THE PEOPLE'S REPUBLIC OF BANGLADESH

DETAILED DESIGN REPORT
ON
CONSTRUCTION PROJECT
OF
AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP

VOLUME—6

OCTOBER 1978

Japan International Cooperation Agency

THE PEOPLE'S REPUBLIC OF BANGLADESH

DETAILED DESIGN REPORT
ON
CONSTRUCTION PROJECT
OF
AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP

VOLUME-6

OCTOBER 1978

Japan International Cooperation Agency

THE PEOPLE'S REPUBLIC OF BANGLADESH

DETAILED DESIGN REPORT
ON
CONSTRUCTION PROJECT
OF
AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP

VOLUME－6

OCTOBER 1978

Japan International Cooperation Agency

CONTENTS

STRUCTURAL ANALYSIS OF

CONSTRUCTION PROJECT OF AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP in BANGLADESH

JAPAN
INTERNATIONAL
COOPERATION
AGENCY

1975

CONTENTS

[TOTAL 533 P
1978 - AUG.]

0 GENERAL NOTE

BUILDING:

'AUTOMOBILE REPAIR AND MAINTENANCE FACTORY'
of
BANGLADESH ROAD TRANSPORT CORPORATION

LOCATION:

JOYDEPUR , BANGLADESH

STRUCTURE:

REINFORCED CONCRETE CEMENT OR STEEL FRAME STRUCTURE

MATERIAL:

CONCRETE:	PILE	Fc 210 kg/sq cm (3000 psi)
	FOUNDATION	Fc 150 kg/sq cm (2200 psi)
	SUPER STRUCTURE	Fc 180 kg/sq cm (2600 psi)
REINFORCEMENT:		JIS SD 30 AND M/S BAR
STEEL:		JIS SS 41
HIGH TENSION BOLT:		JIS F 10 T

LATERAL SEISMIC COEFFICIENT: 0.10

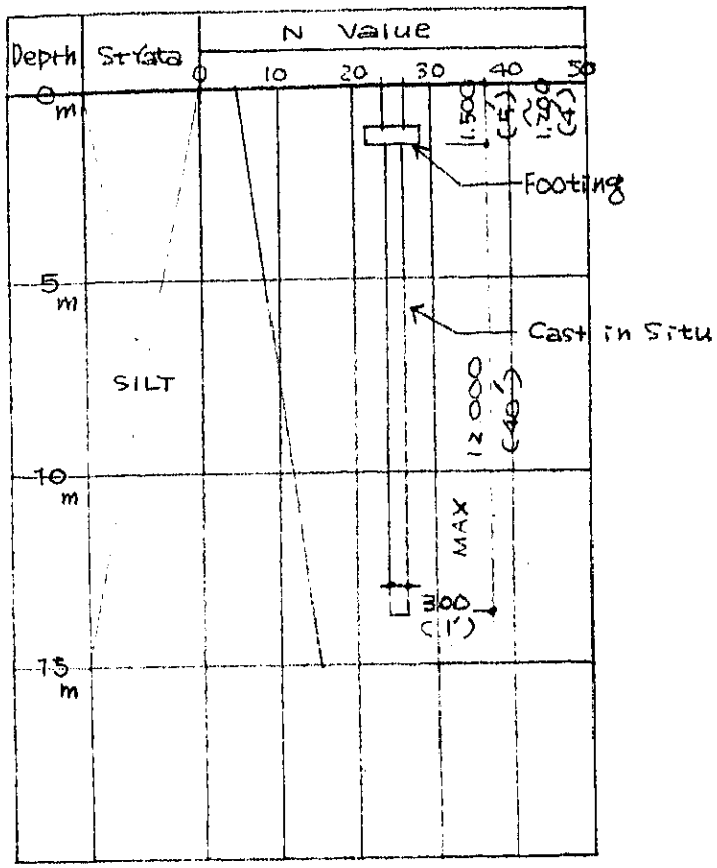
VELOCITY OF WIND: 60 M/SEC (130 MPH)

APPLIED STANDARD AND CODE:

JIS (JAPANESE INDUSTRIAL STANDARD)

AIJ (CODE OF ARCHITECTURAL INSTITUTE OF JAPAN)

Approximate Bore Chart



Bearing Capacity of Soil

Square Footing

8.4 [t/m²]
(0.78 [t/ft²])

Continuous Footing

6.2 [t/m²]
(0.58 [t/ft²])

Formula of Bearing Capacity of Pile

$$Ra = \frac{1}{3}\left\{15\bar{N}Ap + \left(\frac{NsLs}{17} + 2NcLc\right)\psi\right\} - W \sim Apfc - W$$

$$\eta = 1 - \frac{\tan^{-1} d/p}{90}\left\{\frac{(n-1)l}{n\,l} + \frac{(l-1)n}{l}\right\}$$

e.g. Cf. Above Chart

(1) ψ 300
L 12,000 ($L/\psi = 40$)

$\bar{N}$ 15
Ns 0
Ls 0
Nc 10 → 4 (Upper Limit)
Lc 12

$$Ra = \frac{1}{3}\left\{15\times15\times\frac{\pi\times0.3^2}{4} + 2\times4\times12\times\pi\times0.3\right\} - \frac{\pi\times0.3^2}{4}\times12\times2.4$$

$$= \frac{1}{3}\{14.9 + 90.9\} - 2.0 = 35.5 - 2.0 = 33.4$$

$$\therefore (33.4 / \pi\times0.3\times15 = 2.36\ [t/m^2])$$

$$= \frac{\pi\times30^2}{4}\times10 - 2.5 = 49.5 - 2.5 = 47.0$$

$$\eta = 1 - \frac{\tan^{-1} 1/3}{90}\left\{\frac{(\frac{3}{2}-1)\frac{3}{2} + (\frac{3}{2}-1)\frac{3}{2}}{3\times8 \sim 2\times2}\right\} = \begin{matrix}0.726 \\ 0.948\end{matrix}$$

DESIGN CAPACITY 25 (t/p) ← 33.4 × 0.748

(2) ψ 350

$$Ra = \frac{1}{3}\left\{15\times15\times\frac{\pi\times0.35^2}{4} + 2\times4\times12\times\pi\times0.35\right\} - \frac{\pi\times0.35^2}{4}\times12\times2.4$$

$$= \frac{1}{3}\left\{21.6 + 105.7\right\} - 2.8 = 42.4 - 2.8 = 39.6$$

$\eta = 0.77$

DESIGN CAPACITY 30 (t/p)

(3) ψ 400

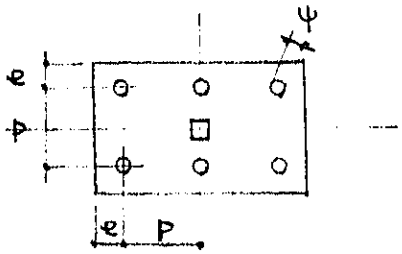
$$Ra = \frac{1}{3}\left\{15\times15\times\frac{\pi\times0.4^2}{4} + 2\times4\times12\times\pi\times0.4\right\} - \frac{\pi\times0.4^2}{4}\times12\times2.4$$

$$= \frac{1}{3}\left\{28.3 + 120.6\right\} - 3.6 = 49.6 - 3.6 = 46.0$$

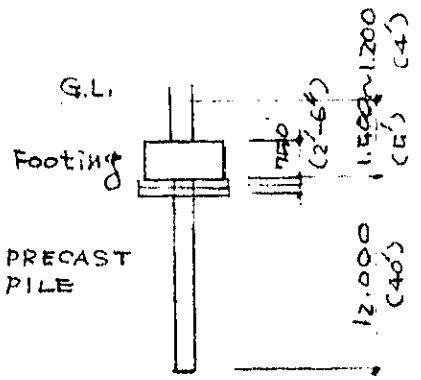
$\eta = 0.77$

DESIGN CAPACITY 35 (t/p)

Specification of Pile Works



$e = 1.5\psi$
$P = 3\psi$



Leveling Concrete $\square 50^2$ (2")
Brick Soling $\square 75^2$ (3")

ψ	Ra	n Main R.	n' Spiral Hoop
300 (12")	25 (55)	6-D16 (6-5/8")	D10 (1/4") @180
350 (14")	30 (66)	〃	〃
400 (16")	35 (77)	〃	〃
CHI	t/p (kip)		

(2.204 lb[kip] = 1[t])

Allowable Stress Intensity

[kg/cm²]

Material	Stress	Sustained Loading: Tension	Compression	Shear	Bond: Position / Fc	Bond: Top R.	Bond: In General	Welding: Butt: In General	Welding: Butt: Shear	Welding: Fillet	Temporary Loading
Concrete	Fc 150 (2,200 PSI)		50								× 2.0
				5							× 1.5
	Fc 180 (2,600 PSI)		60								× 2.0
				6							× 1.5
	Fc 210 (3,000 PSI)		70								× 2.0
				7							× 1.5
Rein Force ment	MS Bar	1,265 (18 kip/in²)	1,125 (16 kip/in²)	1,265 (18 kip/in²)	150	6.0	9.0				× 1.33
					180	7.2	10.8				× 1.5
	SD30	2,000	2,000	2,000							× 1.5
					150	10.0	15.0				× 1.5
					180	12.0	18.0				
Steel	SS41	1,600	1,600	900				1,400	800	800	× 1.5

Allowable Stress of F10T

[t]

	Sust. L. Single Surface	Sust. L. Double Surface	Temp. L.
M 16	3.02	6.03	× 1.5
20	4.71	9.42	
22	5.70	11.4	
24	6.78	13.6	

(1 [psi] = 0.001 [kip/in²] = 0.0703 [kg/cm²])

I GENERAL OFFICE

4-1. LOAD

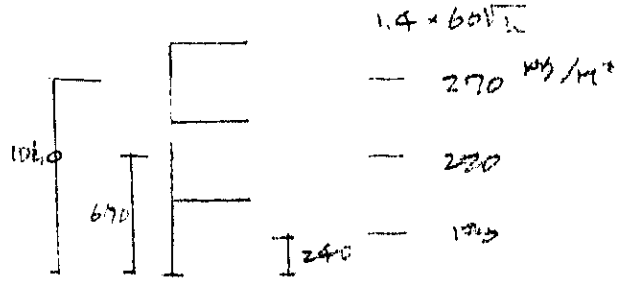
(i) DEAD LOAD

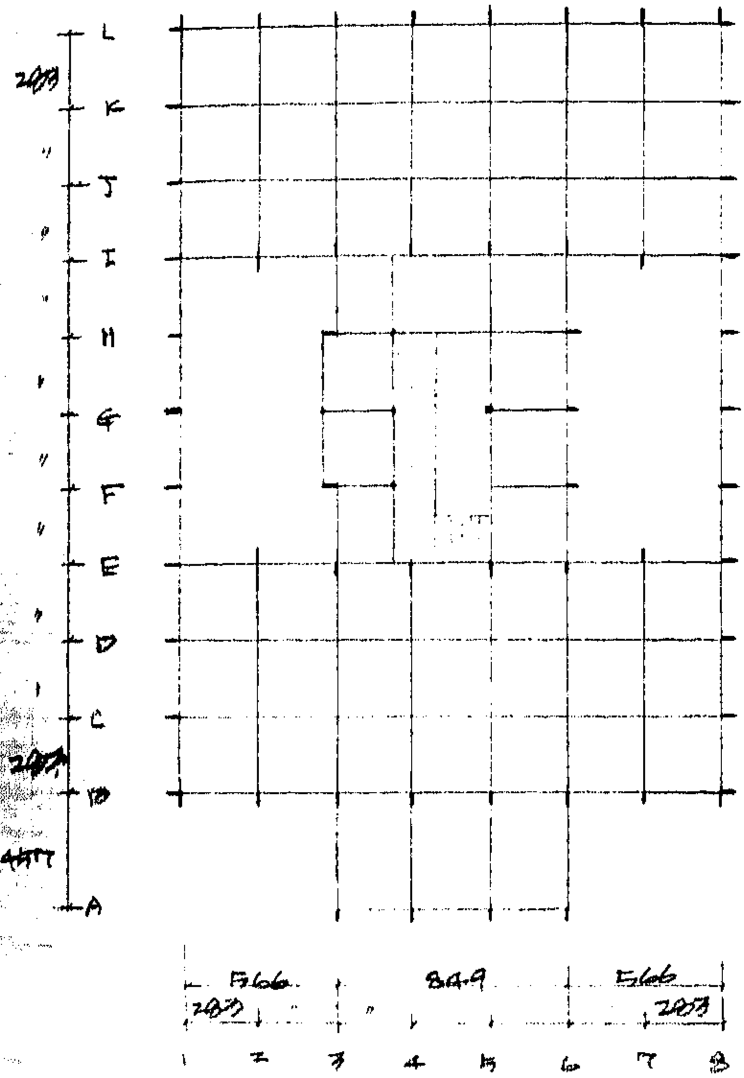
ROOF	LIME CONCRETE	10 cm	200 kg/m²	
	R.C. SLAB	10	240	460 kg/m²
	CEILING		20	
FLOOR	TERRAZZO TILE	5	100	
	RC SLAB	10	240	360
	CEILING		20	
WALL	BRICK	25.4	490	540 "
	CEMENT MORTAR	2.5	50	
COLUMN	20 × 75	510 kg/m		
BEAM	20 × 50	340		
	20 × 75	510		

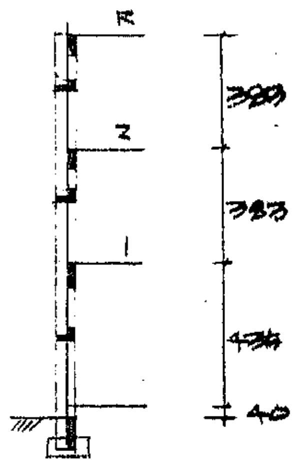
(ii) LIVE LOAD

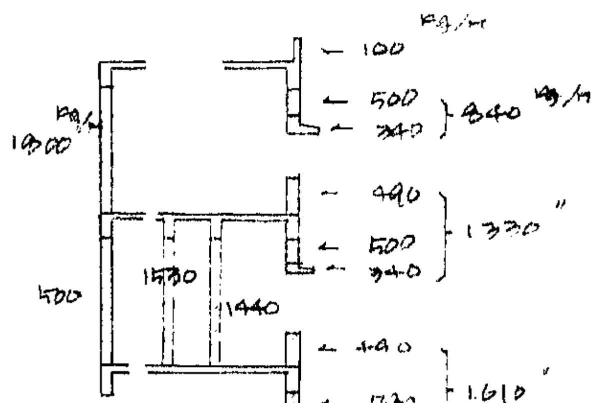
	SLAB	FLAME	EARTHQUAKE
FLOOR	300	180	80
ROOF	100	50	0

