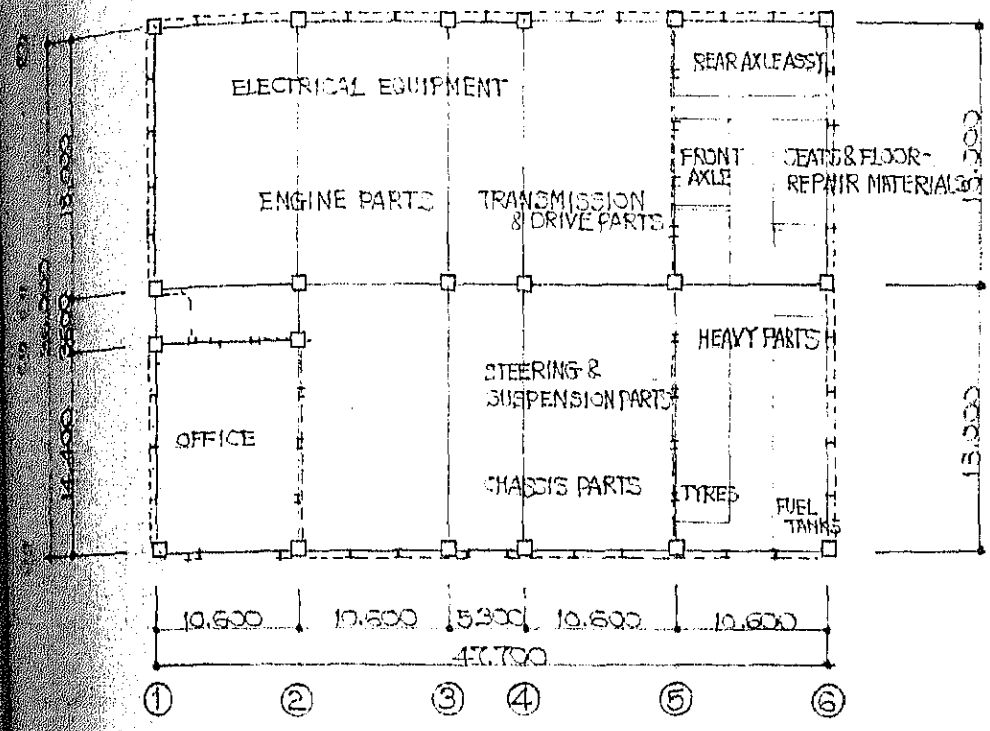
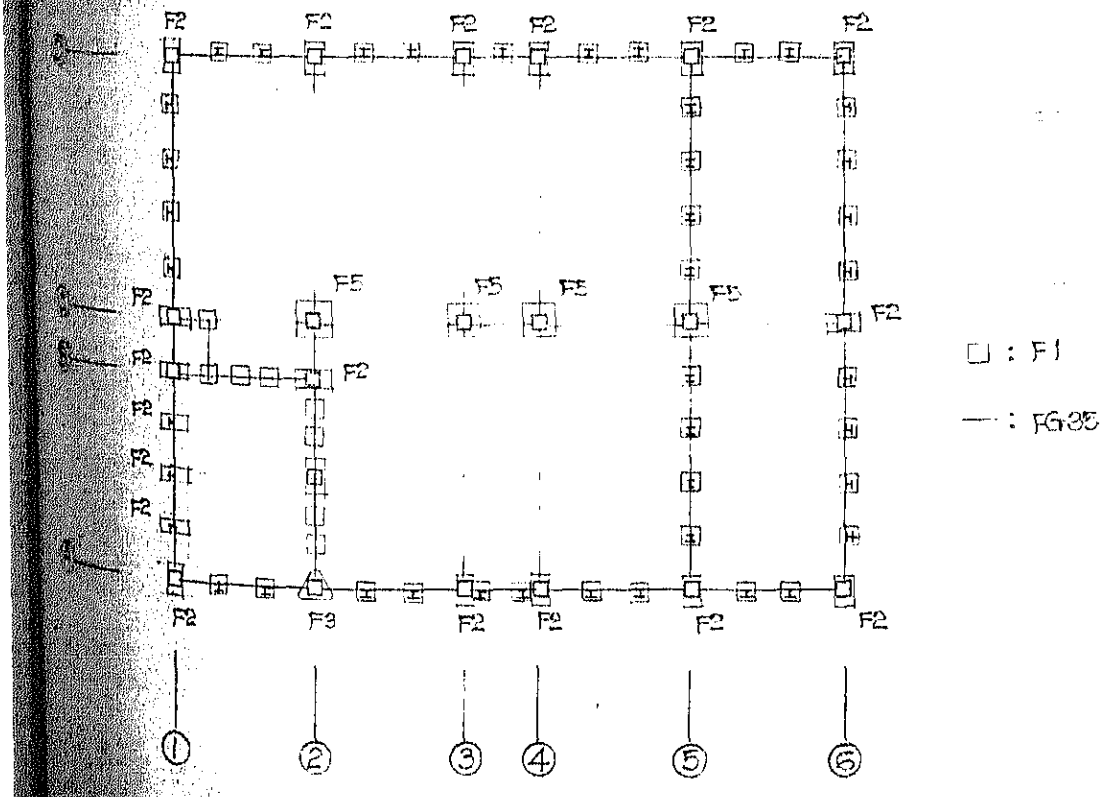
II PARTS STORAGE

