6. Design of Bracing

NOTE : σ c/fc < 1.0
σ t/ft < 1.0

6.1 DECISION OF VERTICAL BRACE ( )
〔鉛直ブレースの断面算定〕

LOCATION	TYPE	MEMBER A / An	ix / iy	lkx / lky	λ x / λ y	lfc / sfc	AXIAL FORCE N1 / Ns	Ne	σ c / fc	σ t / ft	REMARKS
X Direction											
RF		2L-120²×8							0.43	0.78	
A, G	X	37.52 / 20.64	3.71	586	158	0.383 / 0.574		16.2	0.75	0.32	
5TH		2L-120²×8							0.42	0.77	
A	X	37.52 / 20.64	3.71	559	151	0.420 / 0.63		15.9	0.67	0.32	
		H-250²					27.0	48.8	0.82		
H	K	92.18 / 73.7	6.29	707	112	0.751 / 1.126		75.8	0.73		
4TH		2L-130²×9							0.49	0.88	
A	X	45.48 / 25.01	4.01	559	139	0.495 / 0.742		22.1	0.66	0.37	
		H-300²					54.4	72.7	1.06		
H	K	119.8	7.51	707	94	0.948 / 1.422		127.1	0.75		
OPE		2L-130²×9							0.49		
A	X	45.48	4.01	571	142	0.475 / 0.713		22.3	0.69		
		H-250²					55.1	47.9	1.12		
B	K	92.18	6.29	647	103	0.850 / 1.275		103.0	0.88		
		H-300²					87.4	69.2	1.31		
H	K	119.8	7.51	743	99	0.894 / 1.341		156.6	0.98		
MEX		2L-130²×9							0.57		
A	X	45.48	4.01	597	149	0.431 / 0.646		26.0	0.88		
		H-250²					32.4	47.4	0.87		
G	K	92.18	6.29	739	117	0.697 / 1.045		79.8	0.83		
		H-300²					49.7	72.4	1.02		
G	K	119.8	7.51	820	109	0.784 / 1.176		122.1	0.87		
		H-350²					83.3	105.0	1.08		
H	K	173.9	8.84	820	93	0.959 / 1.438		188.3	0.75		

NOTATION: TYPE --- K, X OR N
A --- SECTION AREA (cm2)
An --- 0.8xA·(EFFECTIVE AREA FOR TENSION MEMBER) (cm2)
ix,iy --- RADIUS OF GYRATION (cm)
lkx,lky --- BUCKLING LENGTH (cm)
λ x,λ y --- SLENDER RATIO (lkx/ix,lky/iy)
lfc,sfc --- ALLOWABLE COMPRESSIVE STRESS (t/cm2)
N1,Ne --- AXIAL FORCE OF VERTICAL AND SEISMIC LOAD (t)
Ns --- AXIAL FORCE OF TEMPORARY CONDITIONS (N1+1.5xNe) (t)
σ c,σ t --- STRESS OF COMPRESSION AND TENSION (t/cm2)

NOTE : σ c/fc < 1.0
σ t/ft < 1.0

DECISION OF VERTICAL BRACE ( )
[鉛直ブレースの断面算定]

LOCATION	TYPE	MEMBER A / An	ix / iy	lkx / lky	λ x / λ y	lfc / sfc	AXIAL FORCE N1 / 1.5*Ne	Ne / Ns	σ c / σ c / fc	σ t / σ t / ft	REMARKS
Y Direction											
5TH		H-300²					28.6	67.4	0.80		
107	K	119.8	7.51	707	94	0.948 / 1.422		96.0	0.56		
		H-350²					130.0	63.3	0.75		
103	K	173.9	8.84	707	80	1.10 / 1.65			0.68		
4TH		H-250²					45.3	34.8	0.87		
102	K	92.18	6.29	707	112	0.751 / 1.126		80.1	0.77		
		H-300²					59.5	61.2	1.01		
108	K	119.8	7.51	707	94	0.948 / 1.422		120.7	0.71		
		H-250²					18.3	28.0	0.50		
203	K	92.18	6.29	860	137	0.51 / 0.765		46.3	0.65		
DPE		2L-130²×12					—	20.5	0.34		
107	N	59.52	3.96	711	180	0.295 / 0.44		20.5	0.77		
		2L-130²×9					5.8	21.4	0.60		
108	X	45.48	4.01	389	97	0.916 / 1.374		27.2	0.44		
		H-250²					25.7	40.6	0.72		
105	K	92.18	6.29	743	118	0.686 / 1.029		66.3	0.70		
		H-300²					19.5	61.5	0.68		
201	K	119.8	7.51	743	99	0.894 / 1.341		81.0	0.51		
MEZ		H-200²					0.8	33.8	0.54		
108	N	63.53	5.02	790	157	0.388 / 0.582		34.6	0.93		
		2L-130²×9					—	26.8	0.59		
107	X	45.48	4.01	442	110	0.773 / 1.16		26.8	0.51		
		H-300²					17.5	71.7	0.14		
101	K	119.8	7.51	820	109	0.789 / 1.176		89.2	0.63		
		H-300²					23.9	29.9	0.82		
106	K	119.8	7.51	955	127	0.593 / 0.89		98.8	0.92		

NOTATION: TYPE --- K, X OR N
A --- SECTION AREA (cm2)
An --- 0.8xA·(EFFECTIVE AREA FOR TENSION MEMBER) (cm2)
ix,iy --- RADIUS OF GYRATION (cm)
lkx,lky --- BUCKLING LENGTH (cm)
λ x,λ y --- SLENDER RATIO (lkx/ix,lky/iy)
lfc,sfc --- ALLOWABLE COMPRESSIVE STRESS (t/cm2)
N1,Ne --- AXIAL FORCE OF VERTICAL AND SEISMIC LOAD (t)
Ns --- AXIAL FORCE OF TEMPORARY CONDITIONS (N1+1.5xNe) (t)
σ c,σ t --- STRESS OF COMPRESSION AND TENSION (t/cm2)

6.2 Design of Horizontal bracing.

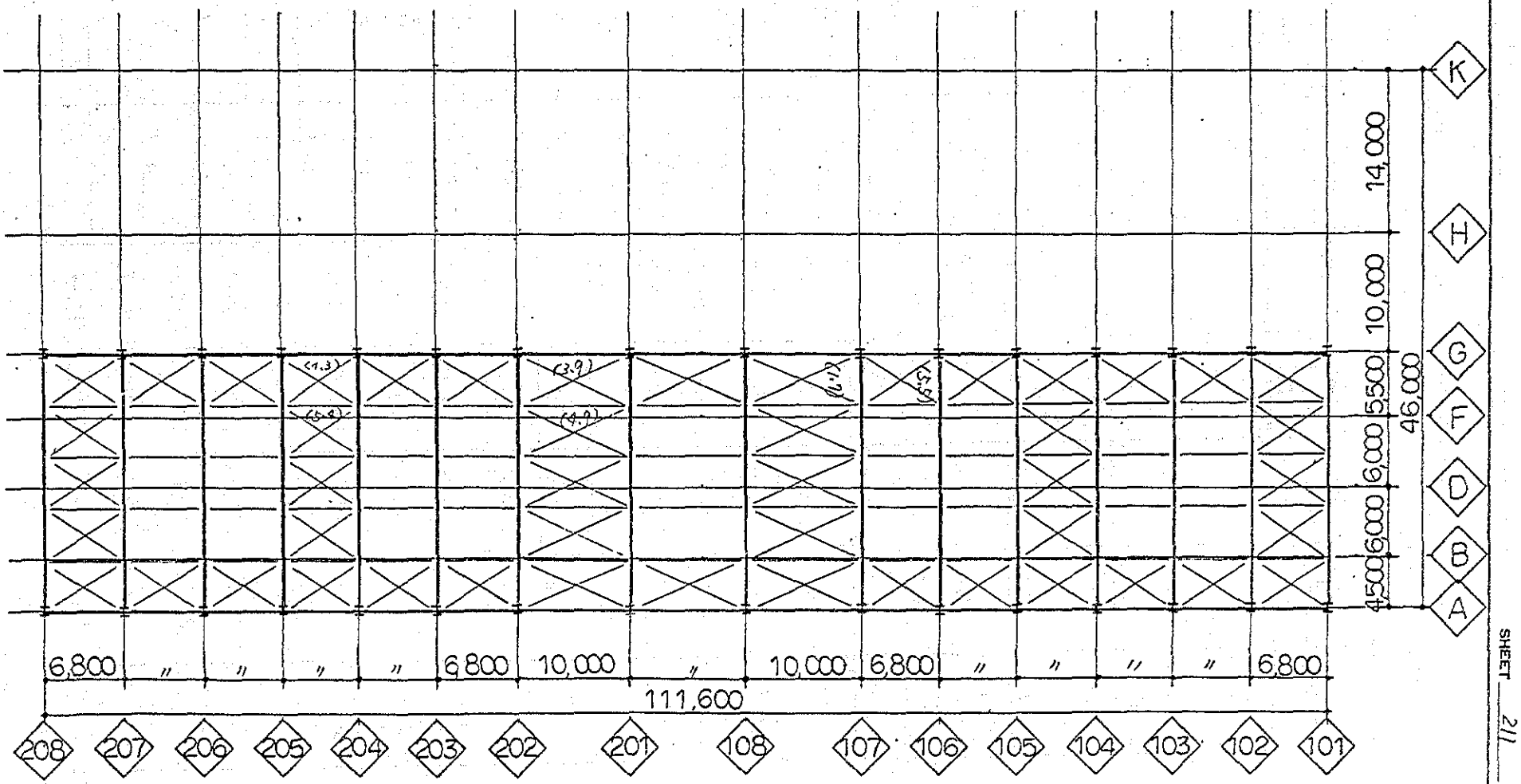
Stress of Holizontal Bracing

R FL

Direction	Frame	Q_1 Upper story (t)	Q_2 Floor (t)	Q_3 Lower story (t)	$Q_1+Q_2-Q_3$ (t)	Load between Frames (t)	No. of Bracing (piece)	Stress of one Bracing (t)
Long Span	A	0.0	54.6	163.7	-109.1			
						109.1	30	3.6
	B	0.0	54.6	0.0	54.6			
						54.5	12	4.5
	D	0.0	54.6	0.0	54.6			
		0.0	54.6	0.0	54.6	54.5	12	4.5
	F	0.0	54.6	0.0	54.6			
						109.1	30	3.6
	G	0.0	54.6	163.7	-109.1			
	H							
	K							
Short Span	101		22.5	14.9	7.6			
						7.6	10	0.8
	102		22.5	21.6	0.9			
						8.5	4	2.1
	103		22.5	21.6	0.9			
						9.4	4	2.4
	104		22.5	21.6	0.9			
						10.3	10	1.0
	105		22.5	21.6	0.9			
						11.2	4	2.8
	106		22.5	21.6	0.9			
						12.1	4	3.0
	107		22.5	26.3	-3.8			
						8.5	10	0.9
	108		22.5	31.0	-8.5			
						0.0	4	0.0
	201		22.5	31.0	-8.5			
						8.5	10	0.9
	202		22.5	26.3	-3.8			
						12.1	4	3.0
	203		22.5	21.6	0.9			
						11.2	4	2.8
	204		22.5	21.6	0.9			
						10.3	10	1.0
	205		22.5	21.6	0.9			
						9.4	4	2.4
	206		22.5	21.6	0.9			
						8.5	4	2.1
	207		22.5	21.6	0.9			
						7.6	10	0.8
	208		22.5	14.9	7.6			

FORM 04

2/2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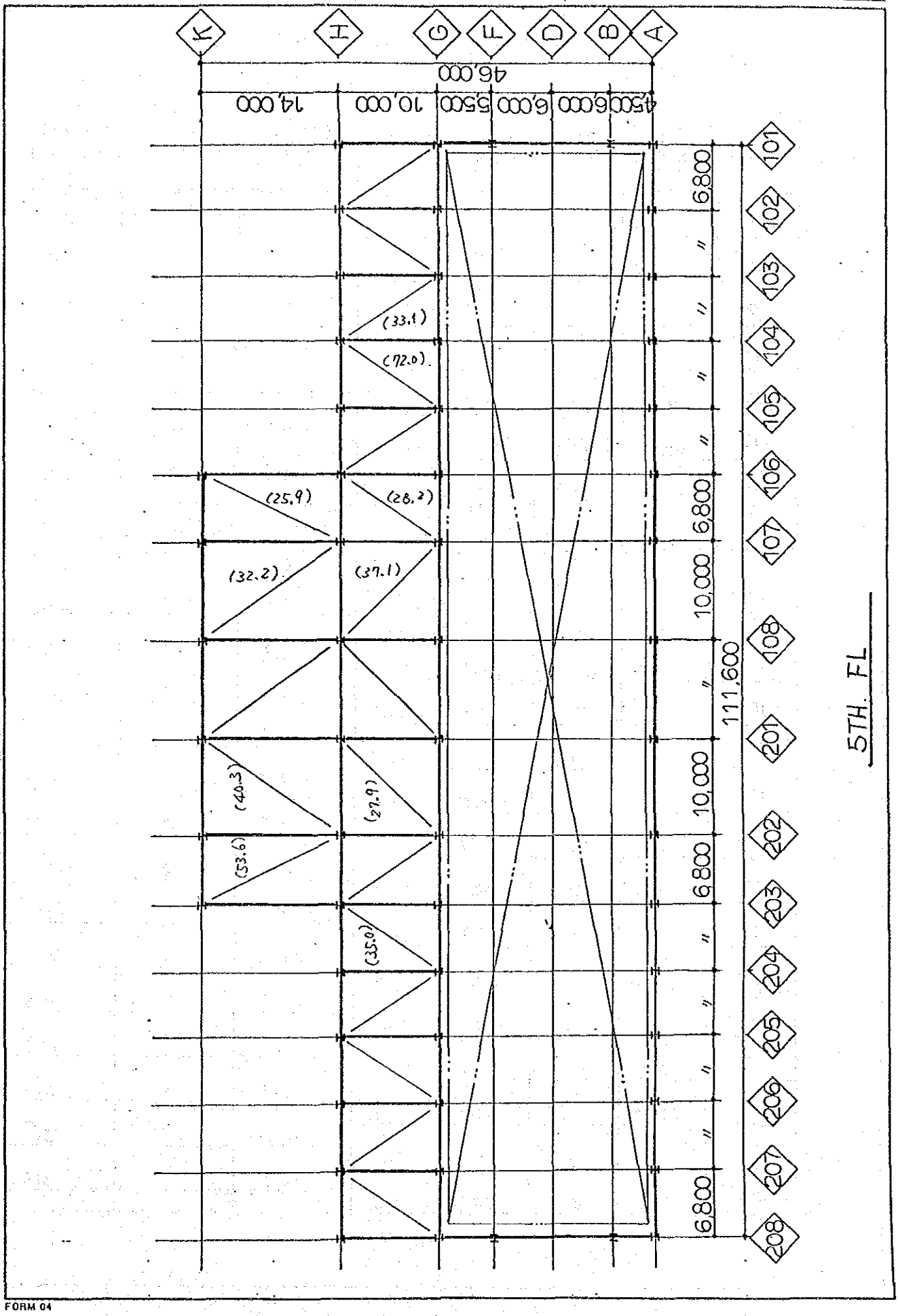
102
101

RFL

Stress of Holizontal Bracing

5TH FL.

Direction	Frame	Q_1 Upper story (t)	Q_2 Floor (t)	Q_3 Lower story (t)	$Q_1+Q_2-Q_3$ (t)	Load between Frames (t)	No. of Bracing (piece)	Stress of one Bracing (t)
Long span	A							
	B							
	D							
	F							
	G	163.7	132.2	0.0	295.9	295.9	15	19.7
	H	0.0	81.2	260.2	-179.0	116.9	5	23.4
	K	0.0	21.1	138.0	-116.9			
Short span	101	14.9	8.3	51.2	-28.0	-28.0	1	28.0
	102	21.6	11.1	0.0	32.7	4.7	1	4.7
	103	21.6	20.7	74.4	-32.1	-27.4	1	27.4
	104	21.6	20.7	74.4	-32.1	-59.5	1	59.5
	105	21.6	11.1	0.0	32.7	-26.8	1	26.8
	106	21.6	14.4	55.8	-19.8	-46.6	2	23.3
	107	26.3	18.8	51.2	-6.1	-52.4	2	26.2
	108	31.0	21.4	0.0	52.4	0.0	2	0.0
	201	31.0	21.4	0.0	52.4	52.4	2	26.2
	202	26.3	18.8	51.2	-6.1	46.3	2	23.2
	203	21.6	14.4	55.8	-19.8	26.5	1	26.5
	204	21.6	11.1	0.0	32.7	59.2	1	59.2
	205	21.6	20.7	74.4	-32.1	27.1	1	27.1
	206	21.6	20.7	74.4	-32.1	-5.0	1	5.0
	207	21.6	11.1	0.0	32.7	28.0	1	28.0
	208	14.9	8.3	51.2	-28.0			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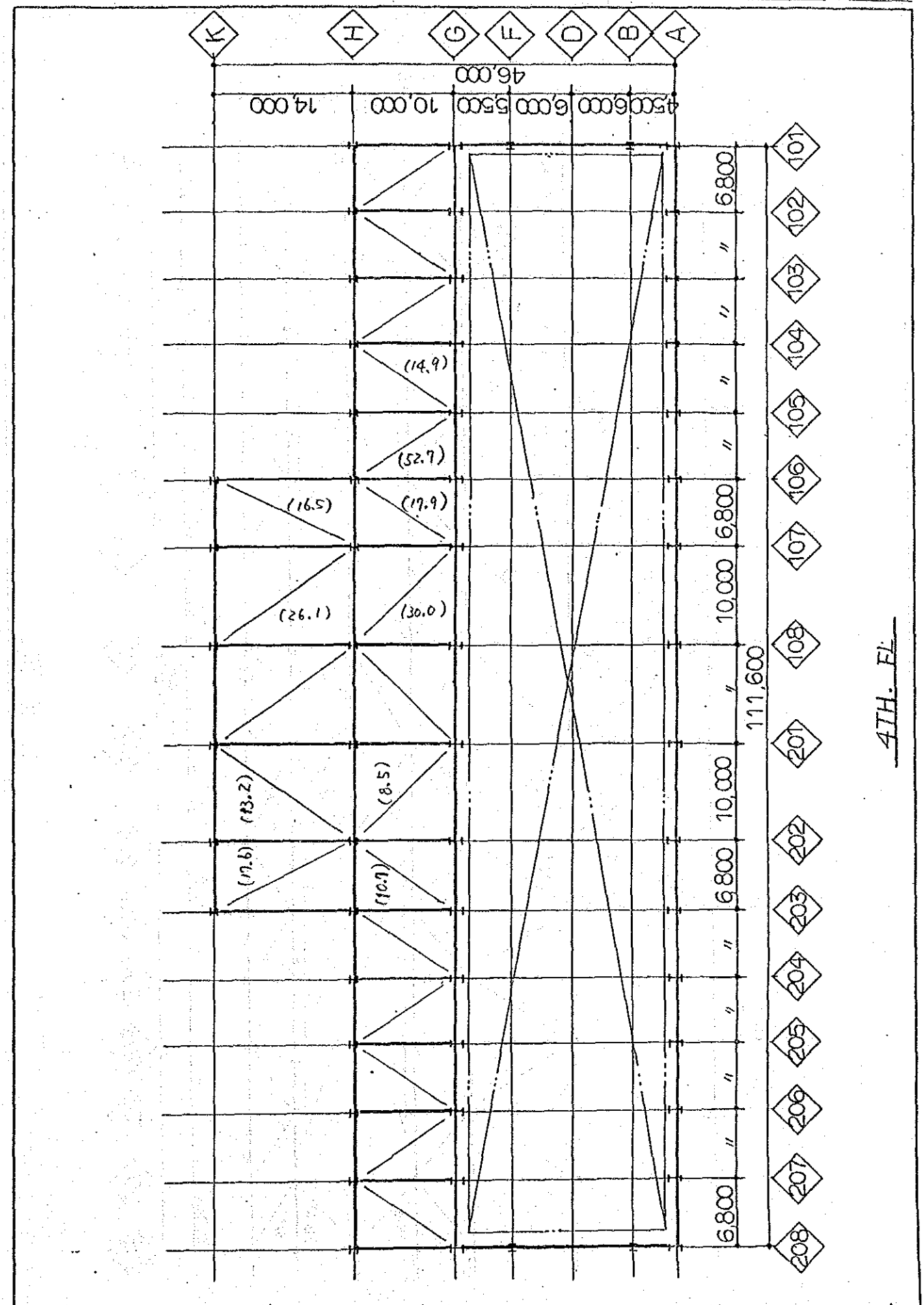
5TH. FL

Stress of Holizontal Bracing

4TH FL

Direction	Frame	Q_1 Upper story (t)	Q_2 Floor (t)	Q_3 Lower story (t)	$Q_1+Q_2-Q_3$ (t)	Load between Frames (t)	No. of Bracing (piece)	Stress of one Bracing (t)
Long span	A							
	B							
	D							
	F							
	G	0.0	83.9	0.0	83.9	83.9	14	6.0
	H	260.2	77.3	375.5	-38.0	45.9	6	7.7
	K	138.0	21.8	205.7	-45.9			
Short span	101	51.2	5.7	50.1	6.8	6.8	1	6.8
	102	0.0	8.5	50.1	-41.6	-34.8	1	34.8
	103	74.4	13.9	65.1	23.2	-11.6	1	11.6
	104	74.4	14.6	65.1	23.9	12.3	1	12.3
	105	0.0	9.2	65.1	-55.9	-43.6	1	43.6
	106	55.8	12.8	54.5	14.1	-29.5	2	14.8
	107	51.2	20.7	0.0	71.9	42.4	2	21.2
	108	0.0	23.5	65.1	-41.6	0.8	2	0.4
	201	0.0	22.5	65.1	-42.6	-41.8	2	20.9
	202	51.2	19.9	0.0	71.1	29.3	2	14.7
	203	55.8	13.7	54.5	15.0	44.3	1	44.3
	204	0.0	9.3	65.1	-55.8	-11.5	1	11.5
	205	74.4	14.6	65.1	23.9	12.4	1	12.4
	206	74.4	13.9	65.1	23.2	35.6	1	35.6
	207	0.0	8.5	50.1	-41.6	-6.8	1	6.8
	208	51.2	5.7	50.1	6.8			

