APPENDIX

CHAPTER 8 PRELIMINARY DESIGN

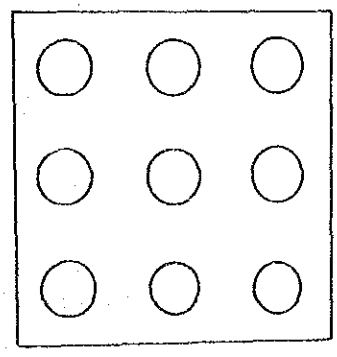
Appendix Table 8.2.9 CHECKING FOR NEW SCORING DEPTH

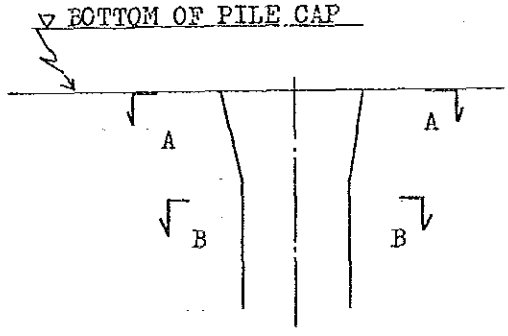
STRESS RESULTANTS OF PILE

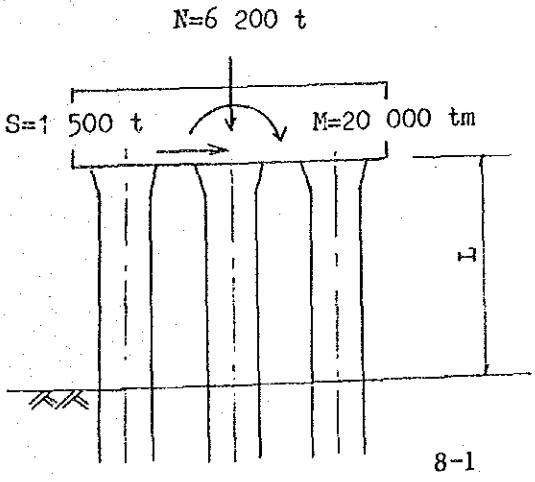
I T E M		CASE 1	CASE 2	CASE 1 - CASE 2
BENDING MOMENT (tm)		2 320	2 050	270 (13%)
AXIAL FORCE (t)	MAX	1 830	1 760	70 (4%)
	MIN	-450	-380	70 (18%)
SHEARING FORCE (t)		170	170	0 (0%)

STRESS OF PILE

SECTION		CASE 1	CASE 2	CASE 1 - CASE 2
A - A	σs (kg/cm2)	58	51	7 (12%)
	σs (kg/cm2)	2 030	1 780	250 (14%)
B - B	σc (kg/cm2)	78	68	10 (13%)
	σc (kg/cm2)	2 160	1 860	300 (16%)





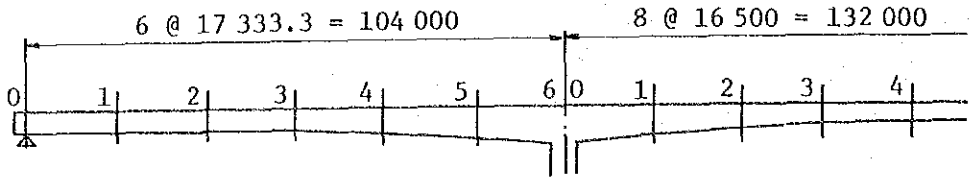


PROJECTED LENGTH OF PILE

	CASE 1	CASE 2
L	20.0 m	17.0 m

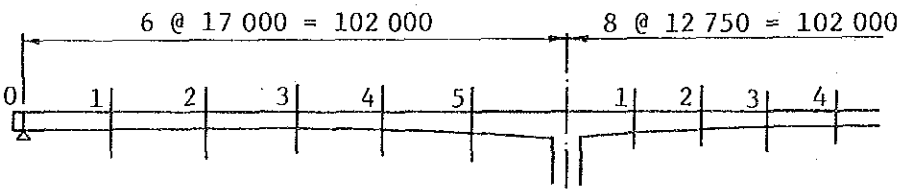
Appendix Table 8.3.2.1 MAIN DIMENSION OF PC BOX GIRDER

1. Main Spans over the Navigational Chanels



Web. T.	550	350		350	550			550	350		350
L.Slab T.	400	200		200	400	600	1 800	600	200		200
U.Slab T.	300										300
Girder H	4 400	4 400	4 400	4 712	5 601	6 931	8 500	6 242	4 328	3 049	2 600

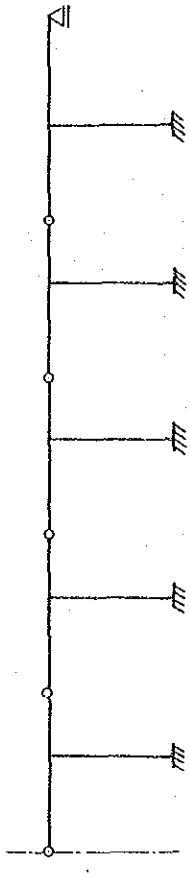
2. Approach Spans over the Shallows



Web. T.	550	350		350	550			550	350	
L.Slab T.	400	200		200	400	600	1 400	600	200	
U.Slab T.	300									
Girder H	4 400	4 400	4 400	4 583	5 103	5 882	6 800	5 040	3 547	2 550	2 200

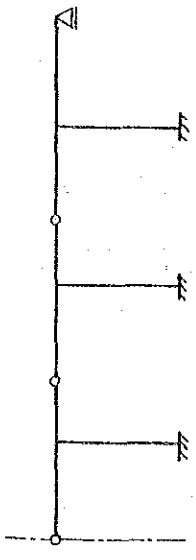
Appendix Table 8.3.2.2 STRESS OF PC BOX GIRDER

(1) Main Spans Over Navigation Channels



POSITION	NUMBER OF PC TENDONS U. SLAB	WEB	L. SLAB	BENDING STRESS (t/m^2) UPPER	LOWER
M-MAX		82	48	1017.3	19.7
PIER-1-L	244			42.1	817.0
R				5.6	844.6
M-MAX		0	0	0.0	0.0
PIER-2-L	242			34.2	816.0
R				10.9	833.6
M-MAX		0	0	0.0	0.0
PIER-3-L	242			2.4	840.0
R				2.4	840.0
M-MAX		0	0	0.0	0.0
PIER-4-L	242			10.9	833.6
R				34.2	816.0
M-MAX		0	0	0.0	0.0
PIER-5-L	244			5.6	844.6
R				42.1	817.0
M-MAX		82	48	1017.3	19.7

(2) Approach Spans over the Shallows



POSITION	NUMBER OF PC TENDONS U. SLAB	WEB	L. SLAB	BENDING STRESS (t/m^2) UPPER	LOWER
M-MAX		100	48	1169.1	0.4
PIER-1-L	214			3.0	938.7
R				67.0	885.2
M-MAX		0	0	0.0	0.0
PIER-2-L	148			11.9	641.0
R				9.9	642.7
M-MAX		0	0	0.0	0.0
PIER-3-L	212			56.1	885.5
R				4.7	928.6
M-MAX		102	48	1152.3	5.6

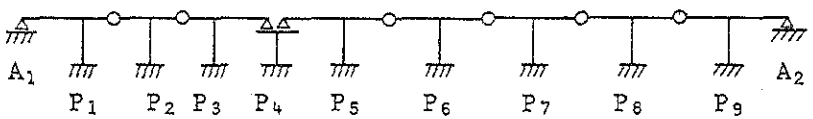
Appendix Table 8.3.2.4 QUANTITIES OF PC BOX GIRDER MATERIALS

ITEM		SPECIFICATION	UNIT	AMOUNT			REMARK
				MAIN SPAN	APPROACH SPAN	TOTAL	
CONCRETE		δck = 350 kg/cm^2	m^3	4,449.8	8,615.9	13,065.7	
FORM			m^3	15,505.5	30,517.9	46,023.4	
REINFORCING BAR		SD-30	t	445.0	861.6	1,306.6	100 kg/m^3
P C TENDON	Lg	SBPR 95/120 ϕ32	t	345.1	630.9	976.0	71 kg/m^3
	Dia	"	t	22.2	43.1	65.3	5 kg/m^3
	TRANVERSE	"	t	51.5	12.9	144.4	ctc 600
	OUT CABLE	"	t	36.6	36.1	72.7	
	TOTAL		t	455.4	803.0	1258.4	
TEMPORARY BENT	BENT	H-beam	t	80.0	100.0	180.0	
	CONCRETE	δck = 240 kg/cm^2	m^3	378.0	468.0	846.0	
	FORM		m^3	162.0	228.0	390.0	
	Re. BAR	SD·30	t	15.1	18.7	33.8	40 kg/m^3
	PILE	Pile Bent	m	90.0	40.0	130.0	
SCAFFOLD	PIER TOP	Bracket	No	3	5	8	
	SIDE SPAN	H-pile	m^3	7,143.2	-	7,143.2	A_1
	CENTER SPAN	Suspension	No	1	2	3	
	CENTER SPAN	Suspenssion	No	2	4	6	
BEARINGS	MOVABLE		t	20.8	18.4	49.2	A_1 P_4 5.2 t P_4 A_2 4.6 t
	FIX		t	5.0	10.0	15.0	Main 2 Apro 4
	TOTAL		t	25.8	28.4	64.2	
V.B WAGEN		M. Size		99	220	319	Set, Move, Dism.

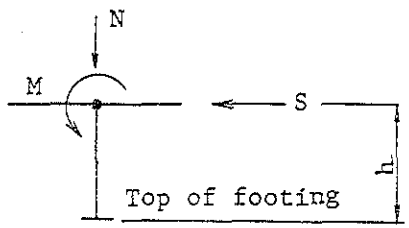
Appendix Table 8.3.2.5 REACTION OF SUPERSTRUCTURE (PC-BOX) IN LONGITUDINAL DIRECTION

Load Case		Dead Load only			Dead and Live Load			Dead Load and Earthquake Effect			Position
		M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)	h (m)
Approach Span	A_1	0	1 129	0	0	1 325	0	0	1 170	59	-
	P_1	-2 795	4 000	0	-6 108	4 501	0	-9 216 3 626	3 960 4 040	626 -626	24.5
	P_2	20	2 957	0	-2 926	3 394	0	-7 752 7 792	2 942 2 972	399 -399	41.5
	P_3	2 267	3 994	0	5 088	4 494	0	-6 185 10 719	4 037 3 951	626 -626	31.0
	P_4	0	2 148	0	0	2 551	0	0	2 233	112	30.6
Main Span	P_5	81	4 888	0	-3 489	5 458	0	-8 702 8 864	4 869 4 907	738 -738	30.1
	P_6	30	4 488	0	5 829	5 033	0	-7 579 7 639	4 499 4 477	562 -562	28.6
	P_7	0	4 503	0	6 304	5 059	0	-6 879 6 879	4 503	562 -562	28.6
	P_8	30	4 488	0	5 829	5 033	0	-7 579 7 639	4 499 4 477	562 -562	28.6
	P_9	81	4 888	0	-3 489	5 458	0	-8 702 8 864	4 869 4 907	738 -738	28.6
	A_2	0	1 109	0	0	1 226	0	0	1 063	53	-

Arrangement of Piers and Abutments

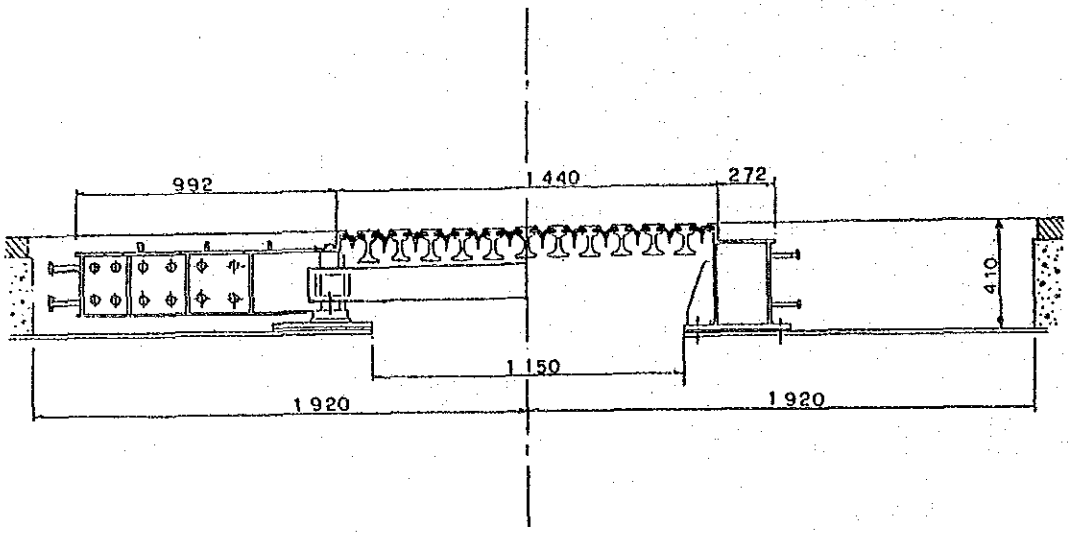


Direction of Sign

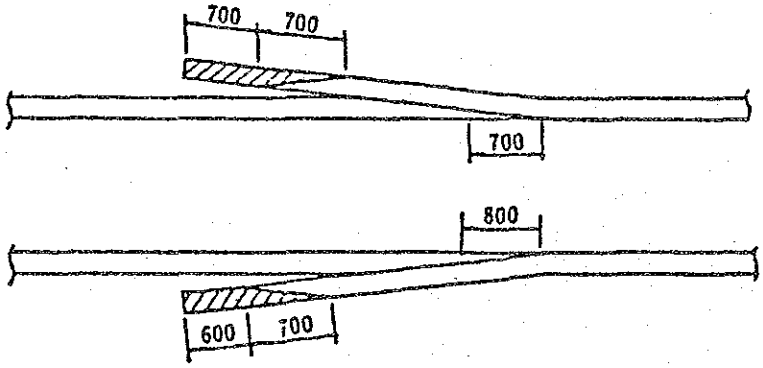


Appendix Fig. 8.3.2.1 EXPANSION JOINT AT P4

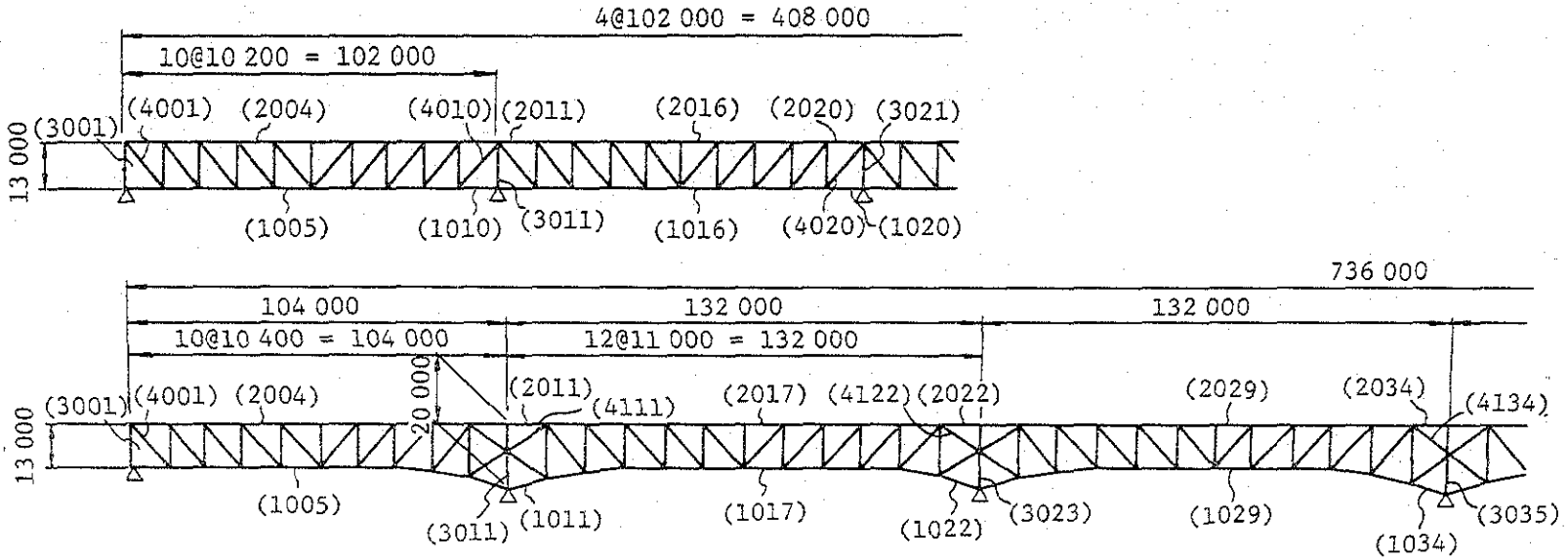
Roadway

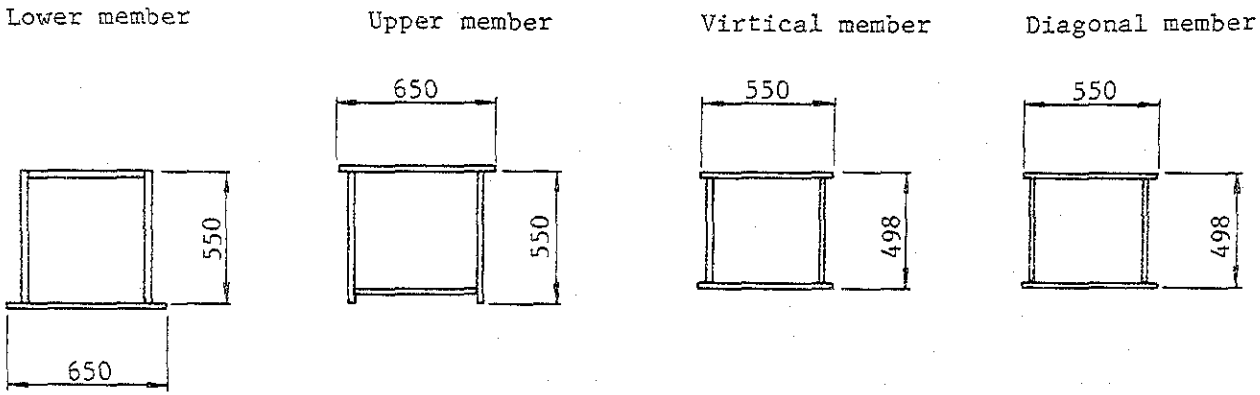


Railway



Appendix Fig. 8.3.2.2 SECTION OF MAIN TRUSS CHORD MEMBER



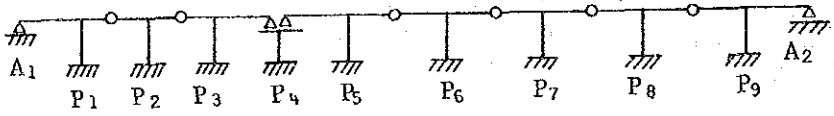


Note: ( ) chord member number.

Appendix Table 8.3.2.6 REACTION OF SUPERSTRUCTURE (PC-BOX) IN TRANSVERSE DIRECTION

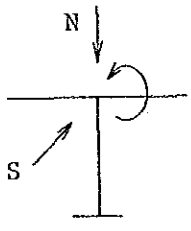
Load Case		Dead Load only			Dead and Live Load		
		M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)
Approach Span	P_1	0	4 000	0	0	4 000	500
	P_2	0	2 957	0	0	2 957	370
	P_3	0	3 994	0	0	3 994	499
	P_4	0	2 148	0	0	2 148	269
Main Span	P_5	0	4 888	0	0	4 888	611
	P_6	0	4 488	0	0	4 488	561
	P_7	0	4 503	0	0	4 503	563
	P_8	0	4 488	0	0	4 488	561
	P_9	0	4 888	0	0	4 888	611

Arrangement of Piers



Direction of Sign

Direction of Sign



Appendix Table 8.3.2.7 STRESS OF MAIN TRUSS CHORD MEMBER IN 6 SPANS (1)

Member No.	(t) A. Force	Quality	(mm) Dimension	(m^2) Area	(kg/cm^2) Stress	(kg/cm^2) A. Stress
1005	1 014.0	SM58	1- 500x17 2- 550x18 1- 650x17	0.0394	2 577	2 600
1011	-1 277.5	SM58	1- 500x29 2- 550x33 1- 650x29	0.0697	1 834	1 841
1017	895.0	SM58	1- 500x15 2- 550x16 1- 650x15	0.0349	2 568	2 600
1022	-1 363.1	SM58	1- 500x31 2- 550x35 1- 650x31	0.0742	1 838	1 842
1029	896.7	SM50Y	1- 500x18 2- 550x21 1- 650x17	0.0432	2 078	2 100
1034	-1 359.2	SM58	1- 500x31 2- 550x35 1- 650x31	0.0742	1 833	1 842
2004	-1 014.0	SM58	1- 650x24 2- 550x24 1- 500x24	0.0540	1 878	1 948
2011	1 155.7	SM58	1- 650x21 2- 550x18 1- 500x22	0.0445	2 599	2 600
2017	-950.2	SM58	1- 650x23 2- 550x23 1- 500x23	0.0518	1 836	1 886
2022	1 227.5	SM58	1- 650x23 2- 550x19 1- 500x23	0.0474	2 592	2 600
2029	-952.0	SM58	1- 650x23 2- 550x23 1- 500x23	0.0518	1 840	1 886
2034	1 223.8	SM58	1- 650x23 2- 550x19 1- 500x23	0.0474	2 585	2 600
3001	-650.6	SM58	2- 550x23 2- 452x23	0.0461	1 452	1 454
3011	-988.2	SM58	2- 650x26 2- 446x26	0.0570	1 742	1 753
3023	-975.6	SM58	2- 650x26 2- 446x26	0.0570	1 720	1 753
3035	-974.6	SM58	2- 650x26 2- 446x26	0.0570	1 718	1 753

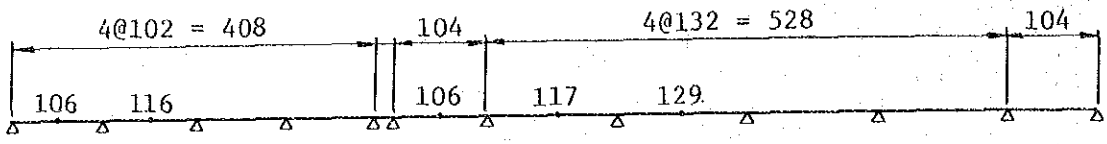
Appendix Table 8.3.2.8 STRESS OF MAIN TRUSS CHORD MEMBER IN 6 SPANS (2)

Member No.	(t) A. Force	Quality	(mm) Dimension	(m^2) Area	(kg/cm^2) Stress	(kg/cm^2) A. Stress
4001	717.2	SM58	2- 550x14 2- 470x14	0.0286	2 586	2 600.
4111	-441.5	SM50Y	2- 550x18 2- 462x18	0.0364	1 235	1 250
4122	-437.9	SM50Y	2- 550x18 2- 462x18	0.0364	1 225	1 250
4134	-438.1	SM50Y	2- 550x18 2- 462x18	0.0364	1 226	1 250

Appendix Table 8.3.2.9 STRESS OF MAIN TRUSS CHORD MEMBER IN 4 SPANS

Member No.	(t) A. Force	Quality	(mm) Dimension	(m^2) Area	(kg/cm^2) Stress	(kg/cm^2) A. Stress
1005	1 121.1	SM58	1- 500x19 2- 550x20 1- 650x18	0.0432	2 574	2 600
1010	-1 073.9	SM58	1- 500x23 2- 550x26 1- 650x22	0.0544	1 974	1 983
1016	683.5	SM50Y	1- 500x14 2- 550x15 1- 650x14	0.0326	2 097	2 100
1020	-941.9	SM58	1- 500x20 2- 550x23 1- 650x19	0.0477	1 977	1 980
2004	-1 112.1	SM58	1- 650x26 2- 550x26 1- 500x26	0.0585	1 901	1 971
2011	586.1	SM50Y	1- 650x13 2- 550x12 1- 500x13	0.0282	2 082	2 100
2016	-724.5	SM58	1- 650x18 2- 550x18 1- 500x18	0.0405	1 789	1 960
2020	474.9	SS41	1- 650x16 2- 550x14 1- 500x17	0.0343	1 385	1 400
3001	-674.6	SM58	2- 550x24 2- 450x24	0.0480	1 444	1 455
3011	-1 506.8	SM58	2- 650x46 2- 406x46	0.0972	1 580	1 590
3021	-1 364.9	SM58	2- 650x40 2- 418x40	0.0854	1 599	1 608
4001	745.0	SM50Y	2- 550x18 2- 462x18	0.0364	2 085	2 100
4010	1 027.0	SM58	2- 550x20 2- 458x20	0.0403	2 591	2 600
4020	878.8	SM58	2- 550x18 2- 462x18	0.0364	2 533	2 600

Appendix Table 8.3.2.10 DEFLECTION OF MAIN TRUSS CHORD MEMBER DUE TO LIVE LOAD



4 Span 6 Span

4 Span : Deflection due to roadway live load
: Deflection due to railway live load

(mm)

	106 (L = 102m)		116 (L = 102m)	
	Railway	Roadway	Railway	Roadway
δℓ	25 < 170	61 < 170	23 < 170	57 < 170
δr	83 < 102	17 < 102	77 < 102	16 < 102
Σδ	108	78	100	73

6 Span

(mm)

	106 (L = 104m)		117 (L = 132m)		129 (L = 132m)	
	Railway	Roadway	Railway	Roadway	Railway	Roadway
δℓ	27 < 173	68 < 173	37 < 220	92 < 220	39 < 220	97 < 220
δr	86 < 104	18 < 104	124 < 132	26 < 132	123 < 132	26 < 132
Σδ	113	86	161	118	162	123

Allowable deflection

(mm)

		L = 102m	L = 104m	L = 132m
Roadway	L/600	170	173	220
Railway	L/1000	102	104	132

Appendix Table 8.3.2.11 STRESS OF FLOOR SYSTEM

Position		(t) A. Force	Quality	(mm) Dimension	(m^2) Area	(kg/cm^2) Stress	(kg/cm^2) A. Stress	(mm) Deflection	A. (mm) Deflection
Roadway	End Mid Span	110.8	SS41	2- 340x15 1- 1200x 9	0.0210	1 347	1 400	5.3	6.1
	Inner Mid Span	98.5	"	2- 340x14 1- 1200x 9	0.0203	1 259	1 400	5.8	6.1
	Inner Support	-86.2	"	2- 340x15 1- 1200x 9	0.0210	1 048	1 117	-	-
Railway	End Mid Span	75.8	"	2- 300x15 1- 1200x 9	0.0198	1 009	1 271	5.3	5.5
	Inner Mid Span Inner Support	66.4	"	2- 300x13 1- 1200x 9	0.0186	977	1 267	5.9	12.2
Side Walk	End Mid Span Inner Mid Span	16.4	"	2- 200x10 1- 500x 9	0.0085	1 205	1 400	6.6	18.3
	Inner Support	-12.7	"	2- 240x10 1- 500x 9	0.0093	814	958	-	-
Floor Beam		633.7	SM50Y	2- 500x25 1- 2300x14	0.0572	1 552	1 912	4.4 6.8	5.0 10.4

Appendix Table 8.3.2.12 QUANTITIES OF STEEL TRUSS

(1) Truss Steel (in t)

		SM41	SM50Y	SM58	Others	Total
Main Structure	Main Chord	799	1 124	2 038	-	3 961
	Floor Beam	-	854	-	-	854
	Stinger	1 683	-	-	-	1 683
	Diag. Member	913	-	-	-	913
	Upper Bracing	582	-	-	-	582
	Lower Bracing	399	-	-	-	399
	Railway Bracing	25	-	-	-	25
	Bracket	66	-	-	-	66
	Sub Total	4 467	1 978	2 038	-	8 483
Accessary	Bearing Shoe	-	-	-	237	237
	Exp. Joint	-	-	-	29	29
	Drainage	30	-	-	-	30
	Guardrail	241	-	-	-	241
	Sub Total	271	-	-	266	537
Total		4 738	1 978	2 038	266	9 020

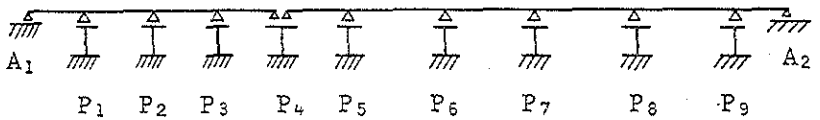
(2) Bridge Surface

Item		Unit	Amount
Concrete		m^3	3 661
Form		m^2	16 884
Asphalt Pavement	t=50	m^2	9 750
	t=30	m^2	3 441
Rail		t	116
Sleeper		m^3	249

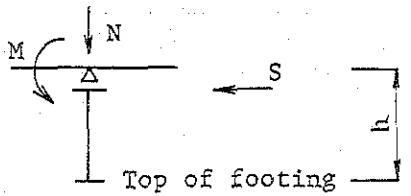
Appendix Table 8.3.2.13 REACTION OF SUPERSTRUCTURE (TRUSS) IN LONGITUDINAL DIRECTIONS

Load Case		Dead Load only			Dead and Live Load			Dead Load and Earth Quake Effect.			Position
		M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)	h (m)
Approach Span	A_1	0	789	0	0	1169	0	0	789	1003	-
	P_1	0	2293	0	0	3264	0	0	2293	115	24.7
	P_2	0	1862	0	0	2783	0	0	1862	93	41.7
	P_3	0	2293	0	0	3264	0	0	2293	115	31.2
	P_4	0	1578	0	0	2338	0	0	1578	79	31.2
Main Span	P_5	0	2685	0	0	3746	0	0	2685	134	24.0
	P_6	0	2719	0	0	3841	0	0	2719	136	24.0
	P_7	0	2700	0	0	3827	0	0	2700	135	24.0
	P_8	0	2719	0	0	3841	0	0	2719	136	22.5
	P_9	0	2685	0	0	3746	0	0	2685	134	22.5
	A_2	0	789	0	0	1169	0	0	789	1886	-

Arrangement of Piers and Abutments

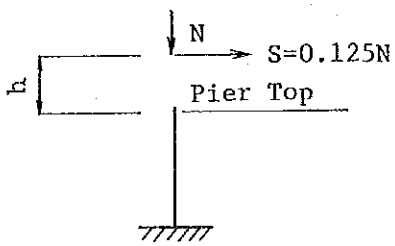


Direction of Sign



Appendix Table 8.3.2.14 REACTION OF SUPERSTRUCTURE (TRUSS)

Load Case		Dead and Live Load			Dead Load and Earthquake			Position
		M (t·m)	N (t)	S (t)	M (t·m)	N (t)	S (t)	h (m)
Approach Span	P_1	0	3 264	0	0	2 293	287	9.3
	P_2	0	2 783	0	0	1 862	233	"
	P_3	0	3 264	0	0	2 293	287	"
	P_4	0	2 338	0	0	1 578	197	9.3
Main Span	P_5	0	3 746	0	0	2 685	336	16.5
	P_6	0	3 841	0	0	2 719	340	"
	P_7	0	3 827	0	0	2 700	338	"
	P_8	0	3 841	0	0	2 719	340	"
	P_9	0	3 746	0	0	2 685	336	16.5

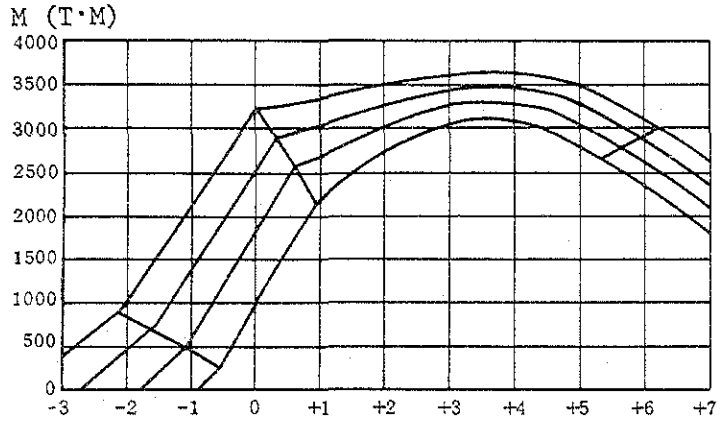


Appendix Table 8.3.3.1 PILE LENGTH AND ALLOWABLE PILE REACTION

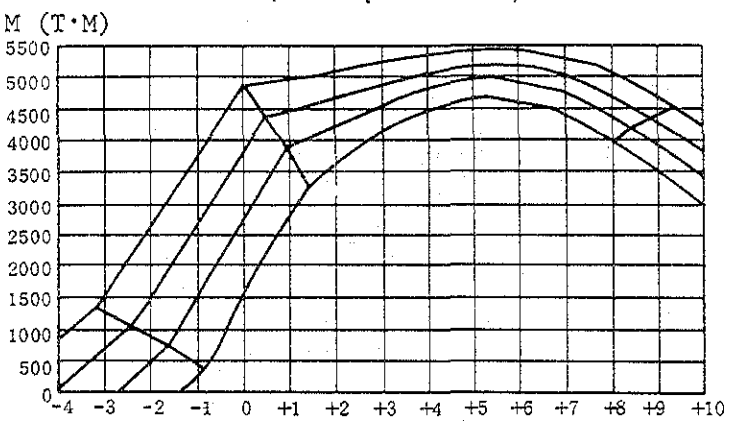
Pier No	(m) Scoring Depth ℓ' (m)	(m) Pile Length L (m)	(m) Projecting Length h (m)	(m) Burying Length ℓ (m	Soil Spring (t/m^3)		Allowable Pile Reaction		
					Virtical Kv	Horizontal kH	Horizontal Ha	Virtical Ra	Pulling Pa
P_3	9.0	24.0	9.0	15.0	1.35×10^5	2331	307	1466	254
							461	2273	
P_4	11.0	31.0	13.0	18.0	1.11×10^5	"	251	1531	329
							376	2397	
P_5	12.0	44.0	17.0	27.0	1.17×10^5	"	212	2001	467
							318	3139	
P_6	12.0	50.0	17.0	33.0	1.22×10^5	"	212	1743	530
							318	2763	
P_7	12.0	50.0	20.0	30.0	1.22×10^5	"	190	1540	530
							285	2470	
P_8	12.0	50.0	26.0	24.0	1.22×10^5	2331	157	1525	530
							236	2467	
P_9	12.0	36.0	24.0	12.0	1.11×10^5	3884	221	1073	382
							332	1758	

Appendix Fig. 8.3.3.1 DIMENSION AND RESISTANTS FORCE OF PILE

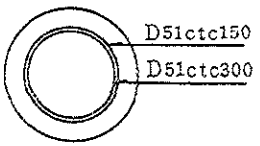
A-A (NORMAL TIME)

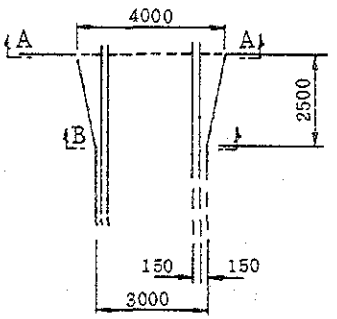


A-A (EARTHQUAKE TIME)