PARTS STORAGE

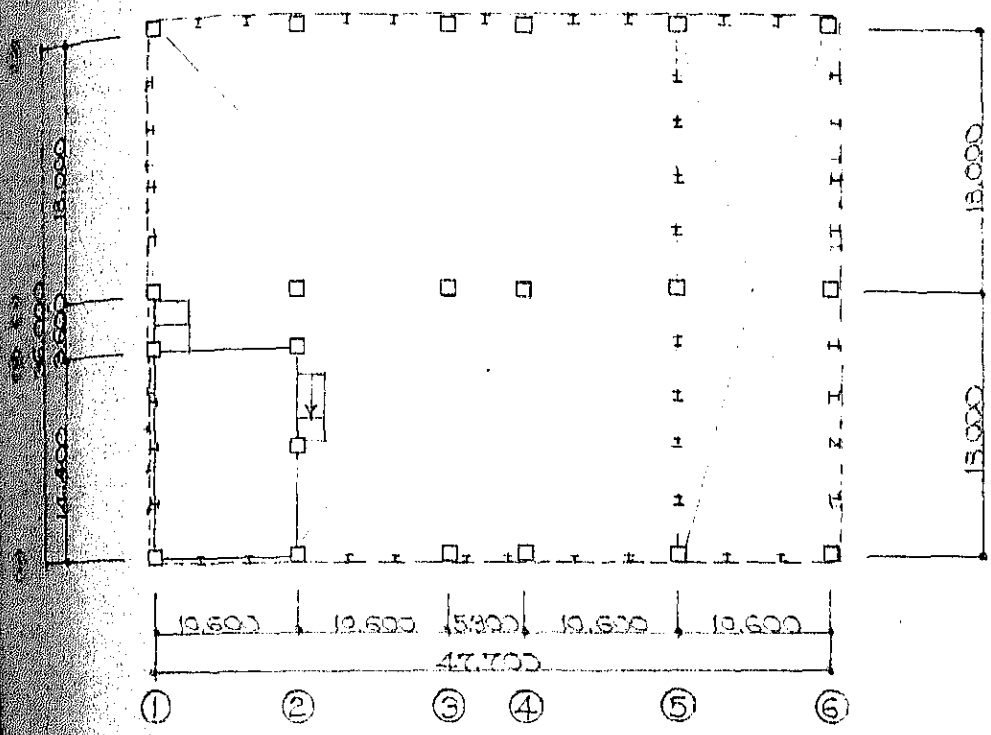
GF PLAN



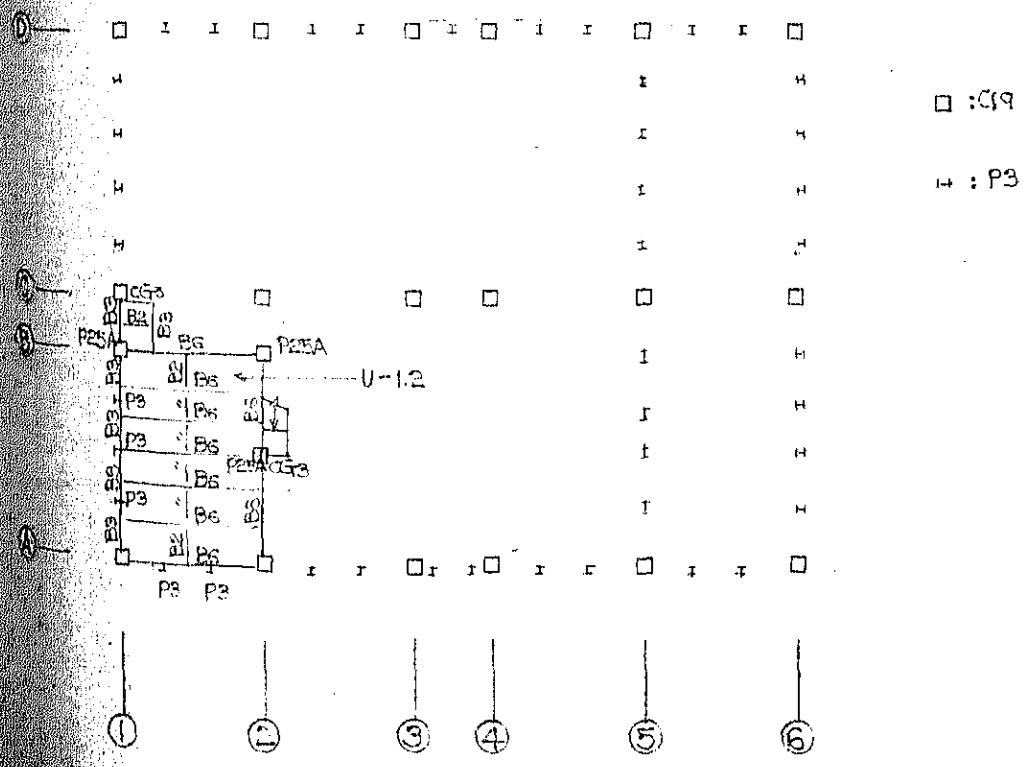
1ST PLAN



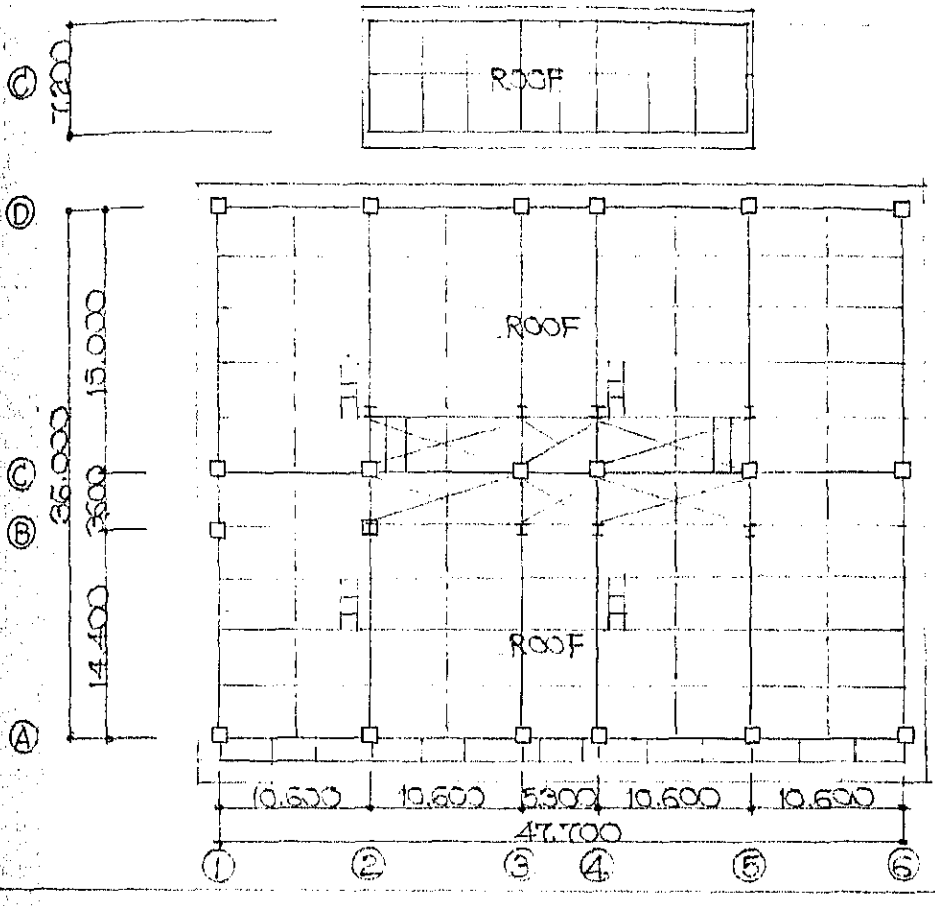
1F PLAN



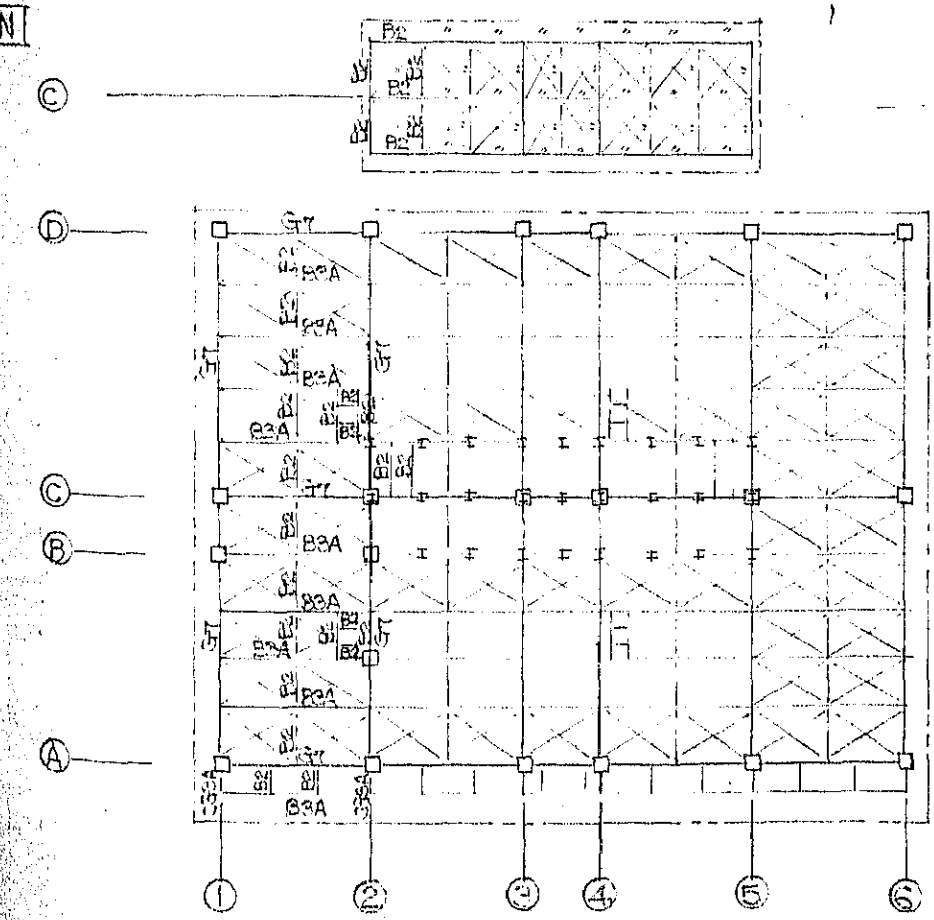
1F KEY PLAN



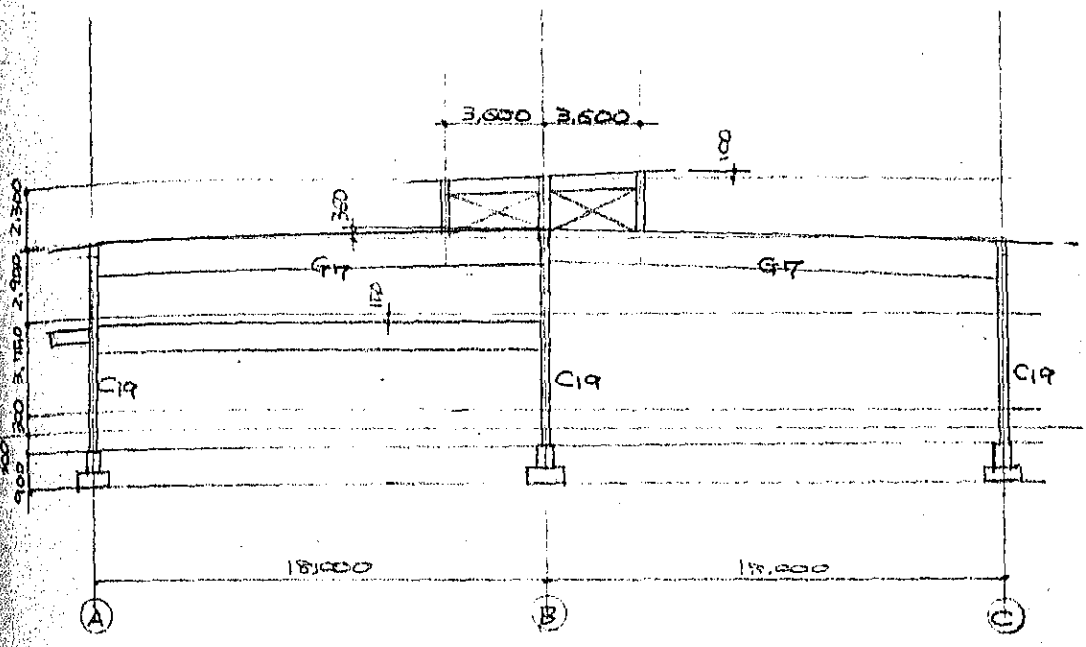
R PLAN



F FLOOR PLAN



Grain Storage —— Section



Unit Load

Floor	D. L.		L. L.		T. L.
roof	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)			
3rd	Finish	0.15	S, B	0.30	0.51
	Deck	0.02	G, C, F	0.18	* 0.39
2nd	Ceiling	0.04	K	0.08	0.29
		0.21			
				* With Above Ceiling	0.18
	Step	0.06	S, B	0.30	0.40
1st	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						
	0.25	0	0.25							
	0.15	0	0.15							
	0.05	0	0.05							
	1.26	0	1.26							

Column

	t/m			t/each						
	Skeleton	Finish	Σ							
	0.20	0	0.25							
	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							

Wind Pressure

Velocity of Wind

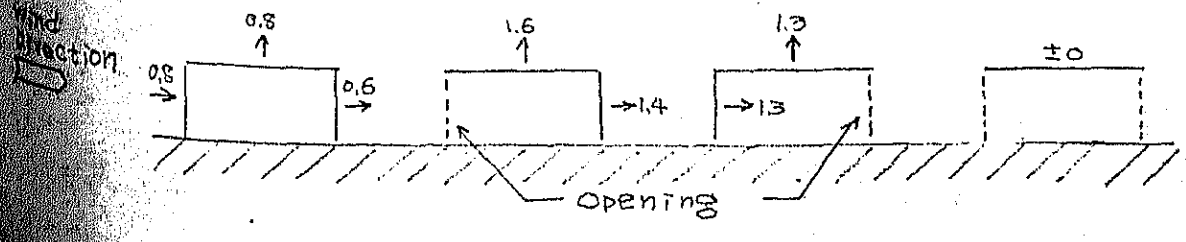
Cyclone 130 Miles/Hour $= 130 \times 1609.34 / 3,600$
$= 58.1$ m/sec
$\rightarrow 60.0$ m/sec (h = 15 m)

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

Velocity Pressure $q = \frac{1}{2} \rho V^2 = \frac{1}{2} \times \frac{1}{8} \left(60 \sqrt[4]{\frac{h}{15}}\right)^2$
$= 60\sqrt{h}$

Block	Surface		$\bar{h}$ [m]	$60\sqrt{h}$	q [kg/m²]	cq [kg/m²]
Heavy Repair Factory	Monitor Roof	Roof	12.7	214	220	
		Wall				
		Roof	10.5, 6.9	194, 148	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	7.31 – 7.00	162	160	
		Wall			120	
Retreading & Metal Casting Factory	Monitor Roof	Roof	9.45 – 9.30	184	180	
		Wall				
		Roof	7.30 – 7.00	162	160	
		Wall			120	

Coefficient of Wind Pressure



	C1		C3		C5	
S G,B C W						
Σ						
W.L.						
Σ'						
S G,B C FG W	0,09 × 68,3 0,15 × 12,8 0,05 × 10,6 0,15 × 6,7 1,26 × 3,6 0,02 × 0 0,08 × 0 0,05 × 18,7 0,60 × 5,4	6,1 1,9 0,5 1,0 4,5 0 0 0,9 3,2	× 83,5 × 17,0 × 15,9 × 6,7 × 3,5 × 0 × 0 × 18,2 × 5,3	7,5 2,6 0,8 1,0 4,4 0 0 0,9 3,2	× 111,3 × 19,6 × 21,2 × 6,7 × 5,3 × 0 × 9,1 × 18,2 × 7,1	10,0 2,9 1,1 1,0 6,7 0 0,7 0,9 4,3
Σ	18,1	18,1	20,4	20,4	27,6	27,6
W.L.	-0,20 × 68,3	-13,7	× 83,5	-16,7	× 111,3	-22,3
Σ'	4,4	4,4	7,7	7,7	5,3	5,3
S G,B C W	0,09 × 15,9 0,05 × 8,0	1,4 0.4	× 23,9 × 11,7	2,2 0,6	× 31,8 × 15,1	2,9 0,8
Σ	19,9	1,8	23,2	2,8	31,3	3,7
W.L.	-0,26 × 15,9	-4,1	× 23,9	-6,2	× 31,8	-8,3
Σ'	2,1	-2,3	4,3	-3,4	0,7	-4,6

