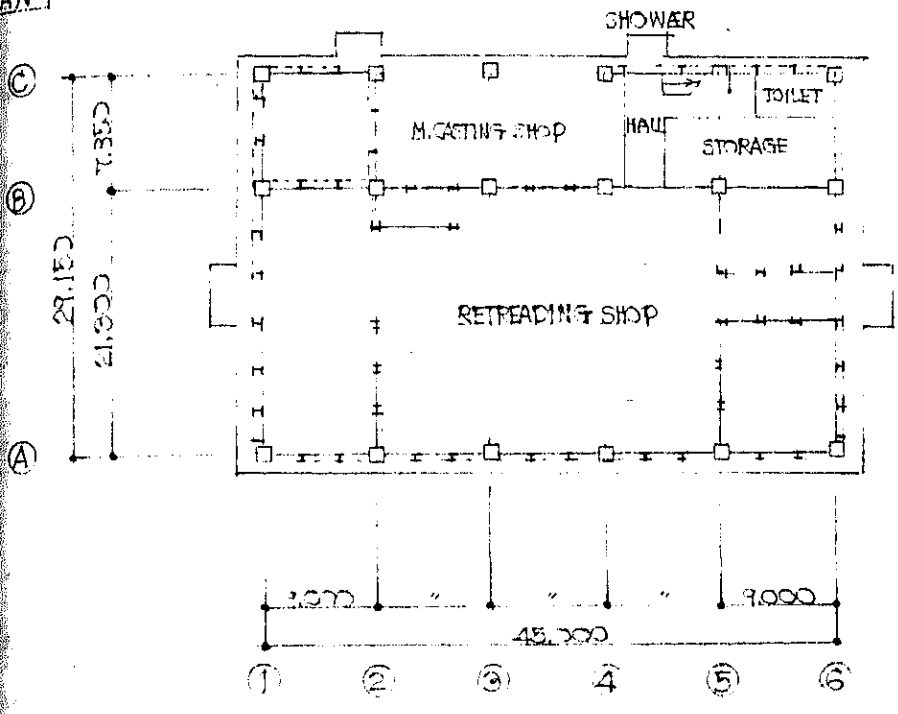
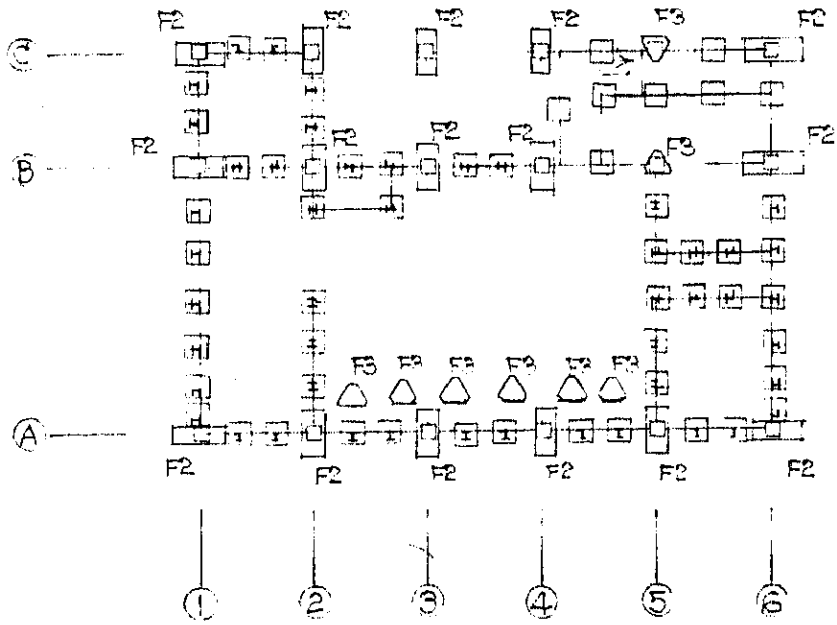
I5 RETREADING & METAL CASTING FACTORY

...ADING & METAL CASTING FACTORY

...LAN



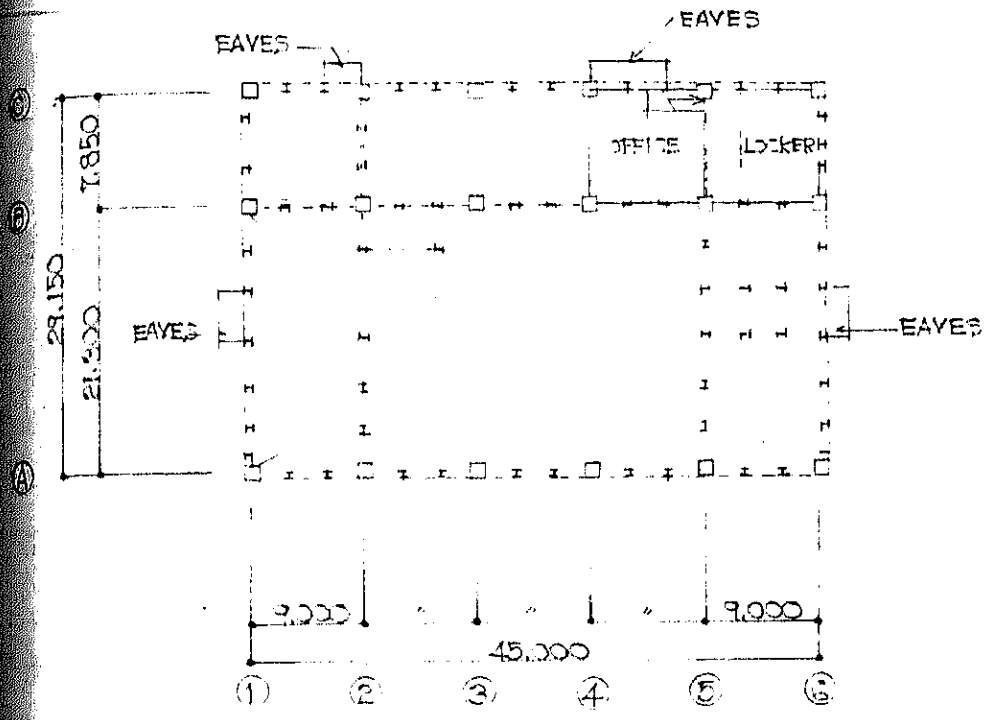
KEY PLAN



□ : F1

— : F2&3

PLAN



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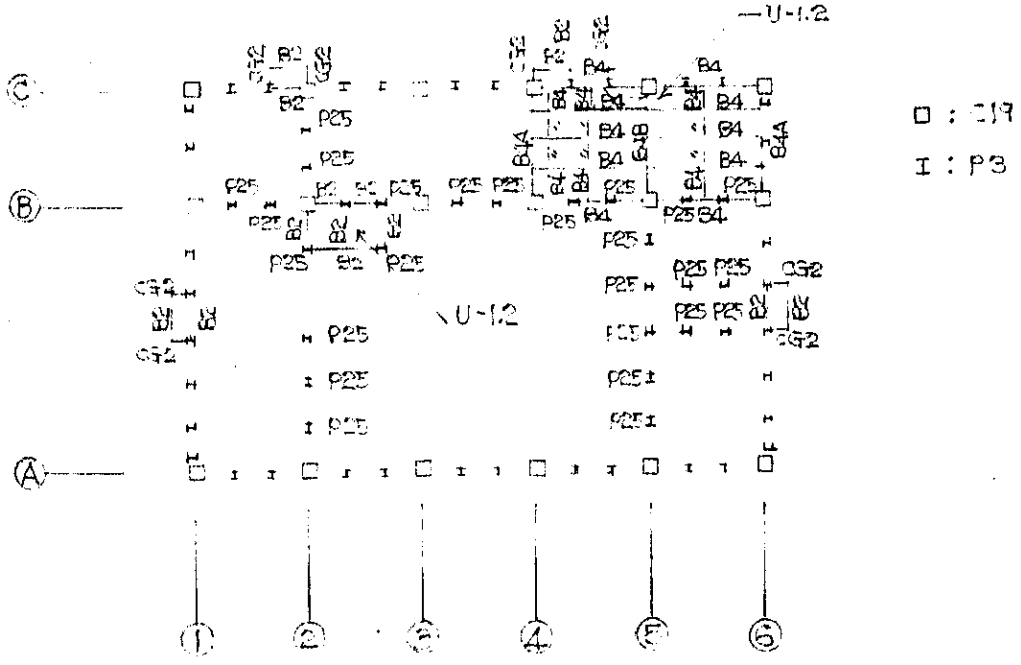
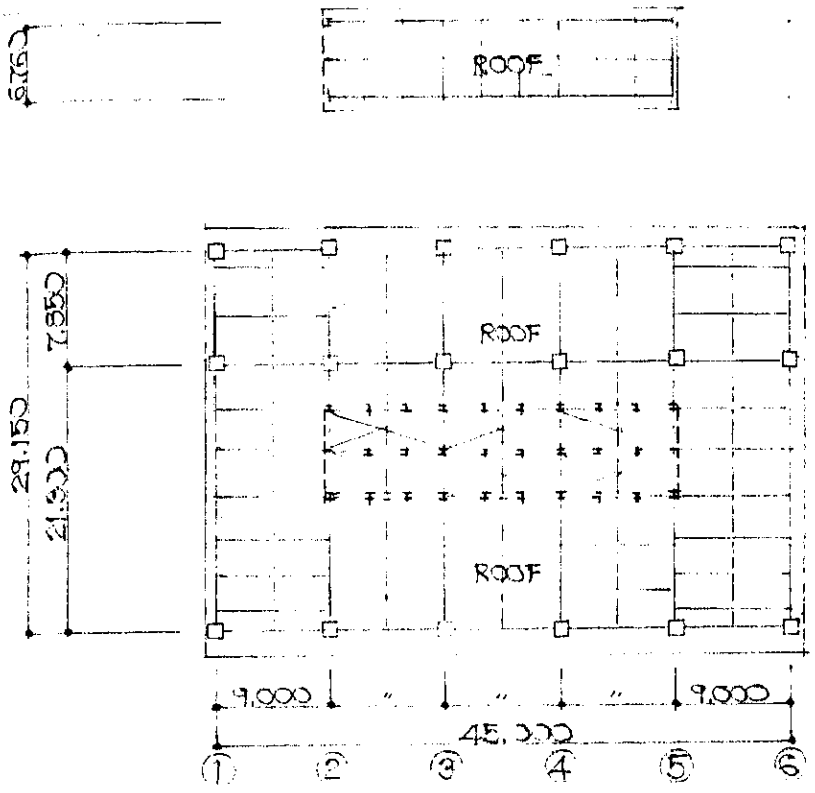
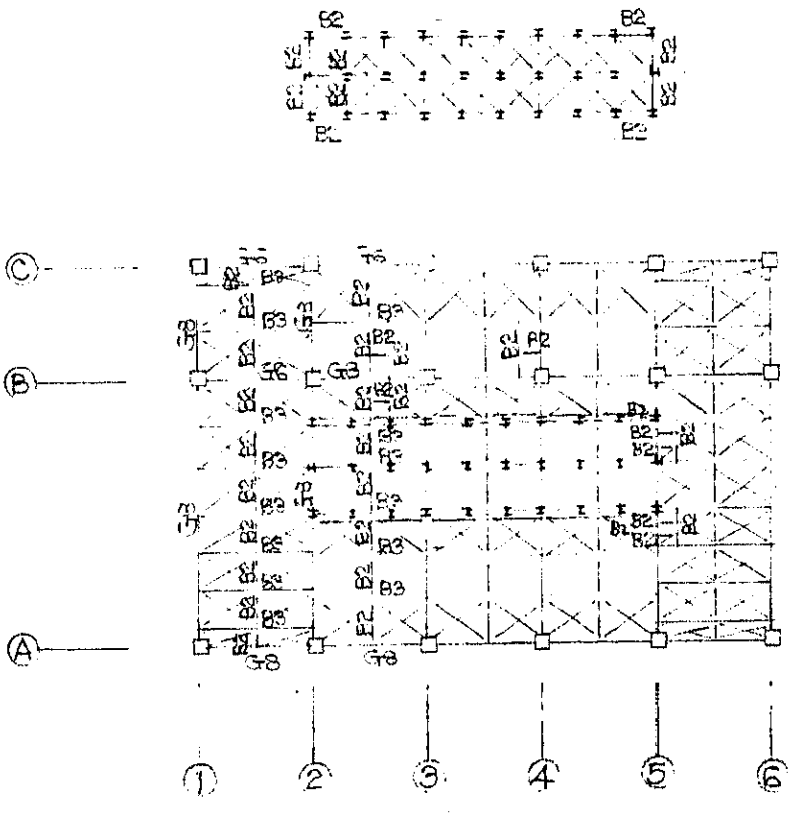


