

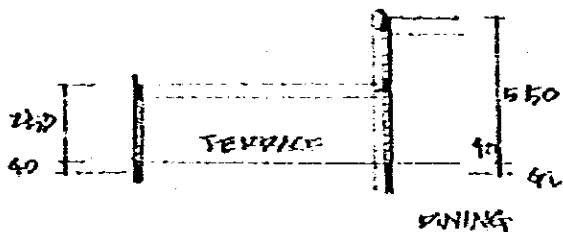
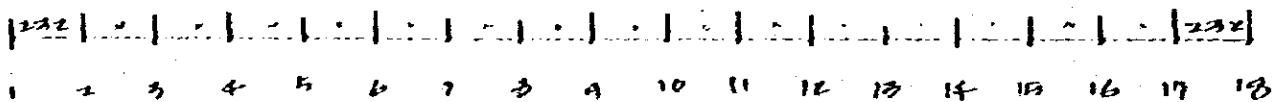
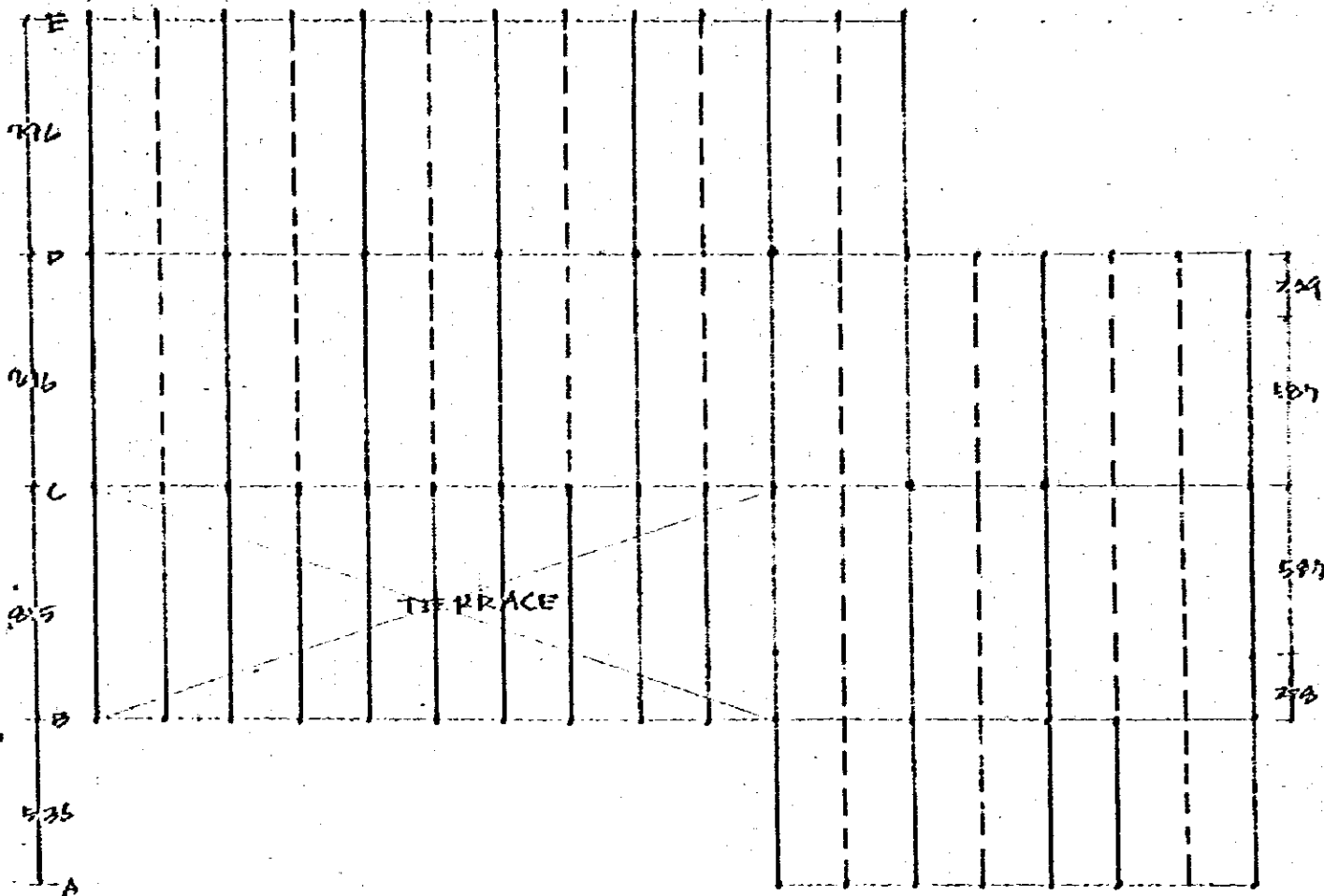
4 食 堂

4.1. LOAD(1) DEAD LOAD

ROOF	LIME CONCRETE	10cm	200	} 460 <sup>kg/m<sup>2</sup></sup>
	R.C. SLAB	10	240	
	CEILING		20	
WALL	BRICK			} 490 <sup>kg/m</sup>
	CEMENT MORTAR		50	
BEAM	20 x 30	1140	<sup>kg/m</sup>	
	20 x 15	510	"	
COLUMN	20 x 25	510	"	
	20 x 20	100	"	
	40 x 40	310	"	
	40 x 40	390	"	


(2) LIVE LOAD

	SLAB	RAKE	EARTHQUAKE
ROOF	100	50	0



4-2 C.P.O. OF BEAM

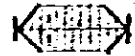
$w = 0.51 \frac{T}{h}$

B<sub>1</sub>   $lx = 112$   $ly = 5.36$   $\lambda = 2.31$   $w' = 0.34$

$C = 2.7 \times 2 \times 0.51 + 0.34 \times 5.36^2 / 12 = 2.75 + 0.41 = 3.6$

$I_{00} = 4.3 \times \dots + \dots / 12 = 5.39 + 1.22 = 5.6$

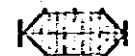
$Q = 2.4 \times \dots + 1.24 \times 5.36 / 2 = 2.45 + 0.91 = 3.4$

B<sub>2</sub>   $lx = 232$   $ly = 9.15$   $\lambda = 3.51$   $w' = 0.51$

$C = 6.2 \times 2 \times 0.51 + 0.51 \times 9.15^2 / 12 = 6.32 + 2.82 = 9.1$

$I_{00} = 9.6 \times \dots + \dots / 12 = 9.59 + 4.23 = 14.0$

$Q = 4.2 \times \dots + 0.51 \times 9.15 / 2 = 4.26 + 2.18 = 6.4$

B<sub>3</sub>   $lx = 232$   $ly = 7.96$   $\lambda = 3.43$   $w' = 0.51$

$C = 6.0 \times 2 \times 0.51 + 0.51 \times 7.96^2 / 12 = 6.12 + 2.69 = 8.8$

$I_{00} = 9.4 \times \dots + \dots / 12 = 9.59 + 4.04 = 13.6$

$Q = 4.1 \times \dots + 0.51 \times 7.96 / 2 = 4.14 + 2.03 = 6.2$

B<sub>4</sub>   $lx = 9.15$   $w = 0.24$   $lx = 232$

$C = 0.24 \times 9.15^2 / 12 = 1.7$  0.1

$I_{00} = \dots / 12 = 2.0$  0.2


$Q = 0.24 \times 9.15 / 2 = 1.0$  0.3

C<sub>1</sub>   $lx = 232$   $\lambda = 1.0$   $w' = 0.44$

$C = 0.32 \times 0.51 + 0.44 \times 2.32^2 / 12 = 0.15 + 2.70 = 2.85$

$I_{00} = 0.63 \times \dots + \dots / 12 = 0.37 + 0.30 = 0.67$


$Q = 0.63 \times \dots + 1.44 \times 2.32 / 2 = 0.38 + 0.51 = 0.89$

C<sub>2</sub>   $lx = 464$   $P = 3.4 + 6.5 = 9.9$   $w' = 0.51$

$C = 1.2 \times 0.51 + 9.9 \times 4.64 / 12 + 0.51 \times 4.64^2 / 12 = 1.27$

$I_{00} = 2.12 \times \dots + \dots / 12 + \dots / 12 = 1.43$


$Q = 2.69 \times \dots + 9.9 / 2 + 0.51 \times 4.64 / 2 = 7.4$

G C 11-13   $l = 664$   $P = 64 + 62 = 126$   $w' = 0.51$

$C = 221 \times 0.51 + 126 \times 664 / 16 + 0.51 \times 9.6^2 / 12 = 94$

$M_0 = 211 \times \dots + \dots / 4 + \dots / 12 = 146$


$Q = 259 \times \dots + 126 / 2 + 0.51 \times 9.6 / 2 = 99$

G C 15-18   $l = 696$   $P = 126$   $w' = 0.61$

$C = 401 \times 0.61 + 126 \times 696^2 / 16 + 0.61 \times 6.96^2 / 12 = 244$

$M_0 = 776 \times \dots + \dots \times 1/2 + \dots / 12 = 31.6$

$Q = 254 \times \dots + 126 + 0.61 \times 6.96 / 2 = 162$

G D 1-3   $l = 514$   $P = 62 + 62 = 124$   $w' = 0.51$

$C = 221 \times 0.51 + 124 \times 514 / 16 + 0.51 \times 4.14^2 / 12 = 92$

$M_0 = 211 \times \dots + \dots / 4 + \dots / 12 = 103$


$Q = 269 \times \dots + 124 / 2 + 0.51 \times 4.14 / 2 = 88$

G 1 C D   $l = 772$   $l_j = 796$   $\lambda = 353$   $w' = 0.61$

$C = 6.0 \times 0.61 + 0.61 \times 7.96^2 / 12 = 64$

$M_0 = 9.4 \times \dots + \dots / 12 = 99$

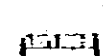
$Q = 5.1 \times \dots + 0.61 \times 7.96 / 2 = 4.6$

G 10 A B   $l = 232$   $l_j = 576$   $\lambda = 273$   $w' = 0.44$

$C = 27 \times 0.51 + 0.44 \times 5.76^2 / 12 = 24$

$M_0 = 4.3 \times \dots + \dots / 12 = 4.6$

$Q = 2.4 \times \dots + 0.44 \times 5.76 / 2 = 2.4$


G 11 B B'   $l = 772$   $w' = 0.94 + 0.51 \times 772 / 2 = 1.04$

$C = 1.04 \times 772^2 / 12 = 0.5$

$M_0 = \dots / 12 = 0.7$

$Q = 1.04 \times 772 / 2 = 1.2$


$l = 772$	$Q = 209$
0.5	0.4
0.7	0.6
1.2	1.1

G117C  l = 54m w' = 1.04

$$C = 1.04 \times 5.4^2 / 12 = 2.9$$

$$P_0 = \dots / 10 = 9.4$$

$$Q = 1.04 \times 5.4 / 12 = 3.0$$

G111-13  l = 46.9 p = 6.2 w' = 0.61

$$C = 1.11 \times 0.61 + 6.2 \times 4.69 / 10 + 0.61 \times 4.69^2 / 12 = 5.3$$

$$P_0 = 1.56 \times \dots + \dots / 10 + \dots / 10 = 9.7$$


$$Q = 1.35 \times \dots + 1.2 / 12 + 0.61 \times 4.69 / 12 = 4.2$$

l = 46.9 p = 6.4 w' = 0.41 + 0.24 \times 1.75 = 0.92

$$C = 1.11 \times 0.41 + 6.4 \times 4.69 / 10 + 0.41 \times 4.69^2 / 12 = 5.9$$

$$P_0 = 1.56 \times \dots + \dots / 10 + \dots / 10 = 10.7$$

$$Q = 1.35 \times \dots + 1.4 / 12 + 0.41 \times 4.69 / 12 = 6.0$$

G1300  l = 76.9 w' = 0.92

$$C = 6.0 \times 0.92 + 0.92 \times 76.9^2 / 12 = 7.6$$

$$P_0 = 9.4 \times \dots + \dots / 10 = 11.6$$

$$Q = 4.1 \times \dots + 0.92 \times 7.69 / 12 = 5.6$$

4-3 AXIAL FORCE OF COLUMN

	ROOF		WALL		BEAM	COLUMN	P
C01					113	055	1.7
C02					124	055	1.9
C01	051 x 116 x 2.96	2.35	1.47 x 3.76 0.47 x 1.02	051 5.74 0.43	316	3.23	15.0
C02	051 x 2.32 x 3.96	4.11	0.42 x 2.04	0.23 0.26	354	3.23	12.6
C01	051 x 2.32 x 1.96	2.42		0.60	490	3.09	20.2
C03	051 x 4.64 x 1.96	13.14			1823	183	30.1
CE1	051 x 116 x 2.96	2.35	1.47 x 3.65 2.45 x 1.02	051 5.74 2.54	221	3.23	16.2
CE2	051 x 2.32 x 3.96	4.11	2.48 x 2.04	0.23 5.08	265	3.23	15.9
CA11	051 x 1.16 x 2.66	1.59	0.93 x 3.56	0.36 3.31	1.21	0.84	7.3
CA12	051 x 2.32 x 2.66	3.17	0.93 x 2.04	0.23 1.90	156	0.84	7.7
CA13	051 x 2.32 x 2.66	3.17	0.93 x 4.56	0.23 4.26	156	0.84	10.1
CB11	051 x 2.32 x 3.96	4.66	0.93 x 5.72	0.39 4.66	1.45	1.84	11.6
CB13	051 x 4.64 x 6.76	16.60	0.93 x 8.62	0.02	9.97	0.84	32.6
CB14	051 x 3.48 x 6.76	12.00	0.93 x 5.74	5.34 0.41	7.37	0.84	26.1
CB11	051 x 1.16 x 4.06	2.41	0.93 x 3.70	3.15	124	0.84	8.1
CC11	0.51 x 2.96 x 2.96 x 2.36 x 2.92	7.06 3.51	0.42 x 1.02 0.43 x 3.07	0.36 0.29	0.43 2.61	3.23	23.8
CCB	051 x 4.64 x 3.06	19.07	0.93 x 3.66	1223	10.00	1.72	36.1
CC15	051 x 4.64 x 3.06	23.26			1236	1.72	36.4
CC13	051 x 2.96 x 3.06	15.30	0.93 x 5.60	0.49 5.21	336	1.72	25.4
CD13	051 x 2.32 x 1.96 x 1.16 x 2.96	2.42 2.35	1.47 x 3.65 0.93 x 1.02	0.20 0.12	5.18 0.95	1.72	26.6
CD14	051 x 2.32 x 2.96	4.11	0.93 x 2.04	0.23 1.90	2.65	0.84	10.3
CD13	051 x 1.16 x 1.06	0.62	0.93 x 2.04	0.23 1.90	0.69	0.84	4.3
CD16	051 x 1.16 x 2.96	2.35	0.93 x 3.70	0.40 2.44	1.29	0.84	8.3

### 4-4 SEISMIC FORCE

ROOF	$0.46 \times 2709 \times 24.01$	308.3
WALL	$0.10 \times 103.8$	10.4
	$0.42 \times 7.05 \times 10$	8.6
	$0.34 \times 2.75 \times 40.6$	60.3
BEAM	$0.34 \times 44.9$	15.3
	$0.51 \times 199.0$	101.5
COLUMN	$0.53 \times 3.35 \times 20$	44.4
	$0.31 \times 2.95 \times 6$	5.5

$$Q_c = 559.3 \times 0.1 = 55.93$$

TERACE COLUMN	$0.19 \times 145 \times 10$	27.0
	$0.24 \times 92.4$	22.2
		<hr/> 25.0

$$Q_T = 25.0 \times 0.1 = 2.50$$

KITCHEN		
ROOF	$0.46 \times (11.6 \times 21.47 + 13.4 \times 13.51)$	143.4
WALL	$0.10 \times 62.8$	6.3
	$0.42 \times 3.04 \times (12 + 23.6)$	44.1
	$0.45 \times 50.6$	43.1
BEAM	$0.34 \times 85.3$	29.1
	$0.51 \times 103.2$	52.6
	$0.61 \times 5.5$	3.4
COLUMN	$0.19 \times 2.2 \times 21$	8.1
	$0.29 \times 2.2 \times 7$	2.6
		<hr/> 339.5

$$Q_k = 339.5 \times 0.1 = 33.95$$

$$IQ = 91.48$$



4-5 STIFFNESS RATIO

	b x D	$J_{10^4}$	$l$	$K_{10^3}$	$\phi$	$l_c$	$K_0 = 10^3$
C	2B x 115	93.4	5A0	16.1		1.67	
	11A x 2B	13.7	"	2.3		0.23	
	2B x 60	50.4	"	8.5		0.85	
	60 x 2B	11.0	"	1.9		0.19	
	40 $\phi$	12.6	"	2.1		0.21	
	40 x 40	21.3	440	4.0		0.40	
	2B x 2B	5.1	"	1.2		0.12	
G	"	"	290	1.8		0.18	
	2B x 50	29.1	232	12.6	1.277 1.416	1.36	1.60
	"	"	536	5.4	1.56 1.88	1.01	0.84
	"	"	587	5.0	1.59 1.92	0.96	0.79
	2B x 7A	94.5	464	20.4	1.40 1.70	2.46	2.45
	"	"	796	11.9	1.54 1.95	2.32	1.89
	"	"	815	11.6	1.63 1.97	2.28	1.85
	2B x 90	170.1	464	36.7	1.63	5.98	
	"	"	696	24.9	1.83	4.58	
	EG	35 x 90	2126	232	91.6		9.16
"		"	464	45.8		4.58	
"		"	696	30.5		3.05	
"		"	796	26.7		2.67	
"		"	815	26.1		2.61	

(E)

1.60	1.60	1.60	1.60	1.60	
0.23	0.23	0.23	0.23	0.23	0.23
A.16	A.16	A.16	A.16	A.16	

(D)

5.96			5.96			5.96			0.77
0.19		0.21	0.21			1.60	1.60	1.60	0.12
	4.56	4.56	4.56			0.25	0.22	0.22	
						A.16	A.16	A.16	

(C)

1.60	1.60	0.91	2.95	1.42	
	0.23		2.95	1.98	5.46
A.16	A.16	0.31	4.56	4.56	3.05
					1.15

(B)

2.57	2.57	0.24	3.96	3.96	1.86	3.96
	0.13	0.12		0.12	0.12	0.12
2.01	2.01	0.16	4.56	4.56	A.16	4.56
						2.12

(A)

1.60	1.60	1.60		1.60	1.60
0.12	0.12	0.12	4.90		0.12
A.16	A.16	A.16		A.16	A.16

(C)

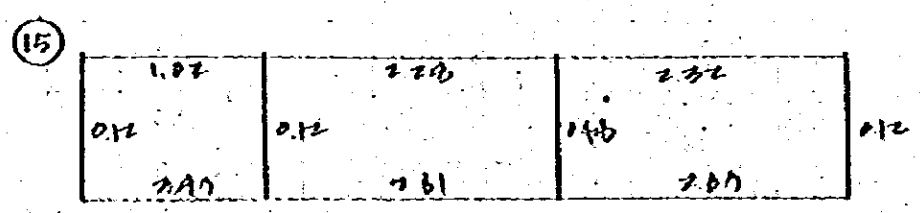
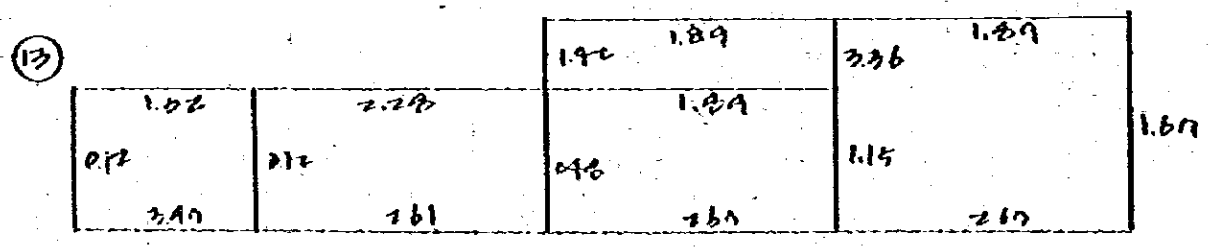
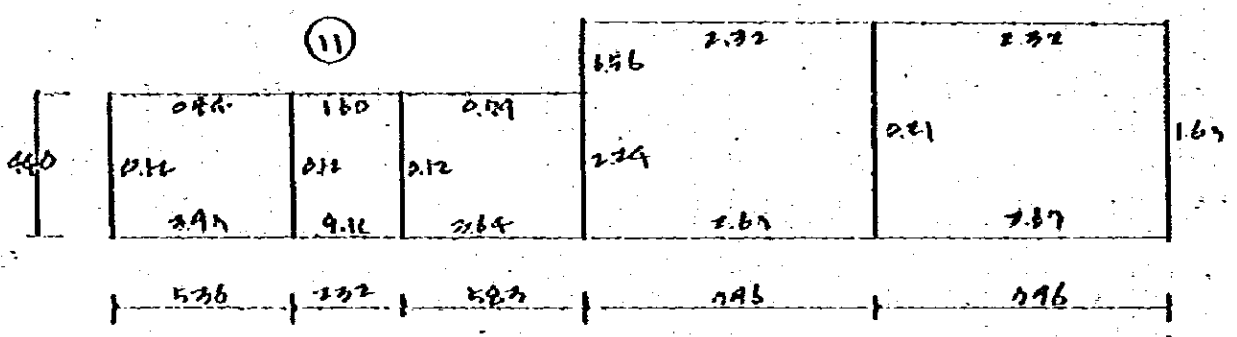
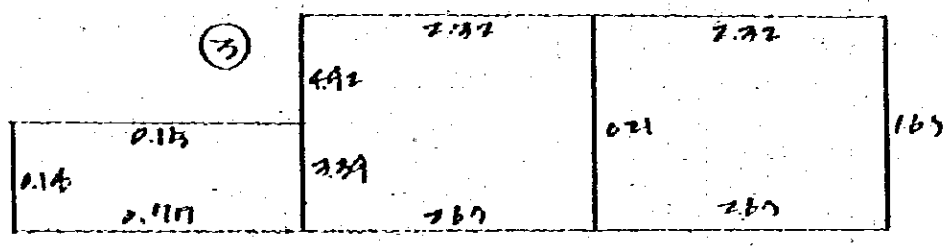
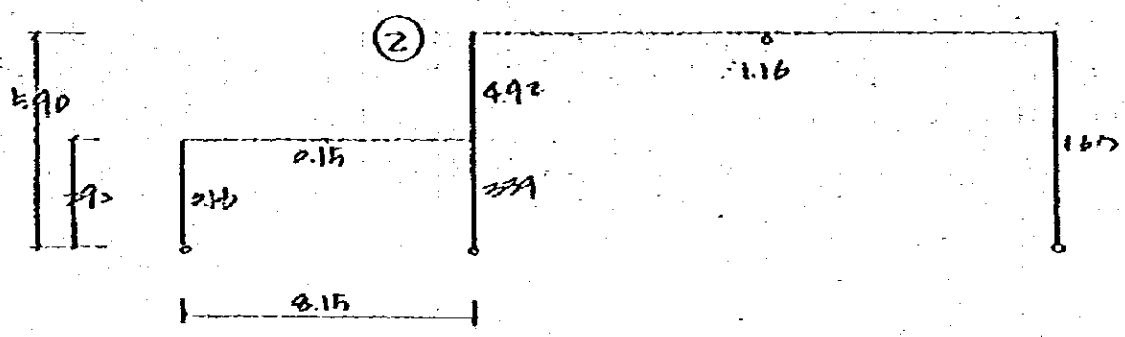
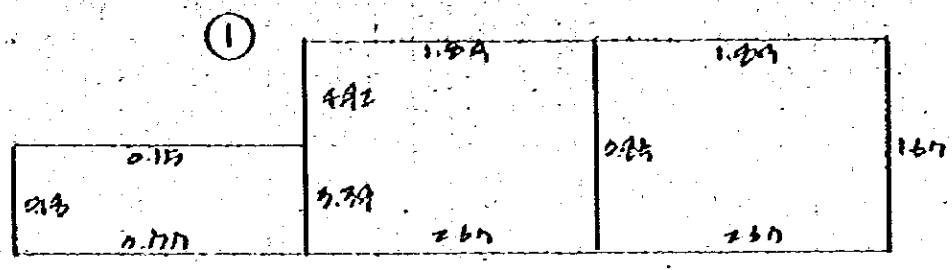
1.60	1.60	1.60	5.90
0.23	0.23	0.23	
A.16	A.16		

(B)

0.57	0.57	0.57	2.90
0.16	0.16	0.16	
2.01	2.01	2.01	

2.77 | 2.77 | "

2.72 | 2.72 | "



4-6 CALCULATION OF STRESS

D	6.95	13.91	21.87	56.95	10.33		
	0.19	0.21	0.19	0.20	0.612		
Q	1.4	1.5	1.3	1.5	2.6		
					0.45 -0.05		
Z	0.55	0.55	0.55	0.55	0.55	0.55	0.55
					0.40	2.67	1.33
					0.215	0.081	0.05
					1.0	0.15	0.12
					0.15	0.15	0.15

$(\frac{1.9}{4.4})^2 = 1.993$

5.95	13.91	9.01	9.11		
0.19	0.21	0.607	0.935		
1.4	1.5	3.4	5.6		
		0.45 -0.05	0.45 -0.05		
0.55	0.55	0.55	0.55	0.55	0.55
		0.19	1.33	22.00	3.88
		0.265	0.445	0.450	0.862
		3.3	5.5	5.5	1.55
		0.55	0.55	0.55	0.55

2.95	5.89	5.89	44.33	9.973	20.83
0.125	0.146	0.117	0.116	0.116	0.114
2.5	2.6	1.4	1.4	1.4	1.4
0.55	0.55	0.55	0.55	0.55	0.55
		0.21	0.21	0.21	0.20
		0.45 -0.10			

$(\frac{5.9}{2.9})^2 = 4.139$

1.33	2.67
0.19	0.112
1.3	1.4
0.55	0.55
	0.20



①

0.277	0.441	6.45	1.13
0.065	0.34	0.59	0.07
1.2	4.1	2.0	3.0
0.60	0.40 -0.40		
	0.054	0.54	0.55
	0.92		
	2.1		
	0.87		

1.21

②

0.133	0.307	0.69
0.9	0.27	0.8
0.042 -0.040		
0.044		
0.028	0.069	
0.16		
0.5	0.8	

0.25

③

0.277	0.441	22.09	1.39
0.065	0.34	0.20	0.93
1.2	4.6	0.7	3.2
0.60	0.38 -0.40		
	0.054	0.54	0.55
	0.92		
	3.4		
	1.97		

1.21

④

0.250	0.103	0.114	0.458	19.33
0.19	0.20	0.418	0.95	0.112
1.5	1.6	6.0	1.6	0.20
0.55	0.55	0.55	0.55	1.6
				0.55

⑤

0.277	0.441	22.09	1.39
0.065	0.34	0.20	0.93
1.2	4.4	0.7	3.2
0.60	0.38 -0.40		
	0.054	0.54	0.55
	0.92		
	1.6		
	1.55		

1.21

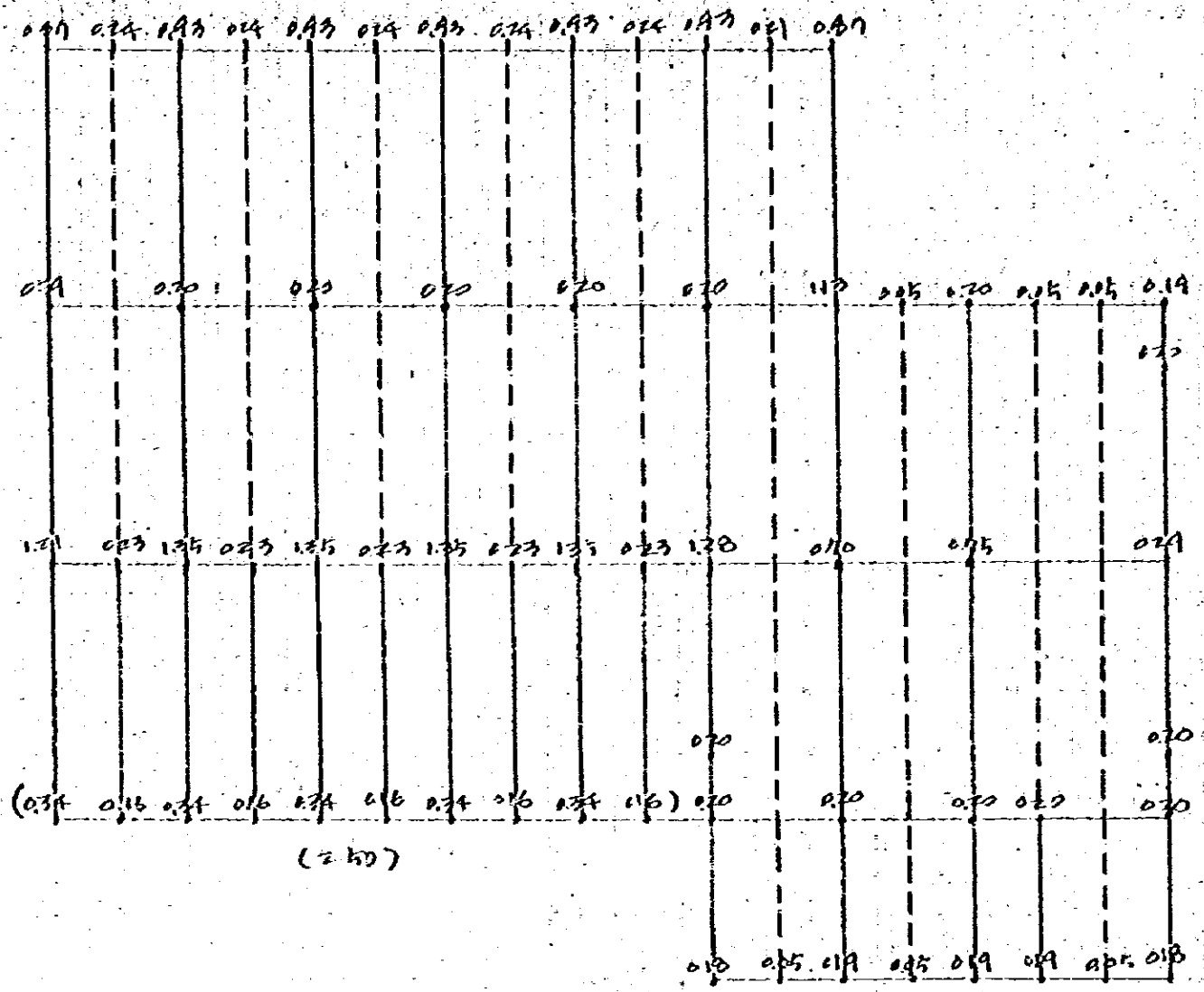
⑥

0.277	0.441	2.13	0.84	1.13
0.065	0.34	0.32	0.884	0.07
1.5	2.4	0.05 -0.05	7.8	3.0
0.55	0.05 -0.10	1.13	0.50	
	0.677	0.14	1.64	
	0.413		0.571	1.22
	5.9		9.0	
	0.50		0.5	0.55

