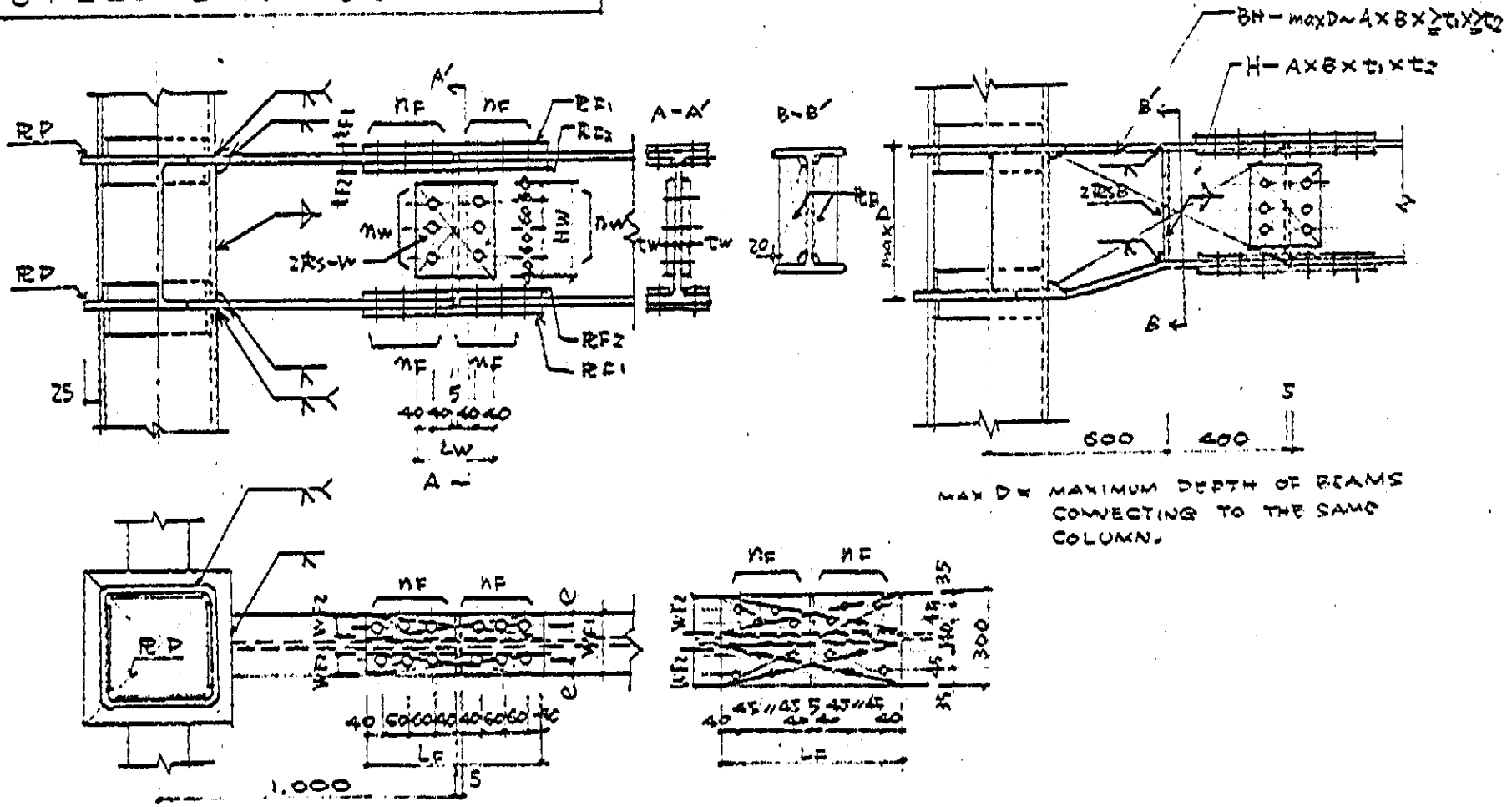
Design of Beam

			Stress V	K	W1	W2	1.5V	V+K	V+W1	V+W2	M·2X	Member	-2b	2b	λb	M	C	fb	M	A/t	Type	Note
2G (M)	M	Ⓓ	6.9		1.1	24.7	10.5		5.8	17.8		H-700X300 X13X24										
		CENT	6.3		15.2	10.3	14.0		8.9	4.0												
		Ⓒ	22.2		51.5	39.8	33.3		29.3	15.6										OK	G7	
	Q		8.2		-15.1	-20.4	12.3		6.9	12.2												
2G (M)	M	Ⓒ	24.0		52.1	54.8	36.0		29.1	30.8												
		CENT	16.0		29.1	33.7	24.0		23.1	17.7												
		Ⓑ	6.8		26.7	0.4	10.2		19.9	7.2										OK	G7	
	Q		9.7		-20.8	-21.4	14.6		11.1	11.7												
2G (M)	M	Ⓒ	6.4		23.1	29.1	9.6		16.7	22.7												
		CENT	3.7		13.5	17.5	5.6		9.8	21.2												
		Ⓑ	10.3		41.4	18.6	15.9		31.1	28.9										OK	G7	
	Q		4.9		-13.2	-14.8	6.8		9.7	10.3												
2G (M)	M	Ⓑ	15.7		15.7	30.8	23.6		31.4	15.1												
		CENT	9.8		13.2	9.9	14.7		23.0	1.9												
		Ⓐ	8.7		42.1	46.6	13.1		33.4	38.9	38.9		3.03	7.87	38.5	7.65	1.00	1.60	5.760	0.28	G7	
	Q		11.0		-4.8	26.5	16.5		14.8	17.5	17.5											

			Stress									Member									Type	Note
			V	K	W1	W2	1.5V	V+K	V+W1	V+W2	Max		ℓ_b	c_b	λ_b	M	C	ϕ_b	$\bar{\lambda}$	σ/f_t		
②G	M	⊖F	3.5	1.4			5.3	4.9				H-700X300 X13X24										
			3.4	0.2			5.1	3.6														
		⊕F	5.8	1.8			8.7	7.6													G7	
	Q		3.1	0.3			4.7	3.4														
②G	M	⊖F	6.0	18.9			9.0	24.9			24.9											
			8.8	4.4			13.2	13.2														
		⊕F	11.2	10.2			16.8	21.4					530	7.87	67.3	7.65	1.00	1.60	5.760	0.18	G7	
	Q		4.8	2.7			7.2	7.5			7.5											
	M	○																				
		○																				
	Q																					
②G	M	⊖F	4.4	7.6			2.1	9.0			9.0	H-488X300 X11X18										
			2.5	4.4			3.8	7.9														
		⊕F	4.2	4.4			6.3	8.6					530	7.77	66.5	7.20	1.00	1.60	2.910	0.13	G5	
	Q		2.3	4.1			3.5	3.4			3.5											

STEEL BEAM SCHEDULE



WF	e
150	30
175	30
200	35
250	45

$$t_\alpha \geq \sqrt{B}\,\frac{t_F}{\alpha}$$

MARK	MEMBER	RP	RB	RF1 $t_{F1} \times L_F \times W_{F1}$	RF2 $t_{F2} \times L_F \times W_{F2}$	nF	RW $t_W \times L_W \times H_W$	nW	NOTE
G9	H900X300X16X28	28							
G8	H800X300X14X26	28	16	19 X 300 X 615	22 X 107 X 615	2X6-M22	12 X 165 X 620	10-M22	
G7	H700X300X13X24	25	16	19 X 300 X 525	19 X 107 X 525	2X5-M22	9 X 165 X 560	9-M22	
G6	H588X300X12X20	22	16	16 X 300 X 435	16 X 107 X 435	2X4-M22	9 X 165 X 440	7-M22	
G6A	H600X200X11X17	19	16	16 X 200 X 405	16 X 73 X 405	2X3-M22	9 X 165 X 440	7-M22	
G5	H-482X300X11X15	16	16						
G5A	H500X200X10X16	16	16	12 X 200 X 405	16 X 73 X 405	2X3-M22	9 X 165 X 380	6-M22	
G4	H390X300X10X16	16	16						
G4A	H400X200X8X13	16	16	9 X 200 X 285	12 X 73 X 285	2X2-M22	9 X 165 X 260	4-M22	

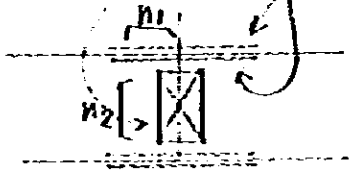
BEAM FIELD JOINT

According to AIJ Standard

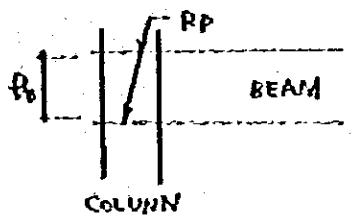
Generally

FLG
- $Ze = 0.8Z$
- $SM = Ze \times f_b$
- $SN = \frac{SM}{\delta}$
- $An = \frac{SN}{ft}$ $< 2 R_{gA}$ $\left(\frac{An}{2} < R_{nA} \right)$
- $n_1 = \frac{SN}{R}$

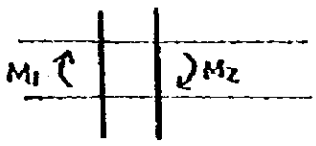
WEB
- $SQ = 0.8 \times t_w \times f_s$
- $An = \frac{SQ}{f_s} < R_A$
- $n_2 = \frac{SQ}{R}$



PANEL ZONE



	BEAM	COLUMN	Rp	ϕ_{ho}	A	
HEAVY R.E.	C18A (C18)	G7 (G7)	25 (25)	55 (55)	213.4 (183.5)	
PARTS S.	C9	G17	25	55	183.5	
INSPECTION E.	C9	G4	16	35.8	92.9	
PERIODICAL R.E.	C12	G5	16	45	122.5	
PAINT & B. E.	C19	G7	25	55	183.5	
RETREADING & M.C.E.	C19	G8	28	74.4	183.5	



$$\frac{(M_1+M_2)}{2Ve} \leq fs$$

$$Ve = \left(\frac{1}{2}A\right)\phi_{ho}$$

$$fs = 1.35 \quad [t/cm^2]$$

$$\sim$$

$$(M_1+M_2) < 2 \times 1.35 Ve$$

$$< 1.35 A \phi_{ho}$$

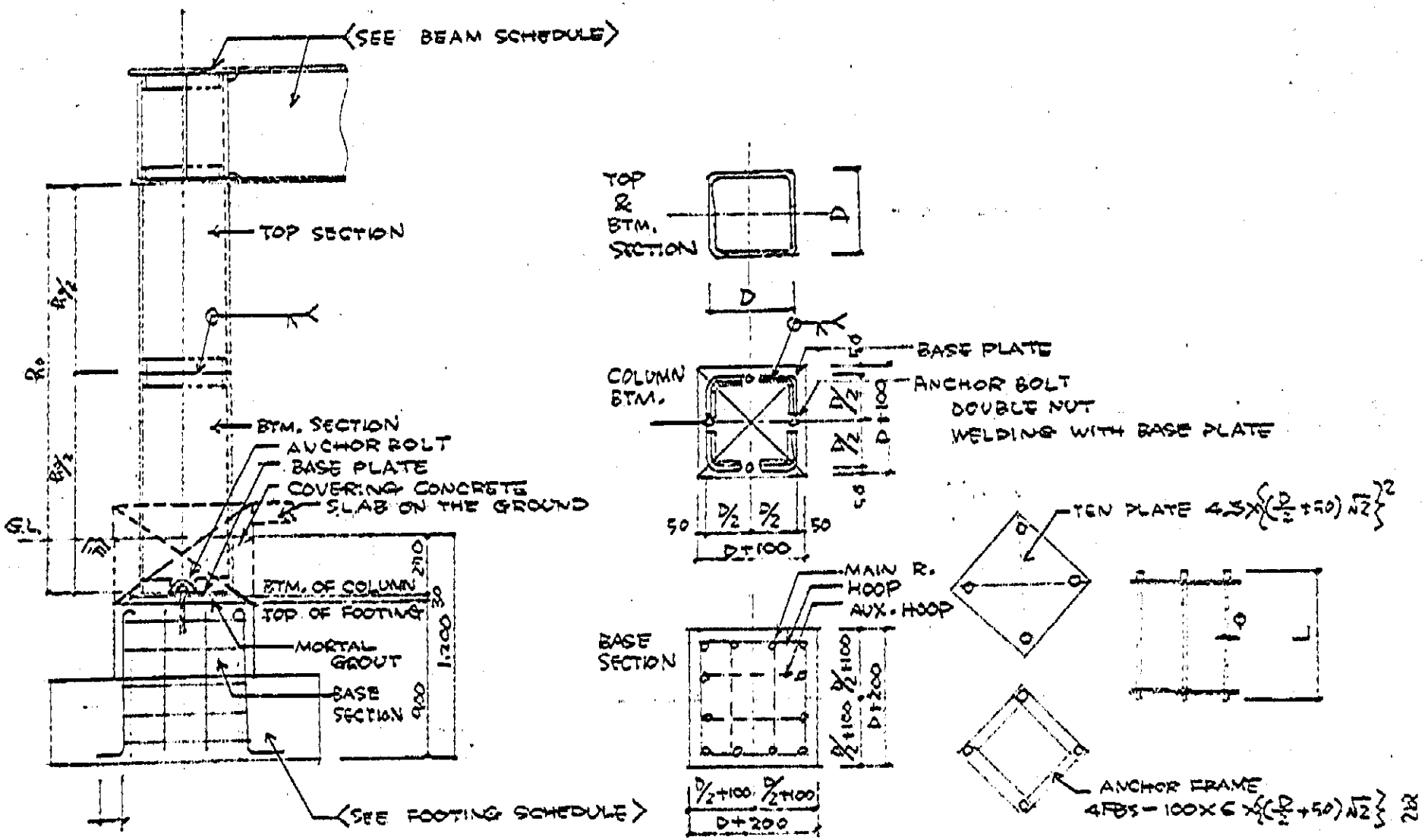
(t/m)

	$V_R = \frac{1}{2} A k_0$	$1.35 A h_0$	M_1	M_2	ΣM		$\Sigma M < 2V_{ef}s$
HEAVY R.F.		158.4 (136.2)	30.8 (4.4)	18.6 (4.4)	49.4 (8.8)		ok
PARTS S.		136.2			MAX 25.1		//
INSPECTION F.		44.9			MAX 8.5		//
PERIODICAL R.F.		84.4			MAX 15.9		//
PAINT & B. F.		136.3			MAX 36.6		//
RETREADING & M.C.F.		184.3			MAX 31.3		//

Design of Column

			Stress									Member										Note
			V	K	W_1	W_2	1.5V	V+K	V+W_1	V+W_2	MAX		l_E/i_D	l_E/i_D	λ_E/λ_D	η	C	f_c/f_b	A/B	N/f	Type	
		N	23.5	±3.0			35.3	26.5				□ 350×350×19 ~16										
	←	M U	1.2	±6.0			1.8	17.2							Cf.	Chart						
		M L	0	0			0	0														
		Q	0.2	±2.6			0.3	2.8														
Ⓓ		N			-1.8	-14.8	35.3		24.7	8.7												
	↓	M U	6.4		23.1	-29.1	9.6		21.9	27.9	27.9											
		M L	0		0	0	0		0	0												
		Q	1.0		5.2	-5.9	1.5		5.4	5.7										OK	C1a	
		N	52.1									□ 400×400×19 ~16										
	←	M U																				
		M L																				
		Q																				
Ⓒ		N			-23.5	-26.9	78.2		18.6	24.2												
	↓	M U	0.6		45.7	-38.8	0.9		46.3	38.2	46.3											
		M L	0		0	0	0		0	0												
		Q	0.1		7.3	-6.2	0.2		7.4	6.1										OK	C2A	
		N	64.4	±6.1			96.6															
	←	M U	1.4	±7.6			2.1															
		M L	0	0			0															
		Q	0.2	±0.2			0.3															
Ⓑ		N			-38.4	-26.0	96.6		26.0	38.4												
	↓	M U	2.1		-38.4	39.1	3.2		37.0	34.7												
		M L	0		0	0	0		0	0												
		Q	0.3		-5.1	5.1	0.5		5.9	5.8										OK	C19A	
		N	26.4																			
	←	M U																				
		M L																				
		Q																				
Ⓐ		N			-16.8	-13.3	39.6		9.9	13.1												
	↓	M U	0.8		-24.7	0.4	10.2		19.9	11.2												
		M L	0		0	0	0		0	0												
		Q	0.7		-5.1	2.3	1.1		4.4	3.0										OK	C9A	

STEEL COLUMN SCHEDULE



MARK	SECTION		BASE PLATE	ANCHOR BOLT Ø x L	BASE SECTION				NOTE
	TOP	BTM			SIZE	MAIN R.	HOOP	AUX. HOOP	
C9	□-350×350×9	□-350×350×9	PL 19 X450X450	4-M 22 X1,000	550×550	12-D19	□D10-@100	⊕D10-@600	
C12	□-350×350×12	DO	PL 22 X450X450	4-M 〃 X 〃	DO	DO	DO	DO	
C16	□-350×350×16	□-350×350×12	PL 25 X450X450	4-M 〃 X 〃	DO	DO	DO	DO	
C19	□-350×350×19	□-350×350×16	PL 29 X450X450	4-M 〃 X 〃	DO	DO	DO	DO	
C9A	□-400×400×9	□-400×400×9	PL 19 X500X500	4-M 24 X 1,100	600×600	12-D19	□D10-@100	⊕D10@600	
C12A	□-400×400×12	DO	PL 22 X500X500	4-M 〃 X 〃	DO	DO	DO	DO	
C16A	□-400×400×16	□-400×400×12	PL 25 X500X500	4-M 〃 X 〃	DO	DO	DO	DO	
C19A	□-400×400×19	□-400×400×16	PL 29 X500X500	4-M 〃 X 〃	DO	DO	DO	DO	

Base Plate & Anchor Bolt

[tcm]

	N_{max}	A	σ_c		M_1		M_2	Z_{n1}	t_{n1}		t	M
C9	24.8	2025	12.25	12.25×9 1/2	153.1	12.25×35 1/16	939.9	0.58	19		19	4-M24
C12	30.5	〃	15.06		188.3		1153.0	0.92	22		22	〃
C16		〃									25	〃
C19	36.1	〃	17.83		222.9		1365.1	0.86	25		28	〃

(σ_b=1600)

For Tension

MAX $-N = 17.7 \sim 17.7/4 = 4.425 \sim M = 4.425 \times 10/4 = 11.0625$ [tcm] $\sim Z_n = 4.61$

(Parts Stolage) (σ_b=2400)

∧

4-M24 $R = (5.42 \times 1.5) \times 4 = 32.5$ [t]

B = 10

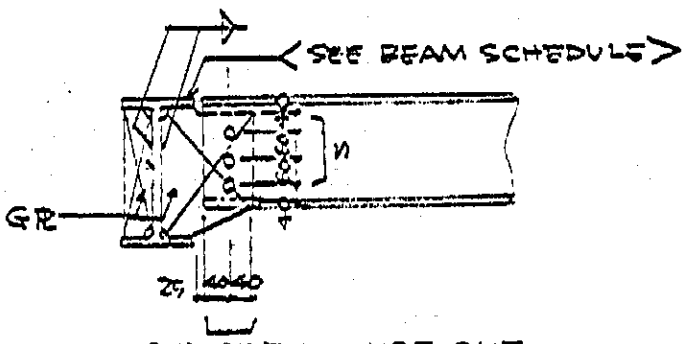
$t = \sqrt{6 \times 9.61/10} = 1.66$

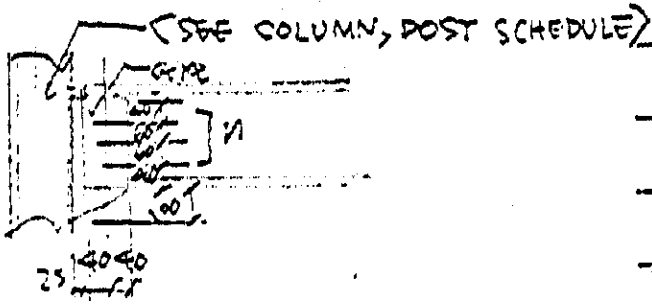
Design of Sub Beam

	h	l	@	ω D.L.	ω W.L.	ω T.L.	q	Mo	Q	Jn	Zn	Member	J	Z	lb	ib	λb	η	C	fb	σ/f	Type
	12.92	3.93	3.93	0.02	0.8×0.2	0.156	0.563	0.88	0.99	460.7	36.5	H-200×100	1,840	184	350	2.60	135.0	6.49	1.00	0.80	0.36	B2
	10.45	10.6	3.69	0.02	0.8×0.20	0.140	0.467	6.55	2.47	10,337	272.9	H-350×175	13,600	775	530	4.88	115.7	8.33	1.75	1.25	0.45	B3A
	7.03	〃	3.06	〃	0.8×0.16	0.108	0.280	3.93	1.48	6,203	163.8	H-300×150	7,210	481	〃	3.87	137.0	8.61	〃	1.10	0.90	B3
	7.15	〃	2.06	0.51		1.951	1.100	15.48	5.83	43,053	965.6	H-500×200	47,800	1,910	〃	5.14	103.1	8.03	〃	1.20	0.67	B5
	〃	5.3	〃	〃		〃	〃	3.86	2.92	3,046	241.3	H-300×150	7,210	481	〃	3.87	137.0	8.61	1.00	1.25	0.64	B3
	〃	12.1					0.62	11.35	3.75	41,202	709.9	H-500×200	47,800	1,910	275	5.14		8.03	1.00			B5
			P={0.51×2.65×4.125}+{0.05×(2.65×3+12.1)}+{0.02×(2.65×3+4.1)}=5.57+1.00+0.96=7.53 ~ 7.53/12.1=0.62																			
	7.03	10.6	2.25	0.02	1.6×0.14	0.200	0.409	5.74	2.17	9,061	239.2	H-350×175	13,600	775								B3A
	5.00	〃	1.5	0.02	〃																	B3A
	3.85	10.6	D.L. (0.05×6.5)+0.05 W.L. 0.8×0.14×3.5				0.305 0.392	5.27 5.51	1.99 2.48	8,302.9 8,684.5	219.5 229.4	H-356×12×19	13,600 40,300	776 2300	253	9.65	36.6	5.08	1.00	1.60		B3
	〃	6.05	2.65	0.51			1.40	6.41	4.24	7,814.7	400.6	H-300×100	7,210	508								B3
	5.00	8.25	3.53	〃			4.80	15.31	7.43	25,870	946.9	H-450×200										B4A
MONITOR ROOF	〃	3.53	2.06	〃			1.04	1.63	1.85	359.1	101.9	H-200×100										B2
	10.45 〃		3.09/2	0.02	0.8×0.20	0.14	0.24			1,226.0	22.8 62.0	H-200×100 〃	1,840	184 〃	650	2.60	250	6.49	1.00	0.55×2.5		B2 〃
			P=0.36×0.9/2=0.75 ~ ×2=1.56																			

M=1.56×1.0=1.56

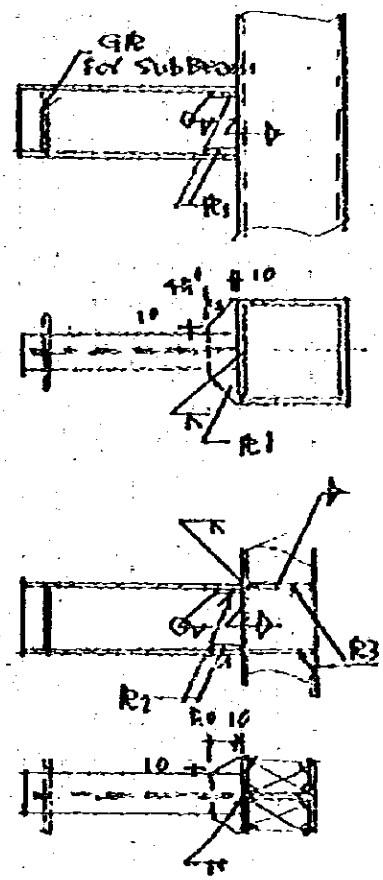
STEEL SUBBEAM SCHEDULE





MARK	SECTION	GR	M
B4B	H-390X300X10X16	12	5-M22
B4A	H-450X200XXXX14	〃	〃
B4	H-400X200X8X13	〃	4-M22
B3A	H-350X175X7X11	〃	〃
B3	H-300X150X6.5X9	〃	3-M22
B2A	H-250X125X6X9	9	〃
B2	H-200X100X5.5X8	〃	2-M22
B9	H-900X300X16X28	19	12-M22
B6A	H-588X300X12X20	16	17-M22
B6	H-600X200X11X17	〃	〃
B5	H-500X200X10X16	12	6-M22
B3S	H-350X350X12X19	12	2X3-M22

SCHEDULE OF CANTILEVER



MARK	MEMBER	R1	R2	R3
CG4	H-400x200x8x13	R12	R12	R12
CG3A	H-350x175x7x11	"	"	"
CG3	H-300x150x6.5x9	R9	R9	R9
CG2	H-200x100x5.5x8	"	"	"

Design of Cantilever

h	l	@	w D.L.	w W.L.	w T.L.	P (S.L. 0.05)	M =	Q	Ju	Zu	Member	J	Z	Fb	Cb	λb	M	C	fb	D/t	Type
5.0	3.0	5.3	0.02	1.6×0.13	0.204	1.6	4.9	1.6	5.714	306	H-35×17E										CGSA

DESIGN OF POST

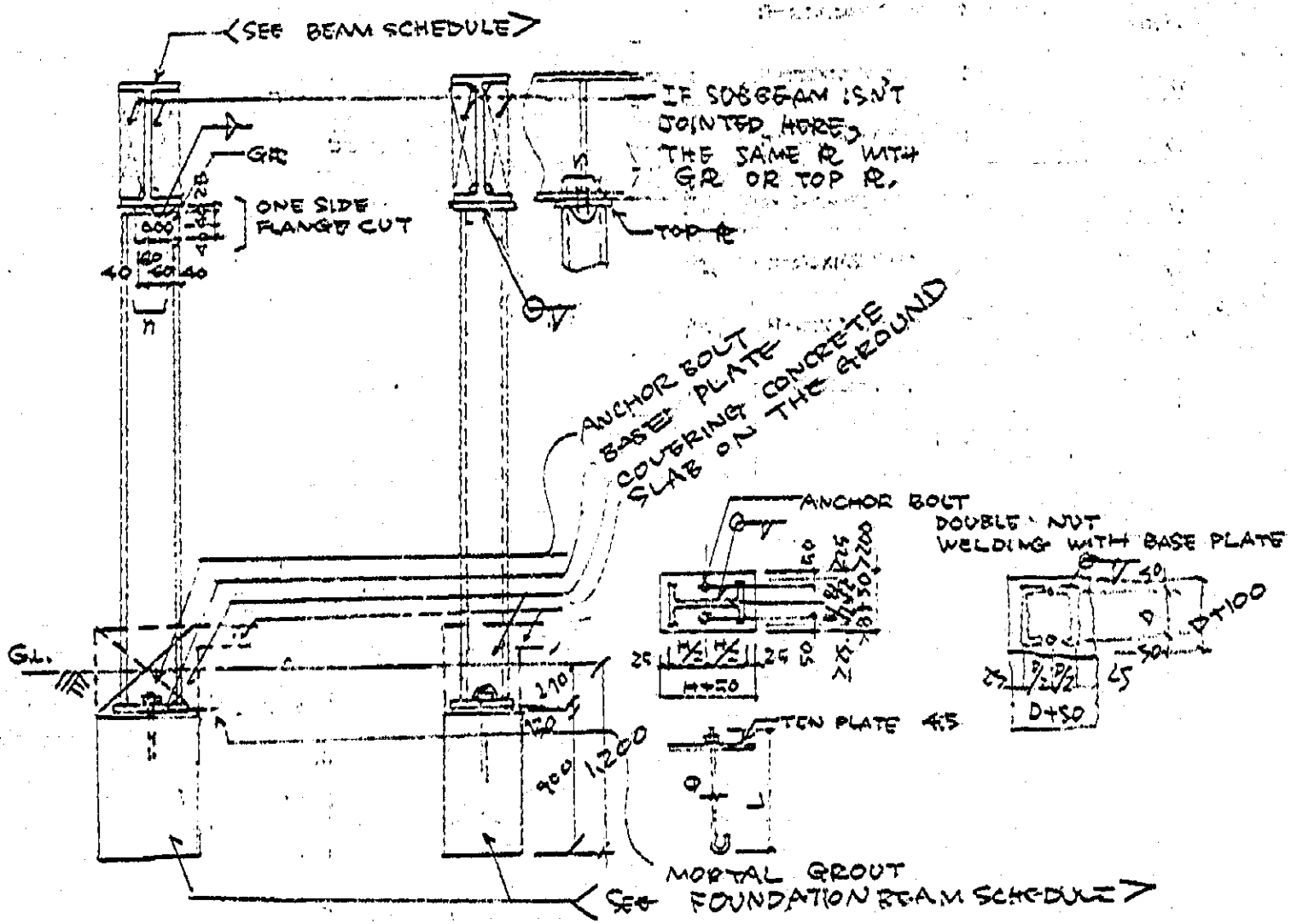
BTM	TOP	h	⊕	D.L. w	D.L. q	N	W.L. w	W.L. q	M_o	Q	J_n	Z_n	Member	J	l_k / l_b	i_k / i_b	λ_k / λ_b	η / C	f_c / f_b	A / Z	σ/f	Type
10,35	12,93	2.58	3,53	0.05	0.280	0.58	0.5×4.22	0.620	0.82	0.80	[illegible]	21.7	H-100×100	383	258	2.42	106.6	3.42	0.51	21.9	0.02	P1
															〃	2.73	94.5	1.00	1.60	765	0.29 / 0.31	
0.45	10.45	10.0	3.69	0.02	0.124	1.24	0.8×0.36	0.472	5.90	2.36	[illegible]	245.8	H-350×175	13,600	500	3.95	126.6	8.35	0.60	62.14		P3A
															〃	4.58	109.2	1.75	1.20	775		
		0.4					0.8×0.42						H-300×150									P3

Base Plate & Anchor Bolt

P20A
$N = 10.1$
$A = 25 \times 30$
$\sigma' = 13.5$
$M = 13.5 \times 26^2/16 = 336.7$
$Z_n = 0.210$
$t_n = 1.12$ → R16

P29A
$N = 29.0$
$A = 30 \times 38$
$\sigma' = 22.9$
$M = 22.9 \times 26^2/16 = 892.9$
$Z_n = 0.558$
$t_n = 1.82$ → R19

STEEL POST SCHEDULE



MARK	SECTION	GR	n	BASE PLATE	ANCHOR BOLT Φ × L	NOTE
P1	H-400×400×6×8	PL 9	2-M22	PL 16 × 1100 × 200	2-M20 × 900	
P2	H-200×100×5.5×8	DO	〃	PL 〃 × 250 × 200	2-M 〃 × 〃	
P2A	H-250×125×6.5×9	DO	3-M22	PL 〃 × 300 × 200	2-M 〃 × 〃	
P3	H-300×150×6.5×9	DO	〃	PL 〃 × 350 × 200	2-M 〃 × 〃	
P3A	H-350×175×7×11	PL 12	4-M22	PL 〃 × 400 × 225	2-M 〃 × 〃	
P4	H-400×200×8×13	DO	〃	PL 〃 × 450 × 250	2-M 〃 × 〃	
P4A	H-450×200×9×14	DO	4-M22	PL 〃 × 500 × 250	2-M 〃 × 〃	
P25	H-250×250×9×14	PL 9	2×2-M22	PL 19 × 300 × 300	〃	
P20A	□-200×200×8	TOP PL 16×300×300	〃	PL 16 × 250 × 300	〃	
P25A	□-250×250×8	〃 19×300×350	〃	PL 19×300×350	〃	

Design of Shell Type Roof

Bldg.	Roof Level [M]	$q = C\sqrt{h}$	C	cq [kg/m²]
Heavy Repair Factory	10.5 ~ 13.0	144 ~ 216	1.5	310 ~ 346
Parts Storage	7.0 ~ 9.5	168 ~ 184	〃	243 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

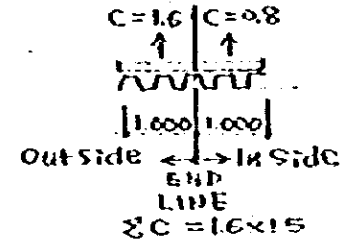
Continuous Beam Type

$$\frac{M}{Z} = \frac{\omega l^2}{8Z} \le f \quad \sim \quad l_2 \le \sqrt{\frac{8Zf}{\omega}}$$

$$\frac{5}{384}\frac{\omega l^4}{EI} \le \frac{l}{300} \quad \sim \quad l_1 \ge \sqrt[3]{\frac{384 \times 2{,}100 I}{300 \times 5\omega}}$$

S-60 0.8 M/M Use Z 61.33 [cm³/m]
I 619.84 [cm⁴/m]
Self-ω 13.5 [kg/m²]

ω	Net ω	l_2	l_1	l_{min}
1.5X 0.346 [t/m²]	0.00492 [t/cm/m]	373.6 [cm]	404.6 [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 0.243	0.00343	441.1	458.3	441.1



$$l_2 \le \sqrt{\frac{8 \times 61.33 \times 1.4}{\omega}} = \sqrt{\frac{686.896}{\omega}}$$

$$l_1 \le \sqrt[3]{\frac{384 \times 2{,}100 \times 619.84}{300 \times 5 \times \omega}} = \sqrt[3]{\frac{333{,}279.744}{\omega}}$$

Allowable Stress [kg/cm²]

	M. Roof	Roof
H.R. Factory	310	390
Generally	400	440

Cantilever Type

$$\frac{M}{Z} = \frac{\omega l^2}{2Z} \leq f \quad \sim \quad l_2 \leq \sqrt{\frac{2Zf}{\omega}}$$

$$\frac{\omega l^4}{8EI} \leq \frac{l}{250} \quad \sim \quad l_1 \leq \sqrt[3]{\frac{8 \times 2{,}100\, I}{250\,\omega}}$$

ω	Net ω	l_2	l_1	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

$$l_2 \leq \sqrt{\frac{2 \times 61.33 \times 0.85^{*} \times 1.4}{\omega}} = \sqrt{\frac{128.793}{\omega}}$$

$$l_1 \leq \sqrt[3]{\frac{8 \times 2{,}100 \times 618.84 \times 0.75^{*}}{250\,\omega}} = \sqrt[3]{\frac{31{,}244.976}{\omega}}$$

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 ⟶ Size up to 1.0 M/M

Design of Mezzanine Floor

$w = 0.81$ [t/m²]

U-1.2 Deck Plate (AL-31) $Z = 35.5$ $I = 13.6$

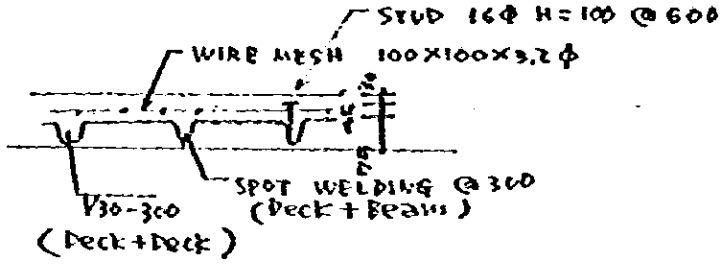
$$\frac{wl^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{w}}$$

$$= \sqrt{\frac{8 \times 35.5 \times 1.4}{0.0081}} = 279.2$$

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

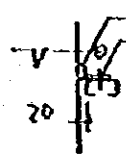
$$= \sqrt[3]{\frac{384 \times 2100 \times 13.6}{1500 \times 0.0081}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Outside Wall



MONITOR ROOF　C-120×60×20-4.5　@1900
GENERAL　C-100×50×20-3.2　@1900
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.	3.60 ~ 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.	3.66 ~ 3.38	〃	〃	180 ~ 120

CASE-1. (H.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]

C-100×50×20-2.3

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

$$= 2.08 < 2.10$$

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{19.8}\right)^2 + \left(\frac{0.00158}{80.7}\right)^2}$$

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

C-100×50×20-3.2

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00158}{101}\right)^2}$$

$$= 2.69 \text{ [cm]}$$

C-100×50×20-4.5

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

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

C-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. $0.08 \times 0.9 = 0.045$ [t/m]
W.L. $0.18 \times 0.8 \times 0.9 = 0.130$ ["]
Span 3.60 [m]

$C = 100 \times 80 \times 20 - 3.2$

$$\delta = \frac{5 \times 360^4}{384 \times 2{,}100_n} \sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00198}{101}\right)^2}$$

$= 2.49$ [cm]

$C = 100 \times 50 \times 20 - 4.5$

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

$= 1.92$ [cm]

$C = 120 \times 60 \times 25 - 4.5$

$$\delta = \sqrt{\left(\frac{\quad}{58.0}\right)^2 + \left(\frac{\quad}{259.0}\right)^2}$$

$= 1.03$ [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 3.85 m

$C = 100 \times 80 \times 20 - 2.3$

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

$= 1.51$ [cm]

$C = 100 \times 80 \times 20 - 3.2$

$$\delta = \sqrt{\left(\frac{\quad}{24.5}\right)^2 + \left(\frac{\quad}{101}\right)^2}$$

