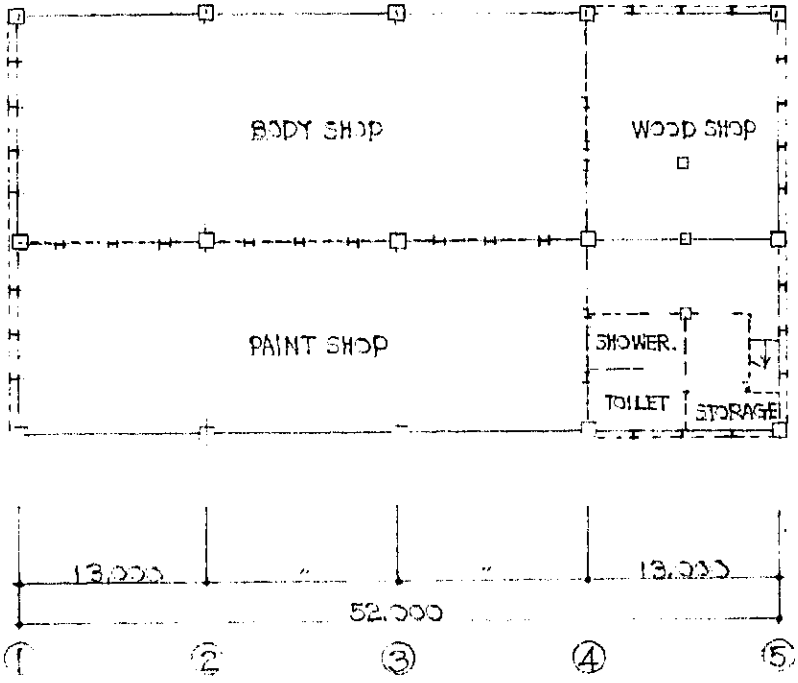
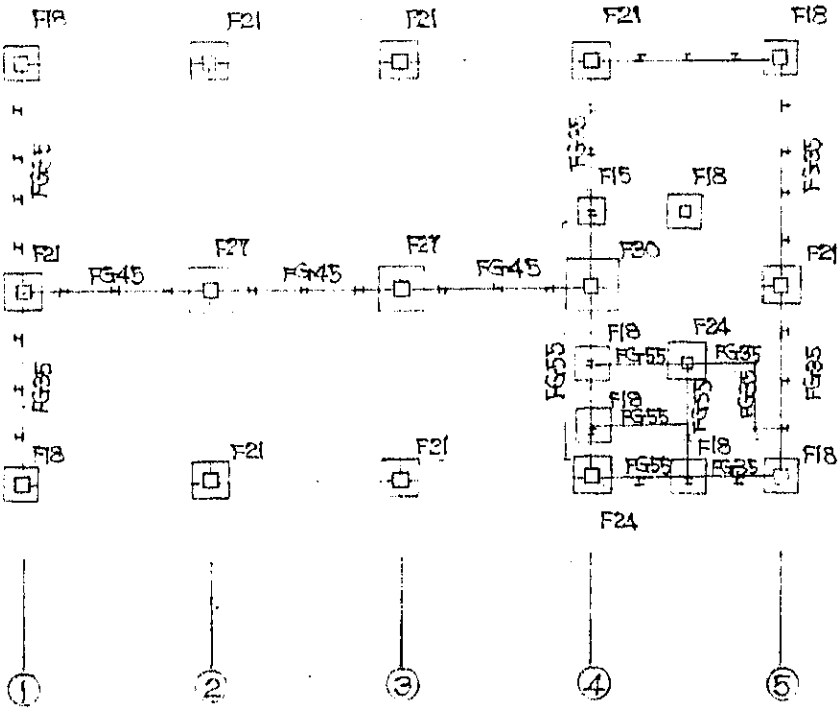
14 PAINT & BODY FACTORY