0.77

$\Sigma D_c = 20.26$

$Q_c = 85.93 + 2.50 = 88.43$



$\Sigma D = 24.52$   
 (2.50)  


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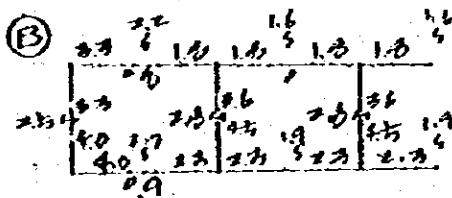
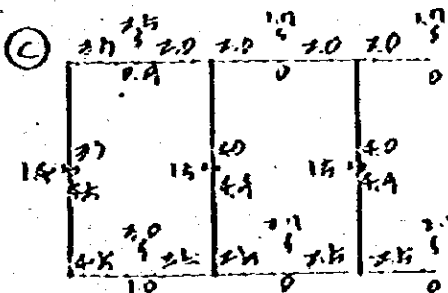
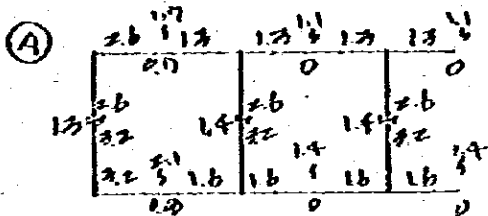
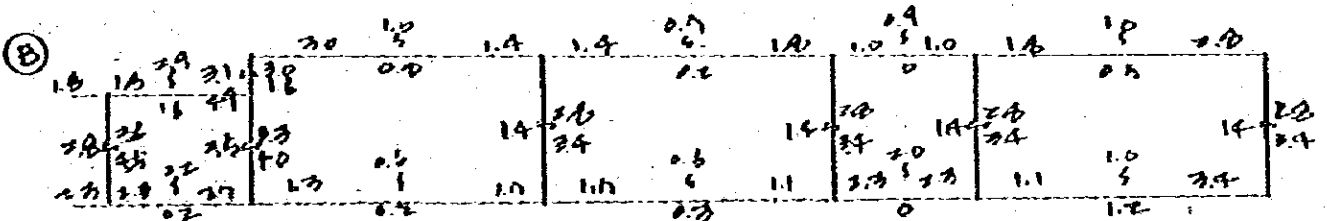
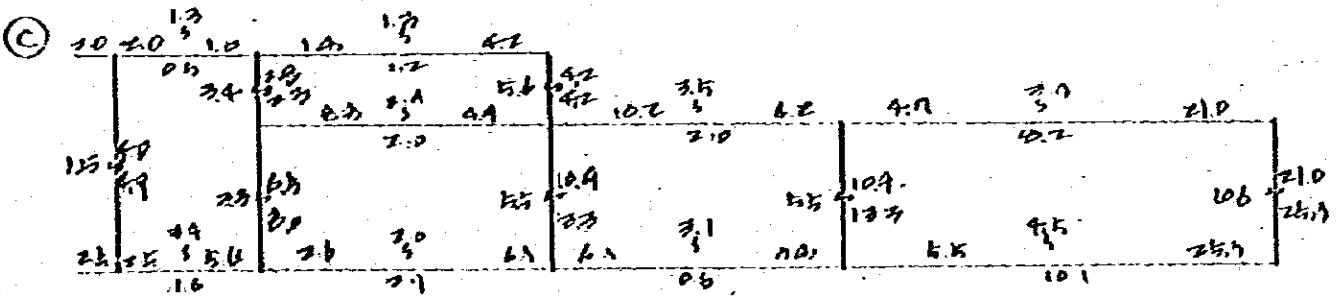
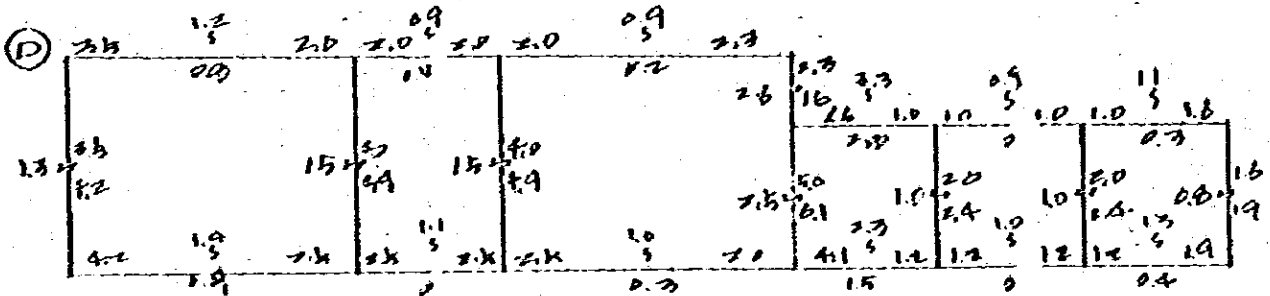
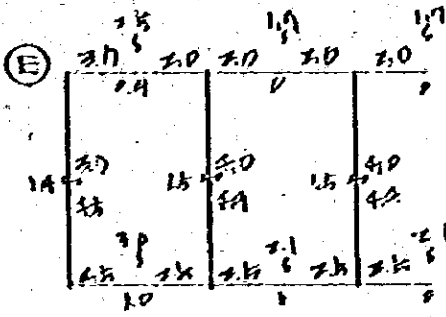
 27.02

$\Sigma D_c = 4.26$

$Q_c = 33.95$

$\Sigma D = 91.88$

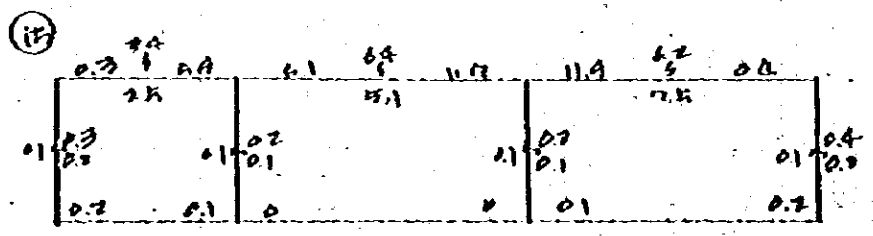
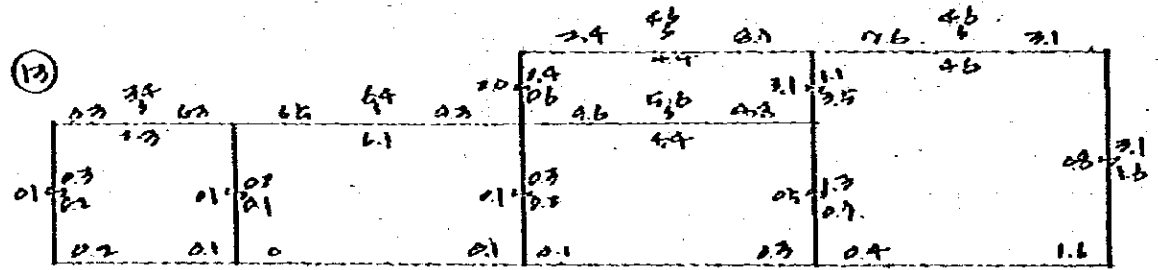
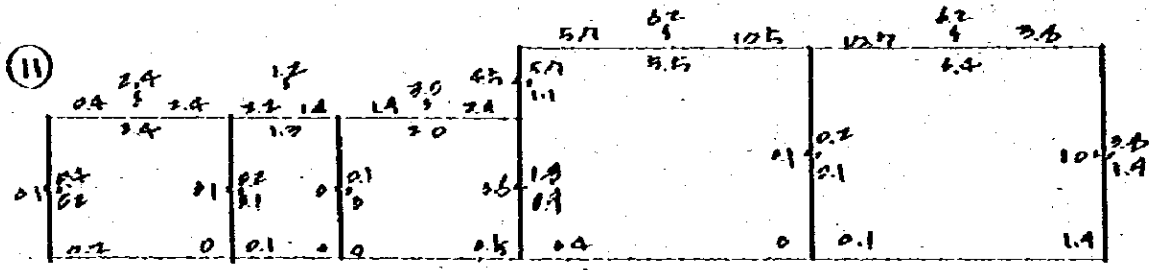
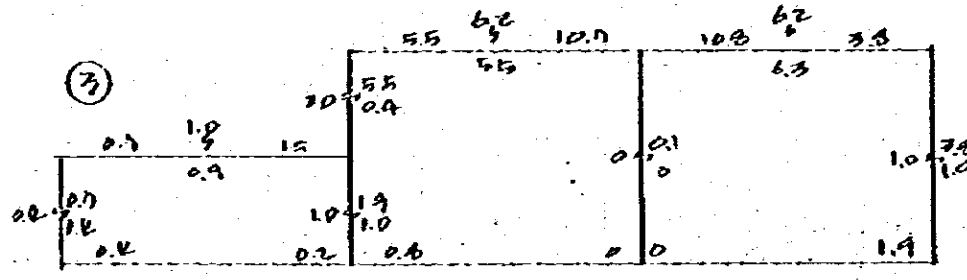
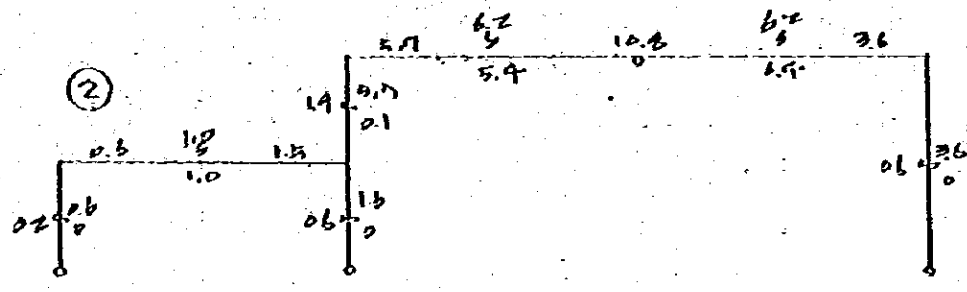
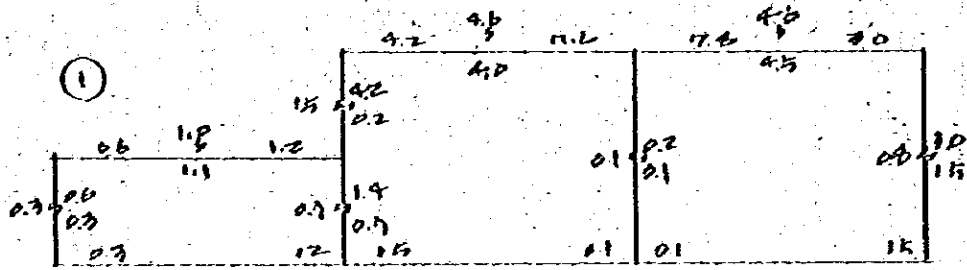
# STRESS DIAGRAM OF SEISMIC FORCE











4-7 DESIGN OF SECTION

(1) BEAM

GRAIN W/B	$\mu_{OE}$	$\mu_{EC}$	$\mu_{EB}$	$Q$	$\mu_{EB}$	$\mu_{EC}$	$Q$
L	0	0.3	0.5	0.9	0.5	0.1	0.9
E	2.6	0.7	1.3	1.7	1.3	0	1.1
S	3.5	1.0	1.8	4.3	1.8		3.1

$b \times D = 20 \times 50$        $\rho = 39.3$        $Q_A = 9.9$

a	2.2	0.8	1.5		1.5	0.1	
n	2-D16	2-D16	2-D16		2-D16	2-D16	

TERRACE	$G_x$	$\mu_E$	$\mu_C$	$Q$	$G_x$	$\mu_E$	$\mu_C$	$Q$
L		0.1	0.1	0.2		1.5	1.0	1.0
E		3.3	0.8	3.2		1.5	0.6	0.3
S		3.9	0.9	4.6		3.0	1.6	1.6

$b \times D = 20 \times 42$        $\rho = 37.3$        $Q_A = 5.8$

a	3.3	0.9			3.1	1.6		
n	2-D16	2-D16			2-D16	2-D16		

GRAIN W/B

	$\mu_{OE}$	$\mu_C$	$\mu_{SE}$	$Q$	$\mu_E$	$\mu_C$	$Q$	$\mu_{SE}$	$\mu_C$	$\mu_{OE}$	$Q$
L	0.7	0.6	10.3	7.4	4.0	2.2	1.2	4.3	12.0	0.3	12.1
E	3.0	0.5	1.4	0.7	1.0	0	0.9	1.8	0.5	2.6	1.0
S	3.7						3.0				3.1

$b \times D = 23 \times 74$        $20 \times 50$        $20 \times 77$

$\rho = 60.7$        $Q_A = 10.1$

a	2.0	7.1	8.9		5.1	2.6		2.6	10.0	1.7	
n	2-D19	2-D19	4-D19		2-D19	2-D19		2-D19	4-D19	2-D19	

$\rho = 1500 / 60.3 \times 12 = 10.2$

GC1111	$\mu_{00}$	$\mu_c$	$\mu_{0E}$	$Q$	$\mu_{01}$	$\mu_c$	$Q$	$\mu_{0E}$	$\mu_c$	$\mu_{0E}$	$Q$
L	0	0.3	0.5	0.9	0.4	0.1	0.9	0	0.7	2.4	0.9
E	3.7	0.9	2.0	2.6	2.0	0	1.7	2.0	0.5	1.0	1.3
S	3.7	1.2	2.5	5.9	2.4		4.3	2.0	1.2	3.0	3.5

$b \times D = 2.0 \times 5.0$

A	3.1	1.0	2.1		2.0	0.1		1.7	1.0	2.9	
M	2.016	2.016	2.016		2.016	2.016		2.016	2.016	2.016	2.016

GC11113	$\mu_{0E}$	$\mu_c$	$\mu_{0E}$	$Q$
L	4.0	6.5	2.4	4.2
E	1.4	1.2	4.2	1.3
S			6.6	6.6

$b \times D = 2.0 \times 7.4$        $y = 6800 / 60.3 \times 1.6 = 6.7$

A	3.3	5.4	2.7
M	2.016	2.016	2.016

GC11115	$\mu_{0E}$	$\mu_c$	$\mu_{0E}$	$Q$	$\mu_{0E}$	$\mu_c$	$\mu_{0E}$	$Q$	$\mu_{0E}$	$\mu_c$	$\mu_{0E}$	$Q$
L	2.2	6.3	6.6	6.0	4.9	3.5	3.3	6.9	24.6	21.3	6.0	14.8
E	6.4	2.0	4.9	2.9	1.7	2.0	1.2	3.5	4.7	8.2	2.6	3.7
S	11.0		11.5	11.0	15.1	5.5		15.9				27.0

$b \times D = 2.0 \times 9.5$        $2.0 \times 9.0$        $j = 9.5$        $2.0 \times 9.0$   
 $i \times Q = 12.5$

A	6.1	13.2	6.4		6.6	2.5	15.7		14.6	14.3	12.1	
M	4.016	3.016	4.016		2.016	2.016	4.016		4.016	3.016	4.016	4.016

$\Delta Q = 13.3 - 12.5 = 0.8$

$\Delta Q / j = 2.07$

$P_{10} = 0.41$

$v_{13} x = 25.5 / 1.3 \times 0.41 = 22$   
 $\rightarrow 11.5 \text{ @}$

$y = 14.8 / 1.3 \times 1.2 = 14.1$

GRIN 13	ROE	RL	REZ Q	RS	RL	Q
L	0.7	11.4	11.5	1.0	11.4	2.6
E	2.8	0.0	2.0	1.2	2.0	0.4
S	3.8					

$S = 11.0 / 1.2 = 9.1$

$4.4 = 2.0 \times 2.2 \quad j = 74.7$

A	1.7	7.7	7.7	7.7	5.8
n	2.22	2.22	2.22	2.22	2.22

GRIN 14	ROE	RL	REZ Q	RS	RL	ROE	Q
L	0.7	0.2	0.4	0.9	0.4	0.3	0.1
E	6.6	2.0	1.0	3.3	1.0	0.3	1.6
S	6.6	3.0	1.4	7.5	1.4	0.6	1.7

$6 \times 10 = 2.4 \times 2.5$

A	5.8	2.5	1.2	1.2	0.5	1.4
n	1.16	2.16	2.16	2.16	2.16	2.16

GRIN 15	ROE	RL	REZ Q	RS	RL	Q
L	0.1	0.3	0.4	0.9	0.4	0.1
E	3.7	0.9	2.0	2.5	2.0	0
S	2.0	1.2	2.4	5.9	2.4	4.3

$6 \times 6 = 2.4 \times 2.5$

A	3.2	1.0	2.0	2.0	0.1
n	2.16	2.16	2.16	2.16	2.16

Figure	$\mu_{FE}$	$\mu_c$	$\mu_{SE}$	$\alpha$	$\mu_{SE}$	$\mu_c$	$\mu_{OE}$	$\alpha$
L	4.2	4.0	7.6	4.6	7.4	4.5	3.0	4.6
E	12.7	4.6	2.7	1.9	2.7	2.7	2.0	1.3
S	16.5	4.6		2.4		7.2	11.0	7.2

$b \times D = 2.0 \times 17.4$

A	6.7	4.9	6.3		6.5	4.0	6.1	
M	4-D19	2-D19	4-D19		4-D19	2-D19	4-D19	

Figure	$\mu_{FE}$	$\mu_c$	$\mu_{SE}$	$\alpha$	$\mu_{SE}$	$\mu_c$	$\mu_{OE}$	$\alpha$
L	5.7	5.4	10.8	6.2	10.8	6.4	3.6	6.2
E	2.7	1.4	0	0.3	0	2.4	4.7	0.6
S							4.3	

$b \times D = 2.0 \times 17.4$

$\delta = 6700 / 62.7 \times 12 = 2.6$

A	4.7	4.6	8.9		4.9	5.3	4.6	
M	2-D19	2-D19	4-D19		4-D19	2-D19	2-D19	

Figure	$\mu_{FE}$	$\mu_c$	$\mu_{SE}$	$\alpha$	$\mu_{SE}$	$\mu_c$	$\mu_{OE}$	$\alpha$
L	5.5	5.5	10.7	6.2	10.6	6.3	3.6	6.2
E	11.1	6.6	1.0	1.9	1.0	3.6	8.5	1.2
S	19.6	12.1		10.0		10.1	12.3	

$b \times D = 2.0 \times 17.4$

A	10.8	6.7	3.9		9.0	5.6	6.8	
M	4-D19	2-D19	4-D19		4-D19	2-D19	4-D19	

Figure	$\mu_{FE}$	$\mu_c$	$\mu_{SE}$	$\alpha$	$\mu_{SE}$	$\mu_c$	$\mu_{OE}$	$\alpha$
L	5.7	5.5	10.5	6.2	10.7	6.4	3.6	6.2
E	6.7	2.9	1.0	1.0	1.0	3.8	8.5	1.2
S	12.4	8.5				10.2	12.3	

2.0 x 17.4

A	6.3	4.6	4.7		3.9	5.6	6.8	
M	4-D19	2-D19	4-D19		4-D19	2-D19	4-D19	

GRADE	ROE	MC	MSE	Q	MSE	MC	ROE	Q
L	7.4	4.4	4.7	4.6	4.6	4.6	3.1	4.6
E	1.0	0.1	2.0	0.5	2.0	2.0	4.0	1.3
S	4.2					2.6	11.1	

6x02 20x75

A	2.3	3.6	7.2		6.3	4.2	6.1
n	2-D19	2-D19	4-D19		4-D19	2-D19	4-D19

GRADE

	ROE	MC	MSE	Q	MSE	MC	Q	MSE	MC	ROE	Q
L	0.4	2.4	2.4	2.4	2.2	1.3	1.2	1.4	2.0	2.4	3.0
E	2.6	0.1	1.1	0.1	2.1	0	1.2	1.1	6.9	14.4	2.0
S	3.2			3.0	4.3		4.6	2.0	4.9	12.3	4.4

6x02 26x50

A	2.7	3.1	3.1		3.6	1.7		2.5	7.5	14.7
n	2-D16	2-D16	2-D16		2-D16	2-D16		2-D16	4-D16	4-D22

GRADE

	ROE	MC	MSE	Q	MSE	MC	MSE	Q	MSE	MC	ROE	Q
L	0.2	2.2	6.2	2.4	6.5	6.1	9.2	6.4	4.6	4.4	4.3	5.6
E	2.0	1.0	1.0	0.7	2.2	2.1	3.2	1.3	6.5	6.3	20.1	3.4
S	2.2					9.2	17.6		16.1	11.2	24.9	12.4

6x02 28x50

28x74

28x74

A	2.6	2.7	4.0		5.4	5.1	9.7		3.9	6.2	13.0
n	2-D19	2-D19	4-D19		2-D19	2-D19	4-D19		4-D19	3-D19	4-D22

GRADE

	ROE	MC	MSE	Q	MSE	MC	MSE	Q	MSE	MC	ROE	Q
L	0.2	2.5	5.9	3.9	6.1	5.1	11.7	6.9	11.9	2.5	0.4	6.0
E	3.0	1.0	1.0	0.7	2.2	1.9	5.9	1.0	6.0	1.4	3.2	1.2
S	3.3						17.6		17.9		3.6	

A	2.0	3.1	7.5		5.1	4.2	9.7		9.9	6.2	2.0
n	2-D19	2-D19	4-D19		2-D19	2-D19	4-D19		4-D19	3-D19	2-D19



(2) COLUMN

CB1	x P Y	x M Y	x Q Y
L	1.7	0 0.6	0 0.3
E	2.2 0.2	3.3 1.4	2.5 1.2
S	3.9 1.9 -0.5 1.5	4.0 2.4	5.0 2.7

$b \times D = 2.8 \times 2.8$        $s \times A = 5.1$

	x P/10 Y	x M/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x A <sub>1</sub> Y	x M <sub>1</sub> Y
L	2.2	0 3.4	- 0.14		
E	3.0 2.4 -0.5 1.9	1.8 13.6	0.03 0.95	6.2 7.4	4.2 2.022 2.022

CB3	x P Y	x M Y	x Q Y
L	1.9	0 0.9	0 0.4
E	0.6 0.3	3.6 1.4	2.8 1.2
S	2.5 2.2 1.3 1.5	4.5 2.5	5.6 2.8

$b \times D = 2.8 \times 2.8$        $s \times A = 5.1$

$\Delta Q = 5.6 - 5.1 = 0.5$   
 $0.7/1.1 = 0.6$   
 $P_{10} = 0.25$   
 $D \times X = 14.3 / 1.1 \times 1.1 = 2.4$

	x P/10 Y	x M/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x A <sub>1</sub> Y	x M <sub>1</sub> Y
L	2.4	0 4.0	- 0.18		
S	3.2 2.8 1.7 2.0	2.3 14.1	0.18 1.03	6.1 8.0	4.2 2.022 3.022 2.022

CB1	x P Y	x M Y	x Q Y
L	15.0	0 4.2	0 1.5
E	2.5 1.7	3.7 12.3	1.4 4.1
S	17.5 15.0 12.5 12.3	4.5 16.5	2.8 4.7

$b \times D = 7.5 \times 2.8$

$s \times P_A = 12.6$   
 $s \times Q_A = 15.4$

	x P/10 <sup>2</sup> Y	x M/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x A <sub>1</sub> Y	x M <sub>1</sub> Y
L	0.2	0.2 7.7	-		
S	8.4 8.0 5.9 6.3	9.6 10.5	0.3 0.33	6.3 6.9	3.019 4.019

Cc2

	x P Y	x H Y	x Q Y
L	12.6	0 0 5.7 0	0 1.9
E	0.8 0	4.9 2.1 4.9 0	15 0.9
S	12.9 11.4	12.6 4.9 2.4	30 3.7

$b \times D = 115 \times 2.8$

	x P/10 Y	x H/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x Q <sub>1</sub> Y	x H Y
L	6.0	0 3.6	- 0.0		
S	6.4 6.0	10.4 5.4	2.3 0.12	4.8 2.5	2.0 1.9 7.0 1.9

Cc3

	x P Y	x H Y	x Q Y
L	12.6	0 5.5 0 1.0	0 2.0
E	0 1.7	4.9 1.1 4.9 0.6	1.5 4.6
S	12.3 14.3 10.9	4.9 1.6	3.0 11.2

$b \times D = 175 \times 2.8$

	x P/10 Y	x H/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x Q <sub>1</sub> Y	x H Y
L	6.0	0 2.5	- 0.0		
S	6.0 6.5 5.2	10.4 12.5	2.3 0.3	4.8 9.0	2.0 1.9 9.0 1.9

C11

	x P Y	x H Y	x Q Y
L	20.2	0.3 0.8 0.2 0.1	0.1 0.1
E	1.2 0.6	3.5 5.3 5.2 0.5	1.3 2.0
S	21.4 20.2 19.0 14.6	4.4 6.6	2.7 4.1

$b \times D = 60 \times 2.8$

$H/D = 590/120 = 4.9$   
 $\beta = 1.31$

	x P/10 Y	x H/10 <sup>2</sup> Y	x P <sub>1</sub> Y	x Q <sub>1</sub> Y	x H Y
L	15.8	1.0 0.3	- -		
S	16.7 16.3 15.0 15.3	10.3 8.6	2.3 0.12	4.6 2.0	2.0 1.9 7.0 1.9

CD	x P Y	x M Y	x Q Y
L	307	0 0	0 0
E	0.3 0.7	40 49	1.5 0.1
S	31.0 31.4 30.4 32.0	4.4 2.3	2.0 1.4

$b \times D = 40.8$

$aB \frac{1}{2} = 10.1$

	x P/100 Y	x M/100 Y	x P1 Y	x Q1 Y	x M Y
L	11.2	0.2 0.2	-	-	-
S	11.0 11.6 11.0 11.7	0.2 3.0	1.10	-	12.6

$\Sigma A = 12 - 0.13$

CE1	x P Y	x M Y	x Q Y
L	16.2	0 3.0 0 1.5	0 0.3
E	2.5 1.3	3.3 4.5 4.5 9.3	1.4 2.0
S	12.7 12.5 12.7 14.4	4.4 11.3	2.3 6.3

$b \times D = 75 \times 2.2$

	x P/100 Y	x M/100 Y	x P1 Y	x Q1 Y	x M Y
L	7.1	0.2 1.4	-	-	-
S	9.0 8.3 6.5 11.1	12.4 7.2	0.33 0.16	6.9 3.3	3.019 7.019

CE2	x P Y	x M Y	x Q Y
L	15.4	0 2.6 0 0	0 0.6
E	0.7 0.6	4.0 4.7 4.9 0	1.5 0.3
S	16.7 16.5 15.1 15.3	4.4 0.3	2.0 2.2

$b \times D = 75 \times 2.2$

	x P/100 Y	x M/100 Y	x P1 Y	x Q1 Y	x M Y
L	0.6	0 2.3	-	-	-
S	2.0 2.4 7.2 7.3	10.4 5.3	0.32 0.1	6.7 2.1	3.019 2.019

Case	x P Y	x R Y	x Q Y
L	15.9	0 3.4 0 1.9	0 1.0
E	0 1.2	4.0 2.15 4.9 10.4	15 22
S	15.9 17.1 15.7	4.9 12.3	2.0 24

$b \times D = 15 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	7.6	0 2.0	-	-	-
B	7.6 3.1 2.0	10.9 2.6	0.35 0.20	2.4 4.2	2.014 2.019

Case	x P Y	x R Y	x Q Y
L	7.3	0 0.4 0 0.2	0 0.1
E	1.7 0.7	2.6 2.8 2.2 3.4	1.3 4.9
S	9.0 2.0 5.6 6.6	3.2 3.6	2.6 2.9

$b \times D = 2.8 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	9.0	0 2.3	-	-	-
S	14.6 10.3 9.2 8.5	14.1 10.3	0.15 0.76	5.1 5.4	2.022 2.022

Case	x P Y	x R Y	x Q Y
L	7.7	0 0.3 0 0.2	0 0.1
E	0 0.7	2.6 2.0 1.2 3.6	1.4 1.5
S	7.7 4.4 2.0	3.2 3.6	2.6 3.1

$b \times D = 2.8 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	9.6	0 1.7	-	-	-
S	9.6 10.6 9.0	14.1 21.5	0.6 0.34	4.7 6.6	2.022 2.022

Case	x P Y	x R Y	x Q Y
L	10.1	0 0.3	0 0.1
E	0 0.7	26 3.2	14 1.5
S	10.1 10.3 9.9	22 2.4	2.8 3.1

$b \times D = 2.8 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	13.0	0 1.7	-	-	-
S	13.0 13.9 12.1	12.1 2.5	0.2 0.7	4.5 6.6	2.022 2.022

Case	x P Y	x R Y	x Q Y
L	11.2	0 0.1	0.6 0.1
E	1.9 1.1	2.2 2.9	2.1 1.6
S	12.7 12.9 9.9 10.7	4.0 4.0	6.2 3.3

$b \times D = 2.8 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	15.2	4.0 1.1	-	-	-
S	17.6 16.6 12.7 13.4	22.6 22.6	2.4 2.1	7.5 12.6	2.022 2.022

Case	x P Y	x R Y	x Q Y
L	22.0	0 0.1	0 0.1
E	0.3 0.6	2.8 3.2	1.4 1.6
S	22.1 22.4 22.5 22.2	2.4 4.0	2.8 3.3

$b \times D = 2.8 \times 2.8$

	x P/100 Y	x R/100 Y	x P1 Y	x A1 Y	x M Y
L	42.2	0 1.1	-	-	-
S	22.5 42.9 41.3 41.4	12.2 12.2	0.4 1.2	7.0 9.6	2.022 2.022

C <sub>1213</sub>	x	P	Y	x	Π	Y	x	Q	Y
L		26.1		0.1	0.1	0.1	0	0.1	
E	0.2	0.3		2.8	3.1	3.9	1.4	1.6	
S	26.3	26.4		3.4	3.5	4.0	2.7	3.3	
		25A	25.8						