$= 1.19$ [cm]

$\delta/\text{span} = 1.19/385 = 1/330 < 1/300$
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

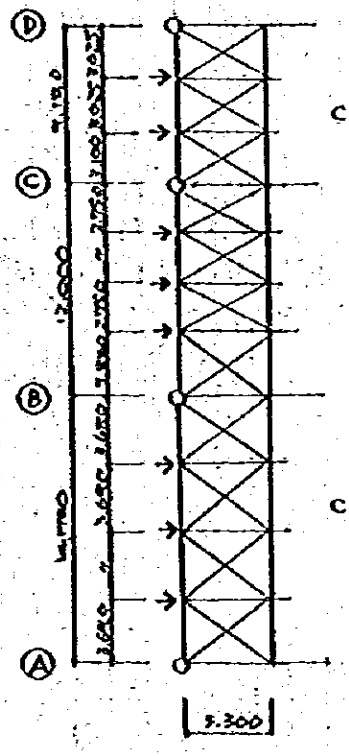
$C = 100 \times 80 \times 20 - 2.3$

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

$= 0.69$ [cm]

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

Design of Bracing



P 6.6
@ 3.10
C&A $0.8 \times 0.12 \times 3.10 \times 0.70$
Q $0.30 \times 6.6/2 = 0.98$
D $0.98 \times 6.14/5.30 = 1.14 \sim \times 1.0 = 1.14$, $A_H = 1.14/2.4 = 0.5$

$$J_H = \frac{13 \times 0.0002 \times 614^3 \times 300}{384 \times 2,100} = 223.9$$

$$Z_H = \frac{3 \times 0.02 \times 614^2 \times 100}{8 \times 2.4} = 11.8$$

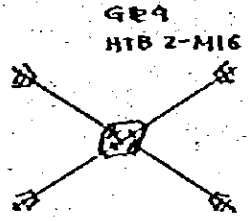
L-130×130×9
A 22.7 , J 366.0 , Z 38.7

P 10.0
@ 3.69
C&A $0.8 \times 0.16 \times 3.69 = 0.47$
Q $0.47 \times 10.0/2 = 2.36$
D $2.36 \times 6.46/5.30 = 2.88 \sim \times 1.5 = 4.32$, $A_H = 4.32/2.4 = 1.8$

$$J_H = \frac{13 \times 0.0002 \times 643^3 \times 300}{384 \times 2,100} = 257.1$$

$$Z_H = \frac{3 \times 0.02 \times 643^2 \times 100}{8 \times 2.4} = 12.9$$

L-130×130×9
A 22.7 , J 366.0 , Z 38.7

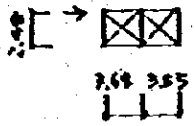


$$J_H' = \frac{5 \times 0.0002 \times 322^3 \times 300}{384 \times 2,100} = 12.4$$

$$Z_H' = \frac{0.02 \times 3.22^3 \times 100}{8 \times 2.4} = 1.1$$

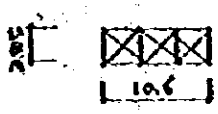
L-75×75×6
A 8.7 J 46.1, Z 8.5

Monitor Roof



Vertical
P $0.8 \times 0.22 \times 10.6 \times 2.48/2 = 2.31$
b $2.31 \times 4.59/3.68 = 2.87$ $A_H = 2.87/2.4 = 1.2$

L-75×75×6

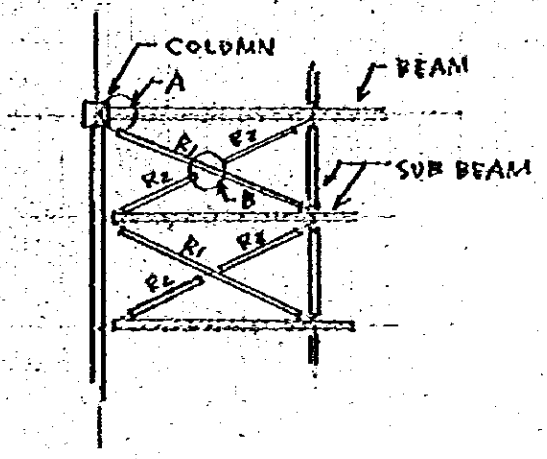


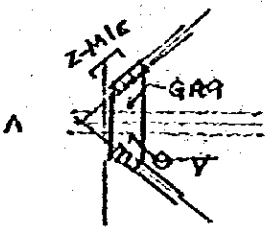
Horizontal

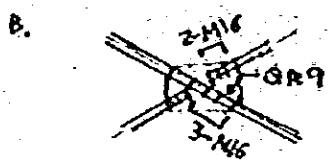
$$J_H = \frac{13 \times 0.0002 \times 523^3 \times 300}{384 \times 2,100} = 138.4$$

L-100×100×10
A 19.0 , J 115.0 , Z 24.4

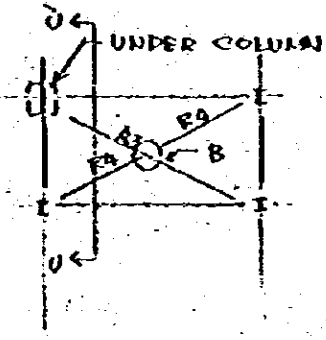
BRACING SCHEDULE

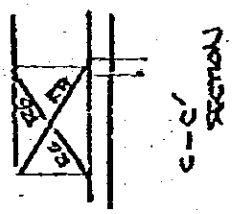






MONITOR ROOF

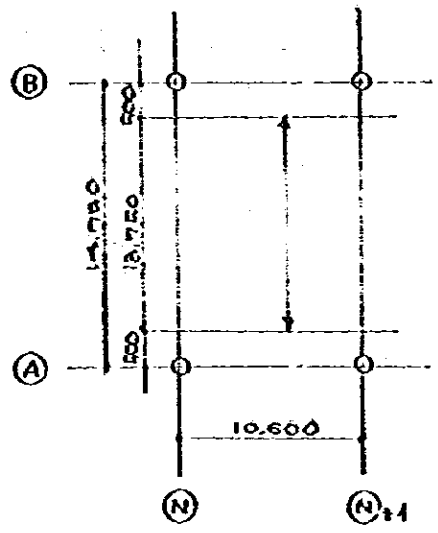




Mark	Member	Note
R_1	L-130×130×9	At. Paint & Body F. ~ L-130×130×12
2	L-75×75×6	
3	L-100×100×10	
4	L-75×75×6	
5	〃	
6	〃	

Design of Crane Girder

CASE – 1.



Capacity	2.0 [t] × Impact 140[%] =	2.8 [t]
Net Weight		0.2 [t]
Girder		1.6 [t]

Maximum Load $2.8 + 0.2 + \frac{1.6}{2} = 3.8$ [t]

Self Load 0.15 [t/m]

Limit of Deflection $\frac{1}{1,200} \times \text{span} = \frac{1,060}{1,200} = 0.88$ [cm]

$$J_{II} = \frac{Pl^3}{48E\delta} + \frac{5ql^4}{384E\delta} = \frac{3.8\times 1060^3}{48\times 2{,}100\times 0.88} + \frac{5\times 0.0015\times 1060^4}{384\times 2{,}100\times 0.88}$$

$$= 51{,}022.1 + 13{,}342.9$$

$$= 64{,}365.0 \quad [cm^4]$$

CB5 H-488×300×11×18

$$J = 71{,}000 > 64{,}365.0$$

(S.L. = 128 [kg/m] + Rail 22 = 150 [kg/m])

$$M_b = \frac{3.8\times 10.6}{4} + \frac{0.15\times 10.6^2}{8} = 10.07 + 2.11 = 12.18 \text{ [tm]}$$

$l_b = 1{,}060$, $i_b = 7.97$, $\lambda_b = 132.9$, $\eta = 1.20$, $C = 1.00$

$\sim f_b = 0.94$, $Z_x = 2{,}910$

$$\frac{\sigma}{f} = \frac{1218}{2{,}910\times 0.94} = 0.49 < 1.00$$

$$\max Q = 3.8 + \left(0.15\times 10.6/2\right) = 4.6 \text{ [t]}$$

Horizontal Direction

Sustained Loading 10%
Seismic " 20%
Σ 30%

3.8[t] × 10[%] = 0.38 [t] ↓ — M_{10} $0.38 \times 10.6/4 = 1.06$ [tm], $_{max}Q$ 0.38 [t]

3.8[t] × 30[%] = 1.14 [t] ↓ — M_{30} $1.14 \times 10.6/4 = 3.02$ [tm] $> 1.06 \times 1.5$, $_{max}Q$ 1.14 [t] $> 0.38 \times 1.5$

$I_Y = 8{,}110$ [cm⁴]
$Z_Y = 541$ [cm³]

$$\delta = \frac{0.38 \sim 1.14 \times 1060^3}{48 \times 2{,}100 \times 8{,}110} = 0.55 \sim 1.66 \text{ [cm]}$$

$$\frac{\delta}{l_{span}} = \frac{1}{1{,}914} \sim \frac{1}{638}$$

$$\frac{\sigma}{f} = \frac{302}{541 \times 0.94} = 0.59 < 1.50$$

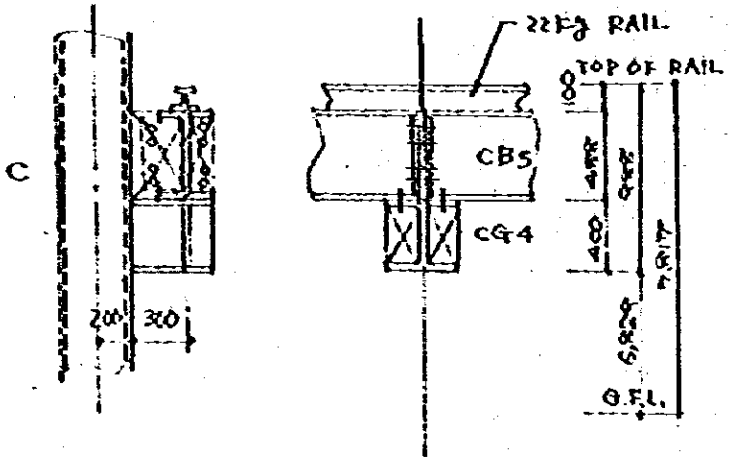
CG4A H-400×400×13×21

P = 3.8 + (0.15 × 10.6) = 5.4 [t] ↓

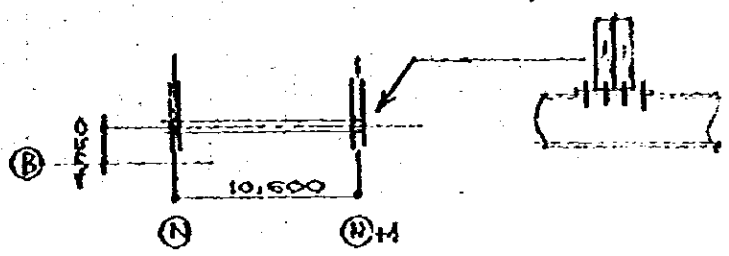
Q = 5.4 [t]
M = 5.4 × 0.5 = 2.7 [tm]

$$I_n = \frac{Pl^3}{3E\delta} = \frac{5.4 \times 50^3}{3 \times 2{,}100 \times (50/1{,}200)} = 2{,}571.4 \text{ [cm⁴]}$$

$$Z_n = 240/1.6 = 168.8 \text{ [cm³]}$$



CASE - 2. (Monorail)



Capacity 1.0 [t] × Impact 140 [%] = 1.4 [t]
Net Weight 0.1 [t]

Maximum Load 1.4 + 0.1 = 1.5 [t]

Self Load 0.15 [t/m]

$$J_H = \frac{1.5\times1060^3}{48\times2{,}100\times0.88} + \frac{5\times0.0015\times1060^4}{384\times2{,}100\times0.88}$$
$$= 20{,}140.3 + 13{,}342.9$$
$$= 33{,}483.2 \quad [cm^4]$$

CB4 H-390×300×10×16

$J = 38{,}700 > 33{,}483.2$
(S.L. × 10% [t/m])

$$M_0 = \frac{1.5\times10.6}{4} + \frac{0.15\times10.6^2}{8} = 3.98 + 2.11 = 6.09 \ [t\cdot m]$$

$l_b = 1{,}060$, $i_b = 8.10$, $\lambda_1 = 130.9$, $\eta = 6.58$, $C = 1.00$
$\sim f_b = 1.04$ $\quad _{ZX} = 1{,}980$

$$\frac{\delta'}{f} = \frac{609}{1{,}980\times1.04} = 0.30 < 1.00$$

max $Q = 1.5 + (0.15\times10.6/2) = 2.3$ [t]

Horizontal Direction

$H = 0.1\sim0.3\times1.5 = 0.15\sim0.45$ [t]

M_0 $0.45\times10.6/4 = 1.19$ [t·m]

max Q 0.45 [t]

$J_Y = 7{,}210$ [cm⁴]
$Z_Y = 481$ [cm³]

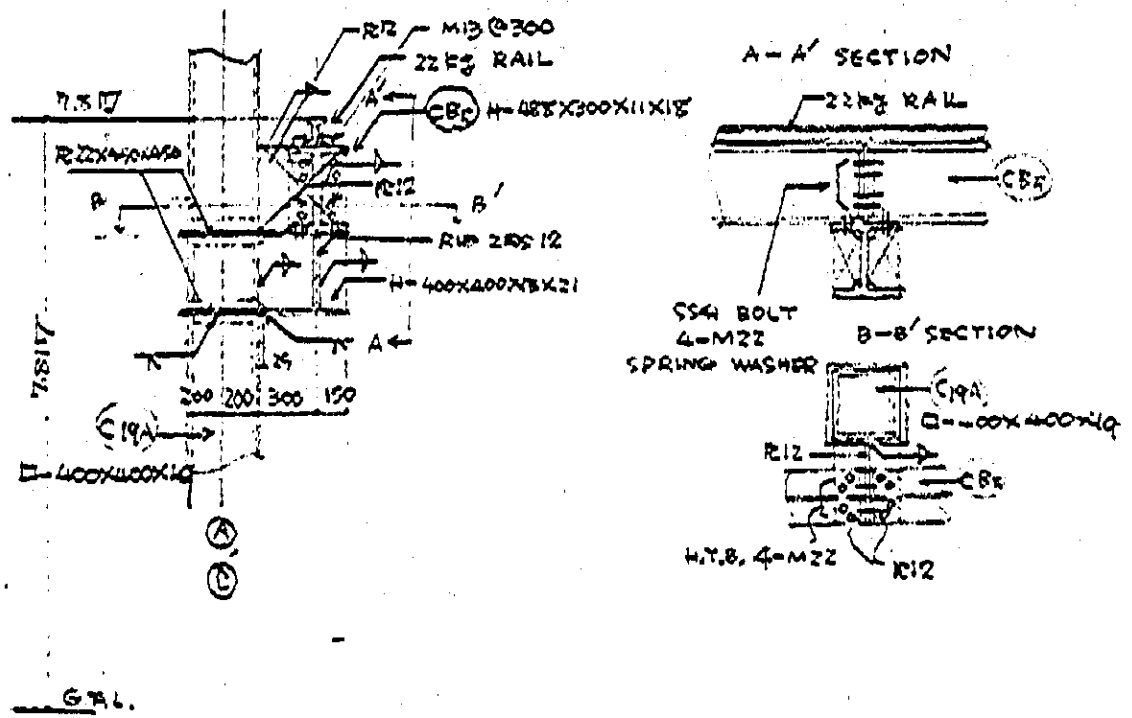
$$\delta = \frac{0.15\sim0.45\times1060^3}{48\times2{,}100\times7{,}210} = 0.25\sim0.74 \ [cm]$$

$$\frac{\delta}{span} = \frac{1}{4312}\sim\frac{1}{1437}$$

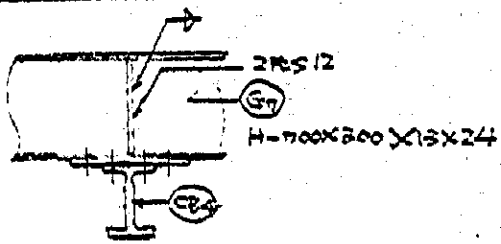
$$\frac{\delta'}{f} = \frac{119}{481\times1.04} = 0.24 < 1.50$$

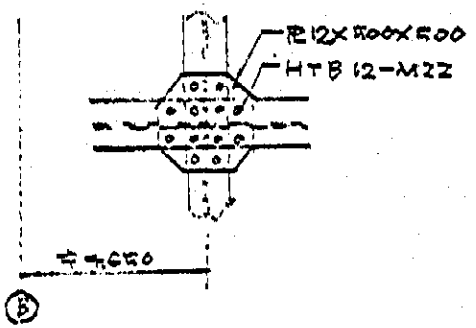
CRANE GIRDER SCHEDULE

CB5 : H-488X300X11X18



CB4 : H-390X300X10X16





Design of Corridor

(1) Roof

S-60 0.8
ℓ 3890
cantilever 500

(2) Beam

ℓmax 6.325
Cantilever 2.000

$$w = \text{W.L.} \quad 0.8 \times 0.12 \times 2.428 = 0.24 \ [t/m]$$

$$z_n = \frac{0.24 \times 6325^2 \times 100}{8 \times 24} \sim \frac{0.24 \times 1^2 \times 100}{2 \times 2.4}$$

$$= 50.0 \sim 20.0 \quad [cm^3]$$

$$I_n = \frac{5 \times 0.0024 \times 6321.9^3 \times 300}{384 \times 2,100} \sim \frac{0.0024 \times 200^3 \times 300}{8 \times 2.100}$$

$$= 1129.6 \sim 342.9 \quad [cm^4]$$

H-200×100×5.5×8
z 184
I 1840

ℓb 317 tb 2.60 λb 121.9 η 6.49 C1.75 ·fb 1.20

$$z_z = 184 \times \frac{1.2}{1.6} = 138 > 50.0$$

(3) Column

MAX −N $0.8 \times 0.12 \times 4.1625 \times 2.428 = 0.97$

kw $0.1 \times (0.05 \times 4.1625 \times 2.428) = 0.05 < Q$

$M = 0.05 \times 4 = 0.20$

φ − 190.7 × 5.3 A 30.87 z 139

(4) Brace (Roof)

16φ

(5) Footing

D.L. $= 0.97$

Slab on the ground $0.97/0.2 = 4.85 \sim 2.20^{\square}$

Design of Watchman's office

(1) Bridge

L.L. 1.00
D.L. 0.73
T.L. 1.73 [t/m²]

Slab $M_0 = 1.73 \times 1.25^2/8 = 0.34$ [tm] at 0.9 D13-@200

$Q = 1.73 \times 1.25/2 = 1.08$ [t] Cp 28

Base

$w \fallingdotseq 3.00$ <fc

$M_0 \fallingdotseq 0.34 \times 2 = 0.68$ at 3.1 D13-@200
$Q \fallingdotseq 1.08 \times 2 = 2.16$ Cp 9.4

(2) Roof

S-60 0.8t Span 1.500 ~ Cantilever 200

(3) Floor

L.L. 0.30
D.L. 0.24 RC
0.02 Deck
T.L. 0.56 [t/m²] Span 1.5 m V-1.2

(4) Beam

$\fallingdotseq 0.56 \times 0.75$ + self load 0.02 = 0.44 [t/m]

Span 1.5 [m]

$$z_n = \frac{0.44 \times 1.5^2 \times 100}{8 \times 1.6} = 7.7 \quad < 88.8$$

$$J_n = \frac{5 \times 0.0044 \times 150^3 \times 300}{384 \times 2.100} = 21.6 \quad < 666.0$$

H-150×75×5×7

(5) Column

$N \fallingdotseq 0.56 \times 1.5^2/4 = 0.32 \rightarrow 1.00$

ϕ 165.2×4.5
A 22.92 i 5.68 λ: 200 > 35.2 ~ fc 1.49
N_A 22.92×1.49×33.9 ≫ 1.00

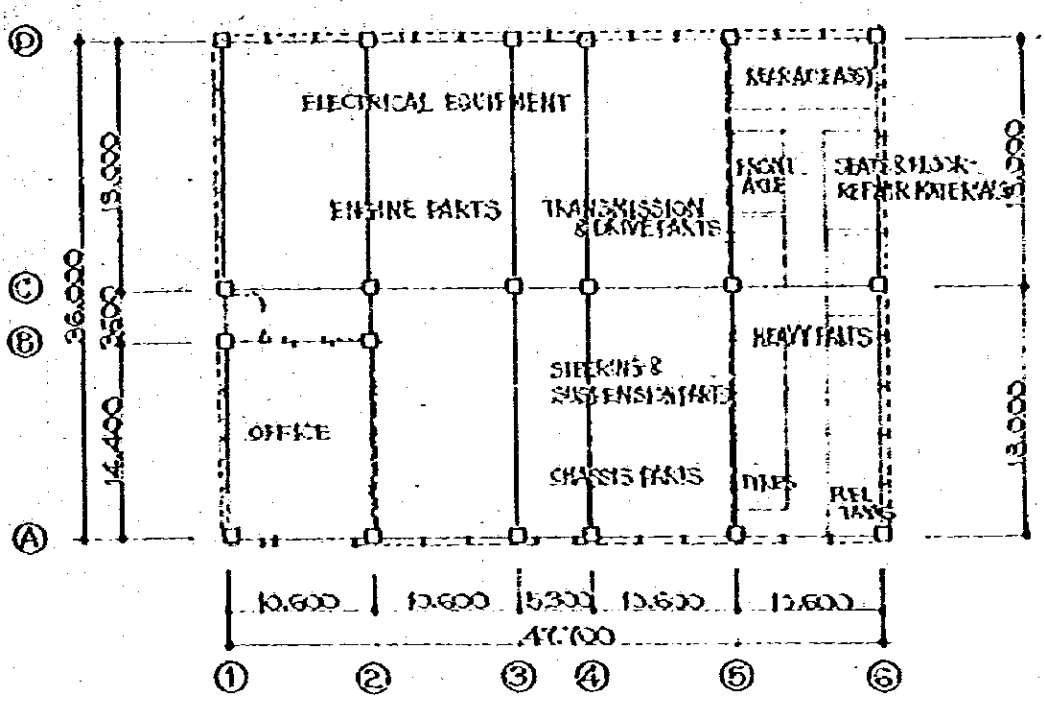
(<N $0.8 \times 0.12 \times (1.9^2 + 1.8^2) = 0.86$ < N 0.8)

(6) Brace

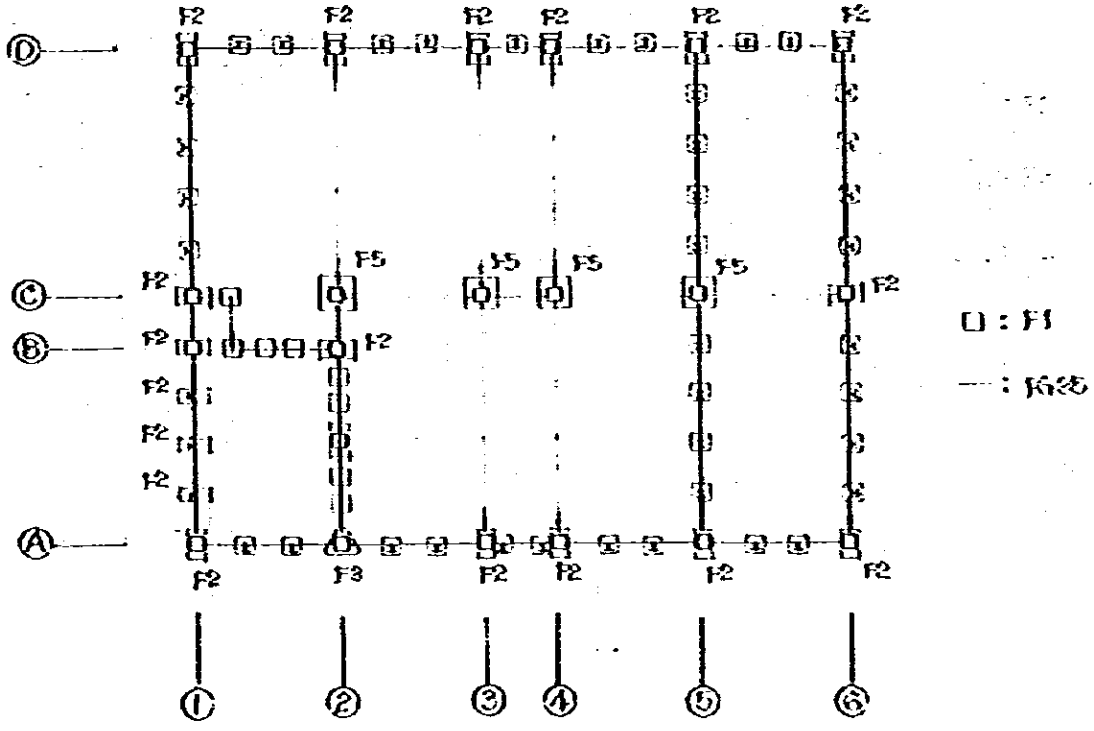
16 ϕ

11　部品倉庫

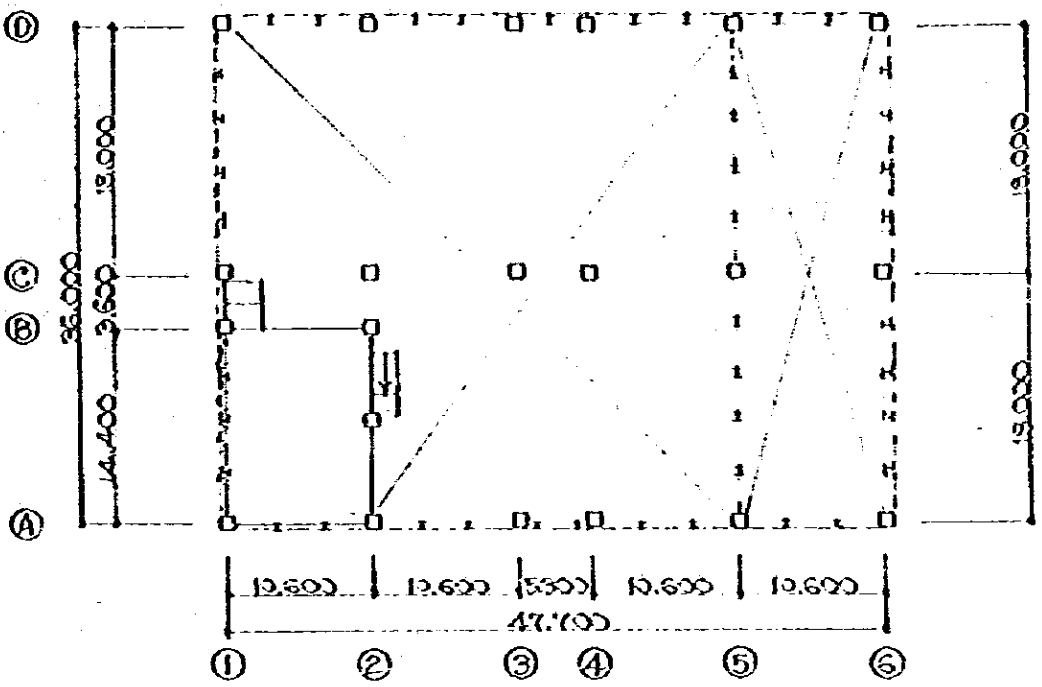
PARTS STORAGE　GF PLAN



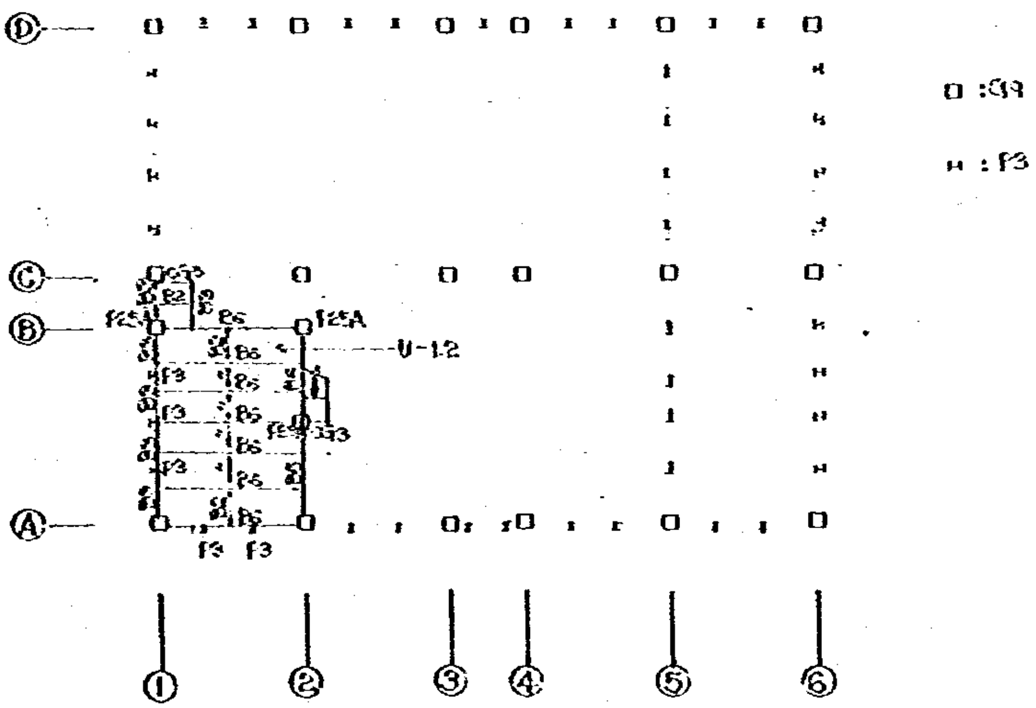
GF KEY PLAN



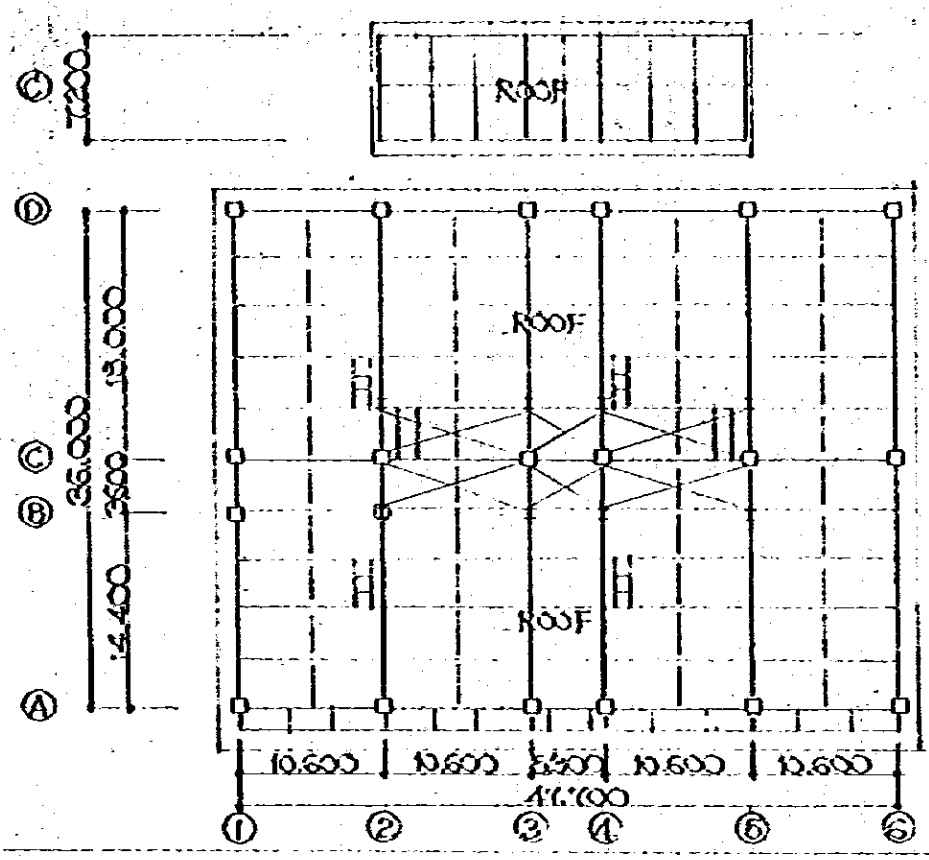
1F PLAN



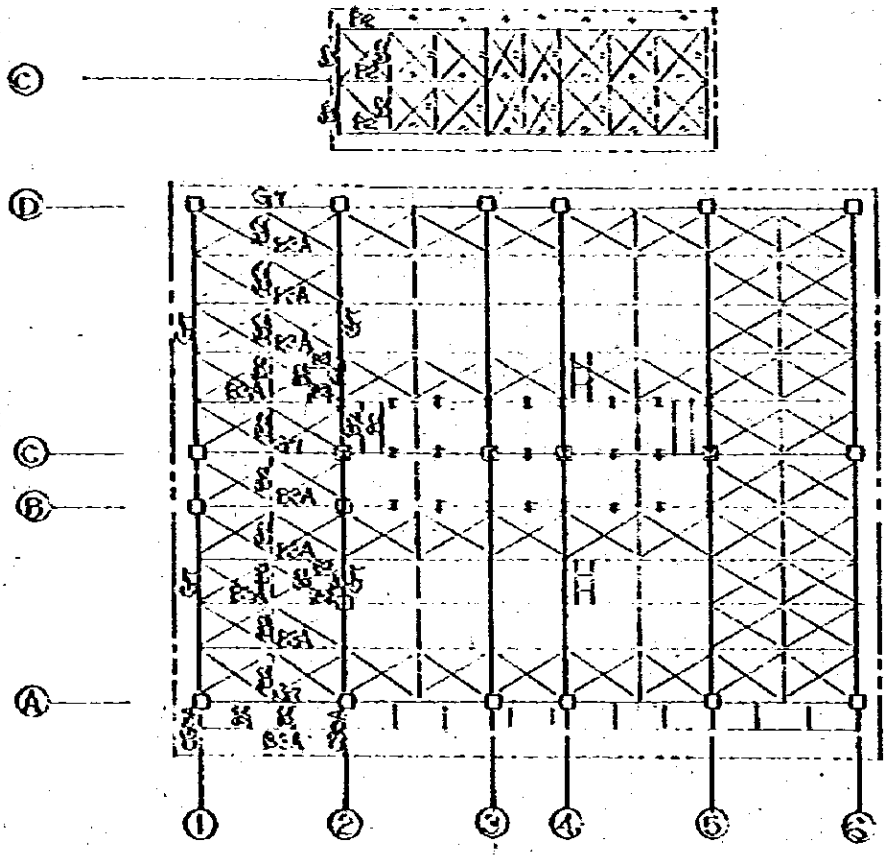
1F KEY PLAN



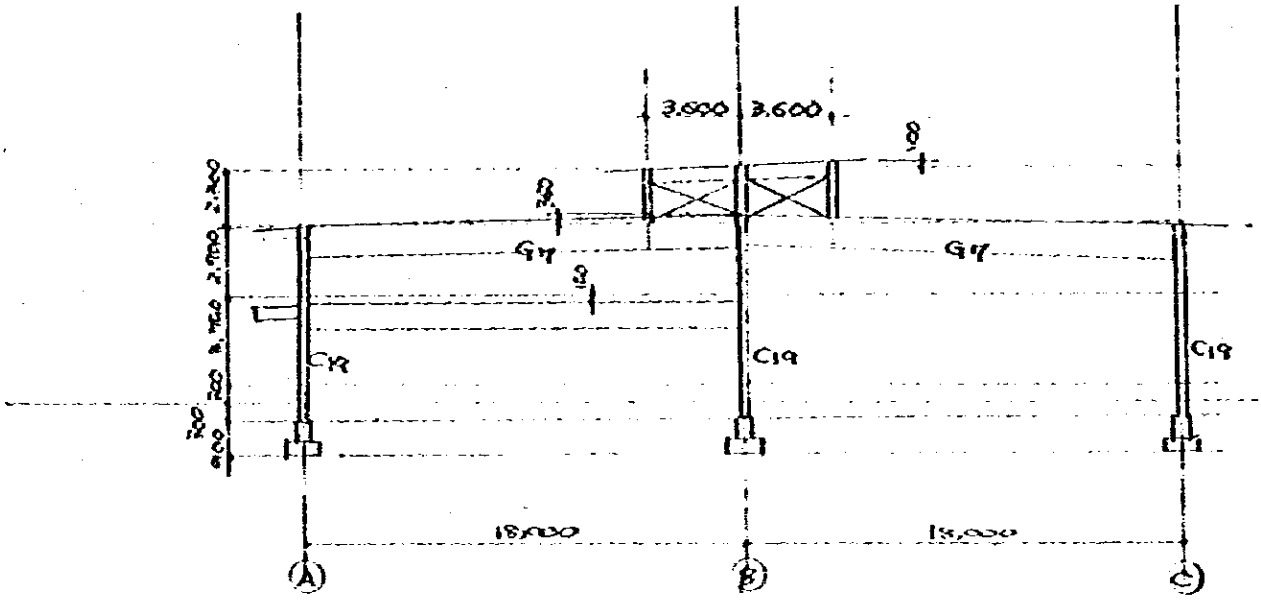
RF PLAN



RF KEY PLAN



Parts 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)			
Office Locker		Finish	0.13	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 0.13
Stair case		Step	0.06	S,B	0.30	0.46
		String	0.04	G,C,F	0.18	0.28
				K	0.13	0.18
			0.10			