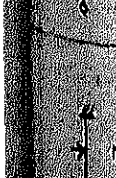
	B1		B3		B5		B2
S G,B C W			0,09 × 73,1 0,05 × 19,1 0,05 × 5,8 0,02 × 0 0,08 × 0 0,05 × 18,3	6,6 1,0 0,3 0 0 0,9	× 48,8 × 15,2 × 5,8 × 0 × 8,5 × 12,2	4,4 0,8 0,3 0 0,7 0,6	
Σ			8,8	8,8	6,8	6,8	
W.L.			-0,21 × 73,1	-15,4	× 48,8	-10,2	
Σ'			-6,6	-6,6	-3,4	-3,4	
S G,B C FG W	0,09 × 117,0 0,15 × 23,3 0,05 × 30,2 0,15 × 7,1 1,26 × 3,6 0,02 × 18,7 0,08 × 0 0,05 × 0 0,60 × 5,4	10,5 3,5 1,5 1,1 4,5 0,4 0 0 3,2	× 85,9 × 26,0 × 40,8 × 7,1 × 0 × 0 × 0 × 0 × 0	7,7 3,9 2,0 1,1 0 0 0 0 0	× 152,6 × 28,6 × 60,4 × 7,1 × 3,6 × 0 × 18,7 × 0 × 5,4	13,7 4,3 3,0 1,1 4,5 0 1,5 0 3,2	9,2 38,1-9,2
Σ	24,7	24,7	23,5	14,7	38,1	31,3	28,9
W.L.	-0,20 × 117,0	-23,4	× 85,9	-17,2	× 152,6	-30,5	
Σ'	1,3	1,3	-9,1	-2,5	-2,6	0,8	
S G,B C W							
Σ							
W.L.							
Σ'							

	P1		P2		P5		P6	
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S	0.43 × 19.1	8.2	× 38.4	16.5				
G,B	0.05 × 8.9	0.4	× 25.8	1.3				
C	0.05 × 6.7	0.3	× 6.7	0.3	× 6.7	0.3	× 6.7	0.3
FG	1.26 × 3.6	4.5	× 7.1	9.0	× 3.6	4.5	× 3.6	4.5
W	0.02 × 0	0	× 0	0	× 0	0	× 0	0
	0.08 × 0	0	× 0	0	× 18.7	1.5	× 18.7	0.9
	0.05 × 10.6	0.5	× 0	0	× 0	0	× 4.4	3.2
	0.60 × 11.2	6.7	× 22.0	13.2	× 5.4	3.2		
Σ	20.6	20.6	40.3	40.3	9.5	9.5	8.9	8.9
W.L.								
Σ'								

	A1		A2		PA		B,2 W	
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S	0.09 ×		×					
G,B	0.15 ×		×					
C	0.05 ×		×					
FG	0.15 ×	=D1	×	=D5				
W	1.26 ×	14.0	×	21.7				
	0.02 × 0	0	× 0	0				
	0.08 × 0	0	× 0	0				
	0.05 × 10.6	0.5	× 15.6	0.8				
	0.60 × 11.2	6.7	× 16.4	9.8				
Σ	21.2	21.2	32.3	32.3				
W.L.	-0.20 × 68.3	-13.7	× 111.3	-22.3				
Σ'	7.5	7.5	10.0	10.0				
S	0.09 × 15.9	1.4	× 23.9	2.2	× 6.3	2.7	× 5.3	2.3
G,B	0.43 × 9.5	4.1	× 38.4	16.5	× 3.5	0.2	× 3.5	0.2
C	0.05 × 8.0	0.4	× 15.1	0.8	0.05 × 6.7	0.3	× 0	0
FG	0.05 × 7.1	0.4	× 25.8	1.3	1.26 × 3.5	4.4	× 1.0	1.3
W					0.02 × 0	0	× 0	0
					0.08 × 0	0	× 0	0
					0.05 × 10.3	0.5	× 0	0
					0.60 × 10.9	6.5	× 3.1	1.9
Σ	27.5	6.3	53.1	20.8	14.6	14.6	[illegible] 5.17	5.17
W.L.		0		0		0		
Σ'	13.8	6.3	30.8	20.8	14.6	14.6		

[tm , t]

Load			C		M_o		Q
10.6	$(0.09 \times 3.6) + 0.15$	g	$0.714 \times 10.6^2/12$	4.4	$\times$ /8	6.17	$\times 10.6/2$ 2.5
				4.4		6.17	2.5
10.6	$(0.8 \times 0.16 - 0.07) \times 3.6$	g	$-0.713 \times 10.6^2/12$	-6.17	$\times$ /8	-10.0	$\times 10.6/2$ -3.8
				-6.17		-10.0	-3.8
4.0		g	$0.414 \times 4.0^2/12$	0.6	$\times$ /8	0.9	$\times 4.0/2$ 0.9
				0.6		0.9	0.9
4.0		g	$-0.713 \times 4.0^2/12$	-1.0	$\times$ /8	-1.4	$\times 4.0/2$ -1.4
				-1.0		-1.4	-1.4
7.3	$5.0 \times 1/2$	P	$2.5 \times 7.3/8$	1.8	$\times$ /4	3.7	$\times 1/2$ 1.3
			$(1.8 \times 1.11 \quad 2.7)$				
				1.8		3.7	1.3
7.3	$(0.8 \sim 0.6 \times 0.12) \times 3.6$	g	$\underset{0.26}{0.35} \times 7.3^2/12$	$\underset{1.2}{1.6}$	$\times$ /8	$\underset{1.7}{2.4}$	$\times 7.3/2$ $\underset{0.9}{1.3}$
			$\underset{1.2}{1.6} \times 1.11 \quad \underset{1.8}{2.7}$				
				$\underset{1.2}{1.6}$		$\underset{1.7}{2.4}$	$\underset{0.9}{1.3}$

Load			C		Mo		Q
	(0.09×38.2) (0.01×10.6)	P	$3.96 \times 18.0/2.5$	28.5	$\times 18.0/1.67$	42.7	$\times 2$ 7.9
		q	$0.18 \times 14.0^2/12$	2.5	$\times 1/8$	3.7	$\times 14.0/2$ 1.1
				31.0		46.4	9.0
	$(-0.8 \times 0.16 - 0.01) \times 38.2$	P	$-7.56 \times 18.0/2.5$	-54.5	$\times 18.0/1.67$	-81.7	$\times 2$ -15.1
		P′	$0.9 \times 3.6 \times \begin{matrix} 0.8 \\ 0.2 \end{matrix}$	± 2.6 ± 0.6	0.2×9.0	± 1.8	$\times \begin{matrix} 0.8 \\ 0.2 \end{matrix}$ ± 0.9 ± 0.2
			U	D	U	D	U D
			$-56.1 \sim 57.1$	$51.9 \sim 53.9$	$-83.5 \sim 79.9$		$-14.9 \sim 14.2$ $16.0 \sim 14.9$
	(0.09×23.9) (0.05×12.1) P 2.76 2.76×1.5 M 4.1	M	$4.1 \times 0.125 \sim 0$	$0.5 \sim 0$			$1.125 \times 4.1/7.3$ 0.6
				0.5			0.6
	$(1.6 \times 0.12 - 0.07) \times 23.9$ P 6.26 6.26×1.5 M 9.4	M	$9.4 \times 0.125 \sim 0$	$1.2 \sim 0$			$1.125 \times 9.4/7.3$ 1.5
	$0.8 \times 0.12 \times 10.6/3$	q	$0.34 \times 7.3^2/12$	$(1.5 \times 1.1 = 2.1)$ 1.5	$\times 1/8$	2.3	$\times 7.3/2$ 1.2
				$3.6 \sim 3$		2.3	2.7
	$0.6 \times 0.12 \times 10.6/3$	q	$0.25 \times 7.3^2/12$	$(1.5 \times 1.1 = 1.7)$ 1.1	$\times 1/8$	1.7	$\times 7.3/2$ 0.9
				1.1		1.7	0.9
	$7.0 \times 1/2$	P	$2.5 \times 7.3/8$	1.8	$\times 1/4$	3.7	$\times 1/2$ 1.3
			$C\ 1.8 \times 1.5$	2.7			
				1.8		3.7	1.3

Seismic Force

[t]

		W	K	KW	Q
5	0.08×27.0×9.2	12.4			
4	0.08×{(26.8×3)+(7.2×9)}	7.2			
3	0.08×2.1×27	2.8			
R	(0.08×19.4×2.1)+(0.08×54.0×2.1)	8.3			
	$\bar{w}$ = 30.7/(26.8×9.2) = 0.16 [t/m²]	30.7	0.10	3.1	4.0
5	0.08×{(49.7×39.0)−(26.6×9.2)}	87.4			
4	0.18×{(41.7×3)+(36.0×6)}	49.0			
3	0.08×{(47.7×8)+(36.0×4)}	26.3			
2	0.18×7.1×18/2	9.6			
1	0.18×7.1×43/2	7.6			
R	(0.08×160.4×3.8)+(0.08×36.0×3.8)	39.4			
	$\bar{w}$ = 219.3/(47.7×36.0) = 0.13 [t/m²]	219.3	〃	21.9	26.0 ↓ 29.0
3	0.24×10.6×14.4	44.3		→	
2	0.08×{(10.6×17)+(14.4×3)}	5.9		1/2	
1				↓	
	$\bar{w}$ = 50.2/(10.6×14.4) = 0.33 [t/m²]	50.2	〃	5.0	

Wind Force

[t]

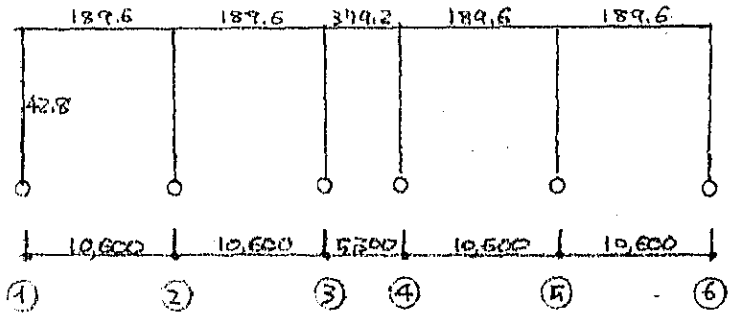
	C	q		A	H	Q	
5	0.8+0.6	0.18	7.7×2.1	16.2	4.1	5.0	
4	〃	0.12	36.5×3.8	127.8	21.5	26.0	< K.L.
3	〃	〃					
2	0.8+0.6	0.18	27.0×2.1	56.7	14.3	19.0	
1	〃	0.12	48.2×3.8	168.7	28.3	43.0	> K.L.
R	〃	〃					

Stiffness Ratio

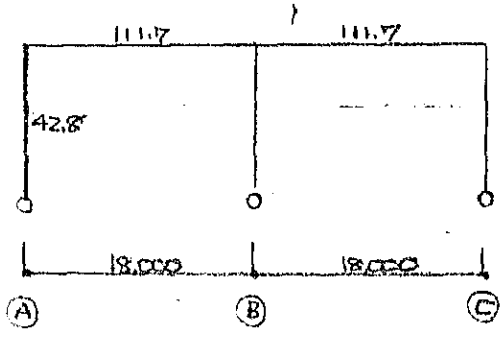
	J	k					
		l/ft	1060	830	1800		635
	201,000		189.6	379.2	111.7		
	40,700 ~39,300						57.0 (x0.75=42.8)

$J_0 = \mu J_{max} = 0.20 + 0.80 \sqrt{\left(\frac{39,300}{40,700}\right)^2} J_{max} = 0.99\, J_{max}$