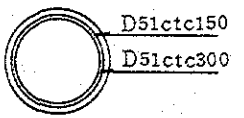


A-A

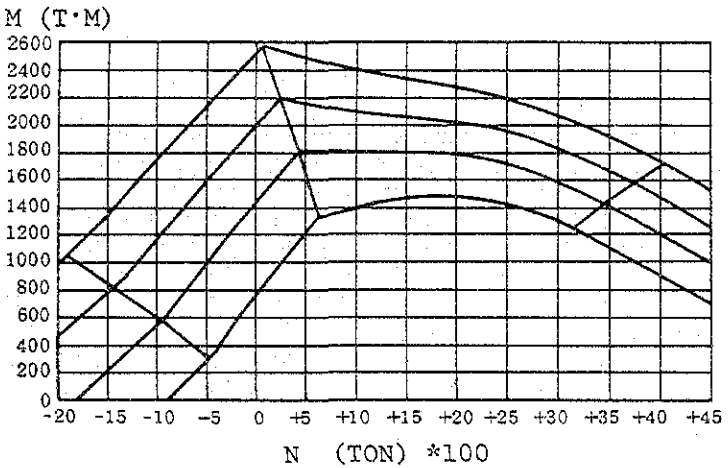




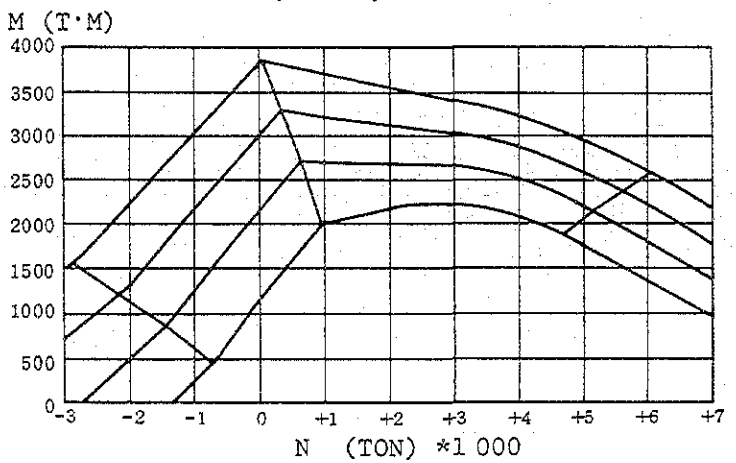
B-B



B-B (NORMAL TIME)



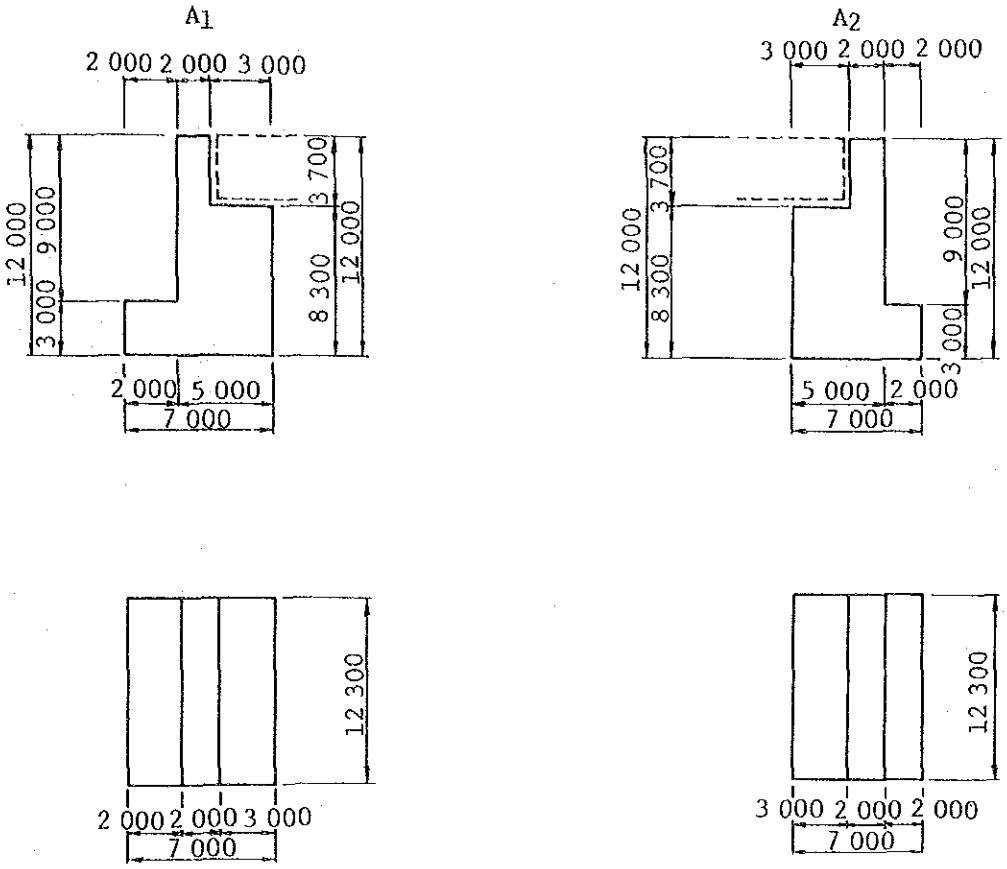
B-B (EARTHQUAKE TIME)



Note: M = Moment, N = AXIAL FORCE

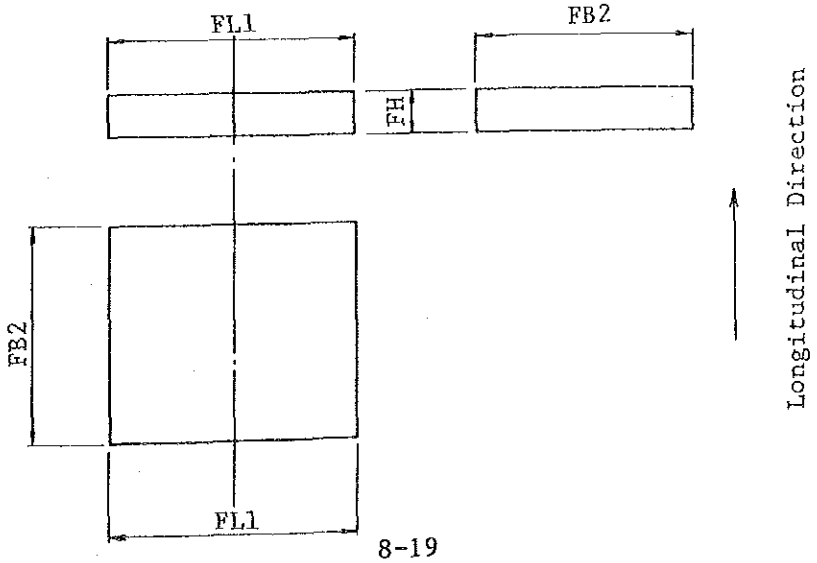
Appendix Fig. 8.3.3.2 DIMENSION OF DIRECT FOUNDATION (PC-BOX)

1) ABUTMENT



2) PIER

	FL1 (m)	FB2 (m)	FH (m)	A (m^2)
P_1	10.0	12.0	3.5	154 000
P_2	16.0	11.0	3.5	189 000



Appendix Table 8.3.3.2 STABILITY CHECK (PC-BOX)

Position	ECCENTRICITY (m) N.T	E.T	SLIDE SAFETY N.T	E.T	REACTION (t/m^2) N.T	E.T
A1 (L)	1.165	1.843	4.8	2.3	80	107
	1.167	2.333	1.5	1.2	100	150
A2 (L)	1.140	1.821	4.7	2.2	77	102
	1.167	2.333	1.5	1.2	100	150
P1 (L)	1.035	2.908	∞	5.2	75	117
	2.000	4.000	1.5	1.2	100	150
P1 (T)		2.967		6.5		148
		3.333		1.2		150
P2 (L)	0.566	3.488	∞	7.1	38	98
	1.833	3.667	1.5	1.2	100	150
P2 (T)		5.100		7.7		99
		5.333		1.2		150

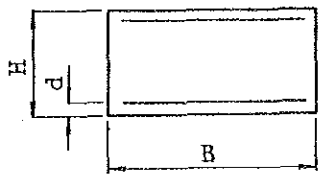
Note 1. UPPER : Acting reaction
LOWER : Allowerable bearing reaction

2. N.T : Normal Time
E.T : Earth Quake Time
(L) : Longitudinal Direction
(T) : Transverse Direction

Appendix Table 8.3.3.3 STRESS OF DIRECT FOUNDATION (PC-BOX)

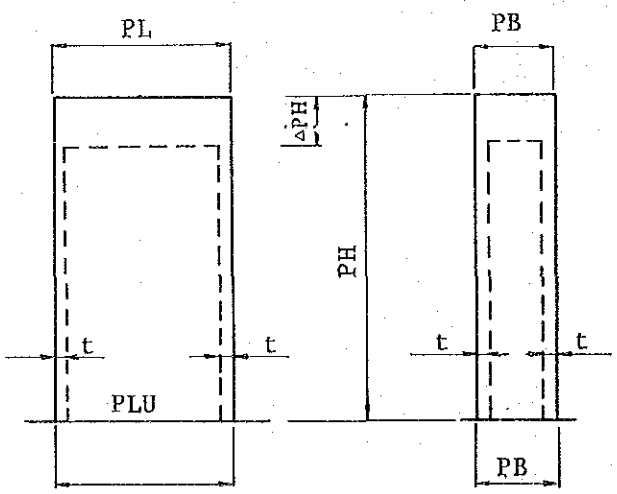
	A_1		A_2		P_1		P_2	
	Footing	Body	Footing	Body	Longi	Tran	Longi	Tran
B (m)	1.0	1.0	1.0	1.0	10.0		13.7	11.0
H (m)	3.0	5.0	3.0	5.0	3.5		3.5	3.5
d (m)	0.1	0.1	0.1	0.1	0.225		0.15	0.225
M (t·m)	34	137	50	137	5 180		4 704	8 548
N (t)	0	0	0	0	0		0	0
S (t)	26 (49)	39	48	39	1 534		1 353	2 364
As (cm^2/m)	6.69	10.63	6.56	10.63				
Bar-Pitch	D13 ctc 150	D16 ctc 150	D13 ctc 150	D16 ctc 150	2-D25 ctc 150		D32 ctc 150	2-D32 ctc 150
δc (kg/cm^2)	9	14	14	14	48		34	60
δs (kg/cm^2)	1 430	2 174	2 103	2 174	2 576		2 071	2 503
φ (kg/cm^2)	0.9 (1.7)	0.8	1.7	0.8	5.1		3.2	7.2
δca (kg/cm^2)	80	120	120	120	120		120	120
δsa (kg/cm^2)	1 800	2 700	2 700	2 700	2 700		2 700	2 700
φa_1 (kg/cm)	3.9 (5.85)	5.85	5.85	5.85	5.85	5.85	5.85	5.85

Note Earthquake Time



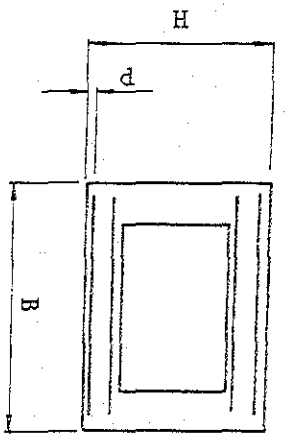
Appendix Table 8.3.3.4 DIMENSION OF PIERS (PC-Box)

	PL (m)	PB (m)	t (m)	PH (m)	Δ PH (m)
P_1	7.0	5.5	0.8	22.2	0
P_2	7.0	5.5	0.8	39.2	0
P_3	7.0	5.5	0.8	27.7	0
P_4	7.0	4.0	0.8	29.6	4.0
P_5	7.0	5.5	0.8	26.0	0
P_6	7.0	4.5	0.8	24.5	0
P_7	7.0	4.5	0.8	24.5	0
P_8	7.0	4.5	0.8	24.5	0
P_9	7.0	5.5	0.8	24.5	0



Appendix Table 8.3.3.5 STRESS OF PIER (PC-BOX) IN LONGITUDINAL DIRECTION

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
B (m)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
H (m)	5.5	5.5	5.5	4.0	5.5	4.5	4.5	4.5	5.5
d (m)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
M (t·m)	12 961	13 704	15 522	6 226	15 568	10 125	10 825	10 129	14 196
N (t)	4 810	3 799	4 841	3 200	5 599	5 185	5 189	5 185	5 590
S (t)	752	695	817	310	920	716	716	716	905
R-Bar	D25 ctc 150	D29 ctc 150	D25 ctc 150	D22 ctc 150	D25 ctc 150	D22 ctc 150	D22 ctc 150	D22 ctc 150	D25 ctc 150
Layer	1	1	1	1	1	1	1	1	1
δc (kg/cm^2)	84	84	101	69	101	92	99	92	91
δs (kg/cm^2)	1 269	2 018	2 307	1 221	1 665	1 075	1 482	1 077	1 153
φm (kg/cm^2)	7.7	8.5	9.6	4.8	9.8	7.9	8.9	7.9	8.6
δca (kg/cm^2)	120	120	120	120	120	120	120	120	120
δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700
φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85

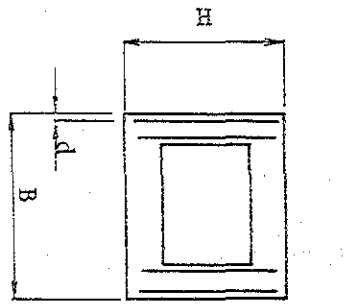


Longitudinal Direction

Note: Earth Quak Time

Appendix Table 8.3.3.6 STRESS OF PIERS (PC-BOX) IN TRANSVERSE DIRECTION

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
B (m)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
H (m)	5.5	5.5	5.5	4.0	5.5	4.5	4.5	4.5	5.5
d (m)	0.1	0.175	0.1	0.1	0.1	0.1	0.1	0.1	0.1
M (t·m)	13 542	21 239	18 025	11 698	20 702	17 795	17 852	17 795	19 459
N (t)	4 770	3 814	4 798	3 115	5 618	5 174	5 189	5 174	5 609
S (t)	643	739	728	479	831	734	736	734	812
R-Bar	D25 ctc 150	D29 ctc 150	D25 ctc 150	D25 ctc 150	D25 ctc 150	D25 ctc 150	D25 ctc 150	D25 ctc 150	D25 ctc 150
Layer	1	2	1	1	1	1	1	1	1
δc (kg/cm^2)	74	99	101	87	116	118	118	118	109
δs (kg/cm^2)	678	2 535	2 126	1 999	2 334	2 148	2 156	2 148	1 883
φm (kg/cm^2)	3.3	7.0	6.0	3.9	6.7	5.5	5.5	5.5	6.1
δca (kg/cm^2)	120	120	120	120	120	120	120	120	120
δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700
φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85



Note: Earth Quak Time

Appendix Table 8.3.3.7 PILE REACTION (PC-BOX) AT EARTH QUAKE TIME

(1) Longitudinal Direction

Pier	V max (t)	R min (t)	H (t)	V a (t)	Ha (t)
P_3	1 608	- 154	156	2 276 - 254	461
P_4	1 048	41	105	2 397 - 329	376
P_5	1 886	- 264	179	3 139 - 467	318
P_6	1 664	21	192	2 763 - 530	318
P_7	1 753	- 67	197	2 470 - 530	285
P_8	1 778	- 374	178	2 467 - 530	236
P_9	1 446	- 207	166	1 758 - 382	332

(2) Transverse Direction

Pier	V max (t)	V min (t)	H (t)	V a (t)	Ha (t)
P_3	1 667	- 223	156	2 276 - 254	461
P_4	1 291	- 220	137	2 397 - 329	376
P_5	2 034	- 408	184	3 139 - 467	318
P_6	1 676	7	198	2 763 - 530	318
P_7	1 745	- 60	204	2 470 - 530	285
P_8	1 734	- 332	188	2 467 - 530	236
P_9	1 548	- 307	178	1 758 - 382	332

Note: V = Virtical Reaction
H = Horizontal Reaction
a = Allowable Reaction
max = Maximum Reaction
min = Minimum Reaction

Appendix Table 8.3.3.8 STRESS OF PILE (PC-BOX) IN LONGITUDINAL DIRECTION

	ITEM	P_3	P_4	P_5	P_6	P_7	P_8	P_9
SECTION A-A	DIG (m)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	M (t·m)	1 392	1 433	2 184	2 461	2 850	3 183	2 963
	N (t)	-223	-220	-414	7	-60	-332	-307
	S (t)	156	137	184	198	204	188	178
	AS	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1.5	1	1.5	2	1.5
	δc (kg/cm^2)	49	50	59	84	83	83	87
	δs (kg/cm^2)	1 718	1 756	1 645	2 525	2 174	2 095	2 469
	φ (kg/cm^2)	1.9	1.7	2.2	2.4	2.5	2.3	2.2
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85
SECTION B-B	Dia (m)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	M (t)	1 001	1 091	1 724	1 966	2 339	2 713	2 519
	N (t)	-223	-220	-414	7	-60	-332	-307
	S (t)	156	137	184	198	204	188	178
	AS	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1.5	1	1.5	2	1.5
	δc (kg/cm^2)	44	48	63	90	89	87	94
	δs (kg/cm^2)	1 594	1 710	1 983	2 611	2 299	2 255	2 664
	φ (kg/cm^2)	2.8	2.5	3.4	3.5	3.7	3.4	3.2
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85

Appendix Table 8.3.3.9 STRESS OF PILE (PC-BOX) IN LONGITUDINAL DIRECTION

	ITEM	P_3	P_4	P_5	P_6	P_7	P_8	P_9
SECTION A-A	Dia (m)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	M (t·m)	1 392	1 114	2 124	2 336	2 690	2 964	2 779
	N (t)	-154	41	-264	21	-67	-374	-207
	S (t)	156	105	179	192	197	178	166
	Re-Bar AS	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1.5	1	1.5	2	1.5
	δc (kg/cm^2)	48	38	63	79	78	77	81
	δs (kg/cm^2)	1 629	1 095	1 807	2 378	2 061	1 992	2 246
	φ (kg/cm^2)	1.9	1.2	2.2	2.3	2.4	2.2	2.0
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85
SECTION B-B	Dia (m)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	M (t·m)	1 003	850	1 676	1 855	2 198	2 518	2 363
	N (t)	-154	41	-264	21	-67	-374	-207
	S (t)	156	105	179	192	197	178	1656
	Re-Bar AS	D51 ctc 150	D51 ctc 150	D51 d51d 150	ctcD51 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1.5	1	1.5	2	1.5
	δc (kg/cm^2)	45	39	62	85	83	81	89
	δs (kg/cm^2)	1 516	1 086	1 819	2 448	2 169	2 131	2 436
	φ (kg/cm^2)	2.8	1.9	3.3	3.4	3.6	3.3	3.0
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85

Appendix Table 8.3.3.10 RIGIDITY OF PILE CAPS

Pier No	(m) B	(m) H	(m) I	(t/m) E	(t/m) Kv	(m) ℓ	$\mu = \frac{6EI}{Kv \cdot \ell^3}$	$\frac{n^4}{10}$	n
P_3	6.0	3.5	21.4	$2.7 \quad 10^6$	1.35×10^5	7.0	7.5	1.6	2
P_4	6.0	3.5	21.4	"	1.11×10^5	6.0	14.5	1.6	2
P_5	6.0	3.5	21.4	"	1.17×10^5	6.0	13.7	1.6	2
P_6	6.0	3.5	21.4	"	1.22×10^5	6.0	13.2	1.6	2
P_7	6.0	3.5	21.4	"	1.22×10^5	6.0	13.2	1.6	2
P_8	6.0	5.0	62.5	"	1.22×10^5	6.0	38.4	25.6	4
P_9	6.0	5.0	62.5	"	1.11×10^5	6.0	42.2	25.6	4

Note: μ : Rigidity coefficient of footing
E : Modulus of elasticity of footing (t/m^2)
I : Moment of intertia of area of footing per row of piles (m^4)
Kv : Axial spring constant of a pile (t/m)
ℓ : Center-to-center distance between piles (m)
n : Number of rows of piles
Decision: $\mu > n^4/10$

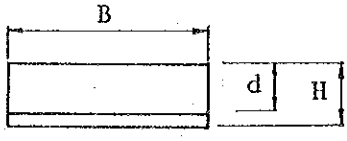
Appendix Table 8.3.3.11 STRESS OF TIPICAL PILE CAPS

Pier No	P_3 (T)	P_9 (T)
B (m)	9.4	16.4
H (m)	3.5	5.0
d (m)	3.2	4.7
M (tm)	15 850	21 147
S (t)	3 538	3 854
As (cm^2)	2 541	1 970
Bar Pitch	2-D51 ctc 150	3-D32 ctc 150
δc (kg/cm^2)	93	62
δs (kg/cm^2)	2 269	2 619
φ (kg/cm^2)	9.2	4.6

Note

- (T): Transverse Direction
- Checking at E. Quak Time
- Allowable Stress

$\delta ca = 120 \ kg/cm^2$
$\delta sa = 2700 \ kg/cm^2$
$\varphi a = 5.85 \ kg/cm^2$

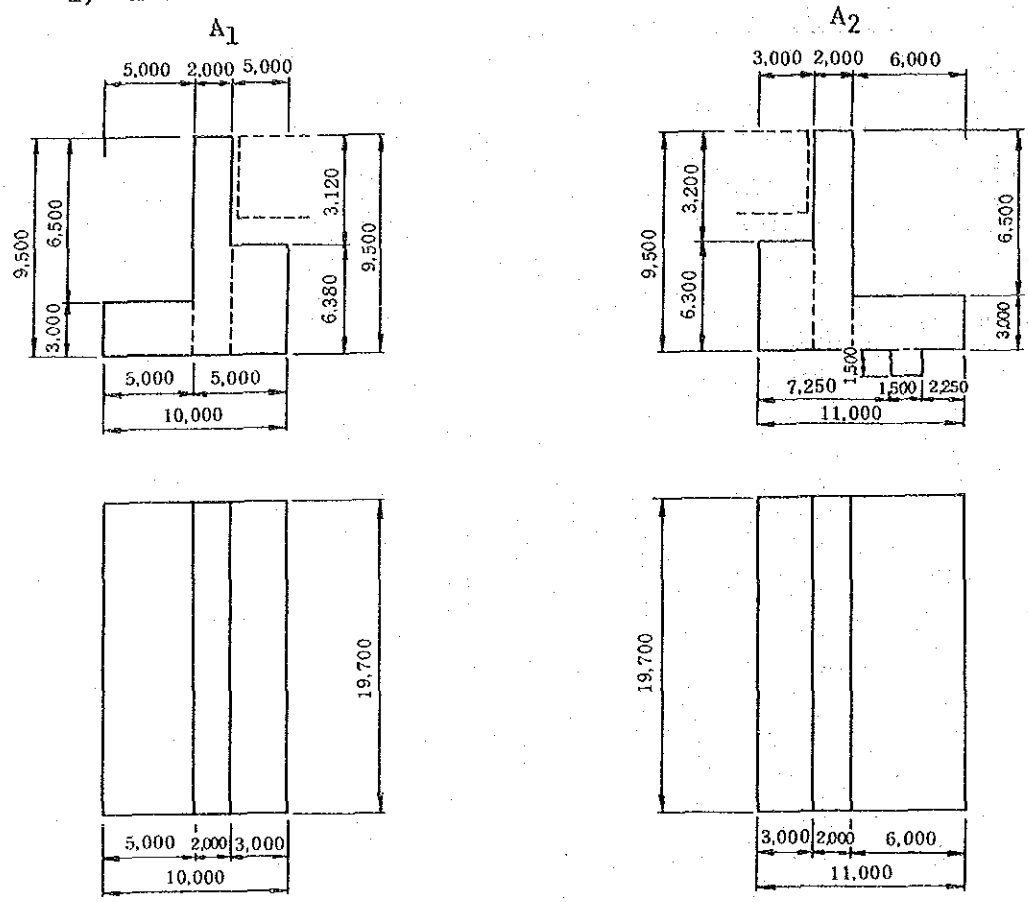


Appendix Table 8.3.3.12 QUANTITY OF SUBSTRUCTURE (PC-BOX)

ITEM		UNIT	AMOUNT	REMARK
CONCRETE	ABUTMENT	m^3	1262	
	PIER	"	4096	
	FOOTING	"	13798	
	RCD PILE	"	22589	
	LEVEL CONCRETE	"	52	A_1, A_2, P_1, P_2
FORM	ABUTMENT	m^2	796	
	PIER	"	10061	
	FOOTING	"	2839	
CASING PIPE	RCD PILE	m	1437	Loss + 20.0 m
Re-BAR	ABUTMENT	t	104	Loss x 1.03
	PIER	"	337	"
	FOOTING	"	1663	"
	RCD PILE	"	3929	"
WORKING SPACE	ABUTMENT	m^3	955	
	PIER	"	12073	
	FOOTING	"	3407	
SCAFOLD		"	13	P_4
STAGING		"	2844	P_3 - P_9
COFFER DAM	FOOTING	m	114	P_1, P_2
EXCAVATION	ABUTMENT	m^3	3089	
	FOOTING	"	3852	P_1, P_2

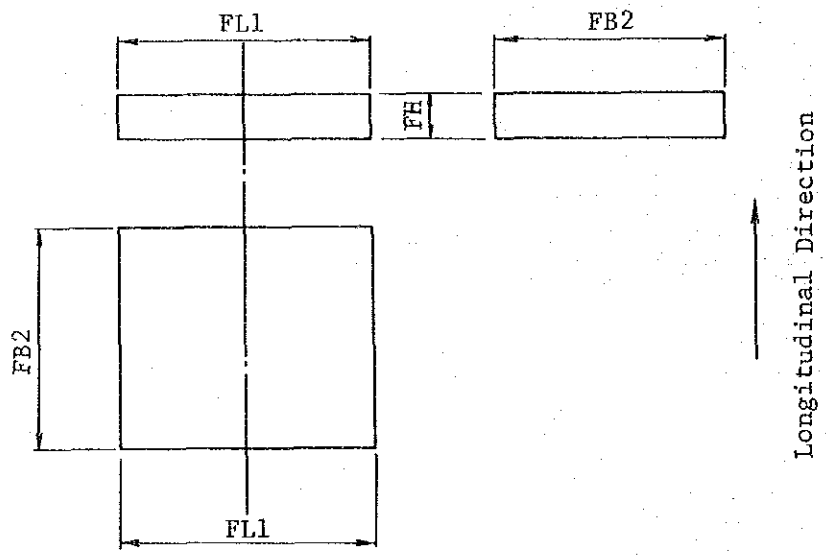
Appendix Fig. 8.3.3.3 DIMENSION OF DIRECT FOUNDATION (TRUSS)

1) ABUTMENT



2) PIER

	BL1 (m)	FB2 (m)	FH (m)
P1	12.0	8.0	3.5
P2	15.0	10.0	3.5



Appendix Table 8.3.3.13 STABILITY CHECK (TRUSS)

Position	ECCENTRICITY (m) N.T	E.T	SLIDE SAFETY N.T	E.T	REACTION (t/m^2) N.T	E.T
A1 (L)	0.904	2.831	5.0	1.3	45	83
	1.667	3.333	1.5	1.2	100	150
A2 (L)	0.852	3.533	12.3	2.7	41	88
	2.000	4.000	1.5	1.2	100	150
P1 (L)	0.0	1.674	∞	6.0	56	106
	1.333	2.667	1.5	1.2	100	150
P1 (T)	0.012	3.422	295.2	4.3	57	96
	2.000	4.000	1.5	1.2	100	150
P2 (L)	0.0	3.038	∞	4.3	38	109
	2.000	3.333	1.5	1.2	100	150
P2 (T)	0.159	4.819	61.0	3.6	41	120
	2.500	5.000	1.5	1.2	100	150

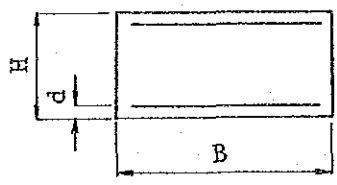
Note 1. UPPER : Acting reaction
LOWER : Allowerable bearing reaction

2. N.T : Normal Time
E.T : Earth Quake Time
(L) : Longitudinal Direction
(T) : Transverse Direction

Appendix Table 8.3.3.14 STRESS OF DIRECT FOUNDATION (TRUSS)

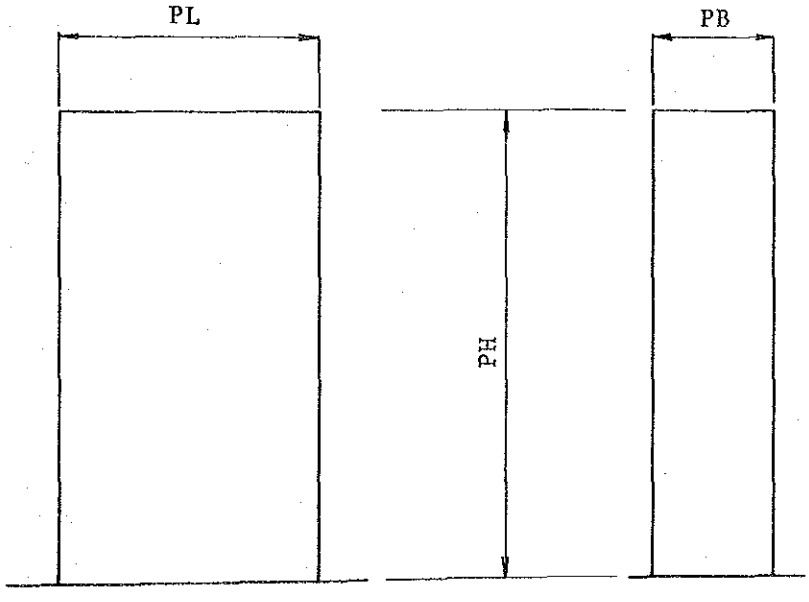
	A_1		A_2		P_1		P_2	
	Footing	Body	Footing	Body	Long	Tran	Long	Tran
B (m)	1.0	1.0	1.0	1.0	7.0	7.0	7.0	7.0
H (m)	5.0	5.0	3.0	5.0	3.0	3.0	3.0	3.0
d (m)	0.15	0.15	0.225	0.15	0.175	0.175	0.175	0.175
M (t·m)	300	137	575	137	6 055	13 199	12 604	20 757
N (t)	0	0	0	0	3 937	3 937	4 041	4 041
S t)	109	39	137	39	341	517	508	634
As (cm^2/m)	41.6	70.71	84.00	10.71				
Bar-Pitch	D29 ctc 150	D16 ctc 150	D29 ctc 150	D16 ctc 150	2-D32 ctc 150	2-D32 ctc 150	2-D51 ctc 150	2-D51 ctc 150
δc (kg/cm^2)	41	14	63	14	79	92	105	107
δs (kg/cm^2)	2 625	2 197	2 650	2 197	1 157	1 797	1 845	2 220
φ (kg/cm^2)	4:1	0.8	5.4	0.8	1.5	2.0	2.7	3.1
δca (kg/cm^2)	120	120	120	120	120	120	120	120
δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700	2 700
φa_1 (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85

Note Earthquake Time



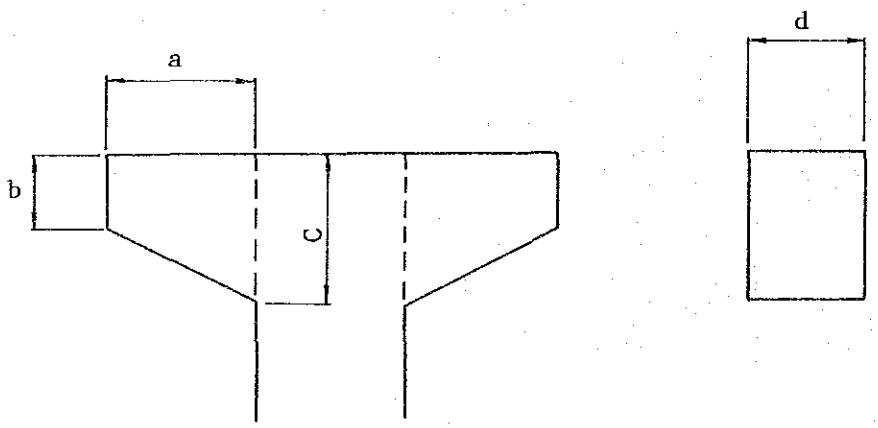
Appendix Table 8.3.3.15 DIMENSION OF PIERES (TRUSS)

	PL (m)	PB (m)	PH (m)
P_1	7.0	3.0	22.89
P_2	"	"	39.89
P_3	"	"	28.39
P_5	"	"	21.29
P_6	"	"	21.29
P_7	"	"	21.29
P_8	"	"	19.81
P_9	"	"	19.81



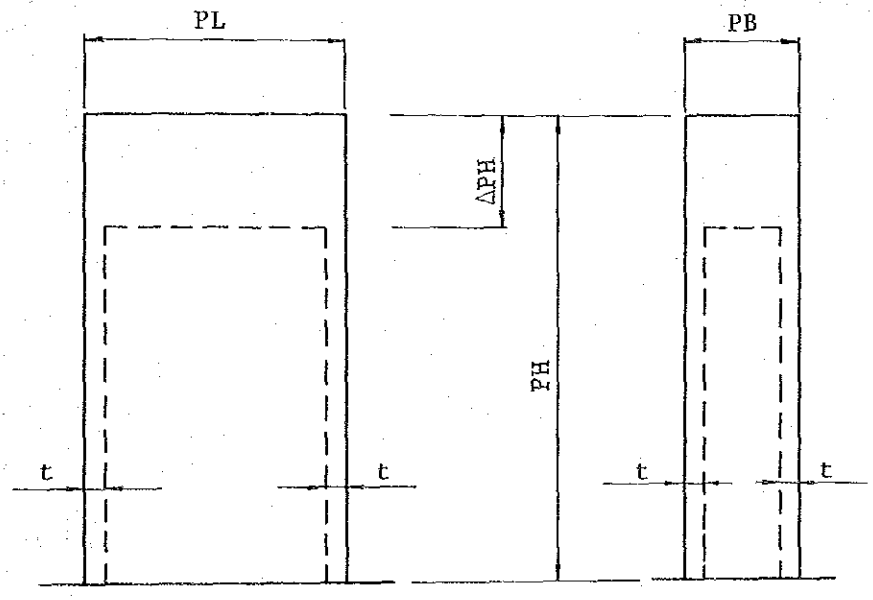
Appendix Table 8.3.3.16 DIMENSION OF BRACKET (TRUSS)

	a (m)	b (m)	c (m)	d (m)
P_1	5.75	4.0	6.0	3.0
P_2	5.75	4.0	6.0	3.0
P_3	5.75	4.0	6.0	3.0
P_4	5.75	4.0	6.0	5.0
P_5	5.75	5.0	7.0	3.0
P_6	5.75	5.0	7.0	3.0
P_7	5.75	5.0	7.0	3.0
P_8	5.75	5.0	7.0	3.0
P_9	5.75	5.0	7.0	3.0



Appendix Table 8.3.3.17 DIMENSION OF PIERS (TRUSS)