Beam

	t/m			t/each						
	Steleton	Finish	Σ	ℓ						
Beam G4	0.25	0	0.25							
G4	0.15	0	0.15							
Subbeam	0.05	0	0.05							
Foundation Beam	1.26	0	1.26							

Column

	t/m			t/each						
	Steleton	Finish	Σ							
Column □ 400	0.20	0	0.25							
□ 350	0.15	0	0.15							
Post	0.05	0	0.05							

Wall

	t/m2			t/m						
	Steleton	Finish	Σ							
Siding	0.01	0.01	0.02							
Partition	0.01	0.07	0.08							
Sash	0.01	0.04	0.05							
Brick ‖ 25t	0.49	0.11	0.60							

Wind Pressure

Velosity of Wind

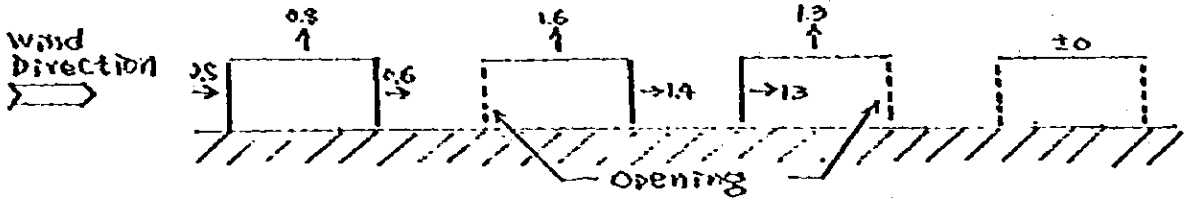
Cyclone 130 Miles/Hour = 130 × 1609.34/3,600
= 58.1 m/sec
→ 60.0 m/sec (h = 10 m)

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

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

Block	Surface		$\bar{h}$ [m]	$60\sqrt{\bar{h}}$	q [kg/m²]	c_q [kg/m²]
Heavy Repair Factory	Monitor Roof	Roof Wall	12.7	214	220	
		Roof Wall	10.5, 6.9	194, 153	200, 160 140, 120	
Parts Storage	Monitor Roof	Roof Wall	11.4 – 9.29	184 – 183	180	
		Roof Wall	9.35 – 8.10	183	160 120	
Inspection Factory	Monitor Roof	Roof Wall				
		Roof Wall	11.20 – 9.10	181	160 120	
Periodical Repair Factory	Monitor Roof	Roof Wall	9.33 – 9.23	183	180	
		Roof Wall	9.23 – 8.00	181	160 120	
Paint & Body Factory	Monitor Roof	Roof Wall	9.41 – 9.31	184	180	
		Roof Wall	9.31 – 8.00	182	160 120	
Retreading & Metal Casting Factory	Monitor Roof	Roof Wall	9.45 – 9.39	184	180	
		Roof Wall	9.39 – 8.09	182	160 120	

Coefficient of Wind Pressure



		C1		C3		C5	
MR_F	S						
	G,B						
	C						
	W						
(0.8×0.18 +0.017)	Σ						
	W.L.						
	Σ'						
R_F	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
(0.8×0.16 +0.017)	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
f_F	S	0.09 × 15.9	1.4	× 23.9	2.2	× 31.8	2.9
	G,B	0.05 × 8.0	0.4	× 11.7	0.6	× 15.1	0.8
	C						
	W						
(1.6×0.12 +0.017)	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
MR_F	S			0.09 × 73.1	6.6	× 48.8	4.4		
	G,B			0.05 × 19.1	1.0	× 15.7	0.8		
	C			0.05 × 5.8	0.3	× 5.8	0.3		
	W			0.02 × 0 0.08 × 0 0.05 × 18.3	0 0 0.9	× 0 × 8.3 × 12.2	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		
R_F	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	-2.9	-2.6	0.8		
f_F	S								
	G,B								
	C								
	W								
	Σ								
	W.L.								
	Σ'								

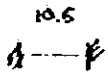
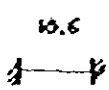
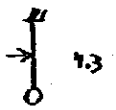
PS

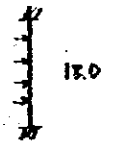
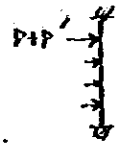
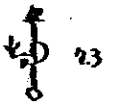
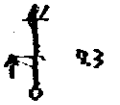
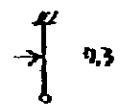
		P1		P2		PA		P6	
MRF	S								
	G,B								
	C								
	W								
	Σ								
	W.L.								
	Σ'								
RF	S								
	G,B								
	C								
	FG								
	W								
	Σ								
	W.L.								
	Σ'								
fF	S	0.43 × 19.1	8.2	× 38.4	16.5				
	G,B	0.04 × 8.9	0.4	× 25.8	1.3				
	C	0.05 × 6.7	0.3	× 6.7	0.3	× 6.71	0.3	× 6.71	0.3
	FG	1.26 × 3.6	4.5	× 9.1	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	× 18.17	1.5	× 18.17	0.9
		0.05 × 10.6	0.5	× 0	0	× 0	0	× 5.4	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	8.5	8.5	8.9	8.9
	W.L.								
	Σ'								

		A1		A2		PA		B,2W	
MRF	S								
	G,B								
	C								
	W								
	Σ								
	W.L.								
	Σ'								
RF	S								
	G,B								
	C								
	FG								
	W								
	Σ								
	W.L.								
	Σ'								
fF	S	0.09 × } =.01		× } =.05					
	G,B	0.15 ×		×					
	C	0.04 ×		×					
	FG	0.18 ×		×					
	W	1.26 × 0	14.0	× 0	21.7				
		0.02 × 0	0	× 0	0				
		0.08 × 10.6	0.8	× 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	0.03 × 19.9	1.4	× 33.9	2.2	× 6.3	2.7	× 5.3	2.3
	G,B	0.43 × 9.5	4.1	× 38.4	16.5	× 3.6	0.2	× 3.6	0.2
	C	0.05 × 8.0	0.4	× 15.1	0.8	0.05 × 6.7	0.3	× 0	0
	FG	0.04 × 8.1	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	× 0.1	0
						0.60 × 10.7	6.5	× 3.1	1.9
	Σ	27.5	6.3	53.1	20.8	14.6	14.6	[1/11] 5.7	5.7
	W.L.		0		0		0		
	Σ'	13.8	6.3	30.8	20.8	19.6	19.6		

C M,Q

[tm, t]

	Load			C		M_0		Q	
↪ RG	 10.6	(8.89×3.6)+0.12	t	0.479 × $10.6^2/12$	4.4	× 1/8	6.17	× 10.6/2	2.5
T.L.					4.4		6.17		2.5
//	 10.6	(0.85×0.16−0.07)×3.6	t	0.913 × $10.6^2/12$	-0.7	× 1/8	-10.0	× 10.6/2	-3.8
W.L.					-0.7		-10.6		-3.8
↪ RG	 4.0		t	0.479 × $4.0^2/12$	0.6	× 1/8	0.9	× 4.0/2	0.9
T.L.					0.6		0.9		0.9
//	 4.0		t	0.913 × $4.0^2/12$	-1.0	× 1/8	-1.4	× 4.0/2	-1.4
W.L.					-1.0		-1.4		-1.4
↪ C	 1.3	5.0 × 1/2	P	2.5 × $1.3^2/8$	1.8	× 1/4	3.7	× 1/2	1.3
				(1.8 × 1.5	2.7)				
F.L.					1.8		3.7		1.3
//	 1.3	(0.8−0.6×0.12)×3.6	t	0.35 ~0.26 × $1.3^2/12$	1.6 ~1.2	× 1/8	2.4 ~1.7	× 1.3/2	1.3 ~0.9
				(1.6 ~1.2 × 1.5	2.4 ~1.8)				
W.L.					1.6 ~1.2		2.4 ~1.7		1.3 ~0.9

	Load			C		M		Q	
↑ RG	 18.0	(0.09 × 38.2) (0.08 × 10.6)	P	3.96 × 18.0/2.5	28.5	× 18.0/10.1	42.7	× 2	71.9
			↑	0.18 × 14.0²/12	2.6	× 1/8	3.7	× 14.0/2	1.1
T.L.					31.0		46.4		9.0
〃	 18.0	(-0.8×0.16-0.01) ×38.2	P	-7.86 × 18.0/2.5	-54.5	× 18.0/10.1	-81.7	× 2	-15.1
			P′	0.9336 × 0.8/0.2	12.6 / -0.6	0.2 × 9.0 U	11.8 D	× 0.8/0.2 U	10.9/0.2 D
W.L.					-55.1 / 57.1	51.9 / 53.9	-83.9 / 88.9	-14.9 / 16.0	14.2 / 14.9
↑ C	 9.3	(0.09 × 23.9) (0.05 × 12.1) P 2.76 2.76 × 1.5 M 4.1	M	4.1 × 0.125 ≒ 0	0.5 ≒ 0			1.125 × 4.1/9.3	0.6
T.L.					0.5 ≒ 0				0.6
〃	 9.3	(1.6×0.12-0.07) ×23.9 P 6.26 6.26 × 1.5 M 9.4	M	9.4 × 0.125 ≒ 0	1.2 ≒ 0			1.125 × 9.4/9.3	1.5
		0.8×0.12×10.6/3	↑	0.34 × 9.3²/12	(1.5×1.5 =2.1) 1.5	/8	2.3	× 9.3/2	1.2
W.L.					3.6 ≒ 0		2.3		2.4
〃	 9.3	0.6 × 0.12 × 0.6/3	↑	0.25 × 9.3²/12	(1.5×1.1 =1.7) 1.1	/8	1.7	× 9.3/2	0.9
					1.1		1.7		0.9
〃	 9.3	5.0 × 1/2	P	2.5 × 9.3/8	1.8	× 1/4	3.7	× 1/2	1.3
				(1.8 × 1.5)	2.7				
K.L.					1.8		3.7		1.3

Seismic Force

(t.)

			W	K	KW	Q
	S	0.05×29.0×9.2	12.4			
	B	0.05×{(26.8×3)+(9.2×9)}	9.2			
	P	0.05×2.1×27	2.8			
MRF	W	(0.08×15.4×2.1)+(0.05×54.0×2.1)	8.3			
	Σ	w = 30.7/(26.8×9.2) = 0.16 (t/m²)	30.7	0.16	3.1	4.0
	S	0.05×{49.9×39.0)-(26.6×9.2)}	87.4			
	G	0.18×{(9.2×3)+(36.0×6)}	49.0			
	B	0.05×{(49.9×8)+(36.0×4)}	26.3			
RF	C	0.18×9.1×18/2	9.6			
	P	0.05×9.1×43/2	9.6			
	W	(0.05×16.9×3.5)+(0.08×36.0×3.5)	39.4			
	Σ	w = 219.3/(49.9×36.0) = 0.13 (t/m²)	219.3	〃	28.9	26.0
	S	0.28×10.6×14.9	44.3		↗	29.0
	B	0.05×{10.6×17)+(14.9×3)}	9.9		1/2	
	W					
1F					↘	
	Σ	w = 50.2/(10.6×14.9) = 0.33 (t/m²)	50.2	〃	9.0	

Wind Force

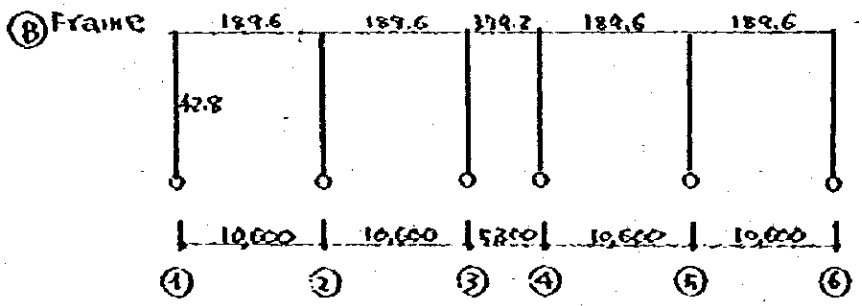
(t.)

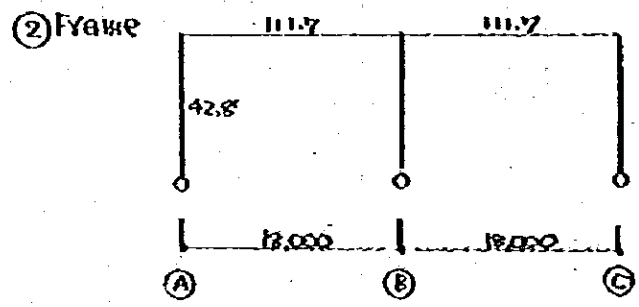
		C	q	A	H	Q	
	MRF	0.8+0.6	0.18	9.7×2.1	16.2	4.1	5.0	
↓	RF	〃	0.12	36.5×3.5	127.8	21.5	26.0	< K.L.
	1F	〃	〃					
	MRF	0.8+0.6	0.18	29.0×2.1	56.7	14.3	18.0	
↑	RF	〃	0.12	48.2×3.5	168.7	28.3	43.0	> K.L.
	1F	〃	〃					

Stiffness Ratio

	J	k/ft	k					
H - 700X300X13X24	201,000		1060	830	1800		638	
D - 350X350X19 ~16	40,700 ~35,300						57.0 (x0.75=42.8)	

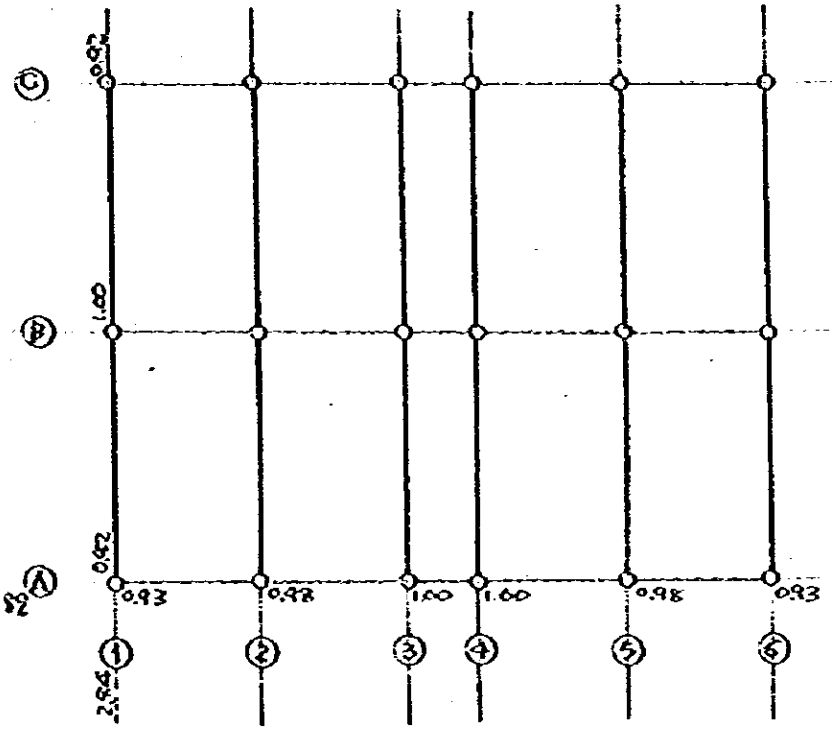
$$Je = \mu J_{max} = 0.20 + 0.80\left(\frac{35,300}{40,700}\right) J_{max} = 0.89\, J_{max}$$





Distribution Factor & Inflection Point

	D					D'	Y			ΣY	h	K.L.			W.L.		
	Kc	ΣKb	K̄	a	D		Y_0	Y_1	$Y_{2,3}$			Q	MU	ML	Q	MU	ML
↔	42.8	139.6	4.43	0.22	9.61	0.93	0			0	4.3	2.8	20.4	0	2.4	17.7	0
		399.2	8.86	0.24	10.13	0.98	0			0	〃	2.9	21.5	0	2.5	18.6	0
		568.8	13.29	0.24	10.31	1.00	0			0	〃	3.0	21.9	0	2.6	19.0	0
↕	42.8	111.7	2.61	0.21	8.98	0.92	0			0	4.3	2.7	19.5	0	3.3	24.1	0
		223.4	5.22	0.29	9.76	1.00	0			0	〃	2.9	21.2	0	3.6	26.3	0



Unit Stress

Case / DIR.	K.L. Total Q	K.L. Total ΣD	K.L. Total Q/ΣD	K.L. ⑧/② Frame Q	K.L. ⑧/② Frame ΣD	K.L. ⑧/② Frame Q/ΣD	W.L. Total Q	W.L. Total ΣD	W.L. Total Q/ΣD	W.L. ⑧/② Frame Q	W.L. ⑧/② Frame ΣD	W.L. ⑧/② Frame 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

3.1 + 21.9/2 + 5.0/2 = 16.6
3.1/4 + 21.9/5 + 5.0/2 = 7.1

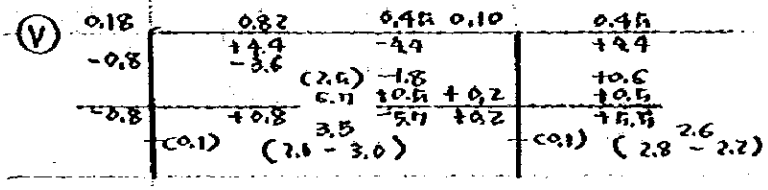
4.1 + 21.5/2 = 14.9
14.3/4 + 14.3/4 + 28.3/5 = 9.2

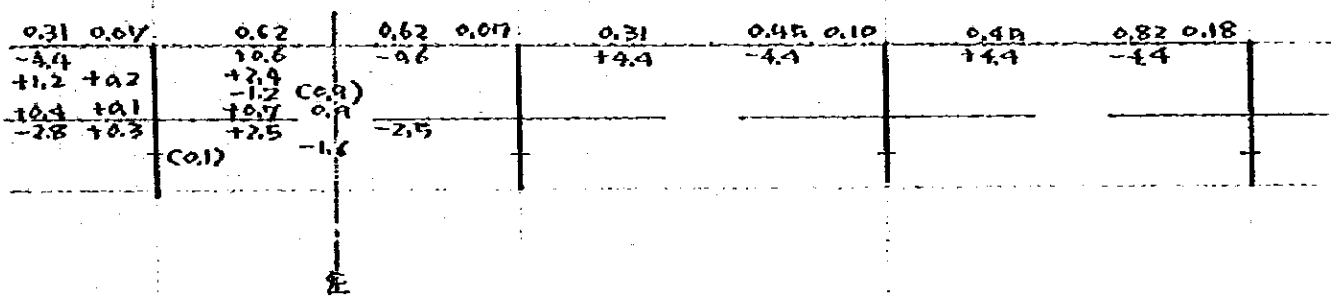
Deflection by Horizontal Force

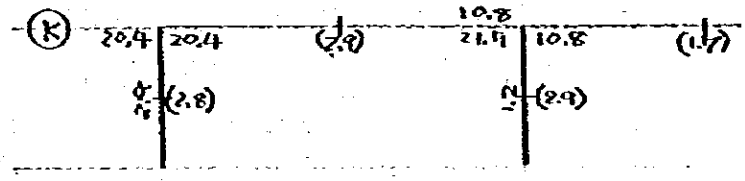
			Q	ΣD_{b_0}	$h_0^2/12Ek_0$	δ	δ/h	
←	K.L.	Σ	29.0	17.96×10.13	$(35)^2/12\times2100$	2.62	1/242	
		Ⓑ	17.0	5.82× 〃	〃	4.61	1/138	
	W.L.	Σ	26.0	17.96× 〃	〃	2.35	1/270	
		Ⓑ	15.0	5.82× 〃	〃	4.071	1/156	
1	K.L.	Σ	29.0	13.04×9.76	〃	2.09	1/228	
		②	8.0	2.84× 〃	〃	4.61	1/138	
	W.L.	Σ	43.0	13.04× 〃	〃	4.14	1/143	
		②	10.0	2.84× 〃	〃	5.077	1/110	

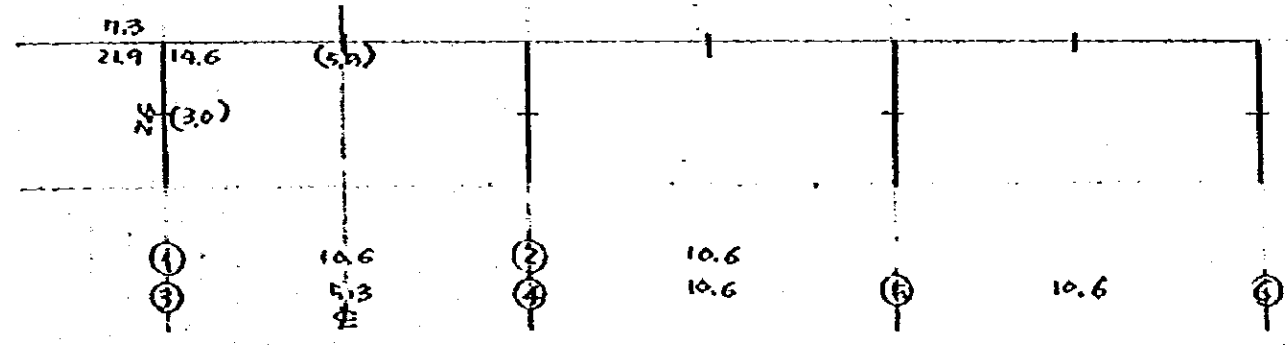
Stress

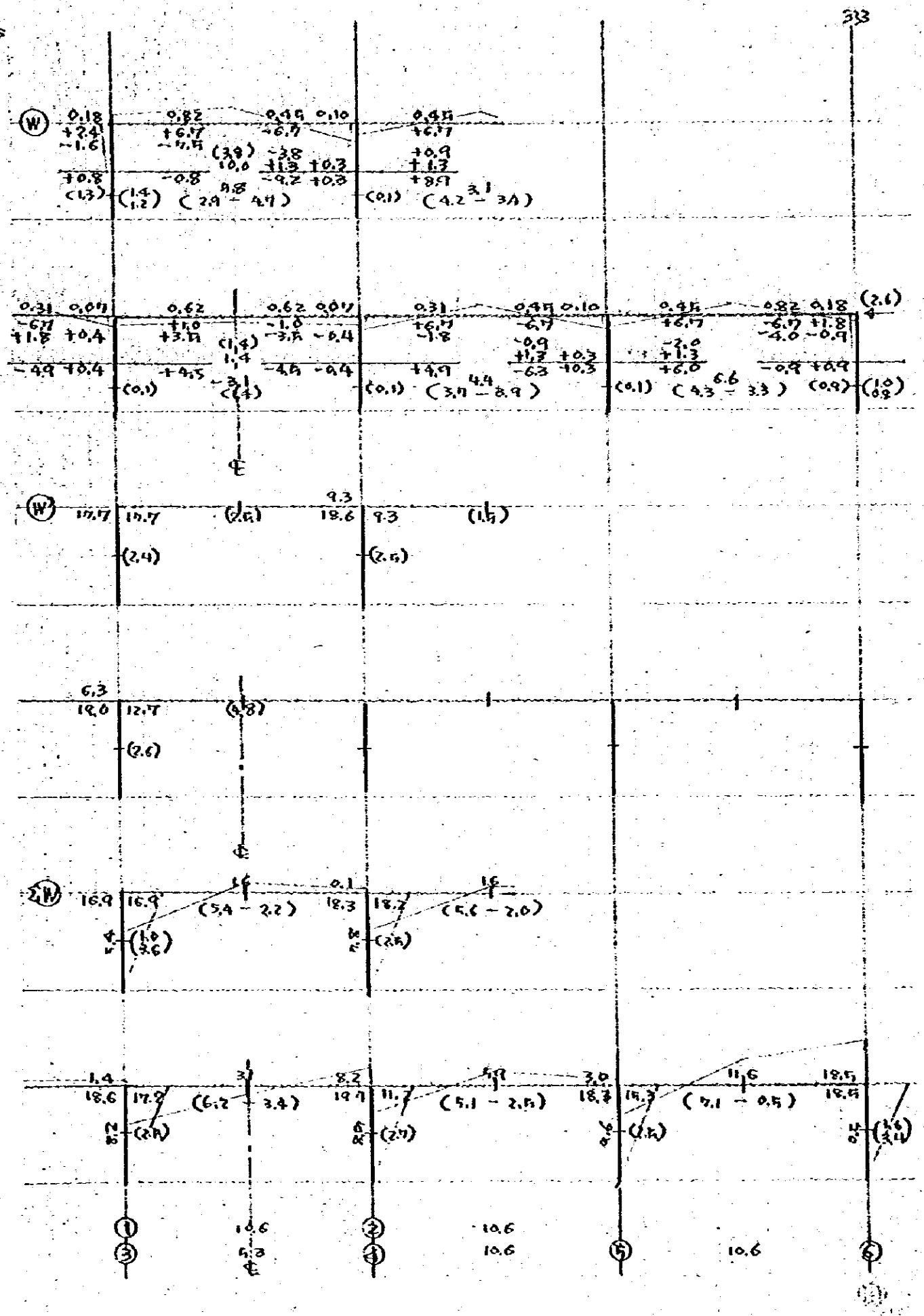
Ⓒ Frame (b=1.3)





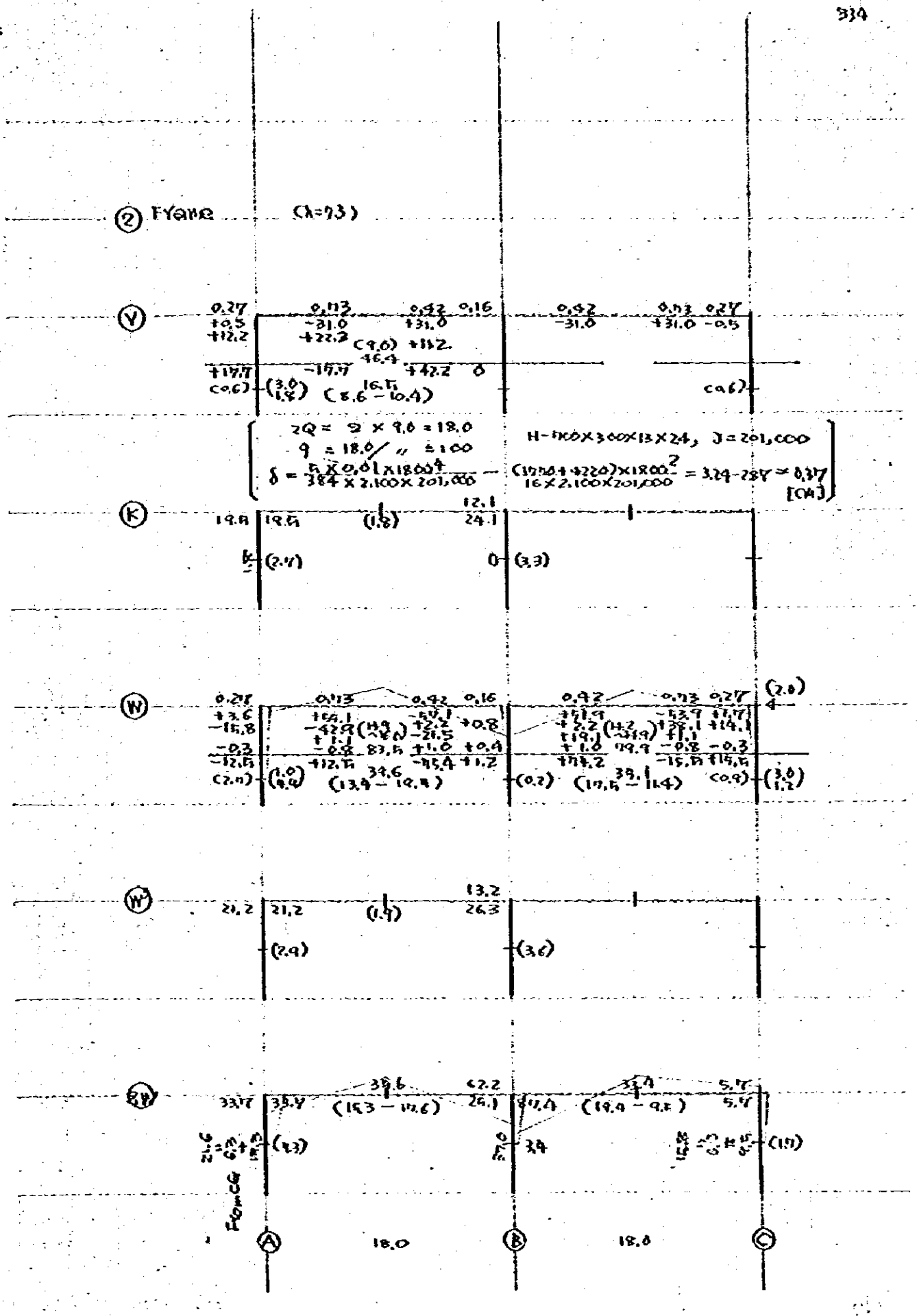




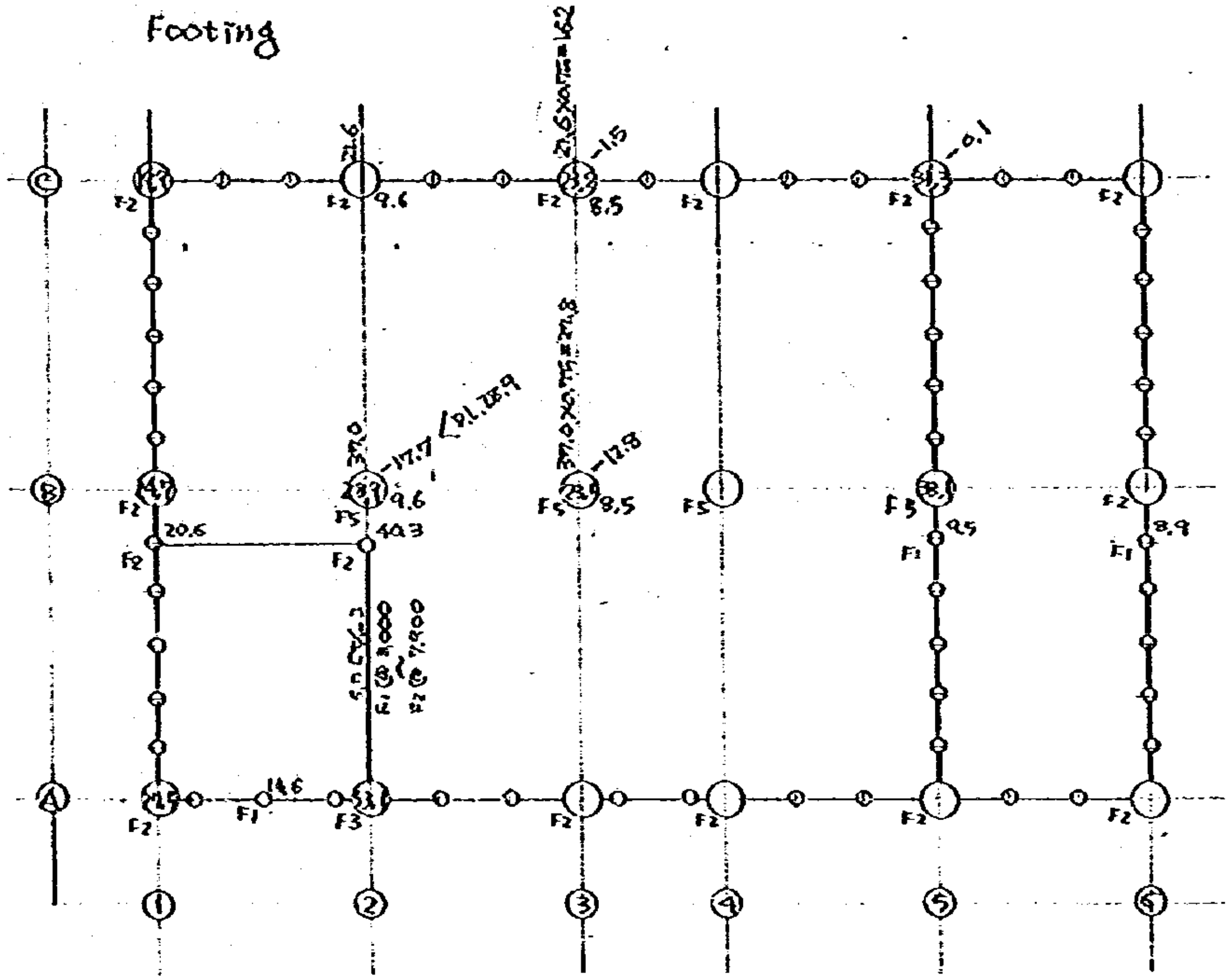

(W)
(W')
(N)
1
2
3
4
5
6
10.6
10.6
10.6

PS

② Frame (λ=93)



Footing



Design of Piling Footing

$N \geq 2$ (R 100%)

PILE

Φ	L	R	4W	Ra
300	12,000	25	$0.9^2 \times 1.5 \times 2.0 = 2.4$	22.6
350	〃	30	$1.05^2 \times$ 〃 $= 3.3$	26.7
400	〃	35	$1.2^2 \times$ 〃 $= 4.3$	30.7

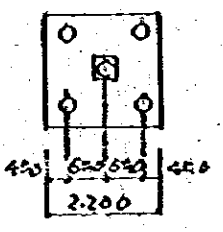
$N = 1$ (R 80%)

PILE

Φ	L	R	4W	Ra
300	12.000	20	2.4	17.6
350	〃	24	3.3	20.7
400	〃	28	4.3	23.7

Φ = 300 type

F5



Qf = 22.6 [t]

Mf = 22.6 × (0.65 − 0.275) = 8.5 [t-m]

2D+Q 14Ø D10 @ 543 [cm]

Qa 27.7 [t/m] QAL 52.9 [t]

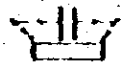
at 1.9 [cm²]

Lower Bar ┼ 14-D13

For Lift Up

W = 2.2² × 1.5 × 2.0 = 14.5 [t]

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



Qf 19.7/4 = 4.9

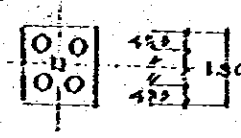
Mf 4.9 × (1.05 − 0.275) × 2/3 = 2.3

Qa 3.9 at 1.4

Upper Bar ┼ 8-D10

ϕ = 300 Type

F4



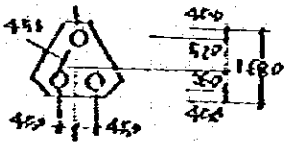
Q_F = 22.6 [t]
M_F = 22.6 × (0.45 − 0.275) = 4.0 [t·m]

2D+Q 14a

D 45 j_t 32.4 [cm]
σ_c 46.6 Q_{AL} 23.5
σ_t 0.6

12-D13

F3



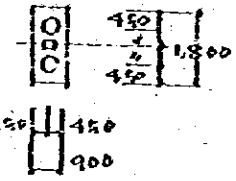
Q_F = 22.6
M_F = 22.6 × (0.52 − 0.275) = 5.5

2D+Q→8=90

D 70 j_t 54.3
σ_c 27.7 Q_{AL} 23.4
σ_t 0.5

11-D13

F2



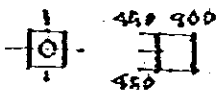
Q_F = 22.6
M_F = 22.6 × (0.45 − 0.275) = 4.0

8-90

D 70 j_t 54.3
σ_c 27.7 Q_{AL} 23.4
σ_t 0.4

11-D13

F1



D = 450

6-D13

For Lift Up

w = 1.5 × 2.0 = 3.0 t/m²

D 45

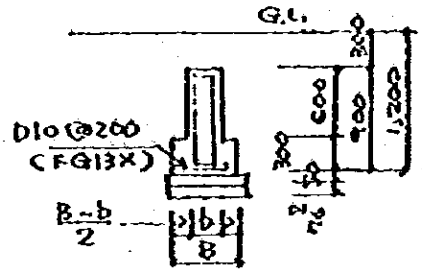
F4 Q = 1.5² × 3.0/4 = 2.43 σ_c 5.0
M = 2.43 × 0.9 × 1/3 = 0.73 σ_t 0.8

6-D10

F2 Q = 2.43 = 2.43 σ_c 6.0
M = 2.43 × 0.45 = 1.09 σ_t 1.1

3-D10

Design of Foundation Beam



Type	B	b		TOP R.	BTM R.	SIDE R.	Stirp.	TIE
FG_{35}	350	350		2-D19	2-D19	2-D10	□D10 @200	⌐D10 @600
45	450	〃		〃	〃	〃	〃	〃
55	550	〃		〃	〃	〃	〃	〃

For Stress Between Piling Footing

$$q = (FG35)\ 1.26 + (\text{Brick Wainscot})\ 0.6\times 2.9$$
$$= 3.0\ [t/m]$$

Span 4.5 [m]

