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CALCULATIONS FOR

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Design of 41D Bridge for City of Tokyo

General Datas.
The width of Canal 40.0 meters between faces of walls at Elevation + 10.0AP.
The span length of bridge between end bearings 39.0 meters = 127.953'
Mating the panel length 14'-2 5/8" (horizontal dimensions) for 9 panel = 127'-11 5/8" or 127.969'
Skew of bridge assumed $1\frac{1}{2}°$
Pratt Truss Type has been approved by the City Bridge Engineer Mr. Koike on account of appearance suitable to the site instead of Warren Type which will be most economical.
Roadway between curb lines 9.0 meters = 29.528'
Sidewalk from clearance of truss to edge of coping stone 3 meters clear or 9.843'

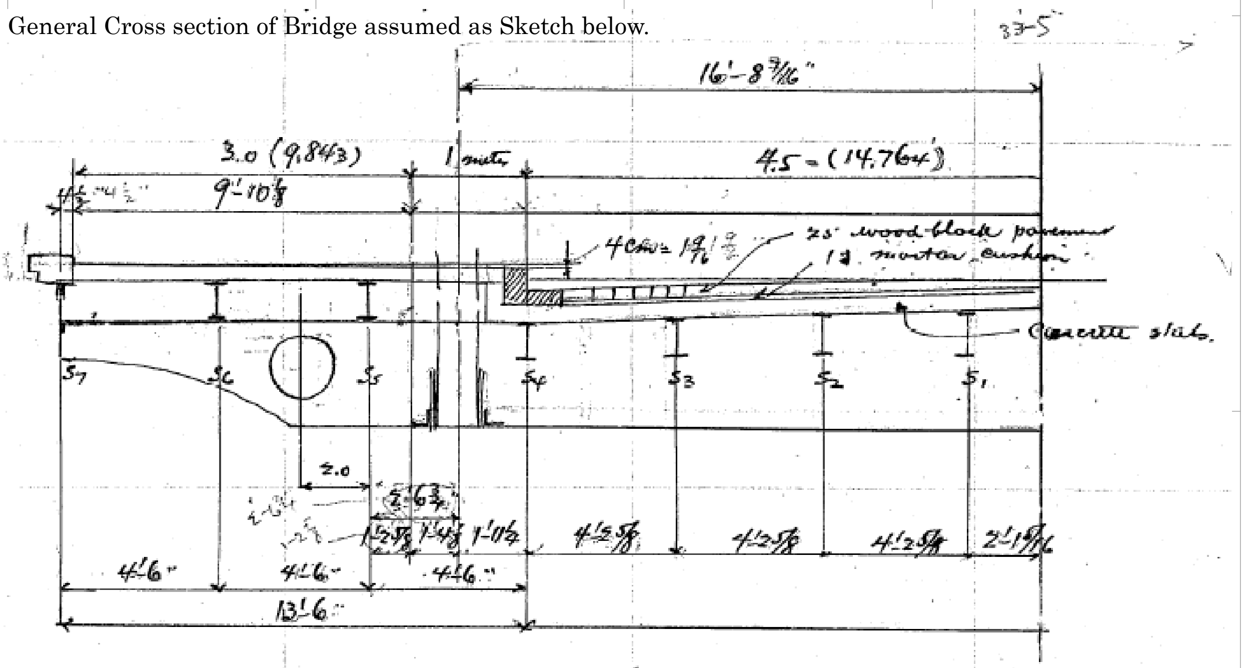
From curb line to edge of protection chord 1.00 meter, which makes 15 meters clear for roadway and sidewalk and 17 meters between inside lines of coping stone at edge of sidewalks.

Longitudinal slope of bridge forward center of span 1/60 parabolic slope and Transverse slope of roadway also 1/60 parabolic slope.
Slope of sidewalk 1/100 forward curb line of roadway.

Loading on bridge as per specification (Standard City Bridge specification of City of Tokyo).

Other miscellaneous datas given by Mr. Koike (City bride Engineer) in contract paper.

General Cross section of Bridge assumed as Sketch below.



Cross Section of bridge Scale 1/50

Design of Floor slab. span length 4'-2 5/8 = 4.22'

Dead Load	3" wood block pavement @ $\frac{60^{\#}}{12}$	=	15.0#	
	$1\frac{1}{4}$" motor cushion @ 110/12	=	11.5	
	floor slab assumed		75.0	note slab changed to $6\frac{1}{4}$" thick
	allowance		3.5	
			105.0#	per sq ft.

Dead Load moment = $\frac{1}{10} \times 105 \times 4.22^2$ = 187'#
Dead Load shear = $\frac{1}{2} \times 105 \times 4.22$ = 222# per ft strip

Design of 41D Bridge for City of Tokyo

Design of floor slab.

Live Load motor truck loading rear wheel concentration = 9920#

30% impact = 2980

12900#

Front wheel Concentration say 12900 ÷ 3 = 4300#

Distribution of wheel concentration on floor slab.