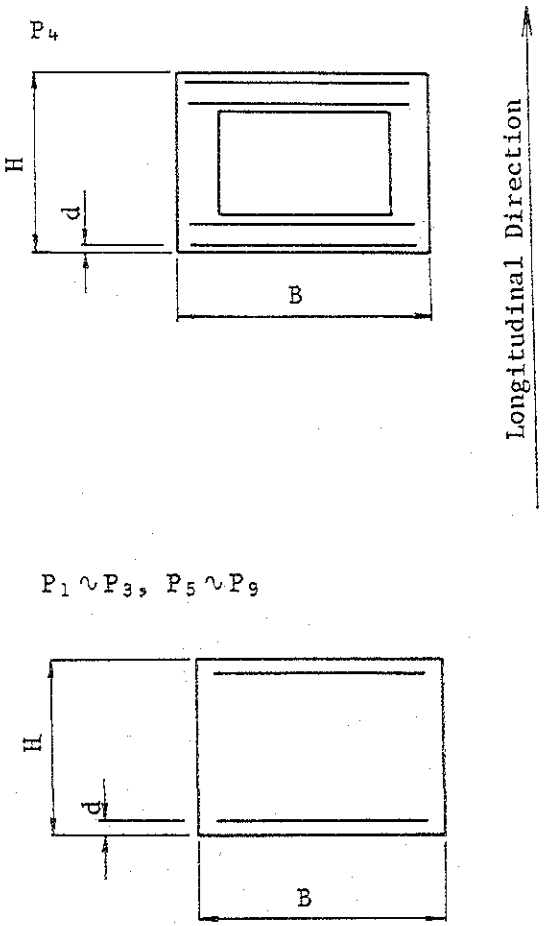
	PL (m)	PB (m)	t (m)	PH (m)	Δ PH (m)
P_4	7.0	5.0	0.8	28.67	6.0



Appendix Table 8.3.3.18 STRESS OF PIERS (TRUSS) IN TRANSVERSE DIRECTION

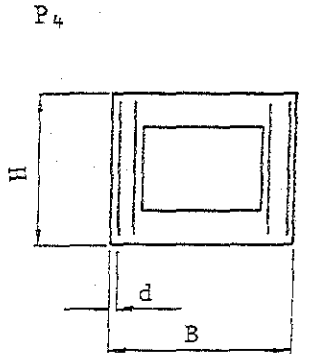
	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
B (m)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
H (m)	3.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0
d (m)	0.175	0.175	0.175	0.400	0.175	0.175	0.175	0.175	0.175
M (t·m)	6055	12604	8520	8765	6683	6731	6707	6139	6094
N (t)	3937	4041	4141	3502	4242	4276	4257	4229	4195
S (t)	341	508	413	406	397	399	398	382	380
R-BAR	D32 ctc 150	D51 ctc 150	D32 ctc 150	D25 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150
Layer	2	2	2	2	2	2	2	2	2
δc (kg/cm^2)	79	105	111	65	87	87	87	80	79
δs (kg/cm^2)	1157	1845	2266	1053	1320	1328	1325	1079	1072
φm (kg/cm^2)	1.5	2.7	2.1	4.8	1.8	1.8	1.8	1.7	1.6
δca (kg/cm^2)	120	120	120	120	120	120	120	120	120
δsa (kg/cm^2)	2700	2700	2700	2700	2700	2700	2700	2700	2700
φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85

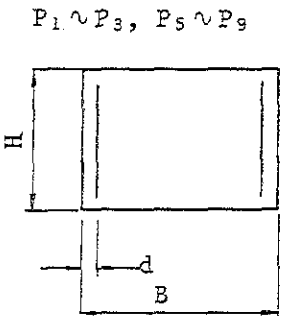
Note: Earth Quak Time



Appendix Table 8.3.3.19 STRESS OF PIERS (TRUSS) IN TRANSVERSE DIRECTION

	P_1	P_2	P_3	P_4	P_5	P_6	P_7	P_8	P_9
B (m)	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
H (m)	3.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0
d (m)	0.175	0.175	0.250	0.400	0.250	0.250	0.250	0.175	0.175
M (t·m)	13199	20757	16577	14512	17090	17252	17171	16352	16196
N (t)	3937	4041	4141	3502	4242	4276	4257	4229	4195
S (t)	517	634	582	555	596	600	598	584	580
R-BAR	D32 ctc 150	D51 ctc 150	D32 ctc 150	D25 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150	D32 ctc 150
Layer	2	2	3	2	3	3	3	3	3
δc (kg/cm^2)	92	107	105	90	109	110	109	104	103
δs (kg/cm^2)	1797	2220	2250	2335	2339	2366	2354	2118	2093
φm (kg/cm^2)	2.0	3.1	2.6	4.9	2.7	2.7	2.7	2.6	2.6
δca (kg/cm^2)	120	120	120	120	120	120	120	120	120
δsa (kg/cm^2)	2700	2700	2700	2700	2700	2700	2700	2700	2700
φa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85	5.85





Note: Earth Quak Time

Appendix Table 8.3.3.20 PILE REACTION (TRUSS) AT EARTH QUAKE TIME

Transverse Direction

Pier	V max (t)	R min (t)	H (t)	Va (t)	Ha (t)
P_3	1 958	-116	180	2 276 -254	461
P_4	1 507	-207	161	2 397 -329	376
P_5	1 688	-367	158	3 139 -467	318
P_6	1 693	-364	158	2 763 -530	318
P_7	1 770	-446	164	2 470 -530	285
P_8	1 577	-331	175	2 467 -530	236
P_9	1 547	-307	171	1 758 - 382	332

Note: V = Virtical Reaction
H = Horizontal Reaction
a = Allowable Reaction
max = Maximum Reaction
min = Minimum Reaction

Appendix Table 8.3.3.21 STRESS OF PILE IN TRANSVERSE DIRECTION

	ITEM	P_3	P_4	P_5	P_6	P_7	P_8	P_9
SECTION A-A	Dia (m)	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	M (t·m)	1 625	1 688	1 878	1 861	2 189	2 972	28
	N (t)	-116	-207	-368	-364	-446	-332	-307
	S (t)	180	161	158	158	164	175	171
	AS	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1	1	1.5	1.5	1.5
	δc (kg/cm^2)	56	59	66	65	66	88	85
	δs (kg/cm^2)	1 820	2 002	2 405	2 382	1 937	2 409	2 301
	ψ (kg/cm^2)	2.1	1.9	1.9	1.9	2.0	2.2	2.1
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	ψa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85
SECTION B-B	Dia (m)	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	M (t)	1175	1 286	1 483	1 465	1 779	2 534	2 423
	N (t)	-116	-207	-368	-364	-446	-332	-307
	S (t)	180	161	158	158	164	175	171
	AS	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150	D51 ctc 150
	Layer	1	1	1	1	1.5	1.5	1.5
	δc (kg/cm^2)	53	56	65	65	65	94	90
	δs (kg/cm^2)	1 700	1 954	2 407	2 378	2 061	2 698	2 571
	ψ (kg/cm^2)	3.2	2.9	2.9	2.9	3.0	3.2	3.1
	δca (kg/cm^2)	120	120	120	120	120	120	120
	δsa (kg/cm^2)	2 700	2 700	2 700	2 700	2 700	2 700	2 700
	ψa (kg/cm^2)	5.85	5.85	5.85	5.85	5.85	5.85	5.85

Appendix Table 8.3.3.22 RIGIDITY OF PILE CAPS (PC-BOX)

Pier No	(m) B	(m) H	(m) I	(t/m) E	(t/m) Kv	(m) ℓ	$\mu = \frac{6EI}{Kv \cdot \ell^3}$	$\frac{n^4}{10}$	n
P_3	6.0	3.5	21.4	$2.7 \quad 10^4$	1.35×10^5	6.0	11.9	1.6	2
P_4	6.0	3.5	21.4	"	1.11×10^5	6.0	14.5	1.6	2
P_5	6.0	3.5	21.4	"	1.17×10^5	6.0	13.7	1.6	2
P_6	6.0	5.0	62.5	"	1.22×10^5	6.0	38.4	25.6	4
P_7	6.0	5.0	62.5	"	1.22×10^5	6.0	38.4	25.6	4
P_8	6.0	5.0	62.5	"	1.22×10^5	6.0	38.4	25.6	4
P_9	6.0	5.0	62.5	"	1.11×10^5	6.0	42.2	25.6	4

Note
- μ : Rigidity coefficient of footing
- E : Modulus of elasticity of footing (t/m^2)
- I : Moment of intertia of area of footing per row of piles (m^4)
- Kv : Axial spring constant of a pile (t/m)
- ℓ : Center-to-center distance between piles (m)
- n : Number of rows of piles
- Decision: $\mu > n^4/10$

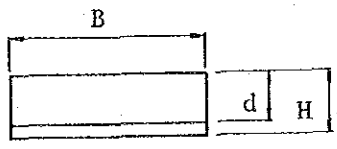
Appendix Table 8.3.3.23 STRESS OF TIPICAL PILE CAPS

Pier No	P_5 (L)	P_9 (L)
B (m)	13.4	16.4
H (m)	3.5	5.0
d (m)	3.2	4.7
M (tm)	17 014	31 783
S (t)	5 279	8 629
As (cm^2)	3 621	4 432
Bar Pitch	D51 ctc 150	2-D51 ctc 150
δc (kg/cm^2)	73	59
δs (kg/cm^2)	1 689	1 719
φ (kg/cm^2)	12.3	11.2

Note

- (L): Longitudinal Direction
- Checking at E. Quak Time
- Allowable Stress

  $\delta ca = 120 \ kg/cm^2$
  $\delta sa = 2700 \ kg/cm^2$
  $\varphi a = 5.85 \ kg/cm^2$

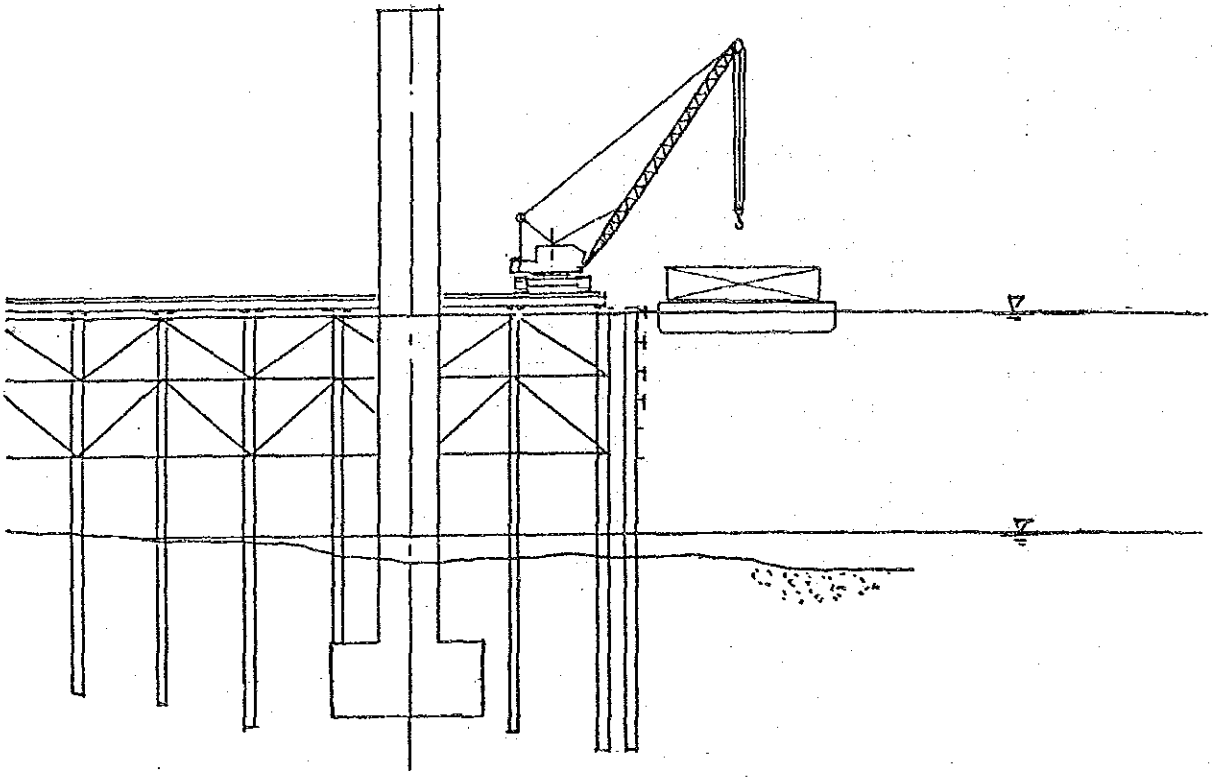


Appendix Table 8.3.3.24 QUANTITY OF SUBSTRUCTURE (PC-BOX)

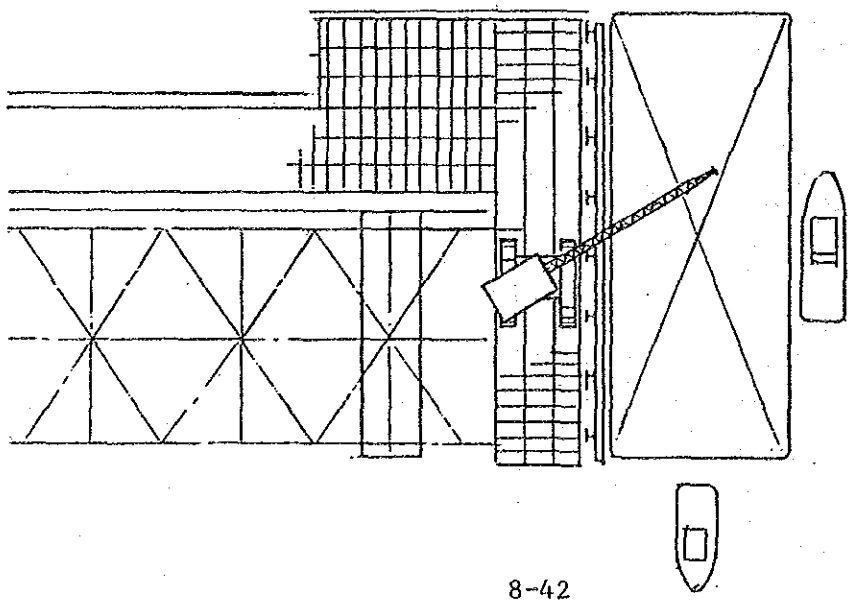
ITEM		UNIT	AMOUNT	REMARK
CONCRETE	ABUTMENT	m^3	2193	
	PIER	"	4675	
	FOOTING	"	10641	
	RCD PILE	"	19239	
	BRACKET	"	1840	
	LEVEL CONCRETE	"	73	A_1, A_2, P_1, P_2
FORM	ABUTMENT	m^2	967	
	PIER	"	4999	
	FOOTING	"	2401	
	BRACKET	"	1387	
CASING PIPE	RCD PILE	m	1264	Loss + 20.0 m
Re-BAR	ABUTMENT	t	181	Loss x 1.03
	PIER	"	385	"
	FOOTING	"	1243	"
	RCD PILE	"	3306	"
	BRACKET	"	184	"
WORKING SPACE	ABUTMENT	m^3	1160	
	PIER	"	5998	
	FOOTING	"	2881	
	BRACKET	"	1664	
SCAFOLD	BRACKET	m^2	353	
SCAFOLD		"	18	P_4
STAGING		"	1992	P_3 - P_9
COFFER DAM	FOOTING	m	106	P_1, P_2
EXCAVATION	ABUTMENT	m^3	5154	
	FOOTING	"	3300	P_1, P_2

Appendix Fig. 8.4.3.1 JETTY

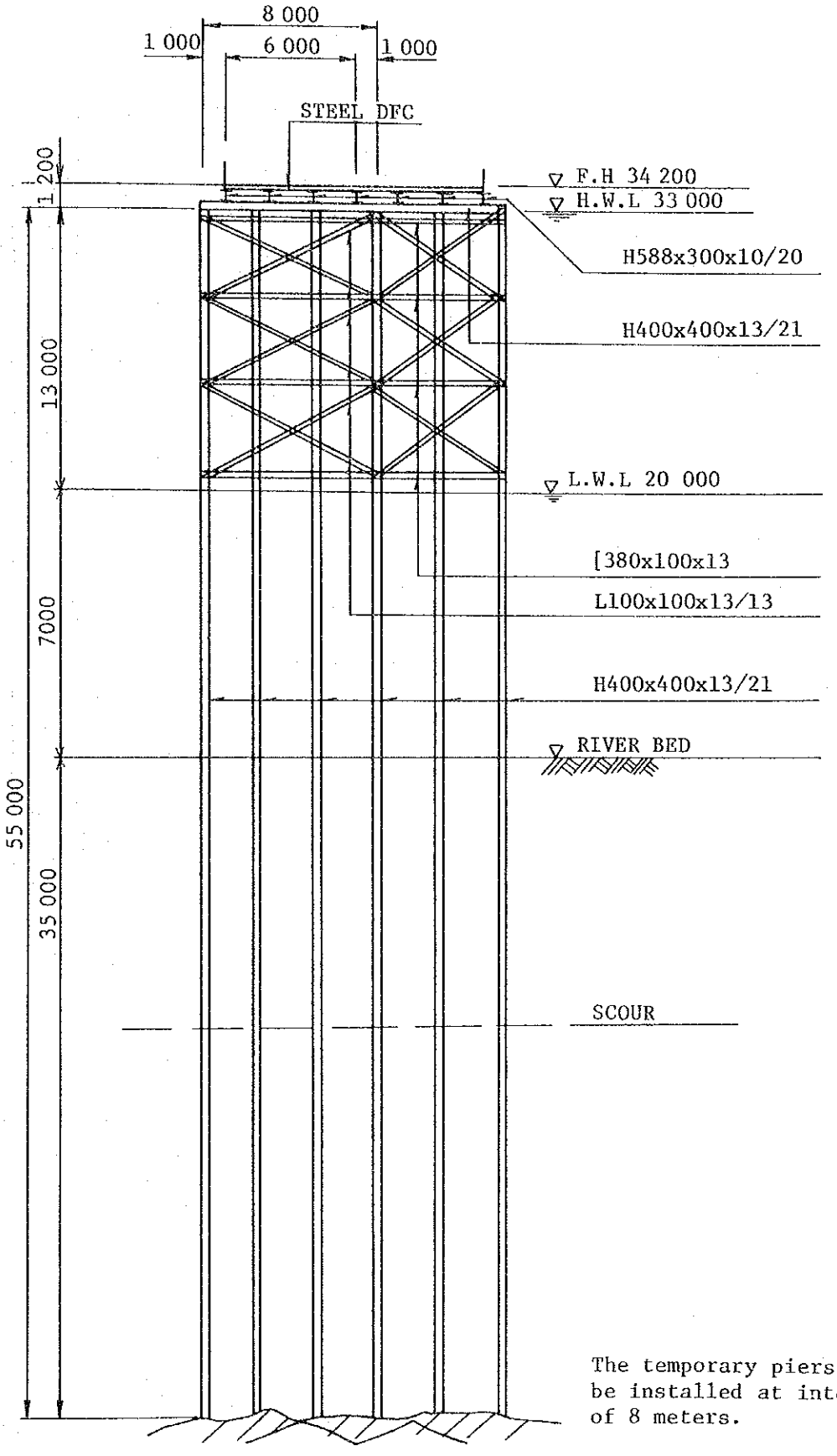
Profile



Plan

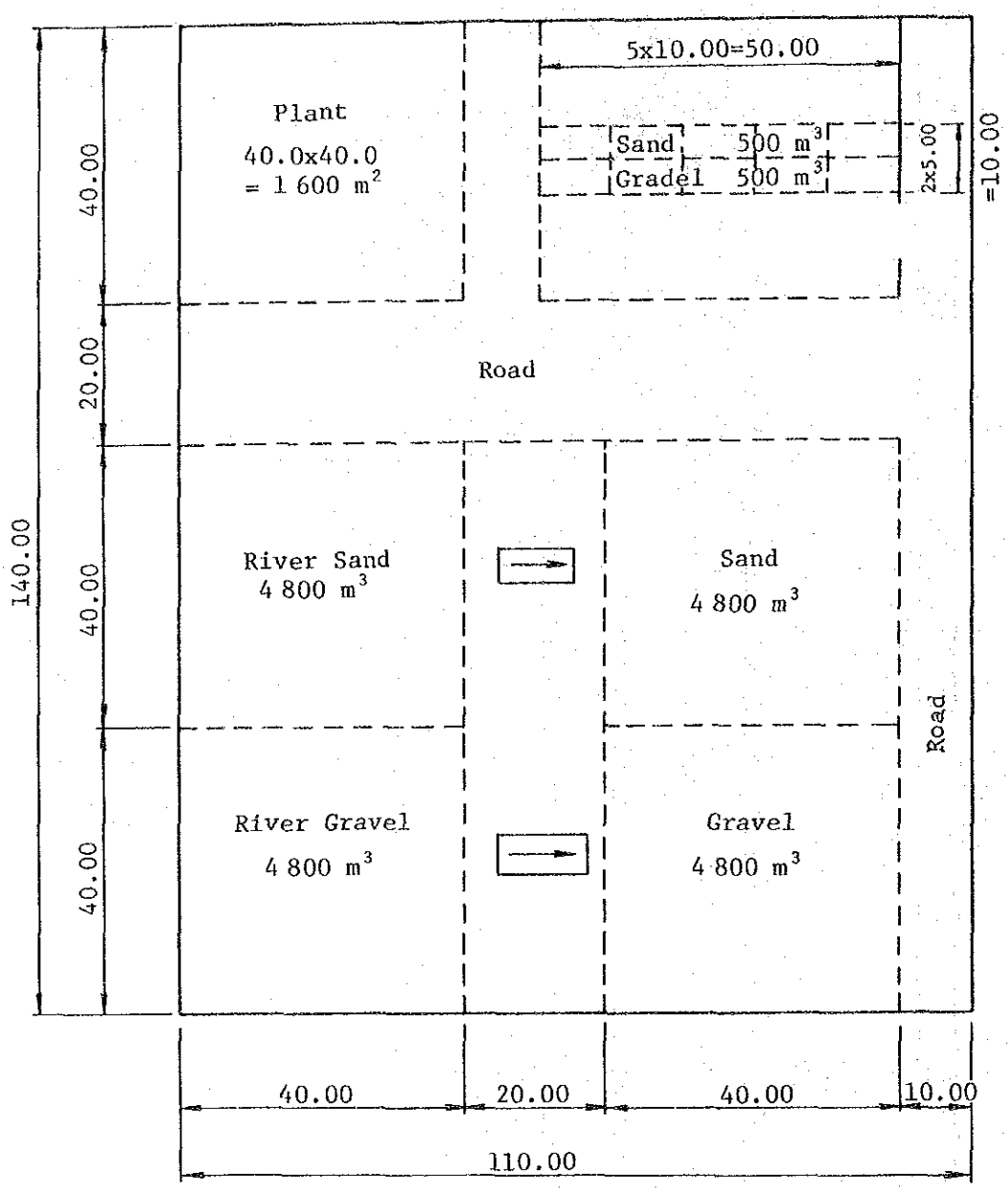


Appendix Fig. 8.4.3.2 WORKING PLATFORM



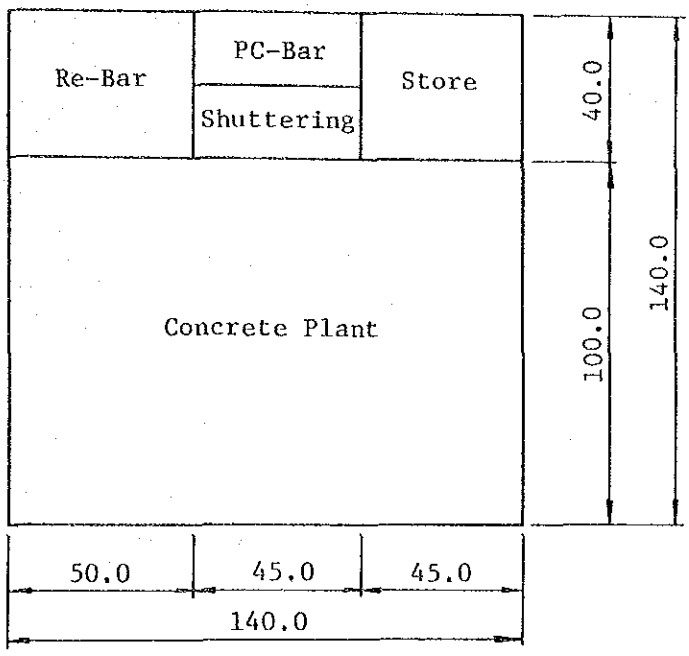
The temporary piers shall be installed at interval of 8 meters.

Appendix Fig. 8.4.3.3 LAYOUT OF CONCRETE PLANT

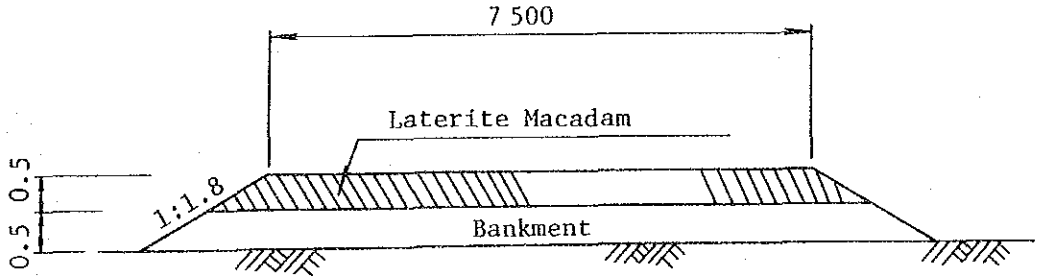


A = 110.00x140.00 = 15 400 m²

Appendix Fig. 8.4.3.4 TEMPORARY YARD



Appendix Fig. 8.4.3.5 TEMPORARY ROAD



Appendix Table 8.4.4.1 MACHINERY FOR PC BOX GIRDER CONSTRUCTION

Item	Specification	Nos.	Remarks
Vorbau Wagen	Middle size	6	Cantilever erection
Wagen Roof		6	"
Generator	30 KVA	6*	"
Fork Lift		3	Transportation
Cable Cane		1	"
Power Reach	28 t	3	"
High Speed Cutter	4 t	4	Processing PC tendon
Bar Bender		1	Processing R. bar
Lever Block	3 t	30	Form Work
Chain Block	3 t	12	"
Lever Winch	3 t	6	"
Htdraulic Jack	500 t	6	"
"	50 t	6	"
Electric Welder	300 A	6	"
Submergible Pump		6	"
Ground Hopper	4 m^3	3	Concrete Placement
Belt Conveyer	350x7m	4	"
Concrete Backet	2.0 m^3	4	"
Vibrator	360x1.9KW	10	"
"	445x0.75KW	40	"
Finisher		2	"
Concrete Cutter		2	Finishing
Pit Hammer		6	Pitching
High Washer		6	Cleaning
Compressor		4	General
D&W Jack		8	Prestressing
D&W Electric Pump		10	"

Appendix Table 8.4.4.1 MACHINERY FOR PC BOX GIRDER CONSTRUCTION (cont'd)

Item	Specification	Nos.	Remarks
Center Hole Jack	20 t	4	prestressing
Dynamo Meter		1	Calibration
Grout Mixer		3	Grouting
Grout pump		4	"
Water Tank	10 m^3	5	"

* available in Burma

Appendix Table 8.4.4.2 MACHINERY FOR STEEL TRUSS CONSTRUCTION

Item	Specification	Nos.	Remarks
Traveler Crane	15 t	2	Cantilever erection
Auto Dolly	35 t	8	"
Dolly Frame		1	"
Compressor	5.5 m^3	2	"
Welder	500 A	4	"
Erection Tool		8	"
Generator	100 KVA	2*	"
Crawler Crane	70 t	2	General
"	40 t	1	"
"	20 t	2	"
Asphalt Finisher	3.6 m	1*	Pavement
Tire Roller	20 t	1*	"
Tamper	0.8	2*	"
Asphalt Plant	30 t/h	1*	"
Concrete Finisher	4 m	1	Slab Work

* available in Burma

Appendix Table 8.4.4.3 MACHINERY FOR SUBSTRUCTURE CONSTRUCTION (1)

Item	Specification	Nos.	Remarks
Hydraulic Track Crane	20 t	3	Temporary work
Hydraulic Shovel	0.3 m^3	1*	"
Dump Truck	11t	2*	"
Bull Dozer	16 t	1*	"
Truck	11 t	4*	"
Magnetic Drilling Machine		3	Temporary work
Impact Wrench		5	"
High Speed Cutter		1	"
Wheel Loader	1.4 m^3	1*	Concrete mixing
Concrete Mixer Car	6 m^3	6	"
Portable Compressor	10.5 m^3/min	3	"
Concrete Plant	60 m/h	2	"
Cement Silo	200 t	2	"
Classifier	30 t/h	1*	"
Stone Crasher	1500x300	1*	"
Bar Cutter		2	processing R. bar
Bar Processor		2	"
Bar Bender		2	"
Concrete Test Equipment		1*	Quality control
Concrete Breaker		8	Concrete placement
Submergeble Pump	150	4	"
High Frequence Vibrator		5	"
Transit		5	Survey work
Level		5	"
Optical Distant Meter		1	"

* available in Burma

Appendix Table 8.4.4.3 MACHINERY FOR SUBSTRUCTURE CONSTRUCTION (1) (cont'd)

Item	Specification	Nos.	Remarks
Generator	150 KVA	1*	Temporary work
"	75 KVA	1*	"
"	35 KVA	2*	"
Micro-Buss		1	Transportation
Saloon Car		2	"
Zeep		2*	"

* available in Burma

Appendix Table 8.4.4.4 MACHINERY FOR SUBSTRUCTURE CONSTRUCTION (2)

Item	Specification	Nos.	Remarks
Crawler Crane	150 t	3	R.C.D. work
"	40 t	3	"
Vibro-Hammer	90 KW	2	"
"	150 KW	2	"
R.C.D. Drill	5400	3	R.C.D. work
Mud Pit Tank Equipment		3	"
Roller Bit		2	"
Bentnite Mixer		3	"
Clamshell Backet	0.3 m^3	3	"
Bending Roll Machine	with welder	1	Casing processing
Semi-auto-welder		13	"
Electric Welder		5	"
Goliath Crane	5 t	1	"
Concrete Backet	1.0 m^3	36	Concrete placement
Treamie Pipe		3	"
Generator	300 KVA	9*	R.C.D. work
"	125 KVA	1*	"
Inside Drill		5	Measurement
Sinker		4	"
Barge	1000 t	2*	Transportation
"	500 t	2*	"
"	300 t	2*	"
Anchor Barge	240 HP	1	"
Tag Boat	800 HP	1	"
Accompany Ship	300 HP	1	"
Transport Ship	60 HP	2	"
Concrete Carrying Ship	80 HP	3	"
Deck Barge	1000 t	2*	"
Winch		4	"

* available in Burma

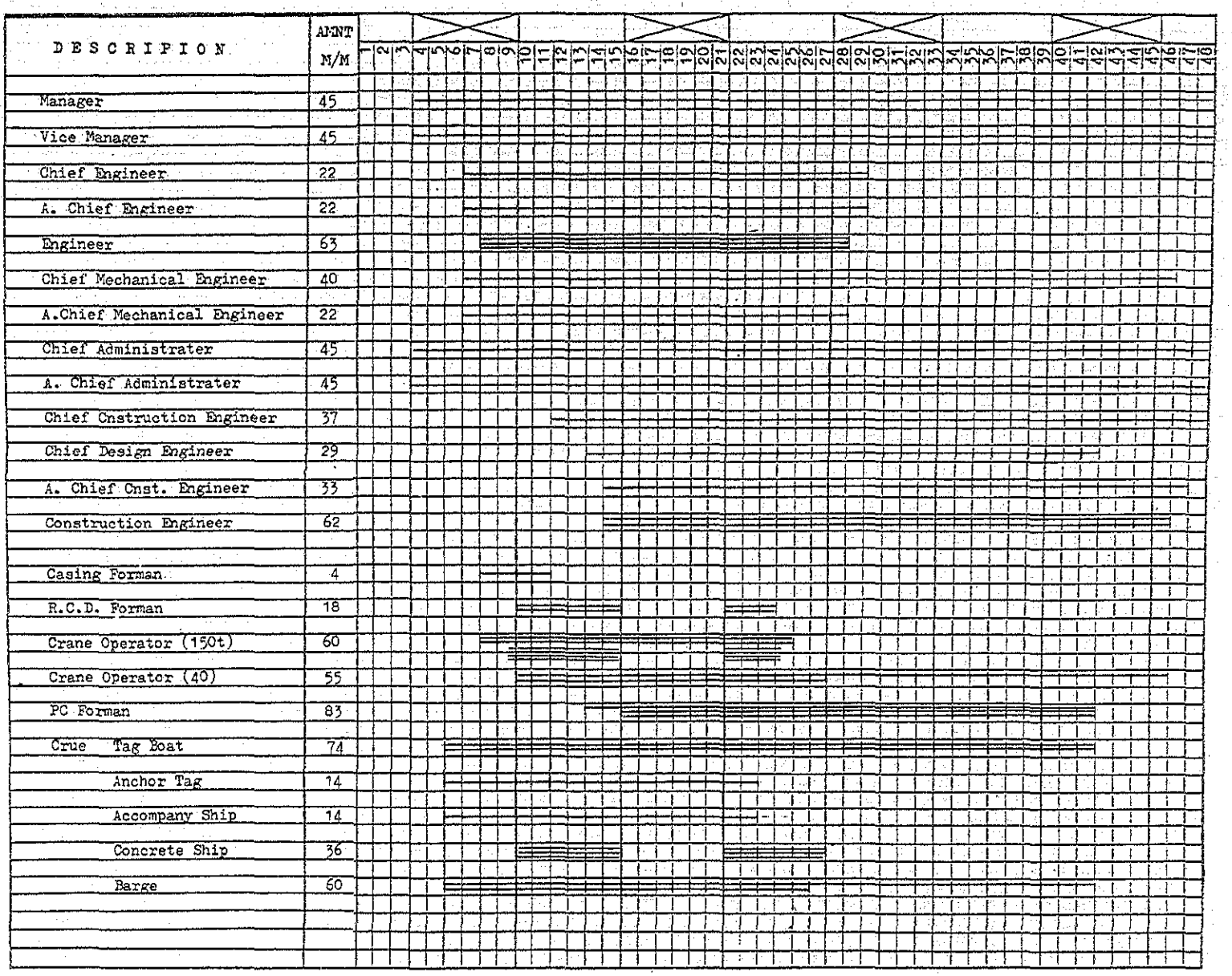
Appendix Table 8.4.4.5 COMPARISON OF COST A AND B ON BARGES