(iii) WIND PRESSURE




L
K
J
I
H
G
F
E
D
C
B
A
283
566
849
566
1
2
3
4
5
6
7
8


R
2
1
383
40


100
500
340
840
1900
490
500
340
1330
1530
1440
500
440
720
340
1610

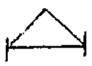
1-2

C, M, Q OF BEAM

$W_R = 460 + 50 = 510$ kg/m²

$W_n = 360 + 180 = 540$ "

GA34 $l_x = 2.83$ $\lambda = 1.00$

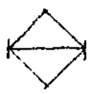


0.34+0.10=0.44 0.34+0.49=0.83

$C = 0.60w + w' \times 2.83^2/12$ 0.31+0.30=0.6 0.32+0.66=0.9

$M_0 = 1.00w + w' \times 2.83^2/8$ 0.51+0.44=1.0 0.54+0.83=1.4

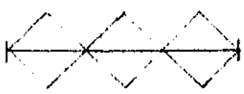
$Q = 1.05w + w' \times 2.83/2$ 0.54+0.63=1.2 0.57+1.18=1.8

GB34  $l_x = 2.83$ $\lambda = 1.00$ $w' = 0.34$

$C = 0.6 \times 2w + 0.23$	0.8	0.9
$M_0 = 1.0 \times 2w + 0.34$	1.4	1.4
$Q = 1.05 \times 2w + 0.48$	1.6	1.6

GC13  $l_x = 2.83$ $l_y = 5.66$ $\lambda = 2.00$ $w' = 0.51$

$C = 3.6 \times 2w + 1.36$	5.0	5.2
$M_0 = 5.4 \times 2w + 2.04$	7.5	7.9
$Q =$ [illegible] $\times 2w + 1.44$	4.5	4.7

GC36  $l = 8.49$ $w' = 0.51$

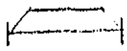
$C = 8.74w + 3.06$	7.5	7.8
$M_0 = 13.22w + 4.60$	11.3	11.7
$Q = 6.01w + 2.16$	5.2	5.4

GG34  $l_x = 240$ $\lambda = 1.00$ $w' = 0.34 + 1.53 = 1.87$

$C = 0.36 \times 2w + w' \times 2.4^2/12$ 0.37 + 0.15 = 0.5 0.39 + 0.90 = 1.3

$M_0 = 0.6 \times 2w + w' \times 2.4^2/8$ 0.61 + 0.24 = 0.9 0.66 + 1.39 = 2.0

$Q = 0.75 \times 2w + w' \times 2.4/2$ 0.77 + 0.41 = 1.2 0.81 + 2.24 = 3.1

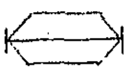
G3AB  $l_x = 293$ $l_y = 457$ $\lambda = 1.61$ $w' = 0.34 + 1.80 = 2.14$

6AB

$C = 2.1w + w' \times 4.57^2/12$ 1.07 + 0.77 = 1.8 1.13 + 3.72 = 4.9 2.6

$M_0 = 3.35w + w' \times 4.57^2/8$ 1.71 + 1.15 = 2.9 1.81 + 5.59 = 7.4 4.0

$Q = 2.3w + w' \times 4.57/2$ 1.17 + 1.01 = 2.2 1.24 + 4.89 = 6.1 3.1

G4AB  $l_x = 293$ $l_y = 457$ $\lambda = 1.61$ $w' = 0.51 + 1.44 = 1.95$

5AB

$C = 2.1 \times 2w + 0.99$ 3.0 3.2 5.7

$M_0 = 3.35 \times 2w + 1.33$ 4.8 5.0 8.7

$Q = 2.3 \times 2w + 1.17$ 3.5 3.6 6.9

RG5BG  $l_x = 293$ $l_y = 360$ $\lambda = 1.20$ $w' = 0.51$

$l_x = 293$ $l_y = 240$ $\lambda = 1.00$

$C = (4.1 + 3.4) \times 0.51 + 1.36$ 5.2

$M_0 = (5.3 + 5.6) \times 0.51 + 2.04$ 8.4

$Q = (3.4 + 3.0) \times 0.51 + 1.44$ 4.7

B_{51} $l = 866$ $w = ([illegible] + 0.24) \times 1.4/2 + 0.36 = 1.06$

$M_0 = 1.06 \times 8.66^2/8 = 9.9$

$Q = 1.06 \times 8.66/2 = 4.6$

mG5BG  $l = 293$

$l_x = 293$ $l_y = 293$ $\lambda = 1.0$

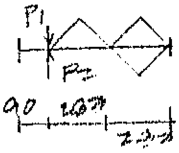
$C_{BG} = (3.4 + 1.15) \times 0.54 + 1.36$ 4.0

$C_{GB} = (3.4 + 0.6) \times 0.54 + 1.36$ 3.5

$M_0 = (5.6 + 1.4) \times 0.54 + 2.04$ 5.8

$Q = (3.0 + 1.15) \times 0.54 + 1.44$ 3.9

GH 46



ℓ = 6.56 w' = 0.51

$P_1 = 1.6$ $P_2 = 4.6 \times 2 = 9.2$ $\Sigma P = 10.8$

Cs = 7.30 + (1.94 + 3.36) × 0.61 + 1.43 12.0

Ca = 1.16 + (1.06 + 1.12) × 0.66 + 1.43 4.2

Mo = 4.90 + (2.37 + 2.84) × 0.66 + 2.04 10.4

Q = 9.40 + (1.29 + 0.87) × 0.74 + 1.67 12.7

1.-3 AXIAL FORCE OF COLUMN

	ROOF & FLOOR		WALL		BEAM	COLUMN	W	P
			0.10 × 3.7	0.37				
C43	0.51 × 1.42 × 2.29	1.66	0.84 × 1.29	1.08	1.09	0.98	5.19	49.2
			1.40 × 1.91	3.44				
C11	0.54 × "	1.76	1.73 × 1.29	1.69	1.09	1.95	9.93	15.1
			1.40 × 1.91	3.44				
C11	0.54 × "	1.76	1.61 × 1.29	2.06	1.09	3.40	11.75	26.9
			0.10 × 2.4	0.24				
C44	0.51 × 2.83 × 2.29	3.31	0.84 × 2.55	2.14	1.84	0.98	8.55	8.6
C11	0.54 × "	3.50	1.73 × 2.55	3.71	1.84	1.95	10.66	19.2
C11	0.54 × "	3.50	1.61 × 2.55	4.11	1.84	3.40	12.45	32.1
			2.13 × 2.4	0.24				
C81	0.51 × 1.42 × 1.42	1.03	0.84 × 2.55	2.14	0.81	1.57	5.29	5.9
C11	0.54 × "	1.09	1.73 × 2.55	3.71	0.80	3.14	7.60	13.5
C11	0.54 × "	1.09	1.61 × 2.55	4.11	0.81	5.47	11.54	25.0
			0.10 × 2.4	0.24				
C82	0.51 × 2.83 × (1.42 + 0.44)	3.41	0.84 × 2.55	2.14	3.01	0.98	9.82	9.8
2C11	0.54 × "	3.61	1.73 × 2.55	3.71	7.01	1.95	11.94	21.8
C11	0.54 × "	3.61	1.61 × 2.55	4.11	7.01	3.40	14.13	35.9
			0.10 × 3.7	0.37				
C83	0.51 × 1.42 × (1.42 + 4.41)	4.72	0.84 × 1.29	1.08	1.02	0.98	7.67	7.7
			1.73 × 1.29	1.69				
2C11	0.54 × "	4.47	1.80 × 1.29	2.06	1.02	1.95	13.05	21.5
			1.61 × 1.29	1.96				
C11	0.54 × "	4.47	1.73 × 1.29	1.96	1.02	3.40	12.91	34.4
C84	0.51 × 2.83 × 4.41	6.36			3.43	0.98	11.27	11.3
2C11	0.54 × "	6.74			3.43	1.95	12.62	23.9
C11	0.54 × "	6.74			7.93	3.40	14.07	38.0
			0.10 × 2.4	0.24				
C81	0.51 × (1.42 + 0.44) × 2.83	3.41	0.84 × 2.55	2.14	2.25	0.98	9.06	9.1
C11	0.54 × "	3.61	1.73 × 2.55	3.71	2.25	1.95	11.18	20.2
C11	0.54 × "	3.61	1.61 × 2.55	4.11	2.25	3.40	12.37	33.6
C83	0.51 × (2.36 + 2.12) × 2.83	6.41			4.04	0.98	11.54	11.5
C11	0.54 × "	6.96	1.53 × 2.55	3.90	4.04	1.95	12.74	24.3

	ROOF & FLOOR		WALL		BEAM	COLUMN	w	P
C_{G3}	0.54 × 4.48 × 2.83	6.85	1.53 × 2.55	3.90	4.09	3.04	17.88	45.2
C_{B1}	0.51 × 1.42 × 1.42	1.03	0.10 × 2.8 0.84 × 2.55	0.28 2.14	0.87	0.98	5.30	5.3
C_{11}	0.54 × "	1.09	0.50 × 1.28 1.33 × 2.55	0.64 3.39	0.87	1.95	7.94	13.2
C_{11}	0.54 × "	1.09	0.50 × 1.28 1.61 × 2.55	0.64 4.11	0.87	3.40	11.11	24.4
C_{F7}	0.51 × 2.83 × 3.54	5.11	0.10 × 2.8 0.84 × 2.55	0.28 2.14	1.73	0.98	10.24	10.2
C_{11}	0.54 ×	5.41	1.53 × 1.28 1.33 × 2.55	1.96 3.39	1.73	1.95	14.44	24.7
C_{11}	0.54 ×	5.41	1.61 × 2.55	4.11	1.73	3.40	14.65	39.3
C_{F4}	0.51 × 2.83 × 3.54	5.11			3.25	0.98	9.34	9.3
C_{11}	0.54 ×	5.41	1.53 × 3.83	5.86	3.25	1.95	46 16.47	30.4
C_{11}	0.54 ×	5.41	1.53 × 3.83	5.86	3.25	3.40	46 17.92	47.9
C_{F1}			0.10 × 2.8	0.28	2.12	0.98	3.38	3.4
C_{11}			0.50 × 2.55	1.28	2.12	1.95	5.35	8.7
C_{11}			0.50 × 2.55	1.28	0.87	3.40	5.55	14.3
C_{F3}	0.51 × 1.07 × 2.83	1.54	0.10 × 2.8 0.84 × 2.55	0.28 2.14	2.44	0.98	7.38	7.4
C_{11}	0.54 ×	1.64	1.33 × 2.55	3.39	2.44	1.95	9.42	16.8
C_{11}	0.54 ×	1.64	1.61 × 2.55	4.11	1.19	3.40	10.34	27.1
$C_{F4'}$	0.51 × 4.25 × 2.83	6.13			2.90	0.36	9.39	9.4
C_{11}	0.54 × 2.73 × 2.83	4.17	1.53 × 2.55	3.90	1.18	0.72	9.97	19.4
C_{11}	0.54 ×	4.17	1.53 × 2.55	3.90	1.18	1.18	10.43	29.8
C_{F6}	0.51 × 3.31 × 2.83	4.78	0.10 × 2	0.28	2.90	0.98	8.94	8.9
C_{11}	0.54 × 1.42 × 2.83	2.17	0.13 × 2.55	0.33	1.18	1.95	5.63	14.6
C_{11}	0.54 × "	2.17	0.13 × 2.55	0.33	1.18	3.40	7.08	21.7
C_{G3}	0.51 × 1.07 × 2.83	1.54	0.10 × 2.8 0.84 × 2.55	0.28 2.14	2.44	0.36	6.76	6.8
C_{11}	0.54 × "	1.64	1.53 × 1.28 1.88 × 2.55	1.95 4.79	2.44	0.72	11.10	17.9

	ROOF & FLOOR		WALL		BEAM	COLUMN	W	P
C[illegible]	[illegible]	1.64	[illegible]	[illegible]	[illegible]	1.1[illegible]	11.56	29.4
C[illegible]	[illegible]	[illegible]			3.4[illegible]	0.5[illegible]	[illegible]	4.[illegible]
C[illegible]	[illegible]	[illegible]			[illegible]	1.16	[illegible]	17.[illegible]
C[illegible]	[illegible]	[illegible]			[illegible]	1.[illegible]	[illegible]	27.5
C[illegible]	[illegible]	6.13			[illegible]	[illegible]	[illegible]	9.4
C[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.72	11.760	20.17
C[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.19	11.74	32.4

1.-4 SEISMIC FORCE

ROOF	0.46 × 523.0	240.6	
PARAPET	0.10 × 175.3	17.5	
WALL	0.93 × 2.54 × 4.0	94.7	
	0.54 × 1.66 × 12.54	11.2	
ORNAMENT	0.15 × 1.66 × 20.4	5.1	48.4
PARTITION	0.46 × 1.66 × 47.1	32.1	
BEAM	0.34 × 194.9	66.3	
	0.51 × 181.7	92.5	
COLUMN	0.51 × 2.04 × 68	70.7	625.1
2ND FLOOR	0.46 × 526.4	231.6	
WALL	1.76 × 2.54 × 60	134.6	
FROM UPPER STAIRS		48.0	
	0.54 × 1.66 × 12.54	11.2	
ORNAMENT	0.15 × 1.66 × 20.4	5.1	64.4
PARTITION	0.46 × 1.66 × 39.2	60.1	
BEAM	0.34 × 194.9	66.3	
	0.51 × 203.2	103.6	
COLUMN	0.51 × 3.473 × 68	172.4	401.6
1ST FLOOR	0.46 × 526.4	231.6	
WALL	1.61 × 2.54 × 20	82.1	
	0.46 × 2.54 × 20	23.0	
FROM UPPER STAIRS		94.6	
ORNAMENT	0.15 × 1.92 × 35.7	10.3	

PARTITION	0.46 × 1.92 × 42.4	37.4	
	0.54 × 1.96 × 10.2	10.8	
BEAM	0.34 × 194.9	66.3	
	0.51 × 175.0	89.3	
COLUMN	0.51 × 4.09 × 68	141.8	
PORCH ROOF	0.10 × 8.2 × 5.0	4.1	793.7

