昭和四年十二月

宮崎縣鹿狩戸橋設計々算書

増田淳氏関係資料
（独立行政法人 土木研究所蔵）

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyazaki Ken.

General layout of Bridge.

A spandrel Braced arch 12 panels @ 3.75 = 45.00 meters
2 side simple spans 2 spans @ 6.00 = 12.00
57.00 meters between end bearings.

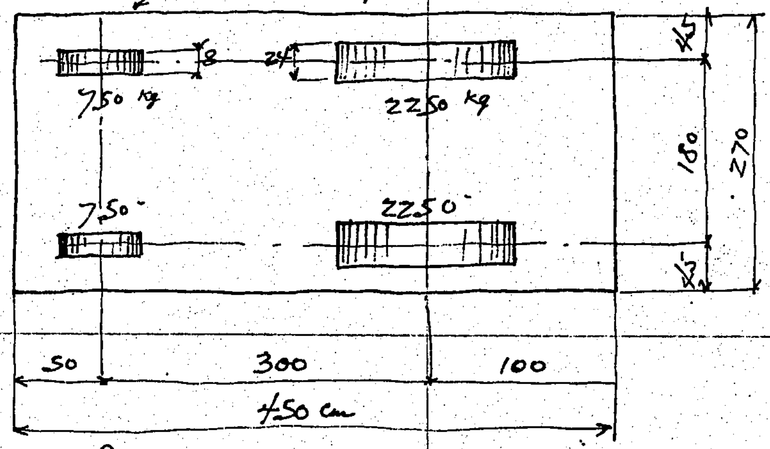
Assumed Loadings.

Uniform load on Roadway $w = \frac{100,000}{170+l} \leq 500$ kg/m²

where w = uniform load in kg. per sq meter.
l = Span length in meters.

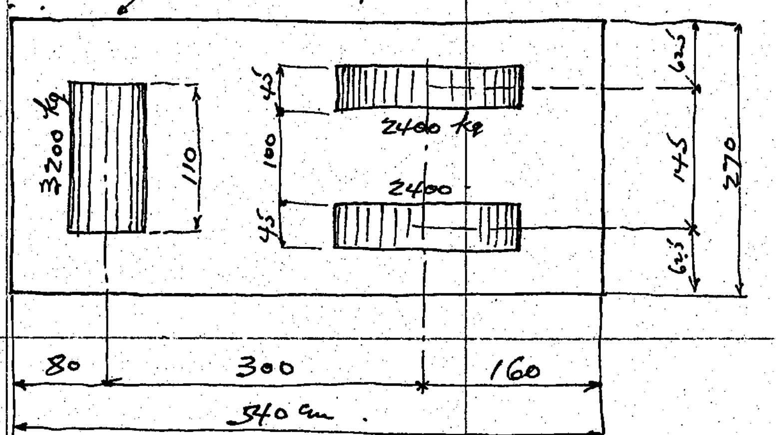
6 ton motor truck loading

Assumed occupied area



8 ton Road roller.

Assumed occupied area.



~~One~~ Two row of mortor traffic on roadway with occupied width of 270 cm: Unoccupied space around the motor truck shall be filled with uniform load specified above.
One road roller on span.
Impact for motor truck loading.

$Coef. = \frac{20}{60+l}$ where l = loaded length in meter
max. impact 30%.

No impact for road roller and uniform live load.

Allowable Working Strength.

Structural steel or Reinforcements

Tension net.	1,200 kg/cm²
Extreme fibre stress net	1200 〃
Shear ~~and~~ of web gross section	900 〃
Compression member $1500(1-0.0055\ l/r)$ not over	1000 〃

where l = length of member in cm
r = least radius of gyration in cm.

Compression flange of girder $1200(1-0.012\ l/b)$ not over	1,100 〃
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 〃
Rollers 45d. where d = diameter of roller in cm.	

Concrete. 1:2:4 mixture.

Direct compression	35 〃
Fibre stress due to bending	45 〃
Combined stress direct and bending	35 〃
Punching shear of concrete	9 〃
Shear of plain concrete	4 〃
Bearing	45 〃

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki Ken.

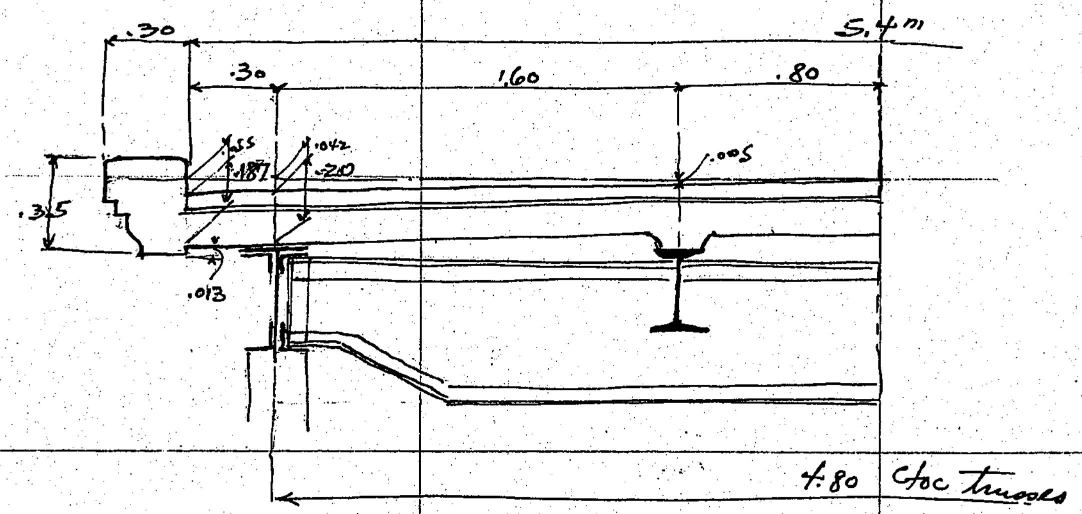
Bond stress for plain bars. 6 kg/cm
" " " deformed bars. 9 "

Considering wind or temperature stress in addition to dead, live and impact stress the allowable working strength shall be increased 25%. In case of earthquake increase unit stress 80 %

Seismic acceleration mm/sec^2.

Design of Arch span

Cross section of Bridge assumed as shown on sketch.



Design of Floor slab. Span length 1.60 meters.

Dead Load

pavement. 5cm asphalt-block.	@ 21^{kg} =	105	
2cm cement mortar cushion	@ 17^{kg} =	34	
Concrete slab 14^{cm}.	@ 24 =	336	revised to 13cm slab.
miscellaneous concrete say		15	
		490 kg per sq. meter.	

Dead Load moment = $\frac{1}{10} \times 490 \times 1.60^2$ = 125 kgm.
" " shear = $\frac{1}{2} \times 490 \times 1.60$ = 392 kg.

Live Load motor truck loading

Rear wheel 2250
Impact 30% 675
2925 kg

Front wheel 2925 ÷ 3 = 975 kg

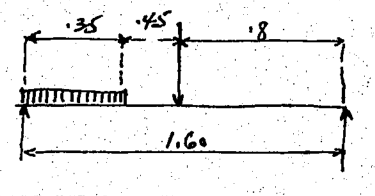
Distribution of wheel concentration

Contact between wheel and pavement 20
distribution 2×7 = 14
Longitudinal distribution a = 34 cm
Transverse distribution b = 24 + 14 = 38 cm

Effective width of slab $E = \frac{2}{3}l + a$ where l = span length in meter.
$= \frac{2}{3} \times 1.6 + .34 = 1.41$ meter.

Load per meter strip 2925 ÷ 1.41 = 2,070 kg

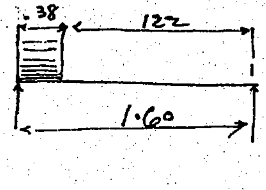
Uniform live load 500 kg per sq. meter.



Uniform load $\frac{500 \times .35^2}{2 \times 1.6} \times .80 = 15$
motor truck $\frac{2070}{2} \times .80 = 828$
843 kg meter.

for continuity of slab moment $= 843 \times \frac{8}{10} = 674$ kg meter.

End shear.



$2070 \times \frac{1.41}{1.60} = $ 1,810 kg.

Summary for moments and shears.

	moment	Shear
Dead Load	125	392
Live Load	674	1810
	799 kgm	2,202 kg

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki Ken.

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

$R = \frac{M}{bd^2}$ - $d = \sqrt{\frac{M}{bR}}$ ∙ $R = 7.18$ $d = \sqrt{\frac{799 \times 100}{100 \times 7.18}} = 10.6$ cm

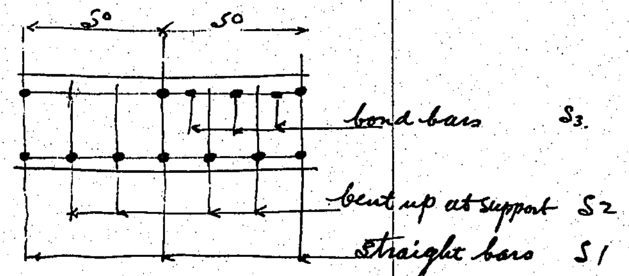
use 13 cm slab insulation at bottom 2.4 cm.

Steel area required $= \frac{799 \times 100}{1200 \times \frac{7}{8} \times 10.6} = 7.17$ cm² per meter strip.

Spacing for 13 mm φ bars. $= \frac{1.33 \times 100}{6.95\ 7.17} = 18.5$ cm use 16.7 cm spacing

Bond stress

total perimeter of reinforcements required $= \frac{2202}{6.0 \times \frac{7}{8} \times 10.6} = 39.5$ cm²



	dia	circumference		
S1	13 mm	4.08	× 2	= 8.16
S2	'	4.08	× 4	= 16.32
S3	9 mm	2.85	× 6	= 17.10
				41.58 cm.

Over hanging Slab
weight of coping and slab beyond truss.

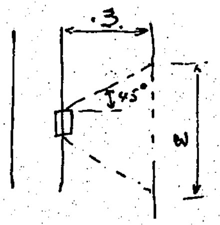
Coping $.15 \times .30 = .045 \times .15 = .00675$ wt. of coping $= .0875 \times 2400 = 210$ kg
$.05 \times .25 = .0125 \times .125 = .00156$
$.15 \times .20 = .0300 \times .10 = .00300$
$.0875$ m² $\times .13$ m $= .01131$

Slab and pavement $0.3 \times 490 = 147$ kg.
Handrail assume 40 kg per lin meter.

Dead Load moment				
coping	210	× .43	=	90.3
Slab & pav.	147	× .15	=	22.1
handrail	40	× .45	=	18.0
	397.			130.4 kgm.

Dead Load shear = 397 kg

Live Load. motor truck rear wheel concentration with impact = 2925 kg. wheel just on the curb line assumed
Effective width assumed $\Sigma = 2 \times .3 + .34 = .94$ m
Load per meter strip $= 2925 \div .94 = 3110$ kg
Live Load moment $= 3110 \times .3 = 933$ kgm.
" " shear $= 3,110$ kg.



Summary for moments and shears.

	moment	Shear
Dead Load	130	397
Live Load	933	3,110
	1063 kgm	3,507 kg

Effective depth reqd. $= \sqrt{\frac{1063 \times 100}{100 \times 7.18}} = 12.2$ cm use 14.5 cm slab.

Steel area reqd $= \frac{1063 \times 100}{1200 \times \frac{7}{8} \times 12.2} = 8.3$ cm²

Spacing for 13 mm φ bars $= \frac{1.33 \times 100}{8.3} = 16.0$ cm

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CALCULATIONS FOR

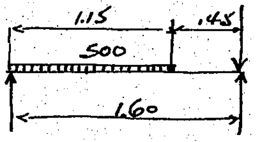
Design of Kagarito Bashi for Miyasaki ken.

Design of I beam stringer Span length 3.75 meters Spacing 1.6 meters.

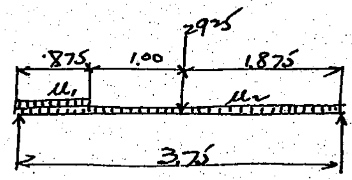
Dead Load
Floor slab and pavement 490 × 1.6 = 784
Beam assumed 40
uplift due to neg. moment 130 ÷ 1.6 = −81
743 kg per lin meter.

Dead Load moment $= \frac{1}{8} \times 743 \times 3.75^2 = 1305$ kgm.
Dead Load shear $= \frac{1}{2} \times 743 \times 3.75 = 1392$ kg.

Live Load
motor truck rear wheel with impact = 2925 kg
Uniform live load 500 kg per sq. meter.



Load on stringer $\frac{500 \times 1.15^2}{2 \times 1.6}$ = 207 kg = u_2
Full live load 500 × 1.6 = 800
593 kg = u_1



u_1 Reaction $\frac{593 \times .875^2}{2 \times 3.75}$ = 60.5 kg

moment due to motor truck $= \frac{2925}{2} \times 1.875 = 2740$
" " " u_2 $= \frac{1}{8} \times 207 \times 3.75^2 = 353$
" " " u_1 $= 60.5 \times \frac{3.75}{2} = 114$
3207 kgm.

End shear u_1 $\frac{2.75^2 \times 593}{2 \times 3.75}$ = 598
u_2 207 × 1.875 = 388
2925
3911 kg.

Summary for moments and shears.

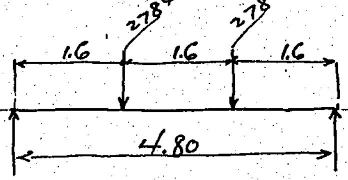
	Moments	Shears.
Dead Load	1305	1392
Live Load.	3207	3911
	4512 kgm.	5303 kg

Section modulus required $= \frac{4512 \times 100}{1100} = 410$ cm³.

Use I beam 250 × 125 @ 38.29 kg Sm. = 414.9 cm³ ok.

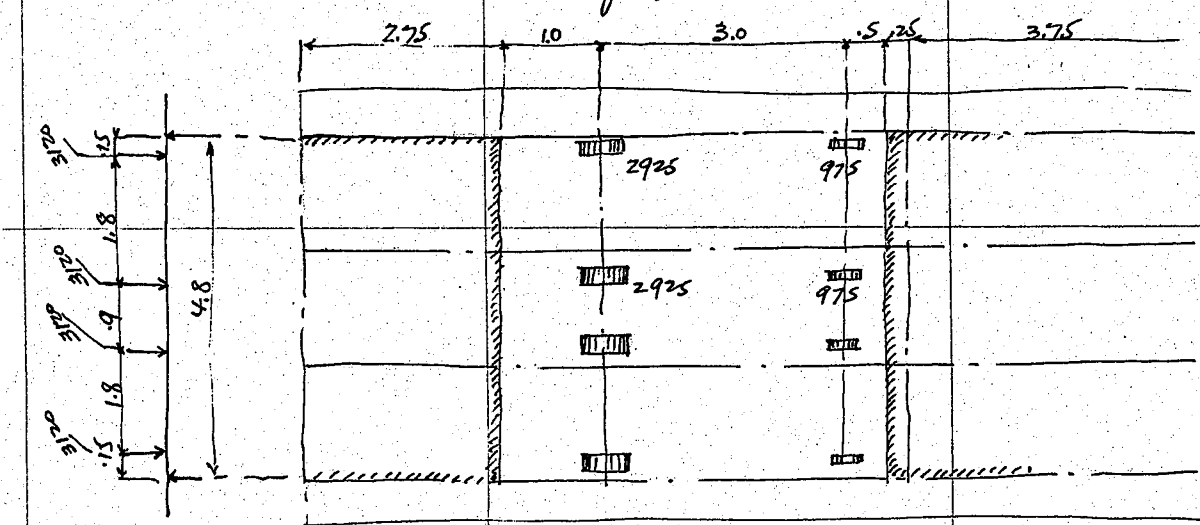
Design of Intermediate floor beams. Span length 4.80 meters, spacing 3.75 meters.

Dead Load.
Stringer concentration on floor beam = 2 × 1392 = 2784 kg.
moment due to stringer con. = 2784 × 1.6 = 4450 kgm
Beam assumed. 100 kg/m moment $= \frac{1}{8} \times 100 \times 4.8^2 = 288$
4738 kgm.



Dead Load shear 100 × 2.4 = 240
2784
3024 kg.

Live Load. motor truck rear wheel concentration with impact = 2925 kg.
" front wheel " " = 975.



Front wheel $975 \times \frac{.75}{3.75} = 195$
rear wheel 2925
3120 kg

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki Ken

moment due to motor truck wheels.

Reactions $3120 \times 2 = 6240$ kg

moment $6240 \times 1.95 = 12,160$

$3120 \times 1.80 = \underline{5620}$

$6,540$ Kgm.

moment due to Uniform live load. 500 kg per sq. meter.

Stringer concentration $500 \times 1.6 = 800$ kg/m.

$\frac{800 \times 2.75^2}{2 \times 3.75} = 807$

$\frac{800 \times 0.25^2}{2 \times 3.75} = \underline{7}$

814 kg.

moment $814 \times 1.6 = 1,303$ kgm.

Summary for moments and shears.

	moment	shear
Dead Load	4,738	3,024
Live Load	7,843	7,444
	12,581 Kgm.	10,468 kg

End shear.

$3120 \times \frac{(4.8+3.0+2.1+.3)}{4.8} = 6,630$ kg

Total shear $6630 + 814 = 7,444$ kg

Total moment $6540 + 1303 = 7843$ Kgm.

Depth assumed 51^{cm} b to b Ls

Effective depth say 46.5^{cm}

$\frac{1}{8}$ Web area $= 50 \times .8 \div 8 = 5.0^{cm^2}$

Flange stress $= \frac{12581 \times 100}{46.5} = 27,050^{kgs}$

Flange area req'd $= \frac{27050}{1200} = 22.6^{cm^2}$ net

$\frac{1}{8}$ web area $\underline{-5.0}$

17.60^{cm^2} net

use 2Ls $75 \times 75 \times 9 = 25.38 - 4.5 = 20.88^{cm^2}$

Use Same details for End floor Beams.

Approximate wt. of floor beam.

Flange Ls.	4Ls	75×75×9 @ 9.96 kg × 4.8	=	191 kg
1 web Pl.		500×8 @ 31.4 × 4.8	=	151
4 Shelf Ls		75×75×9 @ 9.96 × .15	=	6
4 stiff Ls		" " × .25	=	10
2 " Ls		" " × .51	=	10
4 conn. Ls		150×100×9 @ 16.32 × .49	=	32
4 fills		140×9 @ 9.89 × .35	=	14
Rivet heads + variations say				16
				430 kg

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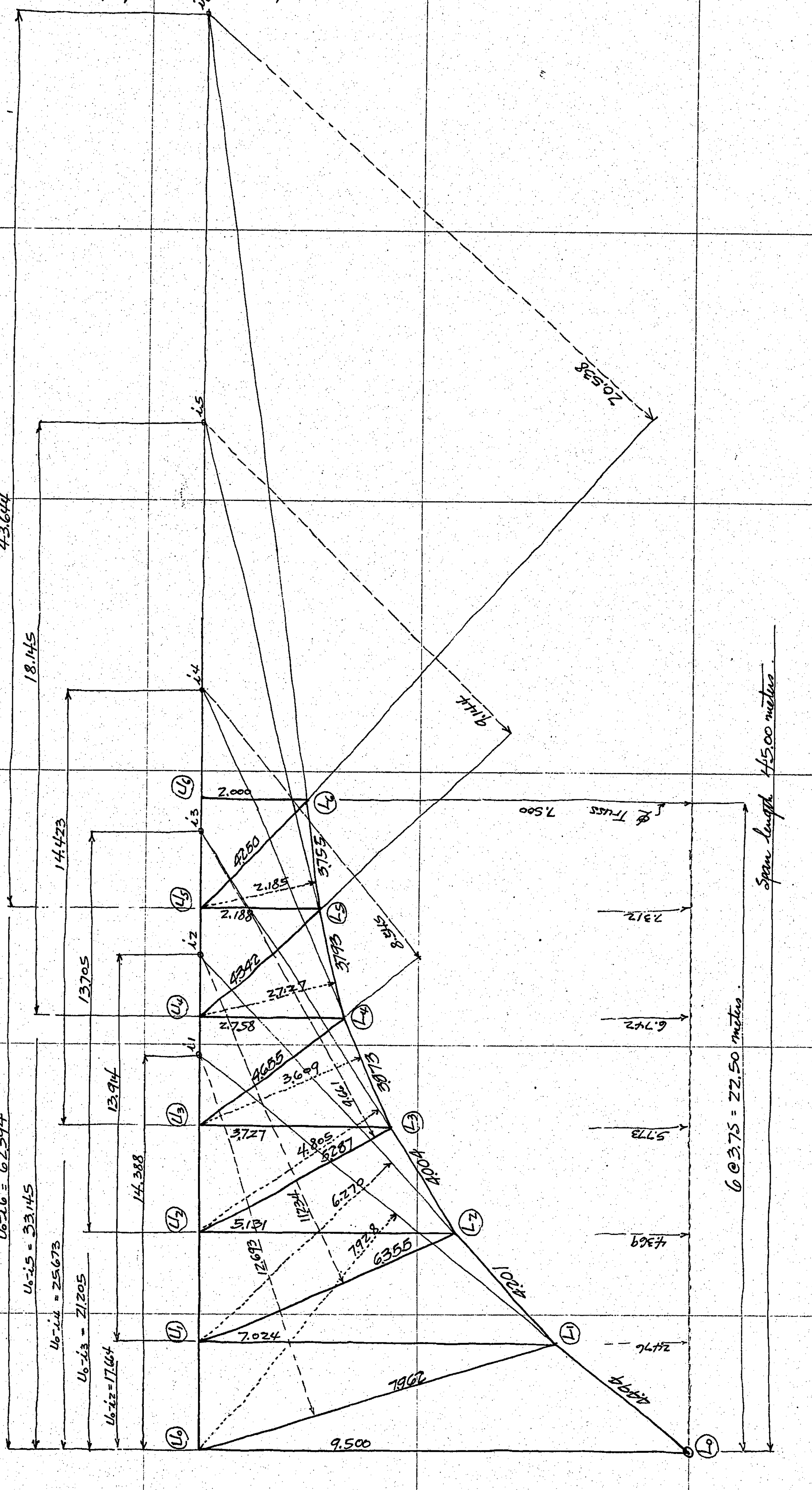
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Dimensions necessary for calculations of stresses.



Final Design of Kagarito Bashi for Miyasaki Ken.

Design of Arch truss.

Determination of H-Surface.

Foundamental formula $$H = P\frac{\Sigma S_0 S_1 \frac{L}{A}}{\Sigma S_1^2 \frac{L}{A}}$$

where H = Horizontal thrust due to a load P.

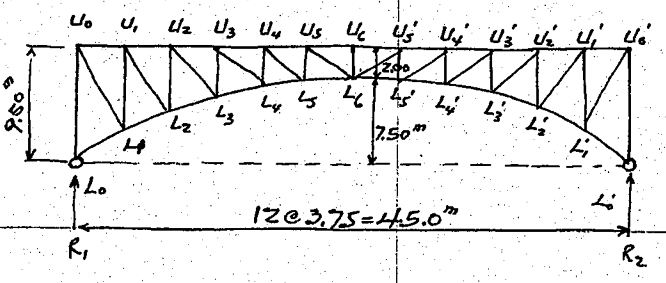
S_0 = Stress caused by the vertical load unity ($P=1$) if the arch is considered as a simple span

S_1 = Stress caused by the sole application of a horizontal force unity acting in the line of horizontal reaction but in opposite direction to the latter.

L = Length of member.

A = The area of member in gross section

Find So



Vertical reactions due to unity

Load at	Left reaction R_1	Right reaction R_2
1	11/12 = .917	1/12 = .083
2	10/12 = .833	2/12 = .167
3	9/12 = .750	3/12 = .250
4	8/12 = .667	4/12 = .333
5	7/12 = .583	5/12 = .417
6	6/12 = .500	6/12 = .500

Chord stresses

Load unity at panel pt. 1.

moment at	Reaction R_2	arm	moment	arm	Upper chord stress	arm	Lower chord stress.
1	0.083	41.25	3.424	7.024	U_0-U_1 = 0.487	6.270	L_1-L_2 = 0.546
2	"	37.50	3.113	5.131	U_1-U_2 = 0.607	4.805	L_2-L_3 = 0.648
3	"	33.75	2.801	3.727	U_2-U_3 = 0.752	3.609	L_3-L_4 = 0.776
4	"	30.00	2.490	2.758	U_3-U_4 = 0.903	2.727	L_4-L_5 = 0.913
5	"	26.25	2.179	2.188	U_4-U_5 = 0.996	2.185	L_5-L_6 = 0.997
6	"	22.50	1.868	2.000	$U_5-U_6-U_5'$ = 0.934		
5'	"	18.75	1.556	2.188	$U_4'-U_5'$ = 0.711	2.185	$L_5'-L_6'$ = 0.712
4'	"	15.00	1.245	2.758	$U_3'-U_4'$ = 0.451	2.727	$L_4'-L_5'$ = 0.456
3'	"	11.25	0.934	3.727	$U_2'-U_3'$ = 0.251	3.609	$L_3'-L_4'$ = 0.259
2'	"	7.50	0.623	5.131	$U_1'-U_2'$ = 0.121	4.805	$L_2'-L_3'$ = 0.130
1'	"	3.75	0.311	7.024	$U_0'-U_1'$ = 0.044	6.270	$L_1'-L_2'$ = 0.050

Load unity at panel pt. 2.

1	0.167	41.25 - 3.75	3.139	7.024	U_0-U_1 = 0.447	6.270	L_1-L_2 = 0.501
2	"	37.50	6.263	5.131	U_1-U_2 = 1.221	4.805	L_2-L_3 = 1.303
3	"	33.75	5.636	3.727	U_2-U_3 = 1.512	3.609	L_3-L_4 = 1.562
4	"	30.00	5.010	2.758	U_3-U_4 = 1.817	2.727	L_4-L_5 = 1.837
5	"	26.25	4.384	2.188	U_4-U_5 = 2.004	2.185	L_5-L_6 = 2.006
6	"	22.50	3.758	2.000	$U_5-U_6-U_5'$ = 1.879		
5'	"	18.75	3.131	2.188	$U_4'-U_5'$ = 1.431	2.185	$L_5'-L_6'$ = 1.433
4'	"	15.00	2.505	2.758	$U_3'-U_4'$ = 0.908	2.727	L_4' - [illegible] = 0.919
3'	"	11.25	1.879	3.727	$U_2'-U_3'$ = 0.504	3.609	$L_3'-L_4'$ = 0.521
2'	"	7.50	1.253	5.131	$U_1'-U_2'$ = 0.244	4.805	$L_2'-L_3'$ = 0.261
1'	"	3.75	0.626	7.024	$U_0'-U_1'$ = 0.089	6.270	$L_1'-L_2'$ = 0.100

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken.

Load unity at panel point 3.

Moment at	Reaction R_2	arm		moment	arm	Upper chord stress	arm	Lower chord stress.
1	0.250	41.25	-7.500	2.813	7.024	$U_0 - U_1$ = 0.400	6.270	$L_1 - L_2$ = 0.449
2	"	37.50	-3.750	5.625	5.131	$U_1 - U_2$ = 1.096	4.805	$L_2 - L_3$ = 1.171
3	"	33.75		8.438	3.727	$U_2 - U_3$ = 2.264	3.609	$L_3 - L_4$ = 2.338
4	"	30.00		7.500	2.758	$U_3 - U_4$ = 2.719	2.727	$L_4 - L_5$ = 2.750
5	"	26.25		6.563	2.188	$U_4 - U_5$ = 3.000	2.185	$L_5 - L_6$ = 3.004
6	"	22.50		5.625	2.000	$U_5 - U_6 - U_5'$ = 2.813		
5'	"	18.75		4.688	2.188	$U_4' - U_5'$ = 2.143	2.185	$L_5' - L_6'$ = 2.146
4'	"	15.00		3.750	2.758	$U_3' - U_4'$ = 1.360	2.727	$L_4' - L_5'$ = 1.375
3'	"	11.25		2.813	3.727	$U_2' - U_3'$ = 0.755	3.609	$L_3' - L_4'$ = 0.779
2'	"	7.50		1.875	5.131	$U_1' - U_2'$ = 0.365	4.805	$L_2' - L_3'$ = 0.390
1'	"	3.75		0.938	7.024	$U_0' - U_1'$ = 0.134	6.270	$L_1' - L_2'$ = 0.150

Load unity at panel point 4.

1	0.333	41.25	-11.25	2.486	7.024	$U_0 - U_1$ = 0.354	6.270	$L_1 - L_2$ = 0.396
2	"	37.50	-7.50	4.988	5.131	$U_1 - U_2$ = 0.972	4.805	$L_2 - L_3$ = 1.038
3	"	33.75	-3.75	7.489	3.727	$U_2 - U_3$ = 2.009	3.609	$L_3 - L_4$ = 2.075
4	"	30.00		9.990	2.758	$U_3 - U_4$ = 3.622	2.727	$L_4 - L_5$ = 3.663
5	"	26.25		8.741	2.188	$U_4 - U_5$ = 3.995	2.185	$L_5 - L_6$ = 4.000
6	"	22.50		7.493	2.000	$U_5 - U_6 - U_5'$ = 3.747		
5'	"	18.75		6.244	2.188	$U_4' - U_5'$ = 2.854	2.185	$L_5' - L_6'$ = 2.858
4'	"	15.00		4.995	2.758	$U_3' - U_4'$ = 1.811	2.727	$L_4' - L_5'$ = 1.832
3'	"	11.25		3.746	3.727	$U_2' - U_3'$ = 1.005	3.609	$L_3' - L_4'$ = 1.038
2'	"	7.50		2.498	5.131	$U_1' - U_2'$ = 0.487	4.805	$L_2' - L_3'$ = 0.520
1'	"	3.75		1.249	7.024	$U_0' - U_1'$ = 0.178	6.270	$L_1' - L_2'$ = 0.199

Load unity at panel point 5.

1	0.417	41.25	-15.00	2.201	7.024	$U_0 - U_1$ = 0.313	6.270	$L_1 - L_2$ = 0.351
2	"	37.50	-11.25	4.388	5.131	$U_1 - U_2$ = 0.855	4.805	$L_2 - L_3$ = 0.913
3	"	33.75	-7.50	6.574	3.727	$U_2 - U_3$ = 1.764	3.609	$L_3 - L_4$ = 1.827
4	"	30.00	-3.75	8.760	2.758	$U_3 - U_4$ = 3.176	2.727	$L_4 - L_5$ = 3.212
5	"	26.25		10.946	2.188	$U_4 - U_5$ = 5.003	2.185	$L_5 - L_6$ = 5.010
6	"	22.50		9.383	2.000	$U_5 - U_6 - U_5'$ = 4.692		
5'	"	18.75		7.819	2.188	$U_4' - U_5'$ = 3.574	2.185	$L_5' - L_6'$ = 3.578
4'	"	15.00		6.255	2.758	$U_3' - U_4'$ = 2.268	2.727	$L_4' - L_5'$ = 2.294
3'	"	11.25		4.691	3.727	$U_2' - U_3'$ = 1.259	3.609	$L_3' - L_4'$ = 1.300
2'	"	7.50		3.128	5.131	$U_1' - U_2'$ = 0.610	4.805	$L_2' - L_3'$ = 0.651
1'	"	3.75		1.564	7.024	$U_0' - U_1'$ = 0.223	6.270	$L_1' - L_2'$ = 0.249

Load unity at panel point 6.

