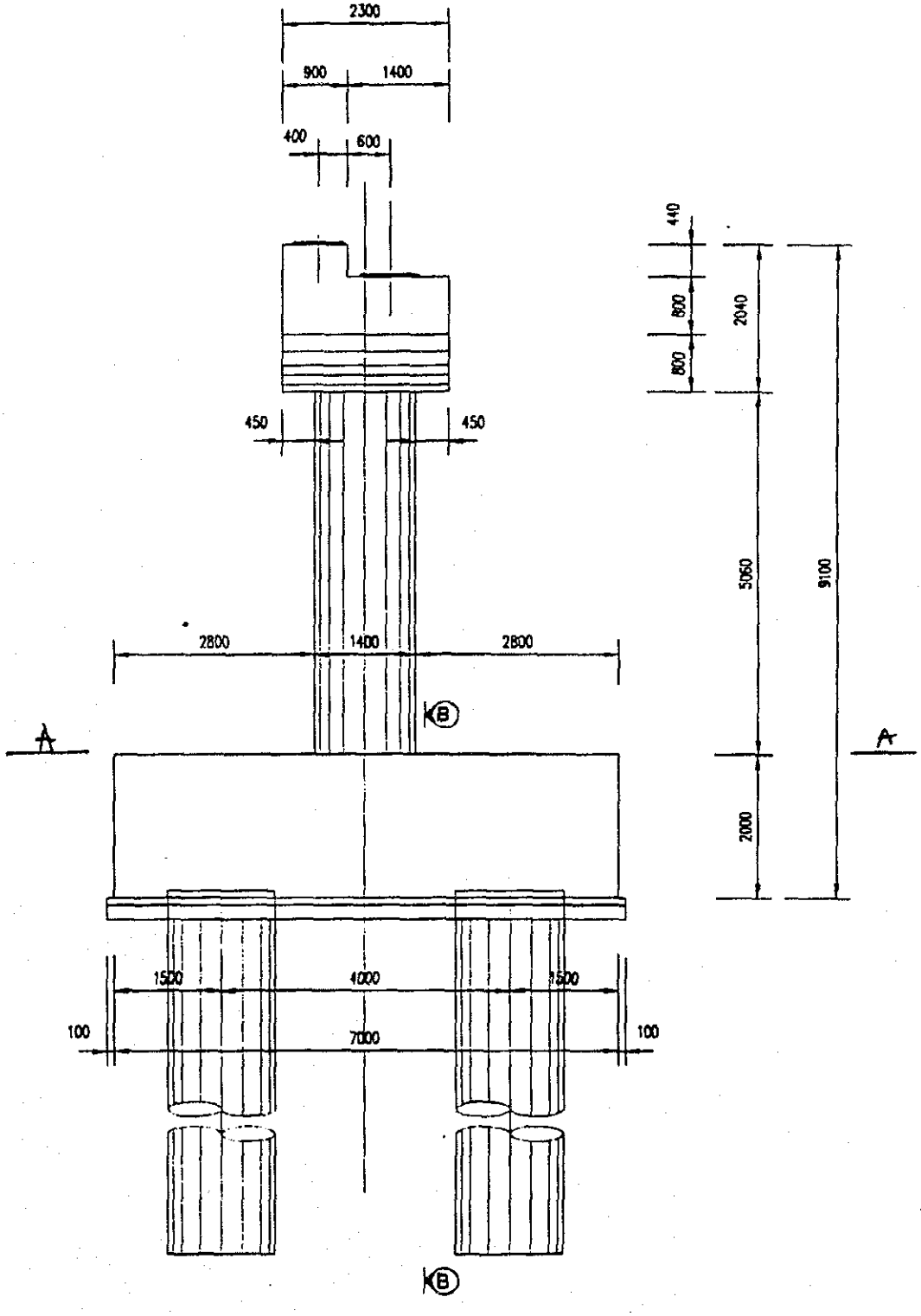
SIDE VIEW


2300
900
1400
400
600
450
450
2800
1400
2800
B
A
A
B
1500
4000
1500
100
7000
100
440
800
800
2040
5060
9100
2000

Nos	Items	Pz			Hx			My			Hy			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	n=1		n>1	
7	Earthquake - EQ (n=1)				-195			-1,136			-157			-849			main load
	+ Pier				-24			-136			-24			-136			
	+ Pile cap				-44			-44			-44			-44			
	+ Superstructure				-127			-955			-89			-668			
8	Vessel collision force - CV (n=1)				0			0			0			0			
9	Wind load																
	+ Superstructure (n=0.4,n=1.4) (WS)										25	10	35	230	92	322	
	+ Live load(n=1.0) (WL)										7			81			
10	Stream force (WA)										0			0			
	+ Pier										0			0			
	+ Pile cap										0			0			

PIER P1
LOAD COMBINATION TABLE

No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I - 1	2044.6	-32.7	-649.6	0.0	0.0
2	STRENGTH-I - 2	1910.6	-32.7	-696.6	0.0	0.0
3	STRENGTH-III	1,142	0	-111	35	322
4	STRENGTH-V	1,944	-25	-540	17	173
5	EXTREME EVEN-I - 1	1,731	-205	-1,442	-157	-849
6	EXTREME EVEN-I - 2	1,268	-205	-1,384	-157	-849
8	SERVICE-I	1,559	-19	-395	17	173

1	**STRENGTH-I-1**	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA
2	**STRENGTH-I-2**	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA
3	**STRENGTH-III**	0.9DC + 0.65DW + 1.0WA + 1.4WS
4	**STRENGTH-V**	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
5	**EXTREME EVEN-I - 1**	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6	**EXTREME EVEN-I - 2**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
7	**SERVICE-I**	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV

Bridge name **TRA ON-P1**

Pile Type Dia = 1500 mm Length = 77.0 m

Bearing Capacity *Qs* = 20867 kN *Qult* = 23253 kN

Longitudinal direction

Load Combination	Displacement δ x(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	2.4	30	5737	10219	4288	-8953	OK
Strength I-2	2.5	30	5453	10219	3915	-8953	OK
Strength I-III	0.2	30	2906	10219	2694	-8953	OK
Strength I-V	2.0	30	5361	10219	4171	-8953	OK
Extremme Event I-1	10.2	20	6271	10219	2217	-8953	O.K
Extremme Event I-2	10	20	5080	10219	1137	-8953	OK
Service-I	2.1	15	4287	6541	3357	-5482	OK

Transverse direction

Load Combination	Displacement δ y(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	0	30	5013	10219	5013	-8953	OK
Strength I-2	0	30	4684	10219	4684	-8953	OK
Strength I-III	1.3	30	3065	10219	2535	-8953	OK
Strength I-V	0.7	20	4905	10219	4627	-8953	OK
Extremme Event I-1	5.5	20	5073	10219	3415	-8953	O.K
Extremme Event I-2	5.5	30	3937	6541	2280	-8953	OK
Service-I	1.0	15	3969	6541	3675	-5482	OK

SECTION CALCULATION

A. BODY

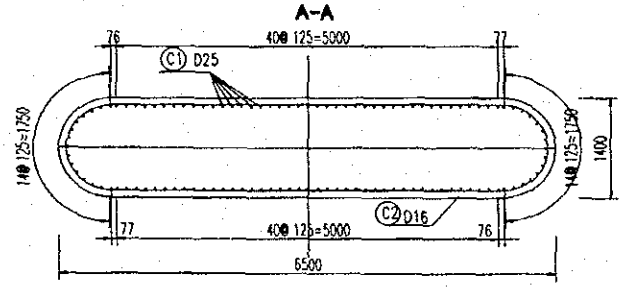
LOAD COMBINATION TABLE

No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I - 1	2066.5	-32.7	-519.0	0.0	0.0
2	STRENGTH-I - 2	1932.5	-32.7	-565.9	0.0	0.0
3	STRENGTH-III	1,158	0	-111	35	253
4	STRENGTH-V	1,966	-25	-439	17	112
5	EXTREME EVEN-I - 1	1,753	-160	-1,058	-113	-579
6	EXTREME EVEN-I - 2	1,284	-160	-1,001	-113	-579
7	EXTREME EVEN-II	0	0	0	0	0
8	SERVICE-I	1,576	-19	-320	17	112

1 STRENGTH-I 1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA
2 STRENGTH-III 0.9DC + 0.65DW + 1.0WA + 1.4WS
3 STRENGTH-V 1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
4 EXTREME EVEN-I - 1 1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5 EXTREME EVEN-I - 2 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6 EXTREME EVEN-II 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV
7 SERVICE-I 1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV

SECTION CALCULATION SECTION A - A

Combination		1		2	
Actual Moment	kN.m	5090	20270	9816	12592
Allowable Moment	kN.m	19447	77482	21830	27998
		OK		OK	
Reinforcement		D25 @ 125			



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕMn (kN·m)	1.33M < 1.2Mcr or Mr
1	1180	1570	2422	2491	OK
2	1110	1476			OK
3	547	727			OK
4	1087	1446			OK
5	1313	1746			OK
6	1085	1443			OK

As = 40 cm2 (D=3.2cm, 5 Nos)
A's = 11 cm2 (D=2.2cm, 3 Nos)
ρ s = As/Ac = 0.0020
ρ min = 0.03 f'/fy = 0.0018
∴ ρ s > ρ min ..... O.K
c/de = 0.04
∴ c/de < 0.42 ..... O.K

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

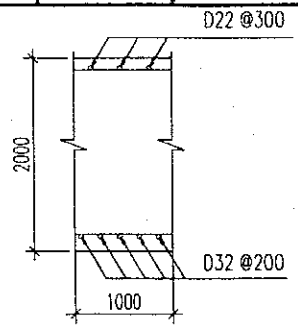
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·fy (MPa)	fsa < 0.6·fy
7	869.46	119	119	229	OK

Stress

Actual			Allowable			Remark
fc tensile	=	1.25 (MPa)	$fr = 0.63\cdot(fc)^{0.5}$	=	3.03 (MPa)	OK
fc compress	=	1.28 (MPa)	fca = 0.4fc	=	9.41 (MPa)	OK
fs	=	8.08 (MPa)	fsa = 0.6fy	=	229.48 (MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
a. Longitudinal direction							
Combination 1	P	kN	4288	32386			OK
	M	kN·m	267	2019			OK
Combination 2	P	kN	3915	31828			OK
	M	kN·m	284	2311			OK
Combination 3	P	kN	2694	34891			OK
	M	kN·m	40	518			OK
Combination 4	P	kN	4171	32907			O.K
	M	kN·m	220	1734			O.K
Combination 5	P	kN	2217	11397			O.K
	M	kN·m	1074	5520			O.K
Combination 6	P	kN	1137	3122			O.K
	M	kN·m	1074	2948			O.K
Combination 7	P	kN	3357	33436			O.K
	M	kN·m	144	1430			O.K

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
b. Transverse direction							
Combination 1	P	kN	5013	35807			OK
	M	kN·m	0	0			OK
Combination 2	P	kN	4684	35807			OK
	M	kN·m	0	0			OK
Combination 3	P	kN	2535	31843			OK
	M	kN·m	183	2303			OK
Combination 4	P	kN	4627	34668			O.K
	M	kN·m	89	666			O.K
Combination 5	P	kN	3415	22419			O.K
	M	kN·m	822	5399			O.K
Combination 6	P	kN	2280	16302			O.K
	M	kN·m	822	5879			O.K
Combination 7	P	kN	3675	34210			O.K
	M	kN·m	103	960			O.K

STRESS

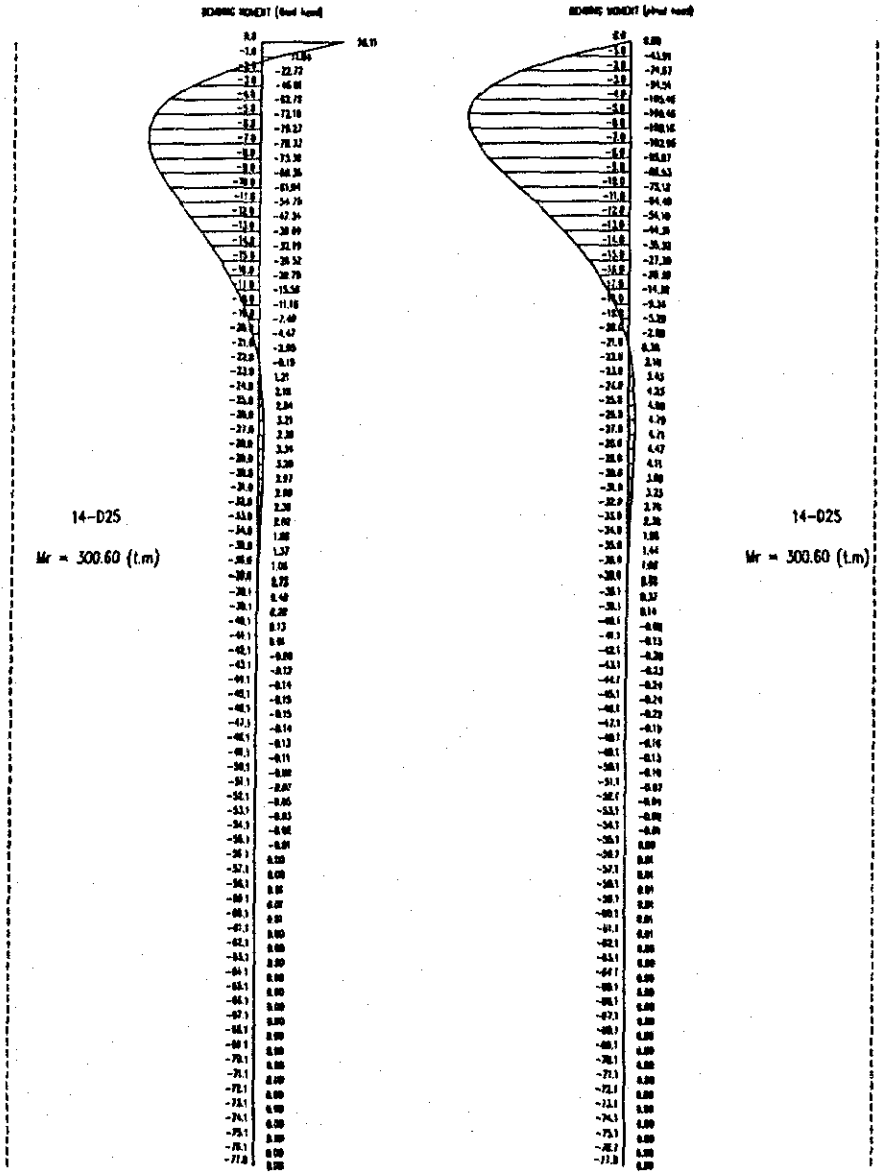
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-55.2	220.6	3.83	12.26	OK
Combination 2	-53.6	220.6	3.76	12.26	OK
Combination 3	-25.3	220.6	1.72	12.26	OK
Combination 4	-50.6	220.6	3.50	12.26	OK
Combination 5	-86.3	294.2	6.35	14.71	OK
Combination 6	175.7	294.2	6.96	14.71	OK
Combination 7	-39.2	176.5	2.70	9.81	OK
b. Transverse direction					
Combination 1	-40.1	220.6	2.68	12.26	OK
Combination 2	-37.5	220.6	2.50	12.26	OK
Combination 3	-31.4	220.6	2.23	12.26	OK
Combination 4	-42.5	220.6	2.88	12.26	OK
Combination 5	-75.1	294.2	5.58	14.71	OK
Combination 6	-66.9	294.2	5.12	14.71	OK
Combination 7	-36.0	176.5	2.47	9.81	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	3.55	σ ca=0.5x σ ck = 11.77	OK
Vertical Punching Shear	τ c =	0.31	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	3.35	σ 'ca=0.3x σ ck = 7.06	OK
Horizontal Bearing Pressure	τ c =	0.21	τ a = 0.88	OK

COMBINATION 6 : PILE (1,1)

LONGITUDINAL DIRECTION



14-D25

Mr = 300.60 (t.m)

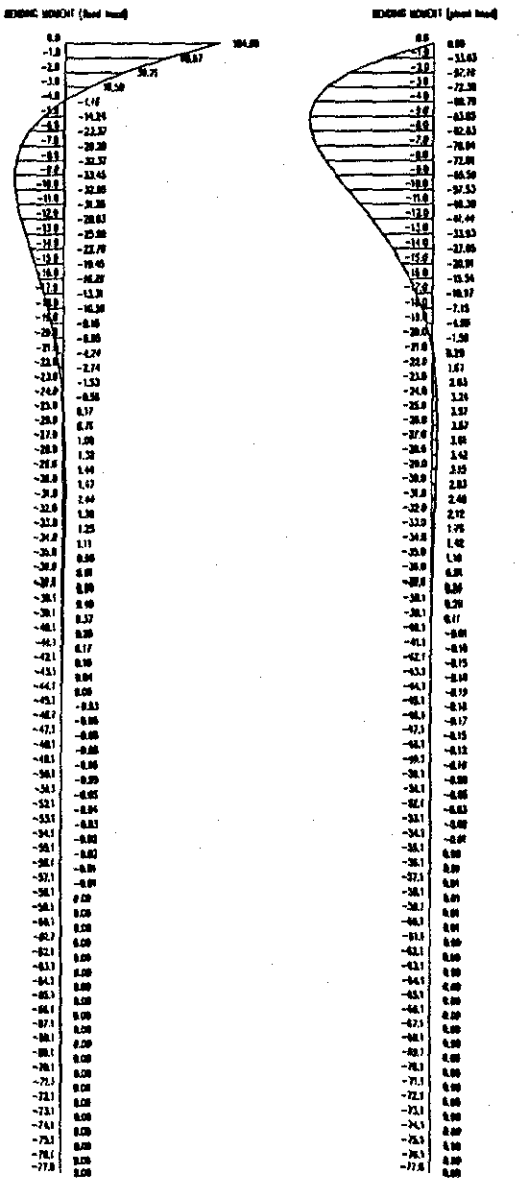
14-D25

Mr = 300.60 (t.m)

PIER P1 - TRA ON BRIDGE

COMBINATION 6 : PILE (1,1)

TRANSVERSE DIRECTION

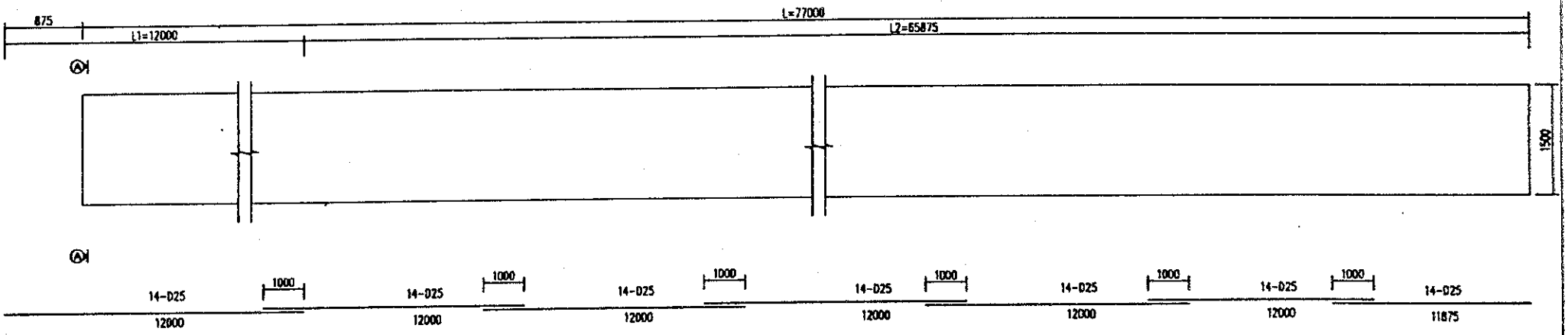


14-D25
Mr=599.45 T.m

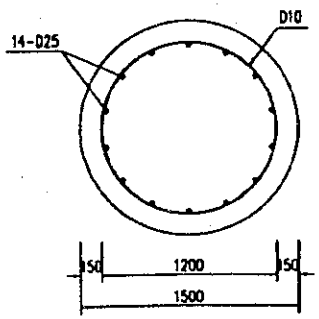
14-D25
Mr=599.45 T.m

PIER P1 – TRA ON BRIDGE

PILE PLAN OF PIER P1 - TRA ON BRIDGE

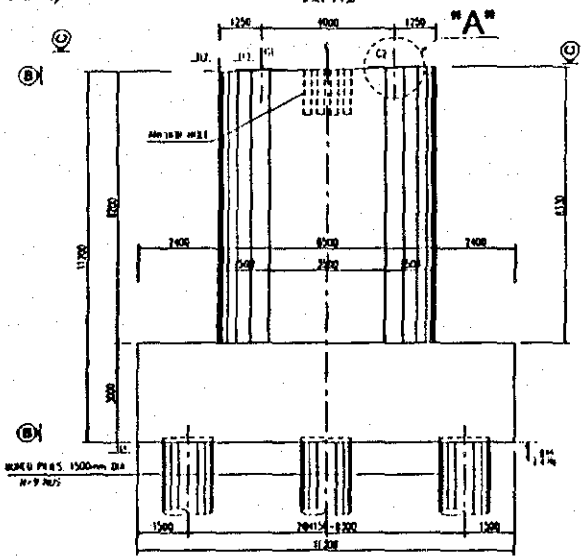


A - A

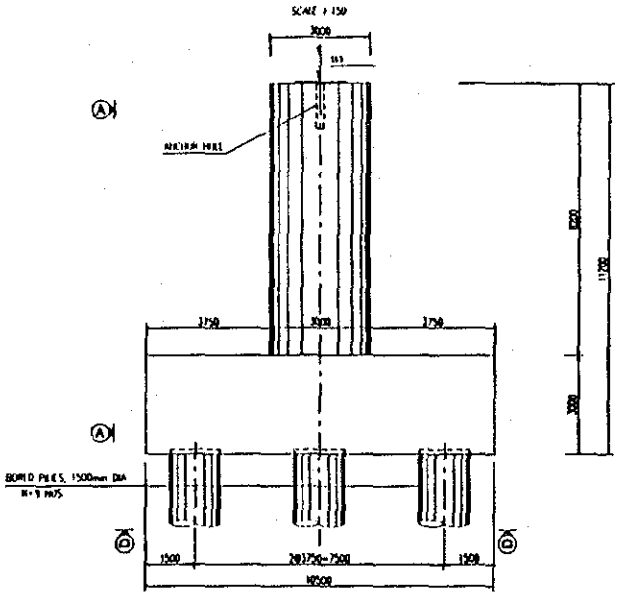


(2) *PIER, TYPE P5*

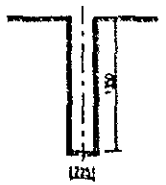
SECTION A-A



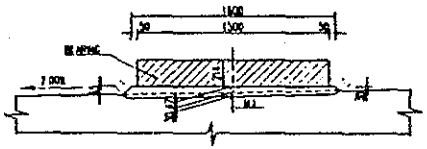
SECTION B-B



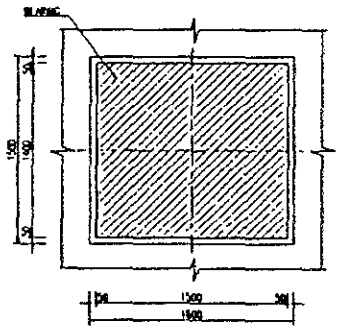
DETAIL OF ANCHOR HOLE



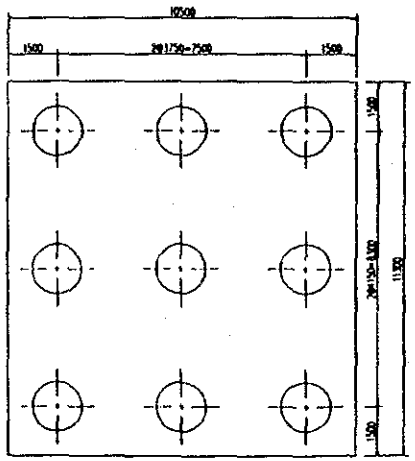
DETAIL "A"



PLAN



PLAN OF PILES
SECTION D-D



SECTION C-C

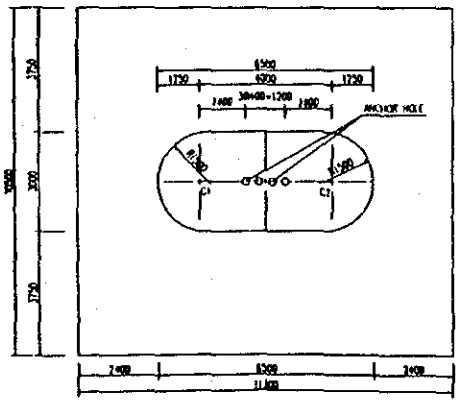


TABLE OF ELEVATION

DIRECTION	PIERS	E1	E2	E3	
				C1	C2
HO CHI MINH CITY - CA MAU	P2	-6.09	+5.11	+5.16	+5.24
	P3	-6.05	+5.15	+5.20	+5.28
CA MAU - HO CHI MINH CITY	P2	-6.03	+5.17	+5.22	+5.30
	P3	-6.11	+5.09	+5.14	+5.22

NOTES:

1. FOR STANDARD STRUCTURAL NOTES SEE DRAWING No. P3/BR7/0010

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kanetani	K.Matsumoto	K. Enomoto	CAI RANG BRIDGE PIERS PIER P2&P3-GENERAL VIEW	P3/BR7/0910
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

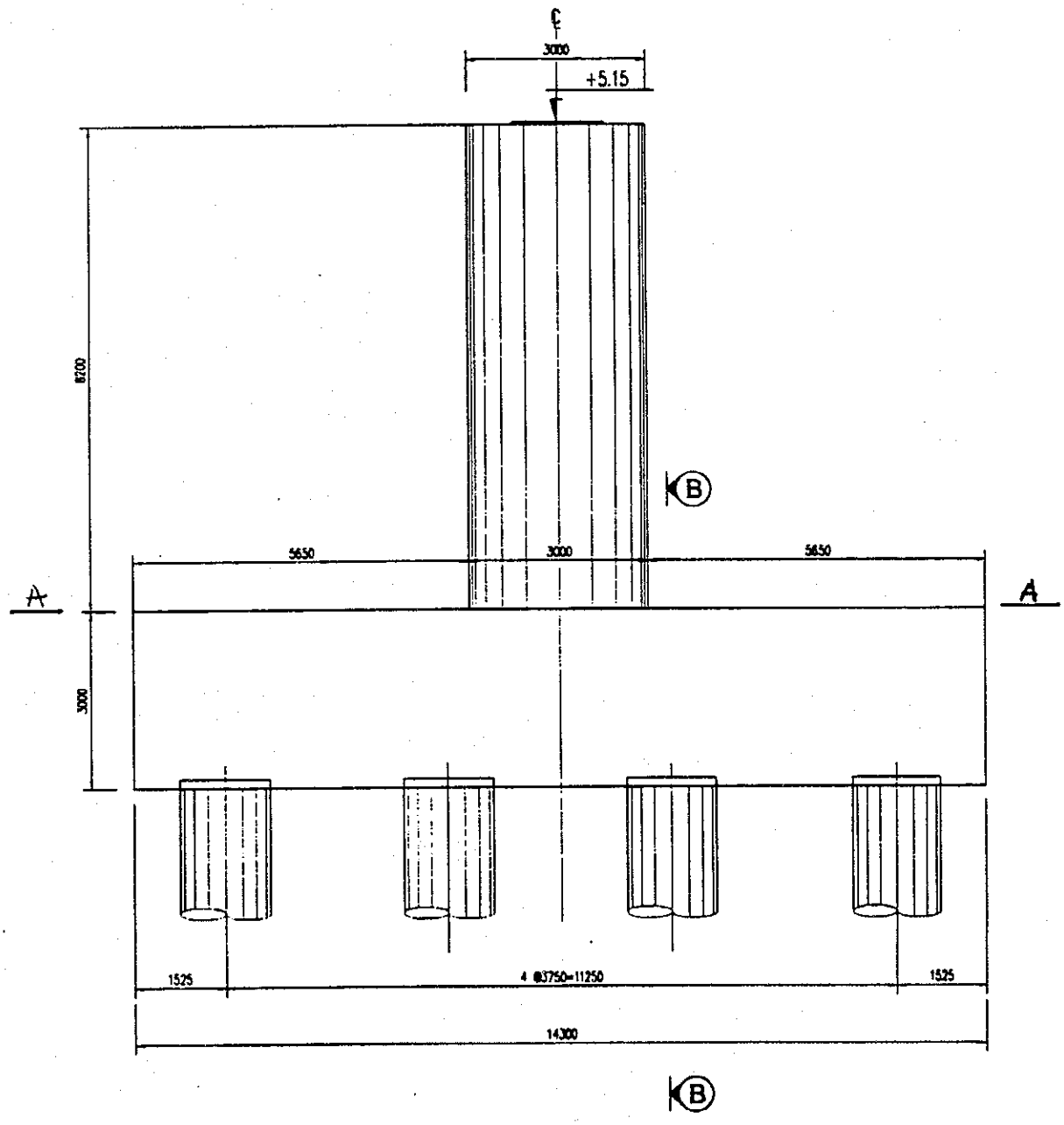
2. LOAD COMBINATIONS - CAI RANG - PIER 2