BODY FACTORY

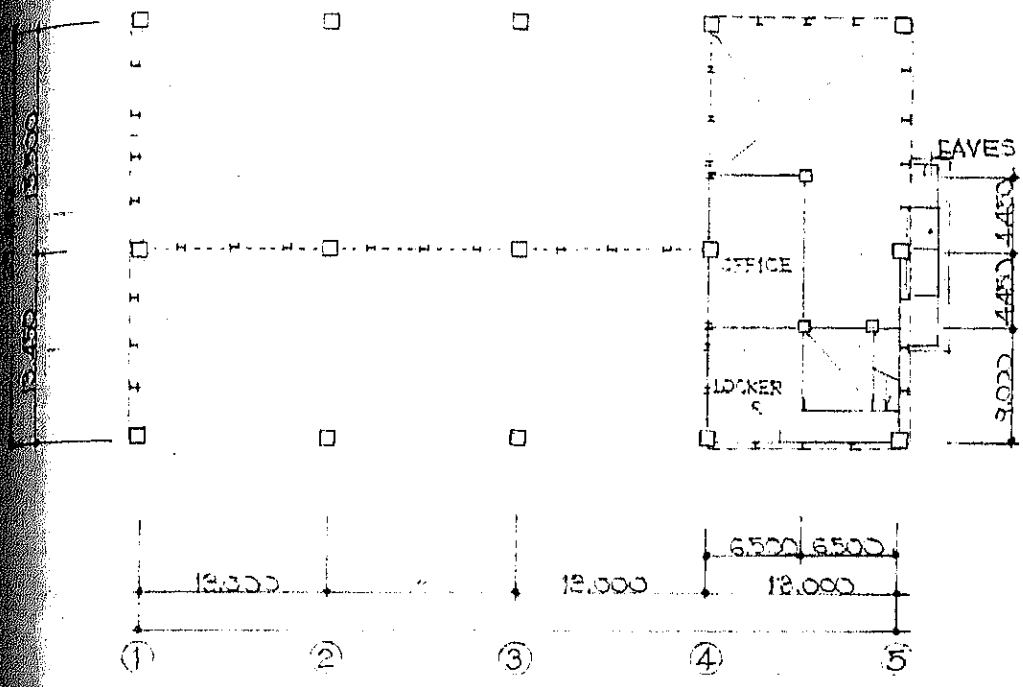
PLAN



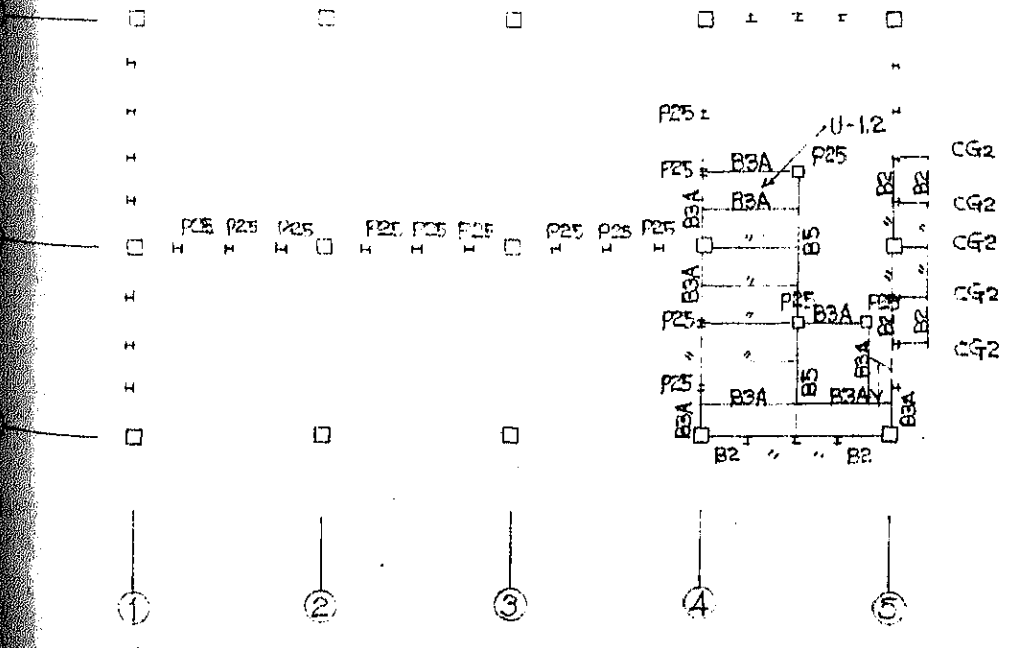
ET PLAN



...AN



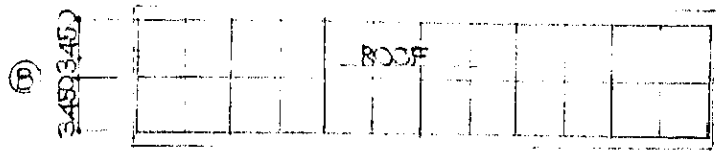
...R PLAN

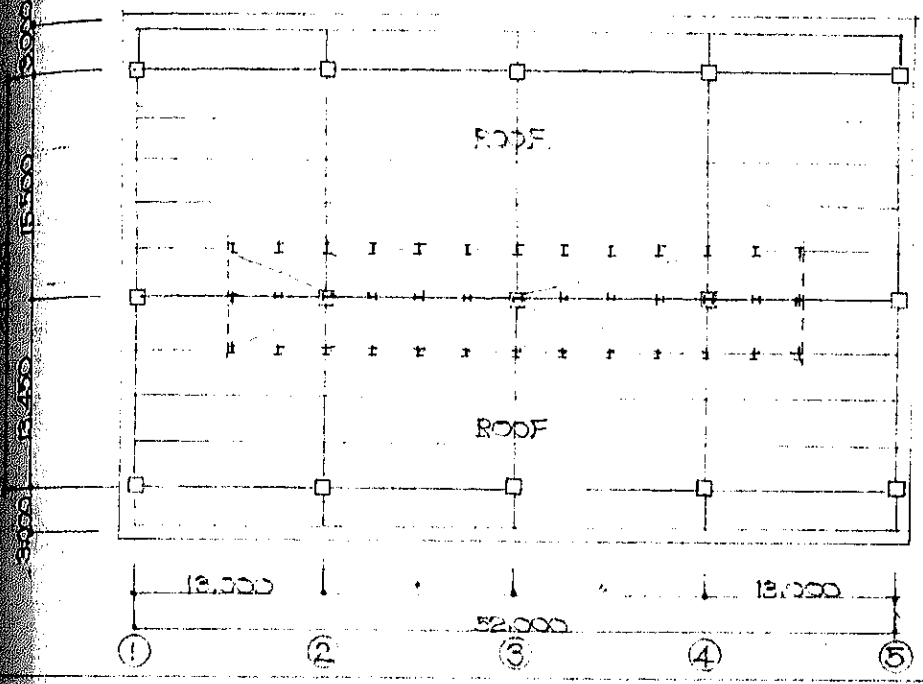


□ : C19

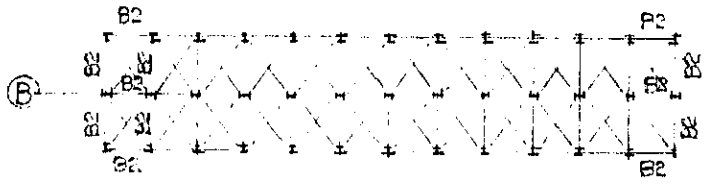
I : P3

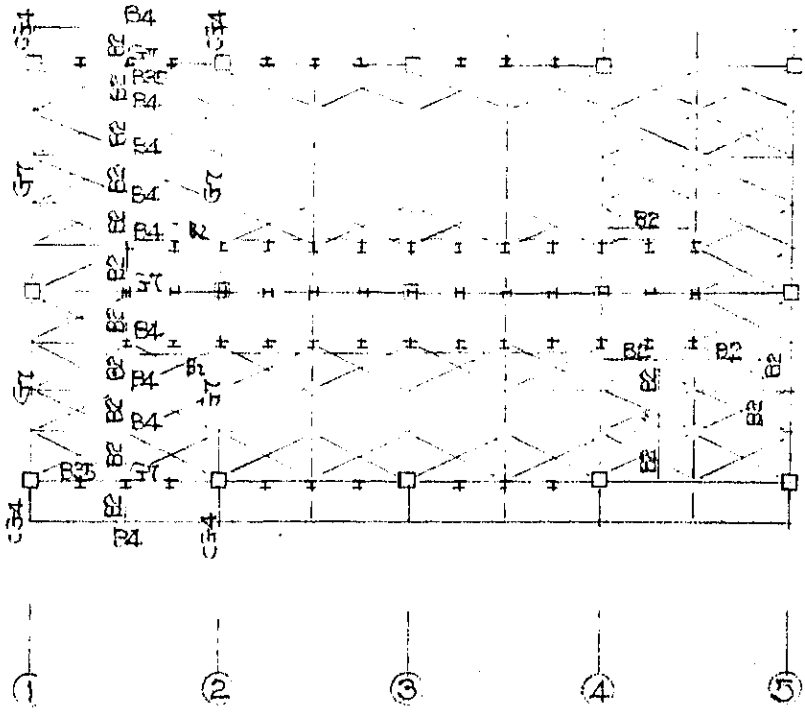
AN





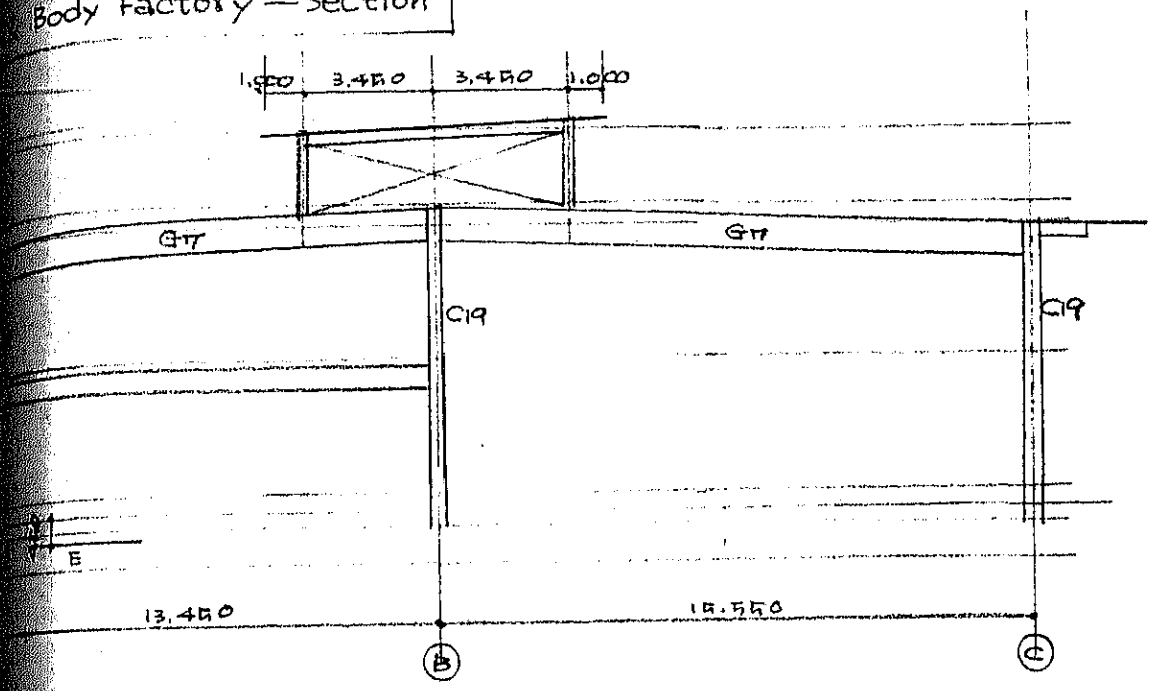
PLAN





1 : P1

Body 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						
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							

essure

locity of Wind

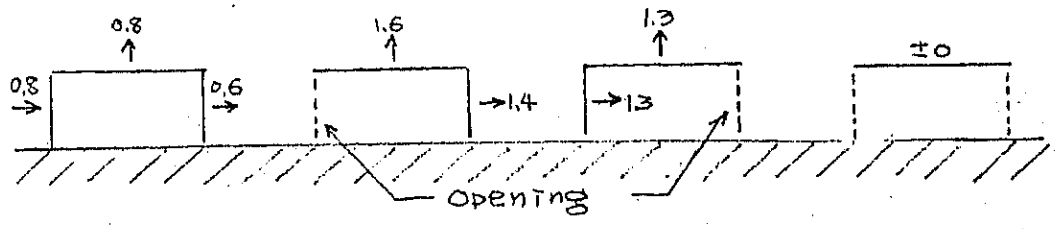
Cyclone 130 Miles/Hour = 130 × 1609.34/3,600
= 58.1 m/sec
→ 66.0 m/sec (h = 15 m)

(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]	$60\sqrt{\bar{h}}$	q [kg/m²]	cq [kg/m²]
Heavy Repair Factory	Monitor Roof	Roof	12.17	214	220	
		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	7.31 – 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



Axial Force [t]

	C1		C2					
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S	0.09 × 80.6	7.3	× 139.8	12.6				
G,B	0.15 × 14.3	2.1	× 20.8	1.9				
	0.05 × 25.6	1.3	× 49.8	2.5				
C	0.15 × 6.7	1.0	× 6.7	1.0				
W	0.02 × 8.1	0.2	× 0					
	0.08 × 0		× 0					
	0.05 × 43.6	2.2	× 87.2	4.4				
	0.60 × 2.3	1.4	× 0					
Σ		15.5		22.4				
W.L.	−0.20 × 80.6	−16.1	× 139.8	−28.0				
Σ'		−0.6		−5.6				
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								

	B1		B2		B4		BW	
S			0.09 × 57.9	5.2				
G,B			0.05 × 70.1	3.5				
C			0.05 × 20.0	1.0	=B2			
W			0.05 × 6.9	0.6				
			0.05 × 52.0	2.6				
Σ				12.9	12.9	12.9		
W.L.			−0.21 × 57.9	−12.2		−12.2		
Σ'				0.7	0.7	0.7		
S	0.09 × 108.6	9.8	× 98.5	8.9				
G,B	0.15 × 21.0	3.2	× 27.5	4.1	=B2	17.1		
	0.05 × 34.0	1.7	× 60.0	3.0				
C	0.15 × 7.0	1.1	× 7.0	1.1				
W	0.02 × 8.9	0.2	× 0		× 0			
	0.08 × 8.9	0.7	× 17.9	1.4	× 8.9	0.7		
	0.05 × 0		× 0		× 0			
	0.60 × 4.9	2.9	× 4.9	2.9	× 2.4	1.4		
Σ		19.6		34.3	21.4	32.1	19.2	
W.L.	−0.20 × 108.6	−21.7	× 98.5	−19.7	=B2	−19.7		
Σ'		−2.1		2.1	1.4	0.2	−0.5	
S					0.43 × 7.3	3.1		
G,B					0.05 × 11.0	0.6		
C								
W					0.02 × 0			
					0.08 × 11.1	0.9	0.08 × 5.5	0.4
					0.05 × 15.3	0.8		
					0.60 × 12.6	7.6	0.60 × 1.5	0.9
Σ					45.1	13.0	[t/m] 1.3	1.3
W.L.						0		0
Σ'					13.2	13.0	1.3	1.3

	A1		A2		A4		1W	
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S	0,09 × 72,9	6.6	× 126.4	11.4				
G,B	0,15 × 13,2	2.0	× 19,7	3,0		=A2 17.5		
	0,05 × 28,4	1.4	× 42,2	2,1				
C	0,15 × 6.7	1.0	× 6.7	1.0				
W	0,02 × 8.7	0,2	× 0		× 8,5	0,2		
	0,08 ×		× 0		× 0			
	0,05 × 43,6	2.2	× 87.2	4.4	× 43,6	2.2		
	0,60 × 2,5	1.5	× 0		× 2.4	1.4		
Σ	14.9	14.9	21,9	21.9	21,3	21,3		
W.L.	-0,20 × 72,9	-14.6	× 126,4	-25,3	=A2	-25,3		
Σ'	0,3	0,3	-3,4	-3,4	-4,0	-4,0		
S					0,43 × 7,3	3,1		
G,B					0,05 × 7,1	0,4		
C								
W					0,02 × 0		0,02 × 5,5	0,1
					0,08 × 7,7	0,6		
					0,05 × 0		0,60 × 1,5	0,9
					0,60 × 6,3	3,8		
Σ					29,2	7,9	[4/m] 1,0	1,0
W.L.						0		0
Σ'					3,9	7,9	1,0	1,0

	A 4/5		4/B 4		4/B 4/5		4W	
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S								
G,B								
C								
W								
Σ								
W.L.								
Σ'								
S	0,43 × 21,9	9,4	× 14,6	6,3	× 29,3	12,6		
G,B	0,05 × 15,9	0,8	× 11,8	0,6	× 22,0	1,1		
C	0,05 × 6,7	0,3	× 6,7	0,3	× 6,7	0,3		
W	0,02 × 16,9	0,3	× 0		× 0			
	0,08 × 0		× 11,1	0,9	× 11,1	0,9		
	0,05 × 0		× 15,3	0,8	× 30,6	1,5		
	0,60 × 4,9	2,9	× 12,6	7,6	× 12,6	7,6	0,60 × 2,8	1,7
Σ	13,7	13,7	16,5	16,5	24,0	24,0	[4/m] 1,7	1,7
W.L.		0		0		0		0
Σ'	13,7	13,7	16,5	16,5	24,0	24,0	1,7	1,7

