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CALCULATIONS FOR

大正十五年七月

徳島縣穴吹橋設計計算書
材料調書

JIUN MASUDA
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MADE BY J. Masuda DATE 15-6-18 FILE NO
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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

This bridge is to cross Yoshino-gawa at Anabuki-machi, Tokushima-Ken. The bridge over river channel will be cantilever type on account of difficulties in erecting false work under bridge. The remaining portion of river will be of deck plate girder span of shallow depth to clear 5.0 ft above high water line ever recorded which is 143.0 A.P. The slope of both earth fill approaches will be of 1:30 and the slope of girder span = 1.5 per span. The crown of slope at ℄ of cantilever bridge over water way channel.

The span lengths decided are as follows.

2 side spans @ 120'-0"	= 240'-0"		
1 center span	240'-0"		
2 spaces @ 1'-6"	3'-0"		
		483'-0"	
12 spans @ 60'-0"	= 720'-0"		
3 spans @ 54'-0"	= 162'-0"		
15 spaces @ 2"	= 2'-6"		
		884'-6"	
		1367'-6"	face to face of parapet wall of abutments.

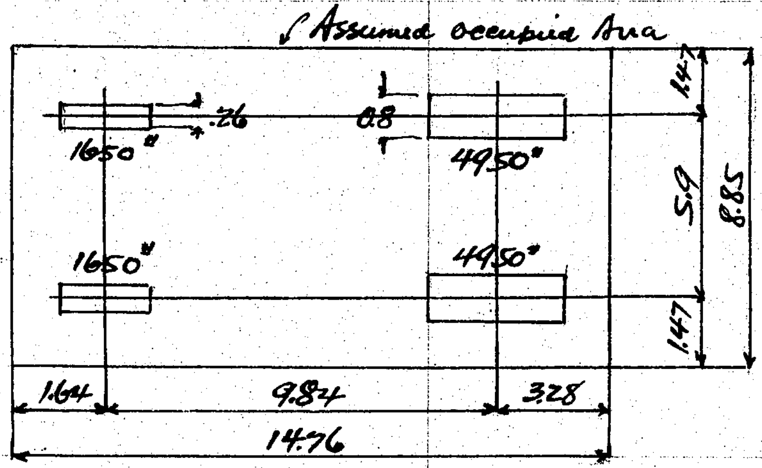
The width of roadway = 18.0 ft clear between curb line. The pavement will be of 2" asphaltic concrete or Soliditit on reinforced concrete slab. The handrail made of structural steel or cast iron.

Assumed Loadings

Uniform load on roadway $w = \frac{100.000}{170+l} \leq 500\ kg/m^2$ or say 100 #/□'

where w = Uniform load in kg per sqare meter
l = span length in meter.

6 ton motor truck loading



2 rows of motor traffic on roadway with impact: Occupied width 8.85' each
Unoccupied space of roadway to be filled in with the uniform load
One road motor truck in each row on one span

One roadroller on one span no impact

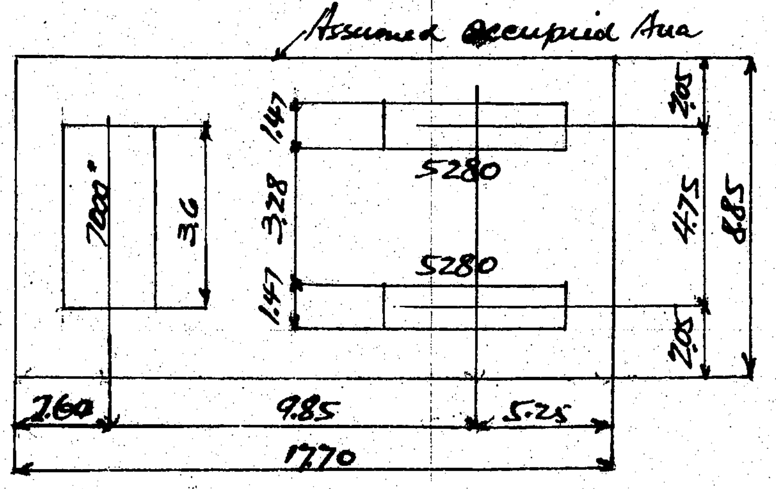
Impact for motor truck loading

$\frac{20}{60+l}$

where l = span length in meter
max impact 30%.

No impact for roadroller and uniform load.

8 ton Roadroller



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CALCULATIONS FOR

Design of Onabuki-Bashi for Tokushima-ken

Assumed weight of materials

plain Concrete	140# per cubic ft.
Reinforced Concrete	150
Structural steel	490
Cast iron	450
masonry	160
Asphaltic Concrete or Soliditit	140

Allowable working strength

Structural steel or Reinforcing bars

Tension	17000 #/□"
Extreme fibre Stress	17000
Shear on web gross section	12800

Compression member $21300\,(1-0.0055\,\frac{l}{r})$ or not over 14000 #/□"

Compression flange of plate girder

$$17000\,(1-0.012\,\frac{l}{b}) \leqq 15400 \text{ \#/□"}$$

where l = unsupported length of flange in inches
b = width of flange in inches

Shearing on shop rivet (machine driven)	12000 #/□"
" " field "	10,000
Extreme fibre stress of pin	24,000
Bearing on shop rivets	24,000
" " field "	20,000
Bearing on pin	24,000

Expansion roller 610 d per lin. inch where d = diameter of roller in inches

Bearing on masonry 640 #/□"

Concrete 1:2:4 mixture

Compression fibre stress	640 #/□"
Shear for plain Concrete	58
punching shear	128
Bond stress of plain bar	85
Shear for reinforced Concrete with web reinforcement	128
Bond stress of deformed bar	130

Considering wind and temperature stresses in addition to dead live and impact stresses, the allowable working strength shall be increased 25% and proportioned the parts. In figuring earthquake, the working strength shall be increased 80% and proportioned the parts.
Accelleration of Earthquake assumed 2000 mm/sec k = 0.2.

Cross section of bridge and construction of floor as shown on sketch on next page.

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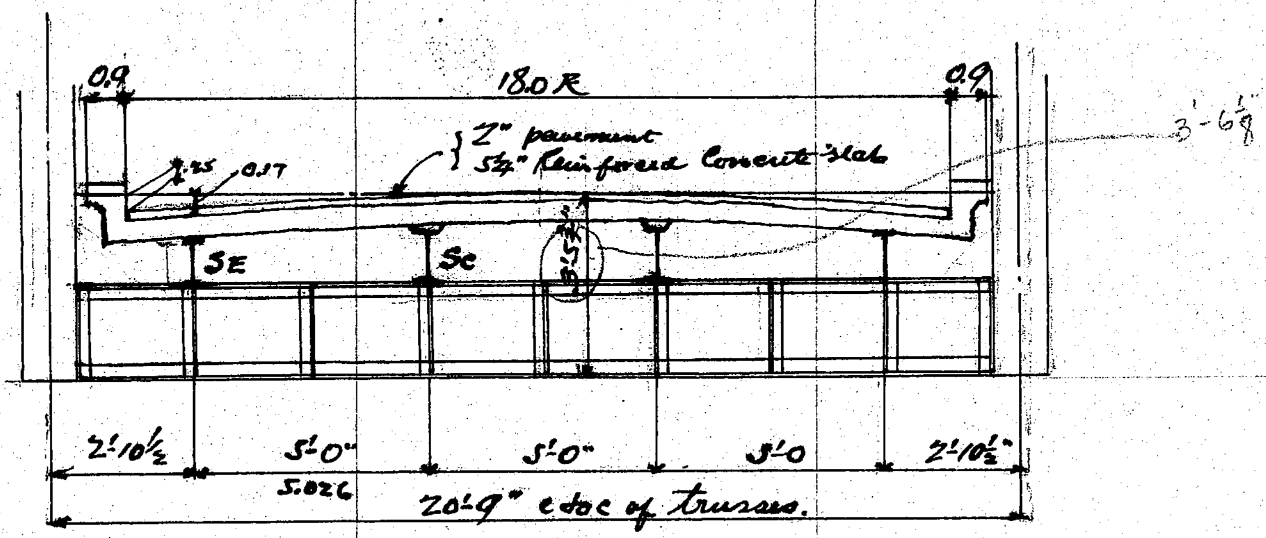
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Cross section of truss span



Reinforced Concrete slab. span length 5'-0" c to c of stringers

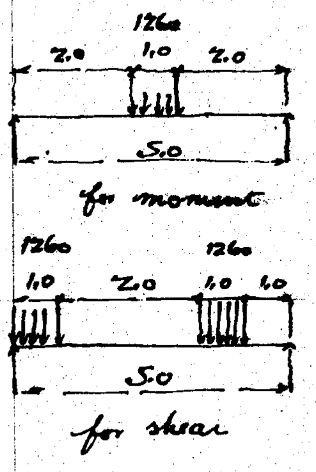
Dead Load 2" pavement 24
5 1/4" slab. 66
90#/□'

Dead Load moment = $\frac{1}{10} \cdot 90 \cdot 5^2 = 225.''$#

Dead Load shear = $\frac{1}{2} \cdot 90 \cdot 5 = 225$#

Live Load motor truck rear wheel concentration 4950#
30% impact 1485
6435#

Front wheel Concentration $6435 \cdot \frac{1}{3} =$ 2145#



Distribution of wheel concentration

Contact between wheel and pavement assumed 20 cm = 0.66
2 × thickness of pavement .17 = 0.34
Longitudinal distribution a = 1.00

Transverse distribution b = 0.8 + 0.34 = 1.14

Effective width $E = \frac{2}{3}(l+b) + a$ where l = span length in ft
$= \frac{2}{3}(5.00 + 1.14) + 1.00 = 5.1$

Load for one ft strip = 6435 ÷ 5.1 = 1260# assumed

Moment due to Concentration 630 × 2.5 = 1575
Less moment 630 × 0.25 = 157
1418''#

For Continuity of slab take moment 0.8 × 1418 = 1135''#

Max shear as simple beam $1260 \cdot \frac{6.0}{5.0} = 1510$#

Summary for moments and shears

	moment	shear
Dead Load	225	225
Live Load	1135	1510
	1360''#	1735#

Effective depth of slab for steel stress of 17000#/□" and Concrete stress of 640#/□".

$d = \sqrt{\frac{1360}{102}} = 3.65''$ Use 5 1/4" slab with 1 1/4" insulation at bottom

Steel Area required $= \frac{1360 \times 12}{\frac{7}{8} \cdot 4.0 \cdot 17000} = 0.274$□" per ft

Use 1/2"□ bars 6" centers = 0.390□" per ft.

Unit shear $= \frac{1735}{\frac{7}{8} \cdot 4 \cdot 12} = 41.0$#/□"

Bond stress $= u = \frac{1735}{\frac{7}{8} \cdot 4.0} = 496$# per ft 2-1/2"□ @ 1.57 × 130" = 409#

add extra reinforcement for bond.

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Longitudinal stringers span length 12'-0" stringer spacing 5'-0"

Stringer Sc neglect cantilever action at SE.

Dead Load slab and pavement 9.0 × 5.0 = 450

stringer assumed 35

485# per lin. ft of stringer.

Dead Load moment = 1/8 × 485 × 12.0² = 8730'#

Dead Load shear = 1/2 × 485 × 12.0 = 2910#

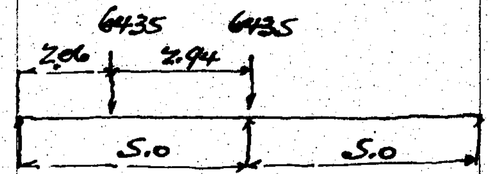
Live Load motor truck loading Rear wheel Concentration with impact = 6435#

Front " " " " = 2145#

Reaction on stringer Rear wheel conc. 6435 × 2.06/5.00 = 2650

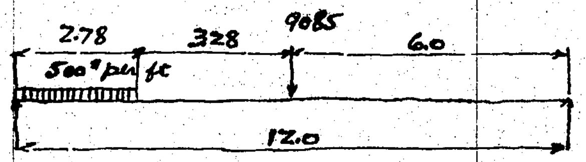
6435

9085#



Front wheel concentration 3030#

Uniform load 100# per ft 100 × 5 = 500# per lin. ft.

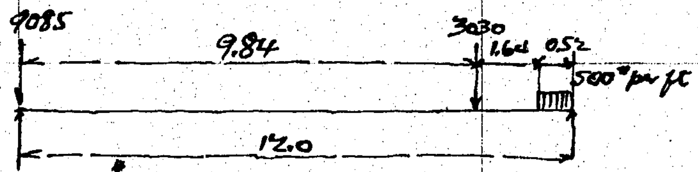


Live Load moment

moment due to concentration 9085/2 × 6.0 = 27255'#

" " " Unif. load 1390 × 1.39/12 × 6.0 = 966

28221'#



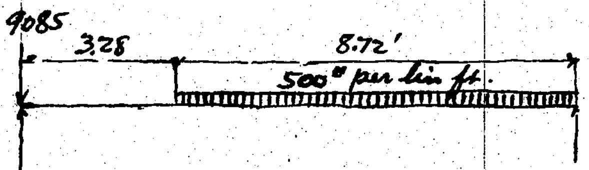
End shear

Uniform load = 500 × 0.52²/(2 × 12) = 10

Rear wheel 9085

Front wheel = 3030 × 2.16/12 = 545

9640#



Unif. Load = 500 × 8.72²/(2 × 12) = 1580

9085

10665#

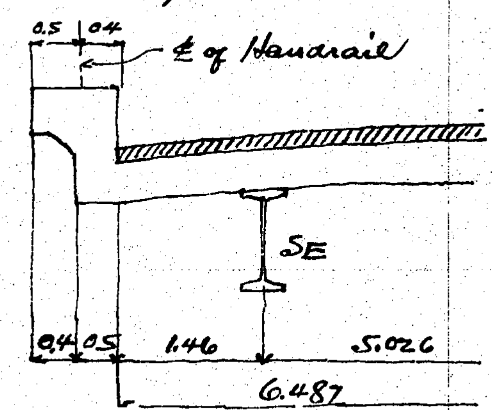
Summary for moments and shears

	moment	shear
Dead Load	8730	2910
Live Load	28221	10665
	36951'#	13575#

10" 5" I @ 29.99# Sm = 29.14

Unit stress = 36951/29.14 = 15200#/□" ok

End Stringer SE



		wt	arm	moment
Slab.	90 × 6.5 =	585	× 3.25 =	1901
Coping	150 × 0.5 × 1.1 =	83	× 6.75 =	560
do	150 × 0.4 × 0.5 =	30	× 7.20 =	216
Handrail	assumed	60	× 6.90 =	414
		758		3091'#

Reaction on stringer = 3091 ÷ 5.0 = 618

stringer assumed 35

653# per lin. ft.

Dead Load moment = 1/8 × 653 × 12.0² = 11.754'#

Dead Load shear = 1/2 × 653 × 12 = 3918#

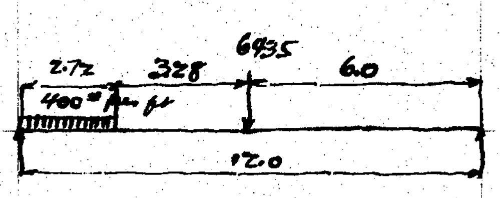
Live Load Uniform live load assumed 400# per lin. ft

motor truck rear wheel concentration 6435# on ℄ stringer assumed

moment due to wheel 6435/2 × 6.0 = 19305

" Unif. load 400 × 1.36 × 2.72 × 6/12 = 740

20045'#



増田淳氏関係資料
(独立行政法人 土木研究所蔵)

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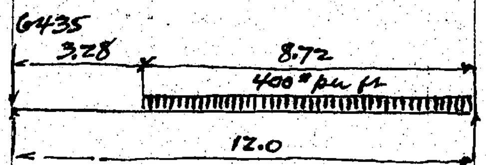
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken



max End shear
Unif load $400 \times \frac{8.72^2}{2 \times 12}$ = 1267
wheel load 6435
7702#

Summary for moments and shears

	moment	shear
Dead Load	11754	3918
Live Load	20045	7702
	31799'#	11620#

10" × 5" I @ 29.99# Sm = 29.14

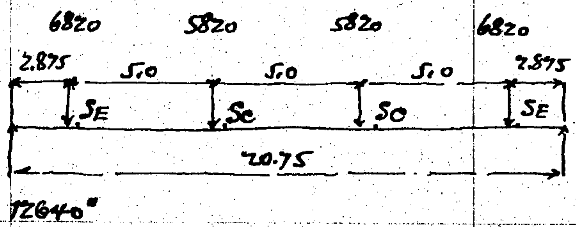
Unit stress = $\frac{31799}{29.14}$ = 10.900#/□" Ok.

Intermediate floor beam

Dead Load
Load beyond Sc 2 @ 758 = 1516
Load between Sc & Se 90 × 5 = 450

Load on stringer connection
Sc flooring 90 × 5 = 450; stringer 35; 485#
SE floor 533; stringer 35; 568

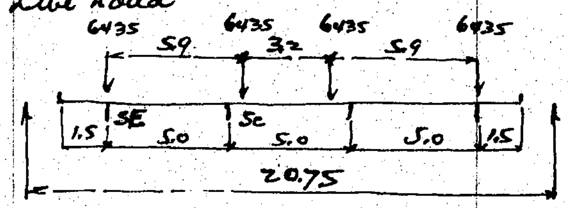
Conc = 485 × 12 = 5820#
Conc = 568 × 12 = 6820#



moment due to dead load
12640 × 7.875 = 99540
6820 × 5.0 = 34100
65440'#

End shear = 12640#

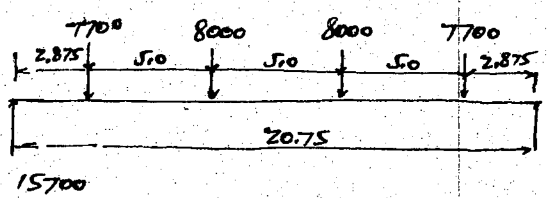
Live Load



wheel concentration
on Sc 6435# including impact
on SE 6435# " "

Uniform load
On Sc $100 \times 5.0 \times \frac{8.72^2}{2 \times 12}$ = 1584#
On SE $100 \times 4.0 \times$ " = 1267#

Summary
Sc 6435 + 1584 = 8019 say 8000
SE 6435 + 1267 = 7702 " 7700
15700#



moment due to live load
15700 × 7.875 = 123638
7700 × 5.0 = 38500
85138'#

Live Load shear = 15700#

Girder assumed 80# per lin. ft
m = $\frac{1}{8} \times 80 \times 20.75^2$ = 4310'#
shear = 80 × 20.75 ÷ 2 = 830#

Summary for moments and shears

	moment	shear
Dead Load	69750	13470
Live Load	85140	15700
	154890'#	29170#

web assumed 22 × 5/16 = 6.88□" ; ⅛ web = 0.86□"

Section required = $\frac{155000 \times 12}{17000 \times 20.8}$ = 5.26
− 0.86
4.40□" net

Use 2Ls 5 × 3½ × 3/8 = 6.10
4 @ .33 = 1.32
4.78□" net

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Approximate weight of intermediate floor beam

1 Pl.	22 × 5/16	@	23.38	× 19.75	=	463
4 Ls	5 × 3½ × 3/8"	@	10.40	× 19.75	=	823
14 Ls	3½ × 3½ × 5/16	@	7.2	× 1.8	=	181
8 fills	3½ × 3/8	@	4.46	× 1.25	=	45
4 Ls	3½ × 3½ × 3/8	@	8.5	× 1.8	=	61
4 fills	3½ × 3/8	@	4.46	× 1.25	=	22
						1595
		Rivet heads and variation				105
						1700#

1700 ÷ 20.75 = 82# per lin. ft.
1700 ÷ 12 = 142# per lin ft of span.

For End Floor beam use same as for intermediate floor beam.

Summary for Dead Load

Floor slab and pavement	90 × 18 =	1620
Coping		226
Handrails	2 @ 60 =	120
		1966# per lin. ft.

Dead Load metal in floor system

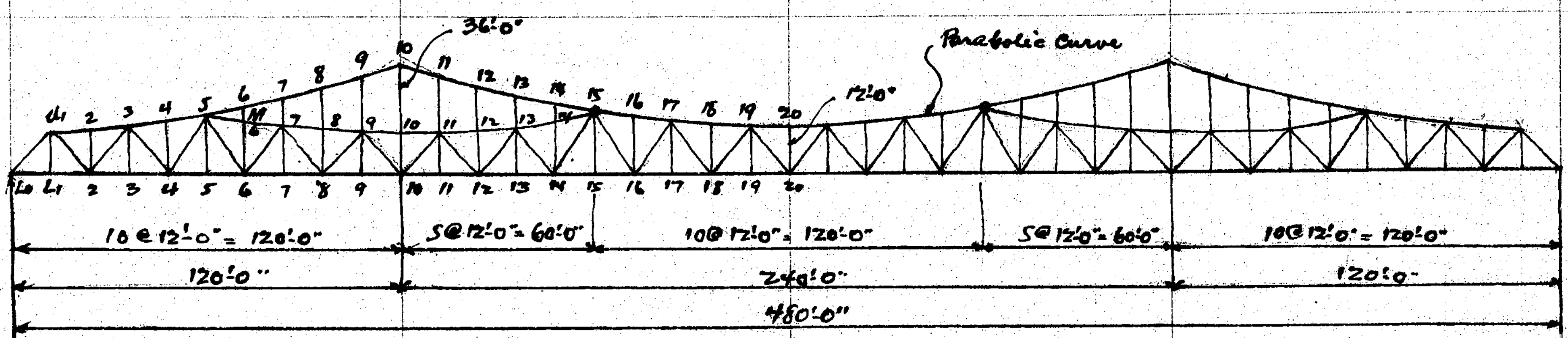
Stringers	4 @ 35 =	140
Floor beam		142
		282
Bottom lateral Bracings		55
Sway and top laterals		140
Two trusses assumed		700
		1157#
		3143# per lin ft of span.

Dead Load panel Concentration 3143 × 12/2 = 18.858# say 19000# per truss

Uniform live load assumed 97# per sq ft.

Live Load panel Concentration 97 × 18.0 × 12/2 = 10476# say 10500# per truss
For truss span consider uniform load only of the above intensity neglecting road roller and motor truck Concentration on span.

Design of truss span



General sketch of truss span.

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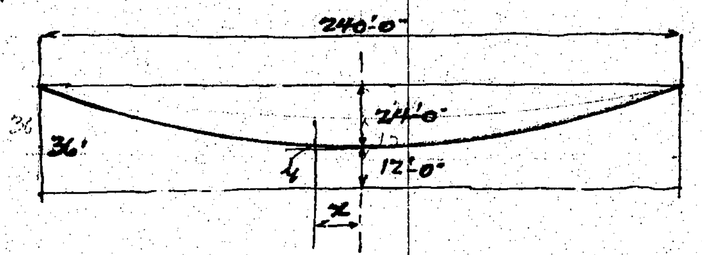
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Dimensions of truss members.

Upper chord on parabolic curve.



Equation of parabola $y = ax^2$

$x = 120 \quad y = 24 \quad a = \frac{y}{x^2} = \frac{24}{120^2}$

$y = \frac{24}{120^2} x^2 = 0.24 \left(\frac{x}{12}\right)^2$

x	$\frac{x}{12}$	$(\frac{x}{12})^2$	y	Ordinate		Length of verticals		member
0	0	0	0.000	12.00		12.00	12'-0"	U20-L20
12	1	1	0.24	12.24		12.24	12'-2 7/8	U19-L19
24	2	4	0.96	12.96		12.96	12'-11 1/2	U18-L18
36	3	9	2.16	14.16		14.16	14'-1 15/16	U17-L17
48	4	16	3.84	15.84		15.84	15'-10 1/16	U16-L16
60	5	25	6.00	18.00		18.00	18'-0"	U15-L15
72	6	36	8.64	20.64	-15.84	4.80	4'-9 5/8	U14-M14
84	7	49	11.76	23.76	-14.16	9.60	9'-7 3/16	U13-M13
96	8	64	15.36	27.36	12.96	14.40	14'-4 13/16	U12-M12
108	9	81	19.44	31.44	12.24	19.20	19'-2 3/8	U11-M11
120	10	100	24.00	36.00		36.00	36'-0"	U10-L10

member						
U6-L6	4'-9 5/8	+	15'-10 1/16	=	20'-7 11/16	(20.64)
U7-L7	9'-7 3/16	+	14'-1 15/16	=	23'-9 1/8	(23.76)
U8-L8	14'-4 13/16	+	12'-11 1/2"	=	27'-4 5/16	(27.36)
U9-L9	19'-2 3/8	+	12'-2 7/8	=	31'-5 1/4	(31.44)

Length of upper chord.

				sq	Plus (12'-0)²	√	member
36'-0"	-	31'-5 1/4	= 4'-6 3/4	20.8164	164.8164	12'-10 1/16	U10-U9
31'-5 1/4		27'-4 5/16	= 4'-0 15/16	16.6311	160.6311	12'-8 1/16	U9-U8
27'-4 5/16		23'-9 1/8	= 3'-7 3/16	12.9525	156.9525	12'-6 5/16	U8-U7
23'-9 1/8		20'-7 11/16	= 3'-1 7/16	9.7331	153.7331	12'-4 13/16	U7-U6
20'-7 11/16		18'-0"	= 2'-7 11/16	6.9729	150.9729	12'-3 7/16	U6-U5
18'-0"		15'-10 1/16	= 2'-1 15/16	4.6719	148.6719	12'-2 5/16	U5-U4
15'-10 1/16		14'-1 15/16	= 1'-8 1/8	2.8126	146.8128	12'-1 3/8	U4-U3
14'-1 15/16		12'-11 1/2	= 1'-2 7/16	1.4475	145.4475	12'-0 3/4	U3-U2
12'-11 1/2		12'-2 7/8	= 0'-8 5/8	0.5166	144.5166	12'-0 1/4"	U2-U1
12'-2 7/8		12'-0"	= 0'-2 7/8	0.0574	144.0574	12'-0"	U1-U0
12'-0"		——					

Diagonal Lengths.

verticals	sq				Length of Diag.	members
12'-2 7/8	149.8074	+ 144.	=	293.8074	17'-1 1/16	L0-U1
14'-1 15/16	200.5469	+ "	=	344.5469	18'-6 3/4	U1-L2, L2-U3
18'-0"	324.0000	+ "	=	468.0000	21'-7 7/8	U3-L4, L4-U5

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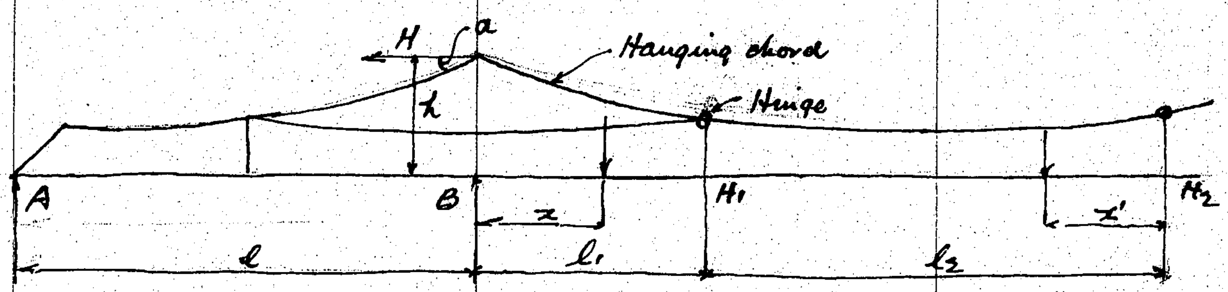
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

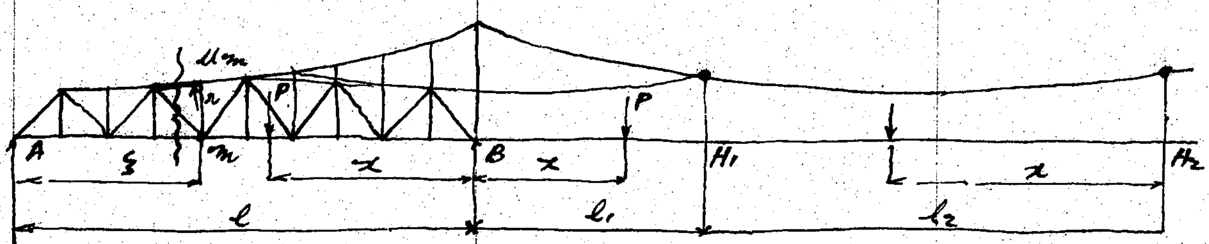
Stresses for Hanging Chord



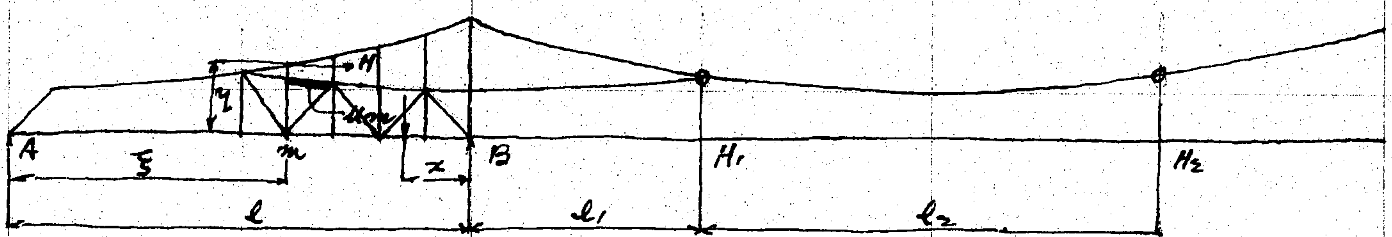
H = horizontal component of the hanging chord
h = height of tower.
x = distance from B to load.
p = load.
Load on AB no stress
Load on BH1 $H = \frac{px}{h}$ x from B to H1.
Load on H1-H2 $H = \frac{pl_1x'}{hl_2}$ x' measured from H2 to H1

C = stress of hanger = $H.\sec\alpha = \frac{px}{h\cos\alpha}$

Stress for upper chord members.



Load on AB $U_m = -p\frac{x}{l}\frac{\xi}{r}$ x measured from B to A
r perpendicular distance from point m to member Um
Load on BH1 $U_m = p\frac{x}{l}\frac{\xi}{r}$ x measured from B to H1
Load on H1-H2 $U_m = p\frac{x}{l}\frac{l_1}{l_2}\frac{\xi}{r}$ x measured from H2 to H1.



Load on AB. $U_m = -p\frac{x}{l}\frac{\xi}{r}$ x measured from B to A.
Load on BH1 $U_m = p\frac{x}{l}\frac{\xi}{r} - H\frac{\eta}{r}$ x measured from B to H1
Load on H1-H2 $U_m = p\frac{x\,l_1}{l_2\,l}\frac{\xi}{r} - H\frac{\eta}{r}$ x measured from H2 to H1

1°

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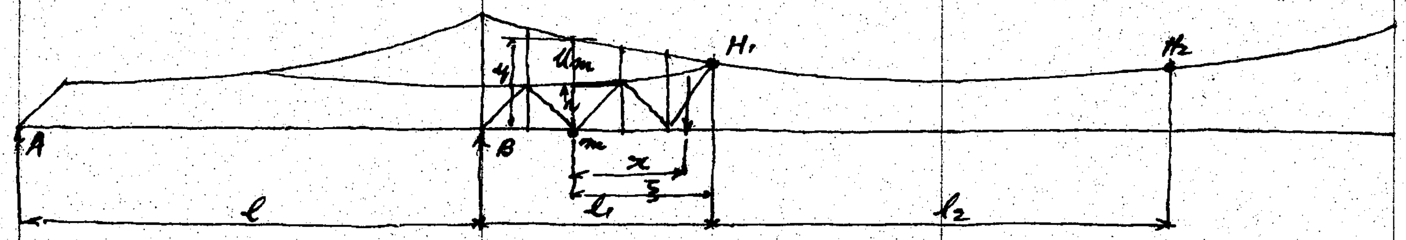
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Stresses for upper chord members.



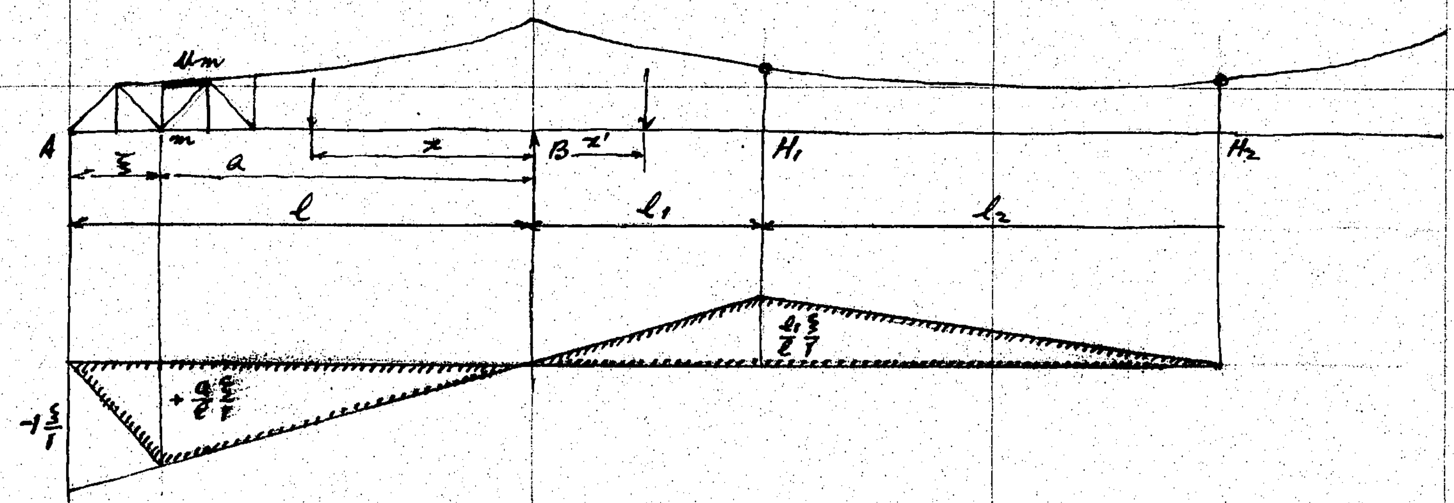
Load on AB no stress

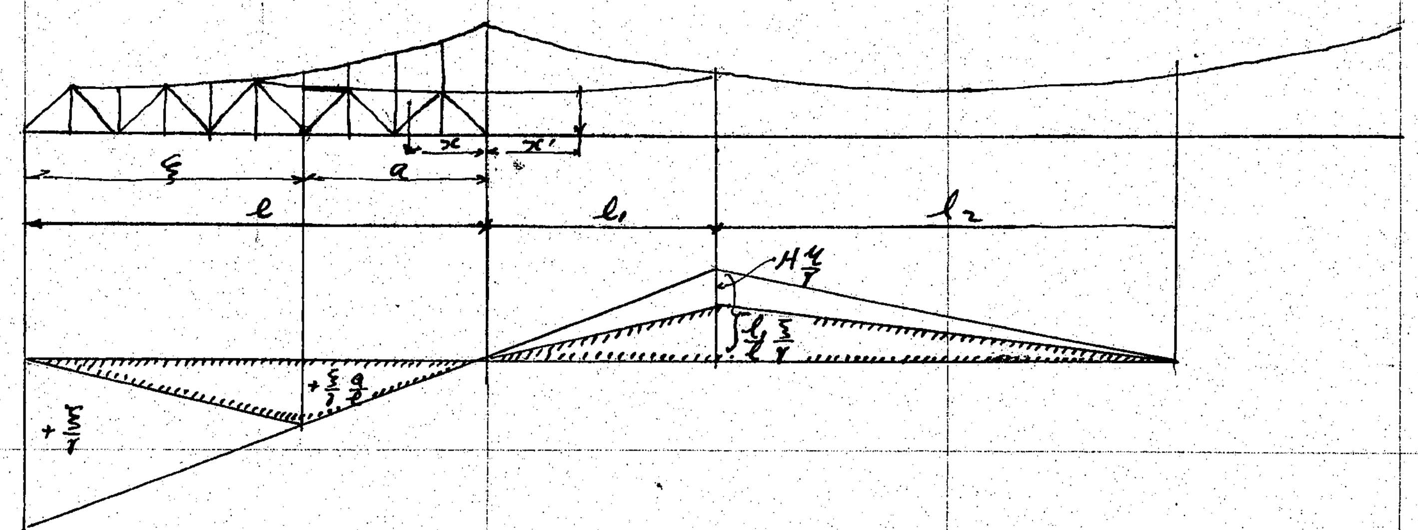
Load on BH_1 $U_m = p\frac{x}{r} - H\frac{y}{r}$

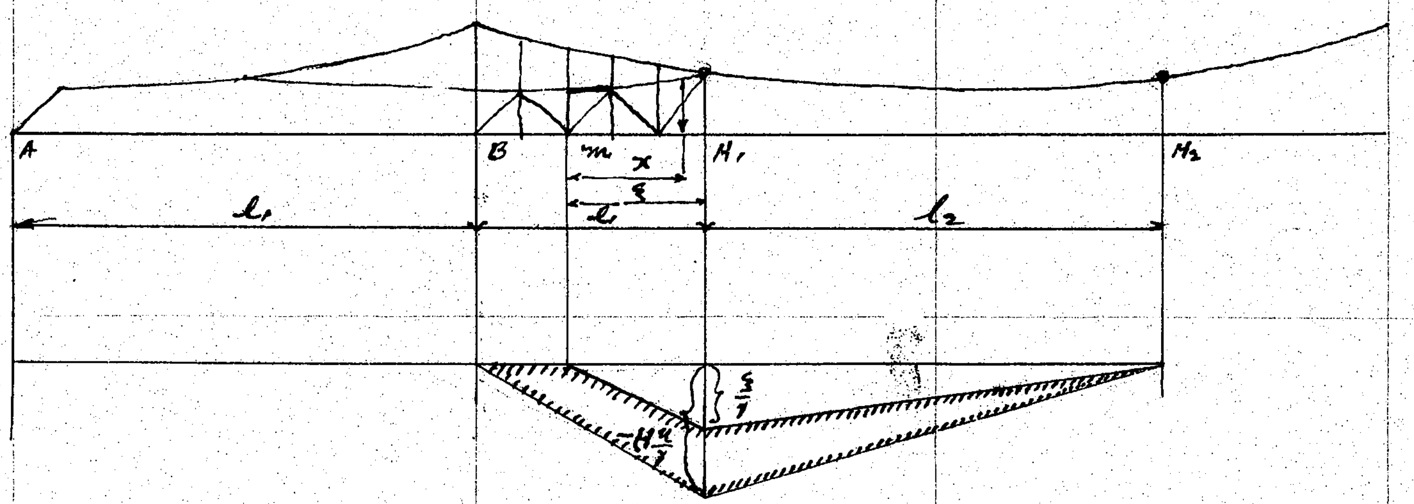
Load on H_1-H_2 $U_m = p\frac{x}{l_2}\frac{\xi}{r} - H\frac{y}{r}$

Method of analysis to find the stresses in lower chord and web members similar to those for upper chord members.

Influence diagram for upper chord







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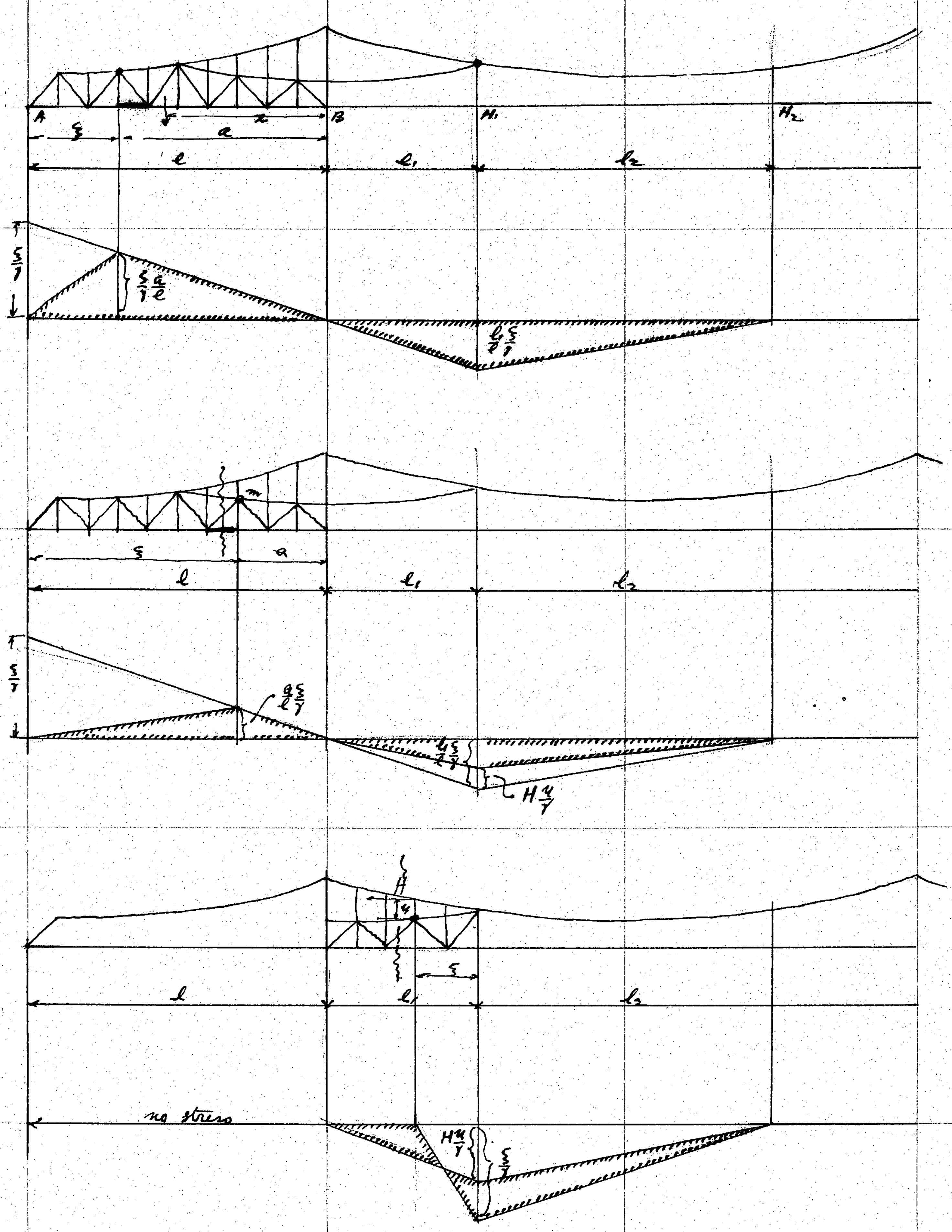
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-ken.

Influence diagram for Lower chords.



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CALCULATIONS FOR

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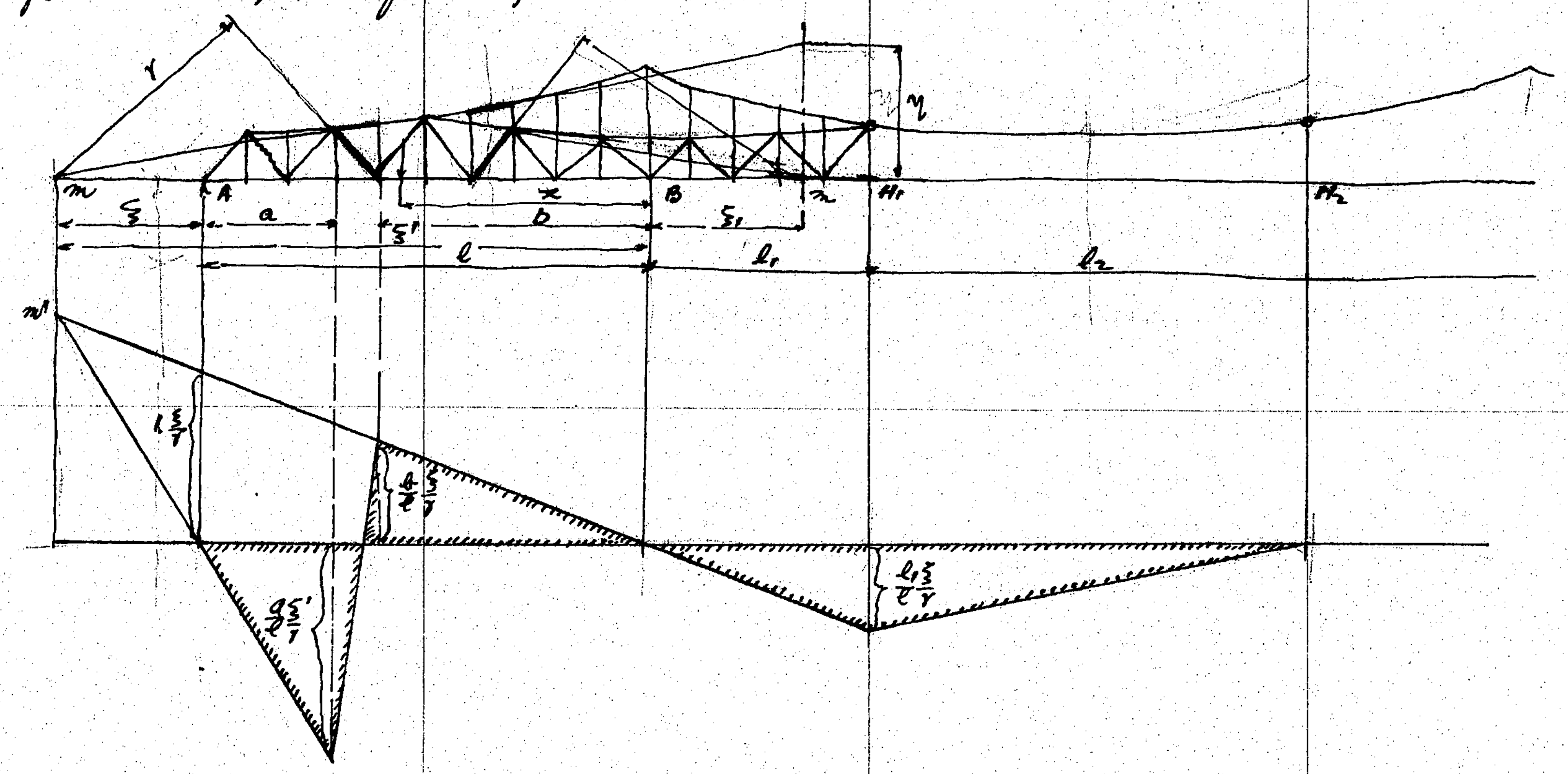
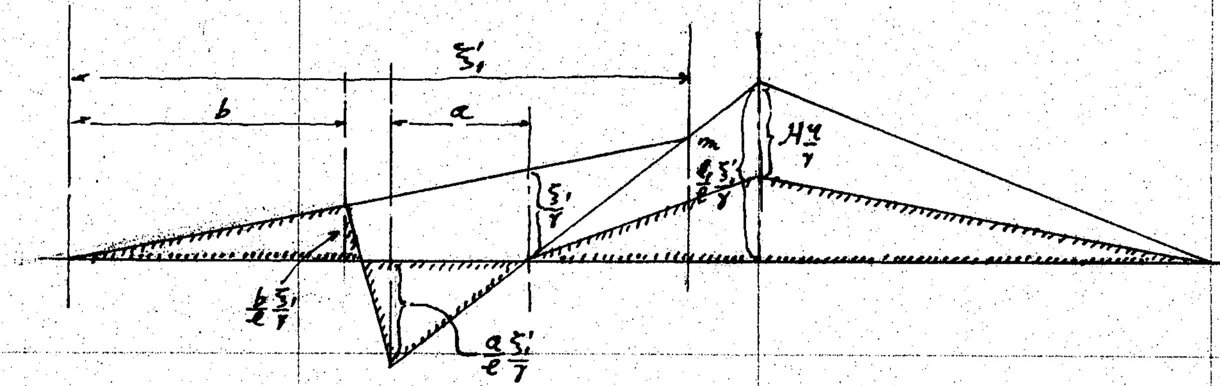
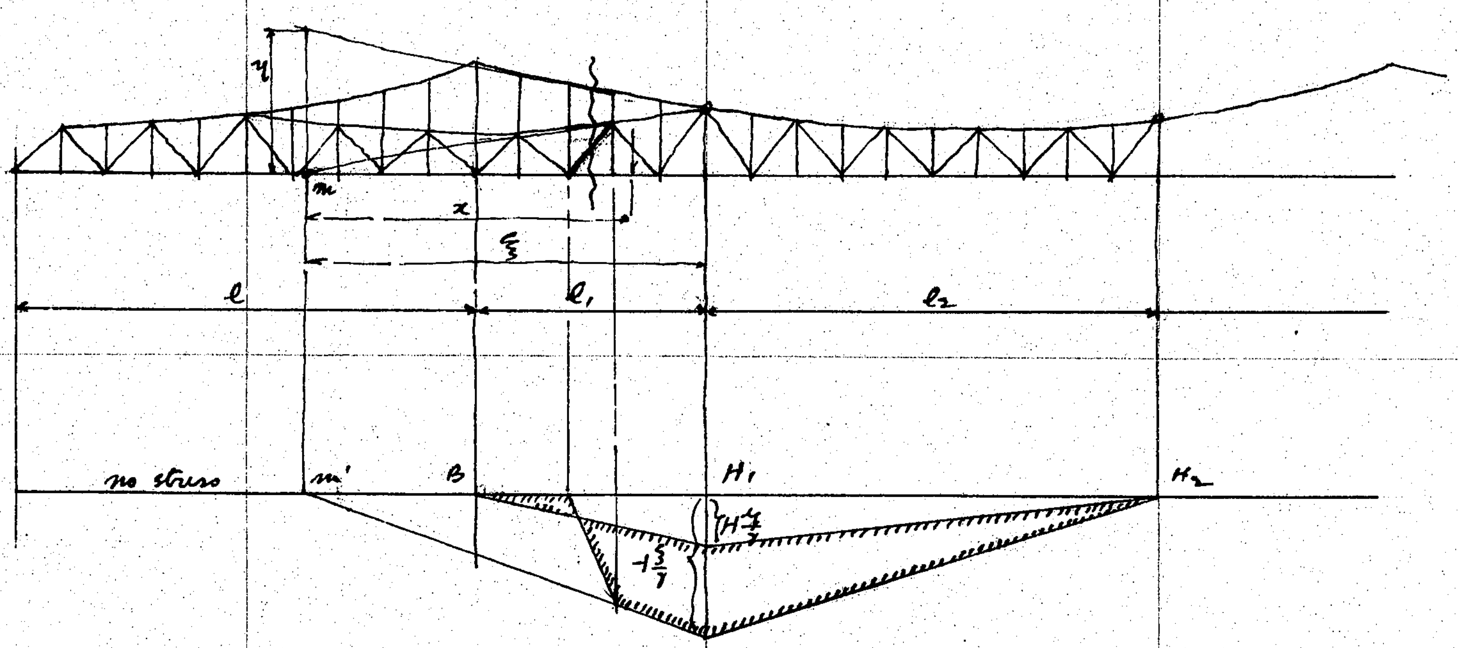
Influence diagram for diagonals.







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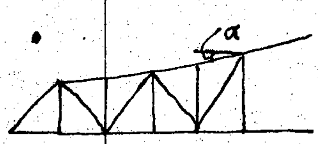
Design of Anabuki-Bashi for Tokushima-Ken.

Data to find the stresses of truss members.

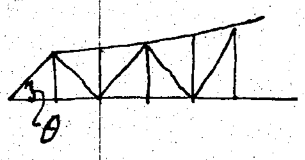
α inclination of upper chords.

member	diff of height	log	log 12.0	log tan α	α
U_0-U_1	0'-2 7/8	$\bar{1}$.37946	1.07918	$\bar{2}$.3008	1°-9'
U_1	0'-8 5/8	$\bar{1}$.85658		$\bar{2}$.77740	3°-24'
U_2	1'-2 7/16	0.08031		$\bar{1}$.00113	5°-44'
U_3	1'-8 3/8	0.22455		$\bar{1}$.14537	7°-57'
U_4	2'-1 15/16	0.33475		$\bar{1}$.25557	10°-13'
U_5	2-7 1/16	0.42171		$\bar{1}$.34253	12°-25'
U_6	3'-1 1/16	0.49413		$\bar{1}$.41495	14°-34'
U_7	3'-7 3/16	0.55618		$\bar{1}$.47700	16°-42'
U_8	4'-0 15/16	0.61046		$\bar{1}$.53128	18°-46'
U_9-U_{10}	4'-6 3/4	0.65920		$\bar{1}$.58002	20°-49'



θ inclination for diagonals

member		log	log 12.0	log tan θ	θ
L_0U_1 U_1-L_2	12'-2 7/8	1.08777	1.07918	0.00859	45°-34'
L_2-U_3 U_3-L_4	14'-1 15/16	1.15111	"	0.07193	49°-44'
L_4-U_5	18'-0"	1.25527	"	0.17609	56°-18'

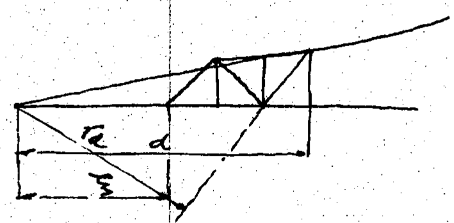


Moment arm for upper chords. r_u

member	r_u
U_0-U_1	12.00'
U_1-U_2	12.94
U_2-U_3	12.90
U_3-U_4	15.69
U_4-U_5	15.59

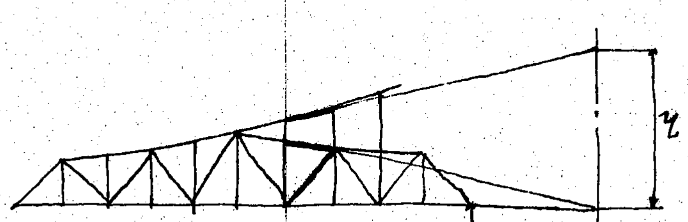
Moment arm for lower chords.

member	
L_0-L_1	12'-2 7/8
L_1-L_2	12'-2 7/8
L_2-L_3	14'-1 15/16
L_3-L_4	14'-1 15/16
L_4-L_5	18'-0"



ξ = horizontal distance from intersection of upper and lower chords.

member	ξ
U_0-U_1	597.74
U_1-U_2	193.61
U_2-U_3	105.05
U_3-U_4	65.42
U_4-U_5	39.87



Arm length for diagonals. r_d

member	r_d
L_0-U_1	435.40
U_1-L_2	155.40
L_2-U_3	168.93
U_3-L_4	86.55
L_4-U_5	94.36

η for diagonals.

member	η
U_5-L_6	39.99
L_6-U_7	50.11
U_7-L_8	66.08
L_8-U_9	101.30
U_9-L_{10}	263.26

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Influence surfaces for Hanging chords.

member	α	log cos α	log h = log 36	log h cos α	log 1/(h cos α)	1/(h cos α)
U5-U6	12°-25'	$\bar{1}$.98972	1.55630	1.54602	$\bar{2}$.45398	0.0284
U6-U7	14°-34'	$\bar{1}$.98581	"	1.54211	$\bar{2}$.45789	0.0287
U7-U8	16°-42'	$\bar{1}$.98129	"	1.53759	$\bar{2}$.46241	0.0290
U8-U9	18°-46'	$\bar{1}$.97628	"	1.53258	$\bar{2}$.46742	0.0293
U9-U10	20°-49'	$\bar{1}$.97068	"	1.52698	$\bar{2}$.47302	0.0297

Load on	x	U5-U6 (0.0284)	U6-U7 (0.0287)	U7-U8 (0.0290)	U8-U9 (0.0293)	U9-U10 (0.0297)
10	0	0.000	0.000	0.000	0.000	0.000
11	12	0.341	0.344	0.348	0.352	0.356
12	24	0.682	0.689	0.696	0.703	0.713
13	36	1.022	1.033	1.044	1.055	1.069
14	48	1.363	1.378	1.392	1.406	1.426
15	60	1.704	1.722	1.740	1.758	1.782
16	54	1.534	1.550	1.566	1.582	1.604
17	48	1.363	1.378	1.392	1.406	1.426
18	42	1.193	1.205	1.218	1.231	1.247
19	36	1.022	1.033	1.044	1.055	1.069
20	30	0.852	0.861	0.870	0.879	0.891
19'	24	0.682	0.688	0.696	0.703	0.713
18'	18	0.511	0.516	0.522	0.527	0.535
17'	12	0.341	0.344	0.348	0.352	0.356
16'	6	0.170	0.172	0.174	0.176	0.178
15'	0	0.000	0.000	0.000	0.000	0.000
Summary		12.780	12.913	13.050	13.185	13.365

Influence surfaces for Hangers $z = H(\tan\alpha - \tan\alpha')$.
If the upper chord lie in parabolic curve, the stresses in hangers are equal.

member	α'	α	tan α	tan α'	tan α - tan α'
U6-M6	12°-25'	14°-34'	0.260	0.220	0.040
U7-M7	14°-34'	16°-42'	0.300	0.260	0.040
U8-M8	16°-42'	18°-46'	0.340	0.300	0.040
U9-M9	18°-46'	20°-49'	0.380	0.340	0.040
U10-L10	20°-49'	-(20°-49').	-0.380	0.380	-0.760

Influence surfaces for H. $H = \frac{x}{h}$

Load on	H	Load on	H
10	0.000	19'	0.667
11	0.333	18'	0.500
12	0.667	17'	0.333
13	1.000	16'	0.167
14	1.333	15'	0.000
15	1.667	Summary	12.500
16	1.500		
17	1.333		
18	1.167		
19	1.000		
20	0.833		

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Load on	H surfaces	Hangers (U_6-M_6)	M_{10}-L_{10} (tower)
10	0.000	0.000	- 0.000
11	0.333	0.133	- 0.253
12	0.667	0.267	- 0.507
13	1,000	0.400	- 0.760
14	1.333	0.533	- 1.013
15	1.667	0.667	- 1.267
16	1.500	0.600	- 1.140
17	1.333	0.533	- 1,013
18	1.167	0.467	- 0.887
19	1.000	0.400	- 0.760
20	0.833	0.333	- 0.633
19'	0.667	0.267	- 0.507
18'	0.500	0.200	- 0.380
17'	0.333	0.133	- 0.253
16'	0.167	0.067	- 0.127
15'	0.000	0.000	0.000
	12.500	5.000	- 9.500

Influence surfaces for upper chords.

		ξ	γ	ξ/γ
U_1-U_2	2@12 =	24'-0"	12.94	1.855
U_2-U_3		24'-0"	12.90	1.861
U_3-U_4	4@12 =	48'-0"	15.69	3.059
U_4-U_5		48'-0"	15.50	3.079

Load on	U_1-U_2	U_2-U_3	U_3-U_4	U_4-U_5	U_5-M_6	M_6-M_7	M_7-M_8	M_8-M_9
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	- 0.742	- 0.745	- 0.459	- 0.462	- 0.308	- 0.306	- 0.186	- 0.186
2	- 1.484	- 1.489	- 0.918	- 0.924	- 0.616	- 0.612	- 0.372	- 0.371
3	- 1.299	- 1.303	- 1.375	- 1.385	- 0.924	- 0.918	- 0.558	- 0.557
4	- 1.113	- 1.117	- 1.835	- 1.847	- 1.232	- 1.224	- 0.744	- 0.742
5	- 0.928	- 0.931	- 1.530	- 1.540	- 1.540	- 1.530	- 0.931	- 0.928
6	- 0.742	- 0.744	- 1.224	- 1.232	- 1.847	- 1.835	- 1.117	- 1.113
7	- 0.557	- 0.558	- 0.918	- 0.924	- 1.385	- 1.375	- 1.303	- 1.299
8	- 0.371	- 0.372	- 0.612	- 0.616	- 0.924	- 0.918	- 1.489	- 1.484
9	- 0.186	- 0.186	- 0.306	- 0.308	- 0.462	- 0.459	- 0.745	- 0.742
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.186	0.186	0.306	0.308	0.021	0.024	0.037	0.037
12	0.371	0.372	0.612	0.616	0.042	0.048	0.074	0.074
13	0.557	0.558	0.918	0.924	0.064	0.072	0.112	0.112
14	0.742	0.744	1.224	1.232	0.085	0.096	0.149	0.149
15	0.928	0.931	1.530	1.540	0.106	0.120	0.186	0.186
16	0.835	0.838	1.377	1.386	0.095	0.108	0.167	0.167
17	0.742	0.745	1.224	1.232	0.085	0.096	0.149	0.149
18	0.650	0.652	1.071	1.078	0.074	0.084	0.130	0.130
19	0.557	0.559	0.918	0.924	0.064	0.072	0.112	0.112
20	0.464	0.466	0.765	0.770	0.053	0.060	0.093	0.093
19'	0.371	0.372	0.612	0.616	0.042	0.048	0.074	0.074
18'	0.278	0.279	0.459	0.462	0.032	0.036	0.056	0.056
17'	0.186	0.186	0.306	0.308	0.021	0.024	0.037	0.037
16'	0.093	0.093	0.153	0.154	0.011	0.012	0.019	0.019
15'	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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CALCULATIONS FOR

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	M_1-M_2	M_2-M_3	M_3-M_4	M_4-M_5	M_5-M_6	M_6-M_7	M_7-M_8	M_8-M_9
Summary +	6.960	6.981	11.475	11.550	0.795	0.900	1.395	1.395
−	7.422	7.445	9.177	9.238	9.238	9.177	7.445	7.422
Tot. Sum	−0.462	−0.464	+2.298	+2.312	−8.443	−8.277	−6.050	−6.027

For	ξ'	γ	ξ'/γ	ξ'/γ · l/l	H	η	H η/γ	l/l ξ'/γ − H η/γ
M5-M6	6@12.0 = 72.0	15.59	4.620	2.310	1.667	20.64	2.204	0.106
M6-M7	72.0	15.69	4.590	2.295	"	"	2.175	0.120
M7-M8	8@12.0 = 96.0	12.90	7.440	3.720	"	27.36	3.534	0.186
M8-M9	96.0	12.94	7.420	3.710	"	"	3.524	0.186

Load on	M11-M12	M12-M13	M13-M14	M14-M15
10	0.000	0.000	0.000	0.000
11	−0.705	−0.707	−0.435	−0.441
12	−1.410	−1.414	−0.870	−0.882
13	−1.188	−1.190	−1.305	−1.322
14	−0.965	−0.967	−1.740	−1.763
15	−0.742	−0.744	−1.410	−1.435
16	−0.668	−0.670	−1.269	−1.292
17	−0.594	−0.595	−1.128	−1.148
18	−0.519	−0.521	−0.987	−1.005
19	−0.445	−0.446	−0.846	−0.861
20	−0.371	−0.372	−0.705	−0.718
19'	−0.297	−0.298	−0.564	−0.574
18'	−0.223	−0.223	−0.423	−0.431
17'	−0.148	−0.149	−0.282	−0.287
16'	−0.074	−0.074	−0.141	−0.144
15'	0.000	0.000	0.000	0.000
Summary	−8.349	−8.370	−12.105	−12.303

	ξ	γ	ξ/γ	−H η/γ	−H η/γ − 1 ξ/γ
M11-M12	3@12.0 = 36.0	12.94	2.782	−3.524	−0.742
M12-M13	36.0	12.90	2.790	−3.534	−0.744
M13-M14	12.0	15.69	0.765	−2.175	−1.410
M14-M15	12.0	15.60	0.769	−2.204	−1.435

Influence Surfaces for Lower Chords.

	ξ	γ	ξ/γ	H	η	H η/γ
L0-L1 L1-L2	12.0	12.24	0.981			
L2-L4	3@12.0 = 36.0	14.16	2.543			
L4-L6	5@12.0 = 60.0	18.00	3.335			
L6-L8	7@12.0 = 84.0	14.16	5.933	1.667	9.60	1.130
L8-L10	9@12.0 = 108.0	12.24	8.824	1.667	19.20	2.614
L10-L12	4@12.0 = 48.0	12.24	3.921	1.667	19.20	2.614
L12-L14	2@12.0 = 24.0	14.16	1.696	1.667	9.60	1.130

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Load on	L_0-L_1, L_1-L_2	L_2-L_4	L_4-L_6	L_6-L_8	L_8-L_{10}	L_{10}-L_{12}	L_{12}-L_{14}
0	0.000	0.000	0.000	0.000	0.000		
1	0.883	0.593	0.334	0.254	0.098		
2	0.786	1.187	0.667	0.509	0.196		
3	0.688	1.780	1.001	0.763	0.294		
4	0.590	1.526	1.334	1.017	0.393		
5	0.491	1.272	1.668	1.272	0.491		
6	0.393	1.017	1.334	1.526	0.590		
7	0.294	0.763	1.001	1.780	0.688		
8	0.196	0.509	0.663	1.187	0.786		
9	0.098	0.254	0.334	0.593	0.883		
10	0.000	0.000	0.000	0.000	0.000		
11	-0.098	-0.254	-0.334	-0.367	-0.360	0.523	0.226
12	-0.196	-0.509	-0.667	-0.735	-0.719	0.066	0.452
13	-0.294	-0.763	-1.001	-1.102	-1.079	-0.392	0.678
14	-0.393	-1.017	-1.334	-1.470	-1.438	-1.607 -.850	0.056
15	-0.491	-1.272	-1.668	-1.837	-1.798	-1.307	-0.566
16	-0.442	-1.145	-1.501	-1.653	-1.618	-1.176	-0.509
17	-0.393	-1.018	-1.334	-1.470	-1.438	-1.046	-0.453
18	-0.344	-0.890	-1.168	-1.286	-1.259	-0.915	-0.396
19	-0.295	-0.763	-1.001	-1.102	-1.079	-0.784	-0.340
20	-0.246	-0.636	-0.834	-0.919	-0.899	-0.654	-0.283
19'	-0.196	-0.509	-0.667	-0.735	-0.719	-0.523	-0.226
18'	-0.147	-0.382	-0.500	-0.551	-0.539	-0.392	-0.170
17'	-0.098	-0.254	-0.334	-0.367	-0.360	-0.261	-0.113
16'	-0.049	-0.127	-0.167	-0.184	-0.180	-0.131	-0.057
15'	-0.000	0.000	0.000	0.000	0.000	0.000	0.000
+	4.419	+8.901	+8.340	+8.901	+4.419	+0.589	+1.412
−	3.682	-9.539	-12.510	-13.778	-13.485	-8.431	-3.107

Influence surfaces for diagonals.