FORM 04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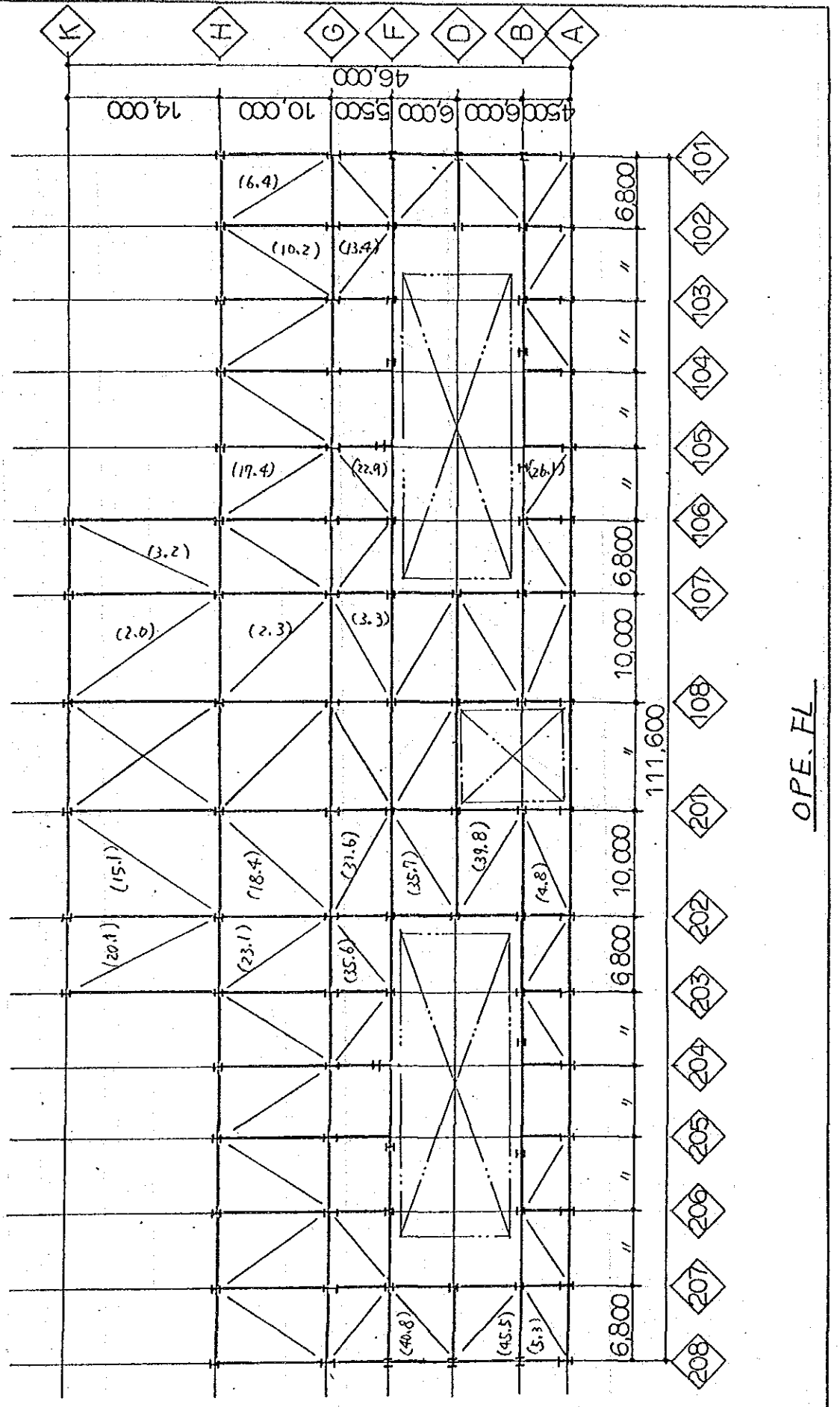
4TH. FL.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OPE. FL

Stress of Holizontal Bracing

OPE FL

Direction	Frame	Q_1 Upper story (t)	Q_2 Floor (t)	Q_3 Lower story (t)	$Q_1+Q_2-Q_3$ (t)	Load between Frames (t)	No. of Bracing (piece)	Stress of one Bracing (t)
Long span	A	248.8	42.9	238.6	53.1			
						53.1	12	4.4
	B		11.9	201.2	-189.3			
						-136.2	4	34.1
	D		13.9	0.0	13.9			
						-122.3	4	30.6
	F		18.7	201.2	-182.5			
						-304.8	11	27.7
	G		110.3	0.0	110.3			
						-194.5	15	13.0
	H	375.5	112.5	346.7	141.3			
						-52.7	6	8.8
	K	205.7	33.2	186.2	52.7			
Short span	101	50.1	11.2	87.7	-26.4			
						-26.4	5	5.3
	102	50.1	17.2	66.2	1.1			
						-25.3	3	8.4
	103	65.1	19.0	83.1	1.0			
						-24.3	2	12.2
	104	65.1	19.1	48.1	36.1			
						11.8	1	11.8
	105	65.1	14.4	48.1	31.4			
						43.2	3	14.4
	106	54.5	20.0	106.3	-31.8			
						11.4	4	2.9
	107	0.0	33.0	35.0	-2.0			
						9.4	6	1.6
	108	65.1	37.9	113.4	-10.4			
						-1.0	5	0.2
	201	65.1	36.4	113.4	-11.9			
						-12.9	6	2.2
	202	0.0	32.1	35.0	-2.9			
						-15.8	4	4.0
	203	54.5	22.5	106.3	-29.3			
						-45.1	3	15.0
	204	65.1	14.0	48.1	31.0			
						-14.1	1	14.1
	205	65.1	19.1	48.1	36.1			
						22.0	2	11.0
	206	65.1	19.4	83.1	1.4			
						23.4	3	7.8
	207	50.1	17.0	66.2	0.9			
						26.4	5	5.3
	208	50.1	11.2	87.7	-26.4			

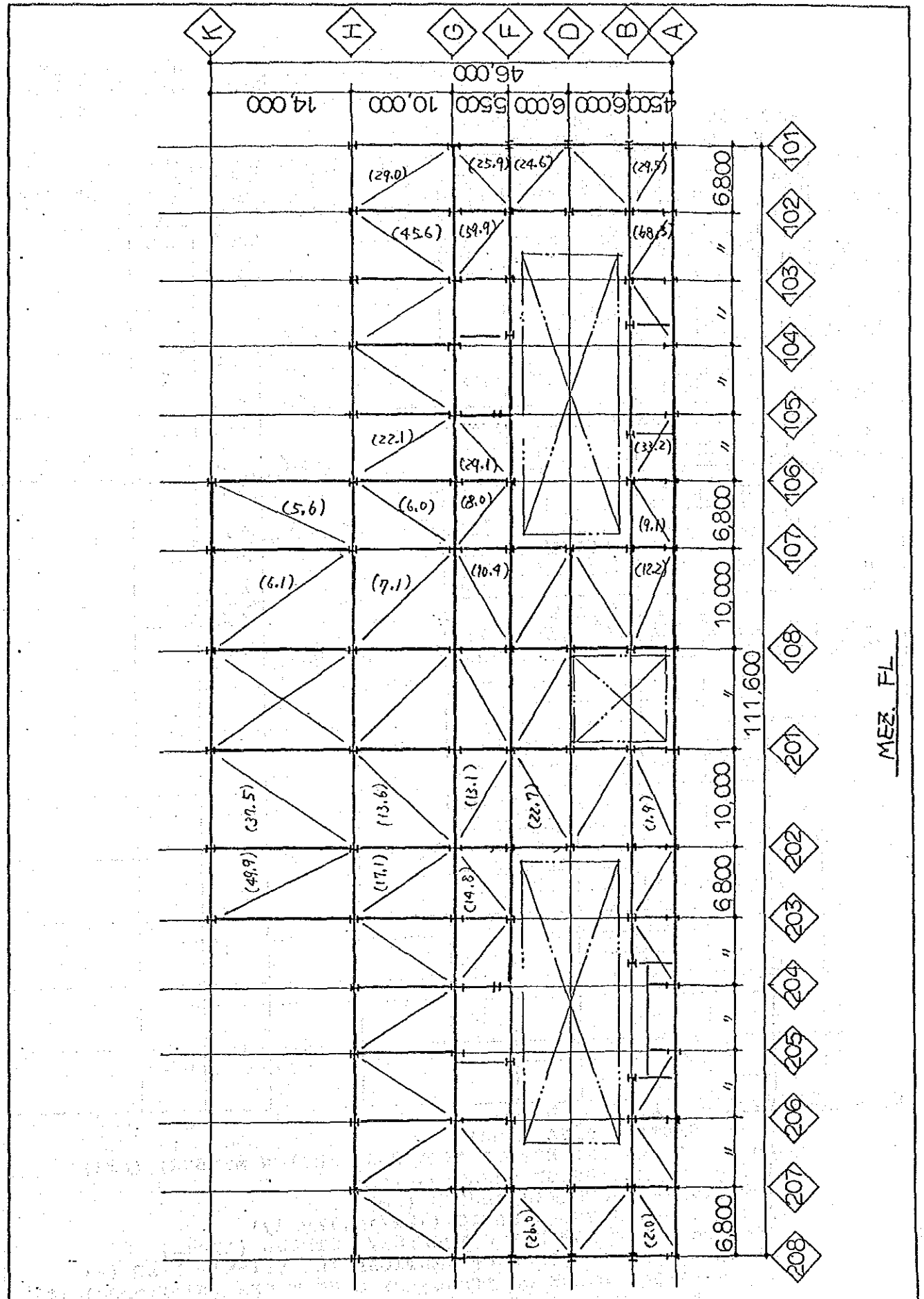
FORM 04

Stress of Holizontal Bracing

MEB EL

Direction	Frame	Q_1 Upper story (t)	Q_2 Floor (t)	Q_3 Lower story (t)	$Q_1+Q_2-Q_3$ (t)	Load between Frames (t)	No. of Bracing (piece)	Stress of one Bracing (t)
Long Span	A	238.6	32.7	251.4	19.9	19.9	12	1.7
	B	201.2	16.1	175.5	41.8	61.7	4	15.4
	D	0.0	16.3	0.0	16.3	78.0	4	19.5
	F	201.2	22.4	175.5	48.1	126.1	11	11.5
	G	0.0	81.6	352.1	-270.5	-144.4	15	9.6
	H	346.7	89.2	420.5	15.4	-130.5	6	21.8
	K	186.2	26.4	82.1	130.5			
Short Span	101	87.7	10.3	179.7	-81.7	-81.7	5	16.3
	102	66.2	15.6	113.3	-31.5	-113.2	3	37.7
	103	83.1	14.8	50.5	47.4	-65.8	2	32.9
	104	48.1	13.6	0.0	61.7	-4.1	1	4.1
	105	48.1	11.0	0.0	59.1	55.0	3	18.3
	106	106.3	17.5	158.8	-35.0	20.0	4	5.0
	107	35.0	28.5	113.3	-49.8	-29.8	6	5.0
	108	113.4	32.1	113.3	32.2	2.4	5	0.5
	201	113.4	30.3	113.3	30.4	32.8	6	5.5
	202	35.0	27.1	113.3	-51.2	-18.4	4	4.6
	203	106.3	18.7	158.8	-33.8	-52.2	3	17.4
	204	48.1	10.8	0.0	58.9	6.7	1	6.7
	205	48.1	13.6	0.0	61.7	68.4	2	34.2
	206	83.1	15.1	50.5	47.7	116.1	3	38.7
	207	66.2	15.5	113.3	-31.6	81.7	5	16.3
	208	87.7	10.3	179.7	-81.7			

FORM 04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MEZ. FL

FORM 04

NOTE : σ c/fc < 1.0
σ t/ft < 1.0

DECISION OF HORIZONTAL BRACE (3)
〔水平ブレースの断面算定〕

LOCATION	TYPE	MEMBER A / An	ix / iy	lkx / lky	λ x / λ y	lfc / sfc	AXIAL FORCE N1 / 1.5*Ne	Ne / Ns	σ c / fc	σ t / ft	REMARKS
F-G 105-106	N	2L-100²×7 2×13.62	3.08	292	95	0.937 1.40		29.1	1.07 0.76		
F-G 201-202	N	2L-100²×7		228				13.1			
G-H 101-102	N	2L-130²×9 2×22.74	4.01	403	100	0.883 1.32		29.0	0.64 0.48		
G-H 102-103	N	2L-130²×9		403	100			45.6	1.00 0.76		
G-H 201-202	N	2L-100²×7 2×13.62	3.08	283	92	0.97 1.45		13.6	0.50 0.34		
H-K 201-202	N	2L-130²×9 2×22.74	4.01	349	86	1.03 1.54		37.5	0.82 0.53		
H-K 202-203	N	2L-150²×10 2×29.21	4.63	519	112	0.751 1.13		49.9	0.85 0.75		

NOTATION: TYPE --- K, X OR N
A --- SECTION AREA (cm2)
An --- 0.8xA (EFFECTIVE AREA FOR TENSION MEMBER) (cm2)
ix,iy --- RADIUS OF GYRATION (cm)
lkx,lky --- BUCKLING LENGTH (cm)
λ x,λ y --- SLENDER RATIO (lkx/ix,lky/iy)
lfc,sfc --- ALLOWABLE COMPRESSIVE STRESS (t/cm2)
N1,Ne --- AXIAL FORCE OF VERTICAL AND SEISMIC LOAD (t)
Ns --- AXIAL FORCE OF TEMPORARY CONDITIONS (N1+1.5xNe) (t)
σ c,σ t --- STRESS OF COMPRESSION AND TENSION (t/cm2)

NOTE : σ c/fc < 1.0
σ t/ft < 1.0

DECISION OF HORIZONTAL BRACE (1)
〔水平ブレースの断面算定〕

LOCATION	TYPE	MEMBER A / An	ix / iy	lkx / lky	λ x / λ y	lfc / sfc	AXIAL FORCE Nl / 1.5*Ne	Ne / Ns	σ c / σ c / fc	σ t / σ t / ft	REMARKS
RFL		2L-90²×6							0.26		
ℓ=6.8m	X	2×10.55	2.77	400	144	0.461 / 0.69		5.5	0.38		
		2L-100²×7							0.18		
ℓ=10.0m	X	2×13.62	3.08	550	179	0.299 / 0.45		4.9	0.27		
SFL		2L-130²×9							0.89		
H-K 201-202	N	2×22.74	4.01	430	107	0.806 / 1.20		40.3	0.94		
		2L-150²×10							0.92		
H-K 202-203	N	2×29.21	4.63	519	112	0.751 / 1.12		53.6	0.82		
		2L-130²×9							0.82		
G-H 107-108	N	2×22.74	4.01	283	71	1.19 / 1.78		37.1	0.96		
		2L-130²×9							0.77		
G-H 203-204	N	2×22.74	4.01	403	100	0.883 / 1.32		35.0	0.58		
		2L-150²×10							1.23		
G-H 104-105	N	2×29.21	4.63	403	87	1.02 / 1.53		72.0	0.80		
4FL		2L-130²×9							0.57		
H-K 107-108	N	2×22.74	4.01	430	107	0.806 / 1.20		26.1	0.48		
		2L-130²×9							0.65		
H-K 202-203	N			519	129	0.575 / 0.86		17.6	0.76		
		2L-100²×7							1.10		
G-H 107-108	N	2×13.62	3.08	283	92	0.97 / 1.45		30.0	0.76		
		2L-130²×9							1.16		
G-H 105-106	N	2×22.74	4.01	403	101	0.872 / 1.30		52.7	0.89		
		2L-100²×7							0.66		
G-H 106-107	N	2×13.62	3.08	403	131	0.558 / 0.83		17.9	0.80		

NOTATION: TYPE --- K, X OR N
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lkx,lky --- BUCKLING LENGTH (cm)
λ x,λ y --- SLENDER RATIO (lkx/ix,lky/iy)
lfc,sfc --- ALLOWABLE COMPRESSIVE STRESS (t/cm2)
Nl,Ne --- AXIAL FORCE OF VERTICAL AND SEISMIC LOAD (t)
Ns --- AXIAL FORCE OF TEMPORARY CONDITIONS (Nl+1.5xNe) (t)
σ c,σ t --- STRESS OF COMPRESSION AND TENSION (t/cm2)

NOTE : σ c/fc < 1.0
σ t/ft < 1.0

DECISION OF HORIZONTAL BRACE (2)
[水平ブレースの断面算定]

LOCATION	TYPE	MEMBER A / An	ix / iy	lkx / lky	λ x / λ y	lfc / sfc	AXIAL FORCE N1 / 1.5*Ne	Ne / Ns	σ c / fc	σ t / ft	REMARKS
OPE FL		2L-100²×7							0.96		
A-B 105-106	N	2×13.62	3.08	272	88	1.01 / 1.51		26.1	0.69		
		2L-130²×9							1.00		
B-D 207-208	N	2×22.94	4.01	302	75	1.15 / 1.72		45.5	0.58		
		2L-100²×7							0.49		
F-G 102-103	N	2×13.62	3.08	292	95	0.937 / 1.40		13.4	0.35		
		2L-130²×9							0.78		
F-G 202-203	N	2×22.94	4.01	292	73	1.17 / 1.76		35.6	0.46		
		2L-100²×7							0.37		
G-H 102-103	N	2×13.62	3.08	403	131	0.558 / 0.837		10.2	0.44		
		2L-130²×9							0.51		
G-H 202-203	N	2×22.94	4.01	403	100	0.883 / 1.32		23.1	0.39		
		2L-100²×7							0.68		
G-H 201-202	N	2×13.62	3.08	283	92	0.97 / 1.45		18.4	0.47		
		2L-100²×7							0.55		
H-K 201-202	N			394	117	0.697 / 1.04		15.1	0.53		
		2L-130²×9							0.44		
H-K 202-203	N	2×22.94	4.01	519	130	0.566 / 0.85		20.1	0.52		
MEX FL		2L-130²×9							1.50		
A-B 102-103	N			272	68	1.22 / 1.83		68.3	0.82		
		2L-100²×7							1.22		
A-B 105-106	N	2×13.62	3.08	272	88	1.01 / 1.51		33.2	0.81		
		2L-100²×7							0.95		
B-D 207-208	N			302	98	0.905 / 1.35		26.0	0.70		
		2L-100²×7							0.83		
B-D 201-202	N			233	76	1.14 / 1.71		22.7	0.49		
		2L-130²×9							1.32		
F-G 102-103	N	2×21.94	4.01	292	73	1.17 / 1.75		59.9	0.75		

NOTATION: TYPE --- K, X OR N
A --- SECTION AREA (cm2)
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ix,iy --- RADIUS OF GYRATION (cm)
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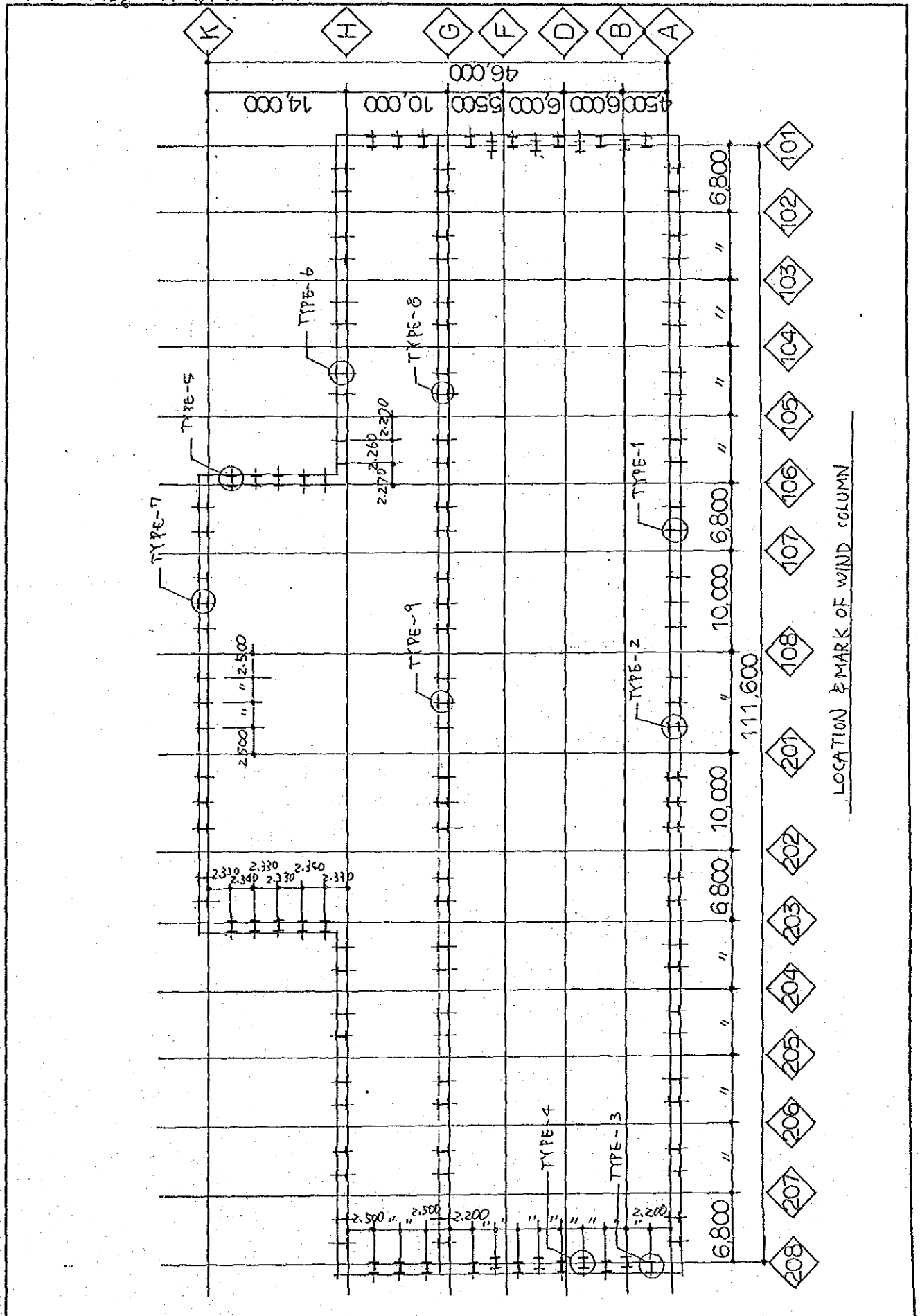
λ x,λ y --- SLENDER RATIO (lkx/ix,lky/iy)
lfc,sfc --- ALLOWABLE COMPRESSIVE STRESS (t/cm2)
N1,Ne --- AXIAL FORCE OF VERTICAL AND SEISMIC LOAD (t)
Ns --- AXIAL FORCE OF TEMPORARY CONDITIONS (N1+1.5xNe) (t)
σ c,σ t --- STRESS OF COMPRESSION AND TENSION (t/cm2)

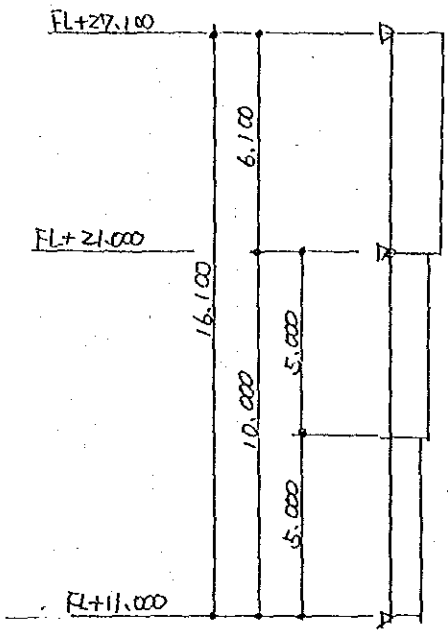
7. Miscellaneous Design

7.1 Design of Wind Column



TYPE-1

1) CALCULATION OF STRESS



$W_1 = 187 \times 2.27 = 0.42$ T/m

$W_2 = 165 \times 2.27 = 0.37$ T/m

$W_3 = 144 \times 2.27 = 0.33$ T/m

$Q = \frac{1}{2} \times 0.42 \times 6.1 = 1.28$ T

$M = \frac{1}{8} \times 0.42 \times \overline{6.1}^2 = 1.95$ T·m

1.28

$Q = \frac{5.0}{10.0} \times (0.37 \times 7.5 + 0.33 \times 2.5)$

$= 1.8$ T

$M = 1.8 \times 4.86 - \frac{1}{2} \times 0.37 \times \overline{4.86}^2$

$= 4.38$ T·m

$Q = \frac{5.0}{10.0} \times (0.37 \times 2.5 + 0.33 \times 7.5)$

$= 1.7$ T

$N = (0.045 + 0.047) \times 2.27 \times 16.1 = 3.4$ T

2) CHECK OF SECTION

$M = 4.38$ T·m

$N = 1.64$ T

Use H-300×150×6.5×9

$A = 46.78$ $i_x = 12.4$ $\ell_k = 500$ $\lambda = 40$ $f_c = 1.46$

$i_y = 3.29$ $\ell_h = 100$ $\lambda = 30$

$Z = 481$ $i_b = 3.87$ $\ell_b = 100$ $\lambda = 26$ $f_b = 1.6$

$\sigma_b = \frac{438}{481} = 0.91$

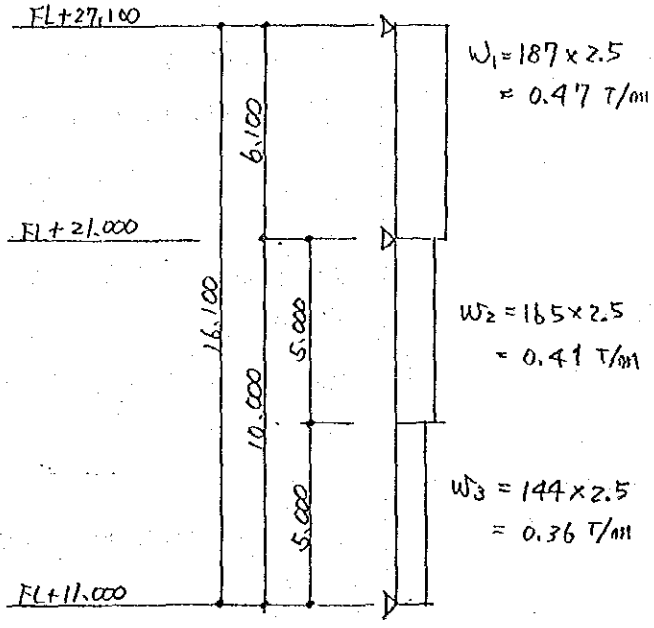
$\sigma_c = \frac{3.4}{46.78} = 0.07$

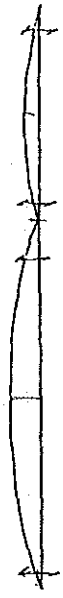
$\frac{\sigma}{f} = 0.38 + 0.03 = 0.41 < 1.0$ OK