M_0	$3.0\times 4.5^2/8$	7.6 [tm]	at	5.4 [cm²]	) 2-D19
Q	$\times 4.5/2$	6.8 [t]	Q	6.9 [cm]	

b 35 D 90 j 80.9 Q_{AL} 12.4 [t] > Q

$$q = 1.26 + (0.6\times 1.5) + (0.08\times 2.5) = 2.84$$

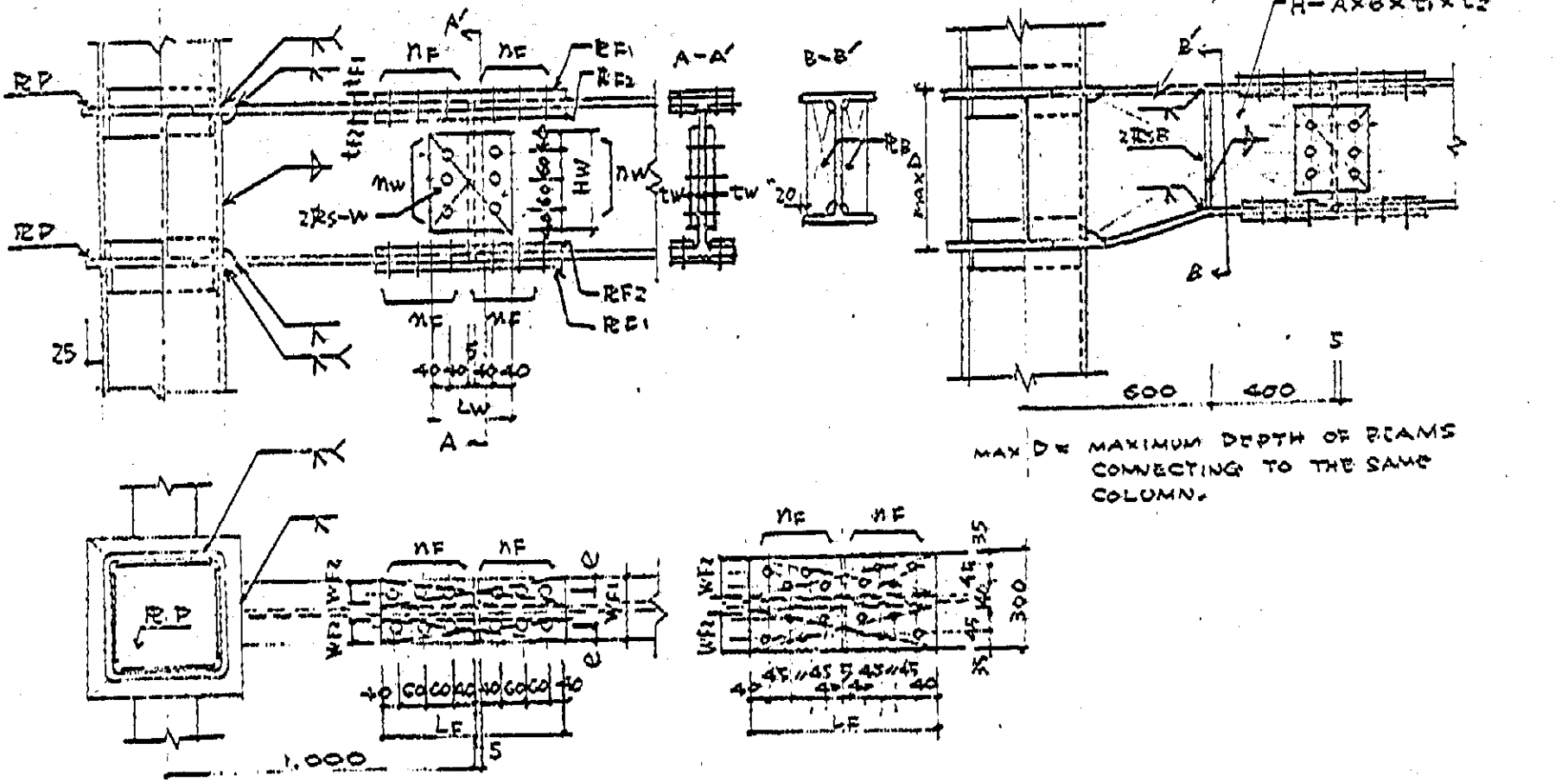
Span 5.3

M_0	$2.84\times 5.3^2/8$	10.0	at 11.0	∼ 3-D19
Q	$\times 5.3/2$	7.5		

Design of Beam

			Stress									Member	ℓb	ib	λb	η	C	fb	Z	σ/f	Type	Note
			V	K	W1	W2	1.5V	V+K	V+W1	V+W2	Max											
←	M	O.E.	0.8	20.4	16.9	18.5	1.2	21.2	16.1	19.3	21.2	H 700X300X13X24										
		CENT	3.5	4.8	4.6	11.6	5.3	8.3	1.9	8.1	8.3											
		C.E.	5.7	10.8	0.1	15.3	8.6	16.5	5.8	9.6	16.9										G7	
	Q		2.0 / 3.0	2.9	-5.4 / -2.2	-0.5 / -7.1	3.0 / 4.5	4.9 / 5.9	-3.4 / 0.8	1.5 / -4.1	5.9											
	M	O.E.	2.5	14.6	17.2	8.2	3.8	17.1	14.7	10.7	17.1	H 700X300X13X24										
		CENT	1.6	0	3.1	3.1	2.4	1.6	1.5	4.5	2.4											
		○																			G7	
	Q		0.9	5.5	-6.2	-3.4	1.4	6.4	5.3	-2.5	6.4											
	M	○																				
		○																				
	Q																					
↓	M	1.E	42.2	12.1	76.4	74.2	63.3	53.3	33.2	32.0	63.2	H 700X300X13X24										
		CENT	16.5	3.7	39.6	35.1	24.8	20.2	23.1	18.6	24.8											
		O.E	17.7	19.5	12.5	15.5	26.6	37.2	5.2	2.2	37.2		360	7.87	45.7	7.65	1.00	1.60	5,760	0.46	G7	
	Q		10.4 / 8.6	1.8	-19.5 / -13.4	-17.5 / -11.4	15.6 / 12.9	12.2 / 10.4	-9.1 / -4.8	-7.1 / -2.8	15.6											

STEEL BEAM SCHEDULE



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

W#	R
150	30
175	30
200	35
250	45

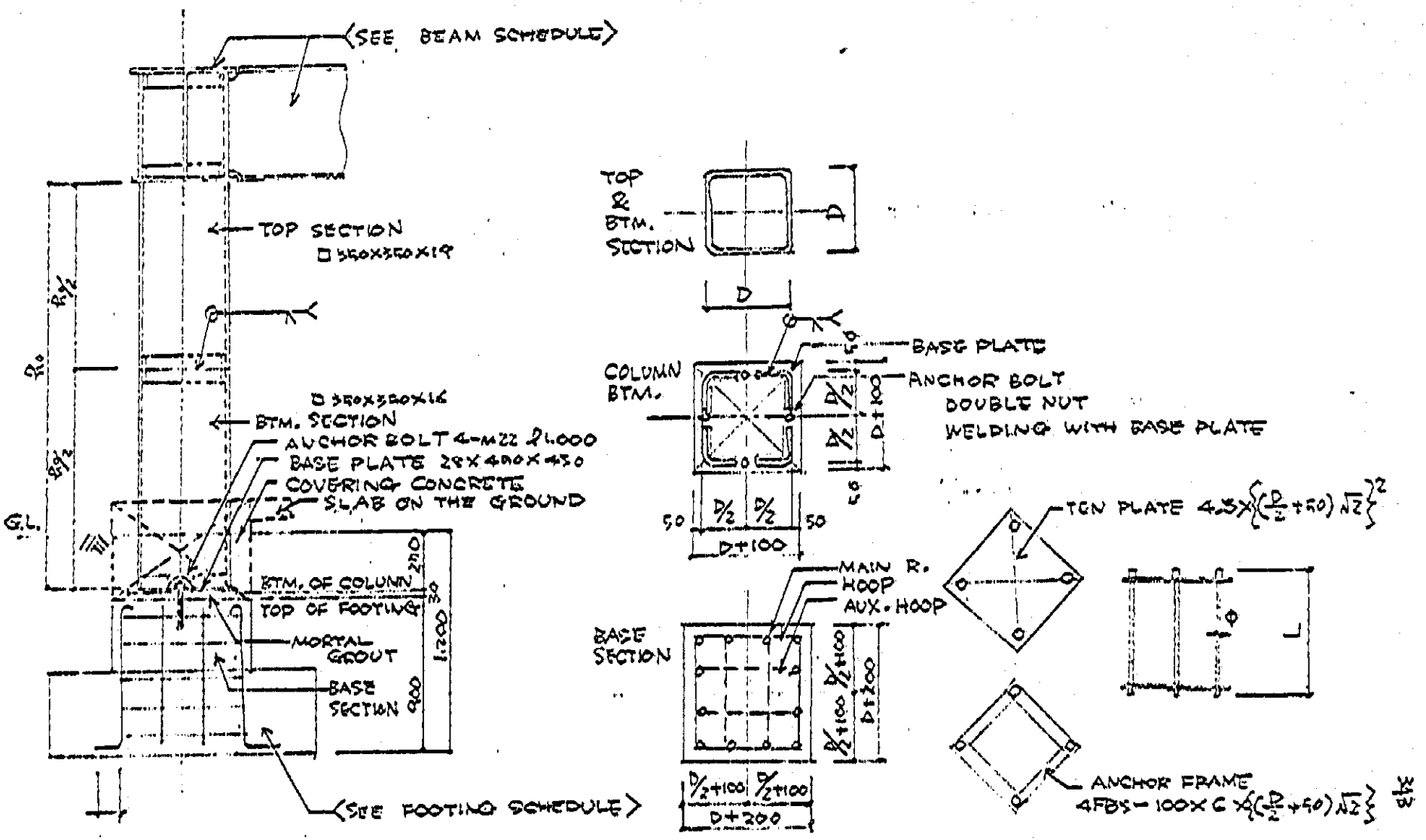
$$t_d \geqq \sqrt{3}\,\frac{t_f}{2d}$$

MARK	MEMBER	RP	RB	RF1 tF1 × LF × WF1	RF2 tF2 × LF × WF2	nF	RW tW × LW × hW	nW	NOTE
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	

Design of Column

			Stress V	K	W₁	W₂	1.5V	V+K	V+W₁	V+W₂	MAX	Member	fc/fb	σc/σb	λc/λb	η	C	fc/fb	A/Z	N/fc	Type	Note
		N	24.7	2.9	-3.4	-0.5	37.1	27.6	19.3	24.2	37.1	□										
	↔	M U	0.8	20.4	-16.9	18.5	1.2	21.2	16.1	17.17	21.2	350×350×19			Ct. Chart							
		M L										□16										
		Q	0.1	2.8	-3.6	3.4	0.2	2.9		3.5	3.5									OK		
B①—		N																				
	↕	M U																				
		M L																				
		Q																			C19	
		N	28.9	1.2	-7.8	/	43.4	30.1	21.1	/	43.4	□										
	↔	M U	0.2	21.5	18.3		0.3	21.7	18.5		21.7	350×350×19										
		M L				/				/		□16										
		Q	0.1	2.9	2.5	/	0.2	3.0	2.6	/	3.0									OK		
B②—		N	28.9	0	37.0	/	43.4	28.9	65.9	/	43.4											
	↕	M U	0	24.1	23.1	/	0	24.1	23.1	/	24.1											
		M L					0															
		Q	0	3.3	3.4	/	0	3.3	2.4	/	3.4									OK	C19	
		N	23.5	2.6	-5.2	/	35.3	26.1	18.3	/	35.3	□										
	↔	M U	0.3	21.9	18.6		0.5	22.2	18.9		22.2	350×350×19										
		M L				/				/		□16										
		Q	0.1	3.0	2.5	/	0.2	3.1	2.6	/	3.1									OK		
B③—		N																				
	↕	M U																				
		M L																				
		Q																			C19	
		N	31.3	1.2	-7.8	/	47.0	32.5	23.5	/	47.0	□										
	↔	M U	0.2	21.5	18.3		0.3	21.7	18.9		21.7	350×350×19										
		M L				/				/		□16										
		Q	0.1	2.9	2.5	/	0.2	3.0	2.6	/	3.0									OK		
A②—		N	31.3	1.8	-21.6	-15.8	47.0	33.1	9.7	15.5	47.0											
	↕	M U	17.7	19.5	-33.7	9.7	26.6	37.2	16.0	23.4	37.2											
		M L																				
		Q	3.0	2.7	-7.3	1.7	4.5	5.7	4.3	4.7	5.7									OK	C19	

STEEL COLUMN SCHEDULE



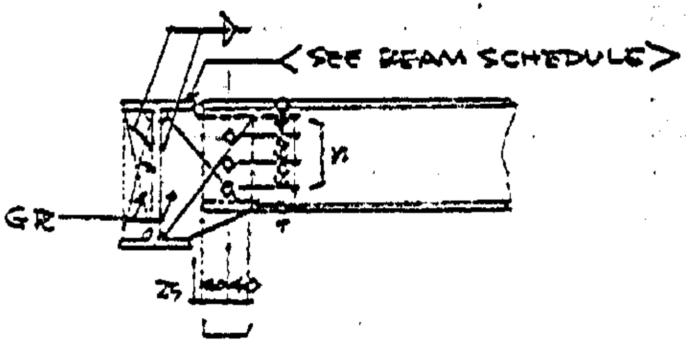
Design of Sub Beam

h	l	@	w D.L.	w W.L.	w T.L.	q	Mo	Q	In	Zn	Member	I	Z	l_b	i_b	λ_b	η	C	f_b	σ/f	Type
4.4	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	553	2.60	135.8	6.49	1.00	0.80	0.28	B2
4.05	10.6	2.25	0.02	1.6×0.18	0.172	0.337	4.73	1.79	7,466	197.1	H-350×175	13,600	775								B3A
〃	5.6	〃				〃	0.55	0.61	292	229	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	199.3	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			1.274 (S.L. 0.06)	17.89	6.75	44,263	1118.1	H-600×200	35,500	1,090	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	1124	H-600×200										B6
〃	3.6						0.18	3.44	2649.9	386.3	H-300×150										B5

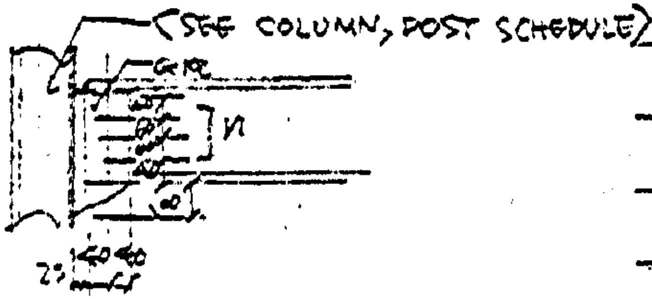
$q = (0.51 \times 5.3) + (0.05 \times 2.3 \times 5 / 14.4) + (0.08 \times 1.75) = 2.87$

$F = (0.21 \times 2.4 \times 5.3) + 5,000 \times (4.5 + 7.6) / 2 = 6.87$

STEEL SUBBEAM SCHEDULE



ONE SIDE FLANGE CUT

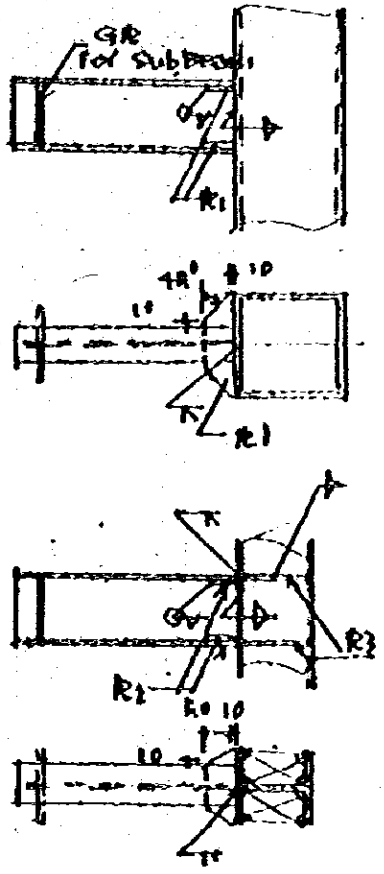


MARK	SECTION	GR	n	
B4B	H-390X300X10X16	12	5-M22	
B4A	H-450X200X9X14	"	"	
B4	H-400X200X8X13	"	4-M22	
B3A	H-350X175X7X11	"	"	
B3	H-300X150X6.5X9	"	3-M22	
B2A	H-250X125X6X9	9	"	
B2	H-200X100X5.5X8	"	2-M22	
B9	H-900X300X16X28	19	12-M22	
B6A	H-588X300X12X20	16	7-M22	
B6	H-600X200X11X17	"	"	
B5	H-500X200X10X16	12	6-M22	
B3E	H-300X300X12X10	12	2X3-M22	

Design of Cantilever

				w_u			P (S.L.) (0.05)	No.	Q	J_m	Z_m	Member	J	Z	l_b	i_b	λ_b	η	C	f_{ba}	σ/f	Type
				D.L.	W.L.	T.L.																
	4.05	1.15	10.6	0.02	1.6x0.12							H-350x175										CG1A
	//	1.15	3.6									H-200x100										CG2
	//	2.5		$\{0.05 \times 1.8 \times 1.25 + \frac{1}{2}\{0.05 \times (1.8-0.25)\}\}$			1.31	3.27	4.31	243.7	204.3	H-300x150	9210	1108								CG3

SCHEDULE OF CANTILEVER

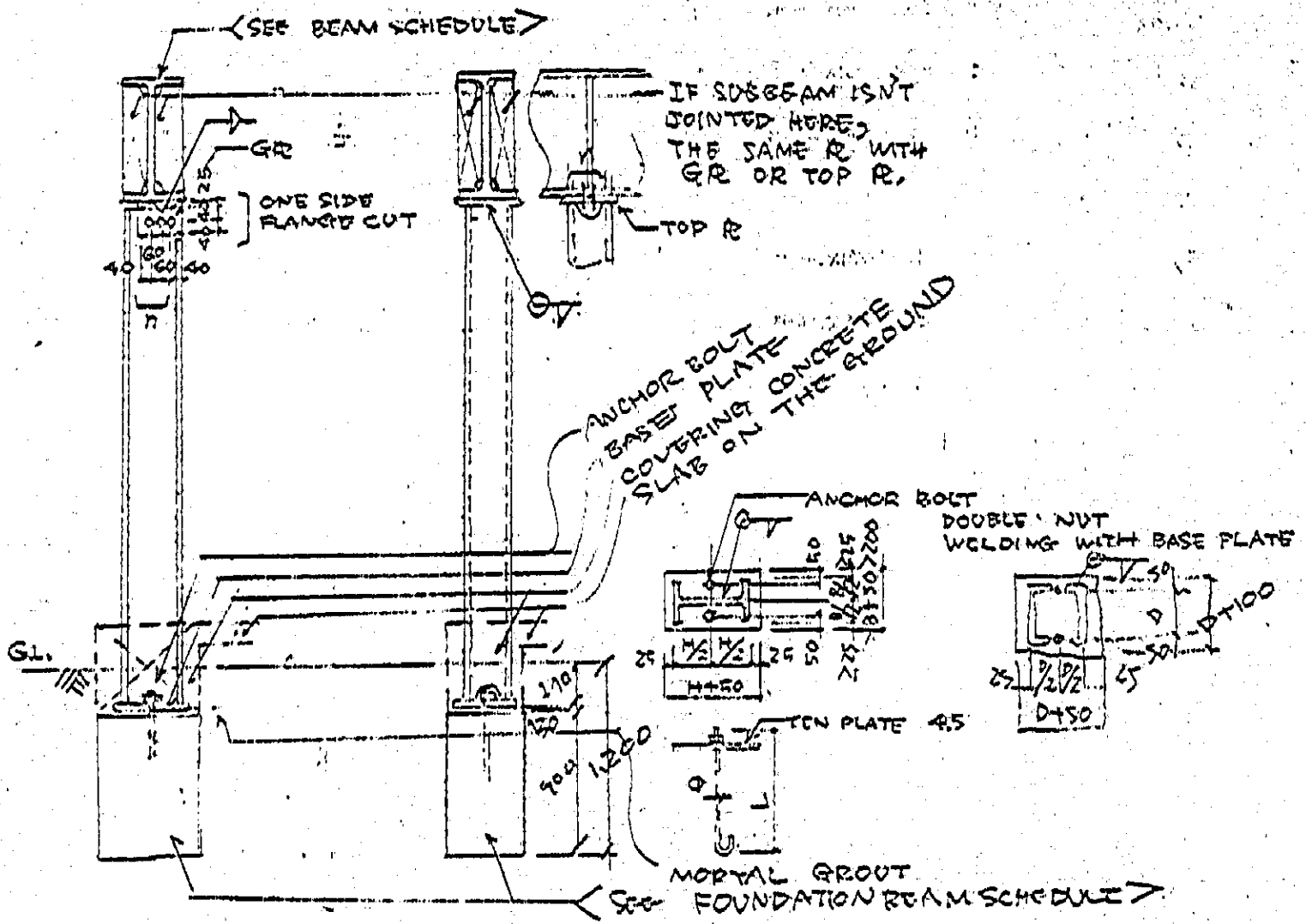


MARK	MEMBER	R1	R2	R3
CG4	H-400×200×8×13	R12	R12	R12
CG3A	H-350×175×7×11	〃	〃	〃
CG3	H-300×150×6.5×9	R9	R9	R9
CG2	H-200×100×5.5×8	〃	〃	〃

DESIGN OF POST

BTM	TOP	h	Θ	D.L. ω	D.L. q	N	W.L. ω	W.L. q	Mo	Q	Jx	Zx	Member	J	lk lb	ix ib	λx λb	η C	fc fb	A Z	σ/f	TYPE
7.0	9.3	2.3	3.53	0.05	0.23 (5.6 / 0.05)		08×0.18	0.51					H-100×100									P1
0.3	7.3	7.0	3.6	0.02	0.12 (〃)	0.85	08×0.12	0.36	2.11	1.21	2297	87.9	H-300×150	7,210	700	3.29 3.87	213 181	8.61 1.00	0.21 0.60	46.8 481	0.55	P3
						20.6							〃	〃	350	〃 〃	106.4 90.4	〃 1.75	0.82 1.40		0.55	P3
						40.3							H-250×250		〃	6.29	55.6		1.33	92.7	0.33	P25
						〃							□-250×8.0		〃	9.82	35.6		1.48	75.8	0.36	P25A

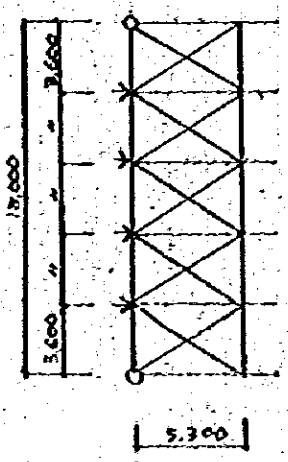
STEEL POST SCHEDULE



MARK	SECTION	GR	n	BASE PLATE	ANCHOR BOLT ΦXL	NOTE
P1	H-100X100X6X8	PL 9	2-M22	PL 16 X 180 X 200	2-M20 X 900	
P2	H-200X100X5.5X8	DO	〃	PL 〃 X 250 X 200	2-M 〃 X 〃	
P2A	H-250X125X6X9	DO	3-M22	PL 〃 X 300 X 200	2-M 〃 X 〃	
P3	H-300X150X6.5X9	DO	〃	PL 〃 X 350 X 200	2-M 〃 X 〃	
P3A	H-350X175X7X11	PL 12	4-M22	PL 〃 X 400 X 225	2-M 〃 X 〃	
P4	H-400X200X8X13	DO	〃	PL 〃 X 450 X 250	2-M 〃 X 〃	
P4A	H-450X200X9X14	DO	5-M22	PL 〃 X 500 X 250	2-M 〃 X 〃	
P25	H-250X250X9X14	PL 9	2X2-M22	PL 19 X 300 X 300	〃	
P20A	□-200X200X8	TOP PL 16X300X300	〃	PL 16 X 200 X 300	〃	
P25A	□-250X250X8	〃 19X300X350	〃	PL 19 X 300 X 350	〃	

PS

Design of Bracing



θ 9.06

@ 3.6

$\sum A$ $0.8 \times 0.12 \times 3.6 = 0.346$

Q $6.346 \times 9.06/2 = 1.22$

P $1.22 \times 6.41/5.30 = 1.49 \sim \times 2 = 2.94$, $A_n = 2.94/2.4 = 1.2$

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

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

L-130×130×9

A 22.7, J 366.0, Z 38.7

$$J_n' = \frac{5 \times 0.0002 \times 321^3 \times 300}{384 \times 2,100} = 12.3$$

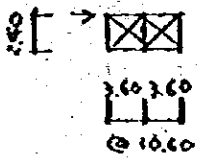
$$Z_n' = \frac{0.02 \times 3.21^2 \times 100}{8 \times 2.4} = 1.1$$

L-75×75×6

A 18.7, J 46.1 Z 8.5

Monitor Roof

Vertical

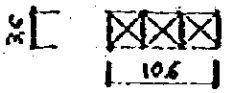


P $0.8 \times 0.18 \times 10.6 \times 2.4/2 = 1.83$

D $1.83 \times 9.32/3.60 = 2.26$ A_n $2.26/2.4 = 0.9$

L-75×75×6

Horizontal

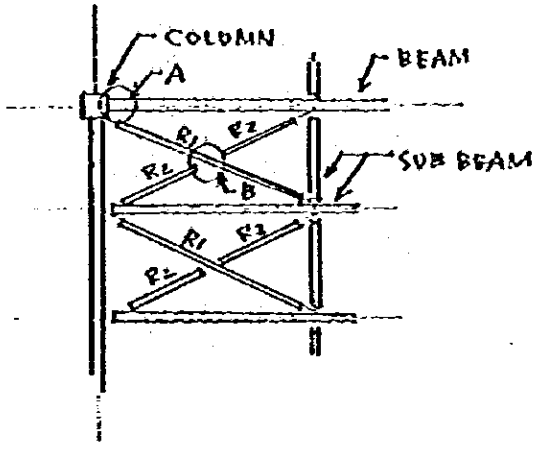


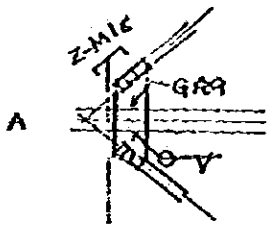
$$J_n = \frac{13 \times 0.0002 \times 504^3 \times 300}{384 \times 2,100} = 123.8$$

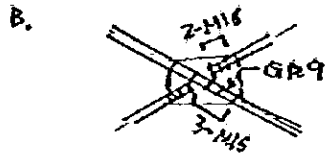
L-100×100×10

A 19.0, J 175.0, Z 24.4

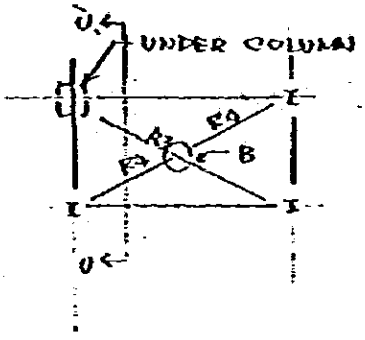
BRACING SCHEDULE

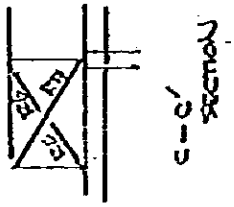






MONITOR ROOF





Mark	Member	Note
R1	L-130×130×9	At. Paint & Body F. ~L-130×130×12
2	L-65×65×6	
3	L-100×100×10	
4	L-65×65×6	
5	〃	
6	〃	

Design of Shell Type Roof

Bldg.	Roof level [m]	$q = 60\sqrt{h}$	C	Cq [kg/m²]
Heavy Repair Factory	13.5 ~ 13.0	194 ~ 216	1.6	310 ~ 346
Parts Storage	11.0 ~ 9.5	168 ~ 185	〃	253 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

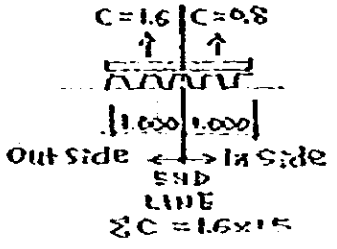
Continuous Beam Type

$$\frac{M}{Z} = \frac{\omega l^2}{8Z} \le f \quad \sim \quad l_2 \le \sqrt{\frac{8Zf}{\omega}}$$

$$\frac{5}{384}\frac{\omega l^4}{EI} \le \frac{l}{300} \quad \sim \quad l_1 \ge \sqrt[3]{\frac{384 \times 2{,}100\, I}{300 \times 5\, \omega}}$$

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

ω	Net ω	l_2	l_1	l_{min}
1.5 × 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
× 0.243	0.00343	441.1	455.3	441.1



$\Sigma C = 1.6 \times 1.5$

$$l_2 \le \sqrt{\frac{8 \times 61.33 \times 1.4}{\omega}} = \sqrt{\frac{686.896}{\omega}}$$

$$l_1 \le \sqrt[3]{\frac{384 \times 2{,}100 \times 619.94}{300 \times 5 \times \omega}} = \sqrt[3]{\frac{333{,}279.744}{\omega}}$$

Allowable Span [cm]

	M. Roof	Roof
H.R. Factory	510	390
Generally	400	440

Cantilever Type

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

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

w	Net w	ℓ_Z	ℓ_I	ℓ_{min}
0.345 [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

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

$$\ell_I \leq \sqrt[3]{\frac{8 \times 2{,}100 \times 612.94 \times 0.75^{*}}{250\, w}} = \sqrt[3]{\frac{31{,}244.976}{w}}$$

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 ⟶ Size up to 1.0 M/M

Design of Mezzanine Floor

$w = 0.81$ [t/m²]

U – 1.2 Deck Plate (AL-31) $Z = 35.5$ $J = 13.6$

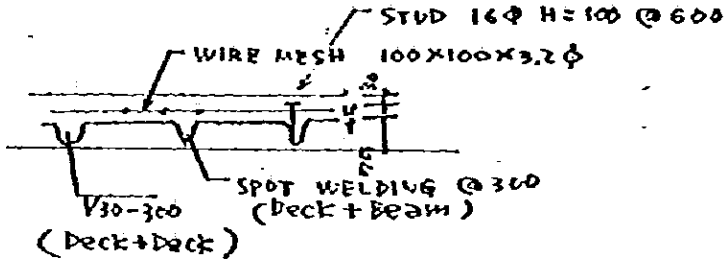
$$\frac{w\ell^2}{8Z} < f \sim \ell > \sqrt{\frac{8Zf}{w}}$$

$$= \sqrt{\frac{8 \times 35.5 \times 1.4}{0.0081}} = 249.2$$

$$\frac{5\,w\ell^4}{384\,EJ} < \frac{\ell}{350} \sim \ell > \sqrt[3]{\frac{384\,EJ}{1500\,w}}$$

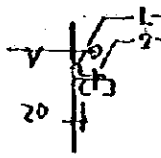
$$= \sqrt[3]{\frac{384 \times 2{,}100 \times 13.6}{1{,}500 \times 0.0081}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Outside Wall



MONITOR ROOF C-120×60×20-4.5 @±900
GENERAL C-100×50×20-3.2 @±900
OR -2.3 @±900

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
I.F.	/ ~ 3.33	〃	〃	/ ~ 120
P.R.F.	3.53 ~ 3.90	〃	〃	183 ~ 120
P.B.F.	3.45 ~ 3.25	〃	〃	180 ~ 120
R.M.C.F.	3.00 ~ 3.38	〃	〃	180 ~ 120

CASE-1. (H.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]

C-100×50×20-2.3

$$\frac{\delta}{f} = \frac{3.68^2 \times 100}{8 \times 1.4}\left(\frac{0.045}{6.05} + \frac{0.158}{16.1}\right)$$

$$= 2.68 < 2.10$$

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

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

C-100×50×20-3.2

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{24.8}\right)^2 + \left(\frac{0.00158}{101}\right)^2}$$

$$= 2.69 \text{ [cm]}$$

C-100×50×20-4.5

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{36.9}\right)^2 + \left(\frac{0.00158}{139}\right)^2}$$

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

C-120×60×20-4.5

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

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

δ/span = 1.13/368 = 1/324 < 1/300
O.K.