1.	0.500	41.25	-18.75	1.875	7.024	$U_0 - U_1$ = 0.267	6.270	$L_1 - L_2$ = 0.299
2	"	37.50	-15.00	3.750	5.131	$U_1 - U_2$ = 0.731	4.805	$L_2 - L_3$ = 0.780
3	"	33.75	-11.25	5.626	3.727	$U_2 - U_3$ = 1.509	3.609	$L_3 - L_4$ = 1.559
4	"	30.00	-7.50	7.500	2.758	$U_3 - U_4$ = 2.719	2.727	$L_4 - L_5$ = 2.750
5	"	26.25	-3.75	9.375	2.188	$U_4 - U_5$ = 4.285	2.185	$L_5 - L_6$ = 4.291
6	"	22.50		11.250	2.000	$U_5 - U_6 - U_5'$ = 5.626		
5'	"	18.75		9.375	2.188	$U_4' - U_5'$ = 4.285	2.185	$L_5' - L_6'$ = 4.291
4'	"	15.00		7.500	2.758	$U_3' - U_4'$ = 2.719	2.727	$L_4' - L_5'$ = 2.750
3'	"	11.25		5.625	3.727	$U_2' - U_3'$ = 1.509	3.609	$L_3' - L_4'$ = 1.559
2'	"	7.50		3.750	5.131	$U_1' - U_2'$ = 0.731	4.805	$L_2' - L_3'$ = 0.780
1'	"	3.75		1.875	7.024	$U_0' - U_1'$ = 0.267	6.270	$L_1' - L_2'$ = 0.299

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（独立行政法人 土木研究所蔵）

JIUN MASUDA
CONSULTING ENGINEER
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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken

Stress S_0 for web members.

Load unity at panel pt. 1 Reaction R_1 = 0.917 , R_2 = 0.083

Moment about.	R_1	Dist. R_1 i	Product	-m	moment	lev. arm	Verticals	S_0	lev. arm	Diagonals	S_0
i_1	0.917	14.388	13.194	—	—		* U_0-L_0	0.917 C	12.693	U_0-L_1	1.039 T
i_2	,	17.664	16.198	13.914	2.284	13.914	U_1-L_1	* 1.164 C	11.234	U_1-L_2	0.203 T
i_3	,	21.205	19.445	17.455	1.990	13.705	U_2-L_2	0.145 C	9.661	U_2-L_3	0.206 T
i_4	,	25.673	23.542	21.923	1.619	14.423	U_3-L_3	0.112 C	8.545	U_3-L_4	0.189 T
i_5	,	33.145	30.394	29.395	0.999	18.145	U_4-L_4	0.055 C	9.144	U_4-L_5	0.109 T
i_6	,	62.394	57.215	58.644	-1.429	43.644	U_5-L_5	0.033 T	20.538	U_5-L_6	0.070 C
	R_2						U_6-L_6	0.000			
i'_6	0.083	62.394	5.179	—	—	43.644	U'_5-L'_5	0.119 C	20.538	U'_5-L'_6	0.252 T
i'_5	,	33.145	2.751	—	—	18.145	U'_4-L'_4	0.152 C	9.144	U'_4-L'_5	0.301 T
i'_4	,	25.673	2.131			14.428	U'_3-L'_3	0.148 C	8.545	U'_3-L'_4	0.249 T
i'_3	,	21.205	1.760			13.705	U'_2-L'_2	0.128 C	9.661	U'_2-L'_3	0.182 T
i'_2	,	17.664	1.466			13.914	U'_1-L'_1	0.105 C	11.234	U'_1-L'_2	0.130 T
i'_1	,	14.388	1.194				* U'_0-L'_0	0.083 C	12.693	U'_0-L'_1	0.094 T

Load unity at panel pt. 2. Reaction R_1 = 0.833 , R_2 = 0.167

i_1	0.833	14.388	11.985	—	—		U_0-L_0	0.833 C	12.693	U_0-L_1	0.944 T
i_2	,	17.664	14.714	—	—	13.914	U_1-L_1	1.057 C	11.234	U_1-L_2	1.310 T
i_3	,	21.205	17.664	13.705	3.959	13.705	U_2-L_2	* 1.289 C	9.661	U_2-L_3	0.410 T
i_4	,	25.673	21.386	18.173	3.213	14.423	U_3-L_3	0.223 C	8.545	U_3-L_4	0.376 T
i_5	,	33.145	27.610	25.645	1.965	18.145	U_4-L_4	0.108 C	9.144	U_4-L_5	0.215 T
i_6	,	62.394	51.974	54.894	-2.920	43.644	U_5-L_5	0.067 T	20.538	U_5-L_6	0.142 C
	R_2						U_6-L_6	0.000			
i'_6	0.167	62.394	10.420	—	—	43.644	U'_5-L'_5	0.239 C	20.538	U'_5-L'_6	0.507 T
i'_5	,	33.145	5.535	—	—	18.145	U'_4-L'_4	0.305 C	9.144	U'_4-L'_5	0.605 T
i'_4	,	25.673	4.287			14.423	U'_3-L'_3	0.297 C	8.545	U'_3-L'_4	0.502 T
i'_3	,	21.205	3.541			13.705	U'_2-L'_2	0.258 C	9.661	U'_2-L'_3	0.367 T
i'_2	,	17.664	2.950			13.914	U'_1-L'_1	0.212 C	11.234	U'_1-L'_2	0.263 T
i'_1	,	14.388	2.403				U'_0-L'_0	0.167 C	12.693	U'_0-L'_1	0.189 T

Load unity at panel pt. 3 . Reaction R_1 = 0.750, R_2 = 0.250

i_1	0.750	14.388	10.791			[illegible]	U_0-L_0	0.750 C	12.693	U_0-L_1	0.850 T
i_2	,	17.664	13.248			13.914	U_1-L_1	0.952 C	11.234	U_1-L_2	1.179 T
i_3	,	21.205	15.904			13.705	U_2-L_2	1.160 C	9.661	U_2-L_3	1.646 T
i_4	,	25.673	19.255	14.423	4.832	14.423	U_3-L_3	* 1.335 C	8.545	U_3-L_4	0.565 T
i_5	,	33.145	24.859	21.895	2.964	18.145	U_4-L_4	0.163 C	9.144	U_4-L_5	0.324 T
i_6	,	62.394	46.796	51.144	-4.348	43.644	U_5-L_5	0.100 T	20.538	U_5-L_6	0.212 C
	R_2						U_6-L_6	0.000			
i'_6	0.250	62.394	15.599			43.644	U'_5-L'_5	0.357 C	20.538	U'_5-L'_6	0.760 T
i'_5	,	33.145	8.286			18.145	U'_4-L'_4	0.457 C	9.144	U'_4-L'_5	0.906 T
i'_4	,	25.673	6.418			14.423	U'_3-L'_3	0.445 C	8.545	U'_3-L'_4	0.751 T
i'_3	,	21.205	5.301			13.705	U'_2-L'_2	0.368 C	9.661	U'_2-L'_3	0.549 T
i'_2	,	17.664	4.416			13.914	U'_1-L'_1	0.317 C	11.234	U'_1-L'_2	0.393 T
i'_1	,	14.388	3.597				U'_0-L'_0	0.250 C	12.693	U'_0-L'_1	0.283 T

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken.

Load unity at panel point 4. Reaction R1. =0.667, R_2= 0.333

i_1	0.667	14.388	9.597				U_0-L_0	0.667 C	12.693	U_0-L_1	0.756 T
i_2	,	17.664	11.782			13.914	U_1-L_1	0.847C	11.234	U_1-L_2	1.049T
i_3	,	21.205	14.144			13.705	U_2-L_2	1.032C	9.661	U_2-L_3	1.464T
i_4	,	25.673	17.124			14.423	U_3-L_3	1.187C	8.545	U_3-L_4	2.004T
i_5	,	33.145	22.108	18.145	3.963	18.145	U_4-L_4	* 1.218C	9.144	U_4-L_5	0.433T
i_6	,	62.394	41.617	47.394	-5.777	43.644	U_5-L_5	0.132T	20.538	U_5-L_6	0.281C
	R_2						U_6-L_6	0.000			
i'_6	0.333	62.394	20.777			43.644	$U'_5-L'_5$	0.476C	20.538	$U'_5-L'_6$	1.012T
i'_5	,	33.145	11.037			18.145	$U'_4-L'_4$	0.608C	9.144	$U'_4-L'_5$	1.207T
i'_4	,	25.673	8.549			14.423	$U'_3-L'_3$	0.593C	8.545	$U'_3-L'_4$	1.000T
i'_3	,	21.205	7.061			13.705	$U'_2-L'_2$	0.515C	9.661	$U'_2-L'_3$	0.731T
i'_2	,	17.664	5.882			13.914	$U'_1-L'_1$	0.423C	11.234	$U'_1-L'_2$	0.524T
i'_1	,	14.388	4.791				$U'_0-L'_0$	0.333C	12.693	$U'_0-L'_1$	0.377T

Load unity at panel pt. 5. Reaction R_1 = 0.583, R_2 = 0.417.

i_1	0.583	14.388	8.388			[illegible]	U_0-L_0	0.583C	12.693	U_0-L_1	0.661T
i_2	,	17.664	10.298			13.914	U_1-L_1	0.740 C	11.234	U_1-L_2	0.917T
i_3	,	21.205	12.363			13.705	U_2-L_2	0.902 C	9.661	U_2-L_3	1.280T
i_4	,	25.673	14.967			14.423	U_3-L_3	1.038 C	8.545	U_3-L_4	1.752T
i_5	,	33.145	19.324			18.145	U_4-L_4	1.065 C	9.144	U_4-L_5	2.113T
i_6	,	62.394	36.376	43.644	-7.268	43.644	U_5-L_5	0.833C	20.538	U_5-L_6	0.354C
	R_2						U_6-L_6	0.000			
i'_6	0.417	62.394	26.018			43.644	$U'_5-L'_5$	0.596C	20.538	$U'_5-L'_6$	1.267T
i'_5	,	33.145	13.821			18.145	$U'_4-L'_4$	0.762C	9.144	$U'_4-L'_5$	1.511T
i'_4	,	25.673	10.706			14.423	$U'_3-L'_3$	0.742C	8.545	$U'_3-L'_4$	1.253T
i'_3	,	21.205	8.842			13.705	$U'_2-L'_2$	0.645C	9.661	$U'_2-L'_3$	0.915T
i'_2	,	17.664	7.366			13.914	$U'_1-L'_1$	0.529C	11.234	$U'_1-L'_2$	0.656T
i'_1	,	14.388	6.000				$U'_0-L'_0$	0.417C	12.693	$U'_0-L'_1$	0.473T

Load unity at panel point 6. Reaction $R_1=R_2$=0.500

i_1	0.500	14.388	7.194				U_0-L_0	0.500 C	12.693	U_0-L_1	0.557T
i_2	,	17.664	8.832			13.914	U_1-L_1	0.635 C	11.234	U_1-L_2	0.786T
i_3	,	21.205	10.603			13.705	U_2-L_2	0.774 C	9.661	U_2-L_3	1.098T
i_4	,	25.673	12.837			14.423	U_3-L_3	0.890 C	8.545	U_3-L_4	1.502T
i_5	,	33.145	16.573			18.145	U_4-L_4	0.913 C	9.144	U_4-L_5	1.812T
i_6	,	62.394	31.197			43.644	U_5-L_5	0.715 C	20.538	U_5-L_6	1.519T
							U_6-L_6	1.000 C			
i'_6	,						$U'_5-L'_5$	0.715 C		U'_5-L_6	1.519T
i'_5	,						$U'_4-L'_4$	0.913 C		$U'_4-L'_5$	1.812T
i'_4	,						$U'_3-L'_3$	0.890C		$U'_3-L'_4$	1.502T
i'_3	,						$U'_2-L'_2$	0.774C		$U'_2-L'_3$	1.098T
i'_2	,						$U'_1-L'_1$	0.636 C		$U'_1-L'_2$	0.786T
i'_1	,						$U'_0-L'_0$	0.500C		$U'_0-L'_1$	0.557T

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Find S_1. Load unity at L_0 horizontally outward. + Sign Tension, − Sign Compression

Moment about.	moment	lever arm	members	S_1.	S_1^2	L	A	L/A	$S_1^2 L/A$	$S_1 L/A$
Top chord members.										
L_1	2.476	7.024	U_0-U_1 $U_0'-U_1'$	0.353 C	0.125	375.00	131.00	2.863	+ 0.358	− 1.011
L_2	4369	5.131	U_1-U_2 $U_1'-U_2'$	0.851 C	0.724	〃	〃	〃	+ 2.073	− 2.436
L_3	5.773	3.727	U_2-U_3 $U_2'-U_3'$	1.549 C	2.399	〃	〃	〃	+ 6.868	− 4.435
L_4	6.742	2.758	U_3-U_4 $U_3'-U_4'$	2.445 C	5.978	〃	〃	〃	+ 17.115	− 7.000
L_5	7.312	2.188	U_4-U_5 $U_4'-U_5'$	3.342 C	11.169	〃	〃	〃	+ 31.977	− 9.568
L_6	7.500	2.000	U_5-U_6 $U_5'-U_6'$	3.750 C	14.063	〃	〃	〃	+ 40.262	− 10.736
Lower chord members										
U_0	9.500	7.928	L_0-L_1 $L_0'-L_1'$	1.198 T	1.435	449.40	141.76	3.170	+ 4.549	+ 3.798
U_1	〃	6.270	L_1-L_2 $L_1'-L_2'$	1.515 T	2.295	420.10	〃	2.963	+ 6.800	+ 4.489
U_2	〃	4.805	L_2-L_3 $L_2'-L_3'$	1.977 T	3.909	400.40	〃	2.824	+ 11.039	+ 5.583
U_3	〃	3.609	L_3-L_4 $L_3'-L_4'$	2.632 T	6.927	387.30	〃	2.732	+ 18.925	+ 7.191
U_4	〃	2.727	L_4-L_5 $L_4'-L_5'$	3.484 T	12.138	379.30	〃	2.676	+ 32.481	+ 9.323
U_5	〃	2.185	L_5-L_6 $L_5'-L_6'$	4.402 T	19.378	375.50	〃	2.649	+ 51.332	+ 11.661
Vertical members.										
i_1	9.500	14.388	U_0-L_0 $U_0'-L_0'$	0.660 C	0.436	950.00	167.20	5.682	+ 2.477	− 3.750
i_2	〃	13.914	U_1-L_1 $U_1'-L_1'$	0.683 C	0.466	702.40	63.18	11.117	+ 5.181	− 7.593
i_3	〃	13.705	U_2-L_2 $U_2'-L_2'$	0.693 C	0.480	513.10	45.18	11.357	+ 5.451	− 7.870
i_4	〃	14.423	U_3-L_3 $U_3'-L_3'$	0.659 C	0.434	372.70	〃	8.249	+ 3.580	− 5.436
i_5	〃	18.145	U_4-L_4 $U_4'-L_4'$	0.524 C	0.275	275.80	〃	6.104	+ 1.679	− 3.198
i_6	〃	43.644	U_5-L_5 $U_5'-L_5'$	0.218 C	0.048	218.80	〃	4.843	+ 0.232	− 1.056
			U_6-L_6	0.000 C	0.000	200.00	〃	4.427	+ 0.000	− 0.000
Diagonal members.										
i_1	9.500	12.693	U_0-L_1 $U_0'-L_1'$	0.748 T	0.560	796.20	59.00	13.495	+ 7.557	+ 10.094
i_2	〃	11.234	U_1-L_2 $U_1'-L_2'$	0.846 T	0.716	635.50	59.00	10.771	+ 7.712	+ 9.112
i_3	〃	9.661	U_2-L_3 $U_2'-L_3'$	0.983 T	0.966	528.70	45.18	11.702	+ 11.304	+ 11.503
i_4	〃	$8.\overset{5}{8}45$	U_3-L_4 $U_3'-L_4'$	1.112 T	1.237	465.50	〃	10.303	+ 12.745	+ 11.457
i_5	〃	9.144	U_4-L_5 $U_4'-L_5'$	1.039 T	1.080	434.10	〃	9.608	+ 10.377	+ 9.983
i_6	〃	20.538	U_5-L_6 $U_5'-L_6'$	0.463 T	0.214	425.00	〃	9.407	+ 2.013	+ 4.355

Denominator $\Sigma S_1^2 \frac{L}{A}$ = 294.087×2 = 588.174

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Influence surface of Horizontal Thrust H.

Load unity at panel pt. 1					Load unity at panel pt 2			Load unity at panel pt. 3.			Load unity at panel pt. 4.		
Members	S_0	S_0 Sum	$S_1\frac{L}{A}$	$S_0S_1\frac{L}{A}$	S_0	S_0 Sum	$S_0S_1\frac{L}{A}$	S_0	S_0 Sum	$S_0S_1\frac{L}{A}$	S_0	S_0 sum	$S_0S_1\frac{L}{A}$
U_0-U_1	-0.487	-0.531	-1.061	0.537	-0.447	-0.536	0.542	-0.400	-0.534	0.540	-0.354	-0.532	0.538
$U_0'-U_1'$	-0.044				-0.089			-0.134			-0.178		
U_1-U_2	-0.607	-0.728	-2.436	1.773	-1.221	-1.465	3.569	-1.096	-1.461	3.559	-0.972	-1.459	3.554
$U_1'-U_2'$	-0.121				-0.244			-0.365			-0.487		
U_2-U_3	-0.752	-1.003	-4.435	4.448	-1.512	-2.016	8.941	-2.264	-3.019	13.389	-2.009	-3.014	13.367
$U_2'-U_3'$	-0.251				-0.504			-0.755			-1.005		
U_3-U_4	-0.903	-1.354	-7.000	9.478	-1.817	-2.725	19.075	-2.719	-4.079	28.553	-3.622	-5.433	38.031
$U_3'-U_4'$	-0.451				-0.908			-1.360			-1.811		
U_4-U_5	-0.996	-1.707	-9.568	16.333	-2.004	-3.435	32.866	-3.000	-5.143	49.208	-3.995	-6.849	65.531
$U_4'-U_5'$	-0.711				-1.431			-2.143			-2.854		
U_5-U_6	-0.934	-1.868	-10.736	20.055	-1.879	-3.758	40.346	-2.813	-5.626	60.401	-3.747	-7.494	80.456
$U_5'=U_6$	-0.934				-1.879			-2.813			-3.747		
L_0-L_1	0.000	0.000	+3.798	+0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$L_0'-L_1'$	0.000				0.000			0.000			0.000		
L_1-L_2	+0.546	+0.596	+4.489	+2.675	0.501	0.601	2.698	0.449	0.599	2.689	0.396	0.595	2.671
$L_1'-L_2'$	+0.050				0.100			0.150			0.199		
L_2-L_3	0.648	0.778	5.583	4.344	1.303	1.564	8.732	1.171	1.561	8.715	1.038	1.558	8.698
$L_2'-L_3'$	0.130				0.261			0.390			0.520		
L_3-L_4	0.776	1.035	7.191	7.443	1.562	2.083	14.979	2.338	3.117	22.414	2.075	3.113	22.386
$L_3'-L_4'$	0.259				0.521			0.779			1.038		
L_4-L_5	0.913	1.369	9.323	12.763	1.837	2.756	25.694	2.750	4.125	38.457	3.663	5.495	51.230
$L_4'-L_5'$	0.456				0.919			1.375			1.832		
L_5-L_6	0.997	1.709	11.661	19.929	2.006	3.439	40.102	3.004	5.150	60.054	4.000	6.858	79.971
$L_5'-L_6$	0.712				1.433			2.146			2.858		
U_0-L_0	-0.917	-1.000	-3.750	3.750	-0.833	-1.000	3.750	-0.750	-1.000	3.750	-0.667	-1.000	3.750
$U_0'-L_0'$	-0.083				-0.167			-0.250			-0.333		
U_1-L_1	-1.164	-1.269	-7.593	9.636	-1.057	-1.269	9.636	-0.952	-1.269	9.636	-0.847	-1.270	9.643
$U_1'-L_1'$	-0.105				-0.212			-0.317			-0.423		
U_2-L_2	-0.145	-0.273	-7.870	2.149	-1.289	-1.547	12.175	-1.160	-1.528	12.026	-1.032	-1.547	12.175
$U_2'-L_2'$	-0.128				-0.258			-0.368			-0.515		
U_3-L_3	-0.112	-0.260	-5.436	1.413	-0.223	-0.520	2.827	-1.335	-1.780	9.676	-1.187	-1.780	9.676
$U_3'-L_3'$	-0.148				-0.297			-0.445			-0.593		
U_4-L_4	-0.055	-0.207	-3.198	0.662	-0.108	-0.413	1.321	-0.163	-0.620	1.983	-1.218	-1.826	5.840
$U_4'-L_4'$	-0.152				-0.305			-0.457			-0.608		
U_5-L_5	+0.033	-0.086	-1.056	0.091	+0.067	-0.172	0.182	+0.100	-0.257	0.271	+0.132	-0.344	0.363
$U_5'-L_5'$	-0.119				-0.239			-0.357			-0.476		
U_6-L_6	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U_0-L_1	+1.039	+1.133	+10.094	11.437	+0.944	+1.133	11.437	+0.850	+1.133	11.437	+0.756	+1.133	11.437
$U_0'-L_1'$	+0.094				+0.189			+0.283			+0.377		
U_1-L_2	+0.203	+0.333	+9.112	3.034	+1.310	+1.573	14.333	+1.179	+1.572	14.324	+1.049	+1.573	14.333
$U_1'-L_2'$	+0.130				+0.263			+0.393			+0.524		
U_2-L_3	+0.206	+0.388	+11.503	4.463	+0.410	+0.777	8.938	+1.646	+2.195	25.249	+1.464	+2.195	25.249
$U_2'-L_3'$	+0.182				+0.367			+0.549			+0.731		
U_3-L_4	+0.189	+0.438	+11.457	5.018	+0.376	+0.878	10.059	+0.565	+1.316	15.077	+2.004	+3.004	34.417
$U_3'-L_4'$	+0.249				+0.502			+0.751			+1.000		
U_4-L_5	+0.109	+0.410	+9.983	4.093	+0.215	+0.820	8.186	+0.324	+1.230	12.279	+0.433	+1.640	16.372
$U_4'-L_5'$	+0.301				+0.605			+0.906			+1.207		
U_5-L_6	-0.070	+0.182	+4.355	0.793	-0.142	+0.365	1.590	-0.212	+0.548	2.387	-0.281	+0.731	3.184
$U_5'-L_6$	+0.252				+0.507			+0.760			+1.012		
			Sum =	146.317			281.978			406.073			512.872

$$H_1 = \frac{146.317}{588.174} = 0.249 \qquad H_2 = \frac{281.978}{588.174} = 0.479 \qquad H_3 = \frac{406.073}{588.174} = 0.690 \qquad H_4 = \frac{512.872}{588.174} = 0.872$$

増田淳氏関係資料
（独立行政法人 土木研究所蔵）

JIUN MASUDA
CONSULTING ENGINEER
SEIYU BLDG, TOKIO

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyazaki Ken.

Load unity at panel pt 5					Load unity at panel pt 6.		
Members.	$S_1 \frac{L}{A}$	S_0	S_0 sum	$S_0 S_1 \frac{L}{A}$	S_0	S_0 Sum	$S_0 S_1 \frac{L}{A}$
U_0-U_1	-1.011	0.313	0.536	0.542	0.267	0.534	0.540
$U_0'-U_1'$		0.223			0.267		
U_1-U_2	-2.436	0.855	1.465	3.569	0.731	1.462	3.561
$U_1'-U_2'$		0.610			0.731		
U_2-U_3	-4.435	1.764	3.023	13.407	1.509	3.018	13.385
$U_2'-U_3'$		1.259			1.509		
U_3-U_4	-7.000	3.176	5.444	38.108	2.719	5.438	38.066
$U_3'-U_4'$		2.268			2.719		
U_4-U_5	-9.568	5.003	8.577	82.065	4.285	8.570	81.998
$U_4'-U_5'$		3.574			4.285		
U_5-U_6	-10.736	4.692	9.384	100.747	5.626	11.260	120.780
$U_5'-U_6'$		4.692			5.626		
L_0-L_1	3.798	0.000	0.000	0.000	0.000	0.000	0.000
$L_0'-L_1'$		0.000			0.000		
L_1-L_2	4.489	0.351	0.600	2.693	0.299	0.598	26.84
$L_1'-L_2'$		0.249			0.299		
L_2-L_3	5.583	0.913	1.564	8.732	0.780	1.560	8.709
$L_2'-L_3'$		0.651			0.780		
L_3-L_4	7.191	1.822	3.122	22.450	1.559	3.118	22.422
$L_3'-L_4'$		1.300			1.559		
L_4-L_5	9.323	3.212	5.506	51.332	2.750	5.500	51.277
$L_4'-L_5'$		2.294			2.750		
L_5-L_6	11.661	5.010	8.588	100.145	4.291	8.582	100.075
$L_5'-L_6$		3.578			4.291		
U_0-L_0	-3.750	-0.583	1.000	3.750	-0.500	1.000	3.750
$U_0'-L_0'$		-0.417			-0.500		
U_1-L_1	-7.593	-0.740	1.269	9.636	-0.635	1.270	9.643
$U_1'-L_1'$		-0.529			-0.635		
U_2-L_2	-7.870	-0.902	1.547	12.175	-0.774	1.548	12.183
$U_2'-L_2'$		-0.645			-0.774		
U_3-L_3	-5.436	-1.038	1.780	9.676	-0.890	1.780	9.676
$U_3'-L_3'$		-0.742			-0.890		
U_4-L_4	-3.198	-1.065	1.827	5.843	-0.913	1.826	5.840
$U_4'-L_4'$		-0.762			-0.913		
U_5-L_5	-1.056	-0.833	1.429	1.509	-0.715	1.430	1.510
$U_5'-L_5'$		-0.596			-0.715		
U_6-L_6	0.000	0.000	0.000	0.000	-1.000	1.000	0.000
U_0-L_1	10.094	0.661	1.134	11.447	0.557	1.114	11.245
$U_0'-L_1'$		0.473			0.557		
U_1-L_2	9.112	0.917	1.573	14.333	0.786	1.572	14.324
$U_1'-L_2'$		0.656			0.786		
U_2-L_3	11.503	1.280	2.195	25.249	1.098	2.196	25.261
$U_2'-L_3'$		0.915			1.098		
U_3-L_4	11.457	1.752	3.005	34.428	1.502	3.004	34.417
$U_3'-L_4'$		1.253			1.502		
U_4-L_5	9.983	2.113	3.624	36.178	1.812	3.624	36.178
$U_4'-L_5'$		1.511			1.812		
U_5-L_6	4.355	-0.354	0.913	3.976	+1.519	3.038	13.230
$U_5'-L_6$		1.267			1.519		
			Sum =	591.990		Sum =	620.754

$$H_5 = \frac{591.990}{588.174} = 1.006$$

$$H_6 = \frac{620.754}{588.174} = 1.055$$

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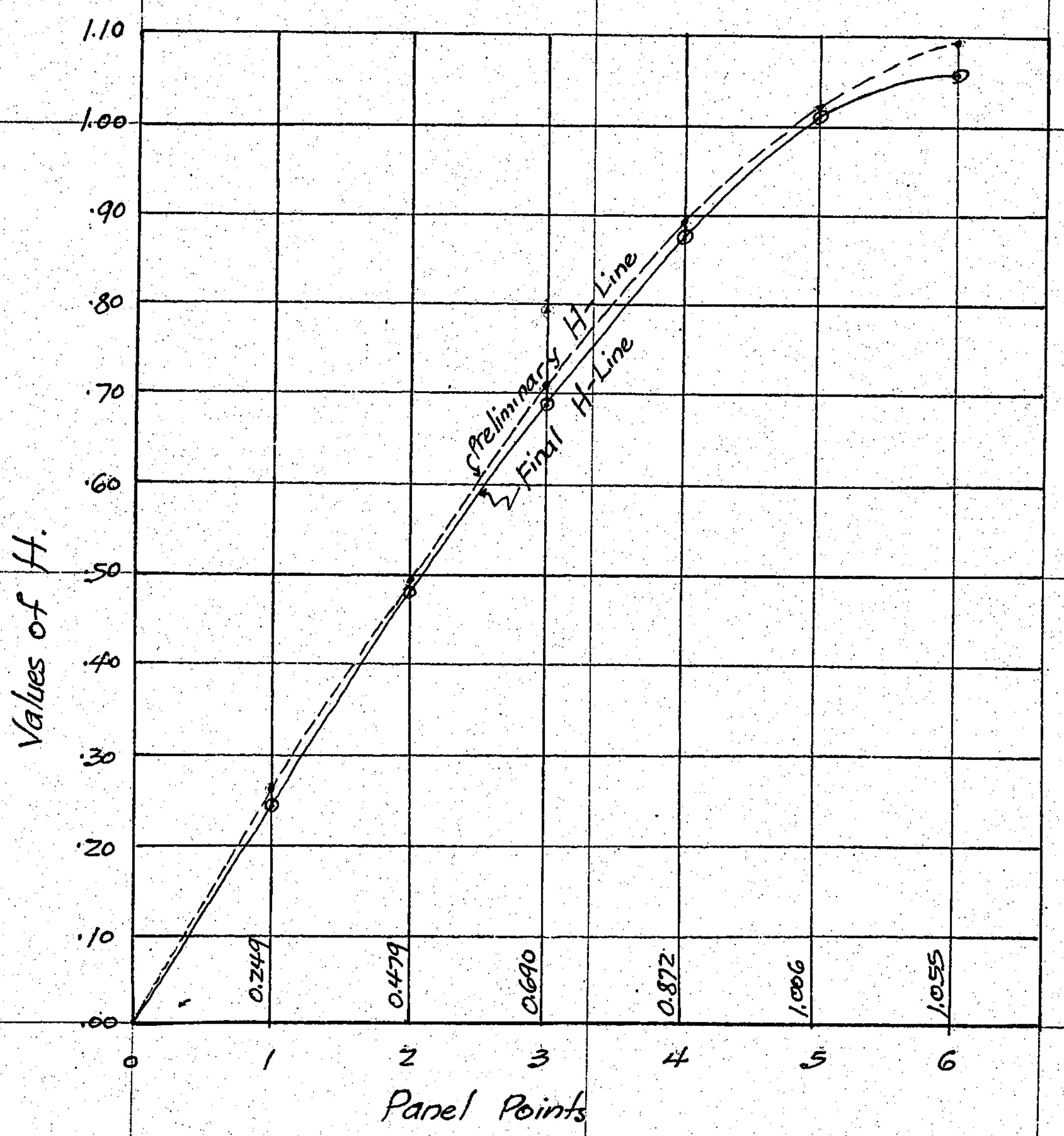
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Influence Line of Horizontal Thrust H.



Comparison of H. for Preliminary and Final Designs.