	ξ	γ	ξ/γ	b/l	$\frac{b}{l}\frac{\xi}{\gamma}$	ξ	ξ'/γ	a/l	$\frac{a}{l}\frac{\xi'}{\gamma}$
U_1-L_2	193.61	155.40	1.246	0.8	0.997	313.61	2.018	0.1	0.202
L_2-U_3	105.05	168.93	0.622	0.7	0.435	225.05	1.332	0.2	0.266
U_3-L_4	65.42	86.55	0.756	0.6	0.454	185.42	2.142	0.3	0.643
L_4-U_5	39.87	94.36	0.423	0.5	0.212	159.87	1.694	0.4	0.678

For L_0-U_1, R_A cosec $45°34' = R_A \cdot 1.400$

Load on	L_0-U_1	U_1-L_2	L_2-U_3	U_3-L_4	L_4-U_5
0	0.000	0.000	0.000	0.000	0.000
1	-1.260	-0.202	-0.133	-0.214	+0.169
2	-1.120	+0.997	+0.266	-0.428	+0.339
3	-0.980	+0.872	-0.435	-0.643	+0.508
4	-0.840	0.748	-0.373	0.454	+0.678
5	-0.700	0.623	-0.311	0.378	+0.212
6	-0.560	0.498	-0.249	0.302	-0.169
7	-0.420	0.374	-0.187	0.227	-0.127
8	-0.280	0.249	-0.124	0.151	-0.085
9	-0.140	0.125	-0.062	0.076	-0.042
10	0.000	0.000	0.000	0.000	0.000

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Load on	L_0-U_1	U_1-L_2	L_2-U_3	U_3-L_4	L_4-U_5
11	0.140	-0.125	0.062	-0.076	0.042
12	0.280	-0.249	0.124	-0.151	0.085
13	0.420	-0.374	0.187	-0.227	0.127
14	0.560	-0.498	0.249	-0.302	0.169
15	0.700	-0.623	0.311	-0.378	0.212
16	0.630	-0.561	0.280	-0.340	0.191
17	0.560	-0.498	0.249	-0.302	0.170
18	0.490	-0.436	0.218	-0.265	0.148
19	0.420	-0.374	0.187	-0.227	0.127
20	0.350	-0.312	0.156	-0.189	0.106
19'	0.280	-0.249	0.124	-0.151	0.085
18'	0.210	-0.187	0.093	-0.113	0.064
17'	0.140	-0.125	0.062	-0.076	0.042
16'	0.070	-0.062	0.031	-0.038	0.021
15'	0.000	0.000	0.000	0.000	0.000
	-6.300	-4.875	-1.741	-4.120	-0.639
	+5.250	+4.486	+2.732	+1.588	+3.283

	$\frac{\xi'}{r}$	l/l	$\frac{\xi'}{r}\cdot\frac{l}{l}$	H	y	r	$H\frac{y}{r}$	$\frac{\xi'}{r}\frac{l}{l} - H\frac{y}{r}$
U_5-L_6	1.694	0.5	0.847	1.667	39.99	94.36	0.706	0.141
L_6-U_7	2.142	"	1.071	"	50.11	86.55	0.965	0.106
U_7-L_8	1.332	"	0.666	"	66.08	168.93	0.652	0.041
L_8-U_9	2.018	"	1.009	"	101.30	155.40	1.087	-0.078
U_9-L_{10}	1.648	"	0.824	"	263.26	435.40	1.007	-0.183

Load on	U_5-L_6	L_6-M_7	M_7-L_8	L_8-M_9	M_9-L_{10}
0					
1	-0.042	0.076	-0.062	0.125	-0.140
2	-0.085	0.151	-0.124	0.249	-0.280
3	-0.127	0.227	-0.187	0.374	-0.420
4	-0.169	0.302	-0.249	0.498	-0.560
5	+0.212	0.378	-0.311	0.623	-0.700
6	0.678	0.454	-0.373	0.748	-0.840
7	0.508	-0.643	-0.435	0.872	-0.980
8	0.339	-0.428	+0.266	0.997	-1.120
9	0.169	-0.214	0.133	-0.202	-1.260
10	0.000	0.000	0.000	0.000	0.000
11	-0.028	0.021	-0.008	-0.016	0.037
12	-0.056	0.042	-0.016	-0.031	0.073
13	-0.085	0.064	-0.025	-0.047	0.110
14	-0.113	0.085	-0.033	-0.062	0.146
15	-0.141	0.106	-0.041	-0.078	0.183
16	-0.127	0.095	-0.037	-0.070	0.166
17	-0.113	0.085	-0.033	-0.062	0.146
18	-0.099	0.074	-0.029	-0.055	0.128
19	-0.085	0.064	-0.025	-0.047	0.110
20	-0.071	0.053	-0.021	-0.039	0.092
19'	-0.056	0.042	-0.016	-0.031	0.073
18'	-0.042	0.032	-0.012	-0.023	0.055
17'	-0.028	0.021	-0.008	-0.016	0.037
16'	-0.014	0.011	-0.004	-0.008	0.018
15'	0.000	0.000	0.000	0.000	0.000
	-1.481	-1.285	-1.800	-0.787	-6.300
	+1.906	+2.783	+0.399	+4.486	+1.374

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	ξ			γ	ξ/γ	H ξ/γ	ξ/4 - H ξ/γ	at B
L10-U11	597.74 + 60	=	657.74	435.40	1.511	1.007	0.504	1.373
U11-L12	193.61 + 60	=	253.61	155.40	1.632	1.087	0.545	1.246
L12-U13	105.05 + 60	=	165.05	168.93	0.977	0.652	0.325	0.622
U13-L14	65.42 + 60	=	125.42	86.55	1.449	0.965	0.484	0.756
L14-U15	39.87 + 60	=	99.87	94.36	1.058	0.706	0.352	0.422

Load on	L10-M11	M11-L12	L12-M13	M13-L14	L14-M15
10	0.000	0.000	0.000	0.000	0.000
11	-1.199	-0.217	0.130	-0.193	0.141
12	-1.026	+0.966	0.261	-0.386	0.282
13	-0.852	0.825	0.444	-0.579	0.424
14	-0.678	0.685	-0.384	+0.538	0.565
15	-0.504	0.545	-0.325	0.484	-0.357
16	-0.454	0.491	-0.293	0.436	-0.317
17	-0.403	0.436	-0.260	0.387	-0.282
18	-0.353	0.382	-0.228	0.339	-0.246
19	-0.302	0.327	-0.195	0.290	-0.211
20	-0.252	0.273	-0.163	0.242	-0.176
19'	-0.202	0.218	-0.130	0.194	-0.141
18'	-0.151	0.164	-0.098	0.145	-0.106
17'	-0.101	0.109	-0.065	0.097	-0.070
16'	-0.056	0.055	-0.033	0.048	-0.035
15'	0.000	0.000	0.000	0.000	0.000
	+6.527	-0.217	-2.618	-1.158	-1.986
	+0.000	+5.476	+0.391	+3.200	+1.412

Influence surfaces for verticals

Load on	U2-L2	M4L4	M6-L6	M8-L8	M12-L12	M14-L14
0	0.000	0.000	0.000	0.000		
1	-0.031	-0.019	-0.012	-0.008		
2	-0.062	-0.037	-0.025	-0.016		
3	-0.054	-0.056	-0.037	-0.023		
4	-0.047	-0.074	-0.049	-0.031		
5	-0.039	-0.062	-0.062	-0.039		
6	-0.031	-0.049	-0.074	-0.047		
7	-0.023	-0.037	-0.056	-0.054		
8	-0.016	-0.025	-0.037	-0.062		
9	-0.008	-0.012	-0.019	-0.031		
10	0.000	0.000	0.000	0.000		
11	0.008	0.012	0.134	0.135	0.104	0.115
12	0.016	0.025	0.268	0.270	0.210	0.231
13	0.023	0.037	0.401	0.405	0.351	0.345
14	0.031	0.049	0.535	0.540	0.493	0.461
15	0.039	0.062	0.669	0.675	0.637	0.607
16	0.035	0.056	0.602	0.608	0.573	0.546
17	0.031	0.050	0.535	0.540	0.510	0.486
18	0.027	0.043	0.468	0.473	0.446	0.425
19	0.023	0.037	0.401	0.405	0.382	0.364
20	0.020	0.031	0.335	0.338	0.319	0.304
19'	0.016	0.025	0.268	0.270	0.255	0.243
18'	0.012	0.019	0.201	0.203	0.191	0.182
17'	0.008	0.012	0.134	0.135	0.127	0.121
16'	0.004	0.006	0.067	0.068	0.064	0.061
15'	-0.311	-0.371	-0.371	-0.311		
	+0.293	+0.464	+5.018	+5.065	+4.662	+4.481

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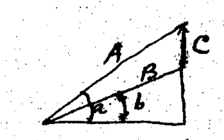
U2-L2 + 1.489 · Sin 5°44' + 1.484 · Sin 3°24' = − 0.149 + 0.088 = − 0.062
U4-L4 − 1.847 · Sin 10°13' + 1.835 · Sin 7°57' = − 0.328 + 0.254 = − 0.074
M6-L6 0.106 · Sin 10°13' − 0.120 · Sin 7°57' + 0.667 = 0.019 − 0.017 + 0.667 = 0.669
M8-L8 0.186 · Sin 5°44' − 0.186 · Sin 3°24' + 0.667 = 0.008 + 0.667 = 0.675

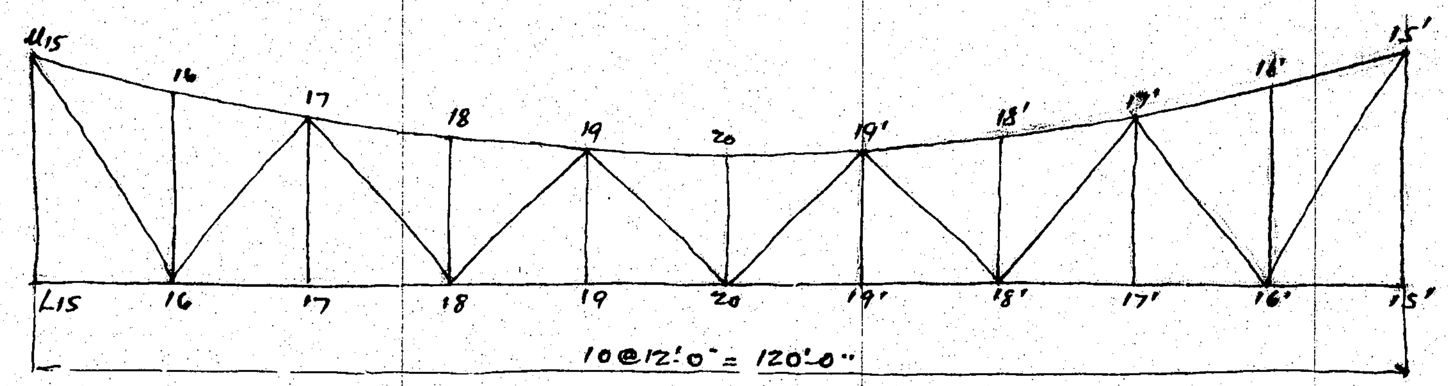


A sin a − B sin b = C

	M12-L12						M14-L14				
Load on	M11-M12	0.0584 Sin 3°21'	M12-L13	0.0999 Sin 5°44'	Suspender	M12-U12	M14-M15	.1774 Sin 10°13'	M13 M14	.1383 Sin 7°57'	M14-L14
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	−0.705	−0.042	−0.707	−0.071	0.133	0.104	−0.441	−0.078	−0.435	−0.060	0.115
12	−1.410	−0.084	−1.414	−0.141	0.267	0.210	−0.882	−0.156	−0.870	−0.120	0.231
13	−1.188	−0.070	−1.190	−0.119	0.400	0.351	−1.322	−0.235	−1.305	−0.180	0.345
14	−0.965	−0.057	−0.967	−0.097	0.533	0.493	−1.763	−0.313	−1.740	−0.241	0.461
15	−0.742	−0.043	−0.744	−0.074	0.667	0.637	−1.435	−0.254	−1.410	−0.181	0.594 · 0.607
16	−0.668	−0.039	−0.670	−0.067	0.600	0.572	−1.292	−0.229	−1.179	−0.163	0.535
17	−0.594	−0.034	−0.595	−0.059	0.533	0.508	−1.148	−0.203	−1.048	−0.145	0.475
18	−0.519	−0.030	−0.521	−0.052	0.467	0.445	−1.005	−0.178	−0.917	−0.127	0.416
19	−0.445	−0.026	−0.446	−0.045	0.400	0.381	−0.861	−0.152	−0.786	−0.109	0.356
20	−0.371	−0.022	−0.372	−0.037	0.333	0.318	−0.718	−0.127	−0.655	−0.091	0.297
19'	−0.297	−0.017	−0.298	−0.030	0.267	0.254	−0.574	−0.102	−0.524	−0.072	0.238
18'	−0.223	−0.013	−0.223	−0.022	0.200	0.191	−0.431	−0.076	−0.393	−0.054	0.178
17'	−0.148	−0.009	−0.149	−0.015	0.133	0.127	−0.287	−0.051	−0.262	−0.036	0.119
16'	−0.074	−0.004	−0.074	−0.007	0.067	0.064	−0.144	−0.025	−0.131	−0.018	0.059
15'	0.000	−0.000	−0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

0.742 Sin 3°24' − 0.744 Sin 5°44' + 0.667 = 0.637
− 1.435 · Sin 10°13' + 1.410 · Sin 7°57' + 0.667 = 0.607

Suspended span



Upper chord influence surface.

	ξ	r	ξ/r	a/l	
U15-U16	12.0	15.59	0.770	0.9	0.693
U16-U17	12.0	15.69	0.765	0.9	0.689
U17-U18	36.0	12.90	2.809	0.7	1.966
U18-U19	36.0	12.94	2.782	0.7	1.947
U19-U20	60.0	12.00	5.000	0.5	2.500

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Load on	U15-U16	U16-U17	U17-U18	U18-U19	U19-U20
15	0.000	0.000	0.000	0.000	0.000
16	-0.693	-0.689	-0.655	-0.649	-0.500
17	-0.616	-0.612	-1.311	-1.298	-1.000
18	-0.539	-0.536	-1.966	-1.947	-1.500
19	-0.462	0.459	-1.685	-1.669	-2.000
20	-0.385	0.383	-1.405	-1.391	-2.500
19'	-0.308	0.306	-1.124	-1.113	-2.000
18'	-0.231	0.230	-0.843	-0.835	-1.500
17'	-0.154	0.153	-0.562	-0.556	-1.000
16'	-0.077	0.077	-0.281	-0.278	-0.500
15'	0.000	0.000	0.000	0.000	0.000
	-3.465	-3.445	-9.832	-9.736	-12.500

Lower chord influence surfaces.

	ξ	y	ξ/y
L16-L17	2@12.0 = 24.0	14.16	1.694
L17-L18	24.0	"	"
L18-L19	4@12.0 = 48.0	12.24	3.921
L19-L20	48.0	"	"

Load on	L16-L18	L18-L20
16	0.678	0.588
17	1.355	1.176
18	1.186	1.764
19	1.016	2.353
20	0.847	1.961
19'	0.~~508~~ 678	1.568
18'	0.~~339~~ 508	1.176
17'	0.339	0.784
16'	0.169	0.392
	6.776	11.762

Diagonals.

	d	ξ	x	sin θ	log sin θ	log x	log x sin θ
U15-L16	99.87	99.87	87.87	56°-18'	1̄.92010	1.94384	1.86394
L16-U17	113.42	125.42	113.42	49°-44'	1̄.88255	2.05469	1.93724
U17-L18	141.05	165.05	129.05	49°44'	1̄.88255	2.11076	1.99331
L18-U19	217.61	253.61	217.61	45°34'	1̄.85374	2.33768	2.19142
U19-L20	609.74	657.74	597.74	45°34'	1̄.85374	2.77651	2.63025

	y	ξ/y	ξ'	ξ'/y
U15-L16	73.10	1.367	20.13	0.275
L16-U17	86.55	1.449	5.42	0.063
U17-L18	98.47	1.676	45.05	0.457
L18-U19	155.39	1.632	133.61	0.971
U19-L20	426.83	1.541	537.74	1.260

Load on	U15-L16	L16-U17	U17-L18	L18-U19	U19-L20
16	1.230	0.006	-0.046	0.097	-0.126
17	1.094	-1.159	-0.091	0.194	-0.252
18	0.957	-1.014	1.173	0.291	-0.378
19	0.820	-0.869	1.006	-0.979	-0.504
20	0.684	-0.724	0.838	-0.816	-0.771
19'	0.547	-0.579	0.670	-0.653	-0.616
18'	0.410	-0.435	0.503	-0.490	-0.462
17'	0.273	-0.290	0.335	-0.327	-0.308
16'	0.137	-0.145	0.168	-0.163	-0.154
15'	0.000	0.000	0.000	0.000	0.000
	+ 6.152	0.006	4.693	0.582	2.311
	- 0.000	-5.215	-0.137	-3.428	-1.260

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

verticals

M15-L15 - M17-L17 M19-L19 equal to 1.000

M16-L16 - 0.693 Sin 10°-13' + 0.689 Sin 7°-57' = - 0.123 + 0.095 = - 0.028
M18-L18 - 1.966 Sin 5°-44' + 1.947 Sin 3°-24' = - 0.196 + 0.115 = - 0.081

Load on	M16-L16	M18-L18
15	0.000	0.000
16	-0.028	-0.027
17	-0.026	-0.054
18	-0.023	-0.081
19	-0.019	-0.070
20	-0.016	-0.058
19'	-0.013	-0.046
18'	-0.010	-0.035
17'	-0.006	-0.023
16'	-0.003	-0.012
15'	0.000	0.000
	-0.144	-0.406

Dead Load Panel Concentration = 19.000# per truss assumed
Live Load Panel concentration = 10500# " " "

Stresses in Suspended Span.

Upper chord stresses

member	Influence surfaces	D.L. Stress (19000)	L.L. Stress (10500)	Total stress
M15-M16	- 3.465	65.835 C	36.383 C	102.200 C
M16-M17	- 3.445	65.455 C	36.173 C	101.600 C
M17-M18	- 9.833	186.808 C	103.236 C	290.000 C
M18-M19	- 9.736	184.984 C	102.228 C	287.200 C
M19-M20	- 12.500	237.500 C	131.250 C	368.800 C

Lower chord stresses

member	Influence	D.L. Stress	L.L. stress	Total stress
L15-L16	0.000	0.00	00	00
L16-L18	6.776	128.700 T	71.200 T	199.900 T
L18-L20	11.762	223.500 T	123.500 T	347.000 T

Diagonal stresses

member	+	−	Sum	D.L. Stress	LL Stress	Total. stress
M15-L16	6.152	0.000	6.152	116.900 T	64.600 T	181.500 T
L16-M17	0.006	5.215	- 5.209	99.000 C	54.800 C	153.800 C
M17-L18	4.693	0.137	4.556	86.600 T	49.300 T	135.900 T
L18-M19	0.582	3.428	- 2.846	54.100 C	36.000 C	90.100 C
M19-L20	2.311	1.260	1.051	20.000 T	24.300 T	44.300 T

Vertical Stresses

		D.L. stress	LL stress	Total stress 1/2
M16-M16	-0.144	2700 C	1.500 C	4.200 C
M18-L18	-0.406	7700 C	4.300 C	12.000 C

Hangers. D.L. stress = 19.000 T
LL stress 15700 T
34.700# T.

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CALCULATIONS FOR

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Cantilever span

upper chord stresses

member	+A	−A	Sum	D.L. stress	L.L. stress	L.L. stress
U_1-U_2	6.960	7.422	−0.462	8.800 C	73100 T	77.900 C
U_2-U_3	6.981	7.445	−0.464	8.800 C	73300 T	78200 C
U_3-U_4	11.475	9.177	+2.298	43700 T	120500 T	96400 C
U_4-U_5	11.550	9.238	+2.312	43900 T	121300 T	96000 C
U_5-U_6^M	0.795	9.238	−8.443	160400 C		96000 C
U_6^M-M_7	0.900	9.177	−8.277	157300 C		96400 C
M_7-M_8	1.395	7.445	−6.050	115000 C		78200 C
M_8-M_9	1.395	7.422	−6.027	114500 C		77.900 C
M_{11}-M_{12}		8.349		158600 C		87700 C
M_{12}-M_{13}		8.370		159000 C		87900 C
M_{13}-M_{14}		12.105		230.000 C		127100 C
M_{14}-M_{15}		12.303		233800 C		129200 C

Lower Chord stresses

member	+A	−A	Sum	D.L. stress	L.L. stress	L.L. stress
L_0-L_2	4.419	3.682	0.737	14.000 T	46.400 T	38700 C
L_2-L_4	8.901	9.539	−0.638	12100 C	93500 T	100200 C
L_4-L_6	8.340	12.510	−4.170	83.000 C	87600 T	131400 C
L_6-L_8	8.901	13.778	−4.877	92.700 C	93500 T	144700 C
L_8-L_{10}	4.419	13.485	−9.066	172.300 C		141600 C
L_{10}-L_{12}	0.589	8.431	−7.842	149.000 C		88500 C
L_{12}-L_{14},	1.412	3.107	−1.695	32.200 C		32600 C
L_{14}-L_{16}						

Diagonals

member	+A	−A	Sum	D.L. stress	LL stress	L.L. stress
L_0-U_1	5.250	6.300	−1.050	20.000 C	55100 T	66200 C
U_1-L_2	4.486	4.875	−0.389	7.400 C	47100 T	51200 C
L_2-U_3	2.732	1.741	+0.991	18.860 T	28700 T	18300 C
U_3-L_4	1.588	4.120	−2.432	46.200 C	16700 T	43300 C
L_4-U_5	3.283	0.639	+2.644	50.200 T	34500 T	
U_5 L_6	1.906	1.481	+0.425	8.100 T	20000 T	15.600 C
L_6-M_7	2.783	1.285	+1.498	28500 T	29200 T	
M_7-L_8	0.399	1.800	−1.401	26.600 C		18900 C
L_8-M_9	4.486	0.787	+3.699	70.400 T	47100 T	
M_9-L_{10}	1.374	6.300	−4.926	93600 C		66200 C
L_{10}-M_{11}	0.000	6.527	−6.527	124.000 C		~~66200~~ 68500 C
M_{11}-L_{12}	5.476	0.217	+5.259	99.900 T	57500 T	
L_{12}-M_{13}	0.391	2.618	−2.227	42.300 C		27.500 C
M_{13}-L_{14}	3.200	1.158	+2.042	38800 T	33600 T	
L_{14}-U_{15}	1.412	1.986	−0.574	10.900 C	14800 T	20900 C

verticals

member	+A	−A	Sum	D.L. stress	LL stress	LL stress
U_2-L_2	0.293	0.311	−0.018	300 C	3.100 T	3300 C
U_4-L_4	0.464	0.371	+0.093	1800 T	4900 T	3900 C
U_6-L_6	5.018	0.371	+4.647	88300 T	52700 T	
M_8-L_8	5.065	0.311	+4.754	90300 T	53200 T	
M_{12}-L_{12}	4.662	0.000	+4.662	88600 T	39100 T	
M_{14}-L_{14}	4.481	0.000	+4.481	85100 T	47100 T	

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Hanging chord

member	+A.	Dead Load Stress	LL stress	Total stress
U_5-U_6	12780	242.800 T	134.200 T	377.000 T
U_6-U_7	12.913	245300 T	135600 T	380.900
U_7-U_8	13.050	248000 T	137000 T	385.000
U_8-U_9	13.185	250500 T	138400 T	388.900
U_9-U_{10}	13.365	253900 T	140300 T	394.200

Hangers

		DL. stress	LL stress	Total stress
U_6-M_6	5.00	95.000 T	52.500 T	147.500
U_7-M_7	"	"	"	"
U_8-M_8	"	"	"	"
U_9-M_9	"	"	"	"

Tower

		DL. stress.	LL. stress	Total stress
U_{10}-L_{10}	−9.500	180.500 C	99.000 C	280.300 C

Reaction at support
max negative reaction at end support.

Reaction A. 6300 ÷ 1.4 = 4.50
−5.25 ÷ 1.4 = −3.75
+0.65

Due to Dead load = 0.65 × 19.000 = 12.400
" " live load = −3.75 × 10.500 = −39.400
27.000 Upward reaction.

Section of truss members.
Chord members. lower chord.
Unsupported length = 144" section assumed 2[s 12·3½ @ 26.10 = 15.350 □" r = 4.55
p = 21300 (1 − 0.0055 l/r) = 17600 #/□" use 14000 #/□" unit stress for channel section of top and bottom compression members.

Diagonals U_1-L_2 Unsupported length 206" section assumed 4Ls 5×3×5/16 = 9.60 □" gross.
r = 2.54 p = 21300 (1 − 0.0055 l/r) = 11800 #/□"
section required 79700 ÷ 11800 = 6.75 □" gross.

Diagonal U_3-L_4 unsupported length 222" Section assumed 4Ls 5×3×5/16 = 9.60 □" gross.
r = 2.54 p = 21300 (1 − 0.0055 l/r) = 11080 #/□"
section required 89500 c. ÷ 11080 = 8.06 □" gross.

diagonal M_7-L_8 unsupported length 222" Section assumed 4Ls 4×3×5/16 = 8.36 □"
r = 1.95 p = 21300 (1 − 0.0055 l/r) = 7980 #/□"
section required = 45500 ÷ 7980 = 5.70 □" gross.

Diagonal M_9-L_{10} Unsupported length 206" Section assumed 4Ls 6×3½×3/8 = 13.68
r = 3.00 p = 21300 (1 − 0.0055 l/r) = 13250 #/□"
section required = 159800 ÷ 13250 = 12.050 □" gross.

Diagonal L_{10}-M_{11} unsupported length 206" section assumed 4Ls 6×3½×7/16 = 15.880 □"
r = 3.00 p = 21300 (1 − 0.0055 l/r) = 13250 #/□"
section required = 192500 ÷ 13250 = 14.520 □" gross.

Diagonal L_{12}-M_{13} Unsupported length 222" Section assumed 4Ls 5×3×5/16 = 9.60
r = 2.54 p = 11080 #/□" section req'd = 69800 ÷ 11080 = 6.300 □"

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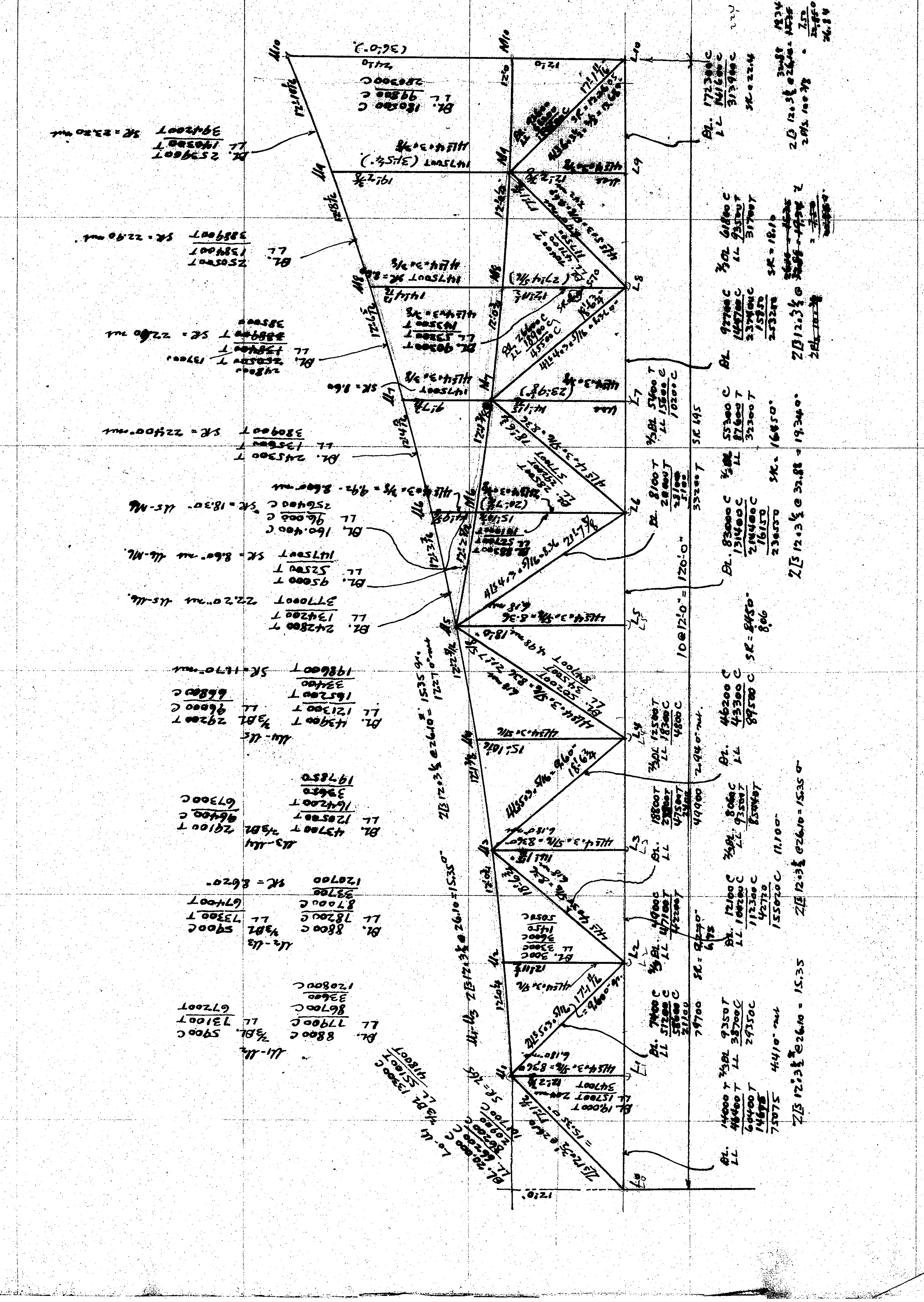
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-ken.



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

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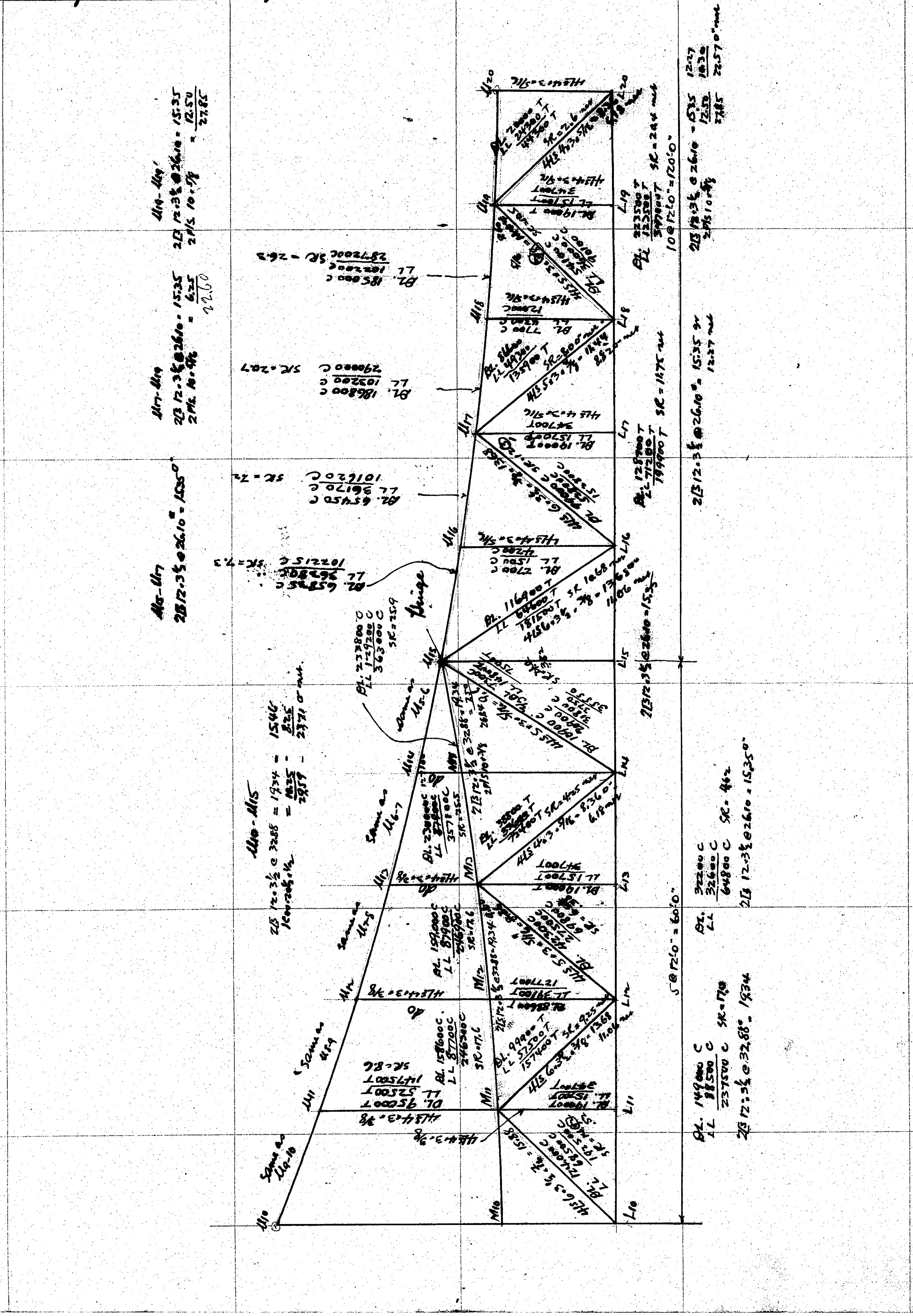

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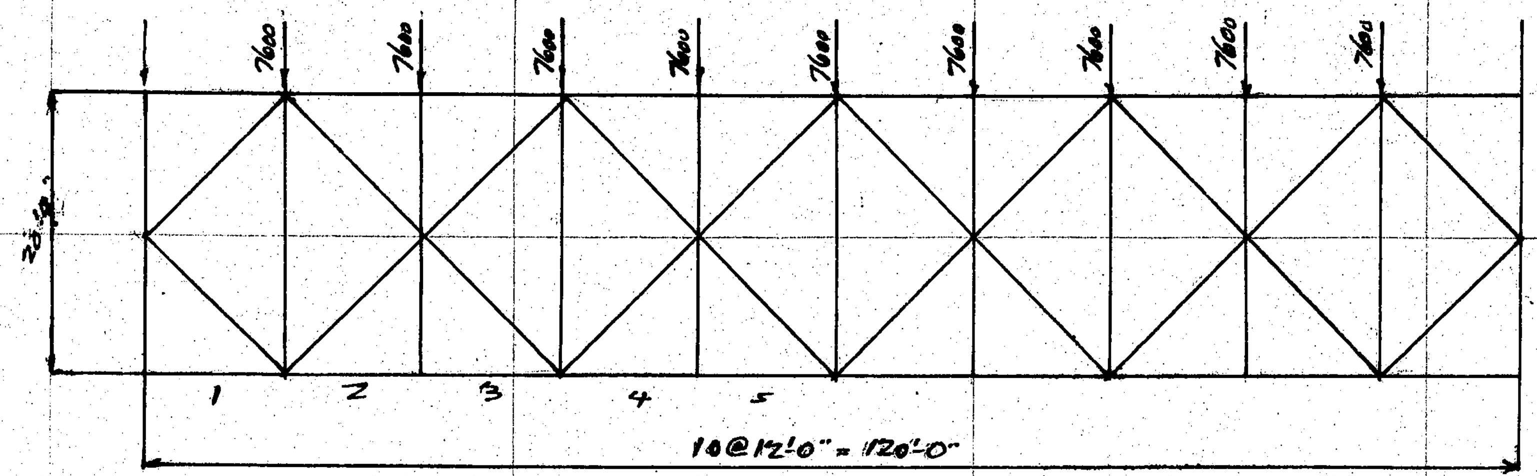
Design of Anabuki-Bashi for Tokushima-Ken.

Diagonal ~~L14~~-M15 Unsupported length 260" Section assumed 4Ls 5 × 3 × 5/16 = 9.60 □"
r = 2.54 p = 21300 (1 - 0.0055 l/r) = 9300 #/□"
Section required 35550 ÷ 9300 = 3.82 □"

Diagonal L16-U17 . Unsupported length 222" Section assumed 4Ls 6 × 3½ × 3/8 = 13.68 □"
r = 3.0 p = 21300 (1 - 0.0055 l/r) = 12600 #/□"
Section required 152800 ÷ 12600 = 12.10 □"

Diagonal L18-U19 Unsupported length 206" Section assumed 4Ls 5 × 3 × ~~3/8~~ 5/16 = ~~11.44~~ 9.60 □"
r = 2.54 p = 21300 (1 - 0.0055 l/r) = 11800 #/□"
Section required 90100 ÷ 11800 = 7.64 □"

Bottom Lateral Bracing for suspended span.



Dead Load panel concentration = 19000 #
For Earthquake Hor. force = 19000 × 0.2 = 3800 # per truss or
7600 # for bridge.

$\tan\theta = \frac{24}{20.75} = 1.158$ $\sec\theta = \frac{31.8}{20.75} = 1.53$

Reaction = 7600 × 4.5 = 34200 #
As Compression member 2Ls 4 × 3 × 5/16 r = 1.16 unsupported length 15.9 × 12 = 191"
l/r = 191/1.16 = 165 this section is not able to resist to compression stress.
For K truss at end panel Use 2Ls 5 × 3½ × 5/16 ½" apart r = 1.50
l/r = 191/1.50 = 1.27. p = 21300 (1 - 0.0055 l/r) = 6400 #/□"

Panel	End shear	For tension only	Section req'd	Use	¾" Rivet
1	34200	52300 ÷ ~~17000~~ 30600 =	~~3.08~~ 1.68 □" net	2Ls	7.
2	26600	40700	~~2.40~~ 1.33	2Ls 4 × 3 × 5/16	6
3	19000	29100	~~1.71~~ .950	do	"
4	11400	17400	~~1.02~~ .57	do	"
5	3800	5800	~~0.34~~ .19	do	"

Bottom Lateral Bracing for Cantilever span.

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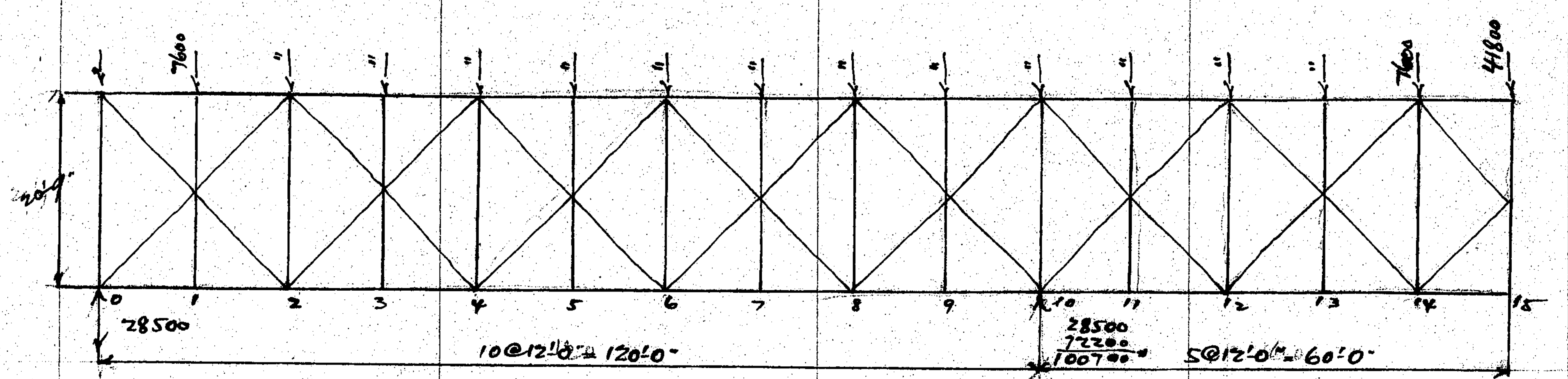
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken



Concentration at 15 7600 × 5.5 = 41800

Panel	Shear				section req'd	3/4 R.		Use 3/4"
15-14	41800	× 1.53 =	64000	÷ 30600 =	2.09	8	2Ls 4×3×3/8	8
14-13	49400	=	75500	=	2.47	10	2Ls 5×4×3/8	10
13-12	57000	=	87200	=	2.85	11	2Ls 5×4×3/8	12
12-11	64600	=	99000	=	3.24	13	2Ls 5×4×3/8	14
11-10	72200	=	110500	=	3.60	14	2Ls 5×4×3/8	14
						3/4 R		Use 3/4 Rivet
10-9	62700	× 1.53 =	96000	÷ 30600 =	3.14	12	2Ls 5×4×3/8	12 14
9-8	54900	=	84000		2.74	11	2Ls 5×4×3/8	12
8-7	47300	=	72200		2.36	9.1	2Ls do	10
7-6	39700	=	60600		1.98	7.6	2Ls 4×3×3/8	8
6-5	32100	=	49000		1.60	6.2	do	8
5-4	24500 - 28500	=	43500		1.42	5.5	2Ls 4×3×5/16	6
4-3	- 28500	=	43500		1.42	5.5	do	6
3-2	- 28500	=	43500		1.42	5.5	do	6
2-1	- 28500	=	43500		1.42	5.5	do	6
1-0	34200	=	52200		1.71	6.6	2Ls 4×3×3/8	8

For End panels 14-15 and 15-16. Use 2Ls 5×4×3/8 r = 1.59
unsupported length 191" l/r = 120
p = 21300 (1 - 0.0055 l/r) = 7240 #/□" 7240 × 1.8 = 13000 #/□"
stress for 14-15 64000/2 = 32000 SR = 32000 ÷ 13000 = 2.46 □" gross.
2Ls 5×4×3/8 = 6.46 □"
Use 8 Rivet Connection in details.

Chord stress at 10 moment at 10 41800 × 60 = 2,510,000 '#
7600 × 12 × 8 = 730,000
3,240,000 '#

Stress in chord 3,240,000 ÷ 20.75 = 156,000 #
Live and dead load stresses 237500
Unit stress = 14000 × 1.8 = 25200 #/□" 393500 #
Section required 393500 ÷ 25200 = 15.60 □" gross
section used 2[12" 3½" @ 32.88 = 19.34 □"

Wind pressure for 240' span = 73.2 meter
unloaded chord. 400 kg per meter. under 50 meter in span
loaded chord 400 kg per meter. " 50 " " "
increase 15 kg per meter increasing span 10 meter each.

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CALCULATIONS FOR

Design of Anabuki Bashi for Tokushima-Ken

For 240' span 445 kg per meter
For 120' span 400 " "
For 180' span 415 " "
Assume span length $\frac{415 \times 2.2}{3.28} = 287^{\#}$

Unloaded chord say 143
430# × 12 = 5160# concentration
Earthquake effect 7600# " "
for wind stress 5160 ÷ 1.25 = 4130
for Earth quake 7600 ÷ 1.800 = 4220

Section for lower lateral bracings will be determined by Earthquake effect.
For combined stress for chord member wind effect will give larger of section.

Chord stress at 10
Concentration at Panel Point 15 5160 × 5.5 = 28400#
moment at 10 28400 × 60 = 1,705,000
5160 × 12 × 10 = 620,000
2325,000
Stress in chord 2,325,000 ÷ 20.75 = 112,000
Live and Dead Load stress 237500
349500#
Unit stress = 14000 × 1.25 = 17500#/□"
section required = 349500 ÷ 17500 = 19.950" gross.

Cantilever portion will have top chord bracing
wind load for bottom chord 287#
panel concentration 287 × 12 = 3450#

Moment at 10 28400 × 60 = 1,705,000
3450 × 12 × 10 = 414000
2,119,000#
Chord stress 2119,000 ÷ 20.75 = 102,000
Live and dead load stress = 237500
339500
section required 339500 ÷ 17500 = 19.40 □" gross
used section 2[12" × 3½" @ 32.88 = 19.34 □" say ok.

Combined Floor beam and Strut at Panel Point 10.
Direct stress due to Earthquake = 100700#
Flange stress 155000 × $\frac{12}{20.8}$ = 89500# in compression flange.
For uniform direct load 50350
139850#
Unit stress = 139850 ÷ ~~5.06~~ 6.10 = 22900#/□"
Use 2L 5 × 3½ × ½ = 8.0 □" flange stress 100700 + 89500 = 190200
Unit stress = 139850 ÷ 8.00 = 17500#/□"
$\frac{17500}{1.8}$ = 9750#/□"

Unit stress = 190200 ÷ 8.00 = 23800#/□" ok.

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima Ken

Bottom Lateral Bracing for suspended span

wind load. 400 kg per meter. or - 268# per lin ft.
on unloaded chord. 134
402 call this 400# per lin ft.

$\tan\theta = \frac{24}{20.75} = 1.158$ $\sec\theta = \frac{31.8}{20.75} = 1.53$

Panel Concentration 400 × 12 = 4800# Reaction 4800 × 4.5 = 21600#

Stresses in bracings.

Panel	End shear		stress tension only			section net	Use	3/4" Rivets
1	21600	× 1.53 =	33000	÷ 17000	=	1.94 □"		7.5
2	16800		25700		=	1.51	2Ls 4·3·5/16 = 4.19	5.8
3	12000		18350		=	1.08	2Ls do	4.2
4	7200		11000		=	0.65	2Ls do	2.5
5	2400		3700		=	0.22	2Ls do.	0.9

Bottom Lateral Bracings for Cantilever span.

wind load 400# per lin ft for suspended span
" " 415 kg or 287# per lin ft.
upper chord 143
430# per lin ft. Conc = 430 × 12 = 5160# assumed throughout the span.

Concentration at panel point 15 21600#

Stresses in bottom lateral.

Panel	Shear		stresses.			Section	Use	Use 3/4" Rivets	
15-14	21600	× 1.53 =	33000	÷ 17000	=	1.94	2Ls 4·3·3/8	8	
14-13	26760	=	40900	9.5		2.40	2Ls 5·4·3/8	10	
13-12	31920	=	48800	11.0		2.87	2Ls 5·4·3/8	12	
12-11	37080	=	56800	12.9		3.34	2Ls 5·4·3/8	14	
11-10	42240	=	64500	14.6		3.80	2Ls 5·4·3/8	14	
10-9	39160	× 1.53 =	60,000	÷ 17000	=	3.53	2Ls 5·4·3/8	14	13.6
9-8	34000		52000			3.06	2Ls 5·4·3/8	12	11.8
8-7	28840		44000			2.59	2Ls 5·4·3/8	10	10.0
7-6	23680		36200			2.12	2Ls 4·3·3/8	8	8.2
6-5	18520		28300			1.66	do	8	6.4
5-4	-15960		24400			1.44	2Ls 4·3·5/16	6	5.5
4-3	-15960		"			"	"	6	"
3-2	-15960		"			"	"	6	"
2-1	-15960		"			"	"	6	"
1-0	23200		35500			2.09	2Ls 4·3·3/8.	8.	8.0

Reaction

$21600 \times \frac{60}{120} = 10800$

$5160 \times \frac{10}{10} = 5160$

15960

23200
15960
39160

4@5160 = 20640
21600
42240
58200#

5160 × 4.5 = 23200

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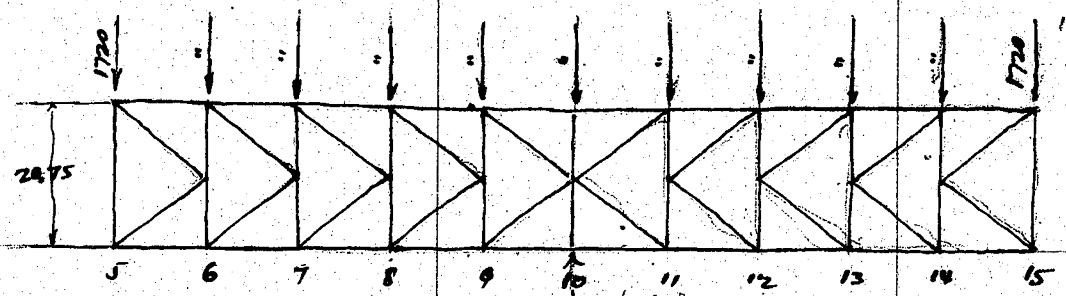
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

upper lateral system. for wind load
wind load for upper chord 143# per lin ft of truss.
panel concentration 143 × 12 = 1720#

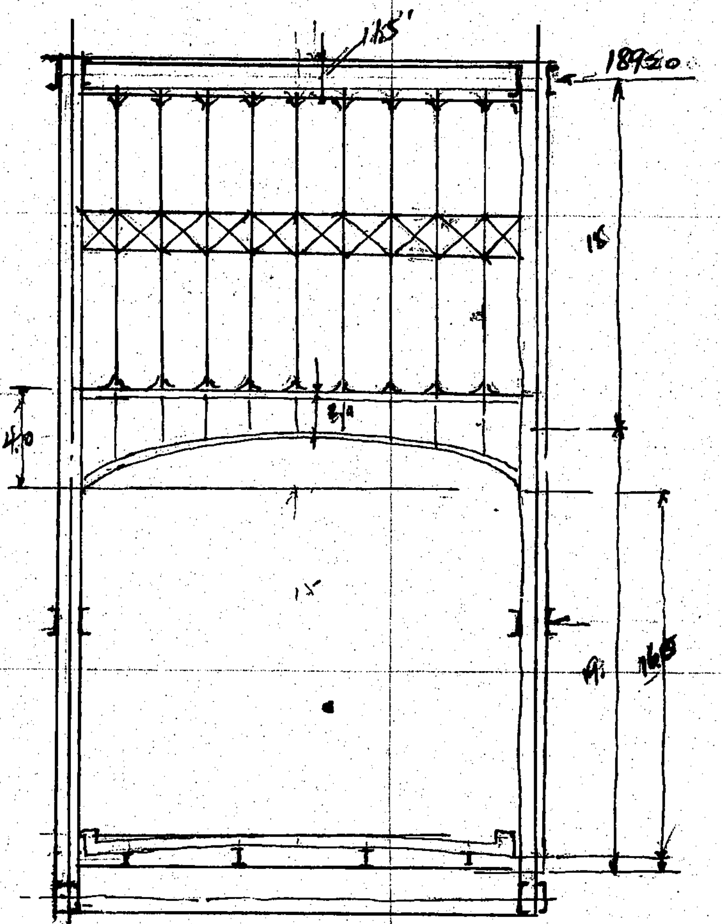


Loading assumed as shown on sketch. and all loads carried by panel point 10 to the lower chord.

11 @ 1720 = 18920 shear at panel 10 to 11. 1720 × 5 = 8600#

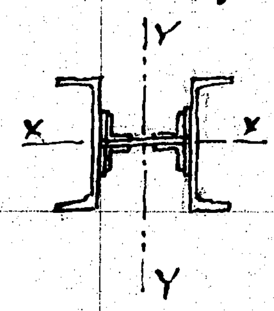
Diagonal stress chord length 12.84^2
Diagonal length $\sqrt{12.84^2 + 10.38^2} = 16.55$
$\sec\theta = \frac{16.55}{10.38} = 1.595$
stress in diagonal 4300 × 1.595 = 6860#
stress in strut 2 @ 8600 = 17200#

For strut use 4 Ls 4 × 3 × 5/16 r = 1.9 $l/r = \frac{249}{1.9 \times 2} = 62.2$
p = 21300 (1 − 0.0055 l/r) = 14000#/□"
section required 17200 ÷ 14000 = 1.23



Approximate bending moment due to wind pressure.
18920# at upper chord panel point
unsupported length lower section 16.0'
point of contraflexure at 8.0' from bottom
for neutral axis 19.1/2 = 9.5'
moment per col
$\frac{18920}{2} \times 9.5 = 90,000$ in#

Moment of inertia of column section



Moment of inertia YY axis

2 [s 15 × 4 @ 41.94	@ 24.67 × 7.56² + 29	=	1439
4 Ls 3½ × 3½ × 3/8	@ 9.92 × 5.23² + 12	=	282
1 Pl 12 × 3/8	4.50		54
	39.09		1775

Moment of inertia XX axis

2 [s 15 × 4 × 41.94	@ 24.67	=	754
4 Ls 3½ × 3½ × 3/8	@ 9.92 × 1.2² + 12	=	26
1 Pl 12 × 3/8	4.50		0
	39.09		780

Radius of gyration
$r = \sqrt{\frac{780}{39.09}} = 4.46$

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CALCULATIONS FOR

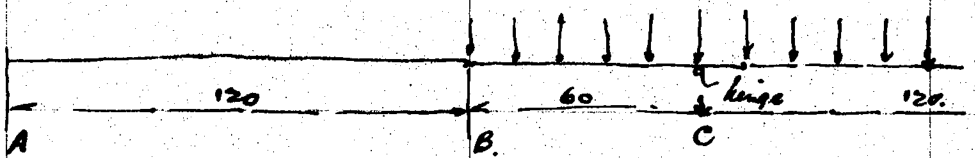
Design of Anabuki-Bashi for Tokushima-Ken.

Direct load due to dead and live load = 280300
Direct load due to wind load $\frac{18920 \cdot 36}{20.75}$ = 32800
313100# ÷ 3909 = 8000 #/□"
Stress due to bending moment = $\frac{90000 \cdot 12 \cdot 10.62}{1775}$ = 6500
14500 #/□"

assumed section of main Column ok.

For top strut use 4 L.S 4·3·5/16 and for middle arched girder use same section as for above strut
radius of gyration = 1.9 unsupported length say 249" l/r = $\frac{249}{1.9}$ = 131 ok
use rigid end connection.
vertical bars 2 L.S 3·3·5/16 - use double lacings midway as shown on sketch.

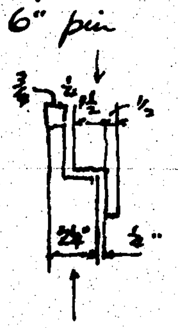
max load on pier.
panel concentration D.L. 19000# L.L 10500#



Reaction on hinge from suspended span 19000 · 4.5 = 85500
19000
104500# at hinge.

Reaction on B. 104500 · $\frac{60}{120}$ = 52250
19000 · $\frac{10}{10}$ = 19000
71250#
104500
5@19000 = 95000
4.5@19000 = 85500
356250#
For live load 356250 · $\frac{10500}{19000}$ = 197000
553250# on pin
Load on pier say 560750# as for preliminary design.

Load on pin say 553250# Bearing on pin for one rib = 276600#
Use 6" pin thickness for bearing 2" Unit bearing = $\frac{276600}{6 \cdot 2}$ = 23000 #/□" ok.



Arm 7/8" bending moment = 276600# · 7/8" = 242000 "#
Unit bending stress
$\frac{242000 \cdot 6/2}{0.049 \cdot 6^4}$ = 11430 #/□" ok.

Bearing on masonry bearing area assumed 36 · 36" = 1296 □"
Unit bearing = $\frac{560750}{1296}$ = 432 #/□" ok.

Dead Load on bearing say 360000# Horizontal Earthquake force = 360.000 · 0.2 = 72000#
Unit shearing stress = 12800 · 1.8 = 23000 #/□"
section required = $\frac{72000}{23000}$ = 3.13 □"

Use 6 - $1\frac{1}{2}$"ø anchor bolts @ 1.77 = 10.62 □"

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Load on abutment

Dead Load negative reaction $104500 \cdot \frac{60}{120} = 52250$

$19000 \cdot \frac{4}{10} = 19000$

71250 upward

$19000 \cdot 4.5 = 85500$ downward reaction

14250#

Add ½ panel load 9500

23750# downward load.

Live Load max downward $10500 \cdot 5$ 52500

76250 max down ward

max negative reaction due to cantilever action

Load at hinge $10500 \cdot 4.5 = 47250$

10500

57750

negative reaction $57750 \cdot \frac{60}{120} = 28875$

$10500 \cdot \frac{4}{10} = 10500$

39375# max upward

⅔ D.L. $23750 \cdot ⅔ = 15850$ downward

L.L. max upward 39375 upward

23525 upward. max load

3" roller $610\,d = 610 \cdot 3 = 1830$# per lin inch

length of roller $76250 \div 1830 = 41.7$ inch.

use 4 rollers 11" ml.

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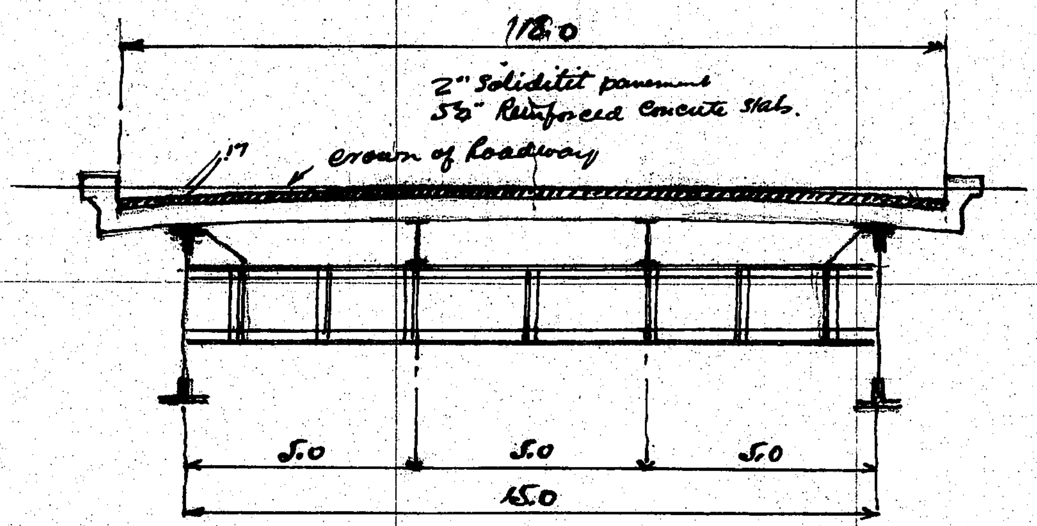
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Design of 60' girder
Cross section of Roadway and arrangement of framing as shown on sketch.

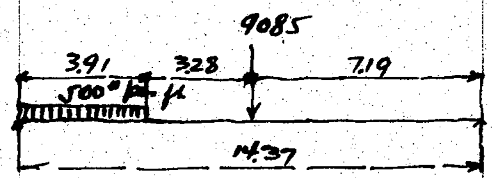


Design of floor slab same as truss span
See page 3.

Design of Longitudinal Stringer span length 14'-4½" spacing of stringers 5'-0"
Dead Load floor and pavement 90 · 5 = 450
stringer assumed 35
485# per lin. ft.

Dead Load moment = ⅛ · 485 · 14.37² = 12.470 '#
Dead Load shear = ½ · 485 · 14.37 = 3480 #
Live Load motor truck loading Rear wheel Conc. with impact = 6435 #
Front " " " = 2145 #

Reaction 6435 · 2.06/5.00 = 2650
6435
9085 #



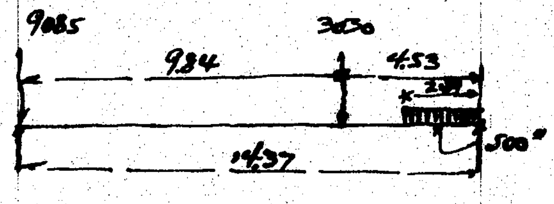
Uniform load = 100 · 5 = 500 # per ft
total unif. load = 500 · 3.91 = 1955 #
moment at center of span

Reaction = 1955 · 1.95/14.37 = 265 #

motor truck loading ½ · 9085 · 7.19 = 32.650 '#
Uniform load 265 · 7.19 = 1905
34555 '#

max End shear

Uniform load 500 · 2.89 = 1450 #



Front wheel 3030 · 4.53/14.37 = 955
Rear wheel 9085
Unif. load 1450 · 1.45/14.37 = 147
10187 #

Summary for moments and shears

	Moment	Shear
Dead Load	12470 '#	3480 #
Live Load	34555	10187
	47025	13667

section modulus reqd = 47025 · 12 / 17000 = 33.2

Use 1 I 12" - 5" @ 31.99 # Sm. = 36.69

Intermediate Floor Beam span length 15'-0" spacing = 14'-4½"
Dead Load Concentration at stringer Conn. 485 · 14.37 = 6970 #
moment at center = 6970 · 5.0 = 34.860 '#
Floor beam ⅛ · 65 · 15² = 1830
36690 '#

Dead Load shear Concentration 6970
Floor beam ½ · 65 · 15 = 488
7458 #

35

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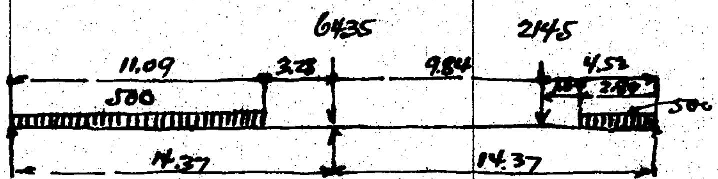
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

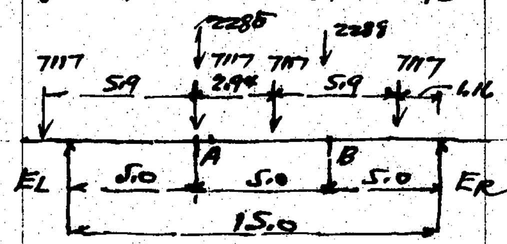
Live Load - Load on floor beam



motor truck Front wheel $2145 \cdot \frac{4.53}{14.37} = 682$
6435 — 7117

Unif. load $1445 \cdot \frac{1.45}{14.37} = 146$
" " $5550 \cdot \frac{5.54}{14.37} = 2142$ — 2288

Unif. load $500 \cdot 11.09 = 5550^{\#}$
" " $500 \cdot 2.89 = 1445^{\#}$



Concentration at A $7117 \cdot \frac{2.06}{5.} = 2930$
7117
10047#

Concentration at B $7117 \cdot \frac{2.94+1.16}{5} = 5833$

Reaction at EL $10.047 \cdot 2/3 = 6698$
$5833 \cdot 1/3 = 1944$
8642#

moment at A due to unif. $2288 \cdot 5 = 11440$
" " " " truck $8642 \cdot 5 = 43210$
10930# — 54.650'#

Summary for moments and shears

	moment	shear
Dead Load	36.690	7458
Live Load	54.650	10930
	91340'#	18388#

web assumed $18 \times 5/16 = 5.62\,\square''$ 1/8 web. 0.70
Effective depth = 1.38
flange stress $91340 \div 1.38 = 66200^{\#}$
Section req'd $= \frac{66200}{17000} = 3.90 - 0.70 = 3.20\,\square''$ net

Assume 2Ls 3.3.3/8" = 4.22□" gross or 3.62□" net.

weight of intermediate floor Beam

2Ls 3.3.3/8	@ 7.2#	· 15.0	=	216
2Ls 3.3.3/8	@ 7.2	· 14.2	=	204
1Pl. 18.5/16	@ 19.13	· 15.0	=	287

707
Details & Rivet Heads - 223
930# per le

$930 \div 15. = 62^{\#}$ per lin. ft.

End Floor Beam — Span length 15'-0" overhang 1.25

Dead Load — Load on stringer 485# per lin. ft.

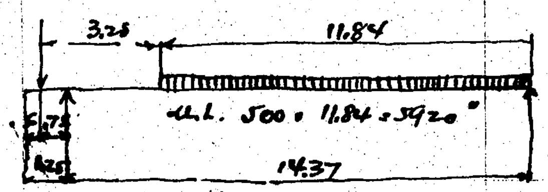
Load on Floor Beam $\frac{485 \cdot 15.62^2}{2 \cdot 14.37} = 4120$

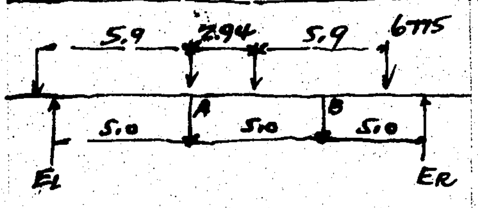
moment due to concentration $4120 \cdot 5 = 20600$
DL. Floor Beam $1/8 \cdot 50 \cdot 15^2 = 1407$
22007'#

DL. shear 4120
Floor $1/2 \cdot 50 \cdot 15 = 375$
4495#

Live Load — motor truck rear wheel

Load on floor beam $6435 \cdot \frac{15.12}{14.37} = 6775^{\#}$





Concentration A. $6775 \cdot \frac{2.06}{5.0} = 2790$
6775
9565#

Concentration B $6775 \cdot \frac{2.94+1.16}{5.0} = 5550^{\#}$

Reaction at EL. $9565 \cdot 2/3 = 6380$
$5550 \cdot 1/3 = 1850$
8230

R unif. load $5920 \cdot \frac{5.92}{14.37} = 2440^{\#}$

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

moment due to ~~motor~~ truck 8230 . 5 = 41150
" " " Unif. load 2440 . 5 = 12200
10670" 53350"

Summary for moments and shears

	moment	shear
Dead Load	22007	4495
Live Load	53350	10670
	75357"	15165"

~~web assumed~~ 18 . 5/16 = 5.620" ⅛ ~~web~~ = 0.700"
Effective depth = 1.38
flange stress 75357 ÷ 1.38 = 54600"
section required = 54600/17000 = 3.21 - 0.70 = 2.510" net

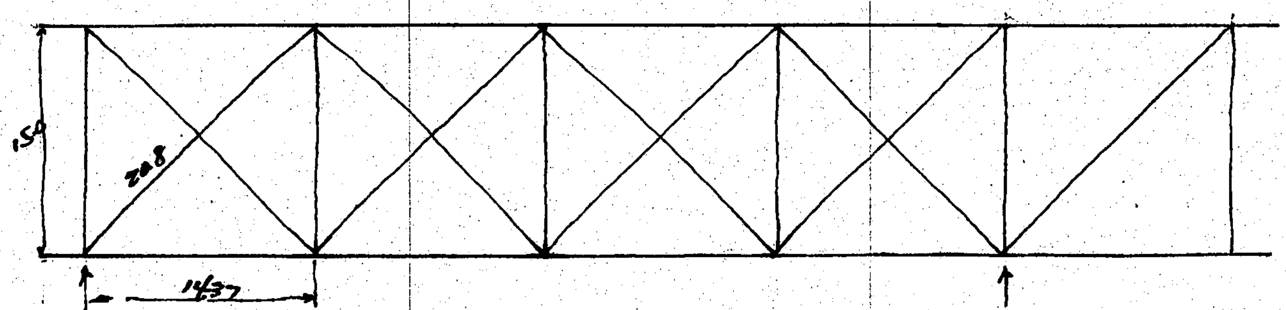
Use 2⅃s 3.3.5/16 = 3.56 - ~~0.54~~ = 3.02 o" net

Approximate weight of End floor Beam.