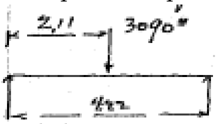
Longitudinal distribution $a = 2\times 4\frac{1}{4}" = .70$

20cm = .66

a = 1.36

Effective width = $\frac{2}{3}l + a = \frac{2}{3}\times 4.22 + 1.36 = 4.17$

Load per ft strip 12900 ÷ 4.17 = 3090#

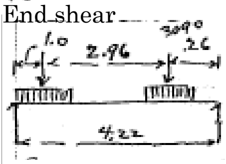


moment = 1545 × 2.11 = 3260'#

for continuity of slab reduced the moment to

0.8 × 3.26 = 2600'#

End shear



Transverse distribution b = 1.28 + .70 = 1.98 call this 2.0'

From distribution shown on diagram assumed the end shear 3090#

when loaded symmetrically

Considering concentration only $3090\times\frac{3.48}{4.22} = 2550^{\#}$

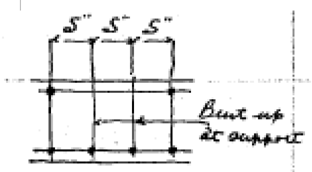
Sum many for moment and shear

	moment	shear
Dead Load	187	222
Live Load	2600	2550
	2787'#	2772#

Effective depth of slab for 17000#/□" steel stress and 640#/□" Concentration n=15

$d = \sqrt{\frac{2787}{102}} = 5.22"$

Make depth of concrete slab $6\frac{1}{4}"$ over all with 1" insulation at bottom



Steel area required = $\frac{2787\times 12}{\frac{7}{8}\times 5.25\times 17067}$ = 0.427□" per ft strip

$\frac{1}{2}"\phi$ bars .455' spacing required

use $\frac{1}{2}"\phi$ bars 5" spacing = .467□" per ft

Unit shear at End = $\frac{2772}{5.25\times 12}$ = 44#/□" OK

Bond stress for 15" strip = $\frac{2772\times\frac{15}{12}}{\frac{7}{8}\times 5.25\times 6.28}$ = 120#/□"

Use 4 - $\frac{1}{2}"\phi$ bars in 15" strip

perimeter = 4 - $\frac{1}{2}"\phi$ = 6.28

Use deformed bars in slab

Sidewalk slab. span length 4'-6"

Dead Load

wearing course (mortar)	9.5	
4" concrete slab	50.0	Note changed to $3\frac{1}{2}"$ slab
miscellaneous	0.5	
	60.0#	per sq. ft.

Dead Load moment = $\frac{1}{10}\times 60\times 4.5^2$ = 122'#

Dead Load shear = $\frac{1}{10}\times 60\times 4.5$ = 135#

Live Load 100#/□"

Dead Load moment = $\frac{1}{10}\times 100\times 4.5^2$ = 202'#

Dead Load shear = $\frac{1}{2}\times 100\times 4.5$ = 225#

Sum many for moment and shear

	moment	shear
Dead Load	122	135
Live Load	202	225
	324'#	360#

Effective depth = $\sqrt{\frac{324}{102}}$ = 1.79"

Use $3\frac{1}{2}"$ concrete slab with 1" insulation at bottom and $\frac{3}{4}"$ wearing course at top.

Over all depth $4\frac{1}{4}"$ including wearing course.

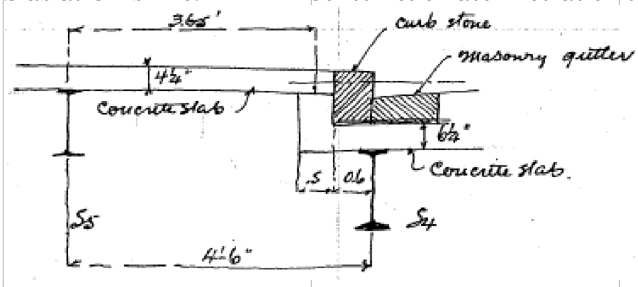
Design of 41D Bridge for City of Tokyo

Steel area required = $\frac{324\times12}{\frac{7}{8}\times2.5\times17067}$ = 0.104□" per ft strip

Use $\frac{3}{8}$"$^{\phi}$ bars 6" centers = 0.22□"

Every other bar should be bent up at support to take care of negative moment

Slab at Curb line. Construction assumed as on sketch



Sidewalk slab span length 3.65'

Dead Load

$4\frac{1}{4}$" slab	$\frac{150^{\#}}{12}$	=	$53^{\#}$
misc say			2
			55 per sq ft.

End reaction = $55\times\frac{1}{2}\times3.65$ = say $100^{\#}$ per lin. ft.

moment = $\frac{1}{10}\times55\times3.65^2 = 73.3'^{\#}$

Over hang beyond S_4

Dead Load

Curb stone	0.6×0.9 @ 160	=	86.5	
slab and cushion say	$6\frac{3}{4}$"×0.6	=	50.5	
			$137.0^{\#}$	arm 0.3
side concrete beam	0.5×.85 @ 150	=	64.0	
Reaction from sidewalk slab			100	
			$164.0^{\#}$	arm 0.85

Dead Load moment

137.0 ×	0.3	=	41.0
164.0 ×	0.85	=	140.0
301.0			$181.0'^{\#}$

Live Load say $100^{\#}/_{\square'}$

Reaction =	$\frac{1}{2}\times100\times3.65'$	=	182.5
direct	$100\times.85$	=	85.0

Live Load moment

182.5×0.85	=	155
85.0×.425	=	36
267.5		$191'^{\#}$

Sum many for moment and shear

	moment	shear
Dead Load	181.0	301.0
Live Load	191.0	267.5
	$372.0'^{\#}$	$568.5^{\#}$

Depth of slab $6\frac{1}{4}$"

Effective depth 5.25

steel area = $\frac{372\times12}{\frac{7}{8}\times5.25\times17067}$ = 0.057□"

Longitudinal stringer for Roadway S_1 span length 14'-2$\frac{5}{8}$" = 14.22'

Dead Load

3" wood block pavement @	$\frac{60^{\#}}{12}$	=	15.0
$1\frac{1}{4}$ mortar cushion			11.5
floor slab $6\frac{1}{4}$"			78.0
allowance for filler ??			3.5
			$108.0^{\#}$ per sq ft.

fillet ではない？

Load on stringer	108.0 × 4.22 =		455.
stringer assumed			50
			$505^{\#}$ per lin ft.