PLAN

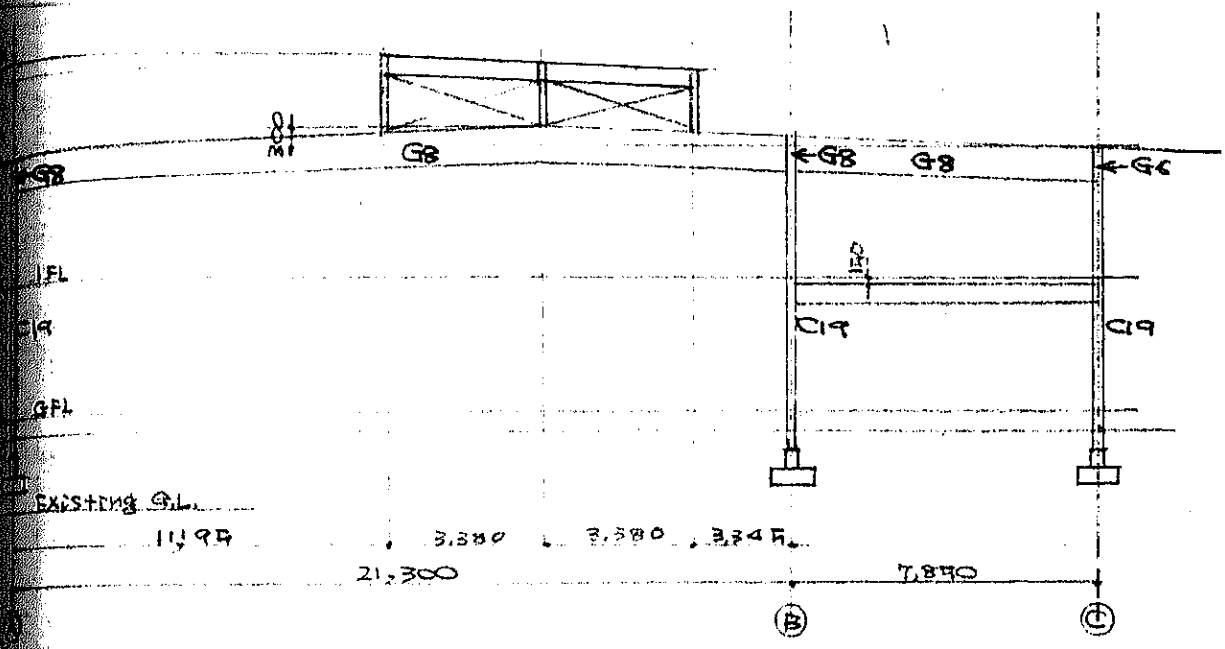


KEY PLAN



1 : P1

Spreading & Metal Casting Factory — Section



Unit Load

Floor

	D. L.			L. L.	T. L.
	Shell type roof	0.02	S, B	0.09	0.11 (0.15)
			G, C, F	0.07	0.09 (0.13)
	Ceiling	(0.04)	K	0.03	0.05 (0.09)
		0.02 (0.06)			
	Finish	0.15	S, B	0.30	0.51
	Deck	0.02	G, C, F	0.18	* 0.39
	Ceiling	0.04	K	0.08	0.29
		0.21			
				* With Above Ceiling	0.43
	Step	0.06	S, B	0.30	0.40
	String	0.04	G, C, F	0.18	0.28
			K	0.08	0.18
		0.10			

Beam

	t/m			t/each						
	Skeleton	Finish	Σ	ℓ						
G9	0.25	0	0.25							
G5	0.15	0	0.15							
G1	0.05	0	0.05							
G1 G5 G9	1.26	0	1.26							

Column

	t/m			t/each						
	Skeleton	Finish	Σ							
□ 60	0.20	0	0.25							
□ 50	0.15	0	0.15							
	0.05	0	0.05							

Wall

	t/m2			t/m						
	Skeleton	Finish	Σ							
	0.01	0.01	0.02							
	0.01	0.07	0.08							
	0.01	0.04	0.05							
	0.49	0.11	0.60							

Pressure

Velosity of Wind

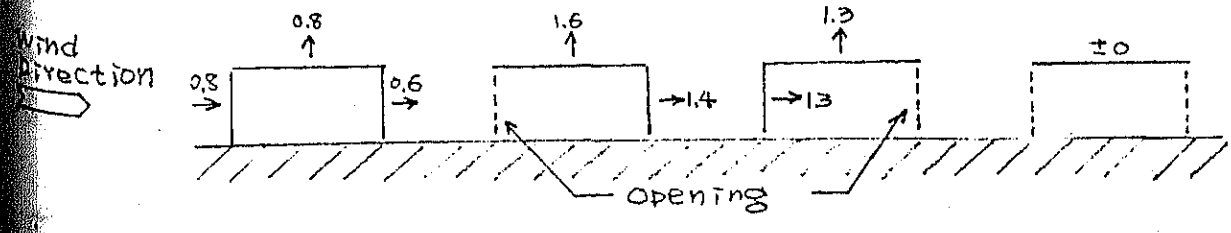
Cyclone 130 Miles/Hour = 130 × 1609.34/3,600
= 58.1 m/sec
→ 60.0 m/sec (h = 15 m)

(In 1970, At chittagon, recorded
103 m.p.h. = 46.0 m/sec)

Velosity Pressure $q = \frac{1}{2}\rho V^2 = \frac{1}{2} \times \frac{1}{8}\left(60\sqrt{\frac{h}{15}}\right)^2$
$= 60\sqrt{h}$

Block	Surface		$\bar{h}$ [m]	$60\sqrt{h}$	q [kg/m²]	cq [kg/m²]
Heavy Repair Factory	Monitor Roof	Roof	12.7	214	270	
		Wall				
		Roof	10.5, 6.9	194, 158	200, 160	
		Wall			140, 120	
Parts Storage	Monitor Roof	Roof	9.39 – 9.29	184 – 183	180	
		Wall				
		Roof	7.36 – 7.00	163	160	
		Wall			120	
Inspection Factory	Monitor Roof	Roof				
		Wall				
		Roof	7.20 – 7.00	161	160	
		Wall			120	
Periodical Repair Factory	Monitor Roof	Roof	9.33 – 9.23	183	180	
		Wall				
		Roof	7.23 – 7.00	161	160	
		Wall			120	
Paint & Body Factory	Monitor Roof	Roof	9.41 – 9.31	184	180	
		Wall				
		Roof	9.31 – 7.00	162	160	
		Wall			120	
Retreading & Metal Casting Factory	Monitor Roof	Roof	9.45 – 9.30	184	180	
		Wall				
		Roof	9.30 – 7.00	162	160	
		Wall			120	

Coefficient of Wind Pressure



	C1		C2		C4		C5	
S								
G,B								
C								
W								
M								
W.L.								
M'								
S	0.09 × 38.1	3.4	× 62.3	5.6	×]		×]	
G,B	0.15 × 8.4	1.3	× 12.9	1.9	×	=C2	×	=C2
C	0.05 × 11.6	0.6	× 18.9	0.9	×		×	
FG	1.26 × 6.7	1.0	× 6.7	1.0	×	9.4	×	9.4
W	1.26 × 2.0	2.5	× 4.2	5.3	× 9.0	11.3	× 9.0	11.3
	0.00 × 0	0	× 0	0	× 13.0	1.0	× 13.0	1.0
	0.05 × 10.4	0.5	× 52.2	2.6	× 45.1	2.3	× 29.7	1.5
	0.60 × 3.0	1.8	× 6.4	3.8	× 13.1	7.9	× 26.1	15.7
Σ		11.1		21.1		31.9		38.9
W.L.	-0.20 × 38.1	-7.6	× 62.3	-12.5	× =C2	-12.5	× =C2	-12.5
Σ'		3.6		8.6		19.4		26.4
S					0.43 × 17.7	7.6	× 35.3	15.2
G,B					0.05 × 19.2	0.8	× 26.4	1.3
C								
W								
M					40.3	8.4	55.4	16.5
W.L.						0		0
Σ'					27.8	8.4	42.9	16.5

	C6		B1		B2		B4	
S					0.09 × 48.2	4.3	-× 78.8	7.1
G,B					0.05 × 23.6	1.2	× 40.5	2.0
C					0.05 × 2.1	0.1	× 2.1	0.1
W					0.00 × 0	0	× 0	0
					0.09 × 14.3	1.1	× 0	0
					0.05 × 18.9	0.9	× 37.8	1.9
Σ					7.6	7.6	11.1	11.1
W.L.					-0.21 × 48.2	-10.1	× 78.8	-16.5
Σ'					-2.5	-2.5	-5.4	-5.4
S	0.09 ×]		× 80.2	7.2	× 100.8	9.1	× 65.4	5.9
G,B	0.15 ×	=C1	× 19.1	2.9	× 23.6	3.5	×]	=B2
C	0.05 ×		× 18.0	0.9	× 31.5	1.6	×	6.1
FG	0.15 ×		× 5.7	1.0	× 6.7	1.0	×	
W	1.26 × 5.0	6.3	× 4.9	6.2	× 0	0	× 0	0
	0.00 × 0	0	× 0	0	× 0	0	× 0	0
	0.05 × 0	0	× 7.8	0.6	× 34.8	2.8	× 17.9	1.4
	0.05 × 22.1	1.1	× 27.0	1.4	× 6.4	0.3	× 3.0	0.2
	0.60 × 16.4	9.8	× 10.1	6.1	× 10.1	6.1	× 6.6	4.0
Σ		23.5		26.3	32.0	24.4	28.7	17.6
W.L.	-0.20 × 38.1	-7.6	× 80.2	-16.0	× 100.8	-20.2	× 65.4	-13.1
Σ'		15.9		9.7	1.7	4.2	-0.9	4.5
S	0.43 × 17.7	7.6					0.43 × 17.7	7.6
G,B	0.05 × 15.2	0.8					0.05 × 15.2	0.8
C								
W								
M		31.9	8.4				30.1	8.4
W.L.			0					0
Σ'		24.3	8.4				7.5	8.4

	BT		BG		A1		A2	
S	0.09 ×							
G,B	0.05 ×							
C	0.05 ×							
W	0.02 ×							
	0.08 ×							
	0.05 ×	=B2						
Σ		17.6	17.6					
W.L.	−0.21 ×	= B2	−10.1					
Σ'		−2.5	−2.5					
S	0.09 ×			×		× 79.1	6.8	× 122.9	11.1
G,B	0.15 ×			×		× 15.2	2.3	× 19.17	3.0
C	0.05 ×	=B2	15.2	×	=B1 12.0	× 19.15	1.00	× 37.5	1.9
FG	0.15 ×			×		× 6.17	1.00	× 6.17	1.0
W	1.26 ×	3.0	3.8	×	4.7 6.2	× 3.17	4.7	× 3.0	3.8
	0.02 ×	0	0	×	0 0	× 0	0	× 0	0
	0.08 ×	42.17	3.4	×	5.0 0.4	× 0	0	× 0	0
	0.05 ×	0	0	×	17.17 0.9	× 19.2	1.0	× 15.6	0.8
	0.60 ×	8.17	5.2	×	9.5 5.7	× 5.6	3.4	× 4.5	2.17
Σ		35.2	27.6		25.2 25.2		20.2 20.2		24.3 24.3
W.L.	−0.20 ×	= B2	−20.2	×	= B1 −16.0	× 79.1	−15.0	× 122.9	−24.6
Σ'		4.9	7.4		9.2 9.2		5.2 5.2		−0.3 −0.3
S	0.43 ×	38.3	16.2	×	17.7 7.6				
G,B	0.05 ×	26.4	1.3	×	15.2 0.8				
C									
W									
Σ		51.17	16.5		34.6 8.4				
W.L.			0		0				
Σ'		20.9	16.5		16.6 8.4				