4⅃s 3.3.5/16 @ 6.1 . 15.0 = 366
1Pl. 18 . 5/16 @ 19.13 . 15.0 = 287
653
Details and rivet heads 217
870"

870 ÷ 15 = 58" per lin. ft.

Lateral Bracing wind pressure 30#/□' assumed. Exposed area say 8.0' or 240" per lin. ft.



$\sec\theta = \frac{20.8}{15} = 1.386$ panel concentration 240 . 14.37 = 3440"
Reaction = 3440 . 1.5 = 5160" Stress in End panel = 7160"
Use 2⅃s 4.3.5/16" riveted back to back of ⅃s r = 1.18
Unsupported length = 20.8 . 12 = 250" ℓ/r = 212

Approximate weight of Lateral Bracing.

2⅃s 4.3.5/16 @ 7.2" . 19'-4½" = 279.00
4⅃s 4.3.5/16 @ 7.2 . 9'-4¾" = 270.60
1Pl. 6.½". @ 10.2 . 1'-10" = 18.70
568.30
Rivet heads and variation 16.7
585.0"

4@585.0 = 2340"
2340 ÷ 60 = 39" per lin ft

Main girder
Dead Load Floor slab and pavement 90 . 18 = 1620
Coping 226
Handrails 2@60 = 120
1966" per lin ft.

Dead Load metal.
Intermediate Panel:- Stringers 2@35" . 14.37 = 1050
Floor beam 930
Lateral Bracing 585
2565 ÷ 2 = say 1285"

37

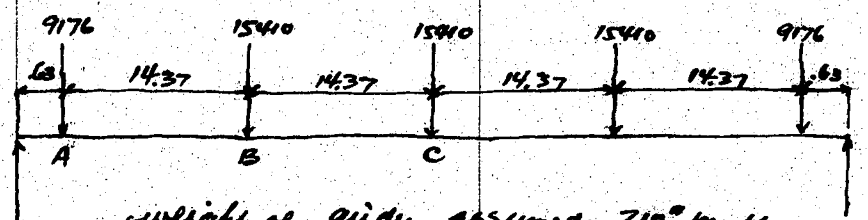
Design of Anabuki-Bashi for Tokushima-Ken.

End panel point — stringers 2@35 × 8.44 = 591
Floor beam 870
Lateral Bracing 292
1753 ÷ 2 = 876#

Summary for panel Concentration

	Intermediate Panel Pt	End panel Point
Floor	14125	8300
metal	1285	876
	15.410#	9176#

moment due to panel concentration.



weight of girder assumed 210# per ft

Reaction = 15410 × 1.5 = 23114
9176
32290#
½ × 210 × 58.75 = 6170
38460

moment at A 32290 × 0.63 = 20.350'#

moment at B
32290 × 15 = 484 000
9176 × 14.37 = −131 800
352200'#

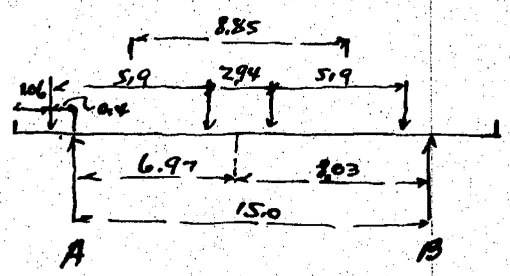
moment at C
32290 × 29.37 = 948000
9176 × 28.74 = −263600
15410 × 14.37 = −221500
462900'#

moment due to weight of girder
moment at A = ½ × 210 × 0.63 × 58.12 = 3850'#
" " B = ½ × 210 × 15. × 43.75 = 68900 "
" " C = ⅛ × 210 × 58.75² = 90 600 "

Summary for Dead Load moment

	at A	B	C
Due to Concentration	20.350	352.200	462900
" " wt of girder	3850	68.900	90 600
	24200'#	421,100'#	553.500'#

Live Load motor truck loading



impact $\frac{20}{60+l} = \frac{20}{77.9} = 25.7\%$

Rear wheels 2@ 4950 = 9900
Impact 25.7 % = 2545
12445#

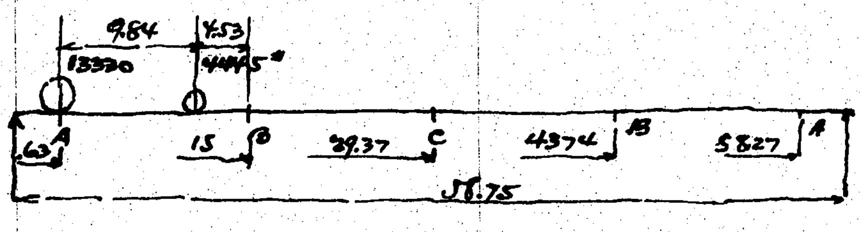
Front wheels ⅓ × 12445 = 4150#

Reaction A 2 @ 12.445 × $\frac{8.03}{15.}$ = 13.330# for rear wheels.

Reaction B 2@ 4150 × $\frac{8.03}{15}$ = 4445# for Front wheels

Uniform live load 100# per square ft 16.46' wide 1646#

Reaction A = 1646 × $\frac{8.23}{15}$ = 903# per lin. ft of girder.



moment at A due to motor truck loading
R = 13330 × 58.12 = 775.000
4445 × 48.27 = 214.500
989500 ÷ 58.75 = 16840#

m = 16840 × 0.63 = 10610'#

moment at B R = 13330 × 43.74 = 583.300
4445 × 33.90 = 150.700
733.000 ÷ 58.75 = 12.470#

m = 12470 × 15.0 = 187050'#

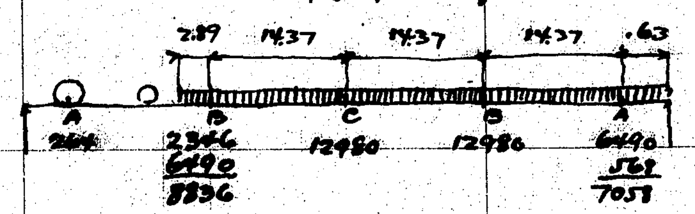
Design of Anabuki-Bashi for Tokushima-Ken

moment at c R = 13.330 • 29.37 = 391.500
4.445 • 19.53 = 86.800
478.300 ÷ 58.75 = 7760#

m = 7760 • 29.37 = 228.000 '#

moment due to Uniform load.

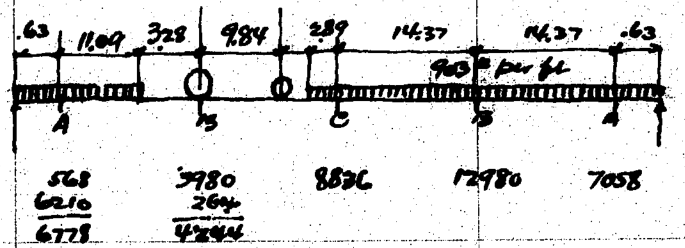
moment at A



R = 7058 • 0.63 = 4.446
12980 • 15.00 = 195.000
12980 • 29.37 = 381.300
8836 • 43.74 = 386.400
264 • 58.27 = 15400
982.546 ÷ 58.75 = 16.730

m = 16.730 • 0.63 = 10.540 '#

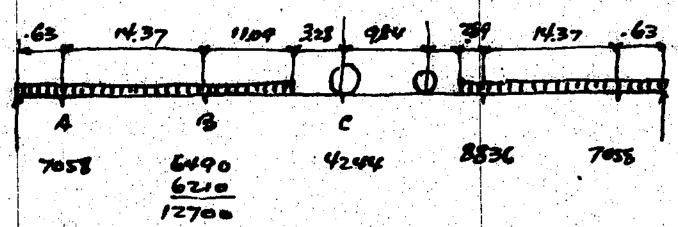
moment at B



R = 7058 • 0.63 = 4.446
12980 • 15.00 = 195.000
8836 • 29.37 = 259.500
4244 • 43.74 = 185.700
6778 • 58.27 = 395.000
1039.646 ÷ 58.75 = 17.700#

m = 17.700 • 15 = 265.300
903 • 11.72 • 9.14 = - 96.800
168.500 '#

moment at C



R = 8836 • 15.0 = 132.500
4244 • 29.37 = 124.700
12700 • 43.75 = 556.000
813.200 ÷ 58.75 = 13830
7058
20.888#

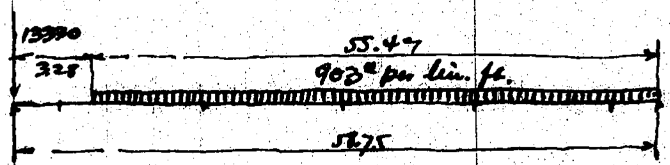
m = 20.888 • 29.37 = 613.300
26.1 • 903 • 16.94 = - 399.000
214300 '#

Summary for Live Load moment

	A	B	C
motor truck loading	10.610	187050	228.000
Uniform load	10.540	168500	214300
	21.150 '#	355550 '#	442.300 '#

Max Live Load shear

Uniform live load = 903 • 55.47 = 50300#



R = 50300 • $\frac{27.73}{58.75}$ = 23700
motor truck rear wheels 13330
37030#

Summary for moments and shears

	A	B	C	shears max
Dead Load	24200	421.100	553500	38460
Live Load	21150	355550	442300	37030
	45350 '#	776650 '#	995800 '#	75490#

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Section of main girder m = 995800 ″# shear = 75490#
~~web assumed~~ 42 × 3/8 = 15.750 □″ 1/8 web = 1.970 □″
Effective depth 3.54 − 0.16 = 3.38′ flange stress = 995800 ÷ 3.38 = 295000#
Section required = 295000 ÷ 17000 = 17.350 □″ − 1.97 = 15.380 □″ net
flange Ls 2Ls 6×6×1/2 = 11.50 − 9.50 □″ net
1 cov. pl. 14×1/2 = 7.00 6.00
18.500 □″ 15.500 □″ net

Approximate weight of main girder

web	1Pl 42 × 3/8	@ 53.55	×	60.0	=	3215
	4Ls 6×6×1/2	@ 19.60	×	60.0	=	4710
	2Pls 14×1/2	@ 23.80	×	35′1″	=	1670
Stiffs	11Ls 5×3 1/2×1/2	@ 13.60	×	3′5 1/2	=	518
″	27Ls 5×3 1/2×9/16	@ 3′6 1/2	@	8.7#	=	832
fills	11Pls 3 1/2×1/2	@ 5.95	×	2′6″	=	164
web and flange splices						730
	2Pls 15×3/4	@ 38.3	×	1′5″	=	109
	Rivet heads and variation say					700
						12648

12648 ÷ 60 = 210# per lin ft.

Summary for weight of metal.

Stringers	2@35# × 60	=	4200
Int. Floor Beams	3 @ 930	=	2790
End Floor Beams	2@ 870	=	1740
Lateral Bracings			2340
main girders	2@12650	=	25300
Base plates & anchors	2@300	=	600
			36970 ÷ 2240 = 16.50 tons.

Load on Bearing
metal 37000 ÷ 2 = 18500#
Floor 1966 × 60/2 = 59000
77500 ÷ 2 = 38750#
Live Load End Reaction. 37070
75820#
Bearing Area = 15 × 21 = 315 □″
Unit Bearing 75820 ÷ 315 = 240#/□″

Earthquake horizontal force 38750 × 0.2 = 7750#
For anchor use 4-1 1/4″ϕ bolts on fixed End
2-1 1/4″ϕ bolts on Expansion End.

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

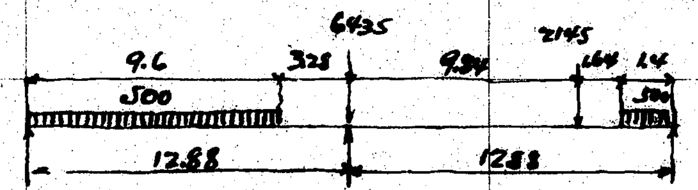
54' girder span
Cross section same as for 60' girder span
span will be divided into 4 panels @ 12'-10½" each 1'-3" at ends.

Floor slab and stringers same as for 60' girder span
2" Soliditit pavement
5¼" Reinforced concrete slab span will be 5'-0"
For stringers use 12"×5" @ 31.99# I.

Floor Beam (Intermediate) span length 15'-0" spacing 12'-10½"
Dead Load Concentration at Stringer Conn 485 × 12.88 = 6240
moment due to Concentration 6240 × 5 = 31200
max m floor beam = ⅛ × 60 × 15² = 1688
32888'#

End shear Concentration 6240
Floor Beam ½ × 60 × 15 = 450
6690#

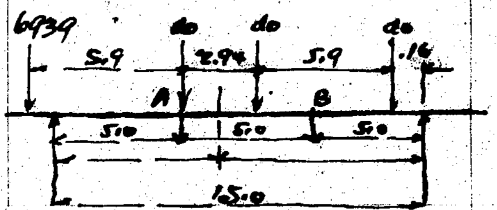
Live Load impact assumed same as for 60' span



motor truck Rear wheel 6435#
Front wheel 2145#
Uniform load 100 × 5 = 500# per lin ft.

Reaction due to unif. load 500 × 9.6 × 4.8/12.88 = 1788
500 × 1.4 × 0.7/12.88 = 380
2168#

R due to truck 2145 × 3.04/12.88 = 504
Rear wheel 6435
6939#



Concentration at A 6939 × 2.06/5.00 = 2860
6939
due to motor truck 9799#
" " unif. load 2168
11967#

Concentration at B 6939 − 2860 = 4079
6939 × .16/5.0 = 222
due to motor truck 4301
" " Unif. load 2168
6469#

moment due to live load at A.
Reaction 11967 × ⅔ = 7980
6469 × ⅓ = 2190
10170#

moment = 10170 × 5 = 50850'#

Summary for moments and shears

	moment	shear
Dead Load	32888	6690
Live Load	50850	10170
	83738'#	16860#

web assumed 18 × 5/16 = 5.62□" ⅛ web = 0.70□"
Effective depth 1.38'
flange stress = 83738 ÷ 1.38 = 60500#
section req'd = 60500 ÷ 17000 = 3.57 − 0.70 = 2.87□" net
use 2∟s 3×3×5/16 = 3.56 − 0.54 = 3.02□" net

Approximate weight of Intermediate Floor beam
4∟s 3×3×5/16 @ 6.1 × 15.0 = 366
1Pl. 18×5/16 @ 19.13 × 15.0 = 287
653
Details say 217
870#

870 ÷ 15.0 = 58# per lin ft.

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

End floor beam same as for intermediate floor beam

Lateral Bracing same as for 60' span use 2L 4.3.5/16 riveted back to back.

2L 4.3.5/16	@ 7.2 . 18.3	=	264
4L 4.3.5/16	@ 7.2 . 8.7	=	251
1PL 6.½	@ 10.2 . 1.83	=	19
Rivet heads and variation			17.
			551#

4 @ 551 = 2204#

551 ÷ 12.88 = 43# per lin ft of main girder.

Main girder.

Dead Load

Floor slab and pavement	90 . 18	=	1620
Coping			226
Handrails.	2 @ 60	=	120
			1966. . 12.

Intermediate Panel

Stringers	2 @ 35# . 12.88	=	900
Floor Beam			870
Lateral Bracing			550 / 275
			2045 ÷ 2 = ~~1022~~
			275
			2320 1160.

End panel

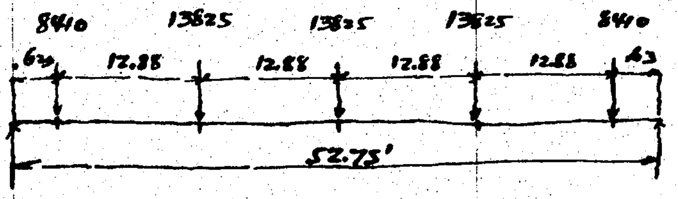
Stringers	2 @ 35 . 7.69	=	538
Floor Beam			870
Lateral Bracing			275
			1683 ÷ 2 = 842# say 840

Floor slab &c intermediate 1966 . 12.88 = 25330 ÷ 2 = 12665#
End 1966 . 7.69 = 15140 ÷ 2 = 7570#

Summary for panel concentration

	Int. Panel Concentration	End Panel Concentration
Dead Load Floor	12665	7570
Dead Load metal	1160	840
	13825#	8410#

Dead Load moment due to panel concentration.



End Reaction = 13825 . 1.5 = 20737
8410
29147

moment at A 29147 . 0.63 = 18350"#

moment at B. 29147 . 13.51 = 394.000
8410 . 12.88 = −108.000
286,000"#

moment at C 29147 . 26.39 = 769.000
8410 . 25.76 = 217.000
13825 . 12.88 = 178.000
395.000
374,000"#

Weight of main girder assumed 200# per lin ft.

moment at A ½ . 200 . 0.63 . 52.15 = 3280"#
" " B ½ . 200 . 13.51 . 39.27 = 53000"
" " C ⅛ . 200 . 52.75² = 69500"

Summary for Dead Load moment

	A.	B	C	Shear
Due to Concentration	18350	286.000	374000	29147
" " wt of girder	3280	53.000	69500	5275
	21630	339000	443500	34422

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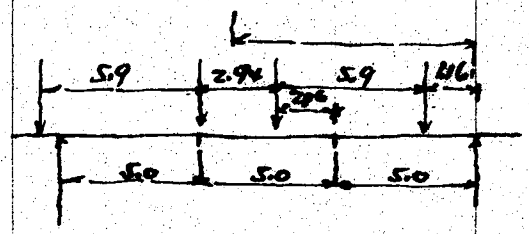
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Live Load motor truck loading

impact $\frac{20}{60+l}$ = 26.2 %



Rear wheels 2 @ 4950 = 9900
26.2 % impact = 2593
12493#

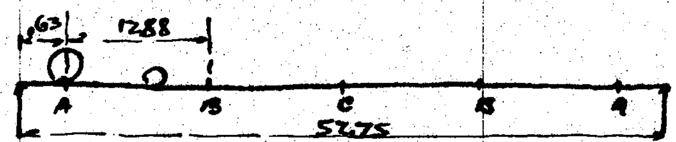
Front wheels ⅓ · 12493 = 4164#

Reaction on girder 12493 · $\frac{17.06}{15.00}$ = 14200# for rear wheel

4164 · $\frac{17.06}{15.00}$ = 4735 for front wheel

Max load on girder due to uniform load 903# per lin ft.
Live Load moment due to motor truck loading,

moment at A.



R = 14200 · 52.15 = 740.000
4735 · 42.28 = 200.000
940.000 ÷ 52.75 = 17.830#

m = 17830 · 0.63 = 11240'#

moment at B. R = 14200 · 39.29 = 557.500
4735 · 29.40 = 139.200
696700 ÷ 52.75 = 13200

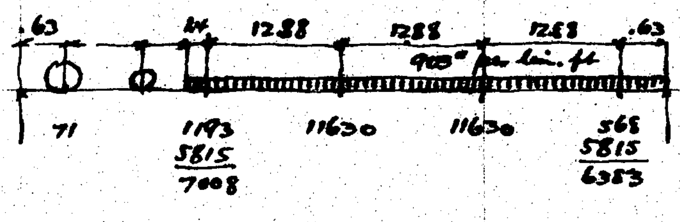
m = 13200 · 13.51 = 178300'#

Moment at C R = 14200 · 26.39 = 374.500
4735 · 16.55 = 78300
452800 ÷ 52.75 = 8580

m = 8580 · 26.39 = 226.500'#

Uniform live load moments

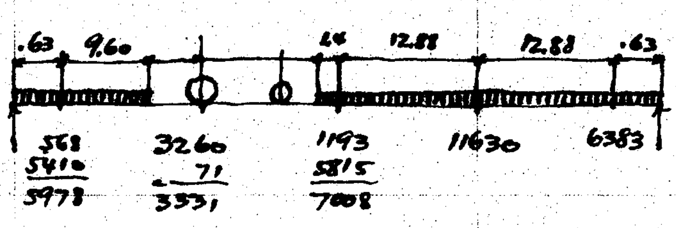
moment at A



R 71 · 52.15 = 3.700
7008 · 39.27 = 275300
11630 · 26.39 = 307.000
11630 · 13.51 = 157.100
6383 · 0.63 = 4020
747120 ÷ 52.75 = 14160

m = 14160 · 0.63 = 8920'#

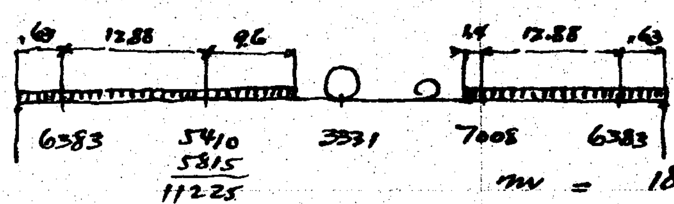
Moment at B



R = 5978 · 52.15 = 311.800
3331 · 39.27 = 130.800
7008 · 26.39 = 185.000
11630 · 13.51 = 157.100
6383 · 0.63 = 4020
788720 ÷ 52.75 = 14960

m = 14960 · 13.51 = 202.000
5978 · 12.88 = -77.000
125.000'#

Moment at C



R = 11225 · 39.27 = 440800
3331 · 26.39 = 87800
7008 · 13.51 = 94600
623000 ÷ 52.75 = 11800
6383
18183

m = 18183 · 26.39 = 480.000
11225 · 12.88 = 144700
6383 · 25.76 = 164500
-309200
170.800'#

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CALCULATIONS FOR

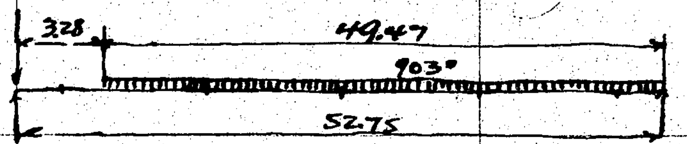
Design of Anabuki-Bashi for Tokushima-ken.

Summary for Live Load moments.

	A	B	C
motor truck loading	11240	178300	226500
Uniform live load.	8920	125000	170800
	20160	303300	397300 ″#

Max Live Load shear

Uniform load 903 · 49.47 = 44700#
R = 44700 · 24.73/52.75 = 21000
14200
35200#



Summary for moments and shears

	A	B	C	Shear
Dead Load	21630	339000	443500	34400
Live Load	20160	303300	397300	35200
	41790 ″#	642300 ″#	840800 ″#	69600#

web assumed 42 · 3/8 = 15.75 □″ 1/8 web = 1.97 Effective depth say 33.8′

flange stress = 840800 ÷ 33.8 = 24900# SR = 24900 ÷ 17000 = 14.70 - 1.97 = 12.73 □″ net.

2Ls 6·6 · 3/8 = 8.72 - 7.96 □″

1 Cov. Pl 13 · 1/2 = 6.50 5.50

15.22 13.46 □″ net

approximate weight of 54′ main girder.

web.	1Pl. 42 · 3/8	@ 53.55	· 54.0	=	2890
flange	4Ls 6·6 · 3/8	@ 14.9	· 54.0	=	3220
	2 Pls. 13 · 1/2	@ 22.10	· 34.42	=	1520
	Stiffeners and fills. say				1000
	flange and web splices say				700
	misc details				100
	Rivet heads and variations				500
					9930

9930 ÷ 54.0 = 184# per lin. ft.

Summary for weight of metal.

Stringers	2 @ 35# · 54	=	3780
Floor beams	5 @ 870	=	4350
Lateral Bracings.			2200
main girders	2 @ 9930	=	19860
base plates and anchor bolts say			600

30790 ÷ 2240 = 13.75 tons.

Max load on bearing. 69600# Bearing area = 15 · 21 = 315 □″

Unit bearing on masonry 69600 ÷ 315 = 221#/□″ ok

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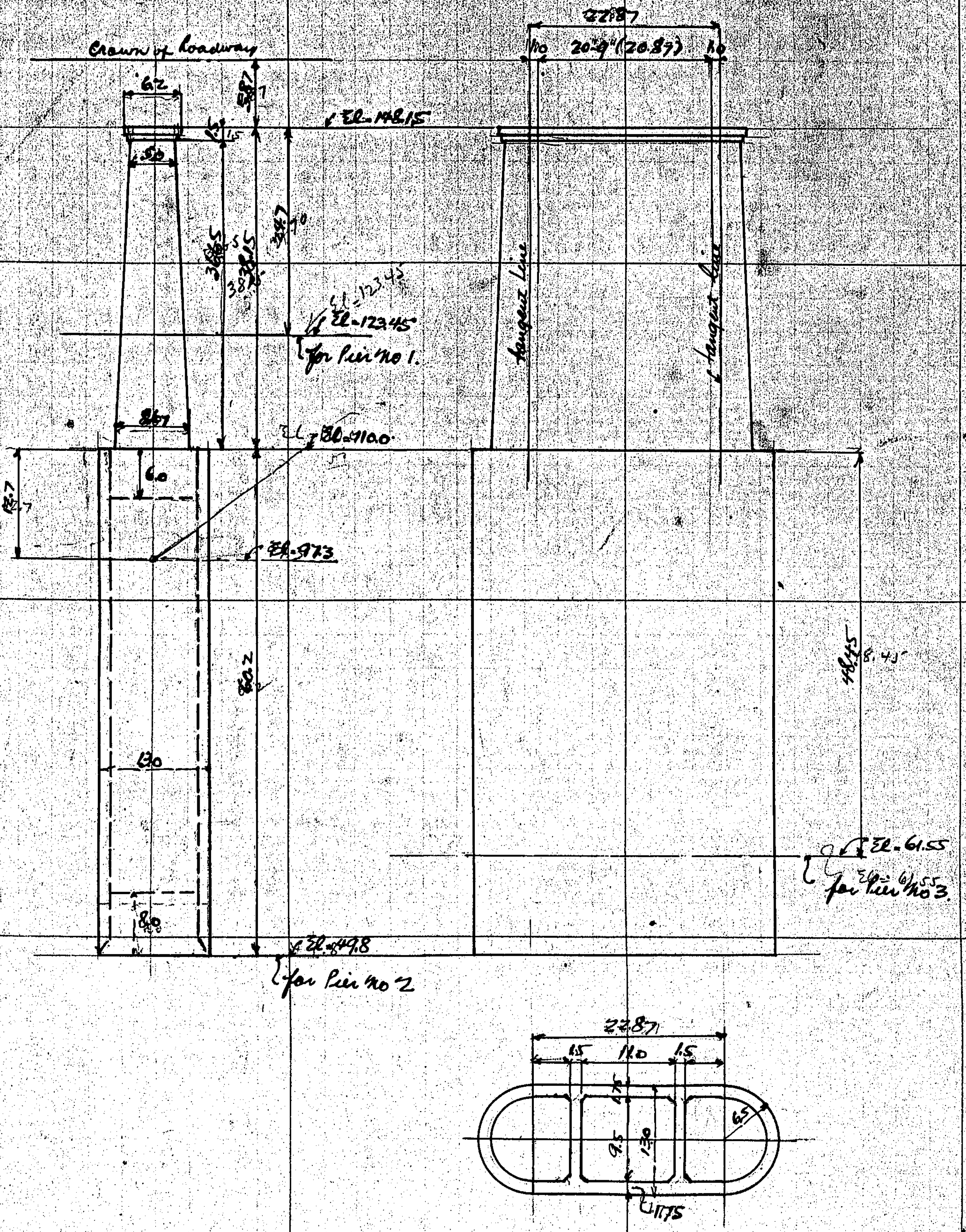
CALCULATIONS FOR

Design of Anabuki-Bridge for Tokushima-ken

Piers No 1, 2 and 3



Pier No 2.
volume of Concrete

Coping	$6.2^{2}\frac{\pi}{4}$	30.2		
	6.2 × 22.87 =	141.8		
		172.0 × 1.0 =	172.0	
	$5.6^{2}\frac{\pi}{4}$	24.6		wt of Coping 1.15 @ 30200 = 34700#
	5.6 × 22.87 =	128.0		
		152.6 × 0.5 =	76.2	
			248.2 ÷ 216 = 1.15 立坪	
Shaft	$5.0^{2}\frac{\pi}{4}$	19.6		
	5.0 × 22.87 =	114.3		
		133.9		
	$8.67^{2}\frac{\pi}{4}$	59.2		wt of Shaft 33.2 @ 30200 = 1002000#
	8.67 × 22.87 =	198.0		
		257.2		
		391.1 ÷ 2 = 195.5		

volume = 195.5 × 36.65 = 7160 or 33.2 立坪

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

well:-

shell	13.$^{\circ}$	132.7	
	9.5°	70.9	
			61.8
	2·1.75·22.87 =		80.0
webs	2-1.5·9.5 =		28.5
fillet			4.0
			174.3

volume = 174.3 · 60.2 = 10500 cu ft or 48.6 cu yd

Top and bottom fillings inside of well shell

9.5°	=	70.9
9.5·22.87	=	217.0
		287.9
Web and fillet		32.5
		255.4

bottom filling 255.4 · 8 = 2040 or 9.45 cu yd
Top filling 255.4 · 6 = 1530 or 7.08 cu yd

Sand filling 255.4 · 46.2 = 11800 or 54.6 cu yd

Weight of well -

Shell	48.6	@ 30200	=	1.470.000
bott. fill	9.45	@ "	=	285.000
Top fill	7.08	@ "	=	215.000
Int. fill	54.60	@ 21600	=	1180.000
				3150.000#

Total weight of Pier

coping	34700#
shaft	1002000
well	3150.000
	4186700#
Superimposed dead and Live Loads	1121500
	5308200#

bottom area 13.5° = 143.1
13.5·22.87 = 308.5
451.6 □'

not counting friction of well
bearing pressure = 5308200 ÷ 451.6 = 11.750 #/□' or 5.25 tons/□'

Friction of well Circumference of well - 13.0 40.8
2·22.87 = 45.74
86.54

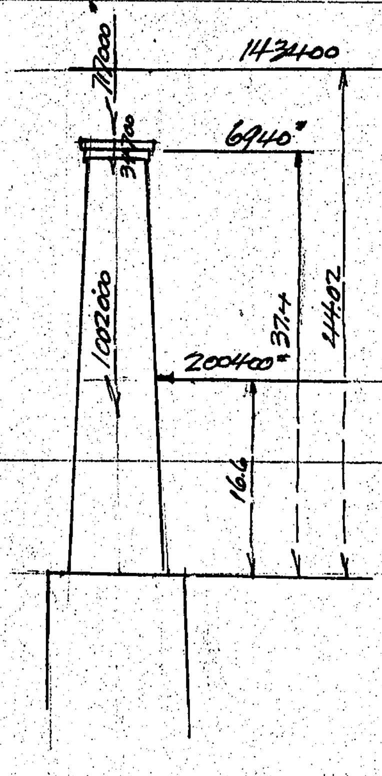
Frictional area assumed 86.54 · 45.0 = 3900 □'
Friction assumed 200#/□ or 200·3900 = 780.000# which is 50% of wt of shell

Load on bottom area 5308200
780000
4528200# ÷ 451.6□' = say 10.000#/□' or 4.46 tons/□'

The bottom of well rest on solid rock will carry any load which may encounter

Reinforcement in the shaft due to Earthquake

Earthquake force assumed k = 0.2



Superimposed Load	717000	· 0.2	=	143400#
Coping	34700	· 0.2	=	6940#
Shaft	1002000	· 0.2	=	200400#
	1753700#			

Moment about bottom of shaft

143400	· 44.02	=	6310.000
6940	· 37.40	=	260.000
200400	· 16.60	=	3330.000
			9900.000 1#

Moment of inertia of bottom section of shaft.

Intermediate Portion $\frac{22.87 \cdot 8.67^3}{12}$ = 1242
Circular ends $0.049 \cdot 8.67^4$ = 277
1519 ft^4

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CALCULATIONS FOR

Design of Anabuki Bashi for Tokushima-Ken

Fibre stress = 9.900.000 × 4.33 / 1519 = 28300 #/□' or 197 #/□" — 244 #/□" Compression or 150 #/□" tension without reinforcement

Direct Pressure = 1753700# ÷ 257.2□' = 6820 #/□' or 47 #/□"

Neglecting tension in Concrete

moment per ft strip say 9.900.000 ÷ 23 = 430.000 1# — Ecc = 430000 / 76000 = 5.66'

Direct load per ft strip " 1753700 ÷ 23 = 76.000 #

Ratio to depth = 5.66 / 8.67 = 0.653

Using 7/8"φ bars 9" centers = 0.920□" — % of Steel = 1.84 / 12 × 104" = 0.148 %

Depth of neutral axis k = 0.27 — Coefficient = 0.0766

Stress in Concrete = 430.000 / 0.0766 × 8.67² = 74800 #/□' or 520 #/□"

Stress in Steel = 15 × 520 (102/27.8 − 1) = 21000 #/□"

Try 3/4"φ bars 9" centers 0.59□" per ft

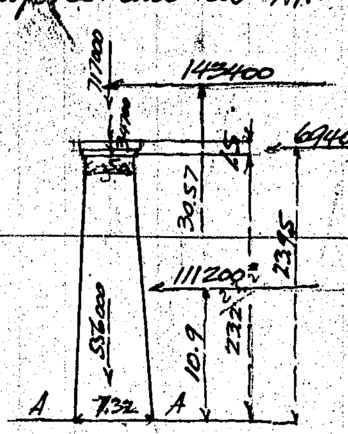
Steel % = 1.18 / 12 × 104 = 0.0945 %

k = .23 C = 0.608

fc = 430.000 / 0.0608 × 8.67² = 94000 #/□' or 652 #/□"

fs = 15 × 652 (102/23.4 − 1) = 33000 #/□"

Reinforcement at AA.



Volume of shaft

top area	5.0		19.6
	5.0 × 22.87	=	114.3
			133.9
Bott. area	7.32		42.1
	7.32 × 22.87	=	167.0
			209.1
			343.0 ÷ 2 = 171.50

volume = 171.5 × 23.20 = 3980 □³ = 18.4 ±

weight = 18.4 @ 30200 = 556 000 #

Seismic force = 556000 × 0.2 = 111200 #

Center of gravity of shaft.

5.0 × 23.2	=	116.0	×	11.6	=	1345.0
2.32/2 × 23.2	=	27.0	×	7.73	=	209.0
		143.0	×	10.90	=	1554.0

				Seismic force		Arm		
Dead Load	717000 × 0.2	=		143400	×	30.57	=	4380.000
Coping	34700 × 0.2	=		6940	×	23.95	=	166.000
Shaft	556000 × 0.2	=		111200	×	10.90	=	1211.000
	1307700							5.757.000 1#

Moment of inertia of section AA.

Intermediate section 22.87 × 7.32³ / 12 = 748.0

Circular Ends 0.049 × 7.32⁴ = 140.0

888.0

Fibre stress = 5.757.000 × 3.66 / 888 = 23700 #/□' or 165 #/□" — 208 #/□" compression or 122 #/□" Tension without reinforcement.

Direct Load 1.307.700 ÷ 209.5 = 6240 #/□' or 43 #/□"

Reinforcement required for the section neglecting tension in concrete

moment per ft strip say 5.757.000 ÷ 23 = 250.000 1# — Ecc = 250.000 / 56700 = 4.41'

Direct load per ft strip " 1307700 ÷ 23 = 56700 #

Ratio to depth = 4.41 / 7.32 = 0.602

Using 3/4"φ bars 9" centers = 0.59□" per ft — % of Steel Ratio = 1.18 / 12 × 88 = 0.112 %

Depth of neutral axis k = 0.27 Coefficient = 0.0766 about

Stress in concrete = 250.000 / 0.0766 × 7.32² = 61900 #/□' or 424 #/□"

Stress in Steel = 15 × 424 (86/23.2 − 1) = 17200 #/□"

Try 5/8"φ bars 9" centers = 0.40 — % Ratio = 0.80 / 12 × 88 = 0.076 % — k = .23 — C = 0.608

Stress in Concrete = 250.000 / 0.608 × 7.32² = 76900 #/□' or 533 #/□"

Stress in Steel = 15 × 533 × (86/19.8 − 1) = 26800 #/□"

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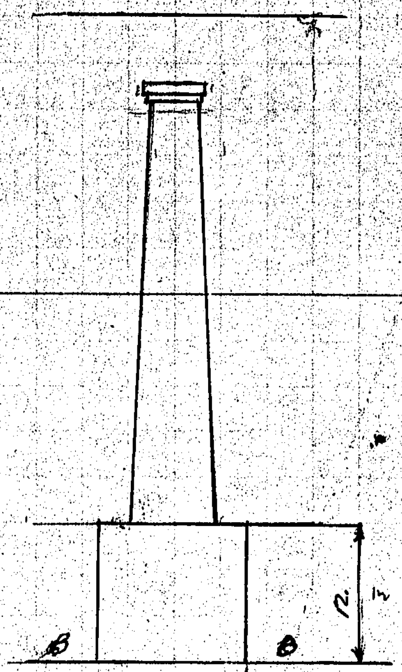
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Reinforcement in the well due to Earthquake
12' below top of well.



Approximate weight of Concrete in well above line B-B.
As solid well 13.0^2 132.7
13.0 × 22.87 = 297.0
429.7 □'

volume = 429.7 × 12 = 5160 cubic or 239 立坪
weight = 239 @ 30200# = 720.000#
Seismic force = 720.000 × 0.2 = 144.000#
Figures above top of well see page 7

		Seismic force	arm		moment
Dead Load	717000	143400 ×	56.02	=	8030.000
Coping	34700	6940 ×	49.40	=	343.000
Shaft	1002000	200400 ×	28.60	=	5730.000
well 12'	720.000	144000 ×	6.00	=	864.000
	2473700#				14967.000 1#

moment of inertia of well section as solid.

Intermediate Portion $\frac{22.87 \times 13^3}{12}$ = 4180
Circular Ends 0.049 × 13^4 = 1400
5580 (ft)^4

Fibre stress = $\frac{14.967.000 \times 6.5}{5580}$ = 17400#/□' or 121#/□" 161#/□" Compression
or 81#/□" tension
Direct load = 2473700 ÷ 429.7 = 5750#/□' or 40#/□" which may require some reinforcement

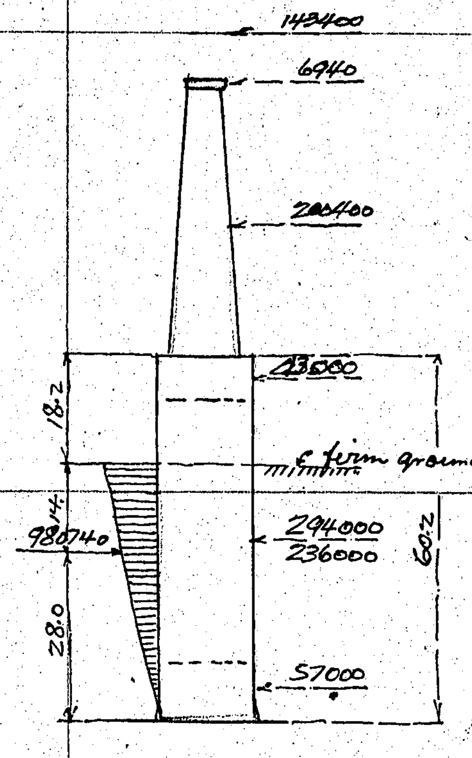
Try 5/8"ϕ bars 1.0' centers = 0.30□" For both sides 0.60□"
Steel % = $\frac{0.60}{12 \times 156}$ = 0.032%. This % of steel is too small to figure.
14967000 ÷ 23 = 650.000 1# per ft
Let us try 3/4"ϕ bars 1.0 centers 0.44□" For both sides 0.88□"
Steel Ratio in percentage = $\frac{0.88}{12 \times 156}$ = 0.047% Ecc = $\frac{14967.000}{2473700}$ = 6.05'

Ecc/to depth = $\frac{6.05}{13.0}$ = 0.465 Depth of neutral axis k = 0.30 Coefficient = 0.070
Stress in concrete = $\frac{650.000}{0.070 \times 13^2}$ = 54800#/□' or 381#/□"

Stress in steel = 15 × 381 × ($\frac{156}{156 \times .3}$ − 1) = 13350#/□"

Use proper amount of reinforcing bars in vertical direction in the course of detailing well.

Stability of Pier due to Earthquake. (case I)



Superimposed load	Load			force	arm		moment
Coping	717000	× 0.2	=	143400 ×	104.22	=	14.950.000
Shaft	34700	× 0.2	=	6940 ×	97.60	=	680.000
	1002000	"	=	200400 ×	76.80	=	15400.000
well shell	1470000	"	=	294000 ×	30.10	=	8850.000
" bott. filling	285000	"	=	57000 ×	4.00	=	228.000
" Top filling	215000	"	=	43000 ×	57.20	=	2460.000
" Int. filling	1180000	"	=	236000 ×	36.10	=	7110.000
	4903700#			980740#			49.678.000
Less moment			=	980740 ×	28	=	27.500.000
							22.178.000 1#

Moment of inertia of bottom section
Intermediate portion $\frac{22.87 \times 13.5^3}{12}$ = 4680
Circular Ends 0.049 × 13.5^4 = 1630
6310 (')^4

Fibre stress = $\frac{22.178.000 \times 6.75}{6310}$ = 23700#/□' or ± 10.6 tons

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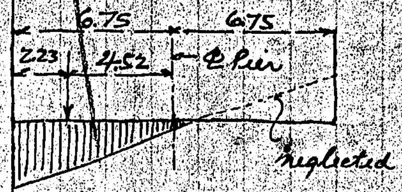
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Eccentricity = 22178.000 ÷ 4903700 = 4.52'



neglecting tension max toe pressure will be as follow.
Pressure area = 23.0 about × 2.23 × 3 = 154.0 □'
max toe P = $\frac{2 \times 4903700}{1540}$ = 63700# or 28.4 tons/□' on solid rock
not counting friction of well.
If count the friction on well. see page 7
Total friction for 200#/□' 780.000#
frictional couple 390.000 × 13.0 = 5070.000'#

Summary direct load 4903700 Summary moment = 22178.000
− 780000 − 5070.000
4123700 17108.000'#

Eccentricity = $\frac{17108.000}{4123700}$ = 4.15

Pressure area = 23.0 abt × (6.75 − 4.15) × 3 = 179.0 □'
max toe Pressure = $\frac{2 \times 4123700}{179}$ = 46000#/□' or 20.5 tons/□'
on solid rock.

As Case II assume fixed point of well at 30' in the ground, that is, 40' below top of well,
Stability of Pier no 2

					Arm		
Superimposed load	717000	× 0.2	=	143400	× 84.02	=	12050.000
coping	34700	"	=	6940	× 77.40	=	537.000
Shaft	1002000	"	=	200400	× 56.60	=	11220.000
well shell	978000	"	=	195600	× 20.00	=	3920.000
Top filling	215000	"	=	43000	× 37.00	=	1590.000
Int. filling	870000	"	=	174000	× 17.00	=	2960.000
							32277.000'#

Case III assume fixed point of well at 20' in the ground or 30' below top of well. or moment at ½ depth of well.

Superimposed Load	717000	× 0.2	=	143400	× 74.02	=	10600.000
coping	34700		=	6940	× 67.40	=	468.000
Shaft	1002000		=	200400	× 46.60	=	9330.000
wellshell	735000		=	147000	× 15.00	=	2200.000
Top filling	215000		=	43000	× 27.00	=	1160.000
Int. filling	614000		=	122800	× 12.00	=	1470.000
							25228.000'#

Use assumption Case I to figure the bottom pressure of well.
Design of well shell. Depth of well 60.0'
Earth Pressure assumed 60 × ⅓ × 100# = 2000#/□' During well sinking, which is temporary let us assume the earth pressure 60% of above or 1200# per sq ft. The equivalent water depth is 1200 ÷ 62.5 = 19.2' That will be all right for this case.
Thickness of well 1.75'
Center portion span length 12.5'. On account of continuity of beam the moment assumed as $\frac{1}{12}wl^2$ for negative and positive Then $m = \frac{1}{12} \times 1200 \times 12.5^2 = 15600$ '#
Depth required for 17000# steel stress and 640#/□" concrete stress

$$d = \sqrt{\frac{15600}{102}} = 12.4''$$

$$\text{Reinf} = \frac{15600 \times 12}{\frac{7}{8} \times 16'' \times 17000} = 0.780'' \text{ per ft.}$$
(19) (0.66)

Circular Ends as ring of 11.25 dia = $\frac{1}{12}wl^2$ approx.

$$m = \frac{1}{12} \times 1200 \times 11.25^2 = 12700 \text{'\#}$$

$$\text{Reinf} = \frac{12700 \times 12}{\frac{7}{8} \times 16 \times 17000} = 0.640'' \text{ per ft}$$
(19) (0.540)

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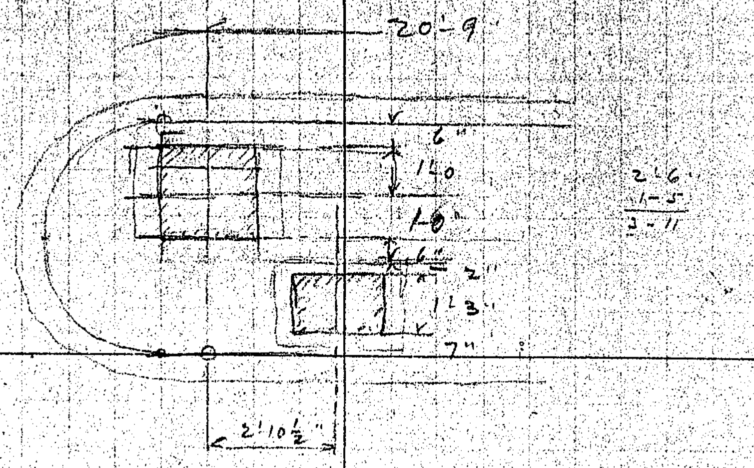
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Design of Pier no 3. to carry truss and girder



Truss span

Dead Load Downward	48500 #	
Live Load "	108.000	
		156500 # on pier
Max upward reaction		48600 # " "

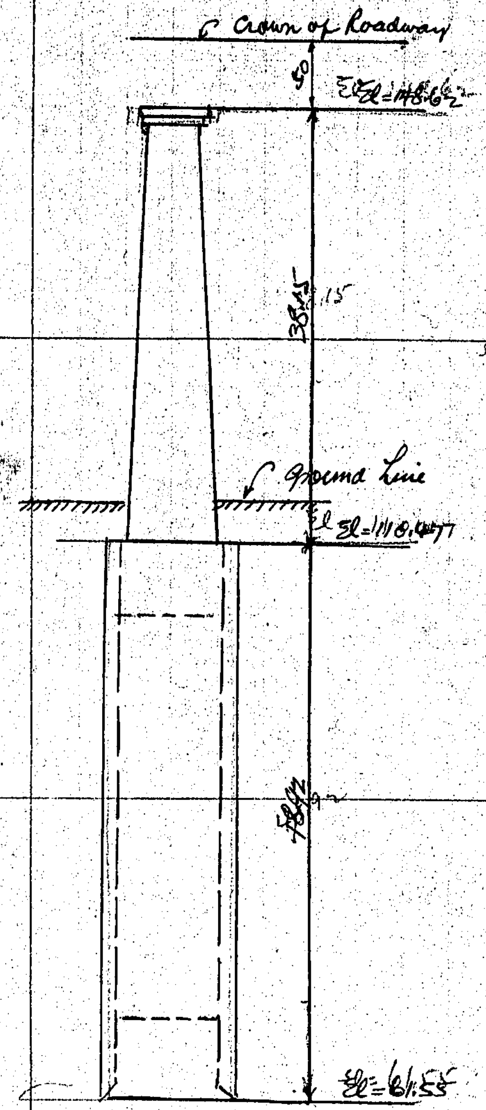
Girder span

Dead Load Downward	157700 ÷ 2 = 78850 #
Live Load "	108000 ÷ 2 = 54000 #
	265700 ÷ 2 = 132850 #

For max Dead Load - 78850 #
Live Load say 74800 #
153650 # on pier.

Total dead Load on pier
From truss 48500 #
" girder 78850
127350 #

Total Live Load say 1800 # × 90 = 162000 #
289350 # say 290.000 #



Coping and shaft same as for Pier no 2.
well. Shell :- cross section 174.3 □' see page 7
volume = 174.3 × 48.92 = 8530 or 39.5 立坪

Bottom filling 255.4 × 8 = 2040 or 9.45 立坪
Top filling 255.4 × 6 = 1530 or 7.08 立坪

Sand filling 255.4 × 34.92 = 8900 or 41.20 立坪

Weight of well				
Shell	39.5	@ 30200	=	1192.000
bott. filling	9.45	"	=	285.000
Top filling	7.08	"	=	215.000
Int. fill	41.20	@ 21600	=	890.000
				2582.000 #

Total weight of Pier

Coping	34700
Shaft	1002000
Well	2582000
	3618700
Superimposed Dead + Live Loads	290.000
	3908.700 #

The bottom area same as for Pier no 2 451.6 □' not counting friction of well

The bearing Pressure = $\frac{3908.700}{451.6}$ = 8660 #/□' or 3.87 tons/□'

Friction of well circumference of well 86.54 lin ft. Frictional area assumed 86.54 × 40 = 3460 □'
Friction assumed 200 × 3460 = 692.000 #

Load on bottom area = 3908.700
692.000
3216,700 # ÷ 451.6 = 7110 #/□' or 3.18 tons/□'

Reinforcement in the shaft due to Earthquake Earthquake force assumed k = 0.2
Diminsions of shaft same as for Pier no 2
Superimposed load say 128.000 # instead of 717000 # in Pier no 2. (referred to page no 7).

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CALCULATIONS FOR:

Design of Anabuki-Bashi for Tokushima-ken

	Load		Seismic force	arm		moment about bottom of shaft
Superimposed load	128000	× 0.2 =	25600	× 43.15	=	1,105,000
coping	34700	" =	6940	× 37.40	=	260,000
shaft	1002000	=	200400	× 16.60	=	3,330,000
	1164700					4,695,000 #

Moment of inertia of bottom section of shaft = 1519 ′⁴ see page 7.

Fibre stress = $\frac{4695.000 \times 4.33}{1519}$ = 13400 #/□′ or 93 #/□″ 124 #/□″ compression

Direct load = 1164700 ÷ 257.2 = 4520 #/□′ or 31 #/□″ or 62 #/□″ tension without reinforcement

Reinforcement in shaft neglecting tension in concrete.

Eccentricity = 4695.000 ÷ 1164700 = 4.04′ $e/h = \frac{4.04}{8.67} = 0.466$

moment per ft strip say 4695000 ÷ 23 = 204000 #

Try 3/4″⌀ bars 9″ centers 0.59 □″ per ft. Steel % = $\frac{1.18}{12 \times 104}$ = 0.0945 % k = 0.35

Coefficent = 0.0765

$fc = \frac{204000}{0.0765 \times 8.67^2}$ = 35500 #/□′ or 246 #/□″

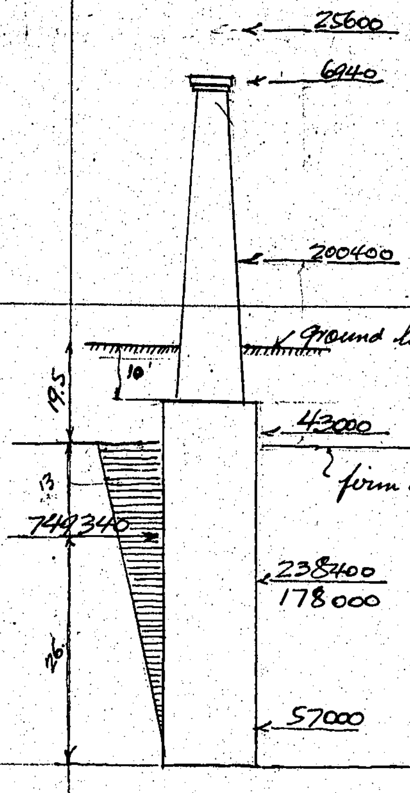
$fs = 15 \times 246 \left(\frac{1}{0.35} - 1\right)$ = 6850 #/□″

Try 5/8″⌀ bars 9″ centers = 0.400 □″ % of steel ratio = $\frac{0.80}{12 \times 104}$ = 0.064 %. k = 0.31 C = 0.0687

$fc = \frac{204000}{0.0687 \times 8.67^2}$ = 39500 #/□′ or 274 #/□″

$fs = 15 \times 274 \left(\frac{1}{.31} - 1\right)$ = 9100 #/□″

Stability of Pier due to Earthquake



Superimposed load	128000	× 0.2 =	25600	× 92.07	=	2,355,000
coping	34700	=	6940	× 86.32	=	600,000
shaft	1002000	=	200400	× 65.52	=	13,100,000
well shell	1192000	=	238400	× 24.46	=	5830,000
bott. filling	285000	=	57000	× 4.00	=	228,000
Top filling	215000	=	43000	× 45.92	=	1975,000
Int. filling	890000	=	178000	× 25.46	=	4,530,000
	3746700		749340			28,618,000 #
		Less moment =	749340 × 26.0 =			19,500,000
						9,118,000

Moment of inertia of bottom section

Intermediate section $\frac{22.87 \times 13.5^3}{12}$ = 4680

Circular Ends. 0.049×13.5^4 = 1630

6310 (′)⁴

Fibre stress = $\frac{9118.000 \times 6.75}{6310}$ = 9750 #/□′ or ± 4.35 tons/□′

If count the friction on well 200 #/□′ Total friction = 692.000 #

Direct load		moment
3746700		9,118,000
− 692,000	346000 × 13 =	4500,000
3,054700 #		4,618,000

Eccentricity = $\frac{4618.000}{3054700}$ = 1.51

bottom area = 451.6

Toe Pressure = $\frac{3054700}{451.6} \times \left(1 \pm \frac{6 \times 1.51}{13.5}\right)$ = 11300 #/□′ or 5.02 tons/□′ ok

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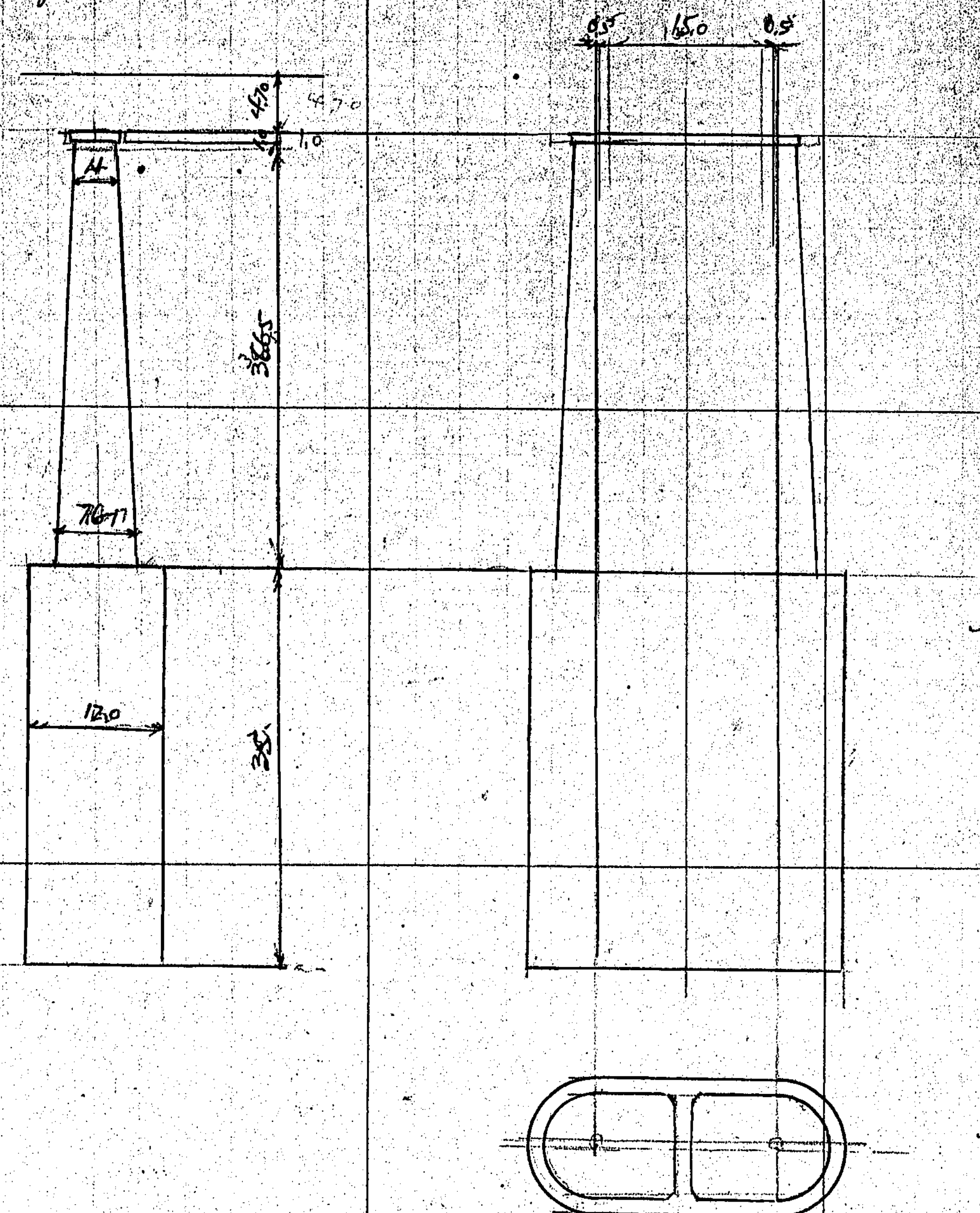
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Design of Piers 4, 5 and 6.



Coping 5.0ᶲ 19.6
5.0 × 16.0 = 80.0
99.6 · 1.0 = 99.6 .46 立方

Shaft
Top area 4.0ᶲ 12.56
4.0 × 16 = 64.00
76.56

Bot. area 7.67ᶲ 46.2
7.67 × 16 = 122.8
169.00
245.56 ÷ 2 = 122.78

vol = 122.78 · 36.65 = 4500 立尺 or 20.80 立方

well Shell
12.0ᶲ 113.1
12 × 16 = 192.0
305.1

9.0ᶲ = 63.6
9.0 × 16 = 144.0
− 207.6
97.5

Partition wall 1.5 × 9.0 13.5
filler 2.0
113.0

volume = 113.0 · 35 = 3960 18.3 立方

bottom filling 207.6 − 15.5 = 192.1
" " 192.1 · 8 = 1535 7.1 立方
Top filling " · 6 = 1150 5.33 "
Int. filling " · 21 = 4040 18.70 "

weight of Pier
coping 0.46 @ 30200 = 14000
Shaft 20.80 " 628000
642000

Shell 18.3 @ 30200 = 552000
bott fill 7.10 " = 214000
Top. 5.33 " = 161000
Int. 18.70 @ 21600 = 404000
1331000

bottom area = 12.5ᶲ = 122.7
16 × 12.5 = 200.0
322.7 □'

Superimposed Dead Load 2 @ 79000 = 158000
Live Load 108000
266000 #

Soil Bearing. Superimposed Load 266.000
Shaft and coping 642.000
well 1331.000
2239.000 ÷ 322.7 = 6930 #/□' or 3.1 tons/□'

Reinforcement in the shaft Earthquake force k = 0.2 arm moment
superimposed Dead Load 158000 · 0.2 = 31600 · 42.35 = 1340000
Shaft and coping 642.000 · 0.2 = 128400 · 16.9 = 2190.000
801.000 3530.000

moment of inertia of bottom section $7.67^3 \cdot \frac{16}{12}$ = 601.0
Circular Ends 0.049×7.67^4 = 169.5
770.5

Fibre Stress $\frac{3530.000 \times 3.83}{770.5}$ = 17550 #/□' or 121 #/□" 154 #/□" compression
88 #/□" tension

Direct load 801000 ÷ 169.0 = 4750 #/□' or 33 #/□" without reinforcement

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Design of Anabuki-Bashi for Tokushima-Ken

Reinforce with 7/8" bars 9" centers 0.400□" per ft % Steel = $\frac{0.8}{12 \cdot 90}$ = 0.074 %

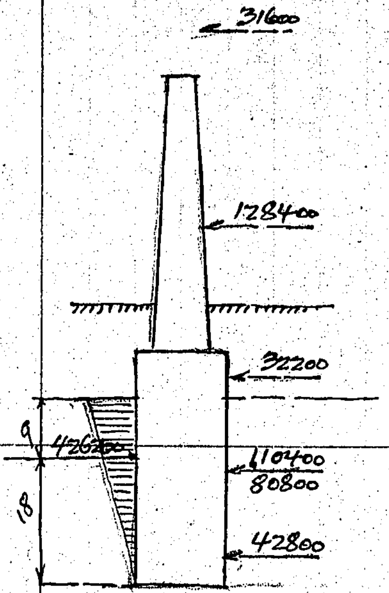
Eccentricity = $\frac{3530.000}{801.000}$ = 4.4 e/h = $\frac{4.4}{7.5}$ = 0.587 neutral axis k = 0.23

Coefficient = 0.0610 fc = $\frac{3530.000}{18.0 \text{ say} \cdot 0.0610 \cdot 7.5^2}$ = 57000 #/□' or 396 #/□"

fs = 15 · 396 ($\frac{1}{.23}$ − 1) = 19900 #/□"

Use 7/8" bars 9" centers throughout.

Stability of Pier due to Earthquake.



	force		arm		moment
158000 · 0.2 =	31600	·	77.35	=	2.440.000
642000	128400	·	51.90	=	6.660.000
552000	110400	·	17.50	=	1.930.000
214000	42800	·	4.00	=	171.000
161000	32200	·	32.00	=	1030.000
404000	80800	·	18.50	=	1495.000
2131000	426200				13.726.000
	426200	·	18	=	7660.000
					6066.000 #

Moment of inertia bottom area
Intermediate section $12.5^3 \cdot \frac{16}{12}$ = 2600
Circular Ends $0.049 \cdot 12.5^4$ = 1270
3870 (')⁴

Fibre stress = $\frac{6066.000 \cdot 6.25}{3870}$ = 9800 #/□' or ± 4.38 tons/□'

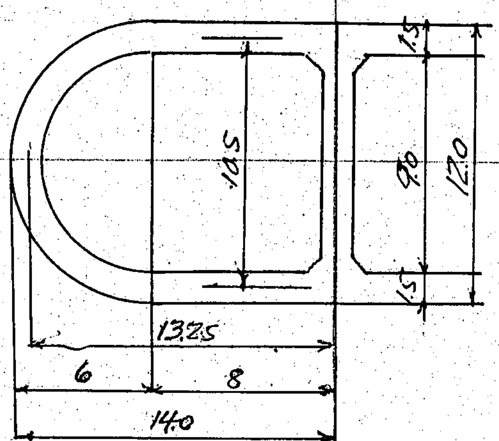
Friction 69.7 · 200 · 27 = 376000 #

Summary load on base.
2131.000
− 376.000
1755000

Summary moment
6066.000
188000 · 12 = − 2260.000
3806.000

Ecc = $\frac{3806.000}{1755000}$ = 2.17 Pressure area say (6.25 − 2.17) = 4.08
4.08 · 3 = 12.24
322.7 · $\frac{12.24}{12.50}$ = say 316.0'

Bearing Pressure = $\frac{1755000 \cdot 2}{316}$ = 11100 #/□' or 4.95 tons/□' neglecting tension in soil.



Reinforcement in shell of well
Circular ends as dia of 10.5' moment say $\frac{1}{12}wl^2$
At partition wall say span 13.25 " " $\frac{1}{12}wl^2$

Earth Pressure $\frac{1}{3} \cdot 100 \cdot 35$ = 1170 #/□'
For temporary say .60 · 1170 = 700 #/□'

moment Circular ends = $\frac{1}{12} \cdot 700 \cdot 10.5^2$ = 6430 #

At Partition wall = $\frac{1}{2} \cdot 700 \cdot 13.25^2$ = 10250 #
depth = 18"

Steel Area required Circular Ends = $\frac{6430 \cdot 12}{\frac{7}{8} \cdot 16 \cdot 17000}$ = 0.324 □" per ft

Steel Area required at Partition = $\frac{10250 \cdot 12}{\frac{7}{8} \cdot 16 \cdot 17000}$ = 0.515 (ok?) per ft

.535 ?

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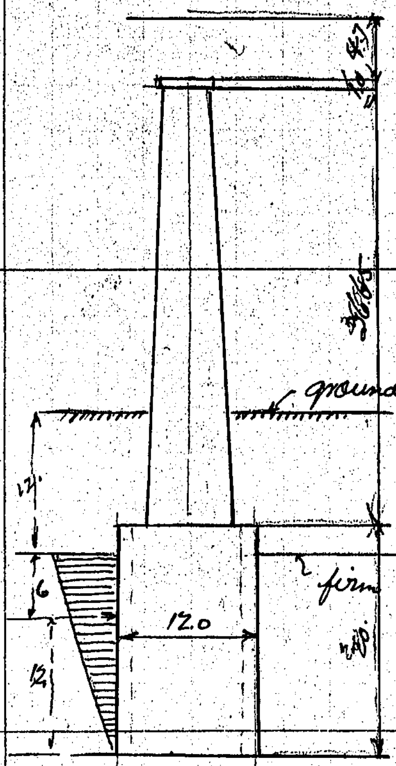
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Design of Piers 7-8-9-10-11-⑫.
Details of shaft and coping same as for Pier No 4 See page 13.
Height of well - 20.0 ft instead of 35.0

well shell.	113.0 · 20 =	2260 cu ft	or	10.46 cu yd
Top filling	192.1 · 6 =	1150 "	or	5.33 "
Bott. filling	do.	"		do "
Int filling	· 8 =	1535	or	7.10 cu yd



weight of well

shell	10.46 @ 30200	=	316000
Bottom filling	5.33	=	161000
Top "	5.33	=	161000
Int. "	7.10 @ 21600	=	153000
			791000 #

Superimposed load	266.000
shaft and coping	642.000
	791.000
	1.699.000 # ÷ 322.7 = 5260 #/□' or 2.35 tons/□'

Stability of Pier due to Earthquake.