	W	K	Q	Q_T
3	628.1	0.1	62.8	62.8
2	801.6	0.1	80.2	143.0
1	793.7	0.1	78.4	221.4

WIND PRESSURE

3 0.27 × 341 × 3.83 = 35.76 T

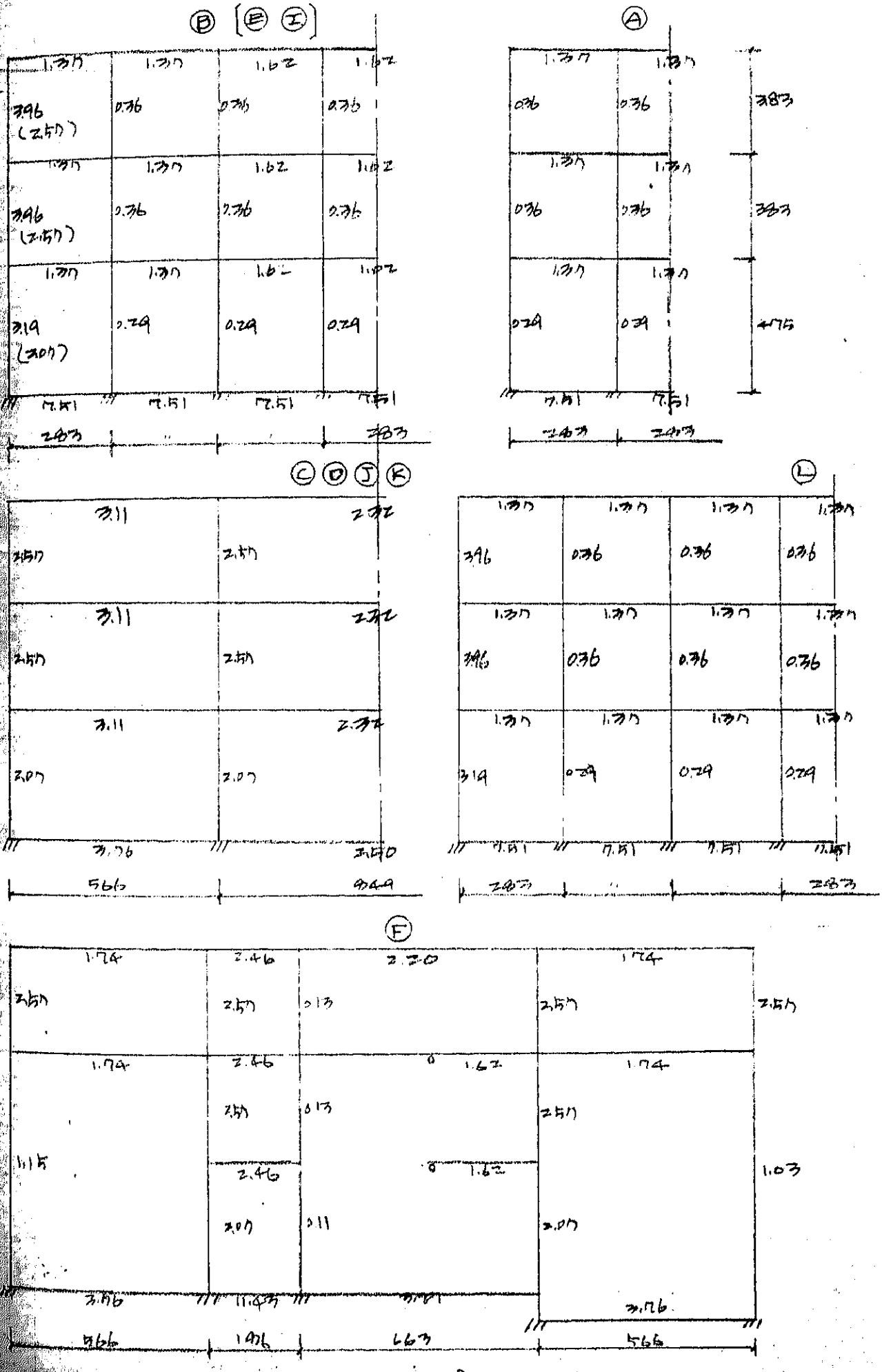
2 0.22 × " = 28.73

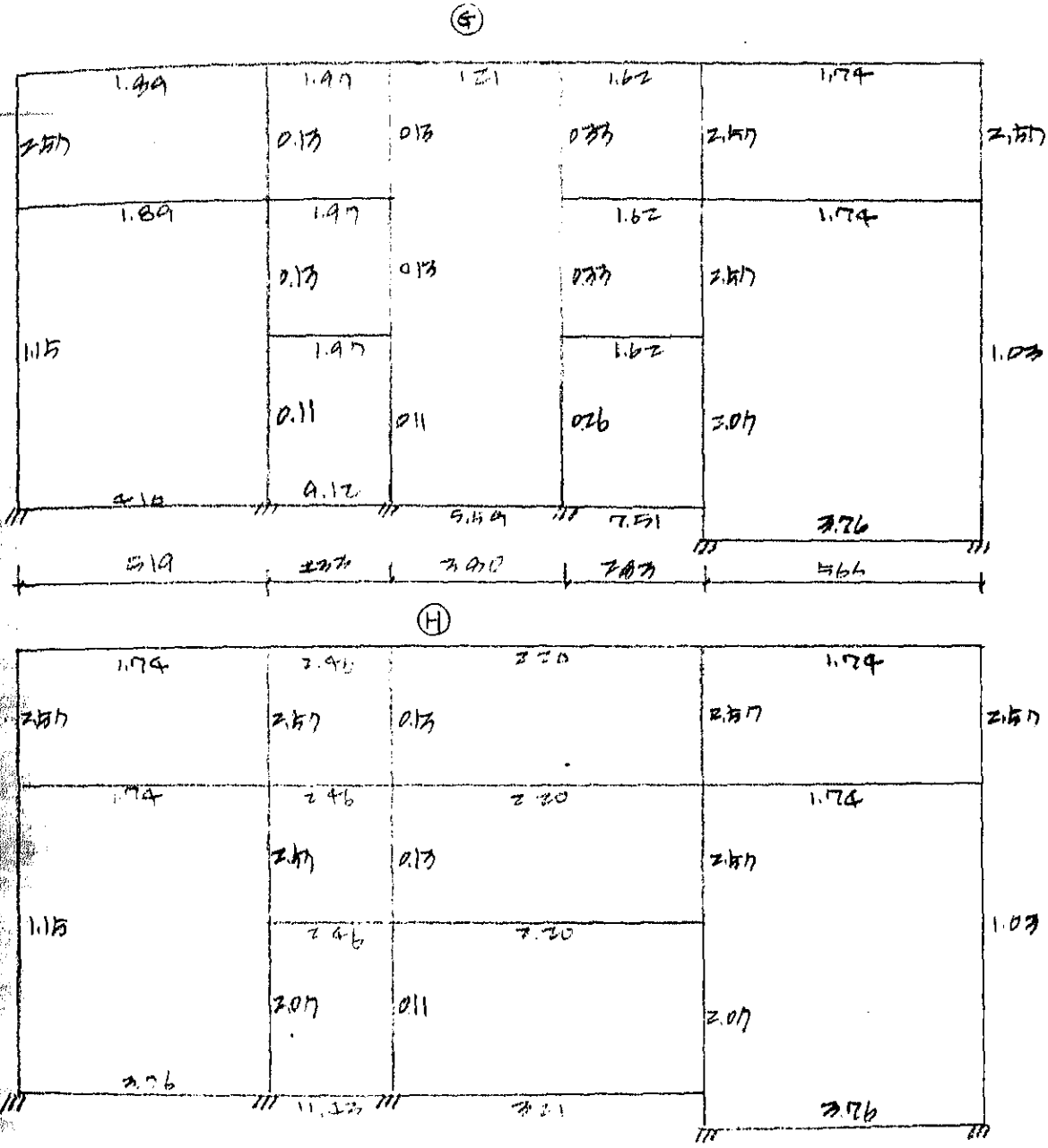
1 0.13 × 341 × 4.75 = 21.05

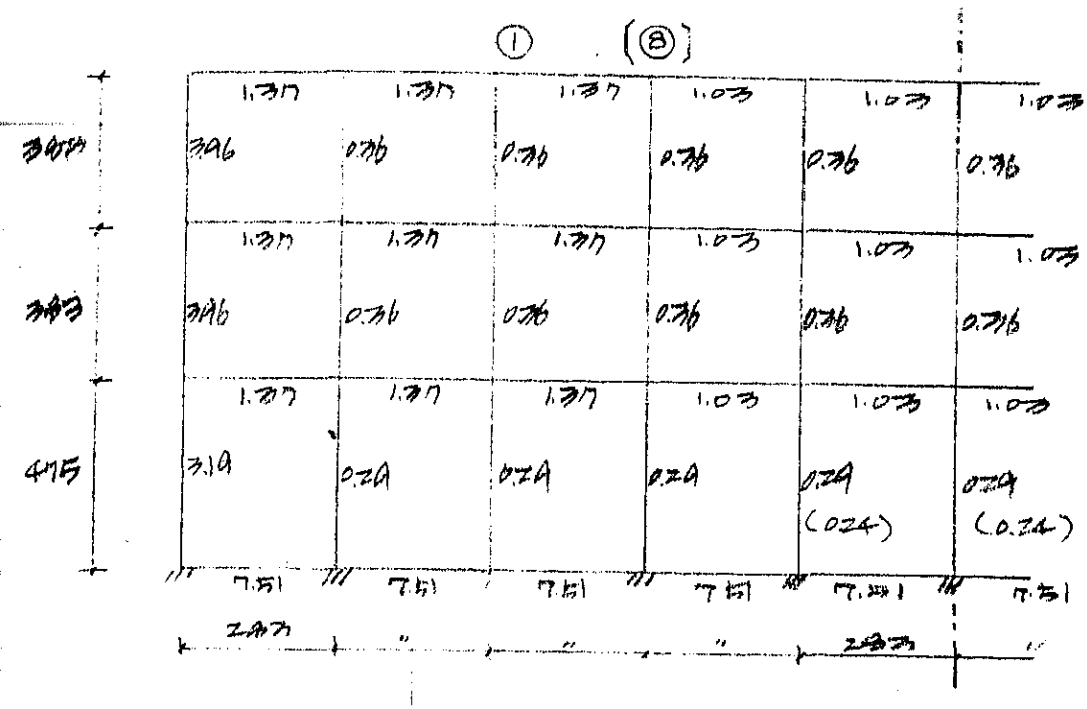
1-5 STIFFNESS RATIO

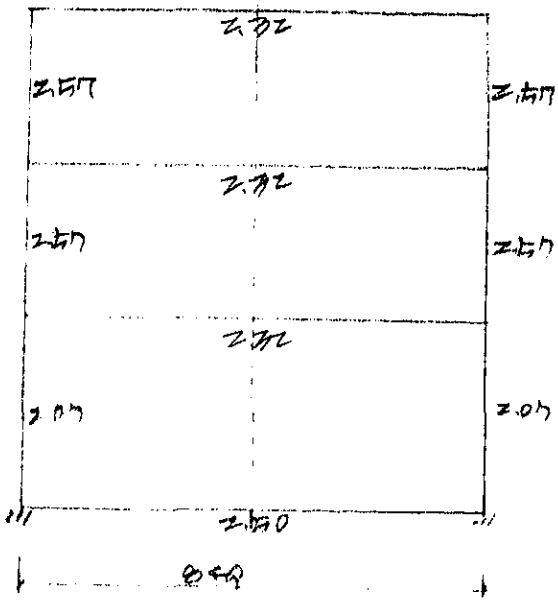
$K_0 = 10^3$

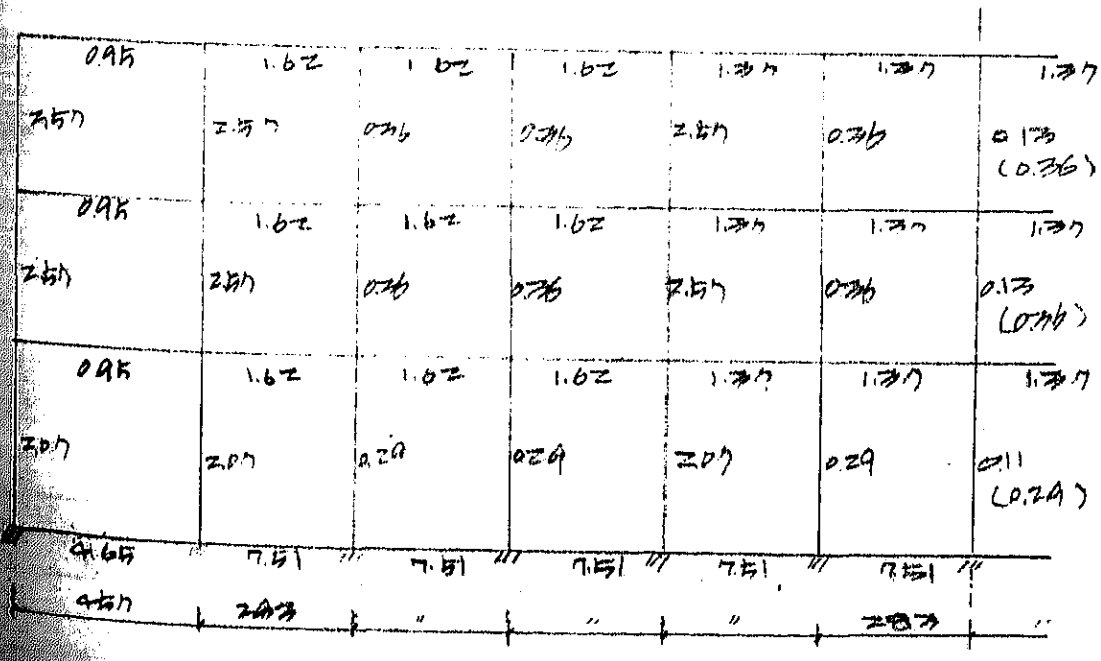
	b×D	I (10^4)	l	K (10^2)	φ	k
2C	28×75	98.4	383	25.7		2.57
	75×28	13.7	"	3.6		0.36
1C	28×75	98.4	475	20.7		2.07
	75×28	13.7	"	2.9		0.29
2C	28×28	5.1	383	1.3		0.13
1C		"	475	1.1		0.11
2C	40φ	12.5	383	3.3		0.33
1C		"	475	2.6		0.26
G	28×50	29.2	283	10.3	1.33	1.37
	"	"		10.3	1.57	1.62
	"	"	457	6.4	1.48	0.95
	"		228	12.8	1.48	1.89
	28×75	98.4	566	17.4	1.79	3.11
	"		849	11.6	2.0	2.32
	"		457	21.5	1.68	3.61
FG	35×90	212.6	283	75.1		7.51
			457	46.5		4.65
			566	37.6		3.76
			849	25.0		2.50

