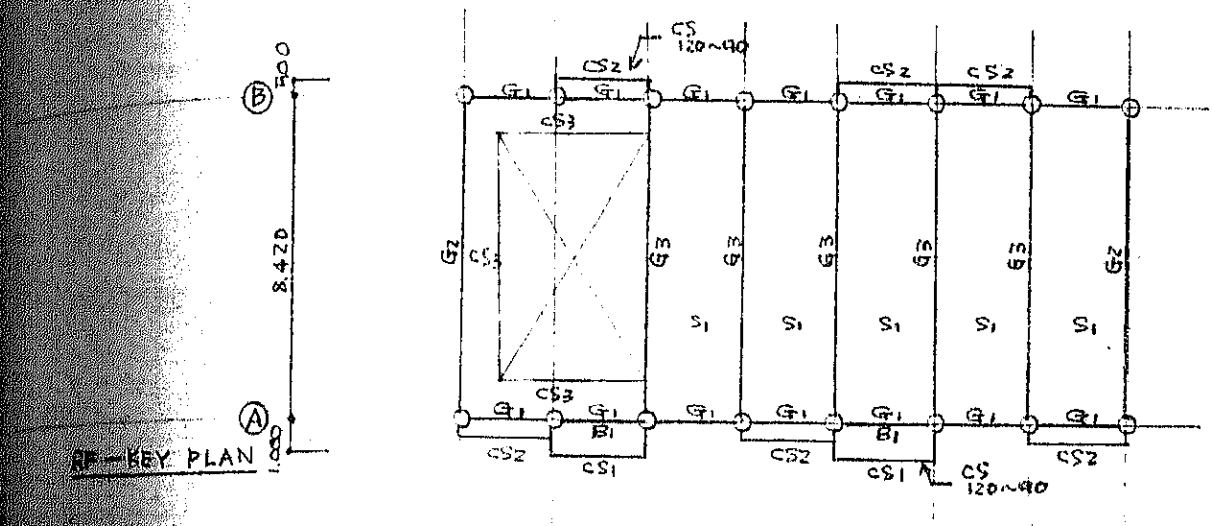
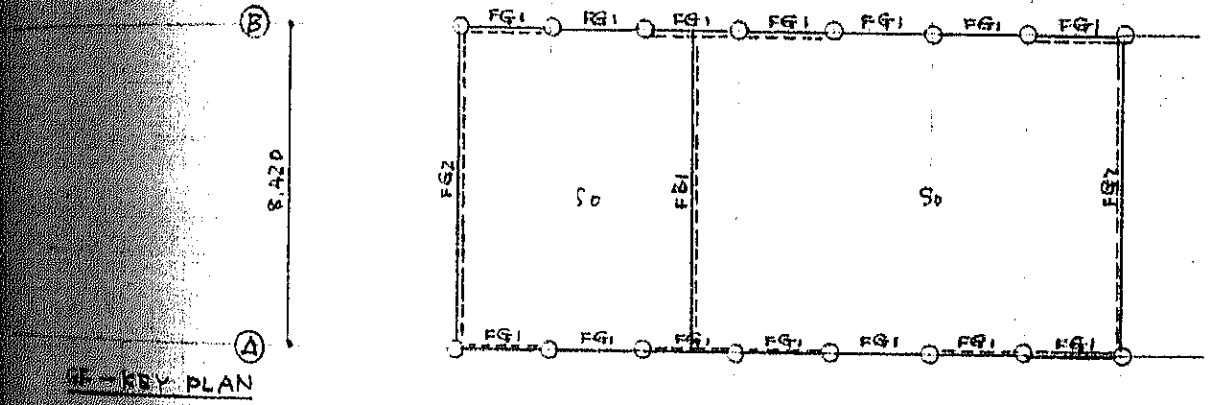
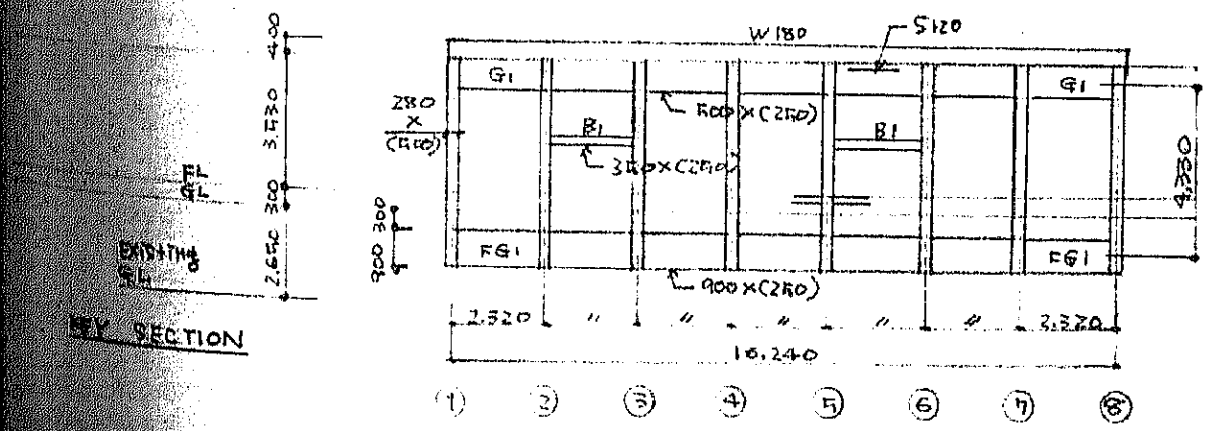
8 PAINT GREASE & OIL STORAGE