$\delta = \frac{5 \times 0.0035 \times \overline{1000}^2}{384 \times 2100 \times 17210} = 3.0$ cm $\quad \delta/\ell = 1/333 < 1/250$

TYPE-2

1) CALCULATION OF STRESS





$Q = \frac{1}{2} \times 0.47 \times 6.1 = 1.43\ T$

$M = \frac{1}{8} \times 0.47 \times \overline{6.1}^{2} = 2.19\ T\cdot m$

1.43

$Q = \frac{5.0}{10.0} \times (0.41 \times 7.5 + 0.36 \times 2.5)$

$= 2.0\ T$

$M = 2.0 \times 4.88 - \frac{1}{2} \times 0.41 \times \overline{4.88}^{2}$

$= 4.88\ T\cdot m$

$Q = \frac{5.0}{10.0} \times (0.41 \times 2.5 + 0.36 \times 7.5)$

$= 1.9\ T$

$N = (6.045 + 0.047) \times 2.5 \times 16.1 = 3.7\ T$

2) CHECK OF SECTION

$M = 4.88\ T\cdot m$

$N = 1.81\ T$

Use H-300 x 150 x 6.5 x 9

$A = 46.78 \quad i_x = 12.4 \quad l_k = 500 \quad \lambda = 40 \quad f_c = 1.46$

$i_y = 3.29 \quad l_k = 100 \quad \lambda = 30$

$Z = 481 \quad i_b = 3.87 \quad l_b = 100 \quad \lambda = 26 \quad f_b = 1.6$

$\sigma_b = \frac{488}{481} = 1.01$

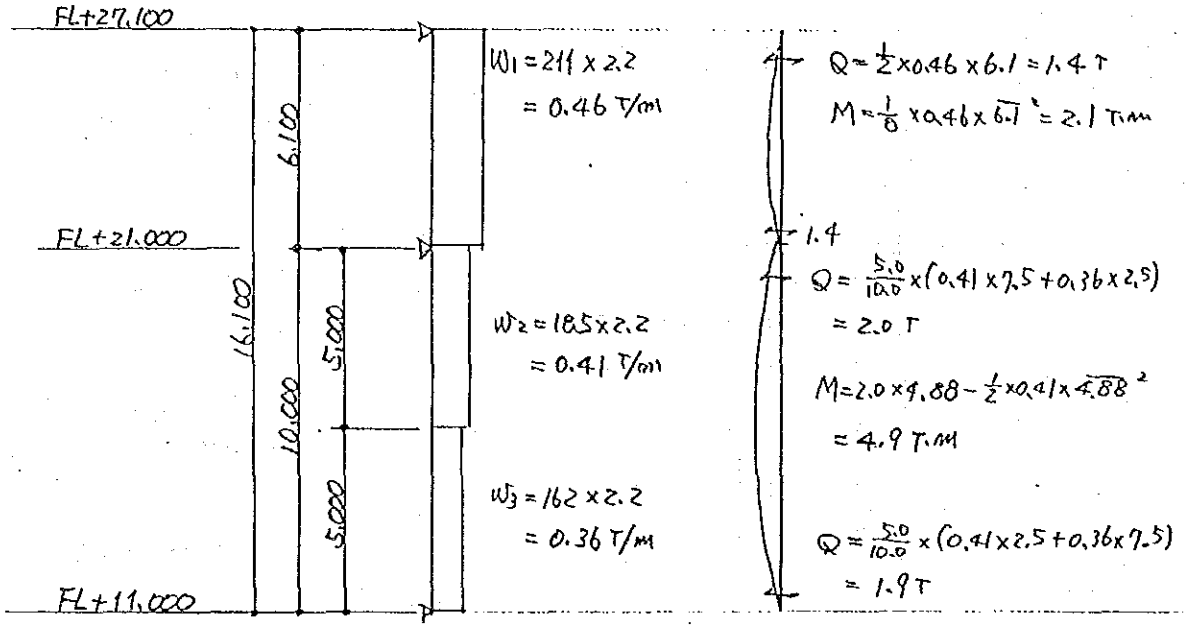
$\sigma_c = \frac{3.7}{46.78} = 0.08$

$\frac{\sigma}{f} = 0.42 + 0.04 = 0.46 < 1.0$ OK

$\delta = \frac{5 \times 0.0039 \times \overline{1000}^{4}}{384 \times 2100 \times 7210} = 3.4\ cm \qquad \delta/l = 1/294 < 1/250$ OK

TYPE-3

1) CALCULATION OF STRESS



$N = (0.045 + 0.047) \times 2.2 \times 16.1 = 3.3\ T$

2) CHECK OF SECTION

$M = 4.9\ T.m$

$N = 1.6\ T$

USE H-300x150x6.5x9

$A = 46.78$ $i_x = 12.4$ $\ell_k = 500$ $\lambda = 40$ $f_c = 1.46$

$i_y = 3.29$ $\ell_k = 100$ $\lambda = 30$

$Z = 481$ $i_b = 3.07$ $\ell_b = 100$ $\lambda = 26$ $f_b = 1.6$

$$\sigma_b = \frac{490}{481} = 1.01$$

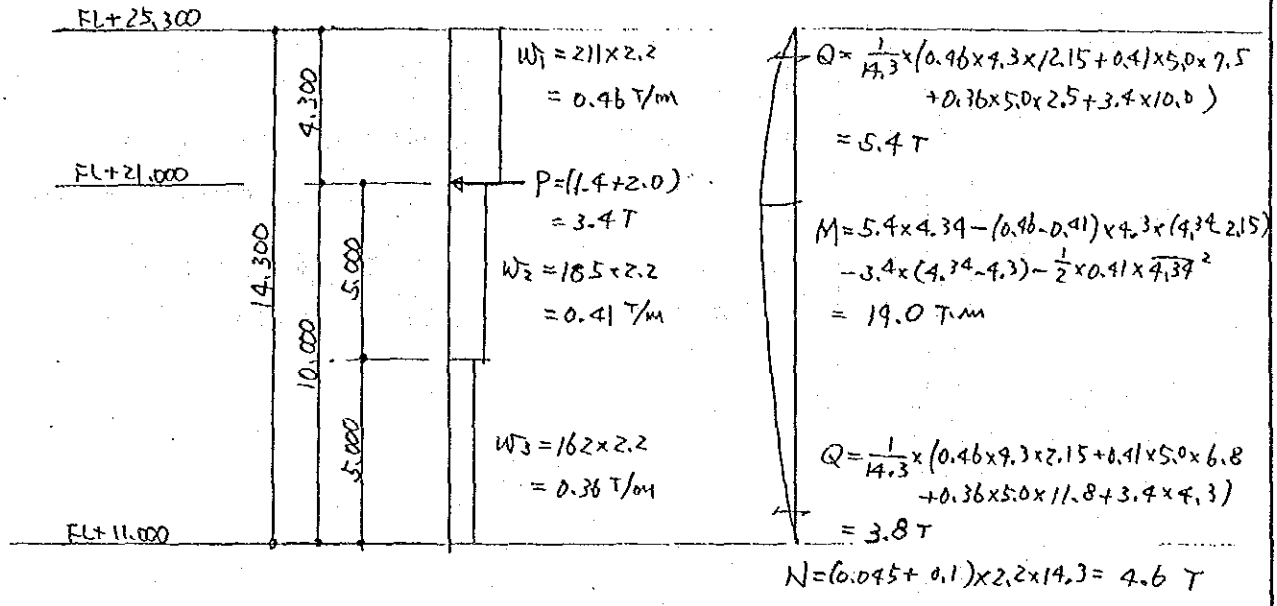
$$\frac{\sigma}{f} = 0.42 + 0.03 = 0.45 < 1.0 \quad \text{ok}$$

$$\sigma_c = \frac{3.3}{46.78} = 0.07$$

$$\delta = \frac{5 \times 0.0039 \times 1000^4}{384 \times 2100 \times 9210} = 3.4\ cm \qquad \delta/\ell = 1/294 < 1/250 \quad \text{ok}$$

TYPE-4

1) CALCULATION OF STRESS



N = (0.045 + 0.1)×2.2×14.3 = 4.6 T

2) CHECK OF SECTION

M = 19.0 T·m

N = 4.6 T

Use H-400×200×8×13

A = 84.12 i_x = 16.8 l_k = 500 λ = 30 f_c = 1.52

i_y = 4.54 l_k = 100 λ = 22

Z = 1190 i_b = 5.26 l_b = 100 λ = 19 f_b = 1.6

$\sigma_b = \frac{1900}{1190} = 1.60$

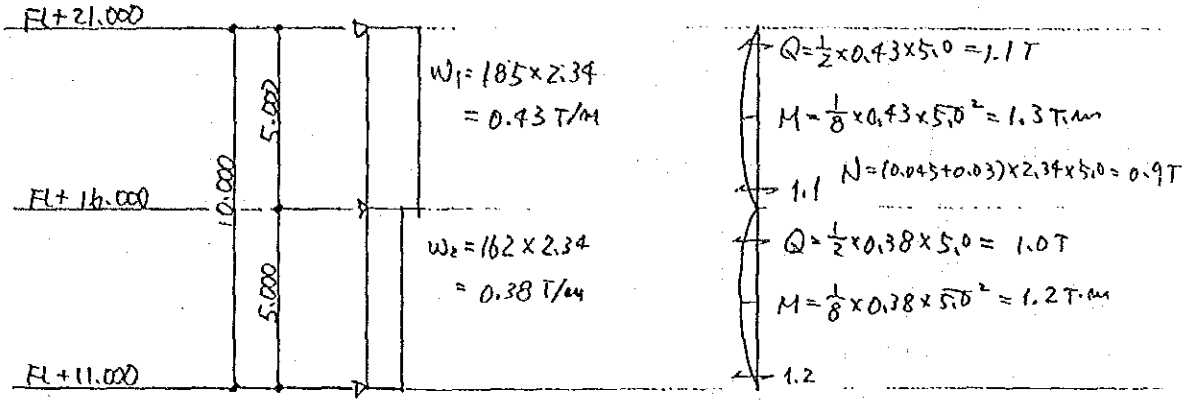
$\sigma_c = \frac{4.6}{84.12} = 0.05$

$\frac{\sigma}{f} = 0.67 + 0.02 = 0.69 < 1.0$ ok

$\delta = \frac{5 \times 0.0045 \times 1430^4}{384 \times 2100 \times 23700} = 4.92\,cm$ $\delta/\ell = 1/290 < 1/250$ ok

TYPE-5

1) CALCULATION OF STRESS



2) CHECK OF SECTION

M = 1.3 T·m

N = 0.9 T

use H-250×125×6×9

A = 37.66 i_x = 10.4 l_k = 500 λ = 48 f_c = 1.40

i_y = 2.79 l_k = 100 λ = 36

Z = 324 i_b = 2.76 l_b = 100 λ = 31 f_b = 1.6

$\sigma_b = \frac{130}{324} = 0.40$

$\sigma_c = \frac{0.9}{37.66} = 0.02$

$\frac{\sigma}{f} = 0.17 + 0.01 = 0.18 < 1.0$ ok

$\delta = \frac{5 \times 0.0043 \times 500^4}{389 \times 2100 \times 4050} = 0.91$ cm $\delta/\ell = 1/1220 < 1/250$ ok

TYPE-6 same as TYPE-5

TYPE-7 Same as TYPE-5

TYPE-8

1) CALCULATION OF STRESS

See TYPE-1

2) CHECK OF SECTION

$M = 1.95$ T·m

$N = (0.045+0.03)\times 2.27\times 6.1 = 1.0$ T

Use H-250×125×6×9

$A = 37.66$ $i_x = 10.4$ $l_k = 610$ $\lambda = 59$ $f_c = 1.30$

$i_y = 2.79$ $l_k = 100$ $\lambda = 36$

$Z = 324$ $i_b = 3.26$ $l_b = 100$ $\lambda = 31$ $f_b = 1.6$

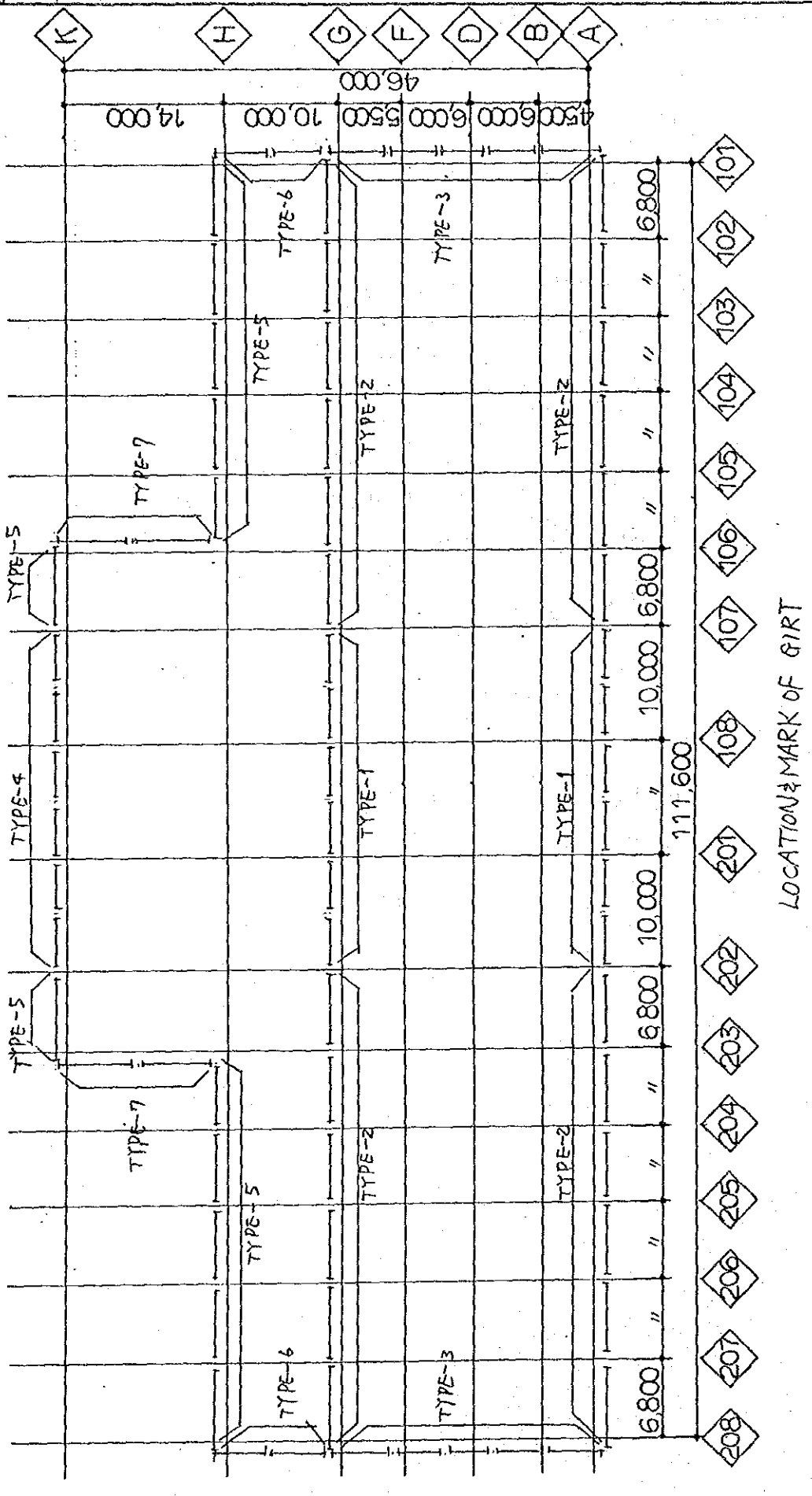
$\sigma_b = \frac{195}{324} = 0.60$

$\sigma_c = \frac{1.0}{37.66} = 0.03$

$\frac{\sigma}{f} = 0.25 + 0.02 = 0.27 < 1.0$ ok

$\delta = \frac{5\times 0.0042\times 610^2}{3.84\times 2100\times 4050} = 0.89$ cm $\quad \delta/\ell = 1/685 < 1/250$ ok

TYPE-9 same as TYPE-8

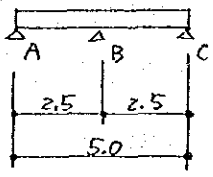

K
I
G
E
D
B
A
46,000
14,000
10,000
5500
6,000
6,000
4500
101
102
103
104
105
106
107
108
201
202
203
204
205
206
207
208
6800
"
"
"
"
6,800
10,000
"
111,600
10,000
6800
"
"
"
"
6,800
TYPE-6
TYPE-3
TYPE-5
TYPE-2
TYPE-2
TYPE-7
TYPE-5
TYPE-4
TYPE-1
TYPE-1
TYPE-5
TYPE-7
TYPE-2
TYPE-2
TYPE-5
TYPE-6
TYPE-3
LOCATION & MARK OF GIRT

TYPE - 1

1) CALCULATION OF STRESS

a) WIND LOAD (HORIZONTAL)

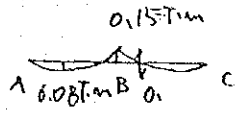
$w = 0.187 \times 1.0 = 0.19$ T/m



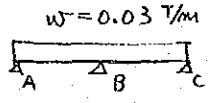
$Q = \frac{1}{2} \times 0.19 \times 2.5 = 0.24$ T

$M = \frac{1}{8} \times 0.19 \times \overline{2.5}^2 = 0.15$ T·m

$C = \frac{1}{12} \times 0.19 \times \overline{2.5}^2 = 0.10$ T·m



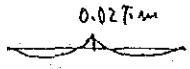
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.5 = 0.04$ T

$M = \frac{1}{8} \times 0.03 \times \overline{2.5}^2 = 0.02$ T·m

$C = \frac{1}{12} \times 0.03 \times \overline{2.5}^2 = 0.02$ T·m



2) CHECK OF SECTION

$M_H = 0.15$ T·m

$M_V = 0.02$ T·m

use $L-75^2 \times 6$

$I_x = I_y = 46.1 \quad Z_x = Z_y = 8.47 \quad f_b = 1.6$

$\sigma_{bH} = \frac{15}{8.47} = 1.77$

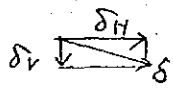
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.74 + 0.10 = 0.84 < 1.0$ ok

$\delta_H = \frac{0.0019 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.41$

$\delta_V = \frac{0.0003 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.07$

$\delta = 0.42$cm $\quad \delta/\ell = 1/595 < 1/250$ ok

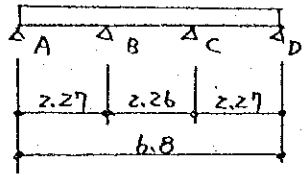


TYPE-2

1) CALCULATION OF STRESS

a) WIND LOAD (HORIZONTAL)

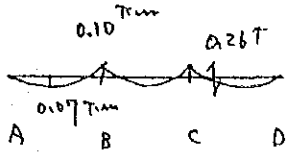
$w = 0.187 \times 1.0 \approx 0.19$ T/m



$Q = \frac{1}{2} \times 0.19 \times 2.27 = 0.22$ T

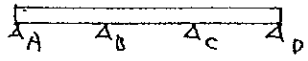
$M = \frac{1}{8} \times 0.19 \times \overline{2.27}^2 = 0.12$ T·m

$C = \frac{1}{12} \times 0.19 \times \overline{2.27}^2 = 0.08$ T·m



b) DEAD LOAD (VERTICAL)

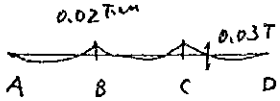
$w = 18+9$ Kg/m $= 0.03$ T/m



$Q = \frac{1}{2} \times 0.03 \times 2.27 = 0.03$ T

$M = \frac{1}{8} \times 0.03 \times \overline{2.27}^2 = 0.02$ T·m

$C = \frac{1}{12} \times 0.03 \times \overline{2.27}^2 = 0.01$ T·m



2) CHECK OF SECTION

$M_H = 0.10$ T·m

$M_V = 0.02$ T·m

USE $L-75^2 \times 6$

$I_x = I_y = 46.1$ $\quad z_x = z_y = 8.47$ $\quad f_b = 1.6$

$\sigma_{bH} = \frac{10}{8.47} = 1.18$

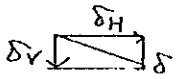
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.49 + 0.10 = 0.59 < 1.0$ ok

$\delta_H = \frac{5 \times 0.00019 \times \overline{227}^4}{384 \times 2100 \times 46.1} = 0.68$

$\delta_V = \frac{5 \times 0.0003 \times \overline{227}^4}{384 \times 2100 \times 46.1} = 0.11$

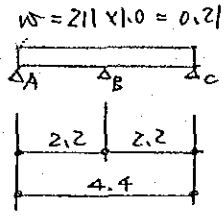
$\delta = 0.69$ cm $\quad \frac{\delta}{\ell} = 1/328 < 1/250$ ok



TYPE-3

1) CALCULATION OF STRESS

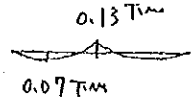
a) WIND LOAD (HORIZONTAL)



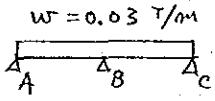
$Q = \frac{1}{2} \times 0.21 \times 2.2 = 0.23$ T

$M = \frac{1}{8} \times 0.21 \times \overline{2.2}^2 = 0.13$ T·M

$C = \frac{1}{12} \times 0.21 \times \overline{2.2}^2 = 0.08$ T·M



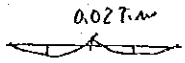
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.2 = 0.03$ T

$M = \frac{1}{8} \times 0.03 \times \overline{2.2}^2 = 0.02$ T·M

$C = \frac{1}{12} \times 0.03 \times \overline{2.2}^2 = 0.01$ T·M



2) CHECK OF SECTION

$M_H = 0.13$ T·M

$M_V = 0.02$ T·M

USE L-75²x6

$I_x = I_y = 46.1$ $\quad Z_x = Z_y = 8.47$ $\quad f_b = 1.6$

$\sigma_{bH} = \frac{13}{8.47} = 1.53$

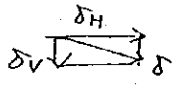
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.64 + 0.10 = 0.74 < 1.0$ ok

$\delta_H = \frac{0.0021 \times \overline{220}^4}{185 \times 2100 \times 46.1} = 0.27$

$\delta_V = \frac{0.0003 \times \overline{220}^4}{185 \times 2100 \times 46.1} = 0.04$

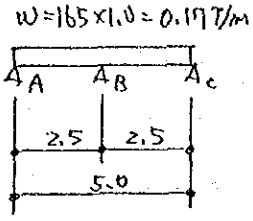
$\delta = 0.27$ cm $\quad \delta/\ell = 1/814 < 1/250$ ok



TYPE - 4

1) CALCULATION OF STRESS

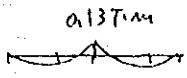
a) WIND LOAD (HORIZONTAL)



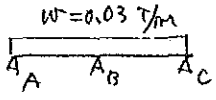
$Q = \frac{1}{2} \times 0.17 \times 2.5 = 0.21$ T

$M = \frac{1}{8} \times 0.17 \times \overline{2.5}^2 = 0.13$ T·M

$C = \frac{1}{12} \times 0.17 \times \overline{2.5}^2 = 0.09$ T·M



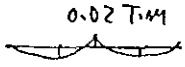
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.5 = 0.04$ T