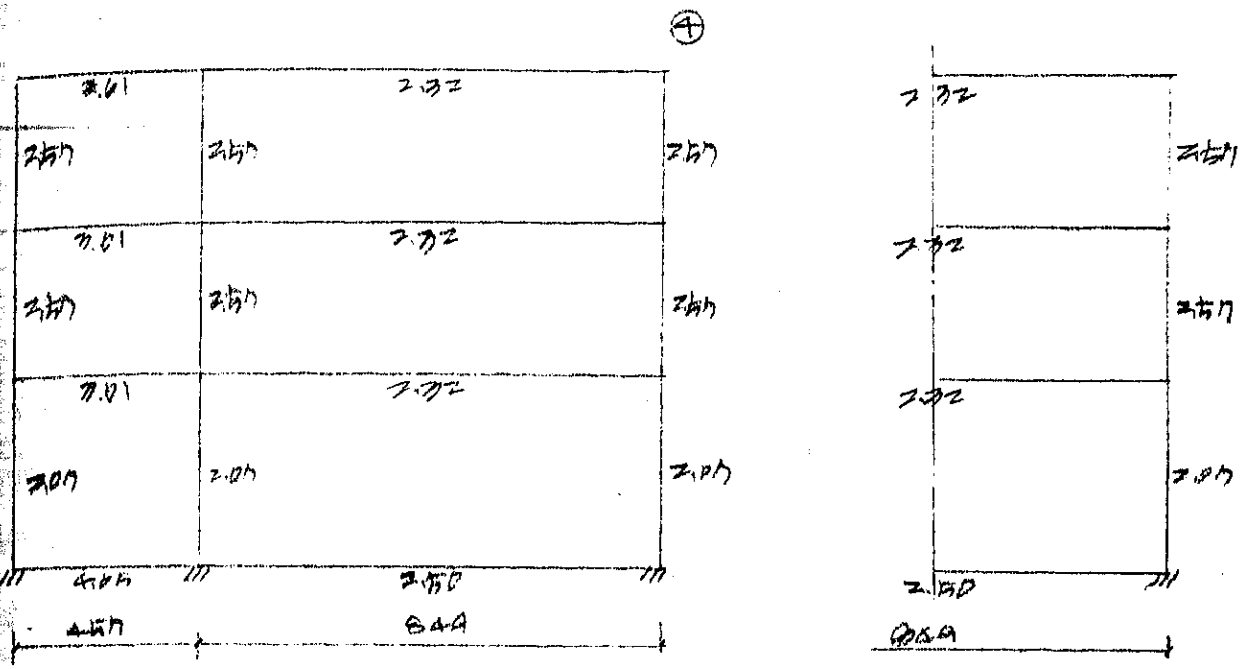


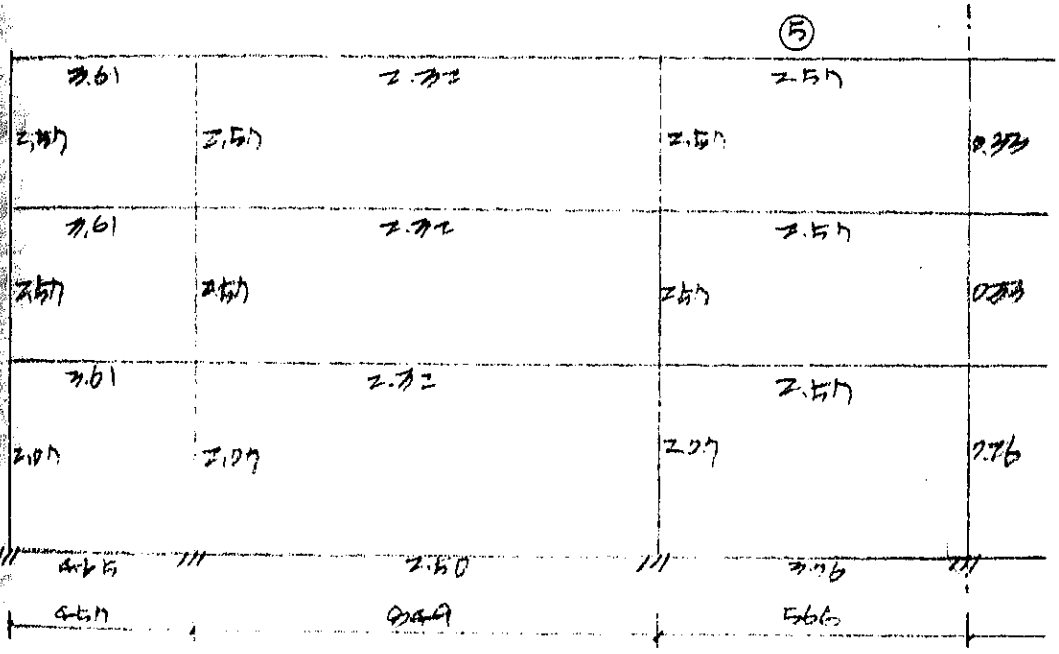


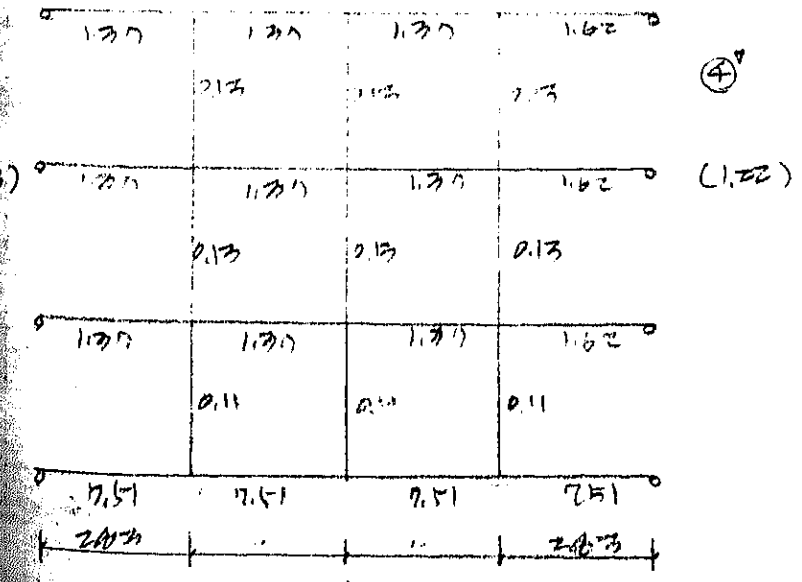







④


⑤


④'
(1.03)
(1.22)

1-6 CALCULATION OF STRESS

(1) D: 1.20

Ⓐ

3.81	7.61
0.24	0.29
0.4	0.5
0.65	0.47
3.81	7.61
0.24	0.29
1.1	1.3
0.60	0.50
–	–
4.07	9.45
0.23	0.25
1.2	1.3
0.55	0.45
–	–

Ⓑ

0.35	7.61	8.31	9.00
0.59	0.29	0.29	0.29
1.1	0.5	0.5	0.5
0.23	0.47	0.47	0.47
0.35	7.61	8.31	9.00
0.59	0.29	0.29	0.29
2.7	1.3	1.3	1.3
0.21	0.50	0.50	0.50
–	–	–	–
0.43	9.45	10.31	11.17
1.22	0.25	0.25	0.26
6.4	1.3	1.3	1.4
0.74	0.45	0.45	0.45
–	–	–	–

Ⓒ

1.21	2.11
0.49	1.32
1.7	2.3
0.36	0.40
1.29	2.11
0.49	1.32
4.2	5.7
0.45	0.45
1.50	2.62
1.14	1.40
6.0	7.1
0.56	0.55

Ⓓ

0.66	1.63	2.736	1.34	0.66
0.65	1.15	0.12	1.07	0.65
1.2	2.1	0.2	1.9	1.2
0.34)	0.30)	)	0.36)	0.34)
1.51	1.30	1.392	0.91	1.69
0.66	1.01	0.12	0.74	0.61
1.5	4.6	0.5	3.4	1.4
0.57)	0.45 −0.05)	0.50)	0.45 −0.15)	0.55)
	1.19	2.336	2.57	
	1.10	0.10	0.96	
	5.6	0.5	4.5	
	0.59)	0.55)	0.70)	

Ⓔ

2.53	
0.54	
1.0	
0.30)	
0.53	
0.54	
2.5	
0.45)	
0.66	
0.40	
4.7	
0.67)	

{(0.74 − 0.36) × 2.5 + 1.95} × 0.1 = 0.47 → 0.5

(G)

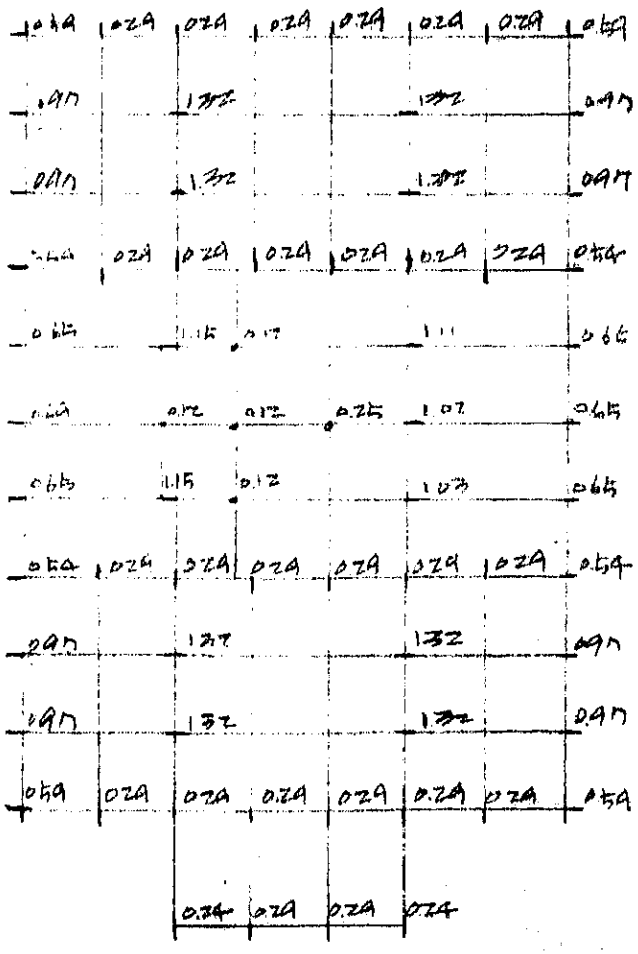
0.74	29.69	19.81	6.94	1.31	0.64
0.64	0.12	0.12	0.25	1.02	0.65
1.3	0.2	0.2	0.5	1.9	1.2
0.40	0.45	0.45	0.45	0.76	0.39
-0.10	-	-	-	-	-0.10
1.64	23.42	15.15	4.41	0.91	1.69
0.50	0.12	0.11	0.23	0.86	0.61
1.6	0.5	0.5	1.1	3.9	1.4
0.57	0.50	0.50	0.450	0.45	0.57
-	-	-	-	-0.10	-
	12.00	10.00	6.23	0.78	
	0.10	0.16	0.21	0.95	
	0.5	0.5	1.1	5.0	
	0.45	0.45	0.43	0.65	
	-	-	-	-	

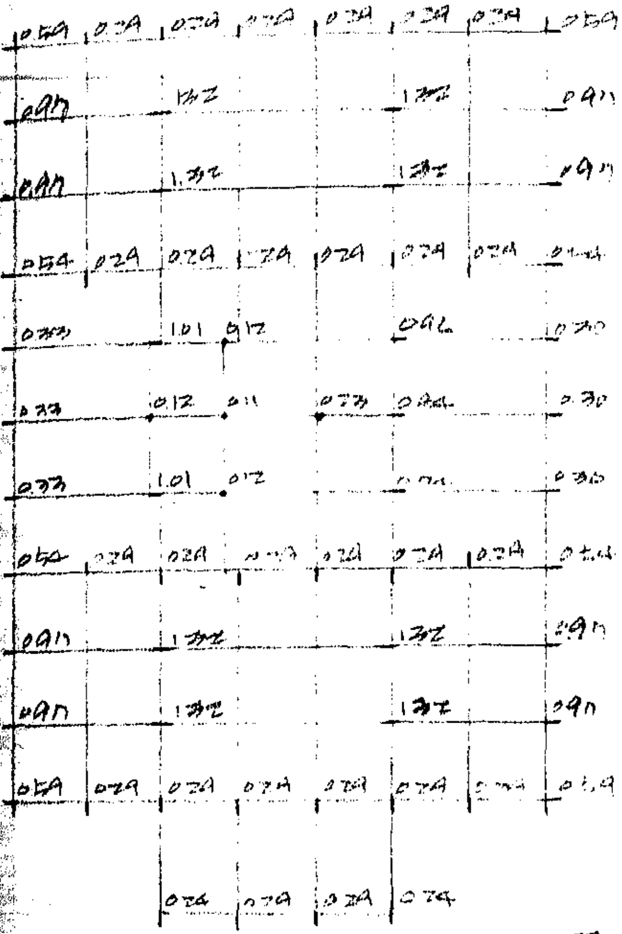
$3\bar{G} = 62.3$

$ID_x = 36.27$

(H)

0.64	1.63	35.85	1.53	0.69
0.54	1.15	0.12	1.11	0.66
1.2	2.1	0.2	2.0	1.2
0.39			0.76	0.39
-0.10				-0.10
1.51	1.70	35.45	1.19	1.69
0.66	1.01	0.12	0.96	0.61
1.5	4.6	0.5	4.4	1.4
0.57	0.45	0.50	0.46	0.57
-	-0.05		-0.07	-
	1.19	32.36	1.06	
	1.10	0.11	1.06	
	5.4	0.6	5.6	
	0.54	0.45	0.60	
	-	-	-	





