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JIUN MASUDA
CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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CALCULATIONS FOR

三重県指定文化財
上野工事計画書

JIUN MASUDA
CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

MADE BY J. Masuda DATE 5-6-20 FILE NO
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CALCULATIONS FOR

Design of Hi-nagara-gawa-Bashi for Mieken

The total length of the new bridge is 1105.70 meters (608 ken about) between parapet walls of both abutments. Said total length is divided into 15 equal spans of 72.80 meters (240 R or 40 ken) between end bearings under the careful study of economic span length for this bridge.

The width of roadway is 7.5 mitre wide clear between curb lines, paved with asphaltic block on reinforced concrete slab.

The handrails throughout the bridge are made of cast iron and the pedestals and handrails at entrance over both abutments are of cut stone and ornamental design.

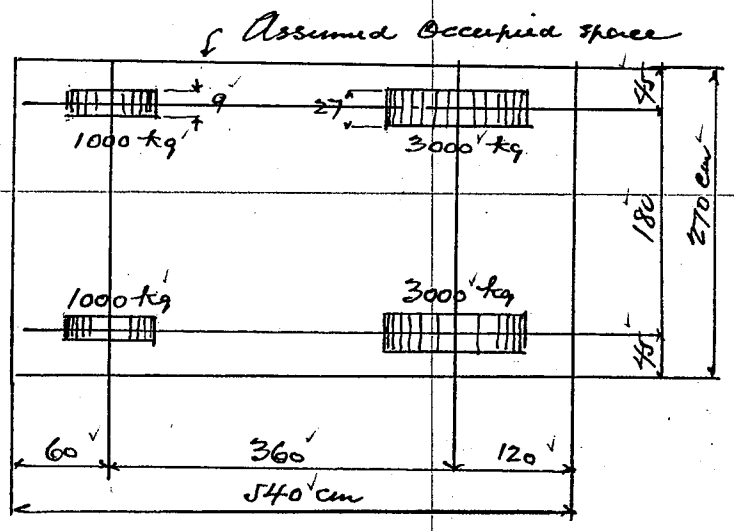
The findings of borings at the bridge site and also at the railway bridge upstream show the layer of fine sand at top ground and then clay soil of low bearing power until the firm sand is reached at a depth of 55 meters below ground line. It is impossible to sink the piers such a depth with the present practice of caisson sinking. Most practical method, therefore, in this case is to use pneumatic process and carry the pier enough depth to get side friction and spread base to ashure the designed safety.

Assumed loadings

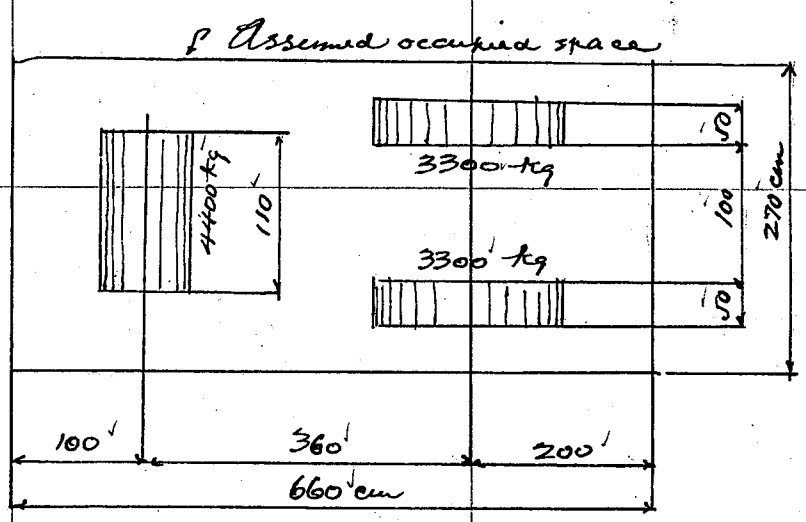
Uniform load on roadway $w = \frac{100\,000}{170+l} \leqq 500\ kg/m^2$

where w = uniform load in kg per sq meter
l = span length in meter

8 ton motor truck loading



11 ton Road Roller loading



2 lines of motor traffic on roadway with occupied width of 270 cm each; unoccupied space around the motor trucks shall be filled with uniform load specified above.

One road roller on one span assumed

Impact for motor truck loading Coef $= \frac{20}{60+l}$

where l = loaded length in meter
max impact 30%

No impact for motor bus, road roller and uniform live load.

Allowable working Strength

Concrete 1:2:4 mixture

Direct compression	35 kg/cm²
Fibre stress due to bending	45 "
Combined stresses due to direct and bending (compression)	35 "
Punching Shear of Concrete	9 "

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CONSULTIEG ENGINEER
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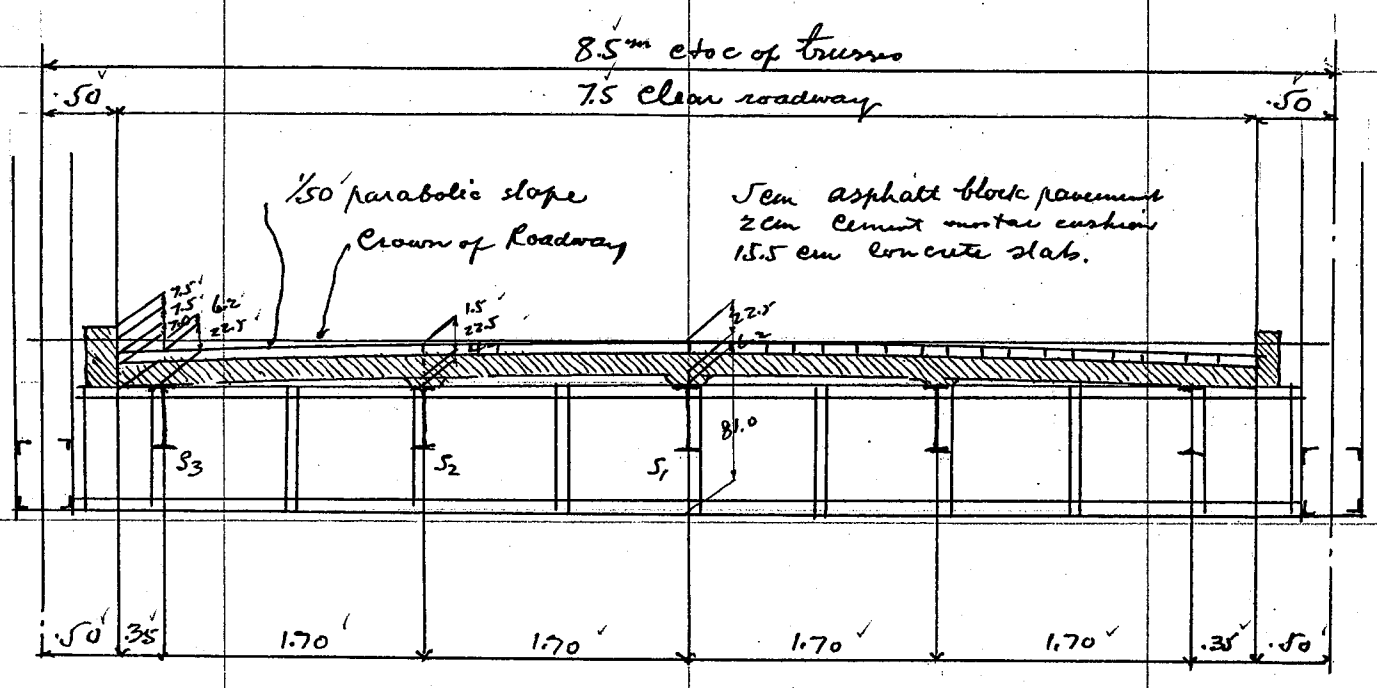
CALCULATIONS FOR

Design of Hoi-Nagara-Gawa Bashi for Mie-ken

Shear of plain Concrete	4	kg/cm²
Bearing value	45	"
Bond stress for plain bars	6	"
" " " deformed bars	9	"
Reinforcing Bars		
Tension or compression	1200	kg/cm²
Shearing strength	900	"
Structural Steel		
Tension net	1200	kg/cm²
Extreme fibre stress net	1200	"
Shear of web gross section	900	"
Compression member		
$1500\left(1-0.0055\frac{l}{r}\right)$ not over	1000	"
where l = length of member in cm		
r = least radius of gyration in cm		
Compression Flange of Girder		
$1200\left(1-0.012\frac{l}{b}\right)$ not over	1100	"
where l = Unsupported length of flange in cm		
b = width of flange in cm		
Shear on Shop driven rivets (machine driven)	850	"
" " field " " and turned bolts (machine driven	750	"
Shear on pin	900	"
Bearing on shop driven rivets (machine driven)	1700	"
" " field " "	1500	"
" " pin	1800	"
Roller	45d kg/cm where d = diameter of roller in cm	

Considering wind or temperature stress in addition to dead, live and impact stresses the allowable working strength shall be increased 25%; in case of earthquake increase working strength by 60%
Seismic acceleration assumed as 3000 mm per sec² or $k = 0.30$

Cross section of bridge assumed as shown on Sketch below.



Scale 1:50

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CONSULTIEG ENGINEER
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CALCULATIONS FOR

Design of Ibi-Nagara-Bashi for Mieken

Floor Slab. span length 1.70 ✓ meters

Dead Load

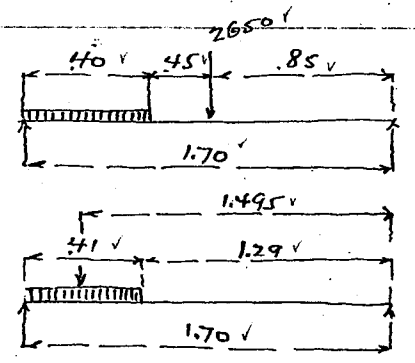
5cm Asphalt Block Pavement	@	21 ✓ kg	=	105 ✓
2 cm Cement mortar cushion	@	17 ✓ "	=	34 ✓
15.5 cm reinforced Concrete slab	@	24 ✓ "	=	372 ✓
Miscellaneous fillets etc	say			9 ✓
				520 ✓ kg/m²

Dead Load Moment ✓ = $\frac{1}{10} \times 520 \times 1.70^{2}$ ✓ = 150 ✓ kgm
Dead Load Shear ✓ = $\frac{1}{2} \times 520 \times 1.70$ ✓ = 442 ✓ kg.

Live Load motor truck rear wheel concentration 3000 ✓
Impact 30% ✓ 900 ✓
3900 ✓ kg

Distribution of wheel concentration on Slab.
Longitudinal distribution a = Contact between wheel and pavement 20 cm ✓
Distribution 2.7 ✓ 14 ✓
34 ✓

Transverse distribution b = 27 ✓ + 2.7 ✓ = 41 ✓ cm
Effective width E = $\frac{2}{3}l + a$ ✓ = $\frac{2}{3} \times 1.70$ ✓ + .34 ✓ = 1.47 ✓ meters



Load per meter strip 3900 ✓ ÷ 1.47 ✓ = 2650 ✓ kg
Uniform live load 500 ✓ kg per square meter
motor truck loading

$m = \frac{2650}{2}$ ✓ × .85 ✓ = 1125 ✓
uniform load $\frac{500 \times 1.4^{2}}{2 \times 1.70}$ ✓ × 0.85 ✓ = 20 ✓
1145 ✓ kgm

For Continuity of slabs moment reduced to 1145 × 0.8 ✓ = 915 ✓ kgm

End shear per meter strip assumed as 2650 × $\frac{1.495}{1.70}$ ✓ = 2330 ✓ kg

Summary for moments and shears

	Moment	Shear
Dead Load	150 ✓	442 ✓
Live Load	915 ✓	2330 ✓
	1065 ✓ kgm	2772 ✓ kg.

add for moment
of live load

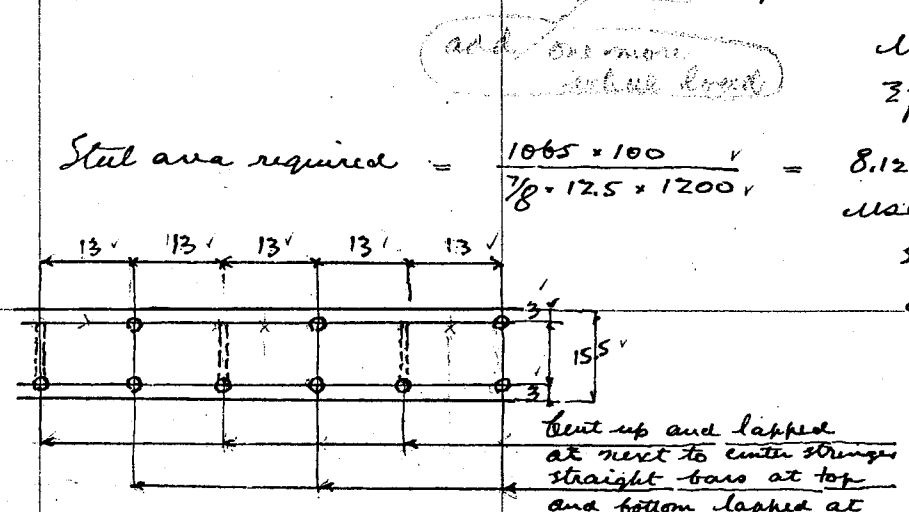
Effective depth required for f_c = 45 and f_s = 1200 kg/cm²

$R = \frac{M}{bd^{2}}$ $d = \sqrt{\frac{M}{bR}}$ ✓ where R = 7.18 ✓

$d = \sqrt{\frac{1065 \times 100}{100 \times 7.18}}$ ✓ = 12.2 ✓ cm

Use 15.5 cm ✓ slabs with 3 ✓ cm insulation
Effective depth 15.5 − 3.0 ✓ = 12.5 ✓ cm

Steel area required = $\frac{1065 \times 100}{7/8 \times 12.5 \times 1200}$ ✓ = 8.12 ✓ cm² per meter strip.



use 12 mm ϕ plain bars 13 cm etc = 8.7 ✓ cm²/m

Stresses in Concrete and Steel reinforcement as double reinforcement

d = 12.5 ✓ d' = 3.0 ✓ d'/d = .24 ✓

tensile steel .113 × $\frac{100}{13}$ ✓ = 8.70 ✓ a cm per meter

Steel % $\frac{8.7}{1250}$ ✓ = 0.696 ✓ %
Compressive steel 0.348 ✓ %

k = .35 about

$f_c = \frac{106500}{.183 \times 100 \times 12.5^{2}}$ ✓ = 37.3 ✓ kg/cm²

$f_s = \frac{106500}{0.006 \times 100 \times 12.5^{2}}$ ✓ = 1138 ✓ kg/cm²

Unit shearing strength = $\frac{2772}{7/8 \times 100 \times 12.5}$ ✓ = 2.54 ✓ kg/cm²

Unit bond stress

Total perimeter of bars in bond

main bars	7.70 ✓ ×	3.77 ✓ =	29.0 ✓
lapped bars	3.85 ✓ ×	3.77 ✓ =	14.5 ✓
			43.5 ✓

Unit bond = $\frac{2772}{43.5 \times 7/8 \times 12.5}$ ✓ = 5.8 ✓ kg/cm²

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CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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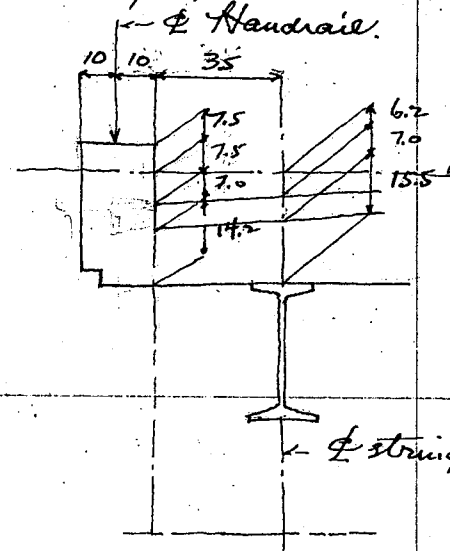
CALCULATIONS FOR

Design of Hoi-Nagara Bashi for Nieken

Overhanging slab beyond end stringer



Dead Load

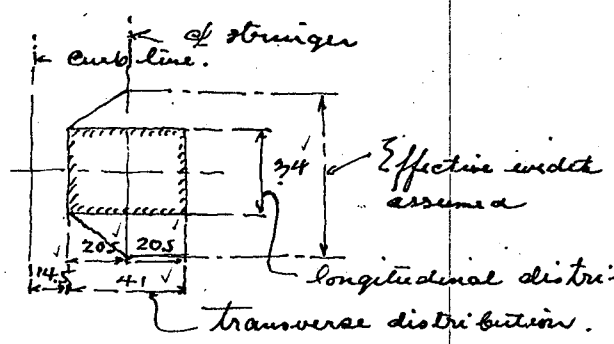
			weight	arm	moment
coping			173 ✓	× .45 ✓ =	77.8 ✓
slab and pavement	0.35 × 520 ✓ =		182 ✓	× .175 ✓ =	31.8 ✓
Handrail assumed			80 ✓	× .45 ✓ =	36.0 ✓
			435 ✓ kg		145.6 ✓
Extra	145.6 ÷ 1.70 ✓ =		86 ✓		
			521 ✓ kg.		

Live Load Uniform 500 kg per sq meter

moment due to Unif. load	500 × 3.5² / 2 ✓	=	31.0 ✓
Shear Force at top rail	50.0 × 1.20 ✓	=	60.0 ✓
			91.0 ✓ kg meter

Live Load motor truck loading rear wheel assumed on ℄ stringer

Rear wheel Concentration	3000 ✓	
impact 30%	900 ✓	
	3900 ✓ kg	



Effective width assumed 2/3 × 20.5 ✓ + .34 ✓ = .47 ✓ meter

Load per meter strip = 3900 / .47 = 8300 kg.

Load on overhanging arm 8300 ÷ 2 ✓ = 4150 ✓ kg.

moment = 4150 ✓ × 0.1025 ✓ = 425 ✓ kgm

Summary for moments and shears

	moment	shear
Dead Load	146.0 ✓	435 ✓
Live Load	425.0 ✓	4150 ✓
	571.0 ✓ kgm	4585 ✓ kg.

Steel area reqd = 57100 ✓ / 7/8 × 12.5 × 1200 = 4.35 ✓ cm² per meter

Unit shear = 4585 ✓ / 7/8 × 12.5 × 100 = 4.2 ✓ kg/cm²

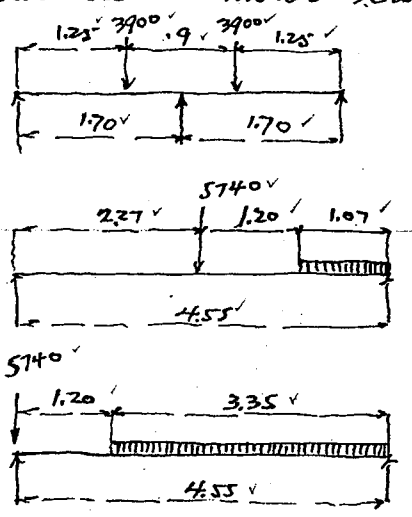
Use 15.5 ✓ cm slab with same reinforcement.

Design of Stringers S1 and S2 span length 4.55 ✓ meters spacing 1.70 ✓ meters

Dead Load

floor slab and pavement	520 × 1.7 ✓ =	885 ✓	
beam assumed		75 ✓	
		960 ✓ kg per lin. meter	
Dead Load Moment	= 1/8 × 960 × 4.55² ✓ =	2490 ✓ kgm	
Dead Load Shear	= 1/2 × 960 × 4.55 ✓ =	2180 ✓ kg.	

Live Load motor truck loading Reaction due to rear wheel Concentration 2 × 3900 ✓ × 1.25 ✓ / 1.70 ✓ = 5740 ✓ kg.



Uniform live load 500 × 1.7 ✓ = 850 ✓ kg per lin. meter

Reaction	motor truck	5740 ÷ 2 ✓	2870 ✓
	Uniform load	850 × 1.07² ✓ / 2 × 4.55 =	107. ✓
			2977 ✓ kg.
Moment at Center of Span	= 2977 × 2.27 ✓ =		6760 ✓ kgm
End shear	Unif. load	850 × 3.35² / 2 × 4.55 ✓ =	1050 ✓
	motor truck		5740 ✓
			6790 ✓ kg.

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CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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CALCULATIONS FOR

Design of Obi-Nagara-Gawa Bashi for Mie Ken.

Summary for moments and shears

	moment	shear
Dead Load	2490 ✓	2180 ✓
Live Load	6760 ✓	6790 ✓
	9250 ✓ kgm	8970 ✓ kg

Section modulus req'd = $\frac{925000}{1100}$ ✓ = 840. ✓

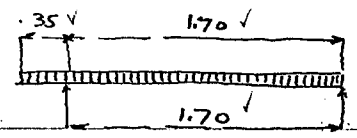
use I beam 350×150×9 ✓ @ 58.54 ✓ kg
section modulus 870.6 ✓

Design of End Stringer S_3 span length 4.55 ✓ meters spacing 1.70 ✓ meters
Dead Load

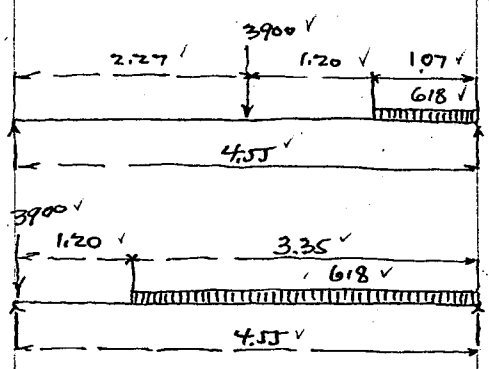
Floor and pavement between S_2 and S_3 520 × 0.85 ✓ = 442 ✓
overhanging slab pavement coping & Handrail 521 ✓
beam assumed 62 ✓
1025 ✓ kg per meter

Dead Load moment = ⅛ × 1025 × 4.55² ✓ = 2660 ✓ kgm
Dead Load Shear = ½ × 1025 × 4.55 ✓ = 2330 kg.

Live Load Rear wheel directly on Stringer assumed with impact 3900 ✓ kg
Uniform live load



$\frac{500 \times 2.05^2}{2 \times 1.70}$ ✓ = 618 ✓ kg per lin. meter



Reaction
uniform load $\frac{618 \times 1.07^2}{2 \times 4.55}$ ✓ = 78 ✓
wheel load 3900 ÷ 2 ✓ = 1950 ✓
2028 ✓ kg.

Moment = 2028 × 2.27 ✓ = 4600 ✓ kgm
End shear
uniform load $\frac{618 \times 3.35^2}{2 \times 4.55}$ ✓ = 762 ✓
wheel load 3900 ✓
4662 ✓ kg

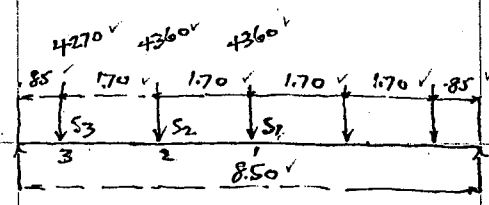
Summary for moments and sheers

	moment	shear
Dead Load	2660 ✓	2330 ✓
Live Load	4600 ✓	4662 ✓
	7260 ✓ kgm	6992 ✓ kg.

Section modulus req'd = $\frac{726000}{1100}$ ✓ = 660.0 ✓

use I beam 350.150×9 @ 58.54 ✓ kg
section modulus 870.6 ✓
unit stress = $\frac{726000}{870.6}$ ✓ = 835 ✓ kg/cm²

Intermediate Floor Beam span length 8.50 ✓ meters spacing 4.55 ✓ meters



Stringer concentration
" "

S_1 or S_2 2 × 2180 ✓ = 4360 ✓ kg.
S_3 without cantilever effect
overhang 435 ✓
Slab & pavement 442 ✓
beam assumed 62 ✓
939 ✓ × 4.55 ✓ = 4270 ✓ kg.

Reaction or End Shear 4360 × 1.5 ✓ = 6540 ✓
4270 ✓
10810 ✓ kg.

moment at center (1)
10810 ✓ × 4.25 ✓ = 45950 ✓
4360 ✓ × 1.7 ✓ = − 7410 ✓
4270 ✓ × 3.4 ✓ = − 14510 ✓
24030 ✓ kgm

moment at panel Point (2)
10810 ✓ × 2.55 ✓ = 27550 ✓
4270 ✓ × 1.7 ✓ = − 7250 ✓
20300 ✓ kgm

moment at panel Point (3)
10810 ✓ × 0.85 ✓ = 9190 ✓ kgm

60

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CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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CALCULATIONS FOR

Design of Ibi-Nagara-Gawa Bashi for Mieken.

Dead Load of floor beam assumed 200 ✓ kg per lin. meter

End reaction $\frac{1}{2} \cdot 200 \cdot 8.5$ ✓ = 850 ✓ kg.

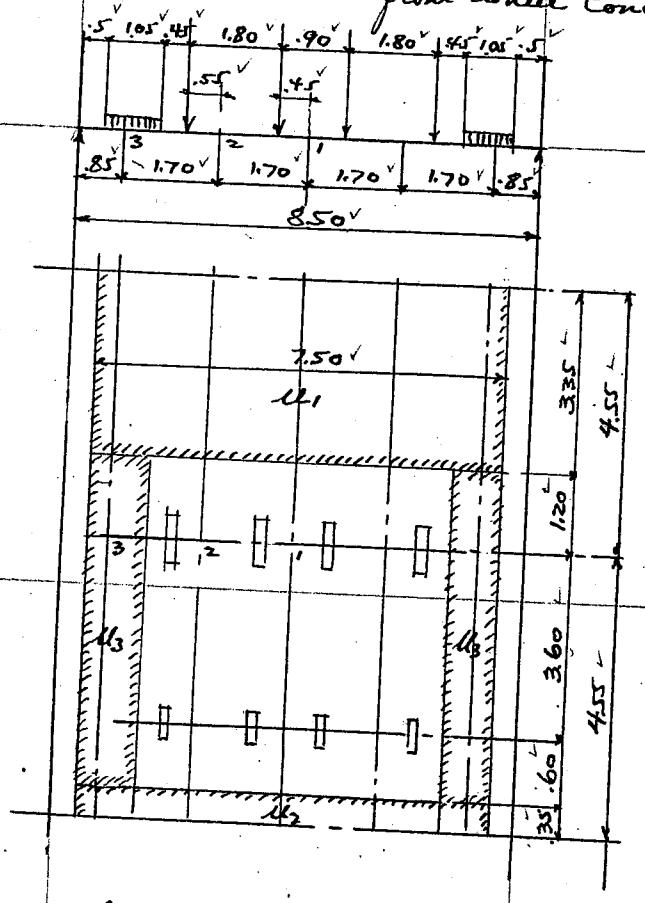
Moment at center (1) ✓ $\frac{1}{8} \cdot 200 \cdot 8.5^2$ ✓ = 1800 ✓ kgm
Moment at 2 ✓ $\frac{200}{2}$ ✓ × 2.55 ✓ · 5.95 ✓ = 1520 ✓ "
Moment at 3 ✓ $\frac{200}{2}$ ✓ · 0.85 ✓ · 7.65 ✓ = 650 ✓ "

Summary for moments and shears (Dead Load only).

	mat 3	mat 2	mat 1	End shear
Stringer concentration	9190 ✓	20300 ✓	24030 ✓	10810 ✓
weight of floor beam	650 ✓	1520 ✓	1800 ✓	850 ✓
	9840 ✓	21820 ✓	25830 ✓	11660 ✓

Live Load Motor truck loading rear wheel concentration 3000 ✓
impact assumed 30% 900 ✓
3900 ✓ kg

Front wheel Concentration with impact say 3900÷3 ✓ = 1300 ✓ "



Uniform live load 500 kg per square meter
motor truck rear wheels directly on floor beam; front wheels and uniform live load through stringers concentrated to floor beam assumed

Reaction on stringer connections due to front wheel of motor truck.

R On floor beam 1300 ✓ · $\frac{.95}{4.55}$ ✓ = 272. ✓ kg.

at ① 272 ✓ · $\frac{1.25}{1.70}$ ✓ · 2 ✓ = 400 ✓ kg

at ② 272 ✓ · $\frac{4.5}{1.70}$ ✓ = 72 ✓
272 ✓ · $\frac{1.15}{1.70}$ ✓ = 184 ✓
256 ✓ kg.

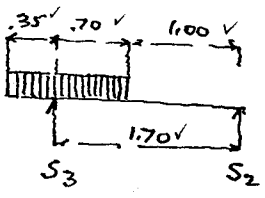
at ③ 272 ✓ · $\frac{.55}{1.70}$ ✓ = 88 ✓ kg.

Full uniform load at front and rear of motor trucks

U_1 ✓ 500 ✓ · $\frac{3.35^2}{2 \cdot 4.55}$ ✓ = 615 ✓
U_2 ✓ 500 ✓ · $\frac{.35^2}{2 \cdot 4.55}$ ✓ = 7 ✓
622 ✓ Reaction on floor beam

Load on stringer connections
at 1 and 2 622 ✓ · 1.70 ✓ = 1060 ✓ kg
at 3 622 ✓ · (.85 ✓ + .35 ✓) = 745 ✓ kg assumed

Uniform load on sides of motor trucks U_3.
1 meter strip load on floor beam



load on stringer S_3 500 ✓ · 1.2 ✓ · $\frac{3.95}{4.55}$ ✓ = 521 ✓
500 ✓ · 4.2 ✓ · $\frac{2.45}{4.55}$ ✓ = 1130 ✓
1651 ✓ kg

load on stringer S_2 1651 ✓ · .35 ✓ = 577 ✓ assumed
1651 ✓ · .70 · $\frac{1.35}{1.70}$ ✓ = 916 ✓
1493 ✓ kg.

load on stringer S_2 1651 ✓ · .70 ✓ · $\frac{.35}{1.70}$ ✓ = 238 ✓ kg.

Summary for loads on stringer connections

	Stringer S_3	Stringer S_2	Stringer S_1
motor truck front wheel	88 ✓	256 ✓	400 ✓
Uniform load rear and front of motor truck	745 ✓	1060 ✓	1060 ✓
Uniform load on sides of motor truck	1493 ✓	238 ✓	
	2326 ✓	1554 ✓	1460 ✓

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CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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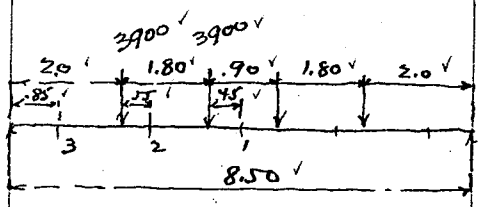
CALCULATIONS FOR

Design of Hei Nagara Gawa Bashi for Mieken

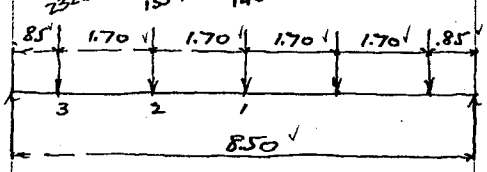
Moment due to rear wheels of motor truck



Reaction 7800

Moment at center	7800 ✓ × 4.25 ✓ =	33200 ✓	
	3900 ✓ × 2.70 ✓ =	− 10540 ✓	
			22660 ✓ kgm
Moment at 2	7800 ✓ × 2.55 ✓ =	19900 ✓	
	3900 ✓ × .55 ✓ =	− 2140 ✓	
			17760 ✓ kgm
Moment at 3	7800 ✓ × .85 ✓ =		6625 ✓ "

Moment due to front wheels of motor trucks and Uniform live loads

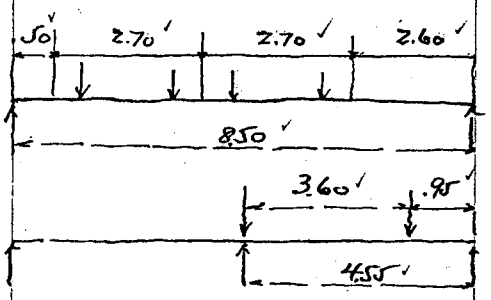


Reaction 2326 ✓
1554 ✓
730 ✓
4610 ✓ kg.

Moment at center	4610 ✓ × 4.25 ✓ =	19600 ✓	
	1554 ✓ × 1.70 ✓ =	− 2640 ✓	
	2326 ✓ × 3.40 ✓ =	− 7910 ✓	
			9050 ✓ kgm
Moment at 2	4610 ✓ × 2.55 ✓ =	11760 ✓	
	2326 ✓ × 1.70 ✓ =	− 3950 ✓	
			7810 ✓ kgm
Moment at 3	4610 ✓ × 0.85 ✓ =		3920 ✓ "

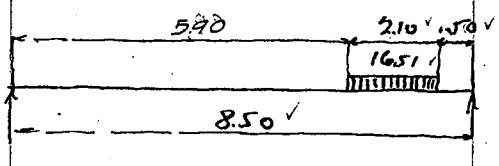
End shear.

motor truck loading



Front wheel	1300 ✓ × .95 ✓ / 4.55 ✓ =	272 ✓
Rear wheel		3900 ✓
		4172 ✓ kg.
For 2 trucks	4 ✓ × 4172 ✓ =	16688 ✓ kg
End reaction =	16688 ✓ × 5.30 ✓ / 8.50 ✓ =	10400 ✓ kg.

Uniform live load M_1 and M_2 622 ✓ kg per lin. meter



End reaction = 622 ✓ × 7.5 ✓ / 2 = 2330 ✓ kg.

Uniform live load on side of motor truck 1651 ✓ kg per meter

End reaction = 1651 ✓ × 2.10 ✓ × 1.55 ✓ / 8.50 ✓ = 634 ✓ kg

Summary for End shears.

motor truck loading	10400 ✓
Uniform load	2330 ✓
Uniform load	634 ✓
	13364 ✓ kg.

Summary for Live load moments

	Stringer 3	Stringer 2	Stringer 1
motor truck rear wheel	6625 ✓	17760 ✓	22660 ✓
front wheel & Uniform load	3920 ✓	7810 ✓	9050 ✓
	10545 ✓	25570 ✓	31710 ✓

Summary for moments and shears

	Moment at Stringer 3	Moment at Stringer 2	Moment at Stringer 1	End shear
Dead Load	9840 ✓	21820 ✓	25830 ✓	11660 ✓
Live Load	10545 ✓	25570 ✓	31710 ✓	13364 ✓
	20385 ✓	47390 ✓	57540 ✓ kgm	25024 ✓ kg.

JIUN MASUDA
CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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CALCULATIONS FOR

Design of Ibi-Nagara-Gawa Badai for Mieken

Section of Intermediate floor beam

Ivy web plate 800 × 9 ✓ = 72.0 □cm ✓ 1/8 web = 9.0 ✓ □cm back to back of Ls 81.0 ✓ cm

Flange	2 Ls 125×90×10 ✓ =	41.0 ✓ − 8.8 ✓ = 32.2 ✓	@ 2.22 ✓ =	91.0 ✓
	1 Pl 280 × 9 ✓ =	25.2 ✓ − 4.0 ✓ = −21.2 ✓	@ 0.45 ✓ =	−11.3 ✓
		66.2 ✓ 53.4 net		79.7 ✓

℄ gravity $\frac{79.7}{66.2}$ ✓ = 1.2 ✓ 2.4 ✓ cm

Effective depth 81. − 2.4 ✓ = 78.6 ✓ cm flange stress = $\frac{57540}{.786}$ ✓ = 73300 ✓ kg

flange area reqd = 73300 ÷ 1200 ✓ = 61.00 ✓
1/8 web 9.00 ✓
72.00 ✓□ net

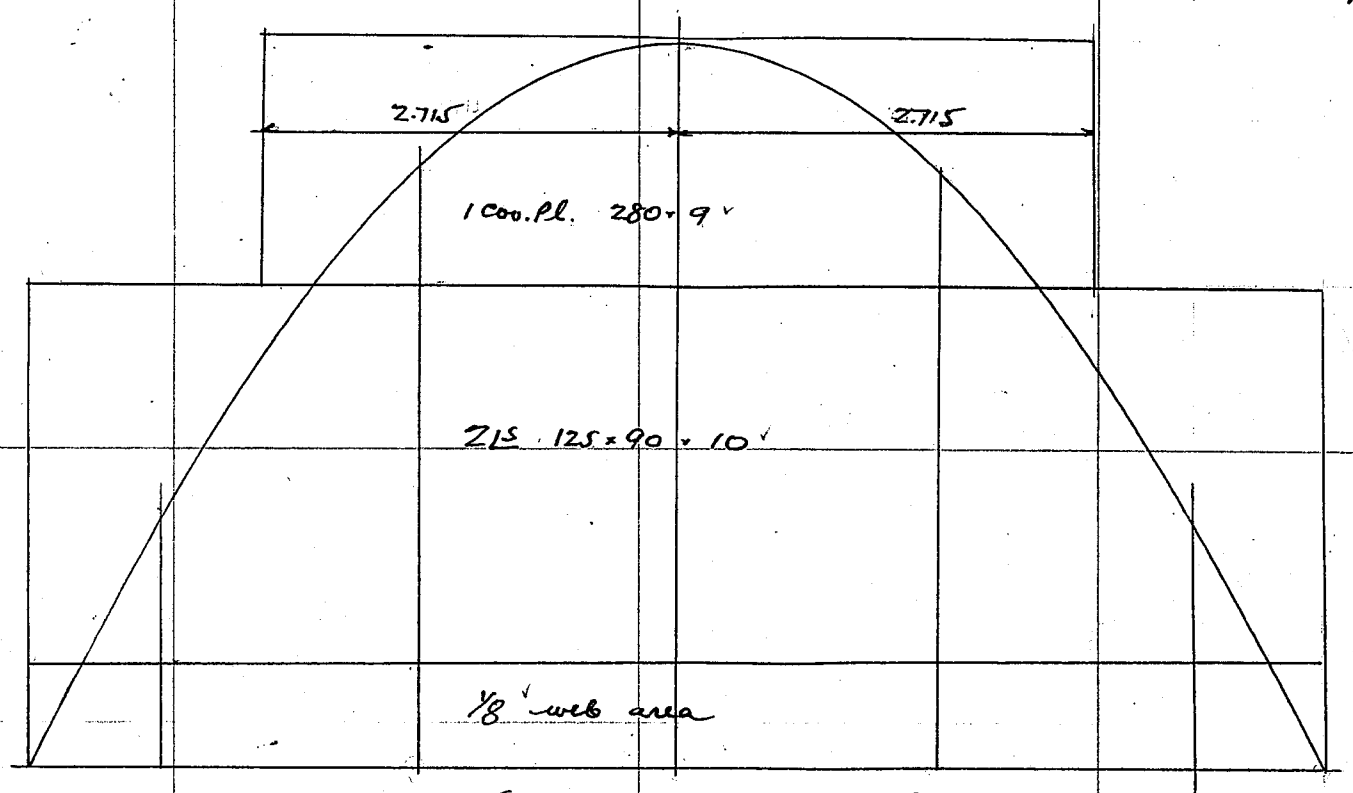
Assumed section ok

Unit shear = $\frac{25024}{72}$ ✓ = 347 ✓ kg/cm² ok

Section reqd for top flange $\frac{57540}{.786}$ ✓ = 73300 ✓ 73300 ÷ 1100 ✓ = 66.6 ✓□cm

Total area flange section 66.2 ✓ gross
1/8 web area 9.0 ✓
75.2 ✓□cm gross ok

Moment Diagram



Scale of space 1:50
" " moment 1 cm = 6000 kgm

Approximate weights of Intermediate floor beam

web plate ✓	1 Pl 800 − 9 ✓	@	56.52 ✓	× 8.07 ✓	=	456. ✓
flanges ✓	4 Ls 125 × 90 × 10 ✓	@	16.09 ✓	× 8.07 ✓	=	519 ✓
Cov. Pl ✓	2 Pls. 280 × 9 ✓	@	19.78 ✓	× 5.43 ✓	=	214 ✓
End conn. ✓	4 Ls 150 × 100 × 9 ✓	@	17.02 ✓	× .80 ✓	=	55 ✓
fills ✓	4 Pls. 220 × 10 ✓	@	17.27 ✓	× .625 ✓	=	43 ✓
Stringer conn ✓	10 Ls 100 × 75 × 10 ✓	@	12.95 ✓	× .79 ✓	=	102 ✓
fills ✓	10 Pls 75 × 10 ✓	@	5.89 ✓	× .625 ✓	=	37 ✓
" ✓	10 Pls. 100 × 10 ✓	@	7.85 ✓	× .30	=	24 ✓
End fills	2 Pls. 260 × 9	@	18.37	× .335	=	12 ✓

1462 ✓
End brackets 30 ✓
Rivet heads & variations 53 ✓
1545 ✓ kg.

1545 ✓ ÷ 8.07 ✓ = 191 ✓ kg per lin. metre of span

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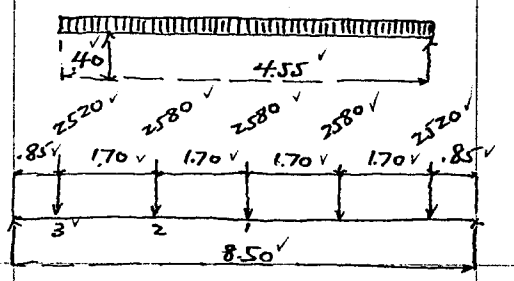
CALCULATIONS FOR

Design of Hei-Nagara-Gawa Bashi for Mieken

Design of End Floor Beam Span length 8.5 m. overhang .40 floor beam spacing 4.55 m
Dead load



Stringer concentration on floor beam

S_1 and S_2 $960 \times \frac{4.95^2}{2 \times 4.55} = 2580$ kg

S_3 $939 \times \frac{4.95^2}{2 \times 4.55} = 2520$ kg.

Moment at Center 1

6390	× 4.25	=	27200
2580	× 1.70	=	− 4390
2520	× 3.40	=	− 8570
			14240 kgm

Moment at 2

6390	× 2.55	=	16300
2520	× 1.70	=	− 4290
			12010 kgm

Reaction 2580 / 1290 / 2520 / 6390 kg.

Moment at 3

6390 × 0.85 = 5425 kgm

Dead Load beam assumed 185 kg per lin. meter
End Reaction $\frac{185}{2} \times 8.50 = 785.$ kg.

Moment at center 1 $\frac{1}{8} \times 185 \times 8.5^2 = 1670$ kgm

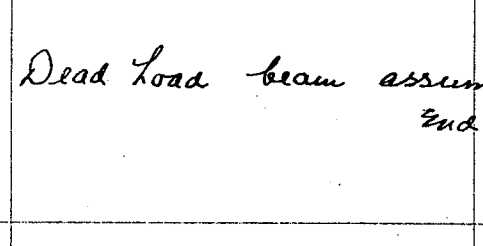
Moment at panel 2 $\frac{185}{2} \times 2.55 \times 5.95 = 1400$ ..

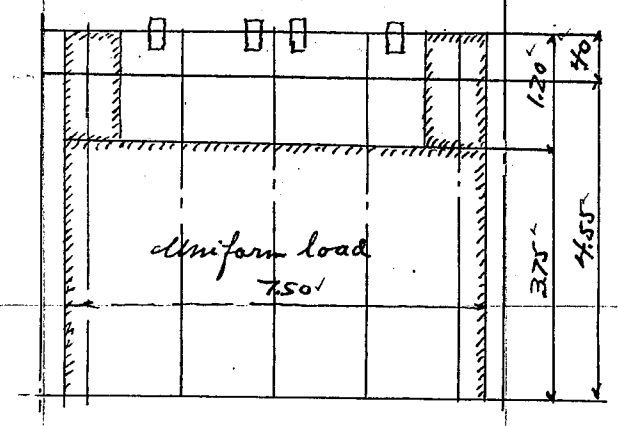
Moment at panel 3 $\frac{185}{2} \times 0.85 \times 7.65 = 602$ ..

Summary for Dead Load moments and shears

	Moments at S_3	S_2	S_1	Shear
Stringer connection	5425	12010	14240	6390
Floor Beam	602	1400	1670	785
	6027	13410	15910 kgm	7175 kg

Live load motor truck rear wheel concentration with impact 3900 kg
front .. .. . . 1300 ..
Uniform live load 500 kg per square meter.
Wheel loads and uniform live loads assumed as concentrated on floor beam through stringers.





Motor truck rear wheel
Reaction on floor beam $3900 \times \frac{4.95}{4.55} = 4250$ kg.

Concentration at 1 2 $4250 \times \frac{1.25}{1.70} = 6250$

" " 2 $4250 \times \frac{1.60}{1.70} = 4000$

" " 3 $4250 \times \frac{.55}{1.70} = 1375$

full uniform load at rear of motor truck
Reaction on F.B. $500 \times \frac{3.75^2}{2 \times 4.55} = 773$ kg per lin meter

Concentration at 1+2 $773 \times 1.70 = 1315$ kg

3 $773 \times (.85 + 3.5) = 928$ kg.

Uniform load on sides of motor truck
Reaction on Floor Beam $500 \times 1.20 \times \frac{4.35}{4.55} = 573.0$ kg.

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CALCULATIONS FOR

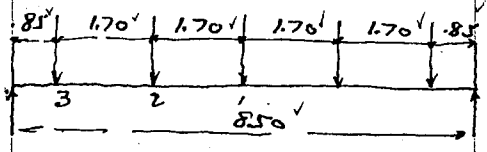
Design of Hei-Nagara Gawa Bashi for Mieken

load on S_3 : 573 × 0.35 = 200
573 × .70 × 1.35/1.70 = 318
518 kg

load on S_2 : 573 × .70 × .35/1.70 = 82 "

Summary for loads

	S_3	S_2	S_1
motor truck loading	1375	4000	6250
Unif. load rear	928	1315	1315
Unif. load side	518	82	—
	2821	5397	7565 kg.



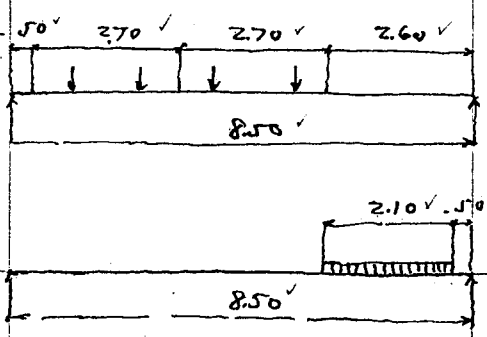
Reaction 2821
5397
3782
12000 kg.

moment at center 1 : 12000 × 4.25 = 51000
5397 × 1.90 = − 9180
2821 × 3.40 = − 9600
32220 kgm

moment at panel 2 : 12000 × 2.55 = 30600
2821 × 1.70 = − 4800
25800 "

moment at panel 3 : 12000 × .85 = 10200 "

Live Load End Shear



motor truck loading
Reaction on floor beam rear wheel 4250
for 4 wheels 4250 × 4 = 17000 kg.

End Reaction 17000 × 5.30/8.50 = 10600
Unif. load 773 × 7.5/2 = 2900
" 573 × 2.1 × 1.55/8.5 = 220
13720

Summary for moments and shears

	m at 3	m at 2	m at 1	End shear
Dead Load	6027	13410	15910	7175
Live Load	10200	25800	32220	13720
	16227	39210	48130 kgm	20895 kg.

Try web plate 800 × 9 = 72.0 □cm ℄ web = 9.0 cm² Back to back of Ls = 81.0 cm
℄ flange assumed

2Ls 100 × 90 × 10	= 36.00	× 2.46 =	88.5
1Pl. 240 × 9	= 21.60	× .45 =	− 9.7
	57.60		78.8

℄ gravity 78.8/57.6 = 1.4 2@1.4 = 2.8

Effective depth 81.0 − 2.8 = 78.2 cm

Flange stress = 48130/.782 = 61500

Section required = 61500000/1200 = 51.25
℄ web 9.00
42.25 □cm net.

Flange sections				
2Ls 100 × 90 × 10	= 3600	− 8.8 =	27.2
1Pl 240 × 9	= 21.60	− 4.0 =	17.6
	57.60 □cm		44.8 □ net

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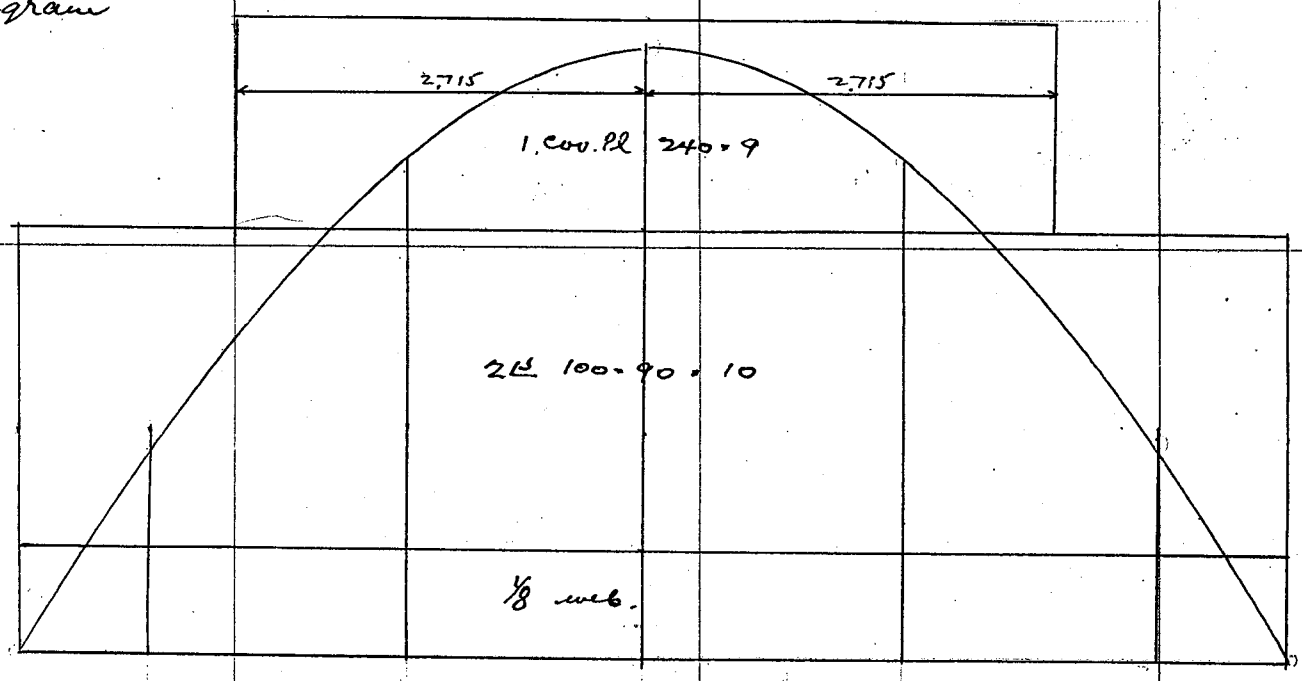
CALCULATIONS FOR

Design of Ibi-Nagara Gawa Bashi for Mieken

Gross area req'd = $\frac{61500}{1100}$ ✓ = 56.0 ✓ 0 cm

Unit shear = $\frac{20895}{72}$ ✓ = 290 ✓ kg/cm²

Moment Diagram



Scale of space 1:50
Scale of moment 1 cm = 6000 kg m

Approximate weight of 2nd Floor Beam

Cov Pls.	2 Pls 240 × 9 ✓	@	16.96 ✓	× 5.43 ✓	=	184 ✓
	4 L's ✓ 100 × 90 × 10 ✓	@	14.13 ✓	× 8.05 ✓	=	455 ✓
web.	1 Pl ✓ 200 × 9 ✓	@	56.52 ✓	× 8.05	=	455 ✓
End conn	4 L's ✓ 150 × 100 × 9	@	17.02 ✓	× .79 ✓	=	54 ✓
	4 fills 220 × 10	@	17.27	× .625	=	43 ✓
	16 L's ✓ 75 × 75 × 9	@	9.96 ✓	× .810 ✓	=	129 ✓
	10 L's "			× .79 ✓	=	79 ✓
	10 fills ✓ 75 × 10 ✓	@	5.89 ✓	× .625 ✓	=	37 ✓
	5 fills 100 × 10	@	7.85 ✓	× .300 ✓	=	12 ✓
	2 Pls. 210 × 10	@	16.49	× .445 ✓	=	15 ✓

1463 ✓
52 ✓
1515 ✓ kg.