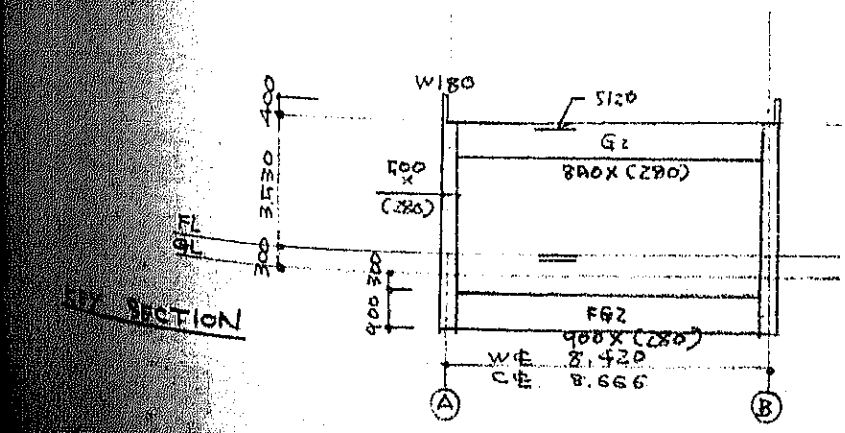
RF~KEY PLAN



RF~KEY PLAN



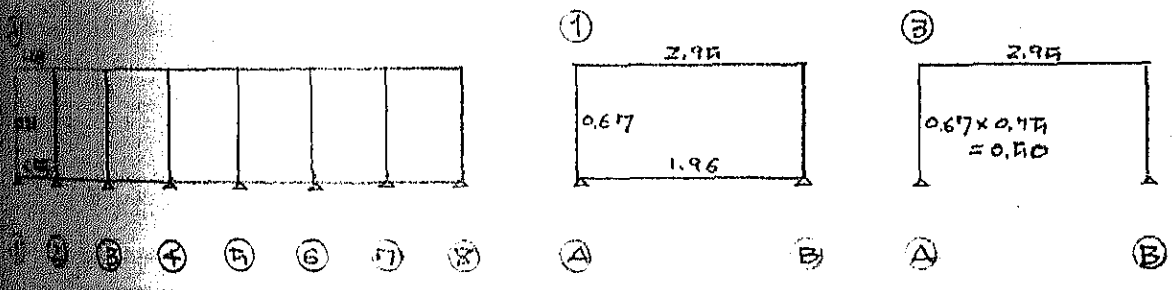
KEY SECTION



KEY SECTION

Stiffness Ratio

		$J_{\times 10^3}$	ϕ	$\phi J_{\times 10^3}$	k_a				$\times 10^3$
						232	866.6		435
		260.4	1.5	390.6	—	1.68	—	—	—
		1,279.4	2.0	2,558.9	—	—	2.95	—	—
		1,518.8	1.0	1,518.8	—	6.55	—	—	—
		1,710.0	1.0	1,710.0	—	—	1.96	—	—
		91.5	1.0	91.5	—	—	—	—	0.21
		291.17	1.0	291.17	—	—	—	—	0.67



Unit Load

Floor [t/m²]

	D.L.			L.L.			T.L.
Roof	116.2 / 120	Finish	0.20	For	S	0.09	0.62
		Slab	0.29		R	0.017	0.60
		Ceiling	0.04		E	0.03	0.56
			0.53				
Eaves		Finish	0.06			0.09	0.39
		Slab	0.24		〃	0.017	0.317
						0.03	0.33
			0.30				

Beam

	t/m			t/each						
	Skeleton	Finish	Σ	l	2.32		18.617			
[illegible]	0.24	0.04	0.28		0.6					
[illegible]	0.49	0.017	0.56				4.6			
[illegible]	0.54	—	0.54		1.1					
[illegible]	0.60	—	0.60				4.9			

Column

	t/m			t/each						
	Skeleton	Finish	Σ	h		15.00				
[illegible]	0.34	0.08	0.42			2.1				

Wall

	t/m²			t/m (Horizontal)						
	Skeleton	Finish	Σ	h	0.3		3.7			
[illegible]	0.43	0.10	0.53		0.2					
[illegible]	0.483	0	0.483				1.8			

Axial Force

[t]

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

CMoQ of Beam

[tm, t]

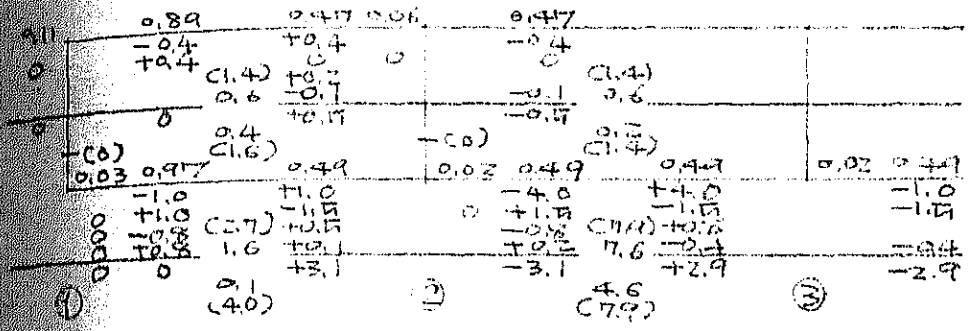
			C		Mo		Q
	w 0.60	w	0.60 × 0.3	0.2	× 0.5	0.3	× 1.3	0.8
	l × 2.32 λ 1.0	q	0.48 × 2.32²/12	0.2	/8	0.3	× 2.32/2	0.6
	q 0.28 + 0.2							
				0.4		0.6		1.4
	q 0.54 + 1.8	q	2.34 × 2.32²/12	1.0	/8	1.6	× 2.32/2	2.7
	P 10.4	(P	10.4 × 2.32/8	3.0	/4	6.0	× 1/2	5.2)
				1.0		1.6		2.7
				C 4.0		7.6		7.9)
	w 0.60 × 2	w	1.20 × 7.0	8.4	× 10.6	12.7	× 4.4	5.3
	l × 2.32 λ 3.7	q	0.56 × 8.67²/12	3.5	/8	5.3	× 8.67/2	2.4
	q 0.56							
				11.9		18.0		7.7
	q 0.60 + 1.8	q	2.40 × 8.67²/12	15.0	/8	22.6	× 8.67/2	10.4
				15.0		22.6		10.4
	w 0.60	w	0.60 × 7.0	4.2	× 10.6	6.4	× 4.4	2.6
	l × 2.32 λ 3.7	q	0.76 × 8.67²/12	4.8	/8	7.1	× 8.67/2	3.3
	q 0.56 + 0.2							
				9.0		13.5		5.9