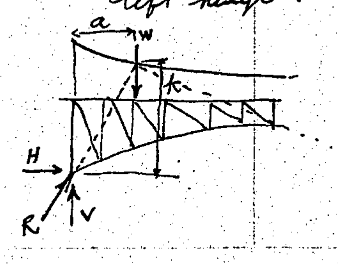
	Preliminary H.	Final H.	difference
Panel pt 1	0.262	0.249	0.013
〃 2	0.493	0.479	0.014
〃 3	0.704	0.690	0.014
〃 4	0.881	0.872	0.009
〃 5	1.012	1.006	0.006
〃 6	1.095	1.055	0.040
Summary for 1 span	7.799	7.647	0.152 ÷ 7.647 = 1.99 % of Final H.

Reaction Locus of the arch

$k = \frac{V_1}{H} . a$

where k = ordinate to the locus of R.
H = Horizontal component of R
V_1 = vertical 〃 〃
a = Distance of vert load from left hinge.

Panel pt.	V_1	H.	V_1/H	a.	k
1	0.917	0.249	3.6827	3.75	13.810
2	0.833	0.479	1.7390	7.50	13.043
3	0.750	0.690	1.0870	11.25	12.229
4	0.667	0.872	0.7649	15.00	11.474
5	0.583	1.006	0.5795	18.75	10.866
6	0.500	1.055	0.4739	22.50	10.663



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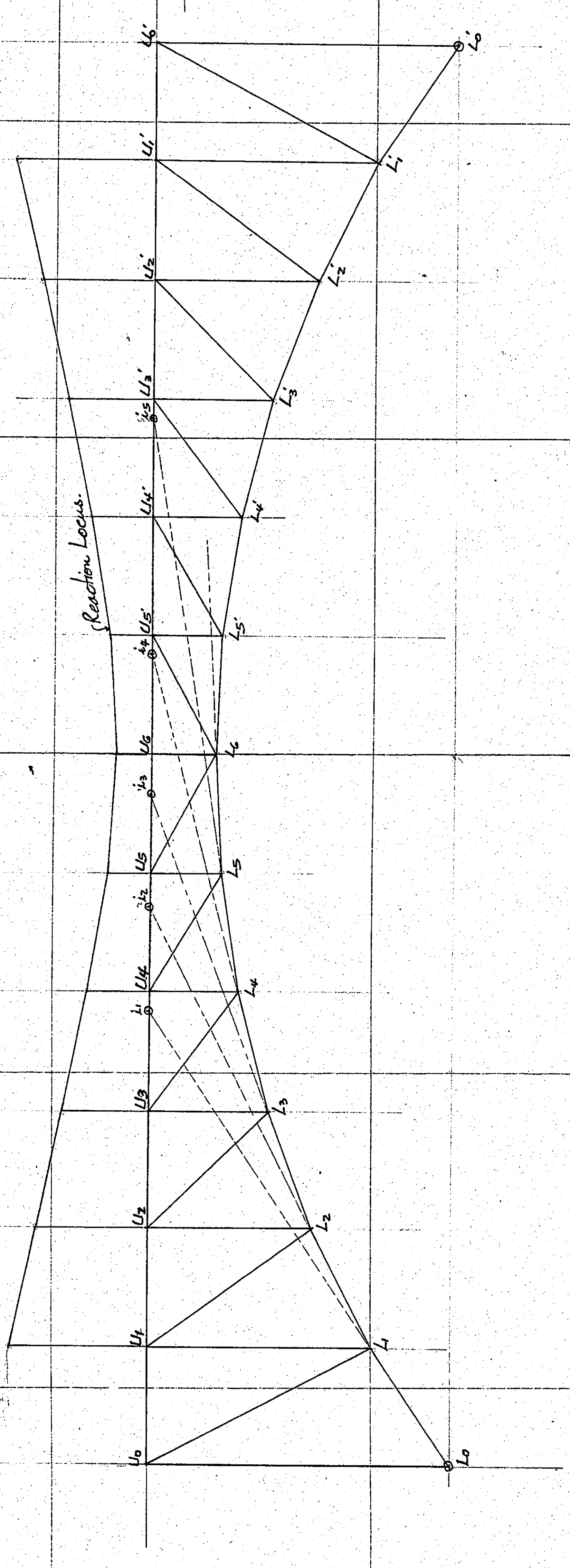
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken.

Reaction Locus diagram for the arch truss.

注意　本図表ハ Influence surface ヲ計算セズシテ各部材ノ最大應力ニ対スル Loading condition ヲ決定スルニ用フルモノナルヲ以テ此場合不必要ナルモ influence diagram ヲ Check スル参考ニ製作シタリ



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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken

Stress $-S_1H$ for each members.

member	$-S_1$	Panel pt. 1		Panel pt. 2.		Panel pt. 3		Panel pt. 4		Panel pt. 5		panel pt. 6	
		H	$-S_1H$	H	$-S_1.H.$	H	$-S_1H$	H	$-S_1H$	H	$-SH$	H	$-SH$
$U_0-U_1+U_0'U_1'$	+0.353	0.249	+0.088	0.479	+ 0.$\overset{169}{042}$	0.690	+0.244	0.872	+ 0.308	1.006	+ 0.355	1.055	+ 0.372
$U_1-U_2+U_1'-U_2'$	+ 0.851	〃	+0.212	〃	+ 0.408	〃	+ 0.587	〃	+ 0.742	〃	+ 0.856	〃	+ 0.898
$U_2-U_3+U_2'-U_3'$	+ 1.549	〃	+ 0.386	〃	+ 0.742	〃	+ 1.069	〃	+ 1.351	〃	+ 1.558	〃	+ 1.634
$U_3-U_4+U_3'-U_4'$	+ 2.445	〃	+0.609	〃	+ 1.171	〃	+ 1.687	〃	+ 2.132	〃	+ 2.460	〃	+ 2.590
$U_4-U_5+U_4'-U_5'$	+3.342	〃	+0.832	〃	+ 1.601	〃	+ 2.306	〃	+ 2.914	〃	+ 3.362	〃	+ 3.526
$U_5-U_6+U_5'-U_6'$	+3.750	〃	+0.934	〃	+ 1.796	〃	+ 2.588	〃	+ 3.270	〃	+ 3.773	〃	+ 3.956
$L_0-L_1+L_0'-L_1'$	- 1.198	〃	-0.298	〃	- 0.574	〃	- 0.827	〃	- 1.045	〃	- 1.205	〃	- 1.264
$L_1-L_2+L_1'-L_2'$	- 1.515	〃	-0.377	〃	- 0.726	〃	- 1.045	〃	- 1.321	〃	- 1.524	〃	- 1.598
$L_2-L_3+L_2'-L_3'$	- 1.977	〃	-0.492	〃	- 0.947	〃	- 1.364	〃	- 1.724	〃	- 1.989	〃	- 2.086
$L_3-L_4+L_3'-L_4'$	- 2.632	〃	-0.655	〃	- 1.261	〃	- 1.816	〃	- 2.295	〃	- 2.648	〃	- 2.777
$L_4-L_5+L_4'-L_5'$	- 3.484	〃	-0.868	〃	- 1.669	〃	- 2.404	〃	- 3.038	〃	- 3.505	〃	- 3.676
$L_5-L_6+L_5'-L_6$	- 4.402	〃	-1.096	〃	- 2.109	〃	- 3.037	〃	- 3.839	〃	- 4.428	〃	- 4.644
$U_0-L_0+U_0'-L_0'$	+ 0.660	〃	+0.164	〃	+ 0.316	〃	+0.455	〃	+ 0.576	〃	+ 0.664	〃	+ 0.696
$U_1-L_1+U_1'-L_1'$	+ 0.683	〃	+0.170	〃	+ 0.327	〃	+0.471	〃	+ 0.596	〃	+ 0.687	〃	+ 0.721
$U_2-L_2+U_2'-L_2'$	+ 0.693	〃	+0.173	〃	+ 0.332	〃	+ 0.478	〃	+ 0.604	〃	+ 0.697	〃	+ 0.731
$U_3-L_3+U_3'-L_3'$	+0.659	〃	+0.164	〃	+ 0.316	〃	+0.455	〃	+0.575	〃	+ 0.663	〃	+ 0.695
$U_4-L_4+U_4'-L_4'$	+0.524	〃	+0.130	〃	+ 0.251	〃	+0.362	〃	+ 0.457	〃	+ 0.527	〃	+ 0.553
$U_5-L_5+U_5'-L_5'$	+0.218	〃	+ 0.054	〃	+ 0.104	〃	+0.150	〃	+0.190	〃	+ 0.219	〃	+ 0.230
U_6-L_6+	+0.000	〃	+ 0.000	〃	+ 0.000	〃	+0.000	〃	+0.000	〃	+ 0.000	〃	+ 0.000
$U_0-L_1+U_0'-L_0'$	-0.748	〃	-0.186	〃	- 0.358	〃	-0.516	〃	+0.652	〃	- 0.752	〃	- 0.789
$U_1-L_2+U_1'-L_2'$	-0.846	〃	- 0.211	〃	- 0.405	〃	-0.584	〃	- 0.738	〃	- 0.851	〃	- 0.893
$U_2-L_3+U_2'-L_3'$	-0.983	〃	- 0.245	〃	- 0.471	〃	- 0.678	〃	- 0.857	〃	- 0.989	〃	- 1.037
$U_3-L_4+U_3'-L_4'$	- 1.112	〃	- 0.277	〃	- 0.533	〃	- 0.767	〃	- 0.970	〃	- 1.119	〃	- 1.173
$U_4-L_5+U_4'-L_5'$	- 1.039	〃	- 0.259	〃	- 0.498	〃	- 0.717	〃	- 0.906	〃	- 1.045	〃	- 1.096
$U_5-L_6+U_5'-L_6$	- 0.463	〃	- 0.415	〃	- 0.222	〃	- 0.319	〃	- 0.404	〃	- 0.466	〃	- 0.488

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Influence Surfaces of stress for truss members.
Chord members

	M_0-M_1.			M_1-M_2			M_2-M_3			M_3-M_4		
Panel pt.	S_o	$-S_1H$	S	S_o	$-S_1H$	S	S_o	$-S_1H$.	S	S_o	$-S_1H$	S.
1	-0.487	+0.088	-0.399	-0.607	+0.212	-0.395	-0.752	+0.386	-0.366	-0.903	+0.609	-0.294
2	-0.447	+0.169	-0.278	-1.221	+0.408	-0.813	-1.512	+0.742	-0.770	-1.817	+1.171	-0.646
3	-0.400	+0.244	-0.156	-1.096	+0.587	-0.509	-2.264	+1.069	-1.195	-2.719	+1.687	-1.032
4	-0.354	+0.308	-0.046	-0.972	+0.742	-0.230	-2.009	+1.351	-0.658	-3.622	+2.132	-1.490
5	-0.313	+0.355	+0.042	-0.855	+0.856	+0.001	-1.764	+1.558	-0.206	-3.176	+2.460	-0.716
6	-0.267	+0.372	+0.105	-0.731	+0.898	+0.176	-1.509	+1.634	+0.125	-2.719	+2.590	-0.129
5'	-0.223	+0.355	+0.132	-0.610	+0.856	+0.246	-1.259	+1.558	+0.299	-2.268	+2.460	+0.192
4'	-0.178	+0.308	+0.130	-0.487	+0.742	+0.255	-1.005	+1.351	+0.346	-1.811	+2.132	+0.321
3'	-0.134	+0.244	+0.110	-0.365	+0.587	+0.222	-0.755	+1.069	+0.314	-1.360	+1.687	+0.327
2'	-0.089	+0.169	+0.080	-0.244	+0.408	+0.164	-0.504	+0.742	+0.238	-0.908	+1.171	+0.263
1'	-0.044	+0.088	+0.044	-0.121	+0.212	+0.091	-0.251	+0.386	+0.135	-0.451	+0.609	+0.158
			-0.879			-1.947			-3.195			-4.307
			+0.643			+1.155			+1.457			+1.261
			-0.236			-0.792			-1.738			-3.046

	M_4-M_5			M_5-M_6			L_0-L_1			L_1-L_2		
1	-0.996	+0.832	-0.164	-0.934	+0.934	0.000	0.000	-0.298	-0.298	+0.546	-0.377	+0.169
2	-2.004	+1.601	-0.403	-1.879	+1.796	-0.083	,	-0.574	-0.574	+0.501	-0.726	-0.225
3	-3.000	+2.306	-0.694	-2.813	+2.588	-0.225	,	-0.827	-0.827	+0.449	-1.045	-0.596
4	-3.995	+2.914	-1.081	-3.747	+3.270	-0.477	,	-1.045	-1.045	+0.396	-1.321	-0.925
5	-5.003	+3.362	-1.641	-4.692	+3.773	-0.919	,	-1.205	-1.205	+0.351	-1.524	-1.173
6	-4.285	+3.526	-0.759	-5.625	+3.956	-1.669	,	-1.264	-1.264	+0.299	-1.598	-1.299
5'	-3.574	+3.362	-0.212	-4.692	+3.773	-0.919	,	-1.205	-1.205	+0.249	-1.524	-1.275
4'	-2.854	+2.914	+0.060	-3.747	+3.270	-0.477	,	-1.045	-1.045	+0.199	-1.321	-1.122
3'	-2.143	+2.306	+0.163	-2.813	+2.588	-0.225	,	-0.827	-0.827	+0.150	-1.045	-0.895
2'	-1.431	+1.601	+0.170	-1.879	+1.796	-0.083	,	-0.574	-0.574	+0.100	-0.726	-0.626
1'	-0.711	+0.832	+0.121	-0.934	+0.934	0.000	,	-0.298	-0.298	+0.050	-0.377	-0.327
			-4.954			-5.077			-9.162			-8.463
			+0.514			+0.000			+0.000			+0.169
			-4.440			-5.077			-9.162			-8.294

	L_2-L_3			L_3-L_4			L_4-L_5			L_5-L_6		
1	+0.648	-0.492	+0.156	+0.776	-0.655	+0.121	+0.913	-0.868	+0.045	+0.997	-1.096	-0.099
2	+1.303	-0.947	+0.356	+1.562	-1.261	+0.301	+1.837	-1.669	+0.168	+2.006	-2.109	-0.103
3	+1.171	-1.364	-0.183	+2.338	-1.816	+0.522	+2.750	-2.404	+0.346	+3.004	-3.037	-0.033
4	+1.038	-1.724	-0.686	+2.075	-2.295	-0.220	+3.663	-3.038	+0.626	+4.000	-3.839	+0.161
5	+0.913	-1.989	-1.076	+1.822	-2.648	-0.826	+3.212	-3.505	-0.293	+5.010	-4.428	+0.582
6	+0.780	-2.086	-1.306	+1.559	-2.777	-1.218	+2.750	-3.676	-0.926	+4.291	-4.644	-0.353
5'	+0.651	-1.989	-1.338	+1.300	-2.648	-1.348	+2.294	-3.505	-1.211	+3.578	-4.428	-0.850
4'	+0.520	-1.724	-1.204	+1.038	-2.295	-1.257	+1.832	-3.038	-1.206	+2.858	-3.839	-0.981
3'	+0.390	-1.364	-0.974	+0.779	-1.816	-1.037	+1.375	-2.404	-1.029	+2.146	-3.037	-0.891
2'	+0.261	-0.947	-0.686	+0.521	-1.261	-0.740	+0.919	-1.669	-0.750	+1.433	-2.109	-0.676
1'	+0.130	-0.492	-0.362	+0.259	-0.655	-0.396	+0.456	-0.868	-0.412	+0.712	-1.096	-0.384
			+0.512			+0.944			+1.184			+0.743
			-7.825			-7.042			-5.827			-4.370
			-7.303			-6.098			-4.643			-3.627

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Web members.

Panel pt.	Mo-Lo.			M1-L1			M2-L2			M3-L3		
	So	-SH	S	So	-HS1	S	So	-S1H	S	So	-S1H	S
1	-0.917	+0.164	-1.000 -0.753	-1.164	+0.170	-0.994	-0.145	+0.173	+0.028	-0.112	+0.164	+0.052
2	-0.833	+0.316	-0.517	-1.057	+0.327	-0.730	-1.289	+0.332	-0.957	-0.223	+0.316	+0.093
3	-0.750	+0.455	-0.295	-0.952	+0.471	-0.481	-1.160	+0.478	-0.682	-1.335	+0.455	-0.880
4	-0.667	+0.576	-0.091	-0.847	+0.596	-0.251	-1.032	+0.604	-0.428	-1.187	+0.575	-0.612
5	-0.583	+0.664	+0.081	-0.740	+0.687	-0.053	-0.902	+0.697	-0.205	-1.038	+0.663	-0.375
6	-0.500	+0.696	+0.196	-0.635	+0.721	+0.086	-0.774	+0.731	-0.043	-0.890	+0.695	-0.195
5'	-0.417	+0.664	+0.247	-0.529	+0.687	+0.158	-0.645	+0.697	+0.052	-0.742	+0.663	-0.079
4'	-0.333	+0.576	+0.243	-0.423	+0.596	+0.173	-0.515	+0.604	+0.089	-0.593	+0.575	-0.018
3'	-0.250	+0.455	+0.205	-0.317	+0.471	+0.154	-0.368	+0.478	+0.110	-0.445	+0.455	+0.010
2'	-0.167	+0.316	+0.149	-0.212	+0.327	+0.115	-0.258	+0.332	+0.074	-0.297	+0.316	+0.019
1'	-0.083	+0.164	+0.081	-0.105	+0.170	+0.065	-0.128	+0.173	+0.045	-0.148	+0.164	+0.016
			-1.656			-2.509			+0.398			+0.190
			+1.202			+0.751			-2.315			-2.159
			-0.454			-1.758			-1.917			-1.969

Panel pt.	M4-L4			M5-L5			M6-L6			M0-L1		
1	-0.055	+0.130	+0.075	+0.033	+0.054	+0.087	0.000	+0.000	0.000	+1.039	-0.186	+0.853
2	-0.108	+0.251	+0.143	+0.067	+0.104	+0.171	〃	〃	〃	+0.944	-0.358	+0.586
3	-0.163	+0.362	+0.199	+0.100	+0.150	+0.250	〃	〃	〃	+0.850	-0.516	+0.334
4	-1.218	+0.457	-0.761	+0.132	+0.190	+0.322	〃	〃	〃	+0.756	-0.652	+0.104
5	-1.065	+0.527	-0.538	-0.833	+0.219	-0.614	〃	〃	〃	+0.661	-0.752	-0.091
6	-0.913	+0.553	-0.360	-0.715	+0.230	-0.485	-1.000	〃	-1.000	+0.557	-0.789	-0.232
5'	-0.762	+0.527	-0.235	-0.596	+0.219	-0.377	0.000	〃	0.000	+0.473	-0.752	-0.279
4'	-0.608	+0.457	-0.151	-0.476	+0.190	-0.286	〃	〃	〃	+0.377	-0.652	-0.275
3'	-0.457	+0.362	-0.095	-0.357	+0.150	-0.207	〃	〃	〃	+0.283	-0.516	-0.233
2'	-0.305	+0.251	-0.054	-0.239	+0.104	-0.135	〃	〃	〃	+0.189	-0.358	-0.169
1'	-0.152	+0.130	-0.022	-0.119	+0.054	-0.065	〃	〃	〃	+0.094	-0.186	-0.092
			+0.417			+0.830			0.000			+1.877
			-2.216			-2.169			-1.000			-1.371
			-1.799			-1.339			-1.000			+0.506

Panel pt.	M1-L2			M2-L3			M3-L4			M4-L5		
1	+0.203	-0.211	-0.008	+0.206	-0.245	-0.039	+0.189	-0.277	-0.088	+0.109	-0.259	-0.150
2	+1.310	-0.405	+0.905	+0.410	-0.471	-0.061	+0.376	-0.533	-0.157	+0.215	-0.498	-0.283
3	+1.179	-0.584	+0.595	+1.646	-0.678	+0.968	+0.565	-0.767	-0.202	+0.324	-0.717	-0.393
4	+1.049	-0.738	+0.311	+1.464	-0.857	+0.607	+2.004	-0.970	+1.034	+0.433	-0.906	-0.473
5	+0.917	-0.851	+0.066	+1.280	-0.989	+0.291	+1.752	-1.119	+0.633	+2.113	-1.045	+1.068
6	+0.786	-0.893	-0.107	+1.098	-1.037	+0.061	+1.502	-1.173	+0.329	+1.812	-1.096	+0.716
5'	+0.656	-0.851	-0.195	+0.915	-0.989	-0.074	+1.253	-1.119	+0.134	+1.511	-1.045	+0.466
4'	+0.524	-0.738	-0.214	+0.731	-0.857	-0.126	+1.000	-0.970	+0.030	+1.207	-0.906	+0.301
3'	+0.393	-0.584	-0.191	+0.549	-0.678	-0.129	+0.751	-0.767	-0.016	+0.906	-0.717	+0.189
2'	+0.263	-0.405	-0.142	+0.367	-0.471	-0.104	+0.502	-0.533	-0.031	+0.605	-0.498	+0.107
1'	+0.130	-0.211	-0.081	+0.182	-0.245	-0.063	+0.249	-0.277	-0.028	+0.301	-0.259	+0.042
			+1.877			+1.927			+2.160			+2.889
			-0.938			-0.596			-0.522			-1.299
			+0.939			+1.331			+1.638			+1.590

Panel pt.	M5-L6		
1	-0.070	-0.115	-0.185
2	-0.142	-0.222	-0.364
3	-0.212	-0.319	-0.531
4	-0.281	-0.404	-0.685
5	-0.354	-0.466	-0.820
6	+1.519	-0.488	+1.031
5'	+1.267	-0.466	+0.801
4'	+1.012	-0.404	+0.608
3'	+0.760	-0.319	+0.441
2'	+0.507	-0.222	+0.285
1'	+0.252	-0.115	+0.137
			+3.303
			-2.585
			+0.718

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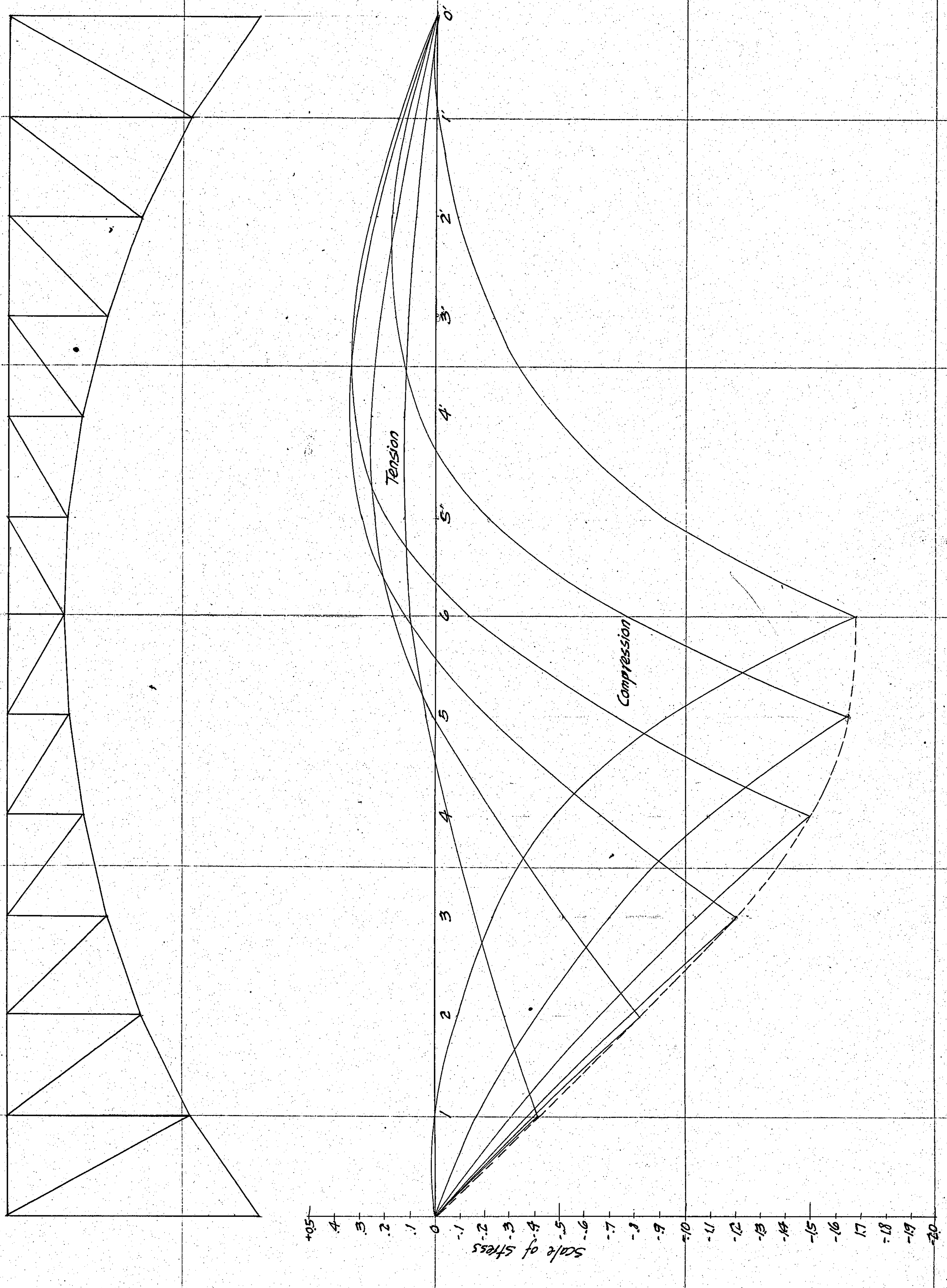
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken.
Influence Diagrams of stresses for truss members.
Upper chord members.



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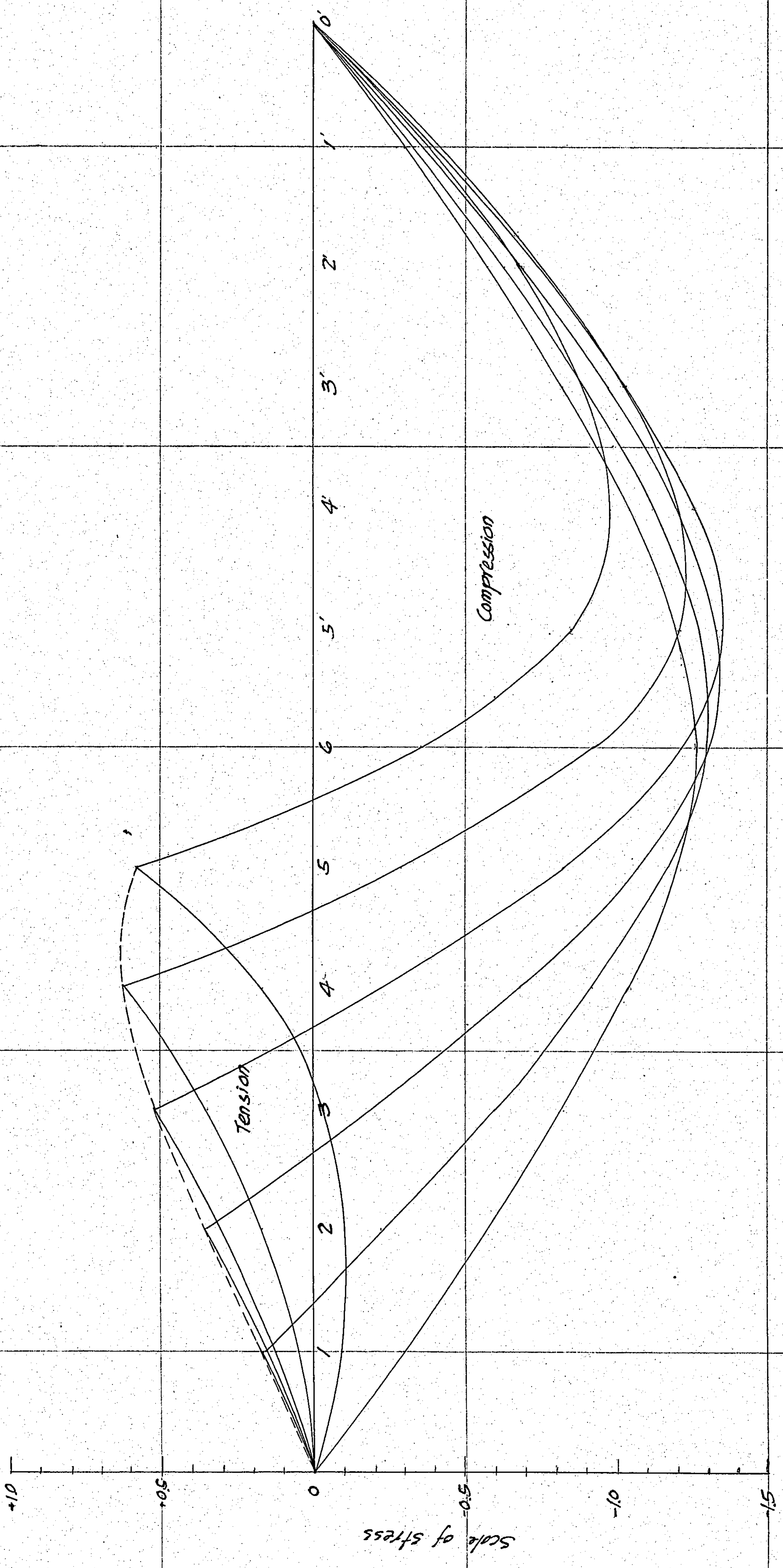
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken
Lower Chord members



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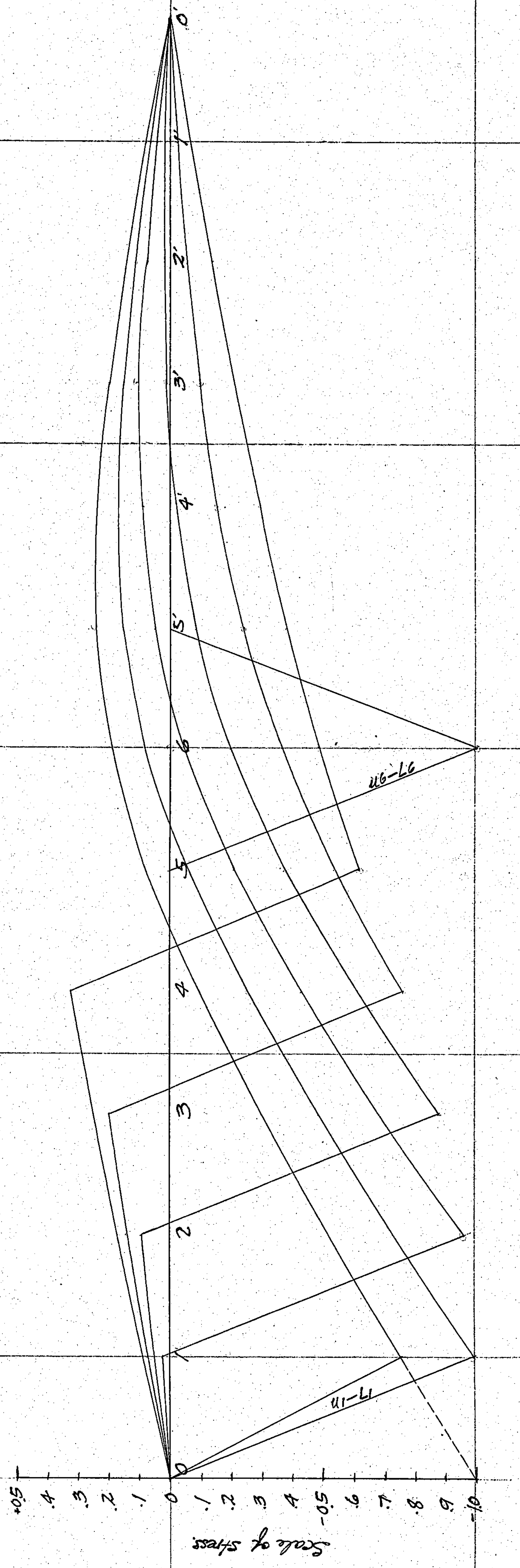
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyazaki ken.