[tm, tJ

Load		C	M_o	Q
0.04 × 29.3 0.05 × 14.5	P	3.56 × 1.5	5.0	× 1.0	3.4
			5.0		3.4
(-1.6×0.16 - 0.07) × 29.3	P	-9.55 × 1.5	-14.3	× 1.0	-9.6
			-14.3		-9.6
0.09 × 13.0 0.05×13×4/13.45 0.15	q	1.513 × 13.45²/12	22.8	× 1/8 34.2	× 13.45/2	10.2
			22.8	34.2		10.2
(0.8×0.16 - 0.07) × 13.0	q	-2.574 × 13.45²/12	-38.8	× 1/8 -58.2	× 13.45/2	-17.3
2.5	F	1.8×3.45×0.174/0.26	±4.6 ±1.6	0.7 × 13.45/2 ±4.7	2.5 × 0.174/0.26	±1.8 ±0.17
		D	U			
		43.4 40.4 ~	34.2 37.2	62.9 ~ 53.5	19.1 ~ 18.0 ~	15.5 16.6
0.09 × 13.0 0.05×13×5/15.55 0.15	q	1.529 × 15.55²/12	30.8	× 1/8 46.2	× 15.55/2	11.9
			30.8	46.2		11.9
(0.8 × 0.16 - 0.07) × 13.0	q	-2.574 × 15.55²/12	-51.9	× 1/8 -77.8	× 15.55/2	-20.0
2.5	P	2.5×3.45×0.22/0.28	±1.9 ±1.7	0.6 × 15.55/2 ±4.7	2.5 × 0.22/0.28	±0.6 ±1.9
		D	U			
		53.8 58.6 ~	50.0 45.2	82.5 ~ 73.1	20.6 ~ 21.9 ~	19.4 18.1
5.6 × 1/4	P	2.8 × 11.3/8	2.6	× 1/4 5.1	× 1/2	1.4
		(2.6 × 1.5	3.9)			
			2.6	5.1		1.4
(0.8~0.6 × 0.12) × 17.5	P	4.6 ~ 3.4 × 11.3/8	4.2 ~ 3.1	× 1/4 8.4 ~ 6.2	× 1/2	2.3 ~ 1.7
		(4.2 × 1.5	6.3 4.7)			
			4.2 ~ 3.1	8.4 ~ 6.2		2.3 ~ 1.7

[tm , t]

Load			C		Mo		Q	
	(6.09×3.36)+0.15	g	0.452 × 13.0²/12	6.4	× /8	9.51	× 13.0/2	2.9
				6.4		9.5		2.9
	(-0.8×0.16−0.07) ×3.36	g	-0.665 × 13.0²/12	-9.4	× /8	-14.0	× 13.0/2	-4.3
				-9.4		-14.0		-4.3
	5.6 × 1/3	P	3.17 × 7.3/8	3.4	× /4	6.8	× 1/2	1.9
			(3.4 × 1.5	5.1)				
				3.4		6.8		1.9
	(0.8+0.6 ×0.12) ×3.36	g	0.31 / 0.23 × 7.3²/12	1.4 / 1.0	× /8	2.1 / 1.5	× 7.3/2	1.1 / 0.8
			(1.4 / 1.0 × 1.5	2.1 / 1.5)				
				1.4 / 1.0		2.1 / 1.5		1.1 / 0.8

Seismic Force

[t]

	W	k	kw	Q
RF				
	39.5 × 8.9	17.6		
	(39.0 × 3) + (6.9 × 13)/2	10.3		
	2.2 × 39	4.3		
	13.8 × 2.2) + (0.05 × 78.0 × 2.2)	11.0		
	$\bar{w}$ = 43.2 / (39.0 × 6.9) = 0.16 [t/m²]	43.2	0.10	4.3	5.0
3F	(52.5 × 35.0) − (39.0 × 6.9)/2	17.4			
	(52.0 × 3) + (29.0 × 5)/2	19.2			
	(52.0 × 9) + (1.5 × 10) + (29.0 × 4)/2	30.0			
	7.0 × 1m/2	7.9			
	17.0 × 35/2	6.1			
	74 × 3.4) + (0.08 × 78 × 3.4) + (0.05 × 78 × 2.7)	36.7			
	$\bar{w}$ = 204.3 / (52.5 × 35.0) = 0.11 [t/m²]	204.3	〃	20.4	26.0 → 29.0
2F	132.0	38.3		→	
	(6.5 × 11) + (4.9 × 8)/2	5.4		1/2	
	43.0 × 3.17	12.7			
	$\bar{w}$ = 56.4 / 132.0 = 0.43 [t/m²]	56.4	〃	5.6	

Wind Force

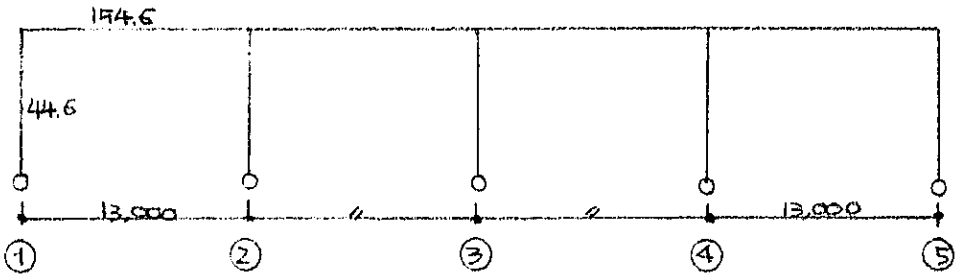
[t]

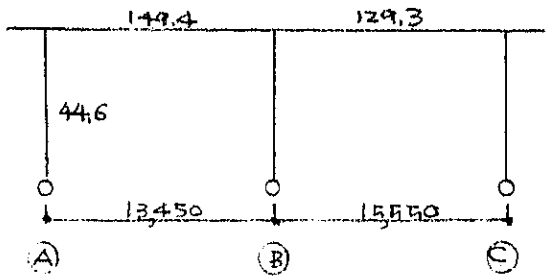
C	q		A	H	Q	
RF + 0.6	0.18	17.2 × 2.3	16.6	4.3	4.5	
〃	0.12	29.5 × 3.5	103.3	17.3	22.0	< K.L.
〃	〃	↑				
3F + 0.6	0.18	39.3 × 2.3	90.4	22.8	23.0	
〃	0.12	52.5 × 3.4	178.5	30.0	53.0	> K.L.
〃	〃	↑				

Ass Ratio

	J	ℓ. ft	1300	1345	1555		637	
24	201,000		194.6	149.4	129.3			
49 / 16	40,700 ~35,300						59.5 (x0.75 = 44.6)	

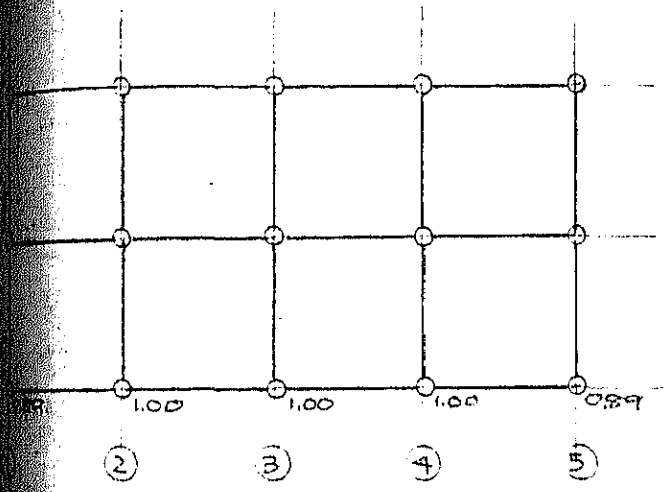
$R = \mu J_{max} = 0.20 + 0.80\sqrt[3]{\left(\frac{35,300}{40,700}\right)^2} J_{max} = 0.93\, J_{max}$





ribution Factor & Inflection Point

	D				Y				h	K.L.			W.L.		
	K	a	D	D'	Y_0	Y_1	$Y_{2,3}$	ΣY		Q	MU	ML	Q	MU	ML
⑥	3,61	0.22	9.40	0.89				0	6.35	2.8	20.3	0	2.6	19.0	0
⑦	7.22	0.23	10.00	1.00				0	〃	3.1	22.8	0	2.3	16.9	0
⑭	3,50	0.22	9.36	0.95				0	〃	3.1	23.0	0	4.5	33.0	0
⑰	6.81	0.23	9.94	1.00				0	〃	3.3	24.3	0	4.7	34.5	0
⑱	3.02	0.21	9.18	0.95				0	〃	3.1	23.0	0	4.5	33.0	0



nit Stress

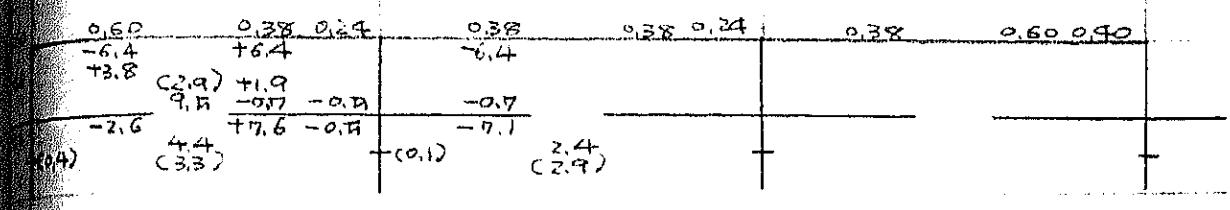
	K.L.					W.L.					
	Total			⑧/④ Frame		Total			④ Frame		
Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD
30	14.34	2.0		15.0	4.18	3.1	22.0	14.34	1.5	11.0	4.18	2.3
	14.50		2.0	9.5	2.90	3.3	53.0	14.50	3.7	13.5	2.90	4.7