Rivet heads & variations 3½% say

1515 ✓ ÷ 805 ✓ = 188 ✓ kg per lin. metre

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CALCULATIONS FOR

Design of Hoi-Nagara Gawa Bashi for Mie Ken

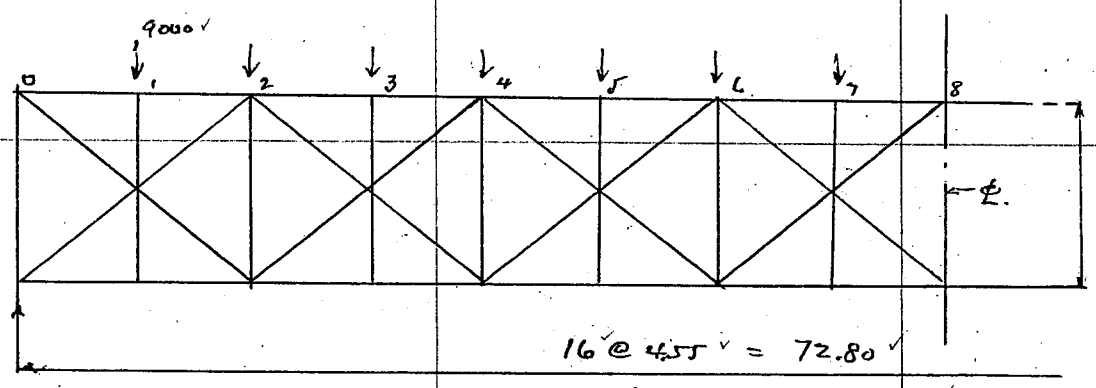
Bottom Lateral Bracings Seismic force assumed k = 0.3 ✓

Dead Load

Floor slab and pavement	520 × 7.5 ✓	= 3900 ✓	
Copings	2 @ 173 ✓	= 346 ✓	
Handrails	2 @ 80 ✓	= 160 ✓	
			4406 ✓ kg
Structural Steel			
stringers	5 @ 62 ✓	= 310 ✓	
floor beam	1545 ÷ 4.55 ✓	= 339 ✓	
Bottom laterals	assumed	120 ✓	
trusses	2/3 × 2090 ✓	1400 ✓	
			2169 ✓
			6575 ✓ kg

Panel Concentration 6575 ✓ × 4.55 ✓ = 30.000 ✓ kg.

Horizontal force assumed 30.000 × 0.3 ✓ = 9000 ✓ kg



Diagonal length

4.55² ✓ = 20.70 ✓
4.25² ✓ = 18.05 ✓
38.75 ✓ − 6.23 ✓
6.23 ✓ / 4.25 = 1.466 ✓

Unit stress for tension 1200 × 1.6 = 1920 ✓ kg/cm²

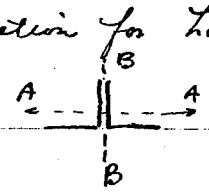
Field rivets 220 ✓ mm² 2851 × 1.0 = 4560 ✓ single shear.

For tension only

					Rivet reqd	use
0-1	67500 ✓ @ 1.466 ✓ =	99000 ✓ ÷ 1920 ✓ =	51.6 ✓ cm² net	2L 150×150×11 = 63.58 − 11.0 = 52.58 ✓	21.7 ✓	22 ✓
1-2	58500 ✓ =	85800 ✓ =	44.7	"	18.8	19
2-3	49500 ✓ =	72500 ✓ =	37.8	"	15.9	16 ✓
3-4	40500 ✓ =	59400 ✓ =	31.05	"	13.0	16
4-5	31500 ✓ =	46200 ✓ =	24.1	2L 130×130×9 = 45.18 − 9.0 = 36.18 ✓	10.1	14 ✓
5-6	22500 ✓ =	33000 ✓ =	17.2	"	7.2	10 ✓
6-7	13500 ✓ =	19800 ✓ =	10.3	2L 100×100×10 = 38.0 − 10.0 = 28.00 ✓	3.3	6 ✓
7-8	4500 ✓ =	6600 ✓ =	3.4	"	1.5	6 ✓

For tension & Compression			Section reqd	Rivets reqd	Use
0-1	49500 ✓ T or C	÷ 1056 ✓ =	46.8 ✓ cm² gross	10.9	22 ✓
1-2	42900 ✓	1056 =	40.6 "	9.4	18
2-3	36250 ✓	1056 ✓ =	34.4 ✓ "	8.0	16
3-4	29700 ✓	1056 =	28.6 ✓ "	6.5	16
4-5	23100 ✓	850 ✓ =	27.2 ✓ "	5.1	10
5-6	16500 ✓	850 ✓ =	19.4 ✓ "	3.6	10
6-7	9900 ✓	408 ✓ =	24.0 ✓ "	2.2	6
7-8	3300 ✓	408 ✓ =	8.1 ✓ "	0.7	6

Section for Lower Lateral Bracings



Radius of gyration AA axis r = 4.57 ✓ l = 3.74 ✓ m.

2L 150 × 150 × 11 ✓ = 63.58 ✓ × 4.07² ✓ + 1327 ✓ = 2382 ✓

axis BB $r = \sqrt{\frac{2382}{63.58}}$ ✓ = 6.11 ✓ l = 6.23 ✓ meter

AA axis Allowable Unit stress = 1500 ✓ (1 − 0.0055 × 3.74 ✓ / 4.57) = 825 ✓ kg/cm²

BB axis Allowable Unit stress = 1500 ✓ (1 − 0.0055 × 6.23 / 6.11) = 660 ✓ kg/cm²

For Seismic Stress 660 × 1.6 = 1056 ✓ kg/cm²

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CONSULTIEG ENGINEER
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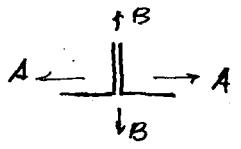
CALCULATIONS FOR

Design of Hoi-Nagara-Gawa Bashi for Mieken

Section for lower lateral bracings

ZL 130·130·9 = 45.18 cm



AA axis Radius of gyration r = 3.96 l = 3.74 m

BB axis Radius of gyration

	moment of Inertia
ZL 130·130·9 = 45.18 × 3.51² + 710 =	1266

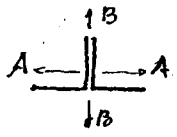
$r = \sqrt{\frac{1266}{45.18}} = 5.30$ $l = 6.23$ m

AA axis allowable Unit Stress = $1500 (1 - 0.0055 \times \frac{374}{3.96}) = 721$ kg/cm²

BB axis allowable Unit Stress = $1500 (1 - 0.0055 \times \frac{623}{5.30}) = 534$ kg/cm²

For Seismic stress $534 \times 1.00 = 950$ kg/cm²

ZL 100·100·10 = 38.0



AA Axis Radius of gyration r = 3.03 l = 3.74 m

BB Axis Radius of gyration

	moment of Inertia
ZL 100·100·10 = 38.0 × 2.81² + 349 =	649

$r = \sqrt{\frac{649}{38}} = 4.13$ $l = 6.23$ m

AA axis allowable Unit stress = $1500 (1 - 0.0055 \times \frac{374}{3.03}) = 483$ kg/cm²

BB axis allowable Unit Stress = $1500 (1 - 0.0055 \times \frac{623}{4.13}) = 255$ kg/cm²

For Seismic Stress $255 \times 1.6 = 408$ kg/cm²

Wind pressure on Lower Deck. wind load 45 #/per sq ft. or 220 kg per sq meter

Exposed area bottom to crown of roadway 1.10
Curb and handrail assumed .50
middle chord, verticals + diagonals .90

Leeward exposed area assumed 2.50 / 1.25
$3.75 \times 220 = 825$ kg/m lineal

Panel concentration $825 \times 4.55 = 3750$

Unit stress = 1200 kg/cm² net 22 mm field rivet 2851 kg/ single shear

	Shear		Stress		SR		No of Rivets		
0-1	28100 × 1.466 =		41100 ÷ 1200 =		34.2 mill	ZL 150·150·11 = 52.58	mill	14.6	22
1-2	24600		36000		30.0	do "		12.8	18
2-3	21300		31200		26.0	do "		11.0	16
3-4	18300		26800		22.4	do "		9.4	14
4-5	15500		22700		18.9	ZL 130·130·9 = 36.18		8.0	10
5-6	12900		18900		15.75	do "		6.7	10
6-7	10550		15500		12.90	ZL 100·100·10 = 28.00		5.5	6
7-8	8440		12300		10.25	do "		4.4	6

	Tension or Comp.			SR	Gross section used
0-1	20550	÷	660 =	31.0 cm gross	63.58
1-2	18000		" =	27.3	"
2-3	15600		" =	23.6	"
3-4	13400		" =	20.3	"
4-5	11350		531 =	21.4	45.18
5-6	9450		" =	17.8	"
6-7	7750		255 =	30.4	38.0
7-8	6150		255 =	24.1	"

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CALCULATIONS FOR

Design of Yobi-Nagara-Gawa Bashi for Mieken

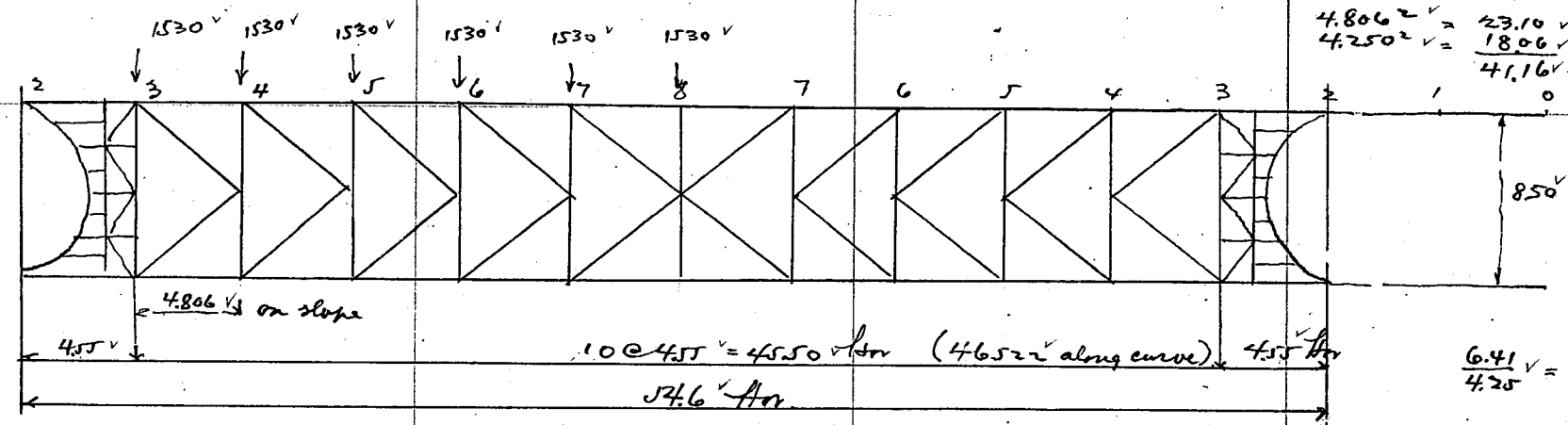
Top Lateral Bracings

Seismic force for top laterals

Dead load assumed top laterals, Sways + Portals 23500 ÷ 546' = 430'
trusses assumed 1/3 × 2090' = 697'
1127' kg

Panel concentration 1127' × 4.55' = 5120' kg
Hor. Force 5120' × 0.3' = 1530' kg.

Diagonal length 3-4
4.806²' = 23.10'
4.250²' = 18.06'
41.16' − 6.41'

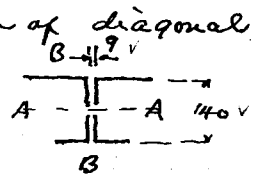


6.41' / 4.25' = 1.510'

19mm Rivet 2126' − 1.6' = 3400'

	shear		Diagl stress	one diagl		no of Rivet
3-4	6885.0'	× 1.51' = 10400'	5200' kg.	÷ 366 = 14.2	□cm gross	1.5'

Section of diagonal bracing.



Center of gravity of section.

AA axis				
2L's 100 × 75 × 10' =	33.00'	× 1.94' =	64.0'	
2L's 60 × 60 × 9' =	19.98'	× 12.21' =	244.0'	
	52.98'	5.82'	308.0'	

Moment of inertia

2L's 100 × 75 × 10' =	33.00'	× 3.88²' +	152' =	649'
2L's 60 × 60 × 9' =	19.98'	× 6.39²' +	624' =	880
	52.98'			1529'

Radius of gyration $r = \sqrt{\frac{1529'}{52.98'}} = 5.37'$

BB Axis moment of inertia

2L's 100 × 75 × 10' =	33.00'	× 3.62²' +	318' =	751'
2L's 60 × 60 × 9 =	19.98'	× 2.24²' +	624' =	164
	52.98'			915'

Radius of gyration $r = \sqrt{\frac{915'}{52.98'}} = 4.16'$

Unsupported length 6.41' meters

allowable unit stress = $1500 \left(1 - 0.0055 \times \frac{641'}{154' \times 4.16'}\right)$ = 229 kg/cm²

For seismic stress P = 229 × 1.6 = 366 kg/cm²

Wind pressure 45 #/0' or 220' kg/m²
Exposed area assumed chord & vertical 1.00' m
Leeward assumed .80'
On horizontal projection 1.80' × 220' = 396' kg per lin. meter
Panel concentration 396' × 4.55' = 1800' kg.

	shear		stress	one diagonal	Unit stress	SR	Rivet No 19mm	Rivet No used
3-4	8100'	× 1.51' =	12220'	6110'	229'	267'	2.9'	6.0'

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CALCULATIONS FOR

Design of Hi-nagara-Gawa-Bashi for Mieken.

Approximate weight of Bottom lateral Bracings

32 LS ✓	150-150-11.0 ✓ @	24.95 ✓ ×	5.50	= 4380 ✓
16 LS ✓	130-130-9.0 ✓ @	17.73 ✓ ×	5.60 ✓	= 1590 ✓
16 LS ✓	100-100-10.0 ✓ @	14.91 ✓ ×	5.60 ✓	= 1335 ✓
Center connections	2 @ 110 ✓			220 ✓
	2 @ 90 ✓			180 ✓
	2 @ 60 ✓			120 ✓
	2 @ 50 ✓			100 ✓
Hangers.	32 @ 7			224 ✓
Rivet heads & variations		Say		120 ✓
				8269 ✓ kg.

8269 ✓ kg ÷ 72.8 ✓ = 114 ✓ kg per lin. metre.

Approximate weight of Top lateral Bracing For one panel

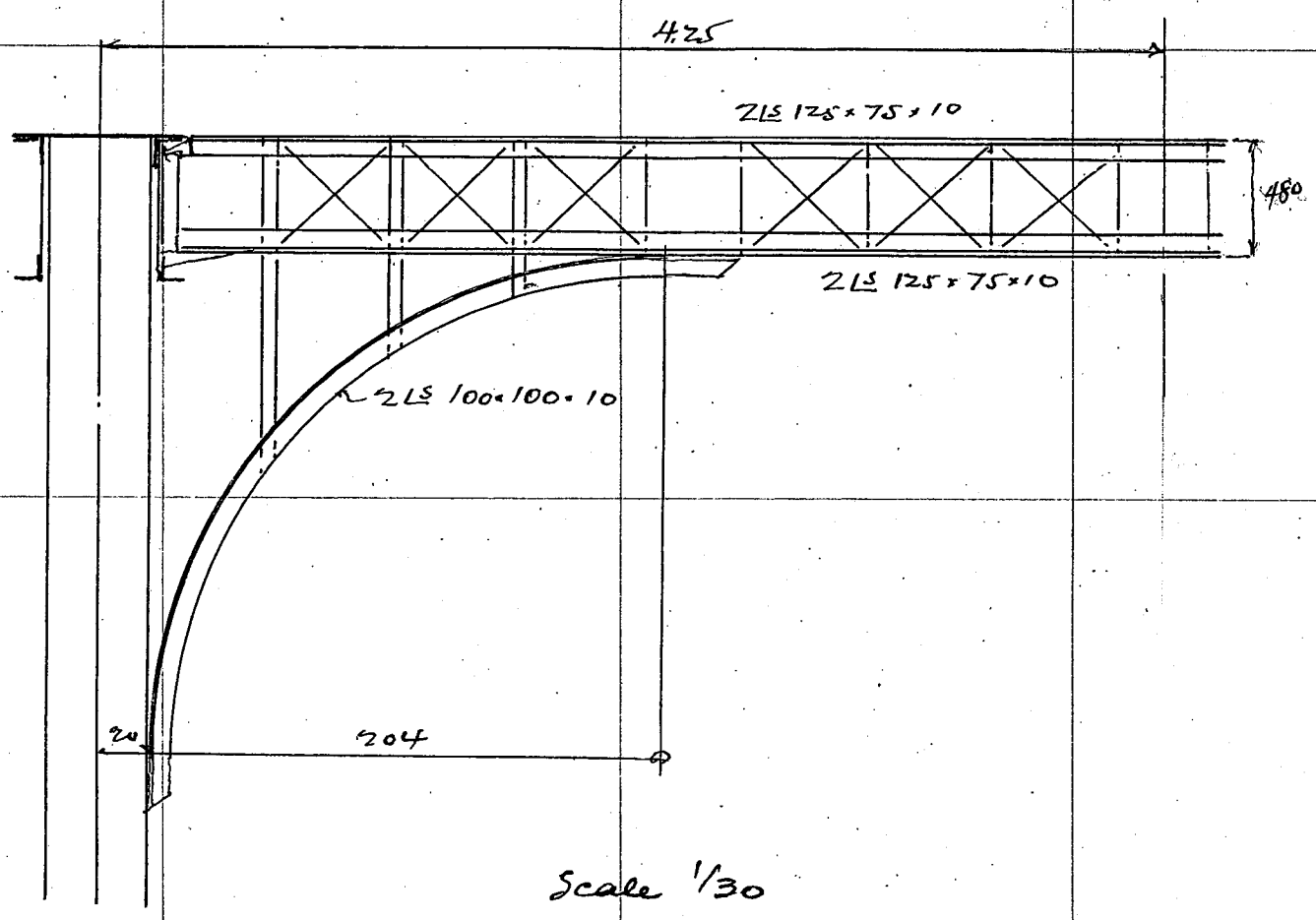
4 LS ✓	100-75-10 ✓ @	12.95 ✓ ×	5.80 ✓	= 300 ✓
4 LS ✓	60-60-9 ✓ @	7.84 ✓ ×	5.80 ✓	= 182 ✓
Tie plates	4 ✓ @	3 ✓		12 ✓
do	10 @	2 ✓		20 ✓
Connection of sway bracings				220 ✓
Rivet heads & variations				20 ✓
				554 ✓

10 ✓ panels @ 554 ✓ = 5540 ✓ kg

For average for span length 5540 ✓ ÷ 72.8 ✓ = 76 ✓ kg per metre

For one panel 5540 ✓ ÷ 45.5 ✓ = 122 ✓ kg per metre

Sway Bracings for Intermediate Panel



Scale 1/30

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CALCULATIONS FOR

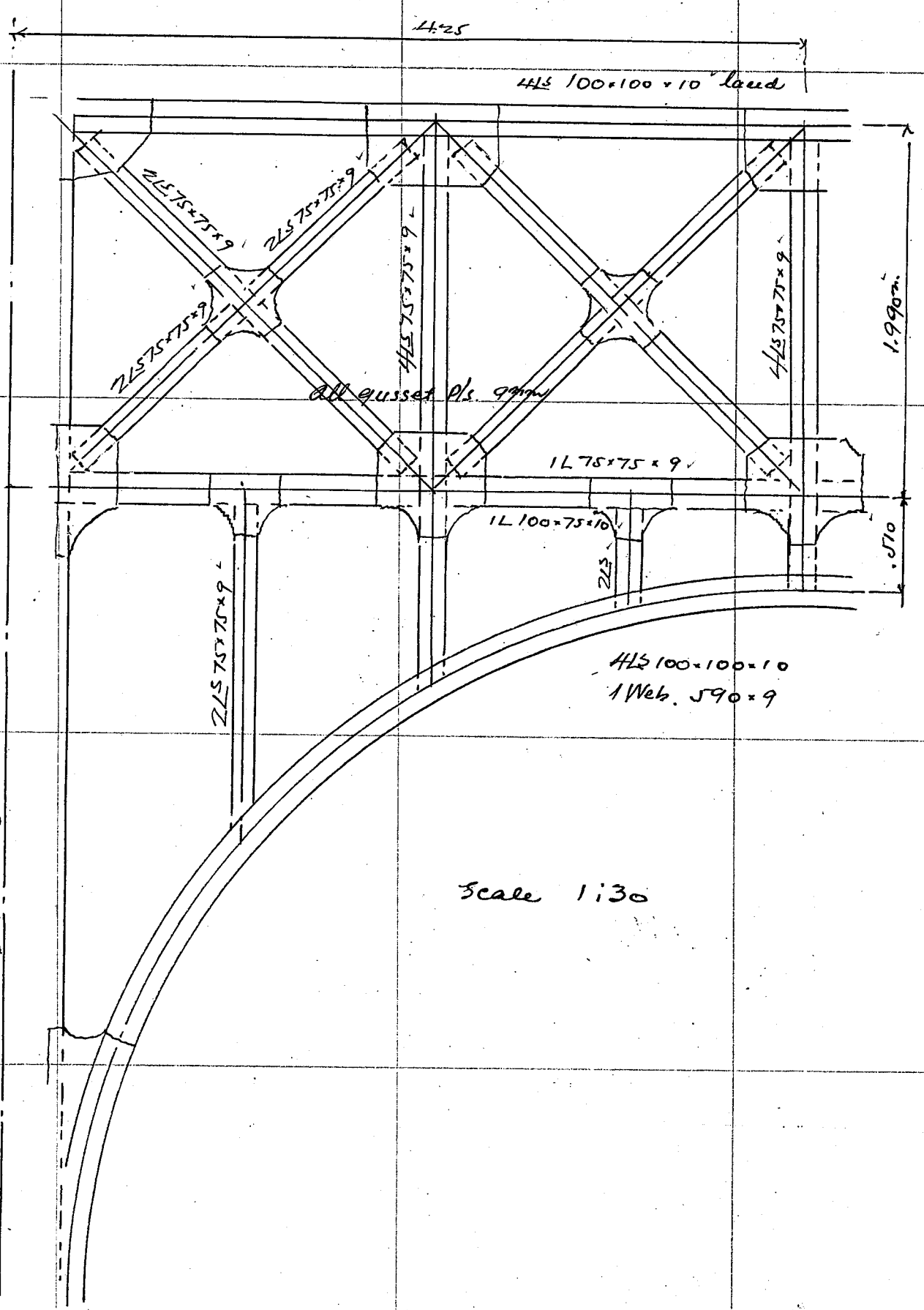
Design of Hoi-Nagara-Tawa Bashi for Mie Ken

Approximate weights of Sway Bracings

4 LS	100-75×10	@	12.95	× 7.83	=	405.6	
4 LS	100-100-10	@	14.9	× 3.69	=	220.1	
2 Pls.	280×9	@	19.78	× .575	=	22.7	
2 Pls.	405×9	@	28.61	× .400	=	22.9	
1 Pl.	370×9	@	26.14	× .470	=	12.3	
2 bars	70×9	@	4.946	× 1.400	=	13.8	
2 bars	"			× .880	=	8.7	
2 bars	"			× .650	=	6.4	
4 bars	"			× .470	=	9.3	
12 Lac bars	60×9	@	4.239	× .610	=	31.0	
12 " "	"	@	"	× .625	=	31.8	
2 Fills	100×9	@	7.065	× .280	=	4.0	
Connection 15						15.0	
River heads and variations say						21.4	
						815.0	kg.

9 Sways required @ 815 = 7335 kg.

Portal Bracings



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MADE BY J. Masuda DATE 5-7-14 FILE NO
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CALCULATIONS FOR

Design of Hoi-Nagara Gawa Bashi for Nichiei

approximate weights of Portal Bracings								
strut at top	main	4Ls	100×100×10	@	14.91	× 7.83	= 467	
	tie Pls.		640×10	@	50.24	× say 2.80	= 142	
	lacing bars						70	
	intermediate tie plate						99	778
longl strut.	main sect	4Ls	75×75×9	@	9.96	× 8.2	= 326	
	connection Ls	12Ls	100×100×10	@	14.91	say	75	
	tie Pls						113	
	lacing bars						70	
								584
Brace	main section	2Ls	100×100×10	@	14.91	× 12.0	= 358	
	"	2Ls	"	@	14.91	× 11.0	= 328	
	web	1Pl.	580×9	@	40.98	× 12.0	= 492	
								1178
Diagonals		2Ls	75×75×9	@	9.96	× 20.0	= 400	
longl strut		2Ls	75×75×9	@	9.96	× 4.8	= 96	
Hor. strut.		4Ls	75×75×9	@	9.96	× 1.81	= 72	
"		4Ls	100×100×10	@	14.91	× 1.81	= 108	
								676
Connection plates	From top inter.	3	@ 20	=	60			
	ends	2	@ 15	=	30			
	Diagonal inter.	4	@ 10	=	40			
	intermediate strut	3	@ 20	=	60			
	" End	2	@ 12	=	24			
	longl strut	4	@ 6	=	24			
Bottom plates	intermediate	3	@ 15	=	45			
	Ends	2	@ 15	=	30			
End brace	Top and bottom plates	4	@ 50	=	200			
								513
	Rivet heads and variations				say			116
								3845 kg.

Summary for top laterals Sways and Portal Bracings.

top lateral bracings			5540	
Sway bracings	9	@ 815 =	7335	
Portal bracings	2	@ 3845 =	7690	
			20565	kg.

average weights for 12 panels	20565	÷ 54.6	= 376	kg per meter
average weights for entire span	20565	÷ 72.8	= 282	kg per meter

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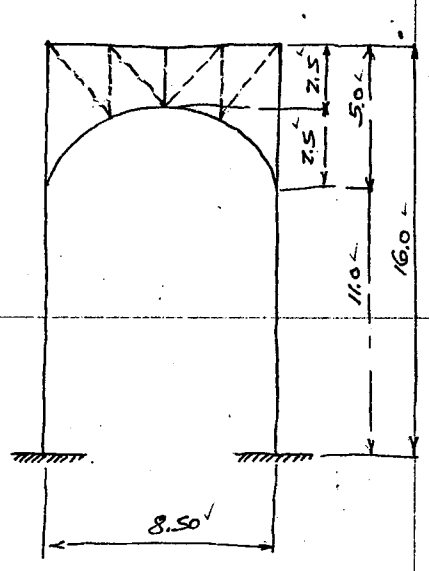
CALCULATIONS FOR

Design of Ibi Nagara Bashi for Mie Ken.

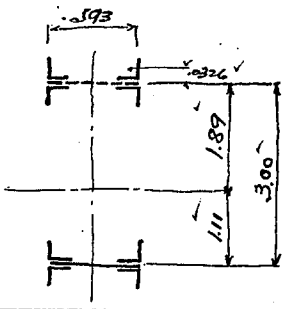
Section of End Post and Portal Bracing.



moment ● of Portal bracing

Center of gravity — Average depth assumed 3.0 meters.

4 ∠s 100×100×10	76.00	× 0	= 0	
4 ∠s 100×100×10	76.00	× 3.0	= 228.0	
1 Pl. 590 × 9	53.10	× 3.0	= 159.3	
	205.10 cm²gr.	1.89 m	387.3	



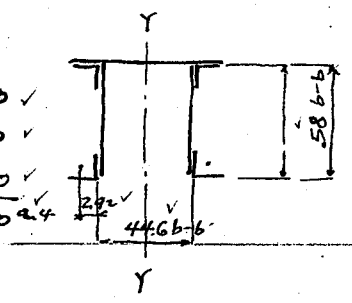
Height h = 16.0 − 1.89 = 14.11 meters

moment of inertia

2 ∠s 100×100×10	38.00 × 192.26² + 349.0	= 1405300	
2 ∠s 100×100×10	38.00 × 185.74² + 349.0	= 1310,400	
2 ∠s 100×100×10	38.00 × 107.74² + 349.0	= 441,400	
2 ∠s 100×100×10	38.00 × 114.26² + 349.0	= 496,300	
1 Pl. 590 × 9	53.10 × 111.00²	= 654,000	
	205.10	J_2 = 4,307,400 cm⁴	

moment of inertia of End post Y–Y axis

1 cov. Pl. 660 × 13	85.80	66.0³ × 1.3 ÷ 12	= 31,100	
4 ∠s 100×100×13	97.24	× 25.22² + 884	= 62,800	
2 Pls 570 × 13	148.20	× 21.65²	= 69,400	
	331.24		163,300 cm⁴	



$M_1 - M_2$

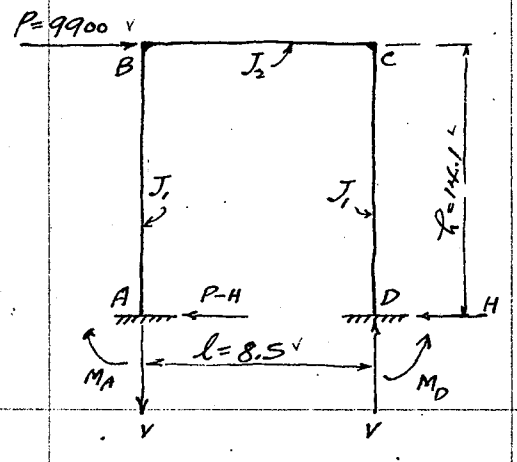
1 cov. Pl. 660 × 13	85.80		
4 ∠s 100×100×13	97.24		
2 Pls 570 × 13	148.20		
	331.24		163,300
2 Pls 370 × 9	66.60 × 22.75²	=	34,400
	397.84		197,700 cm⁴

J_1 = 163,300 / 361000 ÷ 2 = 180,500 cm⁴ average

Radius of gyration Y-Y axis $r = \sqrt{\frac{180500}{364.54}}$ = 22.3 cm average.

Wind thrust on Portal bracing for 45°/0' wind (220 kg/m²)

Panel load = 1800, thrust = 1800 × 5.5 = 9900 kg = P.



Referring to Kleinlogel's Rahmenformeln on page 94–95

$V = \frac{3Phk}{l(6k+1)}$, $H = \frac{P}{2}$. $k = \frac{J_2}{J_1} \cdot \frac{h}{l} = \frac{43074400}{180500} \times \frac{14.1}{8.5} = 39.6$

$M_A = -\frac{Ph}{2} \cdot \frac{3k+1}{6k+1}$, $M_D = -M_A$. $\frac{3k+1}{6k+1} = \frac{396 \times 3 + 1}{396 \times 6 + 1} = \frac{1189.8}{2386} = 0.502$

$M_B = +\frac{Ph}{2} \cdot \frac{3k}{6k+1}$, $M_C = -M_B$. $\frac{3k}{6k+1} = \frac{118.8}{238.6} = 0.498$

$V = \frac{9900 \times 14.1}{8.5} \times 0.498 = 8180$ kg.

$H = \frac{9900}{2} = 4950$

$M_A = -\frac{9900 \times 14.1}{2} \times 0.502 = -35,000$ kg-m, $M_D = 35,000$ kg-m.

$M_B = +\frac{9900 \times 14.1}{2} \times 0.498 = +34,720$ kg-m, $M_C = -34,720$ kg-m.

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MADE BY K. Inaba DATE 5-7-29 FILE NO
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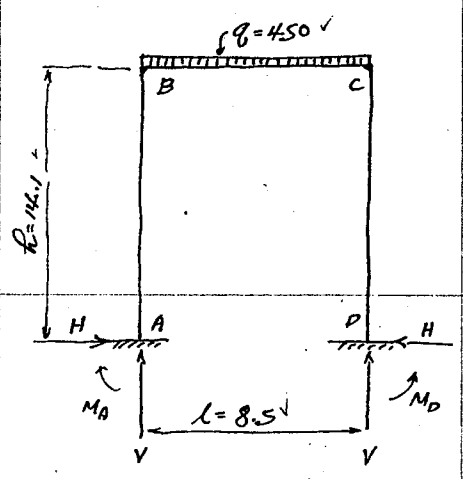
CALCULATIONS FOR

Design of Ibi-Nagara Bashi for Mie-ken.

Stresses due to Dead load of portal bracings.

Average load = 3845 ÷ 8.5 = 450 kg per lin metre. = q



$$V = \frac{3845}{2} = 1920 \text{ kg}$$

$$H = \frac{ql^2}{4h(K+2)} = \frac{450 \times 8.5^2}{4 \times 14.1 \times 41.6} = 15 \text{ kg}$$

$$M_B = M_C = -\frac{ql^2}{6(K+2)} = -\frac{450 \times 8.5^2}{6 \times 41.6} = -130 \text{ kgm}$$

$$M_A = M_D = +\frac{ql^2}{12(K+2)} = +65 \text{ kgm}$$

Summary of moments and reactions

	M_A	M_D	M_B	M_C	V_A	V_D	H_A	H_D
Due to wind load.	−35,000	+35,000	+34,720	−34,720	−8180	+8180	+4950	+4950
" Dead load of portal	+ 65	+ 65	− 130	− 130	+1920	+1920	− 15	+ 15
	−34,935 kgm	+35,065	+34,590	−34,850	−6260 kg	+10100	+4935	+4965

Allowable unit compression $f = 1500(1 - 0.0055 \times \frac{1100}{22.3}) = 1092$ kg/cm² use 1000 kg/cm² C

for wind + dead load $f = 1000 \times 1.25 = 1250$ kg/cm²

Dead Load stress 232580
Live Load " 100810
333390 C

Dead Load stress 232,580
wind " " 10600
243,180 C

Direct stress for D.L. + L.L.

$= \frac{333390}{397.84} = 840 \text{ kg/cm}^2 < 1000$ ok.

Direct stress $= \frac{243.180}{397.84} = 611$

Bending stress $= \frac{35065 \times 100}{197700} \times 33 = 586$

1197 kg/cm² < 1250 ok

End shear on portal bracing = +10100 kg
Sectional area reqd = $\frac{10100}{1200 \times 1.25} = 6.74$ cm² net

Use ∠s 75×75×9 = 25.38 − 9.0 = 16.38 cm² net

Moment on portal bracing at end = 34,850 kgm arm say 3.70 m
chord stress = $\frac{34.850}{3.70} = 9430$ kg C or T
Sectional area required = $\frac{9430}{1200 \times 1.25} = 6.3$ cm² net ok.

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CALCULATIONS FOR

Design of Hi-nagara Gawa Bashi for Mieken

Design of truss. Span length 72.8' meters 16 panels @ 4.55'

Dead Load — Floor Slab and Pavement 520' × 7.5' = 3900'
Copings 2 @ 173' = 346'
Handrails 2 @ 80' = 160'
4406'

Structural Steel
Stringers 5' @ 62' = 310'
Floor beam 1545' ÷ 4.55' = 339'
Bottom laterals 114'
Top laterals 554' ÷ 4.55 = 122'
Sways 815' ÷ 4.55 = 179'
trusses assumed 2090'
3154'

Panel Point 4 to 8
floor load 4406'
Steel 3154'
7560' × 4.55' = 34400'
For one truss 34400' ÷ 2' = 17200' kg.

Panel Point 3.
Structural Steel
stringers 310'
floor beam 339'
Bottom lateral 114'
trusses 2090'
2853'
floor load complete 4406'
7259' × 455' = 33000'
Top lateral 122 × 455/2' = 280'
Portal bracing 3845' × 3/4' = 2880'
36160'
For one truss 36160' ÷ 2' = 18080' kg.
Call this 18000 kg.

Panel Point 2.
floor load + structural steel as above 33000'
Portal bracings 3845' × 1/4' = 960'
33960'
For one truss 33960' ÷ 2' = say 17000' kg.

Panel Point 1 — For one truss 33000' ÷ 2' = 16500' kg.

Average for 1, 2 and 3
18080'
17000'
16500'
51580' ÷ 3' = 17200' kg.
Taking allowance use panel load 17200' kg per panel throughout the span.

Live load $w = \frac{100.000'}{170 + 72.8} = 412'$ kg/m²

Panel Concentration 412' × 7.5'/2 × 4.55' = 7020' kg.

Motor truck loading
Rear wheel concentration 3000'
impact $\frac{20}{60+72.8}$' = 16.1% 453'
3453' call this 3450' kg
front wheel concentration 3450 ÷ 3' = 1150' "

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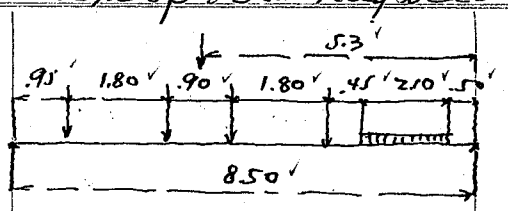
CALCULATIONS FOR

Design of Hi-nagara-gawa Bashi for Mieken



Reaction on truss

motor truck rear wheel $3450^{\vee} \times 4^{\vee} \times \frac{5.3^{\vee}}{8.5} = 8600^{\vee}$ kg

front wheel $8600 \div 3^{\vee} = 2870^{\vee}$ "

Uniform live load $412 \times \frac{7.5}{2}^{\vee} = 1545^{\vee}$ kg/m

Sides of truck $412^{\vee} \times 2.10^{\vee} \times \frac{1.55}{8.50}^{\vee} = 158^{\vee}$

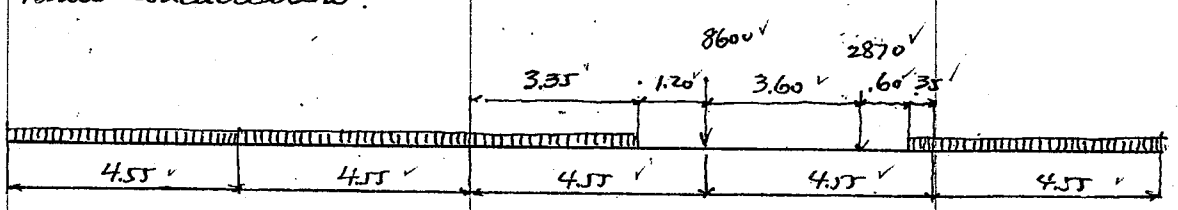
$1387^{\vee}$ kg.

$158^{\vee} \times 4.55^{\vee} = 719^{\vee}$

$1387^{\vee} \times 4.55^{\vee} = 6310^{\vee}$

$7029^{\vee}$ kg say $7030^{\vee}$ kg.

Panel Concentration.



	720	720	720	720
	6310	3160	1710	3160
		2940	20	465
			8600	3160
			600	2270
	7030	6820	11650	6615
Assume	7000	7000	7000	7000

4650 extra

$\frac{3.35}{2}^{\vee} \div 4.55^{\vee} = 0.368^{\vee}$

$1 - 0.368^{\vee} = 0.632^{\vee}$

$1387^{\vee} \times 3.35^{\vee} \times 0.368^{\vee} = 1710^{\vee}$

$1387^{\vee} \times 3.35^{\vee} \times 0.632^{\vee} = 2940^{\vee}$

$2870^{\vee} \times \frac{3.6}{4.55}^{\vee} = 2270^{\vee}$

$-2270 +^{\vee}$

$600^{\vee}$

$1387^{\vee} \times 0.35^{\vee} = 485^{\vee}$ kg

Assume the load listed above as panel concentration for combined uniform and wheel concentration. that is, 7000 kg throughout the panels and 4650 kg extra special load for motor truck loading.

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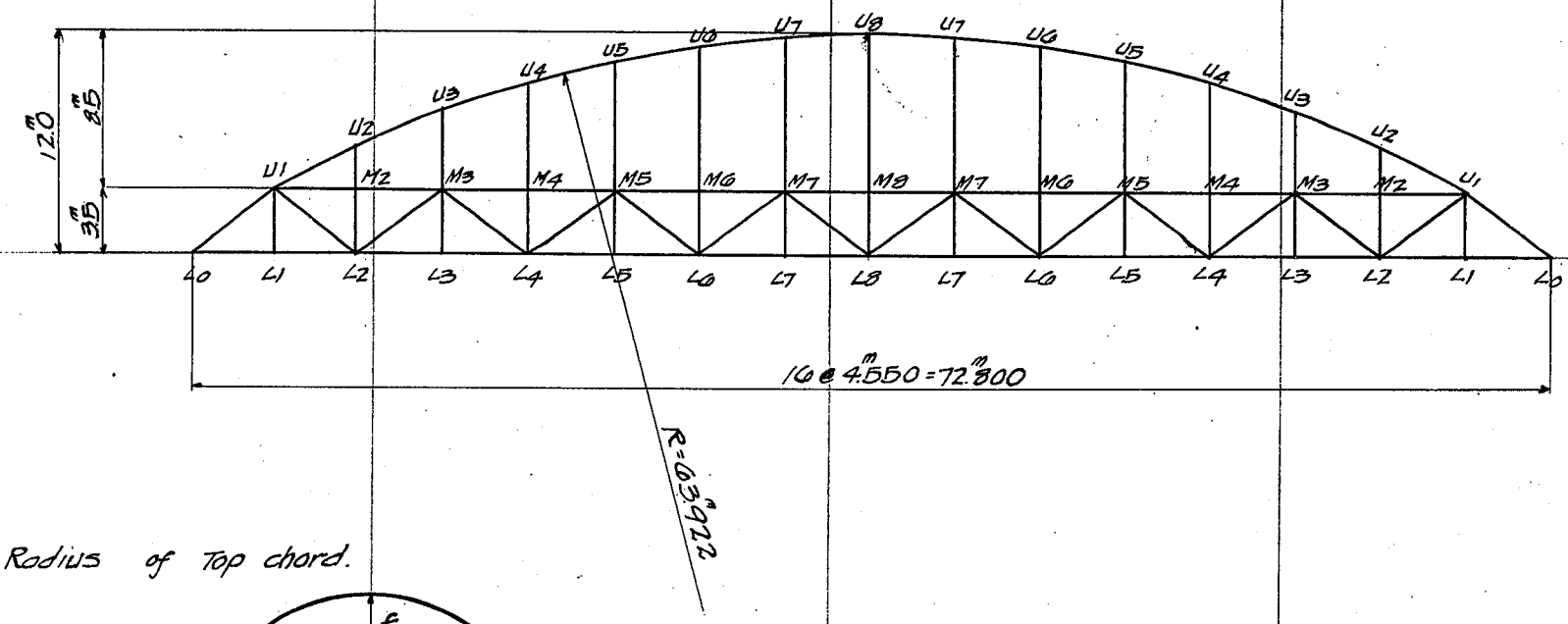
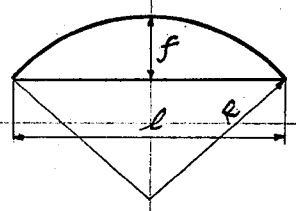
CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Skeleton diagram of Truss



Radius of Top chord.

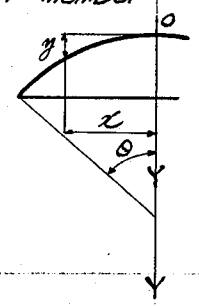


$R = \frac{4f^2+\ell^2}{8f}$ put in. $\ell = 72.800-2@4.550=63.700^m$

$f = 8.500$

Then $R=63.922^m$

Length of each member



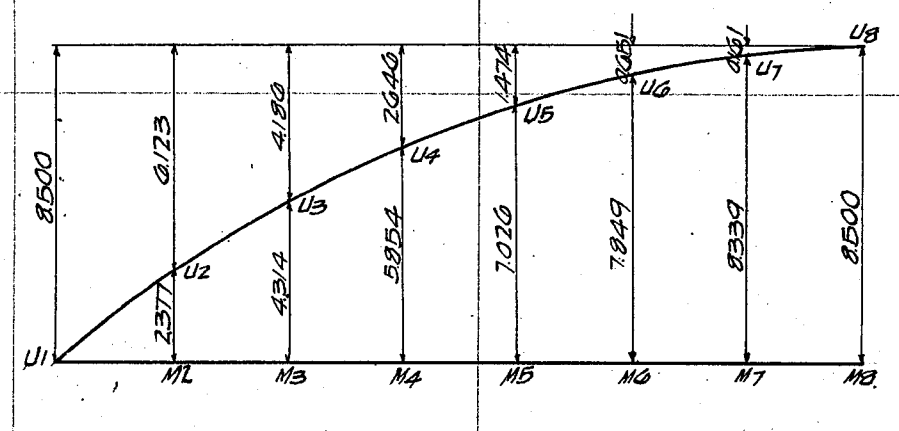
In general. $\sin\theta = \frac{x}{R}$ $y = R-R\cos\theta = R(1-\cos\theta)$

$R=63.922^m$

Ordinates of each panel.

panel point	x	x/4.550	sinθ=x/R	θ	cosθ	1-cosθ	y
8	0	0	0	0°-0'	1.000	0.00000	0.000
7	1@4.550	1	0.071181	4°-4.1'	0.997480	0.002520	0.161
6	2@ "	2	0.142361	8°-11.1'	0.989813	0.010187	0.651
5	3@ "	3	0.213542	12°-19.8'	0.976934	0.023066	1.474
4	4@ "	4	0.284722	16°-32.5'	0.958613	0.041387	2.646
3	5@ "	5	0.355903	20°-51.0'	0.934515	0.065485	4.186
2	6@ "	6	0.427084	25°-17.0'	0.904207	0.095793	6.123
1	7@ "	7	0.498264	29°-53.1'	0.867027	0.132973	8.500
0	8@ "	8	0.569445	34°-42.7'	0.822029	0.177971	8.500+2.876

Verticals



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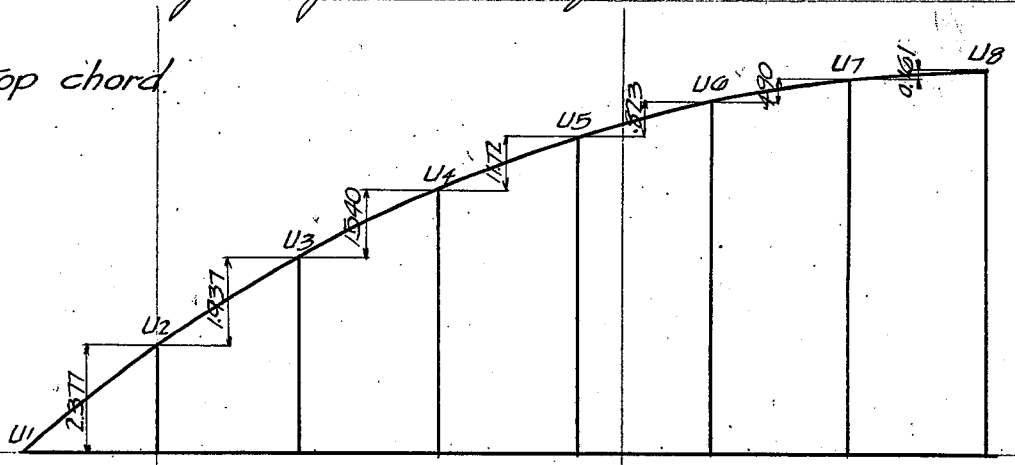
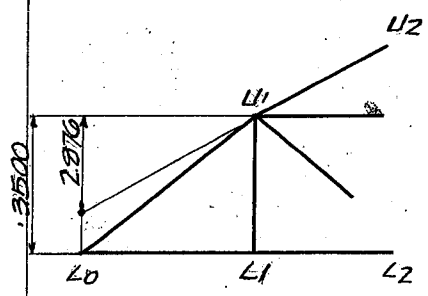
CALCULATIONS FOR

Design of Ibi-Nagara-gawa Bashi for Mie-Ken

Length of Top chord

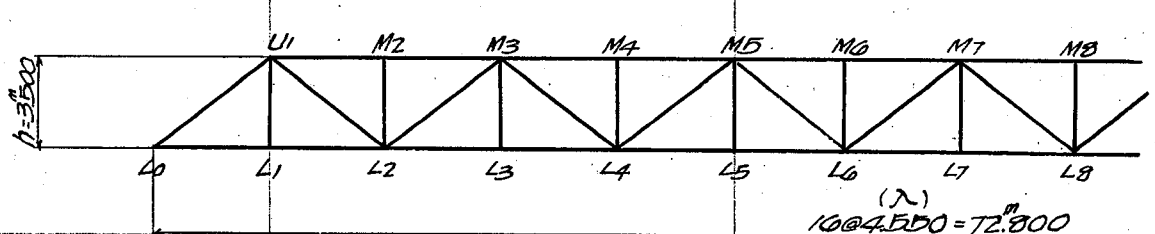




3.500 - 2.876 = 0.624

Member	$4.550^2 = 20.7025$		
U1 - U2	"	$2.377^2 = 5.6501$	$26.353^{\frac{1}{2}} = 5.134$
U2 - U3	"	$1.937^2 = 3.7520$	$24.455'' = 4.945$
U3 - U4	"	$1.540^2 = 2.3716$	$23.074'' = 4.804$
U4 - U5	"	$1.172^2 = 1.3736$	$22.070'' = 4.699$
U5 - U6	"	$.823^2 = .6773$	$21.370'' = 4.623$
U6 - U7	"	$.490^2 = .2401$	$20.943'' = 4.576$
U7 - U8	"	$.161^2 = .0259$	$20.728'' = 4.553$
L0 - U1	$4.550^2 = 20.7025$	$3.500^2 = 12.25$	$32.953'' = 5.740$

Stresses of each member for Load unity, redundancy removed



Middle chord

U1 - M2	$-\frac{14}{16}\cdot\frac{2\lambda}{h} = -\frac{14}{16}\cdot\frac{2\times 4.55}{3.5} = -14\times\frac{9.10}{56.0} = -14\times 0.1625$
M2 - M3	same as U1 - M2
M3 - M4	$-\frac{12}{16}\cdot\frac{4\lambda}{h} = -12\times\frac{4\times 4.55}{16\times 3.5} = -12\times 0.325$
M4 - M5	Same as M3 - M4
M5 - M6	$-\frac{10}{16}\cdot\frac{6\lambda}{h} = -10\times 0.4875$
M6 - M7	Same as M5 - M6
M7 - M8	$-\frac{8}{16}\cdot\frac{8\lambda}{h} = -8\times 0.650$

Bottom chord

L0 - L1	$\frac{15}{16}\times\frac{4.55}{3.5} = 15\times 0.08125$
L1 - L2	Same as L0 - L1
L2 - L3	$\frac{13}{16}\times\frac{4.55\times 3}{3.5} = 13\times 0.24375$
L3 - L4	Same as L2 - L3
L4 - L5	$\frac{11}{16}\times\frac{4.55}{3.5}\times 5 = 11\times 0.40625$
L5 - L6	Same as L4 - L5

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CALCULATIONS FOR

Design of Ibi nagara-gawa Bashi for Mie-Ken

Diagonal.

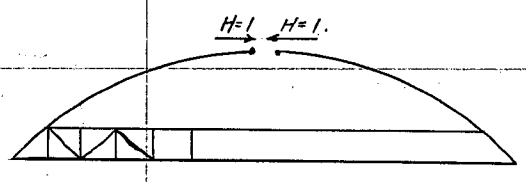
L6 - L7	$\frac{9}{16} \times \frac{4.55}{35} \times 7 = 9 \times 0.56875$
L7 - L8	Same as L6-L7
L0 - U1	$-\frac{15}{16} \times \frac{5.740}{3.500} = -15 \times 0.1025$
U1 - L2	$\frac{14}{16} \times \frac{5.740}{3.500} = 14 \times 0.1025$ or $(\frac{15}{16}-1) \times \frac{5.74}{3.5} = -\frac{1}{16} \times \frac{5.74}{3.5} = -0.1025$
L2 - M3	$-\frac{13}{16} \times \frac{5.740}{3.500} = -13 \times 0.1025$ or 2×0.1025
M3 - L4	$\frac{12}{16} \times \frac{5.740}{3.500} = 12 \times 0.1025$ or -3×0.1025
L4 - M5	$-\frac{11}{16} \times \frac{5.740}{3.500} = -11 \times 0.1025$ or 4×0.1025
M5 - L6	$\frac{10}{16} \times \frac{5.740}{3.500} = 10 \times 0.1025$ or -5×0.1025
L6 - M7	$-\frac{9}{16} \times \frac{5.740}{3.500} = -9 \times 0.1025$ or 6×0.1025
M7 - L8	$\frac{8}{16} \times \frac{5.740}{3.500} = 8 \times 0.1025$ or -7×0.1025

Vertical.

U1 - L1, M3 - L3, M5 - L5, M7 - L7 : 1.00 for each

M2 - L2, M4 - L4, M6 - L6, M8 - L8 : 0.000 for all if upper panel load = 0

Stresses of each member when H = -1. applied



Horizontal component of top chord = H.

Middle chord.

U1 - M2	$\frac{3.5+2.377}{3.5} = 1 + \frac{2.377}{3.5} = 1.679$
M2 - M3	Same as U1 - M2
M3 - M4	$1 + \frac{5.854}{3.5} = 1 + 1.673 = 2.673$
M4 - M5	Same as M3 - M4
M5 - M6	$1 + \frac{7.849}{3.5} = 1 + 2.243 = 3.243$
M6 - M7	Same as M5 - M6
M7 - M8	$1 + \frac{8.500}{3.5} = 1 + 2.429 = 3.429$

Bottom chord.