(B) Frame

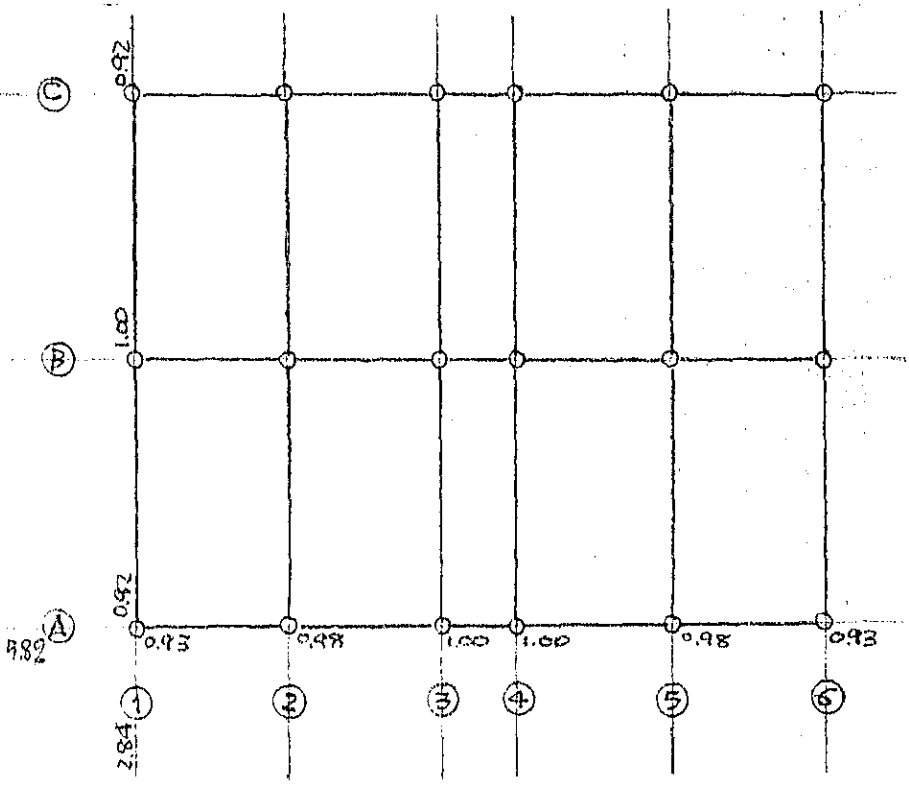


(2) Frame



Distribution Factor & Inflection Point

	D				Y				R	K.L.			W.L.		
	K	a	D	D'	Y_0	Y_1	$Y_{2,3}$	ΣY		Q	MU	ML	Q	MU	ML
	4.43	0.22	9.61	0.93	0			0	7.3	2.8	20.4	0	2.4	17.77	0
	8.86	0.24	10.13	0.98	0			0	〃	2.9	21.5	0	2.5	18.6	0
	13.29	0.24	10.31	1.00	0			0	〃	3.0	21.9	0	2.6	19.0	0
	2.61	0.21	8.98	0.92	0			0	7.3	2.7	19.5	0	3.3	24.1	0
	4.22	0.29	9.176	1.00	0			0	〃	2.9	21.2	0	3.6	26.3	0



Unit Stress

	K.L.						W.L.					
	Total			Ⓑ/② Frame			Total			Ⓑ/② Frame		
	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD
	29.0	17.46	1.7	17.0	5.82	3.0	26.0	17.46	1.5	15.0	5.82	2.6
	17.04		1.7	8.0	2.84	2.9	43.0	17.04	2.6	10.0	2.84	3.6

$21.9/2 + 5.0/2 = 16.6$ ↑

$11/4 + 21.9/5 + 5.0/2 = 7.7$

$4.1 + 21.5/2 = 14.9$ ↑

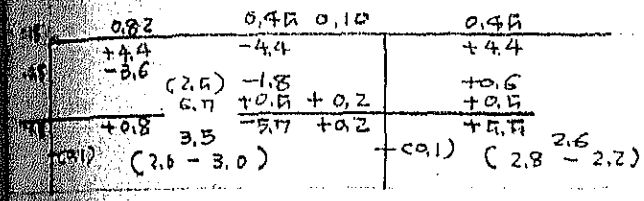
$14.3/4 + 14.3/4 + 28.3/5 = 9.2$

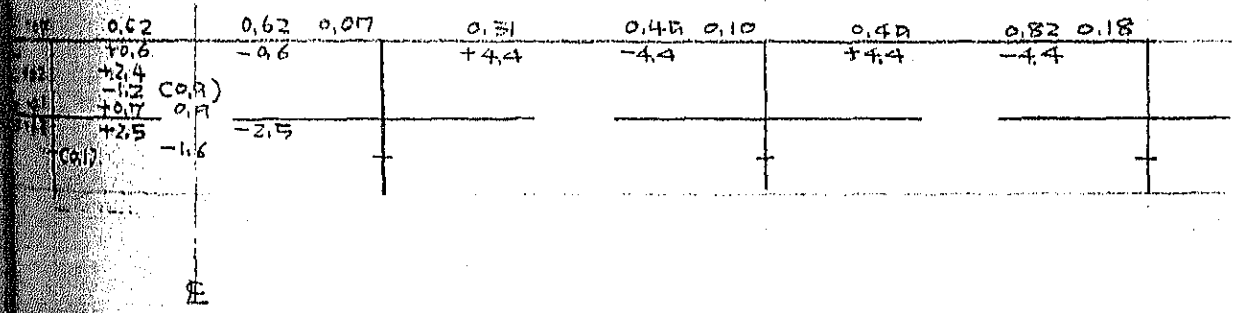
Deflection by Horizontal Force

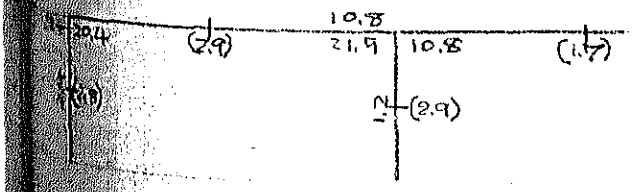
		Q	ΣD_{bo}	$h_o^2/12Ek_o$	δ	δ/h	
K.L.	Σ	29.0	17.46 × 10.13	$635^2/12\times2,100$	2.62	1/242	
	Ⓑ	17.0	5.82 × 〃	〃	4.61	1/138	
W.L.	Σ	26.0	17.46 × 〃	〃	2.35	1/270	
	Ⓑ	15.0	5.82 × 〃	〃	4.07	1/156	
K.L.	Σ	29.0	17.04 × 9.76	〃	2.79	1/228	
	②	8.0	2.84 × 〃	〃	4.61	1/138	
W.L.	Σ	43.0	17.04 × 〃	〃	4.14	1/153	
	②	10.0	2.84 × 〃	〃	5.717	1/110	

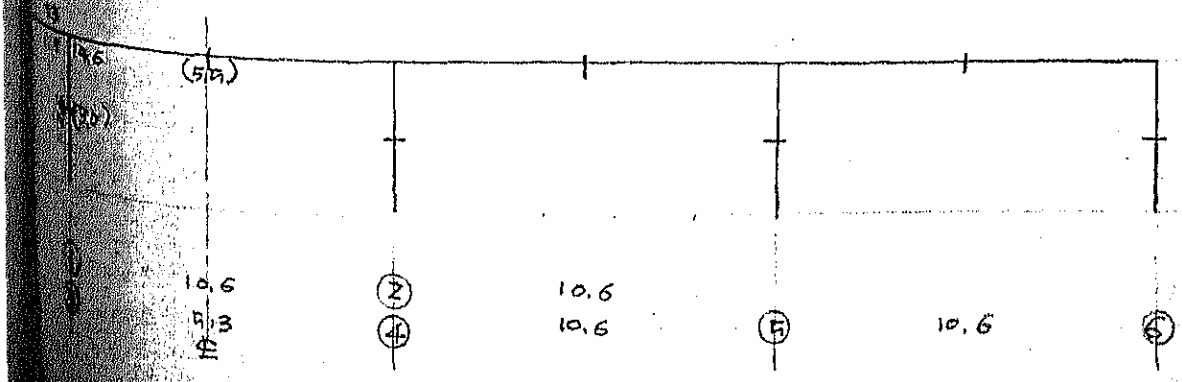
CROSS

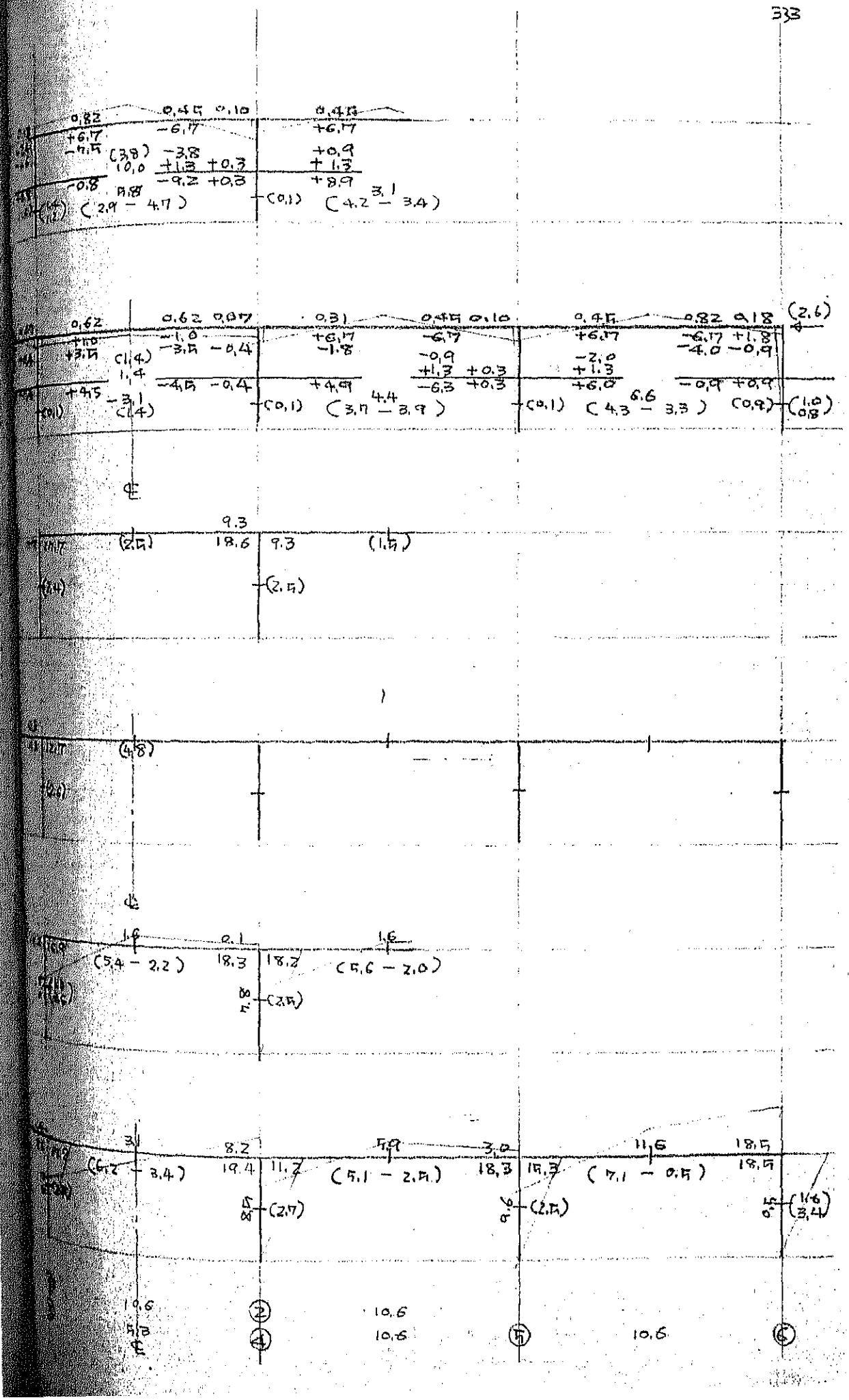
FRAME (H=11.3)