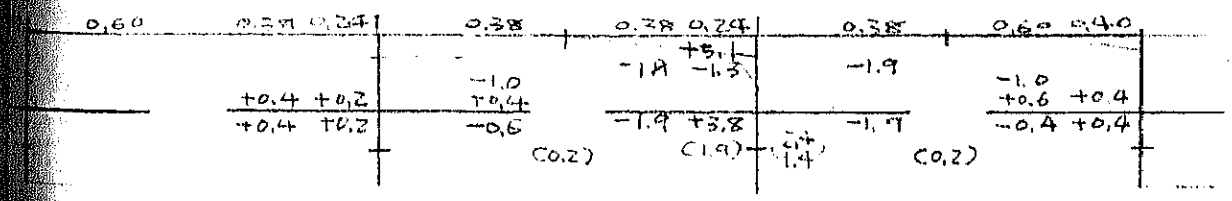
flection by Horizontal Force

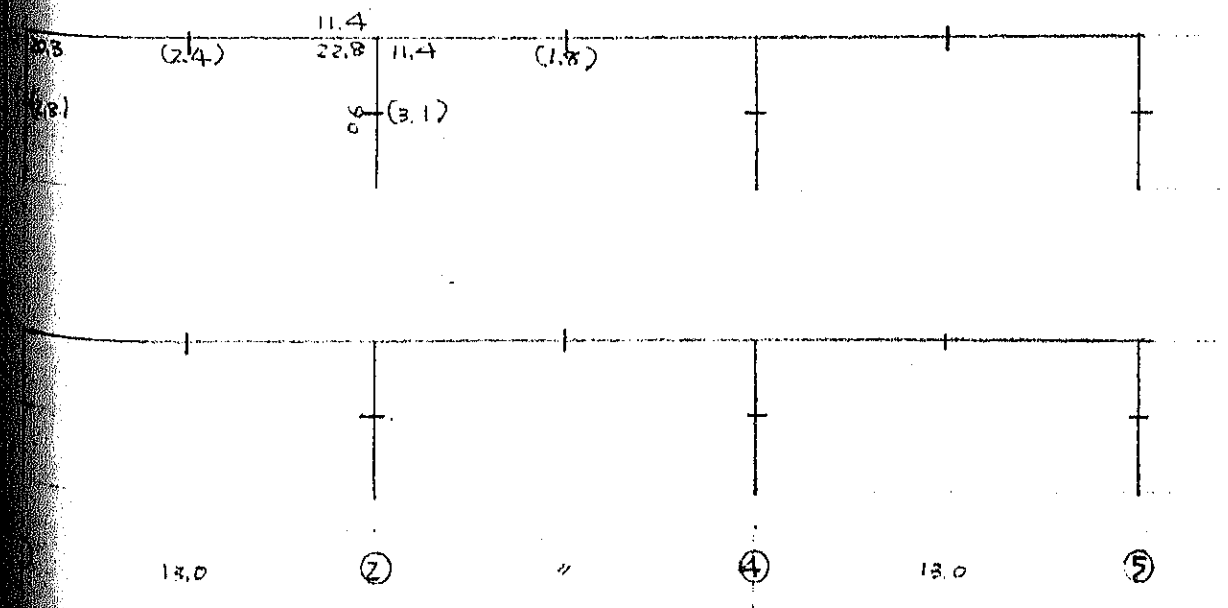
		Q	ΣD	$h_0^2/12Ek_0$	δ	δ/h	
K.L.	Σ	29.0	14.34×10.00	$636^2/12\times2,100$	3,24	1/196	
W.L.		22.0	〃	〃	2.45	1/259	
K.L.		29.0	14.50×9.94	〃	3,22	1/197	
W.L.		53.0	〃	〃	5.88	1/108	

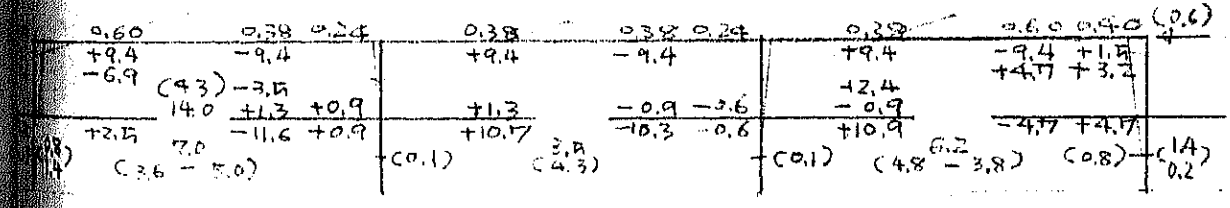
ress

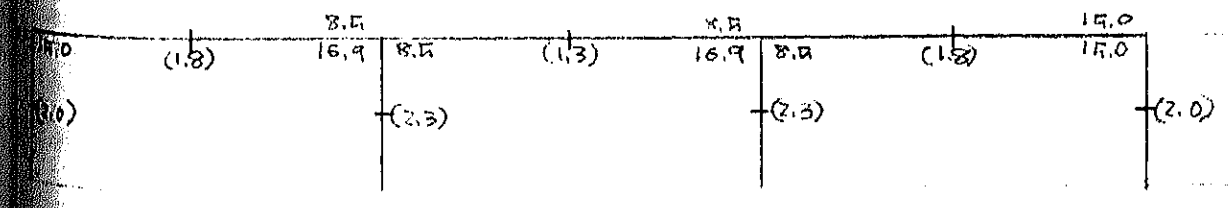
(B=17.5t)

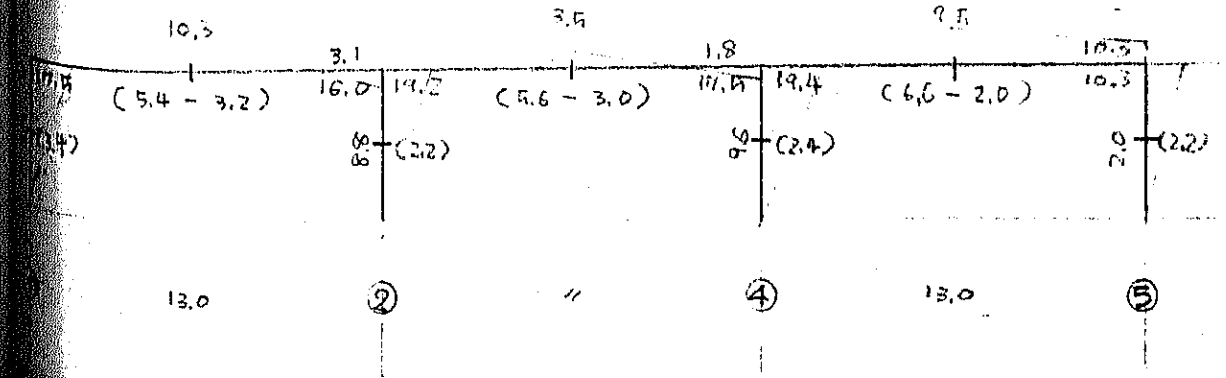

0.60
0.38 0.24
0.38
0.38 0.24
0.38
0.60 0.90
-6.4
+3.8
+6.4
-6.4
(2.9)
9.5
+1.9
-0.7
-0.7
-2.6
+7.6
-0.5
-7.1
4.4
(3.3)
(0.1)
2.4
(2.9)
(0.4)


0.60
0.38 0.24
0.38
0.38 0.24
0.38
0.60 0.40
+5.1
-1.9
-1.5
-1.9
-1.0
+0.6
+0.4
+0.4
+0.2
+0.4
-0.6
-1.9
+3.8
-1.9
-0.4
+0.4
(0.2)
(1.9)
(0.2)

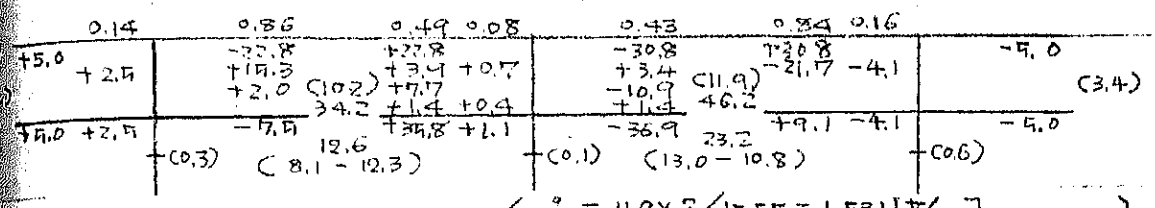

11.4
22.8
11.4
(2.4)
(1.8)
(3.1)
18.0
②
④
18.0
⑤






13.0
②
④
13.0
⑤

③ FRAME (H=11.35)



$$\delta = 11.9 \times 2 / 14.5\text{m} = 1.581\ [t/m]$$

$$\delta \fallingdotseq \frac{5 q l^4}{384 E J} - \frac{\Sigma M_c l^2}{16 E J}$$

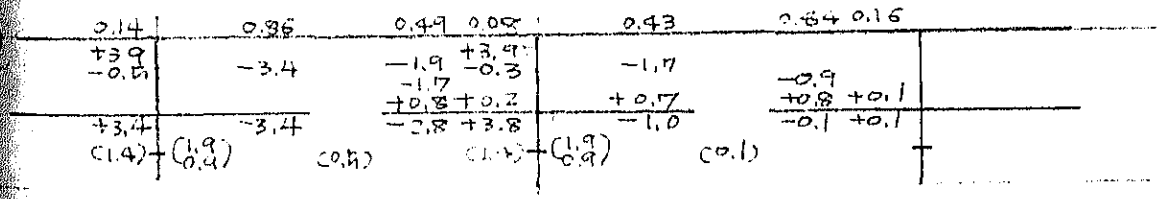
$$= \frac{5 \times 0.01581 \times 1550^4}{384 \times 2{,}100 \times 201{,}000} - \frac{(3690 + 310) \times 1550^2}{16 \times 2{,}100 \times 201{,}000}$$