L0 - L1 = L1 - L2 = 0

L2 - L3	$-\frac{4.314}{3.5} = -1.233$	L3 - L4	Same as L2 - L3
L4 - L5	$-\frac{7.026}{3.5} = -2.007$	L5 - L6	Same as L4 - L5
L6 - L7	$-\frac{8.339}{3.5} = -2.383$	L7 - L8	Same as L6 - L7

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CALCULATIONS FOR

Design of Ibi nagara-gawa Bashi for Miéken

Diagonals	L0 - U1	no stress for H = -1.	
	U1 - L2	$U1\text{-}L2 \times \frac{3.500}{5.740} + \frac{2.377}{4.550} = 0$	$\therefore U1\text{-}L2 = -\frac{2.377}{4.550} \times \frac{5.740}{3.500} = -0.522 \times 1.64 = -0.856$
	L2 - M3	$\frac{1.937}{4.550} \times \frac{5.740}{3.500} =$	$0.426 \times 1.64 = 0.699$
	M3 - L4	$-\frac{1.540}{4.550} \times \frac{5.740}{3.500} =$	$-0.3385 \times 1.64 = -0.555$
	L4 - M5	$\frac{1.172}{4.550} \times \frac{5.740}{3.500} =$	$0.2575 \times 1.64 = 0.422$
	M5 - L6	$-\frac{.823}{4.550} \times \frac{5.740}{3.500} =$	$-0.181 \times 1.64 = -0.297$
	L6 - M7	$\frac{.490}{4.550} \times \frac{5.740}{3.500} =$	$0.1077 \times 1.64 = 0.177$
	M7 - L8	$-\frac{.161}{4.550} \times \frac{5.740}{3.500} =$	$-0.0354 \times 1.64 = 0.058$
	U1 - L1	No stress for H = -1.	
Verticals	U2 - M2 and M2 - L2	$\frac{2.377 - 1.937}{4.550} =$	$= 0.440 \div 4.550 = 0.097$
	U3 - M3	$(1.937 - 1.540) \div 4.550$	$= 0.397 \div 4.550 = 0.087$
	U4 - M4 and M4 - L4	$(1.540 - 1.172) \div 4.550$	$= 0.368 \div 4.550 = 0.081$
	U5 - M5	$(1.172 - 0.823) \div 4.550$	$= 0.349 \div 4.550 = 0.077$
	U6 - M6 and M6 - L6	$(0.823 - 0.490) \div 4.550$	$= 0.333 \div 4.550 = 0.073$
	U7 - M7	$(0.490 - 0.161) \div 4.550$	$= 0.329 \div 4.550 = 0.072$
	U8 - M8 and M8 - L8	$(0.161 + 0.161) \div 4.550$	$= 0.322 \div 4.550 = 0.071$

Ia for Top chord (Where Ia = Stress due to H = -1)

U1 - U2	$-5.134 \div 4.550 = -1.128$
U2 - U3	$-4.945 \div$ 〃 $= -1.087$
U3 - U4	$-4.804 \div$ 〃 $= -1.056$
U4 - U5	$-4.699 \div$ 〃 $= -1.033$
U5 - U6	$-4.623 \div$ 〃 $= -1.016$
U6 - U7	$-4.576 \div$ 〃 $= -1.006$
U7 - U8	$-4.553 \div$ 〃 $= -1.000$

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for MieKen

$\Sigma o.1\ \Sigma a\ l$ and $\Sigma a^2 l$ for Middle chords

Member	$\Sigma o.1$	Σa	l	$\Sigma o.1 \Sigma a$	Σa^2	$\Sigma o.1 \Sigma a\, l$	$\Sigma a^2 l$
U1 - M2	-0.1625	1.679	4.550	-0.2728	2.8190	-1.241	12.826
M2 - M3	-0.1625	1.679	〃	〃	〃	〃	〃
M3 - M4	-0.3250	2.673	〃	-0.8687	7.1449	-3.953	32.509
M4 - M5	-0.3250	2.673	〃	〃	〃	〃	〃
M5 - M6	-0.4875	3.243	〃	-1.5810	10.5170	-7.194	47.852
M6 - M7	-0.4875	3.243	〃	〃	〃	〃	〃
M7 - M8	-0.6500	3.429	〃	-2.2289	11.7580	-10.141	53.500
M8 - M7'	-0.6500	3.429	〃	〃	〃	〃	〃
M7' - M6'	-0.8125	3.243	〃	-2.6349	10.5170	-11.989	47.852
M6' - M5'	-0.8125	3.243	〃	〃	〃	〃	〃
M5' - M4'	-0.9750	2.673	〃	-2.6062	7.1449	-11.858	32.509
M4' - M3'	-0.9750	2.673	〃	〃	〃	〃	〃
M3' - M2'	-1.1375	1.679	〃	-1.9099	2.8190	-8.690	12.826
M2' - U1'	-1.1375	1.679	〃	〃	〃	〃	〃

$\Sigma o.1\ \Sigma a\ l$ and $\Sigma a^2 l$ for Bottom chord.

Member	$\Sigma o.1$	Σa	l	$\Sigma o.1 \Sigma a$	Σa^2	$\Sigma o.1 \Sigma a\, l$	$\Sigma a^2 l$
L0 - L1	0.0813	0	4.550	0	0	0.000	0.000
L1 - L2	〃	0	〃	0	0	〃	〃
L2 - L3	0.2438	-1.233	〃	-0.3006	1.5203	-1.368	6.917
L3 - L4	〃	〃	〃	〃	〃	〃	〃
L4 - L5	0.4063	-2.007	〃	-0.8154	4.0280	-3.710	18.327
L5 - L6	〃	〃	〃	〃	〃	〃	〃
L6 - L7	0.5688	-2.383	〃	-1.3555	5.6787	-6.168	25.838
L7 - L8	〃	〃	〃	〃	〃	〃	〃
L8 - L7'	0.8313	-2.383	〃	-1.9810	5.6787	-9.014	25.938
L7' - L6'	〃	〃	〃	〃	〃	〃	〃
L6' - L5'	0.8938	-2.007	〃	-1.7939	4.0280	-8.162	18.327
L5' - L4'	〃	〃	〃	〃	〃	〃	〃
L4' - L3'	1.0563	-1.233	〃	-1.3024	1.5203	-5.926	6.917
L3' - L2'	〃	〃	〃	〃	〃	〃	〃
L2' - L1'	1.2188	0.000	〃	0.0000	0.0000	0.000	0.000
L1' - L0	〃	〃	〃	〃	〃	〃	〃

$\Sigma o.1\ \Sigma a\, l$ and $\Sigma a^2 l$ for Diagonals

Member	$\Sigma o.1$	Σa	l	$\Sigma o.1 \Sigma a$	Σa^2	$\Sigma o.1 \Sigma a\, l$	$\Sigma a^2 l$
L0 - U1	-0.1025	0	5.740	0	0	0	0
U1 - L2	0.1025	-0.856	〃	-0.0877	0.7327	-0.503	4.206
L2 - M3	-0.1025	0.699	〃	-0.0716	0.4886	-0.411	2.805
M3 - L4	0.1025	-0.555	〃	-0.0569	0.3080	-0.327	1.768
L4 - M5	-0.1025	0.422	〃	-0.0433	0.1781	-0.249	1.022
M5 - L6	0.1025	-0.297	〃	-0.0304	0.0882	-0.175	0.506
L6 - M7	-0.1025	0.177	〃	-0.0181	0.0313	-0.104	0.180
M7 - L8	0.1025	-0.058	〃	-0.0059	0.0034	-0.034	0.020
L8 - M7'	-0.1025	-0.058	〃	+0.0059	0.0034	+0.034	0.020
M7' - L6'	+0.1025	0.177	〃	+0.0181	0.0313	+0.104	0.180
L6' - M5'	-0.1025	-0.297	〃	+0.0304	0.0882	+0.175	0.506
M5' - L4'	+0.1025	0.422	〃	+0.0433	0.1781	+0.249	1.022
L4' - M3'	-0.1025	-0.555	〃	+0.0569	0.3080	+0.327	1.768
M3' - L2'	+0.1025	0.699	〃	+0.0716	0.4886	+0.411	2.805
L2' - U1'	-0.1025	-0.856	〃	+0.0877	0.7327	+0.503	4.206
U1' - L0'	-1.5375	0.000	〃	0.0000	0.0000	0	0

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

$\Sigma o.l\Sigma al$ and $\Sigma a^2 l$ for Verticals

Member	$\Sigma o.l$	Σa	l	$\Sigma o.l\Sigma a$	Σa^2	$\Sigma o.l\Sigma al$	$\Sigma a^2 l$
U1 – L1	0.000	0.000	3.500	0.000	0.000	0.000	0.000
M2 – L2	〃	0.097	〃	〃	0.0094	〃	0.033
M3 – L3	〃	0.000	〃	〃	0.000	〃	0.000
M4 – L4	〃	0.081	〃	〃	0.0066	〃	0.023
M5 – L5	〃	0.000	〃	〃	0.000	〃	0.000
M6 – L6	〃	0.073	〃	〃	0.0053	〃	0.019
M7 – L7	〃	0.000	〃	〃	0.000	〃	0.000
M8 – L8	〃	0.071	〃	〃	0.0050	〃	0.018
M7' – L7'	〃	0.000	〃	〃	0.000	〃	0.000
M6' – L6'	〃	0.073	〃	〃	0.0053	〃	0.019
M5' – L5'	〃	0.000	〃	〃	0.000	〃	0.000
M4' – L4'	〃	0.081	〃	〃	0.0066	〃	0.023
M3' – L3'	〃	0.000	〃	〃	0.000	〃	0.000
M2' – L2'	〃	0.097	〃	〃	0.0094	〃	0.033
U1' – L1'	〃	0.000	〃	〃	0.000	〃	0.000

$\Sigma o.l\Sigma al$ and $\Sigma a^2 l$ for Suspender

Member	$\Sigma o.l$	Σa	l	$\Sigma o.l\Sigma a$	Σa^2	$\Sigma o.l\Sigma al$	$\Sigma a^2 l$
U2 – M2	0.000	0.097	2.377	0.000	0.0094	0.000	0.0223
U3 – M3	〃	0.087	4.314	〃	0.0076	〃	0.0326
U4 – M4	〃	0.081	5.854	〃	0.0066	〃	0.0384
U5 – M5	〃	0.077	7.026	〃	0.0059	〃	0.0417
U6 – M6	〃	0.073	7.849	〃	0.0053	〃	0.0418
U7 – M7	〃	0.072	8.339	〃	0.0052	〃	0.0432
U8 – M8	〃	0.071	8.500	〃	0.0050	〃	0.0428
U7' – M7'	〃	0.072	8.339	〃	0.0052	〃	0.0432
U6' – M6'	〃	0.073	7.849	〃	0.0053	〃	0.0418
U5' – M5'	〃	0.077	7.026	〃	0.0059	〃	0.0417
U4' – M4'	〃	0.081	5.854	〃	0.0066	〃	0.0384
U3' – M3'	〃	0.087	4.314	〃	0.0076	〃	0.0326
U2' – M2'	〃	0.097	2.377	〃	0.0094	〃	0.0223

$\Sigma o.l\Sigma al$ and $\Sigma a^2 l$ for Top chord.

Member	$\Sigma o.l$	Σa	l	$\Sigma o.l\Sigma a$	Σa^2	$\Sigma o.l\Sigma al$	$\Sigma a^2 l$
U1 – U2	0.000	1.128	5.134	0.000	1.2724	0.000	6.533
U2 – U3	〃	1.087	4.945	〃	1.1816	〃	5.843
U3 – U4	〃	1.056	4.804	〃	1.1151	〃	5.357
U4 – U5	〃	1.033	4.699	〃	1.0671	〃	5.014
U5 – U6	〃	1.016	4.623	〃	1.0323	〃	4.772
U6 – U7	〃	1.006	4.576	〃	1.0012	〃	4.576
U7 – U8	〃	1.000	4.553	〃	1.0000	〃	4.553
U8 – U7'	〃	1.000	4.553	〃	1.0000	〃	4.553
U7' – U6'	〃	1.006	4.576	〃	1.0012	〃	4.576
U6' – U5'	〃	1.016	4.623	〃	1.0323	〃	4.772
U5' – U4'	〃	1.033	4.699	〃	1.0671	〃	5.014
U4' – U3'	〃	1.056	4.804	〃	1.1151	〃	5.357
U3' – U2'	〃	1.087	4.945	〃	1.1816	〃	5.843
U2' – U1'	〃	1.128	5.134	〃	1.2724	〃	6.533

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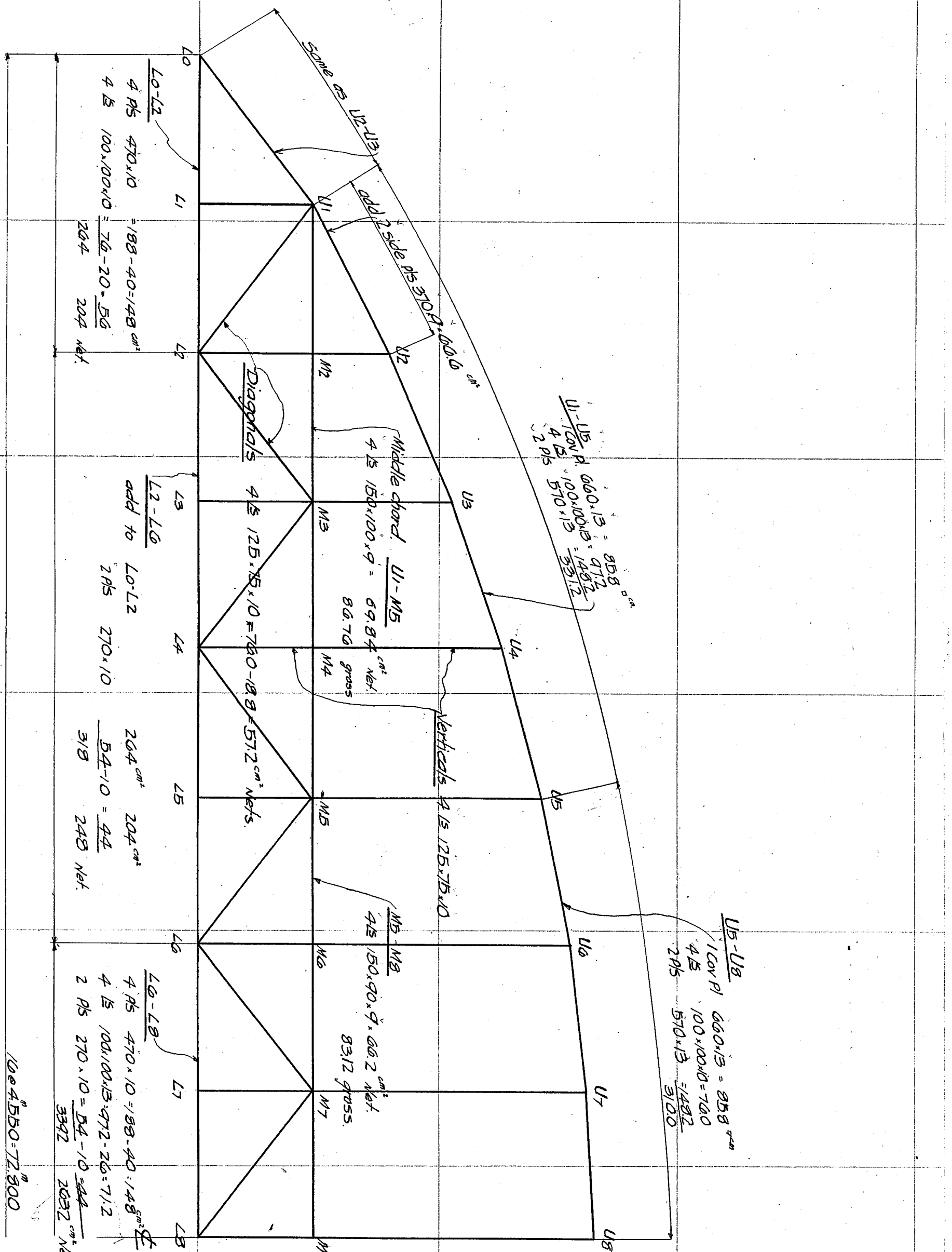

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

$\Sigma o_i \Sigma a \ell/A$ and $\Sigma a^2 \ell/A$ for Middle chord.

Member	A	$\Sigma o_i \Sigma a \ell$	$\Sigma a^2 \ell$	$\Sigma o_i \Sigma a \ell/A$	$\Sigma a^2 \ell/A$
U1 - M2	80.76	-1.241	12.826	-1.430	14.800
M2 - M3	"	"	"	"	"
M3 - M4	"	-3.953	32.509	-4.555	37.500
M4 - M5	"	"	"	"	"
M5 - M6	83.12	-7.194	47.852	-8.050	57.600
M6 - M7	"	"	"	"	"
M7 - M8	"	-10.141	53.500	-12.220	64.400
M8 - M7'	"	"	"	"	"
M7' - M6'	"	-11.989	47.852	-14.430	57.600
M6' - M5'	"	"	"	"	"
M5' - M4'	80.76	-11.858	32.509	-13.670	37.500
M4' - M3'	"	"	"	"	"
M3' - M2'	"	-8.690	12.826	-10.000	14.800
M2' - U1'	"	"	"	"	"
					Σ = 568.400

$\Sigma o_i \Sigma a \ell/A$ and $\Sigma a^2 \ell/A$ for Bottom chord

Member	A	$\Sigma o_i \Sigma a \ell$	$\Sigma a^2 \ell$	$\Sigma o_i \Sigma a \ell/A$	$\Sigma a^2 \ell/A$
L0 - L1	264.0	0.000	0.000	0.000	0.000
L1 - L2	"	"	"	"	"
L2 - L3	318.0	-1.368	6.917	-0.431	2.175
L3 - L4	"	"	"	"	"
L4 - L5	"	-3.710	18.327	-1.107	5.767
L5 - L6	"	"	"	"	"
L6 - L7	339.2	-6.1.608	25.838	-1.818	7.620
L7 - L8	"	"	"	"	"
L8 - L7'	"	-9.014	"	-2.657	"
L7' - L6'	"	"	"	"	"
L6' - L5'	318.0	-8.162	18.327	-2.568	5.767
L5' - L4'	"	"	"	"	"
L4' - L3'	"	-5.926	6.917	-1.865	2.175
L3' - L2'	"	"	"	"	"
L2' - L1'	264.0	0.000	0.000	0.000	0.000
L1' - L0'	"	"	"	"	"
					Σ = 62.248

$\Sigma o_i \Sigma a \ell/A$ and $\Sigma a^2 \ell/A$ for Diagonals

Member	A	$\Sigma o_i \Sigma a \ell$	$\Sigma a^2 \ell$	$\Sigma o_i \Sigma a \ell/A$	$\Sigma a^2 \ell/A$
L0 - U1	331.2	0	0	0	0
U1 - L2	70.0	-0.503	4.206	-0.662	5.530
L2 - M3	"	-0.411	2.805	-0.541	3.690
M3 - L4	"	-0.327	1.768	-0.431	2.328
L4 - M5	"	-0.249	1.022	-0.328	1.345
M5 - L6	"	-0.175	0.506	-0.230	0.666
L6 - M7	"	-0.104	0.180	-0.137	0.237
M7 - L8	"	-0.034	0.020	-0.045	0.026
L8 - M7'	"	+0.034	0.020	+0.045	0.026
M7' - L6'	"	+0.104	0.180	+0.137	0.237
L6' - M5'	"	+0.175	0.506	+0.230	0.666
M5' - L4'	"	+0.249	1.022	+0.328	1.345
L4' - M3'	"	+0.327	1.768	+0.431	2.328
M3' - L2'	"	+0.411	2.805	+0.541	3.690
L2' - U1'	"	+0.503	4.206	+0.662	5.530
U1' - L0	331.2	0	0	0	0
					Σ = 27.644

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken.

$\Sigma a.l\,\Sigma a\,l/A$ and $\Sigma a^2 l/A$ for Vertical members.

Member	A	$\Sigma a.l\,\Sigma a\,l$	$\Sigma a^2 l$	$\Sigma a.l\,\Sigma a\,l/A$	$\Sigma a^2 l/A$
U1 - L1	760	0.000	0.000	0.000	0.000
M2 - L2	〃	〃	0.033	〃	0.043
M3 - L3	〃	〃	0.000	〃	0.000
M4 - L4	〃	〃	0.023	〃	0.030
M5 - L5	〃	〃	0.000	〃	0.000
M6 - L6	〃	〃	0.019	〃	0.025
M7 - L7	〃	〃	0.000	〃	0.000
M8 - L8	〃	〃	0.018	〃	0.023
M7' - L7'	〃	〃	0.000	〃	0.000
M6' - L6'	〃	〃	0.019	〃	0.025
M5' - L5'	〃	〃	0.000	〃	0.000
M4' - L4'	〃	〃	0.023	〃	0.030
M3' - L3'	〃	〃	0.000	〃	0.000
M2' - L2'	〃	〃	0.033	〃	0.043
U1' - L1'	〃	〃	0.000	〃	0.000
					$\Sigma = 0.219$

$\Sigma a.l\,\Sigma a\,l/A$ and $\Sigma a^2 l/A$ for Suspender

Member	A	$\Sigma a.l\,\Sigma a\,l$	$\Sigma a^2 l$	$\Sigma a.l\,\Sigma a\,l/A$	$\Sigma a^2 l/A$
U2 - M2	760	0.000	0.022	0.000	0.029
U3 - M3	〃	〃	0.033	〃	0.043
U4 - M4	〃	〃	0.038	〃	0.051
U5 - M5	〃	〃	0.042	〃	0.055
U6 - M6	〃	〃	0.042	〃	0.055
U7 - M7	〃	〃	0.043	〃	0.057
U8 - M8	〃	〃	0.043	〃	0.056
U7' - M7'	〃	〃	0.043	〃	0.057
U6' - M6'	〃	〃	0.042	〃	0.055
U5' - M5'	〃	〃	0.042	〃	0.055
U4' - M4'	〃	〃	0.038	〃	0.051
U3' - M3'	〃	〃	0.033	〃	0.043
U2' - M2'	〃	〃	0.022	〃	0.029
					$\Sigma = 0.636$

$\Sigma a.l\,\Sigma a\,l/A$ and $\Sigma a^2 l/A$ for Top chord.

Member	A	$\Sigma a.l\,\Sigma a\,l$	$\Sigma a^2 l$	$\Sigma a.l\,\Sigma a\,l/A$	$\Sigma a^2 l/A$
U1 - U2	397.8	0.000	0.533	0.000	1.643
U2 - U3	331.2	〃	5.843	〃	1.765
U3 - U4	〃	〃	5.357	〃	1.617
U4 - U5	〃	〃	5.014	〃	1.514
U5 - U6	310.0	〃	4.772	〃	1.538
U6 - U7	〃	〃	4.576	〃	1.477
U7 - U8	〃	〃	4.553	〃	1.468
U8 - U7'	〃	〃	4.553	〃	1.468
U7' - U6'	〃	〃	4.576	〃	1.477
U6' - U5'	〃	〃	4.772	〃	1.538
U5' - U4'	331.2	〃	5.014	〃	1.514
U4' - U3'	〃	〃	5.357	〃	1.617
U3' - U2'	〃	〃	5.843	〃	1.765
U2' - U1'	397.8	〃	0.533	〃	1.643
					$\Sigma = 22.044$

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

So.1 Sa $^{\ell}/_{A}$ and Σ So. Sa $^{\ell}/_{A}$ for Middle chord.

	Σ				
		ΣSo1.Sa $^{\ell}/_{A}$			
-1.430	-1.430		-129.910	= -129.910	= -129.910
〃	-2.860				
-4.555	-7.415	2	2@-109.910+14@-2.860 = -219.820	-40.040	= -259.860
〃	-11.970				
-8.650	-20.620	3	3@-109.910+13@-2.860 = -329.730	-37.180	= -366.910
〃	-29.270				
-12.220	-41.490	4	4@-82.570+12@-11.970 = -330.280	-143.640	= -473.920
〃	-53.710				
-14.430	-68.140	5	5@-82.570+11@-11.970 = -412.850	-131.670	= -544.520
〃	-82.570				
-13.670	-96.240	6	6@-53.710+10@-29.270 = 322.260	-292.700	= -614.960
〃	-109.910				
-10.000	-119.910	7	7@-53.710+9@-29.270 = -375.970	-263.430	= -639.400
〃	-129.910				
		8	8@-41.490+8@-41.490 = -331.920	-331.920	= -663.840

For Bottom chord.

		ΣSo1.Sa $^{\ell}/_{A}$			
-0.431	-0.431		-21.012		= -21.012
〃	-0.862				
-1.167	-2.029	2	2@-21.012	= -42.024	= -42.024
〃	-3.196				
-1.818	-5.014	3	3@-17.282+13@-0.862 = -51.846	-11.206	= -63.052
〃	-6.832				
-2.657	-9.489	4	4@-17.282+12@-0.862 = -69.128	-10.344	= -79.472
〃	-12.146				
-2.568	-14.714	5	5@-12.146+11@-3.196 = -60.730	-35.156	= -95.886
〃	-17.282				
-1.865	-19.147	6	6@-12.146+10@-3.196 = -72.876	-31.960	= -104.836
〃	-21.012				
		7	7@-6.832+9@-6.832 = -47.824	-61.488	= -109.312
		8	8@-6.832+8@-6.832 = -54.656	-54.656	= -109.312

For diagonals

	Σ				
		ΣSo1.Sa $^{\ell}/_{A}$			
-0.662	-0.662		0	= 0	= 0
-0.541	-1.203				
-0.431	-1.634	2	2@-0.662+14@-0.662 = -1.324	-9.268	= -10.592
-0.328	-1.962				
-0.230	-2.192	3	3@-1.203+13@-1.203 = -3.609	-15.639	= -19.248
-0.137	-2.329				
-0.045	-2.374	4	4@-1.634+12@-1.634 = -0.536	-19.608	= -26.144
+0.045	-2.329				
+0.137	-2.192	5	5@-1.962+11@-1.962 = -9.810	-21.582	= -31.392
+0.230	-1.962				
+0.328	-1.634	6	6@-2.192+10@-2.192 = -13.152	-21.920	= -35.072
+0.431	-1.203				
+0.541	-0.660	7	7@-2.329+9@-2.329 = -16.303	-20.961	= -37.264
+0.662	0.000				
		8	8@-2.374+8@-2.374 = -18.992	-18.992	= -37.984

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

For Verticals

$\Sigma S_o S_a g/A$	$\Sigma S_{a1}.S_a g/A$	
0		= 0
〃		
〃	2	= 〃
〃		
〃	3	= 〃
〃		
〃	4	= 〃
〃		
〃	5	= 〃
〃		
〃	6	= 〃
	7	= 〃
	8	= 〃

Find H surfaces

$\Sigma S_{o1}.S_a g/A$	Middle chord.	Bottom chord	Diagonals	Verticals	Sum.	H
	-129.910	-21.012	0.000	0	-150.922	-0.222
2	-259.860	-42.024	-10.592	〃	-312.476	-0.459
3	-360.910	-03.052	-19.248	〃	-449.210	-0.659
4	-473.920	-79.472	-26.144	〃	-579.536	-0.851
5	-544.520	-95.886	-31.392	〃	-671.798	-0.986
6	-614.960	-104.836	-35.072	〃	-754.868	-1.108
7	-639.400	-109.312	-37.264	〃	-785.976	-1.154
8	-663.840	-109.312	-37.984	〃	-811.136	-1.191

$\Sigma.S_a^2 g/A$ 568.400 + 62.248 + 27.644 + 0.219 + 0.636 + 22.044 = 681.191

ΣH=-12.069

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie Ken

Find Σa H for Middle chord.

Member	Load on H= Σa	1	2	3	4	5	6	7	8
		-0.222	-0.459	-0.659	-0.851	-0.986	-1.108	-1.154	-1.191
U1 - M2	1.679	-0.373	-0.771	-1.106	-1.429	-1.655	-1.860	-1.938	-2.000
M2 - M3	〃	〃							
M3 - M4	2.673	-0.593	-1.227	-1.762	-2.275	-2.636	-2.962	-3.085	-3.184
M4 - M5	〃	〃							
M5 - M6	3.243	-0.720	-1.489	-2.137	-2.760	-3.198	-3.593	-3.742	-3.862
M6 - M7	〃	〃							
M7 - M8	3.429	-0.761	-1.574	-2.260	-2.918	-3.381	-3.799	-3.957	-4.084

Find Σa H for Bottom chord

L2 - L3	-1.233	0.274	0.566	0.813	1.049	1.216	1.366	1.423	1.469
L3 - L4	〃								
L4 - L5	-2.007	0.446	0.921	1.323	1.708	1.979	2.224	2.316	2.391
L5 - L6	〃								
L6 - L7	-2.383	0.529	1.094	1.570	2.028	2.350	2.640	2.750	2.838
L7 - L8	〃								

Find Σa H for Diagonals.

U1 - L2	-0.856	0.190	0.393	0.564	0.728	0.844	0.948	0.988	1.019
L2 - M3	0.699	-0.155	-0.321	-0.461	-0.595	-0.689	-0.774	-0.807	-0.833
M3 - L4	-0.555	0.123	0.256	0.366	0.472	0.547	0.615	0.640	0.661
L4 - M5	0.422	-0.094	-0.194	-0.278	-0.359	-0.416	-0.468	-0.487	-0.503
M5 - L6	-0.297	0.066	0.136	0.196	0.253	0.293	0.329	0.343	0.354
L6 - M7	0.177	-0.039	-0.081	-0.117	-0.151	-0.175	-0.196	-0.204	-0.211
M7 - L8	-0.058	0.013	0.027	0.038	0.049	0.057	0.064	0.067	0.069

Find Σa H for Suspenders and Verticals

U2 - L2	0.097	-0.022	-0.045	-0.064	-0.083	-0.096	-0.107	-0.112	-0.116
U3 - M3	0.087	-0.019	-0.040	-0.057	-0.074	-0.086	-0.096	-0.100	-0.104
U4 - L4	0.081	-0.018	-0.037	-0.053	-0.069	-0.080	-0.090	-0.093	-0.096
U5 - M5	0.077	-0.017	-0.035	-0.051	-0.066	-0.076	-0.085	-0.089	-0.092
U6 - L6	0.073	-0.016	-0.034	-0.048	-0.062	-0.072	-0.081	-0.084	-0.087
U7 - M7	0.072	-0.016	-0.033	-0.047	-0.061	-0.071	-0.080	-0.083	-0.086
U8 - L8	0.071	-0.016	-0.033	-0.047	-0.060	-0.070	-0.079	-0.082	-0.085

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MADE BY Y.O DATE 5-5-28 FILE NO.
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CALCULATIONS FOR

Design of Ibi-nagara gawa Bashi for Mie-Ken.

Influence Surfaces for Middle chord.

	U1-M2 & M2-M3			M3-M4 & M4-M5			M5-M6 & M6-M7			M7-M8		
	So	SaH	Final									
1	-0.163	-0.373	0.210	-0.325	-0.593	0.268	-0.488	-0.720	0.232	-0.650	-0.761	0.111
2	-0.325	-0.771	0.446	-0.650	-1.227	0.577	-0.975	-1.489	0.514	-1.300	-1.574	0.274
3	-0.488	-1.106	0.618	-0.975	-1.762	0.787	-1.463	-2.137	0.674	-1.950	-2.260	0.310
4	-0.650	-1.429	0.779	-1.300	-2.275	0.975	-1.950	-2.760	0.810	-2.600	-2.918	0.318
5	-0.813	-1.655	0.842	-1.625	-2.636	1.011	-2.438	-3.198	0.760	-3.250	-3.381	0.131
6	-0.975	-1.860	0.885	-1.950	-2.962	1.012	-2.925	-3.593	0.668	-3.900	-3.799	-0.101
7	-1.138	-1.938	0.800	-2.275	-3.085	0.810	-3.413	-3.742	0.329	-4.550	-3.957	-0.593
8	-1.300	-2.000	0.700	-2.600	-3.184	0.584	-3.900	-3.862	-0.038	-5.200	-4.084	-1.116
7	-1.463	-1.938	0.475	-2.925	-3.085	0.160	-4.388	-3.742	-0.646	-4.550	-3.957	-0.593
6	-1.625	-1.860	0.235	-3.250	-2.962	-0.288	-4.875	-3.593	-1.282	-3.900	-3.799	-0.101
5	-1.788	-1.655	-0.133	-3.575	-2.636	-0.939	-4.063	-3.198	-0.865	-3.250	-3.381	0.131
4	-1.950	-1.429	-0.521	-3.900	-2.275	-1.625	-3.250	-2.760	-0.490	-2.600	-2.918	0.318
3	-2.113	-1.106	-1.007	-2.925	-1.762	-1.163	-2.438	-2.137	-0.301	-1.950	-2.260	0.310
2	-2.275	-0.771	-1.504	-1.950	-1.227	-0.723	-1.625	-1.489	-0.136	-1.300	-1.574	0.274
1	-1.138	-0.373	-0.765	-0.975	-0.593	-0.382	-0.813	-0.720	-0.093	-0.650	-0.761	0.111
			5.990			6.184			3.987			2.288
			-3.930			-5.120			-3.851			-2.504
		Sum.	2.060			1.064			0.136			-0.216

Influence Surfaces for Bottom chord.

	L0-L1 & L1-L2			L2-L3 & L3-L4			L4-L5 & L5-L6			L6-L7 & L7-L8		
	So	SaH	Final									
1			0.081	0.244	0.274	-0.030	0.406	0.446	-0.046	0.569	0.529	0.040
2			0.163	0.488	0.566	-0.078	0.813	0.921	-0.108	1.138	1.094	0.044
3			0.244	0.731	0.813	-0.082	1.219	1.323	-0.104	1.706	1.570	0.136
4			0.325	0.975	1.049	-0.074	1.625	1.708	-0.083	2.275	2.028	0.247
5			0.406	1.219	1.216	-0.003	2.031	1.979	0.052	2.844	2.350	0.484
6			0.488	1.463	1.366	0.097	2.438	2.224	0.214	3.413	2.640	0.773
7			0.569	1.706	1.423	0.283	2.844	2.316	0.528	3.981	2.750	1.231
8			0.650	1.950	1.469	0.481	3.250	2.391	0.859	4.550	2.838	1.712
7			0.731	2.194	1.423	0.771	3.656	2.316	1.340	5.119	2.750	2.369
6			0.813	2.438	1.366	1.072	4.063	2.224	1.839	4.388	2.640	1.748
5			0.894	2.681	1.216	1.465	4.469	1.979	2.490	3.656	2.350	1.306
4			0.975	2.925	1.049	1.876	3.575	1.708	1.867	2.925	2.028	0.897
3			1.056	3.169	0.813	2.356	2.681	1.323	1.358	2.194	1.570	0.624
2			1.138	2.113	0.566	1.547	1.787	0.921	0.866	1.463	1.094	0.369
1			1.219	1.056	0.274	0.782	0.894	0.446	0.448	0.731	0.529	0.202
			9.752			10.730			11.861			12.182
			-0.000			-0.267			-0.335			-0.000
			9.752			10.463			11.526			12.182

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Influence Surfaces for Diagonals

	Lo-U1			U1-L2			L2-M3			M3-L4		
	Io	IaH	Final									
1	-0.103		-0.103	0.103	0.190	-0.087	-0.103	-0.155	0.052	0.103	0.123	-0.020
2	-0.205		-0.205	0.205	0.393	-0.188	-0.205	-0.321	0.116	0.205	0.256	-0.051
3	-0.308		-0.308	0.308	0.564	-0.256	-0.308	-0.461	0.153	0.308	0.366	-0.058
4	-0.410		-0.410	0.410	0.728	-0.318	-0.410	-0.595	0.185	0.410	0.472	-0.062
5	-0.513		-0.513	0.513	0.844	-0.331	-0.513	-0.689	0.176	0.513	0.547	-0.034
6	-0.615		-0.615	0.615	0.948	-0.333	-0.615	-0.774	0.159	0.615	0.615	0.000
7	-0.718		-0.718	0.718	0.988	-0.270	-0.718	-0.807	0.089	0.718	0.640	0.078
8	-0.820		-0.820	0.820	1.019	-0.199	-0.820	-0.833	0.013	0.820	0.661	0.159
7	-0.923		-0.923	0.923	0.988	-0.065	-0.923	-0.807	-0.116	0.923	0.640	0.283
6	-1.025		-1.025	1.025	0.948	0.077	-1.025	-0.774	-0.251	1.025	0.615	0.410
5	-1.128		-1.128	1.128	0.844	0.284	-1.128	-0.689	-0.439	1.128	0.547	0.581
4	-1.230		-1.230	1.230	0.728	0.502	-1.230	-0.595	-0.635	1.230	0.472	0.758
3	-1.333		-1.333	1.333	0.564	0.769	-1.333	-0.461	-0.872	-0.308	0.366	-0.674
2	-1.435		-1.435	1.435	0.393	1.042	0.205	-0.321	-0.526	-0.205	0.256	-0.461
1	-1.538		-1.538	-0.103	0.190	-0.293	0.103	-0.155	-0.258	-0.103	0.123	-0.226
			-12.304			2.674			1.727			2.269
			0.000			-2.340			-2.313			-1.586
		Sum.	-12.304			0.334			-0.586			0.683

	L4-M5			M5-L6			L6-M7			M7-L8		
	Io	IaH	Final									
1	-0.103	-0.094	-0.009	0.103	0.066	0.037	-0.103	-0.039	-0.064	0.103	0.013	0.090
2	-0.205	-0.194	-0.011	0.205	0.136	0.069	-0.205	-0.081	-0.124	0.205	0.027	0.178
3	-0.308	-0.278	-0.030	0.308	0.196	0.112	-0.308	-0.117	-0.191	0.308	0.038	0.270
4	-0.410	-0.359	-0.051	0.410	0.253	0.157	-0.410	-0.151	-0.259	0.410	0.049	0.361
5	-0.513	-0.416	-0.097	0.513	0.293	0.220	-0.513	-0.175	-0.338	0.513	0.057	0.456
6	-0.615	-0.468	-0.147	0.615	0.329	0.286	-0.615	-0.196	-0.419	0.615	0.064	0.551
7	-0.718	-0.487	-0.231	0.718	0.343	0.375	-0.718	-0.204	-0.514	0.718	0.067	0.651
8	-0.820	-0.503	-0.317	0.820	0.354	0.466	-0.820	-0.211	-0.609	0.820	0.069	0.751
7	-0.923	-0.487	-0.436	0.923	0.343	0.580	-0.923	-0.204	-0.719	0.718	0.067	-0.785
6	-1.025	-0.468	-0.557	1.025	0.329	0.696	0.615	-0.196	0.811	-0.615	0.064	-0.679
5	-1.128	-0.416	-0.712	-0.513	0.293	-0.806	0.513	-0.175	0.688	-0.513	0.057	-0.570
4	0.410	-0.359	0.769	-0.410	0.253	-0.663	0.410	-0.151	0.561	-0.410	0.049	-0.459
3	0.308	-0.278	0.586	-0.308	0.196	-0.504	0.308	-0.117	0.425	-0.308	0.038	-0.346
2	0.205	-0.194	0.399	-0.205	0.136	-0.341	0.205	-0.081	0.286	-0.205	0.027	-0.232
1	0.103	-0.094	0.197	-0.103	0.066	-0.169	0.103	-0.039	0.142	-0.103	0.013	-0.116
			-2.598			2.998			2.913			3.309
			+1.951			-2.483			-3.237			-3.187
		Sum.	-0.647			0.515			-0.324			0.121

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken.

Influence surfaces for Suspenders and Verticals.

	U1-L1 (M3-L3 M5-L5. M7-L7)			U2-M2-L2			U3-M3			U4-M4-L4		
	So	SaH	Final.	So	SaH.	Final.	So	SaH.	Final.	So	SaH	Final.
1	0	0	0	0	-0.022	0.022	0.000	-0.019	0.019	0.00	-0.018	0.018
2	〃	〃	〃	〃	-0.045	0.045	〃	-0.040	0.040	〃	-0.037	0.037
3	〃	〃	〃	〃	-0.064	0.064	〃	-0.057	0.057	〃	-0.053	0.053
4	〃	〃	〃	〃	-0.083	0.083	〃	-0.074	0.074	〃	-0.069	0.069
5	〃	〃	〃	〃	-0.096	0.096	〃	-0.086	0.086	〃	-0.080	0.080
6	〃	〃	〃	〃	-0.107	0.107	〃	-0.096	0.096	〃	-0.090	0.090
7	〃	〃	〃	〃	-0.112	0.112	〃	-0.100	0.100	〃	-0.093	0.093
8	〃	〃	〃	〃	-0.116	0.116	〃	-0.104	0.104	〃	-0.096	0.096
7	〃	〃	〃	〃	-0.112	0.112	〃	-0.100	0.100	〃	-0.093	0.093
6	〃	〃	〃	〃	-0.107	0.107	〃	-0.096	0.096	〃	-0.090	0.090
5	〃	〃	〃	〃	-0.096	0.096	〃	-0.086	0.086	〃	-0.080	0.080
4	〃	〃	〃	〃	-0.083	0.083	〃	-0.074	0.074	〃	-0.069	0.069
3	〃	〃	〃	〃	-0.064	0.064	〃	-0.057	0.057	〃	-0.053	0.053
2	〃	〃	〃	〃	-0.045	0.045	〃	-0.040	0.040	〃	-0.037	0.037
1	1.000	〃	1.000	〃	-0.022	0.022	〃	-0.019	0.019	〃	-0.018	0.018
			1.000			1.174			1.048			0.976
			-0.000			-0.000			-0.000			-0.000
			1.000			1.174			1.048			0.976

	U5-M5			U6-M6-L6			U7-M7			U8-M8-L8		
	So	SaH.	Final.	So	SaH	Final.	So	SaH	Final	So	SaH	Final
1	0	-0.017	0.017	0	-0.016	0.016	0.000	-0.016	0.016	0.00	-0.016	0.016
2	〃	-0.035	0.035	〃	-0.034	0.034	〃	-0.033	0.033	〃	-0.033	0.033
3	〃	-0.051	0.051	〃	-0.048	0.048	〃	-0.047	0.047	〃	-0.047	0.047
4	〃	-0.066	0.066	〃	-0.062	0.062	〃	-0.061	0.061	〃	-0.060	0.060
5	〃	-0.076	0.076	〃	-0.072	0.072	〃	-0.071	0.071	〃	-0.070	0.070
6	〃	-0.085	0.085	〃	-0.081	0.081	〃	-0.080	0.080	〃	-0.079	0.079
7	〃	-0.089	0.089	〃	-0.084	0.084	〃	-0.083	0.083	〃	-0.082	0.082
8	〃	-0.092	0.092	〃	-0.087	0.087	〃	-0.086	0.086	〃	-0.085	0.085
7	〃	-0.089	0.089	〃	-0.084	0.084	〃	-0.083	0.083	〃	-0.082	0.082
6	〃	-0.085	0.085	〃	-0.081	0.081	〃	-0.080	0.080	〃	-0.079	0.079
5	〃	-0.076	0.076	〃	-0.072	0.072	〃	-0.071	0.071	〃	-0.070	0.070
4	〃	-0.066	0.066	〃	-0.062	0.062	〃	-0.061	0.061	〃	-0.060	0.060
3	〃	-0.051	0.051	〃	-0.048	0.048	〃	-0.047	0.047	〃	-0.047	0.047
2	〃	-0.035	0.035	〃	-0.034	0.034	〃	-0.033	0.033	〃	-0.033	0.033
1	〃	-0.017	0.017	〃	-0.016	0.016	〃	-0.016	0.016	〃	-0.016	0.016
			0.930			0.881			0.868			0.859
			-0.000			-0.000			-0.000			-0.000
			0.930			0.881			0.868			0.859

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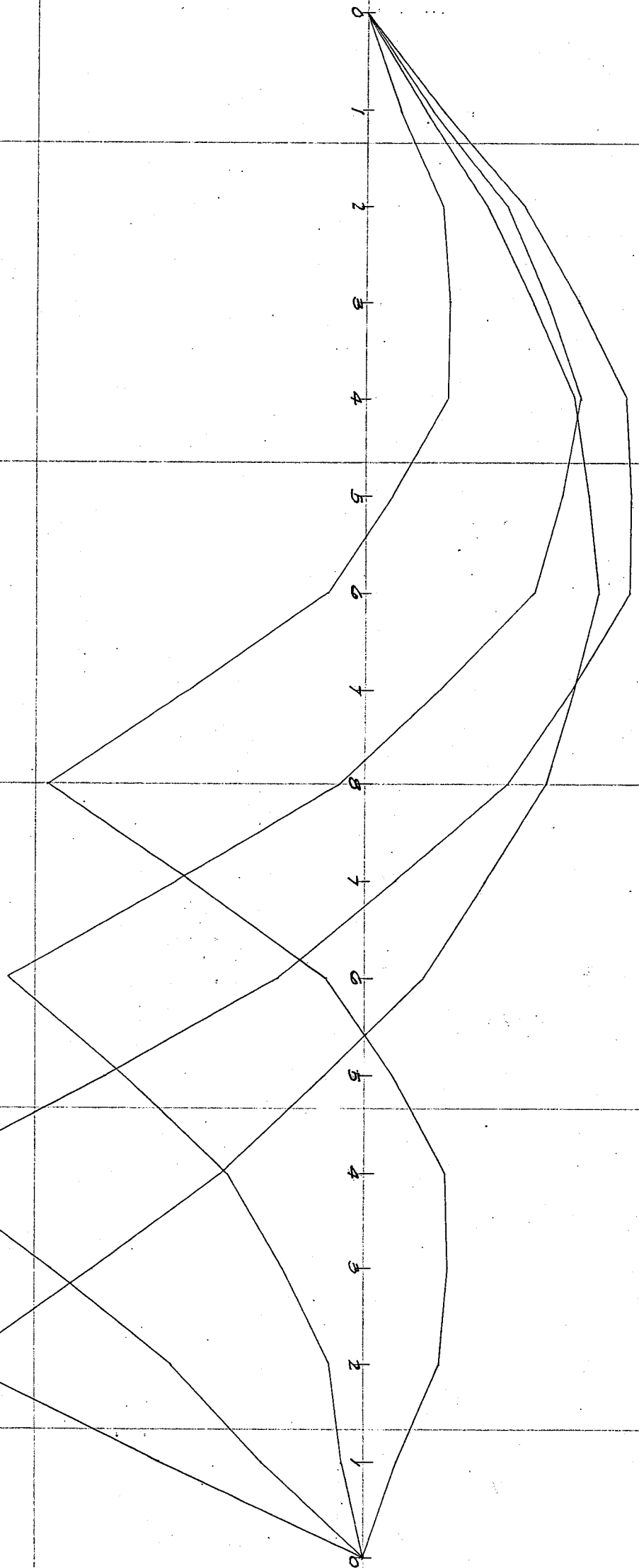
CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Influence surface for Middle chord



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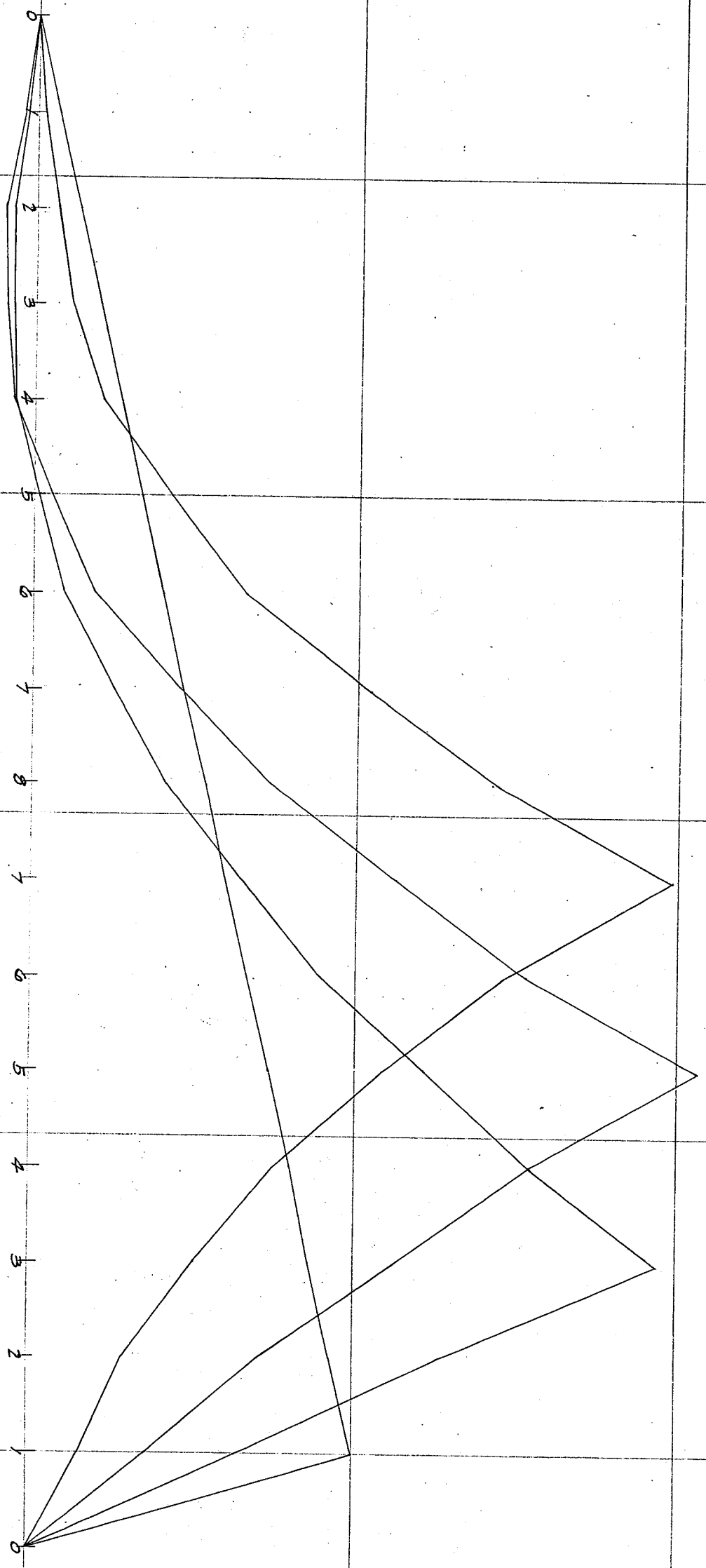
CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Influence surface for Bottom chord



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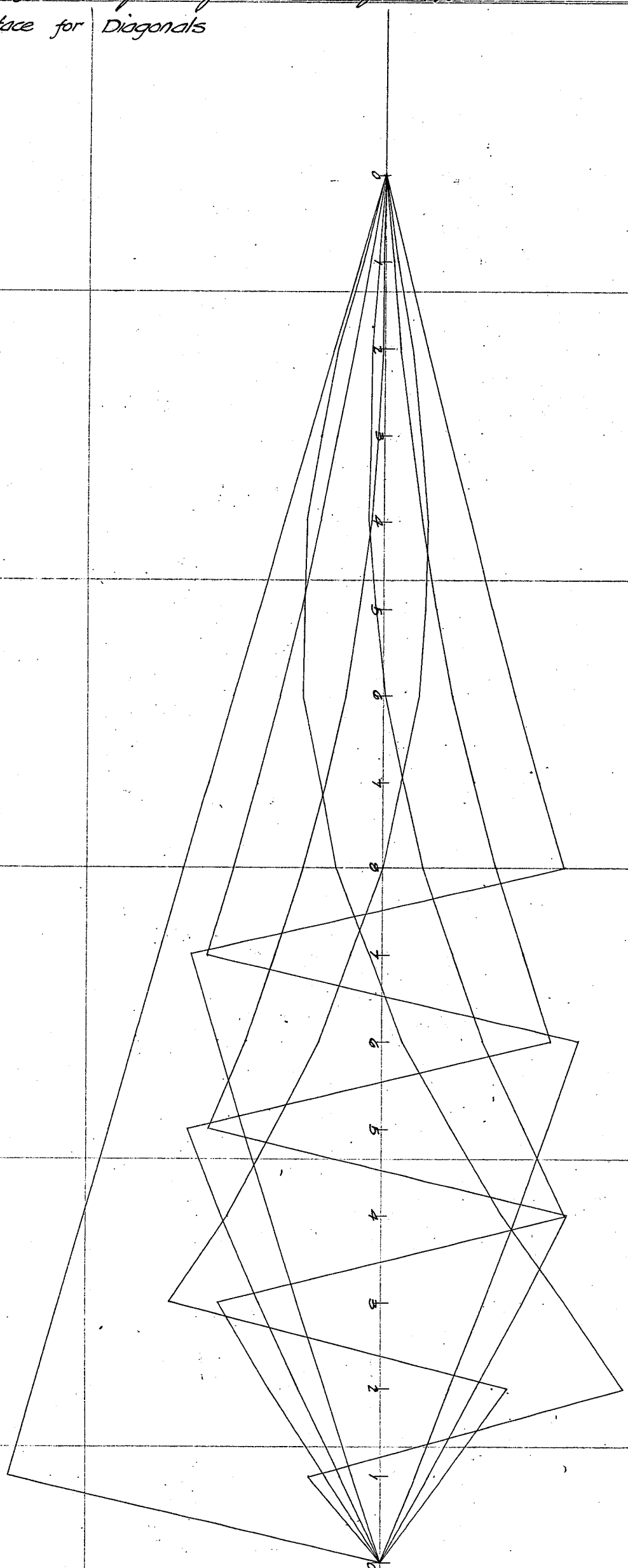
CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Influence surface for Diagonals



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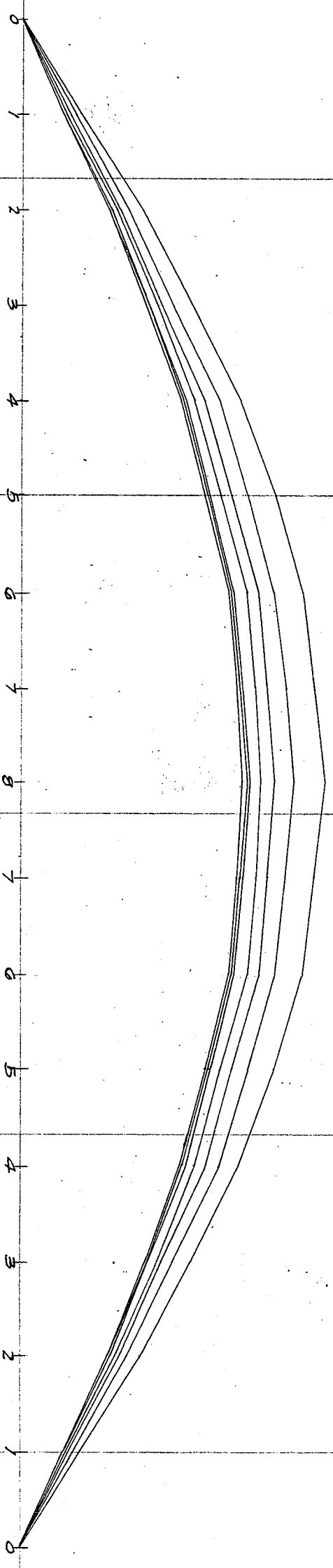
CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Influence Surface for Suspenders and Verticalls



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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken.