Nos	Items	Pz			Mz			Hx			My			Hy			Mx			Notes
		n=1	n<1	n>1				n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	n=1		n>1	
	Permanent load																			
1	Superstructure - Pier self weigh	3,277	2,889	4,156	0	0	0	6	4	9	81	58	117	0	0	0	0	0	0	
	Transient Loads																			
2	Live load - LL(n= 0.5,1.75)	316	158	553	0	0	0	5	2	8	54	27	94	0	0	0	0	0	0	
	Live load - LL(n= 0.8,1.35)	316	253	426				5	4	6	54	43	73							
3	Dynamic load allowance - IM (n=0.5,1.75)	104	52	182				2	1	3	18	9	31							
	Dynamic load allowance - IM (n=0.8,1.35)	104	83	141				2	1	2	18	14	24							
4	Braking force - BR (n=0.5,1.75)							53	26	92	850	425	1,488							25% of
	Braking force - BR (n=0.8,1.35)							53	42	71	850	680	1,148							main load
5	Centrifugal force - CE (n=0.5,1.75)							31.8	16	56	571	285	999							
6	Friction force - FR (n=1)							101			1,135									
7	Temperature gradient TG (n=1)																			
	a. + 5 degrees	22.2						3			44									
8	Settlement SE (n=1)	21						2			25									
9	Earthquake - EQ (n=1)							414			3,785			393			3,547			
	+ Pier							107			758			107			758			
	+ Pile cap							43			65			43			65			
	+ Superstructure							264			2,962			243			2,724			
10	Vessel collision force - CV (n=1)							166			1,309			333			2,617			
11	Wind load																			
	+ Superstructure (n=0.4,n=1.4) (WS)													84	34	118	1,269	508	1,777	
	+ Live load(n=1.0) (WL)													12			208			
12	Stream force (WA)													43			143			
	+ Pier													15			100			
	+ Pile cap													28			43			

LOAD COMBINATION TABLE

No	Load combinations	Pz	Mz	Hx	My	Hy	Mx
1	STRENGTH-I	4935.1	0.0	274.2	3932.2	43.2	142.9
2	STRENGTH-III	2,932	0	111	1,262	161	1,920
3	STRENGTH-V	4,723	0	88	1,361	88	859
4	EXTREME EVEN-I - 1	4,366	0	453	4,362	436	3,690
5	EXTREME EVEN-I - 2	3,099	0	550	5,439	436	3,690
6	EXTREME EVEN-II	3,099	0	317	3,248	376	2,760
7	SERVICE-I	3,719	0	201	2,743	88	859

1	**STRENGTH-I**	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA +1.75CE+ 1FR(b)+1TG+1SE
2	**STRENGTH-III**	0.9DC + 0.65DW + 1.0WA + 1.4WS ++ 1FR(a) +TG + SE
3	**STRENGTH-V**	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
4	**EXTREME EVEN-I - 1**	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5	**EXTREME EVEN-I - 2**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ +1.0FR(a)
6	**EXTREME EVEN-II**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV ++0.5CE+1.0FR(a)
7	**SERVICE-I**	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV++1.0CE+FR(b) + 0.5TG+0.5SE


℄
3000
+5.15
8700
B
5650
3000
5650
A
A
3000
1525
4 @3750=11250
1525
14300
B

Bridge name **CAI RANG-P2**

Pile Type Dia = 1500 mm Length = 49.0 m

Bearing Capacity Qs = 17519 kN Qult = 19905 kN

Longitudinal direction

Load Combination	Displacement δ x(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	5.6	30	7249	9071	3506	-7110	OK
Strength III	2.1	30	3825	9071	2564	-7110	OK
Strength V	1.9	30	5785	9071	4508	-7110	OK
Extremme Event I-1	8.3	20	7027	9071	2487	-7110	O.K
Extremme Event I-2	10.2	20	6188	9071	566	-7110	OK
Extremme Event II	5.9	30	5041	9071	1713	-7110	OK
Service I	6.1	15	5447	5894	2658	-4197	OK

Longitudinal direction

Load Combination	Displacement δ y(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	0.6	30	5480	9071	5275	-7110	OK
Strength III	2.9	30	4071	9071	2318	-7110	OK
Strength V	1.5	30	5558	9071	4735	-7110	OK
Extremme Event I-1	7.4	20	6594	9071	2921	-7110	O.K
Extremme Event I-2	7.4	20	5213	9071	1540	-7110	OK
Extremme Event II	6.2	30	4810	9071	1943	-7110	OK
Service I	2.4	15	4491	5894	3614	-4197	OK

SECTION CALCULATION

A. BODY

LOAD COMBINATION TABLE

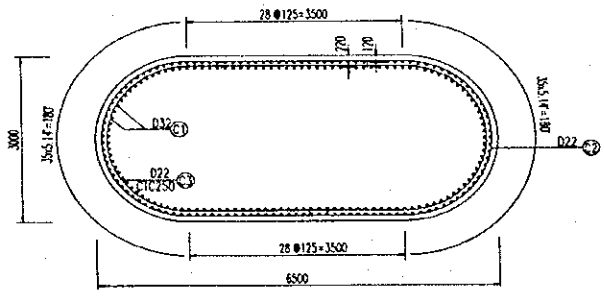
No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I	3823	274.2	3151	43.2	143
2	STRENGTH-III	2132	111.0	958	161.0	1567
3	STRENGTH-V	3611	88.0	1122	88.0	723
4	EXTREME EVEN-I - 1	3254	346.0	2657	330.0	2137
5	EXTREME EVEN-I - 2	2298	443.0	3430	330.0	2137
6	EXTREME EVEN-II	2298	317.0	2309	376.0	1762
7	SERVICE-I	2829	201.0	2167	88.0	723

1	STRENGTH-I	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA +1.75CE+ 1FR(b)+1TG+1SE
2	STRENGTH-III	0.9DC + 0.65DW + 1.0WA + 1.4WS ++ 1FR(a) +TG + SE
3	STRENGTH-V	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
4	EXTREME EVEN-I - 1	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5	EXTREME EVEN-I - 2	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ +1.0FR(a)
6	EXTREME EVEN-II	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV ++0.5CE+1.0FR(a)
7	SERVICE-I	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV++1.0CE+ + 0.5TG+0.5SE

SECTION CALCULATION SECTION A - A

Combination		1		2	
Actual Moment	kN.m	30901	37481	33637	22536
Allowable Moment	kN.m	110609	134175	142314	95399
		OK		OK	
Reinforcement		2 layers D25 @ 125			

A - A



FOOTING

B pier 11.30 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 300 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr= ϕ Mn (kN·m)	1.33M < 1.2Mcr or Mr
1	3684	4899	5452	6041	OK
2	1820	2420			OK
3	2809	3736			OK
4	3551	4723			OK
5	3231	4297			OK
6	2546	3386			OK

As = 64 cm2 (D=3.2cm, 8 Nos)
A's = 39 cm2 (D=2.5cm, 8 Nos)
ρ s = As/Ac = 0.0021
ρ min = 0.03 f'/fy = 0.0018
$\therefore$ ρ s > ρ min ..... O.K
c/de = 0.02
$\therefore$ c/de < 0.42 ..... O.K

SERVICE LIMIT STATE

(h = 300 cm , b = 100 cm)

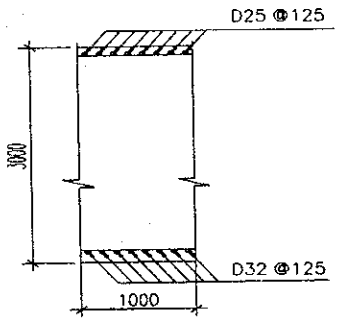
As = 64 cm2 (D=3.2cm, 8 Nos) A's = 39 cm2 (D=2.5cm, 8 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
7	2736.45	126	153	229	OK

Stress

Actual			Allowable			Remark
fc tensile	=	1.75 (MPa)	fr = 0.63·(fc)$^{0.5}$	=	3.03 (MPa)	OK
fc compress	=	1.79 (MPa)	fca = 0.4fc	=	9.41 (MPa)	OK
fs	=	11.48 (MPa)	fsa = 0.6fy	=	229.48 (MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

		Unit	Z=5 m		Z=11 m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D28		14-D25		
Area As		cm2	86.21		68.72		
a. Longitudinal direction							
Combination 1	P	kN	3506	25876	3506	30032	OK
	M	kN·m	649	4789	369	3160	OK
Combination 2	P	kN	2564	30595	2564	32607	OK
	M	kN·m	263	3133	149	1900	OK
Combination 3	P	kN	4508	33693	4508	34306	OK
	M	kN·m	208	1556	118	900	OK
Combination 4	P	kN	2487	13778	2487	22190	O.K
	M	kN·m	1072	5937	609	5438	O.K
Combination 5	P	kN	566	910	566	1718	O.K
	M	kN·m	1301	2094	740	2247	O.K
Combination 6	P	kN	1713	13525	1713	21978	O.K
	M	kN·m	750	5922	426	5472	O.K
Combination 7	P	kN	2658	24512	2658	26772	O.K
	M	kN·m	557	5134	433	4358	O.K

		Unit	Z=5 m		Z=11 m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D28		14-D25		
Area As		cm2	86.21		68.72		
b. Transverse direction							
Combination 1	P	kN	5275	35113	5275	35084	OK
	M	kN·m	102	681	58	387	OK
Combination 2	P	kN	2318	27054	2318	30684	OK
	M	kN·m	381	4444	217	2867	OK
Combination 3	P	kN	4735	33813	4735	34371	OK
	M	kN·m	208	1486	118	859	OK
Combination 4	P	kN	2921	17004	2920	24641	O.K
	M	kN·m	1032	6006	587	4949	O.K
Combination 5	P	kN	1540	6952	1541	15393	O.K
	M	kN·m	1032	4657	587	5863	O.K
Combination 6	P	kN	1943	12818	1943	21356	O.K
	M	kN·m	890	5868	506	5562	O.K
Combination 7	P	kN	3614	32535	3614	32921	O.K
	M	kN·m	244	2194	189	1726	O.K

STRESS

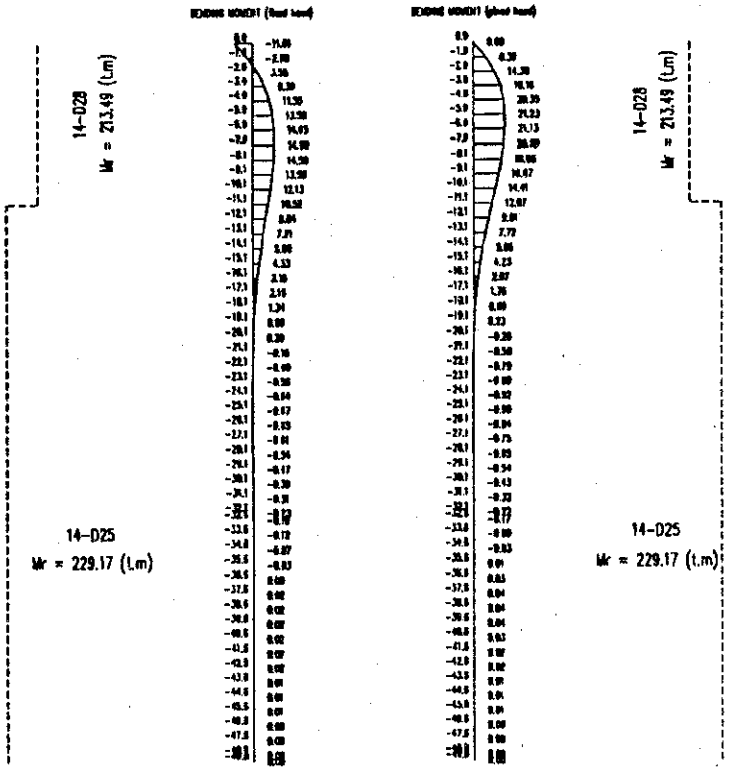
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-78.6	220.6	5.60	12.26	OK
Combination 2	-38.9	220.6	2.74	12.26	OK
Combination 3	-52.5	220.6	3.62	12.26	OK
Combination 4	-90.9	220.6	6.65	12.26	OK
Combination 5	276.1	294.2	8.47	14.71	OK
Combination 6	-64.6	294.2	4.72	14.71	OK
Combination 7	-62.1	176.5	4.45	9.81	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-51.8	220.6	3.45	12.26	OK
Combination 3	-31.9	220.6	2.17	12.26	OK
Combination 4	-51.2	220.6	3.43	12.26	OK
Combination 5	-98.6	220.6	7.31	12.26	OK
Combination 6	-70.9	294.2	5.29	14.71	OK
Combination 7	-40.8	176.5	2.75	9.81	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	4.10	σ ca=0.5x σ ck = 17.65	OK
Vertical Punching Shear	τ c =	0.18	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	4.00	σ 'ca=0.3x σ ck = 10.59	OK
Horizontal Bearing Pressure	τ c =	0.25	τ a = 0.88	OK

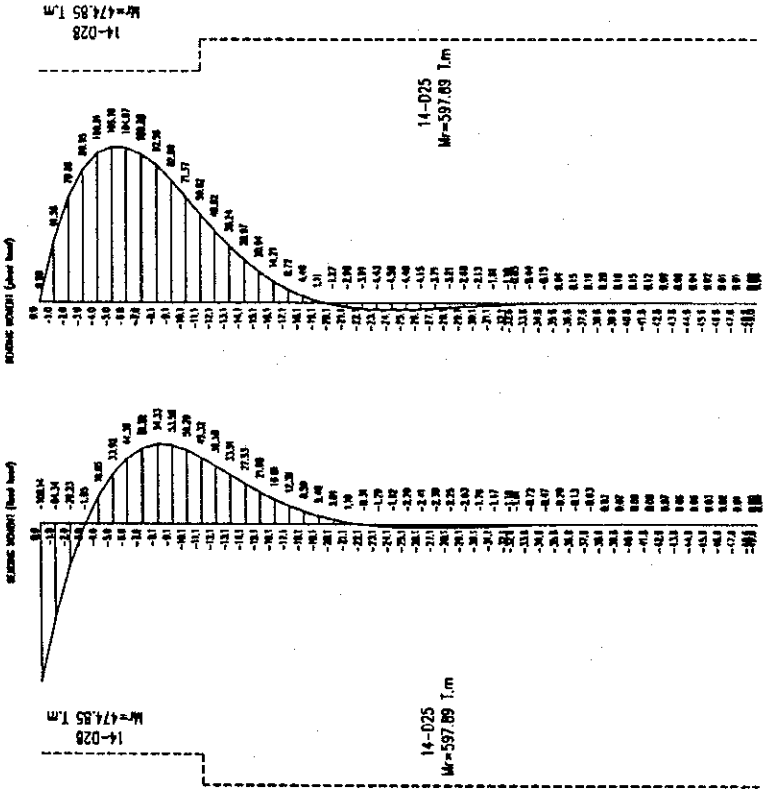
COMBINATION 5 : PILE (1,1)

LONGITUDINAL DIRECTION

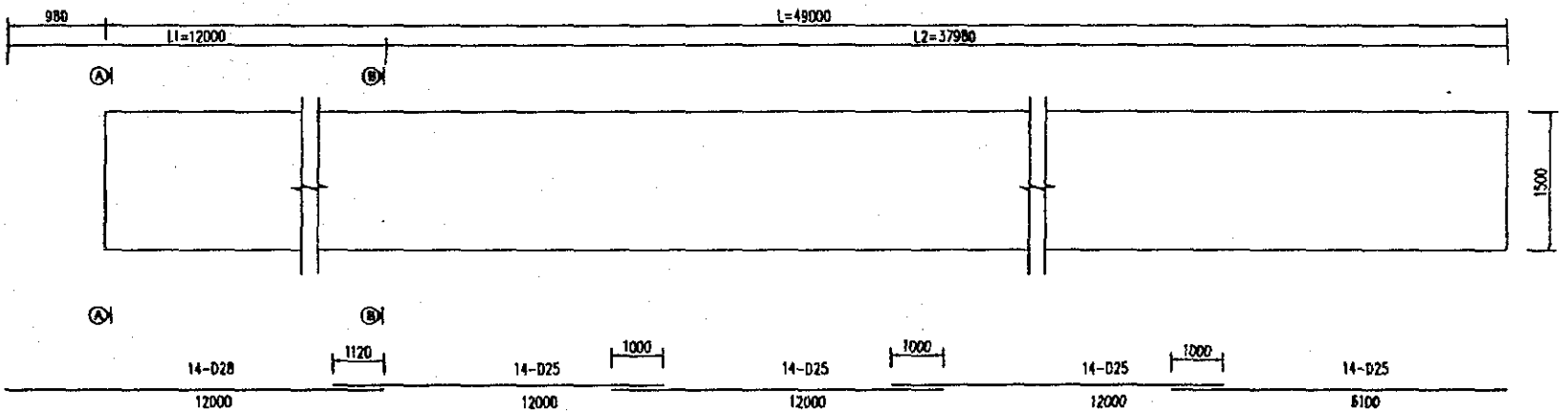


COMBINATION 5 : PILE (1,1)

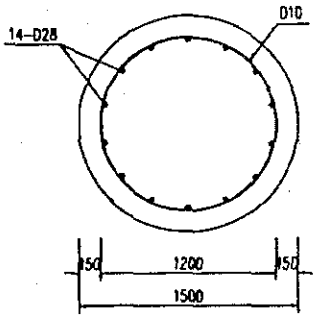
TRANSVERSE DIRECTION



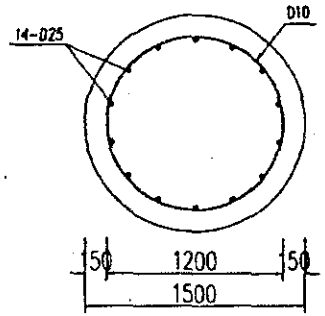
PILE PLAN OF PIER P2 - CAI RANG BRIDGE



A - A



B - B

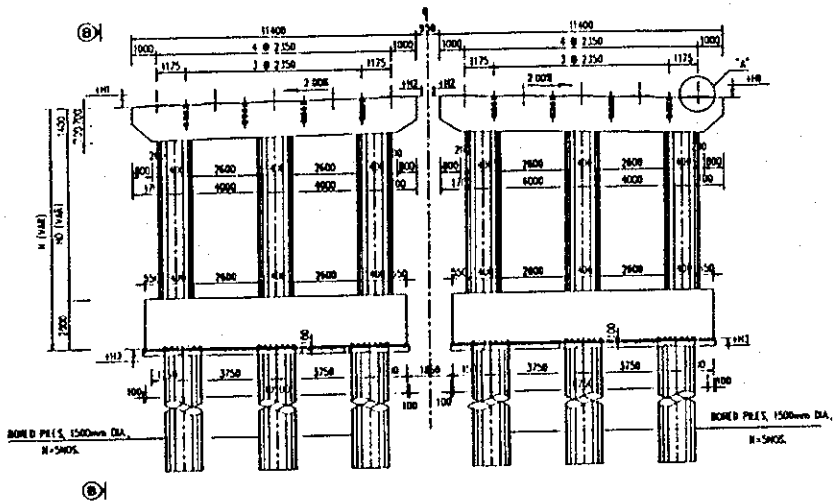


(3) *PIER, TYPE P8*

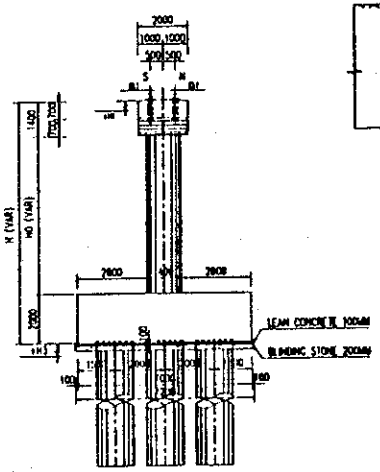
DETAILS OF PIERS

SCALE 1:200

PIER ELEVATION

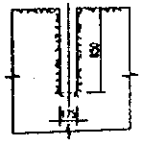


B - B



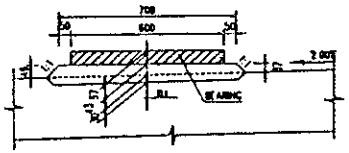
DETAIL OF ANCHOR HOLE

SCALE 1:50

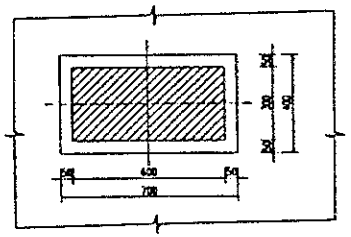


DETAIL "A"

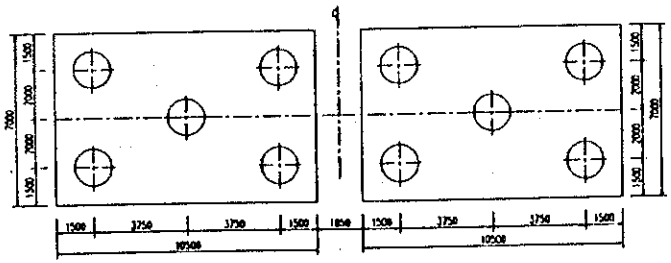
SCALE 1:20



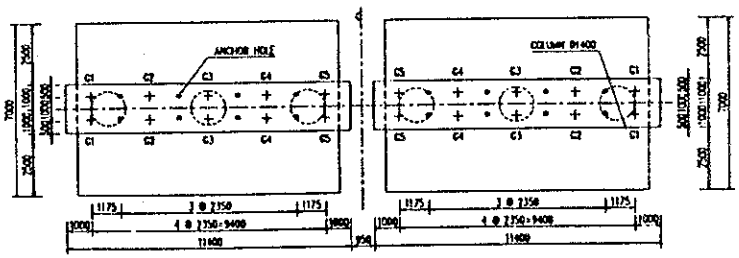
PLAN



PILE CAP - PLAN



GIRDER BEARING SEAT - PLAN



GIRDER BEARING SEAT ELEVATION OF EL1

PIER TYPE	GROUT PAD	C1	C2	C3	C4	C5
P1	R	4.585	4.632	4.659	4.726	4.773
	S	4.585	4.632	4.659	4.726	4.773
P2	R	5.255	5.302	5.329	5.396	5.443
	S	5.255	5.302	5.329	5.396	5.443
P3	R	5.595	5.642	5.669	5.736	5.783
	S	5.595	5.642	5.669	5.736	5.783
P4	R	5.605	5.652	5.679	5.746	5.793
	S	5.605	5.652	5.679	5.746	5.793

TABLE OF DIMENSIONS

DIMENSIONS \ ELEVATIONS	PIER TYPE P1	P2	P3	P4
PIER HEIGHT H1 (m)	5.00	6.60	5.80	5.60
PIER HEIGHT H (m)	8.60	8.00	8.00	8.00
ELEVATION H1 (m)	+5.55	+5.22	+5.56	+5.57
ELEVATION H2 (m)	+4.33	+4.00	+5.33	+5.34
ELEVATION H3 (m)	-3.85	-2.70	-3.44	-3.45
NUMBER OF PILE /LINGHT (N)	10/49	10/53	10/53	10/53

NOTES

1 FOR STANDARD STRUCTURAL NOTES SEE DRAWING No P3/BR1/0030

2 PIERS P1B, P2B, P3B, P4B BELONG TO HO CHI MINH CITY - CA MAU PROVINCE DIRECTION
PIERS P1E, P2E, P3E, P4E BELONG TO CA MAU PROVINCE - HO CHI MINH CITY DIRECTION

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kameteni	K Matsumoto	K. Enomoto	CAI TAC 1 BRIDGE PIERS GENERAL VIEW OF PIERS P1,P2,P3&P4	P3/BR1/0390
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

2. LOAD COMBINATIONS - CAI TAC 1 - PIER 3

Nos	Items	Pz			Hx			Hy			My			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	
	Permanent load																
1	Superstructure (stage1)- DC (n=0.9,1.25)																
	+ Left	303	273	379							-151	-136	-189				
	+ Right	303	273	379							151	136	189				
2	Wearing surface (stage2) - DW (n=0.65,1.5)	133	87	200							-9.5	-6.2	-11.9				
	+ Left	76	49	114							-38	-25	-57				
	+ Right	57	37	86							29	19	43				
3	Pier - DC (n=0.9,1.25)	509	458	636							0	0	0				
	Transient Loads																
4	Live load - LL(n= 0.5,1.75)	212	106	372							-60	-30	-105	-189	-94	-330	
	a- Main load	144	72	252							-41	-20	-71	-377	-189	-660	
	b- Sub load	69	34	120							-19	-10	-34	189	94	330	
5	Dynamic load allowance - IM (n=0.5,1.75)	70	35	123							-20	-10	-35	-62	-31	-109	
	a- Main load	47	24	83							-13	-7	-23	-125	-62	-218	
	b- Sub load	23	11	40							-6	-3	-11	62	31	109	
6	Braking force - BR (n=0.5,1.75)				-27.5	-13.8	-48.1				-365	-182	-638				10% of Japanese Load - p1
7	Centrifugal force - CE (n=0.5,1.75)							14.8	7.4	25.9				196	98	343	
	+ Left							7.4	3.7	13.0				98	49	172	10% of Japanese Load - p1
	+ Right							7.4	3.7	13.0				98	49	172	25% of Japanese Load - p1
8	Friction force - FR (n=1)																f=0.25
	a- Dead load				-37						-333						
	b- Dead load + Live load				-48						-428						
9	Vessel collision load - CV (n=1)																
	a- Transverse							192						1,002			
	b- Longitudinal				-96						-501						
10	Temperature gradient TG (n=1)																
	a. + 5 degrees	-3.6									-157						
11	Settlement SE (n=1)	44									-10						
12	Wind load - (n= 0.5,1.75)																
	a- Transverse - WS (n=0.4, 1.4)							30	12	42				324	130	454	
	b- Longitudinal - WL (n=1)				-8						-49						12% of Dead load
13	Earthquake - EQ (n=1)																
	a- Transverse							150						956			
	b- Longitudinal				-193						-1,345						

LOAD COMBINATION TABLE

Load combinations	Pz	Hx	Hy	My	Mx
1	2128.1	-95.7	45.3	-1387.8	-95.3
2	1580.9	-85.1	45.3	-1274.3	-95.3
3	1130.2	-37.0	42.2	-506.1	324.1
4	1231.4	-243.7	150	-1906.5	831.0
5	1231.4	-146.7	205.0	-1062.3	975.0
6	1550.8	-82.6	35.0	-1093.5	269.6

Combination 1 (STRENGHT - I-1) 1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE

Combination 2 (STRENGHT - I-2) 0.9DC + 0.65DW + 1.75(LL + IM + CE + BR) + 1FR(a) +TG