Unit: 1,000 kyats

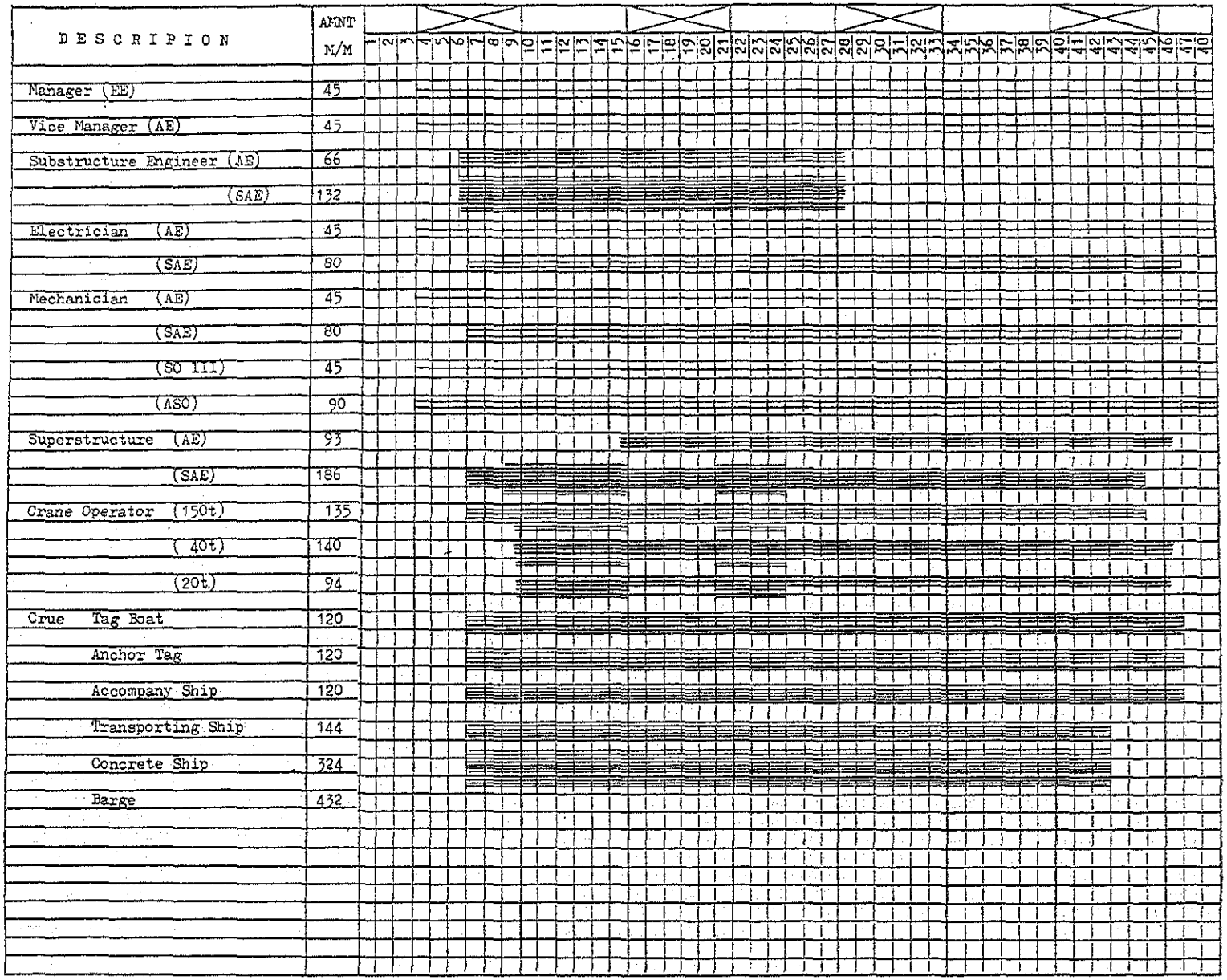
Item	Term (Months)	M.Cost Depreciation	Repairing Fee	Transportation Fee	Total
Barge (1000t)	-	2804	280	821	3905
	31	2835	-	1642	4477
Barge (500t)	-	1583	158	464	2205
	31	1602	-	928	2530
Anchor Barge (15t)240 HP	-	5875	578	1721	8174
	31	6110	-	3442	9552
Tug Boat 800 HP	-	6708	671	1965	9344
	31	5833	-	3930	9763
Sub Tug Boat 300 HP	-	3021	302	886	4209
	31	2714	-	1776	4490
Launch 160 HP	-	854	85	250	1189
	31	1072	-	500	1572
Launch for Concrete-30 m^3 80 HP	-	1333	133	392	1858
	31	1343	-	784	2127
Deck Barge for Mud water (100t)	-	1804	280	821	3905
	31	3373	-	1642	5015

Note: Upper : Cost A
Lower : Cost B

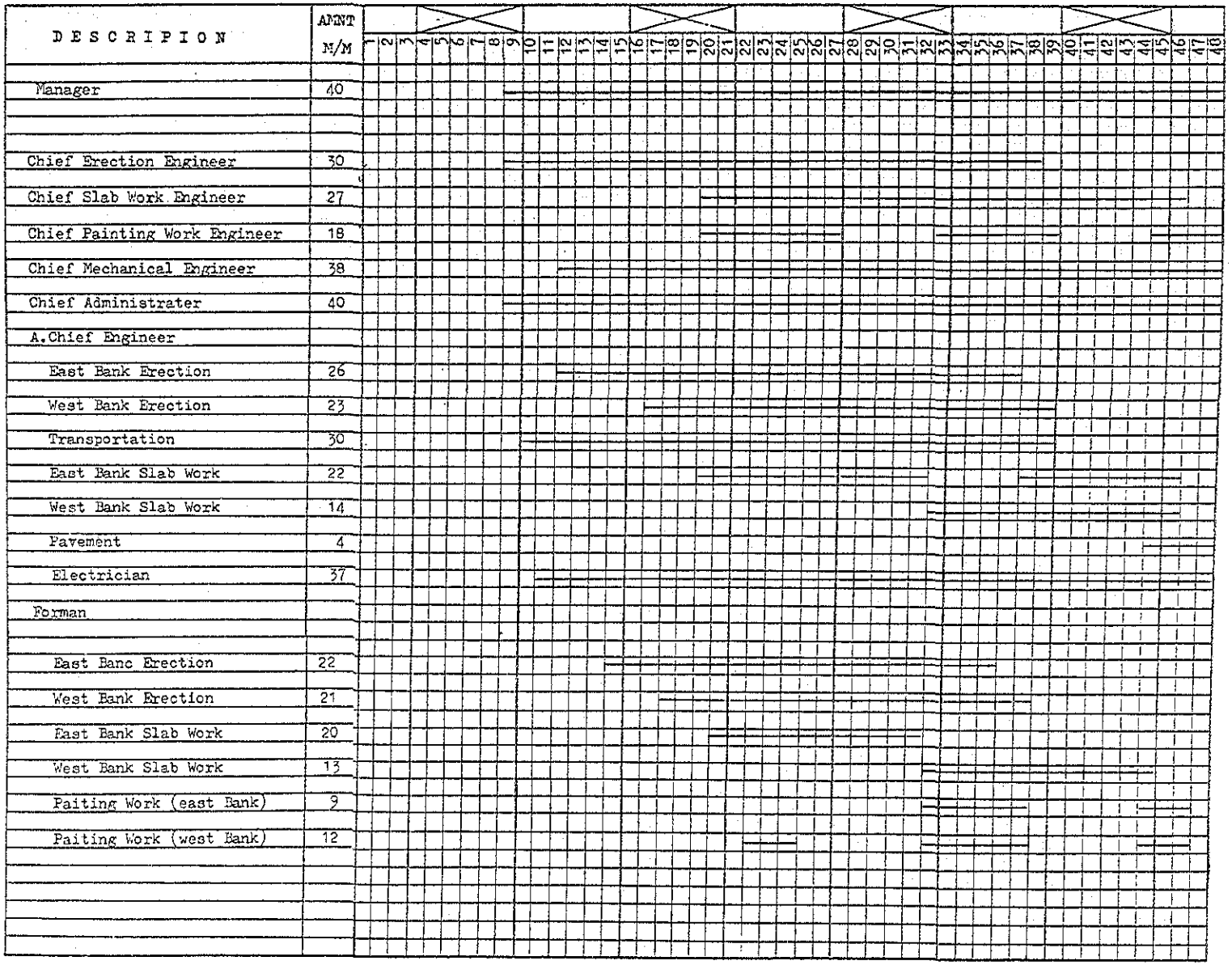
Appendix Fig. 8.4.5.1 MOBILIZATION OF STAFF FOR SUPERSTRUCTURE (PC BOX)



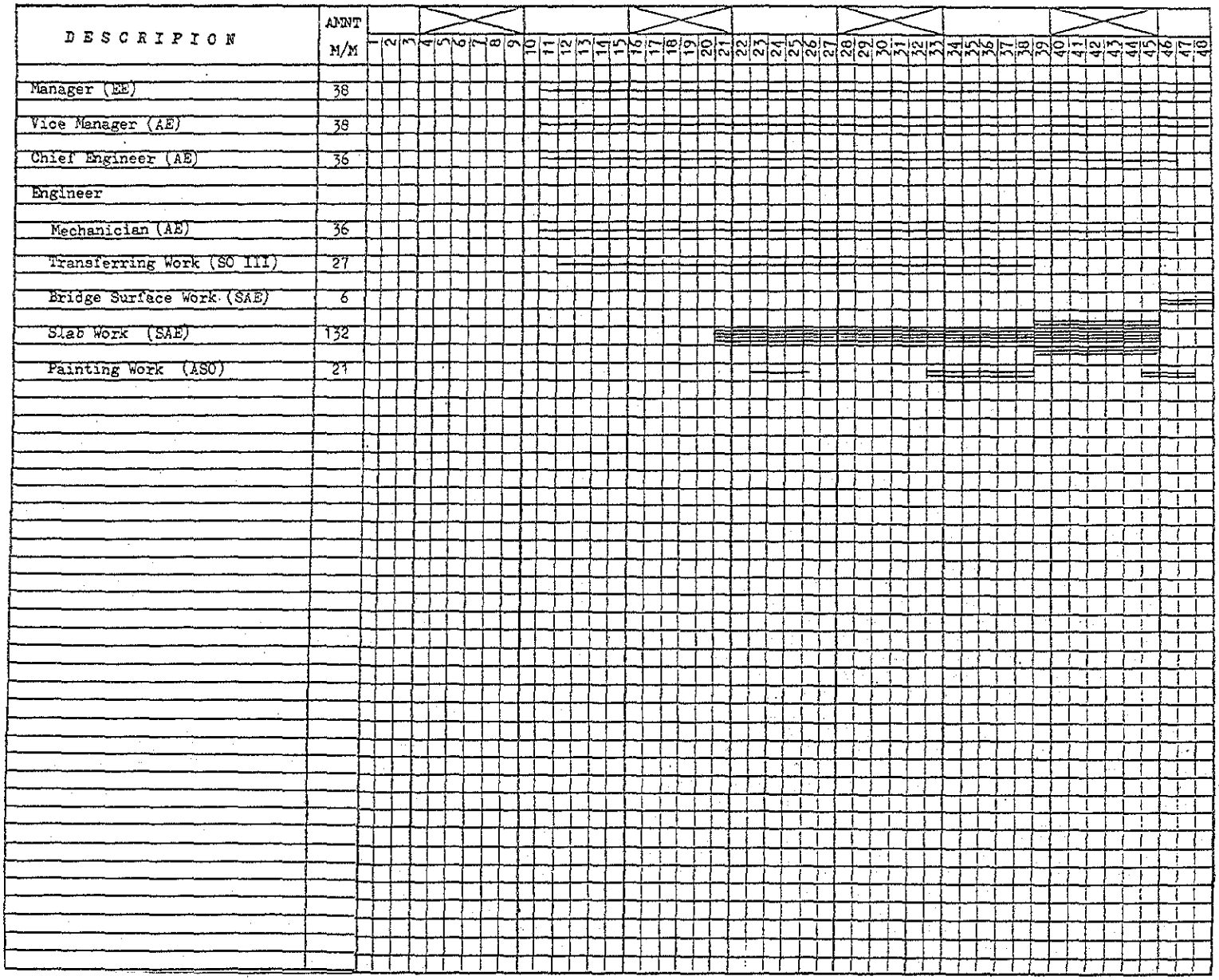
Appendix Fig. 8.4.5.2 MOBILIZATION OF LOCAL STAFF FOR SUPERSTRUCTURE (PC BOX)



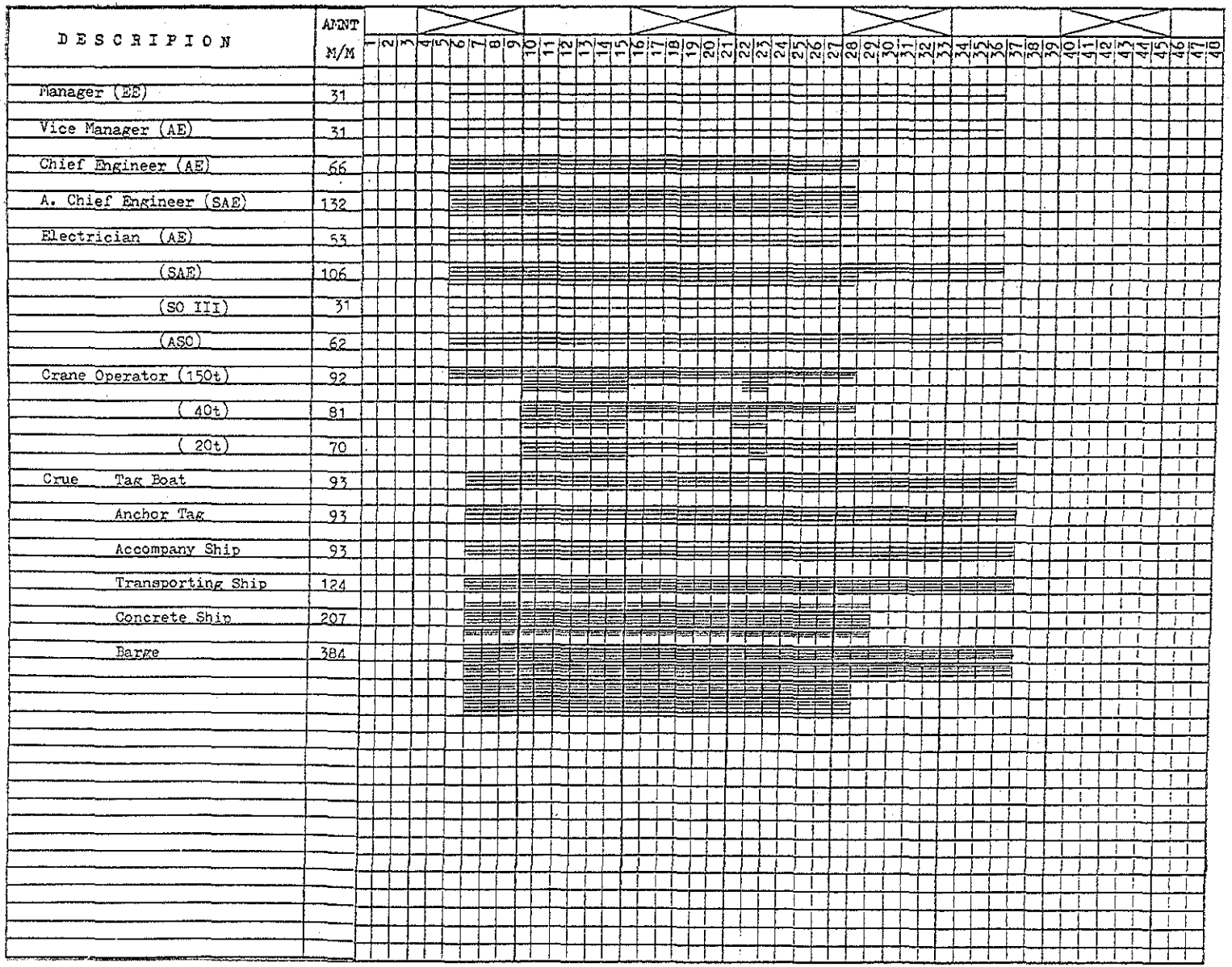
Appendix Fig. 8.4.5.3 MOBILIZATION OF STAFF FOR SUPERSTRUCTURE (TRUSS)



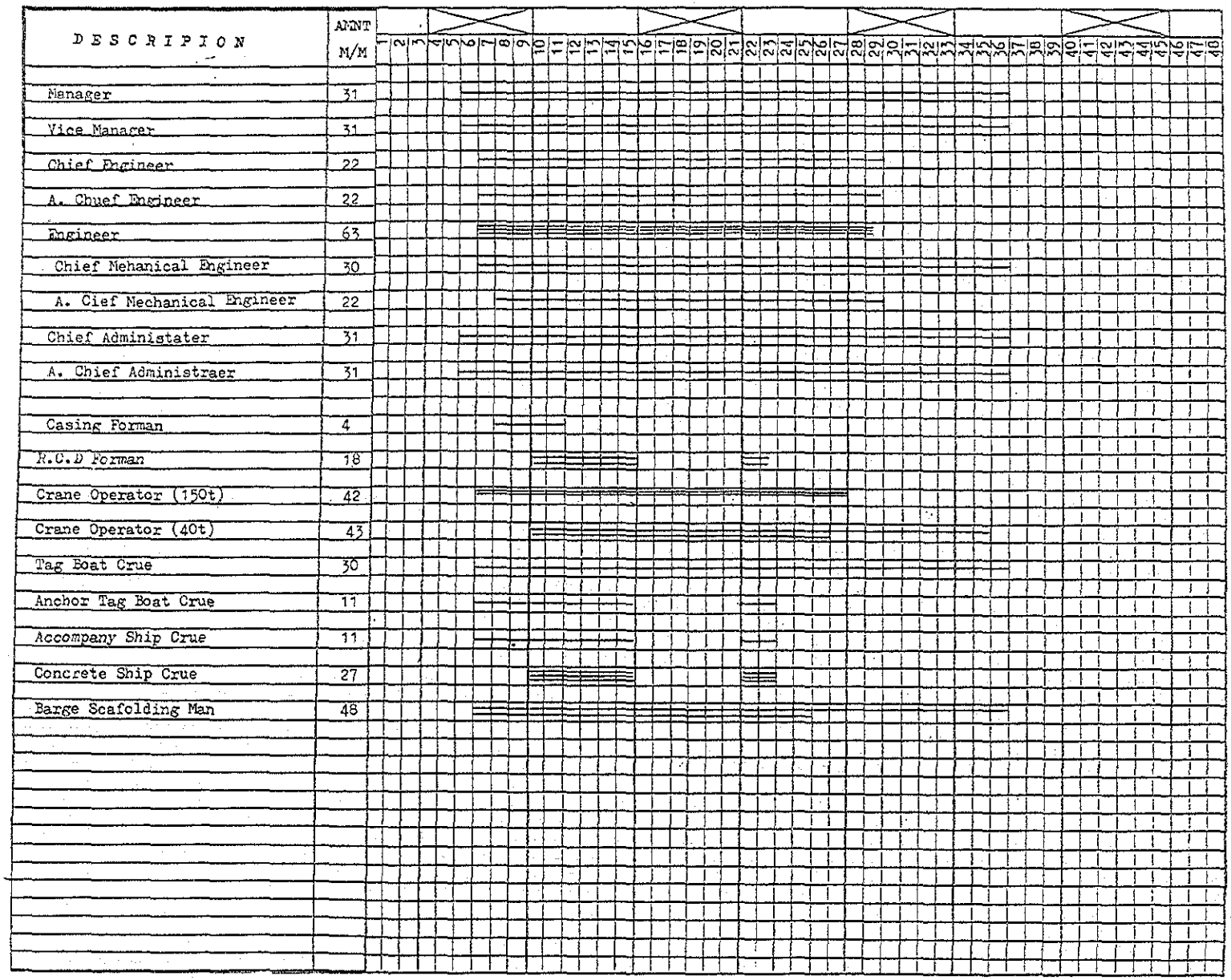
Appendix Fig. 8.4.5.4 MOBILIZATION OF LOCAL STAFF FOR SUPERSTRUCTURE (TRUSS)



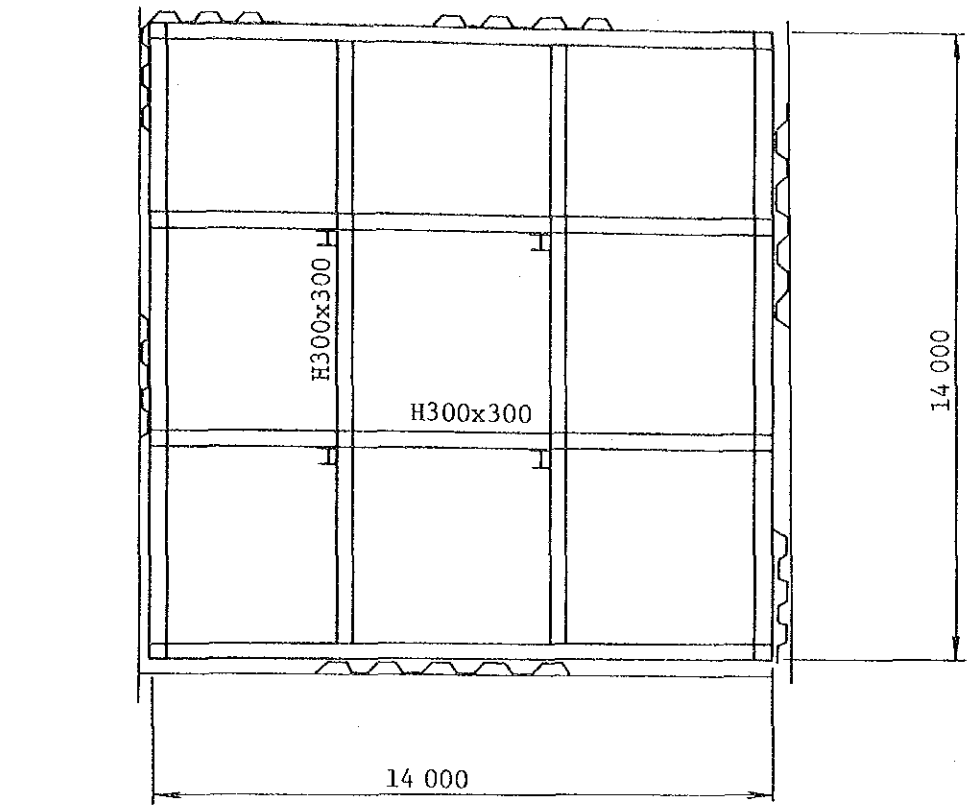
Appendix Fig. 8.4.5.5 MOBILIZATION OF LOCAL STAFF FOR SUBSTRUCTURE

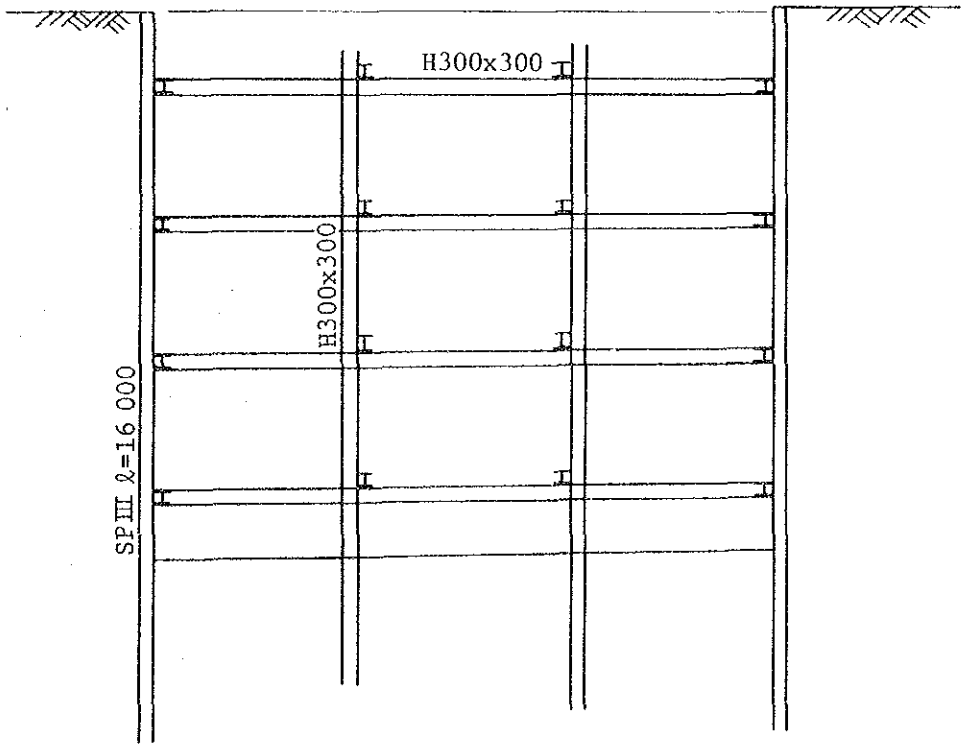


Appendix Fig. 8.4.5.6 MOBILIZATION OF STAFF FOR SUBSTRUCTURE

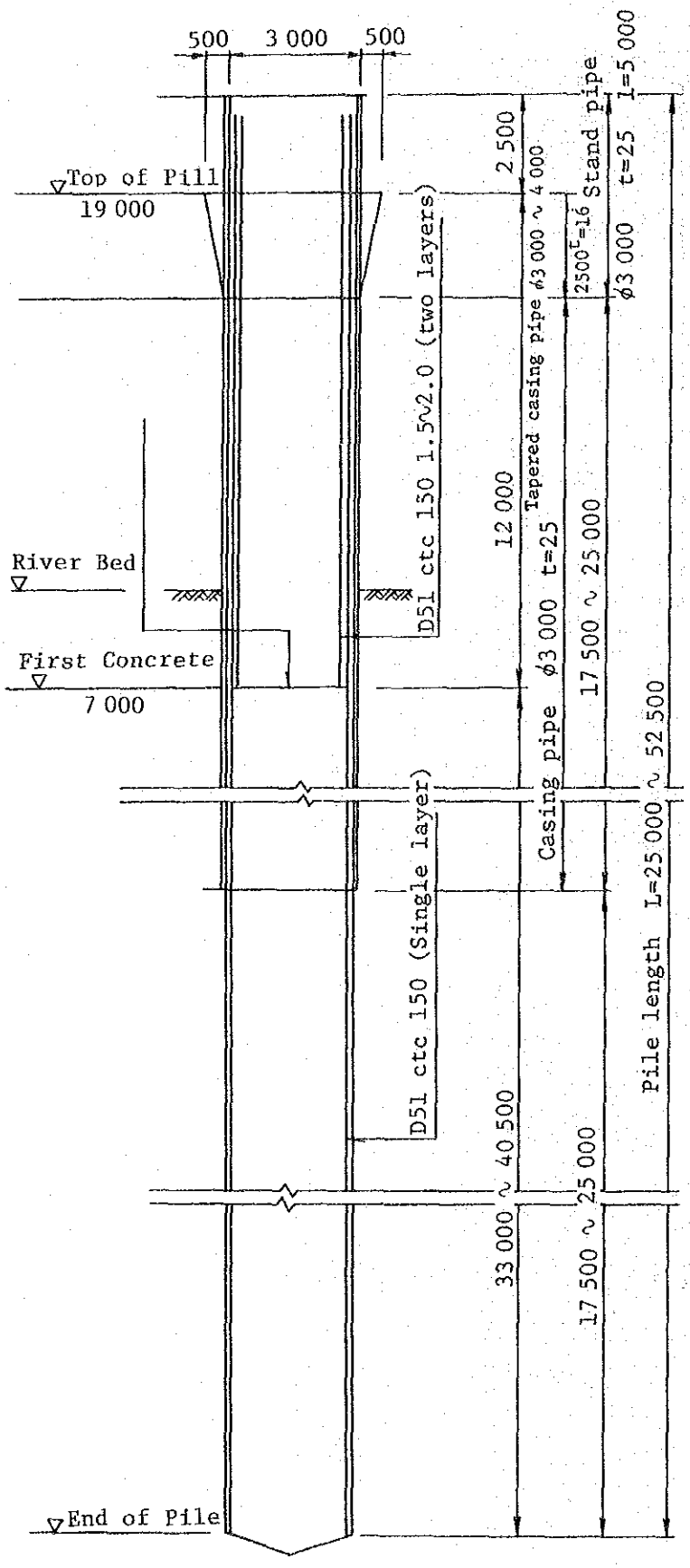


Appendix Fig. 8.4.6.3 COFFER DAM

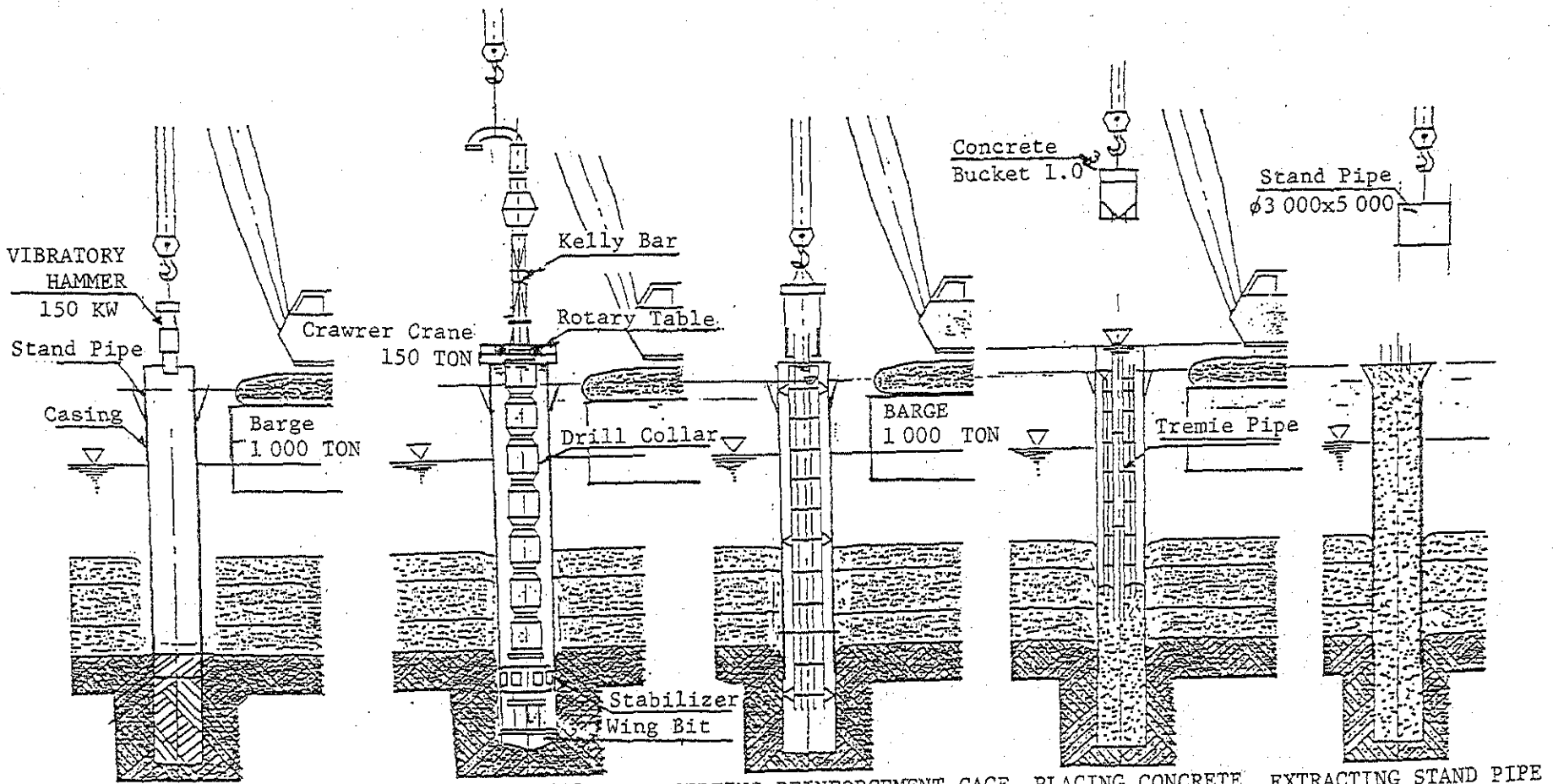




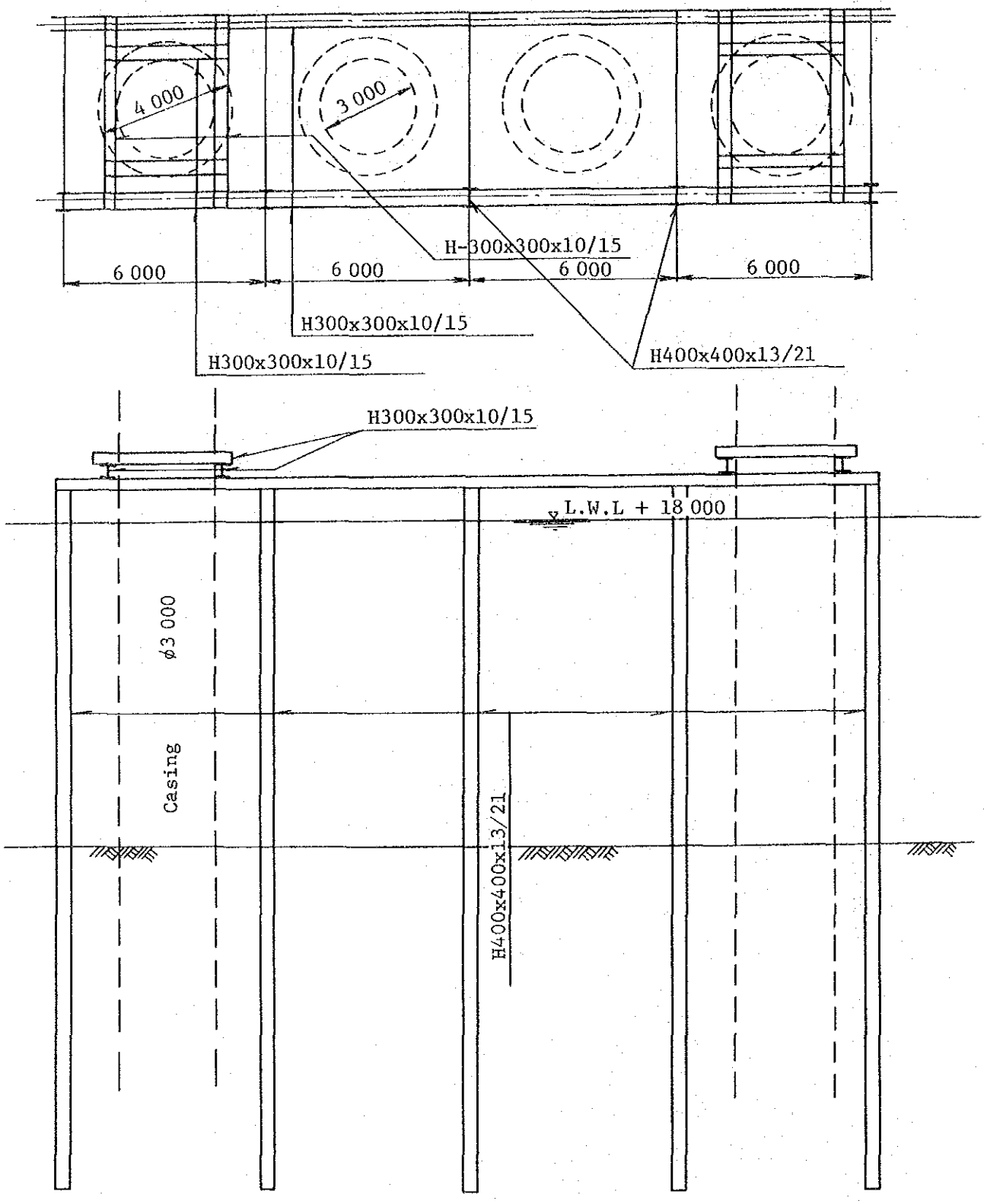
Appendix Fig. 8.4.6.4 R.C.D PILE



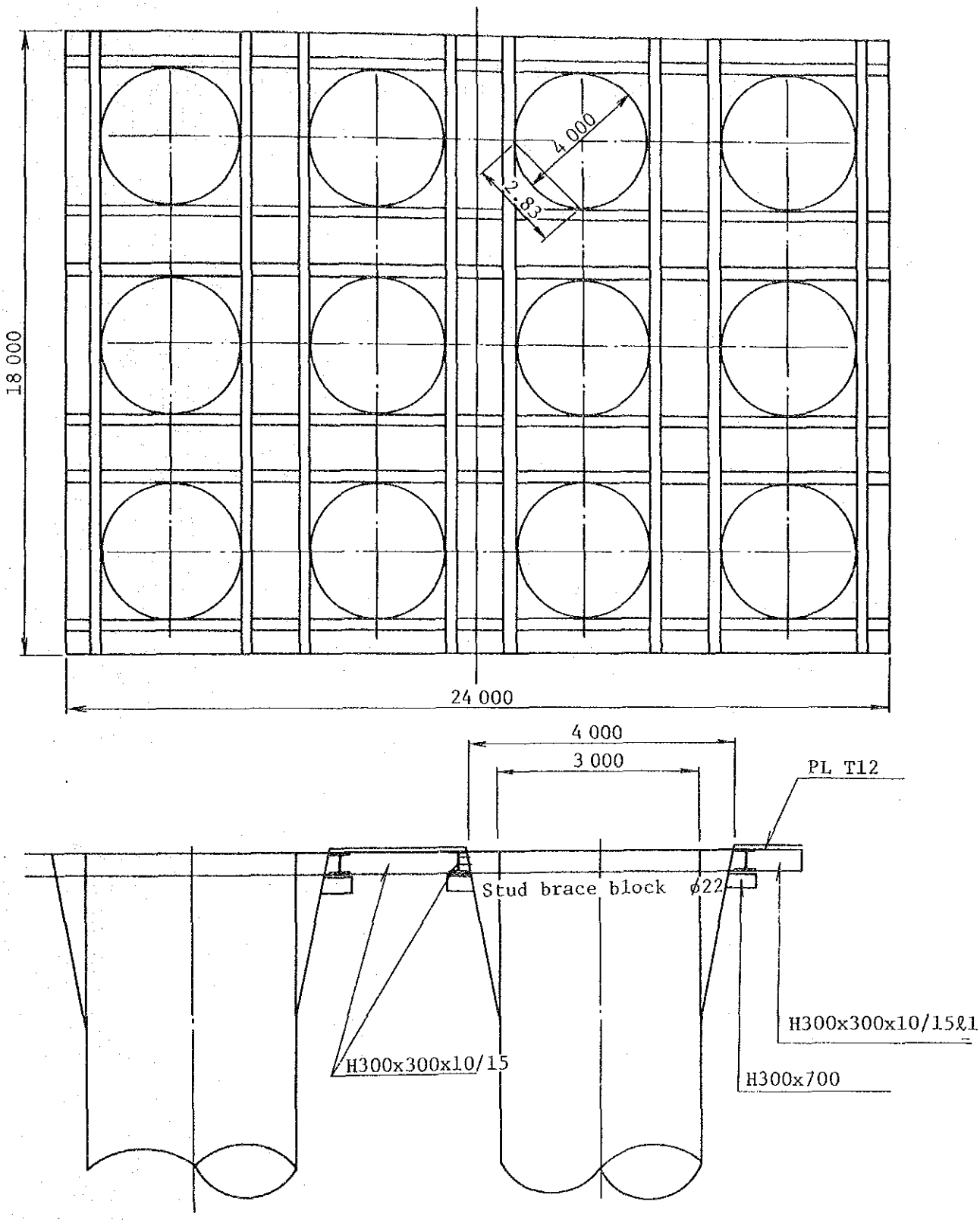
Appendix Fig. 8.4.6.5 PROCEDURE OF BORED CAST IN PLACE PILES