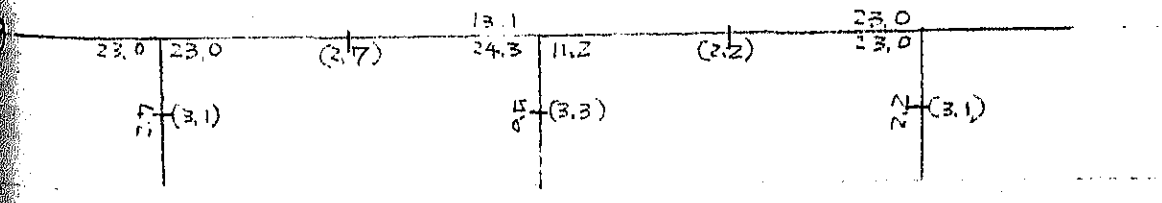
$$= 2.176 - 1.64$$

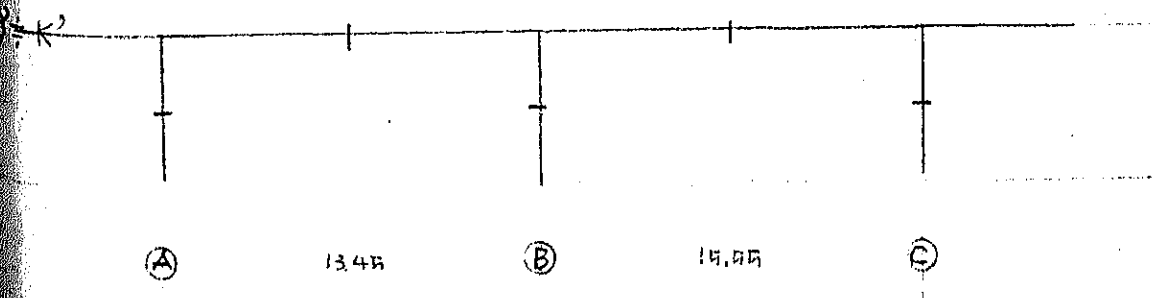
$$= 1.12 \quad < 2.00$$

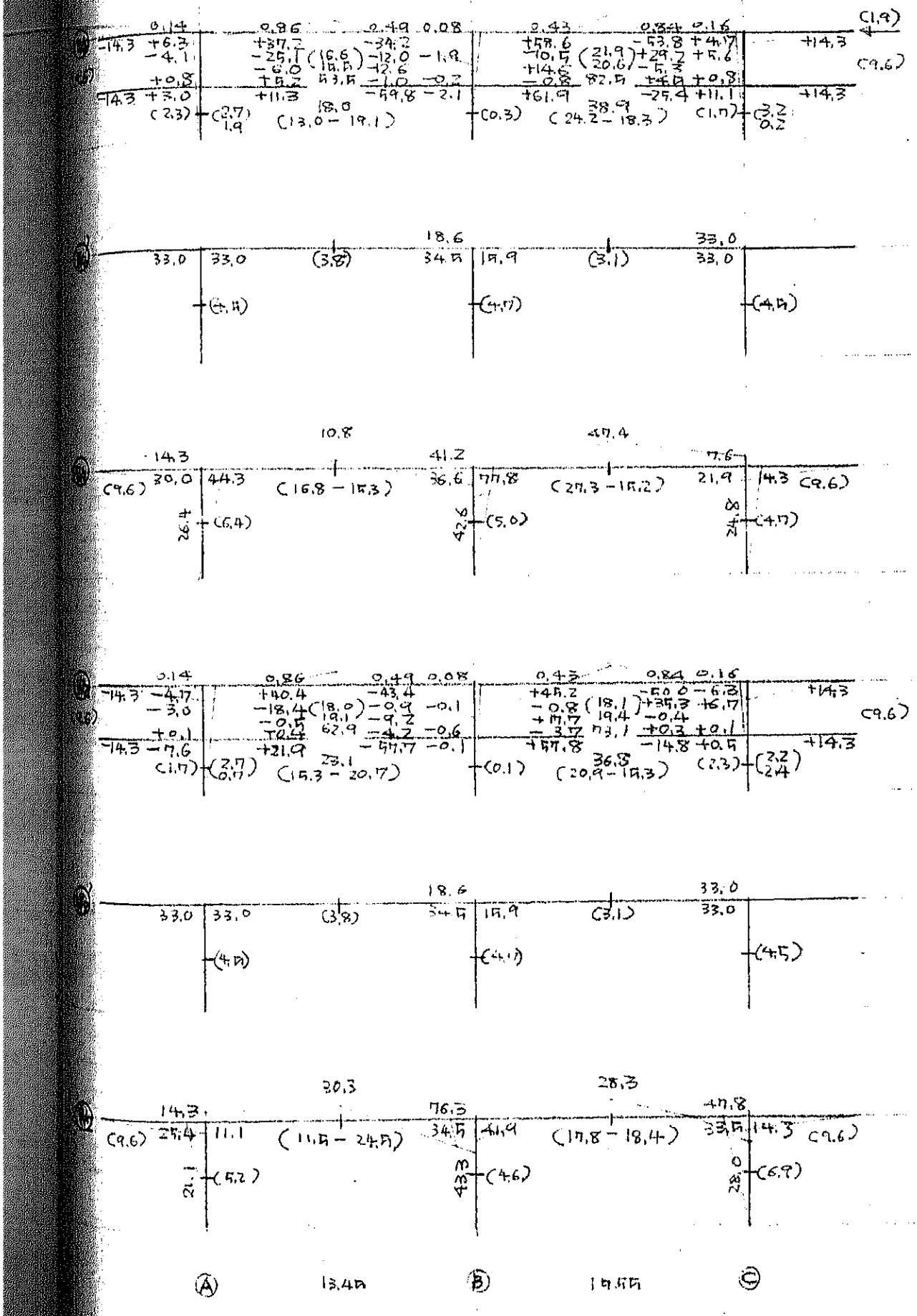
$$\frac{\delta}{\text{span}} = \frac{1.12}{1550} \fallingdotseq \frac{1}{1{,}388} < \frac{1}{300}$$

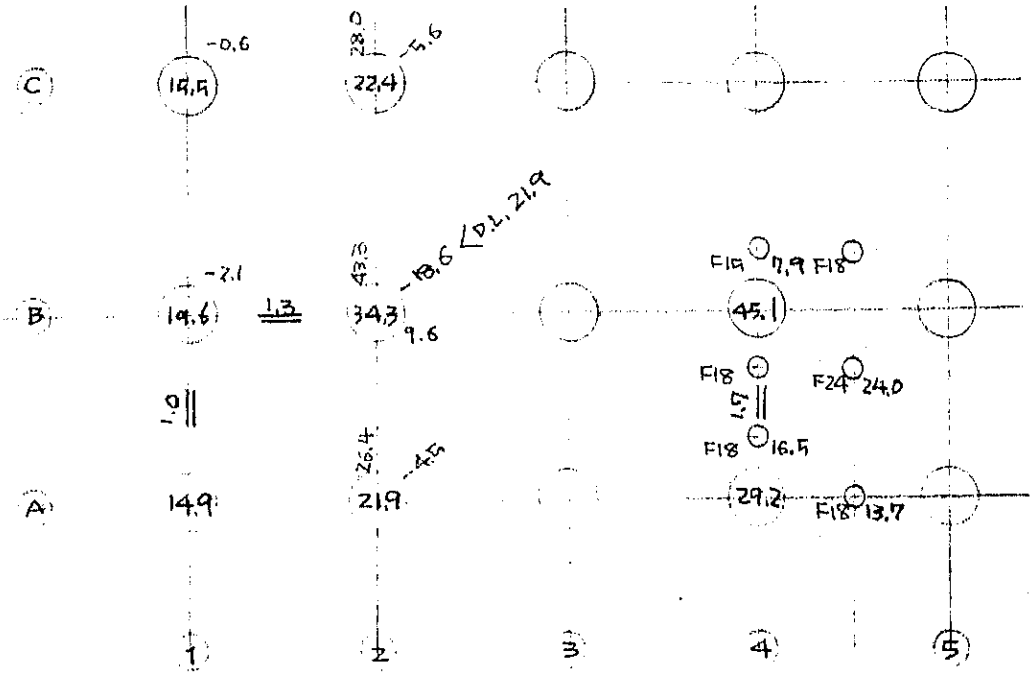
H-700 × 300 × 13 × 24 , J = 201,000 [cm⁴]








(A)
(B)
(C)
13.4m
14.5m



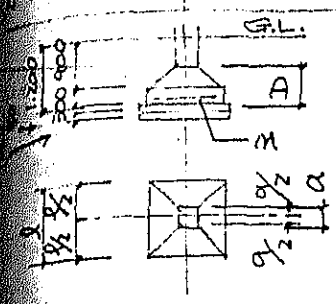
ndent Footing

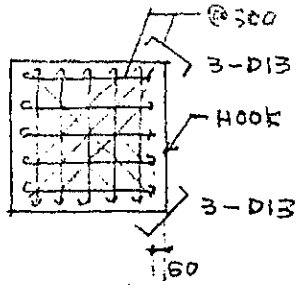
fe	fea	An	Bn	-l	Type	-N	ΔN	-N ∨ ΔN
14	5.4	2.87	1.69	1.8	F18			
		4.15	2.04	2.1	F21	-5.6	13.2	OK
		3.63	1.91	2.1	〃			
		6.35	2.52	2.17	F27	-9.0	21.8	OK
		8.36	2.89	3.0	F30			
		2.76	1.67	1.8	F18			
		4.06	2.02	2.1	F21	-4.5	13.2	OK
		5.41	2.33	2.4	F24			

nuous Footing

fe	fea	An	Bn	B	Type
42	3.2	0.32	0.32	0.35	FG1
		0.41	0.41	0.45	FG2
		0.54	0.54	0.55	FG3

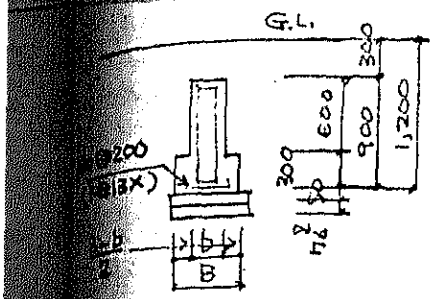
of Independent Footing





A	fca	Na	a	ℓ/a	N/Na	Q/N	M	Q	D	j	at	Cp	2D+a	QA	n
600	5.4	48.6	550	5.45	0.365	0.243	9.8	11.8	800	62.1	7.9	12.7	215	66.8	10-D13 @300
529	〃	39.4	〃	4.91	0.285	0.240	6.2	9.4	〃	〃	5.0	10.1	〃	〃	9-D13 〃
476	〃	34.1	〃	4.36	0.240	0.238	4.1	7.4	700	53.4	3.8	9.2	195	52.0	8-D13 〃
411	〃	23.8	〃	3.82	0.197	0.233	2.6	5.5	〃	〃	2.4	6.9	〃	〃	7-D13 〃
341	〃	17.5	〃	3.27	0.160	0.229	1.5	4.0	600	44.6	1.7	6.0	175	39.0	6-D13 〃
271	〃	12.2	〃	2.73	0.110	0.217	0.7	2.6	〃	〃	0.8	3.9	〃	〃	5-D13 〃

of Foundation Beam



	TOP R.	BTM R.	SIDE R.	Styp.	TIE
300	2-D19	2-D19	2-D10	□D10 @200	⊓D10 @600
〃	〃	〃	〃	〃	〃
〃	〃	〃	〃	〃	〃

Stress Between Piling Footing

$q = (FG35)\,1.26 + (Brick\ Wainscot)\,0.6 \times 2.9$
$= 3.0$ [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]	Q	6.4 [cm]	