$M = \frac{1}{8} \times 0.03 \times \overline{2.5}^2 = 0.02$ T·M

$C = \frac{1}{12} \times 0.03 \times \overline{2.5}^2 = 0.02$ T·M



2) CHECK OF SECTION

$M_H = 0.13$ T·M

$M_V = 0.02$ T·M

Use L-75²×6

$I_x = I_y = 46.1$ $\quad Z_x = Z_y = 8.47$ $\quad f_b = 1.6$

$\sigma_{bH} = \frac{13}{8.47} = 1.53$

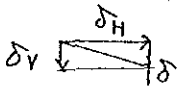
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.64 + 0.10 = 0.74 < 1.0$ ok

$\delta_H = \frac{0.0017 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.37$

$\delta_V = \frac{0.0003 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.07$

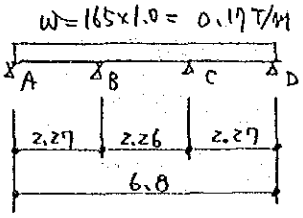
$\delta = 0.38$cm $\quad \delta/\ell = 1/659 < 1/250$ ok



TYPE-5

1) CALCULATION OF STRESS

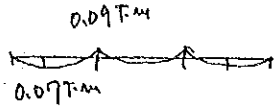
a) WIND LOAD (HORIZONTAL)



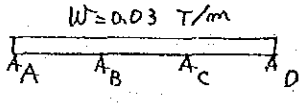
$Q = \frac{1}{2} \times 0.17 \times 2.27 = 0.19\ T$

$M = \frac{1}{8} \times 0.17 \times \overline{2.27}^2 = 0.11\ T\cdot M$

$C = \frac{1}{12} \times 0.17 \times \overline{2.27}^2 = 0.07\ T\cdot M$



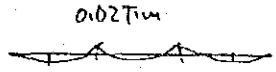
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.27 = 0.03\ T$

$M = \frac{1}{8} \times 0.03 \times \overline{2.27}^2 = 0.02\ T\cdot M$

$C = \frac{1}{12} \times 0.03 \times \overline{2.27}^2 = 0.01\ T\cdot M$



2) CHECK OF SECTION

$M_H = 0.09\ T\cdot M$

$M_V = 0.02\ T\cdot M$

use $L-75^2 \times 6$

$I_x = I_Y = 46.1 \quad Z_x = Z_Y = 8.47 \quad f_b = 1.6$

$\sigma_{bH} = \frac{9}{8.47} = 1.06$

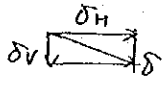
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.44 + 0.10 = 0.54 < 1.0$ OK

$\delta_H = \frac{5 \times 0.0017 \times \overline{227}^4}{384 \times 2100 \times 46.1} = 0.61$

$\delta_V = \frac{5 \times 0.0003 \times \overline{227}^4}{384 \times 2100 \times 46.1} = 0.11$

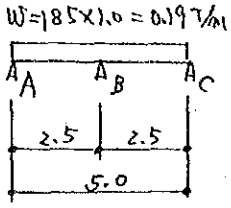
$\delta = 0.62\ cm \quad \delta/\ell = 1/366 < 1/250$ OK



TYPE-6

1) CALCULATION OF STRESS

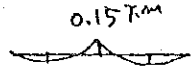
a) WIND LOAD (HORIZONTAL)



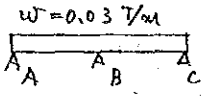
$Q = \frac{1}{2} \times 0.19 \times 2.5 = 0.24\ T$

$M = \frac{1}{8} \times 0.19 \times \overline{2.5}^2 = 0.15\ T\cdot m$

$C = \frac{1}{12} \times 0.19 \times \overline{2.5}^2 = 0.10\ T\cdot m$



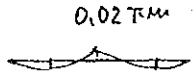
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.5 = 0.04\ T$

$M = \frac{1}{8} \times 0.03 \times \overline{2.5}^2 = 0.02\ T\cdot m$

$C = \frac{1}{12} \times 0.03 \times \overline{2.5}^2 = 0.02\ T\cdot m$



2) CHECK OF SECTION

$M_H = 0.15\ T\cdot m$

$M_V = 0.02\ T\cdot m$

Use $L-75^2 \times 6$

$I_X = I_Y = 46.1 \quad Z_X = Z_Y = 8.47 \quad f_b = 1.6$

$\sigma_{bH} = \frac{15}{8.47} = 1.77$

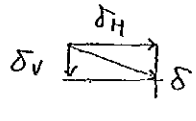
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

$\frac{\sigma}{f} = 0.74 + 0.1 = 0.84 < 1.0$ ok

$\delta_H = \frac{0.0019 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.41$

$\delta_V = \frac{0.0003 \times \overline{250}^4}{185 \times 2100 \times 46.1} = 0.07$

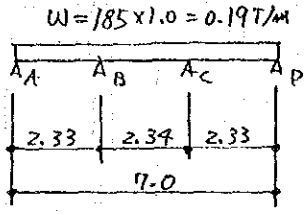
$\delta = 0.42\ cm \quad \delta/\ell = 1/595 < 1/250$ ok



TYPE-7

1) CALCULATION OF STRESS

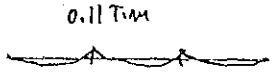
a) WIND LOAD (HORIZONTAL)



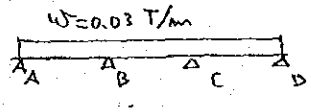
$Q = \frac{1}{2} \times 0.19 \times 2.34 = 0.22\ T$

$M = \frac{1}{8} \times 0.19 \times \overline{2.34}^2 = 0.13\ T\cdot M$

$C = \frac{1}{12} \times 0.19 \times \overline{2.34}^2 = 0.09\ T\cdot M$



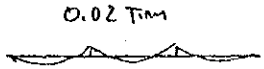
b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.03 \times 2.34 = 0.04\ T$

$M = \frac{1}{8} \times 0.03 \times \overline{2.34}^2 = 0.02\ T\cdot M$

$C = \frac{1}{12} \times 0.03 \times \overline{2.34}^2 = 0.01\ T\cdot M$



2) CHECK OF SECTION

$M_H = 0.11\ T\cdot M$

$M_V = 0.02\ T\cdot M$

USE $L-75^2 \times 6$

$I_X = I_Y = 46.1 \quad Z_X = Z_Y = 8.47 \quad t_b = 1.6$

$\sigma_{bH} = \frac{11}{8.47} = 1.30$

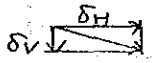
$\sigma_{bV} = \frac{2}{8.47} = 0.24$

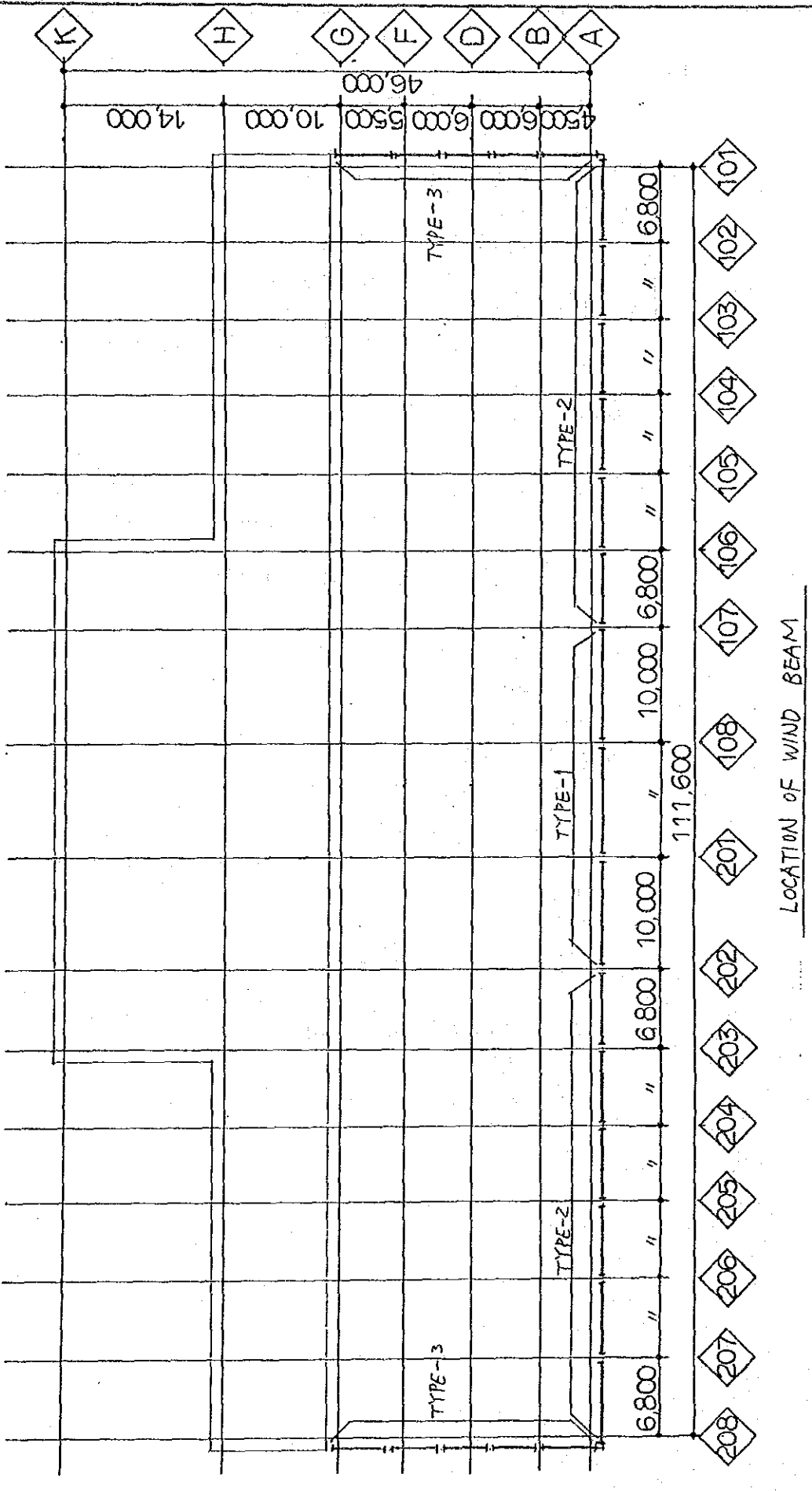
$\frac{\sigma}{f} = 0.54 + 0.10 = 0.64 < 1.0$ ok

$\delta_H = \frac{5 \times 0.0019 \times \overline{234}^4}{384 \times 2100 \times 46.1} = 0.77$

$\delta_V = \frac{5 \times 0.0003 \times \overline{234}^4}{384 \times 2100 \times 46.1} = 0.12$

$\delta = 0.78 \quad \delta/\ell = 1/300 < 1/250$ ok



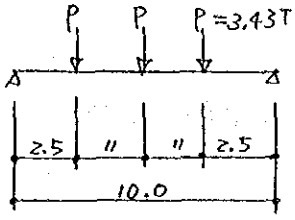


LOCATION OF WIND BEAM

TYPE-1

1) CALCULATION OF STRESS

a) WIND LOAD (HORIZONTAL)



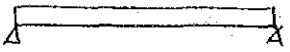
$Q = \frac{1}{2} \times 3 \times 3.43 = 5.15\,T$

$M = 5.15 \times 5.0 - 3.43 \times 2.5$

$= 17.18\ T\cdot m$

b) DEAD LOAD (VERTICAL)

$W = 0.045 \times 6.1 \times \frac{1}{2} + 0.05 = 0.19\,T/m$



$Q = \frac{1}{2} \times 0.19 \times 10.0 = 0.95\ T$

$M = \frac{1}{8} \times 0.19 \times \overline{10.0}^2 = 2.38\ T\cdot m$

2) CHECK OF SECTION

$M_H = 17.18\ T\cdot m$

$M_V = 2.38\ T\cdot m$

use H-390×300×10×16

$Z_x = 1980$ $i_b = 8.09$, $l_b = 250$ $\lambda = 31$ $f_b = 1.6$

$Z_y = 481$

$I_x = 38.700$ $I_y = 9210$

$$\sigma_H = \frac{1718}{1980} = 0.87$$

$$\sigma_V = \frac{238}{481} = 0.49$$

$\frac{\sigma}{f} = 0.36 + 0.20 = 0.56 < 1.0$ ok

$$\delta_H = \frac{5 \times 0.011 \times \overline{1000}^4}{384 \times 2100 \times 38700} = 1.76$$

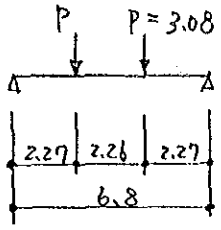
$$\delta_V = \frac{5 \times 0.0019 \times \overline{1000}^4}{384 \times 2100 \times 9210} = 1.63$$

$\delta = 2.40$ $\delta/\ell = 1/416 < 1/300$

TYPE - 2

1) CALCULATION OF STRESS

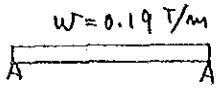
a) WIND LOAD (HORIZONTAL)



$Q = 3.08\ T$

$M = 3.08 \times 2.27 = 6.99\ T\cdot m$

b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.19 \times 6.8 = 0.65\ T$

$M = \frac{1}{8} \times 0.19 \times \overline{6.8}^{2} = 1.10\ T\cdot m$

2) CHECK OF SECTION

$M_H = 6.99\ T\cdot m$

$M_V = 1.10\ T\cdot m$

use H-294 × 200 × 8 × 12

$Z_x = 971 \quad l_b = 5.32 \quad \lambda_b = 229 \quad \lambda = 43 \quad f_b = 1.6$

$Z_y = 160$

$I_x = 11300 \qquad I_y = 1600$

$\sigma_H = \frac{699}{971} = 0.91$

$\sigma_V = \frac{110}{160} = 0.69$

$\frac{\sigma}{f} = 0.38 + 0.29 = 0.67 < 1.0$ ok

$\delta_H = \frac{5 \times 0.01 \times \overline{680}^{4}}{384 \times 2100 \times 11300} = 1.17$

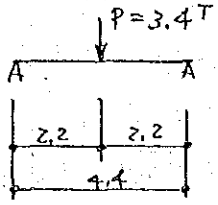
$\delta_V = \frac{5 \times 0.0019 \times \overline{680}^{4}}{384 \times 2100 \times 1600} = 1.57$

$\delta = 1.96\ mm \quad \delta/\ell = 1/346 < 1/300$ ok

TYPE-3

1) CALCULATION OF STRESS

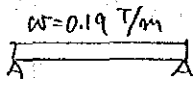
a) WIND LOAD (HORIZONTAL)



$Q = \frac{1}{2} \times 3.4 = 1.7\,T$

$M = \frac{1}{4} \times 3.4 \times 4.4 = 3.74\,T\cdot m$

b) DEAD LOAD (VERTICAL)



$Q = \frac{1}{2} \times 0.19 \times 4.4 = 0.42\,T$

$M = \frac{1}{8} \times 0.19 \times 4.4^2 = 0.46\,T\cdot m$

2) CHECK OF SECTION

$M_H = 3.74\,T\cdot m$

$M_V = 0.46\,T\cdot m$

Use H-300×150×6.5×9

$Z_x = 481 \quad i_b = 3.87 \quad l_b = 220 \quad \lambda = 57 \quad f_b = 1.6$

$Z_y = 67.7$

$I_x = 7210 \qquad I_y = 508$

$\sigma_H = \frac{374}{481} = 0.78$

$\sigma_V = \frac{46}{67.7} = 0.68$

$\frac{\sigma}{f} = 0.33 + 0.28 = 0.61 < 1.0$ ok

$\delta_H = \frac{3.4 \times 440^3}{48 \times 2100 \times 7210} = 0.40$

$\delta_V = \frac{5 \times 0.00019 \times 440^4}{384 \times 2100 \times 508} = 0.87$

$\delta = 0.96 \quad \delta/\ell = 1/458 < 1/300$ ok

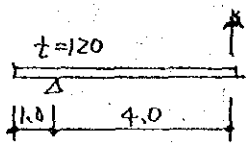
7-4 DESIGN OF SLAB ( )
[スラブの断面算定]

FL	ROOM NAME	SHAPE	w	t (cm)	d (cm)	DP	lx (m)	λ	α	β	M (tm)	Q (t)	at	τ	ψ	RE-BAR
						SEC										
R	Roof		0.495	10 15	12 (10.5)	LEC	2.2		1/8	1/2	0.29	0.52	1.48	0.50	2.36	#3@204.7
						SEC										
5	Cooling Tower		0.615	10 15	12 (10.5)	LEC	2.5				0.48	0.77	2.94	0.73	3.99	#3@204.7
						SEC										
	Deaerator		0.885	10 15	12 (10.5)	LEC	2.0				0.44	0.89	2.24	0.85	4.04	#3@204.7
						SEC										
4	Electrical Instrument		0.80	10 15	12 (10.5)	LEC	2.5				0.69	1.10	3.51	1.05	4.99	#3+#4
						SEC										
	HP Heater		1.29	10 15	12 (10.5)	LEC	2.0				0.65	1.29	3.31	1.23	5.85	#3+#4
						SEC										
	A/C MACHINE		0.985	10 15	12 (10.5)	LEC	2.0				0.49	0.99	2.50	0.94	4.49	#3
						SEC										
3	T/G OVER HAUL		2.425	13 18	15 (13.125)	LEC	2.27				1.56	2.75	6.36	2.10	9.98	#4+#5
						SEC										
	Computer		0.925	13 18	15 (13.125)	LEC	2.27				0.60	1.05	2.44	0.80	3.81	#3
						SEC										
2	T/G Room		1.225	13 18	15 (13.125)	LEC	2.27				0.79	1.39	3.22	1.06	5.04	#4
						SEC										
	Control Equip.		0.925	13 18	15 (13.125)	LEC	2.27				0.60	1.05	2.44	0.80	3.81	#3

NOTE: w --- DESIGN LOAD FOR SLAB (t/m2)
t,d --- SLAB THICKNESS, DISTANCE BETWEEN RE-BAR & COMPRESSIVE END
D --- DIRECTION (S:SHORT SPAN DIR. L:LONG SPAN DIR.)
P --- POSITION (E:END OF SPAN, C:CENTER OF SPAN)
lx,ly --- EFFECTIVE SPAN LENGTH OF SHORTER ONE AND LONGER ONE
λ --- ly/lx
α , β --- COEFFICIENT FOR BENDING MOMENT AND SHEAR FORCE
M,Q --- BENDING MOMENT (=α w lx^2), SHEAR FORCE (=β w lx)
at --- REQUIRED SECTION AREA OF REINFORCING BAR PER ONE METER WIDTH (cm2) = M/(ftj)
j --- (7/8)*d
τ --- SHEAR STRESS (kg/cm2) = Q/(100j)
ψ --- REQUIRED CIRCUMFERENCE OF REINFORCING BAR (cm) = Q/(faj)

7-5 DESIGN OF PRECAST CONCRETE WALL

The stress is maximum in case of lifting.



$W = 2.4\ ^{T/m^3} \times 0.12 = 0.288$

$M = \frac{1}{8} \times 0.288 \times \overline{4}^2 = 0.576\ T\cdot m$

$Z = \frac{100 \times \overline{12}^2}{6} = 2,400\ cm^3$

$\sigma = \frac{0.576 \times 10^5}{2,400} = 24\ kg/cm^2 < 2\sqrt{F_c} = 28.98\ kg/cm^2$

$a_t = \frac{57.6}{3.0 \times \frac{7}{8} \times 6.0}$

$= 3.66\ cm^2$ #4 @250 ($5.08\ cm^2$)

8. Calculation of the angle of relative displacement

Direction	FL	Qi (t)	Ki (t/cm)	δ (cm)	Δδ (cm)	h (cm)	$\frac{\Delta\delta}{h} \leqq 1/200$
Short span	RF	360.4	(228.4)	2.877	1.578	610	1/386 ok
	5TH	613.0		1.299	0.346	500	1/1445 ok
	4TH	830.1		0.953	0.264	500	1/1893 ok
	OPE.	1173.6		0.689	0.305	550	1/1803 ok
	MEZ	1458.2		0.384	0.384	650	1/1692 ok
Long span	RF	327.7	1156.8	1.515	0.283	610	1/2155 ok
	5TH	576.9	2290.4	1.232	0.252	500	1/1984 ok
	4TH	830.1	2871.8	0.980	0.289	500	1/1730 ok
	OPE	1173.6	3862.2	0.691	0.304	550	1/1809 ok
	MEZ	1458.2	3765.4	0.387	0.387	650	1/1679 ok

The displacement of short span is due to computer out put.

The angle of relative displacement on each floor in each direction is less than 1/200.