Vertical members.



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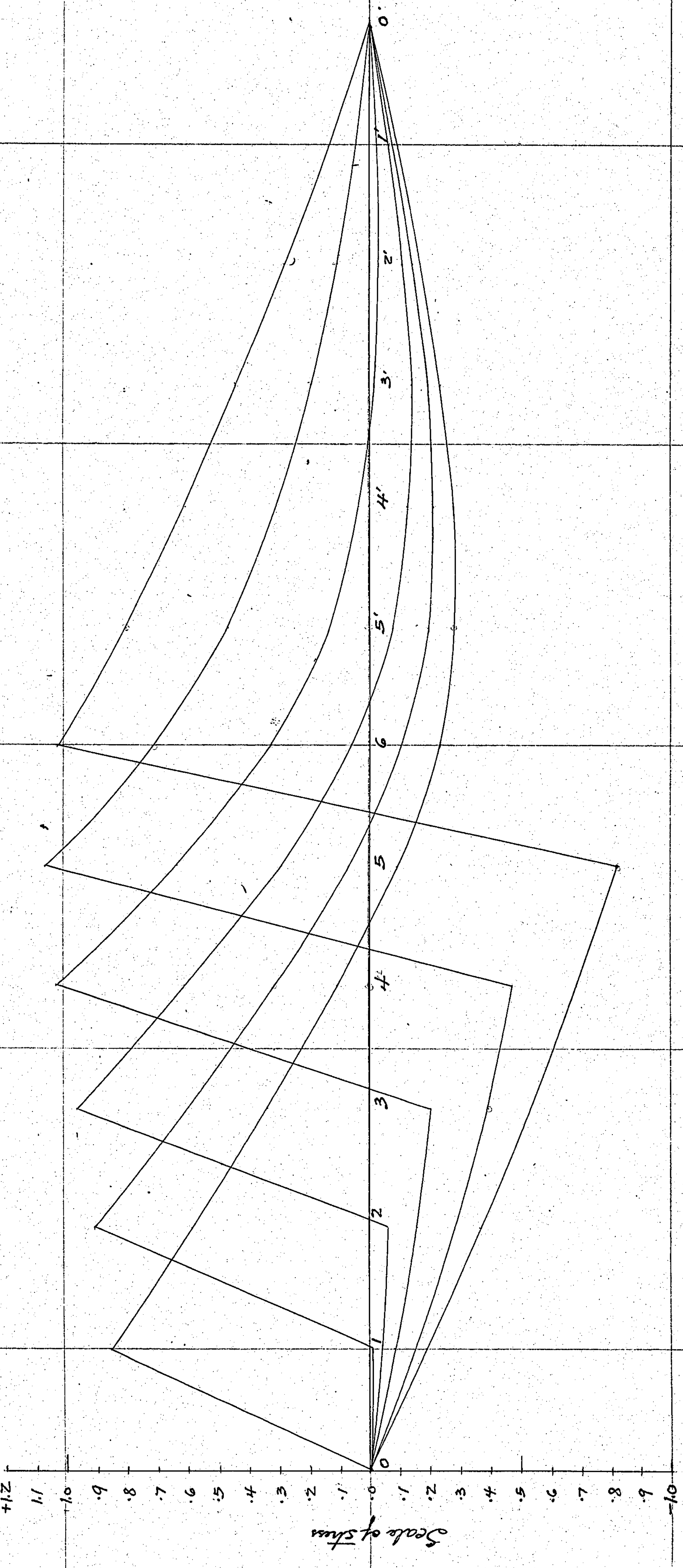
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.
Diagonal members.



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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Stresses of truss members.

Panel Dead Load for one truss.

Floor	Slab and pavement	2.7 @ 490 =	1323
	Coping		210
	Stringers		42
	Floor beams		63
	lateral bracings + sways.		120
	handrail.		40
main truss			485
	Shoes +c say		22
			2,305 kg per lin meter.

Panel load = 2305 × 3.75 = 8650 kg

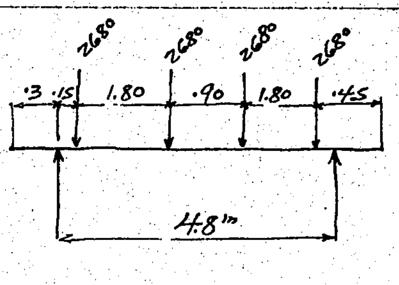
Panel Live Load.

motor truck rear wheel concentration = 2,250 kg

Impact coefficient = $\frac{20}{60+45}$ = 19.1% or 430

2680 kg

front wheel concentration with impact say $\frac{1}{3}$ × 2680 = 900 kg



wheel concentration on main truss.

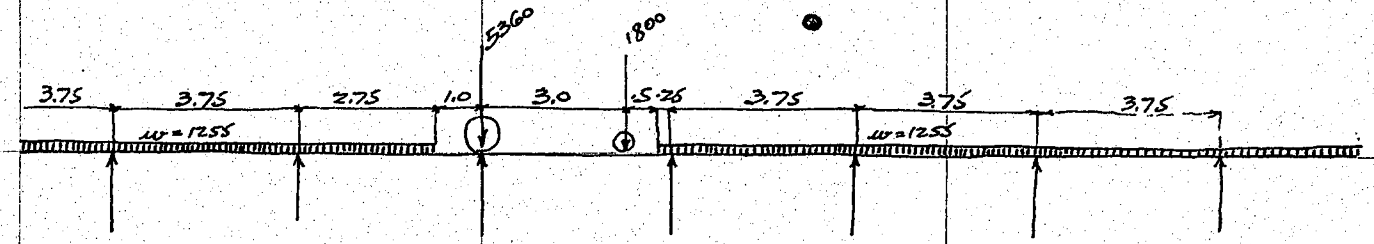
Rear wheel 2@ 2680 = 5360 kg

Front wheel 2@ 900 = 1,800 "

Uniform live load.

w = $\frac{100,000}{170+45}$ = 465 kg per sq. meter.

or 2.70 × 465 = 1,255 kg per lin meter.



5360 0

4700 ...... 2350 360 1440

2185 1265

10 305

2350 ...... 4700 ...... 4700 4700

4,700 4,535 6,995 4,095 4,700 4,700 4,700

assume live panel loads as follows:-

4,700 kg 4,700 kg {4700 kg, 1,800} 4,700 kg 4,700 kg 4,700 kg 4,700 kg

Live Load for member U_6-L_6 and for calculating bending stresses of top chord members

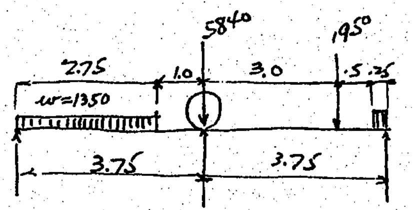
motor truck rear wheel concentration = 2,250

Impact coef. = $\frac{20}{60+7.5}$ = 29.7% = 670

2,920 × 2 = 5,840 kg

front wheel concentration with impact = 5840 ÷ 3 = 1,950 "

Unif. load 500 × 2.7 = 1350 kg/m



Rear wheel 5,840

front wheel 1950 × $\frac{.75}{3.75}$ = 390

Unif. load. 1350 × $\frac{2.75^2}{2×3.75}$ = 1360

" 1350 × $\frac{.25^2}{2×3.75}$ = 10

L.L. for U_6-L_6 only = 7,600 kg

for bending stress of top chord member.

wheel concentration say ~~2,680~~ 2,920 kg

unif. load say 500 × 1.9 = 1050

1050 × $\frac{.95}{1.60}$ = 625 kg/lin m.

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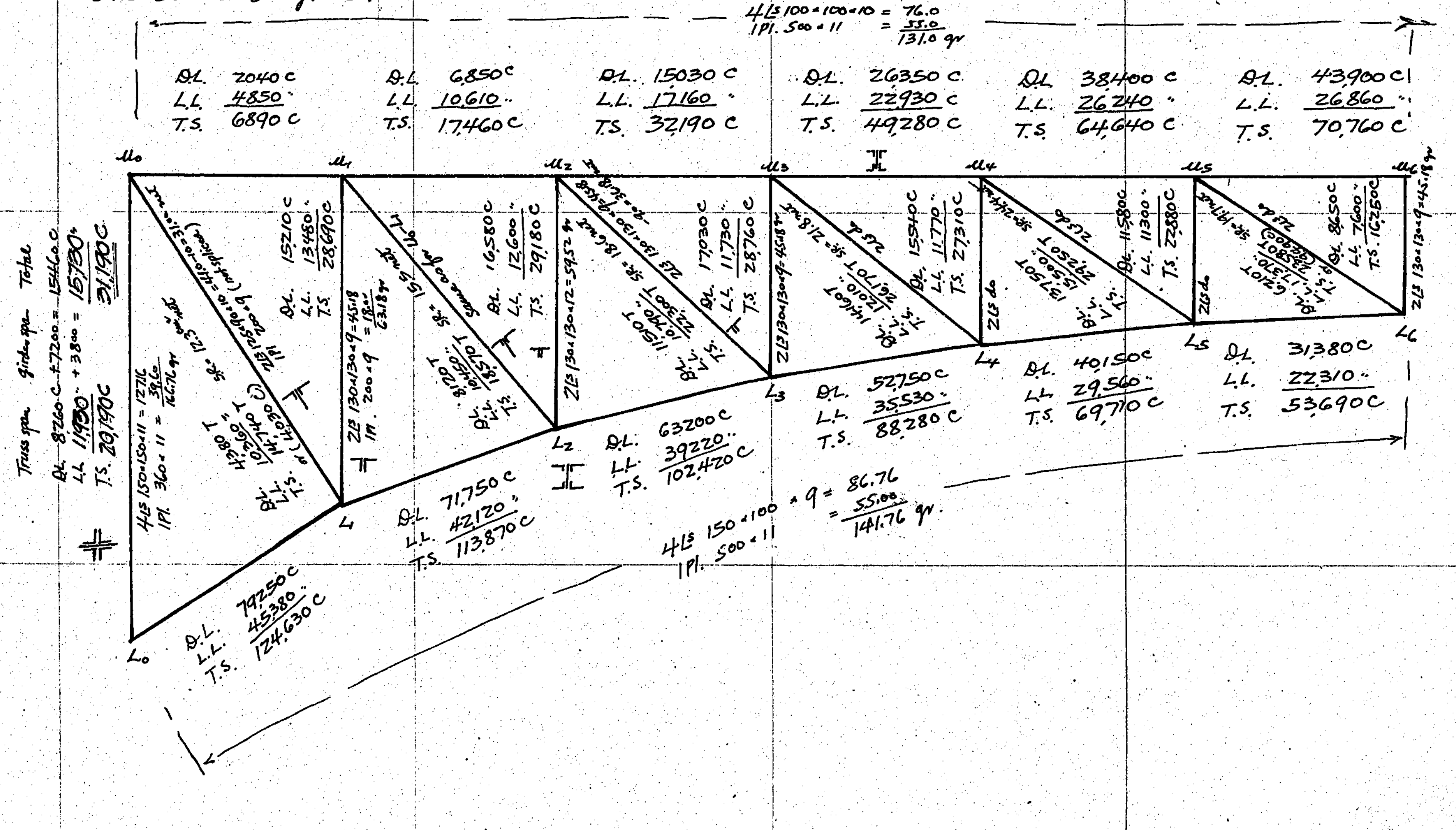
CALCULATIONS FOR

Final Design of Kagarite Bashi for Miyazaki Ken.

Dead and Live Load Stresses of truss members

Members.		Sum of Influence ordinates				Stresses of members.						Total stresses.	
		Dead Load	Live Load			D.L.S.	L.L.S						
		(+)or(-)	(+)	(-)	max (+)or(-)	8650^kg	(+) 4700	(-)	(+) 1800	(-)	Total L.L.S.	DL+LL.	$\frac{2}{3}$DL+L.L.
upper chords	U_0-U_1	-0.236	0.643	0.879	-0.399	- 2040	3,020	4130	240	720	- 4850	- 6890	+ 900
	U_1-U_2	-0.792	1.155	1.947	-0.813	- 6,850	5,430	9150	460	1,460	- 10,610	- 17,460	+1,320
	U_2-U_3	-1.738	1.457	3.195	-1.195	- 15,030	6,850	15,010	620	2,150	- 17,160	- 32,190	
	U_3-U_4	-3.046	1.261	4.307	-1.490	- 26,350	5930	20,250	590	2,680	- 22,930	- 49,280	
	U_4-U_5	-4.440	0.514	4.954	-1.641	- 38,400	2,420	23,280	310	2,960	- 26,240	- 64,640	
	U_5-U_6	-5.077	0.000	5.077	-1.669	- 43,900	0	23,850	0	3,010	- 26,860	- 70,760	
Lower chords	L_0-L_1	-9.162	0.000	9.162	-1.264	- 79,250	0	43,100	0	2,280	- 45,380	-124,630	
	L_1-L_2	-8.294	0.169	8.463	-1.299	- 71,750	790	39,780	300	2,340	- 42,120	- 113,870	
	L_2-L_3	-7.303	0.512	7.815	-1.388	- 63,200	2,410	36,720	640	2,500	- 39,220	- 102,420	
	L_3-L_4	-6.098	0.944	7.042	-1.348	- 52,750	4,440	33,100	940	2,430	- 35,530	- 88,280	
	L_4-L_5	-4.643	1.184	5.827	-1.211	- 40,150	5,560	27,380	1130	2,180	- 29,560	- 69,710	
	L_5-L_6	-3.627	0.743	4.370	-0.981	- 31,380	3,490	20,540	1050	1,770	- 22,310	- 53,690	
	U_0-L_0	-0.454	1.202	1.656	-1.000	- {4330 - 3930	5650	{2,350 7,780	440	1,800	- 11,930	-20,190	+ 580
	U_1-L_1	-1.758	0.751	2.509	-0.944	- 15,210	3530	11,780	310	1,700	- 13,480	- 28,690	
Verticals	U_2-L_2	-1.917	0.398	2.315	-0.957	- 16,580	1,870	10,880	200	1,720	- 12,600	- 29,180	
	U_3-L_3	-1.969	0.190	2.159	-0.880	- 17,030	890	10,150	170	1,580	- 11,730	- 28,760	
	U_4-L_4	-1.797	0.417	2.214	-0.761	- 15,540	1960	10,400	360	1,370	- 11,770	- 27,310	
	U_5-L_5	-1.339	0.830	2.169	-0.614	- 11,580	3,900	10,190	580	1,110	- 11,300	- 22,880	
	U_6-L_6	-1.000	0.000	1,000	- 1,000	- 8,650	0	* 7,600	0	—	- 7600	- 16,250	
Diagonals	U_0-L_1	+0.506	1.877	1.371	+ 0.853	+ 4,380	8820	6,450	1,540	500	+ 10,360	+ 14,740	-4,030
	U_1-L_2	+0.939	1.877	0.938	+ 0.905	+ 8,120	8,820	4,410	1,630	390	+ 10,450	+ 18,570	
	U_2-L_3	+1.331	1.927	0.596	+ 0.968	+ 11,510	9050	2,800	1,740	1,230	+ 10,790	+ 22,300	
	U_3-L_4	+1.638	2.160	0.522	+ 1.034	+ 14,160	10,150	2,610	1,860	360	+ 12,010	+ 26,170	
	U_4-L_5	+1.590	2.889	1.299	+ 1.068	+ 13,750	13,580	6,100	1,920	850	+ 15,500	+ 29,250	
	U_5-L_6	+0.718	3.303	2.585	+ 1.031	+ 6,210	15,510	12,150	1,860	1,480	+ 17,370	+ 23,580	- 9,490

The Stress Diagram.



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CALCULATIONS FOR

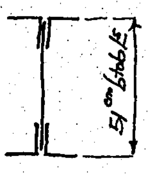
Final Design of Kagarito Bashi for Miyazaki Ken.

Sections of Truss members.

Upper chord members.

U5-U6 Stress = 70760 kg C l = 375 cm

assumed section



4Ls 100×100×10 = 76.0
1Pl. 500 × 11 = 55.0
131.0 cm² gross.

Compression flange area 38.00
$\frac{1}{8}$ web area = 55.0 ÷ 8 = 6.88
44.88 cm² gross.

Effective depth say 51.0 − 5.6 = 45.4 cm

flange stress due to bending moment

$\frac{3740 \times 100}{45.4}$ = 8,240 kg

Unit stress on comp. flange = $\frac{8240}{44.88}$ = 184 kg/cm² C

Direct compression = $\frac{70760}{131.0}$ = 540 " "
724 " "

least radius of gyration = 4.7 cm $l/r = \frac{375}{4.7} = 79.7$ ok

allowable unit comp = $1500\,(1 - 0.0055\,\frac{l}{r})$
= $1500\,(1 - .0055 \times 79.7)$ = 843 kg/cm² > 724 ok.

Use same section as above for all the upper chord members.

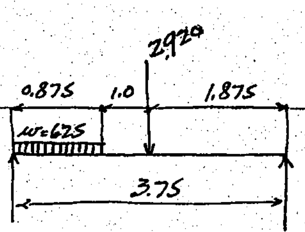
Direct Bending stress

Dead Load.

Slab and pavement 0.8 @ 490 = 392.
overhanging " " 0.3 @ 490 = 147
Coping 210
handrail 40
397
overhanging effect $\frac{397 \times 0.4}{1.6}$ = 99
496
Chord member assumed 142
1,030 kg/lin. m

Dead Load moment = $\frac{1}{10} \times 1030 \times 3.75^2$ = 1,450 kgm
" " Shear = $\frac{1}{2} \times 1030 \times 3.75$ = 1,930 kg

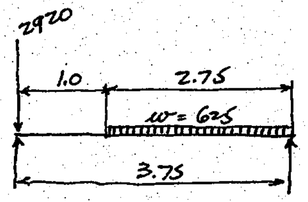
Live Load see on page 28



Reaction
$\frac{625 \times .875^2}{2 \times 3.75}$ = 64
2920 ÷ 2 = 1460
1524 kg

moment 1524 × 1.875 = 2860

for continuity of member
moment = 0.8 × 2860 = 2,290 kgm



Shear
$\frac{625 \times 2.75^2}{2 \times 3.75}$ = 630
2920
3,550 kg

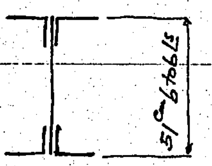
Summary of moments and end shears

	moment	end shear
Dead Load	1,450	1,930
Live Load.	2,290	3550
	3,740 kgm	5,480 kg

Lower chord members.

L0-L1. Stress = 124,630 kg C l = 4.494 m

assumed section



4Ls 150×100×9 = 86.76
1Pl 500 × 11 = 55.00
141.76 cm² gross.

least radius of gyration = 7.36 cm

$l/r = \frac{449.4}{7.36} = 61.$ ok

allowable unit compression
= 1500 × (1 − 0.0055 × 61) = 998 kg/cm² C

Unit stress = $\frac{124630}{141.76}$ = 880 kg/cm² C ok.

Use the same section throughout the lower chord.

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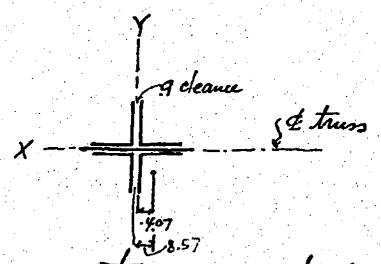
Final Design of Kagarito Bashi for Miyasaki Ken:

Sections for Vertical members.

M_0-L_0. Stress 31,190 kg C, l = 880 cm

assumed section



4∟s 150×150×11 = 127.16
1Pl. 360×11 = 39.60 (not spliced)
166.76 cm² gr.

allowable unit compression

$= 1500\left(1-0.0055\frac{l}{r}\right)$

$= 1500\,(1-0.0055\times116)$

$= 542$ kg/cm² C

Use transverse strut at center of its length.

radius of gyration abt X-X axis = 6.8 cm $l=\frac{880}{2}=440$

$l/r=\frac{440}{6.8}=64.7$

Unit stress on member

$= \frac{31,190}{\cancel{166.76}\ 127.16} = \cancel{185}\ 245$ kg/cm² ok.

radius of gyration about Y-Y axis

2∟s $2\times663+63.58\times4.52^2=$ 2,626
2∟s = 2,626
1Pl. = 4277
I_y = 19,529 cm⁴

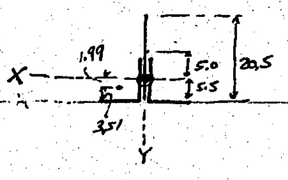
radius of gyration about Y-Y axis

$r_y=\sqrt{\frac{I_y}{A}}=\sqrt{\frac{9529}{166.76}}=7.6$ cm $l=880$

$l/r=\frac{880}{7.6}=116$

M_1-L_1 stress 28690 kg C. l = 640 cm

assumed section



2∟s 130×130×9 = 45.18
1Pl. 200×9 = 18.00
63.18 cm² gr.

$r_y=5.74$ cm $l/r_y=\frac{640}{5.74}=112$ ok

allowable unit compression

$= 1500\,(1-0.0055\times115.5)$

$= 546$ kg/cm² C

Unit stress on member

$= \frac{28690}{63.18} = 455$ kg/cm² C ok.

2∟s 45.18×3.51 = 158.5
1Pl. 18.0×10.5 = 189.0
347.5÷63.18 = 5.5 cm

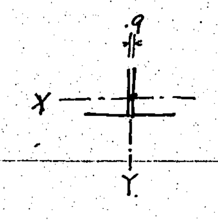
2∟s. $3.55\times2+45.18\times1.99^2=889$
1Pl. $600+18\times5.0^2=1050$
$I_x=1939$ cm⁴

$r_x=\sqrt{\frac{1939}{63.18}}=5.54$ cm

$l/r_x=115.5$ ok

M_2-L_2 stress = 29180 kg C l = 435 cm

assumed section



2∟s 130×130×9 = 45.18 cm² gross.

$r_x=3.96$ cm $l/r=\frac{435}{3.96}=110$. ok

allowable unit compression

$=1500(1-0.0055\times110)=582$ kg/cm C

Unit stress of member

$=\frac{29180}{45.18}=646$ kg/cm² over.

change the section to 2∟s 130×130×12 = 59.52 cm² gr

unit stress $=\frac{29180}{59.52}=491$ kg/cm² ok.

M_3-L_3. Stress 28760 kg c l = 300 cm

$l/r=\frac{300}{3.96}=76$

2∟s 130×130×9 = 45.18 cm² gr.

allowable unit stress = $1500(1-0.0055\times76)=872$ kg/cm² C

unit stress of member $=\frac{28,760}{45.18}=637$ kg/cm² C ok

use same section for M_4-~~L_4~~ M_5-~~L_5~~ + M_6-L_6

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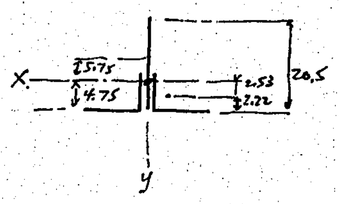
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyazaki Ken.

Sections for Diagonal members.

U_0-L_1 Stress = 14740 kg ¢T or 4,030 kg C $l = 720^{cm}$ Section req'd = 12.3^{cm^2} net.

assumed section



2∠s $125 \times 90 \times 10 = 41.00 - 10.00 = 31.00$

1Pl. $200 \times 9 = 18.00$ - -- ·0 ---- this plate will not be spliced.

59.00^{cm^2} gr 31.00^{cm^2} net ok.

$r_y = 6.1^{cm}$ $l/r_y = 720/6.1 = 118$ ok. < 150

2∠s $41.0 \times 2.22 = 91.0$

$18.0 \times 10.5 = 189.0$

$280. \div 59.0 = 4.75^{cm}$

2∠s $138 \times 2 + 41 \times 2.53^2 = 539$

$600 + 18 \times 5.75^2 = 1195$

$I_x = 1734^{cm^4}$

$$r_x = \sqrt{\frac{1734}{59.0}} = 5.42^{cm}$$

$l/r_x = 720/5.42 = 133$ ok < 150. ✓

U_1-L_2 Stress = 18570 kg T Section req'd = 15.5^{cm^2} net.

Use same section as for U_0-L_1.

U_2-L_3 Stress = 22300 kg T section req'd. = 18.6^{cm^2} net. $l = 450^{cm}$

2∠s $130 \times 130 \times 9 = 45.18^{cm^2} - 9.0 = 36.18^{cm^2}$ net.

$l/r = 450/3.96 = 114$ ok < 150.

Use same section for U_3-L_4, U_4-L_5 and U_5-L_6.

max. load on shoe

Dead Load. Truss span $V_T = 8650 \times 6 = 51,900$ kg

girder span say $V_g = 2400 \times 3 = 7,200$

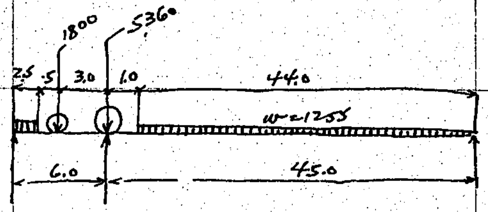
$V = 59,100$ kg on one shoe.

$H = 8650 \times 7.647 = 66,200$ kg "

Live Load. for V max. V_T $\frac{1255 \times 44^2}{2 \times 45} = 27,000$

5360

32,360



V_G $\frac{1255 \times 2.5^2}{2 \times 6.0} = 650$

$1800 \times \frac{1}{2} = 900$

1550

$V_{max.} = 33,910$ kg on one shoe

H say $4700 \times 7.647 = 35,900$ kg "

for H max. ~~V min~~ $H_{max.}$ $4700 \times 7.647 = 35,900$

$1800 \times 1.055 = 1900$

$H_{max.} = 37,800$ kg on one shoe.

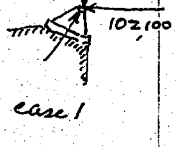
V_T $*4700 \times 5.5 = 25,800$

$1800 \div 2 = 900$

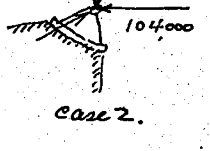
$V_T = 26,700$ kg " (no load on side span)

Summary of Vert. + Hor. reactions

	V	H.
Dead Load.	59,100	66,200
Live Load	33,900	35,900
	or 26,700	or 37,800
case (1)	93,000 kg	..... 102,100 kg
case (2)	or 85,800 "	.... or .. 104,000 "



case 1



case 2.

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JIUN MASUDA
CONSULTIEG ENGINEER
JIJI BLDG, TOKYO

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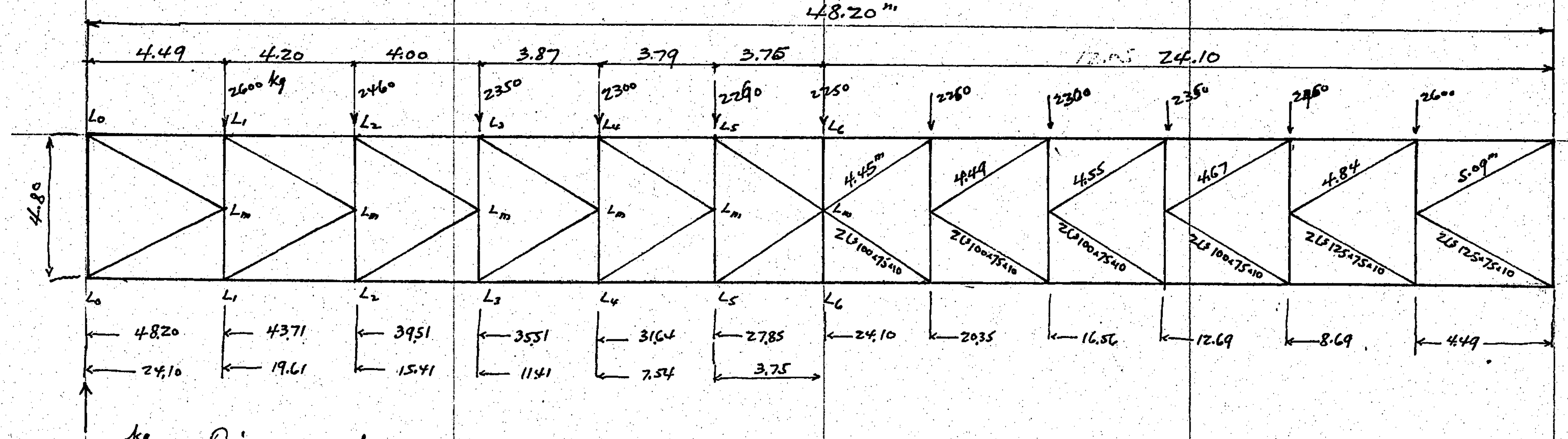
CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Lateral Bracing
wind load

400 kg per lin meter for loaded chord } total 600 kg/lin m.
200 " " unloaded chord.
all wind loads shall be taken care of by lower lateral bracing.
wind load on upper chord will be transmitted by sway bracing to lower lateral.



Diagonal stresses.

2,600 × 4.49 = 11,700							
2460 × 8.69 = 21,400							
2,350 × 12.69 = 29,800							
2,300 × 16.56 = 38,100		Shear in Panel		Diagonal stress for one member			
2,260 × 20.35 = 46,000						22φ rivet no.	use
2,250 × 24.10 = 54,200	201,200	L5-L6	4,170 kg	3,870 kg T or C	∠s 100×75×10	1.4	6
2,260 × 27.85 = ~~62,900~~	264,100	L4-L5	5480	5,130	do	1.8	6
2,300 × 31.64 = 72,700	336,800	L3-L4	6,990	6,620	do	2.4	6
2,350 × 35.51 = 83,500	420,300	L2-L3	8,720	8,480	∠s 100×75×10	3.0	6
2,460 × 39.51 = 97,200	517,500	L1-L2	10,730	10,820	∠s 125×75×10	3.8	6
2600 × 43.71 = 113,600	631,800	L0-L1	13,100	13,900	∠s 125×75×10	4.9	6

Chord stresses.

L5-L6
13,100 × 24.10 = + 316,000
2600 × 19.61 = − 51,000
2460 × 15.41 = − 37,900
2350 × 11.41 = − 26,800
2300 × 7.54 = − 17,350
2260 × 3.75 = − 8,470
174480 kgm
174480 ÷ 4.8 = 36400 kg T or C

L4-L5
13,100 × 20.35 = + 266,800
2600 × 15.86 = − 41,250
2460 × 11.66 = − 28,700
2350 × 7.66 = − 18,000
2300 × 3.79 = − 8,720
170,130
170,130 ÷ 4.8 = 35400 kg T or C.