$b \times D = 2.0 \times 2.0$

	x	P/60Y	x	Π/60 <sup>2</sup> Y	x	P <sub>A</sub> Y	x	A <sub>A</sub> Y	x	ΠY
L		3.35		0.6	1.1	-	-	-	-	-
B	3.3	3.9		4.2	14.4	0.2	0.2	6.4	2.0	2.0
		3.2	3.2		2.6		1.1			

C <sub>111</sub>	x	P	Y	x	Π	Y	x	Q	Y
L		8.1			0.1	0		0	
E		0.9			2.7	3.9		1.6	
S		9.0			3.9			3.2	
			7.2						

$\frac{N}{P} = \frac{450}{30} = 15.0$   
 $\beta = 1.05$

$b \times D = 2.0 \times 2.0$

	x	P/60Y	x	Π/60 <sup>2</sup> Y	x	P <sub>A</sub> Y	x	A <sub>A</sub> Y	x	ΠY
L		10.9			0.6	-	-	-	-	-
B			12.2		2.1	0.45		3.9		2.0
			9.0							

C <sub>111</sub>	x	P	Y	x	Π	Y	x	Q	Y
L		23.0		1.6	5.0	0.7	2.2	4.5	
E	2.9	1.7		2.8	6.9	8.0	3.4	11.6	
S	26.1	25.5		3.3	12.9	2.7	4.0	20.7	
		10.9	22.1		2.6				

$\Delta Q = 23.7 - 15.0 = 17.3$   
 $\Delta Q / Q = 0.116$   
 $PW = 0.66$   
 $\Delta P = 2.2 \times 25.4 / 28 \times 0.66 = 13.3$   
 $\rightarrow 10.0$

$b \times D = 7.5 \times 2.0$

	x	P/60Y	x	Π/60 <sup>2</sup> Y	x	P <sub>A</sub> Y	x	A <sub>A</sub> Y	x	ΠY
L		11.3		3.4	3.6	-	-	-	-	-
S	12.0	9.9		17.7	3.9	0.4	2.1	12.4	2.0	2.0
			10.5		2.9	1.0		21.9		

Cc13	x P Y	x M Y	x Q Y
L	28.1	2.4 0.1	2.4 0.2
E	0.9 2.6	4.2 13.3	1.8 13.0
S	39.0 40.1 30.2 35.5	13.4	13.2 13.6 13.2

b x D = 40 x 40

	x P/b <sup>2</sup> Y	x M/b <sup>2</sup> Y	x P Y	x At Y	x M Y
L	23.8	4.0 4.0	-	-	-
S	24.4 25.4 23.2 23.2	22.4 22.1	1.02 0.99	16.3 15.6	4-D25 4-D25

Cc15	x P Y	x M Y	x Q Y
L	38.4	1.3 0.1	0.2 0.1
E	2.2 0.2	10.4 13.3	11.9 14.5
S	38.6 38.6 38.2 38.2	14.0 14.6	11.5 12.1

b x D = 40 x 40

	x P/b <sup>2</sup> Y	x M/b <sup>2</sup> Y	x P Y	x At Y	x M Y
L	24.0	2.2 0.3	-	-	-
S	24.1 24.1 23.6 23.4	23.4 24.4	1.11 1.16	17.6 18.6	4-D25 4-D25

Cc16	x P Y	x M Y	x Q Y
L	25.8	6.0 3.0	0 0
E	3.7 0	21.0 25.7	6.6 5.6
S	29.5 25.8 22.1	28.7 5.6	23.3 4.6

b x D = 60 x 20

	x P/b <sup>2</sup> Y	x M/b <sup>2</sup> Y	x P Y	x At Y	x M Y
L	15.9	6.0 0	0.13 -	-	-
S	17.6 15.4 17.1	28.5 18.6	1.44 0.91	24.2 6.9	5-D25 2-D25

Col 3	x P Y	x R Y	x Q Y
L	28.8	0 0	0.6 3.1
E	2.4 2.6	2.3 4.1	2.6 4.1
S	31.2 31.4 26.4 16.2	6.1 26.1	5.0 22.5

$b \times D = 60 \times 2.8$

	x P/bD Y	x R/bD <sup>2</sup> Y	x P <sup>2</sup> Y	x d <sub>1</sub> Y	x M Y
L	17.2	2.4 1.1	-	-	-
S	16.6 15.7 15.0 15.6	16.1 24.9	0.52 1.17	0.6 1.6	2.075 4.075

Col 14	x P Y	x R Y	x Q Y
L	10.3	0 0	0 0
E	2.4 0.2	2.2 1.3	1.0 0.4
S	12.7 15.5 0.9 10.1	2.4 1.0	2.0 0.0

$b \times D = 2.0 \times 2.0$

	x P/bD Y	x R/bD <sup>2</sup> Y	x P <sup>2</sup> Y	x d <sub>1</sub> Y	x M Y
L	13.2	0 0	-	-	-
S	16.2 13.5 10.1 12.9	13.6 10.2	0.61 0.21	0.2 1.6	2.019 2.019

Col 18	x P Y	x R Y	x Q Y
L	4.3	0 0	0 0
E	1.1 2.4	1.8 3.0	0.8 1.5
S	5.4 6.0 2.2 1.9	1.9 3.6	1.6 3.0

$b \times D = 2.8 \times 2.8$

	x P/bD Y	x R/bD <sup>2</sup> Y	x P <sup>2</sup> Y	x d <sub>1</sub> Y	x M Y
L	5.8	0.6 0	-	-	-
S	6.4 4.6 2.1 2.5	10.7 20.3	0.77 0.81	2.9 6.3	2.022 2.022



(3) TIE BEAM

FGA 1211 B 1213 35 x 90

$$j = 92.6$$

$$w = 0.76$$

$$M_{DE} = 32 + 0 = 32$$

$$M_{FE} = 1.6 + 0 = 1.6$$

$$l = 232 \quad w' = 0.55 + 0.55 \times 1.11 = 1.16$$

$$C = 1.776 \times 232^2 / 12 = 0.6$$

$$M_0 = \quad \quad \quad / d = 0.9$$

$$D = 1.76 \times 232 / 2 = 1.6$$

$$M_E = 1.20 = 0.7 \quad \Sigma M_{FE} = 1.6 + 0.7 = 2.3$$

$$A_{DE} = 3.2 / 0.726 \times 3.0 = 1.5 \quad 2-D19$$

$$A_{FE} = 2.3 / \quad \quad \quad = 1.1 \quad 2-D19$$

FGC 1211 B 1213

$$M_{DE} = 4.5 + 0 = 4.5$$

$$M_{FE} = 2.5 + 0 = 2.5$$

$$\Sigma M_{FE} = 2.5 + 0.7 = 3.2$$

$$A_{DE} = 4.5 / 1.776 \times 3.0 = 2.1 \quad 2-D19$$

$$A_{FE} = 3.2 / \quad \quad \quad = 1.5 \quad 2-D19$$

FGB 1211 35 x 60

$$j = 46.3$$

$$w = 0.51$$

$$M_{DE} = 4.0$$

$$M_{FE} = 2.3$$

$$l = 232 \times 1.7 = 4.64 \quad w' = 0.51 \quad p = 1.9^T$$

$$C = 0.51 \times 4.64^2 / 12 + 1.9 \times 4.64 / 1.7 = 0.92 + 1.10 = 2.0$$

$$M_0 = \quad \quad \quad / d + \quad \quad \quad / d = 1.37 + 2.20 = 3.6$$

$$D = 0.51 \times 4.64 / 2 + 1.9 / 1.7 = 1.13 + 0.95 = 2.1$$

$$\Sigma M_{FE} = 2.3 + 2.0 \times 1.2 = 4.7$$

$A_{0E} = 4.0 / 0.163 \times 3.0 = 7.4 \quad 2-019$

$A_{1E} = 4.7 / \quad \quad \quad = 3.4 \quad 2-019$

$A_{2E} = 3.6 / 0.117 \times 2.0 = 3.1 \quad 2-019$

FGD II ~ 18

$R_{0E} = 3.4 + 0.0 = 3.4$

$R_{1E} = 1.7 + 0 = 1.7$

$l = 4.64 \quad w' = 0.15 + 0.54 \times 2.1 = 1.90 \quad l = 1.72$

$C = 1.90 \times 4.64^2 / 12 = 3.4 \quad 0.96 \quad 1.4 \quad 1.90 \times 2.37^2 / 12 = 0.9$

$R_{00} = \quad \quad \quad / b = 5.1 \quad 2.0 \quad \quad \quad / b = 1.3$

$Q = 1.90 \times 4.64 / 2 = 4.4 \quad 1.8 \quad 1.90 \times 2.37 / 2 = 2.2$

0	0.15	0	0.5	0	1.5	0	1.0	0	0.38	0
0.5	0.5	0.3	0.7	0.5	0.5	0.3	0.7	0.7	0.2	
+7.9	-2.0	+2.0	-3.4	+3.6	-2.4	+3.4	-1.4	+1.4	-1.3	
"	"	+0.3	+1.1	0	"	-0.7	-1.3	-0.1	0	
10.1	0	0	0	+0.5	-0.3	0	0	-0.6		
-0.1	0	0	0	-0.1	-0.1	0	0	+0.4	+0.2	



$2R_{1E} = 1.7 + 3.8$

$A_{0E} = 3.6 / 0.156 \times 3.0 = 1.7 \quad 2-019$

$A_{1E} = 3.7 / 0.176 \times 2.0 = 2.1 \quad 2-019$

FGD II ~ 19

$R_{0E} = 2.5 + 0.0 = 2.5$

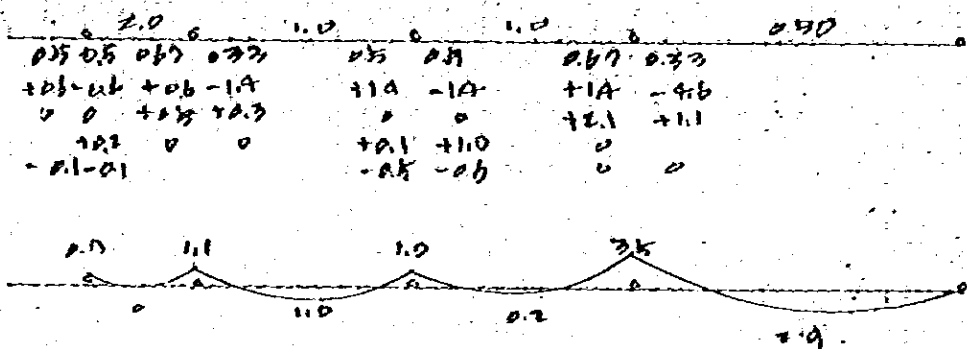
$R_{1E} = 0.7 + 0.5 = 1.2$

$l = 6.96 \quad w' = 0.76$

$C = 0.76 \times 6.96^2 / 12 = 3.1$

$R_{00} = \quad \quad \quad / b = 4.6$

$Q = 0.76 \times 6.96 / 2 = 2.6$



$$\Sigma M_{2E} = 3.2 + 3.5 = 11.7$$

$$A_{0E} = 20.7 / 0.76 \times 3.0 = 13.2 \quad \text{z-222}$$

$$A_{1E} = 11.7 / \dots = 5.4 \quad \text{z-222}$$

FQ 1213

$$M_{2E} = 4.2 + 0.2 = 4.4$$

$$M_{1E} = 2.5 + 0 = 2.5$$

$$M_D = 1.76 = 1.4 \times 1.2 = 1.7$$

$$\Sigma M_{2E} = 2.5 + 1.7 = 4.2$$

$$A_{0E} = 9.4 / 0.76 \times 3.0 = 2.0 \quad \text{z-219}$$

$$A_{1E} = 4.2 / \dots = 1.9 \quad \text{z-219}$$

FQ 3D~E 1E~E

$$M_{1E} = 2.1 + 0.4 = 2.5$$

$$2.1 + 0.3 = 2.4$$

$$M_{2E} = 7.5 + 0.8 = 8.3$$

$$6.4 + 0.5 = 6.9$$

$$M_{3E} = 1.2 + 0 = 1.2$$

$$2.3 + 0.1 = 2.4$$

$$M_{4E} = 10.4 + 1.9 = 12.3$$

$$9.0 + 1.5 = 11.7$$

$$l = 3.17 \quad w = 0.51$$

$$l = 2.96 \quad w = 0.76 \quad (2.58)$$

$$C = 0.67 \times 2.96^2 / 12 = 2.8$$

$$0.76 \times 2.96^2 / 12 = 4.0 \quad 19.4$$

$$M_0 = \dots / 1.3 = 4.2$$

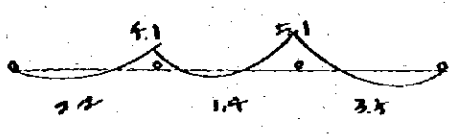
$$\dots / 1.3 = 6.0 \quad 29.1$$

$$D = 0.67 \times 3.17^2 / 12 = 2.1$$

$$0.76 \times 2.96^2 / 12 = 3.0 \quad 19.6$$

③

0	0.22	0	1.0	0	0.22	0
	0.17	0.42	0.17	0.42		
	+52	-40	+50	-60		
	0	-12	+11	+0.9		
		+0.5	-0.1			
	-0.1	-0.4	+0.1			



2nd  $b \times D = 70 \times 10 \quad j = 42.3$

$\Sigma H_{2E} = 2.1 + 0.2 + 5.1 = 6.5$

$a = 6.5 / 0.467 \times 2.0 = 9.7 \quad 2-D19$

1st  $b \times D = 75 \times 90 \quad j = 72.6$

$\Sigma L_E = 8.7 + 5.1 = 13.4$

$\Sigma E = 1.2 + 5.1$

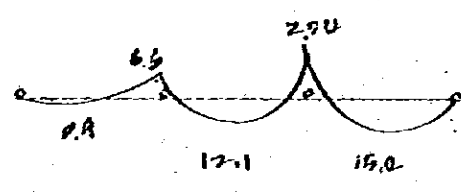
$a_{1E} = 13.4 / 0.546 \times 2.0 = 5.9 \quad 2-D19$

$a_{2E} = 5.1 / 0.771 \times 2.0 = 3.5$

$a_{3E} = 12.7 / 0.776 \times 2.0 = 5.6 \quad 2-D19$

①

0	0.17	0.42	0.17	0.42	0
	+42	-19.4	+18.4	-29.1	
	+2.7	+12.5	+5.5	+4.2	
		+3.7	+6.2		
	-0.5	-2.2	-2.5	-2.7	
		-1.7	-1.1		
	+0.3	+1.4	+0.6	+2.5	
		+0.3	+0.7		
	-0.1	-0.2	-0.4	-0.3	



$1.3 + 0.2 + 6.6 = 6.9$

$6.9 / 0.467 \times 2.0 = 9.7 \quad 2-D19$

$\Sigma L_E = 12.7$

$6.9 + 6.6 = 13.5$

$2.9 + 27.4$

$13.5 / 0.546 \times 2.0 = 6.2 \quad 3-D22$

$27.4 / 0.776 \times 2.0 = 17.9 \quad 5-D22$

$11.7 / 0.776 \times 2.0 = 5.2 \quad 3-D22$

$a_{1E} = 15.4 / 0.776 \times 2.0 = 10.6 \quad 3-D22$

$\omega = 14.680 / 17.4 \times 10 = 20$

$a_{2E} = 14.6 + 27.4 / 17.4 - 12.7 = 5.3$

$a_{3E} = 2.09 \quad p_{4E} = 0.41$

$p_{13} \times 2.54 / 3.5 \times 2.54 = 17.7 \rightarrow 15 \text{ @}$

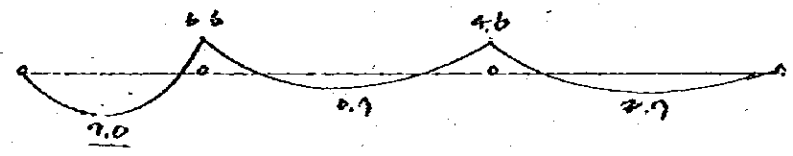




FG 15A 20

R	536	315	1746
w	247	0.76	0.73
L	69	4.2	4.0
M <sub>0</sub>	10.3	6.7	6.0
Q	50	7.1	7.0

1.14	0	1.0	0	0.57	0
0.53	0.47	0.66	0.44		
+1.03	-4.2	+4.2	-6.0		
-3.2	-2.9	+1.0	+0.6		
-0.7	+1.5	-1.4	+0.6		
-0.2	-0.2	+0.6	+0.6		
-0.2	-0.2	-0.1	0		
		+0.2	0		



M <sub>L</sub>	0.2	0.1	0	0	0.1	0.2
M <sub>E</sub>	3.6	2.4	1.6	2.2	1.7	3.4

M <sub>L</sub>	7.8	9.1	12.0	9.1
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A	1.7	4.3	4.2	3.5	1.9
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n-DIA	2	2	2	2	2	2	2
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FG 16 A2      M<sub>E</sub> = 3.6 + 0.0 = 3.6

M<sub>L</sub> = 10.3

A<sub>13</sub> = 1.8      7-DIA

A<sub>12</sub> = 9.1      7-DIA

(4) FOOTING:

$$f_p \approx 3 * 25 \text{ T}$$

$$w = 0.9 \times 0.9 \times 0.15 \times 2.4 = 1.15$$

$$s_p' = 25 - 2.5 = 22.5$$

	P	WALL	F <sub>q</sub>	ZP	355 x 50	l x l'
B3	3.8		44	8.2	1	90 x 90
C1	115.0	0.81 x 1.02 0.83 2.91 x 3.76 10.8	11.50	38.3	3	90 x 750
C2	17.6	0.81 x 2.04 1.65	66.0	20.9	2	90 x 160
D1	20.2	2.91 x 5.42 15.7	78.1	43.8	3	90 x 750
D3	30.7		95.8	40.3	3	"
E1	16.2	0.81 x 1.02 0.83 2.91 x 3.76 10.8	39.1	31.9	2	90 x 180
E2	15.9	0.81 x 2.04 1.65	47.9	22.3	2	"
A11	7.3	0.81 x 1.02 0.83 1.75 x 2.54 3.83	2.92	14.5	1	90 x 90
A12	7.7	0.81 x 2.04 1.65	17.6	11.1	1	"
A15	10.1	0.81 x 2.04 1.65 1.75 x 1.65 2.21	3.30	17.3	1	"
B11	11.9 11.8	1.35 x 4.72 6.37	66.2	25.7	2	90 x 180
B13	32.8	1.35 x 6.30 8.51	86.6	48.0	3	90 x 200
B15	26.1	1.35 x 4.55 6.16	77.7	40.8	3	"
B11	8.1		3.10	11.1	1	90 x 90
C11	23.8	0.81 x 2.76 2.21	2.83	35.7	3	90 x 200
C13	38.1		2.83	46.0	3	"
C15	38.4		10.53	48.9	4	180 x 180
C18	24.8	0.81 x 2.76 2.21 2.91 x 3.76 10.8	7.11	36.6	3	90 x 750
D13	28.8	0.81 x 1.02 0.83	3.51	41.2	4	180 x 180
D14	10.3	0.81 x 2.04 1.65	4.74	16.7	1	90 x 90



F1 90x90  $b = 60$   $d = 46.3$   
 $n = 15 - 0.16$

F2 90x120  $p = 60$   
 $r_p = 0.94 \times 16.0$   
 $T_2 = 16.000 / 90 \times 46.3 = 3.8 < 5.0$   
 $g = 16.000 / 46.3 \times 15 = 27$   
 $A = 16.0 \times 0.45 / 0.463 \times 2.0 = 9.0$  }  $b = 0.16$

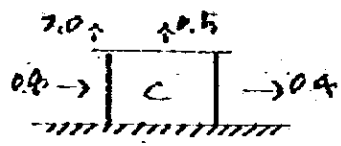
F3 90x270  
 $r_p = 46.0 / 3 = 15.3$   
 $g = 15.300 / 46.3 \times 15 = 27.0$   
 $A = 15.3 \times 0.9 / 0.463 \times 2.0 = 14.9$  }  $b = 0.19$

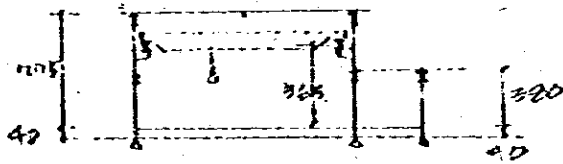
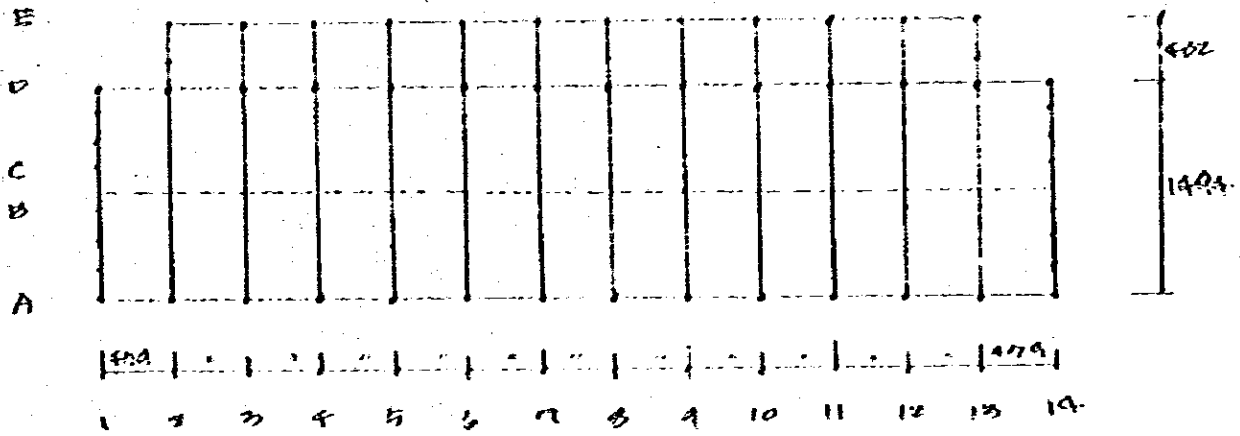
F4 120x120  
 $r_p = 49.2 / 4 = 12.3$   
 $T_4 = 12.300 \times 2 / 120 \times 46.3 = 4.4 < 5.0$   
 $g = 24.600 / 46.3 \times 15 = 35.4$   
 $A = 12.3 \times 2 \times 0.45 / 0.463 \times 2.0 = 12.0$  }  $b = 0.19$

5 実 習 棟

5-1 LOAD

ROOF	STEEL FOLDED PLATE	20	} 60 $\text{PSF}/\text{ft}^2$
	BEAM	25	
	TIE etc	15	
WALL	SIDING	25	} 40
	STUB	15	
	BRICK	400	
COLUMN		70 $\text{PSF}/\text{ft}^2$	
CRANE	15T CRANE	SPAN 14.5 ft	
	WHEEL PRESSURE	1.62T	
	WHEEL BASE	11.00	
WIND PRESSURE	$H = 21.0$	$H = 400$	
	$q = 60 \sqrt{H} = 170 \text{ PSF}/\text{ft}^2$	170 "	





E-2 CRANE GIRDER  $l = 47.9$

$P = 1.62^T$   $l = 100$

$MAX M = 1.62 \times (47.9 - 100/4)^2 / 2 \times 47.9 = 3.11$

$MAX Q = 1.62 \left( 1 + \frac{47.9 - 100}{47.9} \right) = 2.90$

GIRDER  $w' = 50 + 22 + 2 = 80 \text{ kg/m}$

$\pi = 0.08 \times 47.9^2 / 80 = 0.23$

$Q = 1 < 47.9 / 4 = 0.19$

IMPACT LOAD  $\alpha_x = 0.15 P$

$\alpha_y = 0.1 P$

$\Sigma M_x = 3.11 \times 1.15 + 0.23 = 3.81$

$\Sigma Q_x = 2.90 \times 1.15 + 0.19 = 3.53$

$M_y = 3.11 \times 0.10 = 0.31$

$Q_y = 2.90 \times 0.10 = 0.29$

II-  $366 \times 174 \times 6 \times 9$

$f_b = 90 / 47.9 \times 366 / 174 \times 0.9 = 0.85$

$f'_b = 3.81 / 641 = 0.59 < 0.85$

$\delta = 3.530 \times 47.9^3 / 43 \times 2.1 \times 10^6 \times 11.100 = 0.29 = \frac{47.9}{1390}$

$\gamma'_b = 31 / 91 = 0.34 < 1.60$

$\tau_b = 3.53 / 12.4 \times 0.6 = 0.19 < 0.90$

5-3 SUB MEMBER

TOIST  $\theta_1$   $l = 479$   $w = 40$   $100/100$

$$W_{10} = 170 \times (0.5) = -85 \text{ " } \left. \vphantom{W_{10}} \right\} -45 \text{ "}$$

$$w' = 40 \times 14.94 / 2 = 299 \text{ lb/in}$$

$$r_{10} = 0.299 \times 4.79^2 / 8 = 0.86 \text{ T-in}$$

$$Q = \text{"} \times 4.79 / 2 = 0.72 \text{ T}$$

$$H = 200 \times 100 \times 5.5 \times \phi$$

$$f_b = 900 / 479 \times 20 / 10 \times 0.8 = 0.75$$

$$r_b = 86 / 479 = 0.18 < 0.75$$

$$\delta = 5.23 \times 4.79^2 / 2.14 \times 2.1 \times 10^6 \times 1.750 = 0.57 \neq 479/900$$

$\theta_2$   $l = 479$

$$w' = 40 \times 4.01 / 2 + 40 \times 3.65 = 270 \text{ lb/in}$$

$$r_{10} = 0.27 \times 4.79^2 / 8 = 0.66$$

$$Q = \text{"} \times 4.79 / 2 = 0.55$$

$$H = 295 \times 149 \times 5.5 \times \phi$$

$$f_b = 900 / 479 \times 29.5 / 4.79 \times 0.8 = 0.75$$

$$r_b = 66 / 479 = 0.14 < 0.75$$

$\theta_3$   $l = 479$   $w = 40$

$$w_x = 40 \times 3.65 = 150 \text{ lb/in}$$

$$w_y' = 170 \times 0.9 \times 7.05 / 2 = 570$$

$$r_x = 0.15 \times 4.79^2 / 8 = 0.47$$

$$r_y = 0.51 \times \text{"} = 1.49$$

$$H = 300 \times 150 \times 6.5 \times \phi$$

$$f_{bx} = 900 / 479 \times 30 / 15 \times 0.9 = 0.845$$

$$r_{bx} = 47 / 401 = 0.089$$

$$N_{by} = 199 / 0.11 = 2120$$

$$0.089 / 0.085 + 2120 / 1.60 = 0.105 + 1.325 = 1.43 < 1.5$$

$$E_1 \quad l_y = 5.417 \quad l_x = 1.96$$

$$w_x' = 420 \times 3.35 = 1610$$

$$w_y' = 170 \times 0.8 \times 1175/2 = 570$$

$$M_x = 1.61 \times 1.96^2 / 10 = 0.62$$

$$M_y = 0.57 \times 5.417^2 / 10 = 2.24$$

$$H = 194 \times 140 \times 6 \times 9$$

$$f_{by} = 900 / 4.37 \times 19.4 / 15 \times 0.9 = 1.067$$

$$f_{bx} = 0.62 / 67.6 = 0.917$$

$$r_{by} = 2.24 / 477 = 0.469$$

$$0.917 / 1.160 + 0.469 / 1.067 = 0.790 + 0.440 = 1.231 < 1.5$$

STUB

$$l = 4.75 \quad 1.96 \text{ (D)}$$

$$w' = 1520 \times 0.8 \times 1.96 = 270$$

$$M = 0.27 \times 4.75^2 / 10 = 0.66$$

$$H = 194 \times 140 \times 6 \times 9$$

$$f_b = 900 / 4.75 \times 19.4 / 15 \times 0.9 = 1.316$$

$$f_b = 0.66 / 277 = 0.274 < 1.316 \times 1.5$$

$$l = 300$$

$$P = 0.08 \times 1.96 \times 4.75 = 4.47$$

$$M = 0.27 \times 300^2 / 10 = 0.70$$

$$\lambda = 300 / 3.61 = 83 \quad f_c = 1.07$$

$$f_c = 900 / 300 \times 19.4 / 15 \times 0.9 = 2.98 \rightarrow 1.60$$

$$r_c = 4.46 / 30.6 = 0.146$$

$$r_b = 30 / 177 = 0.169$$

$$0.146/1.05 + 0.108/1.60 = 0.136 + 0.068 = 0.204 < 1.5$$

$$\text{BASE } A = 4470 / 50 = 89.4 \rightarrow 20 \times 20$$

$$f_c = 4470 / 20 \times 20 = 11.1 \text{ kg/cm}^2$$

$$m = 11.1 \times 10^2 / 2 = 555$$

$$\lambda = \sqrt{6 \times 555 / 1600} = 1.44 \rightarrow \text{R-16}$$

$$L = 0.75k$$

$$P = 4.47k + 0.04 \times 1.6 \times 4.7k = 2.54$$

$$w' = 110 \times 0.8 \times 1.6 = 210 \text{ lb/ft}$$

$$F_y = 0.32 \times 5.47k = 1.53^T$$

$$m = 0.21 \times 2.75^2 / 0 + 1.53 \times 3.0 / 2 = 1.58 + 2.30 = 3.88$$

$$Q = 0.21 \times 0.75k + 1.53 \times 4.7k / 0.75 = 0.81 + 0.94 = 1.75$$

$$11-200 \times 200 \times 16 \times 12$$

$$\lambda = 300 / 5.02 = 60 \quad f_c = 1.30$$

$$f_b = 900 / 0.75k \times 20 / 20 \times 12 = 1.393$$

$$f_c = 2.54 / 63.4 = 0.04$$

$$f_b = 3.88 / 4.7k = 0.422$$

$$0.04 / 1.30 + 0.422 / 1.393 = 0.031 + 0.299 = 0.33 < 1.6$$

$$\text{BASE } A = 2540 / 50 = 50.8 \rightarrow 20 \times 20$$

$$f_c = 2540 / 20 \times 20 = 6.4$$

$$m = 6.4 \times 10^2 / 2 = 320$$

$$t = \sqrt{6 \times 320 / 1600} = 1.10 \rightarrow \text{R-16}$$

$$AB = 4 - 016$$



Ex-9. C.No 1 OF BEAM

G<sub>3AD</sub>   $l = 14.94$

$P = 60 \times 4.779 \times 14.94 / 2 = 2150 \text{ Kg}$

$-W_u = 2040$

$C = 2.15 \times 14.94 / 4 = 4.02 \text{ Tm}$

0.63

$M_0 = \quad \quad \quad / 4 = 0.03$

11.35

$Q = 2.15 / 2 = 1.07 \text{ T}$

1.52

G<sub>A 24</sub>   $l = 9.79$

$w = 60 \times (14.94/4 + 100) = 230 \text{ Kg/m}$   $-W_u = 650$

$C = 0.23 \times 9.79^2 / 12 = 0.54$

1.24

$M_0 = \quad \quad \quad / 4 = 0.10$

1.06

$Q = \quad \quad \quad \times 9.79 / 2 = 0.67$

1.59

G<sub>1134</sub>   $l = 4.79$

$w = 60 \times 4.02 / 2 = 120$

$C = 0.12 \times 4.79^2 / 12 = 0.23$

$M_0 = \quad \quad \quad / 4 = 0.29$

$Q = \quad \quad \quad \times 4.79 / 2 = 0.29$

G<sub>E 34</sub>   $l = 4.79$

$w = 60 \times 4.02 / 2 + 20 \times 30 = 190$

$-W_u = 120 \times 0.5 \times 4.79 / 2 + 120 \times 2.0 \times 3.0 = 250$

$C = 0.19 \times 4.79^2 / 12 = 0.34$

1.61

$M_0 = \quad \quad \quad / 4 = 0.52$

2.41

$Q = 0.19 \times 4.79 / 2 = 0.43$

2.01

G<sub>0</sub>  $l = 100$

$w = 0.23$

$w = 0.12$

$w = 0.19$

$-W_u = 0.81$

$C = 0.23 \times 100^2 / 12 = 0.19$

0.06

0.09

0.42

$Q = \quad \quad \quad \times 100 = 0.23$

0.12

0.19

0.81

$$C_{90} \quad l = 100$$

$$w = 40 \cdot (4.02/2 + 3.0) = 700 \quad -w_w = 120 \times 2.0 \times 5.0 = 1200$$