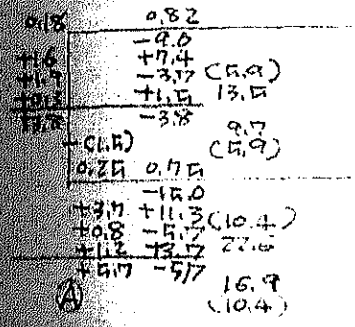
Seismic Force

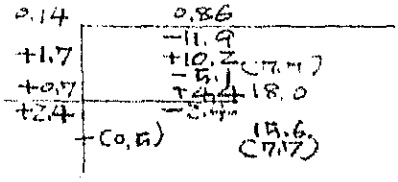
[t]

	W	K	KW	Q
[illegible] × 151.5) + (0.33 × 10.1)	88.2			
[illegible] × 14) + (4.6 × 7)	40.6			
[illegible] × 16/2)	16.8			
[illegible] × 49.8) + (1.8 × 52.3/2)	57.0			
$\bar{w}$ = 202.6 / 151.5 = 1.34 [t/m²]	202.6	0.10	20.3	21.0

Stress by Vertical Load



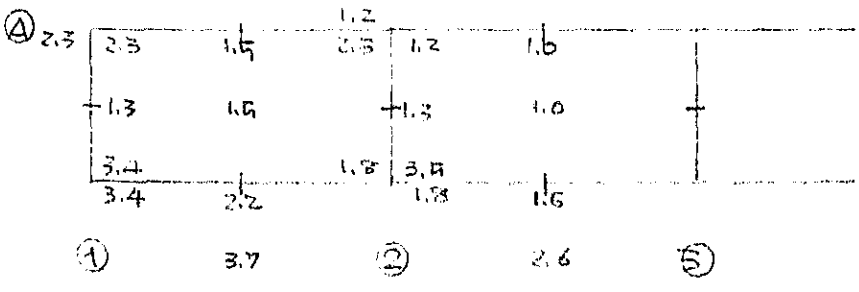


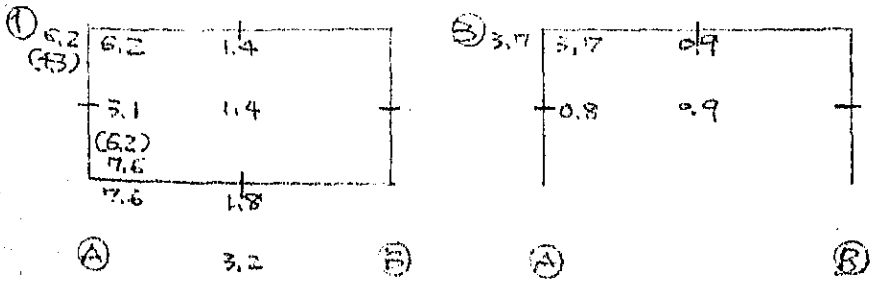


D-Value , Inflection Point

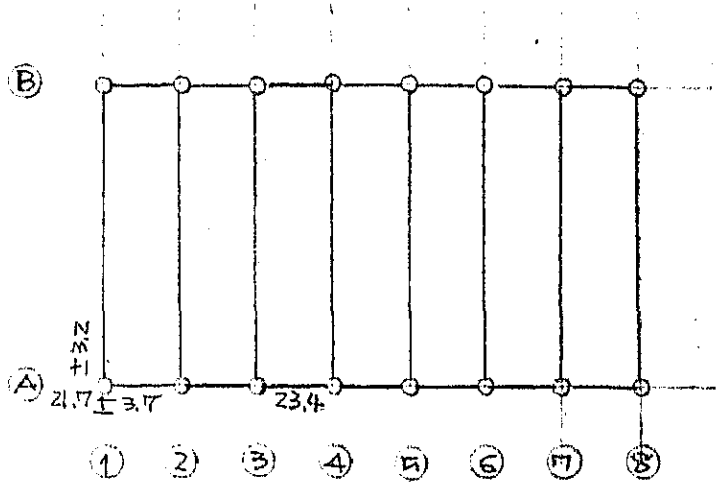
			D				Y					Q, M			
		Kc	ΣKb	K	Q	D	D'	Y0	Y1	Y2	Y3	S	Q	TM	MU	ML
A	1	0.21	8.23	19.60	0.41		0.96	0.55	0.05			0.60	1.28	5.62	2.25	3.37
"	2	"	16.46	39.19	0.94		1.00	0.55	0.05			0.60	1.33	5.85	2.34	3.51
1	A	0.67	4.91	3.72	0.65	0.43	3.73	0.55	0			0.55	3.13	13.79	6.21	7.58
3	B	0.70	2.95	5.90	0.23	0.12	1.00					0	0.84	3.70	3.70	0