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]

$C = 100 \times 50 \times 20 - 3.2$

$$\delta = \frac{5 \times 360^4}{384 \times 2{,}100} \sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00158}{101}\right)^2}$$

$= 2.45$ [cm]

$C = 100 \times 50 \times 20 - 4.5$

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

$= 1.92$ [cm]

$C = 110 \times 60 \times 25 - 4.5$

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

$= 1.03$ [cm]

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

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 3.85 m

$C = 100 \times 50 \times 20 - 2.3$

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

$= 1.51$ [cm]

$C = 100 \times 50 \times 20 - 3.2$

$$\delta = \sqrt{\left(\frac{\quad}{24.5}\right)^2 + \left(\frac{\quad}{101}\right)^2}$$

$= 1.11$ [cm]

$\delta/\text{span} = 1.11/385 = 1/330 < 1/300$ 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

$C = 100 \times 50 \times 20 - 2.3$

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

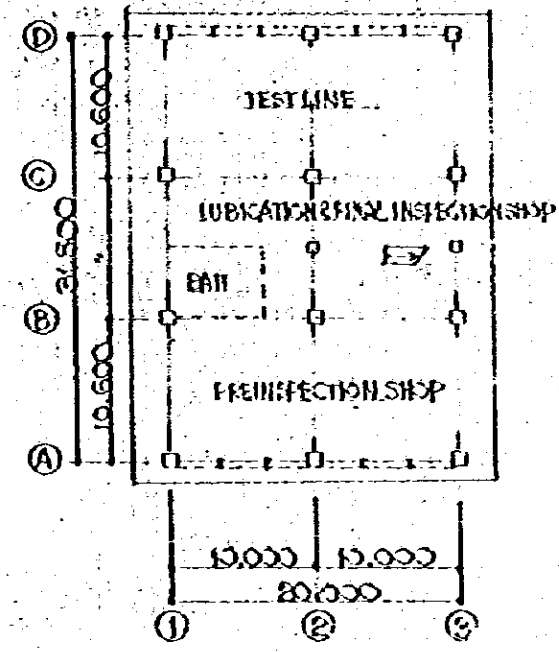
$= 0.69$ [cm]

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

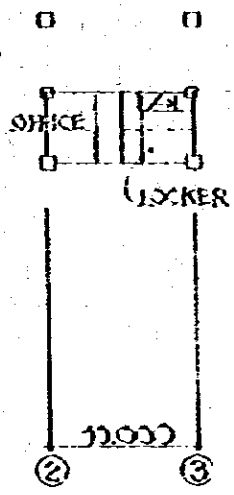
12　タイヤ再生・鋳鍛造工場

INSPECTION FACTORY

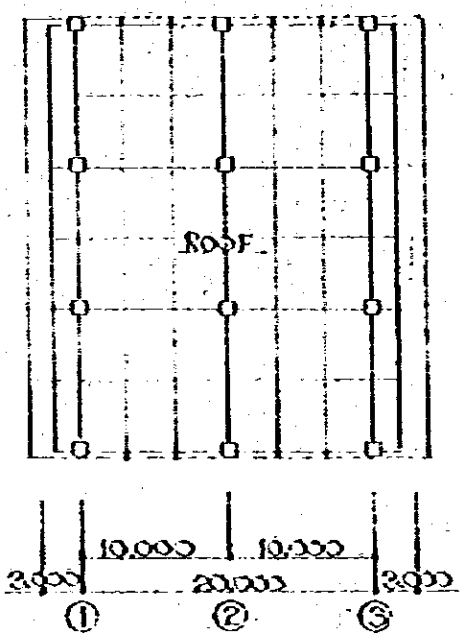
GF PLAN



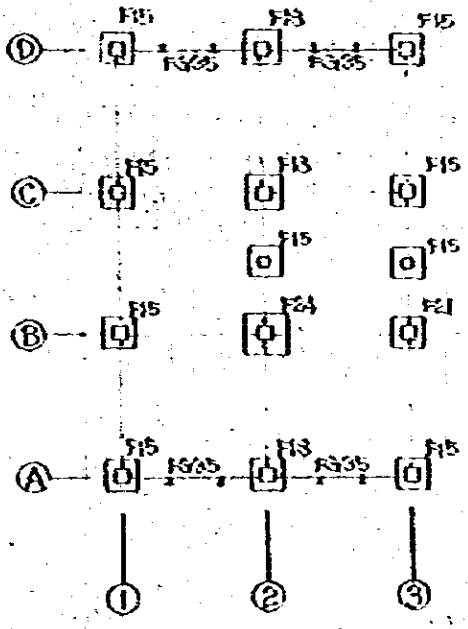
1F PLAN



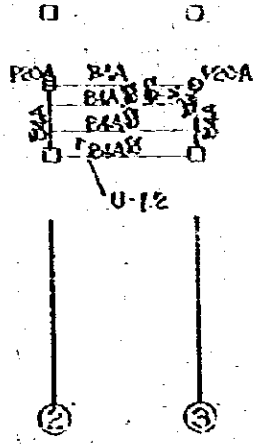
RF PLAN



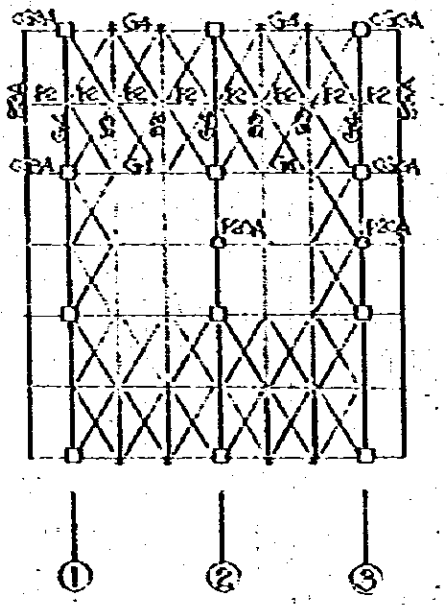
GF KEY PLAN



1F KEY PLAN



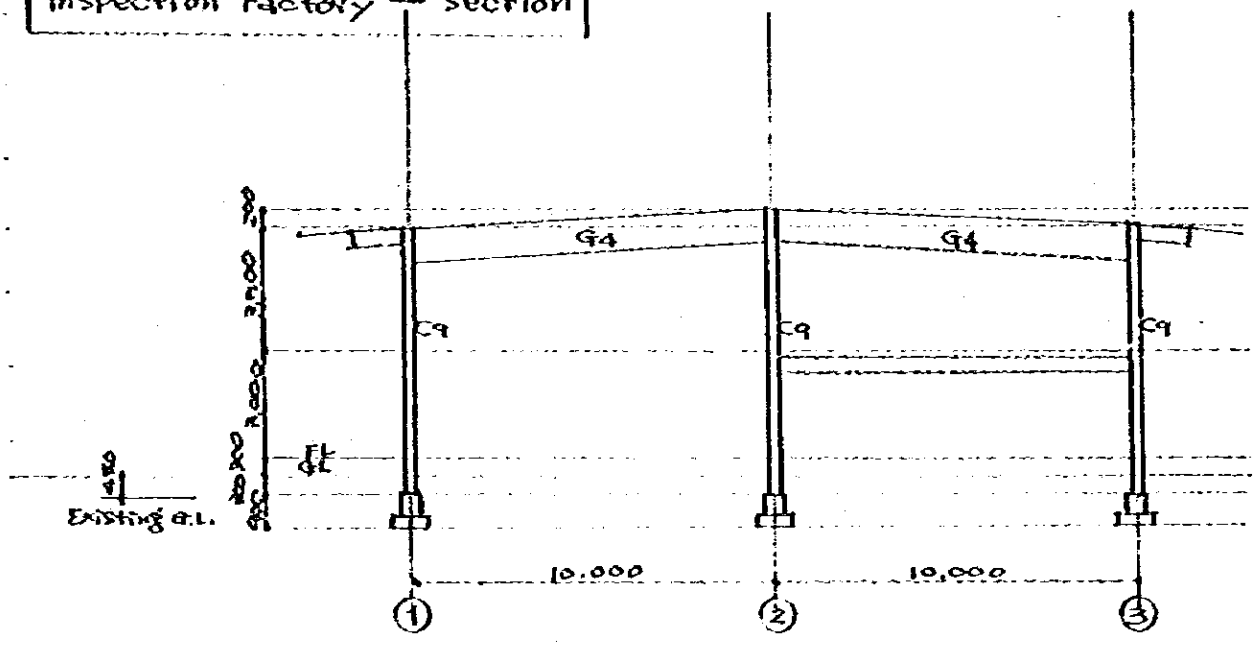
RF KEY PLAN



○ : C1
▮ : P3

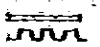
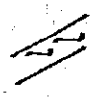
In

Inspection Factory — 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)			
Office Locker		Finish	0.13	S,B	0.30	2.51
		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
Stair case		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						
Beam Gg	0.26	0	0.25							
$\vec{Gg}$	0.15	0	0.15							
Subbeam	0.05	0	0.05							
Foundation Beam	1.26	0	1.26							

Column

	t/m			t/each						
	Skeleton	Finish	Σ							
Column □ 400	0.20	0	0.25							
□ 350	0.15	0	0.15							
Post	0.05	0	0.05							

Wall

	t/m2			t/m						
	Skeleton	Finish	Σ							
Siding	0.01	0.01	0.02							
Partition	0.01	0.07	0.08							
Sash	0.01	0.04	0.05							
Brick ‖ 254	0.09	0.11	0.60							

Wind Pressure

Velosity of Wind

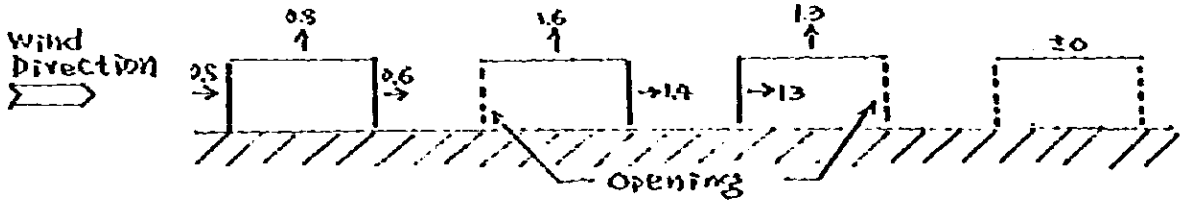
Cyclone 130 Miles/Hour = 130 × 1609.34/3,600
= 58.1 m/sec
→ 60.0 m/sec (h = 15 m)

(In 1970, At chitagon, 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	12.77	214	220	
		Wall				
		Roof	10.5, 6.9	194, 152	200, 160	
		Wall			140, 120	
Parts Storage	Monitor Roof	Roof	13.1 – 9.29	184 – 153	180	
		Wall				
		Roof	9.35 – 7.00	153	160	
		Wall			120	
Inspection Factory	Monitor Roof	Roof				
		Wall				
		Roof	9.20 – 7.10	161	160	
		Wall			120	
Periodical Repair Factory	Monitor Roof	Roof	9.33 – 9.23	183	180	
		Wall				
		Roof	9.23 – 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 – 7.13	162	160	
		Wall			120	

Coefficient of Wind Pressure



Axial force [t]

		P3		C3		C_B3		B3	
R_F	S	0.09 × 46.4	4.3	× 59.8	9.6			×	
	G,B	0.15 × 10.3	1.5	× 15.6	2.3			×	
	C	0.05 × 12.1	0.6	× 22.97	1.1			×	
	W	0.15 × 6.7	1.0	× 6.7	1.0			×	=C3
		0.02 × 8.7	0.2	× 0				×	
		0.08 × 0		× 0				×	
		0.05 × 0		× 0				×	
		0.60 × 2.5	1.5	× 0				×	
	Σ		9.1		12.0				12.0
	W.L.		0		0				0
	Σ'		9.1		12.0				12.0
1_F	S					0.43 × 13.3	5.7	×	
	G,B					0.05 × 10.3	0.5	×	
	C					0.05 × 6.97	0.3	×	$=C_{B3}$
	W					0.02 × 0		×	
						0.08 × 32.6	2.6	×	
						0.05 × 19.6	1.0	×	
						0.60 × 0		×	
	Σ					10.1	10.1	22.1	10.1
	W.L.						0		0
	Σ'					10.1	10.1	22.1	10.1

		D2		C2		B2		DW	
R_F	S	0.09 × 58.0	5.2	× 106.0	9.5	×			
	G,B	0.15 × 15.3	2.3	× 20.6	3.1	×			
	C	0.05 × 10.6	0.5	× 21.2	1.1	×			
	W	0.15 × 6.9	1.0	× 6.9	1.0	×	=C2		
		0.02 × 17.4	0.4	× 0		×			
		0.08 × 0		× 0		×			
		0.05 × 0		× 0		×			
		0.60 × 5.0	3.0	× 0		×			
	Σ		12.4		14.7	14.7	14.7		
	W.L.		0		0		0		
	Σ'		12.4		14.7	14.7	14.7		
1_F	S					0.43 ×			
	G,B					0.05 ×			
	C					0.05 ×	$=C_{B3}$		
	W					0.02 ×		× 5.4	0.1
						0.08 ×			
						0.05 ×		× 1.4	0.8
						0.60 ×			
	Σ					24.8	10.1		0.9
	W.L.						0		0
	Σ'					24.8	10.1		0.9

In

C M₀ Q

(tm, t)

	Load			C		M₀		Q	
↪ RCG	1.5 ↓	(0.09 × 23.9) (0.05 × 12.1)	P	2.8 × 1.5	4.2			× 1.0	2.8
T.L.					4.2				2.8
//	1.5 ↑ (1.6 × 0.16) − 0.09	−0.326 × 23.9	P	−7.8 × 1.5	−11.7			× 1.0	−7.8
W.L.					−11.7				−7.8
↪ RG	10.0 ↓ ↓	(0.09 × 39.3) (0.05 × 10.6) 0.15	P g	3.7 × 10/4.5 0.15 × 10²/12	8.2 1.3	× 10/3 × 1/8	12.3 1.9	× 1.0 × 10/2	3.7 0.8
T.L.					9.5		13.2		4.5
//	10.0 ↓ ↑ (0.8 × 0.16) − 0.09	−0.188 × 36.3	P	−7.0 × 10/4.5	−15.6	× 10/3	−23.3	× 1.0	−7.0
W.L.					−15.6		−23.3		−7.0
↓ RG	10.6	0.09 × 10/3 + 0.15	g	0.38 × 10.6³/12	4.2	1/8	6.3	× 10.6/2	2.4
T.L.					4.2		6.3		2.4
//	10.6	−0.138 × 10/3	g	0.66 × 10.6³/12	6.2	1/8	9.3	× 10.6/2	3.5
W.L.					0.2		9.3		3.5
↓ C	9.2	0.8 × 0.09 × 10/3	g	0.32 × 9.2²/12	1.4 ~ 1.1	1/8	2.1 ~ 1.6	× 9.2/2	1.2 ~ 0.9
	0.8 × 0.12			0.24					
W.L.					1.4 1.1		2.1 1.6		1.2 0.9

In

Wind Force [t]

DIR.	LEV.	C	q		A	H	Q
←	MRF				8	0	0
	RF	0.8 + 0.6	0.12	5.3 × 2.3	12.2	2.1	2.1
	IF	0.8 + 0.6	0.12	5.3 × 2.3	12.2	2.1	4.2
→	MRF				8	0	0
	RF	0.8 + 0.6	0.12	26.9 × 3.5	94.8	12.1	12.1
	IF						

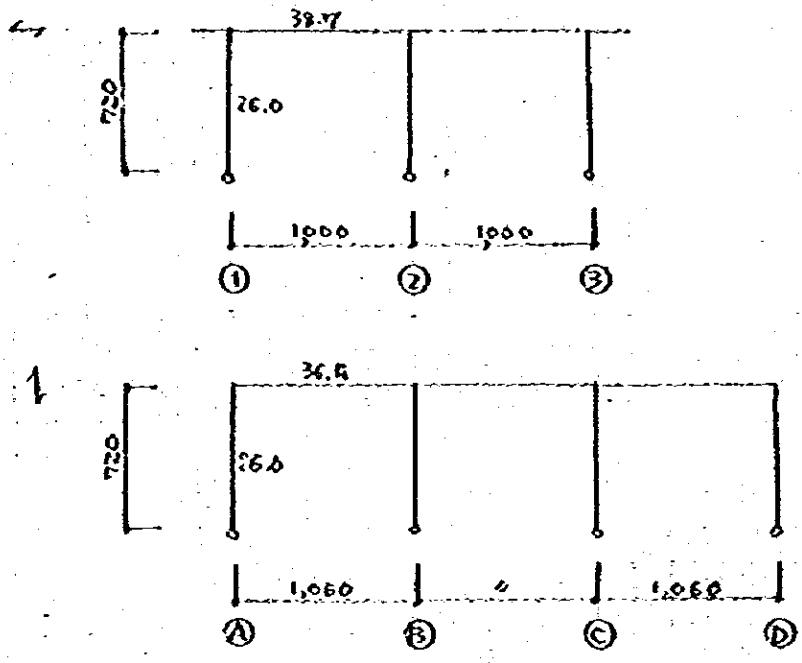
Seismic Force [t]

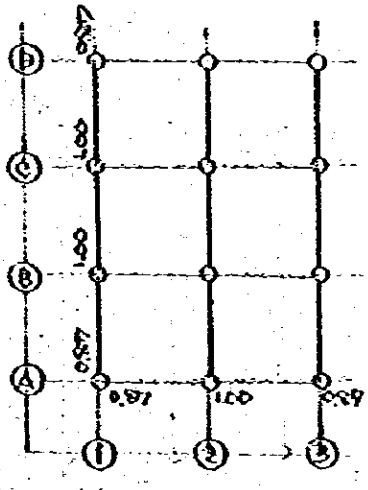
			W	K	KW	Q
MRF	S		0			
	G,B		0			
	C		0			
	W		0			
	Σ		0	0.10	0	0
RF	S	0.05×26.0×32.3	42.0			
	G,B	0.15×{(10.0×8)+(10.6×9)}+0.02×{(4.5×8)+(10.6×18)}	30.9			
	C	(0.15×6.9×12/2)	6.2			
	W	(0.18×4.0h×30.6/2)	5.0			
	Σ	$\bar{u}_1$ = 89.1/838 = 0.11	89.1	〃	9.0	9.0
IF	S	0.29×16.0×5.3	13.4			
	G,B	0.04×{(10.0×4)+(8.3×3)}	4.8			
	C	(0.04×6.9×2/2)	0.3			
	W	〃	5.0			
	Σ	$\bar{u}_2$ = 24.5/538 = 0.48	24.5	〃	2.6	12.0

In

Stiffness Ratio

	J							
		ℓ,R	1000	1060		650		
H-350 X 350X10X16	38,700		38.7	36.5				
□-356²× 9	22,500					34.6 (×0.75 = 26.0)		





Distribution Factor & Inflection Point

DIR.	Kc	ΣKb	E	α	D	D'	α	Df	Yo	Y1	Y1.3	ΣY	Q	ℓi	rM	Mo	ML
←	26.0	39.7	1.49	0.19	4.817	0.87			0				1.3	6.5	9.4	9.4	0
	〃	77.4	2.98	0.21	5.537	1.00			0				1.5	〃	10.8	10.8	0
↓	〃	36.5	1.40	0.18	4.719	0.87			0				1.0	〃	7.2	7.2	0
	〃	73.0	2.81	0.21	5.51	1.00			0				1.1	〃	7.9	7.9	0

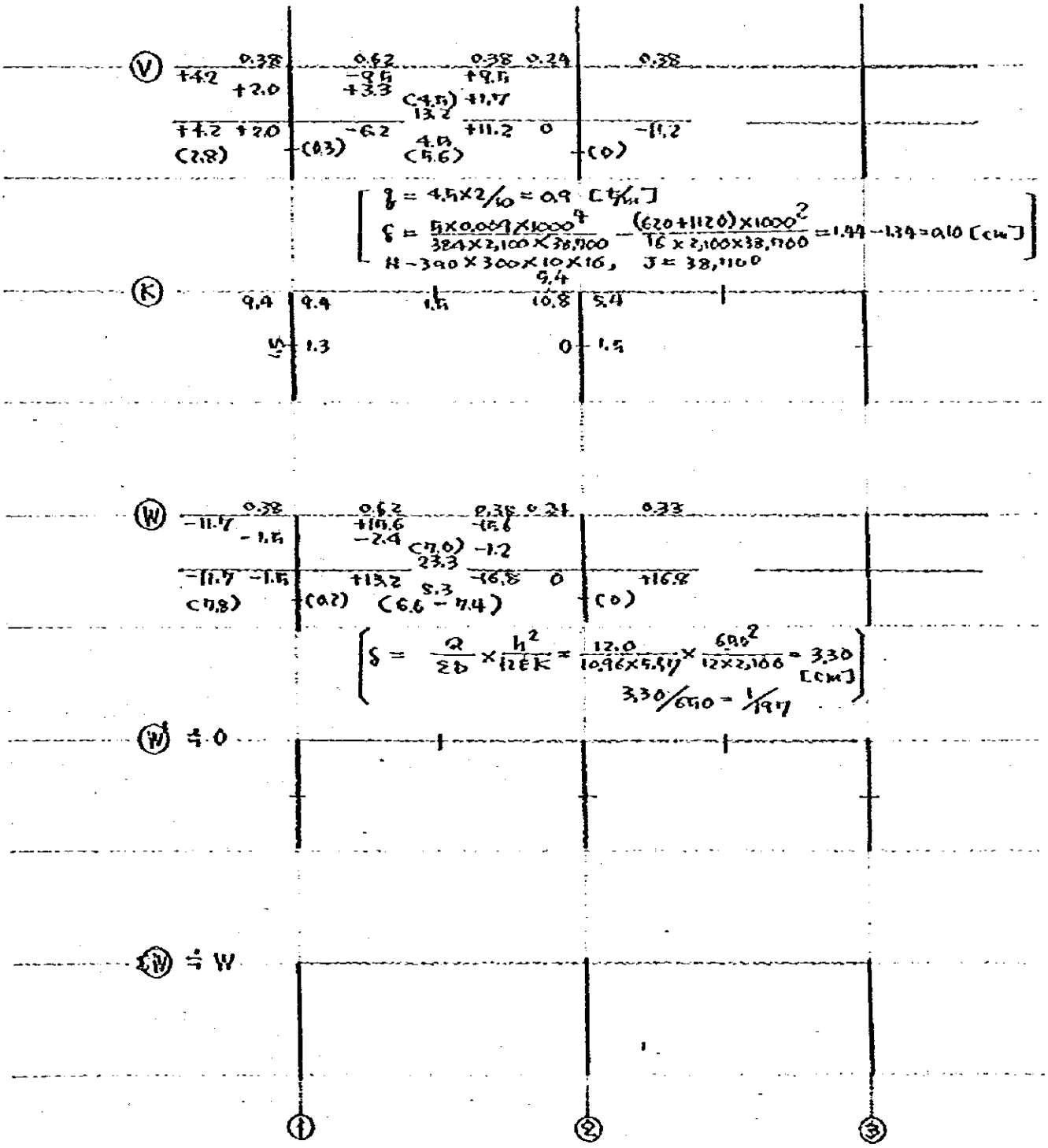
Unit Stress

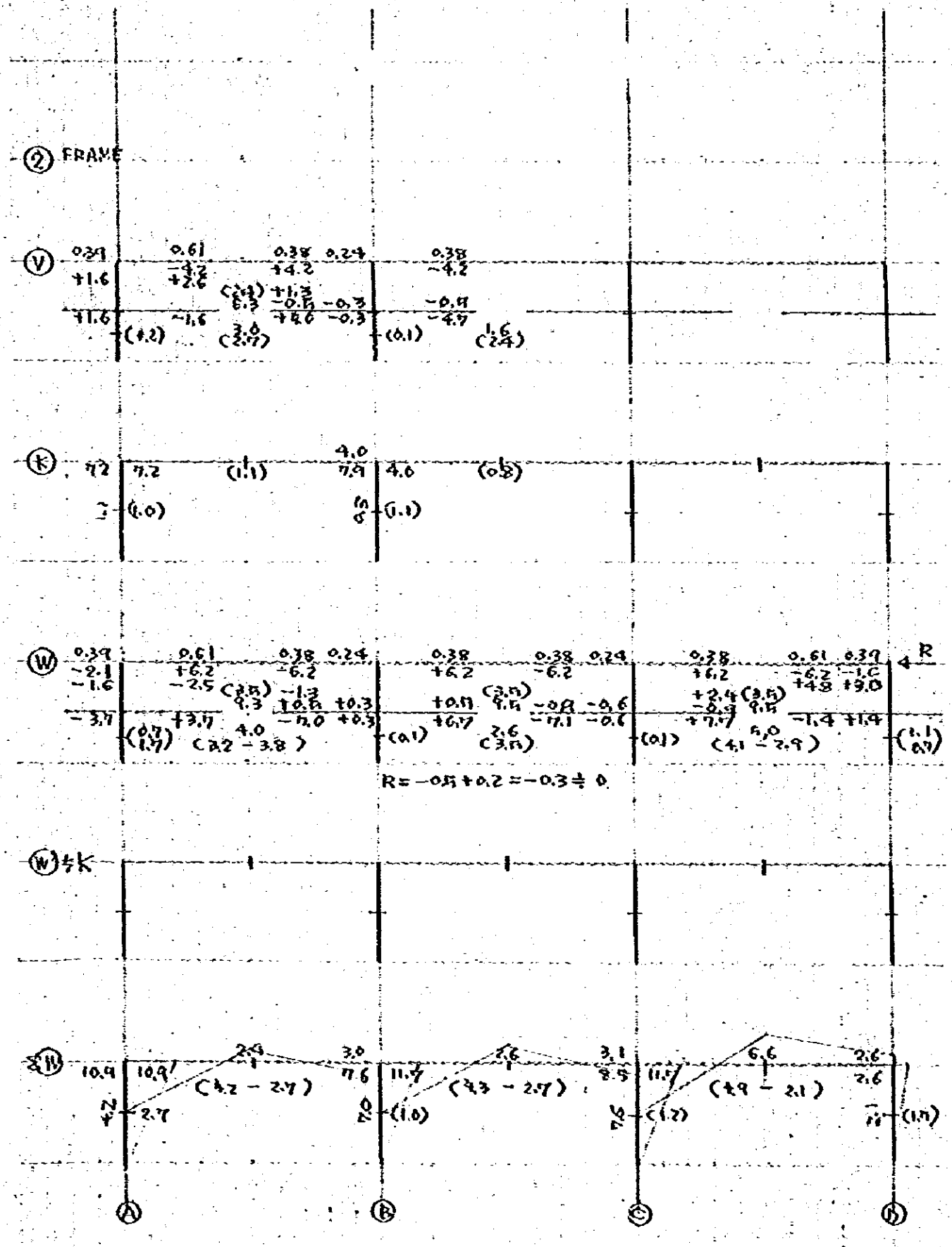
DIR.	ΣD	Q	Q/ΣD		Di	Qi	Qi/ΣD
←	10.96	12.0	1.1		2.74	12.0/3	1.1
↓	11.22	12.1	0.9		3.74	12.1/2	1.1

In

Stress

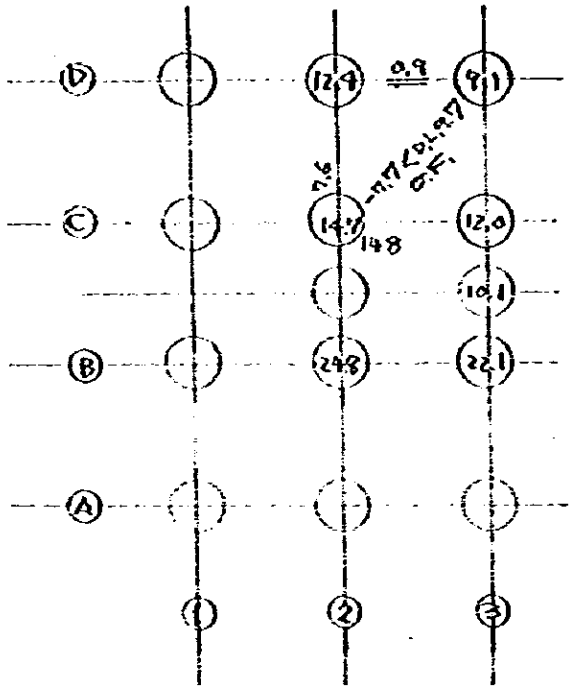
Ⓑ FRAME




② FRAME
Ⓥ
Ⓚ
Ⓦ
R = −0.5 + 0.2 = −0.3 ≒ 0
Ⓦ½K
Ⓜ
Ⓐ
Ⓑ
Ⓒ
Ⓓ

In

Footing



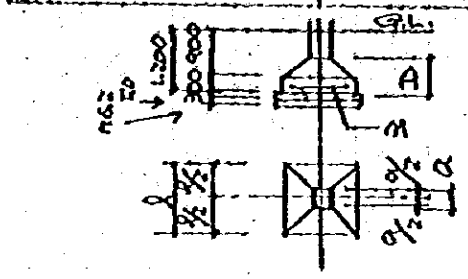
Indendent Footing

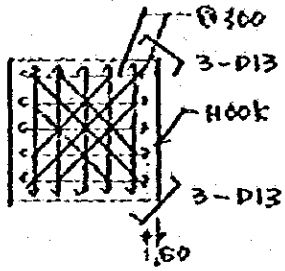
	N	fe	fea	An	Bn	l	Type
D3	9.1	8.9	5.4	1.69	1.30	1.5	F15
C3	12.0			2.22	1.49	〃	F15
B3	10.1			1.87	1.37	〃	F15
B3	22.1			4.09	2.03	2.1	F21
D2	12.4			2.30	1.52	1.8	F18
C2	14.7			2.73	1.65	〃	F18
B2	24.8			4.59	2.15	2.4	F24

Continuous Footing

	l	fe	fea	An	B11	B	Type
D	0.9	8.2	3.2	0.29	0.29	0.35	FG1

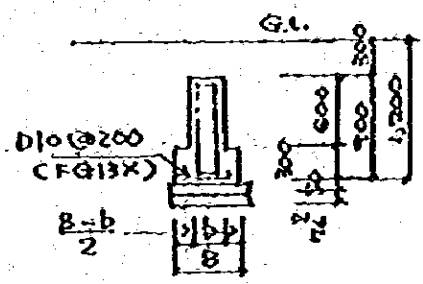
Design of Independent Footing





Type	ℓ	A	σca	Na	Q	ℓ/a	H/Na	Q/N	M	a	D	j	at	cp	2Dia	QA	n
F30	3.000	9.00	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
27	2.700	7.29	〃	39.4	〃	4.91	0.285	0.240	6.2	9.4	〃	〃	5.0	10.1	〃	〃	9-D13 〃
24	2.400	5.76	〃	31.1	〃	4.36	0.249	0.238	4.1	7.4	700	53.4	3.8	9.2	195	52.0	8-D13 〃
21	2.100	4.41	〃	23.8	〃	3.82	0.197	0.233	2.6	5.5	〃	〃	2.4	6.9	〃	〃	7-D13 〃
18	1.800	3.24	〃	17.5	〃	3.28	0.160	0.229	1.5	4.0	600	44.6	1.7	6.0	175	39.0	6-D13 〃
15	1.500	2.25	〃	12.2	〃	2.73	0.110	0.217	0.7	2.6	〃	〃	0.8	3.9	〃	〃	5-D13 〃

Design of Foundation Beam



Type	B	b		TOP R.	BTM R.	SIDE R.	Stirp.	TIE
FG_{35}	350	350		2-D19	2-D19	2-D10	□D10 @200	⌐D10 @600
45	450	〃		〃	〃	〃	〃	〃
55	550	〃		〃	〃	〃	〃	〃

For Stress Between Piling Footing

$$q = (FG35)\,1.26 + (Brick\ Wainscot)\,0.6\times2.9$$
$$= 3.0\ [t/m]$$

Span 4.5 [m]

M_0 $3.0\times4.5^2/8$ 7.6 [tm] at 5.4 [cm²]) 2-D19
Q $\times4.5/2$ 6.8 [t] ϕ 6.4 [cm]

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

$$q = 1.26+(0.6\times1.5)+(0.08\times2.5) = 2.84$$

Span 5.3

M_0 $2.84\times5.3^2/8$ 10.0 at 11.0 ∼ 3-D19
Q $\times5.3/2$ 7.5

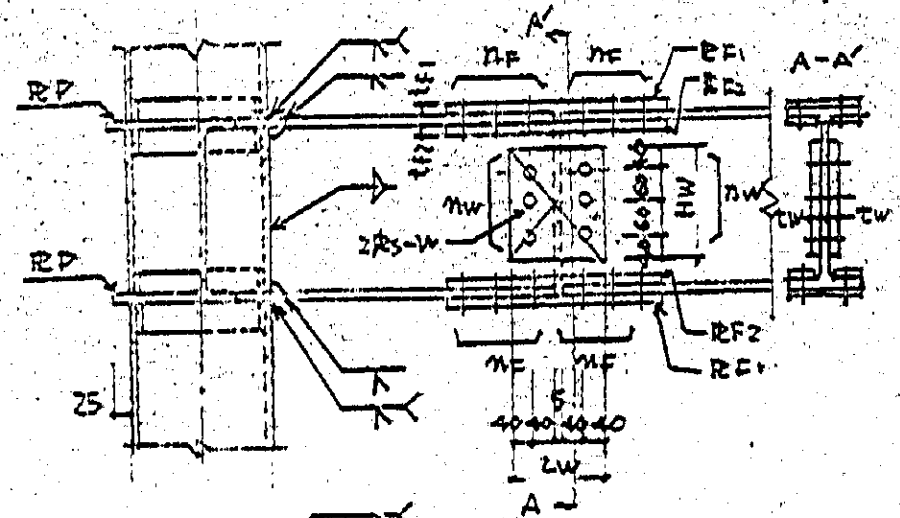
Design of Beam

			Stress V	K	W1	W2	1.5V	V+K	V+W1	V+W2	max	Member	lb	cb	λb	η	c	fb	Z	B/t	Type	Note
←	M	0.E	6.2	9.4	12.2	/	9.3	3.2	7.0	/	9.3	H-390×300 ×10×16							1,980			
		C	4.5	2.0	5.3		6.8	6.5	2.8		6.8											
		1.E	11.2	5.4	16.8		16.8	16.6	28.0		28.0		3.23	8.10	41.1	6.58	1.6	1.60		0.52		
	Q		5.6	1.8	7.4		8.4	7.1	1.8		8.4										G4	
↕	M	0.E	1.6	7.2	10.9	2.6	2.4	5.6	9.3	4.2	9.3	//							1,980			
		C	3.0	1.6	2.4	6.6	4.5	4.6	0.6	3.6	3.6											
		1.E	5.0	4.0	3.0		7.5	9.0	9.0		9.0											
	Q		2.7	1.1	4.2	4.9	4.1	3.8	1.5	2.2	4.1										//	

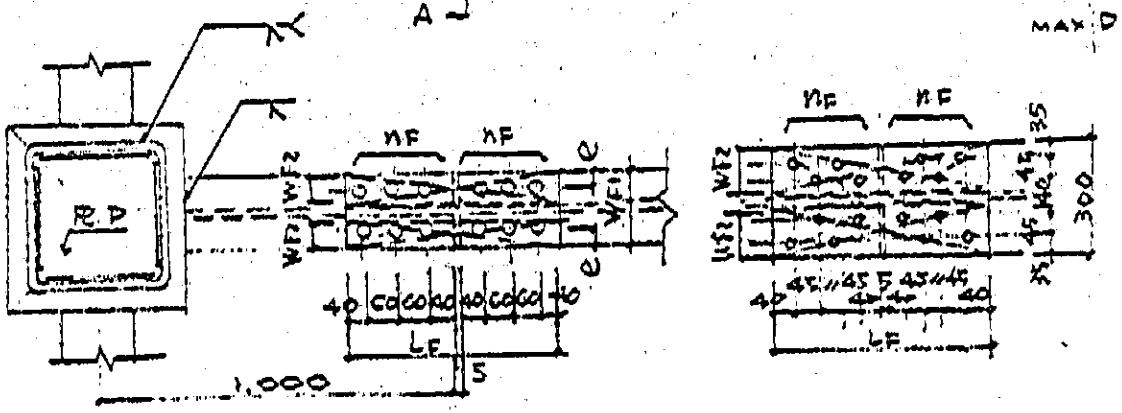
Design of Column

			Stress V	K	W1	W2	1.5V	V+K	V+W1	V+W2	max	Member	lK/lb	lK/lb	λK/λb	η	c	fc/fb	A/Z	B/t	Type	Note
A2	↑	N	12.4	1.1	-4.2	-2.1	18.6	13.5	8.2	10.3	18.6	D-350×350 ×9										
	↕	M U L	1.6	7.2	10.8	2.6	2.4	8.8	9.3	4.2	9.3		Cf. Chart									
		Q	0.2	1.0	2.7	1.7	0.3	1.2	2.5	1.9	2.5											
B1	←	N	22.1	1.5	-4.4		33.2	23.6	17.7		33.2	//								OK	C9	
		M U L	2.0	9.4	1.5	/	3.0	11.4	3.5	/	11.4											
		Q	0.3	1.3	0.2		0.5	1.6	0.5		1.6											
B2	←	N	24.8	0	-14.8		37.2	24.8	10.0		37.2	//										
		M U L	0	10.8	0	/	0	10.8	0	/	10.8											
		Q	0	1.5	0		0	1.5	0		1.5											
	↕	N	24.8	0.3	-7.6		37.2	27.1	17.2		37.2	//										
		M U L	0.3	7.9	8.5	/	0.5	8.2	8.8	/	8.8											
		Q	0.1	1.1	1.2		0.2	1.2	1.3		1.3											

STEEL BEAM SCHEDULE



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

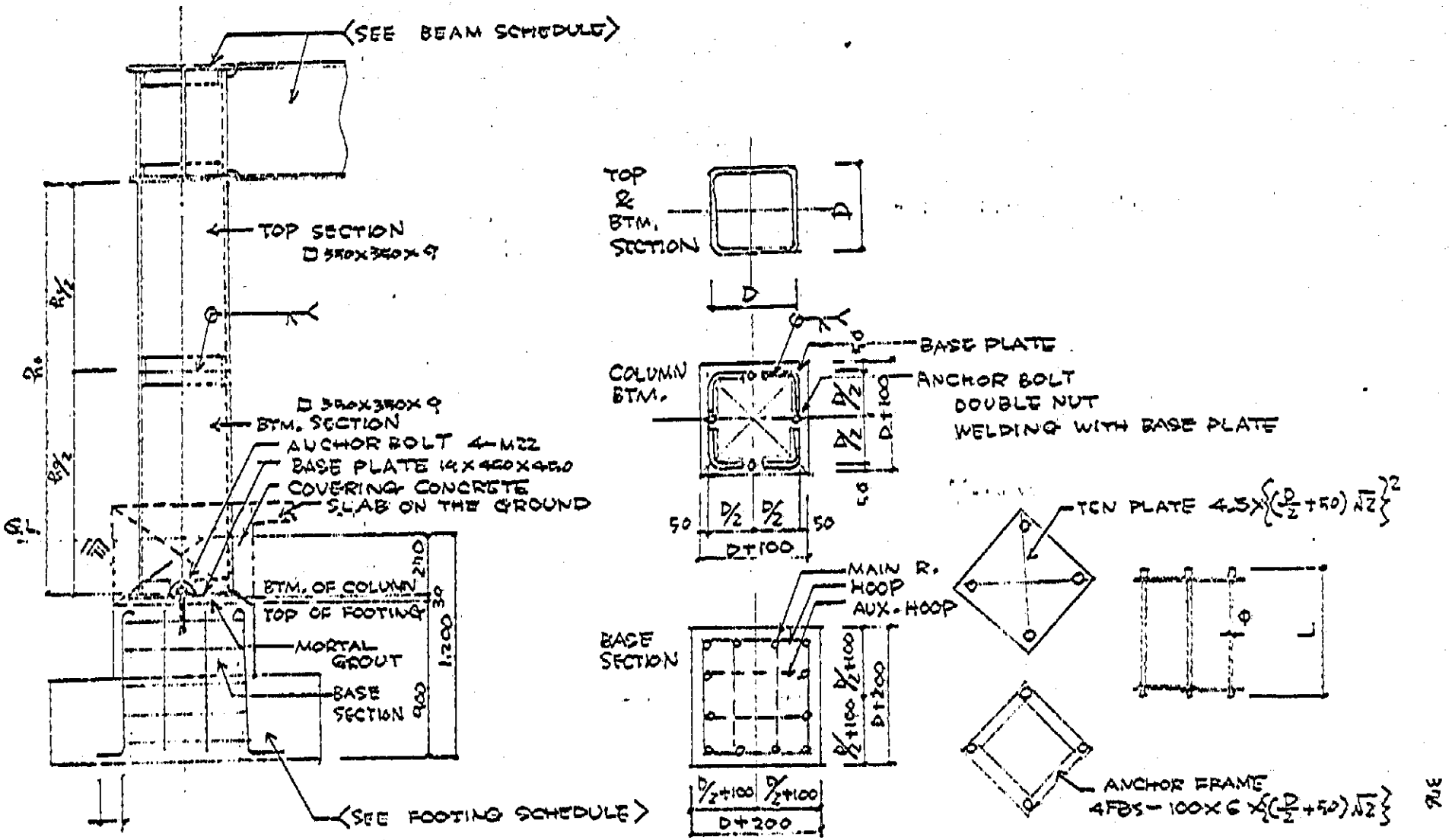


WF	e
150	30
175	30
200	35
250	45

$$t\alpha \geq \sqrt{3}\,\frac{tf}{\ell d}$$

MARK	MEMBER	RP	RB	RF1 $t_{F1} \times L_F \times W_{F1}$	RF2 $t_{F2} \times L_F \times W_{F2}$	n_F	RW $t_W \times L_W \times H_W$	n_W	NOTE
G9	H900×300×16×28	28							
G8	H800×300×14×26	28	16	19×300×615	22×107×615	2×6-M22	12×165×620	10-M22	
G7	H700×300×13×24	25	16	19×300×525	19×107×525	2×5-M22	9×165×560	9-M22	
G6	H588×300×12×20	22	16	16×300×435	16×107×435	2×4-M22	9×165×440	7-M22	
G6A	H600×200×11×17	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	H500×200×10×16	16	16	12×200×405	16×73×405	2×3-M22	9×165×380	6-M22	
G4	H390×300×10×16	16	16						
G4A	H400×200×8×13	16	16	9×200×285	12×73×285	2×2-M22	9×165×260	4-M22	