Superimposed Dead Load	158000	· 0.2 =	31600	·	62.35	=	1970.000
Shaft and coping	642.000	=	128400	·	36.9	=	4730.000
well.	791.000	=	158200	·	10.0	=	1582.000
	1591.000		318200				8282.000 '#
			318200 · 12			= -	3820.000
							4462.000 '#

Moment of inertia of bottom area 3870 (')⁴ Fibre stress = $\frac{4462.000 \cdot 6.25}{3870}$ = ± 7200 #/□' or ± 3.22 tons/□'

Direct load 1591000 ÷ 322.7 = 4930 2.20

5.42 tons C or 1.02 tons Ten

Friction 69.7 · 200 · 18. = 251.000 #

Summary load on base Summary moment

1591000		4.462.000
251000	125500 · 12 =	1.500.000
1,340,000		2.962,000 '#

Ecc = $\frac{2962.000}{1340.000}$ = 2.21 Pressure area 6.25 - 2.21 = 4.04

4.04 · 3 = 12.12

322.7 · $\frac{12.12}{12.50}$ = 313.0 □' about

Bearing Pressure = $\frac{1340.000 \cdot 2}{313}$ = 8560 #/□' or 3.82 tons/□' neglecting tension

Reinforcement in shell
Horizontal Pressure assumed $\frac{1}{3} \cdot 100 \cdot 20$ = 667 #/□' For temporary 667 · 0.6 = 400 #/□'

moment Circular Ends. = $\frac{1}{12} \cdot 400 \cdot 10.5^2$ = 3680 '#

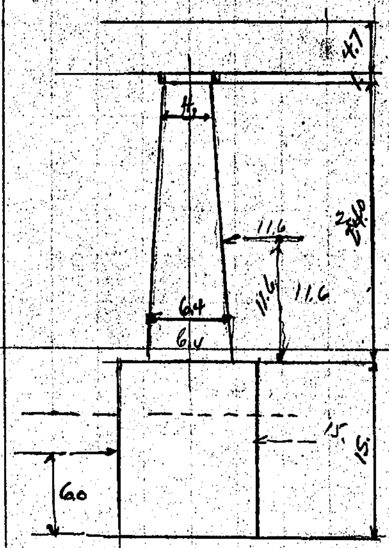
At Partition wall = $\frac{1}{12} \cdot 400 \cdot 13.25^2$ = 5850 '#

Steel Area Circular End = $\frac{3680 \cdot 12}{\frac{7}{8} \cdot 16 \cdot 17000}$ = .185 □" per ft

Steel Area Partition wall = $\frac{5850 \cdot 12}{\frac{7}{8} \cdot 16 \cdot 17000}$ = .295 □" per ft

Design of Anabuki-Bashi for Tokushima-Ken

Design of Piers 12-13-and 14.



Coping 5.0^2 = 19.6
5.0 · 16.0 = 80.0
99.6 · 1.0 = 99.6 0.46 立坪

Shaft 4.0^2 12.56
4.0 · 16.0 = 64.00
76.56
6.4^2 32.2
6.4 · 16.0 = 102.2
134.40
210.96 ÷ 2 = 105.5

volume = 105.5 · 24 = 2530 or 11.7 立坪
well shell 113.0 · 15 = 1695 or 7.85 立坪

inside filling 192.1 · 15 = 2880 or 13.3 立坪
21.15

weight of Pier. bottom area = 322.7
coping 0.46 @ 30200 = 14000 Superimposed loads
Shaft 11.70 @ " = 354000 Dead Load 158000
368000 Live Load 108000
well 21.15 @ 30200 = 638000 266000#

Bearing Pressure Superimposed loads 266000
shaft and coping 368000
well 638000
1272000 ÷ 322.7 = 3940 #/□' or 1.76 tons/□'

Reinforcement in the shaft use 7/8" bars 9" centers same as for Pier No 4.

Stability of Pier due to Earthquake.

Superimposed load	158000	· 0.2	=	31600	· 38.5	=	1217.000	
shaft and coping	368000		=	73600	· 26.6	=	1960.000	
well	638000		=	127600	· 7.5	=	956.000	
	1164000			232800			4133.000	
				232800	· 6	=	1395.000	
							2738.000	1#

Moment of inertia of bottom section = $3870^{(1)4}$

Fibre stress = $\frac{2738.000 \cdot 6.25}{3870}$ = 4420 or 1.98 tons/□'

Direct load = 1.164.000 ÷ 322.7 = 3610 or 1.61
3.59 tons comp or 0.37 tons tension.

Friction 69.7 · 200 · 9 = 125.000#

Summary load on base Summary moment
1164.000 2.738.000
125.000 62500 · 12 = 750.000
1039000 1988.000

Ecc = $\frac{1988000}{1.039000}$ = 1.915

Toe Pressure = $\frac{1039000}{322.7}\left(1+\frac{6 \cdot 1.915}{12.5}\right)$ = 6170 #/□' or 2.75 tons/□' ok

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CALCULATIONS FOR

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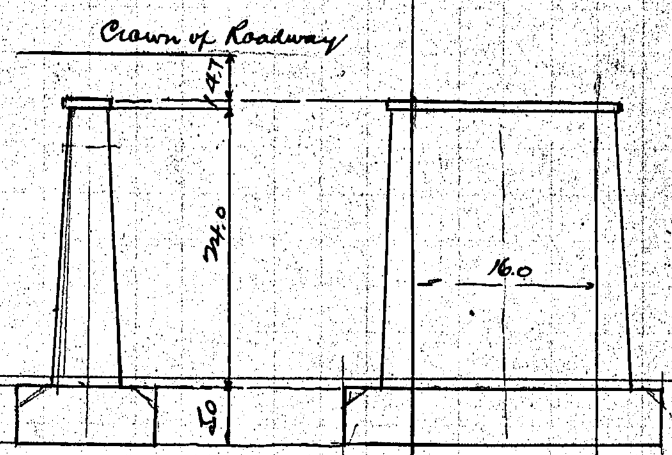
Design of Anabuki Bridge for Tokushima-ken

Design of Piers 15 and 16



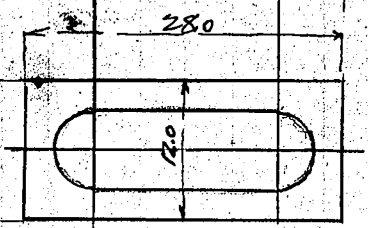
Coping 5.0² = 19.6
.50 · 16.0 = 80.0
99.6 · 1.0 = 99.6   0.46 立坪

Shaft 4.0 = 12.56
4.0 · 16.0 = 64.00
76.56

6.4 = 32.2
6.4 · 16.0 = 102.2
134.40

2109.6 ÷ 2 = 105.5

vol = 105.5 · 24 = 2530 or 11.7 立坪



Base = 12 · 28 · 5 = 1680 or 7.77 立坪

Weight of Pier
Coping 0.46 @ 30200 = 14000
Shaft 11.70 @ " = 354000
368000

Base area = 12 · 28 = 336.0

Base = 7.77 @ 30200 = 234000

Bearing Pressure   Superimposed Dead & Live Loads 266000
Shaft and Coping 368000
Base 234000
868000# ÷ 336.0 = 2580#/□' or 1.15 tons/□'

Stability of Pier due to Earthquake
Superimposed load 158000 · 0.2 = 31600 · 34.7 = 1096000
Shaft and Coping 368000 = 73600 · 16.6 = 1222000
Base 234000 = 46800 · 2.5 = 117000
760000   152000   2435000 1#

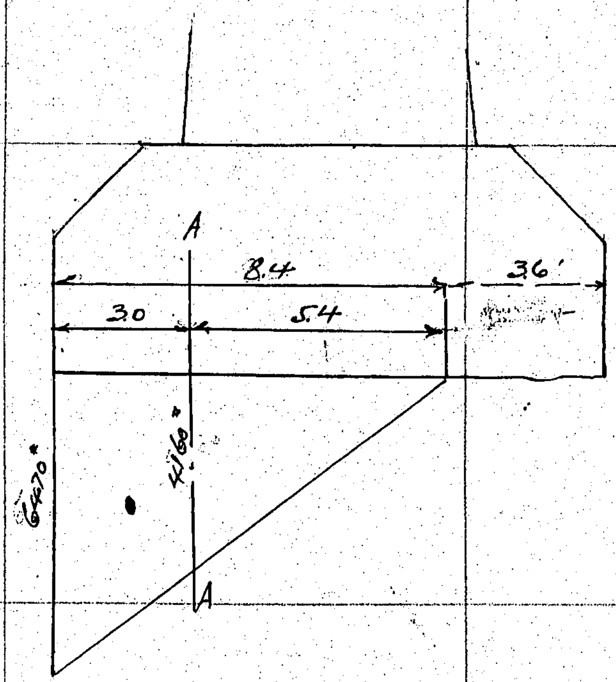
Eccentricity = 2435000 / 760000 = 3.2

Pressure area = (6.0 - 3.2) · 3 · 28 = 2350

Max Toe Pressure = 760000 × 2 / 2350 = 6470 #/□' or 2.88 tons/□'

Base. max toe Pressure 6470# due to Earthquake

Downward Pressure say 140 · 5' = 700# per ft
upward Pressure 6470 - 700 = 5770#
moment at line AA.
3460 · 3 · 1.5 = 15580
2310 · 3/2 · 2 = 6930
22510 1#



Fibre stress = 6 · 22510 · 12 / 12 · 60² = 37.6 #/□"

All right without reinforcement in the base.

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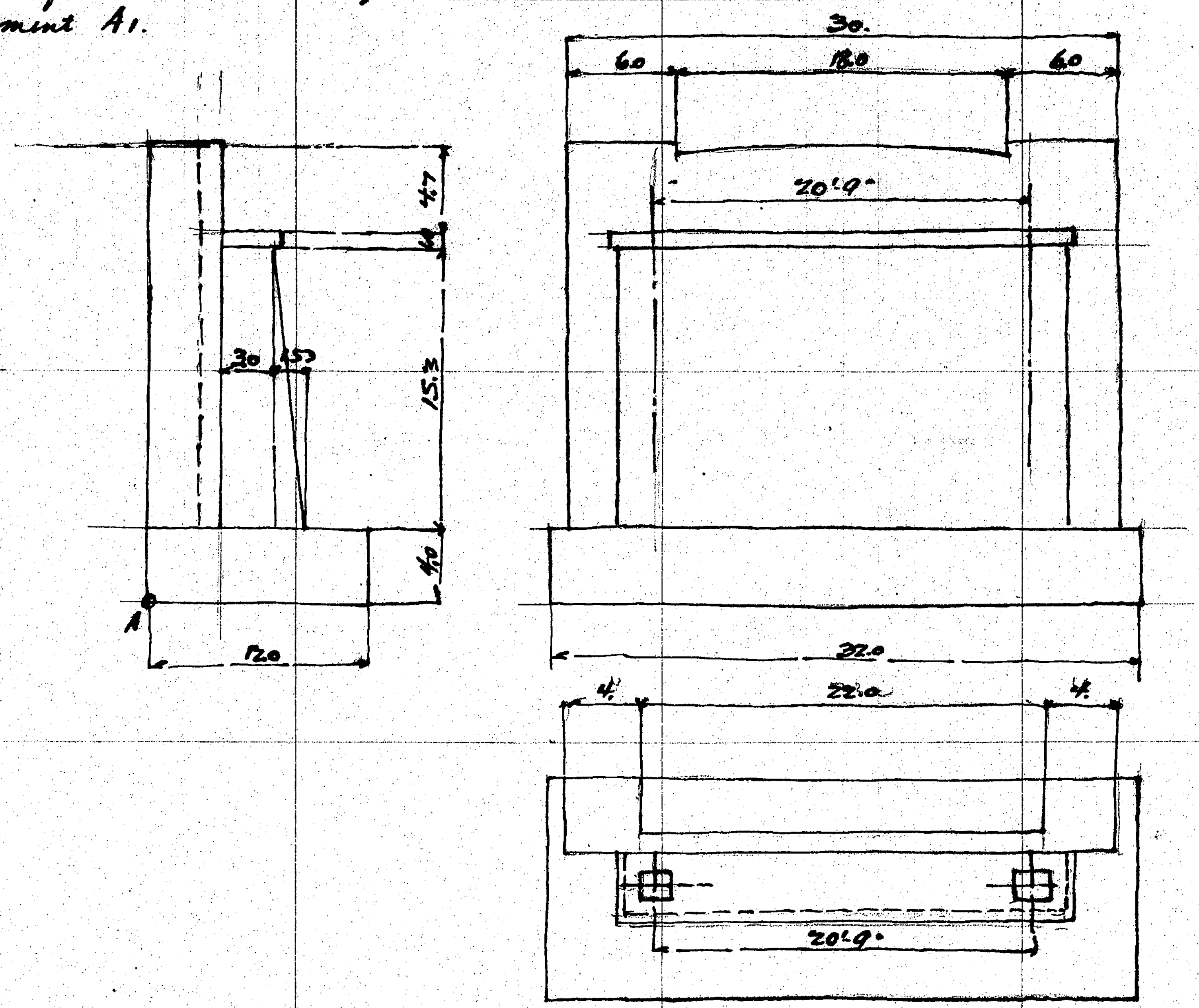
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima Ken

Abutment A1.



Volume of Concrete in abutment

Body of abutment

					立坪			
Coping	3.5 · 1.0 · 26.0	=	91.0	"	0.42	@ 30200	=	12700 #
body of abut. batter	$\frac{1.53}{2}$ · 1.53 · 25.0	=	293.0		1.35	@ "	=	40800
Rear	3.0 · 15.3 · 25.0	=	1148.0		5.31	@ "	=	160500

Front wall to the top of base

wall	22.0 · 1.0 · 21.0	=	462.0	2.14	@ "	=	64600
side wall	2 - 4.4 · 21.0	=	672.0	3.11	@ "	=	94000
volume of base	4 · 12 · 32.0	=	1535.0	7.10	@ "	=	214500

Moment about A (heel of base)

	Weight		Arm		
	12700	·	6.75	=	85600
	40800	·	8.50	=	347000
	160500	·	6.50	=	1041000
	64600	·	4.50	=	291000
	94000	·	2.00	=	188000
	372600#	·	5.25'	=	1952600'#
Base	214500	·	6.00	=	1348000
	587100#	·	5.62'	=	3300600'#

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.

Horizontal moment

12700	•	19.80	=	252.000
40800	•	9.10	=	371.000
160500	•	11.65	=	1870.000
64600	•	14.50	=	952.000
94000	•	14.50	=	1362.000
372600		12.90		4807.000
214500	•	2.0	=	429.000
587100	•	8.93		5236.000

max load on abutment assumed 156500#

Earth fill on rear 22.3 • 21. = 1385 @100# = 138500#

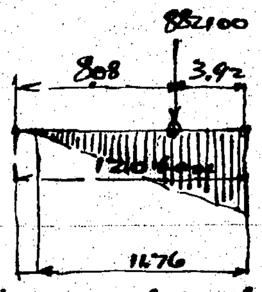
Horizontal Earth pressure $\frac{1}{3}$•100 • $\frac{h^2}{2}$ = 10.420# h = 25.0'

For 30' wide 312600#

moment = 312600 • $\frac{25}{3}$ = 2605.000 "

Moment about A (heel of base)

	load		arm		moment
Superimposed load	156500	•	6.5	=	1018.000
shaft	372600	•	5.25	=	1952600
base	214500	•	6.00	=	1348000
back filling	138500	•	1.50	=	208000
	882100				4526600
			Hor. m	=	2605000
					7131600

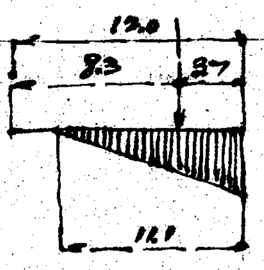


Resultant arm = 7131600 ÷ 882100 = 8.08

max toe Pressure = $\frac{882100 \cdot 2}{11.76 \cdot 32}$ = 4700 #/□' or 2.1 tons/□'

without live load

Superimposed load	48500	•	6.5	=	315.000
shaft	372600	•	5.25	=	1952600
base	214500	•	6.00	=	1348000
back filling	138500	•	1.50	=	208000
	774100				~~4526600~~ 3823600
			Hor. m	=	2605000
					6428600



Resultant arm = 6428600 ÷ 774100 = 8.3

max toe Pressure = $\frac{774100 \cdot 2}{11.1 \cdot 32}$ = 4360 #/□' or 1.95 tons/□'

Bearing Pressure due to Earthquake No Earth pressure. k = 0.2

	load			Hor. Force		arm		moment
Superimposed DL.	48500	• 0.2	=	9700	•	25.0	=	242.000
shaft	372600	• 0.2	=	74540	•	12.9	=	962.000
Base	214500	• 0.2	=	42900	•	2.0	=	86.000
	635600							1.290.000

5-8

Design of Anabuki-Bashi for Tokushima-Ken

Vertical moment

			arm		Moment		
Superimposed Dead Load	48500	·	6.5	=	315.000		
Shaft	372600	·	5.25	=	1960.000		
Base	214500	·	6.00	=	1285.000		
	635.600					3,560.000	3,560.000
Horizontal moment						+ 1,290.000	− 1,290.000
						4,850.000	2,270.000

Resultant ~~moment~~ arm = 4,850.000 ÷ 635.600 = 7.62′ Ecc = 1.62
Resultant arm = 2,270.000 ÷ 635.600 = 3.57′ Ecc = 2.43

Toe Pressure = $\frac{635600}{12 \cdot 32}$ (1 ± $\frac{6 \cdot 1.62}{12}$) = 3000 #/□′ or 1.34 tons/□′

Toe Pressure = $\frac{635600}{12 \cdot 32}$ (± $\frac{6 \cdot 2.43}{12}$) = 3660 #/□′ or 1.65 tons/□′

Bearing Pressure due to Earthquake k = 0.2 For Earth pressure ¾k = 0.175
β = 16° 50′ E = .445 cos β = 0.957 sin β = 0.290

					Hor Force				
Superimposed Dead Load	48500	· 0.175	=		8500	·	25.0	=	187.500
Shaft	372600	· "	=		65200	·	12.9	=	840.000
Base	214500	· "	=		37600	·	2.0	=	75200
									1,102700 #

Vertical moment

	48500				
Superimposed Dead Load	372600	48500	· 6.5	=	315.000
Shaft	214500	372600	· 5.25	=	1960.000
Base		214500	· 6.00	=	1285.000
filling		138500	· 1.50	=	208.000
					3768.000
Hor. Moment					1102.700
					4870.700 #

Earth pressure = 0.445 · 100 · $\frac{25^2}{2}$ = 13900
For 30′ 13900 · 30 = 417000 #

Hor. 417000 · 0.957 = 400.000 #
Vert 417000 · 0.29 = 121.000 #

Load		
774100		4.870.700
121000	400.000 · $\frac{25}{3}$ =	3.340.000
895100 #	121.000 · 1.5 =	181.500
		8392.200

Resultant arm = 8392.200 ÷ 895100 = 9.38′
From toe 12.00 − 9.38 = 2.62
Pressure area = 2.62 · 3 = 7.86
max toe pressure = $\frac{895100 \cdot 2}{32 \cdot 7.86}$ = 7120 #/□′ or 3.72 tons/□′

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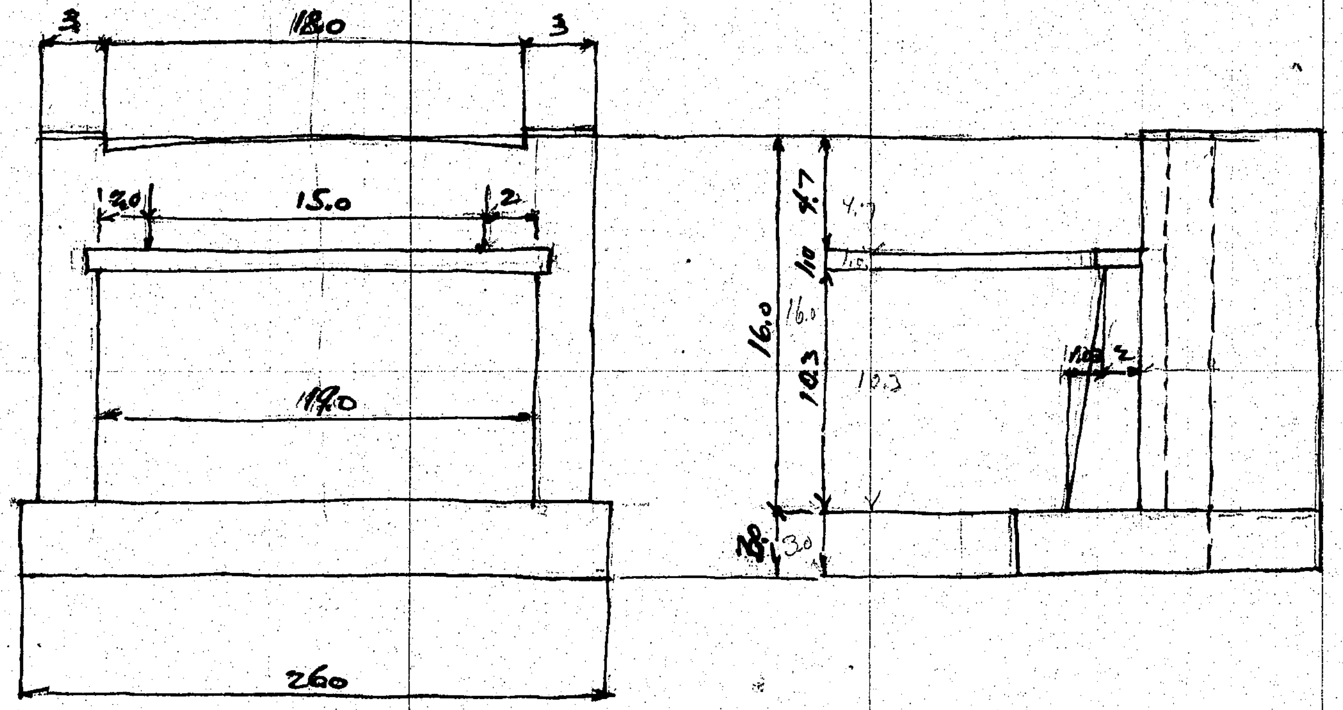
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken
Abutment A2



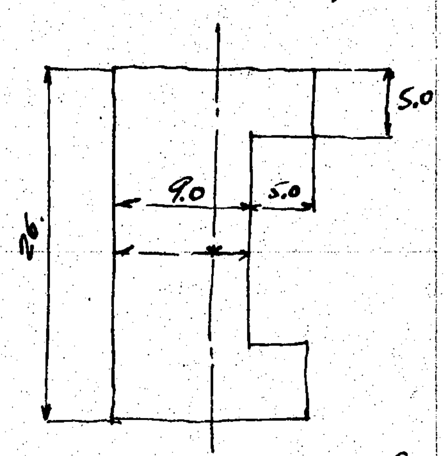
Volume of Concrete

						weight
Coping	2.5 · 20 · 1.0	=	50.0	- 0.231	@30200 =	6980
batter	$\frac{1.03}{2}$ · 10.3 · 20	=	106.0	- 0.491		14820
body	2.0 · 10.3 · 20	=	412.0	- 1.910		57600
				2.632		

Front wall to the top of base

	18 · 1.0 · 16	=	288.0	1.333	@30200 =	~~11200~~ 40300
Side Col.	2 - 3.3 . 16	=	288.0	1.333		7200 40300
wings	1.0 · 16 · 5	=	80.	.37		11200
	10.3 · $\frac{2}{2}$ · 5	=	51.5	.238		7200
				.608		18400
				2@608 = 1.216		2@18400 = 36800#
Base	26 · 9 · 3	=	702.	- 3.25	@30200 =	98000
	2 - 5 · 5 · 3	=	150	0.695		21000
				3.945		119000#

Center of gravity of base



26 · 9 = 234 · 4.5 = 1010
2 - 5 · 5 = 50 · 11.5 = 575
284 · 5.57 = 1585

moment of inertia of base area about ℄ gravity

$9 \cdot 26 = 234 \cdot 1.07^2 + \frac{26 \cdot 9^3}{12} = 1848$
$2 @ 25 = 50 \cdot 5.93^2 + 2 \cdot \frac{10 \cdot 5^3}{12} = 1968$
3814

Center of gravity of abutment moment taken at toe of base

Coping	6980	·	4.75	=	33200
batter	14820	·	3.66	=	54300
body	57600	·	5.00	=	288000
walls	40300	·	6.50	=	262000
Cols	40300	·	7.50	=	302500
wings	36800	·	11.50	=	423000
base	119000	·	5.57	=	663000
	315800		6.425		2026000 ′′

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

Superimposed load

Live Load	1800 · 54/2	=	48600#
Dead Load	15770/2 · 54/60	=	71000
			119600#

Earth fill on rear of on base.

						arm		moment
Rear	2.0 · 16 · 18		= 576 @ 100	=	57600 ·	6.5	=	374.000
wing	1.0 · 5.0 · 16 =	80						
	10.3 · 2/2 · 10 =	103	297·2 = 594 @ 100	=	59400 ·	11.5	=	683.000
	5.7 · 2 · 10 =	114			117000	9.03		1057.000

Horizontal Earth pressure = 1/3 · 100 · 19²/2 = 6000#
For 24' 6000 · 24 = 144.000#
Moment = 144000 · 19/3 = 912.000 '#

Superimposed load	119600	· 5.2	=	621.000
structure	315800	· 6.425	=	2026.000
Earth fill.	117000	· 9.03	=	1057.000
	552400			3.704.000
Horizontal moment			−	912.000
				2.792.000

Resultant arm = 2.792.000 ÷ 552.400 = 5.05'
Eccentricity 5.93 − 5.05 = 0.88 m = 552400 · 0.88 = 487.000 '#

Fibre stress = 487.000 · 5.57 / 3814 = 710 #/□'

Due to direct load 552400 ÷ 284 = 1945 #/□'
Due to fibre stress 710
2655 #/□' or 1.18 tons/□'

Horizontal moment

coping	6980	· 13.8	=	96300
batter	14820	· 6.44	=	95500
body	57600	· 8.15	=	477000
wall	40300	· 11.00	=	443000
Colo	40300	· 11.00	=	443000
wing	22400	· 11.00	=	246000
wing	14400	· 6.44	=	92700
base	119.000	· 1.50	=	178500
	315800	6.56		2.072.000

Bearing Pressure due to Earthquake no Earth pressure. k = 0.2

			Hor. Force			
Superimposed dead load	71000 · 0.2	=	14200	· 19.0	=	270.000
structure	315800 · 0.2	=	63160	· 6.56	=	415.000
	386800					685.000 '#

Fibre stress = 685.000 · 5.57 / 3814 = 1000 #/□'

Direct load 386800 ÷ 284 = 1360
2360 #/□' C = 1.05 tons/□'

Bearing Pressure due to Earthquake with earth pressure
Earthquake intensity k = 0.175 β = 16° − 50' Σ = .445

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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken

				Hor. Force		arm		moment
Superimposed Dead Load	71000	× 0.175	=	12400	×	19.0	=	216.000
Shaft + base	315800	× 0.175	=	55200	×	6.56	=	362.000
	386800							578.000 ″#
Earth	117000							
	503800							

Vertical Moment

Superimposed Dead Load	71000	× 5.20	=	369.000
Shaft and base	315800	× 6.425	=	2026.000
Earth rear	57600	× 8.00	=	374.000
〃 wings	59400	× 11.50	=	684.000
				3453 000
		Less		578.000
				2,875,000

Earth pressure = 0.445 × 100 × $\frac{19^2}{2}$ = 8030#

For 20′ 8030 × 20 = 160600#
〃 4′ 8030 × 4 = 32120#

Hor. 160600 × 0.957 = 153800 vert 160600 × 0.29 = 46600
Hor. 32120 × 0.957 = 30700 〃 32120 × 0.29 = 9300
184500 55900

Summary for moments
with Earthquake 2,875.000
Earth Pressure 184500 × 6.33 = - 1.168.000
46600 × 7.0 = 326.000
9300 × 14.0 = 130.000
- 712.000 - 712.000
2,163,000 ″# moment about toe

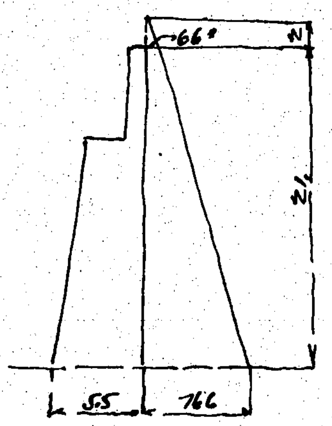
Total vertical load 503800
55900
559700#

Resultant arm = 2163.000 ÷ 559700 = 3.87′
Eccentricity = 5.57 - 3.87 = 1.70
moment = 559700 × 1.70 = 952.000 ″#

Fibre stress = $\frac{952.000 \times 5.57}{3814}$ = 1390 #/□′ or 0.62 ton/□′

Direct load = 559700 ÷ 284 = 1970 #/□′ or 0.88
1.50 tons/□′

Details of Design
Reinforcement in shaft due to Earthquake.
Abutment A, Rear reinforcement neglecting weight of shaft.



33.3 × 23 = 766
66
700

						moment
66 × 21	=	1388	×	10.5	=	14580
700 × $\frac{21}{2}$	=	7350	×	7.0	=	51500
						66080 ″#

Reinforcement = $\frac{66080 \times 12}{\frac{7}{8} \times 64'' \times 17000}$ = 0.83 □″ per ft.

use 5/8″ϕ bars 4″ centres = 0.920 □″ per ft.

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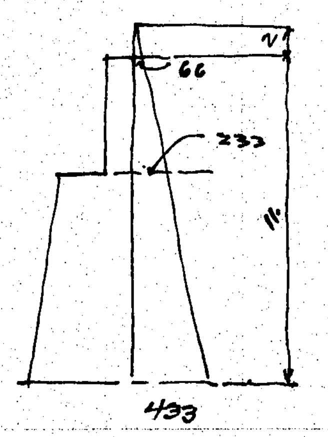
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.



66 × 11 = 660 × 5.5 = 3640

$\frac{367}{2}$ × 11 = 2020 × 3.67 = 7420

11060

Steel = $\frac{11060 \times 12}{\frac{7}{8} \times 52 \times 17000}$ = 0.172 □"

Use ½"□ bars 1.0' centres = 0.20 □" per ft.

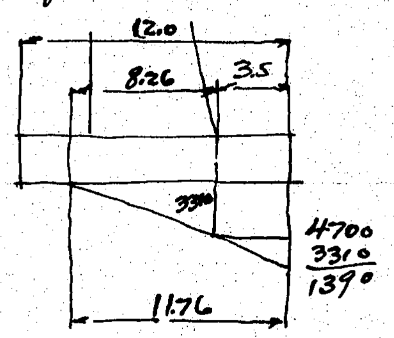
Reinforcement in parapet wall 66 × 5 = 330 × 2.5 = 825

$\frac{167}{2}$ × 5 = 417 × 1.67 = 696

1521

depth 1.0 Steel area = $\frac{1521 \times 12}{\frac{7}{8} \times 11 \times 17000}$ = 0.11 use ½"□ bars 1.0 centres = 0.200" per ft

Reinforcement in the base



4700 × $\frac{8.26}{11.76}$ = 3310

3310 × 3.5 = 11600# × 1.75 = 20300

$\frac{1390}{2}$ × 3.5 = 2440 × 2.33 = 5680

25980

Less. 560 × $\frac{3.5^2}{2}$ − 3430

22550'#

Steel area = $\frac{22550 \times 12}{\frac{7}{8} \times 45 \times 17000}$ = 0.405 □"

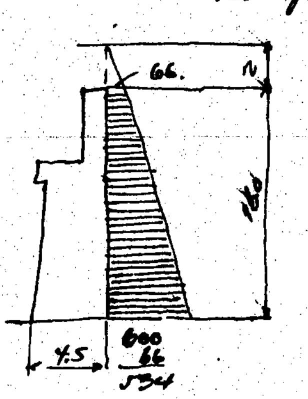
Abutment A2 Reinforcement in shaft

moment

66 × 16 = 1056 × 8.0 = 8450

$\frac{534}{2}$ × 16 = 4270 × 5.33 = 22800

31250'#



neglecting direct load in the shaft

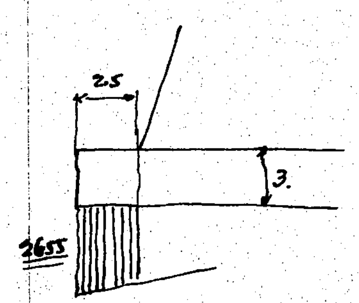
Steel area = $\frac{31250 \times 12}{\frac{7}{8} \times 52 \times 17000}$ = 0.482 □"

Use ⅝"□ bars 6" centres = 0.61 □" per ft.

Wing walls. thickness at base = 3.0 Steel Area = $\frac{31250 \times 12}{\frac{7}{8} \times 34 \times 17000}$ = 0.74 □"

Part of stress will be carried by front wall use ⅝"□ bars 6" centres = 0.61 □"

Reinforcement in the base.



upward assumed 2655# throughout.

downward 3.0' 450

2205#

moment = 2205 × $\frac{2.5^2}{2}$ = 6880'#

Steel Area required = $\frac{6880 \times 12}{\frac{7}{8} \times 33 \times 17000}$ = 0.17 □" per ft.

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken

Weight of truss

End Posts 4 Required					
main section	2[s	12"·3½"·16'-9"	@ 26.10	=	874
" "	1 Pl.	20½"·5/16·15'-2 3/8"	@ 21.78	=	331
tie Pls.	2 Pls.	20½·3/8·1'-8½"	@ 26.14	=	89
Lacing bars	14 bars	2½·3/8·2'-3"	@ 3.19	=	100
Gusset pls.	2 Pls.	29·½·3'-3¼	@ 49.30	=	322
" "	2 Pls.	13½·3/8·1'-5¼	@ 17.21	=	50
					1766·4 = 7064
Top chord U1-U2 4 Required					
main section	2[s	12"·3½"·12'-3"	@ 26.10	=	639
Tie Pls.	1 Pl.	20½·3/8·1'-5½	@ 26.14	=	38
"	1 Pl.	20½·3/8·1'-8½"	@ 26.14	=	45
"	1 Pl.	20½·3/8·1'-7¼"	@ 26.14	=	42
Sp. pl. U1	1 Pl.	7½"·5/16·1'-8½	@ 7.96	=	14
" U1	2 Pls.	3½·½·2'-2 5/8"	@ 5.95	=	26
" U2	1 Pl.	20½·3/8"·2'-3¾"	@ 26.14	=	60
U2	2 Pls.	3½·½·1'-10"	@ 5.95	=	22
Lacing bars	8 Pls.	2½·3/8·2'-3"	@ 3.19	=	57
	10 Pls.	2½·3/8·2'-3"	@ 3.19	=	72
	2 Pls.	2½·3/8·2'-7"	@ 3.19	=	16
Gusset Pls.	2 Pls.	12·½·2'-1"	@ 20.40	=	85
" "	2 Pls.	9¾·3/8·1'-3"	@ 12.43	=	31
					1147·4 = 4578
Top Chord U2-U3 4 Required					
main section	2[s	12·3½·12'-1½	@ 26.10	=	633
Tie Pl.	1 Pl.	20½·3/8·1'-8½	@ 26.14	=	45
"	1 Pl.	20½·3/8·1'-5½	@ 26.14	=	38
Splice plate	1 Pl.	20½·3/8·2'-4"	@ 26.14	=	61
" "	2 Pls.	3½·½·1'-11"	@ 5.95	=	23
Lacing bars	8 Pls.	2½·3/8·2'-3"	@ 3.19	=	57
" "	8 Pls.	2½·3/8·2'-3"	@ 3.19	=	57
" "	2 Pls.	2½·3/8·2'-7"	@ 3.19	=	16
	2 Pls.	2½·3/8·2'-5"	@ 3.19	=	15
Gusset Pls.	2 Pls.	25½·½·2'-11½	@ 43.35	=	256
" "	2 Pls.	9¾"·3/8·1'-3½	@ 12.43	=	32
					1233·4 = 4932
Top Chord U3-U4 4 Required					
main section	2[s	12"·3½"·12'-2¾	@ 26.10	=	639
Tie Pls.	2 Pls.	20½·3/8·1'-8½	@ 26.14	=	90
Spl. pl. U4	1 Pl.	20½·3/8·2'-4"	@ 26.14	=	61
" U4	2 Pls.	3½·½·1'-11"	@ 5.95	=	23
Lacing bars	20 Pls.	2½·3/8·2'-3"	@ 3.19	=	143
U4 gusset pls	2 Pls.	10·½·2'-1¾	@ 20.40	=	87
" "	2 Pls.	9¾·3/8·1'-3¾	@ 12.43	=	32
					1075·4 = 4300#
Top Chord U4-U5 4 Required					
main section	2[s	12·3½·12'-3"	@ 26.10	=	639
Tie Pls.	1 Pl.	20½·3/8·1'-8½	@ 26.14	=	45
	1 Pl.	20½·3/8·2'-2½	@ 26.14	=	58
Lacing bars	18 Pls.	2½·3/8·2'-3"	@ 3.19	=	129
					871·4 = 3484#

6K

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

Top Chord U5-U6.	4 Required					
main section	2 [s	12 • 3½	• 12' 4¾"	@ 32.88"	=	812
" "	1 Pl.	20½ • ½	• 13' 7½"	@ 34.85	=	475
Tie Pl.	1 Pl.	20½ • 3/8	• 2' 2½	@ 26.14	=	58
"	1 Pl.	20½ • 3/8	• 1' 8½"	@ 26.14	=	45
Lacing bars	4 Pls.	2½ • 3/8	• 2' 3"	@ 3.19	=	29
U5 gusset pls.	2 Pls.	36 • ½	• 5' 5"	@ 61.20	=	663
splice	2 Pls.	9¾ • 3/8	• 2' 3"	@ 12.43	=	56
fills	2 Pls.	9¾ • 1/8	• 1' 2"	@ 4.14	=	10
	2 Ls	6 • 6 • ½	• 3' 3"	@ 19.60	=	128
	1 Pl.	3½ • 5/8	• 2' 9½	@ 7.44	=	21
Gusset	1 Pl.	14 • 3/8	• 2' 9½"	@ 17.85	=	50
"	1 Pl.	14 • 3/8	• 2' 9½	@ 17.85	=	50
Diaphragm	2 Ls	4 • 3½ • 3/8	• 1' 2½	@ 9.10	=	22
	1 Pl.	12 • 3/8	• 1' 2½	@ 15.30	=	19
						2438 • 4 = 9752
Top Chord U6-U7	4 Required	U13-U14	4 Required			
main section	2 [s	12 • 3½	• 12' 5¾	@ 32.88	=	820
" "	1 Pl.	20½ • ½	• 12' 5"	@ 34.85	=	433
Tie Pls.	2 Pls.	20½ • 3/8	• 1' 8½	@ 26.14	=	90
lacing bars	8 bars	2½ • 3/8	• 2' 3"	@ 3.19	=	57
U6. gusset	2 Pls.	29 • ½	• 2' 7"	@ 49.30	=	255
splice	2 Pls.	9¾ • 3/8	• 2' 7"	@ 12.43	=	64
"	1 Pl.	3½ • 5/8	• 2' 5"	@ 7.44	=	18
"	1 Pl.	17 • ½	• 2' 10"	@ 28.90	=	82
gussets	1 Pl.	14 • 3/8	• 2' 10"	@ 17.85	=	51
"	1 Pl.	14 • 3/8	• 2' 5"	@ 17.85	=	43
						1913 • 8 = 15304
Top Chord U7-U8	4 Required	U12-U13	4 Required			
main section	2 [s	12 • 3½	• 12' 7/8	@ 32.88	=	828
" "	1 Pl.	20½ • ½	• 12' 6½	@ 34.85	=	437
Tie Pls.	2 Pls.	20½ • 3/8	• 1' 8½	@ 26.14	=	90
lacing bars	8 Pls.	2½ • 3/8	• 2' 3"	@ 3.19	=	57
U7. gusset pls.	2 Pls.	29 • ½	• 2' 7½	@ 49.30	=	259
splice	2 Pls.	9¾ • 3/8	• 2' 7½	@ 12.43	=	65
"	1 Pl.	17 • ½	• 2' 5"	@ 28.90	=	70
"	1 Pl.	3½ • 5/8	• 2' 0"	@ 7.44	=	15
gussets	1 Pl.	14 • 3/8	• 2' 0"	@ 17.85	=	36
"	1 Pl.	14 • 3/8	• 2' 5"	@ 17.85	=	43
						1900 • 8 = 15200"
Top chord U8-U9	4 Required	U11-U12	4 Required			
main section	2 [s	12 • 3½	• 12' 8¾	@ 32.88	=	837
"	1 Pl.	20½ • ½	• 12' 8 3/8	@ 34.85	=	443
Tie Pls.	2 Pls.	20½ • 3/8	• 1' 8½	@ 26.14	=	90
lacing bars	8 Pls.	2½ • 3/8	• 2' 3"	@ 3.19	=	58
U8 gusset	2 Pls.	27 • ½	• 2' 8½"	@ 45.90	=	248
splice	2 Pls.	10 • 3/8	• 2' 8½	@ 12.75	=	69
"	1 Pl.	17 • ½	• 2' 5½	@ 28.90	=	71
"	1 Pl.	3½ • 5/8	• 2' 0¾	@ 7.44	=	15
"	1 Pl.	14 • 3/8	• 2' 5½	@ 17.85	=	44
	1 Pl.	14 • 3/8	• 2' 0¾	@ 17.85	=	37
						1912 • 8 = 15269"

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

Top chord M9-M10. 4 Required M10-M11. 4 Required

main section	2[s	12"·3½"· 12'5"	@ 32.88	=	817	
" "	1 Pl.	20½·½·12'5"	@ 34.85	=	433	
Tie Pls.	2 Pls.	20½·3/8·1'8½	@ 26.14	=	90.	
Lacing bars	6 Pls.	2½·3/8·2'3"	@ 3.19	=	43.	
M9 gusset	2 Pls.	27½·½·2'9"	@ 46.75	=	257.0	
splice	2 Pls.	10·3/8·2'9"	@ 12.75	=	35.	
"	1 Pl.	17·½·2'6"	@ 28.90	=	72	
	1 Pl.	3½·5/8·2'1¼	@ 7.44	=	16.	
Gusset	1 Pl.	14·3/8·2'6"	@ 17.85	=	45	
"	1 Pl.	14·3/8·2'1¼	@ 17.85	=	37	
M10.	2 Ls	6.6.½·2'7½	@ 19.60	=	51.	
fills	2 Pls.	6·½·0'10"	@ 10.20	=	8	
					1904 · 8 =	15232

Top chord M14-M15 2 Required

main section	2[s	12·3½·12'11½	@ 32.88	=	853	
" "	1 Pl.	20½·½·12'7½	@ 34.85	=	440	
Tie Pls	2 Pls.	20½·3/8·1'8½	@ 26.14	=	90	
Lacing bars	4 Pls	2½·3/8·2'3"	@ 3.19	=	29	
M15 gusset pls	2 Pls.	37·½·5'5"	@ 62.90	=	681.	
" "	2 Pls.	26·½·3'1"	@ 44.20	=	272	
	3 Ls	6·4·½·2'10	@ 16.20	=	92	
diaphragm	2 Ls	4·3½·3/8·1'4½	@ 9.10	=	25	
	1 Pl.	11·3/8·1'4½"	@ 14.03	=	19	
Gusset pls.	1 Pl.	15·3/8·1'8½	@ 19.13	=	33	
	1 Pl.	14·3/8·1'5½	@ 17.85	=	26.	
Reinf. Pls.	2 Pls.	12·½·1'10"	@ 20.40	=	37.	
					2597 · 2 =	5194"

Top chord M14'-M15' 2 Required
materials same as for M14-M15 except omit Reinf. Pl.
2560 · 2 = 5120"

Lower chord L0-L2. 4 Required

main section	2[s	12·3½·21'1½"	@ 26.10	=	1100	
Tie Pl.	1 Pl.	11¾·3/8·1'2½	@ 14.98	=	18	
"	2 Pls.	11½·3/8·0'11¾	@ 14.66	=	29	
Lacing bars	42 Pls.	2¼·5/16·1'0⅛"	@ 2.39	=	101	
	39 Pls.	2¼·5/16·1'0⅛	@ 2.39	=	94	
L0. gussets	2 Pls.	37·½·3'11"	@ 62.90	=	493	
Bent cover	1 Pl.	16·5/16·2'1½	@ 17.00	=	36	
	1 L	3½·3½·5/16·0'11½	@ 7.2	=	7	
Diaphragm	4 Ls	4·3·5/16·1'0½	@ 7.2	=	28	
"	1 Pl.	12·5/16·1'0½	@ 12.75	=	13	
"	1 L	3½·3½·5/16·0'11½	@ 7.2	=	7	
Diaphragm	2 Ls	3½·3·5/16·0'10"	@ 6.6	=	11	
	1 Pl.	10·5/16·1'0"	@ 10.63	=	11	
cov. pl.	1 Pl.	20·3/8·1'6½	@ 25.50	=	39	
L1	1 Pl.	16½·3/8·1'8"	@ 21.04	=	35	
diaphragm	4 Ls	4·3·5/16·0'9½	@ 7.2	=	23	
	1 Pl.	9½·5/16·0'11"	@ 10.09	=	9	
gusset	1 Pl.	8¼·3/8·1'9½	@ 10.52	=	19	
splice	2 Pls.	9½·3/8·1'3½	@ 12.11	=	31	
"	2 Pls.	12·3/8·1'3½	@ 15.30	=	40	
"	2 Pls.	11¾·3/8·1'11"	@ 14.98	=	58	
					2202 · 4 =	8808"

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

Lower Chord L2-L4	4 Required				
main section	2[s	12 . 3½	24'-0"	@ 26.10	= 1252
Tie Plo.	3 Pls.	11½ . 3/8	0'-11¾"	@ 14.66	= 43
Lacing bars	83 Pls.	2¼ . 5/16	1'-0⅛"	@ 2.39	= 200
L2 - gusset	1 Pl.	20 . 3/8	2'-10½"	@ 25.50	= 73
Diaphragm	4 Ls	4 . 3 . 5/16	0'-9½"	@ 7.2	= 23
	1 Pl.	9½ . 5/16	0'-11"	@ 10.09	= 9
Gusset plo	2 Pls.	17½ . 3/8	2'-11"	@ 22.31	= 130
L3 gusset pl	1 Pl.	16½ . 3/8	1'-8"	@ 21.04	= 35
Diaphragm	4 Ls	4 . 3 . 5/16	0'-9½	@ 7.2	= 23
	1 Pl.	9½ . 5/16	0'-11"	@ 10.09	= 9
Gusset plo.	1 Pl.	8¼ . 3/8	1'-9½	@ 10.52	= 19
splices	2 Pls.	9½ . 3/8	1'-8½	@ 12.11	= 42
"	2 Pls.	12 . 3/8	1'-8½	@ 15.30	= 52
"	2 Pls.	11¾ . 3/8	1'-11"	@ 14.98	= 58
"	2 fills	9½ . ⅛	0'-10¼"	@ 4.04	= 7
					1975 × 4 = 7900#
Lower chord L4-L6	4 Required				
main section	2[s	12 . 3½	23'-6"	@ 32.88	= 1546
tie Plo	3 Pls	11½ . 3/8	0'-11¾	@ 14.66	= 43
Lacing bars	79 Pls.	2¼ . 5/16	1'-0⅛"	@ 2.39	= 191
L4 gusset	1 Pl.	20 . 3/8	2'-10½	@ 25.50	= 73
diaphragm	4 Ls	4 . 3 . 5/16	0'-9½	@ 7.2	= 23
	1 Pl.	9½ . 5/16	0'-11"	@ 10.09	= 9
Gusset plo.	2 Pls.	29 . 3/8	2'-10½	@ 36.98	= 212
L5 gusset pl	1 Pl	16½ . 3/8	1'-8"	@ 21.04	= 35
diaphragm	4 Ls	4 . 3 . 5/16	0'-9½	@ 7.2	= 23
"	1 Pl.	9½ . 5/16	0'-11"	@ 10.09	= 9
gusset	1 Pl.	8¼ . 3/8	1'-9½	@ 10.52	= 19.
splice	2 Pls.	9½ . 3/8	1'-8½	@ 12.11	= 42
	2 Pls.	12 . 3/8	1'-8½	@ 15.30	= 52
	2 Pls.	11¾ . 3/8	2'-4"	@ 14.98	= 70
					2347 × 4 = 9388#
Lower chord L6-L8	4 Required				
main section	2[s	12 . 3½	24'-0"	@ 32.88	= 1579
Tie Plo.	3 Pls.	11½ . 3/8	0'-11¾	@ 14.66	= 43
Lacing bars	78 Pls.	2¼ . 5/16	1'-0⅛	@ 2.39	= 188
L6. gusset	1 Pl.	21 . 3/8	3'-2"	@ 26.78	= 85
diaphragm	4 Ls	9½ . 5/16	0'-9½	@ 7.20	= 23
	1 Pl.	9½ . 5/16	0'-11"	@ 10.09	= 9
gusset plo.	1 Pl	31½ . 3/8	3'-0"	@ 40.17	= 121
" "	1 Pl.	34½ . 3/8	3'-0"	@ 42.72	= 128
L7	1 Pl.	16½ . 3/8	1'-8"	@ 21.04	= 35
diaphragm	4 Ls	4 . 3 . 5/16	0'-9½	@ 7.2	= 23
	1 Pl	9½ . 5/16	0'-11"	@ 10.09	= 9
gusset	1 Pl.	8¼ . 3/8	1'-9½	@ 10.52	= 19
splice	2 Pls.	12 . 3/8	1'-8½	@ 15.30	= 52
"	2 Pls.	9½ . 3/8	1'-8½	@ 12.11	= 42
"	2 Pls	11¾ . 3/8	2'-4"	@ 14.98	= 70
					2426 × 4 = 9704#
Lower Chord L8-L10	4 Required				
main section	2[s	12 . 3½	23'-7"	@ 32.88	= 1550
" "	2 Pls.	9½ . 3/8	21'-9½	@ 12.11	= 528.
tie Plo.	3 Pls.	11½ . 3/8	0'-11¾	@ 14.66	= 43.

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Lower Chord L8-L10 Continued							
Lacing bars	72 Pls.	2¼ · 5/16 ·	1'-0⅝"	@	2.39	=	174
L8 gusset	1 Pl.	24 · 3/8 ·	3'-6"	@	30.60	=	107
diaphragm	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
"	1 Pl.	9½ · 5/16 ·	0'-10"	@	10.09	=	9
gusset pls.	1 Pl.	34½ · 3/8 ·	3'-0"	@	42.72	=	128
	1 Pl.	26½ · 3/8 ·	3'-0"	@	33.79	=	101
L9	1 Pl.	16½ · 3/8 ·	1'-8"	@	21.04	=	35
diaphragm	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
	1 Pl.	9½ · 5/16 ·	0'-10"	@	10.09	=	9
gusset	1 Pl.	8¼ · 3/8 ·	1'-9½	@	10.52	=	19
splices	2 Pls.	12 · ½ ·	2'-7½	@	20.40	=	107
"	2 Pls.	9½ · 3/8 ·	1'-3½	@	12.11	=	31
"	2 Pls.	11¾ · 3/8 ·	2'-4"	@	14.98	=	70
							2957 · 4 = 11828#
Lower Chord L10-L12 4 Required							
main section	2 [s	12 · 3½ ·	30'-7"	@	32.88	=	2010
Tie Pls.	1 Pl.	11¾ · 3/8 ·	1'-5½	@	14.98	=	22
"	3 Pls.	11½ · 3/8 ·	0'-11¾	@	14.66	=	43
Lacing bars	81 Pls.	2¼ · 5/16 ·	1'-0⅝"	@	2.39	=	196
L10	2 Pls.	9½ · 3/8 ·	4'-9½	@	12.11	=	116
gusset	1 Pl.	27 · 3/8 ·	4'-6½	@	34.43	=	156
"	1 L	4 · 3½ · 3/8 ·	1'-2½	@	9.10	=	11
"	1 L	4 · 3½ · 3/8 ·	1'-5½	@	9.10	=	13
Diaphragm	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.20	=	23
	1 Pl.	9½ · 5/16 ·	0'-10"	@	10.09	=	9
L11 Gusset	1 Pl.	16½ · 3/8 ·	1'-8"	@	21.04	=	35
Diaphragm	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
"	1 Pl.	9½ · 5/16 ·	0'-11"	@	10.09	=	9
Gusset	1 Pl.	8¼ · 3/8 ·	1'-9½	@	10.52	=	19
Splice	2 Pls.	9½ · 3/8 ·	1'-3½	@	12.11	=	31
	2 Pls.	12 · 3/8 ·	1'-3½	@	15.30	=	40
	2 Pls.	11¾ · 3/8 ·	1'-11"	@	14.98	=	58
	2 fills	7½ · ⅛ ·	0'-9½	@	3.18	=	6
L12	2 Pls.	36 · 3/8 ·	3'-5"	@	45.90	=	313
	1 Pl.	24 · 3/8 ·	3'-8½	@	30.60	=	113
diaphragm	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
	1 Pl.	9½ · 5/16 ·	0'-11"	@	10.09	=	9
							3278 · 4 = 13096#
Lower chord L12-L14 4 Required							
main section	2 [s	12 · 3½ ·	21'-5¼	@	26.10	=	1120
Tie Pls.	3 Pls.	11½ · 3/8 ·	0'-11¾	@	14.66	=	43
Lacing bars	76 Pls.	2¼ · 5/16 ·	1'-0⅝	@	2.39	=	184
L13	1 Pl.	8¼ · 3/8 ·	1'-9½	@	10.52	=	19
	1 Pl.	16½ · 3/8 ·	1'-8"	@	21.04	=	35
	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
	1 Pl.	9½ · 5/16 ·	0'-11"	@	10.09	=	9
L14	2 Pls.	34 · 3/8 ·	2'-10½	@	43.35	=	249
	1 Pl.	25½ · 3/8 ·	3'-9"	@	32.52	=	122
	4 Ls	4 · 3 · 5/16 ·	0'-9½	@	7.2	=	23
	1 Pl.	9½ · 5/16 ·	0'-11"	@	10.09	=	9
							1836 · 4 = 7344#

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Lower Chord L14-L15 4 Required

main section	2[	12·3½	12'-11¼"	@ 26.10	=	675
Tie Pls.	2Pls.	11½·3/8	0'-11¾"	@ 14.66	=	29
Lacing bars	42 bars	2¼"·5/16	1'-0⅜"	@ 2.39	=	102
diaphragm	4[	4·3·5/16	0'-9½	@ 7.2	=	23
	1Pl.	9½·5/16	0'-11"	@ 10.09	=	9
	1Pl.	22½·3/8	2'-2"	@ 28.69	=	62
	1Pl.	8½·3/8	0'-11¾"	@ 10.84	=	11
	2Pls.	12·½	1'-0"	@ 20.40	=	41

952 · 4 = 3808#

Middle chord M5-M6. 4 Required

main section	2[	12·3½	10'-11"	@ 26.10	=	571
tie Pls.	4Pls.	20¼"·3/8	1'-8½"	@ 25.82	=	177
Lacing bars	12Pls.	2½·3/8	2'-3"	@ 3.19	=	86

834 · 4 = 3336#

Middle chord M6-M7. 4 Required

main section	2[	12·3½	12'-2⅜	@ 26.10	=	637
Tie Pls.	4Pls.	20¼"·3/8	1'-8½	@ 25.82	=	177
Lacing bars	16Pls.	2½·3/8	2'-3"	@ 3.19	=	115
M6 -	4Pls.	3½·3/8	1'-6½"	@ 4.46	=	27
	2Pls.	12·½	2'-2"	@ 20.40	=	88
	2Pls.	9¾·3/8	2'-2"	@ 12.43	=	54

1098 · 4 = 4392#

Middle Chord M7-M8 4 Required

main section	2[	12·3½	12'-1½"	@ 26.10	=	634
Tie Pls.	4Pls.	20¼·3/8	1'-8½	@ 25.82	=	177
Lacing bars	18Pls.	2½·3/8	2'-3"	@ 3.19	=	129
M7	2Pls.	27·½	3'-2"	@ 45.90	=	291
	2Pls.	9¾·3/8	1'-3"	@ 12.43	=	31
	4Pls.	3½·3/8	1'-5½"	@ 4.46	=	26

1288 · 4 = 5152#

Middle chord M8-M9 4 Required

main section	2[	12·3½	12'-1"	@ 26.10	=	631
Tie Pls.	4Pls.	20¼·3/8	1'-8½	@ 25.82	=	177
Lacing bars	18Pls.	2½·3/8	2'-3"	@ 3.19	=	129
M8	4Pls.	3½·3/8	1'-5½	@ 4.46	=	26
	2Pls.	9¾·3/8	2'-1"	@ 12.43	=	52
	2Pls.	12·½	2'-1"	@ 20.40	=	85
M9	2Pls.	27½·½	3'-10"	@ 46.75	=	358
	4Pls.	3½·3/8	1'-6"	@ 4.46	=	27
	2Pls.	9¾·3/8	1'-3½"	@ 12.43	=	32

1517 · 4 = 6068#

Middle chord M9-M10 4 Required

main section	2[	12·3½	11'-5½	@ 26.10	=	598
Tie Pls.	4Pls.	20¼·3/8	1'-8½	@ 25.82	=	177
Lacing bars	16Pls.	2½·3/8	2'-3"	@ 3.19	=	115

890 · 4 = 3560#

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Middle chord M10-M11 4 Required

main section	2[	12 . 3½"	. 11'-5½"	@	26.10	=	598
Tie Pls.	4 Pls.	20¼ . 3/8	. 1'-8½"	@	25.82	=	177
Lacing bars.	16 Pls.	2½ . 3/8	. 2'-3"	@	3.19	=	115
M11	2 Pls.	30 . ½	. 3'-11½	@	51.00	=	404
	4 Pls	3½ . 3/8	. 1'-5½	@	4.46	=	26
	2 Pls.	9¾ . 3/8	. 1'-3"	@	12.43	=	31
	2 fill	7" . 8"	. 0'-9½"	@	2.97	=	5
							1356 . 4 = 5424#

Middle chord M11-M12 4 Required

main section	2[	12 . 3½	. 12'-1¼	@	32.88	=	795
Tie Pls.	4 Pls.	20¼ . 3/8	. 1'-8½	@	25.82	=	177
Lacing bars	16 Pls.	2½ . 3/8	. 2'-3"	@	3.19	=	115
M12	4 Pls	3½ . 5/8	. 2'-1"	@	4.46	=	37
	2 Pls	9¾ . 3/8	. 2'-1"	@	12.43	=	52
	2 Pls.	12 . ½	. 2'-1"	@	20.40	=	85.
							1261 . 4 = 5044#

Middle chord M12-M13 4 Required

main section	2[	12 . 3½	. 12'-1½	@	32.88	=	795.
Tie Pls.	4 Pls.	20¼ . 3/8	. 1'-8½	@	25.82	=	177
Lacing bars	16 Pls.	2½ . 3/8	. 2'-3"	@	3.19	=	115
M13	2 Pls.	30 . ½	. 3'-3"	@	51.00	=	332
	4 Pls.	3½ . 5/8	. 2'-1"	@	4.46	=	37
	2 Pls.	9¾ . 3/8	. 1'-8"	@	12.43	=	42
	2 fills	9½ . 3/8	. 0'-10"	@	12.11	=	20
							1518 . 4 = 6072#

Middle Chord M13-M14 4 Required

main section	2[	12 . 3½	. 12'-2½	@	32.88	=	803
"	2 Pls.	9½ . 3/8	. 12'-2½	@	12.11	=	296
Tie Pls.	4 Pls.	20¼ . 3/8	. 1'-8½	@	25.82	=	177
Lacing bars	16 Pls.	2½ . 3/8	. 2'-3"	@	3.19	=	115
M14	2 Pls	3½ . 5/8	. 2'-1"	@	4.46	=	18
	2 Pls.	3½ . 5/8	. 2'-1¼	@	4.46	=	19
	2 Pls.	12½ . ½	. 3'-1"	@	21.25	=	131
	2 Pls.	9¾ . 3/8	. 1'-9½	@	12.43	=	45
							1604 . 4 = 6416#

Middle chord M14-M15 4 Required

main section	2[	12 . 3½	. 11'-6"	@	32.88	=	756
" "	2 Pls.	9½ . 3/8	. 11'-6"	@	12.11	=	278
Tie Pls.	4 Pls.	20¼ . 3/8	. 1'-8½	@	25.82	=	177
Lacing bars.	10 Pls.	2½ . 3/8	. 2'-3"	@	3.19	=	72
							1283 . 4 = 5132

Verticals U1-L1 4 Required

main section	2 L	4 . 3 . 5/16	. 10'-10⅛	@	7.2	=	156
	2 L	4 . 3 . 5/16	. 10'-7 5/8	@	7.2	=	153
Gusset	1 Pl	8¼ . 3/8	. 3'-1½	@	10.52	=	33
Tie Pls.	1 Pl	11¾ . 7/16	. 2'-2½	@	12.48	=	28
	1 Pl.	11¾ . 7/16	. 1'-0½	@	12.48	=	13
Lacing bars.	11 Pls.	2¼ . 5/16	. 1'-0 5/8	@	2.31	=	28
							411 . 4 = 1644#

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Verticals U2-L2	4 Required				
main section	4Ls 4.3.5/16	12'-10 5/8	@ 7.2	=	371
	1 Pl. 8 1/4 . 3/8	0'-11 1/2"	@ 10.52	=	10
tie Pl.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
	1 Pl. 11 3/4 . 5/16	1'-6"	@ 12.48	=	19
Lacing bars	13 Pl. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	33
					461 × 4 = 1844#
Vertical U3-L3	4 Required				
main section	4Ls 4.3.5/16	14'-1"	@ 7.2	=	406
Gusset	1 Pl. 8 1/4 . 3/8	3'-1 1/2	@ 10.52	=	33
tie Pl.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
	1 Pl. 11 3/4 . 5/16	1'-8 1/2	@ 12.48	=	21
Lacing bars	15 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	38
					526 × 4 = 2104#
Vertical U4-L4	4 Required				
main section	2Ls 4.3.5/16	15'-8 7/16	@ 7.2	=	226
Gusset	2Ls 4.3.5/16	15'-9 7/16	@ 7.2	=	227
tie Pl.	1 Pl. 8 1/4 . 3/8	0'-8 1/2	@ 10.52	=	7
	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
	1 Pl. 11 3/4 . 5/16	1'-4 1/2	@ 12.48	=	17
Lacing bars	18 Pl. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	45
					600 × 4 = 2400#
Vertical U5-L5	4 Required				
main section	2Ls 4.3.5/16	17'-3	@ 7.2	=	248
	2Ls 4.3.5/16	17'-4"	@ 7.2	=	250
Gusset	1 Pl. 8 1/4 . 3/8	3'-1 1/2	@ 10.52	=	33
Tie Pls.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
"	1 Pl. 11 3/4 . 5/16	2'-1"	@ 12.48	=	26
Lacing bars	20 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	50.
					635 × 4 = 2540
Vertical L6-M6-U6	4 Required	L14-M14-U14 4 Required			
main section	2Ls 4.3.3/8	20'-8"	@ 8.5	=	351
" "	2Ls 4.3.3/8	20'-7"	@ 8.5	=	349
Tie Pls.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
	1 Pl. 11 3/4 . 5/16	1'-9"	@ 12.48	=	22
	1 Pl. 11 3/4 . 5/16	2'-3"	@ 12.48	=	28
Lacing bars	21 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	53.
					831 × 8 = 6648#
Vertical L7-M7-U7	4 Required	L13-M13-U13 4 Required.			
main section	2Ls 4.3.3/8	23'-7 1/2	@ 8.5	=	402
" "	2Ls 4.3.3/8	23'-8 1/2	@ 8.5	=	404
Gusset	1 Pl. 8 1/4 . 3/8	3'-1 1/2	@ 10.52	=	33
Tie Pls.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	=	28
	1 Pl. 11 3/4 . 5/16	2'-1"	@ 12.48	=	25
	1 Pl. 11 3/4 . 5/16	2'-3"	@ 12.48	=	28
Lacing bars	26 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	=	65
					985 × 8 = 7880#

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Vertical L8-M8 4 Required L12-M12 4 Required				
main section	4 Ls 4 . 3 . 3/8	14'-0"	@ 8.5	= 476
Tie Pl.	1 Pl. 11 3/4 . 5/16	2'-2 1/2	@ 12.48	= 28
	1 Pl. 11 3/4 . 5/16	3'-5"	@ 12.48	= 43
Lacing bars.	14 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	= 35
Splice	2 Pls. 8 1/2 . 3/8	1'-8 1/2	@ 10.84	= 37
	2 fills 6 . 3/8	1'-11"	@ 7.65	= 29
	2 Pls. 11 1/4 . 5/16	1'-11"	@ 11.95	= 46
				694 . 8 = 5552"
Verticals M8-U8. 4 Required M12-U12 4 Required				
main section	2 Ls 4 . 3 . 3/8	13'-2 1/2	@ 8.5	= 224
	2 Ls 4 . 3 . 3/8	13'-3 1/2	@ 8.5	= 226
Tie Pl.	1 Pl. 11 3/4 . 5/16	2'-3"	@ 12.48	= 28
Lacing bars	14 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	= 35
				513 . 8 = 4104"
Verticals L9-M9 4 Required L11-M11 4 Required				
main section	4 Ls 4 . 3 . 3/8	13'-3 1/2	@ 8.5	= 451
	1 Pl 8 1/4 . 3/8	3'-1 1/2	@ 10.52	= 33
Tie Pl.	1 Pl 11 3/4 . 5/16	2'-2 1/2	@ 12.48	= 28
" "	1 Pl 11 3/4 . 5/16	4'-2 1/2	@ 12.48	= 53
Lacing bars	11 Pls. 2 1/4 . 5/16	1'-0"	@ 2.39	= 26
splice	2 Pls. 8 1/2 . 3/8	1'-8 1/2	@ 10.84	= 37
	2 fills 6 . 3/8	1'-11"	@ 7.65	= 29
	2 Pls. 11 1/4 . 5/16	1'-11"	@ 11.95	= 46
				703 . 8 = 5624"
Vertical M9-U9 4 Required M11-U11 4 Required				
main section	2 Ls 4 . 3 . 3/8	18'-0"	@ 8.5	= 306
	2 Ls 4 . 3 . 3/8	18'-2"	@ 8.5	= 309
Tie Pl.	1 Pl. 11 3/4 . 5/16	2'-3"	@ 12.48	= 28
Lacing bars	22 Pls. 2 1/4 . 5/16	1'-0 5/8	@ 2.39	= 55
				698 . 8 = 5584
Vertical Post L10-U10 4 Required				
main section	2 [s 15" . 4"	25'-8 1/2	@ 41.99	= 2160
	4 Ls 3 1/2 . 3 1/2 . 3/8	24'-1 1/2	@ 8.5	= 820
	1 Pl. 12 . 3/8	24'-1 1/2	@ 15.30	= 371
	2 Pls. 7 1/2 . 1/2	10'-9 1/2	@ 12.75	= 275
	2 Pls. 7 1/2 . 1/2	9'-0 1/2	@ 12.75	= 230
	2 [s 15 . 4"	11'-10 1/2	@ 41.99	= 997
	4 Ls 3 1/2 . 3 1/2 . 3/8	10'-0"	@ 8.5	= 340
	1 Pl. 12 . 3/8	10'-0"	@ 15.30	= 153
	2 Pls. 7 1/2 . 1/2	7'-8 1/2	@ 12.75	= 197
Tie Pls.	8 Pls. 20 1/2 . 1/2	1'-9 1/4	@ 26.14	= 370
Lacing bars	41 Pls. 2 1/2 . 3/8	2'-4 1/2	@ 3.19	= 362
L10. gusset	2 Pls. 48 . 1/2	4'-0"	@ 81.60	= 653
	4 Pls. 12 1/2 . 1/2	3'-5 3/4	@ 21.25	= 296
M10	2 Pls. 12 . 1/2	2'-7"	@ 20.40	= 105
U10	2 Pls. 20 1/2 . 1/2	4'-7"	@ 34.85	= 319
	2 Pls. 34 1/2 . 1/2	6'-1 1/2	@ 58.65	= 718
Splice	2 Pls. 21 1/4 . 1/2	3'-2"	@ 36.13	= 229
	2 Pls. 14 3/4 . 1/2	2'-6 1/2	@ 25.08	= 77
	2 Pls. 12 1/2 . 1/2	2'-6 1/2	@ 21.25	= 65
	2 Pl. 11 . 3/8	2'-4"	@ 14.03	= 66
	2 fill 5 . 3/8	2'-4"	@ 6.38	= 30
U10.	1 Pl. 32 . 1/2	3'-6 1/2	@ 54.40	= 193
diaphragm	4 Ls 3 1/2 . 3 1/2 . 3/8	0'-10"	@ 8.5	= 28
	1 L 3 1/2 . 3 1/2 . 3/8	0'-8	@ 8.5	= 6
				9060 . 4 = 36240"

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List of materials for Anabuki-Bashi for Tokushima-Ken.