Top chord influence surfaces.

	Lo-U1.	U1-U2	U2-U3	U3-U4
		Ja.H Coeff = 1.128	Coeff = 1.087	Coeff = 1.056
1	See Influence	-0.222 × 1.128	-0.222 × 1.087	-0.222 × 1.056
2	Surfaces for Diagonals	-0.459 × 〃	-0.459 × 〃	-0.459 × 〃
3		-0.659 × 〃	-0.659 × 〃	-0.659 × 〃
4		-0.851 × 〃	-0.851 × 〃	-0.851 × 〃
5		-0.986 × 〃	-0.986 × 〃	-0.986 × 〃
6		-1.108 × 〃	-1.108 × 〃	-1.108 × 〃
7		-1.154 × 〃	-1.154 × 〃	-1.154 × 〃
8		-1.191 × 〃 =-1.343	-1.191 × 〃 =1.295	-1.191 × 〃 =-1.258
7		-1.154 × 〃	-1.154 × 〃	-1.154 × 〃
6		-1.108 × 〃	-1.108 × 〃	-1.108 × 〃
5		-0.986 × 〃	-0.986 × 〃	-0.986 × 〃
4		-0.851 × 〃	-0.851 × 〃	-0.851 × 〃
3		-0.659 × 〃	-0.659 × 〃	-0.659 × 〃
2		-0.459 × 〃	-0.459 × 〃	-0.459 × 〃
1		-0.222 × 〃	-0.222 × 〃	-0.222 × 〃
		Σ=-12.069×1.128 =-13.614	Σ=-12.069×1.087=-13.119	-12.069×1.056=-12.745

	U4-U5	U5-U6	U6-U7	U7-U8
	Coeff=1.033	Coeff = 1.016	Coeff = 1.006	Coeff = 1.000
1	-0.222 × 1.033	-0.222 × 1.016	-0.222 × 1.006	-0.222 × 1.000
2	-0.459 × 〃	-0.459 × 〃	-0.459 × 〃	-0.459 × 〃
3	-0.659 × 〃	-0.659 × 〃	-0.659 × 〃	-0.659 × 〃
4	-0.851 × 〃	-0.851 × 〃	-0.851 × 〃	-0.851 × 〃
5	-0.986 × 〃	-0.986 × 〃	-0.986 × 〃	-0.986 × 〃
6	-1.108 × 〃	-1.108 × 〃	-1.108 × 〃	-1.108 × 〃
7	-1.154 × 〃	-1.154 × 〃	-1.154 × 〃	-1.154 × 〃
8	-1.191 × 〃 =-1.230	-1.191 × 〃 =-1.210	-1.191 × 〃 =-1.198	-1.191 × 〃 =-1.191
7	-1.154 × 〃	-1.154 × 〃	-1.154 × 〃	-1.154 × 〃
6	-1.108 × 〃	-1.108 × 〃	-1.108 × 〃	-1.108 × 〃
5	-0.986 × 〃	-0.986 × 〃	-0.986 × 〃	-0.986 × 〃
4	-0.851 × 〃	-0.851 × 〃	-0.851 × 〃	-0.851 × 〃
3	-0.659 × 〃	-0.659 × 〃	-0.659 × 〃	-0.659 × 〃
2	-0.459 × 〃	-0.459 × 〃	-0.459 × 〃	-0.459 × 〃
1	-0.222 × 〃	-0.222 × 〃	-0.222 × 〃	-0.222 × 〃
	-12.069 × 1.033 =-12.467	-12.069×1.016=-12.262	-12.069 × 1.006=-12.141	-12.069 × 1.000 =-12.069

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MADE BY Y.O DATE 5-6-1 FILE NO
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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

Stresses for each member due to Dead load and Live load.

For Middle chords

Member	-A	+A	Sum.	Max ord.	(17.200) D.L.S.	(7.000) L.L.S.	(4.650) L.L.S.	Total L.L.S.	Total stress	Adj. stress.
U1-M2 } M2-M3 }	-3.930	5.990	2.060	0.885	35.430	41.930	4.120	46.050	81.480	81.480
M3-M4 }	-5.120	6.184	1.064	1.012	18.300	43.290	4.710	48.000	66.300	75.850
M4-M5 }				-1.625		-35.840	-7.560	-43.400	-25.100	
M5-M6 }	-3.851	3.987	0.136	0.810	2.340	-26.960	-5.960	-32.920	-30.580	-47.590
M6-M7 }				-1.282		27.910	3.770	31.680	34.020	49.310
M7-M8	-2.504	2.288	-0.216	0.318	-3.720	-17.530	-5.190	-22.720	-26.440	-33.330
				-1.116		16.020	1.480	17.500	13.780	

For Bottom chords.

Member	-A	+A	Sum.	Max. ord.	(17.200) D.L.S	(7.000) L.L.S	(4.650) L.L.S	Total L.L.S	Total stress	
L0-L1 } L1-L2 }	-0.000	9.752	9.752	1.219	167.730	68.260	5.670	73.930	241.660	
L2-L3 } L3-L4 }	-0.267	10.730	10.463	2.356	179.960	75.110	10.960	86.070	266.030	
L4-L5 } L5-L6 }	-0.335	11.861	11.526	2.490	198.250	83.030	11.580	94.610	292.860	
L6-L7 } L7-L8 }	-0.000	12.182	12.182	2.369	209.530	85.270	11.020	96.290	305.820	

For Diagonals

Member	-A	+A	Sum.	Max ord.	(17.200) D.L.S.	(7.000) L.L.S.	(4.650) L.L.S.	Total L.L.S.	Total stress	Adj. stress
U1-L2	-2.340	2.674	0.334	1.042	5.740	18.720	4.850	23.570	29.310	35.405
				-0.333		-16.380	-1.550	-17.930	-12.190	
L2-M3	-2.313	1.727	-0.586	-0.872	-10.080	-16.190	-4.050	-20.240	-30.320	-37.550
				0.526		12.090	2.450	14.540	4.460	
M3-L4	-1.586	2.269	0.683	0.758	11.750	15.880	3.520	19.400	31.150	32.390
				-0.674		-11.100	-3.130	-14.230	-2.480	
L4-M5	-2.598	1.951	-0.647	-0.712	-11.130	-18.190	-3.310	-21.500	-32.630	-35.685
				0.769		13.660	3.580	17.240	6.110	
M5-L6	-2.483	2.998	0.515	0.696	8.860	20.990	3.240	24.230	33.090	39.225
				-0.806		-17.380	-3.750	-21.130	-12.270	
L6-M7	-3.237	2.913	-0.324	-0.719	-5.570	-22.660	-3.340	-26.000	-31.570	-40.865
				0.811		20.390	3.770	24.160	18.590	
M7-L8	-3.187	3.308	0.121	0.751	2.080	23.160	3.490	26.650	28.730	40.670
				-0.785		-22.310	-3.650	-25.960	-23.880	-38.245

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CALCULATIONS FOR

Design of Ibi-nagara-gawa Bashi for Mie-Ken

For Verticals and Suspenders.

Member	-A	+A	Sum	Max.ord.	(17.200) D.L.S.	(7.000) L.L.S.	(4.650) L.L.S.	Total L.L.S.	Total Stress.
U1-L1, M3-L3, M5-L5, M7-L7	0	1.000	1.000	1.000	17.200	7.000	4.650	11.650	28.850
U2-M2-L2	0	1.174	1.174	0.116	20.190	8.220	540	8.760	28.950
U3-M3	0	1.048	1.048	0.104	18.030	7.340	480	7.820	25.850
U4-M4-L4	0	0.976	0.976	0.096	16.790	6.830	450	7.280	24.070
U5-M5	0	0.930	0.930	0.092	16.000	6.510	430	6.940	22.940
U6-M6-L6	0	0.881	0.881	0.087	15.150	6.170	400	6.570	21.720
U7-M7	0	0.868	0.868	0.086	14.930	6.080	400	6.480	21.410
U8-M8-L8	0	0.859	0.859	0.085	14.770	6.010	400	6.410	21.180

For Top chord.

Member	-A	+A	Sum.	Max.ord.	(17.200) D.L.S.	(7.000) L.L.S.	(4.650) L.L.S.	Total L.L.S.	Total Stress.
L0-U1	-12.304	0.000	-12.304	-1.538	-211.630	-86.130	-7.150	-93.280	-304.910
U1-U2	-13.614	〃	-13.614	-1.343	-234.160	-95.300	-6.240	-101.540	-335.700
U2-U3	-13.119	〃	-13.119	-1.295	-225.650	-91.830	-6.020	-97.850	-323.500
U3-U4	-12.745	〃	-12.745	-1.258	-219.210	-89.220	-5.850	-95.070	-314.280
U4-U5	-12.467	〃	-12.467	-1.230	-214.430	-87.270	-5.720	-92.990	-307.420
U5-U6	-12.262	〃	-12.262	-1.210	-210.910	-85.830	-5.630	-91.460	-302.370
U6-U7	-12.141	〃	-12.141	-1.198	-208.830	-84.990	-5.570	-90.560	-299.390
U7-U8	-12.069	〃	-12.069	-1.191	-207.590	-84.480	-5.540	-90.020	-297.610

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CALCULATIONS FOR

Design of Ibi-Nagaragawa Bashi for Mie-Ken
Stress of each members

- sign for Compression
+ sign for Tension

L0 DL 167730 LL 73930 241660
L1 Same as L0-L1 L2 DL 179960 LL 86070 266030
L3 Same as L2-L3 L4 DL 198250 LL 94610 292860
L5 Same as L4-L5 L6 DL 209530 LL 96290 305820
L7 Same as L6-L7 L8

U1 DL -234,160 LL -101,540 -335,700
U2 DL -225650 LL -97850 -323,500
U3 DL -219210 LL -95070 -314,280
U4 DL -214430 LL -92990 -307,420
U5 DL -210910 LL -91460 -302370
U6 DL -208030 LL -90560 -298,590
U7 DL -207590 LL -90020 -297,610
U8

D1 DL 20190 LL 8760 28950
D1-M2 DL 18030 LL 7820 25850
D2 DL 16790 LL 7280 24070
D3 DL 16000 LL 6940 22940
D4 DL 15150 LL 6570 21720
D5 DL 14930 LL 6480 21410
D6 DL 14770 LL 6410 21180

M1 DL 17200 LL 11650 28850
M2 Same as D1
M3 DL 18300 LL 7000 25300
M4 Same as M3-M4
M5 DL 2340 LL 31680 LL 30580 49310
M6 Same as M5-M6
M7 DL -3720 LL 22720 LL 13790 33530
M8

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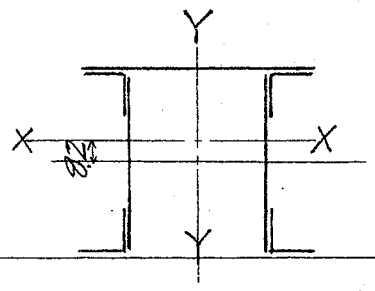
CALCULATIONS FOR

Design of Ibi-Nagaragawa Bashi for Mie Ken

Section of Truss Members

Top chord L0~U3 See page no 18 & 19
U3~U5 Same as L0~U3

Top chord U5~U8



Eccentricity

1 Cov Pl.	660 × 13 = 85.8 cm²	× 29.65 = 2545
4 L's	100×100×10 = 76.0	
2 P/s	570 × 13 = 148.2	
	310.0	

Ecc. $\frac{2545}{310} = 8.2$

Moment of Inertia X-X

1 Cov Pl.	660×13 = 85.8 cm²	× 21.45²		= 39,500
2 L's	100×100×10 = 38.0	× 18.0²	+ 349	= 12,649
2 L's	" = 38.0	× 34.4²	+ 349	= 45,349
2 P/s	570 × 13 = 148.2	× 8.2²	+ 40,140	= 50,120
	310.0			147,618

Radius of gyration X-X $\sqrt{\frac{147618}{310}} = 21.8$ cm

Moment of Inertia Y-Y

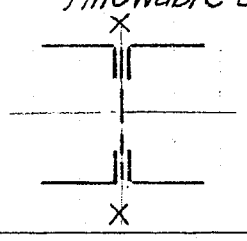
1 Cov Pl	660 × 13 = 85.8 cm²			= 31,130
4 L's	100×100×10 = 76.0	× 25.1²	+ 698	= 48,698
2 P/s	570 × 13 = 148.2	× 21.65²		= 69,500
	310.0			149,328

Radius of gyration Y-Y $\sqrt{\frac{149328}{310}} = 21.9$ cm

Allowable Unit Stress for U5~U8 $P = 1{,}500 \times (1 - 0.0055 \times \frac{4625}{21.8}) = 1{,}325$ kg/cm² Use 1,000 kg/cm²

Middle chord Stress U1 M3 81,480 kg T Section Required 67.9 cm² net
M3 M5 78,350 " T " " 65.7 " "
Used section 4 L's 150×100×9 = 86.76-(9+7.92) = 69.84 cm² net ok.

Middle chord Stress M5 M7 47,590 kg C or 49,310 kg T
M7 M8 33,330 " C
Used section 4 L's 150×90×9 = 83.16-(9+7.92) = 66.24 cm² net r = 7.2 cm
Allowable Unit Stress for Compression P = 1500×(1-0.0055 $\frac{455}{72}$) = 978 kg/cm²
Section Required = $\frac{47{,}590}{978}$ = 48.7 cm² gross ok.



for Tension $\frac{49{,}310}{1{,}200}$ = 41.0 cm² Net ok.

Bottom chord Stress L0 L2 241,660 kg T Section Required 201 cm² Net
Used section 4 P/s 470 × 10 = 188-40 = 148 cm²
4 L's 100×100×10 = 76-20 = 56
264 204 Net ok.

Bottom chord Stress L2 L4 266,030 kg T Section Required 221.8 cm² Net
L4 L6 292,860 " T " " 244.0 " "
Used section 4 P/s 470 × 10 = 188-40 = 148 cm²
4 L's 100×100×10 = 76-20 = 56 "
2 P/s 270 × 10 = 54-10 = 44 "
318 248 Net ok

Bottom chord Stress L6-L8 305,820 kg T Section Required 255 cm² Net
Used section 4 P/s 470 × 10 = 188-40 = 148 cm²
4 L's 100×100×13 = 97.2-26 = 71.2 "
2 P/s 270 × 10 = 54-10 = 44 "
339.2 263.2 cm² Net " ok

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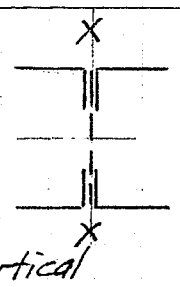
CALCULATIONS FOR

Design of Ibi-Nagaragawa Bashi for mie-Ken

Diagonal	Stress	U_1-L_2	35,405 kg T	Section Required	29.5 cm² Net
		M_3-L_4	32,390 " T		27.0 " "
		M_5-L_6	39,225 " T		32.7 " "
		M_7-L_8	38,245 " T		31.9 " "
	Used Section	4 L 125×75×10 = 760-(10+88) = 572 cm²			Net OK
Diagonal	Stress	L_2 M_3	32,550 kg C		
		L_4 M_5	35,685 " C		
		L_6 M_7	40,865 " C		
	Used Section	4 L 125×75×10 = 760 cm² gross			r = 6.12
	Allowable Unit stress	$1500(1-0.0055\frac{575}{6.12}) = 725$ kg/cm²			
	Section Required	$\frac{40865}{725} = 56.4$ cm² gross OK			



Vertical

	Stress	U_1 L_1 etc.	28,850 kg T	Section Required	24.0 cm² Net
	Used Section	4 L 125×75×10 = 760-(10+88) = 572 cm²			Net OK

For diagram showing sections of each members, see page 28.

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CALCULATIONS FOR

Design of Ibi-Nagaragawa Bashi for Mie-Ken

Deflection at the center of truss due to dead load

	Member	S stress due to DL in Kg.	Length L in m.	Area-A in cm²	S-stress due to unity SL/A ×1,000	Sl/A ×1,000	
Top chords	L_0-U_1	-211,630	5.740	331.20	-0.820	-3.67	3.01	
	U_1-U_2	-234.160	5.134	397.80	-1.343	-3.02	4.06	
	U_2-U_3	-225,650	4.945	331.20	-1.295	-3.37	4.36	
	U_3-U_4	-219,210	4.804	〃	-1.258	-3.18	4.00	
	U_4-U_5	-214,430	4.699	〃	-1.230	-3.04	3.74	
	U_5-U_6	-210,910	4.623	310.00	-1.210	-3.14	3.80	
	U_6-U_7	-208,830	4.576	〃	-1.198	-3.08	3.69	
	U_7-U_8	-207,590	4.553	〃	-1.191	-3.05	3.63	
								Σ = 60.58 ×1,000
Middle chords	U_1-M_2	35,430	4.550	86.72	0.700	1.86	1.30	
	M_2-M_3	〃	〃	〃	〃	〃	〃	
	M_3-M_4	18,300	〃	〃	0.584	0.96	0.56	
	M_4-M_5	〃	〃	〃	〃	〃	〃	
	M_5-M_6	+ 2,340	〃	83.12	-0.038	-0.13	0.00	
	M_6-M_7	〃	〃	〃	〃	〃	〃	
	M_7-M_8	- 3,720	〃	〃	-1.116	-0.20	0.22	
								Σ = 7.88 × 1,000
Bottom chord	L_0-L_1	167,730	4.550	264.00	0.650	2.09	1.88	
	L_1-L_2	〃	〃	〃	〃	〃	〃	
	L_2-L_3	179,960	〃	318.00	0.481	2.57	1.24	
	L_3-L_4	〃	〃	〃	〃	〃	〃	
	L_4-L_5	198,250	〃	〃	0.859	2.84	2.44	
	L_5-L_6	〃	〃	〃	〃	〃	〃	
	L_6-L_7	209,530	〃	339.20	1.712	2.81	4.81	
	L_7-L_8	〃	〃	〃	〃	〃	〃	
								Σ = 41.48 ×1,000
Diagonals	U_1-L_2	5,740	5,740	76.00	-0.199	0.43	0.09	
	L_2-M_3	- 10,080	〃	〃	0.013	-0.76	-0.01	
	M_3-L_4	11,750	〃	〃	0.159	0.89	0.14	
	L_4-M_5	- 11,130	〃	〃	-0.317	-0.84	0.27	
	M_5-L_6	8,860	〃	〃	0.466	0.67	0.31	
	L_6-M_7	- 5,570	〃	〃	-0.609	-0.42	0.26	
	M_7-L_8	2,080	〃	〃	0.751	0.16	0.12	
								Σ = 2.36 × 1,000
Verticals	U_1-L_1	17,200	3.500	76.00	0.000	0.79	0.00	
	M_2-L_2	20,190	〃	〃	0.116	0.93	0.11	
	M_3-L_3	17,200	〃	〃	0.000	0.79	0.00	
	M_4-L_4	16,790	〃	〃	0.096	0.77	0.07	
	M_5-L_5	17,200	〃	〃	0.000	0.79	0.00	
	M_6-L_6	15,150	〃	〃	0.087	0.70	0.06	
	M_7-L_7	17,200	〃	〃	0.000	0.79	0.00	
	M_8-L_8	14,770	〃	〃	0.085	0.68	0.06	
Suspenders	U_2-M_2	20,190	2.377	76.00	0.116	0.63	0.07	
	U_3-M_3	18,030	4.314	〃	0.104	1.02	0.10	
	U_4-M_4	16,790	5.954	〃	0.096	1.29	0.12	
	U_5-M_5	16,000	7.026	〃	0.092	1.48	0.14	
	U_6-M_6	15,150	7.849	〃	0.087	1.56	0.14	
	U_7-M_7	14,930	8.339	〃	0.086	1.64	0.14	
	U_8-M_8	14,770	8.500	〃	0.085	1.65	0.14	
								Σ = 2.00 ×1,000

$$\Sigma \frac{SL}{A} S = (60.58 + 7.88 + 41.48 + 2.36 + 2.00) \times 1{,}000 = 114.30$$

$$\Sigma \frac{Sl}{AE} S = 114.30 \div 2{,}100{,}000 = 0.054^{m} \text{ or } \underline{\underline{5.4^{cm}}}$$

$E = 2{,}100{,}000\ kg/cm^2$

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CALCULATIONS FOR

Material list for Ibinagaragawa-Bashi, Mieken.

No.	Description.	Section in Mm.	Length in Mm.	Wt. of One Meter in Kgs.	Wt. of Main Section in kgs.	Wt. of Details in kgs.	Total Wt.	Remarks.
		TOP CHORD	Lo-U1		Kgs 4 Req'd.			
1	Cov Pl.	660 × 13	5.090	67.353	342.8			
2	L⌐	100.100.13	5.325	19.08	203.2			
2	〃	〃	5.285	〃	201.7			
2	Pls.	570 × 13	5.325	58.169	619.5			
2	〃	920 × 10	1.740	72.220		251.3	Kgs	
2	〃	440 × 9	1.880	31.080		116.9		
2	〃	410 × 9	1.055	28.967		61.1		
2	L⌐	90.90.13	845	17.04		28.8		
2	Fills	185 × 10	615	14.523		17.9		
2	〃	〃	230	〃		6.7		
2	L⌐	100.90.10	1.000	14.13		28.3		
2	〃	〃	845	〃		23.9		
1	Pl.	660 × 13	780	67.353		52.5		
2	Tie Pls	660 × 10	680	51.810		70.5		
2	L⌐	90.90.13	995	17.04		33.9		
2	Pls	95 × 9	400	6.712		5.4		
8	Lac. bars.	70 × 13	880	7.144		50.3		
2	Washers.	70$^{\phi}$ × 13		@ 0.393		.8		
2	Pls.	375 × 9	2.090	26.494		110.7		
					1,367.2 +	859.0	= 2,226.2	
							× 4	
							8,904.8	
		U1 - U2			4 Req'd.			
1	Cov Pl.	660 × 13	5.170	67.353	348.2			
2	L⌐	100.100.13	5.170	19.08	197.3			
2	〃	〃	5.105	〃	194.8			
2	Pls.	570 × 13	5.170	58.169	601.5			
2	〃	370 × 9	3.215	26.141	168.1			
1	Pl.	95 × 9	385	6.712		2.6		
2	L⌐	130.130.15	830	28.84		47.9		
2	〃	〃	870	〃		50.2		
1	Pl.	570 × 13	785	58.169		45.7		
2	Pls.	400 × 13	1.550	40.820		126.5		
2	〃	390 × 10	805	30.615		53.0		
2	〃	590 × 10	870	46.315		80.6		
2	〃	460 × 10	545	36.110		39.4		
1	Fill.	305 × 4	370	9.577		3.5		
1	〃	370 × 4	625	11.618		7.3		
2	Pls.	460 × 10	545	36.110		39.4		
2	Fills.	370 × 4	460	11.618		10.7		
8	Lac bars.	70 × 13	840	7.144		48.0		
2	Washers.	70$^{\phi}$ × 13		@ 0.393		.8		
1	Pl.	605 × 10	600	47.493		31.3		
1	〃	565 × 9	735	39.917		29.3		
1	〃	220 × 9	735	15.543		11.4		
					1,509.9 +	627.6	= 2,137.5	
							× 4	
							8,550.0	
		U2 - U3			4 Req'd.			
1	Cov Pl.	660 × 13	4.965	67.353	334.4			
2	L⌐	100.100.13	4.965	19.08	189.5			
2	〃	〃	4.930	〃	188.1			
2	Pls.	570 × 13	4.965	58.169	577.6			

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Material list for Ibinagaragawa-Bashi, Mieken

1	Pl.	95 x 9	335	6.712	2.2
2	L⌐	130x130x15	870	28.84	50.2
2	〃	〃	840	〃	48.5
1	Pl.	570 x 13	765	58.169	44.5
2	Pls	380 x 10	610	29.830	36.4
2	〃	585 x 10	840	45.923	77.2
2	〃	605 x 10	660	47.493	62.7
10	Lac bars	70 x 13	880	7.144	62.9
2	Washers.	70$^{\phi}$ x 13		@ .393	0.8

1,289.0 + 385.4 = 1,674.4

x 4

6,700.0

U3 - U4

4 Req'd.

1	Cov Pl.	660 x 13	4825	67.353	325.0
2	L⌐	100x100x13	4825	19.08	184.1
2	〃	〃	4790	〃	182.8
2	Pls.	570 x 13	4825	58.169	561.3
2	L⌐	130x130x15	880	28.84	50.8
2	〃	〃	910	〃	52.5
2	Pls.	95 x 9	105	6.712	2.2
1	Pl.	570 x 13	775	58.169	45.1
1	〃	435 x 9	815	30.733	25.0
2	Pls.	385 x 10	650	30.223	39.3
2	〃	585 x 10	805	45.923	73.9
2	〃	605 x 10	660	47.493	62.7
10	Lac bars	70 x 13	850	7.144	60.7
2	Washers.	70$^{\phi}$ x 13		@ .393	0.8

1,253.2 + 413.0 = 1,666.2

x 4

6,664.8

U4 - U5

4 Req'd.

1	Cov Pl.	660 x 13	4715	67.353	317.6
2	L⌐	100x100x13	4715	19.08	179.9
2	〃	〃	4680	〃	178.6
2	Pls	570 x 13	4715	58.169	548.5
2	〃	95 x 9	165	6.712	2.2
1	Pl	570 x 13	765	58.169	44.5
1	〃	435 x 9	765	30.733	23.5
2	L⌐	130x130x15	840	28.84	48.5
2	〃	〃	950	〃	54.8
2	Fills	180 x 3	455	4.239	3.9
2	〃	〃	440	〃	3.7
2	Pls	380 x 10	680	29.830	40.6
2	〃	585 x 10	840	45.923	77.2
2	〃	640 x 10	600	50.240	60.3
10	Lac bars	70 x 13	880	7.144	62.9
2	Washers.	70$^{\phi}$ x 13		@ .393	.8

1,224.6 + 428.9 = 1,653.5

x 4

6,614.0

U5 - U6

4 Req'd.

1	Cov Pl.	660 x 13	4640	67.353	312.5
2	L⌐	100x100x10	〃	14.91	138.4

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CALCULATIONS FOR

Material list for Ibinagaragawa-Bashi, Misken.

2	L's	100x100x10	4.605	14.91	137.3	
2	P/s	570 x 13	4.640	58.109	539.8	
2	"	95 x 9	300	6.712		4.0
1	P/	570 x 13	780	58.109		45.4
1	"	435 x 9	740	30.733		22.7
2	L's	90x90x13	700	17.04		23.9
2	"	"	740	"		25.2
2	P/s	585 x 10	850	45.923		78.1
2	"	385 x 10	700	30.223		42.3
10	Lac bars.	70 x 13	880	7.144		62.9
2	Washers	70$^{\phi}$ x 13		@ .393		.8
2	P/s.	640 x 10	660	50.240		66.3
					1,128.0 +	371.6 = 1,499.6
						x 4
						5998.4

U6 - U7 — 4 Req'd.

1	Cov Pl.	660 x 13	4.595	67.353	309.5	
2	L's	100x100x10	4.595	14.910	137.0	
2	"	"	4.500	"	130.0	
2	P/s	570 x 13	4.595	58.109	534.6	
1	P/.	95 x 9	205	6.712		1.8
1	"	570 x 13	795	58.109		46.1
1	"	435 x 9	755	30.733		23.2
2	L's	90x90x13	715	17.04		24.4
2	"	"	750	"		25.6
2	P/s	380 x 10	630	29.830		37.6
2	"	585 x 10	790	45.923		72.6
2	"	640 x 10	660	50.240		66.3
10	Lac bars.	70 x 13	880	7.144		62.9
2	Washers.	70$^{\phi}$ x 13		@ .393		.8
					1,117.1 +	361.4 = 1,478.5
						4
						5914.0

U7 - U8 — 4 Req'd.

1	Cov Pl.	660 x 13	4.570	67.353	307.8	
2	L's	100x100x10	4.570	14.910	136.3	
2	"	"	4.535	"	135.2	
2	P/s	570 x 13	4.570	58.109	531.7	
10	Lac bars.	70 x 13	880	7.144		62.9
2	Washers.	70$^{\phi}$ x 13		@ .393		.8
2	P/s.	640 x 10	660	50.240		66.3
					1,111.0 +	130.0 = 1,241.0
						x 4
						4,964.0

SPLICE AT U8 — 2 Req'd.

2	P/s	95 x 9	275	6.712	3.7	
1	P/	570 x 13	705	58.109	44.5	
1	"	435 x 9	705	30.733	23.5	
2	L's	90x90x13	615	17.040	21.0	
2	"	"	720	"	24.5	
2	P/s	380 x 10	610	29.830	36.4	
2	"	585 x 10	765	45.923	70.3	
						223.9
						x 2
						447.8

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CALCULATIONS FOR

Material list for Shinagaragawa-Bashi, Mieken.

Summary of Top chords 54,757.8 Kgs ~~43.954~~ T 14.7554

MIDDLE CHORD U1-M2 — 4 Req'd.

2	L⁵	150×100×9	4.070	17.02	138.5	
2	"	"	4.130	"	140.6	
2	P/s	310 × 19	1.150	46.237		106.3
1	P/	390 × 9	520	27.554		14.3
1	"	310 × 9	390	21.902		8.5
13	Lac bars	60 × 9	390	4.239		21.5

279.1 + 150.6 = 429.7
× 4
1,718.8

M2-M3 — 4 Req'd.

4	L⁵	150×100×9	4.280	17.02	291.4	
2	P/s	560×16	1.150	70.336		161.8
2	"	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	390	4.239		23.1

291.4 + 202.0 = 493.4
× 4
1,973.6

M3-M4 — 4 Req'd.

4	L⁵	150×100×9	4.280	17.02	291.4	
2	P/s	310 × 19	1.150	46.237		106.3
2	"	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	390	4.239		23.1

291.4 + 146.5 = 437.9
× 4
1,751.6

M4-M5 — 4 Req'd.

4	L⁵	150×100×9	4.280	17.02	291.4	
2	P/s	560 × 16	1.150	70.336		161.8
2	"	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	390	4.239		23.1

291.4 + 202.0 = 493.4
× 4
1,973.6

M5-M6 — 4 Req'd.

4	L⁵	150×90×9	4.280	16.32	279.4	
2	P/s	310 × 13	990	31.636		62.6
2	"	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	400	4.239		23.7

279.4 + 103.4 = 382.8
× 4
1,531.2

M6-M7 — 4 Req'd.

4	L⁵	150×90×9	4.280	16.32	279.4	
2	P/s	560 × 10	1.150	43.906		101.0
2	"	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	400	4.239		23.7

279.4 + 141.8 = 421.2
× 4
1,684.8

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CALCULATIONS FOR

Material list for Shinagawagawa-Bashi - Meiken.

M7 - M8 — 4 Req'd.

4	L	150×90×9	4.280	16.32	279.4	
2	P/s	310 × 9	390	21.902		17.1
14	Lac bars	60 × 9	400	4.239		23.7
					279.4 +	40.8 = 320.2
						× 4
						1,280.8

SPLICE PLATE AT M8 — 2 Req'd.

2	P/s	310 × 13	990	31.636	626 × 2 = 1252

Summary of Middle chords. 12,039.6 Kgs. 4,073.6

BOTTOM CHORD Lo-L2 — 4 Req'd.

4	L	100×100×10	7.580	14.91	452.1
2	P/s	470 × 10	7.345	36.895	542.0
2	〃	〃	6.550	〃	483.3
2	〃	1,280×10	1.700	100.48	341.6
2	〃	1,100×10	1.275	86.35	220.2
2	〃	690×10	1.120	54.165	121.3
2	〃	455×19	1.120	67.803	152.0
1	P/	660 × 3	1.030	15.543	16.0
1	〃	440 × 9	1.060	31.086	33.0
1	〃	〃	~~795~~ 910	〃	~~247~~ 283
2	Fills	270 × 10	440	21.195	18.7
2	P/s	470 × 10	1.235	36.895	91.1
2	〃	〃	615	〃	45.4
4	〃	85 × 12	405	8.007	14.9
1	P/	350 × 9	715	24.728	17.7
2	L	100×75×10	800	12.950	20.7
1	P/	560 × 9	1.045	39.564	41.3
1	〃	350 × 9	395	24.728	9.8
10	P/s	230 × 9	350	16.250	56.9
1	P/	510 × 9	655	36.032	23.6
2	P/s	350 × 9	535	24.728	26.5
1	L	100×100×10	480	14.91	7.2
1	Bent P/.	670 × 13	820	68.374	56.1
4	L	100×100×10	870	14.91	51.9
1	Fill	210 × 10	560	16.485	9.2
1	〃	200 × 10	265	20.410	5.4
					~~1,477.4~~ + ~~1,405.2~~ = ~~2,882.6~~ 2,886.2
					1,408.8
					× 4
					~~11,530.4~~ 11,544.8

BOTTOM CHORD L2-L4 — 4 Req'd.

4	L	100×100×10	9.095	14.91	542.4
2	P/s	470 × 10	8.475	36.895	625.4
2	〃	〃	9.095	〃	671.1
2	〃	270×10	8.100	21.195	343.4
2	〃	~~720~~ 910 × 9	1.340	~~50.868~~ 64.292	~~363~~ 472.3
1	P/	440 × 9	1.060	31.086	33.0
1	〃	〃	~~795~~ 910	〃	~~247~~ 283
2	P/s	470 × 10	1.235	36.895	91.1
2	〃	〃	615	〃	45.4

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Material list for Ibinagaragawa-Bashi, Mieken.

2	Pls	450 x 10	615	35.325	43.4	
2	"	350 x 9	535	24.728	26.5	
1	Pl	805 x 9	1.430	50.873	81.3	
13	Pls	230 x 9	350	16.250	73.9	
1	Pl	510 x 9	655	36.032	23.6	
1	Fills	200 x 10	415	20.410	8.5	
1	"	"	265	"	5.4	
					2,182.3 + ~~593.1~~ 632.7 = ~~2,775.4~~ 2,815.0	
					x 4	
					~~11,101.6~~ 11,260.0	

BOTTOM CHORD L4-L6 4 Req'd.

2	Pls	470 x 10	9.095	36.895	671.1	
2	"	"	8.475	"	625.4	
4	Ls	100x100x10	9.095	14.91	542.4	
2	Pls	270 x 10	9.095	21.195	385.5	
2	"	~~720~~ 910 x 9	1.340	~~50.868~~ 64.292		~~136.3~~ 172.3
2	"	470 x 10	1.235	36.895	91.1	
2	"	"	615	"	45.4	
2	"	450 x 10	615	35.325	43.4	
2	"	350 x 9	535	24.728	26.5	
2	Fills	305 x 3	445	7.183	8.2	
2	"	270 x 3	305	6.359	5.0	
1	Pl.	440 x 9	1.060	31.086	33.0	
1	"	"	~~795~~ 910	"	~~24.7~~ 28.3	
1	"	730 x 9	1.200	51.575	61.9	
1	"	510 x 9	655	36.032	23.6	
13	Pls	230 x 9	350	16.250	73.9	
1	Fills	260 x 10	340	20.410	6.9	
1	"	"	265	"	5.4	
					2,224.4 + ~~585.3~~ 624.9 = ~~2,809.7~~ 2,849.3	
					x 4	
					~~11,238.8~~ 11,397.2	

BOTTOM CHORD L6-L7 4 Req'd.

4	Ls	100x100x13	6.080	19.08	509.8	
2	Pls	470 x 10	6.080	36.895	492.9	
2	"	"	6.060	"	447.2	
2	"	270 x 10	6.080	21.195	283.2	
2	"	~~720~~ 910 x 9	1.340	~~50.868~~ 64.292		~~136.3~~ 172.3
1	Pl.	440 x 9	1.060	31.086	33.0	
1	"	"	~~795~~ 910	"	~~24.7~~ 28.3	
4	Fills	270 x 3	440	6.359	11.2	
1	Pl.	655 x 9	1.120	46.276	51.8	
8	Pls	230 x 9	350	16.250	45.5	
1	Pl.	510 x 9	655	36.032	23.6	
2	Pls	470 x 10	1.235	36.895	91.1	
2	"	"	615	"	45.4	
2	"	450 x 10	615	35.325	43.4	
2	"	350 x 9	685	24.728	33.9	
2	Fills	270 x 3	615	6.359	10.0	
2	"	200 x 10	205	20.410	10.8	
					1,733.1 + ~~560.7~~ 600.3 = ~~2,293.8~~ 2,333.4	
					x 4	
					~~9,175.2~~ 9,333.6	

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Material list for Shinagawagawa-Bashi, Mieken.

BOTTOM CHORD L7-L7'

2 Req'd.

4	L's	100x100x13	7.410	19.08	565.5		
2	Pls	470 x 10	7.410	36.895	546.8		
2	"	"	0.790	"	50.1.0		
2	"	270 x 10	7.410	21.195	314.1		
2	"	~~720~~ 910 x 9	1.340	~~50.868~~	64.292	~~+363~~	172.3
2	Fills	270 x 3	.440	0.359		5.6	
1	Pl.	055 x 9	1.110	40.270		51.4	
10	Pls	230 x 9	350	16.250		50.9	
1	Fill	200 x 10	205	20.410		5.4	
						1,927.4 + ~~255.6~~ 291.6	= ~~2,183.0~~ 2219.0
							x 2
							~~4,366.0~~
							4,438.0

DIAPHRAGM AT Lo

4 Req'd.

1	Pl.	315 x 9	885	22.255	19.7	
4	L's	125x90x10	885	16.09	57.0	
3	"	100x100x10	302	14.91	13.5	
3	Fill	95 x 10	135	7.458	3.0	
						93.2
						x 4
						372.8

DIAPHRAGM DM1.

20 Req'd.

4	L's	125x90x10	440	16.09	28.3	
1	Pl.	330 x 9	440	23.315	10.3	
2	L's	100x100x10	150	14.91	4.5	
						43.1
						x 20
						862.0

DIAPHRAGM DM2

10 Req'd.

4	L's	125x90x10	440	16.09	28.3	
1	Pl.	320 x 9	440	22.608	9.9	
2	L's	100x100x10	150	14.91	4.5	
						42.7
						x 10
						427.0

Summary of Bottom chords

~~49,073.8~~ Kgs. 49,635.4

14.750

VERTICAL L1, U1R

4 Req'd.

2	L's	125x75x10	~~3,285~~	3295	14.91	98.0	98.3
2	"	"	~~3365~~	3375	"	~~100.3~~	100.6
1	Pl.	385 x 9	870		27.20		23.7
1	"	"	390		"		10.6
7	Lac bars	70 x 9	430		4.946		14.9
						~~198.3~~ 198.9 +	49.2 = ~~247.5~~ 248.1
							x 4
							~~990.0~~ 992.4

VERTICAL L2, M2, U2R

4 Req'd.

2	L's	125x75x10	~~5,700~~	5710	14.91	~~170.0~~	170.3
2	"	"	~~5750~~	5760	"	~~171.5~~	171.8
1	Pl.	385 x 9	870		27.200		23.7

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1	Pl	310 × 9	385	21.902	8.4	
1	"	385 × 9	390	27.200	10.6	
15	Lac bars	70 × 9	430	4.946	3.9	
1	Pl	260 × 9	~~495~~ 305	18.369	~~9.1~~ 5.6	
					~~341.5~~ 342.1 + ~~83.7~~ 80.2 = ~~425.2~~ 422.3	
						× 4
						~~1,700.8~~ 1,689.2

VERTICALS L3M3, L4M4, L5M5, L6M6, L7M7 & L8M8 22 Req'd.

4	L5	125×75×10	~~3,725~~ 3,735	149.1	~~222.2~~	
1	Pl.	385 × 9	870	27.200	222.8	23.7
2	Pls.	200 × 10	645	20.410		26.3
1	Pl.	385 × 9	960	27.200		26.1
8	Lac bars.	70 × 9	430	4.946		17.0
					~~222.2~~ 222.8 +	93.1 = ~~315.3~~ 315.9
						× 22
						~~6,936.6~~ 6,949.8

FILLER FOR L4M4, L6M6 & L8M8 10 Req'd.

1	Fill	260 × 9	~~495~~ 305	18.369	~~9.1~~ 5.6	
					~~9.1~~ 5.6	× 10 = ~~91.0~~ 56.0

Summary of Verticals ~~9,718.4~~ 9,687.4 Kgs 5.6 56.0

DIAGONAL U1L2 4 Req'd.

2	L5	125×75×10	4.860	14.91	144.9	
2	"	"	4.820	"	143.7	
2	Pls	340 × 9	385	24.021		18.5
14	Lac bars	70 × 9	430	4.946		29.8
					288.6 +	48.3 = 336.9
						× 4
						1,347.6

DIAGONALS L2M3, M3L4, L4M5, M5L6, L6M7 & M7L8 24 Req'd.

4	L5	125×75×10	4.950	14.91	295.2	
2	Pls	340 × 9	385	24.021		18.5
15	Lac. bars	70 × 9	430	4.946		31.9
					295.2 +	50.4 = 345.6
						× 24
						8,294.4

Summary of Diagonals 9,642.0 Kgs 14028

SUSPENDER U3M3 4 Req'd.

2	L5	125×75×10	3.910	14.91	116.6	
2	"	"	3.950	"	117.8	
1	Pl	385 × 9	390	27.200		10.6
12	Lac bars	70 × 9	430	4.946		25.5
					234.4 +	36.1 = 270.5
						× 4
						1,082.0

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Material list for Ibinagaragawa-Bashi, Miekeri-

			U4 M4		4 Req'd.			
2	L^S	125×75×10	5.455	14.91	102.7			
2	〃	〃	5.485	〃	103.0			
1	Pl.	280 × 9	385	19.782		7.6		
1	〃	385 × 9	390	27.200		10.6		
16	Lac bars.	70 × 9	430	4.946		34.0		
					326.3 +	52.2	=	378.5
							×	4
								1,514.0
			U5 M5		4 Req'd.			
2	L^S	125×75×10	6.630	14.91	197.7			
2	〃	〃	6.650	〃	198.3			
1	Pl.	280 × 9	385	19.782		7.6		
1	〃	385 × 9	390	27.200		10.6		
21	Lac bars	70 × 9	430	4.946		44.7		
					396.0 +	62.9	=	458.9
							×	4
								1,835.6
			U6 M6		4 Req'd			
4	L^S	125×75×10	7.470	14.91	445.5			
1	Pl	280 × 9	385	19.782		7.6		
1	〃	385 × 9	390	27.200		10.6		
24	Lac bars.	70 × 9	430	4.946		51.0		
					445.5 +	69.2	=	514.7
							×	4
								2,058.8
		SUSPENDER	U7 M7		4 Req'd.			
4	L^S	125×75×10	7.955	14.91	474.4			
1	Pl	280 × 9	385	19.782		7.6		
1	〃	385 × 9	390	27.200		10.6		
26	Lac bars	70 × 9	430	4.946		55.3		
					474.4 +	73.5	=	547.9
							×	4
								2,191.6
			U8 M8		2 Req'd.			
4	L^S	125.75.10	8.115	14.91	484.0			
1	Pl	280 × 9	385	19.782		7.6		
1	〃	385 × 9	390	27.200		10.6		
27	Lac bars	70 × 9	430	4.946		57.4		
					484.0 +	75.6	=	559.6
							×	2
								1,119.2

Summary of Suspenders — 9,801.2 Kgs — 13268

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CALCULATIONS FOR

Material list for Ibinagaragawa-Bashi, Mieken.

			PORTAL BRACING	PB1	Σ Req'd.	
4	L's	100x100x10	5.250	14.91	313.1	
4	"	"	5.780	"	344.7	
2	P/s	590 x 9	5.830	41.684	486.0	
2	L's	75x75x9	1.840	9.96	36.7	
2	"	100x75x10	1.840	12.95	47.7	
2	"	75x75x9	1.820	9.96	36.3	
2	"	100x75x10	1.820	12.95	47.1	
2	P/s	620 x 9	1.570	43.803	137.5	
2	"	315 x 9	605	22.255	26.9	
2	"	335 x 9	520	23.008	24.6	
3	"	540 x 9	560	38.151	64.1	
2	"	335 x 9	520	23.008	24.6	
1	P/	220 x 9	470	15.543	7.3	
2	P/s	465 x 9	775	32.852	50.9	
3	"	515 x 9	570	36.385	62.2	
4	L's	75x75x9	2.520	9.96	100.4	
4	"	"	2.450	"	97.6	
12	"	"	1.145	"	136.9	
4	"	"	1.215	"	48.4	
4	P/s	420 x 9	420	29.673	49.9	
4	L's	100x100x10	7.830	14.91	467.0	
2	"	125x90x10	440	16.09	14.2	
2	"	"	410	"	13.2	
2	P/s	375 x10	625	29.438	36.8	
3	"	390 x10	625	30.615	57.4	
10	bars.	70 x10	625	5.495	34.4	
16	Lac bars.	70 x10	800	"	70.3	
2	Bent P/s.	320 x 9	580	22.008	26.2	
4	P/s	85 x 9	520	6.005	12.5	
1	P/	360 x10	570	28.260	16.1	
2	P/s	390 x 9	735	27.554	40.5	
3	"	320 x 9	355	22.008	24.1	
2	"	620 x 9	1.520	43.803	133.2	
1	P/	220 x 9	470	15.543	7.3	
2	L's	75x75x9	1.810	9.96	36.1	ST1
2	"	"	1.740	"	36.7	
2	P/s	330 x10	375	25.905	19.4	
10	Washers.	60$^{\phi}$ x10		@ 0.222	2.2	
4	Bent P/s	220 x 9	300	15.543	18.7	
2	"	75x75x9	3.035	9.96	60.5	
2	"	"	3.000	"	59.8	
2	"	"	2.785	"	55.5	
2	"	"	2.745	"	54.7	
4	"	100x100x10	400	14.91	23.9	ST2
2	P/s	400 x10	585	31.400	36.7	
2	"	530 x10	585	41.605	48.7	
16	Lac bars.	60 x10	785	4.710	59.2	
4	Bent P/s.	250 x 9	370	17.663	26.1	
2	"	75x75x9	535	9.96	10.7	
2	"	"	515	"	10.3	
2	P/s	330 x10	330	25.905	17.1	ST3
2	Washers	60$^{\phi}$ x10		@ 0.222	0.4	
4	Bent P/s.	220 x 9	250	15.543	15.5	
2	"	75x75x9	2.465	9.96	49.1	
2	"	"	2.215	"	44.1	

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Material list for Ibinagaragawa-Bashi. Micken.

1	Pl.	360 × 10	585	28.260	16.5	ST4	
1	"	530 × 10	585	41.605	24.3		
2	L^s	100×100×10	400	14.91	11.9		
6	Lac bars.	60 × 10	785	4.710	22.2		
2	L^s	100×100×10	370	14.91	11.0		
							3,867.4
							× 2
							7,734.8

SWAY BRACINGS SB1, SB2, SB3, SB4 & SB5 — 9 Req'd

4	L^s	100×75×10	7.830	12.95	405.6		
4	"	100×100×10	3.690	14.91	220.1		
2	Pl^s	280 × 9	575	19.782		22.7	
1	Pl	370 × 9	470	26.141		12.3	
2	Pl^s	405 × 9	400	28.613		22.9	
2	bars	70 × 9	1.400	4.940		13.8	
2	"	"	880	"		8.7	
2	"	"	650	"		6.4	
4	"	"	470	"		9.3	
12	Lac bars	60 × 9	610	4.239		31.0	
12	"	"	625	"		31.8	
2	Fills	100 × 9	280	7.065		4.0	
						625.7 + 162.9	= 788.6
							× 9
							7,097.4

GUSSET PLATES & CONNECTION ANGLES FOR SWAY BRACINGS

4	Pl^s	480 × 9	670	33.912	90.9		
2	"	435 × 9	670	30.733	41.2		
2	"	425 × 9	670	30.026	40.2		
1	Pl	640 × 9	670	45.216	30.3		
4	L^s	125×90×10	395	16.09	25.4		
4	"	"	420	"	27.0		
4	"	"	380	"	24.5		
4	"	"	400	"	25.7		
4	"	"	370	"	23.8		
4	"	"	390	"	25.1		
4	"	"	365	"	23.5		
4	"	"	375	"	24.1		
4	"	"	365	"	23.5		
2	Washers.	70$^{\phi}$ × 9		@ 0.272	0.5		
							425.7

TOP LATERAL BRACINGS.

4	L^s	100×75×10	5.875	12.95	304.3		
4	"	60×60×9	5.875	7.84	184.2		
4	"	100×75×10	5.805	12.95	300.7		
4	"	60×60×9	5.805	7.84	182.0		
4	"	100×75×10	5.785	12.95	299.7		
4	"	60×60×9	5.785	7.84	181.4		
4	"	100×75×10	5.715	12.95	296.0		
4	"	60×60×9	5.715	7.84	179.2		
8	"	100×75×10	5.710	12.95	591.6		
8	"	60×60×9	5.710	7.84	358.1		
8	"	100×75×10	5.680	12.95	588.4		
8	"	60×60×9	5.680	7.84	356.2		

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Material list for Ibinagaragawa-Bashi, Mieken.

8	L's	100x75x10	5.650	12.95	585.3		
8	"	60x60x9	5.650	7.84	354.4		
40	P/s	130 x 9	280	9.185		102.9	
100	"	"	140	"		128.6	
					476 1.5 +	231.5 =	4993.0
		Summary of Sways, Portals & Top laterals			20,250.9		

END FLOOR BEAM FB1 R/L — 2 Req'd.

4	L's	100x90x10	8.070	14.13	456.1		
1	Web P/	800 x 9	8.070	56.520	456.1		
2	Cov P/s	240 x 9	5.420	16.956	183.8		
4	L's	150x100x9	790	17.01		53.8	
16	"	75x75x9	810	9.96		129.1	
10	"	100x75x10	790	12.95		102.3	
4	Fills	220 x 10	625	17.27		43.2	
10	"	75 x 10	625	5.888		30.8	
5	"	100 x 10	300	7.850		11.8	
					1,096.0 +	377.0 =	1,473.0
						x 2	
							2,946.0

INTERMEDIATE FLOOR BEAMS FB2, FB3, FB4 & FB5 — 15 Req'd.

4	L's	125x90x10	8.070	16.09	519.4		
1	Web P/	800 x 9	8.070	56.52	456.1		
2	Cov P/.	280 x 9	5.420	19.782	214.4		
4	L's	150x100x9	1.045	17.02		71.1	
10	"	100x75x10	790	12.95		102.3	
8	"	75x75x9	810	9.96		64.5	
4	Fills	220 x 10	625	17.27		43.2	
10	"	75 x 10	"	5.888		30.8	
10	"	100 x 10	300	7.85		23.6	
4	"	145 x 10	240	11.383		10.9	
2	"	145 x 9	240	10.244		4.9	
					1,189.9 +	357.3 =	1,547.2
						x 15	
							23,208.0

BRACKET R/L — 10 Req'd.

2	L's	75x75x9	275	9.96	5.5		
1	P/	315 x 9	370	22.255	8.2		
							13.7
							10
							137.0

BOTTOM LATERAL PLATE

2	P/s	1,180 x 9	1.320	83.367	220.1		
2	"	1,030 x 9	1.200	72.770	174.6		
2	"	870 x 9	930	61.466	114.3		
2	"	700 x 9	930	53.694	99.9		
							608.9

Summary of Floor Beams and Brackets. 20,899.9 Kgs.

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Material list for Ibinagaragawa-Bashi, Mieken.

STRINGERS S1 & S2 R L — 80 Req'd.

			kgs			
1	I	350 x 150 @	58.54	4510	58.54	264.0
2	L's	100x100x10		305	14.91	9.1

264.0 + 9.1 = 273.1
× 80
21,848.0

BOTTOM LATERAL BRACINGS

4	L's	150x150x11	5.555	24.95	554.4 } LB1
4	"	"	5.355	"	534.4 }
4	"	"	5.705	"	569.4 } LB2
4	"	"	5.505	"	549.4 }
8	"	"	5.705	"	1,138.7 } LB3 & LB4
8	"	"	5.505	"	1,098.8 }
8	"	130x130x9	5.090	17.73	807.1 } LB5
8	"	"	5.540	"	785.8 }
8	"	100x100x10	5.055	14.91	674.5 } LB6
8	"	"	5.505	"	656.6 }
32	"	150x100x9	205	17.02	111.7
32	"	75x75x9	435	9.96	138.6
16	P/s	170 x 9	200	12.011	38.4
8	"	170 x 11	170	14.68	20.0
8	"	150 x 10	170	11.775	16.0

7,369.1 + 324.7 = 7,693.8

ROLLER SHOE RS 1 — 2 Req'd.

