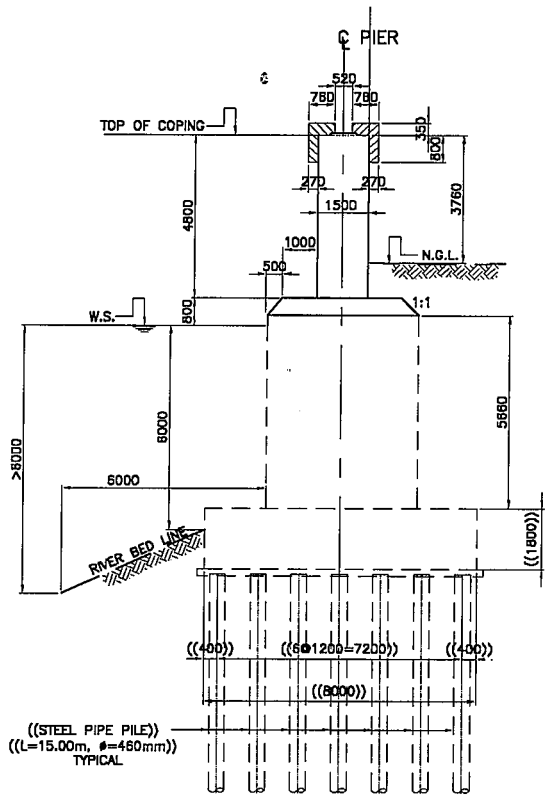


SECTION 3 - 3

NOTE:
DATE OF MEASUREMENT: 11-05-03
TIME OF MEASUREMENT: 2:10 PM
( ) AS-BUILT
(( )) ASSUMPTION

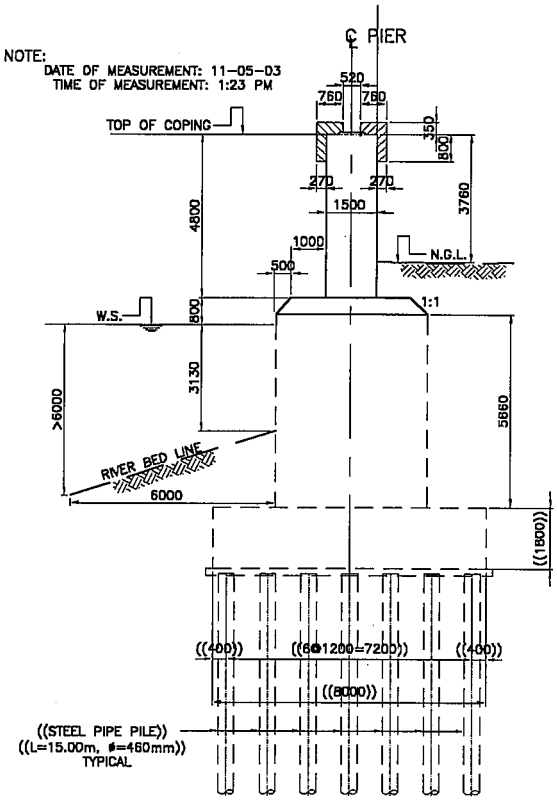


SECTION 4 - 4



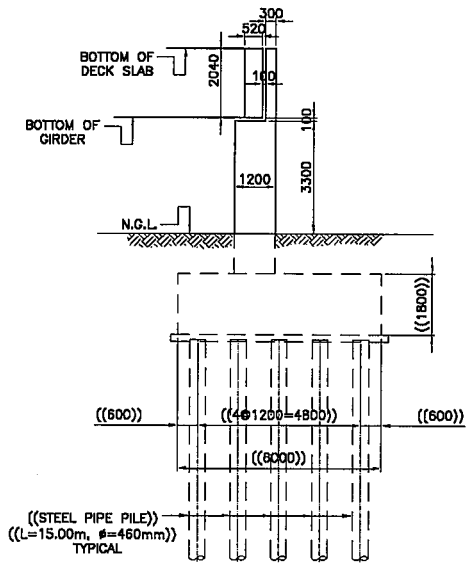
SECTION 5 - 5

NOTE:
DATE OF MEASUREMENT: 11-05-03
TIME OF MEASUREMENT: 2:10 PM



SECTION 6 - 6

NOTE:
DATE OF MEASUREMENT: 11-05-03
TIME OF MEASUREMENT: 1:23 PM
( ) AS-BUILT
(( )) ASSUMPTION



SECTION 7 - 7