Cantilever Brackets

Cantilever Brackets (Spans 5-7, 7-10, 10-12)

Live Load

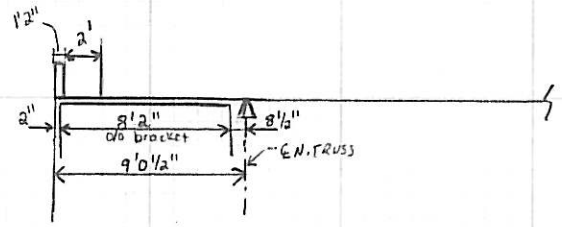
Live Load Reactions will be same as interior (see page 1 of interior calcs)

NORTH Brackets

← N

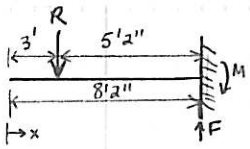
$9'0\frac{1}{2}" - 1'2" - 2' - 8\frac{1}{2}" = 5.1667'$

⇒ 1 wheel



Max. Moment

Will occur when load is as far from support as possible



$M_{max} = R(x - 3') = R(8'2" - 3')$

$\therefore M_{max} = 5.1667R$

(will be same for all load cases)

Max Shear

Location does not matter as the Max Shear will always be the reaction force, which will equal the wheel load

$\therefore V_{max} = R$

(will be same for all load cases)

South Brackets

The South bracket is completely under the sidewalk and the sidewalk is separated from the roadway by a rail, therefore there will be no Vehicular live load rating for the south bracket. Only consider pedestrian loading.

Calculations for 1/8 US Grid

North Cantilever Brackets (Span 5-7, 7-10, 10-12)

Live Loads

Hs 20:

$M_{max} = 5.17(16) = 82.72^{k}\text{-ft}$

$V_{max} = 16^{k}$

2FI:

$M_{max} = 5.17(10.29) = 53.20^{k}\text{-ft}$

$V_{max} = 10.29^{k}$

3FI:

$M_{max} = 5.17(14.15) = 73.16\ k\text{-ft}$

$V_{max} = 14.15^{k}$

4FI:

$M_{max} = 5.17(13.45) = 69.54\ k\text{-ft}$

$V_{max} = 13.45^{k}$

5CI:

$M_{max} = 5.17(13.8) = 71.35\ k\text{-ft}$

$V_{max} = 13.8^{k}$

Calculations for 1/8 US Grid

North Cantilever Bracket Dead Loads

* See dead load calc binder

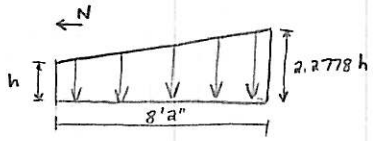
Self Weight:

The bracket has a variable height, therefore approximate self weight load using a triangular distribution

Total Weight = 1.0272 K *

height of north end = 18" *

height of south end = 41" *



41/18 = 2.2778

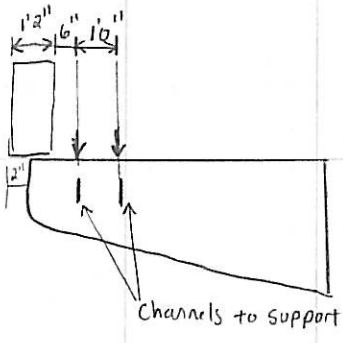
$1.0272^K = h(8'2") + \frac{1}{2}(8'2")(2.2778h - h) \Rightarrow h = .0767\ ^K/_{Ft}$

Deck and Haunch + rails + sidewalk

1.66 K/A *

Drainage (brackets at Piers 5, 7, 8, 9, 10, 12

Max @ P8 = 1.358 K * ← this will be distributed to 2 adjacent cantilever brackets because the drainage system sits on 2 channels attached to the brackets however the drainage is not centered, but very close to only one bracket therefore be conservative and assume only one bracket takes entire load



Assume weight of drainage is applied as 2 point loads at locations shown on left.