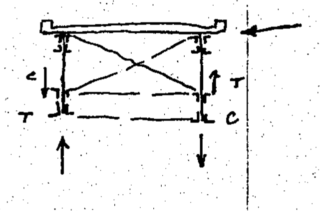
L3-L4
13,100 × 16.56 = + 217,000
2600 × ~~3.87~~ 12.07 = − 31,400
2460 × 7.87 = − 19,350
2350 × 3.87 = − 9090
~~2300 ×~~ = −
− 157,160
157,160 ÷ 4.8 = 32,750 kg T or C

L2-L3
13,100 × 12.69 = + 166,300
2,600 × 8.20 = − 21,300
2,460 × 4.00 = − 9,840
135,160
135160 ÷ 4.8 = 28,150 kg T or C

L1-L2
13100 × 8.69 = + 113,800
2600 × 4.20 = − 10,920
102,880
102,880 ÷ 4.8 = 21,440 kg T or C

L0-L1
13100 × 4.49 = + 58,800
58,800 ÷ 4.8 = 12,250 kg T or C.

Wind stress due to vertical load caused by the overturning moment is small and cancels with the horizontal wind stress, so we neglect this stress in safe side.



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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki Ken.

Temperature Stress of arch truss.

Horizontal thrust due to temperature change.

$$H_t = \pm \frac{\alpha E t l}{\Sigma S_1^2 \frac{L}{A}}$$

where
α = Coefficient of expansion of structural steel = 0.000012
E = modulus of elasticity of steel in kg/cm² = 2,100,000
t = change of temperature in degree c = ± 30° C
l = Span length in ~~meters~~ cm = 45.00 m × 100 = 4500 cm
$\Sigma S_1^2 \frac{L}{A}$ has been calculated already = 588.174 see page 11

putting these values in to the above formula.

$$H_t = \pm \frac{0.000012 \times 2{,}100{,}000 \times 30 \times 4500}{588.174} = \pm 5{,}770 \text{ kg}$$

for 60°c change $H_t = 5770 \times 2 = \pm 11{,}540$ kg

Stresses in members.

Top chords.	S_1.	Temperature stress 60° + or −
M_0-M_1	0.353 C	4,060 T or C
M_1-M_2	0.851 C	9,820 "
M_2-M_3	1.549 C	17,880 "
M_3-M_4	2.445 C	28,200 "
M_4-M_5	3.342 C	38,600 "
M_5-M_6	3.750 C	43,300 "

Bottom chords.		
L_0-L_1	1.198 T	13,840 C or T
L_1-L_2	1.515 T	17,490 "
L_2-L_3	1.977 T	23,050 "
L_3-L_4	2.632 T	30,400 "
L_4-L_5	3.484 T	40,200 "
L_5-L_6	4.402 T	50,800 "

Verticals	S_1	Temperature stress 60°c + or −
M_0-L_0	0.660 C	7,620 T or C
M_1-L_1	0.683 C	7,880 "
M_2-L_2	0.693 C	8,000 "
M_3-L_3	0.659 C	7,600 "
M_4-L_4	0.524 C	6,050 "
M_5-L_5	0.218 C	2,540 "
M_6-L_6	0.000	0

Diagonals		
M_0-L_1	0.748 T	8,630 C or T
M_1-L_2	0.846 T	9,760 "
M_2-L_3	0.983 T	11,350 "
M_3-L_4	1.112 T	12,840 "
M_4-L_5	1.039 T	12,000 "
M_5-L_6	0.463 T	5,340 "

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyasaki ken.

Combination of Several stresses of truss members.

Members.	D.L.+L.L.+Impact.	Wind stress	temperature stress.		Total stress (max)	Capacity of members.
Top chords.						
M_0-M_1	6,890 C	neglected (Safeside)	4,060	T or C	10,950 C	843×1.25×131.0 = 138,100
M_1-M_2	17,460 C	"	9,820	"	27,280 C	184×131.0 = − 24,100
M_2-M_3	32,190 C	"	17,880	"	50,070 C	114,000 kg C
M_3-M_4	49,280 C	"	28,200	"	77,480 C	All top chord members safe.
M_4-M_5	64,640 C	"	38,600	"	103,240 C	
M_5-M_6	70,760 C	"	43,300	"	114,060 C	
Lower chords.						
L_0-L_1	124,630 C	12,250 C or T	<u>13,840</u>	C or T	138,470 C	998×1.25×141.76 = 177,000 kg C
L_1-L_2	113,870 C	<u>21,440</u> "	17,490	"	135,310 C	
L_2-L_3	102,420 C	<u>28,150</u> "	23,050	"	130,570 C	All lower chord members safe.
L_3-L_4	88,280 C	<u>32,750</u> "	30,400	"	121,030 C	
L_4-L_5	69,710 C	35,400 "	<u>40,200</u>	"	109,910 C	
L_5-L_6	53,690 C	36,400 "	<u>50,800</u>	"	104,490 C	
Verticals						
M_0-L_0	20,190 C	neglected	7,620	T or C	27,810 C	765×1.25×127.16 = 121,600 kg C
M_1-L_1	28,690 C	"	7,880	"	36,570 C	546×1.25×63.18 = 43,100 "
M_2-L_2	29,180 C	"	8,000	"	37,180 C	582×1.25×59.52 = 43,300 "
M_3-L_3	28,760 C	"	7,600	"	36,360 C	872×1.25×45.18 = 49,200 "
M_4-L_4	27,310 C	"	6,050	"	33,360 C	Safe
M_5-L_5	22,880 C	"	2,540	"	25,420 C	"
M_6-L_6	16,250 C	"	0	"	16,250 C	"
Diagonals						
M_0-L_1	14,740 T	"	8,630	C or T	23,370 T	31.0×1200×1.25 = 46,500 kg T
M_1-L_2	18,570 T	"	9,760	"	28,330 T	" " "
M_2-L_3	22,300 T	"	11,350	"	33,650 T	~~45.18~~ 36.18 ×1200×1.25 = 54,200 "
M_3-L_4	26,170 T	"	12,840	"	39,010 T	" Safe
M_4-L_5	29,250 T	"	12,000	"	41,250 T	" "
M_5-L_6	23,580 T	"	5,340	"	28,920 T	" "

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CALCULATIONS FOR

Final Design of Kagarito Bashi for Miyazaki Ken.

Deflection of Truss at crown.

General Equation of deflection $\Delta = \Sigma \frac{SL}{EA} T$ or $\frac{1}{E} \Sigma \frac{SL}{A} . T$

where Δ = Deflection at any panel point in cm.
S = Stress of each member.
T = Stress of each member due to unit load on the panel point at which deflection is desired in the direction of the deflection
L = Length of each member in cm.
A = Sectional area of each member in cm². gross section.
E = Modulus of elasticity in kg/cm² = 2,100,000

Members	$	L/A	T	D.L. S ,	L.L. S.	D.L. SLT/A	L.L. SLT/A	Temp stress +60° S_t	S_tLT/A
M_0-M_1		2.863	+0.105	- 2040	- 4850	- 618	- 1460	+ 4060	+ 1220
M_1-M_2		"	+0.176	- 6850	- 10610	- 3450	- 5345	+ 9820	+ 4950
M_2-M_3		"	+0.125	- 15030	- 17160	- 5380	- 6140	+ 17880	+ 6390
M_3-M_4		"	-0.129	- 26350	- 22930	+ 9720	+ 8465	+ 28200	- 10410
M_4-M_5		"	-0.759	- 38400	- 26240	+ 83400	+ 57000	+ 38600	- 83800
M_5-M_6		"	-1.669	- 43900	- 26860	+ 209500	+ 128300	+ 43300	- 209000
L_0-L_1		3.170	-1.264	- 79250	- 45380	+ 317500	+ 181800	- 13840	+ 55400
L_1-L_2		2.963	-1.299	- 71750	- 42120	+ 276300	+ 162200	- 17490	+ 67300
L_2-L_3		2.824	-1.306	- 63200	- 39220	+ 233100	+ 144700	- 23050	+ 85000
L_3-L_4		2.732	-1.218	- 52750	- 35530	+ 175500	+ 118200	- 30400	+ 101200
L_4-L_5		2.676	-0.926	- 40150	- 29560	+ 99400	+ 73200	- 40200	+ 99500
L_5-L_6		2.649	-0.353	- 31380	- 22310	+ 29300	+ 20850	- 50800	+ 47500
M_0-L_0		5.682	+0.196	- 8260	- 11930	- 9200	- 13280	+ 7620	+ 8490
M_1-L_1		11.117	+0.086	- 15210	- 13480	- 14540	- 12880	+ 7880	+ 7530
M_2-L_2		11.357	-0.043	- 16580	- 12600	+ 8100	+ 6160	+ 8000	- 3910
M_3-L_3		8.249	-0.195	- 17030	- 11730	+ 27400	+ 18880	+ 7600	- 12220
M_4-L_4		6.104	-0.360	- 15540	- 11770	+ 34100	+ 25830	+ 6050	- 13280
M_5-L_5		4.843	- 0.485	- 11580	- 11300	+ 27200	+ 26530	+ 2540	- 5960
M_6-L_6		4.427	-1.000	- 8650	- 7600	+ 38300×½	+ 33650×½	+ 0	0
M_0-L_1		13.495	-0.232	+ 4380	+ 10360	- 13700	- 32400	± 8630	+ 27000
M_1-L_2		10.771	-0.107	+ 8120	+ 10450	- 9350	- 12050	- 9760	+ 11250
M_2-L_3		11.702	+0.061	+ 11510	+ 10790	+ 8210	+ 7700	- 11350	- 8100
M_3-L_4		10.303	+0.329	+ 14160	+ 12010	+ 48050	+ 40750	- 12840	- 43500
M_4-L_5		9.608	+0.716	+ 13750	+ 15500	+ 94550	+ 106600	- 12000	- 82500
M_5-L_6		9.407	+1.031	+ 6210	+ 17370	+ 60300	+ 168500	- 5340	- 51800
						- 56230	- 83555		- 522480
						+ 1760780	+ 1312490		+ 522730
				$\sum_0^{l/2} SLT/A$		+ 1704550	+ 1228935		+ 250

Dead Load deflection $= \frac{1704550 \times 2}{2100000} = 1.62$ cm

Live Load deflection $= \frac{1228935 \times 2}{2100000} = 1.17$ "

2.79 cm

for full load $1.62 \times \frac{13350}{8650} = 2.50$ cm

Single concentration — is about 2.75

Temperature deflection $= \pm \frac{250 \times 2}{2100000} = \pm 0.0002$ cm negligible.

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki ken

Design of Approach Beam Span. Span length 6.00 meters c to c bearings.

2 panels @ 2.85 = 5.70
.30
6.00 m

Details of Floor slab, stringers and floor beams same as for truss span.

Design of main girder. span length 6.00 meters.

Dead Load.

Floor.	Slab and pavement	2.7 @ 490 =	1,323
	Coping		210
	Stringers		42
	floor beams		63
	lateral bracing say		100
	handrail		40
main girder	say		135
	misc. details say		17
			1930 kg per lin meter

approximate D.L. moment $= \frac{1}{8} \times 1930 \times 6^2 = 8680$ kgm.

" D.L. shear $= \frac{1}{2} \times 1930 \times 6 = 5,800$ kg

Live Load.

motor truck rear wheel concentration = 2250 kg

Impact coef. $= \frac{20}{60+6} = 30.3\%$ use 30% = 680
2930 kg

2 wheels @ 2930 = 5860 kg

Front wheel concentration with imp. $= \frac{2930}{3} =$ 980 kg.

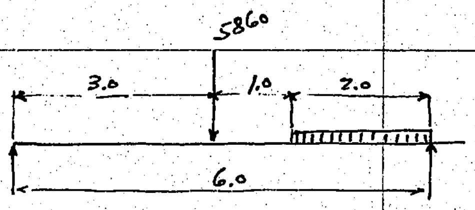
2 " @ 980 = 1,960 "

Uniform live load = 500 kg/□m.

500 × 2.7 = 1350 kg per lin meter.

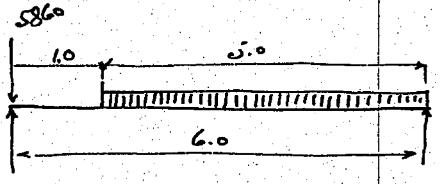
Reaction $\frac{1350 \times 2^2}{2 \times 6} = 450$

$5860 \div 2 = 2930$
3380 kg.



Live Load moment = 3380 × 3 = 10150 kgm.

End shear. $\frac{1350 \times 5^2}{2 \times 6} =$ 2810
5860
8,670 kg.



Summary for moments and shears.

	moments	shears
Dead Load	8680	5800
Live Load	10150	8670
	18830 kgm	14,470 kg.

Use $\overset{2}{\cancel{4}}$ Ls 100 × 100 × 10 = $38.0 - \cancel{4.0}10 = 28.00$ cm² net.

Shearing stress on web.

$= \frac{14470}{55} = 263$ kg/cm² ok.

Use 500 × 11 web. depth 51.0 cm.

$\frac{1}{8}$ web area $= \frac{1}{8} \times 50 \times 11 = 6.88$ cm²

Effective depth say $51.0 - 5.6 = 45.4$ cm

Flange stress $= \frac{18830 \times 100}{45.4} = 34600$ kg T or C

Flange area req'd $= \frac{34600}{1200} = 28.85$
− 6.88
21.97 cm² net.

$\frac{34600}{1100} = 31.45$
− 6.88
24.57 cm² gr.

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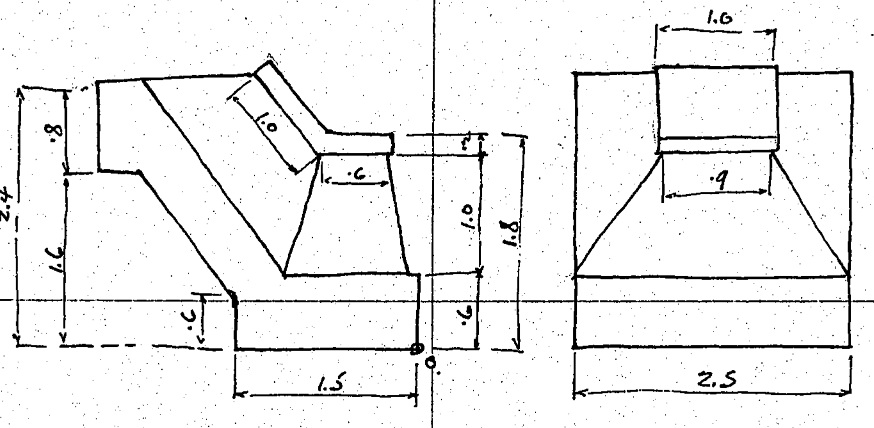
CALCULATIONS FOR

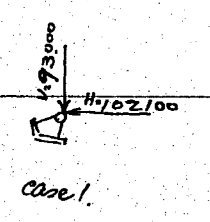
Design of Kagarita Bashi for Miyasaki Ken.

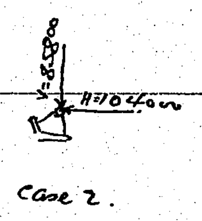
Design of pier.



Superimposed load on pier.

	V	H
D.L.	59100	66,200
L.L.	33,900	35,900
	~ 26,700	~ 37,800
Case 1	93,000 kg	102,100 kg.
Case 2.	85800	104000

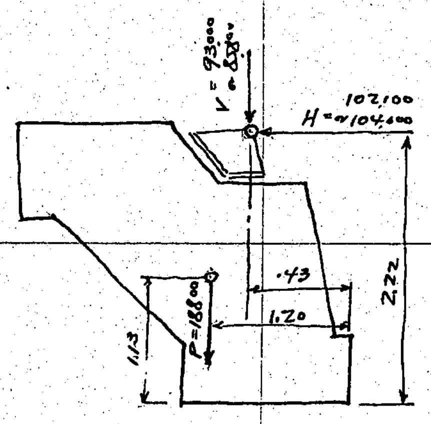


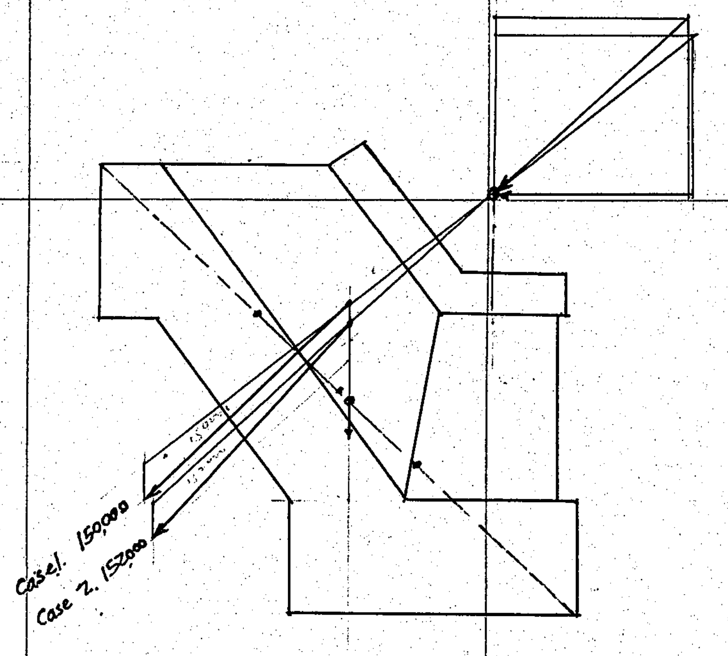


weight and center of gravity of concrete.
moments about point O.

			hor arm	moment	vert arm	moment
Coping	0.2 × 1.0 × .6 =	0.12	.40	.048	1.70	0.204
"	0.2 × 1.0 × 1.0 =	0.20	.90	.780	2.10	0.420
body.	1.6 × $\overset{1.7}{.9}$ × .75 =	2.04	1.35	2.750	1.65	3.370
"	.7 × 1.7 × 1.0 =	1.19	.50	.595	.95	1.130
base.	.5 × 2.2 × 2.5 =	2.75	1.80	4.950	1.40	3.850
"	.6 × 2.5 × 1.5 =	2.25	.75	1.690	.30	0.675
		8.55 m³.	1.20 m	10.213	1.13 m	9.649

P = 8.55 × 2200 = 18,800 kg





Eccentricity for case 1. = .30 m
" Case 2 = .20

Approximate Bearing pressure on bed rock.

case 1. $\frac{150000}{3.5 \times 2.5}\left(1 \pm \frac{6 \times .3}{3.5}\right) = 8,300\ \mathrm{kg/m^2}$ c
" 26,000 " c (2.4 tons/□') ok.

Use proper reinforcements.

Abutment total height 2.0 m base 2.0 × 0.65 = 1.30 m
foundation — Hard rock.
use proper reinforcements.

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

No.	Description	Section in Mm.	Length in Mm.	Wt.of One Meter	Wt.of Main Section in kgs.	Wt.of Details in Kgs.	Total wt.	Remarks
			TOP CHORD	U0-U1	4 Req'd.			
4	Ls.	100x100x10	4550	14.91	271.4			
1	Web Pl.	500 × 11	2950	43.175	127.4			
1	Pl.	880 × 11	960	75.988		72.9		
2	Spl Pls	305 × 9	480	21.548		20.7		
1	Pl.	305 × 10	625	23.943		15.0		
1	"	"	495	"		11.9		
1	"	415 × 9	745	29.32		21.8		
1	"	310 × 9	415	21.902		9.1		
					398.8 +	151.4	= 550.2	
							× 4	
							2,200.8	
			U1-U2		4 Req'd.			
4	Ls.	100x100x10	3830	14.91	228.4			
1	Web Pl.	500 × 11	2870	43.175	123.9			
1	Pl.	900 × 11	960	77.715		74.6		
1	"	305 × 10	625	23.943		15.0		
1	"	305 × 10	495	"		11.9		
1	"	415 × 9	725	29.32		21.3		
					352.3 +	122.8	= 475.1	
							× 4	
							1,900.4	
			U2-U3		4 Req'd.			
4	Ls	100x100x10	3910	14.91	233.2			
1	Pl.	500 × 11	2790	43.175	120.5			
1	Guss. Pl.	900 × 11	1.120	77.715		87.0		
1	Pl.	305 × 10	625	23.943		15.0		
1	"	"	495	"		11.9		
1	"	310 × 9	415	21.902		9.1		
					353.7 +	123.0	= 476.7	
							× 4	
							1,906.8	
			U3-U4		4 Req'd.			
4	Ls	100x100x10	3910	14.91	233.2			
1	Web Pl.	500 × 11	2630	43.175	113.6			
1	Guss. Pl.	850 × 11	1.280	73.398		93.9		
1	Pl.	305 × 10	625	23.943		15.0		
1	"	"	495	"		11.9		
1	"	415 × 9	660	29.32		19.4		
					346.8 +	140.2	= 487.0	
							× 4	
							1,948.0	
			U4-U5		4 Req'd.			
4	Ls	100x100x10	3830	14.91	228.4			
1	Web Pl.	500 × 11	2470	43.175	106.6			
1	Guss Pl.	800 × 11	1.360	69.08		93.9		
1	Pl.	305 × 10	625	23.943		15.0		

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

1	Pl.	305 x 10	495	23943		11.9	
1	"	310 x 9	415	21.902		9.1	
					335.0 +	129.9	= 464.9
							x 4
							1,859.6
			Us-Us'		2 Req'd.		
4	Flg Ls	100x100x10	5340	14.91	318.5		
2	Web Pls	500 x 11	2390	43.175	206.4		
1	Guss Pl.	560 x 11	800	48456		38.8	
2	Pls.	305 x 10	1.040	23943		49.8	
1	Pl.	415 x 9	660	29.32		19.4	
					524.9 +	108.0	= 632.9
							x 2
							1,265.8
			Splice SP2		20 Req'd.		
4	Ls.	100x100x13	480	19.08		36.6	
2	Pls.	305 x 9	480	21.548		20.7	
							57.3
							x 20
							1,146.0
			Summary of Top chords.		12,227.4		
			BOTTOM CHORD Lo-L1		4 Req'd.		
2	Ls	150x100x9	5260	17.02	179.1		
2	"	"	5200	"	177.0		
1	Web Pl.	500 x 11	3345	43.175	144.4		
1	Guss Pl.	890 x 11	1.030	76.852		79.2	
1	"	1,045 x 11	1.125	90.236		101.5	
2	Pls.	305 x 9	1.210	21.548		52.1	
2	"	485 x 16	1.130	60.916		137.7	
2	"	"	485	"		59.1	
2	Ls	100x75x10	492	12.95		12.7	
2	Fills	75 x 9	305	5.299		3.2	
2	Pls	305 x 9	640	21.548		27.6	
1	Fill	310 x 9	315	21.902		6.9	
2	Ls	150x150x11	795	24.95		39.7	
1	Bent Pl.	440 x 9	675	31.086		21.0	
1	Pl.	350 x 9	855	24.728		21.1	
1	Bent Pl.	365 x 9	665	25.787		17.1	
					500.5 +	578.9	= 1,079.4
							x 4
							4,317.6
			L1-L2		4 Req'd.		
2	Ls	150x100x9	4170	17.02	141.9		
2	"	"	4120	"	140.2		
1	Web Pl.	500 x 11	3190	43.175	137.7		
1	Guss Pl.	980 x 11	1.040	84.623		88.0	
2	Pls.	305 x 9	640	21.548		27.6	
1	Fill.	310 x 9	330	21.902		7.2	

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

2	∠s.	100x75x10	492	12.95		12.7	
2	Fills.	75 x 9	305	5.299		3.2	
1	Bent Pl.	365 x 9	780	25.787		20.1	
2	∠s.	150x100x12	480	22.41		21.5	splice
2	Pls.	305 x 9	640	21.548		27.6	
2	〃	85 x 11	480	7.340		7.0	
1	Pl.	320 x 11	480	27.632		13.3	

419.8 + 228.2 = 648.0
× 4
2,592.0

			L_2-L_3		4 Req'd.		
2	∠s	150x100x9	3935	17.02	133.9		
2	〃	〃	3890	〃	132.4		
1	Web Pl.	500 x 11	2980	43.175	128.7		
1	Guss Pl.	955 x 11	970	82.464		80.0	
2	Pls	305 x 9	480	21.548		20.7	
1	Fill	〃	310	〃		6.7	
1	Bent Pl.	365 x 9	640	25.787		16.5	

395.0 + 123.9 = 518.9
× 4
2,075.6

			L_3-L_4		4 Req'd.		
2	∠s.	150x100x9	3905	17.02	132.9		
2	〃	〃	3855	〃	131.2		
1	Web Pl.	500 x 11	2770	43.175	119.6		
1	Guss Pl.	910 x 11	1.130	78.579		88.8	
2	Pls.	305 x 9	480	21.548		20.7	
1	Fill	〃	310	〃		6.7	
1	Bent Pl.	365 x 9	650	25.787		16.8	

383.7 + 133.0 = 516.7
× 4
2,066.8

			L_4-L_5		4 Req'd.		
2	∠s	150x100x9	3810	17.02	129.7		
2	〃	〃	3755	〃	127.8		
1	Web Pl.	500 x 11	2540	43.175	109.7		
1	Guss Pl.	850 x 11.	1.265	73.398		92.8	
2	Pls	305 x 9	480	21.548		20.7	
1	Fill	〃	320	〃		6.9	
1	Bent Pl.	365 x 9	640	25.787		16.5	

367.2 + 136.9 = 504.1
× 4
2,016.4

			L_5-L_6		2 Req'd.		
2	∠s	150x100x9	4340	17.02	147.7		
2	〃	〃	4290	〃	146.0		
1	Web Pl.	500 x 11	2370	43.175	102.3		
1	Guss Pl.	860 x 11	1.960	74.261		145.9	

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

2	Pls.	305 × 9	480	21.548		20.7
1	Fill.	210 × 9	305	14.837		4.5
1	Bent Pl.	290 × 9	470	20.489		9.6

396.0 + 180.7 = 576.7
× 2
1,153.4

Lo-L5' 2 Req'd.

4	Ls.	150×100×9	2370	17.02	161.3
1	Web Pl.	500 × 11	2370	43.175	102.3

263.6
× 2
527.2

Splice SPl. 18 Req'd.

2	Ls.	150×100×12	480	22.41		21.5
2	Pls.	305 × 9	480	21.548		20.7
2	〃	85 × 11	480	7.34		7.0
1	Pl.	320 × 11	480	27.632		13.3

62.5
× 18
1,125.0

Summary of Bottom chords 15,874.0

END POST Lo-Uo 4 Req'd.

2	Ls.	150×150×11	5.105	24.95	254.7		
2	〃	〃	5.000	〃	249.5		
4	〃	〃	3.440	〃	343.3		
1	Pl.	360 × 11	4.730	31.086	147.0		
1	〃	〃	3.120	〃	97.0		
1	〃	430 × 9	450	30.38		13.7	
11	Fills	145 × 9	180	10.244		20.3	
1	Pl.	420 × 9	455	29.673		13.5	
2	Ls.	75×75×9	295	9.96		5.9	
1	Fill	145 × 9	440	10.244		4.5	
4	Ls	150×150×15	960	33.55		128.8	
2	Pls	360 × 11	480	31.086		29.8	Splice
4	〃	150 × 11	480	12.953		24.9	
2	〃	150 × 9	960	10.598		20.3	
1	Pl	1,080 × 11	1.175	93.258		109.6	
1	Fill	210 × 10	305	16.485		5.0	

1,091.5 + 376.3 = 1,467.8
× 4
5,871.2

VERTICALS V1, V2, V3, V4, & V5 4 Req'd.

2	Ls	130×130×9	6.390	17.73	226.6		V1
1	Pl.	200 × 9	5.750	14.13	81.2		
4	Pls.	70 × 8	300	4.396		5.3	
2	Ls	130×130×12	4.530	23.36	211.6		V2
7	Washers	70φ × 9		@ 0.272		1.9	
2	Ls	130×130×9	3.150	17.73	111.7		V3

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

4	Washers	70^{ϕ} × 9		@ 0.272		1.1	V3
2	Ls	130x130x9	2.200	17.73	78.0		V4
3	Washers	70^{ϕ} × 9		@ 0.272		0.8	
2	Ls	130x130x9	1.640	17.73	58.2		V5
2	Washers	70^{ϕ} × 9		@ 0.272		0.5	
					767.3 +	9.6	= 776.9
							× 4
							3,107.6

VERTICAL V6 2 Req'd.

2	Ls.	130x130x9	1.460	17.73	51.8		
2	Washers.	70^{ϕ} × 9		@ 0.272		0.5	
1	Fill.	125 × 9	280	8.831		2.5	
					51.8 +	3.0	= 54.8
							× 2
							109.6

Summary of Endpost & Verticals 9,088.4

DIAGONALS D1, D2, D3, D4, D5, & D6 4 Req'd.

1	L.	125x90x10	7.175	16.09	115.4		D1
1	"	"	7.065	"	113.7		
1	Pl.	200 × 9	7.285	14.13	102.9		
1	L	125x90x10	5.665	16.09	91.1		D2
1	"	"	5.610	"	90.3		
1	Pl.	200 × 9	5.610	14.13	79.3		
1	L	130x130x9	4.485	17.73	79.5		D3
1	"	"	4.585	"	81.3		
2	Ls	"	3.755	"	133.2		D4
2	"	"	3.245	"	115.1		D5
2	"	"	2.990	"	106.0		D6
							1,107.8
							× 4
							4,431.2

Summary of Diagonals 4,431.2

FLOOR BEAM FB1, FB2, FB3, & FB4 13 Req'd.

4	Flg Ls.	75x75x9	4.760	9.96	189.6		
1	Web Pl.	405 × 8	4.760	29.202	139.0		
4	Ls	100x100x10	383	14.91		22.8	
4	Fills	100 × 9	315	7.065		8.9	
6	Ls	75x75x9	457	9.96		27.3	
6	Fills	75 × 9	320	5.299		10.2	
4	Ls	100x75x10	160	12.95		8.3	
4	"	75x75x9	220	9.96		8.8	
4	Washers	70^{ϕ} × 9		@ 0.272		1.1	
4	Fills	127 × 9	210	8.973		7.5	
					328.6 +	94.9	= 423.5
							× 13
							5,505.5

Summary of Floor beams 5,505.5

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

			STRINGERS	S1	24 Req'd.			
1	I	250x125@38.29	3,710		142.1			
4	Ls.	100x100x10	200	14.91		11.9		
					142.1 +	11.9	= 154.0	
							× 24	
							3,696.0	
			Summary of Stringers		3,696.0			
			TOP LATERAL BRACINGS		1 Req'd.			
8	Ls	130x130x9	4,110	17.73	583.0			TR1
16	〃	〃	4,110	〃	1,165.9			TR2
2	Pls	470 × 9	760	33.206		50.5		
4	〃	〃	600	〃		79.7		
					1,748.9 +	130.2	= 1,879.1	
			Summary of Top lateral bracings		1,879.1			
			SWAY BRACING & STRUTS at L_0-U_0		2 Req'd.			
2	Ls	130x130x9	4,760	17.73	168.8			
2	〃	〃	4,620	〃	163.8			
2	〃	100x75x10	4,470	12.95	115.8			
2	Pls	230 × 9	290	16.25		9.4		
1	Pl.	430 × 9	730	30.38		22.2		
1	L.	130x130x9	4,450	17.73	78.9			
					527.3 +	31.6	= 558.9	
							× 2	
							1,117.8	
			SWAY BRACING & STRUTS at L_2-U_2		2 Req'd.			
2	Ls.	100x100x10	6,315	14.91	188.3			
1	Fill.	100 × 9	180	7.065		1.3		
4	Ls	75x75x9	295	9.96		11.8		
2	Pls	340 × 9	420	24.021		20.2		
2	Ls	100x100x10	420	14.91		12.5		
2	〃	〃	380	〃		11.3		
2	Bent Pls.	405 × 9	790	28.613		45.2		
2	Ls	100x75x10	4,740	12.95	122.8			
1	Fill.	70 × 9	580	4.946		2.9		
6	Washers.	70^{ϕ} × 9		@ 0.272		1.6		
					311.1 +	106.8	= 417.9	
							× 2	
							835.8	
			SWAY BRACINGS & STRUTS at L_4-U_4		2 Req'd.			
2	Ls.	75x75x9	5,045	9.96	100.5			
1	Fill.	75 × 9	180	5.299		1.0		
4	Ls.	75x75x9	295	9.96		11.8		
2	Pls.	290 × 9	420	20.489		17.2		
2	Bent Pls.	320 × 9	740	22.608		33.5		
2	Ls	100x100x10	385	14.91		11.5		
2	〃	〃	365	〃		10.9		
2	〃	100x75x10	4,740	12.95	122.8			
1	Fill.	70 × 9	550	4.946		2.7		

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Material list of Kagarido-Bashi for Miyazaki-Ken.