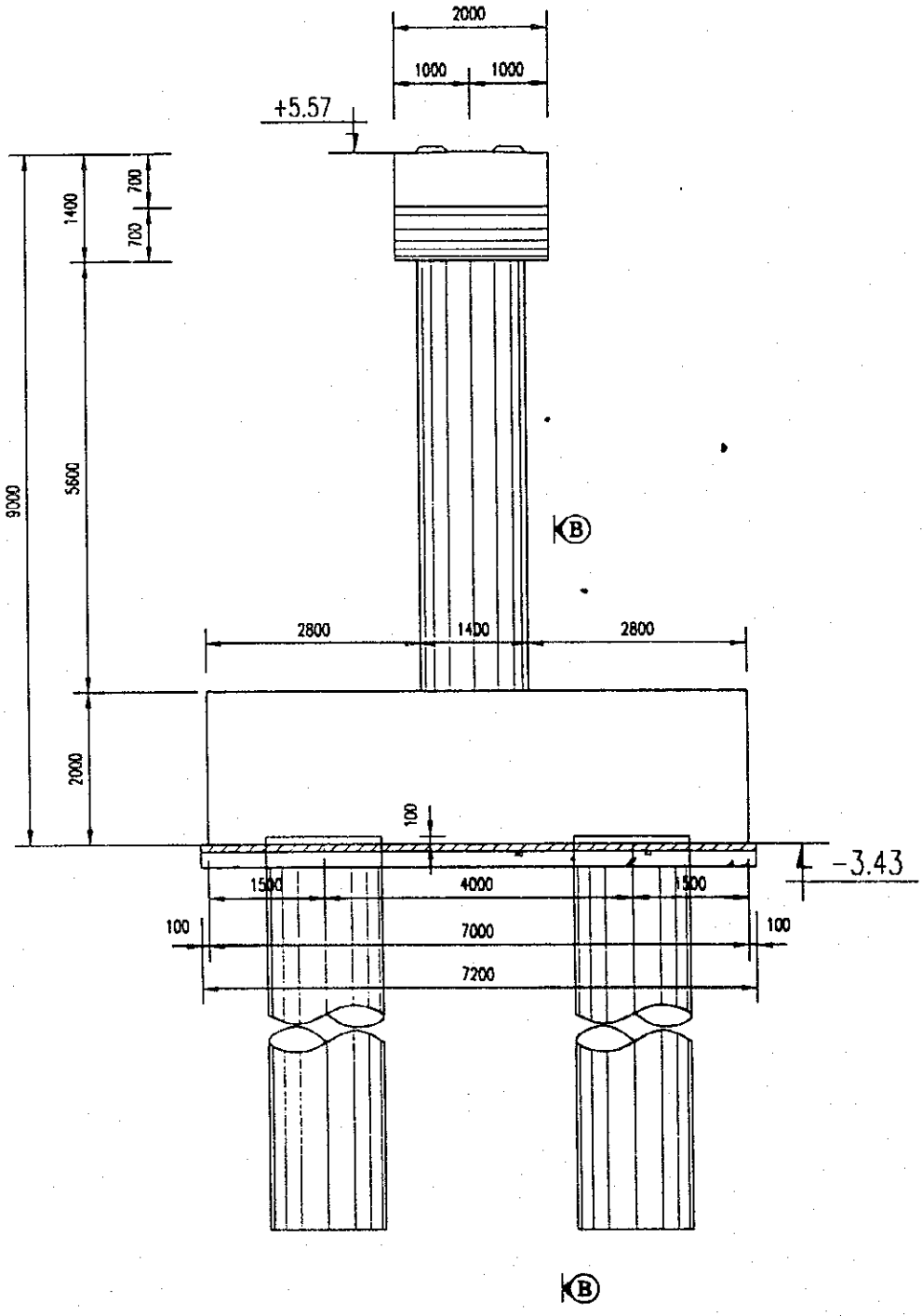
Combination 3 (STRENGHT - III) 0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE

Combination 4 (EXTREME EVENT -I) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ

Combination 5 (EXTREME EVENT-II) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV

Combination 6 (SERVICE -I) DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE

PIER P3


2000
1000
1000
+5.57
1400
700
700
9000
5600
B
2800
1400
2800
2000
100
-3.43
1500
4000
1500
100
7000
100
7200
B

Bridge name CAI TAC 1 - P3

Pile Type Dia = 1500 mm Length = 53.0 m

Bearing Capacity Qs = 15124 kN Qult = 17509 kN

Longitudinal direction

Load Combination	Displacement δ x(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	5.5	30	5698	7786	2650	-6423	OK
Strength I-2	5.0	30	4492	7786	1710	-6423	OK
Strength III	2.1	30	2779	7786	1655	-6423	OK
Extremme Event I	10.9	20	4841	7786	-11	-6423	O.K
Extremme Event II	6.4	30	3799	7786	1031	-6423	OK
Service I	6.6	15	4366	5001	1718	-3903	OK

Longitudinal direction

Load Combination	Displacement δ y(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	1.1	30	4206	7786	4141	-6423	OK
Strength I-2	1.1	30	3133	7786	3068	-6423	OK
Strength III	1.3	30	2491	7786	1942	-6423	OK
Extremme Event I	4.4	20	3201	7786	1630	-6423	O.K
Extremme Event II	5.9	30	3393	7786	1437	-6423	OK
Service I	1.7	15	3286	5001	2797	-3903	OK

SECTION CALCULATION

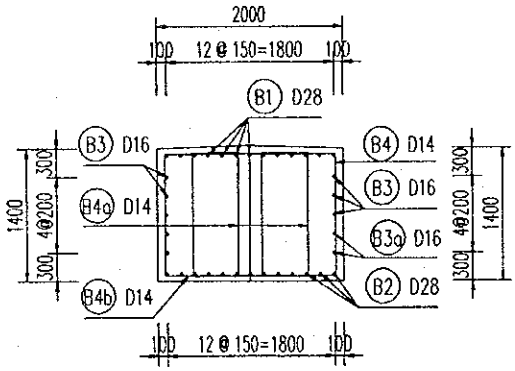
A. PIER CAP

i) Section Calculation for Flexure

		value	ELE	LOAD	LOC	NOD	Remark
Moment	M+ (kN·m)	1382.35	3	STRENGTH I	1.65	4	Mr >= min(1.2Mcr;
	M- (kN·m)	-2460.7	2	STRENGTH I	0.7	3	1.33M)
Width	W (cm)	200.0					
Height	h (cm)	140.0					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
	Dia. (mm)	28.0					
Bar arrangement tensile	Pitch (mm)	150.0					
	As (cm2)	80.1					
	Dia. (mm)	28.0					
Bar arrangement compression	Pitch (mm)	150.0					
	As (cm2)	80.1					
Allowable Moment	Mr+(kN·m)	3442.1					OK, SF=1.45
Allowable Moment	Mr-(kN·m)	3442					OK, SF=1.45

ii) Section Calculation for Shear

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	-2460.68	2	STRENGHT I	0.7	3	
Shear	Q (kN)	3483.9	2	STRENGHT I	0.7	3	
Width	W (cm)	200					
Height	h (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of shear reinforcement	D (mm)	14.0					
Pitch of shear reinforcement	s (mm)	200					
Arear of shear reinforcement	Av (cm2)	9.24					
Allowable Shear	Vr (kN)	302.90					OK, SF= 1.04



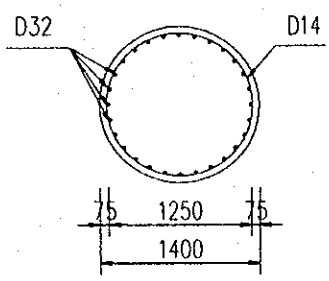
B. COLUMN

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	4269.3	9	EXTREME I	6.4	10	
Axial	P (kN)	2761.4	9	EXTREME I	6.4	10	
Diameter	W (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of reinforcement	D (mm)	32.0					
Number of bars	No (mm)	28.0					
Pitch of shear reinforcement	s (mm)	140					
Arear of shear reinforcement	Av (cm2)	337.78					
Allowable Compressive	Pr (kN)	2981.2					
Allowable Moment	Mr (kN·m)	4609.1					OK, SF= 1.08

$r_s = A_s/A_c$ = 0.0099 (17 nos. tensile)

$r_{min} = 0.135 f'_c/f_y$ = 0.0083

Checking rs > rmin OK



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr= ϕ Mn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) / A's = 11 cm2 (D=2.2cm, 3 Nos)
1	1171	1557	2422	2491	OK	ρ s = As/Ac = 0.0020
2	939	1249			OK	ρ min = 0.03 f'/fy = 0.0018
3	515	685			OK	∴ ρ s > ρ min ..... O.K
4	1026	1364			OK	c/de = 0.04
5	768	1021			OK	∴ c/de < 0.42 ..... O.K

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

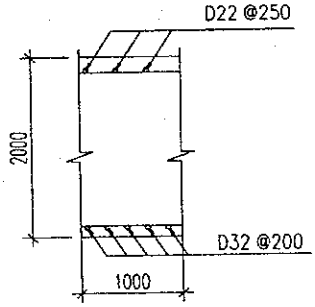
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
6	888.87	119	121	229	OK

Stress

Actual			Allowable				Remark
fc tensile	=	1.28 (MPa)	fr = 0.63·(fc)$^{0.5}$	=	3.03	(MPa)	OK
fc compress	=	1.31 (MPa)	fca = 0.4fc	=	9.41	(MPa)	OK
fs	=	8.26 (MPa)	fsa = 0.6fy	=	229.48	(MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

	Unit	Z=5 m		Z=11 m		Remark
		Atual	Allowable	Atual	Allowable	
Reinforcement	mm	14-D28		14-D25		
Area As	cm2	86.21		68.72		

a. Longitudinal direction

Combination 1	P	kN	2650	23766	2650	29833	OK
	M	kN·m	591	5297	288	3246	OK
Combination 2	P	kN	1710	18827	1710	27390	OK
	M	kN·m	539	5940	260	4167	OK
Combination 3	P	kN	1655	28957	1655	32206	OK
	M	kN·m	218	3807	109	2114	OK
Combination 4	P	kN	-11	-17	-11	-23	O.K
	M	kN·m	1023	1587	609	1284	O.K
Combination 5	P	kN	1031	8541	1031	16554	O.K
	M	kN·m	616	5101	366	5879	O.K
Combination 6	P	kN	1718	22464	1718	25285	O.K
	M	kN·m	423	5531	325	4786	O.K

	Unit	Z=5 m		Z=11 m		Remark
		Atual	Allowable	Atual	Allowable	
Reinforcement	mm	14-D28		14-D25		
Area As	cm2	86.21		68.72		

b. Transverse direction

Combination 1	P	kN	4141	328665	4141	34251	OK
	M	kN·m	190	1093	113	934	OK
Combination 2	P	kN	3068	32832	3068	33750	OK
	M	kN·m	190	2036	113	1244	OK
Combination 3	P	kN	1942	31275	1942	32822	OK
	M	kN·m	175	2821	105	1781	OK
Combination 4	P	kN	1630	15559	1630	23025	O.K
	M	kN·m	630	6004	375	5290	O.K
Combination 5	P	kN	1437	8497	1437	16504	O.K
	M	kN·m	861	5090	512	5879	O.K
Combination 6	P	kN	2797	32882	2797	33151	O.K
	M	kN·m	171	2009	135	1595	O.K

STRESS

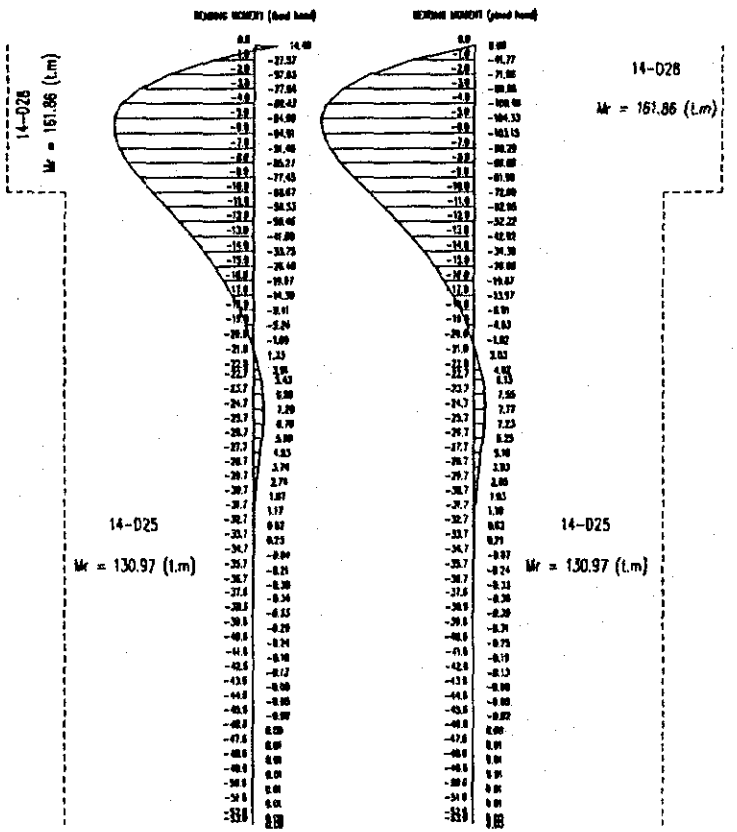
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-64.8	220.6	4.65	12.26	OK
Combination 2	-53.7	220.6	3.88	12.26	OK
Combination 3	-29.2	220.6	2.07	12.26	OK
Combination 4	276.4	220.6	6.91	12.26	OK
Combination 5	-50.3	294.2	3.79	14.71	OK
Combination 6	-48.7	176.5	3.43	9.81	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-42.6	220.6	2.99	12.26	OK
Combination 3	-34.1	220.6	2.43	12.26	OK
Combination 4	-25.8	220.6	1.82	12.26	OK
Combination 5	-49.3	220.6	3.70	12.26	OK
Combination 6	-32.7	176.5	2.29	9.81	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	3.22	σ ca=0.5x σ ck = 14.71	OK
Vertical Punching Shear	τ c =	0.28	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	3.19	σ 'ca=0.3x σ ck = 8.83	OK
Horizontal Bearing Pressure	τ c =	0.20	τ a = 0.88	OK

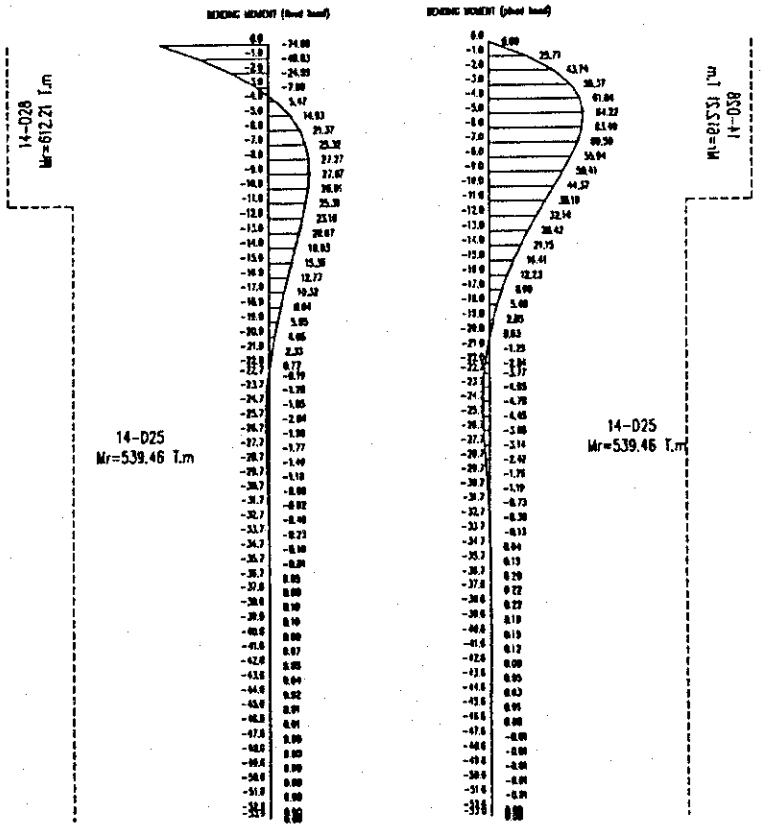
COMBINATION 4 : PILE (1,1)

LONGITUDINAL DIRECTION

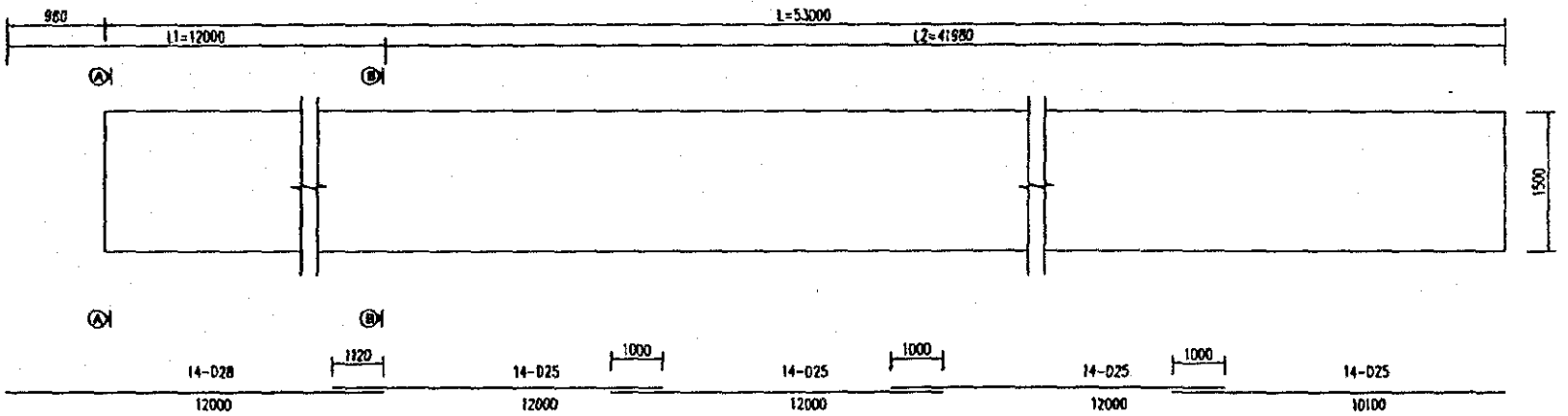


COMBINATION 4 : PILE (1,1)

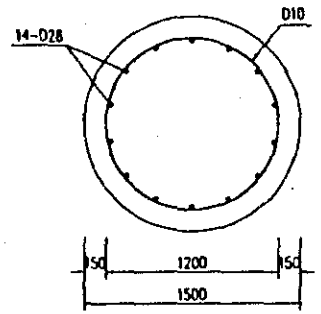
TRANSVERSE DIRECTION



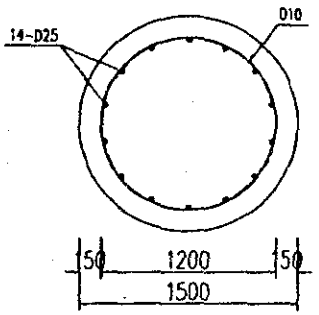
PILE PLAN OF PIER P3 - CAI TAC 1 BRIDGE



A - A



B - B

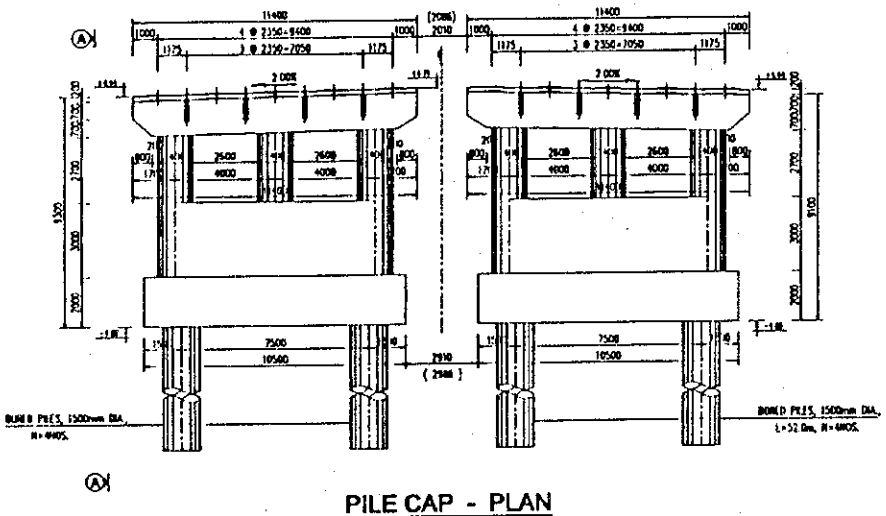


(4) *PIER, TYPE P9*

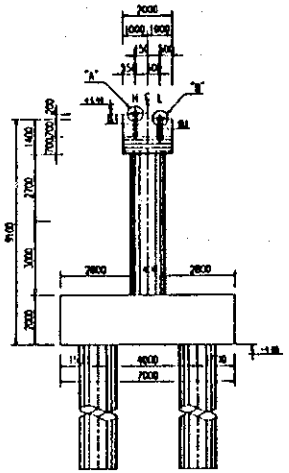
DETAILS OF PIERS P1&P2

(SCALE 1:200)

PIER ELEVATION

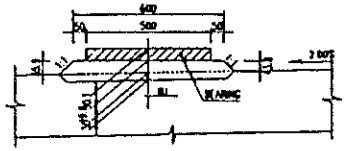


A - A

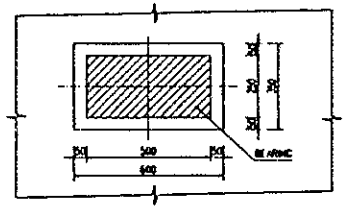


DETAIL "A"

SCALE 1:20

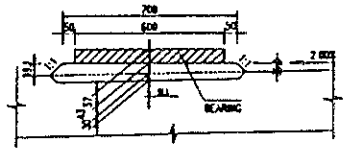


PLAN

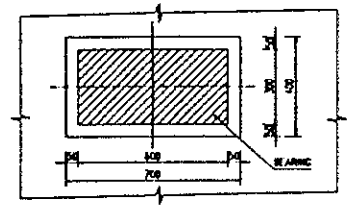


DETAIL "B"

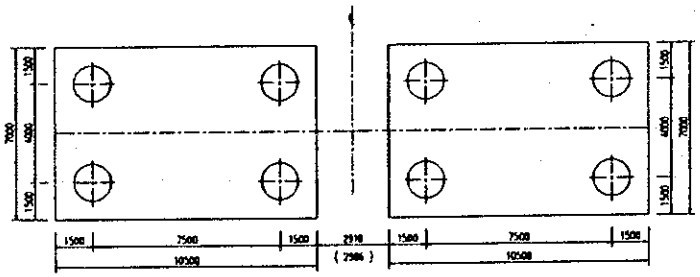
SCALE 1:20



PLAN

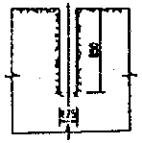


PILE CAP - PLAN

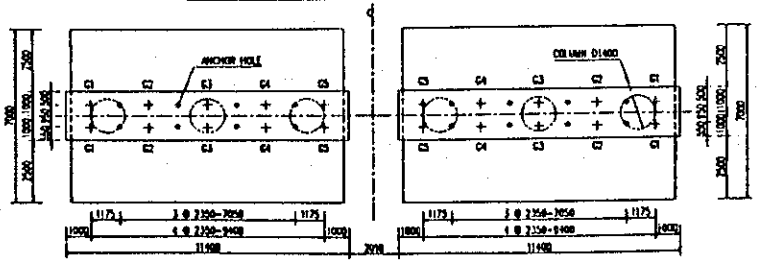


DETAIL OF ANCHOR HOLE

SCALE 1:50



GIRDER BEARING SEAT - PLAN



GIRDER BEARING SEAT ELEVATION OF EL1

PIER TYPE \ GROUT PAD		C1	C2	C3	C4	C5
P1	H	4.457	4.504	4.551	4.598	4.645
	L	4.256	4.302	4.349	4.396	4.443
P2	H	4.256	4.302	4.349	4.396	4.443
	L	4.457	4.504	4.551	4.598	4.645

NOTES

1. FOR STANDARD STRUCTURAL NOTES SEE DRAWING No. P3/BR3/0030
2. PIERS P1R, P2R BELONG TO HO CHI MINH CITY – CA MAU PROVINCE DIRECTION
   PIERS P1C, P2C BELONG TO CA MAU PROVINCE – HO CHI MINH CITY DIRECTION

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kemeteni	K. Matsumoto	K. Enomoto	CAI DA BRIDGE PIERS GENERAL VIEW OF PIERS P1&P2	P3/BR3/0420
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

2. LOAD COMBINATIONS - CAI NAI - PIER 2

Nos	Items	Pz			Hx			Hy			My			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	
	Permanent load																
1	Superstructure (stage1)- DC (n=0.9,1.25)																
	+ Left	303	273	379							-151	-136	-189				
	+ Right	221	199	276							100	90	124				
2	Wearing surface (stage2) - DW (n=0.65,1.5)	133	87	200	0.9	0.6	1.2				10.4	6.8	13.0				
	+ Left	79	51	119							-40	-26	-59				
	+ Right	54	35	81							24	16	37				
3	Pier - DC (n=0.9,1.25)	597	537	746							0	0	0				
	Transient Loads																
4	Live load - LL(n= 0.5,1.75)	52	26	91							-96	-48	-168	-46	-23	-81	
	a- Main load	35	18	61							-65	-32	-113	-92	-46	-161	
	b- Sub load	17	8	29							-31	-15	-54	46	23	81	
5	Dynamic load allowance - IM (n=0.5,1.75)	17	9	30							-32	-16	-55	-15	-8	-27	
	a- Main load	12	6	20							-21	-11	-37	-30	-15	-53	
	b- Sub load	6	3	10							-10	1	4	15	8	27	
6	Braking force - BR (n=0.5,1.75)				13.8	6.9	24.1				207	104	362				25% of Main Load
7	Centrifugal force - CE (n=0.5,1.75)							13.0	6.5	22.8				196	98	343	
	+ Left							7.4	3.7	13.0				111	56	195	
	+ Right							5.6	2.8	9.8				84	42	148	
8	Friction force - FR (n=1)																f=0.05
	a- Dead load				33						434						
	b- Dead load + Live load				35						468						
9	Vessel collision load - CV (n=1)																
	a- Transverse							192						1,591			
	b- Longitudinal				96						795						
10	Temperature gradient TG (n=1)																
	a. + 5 degrees	1.7									78						
11	Settlement SE (n=1)	-27									-41						
10	Wind load - (n= 0.5,1.75)																
	a- Transverse - WS (n=0.4, 1.4)							25	10	36				289	116	405	
	b- Longitudinal - WL (n=1)				7						81						
11	Earthquake - EQ (n=1)																12% of Dead load
	a- Transverse							150						1,087			
	b- Longitudinal				184						1,451						

LOAD COMBINATION TABLE

Load combinations	Pz	Hx	Hy	My	Mx
1	1696.3	60.9	39.8	594.8	235.5
2	1217.8	57.5	39.8	610.9	235.5
3	1070.0	33.5	35.5	430.4	289.4
4	1129.8	223.9	150	1884.2	1056.5
5	1129.8	136.4	203.4	1229.0	1658.2
6	1310.4	57.1	30.4	644.7	424.0

Combination 1 (STRENGHT - I-1) 1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE

Combination 2 (STRENGHT - I-2) 0.9DC + 0.65DW + *1.75(LL + IM + CE + BR) + 1FR(a) +TG*

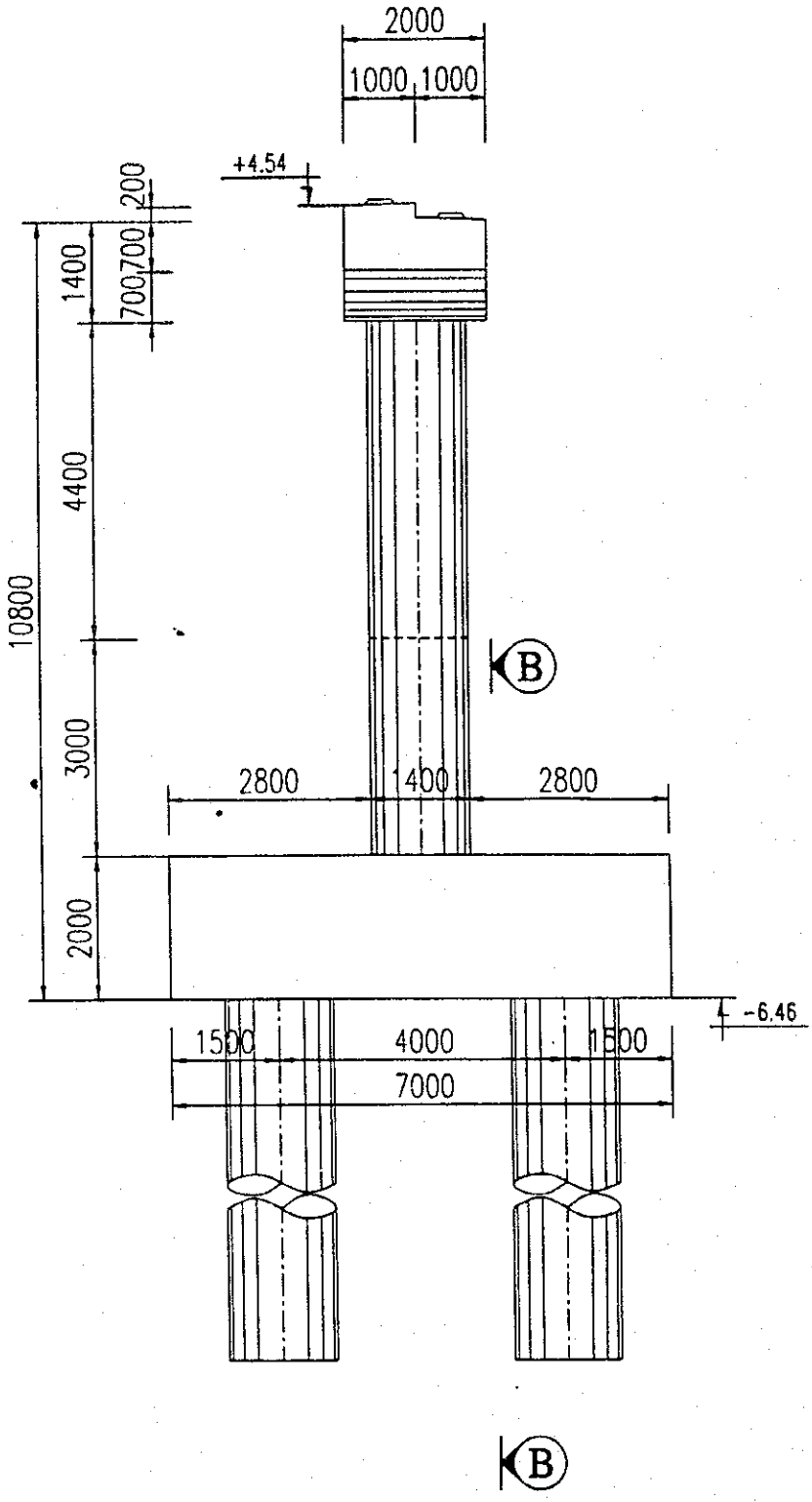
Combination 3 (STRENGHT - III) 0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE

Combination 4 (EXTREME EVENT -I) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ

Combination 5 (EXTREME EVENT-II) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV

Combination 6 (SERVICE -I) DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE

PIER P2


2000
1000 1000
+4.54
200
1400
700 700
4400
10800
3000
2000
B
2800
1400
2800
-6.46
1500
4000
1500
7000
B

Bridge name **CAI NAI - P2**

Pile Type Dia = 1500 mm Length = 55.0 m

Bearing Capacity Qs = 17246 kN Qult = 19631 kN

Longitudinal direction

Load Combination	Displacement δ x(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	3.4	30	4912	8826	3405	-7178	OK
Strength I-2	3.3	30	3743	8826	2228	-7178	OK
Strength III	2.1	30	3135	8826	2112	-7178	OK
Extremme Event I	11.8	20	5255	8826	285	-7178	O.K
Extremme Event II	7.3	30	4360	8826	1180	-7178	OK
Service I	4.9	15	4068	5707	2358	-4305	OK

Longitudinal direction

Load Combination	Displacement δ y(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	1.4	30	4381	8826	3936	-7178	OK
Strength I-2	1.4	30	3208	8826	2763	-7178	OK
Strength III	1.3	30	2870	8826	2377	-7178	OK
Extremme Event I	5.4	20	3711	8826	1829	-7178	O.K
Extremme Event II	7.4	30	4182	8826	1358	-7178	OK
Service I	1.9	15	3546	5707	2879	-4305	OK

SECTION CALCULATION

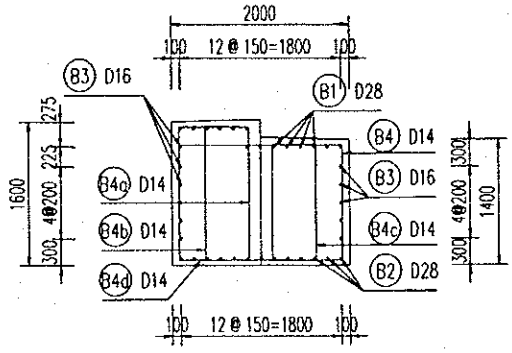
A. PIER CAP

i) Section Calculation for Flexure

		value	ELE	LOAD	LOC	NOD	Remark
Moment	M+ (kN·m)	861.02	3	STRENI 1	1.65	4	Mr >= min(1.2Mcr;
	M- (kN·m)	-1541.3	2	STRENI 1	0.7	3	1.33M)
Width	W (cm)	200.0					
Height	h (cm)	140.0					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
	Dia. (mm)	28.0					
Bar arrangement tensile	Pitch (mm)	150.0					
	As (cm2)	80.1					
	Dia. (mm)	28.0					
Bar arrangement compression	Pitch (mm)	150.0					
	As (cm2)	80.1					
Allowable Moment	Mr+(kN·m)	3442.1					OK, SF=1.55
Allowable Moment	Mr-(kN·m)	3442					OK, SF=1.55

ii) Section Calculation for Shear

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	-1541.31	2	STRENGHT II	0.7	3	
Shear	Q (kN)	2170.6	2	STRENGHT II	0.7	3	
Width	W (cm)	200					
Height	h (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of shear reinforcement	D (mm)	14.0					
Pitch of shear reinforcement	s (mm)	200					
Arear of shear reinforcement	Av (cm2)	9.24					
Allowable Shear	Vr (kN)	302.90					OK, SF= 1.43



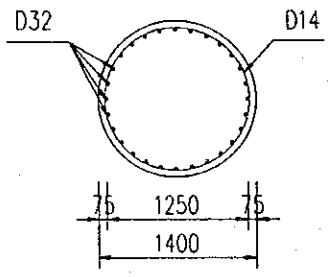
B. COLUMN

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	2479.3	9	EXTRM II	4.8	10	
Axial	P (kN)	-2160.9	9	EXTRM II	4.8	10	
Diameter	W (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of reinforcement	D (mm)	32.0					
Number of bars	No (mm)	28.0					
Pitch of shear reinforcement	s (mm)	140					
Arear of shear reinforcement	Av (cm2)	225.19					
Allowable Compressive	Pr (kN)	4338.5					
Allowable Moment	Mr (kN·m)	4978.0					OK, SF= 2.01

$r_s = A_s/A_c$ = 0.0089 (17 nos. tensile)

$r_{min} = 0.135 f'_c/f_y$ = 0.0083

Checking rs > rmin OK



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr= ϕ Mn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) A's = 15 cm2 (D=2.2cm, 4 Nos)
1	769	1023	2422	2491	OK	ρ s = As/Ac = 0.0020
2	625	831			OK	ρ min = 0.03 f'/fy = 0.0018
3	313	416			OK	∴ ρ s > ρ min ——— O.K
4	612	814			OK	c/de = 0.03
5	414	550			OK	∴ c/de < 0.42 ——— O.K
6	0	0			OK	

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

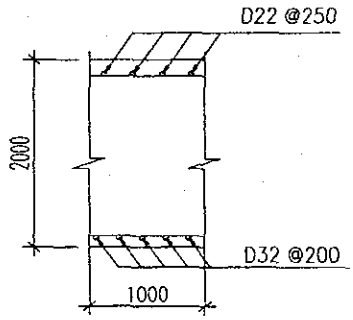
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 15 cm2 (D=2.2cm, 4 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
6	585.65	119	80	229	OK

Stress

Actual			Allowable				Remark
fc tensile	=	0.84 (MPa)	fr = 0.63·(fc)$^{0.5}$	=	3.03	(MPa)	OK
fc compress	=	0.86 (MPa)	fca = 0.4fc	=	9.41	(MPa)	OK
fs	=	5.44 (MPa)	fsa = 0.6fy	=	229.48	(MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

	Unit	Z=5 m		Z=11 m		Remark
		Atual	Allowable	Atual	Allowable	
Reinforcement	mm	14-D28		14-D25		
Area As	cm2	86.21		68.72		

a. Longitudinal direction

Combination 1	P	kN	3405	31027	3405	32698	OK
	M	kN·m	322	2937	193	1849	OK
Combination 2	P	kN	2228	28640	2228	31329	OK
	M	kN·m	304	3914	182	2560	OK
Combination 3	P	kN	2112	31061	2112	32916	OK
	M	kN·m	199	2921	111	1728	OK
Combination 4	P	kN	285	444	285	683	O.K
	M	kN·m	1186	1846	709	1697	O.K
Combination 5	P	kN	1180	8173	1180	16061	O.K
	M	kN·m	722	5004	432	5877	O.K
Combination 6	P	kN	2358	27898	2358	29180	O.K
	M	kN·m	353	4178	284	3517	O.K

	Unit	Z=5 m		Z=11 m		Remark
		Atual	Allowable	Atual	Allowable	
Reinforcement	mm	14-D28		14-D25		
Area As	cm2	86.21		68.72		

b. Transverse direction

Combination 1	P	kN	3936	33293	3936	34004	OK
	M	kN·m	211	1783	126	1089	OK
Combination 2	P	kN	2763	32045	2763	33286	OK
	M	kN·m	211	2446	126	1518	OK
Combination 3	P	kN	2377	31890	2377	33196	OK
	M	kN·m	188	2523	112	1569	OK
Combination 4	P	kN	1829	13654	1829	21404	O.K
	M	kN·m	794	5930	475	5555	O.K
Combination 5	P	kN	1358	5012	1358	11767	O.K
	M	kN·m	1077	3975	644	5578	O.K
Combination 6	P	kN	2879	32652	2879	32916	O.K
	M	kN·m	188	2132	151	1728	O.K

STRESS

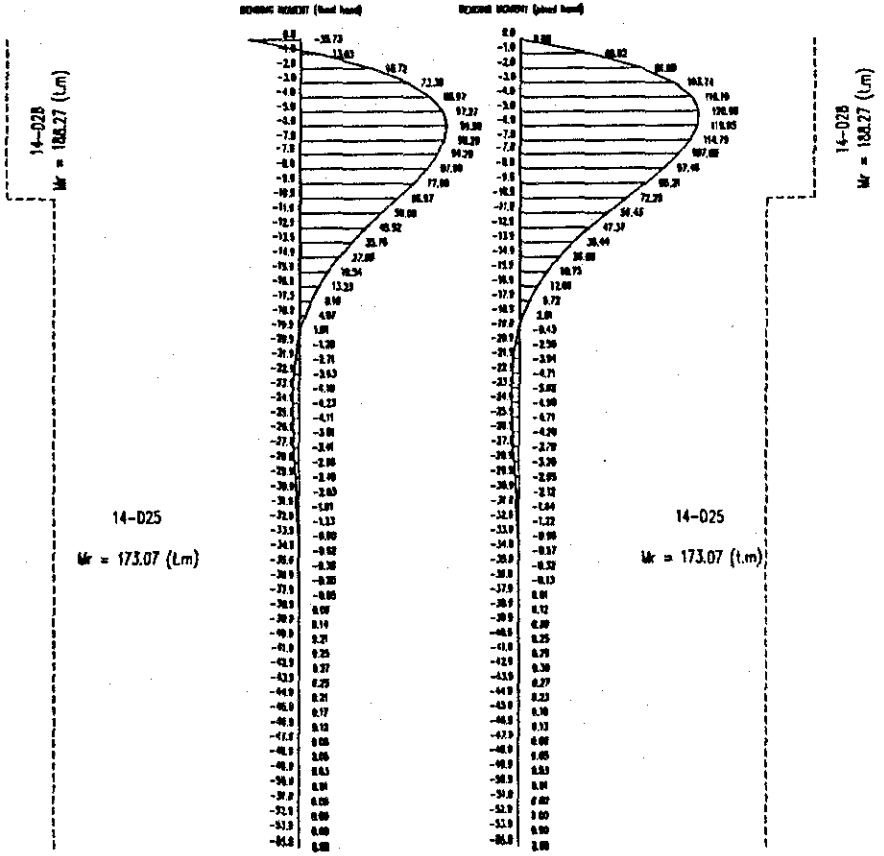
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-49.4	220.6	3.47	12.26	OK
Combination 2	-39.6	220.6	2.80	12.26	OK
Combination 3	-31.3	220.6	2.20	12.26	OK
Combination 4	281.2	220.6	7.86	12.26	OK
Combination 5	-58.3	294.2	4.29	14.71	OK
Combination 6	-44.1	176.5	3.15	9.81	OK
Combination 7	0.0	0.0	0.00	0.00	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-43.1	220.6	3.01	12.26	OK
Combination 3	-33.8	220.6	2.39	12.26	OK
Combination 4	-29.7	220.6	2.10	12.26	OK
Combination 5	-60.8	220.6	4.70	12.26	OK
Combination 6	-34.9	176.5	2.44	9.81	OK
Combination 7	0.0	0.0	0.00	0.00	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	2.97	σ ca=0.5x σ ck = 17.65	OK
Vertical Punching Shear	τ c =	0.26	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	3.66	σ 'ca=0.3x σ ck = 10.59	OK
Horizontal Bearing Pressure	τ c =	0.23	τ a = 0.88	OK

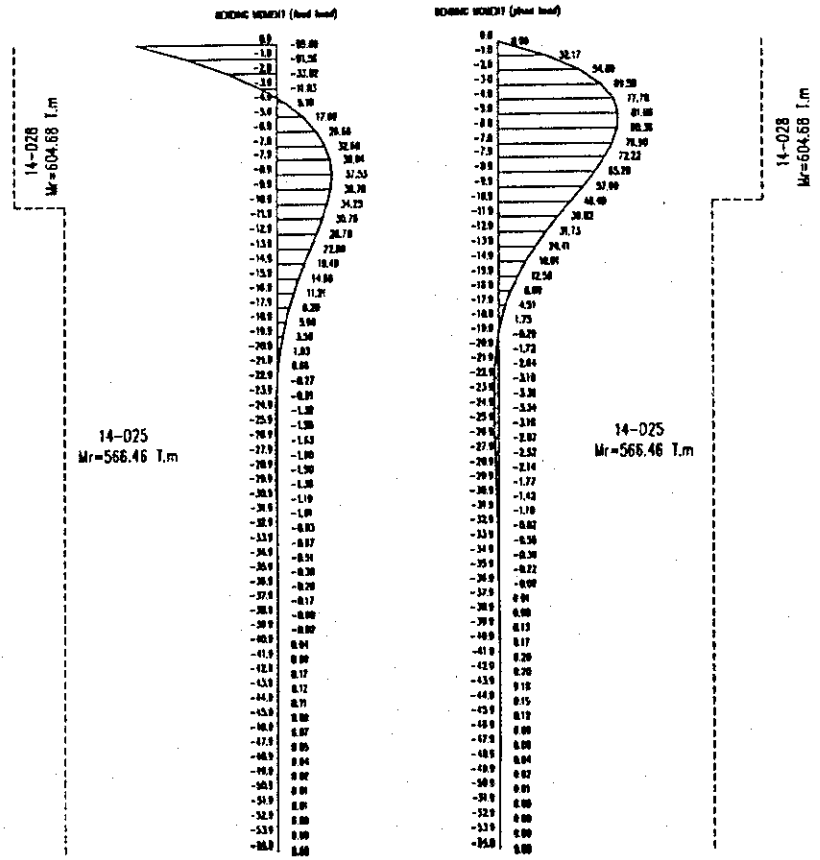
COMBINATION 4 : PILE (1,1)

LONGITUDINAL DIRECTION

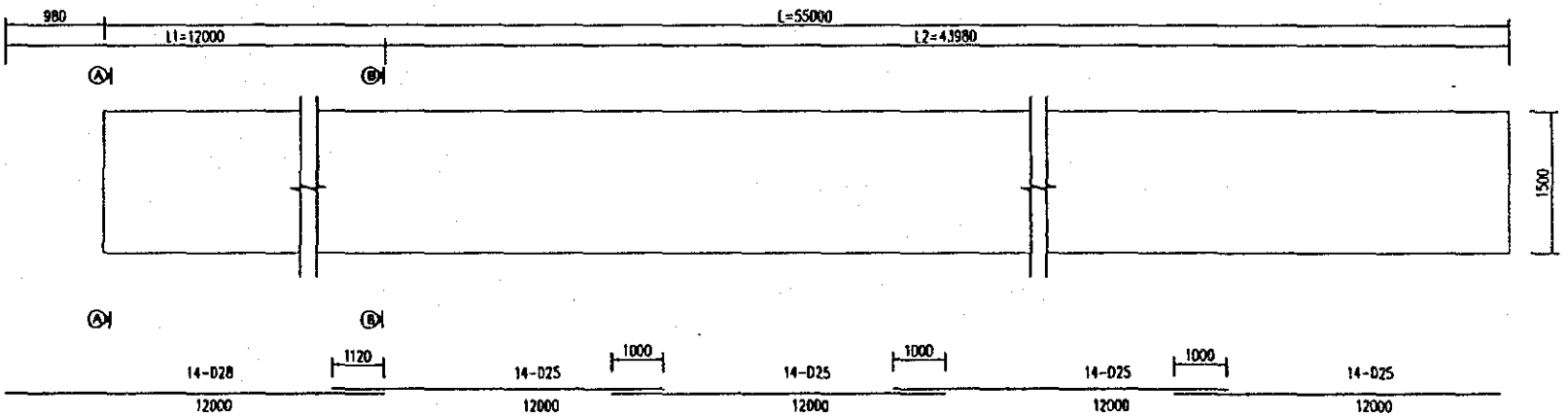


COMBINATION 4 : PILE (1,1)

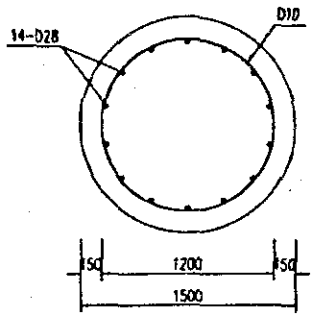
TRANSVERSE DIRECTION



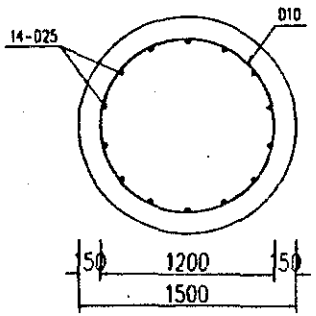
PILE PLAN OF PIER P2 - CAI NAI BRIDGE



A - A



B - B

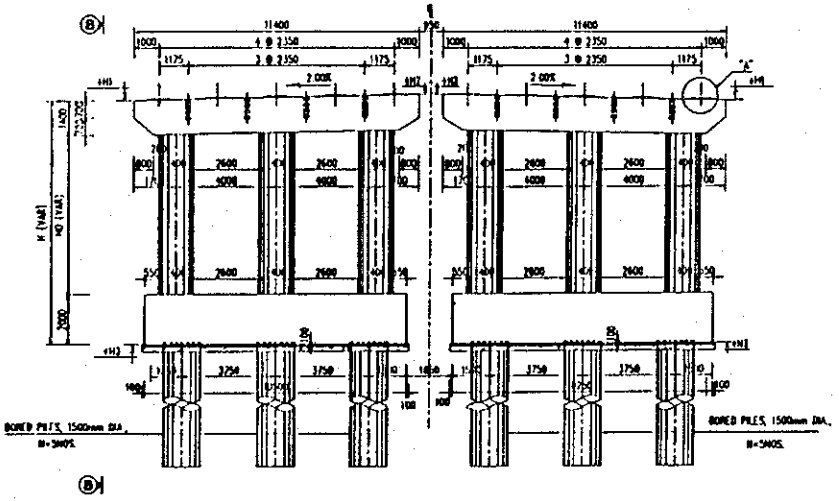


DETAILS OF PIERS

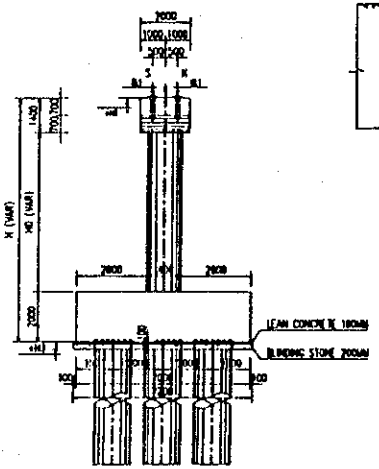
SCALE 1:200

(5) PIER, TYPE P11

PIER ELEVATION

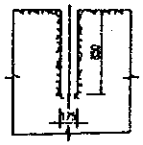


B - B



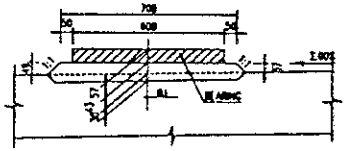
DETAIL OF ANCHOR HOLE

SCALE 1:50

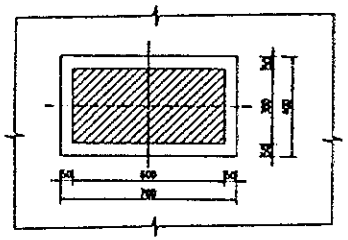


DETAIL "A"

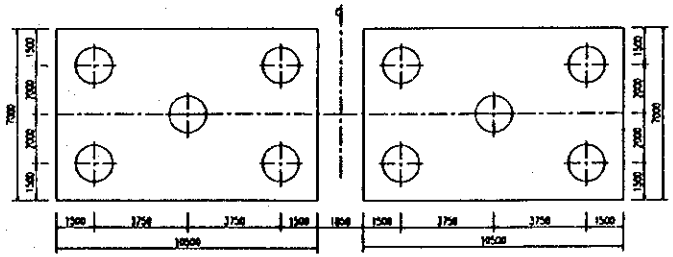
SCALE 1:20



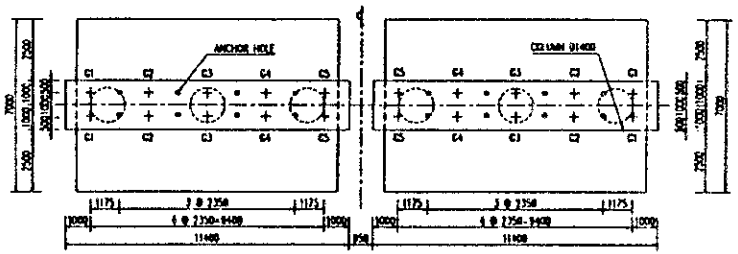
PLAN



PILE CAP - PLAN



GIRDER BEARING SEAT - PLAN



GIRDER BEARING SEAT ELEVATION OF EL1

PIER TYPE	GROUT PAD	C1	C2	C3	C4	C5
P1	M	4.586	4.633	4.650	4.726	4.773
	S	4.586	4.632	4.650	4.726	4.773
P2	M	5.255	5.302	5.320	5.396	5.443
	S	5.255	5.302	5.320	5.396	5.443
P3	M	5.595	5.642	5.660	5.736	5.783
	S	5.595	5.642	5.660	5.736	5.783
P4	M	5.605	5.652	5.670	5.746	5.793
	S	5.605	5.652	5.670	5.746	5.793

TABLE OF DIMENSIONS

DIMENSIONS \ ELEVATIONS	PIER TYPE P1	P2	P3	P4
PIER HEIGHT H0 (M)	5.00	6.00	5.00	5.00
PIER HEIGHT H (M)	8.00	8.00	9.00	9.00
ELEVATION H0 (M)	+4.55	+5.22	+5.56	+5.57
ELEVATION H2 (M)	+4.32	+4.99	+5.33	+5.34
ELEVATION H3 (M)	-3.85	-2.78	-3.44	-3.43
NUMBER OF PILE/LENGHT (M)	30/49	30/53	30/53	30/53

NOTES

1. FOR STANDARD STRUCTURAL NOTES SEE DRAWING No. P3/BRI/0030
2. PIERS P1F, P2F, P3F, P4F BELONG TO HO CHI MINH CITY - CA MAU PROVINCE DIRECTION
   PIERS P1E, P2E, P3E, P4E BELONG TO CA MAU PROVINCE - HO CHI MINH CITY DIRECTION

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kametani	K.Matsumoto	K. Enomoto	CAI TAC I BRIDGE PIERS GENERAL VIEW OF PIERS P1,P2,P3&P4	P3/BRI/0390
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

2. LOAD COMBINATIONS - CAI TAC 1 - PIER 4

Nos	Items	Pz			Hx			Hy			My			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	
	Permanent load																
1	Superstructure (stage1)- DC (n=0.9,1.25)										-151	-136	-189				
	+ Left	303	273	379							151	136	189				
	+ Right	303	273	379							32.5	21.1	40.6				
2	Wearing surface (stage2) - DW (n=0.65,1.5)	154	100	231							-22	-14	-33				
	+ Left	44	29	67							55	36	82				
	+ Right	109	71	164							0	0	0				
3	Pier - DC (n=0.9,1.25)	509	458	636													
	Transient Loads										35	17	60	-194	-97	-339	
4	Live load - LL(n= 0.5,1.75)	218	109	382							23	12	41	-388	-194	-678	
	a- Main load	148	74	258							11	6	20	194	97	339	
	b- Sub load	71	35	123							11	6	20	-64	-32	-112	
5	Dynamic load allowance - IM (n=0.5,1.75)	72	36	126							8	4	13	-128	-64	-224	
	a- Main load	49	24	85							4	6	20	64	32	112	
	b- Sub load	23	12	41							365	182	638				10% of Japanese Load - p1
6	Braking force - BR (n=0.5,1.75)				27.5	13.8	48.1							196	98	343	
7	Centrifugal force - CE (n=0.5,1.75)							14.8	7.4	25.9				98	49	172	10% of Japanese Load - p1
	+ Left							7.4	3.7	13.0				98	49	172	25% of Japanese Load - p1
	+ Right							7.4	3.7	13.0							f=0.25
8	Friction force - FR (n=1)										342						
	a- Dead load				38						440						
	b- Dead load + Live load				49												
9	Vessel collision load - CV (n=1)							192						1,000			
	a- Transverse										500						
	b- Longitudinal				96												
10	Temperature gradient TG (n=1)										-16						
	a. + 5 degrees	4.1									62						
11	Settlement SE (n=1)	-29															
12	Wind load - (n= 0.5,1.75)							30	12	42				324	130	454	
	a- Transverse - WS (n=0.4, 1.4)										49						
	b- Longitudinal - WL (n=1)				8												12% of Dead load
13	Earthquake - EQ (n=1)							152						979			
	a- Transverse				137						842						
	b- Longitudinal																

LOAD COMBINATION TABLE

Load combinations	Pz	Hx	Hy	My	Mx
1	2107.6	97.0	45.3	1252.8	-107.4
2	1615.5	86.1	45.3	1065.3	-107.4
3	1078.7	38.0	42.2	408.5	324.1
4	1248.7	188.8	152	1410.2	849.8
5	1248.7	147.7	205.0	1068.5	969.6
6	1546.7	83.9	35.0	946.6	262.7

Combination 1 (STRENGHT - I-1) 1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE

Combination 2 (STRENGHT - I-2) 0.9DC + 0.65DW + 1.75(LL + IM + CE + BR) + 1FR(a) +TG

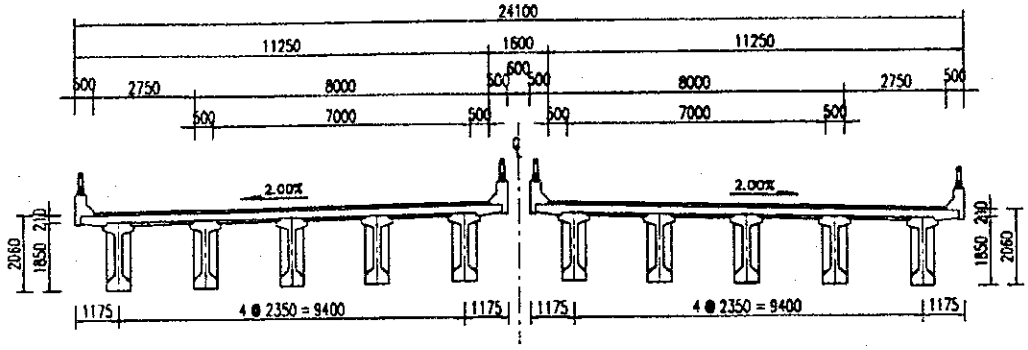
Combination 3 (STRENGHT - III) 0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE

Combination 4 (EXTREME EVENT -I) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ

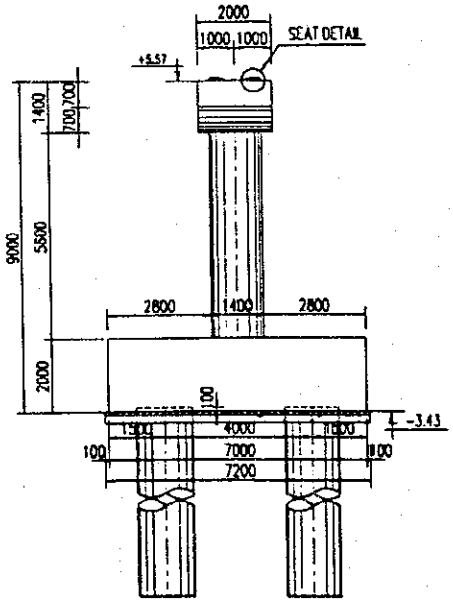
Combination 5 (EXTREME EVENT-II) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV

Combination 6 (SERVICE -I) DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE

LEFT AND RIGHT SPAN



B - B



Bridge name CAI TAC 1 -P4

Pile Type Dia = 1500 mm Length = 53.0 m

Bearing Capacity Qs = 15124 kN Qult = 17509 kN

Longitudinal direction

Load Combination	Displacement δ x(mm)		Bearing Capacity (kN)		Uplift Capacity (t)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	5.3	30	5541	7786	2727	-6423	OK
Strength I-2	4.6	30	4376	7786	1961	-6423	OK
Strength III	1.9	30	2593	7786	1638	-6423	OK
Extremme Event I	8.3	20	4269	7786	629	-6423	O.K
Extremme Event II	6.5	30	3842	7786	1057	-6423	OK
Service I	6.3	15	4225	5001	4225	-3903	OK

Longitudinal direction

Load Combination	Displacement δ y(mm)		Bearing Capacity (kN)		Uplift Capacity (t)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I-1	1.1	30	4159	7786	4108	-6423	OK
Strength I-2	1.1	30	3194	7786	3143	-6423	OK
Strength III	1.3	30	2390	7786	1841	-6423	OK
Extremme Event I	4.5	20	3250	7786	1649	-6423	O.K
Extremme Event II	5.9	30	3424	7786	1474	-6423	OK
Service I	1.7	15	3274	5001	2793	-3903	OK

SECTION CALCULATION

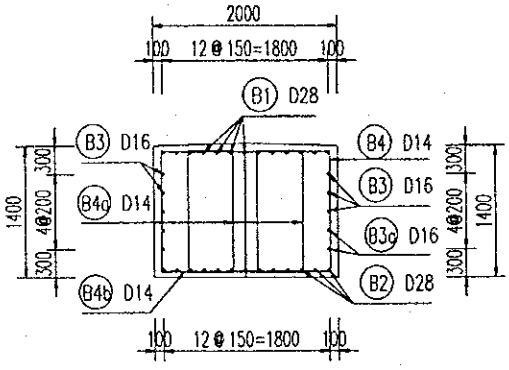
A. PIER CAP

i) Section Calculation for Flexure

		value	ELE	LOAD	LOC	NOD	Remark
Moment	M+ (kN·m)	1360.38	3	STRENGTH II	1.65	4	Mr >= min(1.2Mcr;
	M- (kN·m)	-2427.7	2	STRENGTH II	0.7	3	1.33M)
Width	W (cm)	200.0					
Height	h (cm)	140.0					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
	Dia. (mm)	28.0					
Bar arrangement tensile	Pitch (mm)	150.0					
	As (cm2)	80.1					
	Dia. (mm)	28.0					
Bar arrangement compression	Pitch (mm)	150.0					
	As (cm2)	80.1					
Allowable Moment	Mr+(kN·m)	3442.1					OK, SF=1.45
Allowable Moment	Mr-(kN·m)	3442					OK, SF=1.45

ii) Section Calculation for Shear

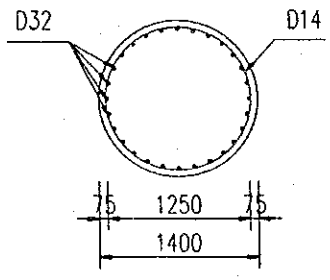
		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	-2427.73	2	STRENGHT I	0.7	3	
Shear	Q (kN)	3437.0	2	STRENGHT I	0.7	3	
Width	W (cm)	200					
Height	h (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of shear reinforcement	D (mm)	14.0					
Pitch of shear reinforcement	s (mm)	200					
Arear of shear reinforcement	Av (cm2)	9.24					
Allowable Shear	Vr (kN)	302.90					OK, SF= 1.06



B. COLUMN

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	3364.8	9	EXTREME I	6.4	10	
Axial	Q (kN)	-3130.9	9	EXTREME I	6.4	10	
Diameter	W (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of reinforcement	D (mm)	32.0					
Number of bars	No (mm)	28.0					
Pitch of shear reinforcement	s (mm)	140					
Arear of shear reinforcement	Av (cm2)	225.19					
Allowable Compressive	Pr (kN)	4713.9					
Allowable Moment	Mr (kN·m)	5065.7					OK, SF= 1.51

$r_s = A_s/A_c$ = 0.0089 (17 nos. tensile)
$r_{min} = 0.135 f'_c/f_y$ = 0.0083
Checking rs > rmin OK



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕMn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)
1	1132	1505			OK	ρ s = As/Ac = 0.0020
2	911	1211			OK	ρ min = 0.03 f'/fy = 0.0018
3	469	624	2422	2491	OK	∴ ρ s > ρ min ——— O.K
4	884	1176			OK	c/de = 0.04
5	778	1035			OK	∴ c/de < 0.42 ——— O.K
6	0	0			OK	

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

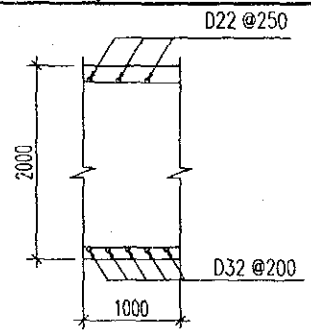
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
6	854.06	119	117	229	OK

Stress

Actual			Allowable				Remark
fc tensile	=	1.23 (MPa)	$fr = 0.63\cdot(fc)^{0.5}$	=	3.03	(MPa)	OK
fc compress	=	1.26 (MPa)	fca = 0.4fc	=	9.41	(MPa)	OK
fs	=	7.94 (MPa)	fsa = 0.6fy	=	229.48	(MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
a. Longitudinal direction							
Combination 1	P	kN	2727	24710			OK
	M	kN·m	544	4932			OK
Combination 2	P	kN	1961	22577			OK
	M	kN·m	467	5372			OK
Combination 3	P	kN	1638	29638			OK
	M	kN·m	184	3329			OK
Combination 4	P	kN	629	1831			O.K
	M	kN·m	793	2306			O.K
Combination 5	P	kN	1057	8215			O.K
	M	kN·m	620	4821			O.K
Combination 6	P	kN	4225	30489			O.K
	M	kN·m	410	2956			O.K

	Unit	Z=5 m		Z= m		Remark
		Atual	Allowable	Atual	Allowable	
Reinforcement	mm	14-D25		14-D25		
Area As	cm2	68.72		68.72		

b. Transverse direction

Combination 1	P	kN	4108	33250			OK
	M	kN·m	190	1538			OK
Combination 2	P	kN	3143	32485			OK
	M	kN·m	190	1966			OK
Combination 3	P	kN	1841	30532			OK
	M	kN·m	177	2937			OK
Combination 4	P	kN	1649	15128			O.K
	M	kN·m	638	5855			O.K
Combination 5	P	kN	1474	8293			O.K
	M	kN·m	861	4843			O.K
Combination 6	P	kN	2793	32445			O.K
	M	kN·m	171	1987			O.K

STRESS

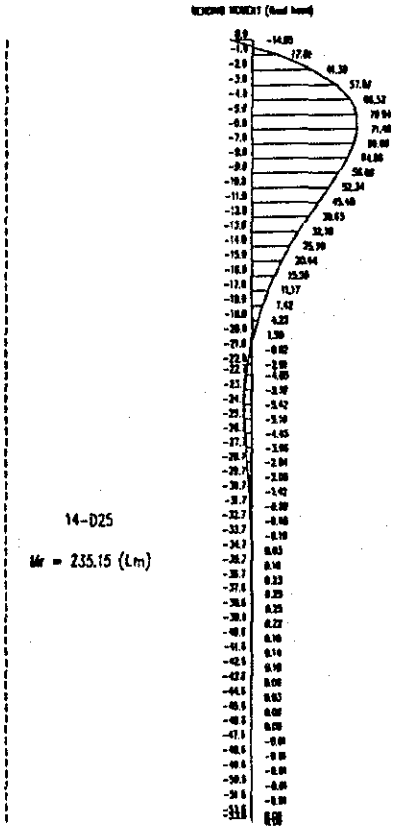
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-62.9	220.6	4.50	12.26	OK
Combination 2	-50.8	220.6	3.65	12.26	OK
Combination 3	-27.0	220.6	1.90	12.26	OK
Combination 4	161.0	220.6	5.42	12.26	OK
Combination 5	52.7	294.2	3.79	14.71	OK
Combination 6	-48.0	176.5	3.43	9.81	OK
Combination 7	0.0	0.0	0.00	0.00	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-48.2	220.6	3.38	12.26	OK
Combination 3	-38.8	220.6	2.76	12.26	OK
Combination 4	-40.2	220.6	2.97	12.26	OK
Combination 5	-57.8	220.6	4.42	12.26	OK
Combination 6	-39.6	176.5	2.81	9.81	OK
Combination 7	0.0	0.0	0.00	0.00	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	3.14	σ ca=0.5x σ ck = 14.71	OK
Vertical Punching Shear	τ c =	0.27	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	2.68	σ 'ca=0.3x σ ck = 8.83	OK
Horizontal Bearing Pressure	τ c =	0.17	τ a = 0.88	OK

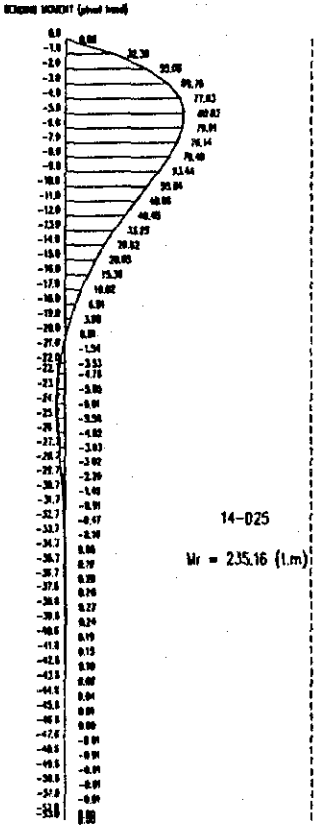
COMBINATION 4 : PILE (1,1)

LONGITUDINAL DIRECTION



14-D25

Mr = 235.15 (t.m)

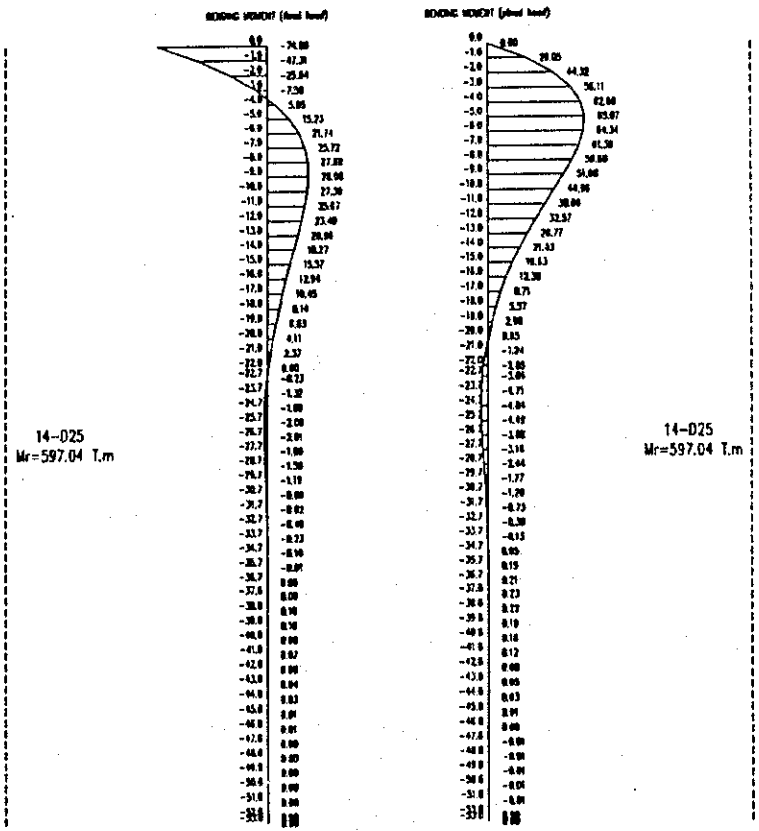


14-D25

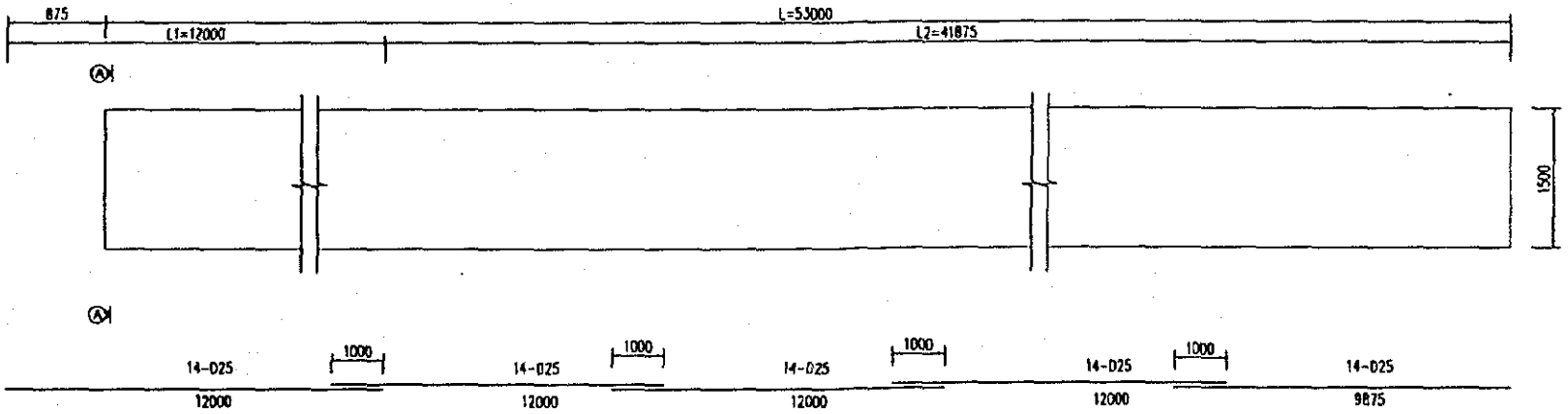
Mr = 235.16 (t.m)

COMBINATION 4 : PILE (1,1)

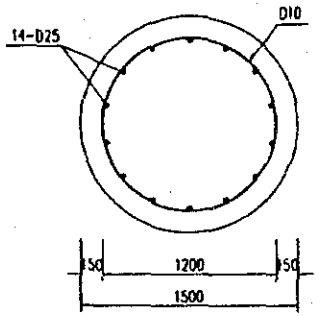
TRANSVERSE DIRECTION



PILE PLAN OF PIER P4 - CAI TAC 1 BRIDGE



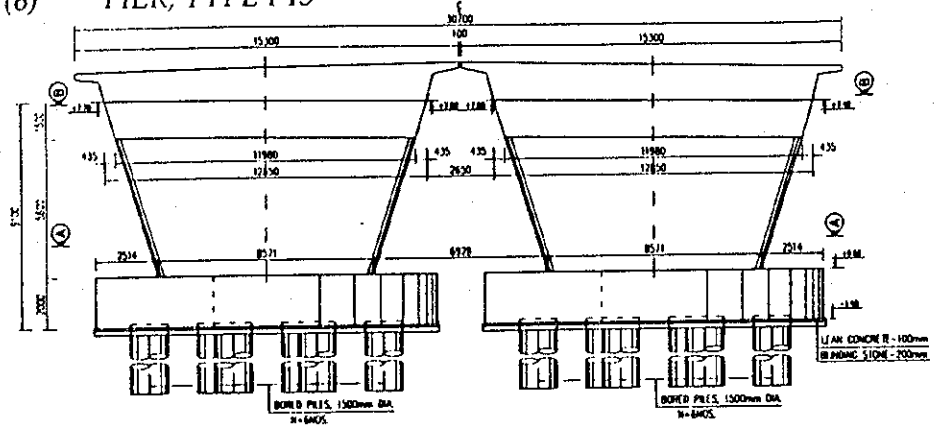
A - A



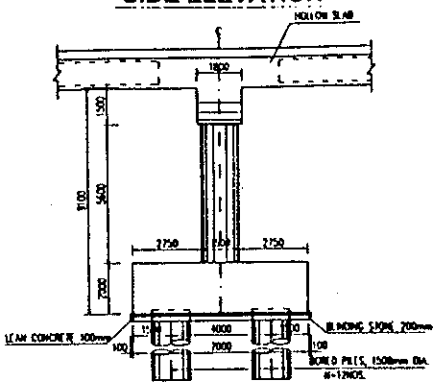
(6) *PIER, TYPE P15*

PIER P1 (P3)

ELEVATION



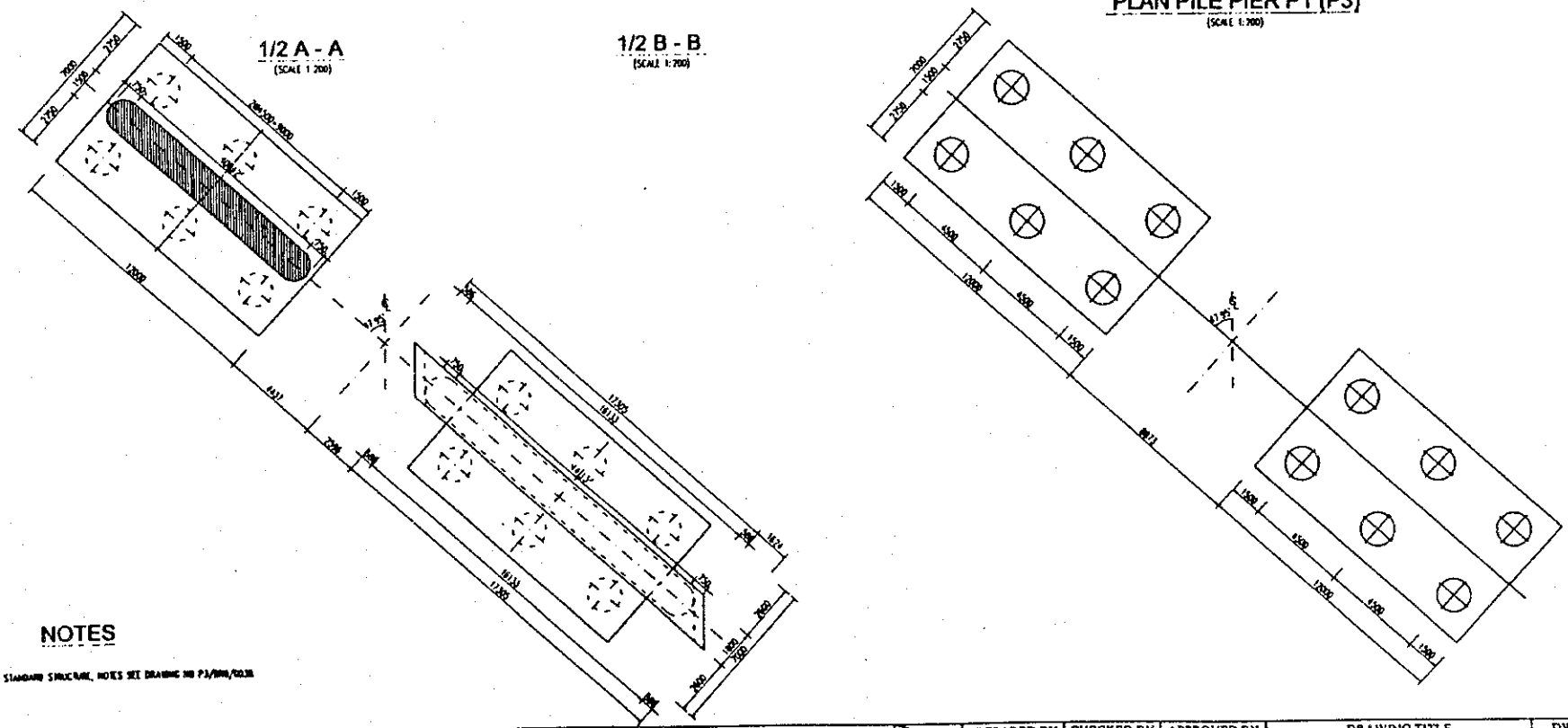
SIDE ELEVATION



1/2 A - A
(SCALE 1:200)

1/2 B - B
(SCALE 1:200)

PLAN PILE PIER P1 (P3)
(SCALE 1:200)



NOTES

1. FOR STANDARD STRUCTURE, NOTES SEE DRAWING NO P3/BRR/0030

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kameiani	K.Matsumoto	K. Enomoto	INTERCHANGE 3 FLYOVER BRIDGE PIERS PIER P1 & PIER P3 - GENERAL VIEW	P3/BRR/0450
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

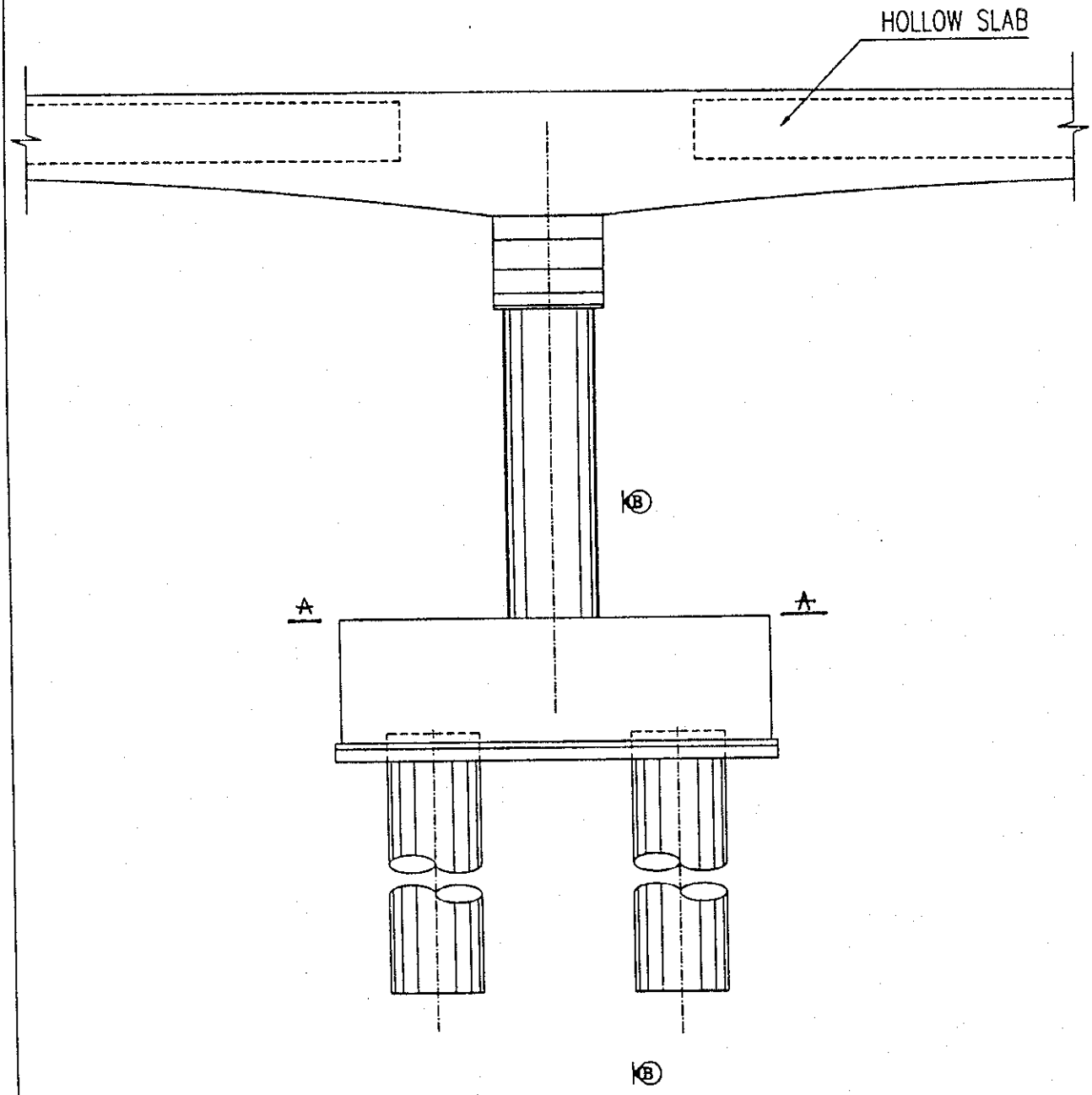
2. LOAD COMBINATIONS - NH91 PIER 1

Nos	Items	Pz			Mz			Hx			My			Hy			Mx			Notes
		n=1	n<1	n>1				n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	n=1		n>1	
	Permanent load																			
1	Superstructure - Pier self weigh	2,487	2,198	3,148	0	0	0	20	17	26	136	117	175	0	0	0	0	0	0	
	Transient Loads																			
2	Live load - LL(n= 0.5,1.75)	293	147	513	0	0	0	10	5	18	214	107	375	0	0	0	0	0	0	
	Live load - LL(n= 0.8,1.35)	293	234	396				10	8	14	214	171	289							
3	Dynamic load allowance - IM (n=0.5,1.75)	97	48	169				3	2	6	71	35	124							
	Dynamic load allowance - IM (n=0.8,1.35)	97	77	131				3	3	4	71	56	95							
4	Braking force - BR (n=0.5,1.75)							49	24	85	519	259	908							25% of
	Braking force - BR (n=0.8,1.35)							49	39	66	519	415	700							
5	Earthquake - EQ (n=1)							231			1,439			231			1,439			main load
	+ Pier body							87			507			87			507			
	+ Pile cap							50			50			50			50			
	+ Superstructure							94			881			94			881			
6	Vehicular collision force - CT (n=1)							180			715			180			715			
7	Uniform temperature - TU (n=0.5,1,1.2)							25			238									
8	Shrinkage - SH (n=0.5,1,1.2)							39			365									
9	Wind load																			
	+ Superstructure (n=0.4,n=1.4) (WS)													8	3	11	75	30	105	
	+ Live load(n=1.0) (WL)													4			45			

LOAD COMBINATION TABLE - PIERS P1 & P3 - INTERCHANGE 3 FLYOVER BRIDGE

No	Load combinations	Pz	Mz	Hx	My	Hy	Mx
1	STRENGTH-I	3830	0	167	1882	0	0
2	STRENGTH-III	2198	0	49	419	11	105
3	STRENGTH-V	3674	0	142	1561	7	75
4	EXTREME EVEN-I - 1	3343	0	288	2015	231	1439
5	EXTREME EVEN-I - 2	2393	0	280	1958	231	1439
6	EXTREME EVEN-II	2393	0	228	1234	180	715
7	SERVICE-I	2877	0	82	1543	7	75

1	**STRENGTH-I**	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA + 0.5TU + 0.5SH
2	**STRENGTH-III**	0.9DC + 0.65DW + 1.0WA + 1.4WS + 0.5TU + 0.5SH
3	**STRENGTH-V**	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL + 0.5TU + 0.5SH
4	**EXTREME EVEN-I - 1**	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5	**EXTREME EVEN-I - 2**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6	**EXTREME EVEN-II**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV
7	**SERVICE-I**	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV+ 1.0TU + 1.0SH


HOLLOW SLAB
A
A

Bridge name NH.91BI.C-P1

Pile Type Dia = 1500 mm Length = 57.0 m

Bearing Capacity Qs = 16674 kN Qult = 21975 kN

Longitudinal direction

Load Combination	Displacement δx(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	6.5	30	7796	9954	4723	-7041	OK
Strength III	1.7	30	3959	9954	3226	-7041	OK
Strength V	5.5	30	7287	9954	4723	-7041	OK
Extremme Event I-1	9.6	20	7337	9954	3591	-7041	O.K
Extremme Event I-2	9.3	20	5732	9954	2091	-7041	OK
Extremme Event II	7.1	30	5166	9954	2656	-7041	OK
Service I	5.8	15	64762	6443	3483	-4256	OK