Vertical Post U15-L15	2 Required					
main section	2 Ls 12 · 3½	· 15' 11¾	@	26.10	=	835
Tie Pls.	2 Pls. 6¾ · 3/8	· 0' 11¾	@	8.61	=	17
	1 Pl. 11¾ · 3/8	· 1' 10½	@	14.98	=	28
	1 Pl. 11¾ · 3/8	· 1' 5½	@	14.98	=	22
Lacing bars	66 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	166
L15 gusset	2 Pls. 12 · 3/8	· 2' 10 5/8	@	15.30	=	88
diaphragm	4 Ls 4 · 3 · 5/16	· 2' 1¼	@	7.2	=	61
	1 Pl. 11 · 5/16	· 2' 1¼	@	11.69	=	25
U15 diaphragm	4 Ls 3 · 3 · 5/16	· 1' 1¾	@	6.1	=	28
	1 Pl. 11 · 5/16	· 1' 1¾	@	11.69	=	13
						1283 · 2 = 2566.
Vertical Post U15'-L15'	2 Required	materials same as for U15-L15				1283 · 2 = 2566
Diagonal U1-L2	4 Required					
main section	4 Ls 5 × 3 · 5/16	· 15' 3"	@	8.2	=	500
Tie Pls	2 Pls. 11¾ · 5/16	· 1' 1½	@	12.48	=	28
	4 fills 2¾ · 5/16	· 1' 1½	@	2.92	=	13
Lacing bars	30 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	75
						616 · 4 = 2464
Diagonal L2-U3	4 Required					
main section	4 Ls 4 · 3 · 5/16	· 16' 6"	@	7.2	=	475
Tie Pls.	2 Pls. 11¾ · 5/16	· 1' 0½	@	12.48	=	26
	4 fills 2¾ · 5/16	· 1' 0½	@	2.92	=	12
Lacing bars	33 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	83
						596 · 4 = 2384
Diagonal U3-L4	4 Required					
main section	4 Ls 5 × 3 · 5/16	· 16' 9½	@	8.2	=	550
Tie Pls.	2 Pls. 11¾ · 5/16	· 1' 2"	@	12.48	=	30
	4 fills 2¾ · 5/16	· 1' 2"	@	2.92	=	14
Lacing bars.	34 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	85
						679 · 4 = 2716
Diagonal L4-U5	4 Required					
main section	4 Ls 4 · 3 · 5/16	· 19' 4 3/32	@	7.2	=	556
Tie Pls.	2 Pls. 11¾ · 5/16	· 1' 0½	@	12.48	=	26
	4 fill 2¾ · 5/16	· 1' 0½	@	2.92	=	12
Lacing bars	40 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	100
						694 · 4 = 2776
Diagonal U5-L6.	4 Required					
main section	2 Ls 4 · 3 · 5/16	· 19' 9"	@	7.2	=	284
	2 Ls 4 · 3 · 5/16	· 19' 4"	@	7.2	=	279
Tie Pls.	2 Pls. 11¾ · 5/16	· 1' 3"	@	12.48	=	31
	4 fills 2¾ · 5/16	· 1' 3"	@	2.92	=	15
Lacing bars	39 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	98
						707 · 4 = 2828"
Diagonal L6-M7.	4 Required					
main section	2 Ls 4 · 3 · 5/16	· 16' 5 5/8	@	7.2	=	474
Tie Pls	2 Pls 11¾ · 5/16	· 1' 0½	@	12.48	=	26
	4 fils 2¾ · 5/16	· 1' 0½	@	2.92	=	12
Lacing bars	37 bars 2¼ · 5/16	· 1' 0 5/8	@	2.39	=	93
						605 · 4 = 2420

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Diagonal M7-L8	4 Required						
main section	2 Ls 4.3.5/16	.	15'0"	@	7.2	=	216
	2 Ls 4.3.5/16	.	15'3"	@	7.2	=	220
Tie Pls.	2 Pls. 11¾.5/16	.	0'11½	@	12.48	=	24
	4 fills 2¾.5/16	.	0'11½	@	2.92	=	10
Lacing bars	31 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	78
							548 . 4 = 2192
Diagonal L8-M9	4 Required						
main section	4 Ls 5.3.5/16	.	15'2"	@	8.2	=	497
Tie Pls.	2 Pls. 11¾.5/16	.	1'2½	@	12.48	=	30
	4 fills 2¾.5/16	.	1'2½	@	2.92	=	14
Lacing bars	28 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	70
							611 . 4 = 2444
Diagonal M9-L10	4 Required						
main section	2 Ls 6.3½.3/8	.	14'8"	@	11.7	=	343
	2 Ls 6.3½.3/8	.	15'2"	@	11.7	=	356
Tie Pls.	2 Pls. 11¾.5/16	.	1'2½	@	12.48	=	30
	4 fills 3¼.5/16	.	1'2½	@	3.45	=	17
	28 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	70
							816 . 4 = 3264
Diagonal L10-M11	4 Required						
main section	2 Ls 6.3½.7/16	.	15'1¾	@	13.50	=	409
	2 Ls 6.3½.7/16	.	14'7¾	@	13.50	=	396
Tie Pls.	2 Pls. 11¾.5/16	.	1'5½	@	12.48	=	37
	4 fills 3¼.5/16	.	1'5½	@	3.45	=	20
Lacing bars	27 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	68.0
							930 . 4 = 3720
Diagonal M11-L12	4 Required						
main section	2 Ls 6.3½.3/8	.	14'11"	@	11.70	=	350
	2 Ls 6.3½.3/8	.	15'2"	@	11.70	=	355
Tie Pls.	2 Pls. 11¾.5/16	.	1'2½	@	12.48	=	30
	4 fills 3¼.5/16	.	1'2½	@	3.45	=	17
Lacing bars	28 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	70
							822 . 4 = 3288
Diagonal L12-M13	4 Required						
main section	4 Ls 5.3.5/16	.	16'5½	@	8.2	=	540
Tie Pls.	2 Pls. 11¾.5/16	.	1'2½	@	12.48	=	30
	4 fills 2¾.5/16	.	1'2½	@	2.92	=	14
Lacing bars	32 bars 2¼.5/16	.	1'0 5/8	@	2.39	=	80
							664 . 4 = 2656
Diagonal M13-L14	4 Required						
main section	2 Ls 4.3.5/16	.	16'8½	@	7.2	=	241
	2 Ls 4.3.5/16	.	16'5	@	7.2	=	236
Tie Pls.	2 Pls. 11¾.5/16	.	1'0½	@	12.48	=	26
	4 fills 2¾.5/16	.	1'0½	@	2.92	=	12
Lacing bars.	37 bars. 2¼.5/16	.	1'0 5/8	@	2.39	=	93
							608 . 4 = 2432
Diagonal L14-M15	4 Required						
main section	2 Ls 5.3.5/16	.	18'9"	@	8.2	=	308
	2 Ls 5.3.5/16	.	19'2	@	8.2	=	314
Tie Pl.	2 Pls. 11¾.5/16	.	1'0½	@	12.48	=	26
	4 fills 2¾.5/16	.	1'0½	@	2.92	=	12
Lacing bars.	39 bars. 2¼.5/16	.	1'0 5/8	@	2.39	=	98
							758 . 4 = 3032"

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Top Chord M15-M16. 2 Required					
main section	2[s 12 . 3½	. 11'-7"	@ 26.10	=	605
tie Pls.	2Pls 20½ . 3/8	. 2'-2½	@ 26.14	=	116
	1Pl. 20½ . 3/8	. 1'-8½	@ 26.14	=	45
Lacing Bars	14 bars 2½ . 3/8	. 2'-3"	@ 3.19	=	101
M15	4Pls. 28¾ . 3/4	. 1'-7¾	@ 73.31	=	480
	2Pls. 28¾ . 3/4	. 1'-10¾	@ 73.31	=	278
	2fills 19½ . 9/16	. 2'-5½	@ 37.29	=	183
	2Pls. 22½ . ½	. 3'-3½	@ 38.25	=	252
	2Pls. 21 . 3/8	. 3'-2"	@ 26.78	=	170
	2Pls. 12 3/8 . ½	. 1'-1½	@ 21.20	=	48
Gusses	1Pl. 20½ . 3/8	. 2'-7"	@ 26.14	=	68
"	1Pl. 13¾ . 3/8	. 1'-5½	@ 17.54	=	26
diaphragm	2Ls 4 . 3 . 3/8	. 1'-3"	@ 7.2	=	36
	1Pl. 6 . 9/16	. 1'-3"	@ 6.38	=	8
					2416 . 2 = 4832"
Top Chord M15'-M16' 2 Required					
main section	2[s 12 . 3½	. 11'-9"	@ 26.10	=	615
	2Pls. 20½ . 3/8	. 2'-2½	@ 26.14	=	116
	1Pl. 20½ . 3/8	. 1'-8½	@ 26.14	=	45
Lacing bars	14 bars 2½ . 3/8	. 2'-3"	@ 3.19	=	101
M15'	4Pls. 28¾ . 3/4	. 1'-7¾	@ 73.31	=	480
	2Pls. 28¾ . 3/4	. 1'-10¾	@ 73.31	=	278
	2fills 20½ . 9/16	. 2'-5½	@ 39.21	=	193
	2Pls. 23½ . ½	. 3'-3½	@ 39.95	=	264
	2Pls. 23 . 3/8	. 3'-2	@ 29.33	=	186.
	2fills 12 3/8 . ½	. 1'-1½	@ 21.20	=	48
	1Pl. 20½ . 3/8	. 2'-7"	@ 26.14	=	68
	1Pl 13¾ . 3/8	. 1'-5½	@ 17.54	=	26
	2Ls 4 . 3 . 3/8	. 1'-3"	@ 7.2	=	36
	1Pl 6 . 9/16	. 1'-3"	@ 6.38	=	8.
					2464 . 2 = 4928"
Top Chord M16-M17 4 Required					
main section	2[s 12 . 3½	. 12'-2¾	@ 26.10	=	640
Tie Pls.	2Pls. 20½ . 3/8	. 1'-8½	@ 26.14	=	90
Lacing bars	20 bars 2½ . 3/8	. 2'-3"	@ 3.19	=	144
M16	2Pls. 12 . ½	. 1'-10"	@ 20.40	=	75
	2Pls. 10 . 3/8	. 1'-4¾	@ 12.75	=	36
	2Pls. 3½ . ½	. 2'-0½	@ 5.95	=	24
	1Pl 20½ . 3/8	. 2'-0½	@ 26.14	=	53
M17	2Pls. 33 . ½	. 3'-8"	@ 56.10	=	411
	2Pls. 9¾ . 5/16	. 1'-7¾	@ 10.36	=	34
	2fills 9½ . 5/16	. 0'-10"	@ 10.09	=	17
	2Pls. 3½ . ½	. 2'-3"	@ 5.95	=	27
	1Pl. 20½ . 3/8	. 2'-5½	@ 26.14	=	38
					1589 . 4 = 6366"
M17-M18. 4 Required					
main section	2[s 12 . 3½	. 12'-1½	@ 26.10	=	633
	2Pls. 9½ . 5/16	. 12'-1½	@ 10.09	=	244
Tie Pls.	1Pl. 17½ . 3/8	. 1'-8½	@ 22.31	=	38
	1Pl 20½ . 3/8	. 1'-8½	@ 26.14	=	45
Lacing bars.	20 bars 2½ . 3/8	. 2'-3"	@ 3.19	=	144
M18	2Pls. 12 . ½	. 2'-0½	@ 20.40	=	83
	2Pls 9¾ . 3/8	. 1'-7½	@ 12.43	=	40
	2Pls. 3½ . ½	. 2'-3"	@ 5.95	=	27
	1Pl. 20½ . 3/8	. 2'-9"	@ 26.14	=	72
					1326 . 4 = 5304"

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List of Materials for Anabuki-Bashi for Tokushima-Ken.

Top Chord U18-U19 4 Required				
main section	2[s 12. 3½	12'1¼	@ 26.10 =	632
	2 Pls. 9½ . 5/16	12'1¼	@ 10.09 =	244
Tie Pls.	2 Pls. 20½ . 3/8	1'8½	@ 26.14 =	90
	20 bars 2½ . 3/8	2'3"	@ 3.19 =	144
U19	2 Pls. 26½ . ½	3'3½	@ 45.05 =	296
	2 Pls. 9¾ . 3/8	1'7½	@ 12.43 =	40
	2 fill 9½ . 5/16	0'9½	@ 6.06 =	10
	2 Pls. 3½ . 5/8	2'3"	@ 7.44 =	34
	1 Pl. 20½ . ½	2'7½	@ 34.85 =	91
				1581 . 4 = 6324#
Top Chord U19-U20 2 Required				
main section	2[s 12. 3½	12'1"	@ 32.88 =	795
	2 Pls 9½ . 3/8	12'1"	@ 12.11 =	292
Tie Pls.	2 Pls. 20½ . 3/8	1'8½	@ 26.14 =	90
	20 bars 2½ . 3/8	2'3"	@ 3.19 =	144
U20	2 Pls. 12 . ½	2'0½	@ 20.40 =	83
	2 Pls. 9¾ . 3/8	1'7½	@ 12.43 =	40
	2 Pls. 3½ . 5/8	2'3"	@ 7.44 =	34
	1 Pl. 20½ . ½	2'7½	@ 34.85 =	91
				1569 . 2 = 3138
Top Chord U19'-U20' 2 Required				
main section	2[s 12. 3½	12'1"	@ 32.88 =	795
	2 Pls. 9½ . 3/8	12'1"	@ 12.11 =	292
Tie Pls.	2 Pls. 20½ . 3/8	1'8½	@ 26.14 =	90
Lacing bars	20 bars 2½ . 3/8	2'3"	@ 3.19 =	144
				1321 . 2 = 2642#
Bottom Chord L15-L16 2 Required				
main section	2[s 12 . 3½	7'7"	@ 26.10 =	396
Tie Pls.	2 Pls. 11¾ . 3/8	1'2½	@ 14.98 =	36
Lacing bars	26 bars 2¼ . 5/16	1'0⅛	@ 2.39 =	63
L15	1 Pl. 10 . ⅛	1'3"	@ 4.25 =	5
	1 Pl. 10 . ⅛	1'0"	@ 4.25 =	4
	4 Pls. 9½ . ½	2'5½	@ 16.15 =	159
	4 Ls 4 . 3½ . 3/8	1'4"	@ 9.1 =	48
	1 Pl. 9 . 3/8	1'4"	@ 11.48 =	15
Splice	2 Pls. 12 . 3/8	1'3½	@ 15.30 =	40
	2 Pls. 9½ . 3/8	1'3½	@ 12.11 =	31
	2 Pls. 11¾ . 3/8	1'11"	@ 14.98 =	58
				855 . 2 = 1710#
L15-L16' 2 Required				
main section	2[s 12 . 3½	7'9"	@ 26.10 =	405#
all other detail same as above				
			Total	846 . 2 = 1692#
Bottom Chord L16-L18 4 Required				
main section	2[s 12 . 3½	23'10"	@ 26.10 =	1245
Tie Pls.	3 Pls. 11½ . 3/8	0'11¾	@ 14.66 =	43
Lacing bars	74 bars 2¼ . 5/16	1'0⅛	@ 2.39 =	178
L16	2 Pls. 34½ . 3/8	3'6"	@ 43.99 =	308
	1 Pl. 25½ . 3/8	3'1"	@ 32.52 =	100
Diaphragm	4 Ls 4 . 3 . 5/16	0'9½	@ 7.2 =	23
	1 Pl. 9½ . 5/16	0'11¾	@ 10.09 =	9
L17	2 Pls. 18¾ . 3/8	1'9½	@ 23.91 =	85

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Bottom chord L16-L18 Continued						
Diaphragm	4Ls 4.3.5/16	.	0'-9½	@	7.2	= 23
	1Pl. 9½ . 5/16	.	0'-11¼	@	10.09	= 9
Gusset pls.	1Pl. 16½ . 3/8	.	1'-8"	@	21.04	= 35
splice	2Pls. 12 . 3/8	.	1'-8½	@	15.30	= 52
	2Pls. 9½ . 3/8	.	1'-8½	@	12.11	= 41
	2 fills 9 . 1/8	.	0'-10¼	@	3.82	= 7
	2Pls. 11¾ . 3/8	.	1'-11"	@	14.98	= 58
						2216 . 4 = 8864#
Bottom chord L18-L20 2 Required						
main section	2[s 12 . 3½	.	24'-0"	@	32.88	= 1580
	2Pls. 9½ . 3/8	.	22'-0"	@	12.11	= 533
	3Pls. 11½ . 3/8	.	0'-11¾	@	14.66	= 43
	72 bars 2¼ . 5/16	.	1'-0⅛	@	2.39	= 174
L18	2Pls. 29 . 3/8	.	3'-8"	@	36.98	= 271
	1Pl. 20 . 3/8	.	3'-0½	@	26.14	= 79
Diaphragm	4Ls 4 . 3 . 5/16	.	0'-9½	@	7.2	= 23
	1Pl. 9 . 5/16	.	0'-9½	@	9.56	= 9
L19	2Pls 21½ . 3/8	.	1'-11¾	@	27.41	= 109
	1Pl. 16½ . 3/8	.	1'-8"	@	21.04	= 35
diaphragm	4Ls 4 . 3 . 5/16	.	0'-9½	@	7.2	= 23
	1Pl. 9 . 5/16	.	0'-9½	@	9.56	= 8
splice	2Pls. 12 . ½	.	2'-6½	@	20.40	= 104
	2Pls. 9½ . 3/8	.	2'-6½	@	12.11	= 62
	2Pls. 11¾ . 3/8	.	2'-4"	@	14.98	= 70
						3123 . 2 = 6246.
Bottom chord L20'-L18' 2 Required						
main section	2[s 12 . 3½	.	29'-8"	@	32.88	= 1950
	2Pls. 9½ . 3/8	.	27'-8"	@	12.11	= 670
	4Pls. 11½ . 3/8	.	0'-11¾	@	14.66	= 43
	81 bars 2¼ . 5/16	.	1'-0⅛	@	2.39	= 195
L18'	2Pls. 29 . 3/8	.	3'-8"	@	36.98	= 271
	1Pl. 20 . 3/8	.	3'-0½	@	26.14	= 79
	4Ls 4 . 3 . 5/16	.	0'-9½	@	7.2	= 23
	1Pl. 9 . 5/16	.	0'-9½	@	9.56	= 9
L19	2Pls. 21½ . 3/8	.	1'-11¾	@	27.41	= 109
	1Pl. 16½ . 3/8	.	1'-8"	@	21.04	= 35
	4Ls 4 . 3 . 5/16	.	0'-9½	@	7.2	= 23
	1Pl. 9 . 5/16	.	0'-9½	@	9.56	= 8
L20	2Pl. 27 . 3/8	.	2'-11"	@	34.43	= 201
	1Pl. 20 . 3/8	.	3'-0½	@	25.50	= 77
	4Ls 4 . 3 . 5/16	.	0'-9½	@	7.2	= 23
	1Pl 9 . 5/16	.	0'-9½	@	9.56	= 9
						3725 × 2 = 7450#
Verticals U16-L16 4 Required						
main section	2Ls 4 . 3 . 5/16	.	15'-10"	@	7.2	= 228
	2Ls 4 . 3 . 5/16	.	15'-9	@	7.2	= 226
Tie Pls.	1Pl. 11¾ . 5/16	.	2'-2½	@	12.48	= 28
	1Pl. 11¾ . 5/16	.	1'-4½	@	12.48	= 17
Lacing bars	18 bars 2¼ . 5/16	.	1'-0⅛	@	2.39	= 45
						544 . 4 = 2176
Verticals U17-L17 4 Required						
main section	2Ls 4 . 3 . 5/16	.	14'-0¾	@	7.2	= 202
	2Ls 4 . 3 . 5/16	.	14'-0½	@	7.2	= 202
	1Pl. 8¼ . 3/8	.	1'-3¾	@	10.52	= 14

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Vertical U17-L17 continued						
Tie Pls.	1 Pl. 11¾ . 5/16	. 2'2½	@	12.48	=	28
	1 Pl. 11¾ . 5/16	. 2'2"	@	12.48	=	27
	14 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	35
						508 . 4 = 2032
Verticals U18-L18	4 Required					
main section	4 Ls 4 . 3 . 5/16	. 12'10 5/8	@	7.2	=	371
	1 Pl. 8¼ . 3/8	. 0'8½	@	10.52	=	7
	1 Pl. 11¾ . 5/16	. 2'2½	@	12.48	=	28
	1 Pl. 11¾ . 5/16	. 1'6"	@	12.48	=	19
	13 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	33
						458 . 4 = 1832
Verticals U19-L19	4 Required					
main section	4 Ls 4 . 3 . 5/16	. 12'2"	=	7.2	=	350
	1 Pl. 8¼ . 3/8	. 1'3¾	@	10.52	=	14
Tie Pls.	1 Pl. 11¾ . 5/16	. 2'2½	@	12.48	=	28
	1 Pl. 11¾ . 5/16	. 1'9½	@	12.48	=	22
Lacing bars	13 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	30
						444 . 4 = 1776
Verticals U20-L20	2 Required					
main section	4 Ls 4 . 3 . 5/16	. 11'10½	@	7.2	=	341
	1 Pl. 8¼ . 3/8	. 0'11½	@	10.52	=	10
	1 Pl. 11¾ . 5/16	. 2'2½	@	12.48	=	28
	1 Pl. 11¾ . 5/16	. 1'6"	@	12.48	=	19
	13 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	33
						431 . 2 = 862
Diagonals U15-L16	4 Required.					
main section	2 Ls 6 . 3½ . 3/8	. 18'5"	@	11.7	=	431
	2 Ls 6 . 3½ . 3/8	. 18'8"	@	11.7	=	436
	1 Pl. 11¾ . 5/16	. 1'5½	@	12.48	=	18
	2 fills 3¼ . 5/16	. 1'5½	@	3.45	=	10
	1 Pl. 11¾ . 5/16	. 1'10"	@	12.48	=	23
	2 fills 3¼ . 5/16	. 1'10"	@	3.45	=	13
	38 bars 2¼ . 5/16	. 1'0"	@	2.39	=	91
						1022 . 4 = 4088
Diagonal L16-U17	4 Required					
main section	4 Ls 6 . 3½ . 3/8	. 16'7½	@	11.7	=	778
	2 Pls. 11¾ . 5/16	. 1'5½	@	12.48	=	18
	4 fills 3¼ . 5/16	. 1'5½	@	3.45	=	10
	34 bars 2¼ . 5/16	. 1'0"	@	2.39	=	81
						887 . 4 = 3548
Diagonal U17-L18	4 Required					
main section	4 Ls 5 . 3 . 3/8	. 16'6½	@	9.8	=	649
	2 Pls. 11¾ . 5/16	. 1'4½	@	12.48	=	17
	4 fills 2¾ . 5/16	. 1'4½	@	2.92	=	16
	32 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	80
						762 . 4 = 3048
	(5/16) 15-8-24 変更					
Diagonal L18-U19	4 Required					
main section	4 Ls 5 . 3 . (3/8)	. 15'1"	@	9.8	=	592
	2 Pls. 11¾ . 5/16	. 1'1"	@	12.48	=	13
	4 fills 2¾ . 5/16	. 1'1"	@	2.92	=	12
	30 bars 2¼ . 5/16	. 1'0 5/8	@	2.39	=	75
						692 . 4 = 2768

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Diagonals U19-L20 4 Required

main section	4 Ls 4×3×5/16	× 15'-0"	@ 7.2	=	432
	2 Pls. 11½×5/16	× 0'-11¾	@ 12.22	=	24
	4 fills 2¾×5/16	× 0'-11½	@ 2.92	=	11
	30 bars 2¼×5/16	× 1'-0 5/8	@ 2.39	=	75
					542. × 4 = 2168#

Summary for truss members.

Side span and Canti-lever Arm

Weight of Top chords	middle chord	web members
7064	3336	5624
4578	4392	5584
4930	5152	36240
4300	6068	2566
34824	3560	2566
9752	5424	2464
15304	5044	2384
15200	6072	2716
15296	6416	2776
15232	5132	2828
5194	50596#	2420
5120		2192
105,454	web members	2444
Weight of Bottom chord	1644	3204
8808	1844	3720
7900	2104	3288
9388	2400	2656
9704	2540	2432
11828	6648	3032
13096	7880	125912#
7344	5552	
3808	4104	
71,876	Continued to next col.	

Summary for side spans complete

Top chord	105.454
bott chord	71876
middle chord	50596
web member	125912
	353.838#

Center span

Top chord	4832	web.	2176
	4928		2032
	6366		1832
	5304		1776
	6324		862
	3138		4088
	2642		3548
	33534#		3048
Bottom chord	1710		2768
	1692		2168
	8864		24298
	6246		
	7450		
	25962#		

Summary for center span

Top chord	33.534
bottom chord	25.962
web members	24298
	83.794#

Grand Summary 437.632#

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Stringers 8 Required (2-S1, 2-S2, 2-S8 & 2-S9)						
	8 I.	10 × 5	× 13'-3¾	@ 29.99	= 3194	
	2 fills	5½ × 1¾	× 0'-5	@ 32.73	= 27	
	2 〃	5 × 2	× 0'-5½	@ 34.00	= 31	
	2 〃	5 × 3¾	× 0'-5½	@ 63.75	= 58	
Splice	16 Pls.	5½ × 5/16	× 0'-7½	@ 5.84	= 58	
						3368#
Stringers 144 Required (140-S3 & 4-S10)						
	140 I.	10 × 5	× 11'-11½	@ 29.99	= 50207	
splice	280 Pls.	5½ × 5/16	× 0'-7½	@ 5.84	= 1022	
						51229#
Stringers 4 Required (2-S4 & 2-S5)						
	4 I.	10 × 5	× 11'-10¼	@ 29.99	= 1422	
	2 fills	5 × 1¾	× 0'-5½	@ 29.75	= 27	
						1449#
Stringers 4 Required (2-S6 & 2-S7)						
	4 I.	10 × 5	× 11'-10¼	@ 29.99	= 1422	
Base	4 Pls.	10⅜ × 3/8	× 1'-0½	@ 13.23	= 55	
	8 fills	5½ × 5/16	× 0'-7½	@ 5.84	= 29	
	2 〃	5½ × 5/16	× 0'-5	@ 〃	= 5	
						1511#
Expansion joint EX 1 Required						
flange	4 Ls.	3 × 3 × 5/16	× 18'-0	@ 6.1	= 439	
Web.	2 Pls.	6½ × 3/8	× 18'-0	@ 8.29	= 298	
checkered	1 Pl.	9½ × 3/8	× 18'-11½	@ 12.11	= 230	
	1 Pl.	6 × 3/8	× 19'-0½	@ 7.65	= 146	
bar	1 Pl.	1½ × 3/8	× 18'-11½	@ 1.91	= 36	
Anchors	14 Pls.	3 × 5/16	× 1'-2	@ 3.19	= 52	
						1201#
Edge Steel ES1 2 Required						
	2 Ls.	3 × 3 × 5/16	× 18'-2	@ 6.1	= 222	
						222#
End Floor Beams EFB 2 Required						
flange	8 Ls.	5 × 3½ × 5/16	× 19'-6¼	@ 8.7	= 1359	
Web	2 Pls.	22 × 5/16	× 19'-6¼	@ 23.38	= 913	
Stiffener	8 Ls.	3½ × 3½ × 3/8	× 1'-9⅞	@ 8.5	= 124	
〃	16 Ls.	4 × 3 × 5/16	× 1'-9⅞	@ 7.2	= 210	
〃	12 Ls.	〃	× 1'-10½	@ 〃	= 162	
	8 fills	3½ × 5/16	× 1'-3¼	@ 3.72	= 38	
	4 〃	8 × 3/4	× 0'-10¼	@ 20.4	= 70	
	16 〃	3 × 5/16	× 1'-3¼	@ 3.19	= 65	
	8 Pls.	10½ × 3/8	× 0'-10 5/16	@ 13.39	= 92	
						3033#
Intermediate floor beams 35 Required (18-FB1 & 17-FB2)						
flange	140 Ls.	5 × 3½ × 3/8	× 19'-8	@ 10.4	= 28635	
Web	35 Pls.	22 × 5/16	× 19'-8	@ 23.38	= 11093	
stiff.	140 Ls.	3½ × 3½ × 3/8	× 1'-9¾	@ 8.5	= 2157	
〃	280 Ls.	4 × 3 × 5/16	× 1'-9¾	@ 7.2	= 3655	
〃	210 Ls.	〃	× 1'-10½	@ 〃	= 2835	
	140 fills.	3½ × 3/8	× 1'-3¼	@ 4.46	= 794	
	280 fill	3 × 3/8	× 1'-3¼	@ 3.83	= 1366	
	140 Pls.	10½ × 3/8	× 0'-10 5/16	@ 13.39	= 1626	
						57147#

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Intermediate floor beams 2 Required (FB3)

Flange	8 Ls.	5×3½×½	×	19'-6 3/8	@	13.60	=	2123	
Web	2 Pls.	22× 3/8	×	19'-6 3/8	@	28.05	=	1090	
Stiffeners	8 Ls.	3½×3½×3/8	×	1'-9½	@	8.5	=	122	
"	16 Ls.	4×3×5/16	×	1'-9½	@	7.2	=	206	
"	12 Ls.	"	×	1'-10½	@	"	=	162	
	8 fills	3½×½	×	1'-3¼	@	5.95	=	60	
	16 "	3×½	×	1'-3¼	@	5.1	=	104	
	8 Pls.	10½×3/8	×	0'-10 5/16	@	13.39	=	92	
									3959#

Inter. floor beams 1 Required (FB4)

Flange	4 Ls.	5×3½×3/8	×	19'-8	@	10.4	=	818	
Web	1 Pl.	22×5/16	×	19'-8	@	23.38	=	460	
Stiffener	4 Ls.	3½×3½×3/8	×	1'-9¾	@	8.5	=	62	
"	10 Ls.	4×3×5/16	×	1'-9¾	@	7.20	=	131	
"	4 Ls.	"	×	1'-10½	@	"	=	54	
	4 fills	3½×3/8	×	1'-3¼	@	4.46	=	23	
	4 "	6¼×3/8	×	1'-3¼	@	7.96	=	41	
	2 "	3×3/8	×	1'-3¼	@	3.83	=	10	
	1 fill	2½×3/8	×	3'-1½	@	3.19	=	10	
	8 Ls.	6×4×3/8	×	0'-5	@	12.3	=	41	
	8 Ls.	4×3×5/16	×	0'-5	@	7.2	=	24	
	4 Pls.	9¾×5/16	×	1'-9 5/8	@	10.36	=	33	
	4 Pls.	9 7/8×3/8	×	0'-11½	@	11.66	=	47	
									1754#

Inter. floor beams 1 Required (FB5)

Flanges	4 Ls.	5×3½×3/8	×	19'-8	@	10.4	=	818	
Web	1 Pl.	22×5/16	×	19'-8	@	23.38	=	460	
Stiff.	4 Ls.	3½×3½×3/8	×	1'-9¾	@	8.50	=	62	
"	10 Ls.	4×3×5/16	×	1'-9¾	@	7.2	=	131	
"	4 Ls.	"	×	1'-10½	@	"	=	54	
	4 fills	3½×3/8	×	1'-3¼	@	4.46	=	23	
	10 "	3×3/8	×	1'-3¼	@	3.83	=	49	
	1 "	2½×3/8	×	3'-1½	@	3.19	=	10	
	4 Pls.	10½×3/8	×	0'-10 5/16	@	13.39	=	46	
									1653#

Bottom lateral bracings Required (BL1 R/L ~ BL9 R/L)

BL1 R/L	4 Ls.	4×3×3/8	×	13'-9 1/8	@	8.5	=	468	
	4 Ls.	"	×	13'-4 1/8	@	"	=	454	
BL1 R/L	32 Ls.	4×3×5/16	×	13'-10 1/8	@	7.2	=	3190	
	32 Ls.	"	×	14'-3 1/8	@	"	=	3286	
BL4 R/L, BL5 R/L, BL7 R/L	20 Ls.	5×4×3/8	×	13'-10	@	11.0	=	3043	
	20 Ls.	"	×	14'-4	@	"	=	3175	
BL6 R/L	8 Ls.	"	×	13'-3¼	@	"	=	1118	
	8 Ls.	"	×	13'-10¾	@	"	=	1223	
BL8 R/L	4 Ls.	"	×	13'-10¾	@	"	=	654	
	4 Ls.	"	×	14'-3¾	@	"	=	630	
BL9 R/L	4 Ls.	"	×	12'-7	@	"	=	554	
	4 Ls.	"	×	12'-9½	@	"	=	563	
BL3 R/L	8 Ls.	4×3×3/8	×	14'-3 1/8	@	8.5	=	970	
	8 Ls.	"	×	13'-10 1/8	@	"	=	941	
Gussets	8 Pls.	29×3/8	×	2'-8½	@	36.98	=	801	
"	4 Pls.	26½×3/8	×	2'-2½	@	33.79	=	298	
"	4 Pls.	30×3/8	×	2'-8½	@	38.25	=	414	
"	4 Pls.	30½×3/8	×	2'-8½	@	38.89	=	421	
									22203#

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Struts ST1 2 Required					
	4 ∟s. 4 × 3½ × 3/8 ×	19′-7¾	@ 9.1 =	715	
	4 ∟s. 5 × 3½ × 3/8 ×	19′-7¾	@ 10.4 =	817	
	4 ∟s. 5 × 5 × 3/8 ×	2′-8	@ 12.3 =	131	
	2 Pls. 31 × 3/8 ×	2′-8	@ 39.53 =	211	
	8 ∟s. 5 × 3½ × 3/8 ×	0′-10½	@ 10.4 =	73	
	8 fill. 3½ × 3/8 ×	0′-4¾	@ 4.46 =	11	
					1958#
Top Lateral Bracings Required (TL1R/L ~ TL6R/L)					
TL1R/L	4 ∟s. 5 × 4 × 3/8 ×	14′-2	@ 11.0 =	623	
	4 ∟s. 〃 ×	14′-4½	@ 〃 =	633	
TL2R/L	8 ∟s. 〃 ×	14′-3	@ 〃 =	1254	
	8 ∟s. 〃 ×	14′-5½	@ 〃 =	1272	
TL3R/L	8 ∟s. 〃 ×	14′-4½	@ 〃 =	1265	
	8 ∟s. 〃 ×	14′-7	@ 〃 =	1283	
TL4R/L	8 ∟s. 〃 ×	14′-6	@ 〃 =	1276	
	8 ∟s. 〃 ×	14′-8½	@ 〃 =	1294	
TL5R/L	8 ∟s. 〃 ×	14′-8½	@ 〃 =	1294	
	8 ∟s. 〃 ×	14′-11	@ 〃 =	1313	
TL6R/L	8 ∟s. 〃 ×	13′-0¾	@ 〃 =	1150	
Gusset	16 Pls. 17 × 3/8 ×	2′-2	@ 21.68 =	752	
〃	2 Pls. 26 × 3/8 ×	2′-2	@ 33.15 =	144	
					13553#
Struts 22 Required (TS1 ~ TS9)					
Flange	88 ∟s. 4 × 3 × 5/16 ×	19′-0	@ 7.2 =	12038	
Lacing bars	440 bars 2 × 5/16 ×	1′-2 5/16	@ 2.13 =	1123	
Tie	44 Pls. 12½ × 5/16 ×	1′-0	@ 13.28 =	584	
〃	22 Pls. 〃 ×	1′-2½	@ 〃 =	353	
					14098#
Sway bracings 2 Required					
	4 ∟s. 4 × 3 × 3/8 ×	21′-2	@ 8.5 =	720	
	8 ∟s. 3 × 3 × 5/16 ×	18′-11½	@ 6.1 =	925	
	4 ∟s. 4 × 3 × 3/8 ×	18′-11½	@ 8.5 =	645	
Stiffeners	8 ∟s. 2½ × 2 × 5/16 ×	3′-0½	@ 4.5 =	110	
〃	8 ∟s. 〃 ×	2′-7	@ 〃 =	93	
〃	8 ∟s. 〃 ×	2′-2¾	@ 〃 =	80	
〃	8 ∟s. 3½ × 2½ × 5/16 ×	2′-0	@ 6.1 =	98	
〃	4 ∟s. 〃 ×	1′-11¼	@ 〃 =	49	
〃	36 ∟s. 2½ × 2 × 5/16 ×	12′-9⅜	@ 4.5 =	2104	
Ring washer	72 Wash. 2¼ ×	0′-1 1/16	@ 13.52 =	81	
Stiff.	36 ∟s. 2½ × 2 × 5/16 ×	1′-6½	@ 4.5 =	250	
Connecting	8 ∟s. 3½ × 3½ × 3/8 ×	2′-7¾	@ 8.5 =	180	
〃	8 ∟s. 〃 ×	5′-6¾	@ 〃 =	378	
〃	8 ∟s. 〃 ×	2′-1½	@ 〃 =	145	
	8 fills 2½ × 3/8 ×	2′-6	@ 3.19 =	64	
	8 〃 〃 ×	2′-1	@ 〃 =	53	
	8 〃 〃 ×	1′-9½	@ 〃 =	46	
	8 〃 〃 ×	1′-6	@ 〃 =	38	
	4 〃 〃 ×	1′-5¾	@ 〃 =	19	
	72 〃 2½ × 5/16 ×	0′-11	@ 2.66 =	176	
	20 〃 2¼ × 5/16 ×	2′-1¼	@ 2.39 =	101	
	4 Pls. 14 × 5/16 ×	19′-6	@ 14.88 =	1168	
	2 〃 18 × 5/16 ×	19′-6	@ 19.13 =	746	
	2 〃 52¼ × 5/16 ×	19′-6	@ 55.55 =	2166	
	4 Pls. 25¼ × 5/16 ×	2′-2¼	@ 26.83 =	235	
	16 Pls. 〃 ×	2′-1¼	@ 〃 =	903	

増田淳氏関係資料
(独立行政法人 土木研究所蔵)

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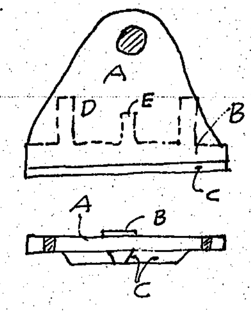
	36 fill. $2\frac{1}{2} \times \frac{3}{8} \times$	1'-0$\frac{1}{2}$	@ 3.19		117
	8 L. $3 \times 3 \times \frac{3}{8} \times$	18'-11$\frac{1}{2}$	@ 7.2		1092
	2 Pl. $26 \times \frac{3}{8} \times$	2'-2	@ 33.15		144
					12926#

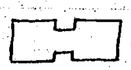
Shoe for Lo 4 Required

dust guard	2 Pl. $4\frac{3}{8} \times \frac{5}{16} \times$	1'-0	@ 4.65		39
〃	2 Pl. $2\frac{1}{2} \times \frac{3}{8} \times$	1'-4	@ 3.19		39



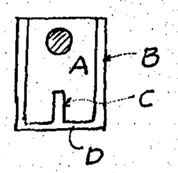
	A	$\left(\frac{19+13.5-4\times3}{2} - 4^2\times\frac{\pi}{4}\right)\times 2$	=	251.5
	B	$19 \times 12.13 \times 1$	=	231.
	C	$1.5 \times 0.5 \times 19$	=	14.25
	D	$5.5 \times 0.75 \times 10.13 \times 2$	=	84.
	E	$4 \times 0.75 \times 10.13$	=	34.
Base	A	$21.75 \times 20 - 1.88^2 \times \frac{\pi}{4} \times 4$	=	424
〃	B	$1.44 \times 0.5 \times 20$	=	14.4
〃	C	$1.25 \times 1.5 \times 16 \times 2$	=	60 in³
				1113.15 @ 0.283 → 315
				333 × 4 = 1332#

Rollers for Lo 16 Required



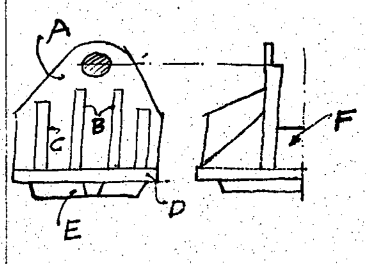
A	$4^2 \times \frac{\pi}{4} \times 4.88 \times 2$	=	122.5
B	$3^2 \times \frac{\pi}{4} \times 1.5$	=	10.6 in³
			133.1 @ 0.283 — 37.7 × 16 = 603#

Cast steel piece for Lo 8 Required



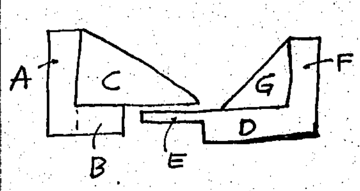
A	$16 \times 26 \times 0.75 - 4^2 \times \frac{\pi}{4} \times 0.75$	=	311
B	$3.25 \times 0.75 \times 26 \times 2$	=	127
C	$\frac{7 \times 3.25}{2} \times 1$	=	11.4
D	$16 \times 1 \times 4 - 1.88 \times 3 \times 2$	=	52.72 in³
			502.12 @ 0.283 — 142.8 = 1136#

Cast Steel Shoe for L10 4 Required



A	$(8.5 \times 5.25 \times 0.75 - 6^2 \times \frac{\pi}{4} \times 0.75 \times \frac{1}{2} + 6 \times 36 \times 2 + 24.25 \times 13.13 \times 2 - 6^2 \times \frac{\pi}{4} \times 2 \times \frac{1}{2}) \times 2$	=	2129.4
B	$(8.5 \times 9 \times 1.25 + \frac{9+7.5}{2} \times 1.25) \times 2$	=	275.6
C	$(9+12) \times \frac{1}{2} \times 1.25 \times 2$	=	13.5
D	$1.5 \times 36^2 - 1.88^2 \times \frac{\pi}{4} \times 1.5 \times 6$	=	1897
E	$1.25 \times 1.5 \times 30 \times 2$	=	112.4
F	$12 \times 13.5 \times 1.25 \times 4$	=	810. in³
			5359.4 @ 0.283 — 1517.4 = 6068#

Expansion joint of Bottom lateral 2 Required



A	$0.75 \times 4.38 \times 11.75 \times 2$	=	77.4
B	$2.5 \times 1.5 \times 11.75 \times 2$	=	88.4
C	$4.38 \times 7.5 \times 0.75 \times \frac{1}{2} \times 2$	=	24.6
D	$1.63 \times 8.5 \times 12.75 \times 2$	=	354.
E	$7 \times 1 \times 9$	=	63.
F	$0.75 \times 4.25 \times 26.5$	=	84.5
G	$1 \times 4.25 \times 7.5 \times \frac{1}{2}$	=	15.9 in³
			707.8 @ 0.283 — 200 × 2 = 400#

8 3

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MADE BY Y. Hirata DATE 15-7-20 FILE NO
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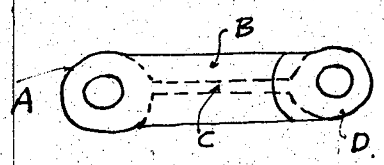
CALCULATIONS FOR

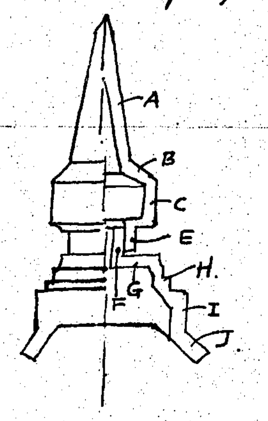
Lists of materials for Anabuki-Bashi for Tokushima-Ken

Cast steel at U15 2 (4) Required



A	$\frac{\pi}{4} \times 6.63 \times (7.5^2 - 4.5^2)$	=	188		
B	$6 \times 1.5 \times 14.5 \times 2$	=	261		
C	$3.63 \times 14.5 \times 1.5$	=	78.4		
D	$\frac{\pi}{4} \cdot 3.88 \cdot (7.5^2 - 4.5^2) \times 2$	=	220		
			747.4 in³ @ 0.283	=	212 × (4) 2 = ~~848~~ 424#

Cast Iron Cap for U10 & U10' CAP 4 Required



A	$33 \times 0.75 \times 7 \times 4$	=	693
B	$4 \times 0.75 \times 10.5 \times 4$	=	126
C	$4.5 \times 0.75 \times 14 \times 4$	=	189
E	$5 \times 0.75 \times 14 \times 4$	=	210
F	$4 \times 0.75 \times 14 \times 4$	=	168
G	$5 \times 0.75 \times 16 \times 4$	=	240
H	$1.25 \times 4 \times 16 \times 4$	=	320
I	$0.75 \times 4.5 \times 18 \times 4$	=	243
J.	$0.75 \times 5 \times 19.5 \times 4$	=	293

2482 in³ @ 0.26 = 645 × 4 = 2580#

Cast Iron Collar for Pin L15' 2 Required

$(6^2 - 4.5^2) \times \frac{\pi}{4} \times 6.63$ = 81.7 in³ @ 0.26 = 21 × 2 = 42#

Pins for L0 4 Required
4- 4"φ × 1'-6 @ 42.73 = 256
8 nuts @ 3.7 = 30
286#

Pins for L10 4 Required
4- 6"φ × 1'-10 @ 96.13 = 705
8 nuts @ 7.8 = 62
767#

Pins for U15 2 Required
2- 4½"φ × 0'-11 @ 54.07 = 100
4 nuts @ 2.5 = 10
110#

Pins for U15 U15' 4 Required
4- 4½"φ × 1'-5¾ @ 54.07 = 320
8 nuts @ 4.6 = 37
357#

Pins for L15 4 Required
4- 3"φ × 1'-4 @ 24.03 = 128
8 nuts @ 2.5 = 20
148#

Anchor Bolts for Shoe L10 24 Required
$(9 + 2.25) \times 22.5 \times \frac{1}{2}$ = 126.5
$1.5^2 \times \frac{\pi}{4} \times 7.5$ = 13.25
139.75 in³ @ 0.283 = 39.6
nuts @ 2.95 = 2.95
~~42~~.55 × 24 = 1024#

Anchorage for L0 4 Required.

Bolts	16 Bolt 1½"φ	× 5'-6	@ 6.0	=	528
	8 [. 6 × 3	× 3'-0	@ 14.49	=	348
	16 [. "	× 2'-0	@ "	=	464
	8 Pl. 5 × 5/16	× 1'-3¾	@ 5.31	=	56
	4 Pl. 15½ × 5/16	× 2'-2	@ 16.47	=	143
	16 Wash. 3"φ × 3/8			=	12
Bolts head & nuts	32		@ 2.95	=	94

1645#

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CALCULATIONS FOR

Lists of materials for Anabuki-Bashi for Tokushima-Ken.

Summary for stringers see p M17

stringer	3368
"	51229
"	1449
"	1511
Expansion of floor	1201
edge steel	222
	58980

Summary for Floor Beams

End Floor beam	3033
Interm. F.B.	57147
"	3959
"	1754
"	1653
	67546#

Bottom laterals

diagonals	22203
strut	1958
	24161#

Top laterals.

diagonal	13553
strut	14098
sways	12926
	40577#

Shoes at L0. Cast steel.

shoe	1332	
roller	603	
cast steel piece	1136	
	3071	
without roller	2468	cast steel only
	603.	forged steel

Shoes at L10 6068#

misc. cast steel.

Rocker	424
Expansion for lateral	400
	824

Cast iron ornamental piece at L0 2580
cast iron collar L10 42
2622#

Pins. 286
767
110
357
148
1668#

Structural Steel anchor bolts and —
anchor bolts L10 1024
anchorage. L0 1645
2669#

Summary for

shoes.	3071
"	6068
Cast steel	824
cast iron	2622
Pins	1668
anchorage	2669
	16922#

Summary for structural steel in truss.

trusses complete	437,632#
stringers &c	58980
Floor Beams	67546
Bottom laterals.	24161
shoes & misc	16922
	605241#
Top lateral complete	40577
	645818
Rivet heads & variation 5%	32291
	678109# — 302.727 tons

54' girder span.
material for one span.
main girder 2 Required

web plate	G3R	1 Pl.	42 × 3/8	10' 11½	@	53.55 =	586.82
	G4R	1 Pl.	42 × 3/8	32' 1"	@	53.55 =	1718.06
	G3AR	1 Pl.	42 × 3/8	10' 11½	@	53.55 =	586.82
flanges.		8 Ls	6.6.3/8	10' 11½	@	14.9 =	1306.24
		4 Ls	6.6.3/8	32' 1"	@	14.9 =	1912.16
Cover plates		2 Pls.	13 × ½	34' 5"	@	22.1 =	1521.22
stiffeners		8 Ls	5 × 3½ × ½	3' 5¾	@	13.6 =	378.54
		3 Ls	5 × 3½ × 3/8	3' 5¾	@	10.4 =	108.55
		23 Ls	5 × 3½ × 3/8	3' 6½	@	10.4 =	847.04
		4 Ls	5 × 3½ × 3/8	3' 6¾	@	10.4 =	141.26
filler		4 Pls.	3½ × 3/8	2' 5½	@	4.46 =	43.86
"		11 Pls.	3½ × 3/8	2' 6½	@	4.46 =	123.67
splice		8 Ls	6 × 5 3/8 × ½	3' 0½	@	19.00 =	462.08
		4 Pls.	12½ × 3/8	2' 6¼	@	15.94	160.73

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

Conn. Ls	2Ls	4.3.3/8	0'5"	@ 8.5	=	7.08
	8Ls	4.3.3/8	0'10"	@ 8.5	=	56.64
Sole plate	2Pls.	15.3/4	1'9"	@ 38.3	=	134.05
	1Pl.	3".3/4	1'3"	@ 2.55	=	3.19
						10098.01
			2@10098 = 20196#			
Floor Beam	5 Required					
web.	2Pls.	14.5/16	2'3½"	@ 14.88	=	68.20
	1Pl.	18.5/16	12'5"	@ 19.13	=	237.59
flange	2Ls	3.3.5/16	14'9⅛	@ 6.1	=	180.08
	2Ls	3.3.5/16	14'0¾	@ 6.1	=	171.56
Stiffener	4Ls	3.2½.5/16	1'5¾	@ 5.6	=	33.13
	10Ls	3.2½.5/16	1'6½	@ 5.6	=	86.33
filler	4Pls.	5¼.5/16	1'0¼	@ 5.58	=	22.78
Connection L	2Ls	5.3½.3/8	0'10½	@ 10.4	=	18.20
"	2Pls	9½.3/8	1'0½	@ 12.11	=	26.25
						844.12
				5@844.12 = 4220.6#		
Stringers						
S3	4Is	12.5"	14'1⅜	@ 31.99#	=	1806.10
S4	4Is.	12.5"	12'10"	@ 31.99	=	1642.15
Connection Pls.	12Pls.	8½.5/16	0'6"	@ 9.03	=	54.18
						3502.43#
Lateral Bracings	4 Required					
Diagonal	2Ls	4.3.5/16	18'4⅝	@ 7.2	=	264.75
"	4Ls	4.3.5/16	8'10 13/16	@ 7.2	=	256.35
Conn	1Pl.	6.½	1'10"	@ 10.20	=	18.70
						539.80
				4@539.80 = 2159.2#		
Gusset Plates.						
	4Pls.	12.3/8	1'11¼	@ 15.30	=	118.57
	6Pls.	12.3/8	2'4"	@ 15.30	=	214.20
						332.77
Expansion Joint	2 Required					
	1L	3.3.5/16	18'2"	@ 6.1	=	112.85
	2Pls.	3.½	1'2½	@ 5.1	=	12.32
						125.17
					2@125.17 = 250.34	
Bed Pls.	4Pls.	15½.1"	1'9½	@ 52.7	=	377.69
	4-	2½Ø	2'1"	@ 7.65	=	63.75
Anchor bolts	12-	1¼"Ø	2'0"	@ 10.07		241.68
washers	12-	6".3/8	0'6"	@ 7.65		45.90
						729.02

Summary for structural steel.

main girders	20196.
Floor beams.	4220
Stringers	3502
Lateral	2159
Gusset pls	333
Expansion	250
Bed Pls etc	729
	31389#
Rivet heads	1321
	32710# or 14.602 tons

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

60' girder span

web pl. G1R	1Pl.	42 × 3/8	× 13'-10½	@ 53.55	=	743.01
G2R	1Pl.	42 × 3/8	× 32'-3	@ 53.55	=	1726.99
1G1AL	1Pl.	42 × 3/8	× 13'-10½	@ 53.55	=	743.01
flange	8Ls	6.6.½	× 13'-10½	@ 19.6	=	2175.60
	4Ls	6.6.½	× 32'-3	@ 19.6	=	2528.40
Cov. pls.	2Pls.	14.½	× 35'-1"	@ 23.80	=	1669.97
stiffs	8Ls	5×3½×½	× 3'-5½	@ 13.60	=	376.26
	3Ls	5×3½×3/8	× 3'-5½	@ 10.4	=	107.90
	27Ls	5×3½×3/8	× 3'-6½	@ 10.4	=	994.50
fills	11Pls.	3½×½	× 2'-6¼	@ 5.95	=	165.00
splice	8Ls	6.5½.½	× 2'-10	@ 19.00	=	430.66
	4Pls.	12.3/8	× 2'-0	@ 15.30	=	122.40
	8Pls.	3 × ½	× 2'-10"	@ 5.10	=	115.60
Conn L	2Ls	4×3×3/8	× 0'-5"	@ 8.5	=	7.08
	8Ls	4×3×3/8	× 0'-10	@ 8.5	=	56.64
Sole plate	2Pls.	15×3/4	× 1'-9	@ 38.3	=	134.05
	2Pls.	3 × ¼	× 1'-3	@ 2.55	=	3.19
						12110.00

2@ 12110 = 24220#

Floor Beam 2 Required

web.	2Pls	14 × 5/16	× 2'-3½	@ 14.88	=	68.20
	1Pl.	18 × 5/16	× 12'-5"	@ 19.13	=	237.59
flange	2Ls	3.3.5/16	× 14'-9⅛	@ 6.10	=	180.08
	2Ls	3.3.5/16	× 14'-0¾	@ 6.10	=	171.56
stiffs	4Ls	3.2½ × 5/16	× 1'-5¾	@ 5.60	=	33.13
	10Ls	3.2½.5/16	× 1'-6½	@ 5.60	=	86.33
fill.	4Pls	5¼.5/16	× 1'-0¼"	@ 5.58	=	22.78
Con L.	2Ls	5×3½.3/8	× 0'-10½	@ 10.4	=	18.20
	2Pls.	9½ . 3/8	× 1'-0½	@ 12.11	=	26.25
						844.50

2@ 1689.0#

Floor Beam 3 Required

web.	2Pls.	14.5/16	× 2'-3½	@ 14.88	=	68.20
	1Pl.	18 × 5/16	× 12'-5"	@ 19.13	=	237.59
flanges.	2Ls	3.3.3/8	× 14'-9⅛	@ 7.2	=	212.55
	2Ls	3.3.3/8	× 14'-0¾	@ 7.2	=	202.50
stiffs	4Ls	3.2½.5/16	× 1'-5¾	@ 5.6	=	33.13
	10Ls	3.2½.5/16	× 1'-6½	@ 5.6	=	86.33
fills.	4Pls.	5¼.3/8	× 1'-0¼	@ 6.69	=	27.32
Conn L	2Ls	5×3½.3/8	× 0'-10½	@ 10.4	=	18.20
	2Pls	9½ . 3/8	× 1'-0½	@ 12.11	=	22.77
						922.5

3@ 922.5 = 2767.5

Stringers

S1	4Is	12" . 5"	× 15'-7⅜	@ 31.99	=	2000
S2	4Is	12 . 5"	× 14'-4	@ 31.99	=	1836
Conn	12Pls.	8½.5/16	× 0'-6	@ 9.03	=	54
						3890#

Lateral Bracing 4 Required

	2Ls	4×3×5/16	× 19'-4½	@ 7.2	=	279.
	4Ls	4.3.5/16	× 9'-4¾	@ 7.2	=	270.60
Con	1Pl.	6.½	× 1'-10	@ 10.20	=	18.70
						568.30#

4@ 568.30 = 2273.20

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken

Gusset plates 4 Pls. 12½ . 5/16 . 1'-10" @ 13.28 = 97.39
6 Pls. 12½ . 5/16 . 2'-2½ @ 13.28 = 175.96
273.35

Expansion Joint 2 Required
1L 3.3.5/16 . 18'-2" @ 6.1 = 113.0
2Pls. 3 . ½ . 1'-2½ @ 5.1 = 12.
125.0

2@125.0 = 250#

Bed Plates &c
4 Pls. 15½ . 1" . 1'-9½ @ 52.7 = 377.69
4- 2¾"0" . 2'-1" @ 7.65 = 63.75
Anchor bolts. 12- 1¾" . 2'-0" @ 10.07 = 241.68
12 6"-3/8 . 0'-6- @ 7.65 = 45.90
729.02#

Summary for metal.

main girders	24220
Floor beams	4457
Stringers	3890
Laterals	2273
Gusset pls.	273
Expansion	250
Bed plates &c	729

36092
Rivet heads say 1414
37506# or 16.744 tons.

Summary for girder spans.
12 - 60' spans @ 16.744 = 200.928
3 - 54' spans @ 14.602 = 43.806
244.734 tons.

15-2-24. 追加 Bracket 78-Req'd.
4L. 4.3.5/16 . 1'-2¾ @ 7.2 = 34
1 Pl. 14½ . 5/16 . 1'-2¾ @ 15.15 = 18
52 × 78 = 4,056#

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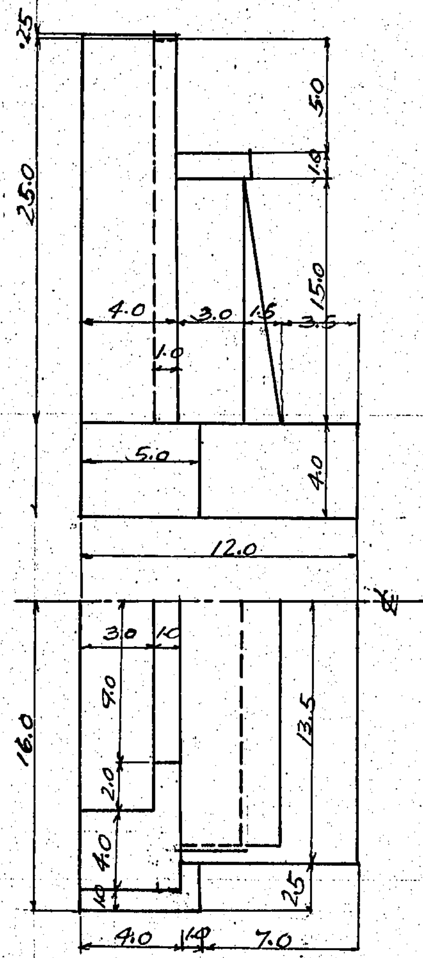
CALCULATIONS FOR

List of Materials for Anabukibashi for Tokushima-Ken.

Abutment A1:



Concrete 1:2:4

parapet wall	2.0 × 1.0 × 1.0 × 2	= 4.0 尺3		
	1.0 × 22.0 × 20.5	= 452.0	or	2.211 立坪
columns	4.0 × 4.0 × 21.25 × 2	= 680.0		3.148 "
abutment, coping	1.0 × 25.5 × 3.25	= 77.2		
body	(3.0+4.5) ÷ 2 × 15.0 × 25.0	= 1405.0		6.862 "
base	7.0 × 27.0 × 4.0	= 756.0		
	5.0 × 32.0 × 4.0	= 640.0		6.463 "
				18.684 立坪

Granit in coping ·5 × 1.0 × 18.0 = 9 才

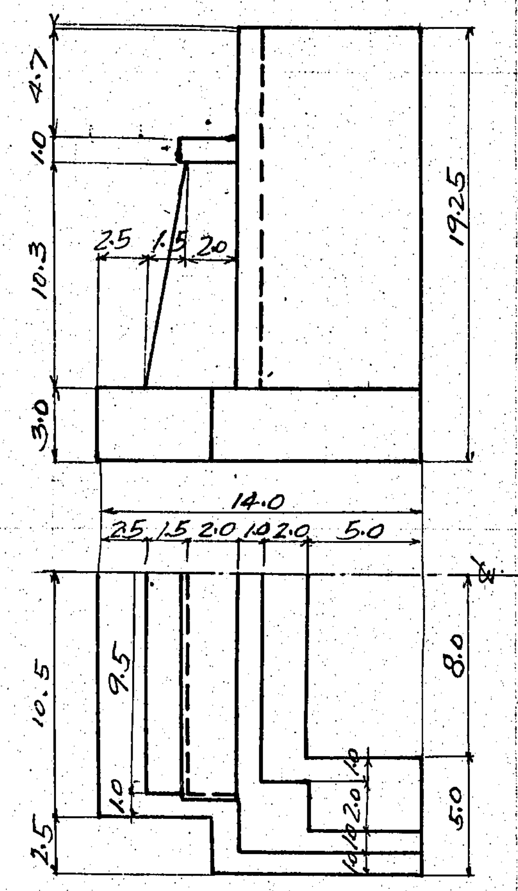
Forms

column	13.5 × 21.25 = 288			
	1.5 × 5.25 = 8	296 × 2 = 592 平方尺	or	16.4 面坪
Prapet wall	22.0 × 20.5 = 452			
	4.5 × 22.0 = 99	559 平方尺	or	15.5 "
	4 × 1.0 × 2.0 = 8			
Abutment				
Coping	1.0 × 32 + .25 × 32 = 32 + 8 = 40			
Body	½ × (3.0+4.5) × 2 + 25.0 × 15.0 = 113 + 375 = 488		or	14.7 "
Base	88.0 × 4.0 = 352			9.8 "
				56.4 面坪

Reinforcement 2704 lbs or 1.207 tons.