Stress by Seismic Force





Footing



Pile　　Φ400　　R = 35.0 × 0.8 = 28.0

ΔN = 1.05² × 1.2 × 2.0 = 2.6

Re = 28.0 − 2.6 = 25.4 > 21.7, 23.4

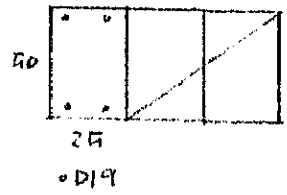
or　Brick　　G.F.L. − 2.950

fea　8.4 − (0.30 + 2.65 + 0.60) × 2.0 = 1.3

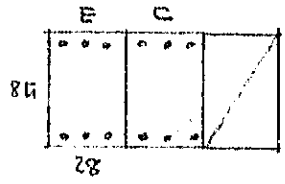
An　23.4 / 1.3 = 18.0 → 2.32 × 7.8

Column No.		Stress V	H	T	N/b.D	M/b.D²	Pt	at			Section
1	N	21.7	1.5	23.2	16.6				Pg 0.8	b 50	
	M U	0	2.3						ag 11.2	D 28	
	M L	0	3.4	3.4		8.7	0.12	1.7		j 20.1	
	Q	0	1.3	2.6	9.1						4-D19
2	N	21.7	1.4	23.1	16.5					b 28	
	M U	3.8	4.3							D 50	
	M L	5.7	6.2	11.9		17.0	0.55	7.7		j 39.4	
	Q	1.5	3.1	7.7	9.9						
3	N	23.4	0.5	23.9	17.1					b 50	
	M U	0	2.3							D 28	
	M L	0	3.5	3.5		8.9	0.15	2.1			
	Q	0	1.3	2.6	9.1						4-D19
4	N	23.4	0.9	24.3	17.4					b 28	
	M U	2.4	3.7	6.1		8.7	0.12	1.7		D 50	
	M L	0	0								
	Q	0.5	0.8	2.1	9.9						

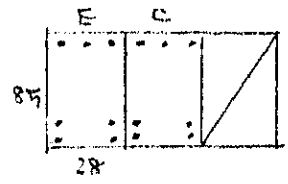
Stress V	Stress H	T	C	Pt	γ	Δt	Cp		Section
0	2.3	2.3				1.9		b 25	
		2.3				1.9		D 50	
								J 39.4	
	0.6	1.8				0.8			
		1.7				1.4			
1.8	1.2	0.7				0.6			
4.6	4.6	4.6	QA 8.9		≤Q 0		9.17		
10.0	6.2	10.0				4.8		b 28	
		2.4				1.1		D 85	
								J 110	
4.7						× 6.9			
9.4	6.4	8.7	11.8				7.0		
6.1	8.7	6.1				2.9		b 28	
		1.3				0.6		D 85	
								J 110	
14.6						× 11.1			
9.7	0.9	---	11.8				9.2		
0	3.4	3.4				1.6		b 25	
		3.4				1.6		D 90	
								J 111.8	
4.6						× 3.2			
8.1	1.8	4.9				2.3			
12.9	8.2	12.3	13.5		0		9.5		
8.7	17.6	13.8				6.2		b 28	
								D 90	
								J 111.8	
16.9						× 11.5			
19.4	1.8	---	10.0	1.34	0		12.0		



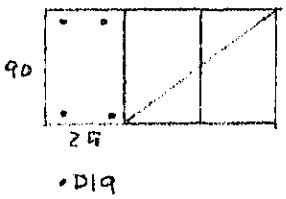
• D19



• D19



• D19



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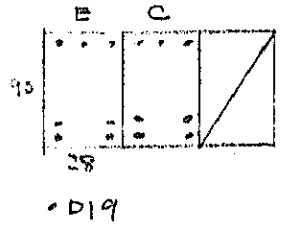
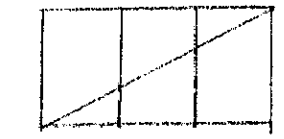
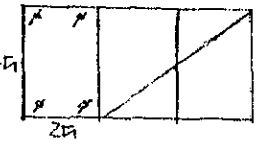


• D19

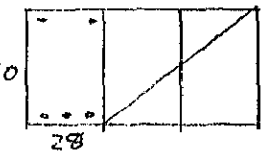


Sub Beam

Load					Stress							Section
From CS1 ΔM 0.28 ΔQ 0.45					MT 0.28 × 2.32/2 = 0.32 Ao 25 × 15 = 375 Ψo 2(25+15) = 80 j 26.3							
						M	C	Pt	γ	at		
C	0.45	2.32/8		0.30	M	0.30				0.6		
						at = (Mt/Ψo)/(Ao) = 1.71 pw = (Mt/2Ψ + bAo) + 0.002 = 0.0029						
					Q	QA	α	ΔQ	pw	St	φ	
Q	0.45	2.32/2		0.52	0.52	3.9					1.6	
											71.8	
Same to FG1				11.6		11.6				8.1		
				7.0		7.0	10.0		0		11.6	



⌿ D16
□ D10-@100



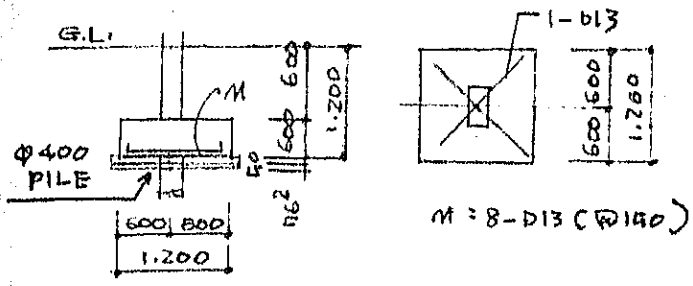
• D19

Sub

Load		DIR.	Stress				D	j	at	φ	Section
2.32	cu 0.62 λ 2.9	S	M E C	3.34	0.082	0.27	12	8.3	1.6		D10 @ 200 ~
			Q	1.44	0.51	0.73				4.9	
		L	M E C		0.055	0.08		7.4	0.5		D10 @ 300 ~
			Q		0.46	0.66				4.9	
0.2	cu 0.39	S	M E C	0.47	0.60	0.28	12 5 9	8.3	1.7		D10 @ 200
			Q	0.39	1.20	0.47				3.1	
		L	M E C								
			Q								
0.5	cu 0.39	S	M E C				12 5 9				〃
			Q								
		L	M E C								
			Q								
											D10 @ 200