Calculation of the angle of relative displacement

UNIT-1 only

Direction	FL	Qi (t)	Ki (t/cm)	δ (cm)	Δδ (cm)	h (cm)	Δδ/h ≦ 1/200
Short span	RF	223.7		2.877	1.896	610	1/321 OK
	5TH	423.6	2,875.0	0.981	0.147	500	1/3401 OK
	4TH	593.7	2,922.6	0.834	0.203	500	1/2463 OK
	OPE.	835.0	3,787.9	0.631	0.220	550	1/2500 OK
	MEZ	1,019.4	2,482.3	0.411	0.411	550	1/1338 OK
Long span	RF	204.3	578.4	1.586	0.353	610	1/1728 OK
	5TH	400.0	1,692.8	1.233	0.236	500	1/2118 OK
	4TH	554.1	2,117.1	0.997	0.262	500	1/1908 OK
	OPE	835.0	2,491.9	0.735	0.335	550	1/1641 OK
	MEZ	1,019.4	2548.0	0.400	0.400	550	1/1375 OK

FORM 04

248

9-1 THE RATIOS OF RIGIDITY

Direction	FLOOR	γ	$r_s=1/\gamma$	Σr_s, $\overline{r_s}$	$Rs=r_s/\overline{r_s}$	REMARKS
Short span	RF	1/386	386		0.27 < 6/10	OUT
	5TH	1/1445	1445	Σr_s= 7219	1.00 > 6/10	
	4TH	1/1893	1893		1.31 > 6/10	
	OPE	1/1803	1803	$\overline{r_s}$= 1443.8	1.25 > 6/10	
	MEZ	1/1692	1692		1.17 > 6/10	
Long span	RF	1/2155	2155		1.15 > 6/10	
	5TH	1/1984	1984	Σr_s= 9357	1.06 > 6/10	
	4TH	1/1730	1730		0.92 > 6/10	
	OPE	1/1809	1809	$\overline{r_s}$= 1871.4	0.97 > 6/10	
	MEZ	1/1679	1679		0.90 > 6/10	

9-2 ECCENTRICITY

FLOOR	W	g_y / g_x	ΣDx / ΣDy	l_y / l_x	e_y / e_x	K_R	Yex / Yey	Rex / Rey	Check
RF	1.638.4	55.8		55.8	0.0	4.28×10^5	19.25	0.0	<0.15
		11.0		11.0	0.0		43.28	0.0	
5TH	3.643.9	55.33		55.8	0.47	6.61×10^6	53.74	0.097	
		20.19		25.42	5.23		39.38	0.012	
4TH	5.572.2	55.45		55.80	0.35	6.98×10^6	49.28	0.039	
		23.97		25.88	1.91		39.21	0.009	
OPE	9.817.8	55.51		55.80	0,29	8.32×10^6	46.42	0.066	
		23.42		20.35	3.07		38.00	0.008	
MEZ	14,619.6	55.69		55.80	0.11	6.03×10^6	40.03	0.076	
		22.72		19.67	3.04		39.81	0.003	

center of gravity
$g_y=\Sigma Wx\cdot Y/\Sigma Wx$
$g_x=\Sigma Wy\cdot X/\Sigma Wy$

Center of rigidity
$l_x=\Sigma Dx\cdot Y/\Sigma Dx$
$l_y=\Sigma Dy\cdot X/\Sigma Dy$

eccentric distance
$e_y=|l_y-g_y|$
$e_x=|l_x-g_x|$

Torsional stiffness
$K_R=\Sigma Dx\cdot\overline{Y}^2+\Sigma Dy\cdot\overline{X}^2$

erastic radius
$re_x=\sqrt{K_R/\Sigma Dx}$
$re_y=\sqrt{K_R/\Sigma Dy}$

eccentricity
$Rex=e_y/Yex$
$Rey=e_x/Yey$

FORM 04

THE RATIOS OF RIGIDITY — UNIT-1 only

Direction	FLOOR	γ	$r_s=1/\gamma$	$\sum r_s$, $\overline{r_s}$	$Rs=r_s/\overline{r_s}$	REMARKS
Short span	RF	1/821	821		0.16 < 6/10	OUT
	5TH	1/3401	3401	$\sum r_s = 10,023$	1.70 > 6/10	
	4TH	1/2463	2463		1.23 > 6/10	
	OPE	1/2500	2500	$\overline{r_s} = 2004.6$	1.25 > 6/10	
	MEZ	1/1338	1338		0.67 > 6/10	
Long span	RF	1/1728	1728		0.99 > 6/10	
	5TH	1/2118	2118		1.21 > 6/10	
	4TH	1/1908	1908	$\sum r_s = 8,770$	1.09 > 6/10	
	OPE	1/1641	1641	$\overline{r_s} = 1,754.0$	0.94 > 6/10	
	MEZ	1/1375	1375		0.78 > 6/10	

ECCENTRICITY

FLOOR	W	g_y / g_x	ΣDx / ΣDy	l_y / l_x	e_y / e_x	K_R	γex / γey	Rex / Rey	Check
RF	972.8	32.27		28.27	4.00	1.17×10^5	14.23	0.000	< 0.15
		11.00		11.00	0.00		30.16	0.133	< 0.15
5TH	2,391.3	35.67		34.95	0.72	2.42×10^6	37.78	0.215	> 0.15 OUT
		21.68		29.81	8.13		28.99	0.025	< 0.15
4TH	3,998.3	40.78		33.05	7.72	2.24×10^6	32.54	0.135	< 0.15
		25.80		30.20	4.40		27.70	0.279	> 0.15 OUT
OPE	6,996.2	40.76		35.08	5.68	2.90×10^6	34.14	0.024	< 0.15
		25.52		24.69	0.83		27.69	0.205	> 0.15 OUT
MEZ	10,231.6	40.19		34.22	5.95	1.86×10^6	33.30	0.274	> 0.15 OUT
		25.00		15.88	9.12		27.34	0.218	> 0.15 OUT

center of gravity

$g_y=\Sigma Wx\cdot Y/\Sigma Wx$

$g_x=\Sigma Wy\cdot X/\Sigma Wy$

Torsional stiffness

$K_R=\Sigma Dx\cdot \overline{Y}^2+\Sigma Dy\cdot \overline{X}^2$

Center of rigidity

$l_x=\Sigma Dx\cdot Y/\Sigma Dx$

$l_y=\Sigma Dy\cdot X/\Sigma Dy$

erastic radius

$\gamma e_x=\sqrt{K_R/\Sigma Dx}$

$\gamma e_y=\sqrt{K_R/\Sigma Dy}$

eccentric distance

$e_y=|l_y-g_y|$

$e_x=|l_x-g_x|$

eccentricity

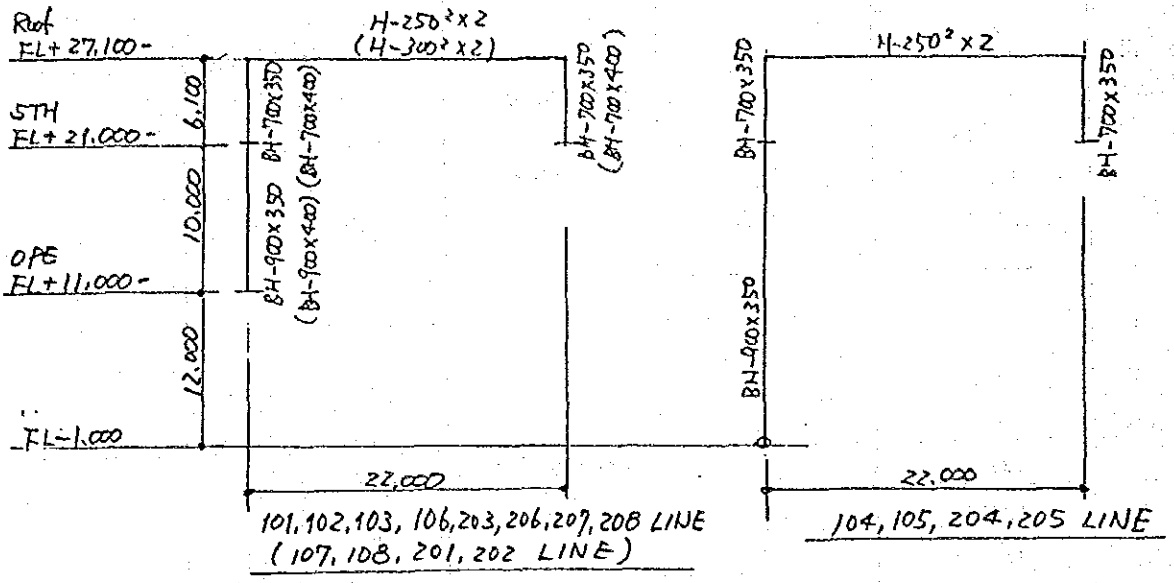
$Rex=e_y/\gamma ex$

$Rey=e_x/\gamma ey$

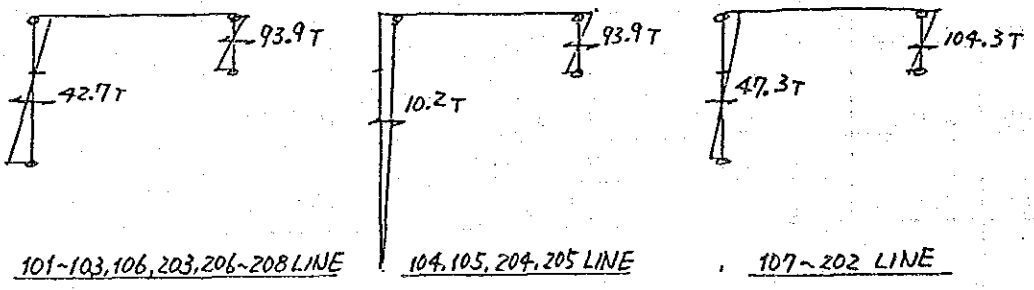
FORM 04

10-1 CALCULATION OF POTENTIAL HORIZONTAL BEARING STRENGTH

1) Roof FL.



MEMBER	Zp (cm³)	Ultimate bending moment (t.m)
BH-900×350×28×40	16,746.8	401.9
BH-900×900×28×40	18,466.8	443.2
BH-700×350×28×40	11,930.8	286.3
BH-700×400×28×40	13,250.8	318.0
H-250² ×2	14,287.9	342.9
H-300²×2	17,970.0	431.2



$\Sigma Q_P = 2,115.6$ T

Potential Horizontal Bearing Strength of Vertical Brace (1)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
101	LINE												
5TH	G-H	H-300² (K)	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-10.6) x2 = 412.4	291.6	291.6
4TH	G-H	H-250² (K)	500	500	707	92.18	6.29	112	1.56	143.8	(143.8-11.5) x2 = 264.6	187.1	187.1
OPE	A-B	2L-120x8 (X)	450	550	(355) 710	37.52	3.71	96	1.78	66.8	66.8x2 = 133.6	84.6	
	D-F	Ditto (X)	600	550	(406) 813	37.52	3.71	109	1.60	60.0	60.0x2 = 120.0	88.5	
	G-H	H-250² (K)	500	550	743	92.18	6.29	118	1.47	135.5	(135.5-19.1) x2 = 232.8	156.6	329.7
MEZ	B-D	2L-120x8 (X)	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4x2 = 108.8	73.8	
	D-F	Ditto	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4x2 = 108.8	73.8	
	F-G	Ditto	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4x2 = 114.8	74.1	
	G-H	H-300² (K)	500	650	820	119.8	7.51	109	1.60	191.6	(191.6-16.0) x2 = 351.2	214.1	435.8
102	LINE												
4TH	G-H	H-250² (K)	500	500	707	92.18	6.29	112	1.56	143.8	(143.8-32.9) x2 = 209.8	148.3	148.3
OPE	A-B	2L-120x8 (X)	450	550	(355) 710	37.52	3.71	95	1.79	67.1	67.1x2 = 134.2	85.0	
	G-H	H-250² (K)	500	550	743	92.18	6.29	118	1.47	135.5	(135.5-19.9) x2 = 231.6	155.8	240.8
MEZ	A-B	H-300² (N)	450	650	790	119.8	7.51	105	1.66	198.8	198.8	113.2	
	B-D D-F	2L-120x8 (X)	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4x2 = 108.8	73.8	
	F-G	Ditto	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4x2 = 114.8	74.1	334.9

$L = \sqrt{B^2 + H^2}$ $\quad Nt = Ag \cdot F$, $Nc = Ag \cdot \sigma cr$

$\lambda = L / i$ $\quad \lambda \leq \Lambda$ $\quad \sigma cr = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}} = 120$ $\quad \lambda > \Lambda$ $\quad \sigma cr = \frac{0.6F}{(\lambda/\Lambda)^2}$

$BQu = Nu * (L/B)$

$\lambda \geq \frac{200}{\sqrt{F}} = 129$ $\quad Nu = Nt$

$\frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}} = 32$ $\quad Nu = 2Nc$

$\lambda \leq \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nt$

FORM 04

Potential Horizontal Bearing Strength of Vertical Brace (2)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
103	LINE												
5TH	G-H	H-350² (K)	500	500	707	173.9	8.84	79	1.98	344.3	(349.3-126.6) x2= 435.4	307.9	307.9
4TH	G-H	H-300² (K)	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-53.6) x2= 326.4	230.8	230.8
OPE	A-B	2L-130×12 (N)	450	550	710	59.52	3.96	179		(142.8)			
	F-G	2L-120×8 (X)	550	550	(388) 777	37.52	3.71	104	1.67	62.6	62.6×2= 125.2	88.6	
	G-H	H-250² (K)	500	550	743	92.18	6.29	118	1.47	135.5	(135.5-19.7) x2= 231.6	155.8	244.4
MEZ	A-B	H-300² (N)	450	650	790	119.8	7.51	105	1.66	198.8	198.8	113.2	
	F-G	2L-120×8 (X)	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4×2= 114.8	74.1	187.3
104	LINE												
5TH	G-H	H-350² (K)	500	500	707	173.9	8.84	79	1.98	344.3	(349.3-126.6) x2= 435.4	307.9	307.9
4TH	G-H	H-300² (K)	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-66.8) x2= 300.0	212.1	212.1
OPE	G-H	H-250² (K)	500	550	743	92.18	6.29	118	1.47	135.5	(135.5-23.0) x2= 225.0	151.4	151.4
105	LINE												
4TH	G-H	H-300² (K)	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-66.8) x2= 300.0	212.1	212.1
OPE	G-H	H-250² (K)	500	550	743	92.18	6.29	118	1.47	135.5	(135.5-23.0) x2= 225.0	151.4	151.4

$L = \sqrt{B^2 + H^2}$ $\quad N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$

$\lambda = L / i$ $\quad \lambda \le \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}}$ $\quad \lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$

$_BQu = Nu * (L/B)$

$\lambda \ge \frac{200}{\sqrt{F}}$ $\quad Nu = Nt$

$\frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nc$

$\lambda \le \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nt$

FORM 04

Potential Horizontal Bearing Strength of Vertical Brace (3)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
106	LINE												
5TH	H-K	H-300² (k)	700	500	860	119.8	7.51	114	1.53	183.3	(183.3-21.8) ×2= 323.0	262.9	262.9
4TH	H-K	H-250² (k)	700	500	860	92.18	6.29	136		221.2	221.2	180.0	180.0
OPE	A-B	2L-130×12 (N)	450	550	710	59.52	3.96	179		(142.8)			
	F-G	2L-120×8 (X)	550	550	(388) 777	37.52	3.71	104	1.67	62.6	62.6×2= 125.2	88.6	
	H-K	H-300² (k)	700	550	890	119.8	7.51	118	1.47	176.1	(176.1-19.7) ×2= 312.8	246.0	334.6
MEZ	A-B	H-300² (N)	450	650	790	119.8	7.51	105	1.66	198.8	198.8	113.2	
	F-G	2L-120×8 (X)	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4×2= 114.8	74.1	
	H-K	H-300² (k)	700	650	955	119.8	7.51	127	1.28	153.3	(153.3-22.6) ×2= 261.4	191.6	378.9
107	LINE												
5TH	G-H	H-300² (k)	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-23.5) ×2= 386.6	273.4	273.4
OPE	A-B	2L-130×12 (N)	450	550	710	59.52	3.96	179		(142.8)			
	F-G	2L-120×8 (X)	550	550	(275) 777	37.52	3.71	74	2.03	76.1	76.1×2= 152.2	107.7	107.7
MEZ	A-B	H-300² (N)	450	650	790	119.8	7.51	105	1.66	198.8	198.8	113.2	
	B-D	2L-120×8 (X)	600	650	(442) 884	37.52	3.71	119	1.45	59.4	54.4×2= 108.8	73.8	
	D-F	Ditto	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4×2= 108.8	73.8	
	F-G	Ditto	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4×2= 114.8	74.1	334.9

$L = \sqrt{B^2 + H^2}$ $\quad N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$

$\lambda = L / i$ $\quad \lambda \le \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}}$ $\quad \lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$

$_BQu = Nu \times (L/B)$

$\lambda \ge \frac{200}{\sqrt{F}}$ $\quad Nu = Nt$

$\frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nc$

$\lambda \le \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nt$

FORM 04

Potential Horizontal Bearing Strength of Vertical Brace (4)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
108	LINE												
4TH	G-H	H-300² (K)	500	500	707	119.8	1.51	94	1.81	216.8	(216.8-50.8) ×2 = 333.0	235.5	235.5
OPE	D-F	2L-120×8 (X)	600	550	(406) 813	37.52	3.71	109	1.60	60.0	60.0×2 = 120.0	88.5	
	F-G	Ditto	550	550	(388) 777	37.52	3.71	104	1.67	62.6	62.6×2 = 125.2	88.6	
	H-K	H-300² (K)	700	550	890	119.8	2.51	118	1.47	176.1	(176.1-19.3) ×2 = 323.8	254.6	431.7
MEZ	A-B	H-300² (N)	450	650	790	119.8	2.51	105	1.66	198.8	198.8	113.2	
	B-D	2L-120×8 (X)	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4×2 = 108.8	73.8	
	D-F	Ditto	600	650	(442) 884	37.52	3.71	119	1.45	54.4	54.4×2 = 108.8	73.8	
	F-G	Ditto	550	650	(425) 851	37.52	3.71	114	1.53	57.4	57.4×2 = 114.8	79.2	335.0

$L = \sqrt{B^2 + H^2}$ $\quad N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$ $\quad {}_BQ_u = N_u * (L/B)$

$\lambda = L/i$ $\quad \lambda \le \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$ $\quad \lambda \ge \frac{200}{\sqrt{F}}$ $\quad N_u = N_t$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}}$ $\quad \lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$ $\quad \frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_c$

$\lambda \le \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_t$

Potential Horizontal Bearing Strength of Vertical Brace (5)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
A	LINE												
Roof	102-103 106-107 202-203 206-207	(X) 2L-120²×8	680	610	(456) 913	37.52	3.71	122	1.39	52.1	52.1×2 = 104.2	77.6	
	107-108 201-202	Ditto	1000	610	(585) 1171	37.52	3.71	157		90.0	90.0	76.8	464.0
5TH	102-103 106-107 202-203 206-207	Ditto	680	500	(422) 844	37.52	3.71	113	1.54	57.7	57.7×2 = 115.4	92.9	
	107-108 201-202	Ditto	1000	500	(559) 1118	37.52	3.71	150		90.0	90.0	80.5	532.6
4TH	102-103 106-107 202-203 206-207	(X) 2L-130×9	680	500	(422) 844	45.48	4.01	105	1.66	75.4	75.4×2 = 150.8	121.5	
	107-108 201-202	Ditto	1000	500	(559) 1118	45.48	4.01	139		109.1	109.1	97.5	675.0
OPE	102-103 106-107 202-203 206-207	Ditto	680	550	(437) 874	45.48	4.01	108	1.62	73.6	73.6×2 = 147.2	119.5	
	107-108 201-202	Ditto	1000	550	(570) 1141	45.48	4.01	142		109.1	109.1	95.6	649.2
MER	102-103 106-107 202-203 206-207	(X) 2L-130×12	680	650	(470) 940	59.52	3.96	118	1.47	87.5	87.5×2 = 175.0	126.6	
	107-108 201-202	Ditto	1000	650	(596) 1192	59.52	3.96	150		142.8	142.8	119.8	746.0
B	LINE												
OPE	102-103 206-207	(K) H-250²	340	550	646	92.18	6.29	102	1.70	156.7	(156.7-55.1) ×2 = 101.6	53.4	
	106-107 202-203	Ditto	340	550	646	92.18	6.29	102	1.70	156.7	(156.7-48.0) ×2 = 219.4	114.4	335.6
MER	102-103 206-207	(K) H-300²	340	650	733	119.8	7.51	97	1.77	212.0	(212.0-23.1) ×2 = 372.6	172.8	
	106-107 202-203	Ditto	340	650	733	119.8	7.51	97	1.77	212.0	(212.0-8.9) ×2 = 406.2	188.4	722.4

$L = \sqrt{B^2 + H^2}$ $\quad N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$ $\quad {}_BQ_u = N_u \times (L/B)$

$\lambda = L / i$ $\quad \lambda \le \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$ $\quad \lambda \ge \frac{200}{\sqrt{F}}$ $\quad N_u = N_t$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}}$ $\quad \lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$ $\quad \frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_c$

$\lambda \le \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_t$

FORM 04

Potential Horizontal Bearing Strength of Vertical Brace (6)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
F	LINE												
OPE	102-103 206-207	(k) H-250²	340	550	646	92.18	6.29	102	1.70	156.7	(156.7-50.1) x2 = 213.2	112.2	
	106-107 202-203	Ditto	340	550	646	92.18	6.29	102	1.70	156.7	(156.7-19.5) x2 = 274.4	149.4	513.2
MEZ	102-103 206-207	(k) H-300²	340	650	733	119.8	7.51	97	1.77	212.0	(212.0-27.6) x2 = 368.8	171.1	
	106-107 202-203	Ditto	340	650	733	119.8	7.51	97	1.77	212.0	(212.0-10.8) x2 = 402.4	186.7	715.6
G	LINE												
Roof	102-103 105-106 203-204 206-207	(x) 2L-120×8	680	610	(456) 913	37.52	3.71	122	1.39	52.1	52.1 x2 = 104.2	77.6	
	107-108 201-202	Ditto	1000	610	(585) 1171	37.52	3.71	157		90.0	90.0	76.8	464.0
MEZ	102-103 105-106 203-204 206-207	(k) H-300²	340	650	733	119.8	7.51	97	1.77	212.0	(212.0-32.4) x2 = 359.2	166.6	
	107-108 201-202	(k) H-350²	500	650	820	173.9	8.84	92	1.83	318.2	(318.2-49.1) x2 = 537.0	327.4	1321.2
H	LINE												
5TH	102-103 105-106 203-204 206-207	(x) 2L-120×8	680	500	(422) 844	37.52	3.71	113	1.54	57.7	57.7 x2 = 115.4	92.9	
	107-108 201-202	(k) H-250²	500	500	707	92.18	6.29	112	1.56	143.8	(143.8-27.0) x2 = 233.6	165.2	702.0
4TH	102-103 105-106 203-204 206-207	(x) 2L-130×9	680	500	(422) 844	45.48	4.01	105	1.66	75.4	75.4 x2 = 150.8	121.5	
	107-108 201-202	(k) H-300²	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-54.4) x2 = 324.8	229.7	945.4
OPE	102-103 105-106 203-204 206-207	(x) 2L-130×9	680	550	(437) 874	45.48	4.01	108	1.62	73.6	73.6 x2 = 147.2	114.5	
	107-108 201-202	(k) H-300²	500	550	743	119.8	7.51	98	1.75	209.6	(209.6-87.4) x2 = 244.4	164.4	786.8

$L = \sqrt{B^2 + H^2}$

$\lambda = L / i$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6 F}}$

$N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$

$\lambda \leq \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$

$\lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$

$BQu = Nu \times (L/B)$

$\lambda \geq \frac{200}{\sqrt{F}}$ $\quad Nu = Nt$

$\frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nc$

$\lambda \leq \frac{50}{\sqrt{F}}$ $\quad Nu = 2Nt$

FORM 04

Potential Horizontal Bearing Strength of Vertical Brace (17)

FL	Location	Member	B (cm)	H (cm)	L (cm)	Ag (cm²)	i min (cm)	λ	σcr (T/cm²)	Nt, Nc (t)	Nu (t)	BQu (t)	ΣBQu (t)
MEZ	102-103 105-106 203-204 206-207	(X) 2L-130×12	680	650	(470) 940	59.52	3.96	118	1.47	87.5	87.5×2= 175.0	126.6	
	107-108 201-202	(K) H-350²	500	650	820	173.9	8.84	92	1.83	318.2	(318.2-83.3) ×2= 469.8	286.4	1,079.2
K	LINE												
5TH	107-108 201-202	(K) H-250²	500	500	707	92.18	6.29	112	1.56	143.8	(143.8-24.9) ×2= 238.2	168.4	336.8
4TH	107-108	(K) H-300²	500	500	707	119.8	7.51	94	1.81	216.8	(216.8-33.2) ×2= 367.2	259.6	
	201-202	Ditto	500	500	707	119.8	7.51	94	1.81	216.8	(241.8-23.5) ×2= 386.6	273.4	533.0
OPE	107-108 108-201	(K) H-300²	500	550	743	119.8	7.51	98	1.75	209.6	(209.6-32.2) ×2= 354.8	238.7	477.4
MEZ	106-107 202-203	(X) 2L-130×12	680	650	(470) 940	59.52	3.96	118	1.47	87.5	87.5×2= 175.0	126.6	253.2

$L = \sqrt{B^2 + H^2}$ $\quad N_t = A_g \cdot F$, $N_c = A_g \cdot \sigma_{cr}$

$\lambda = L / i$ $\quad \lambda \le \Lambda$ $\quad \sigma_{cr} = \{1 - 0.4(\frac{\lambda}{\Lambda})^2\} \cdot F$

$\Lambda = \sqrt{\frac{\pi^2 E}{0.6F}}$ $\quad \lambda > \Lambda$ $\quad \sigma_{cr} = \frac{0.6F}{(\lambda/\Lambda)^2}$

$_BQ_u = N_u \times (L/B)$

$\lambda \ge \frac{200}{\sqrt{F}}$ $\quad N_u = N_t$

$\frac{200}{\sqrt{F}} > \lambda > \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_c$

$\lambda \le \frac{50}{\sqrt{F}}$ $\quad N_u = 2N_t$

10-2 Calculation of required potential horizontal bearing strength

$Qun = Ds \cdot Fes \cdot Qud$

Qud : Required potential horizontal bearing strength on each floor.

Ds : Coefficient of structural characteristic on each floor.

Fes : Coefficient of shape characteristic on each floor.

Qud : Horizontal force by seismic load on each floor.

1) Decision of Ds (see table)

i) Classification of columns and girders

a) Column

$B/tf = 4.4 \sim 10 \rightarrow FB$
$d/tw = 20 \sim 27.5 \rightarrow FA$
$\} \rightarrow FB$

b) Girdes

$\rightarrow FA$

ii) Classification of vertical bracing

$\lambda_e = 74 \sim 150 \quad \left(\frac{90}{\sqrt{H}} = 58,\ \frac{200}{\sqrt{F}} = 129.1\right)$

$\rightarrow BC$

iii) βu

a). Roof FL. short span

$\beta u = 0$

b) other floors

$\beta u = 1.0$

iv) The value of Ds

a) Roof FL. short span

$Ds = 0.3$

b) other floors

$Ds = 0.4$

2) Calculation of Fes

$Fes = Fe \cdot Fs$

i) Fe

a) Roof FL

$Re < 0.15 \longrightarrow Fe = 1.0$

b) Other floors

$Re < 0.15 \longrightarrow Fe = 1.0$ UNIT 1 & 2

$Re > 0.15 \longrightarrow Fe =$ Due to the number. UNIT-1 only

ii) Fs

a) Roof FL. short span

$Rs < 0.6 \longrightarrow Fs = 1.5$

b) Other floors

$Rs > 0.6 \longrightarrow Fs = 1.0$

3) Calculation of Qud

$Qud = Z \cdot Rt \cdot Ai \cdot Co \cdot Wi$

$Z = 1.0$ Zone factor

$Rt = 1.0$

$Ai = 1 + \left(\frac{1}{\sqrt{\beta i}} - \alpha i\right) \frac{2T}{1+3T}$

αi: ratio of the weight of ith story to the total weight of the building.