Excavation 6.0 立坪 earth. call this 12.0

Abutment A2:



Concrete 1:2:4

Parapet wall	1.0 × 18.0 × 15.5 =	279.0 立方尺	or	1.292 立坪
Column	3.0 × 3.0 × 16.25 × 2 =	293.0 "	or	1.356
Abutment, coping	1.0 × 2.25 × 19.5 = 43.8			
body	(2.0+3.5) ÷ 2 × 10.3 × 19 = 538.0	581.8 "	or	2.694
Base	21.0 × 5.0 × 3.0 = 315.0			
	4.0 × 26.0 × 3.0 = 312.0	777.0 "	or	3.597
	5.0 × 5.0 × 3.0 × 2 = 150.0			
Wing walls.	1.0 × 6.0 × 5.0 × 2 = 60.0			
	½ × (1.0+3.0) × 10.25 × 5.0 × 2 = 205.0	265.0 "	or	1.227
				10.166 立坪
~~Extra concrete due to Column change & coping.~~		201.0		0.930
				11.096 立坪

Granit in coping 0.5 × 18.0 × 1.0 = 9.0 才

Forms. Columns & Wingwall

10.5 × 16.25 =	171.0
0.5 × 4.95 =	2.5
2.0 × 16.25 =	32.5
2.0 × 6.0 =	12.0
½ × 2.0 × 10.25 =	10.3
5.0 × 16.5 =	82.5
1.0 × 6.0 =	6.0
½ × (1.0 × 3.0) × 10.25 =	20.5

2 × 337.3 = 674.6 平方尺

1 × 16.255 × 2 × 2 = ~~65.0~~ "

739.6 or ~~18.7~~ 20.55 面坪

Abutment. Coping.	1.0 × 24.0 = 24.0			
	19.0 × 10.3 = 196.0	248.3 平方尺	or	6.9 面坪
	½ × (2.0+3.5) × 10.3 = 28.3			
Base	90.0 × 3.0 = 270 平方尺		or	7.5 面坪
				~~33.1~~ 34.95 面坪

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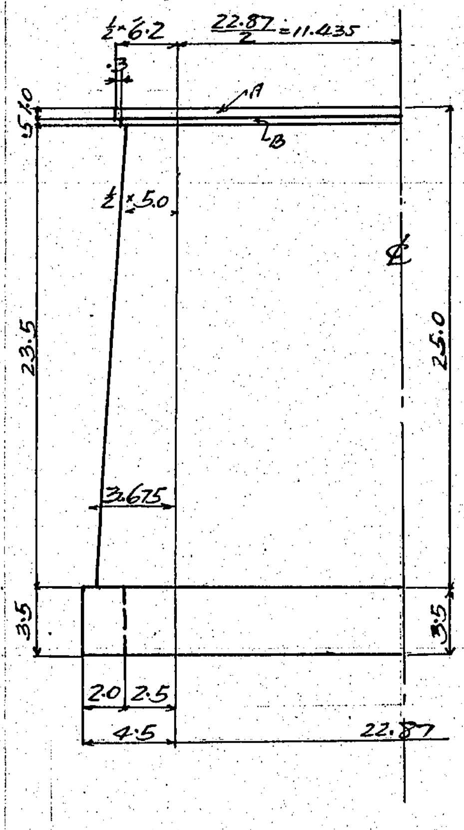
CALCULATIONS FOR

List of Materials for Arabuki-Bashi, Tokushima-Ken.

Reinforcements ~~2003~~ 2268 lbs. or ~~0.894~~ 1.013 tons.

Excavation, Depth of soil, 7.0 average, assumed. 12.5 立坪.

Pier No. 1.



Concrete 1:2:4 Coping 1.150 立坪
Shaft 18.741 "
19.891
Base (Anchoring) 1.824
Total. 21.715 立坪
Reinforcements 3053 lbs or 1.363 tons.
Form for concreting. 48.7 面坪
Excavation Earth
Rock 2.0 立坪 "

Details:-
Volume of concrete. Coping (A). End circle 6.2^ϕ = 30.191
Intermediate 6.2×22.87 = 141.794
1.0 × 171.985 = 171.985 $(ft)^3$

Coping (B). End circle 5.6^ϕ = 24.63
5.6×22.87 = 128.07
.5 × 152.70 = 76.350 $(ft)^3$
248.335 $(ft)^3$
or 1.150 立坪

Shaft. Top area. 5.0^ϕ = 19.635
5×22.87 = 114.350
133.985
Bott. Area 7.35^ϕ = 42.429
7.35×22.87 = 168.095
210.524
1/2 × 344.509 = 172.255 × 23.5 = 4047.993 $(ft)^3$ or 18.741 立坪
19.891

Base. 9.0^ϕ 63.617
9.0×22.87 182.96
246.577
5.0^ϕ 19.635
5.0×22.87 114.35
133.985
3.5 × 112.592 = 394.072 $(ft)^3$ or 1.824 立坪.

Total volume of concrete 19.891 + 1.824 = 21.715 立坪

Pier No. 2
Concrete 1:2:4. Shaft 34.347 立坪
Well 64.874 "
99.221
Reinforcements shaft 2.699
Well 10.775
13.474 tons.
Shoe 3.8~~34~~55 tons. 3.855 tons
Sand-fill 54.681 立坪
Form. 379.9 面坪
Excavation 109.2 立坪.

Details for volume of concrete.

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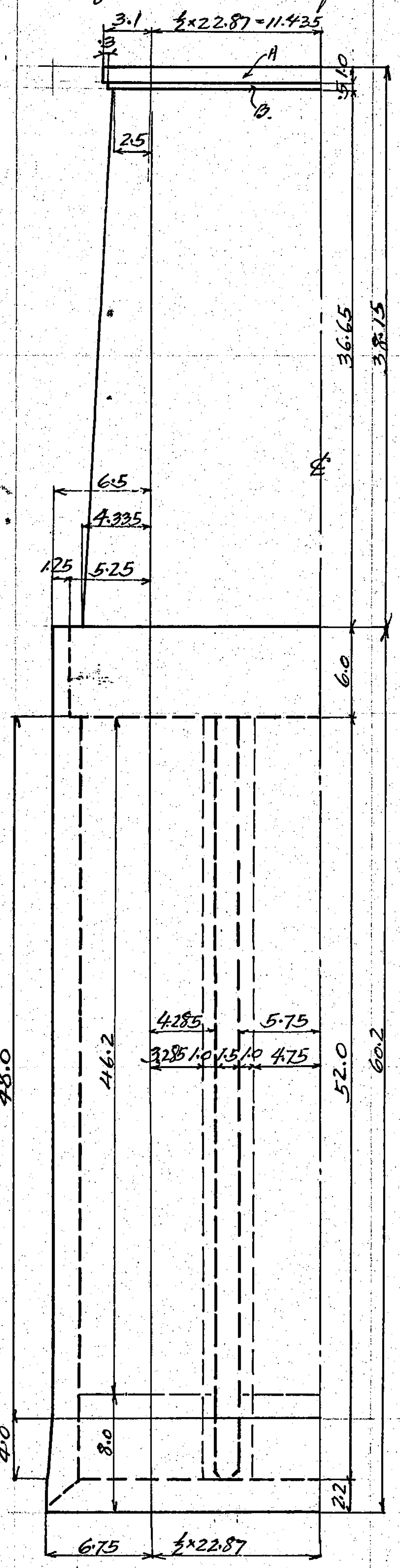
CALCULATIONS FOR

List of materials for Anabuki-bashi, Tokushima-Ken.



Shaft. Coping A 171.985
" B 76.350
248.335 (尺)^3 or 1.150 立坪 — 1.150 立坪

Body. Top area 133.985
Bott. area. 8.67$^\phi$ = 59.038
8.67×22.87 = 198.283
257.321
½ × 391.306 = 195.653 (尺)^2
195.653 × 36.65 = 7170.682 (尺)^3 or 33.197 立坪
Total for shaft = 34.347 "

Well. Top part 6.0
13.0$^\phi$ = 132.732
13.×22.87 = 297.31
430.042 × 6 = 2580.3 (尺)^3 or 11.946 立坪
10.5$^\phi$ = 86.590
10.5×22.87 = 240.135
Top fill. — 326.725 × 6 = 1960.4 (尺)^3 9.075 立坪
2.871 立坪

Intermediate part. 48.0
13.0$^\phi$ 430.042 × 48 = 2064.2. (尺)^3 or 95.56 立坪
9.5$^\phi$ = 70.882
9.5×22.87 = 217.265
288.147 × 48 = 13831. (尺)^3 or 64.032 立坪
31.528 "

Bottom part.
13.5$^\phi$ = 143.139
13.5×22.87 = 308.745
451.884
13.0$^\phi$ 430.135
½ × 882.019 × 4 = 1764.0 (尺)^3 or 8.167 立坪
9.5$^\phi$ 288.147 × 4 = 1152.6 " or 5.336 "
2.831 "

Part inside of shoe
13.5$^\phi$ 451.884 × 2.2 = 994.15 (尺)^3 or 4.603 立坪
12.5$^\phi$ say = 122.718
12.5×22.87 = 285.875
408.593 × 2.2 = 898.91 (尺)^3 or 4.158 立坪
0.445 "

Total volume for shell = 37.675 立坪

Partition walls.
2×1.5×9.5 = 28.5
8×.5 = 4.
32.5 × 52 = 1690. (尺)^3 or 7.907 立坪

Sand fill. 9.5$^\phi$ 288.147 (尺)^2 − 32.5 (尺)^2 = 255.647 × 46.2 = 11811 (尺)^3 or 54.681 立坪

Bottom fill. 225.647 × 5.8 = 1308.75 or 6.059 立坪
Inside of shoe 4.158
10.217

Total volume of concrete in well.
Shell 37.675
Top fill 9.075
Partition walls. 7.907
Bottom fill 10.217
64.874 立坪

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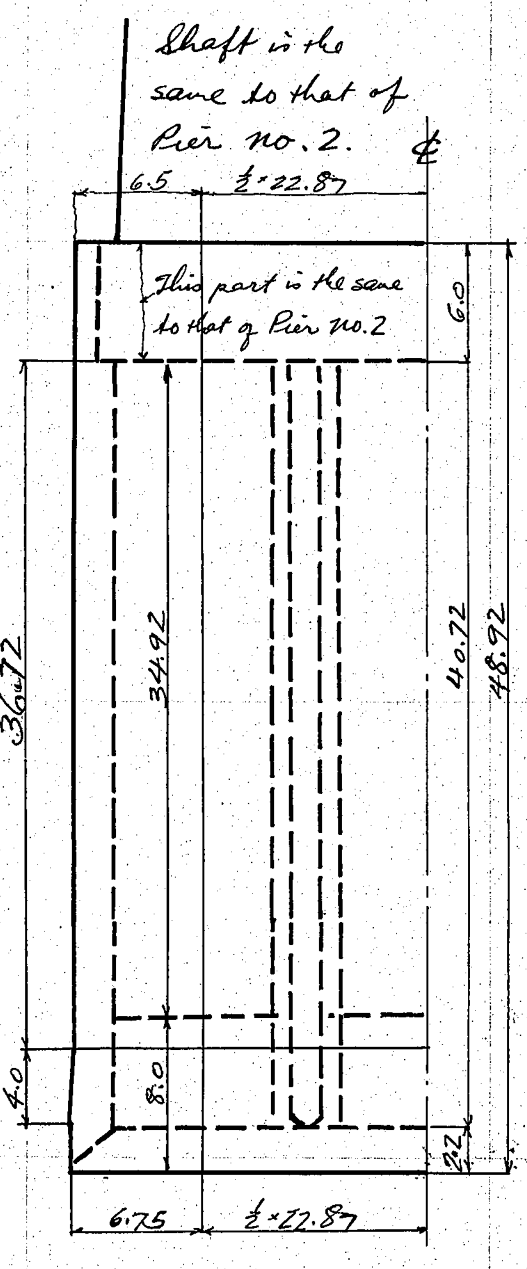
List of materials for Anabuki-Bashi, Tokushima-Ken.

Piers No. 3

Concrete 1:2:4	Shaft.	34.347 立坪	
	Well.	55.689	
	Total	90.036 立坪	
Reinforcement	Shaft	2.700 tons.	
	well	7.942	
	Total.	10.642 tons	
Shoe		~~3.834~~ tons. 3.855 tons	
Sand fill.		41.329 立坪	
Form		321.7 面坪	
Excavation		122.3 立坪	

Details of volume of concrete.



Intermediate part 36.72.

13.0 ϕ	430.042 × 36.72 = 15791 (尺)³	or 73.107 立坪	
9.5 ϕ	288.147 × 36.72 = 10581 (尺)³	or 48.984	
			24.123 立坪
Top parts 6.0,	See Pier no. 2. page		2.871
Bottom parts 4.0,	〃 〃 〃		2.831
Inside the shoe,	〃 〃 〃		0.445
	Total for shell =		30.270 立坪

Partition wall. 32.5 × 40.72 = 1323.4 (尺)³ or 6.127 立坪.

Sand fill. 288.147 × 34.92 = 10062.1 (尺)³ or 46.583
32.5 × 34.92 = 1134.9 〃 or 5.254
41.329 立坪

Summary of concrete in well.

Shell	30.270 立坪
Top fill	9.075
Partition wall	6.127
Bott. fill.	10.217
	55.689 立坪.

Remarks for excavation
Elevation of surface of soil -120.0 say.

Piers Nos. 4, 5 and 6. 3 piers are alike except volume of excavation.

Concrete 1:2:4	Shaft.	21.245 立坪	
	Well.	31.515	
		52.760 立坪	
Reinforcements.	Shaft	1.512	
	Well	4.258	
		5.770 tons.	
Shoe		~~2.756~~ ~~tons~~. 2.865 tons	
Sand fill.		18.678 立坪	
Form		183.18 面坪	
Excavation.		67.72 立坪	for Pier no. 4
		68.77 〃	〃 Pier no. 5
		69.87 〃	〃 Pier no. 6

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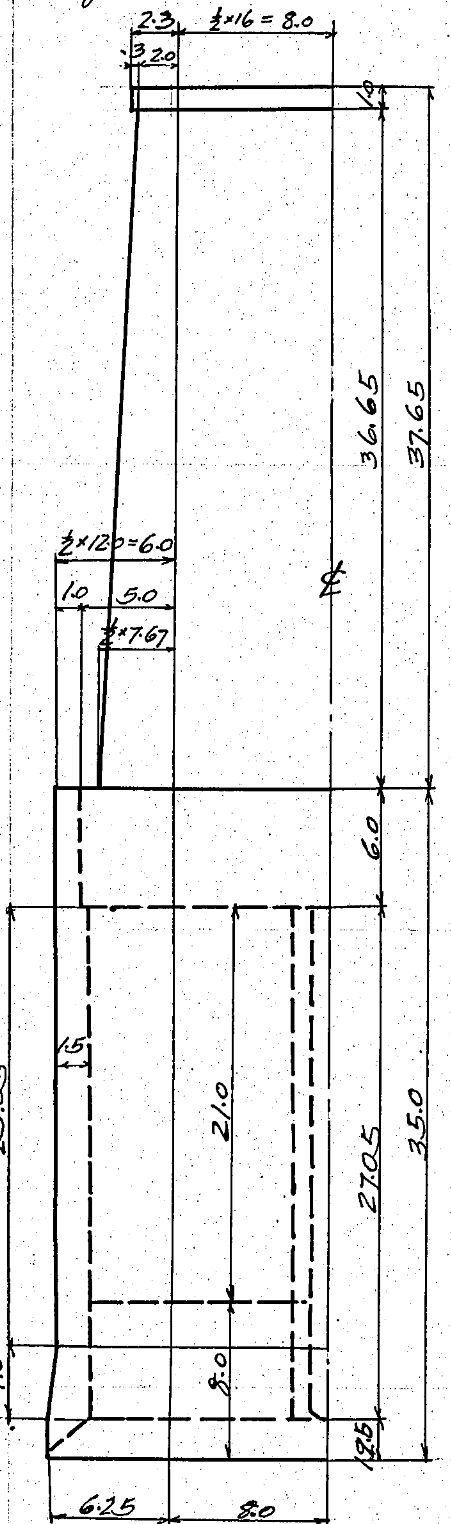
CALCULATIONS FOR

List of Materials for Anabuki-bashi, Tokushima-Ken.



Details for volume of concrete.

Shaft. Coping. End circles. 4.6^{ϕ} = 16.619
4.6 × 16 = 73.6
90.219 × 1.0 = .418 立坪

Body. Top: 4.0^{ϕ} = 12.566
4 × 16.0 = 64.000
76.566

Bottom 7.67^{ϕ} = 46.204
7.67 × 16 = 122.72
168.924

$\frac{1}{216}\times\frac{1}{2}\times 245.490\times36.65$ = 20.827 立坪
21.245

Well. Top part 6.0
12.0^{ϕ} = 113.097
12 × 16.0 = 192.000
305.097 × 6.0 = 1831 (尺)³ or 8.475 立坪
10.0^{ϕ} = 78.540
10 × 16.0 = 160.000
238.540 × 6.0 = 1431. (尺)³ or 6.626
1.849 立坪

Intermediate part 23.05
12.0^{ϕ} 305.097 × 23.05 = 7032. (尺)³ or 32.558
9.0^{ϕ} = 63.617
9 × 16.0 = 144.000
207.617 × 23.05 = 4786 (尺)³ or 22.155
10.403 立坪

Bottom part 4.0
12.5^{ϕ} = 122.718
12.5 × 16. = 200.000
322.718
12.0^{ϕ} 305.097
$\frac{1}{2}$ × 627.815 × 4.0 = 1255.6 (尺)³ or 5.813 立坪
9.0^{ϕ} 207.617 × 4.0 = 830.5 " or 3.845 "
1.968 立坪

Part inside shoe.
12.5^{ϕ} 322.718 × 1.95 = 629.300 (尺)³ or 2.913 立坪
10.7^{ϕ} = 89.92
107 × 16.0 = 171.2
261.12 × 1.95 = 509.184 " or 2.357 立坪
.556 立坪

Concrete in shell ~~&~~ Top. fill = 14.776 立坪

Partition wall. 1.5 × 9 × 27.05 = 365 (尺)³ or 1.691 立坪
Fillets. $\frac{4\times.5}{15.5}$ × 27.05 = 54 " or .250 "
1.941 立坪

Bottom fill 9.0^{ϕ} 207.617 × 6.05 = 1256 (尺)³ or 5.875
2.357
8.172 立坪

Total volume of concrete = ~~24.889~~ 立坪
Top. fill 6.626
31.515 立坪

Sand fill 9.0^{ϕ} 207.617
15.5
192.117 × 21 = 40043.5 (尺)³ or 18.678 立坪.

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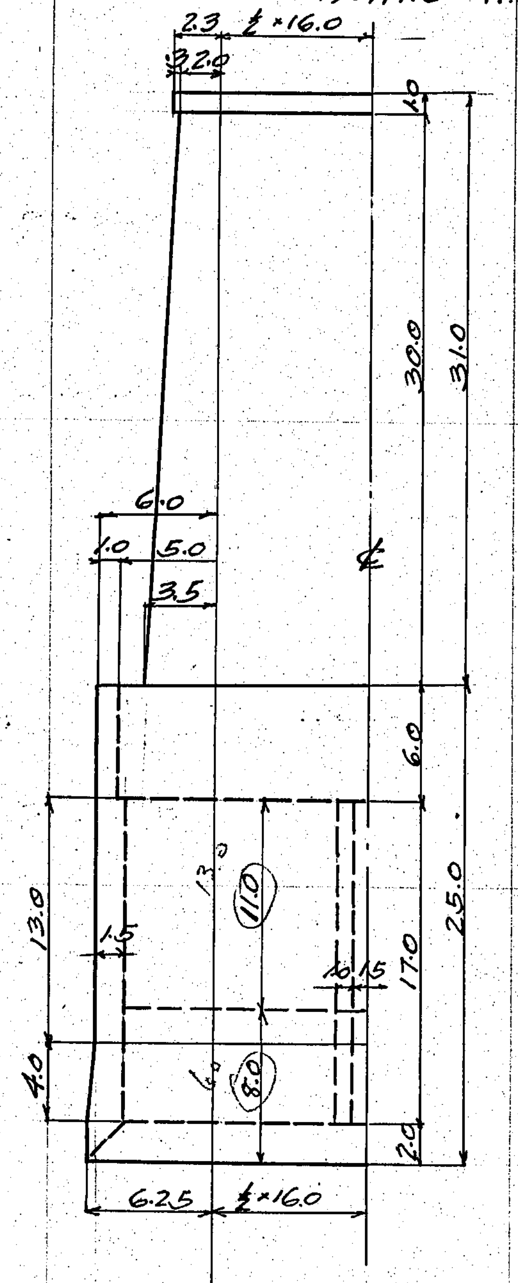
CALCULATIONS FOR

List of Materials for Anabuki-Bashi, Tokushima-Ken.

Piers Nos. 7, 8, 9, 10 & 11.



Concrete 1:2:4	Shaft	16.186	16.186
	Well	24.409	22.629
		40.595 立坪	38.815
Reinforcements	Shaft	1.315	
	Well	2.667	
		3.982 tons	
Shoe		~~2.756~~ tons.	~~2.865~~ tons.
Sand fill		9.784 立坪	
Form		133.20 面坪	

Excavation: Piers Nos.	P_7	P_8	P_9	P_{10}	P_{11}
Volume 立坪	45.99	45.54	48.08	49.12	49.17

Details for volume of concrete.

Shaft. Coping. same as that of Pier No. 4. .418 立坪

Body. Bott. Area. 7.0^φ = 38.485
7×16. = 112.000
150.485

Top. area. 76.566

227.051 × 30.0 = 6812 (尺)³ or 31.535 立坪

31.535 ÷ 2 = 15.768 立坪

16.186 立坪

Well.

Top of shell. same as that of Pier No. 4. 1.849 立坪

Intermediate part 13.0

12.0^φ 305.097 × 13.0 = 3966.3 (尺)³ or 18.362

9.0^φ 207.617 × 13.0 = 2699.0 " or 12.495

5.867 立坪

Bottom part. 4.0. same as that of Pier No. 4 1.968 "

Part inside shoe. " " " " " .556 "

Concrete in shell. = 8.391 立坪

Top fill. Same as that of Pier No. 4 6.626 "

Partition wall, 15.5 × 17 = 263.5 (尺)³ or 1.220 "

Bottom fill, ~~same as that of Pier No. 4~~ 192.1 × 2 / 216 = 1.78 ~~8.172~~ 6.392 "

Total volume of concrete in shell. = ~~24.409~~ 立坪 22.629

Sand fill. 192.117 × 11 = 2113.3 (尺)³ or ~~9.784~~ 立坪.
13 = 2500. " 11.56

Remarks for volume of excavation

	Pier No. 7	Pier No. 8	Pier No. 9	Pier No. 10	Pier No. 11
Elevation of Surface of soil	123.3	123.9	124.5	125.1	125.7
" Top of well.	117.52	117.42	117.32	117.22	117.12
Difference of elevations	5.78	5.48	7.18	7.88	8.58

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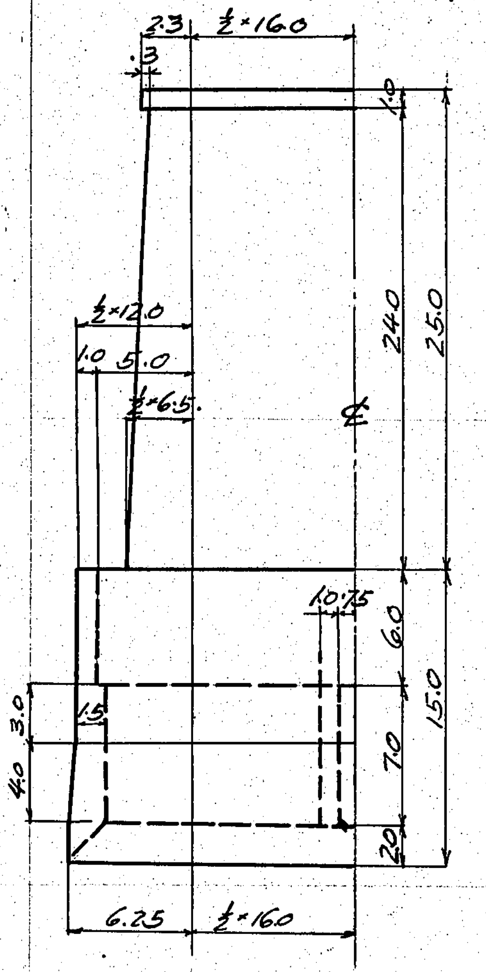
CALCULATIONS FOR

List of materials for Anabuki-bashi, Tokushimaken.

Piers No. 12, 13 & 14.



Concrete 1:2:4	Shaft	12.293	
	Well	21.958	
		34.251 立坪	
Reinforcements	Shaft	1.057	
	Well	1.572	
		2.629 tons	
Shoe		~~0.7~~ tons 0.810 tons.	
Form		56.82 面坪	
Excavation		27.32 立坪	for Pier no. 12
		28.52 〃	〃 Pier no. 13
		32.10 〃	〃 Pier no. 14

Details for volume of concrete.

Shaft. Coping same as that of Pier no. 4 .418

Body. Bottom area. 6.5$^\phi$ = 33.183

6.5 × 16.0 = 104.000

½ × 137.183 × 24.0 = 2565 (尺)^3 or 11.875 立坪

Total volume for shaft. 12.293 立坪

Well. Top of shell, same as that for Pier no. 4. 1.849 立坪

Intermediate part 3.0

12.0$^\phi$ 305.097 × 3.0 = 915.3 (尺)^3 or 4.237

9.0$^\phi$ 207.617 × 3.0 = 622.9 〃 or 2.884

1.353 立坪

Bottom part 4.0, same as that of Pier No. 4 1.968

Part inside shoe, 〃 〃 〃 〃 〃 .556

Concrete in shell = 5.726 5.726 立坪

Top fill, same as that of Pier No. 4 6.626 〃

Partition wall 15.5 × 7.0 = 108.5 or .503 〃

Bottom fill. 9.0$^\phi$, 207.617 × 7.0 = 1453.3 (尺)^3 or 6.728 立坪

2.375

9.103 〃

Total volume in well = 21.958 立坪

Remarks for volume of excavation

	Pier No. 12	Pier No. 13.	Pier No. 14
Elevation of surface of soil	126.3	127.0	129.3
〃 〃 Top of well	123.02	122.92	122.82
Difference of elevations	3.28	4.08	6.48

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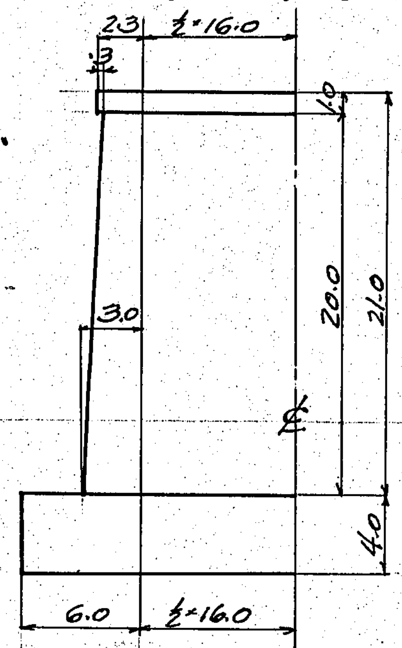
CALCULATIONS FOR

List of Materials for Anabuki-bashi, Tokushima-Ken.

Piers Nos. 15, 16 and 17.



Concrete 1:2:4 Shaft 9.716 立坪
Base 5.650 "
15.366 立坪

Reinforcements shaft 0.858 tons

Form 27.8 面坪

Excavation: Piers Nos.	P15	P16	P17
volume 立坪	12.94	16.51	20.08

Details for volume of concrete.

Shaft. Coping. Same as that of Pier no. 4 .418 立坪

Body. Bottom area. 6.0^{ϕ} = 28.274

60×16.0 = 96.000

½ × 124.274 × 20.0

Top area 76.566

$\frac{1}{216}$ × ½ × 200.840 × 20.0 = 9.298 立坪

Total volume for shaft. 9.716 立坪

Base. 12.0^{ϕ} 305.097 × 4 = 1220.4 $(尺)^3$ or 5.650 立坪

Total volume of concrete = 15.366

Remarks for volume of excavation

	Pier No. 15	Pier No. 16	Pier No. 17
Elevation of surface of soil	131.6	133.9	136.2
" Top of base	126.72	126.63	126.54
Difference of above two elevations	4.88	7.27	9.66

Concrete Floor slab.

Cross section of floor slab Roadway 0.44 × 18.0 = 7.92
coping 2 @ .75 = 1.50
9.42

volume = 9.42 × 13~~6~~72.0尺 = 12925 $(尺)^3$
or 59.8 立坪

Forms. 22 × 1372 = 30184
46 @ 9.42 = 447
30631 ÷ 36 = 851. 面坪

Finish of Coping.
2 @ 2.7' × 1372尺 = 7410 or 206. 面坪

Solidetit Pavement 2" thick
$\frac{18}{6} \times \frac{1372}{6}$ = 686.0 面坪

Handrails.
Cast iron Handrail Posts

HP1.	2 @ 232#	= 464	including anchors
HP2.	420 @ 66	= 27720	
HP3	3 @ ~~66~~ 74	= 222	
HP4	14 @ 70	= 980	
HP5	2 @ 53	= 106	
		29492#	

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

PANEL OF HANDRAIL

Panel	Member	Quantity × Section × Length	Unit wt.	Weight	Subtotal
Panel PA 2 Required	Panel PE 1 Required.				
	gas pipe	2- 2"ø × 7'-8¾"	@ 3.652	= 56	
		2 bars 1½ × ½ × 7'-4 3/8	@ 2.55	= 38	
		1 bar 1¼ × ½ × 7'-8¼"	@ 2.13	= 17	
	vertical bar framing B	21- 1¼ × ½ × 2'-2"	@ 2.13	= 91	
		6- 1¼ × 3/8 × 0'-10"	@ 1.59	= 8	} 107"
		2 L 3 × 2½ × 3/8 × 0'-1½"	@ 6.6	= 2	
				218 × 3 = 654	
Panel PB 401 Required	gas pipe	2- 2"ø × 5'-11½	@ 3.652	= 44	
	bars	2- 1½ × ½ × 5'-8¾	@ 2.55	= 29	
		1- 1¼ × ½ × 5'-8¾	@ 2.13	= 13	
	vertical bars A	16- 1¼ × ½ × 2'-2"	@ 2.13	= 78	
		5- 1¼ × 3/8 × 0'-10"	@ 1.59	= 7	} 87
		2 L 3 × 2½ × 3/8 × 0'-1½	@ 6.6	= 2	
				173 × 401 = 69373	
Panel PC 2 Required	gas pipe	2- 2"ø × 6'-2¼	@ 3.652	= 45	
	bars	2- 1½ × ½ × 5'-9⅞	@ 2.55	= 30	
		1- 1¼ × ½ × 6'-1¾	@ 2.13	= 13	
	vertical bars framing A.			87	
				175 × 2 = 350	
Panel PD 2 Required	gas pipe.	2- 2"ø × 5'-7½	@ 3652	= 41	
		2- 1½ × ½ × 5'-4¾	@ 2.55	= 28	
		1- 1¼ × ½ × 5'-7"	@ 2.13	= 12	
	vertical bars framing A			87	
				168 × 2 = 326	
Panel PF 14 Required	gas pipe	2- 2"ø × 6'-0¾	@ 3.652	= 44	
		2- 1½ × ½ × 5'-9 3/8	@ 2.55	= 29	
		1- 1¼ × ½ × 6'-0½	@ 2.13	= 13	
	vertical bar framing A			87	
				173 × 14 = 2422	
PG 1 Required	gas pipe	2- 2"ø × 7'-9¼	@ 3.652	= 57	
		2- 1½ × ½ × 7'-4⅞	@ 2.55	= 38	
		1- 1¼ × ½ × 7'-6½	@ 2.13	= 16	
	vertical bar framing B			107	
				218 × 1 = 218"	
Panel PH 14 Required	gas pipe	2- 2"ø × 6'-0¼	@ 3.652	= 44	
		2- 1½ × ½ × 5'-8⅞	@ 2.55	= 29	
		1- 1½ × ½ × 5'-10½	@ 2.13	= 13	
	vertical bar framing A			87	
				173 × 14 = 2422	
Panel PJ 15 Required	gas pipe	2- 2"ø × 5'-10¼	@ 3.652	= 43	
		2- 1½ × ½ × 5'-7¼	@ 2.55	= 29	
		1- 1¼ × ½ × 5'-8⅞	@ 2.13	= 12	
	vertical bar framing A			87	
				171 × 15 = 2565	

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-Ken.

Panel PK 2 Required
Gaspipe 2 - 2" . 5'-9½ @ 3.652 = 42
2 - 1½ . ½ . 5'-6⅞ @ 2.55 = 28
1 - 1¼ . ½ . 5'-10" @ 2.13 = 12
vertical bar framing A 87
169 . 2 = 338

Handrail Posts 29492
Total weight of Handrail Panels = 78668#
108160# or 48.30 tons.

Lamp Post LP. 15 Required
weight of casting 9460" . 0.26 = 246#
gaspipe 1 - 2½" . 3'-3" @ 5.793 = 19
1 - 2" . 3'-9" @ 3.652 = 14
Top casting & misc say 6
285#

Structural Bracket 15 Required.
2Ls 3 . 3 . 5/16 . 1'-6½ @ 6.1 = 19
2Ls 3 . 3 . 5/16 . 2'-2" @ 6.1 = 26
2Ls 3 . 3 . 5/16 . 2'-5½ @ 6.1 = 30
2Ls 2½ . 2½ . 5/16 . 0'-6" @ 5.0 = 5
1 Pl. 18 . 3/8 . 2'-2" @ 22.95 = 50
filler 2 - 3" . 5/16 . 1'-0¼ @ 3.19 = 6
1 - 4½ . ½ . 1'-6½ @ 7.65 = 12
1 - 4½ . ½ . 1'-0½ @ 7.65 = 8
156
Rivet heads say 14
170# per piece

Lamp Bracket LB1. 12 Required.
weight of casting 200" @ 0.26 = 52
bolts &c 6
58#

Lamp Bracket LB2 2 Required
weight of casting & misc say 73#

Drains DR1 32 Required on girder spans
32 @ 40# per piece.
Drains DR2 60 Required on truss spans 45# per piece.

親柱 4 Required.
volume of Concrete 3.6 . 3.6 . 4.55 = 52
2.2 . 2.2 . 8.5 = 41
1.2 . 1.2 . 2.8 = 4
97 cubic ft or 0.45 立坪

Forms 3.6 . 4.5 . 4 = 65
3.8 . 6.3 . 4 = 84
1.2 . 2.8 . 4 = 13
162 sq ft or 4.5 面坪

Reinforcement

mark	no.	size			
HR1	2	3/8	. 5.0	@ .376	= 4.0
2	4	"	. 7.0	"	11.0
3	3	"	. 13.6	"	15.0
4	16	"	. 1.5	"	9.0
VR1	4	½	. 3.5	@ .668	9.0
2	12	"	. 7.5	"	60.0
3	6	"	. 7.0	"	28.0
					136.0# or 0.061 tons.

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CALCULATIONS FOR

List of materials for Anabuki-Bashi for Tokushima-ken

人造仕上手摺橋
area of forms 162
3.6 · 3.6 = 13
175
1.4 · 2.8 · 2 = 8
1.7 · .8 · 4 = 5
-13
162 or 4.5 面坪

Gas pipe 2"ø · 13.0 @ 3.652 = 42#.

Bronze fixture 4 Required.

親柱及高欄 2 Required.
volume of Concrete 4.0 · .8 · 2.9 = 9.6 立呎 or 0.045 立坪
Forms. 4.0 · 3.0 · 2 = 24.0
1.2 · 3.0 = 3.6
(1.8 · 2 + 4.5 · 2) · 1. = 12.6
40.0 or 1.1 面坪

Reinforcement

mark	no	size		
HA 1	6	½ · 5.3	@ .668	= 21.
2	3	⅜ · 3.8	@ .376	= 4
VA 1	10	½ · 4.2	@ .668	= 28
				53# or 0.024 tons.

人造仕上 4.0 · 0.8 = 3.2
forms 40
43.2 or 1.2 面坪

Expansion Joint. EZ. steel plate detailed on sheet no. 17
EX1 and EX5
On abutment. lead plate 14 · ⅛"/144 @ 706.# × 20.0 about = 170#

Structural steel. 1L. 3 · 3 · 5/16 · 18'-2" @ 6.1 = 111#
anchor bolts. 10-½"ø @ .667 · 1.0 = 7
bolts and clip etc 2
120#

asphalt filling for 3" expansion. .25 · .67 · 18.0 = 3.00 立方尺
2" expansion .17 · .67 · 18.0 = 2.05 立方尺

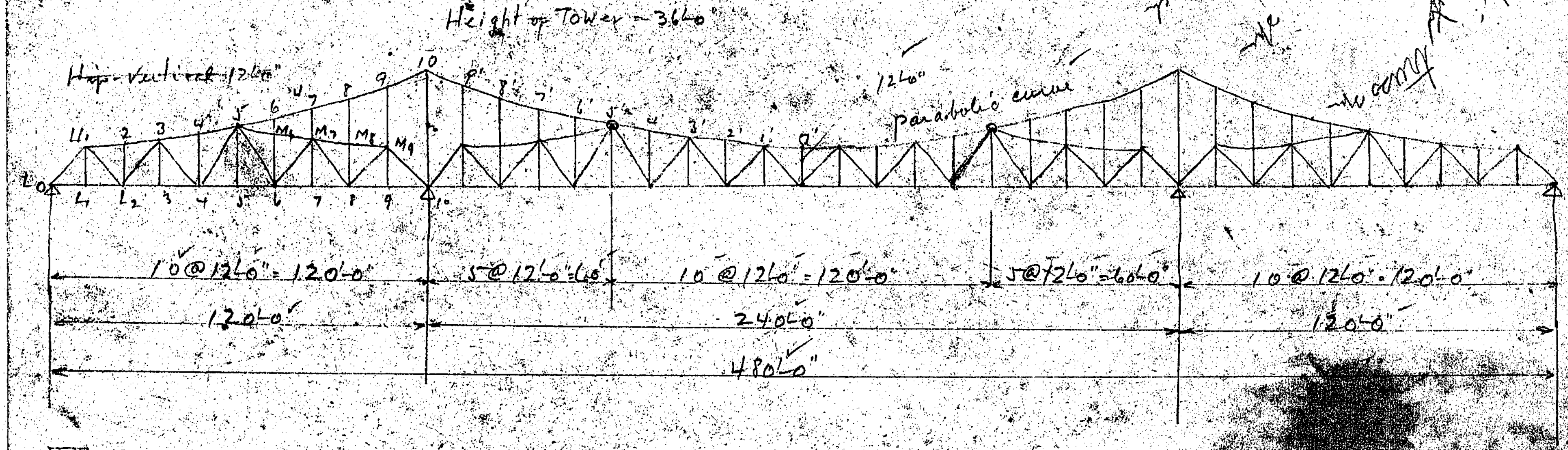
Expansion Joint for girder spans
EX3. expansion space 3" 1 Required.
material. lead plate 170# about
asphalt filling. 3.0 才

EX4 Expansion space 2" 14 Required.
material lead plate 170# about
asphalt filling 2.0 才 about.

Arakawa

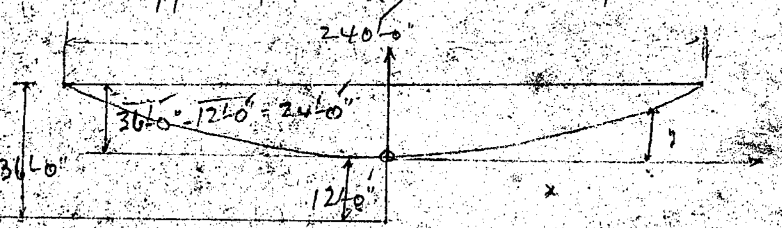
Calculation Papers for Yoshino-Bashi

☐ Skeleton Diagram of Truss.



☐ Length of each members.

Assumed upper panel pts lie on a parabolic curve.



Equation of parabola = $y = ax^2$

when $\begin{cases} x = 0 \\ y = 0 \end{cases}$ $\begin{cases} x = 120'\text{-}0" \\ y = 24'\text{-}0" \end{cases}$ then $a = \frac{y}{x^2} = \frac{24}{120^2}$

$$y = \frac{24}{120^2} x^2 = \frac{24}{120^2} \times \frac{x^2}{12^2} \times 12^2 = 0.24 \times \left(\frac{x}{12}\right)^2$$

Length for Verticals

panel pts	x	$\frac{x}{12}$	$\left(\frac{x}{12}\right)^2$	y	ord. of upper panel (+12.0')		Length of Verticals		Members
10 · 0	0	0	0	0.0000	12.00		12.00	12'-0"	U_0-L_0
1	12	1	1	0.2400	12.24		12.24	12'-2 7/8"	U_1-L_1
2	24	2	4	0.9600	12.96		12.96	12'-11 1/2"	U_2-L_2
3	36	3	9	2.1600	14.16		14.16	14'-1 15/16"	U_3-L_3
4	48	4	16	3.8400	15.84		15.84	15'-10 1/16"	U_4-L_4
5	60	5	25	6.0000	18.00		18.00	18'-0"	U_5-L_5
(6)	72	6	36	8.6400	20.64	-15.84	4.80	4'-9 5/8"	U_6-M_6
7	84	7	49	11.7600	23.76	-14.16	9.60	9'-7 3/16"	U_7-M_7
8	96	8	64	15.3600	27.36	-12.96	14.40	14'-4 13/16"	U_8-M_8
(9)	108	9	81	19.44[illegible]	[illegible]	-12.24	19.20	19'-2 3/8"	U_9-M_9
(10)	120	10	100	24.0000	36.00		36.00	36'-0"	$U_{10}-L_{10}$

for

U_6-L_6 4'-9 5/8" + 15'-10 1/16" = 20'-7 11/16" (20.64)

U_7-L_7 9'-7 3/16" + 14'-1 15/16" = 23'-9 1/8" (23.76)

U_8-L_8 14'-4 13/16" + 12'-11 1/2" = 27'-4 5/16" (27.36)

U_9-L_9 19'-2 3/8" + 12'-2 7/8" = 31'-5 1/4" (31.44)

Upper chord & Hanging chords

Length of upper chords.

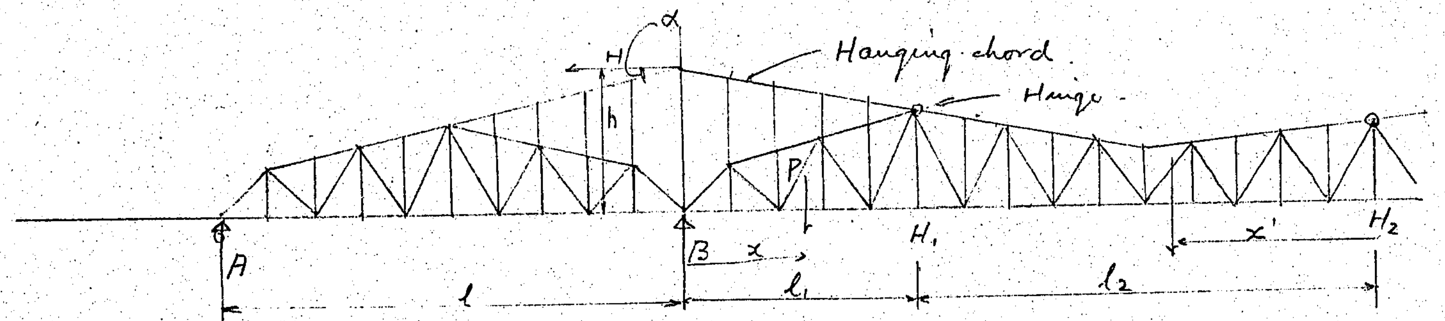
Ord of upper panel.	minus		square	plus $\overline{12'0''}^2$	$\sqrt{\ }$	members.
36'-0"	31'-5 1/4"	4'-6 3/4"	20.8164	164.8164	12'-10 1/16"	U_{10}-U_9
31'-5 1/4"	27'-4 5/16"	4'-0 15/16"	16.6311	160.6311	12'-8 1/16"	U_9-U_8
27'-4 5/16"	23'-9 1/8"	3'-7 3/16"	12.9525	156.9525	12'-6 5/16"	U_8-U_7
23'-9 1/8"	20'-7 11/16"	3'-1 7/16"	9.7331	153.7331	12'-4 13/16"	U_7-U_6
20'-7 11/16"	18'-0"	2'-7 11/16"	6.9729	150.9729	12'-3 7/16"	U_6-U_5
18'-0"	15'-10 1/16"	2'-1 15/16"	4.6719	148.6719	12'-2 5/16"	U_5-U_4
15'-10 1/16"	14'-1 15/16"	1'-8 1/8"	2.8126	146.8126	12'-1 3/8"	U_4-U_3
14'-1 15/16"	12'-11 1/2"	1'-2 7/16"	1.4475	145.4475	12'-0 3/4"	U_3-U_2
12'-11 1/2"	12'-2 7/8"	0'-8 5/8"	0.5166	144.5166	12'-0 1/4"	U_2-U_1
12'-2 7/8"	12'-0"	0'-2 7/8"	0.0574	144.0574	12'-0"	U_1-U_0
12'-0"	———	———				

Diagonals.

Verticals	square	$\overline{12'0''}^2$		Length of diagonal	Members
12'-2 7/8"	149.8074	144.0000	293.8074	17'-1 11/16"	L_0-U_1
14'-1 15/16"	200.5469	"	344.5469	18'-6 3/4"	U_1-L_2, L_2-U_3
18'-0"	324.0000	"	468.0000	21'-7 5/8"	U_3-L_4, L_4-U_5

☐ Stress analysis of Truss in general.

stresses for Hanging chords.



H - horizontal component of the hanging chord.
h - height of Tower
x - distance from B to load.
P - Load

Load on AB. no stress.

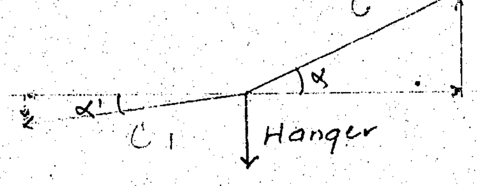
Load on BH_1. $H = \frac{Px}{h}$ x from B → H_1

Load on H_1-H_2 $H = \frac{P l_1 x'}{h \cdot l_2}$ x' measured from H_2 → H_1

C = stress of Hanger $= H \sec\alpha = \frac{Px}{h\cos\alpha}$

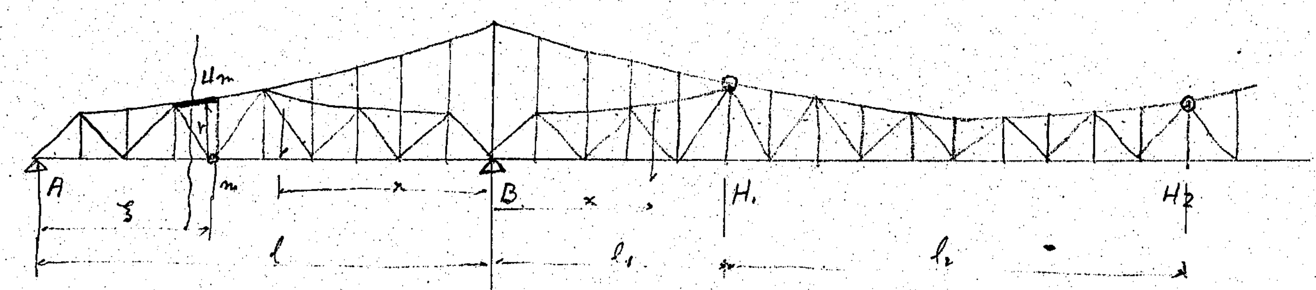
Stresses for Suspenders. Z = stress of Suspender

$(Z) = C\sin\alpha - C'\sin\alpha'$



Stresses for Upper chords.

Case 1.



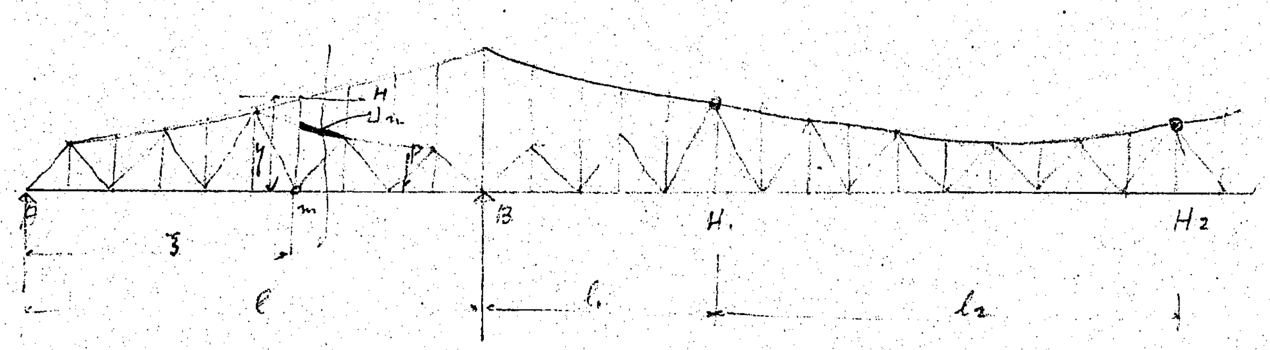
Load on AB. $U_m = -P\frac{x\cdot\xi}{l\cdot r}$ — x - from B to A. measured

r = perpendicular distance from pt. m. to member U_m.

Load on BH_1 $U_m = P\frac{x\,\xi}{l\,r}$ — x from B to H_1

Load on H_1H_2 $U_m = P\frac{x\,l_1}{l\cdot l_2}\frac{\xi}{r}$ — x from H_2 to H_1

Case 2.

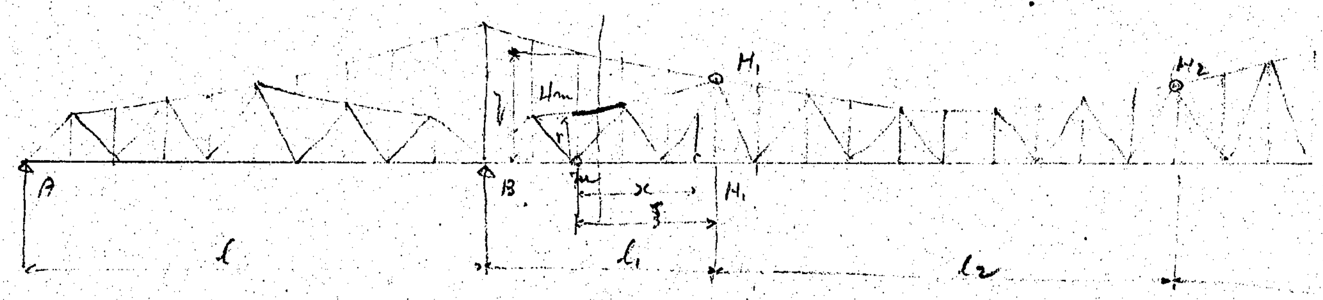


Load on AB $U_m = -P\frac{x\,\xi}{l\cdot r}$ — x from B to A.

Load on BH_1 $U_m = P\frac{x}{l}\frac{\xi}{r} - H\frac{y}{r}$ — x from B to H_1

Load on H_1-H_2 $U_m = P\frac{X\,l_1}{l_2\cdot l}\frac{\xi}{r} - H\frac{y}{r}$ — x from H_2 to H_1

Case 3.



Load on AB no stress

Load on BH_1 $U_m = P\frac{x}{r} - H\frac{y}{r}$

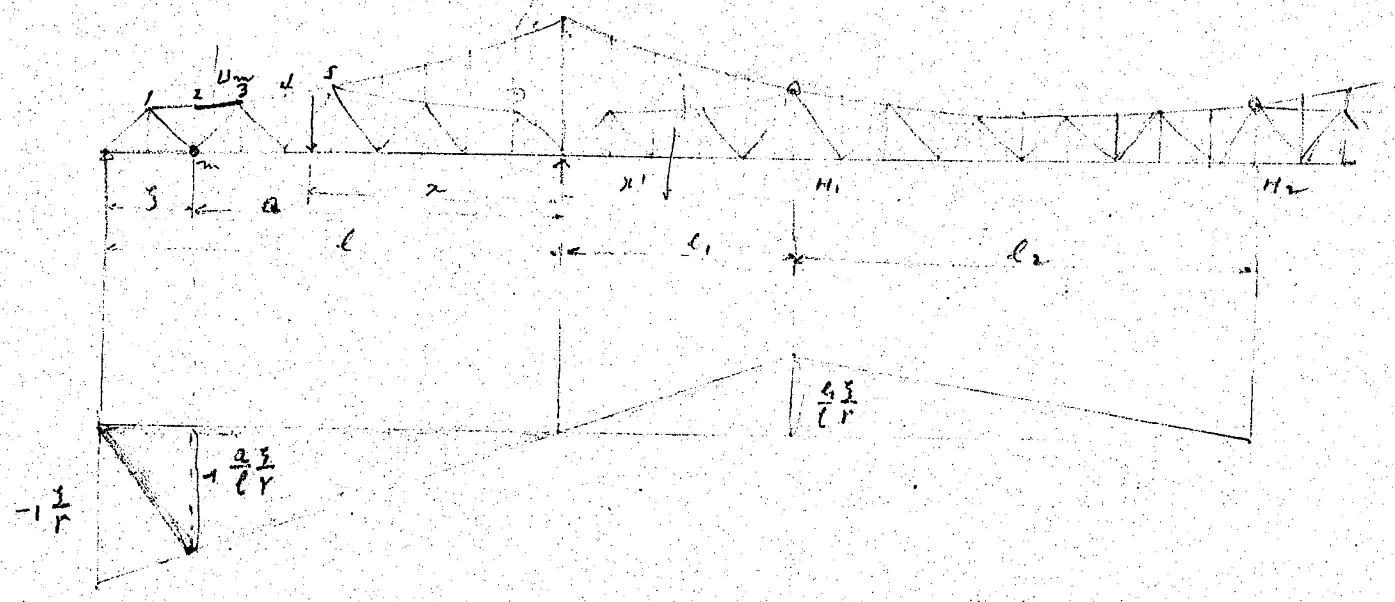
Load on H_1-H_2 $U_m = P\frac{x}{l_2}\frac{\xi}{r} - H\frac{y}{r}$

Method of Analysis to find the stresses for Lower chord and web members same as for upper chords, so omitted.

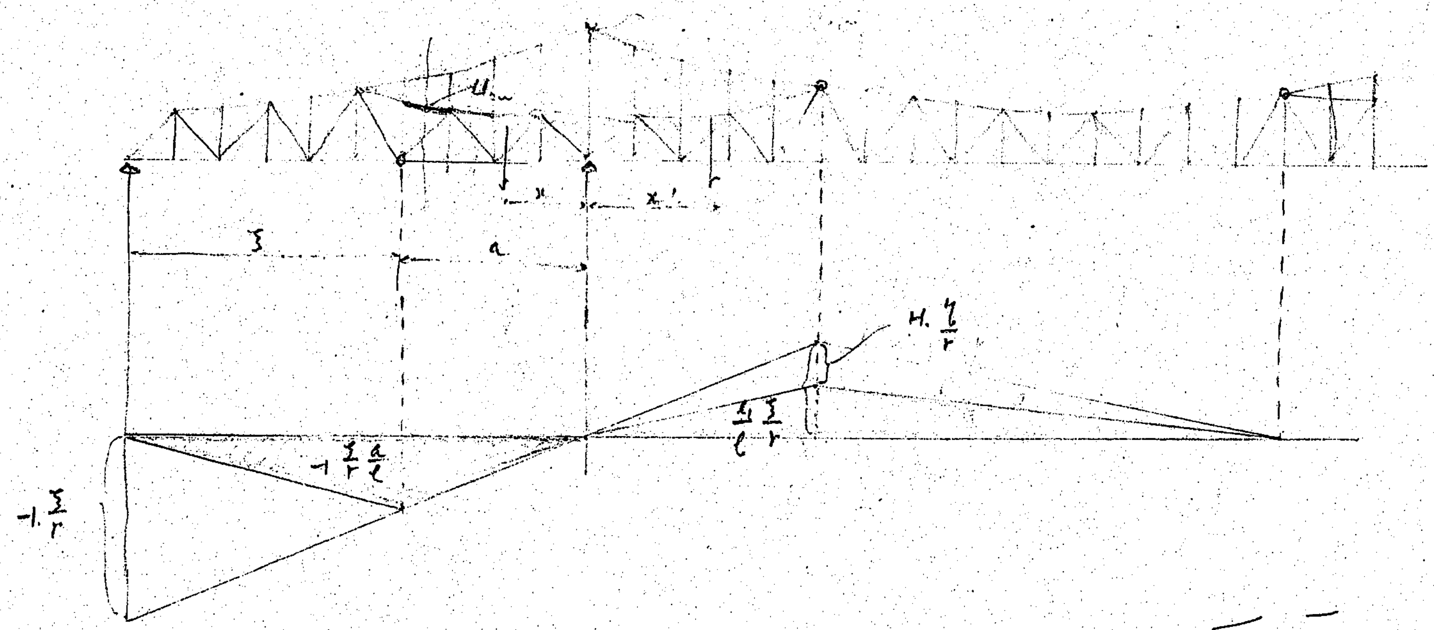
☐ Influence Surface diagram.

for upper chord.

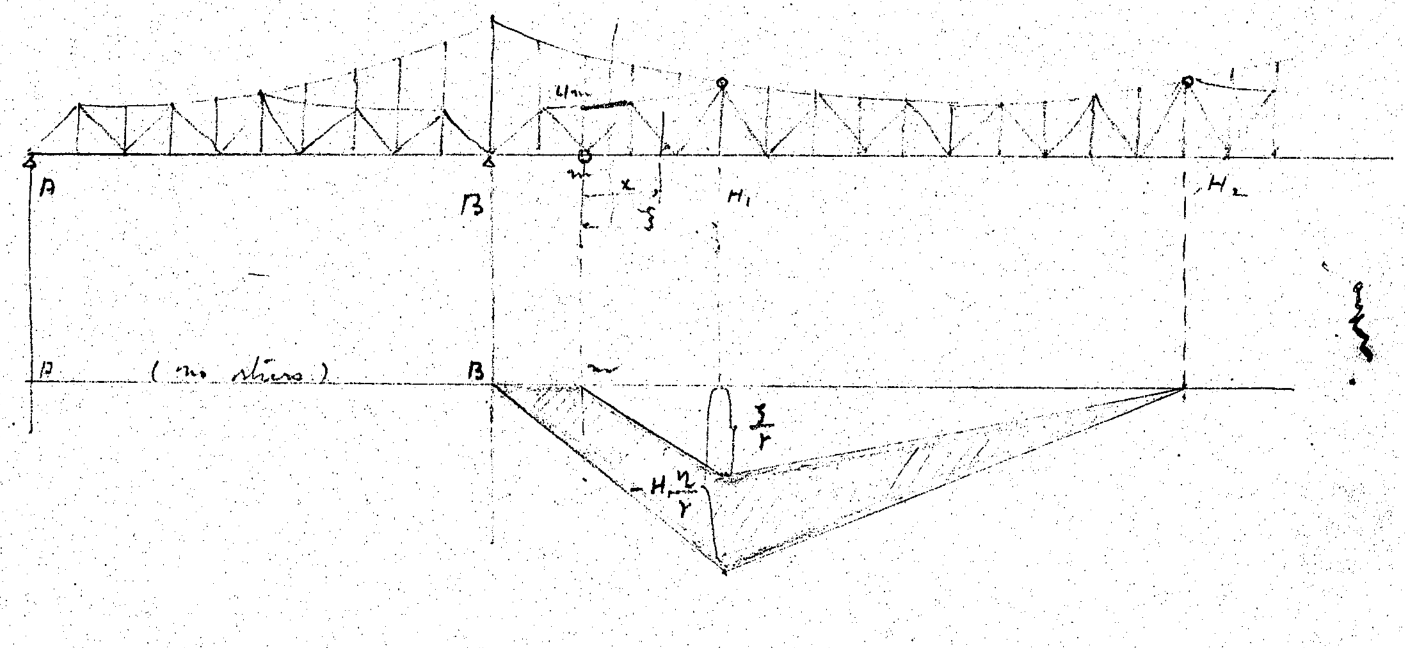
case 1.



case 2.

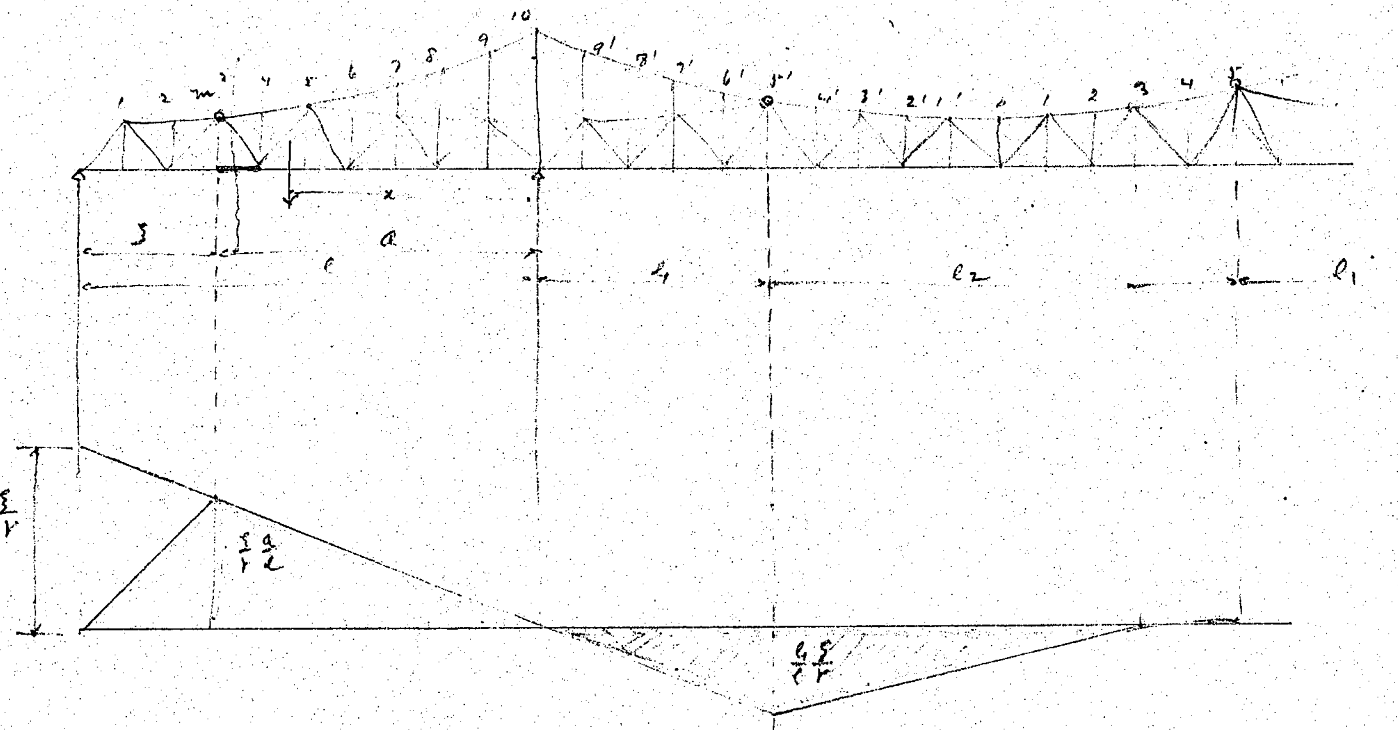


Case 3.

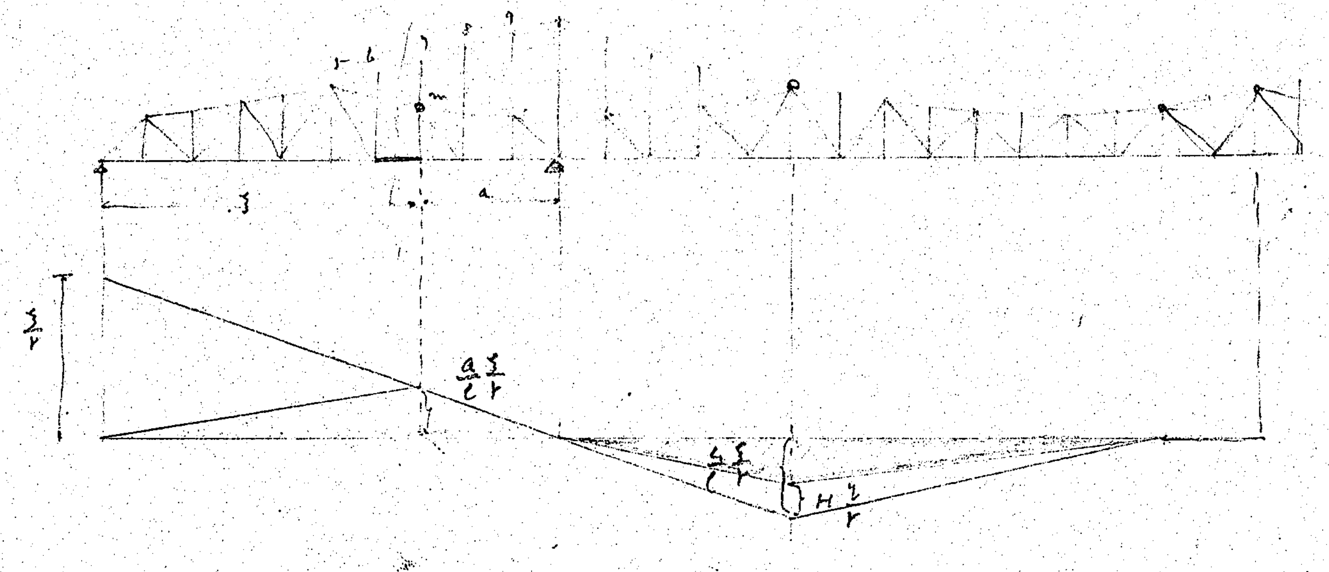


for lower chords in general

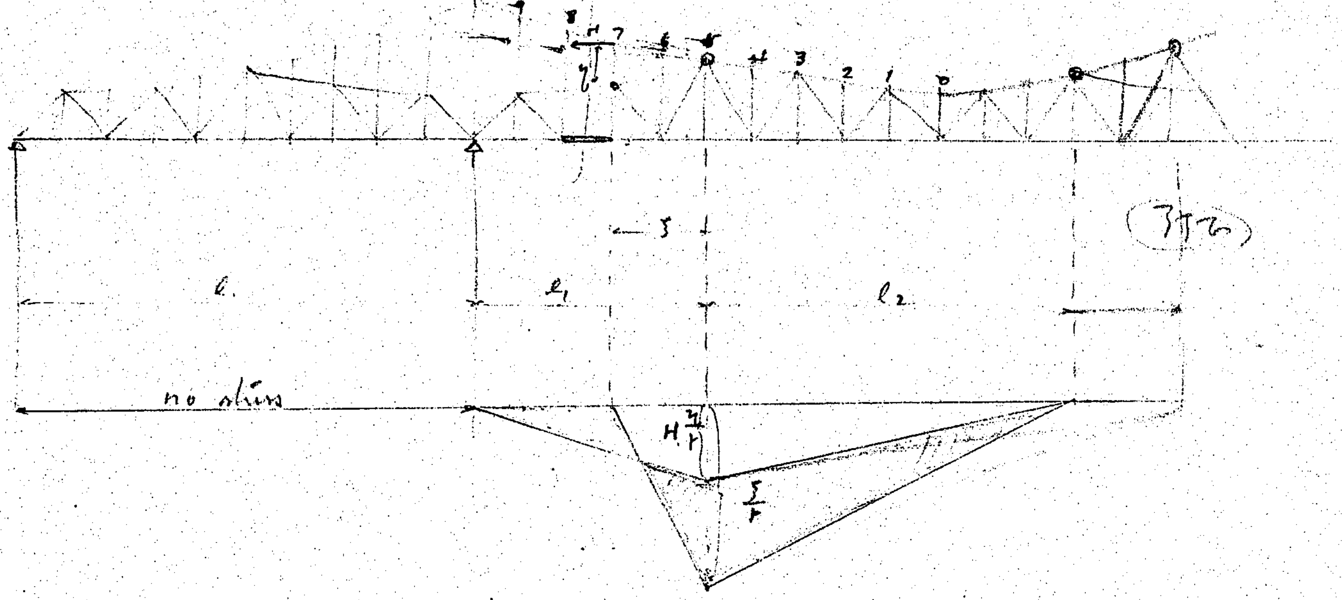
case 1.



case 2.