	1P		2P		BP		C/B W	
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S								
G,B								
C								
FG								
W								
Σ								
W.L.								
Σ'								
S								
G,B								
C	0.05 ×	6.17	0.3	×	6.7 0.3	× 6.7	0.3	× 0	
FG	1.26 ×	3.4	4.3	×	3.9 4.9	× 3.0	3.8	× 1.0	1.3
W	0.02 ×	0		×	0	× 0		× 0	
	0.08 ×	0		×	20.4 1.6	× 0		× 0	
	0.05 ×	17.7	0.9	×	0	× 0		× 0	
	0.60 ×	5.1	3.1	×	5.9 3.5	× 8.7	5.2	× 1.5	0.9
Σ			8.6		10.3		9.3	[t/m]	2.2 2.2
W.L.									
Σ'									

[tm , t]

Load			C		Mo		Q	
9.0	(0.09×3.72)+0.20	q	0.535 × 9.0²/12	3.6	× 1/8	5.4	× 9.0/2	2.4
				3.6		5.4		2.4
9.0	-1.6×0.16×1.85 -0.8×0.08×2.22 -0.017×3.72	q	-0.786 × 9.0²/12	-5.3	× 1/8	-8.0	× 9.0/2	-3.5
				-5.3		-8.0		-3.5
	5.0 × 1/6	P	0.83 × 6.9/8	0.7	× 1/4	1.4	× 1/2	0.4
7.3			(0.7 × 1.5	1.1)				
				0.7		1.4		0.4
	(0.8~0.6×0.12)×3.38	q	0.324 × 6.9²/12 0.243	1.3 ~1.0	× 1/8	1.9 ~1.5	× 6.9/2	1.1 ~0.8
7.3			(1.3 1.0 × 1.5	2.0 1.5)				
				1.3 1.0		1.9 1.5		1.1 0.8

[tm, t]

Load			C		Mo		Q	
 21.0	(0.09 × 37.8 / 0.05 × 9.0)	P	0.917 × 21.0²/12	33.7	× 1/8	40.6	3.85 × 2.5	9.6
	3.85 × 5/21.0	q	0.20 × 21.0²/12	7.4	× 1/8	11.0	× 21.0/2	2.1
				41.1		61.6		11.7
 21.0	(−0.8 × 0.16 − 0.01) × 9.0	q	−1.152 × 21.0²/12	−42.3	× 1/8	−63.5	× 21.0/2	−12.1
				−42.3		−63.5		−12.1
 7.85	(0.09 × 35.3 / 0.05 × 9.0)	P	3.629 × 7.85/8	3.6	× 1/4	7.1	× 1/2	1.8
		q	0.20 × 7.85²/12	1.0	× 1/8	1.5	× 7.85/2	0.8
				4.6		8.6		2.6
 7.85	(−0.8 × 0.16 − 0.01) × 35.3	P	−6.994 × 7.85/8	6.9	× 1/4	13.7	× 1/2	3.5
				−6.9		−13.7		−3.5
 7.3	5.0 × 1/6	P	0.83 × 6.9/8	0.7	× 1/4	1.4	× 1/2	0.4
			(0.7 × 1.5	1.1)				
				0.7		1.4		0.4
 11.3	(0.8~0.6 × 0.12) × 2.94	q	0.282 / 0.212 × 6.9²/12	1.1 ~ 0.8	× 1/8	1.7 ~ 1.3	× 6.9/2	1.0 ~ 0.7
			(1.1 / 0.8 × 1.5	1.7 / 1.3)				
				1.1		1.7		1.0
				0.8		1.3		0.7

Seismic Force [t]

	W	K	KW	Q
0.05×27.5×8.76	12.0			
0.05×{(27.0×3)+(6.76×7)}	6.4			
0.05×2.25×18	2.0			
(0.08×14.52×2.25)+(0.05×45.0×2.25)	8.8			
$\bar{w}$ = 29.2/(27.0×6.76) = 0.16 [t/m²]	29.2	0.10	2.9	3.0
0.05×{(45.5×31.15)−(27.0×6.76)}	62.0			
0.15×{(45.0×3)+(29.15×6)}	46.5			
0.05×{(45.0×6)+(9.0×4)+(29.15×5)}	22.6			
0.15×7.0×18/2	9.5			
0.05×8.0×53/2	9.3			
(0.05×58.3×3.5)+(0.05×90.0×3.3)+(0.08×103.3×3.5)	54.9			
$\bar{w}$ = 204.8/(45.0×29.15) = 0.16 [t/m²]	204.8	〃	20.5	24.0
0.29×18.0×7.85	41.0		↓ 1/2	27.0
0.05×{(18.0×5)+(7.85×5)}	6.5			
0.08×7.85×3.3	2.1			
$\bar{w}$ = 49.6/(18.0×7.85) = 0.35 [t/m²]	49.6	〃	5.0	

Wind Force [t]

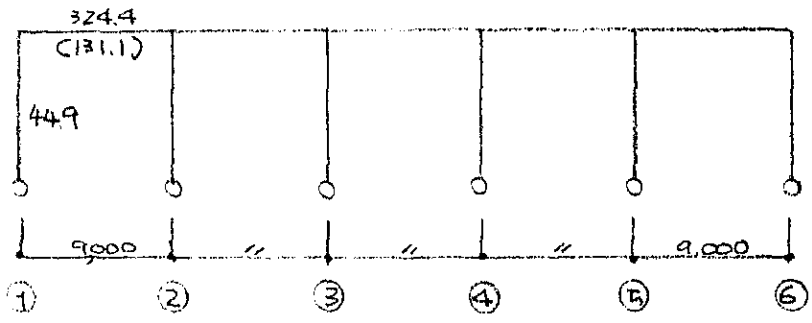
C	q	A	A	H	Q	Note
0.8+0.4	0.18	8.26×2.25	18.6	4.7	5.0	
〃	0.12	29.2×3.35	97.8	16.4	22.0	< K.L.
0.8+0.4	0.18	27.5×2.25	61.9	15.6	16.0	
〃	0.12	45.5×3.35	152.4	25.6	42.0	> K.L.

Stress Ratio

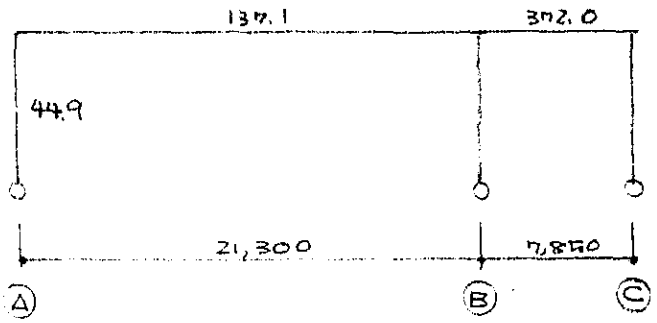
	J	ℓ/r	900	2130	785		630	
W14X26	292,000		324.4	137.1	372.0			
W12X20	118,000		131.1					
W10X19 ~W16	40,700 ~ 35,300						59.9 (X0.115=449)	

$$Je = \mu J_{max} = 0.20 + 0.80\sqrt[3]{\left(\frac{35,300}{40,700}\right)^2} J_{max} = 0.93\ J_{max}$$

(A)(B) (C) Frame

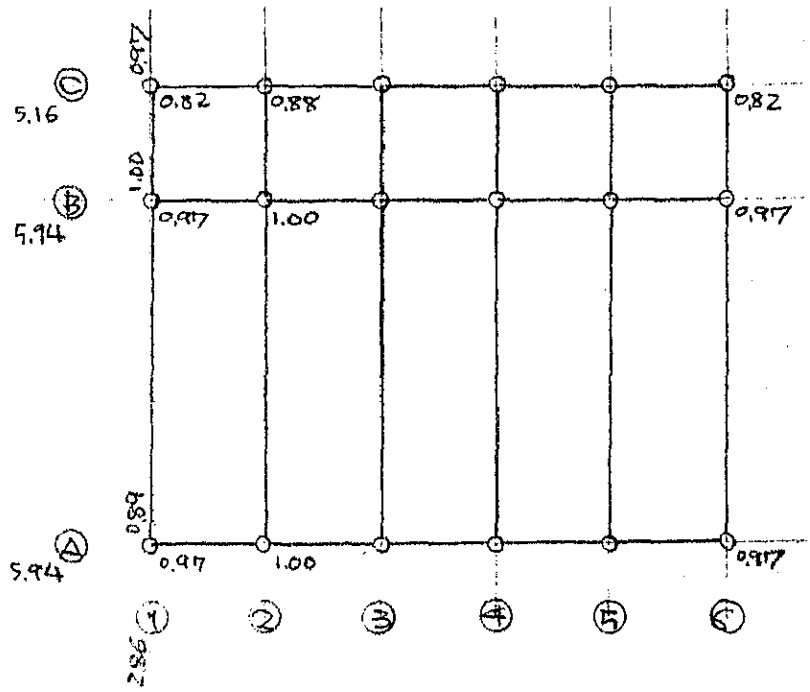


(5) Frame



...tribution Factor & Inflection Point

D									h	K.L.			W.L.		
ΣKb	K	a	D	D'	y_0	y_1	$y_{2,3}$	Σy		Q	MU	ML	Q	MU	ML
244	7.34	0.23	10.35	0.917	0			0	6.3	2.5	17.4	0	1.8	12.17	0
(331.1)			(8.77)	(0.82)											
(488)	14.68	0.24	10.69	1.00	0			0	//	2.6	17.9	0	1.9	13.1	0
(462.7)			(9.40)	(0.88)											
137.1	3.10	0.22	9.52	0.89	0			0	//	2.7	18.4	0	3.6	24.6	0
1109.1	16.04	0.24	10.72	1.00	0			0	//	3.0	20.7	0	4.0	27.6	0
372.0	8.42	0.24	10.43	0.917	0			0	//	2.9	20.1	0	3.9	26.8	0



Unit Stress

K.L.						W.L.					
Total			Ⓑ/⑤ Frame			Total			Ⓑ/⑤ Frame		
Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD
27.0	17.82	1.6	15.0	5.94	2.6	22.0	17.82	1.3	11.8	5.94	1.9
//	17.16	1.6	8.0	2.86	3.0	42.0	17.16	2.5	11.0	2.86	4.0

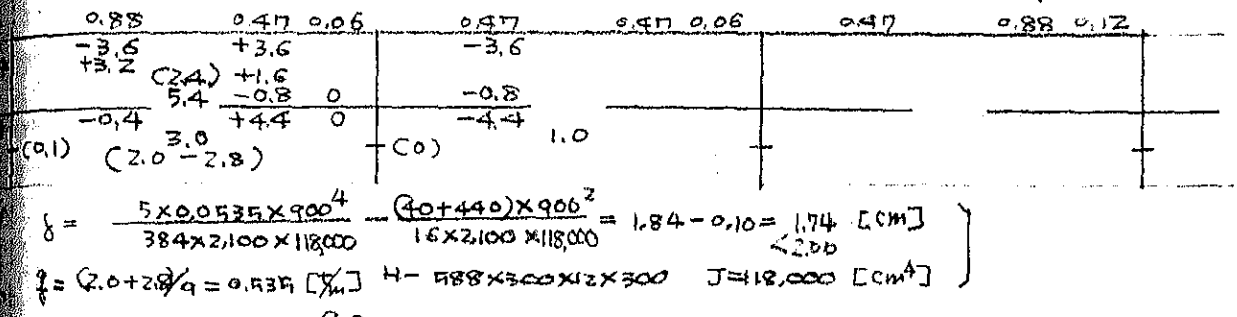
$(2.9/2)+(20.5/2)+2.5=14.2$
$(24.0/5)+(5.0/2)=7.3$