T: natural period of the structure.

$Co = 0.5$ Standerd coefficient of shear force.

Wi: the weight above ith story.

Table for calculation of Ds value

Table 13-2 (1)

Frame / STRUCTURE	(a) ∘Rigid frame ∘Frame with bracing of class BA ∘Except for above and frame with bracing of βu≤0.3	(b) Frame with Bracing of class BB and 0.3≤βu≤0.7, or class BC and 0.3<βu≤0.5	(c) Frame with Bracing of class BB and βu>0.7, or class BC and βu>0.5
(1) RANK I	0.25	0.3	0.35
(2) RANK II	0.3	0.35	0.4
(3) RANK III	0.35	0.4	0.45
(4) RANK IV	0.40	0.45	0.5

Remarks: RANK OF STRUCTURE are shown in Table 13-2 (2)

$$\beta u = \frac{\text{Potential Horizontal Bearing Strength of bracings}}{\text{Total Potential Horizontal Bearing Strength of a Floor}}$$

Table 13-2 (2)

CLASS OF BRACINGS / CLASS AND βu OF COLUMNS AND GURDERS	BA or βu=0	BB			BC		
		βu≤0.3	0.3<βu≤0.7	βu>0.7	βu≤0.3	0.3<βu≤0.5	βu>0.5
CLASS FA	I (0.25)	I (0.25)	I (0.3)	I (0.35)	II (0.3)	II (0.35)	II (0.4)
CLASS FB	II (0.3)	II (0.3)	I (0.3)	I (0.35)	II (0.3)	II (0.35)	II (0.4)
CLASS FC	III (0.35)	III (0.35)	II (0.35)	II (0.4)	III (0.35)	III (0.4)	III (0.45)
OTHERS FD	IV (0.4)	IV (0.4)	IV (0.45)	IV (0.5)	IV (0.4)	IV (0.45)	IV (0.5)

Table 13-2 (3)

BA	BB		BC
$\lambda e \leq 50/\sqrt{F}$	$50/\sqrt{F} < \lambda e \leq 90/\sqrt{F}$	$\lambda e \geq 200/\sqrt{F}$	$90/\sqrt{F} < \lambda e < 200/\sqrt{F}$
λe : effective slenderness ratio of bracing F : Standard strength of bracing			

Table 13-2 (4)

CLASS OF COLUMN AND GIRDER				FA	FB	FC	FD
MEMBER	SECTION	POSITION	CLASS	Width thickness ratios			
COLUMN	H	FLANGE	SS41 SM50	9.5 8	12 10	15.5 13.2	Others
		WEB	SS41 SM50	43 37	45 39	48 41	
	□		SS41 SM50	33 27	37 32	48 41	
	○		SS41 SM50	50 36	70 50	100 73	
GIRDER	H	FLANGE	SS41 SM50	9 7.5	11 9.5	15.5 13.2	
		WEB	SS41 SM50	60 51	65 55	71 61	

Table

Ratios of rigidity R_s	F_s
$0.6 \leq R_s$	1.0
$0.3 < R_s < 0.6$	linear interpolation between 1.0 and 1.5
$R_s \leq 0.3$	1.5

Table

Eccentricity Re	Fe
$Re \leq 0.15$	1.0
$0.15 < Re < 0.3$	linear interpolation between 1.0 and 1.5
$0.3 \leq Re$	1.5

The result of calculation for Potential horizontal bearing strength (t)

Frame	Roof FL	5TH FL	4TH FL	OPE FL	MEB FL	REMARKS
101	136.6	291.6	187.1	329.7	435.8	
102	136.6	—	148.3	240.8	334.9	
103	136.6	307.9	230.8	244.4	187.3	
104	104.1	307.9	212.1	151.4	—	
105	104.1	—	212.1	151.4	—	
106	136.6	262.9	180.0	334.6	378.9	
107	151.6	273.4	—	107.7	334.9	
108	151.6	—	235.5	431.7	335.0	
201	151.6	—	235.5	431.7	335.0	
202	151.6	273.4	—	107.7	334.9	
203	136.6	262.9	180.0	334.6	378.9	
204	104.1	—	212.1	151.4	—	
205	104.1	307.9	212.1	151.4	—	
206	136.6	307.9	230.8	244.4	187.3	
207	136.6	—	148.3	240.8	334.9	
208	136.6	291.6	187.1	329.7	435.8	
Total	2,115.6	2,887.4	2,811.8	3,983.4	4,013.6	
A	464.0	532.6	675.0	649.2	746.0	
B	—	—	—	335.6	722.4	
D	—	—	—	—	—	
F	—	—	—	513.2	715.6	
G	464.0	—	—	—	1,321.2	
H	—	702.0	945.4	786.8	1,079.2	
K	—	336.8	533.0	477.4	253.2	
Total	928.0	1,571.4	2,153.4	2,762.2	4,837.6	

FORM 04

4) Calculation of required potential horizontal bearing strength and check of potential horizontal bearing strength.

Direc-tion	FL	Ds	Fes	Required potential horizontal bearing strength					Qp (t)	Judgment
				Wi (t)	Ai	Ci	Qud (t)	Qum (t)		
Short span	Roof	0.3	1.5	1,638.4	2.04	1.02	1,671.2	752.0	2,115.6	OK
	5TH	0.4	1.0	3,605.6	1.63	0.82	2,956.6	1,182.6	2,887.4	OK
	4TH	0.4	1.0	5,534.1	1.45	0.73	4,039.9	1,616.0	2,811.8	OK
	OPE	0.4	1.0	9,779.7	1.20	0.60	5,867.8	2,347.1	3,983.4	OK
	MEZ	0.4	1.0	14,581.5	1.00	0.50	7,290.8	2,916.3	4,837.6	OK
Long span	Roof	0.4	1.0	1,638.4	2.22	1.11	1,818.6	727.4	928.0	OK
	5TH	0.4	1.0	3,605.6	1.74	0.87	3,136.9	1,254.8	1,571.4	OK
	4TH	0.4	1.0	5,534.1	1.52	0.76	4,205.9	1,682.4	2,153.4	OK
	OPE	0.4	1.0	9,779.7	1.23	0.62	6,063.4	2,425.4	2,762.2	OK
	MEZ	0.4	1.0	14,581.5	1.00	0.50	7,290.8	2,916.3	3,551.6	OK

The result of calculation for Potential horizontal bearing strength (t) UNIT-1 only

Frame	Roof FL	5TH FL	4TH FL	OPE FL	MEB FL	REMARKS
101	136.6	291.6	187.1	329.7	435.8	
102	136.6	—	148.3	240.8	334.9	
103	136.6	307.9	230.8	244.4	187.3	
104	104.1	307.9	212.1	151.4	—	
105	104.1	—	212.1	151.4	—	
106	136.6	262.9	180.0	334.6	378.9	
107	151.6	273.4	—	107.7	334.9	
108	151.6	—	235.5	431.7	335.0	
201	151.6	—	235.5	431.7	335.0	
202		273.4				
203		262.9	180.0	246.0	191.6	
204						
205						
206						
207						
208						
Total	1.209.4	1.980.0	1.821.4	2.669.4	2.533.4	
A	232.0	266.3	340.5	324.6	373.0	
B	—	—	—	167.8	361.2	
D	—	—	—	—	—	
F	—	—	—	256.6	357.8	
G	232.0	—	—	—	988.0	
H	—	576.2	702.4	557.8	826.0	
K	—	336.8	533.0	477.4	253.2	
Total	464.0	1.119.3	1.575.9	1.789.2	3.159.2	

FORM 04

365

4) Calculation of required potential horizontal bearing strength and check of potential horizontal bearing strength.

UNIT-1 only

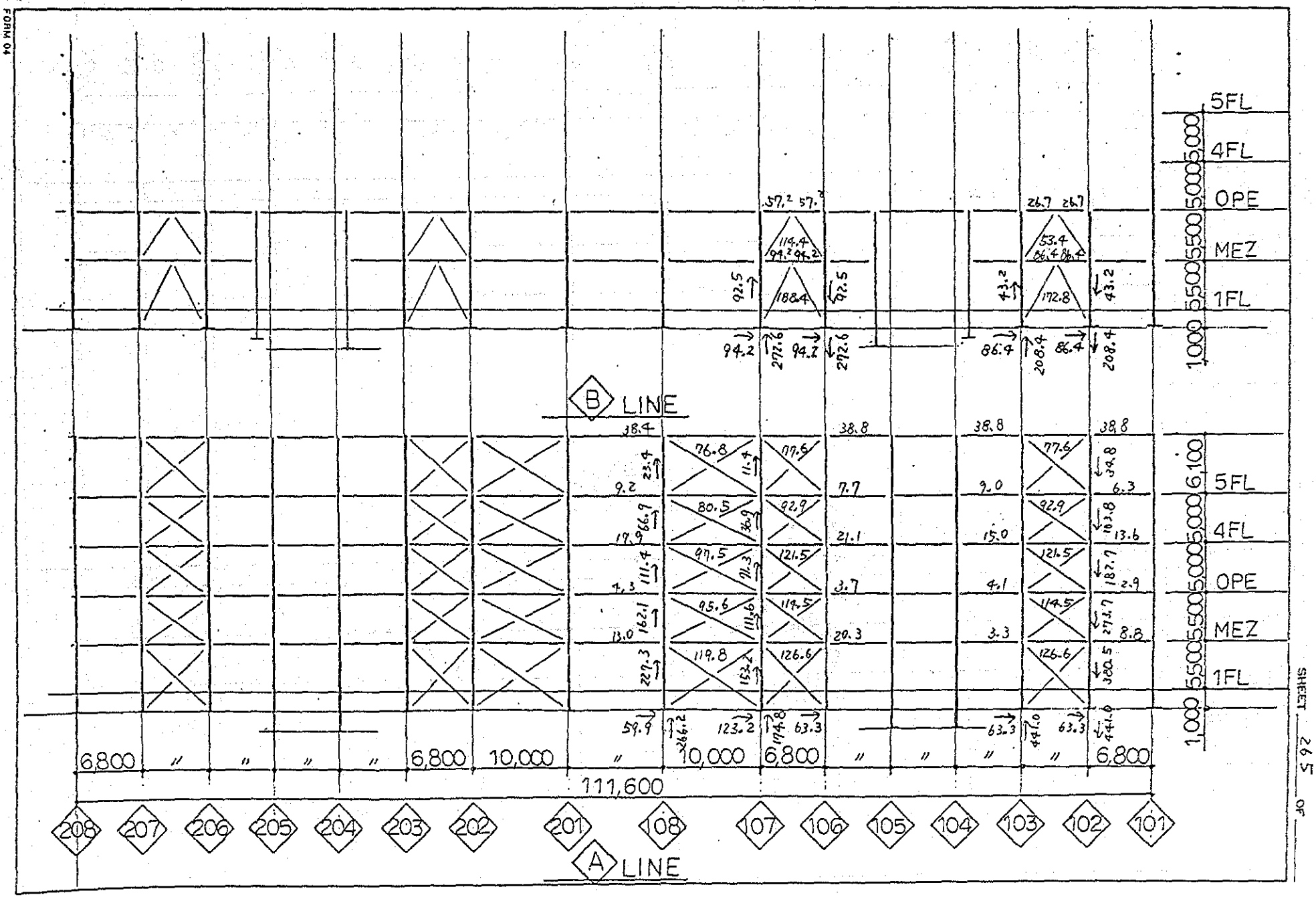
Direc-tion	FL	Ds	Fes	Required potential horizontal bearing strength					Qp (t)	Judgment
				Wi (t)	Ai	Ci	Qud (t)	Qum (t)		
Short span	Roof	0.3	1.5	972.8	2.10	1.05	1,021.4	459.6	1,209.4	OK
	5TH	0.4	1.0	2,353.2	1.67	0.84	1,976.7	790.7	1,980.0	OK
	4TH	0.4	1.43	3,958.2	1.43	0.72	2,849.9	1,630.1	1,821.4	OK
	OPE	0.4	1.18	6,958.1	1.19	0.60	4,174.9	1,970.6	2,669.4	OK
	MEZ	0.4	1.23	10,193.5	1.00	0.5	5,096.8	2,507.6	2,533.4	OK
Long span	Roof	0.4	1.0	972.8	2.29	1.15	1,118.7	447.5	464.0	OK
	5TH	0.4	1.22	2,353.2	1.78	0.89	2,094.3	1,022.0	1,119.3	OK
	4TH	0.4	1.0	3,958.2	1.51	0.76	3,008.2	1,203.3	1,575.9	OK
	OPE	0.4	1.0	6,958.1	1.22	0.61	4,244.4	1,697.8	1,784.2	OK
	MEZ	0.4	1.41	10,193.5	1.00	0.5	5,096.8	2,874.6	3,159.2	OK

10-3 Check of Girders and Columns

The section of girders and columns shall be checked by the additional axial forces which were calculated by the bearing axial strength of vertical bracings of the potential horizontal bearing strength.