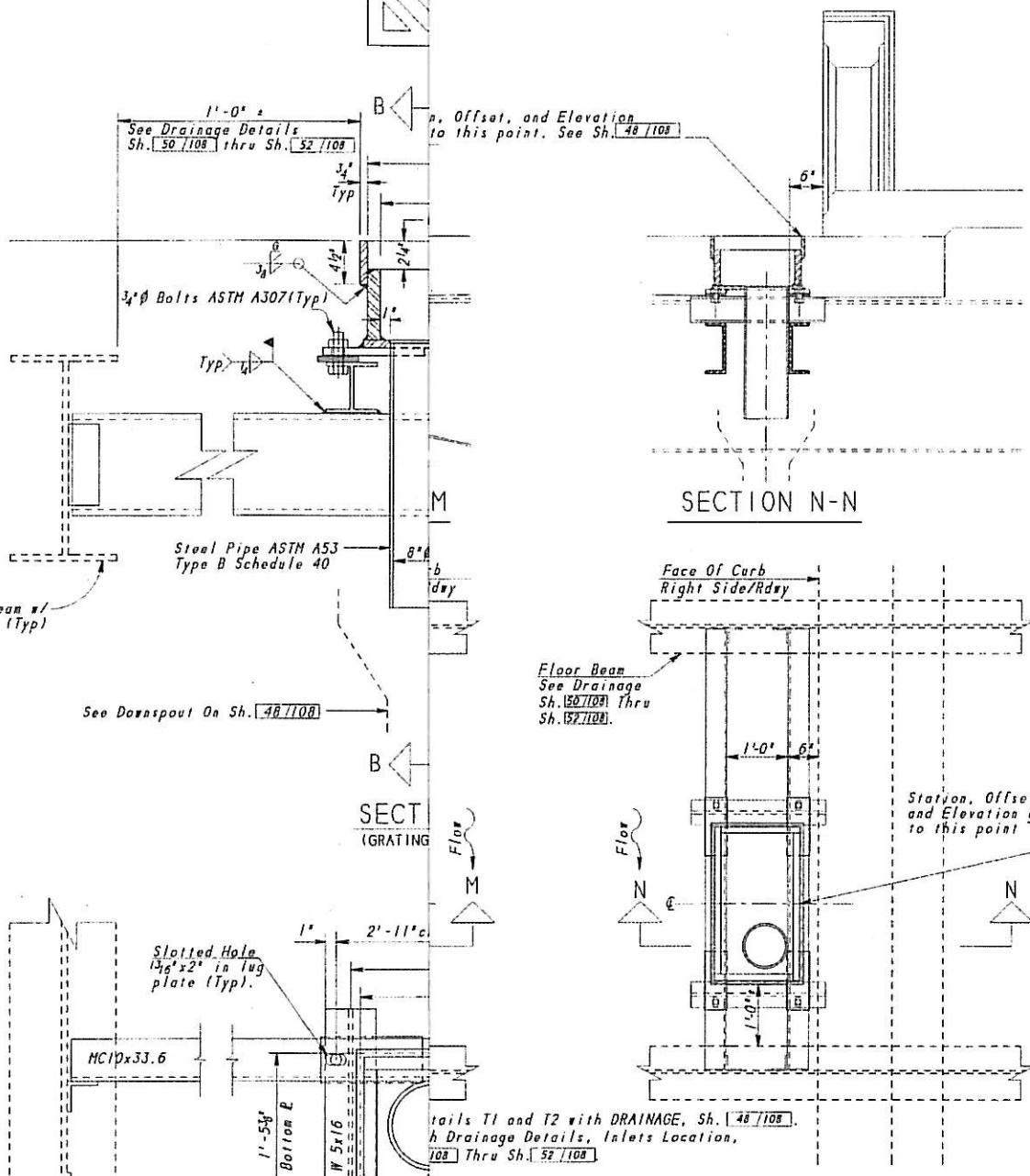
$1.358^K/_2 = .679^K$

Calculations for 1/8 US Grid

F.H.W.A. REGION	STATE	PROJECT	
5	OHIO		

123/182

HAM-471-00.25



Pflum, Klausmeier & Gehrum Consultants
CINCINNATI OHIO
49 /108

DRAINAGE DETAILS TYPICAL INLET

BRIDGE No. HAM-471-0025
(COLUMBIA PARKWAY VIADUCT OVER I-471)

HAMILTON COUNTY

Sta. 30+55.40
Sta. 47+16.19

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
ED	ED/JDR		WDD	IEH	April 96	