4	Washers	70$^\phi$ × 9		@ 0.272		1.1

223.3 + 89.7 = 313.0
× 2
626.0

SWAY BRACINGS & STRUTS at L6-U6 1 Req'd.

2	Ls	75×75×9	2.740	9.96	54.6	
2	〃	〃	2.735	〃	54.5	
2	Fills	75 × 9	160	5.299		1.7
4	Ls	75×75×9	295	9.96		11.8
2	Pls	295 × 9	325	20.842		13.5
2	Ls	75×75×9	630	9.96		12.5
1	Pl.	270 × 9	630	19.076		12.0
4	Ls	100×100×10	365	14.91		21.8
2	Pls	315 × 9	465	22.255		20.7
2	Ls	100×75×10	4.740	12.95	122.8	
1	Pl.	275 × 9	550	19.429		10.7
6	Washers	70$^\phi$ × 9		@ 0.272		1.6

231.9 + 106.3 = 338.2

BOTTOM LATERAL STRUT at Lo, LS1, 2 Req'd.

1	L	100×75×10	4.470	12.95	57.9	
2	Ls	〃	4.690	〃	121.5	
4	〃	100×100×10	400	14.91		23.9
2	Pl.	495 × 9	560	34.972		39.2
14	Lac. bars	70 × 9	680	4.946		47.1
2	Bent Pls	210 × 9	350	14.837		10.4

179.4 + 120.6 = 300.0
× 2
600.0

BOTTOM LATERAL STRUT at L1, ST1 2 Req'd.

2	Ls	100×75×10	4.740	12.95	122.8	
2	〃	100×100×10	455	14.91		13.6
2	〃	〃	400	〃		11.9
2	Bent Pls.	410 × 9	910	28.967		52.7
1	Fill.	70 × 9	710	4.946		3.5
6	Washers.	70$^\phi$ × 9		@ 0.272		1.6

122.8 + 83.3 = 206.1
× 2
412.2

BOTTOM LATERAL STRUT at L3, ST2. 2 Req'd.

2	Ls	100×75×10	4.740	12.95	122.8	
2	〃	100×100×10	405	14.91		12.1
2	〃	〃	375	〃		11.2
2	Bent Pls.	310 × 9	765	21.902		33.5
1	Fill.	70 × 9	710	4.946		3.5
6	Washers.	70$^\phi$ × 9		@ 0.272		1.6

122.8 + 61.9 = 184.7
× 2
369.4

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

BOTTOM LATERAL STRUT at L5, ST3 2 Req'd.

2	∠s	100x75x10	4740	12.95	122.8	
2	〃	100x100x10	375	14.91		11.2
2	〃	〃	370	〃		11.0
2	Bent Pls.	310 x 9	735	21.902		32.2
1	Fill.	70 x 9	710	4.946		3.5
6	Washers.	70$^\phi$ x 9		@ 0.272		1.6

122.8 + 59.5 = 182.3
× 2
364.6

(4 Req'd) (8 Req'd)
BRACKET BT1 & BT2 1 Req'd.

8	∠s	75x75x9	295	9.96	23.5	BT1
4	Pls.	330 x 9	425	23.315	39.6	
16	∠s	75x75x9	295	9.96	47.0	BT2
8	Pls.	290 x 9	425	20.489	69.7	

179.8

Summary of Sway bracings Bottom lateral strut & Brackets 4,843.8

BOTTOM LATERAL BRACINGS 1 Req'd.

8	∠s	125x90x10	4350	16.09	559.9		BR1
8	〃	〃	4375	〃	563.2		BR2
8	〃	〃	4220	〃	543.2		BR3
4	〃	〃	4100	〃	263.9		BR4^R_L
4	〃	〃	4170	〃	268.4		
8	〃	〃	4065	〃	523.2		BR5
8	〃	〃	4035	〃	519.4		BR6
2	Bent Pls	560 x 9	595	39.564		47.1	
2	〃	485 x 9	505	34.265		34.6	
2	〃	490 x 9	500	34.619		34.6	
2	〃	430 x 9	490	30.38		29.8	
2	〃	425 x 9	500	30.026		30.0	
1	Pl.	500 x 9	690	35.325		27.4	

3,241.2 + 203.5 = 3,444.7

Summary of Truss spans.

Top chords.	12,227.4	41,621.0
Bottom chords.	15,874.0	
Vertical & End post.	9,088.4	
Diagonals.	4,431.2	
Floor beams.	5,505.5	
Stringers	3,696.0	
Top laterals	1,879.1	
Sway bracings & lateral struts	4,843.8	
Bottom bracings	3,444.7	
	60,990.1	or 60.9901 Kg.tons.

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MAIN GIRDER G1 $\overset{R}{L}$ 4 Req'd.

4	Flg L^s.	100x100x10	5925	14.91	353.4	
1	Web Pl.	500 × 11	5470	43.175	236.2	
4	L^s.	90x90x10	490	13.34		26.1
2	Fills.	180 × 10	305	14.130		8.6
10	L^s	75x75x9	490	9.96		48.8
2	Fills.	230 × 10	305	18.055		11.0
2	Spl Pl.	305 × 9	460	21.548		19.8
1	Pl.	340 × 9	430	24.021		10.3
1	"	265 × 9	310	18.722		5.8
1	Sole Pl.	250 × 19	360	37.288		13.4
1	Bed Pl.	310 × 19	360	46.237		16.6
2	L^s	125x75x10	230	14.91		6.9
1	L	150x90x15	210	26.49		5.6
1	Fill.	150 × 15	210	17.663		3.7
10	Fills	75 × 10	305	5.888		18.0
2	Anchor bolts.	32^{ϕ} × 600		@ 3.86		7.7
2	Washers.	100 × 9	100	7.065		1.4

589.6 + 203.7 = 793.3
× 4
3,173.2

FLOOR BEAM FB5 (2 Req'd) & FB6 (2 Req'd) 4 Req'd.

See sheet no. 38

328.6 + 94.9 = 423.5
× 4
1,694.0

STRINGER S2 (S2A) & BRACKET BR1 1 Req'd.

8	Is	250x125@$\overset{Kgs}{38.29}$	2810		860.8		S1 & S2A
32	L^s	100x100x10	200	14.91		95.4	S1 & S2A
4	Is	250x125@38.29	400			61.3	B1 $\overset{R}{L}$
8	L^s	100x100x10	200	14.91		23.9	B1 $\overset{R}{L}$
4	Pls	140 × 9	310	9.891		12.3	

860.8 + 192.9 = 1,053.7

TOP LATERAL BRACING 1 Req'd.

8	L^s	130x130x9	3335	17.73	473.0	
2	Pls	600 × 9	630	42.39		53.4

473.0 + 53.4 = 526.4

Summary of Girder spans.

Girder	3,173.2	
Floor beams	1,694.0	
Stringers & brackets	1,053.7	
Top lateral bracings	526.4	Kg. tons
	6,447.3 or	6.4473

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

EXPANSION JOINT EJ1 — 2 Req'd.

1	L.	65×65×8	5.720	7.66	43.8	
1	Checkered Pl.	185 × 9	5.740	14.725	84.5	
2	Pls.	190 × 9	450	13.424	12.1	
2	〃	210 × 9	225	14.837	6.7	
2	Ls	90×75×9	450	11.02	9.9	
2	〃	〃	210	〃	4.6	
6	Bolts.	19ϕ × 50		@ 0.306	1.8	
						✓ 163.4
						× 2
						✓ 326.8

EJ2 — 2 Req'd.

1	L	125×75×10	5.720	14.91	85.3	
1	〃	90×75×9	5.420	11.02	59.7	
1	Bar	50 × 10	5.740	3.925	22.5	
2	Pls	190 × 9	390	13.424	10.5	
2	〃	160 × 9	200	11.304	4.5	
2	〃	〃	215	〃	4.9	
1	Pl.	〃	220	〃	2.5	
7	Anchor bolts.	19ϕ × 200		@ 0.618	4.3	
						✓ 194.2
						× 2
						✓ 388.4

Summary of Expansion joints 715.2 kg. or 0.7152 tons

SHOE — 4 Req'd.

1	Cast steel shoe CS1		@380	380.0	(Caststeel 380×4 = 1,520)
1	140ϕ × 291		@35.2	35.2	
2	Nuts		@ 3.54	7.1	
4	Anchor bolts 35ϕ × 1,000		@ 8.7	34.8	
4	Washer 150×9	150	10.598	6.4	
					463.5
					× 4
					✓ 1,854.0

Summary of Shoes. ✓ 1,854.0 kg. or 1.854 tons

HANDRAIL GR1 — 4 Req'd.

1	Gas Pipe	63ϕ	1.660	8.62	14.3	
2	Ls	45×45×6	1.410	3.95	11.1	
9	Bars	30 × 9	480	2.12	9.2	
2	〃	40 × 9	270	2.826	1.5	
1	Fill	40 × 9	90	〃	0.3	
						36.4
						× 4
						✓ 145.6

GR2 — 12 Req'd.

1	Gas Pipe	63ϕ	1.480	8.62	12.8
2	Ls	45×45×6	1.410	3.95	11.1
9	Bars.	30 × 9	480	2.12	9.2
2	〃	40 × 9	270	2.826	1.5

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CALCULATIONS FOR

Material list of Kagarido-Bashi for Miyazaki-Ken.

1	Fill	40 × 9	90	2.826	0.3
					34.9
					× 12
					418.8

GR3 48 Req'd.

1	Gas Pipe	63$^{\phi}$	1.855	8.62	16.0
2	∠s	45×45×6	1.785	3.95	14.1
11	Bars	30 × 9	480	2.12	11.2
2	〃	40 × 9	270	2.826	1.5
1	Fills	40 × 9	90	〃	0.3
					43.1
					× 48
					2,068.8

Handrail Posts P1 & P2 (Cast iron) 23.0 × 66 = 1,518.0

3720	10$^{\phi}$ Rivet heads.		@	0.0043	16.0
132	Anchor bolts 19$^{\phi}$ × 570		@	1.445	190.7
256	∠s 100×75×10	50		12.95	165.8
396	Bolts 13$^{\phi}$ × 120		@	0.19	75.2
392	Screws 8$^{\phi}$ × 20		@	0.01	3.9
66	Pls 80 × 6	330		3.768	82.1
					533.7

Summary of Handrail & Posts 4,684.9 or 4.6849 kg.tons

Grand Summary.

	kg.tons.	
Truss spans.	60.9901	
Girder spans.	6.4473	
Expansion joints	0.7152	
	68.1526	
Rivet heads ab't 3.5%	2.3800	
	70.5326	
Shoes (For Trusses)	1.8540	(cast steel 1.520 kg.tons)
Handrails	4.6849	
	77.0715	

Structural steel 70.8666
Cast steel 1.5200
72.3866

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CALCULATIONS FOR

Materials of Kagarita Bashi for Miyasaki Ken.

Materials for Floor.

Concrete 1:2:4 mixture.

Total length of slab = 2 @ 6.117ᵐ = 12.234ᵐ
4 @ 11.244 = 44.976
57.21 meters.

Sectional area of slab.

slab. 5.4 × .13 = .702
copings .333 × .27 × 2 = .180
fillets .062 × .2 × 2 = .025
" .013
0.920 ᴰᵐ

volume of concrete = 0.92 × 57.21 = 52.60 cub. meters. drain holes neglected.

Forms. width
slab bottom = 5.40
copings 2 × .633 = 1.266
Curbs 2 × .19 = .38
Stringer top. less 2 × .125 = −.25
truss or girder " 2 × .211 = −.422
6.374 × 57.24 = 365.0 sq. m.

length 57.21
5 × .006 = .03
57.24ᵐ

人造洗出仕上
curb .16
Coping top. .30
outside .333
bottom .107
.90 × 57.24 × 2 = 103.0 sq. m

Reinforcing Bars. plain bars. see drawing. = 5.558 kg. tons.

Pavement 3.8ᶜᵐ asphalt block
5.40 × 57.24 = 309.0 sq. meters Drain holes neglected.

Construction joints 5 ヶ所 Carey Elastite ¼" × 6" 挿入 17.

Drains. 12 drains reqd. @ 14 kg. cast iron.

Materials for Abutment.

Concrete 1:2:4 mixture.

Section parapet .4 × .56 = .224
shaft .925 × .80 = .739
coping .05 × .30 = .015
.978 × 5.40 = 5.28
base 1.3 × .4 × 7.2 = = 3.75
columns .8 × .8 × 1.705 × 2 = 2.18
11.21 cub. m

Forms.
parapet & shaft 5.4 × 1.36 × 2 = 14.70
shaft, sides .4 × .8 × 2 = .64
columns 1.705 × .8 × 6 = 8.18
" .45 × 1.705 × 2 = 1.54
base. .4 × 7.2 × 2 = 5.76
" .4 × 1.3 × 2 = 1.04
31.86 sq. meter

Reinforcements Plain Bars see drawing = 0.278 kg. tons

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CALCULATIONS FOR

Materials of Kagarito Bashi for Miyasaki Ken.

Granite 踏掛石.
8 × ·20 × ·24 × ·67 = 0.257 cub meter

Excavation. say 30 cub meters. ~~one half hard rock + other half soil~~. (大約ノ見当) excavation 1ヶ所

~~Log~~ Pedestal ~~4~~ 2 @ ·6 × ·6 × 1.1 = ~~1.584~~ 0.792 cub meters. granite.

人造仕上.
·8 × 1.705 × 4 = 5.45
·8 × ·15 × 4 = ·48
·8² − ·6² = ·28
6.21 sq. m.

Materials for pier.
~~Concrete~~ 1:2:4 mixture.

Coping	·2 × 1.00 × 1.575 =	0.315
Body.	·70 × ·992 × 1.70 =	1.180
〃	·74 × 1.59 × 1.70 =	2.000
Base	·60 × 1.50 × 2.50 =	2.250
〃	·50 × 1.705 × 2.50 =	2.133
〃	·345 × ·79 × 2.50 =	0.682

8.56 cub meter.

Reinforcements, plain bars, see drawings = 0.297 kg. ton

Form

Top.	1.0 × 1.50 =	1.50
coping	·25 × 5.20 =	1.30
front.	1.7 × ·992 =	1.69
side	·7 × ·992 × 2 =	1.39
〃	1.5 × ·74 × 2 =	2.22
base	·6 × 1.5 × 2 =	1.80
〃	·5 × 1.7 × 2 =	1.70
〃	·35 × ·79 × 2 =	·55
〃	·6 × 2.5 =	1.50

13.65 sq. meter.

Excavation. 8.56 × 3 = 25 cub meter (大約ノ見当) all rock.

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CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki Ken.

Determination of H-surface.

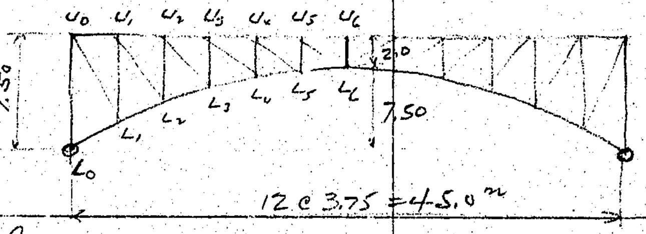
Tied arch $H = P\frac{\Sigma S_0 S_1 \frac{L}{A}}{\Sigma S_1^2 \frac{L}{A} + \frac{L_t}{A_t}}$

Foundamental formula $H = P\frac{\Sigma S_0 S_1 \frac{L}{A}}{\Sigma S_1^2 \frac{L}{A}}$

where H = Horizontal thrust due to load P.
S_0 = Stress caused by the vertical load unity ($P=1$) if the arch is Considered as a simple span
S_1 = Stress caused by the sole application of a horizontal force unity acting in the line of horizontal reaction but in opposite direction to the latter
L = Length of member, A = the area of its gross section and
(E = modulus of elasticity 2100,000 kg/cm²)

此計算多少ノ有効近似値ナトレリ

Find So.



Reactions

Load 1 at			Reaction	Shear		
1	11/12	=	0.916	0.916	1	0.084
2	10/12	=	0.833	0.833	2	0.167
3	9/12	=	0.750	0.750	3	0.250
4	8/12	=	0.667	0.667	4	0.333
5	7/12	=	0.583	0.583	5	0.417
6	6/12	=	0.500	0.500	6	0.500

Chord stresses.

Load unity at panel pt 1.
moment at panel pt.

1. 0.916 × 3.75 = 3.436 kgm.

Stress U_0-U_1 3.436 ÷ 7.10 = 0.484 kg c
L_1-L_2 〃 ÷ 6.25 = 0.550 T

2. 0.916 × 7.50 = 6.870
1.00 × 3.75 = − 3.750
3.120

Stress U_1-U_2 3.120 ÷ 5.15 = 0.606 c
L_2-L_3 〃 ÷ 4.85 = 0.644 T

3. 0.916 × 11.25 = 10.300
1.00 × 7.50 = − 7.500
2.800

U_2-U_3 2.800 ÷ 3.83 = 0.731 c
L_3-L_4 〃 ÷ 3.65 = 0.768 T

4. 0.916 × 15.0 = 13.730
1.0 × 11.25 = 11.250
2.480

U_3-U_4 2.480 ÷ 2.83 = 0.877 c
L_4-L_5 〃 ÷ 2.80 = 0.886 T

5. 0.916 × 18.75 = 17.180
1.0 × 15.0 = 15.00
2.180

U_4-U_5 2.180 ÷ 2.25 = 0.969 c
L_5-L_6 〃 ÷ 〃 = 0.969 T

6. 0.916 × 22.5 = 20.60
1.0 × 18.75 = 18.75
1.85

U_5-U_6 1.850 ÷ 2.0 = 0.925 c

Load unity at panel pt. 2.

1 0.833 × 3.75 = 3.124

Stress U_0-U_1 3.124 ÷ 7.1 = 0.440 c
L_1-L_2 〃 ÷ 6.25 = 0.500 T

2. 0.833 × 7.50 = 6.24.

U_1-U_2 6.240 ÷ 5.15 = 1.212 c
L_2-L_3 〃 ÷ 4.85 = 1.287 T

3. 0.833 × 11.25 = 9.375
1.0 × 3.75 = 3.750
5.625

U_2-U_3 5.625 ÷ 3.83 = 1.469 c
L_3-L_4 〃 ÷ 3.65 = 1.542 T

4. 0.833 × 15.0 = 12.50
1.0 × 9.50 = 7.50
5.00

U_3-U_4 5.00 ÷ 2.83 = 1.767 c
L_4-L_5 〃 ÷ 2.80 = 1.785 T

5 0.833 × 18.75 = 15.62
1.0 × 11.75 = 11.25
4.37

U_4-U_5 4.37 ÷ 2.25 = 1.944 c
L_5-L_6 〃 ÷ 〃 = 1.944 T

6. 0.833 × 22.5 18.75
1.0 × 15.0 15.00
3.75

U_5-U_6 3.75 ÷ 2.0 = 1.875 c

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CALCULATIONS FOR

②

Design of Kagarito Bashi for Miyasaki Ken.

Load unity at panel pt. 3

1	0.750 × 3.75 =	2.81	Stress	U_0-U_1	2.810 ÷ 7.1 =	0.396 kg	C
				L_1-L_2	" ÷ 6.25 =	0.450	T
2.	0.75 × 7.50 =	5.622		U_1-U_2	5.622 ÷ 5.15 =	1,093	C
				L_2-L_3	" ÷ 4.85 =	1160	T
3.	0.75 × 11.25 =	8.43		U_2-U_3	8.430 ÷ 3.83 =	2,20	C
				L_3-L_4	" ÷ 3.65 =	2,31	T
4.	0.75 × 15,00 =	11,25		U_3-U_4	7.50 ÷ 2.83 =	2,650	C
	1.0 × 3.75 =	3.75		L_4-L_5	" ÷ 2,80 =	2,680	T
		7.50					
5	0.75 × 18.75 =	14,06					
	1.0 × 7.5 =	7.50		U_4-U_5	6.56 ÷ 2.25 =	2,916	C
		6.56		L_5-L_6	" ÷ " =	2,916	T
6.	0.75 × 22.5 =	16,88					
	1.0 × 11.25 =	11.25		U_5-U_6	5.63 ÷ 2.0 =	2,815	C
		5.63					

Load unity at panel pt. 4.

1.	0.667 × 3.75 =	2,50	U_0-U_1	2.50 ÷ 7.1 =	0.352	C
			L_1-L_2	" ÷ 6.25 =	0.400	T
2.	0.667 × 7.50 =	5.00	U_1-U_2	5.00 ÷ 5.15 =	0.972	C
			L_2-L_3	" ÷ 4.85 =	1,030	T
3.	0.667 × 11.25 =	7.5	U_2-U_3	7.5 ÷ 3.83 =	1.960	C
			L_3-L_4	" ÷ 3.65 =	2,055	T
4.	0.667 × 15,00 =	10,00	U_3-U_4	10.0 ÷ 2.83 =	3.532	C
			L_4-L_5	" ÷ 2,80 =	3,570	T
5.	0.667 × 18.75 =	12.50				
	1.0 × 3.75 =	3.75	U_4-U_5	8.75 ÷ 2.25 =	3,890	C
		8.75	L_5-L_6	" ÷ " =	3,890	T
6,	.667 × 22.5 =	15.0	U_5-U_6	7.5 ÷ 2 =	3.750	C
	1.0 × 7.5 =	7.5				
		7.50				

Load unity at panel pt 5.

1.	0.583 × 3.75 =	2.185	U_0-U_1	.308	C
			L_1-L_2	.349	T
2	0,583 × 7.5 =	4.370	U_1-U_2	.849	C
			L_2-L_3	.902	T
3	0.583 × 11.25 =	6,550	U_2-U_3	1,710	C
			L_3-L_4	1,794	T
4	0.583 × 15.00 =	8.75	U_3-U_4	3,090	C
			L_4-L_5	3,125	T
5	0.583 × 18.75 =	10,94	U_4-U_5	4.860	C
			L_5-L_6	4.860	T
6	0,583 × 22.5 =	13.13	U_5-U_6	4.690	C
	1.0 × 3.75 =	3.75			
		9.38			

Load unity at panel pt 6.

1	0.500 × 3.75 =	1.875	U_0-U_1	.264	C	5	9.38	U_4-U_5	4.17	C
			L_1-L_2	.300	T			L_5-L_6	4.17	T
2		3.750	U_1-U_2	.728	C	6	11.25	U_5-U_6	5.63	C
			L_2-L_3	.773	T					
3		5.625	U_2-U_3	1.470	C					
			L_3-L_4	1.540	T					
4		7.50	U_3-U_4	2.650	C					
			L_4-L_5	2.680	T					

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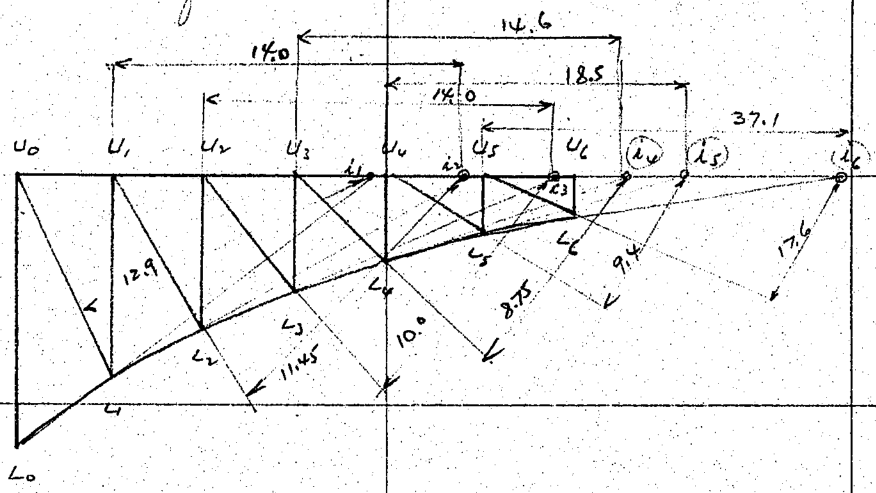
CALCULATIONS FOR

Design of Kagarito Bashi for Miyasaki ken -

Stress So for web members



L_0 —	i_6	55.85
L_0	i_5	33.50
L_0	i_4	25.85
L_0	i_3	21.50
L_0	i_2	17.75
L_0	i_1	14.60

Load 1. at panel pt 1. reaction 0,916^{kg}
moment about

		$u_0 - L_0$	—	- 0,916 C
i_1	.916 × 14.6 = 13.37	$U_0 - L_1$	13.37 ÷ 12.9 =	1,035 T
i_2	.916 × 17.75 = 16.25 1.0 × 14.0 = 14.0 2,25	$U_1 - L_1$ $U_1 - L_2$	16.25 ÷ 14.0 = 2.25 ÷ 11.45 =	1.160 C 0.197 T
i_3	.916 × 21.5 = 19.90 1.0 × 17.75 = 17.75 2.15	$U_2 - L_2$ $U_2 - L_3$	2.15 ÷ 14.0 = 2.15 ÷ 10.0 =	0.154 C 0.215 T
i_4	.916 × 25.85 = 23.70 1.0 × 22.1 = 22.1 1.60	$U_3 - L_3$ $U_3 - L_4$	1.60 ÷ 14.6 = " ÷ 8.75 =	0.110 C 0.183 T
i_5	.916 × 33.5 = 30.68 1.0 × 29.75 = 29.75 0.93	$U_4 - L_4$ $U_4 - L_5$	0.93 ÷ 18.5 = " ÷ 9.4 =	0.050 C 0.099 T
i_6	.916 × 55.85 = 51.15 1.0 × 52.10 = 52.10 − 0.95	$U_5 - L_5$ $U_5 - L_6$	−0.95 ÷ 37.1 = " + 17.6 =	0.026 T 0.054 C

Load unity at panel pt 2. Reaction 0,833^{kg}

		$u_0 - L_0$		0.833 C
i_1	.833 × 14.6 = 12.15	$U_0 - L_1$	12.15 ÷ 12.9 =	0.942 T
i_2	.833 × 17.75 = 14.80	$U_1 - L_1$ $U_1 - L_2$	14.80 ÷ 14.0 = " ÷ 11.45 =	1.057 C 1.292 T
i_3	.833 × 21.5 = 17.91 1.0 × 14.0 = 14.0 3.91	$U_2 - L_2$ $U_2 - L_3$	17.91 ÷ 14 = 3.91 ÷ 10. =	1.280 C 0.391 T
i_4	.833 × 25.85 = 21.54 1.0 × 18.35 = 18.35 3.19	$U_3 - L_3$ $U_3 - L_4$	3.19 ÷ 14.6 = " ÷ 8.75 =	0.219 C 0.365 T
i_5	.833 × 33.50 = 27.90 1.0 × 26.0 = 26.0 1.90	$U_4 - L_4$ $U_4 - L_5$	1.90 ÷ 18.5 = " ÷ 9.4 =	0.103 C 0.202 T
i_6	.833 × 55.85 = 46.50 1.0 × 48.35 = 48.35 −1.85	$U_5 - L_5$ $U_5 - L_6$	−1.85 ÷ 37.1 = " ÷ 17.6 =	0.050 T 0.105 C

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CALCULATIONS FOR

Kagarito Bashi for Miyasaki Ken.

Load unity at panel pt. 3. Reaction 0.750kg.
moment about

i_1 0.75 × 14.6 =	10.95	U_0-L_0		0.750 C
		U_0-L_1	10.95 ÷ 12.9 =	0.849 T
i_2 0.75 × 17.75 =	13.31	U_1-L_1	13.31 ÷ 14 =	0.951 C
		U_1-L_2	" ÷ 11.45 =	1.163 T
i_3 0.75 × 21.5 =	16.11	U_2-L_2	16.11 ÷ 14 =	1.150 C
		U_2-L_3	" ÷ 10. =	1.611 T
i_4 0.75 × 25.85 =	19.40			
1.0 × 14.6 =	14.60	U_3-L_3	19.4 ÷ 14.6 =	1.328 C
	4.80	U_3-L_4	4.8 ÷ 8.75 =	0.549 T
i_5 0.75 × 33.5 =	25.10			
1.0 × 22.25	22.25	U_4-L_4	2.85 ÷ 18.5 =	0.154 C
	2.85	U_4-L_5	" ÷ 9.4 =	0.303 T
i_6. 0.75 × 55.85 =	41.90			
1.0 × 44.60 =	44.60	U_5-L_5	-2.70 ÷ 37.1 =	0.073 T
	-2.70	U_5-L_6	" ÷ 17.6 =	0.153 C

Load unity at panel pt. ④ Reaction 0.667.

i_1 0.667 × 14.6	9.74	U_0-L_0		0.667 C
		U_0-L_1	9.74 ÷ 12.9 =	0.755 T
i_2 " × 17.75	11.84	U_1-L_1	11.84 ÷ 14. =	0.845 C
		U_1-L_2	" ÷ 11.45 =	1.035 T
i_3 " × 21.5	14.35	U_2-L_2	14.35 ÷ 14 =	1.025 C
		U_2-L_3	" ÷ 10 =	1.435 T
i_4 " × 25.85	17.25	U_3-L_3	17.25 ÷ 14.6 =	1.182 C
		U_3-L_4	" ÷ 8.75 =	1.972 T
i_5 " × 33.5	22.35	U_4-L_4	22.35 ÷ 18.5 =	1.210 C
	18.5			
	3.85	U_4-L_5	3.85 ÷ 9.4 =	0.410 T
i_6 " × 55.85	37.25			
	40.85	U_5-L_5	-3.6 ÷ 37.1 =	0.097 T
	-3.60	U_5-L_6	-3.6 ÷ 17.6 =	0.205 C

Load unity on panel pt. ⑤ Reaction 0.583.

i_1 0.583 × 14.6 =	8.53	U_0-L_0		0.583 C
		U_0-L_1		0.661 T
i_2 " × 17.75 =	10.35	U_1-L_1		0.740 C
		U_1-L_2		0.904 T
i_3 " × 21.5 -	12.53	U_2-L_2		0.896 C
		U_2-L_3		1.253 T
i_4 " × 25.85 =	15.07	U_3-L_3		1.032 C
		U_3-L_4		1.722 T
i_5 " × 33.5 =	19.55	U_4-L_4		1.057 C
		U_4-L_5		2.080 T
i_6 " × 55.85 =	32.55			
	37.10	U_5-L_5	32.55 ÷ 37.1	0.878 C
	-4.55	U_5-L_6	-4.55 ÷ 17.6	0.259 C

Load unity on panel pt ⑥ Reaction 0.500

i_1 0.50 × 14.6 =	7.30	U_0-L_0		0.500 C
		U_0-L_1		0.566 T
i_2 " × 17.75 =	8.875	U_1-L_1		0.634 C
		U_1-L_2		0.775 T
i_3 " × 21.5 =	10.75	U_2-L_2		0.768 C
		U_2-C_3		1.075 T
i_4 " × 25.85 =	12.925	U_3-L_3		0.885 C
		U_3-L_4		1.478 T
i_5 " × 33.50 =	16.75	U_4-L_4		0.905 C
		U_4-L_5		1.782 T
i_6 " × 55.85 =	27.925	U_5-L_5		0.753 C
		U_5-L_6		1.587 T

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CALCULATIONS FOR

⑤

Design of Kagarite Bashi for Miyasaki Ken.