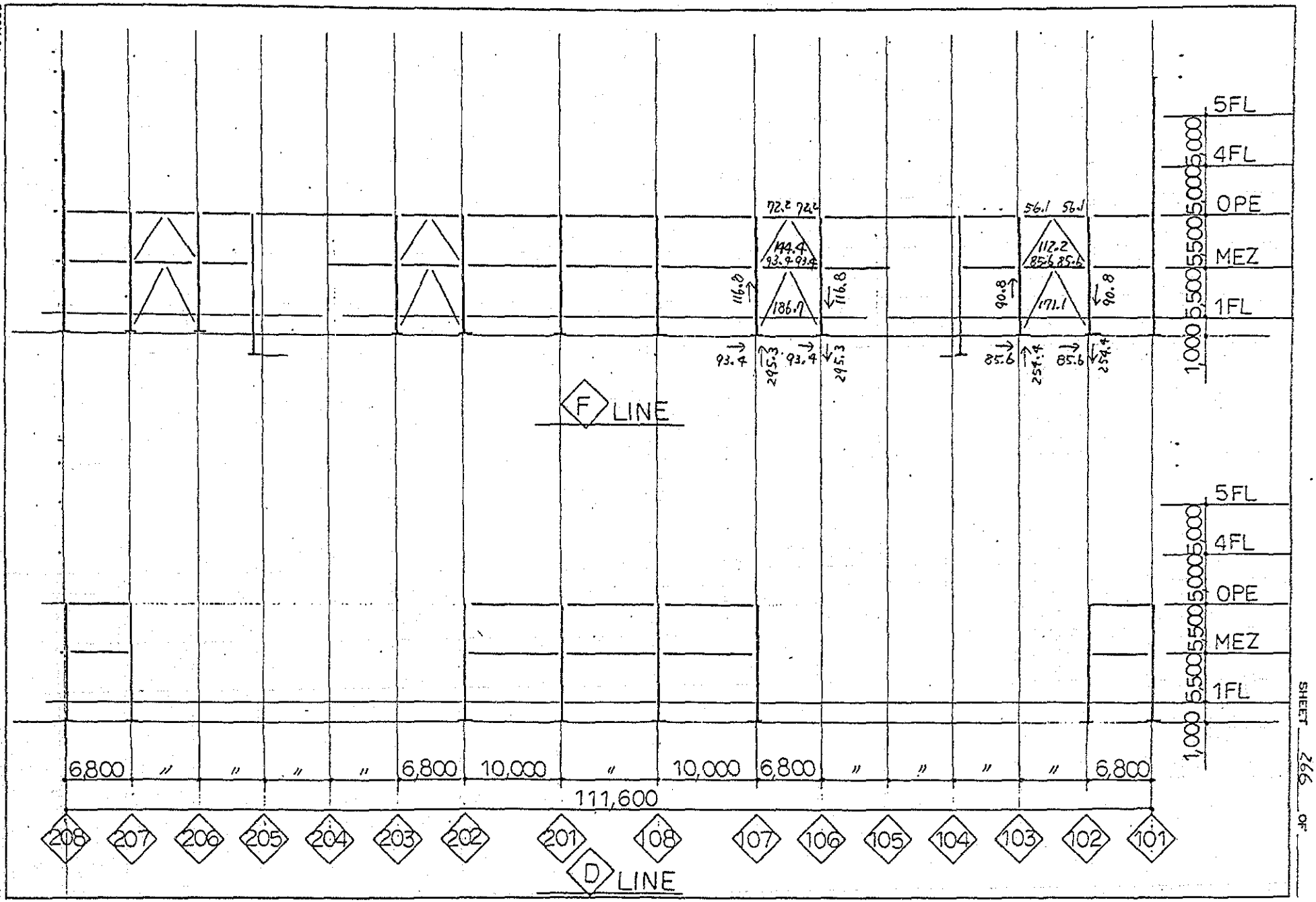
89C

FORM 04



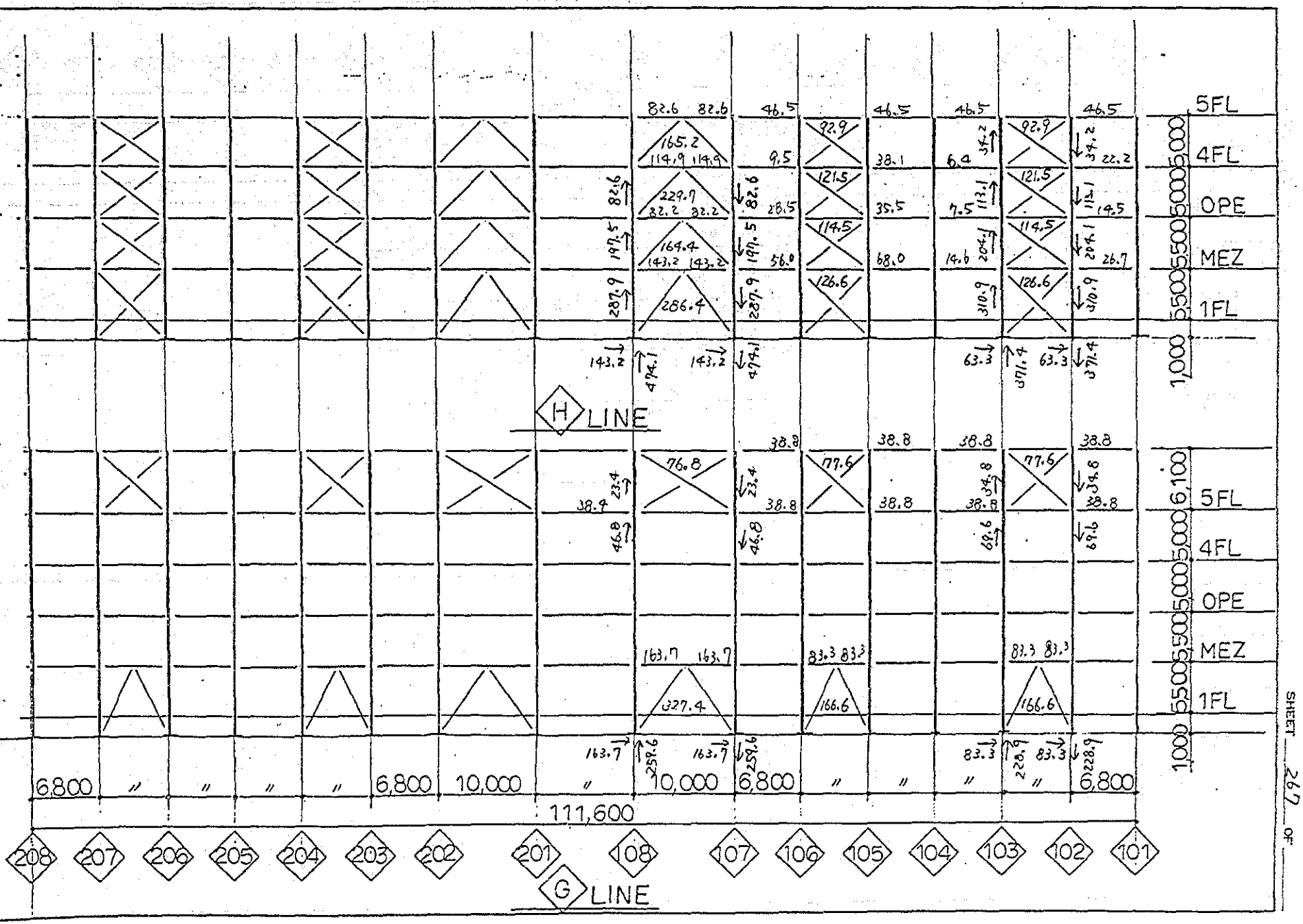
SHEET 265 OF

FORM 04

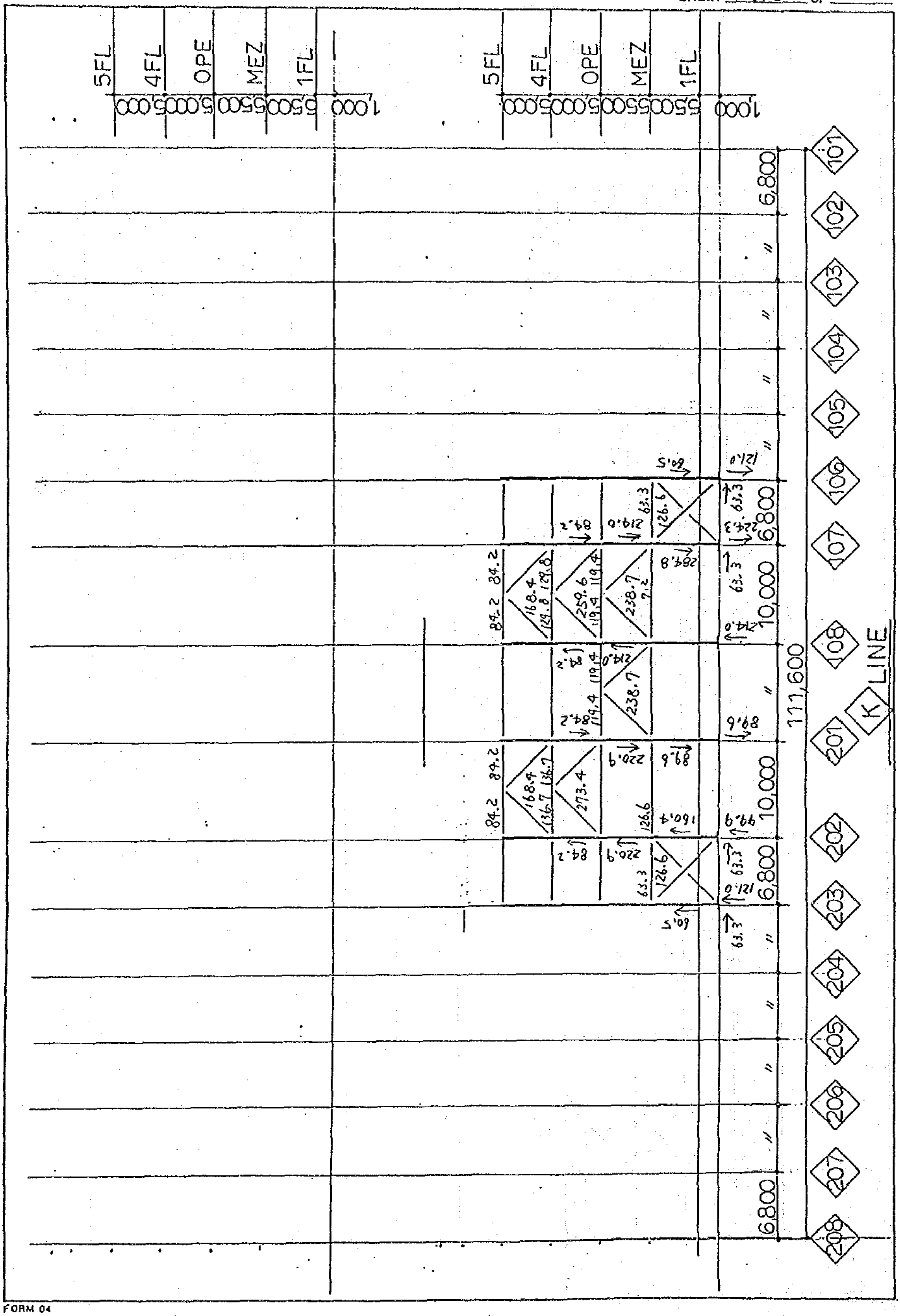


SHEET 266 OF

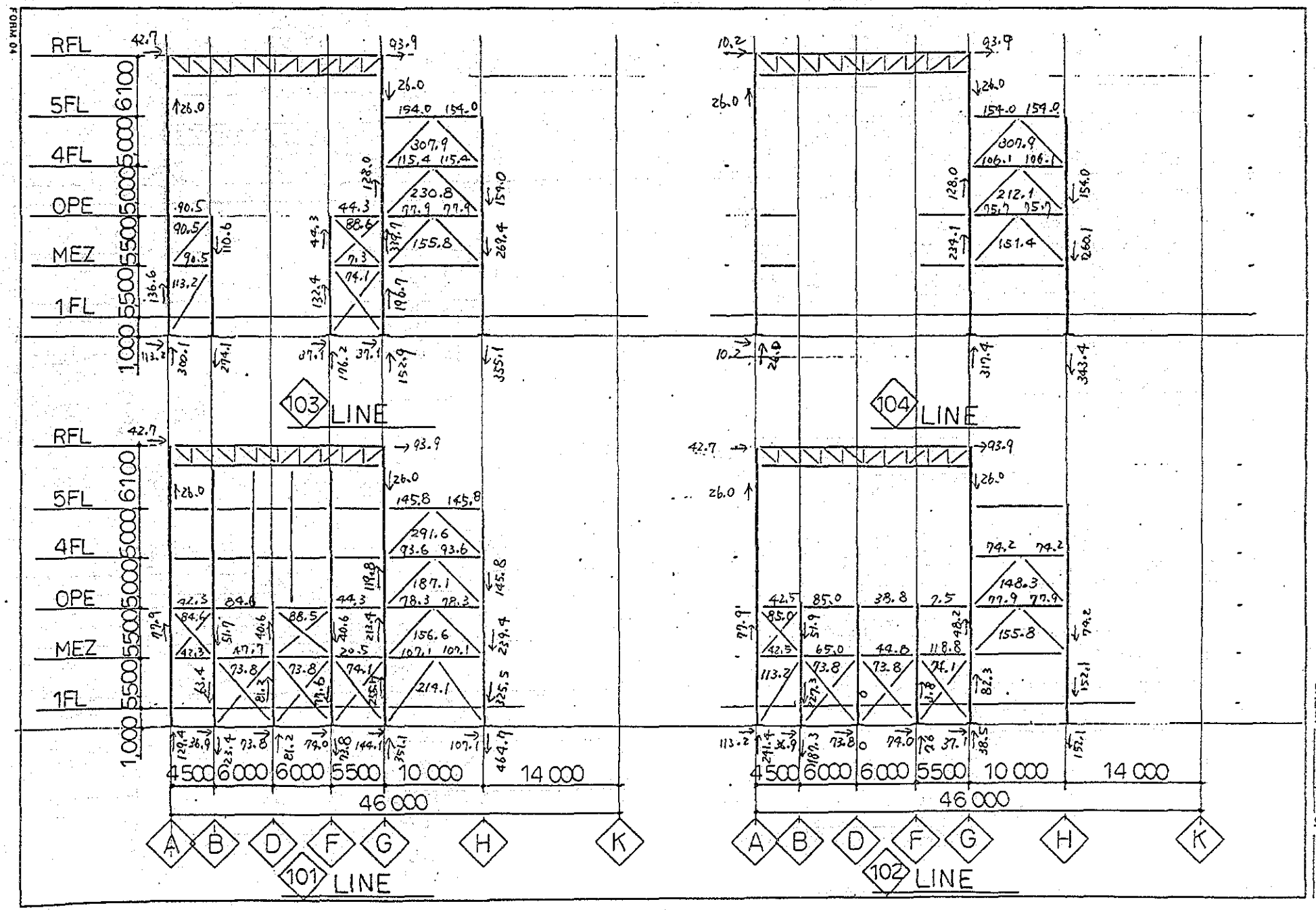
269

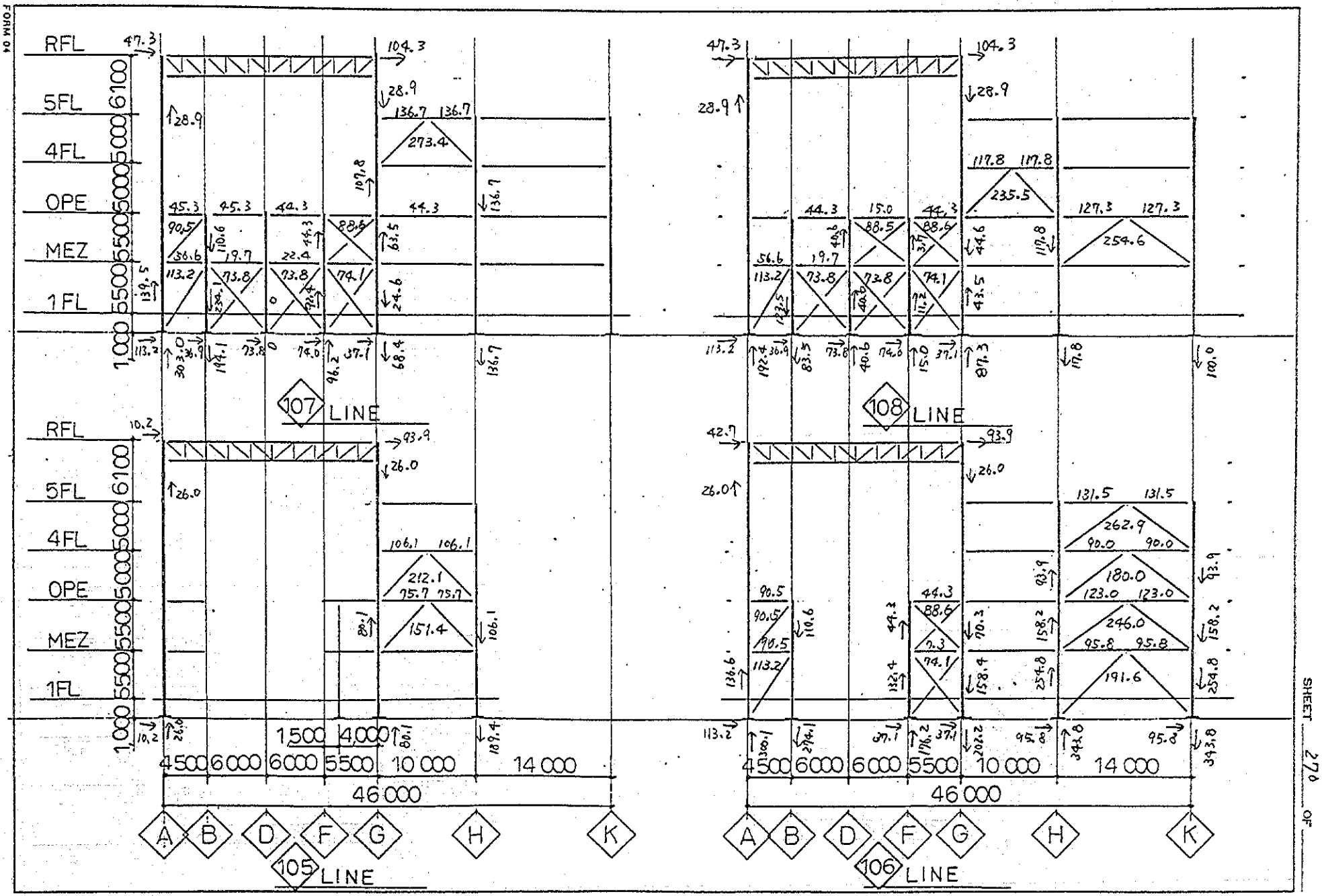

FORM 04
5FL
4FL
OPE
MEZ
1FL
1000
5500
5000
6100
H LINE
G LINE
6,800
10,000
111,600
208
207
206
205
204
203
202
201
108
107
106
105
104
103
102
101

SHEET 268 OF



FORM 04


RFL
5FL
4FL
OPE
MEZ
1FL
6100
5000
5000
5000
5500
5500
1000
103 LINE
104 LINE
101 LINE
102 LINE
A
B
D
F
G
H
K
4500
6000
6000
5500
10 000
14 000
46 000


RFL
5FL
4FL
OPE
MEZ
1FL
6100
5000
5000
5500
5500
1000
107 LINE
105 LINE
106 LINE
108 LINE
4500
6000
6000
5500
10 000
14 000
1500
4000
46 000
A
B
D
F
G
H
K

CHECK OF MEMBER (1)
COLUMN

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{PC} = M_P$ $M_P = Z_P \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{PC} = 1.14\left(1 - \frac{N}{N_Y}\right) M_P$ $N_Y = A \sigma_Y$

Y-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{A}$ $M_{PC} = M_P$ $N_{WY} = A_w \sigma_Y$

$\frac{N}{M_r} > \frac{A_w}{A}$ $M_{PC} = \left\{1 - \left(\frac{N - N_{WY}}{N_Y - N_{WY}}\right)^2\right\} M_P$

LOCATION	DIR	M_1 / M_e / M_s	Q_e / Q_e / Q_s	N_e / N_e / N_s	MEMBER / l_b / l_k	A / I / Z_{PX}	r_{min} / i / Z_{PY}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_Y	M_P / A_w / 2A	M_{PC} / M / M_{PC}
A-106	RF				BH-700x350x28/40	453.6	7.95	54	2.20	997.9	286.3	231.7
					430		9.4	45	2.4			
	Y	(231.7)		79.7	430	11930		173.6		0.29	0.19	
	MEZ				BH-700x350x28x40	509.6	7.51	86	1.91	973.3		
					650		9.15		2.4			
	X			530.8	650		2507			0.55		
					Ditto	509.6	7.51	86	1.91	973.3	401.9	311.6
					650		9.15	71	2.4			
	Y	30.3		310.7	650	16746		229.6		0.32	0.23	0.10
A-107	RF				BH-700x400x28x40	493.6	9.31	46	2.26	1115.5	318.0	318.0
					430		10.85	39	2.4			
	Y	(318.0)		106.2	430	13,250		173.6		0.10	0.18	
	OPE				BH-900x400x28x40	549.6	8.83	62	2.14	1176.1	443.2	443.2
					550		10.58	51	2.4			
	Y	161.5		186.3	550	18,466		229.6		0.16	0.21	0.36
	MEZ				Ditto		8.83	73	2.04	1121.2	443.2	443.2
					650		10.58	61	2.4			
	Y	17.5		239.4	650					0.21	0.21	0.04
G-103	RF				BH-700x350x28x40	453.6	7.95	54	2.20	997.9	286.3	286.3
					430		9.4	45	2.4			
	Y	(286.3)		79.3	430	11930				0.08	0.19	
	5TH				BH-900x350x28x40	509.6	7.51	66	2.11	1075.2	401.9	401.9
					500		9.15	54	2.4			
	Y	140.5		190.0	500	16746				0.18	0.23	0.35
	MEZ				BH-900x350x28x40		7.51	86	1.91	973.3	401.9	183.3
					650		9.15	71	2.4			
	Y	2.8		580.9	650					0.60	0.23	0.02
G-108	RF				BH-700x400x28x40	493.6	9.31	46	2.26	1115.5	318.0	318.0
					430		10.85	39	2.4			
	Y	(318.0)		105.6	430	13,250		173.6		0.09	0.18	
	5TH				BH-900x400x28x40	549.6	8.83	56	2.19	1203.6	443.2	443.2
					500		10.58	47	2.4			
	Y	154.8		149.5	500	18466				0.12	0.23	0.35
	MEZ				BH-900x400x28x40		8.83	73	2.04	1121.2	443.2	272.8
					650		10.58	61	2.4			
	Y	8.9		520.9	650					0.46	0.21	0.03

FORM 04

CHECK OF MEMBER (2)

COLUMN

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A \sigma_Y$

Y-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_x / M_e / M_s	Q_e / Q_e / Q_s	N_e / N_e / N_s	MEMBER / l_b / l_k	A / I / Z_{px}	I_{min} / i / Z_{py}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_Y	M_p / A_w / A	M_{pc} / M / M_{pc}
	MEZ				H-300²	119.8	7.57	87	1.90	227.6		
					650							
B-101	Y			149.8	650	1500				0.66		
	MEZ				※ H-350²	173.9	8.84	62	2.14	372.1		
					(550)							
B-106	Y			370.4	(550)					0.99		
	MEZ				H-350²				2.14	372.1		
					(550)							
B-102	Y			352.6	(550)					0.95		
	MEZ				H-300²	119.8	7.51	87	1.90	227.6		
					650							
D-101	Y			170.5	650					0.75		
	MEZ				H-350²	173.9	8.84	73	2.04	354.8		
					650							
D-106	Y			239.1	650					0.67		
	MEZ				H-300²	119.8	7.51	73	2.04	249.4		
					(550)							
F-103	Y			236.3	(550)					0.94		
	MEZ				H-350²	173.9	8.84	73	2.04	354.8		
F-107	Y			253.0	650					0.71		
	4TH				※ H-390	136.0	7.28	69	2.08	282.9		
H-101	Y			188.6	500					0.67		
	MEZ				※ H-400²	218.7	10.1	64	2.13	465.8		
	Y			405	650					0.87		
	MEZ				H-440²					465.8		
H-102	Y			359.4	650					0.77		
	4TH				H-440	157.4	7.18	70	2.07	325.8		
H-103	Y			314.9	500					0.97		
	MEZ				BH-450²	289.0	11.46	48	2.25	650.3		
	Y			636	(550)					0.98		

FORM 04

CHECK OF MEMBER (3)
COLUMN

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A \sigma_y$

Y-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_y$

$\frac{N}{N_Y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_l / M_e / M_s	Q_l / Q_e / Q_s	N_l / N_e / N_s	MEMBER / l_b / l_k	A / I / Z_{px}	I_{min} / i / Z_{py}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_y	M_P / A_w / A	M_{pc} / M / M_{pc}
	4TH				BH-480x350x16x22	223.76	8.38	59	2.17	485.6		
H-108	X			322.0	500					0.66		
	NE8				BH-516x500x22x40	495.92	12.97	50	2.23	1105.9		
	X			881.0	650					0.80		
	4TH				※H-390	136.0	7.28	69	2.08	282.9		
(K-106) K-203	Y			149.2	500					0.53		
	NE8				※H-400²	218.7	10.1	64	2.13	465.8		
	Y			433.7	650					0.93		
	4TH				H-440	157.4	7.18	70	2.07	325.8		
K-107	X			217.9	500					0.67		
	NE8				BH-450²	289.0	11.46	57	2.18	630.0		
	X			572.9	650					0.91		

FORM 04

CHECK OF MEMBER (1)
GIRDER

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A\sigma_y$

Y-AXIS $\frac{N}{N_y} \leq \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_y$

$\frac{N}{N_y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_s / M_e / M_l	Q_s / Q_e / Q_l	N_s / N_e / N_l	MEMBER / l_b / l_k	A / I / Z_{px}	I_{min} / i / Z_{py}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_y	M_p / A_w / zA	M_{pc} / M / M_{pc}
REL		5.3	3.1		H-350	63.14	3.95	86	1.9	120.0	20.8	16.1
				38.8					2.4			
1GLINE	101~107				340	868		22.96		0.32	0.18	0.33
		11.4	11.4		H-400	84.12	4.54	110	1.59	133.8	31.9	25.8
				38.7					2.4			
	107~202				500	1330		29.9		0.29	0.19	0.99
5TH		23.3	9.5		H-500	119.2	4.33	91	1.85	211.3	52.3	52.3
				38.8					2.4			
GLINE	101~102				395	2180		46.8		0.18	0.20	0.45
		11.1	4.5		H-400	84.12	4.54	110	1.59	133.8	31.9	30.1
				38.4					2.4			
	102~202				500	1330		29.9		0.29	0.17	0.37
		8.9	5.2		H-488	163.5	7.04	97	1.77	289.4	77.5	74.2
				46.5	680		7.97	21	2.4			
HLINE	103~105				680	3230		49.72		0.16	0.15	0.12
		19.1	19.1		H-488	163.5	7.04	71	2.06	336.8	77.5	66.3
				82.6	500		7.97	63	2.4			
	107~108				500	3230		49.72		0.25	0.15	0.29
		7.5	7.5		H-488	163.5	7.04	71	2.06	336.8	77.5	50.4
				145.8	500		7.97	63	2.4			
101 LINE	G~H				500	3230		49.72		0.43	0.15	0.15
		74.7		4.6	H-800	267.4	6.62	30	2.84	625.7	197.8	169.1
103				154.0	200		7.80	26	2.4			
104 LINE	G~H			158.6	200	8240		104.72		0.25	0.20	0.44
		17.8			H-488	163.5	7.04	100	1.73	282.9	63.8	42.4
				131.5	700		7.97	88	2.13			
106 LINE	H~K				700	3230		49.72		0.46	0.15	0.42
		16.6			H-488	163.5	7.04	28	2.35	389.2	77.5	56.5
				136.7					2.4			
107 LINE	G~H				200	3230		49.72		0.36	0.15	0.29
4TH		0.3			H-294	72.38	4.71	144	1.0	72.4	13.9	11.3
				21.1			5.32	128	1.62			
ALINE	101~107				680	859		21.6		0.29	0.15	0.03
		0.6			H-250²	92.18	6.29	159	0.82	75.6	18.1	15.3
				19.9			6.87	146	1.89			
	107~202				1.000	960		19.98		0.26	0.11	0.04

FORM 04

277

CHECK OF MEMBER (2)

GIRDER

X-AXIS $\frac{N}{N_Y} \le \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A\sigma_Y$

Y-AXIS $\frac{N}{N_Y} \le \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_1 / M_e / M_s	Q_e / Q_s	N_e / N_s	MEMBER l_b / l_k	A / I / Z_{px}	I_{min} / i / Z_{py}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_Y	M_P / A_w / A	M_{pc} / M / M_{pc}
		18.9			H-500	114.2	4.33	91	1.85	211.3	52.3	52.3
				22.2	285		5.14	55	2.4			
H LINE	101-102				395	2180		46.8		0.11	0.20	0.36
		11.0			H-488	163.5	7.04	97	1.77	289.4	71.1	71.1
				38.1			7.97	85	2.20			
	103-105				680	3230		49.72		0.13	0.15	0.15
		38.4			H-488	163.5	7.04	36	2.31	377.7	71.1	56.7
				114.9					2.40			
	107-108				250	3230		49.72		0.30	0.15	0.68
		16.6			H-488	163.5	7.04	36	2.31	377.7	71.1	51.9
				136.7	250		7.97	31	2.4			
K LINE	201-202				250	3230		49.72		0.36	0.15	0.32
		8.1			H-488	163.5	7.04	71	2.06	336.8	71.1	58.4
				93.6	500		7.97	63	2.4			
101 LINE	G-H				500	3230		49.72		0.28	0.15	0.14
		28.2			H-488	163.5	7.04	28	2.35	384.2	71.1	65.7
				74.2	200		7.97	25	2.4			
102 LINE	G-H				200	3230		49.72		0.19	0.15	0.43
		38.5			H-488	163.5	7.04	28	2.35	384.2	71.1	56.7
				115.4	200		7.97	25	2.4			
103 LINE	G-H				200	3230		49.72		0.30	0.15	0.68
		9.2			H-488			99	1.74	284.5	68.8	53.3
				90.0	700			88	2.13			
106 LINE	H-K				700					0.32	0.15	0.17
		35.6			H-488			28	2.35	384.2	71.1	55.9
				117.8	200			25	2.4			
108 LINE	G-H				200					0.31	0.15	0.64
OPE		39.3			H-488		7.04	32	2.33	381.0	71.1	71.1
				3.7					2.4			
A LINE	105-106				227					0.01	0.15	0.55
		26.6			H-488				2.33	381.0	71.1	71.1
				56.1					2.4			
F LINE	102-103				227					0.15	0.15	0.39
		11.3			H-488		7.04	32	2.33	381.0	71.1	65.7
				72.2	227		7.97	28	2.4			
	106-107				227					0.19	0.15	0.17

FORM 04

CHECK OF MEMBER (3)
GIRDER

X-AXIS $\frac{N}{N_Y} \le \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A\sigma_Y$

Y-AXIS $\frac{N}{N_Y} \le \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_Y$

$\frac{N}{N_r} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_l / M_e / M_s	Q_l / Q_e / Q_s	N_l / N_e / N_s	MEMBER / l_b / l_k	A / I / Z_{px}	I_{min} / i / Z_{py}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_Y	M_p / A_w / 2A	M_{pc} / M / M_{pc}
		1.7			H-500	114.2	4.33	157	0.87	95.9	27.7	19.9
				35.5	680		5.14	132	1.27			
H LINE	104-105				680	2180		46.8		0.37	0.20	0.09
		64.7			H-700	235.5	6.78	29	2.34	551.1	155.0	155.0
				82.2	200		7.87	25	2.4			
	107-108				200	6460		84.76		0.15	0.18	0.42
		23.8			H-488	163.5	7.04	28	2.35	389.2	71.1	55.9
				119.4	200		7.97	29	2.4			
K LINE	107-108				200	3230		49.72		0.31	0.15	0.43
		8.6			H-350	63.14	3.95	86	1.9	120.0	20.8	15.9
				42.3					2.4			
101 LINE	A-B				450	868		22.96		0.35	0.18	0.56
		25.5			※ H-488	163.5	7.04	85	1.92	313.9	71.1	59.2
				84.6					2.4			
	B-D				600	3230		49.72		0.27	0.15	0.43
		8.3			H-500	114.2	4.33	80	1.97	225.0	52.3	52.3
				44.3	350		5.14	68	2.4			
	F-G				350	2180		46.8		0.20	0.20	0.16
		5.1			H-488	163.5	7.04	71	2.06	336.8	72.5	68.0
				78.3	500		7.97	62	2.4			
	G-H				500	3230		49.72		0.23	0.15	0.07
		16.5			H-450	96.76	4.40	102	1.71	165.5	40.3	34.0
				42.5					2.4			
102 LINE	A-B				450	1680		37.98		0.26	0.24	0.49
		65.0			H-700	235.5	6.78	59	2.17	511.0	155.0	155.0
				85.0					2.4			
	B-D				400	6460		84.76		0.17	0.18	0.42
		16.5			H-450	96.76	4.40	102	1.71	165.5	40.3	20.1
				90.5					2.4			
103 LINE	A-B				450	1680				0.55	0.24	0.80
		13.6			H-450	96.76	4.40	125	1.33	128.7	40.3	30.3
				44.3					2.4			
	F-G				550					0.34	0.24	0.45
		29.6			H-500	114.2	4.33	127	1.29	147.3	52.3	41.7
				44.3					2.4			
106 LINE	F-G				550	2180				0.30	0.20	0.59