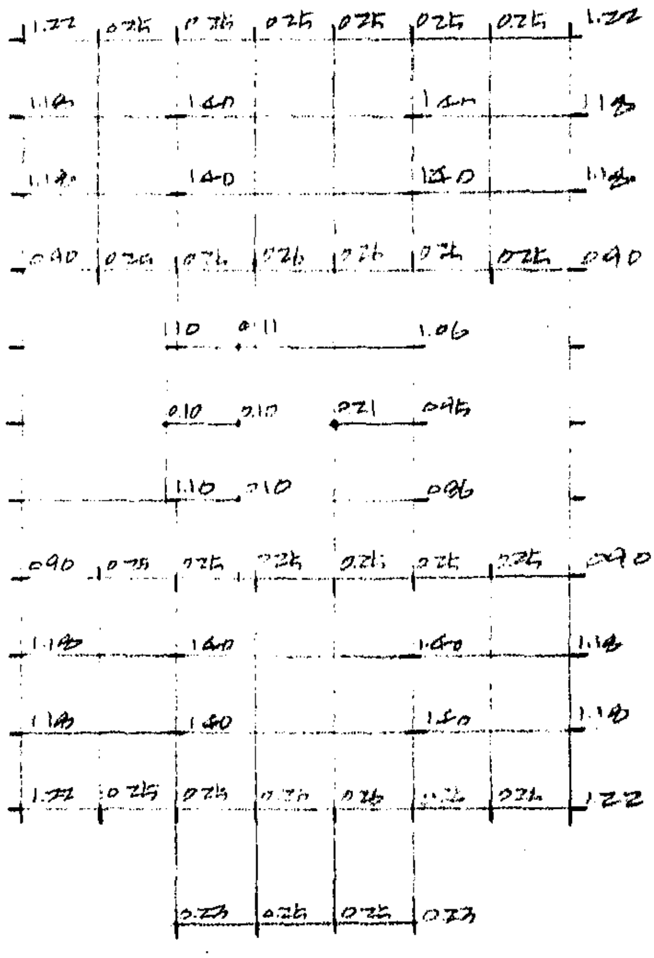
ΣQ = 1430

ΣΔ = 33.29

(108 → 31)

ΣQ = 2214 − 31 = 2183

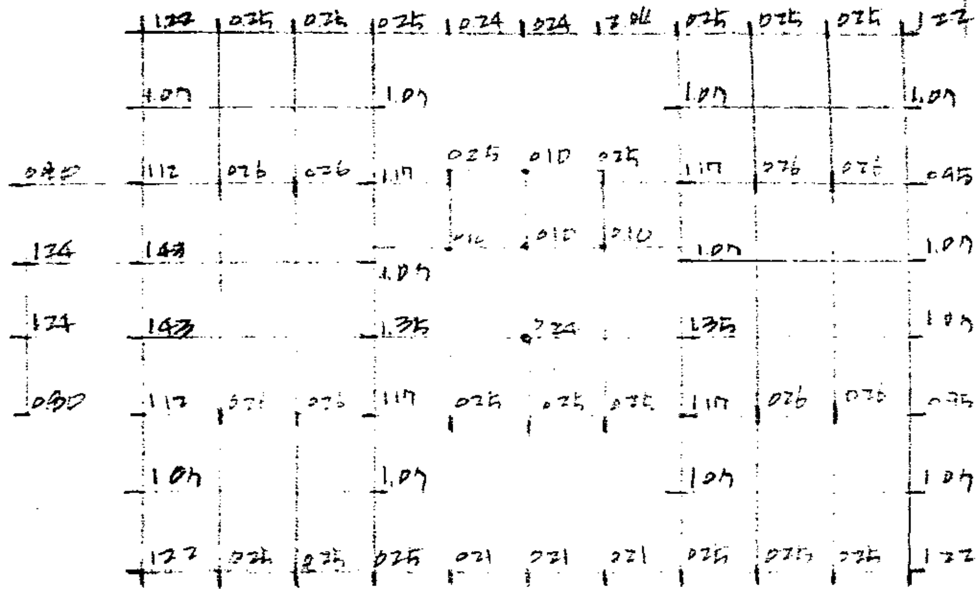
ΣΔ = 41.79



⑤

1.40	2.30	1.90	15.54
1.06	1.77	1.35	12.39
1.48	2.4	2.2	0.5
(0.37)	(0.41)	(0.39)	(0.45)
1.40	2.30	1.90	15.54
1.06	1.77	1.24	0.24
4.72	5.4	4.9	1.2
(2.44)	(2.46)	(0.45)	(0.450)
1.174	2.06	2.36	19.176
1.24	1.43	1.35	0.26
6.72	7.1	6.7	1.2
(0.26)	(0.44)	(0.45)	(0.45)

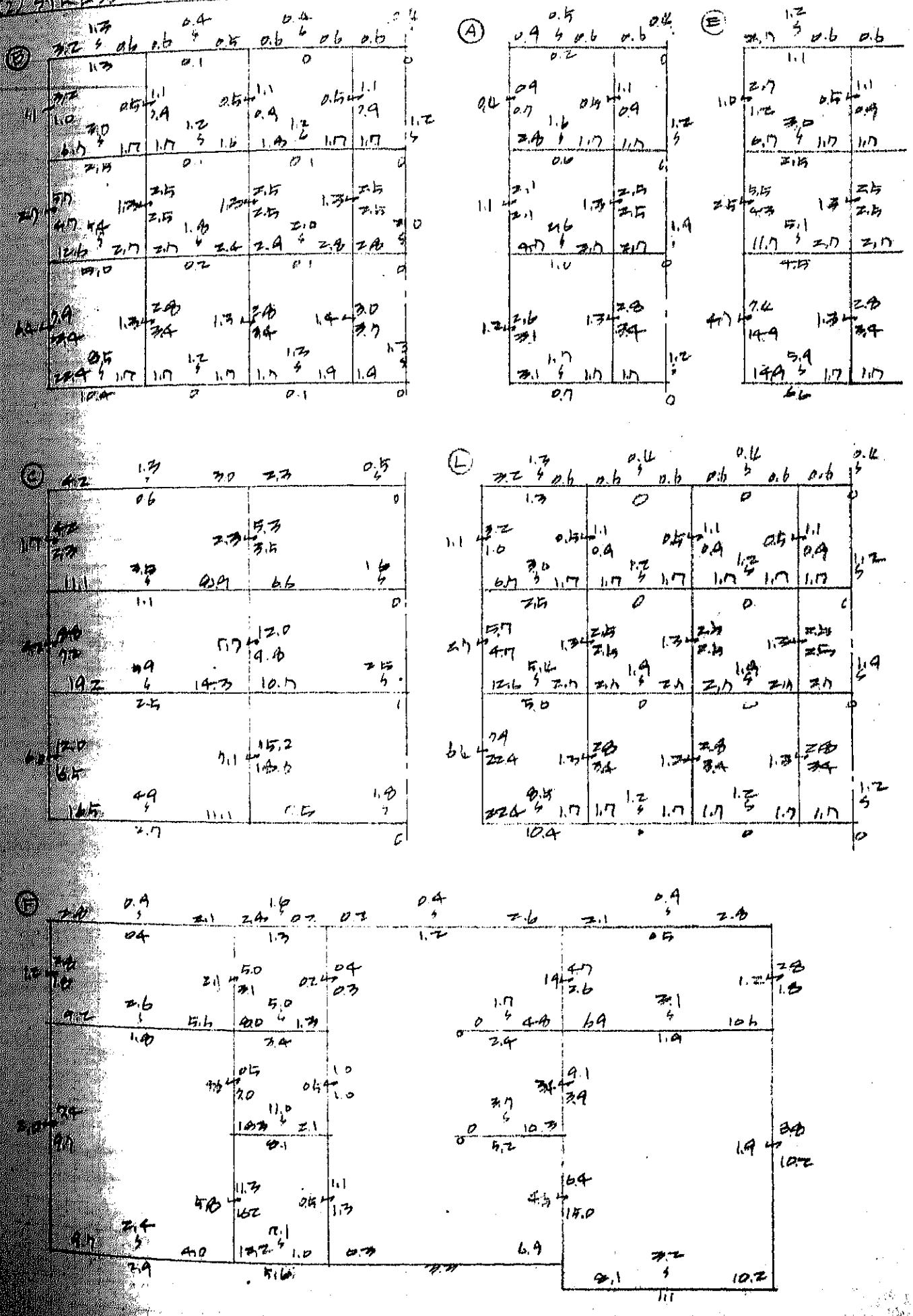
	0.63
	0.62
	1.1
	(0.30)
	0.63
	0.62
	2.6
	(0.44)
	0.170
	0.95
	4.4
	(0.65)