Appendix Fig. 8.4.6.6 CASING GUIDE

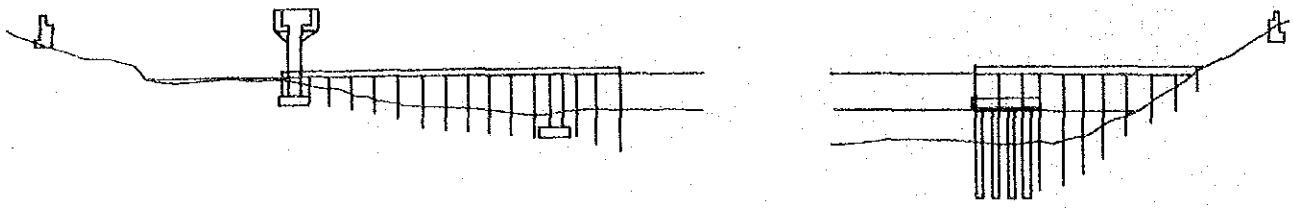


Appendix Fig. 8.4.6.7 SCAFFOLD OF PILE CAP

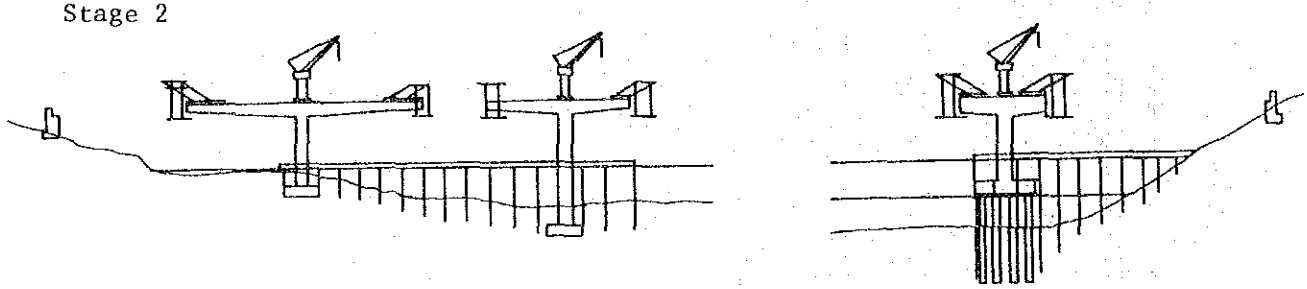


Appendix Fig. 8.4.7.1 ERECTION OF PC-BOX GIRDER

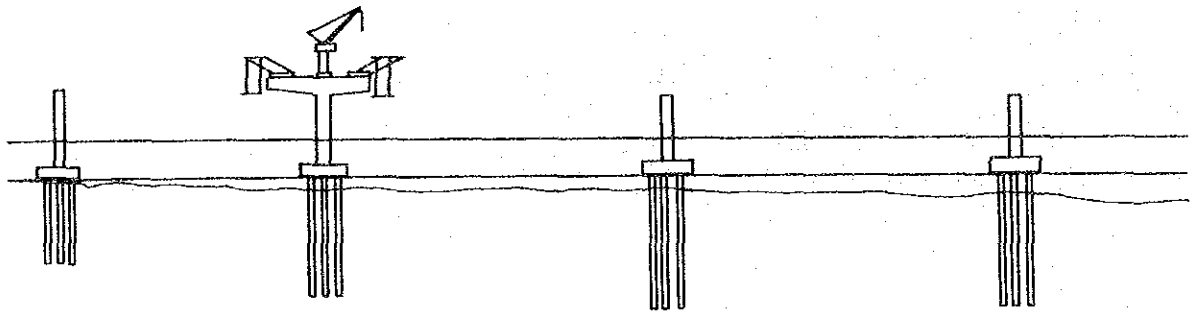
Stage 1



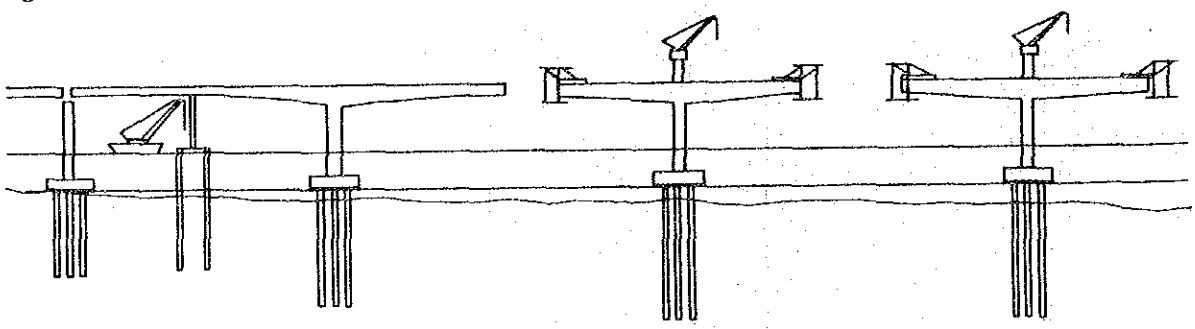
Stage 2



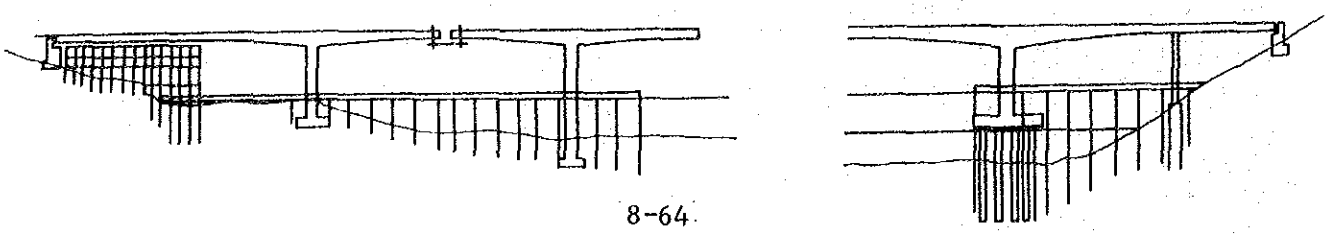
Stage 3



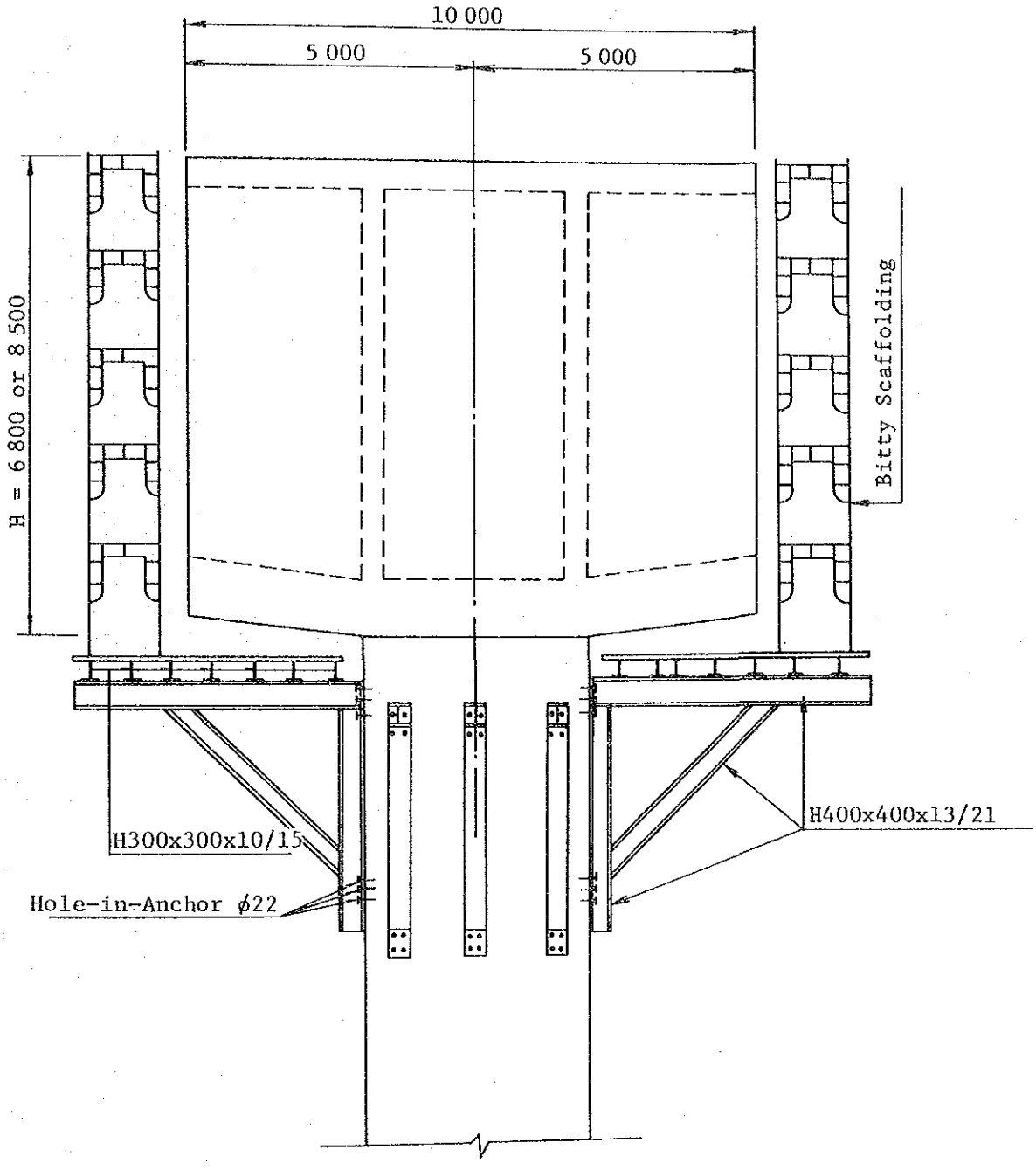
Stage 4



Stage 5

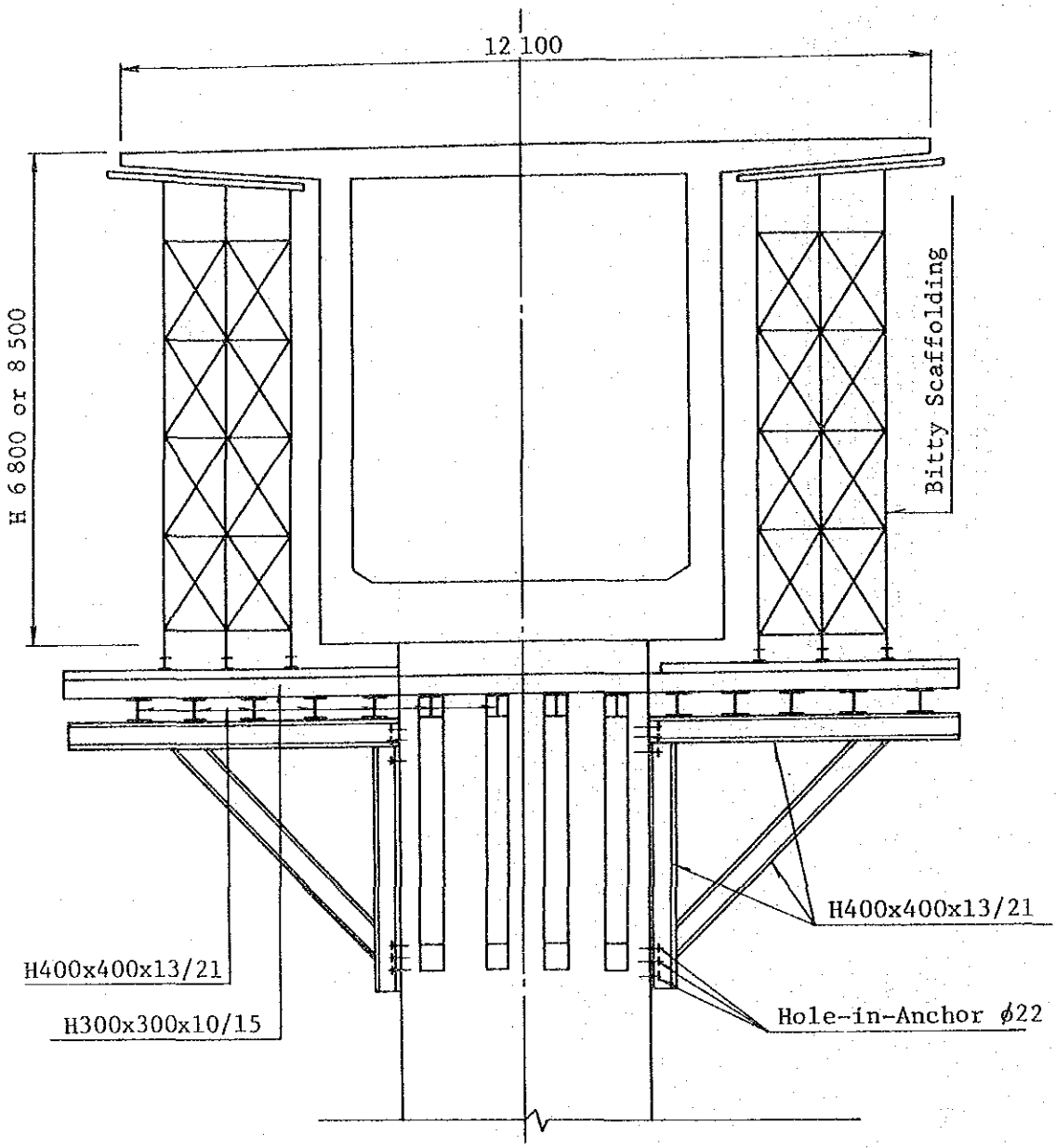


Appendix Fig. 8.4.7.2 SCAFFOLDING FOR PIER HEAD SIDE ELEVATION

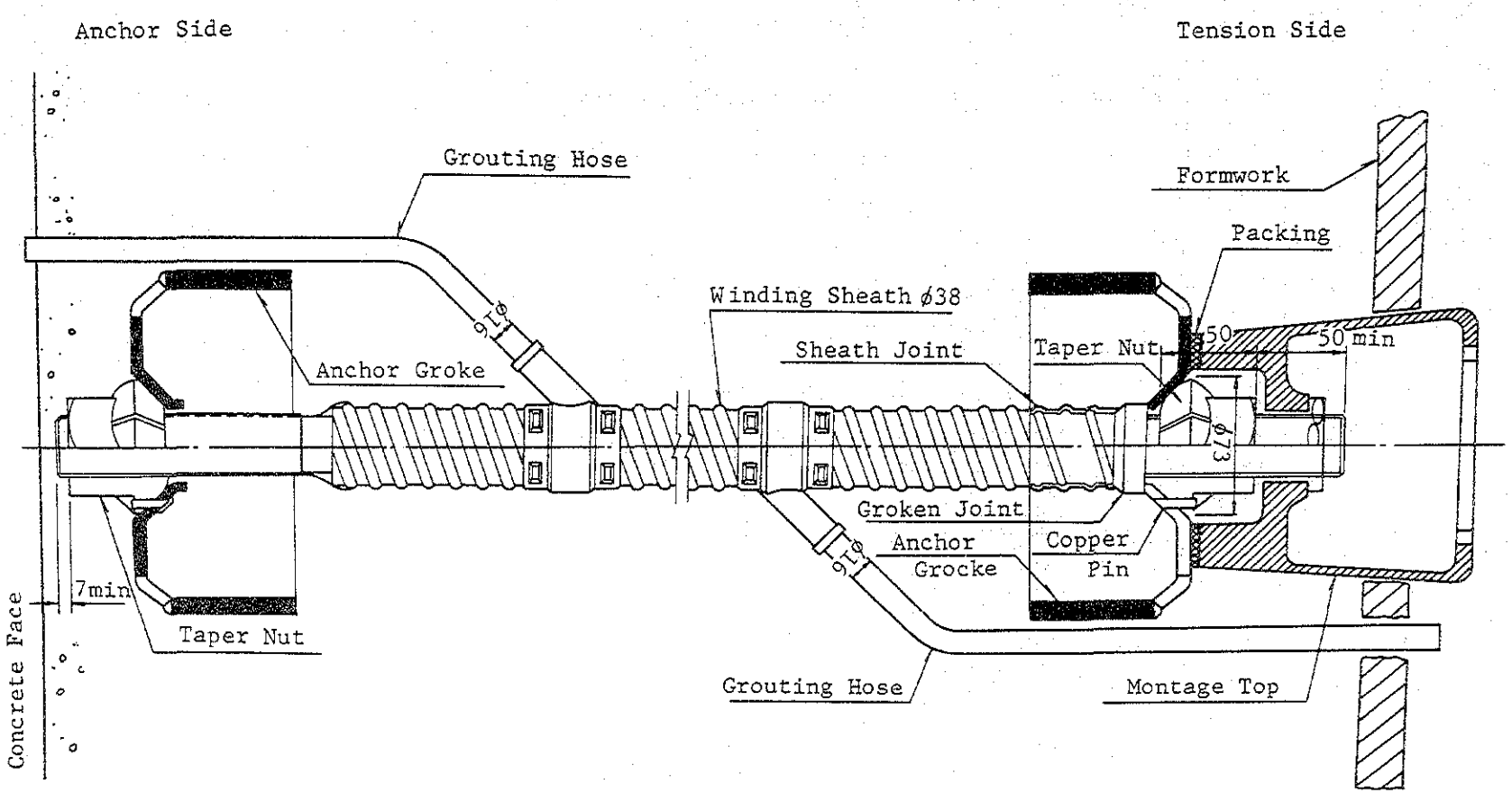


Lay built-up block of H-shape steel on the surface of pier by hole-in-anchor, and errect the scaffolding on the H-shape steel.

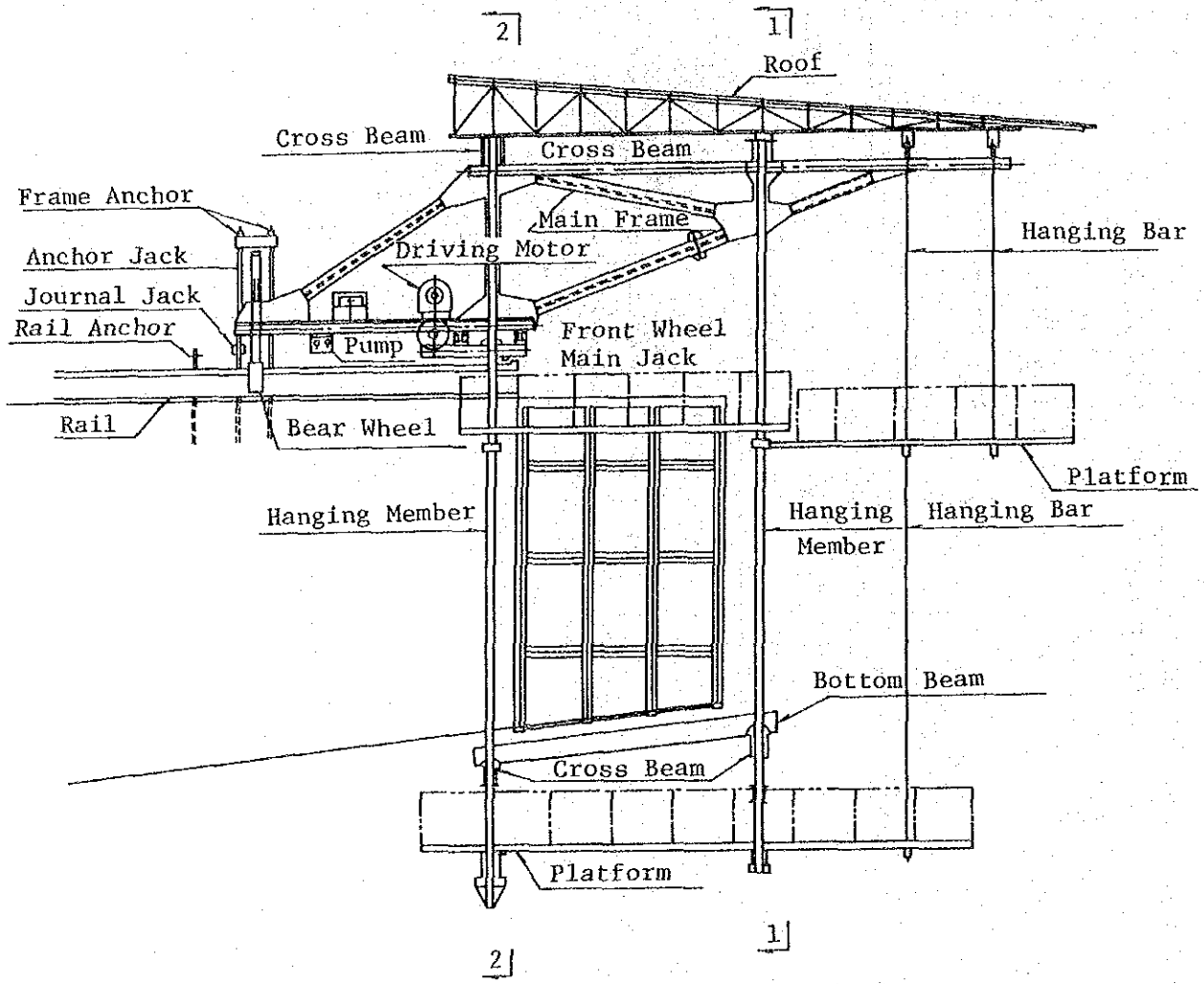
Appendix Fig. 8.4.7.3 FRONT ELEVATION



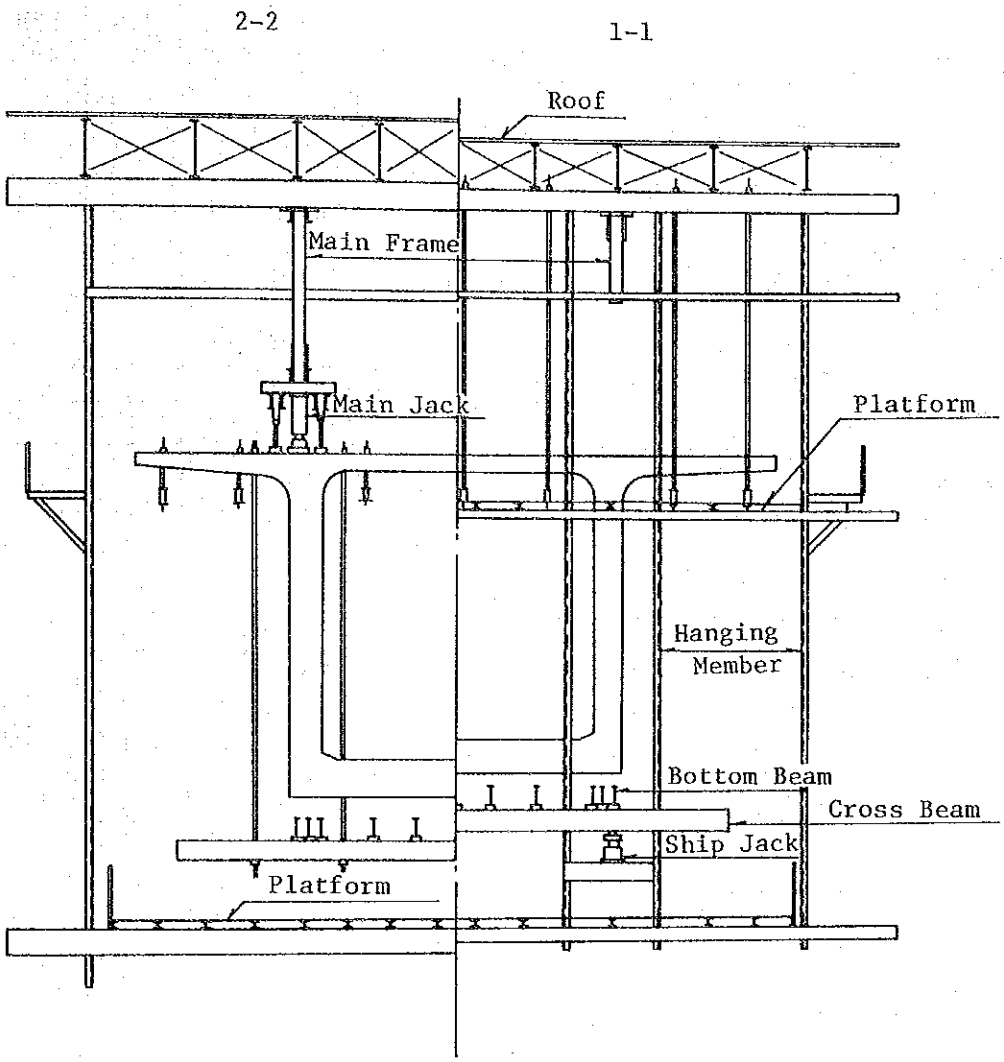
Appendix Fig. 8.4.7.4 ANCHORAGE ASSEMBLY
ø32mm SBPR 80/105, SBPR 95/120



Appendix Fig. 8.4.7.5 VORBAU WAGEN SIDE ELEVATION



Appendix Fig. 8.4.7.6 FRONT ELEVATION



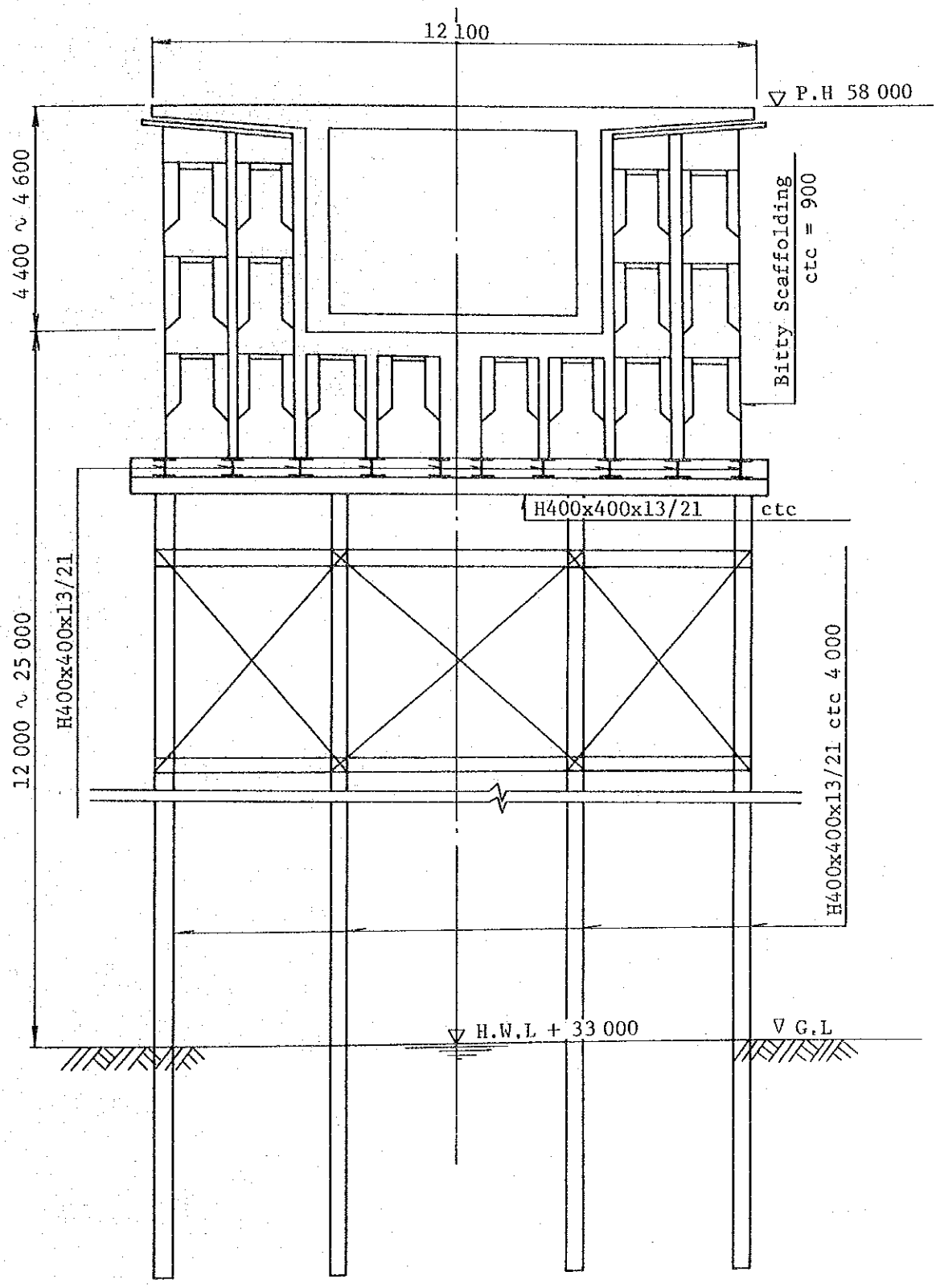
Appendix Table 8.4.7.1 TYPICAL CYCLE PROCEDURE OF FREI VORBAU

DISCRIPTION \ DAY	1ST DAY	2ND DAY	3RD DAY	4TH DAY	5TH DAY	6TH DAY	7TH DAY	8TH DAY	9TH DAY
FORWARDING WAGEN									
FORM WORK									
FABCATEING REIN FORCEMENTS PC BAR									
CONCRETE PLACEING									
CONCRETE CUREING									
PRESTRESSING									

* One Cycle = 9 DAY ÷ 0.75 = 12 Day/Cycle

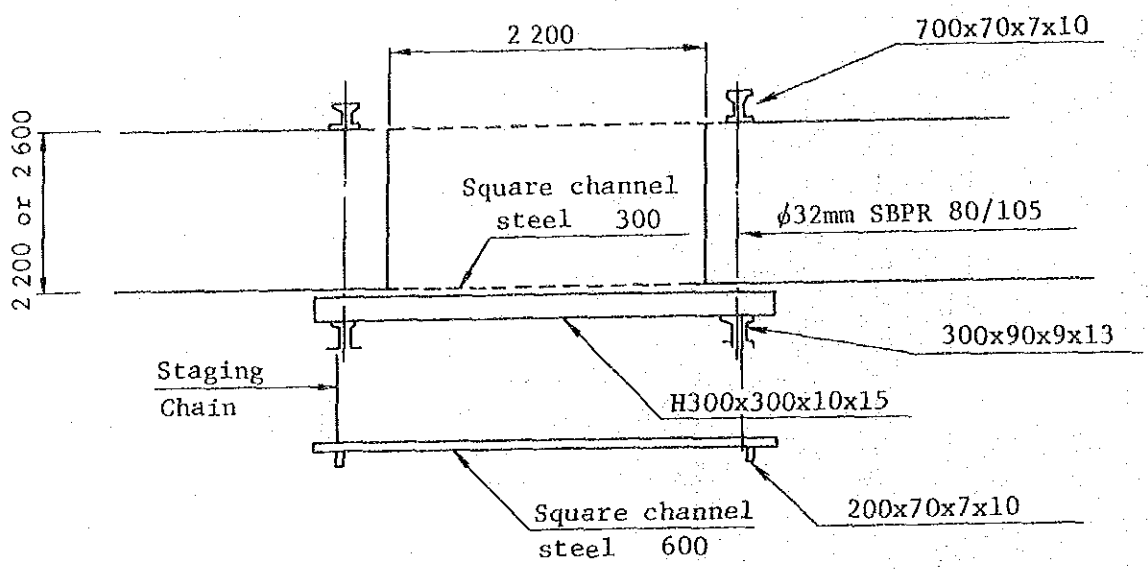
$0.75 = \frac{22.5}{30}$ DAY ----- Rate of operation in consideration of weather and day off.