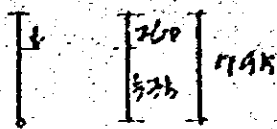
$$L = 0.20 \times 3.0^2 / 2 = 0.45$$

340

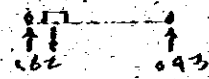
$$Q = 0.20 \times 3.0 = 0.60$$

3.60

COLUMN



$P = 3.53^T$



$P' = 2.10$

$e = 40/2 + 20 = 40 \text{ cm}$

$M = 3.53 \times 40 = 141 \text{ T-cm}$

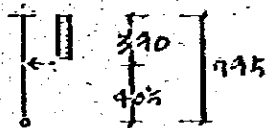
$H_r = 141 \left[ \frac{1}{3} \times 2.6 \times 520^3 + (2.6 - 2 \times 40) \times 2 \times 40 \times 520^2 / 2 \right] / (2 \times 1795^2) = -0.25 \text{ cm}$

$Q = 3.53 \times 40 / 1795 = 0.18 \quad n' = 0.45$

$w_w = 120 \times 0.3 \times 1.1 \times 1795 = 650 \text{ kg/m}$

$n = n_0 = 0.35 \times 1795^2 / 6 = 5.14$

$Q = 0.35 \times 1795 / 2 = 2.53$



$P_w = 120 \times 0.3 \times (4.05/2 \times 1795) = 930 \text{ kg}$

$w = 650 \text{ kg/m}$

$w_s = 0.35 \times 1795 = 2.53$

$H = 2.53 \times 390 (2 \times 1795 - 390)^2 / 6 \times 1795^2$

$+ 0.93 \times 390 \times 4.05 \times (1795 + 405) / 2 \times 1795^2 = 2.01 + 1.39 = 4.20$

$Q_T = 2.53 \times 60 / 1795 + 0.93 \times 4.05 / 1795 = 1.91 + 0.47 = 2.38$

$Q_B = 2.53 + 0.93 = 2.38 = 1.08$

$n_c = 1.08 \times 4.05 = 4.37$

$L = 405$

$w = 120 \times 0.3 \times 4.05 = 460 \text{ kg/m}$

$n = n_0 = 0.35 \times 4.05^2 / 6 = 0.94$

$Q = 0.35 \times 4.05 / 1.1 = 0.93$

$Q = 0.93$

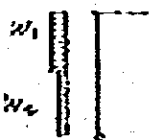
$w_1 = 650 \text{ kg/m}$

$w_2 = 460 \text{ kg/m}$

$H = 2.01 \times 0.19 / 1.15 + 0.93 \times 1795^2 / 6 = 0.32 + 363 = 445$

$Q_T = 1.91 \times 2.10 / 1.15 + 0.46 \times 1795 / 2 = 0.56 + 1.63 = 2.39$

$Q_B = 0.62 \times 0.93 / 1.15 + \dots = 0.18 + 1.63 = 2.01$



5-5 AXIAL FORCE OF COLUMN

	ROOF		WALL	CRANE SIZE EX	COLUMN	P	
CA1	0.06 x 3.4 x 2.5	1.03	0.4A x 0.9A x 4.35 0.14 x 2.4 x 3.25	2.0A 0.24	0.19	0.56	4.06
CA2	0.06 x 4.0 x 2.5	2.45	0.04 x 4.0 x 3.55 0.4A x 0.9A x 4.35 x 2.4 x 3.55	1.0A 2.0A	0.20	0.56	4.07
CD1	0.06 x 3.4 x 2.5	1.03		4.0A	0.19	0.55	2.61
CD2	5.4 x 2.0 0.06 x 4.0 x 2.5	0.64 2.45	0.4A x 2.4 x 3.55	4.0A	0.20	0.56	2.12
CV3	4.0 x 2.0 0.06 x 4.0 x 2.5	0.87 2.45			0.20	0.56	3.96
CE2	0.06 x 5.4 x 5.0	1.62			0.20		1.82
CE3	0.06 x 4.0 x 5.0	1.44			0.20		1.64

5-6 HORIZONTAL LOAD

1. EARTHQUAKE LOAD

ROOF	$0.06 \times 64.7 \times 16.94$	65.25
	$0.06 \times 56.69 \times 9.02$	27.87
WALL	$0.40 \times (39.46 \times 3.55 + 4.2 \times 1.95)$	70.90
	$0.40 \times (115.17 \times 3.55 + 52.7 \times 1.95)$	20.54
CRANE GIRDER	$0.08 \times 1245$	9.96
COLUMN	$0.07 \times 38 \times 40$	7.84
	$0.05 \times 12 \times 20$	1.20

199.64

$Q_E = 199.64 \times 0.1 = 19.96$

2. WIND PRESSURE

←	$0.17 \times 1.2 \times 15.34 \times 0.0/2$	12.32
	$0.17 \times 1.2 \times 3.92 \times 4.0/2$	1.17
	$\times Q_w =$	<u>13.65</u>

↑	$0.17 \times 1.2 \times 62.47 \times 0.0/2$	50.97
	$0.17 \times 0.4 \times 62.47 \times 4.0/2$	6.20
	$\uparrow Q_w =$	<u>56.97</u>

↓	$0.17 \times 1.2 \times 62.47 \times 0.0/2$	50.97
	$0.17 \times 1.2 \times 62.47 \times 4.0/2$	12.00
	$\downarrow Q_w =$	<u>62.97</u>

### 5-7 STIFFNESS RATIO

COLUMN CA CD H-400x200x8x13

$$I_x = 23700 \quad I_y = 1740$$

CB H-200x200x8x12

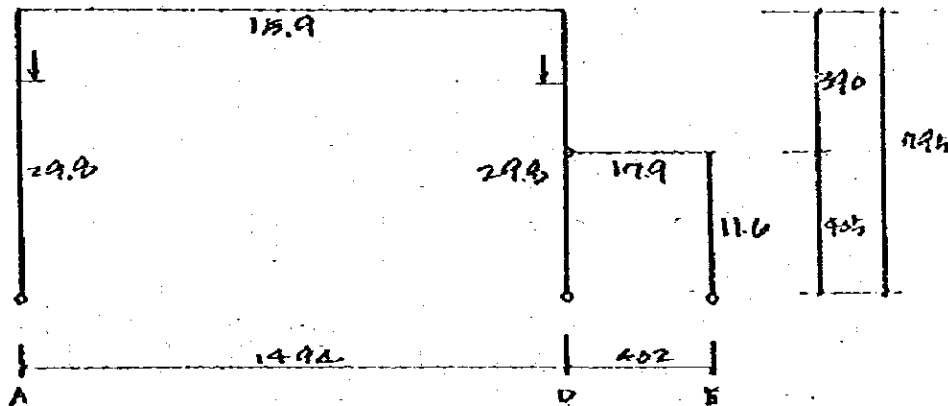
$$I_x = 1170 \quad I_y = 1600$$

BEAM C1 H-400x200x8x13

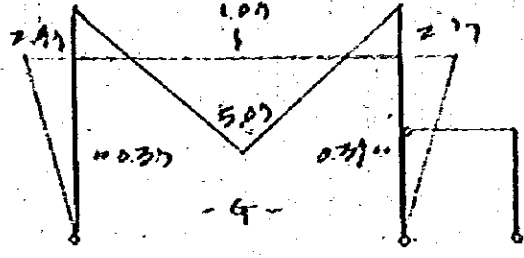
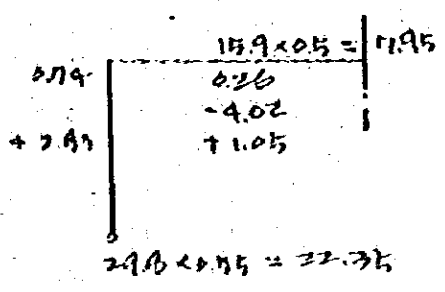
$$I_x = 23700$$

C2 H-300x150x6.5x9

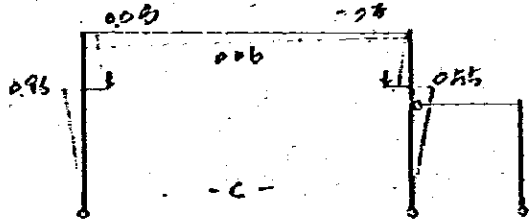
$$I_x = 1720$$



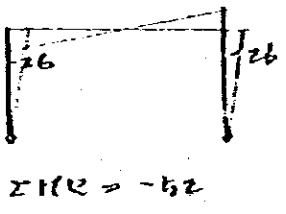
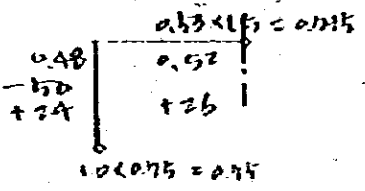
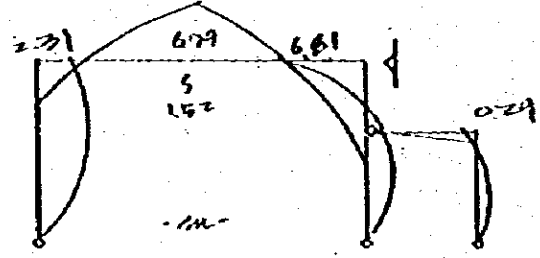
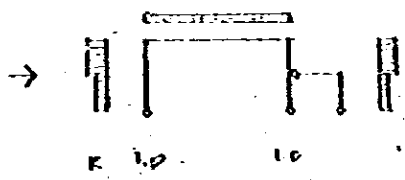
B.B CALCULATION OF STRESS



0.56	0.97	0.01	0.54
-0.25			+0.15
+0.15	+0.10	-0.06	-0.09
+0.02	-0.03	+0.05	
	+0.01	-0.02	-0.03



WIND



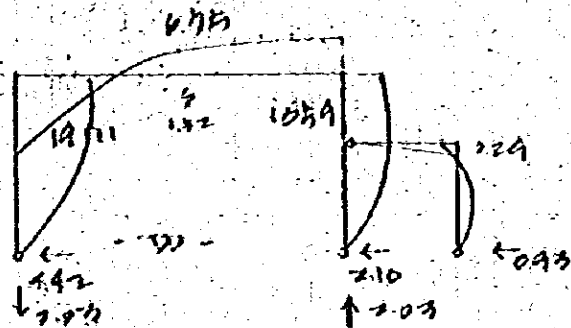
$\Sigma M_R = +4.50$

$\Sigma P_C = 2.6 \times 1.5 \times 60 + 1.06 \times 4.5/2 + 2.97 \times 4.5 = 30.50$

$\therefore -5.2 \times + 30.5 + 4.50 = 0$

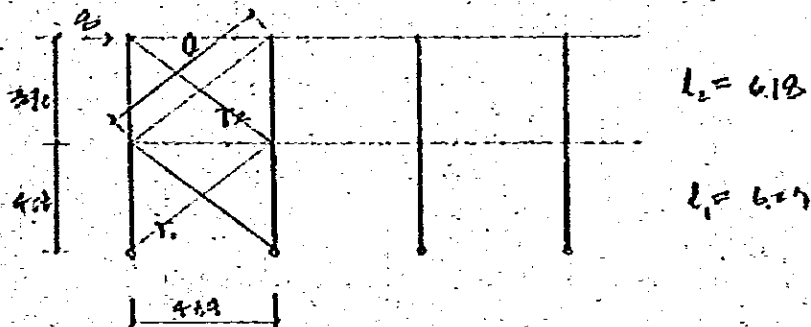
$x = 0.669$

$M_x = -2.6 \times 0.669 = -1.740$



RIDGE DIRECTION

BRACE  $8 = 19.96 / 4 = 4.99$



$$T_2 = 4.99 \times 6.18 / 4.69 = 6.44$$

$$C_2 = 4.99 \times 3.90 / 4.69 = 4.06$$

$$T_1 = 4.99 \times 6.27 / 4.69 = 6.57$$

$$C_1 = 4.99 \times 4.05 / 4.69 = 4.22$$



5-9 DESIGN OF SECTION

1 BEAM

GAO	$M_{L1}$	$M_L$	$M_{R2}$	Q
L	-2.97	+1.507	+2.97	1.07
C	+0.06	+0.06	-0.03	0
W	+19.71	-6.75	+10.59	1.52
S	+16.73	-1.68	+13.56	2.49

$H = 400 \times 700 \times 8 \times 13$

$b_b = 1999 / 4 = 374$

$f_b = 900 / 374 \times 40 / 70 \times 1.3 = 1.56$

$f_{sb} = 1673 / 1190 = 1.41 < 1.56 \times 1.1 = 2.39$

2 COLUMN

CA	P	M	Q
L	4.07	+2.97	0.37
C	3.53	0.06	0
W	2.03	+19.71	1.42
S	9.63	16.73	4.05

$H = 400 \times 700 \times 8 \times 13$

$l_{nx} = 795 \quad l_{ny} = 705$

$\lambda = 705 / 454 = 89.2 \quad f_c = 1.00$

$f_b = 900 / 405 \times 40 / 70 \times 1.3 = 1.44$

$f_c = 9.63 / 24.12 = 0.114$

$f_b = 1673 / 1190 = 1.41$

$0.114 / 1.00 + 1.41 / 1.44 = 0.114 + 0.976 = 1.090 < 1.5$

$H R \quad 45 \times 25$

$$f_c = 7.600 / 45 \times 25 = 6.6 \text{ kg/cm}^2 < 50$$

$$m = 6.6 \times 17.5^2 / 4 = 524$$

$$t = \sqrt{6 \times 524 / 1600} = 1.91 \rightarrow \text{B12-19}$$

AB-4-B19

CE	P	W	Q
L	164	0	0
W	0.011	0.94	0.93
S	1.01	0.94	0.93

$$H = 250 \times 200 \times 8 \times 12$$

$$\lambda = 405 / 4.98 = 81 \quad f_c = 1.01$$

$$f_b = 900 / 405 \times 20 / 20 \times 12 = 2.67 \rightarrow 1.60$$

$$f_c = 1.01 / 635 = 0.027$$

$$f_b = 94 / 472 = 0.199$$

$$0.027 / 1.01 + 0.199 / 1.60 = 0.025 + 0.124 = 0.149 < 1.5$$

$$\text{B12-25} \times 25$$

$$f_c = 1640 / 25 \times 25 = 2.6$$

$$m = 2.6 \times 17.5^2 / 2 = 205$$

$$t = \sqrt{6 \times 205 / 1600} = 0.87 \rightarrow \text{B12-16}$$

AB-4-116

### 3 BRACE

$$T = 6.5 \times 7$$

$$A = 6.5 \times 7 / 0.9 = 2.72$$

$$L = 6.5 \times 6.5 \times 6 \quad \text{HTB-116}$$

$$A_n = 4.04 > A$$

4. TIE BEAM

35 x 90

$f = 172.6$

$l = 4.79$

$w = 0.016 + 0.44 \times 3.5 = 1.54 \text{ T/A}$

$0.56 + 0.44 \times 1.2 + 0.09 = 1.13$

$C = 1.54 \times 4.79^2 / 12 = 4.07$

2.0

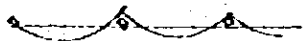
$M_0 = \dots / d = 7.0$

4.1

$\theta = \dots \times 4.79 / 2 = 5.0$

3.7

FIG 12



$M_D = 12C = 3.2$

$M_C = M_D - 0.6C = 2.5$

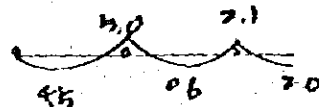
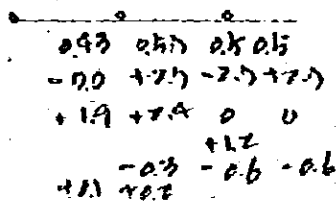
$A_E = 3.2 / 0.016 \times 2.0 = 2.2$

2-D19

$A_C = 2.5 / \dots = 1.7$

2-D19

FIG 13



$A_E = 5.0 / 0.016 \times 2.0 = 3.1$

2-D19

$A_C = 4.5 / \dots = 3.1$

2-D19

FIG 1 AND

$w = 0.56 + 0.44 \times 3.0 = 1.88 \text{ T/A}$

$P = 4.47$

$l = 5.07$

$L = 3.20$

$C = 1.88 \times 5.07^2 / 12 + 4.47 \times 5.07 \times 2 / 4 = 12.2$

0.6

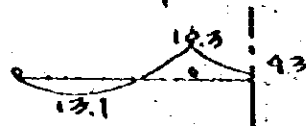
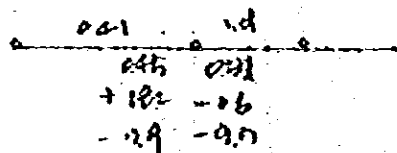
$M_0 = \dots / d = 12.2$

1.0

$\theta = 2.20 \times 5.07 / 2 + 4.47 = 10.9$

10.9

1.2



$$C_3 = 10900 / 177.6 \times 1.5 = 10.0$$

$$A_c = 13.1 / 0.776 \times 2.0 = 9.0 \quad 4-D19$$

$$A_e = 10.7 / \quad \quad = 7.1 \quad 3-D19$$

$$A_c = 9.7 / \quad \quad = 6.4 \quad 3-D19$$

### 5 FOOTING

	P	WALL	TR BEAM	CRAN	JP	n	ℓ × ℓ'
A1	4.06	1.94 × 2.84 423 0.54 × 2.9 1.42	410	3.13	14.6	1	90 × 90
A2	4.07	0.54 × 4.8 2.83	365	3.53	14.1	2	90 × 210
B1	4.47	1.44 × 2.84 423	345		12.2	1	90 × 90
D1	3.61	1.44 × 2.84 423 1.03 × 2.4 403	410	3.13	24.1	2	90 × 210
D2	4.12	1.68 × 2.4 403	5.17	3.53	20.9	2	"
D3	3.46		5.17	3.53	10.5	2	"
E2	1.82	0.54 × 2.4 1.42 1.44 × 2.0 2.84	324		9.5	1	90 × 90
E3	1.64	0.54 × 4.8 2.83	5.17		9.6	1	"

$$\text{If } 30\% = 25 \text{ T}$$

$$W = 0.9 \times 0.9 \times 0.6 \times 2.9 = 1.2$$

$$25 - 1.2 = 23.8$$

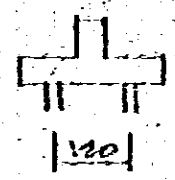
F1 308 x 1      90 x 90      v = 60      z' = 46.3  
 u = 1.016

F2 308 x 1      90 x 210

PA2 = 15.6  
 WP = -20 } 13.6

Q = 442      u = 1.150

W = 442 x 1.150 = 663 T-h



$r^2 = 0.6^2 \times 2 / 0.6 = 1.20$

$s_p = 13.6 / 2 \pm 663 / 120$

$= 6.8 \pm 5.5 = 12.3 \text{ or } 1.3$

$s_0 = 12.3 T$

$s_1 = 12.3 \times 1.20 / 2 = 7.4 T-h$

$\gamma_B = 12.3 \times 10^3 / 90 \times 46.3 = 3.0 < 12.15$

$\gamma_9 = 12.3 \times 10^3 / 90 \times 15 < 1.8 = 11.8$

$A = 7.4 / 0.463 \times 3.0 = 5.3$

$LQ = 24.1 / 2 = 12.1$

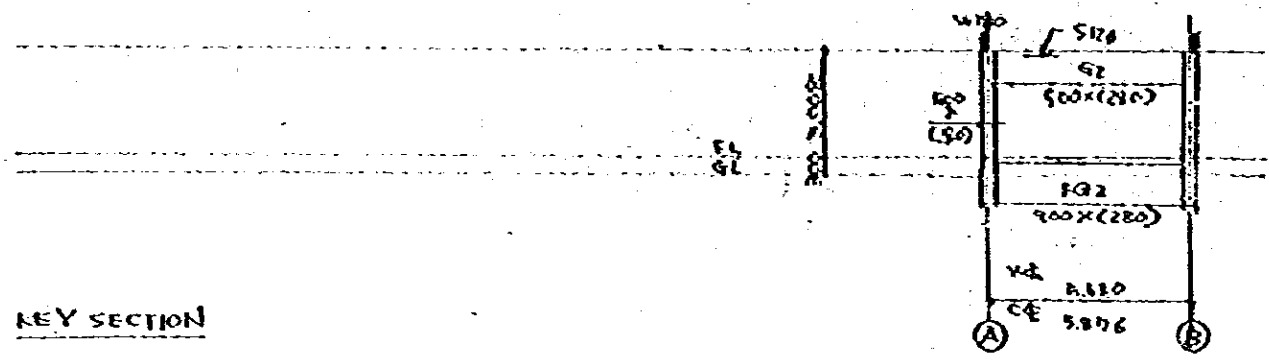
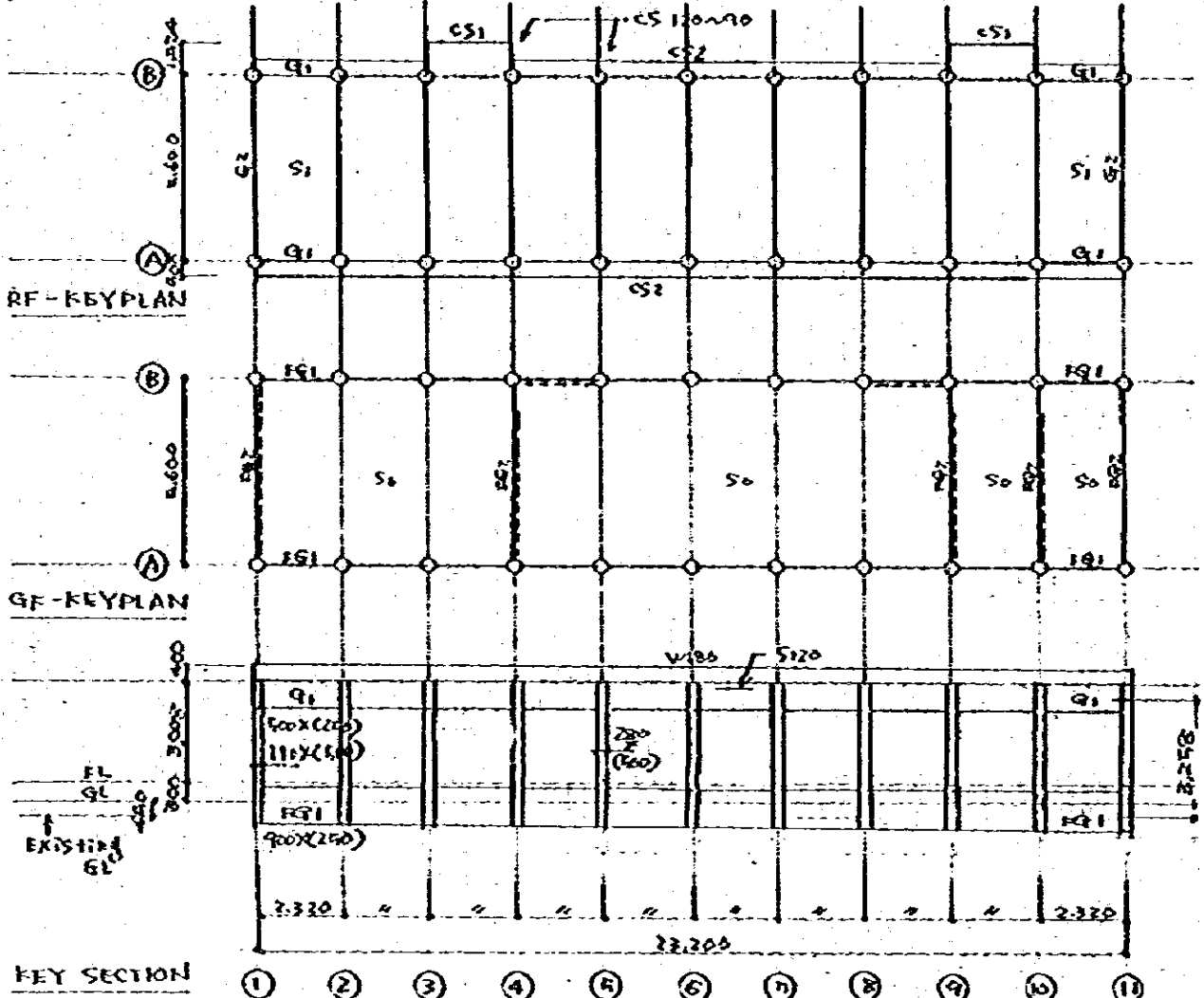
$u = 12.1 \times 1.2 / 1.1 = 12.7$

$\gamma = 12.1 \times 10^3 / 46.3 \times 15 = 17.9$

$A = 12.7 / 0.463 \times 2.0 = 12.9$

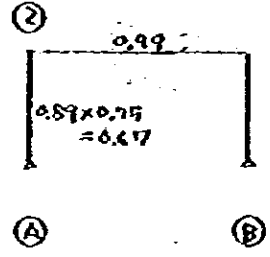
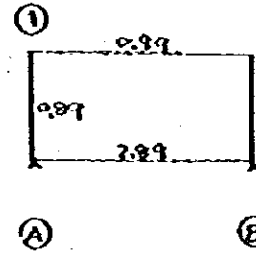
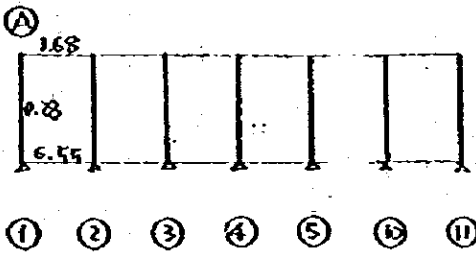
} 1.016

6 守 衛 所



Stiffness Ratio

	b	D	J $\times 10^3$	$\beta$	$\beta J \times 10^3$	$k$				
							232	587.6		$\times 10^3$ 326
$\bar{I}$	25	50	260.4	1.5	390.6	—	168	—	—	—
$\bar{I}$	28	50	291.7	2.0	583.3	—	—	0.99	—	—
$\square$	25	90	1,518.8	1.0	1,518.8	—	6.55	—	—	—
$\square$	28	90	1,710.0	1.0	1,710.0	—	—	2.89	—	—
$\square$	50	28	91.5	1.0	91.5	—	—	—	—	0.28
$\square$	28	50	291.7	1.0	291.7	—	—	—	—	0.89








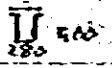
UNIT Load

FLOOR

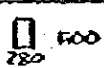
(t/m<sup>2</sup>)

	D.L.			L.L.			T.L.
ROOF		FINISH	0.20	FOR S R E	0.09	0.67	
		Slab	0.24		0.01		0.60
		Ceiling	0.04		0.03	0.56	
			0.48				
Eaves		FINISH	0.06	/	0.09	0.39	
		Slab	0.24		0.07	0.37	
			0.30	0.03	0.33		



Beam

	t/m			P	Σ	Feach		
	Skeletal	Finish	Σ			Σ	Σ	Σ
	0.24	0.04	0.28	0.6	2.32	1.88		
	0.26	0.04	0.30			1.6		

Column

	t/m			P	Feach			
	Skeletal	Finish	Σ		Σ	Σ	Σ	
	0.34	0.08	0.42		3.0	1.4		

Wall

	t/m <sup>2</sup>			P	0.3	t/m (Horizontal)		
	Skeletal	Finish	Σ			Σ	Σ	Σ
	0.43	0.10	0.53	0.2	2.9			
	0.483	0	0.483			1.4		




Axial Force

[t]

	A①		A②					
S	$0.60 \times 4.0$	2.4	$\times 7.1$	4.3				
	$0.37 \times 0.7$	0.3	$\times 2.0$	0.7				
G,B	$0.3 + 0.8$	1.1	$0.6 + 0.8$	1.4				
C		1.4		1.4				
W	$0.2 \times 4.1$	0.8	$\times 2.3$	0.5				
	$1.4 \times 3.7$	(5.2)	$\times 2.0$	(2.8)				
$\Sigma$	6.0	(11.2)	8.3	(11.1)				

Cl. Q. of BEAM

[tm, t]