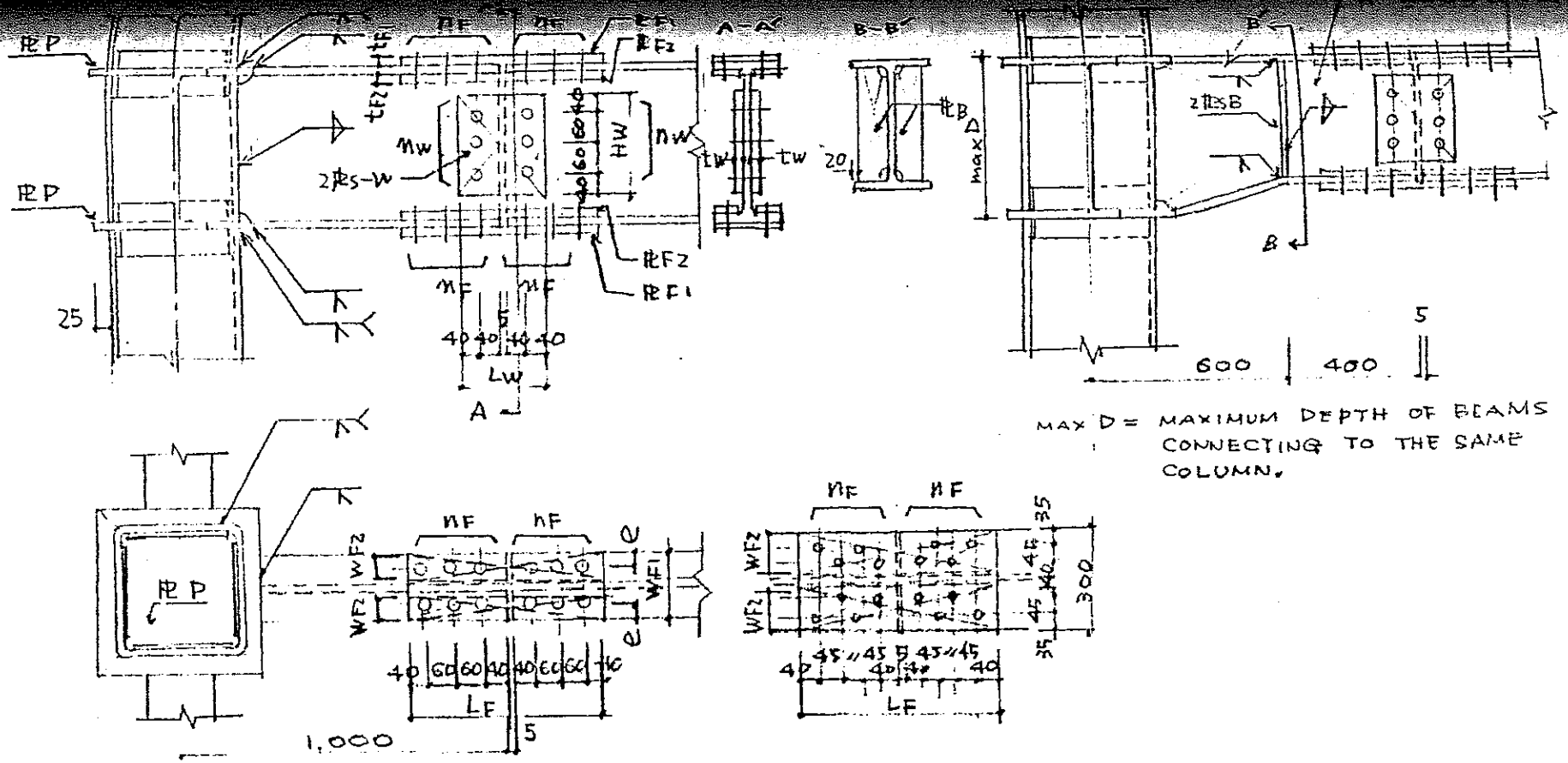
b 35 D 90 j 70.9 QAL 12.4 [t] > Q

$q = 1.26 + (0.6 \times 1.5) + (0.08 \times 3.5) = 2.84$

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			

		Ⓓ	2.6	20.3	17.5	10.3	3.9	22.4	14.9	7.7	22.4	H														
	M	CENT	4.4	4.5	10.3	9.5	6.6	8.9	5.9	5.1	8.9	700×300×13×24														
		Ⓔ	7.6	11.4	3.1	19.4	11.4	19.0	4.5	11.8	19.0															
	Q		3.3	2.4	-5.4	-6.6	5.6	5.7	1.9	3.3	5.7															
	M	Ⓒ																								
		Ⓐ																								
	Q																									
1	M	Ⓒ	9.1	23.0	7.6	47.8	13.7	13.9	16.7	38.7	38.7	H													G7	
		CENT	23.3	6.9	47.4	28.3	34.8	29.1	24.2	5.1	34.8	700×300×13×24														
		Ⓑ	36.9	11.2	77.8	41.9	53.4	25.7	40.9	5.0	53.4															
	Q		10.8	2.2	-15.2	-18.4	16.2	13.0	4.4	7.6																
			13.0		-29.3	-17.8	19.5	10.8	14.3	4.8	19.5															
	M	Ⓑ	35.8	13.1	41.2	76.3	53.7	48.9	5.4	40.5	53.7	H	336	787	42.7	2.65	1.00	1.61	7290	0.31	G7					
		CENT	12.6	5.0	10.8	30.3	18.9	17.5	1.4	17.7	18.9	900×300×13×24														
		Ⓐ	7.5	23.0	44.3	11.1	11.3	30.5	36.8	3.6	36.8															
	Q		12.3	2.7	-15.3	-24.5	18.5	15.0	3.0	12.2	18.5															
			8.1		-16.8	11.5	12.2	10.8	8.7	3.4																



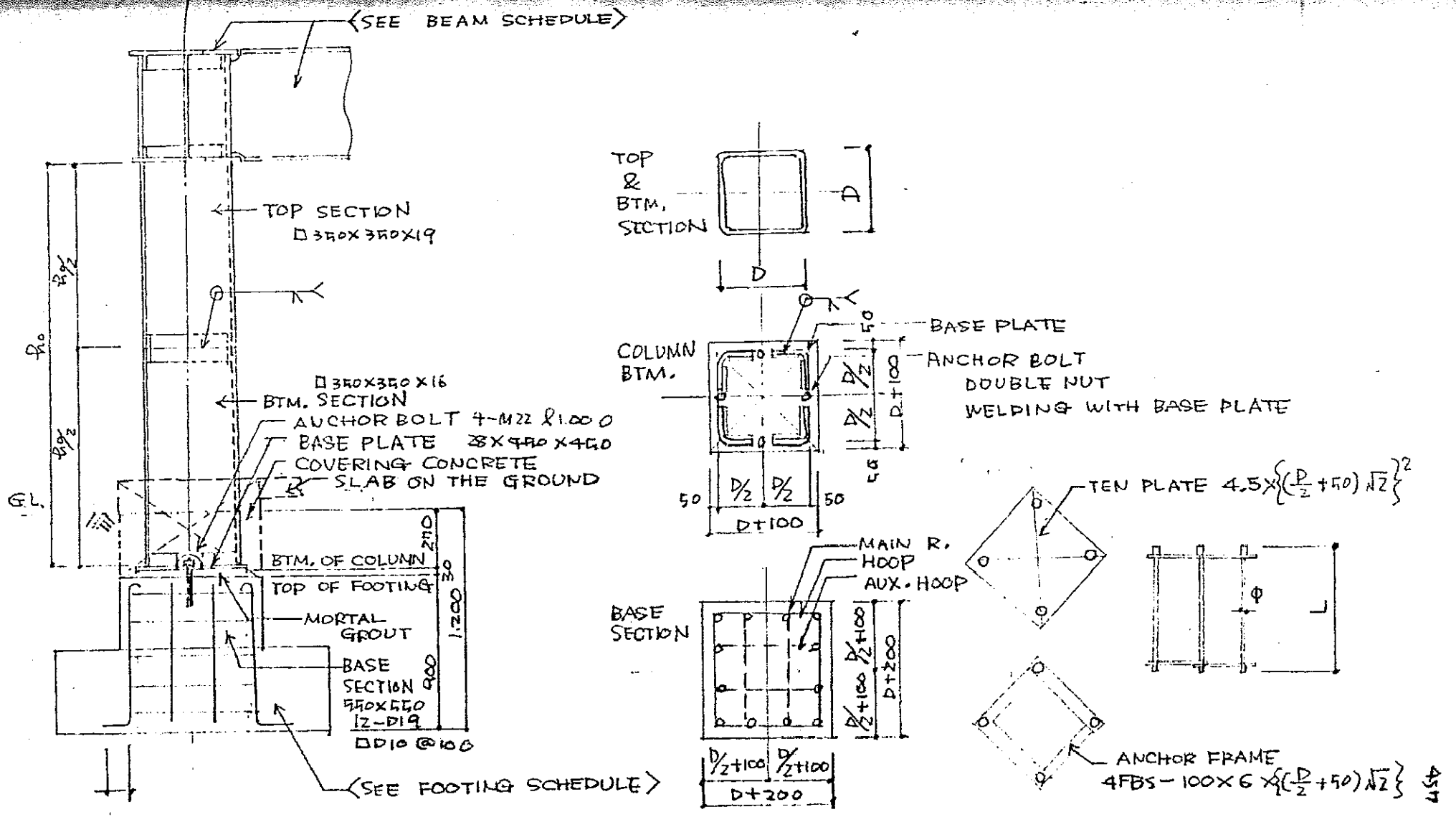
MAX D = MAXIMUM DEPTH OF BEAMS CONNECTING TO THE SAME COLUMN.