$(4.7+16.4)/2=10.6$
$(15.6/3)+(25.6/5)=10.3$

Deflection by Horizontal Force

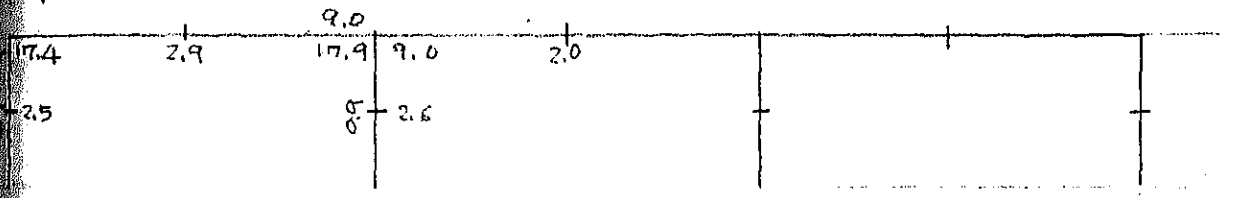
		Q	ΣD_{D_0}	$h_0^2/12Ek_0$	δ	δ/h_0	
K.L.	Σ	27.0	17.04×10.69	630²/12×2.100	2.33	1/270	
W.L.	Σ	22.0	〃	〃	1.96	1/331	
K.L.	Σ	27.0	17.16×10.72	〃	2.31	1/272	
W.L.	Σ	42.0	〃	〃	3.60	1/175	

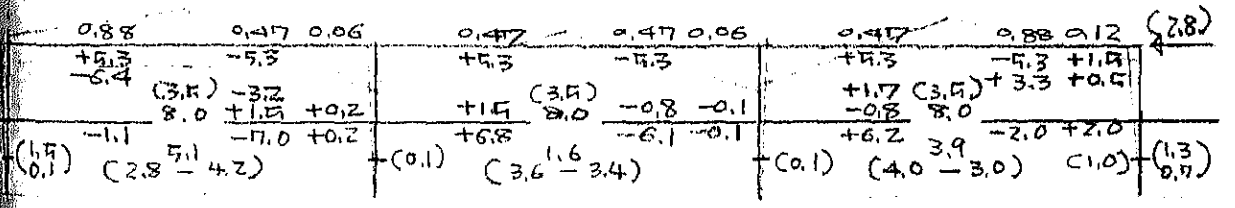
stress

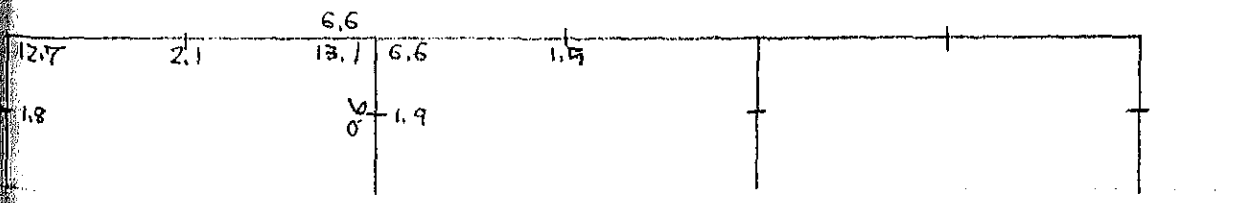


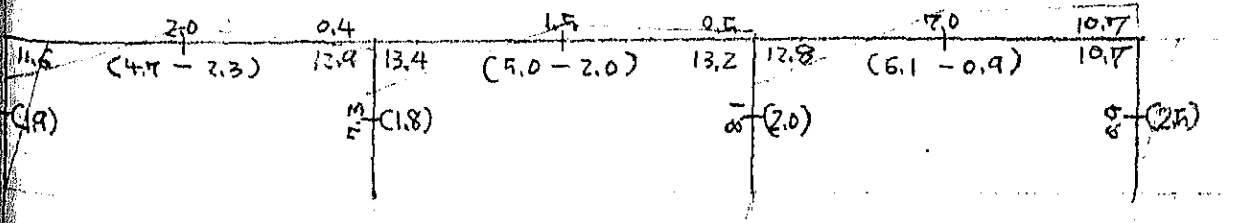
$$\delta = \frac{5\times0.0535\times900^4}{384\times2{,}100\times118{,}000} - \frac{(40+440)\times900^2}{16\times2{,}100\times118{,}000} = 1.84 - 0.10 = 1.74\ [cm] < 2.00$$

$$q = (2.0+2.8)/9 = 0.535\ [t/m] \qquad H-588\times300\times12\times300 \quad J=118{,}000\ [cm^4]$$

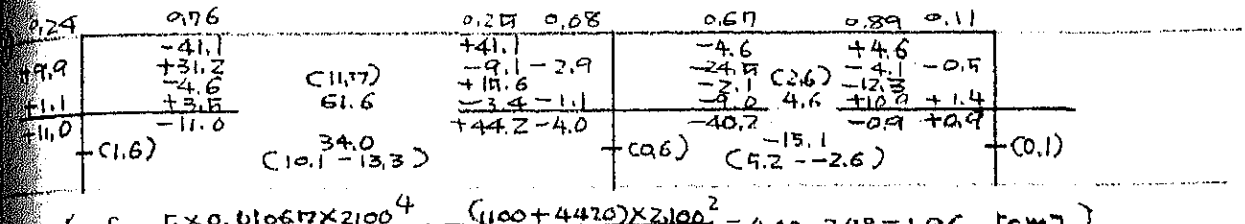






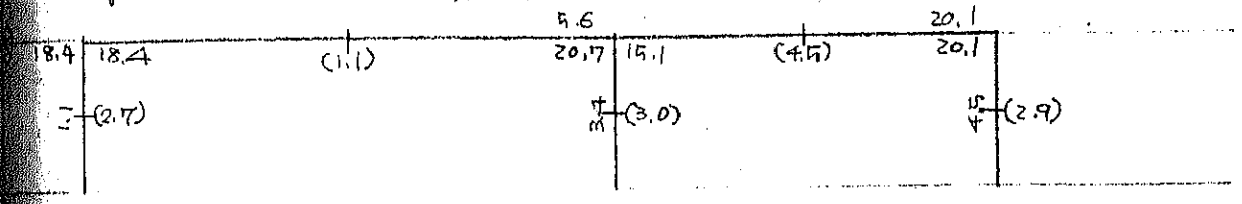


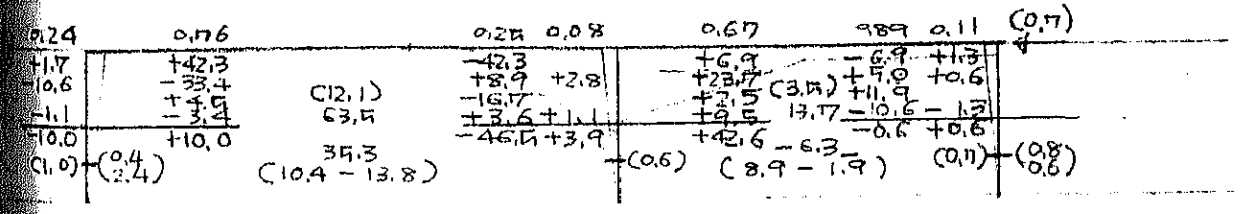
Frame

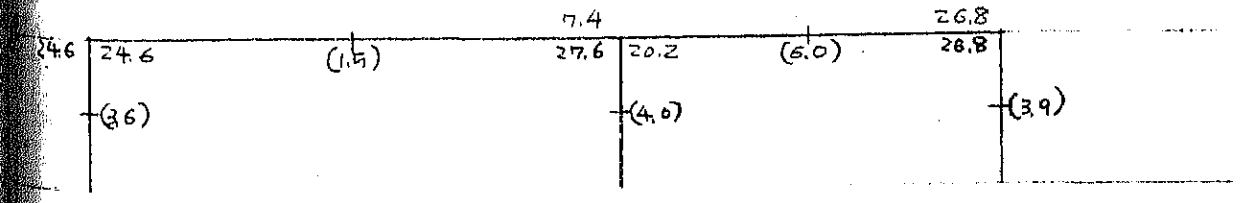


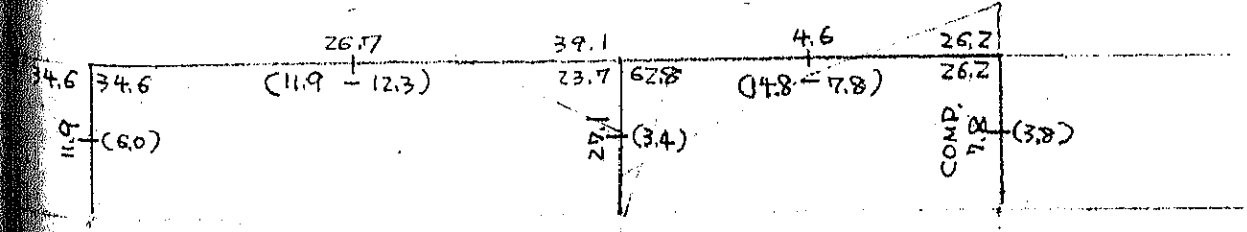
$$\delta = \frac{5\times 0.01617\times 2100^4}{384\times 2{,}100\times 292{,}000} - \frac{(1100+4420)\times 2{,}100^2}{16\times 2{,}100\times 292{,}000} = 4.40 - 2.48 = 1.96 \ [\text{cm}] < 2.00$$

$f = 11.77\times 2/21.0 = 1.114$ [t/cm], H-800×300×12×20, $J = 292{,}000$ [cm^4]