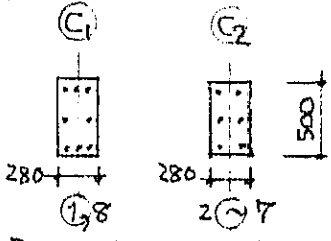
ENG. DATA (Paint, Grease & Oil Storage)

i) Footing Schedule



Pile
OR,
Brick Base
BTM = G.L. − 3.250
2.32 × 7.8
||
Width
↓
P.254

ii) Column Schedule

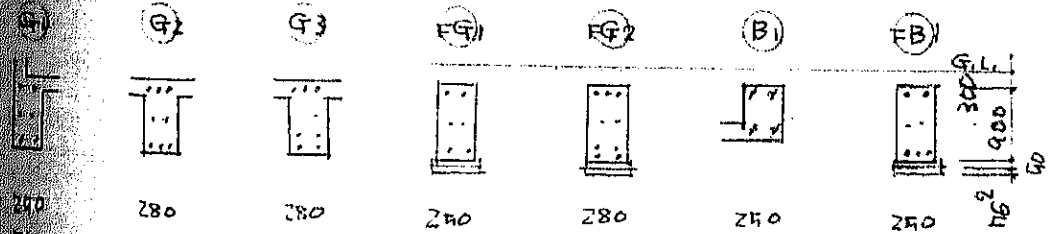


MAIN R. 8-D19 6-D19

HOOP □ D10
General @100
Panel Zone @150

AUX. HOOP
⌐ D10 @800

iii) Beam Schedule



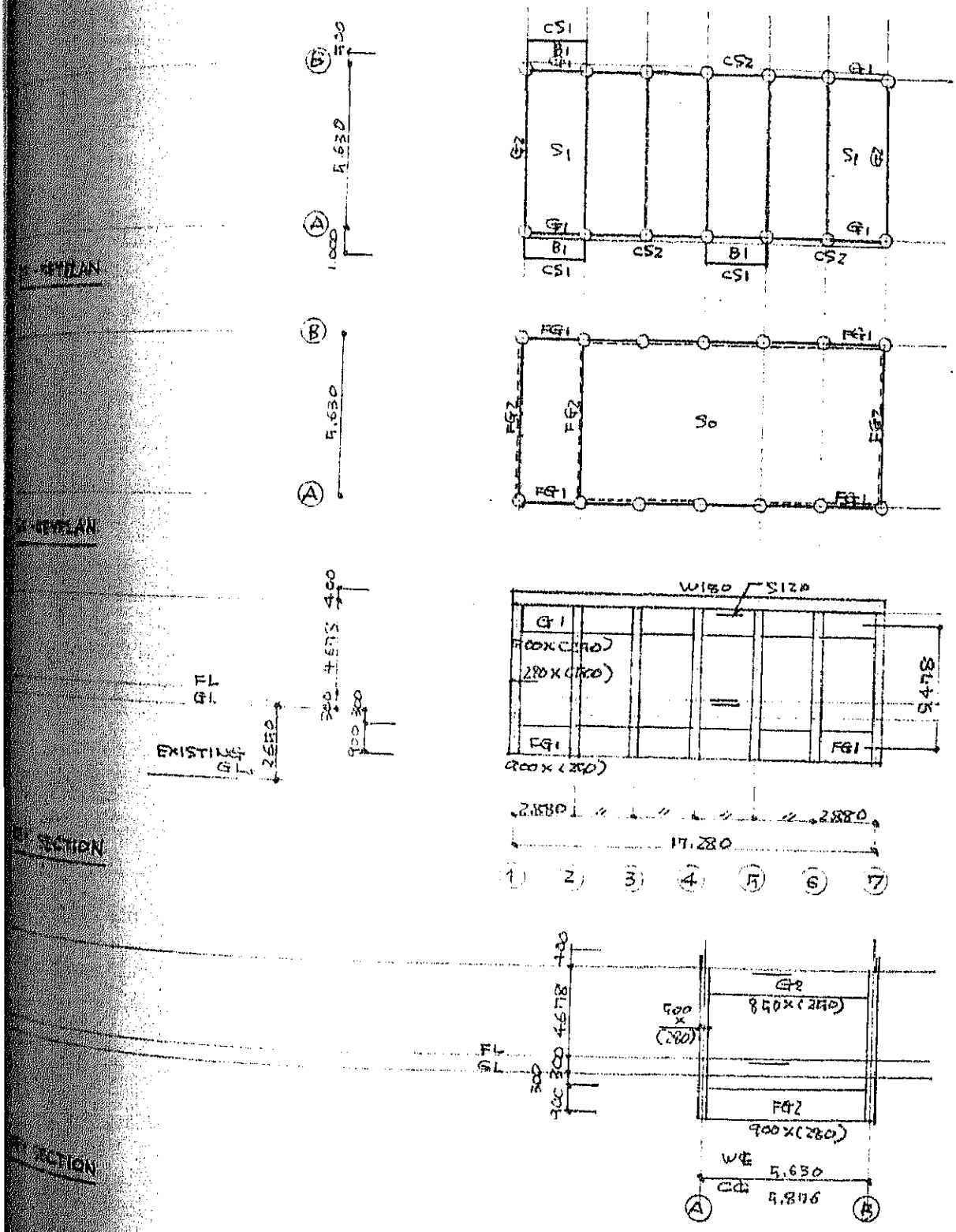
	G1	G2	G3	FG1	FG2	B1	FB1
b	280	280	280	280	280	250	250
D	700	850	850	900	900	350	900
Top R.	2-D19	3-D19	3-D19	2-D19	3-D19	2-D16	2-D19
Top X	2-D19	3-D19	4-D19	2-D19	4-D19	2-D16	3-D19
Top Y	2-D10	←	←	←	←		←
Stirrup	⌐D10@600	←	←	←	←		←
	□D10@200	←	←	←	←	□D10@100	□D10@200

iv) Slab Schedule (cS3 ≒ cS1)

v) Wall Schedule

] See "Air Comp. House"