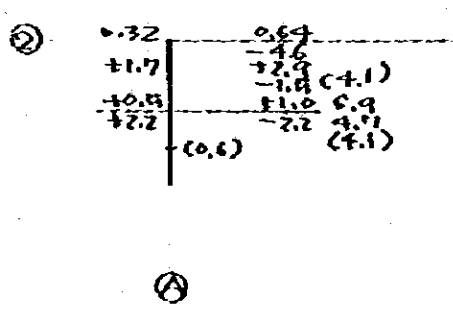
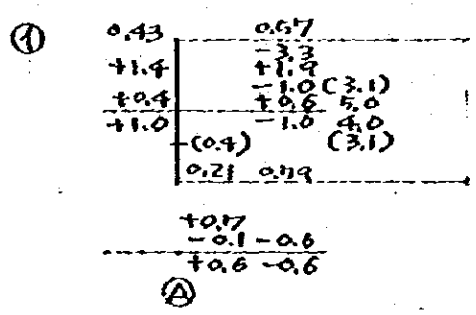
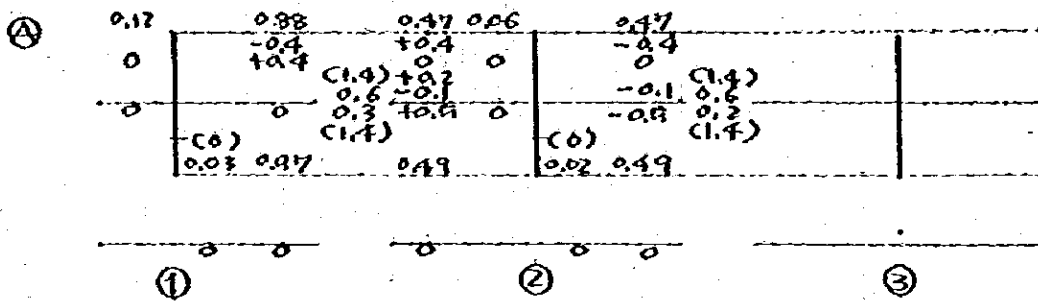
	Load		C	M <sub>0</sub>	Q			
RG ① ②		u	$0.60 \times 0.3$	0.2	$\times 0.5$	0.3	$\times 1.3$	0.8
		f	$0.48 \times 2.32/2$	0.2	$\times 1/8$	0.3	$\times 2.32/2$	0.6
			0.4	0.6	1.4			
RG ① ②		u	$0.60 \times 3.1$	1.9	$\times 4.7$	2.8	$\times 2.7$	1.6
		f	$0.80 \times 5.88/2$	1.4	$\times 1/8$	2.2	$\times 5.88/2$	1.5
			3.3	5.0	3.1			
RG ② ③		u	$1.20 \times 3.1$	3.7	$\times 4.7$	5.6	$\times 2.7$	3.2
		f	$0.30 \times 5.88/2$	0.9	$\times 1/8$	1.3	$\times 5.88/2$	0.9
			4.6	6.9	4.1			

Seismic Force

[t]

		W	F	KW	Q
S	$(0.56 \times 149.7) + (0.33 \times 15.1)$	88.8			
G	$(0.6 \times 20) + (1.6 \times 11)$	29.6			
C	$(1.4 \times 23/2)$	19.4			
W	$(0.2 \times 58.2) + (1.4 \times 69.7/2)$	59.0			
$\Sigma$	$\frac{192.8}{149.7} \times 1.29 [t/m^2]$	192.8	0.10	19.3	22.0

### Stress by Vertical Load

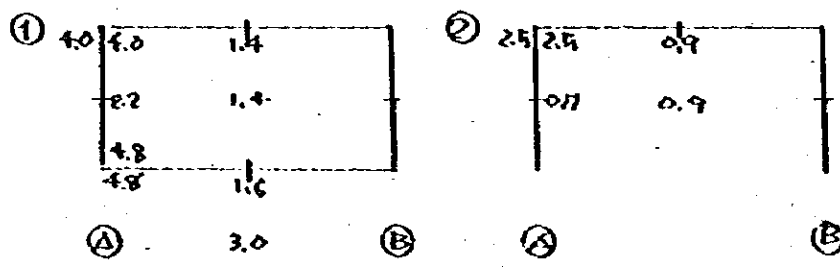
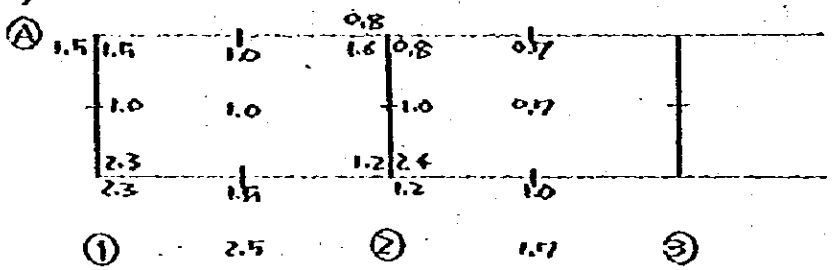


### D-Value, Inflection Point

DIR.	FR.	COL.	D						Y				Q, M				
			Fc	ΣIb	F	a	D	D'	Y0	Y1	Y2	Y3	Σ	Q	TM	MU	ML
→	A	1	0.23	8.73	17.89	0.90		0.95	0.65	0.05			0.60	0.96	3.74	1.49	2.25
	//	2	//	16.46	35.78	0.95		1.00	0.65	0.05			0.60	1.01	3.94	1.88	2.36
↑	1	A	0.89	3.87	2.58	0.66	0.43	3.94	0.65	0			0.65	2.24	8.74	3.96	4.80
	//	2	0.67	0.99	1.77	0.19	0.11	1.00					0	0.65	2.54	2.74	0

### Stress by Seismic Force

DIR.	ΣD	Q/ΣD
→	21.80	1.01
↑	33.76	0.65



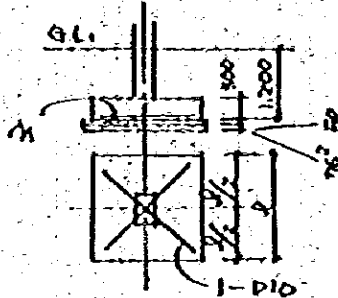






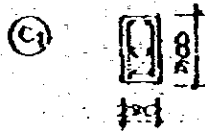
DRGT. DATA ( Check Gate )

1) Footing Schedule



Type	L	M
	1.000	5-D10 (Ø200)
F1	1.200	6-D10 (Ø200)

2) Column Schedule



MAIN R. 6-D19  
 HOOP General Ø10@100  
 Pakel Zaire Ø150  
 AUX. HOOP Ø10@200

3) Beam Schedule

	⊙	⊙	⊙	⊙	⊙	⊙
b	250	280	250	280	250	250
D	800	800	900	900	350	900
TOP R.	2-D19	←	←	←	2-D16	2-D19
BTM "	2-D19	←	←	←	2-D16	2-D19
SIDE "	2-D10	←	←	←	←	←
TIE "	Ø10@100	←	←	←	←	←
ST.	Ø10@200	←	←	←	Ø10@100	Ø10@200

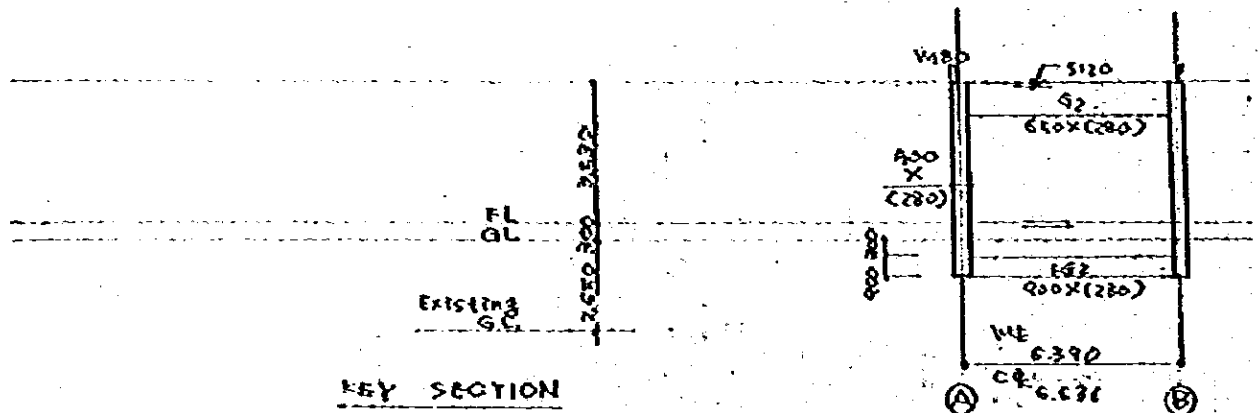
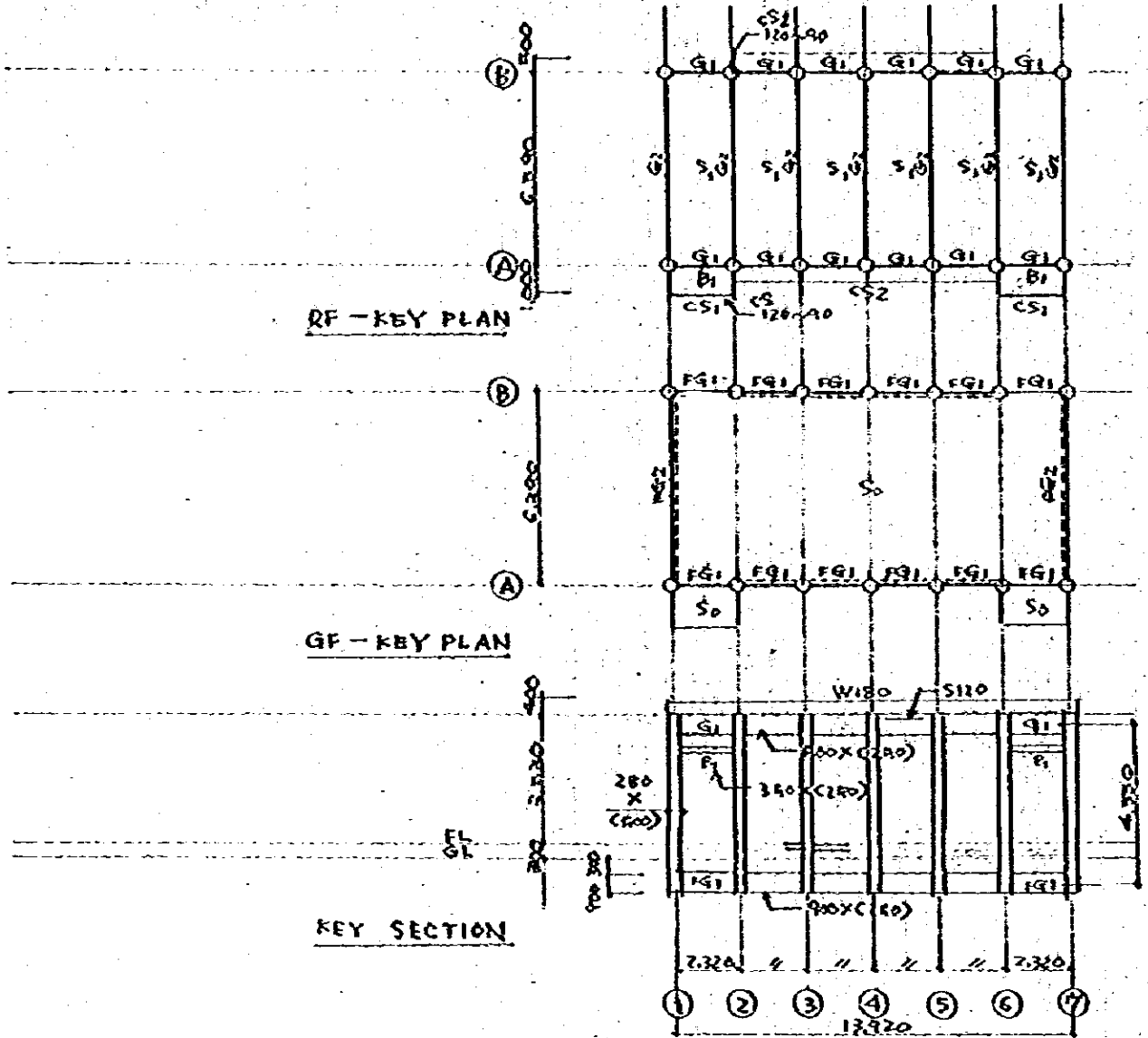
4) Slab Schedule

5) Wall Schedule

} see "AIR COMP. HOUSE"

ア エアコンプレッサー室

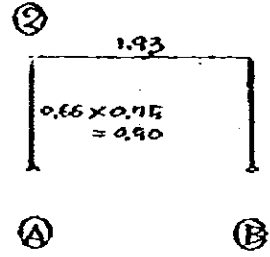
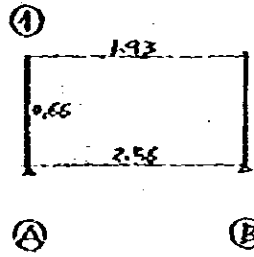
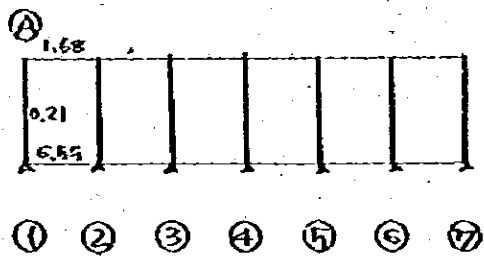




Ac  
2

Stiffness Ratio

	b	D	J $\times 10^3$	$\phi$	$\phi J$ $\times 10^3$		232	663.6		$\times 10^3$ 433
$\bar{U}$	25	50	200.4	1.0	390.6	—	1.68	—	—	—
$\bar{U}$	28	65	640.8	2.0	1,281.6	—	—	1.93	—	—
$\square$	25	90	1,518.8	1.0	1,518.8	—	6.89	—	—	—
$\square$	28	90	1,701.0	1.0	1,701.0	—	—	2.56	—	—
$\square$	50	28	91.5	1.0	91.5	—	—	—	—	0.21
$\square$	28	50	291.7	1.0	291.7	—	—	—	—	0.66



Ac  
3

Unit Load

Floor		D.L.			L.L.			T.L.
								[t/m <sup>2</sup> ]
Roof		Finish	0.20	Foy	S	0.09	0.62	
		Slab	0.29		R	0.07	0.60	
Eaves		Ceiling	0.04	/	E	0.03	0.56	
			0.53					
		Finish	0.06			0.09	0.39	
		Slab	0.24		0.07	0.37		
			0.30		0.03	0.33		

Beam

	t/m	t/m		Σ	l	Σ	t/each	
		Skeleton	Finish				15.00	
	500	0.24	0.04	0.28	0.6			
	650	0.37	0.06	0.43		2.6		
	900	0.54	—	0.54	1.1			
	900	0.60	—	0.60		3.7		

Column

	t/m	t/m		Σ	h	t/each	
		Skeleton	Finish			15.00	
	500	0.34	0.08	0.42		2.1	

Wall

	t/m <sup>2</sup>	t/m <sup>2</sup>		Σ	h	t/each	
		Skeleton	Finish			0.3	3.7
	180	0.43	0.10	0.53	0.2		
	254	0.483	0	0.483		1.5	

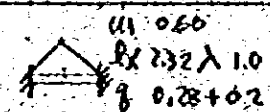




Axial Force

[t]

	A1		A2				
S	$0.60 \times 4.6$ $0.37 \times 1.6$	2.8 0.6	$\times 8.3$ $\times 1.6$	5.0 0.6			
Q, B	$0.3 + 0.6$ $1.3 + 1.9$	0.9 3.2	$0.6 + 1.1$ $1.3 + 1.9$	1.7 3.2			
C		2.1		2.1			
W	$0.2 \times 4.8$ $1.4 \times 4.1$	0.9 6.2	$\times 2.3$ $\times 2.0$	0.5 3.0			
$\Sigma$		16.7		16.1			

C.M. of beam

[cm, t]

	load	C	M <sub>0</sub>	Q	
RT A 12	 u 0.60 l x 2.32 λ 1.0 f 0.28 + 0.2	u $0.60 \times 0.3$ f $0.48 \times 2.32 \frac{1}{11}$	0.2 0.2	$\times 0.5$ 0.3 $\times 1/8$ 0.3	$\times 1.3$ 0.8 $\times 2.32 \frac{1}{2}$ 0.6
		$\Sigma$	0.4	0.6	
FR A 12	 f 0.64 + 1.5	u f $1.94 \times 2.32 \frac{1}{12}$	0.9	$\times 1/8$ 1.3	$\times 2.32 \frac{1}{2}$ 1.2
		$\Sigma$	0.9	1.3	
LR B A B	 u 0.60 x 2 l x 2.32 λ 2.9 f 0.43	u $1.70 \times 4.0$ f $0.43 \times 6.64 \frac{1}{12}$	4.5 1.6	$\times 6.1$ 7.3 $\times 1/8$ 2.4	$\times 3.2$ 3.8 $\times 6.64 \frac{1}{2}$ 1.4
		$\Sigma$	6.4	9.7	
FR A B	 f 0.60 + 1.5	u f $2.10 \times 6.64 \frac{1}{12}$	7.7	$\times 1/8$ 11.6	$\times 6.64 \frac{1}{2}$ 7.0
		$\Sigma$	7.7	11.6	
FR A B	 u 0.60 l x 2.32 λ 2.9 f 0.43 + 0.2	u $0.60 \times 4.0$ f $0.63 \times 6.64 \frac{1}{12}$	2.4 2.3	$\times 6.1$ 3.7 $\times 1/8$ 3.5	$\times 3.2$ 1.9 $\times 6.64 \frac{1}{2}$ 2.1
		$\Sigma$	4.7	7.2	

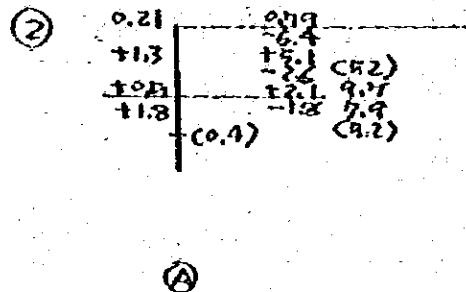
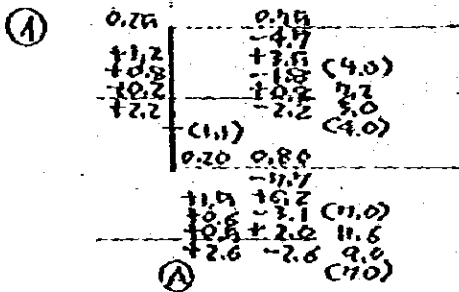
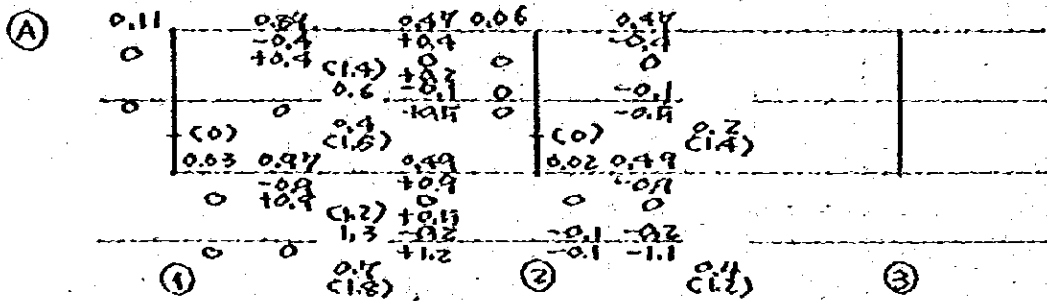
Seismic Force

[t]

		W	K	KW	Q
S	$(0.58 \times 101.3) + (0.33 \times 8.8)$	61.7			
Q	$(0.6 \times 12) + (2.6 \times 7)$	25.4			
C	$(2.1 \times 14 \frac{1}{2})$	14.7			
W	$(0.2 \times 41.1) + (1.5 \times 36.8 \frac{1}{2})$	35.8			
$\Sigma$	$\bar{w} = 137.6 / 101.3 = 1.36 [t/m^2]$	137.6	0.10	13.8	14.0

Ac  
F

Stress by Vertical Load

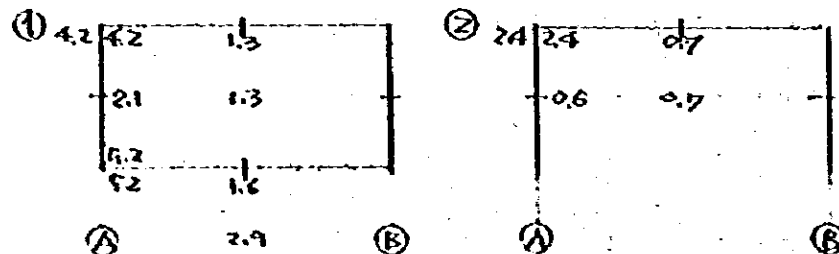
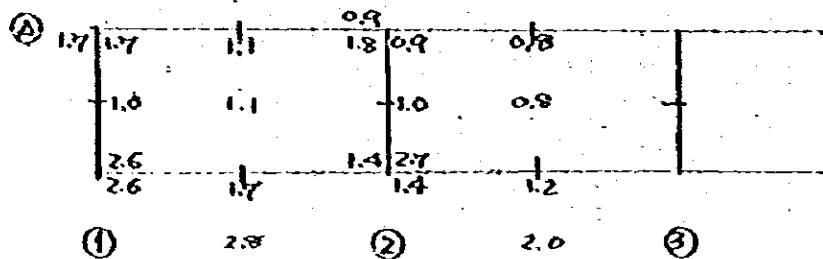


b-Value, Inflection Point:

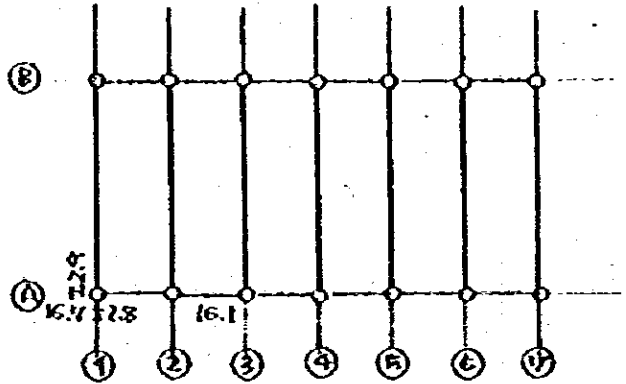
DIR.	FR.	COL.	D							Y				Q, M			
			Kc	EIb	R	a	D	D'	Y0	Y1	Y2	Y3	Σ	Q	TM	MU	ML
←	A	1	0.21	823	19.00	0.91		0.96	0.58	0.05			0.60	0.917	4.27	1.71	2.66
	"	2	"	6.46	3719	0.95		1.60	0.65	0.05			0.60	1.01	4.44	1.78	2.66
↑	1	A	0.06	449	3.40	0.63	0.43	3.89	0.55	0			0.55	2.14	9.42	4.24	5.18
	2	"	0.50	193	3.86	0.22	0.11	1.00					0	0.55	2.43	2.43	0

Stress by Seismic Force

DIR.	ΣD	ΣEB
←	13.89	1.01
↑	25.60	0.48



Footing



Pile  $\phi 300$  R  $25 \frac{3}{4} \times 0.8 = 20.0$   
 $4N$   $0.9^2 \times 1.2 \times 2.0 = 1.9$   
 $Re$   $20.0 - 1.9 = 18.1 > 16.7, 16.1$

OR Brick G.F.L. - 2.950  
 $fea$   $8.4 - (0.30 + 2.65 + 0.60) \times 2.0 = 1.3$   
 $An$   $16.7 / 1.3 = 12.8 \rightarrow 2.32 \times 5.6$

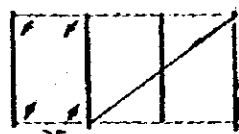
Column

DIR.		STRESS			$\frac{1}{2} \frac{N}{bD}$	$\frac{M}{bD^2}$	Re at				Section
		V	H	T				$P_g$	$a_g$	b	
C A1		N	16.7	1.1	17.8	12.7		$P_g$ 0.8	b	40	
		M	0	1.9			6.6 0.05	$a_g$ 11.2	D	28	
		L	0	2.6	2.6				j	20.1	
	Q	0	1.0	2.0	9.1	0					
	N	16.7	1.3	18.0	12.9			b	28		
	M	2.2	4.2			11.1 0.24		D	40		
C A2		L	2.6	5.2	7.8			j	39.4		
		Q	1.1	2.1	5.3	9.9	0				
		N	16.1	0.3	16.4	11.7		b	50		
	M	0	1.8			6.9 0.10		D	28		
	L	0	2.7	2.7							
	Q	0	1.0	2.0	9.1	0					
	N	16.1	0.7	16.8	12.0		b	28			
	M	1.8	2.4	4.2		6.0 0.05	D	50			
	L	0	0								
	Q	0.4	0.6	1.6	9.9	0					




AC 8

Sub Beam

		Load				Stress							Section
		From CS1 $Q$ 4M 0.28 4Q 0.45				$M$ $0.28 \times 232/2 = 0.32$ $A_s$ $24 \times 15 = 370$ $V_u$ $2(25+15) = 80$							
B	C	0.45	$232/8$		0.30	M	C	FE	$\gamma$	at		$J$ 26.3 $\phi$ D16 (1 D10 @ 100)	
	$M_o$					0.36				0.6			
							$at = \frac{M E_s}{2 A_s f_c} = 1.71$ $P_{req} = \frac{(M_u / 2 f_c A_s)}{0.1002} = 0.0027$						
	Q	0.45	$232/2$		0.42	Q	QA	$\alpha$	$\Delta Q$	PW	ST	CP	
						0.62	3.9					1.6	

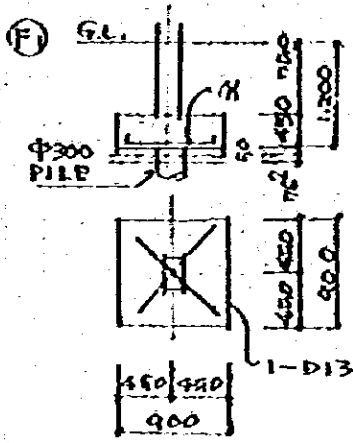
Slab

		Load		Dir.	Stress			D	J	at	$\phi$	Section	
S <sub>1</sub>		$U$ 0.62 $\Delta$ 2.9	S	M	3.34	0.082	0.217	12	8.3	1.6	4.9	D10 @ 200 ~	
				C									
		L	M		0.055	0.08		7.4	0.5				D10 @ 300 ~
			Q		0.46	0.66			4.9				
C S <sub>1</sub>	$U$ 0.39	S	M	0.47	0.60	0.28	12	8.3	1.7	3.1	D10 @ 200		
			C										
		L	M										
			Q										
C S <sub>2</sub>	$U$ 0.39	S	M				12	8.3					
			C										
		L	M										
			Q										



DMGT. DATA ( Air Compressor House )

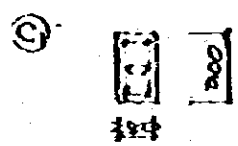
1) Footing Schedule



M = 6-D13 (6190)

Pile  
 OR.  
 Brick Base  
 BTM = G.L. - 3.250  
 2.32 x 3.6  
 " Width  
 ↓  
 1.254

2) Column Schedule

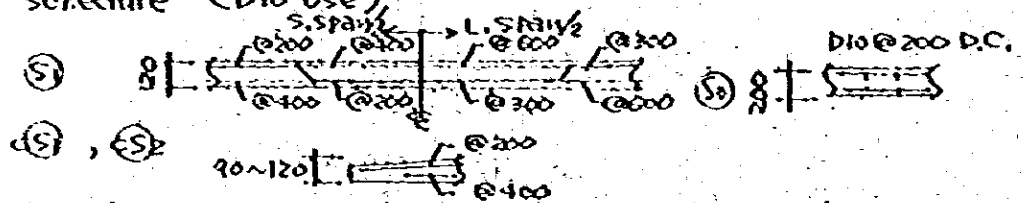


MAIN R. 6-D19  
 HOOP  $\square$  D10-General @100 ~ Panel zone @150  
 AUX. HOOP  $\square$  D10 @200

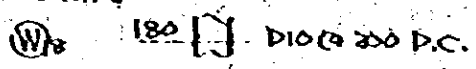
3) Beam Schedule

	(G)	(G)	(G)	(G)	(B)
b	250	280	250	280	250
D	300	350	900	900	350
TOP R.	2-D19	3-D19	2-D19	3-D19	2-D16
BTM +	2-D19	3-D19	2-D19	3-D19	2-D16
SIDE +	2-D10	←	←	←	←
TIE +	$\square$ D10 @ 600	←	←	←	←
ST.	$\square$ D10 @ 200	←	←	←	$\square$ D10 @ 100

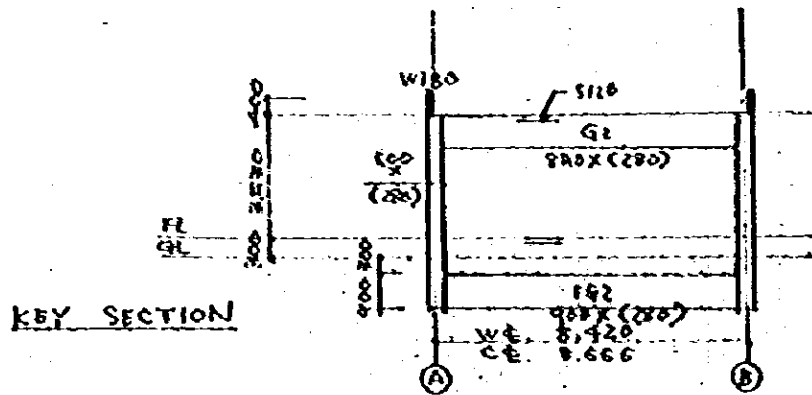
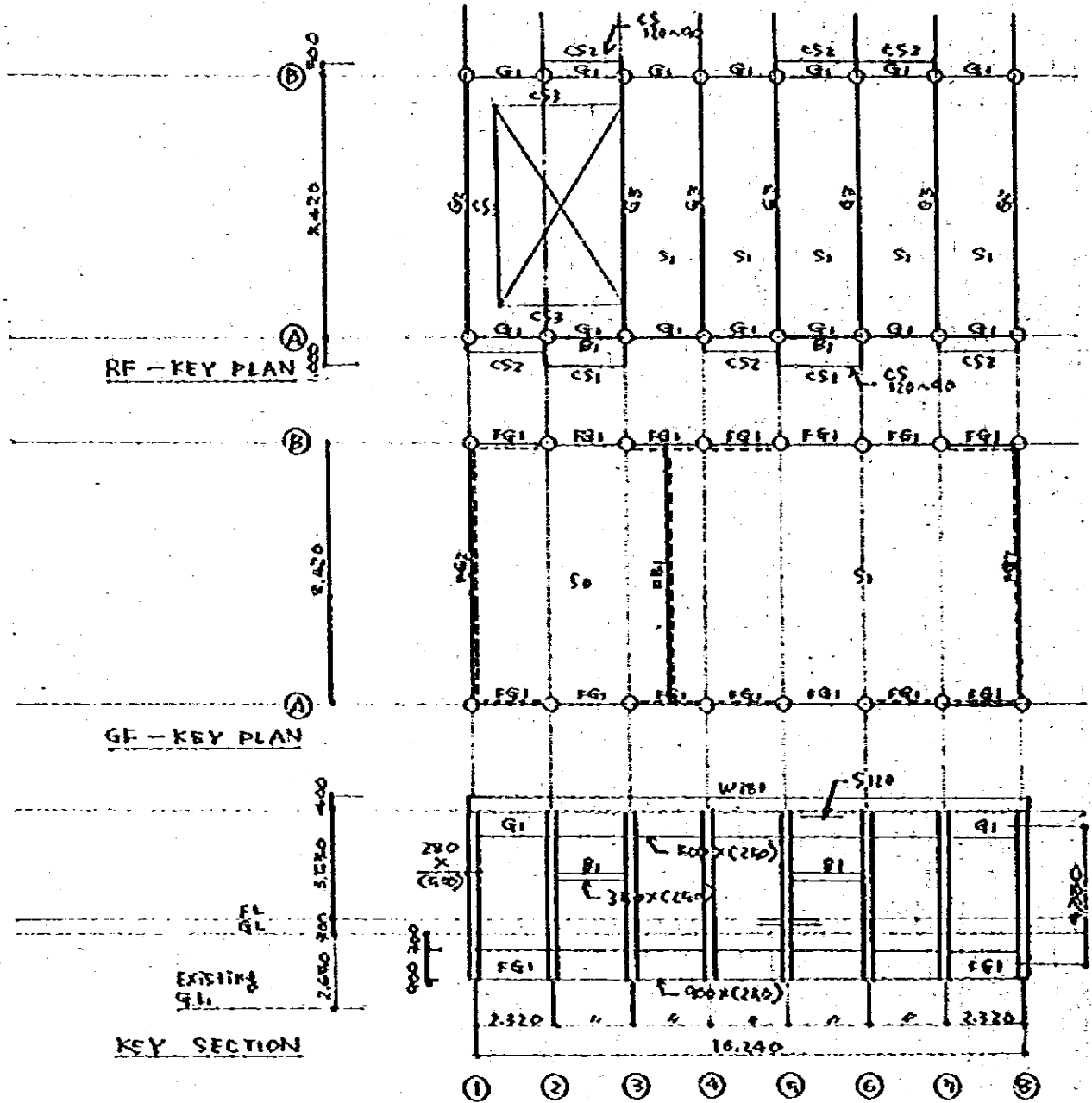
4) Slab Schedule (D10 Use)