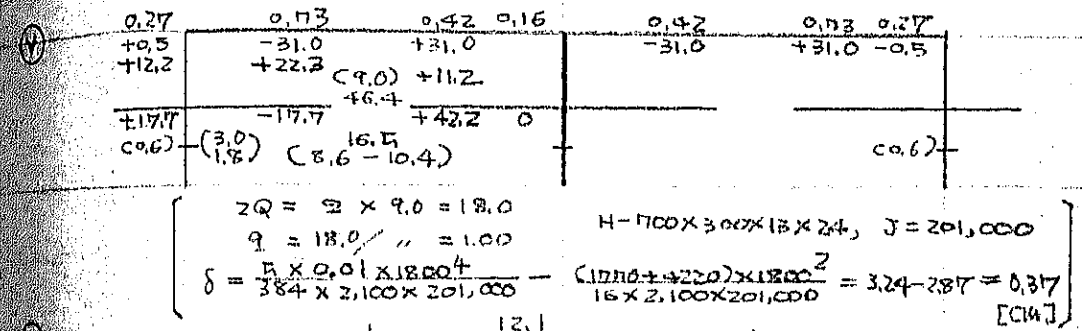








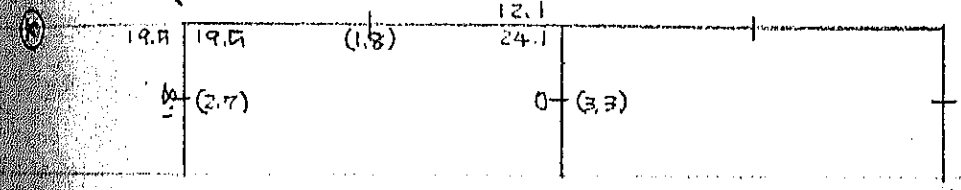
② Eyaine (h=7.3)

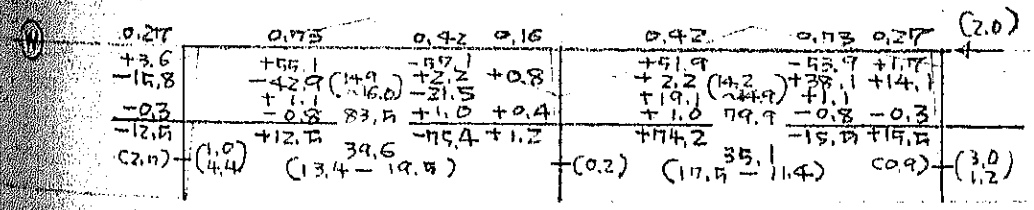


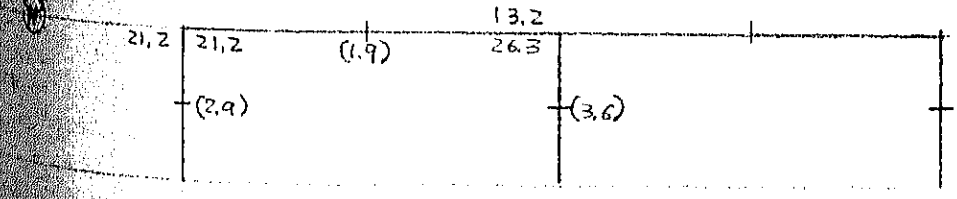
$$\left[\begin{array}{l} zQ = 2 \times 9.0 = 18.0 \\ q = 18.0/\,// = 1.00 \\ \delta = \dfrac{5 \times 0.01 \times 18.00^4}{384 \times 2{,}100 \times 201{,}000} - \dfrac{(12110 + 4220) \times 18.00^2}{16 \times 2{,}100 \times 201{,}000} = 3.24 - 2.87 = 0.37 \end{array}\right.$$

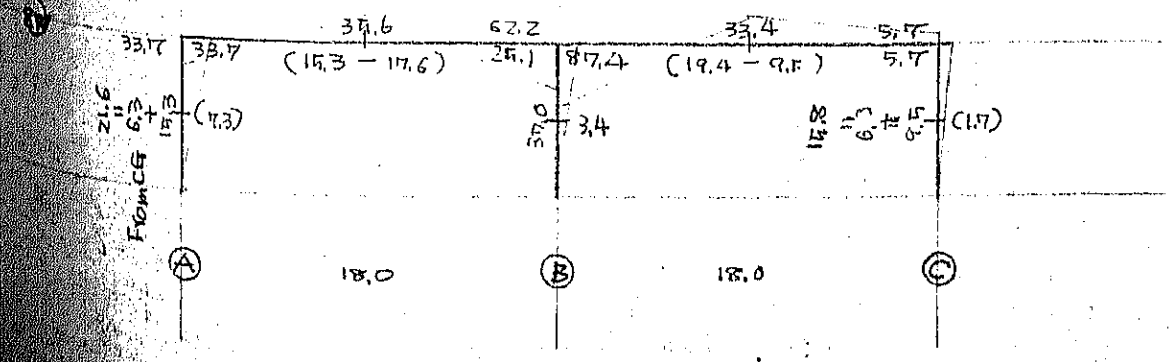
H = 700 × 300 × 13 × 24, J = 201,000

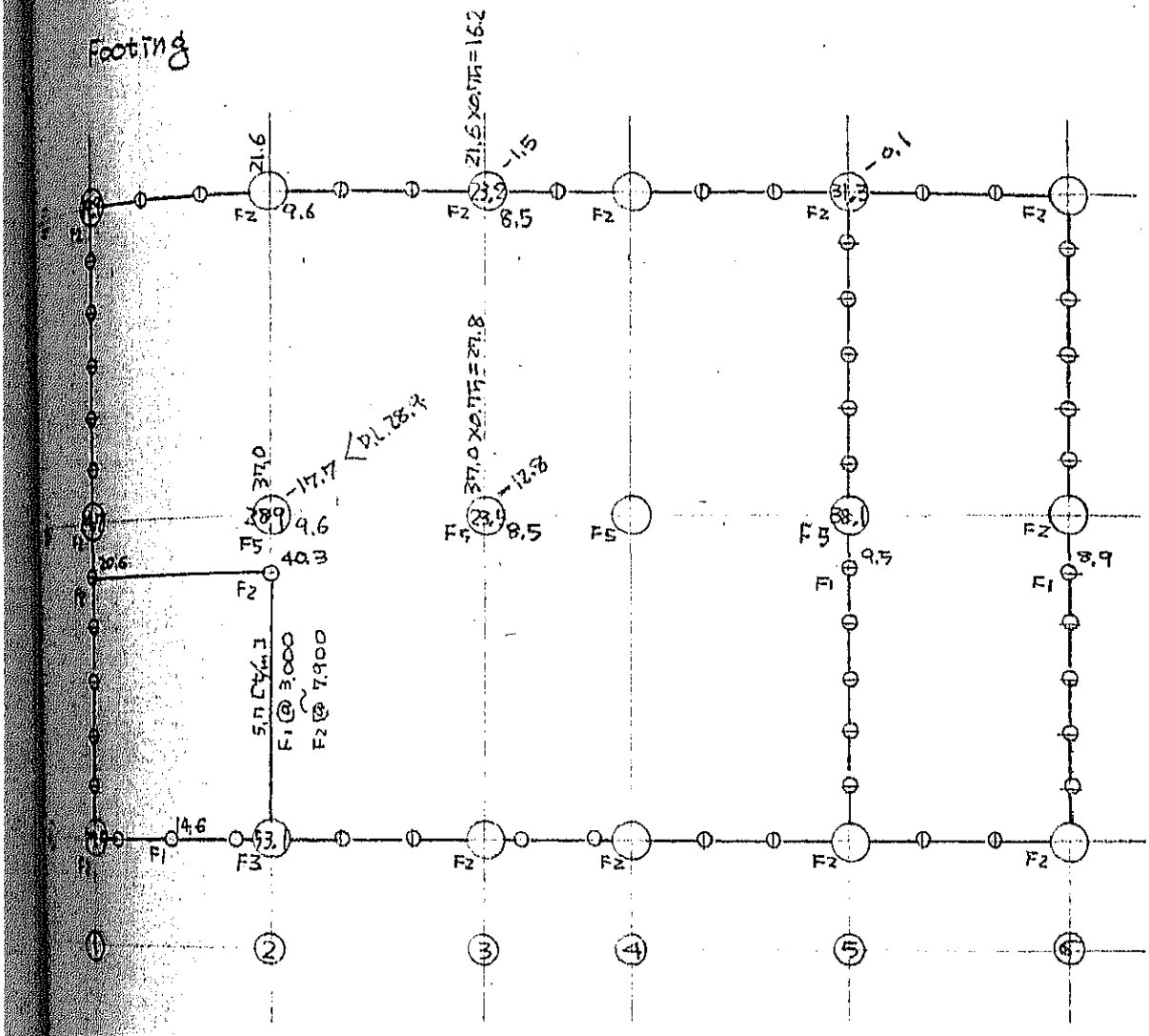
[CM]










Footing
21.6
F2
9.6
21.5 x 0.75 = 16.2
-1.5
23.9
8.5
F2
F2
31.3
-0.1
F2
F2
27.0
-17.7
21.28.2
28.9
F5
9.6
40.3
F2
27.0 x 0.75 = 21.8
-12.8
23.9
F5
8.5
F5
38.1
F3
9.5
F1
F2
8.9
F1
20.6
5.0 Cyl.
F1 @ 3.000
F2 @ 7.900
14.6
F1
53.1
F3
F2
F2
F2
F2
1
2
3
4
5
6

Design of Piling Footing

(CR 100%)

	L	R	ΔW	Re
		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

(CR 80%)

	L	R	ΔW	Re
		20	2.4	17.6
		24	3.3	20.7
		28	4.3	23.7

Type

$Q_F = 22.6$ [t]

$M_F = 22.6 \times (0.65 - 0.275) = 8.5$ [tm]

2D+a 195 D 170 $\bar{d}$ 143 [cm]

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

σ_t 7.8 [cm²]

Lower Bar + 14-D13

For Lift Up

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

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

Q_F 17.7/4 = 4.4

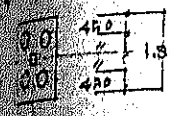
M_F 4.4 × (1.05 − 0.275) × 2/3 = 2.3

C_p 3.9

σ_t 1.4

Upper Bar + 8-D10

3.00 Type



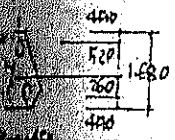
2D+a 14m

$Q_F = 22.6$ [t]

$M_F = 22.6 \times (0.45 - 0.27a) = 4.0$ [tm]