Longitudinal direction

Load Combination	Displacement δy(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	0	30	6260	9954	6260	-7041	OK
Strength III	0.3	30	3663	9954	3522	-7041	OK
Strength V	0.2	30	6054	9954	5956	-7041	OK
Extremme Event I-1	5.5	20	6568	9954	4360	-7041	O.K
Extremme Event I-2	5.5	20	5015	9954	2807	-7041	OK
Extremme Event II	4.1	30	4568	9954	3255	-7041	OK
Service I	0.3	15	4754	6443	4650	-4256	OK

SECTION CALCULATION

A. BODY

LOAD COMBINATION TABLE

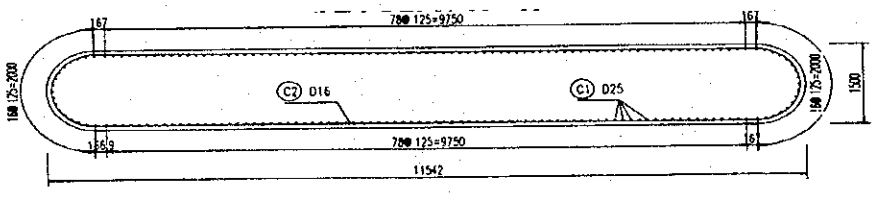
No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I	3305	167	1647	0	0
2	STRENGTH-III	1820	49	355	11	84
3	STRENGTH-V	3149	142	1365	7	62
4	EXTREME EVEN-I - 1	2818	238	1554	181	1026
5	EXTREME EVEN-I - 2	2015	229	1497	181	1026
6	EXTREME EVEN-II	2015	228	825	180	355
7	SERVICE-I	2457	82	1316	7	62

1 **STRENGTH-I** 1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA + 0.5TU + 0.5SH
2 **STRENGTH-III** 0.9DC + 0.65DW + 1.0WA + 1.4WS + 0.5TU + 0.5SH
3 **STRENGTH-V** 1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL + 0.5TU + 0.5SH
4 **EXTREME EVEN-I - 1** 1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5 **EXTREME EVEN-I - 2** 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6 **EXTREME EVEN-II** 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV
7 **SERVICE-I** 1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV+ 1.0TU + 1.0SH

SECTION CALCULATION SECTION A - A

Combination		1		2	
Actual Moment	kN.m	1657	32411	14681	19760
Allowable Moment	kN.m	59997	120406	59183	79659
		OK		OK	
Reinforcement		D25 @ 125			

A - A



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕMn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)
1	1120	1490	2422	2491	OK	ρ s = As/Ac = 0.0020
2	881	1171			OK	ρ min = 0.03 f'/fy = 0.0018
3	487	648			OK	∴ ρ s > ρ min ------ O.K
4	1023	1360			OK	c/de = 0.04
5	996	1324			OK	∴ c/de < 0.42 ------ O.K
6	806	1071			OK	

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

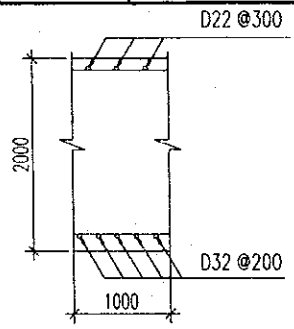
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
7	815.13	119	111	229	OK

Stress

Actual			Allowable			Remark
fc tensile	=	1.18 (MPa)	fr = 0.63·(fc)$^{0.5}$	=	3.03 (MPa)	OK
fc compress	=	1.20 (MPa)	fca = 0.4fc	=	9.41 (MPa)	OK
fs	=	7.58 (MPa)	fsa = 0.6fy	=	229.48 (MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
a. Longitudinal direction							
Combination 1	P	kN	4723	28948			OK
	M	kN·m	589	3609			OK
Combination 2	P	kN	3226	32869			OK
	M	kN·m	172	1755			OK
Combination 3	P	kN	4723	30008			OK
	M	kN·m	499	3170			OK
Combination 4	P	kN	3591	20214			O.K
	M	kN·m	1012	5697			O.K
Combination 5	P	kN	2091	11893			O.K
	M	kN·m	984	5596			O.K
Combination 6	P	kN	2656	19184			O.K
	M	kN·m	801	5787			O.K
Combination 6	P	kN	3483	29548			O.K
	M	kN·m	397	3367			O.K

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
b. Transverse direction							
Combination 1	P	kN	6260	35807			OK
	M	kN·m	0	0			OK
Combination 2	P	kN	3522	35089			OK
	M	kN·m	39	384			OK
Combination 3	P	kN	5956	35489			OK
	M	kN·m	25	148			OK
Combination 4	P	kN	4360	25455			O.K
	M	kN·m	812	4741			O.K
Combination 5	P	kN	2807	19829			O.K
	M	kN·m	812	5734			O.K
Combination 6	P	kN	3255	25002			O.K
	M	kN·m	633	4859			O.K
Combination 6	P	kN	4650	35330			O.K
	M	kN·m	29	217			O.K

STRESS

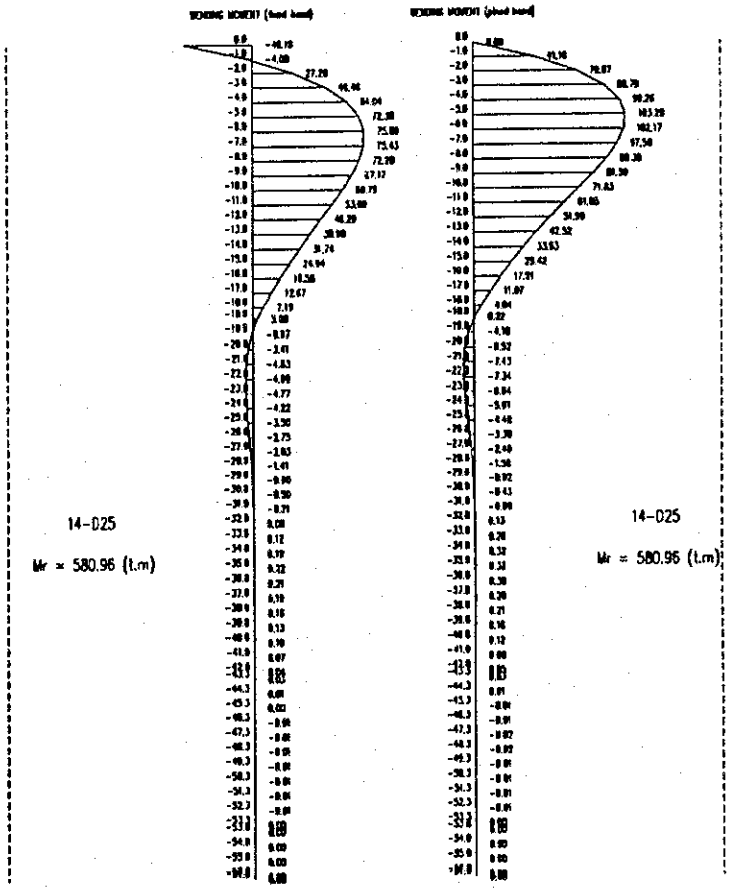
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-82.2	220.6	5.82	12.26	OK
Combination 2	-37.5	220.6	2.60	12.26	OK
Combination 3	-75.1	220.6	5.29	12.26	OK
Combination 4	-92.8	220.6	6.27	12.26	OK
Combination 5	-79.0	294.2	5.83	14.71	OK
Combination 6	-68.3	294.2	5.00	14.71	OK
Combination 7	-60.9	176.5	4.29	9.81	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-48.3	220.6	3.22	12.26	OK
Combination 3	-27.4	220.6	1.86	12.26	OK
Combination 4	-47.1	220.6	3.16	12.26	OK
Combination 5	-83.3	220.6	6.17	12.26	OK
Combination 6	-28.3	294.2	1.88	14.71	OK
Combination 7	-37.5	176.5	2.53	9.81	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	4.41	σ ca=0.5x σ ck = 14.71	OK
Vertical Punching Shear	τ c =	0.38	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	3.14	σ 'ca=0.3x σ ck = 8.83	OK
Horizontal Bearing Pressure	τ c =	0.20	τ a = 0.88	OK

COMBINATION 4 : PILE (1,1)

LONGITUDINAL DIRECTION



14-025

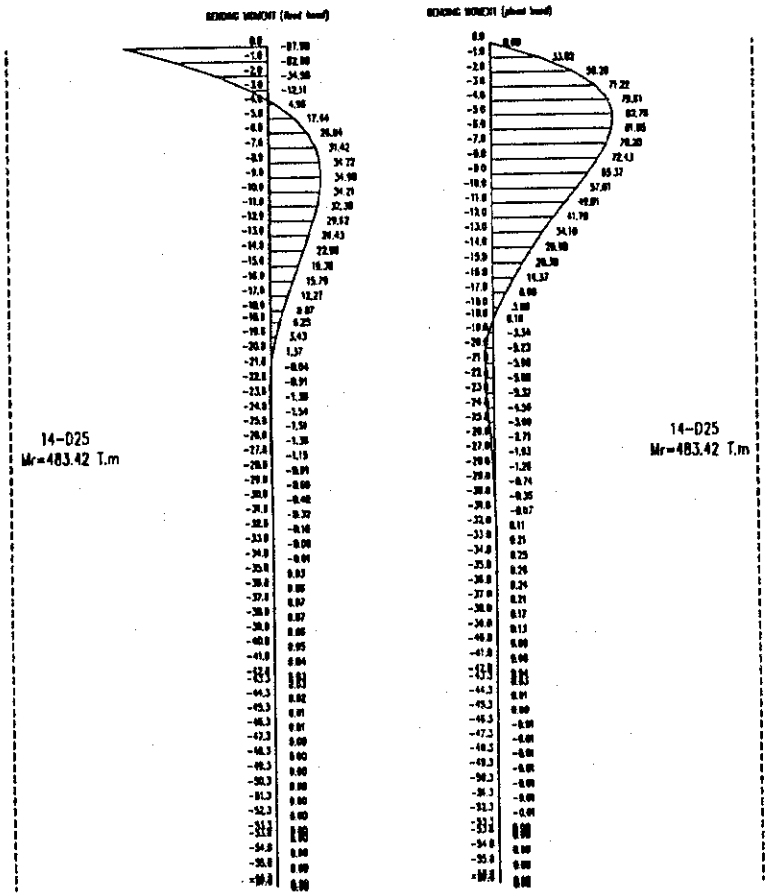
Mr = 580.96 (t.m)

14-025

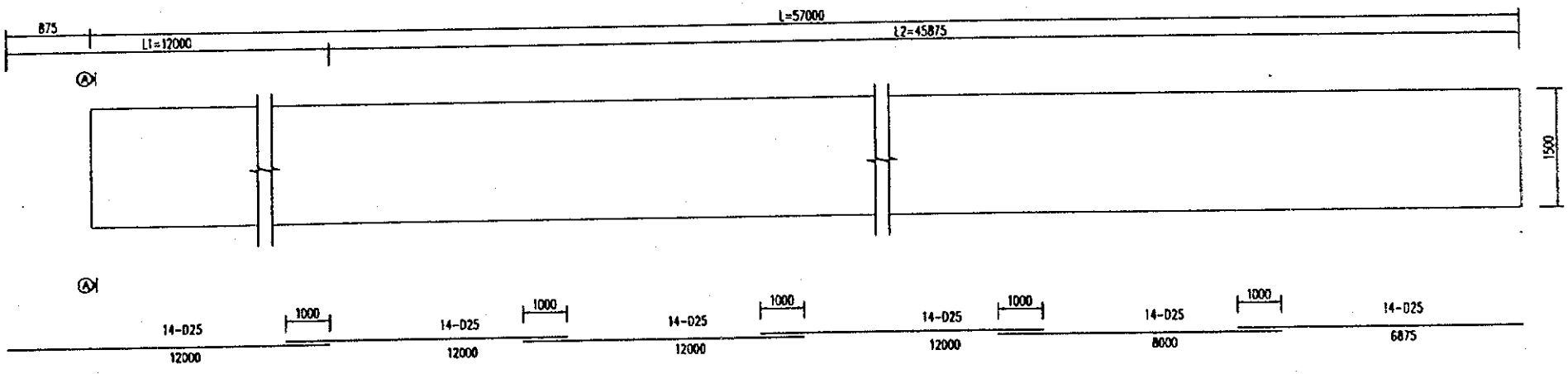
Mr = 580.96 (t.m)

COMBINATION 4 : PILE (1,1)

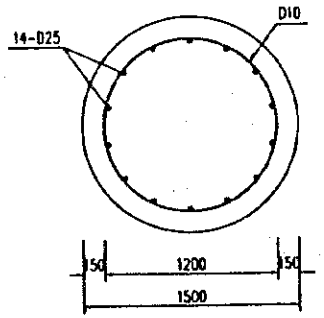
TRANSVERSE DIRECTION



PILE PLAN OF PIER P1 - NH.91B.I.C BRIDGE

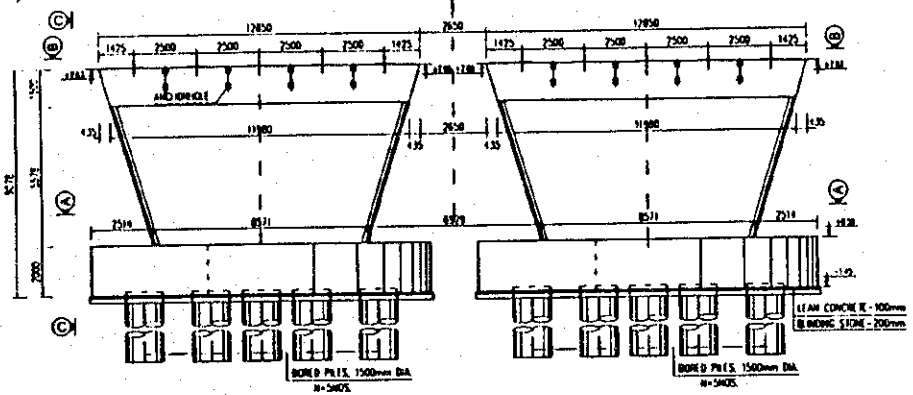


A - A

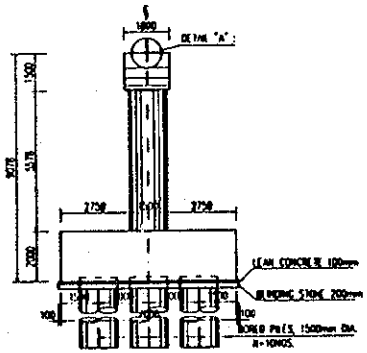


(7) PIER, TYPE P16

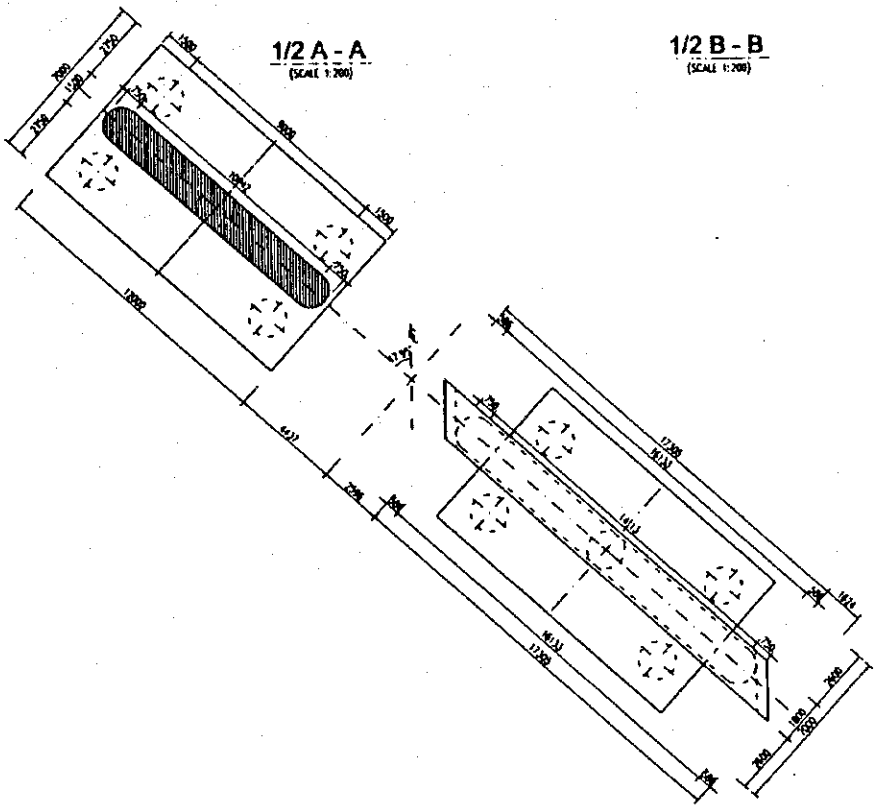
PIER ELEVATION P2



C - C

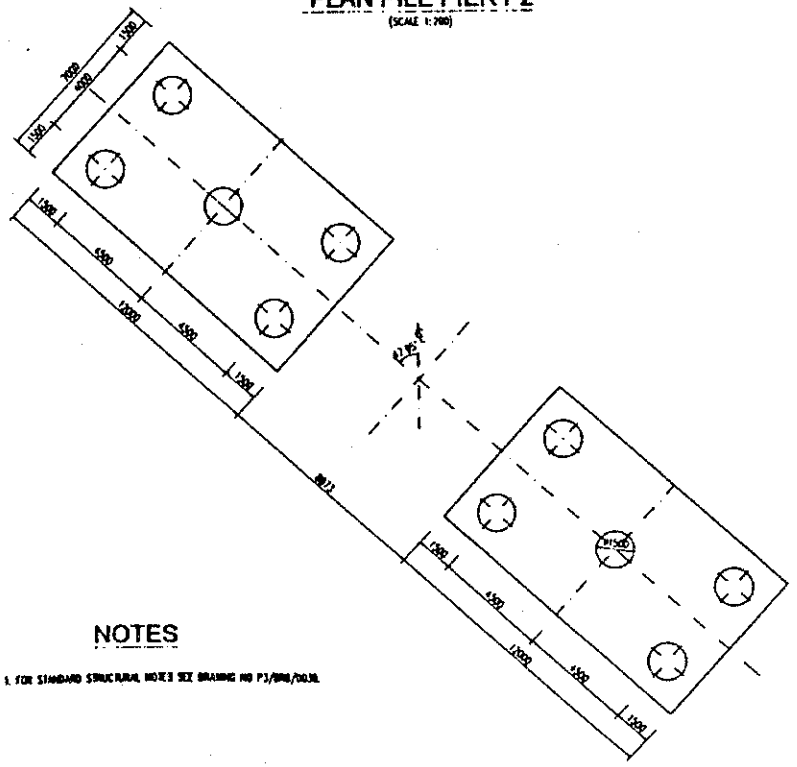


1/2 A - A



1/2 B - B

PLAN PILE PIER P2



NOTES

1. FOR STANDARD STRUCTURAL NOTES SEE DRAWING NO P3/BRI/0030.

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO
DETAILED DESIGN OF TIE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kamotani	K.Matsumoto	K. Enomoto	INTERCHANGE 3 FLYOVER BRIDGE PIERS PIER P2 - GENERAL VIEW - SHEET 1	P3/BRI/0460
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

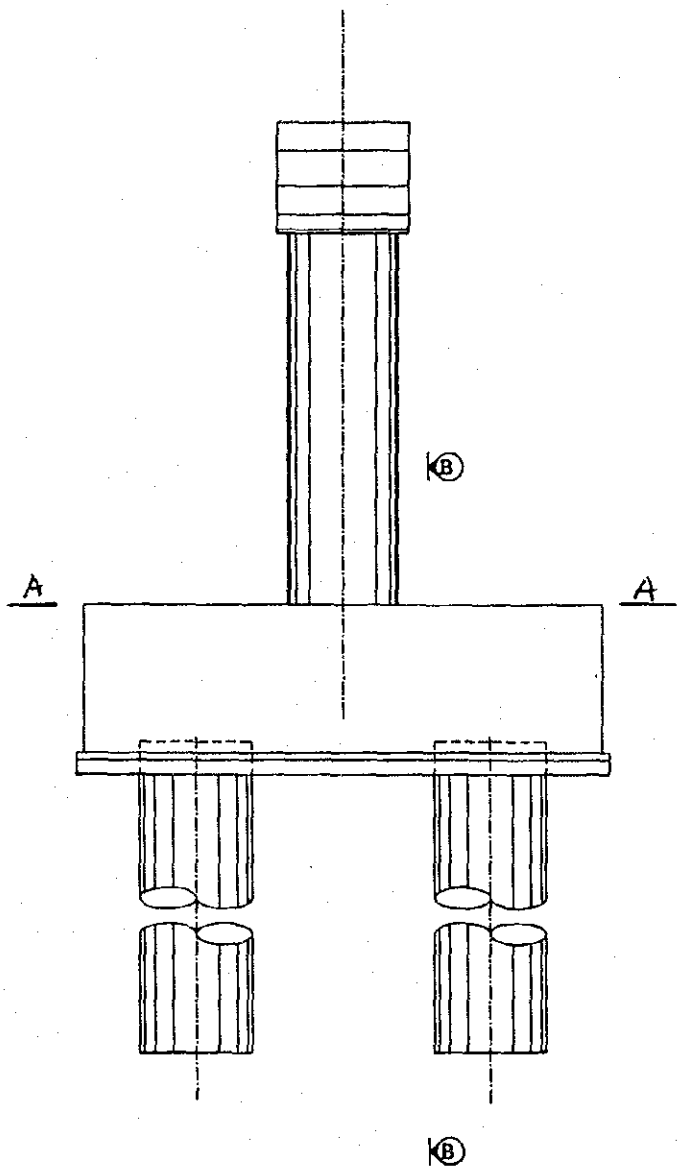
2. LOAD COMBINATIONS - NH91 PIER 2

Nos	Items	Pz			Mz			Hx			My			Hy			Mx			Notes
		n=1	n<1	n>1				n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	n=1		n>1	
	Permanent load																			
1	Superstructure - Pier self weigh	2,099	1,857	2,656	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Transient Loads																			
2	Live load - LL(n= 0.5,1.75)	276	138	483	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	Live load - LL(n= 0.8,1.35)	276	221	373				0	0	0	0	0	0							
3	Dynamic load allowance - IM (n=0.5,1.75)	91	46	159				0	0	0	0	0	0							
	Dynamic load allowance - IM (n=0.8,1.35)	91	73	123				0	0	0	0	0	0							
4	Braking force - BR (n=0.5,1.75)							46	23	81	496	248	869							25% of
	Braking force - BR (n=0.8,1.35)							46	37	62	496	397	670							
5	Earthquake - EQ (n=1)							233			1,430			252			1,602			main load
	+ Pier body							88			518			88			518			
	+ Pile cap							50			50			50			50			
	+ Superstructure							95			861			114			1,033			
6	Vehicular collision force - CT (n=1)							180			688			180			688			
7	Wind load																			
	+ Superstructure (n=0.4,n=1.4) (WS)													9	4	13	88	35	123	
	+ Live load(n=1.0) (WL)													4			55			

LOAD COMBINATION TABLE - PIER P2 - INTERCHANGE 3 FLYOVER BRIDGE

No	Load combinations	Pz	Mz	Hx	My	Hy	Mx
1	STRENGTH-I	3299	0	81	869	0	0
2	STRENGTH-III	1857	0	0	0	13	123
3	STRENGTH-V	3152	0	62	670	8	90
4	EXTREME EVEN-I - 1	2840	0	256	1678	252	1602
5	EXTREME EVEN-I - 2	2040	0	256	1678	252	1602
6	EXTREME EVEN-II	2040	0	203	936	180	688
7	SERVICE-I	2466	0	46	496	8	90

1	**STRENGTH-I**	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA
2	**STRENGTH-III**	0.9DC + 0.65DW + 1.0WA + 1.4WS
3	**STRENGTH-V**	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
4	**EXTREME EVEN-I - 1**	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5	**EXTREME EVEN-I - 2**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6	**EXTREME EVEN-II**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV
7	**SERVICE-I**	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV


A
A
B
B

Bridge name NH.91B I.C-P2

Pile Type Dia = 1500 mm Length = 57.0 m

Bearing Capacity Qs = 16717 kN Qult = 22019 kN

Longitudinal direction

Load Combination	Displacement δx(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	4.1	30	7489	9973	5452	-7051	OK
Strength III	0	30	3642	9973	3642	-7051	OK
Strength V	3.1	30	6966	9973	5398	-7051	OK
Extremme Event I-1	10.8	20	7832	9973	3309	-7051	O.K
Extremme Event I-2	10.8	20	6263	9973	1740	-7051	OK
Extremme Event II	7.8	30	5441	9973	2561	-7051	OK
Service I	3.4	15	5469	6453	4204	-4266	OK

Longitudinal direction

Load Combination	Displacement δy(mm)		Bearing Capacity (kN)		Uplift Capacity (kN)		Remarks
	Actual	Allowable	Pmax	Allowable	Pmin	Allowable	
Strength I	0	30	6470	9973	6470	-7051	OK
Strength III	0.4	30	3727	9973	3558	-7051	OK
Strength V	0.2	30	6241	9973	6123	-7051	OK
Extremme Event I-1	7.1	20	6807	9973	4333	-7051	O.K
Extremme Event I-2	7.1	20	5238	9973	2764	-7051	OK
Extremme Event II	4.8	30	4653	9973	3349	-7051	OK
Service I	0.4	15	4899	6453	4774	-4266	OK

SECTION CALCULATION

A. BODY

LOAD COMBINATION TABLE

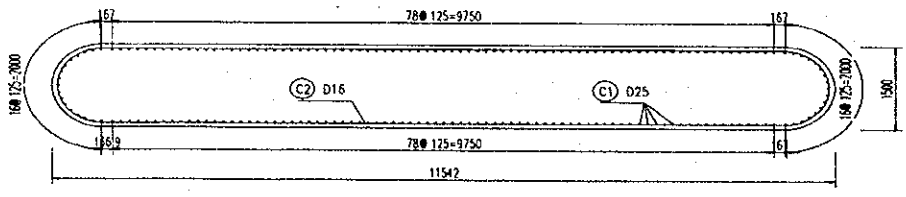
No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I	2774	81	708	0	0
2	STRENGTH-III	1479	0	0	13	97
3	STRENGTH-V	2627	62	546	8	74
4	EXTREME EVEN-I - 1	2315	206	1216	201	1148
5	EXTREME EVEN-I - 2	1662	206	1216	2201	1148
6	EXTREME EVEN-II	1662	203	530	180	328
7	SERVICE-I	2046	46	404	8	74

1	STRENGTH-I	1.25DC + 1.5DW + 1.75LL + 1.75IM + 1.75BR + 1.0WA
2	STRENGTH-III	0.9DC + 0.65DW + 1.0WA + 1.4WS
3	STRENGTH-V	1.25DC + 1.5DW + 1.35LL + 1.35IM + 1.35BR + 1.0WA + 0.4WS + 1.0WL
4	EXTREME EVEN-I - 1	1.25DC + 1.5DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
5	EXTREME EVEN-I - 2	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0EQ
6	EXTREME EVEN-II	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1.0WA + 1.0CV
7	SERVICE-I	1.0DC + 1.0DW + 1.0LL + 1.0IM + 1.0BR + 1.0WA + 0.3WS + 1.0WL +1.0CV

SECTION CALCULATION SECTION A - A

Combination		1		2	
Actual Moment	kN.m	718	27204	11925	16299
Allowable Moment	kN.m	47239	185071	60713	82994
		OK		OK	
Reinforcement		D25 @ 125			

A - A



FOOTING

B pier 12.00 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕMn (kN·m)	1.33M < 1.2Mcr or Mr	As = 49 cm2 (D=2.8cm, 8 Nos) / A's = 15 cm2 (D=2.2cm, 4 Nos)
1	2205	2932	2422	2991	OK	ρs = As/Ac = 0.0025
2	1070	1424			OK	ρ min = 0.03 f'/fy = 0.0018
3	2045	2720			OK	∴ ρs > ρ min ..... O.K
4	2061	2741			OK	c/de = 0.04
5	1624	2160			OK	∴ c/de < 0.42 ..... O.K
6	1448	1925			OK	

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

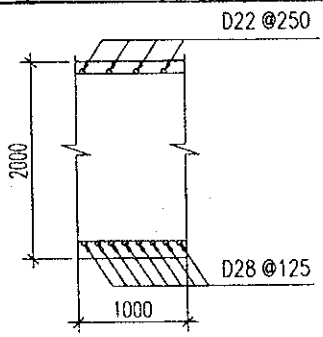
As = 49 cm2 (D=2.8cm, 8 Nos) A's = 15 cm2 (D=2.2cm, 4 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
7	1665.17	132	189	229	OK