STEEL COLUMN SCHEDULE

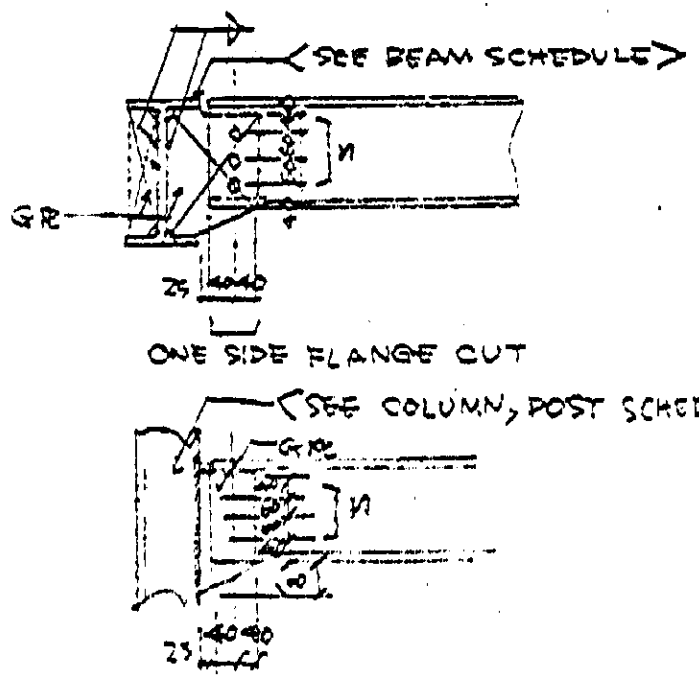


Design of Sub Beam

	h	ℓ	@	ω D.L.	ω W.L.	ω T.L.	δ	Mo	Q	In	Zn	Member	I	Z	fb	lb	λ	η	C	fc	σ/f	Type
	7.2	10.6	2.25	0.02	1.6×0.16	0.236	0.481 (S.L. 0.05)	6.76	2.55	10,656	28.65	H-350×175	13,600	778	520	4.58	116.7	8.33	4.75	4.29	0.47	B3A
	〃	〃	3.33	0.02	0.8×0.16	0.108	0.310	4.35	1.64	6,565	381.4	H-300×150	7,210	481	520	3.87	137.0	8.61	〃	4.15	0.52	B3
	3.19	10.0	1.90	0.51		0.51	1.019	12.73	5.10	31,591	776.1	H-450×200	33,500	1,490	500	5.18	96.9	8.32	〃	4.39	0.43	G4A
	〃	8.3						9.84	5.60	7,046	618.3	〃	〃	〃	1.59							〃

$P = \{0.53 \times 5.0 \times 8.3/2\}^2 + \{0.05 \times 5.6\}^2 + \{0.05 \times 2 \times 5 \times 5.8/3\}^2 = 5.6$ 23 PR³/648 E5 ≈ 23 × 5.6 × 530³/648 × 2,100 × 2 = 0.545 ≤

STEEL SUBBEAM SCHEDULE

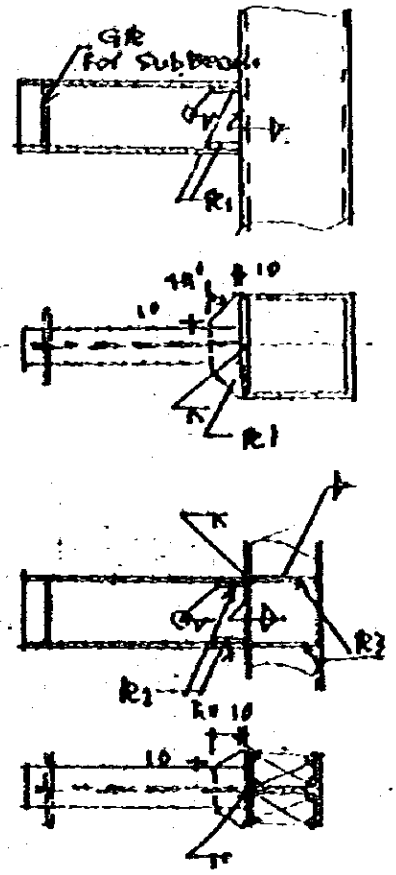


MARK	SECTION	GR	n	
B4B	H-350×300×10×16	12	5-M22	
B4A	H-450×200×9×14	〃	〃	
B4	H-400×300×12×13	〃	4-M22	
B3A	H-350×175×7×11	〃	〃	
B3	H-300×150×6.5×9	〃	3-M22	
B2A	H-250×125×6×9	9	〃	
B2	H-200×100×5.5×8	〃	2-M22	
B9	H-900×300×16×28	19	12-M22	
B6A	H-488×300×11×18	16	7-M22	
B6	H-600×200×11×17	〃	〃	
B5	H-500×200×10×16	12	6-M22	
B3=	H-300×300×12×19	12	2×3-M22	

Design of Cantilever

h	l	@	w D.L.	w W.L.	w T.L.	P (S.L. 0.05)	Mo	Θ	Jn	Zn	Member	J	Z	lb	ib	λb	η	C	fb	σ/f	Type
7.0	1.5	10.6	0.02 {0.235×7.28×10.6}+{0.05×12.1}	1.6×0.6	0.236	6.73	9.35	4.23	55,625	389.6	H-350×175	13,600	775	150	4.58	32.8	8.33	1.75	1.60	0.50	oG3A

SCHEDULE OF CANTILEVER



MARK	MEMBER	R1	R2	R3
CG4	H-400x200x8x13	R12	R12	R12
CG3A	H-350x175x7x11	"	"	"
CG3	H-300x150x6.5x9	R9	R9	R9
CG2	H-250x125x6.5x8	"	"	"

DESIGN OF POST

BTM	TOP	h	θ	D.L. w	D.L. q	N	W.L. w	W.L. q	Mo	Q	Jn	Zy	Member	J	lk / lb	ik / ib	λk / λb	M / C	fc / fb	A / Z	σ/f	Type
0.3	7.2	6.9	10.0/3	0.02	0.07 (S.L. 0.06)	0.48	0.8×0.12	0.32	1.90	1.10	1955.4	79.4	H-300×150	7.210	690	3.29	210	4.61	0.22	46.8		P3
															〃	3.80	178	1.00	0.60	481	0.47	
0.3	7.2	6.9				10.1			0.83 (t·m)		604.3	34.0	D-200²×8	3.620	390	7.78	50.1		1.38	59.8		F20A
																				362		

0.8×0.12×5.3/2×3.9/2 = 0.49

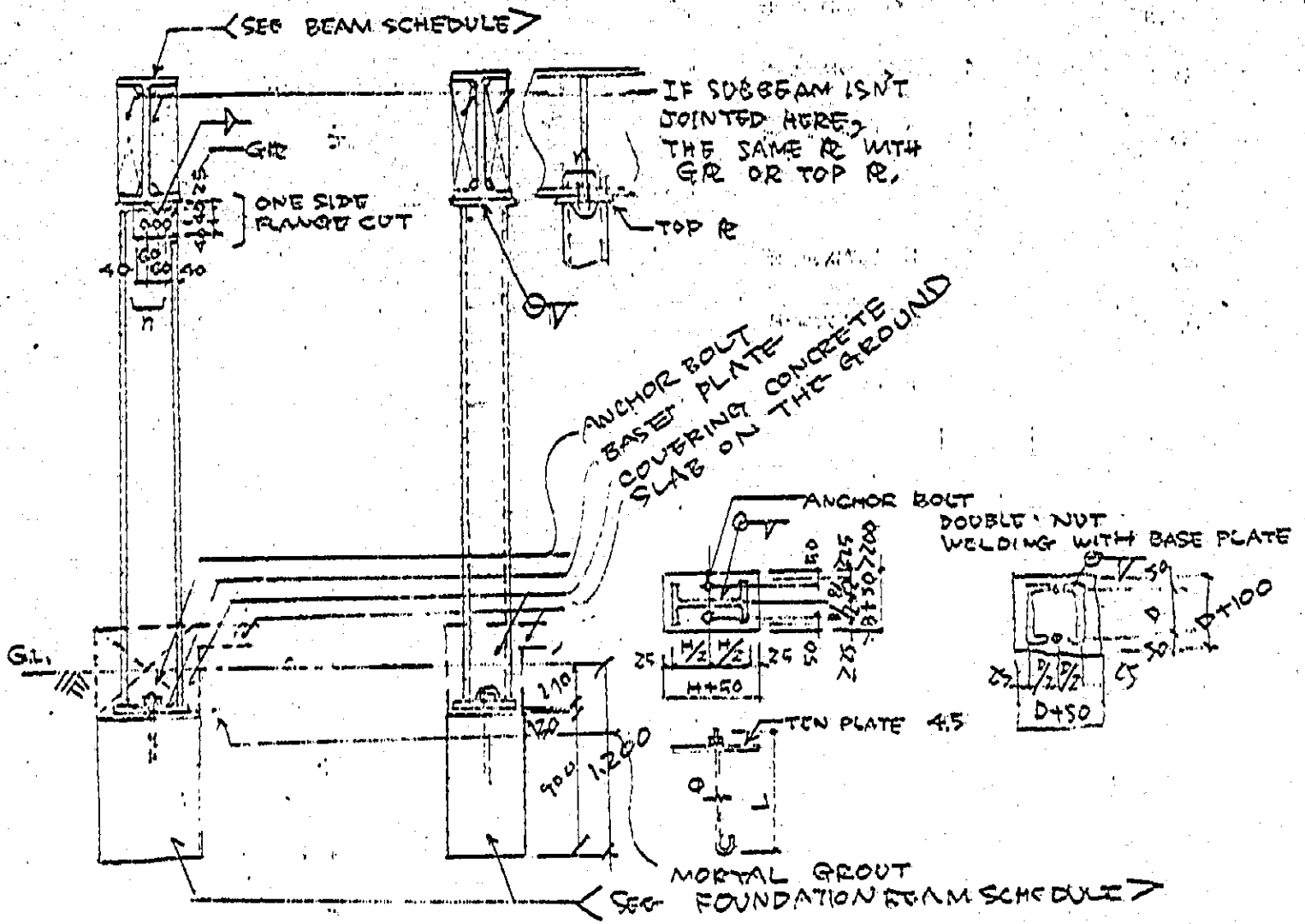
QU 0.49×3.0/6.9 = 0.21

QL 3.9/6.9 = 0.28

Mo 0.38×[illegible] = 0.83

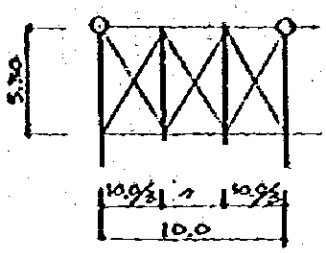
$\frac{0.49 \times 200^3 \times 3.00}{48 \times 2{,}100} = 604.3$

STEEL POST SCHEDULE



MARK	SECTION	GPL	M	BASE PLATE	ANCHOR BOLT Φ×L	NOTE
P1	H-400×100×6×8	PL 9	2-M22	PL 16×190×200	2-M20×900	
P2	H-200×100×5.5×8	DO	〃	PL 〃×250×200	2-M 〃 × 〃	
P2A	H-250×125×6.5×9	DO	3-M22	PL 〃×300×200	2-M 〃 × 〃	
P3	H-300×150×6.5×9	DO	〃	PL 〃×350×200	2-M 〃 × 〃	
P3A	H-350×175×7×11	PL 12	4-M22	PL 〃×400×225	2-M 〃 × 〃	
P4	H-400×200×8×13	DO	〃	PL 〃×450×250	2-M 〃 × 〃	
P4A	H-450×200×9×14	DO	4-M22	PL 〃×500×250	2-M 〃 × 〃	
P25	H-250×250×9×14	PL 9	2×2-M22	PL 19×300×300	〃	
P20A	□-200×200×8	TOP PL 16×300×300	〃	PL 16×250×300	〃	
P25A	□-250×250×8	〃 16×300×350	〃	PL 17×300×350	〃	

Design of Bracing



f_1 6.90

@ 3.33

$C_q A$ $0.8 \times 0.12 \times 3.33 = 0.32$

Q $0.32 \times 6.9/2 = 1.10$

D $1.10 \times 6.26/5.30 = 1.30 \sim \times 1 = 1.30$, $A_H = 130/2.4 = 0.5$

$$J_H = \frac{13 \times 0.0002 \times 626^3 \times 300}{384 \times 2{,}100} = 234.3$$

$$Z_H = \frac{3 \times 0.02 \times 6.26^2 \times 100}{8 \times 2.4} = 12.2$$

L - 130x130x9

A 22.7, J 366.0, Z 38.7

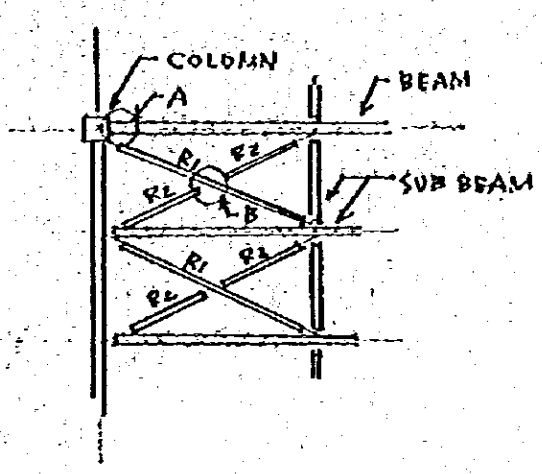
$$J_H' = \frac{5 \times 0.0002 \times 313^3 \times 300}{384 \times 2{,}100} = 11.4$$

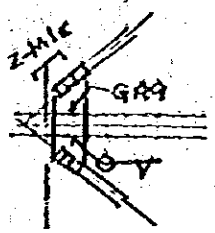
$$Z_H' = \frac{0.02 \times 3.13^2 \times 100}{8 \times 2.4} = 1.6$$

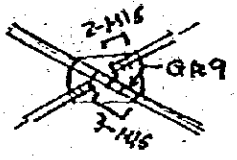
L - ∩∩x∩∩x6

A 8.7, J 46.1, Z 8.5

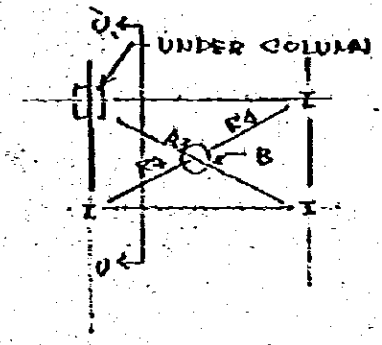
BRACING SCHEDULE

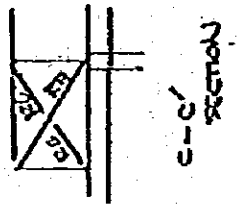






MONITOR ROOF





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	185 ~ 188	〃	243 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

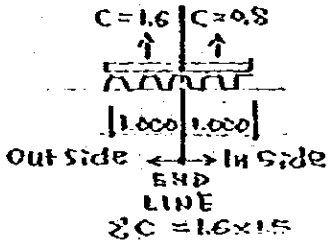
Continuous Beam Type

$$\frac{M}{Z} = \frac{\omega l^2}{8Z} \le f \quad \sim \quad l_2 \le \sqrt{\frac{8Zf}{\omega}}$$

$$\frac{5}{384}\frac{\omega l^4}{EI} \le \frac{l}{300} \quad \sim \quad l_1 \ge \sqrt[3]{\frac{384 \times 2{,}100\, I}{300 \times 5\, \omega}}$$

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

ω	Net ω	l_2	l_1	l_{min}
1.5 × 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
× 0.243	0.00353	441.1	455.3	441.1



$$l_2 \le \sqrt{\frac{8 \times 61.33 \times 1.4}{\omega}} = \sqrt{\frac{686.896}{\omega}}$$

$$l_1 \le \sqrt[3]{\frac{384 \times 2{,}100 \times 619.94}{300 \times 5 \times \omega}} = \sqrt[3]{\frac{333{,}279.744}{\omega}}$$

Allowable Span [cm]

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

Cantilever Type

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

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

ω	Net ω	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
0.253	0.00240	231.7	235.2	231.7

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

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

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 ⟶ Size up to 1.0 M/M

Design of Mezzanine Floor

$w = 0.01 \ [t/m^2]$

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

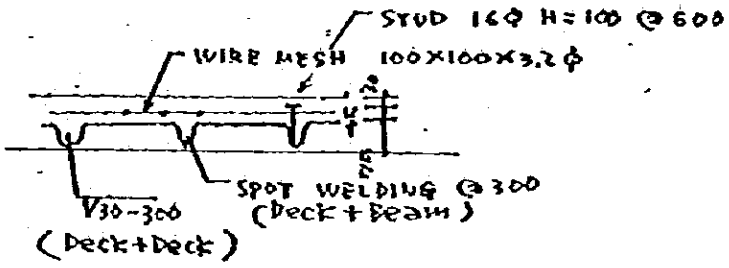
$$\frac{wl^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{w}}$$

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

$$\frac{5\,wl^4}{384\,EJ} < \frac{l}{350} \sim l > \sqrt[3]{\frac{384\,EJ}{1500\,w}}$$

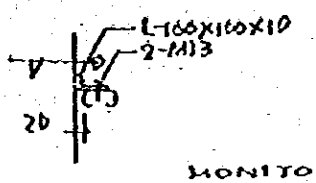
$$= \sqrt[3]{\frac{384 \times 2{,}100 \times 136}{1{,}500 \times 0.0051}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Outside Wall



MONITOR ROOF　C-120×60×20-4.5　@≒900
GENERAL　C-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 ～ 3.58	〃	〃	180 ～ 120

CASE-1. (H.R.F. MONITOR ROOF)

D.L. 0.05×0.9. = 0.045 [t/m]
W.L. 0.22×0.8×0.9 = 0.158 [〃]
span 3.68 [m]

C-100×50×20-2.3

$$\frac{\delta}{f} = \frac{368^2 \times 100}{8 \times 1.4}\left(\frac{0.045}{6.06} + \frac{0.158}{16.1}\right)$$

$$= 2.08 < 2.10$$

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

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

C-100×50×20-3.2

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{24.8}\right)^2 + \left(\frac{0.00158}{101}\right)^2}$$

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

C-100×50×20-4.5

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

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

C-120×60×20-4.5

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

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

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

$C = 100 \times 80 \times 20 - 3.2$

$$\delta = \frac{5 \times 360^4}{384 \times 2{,}100} \sqrt{\left(\frac{0.00045}{24.5}\right)^2 + \left(\frac{0.00158}{60}\right)^2}$$

$= 2.45$ [cm]

$C = 100 \times 50 \times 20 - 4.5$

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

$= 1.92$ [cm]

$C = 120 \times 60 \times 25 - 4.5$

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

$= 1.03$ [cm]

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

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 3.85 m

$C = 100 \times 80 \times 20 - 2.3$

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

$= 1.51$ [cm]

$C = 100 \times 50 \times 20 - 3.2$

$$\delta = \sqrt{\left(\frac{\quad}{24.5}\right)^2 + \left(\frac{\quad}{101}\right)^2}$$

$= 1.17$ [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. $0.14 \times 0.8 \times 0.17 = 0.018$ ["]
Span 3.85 m

$C = 100 \times 50 \times 20 - 2.3$

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00014}{19.5}\right)^2 + \left(\frac{0.00018}{80.7}\right)^2}$$

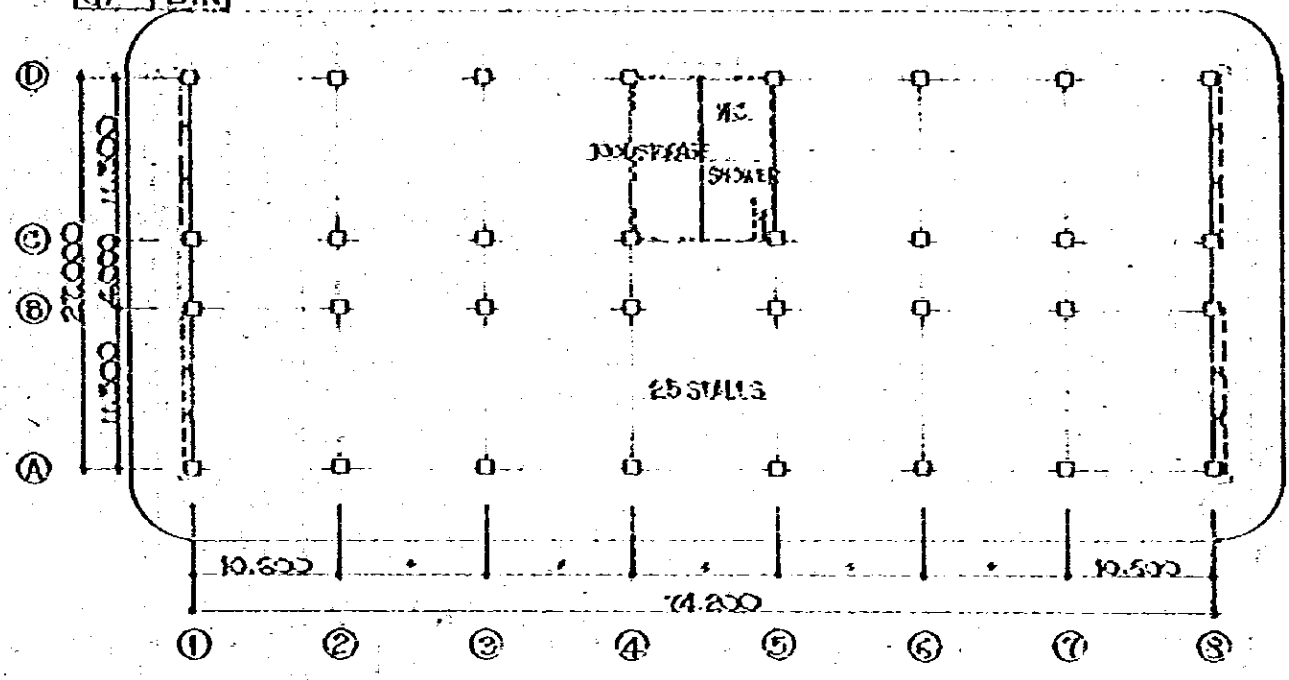
$= 0.69$ [cm]

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

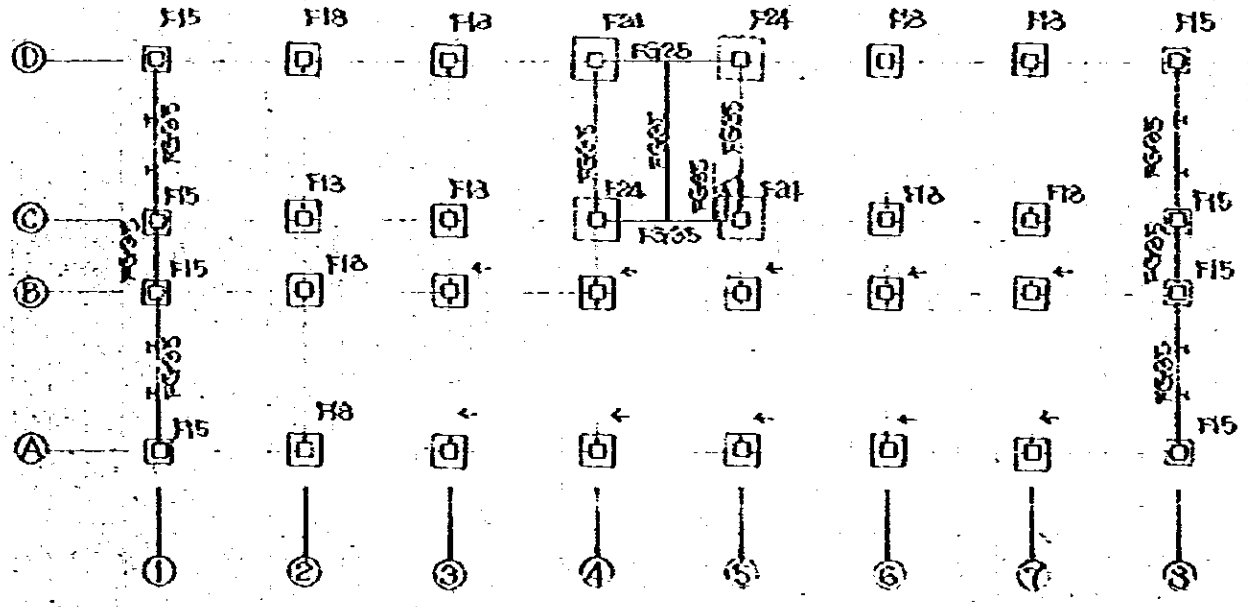
13 検　　査　　場

PERIODICAL REPAIR FACTORY

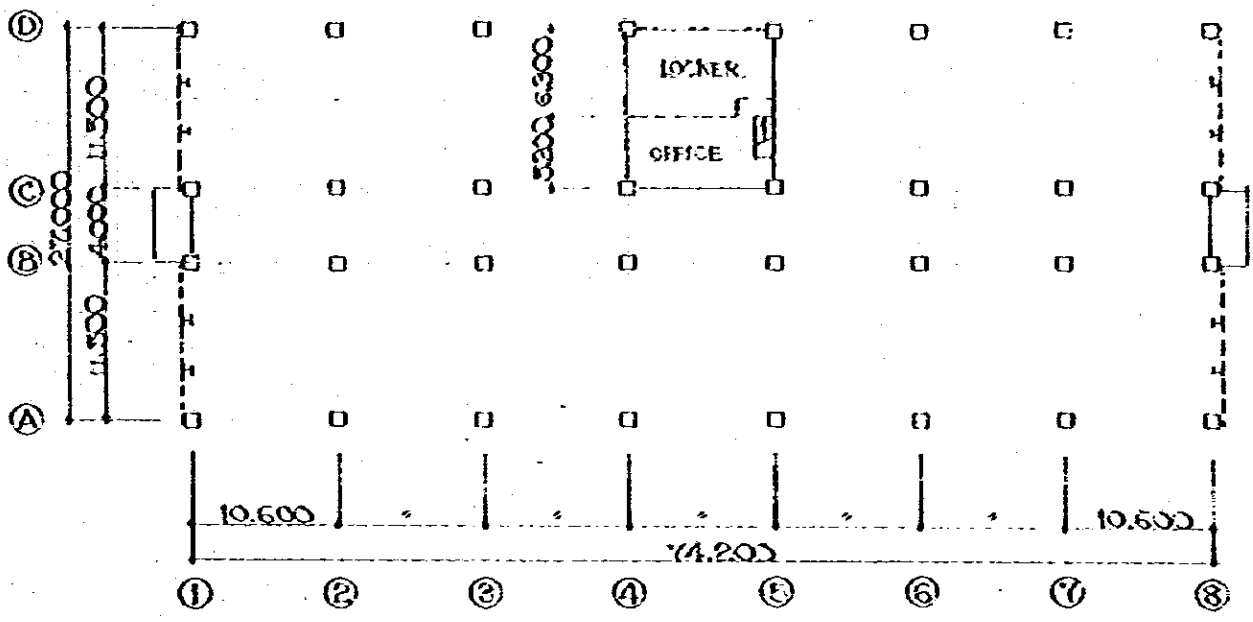
GF PLAN



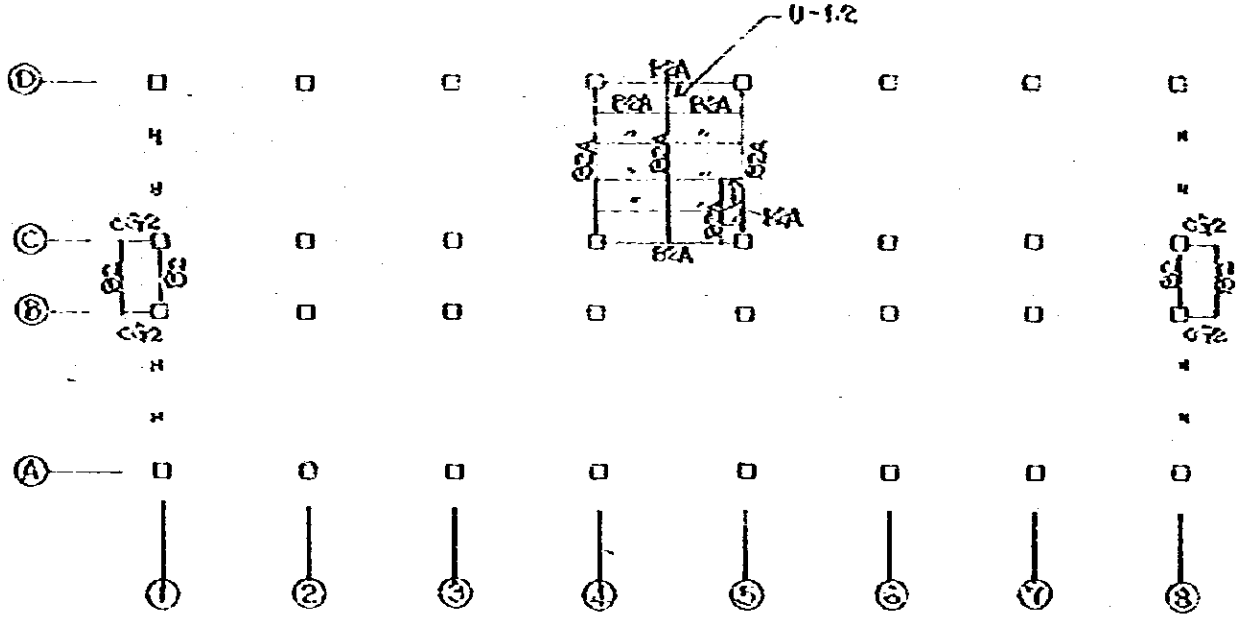
GF KEY PLAN



1F PLAN

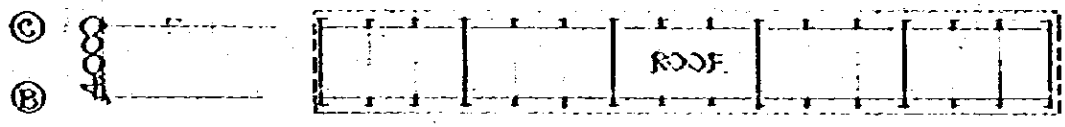


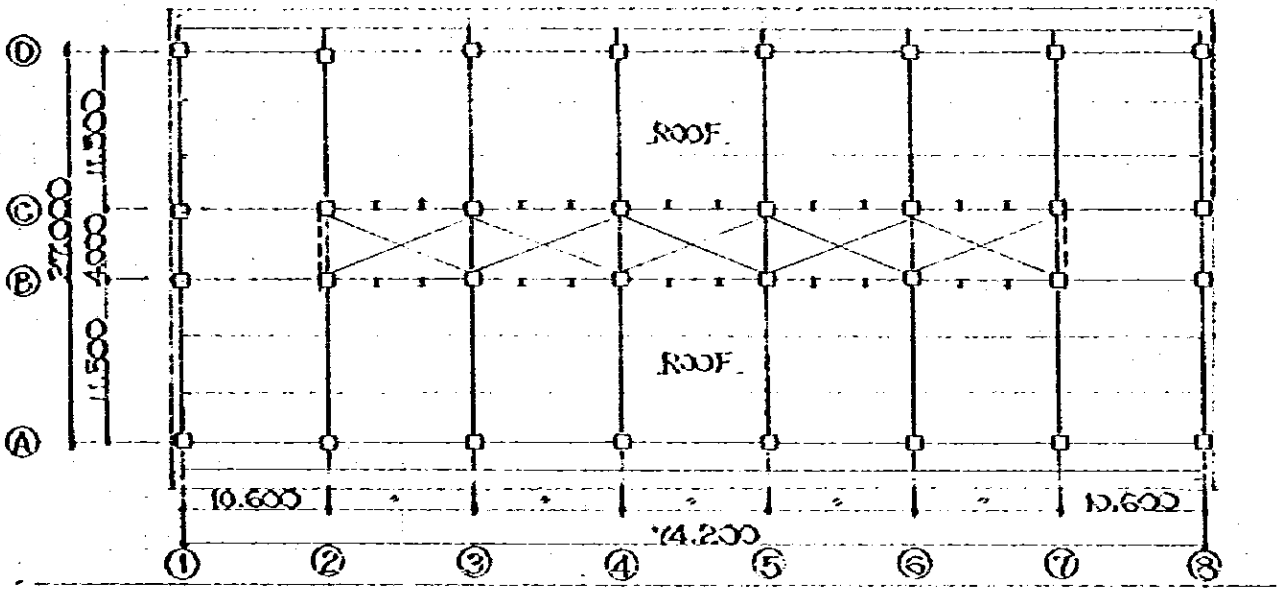
1F KEY PLAN



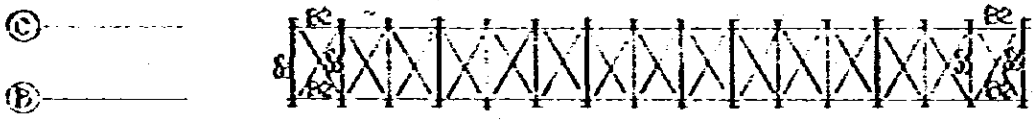
□ : C12
H : P3

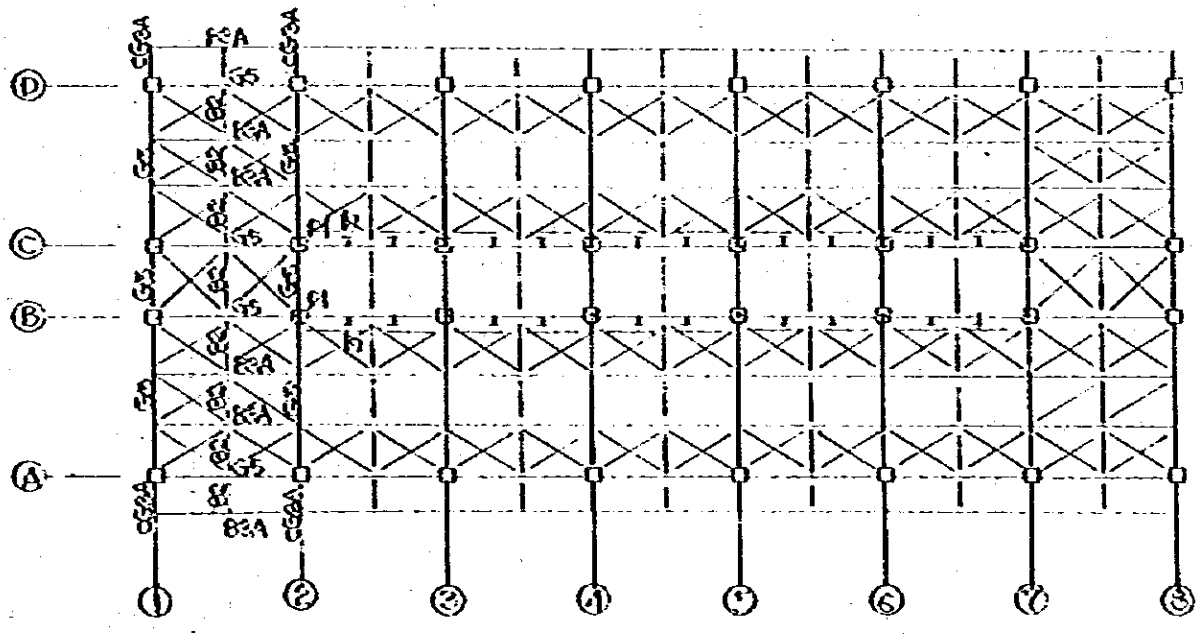
RF PLAN



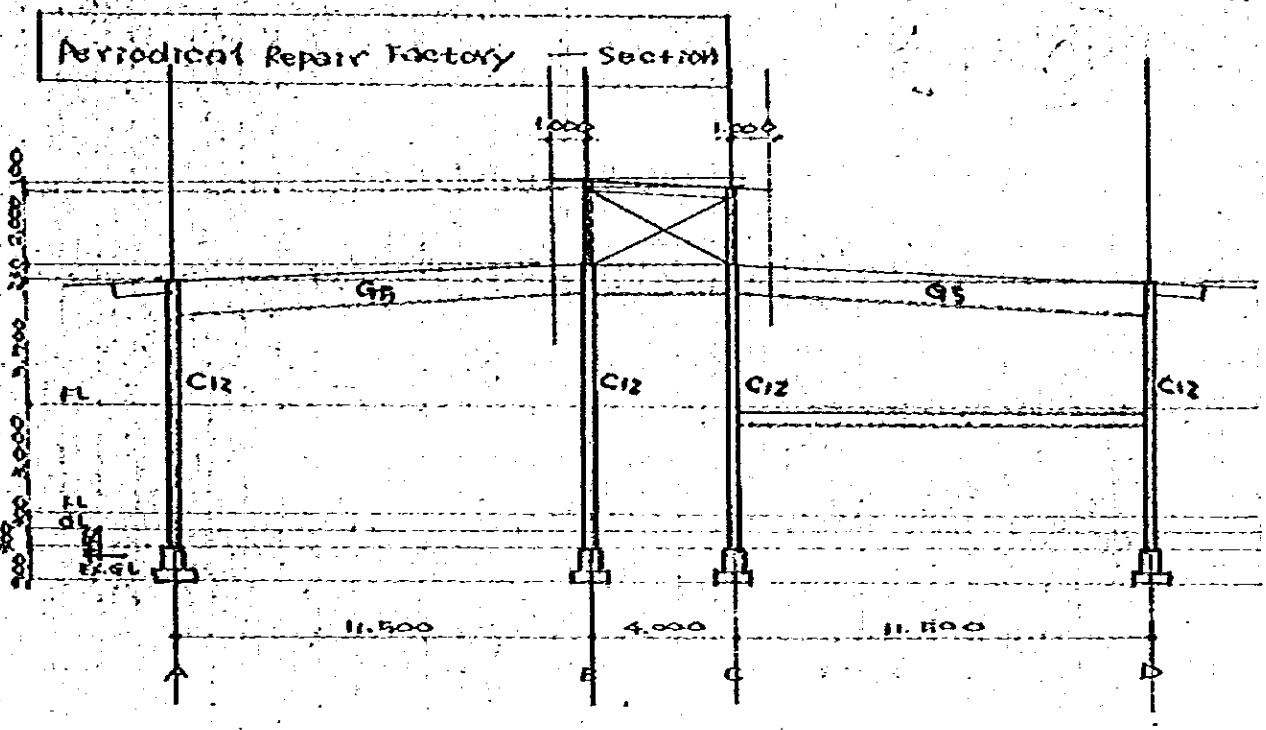


RF KEY PLAN

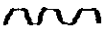




Periodical Repair Factory — Section



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)			
Office Locker		Finish	0.13	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 0.18
Stair case		Step	0.06	S,B	0.30	0.43
		String	0.04	G,C,F	0.13	0.28
				K	0.13	0.18
			0.10			