D 45 σ_s 32.4 [cm]
c_p 46.5 Q_{AL} 23.5
σ_t 0.6

+ 12-D13



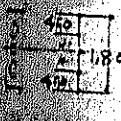
2D+a → B=90

$Q_F = 22.6$

$M_F = 22.6 \times (0.52 - 0.27a) = 5.5$

D 70 σ_s 54.3
c_p 27.7 Q_{AL} 24.4
σ_t 0.5

✳ 7-D13



B 90

$Q_F = 22.6$

$M_F = 22.6 \times (0.45 - 0.27a) = 4.0$

D 70 σ_s 54.3
c_p 27.7 Q_{AL} 24.4
σ_t 0.4

↕ 7-D13

D = 450

+ 6-D13

3.0t

$w = 1.5 \times 2.0 = 3.0$ t/m²

F4 $Q = 1.8^2 \times 3.0/4 = 2.43$
$M = 2.43 \times 0.9 \times 1/3 = 0.73$

D 45
c_p 5.0
σ_t 0.8

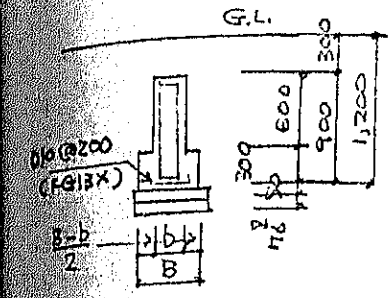
+ 6-D10

F2 $Q = 2.43 = 2.43$
$M = 2.43 \times 0.45 = 1.09$

c_p 5.0
σ_t 1.1

| 3-D10

Design of Foundation Beam



B \ b		TOP R.	BTM R.	SIDE R.	Stup.	TIE
350		2-D19	2-D19	2-D10	□D10 @200	⊓D10 @600
300	//	//	//	//	//	//
250	//	//	//	//	//	//

for Stress Between Piling Footing

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

Span 4.5 [m]

Mo $3.0 \times 4.5^2/8$ 7.6 [tm] at 5.4 [cm²]) 2-D19
Q $\times 4.5/2$ 6.8 [t] Qa 6.4 [cm]

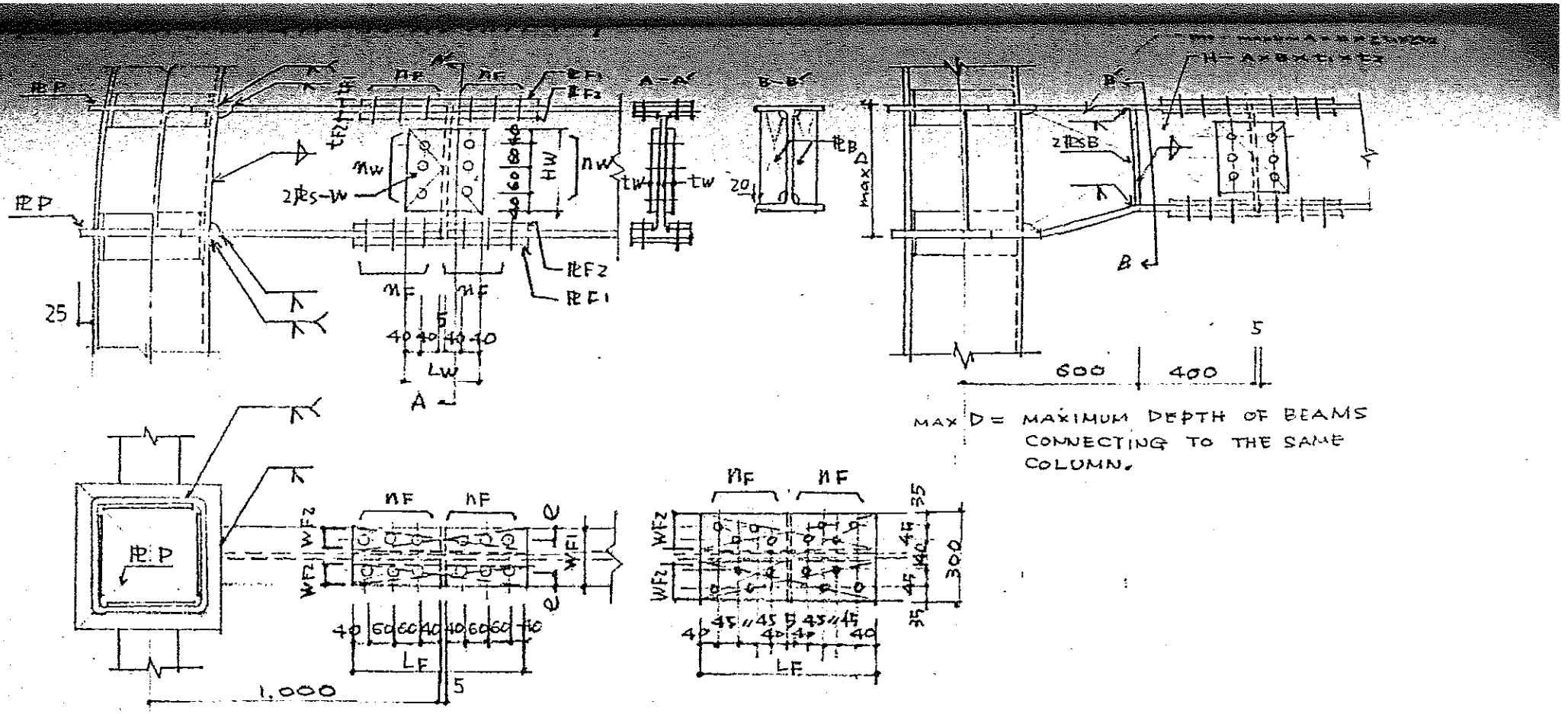
b 35 D 90 j 70.9 QAL 12.4 [t] > Q

w = 1.26 + (0.6×1.5) + (0.08×2.5) = 2.84

Span 5.3

Mo $2.84 \times 5.3^2/8$ 10.0 at 7.0 ~ 3-D19
Q $\times 5.3/2$ 7.5

				20.4	16.9	19.5			16.1	19.3	21.2	H 900X300X13X24									
4	M	CENT	3.5	4.8	1.6	11.6	5.3	<u>8.3</u>	1.9	8.1	8.3										
		I.E.	5.7	10.8	0.1	15.3	8.6	<u>16.5</u>	5.8	9.6	16.5										GT
	Q		2.0 3.0	2.9	-5.4 -2.2	-0.5 -7.1	3.0 4.5	4.9 <u>5.9</u>	-3.4 0.8	1.5 -4.1	5.9										
	M	3.4	2.5	14.6	17.2	8.2	3.8	<u>17.1</u>	14.7	10.7	17.1	H 900X300X13X24									
		CENT	1.6	0	3.1	3.1	<u>2.4</u>	1.6	1.5	1.5	2.4										
		○																			GT
	Q		0.9	5.5	-6.2	-3.4	1.4	<u>6.4</u>	5.3	-2.5	6.4										
	M	○																			
		○																			
	Q																				
1	M	I.E	42.2	12.1	75.4	74.2	<u>63.3</u>	53.3	33.2	32.0	63.2	H 900X300X13X24									
		CENT	16.5	3.7	39.6	35.1	<u>24.8</u>	20.2	23.1	18.6	24.8	~									
		O.E	17.7	19.5	12.5	15.5	26.6	<u>37.2</u>	5.2	2.2	37.2		360	7.817	45.7	7.65	1.00	1.60	5,760	0.46	GT
	Q		10.4 8.6	1.8	-19.5 -13.4	-17.5 -11.4	<u>15.6</u> 12.9	12.2 10.4	-9.1 -4.8	-7.1 -2.8	15.6										

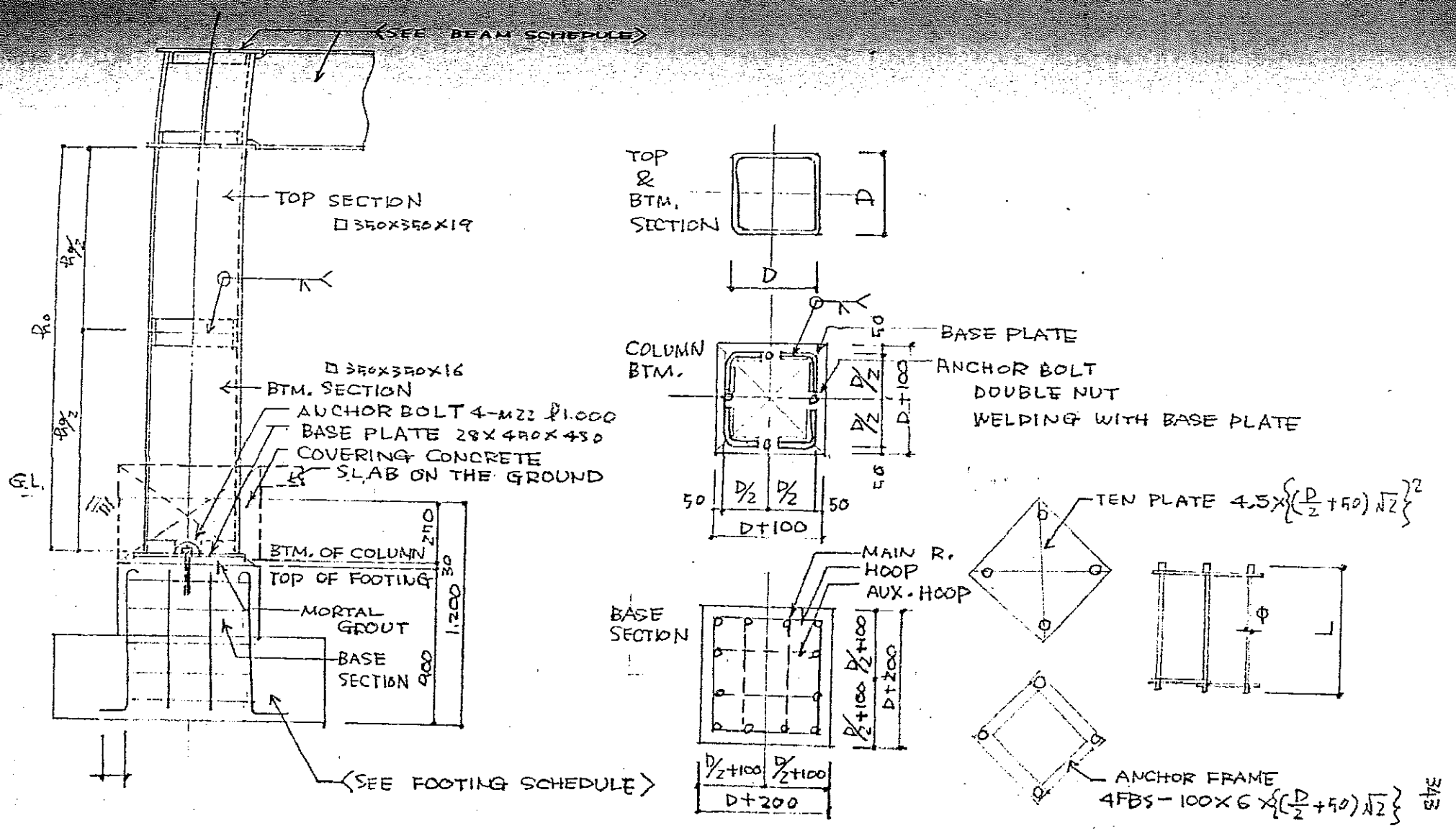


WF	ℓ
150	30
175	30
200	35
250	45

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

G8	H 800X300X14X26	28	16	19 X 300 X 615	22 X 107X 615	2x6-M22	12 X 165X620	10 - M22	
G7	H 700X300X13X24	25	16	19 X 300 X 525	19 X 107 X 525	2x5-M22	9 X 165X560	9 - M22	
G6	H 588X300X12X20	22	16	16 X 300X 435	16 X 107 X 435	2X4-M22	9 X 165X440	7 - M22	
G6A	H 600X200X11X17	19	16	16 X 200 X 405	16 X 73 X 405	2X3-M22	9 X 165X 440	7 - M22	
G5	H-482X300X11X15	16	16						
G5A	H 500X200X10X16	16	16	12X200X 405	16 X 73 X 405	2X3-M22	9 X 165X380	6-M22	
G4	H 390X300X10X16	16	16						
G4A	H 400X200X8X13	16	16	9 X 200X 285	12X 73X 285	2X2-M22	9 X 165X260	4 - M22	