Stress

Actual			Allowable			Remark
fc tensile	=	2.39 (MPa)	$fr = 0.63\cdot(fc)^{0.5}$	=	3.03 (MPa)	OK
fc compress	=	2.45 (MPa)	fca = 0.4fc	=	9.41 (MPa)	OK
fs	=	14.89 (MPa)	fsa = 0.6fy	=	229.48 (MPa)	OK



PILE (1,1) SECTION

NOMINAL RESISTANCES

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
a. Longitudinal direction							
Combination 1	P	kN	5452	31869			OK
	M	kN·m	392	2290			OK
Combination 2	P	kN	3642	35807			OK
	M	kN·m	0	0			OK
Combination 3	P	kN	5398	32736			OK
	M	kN·m	301	1828			OK
Combination 4	P	kN	3309	17948			O.K
	M	kN·m	1080	5856			O.K
Combination 5	P	kN	1740	7385			O.K
	M	kN·m	1080	4583			O.K
Combination 6	P	kN	2561	17559			O.K
	M	kN·m	856	5870			O.K
Combination 7	P	kN	4204	32855			O.K
	M	kN·m	225	1763			O.K

		Unit	Z=5 m		Z= m		Remark
			Atual	Allowable	Atual	Allowable	
Reinforcement		mm	14-D25		14-D25		
Area As		cm2	68.72		68.72		
b. Transverse direction							
Combination 1	P	kN	6470	35807			OK
	M	kN·m	0	0			OK
Combination 2	P	kN	3558	34862			OK
	M	kN·m	55	537			OK
Combination 3	P	kN	6123	35364			OK
	M	kN·m	34	194			OK
Combination 4	P	kN	4333	22179			O.K
	M	kN·m	1063	5439			O.K
Combination 5	P	kN	2764	15239			O.K
	M	kN·m	1063	5859			O.K
Combination 6	P	kN	3349	23195			O.K
	M	kN·m	759	5258			O.K
Combination 7	P	kN	4774	35227			O.K
	M	kN·m	39	289			O.K

STRESS

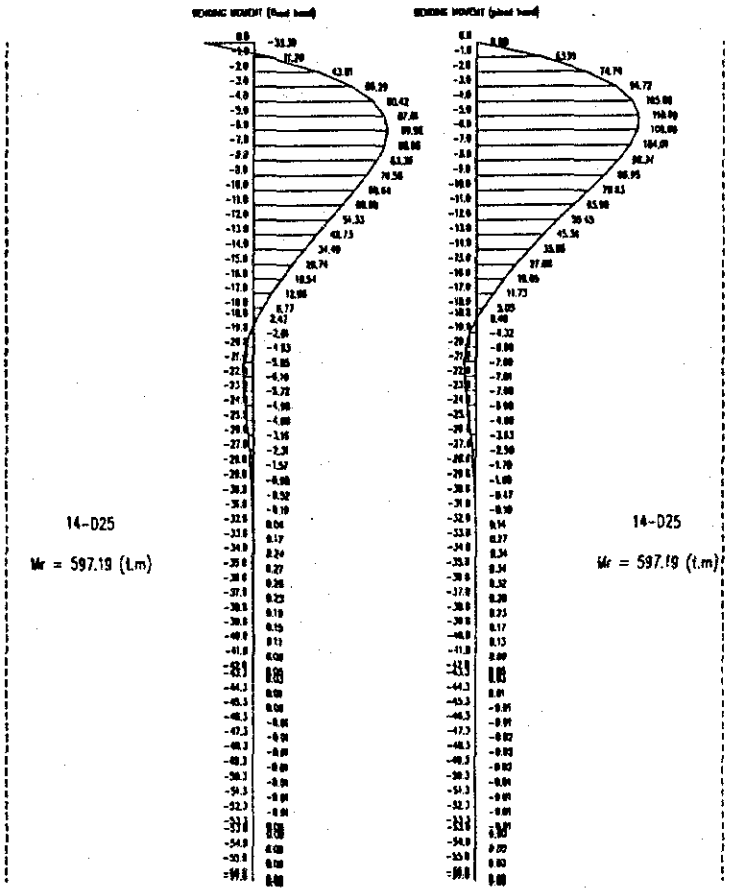
	Stress of reinforcement ds (MPa)		Stress of concrete dc (MPa)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-73.1	220.6	5.10	12.26	OK
Combination 2	-29.2	220.6	1.94	12.26	OK
Combination 3	-65.9	220.6	4.56	12.26	OK
Combination 4	-1079.7	220.6	7.21	12.26	OK
Combination 5	-102.0	294.2	6.37	14.71	OK
Combination 6	-72.4	294.2	5.31	14.71	OK
Combination 7	-51.6	176.5	3.57	9.81	OK
b. Transverse direction					
Combination 1	0.0	0.0	0.00	0.00	OK
Combination 2	-51.8	220.6	3.45	12.26	OK
Combination 3	-31.9	220.6	2.17	12.26	OK
Combination 4	-51.2	220.6	3.43	12.26	OK
Combination 5	-98.6	220.6	7.31	12.26	OK
Combination 6	-70.9	294.2	5.29	14.71	OK
Combination 7	40.8	176.5	2.75	9.81	OK

STRESS OF PILE CAP

	Actual (MPa)		Allowable (MPa)	Remak
Vertical Bearing Pressure	σ cv =	4.43	σ ca=0.5x σ ck = 17.65	OK
Vertical Punching Shear	τ c =	0.39	τ a = 0.88	OK
Horizontal Bearing Pressure	σ ch =	3.35	σ 'ca=0.3x σ ck = 10.59	OK
Horizontal Bearing Pressure	τ c =	0.21	τ a = 0.88	OK

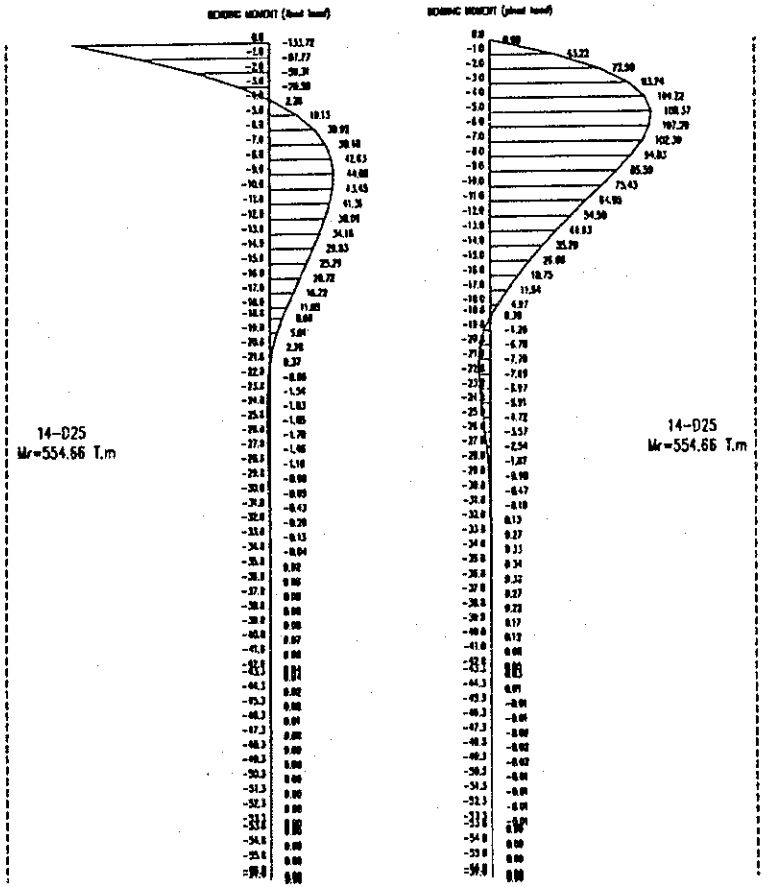
COMBINATION 4 : PILE (1,1)

LONGITUDINAL DIRECTION

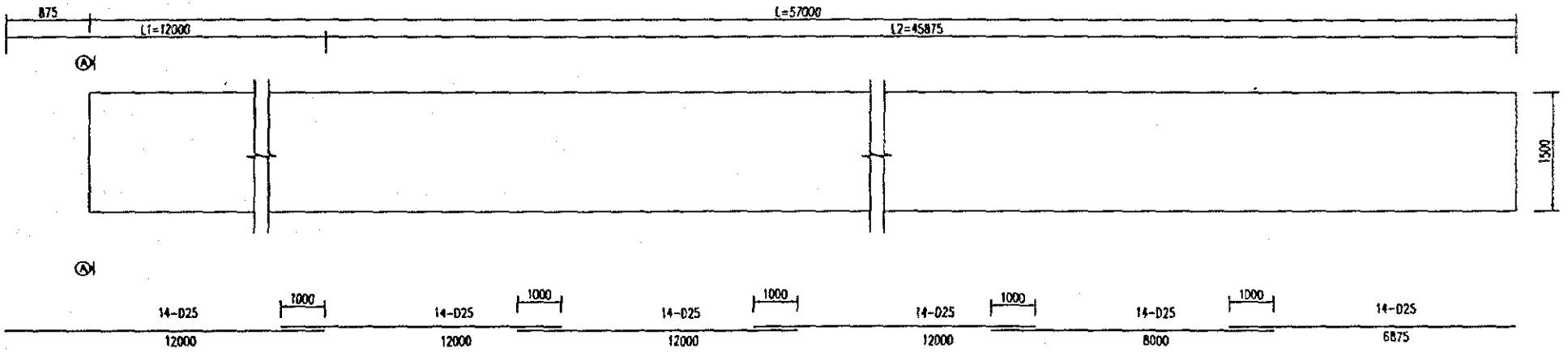


COMBINATION 4 : PILE (1,1)

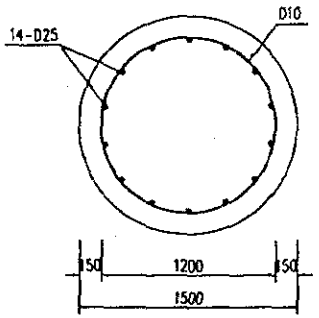
TRANSVERSE DIRECTION



PILE PLAN OF PIER P2 - NH.91B.I.C BRIDGE



A - A

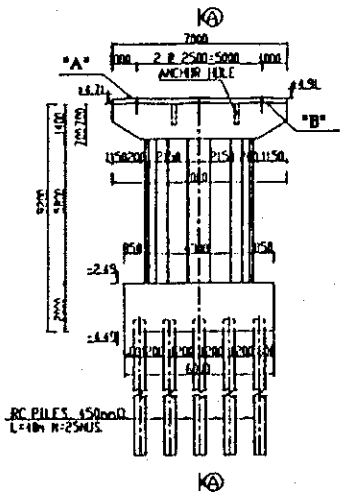


(8) *PIER, TYPE P3-DP*

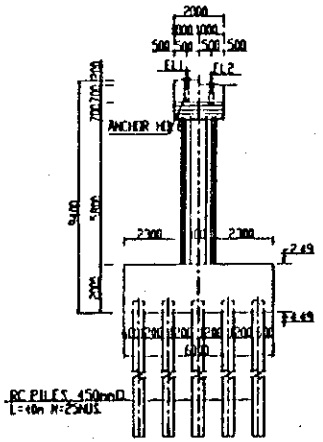
DETAILS OF PIERS

(SCALE 1:200)

PIER ELEVATION

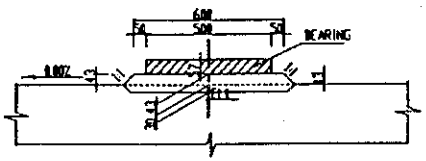


A -A



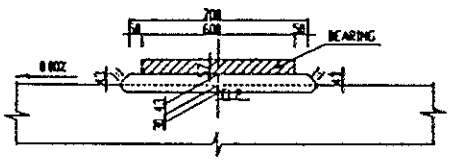
DETAIL"A"

SCALE 1:20

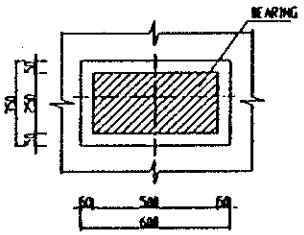


DETAIL"B"

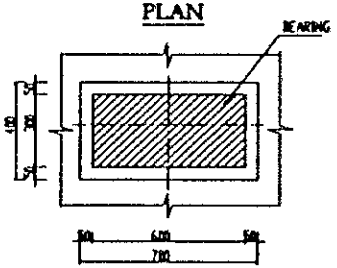
SCALE 1:20



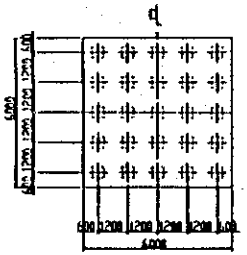
PLAN



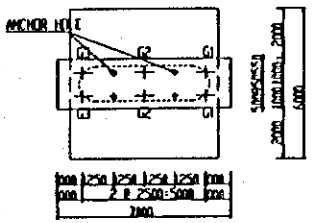
PLAN



PILE CAP-PLAN

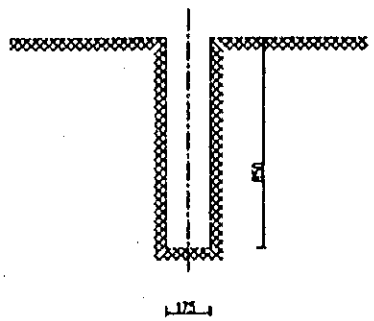


GIRDER BEARING SEAT-PLAN



DETAIL OF ANCHOR HOLE

SCALE 1:50



GIRDER BEARING SEAT ELEVATION

PIER TYPE	GIRDER TYPE	G1	G2	G3
P1	EL2	4.727	4.727	4.727
	EL1	4.925	4.925	4.925
P2	EL2	4.925	4.925	4.925
	EL1	4.727	4.727	4.727

NOTES

FOR STANDARD STRUCTURAL NOTES SEE DRAWING NO.P3/DR9/0030

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kameiani	K.Matsumoto	K. Enomoto	RAMPWAY"D"BRIDGE-INTERCHANGE 3 PIERS GENERAL OF PIERS P1&P2	P3/DR9/0410
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

2. LOAD COMBINATIONS - NH.91B I.C RAMWAY - PIER 1

Nos	Items	Pz			Hx			Hy			My			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	
	Permanent load																
1	Superstructure (stage1)- DC (n=0.9,1.25)																
	+ Left	136	122	170							-61	-61	-85				
	+ Right	186	168	233							93	75	105				
2	Wearing surface (stage2) - DW (n=0.65,1.5)	110	72	165							-7.8	-5.1	-9.7				
	+ Left	66	43	99							-30	-22	-50				
	+ Right	44	29	66							22	13	30				
3	Pier - DC (n=0.9,1.25)	316	285	395							0	0	0				
	Transient Loads																
4	Live load - LL(n= 0.5,1.75)	162	81	283							70	-29	-100	-34	-17	-60	
	a- Main load	137	68	240							59	-34	-120	-103	-51	-180	
	b- Sub load	25	12	44							11	6	20	68	34	120	
5	Dynamic load allowance - IM (n=0.5,1.75)	53	27	93							23	-9	-33	-11	-6	-20	
	a- Main load	45	23	79							20	-11	-40	-34	-17	-59	
	b- Sub load	8	4	14							4	2	6	23	11	40	
6	Braking force - BR (n=0.5,1.75)				-13.8	-6.9	-24.1				-183	-92	-320				25% of Main Load
7	Centrifugal force - CE (n=0.5,1.75)							13.0	6.5	22.8				173	87	303	
	+ Left							7.4	3.7	13.0				98	49	172	
	+ Right							5.6	2.8	9.8				75	37	130	
8	Friction force - FR (n=1)																f=0.05
	a- Dead load				-22						-201						
	b- Dead load + Live load				-30						-290						
9	Vessel collision load - CV (n=1)																
	a- Transverse							192						1,203			
	b- Longitudinal				-96						-602						
10	Temperature gradient TG (n=1)																
	a. + 5 degrees	-176.4			0						5						
11	Settlement SE (n=1)	12									97						
12	Wind load - (n= 0.5,1.75)																
	a- Transverse - WS (n=0.4, 1.4)							26	11	37				245	98	343	
	b- Longitudinal - WL (n=1)				-8						-63						
13	Earthquake - EQ (n=1)																12% of Dead load
	a- Transverse							90						613			
	b- Longitudinal				-117						-873						

LOAD COMBINATION TABLE

Load combinations	Pz	Hx	Hy	My	Mx
1	1175.4	-53.8	39.8	-317.3	223.2
2	846.3	-45.7	39.8	-329.5	223.2
3	481.8	-21.6	36.9	-75.4	245.0
4	753.7	-145.9	90	-1095.1	590.3
5	753.7	-124.5	203.4	-824.0	1266.8
6	881.5	-51.8	30.7	-365.9	372.5

Combination 1 (STRENGHT - I-1) 1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE

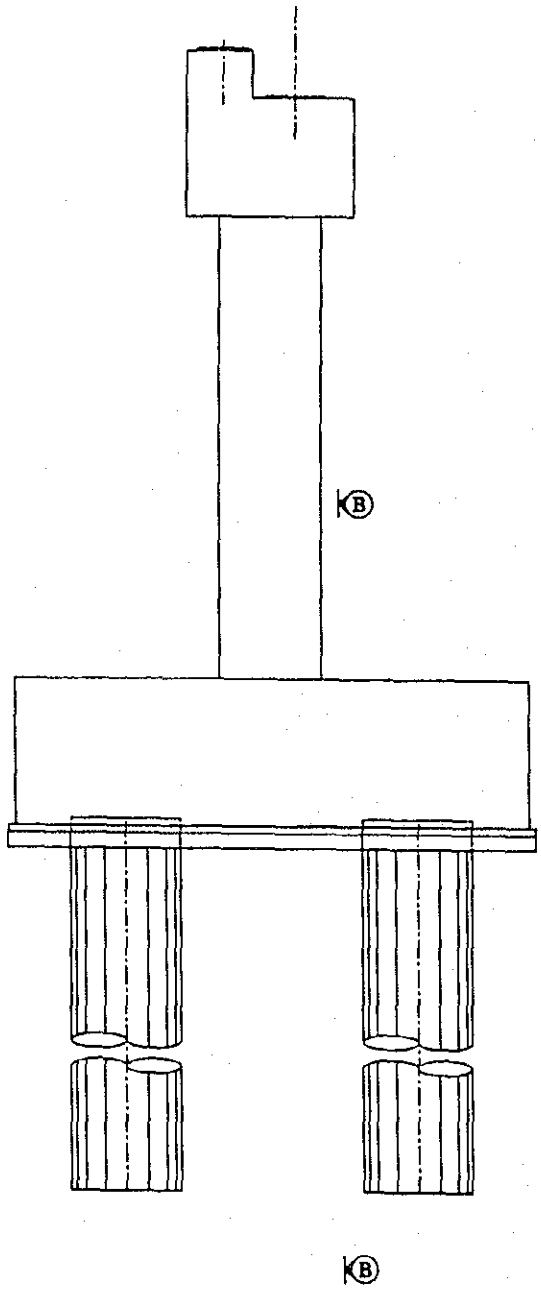
Combination 2 (STRENGHT - I-2) 0.9DC + 0.65DW + 1.75(LL + IM + CE + BR) + 1FR(a) +TG

Combination 3 (STRENGHT - III) 0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE

Combination 4 (EXTREME EVENT -I) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ

Combination 5 (EXTREME EVENT-II) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV

Combination 6 (SERVICE -I) DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE


KB
KB

SECTION CALCULATION

A. BODY

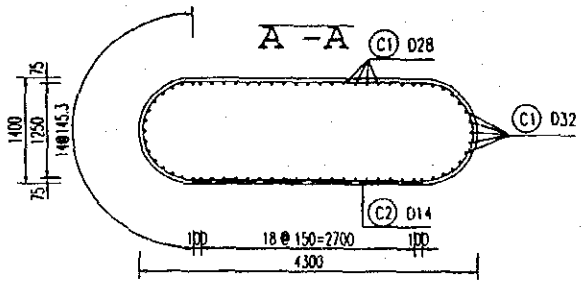
LOAD COMBINATION TABLE

No	Load combinations	Pz	Hx	My	Hy	Mx
1	STRENGTH-I - 1	969.2	-53.8	39.8	-192.1	177.7
2	STRENGTH-I - 2	697.8	-45.7	39.8	-238.1	177.7
3	STRENGTH-III	333.3	-21.6	36.9	-32.2	192.3
4	EXTREME EVEN-I	605.2	-126.1	70.0	-859.3	466.7
5	EXTREME EVEN-II	605.2	-124.5	203.4	-767.0	1253.8
6	SERVICE-I	716.5	-51.8	30.7	-244.7	293.8

1	**STRENGHT - I-1**	1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE
2	**STRENGHT - I-2**	*0.9DC + 0.65DW + 1.75(LL + IM + CE + BR) + 1FR(a) +TG*
3	**STRENGHT - III**	0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE
4	**EXTREME EVENT -I**	*0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ*
5	**EXTREME EVENT-II**	0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV
6	**SERVICE -I**	DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE

SECTION CALCULATION SECTION A - A

Combination		1		2	
Actual Moment	kN.m	8424	5935	7522	5935
Allowable Moment	kN.m	16465	11591	17191	13563
		OK		OK	
Reinforcement		D28 @ 150			



FOOTING

B pier 6.00 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕMn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)
1	833	1108			OK	ρ s = As/Ac = 0.0020
2	638	848			OK	ρ min = 0.03 f'/fy = 0.0018
3	284	378	2422	2491	OK	∴ ρ s > ρ min —— O.K
4	899	1196			OK	c/de = 0.04
5	796	1058			OK	∴ c/de < 0.42 —— O.K
6	0	0			OK	

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

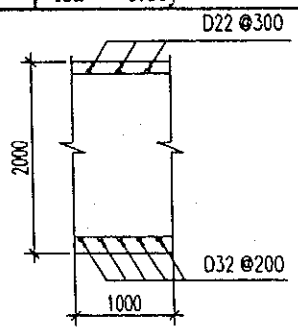
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
6	681.56	119	93	229	OK

Stress

Actual			Allowable			Remark
fc tensile	=	0.98 (MPa)	$fr = 0.63 \cdot (fc)^{0.5}$	=	3.03 (MPa)	OK
fc compress	=	1.01 (MPa)	fca = 0.4fc	=	9.41 (MPa)	OK
fs	=	6.33 (MPa)	fsa = 0.6fy	=	229.48 (MPa)	OK



Pier Type P-3

STABILITY CALCULATION

Longitudinal direction

Load Combination	Displacement δx (mm		Bearing Capacity (T)		Uplift capacity (T)		Remarks
	Actual	Allowable	P_{max}	Allowable	P_{min}	Allowable	
Strength - I-1	-1.2	30	59.25	104	34.78	-82	O.K
Strength - I-2	-1.0	30	46.17	104	21.53	-82	O.K
Strength - III	-0.4	30	22.52	104	16.03	-82	O.K
Extremme Event - I	-3.3	20	70.86	104	-10.56	-82	O.K
Extremme Event - II	-2.7	30	61.34	104	-1.05	-82	O.K
Service - I	-1.8	15	49.44	68	21.08	-47	O.K

Transverse direction

Load Combination	Displacement δy (mm		Bearing Capacity (T)		Uplift capacity (T)		Remarks
	Actual	Allowable	P_{max}	Allowable	P_{min}	Allowable	
Strength - I-1	0.9	30	55.70	104	38.33	-82	O.K
Strength - I-2	0.9	30	42.53	104	25.17	-82	O.K
Strength - III	0.8	30	28.54	104	10.00	-82	O.K
Extremme Event - I	2.0	20	52.53	104	7.77	-82	O.K
Extremme Event - II	4.4	30	78.57	104	-18.27	-82	O.K
Service - I	1.2	15	48.69	68	21.83	-47	O.K

PILE SECTION

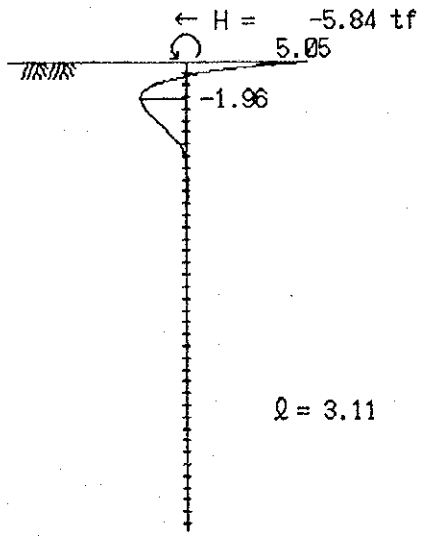
Checking stress

Load Combination	σ s (kg/cm2)		σ c (kg/cm2)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-515.6	2250	36.9	125	OK
Combination 2	-405.5	2250	29.0	125	OK
Combination 3	-205.0	2250	14.8	125	OK
Combination 4	1710.3	2250	60.8	125	OK
Combination 5	1204.8	3000	53.3	150	OK
Combination 6	-484.0	3000	35.2	150	OK
Combination 7		1800		100	OK
b. Transverse direction					
Combination 1	-456.0	2250	32.3	125	OK
Combination 2	-374.7	2250	26.8	125	OK
Combination 3	-275.8	2250	20.0	125	OK
Combination 4	575.1	2250	41.9	125	OK
Combination 5	2620.6	3000	80.3	150	OK
Combination 6	-391.7	3000	27.6	150	OK
Combination 7		1800		100	OK

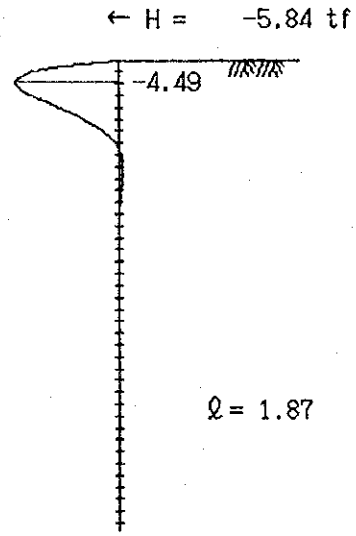
Notes : σ s Stress of reinforcement (kg/cm2)

σ c Stress of concrete (kg/cm2)

<Longitudinal Direction, Combination 4>

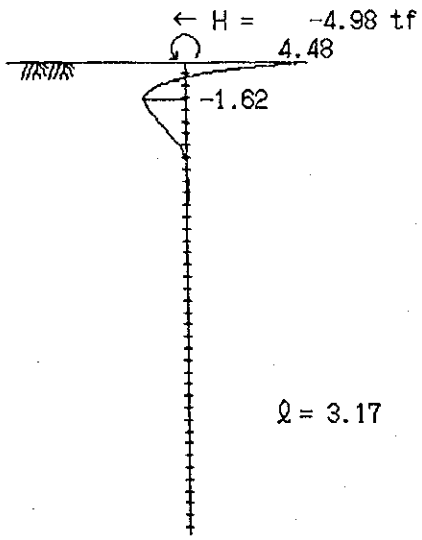


(Pile Head: Rigid)

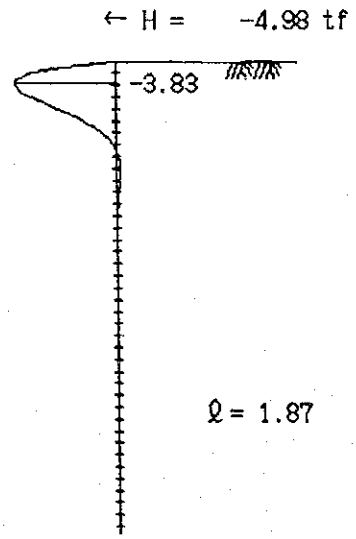


(Pile Head: Hinge)