1	Cast steel shoe RS 1		@ 400	400.0
1	" " Sole P/ SP1		@ 255	255.0
2	" " Dust guard DG2		@ 29	58.0
4	Tapped bolts	12$^{\phi}$ x 40	@ 0.07	0.3
2	P/s (dust guard)	132 x 8 x 870	8.29	14.4
10	Tapped bolts	6$^{\phi}$ x 25	@ 0.01	0.1
6	Bolts	22$^{\phi}$ x 45	@ 0.28	1.7
6	Rollers	100$^{\phi}$ x 850	61.65	314.4
2	P/s	80 x 13 x 030	8.104	10.3
8	Pins	20$^{\phi}$ x 50	@ 0.13	1.0
4	"	"	@ 0.15	0.6
4	Anchor bolts.	40$^{\phi}$ x 950	@ 9.8	39.2
1	Pin & Nuts.	130 x 581	60.0	60.0

1,101.0
× 2
2,322.0

BED PLATE BP1 & BP2

2	Cast steel P/s	BP1	@ 266	532.0
2	" " "	BP2	@ 194	388.0

920.0

FIXED SHOE FS1 — 2 Req'd.

1	Cast steel shoe	FS1	@ 550	550.0
4	Anchor bolts	40$^{\phi}$ x 950	@ 9.8	39.2
1	Pin & Nuts	130$^{\phi}$ x 581	@ 66	66.0

655.2
× 2
1,310.4

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CALCULATIONS FOR

Material list for Obinagaragawa-Bashi. Mieken

Summary of shoes 4,552.4 kgs.

RIVET HEADS.

49,060	Shop rivet heads	22φ	@ 0.09639	4729.0	
~~34,450~~ 35310	Field "	"	@ "	~~3,350.0~~	3,404.0
33,070	Shop "	19φ	@ 0.06464	2,138.0	
5,800	Field "	"	@ "	375.0	
					~~10,592.0~~ 10,646.0

EXPANSION JOINT EJ 1 — 1 Req'd for all spans.

1	L	125×75×10	8.210	14.91	122.4
1	"	75×75×9	7.890	9.96	78.6
1	Pl.	275 × 9	7.275	19.429	141.3
2	Ls.	75×75×9	326	9.96	6.5
2	"	"	190	"	3.8
2	"	"	210	"	4.2
2	"	"	225	"	4.5
2	"	"	240	"	4.8
2	"	"	245	"	4.9
2	"	"	250	"	5.0
2	Pls	310 × 9	350	21.902	15.3
5	"	75 × 9	290	5.299	7.7
2	Fills	75 × 10	190	5.888	2.2
10	Washers.	70φ × 10		@ 0.302	3.0
5	Is.	150×125 @30.22 kgs	300	36.22	54.3
4	Anchor bolts.	12φ	310	@ 0.35	1.4
4	Washers.	70 × 3	70	1.649	0.5
					460.4

EXPANSION JOINT EJ 2 — 1 Req'd for all spans.

1	Checkered Pl.	280 × 9	8.210	22.286	183.0
1	L.	75×75×9	8.210	9.96	81.8
1	Pl.	270 × 9	7.030	19.076	134.1
2	Pls	340 × 9	420	24.021	20.2
2	Ls	75×75×9	595	9.96	11.9
3	"	"	220	"	6.6
					437.6

EXPANSION JOINT EJ 3 — 14 Req'd for all spans.

1	Checkered Pl.	255 × 9	8.210	20.296	166.6
1	L	75×75×9	8.210	9.96	81.8
1	Pl	270 × 9	7.030	19.076	134.1
2	Pls	340 × 9	420	24.021	20.2
2	Ls	75×75×9	595	9.96	11.9
3	"	"	220	"	6.6
					421.2
				×	14
					5,890.8

EXPANSION JOINT EJ 4 — 14 Req'd for all spans.

1	Bar	50 × 10	8.210	3.925	32.2
1	L	150×90×9	8.210	16.32	134.0
1	Pl	270 × 9	7.030	19.076	134.1

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CALCULATIONS FOR

Material list for Ibinagaragawa - Bashi . Mieken.

2	P/G	340 × 9	420	24.021	20.2	
2	L	75×75×9	595	9.96	11.9	
3	〃	〃	220	〃	6.6	
						339.0
						× 14
						4,746.0

Summary for Expansion joint 11,540.8 (for all spans)

Summary for one span.

	Kgs		Details
Top chords.	54,757.8		14,755 4
Middle chords.	12039.6		4.073 6
~~Bottom chords.~~	~~49,635.4~~ ~~40,073.8~~	~~145,032.8~~ Kgs 145,563.4	14.750 ✓
Verticals.	~~9,637.4~~ ~~6,718.4~~		2.6708
Diagonals.	9,642.0		1.4078
Suspenders	9,801.2		1.3268
Sways, Portals & Top bracings	20,250.9		38.979 6 = 26.8%
Floor beams & brackets.	20,899.9		
Stringers.	21,848.0		
Bottom lateral bracings	7,093.8		
	~~22,725.4~~	222,560	
Rivets heads	~~10,592.0~~	10,640.0	
	~~232,317.4~~	232,902.0	
Shoes	4,552.4		
	~~236,869.8~~ Kgs	or ~~236.870~~ Kg tons.	
	237,454.4	237.454	

Grand Summary for all Spans

	237.454	3561.810	Kg tons
	~~236.870~~ × 15 =	~~3,553.05~~	
Expansion joints	11,540.8 Kgs or	17.541	
		~~3,564.591~~	Kg tons
		3,573,351	

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MADE BY M. Jinda DATE 5-7-21 FILE NO
CHECKED BY M. Kojima R.J. DATE 5-7-22 5-8-5 PAGE NO M.16

CALCULATIONS FOR

Materials of Ibi-Nagara Bashi for Mie-Ken

Materials of Floor slab
Concrete 1:2:4 mixture

. 1 Sectional area

Slab	.155	× 7.50 =	1.162
Coping	2@.17	× .342 =	.116
Fillets	.062	× .212 =	.013
	2@.047	× .147 =	.019

1.310 sq. meters

Length of Floor slab for span no. 1 ~ no. 14 (14@73.53)

Floor	1.310	× 73.53 =	96.324
Fillets	15@.035×.315×6.20	=	1.025 on intermediate floor beam
,	2@.035×.275×6.20	=	.119 on end floor beam

97.468 cub. meters

Length of Floor slab for span no. 15 (73.78)

Floor	1.310	× 73.78 =	96.652
Fillets	15@.035×.315×6.20	=	1.025 on intermediate floor beam
,	2@.035×.275×6.20	=	.119 on end floor beam

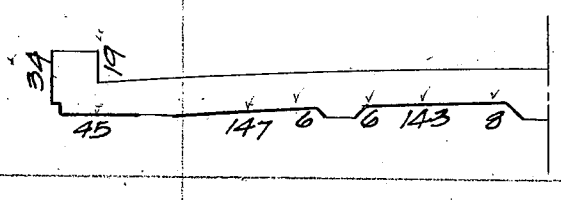
97.796 cub. meters

Total concrete of floor slab

Span no. 1 ~ no. 14	14@97.468	= 1364.552
Span no. 15	1@97.796	= 97.796

Summary of concrete for the whole span 1,462.348 cub. meters drain hole neglected

Forms
width = 0.16 meters net
Span no. 1 ~ no. 14



	0.16 × 73.53	=	600.00
less	15@.25 × 7.15	=	- 26.81 on intermediate floor beam
,	2@.21 × 7.15	=	- 3.00 on end floor beam

570.19 sq. meters

Span no. 15

	0.16 × 73.78	=	602.04
less	15@.25 × 7.15	=	- 26.81 on intermediate floor beam
,	2@.21 × 7.15	=	- 3.00 on end floor beam

572.23 sq. meters

Total Forms of floor slab

Span no. 1 ~ no. 14	14@570.19	= 7982.66
Span no. 15	1@572.23	= 572.23

Summary of Forms for the whole span = 8,554.89 sq. meters

Reinforcements, Plain bars

Span no. 1 ~ no. 14	14@10,956.1	= 153,385.4
Span no. 15	1@10,994.8	= 10,994.8

Summary of Reinforcements for the whole span = 164,380 Kg. tons

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R.O. 5-8-5

CALCULATIONS FOR

Materials of Ibi-Nagara Bashi for Mie-Ken

Pavements (asphalt block)
width = 7.50 meters
Span no. 1 ~ no. 14 14 @ 7.50 × 73.53 = 7,725.9
Span no. 15 1 @ 7.50 × 73.93 = 554.7
8,279.6 sq. meters drain hole neglected

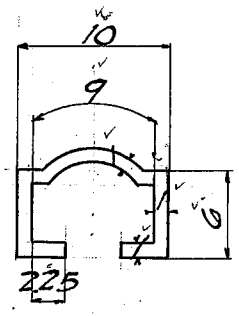
Expansion joints 15 ヶ所

Construction joints (3/8" thick carey elastite 挿入)
Span no. 1 ~ no. 14 14 @ 5 = 70
Span no. 15 1 @ 6 = 6
76 ヶ所

Drain (cast iron) 15 span required
15 @ 20 = 300個 required weight@30 Kgs

人造洗出仕上
Span no. 1 ~ no. 14 14 @ 2 × .93 × 7353 = 17099.4
Span no. 15 1 @ 2 × .93 × 7379 = 1224.7
18323.1 sq. meters

Tar paper on east abutment only 1ヶ所



Materials of handrails
Top rail (cast iron)
Sectional area = 1 × (9 + 6 × 2 + 2.25 × 2) = 25.5 sq. cm
Volume of rib = 8 × 1 × 5 = 40 cub. cm

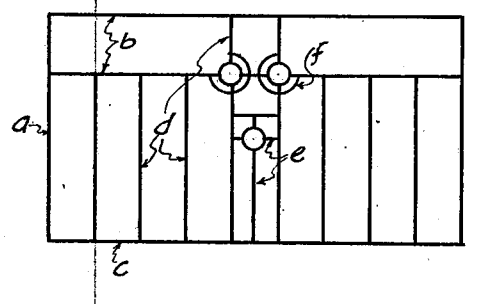
Top rail for H1
Volume = (25.5 × 146.7) + 2 × 40 = 3821 cub cm
Weight = .00725 × 3821 = 27.7 Kgs

" for H2
Volume = (25.5 × 95) + 2 × 40 = 2,248 cub cm
Weight = .00725 × 2,248 = 16.3 Kgs

" for H3
Volume = (25.5 × 48) + 40 = 1,264 cub cm
Weight = .00725 × 1,264 = 9.2 Kgs

Grate for H1

a	(3 × 3 × 75.5) × 2	= 1359
b	(2.5 × 3 × 130.7) × 2	= 2081
c	(2.5 × 4 × 139.7) × 1	= 1397
d	(1.7 × 3 × 56) × 8	= 2285
"	(1.7 × 3 × 12) × 2	= 122
e	(1.5 × 3 × 47) × 1	= 212
"	(1.5 × 3 × 13.3) × 1	= 60
"	(1.7 × 3 × 13.3) × 1	= 68
f	(1.5 × 3 × 7) × 6	= 189
		7,763 × .00725 = 56.3 Kgs



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MADE BY M. Kojima DATE 5-6-19 FILE NO
CHECKED BY M. Jinda R.I. DATE 5-6-20 5-8-5 PAGE NO M 19

CALCULATIONS FOR

Materials of Ibi-Nagara Bashi for Mie-Ken

Grate for H2

a	(3 × 3 × 75.5) × 2	=	1359
b	(2.5 × 3 × 77) × 2	=	1155
c	(2.5 × 4 × 77) × 1	=	770
d	(1.7 × 3 × 56) × 4	=	1142
〃	(1.7 × 3 × 12) × 2	=	122
e	(1.5 × 3 × 47) × 1	=	212
〃	(1.5 × 3 × 13.3) × 1	=	60
〃	(1.7 × 3 × 13.3) × 1	=	68
f	(1.5 × 3 × 7) × 6	=	189

5077 × .00725 = 36.8 Kgs

Grate for H3

a	(3 × 3 × 75.5) × 2	=	1359
b	(2.5 × 3 × 29) × 2	=	435
c	(2.5 × 4 × 29) × 1	=	290
d	(1.7 × 3 × 56) × 1	=	286

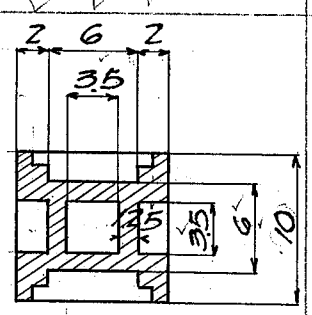
2370 × .00725 = 17.2 Kgs

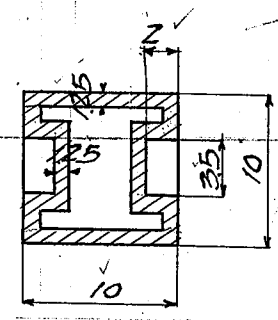
Post P1

at middle 6 × 10 − 3.5 × 7.5 = 33.75
2 × 2 × 3/4 × 4 = 12.00
45.75 × 58 = 2,654 cub.cm

Top and bottom
1.25 × (10 + 7.5 + 2 + 2) × 2 = 53.75 sq.m
53.75 × 26 = 1398 cub cm

Bed 2.1 × 2 × 1.6 = 6.72
less 7.5 × 2 × 7.5 = −1.13
559 cub cm





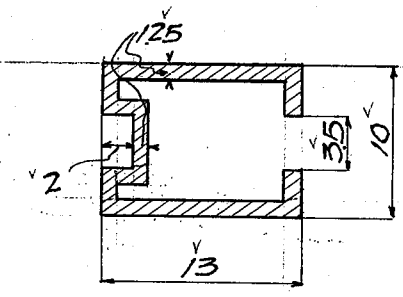
Wright of P1 (2654 + 1398 + 559) × .00725 = 33.4 Kgs

Post P2

at middle 6 × 13 − 3.5 × 11 = 39.50
2 × 2 × 3/4 × 4 = 12.00
51.50 × 58 = 2,987 cub cm

Top and bottom
1.25 × (13 × 2 + 7.5 + 2 × 2 + 4) = 51.88
51.88 × 26 + 3.5 × 9.5 = 1,382 cub cm

Bed 2.4 × 2 × 1.6 = 7.68
less 7.5 × 2 × 1.05 = −1.59
= 6.10 cub cm



weight of P2. (2,987 + 1382 + 610) × .00725 = 36.1 Kgs

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MADE BY M. Kojima DATE 5-6-10 FILE NO
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R.1 5-8-5

CALCULATIONS FOR

Materials of Ibi-Nagara Bashi for Mie-Ken

Weight of handrails (Both sides) cast iron

	mark	Reqd no.	Piece wt.	Total wt.
Top rail	H1	1440	27.7	39,888.0
〃	H2	28	16.3	456.4
〃	H3	4	9.2	36.8
Grate	H1	1440	563	81,072.0
〃	H2	28	36.8	1,030.4
〃	H3	4	17.2	68.8
Post	P1	1446	33.4	48,296.4
〃	P2	28	36.1	1,010.8
			Total	171,859.6 Kgs

Structural steel

Post cov. Pl.	1446	2.51	3,629.5	
〃	28	3.26	91.3	
Anch. bolt 24cm	5888	.28	1,648.6	
〃 55cm	4	.1	.4	
Washer	2944	.46	1,354.2	
Fill.	2	2.37	4.7	
			6,728.7 Kgs	

Summary of handrails 178,588.3 Kgs

親柱石材（一基分）花崗石

Reqd no.	Dimension	Unit Volume	Total Volume	
2	70 × 22.5 × 100cm	.158 cub.m	.316 cub.m	1st course
2	70 × 22.5 × 55	.087	.174	
2	65 × 22.5 × 100	.146	.292	
2	65 × 22.5 × 55	.080	.160	
4	30 × 22.5 × 40	.027	.108	2nd course
2	30 × 22.5 × 35	.024	.048	
2	30 × 17.5 × 15	.008	.016	
2	30 × 15 × 35	.016	.032	
2	30 × 15 × 32.5	.015	.030	
10	30 × 15 × 35	.016	.160	column
10	30 × 15 × 65	.029	.290	
1	35 × 65 × 65	.148	.148	cap
			1.774 cub.m.	

親柱用一基分

Concrete 1:2:4 mixture

upper part .35 × .35 × 2.25 = .276
lower part .55 × .55 × 1.35 = .408
.684 cub m.

Reinforcements, plain bars = 42.1 Kgs

Gas pipes

2 − 1"φ gas pipe 0.30m long
1 − 2"φ 〃 〃 3.60m long
2 − 1"φ 〃 〃 0.50m long

Bronze lamps 2 set @ 53 Kgs for one pedestal
〃 2 〃 @ 6.0 Kgs 〃 〃 〃
milk white glass 5mm thick (see drawing)
Bronze name plate 1 Pl.

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MADE BY M. Jinda DATE 5-7-22 FILE NO

CHECKED BY M. Kojima DATE 5-7-23 PAGE NO M.20
R. I. 5-8-5

CALCULATIONS FOR

Materials of Ibi-Nagara Bashi for Mie-Ken

袖小柱(一箇所分)石材 花崗石

Req'd no.	Dimensions	Unit volume	Total volume	
1	50×60×105 cm	.315	.315	P1
1	50×60×105	.315	.315	P2
1	60×60×105	.378	.378	P3
			1.008 cub.m.	

袖高欄(一ケ所分)石材 花崗石

1	24×20×85 cm	.041	.041
1	24×20×80	.038	.038
1	35×20×82	.057	.057
1	30×26×85	.066	.066
1	30×26×80	.062	.062
1	40×26×86	.089	.089
1	50×15×85	.064	.064
1	50×15×80	.060	.060
1	50×26×75	.098	.098
			.575 cub.m

縁石(一ケ所分)花崗石

3	15×20×65 cm	.020	.060
1	15×20×35	.011	.011
1	15×20×80	.024	.024
1	40×20×65	.052	.052
1	15×20×110	.033	.033
1	30×20×95	.057	.057
			.237 cub.m

Bracket for lamp (90 required)

Casting — 34.2 Kgo

4 Bolts — 1.2φ×45 cm — 4@.1 = 4 Kgo for one bracket

1"φ gas pipe 73 cm long

Bronge fixture — 3.0 Kgo

milk white globe — 30 cm dia. 5 mm thick

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CALCULATIONS FOR

MADE BY_____DATE_____FILE NO_____
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昭和七年十一月

三重縣

揖斐長良橋変更設計

計算書

JIUN MASUDA
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SHOWA

MADE BY J. Masuda DATE 7-9-14 FILE NO ____
CHECKED BY ____ DATE ____ PAGE NO 1

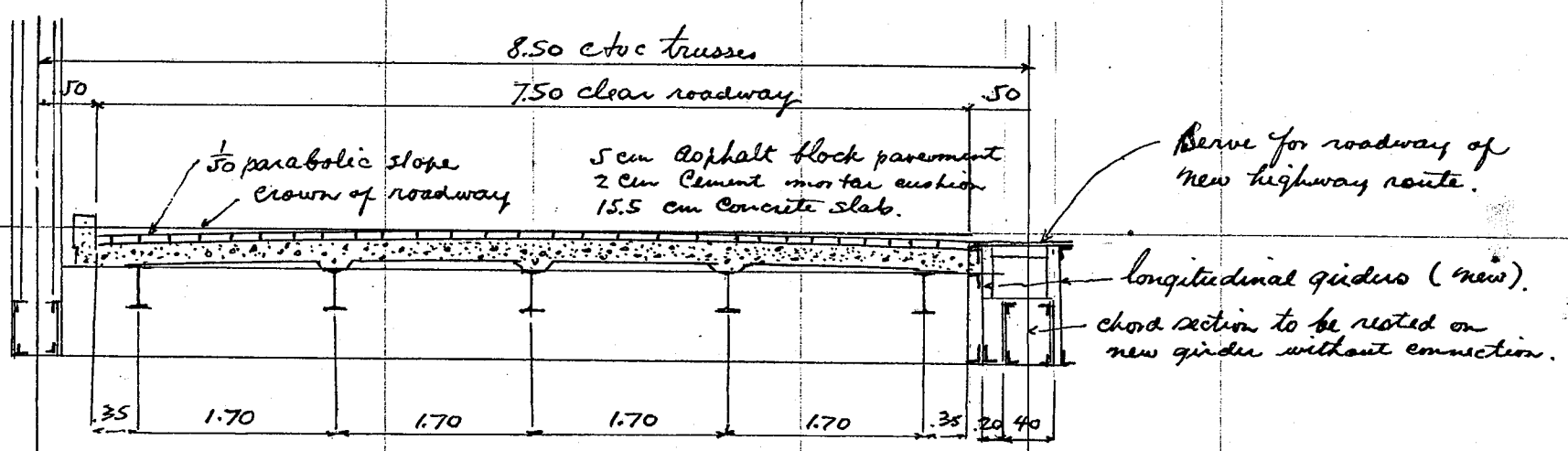
CALCULATIONS FOR

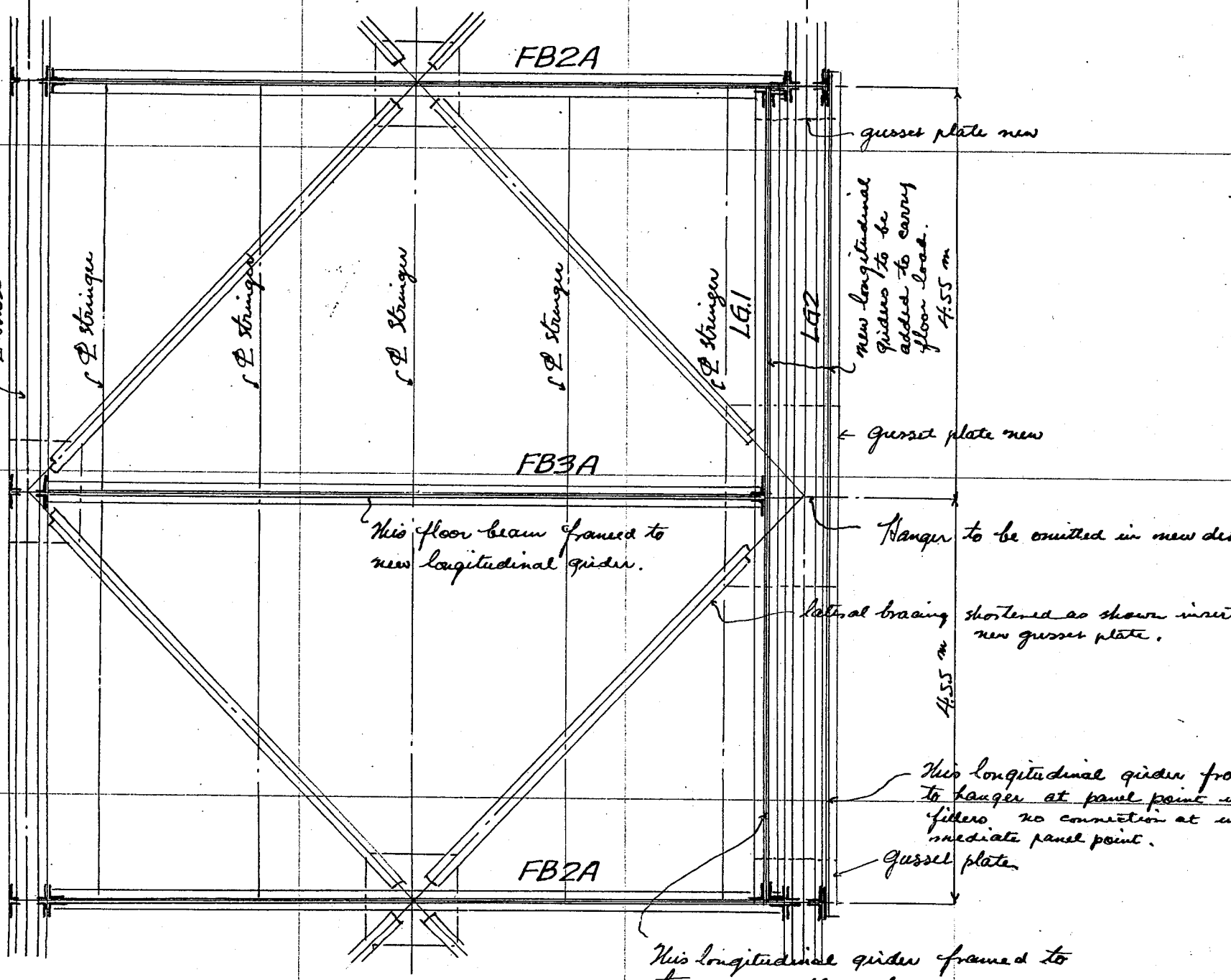
Remodeling of Ibi-Nagara Bashi for Mieken.

Gufu-Ken proposed a highway route on common bank of Ibi and Nagara Rivers and planned from North on the line of the said bank a highway bridge to connect the traffic line to the present bridge in the course of construction by Mie-Ken. The method of remodelling of the truss span is to take off hanger and diagonals (obstruction to new highway route) at the center of truss span in the passage and replace portals and diagonals over head.

Assumed truck loading for new highway route will be 3rd class motor trucks and road roller, however the loading on present bridge shall be 2nd class motor trucks and road roller.

General scheme of remodelling of floor.





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MADE BY J. Masuda DATE 7-9-14 FILE NO
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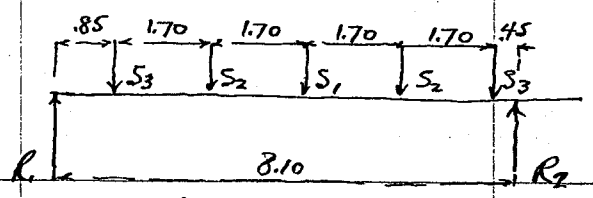
CALCULATIONS FOR

Remodeling of Ibi-Nagara Baski for Mie-Ken.

Design of Transverse Floor Beam FB3A.

Loading same as original design; span length 8.10 meters
Refer to the loading ~~assumed~~ mention on page 5 Ibi-Nagara Baski. calculation.
Spacing of floor beam 4.55 meters



·Floor slab between stringer S3 and longitudinal girder LG1 Concentrated on stringer S3 and assumed symmetrical about ℄ bridge.

Stringer concentration S1 and S2 2 × 2180 = 4360 kg.
S3 939 × 4.55 = 4270 "

Total load
3 × 4360 = 13080
2 × 4270 = 8540
21620

Reaction or End shear

$$R_2 = \frac{4270 \times 8.5 + 4360 \times 12.75}{8.10} = \frac{92000}{8.10} = 11400 \text{ kg.}$$

$$R_1 = 21620 - 11400 = 10220 \text{ kg.}$$

Moment at S1

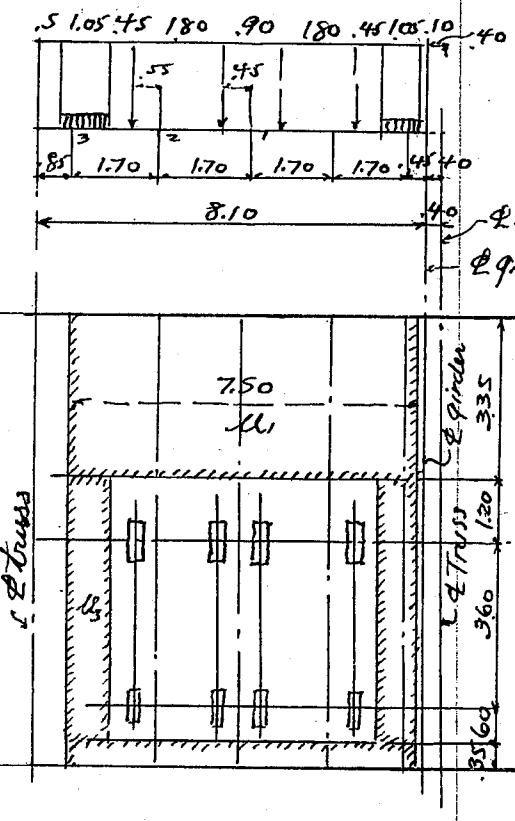
11400 × 3.85 = 43820
4270 × 3.40 = 14500
4360 × 1.70 = 7420
− 21920
21900 kgm

Dead Load of floor beam assumed 200 kg per lin. meter
End reaction = ½ × 200 × 8.10 = 810 kg.
Moment at ℄ of span = ⅛ × 200 × 8.10² = 1640 kgm.

Summary for moments and shears (Dead Load only).

	Moment at S1	Reaction R1	Reaction R2
Due to Stringer concentration	21900	10220	11400
Weight of floor beam	1640	810	810
	23540 kgm	11030 kg	12210 kg.

Live Load



Motor truck loading rear wheel concentration 3000
impact assumed 30% 900
3900 kg
Front wheel concentration say 1300 kg

Uniform live load 500 kg per square meter
motor trucks rear wheels directly on floor beam;
Front wheels and uniform load assumed concentrated to stringer connection of floor beam.

Reaction on stringer connections due to front wheel of motor truck
Reaction on floor beam 1300 × .95/4.55 = 272 kg

at ① 272 × 1.25/1.70 · 2.0 = 400 kg

at ② 272 × .45/1.70 = 72
272 × 1.15/1.70 = 184
= 256 kg

at ③ 272 × .55/1.70 = 88 kg

Full uniform load at front and rear of motor trucks

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MADE BY J. Masuda DATE 7-9-15 FILE NO
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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie-Ken

M_1 $500 \cdot \frac{3.35^2}{2 \times 4.55} = 615$

M_2 $500 \cdot \frac{.35^2}{2 \times 4.55} = \frac{7}{622}$ Reaction on floor beam

Load on stringer connection

at 1 and 2 $622 \cdot 1.70 = 1060$ kg

at 3 $622 \cdot (.85 + .35) = 745$ kg assumed

Uniform load on sides of motor trucks M_3

load on floor beam 1 meter strip

$500 \cdot 1.2 \cdot \frac{3.95}{4.55} = 521$

$500 \cdot 4.2 \cdot \frac{2.45}{4.55} = \frac{1130}{1651}$ kg

at 3 $1651 \cdot .35 = 577$

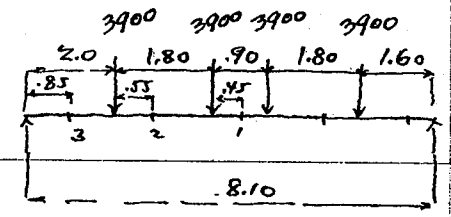
at $1651 \cdot .70 \cdot \frac{1.35}{1.70} = \frac{916}{1493}$ kg

at 2 $1651 \cdot .70 \cdot \frac{.35}{1.70} = 238$ "

Summary for loads on stringer connections

	at S_3	at S_2	at S_1
Motor truck front wheel	88	256	400
Uniform loads M_1 and M_2	745	1060	1060
" " M_3	1493	238	—
	2326	1554	1460 kg

Moment due to rear wheel of motor trucks



$R_2 = 3900 \cdot \frac{17,100}{8.10} = 8170$

$R_1 = 15600 - 8170 = 7430$

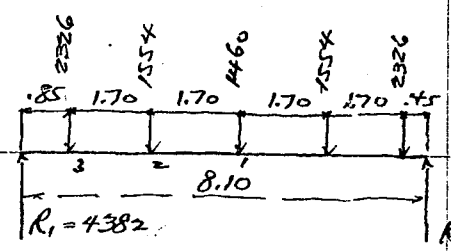
Total load = 3900 · 4 = 15600

Moment at 1 $7430 \cdot 4.25 = 31600$

$3900 \cdot 2.70 = -10530$

21070 kgm

Moment due to front wheels and Uniform live loads.



$R_2 = 2326 \cdot 8.50 \div 8.10 = 2440$

$1554 \cdot \frac{8.50}{5.95} \div 8.10 = 1632$

$1460 \cdot 4.25 \div 8.10 = 766$

4346
4838

$R_1 = 9220 - 4346 = 4382$ kg

Total load 2326
1554
3880 × 2 = 7760
1460
9220 kg.

Moment at 1 $4382 \cdot 4.25 = 18650$

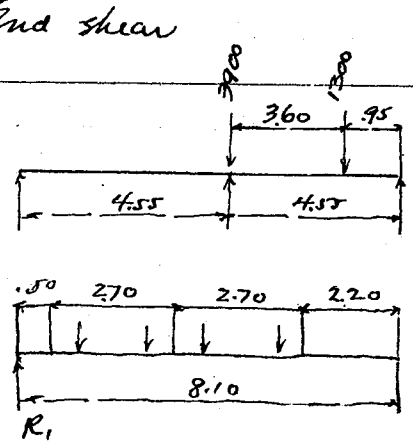
$1554 \cdot 1.70 = 2640$

$2326 \cdot 3.40 = 7900$

-10540

8110 kgm

End shear



Motor truck loading

front wheel $1300 \cdot \frac{.95}{4.55} = 272$

Rear wheel 3900

4172 kg

for two trucks $4 \times 4172 = 16688$ kg

$R_1 = 16688 \cdot \frac{4.90}{8.10} = 10100$ kg.

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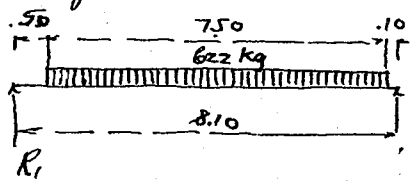
CALCULATIONS FOR

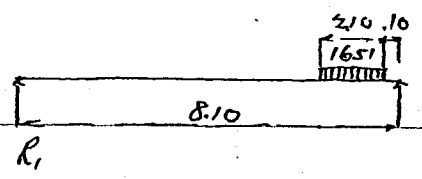
Remodeling of Ibi-Nagara Bashi for Mie-Ken.

By similar method $R_2 = 16688 \cdot \frac{5.30}{8.10} = 10900$ kg

Uniform live load u_1 and u_2 622 kg per lin. meter and u_3 = 1651 kg per lin. meter



$$R_1 = \frac{622 \times 7.50 \times 3.85}{8.10} = 2215$$



$$R_1 = \frac{1651 \times 2.10 \times 1.15}{8.10} = 493$$

2708 kg

Similarly

$$R_2 = \frac{622 \times 7.50 \times 4.25}{8.10} = 2450$$

$$R_2 = \frac{1651 \times 2.10 \times 1.55}{8.10} = 665$$

3115 kg

Summary for End shears (Live Load)

	R_1	R_2
motor truck loading	10100	10900
Uniform load $u_1 + u_2$	2215	2450
" " u_3	493	665
	12808 kg	14015 kg

Total live load moments = 21070 + 8110 = 29180 kgm

Summary for moments and shears

	moment at 1	Reactions R_1	R_2
Dead Load	23540	11030	12210
Live Load	29180	12808	14015
	52720 kgm	23838 kg	26225 kg.

Section of Floor Beam FB3A

web assumed $800 \cdot 9 = 72.0$ cm² ⅛ web = 9.0 cm² back to back of Ls 81.0 cm

Flange	2Ls	125 · 90 · 10	= 41.0	− 8.8	=	32.2
	1Pl	280 · 9	= 25.2	− 4.0	=	21.2
			66.2			53.4 cm² net

℄ gravity of Flange area = 1.2 cm from back of Ls

Effective depth 81. − 2.4 = 78.6 cm

$$\text{flange stress} = \frac{52720}{.786} = 67100 \text{ kg}$$

$$\text{flange area reqd} = \frac{67100}{1200} = 56.0$$

⅛ web 9.0

47.0 cm² net

Assumed section ok

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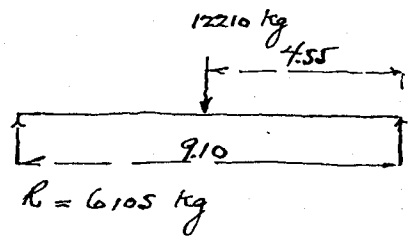
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie-Ken

Design of Longitudinal girder LG1

Span length 9.10 meters floor beam FB3A framed into on ℄ of span.

Dead Load. Dead Load reaction from FB3A 12210 kg (See page 4)



moment at center = 6105 × 4.55 = 27800 kgm

Dead load of girder assumed 250 kg per lin. meter

Reaction = 250 × 4.55 = 1140 kg

Moment = 1140 × 4.55 = 5190 kgm

Summary for Dead Load Moments and Shears

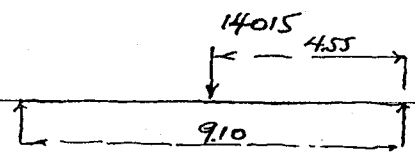
	Moment	Shear
From Concentration	27800	6105
" Own weight	5190	1140
	32990 kgm	7245 kg.

Live Load

Full Live load on ℄ floor beam FB3A + Rear wheels of motor trucks for new highway route this loading ~~will give~~ assumed is rather excessive. however for simplicity of calculation and being on safe side rear wheels of 2 motor truck loaded directly on girder.

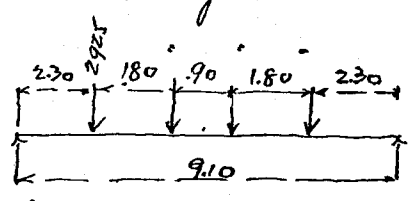
Rear wheel loading of 3rd class motor truck = 2250
Impact assumed 30% 675
2925 kg

Live load reaction from FB3A 14015 kg (See page 4)



Moment at center = 7007 × 4.55 = 31900 kgm

Extra rear wheel loading



Moment = 5850 × 4.10 = 24000
2925 × 1.80 = −5260
18740 kgm

Max End shear say 1st wheel 1.0m assumed $2925 \times 4 \times \frac{5.85}{9.10} = 7530$ kg

Summary for Live load moments and shears

	Moment	Shear
From concentration	31900	7007
		7530
" extra loading	18740	5850
	50640 kgm	12857 kg
		14537

Summary for Dead and Live load moments and shears

	Moment	End reaction
Dead Load	32990	7245
Live Load	50640	14537
	83630 kgm	21782 kg.

Section of girder · Depth 1.032
checkered plate − 19
1.023
2-10mm cover plate − 20
1.003 back to back of LS

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CALCULATIONS FOR.

Remodeling of Hi-Nagara Bashi for Mie-Ken

web assumed 990 · 9 = 89.0 ocm ⅛ web = 11.12 cm²

Assumed flange section

					net area
2 L 150×100×12	= 57.12	× 2.4	= 137.00	− 10.56	= 46.56
1 PL. 210×10	= 21.00	× 0.5	= − 10.50	− 440	= 1660
	78.12		116.50		63.16 cm²

Center of gravity = 116.50 ÷ 78.12 = 1.5 cm

flange stress = $\frac{83630}{.972}$ = 86200 kg section rqd = $\frac{86200}{1200}$ = 72.00
⅛ web − 11.12
60.88 cm² net

assumed section ok for bottom flange
In detailing this girder the cover plate of top flange shall be widened to cover the top flange of outside girder LG2. This will serve for carrying concentration on floor slab with checkered plate on top.

Design of Longitudinal girder LG2. Span length 9.10 meters

Dead Load weight of girder assumed 150 kg per lin. meter

R = 150 × 4.55 = 683 kg
M = ⅛ × 150 × 9.1² = 1550 kgm

Live Load Same as extra live load on LG1.

Moment = 18740 kgm Shear = 7530 kg

Summary for Dead and Live Load moments and shears

	Moment	Shear
Dead Load	1550	683
Live Load	18740	7530
	20290 kgm	8213 kg.

Section of girder
web assumed 1010 × 9 = 90.9 cm² ⅛ web = 11.36 cm²
back to back of ls 1.020 m Effective depth = 1020 − 48 = 972 mm

flange stress = $\frac{2029000}{.972}$ = 208500

Required section = $\frac{20850}{1200}$ = 17.40 cm² net
⅛ web 11.36
6.04 cm² net

use 1 L 150 × 100 × 9 = 21.69 − 3.96 = 17.74 cm² net

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CALCULATIONS FOR

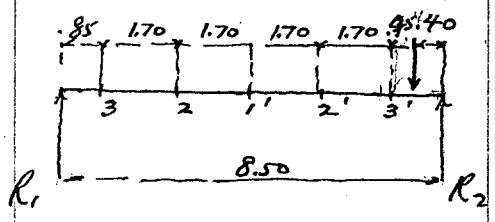
Remodeling of Ibi-Nagara Bashi for Mie-Ken

Design of Floor Beam FB2A
Longitudinal girder LG1 will be framed into this floor beam near end connection.
Calculation of FB2 See page no 7 (old Calculation of Ibi-Nagara Bashi)
Moments and shears from load on LG1 shall be added.

Summary for moments and shears (FB2)

	Moments at Stringer 3	Stringer 2	Stringer 1	End Shears
Dead Load	9840	21820	25830	11660
Live Load	10545	25570	31710	13364
	20385	47390	57540 kgm	25024 kg

Extra load from LG1



Dead Load 7007 kg
Live Load 7530 kg

Dead Load
Reaction $R_1 = 7007 \cdot \frac{4.0}{8.50} = 334$ kg
$R_2 = 7007 - 334 = 6673$

Moment at 3	2	1	2'	3'	4'	Reaction R_1	R_2
284	852	1420	1990	2550	2700	334	6673
9840	21820	25830	21820	9840		11660	11660
10124	22672	27250	23810	12390		11994 kg	18333

Live Load Reaction $R_1 = 7530 \cdot \frac{4.0}{8.50} = 355$ kg
$R_2 = 7530 - 355 = 7175$ kg

Moment at 3	2	1	2'	3'	4'	Reactions R_1	R_2
302	905	1510	2110	2720	2870	355	7175
10545	25570	31710	25570	10545		13364	13364
10847	26475	33220	27680	13265		13719	20539

Summary for moments and shears

Moment at 3	2	1	2'	3'		Reactions R_1	R_2
10124	22672	27250	23810	12390		11994	18333
10847	26475	33220	27680	13265		13719	20539
20971	49147	60470	51490	25655	kgm	25713 kg	38872

Section of girder
web 800 × 9 = 72.0 cm² 1/8 web = 9.0 cm² Back to back of LS = 81.0 cm
flange LS 2LS 125 × 90 × 10 = 41.0 − 8.8 = 32.20
1Pl 280 × 11 = 30.8 − 4.84 = 25.96
71.8 58.16

Effective depth 81.0 − 2.1 = 78.9 cm
flange stress = 60470 ÷ .789 = 76600
Required flange area 76600 ÷ 1200 = 63.90
1/2 web 9.00
54.90 cm net

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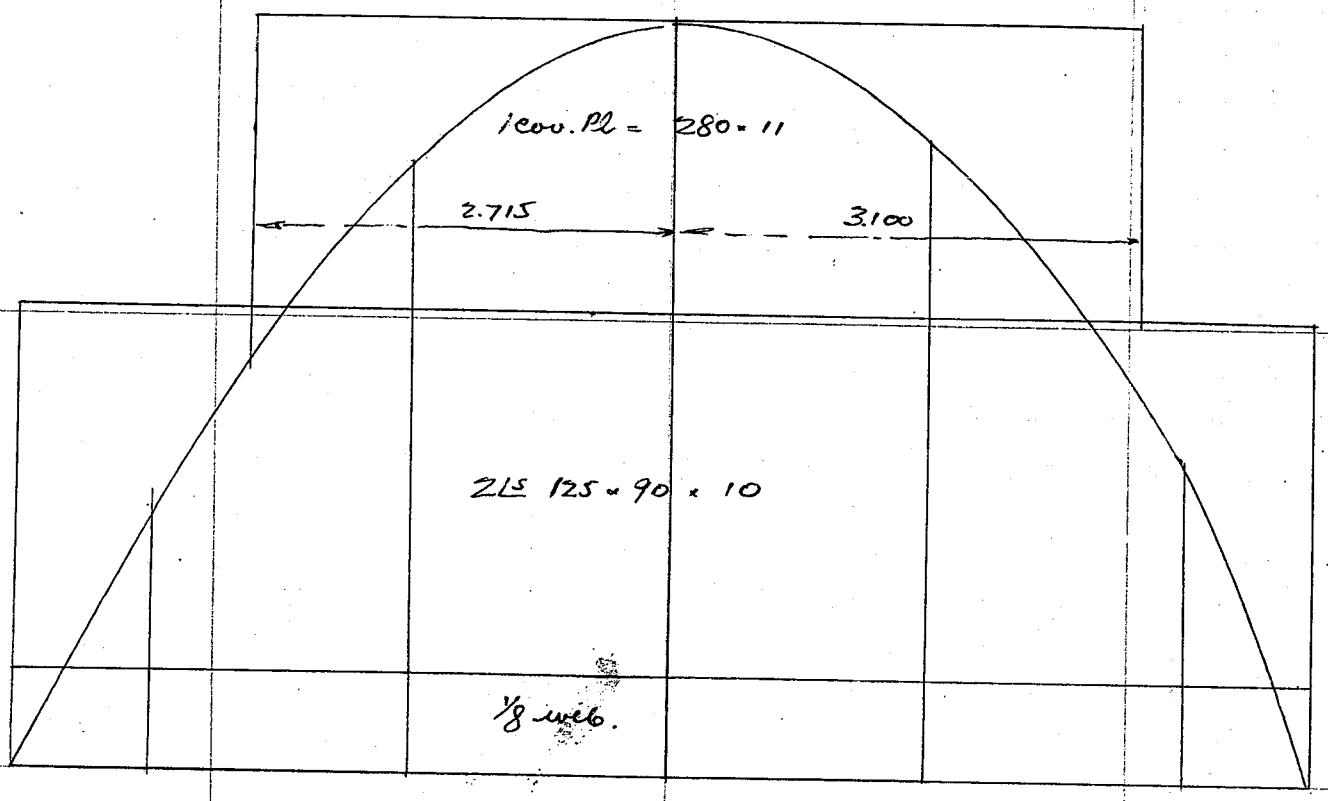
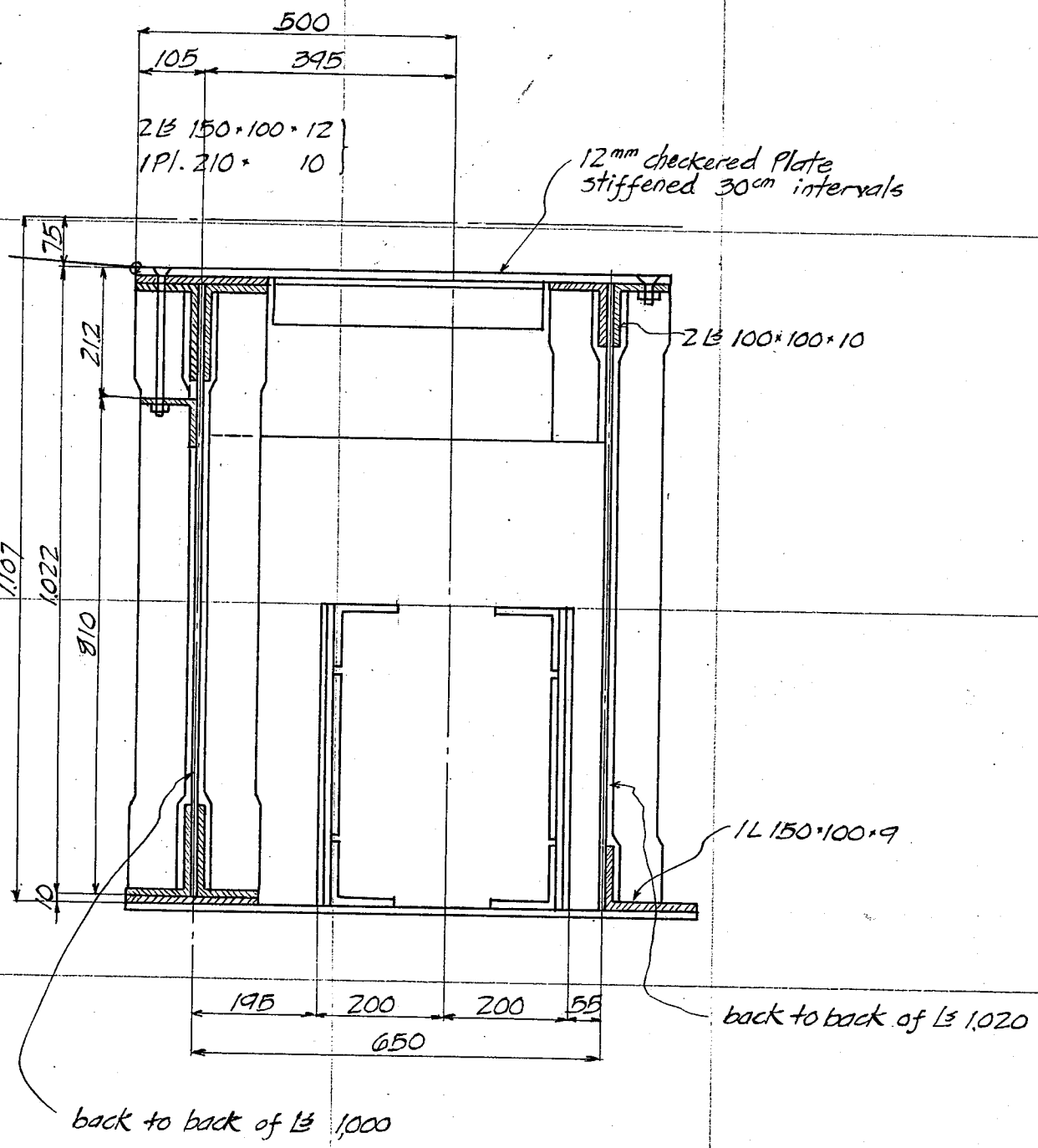
CALCULATIONS FOR

Remodeling of Hi-Nagara Bashi for Mie-Ken

Moment Diagram



Scale of space 1:50
" " moment 1 cm = 6000 kgm



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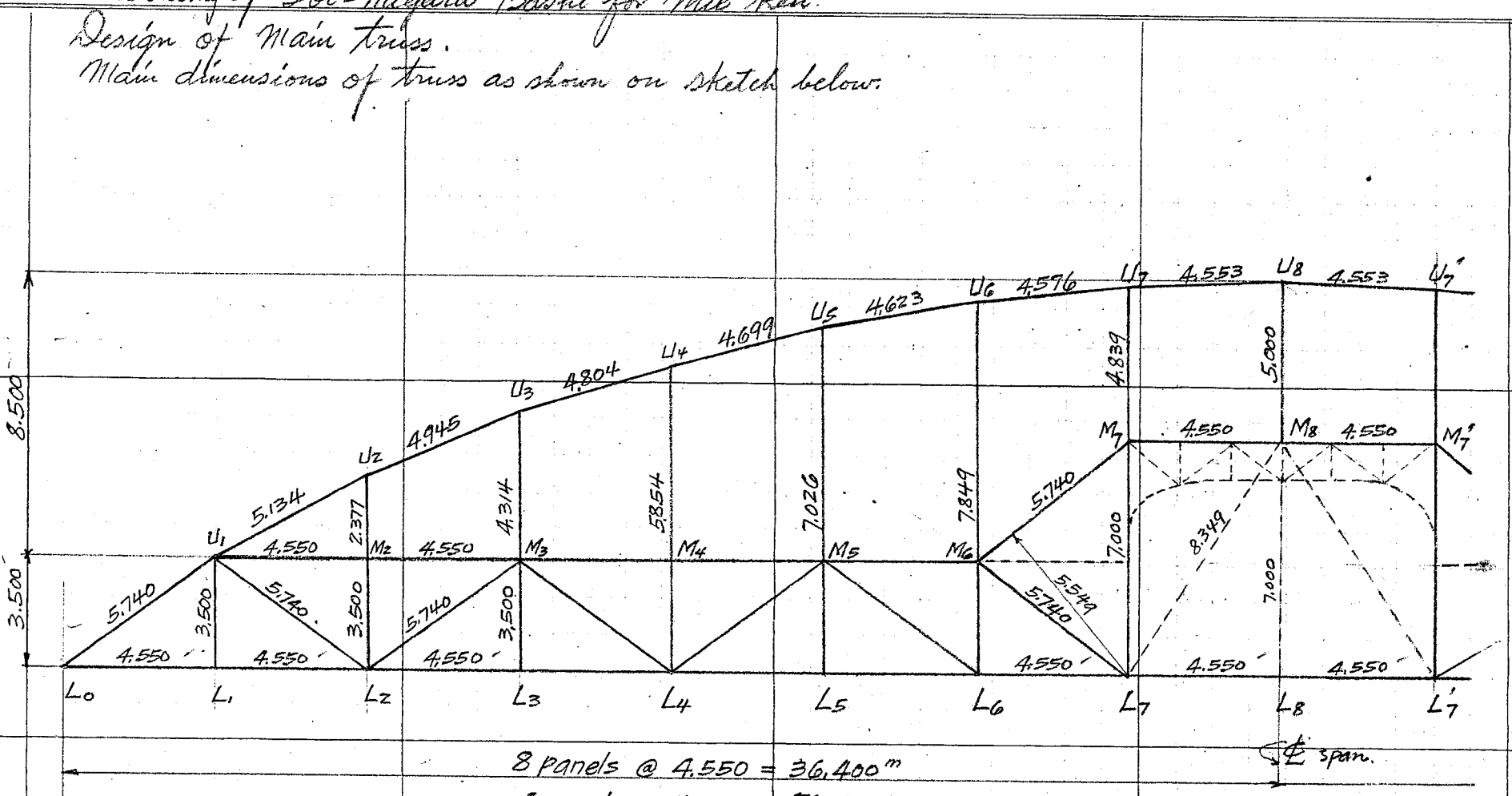
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Design of Main truss.

Main dimensions of truss as shown on sketch below.