	↔	M U L	0.8	20.4	-16.9	18.5	1.2	21.2	16.1	19.7	21.2	□ 350X350X19 ~16		
B1		Q	0.1	2.8	-3.6	3.4	0.2	2.9		3.5	3.5		OK	
	↕	N												
		M U L												
		Q												C19
	↔	N	28.9	1.2	-7.8	/	43.4	30.1	21.1	/	43.4	□		
		M U L	0.2	21.5	18.3	/	0.3	21.7	18.5	/	21.7	350X350X19 ~16		
B2		Q	0.1	2.9	2.5	/	0.2	3.0	2.6	/	3.0		OK	
	↕	N	28.9	0	35.0	/	43.4	28.9	65.9	/	43.4			
		M U L	0	24.1	25.1	/	0 0	24.1	25.1	/	25.1			
		Q	0	3.3	3.4	/	0	3.3	3.4	/	3.4		OK	C19
	↔	N	23.5	2.6	-8.2	/	35.3	26.1	15.3	/	35.3	□		
		M U L	0.3	21.9	18.6	/	0.5	22.2	18.9	/	22.2	350X350X19 ~16		
B3		Q	0.1	3.0	2.5	/	0.2	3.1	2.6	/	3.1		OK	
	↕	N												
		M U L												
		Q												C19
	↔	N	31.3	1.2	-7.8	/	47.0	32.5	23.5	/	47.0	□		
		M U L	0.2	21.5	18.3	/	0.3	21.7	18.9	/	21.7	350X350X19 ~16		
A2		Q	0.1	2.9	2.5	/	0.2	3.0	2.6	/	3.0		OK	
	↕	N	31.3	1.8	-21.6	-15.8	47.0	33.1	9.7	15.5	47.0			
		M U L	17.7	19.5	-33.7	5.7	26.6	37.2	16.0	23.4	37.2			
		Q	3.0	2.7	-5.3	1.7	4.5	5.7	4.3	4.7	5.7		OK	C19

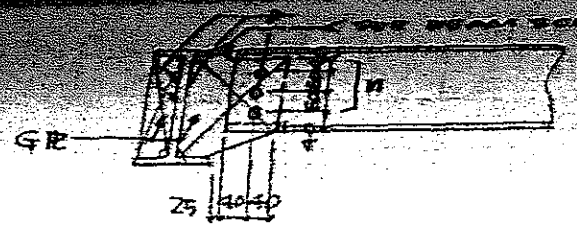

SEE BEAM SCHEDULE
TOP SECTION
□ 350×350×19
□ 350×350×16
BTM. SECTION
ANCHOR BOLT 4-M22 ℓ1.000
BASE PLATE 28×490×490
COVERING CONCRETE
SLAB ON THE GROUND
G.L.
BTM. OF COLUMN
TOP OF FOOTING
MORTAL GROUT
BASE SECTION
1,200
300
900
SEE FOOTING SCHEDULE
TOP & BTM. SECTION
D
COLUMN BTM.
50
BASE PLATE
ANCHOR BOLT
DOUBLE NUT
WELDING WITH BASE PLATE
D/2
D+100
D/2
50
50
D/2
D/2
D+100
MAIN R.
HOOP
AUX. HOOP
BASE SECTION
D/2+100
D/2+100
D+200
D/2+100
D/2+100
D+200
TEN PLATE 4.5×{(D/2+50)√2}²
Φ
ANCHOR FRAME
4FBS-100×6×{(D/2+50)√2}
345

Design of Sub Beam

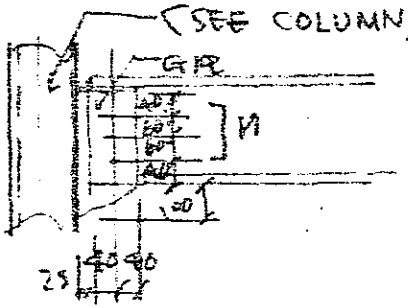
ℓ	P	@	ω D.L.	ω W.L.	ω T.L.	ℓ	Mo	Q	Jn	Zn	Member	J	Z	ℓb	ib	λb	η	C	fb	b/f	Type
9.4	3.53	3.60	0.02	0.8×0.18	0.124	0.346 (S.L. 0.02)	0.62	0.70	324	324	H-200×100	1,840	184	353	2.60	135.8	6.49	1.00	0.86	0.28	B2
4.05	10.6	2.25	0.02	1.6×0.18	0.872	0.357	4.73	1.79	7,466	197.1	H-350×175	13,600	775								B3A
〃	3.6	〃				〃	0.55	0.61	292	27.9	H-200×100										B2
7.4	10.6	3.60	0.02	0.8×0.16	0.108	0.339 (S.L. 0.05)	4.76	1.80	7,510	198.3	H-350×175	13,600	775	530	4.58	115.7	8.33	1.75	1.25	0.33	B3A
〃	5.3	〃				〃	1.19		939	49.6	H-200×100	1,840	184	〃	2.60	203.8	6.49	1.00	0.70	0.62	B2
4.05	10.6	2.40	0.51			1.254 (S.L. 0.25)	17.89	6.75	49,863	1118.1	H-600×200	33,500	1,490	530	5.18	102.3	8.32	1.75	1.30	0.92	B6
〃	7.2	5.3				2.87	18.6		23,911.2	1162.4	H-600×200										B6
〃	3.6						6.18	3.44	2649.9	386.3	H-300×150										B5

ℓ = (0.51×5.3) + (0.05×5.3×5/14.4) + (0.05×1.75) = 2.87

P = {0.51×2.4×5.3} + {0.05×(5.3+2.4)} = 6.87



ONE SIDE FLANGE CUT



MARK	SIZE	QTY	REMARKS
B4A	H-400×200×8×13	4	4-M22
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	77-M22
B6	H-600×200×11×17	4	4
B5	H-500×200×10×16	12	6-M22
B3A	H-350×350×12×19	12	2×3-M22

Design of Cantilever

h	ℓ	@	w D.L.	w W.L.	w T.L.	P (S.L. 0.05)	M	Q	Jn	Zn	Member	J	Z	ℓb	ib	λb	η	C	fb	D/F	Type
4.05	1.5	10.6	0.62	1.6x0.12							H-350x175										CG3A
〃	1.5	3.6									H-200x100										CG2
〃	2.5		{0.51x1.8x1.2} +{0.05x(1.8+2.5)}			1.31	3.277	1.31	243.7	204.3	H-300x150	7,210	508								CG3

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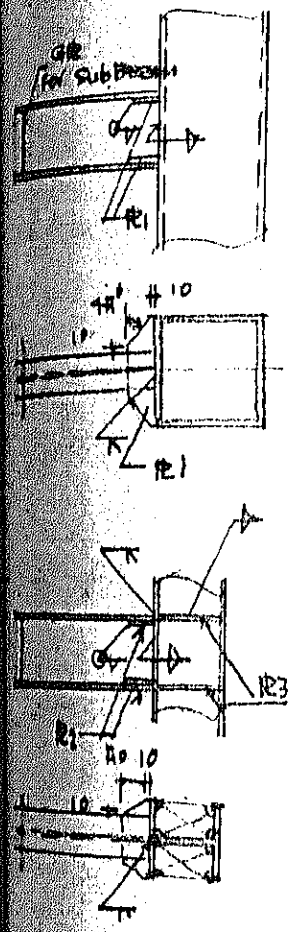
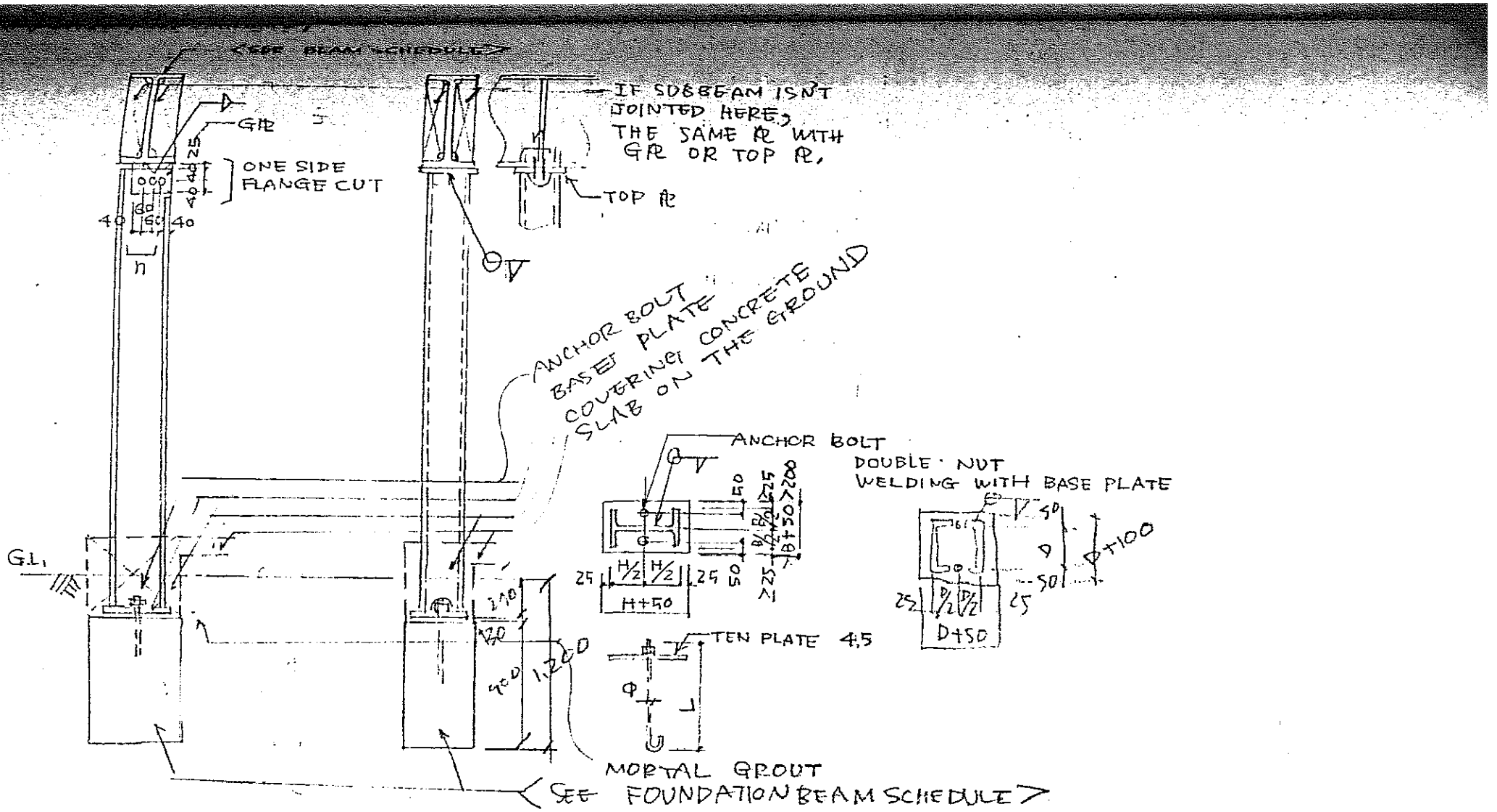
SCHEDULE OF CANTILEVER