<Longitudinal Direction, Combination 5>

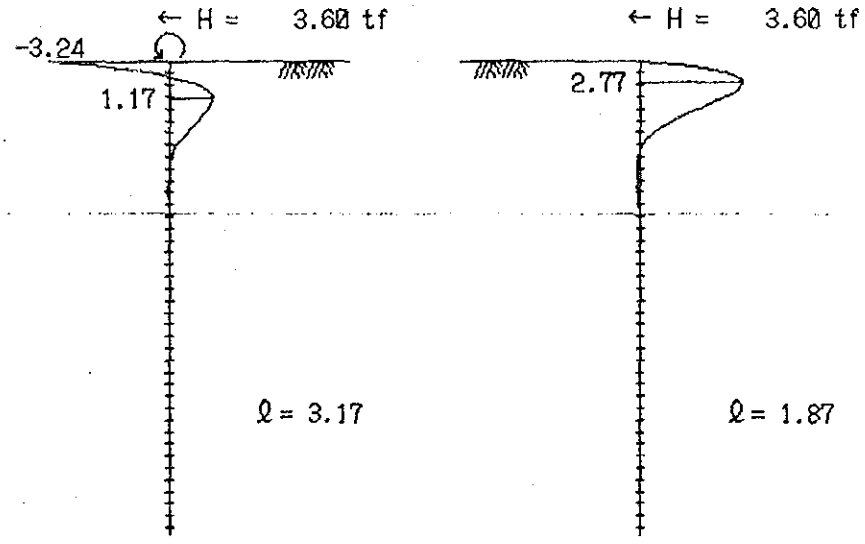


(Pile Head: Rigid)



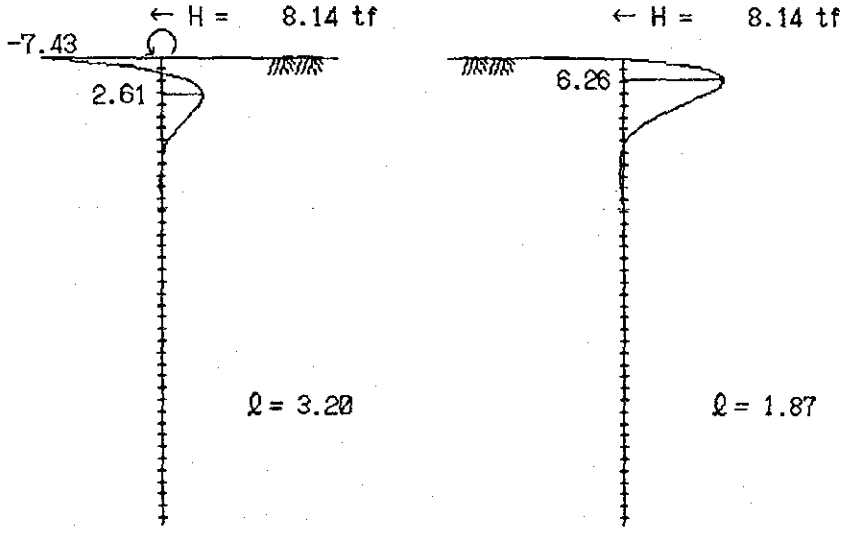
(Pile Head: Hinge)

<Transverse Direction, Combination 4>



(Pile Head: Rigid) (Pile Head: Hinge)

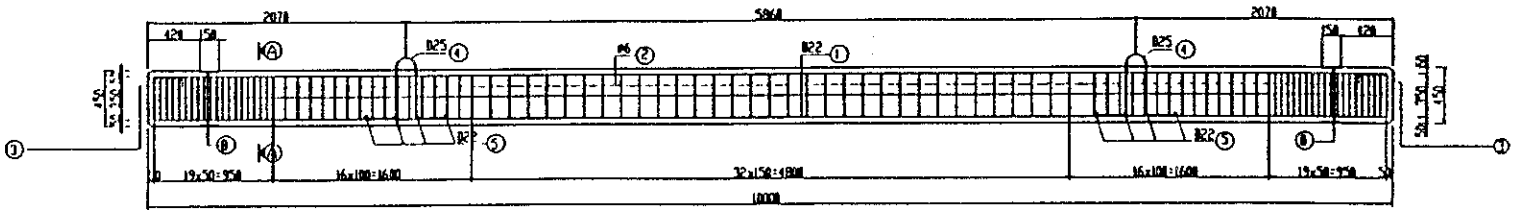
<Transverse Direction, Combination 5>



(Pile Head: Rigid) (Pile Head: Hinge)

R.C.PILE-1 L=10M

SCALE 1:40



R.C.PILE-2 L=10M

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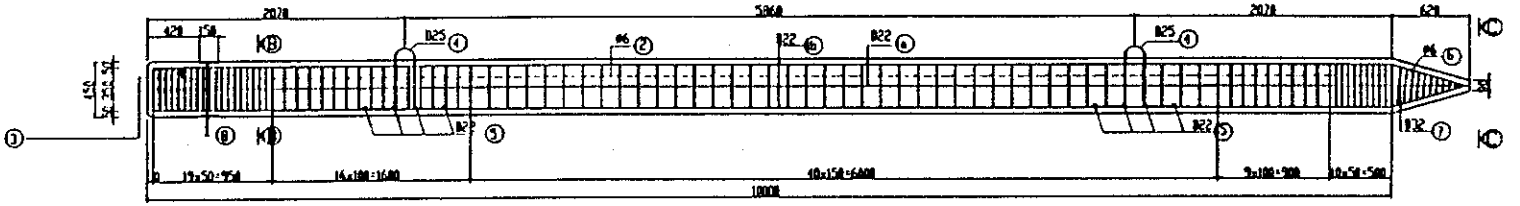
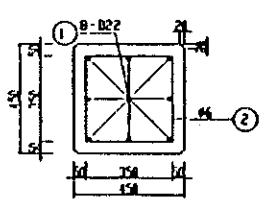


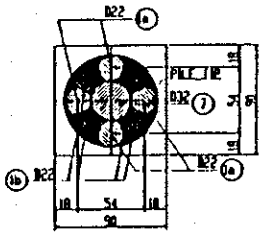
A-A

SCALE 1:20



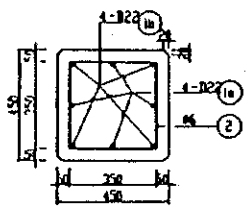
C-C

SCALE 1:4



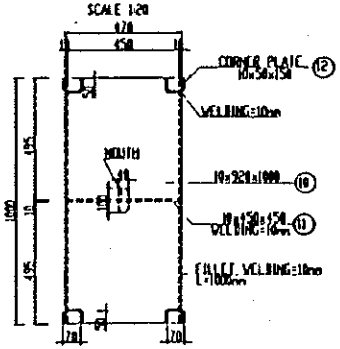
B-B

SCALE 1:20



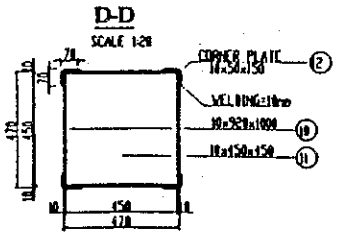
CONPLING BOX

SCALE 1:20



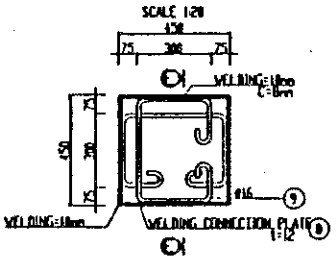
D-D

SCALE 1:20



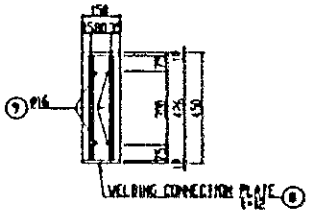
WELDING CONNECTION PLATE

SCALE 1:20



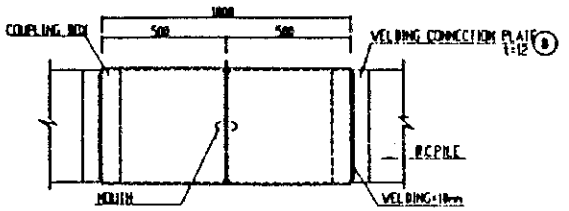
E-E

SCALE 1:20



ELEVATION

SCALE 1:20



MARKING

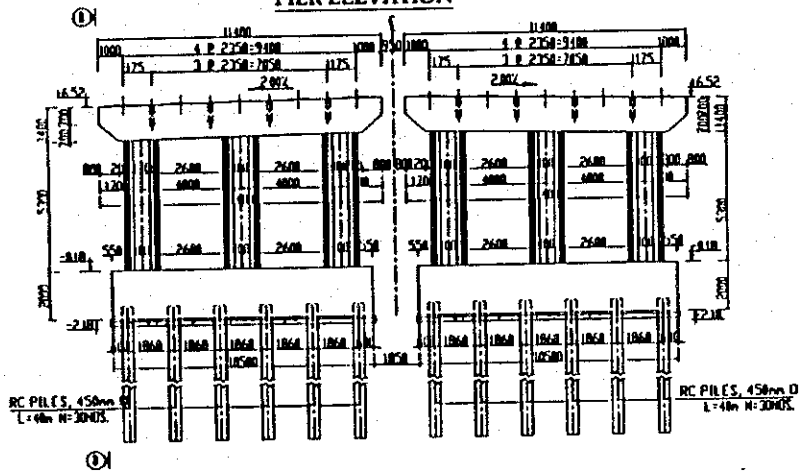
PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF TIEN CANTHO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kameton	K.Matsumoto	K. Enomoto	RAMPWAY"D"BRIDGE-INTERCHANGE 3 PIERS PIERS P1&P2-RC PILE(450-L=40.0m-SHEET 2	P3/BRS/002
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

DETAILS OF PIER P5

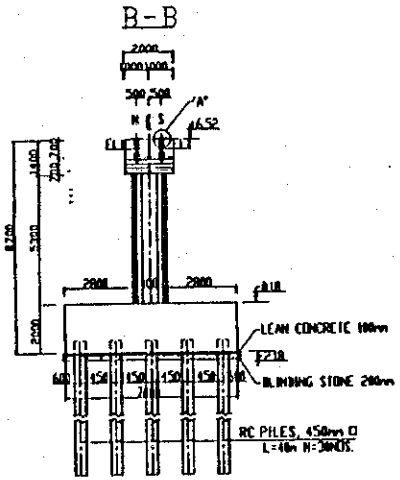
SCALE 1:200

(9) *PIER, TYPE P6-DP*

PIER ELEVATION

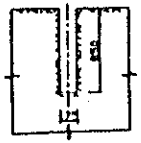


B-B



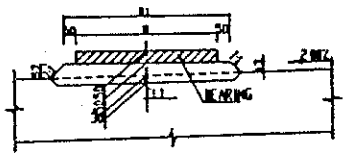
DETAIL OF ANCHOR HOLE

SCALE 1:50

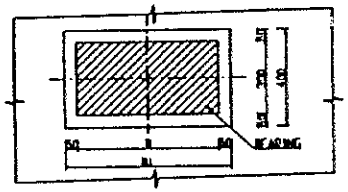


DETAIL "A"

SCALE 1:20



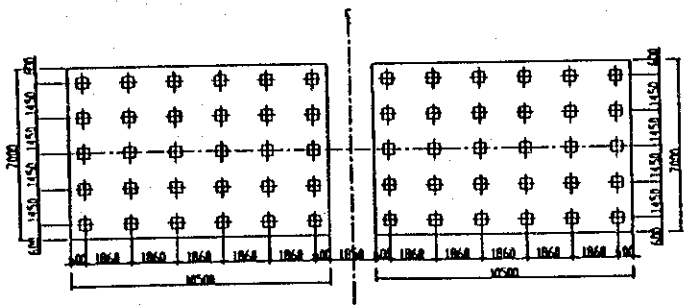
PLAN



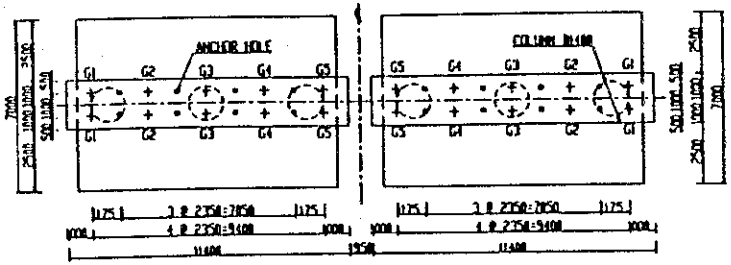
DIMENSIONS OF BEARING "A"

BEARING \ DIMENSIONS (mm)	B1	B
DR GIRDER 1 *, L=37m	700	600
DR GIRDER 1 *, L=33m	650	550

PILE CAP-PLAN



GIRDER BEARING SEAT-PLAN



GIRDER BEARING SEAT ELEVATION OF EL1

PIRE TYPE \ GIRDER PAD		G1	G2	G3	G4	G5
P5	N	6.537	6.584	6.631	6.678	6.724
	S	6.537	6.584	6.631	6.678	6.724

NOTES

1.FOR STANDARD STRUCTURAL NOTES SEE BRAVING NO. P3/BR7/0030

PROJECT NAME	IMPLEMENTATION AGENCY	EXECUTING AGENCY	JICA STUDY TEAM		PREPARED BY	CHECKED BY	APPROVED BY	DRAWING TITLE	DWG NO.
DETAILED DESIGN OF THE CAN THO BRIDGE CONSTRUCTION PROJECT	JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)	SOCIALIST REPUBLIC OF VIET NAM MINISTRY OF TRANSPORT (MOT) MY THUAN PROJECT MANAGEMENT UNIT	NIPPON KOEI CO.,LTD.	NAME	T. Kametani	K.Matsumoto	K. Enomoto	CAI RANG BRIDGE PIERS PIER P5-GENERAL VIEW	P3/BR7/0020
				SIGNATURE					
				DATE	20/9/2000	29/9/2000	5/10/2000		

2. LOAD COMBINATIONS - CAI TAC 1 - PIER 3

Nos	Items	Pz			Hx			Hy			My			Mx			Notes
		n=1	n<1	n>1	n=1	N<1	n>1	n=1	N<1	n>1	n=1	n<1	n>1	n=1	n<1	n>1	
	Permanent load																
1	Superstructure (stage1)- DC (n=0.9,1.25)										-151	-136	-189				
	+ Left	303	273	379							151	136	189				
	+ Right	303	273	379							-9.5	-6.2	-11.9				
2	Wearing surface (stage2) - DW (n=0.65,1.5)	133	87	200							-38	-25	-57				
	+ Left	76	49	114							29	19	43				
	+ Right	57	37	86							0	0	0				
3	Pier - DC (n=0.9,1.25)	509	458	636													
	Transient Loads																
4	Live load - LL(n= 0.5,1.75)	212	106	372							-60	-30	-105	-189	-94	-330	
	a- Main load	144	72	252							-41	-20	-71	-377	-189	-660	
	b- Sub load	69	34	120							-19	-10	-34	189	94	330	
5	Dynamic load allowance - IM (n=0.5,1.75)	70	35	123							-20	-10	-35	-62	-31	-109	
	a- Main load	47	24	83							-13	-7	-23	-125	-62	-218	
	b- Sub load	23	11	40							-6	-3	-11	62	31	109	
6	Braking force - BR (n=0.5,1.75)				-27.5	-13.8	-48.1				-365	-182	-638				10% of Japanese Load - p1
7	Centrifugal force - CE (n=0.5,1.75)							14.8	7.4	25.9				196	98	343	
	+ Left							7.4	3.7	13.0				98	49	172	10% of Japanese Load - p1
	+ Right							7.4	3.7	13.0				98	49	172	25% of Japanese Load - p1
8	Friction force - FR (n=1)																f=0.25
	a- Dead load				-37						-333						
	b- Dead load + Live load				-48						-428						
9	Vessel collision load - CV (n=1)							192						1,002			
	a- Transverse										-501						
	b- Longitudinal				-96												
10	Temperature gradient TG (n=1)										-157						
	a. + 5 degrees	-3.6									-10						
11	Settlement SE (n=1)	44															
12	Wind load - (n= 0.5,1.75)							30	12	42				324	130	454	
	a- Transverse - WS (n=0.4, 1.4)										-49						
	b- Longitudinal - WL (n=1)				-8												12% of Dead load
13	Earthquake - EQ (n=1)							150						956			
	a- Transverse										-1,345						
	b- Longitudinal				-193												

LOAD COMBINATION TABLE

Load combinations	Pz	Hx	Hy	My	Mx
1	2128.1	-95.7	45.3	-1387.8	-95.3
2	1580.9	-85.1	45.3	-1274.3	-95.3
3	1130.2	-37.0	42.2	-506.1	324.1
4	1231.4	-243.7	150	-1906.5	831.0
5	1231.4	-146.7	205.0	-1062.3	975.0
6	1550.8	-82.6	35.0	-1093.5	269.6

Combination 1 (STRENGHT - I-1) 1.25DC + 1.5DW + 1.75LL + 1.75IM +1.75CE+ 1.75BR + 1FR(b)+1TG+1SE

Combination 2 (STRENGHT - I-2) 0.9DC + 0.65DW + 1.75(LL + IM + CE + BR) + 1FR(a) +TG

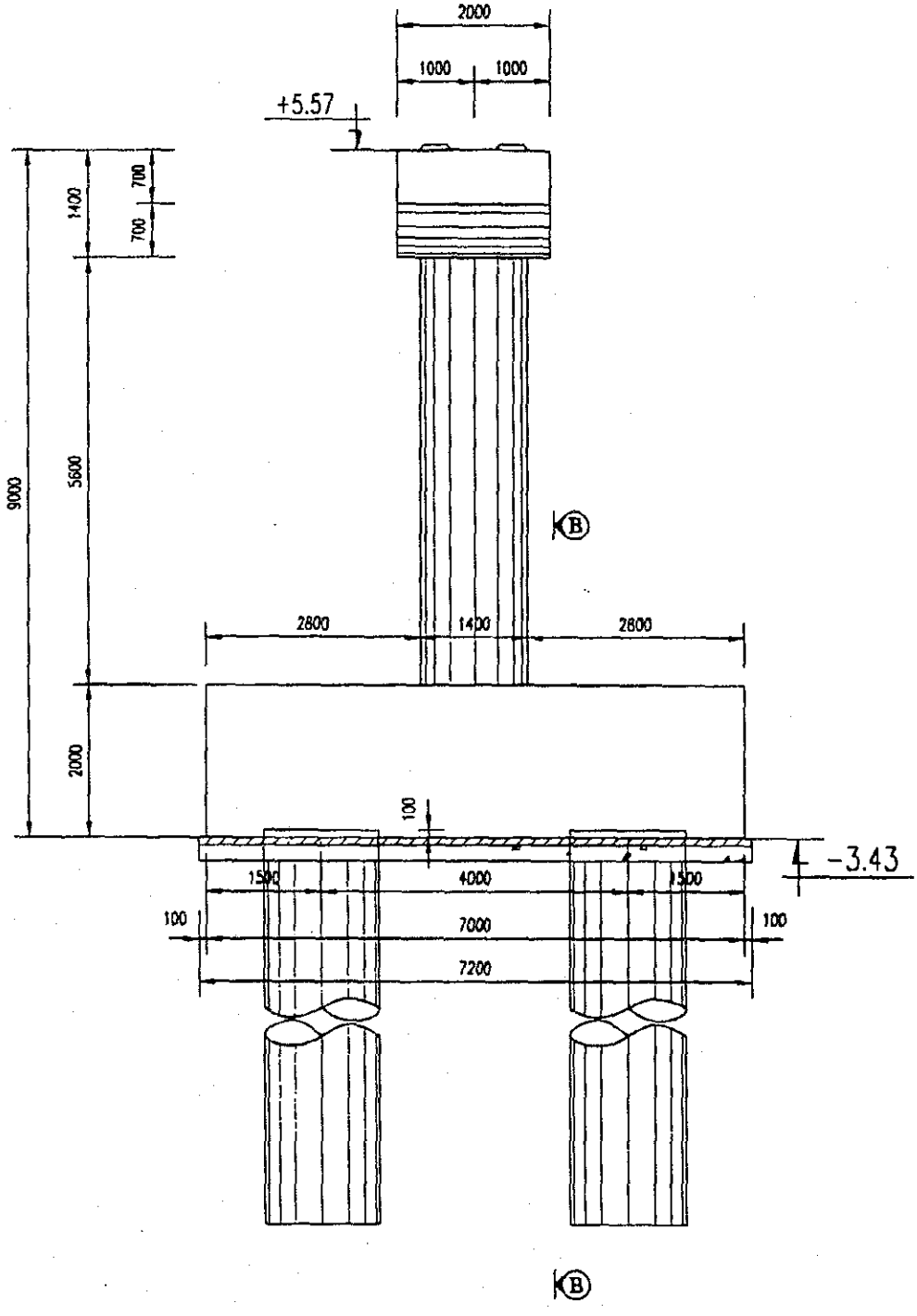
Combination 3 (STRENGHT - III) 0.9DC + 0.65DW +1.4*WS + 1FR(a) +TG + SE

Combination 4 (EXTREME EVENT -I) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5BR + 1FR(a) + 1EQ

Combination 5 (EXTREME EVENT-II) 0.9DC + 0.65DW + 0.5LL + 0.5IM + 0.5CE + 0.5BR + 1FR(a) + CV

Combination 6 (SERVICE -I) DC + DW + LL + IM + BR + CE +0.3WS + WL+FR(b) + 0.5TG+0.5SE

PIER P3


2000
1000
1000
+5.57
1400
700
700
9000
5600
2000
B
2800
1400
2800
100
-3.43
1500
4000
1500
100
7000
100
7200
B

SECTION CALCULATION

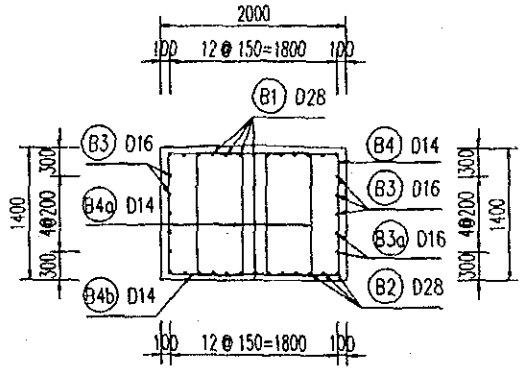
A. PIER CAP

i) Section Calculation for Flexure

		value	ELE	LOAD	LOC	NOD	Remark
Moment	M+ (kN·m)	1382.35	3	STRENGTH I	1.65	4	Mr >= min(1.2Mcr;
	M- (kN·m)	-2460.7	2	STRENGTH I	0.7	3	1.33M)
Width	W (cm)	200.0					
Height	h (cm)	140.0					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
	Dia. (mm)	28.0					
Bar arrangement tensile	Pitch (mm)	150.0					
	As (cm2)	80.1					
	Dia. (mm)	28.0					
Bar arrangement compression	Pitch (mm)	150.0					
	As (cm2)	80.1					
Allowable Moment	Mr+(kN·m)	3442.1					OK, SF=1.45
Allowable Moment	Mr-(kN·m)	3442					OK, SF=1.45

ii) Section Calculation for Shear

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	-2460.68	2	STRENGHT I	0.7	3	
Shear	Q (kN)	3483.9	2	STRENGHT I	0.7	3	
Width	W (cm)	200					
Height	h (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of shear reinforcement	D (mm)	14.0					
Pitch of shear reinforcement	s (mm)	200					
Arear of shear reinforcement	Av (cm2)	9.24					
Allowable Shear	Vr (kN)	302.90					OK, SF= 1.04



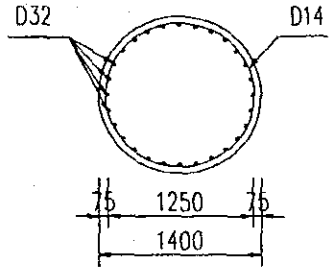
B. COLUMN

		Section	ELE	LOAD	LOC	NOD	Remark
Moment	M (kN·m)	4269.3	9	EXTREME I	6.4	10	
Axial	P (kN)	2761.4	9	EXTREME I	6.4	10	
Diameter	W (cm)	140					
Cover concrete tensile	d (cm)	7.5					
Cover concrete compression	d' (cm)	7.5					
Dia of reinforcement	D (mm)	32.0					
Number of bars	No (mm)	28.0					
Pitch of shear reinforcement	s (mm)	140					
Arear of shear reinforcement	Av (cm2)	337.78					
Allowable Compressive	Pr (kN)	2981.2					
Allowable Moment	Mr (kN·m)	4609.1					OK, SF= 1.08

$r_s=A_s/A_c$ = 0.0099 (17 nos. tensile)

$r_{min}=0.135f'_c/f_y$ = 0.0083

Checking rs > rmin OK



FOOTING

B pier 10.50 (m)

STRENGTH & EXTREME EVENT LIMIT STATE (h = 200 cm , b = 100 cm)

Combination	M (kN·m)	1.33M (kN·m)	1.2Mcr (kN·m)	Mr=ϕ Mn (kN·m)	1.33M < 1.2Mcr or Mr	As = 40 cm2 (D=3.2cm, 5 Nos) / A's = 11 cm2 (D=2.2cm, 3 Nos)
1	1171	1557			OK	ρ s = As/Ac = 0.0020
2	939	1249			OK	ρ min = 0.03 f'/fy = 0.0018
3	515	685	2422	2491	OK	∴ ρ s > ρ min —— O.K
4	1026	1364			OK	c/de = 0.04
5	768	1021			OK	∴ c/de < 0.42 —— O.K

SERVICE LIMIT STATE

(h = 200 cm , b = 100 cm)

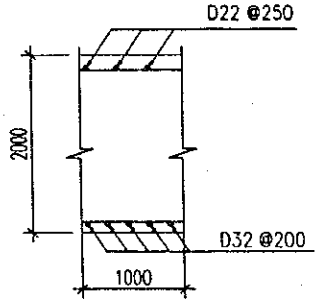
As = 40 cm2 (D=3.2cm, 5 Nos) A's = 11 cm2 (D=2.2cm, 3 Nos)

Cracking

Combination	M (kN·m)	fsa (MPa)	fs (MPa)	0.6·f'y (MPa)	fsa < 0.6·f'y
6	888.87	119	121	229	OK

Stress

Actual			Allowable				Remark
fc tensile	=	1.28 (MPa)	fr = 0.63·(fc)$^{0.5}$	=	3.03	(MPa)	OK
fc compress	=	1.31 (MPa)	fca = 0.4fc	=	9.41	(MPa)	OK
fs	=	8.26 (MPa)	fsa = 0.6fy	=	229.48	(MPa)	OK



Pier Type P-6

STABILITY CALCULATION

Longitudinal direction

Load Combination	Displacement δx (mm)		Bearing Capacity (T)		Uplift capacity (T)		Remarks
	Actual	Allowable	P_{max}	Allowable	P_{min}	Allowable	
Strength - I-1	1.3	30	87.38	118	37.03	-96	O.K
Strength - I-2	1.2	30	71.79	118	23.84	-96	O.K
Strength - III	0.7	30	45.61	118	18.77	-96	O.K
Extremme Event - I	3.8	20	80.12	118	-5.62	-96	O.K
Extremme Event - II	0.7	30	47.21	118	27.30	-96	O.K
Service - I	2.0	15	69.00	77	22.68	-52	O.K

Transverse direction

Load Combination	Displacement δy (mm)		Bearing Capacity (T)		Uplift capacity (T)		Remarks
	Actual	Allowable	P_{max}	Allowable	P_{min}	Allowable	
Strength - I-1	0.6	30	62.95	118	61.47	-96	O.K
Strength - I-2	0.6	30	48.56	118	47.08	-96	O.K
Strength - III	0.6	30	36.56	118	27.82	-96	O.K
Extremme Event - I	2.1	20	51.43	118	23.08	-96	O.K
Extremme Event - II	0.2	30	37.46	118	37.04	-96	O.K
Service - I	0.8	15	49.38	77	42.31	-52	O.K

PILE SECTION

Checking stress

Load Combination	σ s (kg/cm2)		σ c (kg/cm2)		Remark
	Actual	Allowable	Actual	Allowable	
a. Longitudinal direction					
Combination 1	-666.4	2250	46.5	125	OK
Combination 2	-550.5	2250	38.5	125	OK
Combination 3	-342.4	2250	23.8	125	OK
Combination 4	1999.6	2250	76.7	125	OK
Combination 5	-377.2	3000	26.6	150	OK
Combination 6	-593.1	3000	42.3	150	OK
Combination 7		1800		100	OK
b. Transverse direction					
Combination 1	-503.6	2250	35.5	125	OK
Combination 2	-414.7	2250	29.6	125	OK
Combination 3	-326.5	2250	23.4	125	OK
Combination 4	-714.6	2250	54.4	125	OK
Combination 5	-264.4	3000	18.2	150	OK
Combination 6	-404.3	3000	28.6	150	OK
Combination 7		1800		100	OK

Notes : σ s Stress of reinforcement (kg/cm2)
σ c Stress of concrete (kg/cm2)