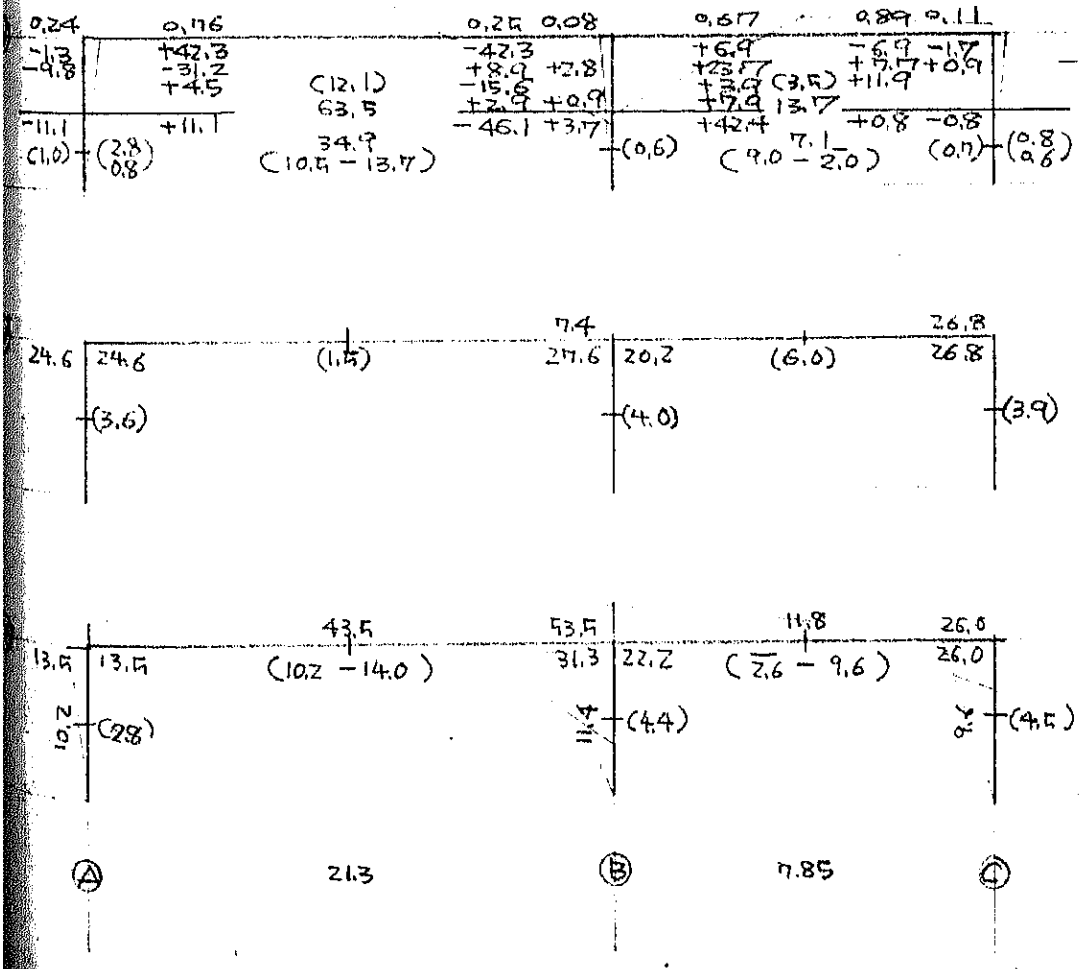


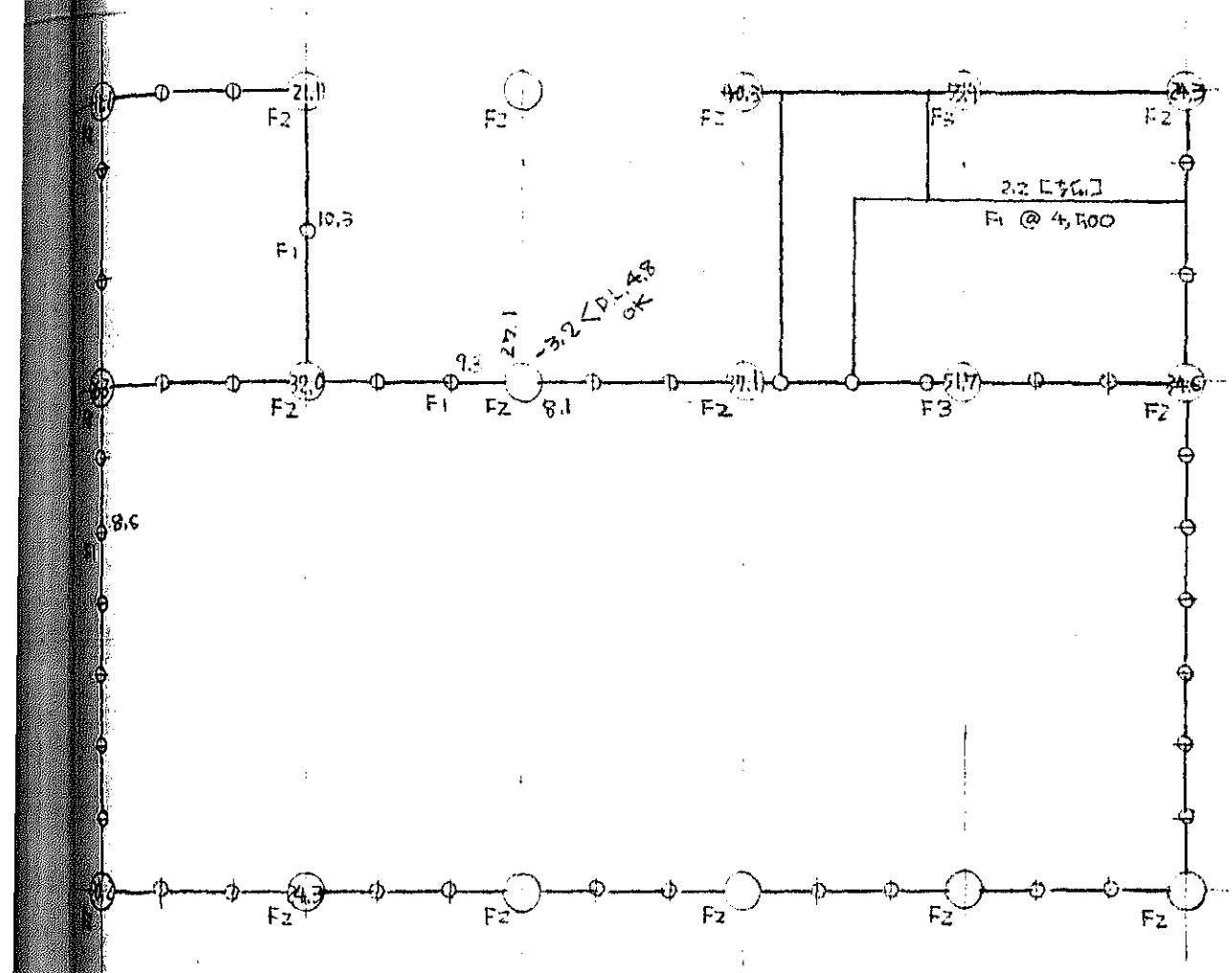






Ⓐ 21.3 Ⓑ 7.85 Ⓒ


0,24
0,176
0,25 0,08
0,617
0,89 0,11
-1,3
-9,8
+42,3
-31,2
+4,5
-42,3
+8,4 +2,8
-15,6
+2,9 +0,9
+6,9
+23,7
+3,9 (3,5)
+7,9 13,7
-6,9 -1,7
+5,7 +0,9
+11,9
-11,1
+11,1
-46,1 +3,7
+42,4
+0,8 -0,8
(1,0)
(2,8) 0,8
(12,1)
63,5
34,9
(10,5 - 13,7)
(0,6)
(9,0 - 17,1 - 2,0)
(0,7)
(0,8) 0,6
24,6
24,6
(1,5)
7,4
27,6
20,2
(6,0)
26,8
26,8
(3,6)
(4,0)
(3,9)
13,5
13,5
(10,2 - 14,0)
53,5
31,3
22,2
(2,6 - 9,6)
11,8
26,0
26,0
10,2
(2,8)
(4,4)
(4,5)
(A)
21,3
(B)
7,85
(C)


21.1
F2
F2
40.3
F2
F2
24.3
2.2 [56.3]
F1 @ 4,500
10.3
F1
-3.2 < DL 4.8 OK
9.3
27.1
30.0
F2
F1
F2
8.1
37.1
F2
51.7
F3
24.6
F2
8.6
24.3
F2
F2
F2
F2
F2

...n of Piling Footing

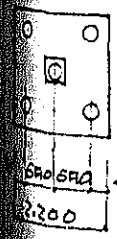
...2 (R 100%)

	L	R	ΔW	Re
	2,000	25	$0.9^2 \times 1.5 \times 2.0 = 2.4$	22.6
	〃	30	$1.05^2 \times$ 〃 $= 3.3$	26.7
	〃	35	$1.2^2 \times$ 〃 $= 4.3$	30.7

...1 (R 80%)

	L	R	ΔW	Re
	2,000	20	2.4	17.6
	〃	24	3.3	20.7
	〃	28	4.3	23.7

...= 300 Type



$Q_F = 22.6$ [t]

$M_F = 22.6 \times (0.65 - 0.275) = 8.5$ [t·m]

2D+Q 19.5 D 70 ϕ 5.43 [cm]

c_p 27.7 [cm] Q_{AL} 52.9 [t]

at 7.8 [cm²]

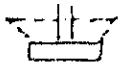
14-D13

For Lift Up

$W = 2.2^2 \times 1.5 \times 2.0 = 14.5$ [t]

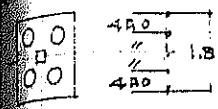
$\sim$

$(3.8^2 + 2.2^2)/2 \times 3.0 = 28.9$ [t]



t = 300 Type

2D+Q 14t D 45 j 32.4 [cm]



Q_F = 22.6 [t]

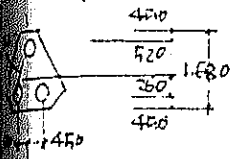
M_F = 22.6 × (0.45 − 0.27t) = 4.0 [t·m]

cp 46.1t Q_{AL} 23.5

act 0.6

+ 12 − D13

2D+Q→B=90 D 70 j 54.3



Q_F = 22.6

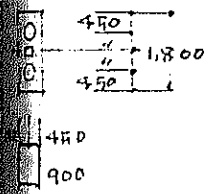
M_F = 22.6 × (0.52 − 0.27t) = 5.1t

cp 27.7 Q_{AL} 24.4

act 0.5

✳ 7 − D13

B 90 D 70 j 54.3



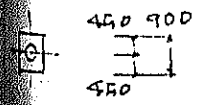
Q_F = 22.6

M_F = 22.6 × (0.45 − 0.27t) = 4.0

cp 27.7 Q_{AL} 24.4

act 0.4

↕ 7 − D13



D = 450

+ 6 − D13

Up $w = 1.5 \times 2.0 = 3.0$ t/m²

D 45

F1 $Q = 1.8^2 \times 3.0/4 = 2.43$ cp 5.0

$M = 2.43 \times 0.9 \times 1/3 = 0.73$ act 0.8

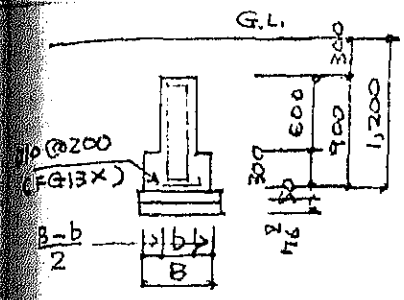
+ 5 − D10

F2 $Q = 2.43 = 2.43$ cp 5.0

$M = 2.43 \times 0.45 = 1.09$ act 1.1

| 3 − D10

Design of Foundation Beam



	b	TOP R.	BTM R.	SIDE R.	Stp.	TIE
G	350	2-D19	2-D19	2-D10	□D10 @200	⌐D10 @600
2	〃	〃	〃	〃	〃	〃
3	〃	〃	〃	〃	〃	〃

For Stress Between Piling Footing

q = (FG35) 1.26 + (Brick Wainscot) 0.6×2.9
= 3.0 [t/m]

Span 4.5 [m]

Mo	$3.0\times4.5^2/8$	7.6	[tm]	a_t	5.4	[cm²]) 2-D19
Q	$\times4.5/2$	6.8	[t]	Φ	6.4	[cm]