DRAINDTI Scale .6666

F.H.W.A. REGION	STATE	PROJECT	
5	OHIO		

122/182

HAM-471-00.25

Inlet At Pier No.3, Left (See Sh. 50/108). Sta.32+ ...ed during concrete removals and Existing inlet to be protected during concrete rem... work. Downspout to be flush cleaned incorporated into the new work. Downspout to be fl... cleanout box. The existing grating down to (and including) the cleanout box. The existi...tioned, with adjustments if necessary, shall be cleaned and repositioned, with adjustments ...ew concrete deck. All labor, material, to match the top of the new concrete deck. All ...tals necessary to complete the work equipment, tools, and incidentals necessary to comple...cluded with the Contract bid price described above shall be included with the Contr...tructure Drainage, Misc.: Straightening, Lump Sum for Item 518, "Structure Drainage, Misc.: Sunspout Including Specials", for payment. Adjusting, And Cleaning Downspout Including Specials"

...e Sh. 52/108). Sta.42+78.8±, 34.2'Lt.±

RAMP A

℄ Pier No.2 Sta.31+33.37

℄ Pier No.3 Sta.32+09.18

℄ Pier No.4 Sta.32+99.30

℄ Pier No.5 Sta.33+07.00

℄ Pier No.13 Sta.43+54.30

℄ Pier No.14 Sta.44+36.95

℄ Pier No.15 Sta.45+19.60

℄ Pier No.16 Sta.45+84.60

℄ Pier No.17 Sta.46+49.60

All in-ground cleanout b... to the nearest municipa... incidentals necessary to... Contract bid price Lum... Straightening, Adjusting... for payment.

LEGEND

- Existing Drain Inlet To Be Incorporated Into The New Work.
- New Drain Inlet

P

Slotted hole 1"x2" in horizontal angle bar, and 7/8"x2" bolt

8"Ø Downspout

P

TRUSS CHORD

4'-3¼"
2'-3"
1'-6¾"
3"
1½"
4½"
1½"
3"
2"
L-4x4x½
Slotted hole 11/16"x1½"
Exist. Truss Bottom Chord
L-4x4x½
L-4x4x½
1'-8½"c/c bolts
4½"
1'-4½"Min. 1'-4¾"Max.
2'-5¾"
7/8"x1'-8" bolts(Typ)

SPECIAL BRACKET DETAIL

4"
1'-8"
1'-1½"
2'-4"
1½"

SIDE VIEW

See DETAIL T2, Sh. 49/108 And DETAIL X This Sh. (Typical)

See DETAIL T1, Sh. 49/108 And DETAIL X This Sh. (Typical)

Grinnel Offset Pipe clamp type 103 Or Approved similar.

8"D. Steel Pipe ASTM A53 Grade B Schedule 40 (Typical)

Face/Curb

N

2'-0"

1'-0"

N

SECTION M-M

Cleanout Fitting (Typ.)

2'-0" Typ.

Offset Pipe Clamps Type 703 As Manufactured by Grinnel Corp. 1025 Laidlaw Ave. Cincinnati, OH 45237 or similar (Typ).

4'-0"c/c Max. Typ.

Extended

Dim. "H1"

Dim. "H2"

Limits Item 518, 8" Pipe Downspout Including Specials

Exist. Concrete Cleanout Box (Typ)

LEFT SIDE/RDWY (TYPICAL)

DOWNSPOUT SCHEMATIC INSTALLATION (PLA...