Appendix Fig. 8.4.7.7 SCAFFOLDING FOR SIDE SPAN FRONT ELEVATION

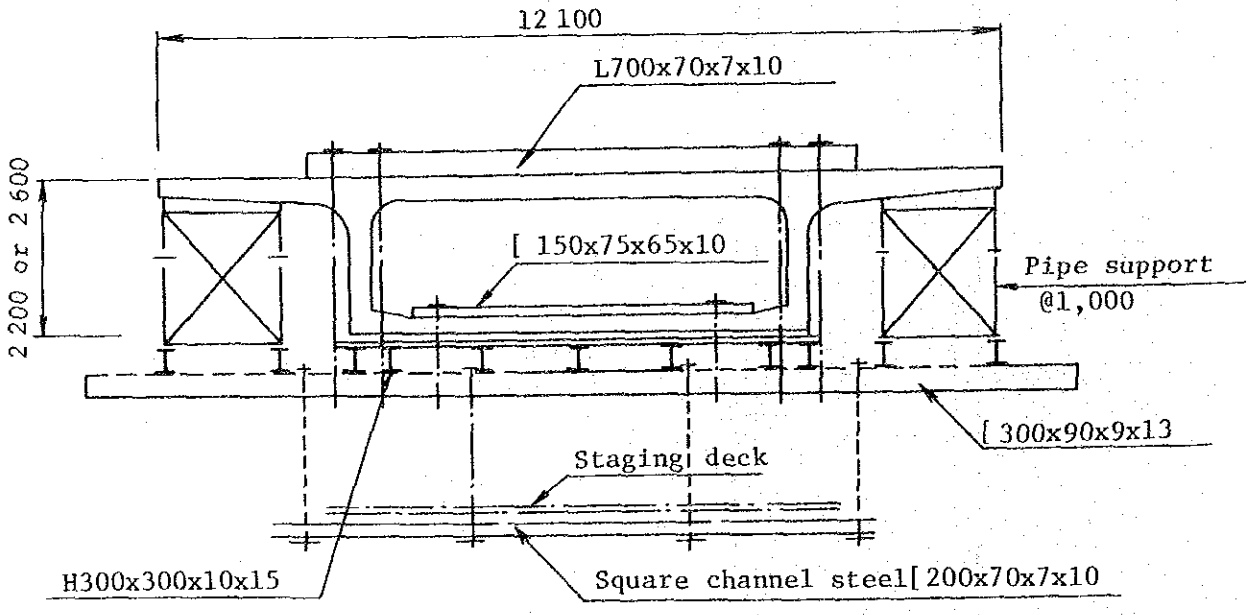


Appendix Fig. 8.4.7.8 SUSPENDED SCAFFOLDING FOR THE CENTRAL JOINT

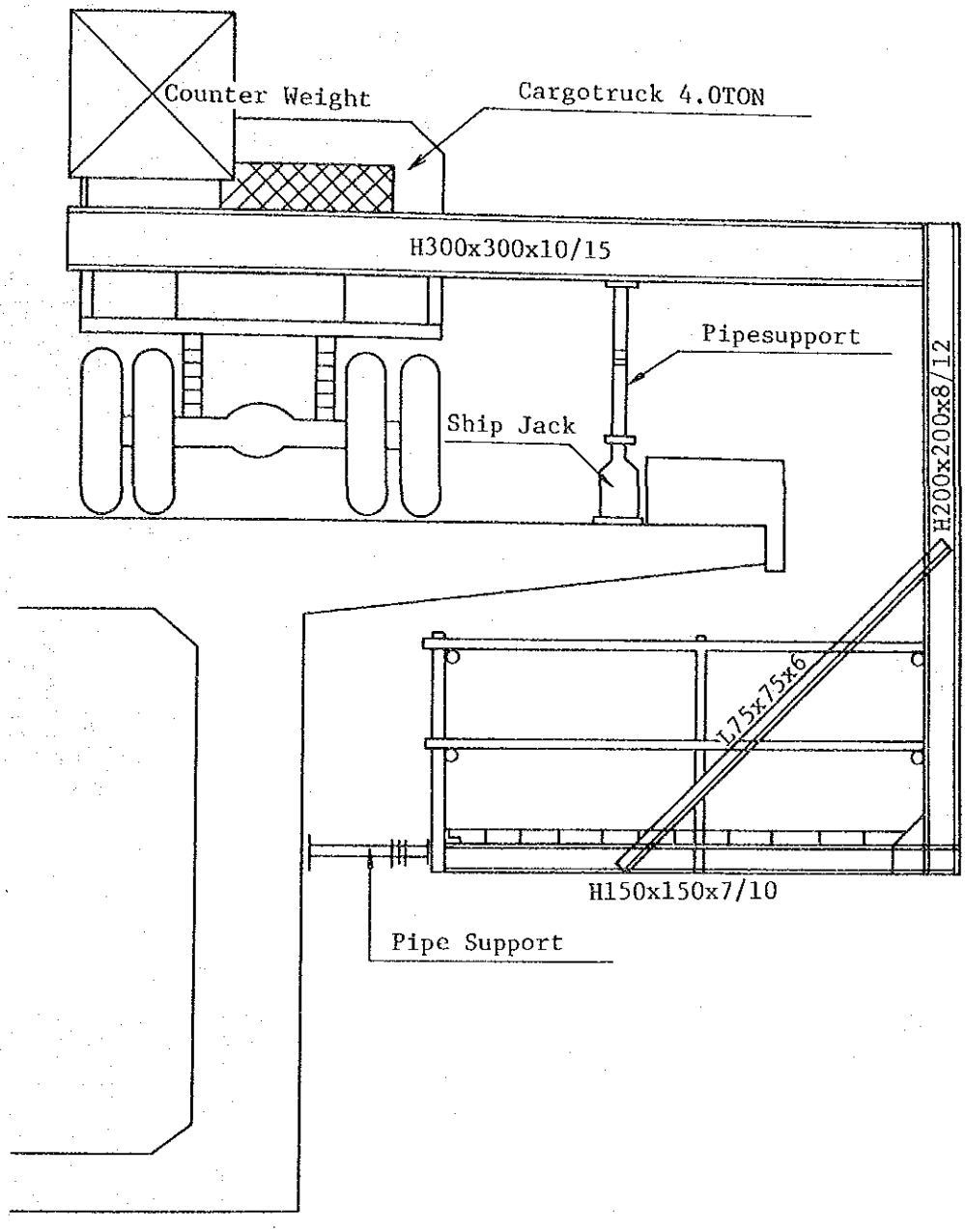
Side Elevation



Front Elevation

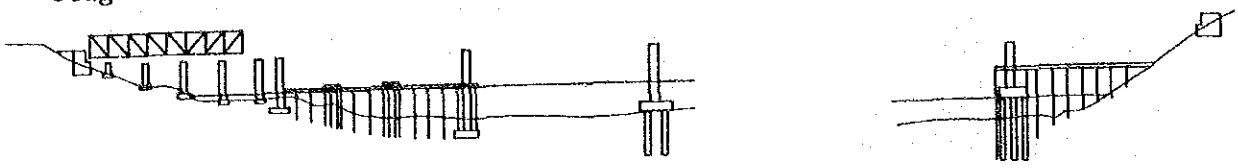


Appendix Fig. 8.4.7.9 WAGEN FOR TRAFFIC BARRIER

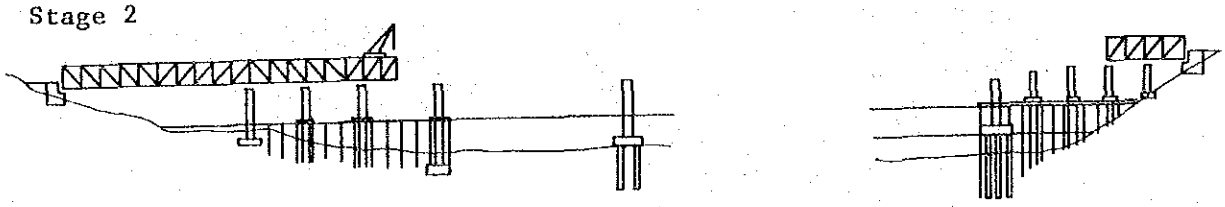


Appendix Fig. 8.4.9.1 ELECTION OF STEEL TRUSS

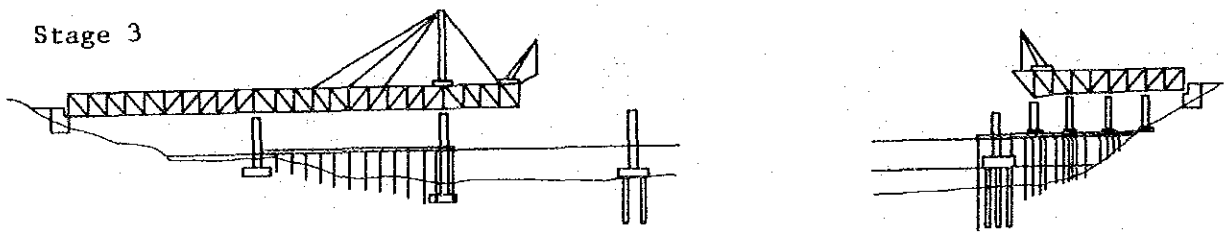
Stage 1



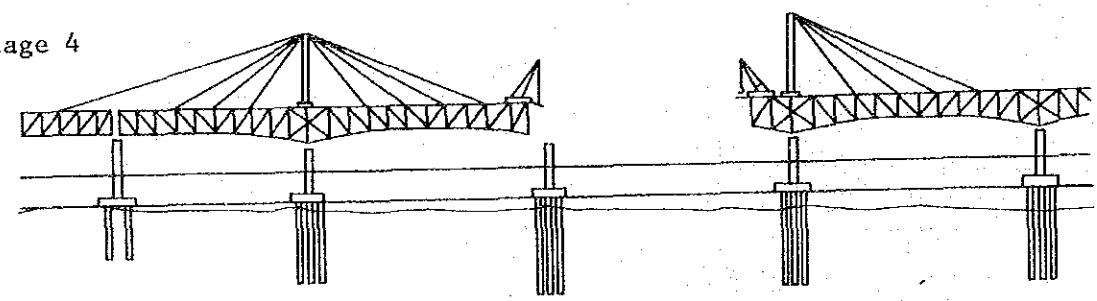
Stage 2



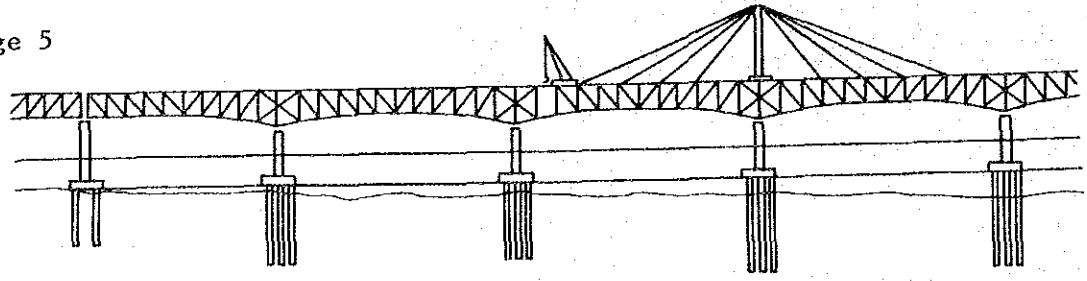
Stage 3



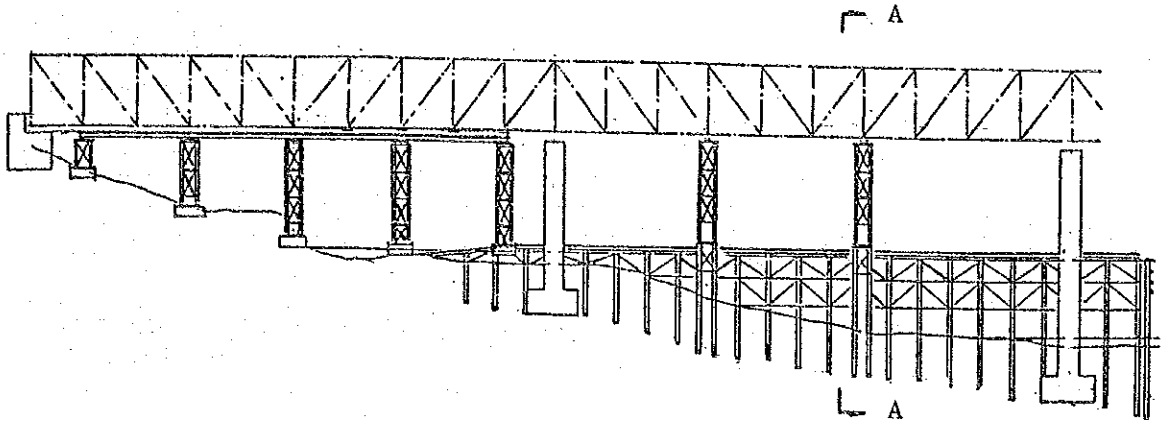
Stage 4



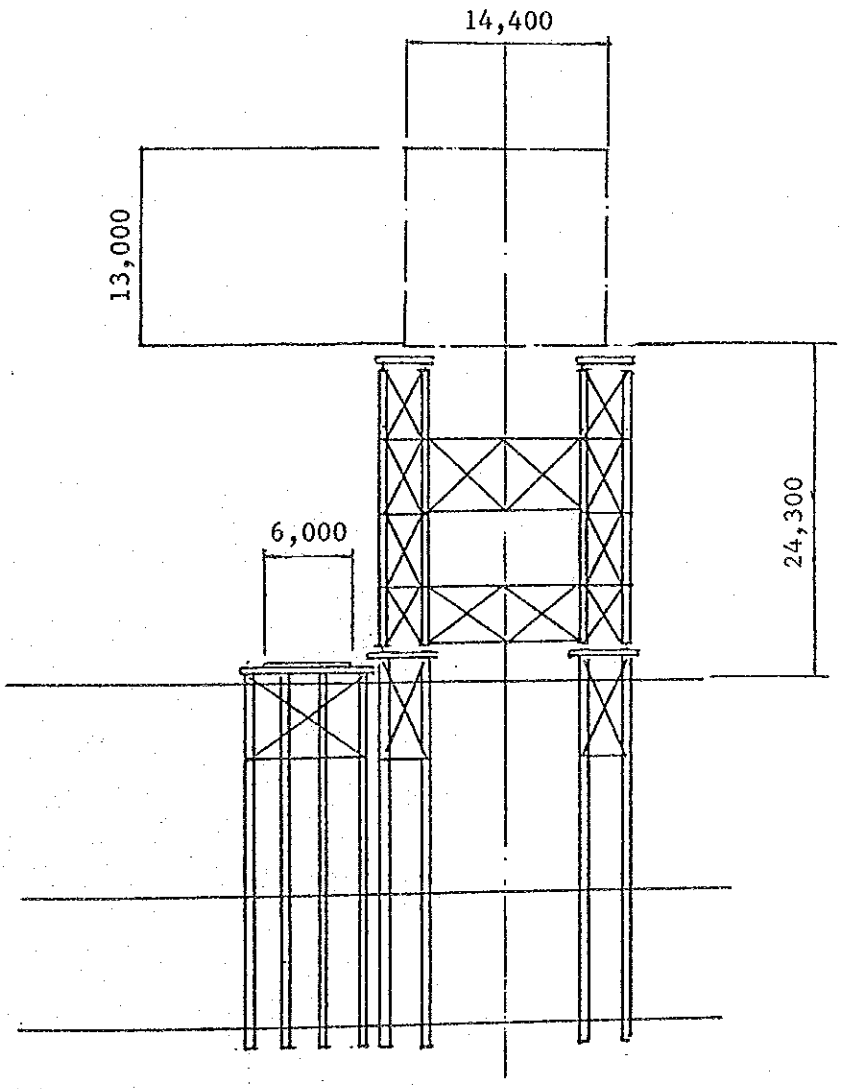
Stage 5



Appendix Fig. 8.4.9.2 BENT ERECTION

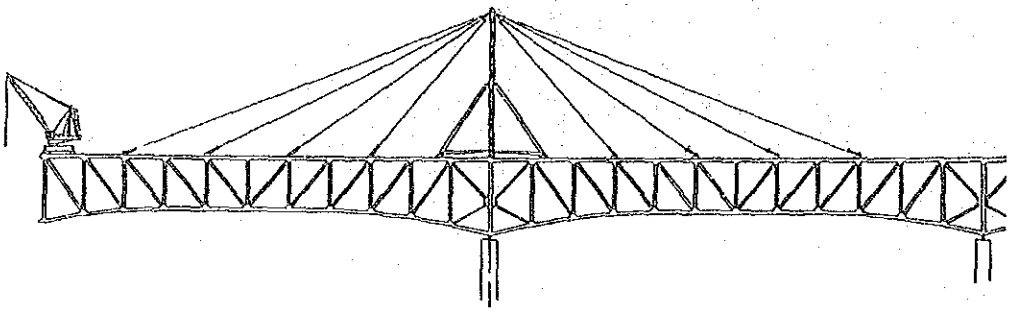


A - A

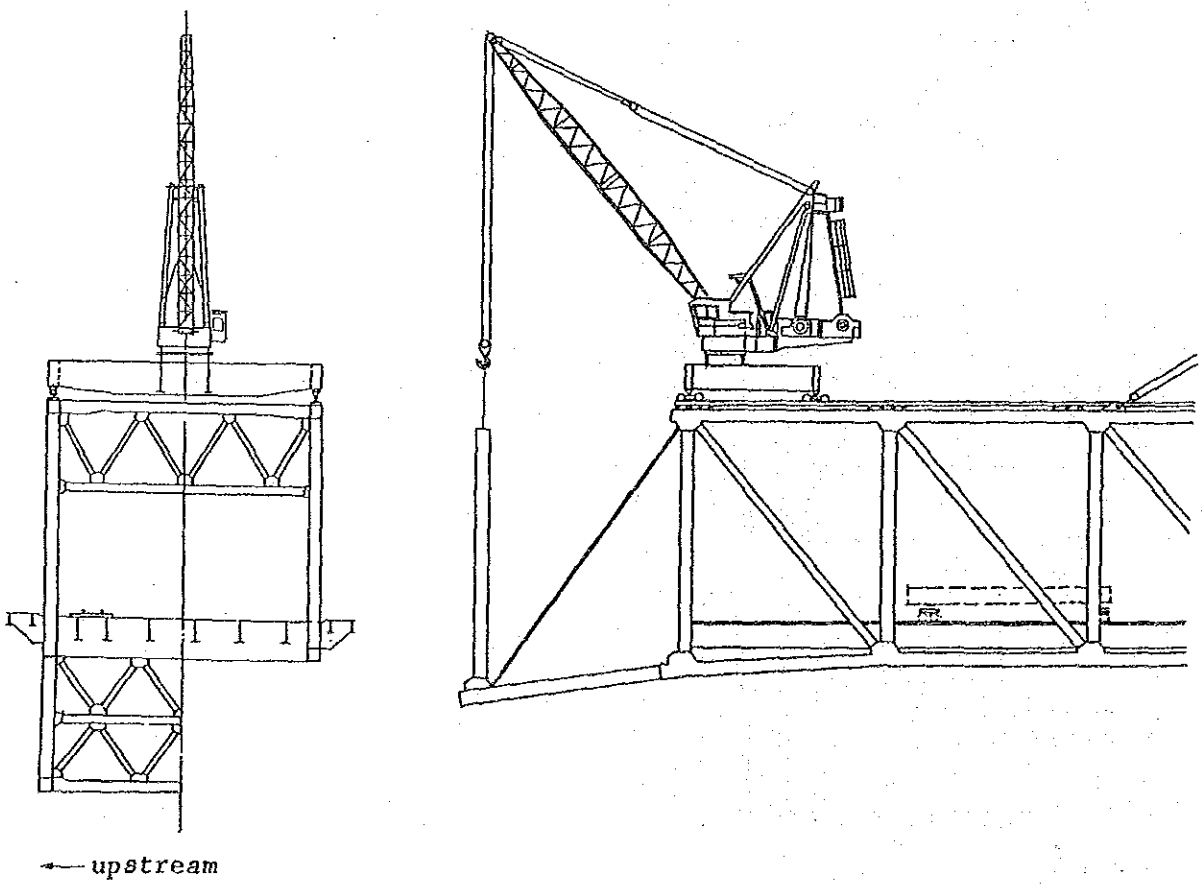


Appendix Fig. 8.4.9.3 CANTILEVER ERECTION

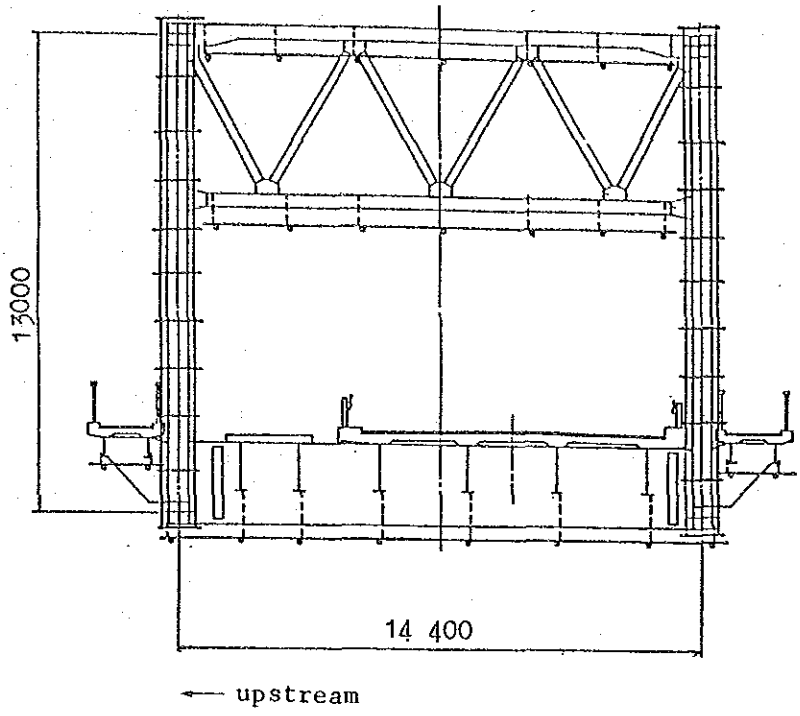
1) Temporary Tower



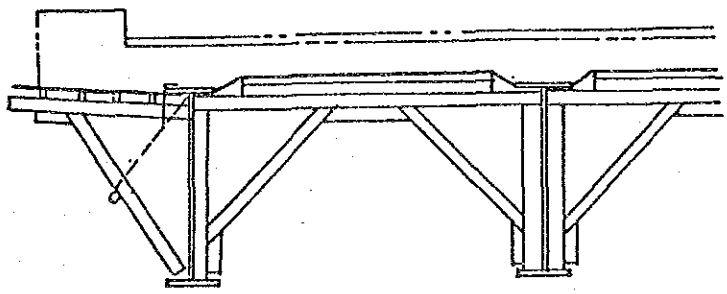
2) Erection Crane



Appendix Fig. 8.4.9.4 WORKING PLATFORM FOR ASSEMBLING GRUSS MEMBERS, SLAB WORK AND PAINTING



Appendix Fig. 8.4.9.5 FORM AND SCAFFOLD FOR SLAB WORK



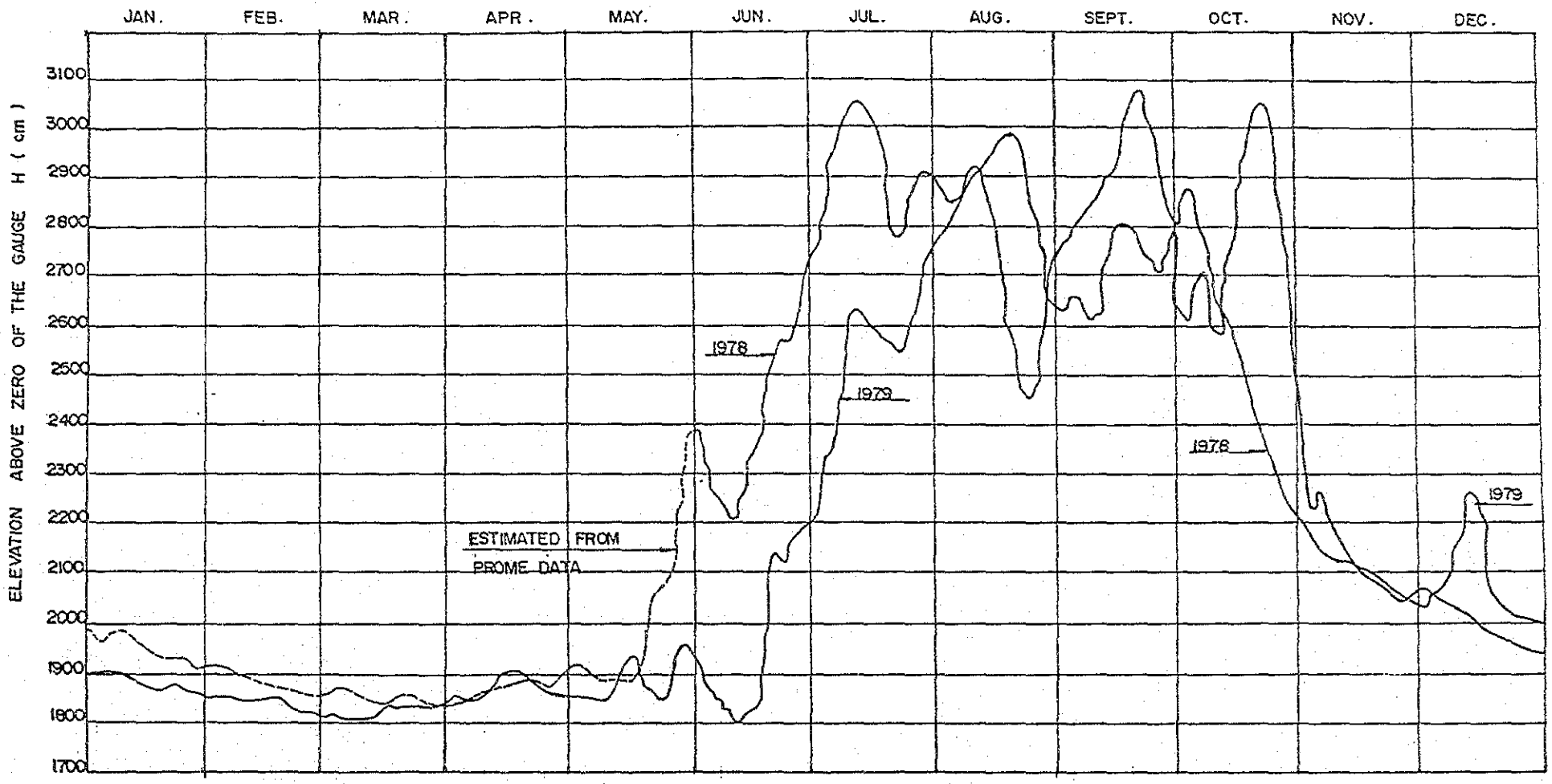
APPENDIX

CHAPTER 9 COST ESTIMATE

Appendix Table 9.2.1 DEPARTMENT OF METEOROLOGY AND HYDROLOGY

YEAR	JAN.	FEB.	MAR.	APR.	MAY.	JUN.	JUL.	AUG.	SEPT.	OCT.	NOV.	DEC.
				10 Years monthly mean rainfall (Inches)								
	0.04	0.10	0.00	0.26	5.28	9.26	10.02	8.86	8.29	6.63	0.57	0.27
				10 Years mean of raining day for each month (Days)								
	0.2	0.1	NIL	0.9	7	14.8	17	17	13.2	9	1.2	0.7
				Heavies 24 hour recorded rainfall in 16 Years (Inches)								
	0.87	0.97	0.28	0.55	5.16	4.96	4.43	3.86	3.72	2.05	2.72	0.83
				Wind Direction / Percentage (1971-1974)								
Direction	N/NE	N/NE	S/SW	SW/W	S/SW	S/SW	S/SW	S/SW	S/SW	N/NW	N/NW	N/NW
Per-tge%	39/16	23/17	13/34	56/16	29/44	46/27	54/30	47/32	38/25	14/15	32/16	54/9
				Mean Wind Speed (Miles per hour) (1968 - 1977)								
	2.3	2.4	2.8	3.5	3.6	3.0	2.9	2.6	2.1	1.9	2.7	2.9
				(1961 to 1976) 16 Years mean of Maximum Temperature (°F)								
	87.2	94.2	100.7	102.9	97.9	89.1	87.0	87.5	88.8	89.6	87.7	85.6
				Highest Maximum Temperature (°F)								
	98	102.9	107.6	111.2	109.4	102.2	95	95	96.3	97.9	98.2	95
				Mean Minimum Temperature (°F)								
	60.7	62.4	69.7	75.2	77.6	75.9	75.7	75.5	75.4	74.3	70.0	59.3
				Lowest Minimum Temperature (°F)								
	52.7	49.3	57.6	66.2	69.8	71	72.5	71.6	70.5	66	58.6	54.0
				Relative Humidity % at 09.30 hrs. B.S.T. (Percentage)								
	71%	62%	58%	59%	70%	84%	87%	87%	86%	85%	80%	76%
				Relative Humidity % at 18.30 hrs. B.S.T. (Percentage)								
	51%	36%	35%	42%	64%	83%	79%	86%	85%	81%	74%	63%

Appendix Fig. 9.2.1 HYDRO GRAPHS OF KYAWZWA FOR THE YEAR 1978 & 1979



Appendix Table 9.2.2 CUSTOMS DUTY

Construction Machinery	15%
Sorts of Metals and Manufactures	75%
Iron bars	15%
Railway materials	10%
Ships and other vessils	20%
Paints and paintirs material	75%
Omnibuss, vans and trucks	30%
Saloon and station-wagons	
upto Kyats 6,000 CIF	75%
Kyats 6,001 to 8,000 CIF	125%
Kyats 8,001 to 10,000 CIF	200%
Above Kyats 10,000 CIF	300%
Spare Parts	50%

Notes 1) Percentages are on ad-valorem

2) Sales tax 15% on the value of a/v and c/d

Appendix Table 9.2.3 INCOME TAX PER YEAR (KYATS)

INCOME			TAX	
8001	-	10000	= 240	Kyats
10001	-	12000	= 360	"
12001	-	14000	= 540	"
14001	-	16000	= 756	"
16001	-	18000	= 1044	"
18001	-	20000	= 1356	"
20001	-	22000	= 1680	"
22001	-	24001	= 2100	"
24001	-	26000	= 2580	"
26001	-	28000	= 3060	"
28001	-	30000	= 3624	"
30001	-	32000	= 4008	"
32001	-	34000	= 5136	"
34001	-	36000	= 5940	"
36001	-	38000	= 6744	"
38001	-	40000	= 7596	"
40001	-	42000	= 8604	"
42001	-	44000	= 9696	"
44001	-	46000	=10896	"
46001	-	48000	=12096	"
48001	-	50000	=13296	"
50001	-	55000	=15396	"
55001	-	60000	=17727	"
60001	-	65000	=20206	"
65001	-	70000	=22835	"
70001	-	75000	=25614	"
75001	-	80000	=28543	"
80001	-	85000	=31622	"
85001	-	90000	=34851	"
90001	-	95000	=38230	"
95001	-	100000	=41759	"
100001	-	110000	=45444	"
110001	-	120000	=50289	"
120001	-	130000	=55225	"
130001	-	140000	=60250	"
140001	-	150000	=65366	"
150001	-	160000	=70571	"
160001	-	170000	=75867	"
170001	-	180000	=81252	"
180001	-	190000	=86728	"
190001	-	200000	=92293	"
200001	-	210000	=97518	"
210001	-	220000	= 102791	"
220001	-	230000	= 108112	"
230001	-	240000	= 113481	"
240001	-	250000	= 118898	"
250001	-	260000	= 124363	"
260001	-	270000	= 129876	"
270001	-	280000	= 135437	"
280001	-	290000	= 141046	"
290001	-	300000	= 146703	"

Appendix Table 9.2.4 OCEAN FRIGHT

Item	Estimated Cost		
Iron and Steel	Insurance		
	Bandle	F/t	125 Ks
	Loading unloading	F/t	125 Ks
	Ocean fright	F/t	450 Ks
Machinery	Insurance		
	Case	m^3	417 Ks
	Crate	m^3	375 Ks
	Skid	F/t	146 Ks
	Ocean fright	F/t	450 Ks

Note: Measure tons in volume.