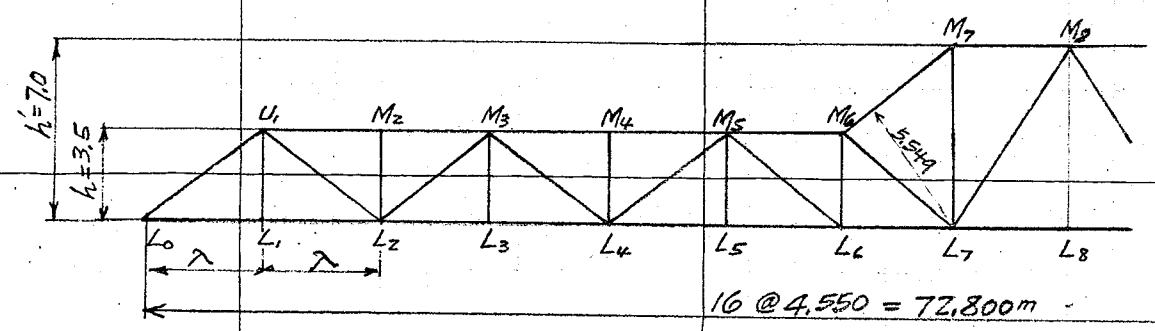
8 panels @ 4.550 = 36.400m

Span Length = 72.800m

$L_7 - M_8 = \sqrt{7.0^2 + 4.55^2} = 8.349^m$

arm of $M_6 - M_7$ $4.550 \times \frac{7.000}{5.740} = 5.549^m$

Stresses of each member for load unity, redundancy removed.



16 @ 4.550 = 72.800m

Middle chords.	$U_1 - M_2$	$-\frac{14}{16}\cdot\frac{2\lambda}{h}' =$	$-\frac{14}{16}\cdot\frac{2\times 4.55}{3.5}' = -14\times 0.1625'$
	$M_2 - M_3$	Same as for $U_1 - M_2$	$= -14\times 0.1625'$
	$M_3 - M_4$	$-\frac{12}{16}\cdot\frac{4\lambda}{h}' =$	$-\frac{12}{16}\cdot\frac{4\times 4.55}{3.5} = -12\times 0.3250$
	$M_4 - M_5$	Same as for $M_3 - M_4$	$= -12\times 0.3250$
	$M_5 - M_6$	$-\frac{10}{16}\cdot\frac{6\lambda}{h}' =$	$-\frac{10}{16}\cdot\frac{6\times 4.55}{3.5} = -10\times 0.4875$
	$M_6 - M_7$	$-\frac{9}{16}\cdot\frac{7\lambda}{(arm)}' =$	$-\frac{9}{16}\cdot\frac{7\times 4.55}{5.549}' = -9\times 0.3587'$
	$M_7 - M_8$	$-\frac{9}{16}\cdot\frac{7\lambda}{h'} =$	$-\frac{9}{16}\cdot\frac{7\times 4.55}{7.00}' = -9\times 0.2844$
Both'm chords	$L_0 - L_1$	$\frac{15}{16}\cdot\frac{\lambda}{h}' =$	$\frac{15}{16}\cdot\frac{4.55}{3.5}' = 15\times 0.08125$
	$L_1 - L_2$	Same as for $L_0 - L_1$	$= 15\times 0.08125'$
	$L_2 - L_3$	$\frac{13}{16}\times\frac{4.55\times 3}{3.5}'$	$= 13\times 0.24375'$
	$L_3 - L_4$	Same as for $L_2 - L_3$	$= 13\times 0.24375'$

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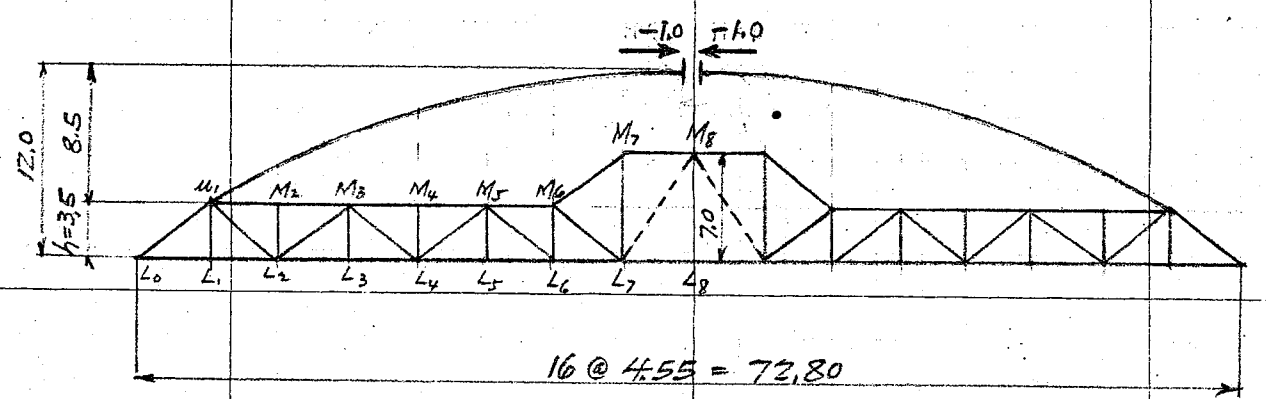
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

	$L_4 - L_5$	$\frac{11}{16} \times \frac{4.55 \times 5}{3.5}$	=	11×0.40625
	$L_5 - L_6$	Same as for $L_4 - L_5$	=	11×0.40625
	$L_6 - L_7$	$\frac{10}{16} \times \frac{4.55 \times 6}{3.5}$	=	10×0.4875
	$L_7 - L_8$	$\frac{8}{16} \times \frac{4.55 \times 8}{7.00}$	=	8×0.3250
Diagonals	$L_0 - U_1$	$-\frac{15}{16} \times \frac{5.74}{3.5}$	=	-15×0.1025
	$U_1 - L_2$	$\frac{14}{16} \times \frac{5.74}{3.5}$	=	14×0.1025 or $(\frac{15}{16}-1) \times \frac{5.74}{3.5} = -0.1025$
	$L_2 - M_3$	$-\frac{13}{16} \times \frac{5.74}{3.5}$	=	-13×0.1025 or 2×0.1025
	$M_3 - L_4$	$\frac{12}{16} \times \frac{5.74}{3.5}$	=	12×0.1025 or -3×0.1025
	$L_4 - M_5$	$-\frac{11}{16} \times$ 〃	=	-11×0.1025 or 4×0.1025
	$M_5 - L_6$	$\frac{10}{16} \times$ 〃	=	10×0.1025 or -5×0.1025
	$M_6 - L_7$	$\left(\frac{9}{16} - \frac{9}{16} \times \frac{4.55 \times 7}{5.549} \times \frac{3.5}{5.74}\right) \times \frac{5.74}{3.5}$	=	-9×0.25624 or $\left(-\frac{6}{16} - \frac{6}{16} \times \frac{9 \times 4.55}{5.549} \times \frac{3.5}{5.74}\right)\frac{5.74}{3.5}$ $= -6 \times 0.56373$
	$L_7 - M_8$	$-\frac{8}{16} \times \frac{8.349}{7.00}$	=	-8×0.07454 or $+7 \times 0.07454$
Verticals	$U_1 - L_1$	1.00	$M_2 - L_2$	0.00
	$M_3 - L_3$	1.00	$M_4 - L_4$	0.00
	$M_5 - L_5$	1.00		
	$M_6 - L_6$	$-\frac{9}{16}$	=	-9×0.0625 or 6×0.0625
	$M_7 - L_7$	$9 \times .3587 \times \frac{3.50}{5.74}$	=	9×0.21872 or 7×0.28121
	$M_8 - L_8$	1.00		

Stresses of each member for redundancy $H = -1$ applied.



note. Horizontal components of top chord stresses = H.

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie ken.

Middle chords.	$U_1 - M_2$	$\frac{3.5+2.377'}{3.5}$ =	$1+\frac{2.377'}{3.5}$ =	1.679 ′	
	$M_2 - M_3$	Same as for	U_1-M_2 =	1.679 ′	
	$M_3 - M_4$	$1+\frac{5.854'}{3.5}$ =	1 + 1.673 =	2.673 ′	
	$M_4 - M_5$	Same as for	M_3-M_4 =	2.673 ′	
	$M_5 - M_6$	$1+\frac{7.849'}{3.5}$ =	1 + 2.243 =	3.243 ′	
	$M_6 - M_7$	$\frac{11.839}{5.549}$ ′	=	2.134 ′	
	$M_7 - M_8$	$\frac{11.839}{7.00}$ ′	=	1.691 ′	
Bottom chords.	$L_0 - L_1 = L_1 - L_2 = 0$ ′				
	$L_2 - L_3$	$-\frac{4.314}{3.5}$ ′ = − 1.233′,	$L_3 - L_4$ = − 1.233 ′		
	$L_4 - L_5$	$-\frac{7.026}{3.5}$ ′ = − 2.007′,	$L_5 - L_6$ = − 2.007 ′		
	$L_6 - L_7$	$-\frac{7.849}{3.5}$ ′ = − 2.237 ′			
	$L_7 - L_8$	$-\frac{5.000}{7.00}$ ′ = − 0.714 ′			
Diagonals	$L_0 - U_1$	= 0 ′			
	$U_1 - L_2$	$(U_1-L_2)\times\frac{3.5}{5.74}' + \frac{2.377'}{4.55} = 0$ ∴	$U_1-L_2 = -\frac{2.377}{4.55}\times\frac{5.74}{3.50}' = -0.522'\times 1.64' = -0.856'$		
	$L_2 - M_3$	$\frac{1.937'}{4.55}\times\frac{5.74}{3.5}'$ =	$0.426\times 1.64'$ =	0.699 ′	
	$M_3 - L_4$	$-\frac{1.540}{4.55}\times\frac{5.74}{3.5}'$ =	$-0.3385\times 1.64'$ =	−0.555 ′	
	$L_4 - M_5$	$\frac{1.172}{4.55}\times\frac{5.74}{3.5}'$ =	$0.2575\times 1.64'$ =	0.422 ′	
	$M_5 - L_6$	$-\frac{1.823}{4.55}\times\frac{5.74}{3.5}'$ =	$-0.181'\times 1.64'$ =	−0.297 ′	
	$M_6 - L_7$	$(M_6-L_7)\times\frac{3.5}{5.74} + \frac{0.49}{4.55}' - 2.134'\times\frac{3.5}{5.74}' = 0$ ∴	M_6-L_7 =	$1.1935\times\frac{5.74}{3.5}' = 1.957$ ✓	
	$L_7 - M_8$	$-\frac{0.161'}{4.55}\times\frac{8.349}{7.00}$ ′	=	+0.042 ′	
Verticals	$U_1 - L_1$	= 0			
	$U_2 - M_2$ and M_2-L_2	$\frac{2.377-1.937}{4.55}$ ′	=	$0.440\div 4.55'$ =	0.097 ′
	$U_3 - M_3$	$(1.937'-1.540')\div 4.55$	=	$0.397\div 4.55'$ =	0.087 ′
	$U_4 - M_4$ and M_4-L_4	$(1.540'-1.172')\div 4.55$	=	$0.368\div$ ′ =	0.081 ′
	$U_5 - M_5$	$(1.172'-0.823')\div$	=	$0.349\div$ ′ =	0.077 ′
	$U_6 - M_6$	$(0.823'-0.490')\div$	=	$0.333\div$ ′ =	0.073 ′
	$M_6 - L_6$	$-(M_5-L_6)\times\frac{3.5}{5.74}$ = $0.297\times\frac{3.5}{5.74}$ ′	=	=	0.181 ✓

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$U_7 - M_7$		$(0.490 - 0.161) \div 4.55 = 0.329 \div 0.455 =$	0.072
$M_7 - L_7$		$0.072 - 2.134 \times \frac{3.5}{5.74} = 0.072 - 1.302 =$	-1.230
$U_8 - M_8$		$(0.161 + 0.161) \div 4.55 = 0.322 \div 4.55 =$	0.071
$M_8 - L_8$	$= 0$		

Horizontal Thrust due to unit load.

$$H = \frac{\Sigma S_o S_a \frac{l}{A}}{\Sigma S_a^2 \frac{l}{A}}$$

where
H = Horizontal thrust due to unit load.
S_o = Stress of each member due to unit load applied and redundancy removed.
S_a = Stress of each member $H = -1$ applied.
l = length of each member
A = Sectional area of each member.

S_a for Top chord members

		S_a
$U_1 - U_2$	$-5.134 \div 4.550$	$= -1.128$
$U_2 - U_3$	$-4.945 \div$ 〃	$= -1.087$
$U_3 - U_4$	$-4.804 \div$ 〃	$= -1.056$
$U_4 - U_5$	$-4.699 \div$ 〃	$= -1.033$
$U_5 - U_6$	$-4.623 \div$ 〃	$= -1.016$
$U_6 - U_7$	$-4.576 \div$ 〃	$= -1.006$
$U_7 - U_8$	$-4.553 \div$ 〃	$= -1.000$

S_o, $S_a l$ and $S_a^2 l$ for Middle chord members.

Members	S_o	S_a	l	$S_o S_a$	S_a^2	$S_o S_a l$	$S_a^2 l$
$U_1 - M_2$	-0.1625	1.679	4.550^m	-0.2728	2.8190	-1.241	12.826
$M_2 - M_3$	-0.1625	1.679	〃	$-$ 〃	〃	$-$ 〃	〃
$M_3 - M_4$	-0.3250	2.673	〃	-0.8687	7.1449	-3.953	32.509
$M_4 - M_5$	-0.3250	2.673	〃	$-$ 〃	〃	$-$ 〃	〃
$M_5 - M_6$	-0.4875	3.243	〃	-1.5810	10.5170	-7.194	47.852
$M_6 - M_7$	-0.3587	2.134	5.740	-0.7655	4.554	-4.394	26.140
$M_7 - M_8$	-0.2844	1.691	4.550	-0.4809	2.859	-2.188	13.008
$M_8 - M_7'$	-0.3660	1.691	〃	-0.6189	〃	-2.816	13.008
$M_7' - M_6'$	-0.4605	2.134	5.740	-0.9827	4.554	-5.641	26.140
$M_6' - M_5'$	-0.8125	3.243	4.550	-2.6349	10.5170	-11.989	47.852
$M_5' - M_4'$	-0.9750	2.673	〃	-2.6062	7.1449	-11.858	32.509
$M_4' - M_3'$	-0.9750	2.673	〃	$-$ 〃	〃	$-$ 〃	〃
$M_3' - M_2'$	-1.1375	1.679	〃	-1.9099	2.8190	-8.690	12.826
$M_2' - U_1'$	-1.1375	1.679	〃	$-$ 〃	〃	$-$ 〃	〃

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

$L_o L_a l$ and $L_a^2 l$ for Bottom chord members.

member	L_o	L_a	l	$L_o L_a$	L_a^2	$L_o L_a l$	$L_a^2 l$
$L_0 - L_1$	0.0813	0.000	4.550m	0.000	0.000	0.000	0.000
$L_1 - L_2$	〃	0.000	〃	0.000	0.000	0.000	0.000
$L_2 - L_3$	0.2438	-1.233	〃	-0.3006	1.5203	-1.368	6.917
$L_3 - L_4$	〃	〃	〃	〃	〃	〃	〃
$L_4 - L_5$	0.4063	-2.007	〃	-0.8154	4.0280	-3.710	18.327
$L_5 - L_6$	〃	〃	〃	〃	〃	〃	〃
$L_6 - L_7$	0.4875	-2.237	〃	-1.0905	5.0042	-4.962	22.769
$L_7 - L_8$	0.3250	-0.714	〃	-0.2321	0.5098	-1.056	2.320
$L_8 - L_7'$	〃	〃	〃	〃	〃	〃	〃
$L_7' - L_6'$	0.8125	-2.237	〃	-1.8176	5.0042	-8.270	22.769
$L_6' - L_5'$	0.8938	-2.007	〃	-1.7939	4.0280	-8.162	18.327
$L_5' - L_4'$	〃	〃	〃	〃	〃	〃	〃
$L_4' - L_3'$	1.0563	-1.233	〃	-1.3024	1.5203	-5.926	6.917
$L_3' - L_2'$	〃	〃	〃	〃	〃	〃	〃
$L_2' - L_1'$	1.2188	0.000	〃	0.0000	0.0000	0.000	0.000
$L_1' - L_0$	〃	0.000	〃	〃	〃	〃	〃

$L_o L_a l$ and $L_a^2 l$ for Diagonals.

members	L_o	L_a	l	$L_o L_a$	L_a^2	$L_o L_a l$	$L_a^2 l$
$L_0 - U_1$	-0.1025	0.000	5.740m	0.0000	0.0000	0.000	0.000
$U_1 - L_2$	0.1025	-0.856	〃	-0.0877	0.7327	-0.503	4.206
$L_2 - M_3$	-0.1025	0.699	〃	-0.0716	0.4886	-0.411	2.805
$M_3 - L_4$	0.1025	-0.555	〃	-0.0569	0.3080	-0.327	1.768
$L_4 - M_5$	-0.1025	0.422	〃	-0.0433	0.1781	-0.249	1.022
$M_5 - L_6$	0.1025	-0.297	〃	-0.0304	0.0882	-0.175	0.506
$M_6 - L_7$	-0.2562	1.957	〃	-0.5014	3.8298	-2.878	21.983
$L_7 - M_8$	-0.0745	+0.042	8.349	-0.0031	0.0018	-0.026	0.015
$M_8 - L_7'$	0.0745	+0.042	〃	+0.0031	0.0018	+0.026	0.015
$L_7' - M_6'$	-0.5637	1.957	5.740	-1.1032	3.8298	-6.332	21.983
$L_6' - M_5'$	-0.1025	-0.297	〃	+0.0304	0.0882	+0.175	0.506
$M_5' - L_4'$	+0.1025	0.422	〃	+0.0433	0.1781	+0.249	1.022
$L_4' - M_3'$	-0.1025	-0.555	〃	+0.0569	0.3080	+0.327	1.768
$M_3' - L_2'$	+0.1025	0.699	〃	+0.0716	0.4886	+0.411	2.805
$L_2' - U_1'$	-0.1025	-0.856	〃	+0.0877	0.7327	+0.503	4.206
$U_1' - L_0'$	-1.5375	0.000	〃	0.0000	0.0000	0.000	0.000

$L_o L_a l$ and $L_a^2 l$ for Verticals

members	L_o	L_a	l	$L_o L_a$	L_a^2	$L_o L_a l$	$L_a^2 l$
$U_1 - L_1$	0.000	0.000	3.500m	0.000	0.000	0.000	0.000
$M_2 - L_2$	〃	0.097	〃	〃	0.0094	〃	0.033
$M_3 - L_3$	〃	0.000	〃	〃	0.000	〃	0.000
$M_4 - L_4$	〃	0.081	〃	〃	0.0066	〃	0.023
$M_5 - L_5$	〃	0.000	〃	〃	0.000	〃	0.000
$M_6 - L_6$	-0.0625	0.181	〃	-0.0113	0.0328	-0.040	0.115
$M_7 - L_7$	0.2187	-1.230	7.000	-0.2690	1.513	-1.883	10.591
$M_8 - L_8$	0.0000	0.000	〃	0.000	0.000	0.000	0.000
$M_7' - L_7'$	0.2812	-1.230	〃	-0.3459	1.513	-2.421	10.591
$M_6' - L_6'$	+0.0625	0.181	3.50	0.0113	0.0328	+0.040	0.115
$M_5' - L_5'$	0.0000	0.000	〃	0.000	0.000	0.000	0.000
$M_4' - L_4'$	〃	0.081	〃	〃	0.0066	〃	0.023
$M_3' - L_3'$	〃	0.000	〃	〃	0.000	〃	0.000
$M_2' - L_2'$	〃	0.097	〃	〃	0.0094	〃	0.033
$U_1' - L_1'$	——	0.000	〃	〃	0.000	〃	0.000

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie ken.

$\Sigma o_1 La\,l$ and $\Sigma a^2 l$ for suspenders.

members	Σo_1	Σa	l	$\Sigma o_1 La$	Σa^2	$\Sigma o_1 La\,l$	$\Sigma a^2 l$
U_2-M_2	0.000	0.097	2,377"	0.000	0.0094	0.000	0.022
U_3-M_3	〃	0.087	4.314	〃	0.0076	〃	0.033
U_4-M_4	〃	0.081	5.854	〃	0.0066	〃	0.039
U_5-M_5	〃	0.077	7.026	〃	0.0059	〃	0.041
U_6-M_6	〃	0.073	7.849	〃	0.0053	〃	0.042
U_7-M_7	〃	0.072	4.839	〃	0.0052	〃	0.025
U_8-M_8	〃	0.071	5.000	〃	0.0050	〃	0.025
$U_7'-M_7'$	〃	0.072	4.839	〃	0.0052	〃	0.025
$U_6'-M_6'$	〃	0.073	7.849	〃	0.0053	〃	0.042
$U_5'-M_5'$	〃	0.077	7.026	〃	0.0059	〃	0.041
$U_4'-M_4'$	〃	0.081	5.854	〃	0.0066	〃	0.039
$U_3'-M_3'$	〃	0.087	4.314	〃	0.0076	〃	0.033
$U_2'-M_2'$	〃	0.097	2.377	〃	0.0094	〃	0.022

$\Sigma o_1 La\,l$ and $\Sigma a^2 l$ for Top chords members.

U_1-U_2	0.000	1.128	5.134"	0.000	1.2724	0.000	6.533
U_2-U_3	〃	1.087	4.945	〃	1.1816	〃	5.843
U_3-U_4	〃	1.056	4.804	〃	1.1151	〃	5.357
U_4-U_5	〃	1.033	4.699	〃	1.0671	〃	5.014
U_5-U_6	〃	1.016	4.623	〃	1.0323	〃	4.772
U_6-U_7	〃	1.006	4.576	〃	1.0012	〃	4.576
U_7-U_8	〃	1.000	4.553	〃	1.0000	〃	4.553
U_8-U_7'	〃	1.000	4.553	〃	1.0000	〃	4.553
$U_7'-U_6'$	〃	1.006	4.576	〃	1.0012	〃	4.576
$U_6'-U_5'$	〃	1.016	4.623	〃	1.0323	〃	4.772
$U_5'-U_4'$	〃	1.033	4.699	〃	1.0671	〃	5.014
$U_4'-U_3'$	〃	1.056	4.804	〃	1.1151	〃	5.357
$U_3'-U_2'$	〃	1.087	4.945	〃	1.1816	〃	5.843
$U_2'-U_1'$	〃	1.128	5.134	〃	1.2724	〃	6.533

Assumed sectional areas of truss members. (See the sketch on next page)

	members	A
Top chords.	U_1-U_2	397.80 cm²/pr.
〃	U_2-U_3 to U_4-U_5	331.20
〃	U_5-U_6 to U_7-U_8	310.00
Middle chords	U_1-M_2 to M_4-M_5	86.76
〃	M_5-M_6 to M_7-M_8	83.12
Diagonals	for all members	76.00
Verticals	〃	76.00
Suspenders	〃	76.00
Bottom chords	L_0-L_1 + L_1-L_2	264.00
〃	L_2-L_3 to L_5-L_6	318.00
〃	L_6-L_7 + L_7-L_8	355.40

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CALCULATIONS FOR

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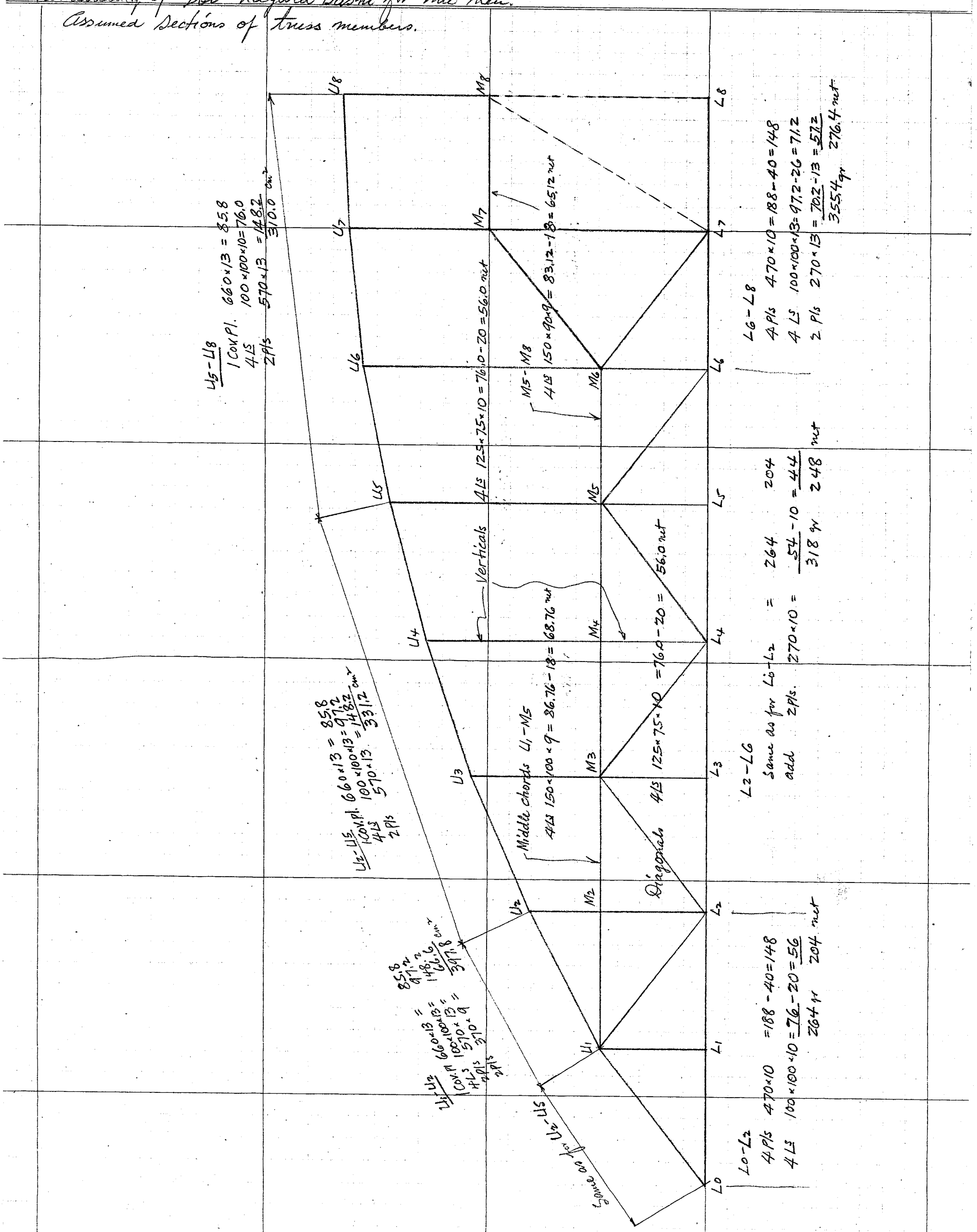
Assumed Sections of truss members.



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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

$L_o L_a l/A$ and $L_a^2 l/A$ for Middle chord members.

Members	A	$L_o L_a l$	$L_a^2 l$	$L_o L_a l/A$	$L_a^2 l/A$
$U_1 - M_2$	86.76 cm^2 gr	-1.241	12.826	- 1.430	14.800
$M_2 - M_3$	〃	- 〃	〃	〃	〃
$M_3 - M_4$	〃	-3.953	32.509	- 4.555	37.500
$M_4 - M_5$	〃	- 〃	〃	〃	〃
$M_5 - M_6$	83.12	- 7.194	47.852	- 8.650	57.600
$M_6 - M_7$	〃	- 4.394	26.140	- 5.286	31.449
$M_7 - M_8$	〃	- 2.188	13.008	- 2.632	15.650
$M_8 - M_7'$	〃	- 2.816	13.008	- 3.388	〃
$M_7' - M_6'$	〃	- 5.641	26.140	- 6.787	31.449
$M_6' - M_5$	〃	-11.989	47.852	-14.430	57.600
$M_5' - M_4'$	86.76	-11.858	32.509	- 13.670	37.500
$M_4' - M_3'$	〃	- 〃	〃	〃	〃
$M_3' - M_2'$	〃	- 8.690	12.826	- 10.000	14.800
$M_2' - M_1'$	〃	- 〃	〃	〃	〃
					Σ = 418.598

$L_o L_a l/A$ and $L_a^2 l/A$ for Bottom chord members.

members	A	$L_o L_a l$	$L_a^2 l$	$L_o L_a l/A$	$L_a^2 l/A$
$L_0 - L_1$	2640 cm^2 gr	0.000	0.000	0.000	0.000
$L_1 - L_2$	〃	〃	〃	〃	〃
$L_2 - L_3$	318.0	- 1.368	6.917	- 0.431	2.175
$L_3 - L_4$	〃	〃	〃	〃	〃
$L_4 - L_5$	〃	- 3.710	18.327	- 1.167	5.767
$L_5 - L_6$	〃	〃	〃	〃	〃
$L_6 - L_7$	3554	- 4.962	22.769	- 1.396	6.407
$L_7 - L_8$	〃	- 1.056	2.320	- 0.297	0.653
$L_8 - L_7'$	〃	〃	〃	- 0.297	〃
$L_7' - L_6'$	〃	- 8.270	22.769	- 2.327	6.407
$L_6' - L_5'$	318.0	- 8.162	18.327	- 2.568	5.767
$L_5' - L_4'$	〃	〃	〃	〃	〃
$L_4' - L_3'$	〃	- 5.926	6.917	- 1.865	2.175
$L_3' - L_2'$	〃	〃	〃	〃	〃
$L_2' - L_1'$	2640	0.000	0.000	0.000	0.000
$L_1' - L_0'$	〃	〃	〃	〃	〃
					Σ = 45.888

$L_o L_a l/A$ and $L_a^2 l/A$ for Dragonals

members	A	$L_o L_a l$	$L_a^2 l$	$L_o L_a l/A$	$L_a^2 l/A$
$L_0 - U_1$	331.20 cm^2 gr	0.000	0.000	0.000	0.000
$U_1 - L_2$	76.00	- 0.503	4.206	- 0.662	5.530
$L_2 - M_3$	〃	- 0.411	2.805	- 0.541	3.690
$M_3 - L_4$	〃	- 0.327	1.768	- 0.431	2.328
$L_4 - M_5$	〃	- 0.249	1.022	- 0.328	1.345
$M_5 - L_6$	〃	- 0.175	0.506	- 0.230	0.666
$M_6 - L_7$	〃	- 2.878	21.983	- 3.787	28.925
$L_7 - M_8$	〃	- 0.026	0.015	- 0.034	0.020
$M_8 - L_7'$	〃	+ 0.026	0.015	+ 0.034	0.020
$L_7' - M_6'$	〃	- 6.332	21.983	- 8.332	28.925
$L_6' - M_5'$	〃	+ 0.175	0.506	+ 0.230	0.666
$M_5' - L_4'$	〃	+ 0.249	1.022	+ 0.328	1.345
$L_4' - M_3'$	〃	+ 0.327	1.768	+ 0.431	2.328
$M_3' - L_2'$	〃	+ 0.411	2.805	+ 0.541	3.690
$L_2' - U_1'$	〃	+ 0.503	4.206	+ 0.662	5.530
$U_1' - L_0'$	331.20	0.000	0.000	0.000	0.000
					Σ = 85.008

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

$\Sigma_0 l_a l\,g/A$ and $\Sigma a^2 l\,g/A$ for vertical members.

Members	A	$\Sigma_0 l_a l$	$\Sigma a^2 l$	$\Sigma_0 l_a l\,g/A$	$\Sigma a^2 l\,g/A$
$U_1 - L_1$	76.00 cm²/m	0.000	0.000	0.000	0.000
$M_2 - L_2$	〃	〃	0.033	〃	0.043
$M_3 - L_3$	〃	〃	0.000	〃	0.000
$M_4 - L_4$	〃	〃	0.023	〃	0.030
$M_5 - L_5$	〃	〃	0.000	〃	0.000
$M_6 - L_6$	〃	−0.040	0.115	− 0.053	0.151
$M_7 - L_7$	〃	− 1.883	10.591	− 2.478	13.936
$M_8 - L_8$	〃	0.000	0.000	0.000	0.000
$M_7' - L_7'$	〃	− 2.421	10.591	− 3.186	13.936
$M_6' - L_6'$	〃	+ 0.040	0.115	+ 0.053	0.151
$M_5' - L_5'$	〃	0.000	0.000	0.000	0.000
$M_4' - L_4'$	〃	〃	0.023	〃	0.030
$M_3' - L_3'$	〃	〃	0.000	〃	0.000
$M_2' - L_2'$	〃	〃	0.033	〃	0.043
$U_1' - L_1'$	〃	〃	0.000	〃	0.000
					Σ = 28.320

$\Sigma_0 l_a l\,g/A$ and $\Sigma a^2 l\,g/A$ for Suspenders

Members	A	$\Sigma_0 l_a l$	$\Sigma a^2 l$	$\Sigma_0 l_a l\,g/A$	$\Sigma a^2 l\,g/A$
$U_2 - M_2$	76.00 cm²/m	0.000	0.022	0.000	0.029
$U_3 - M_3$	〃	〃	0.033	〃	0.043
$U_4 - M_4$	〃	〃	0.039	〃	0.051
$U_5 - M_5$	〃	〃	0.041	〃	0.054
$U_6 - M_6$	〃	〃	0.042	〃	0.055
$U_7 - M_7$	〃	〃	0.025	〃	0.033
$U_8 - M_8$	〃	〃	0.025	〃	0.033
$U_7' - M_7'$	〃	〃	0.025	〃	0.033
$U_6' - M_6'$	〃	〃	0.042	〃	0.055
$U_5' - M_5'$	〃	〃	0.041	〃	0.054
$U_4' - M_4'$	〃	〃	0.039	〃	0.051
$U_3' - M_3'$	〃	〃	0.033	〃	0.043
$U_2' - M_2'$	〃	〃	0.022	〃	0.029
					Σ = 0.563

$\Sigma_0 l_a l\,g/A$ and $\Sigma a^2 l\,g/A$ for Top chord members.

Members	A	$\Sigma_0 l_a l$	$\Sigma a^2 l$	$\Sigma_0 l_a l\,g/A$	$\Sigma a^2 l\,g/A$
$U_1 - U_2$	397.80 cm²/m	0.000	6.533	0.000	1.643
$U_2 - U_3$	331.20	〃	5.843	〃	1.765
$U_3 - U_4$	〃	〃	5.357	〃	1.617
$U_4 - U_5$	〃	〃	5.014	〃	1.514
$U_5 - U_6$	310.00	〃	4.772	〃	1.538
$U_6 - U_7$	〃	〃	4.576	〃	1.477
$U_7 - U_8$	〃	〃	4.553	〃	1.468
$U_8 - U_7'$	〃	〃	4.553	〃	1.468
$U_7' - U_6'$	〃	〃	4.576	〃	1.477
$U_6' - U_5'$	〃	〃	4.772	〃	1.538
$U_5' - U_4'$	331.20	〃	5.014	〃	1.514
$U_4' - U_3'$	〃	〃	5.357	〃	1.617
$U_3' - U_2'$	〃	〃	5.843	〃	1.765
$U_2' - U_1'$	397.80	〃	6.533	〃	1.643
					Σ = 22.044

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken

Σ Lo La l/A for Middle chord members.

	Lo. La l/A	Σ	Loaded pt.				Σ Lo La l/A
2	− 1.430	− 1.430	1				− 100.483
3	〃	− 2.860					
4	− 4.555	− 7.415	2	2@−80.483	+ 14@−2.860 = −160.966	− 40.040	= −201.006
5	〃	− 11.970					
6	− 8.650	− 20.620	3	3@−80.483	+ 13@−2.860 = −241.449	− 37.180	= −278.629
7	− 5.286	− 25.906					
8	− 2.632	− 28.538	4	4@−53.143	+ 12@−11.970 = −212.572	− 143.640	= −356.212
7′	− 3.388	− 31.926					
6′	− 6.787	− 38.713	5	5@−53.143	+ 11@−11.970 = −265.715	− 131.670	= −397.385
5′	− 14.430	− 53.143					
4′	− 13.670	− 66.813	6	6@−38.713	+ 10@−20.620 = −232.278	− 206.200	= −438.478
3′	〃	− 80.483					
2′	− 10.000	− 90.483	7	7@−28.538	+ 9@−28.538 = −199.766	− 256.842	= −456.608
1′	〃	− 100.483					
			8	8@−28.538	+ 8@−28.538 = −228.304	− 228.304	= −456.608

Σ Lo La l/A for Bottom chord members.

	Lo. La l/A	Σ	Loaded pt				
1	0.000	0.000	1				− 16.379
2	〃	0.000					
3	−0.431	− 0.431	2	2@−16.379	+ 14@−0.000 = − 32.758	− 0.000	= − 32.758
4	〃	− 0.862					
5	− 1.167	− 2.029	3	3@−12.649	+ 13@−0.862 = − 37.947	− 11.206	= − 49.153
6	〃	− 3.196					
7	−1.396	− 4.592	4	4@−12.649	+ 12@−0.862 = −50.596	− 10.344	= − 60.940
8	−0.297	− 4.889					
7′	− 〃	− 5.186	5	5@−7.513	+ 11@−3.196 = − 37.565	− 35.156	= − 72.721
6′	−2.327	− 7.513					
5′	−2.568	− 10.081	6	6@−7.513	+ 10@−3.196 = −45.078	− 31.960	= − 77.038
4′	〃	− 12.649					
3′	−1.865	− 14.514	7	7@−5.186	+ 9@−4.592 = − 36.302	− 41.328	= − 77.630
2′	〃	− 16.379					
1′	0.000	− 〃	8	8@−4.889	+ 8@−4.889 = − 39.112	− 39.112	= − 78.224
0′	〃	− 〃					

Σ Lo La l/A for Diagonal members.

	Lo. La l/A	Σ	Loaded pt.				
1	0.000	0.000	1				− 12.119
2	− 0.662	− 0.662					
3	− 0.541	− 1.203	2	2@−12.781	+ 14@−0.662 = − 25.562	− 9.268	= − 34.830
4	− 0.431	− 1.634					
5	− 0.328	− 1.962	3	3@−13.322	+ 13@−1.203 = − 39.966	− 15.639	= − 55.605
6	− 0.230	− 2.192					
7	− 3.787	− 5.979	4	4@−13.753	+ 12@−1.634 = − 55.012	− 19.608	= − 74.620
8	− 0.034	− 6.013					
7′	+ 0.034	− 5.979	5	5@−14.081	+ 11@−1.962 = − 70.405	− 21.582	= − 91.987
6′	− 8.332	− 14.311					
5′	+ 0.230	− 14.081	6	6@−14.311	+ 10@−2.192 = − 85.866	− 21.920	= − 107.786
4′	+ 0.328	− 13.753					
3′	+ 0.431	− 13.322	7	7@−5.979	+ 9@−5.979 = − 41.853	− 53.811	= − 95.664
2′	+ 0.541	− 12.781					
1′	+ 0.662	− 12.119	8	8@−6.013	+ 8@−6.013 = − 48.104	− 48.104	= − 96.208
0′	0.000	− 12.119					

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Σ LoLa l/A for Verticel members.

	LoLa l/A	Σ	Loaded pt.					Σ LoLa l/A
1	0.000	0.000	1					= −5.770
2	〃	〃						
3	〃	〃	2	2@ −5.770 +	14@ 0.000 =	−11.540	− 0.000	= −11.540
4	〃	〃						
5	〃	〃	3	3@ −5.770 +	13@ 0.000 =	−17.310	− 〃	= −17.310
6	−0.053	−0.053						
7	−2.478	−2.531	4	4@ −5.770 +	12@ 0.000 =	−23.080	− 〃	= −23.080
8	0.000	−2.531						
7′	−3.186	−5.717	5	5@ −5.770 +	11@ 0.000 =	−28.850	− 〃	= −28.850
6′	+0.053	−5.770						
5′	0.000	〃	6	6@ −5.770 +	10@ 0.000 =	−34.620	− 〃	= −34.620
4′	〃	〃						
3′	〃	〃	7	7@ −5.717 +	9@ −0.053 =	−40.019	− 0.477	= −40.496
2′	〃	〃						
1′	〃	〃	8	8@ −2.531 +	8@ −2.531 =	−20.248	−20.248	= −40.496

Σ LoLa l/A for Suspenders and Top chords are 0.000 for all points.

Influence Line of Horizontal Thrust H.

Σ La² l/A = 418.598 + 45.888 + 85.008 + 28.320 + 0.563 + 22.044 = 600.421
(middle chords. / Bottom chords / Diagonals / Verticals / Suspenders / Top chords / Summary)

Σ LoLa l/A.

	middle chords	Bottom chords	Diagonals	Verticals	Suspenders	Top chords	Summary	H.
1	−100.483	−16.379	− 12.119	− 5.770	− 0.000	− 0.000	= −134.751	÷600.421 = −0.224
2	−201.006	− 32.758	− 34.830	− 11.540	〃	〃	= −280.134	〃 = −0.467
3	−278.629	− 49.153	− 55.605	− 17.310	〃	〃	= −400.697	〃 = −0.667
4	−356.212	− 60.940	− 74.620	− 23.080	〃	〃	= −514.852	〃 = −0.857
5	−397.385	− 72.721	− 91.987	− 28.850	〃	〃	= −590.943	〃 = −0.984
6	−438.478	− 77.038	− 107.786	− 34.620	〃	〃	= −657.922	〃 = −1.096
7	−456.608	− 77.630	− 95.664	− 40.496	〃	〃	= −670.398	〃 = −1.117
8	−456.608	− 78.224	− 96.208	− 40.496	〃	〃	= −671.536	〃 = −1.118

Summary for the entire span ΣH = −11.942

N.B. Effect of faulse members L_7-M_8, M_8-L_7' and M_8-L_8 on the value of Thrust H.

members	Σ La² l/A	Σ LoLa l/A
L_7-M_8	−0.020	+0.034
M_8-L_7'	−0.020	+0.034
M_8-L_8	0.000	0.000
	−0.040	+0.068

Thrust due to unit load on L_8

$$H_8 = \frac{-671.536 + 0.068}{600.421 - 0.040} = \frac{-671.468}{600.381} = -1.118$$

誤差ヲ生ズルニ到ラズ
$H_1 \sim H_7$ モ亦同様ナリ。

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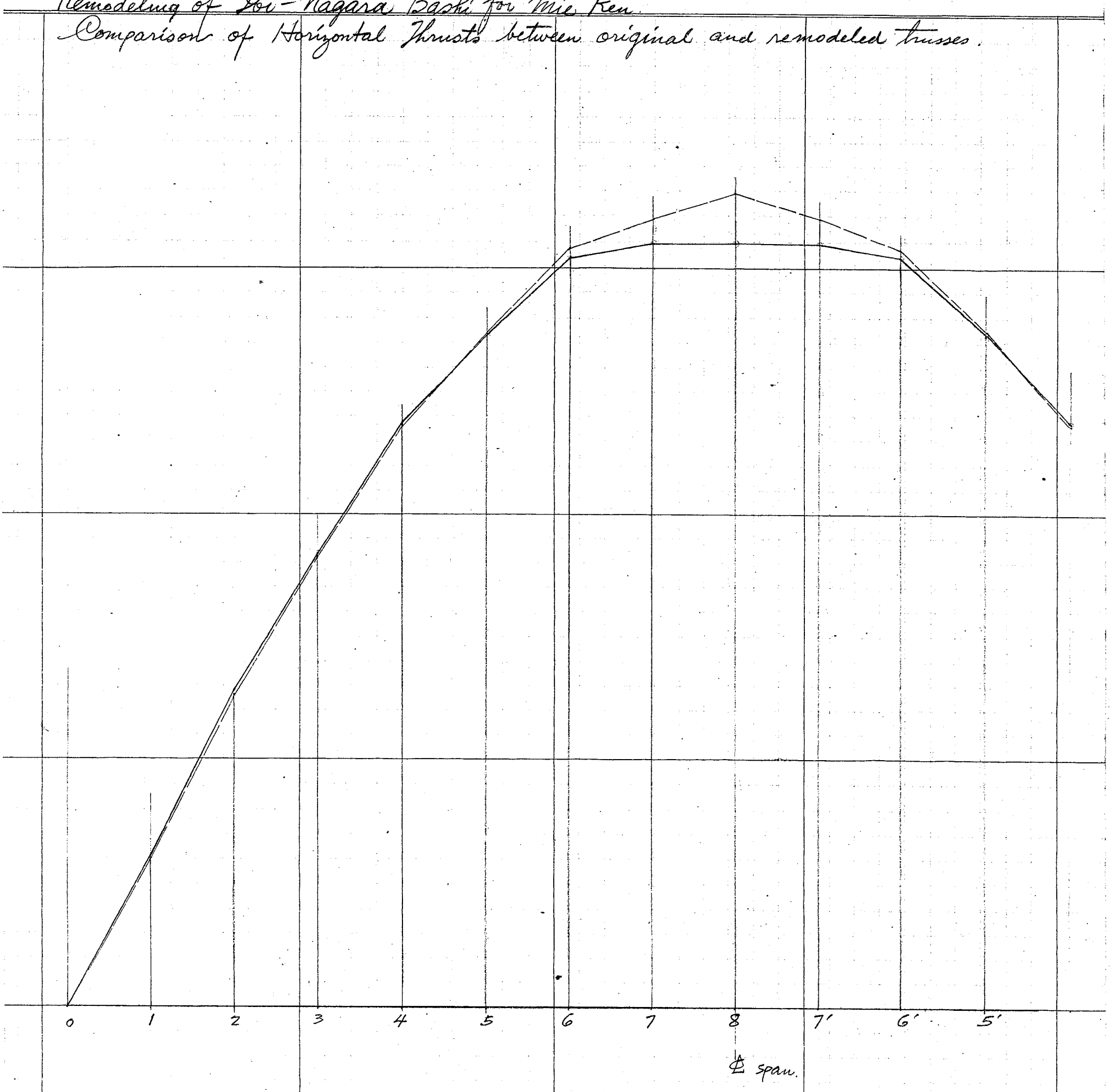
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.
Comparison of Horizontal Thrusts between original and remodeled trusses.



Scale of Thrust $\frac{10^m}{60} = 1.0$

Influence lines ------ original type.
——— remodeled type.

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Influence surfaces of stresses of truss members.

($\mathcal{I} = \mathcal{I}_0 - \mathcal{I}_a H$)

$\mathcal{I}_a H$ for Middle chord members.

Load unity on pt.		1	2	3	4	5	6	7	8
Members	H =	0.224	0.467	0.667	0.857	0.984	1.096	1.117	1.118
	$\mathcal{I}_a$								
$U_1 - M_2$	1.679	0.376	0.784	1.120	1.439	1.652	1.840	1.875	1.877
$M_2 - M_3$	〃	〃	〃	〃	〃	〃	〃	〃	〃
$M_3 - M_4$	2.673	0.599	1.248	1.783	2.291	2.630	2.930	2.986	2.988
$M_4 - M_5$	〃	〃	〃	〃	〃	〃	〃	〃	〃
$M_5 - M_6$	3.243	0.726	1.514	2.163	2.779	3.191	3.554	3.622	3.626
$M_6 - M_7$	2.134	0.478	0.997	1.423	1.829	2.100	2.339	2.384	2.386
$M_7 - M_8$	1.691	0.379	0.790	1.128	1.449	1.664	1.853	1.889	1.891

$\mathcal{I}_a H$ for Bottom chord members.

$L_2 - L_3$	-1.233	-0.276	-0.576	-0.822	-1.057	-1.213	-1.351	-1.377	-1.378
$L_3 - L_4$	〃	〃	〃	〃	〃	〃	〃	〃	〃
$L_4 - L_5$	-2.007	-0.450	-0.937	-1.339	-1.720	-1.975	-2.200	-2.242	-2.244
$L_5 - L_6$	〃	〃	〃	〃	〃	〃	〃	〃	〃
$L_6 - L_7$	-2.237	-0.501	-1.045	-1.492	-1.917	-2.201	-2.452	-2.499	-2.501
$L_7 - L_8$	-0.714	-0.160	-0.333	-0.476	-0.612	-0.703	-0.783	-0.798	-0.798

$\mathcal{I}_a H$ for Diagonal members

$U_1 - L_2$	-0.856	-0.192	-0.400	-0.571	-0.734	-0.842	-0.938	-0.956	-0.957
$L_2 - M_3$	0.699	0.157	0.326	0.466	0.599	0.688	0.766	0.781	0.781
$M_3 - L_4$	-0.555	-0.124	-0.259	-0.370	-0.476	-0.546	-0.608	-0.620	-0.620
$L_4 - M_5$	0.422	0.095	0.197	0.281	0.362	0.415	0.463	0.471	0.472
$M_5 - L_6$	-0.297	-0.067	-0.139	-0.198	-0.255	-0.292	-0.326	-0.332	-0.332
$M_6 - L_7$	1.957	0.438	0.914	1.305	1.677	1.926	2.145	2.186	2.188
$L_7 - M_8$	0.042	0.009	0.020	0.028	0.036	0.041	0.046	0.047	0.047

$\mathcal{I}_a H$ for Suspenders and Verticals.

$U_2 - L_2$	0.097	0.022	0.045	0.065	0.083	0.095	0.106	0.108	0.108
$U_3 - M_3$	0.087	0.019	0.041	0.058	0.075	0.086	0.095	0.097	0.097
$U_4 - L_4$	0.081	0.018	0.038	0.054	0.069	0.080	0.089	0.090	0.091
$U_5 - M_5$	0.077	0.017	0.036	0.051	0.066	0.076	0.084	0.086	0.086
$U_6 - M_6$	0.073	0.016	0.034	0.049	0.063	0.072	0.080	0.082	0.082
$M_6 - L_6$	0.181	0.041	0.085	0.121	0.155	0.178	0.198	0.202	0.202
$U_7 - M_7$	0.072	0.016	0.034	0.048	0.062	0.071	0.079	0.080	0.080
$M_7 - L_7$	-1.230	-0.276	-0.574	-0.820	-1.054	-1.210	-1.348	-1.374	-1.375
$U_8 - M_8$	0.071	0.016	0.033	0.047	0.061	0.070	0.078	0.079	0.079

$\mathcal{I}_a H$ for Top chord members.

$U_1 - U_2$	-1.128	-0.253	-0.527	-0.752	-0.967	-1.110	-1.236	-1.260	-1.261
$U_2 - U_3$	-1.087	-0.243	-0.508	-0.725	-0.932	-1.070	-1.191	-1.214	-1.215
$U_3 - U_4$	-1.056	-0.237	-0.493	-0.704	-0.905	-1.039	-1.157	-1.180	-1.181
$U_4 - U_5$	-1.033	-0.231	-0.482	-0.689	-0.885	-1.016	-1.132	-1.154	-1.155
$U_5 - U_6$	-1.016	-0.228	-0.474	-0.678	-0.868	-1.000	-1.114	-1.135	-1.136
$U_6 - U_7$	-1.006	-0.225	-0.470	-0.671	-0.862	-0.990	-1.103	-1.124	-1.125
$U_7 - U_8$	-1.000	-0.224	-0.467	-0.667	-0.857	-0.984	-1.096	-1.117	-1.118

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Influence Surfaces of Middle chord members.

Load on	U_1-M_2 and M_2-M_3 Lo	La·H	Stress	M_3-M_4 and M_4-M_5 Lo	La·H	Stress	M_5-M_6 Lo	La·H	Stress
1'	-0.163	-0.376	0.213	-0.325	-0.599	0.274	-0.488	-0.726	0.238
2'	-0.325	-0.784	0.459	-0.650	-1.248	0.598	-0.975	-1.514	0.539
3'	-0.488	-1.120	0.632	-0.975	-1.783	0.808	-1.463	-2.163	0.700
4'	-0.650	-1.439	0.789	-1.300	-2.291	0.991	-1.950	-2.779	0.829
5'	-0.813	-1.652	0.839	-1.625	-2.630	1.005	-2.438	-3.191	0.753
6'	-0.975	-1.840	0.865	-1.950	-2.930	0.980	-2.925	-3.554	0.629
7'	-1.138	-1.875	0.737×1.5	-2.275	-2.986	0.711×1.5	-3.413	-3.622	0.209×1.5
8	-1.300	-1.877	0.577×0.0	-2.600	-2.988	0.388×0.0	-3.900	-3.626	-0.264×0.0
7	-1.463	-1.875	0.412×1.5	-2.925	-2.986	0.061×1.5	-4.388	-3.622	-0.766×1.5
6	-1.625	-1.840	0.215	-3.250	-2.930	-0.320	-4.875	-3.554	-1.321
5	-1.788	-1.652	-0.136	-3.575	-2.630	-0.945	-4.063	-3.191	-0.872
4	-1.950	-1.439	-0.511	-3.900	-2.291	-1.609	-3.250	-2.779	-0.471
3	-2.113	-1.120	-0.993	-2.925	-1.783	-1.142	-2.438	-2.163	-0.275
2	-2.275	-0.784	-1.491	-1.950	-1.248	-0.702	-1.625	-1.514	-0.111
1	-1.138	-0.376	-0.762	-0.975	-0.599	-0.376	-0.813	-0.726	-0.087
	Σ plus. stress		5.736			5.814			4.002
	Σ minus "		-3.893			-5.094			-4.286
	Summary		1.843			0.720			-0.284

Load on.	M_6-M_7 Lo	La·H	Stress	M_7-M_8 Lo	La·H	Stress.
1'	-0.359	-0.478	0.119	-0.284	-0.379	0.095
2'	-0.717	-0.997	0.280	-0.569	-0.790	0.221
3'	-1.076	-1.423	0.347	-0.853	-1.128	0.275
4'	-1.435	-1.829	0.394	-1.138	-1.449	0.311
5'	-1.794	-2.100	0.306	-1.422	-1.664	0.242
6'	-2.152	-2.339	0.187	-1.706	-1.853	0.147
7'	-2.511	-2.384	-0.127×1.5	-1.991×1.5	-1.889	-0.102×1.5
8	-2.870	-2.386	-0.484×0.0	-2.275×0.0	-1.891	-0.384×0.0
7	-3.228	-2.384	-0.844×1.5	-2.560×1.5	-1.889	-0.671×1.5
6	-2.767	-2.339	-0.428	-2.194	-1.853	-0.341
5	-2.306	-2.100	-0.206	-1.828	-1.664	-0.164
4	-1.845	-1.829	-0.016	-1.463	-1.449	-0.014
3	-1.384	-1.423	0.039	-1.097	-1.128	0.031
2	-0.922	-0.997	0.075	-0.731	-0.790	0.059
1	-0.461	-0.478	0.017	-0.366	-0.379	0.013
			1.764			1.394
			-2.107			-1.679
			-0.343			-0.285

注意

格間 7-8-7' 間の荷重は L_7 及び L_7' に各半額宛負擔せしめ L_8 は無荷重となる構造とす以下總てこれに準ず

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Influence surfaces of Bottom chord members.