REAR ABUT. And PIERS No.2,3,4,12,13,14,15

X

AND HANGER

DRAINAGE Scale: SO

DRAINAGE INLET SCHEDULE

Location		Position Of Inlet Station, Offset	Final Elev. At Top/Frame	Dim. "H1"	Dim. "H2"
Rear Abutment		30+59.78, 33.88 Lt	538.13	10.9'±	9.2'±
		30+61.75, 22.65 Rt	538.16	11'±	9.2'±
PIER	No.2	31+37.11, 33.02 Lt	539.00	11'±	13.5'±
		31+37.42, 22.65 Rt	539.01	11'±	13.5'±
	No.3	Left Side N/A			
		32+23.18, 22.65 Rt	540.43	12.3'±	16.1'±
	No.4	32+84.68, 33.06 Lt	541.62	11.7'±	20.9'±
		33+21.32, 22.65 Rt	542.43	12.5'±	20.9'±
	No.5	33+75.72, 33.06 Lt	543.81	14.3'±	21.5'±
		34+18.22, 22.65 Rt	545.03	15.5'±	21.5'±
	No.7	35+91.22, 33.06 Lt	550.69	24.5'±	24.2'±
		36+33.71, 22.65 Rt	552.10	25.8'±	24.3'±
	No.8	37+39.96, 33.06 Lt	555.62	31.2'±	25.4'±
		37+82.46, 22.65 Rt	557.02	32.5'±	25.5'±
	No.9	39+09.96, 33.06 Lt	561.24	30.3'±	37.9'±
		39+52.46, 22.65 Rt	562.65	31.6'±	37.9'±
	No.10	40+61.71, 33.06 Lt	566.27	24.5'±	29.3'±
		41+04.21, 22.65 Rt	567.67	26'±	29.2'±
	No.12	Left Side N/A			
		43+20.75, 22.65 Rt	574.84	15.8'±	28.0'±
	No.13	43+58.51, 33.06 Lt	576.09	11'±	31.1'±
		43+58.24, 22.65 Rt	576.08	11'±	31.1'±
	No.14	44+40.96, 33.06 Lt	578.82	11'±	27.8'±
		44+40.71, 22.65 Rt	578.81	11'±	27.8'±
	No.15	45+23.94, 33.06 Lt	581.56	11'±	22.6'±
		45+23.69, 22.65 Rt	581.56	11'±	22.6'±
	No.16	45+88.79, 33.06 Lt	583.71	10'±	20.7'±
		45+88.56, 22.65 Rt	583.70	10'±	20.7'±
	No.17	46+53.71, 33.06 Lt	585.86	10'±	18.9'±
		46+53.39, 22.65 Rt	585.85	10'±	18.9'±

Ptlum, Klausmeier & Gehrum Consultants

CINCINNATI OHIO

48/108

DECK DRAINAGE PLAN AND DOWNSPOUT DETAILS

BRIDGE No.HAM-471-0025
(COLUMBIA PARKWAY VIADUCT OVER I-471)