5) Wall Schedule

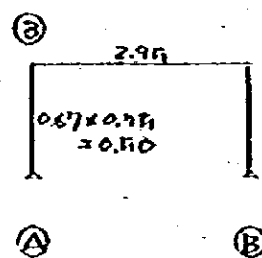
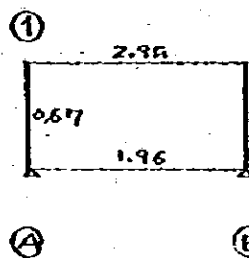
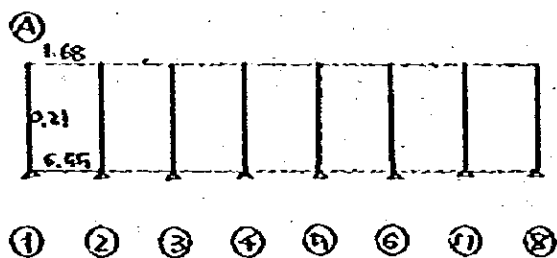


8 貯 油 庫



Stiffness Ratio

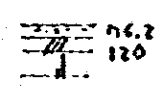

	b	D	J x10 <sup>3</sup>	$\beta$	$\beta J$ x10 <sup>3</sup>		232	866.6		x10 <sup>3</sup> 433
$\bar{U}$	28	50	260.4	1.5	390.6	—	1.68	—	—	—
$\bar{U}$	28	85	1,279.4	2.0	2,558.9	—	—	2.95	—	—
$\square$	28	40	1,518.8	1.0	1,518.8	—	6.55	—	—	—
$\square$	28	46	1,710.0	1.0	1,710.0	—	—	1.96	—	—
$\square$	50	28	91.5	1.0	91.5	—	—	—	—	0.21
$\square$	28	50	291.7	1.0	291.7	—	—	—	—	0.67




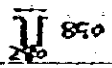
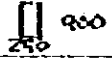
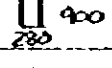
Unit load

FLOOR


[kN/m<sup>2</sup>]

	D.L.			L.L.			T.L.
	Diagram	Material	Value	Material	Value	Value	Value
Roof		Finish Slab	0.20	FOY S R E	0.09	0.62	
		Ceiling	0.29		0.07	0.60	
Eaves		Finish Slab	0.06	//	0.09	0.39	
			0.24		0.07	0.37	
			0.30		0.03	0.33	



Beam

	kN/m			l	Σ	kN	kN		
	Skeleton	Finish	Σ						
	0.24	0.04	0.28	0.6			1.867		
	0.49	0.07	0.56				4.6		
	0.54	-	0.54	1.1					
	0.60	-	0.60				4.9		

Column

	kN			kN	Σ	kN	kN		
	Skeleton	Finish	Σ						
	0.34	0.08	0.42			1.500	2.1		

Wall

	kN/m <sup>2</sup>			kN	Σ	kN (Horizontal)				
	Skeleton	Finish	Σ			kN	Σ	kN		
	0.43	0.10	0.53			0.3	0.2	3.7		
	0.483	0	0.483					1.8		


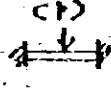



AXIAL FORCE

[t]

		(A) ①	(A) ②			
S	$0.60 \times 6.0$ $0.37 \times 0$	3.6 0	$\times 10.6$ $\times 1.6$	6.4 0.6		
G,B	$0.3 + 0.6$ $2.3 + 2.5$	0.9 4.8	$0.6 + 1.1$ $2.3 + 2.5$	1.7 4.8		
C		2.1		2.1		
W	$0.2 \times 5.5$ $1.8 \times 5.1$	1.1 9.2	$\times 2.3$ $\times 4.1$	0.5 7.3		
$\Sigma$		21.7		23.4		

CALC of REACT

[tw, t]

			C	No	Q			
RG ① ②	 $w 0.60$ $2 \times 232 \lambda 10$ $f 0.28 + 0.2$	$w$ $f$	$0.60 \times 0.3$ $0.48 \times 232^{1/2}$	0.2 0.2	$\times 0.5$ $/8$	0.3 0.3	$\times 1.3$ $\times 232/2$	0.8 0.6
				0.4	0.6	1.4		
FG ① ②	(P)  $f 0.54 + 1.8$ P 10.4	$f$ (P)	$234 \times 232^{1/2}$ $10.4 \times 232/8$	1.0 3.0	$/8$ $/4$	1.6 6.0	$\times 232/2$ $\times 1/2$	2.7 5.2
			1.0 4.0	1.6 7.6	2.7 11.9			
RG ③ A(B)	 $w 0.60 \times 2$ $2 \times 232 \lambda 3.7$ $f 0.56$	$w$ $f$	$1.20 \times 7.0$ $0.46 \times 8.67^{1/2}$	8.4 3.5	$\times 10.6$ $/8$	12.7 5.3	$\times 4.4$ $\times 8.67/2$	5.3 2.4
			11.9	18.0	11.7			
FG ① A(B)	 $f 0.60 + 1.8$	$f$	$2.40 \times 8.67^{1/2}$	17.0	$/8$	22.6	$\times 8.07/2$	10.4
			15.0	22.6	10.4			
RG ① A(B)	 $w 0.60$ $2 \times 232 \lambda 3.7$ $f 0.56 + 0.2$	$w$ $f$	$0.60 \times 7.0$ $0.46 \times 8.67^{1/2}$	4.2 4.8	$\times 10.6$ $/8$	6.4 11.1	$\times 4.4$ $\times 8.67/2$	2.6 3.3
			9.0	13.5	5.9			

SEISMIC FORCE

[t]

		W	K	KW	Q
S	$(0.46 \times 151.5) + (0.33 \times 10.1)$	83.2			
G	$(0.6 \times 14) + (4.6 \times 7)$	40.6			
C	$(2.1 \times 16/2)$	16.8			
W	$(0.2 \times 49.8) + (1.8 \times 52.3/2)$	57.0			
$\Sigma$	$\bar{w} = 202.6 / 101.5 = 1.34 [t/m^2]$	202.6	0.10	20.3	21.0







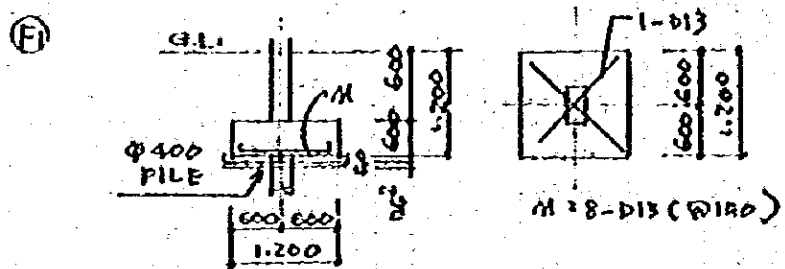




PG 9.

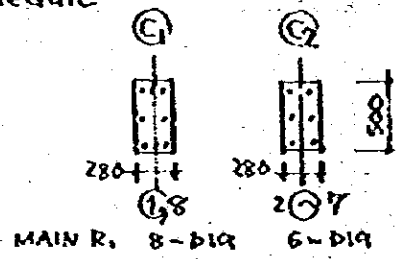
DWG. DATA ( Paint, Grease & Oil Storage )

1) Footing Schedule



Pile  
 OR  
 Brick Base  
 BTH: G.L. - 3.250  
 2.32 x 1.8  
 Width  
 1.254

2) Column Schedule



HOOP  $\square$  D10  
 General @ 100  
 Panel Zone @ 150  
 AUX. HOOP  
 M D10 @ 600

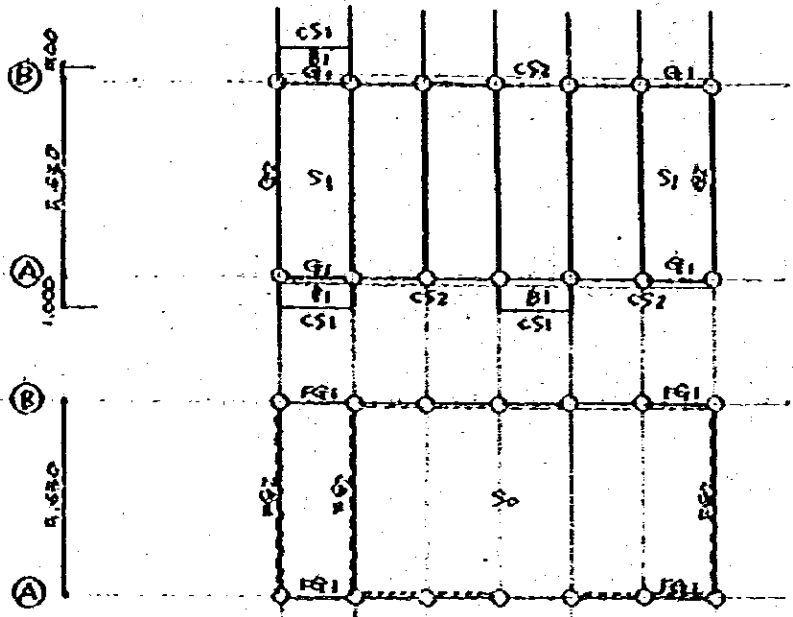
3) Beam Schedule

	(A)	(B)	(C)	(D)	(E)	(F)	(G)
b	250	280	280	250	280	250	250
D	400	650	850	400	400	350	400
TOP R.	2-D19	3-D19	3-D19	2-D19	3-D19	2-D16	2-D19
BTM $\nabla$	2-D19	3-D19	4-D19	2-D19	4-D19	2-D16	3-D19
SIDE $\nabla$	2-D10	←	←	←	←	←	←
TIE $\nabla$	4-D10 @ 600	←	←	←	←	←	←
ST.	D10 @ 200	←	←	←	←	D10 @ 100	D10 @ 200

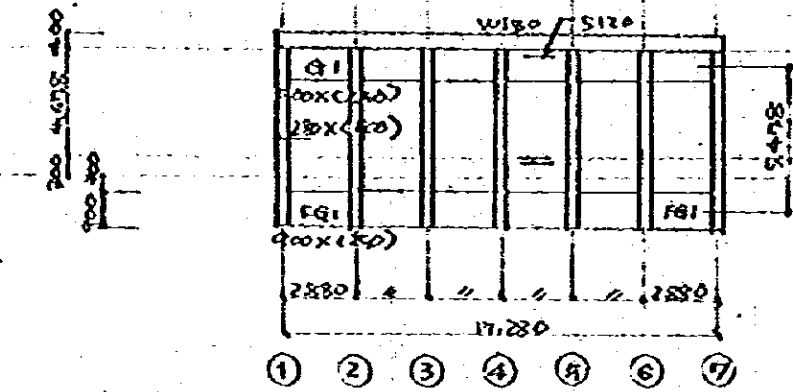
- 4) Slab Schedule (CS3  $\neq$  CS1) } see "Air Comp. House"  
 5) Wall Schedule

9 變 電 所

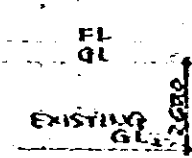
RF - KEYPLAN



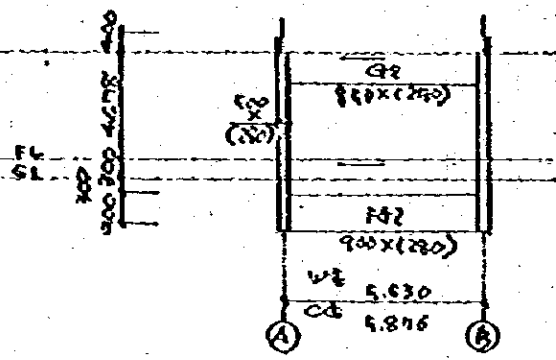
GF - KEYPLAN



KEY SECTION

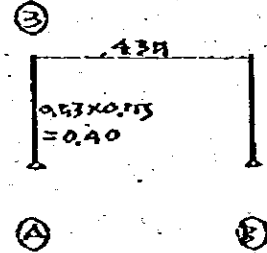
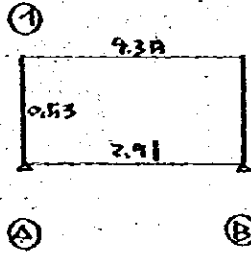
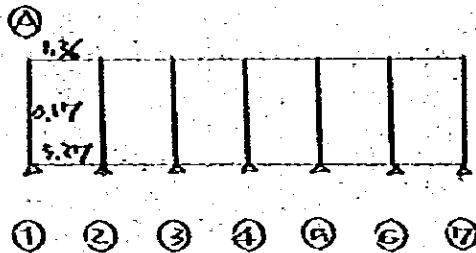


KEY SECTION



Stiffness Ratio



	b	D	J x 10 <sup>3</sup>	$\rho$	$\rho J$ x 10 <sup>3</sup>		288	$\frac{E}{288}$		x 10 <sup>3</sup>
$\bar{U}$	20	50	260.4	1.5	390.6	—	1.36	—	—	—
$\bar{U}$	28	80	1,279.4	2.0	2,558.9	—	—	4.35	—	—
$\square$	25	90	1,518.8	1.0	1,518.8	—	5.27	—	—	—
$\square$	28	90	1,410.0	1.0	1,410.0	—	—	2.91	—	—
$\square$	50	28	91.5	1.0	91.5	—	—	—	—	0.17
$\square$	28	60	291.7	1.0	291.7	—	—	—	—	0.53



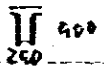

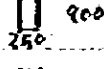
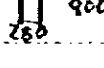
Unit Load

FLOOR


[15/23]

	D.L.	L.L.			T.L.
		For	S	R	
Roof		Finish	0.20	0.09	0.62
		Slab	0.29	0.07	0.60
		Ceiling	0.04	0.03	0.56
LINES		Finish	0.06	0.09	0.39
		Slab	0.74	0.07	0.37
			0.30	0.03	0.33



Beam

	1/m			l	Σ	1/each		
	Skeleton	Finish	Σ			1.6.63		
	0.24	0.04	0.28	0.7				
	0.49	0.49	0.98		3.0			
	0.84	—	0.84	1.4				
	0.66	—	0.66		3.2			

Column

	1/m			h	Σ	1/each		
	Skeleton	Finish	Σ			1.6.20		
	0.34	0.08	0.42		2.6			

Wall

	1/m <sup>2</sup>			h	Σ	1/m (Horizontal)		
	Skeleton	Finish	Σ			4.8		
	0.43	0.10	0.53	0.2				
	0.483		0.483		2.3			

SS  
4


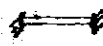


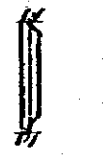
AXIAL FORCE

CLJ

		①	②			
S	0.60 x 5.0 0.37 x 1.5	3.0 0.6	x 4.2 x 1.5	5.5 0.6		
G, B	0.4 + 1.5 0.7 + 1.6	1.9 2.3	0.7 + 1.5 1.4 + 3.2	2.2 4.6		
C		2.6		2.6		
W	0.2 x 5.9 2.3 x 4.0	1.2 9.2	x 2.9 x (5.3)	0.6 5.0 12.2 28.3		
Σ		20.8				

C.M.O. of BEAM

CLJ

			C	M <sub>o</sub>	Q	
RF ① ②	 $w = 0.60$ $Q \times 2.88 \lambda 1$ $f = 0.781420$	$w$ f	$0.60 \times 0.6$ $0.48 \times 2.88^2/12$	0.4 0.3	x 1.0 /8 0.6 0.5	x 1.0 x 2.88/2 0.6 0.7
				0.7	1.1	1.3
RF ① ②	 $f = 0.58 + 2.3$	f	$2.84 \times 2.88^2/12$	2.0	/8 3.0	x 2.88/2 4.1
				2.0	3.0	4.1
RF ③ ④ ⑤	 $w = 0.10 \times 2$ $Q \times 2.88 \lambda 20$ $f = 0.26$	$w$ f	$1.20 \times 3.7$ $0.26 \times 3.88^2/12$	4.4 1.6	x 4.7 /8 6.8 2.4	x 3.2 x 4.88/2 3.8 1.6
				6.0	9.2	5.4
RF ① ②	 $f = 0.68 + 2.3$	f	$2.90 \times 4.88^2/12$	8.4	/8 12.0	x 4.88/2 8.9
				8.4	12.0	8.9
RF ① ②	 $w = 0.60$ $Q \times 2.88 \lambda 20$ $f = 0.5610.2$	$w$ f	$0.60 \times 3.7$ $0.56 \times 4.88^2/12$	2.2 2.2	x 5.7 /8 3.4 3.3	x 3.2 x 4.88/2 1.9 2.2
				4.4	6.7	4.1

SEISMIC FORCE

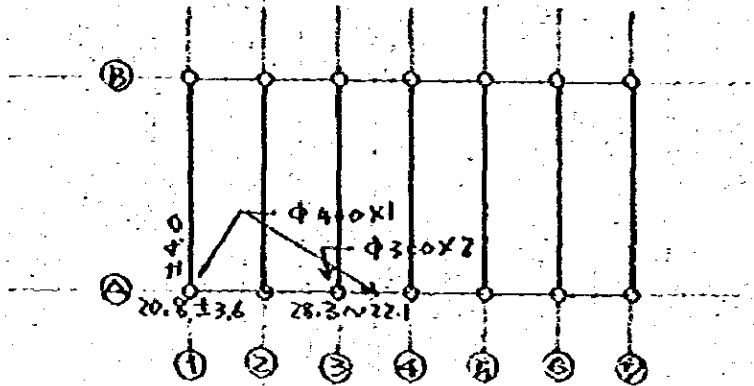
CLJ

		W	K	FW	Q
S	$(0.56 \times 112.0) + (0.33 \times 9.0)$	65.7			
G	$(0.7 \times 12) + (1.9 \times 7)$	18.2			
C	$(2.6 \times 14/2)$	18.2			
W	$(0.2 \times 46.3) + (2.6 \times 39.9/2)$	60.6			
Σ	$\bar{w} = 162.7/112.0 = 1.45 \text{ C/m}^2$	162.7	0.10	16.3	17.0





Footings



Brick Base

G.F.L. = 2.950

for  $8.4 - (0.30 + 1.65 + 0.60) \times 2.0 = 1.3$

At  $22.1 / 1.3 = 17.0 \rightarrow 288 \times 5.9$

$\frac{28.3 + 22.1}{2} / 1.3 = 19.4 \rightarrow 288 \times 6.7$

Pile  $\Phi 400$

$R = 35.0 \times 0.8 = 28.0$

$\Delta N = 1.65^2 \times 1.2 \times 2.0 = 2.6$

$R_e = 28.0 - 2.6 = 25.4 > 20.8, 22.1$

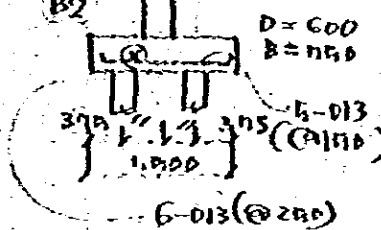
$\Phi 300$

$R = 25.0$

$\Delta N = 0.4^2 \times 1.2 \times 2.0 = 1.9$

$R_e = 25.0 - 1.9 = 23.1 \sim \times 2 = 46.2 > 28.3$

F2 (A2)



$Q = 28.3 / 2 = 14.15$

$M = 14.15 \times (315 - 0.4K) = 39$

$= 39$

$j = 46.4$

$Q = 14.7$

at 3.7

Column

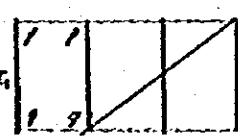
DIR.	Stress	Stress			N/BD	M/BD <sup>2</sup>	P	St	Pg	b	D	Section
		V	H	T								
CA1	N	20.8	1.4	22.2	15.8					50		
	M	0.2	2.7	4.2	10.7	0.20	2.8		28			
	L	0.1	4.1	4.2					28.1			
	Q	0.1	1.2	2.1	9.1							
	N	20.8	1.8	22.6	16.1					28		
	M	1.3	4.4	7.6		10.9	0.20	2.8		50		
L	2.1	5.5	7.6					39.4				
CA3	Q	0.6	2.2	5.0	9.9					50		
	N	23.22	0.4	23.62	29.5					28		
	M	0	2.8	4.2	10.7	0.18	2.1			28		
	L	0	4.2	4.2								
	Q	0	1.3	2.6	9.1							
	N	23.22	0.9	24.12	29.9	16.4				28		
M	0.8	2.7	3.5	10.0	0				90			
L	0	0	0									
Q	0.1	0.1	1.1	3.9								

Beam

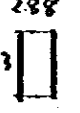
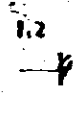
		Stress			C	P	δ	ΔL	CP	b	D	J	Section
		V	H	T									
RG1	M	O	0.2	2.7	2.9			2.0		29	50	39.4	
		E			2.9			2.1					
	C	0.6	0.7	1.3				1.1					
	E	0.7	1.4	2.1				1.8					
	Q	1.3	1.4	4.1	QA 5.9		ΔQ 0	5.0					
RG2	M	E	1.3	5.3	6.6			3.1		28	85	70	
		C	5.4						1.9				
								X 3.9					
	Q	4.1	1.8	7.7	11.8		0	5.2					
RG3	M	E	0.8	2.7	3.5			1.7		28	85	70	
		C	8.4						0.9				
								X 6.0					
	Q	4.4	0.9	---	11.8		0	5.5					
FG1	M	O	0.1	4.1	4.2			1.9		29	90	71.8	
		E			4.0			1.9					
	C	1.7	1.0	2.7				1.3					
	E	2.5	2.1	4.6				2.1					
	Q	4.1	2.2	8.5	13.5		0	6.6					
FG2	M	E	2.1	6.5	8.6			4.0		28	90	71.8	
		C	10.1		9.4				2.0				
								X 7.2					
	Q	8.5	2.2	12.9	10.0		0	8.6					

SS 8.

Sub Beam

Load				Stress						Section
From CSI $\Delta M$ 0.28 $\Delta Q$ 0.48				$M_T = 0.28 \times 2.88 / 2 = 0.40$ $A_0 = 25 \times 15 = 375$ $\Psi = 2(15+15) = 60$						
B1	C	0.95	2.88/2	0.47	M	C	Pt	$\delta$	at	
	M <sub>0</sub>				0.47				0.9	
	Q		2.88/2	0.65	at = $\frac{M_T \Psi}{240 A_0} = 213$				$P_u = (M_T / 240 A_0) \times 1000 = 0.0031$	
					QA	Q	QA	PM	St	lp
					at	3.9				1.8

Slab

Load		Dir.	Stress			D	J	at	lp	Section
S1	$2.88$ 	S.	M	4.14	0.82	0.43	12	8.3	2.6	D16 @ 200
			C							
		Q	1.49	0.71	0.91			5.2		
		L.	M		0.85	0.28		7.4	1.9	
C									~	
			Q		0.96	0.82			5.3	
CS1	$1.2$ 	S.	M	0.47	0.60	0.28	12	8.3	1.7	D10 @ 200
			C							
		Q	0.39	1.20	0.47			3.1		
		L.	M							
C										
			Q							

DRG. DATA (Sub Station)

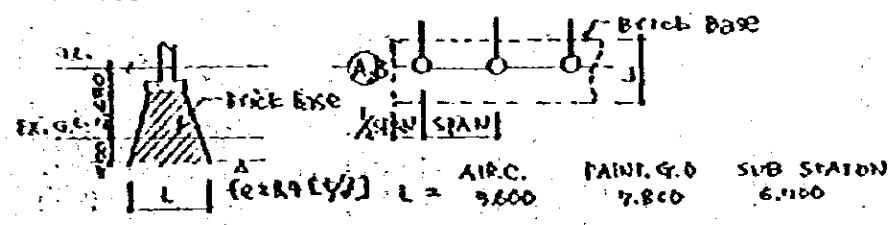
Like to, Paint, Grease & Oil Storage

But Footing of (25x25)