Appendix Table 9.2.5 INLAND TRANSPORTATION CHARGES PER MILE (KYATS/TON)

	RTC	BRC	IWTC
Item	Road	Rail	River
Cement	0.59	0.18	0.08
Timber	0.53	0.15	-
General Cargo	0.80	0.39	0.17
Heavy Equipment			1.2

Note: Loading and unloading charges are:

Cement	Kyats 90 per ton
Timber	Kyats 150 per ton
Sand	Kyats 34 per ton
Heavy Equipment	Kyats 300 per ton

Appendix Table 9.2.6 COST OF MAJOR IMPORTED MATERIALS (KYATS)

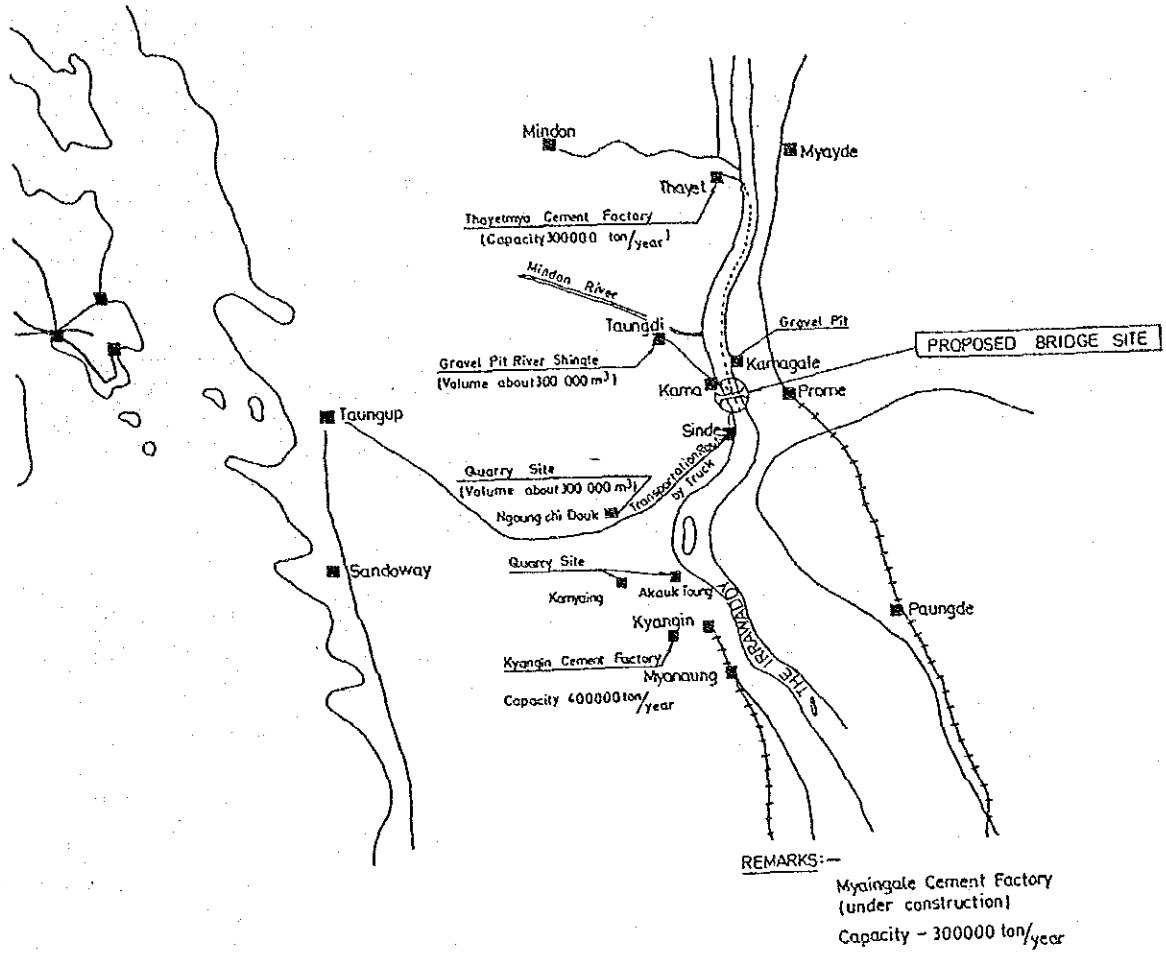
Item	Unit	Yokohama FOB	Transportation Charges & Insurance		Tax & Duty	Total
		FC	FC	LC		
Reinforcing Bar (-D32)	ton	2,580	770	330	395	4,075
Reinforcing Bar (D51)	"	4,500	770	330	689	6,298
PC Tendon	"	3,070	630	330	470	4,500
Buildup Steel Member	"	22,917	1,568	1,125	3,506	29,116
Paint	"	31,250	2,063	1,302	23,909	58,524
Casing for R.C.D	"	4,080	630	4,960	624	10,294
H-Section Steel	"	2,708	1,403	718	414	5,243

Appendix Table 9.2.7 COSTS OF MAJOR LOCAL MATERIALS (KYATS)

Items	Unit	Cast	Producing Place
Cement	ton	870	Kyangin Factory
Stone Boulder	Cu.M	122	Zalon Quarry
Coase Sand	"	75	Zalon Creek
Fine Sand	"	40	Kama Quarry
River Shingle	"	120	Taung D: Quarry
Hard Wood	ton	2,604	Magwe Division
Jungle Wood	"	2,232	"

Note: Above costs include CC overhead Charges, transportation charges, loading and unloading charges and storage charges,

Appendix Fig. 9.2.2 GUIDE MAP OF MATERIAL SURVEY



Appendix Table 9.2.8. FOREIGN LABOUR COSTS (ks/hour)

Staff Engineer Class I	330	ks/hr
" II	290	"
" III	250	"
Senior Supervisor	270	"
Supervisor	230	"

Appendix Table 9.2.9 : LOCAL LABOUR COSTS

	(ks/hour)
Excutive Engineer	10.3
Assistant Enginner	7.9
Sub Assistant Engineer	5.6
General Formen	8.3
Seaffold Man	5.3
Carpenter	7.4
Operator	7.4
Mechanic	
Electrician	
Concrete Placing Man	2.1
Ordinary Worker	
Fabricater	5.3

Appendix Table 9.2.10 COSTS OF MAJOR MACHINERY AND EQUIPMENT

(1,000 Kyats)

Item	Yokohama FOB Cost	Transportation Charges & Insurance		Tax & Duty	Total
	F.C	F.C	L.C	L.C	
Crowler Crane (70t)	3,204	396	224	490	4,314
T.V.C Flame	633	63	39	97	832
Vor Bau Wagen (2-Frames)	1,119	779	324	171	2,393
Root and floor of Vor Bau Wagen	223	12	5	34	274
Truck (11t)	313	60	24	48	445
Concrete Truck Mixer (3 CBM)	388	60	24	59	531
Concrete Plant (60 CBM/H)	1,083	231	84	166	1,564
Cement Silo	570	159	63	87	879
Generator (300 KVA)	409	16	6	63	494
Concrete Test Equipment	513	19	6	78	616
Crowler Crane (150t)	6,750	412	167	1,033	8,362
Vibro Hammer (150 KW)	1,525	18	7	233	1,783
R.C Drill (S400H Class)	2,516	80	47	385	3,028
Roller Bit	1,379	8	3	211	1,601
Bending Roll & Welding Equipment	3,621	102	50	554	4,327
Semi-Auto-Welder	23	1	-	4	28
Barge (1,000t)	2,804	765	306	429	4,304

Appendix Table 9.3.1 UNIT COST OF SUPERSTRUCTURE (1)

Road Bridge -- PC Box Girder

Unit: Kyats

Work Item	Unit	F·C	L·C	F·C+L·C	T & D	Total
Concrete	m^3	76	614	690	12	702
Form	m^2	71	77	148	8	156
R. Bar	Ton	3,152	680	3,832	414	4,246
PC Tendon	"	30,621	1,129	31,750	5,744	37,494
Bearing Shoe	"	49,169	782	49,951	7,802	57,753
Cerbstone	M	38	217	255	5	260
Hand Rail	Ton	25,414	762	26,176	3,771	29,947
Exp. Joint	"	28,677	762	29,439	4,325	33,764
Drainage	"	33,814	762	34,576	5,199	39,775
Pavement (Road)	M^3	21	445	466	3	469
Pavement (Sidewalk)	M^2	42	36	78	6	84
Scafforld	LS	7,095,709	1,829,876	8,925,585	1,148,613	10,074,198
FV work	"	248,250	298,236	546,486	25,000	571,486
Miscellaneous	"	57,500	5,000	57,500	8,625	71,125

Appendix Table 9.3.2 UNIT COST OF SUPERSTRUCTURE (2)

Rail-cum-Road Bridge -- Steel Truss

Unit: Kyats

Work Item	Unit	F·C	L·C	F·C+L·C	T & D	Total
Concrete	M^3	23	545	568	4	572
Form	M^2	34	152	186	4	190
R. Bar	Ton	3,531	491	4,022	454	4,476
Truss Steel (SM58)	"	20,919	447	21,366	1,022	22,388
Truss Steel (SM50Y)	"	18,562	447	19,009	776	19,785
Truss Steel (SS41)	"	17,850	447	18,297	683	18,980
Hand Rail	"	25,414	762	26,176	3,771	29,947
Bearing Shoe	"	49,169	782	49,951	7,802	57,753
Exp. Joint	"	28,677	762	29,436	4,325	33,764
Dranage	"	33,814	762	34,576	5,199	39,775
Painting (Factory)	M^2	70	0	70	0	70
Painting (Site)	M^2	20	4	24	3	27
Track Rail	M^3	313	60	373	47	420
Sleeper	M^2	0	2,542	2,542	0	2,542
Pavement (Road)	"	30	27	57	5	62
Pavement (Sidewalk)	Ton	20	17	37	2	39
Temp. Bent	"	8,922	672	9,594	1,352	10,946
Temp. Tower	"	11,270	702	11,972	1,740	13,712
TC Work	"	697	424	1,121	77	1,198
Cerbstone	M	28	20	48	4	52

Appendix Table 9.3.3 UNIT COST OF SUBSTRUCTURE

Unit: Kyats

Work Item	Unit	F·C	L·C	F·C+L·C	T & D	Total
Concrete (σck=300 kg/cm^2)	M^3	74	620	694	12	706
Concrete (σck=240 kg/cm^2)	"	23	511	534	4	538
Form	M^2	118	85	203	13	216
R. Bar (SD30)	Ton	3,125	680	3,832	414	4,246
R. Bar (D51)	"	5,663	680	6,343	742	7,085
Casing Pipe	M	9,596	858	10,454	1,438	11,892
Casing Guide	Ton	3,757	330	4,087	541	4,628
Drilling Work	M	813	210	1,023	103	1,126
Scafforld	M^3	69	18	87	8	95
Inside Form	M^2	1,000	248	1,248	143	1,391
Scafforld for Pier Bracket	M^3	333	90	423	41	464
Level Concrete	M^3	23	493	516	4	520
Cofferdam	M	6,458	1,290	7,748	782	8,548

Appendix Table 9.4.1 COST OF SUBSTRUCTURE (1)

Road Bridge -- PC Box Girder

Unit: 1000 Kyats

Work Item	Unit	Quantity	F.C		L.C		Sub Total	Tax and duty		Total
			Unit cost	Cost	Unit cost	Cost		Unit cost	Cost	
1 RCD Work										
Casing Pipe	M	1,305	9.596	12,523	0.858	1,120	13,642	1.438	1,877	15,519
Concrete	M^3	20,660	0.074	1,529	0.620	12,809	14,338	0.012	248	14,586
R. Bar	Ton	3,739	5.663	21,174	0.680	2.543	23,717	0.742	2,774	26,490
Casing Guide	Ton	61	3.757	229	0.330	20	249	0.541	33	282
Drilling Work	M	2,923	0.813	2,376	0.210	613	2,989	0.103	301	3,290
Subtotal				37,831		17,105	54,936		5,233	60,169
2. Footing Work										
Concrete	M^3	12,987	0.023	299	0.511	6,636	6,935	0.004	52	6,987
Form	M^2	2,765	0.118	326	0.085	235	561	0.013	36	597
Scaffold	M^3	3,318	0.069	229	0.018	60	289	0.008	27	316
Level Concrete	M^3	49	0.023	1	0.493	24	25	0.004	0	25
Bottom Form	M^2	2,700	1.000	2,700	0.248	670	3,370	0.143	386	3,756
R. Bar	Ton	1,566	3.152	4,936	0.680	1,065	6,001	0.414	648	6,649
Coffer Dam	M	110	6.458	710	1.290	142	852	0.782	86	938
Excavation	M^3	6,641	0	0	0.002	13	13	0	0	13
Subtotal				9,201		8,845	18,046		1,235	19,281
3 Pier Work										
Concrete	M^3	5,425	0.023	125	0.511	2,772	2,897	0.004	22	2,919
Form(outside)	M^2	10,816	0.118	1,276	0.085	919	2,195	0.013	141	2,336
Form(inside)	M^2	13	1.000	13	0.248	3	16	0.143	2	18
R. Bar	Ton	447	3.152	1,409	0.680	304	1,713	0.414	185	1,898
Scaffold	M^3	12,979	0.069	896	0.018	234	1,130	0.008	104	1,234
Miscellaneous	Ls	1	-	0	-	867	867	-	0	867
Subtotal				3,719		5,099	8,818		454	9,272
4 Total				50,751		31,049	81,800		6,922	88,722

Appendix Table 9.4.2 COST OF SUBSTRUCTURE (2)

Rail-cum-Road Bridge -- Steel Truss

Unit: 1000 Kyats

Work Item	Unit	Quantity	F.C		L.C		Sub Total	Tax and duty		Total
			Unit cost	Cost	Unit cost	Cost		Unit cost	Cost	
1 RCD WORK										
Casing Pipe	M	1,179	9.596	11,314	0.858	1,012	12,326	1.438	1,695	14,021
Concrete	M3	18,145	0.074	1,343	0.620	11,250	12,593	0.012	218	12,811
R. Bar	Ton	3,323	5.663	18,818	0.680	2,260	21,078	0.742	2,466	23,544
Casing Guide	Ton	61	3.757	229	0.330	20	249	0.541	33	282
Drilling Work	M	2,567	0.813	2,087	0.210	539	2,626	0.103	264	2,890
Subtotal				33,791		15,081	48,872		4,076	53,548
2 Footing Work										
Concrete	M3	10,557	0.023	243	0.511	5,395	5,638	0.004	42	5,680
Form	M2	2,387	0.118	282	0.085	203	485	0.013	31	516
Scaffold	M3	2,864	0.069	198	0.018	52	250	0.008	23	273
Bottom Form	M2	2,400	1.000	2,400	0.248	595	2,995	0.143	343	3,338
Level Concrete	M3	73	0.023	2	0.493	36	38	0.004	0	38
R. Bar	Ton	1,269	3.152	4,000	0.680	863	4,863	0.414	525	5,388
Coffer Dam	M	106	6.458	685	1.290	137	822	0.782	83	905
Excavation	M3	9,810	0	0	0.002	19	19	0	0	19
Subtotal				7,810		7,300	15,110		1,047	16,157
3 Pier Work										
Concrete	M3	9,349	0.023	215	0.511	4,777	4,992	0.004	37	5,029
Form (Outside)	M2	8,072	0.118	952	0.085	686	1,638	0.013	105	1,743
Form (Inside)	M2	18	1.000	18	0.248	4	22	0.143	3	25
R. Bar	Ton	807	3.152	2,544	0.680	549	3,093	0.414	334	3,427
Scaffold	M3	9,686	0.069	668	0.018	174	842	0.008	78	920
B. Scaffold	M2	353	0.333	118	0.090	32	150	0.041	14	164
Miscellaneous	Ls	1		0	-	775	775	-	0	775
Subtotal				4,515		6,997	11,512		571	12,083
4 Total				46,116		29,378	75,494		6,294	81,788

Appendix Table 9.4.3 COST OF SUPERSTRUCTURE (1)

Road Bridge -- PC Box Girder

Unit: 1000 Kyats

	Work Item	Unit	Quantity	F.C		L.C		Sub Total	Tax and duty		Total
				Unit cost	Cost	Unit cost	Cost		Unit cost	Cost	
1	PC Girder										
	(350 kg/cm^2) Concrete	M^3	13,066	0.076	993	0.614	8,022	9,015	0.012	157	9,172
	Form	M^2	46,023	0.071	3,268	0.077	3,544	6,812	0.008	368	7,180
	R. Bar	Ton	1,307	3.152	4,120	0.680	889	5,009	0.414	541	5,550
	PC Tendon	Ton	1,258	30,621	38,521	1.129	1,420	39,941	5.744	7 225	47,166
	Miscellaneous	LS	1	-	0	-	578	578	0	0	578
	Sub total				46,902		14,453	61,355		8,291	69,646
2	Accessories										
	Exp. Joint	Ton	36	28.667	1,032	0.762	27	1,059	4.325	156	1,215
	Drainage	Ton	30	33.814	1,014	0.762	23	1,037	5.199	156	1,193
	Bearing Shoe	LS	64	49.169	3,147	0.782	50	3,197	7.802	499	3,696
	Cerbstone	M	2,300	0.038	87	0.217	499	586	0.005	12	598
	Hand Rail	Ton	138	25.414	3,507	0.762	105	3,612	3.771	520	4,132
	Pavement (Road)	M^2	9,750	0.042	410	0.036	351	761	0.006	57	820
	Pavement(Sidewalk)	M^3	641	0.021	13	0.445	285	298	0.003	2	300
	Subtotal				9,210		1,340	10,550		1,402	11,954
3	Temporary Work										
	Scaffold	LS	1	-	7,095	-	1,829	8,924	-	1,148	10,072
	F. V work	LS	1	-	248	-	298	546	-	25	571
	Miscellaneous	LS	1	-	57	-	5	62	-	8	70
	Subtotal				7,400		2,132	9,532		1,181	10,713
4	Total				63,512		17,925	81,437		10,874	92,313

Appendix Table 9.4.4 COST OF SUPERSTRUCTURE (2)

Rail-cum-Road Bridge -- Steel Truss

Unit: 1000 Kyats

Work Item	Unit	Quantity	F.C		L.C		Sub Total	Tax and duty		Total
			Unit cost	Cost	Unit cost	Cost		Unit cost	Cost	
1. Truss Work										
SM 58	Ton	1,189	20.919	24,873	0.447	531	25,404	1.022	1,215	26,619
SM50Y	Ton	1,336	18.562	24,799	0.447	597	25,396	0.776	1,036	26,432
SS41	Ton	5,599	17.850	99,942	0.447	2,503	102,445	0.683	3,824	106,269
Subtotal				149,614		3,631	153,242		6,075	159,320
2. Slab Work										
Form	M^2	15,337	0.034	521	0.152	2,331	2,852	0.004	61	2,914
R. Bar	Ton	684	3,531	2,415	0.491	336	2,751	0.454	311	3,062
Concrete	M^3	3,420	0.023	79	0.545	1,864	1,943	0.004	13	1,956
Cerbstone	M	2,300	0.028	64	0.020	46	110	0.004	9	119
Pavement(Road)	M^2	9,750	0.030	293	0.027	263	556	0.005	48	604
Pavement(Sidewalk)	M^2	3,450	0.020	69	0.017	59	128	0.002	6	134
Track Rail	M	4,588	0.313	1,436	0.060	275	1,711	0.047	215	1,926
Sleeper	M^3	354	0	0	2.542	900	900	0	0	900
Subtotal				4,877		6,074	10,951		663	11,614
3 Painting Work										
at Factory	M^2	133,575	0.070	9,350	0	0	9,350	0	0	9,350
at Site	M^2	137,520	0.020	2,750	0.004	550	3,300	0.003	412	3,712
Subtotal				12,100		550	12,650		412	13,062
4 Accessories										
Bearing Shoe	Ton	237	49.169	11,653	0.782	185	11,838	7.802	1,849	13,062
Exp. Joint	Ton	24	28.677	688	0.762	18	706	4.325	104	810
Drainage	Ton	30	33.814	1,014	0.762	23	1,037	5.199	155	1,193
Hand Rail	Ton	241	25.414	6,125	0.762	184	6,309	3.771	909	7,218
Subtotal				19,480		410	19,890		3,018	22,908
5 Temp Work										
Bent	Ton	200	8.922	1,784	0.672	134	1,918	1.352	270	2,188
Erec. Tower	Ton	600	11.270	6,762	0.702	421	7,183	1.740	1,044	8,227
T.C. Work	Ton	8,124	0.567	4,608	0.424	3,445	8,053	0.077	626	8,679
Scaffold	Ton	17,250	0	0	0.045	776	776	0	0	776
Subtotal	M^2			13,154		4,776	17,930		1,940	19,870
6 Total				199,225		15,441	214,666		12,108	226,774

Appendix Table 9.4.5 MACHINE CHARGE (1)

Superstructure

Unit: 1000 kyats

	ITEM	F.C	L.C	FC+LC	T & D	Total
1.	PC Box Girder					
	F.V. Wagen	9,041	635	9,676	1,257	10,933
	for Prestress-ing	1,695	71	1,766	225	1,991
	for Form Work & Concreting	2,525	51	2,576	344	2,920
	for Transportation	9,633	565	10,198	1,314	11,512
	Subtotal	22,894	1,322	24,216	3,140	27,356
	for Pavement	1,063	984	2,047	201	2,248
	Total	23,957	2,306	26,263	3,341	29,604
2.	Steel Truss					
	for Erection	22,527	754	23,281	3,044	26,325
	for Pavement	1,063	984	2,047	201	2,248
	Total	23,590	1,738	25,328	3,245	28,573

Appendix Table 9.4.6 MACHINE CHARGE (2)

Substructure

Unit: 1000 kyats

	ITEM	F.C.	L.C	FC+LC	T & D	Total
1.	General Work					
	for Temporary Work	4,938 4,694	1,974 1,840	6,912 6,534	678 678	7,590 7,212
	Concrete Plant	6,023 5,873	1,517 1,460	7,540 7,333	770 770	8,310 8,103
	for Processing R. Bar	217 217	2 2	219 219	29 29	248 248
	for F. Work & Concreting	1,017 1,001	7 7	1,024 1,008	138 138	1,162 1,146
	Vehicles	1,615 1,564	156 143	1,771 1,707	1,103 1,103	2,874 2,810
	for Survey	207 207	1 1	208 208	47 47	255 255
	Generators	78 58	332 279	410 337	23 23	433 360
	Superstructure	7,047	1,994	9,041	1,394	10,435
	Substructure	7,048	1,995	9,043	1,394	10,437
	Total	14,095	3,989	18,084	2,788	20,872
	Superstructure	1,361	373	1,734	279	2,013
	Substructure	12,253	3,359	15,612	2,509	18,121
	Total	13,614	3,732	17,346	2,788	20,134
2.	RCD Work	56,912 56,449	2,834 2,683	59,746 59,132	7,927 7,927	67,673 67,059
3.	Barge Work					
	Superstructure	4,664	1,276	5,940	530	6,470
	Substructure	26,428	7,232	38,324	3,003	41,327
	Total	31,092	8,508	44,264	3,533	47,797
	Superstructure	31	8	39	4	43
	Substructure	31,016	7,457	38,474	3,529	42,002
	Total	31,047	7,465	38,512	3,533	42,045

Note: Upper: P.C Bridge
Lower: Steel Bridge

Appendix Table 9.4.7 SITE EXPENSE (1)

Road Bridge -- PC Box Girder

Unit: 1000 kyats

	ITEM	F.C	L.C	FC+LC	T & D	Total
1.	Superstructure					
	Labor Fee	24,667	583	25,250	1,725	26,975
	Travel Expense	1,625	167	1,792	0	1,792
	Communication Charge	167	0	167	0	167
	Social Welfare	87	438	525	79	604
	Testing Charge in Foreign Country	1,125	0	1,125	0	1,125
	Rangoon Office Expense	0	354	354	54	408
	Stationery and Safety Goods	500	38	538	83	621
	Miscellaneous	188	333	521	79	600
	Total	28,359	1,913	30,272	2,020	32,292
2.	Substructure					
	Labor Fee	30,163	692	30,855	2,113	32,968
	Travel Expense	1,979	208	2,187	0	2,187
	Communication Charge	167	0	167	0	167
	Social Welfare	117	542	659	100	759
	Testing Charge in Foreign Country	1,333	0	1,333	0	1,333
	Rangoon office Expense	0	354	354	54	408
	Stationery and Safety Goods	458	42	500	75	575
	Miscellaneous	188	417	605	92	697
	Total	34,405	2,255	36,660	2,434	39,094

Appendix Table 9.4.8 SITE EXPENSE (2)

Rail-cum-Road Bridge -- Steel Truss

Unit: 1000 kyats

ITEM	F.C.	L.C	FC+LC	T & D	Total
1. Superstructure					
Labor Fee	23,792	542	24,334	1,667	26,001
Travel Expense	1,567	158	1,725	0	1,725
Communication Charge	167	0	167	0	167
Social Welfare	83	458	541	83	624
Testing Charge in Foreign Country	1,125	0	1,125	0	1,125
Rangoon Office Expense	0	354	354	54	408
Stationery and Safety Goods	500	38	538	83	621
Miscellaneous	188	250	438	67	505
Total	27,422	1,800	29,222	1,954	31,176
2. Substructure					
Labor Fee	31,667	454	32,121	2,217	34,338
Travel Expense	1,188	171	1,359	0	1,359
Communication Charge	167	0	167	0	167
Social Welfare	108	500	608	92	700
Testing Charge in Foreign Country	1,333	0	1,333	0	1,333
Rangoon office Expense	0	354	354	54	408
Stationery and Safety Goods	458	42	500	75	575
Miscellaneous	188	417	605	92	697
Total	35,109	1,938	37,047	2,530	39,577

Appendix Table 9.5.1 MAINTENANCE COST OF AVA BRIDGE

Unit: Kyats 1,000

Sr.	Year	Painting	Replacing Sleepers & Other Works	Cleaning Work	Permanent Labours	Total
1.	1974-75	13.70	-	2.60	6.70	23.00
2.	1975-76	123.70	14.40	2.60	6.70	147.40
3.	1976-77	135.90	5.20	2.60	6.70	150.40
4.	1977-78	158.90	-	2.60	6.70	168.20
5.	1978-79	44.90	17.60	4.30	6.70	73.50
6.	1979-80	22.40	-	4.30	6.70	33.40
7.	1980-81	84.60	-	4.30	6.70	95.60
8.	1981-82	10.20	5.10	4.30	6.70	26.30
9.	1982-83	-	-	4.30	6.70	11.00
10.	1983-84	61.20	-	4.30	6.70	72.20

Appendix Table 9.5.2 MAINTENANCE COST OF SITTANG BRIDGE

Unit: Kyats 1,000

Sr.	Year	Painting	Replacing Sleepers & Other Works	Cleaning Work	Permanent Labours	Total
1.	1975-76	-	17.00	1.32	17.83	36.15
2.	1976-77	-	19.00	1.32	17.83	38.15
3.	1977-78	112.0	17.00	1.32	17.84	148.16
4.	1978-79	126.00	19.00	1.32	17.84	164.16
5.	1979-80	238.00	18.00	1.32	17.85	275.17
6.	1980-81	-	20.00	1.32	17.85	39.17
7.	1981-82	-	18.00	2.16	32.94	53.10
8.	1982-83	-	16.00	2.16	32.94	51.10
9.	1983-84	-	16.00	2.16	32.95	51.10
10.	1984-85	-	100.00	2.16	32.95	135.11

APPENDIX

CHAPTER 10 ECONOMIC EVALUATION

Appendix Table 10.2.1.1 Z-CRAFT OPERATION

No.	Location	Facility				Service									
		Operation	Eng.H.P	Loading Capacity in in Veh [1]	Staff on Ves.	No. of Vessels	Trips per Ves	Daily Trips	Capacity per Vessels	Capacity per day	Traffic per day	Traf/Cap Ratio	Capacity	Passenger	Pass/Cap
						a	b	c [2]	d	e=c x d	f	g=f/e	h	i	j
303	Prome-Sinde	HIC	250x2	8	11	1	12	12	8	96	53	0.49	1,200	695	0.58
304	Prome-Sinde	IWTC	215x2	7	11	1	14	14	7	98	60	0.58	1,400	250	0.18
	Prome-Sinde (Shwedaung)	Coop	120	3	8	1	8	8	3	14	11		560	140	0.25
306	Myede-Thayet	HIC	120x2	5	6	1	4	4	5	20	2	0.17	350	69	0.20
307	Patanago-Malon	HIC	245x2	5	6	1	10	10	5	50	11	0.22	1,000	284	0.28
308	Magwe-Minbu	Coop	126	3	8	2	7	14	3	42	29	0.69	1,680	1,596	0.95
312	Nyaung U-Kyun Chaung	Coop	140x2	7	11	1	4	4	7	28	41	1.46	280	166	0.59
314	Monywa-Nyaung Bin Gyi	Coop	120	3	8	3	8.7	26	3	78	68	0.87	3,120	3,248	1.04
Total				41	69	11	67.7	92	41	436 [3] -87 349	275 275	0.63 0.79	9,590	6,448	0.70

No.	Location	Financial Cost			Fares and Times				
					Fares (Kyat)			Time (Min)	
		Cost [4] K '000	Annual Maint/Y K '000	Wages/Y K '000	Large Vehicles [5]	Small Vehicles	Passenger	Crossing	Waiting [6]
303		7,000	45	54.0	150	100.75	Free	15	60
304		6,000	40	54.0	150	" " "	1.00	45	40
		2,000	20	42.0	150	" " "	1.00	45	"
306		4,000	40	33.6	200	100.75	1.00	60	60
307		5,000	40	33.6	150	100.50	Free	15	140
308		2,000	20	42.0	200	100.50	1.00	50	130
312		4,000	40	54.0	200	125.40	1.00	60	240
314		2,000	20	42.0	150	100.50	1.00	20	50

Source : Surveys in December 1985 - January 1986.

Notes : 1) Usually one or two small vehicles are included.

2) Based on the records of the traffic survey. However, ferry captains said trip number changes often by various reasons.

3) It was assumed 20% was usually occupied by Defence & police vehicles.

4) It was difficult to find the market prices of these Z-craft because they were built by order and there was no standard type and most of them were built more than several years ago. No evidences of accounting documents were obtained. After discussions with boat captains, these figures were determined by the study team.

5) A half loaded truck.

6) Waiting time was the average obtained from the interview with jetty staff and vehicle drivers.

Appendix Table 10.2.1.2 ECONOMIC COST OF Z-CRAFT OPERATION

No.	Location	Operation	Financial Cost	Economic Cost 1)	Life Yrs	Annual Cost Economic 2)	Annual Maint. Cost.	Annual Eco.Main. Cost 1)	Wages per Yr. 3)	Eco.Wages per Yr 4)
		a	b	c	d	e	f	f'	g	g'
303	Prome-Sinde	H.I.C.	7,000,000	4,690,000	40	479,595	45,000	30,150	54,000	48,060
304	Prome-Sinde	I.W.T.C	6,000,000	4,020,000	40	411,081	40,000	26,800	54,000	48,060
	Prome-Sinde (Shwedaung)	Coop	2,000,000	1,340,000	25	147,625	20,000	13,400	42,000	38,440
306	Myede-Thayet	H.I.C.	4,000,000	2,680,000	40	274,054	40,000	26,800	33,600	31,220
307	Patarago-Malon	H.I.C.	5,000,000	3,350,000	40	342,568	40,000	26,800	33,600	31,220
308	Magwe-Ninbu	Coop	2,000,000	1,340,000	25	147,625	20,000	13,400	42,000	38,440
312	Nyaung U-Kyun Chaung	Coop	4,000,000	2,680,000	40	274,054	20,000	26,800	54,000	48,060
314	Monywa-Nyaung Bin Gyi	Coop	2,000,000	1,340,000	25	147,625	20,000	13,400	42,000	38,440
-	Total		11 vessels 25,460,000			Tot. 2,224,227		Tot. 217,750		Tot. 437,300

No.	Location	Operation	Total Economic Cost e,f',g'	No. of Vessels	Total Eco. Cost per Yr	Cost per day j÷365	Cost of Jetties per day 5)	Cost per day k+l	Fuel consu. g/trip	Trips per day	Fuel & Oil cost 6)	Total Cost/day m+p	Econo. Cost per trip
			h	i	j	k	l	m	n	o	p	q	r
303		H.I.C.	557,805	1	557,805	1,528	458	1,986	3.0	12	286	2,272	189
304		I.W.T.C	485,941	1	485,941	1,331	399	1,730	4.0	14	446	2,176	155
		Coop	199,465	1	199,465	546	164	710	2.0	8	127	837	105
306		H.I.C.	332,074	1	332,074	910	273	1,183	6.0	4	191	1,374	344
307		H.I.C.	400,588	1	400,588	1,098	329	1,427	3.0	10	239	1,666	167
308		Coop	199,465	2	398,930	1,093	328	1,421	3.0	14	334	1,755	125
312		Coop	348,914	1	348,914	956	287	1,243	6.0	4	191	1,434	359
314		Coop	199465	3	598,395	1,639	492	2,131	2.0	26	414	2,545	98
-	Total			11	3,322,112	9,101	2,730	11,831 Kyat/day	29.0	92	2,228	14,059 K/day	153

Notes : 1) The economic cost was determined at 67% of the financial cost, where 67% was obtained from the cost analysis of road vehicles assembled in Burma (referring to Appendix Table 10.2.2.4). The maintenance cost included the engine overhaul which was said every 3 or 4 years.

2) Annual cost was calculated by using the "capital recovery formula" $i(1+i)^n/(1+i)^n - 1$, where i = 10% and n is the life years and no salvage value was taken into account.

3) Annual staffing cost was determined as (a) K 800 x 12, 600 x 12, 400 x 12, 300 x 5 x 12 total = K 54,000.
(b) K 800 x 12, 600 x 12, 400 x 3 x 12, 300 x 3 x 12, total K 42,000
and (c) K 800 x 12, 600 x 12, 400 x 2 x 12, 300 x 2 x 12, total K 37,200.

4) Of those staff on board, the lowest grade of K 300 was assessed to be 0.67% for the economic cost: K 300 x 0.67 = K 200/month. No change in other grades.

5) Repair and operation costs of jetties were assumed here at 10% of the daily cost, item "k". In addition, overhead cost of 20% was added.

6) Economic cost of diesel oil was assessed to be equal to the economic cost in a neighbouring country. K 7.58 was used here. See Appendix Table 10.2.2.5. Engine oil was added by 5%.

Appendix Table 10.2.1.3 PASSENGER BOAT OPERATION

No.	Location	Facility				Service						Financial Cost			Fare & Time	
		Operation	Engine H.P	Loading Cap.	Staff on oat	No. of Boats 2)	Trips per Boat	Daily Trips 2)	Capacity/ day	Passenger/day	Pass/Cap Ratio	Cost: A Boat '000	Annual Maint.C 3)	Wages per Year 3)	Fare per pass (K)	Time (min) Cross-
301 (with 302)	Prome-Sinde	Coop.PB	110	150	8	6	3.0	18	2,700	2,685	0.99	400	20,000	31,800	1.00	45
303	Prome-Sinde	Z. HIC 1)	-	100	-	1	12.0	12	1,200	695	0.58	-	-	-	-	-
304	" "	Z.IWIC	-	100	-	1	14.0	14	1,400	250	0.18	-	-	-	-	-
"	" "	Z.Coop	-	70	-	1	8.0	8	560	140	0.25	-	-	-	-	-
305	Myede-Thayet	Coop.PB	120	150	8	2	6.0	12	1,800	1,791	0.99	400	20,000	31,800	1.00	50
"	" "	Priv.PB	30	30	2	20	2.0	55	1,650	646	0.39	40	5,000	10,200	1.00	50
"	" "	Z.Ceracc	-	70	-	-	-	5	350	69	0.20	-	-	-	-	-
307	Patanago-	Pri.SSB	6	15	2	6	2.3	14	210	162	0.77	25	2,000	7,200	1.00	15
"	" Malun	Z. HIC	-	100	-	1	10.0	10	1,000	284	0.28	-	-	-	-	-
308	Magwe-Minbu	Pri.PB	30	30	2	26	2.0	52	1,560	1,305	0.84	40	5,000	10,200	2.00	60
308	" "	Z.Coop	-	120	-	2	7.0	14	1,680	1,596	0.95	-	-	-	1.00	-
309 (with 315)	Chauk-Seikpyu	Priv.PB	120	120	6	4	4.5	18	2,160	866	0.40	400	20,000	25,800	0.50	30
	" "	Pri.SSB	6	15	2	32	2.3	72	1,080	1,078	1.00	25	2,000	7,200	1.00	40
310	Yenanchaung-	Coop.PB	90	80	6	1	4.0	4	320	250	0.78	200	10,000	25,800	2.00	90
	Thangain	Priv.PB	6	30	2	4	2.0	8	240	200	0.83	40	5,000	10,200	3.00	120
312	Nyaung U-	Priv.PB	30	100	2	3	2.0	6	600	484	0.81	40	5,000	10,200	5.00	150
	Kyun Chaung	SSB	6	15	2	6	2.0	12	180	101	0.56	25	2,000	7,200	2.00	50
		Z. Coop	-	70	-	-	-	4	280	166	0.59	-	-	-	-	-
314	Monywa-	Coop.PB	120	200	6	2	8.0	16	3,200	1,926	0.60	400	15,000	25,800	0.50	20
	Nyaung Bin Gyi	Priv.SB	0	8	1	30	10.5	316	2,528	2,260	0.89	2	500	3,000	1.00	20
		Z.Coop	-	-	-	-	-	26	3,120	3,248	1.04	-	-	-	-	-
	Total 4)	(including Z-crafts)						698	27,818	20,202	0.73					
		(passenger boats only)						(606	18,228	13,754	(0.75					

Source : Surveys in December 1985 - January 1986.

Notes : 1) Operations of Z-crafts are shown in Appendix Table 10.2.1.2.

2) An average figure throughout a year. It was ceterminod by discussing with boat captains and jetty staff.

3) Costs were different among the crossings and even among the boats at the same jetty. Accordingly, they were grouped into 5 classes.

4) Total includes passengers on Z-crafts. ( ) are numbers only with passenger boats.

Appendix Table 10.2.1.4 ECONOMIC COST OF PASSENGER BOAT OPERATION

No.	Location	Operation	Finan.Cost	Econo.Cost 1)	Life.Years	Annual Eco.Cost 2)	Annual Maint.Cost	Annual Eco.Maint. Cost 1)	Wages per year 3)	Eco.Wages per year 4)	Total Eco. Cost f+g'+h'
	a	b	c	d	e	f	g	g'	h	h'	i
301	Prome- Sinde	Coop PB	400,000	268,000	15	35,235	20,000	13,400	31,800	27,300	75,935
305	Myede-Thayet	Coop PB	400,000	268,000	15	35,235	20,000	13,400	31,800	27,300	75,935
	" "	Priv. PB	40,000	26,800	10	4,362	5,000	3,350	10,200	9,210	16,922
307	Patanago-Malon	Priv.SSB	25,000	16,750	8	3,149	2,000	1,340	7,200	7,200	11,689
308	Magwe-Minbu	Priv. PB	40,000	26,800	10	4,362	5,000	3,350	10,200	9,210	16,922
309	Chauk-Seikpyu	Priv. PB	400,000	268,000	15	35,235	20,000	13,400	31,800	27,300	75,935
		SSB	25,000	16,750	8	3,149	2,000	1,340	7,200	7,200	11,689
310	Yenanchaung-	Priv. PB	200,000	134,000	15	17,618	15,000	10,050	25,800	22,830	50,498
	Thangain	Priv. PB	40,000	26,800	10	4,362	5,000	3,350	10,200	9,210	16,922
312	Nyaung U-	Priv. PB	200,000	134,000	15	17,618	15,000	10,050	25,800	22,830	50,498
	Kyun Chaung	SSB	25,000	16,750	8	3,149	2,000	1,340	7,200	7,200	11,689
314	Monywa-										
	Nyaung Bin Gyi	Coop PB	200,000	134,000	15	17,618	15,000	10,050	31,800	27,300	54,968
		Priv. SB	8,000	8,000	5	2,110	500	500	4,800	4,800	7,410
	Total			6,337,000				Tot. 462,560		Tot. 1,393,820	

No.	Location	Operation	No. of Vessels	Total Eco. Cost/year	Cost of Jetties/day	Cost/day k/365+l	Fuel Consu gal/trip	Trips/day	Fuel/Oil Cost/day	Total Cost /day m+p	Eco.Cost Cost/trip
			j	k	l 5)	m	n	o	p 6)	q	r
301		Coop PB	6	455,610	374	1,622	2.5	18	358	1,980	110
305		Coop PB	2	151,870	125	540	3.0	12	287	827	69
		Priv. PB	20	338,440	278	1,205	1.0	55	438	1,643	30
307		Priv.SSB	6	70,134	58	250	0.3	14	33	288	21
308		Priv. PB	26	439,972	362	1,567	1.5	52	621	2,188	42
309		Priv. PB	4	303,740	250	1,082	2.0	18	287	1,369	76
		SSB	32	374,048	307	1,332	1.0	72	573	1,905	26
310		Priv. PB	1	50,498	42	180	5.0	4	159	339	85
		Priv. PB	4	67,688	56	241	1.5	8	95	336	42
312		Priv. PB	3	151,494	125	540	3.0	6	143	683	114
		SSB	6	70,134	58	250	1.0	12	96	346	29
314		Coop PB	2	109,936	90	392	1.5	16	191	583	36
		Priv. PB	30	222,300	183	792	-	316	2,515	3,307	10
	Total		142	2,805,864	2,306	9993		603	5,796	15,789	26

Notes : 1) The economic cost was determined at 67% of the financial cost, where 67% was obtained from the cost analysis of road vehicles assembled in Burma (referring to Appendix Table 10. 2. 2. 4). The maintenance cost included the engine overhaul which was said every 3 or 4 years.