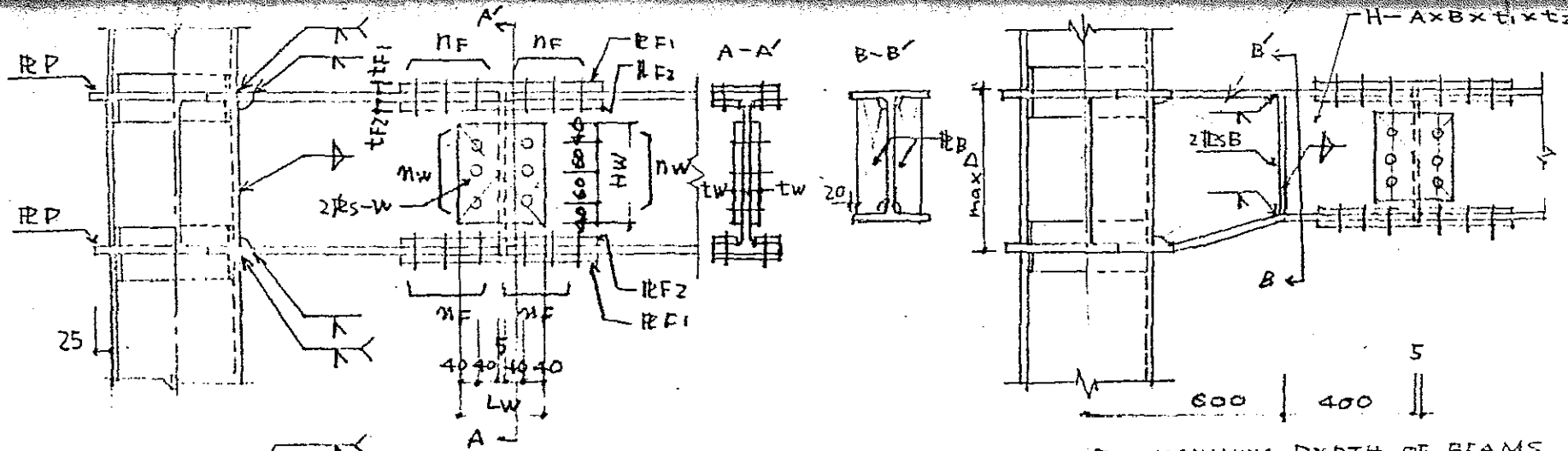
b 35 D 90 j 0.9 Q_{AL} 12.4 [t] > Q

q = 1.26 + (0.6×1.5) + (0.08×5.5) = 2.84

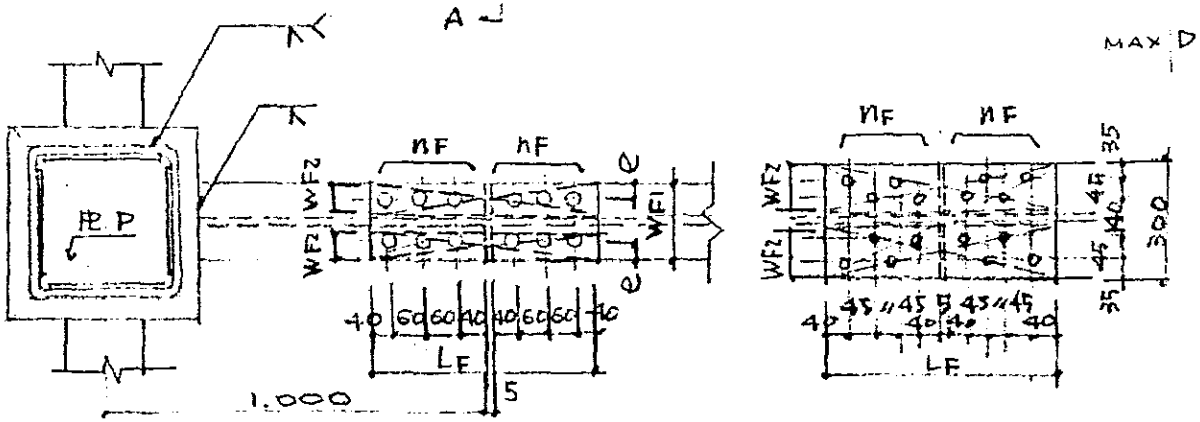
Span 5.3

Mo	$2.84\times5.3^2/8$	10.0	a_t	7.0	~ 3-D19
Q	$\times5.3/2$	7.5			

		○E	9.4	17.4	11.6	10.7	0.6	17.8	11.2	11.1	17.8	H 588X300X12X20											
	M	CENT	3.0	4.2	2.0	7.0	4.5	7.2	1.0	4.6	7.2												
		⑤	4.4	9.0	0.4	12.8	6.6	13.4	4.0	8.4	13.4		450	787	57.2	7.71	1.00	1.60	4,020	0.18	G6		
	Q		2.0 2.8	2.9	-4.7 -2.3	-0.9 -6.1	4.2	5.7	2.7	3.3	5.7												
	M	○										H 800X300X14X26											
		○									//									//	G8		
	Q																			OK			
	M	ⓒ	0.9	20.1	26.2	26.0	1.5	21.0	25.3	26.9	26.9	H 800X300X14X26											
		CENT.	15.1	2.5	4.6	11.8	22.7	17.6	10.5	26.9	26.9												
		Ⓑ	40.2	15.1	62.8	22.2	60.3	55.3	22.6	62.4	62.4										G8		
	Q		-2.6 5.2	4.5	7.8 -14.8	-9.6 2.6	9.8	9.7	9.6	12.2	12.2												
	M	Ⓑ	44.2	5.6	39.1	53.5	66.3	49.8	5.1	9.3	66.3	H 800X300X14X26											
		CENT.	34.0	6.4	26.7	43.5	51.0	40.4	7.3	10.5	51.0												
		Ⓐ	11.0	18.4	34.6	13.5	16.5	29.4	23.6	24.5	29.4		338	780	43.3	8.00	1.00	1.60	7,290	0.38	G8		
	Q		13.3 16.1	1.1	-12.3 -11.9	-14.0 -10.2	20.0	14.4	1.8	0.7	20.0												



MAX D = MAXIMUM DEPTH OF BEAMS CONNECTING TO THE SAME COLUMN.



WF	φ
150	30
175	30
200	35
250	45

$$t_d \geq \sqrt{3}\,\frac{t_F}{\ell_d}$$

G9	H 900X300X16X28	28						
G8	H 800X300X14X26	28	16	19 X 300 X 615	22 X 107X 615	2X6-M22	12 X 165 X 620	10 - M22
G7	H 700X300X13X24	25	16	19 X 300 X 525	19 X 107 X 525	2X5-M22	9 X 165 X 560	9 - M22
G6	H 588X300X12X20	22	16	16 X 300 X 435	16 X 107 X 435	2X4-M22	9 X 165 X 440	7 - M22
G6A	H 600X200X11X17	19	16	16 X 200 X 405	16 X 113 X 405	2X3-M22	9 X 165 X 440	7 - M22
G5	H-482X300X11X15	16	16					
G5A	H 500X200X10X16	16	16	12 X 200 X 405	16 X 113 X 405	2X3-M22	9 X 165 X 380	6-M22
G4	H 390X300X10X16	16	16					
G4A	H 400X200X8X13	16	16	9 X 200 X 285	12 X 113 X 285	2X2-M22	9 X 165 X 260	4 - M22

			E	W	W2																
		N																			
—	M	U																			
		L																			
		Q																			
		N																			
1	M	U																			
		L																			
		Q																			
		N																			
⌙	M	U																			
		L																			
		Q																			
		N	12.0	−4.5	7.8	−9.6	18.0	7.5	19.8	2.4	19.8										
↓	M	U	0.9	20.1	−26.2	26.0	1.5	21.1	25.3	26.9	26.9										
		L																			
		Q	0.1	0.1	−3.8	4.5	0.2	0.2	3.5	4.6	3.7									OK	C19
		N	24.9	0.9	8.1	/	37.5	25.8	33.0		37.5										
⌙	M	U	0	17.9	13.2	/	0	17.9	13.2		17.9										
		L																			
		Q	0	2.6	2.0	/	0	3.9	2.0		3.9									OK	
		N	24.9	−3.4	−27.1	−11.4	37.5	21.5	2.2	13.5	37.5										
↓	M	U	4.0	20.7	23.7	31.3	6.0	24.7	27.7	35.3	35.3										
		L																			
		Q	0.6	3.0	3.4	4.4	0.9	3.6	4.0	5.0	5.0									OK	C19
		N																			
⌙	M	U																			
		L																			
		Q																		OK	
		N	17.8	1.1	−11.9	−10.2	26.2	18.9	5.9	7.6	26.2										
↓	M	U	11.0	18.4	−34.6	13.5	16.5	29.4	24.6	24.5	29.4										
		L																			
		Q	1.6	2.7	−6.0	28	2.4	4.3	4.4	4.4	4.4									OK	C19

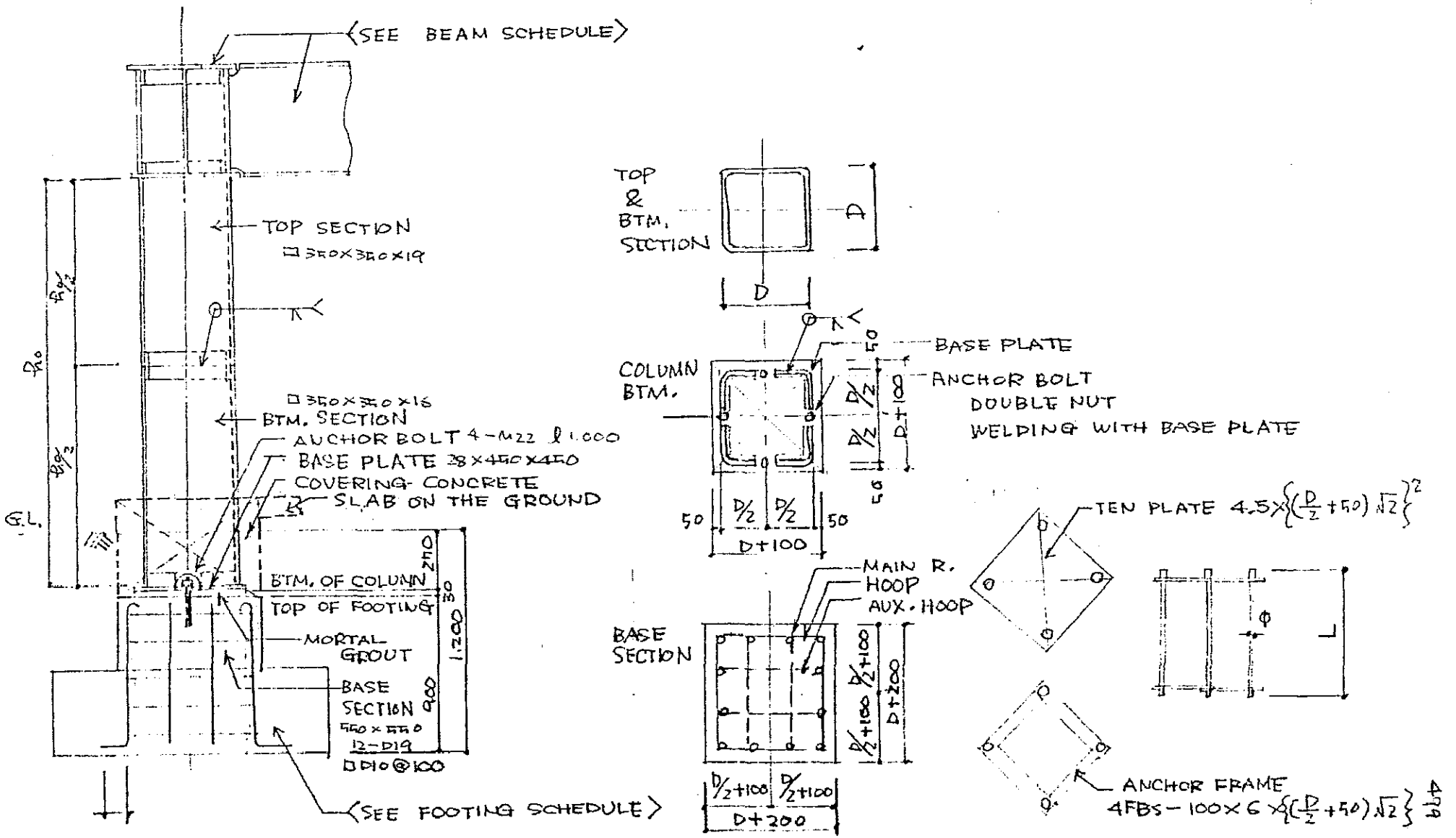
Cf. Chart

□ 350×350×19 ℄6

□ 350×350×19 ℄6

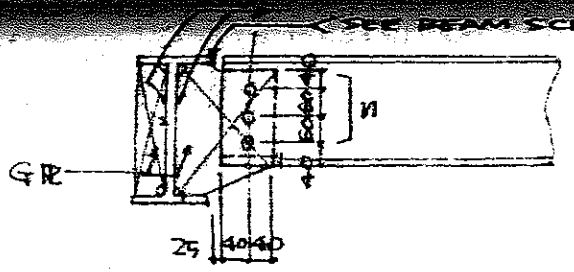
□ 350×350×19 ℄6

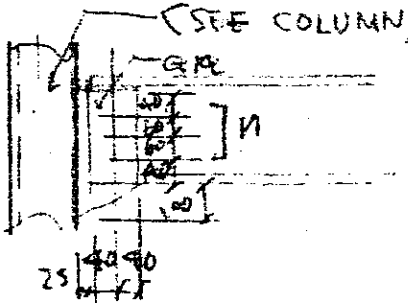
8.4


SEE BEAM SCHEDULE
TOP SECTION
□350×350×19
□350×350×16
BTM. SECTION
ANCHOR BOLT 4-M22 ℓ1,000
BASE PLATE 28×450×450
COVERING CONCRETE
SLAB ON THE GROUND
G.L.
BTM. OF COLUMN
TOP OF FOOTING
MORTAL GROUT
BASE SECTION
550×550
12-D19
D10@100
250
1,200
900
SEE FOOTING SCHEDULE
TOP & BTM. SECTION
D
COLUMN BTM.
50
BASE PLATE
ANCHOR BOLT
DOUBLE NUT
WELDING WITH BASE PLATE
D/2
D+100
D+200
MAIN R.
HOOP
AUX. HOOP
BASE SECTION
D/2+100
TEN PLATE 4.5×{(D/2+50)√2}²
ANCHOR FRAME
4FBS-100×6×{(D/2+50)√2}
4ヶ所