φ300x2 ~ SEE. P. 242

Brick Base

BTM = G.L. - 3.250  
 B = 6.000



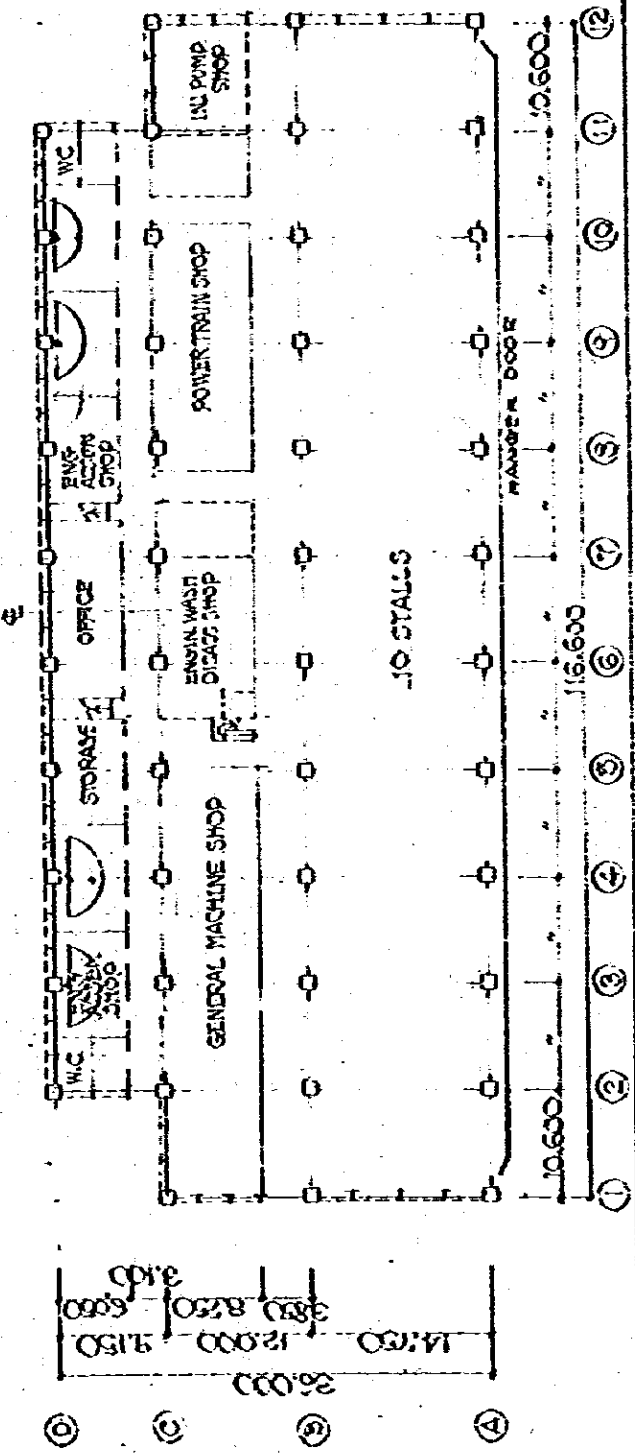
< SUMMARY OF BRICK BASE >

255

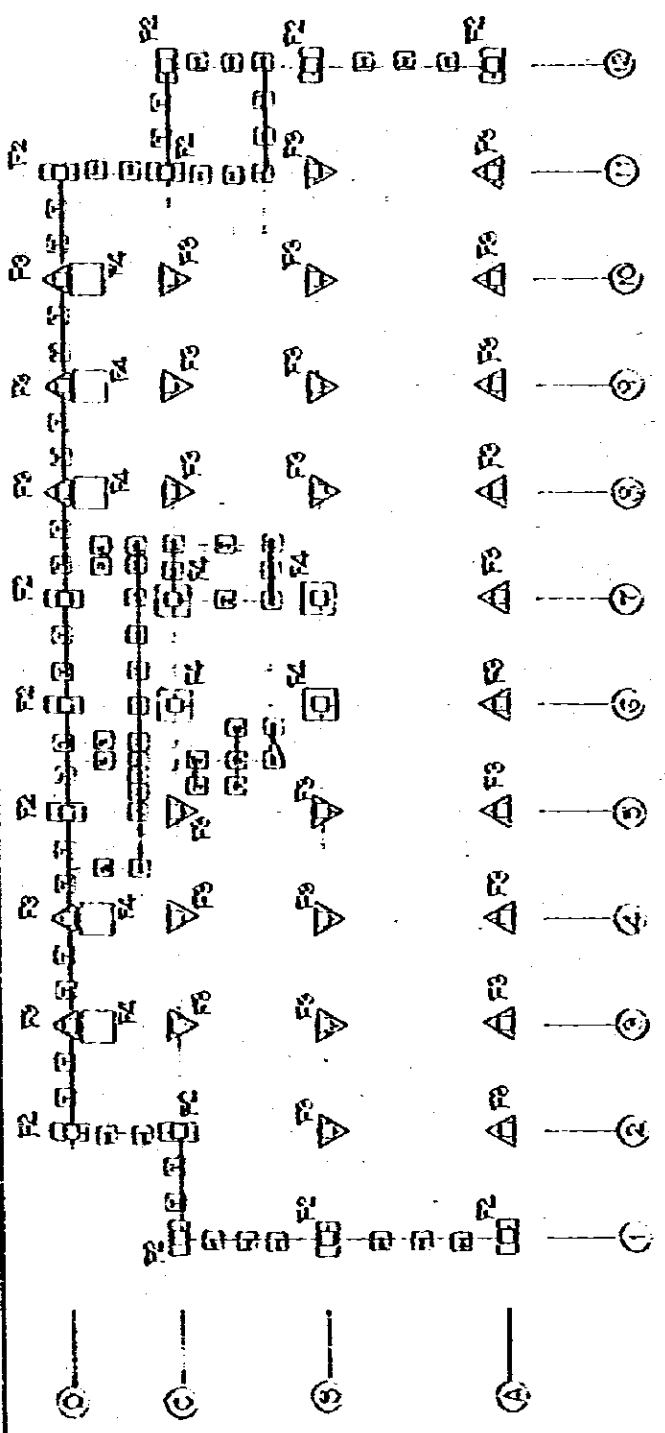
# 10 重 整 備 工 場

**HEAVY REPAIR FACTORY**

**GF PLAN**

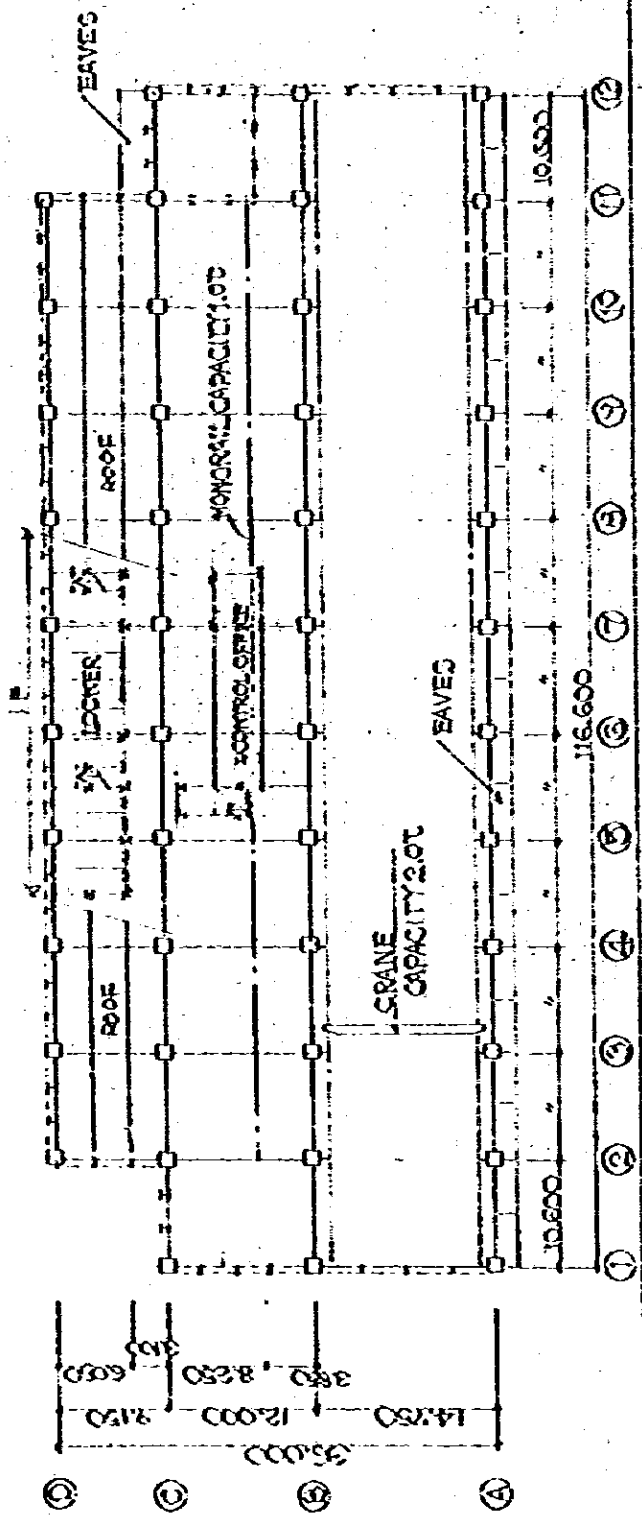


**GF KEY PLAN**

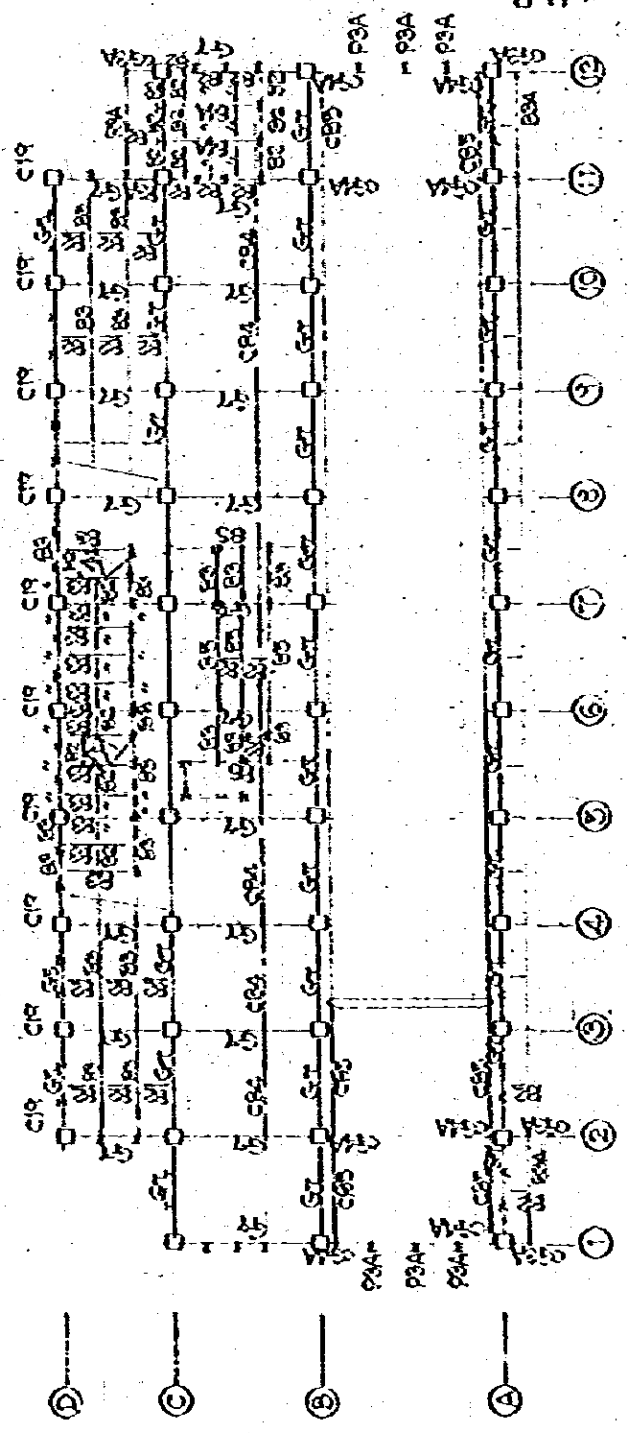


□ : F1  
 △ : F2

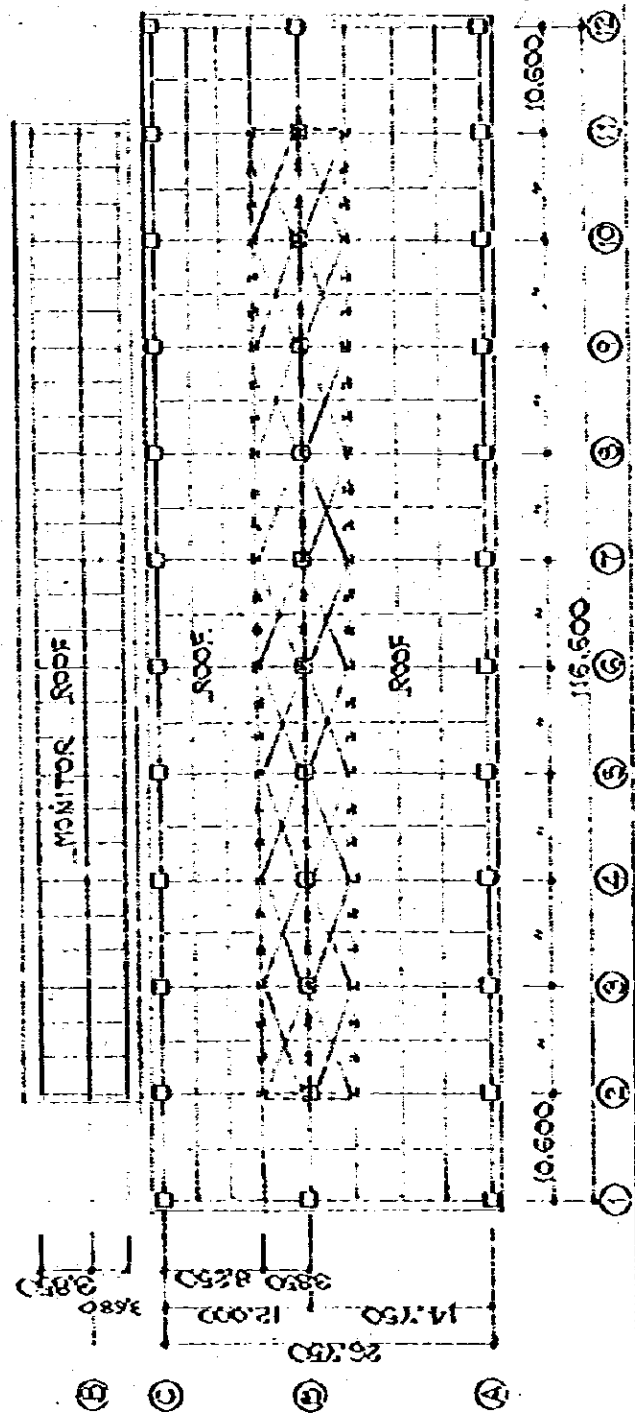
12F PLAN



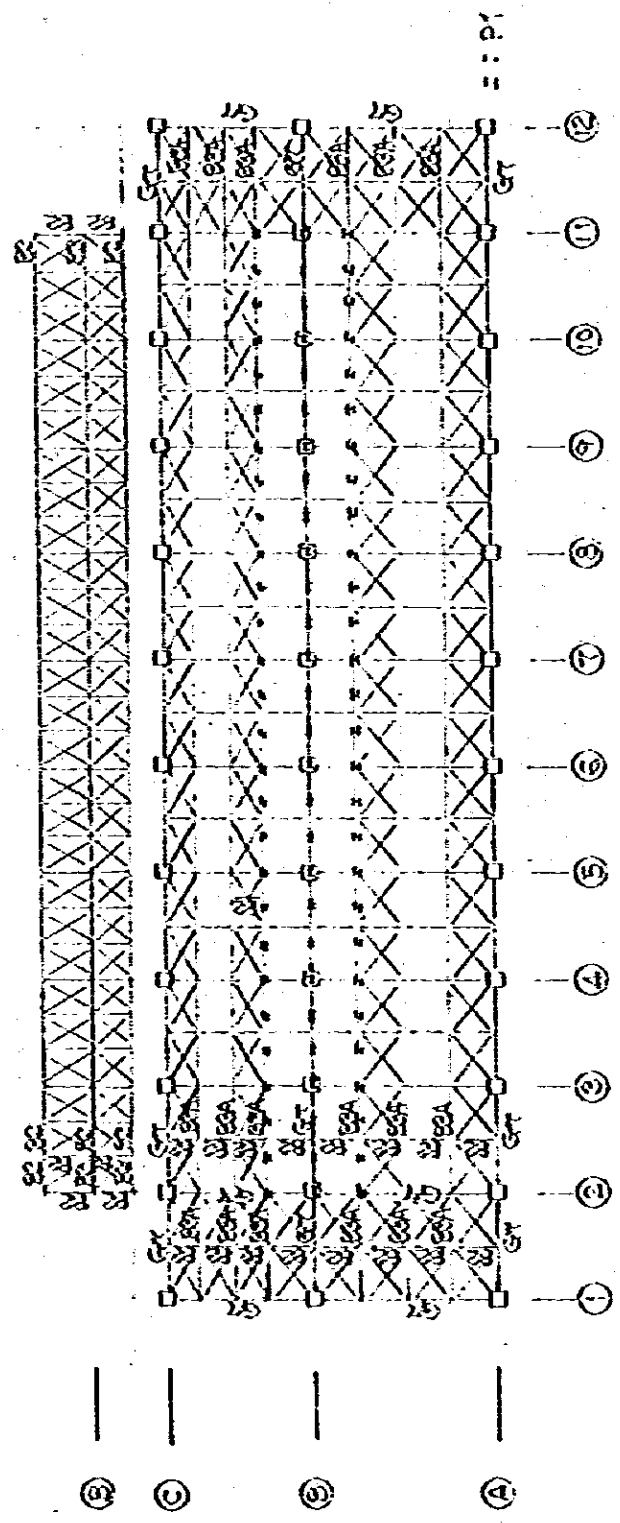
12F KEY PLAN



RF PLAN



RF KEY PLAN







Unit load

Floor

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

Beam									
	v/m			Year					
	Skeleton	Finish	Σ	1					
Beam G9	0.25	0	0.25						
G9	0.15	0	0.15						
Subbeam	0.05	0	0.05						
Foundation Beam	1.26	0	1.26						

Column									
	v/m			Year					
	Skeleton	Finish	Σ	1					
Column □ 400	0.20	0	0.20						
□ 350	0.15	0	0.15						
Post	0.05	0	0.05						

Wall									
	v/m			Year					
	Skeleton	Finish	Σ	1					
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

### Velocity of Wind

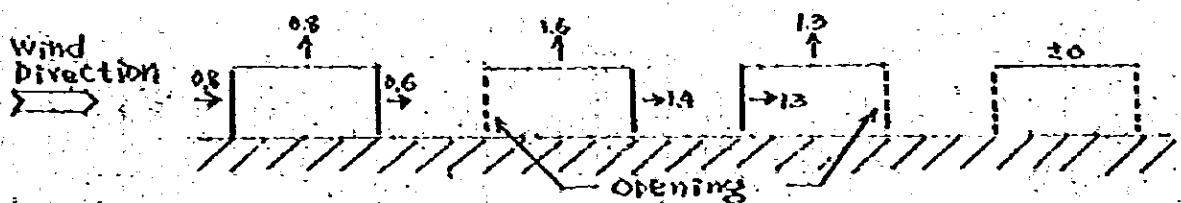
$$\begin{aligned} \text{Cyclone } 130 \text{ Miles/Hour} &= 130 \times 1609.34 / 3,600 \\ &= 48.1 \text{ m/sec} \\ &\rightarrow 60.0 \text{ m/sec } (h = 15 \text{ m}) \end{aligned}$$

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

$$\begin{aligned} \text{Velocity Pressure } q &= \frac{1}{2} \rho v^2 = \frac{1}{2} \times \frac{1}{8} (60 \sqrt{\frac{h}{15}})^2 \\ &= 60 \sqrt{h} \end{aligned}$$

Block	Surface		[m] [kg/m <sup>2</sup> ] [kN/m <sup>2</sup> ]			
			$\bar{h}$	$60\sqrt{\bar{h}}$	q	C <sub>q</sub>
Heavy Repair Factory	Monitor Roof	Roof Wall	12.7	24	270	
		Roof Wall	10.5, 6.9	194, 158	200, 160 140, 120	
Parts Storage	Monitor Roof	Roof Wall	7.4 - 7.29	184 - 183	180	
		Roof Wall	7.36 - 7.00	163	160 120	
Inspection Factory	Monitor Roof	Roof Wall	/	/	/	
		Roof Wall	7.20 - 7.10	161	160 120	
Periodical Repair Factory	Monitor Roof	Roof Wall	7.33 - 7.23	183	180	
		Roof Wall	7.23 - 7.00	161	160 120	
Joint & Body Factory	Monitor Roof	Roof Wall	7.41 - 7.31	184	180	
		Roof Wall	7.31 - 7.00	162	160 120	
Retreading & Metal Casting Factory	Monitor Roof	Roof Wall	7.45 - 7.30	184	180	
		Roof Wall	7.30 - 7.00	162	160 120	

### Coefficient of Wind Pressure





		B1		B2		B3		B6	
MRF	S			0.09 X 45.3	4.0	X 101.1	9.1	X	} = 83
	GB			0.05 X 31.0	1.6	X 76.9	2.3	X	
	C			0.04 X 2.3	0.1	X 2.3	0.1	X	
	W			0.02 X 0	0	X 0	0	X	
	Σ			(12.25 X 47.7) 8.7	9.7	12.7	12.7	12.7	12.7
	W.L.			-0.15 X 45.3	-13.8	X 101.1	-24.3	X = 83	-24.3
	Σ'			-5.1	-5.1	-12.6	-12.6	-12.6	-12.6
RF	S	0.09 X 47.6	7.6	X 101.9	9.2	X 62.0	5.6	X	} = 83
	GB	0.25 X 18.7	4.7	X 24.0	6.0	X 24.0	6.0	X	
		0.05 X 19.9	1.0	X 45.2	2.3	X 45.2	2.3	X	
	Σ	(12.25 X 47.7) 12.7	12.7	26.2	17.5	26.6	13.9	26.6	
	W.L.	-0.13 X 47.6	-17.8	X 101.9	-23.4	X 62.0	-14.3	X = 83	-14.3
	Σ'	-5.1	-5.1	-11.0	-5.9	-13.0	-0.9	-13.0	-0.9
2.1F	S	0.09 X 0	0	X 0	0	X 0	0	X	} = 82
	GB	0.43 X 0	0	X 0	0	X 0	0	X	
	C	0.15 X 22.9	3.4	X 37.8	5.7	X 37.8	5.7	X	
	FA	0.05 X 0	0	X 0	0	X 0	0	X	
	W	1.25 X 10.0	2.5	X 10.0	2.5	X 10.0	2.5	X	
		0.02 X 0	0	X 0	0	X 0	0	X	
		0.05 X 0	0	X 0	0	X 0	0	X	
		0.05 X 0	0	X 0	0	X 0	0	X	
		0.05 X 0	0	X 0	0	X 0	0	X	
		0.60 X 0	0	X 0	0	X 0	0	X	
	Σ	(12.25 X 47.7) 18.6	5.9	34.4	8.2	34.8	8.2	64.4	34.8
	W.L.	-0.20 X 0	0	X 0	0	X 0	0	X = 0	0
	Σ'	0.8	5.9	-2.8	8.2	-4.8	8.2	24.8	37.8
		A1		A2					
MRF	S								
	GB								
	C								
	W								
RF	S	0.04 X 43.6	4.4	X 88.8	8.0				
	GB	0.25 X 12.7	3.2	X 18.0	4.5				
		0.05 X 11.6	0.6	X 23.3	1.2				
	Σ	8.2	8.2	13.7	13.7				
	W.L.	-0.23 X 43.6	-11.2	X 88.8	-20.4				
	Σ'	-3.0	-3.0	-6.7	-6.7				
2.1F	S	0.09 X 17.4	1.6	X 31.8	2.9				
	GB	0.43 X 0	0	X 0	0				
	C	0.15 X 5.3	0.8	X 10.6	1.6				
	FA	0.05 X 7.6	0.4	X 13.6	0.7				
	W	1.25 X 4.7	2.4	X 9.7	2.4				
		0.02 X 0	0	X 0	0				
		0.05 X 10.3	0.5	X 20.6	1.0				
		0.05 X 11.4	0.6	X 22.8	1.2				
		0.10 X 7.4	0.7	X 14.8	1.5				
		Σ	29.8	21.6	26.4	12.7			
	W.L.	-0.33 X 17.4	-5.7	X 31.8	-10.5				
	Σ'	12.9	15.9	-4.4	18				

		C1		C2		C3		C6									
uRF	S	/		/		/		/									
	GB																
	C																
RF	W	/		/		/		/									
	Σ																
	W.L.																
2,1F	Σ'	/		/		/		/									
	S									0.09 X 40.6	3.7	X 74.2	6.7	X 74.2	6.7	X 74.2	6.7
	O.B									0.25 X 11.3 0.04 X 12.6	2.8 0.7	X 16.6 X 16.6	4.2 0.8	X 16.6 X 16.6	4.2 0.8	X 16.6 X 16.6	4.2 0.8
RF	Σ	6.7		11.7		11.7		11.7									
	W.L.	-9.23 X 40.6	-9.3	X 24.2	-17.1	X 24.2	-17.1	X 24.2	-17.1								
	Σ'	-2.6		-5.4		-5.4		-5.4									
2,1F	S	0.09 X 0	0	X 26.8	2.4	X 48.5	4.4	X 48.5	4.4								
	GB	0.43 X 11.3	1.7	X 0	0	X 21.2	3.2	X 21.2	3.2								
	C	0.18 X 0	0	X 7.6	0.9	X 15.2	1.9	X 15.2	1.9								
2,1F	FG	0.25 X 3.1	3.9	X 3.3	4.2	X 0	0	X 0	0								
	W	0.126 X 26.0	2.1	X 27.9	2.2	X 0	0	X 0	0								
	Σ	0.05 X 5.7	2.8	X 5.0	3.0	X 0	0	X 0	0								
RF	Σ	19.7		29.6		22.6		10.9									
	W.L.	-9.26 X 0	0	X 26.5	-5.3	X 48.5	-1.7	X 0	-9.7								
	Σ'	10.4		17.2		-4.2		-25.3									
uRF	S	/		/		/		/									
	GB																
	C																
RF	W	/		/		/		/									
	Σ																
	W.L.																
2,1F	Σ'	/		/		/		/									
	S									0.09 X 0	0	X 0	0	X 0	0	X 0	0
	GB									0.43 X 11.3	1.7	X 0	0	X 0	0	X 0	0
2,1F	C	0.18 X 0	0	X 0	0	X 0	0	X 0	0								
	FG	0.25 X 3.1	3.9	X 0	0	X 0	0	X 0	0								
	W	0.126 X 26.0	2.1	X 0	0	X 0	0	X 0	0								
RF	Σ	10.5		10.5		9.4		11.0									
	W.L.	0		0		0		0									
	Σ'	0		0		0		0									

CMR of Beam

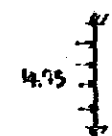
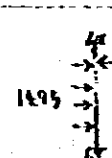

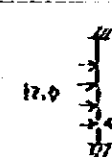
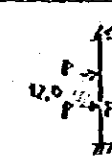
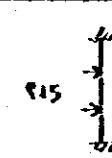
[tm,t]

	Load		C	M <sub>0</sub>	Q
↘ RG (B) T.L.	10.6 ↔	$(0.02 \times 3.77) + 0.20$	$0.539 \times 10.6^{3/2}$ 5.0	$\times / 8$ 7.6	$\times 10.6/2$ 2.9
"	"	"	5.0	7.6	2.9
"	10.6 ↔	$(-0.87 \times 2.20 - 0.07) \times 3.77$	$0.867 \times 10.6^{3/2}$ -8.1	$\times / 8$ -12.2	$\times 10.6/2$ -4.6
(B) W.L.	"	"	-8.1	-12.2	-4.6
↘ 2G (C) T.L.	10.6 ↕	$(0.02 \times 1.59) + 0.20$ $(0.02 \times 2.26) + 0.20$ $(0.12 \times 1.59) + 0.20$ $(0.12 \times 2.26) + 0.20$ $(0.02 \times 1.59) + 0.20$ $(0.02 \times 2.26) + 0.20$ MF (1.04 x 0.39) CRANE	$0.402 \times 10.6^{3/2}$ 3.8 $3.2 \times 10.6/8$ 4.3 $1.2 \times 10.6/8$ 1.6	$\times / 8$ 5.7 $\times / 4$ 8.5 $\times / 4$ 3.2	$\times 10.6/2$ 2.1 $\times 1/2$ 1.6 $\times 1/2$ 0.6
"	"	"	4.7	17.4	4.3
↘ 2G (C) W.L.	10.6 ↔	$(-0.87 \times 2.20 - 0.07) \times 3.77$	$0.867 \times 10.6^{3/2}$ -2.9	$\times / 8$ -4.3	$\times 10.6/2$ -1.6
"	"	"	-2.9	-4.3	-1.6
↘ 2G (B) T.L.	10.6 ↕	MF CRANE (3.07 x 0.52)	$3.2 \times 10.6/8$ 4.3 $1.9 \times 10.6/8$ 2.9	$\times / 4$ 8.5 $\times / 4$ 4.0	$\times 1/2$ 1.6 $\times 1/2$ 1.0
"	"	"	6.8	13.5	2.6
↘ 2G (D) T.L.	10.6 ↔	$(0.02 \times 2.51) + 0.15$	$0.376 \times 10.6^{3/2}$ 3.5	$\times / 8$ 6.3	$\times 10.6/2$ 2.0
"	"	"	3.9	6.3	2.0
"	10.6 ↔	$(0.87 \times 2.20 - 0.07) \times 3.77$	$0.867 \times 10.6^{3/2}$ -4.7	$\times / 8$ -7.0	$\times 10.6/2$ -2.6
"	"	"	-4.7	-7.0	-2.6
	Horizontal Axis 0.8 x 0.4 x 4.25		0.54 $H = 700 \times 200 \quad I_y = 10,800 \quad \approx \text{OK}$ $Z_H = 0.84 \times 10.6 \times 100 / 8 \times 2.2 = 36.0$ $J_H = 5 \times 0.0054 \times 1016^2 \times 300 / 32 \times 2.2 = 11,763.0$		



AR

[ t m s t ]

		Load		C		M0		Q
↓	RG A-B T.L.	$(0.09 \times 12.6) + 0.20$	♀	$1.194 \times 14.75/11$	20.9	Y / 8	31.4	$\times 14.75/2$ 8.5
					20.9		31.4	8.5
∥	B W.L.	$(-0.25 \times 12.6 - 0.07) \times 10.6$ $(4 \times 2.22 \times 6.125/11) \times 2.9/2 = 1.39$	♂ P	$2.938 \times 14.75/11$ $(1.0 \times 3.18) \times 0.7/0.25$	44.2 ± 8.9	Y / 8 $0.3 \times 14.75/2$	-16.3 ± 2.2	$\times 14.75/2$ 18.0 $1.3 \times 0.15/0.25$ 1.0 ± 0.3
					↑ B 47.0 A 43.1	↑ 62.5	↓ 60.9	↑ B 19.0 A 18.3
↓	RG B-C T.L.	$(4.07 \times 12.6) + 0.20$	♀	$1.194 \times 12.6/12$	13.8	Y / 8	20.8	$\times 12.0/2$ 6.9
					13.8		20.8	6.9
∥	B-C W.L.	$(0.8 \times 12.6 - 0.07) \times 10.6$	♀ P	$2.938 \times 12.6/12$ $(0.7 \times 6.0) \times 0.3/0.69$	29.3 ± 3.9	Y / 8 $0.4 \times 12.0/2$	43.9 ± 2.4	$\times 12.0/2$ 14.6 $1.3 \times 0.3/0.69$ 1.0 ± 0.4
					↑ B 24.6 C 25.9	↑ 41.5	↓ 40.3	↑ C 14.2 B 13.7
↓	ZG B-C T.L.	$(0.85 \times 12.6) + 0.05 \times 11.4 + 0.08 \times 8.0$	MF P P'	$9.3 \times 6.0/4.5$ $(1 \times 6.0) \times 0.33/0.67$	10.7 2.8 5.6	$\times 6.0/3$ $1.0 \times 6.0$	16.0 6.0	$\times 1.0$ 8.5 $\times 0.33/0.67$ 1.0 2.1
					↑ C 13.5 B 16.3		22.0	4.3 10.4
↓	ZG C-D T.L.	$(0.04 \times 32.3) + 0.85 \times 10.6$	P ♀	$3.43 \times 9.15/4.5$ $0.15 \times 9.15/12$	7.0 1.0	$\times 1/3$ $\times 1/8$	10.5 1.5	$\times 1.0$ 3.9 $\times 9.15/2$ 0.9
					8.0		12.0	9.1
∥	C-D W.L.	$(0.1 \times 9.15 - 0.01) \times 32.3$	P	$7.83 \times 9.15/4.5$	15.1	$\times 1/3$	22.7	$\times 1.0$ 7.4
					15.1		22.7	7.4

NR

CMoQ of Column

[cm, l]

		Load		C		Mo		Q	
	312	C 0.8 x 0.6 f 0.14 @ 3.07	↓	$0.422 \times 3.42 / 12$ 1.317	0.4 0.3	x 1/8	0.6 0.5	x 3.42/2 0.7 0.9	
				U D	0.4 0.3		0.6 0.5		0.7 0.9
	698	C 0.8 x 0.6 f 0.14 @ 3.07	↓	$0.422 \times 6.98 / 8$ 4.517	2.6 1.9	x 1/2	2.6 1.9	x 6.98/2 1.5 1.1	
				U D	2.6 1.9		2.6 1.9		1.5 1.1
	690	C 0.8 x 0.6 f 0.12 @ 1.63	↓	$0.156 \times 6.90 / 8$ 0.117	0.9 0.7	x 1/8	0.9 0.7	x 6.90/2 0.5 0.4	
				U D	0.9 0.7		0.9 0.7		0.5 0.4
	10.10	M (CRANE) 2.7	M	$\frac{2.7}{2} (3 \frac{10.10^2}{10.10^2} - 1)$	0.9 0	x	$\frac{2.7 \times 10.10}{2 \times 10.10} (1 - \frac{7.35^2}{10.10^2})$	0.2	
					0.9 0		0.2		
	10.10	0.8 x 0.6 x 10.6 x 2.6 // x 3.6	P1 P2	$5.4 \times 0.85$ 4.59	0.4 0.0	x 4.15	5.0 3.9	3.1 2.3	x 0.83 1.6 1.9
				$12.2 \times 0.95$ 11.59	2.2 1.6	x 4.55	12.2 8.9	4.3 3.2	x 0.6 1.5 1.6
				U D	14.5 11.7		12.2 8.9		2.4 1.8
					14.5 11.7		12.2 8.9		2.4 1.8
	326	0.8 x 0.6 x 1.4 x 3.3	↓	$0.334 \times 3.26 / 12$ 0.226	0.4 0.3	x 1/8	0.4 0.3	x 3.26/2 0.6 0.5	
				U D	0.4 0.3		0.4 0.3		0.6 0.5
	690	0.8 x 0.6 x 1.2 x 3.3	↓	$0.334 \times 6.9 / 8$ 0.284	2.0 1.5	x 1/8	2.0 1.5	x 6.9/2 1.2 0.8	
				U D	2.0 1.5		2.0 1.5		1.2 0.8