Load on	L_0-L_1 and L_1-L_2 L_0	L_aH	Stress	L_2-L_3 and L_3-L_4 L_0	L_aH	Stress	L_4-L_5 and L_5-L_6 L_0	L_a	Stress
1'	0.081	0.000	0.081	0.244	0.276	−0.032	0.406	0.450	−0.044
2'	0.163	"	0.163	0.488	0.576	−0.088	0.813	0.937	−0.124
3'	0.244	"	0.244	0.731	0.822	−0.091	1.219	1.339	−0.120
4'	0.325	"	0.325	0.975	1.057	−0.082	1.625	1.720	−0.095
5'	0.406	"	0.406	1.219	1.213	0.006	2.031	1.975	0.056
6'	0.488	"	0.488	1.463	1.351	0.112	2.438	2.200	0.238
7'	0.569	"	0.569×1.5	1.706	1.377	0.329×1.5	2.844	2.242	0.602×1.5
8	0.650	"	0.650×0.0	1.950	1.378	0.572×0.0	3.250	2.244	1.006×0.0
7	0.731	"	0.731×1.5	2.194	1.377	0.817×1.5	3.656	2.242	1.414×1.5
6	0.813	"	0.813	2.438	1.351	1.087	4.063	2.200	1.863
5	0.894	"	0.894	2.681	1.213	1.468	4.469	1.975	2.494
4	0.975	"	0.975	2.925	1.057	1.868	3.575	1.720	1.855
3	1.056	"	1.056	3.169	0.822	2.347	2.681	1.339	1.342
2	1.138	"	1.138	2.113	0.576	1.537	1.788	0.937	0.851
1	1.219	"	1.219	1.056	0.276	0.780	0.894	0.450	0.444
		Σ Plus stress.	9.752			10.924			12.167
		Σ Minus "	−0.000			−0.293			−0.383
		Summary	9.752			10.631			11.784

Load on	L_6-L_7 L_0	L_aH	Stress	L_7-L_8 L_0	L_aH	Stress
1'	0.488	0.501	−0.013	0.325	0.160	0.165
2'	0.975	1.045	−0.070	0.650	0.333	0.317
3'	1.463	1.492	−0.029	0.975	0.476	0.499
4'	1.950	1.917	0.033	1.300	0.612	0.688
5'	2.438	2.201	0.237	1.625	0.703	0.922
6'	2.925	2.452	0.473	1.950	0.783	1.167
7'	3.413	2.499	0.914×1.5	2.275	0.798	1.477×1.5
8	3.900	2.501	1.399×0.0	2.600	0.798	1.802×0.0
7	4.388	2.499	1.889×1.5	2.275	0.798	1.477×1.5
6	4.875	2.452	2.423	1.950	0.783	1.167
5	4.063	2.201	1.862	1.625	0.703	0.922
4	3.250	1.917	1.333	1.300	0.612	0.688
3	2.438	1.492	0.946	0.975	0.476	0.499
2	1.625	1.045	0.580	0.650	0.333	0.317
1	0.813	0.501	0.312	0.325	0.160	0.165
			12.404			11.947
			−0.112			−0.000
			12.292			11.947

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Pref.

Influence surfaces of Diagonal members.

Load on	L_0-U_1 I_0	I_0H	Stress	U_1-L_2 I_0	I_0H	Stress	L_2-M_3 I_0	I_0H	Stress
1'	-0.103	0.000	-0.103	0.103	0.192	-0.089	-0.103	-0.157	0.054
2'	-0.205	〃	-0.205	0.205	0.400	-0.195	-0.205	-0.326	0.121
3'	-0.308	〃	-0.308	0.308	0.571	-0.263	-0.308	-0.466	0.158
4'	-0.410	〃	-0.410	0.410	0.734	-0.324	-0.410	-0.599	0.189
5'	-0.513	〃	-0.513	0.513	0.842	-0.329	-0.513	-0.688	0.175
6'	-0.615	〃	-0.615	0.615	0.938	-0.323	-0.615	-0.766	0.151
7'	-0.718	〃	-0.718×1.5	0.718	0.956	-0.238×1.5	-0.718	-0.781	0.063×1.5
8	-0.820	〃	-0.820×0.0	0.820	0.957	-0.137×0.0	-0.820	-0.781	-0.039×0.0
7	-0.923	〃	-0.923×1.5	0.923	0.956	-0.033×1.5	-0.923	-0.781	-0.142×1.5
6	-1.025	〃	-1.025	1.025	0.938	0.087	-1.025	-0.766	-0.259
5	-1.128	〃	-1.128	1.128	0.842	0.286	-1.128	-0.688	-0.440
4	-1.230	〃	-1.230	1.230	0.734	0.496	-1.230	-0.599	-0.631
3	-1.333	〃	-1.333	1.333	0.571	0.762	-1.333	-0.466	-0.867
2	-1.435	〃	-1.435	1.435	0.400	1.035	0.205	-0.326	0.531
1	-1.538	〃	-1.538	-0.103	0.192	-0.295	0.103	-0.157	0.260
			-12.305			-2.225			1.734
			0.000			2.666			-2.410
			-12.305			0.441			-0.676

Load on	M_3-L_4 I_0	I_0H	Stress	L_4-M_5 I_0	I_0H	Stress	M_5-L_6 I_0	I_0H	Stress
1'	0.103	0.124	-0.021	-0.103	-0.095	-0.008	0.103	0.067	0.036
2'	0.205	0.259	-0.054	-0.205	-0.197	-0.008	0.205	0.139	0.066
3'	0.308	0.370	-0.062	-0.308	-0.281	-0.027	0.308	0.198	0.110
4'	0.410	0.476	-0.066	-0.410	-0.362	-0.048	0.410	0.255	0.155
5'	0.513	0.546	-0.033	-0.513	-0.415	-0.098	0.513	0.292	0.221
6'	0.615	0.608	0.007	-0.615	-0.463	-0.153	0.615	0.326	0.289
7'	0.718	0.620	0.098×1.5	-0.718	-0.471	-0.247×1.5	0.718	0.332	0.386×1.5
8	0.820	0.620	0.200×0.0	-0.820	-0.472	-0.348×0.0	0.820	0.332	0.488×0.0
7	0.923	0.620	0.303×1.5	-0.923	-0.471	-0.452×1.5	0.923	0.332	0.591×1.5
6	1.025	0.608	0.417	-1.025	-0.463	-0.562	1.025	0.326	0.699
5	1.128	0.546	0.582	-1.128	-0.415	-0.713	-0.513	0.292	-0.805
4	1.230	0.476	0.754	0.410	-0.362	0.772	-0.410	0.255	-0.665
3	-0.308	0.370	-0.678	0.308	-0.281	0.589	-0.308	0.198	-0.506
2	-0.205	0.259	-0.464	0.205	-0.197	0.402	-0.205	0.139	-0.344
1	-0.103	0.124	-0.227	0.103	-0.095	0.198	-0.103	0.067	-0.170
			-1.605			-2.666			3.042
			2.362			1.961			-2.490
			0.757			-0.705			0.552

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

	M_6-L_7			L_7-M_8		
Load on	S_o	S_aH	Stress	S_o	S_aH	Stress
1'	−0.256	−0.438	0.182	−0.075	−0.009	−0.066
2'	−0.512	−0.914	0.402	−0.149	−0.020	−0.129
3'	−0.769	−1.305	0.536	−0.224	−0.028	−0.196
4'	−1.025	−1.677	0.652	−0.298	−0.036	−0.262
5'	−1.281	−1.926	0.645	−0.373	−0.041	−0.332
6'	−1.537	−2.145	0.608	−0.447	−0.046	−0.401
7'	−1.794	−2.186	0.392×1.5	−0.522	−0.047	−0.475×1.5
8	−2.050	−2.188	0.138×0.0	−0.596	−0.047	−0.549×0.0
7	−2.306	−2.186	−0.120×1.5	0.522	−0.047	0.569×1.5
6	−3.382	−2.145	−1.237	0.447	−0.046	0.493
5	−2.819	−1.926	−0.893	0.373	−0.041	0.414
4	−2.255	−1.677	−0.578	0.298	−0.036	0.334
3	−1.691	−1.305	−0.386	0.224	−0.028	0.252
2	−1.127	−0.914	−0.213	0.149	−0.020	0.169
1	−0.564	−0.438	−0.126	0.075	−0.009	0.084
Σ Plus stress =			3.613			−2.099
Σ Minus " =			−3.613			2.600
Summary =			0.000			0.501

Influence Surfaces of Suspenders and Verticals.

	U_1-L_1 (U_3-L_3, U_5-L_5)			$U_2-M_2-L_2$			U_3-M_3		
Load on	S_o	S_aH	Stress	S_o	S_aH	Stress	S_o	S_aH	Stress
1'	0.000	0.000	0.000	0.000	−0.022	0.022	0.000	−0.019	0.019
2'	〃	〃	〃	〃	−0.045	0.045	〃	−0.041	0.041
3'	〃	〃	〃	〃	−0.065	0.065	〃	−0.058	0.058
4'	〃	〃	〃	〃	−0.083	0.083	〃	−0.085	0.075
5'	〃	〃	〃	〃	−0.095	0.095	〃	−0.086	0.086
6'	〃	〃	〃	〃	−0.106	0.106	〃	−0.095	0.095
7'	〃	〃	〃	〃	−0.108	0.108×1.5	〃	−0.097	0.097×1.5
8	〃	〃	〃	〃	−0.108	0.108×0.0	〃	−0.097	0.097×0.0
7	〃	〃	〃	〃	−0.108	0.108×1.5	〃	−0.097	0.097×1.5
6	〃	〃	〃	〃	−0.106	0.106	〃	−0.095	0.095
5	〃	〃	〃	〃	−0.095	0.095	〃	−0.086	0.086
4	〃	〃	〃	〃	−0.083	0.083	〃	−0.085	0.075
3	〃	〃	〃	〃	−0.065	0.065	〃	−0.058	0.058
2	〃	〃	〃	〃	−0.045	0.045	〃	−0.041	0.041
1	1.000	〃	1.000	〃	−0.022	0.022	〃	−0.019	0.019
			1.000			1.156			1.039
			−0.000			−0.000			−0.000
			1.000			1.156			1.039

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

	$U_4-M_4-L_4$			U_5-M_5			U_6-M_6		
Load on	Lo	LaH	Stress	Lo	LaH	Stress	Lo	LaH	Stress
1'	0.000	−0.018	0.018	0.000	−0.017	0.017	0.000	−0.016	0.016
2'	〃	−0.038	0.038	〃	−0.036	0.036	〃	−0.034	0.034
3'	〃	−0.054	0.054	〃	−0.051	0.051	〃	−0.049	0.049
4'	〃	−0.069	0.069	〃	−0.066	0.066	〃	−0.063	0.063
5'	〃	−0.080	0.080	〃	−0.076	0.076	〃	−0.072	0.072
6'	〃	−0.089	0.089	〃	−0.084	0.084	〃	−0.080	0.080
7'	〃	−0.090	0.090×1.5	〃	−0.086	0.086×1.5	〃	−0.082	0.082×1.5
8	〃	−0.091	0.091×0.0	〃	−0.086	0.086×0.0	〃	−0.082	0.082×0.0
7	〃	−0.090	0.090×1.5	〃	−0.086	0.086×1.5	〃	−0.082	0.082×1.5
6	〃	−0.089	0.089	〃	−0.084	0.084	〃	−0.080	0.080
5	〃	−0.080	0.080	〃	−0.076	0.076	〃	−0.072	0.072
4	〃	−0.069	0.069	〃	−0.066	0.066	〃	−0.063	0.063
3	〃	−0.054	0.054	〃	−0.051	0.051	〃	−0.049	0.049
2	〃	−0.038	0.038	〃	−0.036	0.036	〃	−0.034	0.034
1	〃	−0.018	0.018	〃	−0.017	0.017	〃	−0.016	0.016
			0.966			0.918			0.874
			−0.000			−0.000			−0.000
			0.966			0.918			0.874

	M_6-L_6			U_7-M_7			M_7-L_7		
Load on	Lo	LaH	Stress	Lo	LaH	Stress	Lo	LaH	Stress
1'	−0.063	−0.041	−0.022	0.000	−0.016	0.016	0.219	0.276	−0.057
2'	−0.125	−0.085	−0.040	〃	−0.034	0.034	0.437	0.574	−0.137
3'	−0.188	−0.121	−0.067	〃	−0.048	0.048	0.656	0.820	−0.164
4'	−0.250	−0.155	−0.095	〃	−0.062	0.062	0.875	1.054	−0.179
5'	−0.313	−0.178	−0.135	〃	−0.071	0.071	1.094	1.210	−0.116
6'	−0.375	−0.198	−0.177	〃	−0.079	0.079	1.312	1.348	−0.036
7'	−0.438	−0.202	−0.236×1.5	〃	−0.080	0.080×1.5	1.531	1.374	0.157×1.5
8	−0.500	−0.202	−0.298×0.0	〃	−0.080	0.080×0.0	1.750	1.375	0.375×0.0
7	−0.563	−0.202	−0.361×1.5	〃	−0.080	0.080×1.5	1.968	1.374	0.594×1.5
6	0.375	−0.198	0.573	〃	−0.079	0.079	1.687	1.348	0.339
5	0.313	−0.178	0.491	〃	−0.071	0.071	1.406	1.210	0.196
4	0.250	−0.155	0.405	〃	−0.062	0.062	1.125	1.054	0.071
3	0.188	−0.121	0.309	〃	−0.048	0.048	0.844	0.820	0.024
2	0.125	−0.085	0.210	〃	−0.034	0.034	0.562	0.574	−0.012
1	0.063	−0.041	0.104	〃	−0.016	0.016	0.281	0.276	0.005
			−1.432			0.860			−0.701
			2.092			−0.000			1.762
			0.660			0.860			1.061

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

$U_8 - M_8$

Load on	L_0	$L_a H$	Stress
1'	0.000	−0.016	0.016
2'	〃	−0.033	0.033
3'	〃	−0.047	0.047
4'	〃	−0.061	0.061
5'	〃	−0.070	0.070
6'	〃	−0.078	0.078
7'	〃	−0.079	0.079 ×1.5
8	〃	−0.079	0.079 ×0.0
7	〃	−0.079	0.079 ×1.5
6	〃	−0.078	0.078
5	〃	−0.070	0.070
4	〃	−0.061	0.061
3	〃	−0.047	0.047
2	〃	−0.033	0.033
1	〃	−0.016	0.016
			0.847
			−0.000
			0.847

Influence Surfaces of Top chord members.

Load on	U_1-U_2 $I = L_a H$	U_2-U_3 $I = L_a H$	U_3-U_4 $I = L_a H$	U_4-U_5 $I = L_a H$	U_5-U_6 $I = L_a H$	U_6-U_7 $I = L_a H$	U_7-U_8 $I = L_a H$
1'	−0.253	−0.243	−0.237	−0.231	−0.228	−0.225	−0.224
2'	−0.527	−0.508	−0.493	−0.482	−0.474	−0.470	−0.467
3'	−0.752	−0.725	−0.704	−0.689	−0.678	−0.671	−0.667
4'	−0.967	−0.932	−0.905	−0.885	−0.868	−0.862	−0.857
5'	−1.110	−1.070	−1.039	−1.016	−1.000	−0.990	−0.984
6'	−1.236	−1.191	−1.157	−1.132	−1.114	−1.103	−1.096
7'	−1.260 ×1.5	−1.214 ×1.5	−1.180 ×1.5	−1.154 ×1.5	−1.135 ×1.5	−1.124 ×1.5	−1.117 ×1.5
8	−1.261 ×0.0	−1.215 ×0.0	−1.181 ×0.0	−1.155 ×0.0	−1.136 ×0.0	−1.125 ×0.0	−1.118 ×0.0
7	−1.260 ×1.5	−1.214 ×1.5	−1.180 ×1.5	−1.154 ×1.5	−1.135 ×1.5	−1.124 ×1.5	−1.117 ×1.5
6	−1.236	−1.191	−1.157	−1.132	−1.114	−1.103	−1.096
5	−1.110	−1.070	−1.039	−1.016	−1.000	−0.990	−0.984
4	−0.967	−0.932	−0.905	−0.885	−0.868	−0.862	−0.857
3	−0.752	−0.725	−0.704	−0.689	−0.678	−0.671	−0.667
2	−0.527	−0.508	−0.493	−0.482	−0.474	−0.470	−0.467
1	−0.253	−0.243	−0.237	−0.231	−0.228	−0.225	−0.224
	−13.470	−12.980	−12.610	−12.332	−12.129	−12.014	−11.941
	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	−13.470	−12.980	−12.610	−12.332	−12.129	−12.014	−11.941

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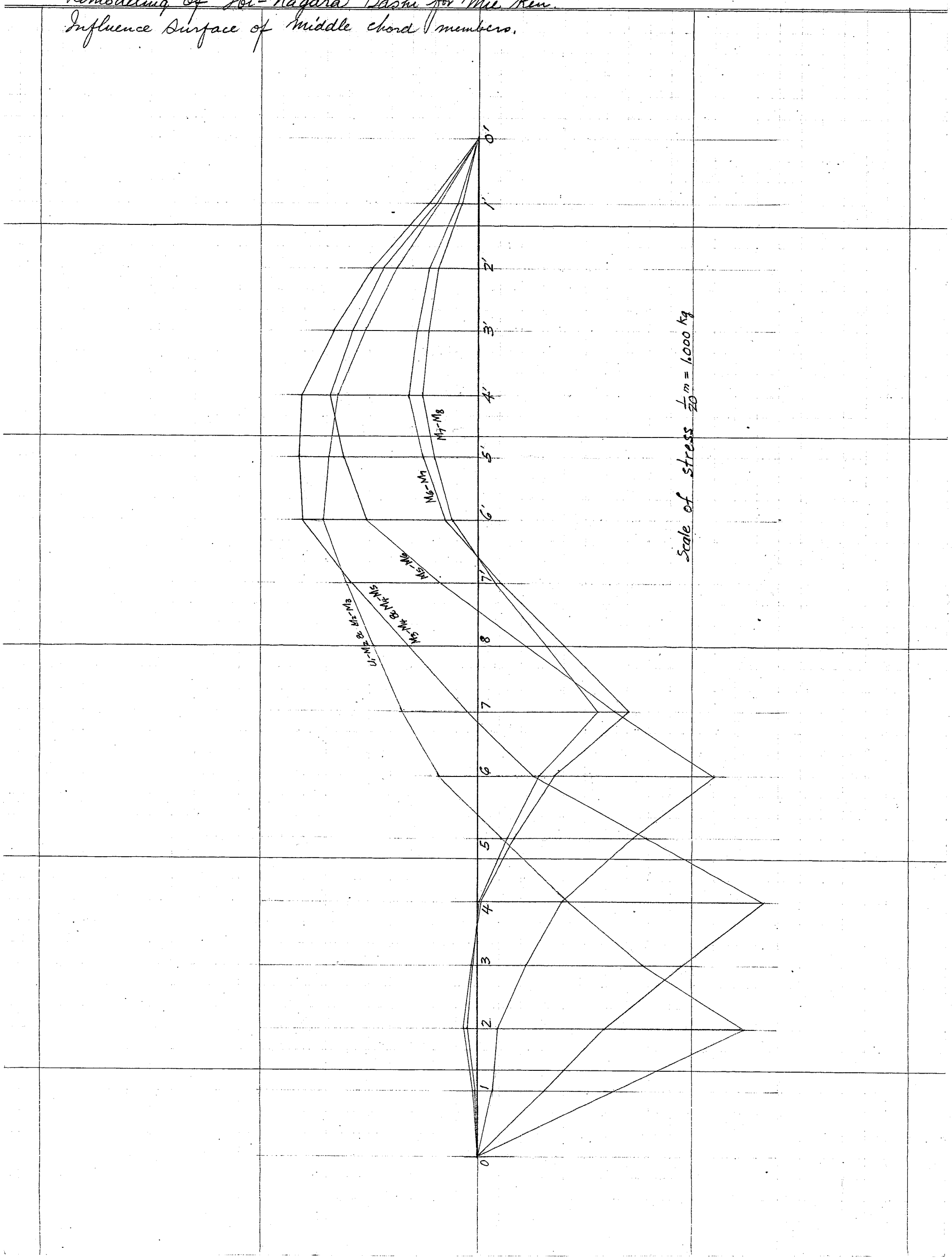
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.
Influence Surface of middle chord members.



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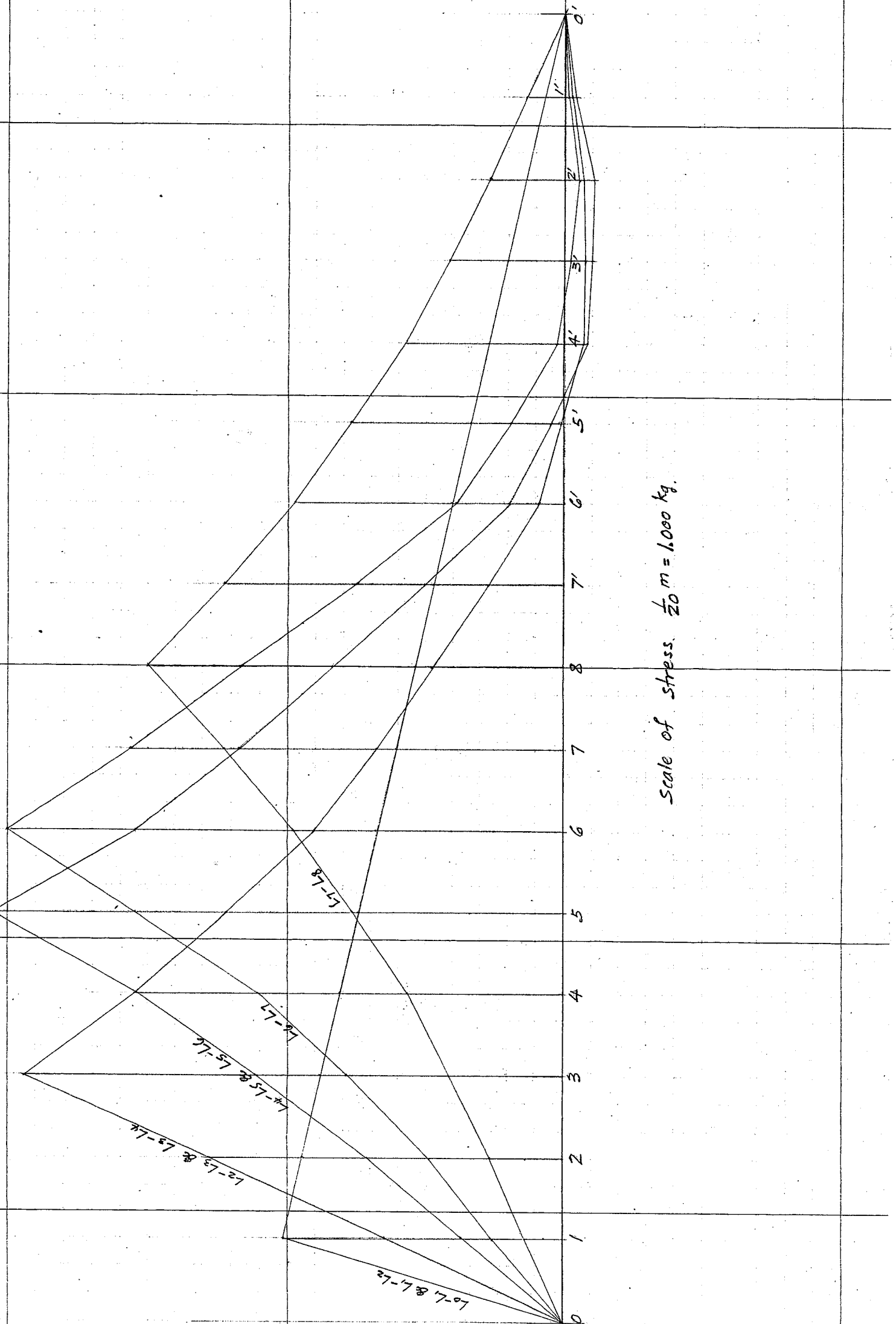
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Influence Surface of Bottom chord members.



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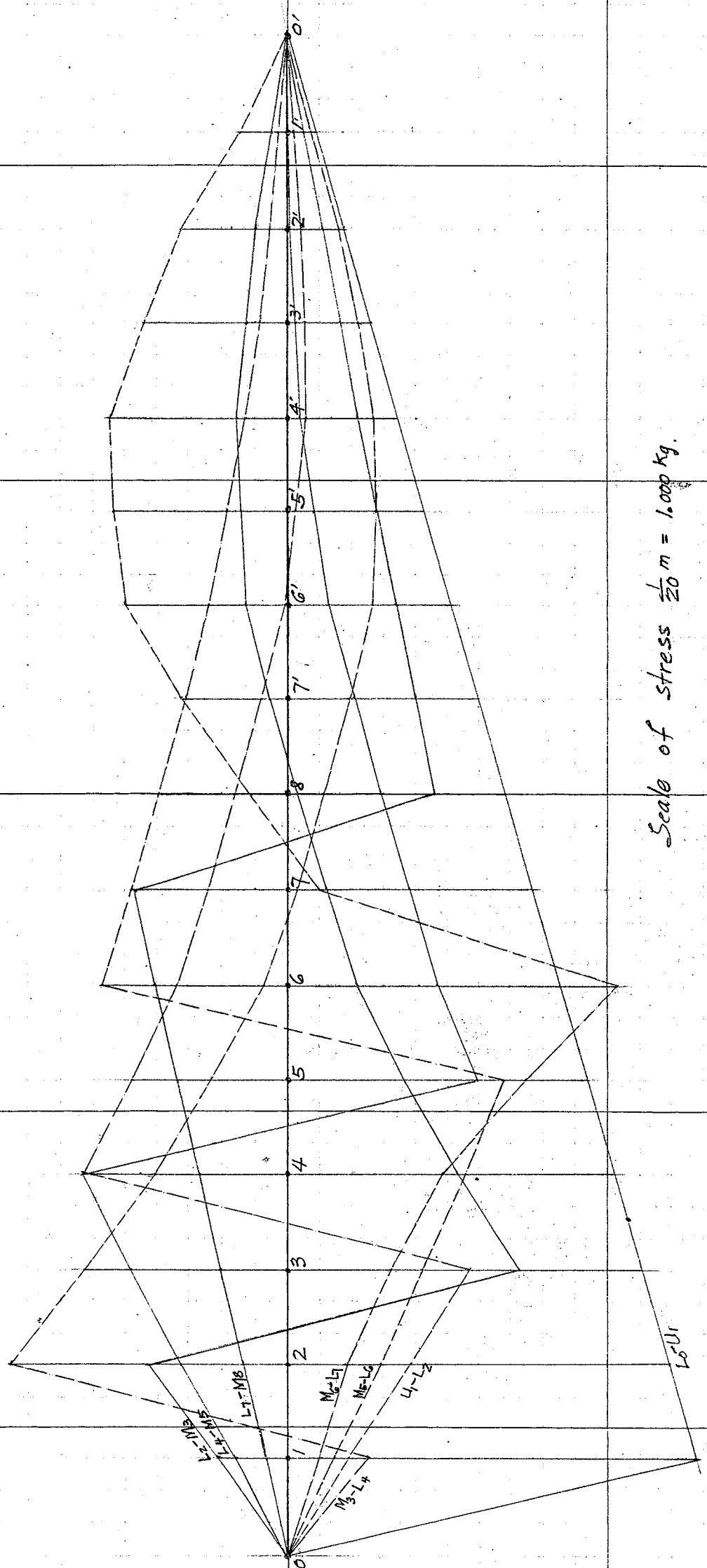
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.
Influence Surface of Diagonal members.



Scale of stress $\frac{1}{20}$ m = 1,000 kg.

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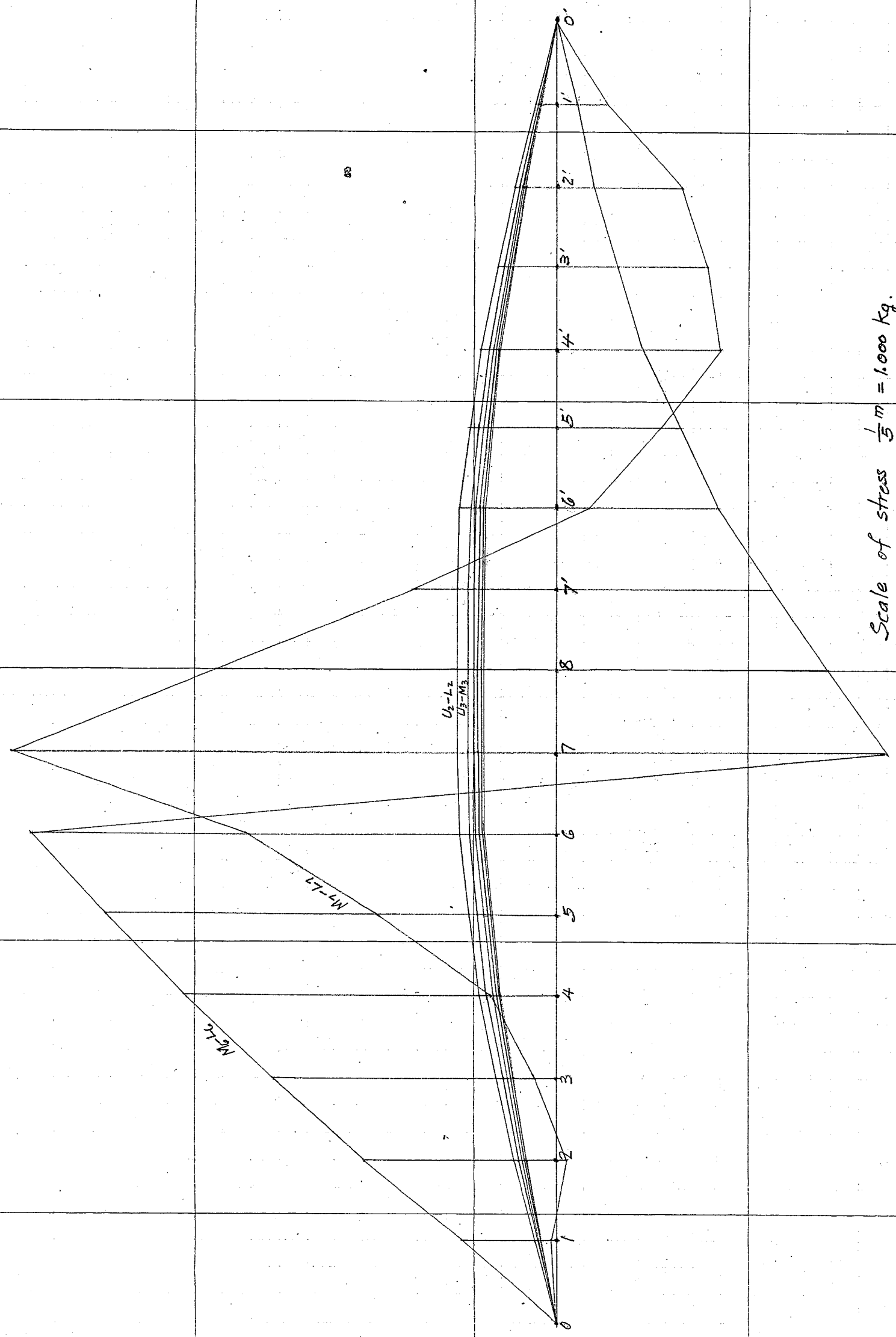
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie ken.

Influence Surface of Suspenders and Vertical members.



Scale of stress $\frac{1}{5}$ m = 1.000 kg.

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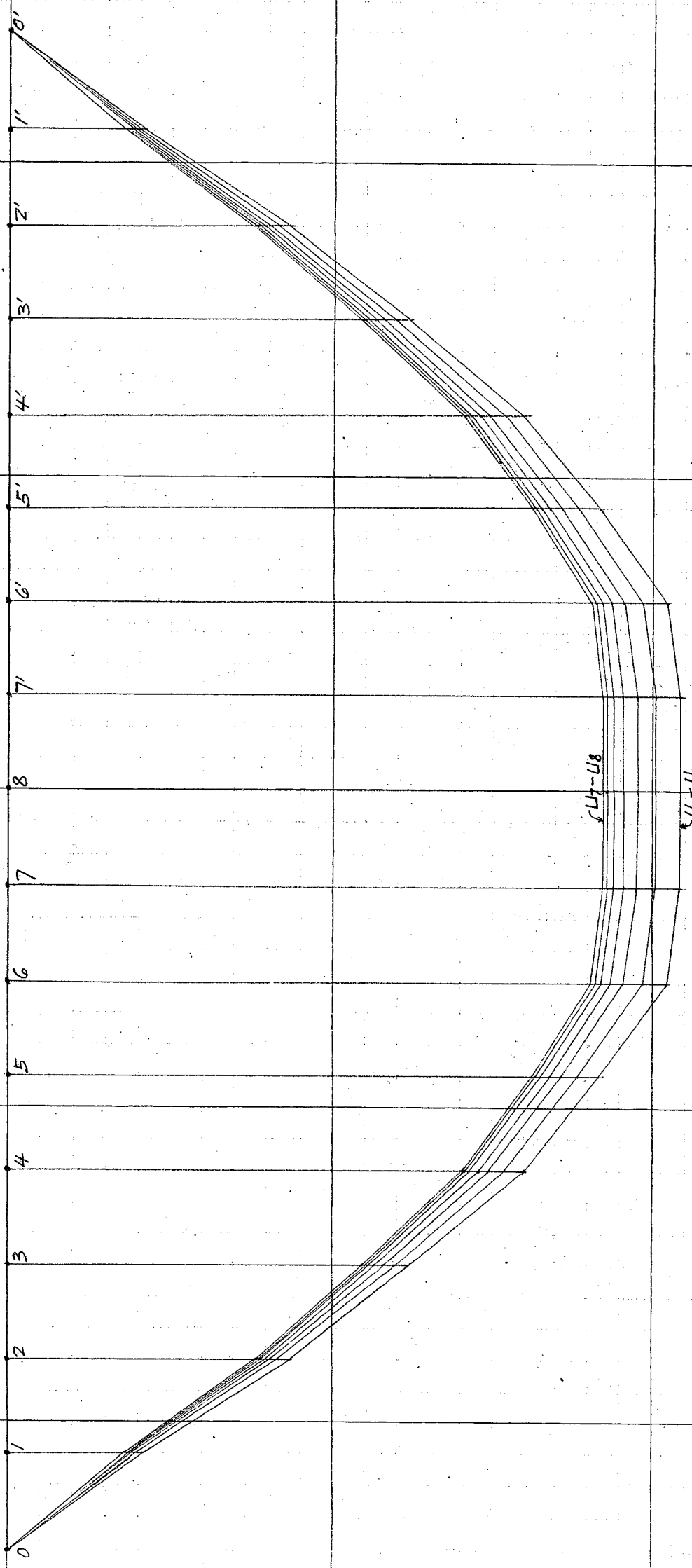
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Influence Surface of Top chord members.



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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Dead and Live panel loads on main truss.

Dead Load.

For panel points L_1 to L_6 same as for original design. = 17,200 kg

For panel points L_7 and L_7'

	between L_6 + L_7		between L_7 + L_8	
Floor.				
Floor slab and pavement	5.20×3.75 =	1950	do	= 1950
Coping		173	0.10×.14 @2400	= 34
Handrail		80		0
		2203 kg/m for one truss		1984 kg/m
Structural steel				
Stringers	5@62 =	310	do	310
floor beams	1545÷4.55 =	339	"	339
bottom lateral bracings		114	"	114
top " "		122	"	122
Sways	815÷4.55 =	179	"	179
truss assumed		2090	23000÷4.55÷1.5 =	3370 (1.5 panel 分)
		3154		4434
	for one truss =	(1,577 kg/m)	for one truss	2217 kg/m

panel load on L_7 + L_7'

Floor.	2203×4.55÷2 =	5010
"	1984×4.55 =	9030
Structural steel	2217×4.55×1.5 =	15130
		29170 call this 29200 kg

1.5 times orginal panel load = 1.5×17200 = 25800

Extra panel dead load on L_7 + L_7' = 3400 kg

Summary.

Dead panel loads on points L_1 to L_6 @ 17200 kg
do L_7 + L_7' @ 17,200×1.5 and @ 3400 kg
do L_8 no load.

Live Load.

panel load on L_1 to L_6 Same as for original design = 7000 kg each
" " L_7 and L_7' 7000×1.5
" " L_8 no load.

Extra concentration due to motor trucks = 4650 kg on point of max. effect.

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Stresses of truss members due to Dead and Live Loads.

Dead Load stresses.

	members	Summary of Ordinates	Ordinates of L_7+L_7'	Unif. panel load. 17,200	Extra panel load 3,400	Dead Load Stresses.
Middle Chords.	U_1-M_2 M_2-M_3	1.843	1.149	31,700	3,910	35,610 kg
	M_3-M_4 M_4-M_5	0.720	0.772	12,380	2,620	15,000
	M_5-M_6	−0.284	−0.557	−4,880	−1,890	−6770
	M_6-M_7	−0.343	−0.971	−5,900	−3300	−9200
	M_7-M_8	−0.285	−0.773	−4,900	−2,630	−7,530
Bottom Chords.	L_0-L_1 L_1-L_2	9.752	1.300	167,500	3300	170,800
	L_2-L_3 L_3-L_4	10.631	1.146	182,800	3600	186,400
	L_4-L_5 L_5-L_6	11.784	2.016	202,800	6700	209,500
	L_6-L_7	12.292	2.803	211,400	9500	220,900
	L_7-L_8	11.947	2.954	206,000	10,100	216,100
Diagonals	L_0-U_1	−12.305	−1.641	−211,800	−5,600	−217,400
	U_1-L_2	0.4441	−0.271	7,580	−920	6,660
	L_2-M_3	−0,676	−0,079	−11,630	−270	−11,900
	M_3-L_4	0.757	0.401	13,020	1360	14,380
	L_4-M_5	−0.705	−0.699	−12,120	−2380	−14,500
	M_5-L_6	0.552	0.977	9,500	3320	12,820
	M_6-L_7	0.000	0.272	0	920	920
	(L_7-M_8)	0.501	0.094	8620	320	8940

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	Members	Summary of ordinates	Ordinates at L_7+L_7'	Unif. panel loads 17,200	Extra panel loads 3400	Dead Load stresses.
	U_1-L_1 U_3-L_3 U_5-L_5	1.000	0.000	17,200	0	17,200 kg
	$U_2-M_2-L_2$	1.156	0.216	19,880	730	20,610
	U_3-M_3	1.039	0.194	17,870	660	18,530
Suspenders and Verticals	$U_4-M_4-L_4$	0.966	0.180	16,620	610	17,230
	U_5-M_5	0.918	0.172	15,780	580	16,360
	U_6-M_6	0.874	0.164	15,030	560	15,590
	M_6-L_6	0.660	−0.597	11,350	−2,030	9,320
	U_7-M_7	0.860	0.160	14,780	540	15,320
	M_7-L_7	1.061	0.751	18,250	2,550	20,800
	U_8-M_8	0.847	0.158	14,570	540	15,110
	L_0-U_1	See Diagonals				−217,400
	U_1-U_2	−13.470	−2.520	−231,600	−8,600	−240,200
Top Chords.	U_2-U_3	−12,980	−2,428	−223,400	−8,300	−231,700
	U_3-U_4	−12.610	−2.360	−216,900	−8,000	−224,900
	U_4-U_5	−12.332	−2.308	−212,000	−7,800	−219,800
	U_5-U_6	−12.129	−2.270	−208,600	−7,700	−216,300
	U_6-U_7	−12.014	−2,248	−206,600	−7,600	−214,200
	U_7-U_8	−11.941	−2.234	−205,300	−7,600	−212,900

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken

Live Load stresses.

	members	Summary of ordinates	Maximum ordinates	Unif. panel loads 7,000	Extra concentration 4650	Live Load Stresses.
	U_1-M_2	5.736	0.865	41,120	4,020	45,140 kg
	M_2-M_3	−3.893	−1.491	−27,250	−6,930	−34,180
	M_3-M_4	5.814	1.005	40,700	4,670	45,370
	M_4-M_5	−5.094	−1.609	−35,650	−7,480	−43,130
Middle Chords	M_5-M_6	4.002	0.829	28,000	3,850	31,850
		−4.286	−1.321	−30,000	−6,140	−36,140
	M_6-M_7	1.764	0.394	12,340	1,830	14,170
		−2.107	−0.844	−14,750	−3,920	−18,670
	M_7-M_8	1.394	0.311	9,760	1,450	11,210
		−1.679	−0.671	−11,750	−3,120	−14,870
Bottom Chords	L_0-L_1	9.752	1.219	68,200	5,700	73,900
	L_1-L_2	−0.000	−0.000	0	0	0
	L_2-L_3	10.924	2.347	76,400	10,900	87,300
	L_3-L_4	−0.293	−0.091	−2,100	−400	−2,500
	L_4-L_5	12.167	2.494	85,200	11,600	96,800
	L_5-L_6	−0.383	−0.124	−2,700	−600	−3,300
	L_6-L_7	12.404	2.423	86,800	11,300	98,100
		−0.112	−0.070	−800	−300	−1,100
	L_7-L_8	11.947	1.477	83,600	6,900	90,500
		−0.000	−0.000	0	0	0
Diagonals	L_0-U_1	0.000	0.000	0		0
		−12.305	−1.538	−86,200	−7,200	−93,400
	U_1-L_2	2.666	1.035	18,660	4,810	23,470
		−2.225	−0.329	−15,580	−1,530	−17,110
	L_2-M_3	1.734	0.531	12,130	2,470	14,600
		−2.410	−0.867	−16,860	−4,030	−20,890
	M_3-L_4	2.362	0.754	16,530	3,500	20,030
		−1.605	−0.678	−11,230	−3,150	−14,380
	L_4-M_5	1.961	0.772	13,730	3,590	17,320
		−2.666	−0.713	−18,660	−3,320	−21,980
	M_5-L_6	3.042	0.699	21,300	3,250	24,550
		−2.490	−0.805	−17,430	−3,740	−21,170
	M_6-L_7	3.613	0.652	25,200	3,030	28,230
		−3.613	−1.237	−25,200	−5,750	−30,950
	(L_7-M_8)	2.600	0.569	18,200	2,650	20,850
		−2.099	−0.475	−14,700	−2,210	−16,910

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

	Members	Summary of Ordinates	Maximum Ordinates	Unif. panel loads 7000	Extra concentration 4650	Live Load Stresses
	U_1-L_1, U_3-L_3, U_5-L_5	1.000 −0.000	1.000 −0.000	7,000 0	4,650 0	11,650 kg 0
	$U_2-M_2-L_2$	1.156 −0.000	0.108 −0.000	8,090 0	500 0	8,590 0
	U_3-M_3	1.039 −0.000	0.097 −0.000	7,270 0	450 0	7,720 0
	$U_4-M_4-L_4$	0.966 −0.000	0.090 −0.000	6,760 0	420 0	7,180 0
Suspenders and Verticals	U_5-M_5	0.918 −0.000	0.086 −0.000	6,420 0	400 0	6,820 0
	U_6-M_6	0.874 −0.000	0.082 −0.000	6,120 0	380 0	6,500 0
	M_6-L_6	2.092 −1.432	0.573 −0.361	14,650 −10,020	2,670 −1,680	17,320 −11,700
	U_7-M_7	0.860 −0.000	0.800 −0.000	6,020 0	3,720 0	9,740 0
	M_7-L_7	1.762 −0.701	0.594 −0.179	12,330 −4,910	2,760 −830	15,090 −5,740
	U_8-M_8	0.847 −0.000	0.079 −0.000	5,930 0	370 0	6,300 0
	L_0-U_1	See Diagonals		−86,200	−7,200	−93,400
	U_1-U_2	−13,470	−1,260	−94,200	−5,900	−100,100
	U_2-U_3	−12,980	−1,214	−90,900	−5,600	−96,500
Top Chords.	U_3-U_4	−12,610	−1,180	−88,300	−5,500	−93,800
	U_4-U_5	−12,332	−1,154	−86,400	−5,400	−91,800
	U_5-U_6	−12,129	−1,135	−84,900	−5,300	−90,200
	U_6-U_7	−12,014	−1,124	−84,100	−5,200	−89,300
	U_7-U_8	−11,941	−1,117	−83,600	−5,200	−88,800

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Summary of Stresses.

	Members	D.L. stres	L.L. stres	Total stress	Adjusted stress.
	U_1-M_2 }	35,610 kg	45,140	80,750	80750 kg
	M_2-M_3 }		− 34,180		
	M_3-M_4 }	15,000	45,370	60,370	74,440
	M_4-M_5 }		− 43,130	− 28,130 ×½	
Middle chords	M_5-M_6		31,850	25080 ×½	
		− 6,770	− 36,140	− 42,910	− 55,450
	M_6-M_7		14,170	4,970 ×½	
		− 9200	− 18,670	− 27,870	− 30,360
	M_7-M_8		11,210	3,680 ×½	
		− 7,530	− 14,870	− 22,400	− 24,240
	L_0-L_1 }	170,800	73,900	244,700	244,700
	L_1-L_2 }		—		~~244,700~~
	L_2-L_3 }	186,400	87,300	273,700	273,700
	L_3-L_4 }		− 2,500		
Bottom Chords	L_4-L_5 }	209,500	96,800	306,300	306,300
	L_5-L_6 }		− 3,300		
	L_6-L_7	220,900	98,100	319,000	319,000
			− 1,100		
	L_7-L_8	216,100	90,500	306,600	306,600 + 8,220 = 314,820 (Comp. H of L_7M_8)
			—		
	L_0-U_1		—		− 310,800
		− 217,400	− 93,400	− 310,800	
	U_1-L_2	6,660	23,470	30,130	35,360
			− 17,110	− 10,450 ×½	
	L_2-M_3		14,600	2,700 ×½	
		− 11,900	− 20,890	− 32,790	− 34,140
Diagonals	M_3-L_4	14,380	20,030	34,410	34,410
			− 14,380		
	L_4-M_5		17,320	2,820 ×½	
		− 14,500	− 21,980	− 36,480	− 37,890
	M_5-L_6	12,820	24,550	37,370	41,550
			− 21,170	− 8,350 ×½	
	M_6-L_7	920	28,230	29,150 ×½	
			− 30,950	− 30,030	− 44,610
	(L_7-M_8)	8,940	20,850	29,790	33,780
			− 16,910	− 7,970 ×½	

L_7-M_8 at full load.

D.L.	8940
L.L. 0.501@7000 =	3510
" 0.569@4650 =	2650
	15140

Components of L_7-M_8

$H = 15100 \times \frac{4.55}{8.349} = 8220$

$V = 15100 \times \frac{7.00}{8.349} = 12650$

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Pref.

	members	D. L. stress	L.L. stress	Total stress	Adjusted stress.
	U_1-L_1 U_3-L_3 U_5-L_5	17,200	11,650	28,850	28,850 kg
	$U_2-M_2-L_2$	20,610	8,590	29,200	29,200
	U_3-M_3	18,530	7,720	26,250	26,250
Suspenders & Verticals	$U_4-M_4-L_4$	17,230	7,180	24,410	24,410
	U_5-M_5	16,360	6,820	23,180	23,180
	U_6-M_6	15,590	6,500	22,090	22,090
	M_6-L_6	9,320	17,320 −11,700	26,640 − 2,380 × ½	27,830
	U_7-M_7	15,320	9,740	25,060	25,060
	M_7-L_7	20,800	15,090 −5,740	35,890	Vert. comp. of L_7-M_8 35,890 + 12650 = 48,540
	U_8-M_8	15,110	6,300	21,410	21,410
	L_0-U_1	− 217,400	− 93,400	− 310,800	− 310,800
	U_1-U_2	− 240,200	− 100,100	− 340,300	− 340,300
Top Chords.	U_2-U_3	− 231,700	− 96,500	− 328,200	− 328,200
	U_3-U_4	− 224,900	− 93,800	− 318,700	− 318,700
	U_4-U_5	− 219,800	− 91,800	− 311,600	− 311,600
	U_5-U_6	− 216,300	− 90,200	− 306,500	− 306,500
	U_6-U_7	− 214,200	− 89,300	− 303,500	− 303,500
	U_7-U_8	− 212,900	− 88,800	− 301,700	− 301,700

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CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken

Stress Diagram.

note. Signs of Stresses
+ --- Tension
− --- Compression.

For Used sections of each members
see on next page.

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CALCULATIONS FOR Remodeling of Uji-Magara Bashi for Mei-Kyu Final sections of Trans members.

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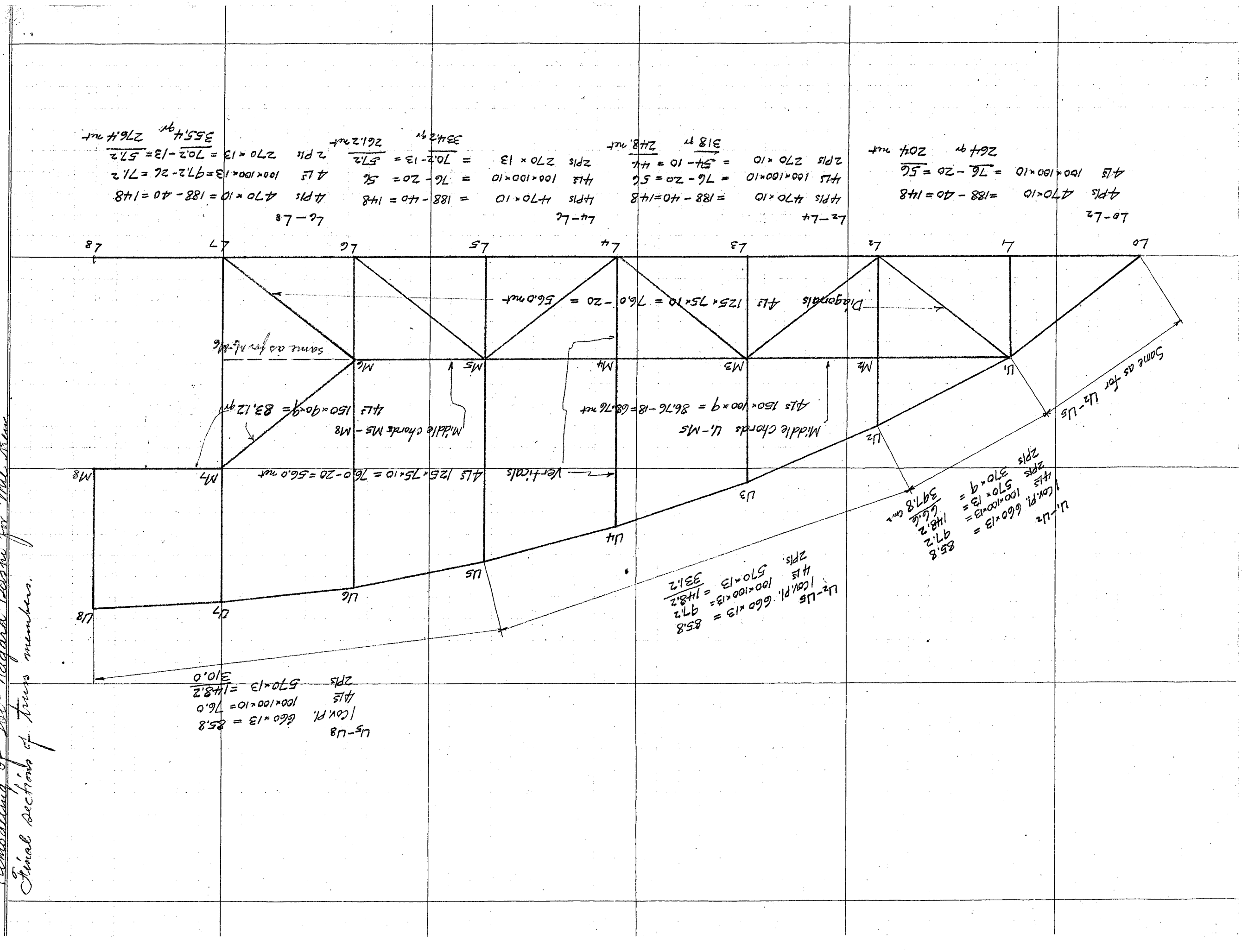

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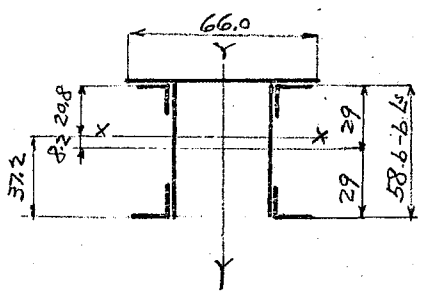
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Pref.