Chord stresses of right half of truss Stresses So by propotion

	Load unity on ⑥ $R_L = 0.500$		Load on ⑤ $R_R = 0.417$	Load on ④ $R_R = 0.333$	Load on ③ $R_R = 0.25$	Load on ② $R_R = .167$	Load on ① $R_R = 0.084$
U_0-U_1	0.264 C ✓	$U_0'-U_1'$	0.220 C ✓	.176 C ✓	.134 ✓	.085 ✓	.044 C
L_1-L_2'	.300 T ✓	$L_1'-L_2'$	0.250 T ✓	.200 T ✓	.150 ✓	.100	.050 T
U_1-U_2	.728 C ✓	$U_1'-U_2'$	.607 C ✓	.485 C ✓	.364 ✓	.243 ✓	.122 C
$L_2'-L_3'$	.773 T ✓	$L_2'-L_3'$	.645 T ✓	.515 T ✓	.387 ✓	.258 ✓	.130 T
$U_2'-U_3'$	1.470 C ✓	$U_2'-U_3'$	1.225 C ✓	.980 C ✓	.735 ✓	.490 ✓	.247 C
$L_3'-L_4'$	1.540 T ✓	$L_3'-L_4'$	1.285 T ✓	1.025 T ✓	.770 ✓	.513 ✓	.259 T
$U_3'-U_4'$	2.650 C ✓	$U_3'-U_4'$	2.210 C ✓	1.765 C ✓	1.325 ✓	.883 ✓	.445 C
$L_4'-L_5'$	2.680 T ✓	$L_4'-L_5'$	2.240 T ✓	1.785 T ✓	1.340 ✓	.893	.450 T
U_4-U_5'	4.170 C ✓	$U_4'-U_5'$	3.480 C ✓	2.780 C ✓	2.085 ✓	1.390	.701 C
$L_5'-L_6'$	4.170 T ✓	$L_5'-L_6'$	3.480 T ✓	2.780 T ✓	2.085 ✓	1.390	.701 T
U_5-U_6	5.630 C ✓	$U_5'-U_6'$	4.700 C ✓	3.750 C ✓	2.815 ✓	1.897	.946 C

Web stress

$U_0'-L_0'$	0.500 C	$U_0'-L_0'$	0.417 ✓	.333 ✓	.250 ✓	.167	.084 C
$U_0'-L_1'$	.566 T	$U_0'-L_1'$	.472 ✓	.377 ✓	.283 ✓	.189	.095 T
$U_1'-L_1'$	.634 C	$U_1'-L_1'$	.528 ✓	.422 ✓	.317 ✓	.212 ✓	.107 C
$U_1'-L_2'$	.775 T	$U_1'-L_2'$	.646 ✓	.516 ✓	.388 ✓	.258 ✓	.130 T
$U_2'-L_2'$	.768 C	$U_2'-L_2'$	.640 ✓	.511 ✓	.384 ✓	.256	.129 C
$U_2'-L_3'$	1.075 T	$U_2'-L_3'$	.896	.716 ✓	.538 ✓	.368 ✓	.181 T
$U_3'-L_3'$	.885 C	$U_3'-L_3'$	.737 ✓	.589 ✓	.443 ✓	.295 ✓	.149 C
$U_3'-L_4'$	1.478 T	$U_3'-L_4'$	1.231	.984 ✓	.739	.493	.248 T
$U_4'-L_4'$	.905 C	$U_4'-L_4'$	.754	.603 ✓	.453 ✓	.302 ✓	.152 C
$U_4'-L_5'$	1.782 T	$U_4'-L_5'$	1.485 ✓	1.190 ✓	.891 ✓	.594 ✓	.299 T
$U_5'-L_5'$	0.753 C	$U_5'-L_5'$	.627	.502 C ✓	.377	.251	.127 C
$U_5'-L_6'$	1.587 T	$U_5'-L_6'$	1.320 ✓	1.057 ✓	.794	.529	.267 T

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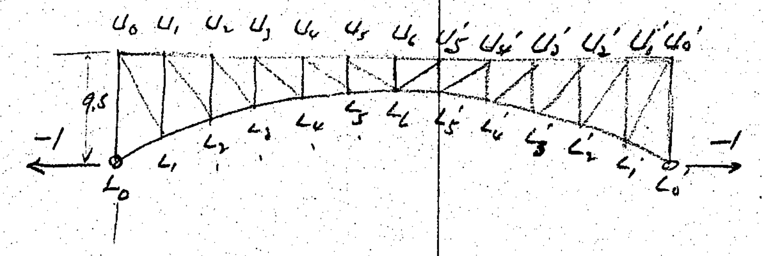
CALCULATIONS FOR

⑥

Design of Kagarito Bashi for Miyasaki Ken

Find Stress S_1.



Moment about

U_0	m = 9.50	L_0-L_1	9.50 ÷ 8.0 =	1.19 T
L_1	2.45	U_0-L_0	2.45 ÷ 375 =	.653 C
		U_0-U_1	2.45 ÷ 7.1 =	.345 C
U_1	9.50	L_1-L_2	6.25	1.520 T
L_2	4.35	U_1-U_2	5.15	.845 C
U_2	9.5	L_2-L_3	4.85	1.960 T
L_3	5.7	U_2-U_3	3.83	1.490 C
U_3	9.5	L_3-L_4	3.65	2.605 T
L_4	6.75	U_3-U_4	2.83	2.385 C
U_4	9.5	L_4-L_5	2.80	3.395 T
L_5	7.25	U_4-U_5	2.25	3.220 C
U_5	9.5	L_5-L_6	2.25	4.220 T
L_6	7.5	U_5-U_6	2.0	3.750 C
i_1	9.5	U_0-L_1	12.9	0.737 T
i_2	"	U_1-L_1	14.0	.679 C
"		U_1-L_2	11.45	.830 T
i_3	"	U_2-L_2	14.0	.679 C
		U_2-L_3	10.0	.950 T
i_4	"	U_3-L_3	14.6	.651 C
		U_3-L_4	8.75	1.085 T
i_5	"	U_4-L_4	18.5	.513 C
		U_4-L_5	9.4	1.010 T
i_6	"	U_5-L_5	37.1	.256 C
		U_5-L_6	17.6	.540 T

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CALCULATIONS FOR

⑦

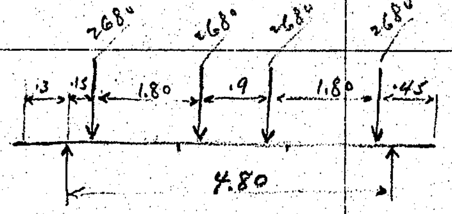
Design of Kagarito Bashi for Miyasaki Ken.

Approximate Dead panel load for one truss.

Floor.	Slab and pavement 2.7^m @ 490 =	1,323
	Coping	210
	handrail	40
	Stringer	40
	floor beam 430÷2 ÷ 3.75 =	57
		1670 kg per lin meter
62.5 tons = 63.5 kg tons.	Truss laterals &c. 30,000 kg ÷ 45 =	690
		2340

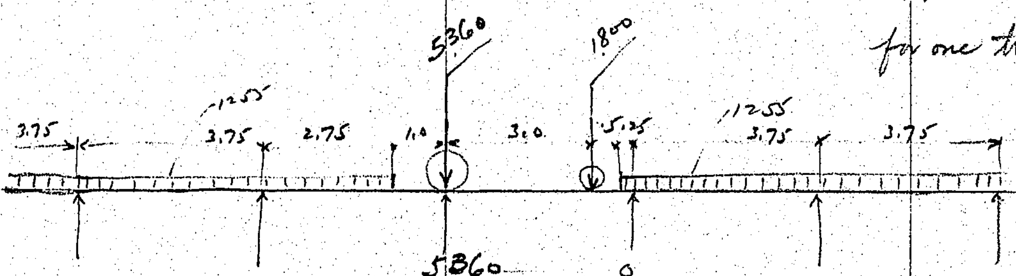
Panel Dead Load for one truss = 2340 × 3.75 = 8,780 kg
Call this 8800 kg

Live panel Load.
motor truck rear wheel concentration 2250 kg
imp coef. = $\frac{20}{60+45}$ = 0.191   430
2680 kg
front wheel with imp. 2680÷3 = say 900 kg



Wheel concentration on main truss.
Rear wheel 2@2680 = 5,360 kg
front wheel 2@900 = 1,800

Uniform live load $w = \frac{100,000}{170+45} = 465$ kg/m²
for one truss 2.7 × 465 = 1255 kg per lin m.



		5,360	0		
4700	2350	360 —	1440		
	2,185	1265			
		10	305		
			2350 —	4700	4700
4,700	4,535	6,995	4095	4,700	4,700

Assumed Live panel load.

4700	4,700	4,700 1,800	4700	4,700	4,700

Approx. Thrust H.
Dead Load   Reaction 5.5 × 8,800 = 48,400 kg
moment 48,400 × 22.5 = 1,089,000
8,800 × 3.75 × 15 = − 495,000
594,000 kgm ÷ 8.5 = 69,900 kg = H

Live Load full load. Reaction 5.5 × 4700 = 25,850 kg
1800 ÷ 2 = 900
26,750 kg

moment 26750 × 22.5 = 602,000
4700 × 3.75 × 15 = − 264,500
337,500 kgm ÷ 8.5 = 39,700 kg = H.

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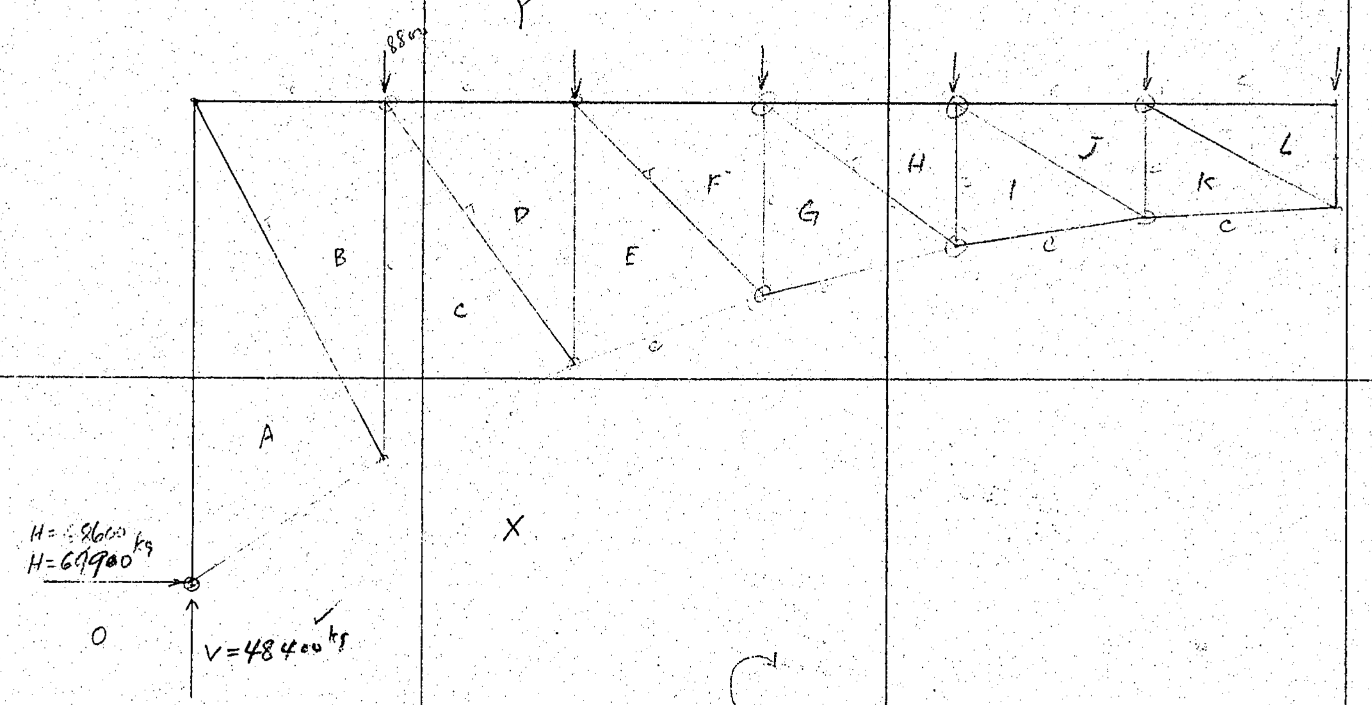
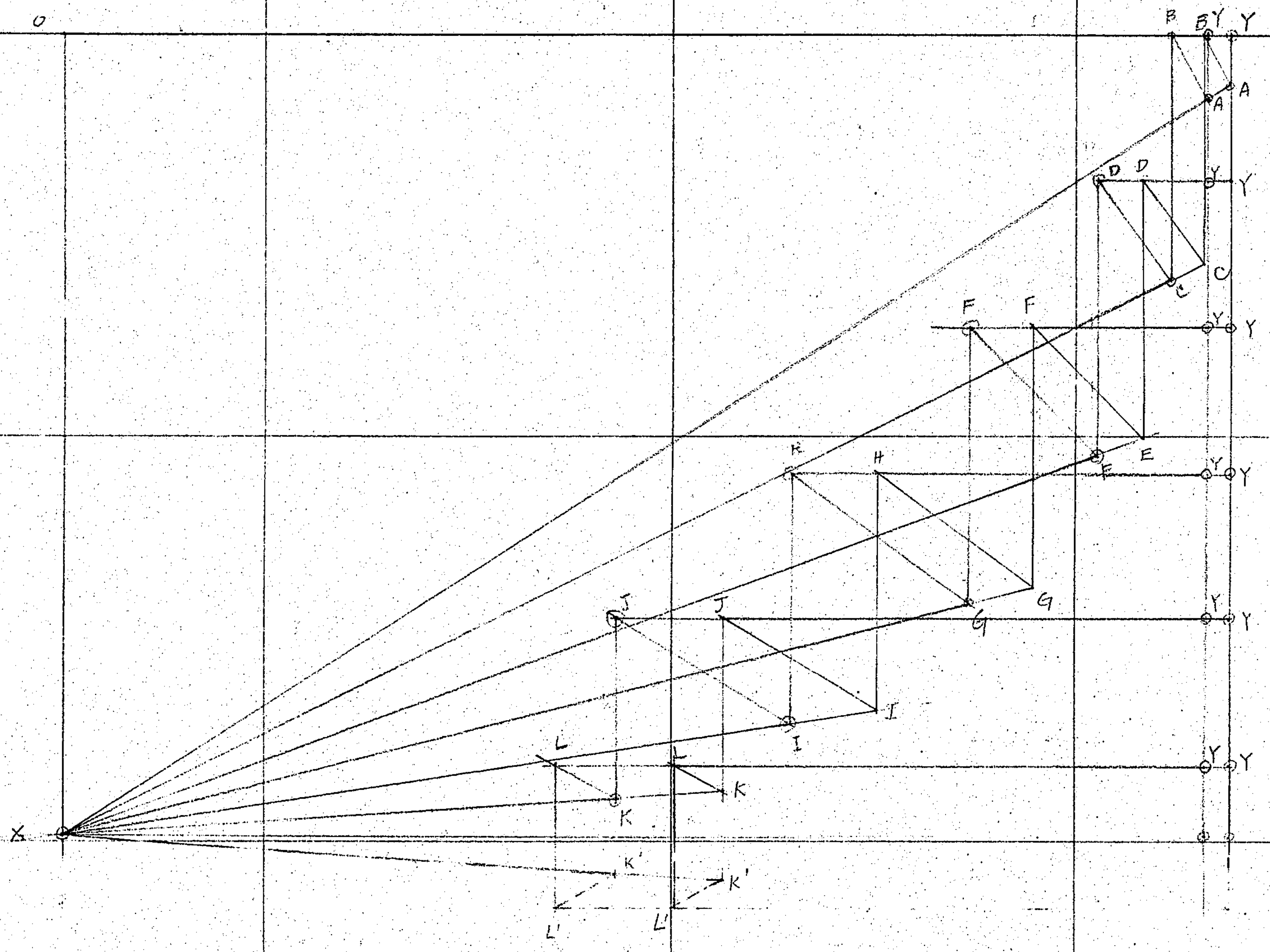
CALCULATIONS FOR

Design of Kagarito Bashi for Miyazaki ken

Dead load stresses of truss members.





scale 1/40 meter = 10,000 kg

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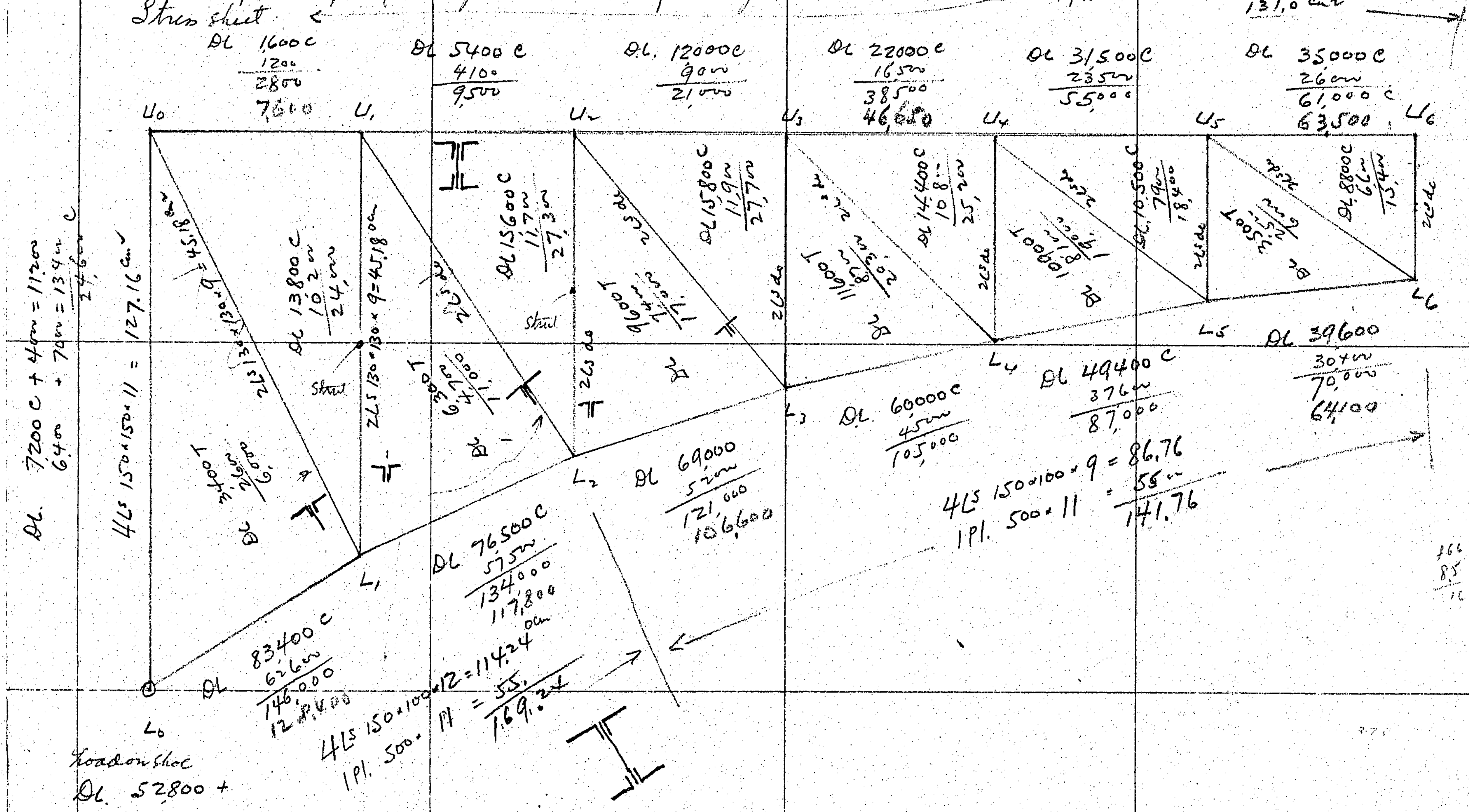
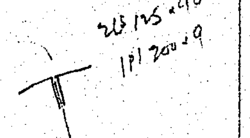
CALCULATIONS FOR

Preliminary Design of Kagarito Bashi for Miyazaki Ken

Stress sheet





$\frac{L}{A}$ for each member.

member length gross area ratio L/A

U_0-L_0

75

$\cancel{\frac{650}{5.1}} = \frac{61}{5.1} = 120$

2.5 $\frac{830}{\cancel{63.5}\ 6.7} = \cancel{113}\ 131$

$\boxed{U_5 - U_6}$ $\frac{61000}{131} = 465$ kg/cm² direct c.

Bending m. $490 \times 1.2 = 590$
fl. 40
cop. 210
840 kg/m + 100 = 950

DL m. $\frac{1}{8} \times 950 \times 3.75^2 = 1670$ kgm
LL m. $\frac{1}{4} \times 7000 \times 3.75 = 6560$
8230 kgm

flange stress $\frac{8230 \times 100}{47} = 17500$ kg.

flange area 2Ls 38.0
$\frac{1}{8}$ web 6.9
44.9

Bending stress $= \frac{17500}{44.9} = 390$ kg/cm²

Direct comp. $= 465$ c
855 kg/cm²

allowable stress
$1200 \left(1 - 0.012 \times \frac{375}{21}\right) =$ 940 kg/cm² ok.

$1500 (1 - 0.0055 \frac{l}{r}) \leq 1000$

141.2

$\frac{450}{3.59} = 1$

$141.2^{4} \times 41.62 = 5,800$ cm⁴

$r = \sqrt{\frac{I}{a}} = \sqrt{\frac{5,800}{\cancel{114.24}\ 149.26}} = \sqrt{\cancel{50.8}\ 34.} = \cancel{22.5}\ 18.5$

$l = 450$ $l/r = \frac{450}{\cancel{22.5}\ 7.35} = \cancel{20}\ 61$

$1500 (1 - 0.0055 \frac{l}{r}) = \cancel{1230}\ 995$

$\frac{bd^3}{12}$

1
.336
.664

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（独立行政法人 土木研究所蔵）

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$\frac{L}{A} = \frac{375^{cm}}{131^{cm^2}} = 2.862$

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(10)

CALCULATIONS FOR

Preliminary Design of Sagarito Bashi, for Miyasaki Ken.

H-Surface $H = P\,\frac{\Sigma S_0 S_1 \frac{L}{A}}{\Sigma S_1^2 \frac{L}{A}}$

\+ sign tension
\- sign compression

	H_1. Load unity at panel pt U_1					H_2. Load unity at panel pt U_2.				
Members	S_0	S_1	$\frac{L}{A}$	$S_0S_1\frac{L}{A}$	$S_1^2\frac{L}{A}$	S_0	S_1	$\frac{L}{A}$	$S_0S_1\frac{L}{A}$	$S_1^2\frac{L}{A}$
$L_0-L_1+L_0'-L_1'$	0	+2,380	2,655	0	15,050	0	+2.380	2,655	0	
$U_0-U_1+U_0'-U_1'$	-0.528	-0,690	2,862	1,043	11,362	-.525	-0.690	2.862	1,038	H_1ニ於ケルモノト同様
$L_1-L_2+L_1'-L_2'$	+0,600	+3,040	2,482	4,530	22,950	+.600	+3,04	2.482	4.430	
$U_1-U_2+U_1'-U_2'$	-0,728	-1,690	2,862	3.520	8.170	-1.455	-1,69	2.862	7,040	
$L_2-L_3+L_2'-L_3'$	+0,774	+3,920	2,825	8.570	43,400	+1,545	+3,92	2.825	17,100	
$U_2-U_3+U_2'-U_3'$	-0,978	-2,980	2,862	8,345	25,42	-1959	-2,98	2.862	16,700	
$L_3-L_4+L_3'-L_4'$	+1,027	+5,210	2,730	14.600	74.18	+2,055	+5.21	2,730	29.200	
$U_3-U_4+U_3'-U_4'$	-1,322	-4,770	2,862	18,050	65.18	-2,650	-4.77	2,862	36.180	
$L_4-L_5+L_4'-L_5'$	+1.336	+6,790	2,675	24,250	123,20	+2,678	+6.79	2,675	48.630	
$U_4-U_5+U_4'-U_5'$	-1,670	-6,440	2,862	30,750	118.70	-3,334	-6.44	2,862	61,400	
$L_5-L_6+L_5'-L_6'$	+1,670	+8,440	2,650	37,350	188.75	+3,334	+8.44	2,650	74,600	
$U_5-U_6+U_5'-U_6'$	-1,871	-7,500	2,862	40,200	161.00	-3,752	-7.50	2,862	80,500	
			(H.226)	(191,208)	(847,362)			(H=.444)	(376,818)	(847,362)
$U_0-L_0+U_0'-L_0'$	-1,000	-1,270	7,47	9,480	12,04	-1,000	-1,27	7,47	9,480	
U_0-L_1	+1,130	+1,474	17,63	29,38	38,25	+1,131	+1,474	17,63	29,400	
U_1-L_1	-1,267	-1,358	15.60	26,85	28,78	-1269	-1,358	15,60	26,900	
U_1-L_2	+.327	+1,660	14,07	7.63	38,75	+1,550	+1,66	14,07	36,15	
U_2-L_2	-.283	-1,358	11.36	4,37	20.95	-1,536	-1,358	11,36	23.73	
U_2-L_3	+.396	+1,900	11,70	8,80	42,20	+.759	+1,90	11,70	16.87	
U_3-L_3	-.259	-1,302	8,24	2.78	13,97	-.514	-1,302	8,24	5,52	
U_3-L_4	+.431	+2,170	10,30	9.64	48.50	+.858	+2,17	10,30	19.18	
U_4-L_4	-.202	-1,026	6.11	1.267	6.43	-.405	-1,026	6,11	2,54	
U_4-L_5	+.398	+2,020	9,61	7,720	39.40	+.796	+2,02	9,61	15,45	
U_5-L_5	-.101	-0,512	4,84	0,250	1.27	-.201	-.512	4,84	.50	
$U_5-L_6+U_5'-L_6'$	+.213	+1,080	9,40	2,160	11,98	+.424	+1,08	9,40	4,30	
U_6-L_6	0	0	4,43	0	0	0	0	4,43	0	
				(110,327)	(302,52)				(196.02)	302.52
			Summary	301,535	1149.882		Summary		566.838	1149.882

$H_1 = \frac{301.327}{1149.882} = \underline{\underline{0.262}}$

$H_2 = \frac{566.838}{1149.882} = \underline{\underline{0.493}}$

此表 改造スル様ニ書ク。
次頁ノ通リ、一枚ニカク。

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CALCULATIONS FOR

(11)

Preliminary Design of Kagarito Bashi for Miyazaki prefecture.

H-Surface continued.