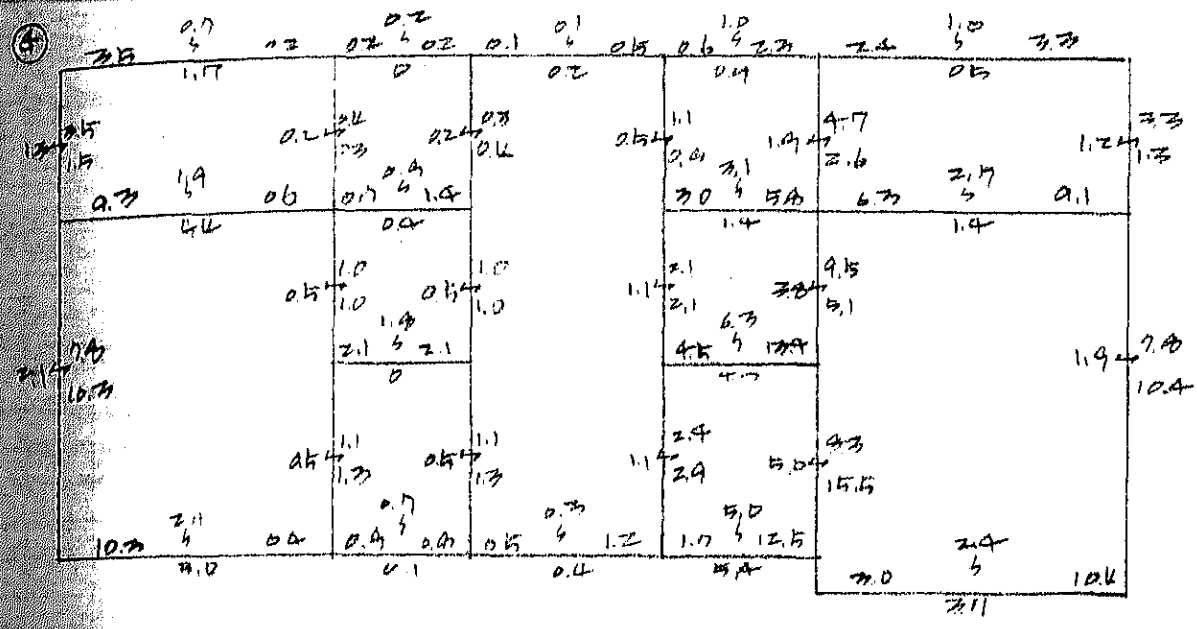


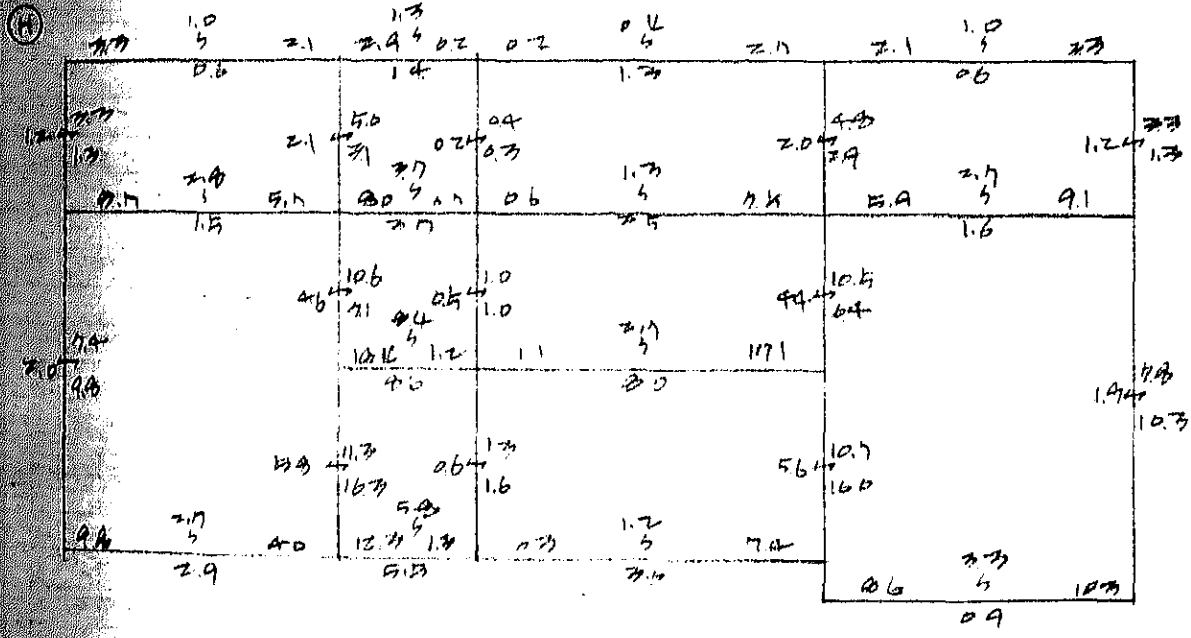
$\Sigma D_1 = 4294$

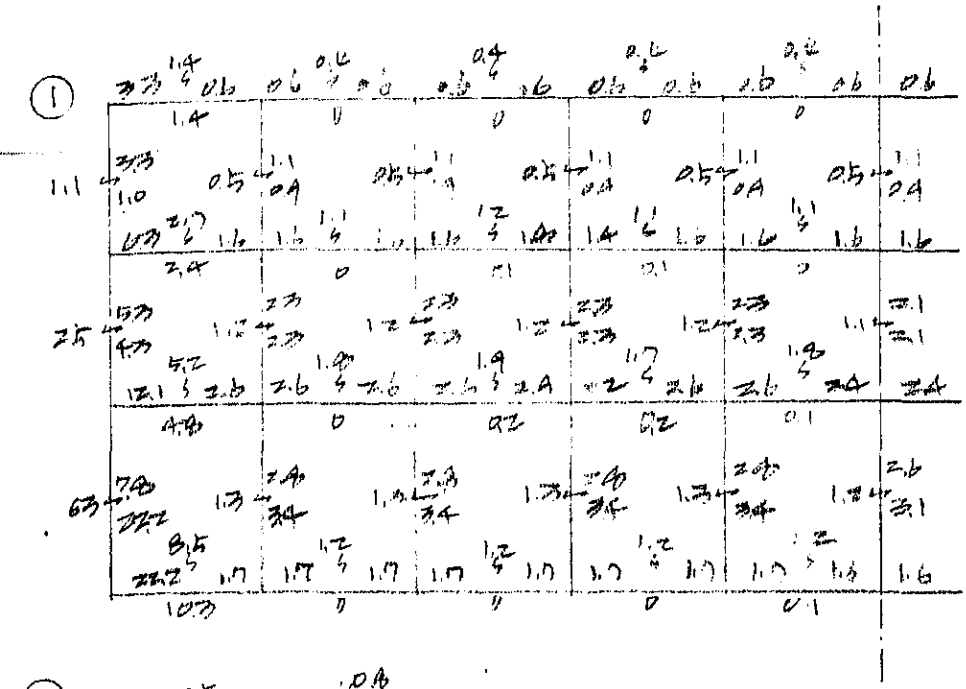
$Q = 221.4$

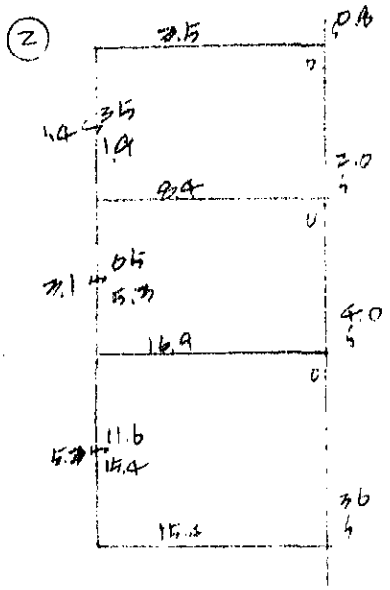
(2) STRESS DIAGRAM OF SEISMIC FORCE

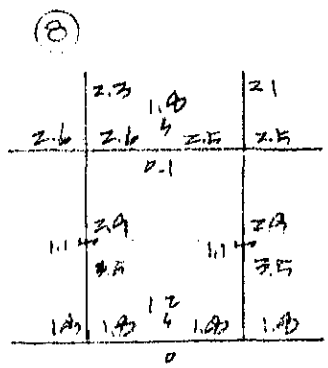


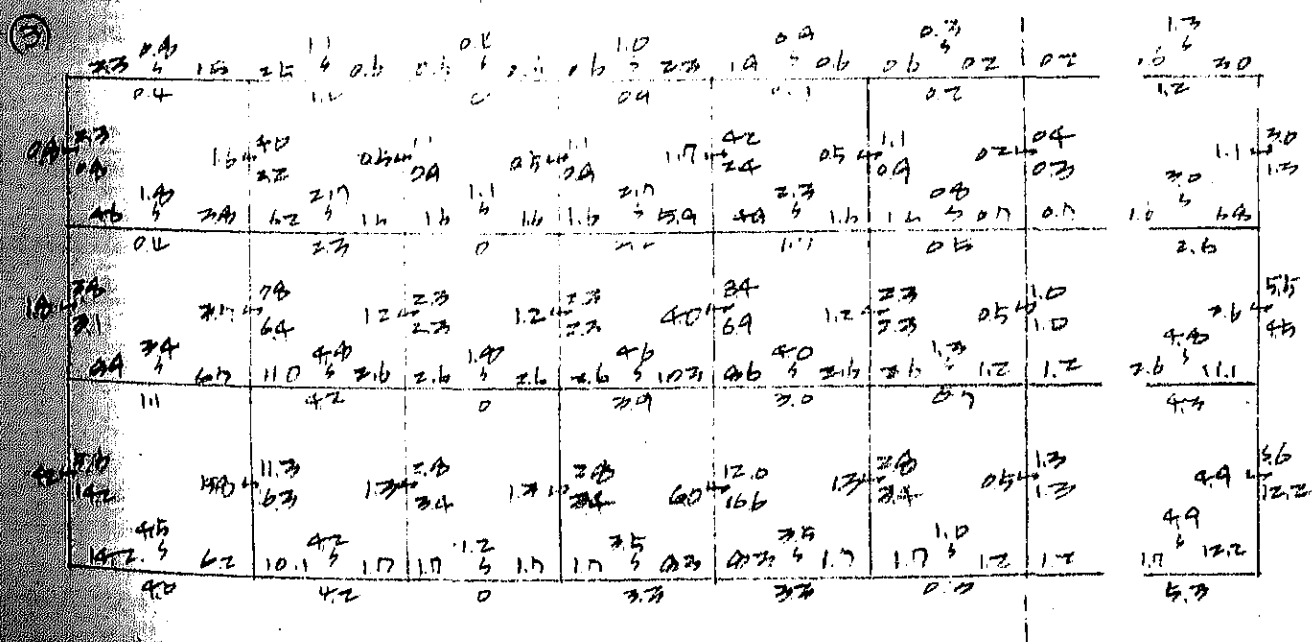


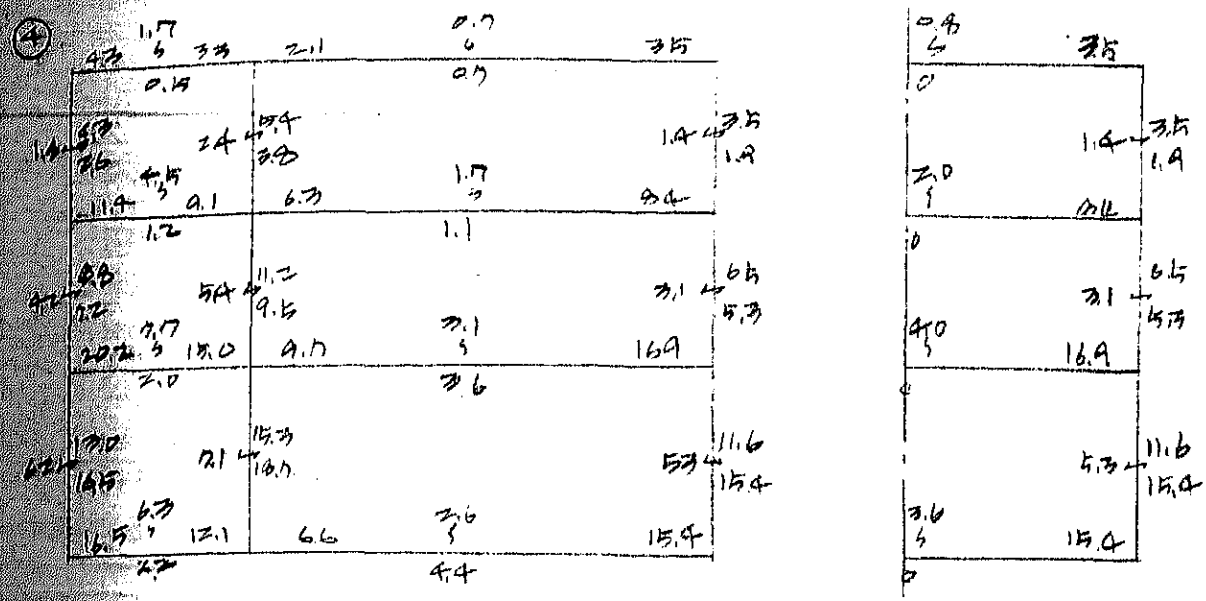


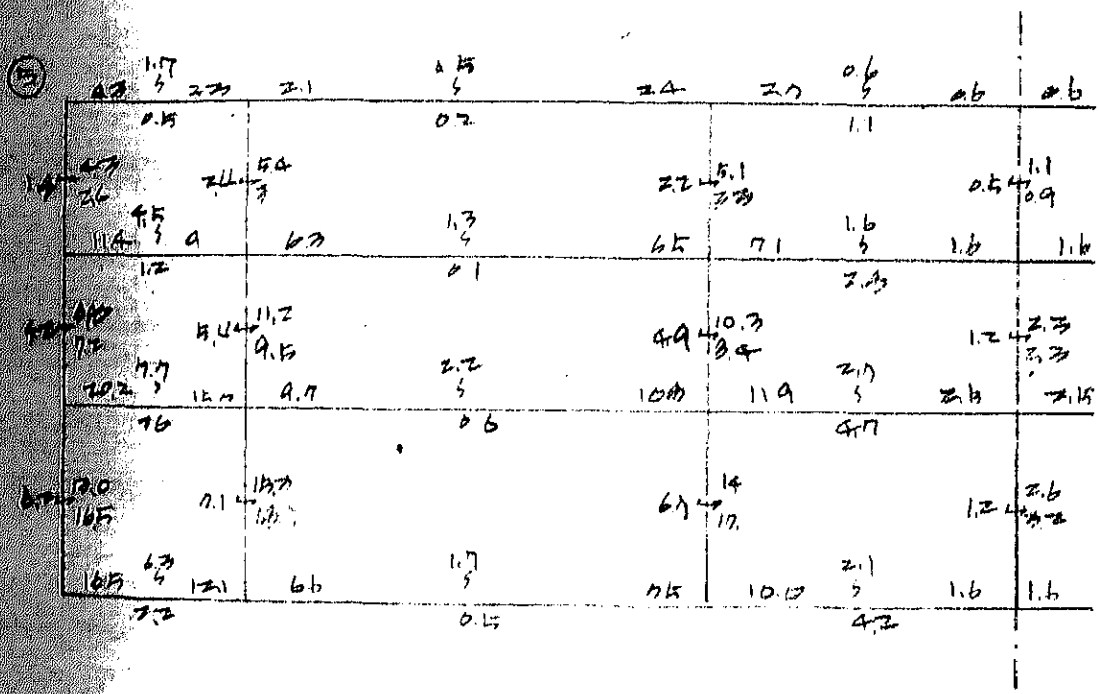

①