Design of member sections.

Top chords: U_5-U_8 max. stress = −306500 kg



1 cov pl.	660×13	= 85.8 cm²
4 L 2	100×100×10	= 76.0
2 Pls	570×13	= 148.2
		310.0

Eccentricity = $\frac{85.8 \times 29.65}{310}$ = 8.2 cm upward.

Moment of inertia about x–x axis

1 cov pl.	85.8 cm² ×	21.45^2	=	39500
2 L 3	38.0 ×	18.0^2 + 349	=	12649
2 L 5	38.0 ×	34.4^2 + 349	=	45349
2 Pls	148.2 ×	8.2^2 + 40140	=	50120
	310.0		I_x =	147,618 cm⁴

Radius of gyration $r_x = \sqrt{\frac{147618}{310}} = 21.8$ cm

Moment of inertia about Y–Y axis

1 cov pl.	85.8		=	31130
4 L 2	76.0	× 25.1^2 + 698	=	48698
2 Pls	148.2	× 21.65^2	=	69500
	310.0		I_y =	149328 cm⁴

$I_y > I_x$ & $r_y > r_x$

Allowable unit compressive stress on section

$f = 1500\left(1-0.0055 \times \frac{462.3}{21.8}\right) = 1325$ kg/cm² use 1,000 kg/cm²

Full strength of section = 310 @ 1000 = 310,000 kg C

For top chords L_0-U_1 and U_2-U_5 max. stress = − 328,200 kg SR = 328.2 cm² gr

use.

1 cov pl.	660×13	= 85.8
4 L 5	100×100×13	= 97.2
2 Pls	570×13	= 148.2
		331.2 cm² gr.

Full strength of the section = 331.2 @ 1000 = 331,200 kg C

For top chord U_1-U_2 stress = − 340,300 SR = 340.3 cm² gr

use.

1 cov pl.	660×13	= 85.8
4 L 5	100×100×13	= 97.2
2 Pls	570×13	= 148.2
2 Pls	370×9	= 66.6
		397.8 cm² gr.

Full strength of the section = 397.8 @ 1000 = 397,800 kg C

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CALCULATIONS FOR

Remodeling of Idé-Nagara Bashi for Mie Ken.

Middle chords

			length of member
U_1-M_5	max. stress	= 80750 kg	4.550 m
M_5-M_6 & M_7-M_8	"	= - 55450	4.550
M_6-M_7	"	= - 30360	5.740

Section used for U_1-M_5

$\angle$ 150 × 100 × 9 = 86.76 − 18 = 68.76 cm² net.

full strength = 68.76 @ 1200 = 82500 kg.

Section used for M_5-M_6, M_7-M_8 and M_6-M_7

$\angle$ 150 × 90 × 9 = 83.12 cm² gr.

least radius of gyration r_x = 7.2 cm, ratio $\frac{l}{r} = \frac{574.0}{7.2} = 79.7$

or $\frac{455}{7.2} = 63.2$

Allowable unit compressive stress on the section.

$f = 1500(1 - 0.0055 \times 79.7) = 844$ kg/cm² for M_6-M_7

or $1500(1 - 0.0055 \times 63.2) = 978$ " " M_5-M_6 and M_7-M_8

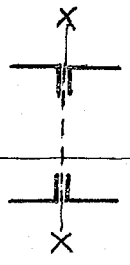
full strength of the section

83.12 @ 844 = 70.200 kg C for M_6-M_7

83.12 @ 978 = 81300 " " M_5-M_6 and M_7-M_8

Diagonals

max. tension	M_5-M_6	41550 kg T
max. compression	M_6-L_7	44610 kg C



used section

$\angle$ 125 × 75 × 10 = 76.0 − 20 = 56.0 cm² net

least radius of gyration r_x = 6.12 cm ratio $\frac{l}{r} = \frac{574}{6.12} = 93.8$

Allowable unit compressive stress on the section

$f = 1500(1 - 0.0055 \times 93.8) = 725$ kg/cm² C

full strengths of the section.

for compression 76.0 @ 725 = 56050 kg C

for tension 56.0 @ 1200 = 67200 kg T

Verticals

max. stress	$U_2-M_2-L_2$	29200 kg T
	M_7-L_7	48,540 " "

used section

$\angle$ 125 × 75 × 10 = 76.0 − 20 = 56.0 cm² net

full strength of the section

56.0 @ 1200 = 67200 kg T.

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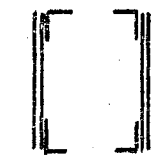
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.

Bottom chords.



L_0-L_2 Stress 244700 kg T SR = 204 cm² net

used section

4 web pls. 470×10 = 188 − 40 = 148

4 LS 100×100×10 = 76 − 20 = 56

264 cm² gr 204 cm² net

L_2-L_4 Stress 273700 kg T SR = 228 cm² net.

Same as for L_0-L_2 = 264 − 60 = 204

add 2 pls 270×10 = 54 − 10 = 44

318 gr 248 net.

L_4-L_6 Stress 306300 kg T SR = 256 cm² net.

Same as for L_0-L_2 = 264 − 60 = 204

add 2 pls 270×13 = 70.2 − 13 = 57.2

334.2 gr 261.2 net

L_6-L_8 max. stress = 319000 kg T SR = 266 net

4 pls 470×10 = 188.0 − 40 = 148.0

4 LS 100×100×13 = 97.2 − 26 = 71.2

2 pls 270 ×13 = 70.2 − 13 = 57.2

355.4 gr 276.4 net

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~~HIHI~~ SHOWA BLDG, TOKYO

MADE BY K. Inaba DATE 7-9-28 FILE NO
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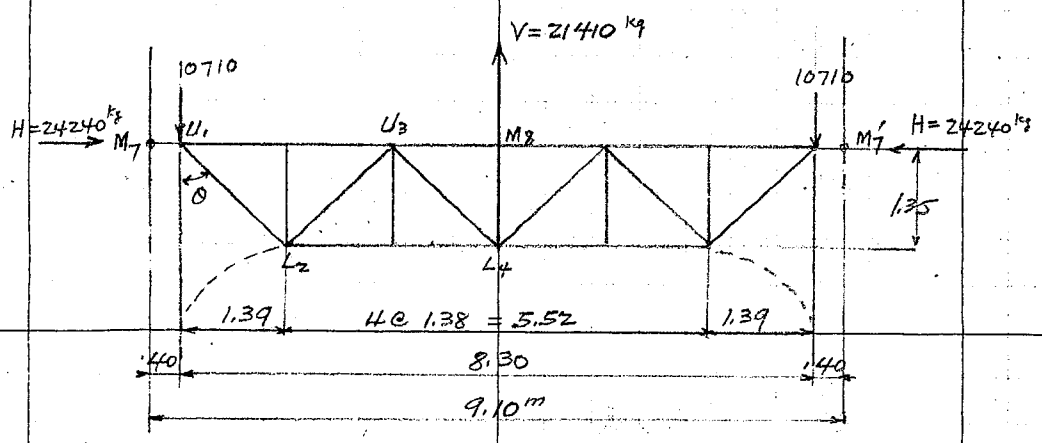
CALCULATIONS FOR

Remodeling of Ibi-Nagara Bashi for Mie Ken.
Design of U-Center portal bracing.



Diagonal length

U_1-L_2 $1.35^2 = 1.8225$, $1.39^2 = 1.9321$, 3.7546, $\sqrt{3.7546} = 1.938^m$

L_2-U_3 $1.35^2 = 1.8225$

U_3-L_4 $1.38^2 = 1.9044$, 3.7269, $\sqrt{3.7269} = 1.931^m$

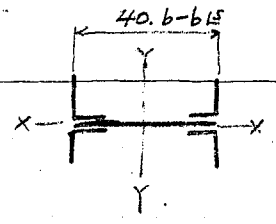
	sec θ	tan θ
$U-L_2$	$\frac{1.938}{1.35} = 1.435$	$\frac{1.39}{1.35} = 1.030$
L_2-U_3 & U_3-L_4	$\frac{1.931}{1.35} = 1.430$	$\frac{1.38}{1.35} = 1.022$

For simplicity and safe side, design the bracing as a simple beam.

		tan θ		Direct stress
Chord stress	U_1-U_3	= 10710 × 1.030	= 11030 kg T	24240 kg C
	L_2-L_4	= 10710 × (1.030+1.022)	= 22000 C	—
	U_3-U_3'	= 10710 × (1.030+2.044)	= 32900 T	24240 C
Diagonal stress	U_1-L_2	= 10700 × 1.435	= 15350 C	
	L_2-U_3	= 10700 × 1.430	= 15300 T	
	U_3-L_4	= " "	= 15300 C	

Top chord section 4Ls 150×90×9 = 83.16 cm² gr − 15.84 = 67.32 net
full strength 67.32 @ 1200 = 81,000 kg T

Bottom chord section 4Ls 125×75×10 = 76.00 × 18.26^2 + 81×4 = 25650.
1 web 385×9 = 34.64 $\frac{9\times38.5^3}{12}$ = 4280
110.64 cm² gr I_y = 29930 cm⁴



$r_y = \sqrt{\frac{29930}{110.64}} = 16.4^{cm}$, $\ell/r = \frac{830}{16.4} = 50.6$

Allowable unit compressive stress
$f = 1500(1 - 0.0055 \cdot 50.6) = 1082$ use 1000 kg/cm²

full strength of the section 110.64 @ 1000 = 110,640 kg C

Diagonal section 4Ls 90×75×9 = 56.16 − 15.84 = 40.32 cm² net
$\ell_r = \frac{194}{3.91} = 50$
$f_c = 1000$ kg/cm²

Good for 56.16 @ 1000 = 56160 kg C
40.32 @ 1200 = 48400 kg T

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MADE BY M. J DATE 7-10-31 FILE NO
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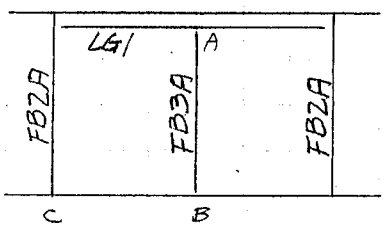
CALCULATIONS FOR

Remodeling design of Obi Nagaragawa Bashi for Mie Ken (South truss for 6th span)

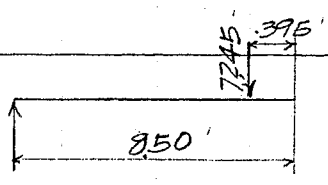
Variation for panel concentration at L7 & L8

Due to dead Load



Reaction at A due to floor beam FB3A 12,210 Kgs.
Reaction at B due to floor beam FB3A 11,030 Kgs.

Concentration on FB2A due to longitudinal girder LG1 6,105.
" " " " " own weight of " 1,140.
7,245 Kgs.



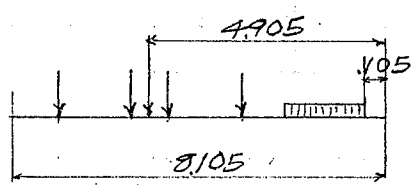
Reaction at C due to LG1 $7{,}245 \times \frac{.395}{8.50} = 337$ Kgs increased

panel concentration for ordinary span

Floor slab and pavement	3,900
Coping	346
Handrails	160
Stringers	310
Floor beams	339
	5,055

$5055 \times 4.55 \div 2 = 11{,}500$
$-11{,}030$
470 Kgs decreased

Due to Live Load

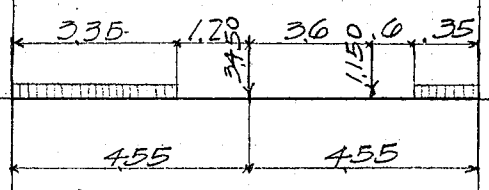


Reaction at B on truss
Due to rear wheel concentration

$3{,}450 \times 4 \times \frac{4.905}{8.105} = 8{,}350$

Reaction at A on truss

$3{,}450 \times 4 \times \frac{3.2}{8.105} = 5{,}450$



Front wheel concentration on floor beam
$11.50 \times \frac{.95}{4.55} = 240$

$240 \times 4 \times \frac{4.905}{8.105} = 580$

$240 \times 4 \times \frac{3.2}{8.105} = 379$

uniform live load for side of motor truck
load on floor beam $412 \times 4.55 = 1{,}875$ Kgs

$1{,}875 \times 2.1 \times \frac{1.155}{8.105} = 560$

$1{,}875 \times 2.1 \times \frac{6.95}{8.105} = 3{,}380$

uniform live load for front and rear of motor truck
load on floor beam for front of motor truck
$412 \times .35 \times \frac{.175}{4.55} = 6$

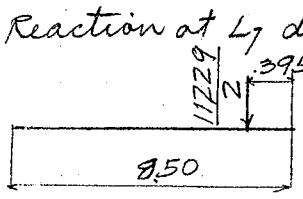
load on floor beam for rear of motor truck
$412 \times 3.35 \times \frac{1.675}{4.55} = \frac{508}{514}$

$514 \times 7.5 \times \frac{3.855}{8.105} = \frac{1{,}835}{11{,}325}$ Kgs

$514 \times 7.5 \times \frac{4.25}{8.105} = \frac{2{,}020}{11{,}229}$ Kgs

$11{,}650 - 11{,}325 = 325$ Kgs decreased

Reaction at L7 due to concentration of LG1



$\frac{11229}{2} \times .395 \div 8.50 = 260$ Kgs increased

Panel concentration

7,030	6,820	11,650	6,015	7,030
	+ 260	- 325	+ 260	
7,030	7,080	11,325	6,875	7,030

assumed 7,000 Kgs for panel and 4,325 Kgs single conc.

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CALCULATIONS FOR

Remodeling design of Obi Nagaragawa Bashi for Mie-Ken (South truss for 6th span)

Variation of stresses for each member due to Dead load and Live load

For middle chords

Member	ordinates at L7	L8	L7'	Max. ord.	Variation of Stresses due to Dead Load AT L7(+337)	L8(-470)	L7'(+337)	Total/st.	Live Load (-325)
U1-M2 } M2-M3 }	0.800	0.700	0.475	0.885	270	330	160	100 (+)	290
M3-M4 } M4-M5 }	0.810	0.584	0.160	1.012 -1.625	270	270	50	50 (+)	330 -530
M5-M6 } M6-M7 }	0.329	-0.038	-0.646	0.810 -1.282	110	-20	-220	-90 (+)	260 -420
M7-M8	-0.593	-1.116	-0.593	0.318 -1.116	-200	-520	-200	-120 (-)	100 -360

For Bottom chords

L0-L1 } L1-L2 }	0.569	0.650	0.731	1.219	190	310	250	130 (+)	400
L2-L3 } L3-L4 }	0.283	0.481	0.771	2.356	100	230	260	130 (+)	770
L4-L5 } L5-L6 }	0.528	0.859	1.340	2.440	180	400	450	230 (+)	810
L6-L7 } L7-L8 }	1.231	1.712	2.369	2.369	410	800	800	410 (+)	770

For Diagonals

U1-L2	-0.270	-0.199	-0.065	1.042 -0.333	-90	-90	-20	-20 (+)	340 -110
L2-M3	0.089	0.013	-0.116	-0.872 0.526	30	10	-40	-20 (+)	-280 170
M3-L4	0.078	0.159	0.283	0.758 -0.674	30	70	100	60 (+)	250 -220
L4-M5	-0.231	-0.317	-0.436	-0.712 0.769	-80	-150	-150	-80 (+)	-230 250
M5-L6	0.375	-0.466	0.580	0.696 -0.806	130	-220	200	550 (+)	230 -260
L6-M7	-0.514	-0.609	-0.719	-0.719 0.811	-170	-290	-240	-120 (+)	-230 260
M7-L8	0.651	0.751	-0.785	0.751 -0.785	220	350	-260	-390 (+)	240 -260

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CALCULATIONS FOR

Remodeling design of Ubi-Nagaragawa Bashi for Mie Ken (South truss for 6th span)

For Verticals and Suspenders

Member	ordinates at L_7	L_8	L_7'	Max.ord.	Variation of Stresses due to Dead Load at L_7 (+337)	L_8 (-470)	L_7' (+337)	Total st.	Live Load (-325)
U_1-L_1, M_3-L_3 M_5-L_5, M_7-L_7	0.000	0.000	0.000	1.000	000	000	000	000	325
$U_2-M_2-L_2$	0.112	0.116	0.112	0.116	40	50	40	30 (+)	40
U_3-M_3	0.100	0.104	0.100	0.104	30	50	30	10 (+)	30
$U_4-M_4-L_4$	0.093	0.096	0.093	0.096	30	50	30	10 (+)	30
U_5-M_5	0.089	0.092	0.089	0.092	30	40	30	20 (+)	30
$U_6-M_6-L_6$	0.084	0.087	0.084	0.087	30	40	30	20 (+)	30
U_7-M_7	0.083	0.086	0.083	0.086	30	40	30	20 (+)	30
$U_8-M_8-L_8$	0.082	0.085	0.082	0.085	30	40	30	20 (+)	30
For Top chords									
L_0-U_1	-0.718	-0.820	-0.923	-1.538	-240	-390	-240	-90 (+)	-500
U_1-U_2	-1.302	-1.343	-1.302	-1.343	-440	-630	-440	-250 (+)	-440
U_2-U_3	-1.254	-1.295	-1.254	-1.295	-420	-610	-420	-230 (+)	-420
U_3-U_4	-1.218	-1.258	-1.218	-1.258	-410	-590	-410	-230 (+)	-410
U_4-U_5	-1.192	-1.230	-1.192	-1.230	-400	-580	-400	-220 (+)	-400
U_5-U_6	-1.172	-1.210	-1.172	-1.210	-390	-570	-390	-210 (+)	-390
U_6-U_7	-1.101	-1.198	-1.161	-1.198	-390	-560	-390	-220 (+)	-390
U_7-U_8	-1.154	-1.191	-1.154	-1.191	-390	-560	-390	-220 (+)	-390

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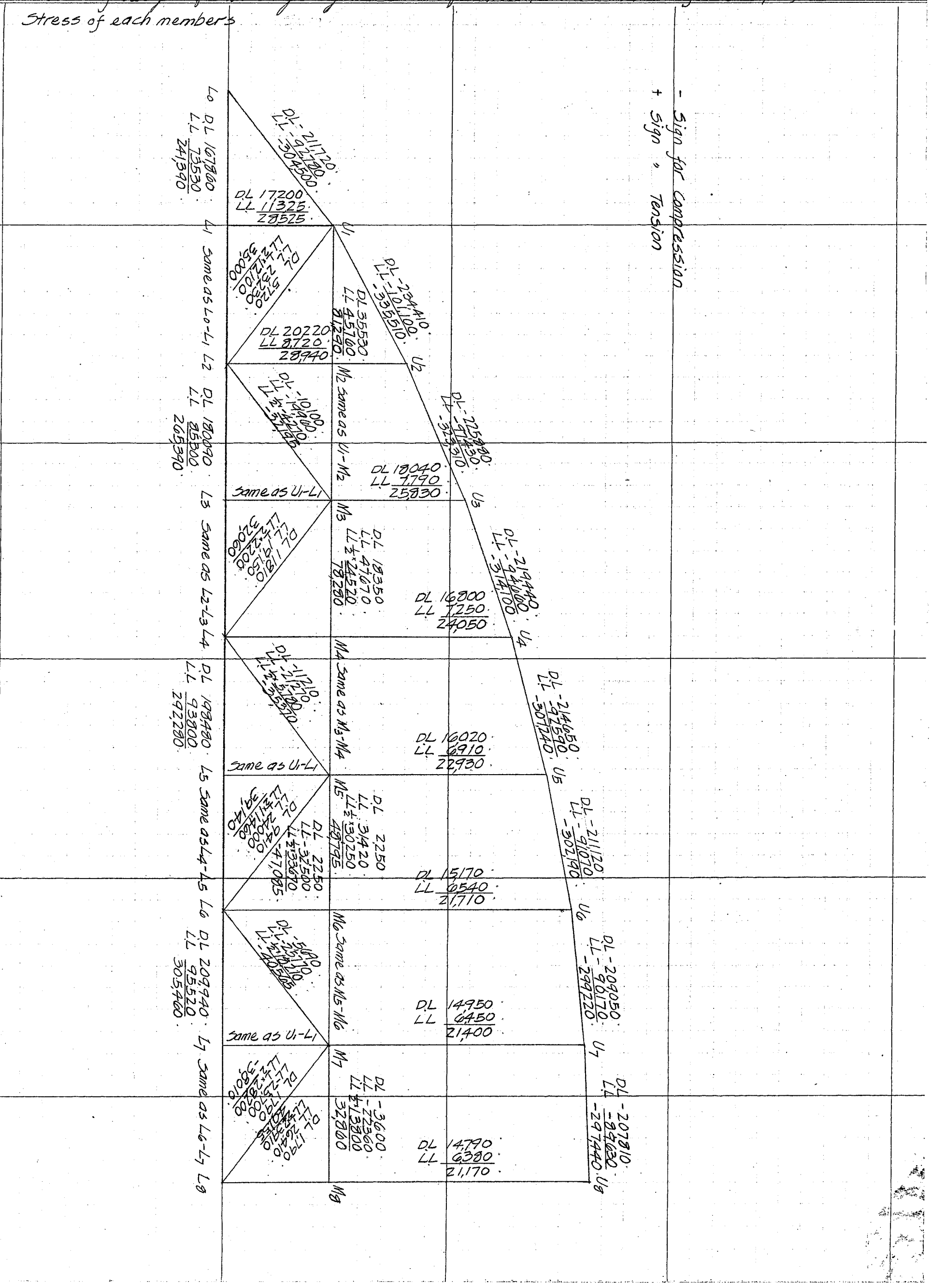
CALCULATIONS FOR

Remodeling design of Ibi Nagaragawa Bashi for Mie Ken (South truss for 6th Span)

Stress of each members



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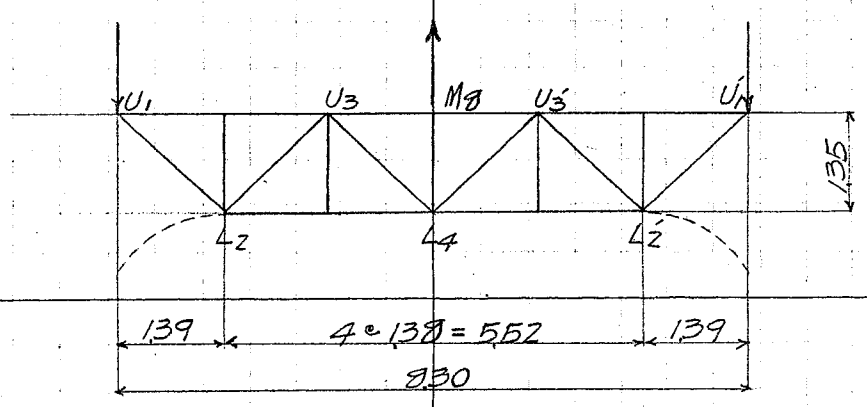
CALCULATIONS FOR

Remodeling design of Ibi-Nagaragawa Bashi for Mie Ken (North truss for 6th span)

Deflection of Portal Bracing



Diagonal Length
U_1-L_2 ----- 1.938
L_2-U_3, U_3-L_4 ----- 1.931

	Sec θ	tan θ
U_1-L_2	1.435	1.030
L_2-U_3, U_3-L_4	1.430	1.022

Stresses of each members when unit load applied at M8. 5

Chord stress	U_1-U_3	0.50 × 1.030	= +0.515
	U_3-M_8	0.50 × (1.030 + 2×1.022)	= +1.537
	L_2-L_4	0.50 × (1.030 + 1.022)	= -1.026
Diagonal stress	U_1-L_2	0.50 × 1.435	= -0.718
	L_2-U_3	0.50 × 1.430	= +0.715
	U_3-L_4	0.50 × 1.430	= -0.715

Stresses due to dead load & live load

		Dead Load stress		Live Load stress	
U_1-U_3	+ 0.515 × 15,110 =	+ 7,780 - 7,530 = + 250	× 6,300 =	+ 3240 - 14,870 =	- 11,030
U_3-M_8	+ 1.537 × " =	+23220 - 7,530 = +15,690	× " =	+ 9,080 - 14,870 =	- 5,190
L_2-L_4	- 1.026 × " =	- 15,500	× " =	- 6,460	
U_1-L_2	- 0.718 × " =	- 10,850	× " =	- 4,520	
L_2-U_3	+ 0.715 × " =	+ 10,800	× " =	+ 4,500	
U_3-L_4	- 0.715 × " =	- 10,800	× " =	- 4,500	
L_4-M_8	+ 1.000 × " =	+ 15,110	× " =	+ 6,300	

Member	S.D.L.St. in kg.	S.L.L.St. in kg	L. Length in m.	A. Area in cm²	S̄	$\frac{\bar{S}L}{A}$	$\frac{\bar{S}S_DL}{A}$	$\frac{\bar{S}S_LL}{A}$
U_1-U_3	+250	-11,630	2.77	83.16	+0.515	+0.0017	+ 4	- 200
U_3-M_8	+15,690	- 5,190	1.38	83.16	+1.537	+0.0255	+400	- 132
L_2-L_4	-15,500	- 6,460	2.76	110.64	-1.026	-0.0255	+395	+ 165
U_1-L_2	-10,850	- 4,520	1.938	56.16	-0.718	-0.0248	+269	+ 112
L_2-U_3	+10,800	+ 4,500	1.931	56.16	+0.715	+0.0246	+266	+ 111
U_3-L_4	-10,800	- 4,500	1.931	56.16	-0.715	-0.0246	+266	+ 111
L_4-M_8	+ 7,555	+ 3,150	1.350	76.00	+1.000	+0.0178	+134	+ 56
							+1,734	+ 223

Deflection due to dead Load $\frac{1734 \times 1000}{2,100,000} \times 2 = 1.7^{mm}$

Deflection due to Live Load $\frac{223 \times 1000}{2,100,000} \times 2 = 0.2^{mm}$

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CALCULATIONS FOR

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昭和七年十一月

三重縣

揖斐長良橋変更設計

材料調書

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MADE BY M. J DATE FILE NO
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CALCULATIONS FOR

Materials of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

NO.	Description	Section in mm.	Length in mm.	Wt. of 1m in Kgs	Wt. of Main section in Kgs	Wt. of details in Kgs	Total Wts.
	Weight of Structural Steel for Span NO. 6						
			TOP CHORD				
	Same as ordinary span						54,757.8 Kgs.
			MIDDLE CHORD U1 - M2				
	Same as ordinary span						1,718.8 '
			M2 - M3				
	〃 〃 〃 〃						1,973.6 '
			M3 - M4				
	〃 〃 〃 〃						1,751.6 '
			M4 - M5				
	〃 〃 〃 〃						1,973.6 '
			M5 - M6 2-Req'd				
	〃 〃 〃 〃				2 e 382.8 =		765.6 '
			M6 - M7 2-Req'd				
	〃 〃 〃 〃				2 e 421.2 =		842.4 '
			M7 - M8 2-Req'd				
					2 e 320.2 =		640.4 '
			M5 - M6 & M6 - Mm7A 4-Req'd				
4	L's	150 * 90 * 9	4,280 '	16.32	279.4 '		
2	P/s	310 * 9	390 '	21.902 '		17.1 '	
14	Lac. bars	60 * 9	400 '	4.239 '		23.7 '	
					279.4 ' +	40.8 ' =	320.2 '
							4
			SPLICE AT M8 1-Req'd				1,280.8 '
					1 e 62.6 =		62.6 '
			Summary of Middle chords				11,009.4 Kgs
			BOTTOM CHORD L0 - L2				
	Same as ordinary span						11,544.8 '
			L2 - L4 2-Req'd				
					2 e 28,150 ' =		56,300 '
			L2 - L4A 2-Req'd				
4	L's	100 * 100 * 10	9,095 '	14.91 '	542.4 '		
2	P/s	470 * 10	8,475 '	36.895 '	625.4 '		
2	〃	〃 〃	9,095 '	〃 '	671.1 '		
2	〃	270 * 10	8,100 '	21.195 '	343.4 '		
2	〃	910 * 9	1,340 '	64.292 '		172.3 '	
1	P/	440 * 9	1,060 '	31.086 '		33.0 '	
1	〃	〃 〃	910 '	〃 '		28.3 '	
2	P/s	470 * 10	1,235 '	36.895 '		91.1 '	
2	〃	〃 〃	615 '	〃 '		45.4 '	
2	〃	450 * 10	615 '	35.325 '		43.4 '	
2	〃	350 * 9	535 '	24.728 '		26.5 '	
4	Fills	85 * 3	615 '	2.002 '		4.9 '	
2	〃	270 * 3	305 '	6.359 '		3.9 '	
1	P/	805 * 9	1,430 '	56.873 '		81.3 '	

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CALCULATIONS FOR

Material List of Ubi-Nagaragawa Bashi for mie ken (Remodeling design)

13	P/s	230	× 9	350	16.250	739		
1	Pl	510	× 10	655	36.032	236		
1	Fill	260	× 10	415	20.410	85		
1	〃	〃	〃	265	〃	54		
						2,1823 +	641.5 =	2,8238
							×	2
								5,647.6
				L4-L6	2-Reqd			
Same as ordinary span						2 c	2,8493 =	5,698.6
				L4-L6A	2-Reqd			
2	P/s	470	× 10	9,020	36.895	665.6		
2	〃	〃	〃	8325	〃	614.3		
4	L	100×100	× 10	9,020	14.900	537.6		
2	P/s	270	× 13	9,020	27.554	497.1		
2	〃	910	× 9	1,340	64.292		172.3	
2	〃	470	× 10	1,385	36.895		102.2	
2	〃	〃	〃	765	〃		56.4	
2	〃	450	× 13	765	45.923		70.3	
2	〃	350	× 9	535	24.728		26.5	
4	Fills	85	× 3	380	2.002		3.0	
1	Pl	440	× 9	1,060	31.086		33.0	
1	〃	〃	〃	910	〃		28.3	
1	〃	730	× 9	1,200	51.575		61.9	
1	〃	510	× 9	655	36.032		23.6	
13	P/s	230	× 9	350	16.250		73.9	
1	Fill	260	× 10	340	20.410		6.9	
1	〃	〃	〃	265	〃		5.4	
8	Fills	85	× 3	440	2.002		7.0	
						2,3146 +	670.7 =	2,9853
							×	2
								5,970.6
				L6-L7	2-Reqd			
Same as ordinary span						2 e	2,333.4 =	4,666.8
				L6-L7A	2-Reqd			
2	P/s	470	× 10	7,145	36.895	527.2		
2	〃	470	× 10	6,375	〃	470.4		
4	L	100×100	× 13	7,145	19,100	545.9		
2	P/s	270	× 13	7,145	27.554	393.7		
2	〃	910	× 9	970	64.292		124.7	
2	〃	1,100	× 9	1,200	77.715		186.5	
2	〃	470	× 10	1,385	36.895		102.2	
2	〃	470	× 10	765	〃		56.4	
2	〃	450	× 13	765	45.923		70.3	
2	〃	350	× 9	685	24.728		33.9	
1	Pl	655	× 9	1,120	46.276		51.8	
1	Fill	260	× 10	265	20.410		5.4	
7	P/s	230	× 9	350	16.250		39.8	
1	Pl	810	× 9	910	57.227		52.1	
1	Fill	260	× 10	285	20.410		5.8	
						1,937.2 +	728.9 =	2,666.1
							×	2
								5,332.2

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CALCULATIONS FOR

material list of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

			L7 - L7'	1 - Req'd			
Same as ordinary span							2,219.0
			L7 - L7'A	1 - Req'd			
4	L's	100 × 100 × 13	6,630	19.1	506.5		
2	P/s	470 × 10	6,630	36.895	489.2		
2	"	" "	5,860	"	432.4		
2	"	270 × 13	6,630	27.554	365.4		
							1,793.5
		DIAPHRAGM AT Lo					
Same as ordinary span							372.8
		DIAPHRAGM DM1		16-Req'd			
				16 @	43.1	=	689.6
		DIAPHRAGM DM2		13-Req'd			
				13 @	42.7	=	555.1
		DIAPHRAGM DM3		7 - Req'd			
4	L's	90 × 90 × 10	440	13.3	23.4		
1	P/	320 × 9	440	22.608	9.9		
					33.3		
					× 7		
							233.1
		Summary of Bottom chords					50,353.7
		VERTICAL L1 - U_{1L}^{R}					
Same as ordinary span							992.4
		$L_2 - M_2 - U_{2L}^{R}$					
"	"	"					1,689.2
"	"	"		$L_3-M_3, L_4-M_4, L_5-M_5, L_6-M_6, L_7-M_7, L_8-M_8$			17 - Req'd
				17 @	315.9	=	5,370.3
		$L_6 - M_6$ 月 $_L^R$		2 - Req'd			
4	L's	125 × 75 × 10	4,060	14.9	242.0		
1	P/	260 × 9	300	18.369	5.5		
2	P/s	900 × 9	1,190	63.585	151.3		
1	P/	385 × 9	870	27.200	23.7		
7	Lac. bars	70 × 9	430	4.946	14.9		
1	P/	385 × 9	1,590	27.200	43.2		
2	P/s	260 × 10	645	20.410	26.3		
					242.0	+ 264.9 =	506.9
						× 2	
							1,013.8

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CALCULATIONS FOR

Material list of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

			L7 - M7 A		2 - Req'd			
4	L's	125×75×10	7,235	14.9	431.2			
4	"	" "	6,595	"	393.0			
4	P/s	500 × 9	660	35.325		93.3		
2	"	" "	1,105	"		78.1		
2	"	970 × 9	1,200	68.531		164.5		
2	"	680 × 9	1,450	48.042		139.3		
2	"	385 × 9	870	27.200		47.3		
2	"	" "	390	"		21.2		
2	"	" "	1,120	"		60.9		
1	P/	" "	1,285	"		35.0		
1	"	280 × 9	385	19.782		7.6		
2	P/s	260 × 10	645	20.410		26.3		
28	Lac. bars	70 × 9	430	4.946		59.5		
					824.2	+ 733.0 =	1,557.2	
						× 2		
							3,114.4	
		FILLER FOR L4-M4, L6-M6, L8-M8			7 - Req'd			
	Same as ordinary span				7 @	5.6 =	39.2	
		Summary of Verticals					12,219.3 Kgs	
		DIAGONALS						
		U1 - L2						
	Same as ordinary span						1,347.6	
		L2-M3, M3-L4, L4-M5, M5-L6, L6-M7, M7-L8					20 - Req'd	
	" " "				20 @	345.6 =	6,912.0	
		M6 - M7 A			2 - Req'd			
2	L's	150×90× 9	5,275	16.3	172.0			
2	"	" "	5,115	"	166.7			
2	P/s	310 × 9	390	21.902		17.1		
17	Lac. bars	60 × 9	400	4.239		28.8		
					338.7	+ 45.9 =	384.6	
						× 2		
							769.2	
		M6 - L7 A			2 - Req'd			
4	L's	125×75×10	4,950	14.9	295.0			
2	P/s	340 × 9	385	24.021		18.5		
15	Lac. bars	70 × 9	430	4.946		31.9		
					295.0	+ 50.4 =	345.4	
						× 2		
							690.8	
		Summary of Diagonals					9,719.6 Kgs	
		SUSPENDERS						
		U3 - M3						
	Same as ordinary span						1,082.0	
		U4 - M_{4L}^{R}						
	" " "						1,514.0	

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

			U5 - M5 R L			
Same as ordinary			Span			1,835.6
			U6 - M6 R L		2 - Req'd	
"	"	"			2 @ 514.7 =	1,029.4
			U6 - M6 A R L		2 - Req'd	
4	L's	125 × 75 × 10	7,140	14.9	425.5	
1	P/	280 × 9	385	19.782	7.6	
1	"	385 × 9	390	27.200	10.6	
23	Lac bars	70 × 9	430	4.946	48.9	
					425.5 + 67.1 =	492.6
					× 2	
						985.2
			U7 - M7 R L		2 - Req'd	
Same as ordinary			Span		2 @ 547.9 =	1,095.8
			U7 - M7 A R L		2 - Req'd	
4	L's	125 × 75 × 10	4,455	14.9	265.5	
1	P/	280 × 9	385	19.782	7.6	
1	"	385 × 9	390	27.200	10.6	
12	Lac. bars	70 × 9	430	4.946	25.5	
					265.5 + 43.7 =	309.2
					× 2	
						618.4
			U8 - M8		1 - Req'd	559.6
			U8 - M8A		1 - Req'd	
4	L's	125 × 75 × 10	4,940	14.9	294.4	
1	P/	280 × 9	385	19.782	7.6	
1	"	385 × 9	390	27.200	10.6	
1	"	"	670	"	18.2	
2	L's	125 × 90 × 9	360	14.6	10.5	
14	Lac. bars	70 × 9	430	4.946	29.8	
					294.4 + 76.7 =	371.1
			Summary of Suspenders			9,091.1 Kgs
			PORTAL BRACING PBA		1 - Req'd	
4	L's	150 × 90 × 9	9,830	16.3	575.7	
4	"	125 × 75 × 10	4,280	14.9	255.1	
4	"	"	4,380	"	261.0	
2	P/s	385 × 9	4,280	27.200	232.8	
2	"	"	770	"	41.9	
2	"	325 × 9	385	22.961	17.7	
1	P/	385 × 9	3,730	27.200	101.5	
2	P/s	210 × 9	330	14.837	9.8	
8	Lac. bars	70 × 9	465	4.946	18.4	
2	P/s	270 × 9	395	19.076	15.1	
4	"	60 × 10	610	4.710	11.5	
2	"	240 × 9	590	16.956	20.0	
16	L's	90 × 75 × 9	1,055	11.0	185.7	
4	P/s	295 × 9	385	20.842	32.1	
4	"	220 × 9	385	15.543	23.9	

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Material List of Obi-Nagaragawa Bashi for mie Ken (Remodeling design)

4	Pls	140 × 9	385	9.891	15.2		
4	Ls	125×75×10	1,055	14.9	62.9		
1	Pl	270 × 9	385	19.076	7.3		
1	"	140 × 9	385	9.891	3.8		
1	"	385 × 9	430	27.200	11.7		
2	Ls	125×90× 9	360	14.6	10.5		
16	"	90×75× 9	1,330	11.0	234.1		
2	Pls	310 × 9	385	21.902	16.9		
6	"	210 × 9	385	14.837	34.3		
10	"	280 × 9	385	19.782	76.2		
8	Ls	90×75× 9	1,345	11.0	118.4		
4	Pls	340 × 9	545	24.021	52.4		
4	"	635 × 9	980	44.863	175.9		
2	"	400 × 9	980	28.260	55.4		
4	"	660 × 9	920	46.629	171.6		
4	"	340 × 9	495	24.021	47.6		
2	"	595 × 9	970	42.037	81.6		
					1,324.6 + 1,653.4	= 2,978.0	

PORTAL BRACING PB1 2-Req'd

Same as ordinary span 7,734.8

SWAY BRACINGS SB1, SB2, SB3, SB4 & SB5 9-Req'd

Same as ordinary span 7,097.4

GUSSET PLATE & CONNECTION ANGLES FOR SWAY BRACINGS

Same as ordinary span 425.7

TOP LATERAL BRACINGS

Same as ordinary span 4,993.0

Summary of sways, portals & Top Laterals 20,250.9 kg

LONGITUDINAL GIRDERS

LG 1 1- Req'd

1	Web Pl.	990 × 9	5,410	69.944	378.4		
2	" Pls	" "	1,815	"	253.9		
1	Cov. Pl.	210 × 10	4,790	16.485	79.0		
2	" Pls	" "	620	"	20.4		
2	" "	" "	1,510	"	49.8		
2	" "	" "	1,705	"	56.2		
1	" Pl.	" "	5,410	"	89.2		
4	Flg. Ls	150×100×12	5,410	22.400	484.7		
8	"	" "	1,820	"	326.1		
8	Ls	150×100×15	760	27.700		168.4	
4	Pls	260 × 12	690	24.492		67.6	
4	Ls	150×100× 9	970	17.0		66.0	
4	Flls	145 × 12	690	13.659		37.7	
12	Ls	90×75× 9	1,000	11.0		132.0	
2	"	" " "	976	"		21.5	
1	L	150×90× 9	976	16.3		15.9	
1	Fill	90 × 12	690	8.478		5.8	
1	L	90×90×10	1,000	13.3		13.3	
1	Fill	110 × 12	650	10.362		6.7	
4	Ls	90×75× 9	755	11.0		33.2	
2	"	" "	260	"		5.7	

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for mie ken (Remodeling design)

2	L's	90 × 75 × 9	725	11.000	16.0		
2	"	"	880	"	19.4		
1	L	"	815	"	9.0		
1	"	"	810	"	8.9		
2	P/s	620 × 9	910	43.803	79.7		
2	"	310 × 9	910	21.902	39.9		
1	P/	1,145 × 9	1,685	80.894	136.3		
1	"	230 × 10	260	18.055	4.7		
					1,737.7 +	887.7 =	2,625.4

LG 2 1 - Req'd

1	Web P/	1,010 × 9	9,360	71.357	667.9		
1	Flg L	100 × 100 × 10	9360	14.900	139.5		
1	"	" "	8,030	"	119.6		
1	"	150 × 100 × 9	9360	17.000	159.1		
9	L's	90 × 75 × 9	1,020	11.000		101.0	
9	L's	" "	265	"		26.2	
2	Fill's	660 × 20	1,010	103.620		209.3	
2	"	660 × 21	1,010	108.801		219.8	
					1,086.1 +	556.3 =	1,642.4

DIAPHRAGMS

D 1 7 - Req'd

2	L's	75 × 75 × 9	430	9.96		8.6	
1	P/	260 × 9	605	18.369		11.1	
						19.7	
						× 7.	
							137.9

D 2 2 - Req'd

2	L's	75 × 75 × 9	410	9.96		8.2	
1	P/	260 × 9	590	18.369		10.8	
						19.0	
						× 2	
							38.0

Summary of Longitudinal Girders 4,443.7 Kgs

END FLOOR BEAM FB 1 $_{L}^{R}$

Same as ordinary span 2,946.0

INTERMEDIATE FLOOR BEAM
FB 2, FB 3, FB 4, & FB 5 12 - Req'd

Same as ordinary span 12 @ 1,547.2 = 18,566.4

FB 2A $_{L}^{R}$ 2 - Req'd

4	L's	125 × 90 × 10	8,070	16,100	519.7		
1	Web Pl.	800 × 9	8,070	56.520	456.1		
2	Cov. P/s	280 × 11	5,810	24.178	280.9		
2	L's	150 × 100 × 9	1,045	17,000		35.5	
2	"	" "	1,085	"		36.9	
10	"	100 × 75 × 10	790	13,000		102.7	
8	"	75 × 75 × 9	810	9.96		64.5	
2	Fill's	145 × 10	240	11,383		5.5	
2	"	" "	280	"		6.4	

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

1	Fill	145 * 9	240	10.244		2.5		
1	"	" "	280	"		2.9		
2	Fills	220 * 10	625	17.270		21.6		
2	"	365 * 10	625	28.653		35.8		
1	Fill	215 * 9	625	15.190		9.5		
10	Fills	75 * 10	625	5.888		36.8		
10	"	100 * 10	300	7.850		23.6		
					1,256.7	+ 384.2	= 1,640.9	
							× 2	
							3,281.8	
			FB3A	1-Req'd				
4	L's	125 * 90 * 10	7,860	16.100	506.6			
1	Web P/.	800 * 9	7,860	56.520	444.6			
2	Cov. P/.	280 * 9	5,420	19.782	214.4			
2	L's	150 * 100 * 9	1,045	17.000		35.5		
1	L	" "	790	"		13.4		
10	L's	100 * 75 * 10	790	13.000		102.7		
8	L's	75 * 75 * 9	810	9.960		64.5		
2	Fills	145 * 10	240	11.383		5.5		
1	Fill	145 * 9	240	10.244		2.5		
2	Fills	220 * 10	625	17.270		21.6		
2	"	225 * 10	625	17.663		22.1		
10	"	75 * 10	625	5.888		36.8		
10	"	100 * 10	300	7.850		23.6		
					1,165.6	+ 328.2	= 1,493.8	
	BRACKETS R/L^R							
	same as ordinary span						137.0	
	BOTTOM LATERAL PLATE							
	" " "						608.9	
	Summary of Floor beams and Bracket						27,033.9 Kgs	
	STRINGERS S1 & S2 R/L^R							
	same as ordinary span						21,848.0 Kgs	
	BOTTOM LATERAL BRACINGS							
4	L's	150 * 150 * 11	5.555	24.95	554.4	LB1 R/L^R		
4	"	"	5.355	"	534.4			
4	"	"	5.705	"	569.4	LB2 R/L^R		
4	"	"	5.505	"	549.4			
8	"	"	5.705	"	1,138.7	LB3 R/L^R & LB4 R/L^R		
8	"	"	5.505	"	1,098.8			
8	"	130 * 130 * 9	5.690	17.73	807.1	LB5 R/L^R		
8	"	"	5.540	"	785.8			
6	"	100 * 100 * 10	5.655	14.91	505.8	LB6 R/L^R		
6	"	100 * 100 * 10	5.505	"	492.5			
2	"	"	5.110	"	152.4	LB6A R/L^R		
2	"	"	5.260	"	156.9			
32	"	150 * 100 * 9	205	17.02		111.7		
32	"	75 * 75 * 9	435	9.96		138.6		
16	P/s	170 * 9	200	12.011		38.4		
8	"	170 * 11	170	14.68		20.0		
8	"	150 * 10	170	11.755		16.0		
					7,345.6	+ 324.7	= 7,670.3	

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for Mieken (Remodeling design)

SHOES (same as ordinary span)
Summary of shoes 45524

CHECKERED PLATE FLOORING 1-Req'd

2	P/s	860 * 12	1,915	81.012	310.3		
2	"	" "	1,845	"	298.9		
24	L's	75*75*9	420	9.96	100.4		
16	bolts	19φ	240 @	0.99	15.8		
16	Gus pipe	1"φ	175 @	0.44	7.0		
16	bolts	19φ	45 @	0.41	6.6		
						739.0	

RIVET HEADS

50,500	shop rivet heads	22φ	@	0.09639	= 4867.7	
37,520	Field " "	"	@	"	= 3,616.6	
37,000	shop "	19φ	@	0.06464	= 2,391.7	
6,660	Field "	"	@	"	= 430.5	
						11,306.5

Summary for one span

Top chords	54,757.8		
Middle chords	11,009.4		
Bottom chords	50,353.7		
Virticals	12,219.3	150,128.9	
Diagonals	9,719.6		
Suspenders	9,091.1		
Portal Bracing	2,978.0		
Sway, portal & Top Bracing	20,250.9		
Longitudinal Girder	4,443.7		
Floor Beam & Bracket	27,033.9		
Stringers	21,848.0		
Bottom Laterals	7,670.3		
Checkered Plate flooring	739.0		
		232,114.7	
Rivet heads	11,306.5		
		243,421.2	
Shoes	45524.		
	247,973.6 kgs	or 247,974 Kg tons	

Summary of structural steel for the entire bridge.

Structural steel	Normal span	14 @	232,902.0 kg	= 3260,628	
	Special span	1 @	243,421.2	= 243,421	
				3504.049 Kg	
	Expan joints			11541.	
				3515,590	
Cast steel	for 15 spans	15 @	4552.4	= 68.286	
				3583.876 Kg	

Total weight of steel for Remodeled design or 3,583.876 Kg tons.
" " " " Original " 3573.351 "
Difference Increase = 10.525 "

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for Miken (Remodeling design)

Materials of Floor Slab
Concrete 1:2:4 Mixture

decreased Volume of concrete	.212 × .10 × 9.090	=	-.193	-.197
〃	2 @ .20 × .07 × .16		-.004	
Volume of the Previous design			1,423.744	
			1,423.547 cub.m	

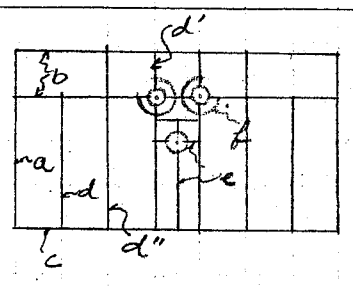
Forms

decreased area	.10 × 9.090	=	-.91	-3.52
〃	.07 × 9.720	=	-.68	
〃	.212 × 9.090	=	-193	
Area of the Previous design			8,135.70	
			8,132.18 sq.m	

Materials of handrails
Top Rail for $H4^{R}_{L}$

Volume	2.55 × 1.13 × 2 × .40	=	2961.5 cub m
Weight	0.00725 × 2961.5	=	21.5 Kgs

Grate for $H4^{R}_{L}$



a		=	1359
b	2.5 × 3 × 105 × 2	=	1575
c	2.5 × 4 × 105 × 1	=	1050
d	1.7 × 3 × 56 × 4	=	1142
d'	1.7 × 3 × 12 × 2	=	122
d"	2.0 × 3 × 68 × 2	=	816
e	1.5 × 3 × 47 × 1	=	212
e	1.5 × 3 × 14 × 1	=	63
e	1.7 × 3 × 14 × 1	=	71
f	1.5 × 3 × 7 × 6	=	189
	6,599 × 0.00725 = 47.8 Kgs		

Coping CCP^{R}_{L}
cast iron 97 Kgs.

Weight of handrails

	Mark	Reqd No.	Piece Wt.		Total Wt.
Top rail	H1	6	27.7	-	166.2
〃	$H4^{R}_{L}$	2	21.5	+	43.0
Grate	H1	6	56.3	-	337.8
〃	$H4^{R}_{L}$	2	47.8	+	95.6
Post	P1	5	33.4	-	167.0
〃	P2	2	33.4	+	66.8
Coping	CCP^{R}_{L}	2	97.0	+	194.0
					-271.6
Weight of Previous design					171,8596
					171,588.0 Kgs

Structural steel

Post cov. Pl	3	@	2.51	-	7.5
Anchor bolt 34cm	28	@	.37	-	10.4
Washer	14	@	.71	-	9.9
Bolts 12φ × 55	16	@	.30	+	4.8
〃 19φ × 50	4	@	.42	+	1.7
〃 19φ × 60	12	@	.46	+	5.5
Pls 440 × 12 × 450	2	@	18.65	+	37.3
					+21.5 Kgs

合計差引 250 kg 減

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CALCULATIONS FOR

Material List of Ibi-Nagaragawa Bashi for Mie Ken (Remodeling design)

Weight of Previous design 79909'
80124 kgs'

Summary of handrail for Final design 179,600.4 kgs'

Curb stone
decreased volume .20 × .15 × 9.38' = -0.281'
Volume of Previous design 65.986'
65.705 cub.m

Bracket for Lamp 1 set decreased

Lamp Bracket for North truss of the 6th span
2 set Required

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CALCULATIONS FOR

Middle Load
$M_7 - M_8$ Dl Thrust. = 11.477 @ 17200 = 197300 kg
load. 6~6' LL " = 5.349 @ 7000 = 37400
1.097 @ 4650 = 5100
42500 kg

$-\frac{7}{16} \cdot \frac{9 \times 4.55}{7.00}$
$= -7 \times .366$

DL. S_0 $-0.2844 \times 45 - 0.366 \times 21 = -12.80 - 7.68 = -20.48$
LL S_0 $-0.2844 \times 30 - 0.366 \times 6 = -8.53 - 2.195 = -10.725$

Stress.

$S_0 P_0 = -20.48 \times 17200 = -352000$
$S_0 P_L = -10.725 \times 7000 = -75100$
$-9 \times .2844 \times 4650 = -11900$
-439000

$S_a H_D = 1.691 \times 19730 = 33350$
$S_a H_L = 1.691 \times 42500 = 71900$
405400
-33600 kg.

$M_6 - M_7$.
Thrust. Dl. 197300
LL 6~6' 4 con. 42500
239800 kg

$-\frac{7}{16} \cdot \frac{9 \times 4.55}{5.00}$
$= -7 \times .461$

Dl. S_0 $-0.3587 \times 45 - 0.461 \times 21 = -16.14 - 9.68 = -25.82$
LL S_0 $-0.3587 \times 30 - 0.461 \times 6 = -10.75 - 2.765 = -13.515$

$S_0 P_D = -25.82 \times 17200 = -444000$
$S_0 P_L = -13.515 \times 7000 = -94600$
$-9 \times 0.3587 \times 4650 = -15000$
-553600

$S_a H = 2.134 \times 23980 =$ 511500
-42100 kg.

$M_6 - L_7$
Thrust Dl 197300
load 0'-7 LL 7.383 @ 7000 = 51700
1.096 @ 4650 = 5100
254100 kg.

$S_0 P$
Dl S_0 $-0.25624 \times 45 - 0.56373 \times 21 = -11.53 - 11.84 = -23.37$ @ 17200 $= -402000$
LL S_0 $-0.25624 \times 45 = -11.53 = -11.53$ @ 7000 $= -80700$
$-0.256 \times 9 = -2.32 = -2.02$ @ 4650 $= -10800$
-493500
497000
$+3500$ kg ?
(+25000 不足分)

$S_a H$ 1.957 @ 25400

$7.5 \times 36.4 = 2730$
$1 \times 4.55 \times 28 = -1275$
1455
$\frac{1455}{11.942} = \frac{12190}{12000} = 1.016$

$\frac{1455}{12.069} = \frac{12.06}{12.00} = 1.005$