WF	t
150	30
175	30
200	35
250	45

$$t_a \geq \sqrt{3}\,\frac{t_F}{l_d}$$

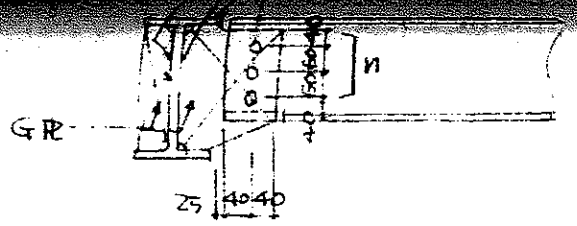
G9	H 900×300×16×28	28						
G8	H 800×300×14×26	28	16	19 × 300 × 615	22 × 107 × 615	2×6-M22	12 × 165 × 620	10 − M22
G7	H 700×300×13×24	25	16	19 × 300 × 525	19 × 107 × 525	2×5-M22	9 × 165 × 560	9 − M22
G6	H 588×300×12×20	22	16	16 × 300 × 435	16 × 107 × 435	2×4-M22	9 × 165 × 440	7 − M22
G6A	H 600×200×11×17	19	16	16 × 200 × 405	16 × 73 × 405	2×3-M22	9 × 165 × 440	7 − M22
G5	H-482×300×11×15	16	16					
G5A	H 500×200×10×16	16	16	12 × 200 × 405	16 × 73 × 405	2×3-M22	9 × 165 × 380	6-M22
G4	H 390×300×10×16	16	16					
G4A	H 400×200×8×13	16	16	9 × 200 × 285	12 × 73 × 285	2×2-M22	9 × 165 × 260	4 − M22

	↪	M U	2.6	20.3	-17.5	10.3	3.9	22.9	14.9	12.9	22.9		cf. chart
		L	0										
(B)(1)		Q	0.4	2.8	-3.4	2.2	0.6	3.2	3.0	2.6	3.2		
		N											
	↿	M U											
		L											
		Q											C19
		N	21.9	0.6	9.6	/	32.9	22.5	31.5	/	32.9		
	↪	M U	0.5	22.8	17.5	/	0.8	23.3	18.0	/	23.3		
		L	0										
		Q	0.1	3.1	2.4	/	0.2	3.2	2.5	/	3.2		
(C)(4)		N	21.9	2.2	-24.8	-28.0	32.9	24.1	46.7	-6.1	46.7		
	↿	M U	4.1	23.0	21.9	-33.5	6.2	29.1	26.0	-29.4	26.0		
		L											
		Q	0.6	3.1	4.7	-6.9	0.9	3.7	5.3	-6.3	6.3		C19
		N	34.3	0.6	9.6	/	51.5	34.9	43.9	/	51.5		
	↪	M U	0.5	22.8	17.5	/	0.8	23.3	18.0	/	23.3		
		L	0										
		Q	0.1	3.1	2.4	/	0.2	3.2	2.5	/	3.2		
(B)(4)		N	34.3	0.5	-42.6	-43.3	51.5	34.8	-8.3	-9.0	51.5	□	
	↿	M U	1.1	24.3	-36.6	-34.5	1.7	25.4	-35.5	-35.4	35.5	350×350×19	
		L										16	
		Q	0.1	3.3	-5.0	-4.6	0.2	3.4	-4.9	-4.5	4.9		OK C19
		N	22.3	0.6	9.6	/	33.5	22.9	31.9	/	33.5		
	↪	M U	0.5	22.8	17.5	/	0.8	23.3	18.0	/	23.3		
		L	0										
		Q	0.1	3.1	2.4	/	0.2	3.2	2.5	/	3.2		
(A)(4)		N	22.3	2.7	-26.4	21.1	33.5	26.0	-4.1	43.4	43.4		
	↿	M U	2.5	23.0	-30.0	25.4	3.8	25.5	-27.5	27.9	27.9		
		L											
		Q	0.3	3.1	-6.4	5.2	0.5	3.4	-6.1	5.5	6.1		C19

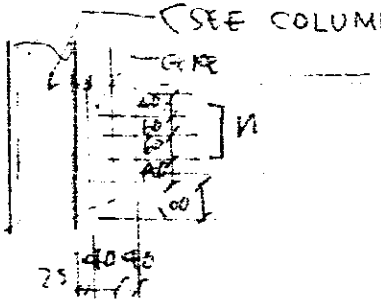

(SEE BEAM SCHEDULE)
TOP SECTION
□350X350X19
□350X350X16
BTM. SECTION
ANCHOR BOLT 4-M22 ℓ1000
BASE PLATE 28X490X450
COVERING CONCRETE
SLAB ON THE GROUND
G.L.
BTM. OF COLUMN
TOP OF FOOTING
MORTAL GROUT
BASE SECTION 550X550
12-D19
□D10 @100
(SEE FOOTING SCHEDULE)
TOP & BTM. SECTION
D
COLUMN BTM.
BASE PLATE
ANCHOR BOLT
DOUBLE NUT
WELDING WITH BASE PLATE
D/2+100
50
D/2
D+100
MAIN R.
HOOP
AUX. HOOP
BASE SECTION
D+200
TEN PLATE 4.5×{(D/2+50)√2}²
ANCHOR FRAME
4FBS-100×6×{(D/2+50)√2}

Design of Sub Beam

h	l	@	w D.L.	w W.L.	w T.L.	δ	Mo	Q	Jn	Zn	Member	J	Z	lb	ib	λb	q	C	fb	B/f	Type
9.0	3.25	3.725	0.02	0.8x0.18	0.124	0.462	0.61	0.75	295.0	25.4	H-200X100	1,840	184	325	2.60	125.0	6.49	1.00	1.10	0.20	B2
4.0	13.0	6.70 3.35	0.5	7.8x0.12		0.335 0.322	7.08 6.80	2.18 2.09	13,690 13,159	442.3 283.3	H-350X350	13,600 40,300	776 2,300	325	9.65	33.7	5.08	〃	1.60	0.50	B5
3.6	3.36		0.02	1.6x0.12	0.172	0.181	0.26	0.30	127.7	10.8	H-200X100										B2
7.0	13.0	2.25	0.52	1.6x0.16	0.236	0.521	11.22	3.49	21,700	465.7	H-400X200	23,700	1,190	650	5.26	123.6	8.09	1.75	1.20	0.52	B4
〃	〃	3.36	〃	0.8x0.16	0.108	0.363	7.67	2.36	14,835	319.6	〃										〃
3.6	6.5	2.25 3.55	0.51 0.08			1.482 (5.1, 8.66)	7.83	4.82	8,201	489.2	H-350X175	13,600	775	325	4.58	170.9	8.33	1.75	1.60	0.63	B3A
〃	4.5				↓	6.13	5.75	2.70	3,125	359.4	〃	〃									〃
〃	9.0				↓↓↓	〃	23.00	7.82	44,039	1437.9	H-500X200	47,800	1,910	225	5.14	43.8	8.03	1.00	〃	0.55	B5
〃	3.25					1.482	1.96	2.41	946	122.5	H-200X100	1,840	184								B2



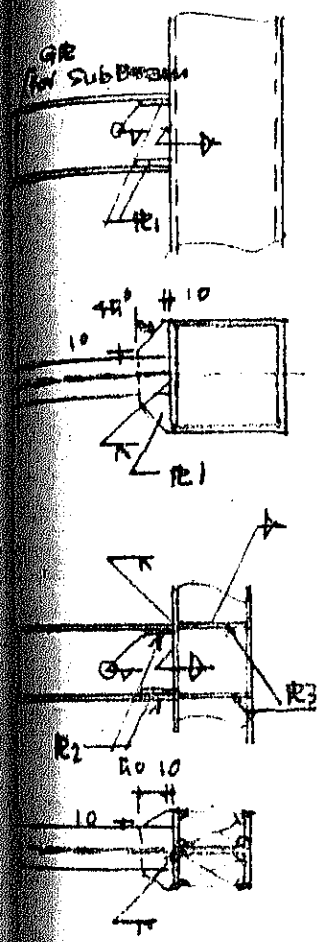
ONE SIDE FLANGE CUT



B4A	H-450x200x8x13	4	4-M22
B4	H-400x200x8x13	4	4-M22
B3A	H-350x175x7x11	4	4
B3	H-300x150x6.5x9	4	3-M22
B2A	H-250x125x6x9	9	4
B2	H-200x100x5.5x8	4	2-M22
B9	H-900x300x16x43	19	12-M22
B6A	H-588x300x12x20	16	17-M22
B6	H-600x200x11x17	4	4
B5	H-500x200x10x16	12	6-M22
B3E	H-350x350x12x19	12	2x3-M22

h_n	ℓ	@	G.L. D.L.	G.L. W.L.	G.L. T.L.	P (S.L. 0.05)	M_n	@	J_n	Z_n	Member	J	Z	f_b	l_b	λ_b	η	C	f_b	b/t	Type
7.0	1.5	13.0	0.02	1.6×0.16	0.236	7.63	11.4	7.63	5,812.5	475.0	H-400×200	23,700	5,190	160	5.18	29.0	8.32	1.05	1.60	9.40	CG4
			0.236×7.35×13.2			−{0.05×14.5}															
3.6	1.5	3.36	0.82	1.6×0.12	0.102	0.61	0.92	0.61	5446	38.3	H-200×100	1,840	184	〃	2.60	57.7	6.49	〃	〃	0.21	CG2

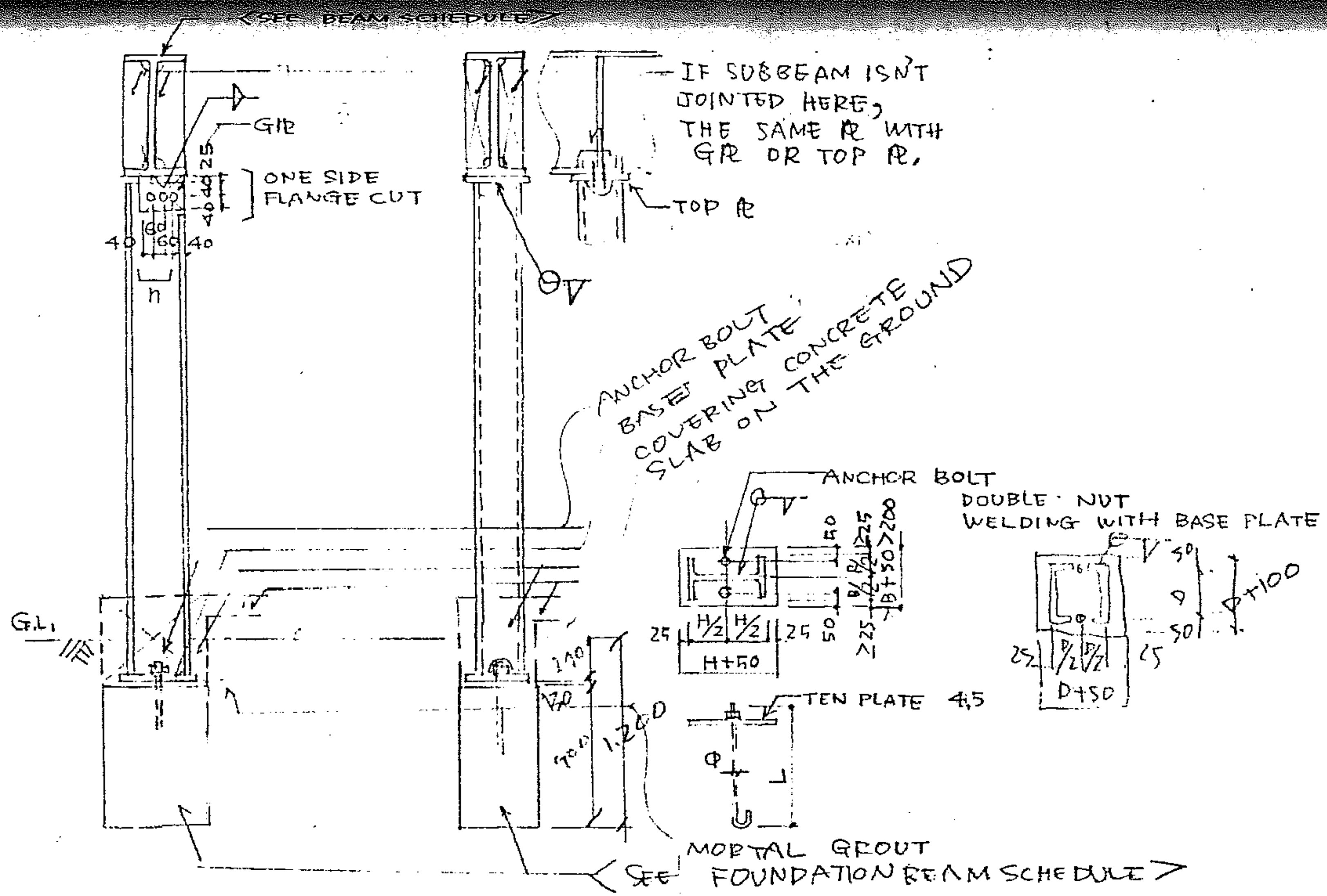
...LE OF CANTILEVER



MARK	MEMBER	#1	#2	#3
CG4	H-400×200×[illegible]×13	#12	#12	#12
CG3A	H-3[illegible]×1[illegible]×17×11	〃	〃	〃
CG3	H-300×150×6.5×9	#9	#9	#9
CG2	H-200×100×5.5×8	〃	〃	〃