FORM 04

CHECK OF MEMBER (4)
GIRDER

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A\sigma_Y$

Y-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_Y$

$\frac{N}{N_Y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	M_l / M_e / M_s	Q_l / Q_e / Q_s	N_l / N_e / N_s	MEMBER l_b / l_k	A / I / Z_{PX}	I_{min} / i / Z_{PY}	λ_k / λ_b / A_w	f_c / f_b / f_s	N_Y / N / N_Y	M_P / A_w / 2A	M_{pc} / M / M_{pc}
		14.0			H-488	163.5	7.04	78	1.99	325.4	77.5	54.8
				123.0	550		7.97	69	2.4			
106 LINE	H-K				550	3230		49.72		0.38	0.15	0.26
		12.6			H-400	84.12	4.54	132	1.19	100.1	31.9	20.0
				45.3					2.4			
107 LINE	B-F				600	1330		29.9		0.45	0.17	0.63
		17.8			H-450	96.76	4.40	125	1.33	128.7	40.3	30.3
				44.3					2.4			
108 LINE	F-G				550	1680		37.98		0.36	0.24	0.59
		12.3			H-488	163.5	7.04	99	1.75	286.1	68.8	43.9
				127.3	700		7.97	88	2.13			
	H-K				700	3230				0.44	0.15	0.28
MEX		30.6			H-600	134.4	4.12	55	2.20	295.7	71.5	71.5
				8.8					2.4			
A LINE	101-102				227	2980		62.26		0.03	0.23	0.43
		45.0			H-588	192.5	6.85	33	2.33	448.5	107.8	107.8
				20.3					2.4			
	105-106				227	4490		65.76		0.05	0.17	0.42
		14.1			H-488	163.5	7.04	32	2.33	381.0	77.5	68.0
				86.4	227		7.97	28	2.4			
B LINE	102-103				227	3230				0.23	0.15	0.21
		5.3			H-488				2.33	381.0	77.5	66.3
				94.2	227				2.4			
	106-107				227					0.25	0.15	0.08
		19.5			H-488				2.33	381.0	77.5	68.9
				83.3	227				2.4			
G LINE	102-103				227					0.22	0.15	0.28
		39.4			H-488		7.04	28	2.35	384.2	77.5	50.4
				163.7	200		7.97	25	2.4			
	107-108				200					0.43	0.15	0.78
		37.6			H-588	192.5	6.85	42	2.28	438.9	107.8	107.8
				26.7	285		7.87	36	2.4			
H LINE	101-102				285	4490				0.06	0.17	0.35
		9.2			H-700	235.5	6.78	100	1.73	407.4	131.8	131.8
				68.0	680		7.87	86	2.04			
	109-105				680	6960				0.17	0.18	0.07

FORM 04

CHECK OF MEMBER (5)
GIRDER

X-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{2A}$ $M_{pc} = M_p$ $M_p = Z_p \sigma_Y$
$\frac{N}{N_Y} > \frac{A_w}{2A}$ $M_{pc} = 1.14\left(1 - \frac{N}{N_Y}\right) M_p$ $N_Y = A\sigma_Y$

Y-AXIS $\frac{N}{N_Y} \leq \frac{A_w}{A}$ $M_{pc} = M_p$ $N_{wy} = A_w \sigma_Y$
$\frac{N}{N_Y} > \frac{A_w}{A}$ $M_{pc} = \left\{1 - \left(\frac{N - N_{wy}}{N_Y - N_{wy}}\right)^2\right\} M_p$

LOCATION	DIR	Mj / Me / Ms	Qe / Qe / Qs	Ne / Ne / Ns	MEMBER / lb / lk	A / I / Zpx	imin / i / Zpy	λk / λb / Aw	fc / fb / fs	NY / N / NY	MP / Aw / zA	Mpc / M / Mpc
H-LINE	106-107	115.1			H-900	309.8	6.39	36	2.31	715.6	252.0	252.0
				56.0					2.4			
					227	10500		135.04		0.08	0.22	0.46
	107-108	65.9			H-900	235.5	6.78	29	2.34	551.1	155.0	130.8
				143.2					2.4			
					200	6460				0.26	0.18	0.50
K-LINE	106-107	59.0			H-700		6.78	33	2.33	548.7	155.0	155.0
				63.3					2.4			
					227					0.12	0.18	0.38
	201-202	98.8			H-800	267.4	6.62	30	2.34	625.7	199.8	180.4
				126.6					2.4			
					200	8240		104.72		0.20	0.20	0.55
	202-203	45.7			H-588	192.5	6.85	33	2.33	498.5	107.8	107.8
				63.3					2.4			
					227	4490				0.14	0.17	0.42
101 LINE	A-B	8.9			H-400	89.12	4.54	99	1.75	147.2	31.9	25.8
				42.3					2.4			
					450	1330				0.29	0.17	0.34
	B-D	15.8			H-600	139.4	4.12	146	0.97	130.4	76.5	51.4
				47.7					2.4			
					600	2980		62.26		0.37	0.23	0.31
	G-H	8.0			H-588	192.5	6.85	73	2.04	392.7	107.8	89.7
				107.1	500		7.87	64	2.4			
					500	4490				0.27	0.17	0.09
102 LINE	F-G	14.0			H-488	163.5	7.04	78	1.99	325.4	77.5	55.7
				118.8					2.4			
					550	3230				0.37	0.15	0.25
103 LINE	A-B	8.9			H-400	89.12	4.54	99	1.75	147.2	31.9	19.2
				90.5					2.4			
					450	1330				0.61	0.17	0.63
106 LINE	H-K	19.5			H-588	192.5	6.85	102	1.71	329.2	89.0	66.0
				95.8	700		7.87	89	1.87			
					700	4490				0.29	0.17	0.21
108 LINE	A-B	3.3			H-350	63.14	3.95	114	1.53	96.6	20.8	9.7
				56.6					2.4			
					450	868				0.59	0.18	0.39

FORM 04

NOTE : VL --- VERTICAL LOAD
CDL --- CRANE DEAD LOAD
CLL --- CRANE LIFTING LOAD
SL --- SEISMIC LOAD
CHL --- CRANE HORIZONTAL LOAD
PC --- PERMANENT CONDITIONS (VL+CLL)
TC --- TEMPORARY CONDITIONS (VL+CDL+CHL+SL)

TABLE FOR COLUMN BASE (1)
〔柱応力表〕

LOCATION	DIR	LEV.	VL N,t	VL M,tm	VL Q,t	CDL N,t	CDL M,tm	CDL Q,t	CLL N,t	CLL M,tm	CLL Q,t	SL N,t	SL M,tm	SL Q,t	CHL N,t	CHL M,tm	CHL Q,t	PC N,t	PC M,tm	PC Q,t	TC N,t	TC M,tm	TC Q,t	REMARKS
A-101																					-32.6			
208	Y		96.8			23.3		-0.2				-129.4		0.0	0.1		0.3				226.2			Y
102	X											441.0		63.3							-298.6		63.3	
207	Y		142.4			23.3		-0.2				-241.9		113.2	0.1		0.3				606.7		63.4	X
103	X											-491.0		63.3							-157.0		113.2	
206	Y		142.4			24.1		-0.1				-300.1		113.2	0.1		0.3							Y
104																								
205	Y		106.5			24.9		-0.3				-26.0		10.2	0.7		0.5							
105																								
204	Y		107.5			24.9		-0.3				-26.0		10.2	0.7		0.5							
106	X											491.0		63.3							615.4		63.3	X
203	Y		150.3			24.1		-0.1				-300.1		113.2	0.1		0.3							
107	X											-179.8		123.2							-1.3		123.2	
202	Y		173.5			28.3		0.0				-303.0		113.2	0.3		0.4				376.6		123.2	X
108	X											-266.2		59.9							-129.5		113.2	
201	Y		133.1			28.3		0.0				-192.4		113.2	0.3		0.4				504.8		113.2	Y
B-101																								
208			86.4			1.4		0.0				23.4		36.9	0.1		0.1							
102					11.9							208.4		86.4							-83.1		-74.5	
207			125.3			1.4		0.0				187.3		36.9	0.1		0.1				333.7		98.3	X
103					-11.9							-208.4		86.4							-129.9		74.5	X
206			79.4			0.9		0.0				279.1			0.2		0.0							
104																								
205			135.1																					
105																								
204			36.1																					
106					11.9							272.6		94.2							369.8		106.1	X
203			96.3			0.9		0.0				274.1			0.0		0.0							
107					-11.9							-272.6		94.2							416.2		106.1	X
202			193.6			0.0		0.0				194.1		36.9	-0.1		0.1							
108																								
			90.8			0.0		0.0				83.5		36.9	-0.1		0.1							
201																								
			82.8			0.0		0.0				83.5		36.9	-0.1		0.1							

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TC --- TEMPORARY CONDITIONS (VL+CDL+CHL+SL)

TABLE FOR COLUMN BASE (2)
[柱応力表]

LOCATION	DIR	LEV.	VL N,t	VL M,tm	VL Q,t	CDL N,t	CDL M,tm	CDL Q,t	CLL N,t	CLL M,tm	CLL Q,t	SL N,t	SL M,tm	SL Q,t	CHL N,t	CHL M,tm	CHL Q,t	PC N,t	PC M,tm	PC Q,t	TC N,t	TC M,tm	TC Q,t	REMARKS
D-101																					8.1		73.8	
208			89.3			0.2		0.3				-81.2		73.8	0.0		0.1				170.5			)Y
102																								
207			136.1			0.2		0.3				0		73.8	0.0		0.1				136.1		73.8	Y
107																								
202			135.1			0.1		0.0				0		73.8	-0.2		0.2							
108																								
			198.5			0.1		0.0				-90.6		73.8	-0.2		0.2				239.1		73.8	Y
201																								
			187.7			0.1		0.0				-90.6		73.8	-0.2		0.2							
F-101																					154.9		74.0	
208			81.1			0.4		-0.2				73.8		74.0	0.0		0.1				7.3		74.0	)Y
102					11.9							259.9		85.6							-126.0		73.7	
207			128.4			0.4		-0.2				-7.6		74.0	0.0		0.1				382.8		99.5	)X
103					-11.9							-259.9		85.6										
206			103.9			0.8		-0.2				-176.2		37.1	-0.3		0.1							
104																								
105																								
304																								
305			43.2																					
106					11.9							259.9		85.6							-179.0		73.7	X
			75.4			0.8		-0.2				-176.2		37.1	-0.3		0.1							
107					-11.9							-259.9		85.6										
202			160.6			1.0		-0.2				-96.2		74.0	-0.1		0.1							
108																								
			188.6			1.0		-0.2				-15.0		74.0	-0.1		0.1							
201																								
			179.7			1.0		-0.2				-15.0		74.0	-0.1		0.1							
203												-259.9		85.6										
			92.6			0.8		-0.2				-176.2		37.1	-0.3		0.1							

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TC --- TEMPORARY CONDITIONS (VL+CDL+CHL+SL)

TABLE FOR COLUMN BASE (3)
〔柱応力表〕

LOCATION	DIR	LEV.	VL N,t	VL M,tm	VL Q,t	CDL N,t	CDL M,tm	CDL Q,t	CLL N,t	CLL M,tm	CLL Q,t	SL N,t	SL M,tm	SL Q,t	CHL N,t	CHL M,tm	CHL Q,t	PC N,t	PC M,tm	PC Q,t	TC N,t	TC M,tm	TC Q,t	REMARKS
G-101																					-170.0		134.4	
208			181.1		-9.7	11.6		0.0				-351.1		144.1	-0.5		0.1				943.8		153.8	)Y
102					15.0							228.9		83.3										
207			300.9			11.6		0.0				-38.5		37.1	-0.5		0.1							
103					-15.0							-228.9		83.3										
206			373.7			10.0		0.1				-152.9		37.1	-0.6		0.0							
104																								
205			365.0			10.8		0.0				-317.4			-1.3		0.0							
105					14.9							228.9		83.3										
204			295.7			10.8		0.0				-80.1			-1.3		0.0							
106					-14.9							-228.9		83.3							44.3		68.4	×
203			273.2			10.0		0.1				202.2		37.1	-0.6		0.0							
107					30.3							259.6		163.7							641.1		194.0	×
202			381.5			12.6		0.1				68.4		37.1	-0.2		0.1							
108					-30.3							-259.6		163.7							729.8		187.6	×
201			465.2			12.6		0.1				-87.3		37.1	-0.2		0.1							
H-101																					-385.2		97.4	
208			79.5		9.7	1.2		0.0				464.7		107.1	0.3		0.0				544.2		116.8	)Y
102												371.4		63.3							-114.1		63.3	×
207			207.3			1.2		0.0				152.1			0.3		0.0							
103												-371.4		63.3							652.3		63.3	×
206			280.9			2.3		0.0				355.1			0.6		0.0							
104																								
205			305.4			2.4		0.0				343.4			0.6		0.0							
105												371.4		63.3										
206			231.8			2.9		0.0				189.9			0.6		0.0							
106												-371.4		63.3							709.8		63.3	×
			338.4		-16.5	2.3		0.0				-393.8		95.8	0.6		0.0				682.2		112.3	Y
107					50.8							474.1		193.2							995.1		194.0	×
202			521.0			1.0		0.0				136.7			0.0		0.0							
108					-50.8							-474.1		193.2							1.067.2		164.2	×
201			693.1			1.0		0.0				17.8			0.0		0.0							
203												371.4		63.3										
			371.8		-15.0	2.3		0.0				-343.8		95.8	0.6		0.0							

TABLE FOR COLUMN BASE (4)
〔柱応力表〕

NOTE : VL --- VERTICAL LOAD
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CHL --- CRANE HORIZONTAL LOAD
PC --- PERMANENT CONDITIONS (VL+CLL)
TC --- TEMPORARY CONDITIONS (VL+CDL+CHL+SL)

LOCATION	DIR	LEV.	VL			CDL			CLL			SL			CHL			PC			TC			REMARKS
			N,t	M,tm	Q,t	N,t	M,tm	Q,t	N,t	M,tm	Q,t	N,t	M,tm	Q,t	N,t	M,tm	Q,t	N,t	M,tm	Q,t	N,t	M,tm	Q,t	
K-106			147.8		16.5	0.2		0.0				121.0 343.8		63.3 95.8	0.3		0.0				-196.0 491.6		99.3 112.3	) Y
107			288.1			0.2		0.0				224.3		63.3	0.3		0.0				517.4		63.3	X
108			303.6			0.2		0.0				-219.0 100.0			0.3		0.0				-517.6			X
201			289.8			0.2		0.0				89.6 100.0			0.3		0.0							
202			248.7			0.2		0.0				-99.9		63.3	0.3		0.0							
203			178.9		15.0	0.2		0.0				-121.0 343.8		63.3 95.8	0.3		0.0							

285

282

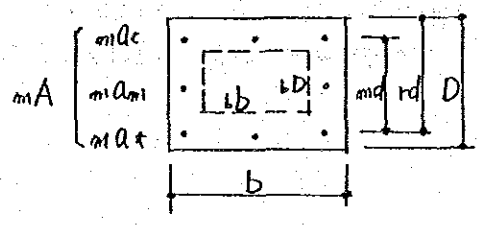
CHECK OF COLUMN BASE (1)
(柱脚の検討)

LOCATION		A-102		G-108 A-107	
COLUMN SIZE		BH-900×350×28×40		BH-900×400×28×40	
DIRECTION		X	＋X	X	Y
LOAD CONDITIONS	M (tm)	31.7	31.7	93.8	
	N (t)	-298.6	606.7	724.8	-129.5
	Q (t)	63.3	63.3	187.6	113.2
FIGURE		TYPE-1A 26-#8 (D25)		TYPE-2A, 2B 26-#8 (D25)	
BASE PLATE bb × bD		1300×700		1300×700	
ANCHOR BOLT n-Dφ		8-30φ		8-35φ	
aA (cm²)		56.55		76.96	
cru=0.85-2.5 sPc		0.828		0.825	
REINFORCEMENT b × D		1600×1000		1600×1000	
md, rd		900, 950		900, 950	1500, 1550
maₘ, maₜ, mA(cm²)		31.78, 35.75, 103.30		31.78, 35.75, 103.30	27.81, 23.83, 103.30
N<0	aNtu = aA·aσy	56.55×1.8 = 101.8		76.96×1.8 = 138.5	
	mNu = N+aNtu	-196.8		8.9 > 0 ok	
	mMu > M	0.9×{35.75×3.0+½×(-196.8+31.78×3.0)}			
	=md·{maₜ·mσy+½(maNu+maₘaₘ·aσy)}	= 50.8 > 31.7 ok			
N≥0	bNcu=bb·bD·0.85·Fc	130×70×0.85×0.21		130×70×0.85×0.21	
	>N	= 1.624 > 606.7 ok		= 1.624 > 724.8 ok	
	cMcy = md·maₜ·mσy	0.9×35.75×3.0 = 96.5			
	mMcu=(bD²-bb·bD²)Fc·cru/8				
	cMcu+mMcu > M	> 31.7 ok		96.5 > 93.8 ok	
Q	sQu=0.5N+¾·aA·0.25·aσy	¾×56.55×0.25×1.8 = 19.1			
	rQu=(b-bb)×⅞·rd·2Fs	(160-130)×⅞×95×2×0.032=159.6			
	sQu+rQu > Q	178.7 > 63.3 ok			
REMARKS					

NOTATION

Fs = min(0.15 Fc, 22.5+4.5 Fc/100)

sPc = compression area of steel / bD



FORM 04

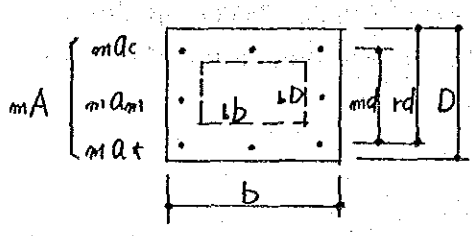
CHECK OF COLUMN BASE (2)
(柱脚の検討)

LOCATION		D-101		H-101	
COLUMN SIZE		H-300² x 10 x 15		H-400² x 13 x 21	
DIRECTION		X	Y	*Y	Y
LOAD CONDITIONS	M (tm)	22.1		35.0	29.2
	N (t)	170.5 (81)		544.2	-385.2
	Q (t)	73.8		116.8	97.4
FIGURE		TYPE-3A 14-#8		TYPE-6S 24-#8	
BASE PLATE bb x bD		700x350		700x700	
ANCHOR BOLT n-Dφ		4-25φ		8-35φ → 8-40φ	
aA (cm²)		19.63		100.53	
cηu = 0.85 - 2.5 sPc		0.832		0.829	
REINFORCEMENT b x D		1000 x 650		1000 x 1000	
md, rd		550, 600		900, 950	
mam, mat, mA(cm²)		15.89, 19.86, 55.6		39.73, 27.81, 95.35	
N<0	aNtu = aA·aσy			100.53 x 1.8 = 181.0	
	mNu = N + aNtu			-385.2 + 181.0 = -209.2	
	mMu > M			0.9 x {27.81 x 3.0 + 1/2 (-209.2 + 39.73 x 3.0)}	
	= md·{mat·mσy + 1/2 (mNu + maminσy)}			= 36.83 > 29.2 OK	
N≥0	bNcu = bb·bD·0.85·Fc	70 x 35 x 0.85 x 0.21		70 x 70 x 0.85 x 0.21	
	> N	= 437.3 > 170.5 OK		= 874.7 > 544.2 OK	
	cMcu = md·mat·mσy	0.55 x 19.86 x 3.0 = 32.8 > 22.1 OK		0.9 x 27.81 x 3.0 = 75.1 > 35.0	
	mMcu = (bD² - bb·bD²) Fc·cηu/8				
	cMcu + mMcu > M				
Q	sQu = 0.5N + 2/3·aA·0.25·aσy	2/3 x 19.63 x 0.25 x 1.8 = 6.63		2/3 x 100.53 x 1.25 x 1.8 = 33.9	
	rQu = (b - bb) x 7/8 rd·2Fs	30 x 7/8 x 60 x 2 x 0.032 = 100.8		30 x 7/8 x 95 x 2 x 0.032 = 159.6	
	sQu + rQu > Q	6.63 + 100.8 = 107.4 > 73.8		193.5 > 116.8 OK	
REMARKS					

NOTATION

Fs = min(0.15 Fc , 22.5 + 4.5 Fc/100)

sPc = Compression area of steel / bD



FORM 04

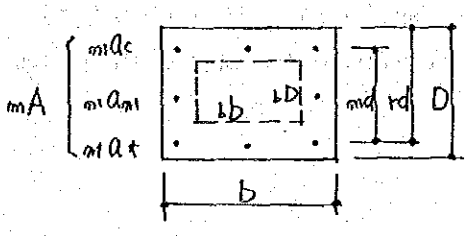
CHECK OF COLUMN BASE (3)
(柱脚の検討)

LOCATION		B-103 , 107		H-103	
COLUMN SIZE		H-350²×12×19		BH-450²×16×25	
DIRECTION		X	半X	X	Y
LOAD CONDITIONS	M (tm)	22.4	31.8	19.0	
	N (t)	-129.0	416.2	652.3	
	Q (t)	74.5	106.1	63.3	
FIGURE		TYPE-S4 12-#8		TYPE-H6 18-#8	
BASE PLATE bb×bD		750×400		750×700	
ANCHOR BOLT n-Dφ		4-25φ		8-25φ	
aA (cm²)		19.63		39.27	
cru=0.85-2.5 sPc		0.827		0.823	
REINFORCEMENT b×D		1050×200		1050×1000	
md, rd		600, 650		900, 950	
mam, mat, mA(cm²)		31.78, 15.89, 63.57		31.78, 19.87, 71.57	
N<0	aNtu=aA·aσy	19.63×1.8=35.3			
	mNu=N+aNtu	-129.0+35.3=-93.7			
	mMu > M	$0.6\times\{15.89\times3.0+\frac{1}{2}(-93.7+31.78\times3.0)\}$			
	=md·{mat·mσy+½(mNu+mam·mσy)}	=29.09 > 22.4 ok			
N≥0	bNcu=bb·bD·0.85·Fc	75×40×0.85×0.21		75×70×0.85×0.21	
	> N	=535.5 > 416.2 ok		=937.1 > 652.3 ok	
	cMcu=md·mat·mσy	0.6×15.89×3.0=28.6		0.9×19.87×3.0=53.6 > 19.0	
	mMcu=(bD²-bb·bD²)Fc·cru/8	$(1.05\times70^2-0.75\times40^2)\times0.21\times0.827/8=85.6$			
	cMcu+mMcu > M	114.2 > 31.8 ok			
Q	sQu=0.5N+¾·aA·0.25·aσy	$\frac{3}{4}\times19.63\times0.25\times1.8=6.62$		0.5×652.3=326.2 > 63.3 ok	
	rQu=(b-bb)×⅞rd·2Fs	$30\times\frac{7}{8}\times65\times2\times0.032=109.2$			
	sQu+rQu > Q	115.8 > 106.1 ok			
REMARKS					

NOTATION

Fs=min(0.15 Fc, 22.5+4.5 Fc/100)

sPc = compression area of steel / bD



FORM 04

CHECK OF COLUMN BASE (4)
(柱脚の検討)

LOCATION		H-106		H-108	
COLUMN SIZE		H-516×500×22×40		H-516×500×22×40	
DIRECTION		X	Y	X	Y
LOAD CONDITIONS	M (tm)	19.0	33.7	49.3	
	N (t)	709.8	682.2	1,067.2	
	Q (t)	63.3	112.3	164.2	
FIGURE		TYPE-B7 20-#8		TYPE-F8 24-#8	
BASE PLATE	bb × bD	700×916		916×1100	
ANCHOR BOLT	n-DΦ	8-25Φ		8-25Φ	
	aA (cm²)	39.27		39.27	
cru=0.85-2.5 sPc		0.809		0.821	
REINFORCEMENT	b × D	1000×1216		1216×1400	
	md, rd	1116, 1166		1300, 1350	
	maml, mat, mA(cm²)	39.73, 19.86, 79.46		39.73, 27.81, 95.35	
N<0	aNtu = aA·aσy				
	mNu = N+aNtu				
	mMu > M				
	=md·{maℓt+maℓy+½(mNu+maℓml+aℓy)}				
N≥0	bNcu = bb·bD·0.85·Fc	700×916×0.85×0.21		916×1100×0.85×0.21	
	>N	=1,144.5 > 682.2		=1,798 > 1,067.2	
	cMcu = md·mat·mσy	1,116×19.86×3.0=66.5>33.7 ok		1300×27.81×3.0=108.5>49.3 ok	
	mMcu = (bD²-bb·bD²)Fc cru/8				
	cMcu+mMcu > M				
Q	sQu = 0.5N+¾·aA·0.25·aσy	0.5×682.2=341.1 > 112.3 ok		0.5×1067.2=533.6 > 164.2 ok	
	rQu = (b-bb)×⅞ rd·2Fs				
	sQu+rQu > Q				
REMARKS					

NOTATION

Fs = min(0.15 Fc, 22.5+4.5 Fc/100)

sPc = (compression area of steel / bD