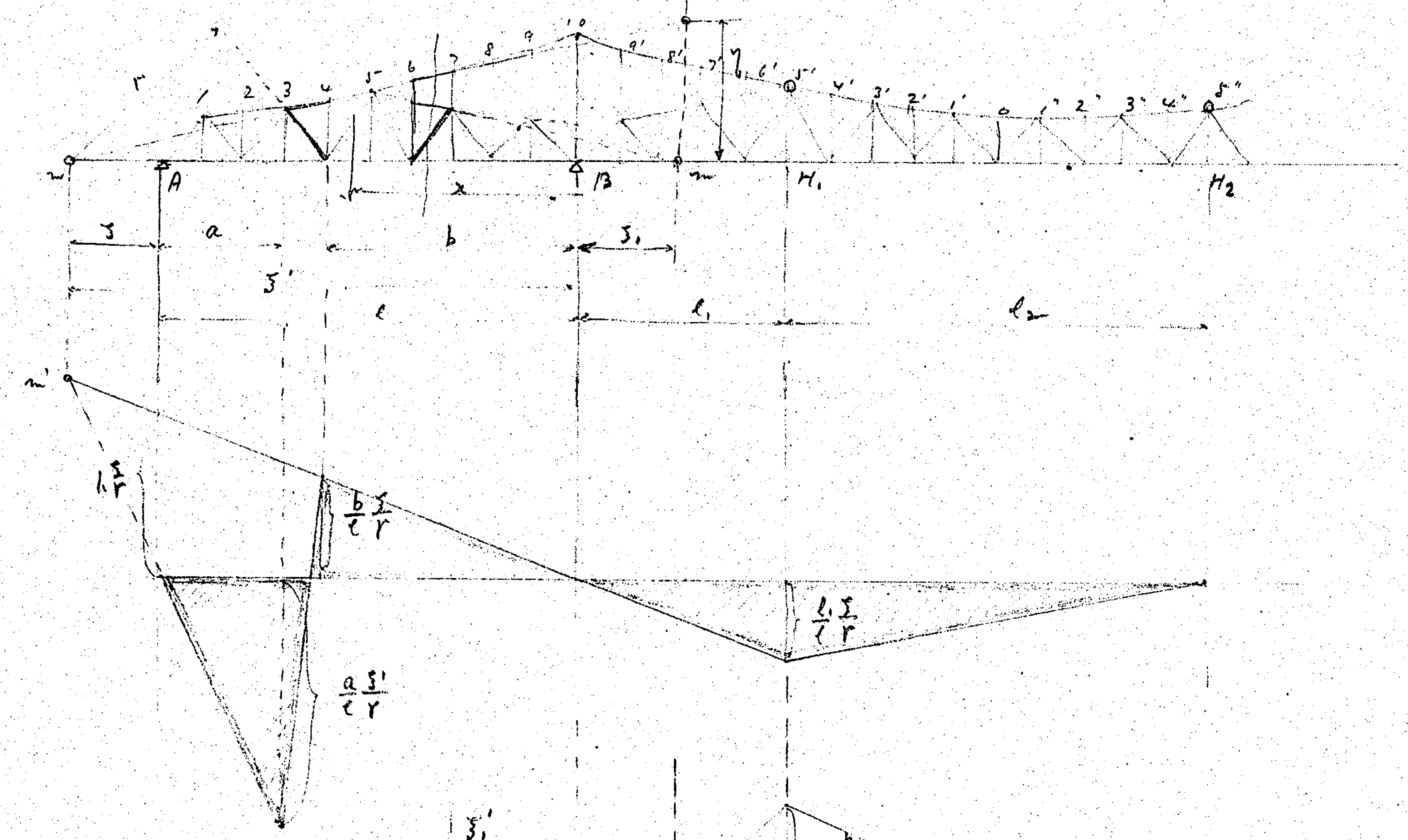


Case 3.

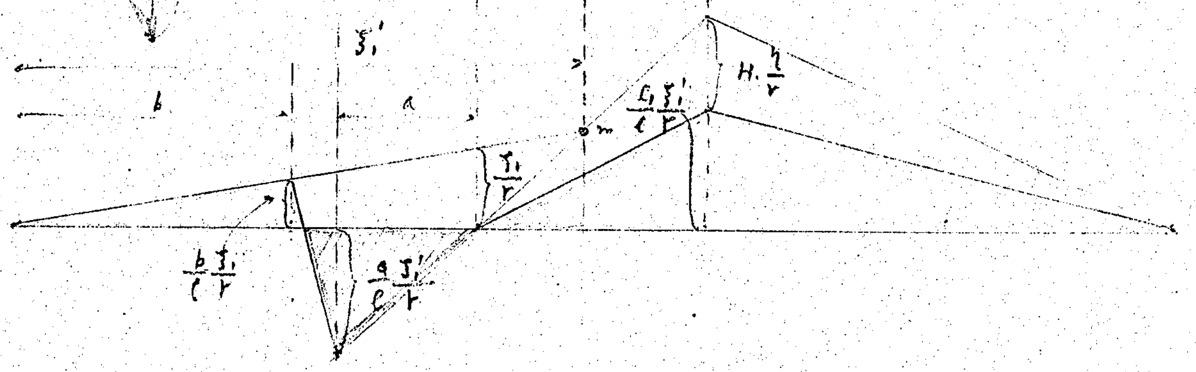


Influence surfaces for diagonals in general.

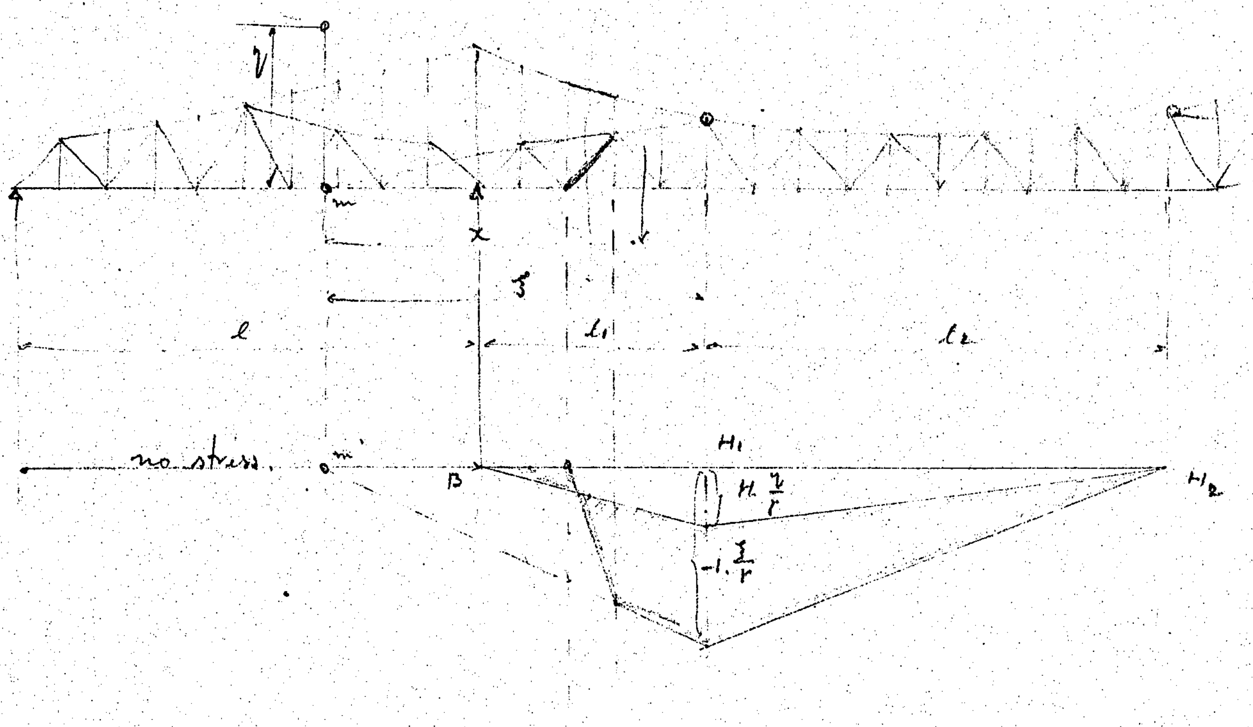
case 1.



Case 2.

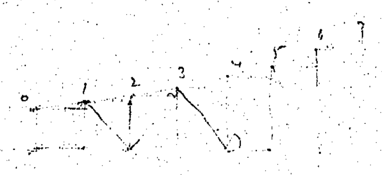


Case 3.



□ Data, to find the stresses of truss members.

α → Inclination of upper chords.



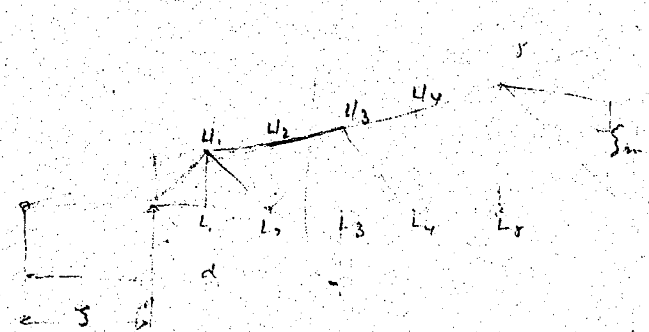
Um+1-Lm+1 - Um-Lm	log.	log 12'-0"	log tan	α	member
0'-2 3/8"	1.37946	1.07918	2.30028	1°-9'	U0-U1
0'-8 5/8"	1.85658	"	2.77740	3°-24'	U1-U2
1'-2 5/16"	0.08031	"	1.00113	5°-44'	U2-U3
1'-8 1/8"	0.22455	"	1.14537	7°-57'	U3-U4
2'-1 15/16"	0.33475	"	1.25557	10°-13'	U4-U5
2'-7 11/16"	0.42171	"	1.34253	12°-25'	U5-U6
3'-1 7/16"	0.49413	"	1.41495	14°-34'	U6-U7
3'-7 3/16"	0.55618	"	1.47700	16°-42'	U7-U8
4'-0 15/16"	0.61046	"	1.53128	18°-46'	U8-U9
4'-6 3/4"	0.65920	"	1.58002	20°-49'	U9-U10

θ = Inclination for Diagonals.

	log.	log 12'-0"	log tan θ	θ.	member
12'-2 7/8"	1.08777	1.07918	0.00859	45°-34'	L0-U1, U1-L2
14'-1 15/16"	1.15111	1.07918	0.07193	49°-44'	L2-U3, U3-L5
18'-0"	1.25527	1.07918	0.17609	56°-18'	L4-U5

r_u → perpendicular distance (arm of moment). for upper chords.

height	Member	α	log cos α.	V = verticals.	log V.	log Cos α. V.	r_u	r_u
U1	U0-U1	1°-~~10'~~ 9'	1.99991	12'-0"	1.07918	1.07909	12'-0"	12.00
U2	U1-U2	3°-~~21'~~ 24'	1.99923	12'-11 1/2"	1.11255	1.11138	12'-11 1/4"	12.94
U3	U2-U3	5°-44'	1.99782	"	1.11255	1.11047	12'-10 3/4"	12.90
U4	U3-U4	7°-57'	1.99581	15'-10 1/16"	1.19972	1.19553	15'-8 1/4"	15.69
U4	U4-U5	10°-13'	1.99306	"	1.19972	1.19278	15'-7 1/16"	15.59



ξm = horizontal distance from intersection pt of Um-Um+1 and Lm-Lm+1

panel	α	log cot α.	V-verticals.	log V.	log V cot α	cot α = d	ξ.	
1	1°-9'	1.69737	12'-2 7/8"	1.08777	2.78514	609.74	597.74	for U0-U1
2	3°-24'	1.22613	12'-11 1/2"	1.11255	2.33768	217.61	193.61	U1-U2
3	5°-44'	0.99826	14'-1 15/16"	1.15111	2.14937	141.05	105.05	U2-U3
4	7°-57'	0.85496	15'-10 1/16"	1.19972	2.05468	113.42	65.42	U3-U4
5.	10°-13'	0.74418	18'-0"	1.25527	1.99945	99.87	39.87	U4-U5

Arm length for Lower chords.

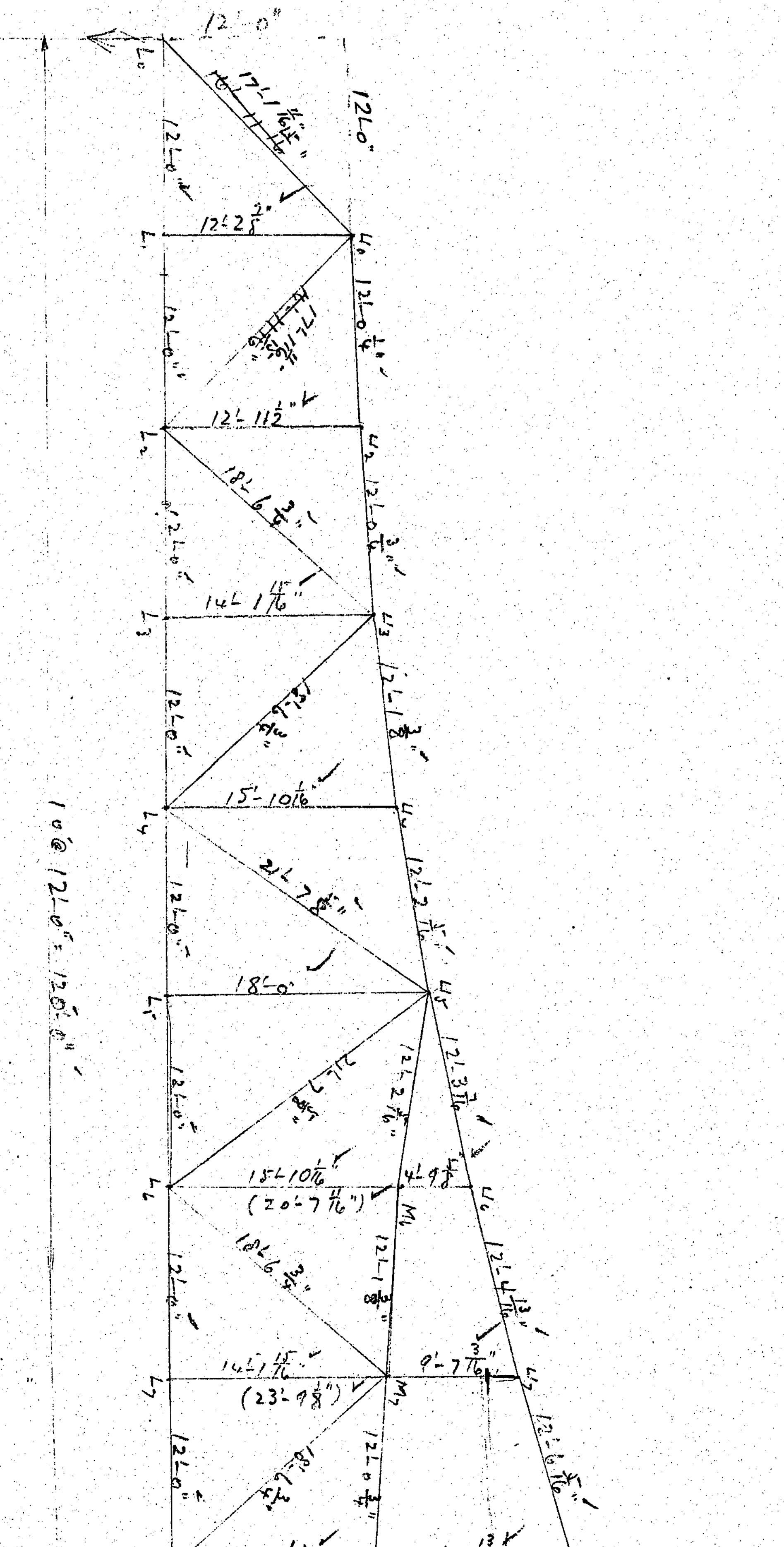
L0-L1	12'-2 7/8"
L1-L2	12'-2 7/8"
L2-L3	14'-1 15/16"
L3-L4	14'-1 15/16"
L4-L5	18'-0"

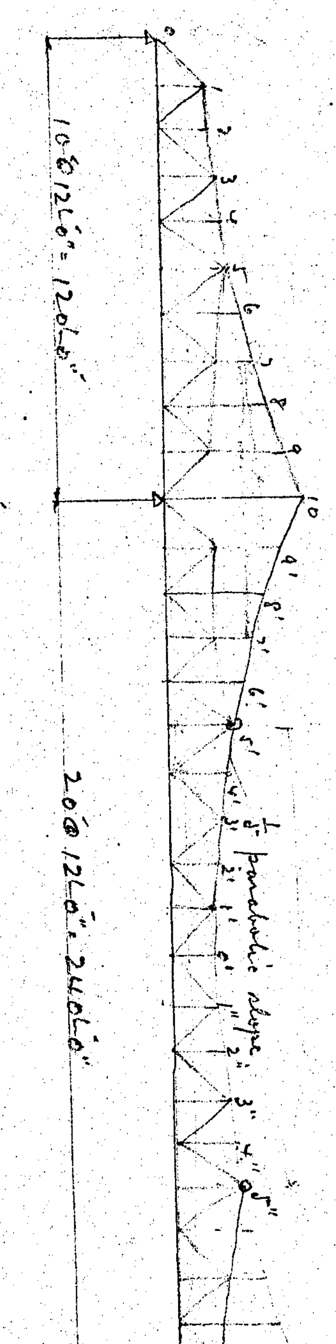
r_D – arm length for Diagonals

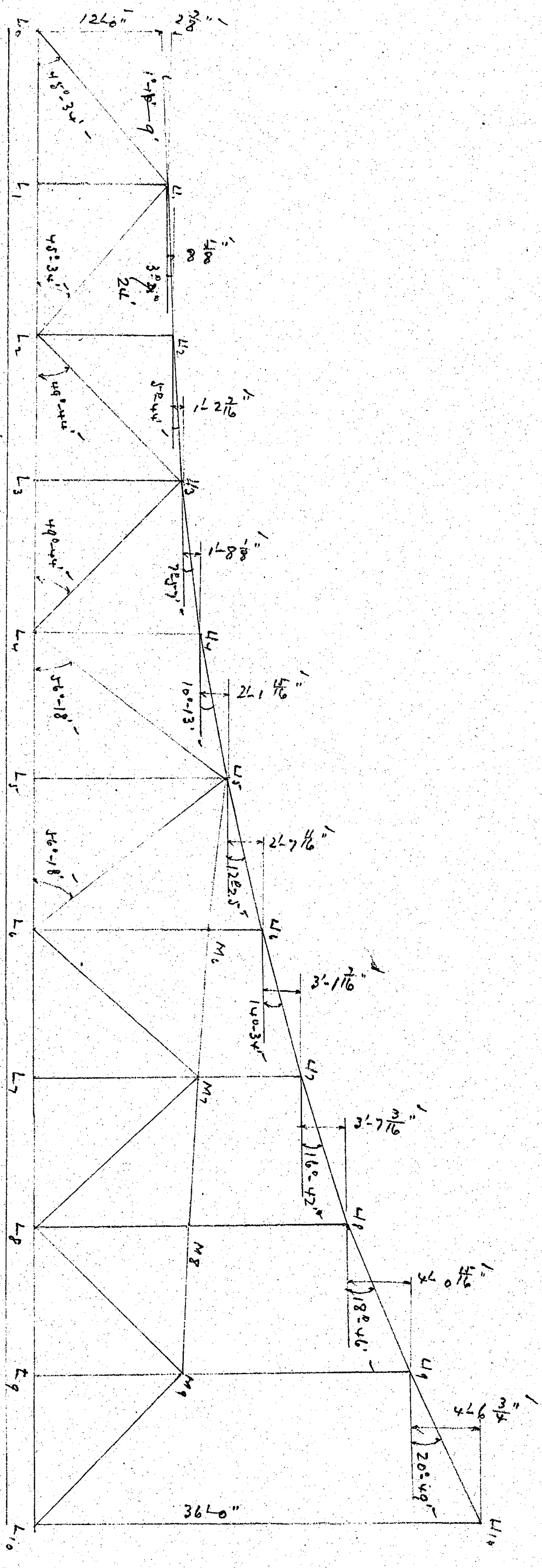
member	D	log D	θ	log sin θ	log D sin θ	r_D
L_0-U_1	597.74	2.78514	45°-34′	$\bar{1}.85374$	2.63888	435.40
U_1-L_2	217.61	2.33768	45°-34′	$\bar{1}.85374$	2.19142	155.40
L_2-U_3	217.61	2.33768	49°-44′	$\bar{1}.88255$	2.22769	168.93
U_3-L_4	113.42	2.05469	49°-44′	$\bar{1}.88255$	1.93724	86.55
L_4-U_5	113.42	2.05469	56°-18′	$\bar{1}.92010$	1.97479	94.36

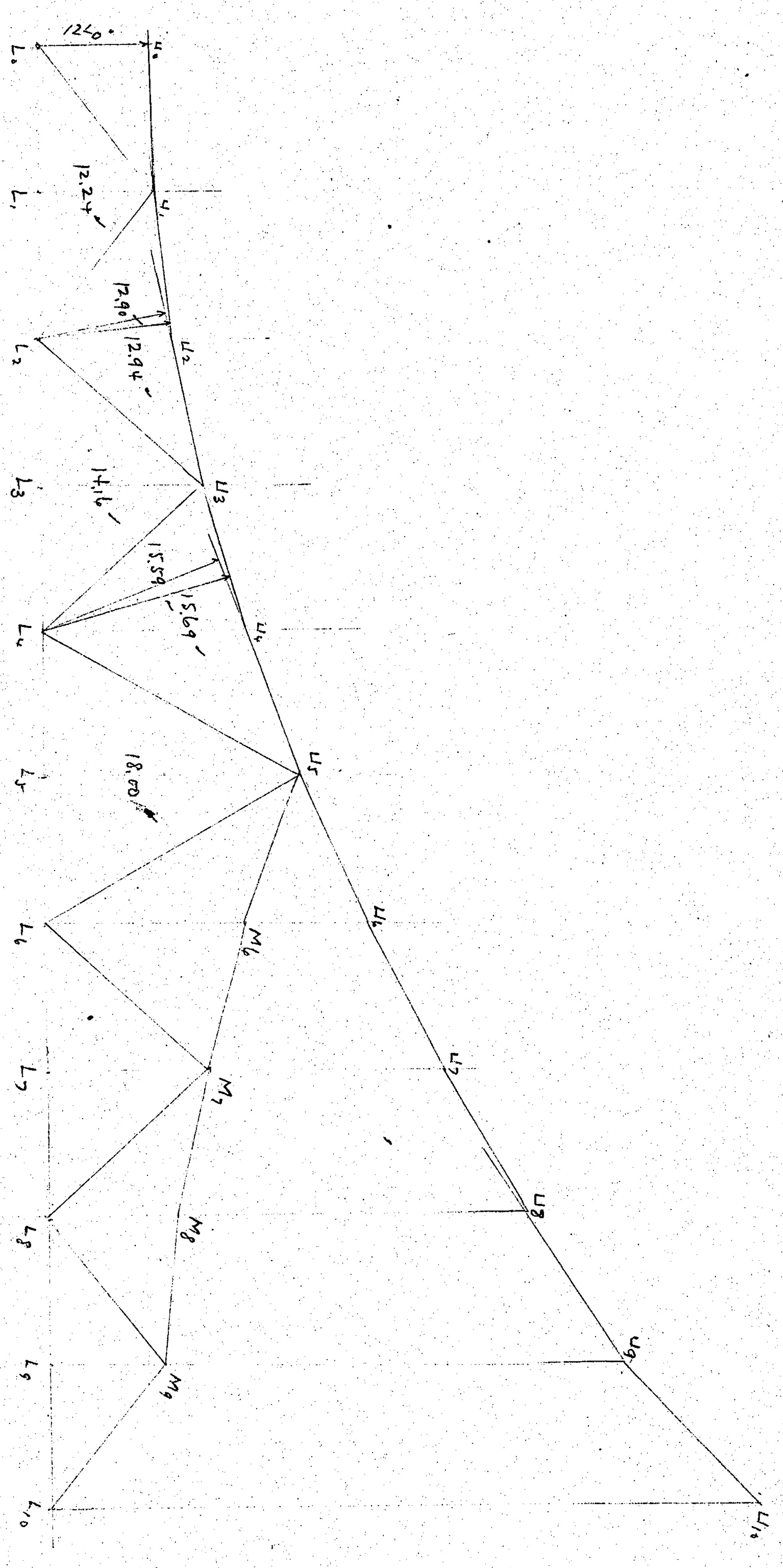
To find η for Diagonals

α	log tan α	d	log d	log d tan α	d tan α	V	η	for
12°-25′	$\bar{1}.34276$	99.87	1.99945	1.34221	21.99	18.00	39.99	U_5-L_6
14°-34′	$\bar{1}.41471$	113.42	2.05468	1.46942	29.47	20.64	50.11	L_6-U_7
16°-42′	$\bar{1}.47714$	141.05	2.14937	1.62651	42.32	23.76	66.08	U_7-L_8
18°-46′	$\bar{1}.53120$	217.61	2.33768	1.86888	73.94	27.36	101.30	L_8-U_9
20°-49′	$\bar{1}.58001$	609.74	2.78514	2.36515	231.82	31.44	263.26	U_9-L_{10}


12'-0"
10@12'-0" = 120'-0"
36'-0"


10@12'-0" = 120'-0"
20@12'-0" = 240'-0"
10@12'-0" = 120'-0"


12'-0"
36'-0"


12.60
12.24
12.90
12.94
14.16
15.59
15.69
18.00
L0
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
U0
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
M6
M7
M8
M9

☐ Influence Surfaces for Hanging chords.

	α	log cos α	log h = log 36.0	log h cos α	$\log \frac{1}{h \cos\alpha}$	$\frac{1}{h\cos\alpha}$
U5-U6, U6'-U5'	12°-25'	$\bar{1}$.98972	1.55630	1.54602	$\bar{2}$.45398	0.0284
U6-U7, U7'-U6'	14°-34'	$\bar{1}$.98581	"	1.54211	$\bar{2}$.45789	0.0287
U7-U8, U8'-U7'	16°-42'	$\bar{1}$.98129	"	1.53759	$\bar{2}$.46241	0.0290
U8-U9, U9'-U8'	18°-46'	$\bar{1}$.97628	"	1.53258	$\bar{2}$.46742	0.0293
U9-U10, U10'-U9'	20°-49'	$\bar{1}$.97068	"	1.52698	$\bar{2}$.47302	0.0297

load on	x	U5-U6 (0.0284)	U6-U7 (0.0287)	U7-U8 (0.0290)	U8-U9 (0.0293)	U9-U10 (0.0297)
10'	0	0.000	0.000	0.000	0.000	0.000
9'	12	0.341	0.344	0.348	0.352	0.356
8'	24	0.682	0.689	0.696	0.703	0.713
7'	36	1.022	1.033	1.044	1.055	1.069
6'	48	1.363	1.378	1.392	1.406	1.42~~8~~6
5'	60	1.704	1.722	1.740	1.758	1.782
4'	54	1.534	1.550	1.566	1.582	1.604
3'	48	1.363	1.378	1.392	1.406	1.426
2'	42	1.193	1.205	1.218	1.231	1.247
1'	36	1.022	1.033	1.044	1.055	1.069
0'	30	0.852	0.861	0.870	0.879	0.891
1"	24	0.682	0.688	0.696	0.703	0.713
2"	18	0.511	0.516	0.522	0.527	0.535
3"	12	0.341	0.344	0.348	0.352	0.356
4"	6	0.170	0.172	0.174	0.176	0.178
5"	0	0.000	0.000	0.000	0.000	0.000
Summary		12.780	12.9183	13.050	13.185	13.365

☐ Influence Surfaces for Hangers. $Z = H(\tan\alpha - \tan\alpha')$

If upper chords perform a parabolic curve, stresses of hangers are equal theoretically.

Member	α'	α	tan α	tan α'	tan α - tan α'
U6-M6	12°-25'	14°-34'	0.260	0.220	0.040
U7-M7	14°-34'	16°-42'	0.300	0.260	0.040
U8-M8	16°-42'	18°-46'	0.340	0.300	0.040
U9-M9	18°-46'	20°-49'	0.380	0.340	0.040
U10-L10	20°-49'	-(20°-49')	-0.380	0.380	-0.760

Influence Surfaces for H. $H = \frac{x}{h}$ $H_{max} = \frac{60}{36} = \frac{10}{6} = 1.6$

load on	H	load on	H
10'	0.000	0"	0.833
9'	0.333	1"	0.667
8'	0.667	2"	0.500
7'	1.000	3"	0.333
6'	1.333	4"	0.167
5'	1.667	5"	0.000
4'	1.500	sum =	12.500
3'	1.333		
2'	1.167		
1'	1.000		
0'	0.833		

Load on	H-Surfaces	Suspenders (U6-M6, M7-U7, U8-M8, U9-M9)	U10-L10 (Tower)
10	0.000	0.000	-0.000
9	0.333	0.133	-0.253
8	0.667	0.267	-0.507
7	1.000	0.400	-0.760
6	1.333	0.533	-1.013
5	1.667	0.667	-1.267
4	1.500	0.600	-1.140
3	1.333	0.533	-1.013
2	1.167	0.467	-0.887
1	1.000	0.400	-0.760
0	0.833	0.333	-0.633
1'	0.667	0.267	-0.507
2'	0.500	0.200	-0.380
3'	0.333	0.133	-0.253
4'	0.167	0.067	-0.127
5'	0.000	0.000	-0.000
	12.500	5.000	-9.500

☐ Influence Surfaces for Upper chords

	S	r	S/r
U1-U2	2@12.0' = 24.0	12.94	1.855
U2-U3	24.0	12.90	1.861
U3-U4	4@12.0 = 48.0	15.69	3.059
U4-U5	48.0	15.50	3.079

Load on	U1-U2	U2-U3	U3-U4	U4-U5	U5-M6	M6-M7	M7-M8	M8-M9
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	-0.742	-0.745	-0.459	-0.462	-0.308	-0.306	-0.186	-0.186
2	-1.484	-1.489	-0.918	-0.924	-0.616	-0.612	-0.372	-0.371
3	-1.299	-1.303	-1.375	-1.385	-0.924	-0.918	-0.558	-0.557
4	-1.113	-1.117	-1.835	-1.847	-1.232	-1.224	-0.744	-0.742
5	-0.928	-0.931	-1.530	-1.540	-1.540	-1.530	-0.931	-0.928
6	-0.742	-0.744	-1.224	-1.232	-1.847	-1.835	-1.117	-1.113
7	-0.557	-0.558	-0.918	-0.924	-1.385	-1.375	-1.303	-1.299
8	-0.371	-0.372	-0.612	-0.616	-0.924	-0.918	-1.489	-1.484
9	-0.186	-0.186	-0.306	-0.308	-0.462	-0.459	-0.745	0.742
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9'	0.186	0.186	0.306	0.308	0.021	0.024	0.037	0.037
8'	0.371	0.372	0.612	0.616	0.042	0.048	0.074	0.074
7'	0.557	0.558	0.918	0.924	0.064	0.072	0.112	0.112
6'	0.742	0.744	1.224	1.232	0.085	0.096	0.149	0.149
5'	0.928	0.931	1.530	1.540	0.106	0.120	0.186	0.186
4'	0.835	0.838	1.377	1.386	0.095	0.108	0.167	0.167
3'	0.742	0.745	1.224	1.232	0.085	0.096	0.149	0.149
2'	0.650	0.652	1.071	1.078	0.074	0.084	0.130	0.130
1'	0.557	0.559	0.918	0.924	0.064	0.072	0.112	0.112
0	0.464	0.466	0.765	0.770	0.053	0.066	0.093	0.093
1'	0.371	0.372	0.612	0.616	0.042	0.048	0.074	0.074
2'	0.278	0.279	0.459	0.462	0.032	0.036	0.056	0.056
3'	0.186	0.186	0.306	0.308	0.021	0.024	0.037	0.037
4'	0.093	0.093	0.153	0.154	0.011	0.012	0.019	0.019
5'	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Summary +	6.960	6.981	11.475	11.550	0.795	0.900	1.395	1.395
−	7.422	7.445	9.177	9.238	9.238	9.177	7.445	7.422
Total sum	-0.462	-0.464	+2.298	2.312	-8.443	-8.277	-6.050	-6.027

	ξ'	r	ξ'/r	$\frac{\xi_1}{r}\frac{l_1}{l}$	H	η	$H\frac{\eta}{r}$	$\frac{l_1}{l}\frac{\xi'}{r}-H\frac{\eta}{r}$
for M5-M6	6@12.0=72.0	15.59	4.620	2.310	1.667	20.64	2.204	0.106
M6-M7'	72.0	15.69	4.590	2.295	"	"	2.175	0.120
M7-M8'	8@12.0=96.0	12.90	7.440	3.720	"	27.36	3.534	0.186
M8-M9'	96.0	12.94	7.420	3.710	"	"	3.524	0.186

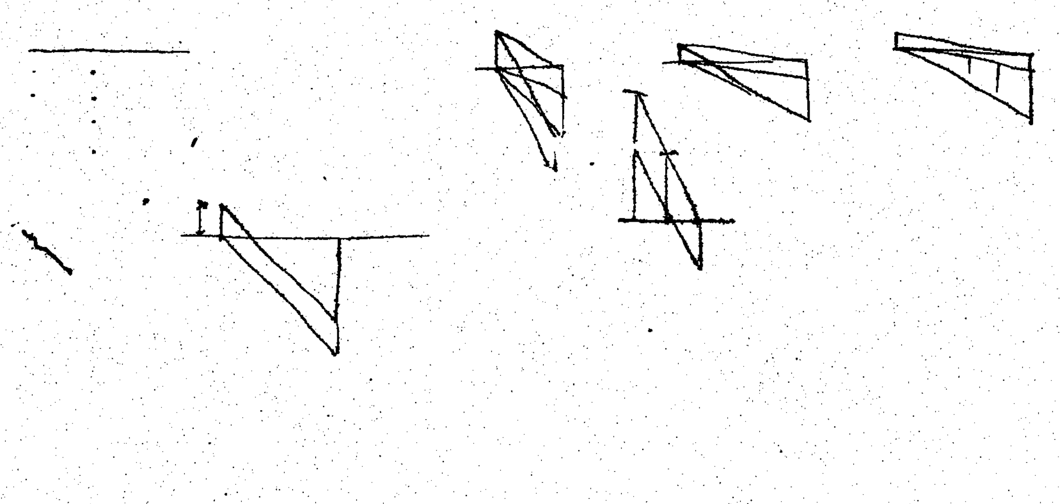
Load on	M9'-M8'	M8'-M7'	M7'-M6'	M6'-M5'
10	0.000	0.000	0.000	0.000
9'	-0.705	-0.707	-0.435	-0.441
8'	-1.400	-1.414	-0.870	-0.882
7'	-1.188	-1.190	-1.305	-1.322
6'	-0.965	-0.967	-1.740	-1.763
5'	-0.742	-0.744	-1.410	-1.435
4'	-0.668	-0.670	-1.269	-1.292
3'	-0.594	-0.595	-1.128	-1.148
2'	-0.519	-0.521	-0.987	-1.005
1'	-0.445	-0.446	-0.846	-0.861
0'	-0.371	-0.372	-0.705	-0.718
1'	-0.297	-0.298	-0.564	-0.574
2'	-0.223	-0.223	-0.423	-0.431
3'	-0.148	-0.149	-0.282	-0.287
4'	-0.074	-0.074	-0.141	-0.144
5'	0.000	0.000	0.000	-0.000
Summary	-8.349	-8.370	-12.105	-12.303

M	ξ	r	ξ/r	$-H\frac{\eta}{r}$	$-H\frac{\eta}{r}+\frac{\xi}{r}$
for M9'-M8'	3@12.0=36.0	12.94	2.782	-3.524	-0.742
for M8'-M7'	36.0	12.90	2.790	-3.534	-0.744
for M7'-M6'	12.0	15.69	0.765	-2.175	-1.410
for M6'-M5'	12.0	15.60	0.769	-2.204	-1.435

☐. Influence Surfaces for Lower chords.

		ξ	r	ξ/r	H.	η.	H η/r
for	L_0-L_1, L_1-L_2	12.0	12.24	0.981 ~~0.980~~			
	L_2-L_3, L_3-L_4	3@12.0 = 36.0	14.16	2.543 ~~2.542~~			
	L_4-L_5 L_5-L_6	5@12.0 = 60.0	18.00	3.331 ~~3.333~~			
for	L_6-L_7 L_7-L_8	7@12.0 = 84.0	14.16	5.933 ~~5.932~~	1.667	9.60	1.130
	L_8-L_9 L_9-L_{10}	9@12.0 = 108.0	12.24	8.824	1.667	19.20	2.614
for	L_{10}-L_9' L_9'-L_8'	4@12.0 = 48.0	12.24	3.921 ~~3.922~~	1.667	19.20	2.614
	L_8'-L_7' L_7'-L_6'	2@12.0 = 24.0	14.16	1.696 ~~1.695~~	1.667	9.60	1.130

Load on	L_0-L_1, L_1-L_2	L_2-L_3, L_3-L_4	L_4-L_5 L_5-L_6	L_6-L_7, L_7-L_8	L_8-L_9, L_9-L_{10}	L_{10}-L_9' L_9'-L_8'	L_8'-L_7' L_7'-L_6'
0	0.000	0.000	0.000	0.000	0.000		
1	0.883	0.593	0.334	0.254	0.098		
2	0.786	1.187	0.667	0.509	0.196		
3	0.688	1.780	1.001	0.763	0.294		
4	0.590	1.526	1.334	1.017	0.393	no stress.	
5	0.491	1.272	1.668	1.272	0.491		
6	0.393	1.017	1.334	1.526	0.590		
7	0.294	0.763	1.001	1.780	0.688		
8	0.196	0.509	0.667	1.187	0.786		
9	0.098	0.254	0.334	0.593	0.883		
10	0.000	0.000	0.000	0.000	0.000		
9'	-0.098	-0.254	-0.334	-0.367	-0.360	~~+0.333~~ 0.523	0.~~333~~ 0.226
8'	-0.196	-0.509	-0.667	-0.735	-0.719	-0.314 ~~0.146~~ 0.066	0.667 0.452
7'	-0.294	-0.763	-1.001	-1.102	-1.079	-0.961 -0.392	1.000 0.678
6'	-0.393	-1.017	-1.334	-1.470	-1.438	-1.607 -~~0.588~~ 0.850	0.486 0.056
5'	-0.491	-1.272	-1.668	-1.837	-1.798	-1.394 2.294	-0.566
4'	-0.442	-1.145	-1.501	-1.653	-1.618	-2.029 1.176	-~~0.026~~ 0.509
3'	-0.393	-1.018	-1.334	-1.470	-1.438	-1.803 1.046	-0.023 0.453
2'	-0.344	-0.890	-1.168	-1.286	-1.259	-1.577 0.915	-0.020 0.396
1'	-0.295	-0.763	-1.001	-1.102	-1.079	-1.352 0.784	-0.017 0.340
0	-0.246	-0.636	-0.834	-0.919	-0.899	-1.127 0.654	-0.015 0.283
1'	-0.196	-0.509	-0.667	-0.735	-0.719	-0.902 0.523	-0.012 0.226
2'	-0.147	-0.382	-0.500	-0.551	-0.539	-0.676 0.392	-0.009 0.170
3'	-0.098	-0.254	-0.334	-0.367	-0.360	-0.451 0.261	-0.006 0.113
4'	-0.049	-0.127	-0.167	-0.184	-0.180	-0.225 0.131	-0.003 0.057
5'	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000 0.000	-0.000 0.000
+	4.419	8.901	8.340	8.901	4.419	+~~0.333~~ 8.593	~~1.412~~
−	3.682	-9.539	-12.510	-13.778	-13.485	~~-15.279~~	~~-0.160~~
						-8.431	-3.107



□ Influence Surfaces for Diagonals

for	ξ	r	ξ/r	b/l	b/l · ξ/r	ξ'	ξ'/r	a/l	a/l · ξ'/r
U_1-L_2	193.61 ~~197.38~~	155.40 ~~158.08~~	1.246 ~~1.248~~	0.8	0.997	313.61 ~~318.38~~	2.018 ~~2.014~~	0.1	0.202
L_2-U_3	105.05	168.93	0.622	0.7	0.435	225.05	1.332	0.2	0.266
U_4-L_4	65.42	86.55	0.756	0.6	0.454	185.42	2.142	0.3	0.643
L_4-U_5	39.87	94.36	0.423	0.5	0.212	159.87	1.694	0.4	0.678

for L_0-U_1 R_A cosec 45°-34' = R_A × 1.400

Load on	L_0-U_1	U_1-L_2	L_2-U_3	U_3-L_4	L_4-U_5
0	-0.000	0.000	0.000	0.000	0.000
1	-1.260	-0.202	0.133	-0.214	0.169
2	-1.120	+0.997	+0.266	-0.428	0.339
3	-0.980	0.872	-0.435	-0.643	0.508
4	-0.840	0.748	-0.373	+0.454	+0.678
5	-0.700	.623	-0.311	0.378	-0.212
6	-0.560	0.498	-0.249	0.302	-0.169
7	-0.420	0.374	-0.187	0.227	-0.128
8	-0.280	0.249	-0.124	0.151	-0.085
9	-0.140	0.125	-0.062	0.076	-0.042
10	0.000	0.000	0.000	0.000	0.000
9'	0.140	-0.125	0.062	-0.076	0.042
8'	0.280	-0.249	0.124	-0.151	0.085
7'	0.420	-0.374	0.187	-0.227	0.128
6'	0.560	-0.498	0.249	-0.302	0.169
5'	0.700	-0.623	0.311	-0.378	0.212
4'	0.630	-0.567	0.280	-0.340	0.191
3'	0.560	-0.498	0.249	-0.302	0.170
2'	0.490	-0.436	0.218	-0.265	0.148
1'	0.420	-0.374	0.187	-0.227	0.128
0'	0.350	-0.312	0.156	-0.189	0.106
1'	0.280	-0.249	0.124	-0.151	0.085
2'	0.210	-0.187	0.093	-0.113	0.064
3'	0.140	-0.125	0.0621	-0.076	0.042
4'	0.070	-0.062	0.031	-0.038	0.021
5'	0.000	-0.000	0.000	-0.000	0.000
	-6.300	-4.875 ~~4.881~~	-1.741	-4.120	-0.639
	+5.250 ~~5.780~~	+4.486 ~~4.473~~	+2.732	+1.588	+3.283 ~~3.292~~

for	ξ'/r	l_1/l	$\frac{\xi_1'}{r}\times\frac{l_1}{l}$	H	η	r	$H\frac{\eta}{r}$	$\frac{\xi_1'}{r}\frac{l_1}{l}-H\frac{\eta}{r}$
U5-L6	1.694	0.5	0.847	1.667	39.99	94.36	0.706	0.141
L6-U7	2.142	〃	1.071	〃	50.11	86.55	0.965	0.106
U7-L8	1.332	〃	0.666	〃	66.08	168.93	0.652	0.041
L8-U9	2.018	〃	1.009	〃	101.30	155.40	1.087	-0.078
U9-L10	1.648	〃	0.824	〃	263.26	435.40	1.007	-0.183

($\xi_1' = 589.74 + 120 = 717.74$
$r = 435.40$)

Load on	U5-L6	L6-M7	M7-L8	L8-M9	M9-L10
0	0.000	0.000	0.000	0.000	0.000
1	-0.042	0.076	-0.062	0.125	-0.140
2	-0.085	0.151	-0.124	0.249	-0.280
3	-0.127	0.227	-0.187	0.374	-0.420
4	-0.169	0.302	-0.249	0.498	-0.560
5	+0.212	0.378	-0.311	0.623	-0.700
6	0.678	0.454	-0.373	0.748	-0.840
7	0.508	-0.643	-0.435	0.872	-0.980
8	0.339	-0.428	+0.266	0.997	-1.120
9	0.169	-0.214	0.133	-0.202	-1.260
10	0.000	-0.000	0.000	0.000	0.000
9'	-0.028	0.021	-0.008	-0.066	0.037
8'	-0.056	0.042	-0.016	-0.031	-0.073
7'	-0.085	0.064	-0.025	-0.047	0.110
6'	-0.113	0.085	-0.033	-0.062	0.146
5'	-0.141	0.106	-0.041	-0.078	0.183
4'	-0.127	0.095	-0.037	-0.070	0.166
3'	-0.113	0.085	-0.033	-0.062	0.146
2'	-0.099	0.074	-0.029	-0.055	0.128
1'	-0.085	0.064	-0.025	-0.047	0.110
0'	-0.071	0.053	-0.021	-0.039	0.092
1''	-0.056	0.042	-0.016	-0.031	0.073
2''	-0.042	0.032	-0.012	-0.023	0.055
3''	-0.028	0.021	-0.008	-0.016	0.037
4''	-0.014	0.011	-0.004	-0.008	0.018
5''	0.000	0.000	0.000	-0.000	0.000
−	-1.481	-1.285	-1.800	-0.787	-6.300
+	+1.906	2.783	0.399	4.486	1.374

for	ξ	r	ξ/r	H·η/r	ξ/r - H η/r	or at B
L10'-U9'	597.74+60=657.74	435.40	1.511	1.007	0.504	1.373
U9'-L8'	193.61+60=253.61	155.40	1.632	1.087	0.545	1.246
L8'-U7'	105.05+60=165.05	168.93	0.977	0.652	0.325	0.622
U7'-L6'	65.42+60=125.42	86.55	1.449	0.952	0.484	0.756
L6'-U5'	39.87+60=99.87	94.36	1.058	0.706 (.65)	0.352	0.422

Load on	L10-M9'	M9'-L8'	L8'-M7'	M7'-L6'	L6'-U5'
10'	0.000	0.000	0.000	0.000	0.000
9'	-1.199	-0.217	0.130	-0.193	0.141
8'	-1.026	+0.966	0.261	-0.386	0.282
7'	-0.852	0.825	0.444	-0.579	0.424
6'	-0.678	0.685	-0.384	+0.538	0.565
5'	-0.504	0.545	-0.325	0.484	-0.357
4'	-0.454	0.491	-0.293	0.436	-0.317
3'	-0.403	0.436	-0.260	0.387	-0.282
2'	-0.353	0.382	-0.228	0.339	-0.246
1'	-0.302	0.327	-0.195	0.290	-0.211
0	-0.252	0.273	-0.163	0.242	-0.176
1	-0.202	0.218	-0.130	0.194	-0.141
2	-0.151	0.164	-0.098	0.145	-0.106
3	-0.101	0.109	-0.065	0.097	-0.070
4	-0.050	0.055	-0.033	0.048	-0.035
5	0.000	0.000	0.000	0.000	0.000
	+6.527	-0.217	-2.618	-1.158	-1.986
	+0.000	+5.476	0.391	3.200	1.412

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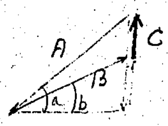
☐ Influence surfaces for Verticals.



$A \sin a - B \sin b = C$

load on	for U_2-L_2	U_4-L_4	M_6-L_6	M_8-L_8	$M_8'-L_8'$	$M_6'-L_6'$
0	0.000	0.000	0.000	0.000		
1	−0.031	−0.019	−0.012	−0.008		
2	−0.062	−0.037	−0.025	−0.016		
3	−0.054	−0.056	−0.037	−0.023		
4	−0.047	−0.074	−0.049	−0.031		
5	−0.039	−0.062	−0.062	−0.039	no stress.	
6	−0.031	−0.049	−0.074	−0.047		
7	−0.023	−0.037	−0.056	−0.054		
8	−0.016	−0.025	−0.037	−0.062		
9	−0.008	−0.012	−0.019	−0.031		
10	0.000	0.000	0.000	0.000	0.000	0.000
9'	0.008	0.012	0.134	0.135	0.104	0.115
8'	0.016	0.025	0.268	0.270	0.210	0.231
7'	0.023	0.037	0.401	0.405	0.351	0.345
6'	0.031	0.049	0.535	0.540	0.493	0.461
5'	0.039	0.062	0.669	0.675	0.637	0.607
4'	0.035	0.056	0.602	0.608	0.573	0.546
3'	0.031	0.050	0.535	0.540	0.510	0.486
2'	0.027	0.043	0.468	0.473	0.446	0.425
1'	0.023	0.037	0.401	0.405	0.382	0.364
0	0.020	0.031	0.335	0.338	0.319	0.304
1'	0.016	0.025	0.268	0.270	0.255	0.243
2'	0.012	0.019	0.201	0.203	0.191	0.182
3'	0.008	0.012	0.134	0.135	0.127	0.121
4'	0.004	0.006	0.067	0.068	0.064	0.061
5'	0.000	0.000	0.000	0.000	0.000	0.000
	−0.311	−0.371	−0.371	−0.311		
	+0.293	0.464	+5.618	5.065	+4.662	+4.481

for U_2-L_2 $-1.489 \times \sin 5°\text{-}44' + 1.484 \times \sin 3°\text{-}24' = -0.149 + 0.088 = -0.062$ (panel 2)

for U_4-L_4 $-1.847 \times \sin 10°\text{-}13' + 1.835 \times \sin 7°\text{-}57' = -0.328 + 0.254 = -0.074$ (panel 4)

for M_6-L_6 $0.166 \times \sin 10°\text{-}13' - 0.120 \times \sin 7°\text{-}57' = 0.019 - 0.017 + 0.667 = 0.669$

for M_8-L_8 $+0.186 \times \sin 5°\text{-}44' - 0.186 \times \sin 3°\text{-}24' + 0.667 = 0.008 + 0.667 = 0.675$

□ Influence Surfaces for Verticals (continued)

for M_8'-L_8' / for M_6'-L_6'

Load on	M_9'-M_8'	Δ 3°21' (0.0584)	M_8'-L_7'	Δ 5°-44' (0.0999)	Suspender	M_8'-U_8'	M_6'-U_5'	Δ 10°-13' (1774)	M_7'-M_6'	Δ 7°-57' (0.1383)	M_6'-L_6'	
10	0.000	0.000	0.000	0.000	0.000	0.000	-0.000	0.000	0.000	0.000	0.000	
9'	-0.705	-0.047	-0.707	-0.071	0.133	0.1034	-0.441	-0.078	-0.435	-0.060	0.115	
8'	-1.410	-0.084	-1.414	-0.141	0.267	~~0.218~~ 0.210	-0.882	-0.156	-0.870	-0.120	0.230	
7'	-1.188	-0.079	-1.190	-0.119	0.400	~~0.350~~ 0.351	-1.322	-0.235	-1.305	-0.180	0.345	
6'	-0.965	-0.057	-0.967	-0.097	0.533	~~0.492~~ 0.493	-1.763	-0.313	-1.740	-0.241	0.461	
5'	-0.742	(-0.043)	-0.744	-0.074	0.667	0.637	-1.435	-0.254	-~~1.310~~ 1.416	-0.181	0.594	0.607
4'	-0.668	-0.039	-0.670	-0.067	0.600	0.572	-1.292	-0.229	-1.179	-0.163	0.535	
3'	-0.594	-0.34	-0.595	-0.059	0.533	0.508	-1.148	-0.203	-1.048	-0.145	0.475	
2'	-0.519	-0.030	-0.521	-0.052	0.467	0.445	-1.005	-0.178	-0.917	-0.127	0.416	
1'	-0.445	-0.026	-0.446	-0.045	0.400	0.381	-0.861	-0.152	-0.786	-0.109	0.356	
0'	-0.371	-0.022	-0.372	-0.037	0.333	0.318	-0.718	-0.127	-0.655	-0.091	0.297	
1"	-0.297	-0.017	-0.298	-0.030	0.267	0.254	-0.574	-0.102	-0.524	-0.072	0.238	
2"	-0.223	-0.013	-0.223	-0.022	0.200	0.191	-0.431	-0.076	-0.393	-0.054	0.178	
3"	-0.148	-0.009	-0.149	-0.015	0.133	0.127	-0.287	-0.051	-0.262	-0.036	0.119	
4"	-0.074	-0.004	-0.074	-0.007	0.067	0.064	-0.144	-0.025	-0.131	-0.018	0.059	
5"	0.000	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

0.0593 − 0.0999

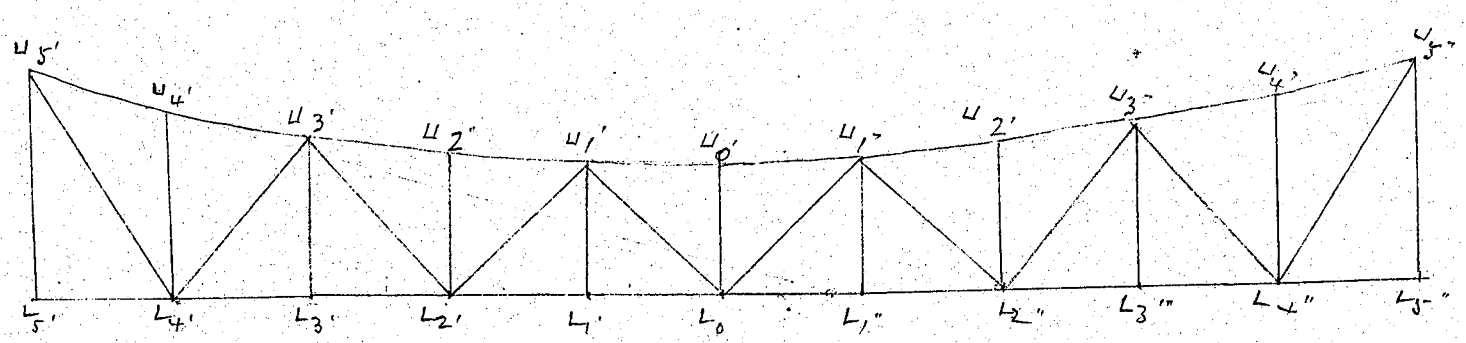
+0.742 × Δ 3°-24' + 0.744 × Δ 5°-44' + 0.667 = 0.637

+0.044   -0.074

−1.435 × Δ 10°-13' + 1.410 × Δ 7°-57' + 0.667 = 0.607

−0.254   0.195

Suspended Span.



Upper chord influence surfaces

	s	r	s/r	a/l	
U5'-U4'	12.0	15.59	0.770	0.9	0.693
U4'-U3'	12.0	15.69	0.765	0.9	0.689
U3'-U2'	36.0	12.90	2.809	0.7	1.966
U2'-U1'	36.0	12.94	2.782	0.7	1.947
U1'-U0'	60.0	12.00	5.000	0.5	2.500

Load on	U5'-U4'	U4'-U3'	U3'-U2'	U2'-U1'	U1'-U0'
U0 5'	0.000	0.000	0.000	0.000	0.000
4'	-0.693	-0.689	-0.655	-0.649	-0.500
3'	-0.616	-0.612	-1.311	-1.298	-1.000
2'	-0.539	-0.536	-1.966	-1.947	-1.500
1'	-0.462	-0.459	-1.685	-1.669	-2.000
0	-0.385	-0.383	-1.405	-1.391	-2.500
1"	-0.308	-0.306	-1.124	-1.113	-2.000
2"	-0.231	-0.230	-0.843	-0.835	-1.500
3"	-0.154	-0.153	-0.562	-0.556	-1.000
4"	-0.077	-0.077	-0.281	-0.278	-0.500
5"	0.000	0.000	0.000	0.000	0.000
	-3.465	-3.445	-9.832	-9.736	-12.500

Lower chord influence surfaces.

	s	r	s/r
L4'-L3'	2@12.0 = 24.0	14.16	1.694
L3'-L2'	24.0	"	"
L2'-L1'	4@12.0 = 48.0	12.24	3.921
L1'-L0'	" = 48.0	"	"

Load on	L4'-L3', L3'-L2'	L2'-L1', L1'-L0'
5'	0.000	0.000
4'	0.678	0.588
3'	1.355	1.176
2'	1.186	1.764
1'	1.016	2.353
0'	0.847	1.961
1"	0.678	1.568
2"	0.508	1.176
3"	0.339	0.784
4"	0.169	0.392
5"	0.000	0.000
	6.776	11.762

for Diagonals.

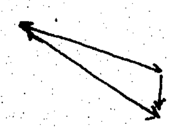
	l d	l	x	sin θ	log sin θ	log x	log r / log x. sin θ
U5'-L4'	99.87	99.87	87.87	56°-18'	$\bar{1}$.92010	1.94384	1.86394
L4'-U3'	113.42	125.42	113.42	49°-44'	$\bar{1}$.88255	2.05469	1.93724
U3'-L2'	141.05	165.05	129.05	49°-44	$\bar{1}$.88255	2.11076	1.99331
L2'-U1'	217.61	253.61	217.61	45°-34'	$\bar{1}$.85374	2.33768	2.19142
U1'-L0	609.74	657.74	597.74	45°-34'	$\bar{1}$.85374	2.77651	2.63025

	r	l/r	l'	l'/r
U5'-L4'	73.104	1.367	20.13	0.275*
L4'-U3'	86.545	1.449	5.42	0.063
U3'-L2'	98.472	1.676	45.05	0.457
L2'-U1'	155.390	1.632	133.61	0.971
U1'-L0	426.83	1.541	537.74	1.260

Load on	U5'-L4'	L4'-U3'	U3'-L2'	L2'-U1'	U1'-L0'
5'	0.000	0.000	0.000	0.000	0.000
4'	1.230	0.006	-0.046	0.097	-0.126
3'	1.094	-1.159	-0.091	0.194	-0.252
2'	0.957	-1.014	1.173	0.291	-0.378
1'	0.820	-0.869	1.006	-0.979	-0.504
0	0.684	-0.724	0.838	-0.816	0.771
1"	0.547	-0.579	0.670	-0.653	0.616
2"	0.410	-0.435	0.503	-0.490	0.462
3"	0.273	-0.290	0.335	-0.327	0.308
4"	0.137	-0.145	0.168	-0.163	0.154
5"	0.000	0.000	0.000	0.000	0.000
	+6.152	. 0.006	4.693	0.582	2.311
	-0.000	-5.215	-0.137	-3.428	-1.260

for Verticals.

U5'-L5', U3'-L3'. U1'-L1' all equal to 1.000.


comp

for U4L4' . $-0.693 \sin 10°\text{-}13' + 0.689 \sin 7°\text{-}57' = -0.123 + 0.095 = -0.028$ (1.774, 1.383)

for U2L2' $-1.966 \sin 5°\text{-}44' + 1.947 \sin 3°\text{-}24' = -0.196 + 0.115 = -0.081$ (0.0999, 0.0593)

Load on	U4'-L4'	U2'-L2'
5'	0.000	0.000
4'	-0.028	-0.027
3'	-0.026	-0.054
2'	-0.023	-0.081
1'	-0.019	-0.070
0	-0.016	-0.058
1"	-0.013	-0.046
2"	-0.010	-0.035
3"		
4"	-0.006	-0.023
5"	-0.003	-0.012
	0.000	0.000
	-0.144	-0.406

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CALCULATIONS FOR

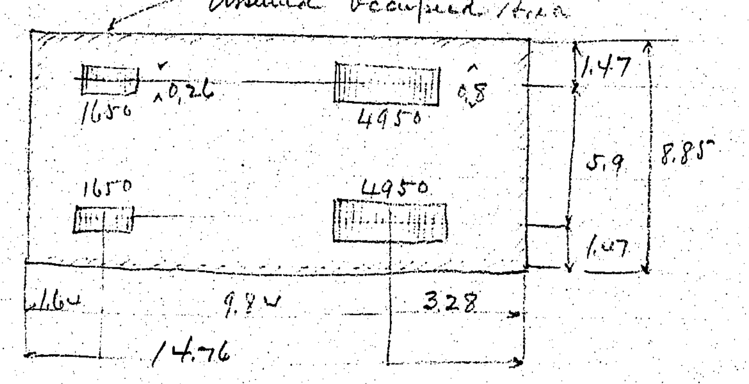
☐ Assumed Loadings.

Uniformed Load on roadway $w = \frac{100.000}{170+l} \doteq 500$ kg/m² or 100 #/□'

where w = Uniform load in kg per sq meter

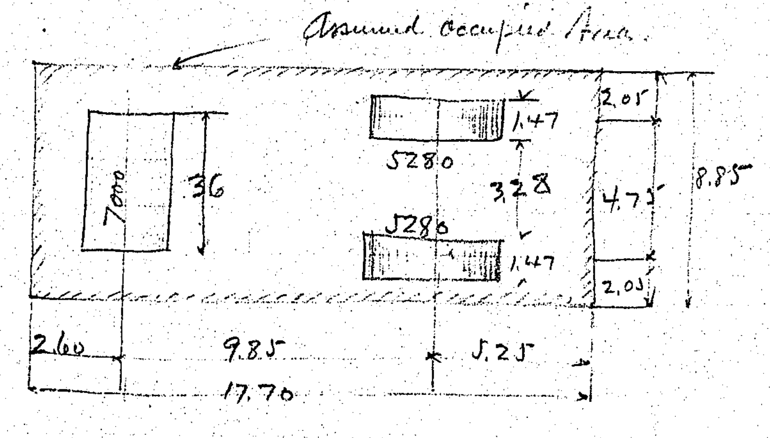
l = span length in meter.

6 ton motor truck loading.



2 rows of motor traffic on roadway with impact; Occupied width 8.85 each, unoccupied space of roadway by motor trucks to be filled in with the uniform load. One motor truck in each row on one span assumed.

8 ton roadroller



One roadroller on one span; no impact assumed.

Impact.

For motor truck loading only $\frac{20}{60+l}$ where l = span length in meter

max impact limited to 30%

No impact for roadroller and uniform load.

☐ Assumed weight of materials

Plain concrete	140 # per cub. ft
Reinforced concrete	150 # 〃 〃
structural steel	490 # 〃 〃
cast iron	450 # 〃 〃
masonry	160 # 〃 〃
asphaltic concrete	140 # 〃 〃

☐ Allowable working strength

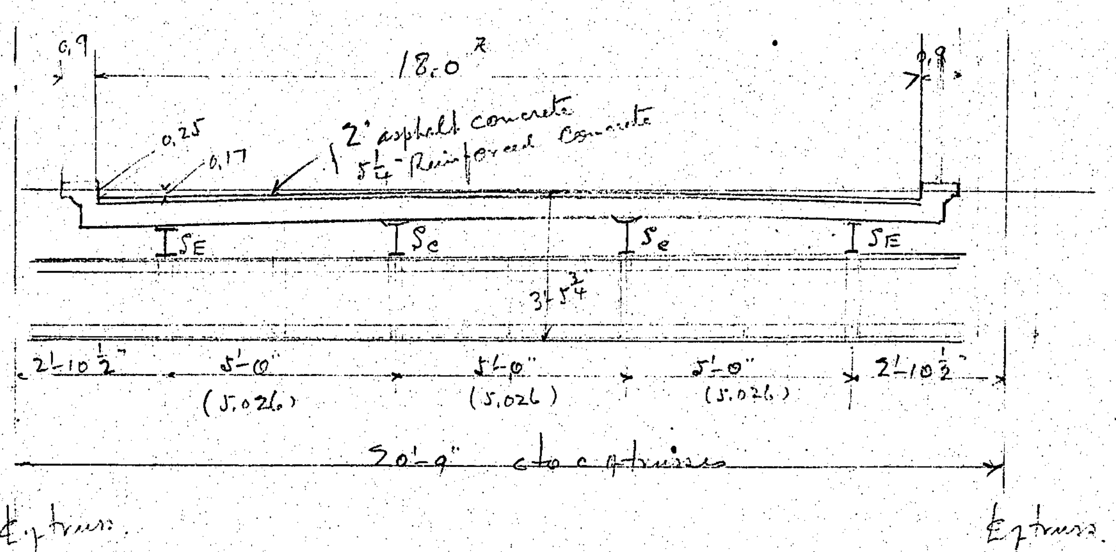
structural steel or Reinforcing Bars.

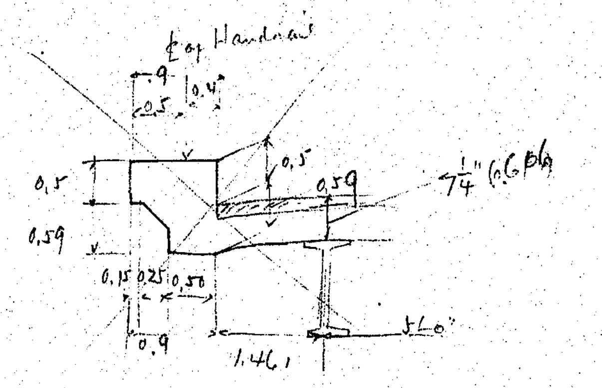
Tension 17,000 #/□"
Extreme fiber stress 17,000
Shear on web gross section 12,800
compression member 21300 (1-0.0055 l/r) or not over 14,000 # gross area
Compression flange of plate girder
$17,000\,(1-0.012\frac{l}{b}) \leq 15400$ #/□"
where l = Unsupported length of flange in inches
b = width of flange in inches
Shearing on shop driven rivets (machine driven) 12,000 #/□"
" " field " 10,000 "
Extreme fiber stress of pin 24,000 "
Bearing on shop rivets 24,000 "
" " field " 20,000 "
Bearing on pin 24,000 "
Expansion roller 610 d per lin inch where d = diameter of roller in inches
Bearing on masonry 640 #/□"

Concrete 1:2:4 mixture
compression fiber stress 640 #/□"
shear for plain concrete 58 #/□"
Punching shear 128 #/□"
Bond stress of plain bar 85 #/□"
shear for reinforced concrete with web reinforcement 128 #/□"
Bond stress of deformed bar 130 #/□"

Considering wind and temperature stresses in addition to dead, live and impact stresses, the allowable working strength shall be increased 25% and proportioned the parts.
In figuring earthquake, the working strength shall be increased 80% and proportioned the parts.
Acceleration of Earthquake assumed 1000 mm/sec²

☐ Cross-section of Truss Span.