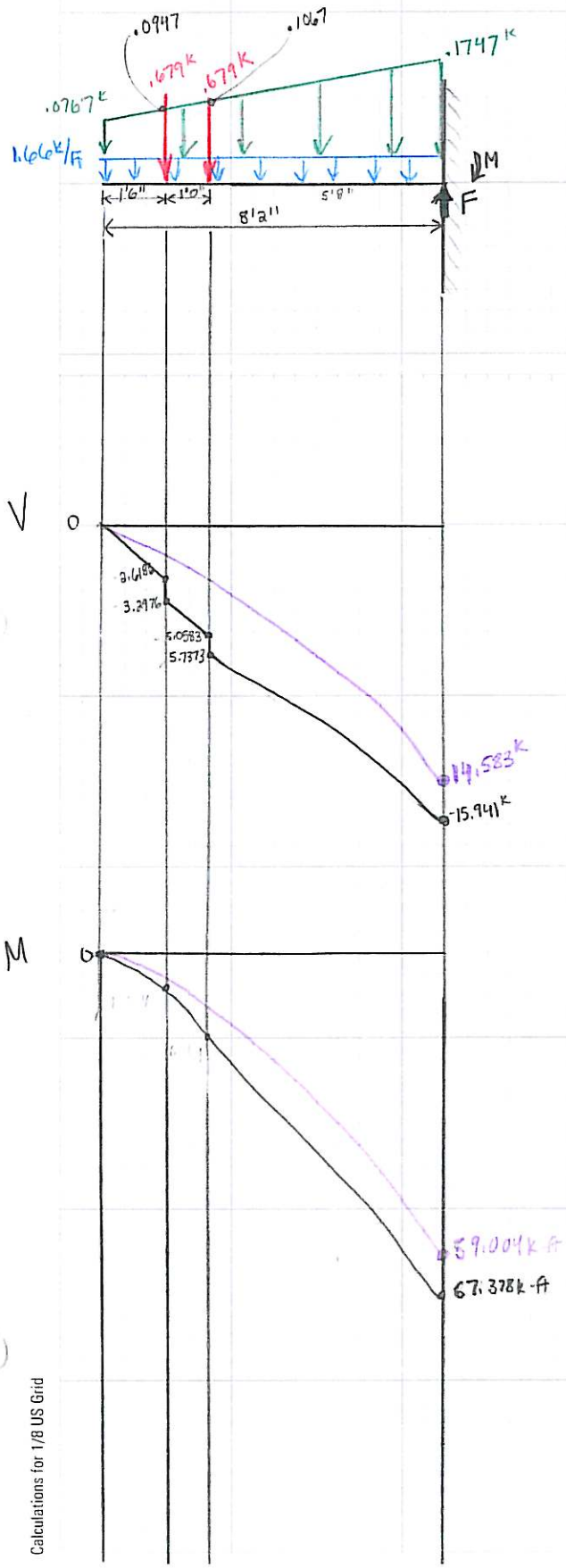
HAMILTON COUNTY

Sta.30+55.40
Sta.47+16.19

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
ED	ED/JDR		WDD	JEH	April 96	

Made By: CTY	Date: 4/3/09	Job No: HAM-471-0025
Checked By: CJM	Date: 4/7/09	Sheet No. 4/6

North Cantilever Bracket Dead Loads



For Brackets With Drainage

$V = F = 1.66^{k}/_{ft}(8'2") + 2(.679^{k}) + .0767^{k}/_{ft}(8'2") + \frac{1}{2}(8'2")(.1747^{k}/_{ft} - .0767^{k}/_{ft})$

$V_{max} = 15.941^{k}$

$M = M_{max} = .679^{k}(6'8") + .679^{k}(5'8") + 1.66^{k}/_{ft}(8'2")\left(\frac{8'2"}{2}\right) + .0767^{k}/_{ft}(8'2")\left(\frac{8'2"}{2}\right) + \frac{1}{2}(8'2")(.1747^{k}/_{ft} - .0767^{k}/_{ft})\left(\frac{8'2"}{3}\right)$

$M_{max} = 67.378$ k-ft

For Brackets Without Drainage

$V_{max} = F = 1.66^{k}/_{ft}(8'2") + .0767^{k}/_{ft}(8'2") + \frac{1}{2}(8'2")(.1747^{k}/_{ft} - .0767^{k}/_{ft})$

$V_{max} = 14.583^{k}$

$M = M_{max} = 1.66^{k}/_{ft}(8'2")\left(\frac{8'2"}{2}\right) + .0767^{k}/_{ft}(8'2")\left(\frac{8'2"}{2}\right) + \frac{1}{2}(8'2")(.1747 - .0767)(8'2"/3)$

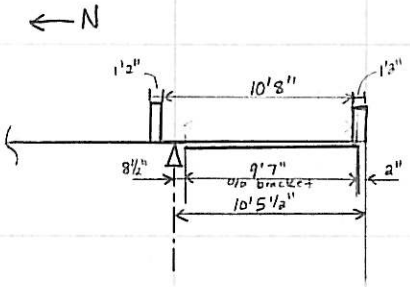
$M_{max} = 59.004$ k-ft

Calculations for 1/8 US Grid

Made By: CTY	Date: 4/3/09	Job No: HAM-471-0025
Checked By: CJM	Date: 4/7/09	Sheet No. 5/6

South Cantilever Brackets - (Truss Spans 5-7, 7-10, 10-12)

Live Load



Available width for pedestrian loading = 10'8"

Sidewalk does not sit on bracket full width → only @ S. end

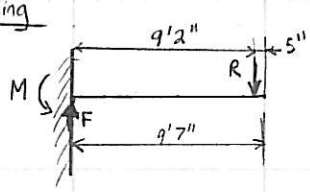
∴ loads will be applied as point loads except self weight

From AASHTO 3.14.1.1 → Ped load = 85psf

∴ loading on floorbeam (say ½ to FB other ½ to Truss)

$$R = \frac{1}{2}\left(\frac{85psf\ (10'7\frac{1}{2}")(10'8")}{1000}\right) = 4,817^{k}$$

Live Loading



Assume it is applied as point load @ center of S. rail

$$M_{max} = M = R(9'2")$$

$$M_{max} = 44.156\ k\text{-}Ft$$

$$V_{max} = F = R$$

$$V_{max} = 4.817^{k}$$

Calculations for 1/8 US Grid

South Cantilever Brackets Dead Load

Self Weight

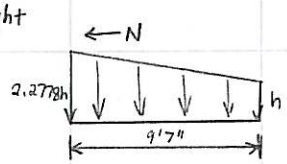
★ see dead load calc binder

- Similar to north bracket → variable height

Total Weight = 1.1503 K

North end = 41"
South end = 18"