Beam

	t/m			t/each						
	Steleton	Finish	Σ	ℓ						
Beam G9	0.25	0	0.25							
$\overline{G9}$	0.15	0	0.15							
Subbeam	0.05	0	0.05							
Foundation Beam	1.26	0	1.26							

Column

	t/m			t/each						
	Steleton	Finish	Σ							
Column □400	0.20	0	0.25							
□350	0.15	0	0.15							
Post	0.05	0	0.05							

Wall

	t/m2			t/m						
	Steleton	Finish	Σ							
Siding	0.01	0.01	0.02							
Partition	0.01	0.07	0.08							
Sash	0.01	0.04	0.05							
Brick ‖ 254	0.49	0.11	0.60							

Wind Pressure

Velosity of Wind

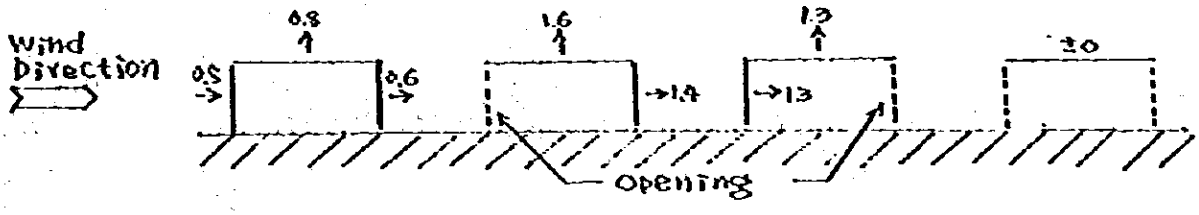
Cyclone 130 Miles/Hour = 130 × 1609.34/3,600
= 58.1 m/sec
→ 60.0 m/sec (h = 10 m)

(In 1940, At Chicagon, 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]	c_q [kg/m²]
Heavy Repair Factory	Monitor Roof	Roof Wall	12.7	214	270	
		Roof Wall	10.5, 6.9	194, 158	200, 150 140, 120	
Parts Storage	Monitor Roof	Roof Wall	8.14 – 9.29	134 – 153	180	
		Roof Wall	7.36 – 9.00	163	160 120	
Inspection Factory	Monitor Roof	Roof Wall				
		Roof Wall	7.20 – 7.60	161	160 120	
Periodical Repair Factory	Monitor Roof	Roof Wall	8.33 – 9.23	183	180	
		Roof Wall	7.23 – 7.80	161	160 120	
Paint & Body Factory	Monitor Roof	Roof Wall	8.41 – 9.31	184	180	
		Roof Wall	7.31 – 7.80	162	160 120	
Retreading & Metal Casting Factory	Monitor Roof	Roof Wall	8.43 – 9.32	184	180	
		Roof Wall	7.39 – 7.83	162	160 120	

Coefficient of Wind Pressure



Pe

Axial Force

		D1		D2		D4		1W	
$M R_F$	S								
	G,B								
	C								
	W								
	Σ								
	W.L.								
	Σ'								
R_F	S	0.09 × 55.1	5.0	× 92.8	8.4	× 92.8	8.4		
	G,B	0.15 × 11.1	1.7	× 16.4	2.5	× 16.4	2.5		
	C	0.05 × 12.1	0.6	× 21.2	1.1	× 21.2	1.1		
	W	0.18 × 6.7	1.0	× 6.7	1.0	× 3.7	0.6		
		0.02 × 10.3	0.2	× 0		× 0			
		0.08 × 0		× 0		× 0			
		0.05 × 0		× 0		× 0			
		0.60 × 2.9	1.7	× 0		× 0			
	Σ		10.2		13.0		12.6		
	W.L.		0		0		0		
	Σ'		10.2		13.0		12.6		
1_F	S					2.43 × 30.5	13.1		
	G,B					0.05 × 19.0	1.0		
	C					0.15 × 3.0	0.5		
	W					0.02 × 0		× 5.4	0.1
						0.08 × 0			
						0.05 × 0		× 1.4	0.8
						0.60 × 0			
	Σ'					29.2	14.6	[1/2] 0.9	0.9
	W.L.						0		0
	Σ'					29.2	14.6	0.9	0.9

		C1		C2		C4		4W	
$M R_F$	S			0.09 × 17.4	1.6	× 31.8	2.9		
	G,B			0.05 × 9.3	0.5	× 16.6	0.8		
	C			0.05 × 4.0	0.2	× 6.0	0.3		
	W			0.02 × 0		× 0			
				0.08 × 4.0	0.3	× 0			
				0.04 × 10.6	0.5	× 21.2	1.1		
				0.60 × 0		× 0			
	Σ				3.1		5.1		
	W.L.			-0.25 × 5.8	-1.5	× 10.6	-2.7		
	Σ'				1.6		2.4		
R_F	S	0.09 × 52.8	4.8	× 71.6	6.4	× 61.0	5.5		
	G,B	0.15 × 13.1	2.0	× 18.4	2.8	× 18.4	2.8		
	C	0.05 × 8.8	0.4	× 10.6	0.5	× 10.6	0.5		
	W	0.15 × 6.9	1.0	× 6.9	1.0	× 3.9	0.6		
		0.02 × 10.3	0.2	× 0		× 19.6	0.4		
		0.08 × 0		× 0		× 31.1	1.0		
		0.05 × 0		× 0		× 0			
		0.60 × 2.9	1.7	× 0		× 0			
	Σ		10.1		13.8		15.9		
0.15 × 0.8 + 0.04 = 1.20	W.L.	0.20 × 4.0	-0.8		0		0		
	Σ'		9.3		12.3		13.2		
1_F	S					0.43 × 30.5	13.1		
	G,B					0.05 × 19.0	1.0		
	C					0.15 × 3.0	0.5		
	W					0.02 × 0			
						0.08 × 0			
						0.05 × 0		× 2.6	1.6
						0.60 × 0			
	Σ					30.5	14.6	[1/2] 1.6	1.6
	W.L.						0		0
	Σ'					29.8	14.6	1.6	1.6

Pc

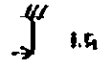
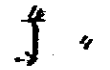
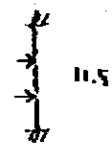
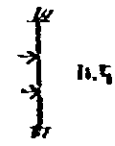
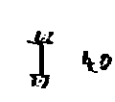
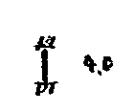
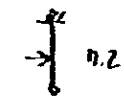
C M, Q

[tx , t]

	Load			C		Mo		Q
↳ RG	10.6	(0.03×3.95)+0.18	b	0.505 × 10.6²/12	4.7	× 1/8	7.1	× 10.6/2	2.7
T.L.					4.7		7.1		2.7
//	10.6	(0.8×0.15 − 0.07) ×3.95	b	0.782 × 10.6²/12	-7.3	× 1/8	-11.0	× 10.6/2	-4.1
W.L.					-7.3		-11.0		-4.1
↳ C	9.2	6.11 × 1/4	P	1.7 × 9.3/8	1.6	× 1/4	3.1	× 1/2	0.9
K.L.				(1.6 × 1.5 | 2.4) 1.6		3.1		0.9
//	9.2	(0.8−0.6 × 0.12) ×3.95		0.384 × 9.3²/12 0.284	1.6 ≈ 1.2	× 1/8	2.5 ≈ 1.8	× 9.3/2	1.4 ≈ 1.0
W.L.				(1.6 × 1.5 | 2.4) 1.8 1.6 ≈ 1.2		2.5 ≈ 1.8		1.4 ≈ 1.0

Pc

[tm, t]

	Load			C		Mo		Q	
↓ RCG	 1.5	0.83 × 23.9 0.05 × 12.1	P	2.96 × 1.5	4.1			× 1.6	2.8
T.L.					4.1				2.8
〃	 〃	(-.26×0.16-0.07) × 23.9	P	-2.79 × 1.5	-11.7			× 1.6	-7.8
W.L.					-11.7				-7.8
↓ RG	 11.5	(0.83 × 40.3) (0.05 × 10.6)	P q	4.16 × 11.5/4.5 0.15 × 11.5²/12	10.6 1.7	× 11.5/3 /8	15.9 2.5	× 1.0 × 11.5/2	4.2 0.9
T.L.					12.3		18.4		5.1
〃	 11.5	(-0.8×0.16-0.07) × 40.3	P	-8.00 × 11.5/4.5	-20.4	× 11.5/3	-30.7	× 1.0	-8.0
W.L.					-20.4		-30.7		-8.0
↓ RG	 4.0	0.09 × 6.3 0.03 × 0.15	q	0.71 × 4.0²/12	0.9	× /8	1.4	× 4.0/2	1.4
T.L.					0.9		1.4		1.4
〃	 4.0	(-0.8×0.16-0.07) × 6.3	q	-1.08 × 4.0²/12	-1.4	× /8	-2.1	× 4.0/2	-2.1
W.L.					-1.9		-2.1		-2.1
↓ C	 11.2	0.31 × 1/4	P	1.7 × 11.3/8 (1.6 × 1.5	1.6 2.4)	× 1/4	3.1	× 1/2	0.9
T.L.					1.6		3.1		0.9
〃	 11.2	≒ 0							
W.L.					0		0		0

Seismic Force

			W	K	kw	Q
MRF	S	0.05×53.5×6.0	16.1			
	B	0.05×{(13.6×2)+(4.0×16)}	8.5			
	P	0.05×2.1×32	3.4			
	W	(0.18×3.5×2.1)+(0.15×109.0×2.1)	12.8			
	Σ	$\bar{w}$ = 40.8/(53.5×6.0) = 0.13 [t/m²]	40.8	0.10	4.1	5.0
RF	S	0.05×{(15.2×33.0)-(13.0×4.0)}	113.1			
	G	0.15×{(9.2×4)+(20.0×8)}	26.9			
	B	0.05×{(9.2×6)+(4.5×16)+(27.0×11)}	32.9			
	C	0.15×6.9×32/2	16.6			
	P	0.05×6.9×8/2	1.4			
	W	(0.82×5.5×3.45)	3.8			
	Σ	$\bar{w}$ = 246.1/(15.2×33.0) = 0.10 [t/m²]	246.7	〃	24.7	39.0
IF	S	0.29×11.1×12.0	38.6		↓ 1/2	35.0
	B	0.05×{(10.6×3)+(11.5×6)}	5.0			
	W	0.08×(41.0+26.0)×4.1	22.6			
	Σ	$\bar{w}$ =	66.2	〃	6.7	

Wind Force

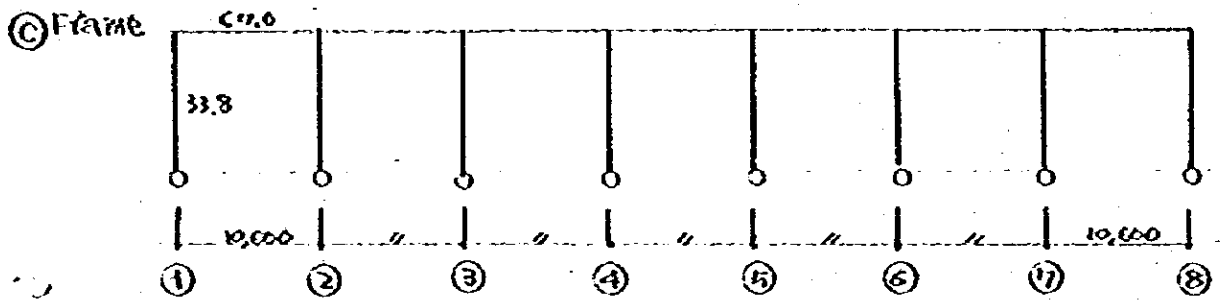
		C	q		A	H	Q	
↳	MRF	0.8+0.6	0.18	4.9×2.1	9.5	2.4	3.0	
	RF	〃	0.12	27.5×3.5	96.3	16.2	20.0	< K.L.
	IF	〃	〃					
↳	MRF	0.8+0.6	0.18	53.5×2.1	112.4	28.3	29.0	
	RF	〃	0.12	11.1×3.5	38.9	6.5	36.0	≒ K.L.
	IF	〃	〃	↓				

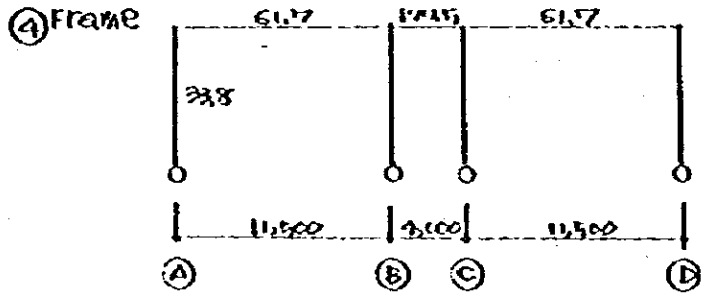
Pe

Stiffness Ratio

	J	I/Ib	1000	1150	400		645	
H-488x300x11x18	71,000		67.0	61.7	107.5			
H-350x12 ~ 9	29,100 ~23,500						45.1 (x0.75=33.8)	

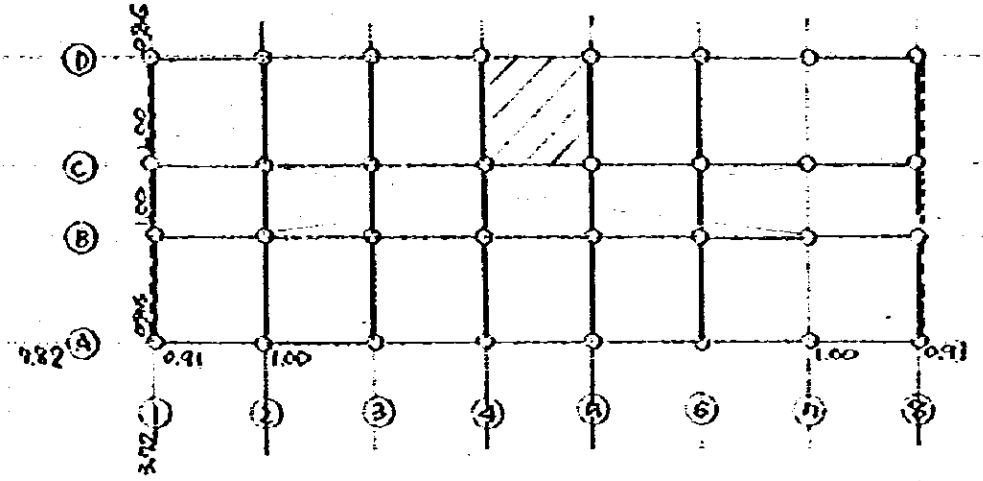
$$Je = \mu J_{max} = 0.20 + 0.80\sqrt[3]{\left(\frac{23,500}{29,100}\right)^2} J_{max} = 1.00\, J_{max}$$





Distribution Factor & Inflection Point

	D						Y				h	K.L.			W.L.		
	kc	ΣKb	K̄	a	D	D'	Y_0	Y_1	$Y_{2,3}$	ΣY		Q	MU	ML	Q	MU	ML
⟷	33.8	69.0	2.42	0.21	5.94	0.91	0			0	GAS	1.2	3.6	0	0.6	4.Y	0
	〃	139.0	4.84	0.23	6.28	1.00	0			0	〃	1.3	9.5	0	0.Y	5.1	0
1	33.8	61.17	2.28	0.20	5.66	0.86	0			0	〃	1.5	11.3	0	2.2	16.3	0
	〃	239.2	8.64	0.24	6.45	1.00	0			0	〃	1.8	13.1	0	2.6	19.0	0



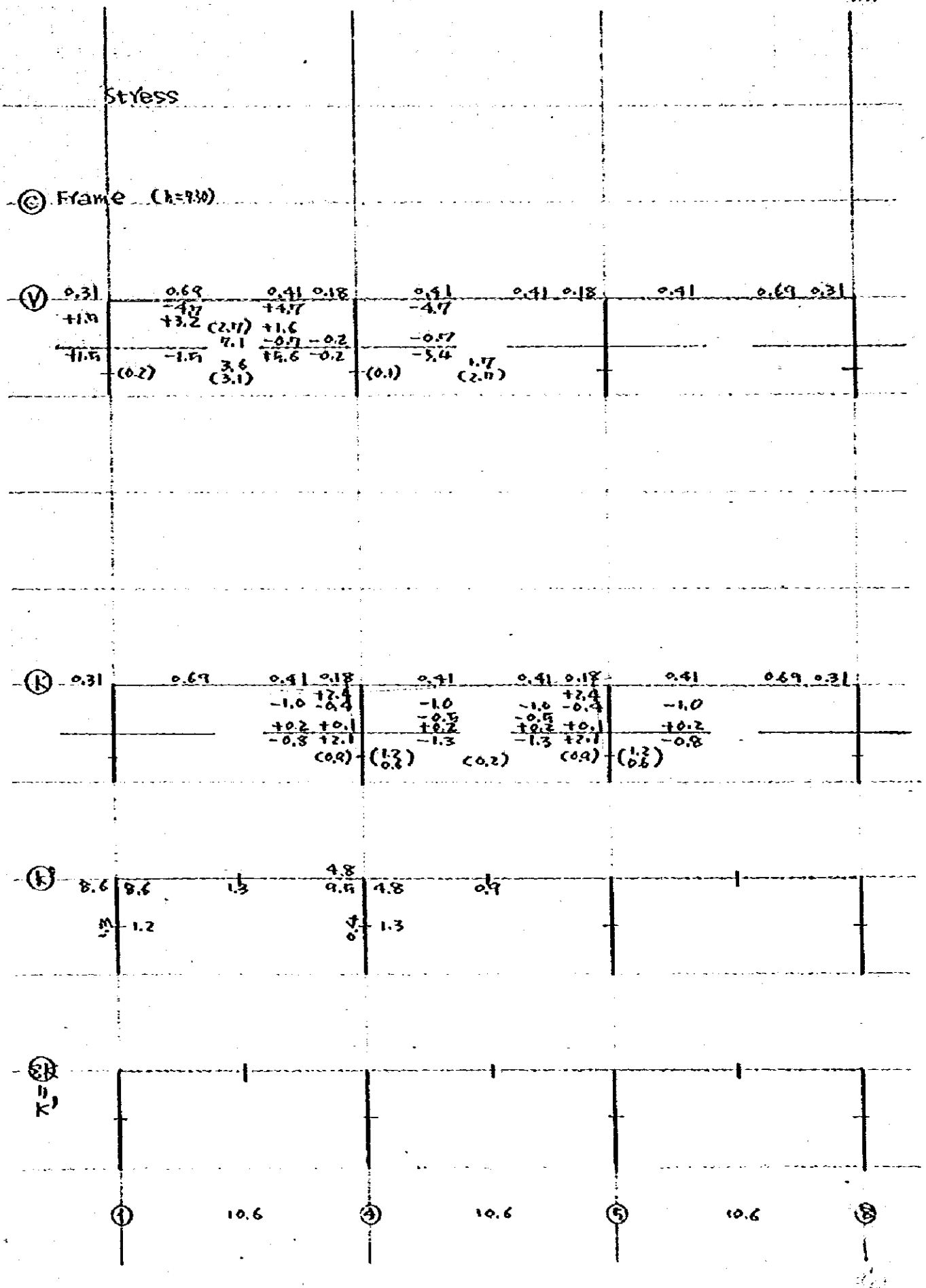
Unit Stress

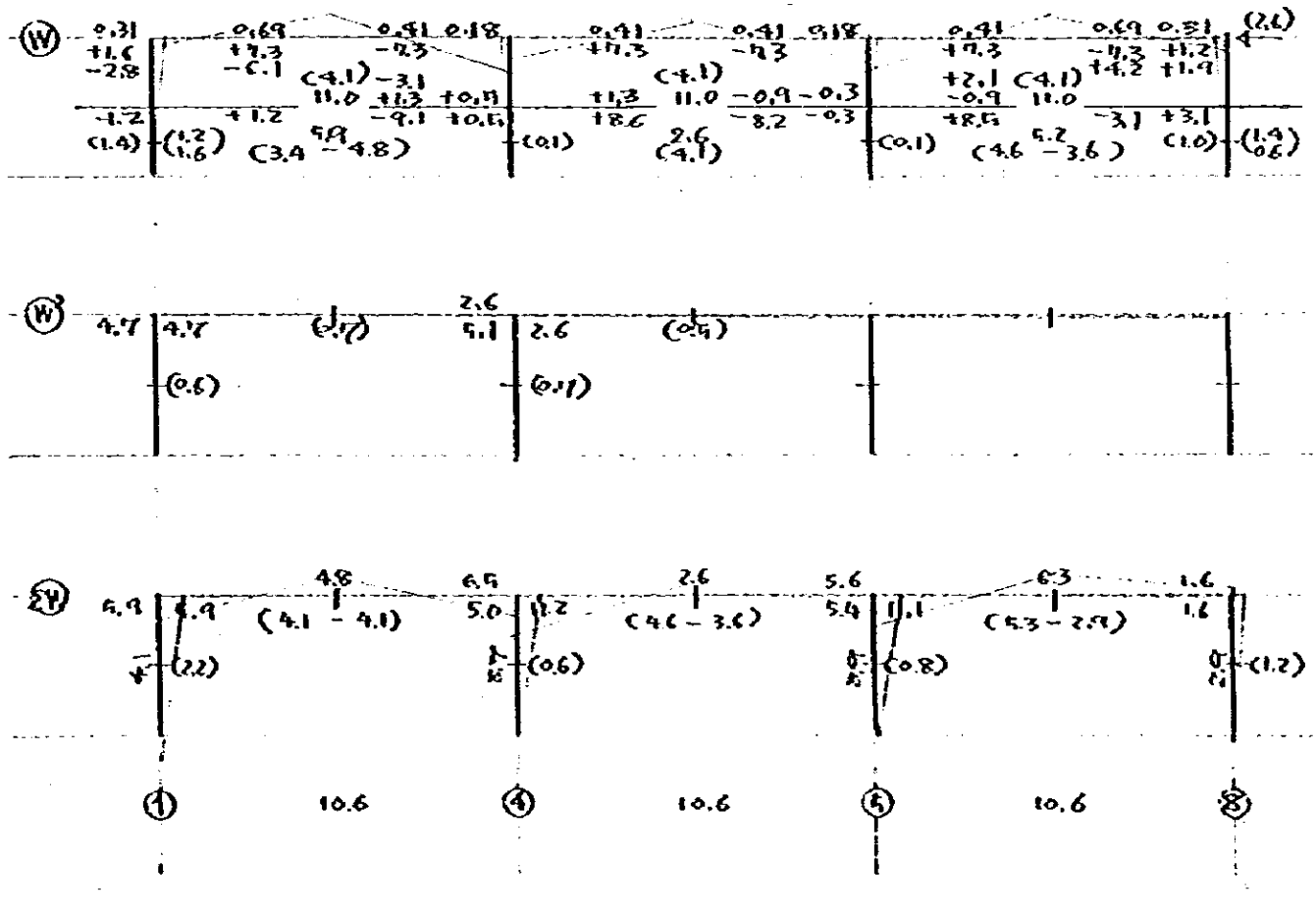
Case / Dir.	K.L. Total			K.L. ⓒ/④ Frame			W.L. Total			W.L. ⓒ/④ Frame		
	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD
⟷	35.0	31.28	1.2	9.5	7.82	1.3	20.0	31.28	0.Y	5.0	7.82	0.Y
1	〃	29.76	1.2	6.5	3.72	1.8	36.0	29.76	1.3 *	9.5	3.72	2.6

Deflection by Horizontal Force

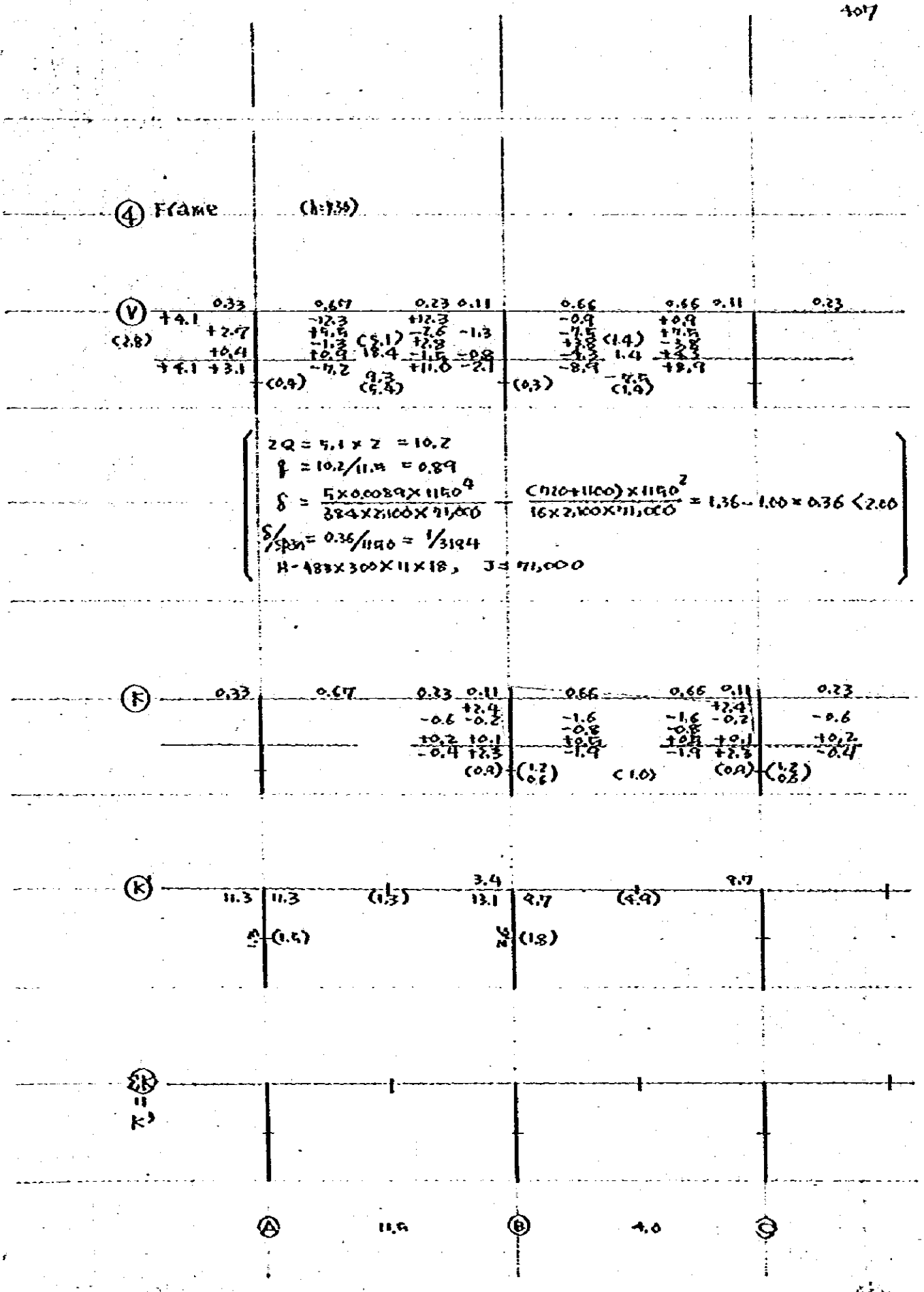
			Q	ΣD D_0	$h_0^2/12EK_0$	δ	δ/h_0	
⟷	K.L.	Σ	35.0	31.28×6.28	645²/12×2,00	2.94	1/219	
	W.L.		20.0	〃		1.68	1/384	
1	K.L.		35.0	29.76×6.45		2.86	1/218	
	W.L.		36.0			3.05	1/218	

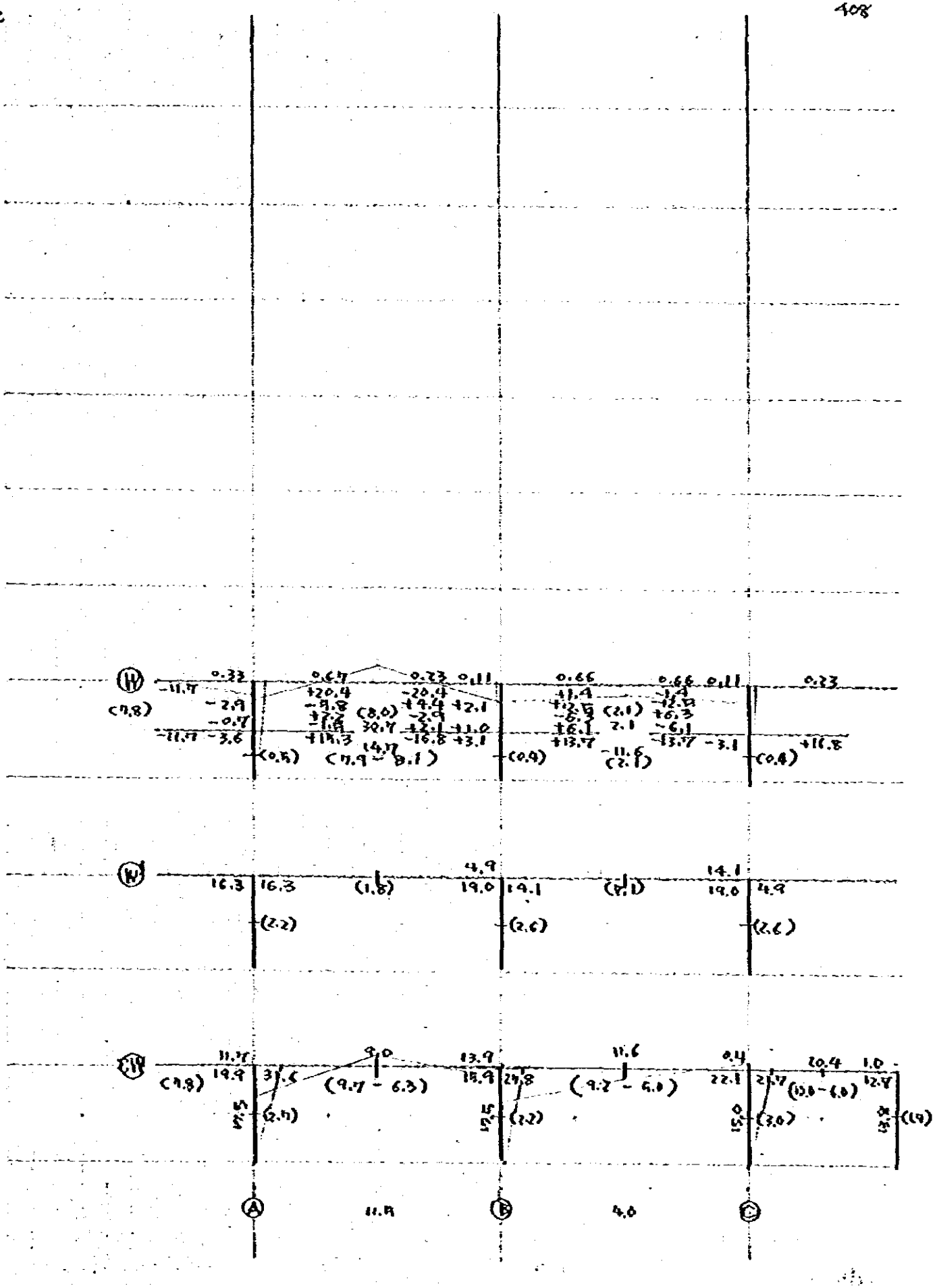
Stress


© Frame (h=930)
Ⓥ
0.31 0.69 0.41 0.18 0.41 0.41 0.18 0.41 0.69 0.31
Ⓚ
0.31 0.69 0.41 0.18 0.41 0.41 0.18 0.41 0.69 0.31
Ⓜ
8.6 8.6 1.3 4.8 9.6 4.8 0.9
1.2
1.3
Ⓝ
(N)
① 10.6 ④ 10.6 ⑤ 10.6 ⑧

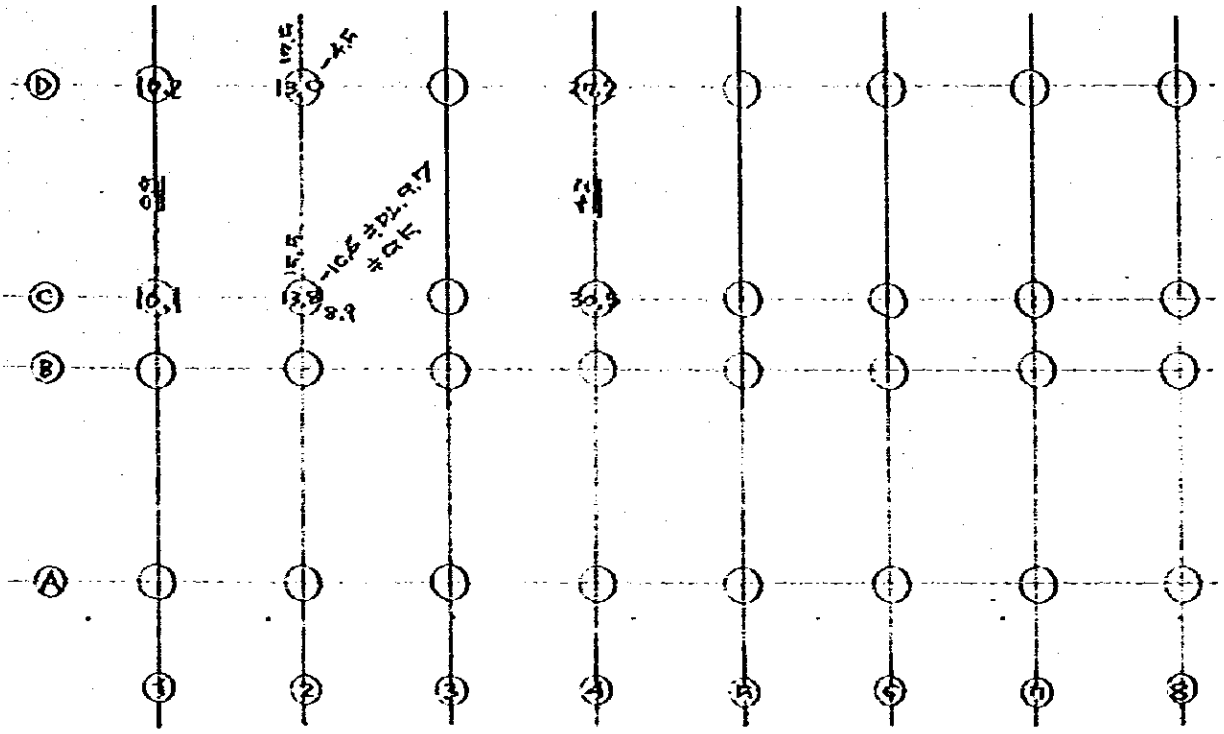

Ⓦ
Ⓦ'
Ⓩ
①
10.6
④
10.6
⑤
10.6
⑧

④ Frame (h=13.5)


Ⓥ
0.33 0.67 0.23 0.11 0.66 0.66 0.11 0.23
+4.1 +2.7 +0.4 +3.1 (2.8)
-12.3 -7.6 -1.3 -2.1 (5.1)
+12.3 +7.6 +1.3 +0.8 +11.0 (0.4)
-0.9 -7.5 +3.8 -8.9 (1.4)
+0.9 +7.5 -3.8 +4.3 +8.9 (1.4)
(0.3)
2Q = 5.1 × 2 = 10.2
β = 10.2/11.5 = 0.89
δ = 5×0.0089×1150⁴ / 384×2,100×71,000 − (210+1100)×1150² / 16×2,100×71,000 = 1.36 − 1.00 × 0.36 < 2.00
δ/span = 0.36/1150 = 1/3194
H-488×300×11×18, J = 71,000
Ⓚ
11.3 11.3 (1.3) 3.4 13.1 9.7 (4.9) 9.7
(1.5) (1.8)
ΣK
K'
Ⓐ 11.5 Ⓑ 4.0 Ⓒ