2) Annual cost was calculated by using the "capital recovery formula " $i(1+i)^n / (1+i)^n - 1$, where i = 10% and n is the life years and no salvage value was taken into account.

3) Annual staffing cost was calculated as (a) 600 X 12, 400 x 2 x 12, 250 x 5 x 12, Total K 31,800 ,(b) 600 x 12, 400 x 2 x 12, 250 x 3 x 12, Total K 25,800 , (c) 600 x 12, 250 x 12, Total K 10,200 , (d) 600 x 12 = K 7,200 , (e) 400 x 12 = 4,800.

4) Of those staff on board, the lowest grade of K 250 was assessed to be 0.67 for the economic cost. K 250 x 0.67 = K 200/month. No change in other grades.

5) Assuming 10% of the daily economic cost. In addition, 20% is added for overhead cost.

6) Economic cost of diesel oil was assessed to be equal to the economic cost in a neighbouring country. K 7.58 was used here. See Appendix Table 10. 2. 2. 5 . Engine oil was added by 5%.

Appendix Table 10.2.2.1 REPRESENTATIVE VEHICLE AND ITS USE 3)

	Jeep 1) x 2,000	Pick-up bus 14 seats 2)	Bus BM 1) 26 seats	Truck 1) T.E 6.5 tons
1. Annual miles	20,000 ml	40,000 ml	30,000 ml	30,000 ml
2. Life years	15 ys	15 ys	30 ys	30 ys
3. Life miles	300,000	600,000	900,000	900,000
4. Tyre-unit	4	4	6	6
-type	6.50-12	6.50-14.8	7.50-16-12	8.20-20-12
5. Tyre life	20,000 ml	20,000 ml	25,000 ml	25,000 ml
6. Staff -Driver	-	1	1	1
-Assistance	-	1	1	1
-Mechanic	-			1
7. Fuel	Gasoline	Gasoline	Diesel	Diesel
8. Fuel consumed on rural & paved roads	20 ml/g	15 ml/g	10 ml/g	10 ml/g

Notes : 1) Assumed to be assembled in Burma.

2) Assumed to be imported.

3) These were determined by the data of RTC and CC. Interviews on private operators of trucks and buses were conducted in Prome and Rangoon, although at a minor magnitude. The table is determined by taking into account all these data.

Appendix Table 10.2.2.2 FINANCIAL AND ECONOMIC COSTS OF VEHICLES

	Jeep x2,000	Pick-up bus 14 seats	Bus BM 26 seats	Truck TE 6.5 tons	
A. Vehicle:					
Government price	K 130,000	K 140,000	K 320,000	K 230,000	(Referring to those assembled in Burma. But imported pick-up is taken up the pick-up bus).
Duties and taxes	K 45,200	K 44,800	K 140,400	K 76,100	
Net price	K 84,800	K 95,200	K 179,600	K 153,900	
Economic Cost	K 84,800	K 42,400	K 179,600	K 153,900	
B. Tyres and tubes	6.50-12	6.50-14.8	7.50-16.12	8.20-20.12	A set, imported (Net x 1.40)x1.15
Government price	K 2,400	K 2,600	K 8,400	K 9,600	
Duties and taxes	K 910	K 980	K 3,180	K 3,640	
Net price	K 1,490	K 1,620	K 5,220	K 5,960	
Economic cost	K 1,490	K 1,620	K 5,220	K 5,960	
C. Fuel per gallon					Engine oil, imported (Kg)
Government price	K 3.50	K 3.50	K 2.50	K 2.50	40.00
Taxes	K 2.37	K 2.37	K 1.30	K 1.30	10.50
Net price	K 1.13	K 1.13	K 1.20	K 1.20	29.50
Economic cost	K 8.31	K 8.31	K 7.58	K 7.58	29.50
D. Wages per year (economic cost)					
Driver	-	K 9,600	K 12,000	K 9,600	
Assistant	-	K 3,000	K 3,000	K 3,000	Unskilled
Mechanic	-	-	-	K 9,600	
E. Maintenance & Repair	K 8,000/yr	K 12,500/yr	K 35,000/yr	K 35,000/yr	(100%)
Import (40%)	3,200	5,000	14,000	14,000	(40%)
Duties & Taxes (30%)	2,400	3,750	10,500	10,500	(30%)
Local material (30%)	2,400	3,750	10,500	10,500	(30%)
Economic cost	5,600	8,750	24,500	24,500	
F. Insurance, registration, etc,.					
Third party	K 750	K 820	K 1,230	K 1,230	
Comprehensive					
Registration	K 110	K 170	K 200	K 230	
Economic cost	K 750	K 820	K 1,230	K 1,230	
G. Interest (i = 10%) per year					
on government price x 1/2 x 0.1	K 6,500	K 7,000	K 16,000	K 11,500	
on economic cost x 1/2 x 0.1	K 4,200	K 2,100	K 9,000	K 7,700	

Source : R T C, C C, Customs Dept., Insurance Corp., other agencies and private owners/operators. Some of the original figures are modified by the Study Team.

Notes : A. Including the tyre cost. *Government prices* are determined by reviewing purchased cost by C C, R T C, etc,. They are assembled in H I C factories in Burma. The economic cost of pick-up is determined by referring to a recent study in Tahiland. (A Review of Feasibility Study and Detailed Design of The Rama VI Bridge Construction Project, December 1985 by C E C, P C I and A E C.)

B. It is said the government supplies two tyres per year in average. Vehicle owners buy other necessary tyres at the market where the prices are 2 to 4 times higher than the government prices. In this table, only the government prices are quoted through which economic cost is calculated because market mechanism in Burma is hard to confirm.

C. Duty and tax factors are given by C C in February 1986. Economic cost is assessed by referring to a recent study in Thailand. (See Notes A above). It is assumed the economic cost is 10% less than Thailand because of less cost in domestic transportation from the refinery to the D I A. B 6.22 x 4.54 l/g x 1/3.06 B = K 9.23/g x 0.9 = 8.31

B 5.68 x 4.54 l/g x 1/3.06 B = K 8.43/g x0.9 = 7.58

Appendix Table 10.2.2.3 CUSTOMS AND TAXES FOR TRANSPORTATION MATERIAL

	Customs duty 1)	Sales 2)	
Sedan car	300%	15%	Completed
Pick-up	30%	30%	"
Truck	30%	15%	"
C K D	30%	15%	To be assembled
Spare parts	50%	15%	
Tyre	40%	15%	
Vessel, parts, engine	20%	15%	
Railway materials	10%	15%	
Iron bars	20%	15%	
Mechinery	15%	15%	

Notes : 1) percentages on ad valorem (not c.i.f.).
2) on the value of a/v and customs duty inclusive.

Source: Customs Department, Rnagoon.

Appendix Table 10.2.2.4 VEHICLE OPERATING COST

—	Small vehicle (Jeep) Financial	Small vehicle (Jeep) Economic	Pick-up bus (14 seats) Financial	Pick-up bus (14 seats) Economic
A. Running Cost.				
Depreciation	130,000 ÷ 300,000 = K 0.43/ml	84,800 ÷ 300,000 = K 0.28/ml	140,000 ÷ 600,000 = K 0.23/ml	42,400 ÷ 600,000 = K 0.07/ml
Tyre wear	2,400 ÷ 20,000 = K 0.12/ml	1,490 ÷ 20,000 = K 0.07/ml	2,600 ÷ 20,000 = K 0.13/ml	1,620 ÷ 20,000 = K 0.08/ml
Fuel regular oil	3.50 ÷ 20=K 0.18/ml 5% of Regular = K 0.01/ml	8.31 ÷ 20=K 0.42/ml 5% of Regular=K 0.02/ml	3.50 ÷ 15=K 0.23/ml (5%) = K 0.01/ml	8.31 ÷ 15=K 0.55/ml (5%)= K 0.03/ml
Maint & repair	8,000 ÷ 20,000 = K 0.40/ml	5,600 ÷ 20,000 = K 0.28/ml	12,500 ÷ 40,000 = K 0.31/ml	8,750 ÷ 40,000 = K 0.22/ml
Total running cost	K 1.14/ml	K 1.07/ml	K 0.91/ml	K 0.95/ml
B. Time Cost (Fixed cost) 8 hrs/day x 25		x 12 = 2,400 hrs		
Wage	-	-	12,600 ÷ 2,400 = K 5.25/hr	11,610 ÷ 2,400 = K 4.84/hr
Insurance,Regd.	860 ÷ 2,400 = K 0.36/hr	750 ÷ 2,400 = K 0.31/hr	990 ÷ 2,400 = K 0.41/hr	820 ÷ 2,400 = K 0.34/hr
Interest	6,500 ÷ 2,400 = K 2.71	4,200 ÷ 2,400 = K 1.75/hr	7,000 ÷ 2,400 = K 2.92/hr	820 ÷ 2,400 = K 0.88/hr
Overhead	-	-	(50% of the above) K 4.29/hr	(50% of the above) K 3.03/hr
Total time cost (v = 25 mph)	K 3.07/hr (K 0.12/ml)	K 2.06/hr (K 0.08/ml)	K 12.87/hr v = 20mph(K 0.64/ml)	K 9.09/hr (K 0.45/ml)
C.Total Vehicle Operation Cost				
operating cost at	v = 25 mph K 1.26/ml	K 1.15/ml	v = 20 mph K 1.55/ml v = 25 mph K 1.42/ml	K 1.40/ml K 1.31/ml

	Bus (26 seats)		Truck (6.5 tons)	
	Financial	Economic	Fonancial	Economic
A. Running Cost.				
Depreciation	320,000 ÷ 900,000 = K 0.36/ml	179,600 ÷ 900,000 = K 0.20/ml	230,000 ÷ 900,000 = K 0.26/ml	153,900 ÷ 900,000 = K 0.14/ml
Tyre	8,400 ÷ 25,000 = K 0.34/ml	5,220 ÷ 25,000 = K 0.21/ml	9,600 ÷ 25,000 = K 0.38/ml	5,960 ÷ 25,000 = K 0.24/ml
Fuel diesel	2.50 ÷ 10=K 0.25/ml (5%) =K 0.01/ml	7.58 ÷ 10=K 0.76/ml (5%) =K 0.04/ml	2.50 ÷ 10=K 0.25/ml (5%) =K 0.01/ml	7.58 ÷ 10=K 0.76/ml (5%) =K 0.04/ml
Maint & repair	35,000 ÷ 30,000 = K 1.16/ml	24,500 ÷ 30,000 = K 0.82/ml	35,000 ÷ 30,000 = K 1.17/ml	24,500 ÷ 30,000 = K 0.82/ml
Running cost	K 2.12/ml	K 2.03/ml	K 2.07/ml	K 2.00/ml
B. Time Cost (Fixed cost) 8 hrs/day x 25 x12 = 2,400 hrs				
Wage	15,000 ÷ 2,400 = K 6.25/hr	14,010 ÷ 2,400 = K 5.84/hr	24,000 ÷ 2,400 = K 10.00/hr	23,010 ÷ 2,400 = K 9.59/hr
Insurance, Regd.	1,430 ÷ 2,400 = K 0.60/hr	1,230 ÷ 2,400 = K 0.51/hr	1,460 ÷ 2,400 = K 4.79/hr	1,230 ÷ 2,400 = K 0.51/hr
Interest	16,000 ÷ 2,400 = K 6.67/hr	9,000 ÷ 2,400 = K 3.75/hr	11,500 ÷ 2,400 = K 7.70/hr	7,700 ÷ 2,400 = K 3.21/hr
Overhead	(50% of the above) = K 6.76/hr	(50% of the above) = K 5.05/hr	(50% of the above) = K 7.70/hr	(50% of the above) = K 6.66/hr
Time cost (v = 15 mph)	K 20.28/hr (K 1.35/ml)	K 15.15/hr (K 1.01/ml)	K 23.10/hr (K 1.54/ml)	K 19.97/hr (K 1.33/ml)
C. Total Vehicle Operating Cost.				
v = 15 mph	K 3.47/ml	K 3.04/ml	K 3.61/ml	K 3.33/ml
v = 25 mph	K 2.39/ml	K 2.64/ml	K 2.99/ml	K 2.80/ml

Appendix Table 10.2.2.5 ECONOMIC COST OF ROAD VEHICLES AND FUEL: BURMA AND THAILAND [1]

Type	Burma, 1985/86.		Burma, 1982. (1)		Type	Thailand, 1985. (2)		
	Government price	Economic cost	Government price	Economic cost		Market price	Economic cost	Economic cost in Kyats [2]
I. Vehicles (with tyres).								
Jeep-Mazda	K 130,000	K 84,800	-	-	Sedan	B 241,000	B 138,000	K 45,100
Pick-up, 4 seats	K 140,000	K 42,400 [3]	-	-	Pick-up	B 168,000	B 133,000	K 43,500
Bus, 24 seats	K 320,000	K 179,600	Reconditioned 5 tons truck in the market		Bus, 44 seats	B 670,000	B 610,000	K 199,300
Truck, 6.5t	K 230,000	K 153,900	K 270,750	K 165,000	Truck, 7.0t	B 557,000	B 463,000	K 151,300
II. Tyres.								
6.50-12, 4 units	K 2,400	K 1,490	-	-	6.50, 4 units	B 3,300	B 3,000	K 980
6.50-14.8 4 units	K 2,600	K 1,620	-	-	6.50, 4 units	B 4,400	B 4,000	K 1,310
7.50-16.12 6 units	K 8,400	K 4,760	-	-	7.00, 6 units	B 10,000	B 9,000	K 2,940
8.20-20.12	K 9,600	K 5,440	K 9,060	K 5,694	8.00,	B 16,700	B 15,000	K 4,900
III. Fuel (per gallon) [4]								
Gasoline -regular	K 3.50	K 8.31	K 3.50	K 8.08	Gasoline -regular	B 10.80/l	B 6.22/l	K 9.23
Diesel	K 2.50	K 7.72	K 2.25	K 8.08	Diesel	B 6.70/l	B 5.68/l	K 8.43
Engine Oil	K 40	K 29.50	-	-	EngineOil	B 24.50/l	B 22.98/l	K 32.40

Source : (1) GITEC consult GMBH, "Rangoon-Prome Road Project Preparation Study" (JUly, 1982).

(2) CEC, PCI, AEC, "A Review of Feasibility Study and Detailed Design of the Rama IV Bridge Construction Project" (November, 1985).

Notes : (1) *Exact comparison is not possible because representative vehicles and times are different between the two countries.*

(2) Kyat 1 = Bahts 3.06.

(3) The economic cost (the border price) of an imported pick-up is assumed at half of that of a Burmese assembled Jeep by considering the relative price differences among the small vehicles of pick-ups, sedan, Jeep, etc. Jeeps are considered to represent the small vehicles in Burma being assembled. Sedan cars are also assembled but quite small *in number when compared with Jeeps.*

(4) The government price of fuel has not been changed in the past several years, while actual production cost is not shown. The economic cost is determined by referring to the economic cost in Thailand.

Appendix Table 10.2.3.1 ECONOMIC COST OF TRAIN OPERATION

	Unit	Fin. cost ('000)	Econ. cost ('000)	Life years'	Annual cost i=10%, K'000	Unit	Train cost/yr Econ., K'000
1 Depreciation							
Locomotive, 1200 HP	1	11,260	8,000	30	848.63	1	848.63
Coach, 60 seats	1	1,120	800	30	84.86	8	678.88
Wagon, 30 ton-capacity	1	340	240	40	24.54	2	49.08
Total Econ. cost	3	12,720	9,040	-	958.03	11	1,576.59
2 Maintenance/year							
Locomotive	1	115.44	87.99	-	87.99	1	87.99
Coach	1	10.90	9.04	-	9.04	8	72.32
Wagon	1	3.30	2.66	-	2.66	2	5.32
Total	3	129.64	99.69		99.69	11	165.63
3 Crew cost in Kyat							
Driver/shunter	2	400x24	400x24		9,600	2	9,600
Guards	2	400x24	400x24		9,60	2	9,600
Total	4	19,200	19,200		19,200	4	19,200
4 Fuel							
I'm pg/m				1.2 g/train-mile, @7.58 = 9.10 Kyat per train-m			
5 Overhead				20% to be added.			

Source: The Study on the Truck, Telecommunication and Signalling Improvement project in Burma (JICA, July 1986 Draft report)

Note: Capital recovery factor is 0.10608, i=10%, y=30 and 0.10226, i=10%, y=40.

Appendix Table 10.2.3.2 ECONOMIC COST PER TRAIN-MILE

Item	Service	Cost
Depreciation	730 trips/yr per train (95 ml/Prome-Kyangin)	1576.59 ÷ 730 ÷ 95 = 0.02273 = 22.73 K/ml-train
Maintenance	165.63	165.63 ÷ 730 ÷ 95 = 2.39 K/ml-train
Crew	19200 Kyat/crews	19200 ÷ 730 ÷ 95 = 0.277 K/ml-train
Fuel	HSD Engine-oil	9.10 K/ml-train 0.91 K/ml-train
Overhead	20% to be added	35.41 x 0.20 = 7.08
Total		42.48 K/ml-train

Total cost per seat per mile	42.48 x 2/3 ÷ 640	= 0.044 K/seat-ml
Total cost per ton per mile	42.48 x 1/3 ÷ 60	= 0.236 K/capacity-ton-ml

Appendix Table 10.3.3.1 SERVICE RATIOS WITHOUT PROJECT BRIDGE

Year	Loading Capacity			Users 1)			Service Ratio		
	Pass.	Tons	Veh.	Passengers	Tons	Vehicles	d/a	e/b	f/c
	a	b	c	d	e	f	g	h	i
1985/86	18,228	1,053	349	13,754	790	275	0.75	0.75	0.79
86				14,442	830	289	0.79	0.79	0.83
87				15,163	871	303	0.83	0.83	0.87
88				15,921	915	318	0.87	0.87	0.92
89				16,718	960	334	0.92	0.92	0.96
90				17,554	1,008	351	0.96	0.96	1.01
91				18,432	1,059	369	1.01	1.01	1.06
92				19,353	1,112	387	1.06	1.06	1.11
93				20,321	1,167	406	1.11	1.11	1.17
94				21,337	1,226	427	1.17	1.17	1.22
95				22,404	1,287	448	1.23	1.23	1.28
96	29,160	1,675	583	23,524	1,351	470	0.81	0.81	0.81
97				24,700	1,418	494	0.85	0.85	0.85
98				25,935	1,490	519	0.89	0.89	0.89
99				27,232	1,564	544	0.93	0.93	0.93
2000				28,594	1,642	572	0.98	0.98	0.98
01				29,881	1,716	598	1.03	1.03	1.03
02				31,226	1,793	625	1.08	1.08	1.07
03				32,631	1,874	653	1.12	1.12	1.12
04				34,099	1,958	682	1.17	1.17	1.17
05				35,634	2,046	713	1.22	1.22	1.22
06	40,092	2,297	817	37,237	2,138	745	0.93	0.93	0.91
07				38,913	2,235	778	0.97	0.97	0.95
08				40,664	2,335	813	1.01	1.02	1.00
09				42,494	2,440	850	1.06	1.06	1.04
10				44,406	2,550	888	1.10	1.11	1.09
11				46,404	2,665	928	1.16	1.16	1.13
12				48,492	2,785	970	1.21	1.21	1.18
13	51,024	2,919	1,051	50,675	2,910	1,013	1.01	1.00	0.96
14				52,955	3,041	1,059	1.04	1.04	1.01
15				55,338	3,178	1,106	1.08	1.09	1.05
16				57,828	3,321	1,156	1.13	1.14	1.10
17				60,430	3,470	1,208	1.18	1.19	1.15
18	61,956	3,541	1,288	63,149	3,626	1,262	1.02	1.02	0.98
19				65,991	3,789	1,319	1.07	1.07	1.02
20				68,961	3,960	1,378	1.11	1.12	1.07
21				72,064	4,138	1,440	1.16	1.17	1.12
22				75,307	4,324	1,505	1.22	1.22	1.17

Appendix Table 10.3.3.2 SERVICE RATIOS WITH PROJECT BRIDGE

Year	Loading Capacity			Users			Service Ratio		
	Pass B	Cargo	Z-craft	Passengers	Cargo	Vehicles	Pass B	Cargo B	Z-craft
	a	b	c						
1993/94	18,228	1,053	349	17,676	808.6	246	0.97	0.77	0.70
94				18,560	849.0	258	1.02	0.81	0.74
95				19,488	891.5	271	1.07	0.85	0.78
96				20,462	936.1	284	1.12	0.89	0.81
97				21,485	982.9	299	1.18	0.93	0.86
98	29,160			22,560	1,032.0	314	0.77	0.98	0.90
99				23,687	1,083.6	330	0.81	1.03	0.95
2000				24,872	1,137.8	346	0.85	1.08	0.99
01				25,991	1,189.0	362	0.89	1.13	1.04
02				27,161	1,242.5	377	0.93	1.18	1.08
03				28,383	1,298.4	395	0.97	1.20	1.13
04		1,675	583	29,660	1,356.8	413	1.02	0.81	0.71
05				30,995	1,417.9	431	1.06	0.85	0.74
06				32,390	1,481.7	450	1.11	0.88	0.77
07				33,847	1,548.3	471	1.16	0.92	0.81
08				35,370	1,618.0	492	1.21	0.97	0.84
09	40,092			36,962	1,690.8	514	0.92	1.01	0.88
10				38,625	1,767.0	537	0.96	1.05	0.92
11				40,364	1,846.5	561	1.01	1.10	0.96
12				42,180	1,929.6	587	1.05	1.15	1.00
13				44,078	2,016.4	613	1.10	1.20	1.05
14		2,297	817	46,062	2,107.1	641	1.15	0.91	0.78
15				48,134	2,202.0	670	1.20	0.96	0.82
16	51,024			50,300	2,301.0	700	0.99	1.00	0.85
17				52,564	2,404.6	731	1.03	1.05	0.89
18				54,929	2,512.8	764	1.08	1.09	0.94
19				57,401	2,625.9	799	1.12	1.14	0.98
20				59,984	2,744.1	834	1.18	1.19	1.02
21	61,956	2,919		62,683	2,867.5	872	1.01	0.98	1.07
22				65,504	2,996.5	911	1.06	1.03	1.11

To Appendix Tables 10.3.3.1 - 10.3.3.2

Notes : 1) Without Project, users in 1993.

- 1 Passengers on passengers boats

  13,754 (in 1985) x 1.05^8 (traffic growth) =
  20,321 (in 1993)

  The above figure excludes those carried by Z-crafts.

- 2 Cargoes in tons on boats

  790 (in 1985) x 1.05^8 (traffic growth) =
  1,167 (in 1993)

- 3 Vehicles on Z-crafts

  275 (in 1985) x 1.05^8 (traffic growth) =
  406 (in 1993).

2) With Project in 1993.

- 1 Passengers on passenger boats

  According to the study, the share of PB and Z-crafts is 0.7 and 0.3 respectively. The followings are estimated.

  Total 28,944 x 0.7 = 20,231

  Diverted 3,819 x 0.7 = 2,555

  20,231 - 2,555 = Remaining 17,676 persons.

- 2 Cargo in tons on boat

  Total 1,167 - Diverted 358.5 = Remaining 808.6 tons

- 3 Vehicles on Z-crafts

  Total 406 - Diverted 140 = Remaining 140 vehicles.

Appendix Table 10.3.3.3 SAVINGS IN FERRY COST

(In '000 Kyat)

Year	Without Project		With Project			Savings in Balance (W/O)-(W)
	Ferries	Op.Cost	Pass.Boats	Cargo boats Z-crafts	Op.Cost	
1993/4						0
94						0
95						0
96	23,427	4,994				28,421
97		4,994				4,994
98		4,994	4,246		2,674	-1,926
99		4,994			2,674	2,320
2000		4,994			2,674	2,320
01		4,994			2,674	2,320
02		4,994			2,674	2,320
03		4,994			2,674	2,320
04		4,994		19,181	4,994	-19,181
05		4,994			4,994	0
06	23,427	9,988			4,994	28,421
07		9,988			4,994	4,994
08		9,988			4,994	4,994
09		9,988	4,246		7,668	-1,926
10		9,988			7,668	2,320
11		9,988			7,668	2,320
12		9,988			7,668	2,320
13	23,427	14,982			7,668	30,741
14		14,982		19,181	9,988	-14,187
15		14,982			9,988	4,994
16		14,982	4,246		12,622	-1,886
17		14,982			12,622	2,360
18	23,427	19,976			12,622	30,781
19		19,976			12,622	7,354
20		19,976			12,622	7,354
21		19,976	4,246	2,123	16,632	-907
22		19,976			16,632	3,344

Notes : 1) Economic cost of additional ferry boats

- 1 Passenger boats

  6,337,000 x 2/3 = 4,246,000 K.

- 2 Cargo boat cost is assumed at half of passenger boats. The estimate is as follows:

  Average loading capacity of a passenger boat is equal to 3.5 tons in terms of cargo. Since the number of trips of river crossing per day is 603 in average, its loading capacity is 603 trips x 3.5 = 2,100 tons. Assuming the capacity and the cost of cargo carrying boats at half of the above 2,100 tons, the cargo carrying capacity is 1,050 tons/day, and the cost is 4,246,000 x 0.5 = 2,123,000 K.

- 3 Z-crafts

  The total cost of Z-crafts currently in operation is estimated at 25,460,000 K.

  25,460 x 0.67 = 17,058,000 K.

2) Economic cost of additional ferry operation per year

- 1 Passenger boats

  Maintenance and wages, 1,856,000 x 0.67 = 1,256,424 K

  Fuel, 365 x 5,796 x 0.67 = 1,417,412 K,

  Total 2,673,836 K.

- 2 Cargo boats

  Half of passenger boats, Total 1,336,918 K.

- 3 Z-crafts

  Maintenance, 217,750 x 0.67 = 145,893 K

  Wages 437,000 x 0.67 = 292,991 K

  Fuel 365 x 2,228 x 0.67 = 544,857 K,

  Total 983,741 K.

Appendix Table 10.5.2 ECONOMIC COST OF FUEL IN CONSTRUCTION WORK

	Item	Consumption in '000 gal	Gov.Price K/gal 1)	Financial Cost ('000)	Econ.Price K/gal 2)	Econ.Cost ('000)
I.	P.C. Bridge					
	Gasoline	6.2	3.50	21.7	8.31	51.5
	Diesel	818.4	2.60	2,127.8	7.72	6,318.1
	Engine Oil	10.0	24.00	240.0	29.00	290.0
	Other Oils	5.9	L.S.	224.1	L.S.	672.3
	Total	839.4	-	2,613.6	- (Adjustment + 4.7 million K)	7,331.8
II.	Steel Truss Bridge					
	Gasoline	4.4	3.50	15.4	8.31	15.4
	Diesel	597.1	2.60	1,552.4	7.72	4,609.6
	Engine Oil	7.3	24.00	175.2	29.00	211.7
	Other Oils	4.4	L.S.	173.8	L.S.	521.4
	Total	613.2	-	1,916.8	- (Adjustment + 3.4 million K)	5,358.1

(March 1986).

Notes: 1) By C.C.
2) Refer to Appendix Table 10.2.2.5.

Appendix Table 10.5.3 ECONOMIC COST OF PERSONNEL

(In Kyat '000, 1985/86 prices)

Item	Net cost	Econ.cost	
PC Bridge			
Engineers Fore. & Loc.	55,246	55,246	
Skilled Loc.	8,067	8,067	
Labour	1,226	820	(Assessed at 2/3 Adjustment
Total	64,539	64,133	-0.4 million kyat)
Steel Truss			
Engineers Fore. & Loc.	58,376	58,376	
Skilled Local	6,562	6,562	
Labour	1,890	1,260	(Assessed 2/3 Adjustment
Total	67,800	67,200	-0.6 million kyat)

Appendix Table 10.5.4 1) ROAD BRIDGE: BENEFITS

(Kyat '000)

	(1) Diverted	(2) Induced	(3) Ferries	(4) (1)-(3) Total	(5) Dev.B	(6) G.Total
1993	14,493	3,369	-	17,862	2,047	19,909
94	15,218	3,537		18,755	4,094	22,849
95	15,979	3,714	-	19,693	6,141	25,834
96	16,777	3,900	3,421	24,098	8,188	32,286
97	17,616	4,095	4,994	26,705	10,235	36,940
98	18,497	4,300	-1,926	20,871	12,282	33,153
99	19,422	4,515	2,320	26,257	14,329	40,586
2000	20,393	4,741	2,320	27,454	16,376	43,830
01	21,311	4,954	2,320	28,585	17,113	45,698
02	22,370	5,177	2,320	29,867	17,883	47,750
03	23,272	5,410	2,320	31,002	18,688	49,690
04	24,319	5,653	-19,181	10,791	19,529	30,320
05	25,413	4,908	0	31,321	20,407	51,728
06	26,557	6,174	28,421	32,731	21,326	54,057
07	27,752	6,451	4,994	39,197	22,285	61,482
08	29,001	6,742	4,994	40,737	23,288	64,025
09	30,306	7,045	-1,926	35,425	24,336	59,761
10	31,670	7,362	2,320	41,352	25,431	66,783
11	33,095	7,692	2,320	43,108	26,576	69,684
12	34,584	8,040	2,320	44,944	27,772	72,716
13	36,140	8,401	20,741	65,282	29,021	94,303
14	37,767	8,779	-14,187	32,359	30,327	62,686
15	39,466	9,175	4,994	53,635	31,692	85,327
16	41,242	9,587	1,886	48,943	33,118	82,061
17	43,098	10,019	2,360	55,477	34,609	90,086
18	45,038	10,470	30,781	85,866	36,166	122,032
19	47,064	10,941	7,354	65,359	37,794	103,153
20	49,182	11,433	7,354	67,969	39,494	107,463
21	51,395	11,948	-907	62,436	41,271	103,707
22	53,708	12,485	3,344	69,537	43,128	112,665

Appendix Table 10.5.4 2) RAIL-CUM-ROAD BRIDGE: BENEFITS

(Kyat '000)

	(1) Diverted	(2) Induced	(3) Ferries	(4) (1)-(3) Total	(5) Dev.B	(6) G.Total
1993	16,101	3,737		19,838	2,353	22,191
94	16,906	3,924		20,830	4,707	25,537
95	17,751	4,120		21,871	7,061	28,932
96	18,639	4,326	28,421	51,386	9,415	60,801
97	19,571	4,542	4,994	29,107	11,768	40,875
98	20,549	4,769	-1,926	23,292	14,122	37,414
99	21,577	5,008	2,320	28,905	16,475	45,380
2000	22,656	5,258	2,320	30,234	18,829	49,063
01	23,676	5,495	2,320	31,491	19,676	51,167
02	24,741	5,742	2,320	32,803	20,562	53,365
03	25,854	6,000	2,320	34,174	21,487	55,661
04	27,018	6,270	-19,181	14,107	22,454	36,561
05	28,232	6,552	0	34,785	23,464	58,249
06	29,504	6,847	28,421	64,772	24,520	89,292
07	30,832	7,155	4,991	42,981	25,624	68,605
08	32,219	7,477	4,994	44,690	26,777	71,467
09	32,669	7,814	-1,926	39,557	27,981	67,538
10	35,184	8,166	2,320	45,670	29,241	74,911
11	36,767	8,533	2,320	47,620	30,557	78,177
12	38,422	8,917	2,320	49,659	31,932	81,591
13	40,151	9,318	30,741	80,210	33,369	113,579
14	41,958	9,738	-14,187	37,509	34,870	72,379
15	43,846	10,176	4,994	59,016	36,439	95,455
16	45,819	10,634	1,886	58,339	38,079	96,418
17	47,881	11,112	2,360	61,353	39,792	101,145
18	50,036	11,612	30,781	92,429	41,583	134,012
19	52,287	12,135	7,354	71,776	43,455	115,231
20	54,640	12,681	7,354	74,675	45,410	120,085
21	57,099	13,251	-907	69,443	47,453	116,896
22	59,668	13,848	3,344	76,860	49,589	126,449

Appendix Table 10.5.5 ECONOMIC COST AND BENEFIT STREAMS

ROAD BRIDGE
P.C. box girder

Year	Cost	Ben.
1987	8600	0
1988	143000	0
1989	82600	0
1990	125400	0
1991	85800	0
1992	115400	0
1993	0	19909
1994	0	22849
1995	0	25834
1996	0	57286
1997	0	36940
1998	0	33153
1999	0	40586
2000	0	43830
2001	0	45698
2002	0	47750
2003	800	49690
2004	0	30320
2005	0	51728
2006	0	54057
2007	0	61482
2008	0	64025
2009	0	59761
2010	0	66781
2011	0	69684
2012	0	72716
2013	800	104303
2014	0	62686
2015	0	85327
2016	0	82061
2017	0	90086
2018	0	122032
2019	0	103153
2020	0	107463
2021	0	103707
2022	-280400	112665
TOTAL	282000	1927560

I.R.R. ..... 6.8 %
B/C ratio(i=10%) 0.61
P.W.(i=10%) K-164 Mil.

RAIL-CUM-ROAD BRIDGE
Steel single deck truss

Year	Cost	Ben.
1987	8600	0
1988	147900	0
1989	160700	0
1990	174100	0
1991	103200	0
1992	114000	0
1993	0	22191
1994	0	25537
1995	0	28932
1996	0	60801
1997	0	40875
1998	0	37414
1999	0	45380
2000	0	49063
2001	0	51167
2002	0	53365
2003	7200	55661
2004	0	36561
2005	0	58249
2006	0	89292
2007	0	68605
2008	0	71467
2009	0	67538
2010	0	74911
2011	0	78177
2012	0	81591
2013	7200	113579
2014	0	72379
2015	0	95455
2016	0	96418
2017	0	101145
2018	0	134012
2019	0	115231
2020	0	120085
2021	0	116896
2022	-354200	126449
TOTAL	368700	2188430

I.R.R. ..... 6.4 %
B/C ratio(i=10%) 0.57
P.W.(i=10%) K-232 Mil.