DESIGN of POST

	BTM	TOP	H	⊕	D.L.		N	W.L.		Mo	Q	Ju	Zu	Member	J	lk / lb	ik / ib	λk / λb	M / C	fc / fb	A / Z	σ/f	Type
					w	q		w	q														
	7.3	9.6	23	3.25	0.05	0.16	0.34	08x018	0.417	0.26	0.49	81.0	10.8	H-100x100									P1
	0.3	7.3	7.0	3.36	0.02	0.07	0.49	08x0.12	0.32	1.96	1.12	2,041.7	81.7	H-300x150	7,210	700	3.29	213	8.61	0.21	46.8		P3
																〃	3.37	181	1.60	0.60	481	0.49	
	〃	〃	〃				13.7			〃	〃	〃	〃	〃	〃	350	〃	106	8.61	0.82	〃		〃
																〃	〃	90	1.75	1.40	〃	0.43	
	0.3	7.3	7.0				24.0							□-200²x8	3.620	355	7.78	45.6		1.41	59.8	<1.00	P20A
	〃	〃	〃				16.5							H-250x250		355	6.29	56.4		1.33	92.1	<1.00	P25

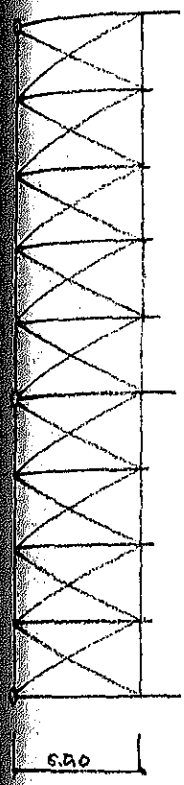


<SEE BEAM SCHEDULE>
GIR
ONE SIDE FLANGE CUT
IF SUBBEAM ISN'T JOINTED HERE, THE SAME PL WITH GR OR TOP PL,
TOP PL
ANCHOR BOLT
BASE PLATE
COVERING CONCRETE
SLAB ON THE GROUND
G.L.
ANCHOR BOLT
DOUBLE · NUT
WELDING WITH BASE PLATE
H+50
B+50
D+50
D+100
TEN PLATE 4.5
MORTAL GROUT
<SEE FOUNDATION BEAM SCHEDULE>

763

P1	H-400×100×6×8	厚9	2-M22	厚16×180×200	2-M20×900	
P2	H-200×100×5.5×8	DO	〃	厚〃×250×200	2-M〃×〃	
P2A	H-250×125×6.5×9	DO	3-M22	厚〃×300×200	2-M〃×〃	
P3	H-300×150×6.5×9	DO	〃	厚〃×350×200	2-M〃×〃	
P3A	H-350×175×7×11	厚12	4-M22	厚〃×400×225	2-M〃×〃	
P4	H-400×200×8×13	DO	〃	厚〃×450×250	2-M〃×〃	
P4A	H-450×200×9×14	DO	5-M22	厚〃×500×250	2-M〃×〃	
P2S	H-250×250×9×14	厚9	2×2-M22	厚19×300×300	〃	
P20A	□-200×200×8	TOP厚 16×300×300	〃	厚16×250×300	〃	
P25A	□-250×250×8	〃 19×350×350	〃	厚19×300×350	〃	

of Bracing



R 7.00

@ 3.39

C₁A $0.8 \times 0.12 \times 3.39 = 0.326$

Q $0.326 \times 7.0/2 = 1.14$

D $1.14 \times 7.36/6.80 = 1.29 \sim \times 2 = 2.58$ $A_n = 2.58/2.4 = 1.1$

$$J_n = \frac{13 \times 0.0002 \times 736^3 \times 300}{384 \times 2,100} = 385.6$$

$$z_n = \frac{3 \times 0.02 \times 7.36^2 \times 100}{8 \times 2.4} = 16.9$$

L − 130×130×12

A 29.8, J 467.0, Z 49.9

$$J_n' = \frac{5 \times 0.0002 \times 368^3 \times 300}{384 \times 2,100} = 18.5$$

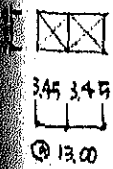
$$z_n' = \frac{0.02 \times 3.68^2 \times 100}{8 \times 2.4} = 1.4$$

L − 75×75×6

A 8.7, J 46.1 Z 8.5

Monitor Roof

Vertical

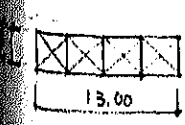


P $1.4 \times 0.18 \times 13.0 \times 2.6/2 = 4.26$

D $4.26 \times 4.32/3.45 \times 1/2 = 2.67$ $A_n = 2.67/2.4 = 1.11$

L − 75×75×6

Horizontal

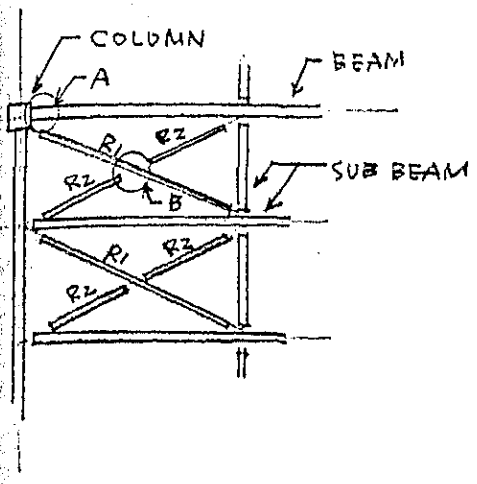


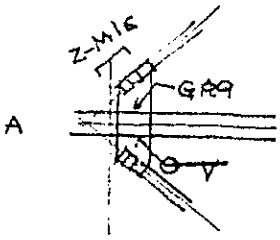
$$J_n = \frac{13 \times 0.0002 \times 474^3 \times 300}{384 \times 2,100} = 103.0$$

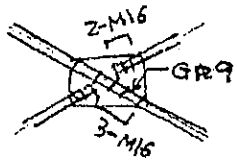
L-100×100×10

A 19.0, J 175.0, Z 24.4

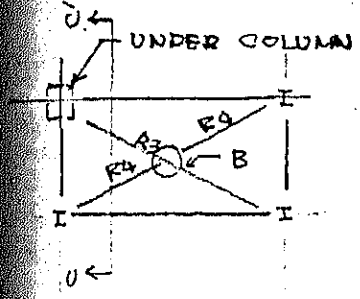
BRACING SCHEDULE

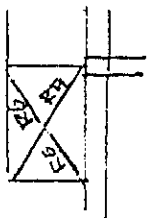






MONITOR ROOF





C – C' SECTION

Mark	Member	Note
R1	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	158 ~ 185	〃	253 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Spreading & M.C. F.	〃		〃	

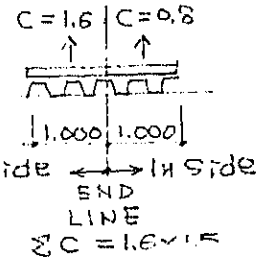
Continuous Beam Type

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

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

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

ω	Net ω	l_z	l_I	l min
× 0.346 [t/m²]	0.00492 [t/cm²]	373.6 [cm]	407.6 [cm]	373.6 [cm]
× 0.310	0.00438	396.0	423.8	396.0
× 0.296	0.00417	405.9	430.7	405.9
× 0.253	0.00353	441.1	455.3	441.1



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

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

Allowable Span [cm]

	M. Roof	Roof
H.R. Factory	570	390
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
0.253	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 t/m

Design of Mezzanine Floor

$w = 0.781 \quad [t/m^2]$

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

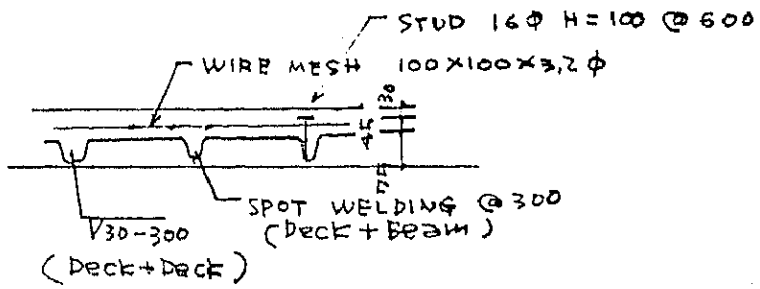
$$\frac{wl^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{w}}$$

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

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

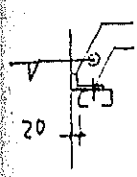
$$= \sqrt{\frac{384 \times 2,100 \times 13.6}{1,500 \times 0.0051}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Side 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

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

D.L. $0.09 \times 0.9 = 0.045$ [t/m]

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

span 3.68 [m]

□-100×50×20-2.3

$$\frac{\sigma}{f} = \frac{3.68^2 \times 100}{8 \times 1.4}\left(\frac{0.045}{8.06} + \frac{0.158}{16.1}\right)$$

$$= 2.08 \leq 2.10$$

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

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

□-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

$$= \sqrt{\left(\frac{\quad}{53.0}\right)^2 + \left(\frac{\quad}{252.0}\right)^2}$$

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

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

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

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

$= 1.03$ [cm]

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

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 3.85 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.

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

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

$= 0.69$ [cm]

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