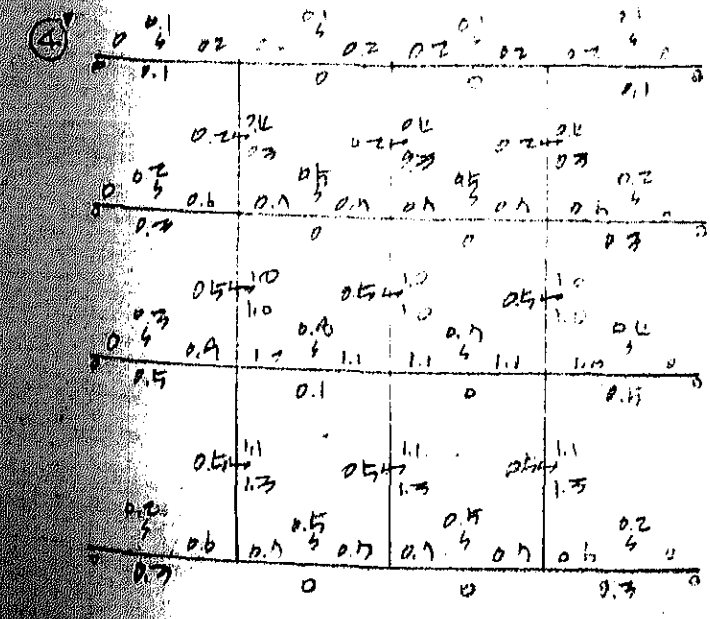

②


③

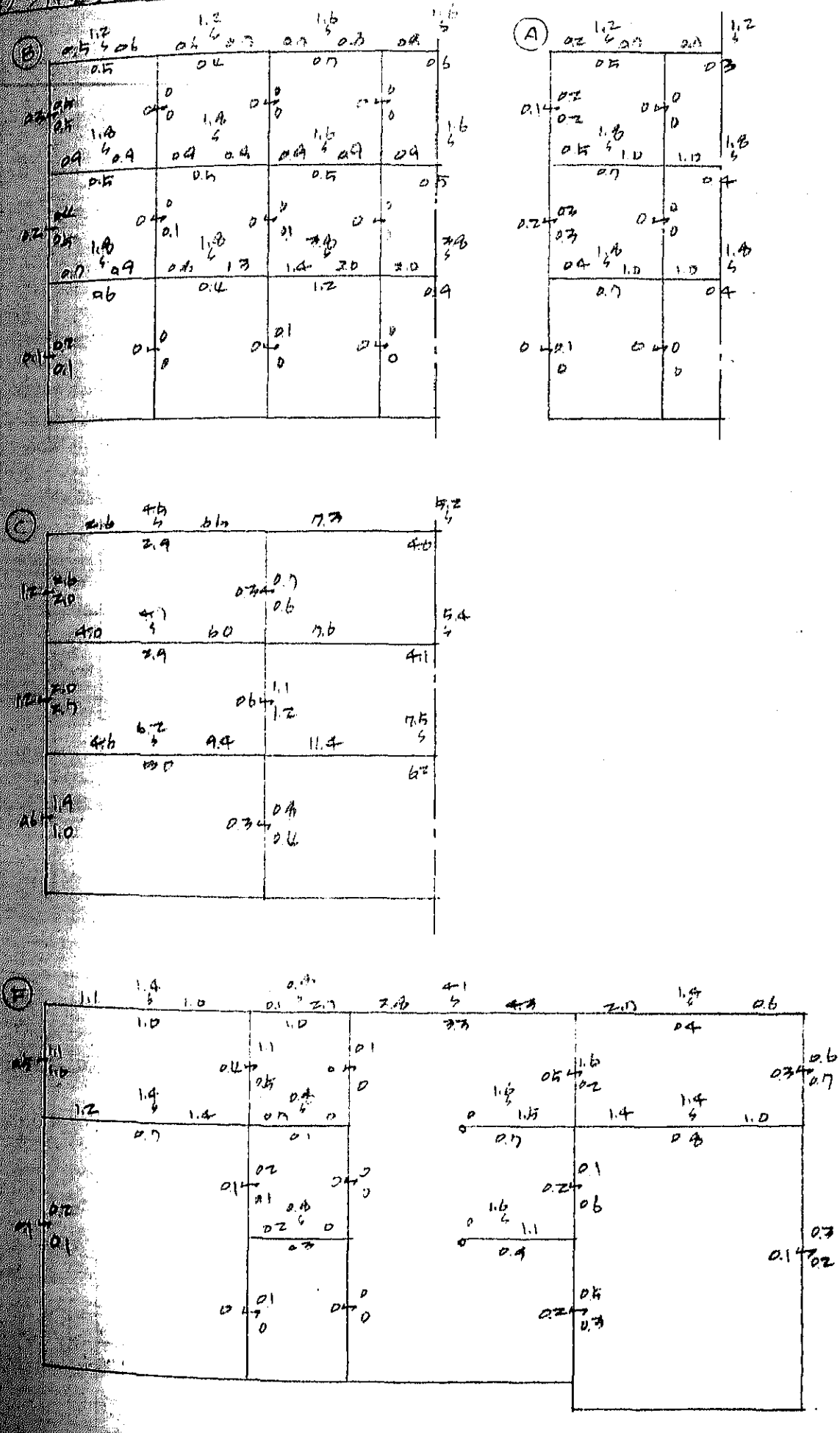

④

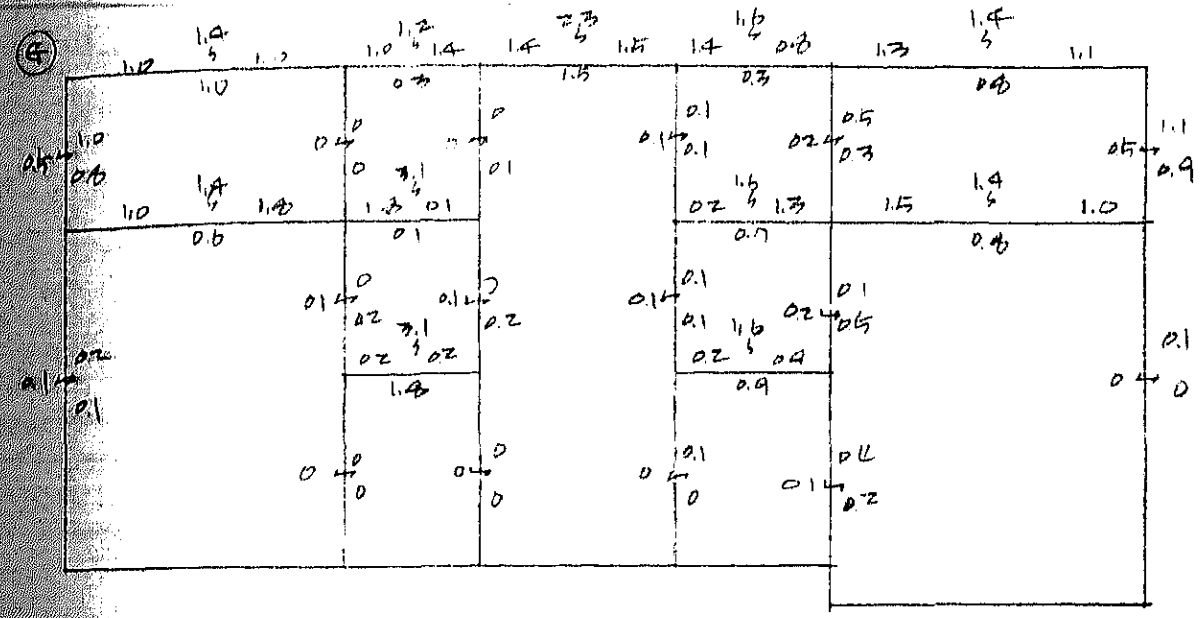


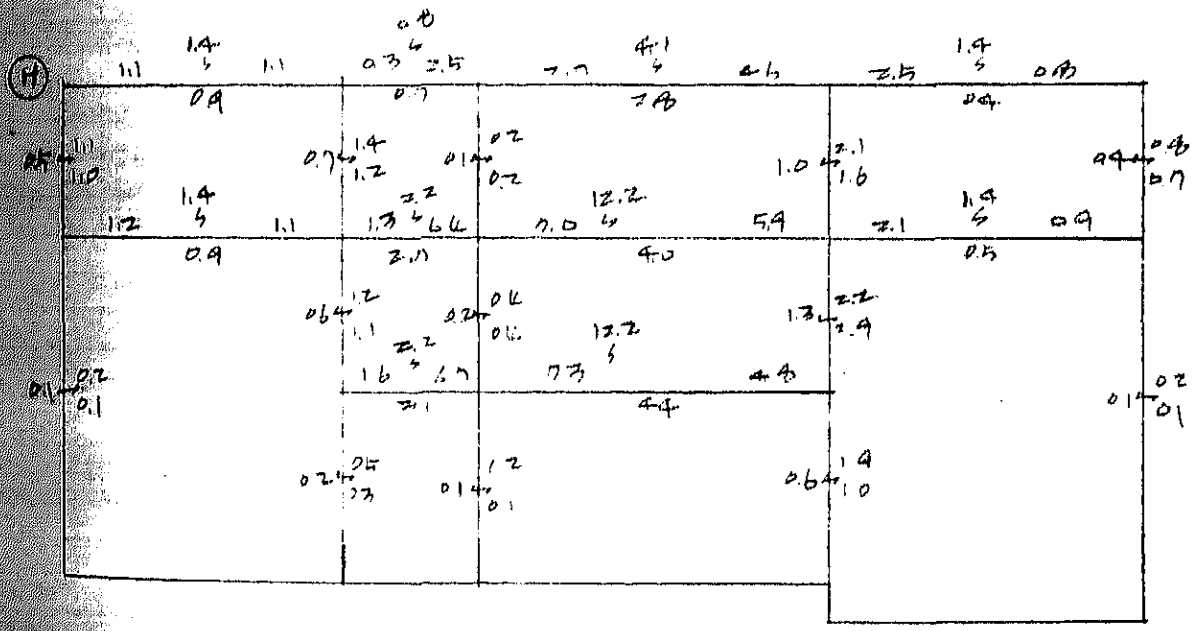


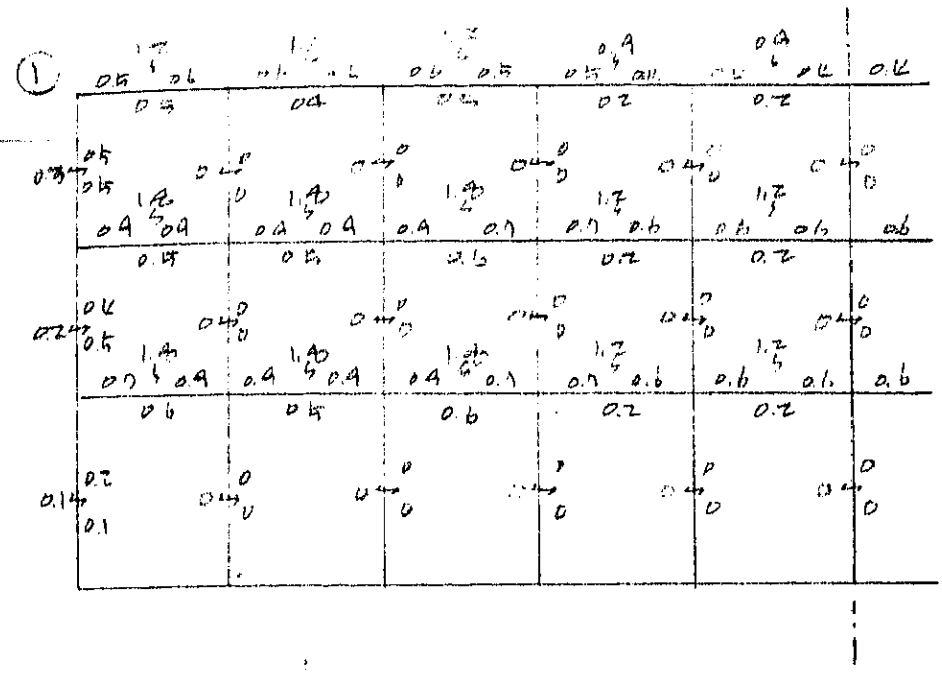


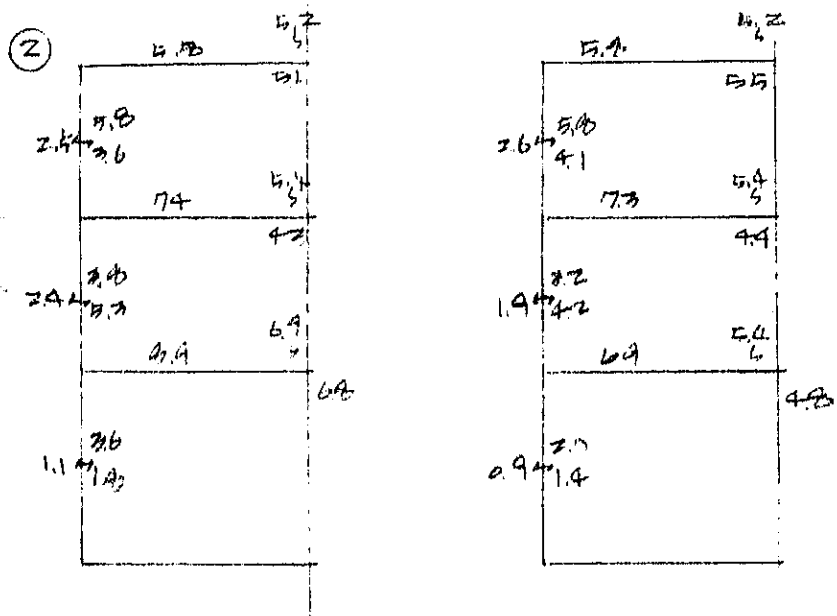
2) STRESS DIAGRAM OF VERTICAL LOAD

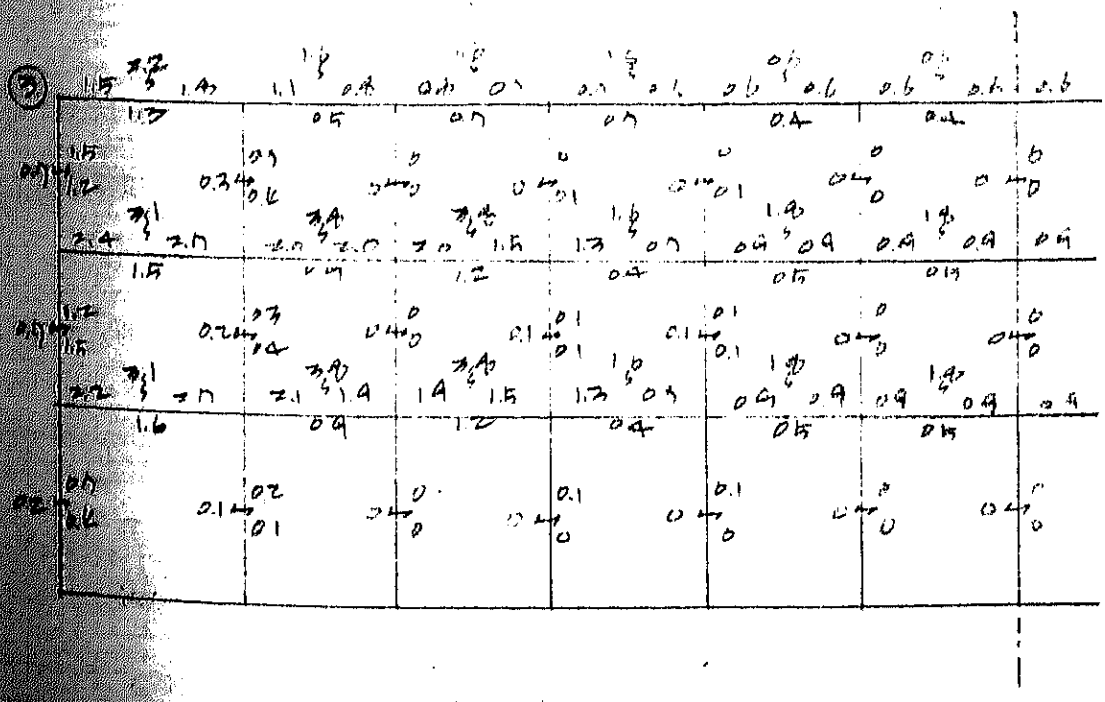


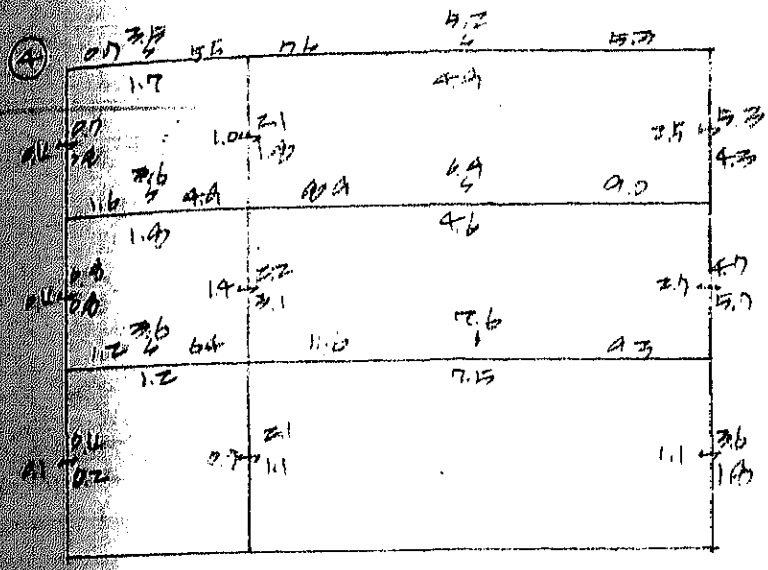

(G)

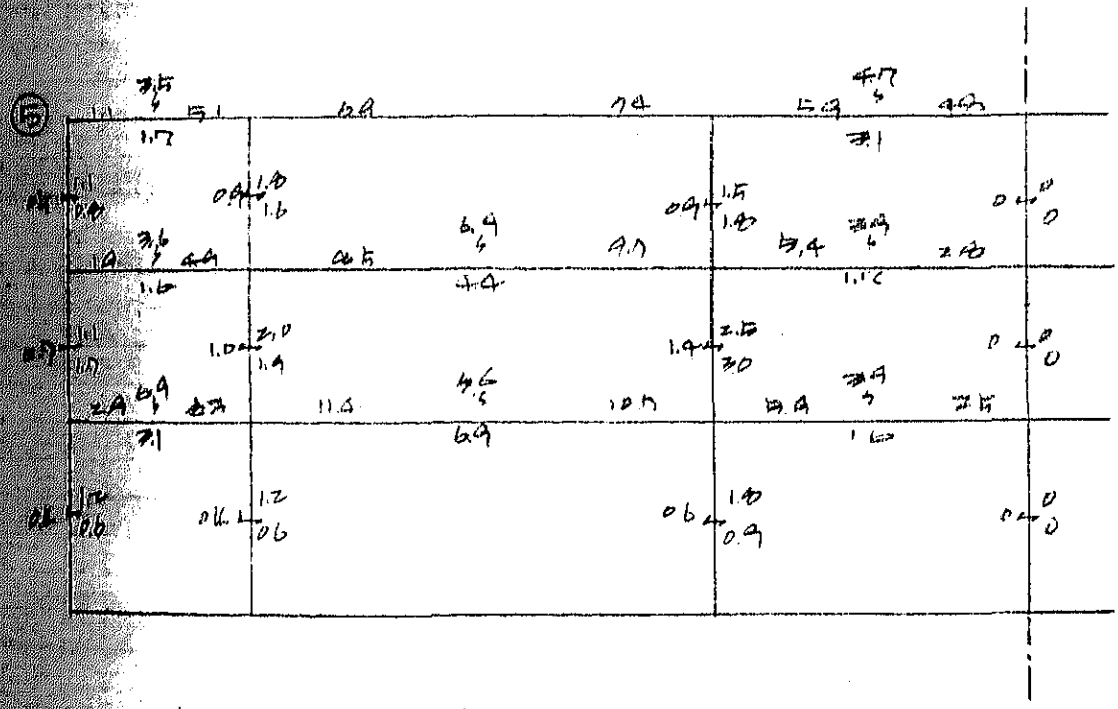

(H)