HR  
EC

SEISMIC FORCE

LEJ

			W	K	KW	Q
MRF (B)	S	$0.05 \times 95.9 \times 9.48$	45.5			
	B	$0.05 \times (843 + 678)$	7.6			
	P	$0.05 \times 2.48 \times 27$	3.3			
	W	$(0.08 \times 10.05 \times 248) + (0.05 \times 169.6 \times 2.48)$	23.0			
	$\Sigma$	$\bar{w} = 79.4 / (95.9 \times 9.59) = 0.09 \text{ [g/m}^2\text{]}$	79.4	4.10	8.0	8.0
RF (B)	S	$0.05 \times \{(119.1 \times 13.43) + (35.9 \times 7.53)\}$	42.7			
	G	$0.20 \times (116.6 + 161.8)$	55.5			
	B	$0.05 \times \{(116.6 \times 2) + (1493 \times 12)\}$	25.5			
	C	$0.25 \times 1.71 \times 12$	4.1			
	P	$0.05 \times 538 \times 6$	1.6			
	W	$0.05 \times 26.9 \times 5.0$	6.7			
	$\Sigma$	$\bar{w} = 139.1 / (119.1 \times 13.43) = 0.09$	139.1	4	13.8	21.8
ZF (C)	S	$(0.05 \times 95.9 \times 9.48) + (0.29 \times 21.2 \times 2.1)$	22.0			
	G	$0.20 \times (116.6 + 12.1 + 106.3)$	49.0			
	B	$0.05 \times (96.4 + 41.2 + 46.9)$	9.2			
	C	$0.25 \times 5.38 \times 12$	16.1			
	P	$0.05 \times 3.42 \times 7$	1.2			
	W	$(0.05 \times 119.1 \times 163) + (0.08 \times 25.3 \times 3.02)$	16.5			
	$\Sigma$	$\bar{w} = 112.0 / (439.2 + 44.5) = 0.23$	112.0	4	11.2	33.0
IF	S					
	B					
	W					

Wind Force (B)

	C	$q \text{ t/m}^2$	$A_w$	$H_f$	$Q_t$
MRF	0.8 + 0.6	0.12	$9.98 \times 248$	198	6.1
RF	0	0.14	$13.43 \times 5.0$	67.2	19.3
ZF					
IF					
MRF					
RF					
ZF					
IF					

HR

(D)

SEISMIC FORCE

(t)

			W	K	Kw	Q
MRF	S					
	B					
RF	S					
	B					
ZF	S	$0.05 \times 99.8 \times 6.68$	29.7			
	G	$(0.20 \times 45.8) + (0.15 \times 99.4)$	23.5			
	B	$0.05 \times (92.4 + 41.2)$	6.8			
	C	$0.10 \times 35.8 \times 1.0$	5.4			
	P	$0.05 \times 3.68 \times (1.8 + 1.9)$	6.6			
	W	$0.05 \times 109.6 \times 3.52$	18.6			
	$\Sigma$	$\bar{w} = 90.6 / (99.8 \times 6.68) = 0.19 \text{ (4\%)}$	90.6	9.10	9.1	13.6
IF	S	$0.27 \times 31.8 \times 4.58$	42.2			↑ 1/2
	B	$0.04 \times \{ (31.8 \times 3) - (4.58 \times 15) \}$	8.2			
	W	$0.08 \times (31.8 + 19.6) \times 4.58$	32.8			
$\Sigma$	$\bar{w} = 89.6 / (31.8 \times 4.58) = 0.62$	89.2	"	9.0		

Wind Force

	C	$Z_{e/4}$	$A_{m^2}$	$H_t$	$Q_t$
MRF					
RF					
ZF	0.8 + 0.6	0.12	$9.83 \times 3.52$	17.0	2.9
IF					
MRF					
RF					
ZF					
IF					

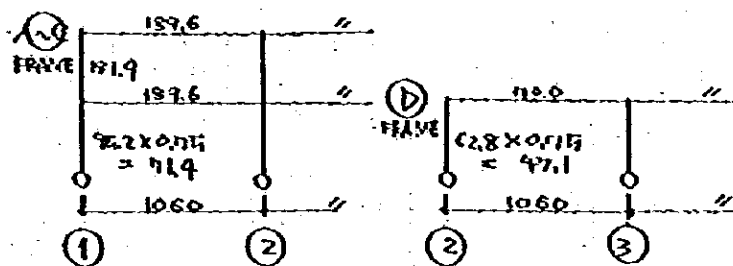
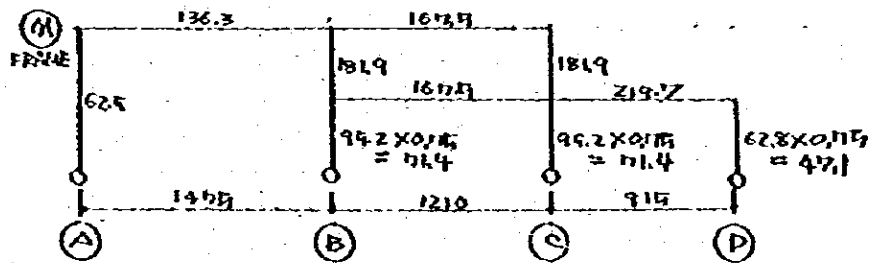
Stiffness Ratio

	J	Σ						
		D/H	1475	1200	915	1060	623	326
H-100x20x13x24	24,000		136.3	1675	219.7	189.6	—	326
H-48x30x4x18	41,000		—	—	—	700	—	—
D-40x40x19x16	63,100 54,600		—	—	—	—	95.2	181.9
D-30x30x17x16	40,700 35,300		—	—	—	—	60.8	67.5

$$J_e = \mu J_{max} = 0.20 + 0.80 \sqrt[3]{\frac{J_{min}}{J_{max}}}$$

$$0.20 + 0.80 \sqrt[3]{\frac{54,600}{63,100}} = 0.94$$

$$0.20 + 0.80 \sqrt[3]{\frac{35,300}{40,700}} = 0.93$$

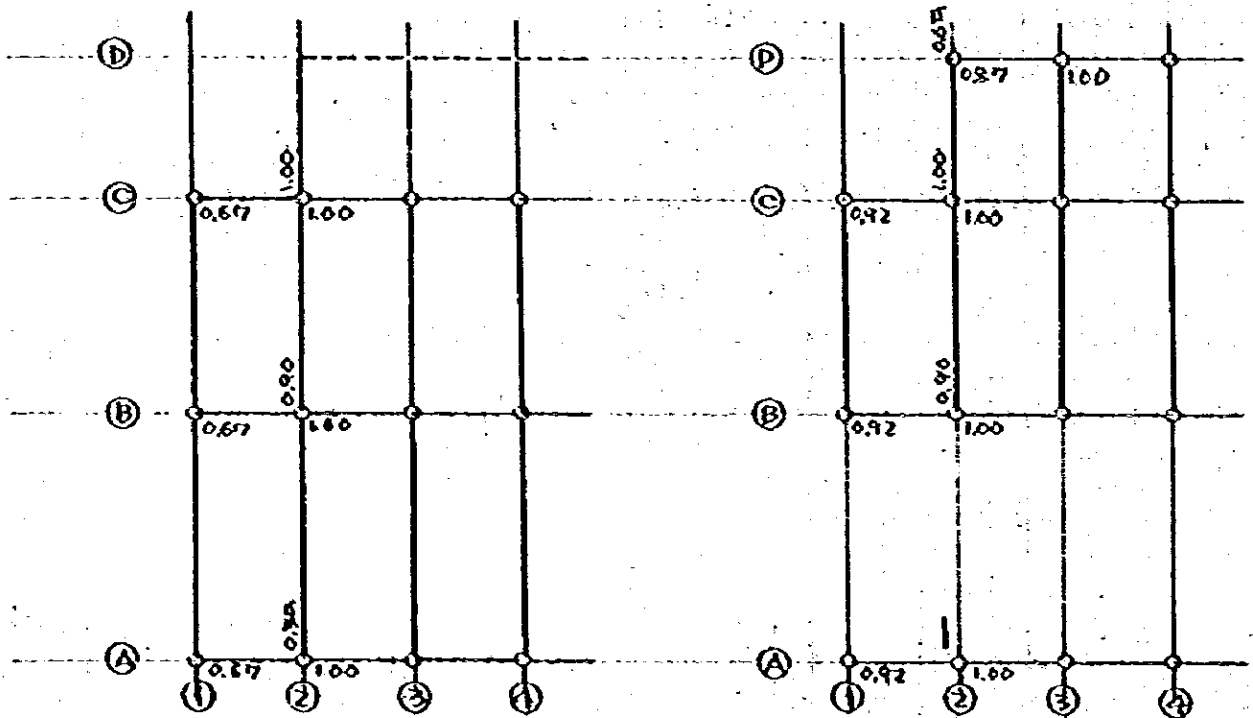


Distribution Factor & Inflection Point

DIR.	D						Y				R	K.L.			W.L.					
	KC	ΣFB	E	α	D	D'	Y <sub>0</sub>	Y <sub>1</sub>	Y <sub>23</sub>	ΣY		Q	M <sub>0</sub>	M <sub>L</sub>	Q	M <sub>0</sub>	M <sub>L</sub>			
↑ JF	62.5	136.3	2.18	0.20	12.7	0.35	0			0	9.99									
					12.7													2.3	21.6	0
	181.9	471.3	1.30	0.39	71.5													0.90	0.40	-0.05
GF	181.9	554.7	1.52	0.43	78.7	1.00	0.49	0.05		0.50	3.26									
					35.8													6.5	10.6	10.6
	71.4	167.5	2.35	0.21	14.7													0.90	0	
A-C	"	377.2	5.42	0.23	16.3	1.00	0			0	"									
					16.3													6.8	42.4	0
	47.1	219.7	4.66	0.23	10.6													0.65	0	
GF	181.9	379.2	1.04	0.34	62.3	0.657	0.40			0.40	3.26	1.3	1.4	2.9						
	"	"	"	"	62.3													2.0	3.6	2.9
	"	"	"	"	62.3													2.0	3.6	2.9
GF	71.4	189.6	2.66	0.21	14.0	0.92	0			0	6.23	2.6	16.0	0						
	"	"	"	"	14.0													2.8	17.4	0
	"	"	"	"	14.0													2.8	17.4	0
GF	47.1	70.0	1.49	0.19	8.8	0.817	0			0	6.23	1.2	7.6	0						
	"	"	"	"	8.8													1.2	7.6	0
	"	"	"	"	8.8													1.2	7.6	0
D	"	"	"	"	10.1	1.00	0			0	"	1.4	8.7	0						
					10.1													1.4	8.7	0
	"	"	"	"	10.1													1.4	8.7	0

$$\frac{1}{14.5} \left( \frac{326}{949} \right)^2 + \frac{1}{14.7} \left( \frac{623}{949} \right)^2 = \frac{1}{(1.65 \times 10^{-3}) + (2.93 \times 10^{-2})} = 32.3$$

$$\frac{1}{18.7} \left( \frac{326}{949} \right)^2 + \frac{1}{16.3} \left( \frac{613}{949} \right)^2 = \frac{1}{(1.50 \times 10^{-3}) + (2.69 \times 10^{-2})} = 35.8$$



UNIT STRESS

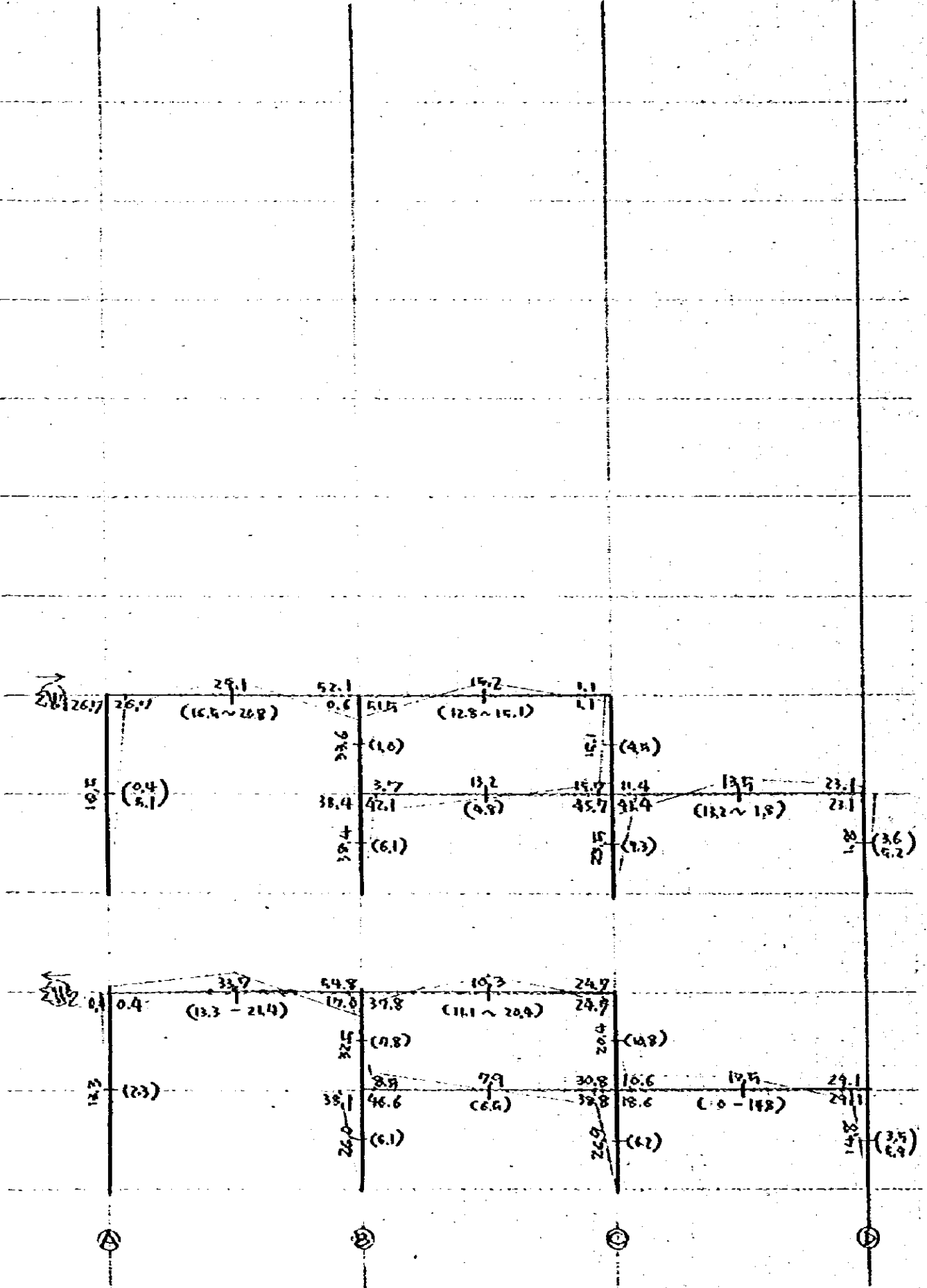
FR	FL	K.L.			W.L.			
		Q	ΣD	Q/ΣD	Q	ΣD	Q/ΣD	
Ⓝ	R	5.5	$0.34 + 0.90 + 10.0$	2.25	2.5	14.6	2.29	6.5
	1	$(5.5 \times \frac{1.98}{2.25}) + 5.0 + 1.7$ 11.4	$0.34 + 1.00 + 10.66$	2.65	4.5	$(14.6 \times \frac{1.98}{2.25}) + 5.1$ 19.4	2.85	6.8
Ⓟ	R	21.8	$0.67 + 2 + 10.0$	11.34	2.0	6.1	11.34	0.6
	1	33.0	$(0.67 \times 2) + 10.0$	11.34	2.8	19.3	11.34	1.7
Ⓧ	1	13.6	$(0.67 \times 2) + 8.00$	9.74	1.4	2.9	9.74	0.3



## Deflection by Horizontal Force

FR.	FL	LOAD	Q	$\Sigma P D_s$	$\frac{h^3}{12Eko}$	$\delta$	$\delta/h_0$
Ⓜ	R	K.L.	5.5	2.35 x 32.3	$623^3/12 \times 2,100$	1.17	$1/332$
		W.L.	14.6	"	"	3.09	$1/209$
	I	K.L.	11.4	2.55 x 16.3	$325^3/12 \times 2,100$	1.16	$1/202$
		W.L.	12.4	"	"	1.97	$1/185$
ⓑ	R	K.L.	2.8	11.34 x 92.8	$623^3/12 \times 2,100$	3.11	$1/95$
		W.L.	6.1	"	"	0.09	$1/698$
	I	K.L.	33.0	11.84 x 10.3	$325^3/12 \times 2,100$	0.72	$1/412$
		W.L.	19.3	"	"	0.43	$1/412$
ⓓ	I	K.L.	13.6	9.99 x 10.1	$325^3/12 \times 2,100$	0.95	$1/419$
		W.L.	2.9	"	"	0.12	$1/598$





ⓑ	Ⓥ	0.49	0.51	0.34	0.32	0.34
		+2.4	-5.0	16.0		-5.0
		+2.8	+2.4	(2.9)	4.3	-0.4
		-1.0	0	7.6	-0.8	-0.4
		+3.5	-3.5	3.4	+5.8	-0.4
		0.16	0.41	0.43	(3.1)	0.30
			-9.7		19.7	0.11
		+1.4	19.6	+4.3	(4.3)	+2.2
		0	11.3	0	17.4	-0.7
		-0.2	-0.5	-0.6	17.4	-0.7
		+1.2	+4.8	-6.0	8.8	-0.7
			(0.2)	(4.8)	+11.2	-0.1
						-0.7
						-10.4

Ⓚ	Ⓥ	1.4	1.4	0.3	1.8	1.8
					3.6	0.1
			1.3	1.3		2.0
			2.9		10.2	2.9
		16.0	18.9	2.7	17.4	10.2
			2.6	3.0		2.8
						2.3

①

②

ⓓ	Ⓥ	0.40	0.60	0.37	0.26	0.37
		+1.4	-3.5	+3.5	2.2	-3.5
			+2.1	(2.0)	+1.1	
				5.3	-0.4	-0.3
			-1.4	2.5	+4.2	-0.3
			(0.2)	(2.3)		
						-0.4
						-3.9

Ⓚ	Ⓥ	7.6	7.6	1.1	4.4	4.4
					8.7	0.8
			1.2	1.1		1.4
						0.8

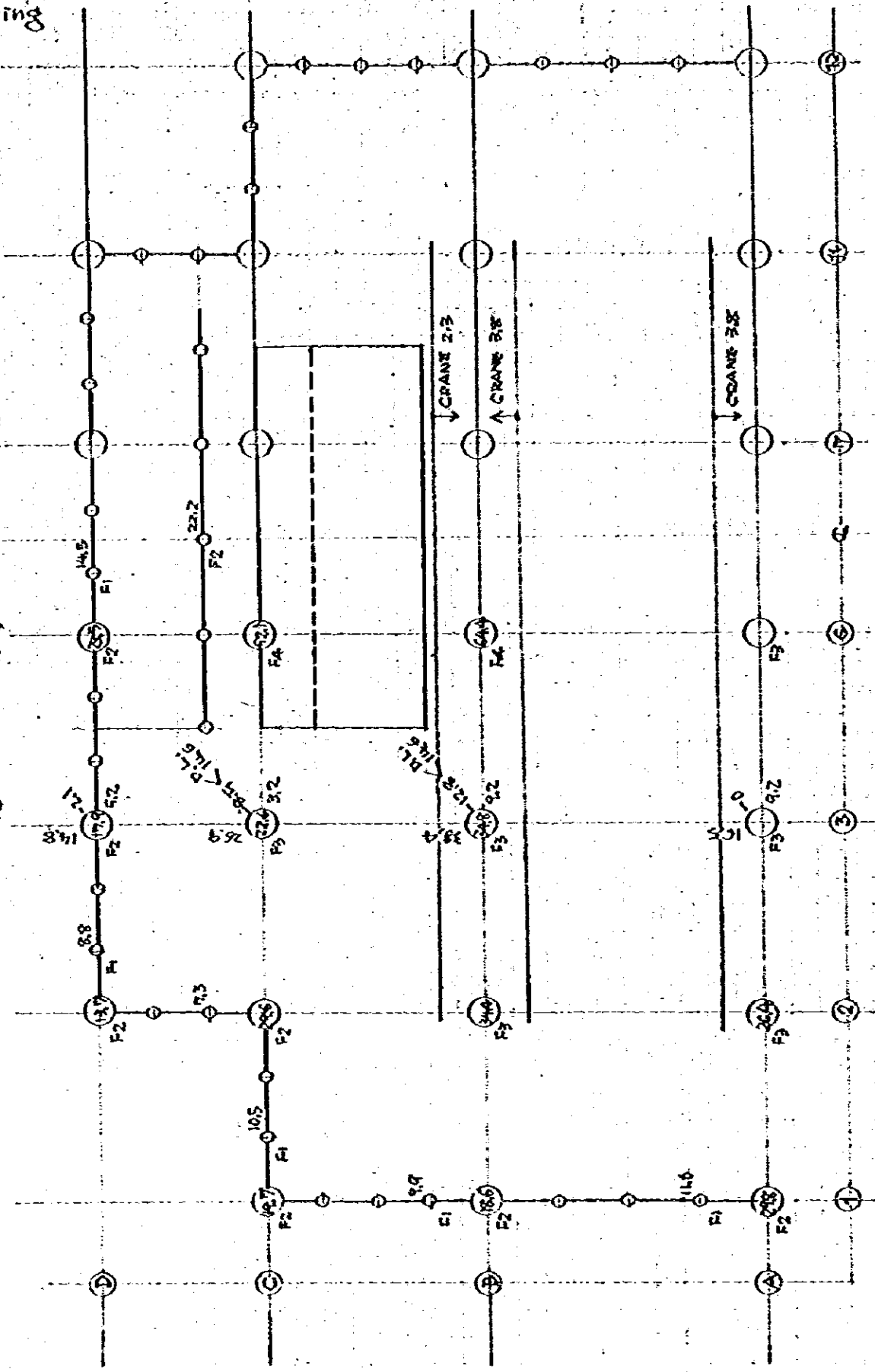
②

③

Footings

Allowable Load & Self Load of Footings

$F_1 = 224 \times 2 = 448$     Self Load  $1.65 \times 1.13 \times 0.9 \times 2.0 = 3.3$   
 $F_2 = 148$      $\times 3 = 448$      $\times 2.7 \times 0.9 \times 2.0 = 3.0$   
 $F_3 = 119$      $\times 4 = 476$      $\times 1.8 \times 2.0 = 10.7$



**Design of Piling Footing**

$n \geq 2$  (R 100%)

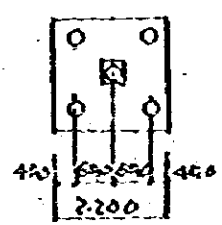
PILE				
$\Phi$	L	R	$\Delta W$	Re
300	12000	25	$0.9^2 \times 1.5 \times 2.0 = 2.4$	22.6
350	"	30	$1.0^2 \times \quad \quad = 3.3$	26.7
400	"	35	$1.2^2 \times \quad \quad = 4.3$	30.7

$n = 1$  (R 80%)

PILE				
$\Phi$	L	R	$\Delta W$	Re
300	12000	26	2.4	17.6
350	"	24	3.3	20.7
400	"	28	4.3	23.7

$\Phi = 300$  TYPE

F5



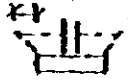
$Q_F = 22.6 \text{ [t]}$   
 $M_F = 22.6 \times (0.16 - 0.2775) = 8.5 \text{ [tm]}$   
 $2010 \text{ [kg]} \quad 0.70 \quad 3543 \text{ [cm]}$   
 $Q = 21.7 \text{ [cm]} \quad QAL \ 62.9 \text{ [t]}$   
 $at \ 7.8 \text{ [cm]}$

14-D13

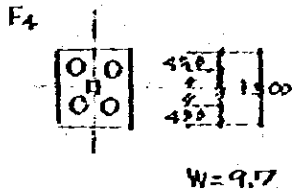
For lift up

$W = 22^2 \times 1.5 \times 2.0 = 14.5 \text{ [t]}$

$310 \text{ [t]}$   
 $(23^2 + 22^2) / 2 \times 3.0 = 28.7 \text{ [t]}$

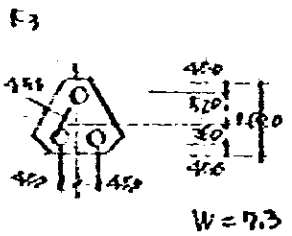


$\Phi = 300$  Type



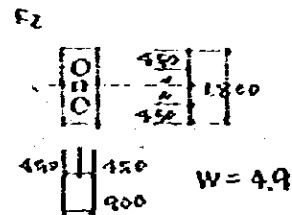
$Q_F = 22.6$  [t]  
 $M_F = 22.6 \times (0.35 - 0.212) = 4.0$  [tm]

2D+A 140 D 45 j 32.4 [cm]  
 Q 16.6 QAL 23.5  
 at 0.6  
 12-D13



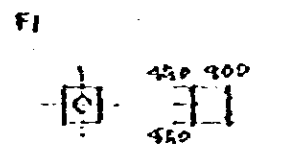
$Q_F = 22.6$   
 $M_F = 22.6 \times (0.02 - 0.2775) = 5.5$   
 For lift up  
 $\approx 14.6$   
 OF  $14.6/3 = 4.9$  Q 4.3  
 MF  $4.9 \times 0.28 = 1.2$  at 0.7

2D+A-B=90 D 70 j 54.3  
 Q 27.7 QAL 24.4  
 at 0.5  
 11-D13  
 3-110  
 B 90 D 70 j 54.3  
 Q 27.7 QAL 24.4  
 at 0.4



$Q_F = 22.6$   
 $M_F = 22.6 \times (0.15 - 0.205) = 4.0$

11-D13



D=450  
 6-D13

For Lift UP

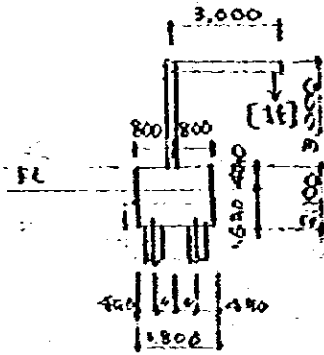
$W = 1.5 \times 2.0 = 3.0$  t/1.2 D 45  
 $F_4$   $Q = 1.8^2 \times 3.0/4 = 2.43$  Q 5.0  
 $M = 2.43 \times 0.9 \times 1/3 = 0.713$  at 0.8

6-D10

$F_2$   $Q = 2.43 = 2.43$  Q 5.0  
 $M = 2.43 \times 0.49 = 1.09$  at 1.1

3-D10

### Footing of self standing crane



#### SUSTAINED LOADING

$$M = 1.0 \times 3 = 3.0 \text{ (t-m)}$$

$$N = \text{CAPACITY} \quad 1.0$$

$$\text{SELF LOAD} \quad 0.17$$

$$\text{FOOTING} \quad 2.1 \times 1.8^2 \times 24 = 16.3$$

$$\Sigma 19.0 \text{ (t)}$$

#### TE<sup>o</sup> DIRECTION

$$R = \frac{18.0}{4} + \frac{3.0}{\sqrt{2} \times 0.9}$$

$$= 4.5 \pm 2.4$$

$$= \text{max } 6.9$$

$$< R_e 27.6$$

$$Q_F 5.3$$

$$Q 2.6$$

$$M_F 9.3 \times 0.95 = 8.8$$

$$M 1.2$$

$$D 16.9 \quad \bar{D} 13.3$$

$$-12-D13$$

#### SEISMIC LOADING

$$N = 1.7 \times 0.1 = 0.2$$

$$16.8 \times 0.1 = 1.6$$

$$M = (2 \times 8.1) + (1.6 \times 1.05) = 2.7$$

$$R = \frac{2.7}{\sqrt{2} \times 0.9}$$

$$= 2.1$$

$$\Sigma R = 4.5 \pm 2.9 \pm 2.1$$

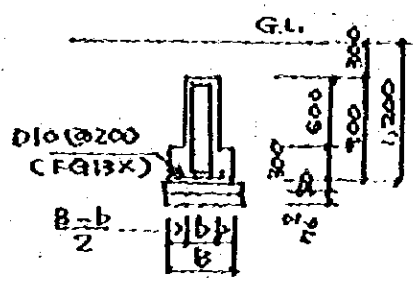
$$= 9.0 \sim 0 < R_e 27.6 \times 2$$

$$= 0$$

O.F.



### Design of Foundation Beam



TYPE	B	b	TOP R.	BTM R.	SIDE R.	STP.	TIE							
FG 35	350	350	2-D10	2-D10	2-D10	D10 @ 200	1-D10 @ 600							
45	450	"	"	"	"	"	"							
65	550	"	"	"	"	"	"							

**For Stress Between Piling Footing**

$$f = (CFG 35) 1.26 + (\text{Brick Wallscot}) 0.6 \times 2.9 = 3.0 \text{ [t/m]}$$

SPAN 4.5 CM

$$M_o = 3.0 \times 4.5^2 / 8 = 7.6 \text{ [tM]} \quad \text{at } 5.4 \text{ [CM}^2\text{]} \\ Q = 3.0 \times 4.5 / 2 = 6.8 \text{ [t]} \quad \text{at } 6.4 \text{ [CM]} \quad \text{) 2-D10}$$

$$b = 35 \text{ D } 90 \quad f = 10.9 \quad Q_{AL} = 12.4 \text{ [t]} > Q$$

$$f = 1.26 + (0.6 \times 1.4) + (0.08 \times 5.4) = 2.84$$

SPAN 5.3

$$M_o = 2.84 \times 5.3^2 / 8 = 10.0 \quad \text{at } 7.0 \quad \sim 3-D10 \\ Q = 2.84 \times 5.3 / 2 = 7.5$$