H3. Load unity at panel pt 3.				H4 Load 1 at panel pt 4.		H5 Load 1 at panel pt 5		H6 Load 1 at panel pt 6.	
Members	$S_1 \frac{L}{A}$	S_0	$S_0 S_1 \frac{L}{A}$	S_0	$S_0 S_1 \frac{L}{A}$	S_0	$S_0 S_1 \frac{L}{A}$	S_0	$S_0 S_1 \frac{L}{A}$
$L_0-L_1 + L_0'-L_1'$	+6.315	0	0	0	0	0.	0	0	0
$U_0-U_1 + U_0'-U_1'$	-1.975	-.530	1,047	-0,528	1,043	-0.528	1,043	-.0,528	1,043
$L_1-L_2 + L_1'-L_2'$	+7,542	+.600	4,525	+0,600	4,525	+0,599	4,515	+0,600	4,525
$U_1-U_2 + U_1'-U_2'$	-4,837	-1.457	7,040	-1.457	7,040	-1,456	7,040	-1.456	7.040
$L_2'-L_3 + L_2'-L_3'$	+11.075	+1,547	17,150	+1,545	17,100	+1,547	17120	+1,546	17.110
$U_2-U_3 + U_2'-U_3'$	-8,525	-2,935	25,000	-2,940	25,050	-2,935	25,000	-2,940	25,050
$L_3-L_4 + L_3'-L_4'$	+14,225	+3,080	43,800	+3,080	43,800	+3,079	43,750	+3,080	43,800
$U_3-U_4 + U_3'-U_4'$	-13.660	-3,975	54,300	-5,297	72,300	-5,300	72,400	-5,300	72,400
$L_4-L_5 + L_4'-L_5'$	+18.150	+4,020	72.950	+5,355	97,100	+5,365	97,350	+5,360	97,300
$U_4-U_5 + U_4'-U_5'$	-18.430	-5.601	92,200	-6,670	122,800	-8,340	153,700	-8,340	153,700
$L_5-L_6 + L_5'-L_6'$	+22,380	+5,001	111,950	+6,670	149,200	+8.340	186,500	+8,340	186,500
$U_5-U_6 + U_5'-U_6'$	-21.480	-5,630	120,900	-7.500	161.050	-9,390	201,500	-11,260	241,700
			(550.862)		(701.008)		(809.918)		(850,168)
$U_0-L_0 + U_0'-L_0'$	-9,480	-1.000	9.480	-1,000	9.480	-1,000	9,480	-1,000	9,480
$U_0-L_1 + U_0'-L_1'$	+26.000	+1,132	29,400	+1,132	29.300	+1,133	29,460	+1,132	29,400
$U_1-L_1 + U_1'-L_1'$	-21,200	-1.268	-26,900	-1,267	26,850	-.1268	26,900	-1,268	26,900
$U_1-L_2 + U_1'-L_2'$	+23.350	+1,551	36,200	+1,551	36,200	+1,550	36,200	+1,550	36.200
$U_2-L_2 + U_2'-L_2'$	-15.430	-1,534	23.680	-1,536	23,550	-1,536	23.550	-1,536	23,550
$U_2-L_3 + U_2'-L_3'$	+22.220	+2,149	47.720	+2,151	47,800	+2,149	47,700	+2,150	47,720
$U_3-L_3 + U_3'-L_3'$	-10.720	-1.771	18.990	-1.771	18.980	-1.769	18,950	-1,770	18,980
$U_3-L_4 + U_3'-L_4'$	+22.350	+1,288	28.790	+2,956	66.050	+2,953	65,980	+2,956	66.120
$U_4-L_4 + U_4'-L_4'$	-6,270	-.607	3.805	-1,813	11.370	-1,811	11,355	-1,810	11,350
$U_4-L_5 + U_4'-L_5'$	+19.410	+1,194	23.195	+1.600	31,050	+3,565	69,200	+3,564	69,180
$U_5-L_5 + U_5'-L_5'$	-2,478	-.450	1,115	-0,405	1.005	-1,505	3,730	-1,506	37,340
$U_5-L_6 + U_5'-L_6'$	+10.150	+.947	9,610	+0.852	8,650	+1,061	10,775	+3,174	32,200
$U_6-L_6 + U_6'-L_6'$	0	0	0	0	0	0	0	0	0
			(258.885)		(310.285)		(353,280)		(408,420)
			809,747		1011.293		1163.198		1258.588

$$H_3 = \frac{809,747}{1149,882} = \underline{\underline{0,704}}$$

$$H_4 = \frac{1011,293}{1149,882} = \underline{\underline{0,881}}$$

$$H_5 = \frac{1163,198}{1149,882} = \underline{\underline{1,012}}$$

$$H_6 = \frac{1258.588}{1149,882} = \underline{\underline{1,095}}$$

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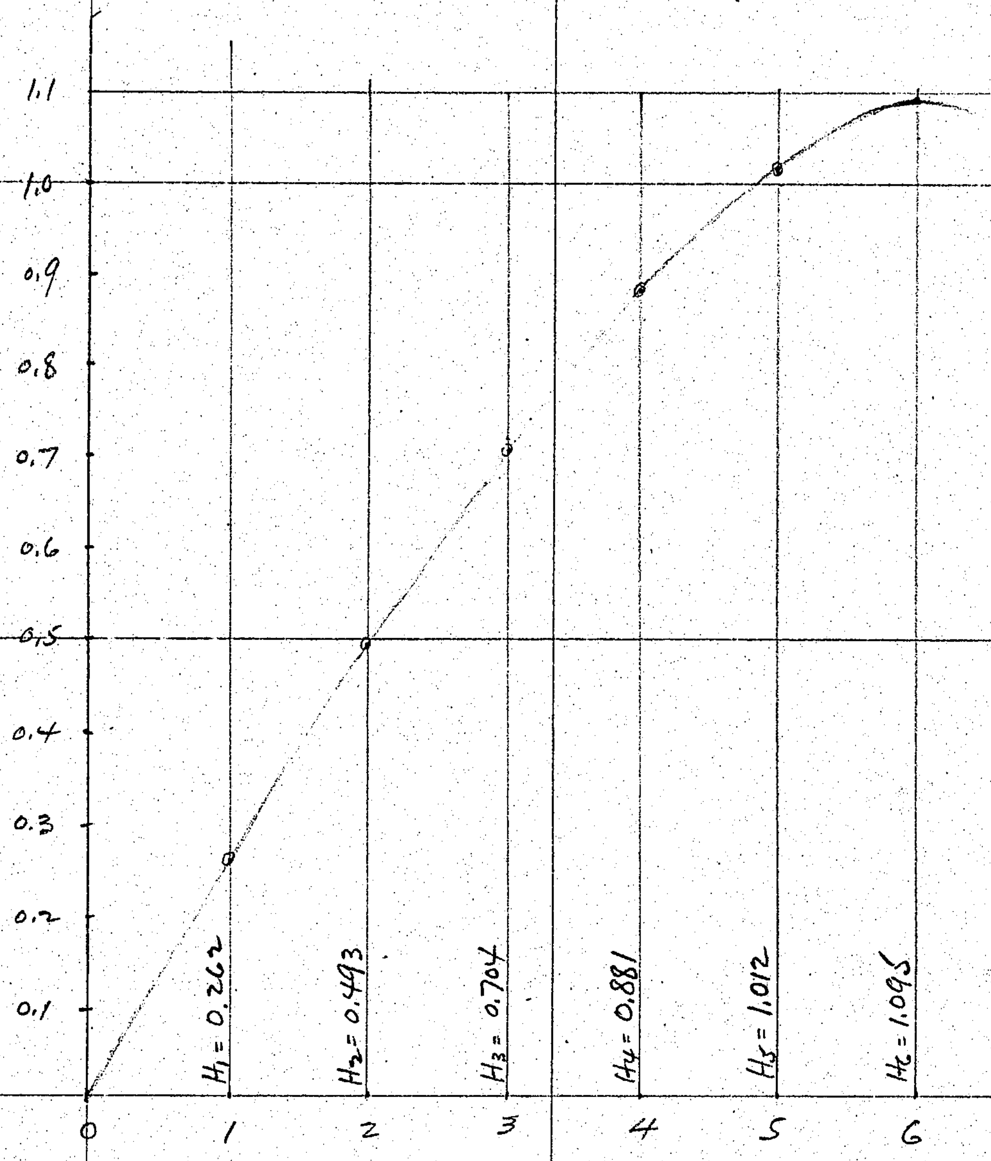
CALCULATIONS FOR

(12)

Preliminary Design of Kagarito Bashi for Miyasaki Ken.

Influence Line of H.



Load at panel pt.	Left Reaction R due to load			Horizontal Thrust H due to load.			
	1.	4700	1800	1	4700	1800	
1.	0.917.	4310	1650	0.262	1,230	470	1
2	0.833	3920	1500	0.493	2320	890	2
3	0.750	3520	1350	0.704	3310	1270	3
4	0.667	3140	1200	0.881	4140	1590	4
5	0.583	2740	1050	1.012	4.760	1820	5
6	0.500	2350	900	1.095	5150	1970	6
5'	0.417	1960	750	1.012	4.760	1.820	5'
4'	0.333	1570	600	0.881	4.140	1590	4'
3'	0.250	1180	450	0.704	3.310	1270	3'
2'	0.167	780	300	0.493	2320	890	2'
1'	0.083	390	150	0.262	1230	470	1'
	5.50 ····	25860✓		7.799 ····	36,670✓		

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CALCULATIONS FOR

Preliminary Design of Kagarito Bashi for miyazaki ken.

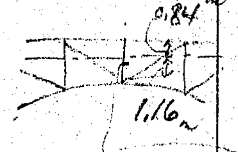
Dead Load Stresses. Panel load = 8860 kg

Dead Load thrust

$H = 8800 \cdot 7.799 = 68600$ kg

$V = 8800 \cdot 5.5 = 48400$ kg

rise $\frac{594 t\text{-}m}{68.6 t}$ = 8.66 m
7.5
7.16 m



中心より2%上

Dead load stresses by graphical solution. see page 8. red lines show new stresses

Top chords.

$U_0 - U_1$	2200 C
$U_1 - U_2$	6600 C
$U_2 - U_3$	14300 C
$U_3 - U_4$	25000 C
$U_4 - U_5$	35500 C
$U_5 - U_6$	39000 C

Bottom Chords

$L_0 - L_1$	82000 C
$L_1 - L_2$	74500 C
$L_2 - L_3$	66200 C
$L_3 - L_4$	56200 C
$L_4 - L_5$	44200 C
$L_5 - L_6$	33300 C

Verticals

$U_0 - L_0$	8200 C
$U_1 - L_1$	14800 C
$U_2 - L_2$	16600 C
$U_3 - L_3$	16800 C
$U_4 - L_4$	15000 C
$U_5 - L_5$	11000 C
$U_6 - L_6$	8800 C

78
44
87

Diagonals

$U_0 - L_1$	4400 T
$U_1 - L_2$	7500 T
$U_2 - L_3$	11000 T
$U_3 - L_4$	13500 T
$U_4 - L_5$	12400 T
$U_5 - L_6$	4400

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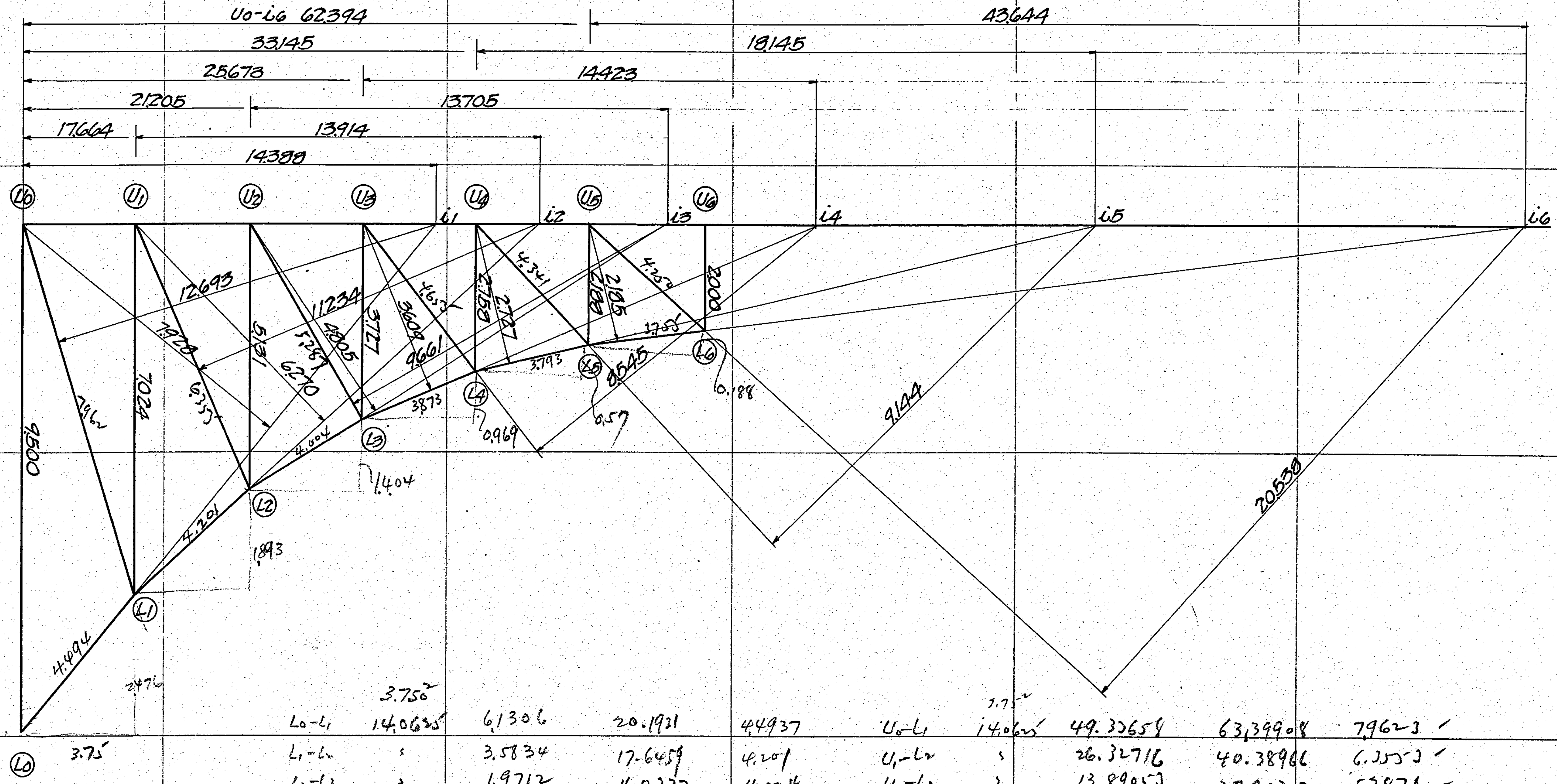
CALCULATIONS FOR

Preliminary Design of Koggrito Bashi for miyasaki-ken



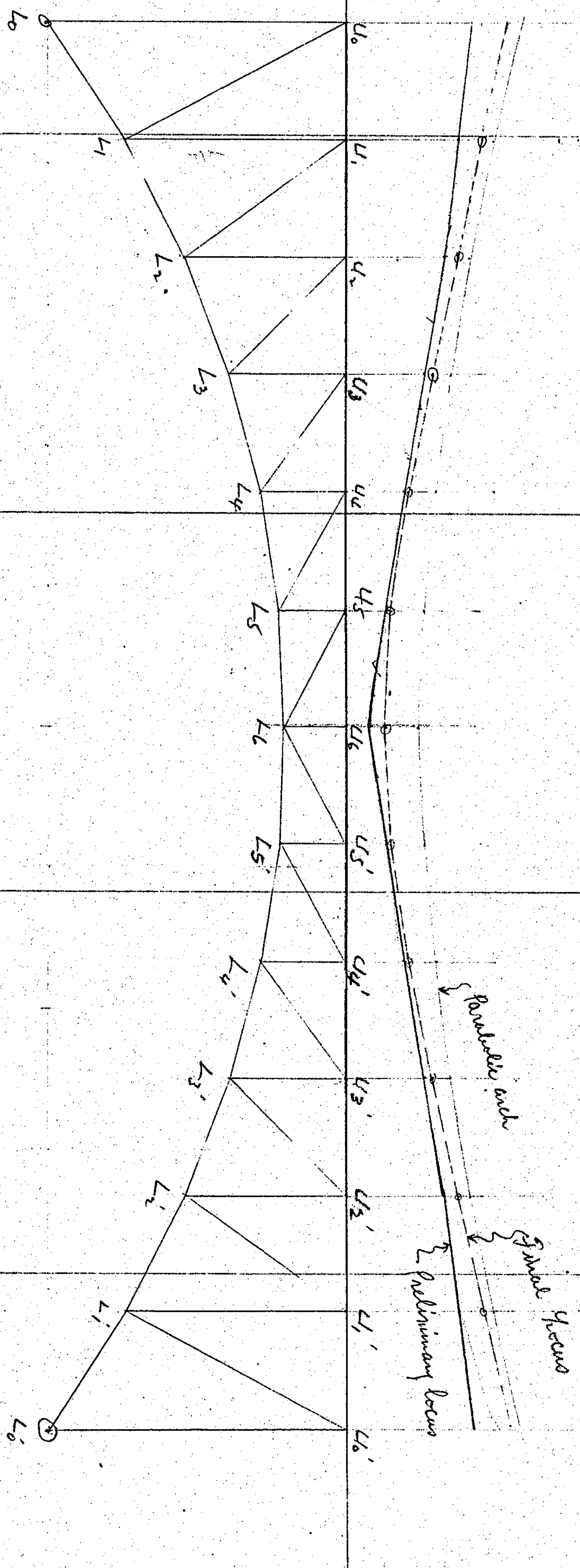
	3.75²			
L0-L1	14.0625	6.1306	20.1931	4.4937
L1-L2	〃	3.5834	17.6459	4.201
L2-L3	〃	1.9712	16.0337	4.004
L3-L4	〃	0.93896	15.00146	3.8733
L4-L5	〃	0.3249	14.3874	3.7930
L5-L6	〃	0.035344	14.09784	3.7546

	3.75²			
U0-L1	14.0625	49.33658	63.39908	7.9623 ✓
U1-L2	〃	26.32716	40.38966	6.3553 ✓
U2-L3	〃	13.89053	27.95303	5.2871 ✓
U3-L4	〃	7.60656	21.66906	4.655 ✓
U4-L5	〃	4.78734	18.84984	4.3413 ✓
U5-L6	〃	4.000	18.0625	4.250 ✓

(15)

Preliminary Design of Kagarite Bashi

The Reaction Locus of the truss



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CALCULATIONS FOR

(16)

Preliminary Design of Kagarito Bashi for miyasaki ken.

Live Load Stresses: Panel load: 4,700 kg for all panels & 1800 kg Extra single load for rear wheel.
By the reaction locus diagram loading crytesion for max stress shall be desided.
Top chord members.

U_5-U_6 center of moment at L_6. loads on panels points u_2 to u_2'

panel pts.	loads.	H	V.
u_2	4700	2320	3,920
u_3	〃	3310	3,520
u_4	〃	4140	3,140
u_5	〃	4760	2,740
u_6	6500	7120	3250
u_5'	4,700	4760	1,960
u_4'	〃	4140	1,570
u_3'	〃	3310	1,180
u_2'	〃	2320	780
		36,180 kg	22,060 kg

moment abt. L_6.
22,060 × 22.5 = 496,500
4,700 × 3.75 × 10 = − 176,300
3,6180 × 7.5 = − 271,200
+ 49,000 kgm

Stress $U_5-U_6 = \frac{49000}{2.00} = \underline{\underline{24500}}$ kg C

U_3-U_4 center of moment L_4 loads on u_1 to u_5 1800 on U_4

panel pt.	loads.	H	V.
u_1	4700	1230	4,310
u_2	4700	2320	3,920
u_3	4700	3310	3520
u_4	6500	5730	4,340
u_5	4700	4760	2740
		17,350	18,830

moment abt L_4
18830 × 15 = 282,500
4,700 × 3.75 × 6 = − 105,800
17,350 × 6.742 = − 117,000
59,700

Stress $U_3-U_4 = \frac{59{,}700}{2.758} = \underline{21650}$ kg C

for neg. m.

H	V
17,350	6,480

6,480 × 15 = 97,200
17350 × 6.742 = 117,000
− 19800 kgm

Stress $u_3-u_4 = \frac{19800}{2.758} = \underline{7200}$ kg T.

u_0-u_1 center of m at L_1 loads on u_1 u_2 u_3

panel pt.	loads.	H	V.
u_1	6500	1,700	5,960
u_2	4700	2,320	3,920
u_3	〃	3310	3,520
		7,330	13,400

moment
13400 × 3.75 = + 50200
7330 × 2.476 = − 18200
38,000 kgm

Stress $u_0-u_1 = \frac{38{,}000}{7.024} = \underline{\underline{5410}}$ kg

Lower chord members.

L_5-L_6 Center of moment at U_5 Loads on 1 2 3 6 5' 4' ③ 2' + 1'

panel pt	loads	H	V
1	4,700	1230	4,310
2	〃	2320	3920
3	〃	3310	3,520
6	〃	5150	2350
5'	〃	4760	1960
4'	〃	4140	1570
③'	6,500	4580	1630
2'	4700	2320	780
1'	〃	1230	390
		29,040	20,530

20,530 × 18.75 = + 385,000
4700 × 3.75 × 10 = − 176,300
29,040 × 9.5 = − 276,000
− 67,300 kgm

Stress $L_5-L_6 = \frac{67300}{2.185} = 30,800$ kg C.

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CALCULATIONS FOR

Preliminary Design of Kagarito Bashi for Miyazaki Ken.

L_2-L_3. center of moment at U_2 | loads on 3 4 5 6 ⑤ 4' 3' 2' + 1'

panel pt.	loads	H	V.
3	4700	3310	3520
4	"	4140	3140
5	"	4760	2740
6	"	5150	2350
5'	6500	6580	2710
4'	4700	4140	1570
3'	"	3310	1180
2'	"	2320	780
1'	"	1230	390
		34940	18380

moment

18380 × 7.5 = + 137800
34940 × 9.5 = − 332000
− 194,200 kgm

Stress L_2-L_3 = $\frac{194,200}{4.805}$ = 40,400 kg C

L_1-L_2 center of m at U_1 loads on 2 3 4 5 ⑥ 5' 4' 3' 2' 1'

Panel pt	loads	H	V.
2	4700	2320	3920
3	"	3310	3520
4	"	4140	3140
5	"	4760	2740
6	6500	7120	3250
5'	4700	4760	1960
4'	"	4140	1570
3'	"	3310	1180
2'	"	2320	780
1'	"	1230	390
		37410	22450

moment

22450 × 3.75 = + 84,200
37410 × 9.50 = − 355,500
− 271,300 kgm

Stress L_1-L_2 = $\frac{271,300}{6.27}$ = 43300 kg C

L_0-L_1 full load.

H	V
37410	22450
1230	4310
38640	26760

moment

38640 × 9.5 = − 367000 kgm

Stress L_0-L_1 = $\frac{367000}{7.928}$ = 46,400 kg C.

Web members.

U_0-L_1 Center of moment L_1. loads full + 1800 load on 1.
U_0-L_0

H	V.
36670	25860
470	1650
37140	27510

moment

27510 × 14.388 = + 396,000
37140 × 9.50 = − 353000
+ 43000 kgm

Stress U_0-L_1 = $\frac{43000}{12.693}$ = 3390 kg T.

Stress U_0-L_0 = $\frac{43000}{14.388}$ = 2990
4700 ÷ 2 = 2350
5,340 kg T.

U_1-L_1 H = 37140 V = 28510 moment about U_2

27510 × 17.664 = + 486500
37140 × 9.50 = − 353000
133500

Stress U_1-L_1 = $\frac{133500}{13.914}$ = 9590 kg c

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CALCULATIONS FOR

(18)

Preliminary Design of Kagarite Bashi for Miyazaki Ken.

$U_1 - L_2$ center of m at i2 loads on (2) to 1'

H = 36670
- 1230
+ 890
36,330

V = 25860
- 4310
+ 1500
23050

moment
23050 × 17.664 = 407000
36330 × 9.50 = -345000
+ 62000

Stress $U_1 - L_2 = \frac{62000}{11.234} = 5520$ kg T

$U_2 - L_2$

moment about i3
23050 × 21,205 = + 489600
36330 × 9.5 = - 345000
144,600

Stress $U_2 - L_2 = \frac{144600}{13.705} = 10550$ kg C

$U_2 - L_3$ center of m at i3. loads on (3) to 1'.

H = 36670
- 1230
- 2320
33120
+ 1,270
34,390

V = 25860
- 4,310
- 3,920
17,630
1,350
18980

moment
18980 × 21,205 = 402500
34390 × 9.5 = - 326,500
76,000

Stress $U_2 - L_3 = \frac{76000}{9.661} = 7860$ kg T

$U_3 - L_3$ center of m at i4 loads on (3) to 1'

H = 34,390 V = 18,980

moment
18980 × 25.673 = 487500
34390 × 9.5 = - 326500
161000

Stress $U_3 - L_3 = \frac{161000}{14.423} = 11,170$ kg C

$U_3 - L_4$ Center of moment at i4. loads on (4) to 1'

H = 33120
- 3,310
+ 1,590
31,400

V = 17,630
- 3,520
+ 1,200
15310

moment
15310 × 25.673 = 393000
31400 × 9.5 = 298400
94600

Stress $U_3 - L_4 = \frac{94600}{8.545} = 11070$ kg T

$U_4 - L_4$ Center of moment at i5 loads on 4 to 1'

H = 31400 V = 15310

moment
15310 × 33,145 = + 507200
31400 × 9.5 = - 298400
208800

Stress $U_4 - L_4 = \frac{208800}{18.145} = 11500$ kg C

$U_4 - L_5$ center of moment at i5 loads on (5) to 1'

H = 27,490 V = 12,020

12,020 × 33,145 = 398400
27490 × 9.5 = 262200
136,200

Stress $U_4 - L_5 = \frac{136200}{9,144} = 14,880$ kg T

$U_5 - L_5$ center of m at i6 loads on (5) to 1'

moment
12020 × 62,394 = 749400
27490 × 9.5 = - 262200
487,200

Stress $U_5 - L_5 = \frac{487200}{43,644} = 11,170$ kg C

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CALCULATIONS FOR

⑲

Preliminary Design of Kagarito Bashi for Miyasaki Ken.

U_5-L_6 center of moment at L_6.
$H = 22880$ $V = 9130$

loads on ⑥ to 1'
m

$9130 \times 62.394 = +569500$
$22880 \times 9.5 = -217500$
$352,000$

$\text{Stress } U_5L_6 = \frac{352000}{20.538} = 17150$ kg T.

U_6-L_6

$\text{Stress } U_6-L_6 \left.\begin{matrix}4700\\1800\end{matrix}\right\} = 6500$ kg C

Summary of stresses of truss members.

members	Dead Load	Live Load	Total stress
U_0-U_1	2,200 C	5400 C	7,600 C
U_1-U_2	6600 〃	(8000)	(14,600) C
U_2-U_3	14,300 〃	(14000)	(28300) C
U_3-U_4	25,000 〃	21,700	46700 C
U_4-U_5	35,500 〃	(23500)	(59000) C
U_5-U_6	39,000 〃	24,500	63500 C
L_0-L_1	82,000 C	46,400 C	128,400 C
L_1-L_2	74,500 〃	43300	117,800 C
L_2-L_3	66,200 〃	40,400	106600 C
L_3-L_4	56,200 〃	(36000)	(92,200) C
L_4-L_5	44,200 〃	(32000)	(76200) C
L_5-L_6	33,300 〃	30800	64,100 C
U_0-L_0	8200 C	5300 C	13,500 C
U_1-L_1	14,800 〃	9600	24,400 C
U_2-L_2	16,600 〃	10600	27,200 C
U_3-L_3	16,800 〃	11,200	28,000 C
U_4-L_4	15,000 〃	11,500	26,500 C
U_5-L_5	11,000 〃	11200	22,200 C
U_6-L_6	8800 〃	6,500	15,300 C
U_0-L_1	4,400 T	3,400 T	7,800 T
U_1-L_2	7,500 〃	5,500	13,000 T
U_2-L_3	11,000 〃	7,900	18,900 T
U_3-L_4	13,500 〃	11,100	24,600 T
U_4-L_5	12,400 〃	14,900	27,300 T
U_5-L_6	4,400 〃	17,200	21,600 T

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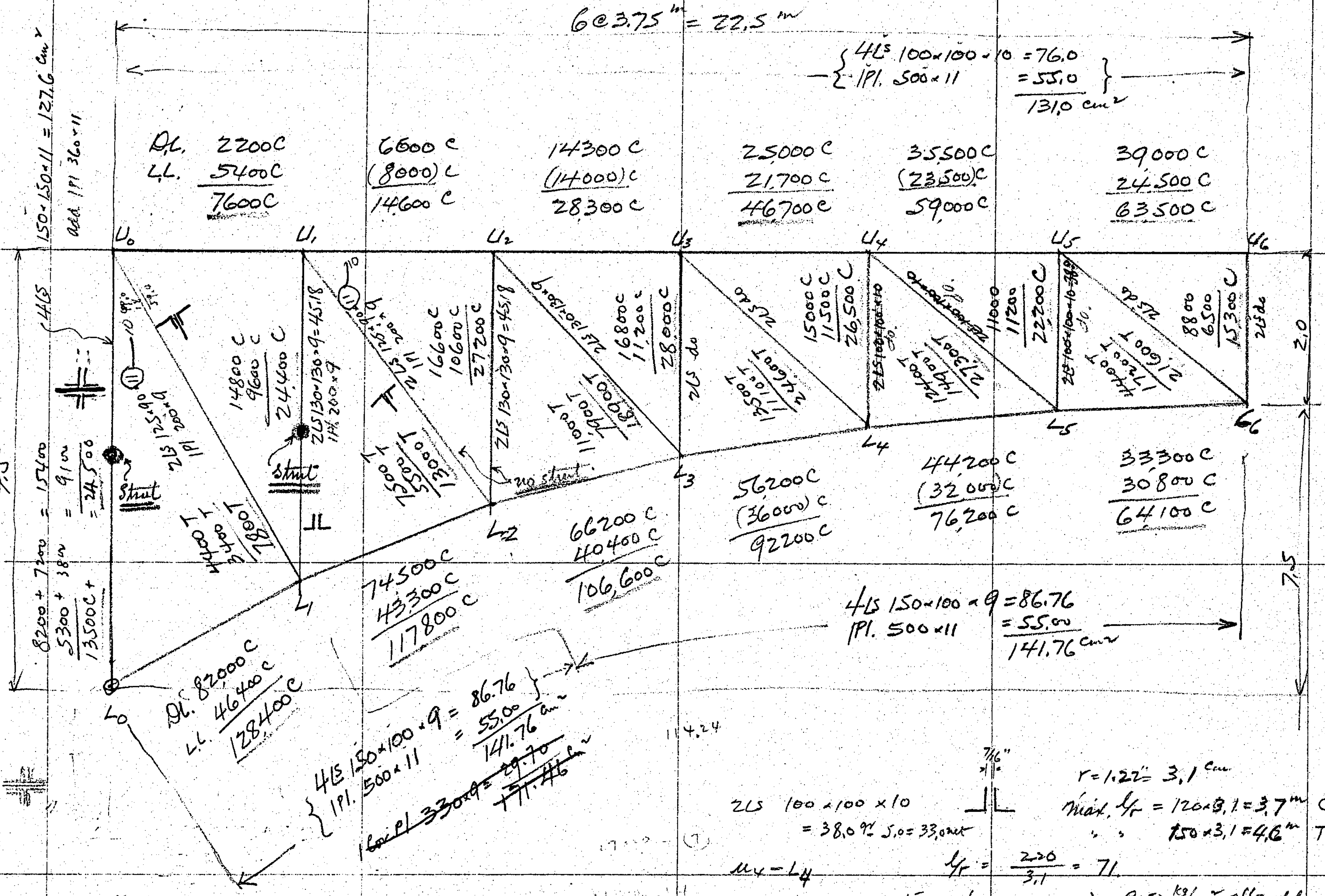
CALCULATIONS FOR

(20)

Preliminary Design of Kagarite Bashi for Miyazaki ken.

The Stress diagram. （括弧内ノ数字ハ 推定ニヨルモノナリ）.



2Ls 100×100×10 = 38.0 $-$ 5.0 = 33.0 net

7/16"

r = 1.22" = 3.1 cm

max. l/r = 120×3.1 = 3.7 m C

" " 150×3.1 = 4.6 m T

U4–L4 $l/r = \frac{220}{3.1} = 71$.

$1500 \times (1 - .0055 \times 71) = 9150$ kg/cm² allowable

S.R. $\frac{26500}{9150} = 29.0$ cm² < 38.0 ok

U4–L5 $l/r = \frac{380}{3.1} = 123 < 200$ ok

S.R. $= \frac{27300}{1200} = 22.8$ cm² < 33.0 ok.

U1–L1 2Ls 130×130×9 = 45.18 cm² gr.

$r_x = 1.56" = 3.95$ cm

$r_y = 2.21" = 5.6$ cm

$l/r_x = 620/3.95 = 157$ over

$l/r_y = 620/5.6 = 111$. ok

use transverse strut between both trusses

$l/r_x = 157 \div 2 = 79$

$1500(1 - .0055 \times 111) = 585$ kg/cm² allowable

SR. $= \frac{24400}{585} = 41.7$ cm² < 45.18 ok.

U2–L2 $l/r_y = \frac{435}{3.95} = 110$ ok.

U0 L0 r = 2.5" = 6.35 cm

$l/r = 8.70/6.35 = 137$

use strut transversely
and 1Pl. longitudinal

1Pl 360×11.

max. vert load on shoe.

		V.	H.
D.L.	52800 + 7200 =	60000	68600
L.L.	30000 + 3800 =	33800	30000
	82800 + 11000 =	93800	98600

Diagonal U0–L1

approx. 2Ls 125×90×11 = 48.0 × 2.3 = 110

1Pl. 200×9 = 18.0 × 10.5 = 189

66.0 × 4.55 = 300

$I = 48 \times 2.25^2 = 242$

48 × 2 = 296

600

$18 \times 6^2 = 648$

1986 cm³

$r = \sqrt{\frac{1986}{66}} = 5.2$ cm

$l/r = \frac{700}{5.2} = 135 < 150$ ok.

3.6 × 2.55"

.9 × 20³ / 12

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