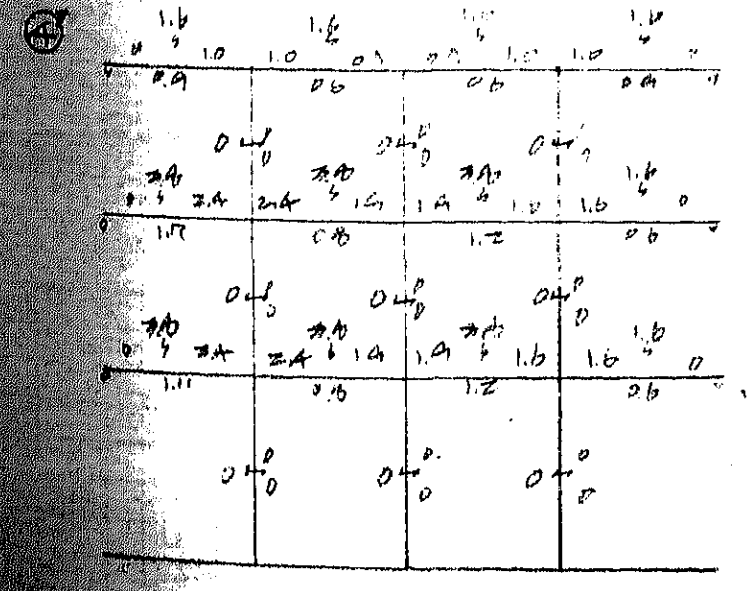

①


②


③







-7. DESIGN OF SECTION

(1) BEAM

6A3~6

	M_{OE} (TM)	M_C	M_{IE}	Q (T)
L	0.2	0.5	0.7	1.2
E	0.9	0.2	0.6	0.5
S	1.1 0.7	0.7	1.3	2.2

b×D = 29×50 d = 45 j = 39.3

LOA = 29×39.3×6 = 6600 kg

a_{OE} = 110 / 39.3×3.0 = 0.9

Q = 1200 / 39.3×7.2 = 4.2 } 2-D13

3GA3~6

	M_{OE}	M_C	M_{IE}	Q
L	0.3	0.7	1.0	1.8
E	2.9	0.6	1.7	1.6
S	3.3 2.3	1.3	2.7 0.7	5.0

b×D = 29×50

a_{OE} = 330 / 39.3×3.0 = 2.8 2-D16

a_{IE} = 340 / 〃 = 2.9

2GA3~6

	M_{OE}	M_C	M_{IE}	Q
L	0.4	0.7	1.0	1.4
E	4.7	1.0	3.7	5.6
S	5.1 4.3	1.7	4.7 3.7	7.0

b×D = 29×50

a_{OE} = 510 / 39.3×3.0 = 4.3 2-D19

a_{IE} = 470 / 〃 = 4.0

??B1NB	M_{OE}	M_C	M_{EE}	Q	M_E	M_C	Q
L	0.5	0.5	0.6	1.2	0.7	0.7	1.6
E	3.2	1.3	2.6	1.3	0.6	0	0.4
S	3.7	1.8	1.2	3.8	1.4		

b × D = 28 × 50

a	3.1	1.5	1.0	1.2	0.9	2.0
n	4-D13	2-D13	2-D13	2-D13	2-D13	

2GB1NB	M_{OE}	M_C	M_{EE}	Q	M_E	M_C	Q
L	0.9	0.7	0.9	1.8	0.9	0.5	1.8
E	6.7	2.6	1.7	3.0	1.4	0.1	1.2
S	7.6	3.3	2.6	7.8	2.7		4.2

b × D = 28 × 50

a	6.4	2.5	2.2	2.3	0.6
n	4-D16	2-D16	2-D16	2-D16	2-D16

2GB1NB	M_{OE}	M_C	M_{EE}	Q	M_E	M_C	Q
L	0.7	0.6	0.9	1.8	2.0	1.2	3.8
E	12.6	5.0	2.5	5.4	2.4	0.1	2.0
S	13.3	5.6	3.6	12.6	4.9		7.8

b × D = 28 × 50

a	11.3	4.7	3.1	4.1	1.5
n	4-D19	2-D19	2-D19	2-D19	2-D19

$_sQ_A = 28 \times 39.3 \times 9 = 9.9^t$

$\Delta Q = 12.6 - 9.9 = 2.7$

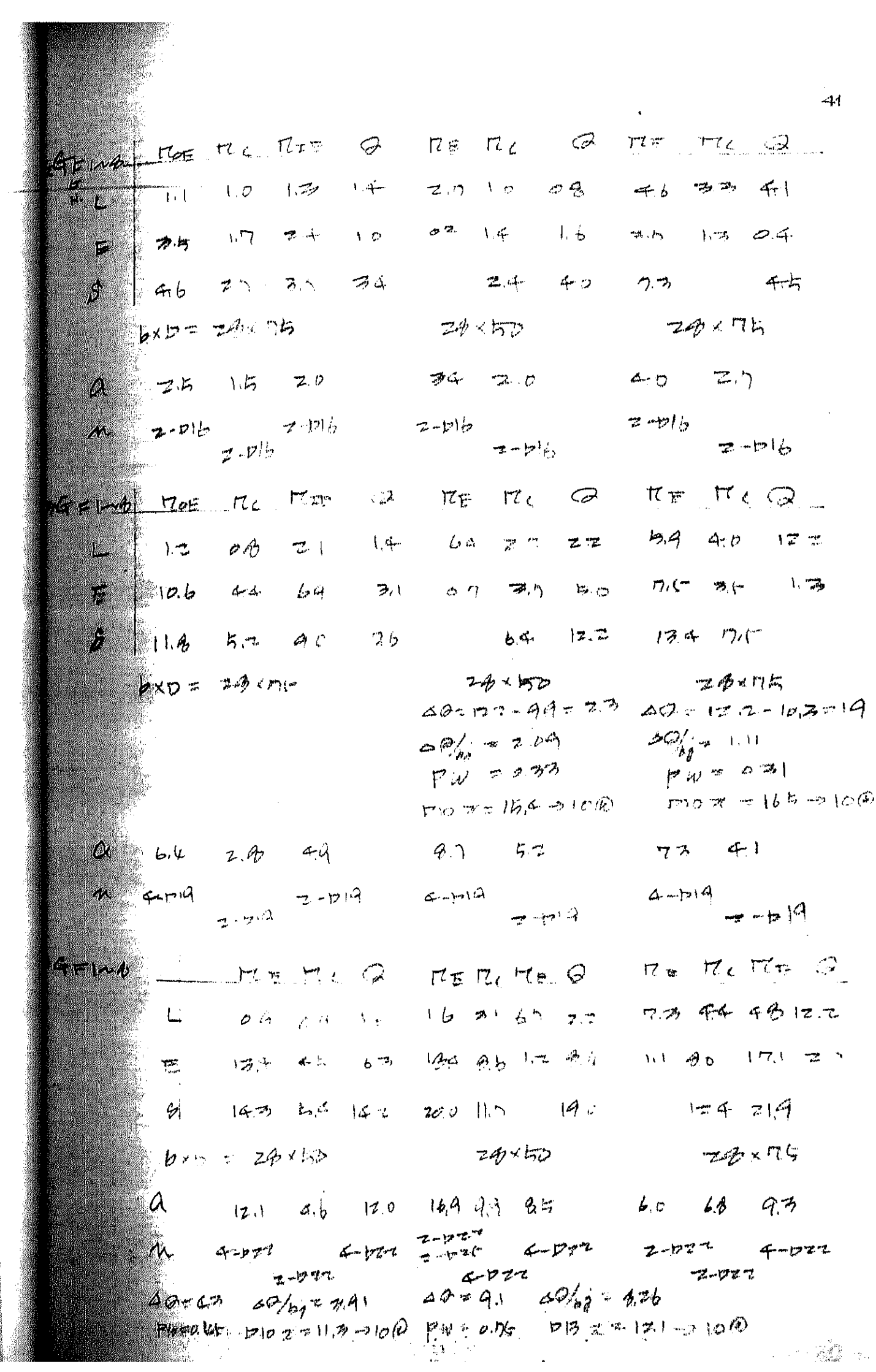
$\Delta Q / bj = 2.45 \qquad P_W = 0.36$

$D10 \; x = 165/28 \times 0.36 = 19.2 \rightarrow 10$ @

RCC No.							
L							
E							
δ							

26C No.							
L							
E							
δ							

24C No.							
L							
E							
δ							



2G1 ANI	Mue	Mc	Mie	Q	Me	Mc	Q
L	0.5	0.5	0.6	1.2	0.5	0.5	1.2
E	3.3	1.4	0.6	1.4	0.6	0	2.4
S	3.3	1.9	1.2	4.0	1.1		3.0

b×D = 28×50

a	3.2	1.6	1.0	0.9	0.6
n	4-D13	2-D13	2-D13	2-D13	2-D13

3G1 ANI	Mue	Mc	Mie	Q	Me	Mc	Q
L	0.9	0.5	0.9	1.8	0.7	0.6	1.8
E	6.3	2.4	1.6	2.7	1.8	0.1	1.2
S	7.2	2.9	2.5	7.2	2.5		4.2

b×D = 28×50

a	6.1	2.4	2.1	2.1	0.8
n	4-D16	2-D16	2-D16	2-D16	2-D16

2G1 ANI	Mue	Mc	Mie	Q	Me	Mc	Q
L	0.7	0.5	0.9	1.8	0.7	0.6	1.8
E	12.1	4.8	2.6	5.2	2.9	0.2	1.9
S	12.8	5.4	3.5	12.2	3.1		5.6

b×D = 28×50

a	10.8	4.6	3.0	3.0	0.8
n	4-D19	2-D19	2-D19	2-D19	2-D19

ΔQ = 12.2 − 9.9 = 2.3

ΔQ/bj = 2.09   Pw = 0.33

D10 @ = 143/(28×0.333) = 15.4 → 10 @

L			
E			
S			

L			
E			
S			

L			
E			
S			

[illegible]BAWI	MOE	MC	MIE	Q	MLE	MC	MEE	Q
L	1.5	1.3	1.8	2.2	1.1	0.7	0.8	1.6
E	2.3	0.4	1.5	0.4	2.5	1.0	0.6	1.1
S	3.8		3.3	3.8	3.6	1.7	1.4	3.3

b×D = 28×75   28×50

a	2.1	1.1	1.8	3.0	1.4	1.2
m	2-D13	2-D13	2-D13	4-D13	2-D13	2-D13

[illegible]BAWI	MOE	MC	MIE	Q	MLE	MC	MEE	Q
L	2.4	1.5	2.7	3.1	2.0	0.9	2.0	3.8
E	4.6	0.4	3.8	1.8	6.2	2.3	1.6	2.7
S	7.0		6.5	6.7	8.2	3.2	3.6	9.2

b×D = 28×75   28×50

a	3.8	1.2	2.1	6.9	2.7	3.0
m	2-D16	2-D16	2-D16	4-D16	2-D16	2-D16

[illegible]BAWI	MOE	MC	MIE	Q	MLE	MC	MEE	Q
L	2.7	1.6	2.7	3.1	2.1	0.9	1.9	3.8
E	8.9	1.1	6.1	3.9	11.0	4.2	2.6	4.8
S	12.1	2.7	4.9	9.9	13.1	5.1	4.5	13.4

b×D = 28×75   28×50

a	6.6	1.4	5.1	11.1	4.3	3.8
m	4-D19	2-D19	2-D19	4-D19	2-D19	2-D19

$\Delta Q = 13.4 - 9.9 = 3.5$

$\Delta Q / bj = 3.18$

$P_w = 0.41$

$D10 \; @ = 153 / (28 \times 0.41) = 12.4 \rightarrow 10@$

[illegible] FRAME	M_{OE}	M_C	M_{IE}	Q	M_{IE}	M_C	M_{OE}	Q
L	0.7	1.7	5.5	3.5	7.6	[illegible]	5.3	5.2
E	4.3	2.6	3.3	1.7	3.1	0.7	3.5	0.5
S	5.0		[illegible]	[illegible]			[illegible]	

$b \times D = 28 \times 75$

A_s	2.7	1.4	4.9		6.2	4.0	4.9
n	2-D16	2-D16	4-D16		4-D16	2-D16	4-D16

[illegible] FRAME	M_{OE}	M_C	M_{IE}	Q	M_{IE}	M_C	M_{OE}	Q
L	1.6	1.9	4.9	3.6	9.9	4.6	9.0	6.9
E	11.4	1.3	4.1	4.5	6.3	1.1	9.6	1.7
S	17.0	[illegible]	14.0	12.6	15.2		17.4	10.3

$b \times D = 28 \times 75$

A_s	7.1	1.5	7.6		9.3	3.6	9.5
n	4-D19	2-D19	4-D19		4-D19	2-D19	4-D19

[illegible] FRAME	M_{OE}	M_C	M_{IE}	Q	M_{IE}	M_C	M_{OE}	Q
L	1.2	1.2	6.6	3.5	11.6	7.5	9.3	7.6
E	20.2	2.6	15.0	7.0	9.8	3.6	16.9	3.1
S	21.4	3.9	21.6	19.0	21.6		26.2	10.1

$b \times D = 28 \times 75$

A_s	11.7	2.1	11.7		11.7	6.1	14.3
n	4-D22	2-D22	4-D22		4-D22	2-D22	4-D22

$\Delta Q = 19.0 - 15.4 = 3.6$

$\Delta Q / bj = 2.10 \qquad p_w = 0.33$

$D10 \quad x = 14.3 / 28 \times 0.33 = 15.4 \rightarrow 10 @$