Design of Sub Beam

—	h	ℓ	@	w D.L.	w W.L.	w T.L.	δ	Mc	Ω	Ix	Zx	Member	J	Z	fb	Lb	λp	η	C	fb	y/ε	Type
	9.25	3.12	3.69	0.02	0.8X0.18	0.124	0.408	0.50	0.64	230.4	20.8	H-200X100										B2
	〃	9.0	3.38	〃	〃	〃	0.369	3.74	1.66	5003.7	155.8	H-300X150	7.210	421	312	3.817	80.6	5.61	1.00	1.35	0.28	B3
	7.3	9.0	3.93	〃	〃	〃	0.437	4.42	1.97	5925.8	184.4	〃										〃
	7.0	〃	2.25	〃	1.6X0.18	0.288	0.503	5.60	2.49	7499	255.5	H-350X175	13.600	480								B3A
	4.0	〃																				B35
	〃	3.38																				B2
	3.4	9.0	1.96	0.51			1.05 (SL 0.65)	19.85	4.73	21,357.4	1240.6	H-400X200	23.700	1.740								B4
	〃	7.85	9.0	(0.51×9.0ℓ + (6.0.58+0.65+0.97)×3.5ℓ			5.07	39.09	19.9	59.686	2440.6	H-440X300										B4B
	〃				5.07×1/2		2.56	19.71	10.0	30137.6	1231.9	H-450X200										B4A



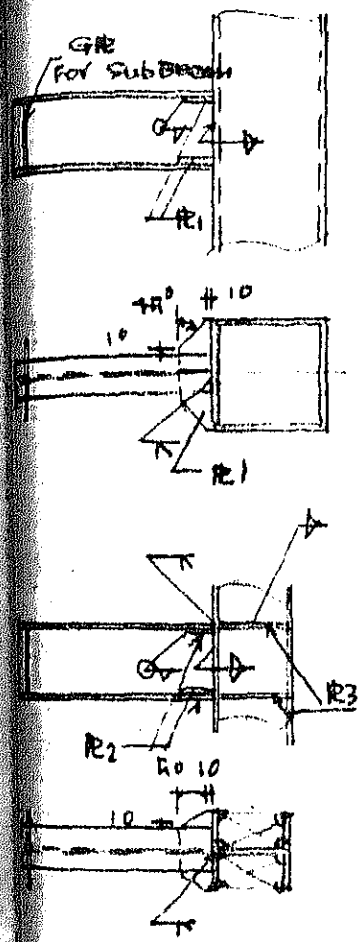


B4A	H-450×200×9×14	4	4
B4	H-400×200×8×13	4	4-M22
B3A	H-350×175×7×11	4	4
B3	H-300×150×6.5×9	4	3-M22
B2A	H-250×125×6×9	9	4
B2	H-200×100×5.5×8	4	2-M22
B9	H-900×300×16×43	19	12-M22
B6A	H-588×300×12×20	16	17-M22
B6	H-600×200×11×17	4	4
B5	H-500×200×10×16	12	6-M22
B3E	H-350×350×12×19	12	2×3-M22

Design of Cantilever

	w_u																				
	t_s	ℓ	@	D.L.	W.L.	T.L.	t_s	No.	@	J_n	Z_n	Member	J	Z	ℓ_b	l_b	λ_b	η	C	f_b	M/f	Type
																						CG3A
																						CG2

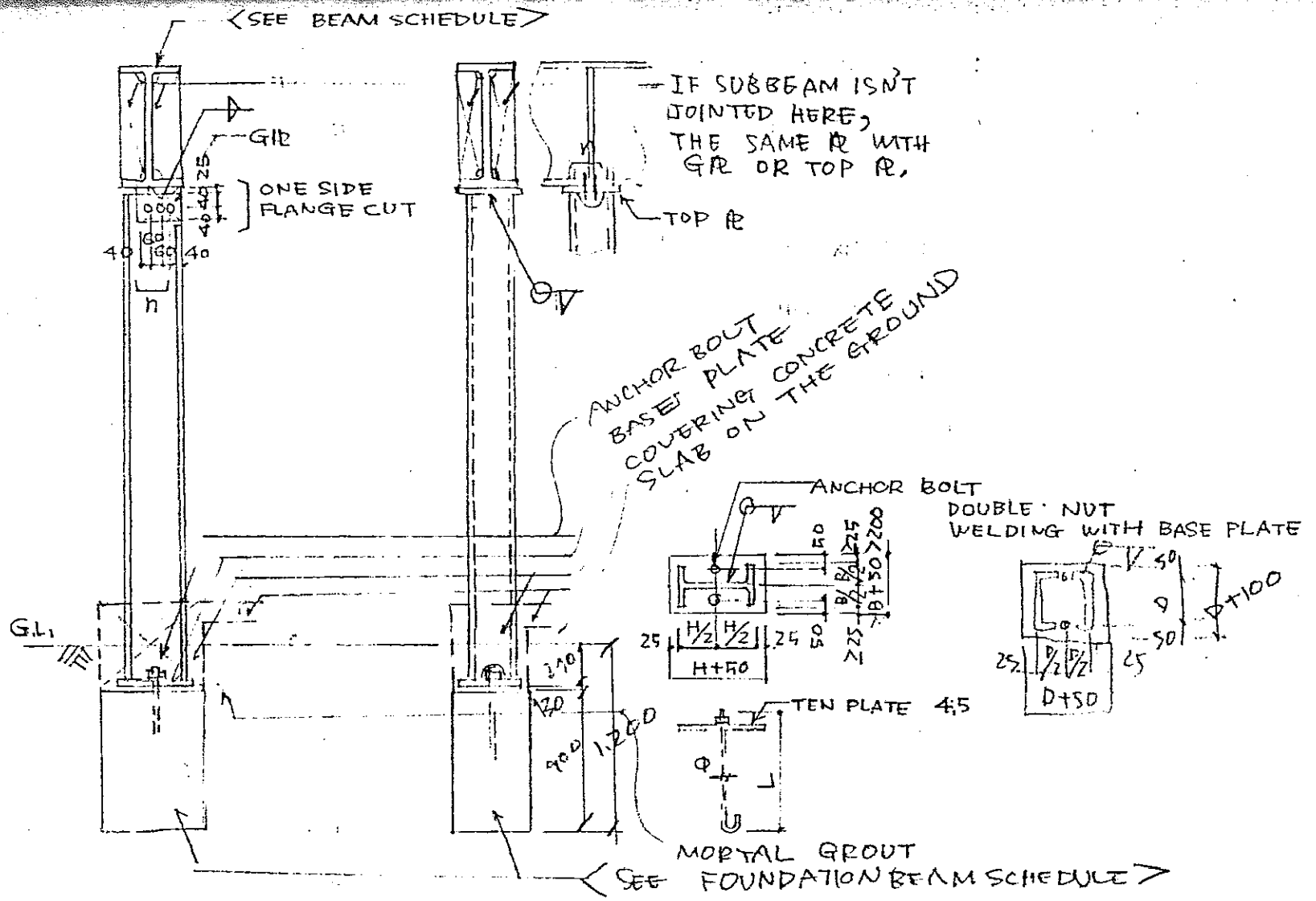
SCHEDULE OF CANTILEVER



MARK	MEMBER	PL1	PL2	PL3
CG4	H-400×200×8×13	PL12	PL12	PL12
CG3A	H-350×175×7×11	〃	〃	〃
CG3	H-300×150×6.5×9	PL9	PL9	PL9
CG2	H-200×100×5.5×8	〃	〃	〃

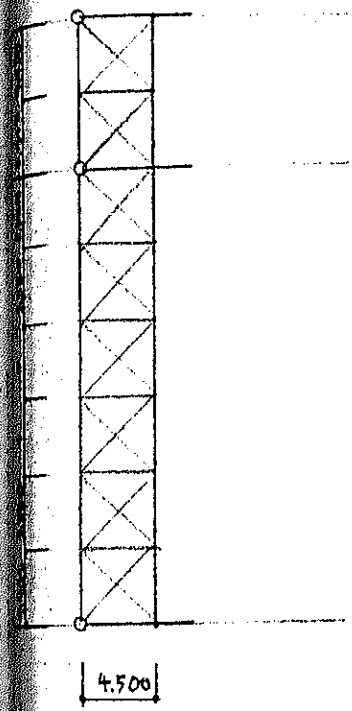
DESIGN of POST

	BTM	TOP	h	ℓ	D.L.		N	W.L.		M_0	Q	I_n	Z_n	Member	I	ℓ_k / ℓ_b	i_k / i_b	λ_k / λ_b	f_t / C	f_c / f_b	A / Z	σ/f	
					w	q		w	q														
	7.3	9.25	2.0	3.00	0.05	0.15	0.30	0.8×0.18	0.43	0.22	0.86	64.0	9.2	H-100×100	35.3	200	2.42	82.6	3.42	1.07	21.9		P1
																〃	2.13	73.3	1.00	1.60	76.5 (Z_y 26.7)	0.35	
			7.0	~																			P3
HANGER DOOR SIDE			4.3	1.45	0.8×4.12	0.137						202.6	13.2	□-100×100×4	226						45.3		


<SEE BEAM SCHEDULE>
GIR
ONE SIDE FLANGE CUT
IF SUBBEAM ISN'T JOINTED HERE, THE SAME AS WITH GIR OR TOP IR.
TOP IR
ANCHOR BOLT
BASE PLATE
COVERING CONCRETE
SLAB ON THE GROUND
ANCHOR BOLT
DOUBLE NUT
WELDING WITH BASE PLATE
TEN PLATE 4;5
G.L.
MORTAL GROUT
<SEE FOUNDATION BEAM SCHEDULE>

MARK	SECTION	材質	M	BASE PLATE	ANCHOR BOLT φ×L	NOTE
P1	H-400×100×6×8	柱 9	2-M22	柱 16×190×200	2-M20×900	
P2	H-200×100×5.5×8	DO	〃	柱 〃×250×200	2-M 〃×〃	
P2A	H-250×125×6.5×9	DO	3-M22	柱 〃×300×200	2-M 〃×〃	
P3	H-300×150×6.5×9	DO	〃	柱 〃×350×200	2-M 〃×〃	
P3A	H-350×175×7×11	柱 12	4-M22	柱 〃×400×225	2-M 〃×〃	
P4	H-400×200×8×13	DO	〃	柱 〃×450×250	2-M 〃×〃	
P4A	H-450×200×9×14	DO	5-M22	柱 〃×500×250	2-M 〃×〃	
P25	H-250×250×9×14	柱 9	2×2-M22	柱19×300×300	〃	
P20A	□-200×200×8	TOP 柱 16×300×300	〃	柱16×250×300	〃	
P25A	□-250×250×8	〃 19×350×350	〃	柱19×300×350	〃	

Design of Bracing



H 7.00
@ 3.91
W A $0.8 \times 0.12 \times 3.91 = 0.375$
Q $0.375 \times 7.0/2 = 1.31$
D $1.31 \times 5.96/4.5 = 1.74 \sim \times 2.5 = 4.34$ $An = 4.34/2.4 = 1.81$

$$Jn = \frac{13 \times 0.0002 \times 596^3 \times 300}{384 \times 2,100} = 204.8$$

$$zn = \frac{3 \times 0.02 \times 5.96^2 \times 100}{8 \times 2.4} = 11.1$$

L-130×130×9
A 22.7, J 366.0, Z 38.7

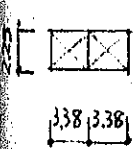
$$Jn' = \frac{5 \times 0.0002 \times 298^3 \times 300}{384 \times 2,100} = 9.8$$

$$zn' = \frac{0.02 \times 2.98^2 \times 100}{8 \times 2.4} = 0.9$$

L-75×75×6
A 8.7, J 46.1, Z 8.5

Monitor Roof

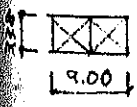
Vertical



P $1.4 \times 0.18 \times 9.0 \times 2.25/2 = 2.55$
D $2.55 \times 4.06/3.38 \times 1/2 = 1.53$ $An = 1.53/2.4 = 0.64$