2"
5¼"
2"
10"
1'-10½"
3'-5¾"

☐ Design of Reinforced Concrete Slab.

Span length of slab 5'-0" center to centre of stringers

Dead load

2" asphaltic concrete	24 #
5¼" slab	66
	90 #/□'

Dead load mt $= \frac{1}{10} \times 90 \times 5^2 = 225$ '#

Dead load shear $= 90 \times 2.5 = 225$ #

Live Load.

motor truck rear wheel concentration		4950 #
Impact		1485
		6435
Front wheel conc. with impact	30%	2145

Distribution of wheel concentration.

Contact between wheel and pavement assumed 20 centimeter = 0.66

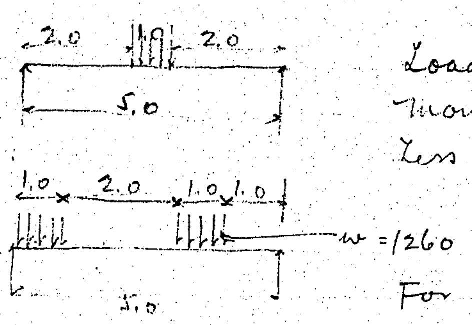
2× thickness of pavement .17 = 0.34

Longitudinal distribution = 1.00 = a

Transverse distribution 0.80 + 0.34 = 1.14 = b

Effective width $E = \frac{2}{3}(l+b)+a$ where l = span length in ft

$= \frac{2}{3}(5.00+1.14)+1.00 = 5.1$



Load for one ft strip $= 6435 \div 5.1 = 1260.0$ # assumed.

Moment due to single wheel load $= 630 \times 2.5 = 1575$ '#

Less moment due to uniform load $= 630 \times 0.25 = 157$

1418 '#

For continuity of slab take moment as $0.8 \times 1418 = 1135$ '#

Max shear as simple beam.

$1260 \times \frac{6.0}{5.0} = 1510$ #

Summary for moment and shear.

	moment	shear
Dead load	225	225
Live load	1135	1510
	1360	1735

Effective depth of slab for steel stress of 17,000 #/□" and concrete stress 640 #/□".

$d = \sqrt{\frac{1360}{102}} = 3.65"$ use 5¼" slab width, effective depth of 4" with 1.25" insulation.

Steel area req'd $= \frac{1360 \times 12}{7/8 \times 4.0 \times 17{,}000} = 0.274$ □" per ft

use ½" φ 6" pitch = 0.39 □"

Max End shear $= \frac{1735}{7/8 \times 4.0 \times 12} = 41$, #/□"

Bond stress $u = \frac{1735}{\frac{7}{8} \times 4.0} = 496$ # per ft

Try 2-½" φ @ 1.57 × 130 # = 409 #

2-⅜" φ @ 1.18 × 130 = 306

715 #

☐ Design of Longitudinal Stringers
stringer spacing 5'0" span length: 12'0"
stringer Sc. (Neglecting cantilever action at SE)

Dead load

slab and Pavement 90 × 5.0 = 450 #
Stringer assumed 35 # including details.
485 # / lin ft

Dead load moment = 1/8 × 485 × 12.0² = 8,730 '#
Shear = 485 × 12.0/2 = 2,910 #

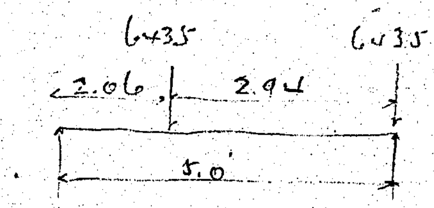
Live load.

motor truck loading Rear wheel conc. with impact = 6435
Front " " " " = 2145

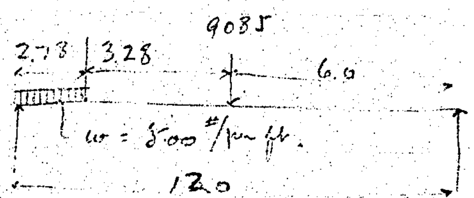
Load on stringer

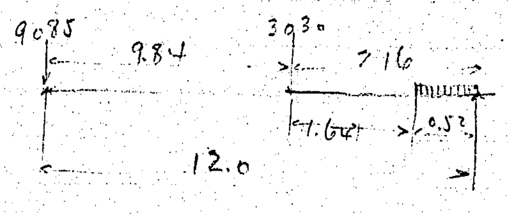
Rear wheel reaction. 6435 × 2.06/5.0 = 2650
6435
9085

Front wheel reaction 3030



Live load moment — moment due to concentration 9085/2 × 12.0/2 = 27,255
" " uniform Load. 1390 × 1.39/12 × 6.0 = 966
28,221 '#





Max end shear
uniform Load = 500 × 0.52²/(2×12) = 10 #
Rear wheel 9085
Front wheel = 3030 × 2.16/12 = 545
9,640 #

Summary for moment and shear.

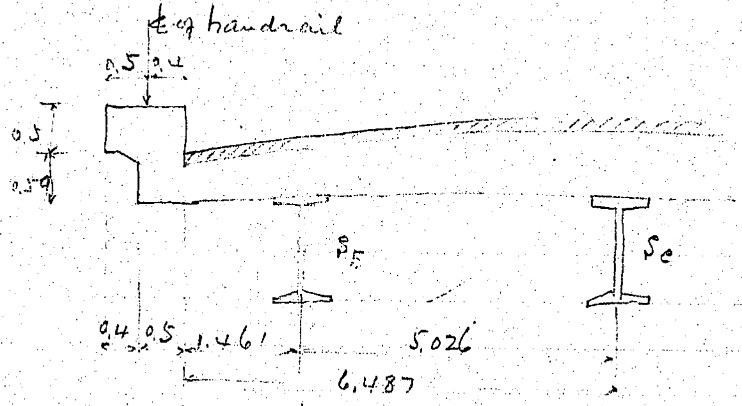
	moment	shear
Dead load	8,730	2910
Live load	28,221	9,640
	36,950	12,550

10" × 5" I @ 29.99, S.m = 29.14

Unit stress = (36,950 × 12)/29.14 = 15,200 #/□" ✓

12.0
6.0
12.0
3.28
8.72² × 500 / 2×12 = 1580
9085
10665

End stringer S_E.



Support S_C assumed as simply supported.

Reaction on stringer S_E

		weight	Arm	moment
slab	90×6.5 =	585	3.25	1901
sill	150×0.5×1.1 =	83	6.75	560
"	150×0.4×0.5 =	30	7.20	216
Handrail		60	6.90	414
		758		3091'#

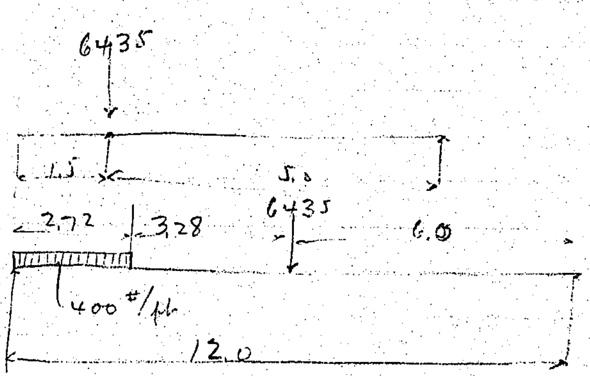
Reaction stringer $= \frac{3091}{5.0} = 618$ #/per ft
35 #
653 #

Dead load moment $= \frac{1}{8} \times 653 \times 12.0^2 = 11.754$ '#
shear $= 653 \times 12.0 \div 2 = 3.918$ #

Live Load.

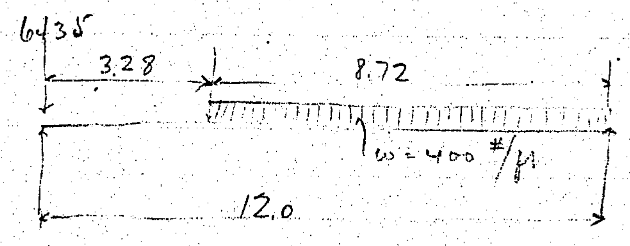
Uniform live load 400 #/ft assumed.

Moment due to uniform live load $= \frac{1}{8} \times 400 \times 12.0^2 = 7.200$ '#
Shear " $= 400 \times 6.0 = 2.400$
Motor truck



Rear wheel of motor truck on ℄ of stringer assumed.

moment due to conc. $= \frac{6435}{2} \times 6.0 = 19.305$
including impact
due to uniform Load $= 400 \times 1.36 \times \frac{6}{12} \times 2.72 = 740$
Total mt $= 19.305 + 740 = 20.045$ '#



shear $= 6435 + 400 \times 8.72^2 \times \frac{1}{2} \times \frac{1}{12} = 6435 + 1267 = 7.702$ #

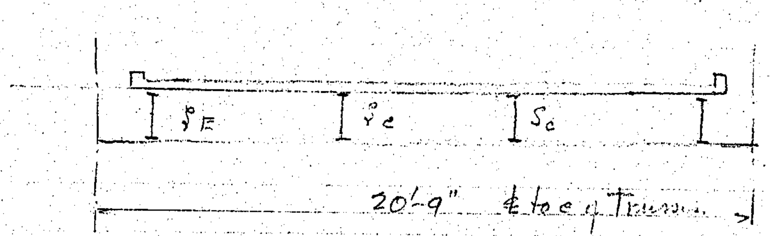
Summary of mt and shear.

	moment	Shear
D.L.	11.754	3.918
L.L.	20.045	7.702
	31.799 '#	11.620 #

10", 5 I @ 29.99 lbs used its $S_m = 29.14$

Unit stress $= \frac{31799}{29.14} = 10.900$ #/□"

☐ Design of Floor Beam.

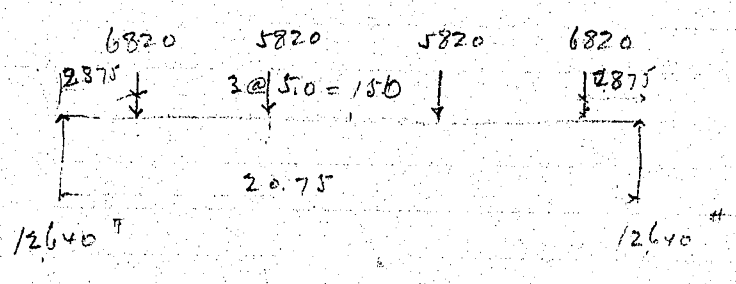


Intermediate floor beam.

Dead load — Load beyond S_C 2@ 758 = 1516
Load between S_C & S_C 90 × 5.0 = 450
1966 say 2,000#

Distribution of load assumed.

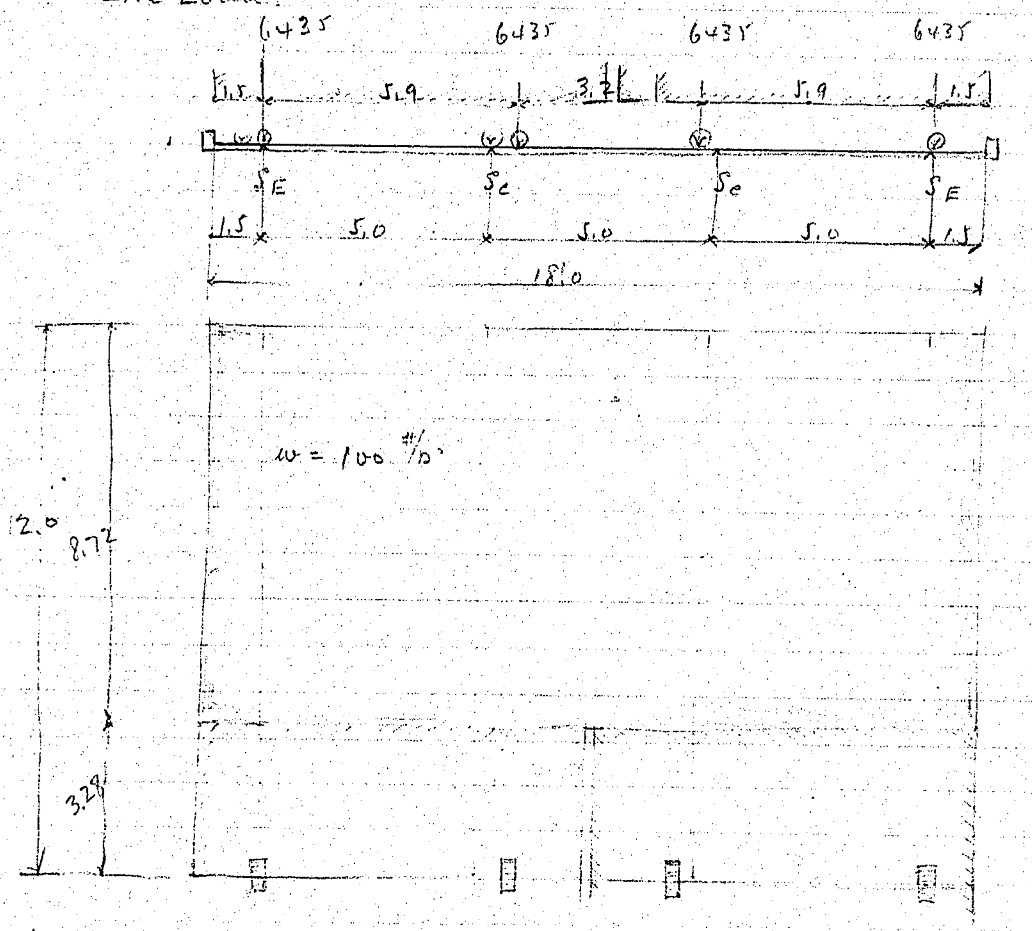
On stringer S_C 90 × 5.0 = 450 stringer assumed 35.0 485#
S_E 758 − 225 = 533 35.0 568#



485 × 12 = 5820#
568 × 12 = 6820#
12,640

moment due to dead load = 12640 × 7.875 − 6820 × 5.0 = 99,540 − 34,100 = 65,440 ′#
Shear " " " " = 12,640#

Live Load.



wheel load
for S_C 6435# including impact
for S_E 6435 "

Uniform load
for S_C $100 \times 5.0 \times \frac{8.72^2}{2} \times \frac{1}{12} = 1584$

for S_E $100 \times 4.0 \times \frac{8.72^2}{2} \times \frac{1}{12} = 1267$

Total live load concentration.

S_C = 6435 + 1584 = 8,019# 8,000
S_E = 6435 + 1267 = 7,702 7,700
reaction 15,700

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CALCULATIONS FOR

2.875   7700   8.000 3@5.0=15.0   8.000   7700   2.875

20.75

reaction = 15,700 #

Moment due to live load = 15,700×7.875 − 7700×5.0 = 123,638 − 38,500 = 85,138 #
Shear = 15,700 #

Summary of
Total wt and shear

	moment	shear
D.L	65,440 (4)	12,640
L.L	85,140	15,700
	150,580 #	28,340 #

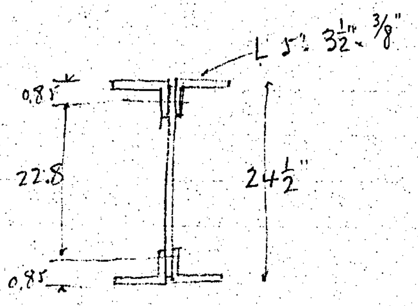
65440
4310
69750

Girder its own wt assumed 80 #/ft

wt = ⅛×80×20.75² = 4,306 #   shear = 80×20.75÷2 = 830 #

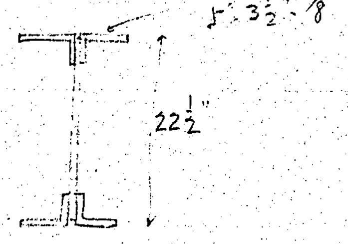
Total wt and shear
wt = 150,580 + 4,310 = 154,890   say 155,000 #
Shear = 28,340 + 830 = 29,170   say 29,000 #

Section req'd = $\frac{155,000\times12}{17,000\times22.8}$ − 0.94 = 4.80 − 0.94 = 3.86 □"



1 web 24"×5/16"   area = 7.5 □"   ⅛×7.5 = 0.94 □"
4 Ls 5"×3½"×⅜"   area = 4@3.05 = 12.20 □"
19.70 × 3.4 = 66.98 = 67.0 #
details 13.0
80.0 /lin ft

Actual area = 2@3.05 − 2×⅜"×⅞" = 6.10 − 1.17 = 4.93 □"



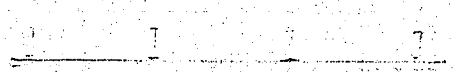
Section req'd = $\frac{155,000\times12}{17,000\times20.8}$ − 0.86 = 5.26 − 0.86 = 4.40 □"

1 web 22"×5/16"   area = 6.88 □"   ⅛×6.88 = 0.86

Actual area = 2@3.05 − 2×⅞"×⅞" = 4.93 □"
4@.33 = 6.10
1.32
4.78

Grand wt of one floor beam

1 web 22"×5/16"×19.75'
4 Ls 5"×3½"×⅜"×19.75 } 6.88 + 12.20 = 19.08 □" × 3.4 = 64.87 #
64.87×19.75 = 1280 #



16 stiff Ls 3½"×3½"×5/16"×1'-7¾" = 7.2×1.8×16 = 250
16 fillers 3½"×⅞"×1.25 = 4.46×1.25×16 = 90
2@ connection 2@40 = 80
1700 #

1700 ÷ 20.75 = 82.0 #/ft of girder
1700 ÷ 12.0 = 142.0 #/lin ft of bridge

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☐ panel load

Dead load

Floor slab	90×18.0 =	1620	
Tibulen		226	
Hand railing		120	
		1966	1966
stringers	4 @ 35.0	140	
floor beam		142	
Bottom lateral		55	
Sway and top lateral		140	
2 Trusses		700	
		1177	1157
			3143 per ft of span

Panel dead load = $3143 \times \frac{12}{2}$ = 18,858 say 19,000 #/ truss

Uniform live load
$w = \frac{100,000}{170+l} = \frac{100,000}{170+\frac{120}{3.3}} = \frac{100,000}{170+36} = 485\ kg/m^2 = 97\ \#/\square'$

panel live load = $97 \times 18.0 \times \frac{12}{2}$ = 10,476 # say 10,500 # / truss

☐ Stresses of each members for Suspended span.

for upper chord

	Influence Surface	Dead load stress (19,000)	L.L. stress (10,500)	Total stress
U5'-U4'	-3.465	-65.835	-36.383	-102.200
U4'-U3'	-3.445	-65.455	-36.173	-101.600
U3'-U2'	-9.832	-186.808	-103.236	-290.000
U2'-U1'	-9.736	-184.984	-102.228	-287.200
U1'-U0'	-12.500	-237.500	-131.250	-368.800

for Lower chord

		D.L. stress	L.L. stress	Total
L5'-L4'	0.000			
L4'-L3'	} 6.776	128.700	71,200	199.900
L3'-L2'				
L2'-L1'	} 11.762	223.500	123.500	347,000
L1'-L0'				

for Diagonals	+A	-A	Sum	D.L stress	L.L. stress	Total
U5'-L4'	6.152	0.000	6.152	+116,900	+64.600	+181.500
L4'-U3'	0.006	5.215	-5.209	-99,000	-54.800	-153.800
U3'-L2'	4.693	0.137	4.556	+86.600	+49.300	+135.900
L2'-U1'	0.582	3.428	-2.846	-54,100	-36.000	-90,100
U1'-L0'	2.321	1.260	1.051	+20.000	+24,300	+44.300

for Verticals		D.L. stress	L.L. stress	Total
U4'-L4'	-0.144	-2,700	-1,500	-4.200
U2'-L2'	-0.406	-7.700	-4.300	-12,000

☐ Stresses of each members for cantilever (main) ~~bridge~~ truss.

for upper chord.

	+A	−A	Sum.	D.L. stress	L.L. stress		Total stress	adjusting stress
H1-H2	6.960	7.422	−0.462	−8,800	+73,100	−77,900	−86,700 (64,300)	−118,900 (96,500)
H2-H3	6.981	7.445	−0.464	−8,800	73,300	−78,200	−87,000 (64,500)	−119,300 (96,800)
H3-H4	11.475	9.177	+2.298	43,700	120,500	−96,400	164,200 (−52,700)	+190,600 (−79,100)
H4-H5	11.550	9.238	+2.312	43,900	121,300	−96,000	165,200 (−52,100)	191,300 (−78,200)
H5-H6 (M)	0.795	9.238	−8.443	−160,400		−96,000	−256,400	−256,400
M6-M7	0.900	9.177	−8.277	−157,300		−96,400	−253,700	−253,700
M7-M8	1.395	7.445	−6.050	−115,000		−78,200	−193,200	−193,200
M8-M9	1.395	7.422	−6.027	−114,500		−77,900	−192,400	−192,400
M9' (11) - M8' (12)		−8.349		−158,600		−87,700	−246,300	
M8' (12) - M7' (13)		−8.370		−159,000		−87,900	−246,900	
M7' (13) - M6' (14)		−12.105		−230,000		−127,100	−357,100	
M6' (14) - M5' (15)		−12.303		−233,800		−129,200	−363,000	

for Lower chords.

	+A	−A	Summary	D.L. stress	L.L. stress		Total		adjusting stress
L0-L1 } L1-L2	4.419	3.682	0.737	1,4,000	46,400	−38,700	47,800	−37,300	66,500 (−56,000)
L2-L3) L3-L4	8.901	9.539	−0.638	−12,100	93,500	−100,200	81,400	−112,300	−153,000 (122,100)
L4-L5) L5-L6	8.340	12.510	−4.170	−83,000	87,600	−131,400	4,600	−214,400	−216,700 (6,900)
L6-L7) L7-L8	8.901	13.778	−4.877	−92,700	93,500	−144,700	0,800	−237,400	−237,400
L8-L9) L9-L10	4.419	13.485	−9.066	−172,300	~~46,400~~	−141,600		−313,900	−313,900
~~L10-L~~									
L10-L9') L9'-L8'	0.589	8.431	−7.842	−149,000		−88,500		−237,500	−237,500
L8'-L7') L7'-L6'	1.412	3.107	−1.695	−32,200		−32,600		−64,800	−64,800

for Diagonals.

	+A	−A	Sum.	D.L. stress	L.L. stress		Total stress		adjusting stress
L0-H1	5.250	6.300	−1.050	−20,000 (~~19.91~~)	55,100	−66,200	35,100	−86,200	−103,800 (52,700)
H1-L2	4.486	4.875	−0.389	−7,400	47,100	−51,200	39,700	−58,600	−78,500 (59,600)
L2-H3	2.732	1.741	+0.991	+18,800	28,700	−18,300	47,500		47,500
H3-L4	1.588	4.120	−2.432	−46,200	16,700	−43,300		−89,500	−89,500
L4-H5	3.283	0.639	+2.644	+50,200	34,500		84,700		84,700
H5-L6	1.906	1.481	+0.425	+8,100	20,000	−15,600	28,100	−7,500	31,900 (−11,300)
L6-M7	2.783	1.285	+1.498	+28,500	29,200		57,700		57,700
M7-L8	0.399	1.800	−1.401	−26,600		−18,900		−45,500	−45,500
L8-M9	4.486	0.787	+3.699	+70,400	47,100		117,500		117,500
M9-L10	1.374	6.300	−4.926	−93,600		−66,200		−159,800	−159,800
L10-M9' (11)	0.000	6.527	−6.527	−124,000		−68,500		−192,500	−192,500
M9' (11) - L8' (14)	5.476	0.217 (~~0.39~~)	+5.259	+99,900 (~~100,0~~)	57,500		+157,400		157,400
L8' (14) - M7' (13)	0.391	2.618	−2.227	−42,300		−27,500		−69,800	−69,800
M7' (13) - L6' (14)	3.200	1.158	+2.042	+38,800	33,600		72,400		72,400
L6' (14) - L5' (15)	1.412	1.986	−0.574	−10,900	14,800	−20,900	3,900	−31,800	−33,800 (5,900)

for Verticals.

	+A.	−A	Sum.	D.L stress	L.L. stress		Total stress		Adjusting stress
U_2-L_2	0.293	0.311	−0.018	−300	3,100	−3,300	2,800	−3,600	−5,000 (4200)
U_4-L_4	0.464	0.371	+0.093	+1,800	4,900	−3,900	6.700	−2,100	+7,800 (−3,200)
U_6-L_6	5.018	0.371	+4.647	+88,300	52,700		141,000		141,000
M_8-L_8	5.065	0.311	+4.754	+90,300	53,200		143,500		143,500
M_8'-L_8'	4.662	0.000	+4.662	+88,600	39,100		127,700		127,700
M_6'-L_6'	4.481	0.000	+4.481	+85,100	47,100		132,200		132,200

for Hanging chord

	+A.	D.L. stress	L.L. stress	Total
U_5-U_6	12.780	242,800	134,200	377,000
U_6-U_7	12.913	245,300	135,600	380,900
U_7-U_8	13.050	248,000	137,000	385,000
U_8-U_9	13.185	250,500	138,400	388,900
U_9-U_{10}	13.365	253,900	140,300	394,200

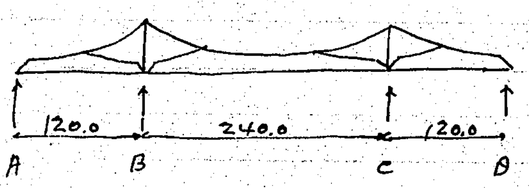
for Hangers

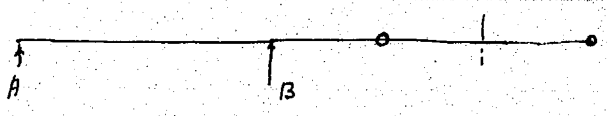
	+A.	D.L. stress	L.L stress	Total
U_6-M_6, M_7-U_7, U_8-M_8, U_9-M_9	+~~4.500~~ 5.000	95,000	52,500	147,500

for Tower

U_{10}-L_{10}	−9.500	−180.500	−99.800	−280,300

□ Reaction of each supports





Reaction A 6,300 ÷ 1.4 = 4.50
−5.25 ÷ 1.4 = −3.75
+0.65

Due to dead load = 0.65×19.000 = 12,400 # ~~4.50×19,000 = 85,500~~

Live load = −3.75×10,500 = −39,400 ~~46,100~~ #
+
−27,000

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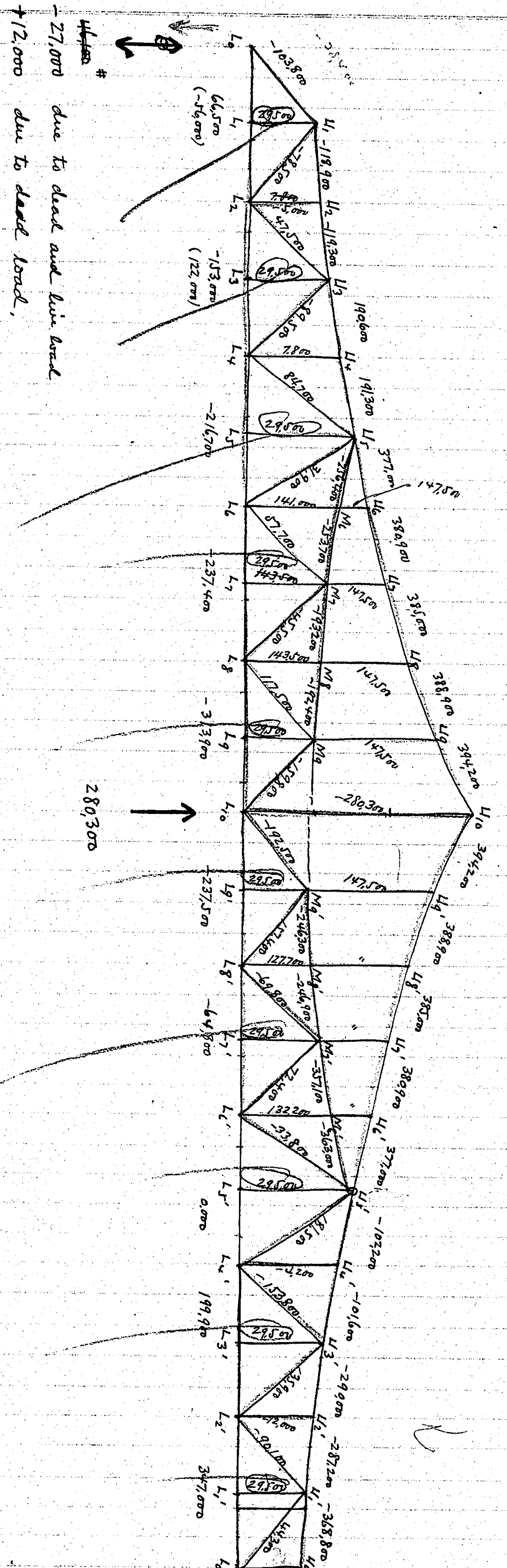
CALCULATIONS FOR



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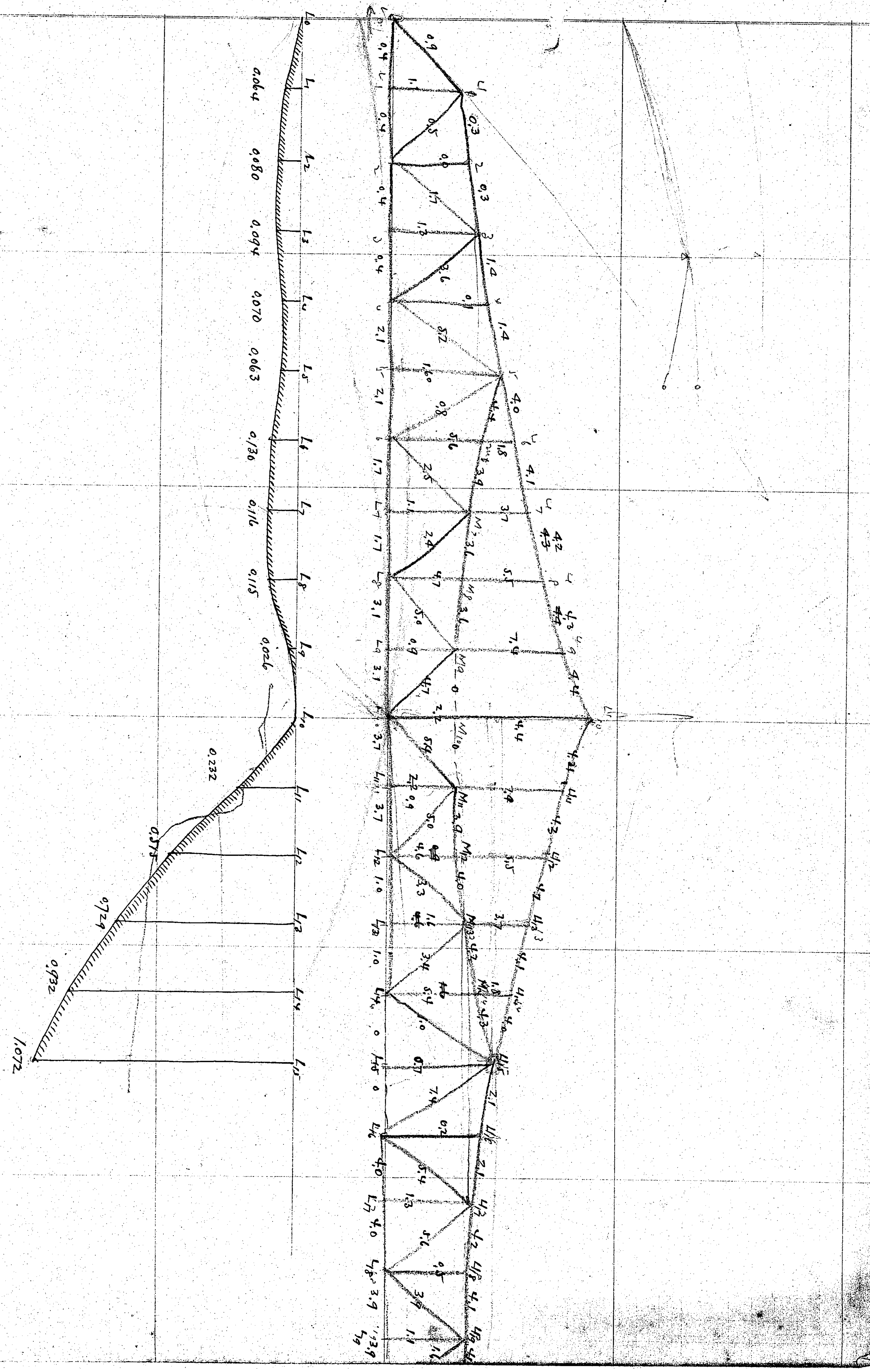
CALCULATIONS FOR



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CONSULTING ENGINEER
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MADE BY 27,520 / ~~10,000,000~~ ; 0.2752 / 100 ______ DATE ______ FILE NO. ______

CHECKED BY ______ DATE ______ PAGE NO. ______

12 4 / 30,000,000 = 4 / 10,000,000

CALCULATIONS FOR

	S.	L		A.	SL/A	SL/AE ×100 in inches	Actual Length.	
U_1-U_2	8800 c	12'-1/4"	12.02	15.35	- 6,880	-0.275	12'-0 7/16"	
U_2-U_3	8800 c	12'-3/4"	12.06	15.35	- 6,920	-0.317	12'-0 15/16"	
U_3-U_4	43,700 T	12'-1 3/8"	12.11	15.35	34,500 ~~43,700~~	1.380	12'-1 9/16	(12'-1 15/16) ?
U_4-U_5	43,900 T	12'-2 5/16"	12.19	15.35	34,900	1.396	12'-2 9/16"	
U_5-U_6	242,800 T	12'-3 7/16"	12.29	29.59	10,0800 ~~10,800~~	4.032	12'-3 11/16"	
U_6-U_7	245,300 T	12'-4 13/16"	12.40	29.59	102,700	4.108	12'-5 1/8"	
U_7-U_8	248 000 T	12'-6 5/16"	12.53	29.59	10,5,000	4.200	12'-6 5/8"	
U_8-U_9	250500 T	12'-8 1/16"	12.67	29.59	10,7,200	4.288	12'-8 7/16"	
U_9-U_{10}	253900 T	12'-10 1/16"	12.84	29.59	11,0,200	4.408	12'-10 7/16"	
U_{10}-U_{11}	253900 T	12'-10 1/16"	12.84	29.59	11,0,200	4.408	12'-10 7/16"	
U_{11}-U_{12}	250500 T	12'-8 1/16"	12.67	29.59	10,7,200	4.288	12'-8 7/16"	
U_{12}-U_{13}	248000 T	12'-6 5/16"	12.53	29.59	10.5,000	4.200	12'-6 5/8"	
U_{13}-U_{14}	245300 T	12'-4 13/16	12.40	29.59	10,2,700	4.108	12'-5 1/8"	
U_{14}-U_{15}	242800 T	12'-3 7/16"	12.29	29.59	10,0800	4.032	12'-3 11/16"	
U_{15}-U_{16}	65,800 c	12'-2 5/16"	12.19	15.35	- 52,300	-2,092	12'-2 9/16"	
U_{16}-U_{17}	65,800 c	12'-1 3/8"	12.11	15.35	- 51,600	- 2,064	12'-1 9/16"	
U_{17}-U_{18}	186 800 c	12'-3/4"	12.06	21.60	- 104,200	- 4.168	? 12'-0 15/16"	
U_{18}-U_{19}	184 500 c	12'-1/4"	12.02	21.60	- 102,700	- 4.108	12'-0 7/16"	
U_{19}-U_{20}	237 500 c	12'-0"	12.00	27.85	- 102,300	- 4.092		
U_5-M_6	160,400 c	12'-2 5/16"	12.19	19.34	- 111,000	- 4.440	12'-2 9/16"	
M_6-M_7	157300 c	12'-1 3/8	12.11	19.34	- 98,500	- 3.940	12'-1 9/16	
M_7-M_8	115000 c	12'-0 3/4"	12.06	15.35	- 90,300	- 3,612	12'-0 15/16"	
M_8-M_9	114500 c	12'-1/4"	12.02	15.35	- 89,700	- 3,588	12'-0 7/16"	
M_9-M_{10}	0	12'-0"	12.00	15.35 ~~26~~	0	0	12'-0 ~~1/8~~" 3/16	
M_{10}-M_{11}	0	12'-0"	12.00	15.35	0	0	12'-0 ~~1/8~~" 3/16"	
M_{11}-M_{12}	158600 c	12'-0 1/4"	12.02	19.34	- 98,500	- 3,940	12'-0 7/16"	
M_{12}-M_{13}	159000 c	12'-3/4"	12.09	19.34	- 99,400	- 3.976	12'-0 15/16"	
M_{13}-M_{14}	230,000 c	12'-1 3/8"	12.11	26.84	- 103,800	- 4.152	12'-1 9/16"	
M_{14}-M_{15}	233,800 c	12'-2 5/16"	12.19	26.84	- 106,200	- 4.248	12'-2 9/16"	
L_0-L_1	14,000 T	12'-0"	12.00	15.35	10,940	0.438	12'-0"	
L_1-L_2	14,000 T	12'-0"	12.00	15.35	10,940	0.438	12'-0"	
L_2-L_3	12,100 c	12'-0"	12.00	15.35	- 9,460	- 0.378	↓	
L_3-L_4	12,100 c	12'-0"	12.00	15.35	- 9,460	- 0.378		
L_4-L_5	83,000 c	12'-0"	12.00	19.34	- 51,500	- 2.060		
L_5-L_6	83 000 c	12'-0"	12.00	19.34	- 51,500	- 2.060		
L_6-L_7	92700 c	12'-0"	12.00	26.84	- 41,400	- 1.656		
L_7-L_8	92700 c	12'-0"	12.00	26.84	- 41.400	- 1.656		
L_8-L_9	172300 c	12'-0"	12.00	26.84	- 77,000	- 3,080		
L_9-L_{10}	172300 c	12'-0"	12.00	26.84	- 77,000	- 3,080		
L_{10}-L_{11}	149 000 c	12'-0"	12.00	19.34	- 92,400	- 3.696		
L_{11}-L_{12}	149 000 c	12'-0"	12.00	19.34	- 92.400	- 3.696		
L_{12}-L_{13}	32,200 c	12'-0	12.00	15.35	- 25,200	- 1.008		
L_{13}-L_{14}	32,200 c	12'-0	12.00	15.35	- 25,200	- 1.008		
L_{14}-L_{15}	0	12'-0	12.00	15.35	0	0		
L_{15}-L_{16}	0	12'-0"	12.00	15.35	0	0		
L_{16}-L_{17}	128,700 T	12'-0"	12.00	15.35	100,600	4.024		
L_{17}-L_{18}	128,700 T	12'-0"	12.00	15.35	100,600	4.024		
L_{18}-L_{19}	223500 T	12'-0"	12.00	27.85	96,300	3.852	12'-0"	
L_{19}-L_{20}	223500 T	12'-0"	12.00	27.85	96,300	3,852	12'-0"	

Upper chords

Lower chords

	Member	S	S	L	L	A	$\frac{SL}{A}$	$\frac{SL}{AE}\times 100$	Actual Length
Diagonals	L_0-U_1		20000^{C}	17'-1 11/16"	17.14	15.34	−22,350	−0.894	17'-1 3/4"
	U_1-L_2		7400^{C}	17'-1 11/16"	17.14	9.60	−13,200	−0.528	
	L_2-U_3		18800^{T}	18'-6 3/4"	18.56	8.36	41,700	1.668	18'-6 13/16"
	U_3-L_4		46200^{C}	18'-6 3/4"	18.56	9.60	−89,300	−3.572	
	L_4-U_5		50200^{T}	21'-7 5/8"	21.64	8.36	130,000	5.200	21'-7 21/32"
	U_5-L_6		$8,100^{T}$	21'-7 5/8"	21.64	8.36	21,000	0.840	etc.
	L_6-M_7		28500^{CT}	18'-6 3/4	18.56	8.36	63,200	2.520	
	M_7-L_8		26600^{C}	18'-6 3/4"	18.56	8.36	−59,000	−2.360	
	L_8-M_9		$70,400^{T}$	17'-1 11/16"	17.14	9.60	125,700	5.028	
	M_9-L_{10}		93600^{C}	17'-1 11/16"	17.14	13.68	−117,200	−4.688	
	L_{10}-M_{11}		$124,000^{C}$	17'-1 11/16"	17.14	15.88	−133,800	−5.352	
	M_{11}-L_{12}		99900^{T}	17'-1 11/16"	17.14	13.68	125,000	5.000	
	L_{12}-M_{13}		42300^{C}	18'-6 3/4	18.56	9.60	−81,800	−3.272	
	M_{13}-L_{14}		38800^{T}	18'-6 3/4"	18.56	8.36	86,200	3.448	
	L_{14}-U_{15}		$10,900^{C}$	21'-7 5/8"	21.64	9.60	−24,600	−0.984	
	U_{15}-L_{16}		$116,900^{T}$	21'-7 5/8	21.64	13.68	184,300	7.372	
	L_{16}-U_{17}	~~2700^{C}~~	$99,000^{C}$	18'-6 3/4	18.56	13.68	−134,300	−5.372	
	U_{17}-L_{18}		86600^{T}	18'-6 3/4	18.56	11.44	140,300	5.612	
	L_{18}-U_{19}		54100^{C}	17'-1 11/16"	17.14	9.60	−96,600 ~~91,200~~	−3.864	
	U_{19}-L_{20}		20000^{T}	17'-1 11/16"	17.14	8.36	41,000	1.640	
Verticals	U_1-L_1		19000^{T}	12'-2 7/8"	12.24	8.36	27,800	1.112	
	U_2-L_2		300^{C}	12'-11 1/2"	12.96	8.36	−500	−0.020	
	U_3-L_3		$19,000^{T}$	14'-1 15/16"	14.16	8.36	32,200	1.288	
	U_4-L_4		1800^{T}	15'-10 1/16"	15.84	8.36	3,400	0.136	
	U_5-L_5		19000^{T}	18'-0"	18.00	8.36	40,900	1.636	
	M_6-L_6		$88,300^{T}$	15'-10 1/16"	15.84	9.92	141,000	5.640	
	M_7-L_7		19000^{T}	14'-1 15/16"	14.16	9.92	27,200	1.088	
	M_8-L_8		90300^{T}	12'-11 1/2"	12.96	9.92	118,000	4.720	
	M_9-L_9		19000^{T}	12'-2 7/8"	12.24	9.92	23,500	0.940	
	M_{10}-L_{10}		180500^{C}	12'-0"	12.00	39.09	−55,400	−2.216	
	M_{11}-L_{11}		$19,000^{T}$	12'-2 7/8"	12.24	9.92	23,500	0.940	
	M_{12}-L_{12}		88600^{T}	12'-11 1/2"	12.96	9.92	115,700	4.628	
	M_{13}-L_{13}		19000^{T}	14'-1 15/16"	14.16	9.92	27,200	1.088	
	M_{14}-L_{14}		85100^{T}	15'-10 1/16"	15.84	9.92	135,800	5.432	
	U_{15}-L_{15}	~~116900^{T}~~	$19,000^{T}$	18'-0"	18.00	19.34	17,600	0.704	
	U_{16}-L_{16}	~~99000^{C}~~	2700^{C}	15'-10 1/16"	15.84	8.36	−5,100	−0.204	
	U_{17}-L_{17}	~~86600^{T}~~	$19,000^{T}$	14'-1 15/16"	14.16	8.36	32,200	1.288	
	U_{18}-L_{18}	~~54100^{C}~~	7700^{C}	12'-11 1/2	12.96	8.36	−11,900	0.476	
	U_{19}-L_{19}	~~$20,000^{T}$~~	19000^{T}	12'-2 7/8"	12.24	8.36	27,800	1.112	
	U_{20}-L_{20}	0	0	12'-0"	12.00	8.36	0	0	
	U_6-M_6	95000^{T}	~~$19,000^{T}$~~	4'-9 5/8"	4.80	9.92	46,000	1.840	
	U_7-M_7	95000^{T}	~~$19,000^{T}$~~	9'-7 3/16"	9.60	9.92	91,900	3.676	
	U_8-M_8	95000^{T}	~~$19,000^{T}$~~	14'-4 13/16"	14.40	9.92	137,800	5.512	
	U_9-M_9	95000^{T}	~~$19,000^{T}$~~	19'-2 3/8"	19.20	9.92	183,800	7.352	
	U_{10}-M_{10}	180500^{C}		24'-0"	24.00	39.09	−110,800	−4.432	
	U_{11}-M_{11}	95000^{T}	~~$19,000^{T}$~~	19'-2 3/8	19.20	9.92	183,800	7.352	
	U_{12}-M_{12}	95000^{T}	~~$19,000^{T}$~~	14'-4 13/16"	14.40	9.92	137,800	5.512	
	U_{13}-M_{13}	95000^{T}	~~$19,000^{T}$~~	9'-7 3/16"	9.60	9.92	91,900	3.676	
	U_{14}-M_{14}	95000^{T}	~~$19,000^{T}$~~	4'-9 5/8"	4.80	9.92	46,000	1.840	

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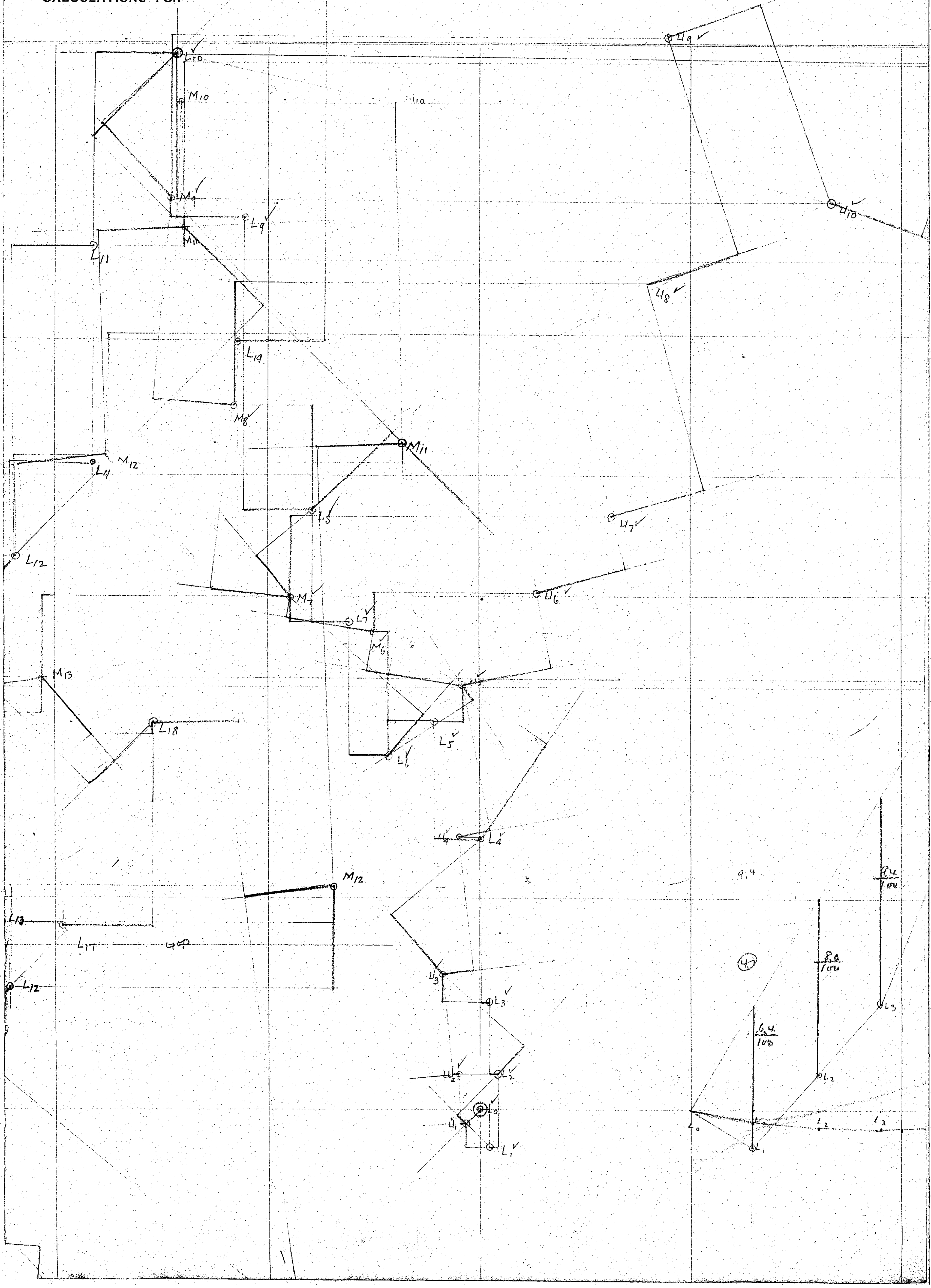

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（独立行政法人 土木研究所蔵）

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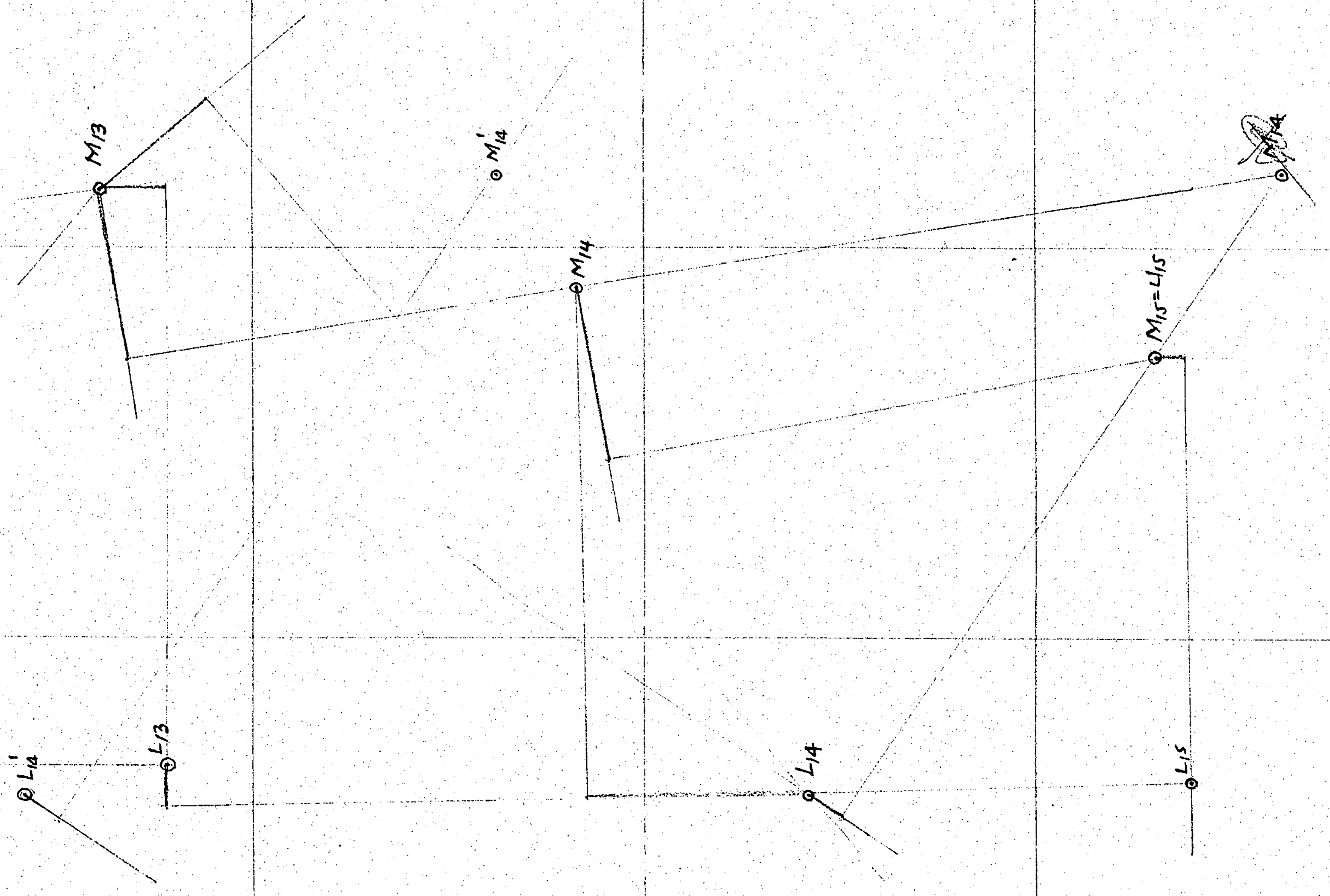

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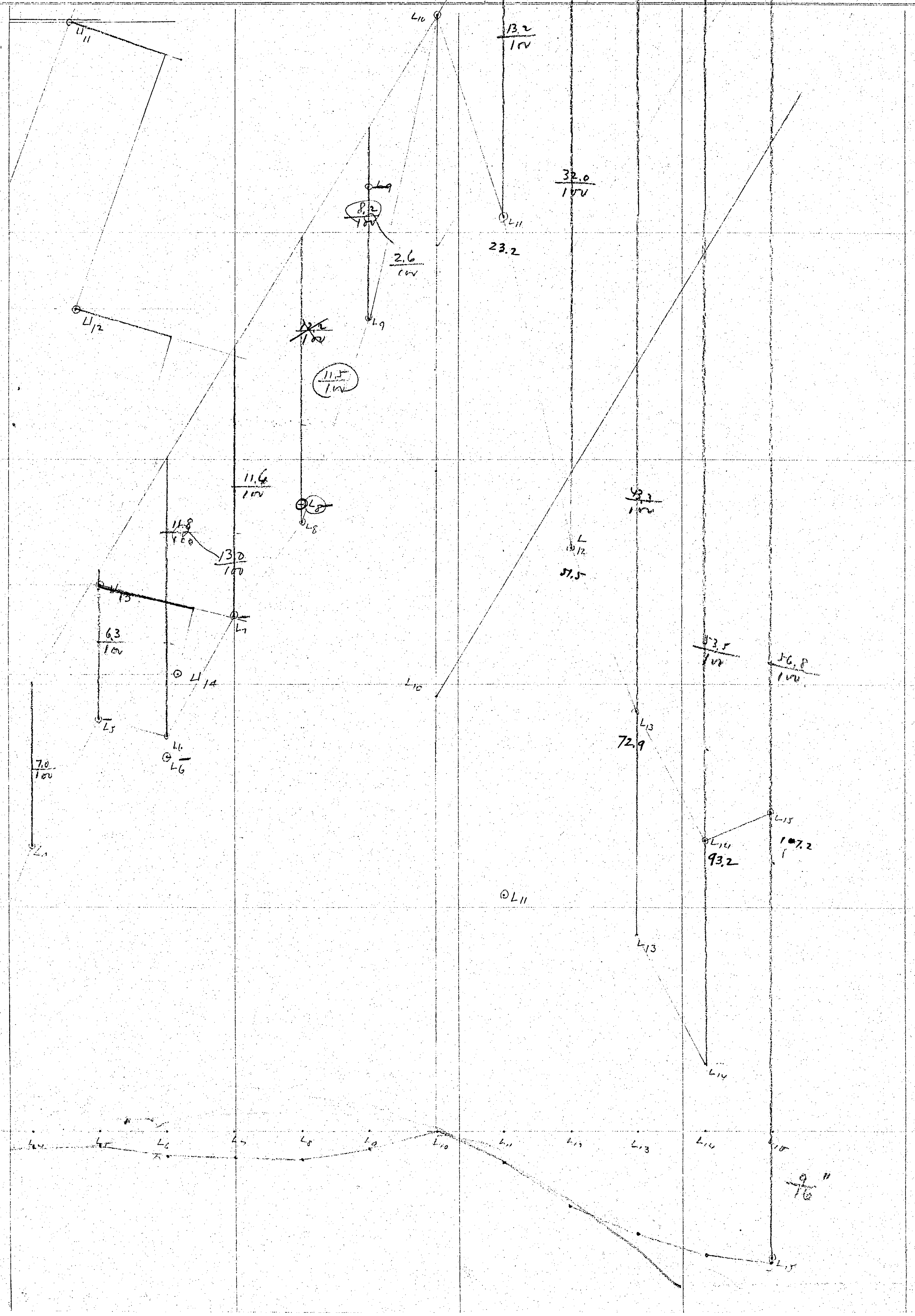

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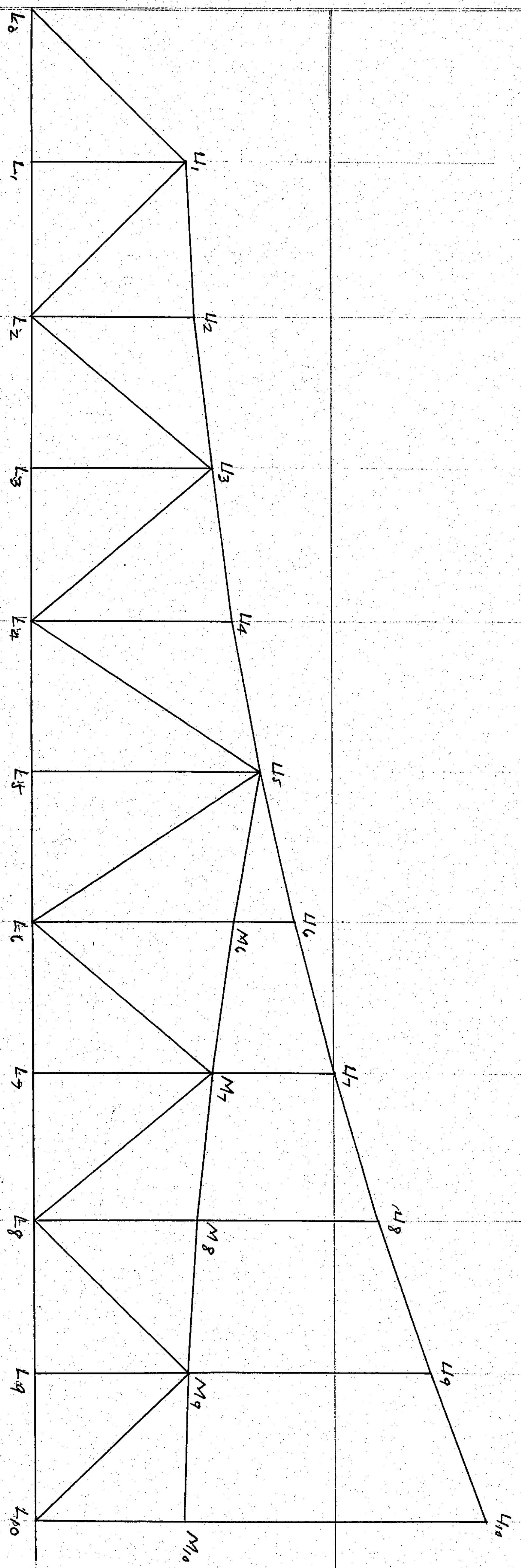

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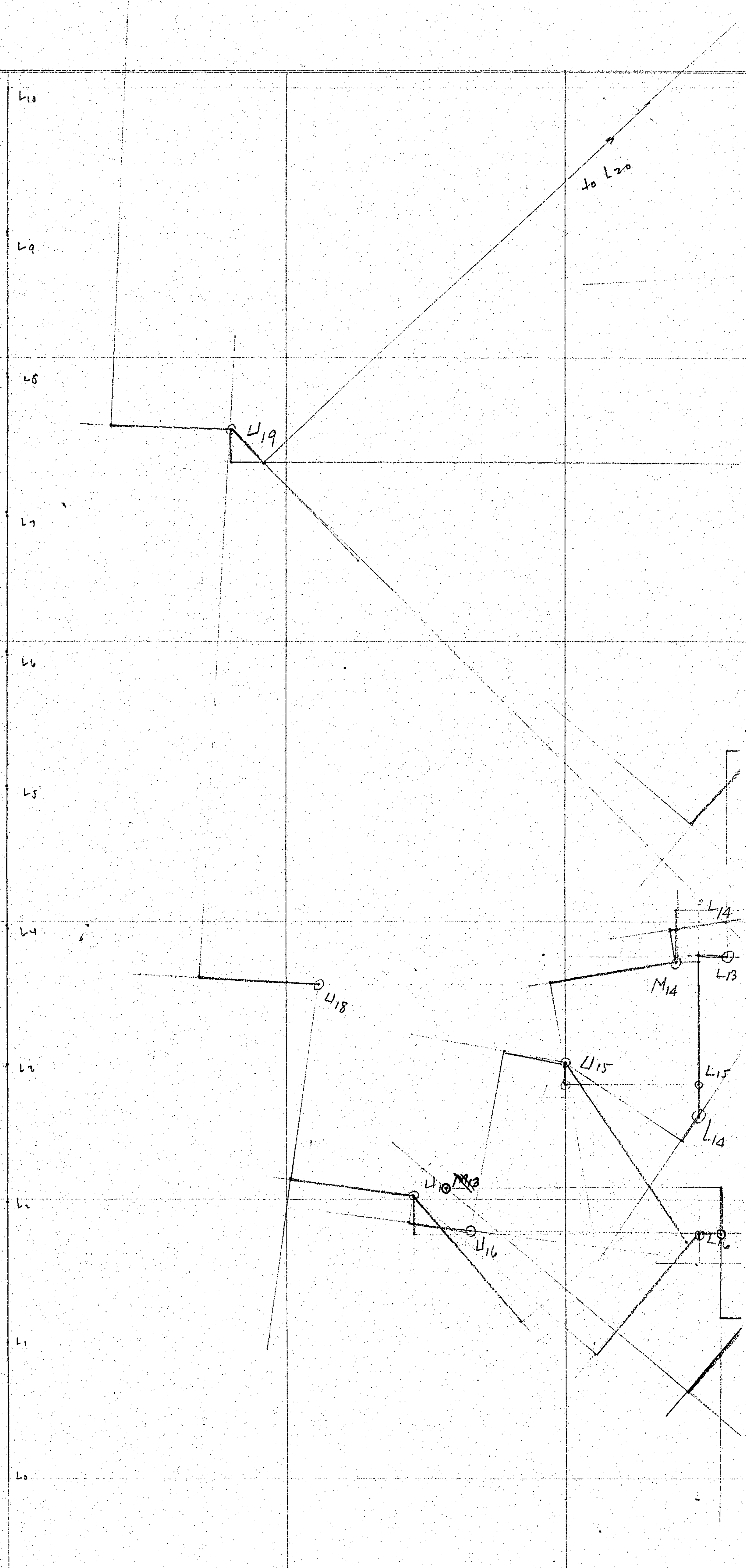

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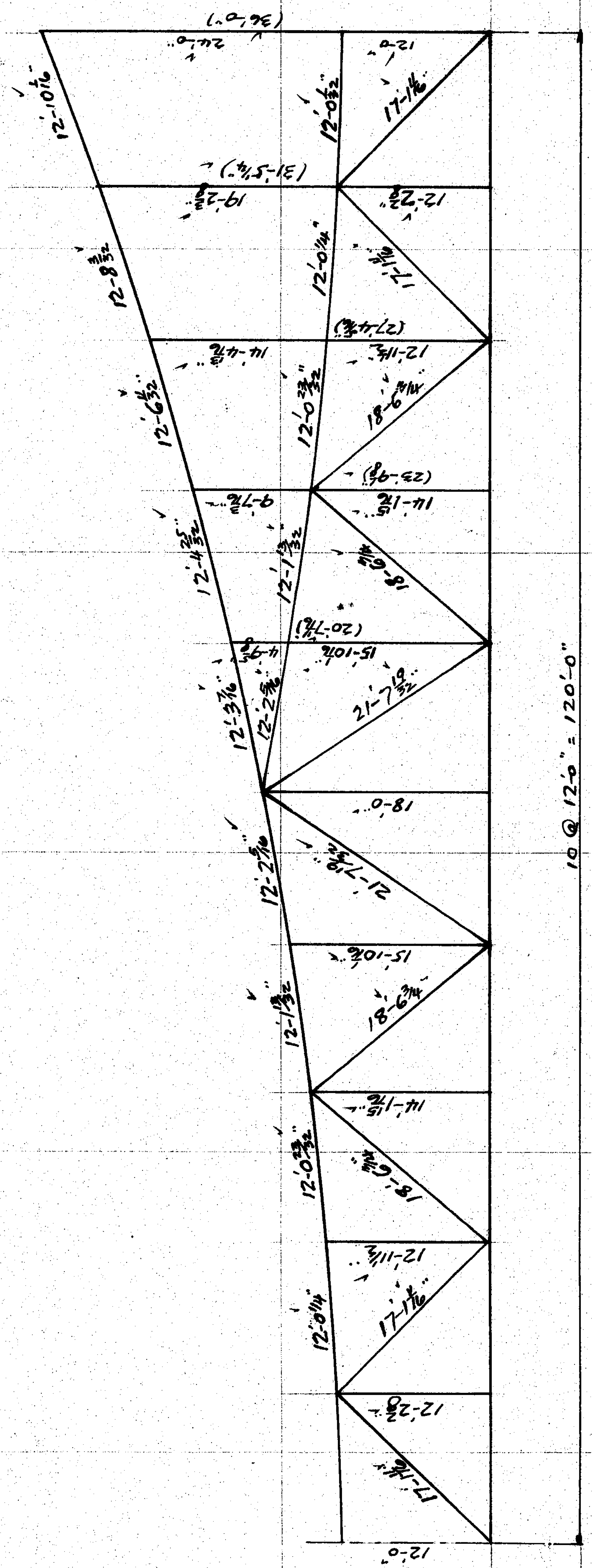
CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-ken.



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CALCULATIONS FOR

Design of Anabuki-Bashi for Tokushima-Ken.