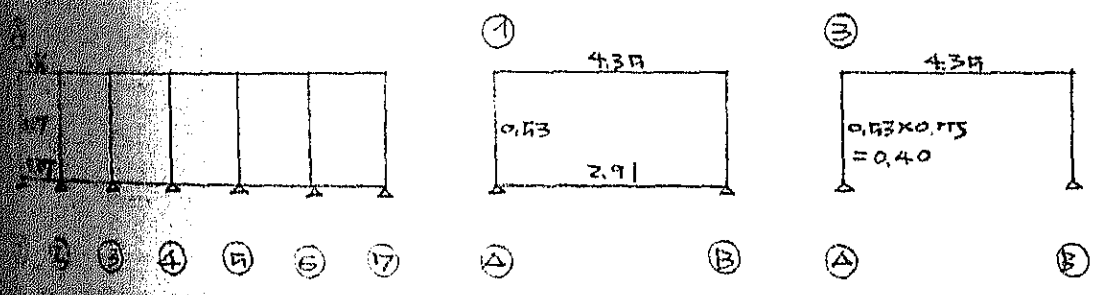
9 SUB STATION



CS1
B1
G1
CS2
G2
S1
5,630
1,000
FG1
FG2
S0
W180
S120
G1
FG1
900 x (250)
280 x (500)
9,478
2,880
17,280
1
2
3
4
5
6
7
FL
GL
EXISTING GL
2,650
4,678
G2
850 x (250)
FG2
900 x (280)
WL
CL
5,630
5,876
A
B

Stiffness Ratio

						Pe			×10³
						288	587.6		547.8
[illegible]	[illegible]	50	260,4	1,5	390.6	—	1,36	—	—	—
[illegible]	[illegible]	80	1,279,4	2,0	2,558,9	—	—	4.35	—	—
[illegible]	[illegible]	90	1,518,8	1.0	1,518,8	—	5,27	—	—	—
[illegible]	[illegible]	90	1,710,0	1,0	1,710,0	—	—	2.91	—	—
[illegible]	[illegible]	28	91,5	1,0	91.5	—	—	—	—	0.17
[illegible]	[illegible]	50	291.7	1,0	291.7	—	—	—	—	0.53



Unit Load

Floor

[t/m²]

	D.L.			L.L.			T.L.
Roof	Finish	0.20	For	S	0.09		0.62
	Slab	0.29		R	0.07		0.60
	Ceiling	0.04		E	0.03		0.56
		0.53					
Eaves	Finish	0.06			0.09		0.39
	Slab	0.24		〃	0.07		0.37
					0.03		0.33
		0.30					

Beam

	t/m				t/each					
	Skeleton	Finish	Σ	l	2.88		15.63			
[illegible]	0.24	0.04	0.28		0.7					
[illegible]	0.49	0.49	0.56				3.0			
[illegible]	0.54	—	0.54		1.4					
[illegible]	0.66	—	0.60				3.2			

Column

	t/m				t/each					
	Skeleton	Finish	Σ	h		16.20				
[illegible]	0.34	0.08	0.42			2.6				

Wall

	t/m²				t/m (Horizontal)					
	Skeleton	Finish	Σ	h	0.3		4.8			
[illegible]	0.43	910	0.53		0.2					
[illegible]	0.483		0.483				2.3			

Axial Force

[t]

	Ⓐ①		Ⓐ②	
S	0.60 × 5.0	3.0	× 9.2	5.5
	0.37 × 1.5	0.6	× 1.5	0.6
G,B	0.4 + 1.5	1.9	0.7 + 1.5	2.2
	0.7 + 1.6	2.3	1.4 + 3.2	4.6
C		2.6		2.6
W	0.2 × 5.9	1.2	× 2.9	0.6
	2.3 × 4.0	9.2	× 2.6 (5.3)	6.0 (12.2)
Σ		20.8		22.1 (28.3)

C Mo Q of Beam

[tm, t]

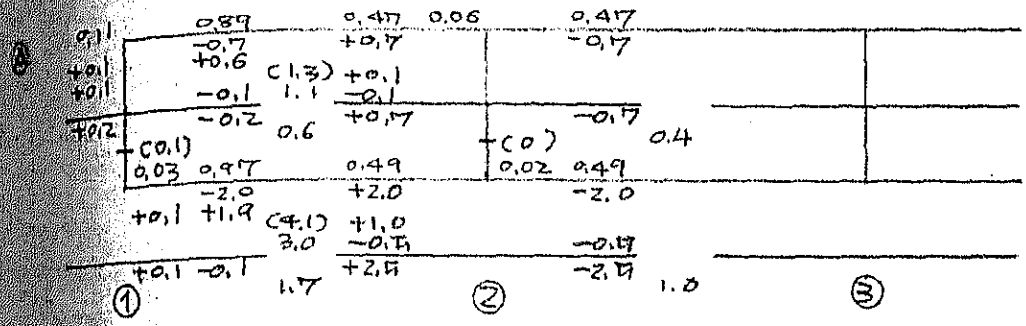
			C		Mo		Q
	w 0.60	w	0.60 × 0.6	0.4	× 1.0	0.6	× 1.0	0.6
	l × 2.88 λ 1	q	0.48 × 2.88²/12	0.3	/8	0.5	× 2.88/2	0.7
	q 0.28+0.20							
				0.7		1.1		1.3
	q 0.54+2.3	q	2.84 × 2.88²/12	2.0	/8	3.0	× 2.88/2	4.1
				2.0		3.0		4.1
	w 0.60 × 2	w	1.20 × 3.7	4.4	× 5.7	6.8	× 3.2	3.8
	l × 2.88 λ 2.0	q	0.56 × 5.88²/12	1.6	/8	2.4	× 5.88/2	1.6
	q 0.56							
				6.0		9.2		5.4
	q 0.60+2.3	q	2.90 × 5.88²/12	8.4	/8	12.5	× 5.88/2	8.5
				8.4		12.5		8.5
	w 0.60	w	0.60 × 3.7	2.2	× 5.7	3.4	× 3.2	1.9
	l × 2.88 λ 2.0	q	0.76 × 5.88²/12	2.2	/8	3.3	× 5.88/2	2.2
	q 0.56+0.2							
				4.4		6.7		4.1