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	〃	〃	〃

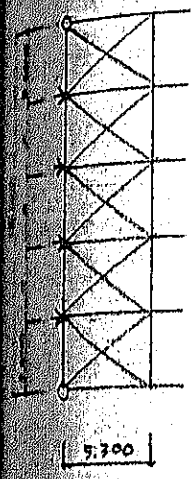
DESIGN OF POST

BTM	TOP	℄	@	D.L. w	D.L. e/f	N	W.L. w	W.L. e/f	M_0	Q	J_H	Z_H	Member	J	σ_K kg	i_E cm	λ_E	M	σ_C	A	e/f	TYPE
7.0	9.3	2.3	3.53	0.05	0.23 (S.L 0.05)		0.8×0.8	0.51					H-100×100									P1
0.3	7.3	7.0	3.6	0.62	0.12 (〃)	0.85	0.8×0.12	0.36	2.11	1.21	22917	87.9	H-300×150	7,210	700	3.29	213	8.61	0.21	46.8		P3
																3.87	181	1.00	0.60	48.1	0.55	
						20.6							〃	〃	350	〃	186.4	〃	0.82			P3
																〃	90.14	1.75	1.40		0.55	
						40.3							H-250×250		〃	6.29	55.6		1.33	92.2	0.33	P25
						〃							□-250²×8.0		〃	9.82	35.6		1.48	77.8	0.36	P25A


< SEE BEAM SCHEDULE >
GR
ONE SIDE FLANGE CUT
IF SD&BEAM ISNT JOINTED HERE, THE SAME AS WITH GR OR TOP R,
TOP R
ANCHOR BOLT
BASE PLATE
COVERING CONCRETE SLAB ON THE GROUND
G.L.
ANCHOR BOLT
DOUBLE NUT
WELDING WITH BASE PLATE
TEN PLATE 4.5
MORTAL GROUT
< SEE FOUNDATION BEAM SCHEDULE >

P1	H-400×180×6×8	同左	2-M22	同左 16×180×200	2-M20×900	
P2	H-200×100×5.5×8	DO	〃	同〃×250×200	2-M 〃 × 4	
P2A	H-250×125×6.5×9	DO	3-M22	同〃×300×200	2-M 〃 × 〃	
P3	H-300×150×6.5×9	DO	〃	同〃×350×200	2-M 〃 × 〃	
P3A	H-350×175×7×11	同12	4-M22	同〃×400×225	2-M 〃 × 〃	
P4	H-400×200×8×13	DO	〃	同〃×450×250	2-M 〃 × 〃	
P4A	H-450×200×9×14	DO	5-M22	同〃×500×250	2-M 4 × 〃	
P25	H-250×250×9×14	同9	2×2-M22	同19×300×300	〃	
P20A	□-200×200×8	TOP同 16×300×300	〃	同16×250×300	〃	
P25A	□-250×250×8	〃 19×350×350	〃	同19×300×350	〃	

Wind of Bracing



ℓ 17.06

@ 3.6

c ℓA $0.8 \times 0.12 \times 3.6 = 0.346$

@ $0.346 \times 17.06/2 = 1.22$

p $1.22 \times 6.41/5.30 = 1.47 \sim \times 2 = 2.94$, $An = 2.94/2.4 = 1.2$

$$Jn = \frac{13 \times 0.0002 \times 641^3 \times 300}{384 \times 2,100} = 254.8$$

$$Zn = \frac{3 \times 0.02 \times 6.14^2 \times 100}{8 \times 2.4} = 11.8$$

L-130×130×9

A 22.7, J 366.0, Z 38.7

$$Jn' = \frac{13 \times 0.0002 \times 321^3 \times 300}{384 \times 2,100} = 12.3$$

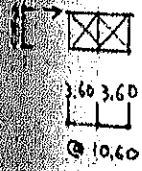
$$Zn' = \frac{0.02 \times 3.21^2 \times 100}{8 \times 2.4} = 1.1$$

L-75×75×6

A 18.7, J 46.1 Z 8.5

Monitor Roof

Vertical

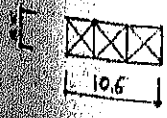


P $0.8 \times 0.18 \times 10.6 \times 2.4/2 = 1.83$

D $1.83 \times 4.32/3.60 = 2.20$ An $2.20/2.4 = 0.9$

L-75×75×6

Horizontal

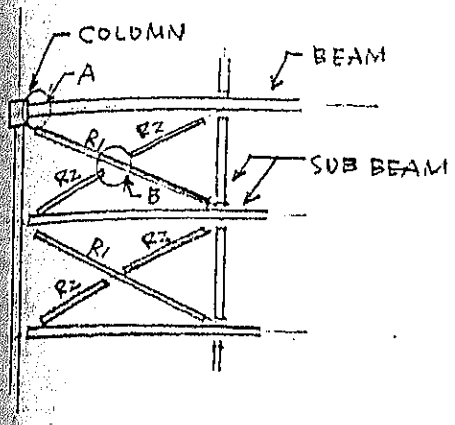


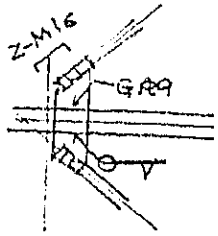
$$Jn = \frac{13 \times 0.0002 \times 504^3 \times 300}{384 \times 2,100} = 123.8$$

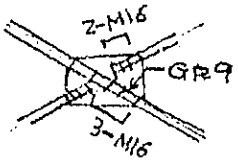
L-100×100×10

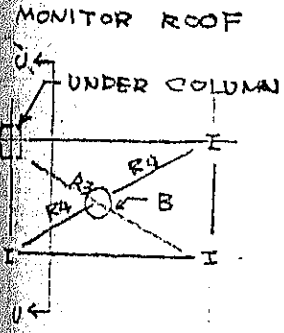
A 19.0, J 175.0, Z 24.4

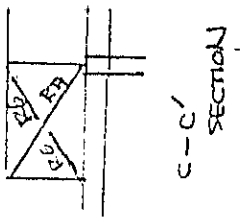
BRACING SCHEDULE











Mark	Member	Note
R_1	L-130×130×9	At. Paint & Body F. ~ L-130×130×12
2	L-75×75×6	
3	L-100×100×10	
4	L-75×75×6	
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	168 ~ 185	〃	253 ~ 296
Inspection Factory	〃		〃	
Mechanical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

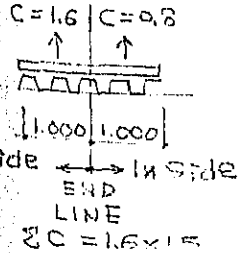
Continuous Beam Type

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

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

S-60 0.8 Mx1 Use Z 61.33 [cm³/m]
I 619.94 [cm⁴/m]
Self-w 13.5 [kg/m²]

w	Net w	l_z	l_I	l_{min}
Mx 0.346 [t/m²]	0.00492 [t/cm²]	373.6 [cm]	407.6 [cm]	373.6 [cm]
X 0.310	0.00433	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



$$l_z \le \sqrt{\frac{8\times 61.33\times 1.4}{w}} = \sqrt{\frac{686.396}{w}}$$

$$l_I \le \sqrt[3]{\frac{384\times 2{,}100\times 619.94}{300\times 5\times w}} = \sqrt[3]{\frac{333{,}279.744}{w}}$$

Allowable Stress [kg/cm²]

	M. Roof	Roof
H.R. Factory	370	390
Generally	400	440

Cantilever Type

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

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

w	Net w	l_Z	l_I	l_{min}
0.348 [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
0.245	0.00240	231.7	235.2	231.7

$$l_Z \le \sqrt{\frac{2 \times 61.33 \times 0.75^{*} \times 1.4}{w}} = \sqrt{\frac{128.793}{w}}$$

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

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 $\longrightarrow$ Size up to 1.0 M

Design of Mezzanine Floor

$w = 0.01$ [t/m²]

$\nu = 1.2$ (AL-31) Deck Plate $Z = 35.5$ $J = 13.6$

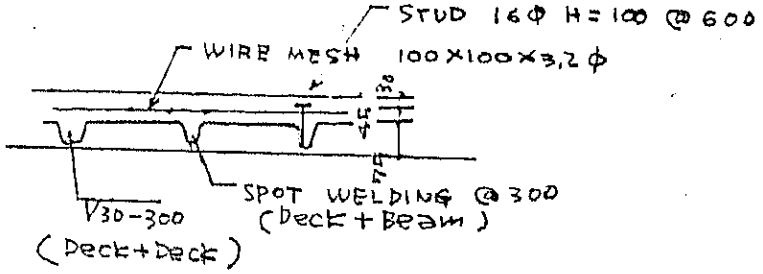
$$\frac{\omega l^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{\omega}}$$

$$= \sqrt{\frac{8 \times 355 \times 1.4}{0.0051}} = 279.2$$

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

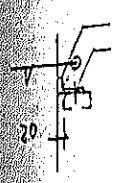
$$= \sqrt[3]{\frac{384 \times 2{,}100 \times 13.6}{1{,}500 \times 0.0051}} = 242.9$$

—— 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　@≒1100

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.	3.50	～	3.60	〃	〃	180	～	120
L.F.	/	～	3.33	〃	〃	/	～	120
R.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

(1) CH.R.F. MONITOR ROOF)

D.L. $0.28 \times 0.9 = 0.045$ [t/m]

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

span 3.68 [m]

[-100×50×20-2.3

$$\frac{\delta}{f} = \frac{3.68^2 \times 100}{8 \times 1.4}\left(\frac{0.045}{6.06} + \frac{0.158}{16.1}\right)$$

$$= 2.08 < 2.10$$

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

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

[-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

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{30.7}\right)^2 + \left(\frac{0.00158}{139}\right)^2}$$

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

[-120×60×25-4.5

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

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

δ/span $= 1.13/368 = 1/324 < 1/300$ o.k.

(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

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

$= 1.03$ [cm]

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

(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 3.85 m

[-100×50×20-2.3

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00045}{19.0}\right)^2 + \left(\frac{0.00101}{80.7}\right)^2}$$

$= 1.51$ [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.

(〃)

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

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00014}{19.0}\right)^2 + \left(\frac{0.00078}{80.7}\right)^2}$$

$= 0.69$ [cm]

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