Ⓐ
Ⓑ
Ⓒ
11.9
4.0

Footing



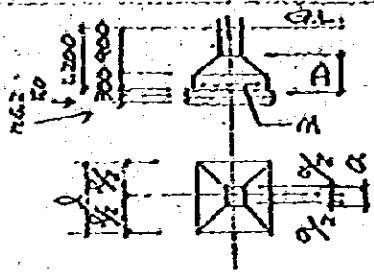
Independent Footing

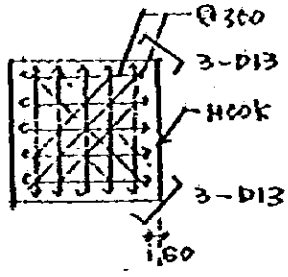
	N	fe	feq	An	ln	l.	Type								-N	ΔN	-N/ΔN
D1	10.2	8.4	5.4	1.89	1.38	1.5	F15										
2	13.0			2.41	1.56	1.8	F18								-4.5	9.7	O.F.
4	27.2			5.04	2.25	2.4	F24										
C1	10.1			1.87	1.37	1.5	F15										
2	13.8			2.56	1.60	1.8	F18								-1.2	9.7	O.F.
4	30.3			5.65	2.38	2.4	F24										

Continuous Footing

	q	fe	feq	An	Bn	B	type
1	0.9	6.2	3.2	0.29	0.29	0.35	FG1
4	1.6	〃	〃	0.26	0.26	〃	〃

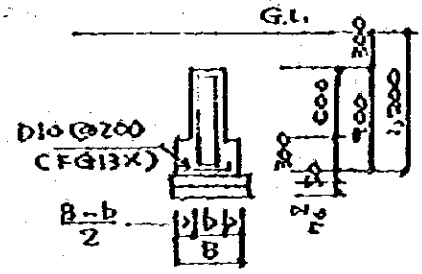
Design of Independent Footing





Type	ℓ	A	fca	Na	a	ℓ/a	N/Na	a/N	M	a	D	j	at	cp	2Dta	QA	M
F30	3.000	9.00	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
27	2.700	7.29	〃	39.4	〃	4.91	0.285	0.240	6.2	9.4	〃	〃	5.0	10.1	〃	〃	9-D13 〃
24	2.400	5.76	〃	31.1	〃	4.36	0.240	0.238	4.1	7.4	700	53.4	3.8	9.2	195	52.0	8-D13 〃
21	2.100	4.41	〃	23.8	〃	3.82	0.199	0.233	2.6	5.5	〃	〃	2.4	6.9	〃	〃	7-D13 〃
18	1.800	3.24	〃	17.5	〃	3.27	0.160	0.229	1.5	4.0	600	44.6	1.7	6.0	175	39.0	6-D13 〃
15	1.500	2.25	〃	12.2	〃	2.73	0.110	0.217	0.7	2.6	〃	〃	0.8	3.9	〃	〃	5-D13 〃

Design of Foundation Beam



Type	B	b		TOP R.	BTM R.	SIDE R.	Stp.	TIE
FG_{35}	350	350		2-D19	2-D19	2-D10	□D10 @200	⊓D10 @600
45	450	〃		〃	〃	〃	〃	〃
55	550	〃		〃	〃	〃	〃	〃

For Stress Between Piling Footing

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

Span 4.5 [m]

M_0 $3.0\times4.5^2/8$ 7.6 [tm] at 5.4 [cm²]
Q $\times 4.5/2$ 6.8 [t] Q 6.4 [cm]) 2-D19

b 35 D 90 j 80.9 Q_{AL} 12.4 [t] > Q

w = 1.26 + (0.6×1.5) + (0.08×3.5) = 2.84

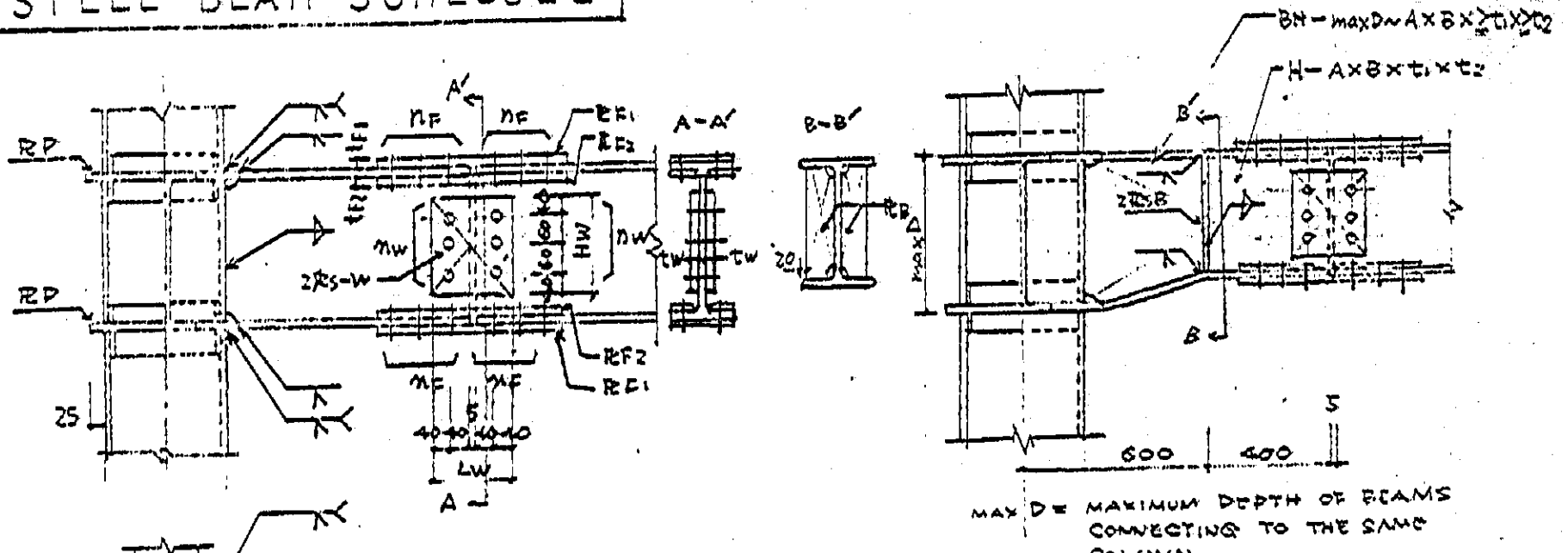
Span 5.3

M_0 $2.84\times5.3^2/8$ 10.0 at 7.0 ~ 3-D19
Q $\times 5.3/2$ 7.5

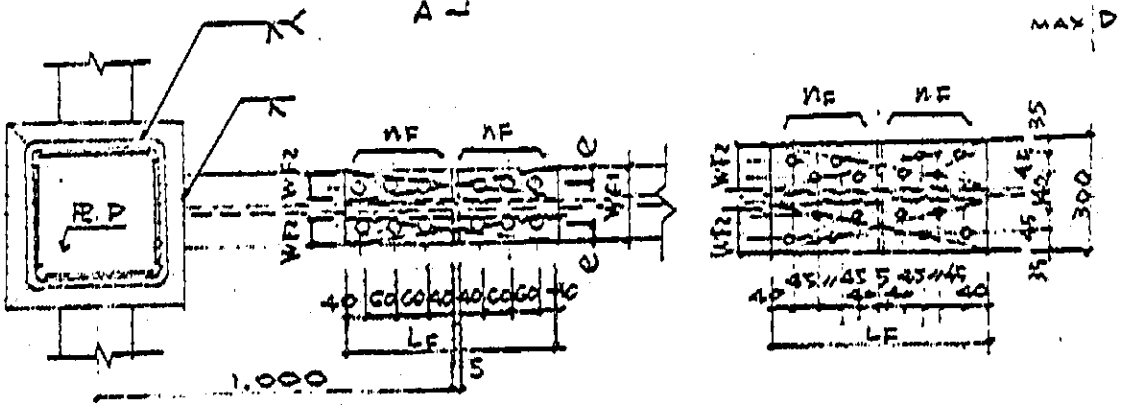
Design of Beam

			Stress									Member	ℓ_b	i_b	λ_b	ν	C	f_b	Z	σ/f	Type	Note
			V	K	W_1	W_2	1.5V	V+K	V+W_1	V+W_2	Max											
4	M	(9.5)	1.5	8.6	5.9	1.6	2.3	<u>10.1</u>	4.4	3.1	10.1	H 488X300X11X18										
		CENT	3.6	1.9	4.8	6.3	5.4	<u>5.5</u>	1.2	2.7	5.5											
		(7.5)	5.6	4.8	6.5	11.1	9.4	10.4	12.1	<u>16.7</u>	16.7		530	7.97	66.5	7.20	1.90	1.60	2,910	0.24	Gr	
	Q		3.1	1.3	-4.1 -4.1	-2.9 -5.3	<u>4.7</u>	4.4	2.0	2.1	4.7											
	M																					
	Q																					
1	M	Ⓒ										H 488X300X11X18										
		CENT	7.5	0	11.6	11.6	<u>11.3</u>	7.5	4.1	4.1	11.3											
		Ⓑ	8.9	9.7	27.8	0.4	13.4	18.6	<u>18.9</u>	9.3	18.9		400	7.97	50.2	7.20	1.00	1.60	2,910	0.27	Gr	
	Q		1.4	4.9	-9.2	-5.0	2.1	6.3	<u>7.8</u>	3.6	7.8											
	M	Ⓑ	11.0	3.4	13.9	21.7	<u>16.5</u>	14.4	2.9	10.7	16.5	H 488X300X11X18										
		CENT	9.3	4.0	9.0	20.4	<u>14.0</u>	13.3	0.3	11.1	14.0											
		Ⓐ	7.2	11.3	31.6	1.0	10.8	18.5	<u>24.4</u>	8.2	24.4		390	7.97	43.9	7.20	1.00	1.60	2,910	0.35	Gr	
	Q		5.4	1.3	-6.3 -9.7	-10.0 -6.0	<u>8.1</u>	6.77	4.3	4.6	8.1											

STEEL BEAM SCHEDULE



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



WF	e
150	30
175	30
200	35
250	45

$$t_d \geq \sqrt{3}\,\frac{t_c}{f_d}$$

MARK	MEMBER	RP	RB	RF1 tF1 × LF × WF1	RF2 tF2 × LF × WF2	nF	RW tW × LW × hW	nW	NOTE
G9	H900X300X16X28	28							
G8	H800X300X14X26	28	16	19 × 300 × 615	22 × 107 × 615	2×6-M22	12 × 165 × 620	10 - M22	
G7	H700X300X13X24	25	16	19 × 300 × 525	19 × 107 × 525	2×5-M22	9 × 165 × 560	9 - M22	
G6	H588X300X12X20	22	16	16 × 300 × 435	16 × 107 × 435	2×4-M22	9 × 165 × 440	7 - M22	
G6A	H600X200X11X17	19	16	16 × 200 × 405	16 × 73 × 405	2×3-M22	9 × 165 × 440	7 - M22	
G5	H-482X300X11X15	16	16						
G5A	H500X200X10X16	16	16	12 × 200 × 405	16 × 73 × 405	2×3-M22	9 × 165 × 380	6-M22	
G4	H390X300X10X16	16	16						
G4A	H400X200X8X13	16	16	9 × 200 × 285	12 × 73 × 285	2×2-M22	9 × 165 × 260	4 - M22	

Design of Column

			Stress V	K	W1	W2	1.5V	V+K	V+W1	V+W2	max	Member	fk/fb	σk/σb	λk/λb	M	C	fc/fb	A/Z	σ/f	Type	Note
⑤①	↪	N	10.2	1.3	-4.1	-2.9	15.3	11.5	6.1	7.3	15.3	□								OK	C12	
		M U	1.5	8.6	-5.9	1.6	2.3	10.1	4.4	3.1	10.1	350×350×12		Cf.	Chart							
		M L																				
		Q	0.2	1.2	-2.2	1.2	0.3	1.4	3.0	1.4	2.0											
	↯	N																				
		M U																				
		M L																				
		Q																				
	↪	N																				
		M U																				
		M L																				
		Q																				
	↯	N																				
		M U																				
		M L																				
		Q																				
③②	↪	N	13.8	0.4	8.9	/	20.7	14.2	22.7	/	22.7	□								OK	C12	
		M U	0.2	9.5	5.4	/	0.3	9.7	5.6	/	9.7	350×350×12										
		M L																				
		Q	0.1	1.3	0.8	/	0.2	1.4	0.9	/	1.4											
	↯	N	13.8	3.6	-15.5	-15.0	20.7	17.4	1.7	1.2	20.7											
		M U	2.1	13.1	18.9	-22.1	3.2	15.2	18.0	20.0	20.0											
		M L																				
		Q	0.3	1.8	2.2	-3.0	0.5	2.1	3.5	1.7	2.5											
	↪	N	13.0	0.4	8.9	/	19.5	13.4	21.9	/	21.9	□								OK	C12	
		M U	0.2	9.5	5.4	/	0.3	9.7	5.6	/	9.7	350×350×12										
		M L																				
		Q	0.1	1.3	0.8	/	0.2	1.4	0.9	/	1.4											
⑧②	↯	N	13.0	1.3	-17.5	-13.8	19.5	14.3	4.8	0.8	19.5											
		M U	3.1	11.3	-19.9	12.7	4.7	14.4	16.8	15.8	16.8											
		M L																				
		Q	0.4	1.5	-2.7	1.7	0.6	1.9	2.3	2.1	2.3											

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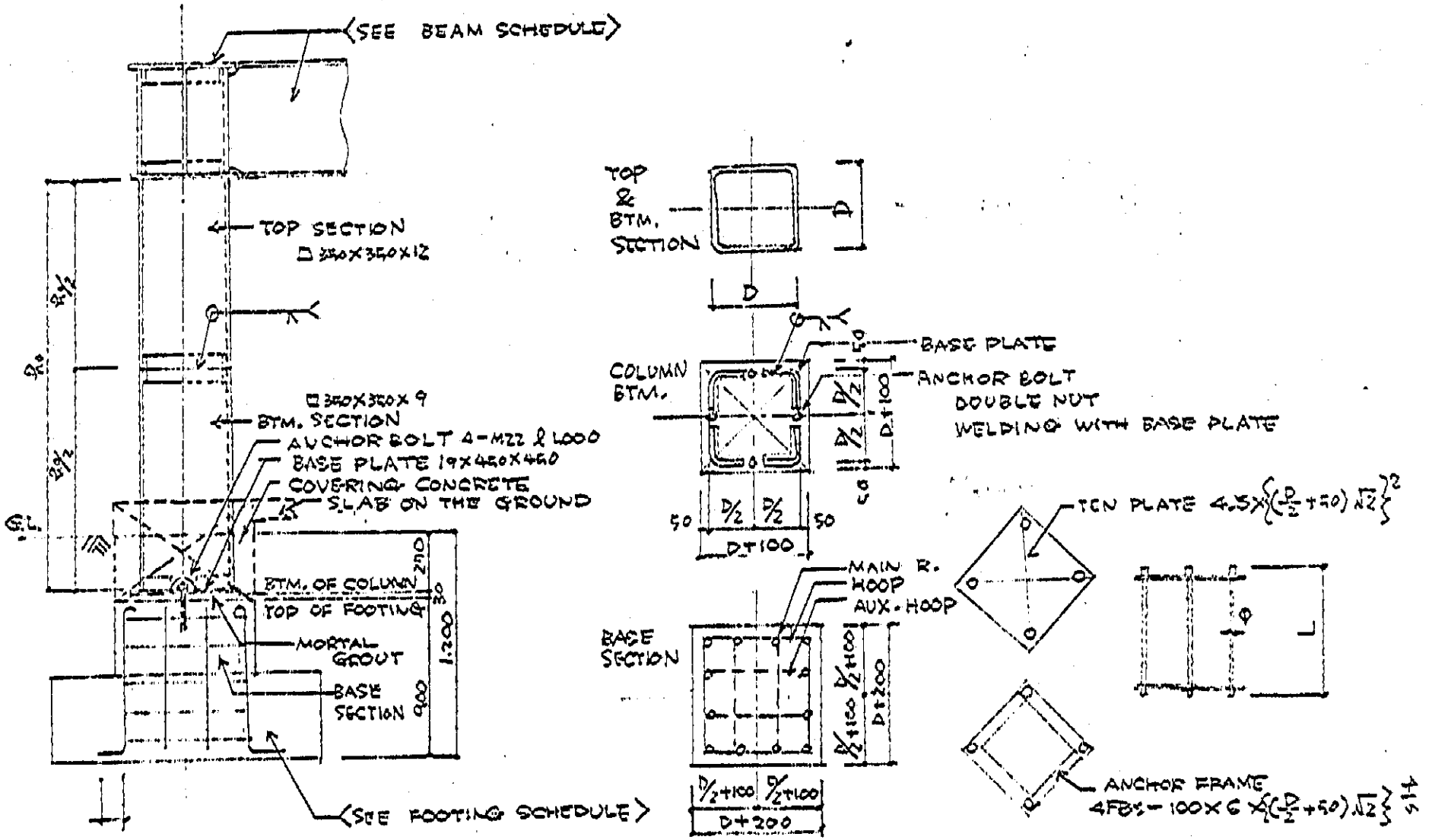
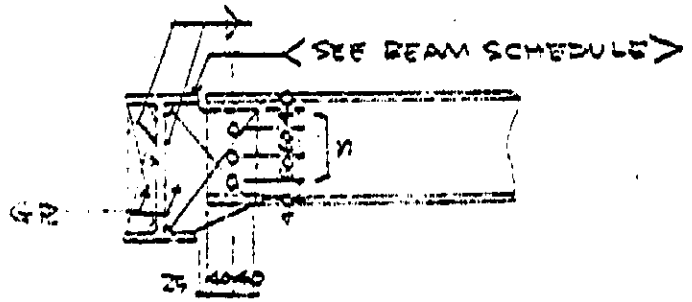
STEEL COLUMN SCHEDULE

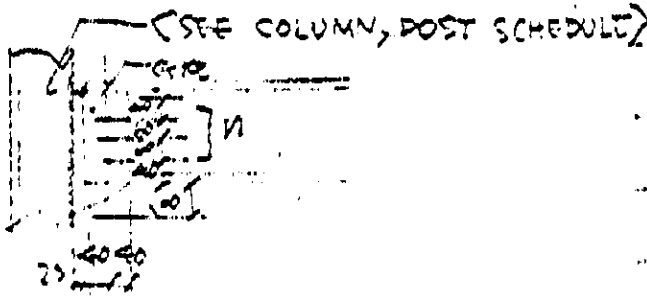


Design of Sub Beam

	[illegible]	ℓ	@	w D.L.	w W.L.	w Y.L.	g	Mo	Q	J_n	Z_n	Member	J	Z	[illegible]	[illegible]	λ	η	C	[illegible]	σ/f	Type
	9.3	3.53	4.00	0.02	0.8×0.18	0.124	0.446	0.69	0.79	365	28.8	H-200×100	1.840	184	353	2.60	155.8	6.49	1.00	0.80	0.31	B2
	3.3	4.00	1.25	〃	1.6×0.12	0.192	0.365	0.33	0.33			〃										〃
	7.2	10.4	2.25	〃	1.6×0.16	0.256	0.481	6.96	2.39	10,456	281.5	H-350×175	13.600	ηηη	530	4.58	115.7	8.33	1.98	1.29	0.47	B3A
	〃	〃	3.80	〃	0.8×0.16	0.108	0.360	5.06	1.91	7,476	20.8	〃		〃								〃
	23	6.3	11.5/2	0.51			1.22 (S.L. 0.95)			2984.3	267.7	H-250×125	4.050	324	530	3.26	162.5	7.24	1.00	0.80		B2A

STEEL SUBBEAM SCHEDULE



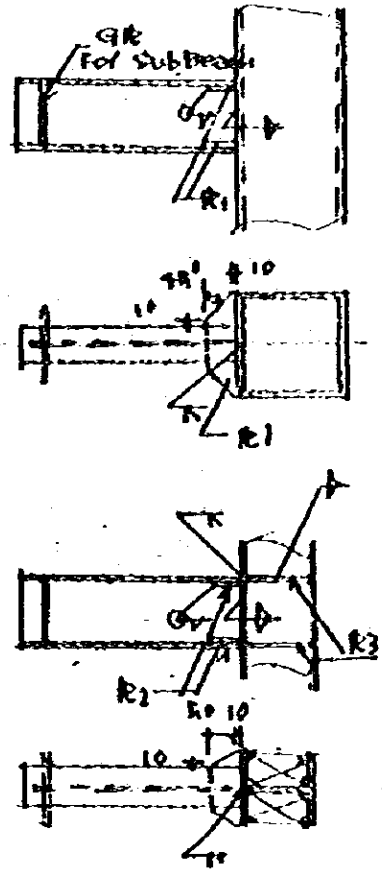


MARK	SECTION	GR	M	
B4B	H-350X300X10X16	12	8-M22	
B4A	H-450X200X9X14	〃	〃	
B4	H-400X200X8X13	〃	4-M22	
B3A	H-350X175X7X11	〃	〃	
B3	H-300X150X6.5X9	〃	3-M22	
B2A	H-250X125X6X9	9	〃	
B2	H-200X100X5.5X8	〃	2-M22	
B9	H-900X300X16X28	16	12-M22	
B6A	H-596X300X12X20	16	7-M22	
B6	H-600X200X11X17	〃	〃	
B5	H-600X200X10X16	12	6-M22	
B3C	H-350X350X12X19	12	2X3-M22	

Design of Cantilever

s	l	@	w.l. D.L.	w.l. W.L.	w.l. T.L.	P (S.L. 0.05)	M.	Φ	In	Sm	Member	J	Z	Lb	Cb	λb	Mr	C	fb	d/t	Type
7.0	1.5	10.6	0.07	1.6×0.6	0.236	6.23	9.35	6.23	5562.5	389.6	H-350×175	13,600	775	150	4.58	32.8	9.33	1.75	1.60	0.50	CGSA

SCHEDULE OF CANTILEVER



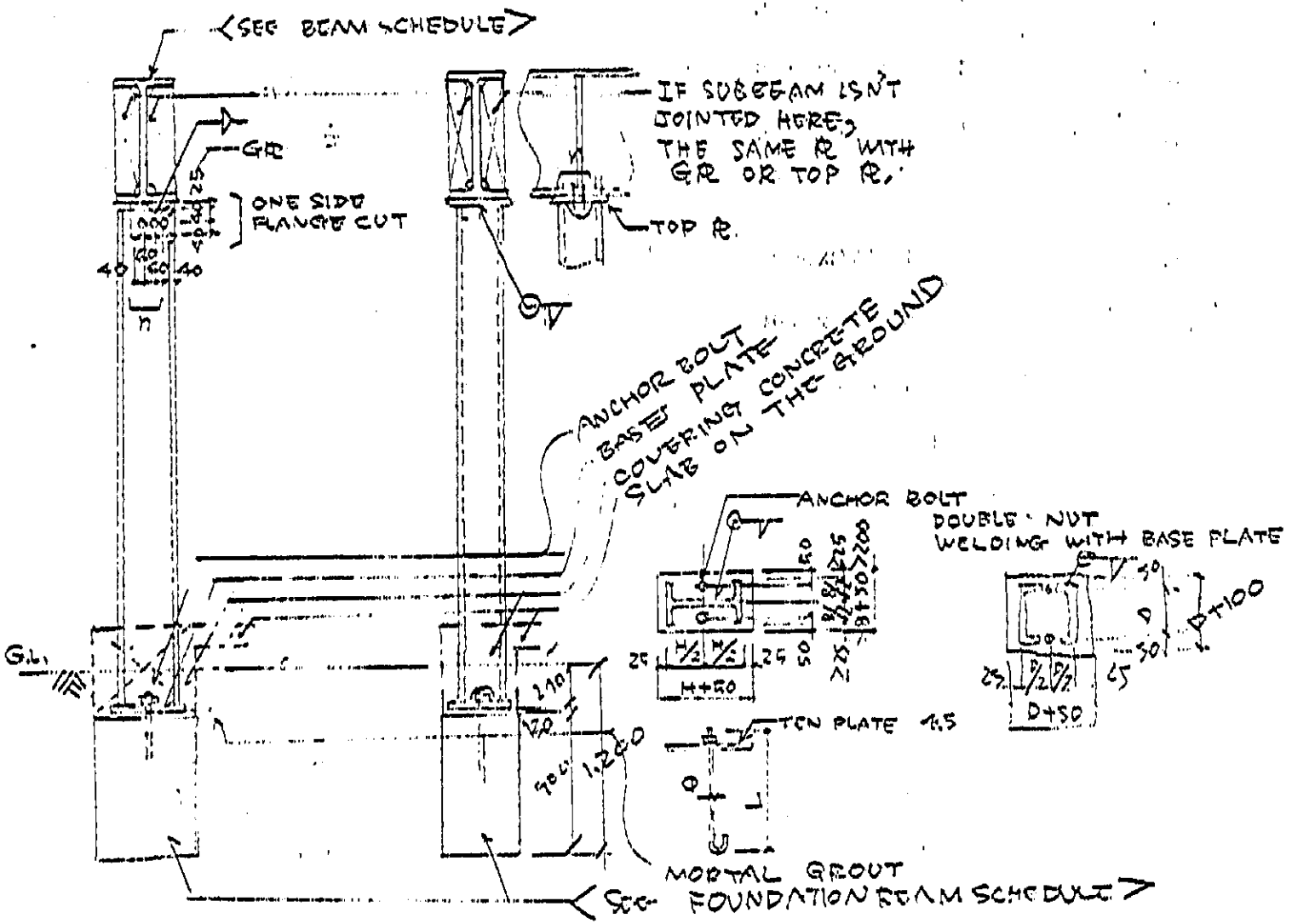
MARK	MEMBER	R1	R2	R3
CG4	H-400X200X8X13	R12	R12	R12
CG3A	H-300X150X6X9	"	"	"
CG3	H-300X150X6X9	R9	R9	R9
CG2	H-200X100X5.5X8	"	"	"

PQ

DESIGN OF POST

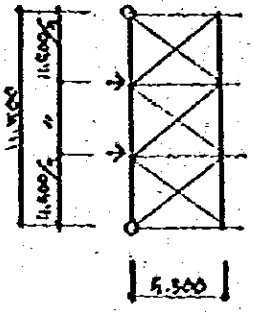
BTM	TOP	ℓ	Ⓗ	D.L.		N	W.L.		M_0	Q	J_x	Z_x	Member	J	i_x / i_b	l_k / l_b	λ_x / λ_b	N / C	f_c / f_b	A / Z	σ/f	Type
				ω	ℓ		ω	ℓ														
7.2	9.3	2.1	3.53	0.05	0.25 (S.L. 0.07)	0.48	0.8×0.18	0.51	0.32	0.34	87.9	13.3	H-100×100	383	26.5							P1
0.3	7.0	6.7	2.8	0.02	0.15	0.80	0.8×0.42	0.36	2.06	1.21	2,040.9	85.4	H-300×150	7,210	690							P3

STEEL POST SCHEDULE



MARK	SECTION	GR	n	BASE PLATE	ANCHOR BOLT Φ X L	NOTE
P1	H-200X100X6X8	R9	2-M22	R16 X 190X 200	2-M20 X 900	
P2	H-200X100X5.5X8	DO	〃	R 〃 X 250 X 200	2-M 〃 X 〃	
P2A	H-250X125X6.5X9	DO	3-M22	R 〃 X 300 X 200	2-M 〃 X 〃	
P3	H-300X150X6.5X9	DO	〃	R 〃 X 350 X 200	2-M 〃 X 〃	
P3A	H-350X175X7X11	R12	4-M22	R 〃 X 400 X 225	2-M 〃 X 〃	
P4	H-400X200X8X13	DO	〃	R 〃 X 450 X 250	2-M 〃 X 〃	
P4A	H-450X200X9X14	DO	4-M22	R 〃 X 500 X 250	2-M 〃 X 〃	
P25	H-250X250X9X14	R9	2X2-M22	R19 X 300X 300	〃	
P20A	□-200X200X8	TOP R 16X300X300	〃	R16X200X300	〃	
P25A	□-250X250X8	〃 19X300X350	〃	R19X300X350	〃	

Design of Bracing



R 6.93
@ 3.85
cgA 0.8×0.12×3.85 = 0.37
Q 0.37×6.93/2 = 1.28
D 1.28×6.34/4.30 = 1.88 ∴×1 = 1.88 , An = 1.88/2.4 = 0.7

$$J_n = \frac{13\times 4.0002\times 6.64^3\times 300}{384\times 2,100} \simeq 210.6$$

$$z_n = \frac{3\times 0.02\times 6.64^2\times 100}{8\times 2.4} = 13.4$$

L-130×130×9
A 22.7, J 366.0, z 38.7

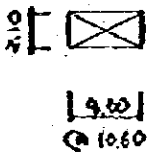
$$J_n' = \frac{5\times 0.0002\times 3.27^3\times 300}{384\times 2,100} = 13.0$$

$$z_n' = \frac{0.02\times 3.27^2\times 100}{8\times 2.4} = 1.1$$

L-65×65×6
A 8.0, J 46.1, z 8.5

Monitor Roof

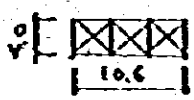
Vertical



P 1.4×0.18×10.6×2.1/2 = 2.80
D 2.80×4.52/4.00 = 3.17 An 3.17/2.4 = 1.32

L-65×65×6

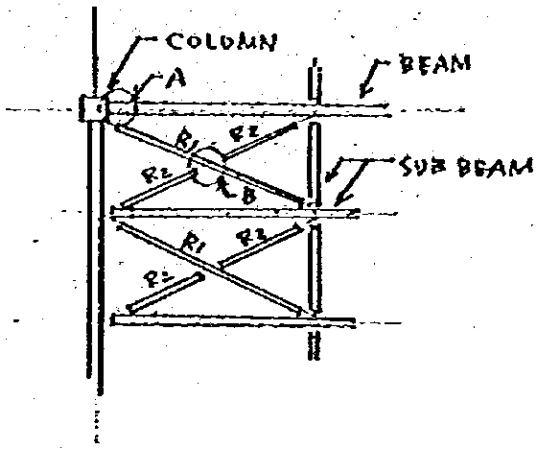
Horizontal

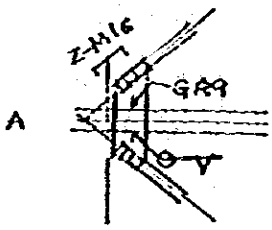


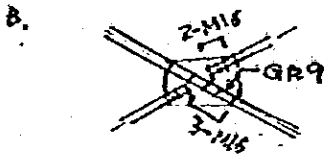
$$J_n = \frac{13\times 0.0002\times 5.34^3\times 300}{384\times 2,100} = 14.23$$

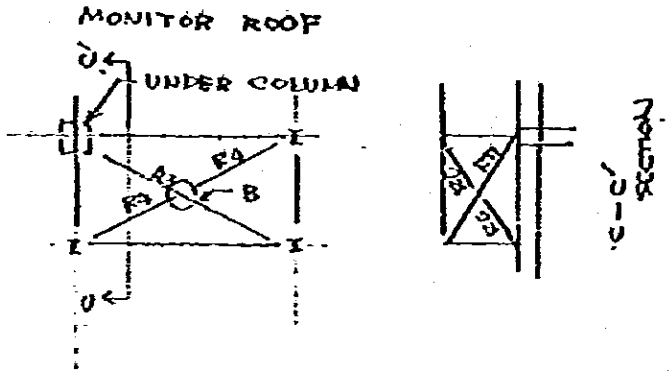
L-100×100×10
A 19.0, J 115.0, z 24.4

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	158 ~ 185	〃	253 ~ 296
Inspection Factory	〃		〃	
Periodical Repair F.	〃		〃	
Paint & Body Factory	〃		〃	
Retreading & M.C. F.	〃		〃	

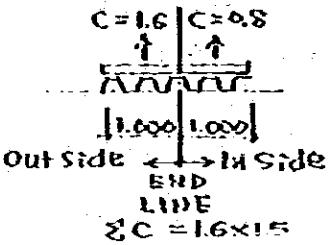
Continuous Beam Type

$$\frac{M}{Z} = \frac{\omega l^2}{8Z} \le f \sim l_2 \le \sqrt{\frac{8Zf}{\omega}}$$

$$\frac{5\,\omega l^4}{384\,EI} \le \frac{l}{300} \sim l_1 \ge \sqrt[3]{\frac{384\times 2{,}100\, I}{300\times 5\,\omega}}$$

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

ω	Net ω	l_2	l_1	l_{min}
1.5 × 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



$$l_2 \le \sqrt{\frac{8\times 61.33\times 1.4}{\omega}} = \sqrt{\frac{686.896}{\omega}}$$

$$l_1 \le \sqrt[3]{\frac{384\times 2{,}100\times 619.94}{300\times 5\times\omega}} = \sqrt[3]{\frac{333{,}259{,}714}{\omega}}$$

Allowable Span [cm]

	M. Roof	Roof
H.R. Factory	510	390
Generally	400	440

Cantilever Type

$$\frac{M}{Z} = \frac{\omega l^2}{2Z} \leq f \quad \sim \quad l_2 \leq \sqrt{\frac{2Zf}{\omega}}$$

$$\frac{\omega l^4}{8EI} \leq \frac{l}{250} \quad \sim \quad l_1 \leq \sqrt[3]{\frac{8 \times 2{,}100\, I}{250\,\omega}}$$

ω	Net ω	l_2	l_1	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
0.253	0.00240	231.7	235.2	231.7

$$l_2 \leq \sqrt{\frac{2 \times 61.33 \times 0.75^* \times 1.4}{\omega}} = \sqrt{\frac{128.793}{\omega}}$$

$$l_1 \leq \sqrt[3]{\frac{8 \times 2{,}100 \times 619.94 \times 0.75^*}{250\,\omega}} = \sqrt[3]{\frac{31{,}244.976}{\omega}}$$

$\sim$

Allowable Span = 190 [cm]

Designed Type

0.8 ⟶ Size up to 1.0 M/M

Design of Mezzanine Floor

$w = 0.211$ [t/m²]

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

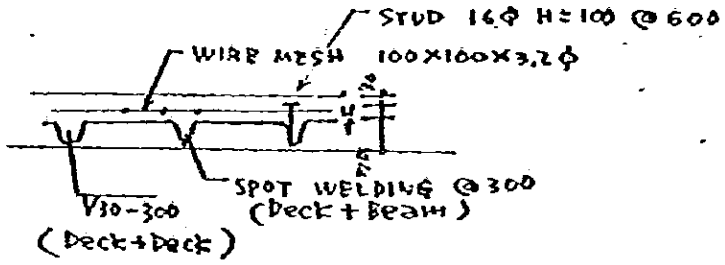
$$\frac{wl^2}{8Z} < f \sim l > \sqrt{\frac{8Zf}{w}}$$

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

$$\frac{5\,w l^4}{384\,EJ} < \frac{l}{350} \sim l > \sqrt[3]{\frac{384\,EJ}{1500\,w}}$$

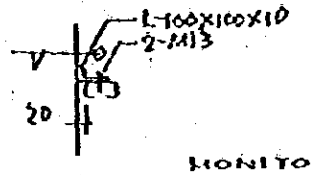
$$= \sqrt[3]{\frac{384 \times 2{,}100 \times 136}{1500 \times 0.0051}} = 242.9$$

—— Allowable Span 240 [cm]



Design of Furring Strip

Outside Wall



MONITOR ROOF　C-120×60×25-4.5　@=900
GENERAL　C-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	〃	〃	130 ~ 120
P.B.F.	3.45 ~ 3.25	〃	〃	180 ~ 120
R.M.C.F.	3.00 ~ 3.38	〃	〃	180 ~ 120

CASE-1. (H.R.F. MONITOR ROOF)

D.L. 0.23×0.9 = 0.045 [t/m]
W.L. 0.22×0.8×0.9 = 0.158 [〃]
span 3.68 [m]

C-100×50×20-2.3

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

$$= 2.68 < 2.10$$

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{19.6}\right)^2 + \left(\frac{0.00158}{80.9}\right)^2}$$

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

C-100×50×20-3.2

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

$$= 2.69 \text{ [cm]}$$

C-100×50×20-4.5

$$\delta = \frac{5 \times 368^4}{384 \times 2100}\sqrt{\left(\frac{0.00045}{38.9}\right)^2 + \left(\frac{0.00158}{139}\right)^2}$$

$$= 2.16 \text{ [cm]}$$

C-120×60×25-4.5

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

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

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

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]

$C = 100 \times 50 \times 20 - 3.2$

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

$= 2.45$ [cm]

$C = 100 \times 50 \times 20 - 4.5$

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

$= 1.92$ [cm]

$C = 120 \times 60 \times 25 - 4.5$

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

$= 1.03$ [cm]

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

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 3.85 m

$C = 100 \times 50 \times 20 - 2.3$

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

$= 1.51$ [cm]

$C = 100 \times 50 \times 20 - 3.2$

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

$= 1.17$ [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

$C = 100 \times 50 \times 20 - 2.3$

$$\delta = \frac{1 \times 385^4}{185 \times 2{,}100} \sqrt{\left(\frac{0.00014}{19.0}\right)^2 + \left(\frac{0.00078}{50.7}\right)^2}$$

$= 0.69$ [cm]

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