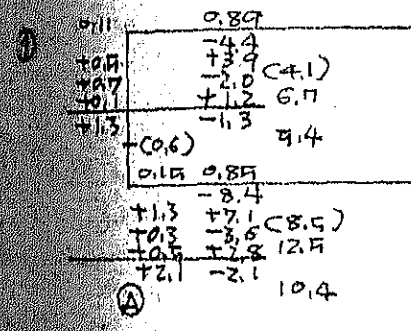
Seismic Force

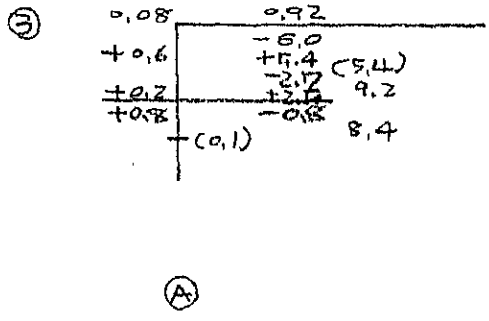
[t]

	W	K	KW	Q
[illegible]×(12.0)+(0.33×9.0)	65.7			
[illegible]×12) + (1.4×7)	18.2			
[illegible]×14/2)	18.2			
[illegible]×46.3) + (2.6×39.5/2)	60.6			
[illegible] = 162.7/112.0 = 1.45 [t/m²]	162.7	0.10	16.3	17.0

Stress by Vertical Load



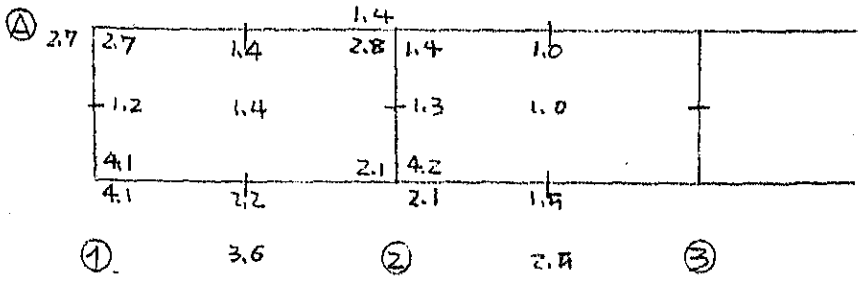


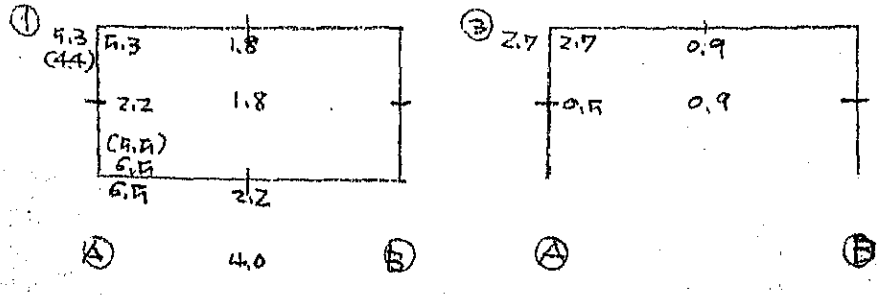


D-Value, Inflection Point

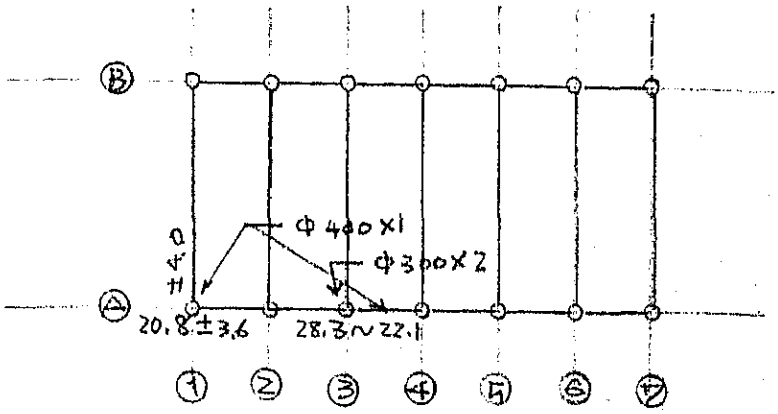
			D						Y					Q, M			
[illegible]	[illegible]	COL	Kc	ΣKb	$\bar{K}$	a	D	D'	Y_0	Y_1	Y_2	Y_3	Σ	Q	TM	MU	ML
[illegible]	A	1	0.17	6.63	19.50	0.91		0.96	0.55	0.05			0.60	1.24	6.79	2.71	4.07
	2	2	〃	13.26	39.00	0.97		1.00	0.55	0.05			0.60	1.29	7.07	2.83	4.24
[illegible]	1	A	0.53	7.26	6.85	0.77	0.41	4.29	0.55	0			0.55	2.15	11.78	5.30	6.48
	3	1	0.40	4.35	10.88	0.24	0.10	1.00	—	—	—	—	0	0.50	2.74	2.74	0