L-75×75×6

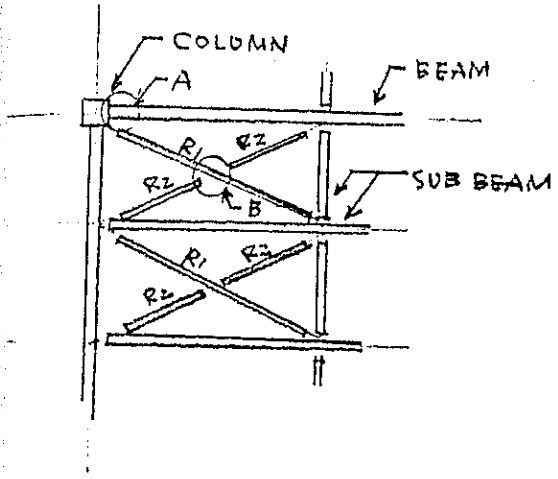
Horizontal

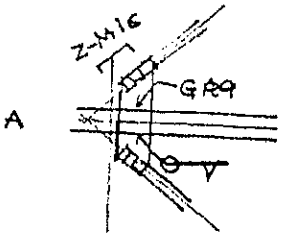


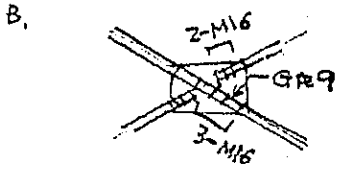
$$Jn = \frac{13 \times 0.0002 \times 562.8^3 \times 300}{384 \times 2,100} = 172.4$$

L-100×100×10
A 19.0, J 175.0, Z 24.4

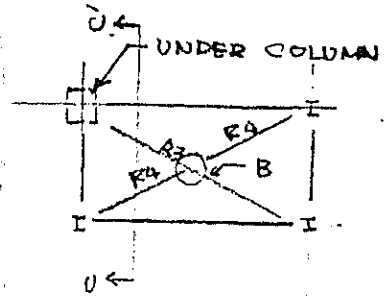
BRACING SCHEDULE

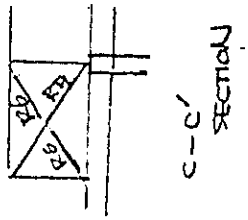






MONITOR ROOF





Mark	Member	Note
R_1	L-130×130×9	At. Paint & Body F. ~L-130×120×12
2	L-□□×□□×6	
3	L-100×100×10	
4	L-□□×□□×6	
5	〃	
6	〃	

Design of Shell Type Roof

Bldg.	Roof Level [m]	$q = 60\sqrt{h}$	C	Cq [kg/m²]
Heavy Repair Factory	10,5 ~ 13.0	194 ~ 216	1.6	310 ~ 346
Parts Storage	7.0 ~ 9,5	158 ~ 185	〃	253 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

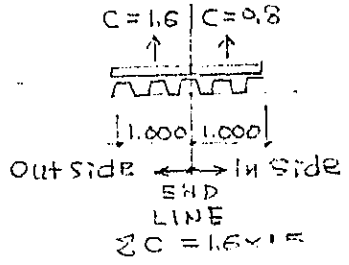
Continuous Beam Type

$$\frac{M}{Z} = \frac{wl^2}{8Z} \le f \quad \sim \quad l_z \le \sqrt{\frac{8Zf}{w}}$$

$$\frac{5\,wl^4}{384\,EI} \le \frac{l}{300} \quad \sim \quad l_I \ge \sqrt[3]{\frac{384 \times 2{,}100\,I}{300 \times 5\,w}}$$

S-60 0.8 M/M Use Z 61.33 [cm³/m]
I 619.94 [cm⁴/m]
Set $f - w$ 13.5 [kg/m²]

w	Net w	l_z	l_I	l min
1.5 X 0, 346 [t/m²]	0.00492 [t/cm/m]	373.6 [cm]	407,6 [cm]	373,6 [cm]
X 0, 310	0.00438	396,0	423,8	396,0
X 0, 296	0.00417	405,9	430,7	405,9
X 0, 253	0.00353	441,1	455,3	441,1



$$l_z \le \sqrt{\frac{8 \times 61.33 \times 1.4}{w}} = \sqrt{\frac{686{,}896}{w}}$$

$$l_I \le \sqrt[3]{\frac{384 \times 2{,}100 \times 619.94}{300 \times 5 \times w}} = \sqrt[3]{\frac{333{,}279{,}744}{w}}$$

Allowable Span [cm]

	M. Roof	Roof
H.R. Factory	570	590
Generally	400	440

Cantilever Type

$$\frac{M}{Z} = \frac{w l^2}{2Z} \leq f \quad \sim \quad l_Z \leq \sqrt{\frac{2Zf}{w}}$$

$$\frac{w l^4}{8EI} \leq \frac{l}{250} \quad \sim \quad l_I \leq \sqrt[3]{\frac{8 \times 2{,}100\, I}{250\, w}}$$

w	Net w	l_Z	l_I	l_{min}
0.346 [t/m]	0.00333 [t/cm]	196.7 [cm]	210.9 [cm]	196.7 [cm]
0.310	0.00297	208.2	219.1	208.2
0.296	0.00283	213.3	222.7	213.3
0.243	0.00240	231.7	235.2	231.7

$$l_Z \leq \sqrt{\frac{2 \times 61.33 \times 0.75 \times 1.4}{w}} = \sqrt{\frac{128.793}{w}}$$

$$l_I \leq \sqrt[3]{\frac{8 \times 2{,}100 \times 619.94 \times 0.75}{250\, w}} = \sqrt[3]{\frac{31{,}244.976}{w}}$$

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 ⟶ Size up to 1.0 M/M

Design of Mezzanine Floor

$w = 0.511$ [t/m²]

U — 1.2 (AL-31) Deck Plate $Z = 35.5$ $J = 136$

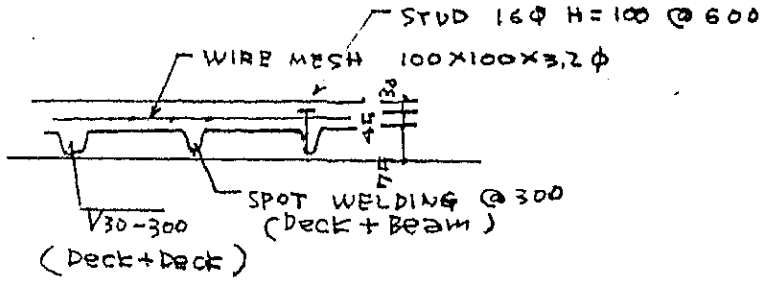
$$\frac{\alpha l^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{w}}$$

$$= \sqrt{\frac{8 \times 35.5 \times 1.4}{0.0051}} = 279.2$$

$$\frac{5}{384}\frac{wl^4}{EJ} < \frac{l}{300} \sim l > \sqrt[3]{\frac{384EJ}{1500w}}$$

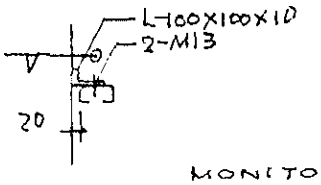
$$= \sqrt{\frac{384 \times 2,100 \times 136}{1,500 \times 0.0051}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Outside Wall



MONITOR ROOF [-120×60×25-4.5 @≒900

GENERAL [-100×50×20-3.2 @≒900
OR -2.3 @≒700

MONITOR ROOF ~ GENERAL WALL

	SPAN			@	D.L.	W.L.		
H.R.F.	3.68	~	3.85	0.9~0.7	50	220	~	140
P.S.	3.60	~	3.60	〃	〃	180	~	120
I.F.	/	~	3.33	〃	〃	/	~	120
P.R.F.	3.53	~	3.90	〃	〃	180	~	120
P.B.F.	3.45	~	3.25	〃	〃	180	~	120
R.M.C.F.	3.00	~	3.38	〃	〃	180	~	120

CASE-1. CH.R.F. MONITOR ROOF)

D.L. $0.05 \times 0.9 = 0.045$ [t/m]

W.L. $0.22 \times 0.8 \times 0.9 = 0.158$ [〃]

span 3.68 [m]

[-100×50×20-2.3

$$\frac{\delta}{f} = \frac{3.68^2 \times 100}{8 \times 1.4}\left(\frac{0.045}{5.05} + \frac{0.158}{16.1}\right)$$

$$= 2.08 < 2.10$$

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{19.6}\right)^2 + \left(\frac{0.00158}{80.7}\right)^2}$$

$$= 3.49 \text{ [cm]}$$

[-100×50×20-3.2

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00158}{107}\right)^2}$$

$$= 2.67 \text{ [cm]}$$

[-100×50×20-4.5

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{30.9}\right)^2 + \left(\frac{0.00158}{139}\right)^2}$$

$$= 2.10 \text{ [cm]}$$

[-120×60×25-4.5

$$= \sqrt{\left(\frac{\quad}{58.0}\right)^2 + \left(\frac{\quad}{252.0}\right)^2}$$

$$= 1.13 \text{ [cm]}$$

$\delta/\text{span} = 1.13/368 = 1/324 < 1/300$

O.K.

Case - 2. (H.R.F. MONITOR ROOF)

D.L. $0.05 \times 0.9 = 0.045$ [t/m]
W.L. $0.18 \times 0.8 \times 0.9 = 0.130$ ["]
Span 3.60 [m]

[- 100 × 50 × 20 - 3.2

$$\delta = \frac{5 \times 360^4}{384 \times 2{,}100} \sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00158}{107}\right)^2}$$

$= 2.45$ [cm]

[- 100 × 50 × 20 - 4.5

$$\delta = \sqrt{\left(\frac{\quad}{30.9}\right)^2 + \left(\frac{\quad}{139}\right)^2}$$

$= 1.92$ [cm]

[- 120 × 60 × 25 - 4.5

$$\delta = \sqrt{\left(\frac{\quad}{58.0}\right)^2 + \left(\frac{\quad}{292.0}\right)^2}$$

$= 1.03$ [cm]

$\delta/\text{span} = 1.03/360 = 1/346 < 1/300$
O.K.

Case - 3. (H.R.F. GENERAL WALL)

D.L. $0.05 \times 0.9 = 0.045$ [t/m]
W.L. $0.14 \times 0.8 \times 0.9 = 0.101$ ["]
Span 3.95 m

[- 100 × 50 × 20 - 2.3

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00045}{19.0}\right)^2 + \left(\frac{0.00101}{90.7}\right)^2}$$

$= 1.51$ [cm]

[- 100 × 50 × 20 - 3.2

$$\delta = \sqrt{\left(\frac{\quad}{24.5}\right)^2 + \left(\frac{\quad}{107}\right)^2}$$

$= 1.17$ [cm]

$\delta/\text{span} = 1.17/385 = 1/330 < 1/300$
O.K.

Case - 4. (")

D.L. $0.02 \times 0.7 = 0.014$ [t/m]
W.L. $0.14 \times 0.8 \times 0.7 = 0.078$ ["]
Span 3.85 m

[- 100 × 50 × 20 - 2.3

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00014}{19.0}\right)^2 + \left(\frac{0.00078}{90.7}\right)^2}$$

$= 0.69$ [cm]

$\delta/\text{span} = 0.69/385 = 1/560 < 1/300$
O.K.

ABOVE HANGER DOOR

D.L. $0.02 \times 1 = 0.02$ @ 1.0 span 3.0
W.L. $0.8 \times 0.12 \times 1 = 0.10$
L - 125 × 75 × 7 Jx 219 Zx 26.1
Jy 60.4 Zy 10.3

$$\delta' = \frac{0.02 \times 3^2 \times 100}{8 \times 26.1} + \frac{0.10 \times 3^2 \times 100}{8 \times 10.3} = 1.17 < 2.4$$

$$\delta = \frac{5 \times 300^4}{384 \times 2{,}100} \sqrt{\left(\frac{0.0002}{219}\right)^2 + \left(\frac{0.00096}{60.4}\right)^2} = 0.92 < 1.00 = \frac{l}{300}$$

O.K.