[illegible]	ΣD	Q/ΣD
[illegible]	[illegible]	1.29
[illegible]	[illegible]	0.50





Footing



Brick Base

G.Fl. − 2.950

fea 8.4 − (0.30 + 2.65 + 0.60) × 2.0 = 1.3

An 22.1/1.3 = 17.0 → 2.88 × 5.9

$\frac{28.3+22.1}{2}$ / 1.3 = 19.4 → 2.88 × 6.7

Pile Φ 400 R = 35.0 × 0.8 = 28.0

ΔN = 1.05² × 1.2 × 2.0 = 2.6

Re = 28.0 − 2.6 = 25.4 > 20.8, 22.1

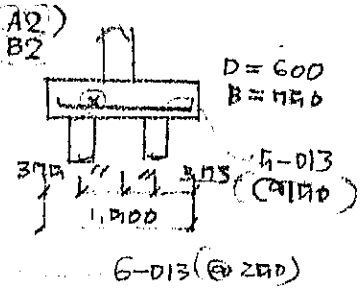
~

Φ 300 R = 25.0

ΔN = 0.9² × 1.2 × 2.0 = 1.9

Re = 25.0 − 1.9 = 23.1 ~ × 2 = 46.2 > 28.3

F2 (A2) B2



D = 600

B = 750

Q = 28.3/2 = 14.3

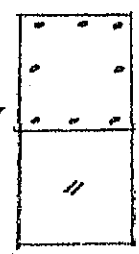
M = 14.3 × (0.375 − 0.14) = 3.4

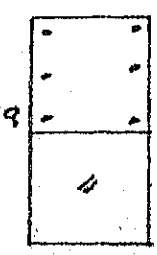
j 46.4

Q 14.7

at 3.7

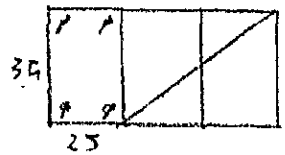
		Stress V	H	T	N/bD	M/bD²	Pt	at				Section
	N	20.8	1.4	22.2	15.8				Pg	b	50	
	M U	0.2	2.7						ag	D	28	
	M L	0.1	4.1	4.2	10.7		0.20	2.8		j	29.1	
	Q	0.1	1.2	2.5	9.1							
	N	20.8	1.8	22.6	16.1					b	28	
	M U	1.3	4.4							D	50	
	M L	2.1	5.5	7.6		10.9	0.20	2.8		j	39.4	
	Q	0.6	2.2	5.0	9.9							
	N	28.3~22.1	0.4	28.7 22.5	20.5 ~ 16.1					b	50	
	M U	0	2.8							D	28	
	M L	0	4.2	4.2		10.7	0.18	2.5				
	Q	0	1.3	2.6	9.1							
	N	28.3~22.1	0.9	29.2 ~ 23.0	20.9 ~ 16.4					b	28	
	M U	0.8	2.7	3.5		5.0	0			D	50	
	M L	0	0									
	Q	0.1	0.5	1.1	9.9							





Beam	Stress V	Stress H	Stress T	c	p+	δ	at	cp		Section
A	4.2	2.7	2.9				2.5		b 25	
B			2.5				2.1		D 50	
									J 39.4	
BC	4.6	0.7	1.3				1.1			50 / 25
C	0.7	1.4	2.1				1.8			
CD			0.7				0.6			
D	1.3	1.4	4.1	QA 8.9		◁Q 0		5.0		•D19
D	1.3	0.3	6.6				3.1		b 28	
DE			4.0				1.9		D 85	
									J 70	E C
EC	5.4						× 3.9			85 / 28
E	5.1	1.8	7.7	11.8		0		5.2		•D19
E	5.8	2.7	3.5				1.7		b 28	
EC			1.9				0.9		D 85	
									J 70	E C
C	5.4						× 6.0			85 / 28
C	5.4	0.9	---	11.8		0		5.5		•D19
C	4.1	4.1	4.2				1.9		b 25	
CD			4.0				1.9		D 90	
									J 71.8	
D	1.7	1.0	2.7				1.3			90 / 25
DE	2.5	2.1	4.6				2.1			
D	5.1	2.2	8.5	13.5		0		6.6		•D19
E	4.1	6.5	8.6				4.0		b 28	
EC			4.4				2.0		D 90	
									J 71.8	E C
C	1021						× 7.2			90 / 28
C	8.5	2.2	12.9	10.0		0		8.6		•D19

Sub Beam

Load					Stress							Section
From CSI ΔM 0.28 ΔQ 0.45					M_T 0.28×2.88/2=0.40 A_0 25×15=375 ψ_0 2(25+15)=80						j 26.3	
						M	C	Pt	γ	at		
C	0.45	2.88²/8		0.47	M	0.47				0.9		
M_0						$at = \frac{M_t}{2f_t}\frac{\psi_0}{A_0} = 2.13$ $p_w = (M_t/2f_t bA_0)+0.002 = 0.0031$						
					Q	QA	α	ΔQ	p_w	St	φ	
Q		2.88/2		0.65	0.65	3.9					1.8	

35
25
D16
□ D10@100

Slab

Load		DIR.	Stress				D	j	at	φ	Section
2.88	w 0.62	S.	$M_{E/C}$	5.14	0.082	0.43	12	8.3	2.6		D10 @ 200 ~
			Q	1.79	0.51	0.91				5.2	
	λ 2.0	L.	$M_{E/C}$		0.055	0.28		7.4	1.9		D10 @ 300 ~
			Q		0.46	0.82				5.3	
1.2	w 0.39	S.	$M_{E/C}$	0.47	0.60	0.28	12 S 9	8.3	1.7		D10@200
			Q	0.39	1.20	0.47				3.1	
		L.	$M_{E/C}$								
			Q								

DWG. DATA (Sub Station)

Like to, Paint, Grease & Oil Storage

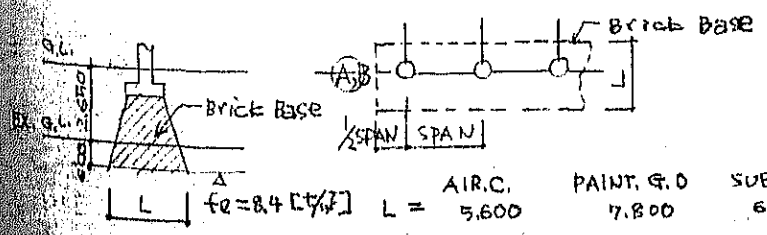
But Footing of A2, B2

φ300×2 ~ SEE. p. 252

Brick Base

BTM = G.L. − 3.250

B = 6.700



	AIR.C.	PAINT. G.O	SUB STATION
L =	5.600	7.800	6.700

< SUMMARY OF BRICK BASE >