41/18 = 2.2778



$1.1503 = h(9'7") + \frac{1}{2}(9'7")(2.2778h - h)$

$\Rightarrow h = .0732\ K/FT$

Sidewalk, South Rail & Vandal Fence (No Fence Span 5-7)

max additional span 10-12

South rail = $(.377\ K/FT^{*} + .0735^{*}\ K/FT) \times 10.625 = 4.787^{K}$

Vandal Fence = $.073^{*}\ K/FT \times 10.625' = .776^{K}$

$\Rightarrow$ Total = 23.3452 K

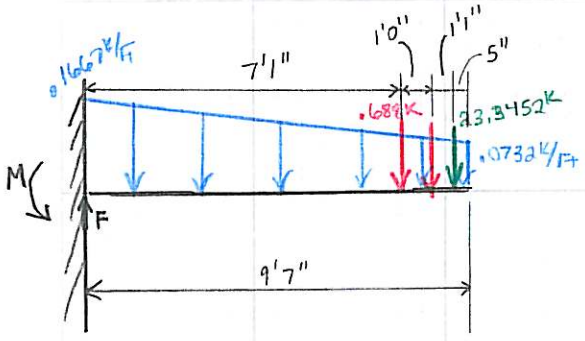
Sidewalk = 17.7822 K ★

Drainage (brackets @ Piers 5, 7, 8, 9, 10, 12)

Max @ P8 = 1.376 K ★ distribute as 2 point loads similar to north bracket



1.376 K/2 = .688 K



For Brackets with Drainage

$V = F = 2(.688^{K}) + 23.3452^{K} + .0732\ K/FT(9'7") + \frac{1}{2}(9'7")(.1667\ K/FT - .0732\ K/FT)$

$V_{max} = 25.8707^{K}$

$M = M_{max} = .688^{K}(7'1") + .688^{K}(8'1") + 23.3452^{K}(9'2") + .0732\ K/FT(9'7")\left(\frac{9'7"}{2}\right) + \frac{1}{2}(.1667\ K/FT - .0732\ K/FT)(9'7")\left(\frac{9'7"}{3}\right)$

$M_{max} = 229.226\ K\text{-}FT$

For Brackets without Drainage

$V_{max} = 25.8707^{K} - 2(.688^{K}) = 24.4947$

$V_{max} = 24.4947^{K}$

$M_{max} = 229.226\ K\text{-}FT - .688(7'1") - .688(8'1")$

$M_{max} = 218.791\ K\text{-}FT$

3.13 ELECTRIC RAILWAY LOADS

If highway bridges carry electric railway traffic, the railway loads shall be determined from the class of traffic which the bridge may be expected to carry. The possibility that the bridge may be required to carry railroad freight cars shall be given consideration.

3.14 SIDEWALK, CURB, AND RAILING LOADING

3.14.1 Sidewalk Loading

3.14.1.1 Sidewalk floors, stringers, and their immediate supports shall be designed for a live load of 85 pounds per square foot of sidewalk area. Girders, trusses, arches, and other members shall be designed for the following sidewalk live loads:

Spans 0 to 25 feet in length .....85 lb./ft.^{2}
Spans 26 to 100 feet in length .....60 lb./ft.^{2}
Spans over 100 feet in length according to the formula

$$P = \left(30 + \frac{3{,}000}{L}\right)\left(\frac{55 - W}{50}\right) \qquad (3\text{-}3)$$

in which

P = live load per square foot, max. 60-lb. per sq. ft.
L = loaded length of sidewalk in feet.
W = width of sidewalk in feet.

3.14.1.2 In calculating stresses in structures that support cantilevered sidewalks, the sidewalk shall be fully loaded on only one side of the structure if this condition produces maximum stress.

3.14.1.3 Bridges for pedestrian and/or bicycle traffic shall be designed for a live load of 85 PSF.

3.14.1.4 Where bicycle or pedestrian bridges are expected to be used by maintenance vehicles, special design consideration should be made for these loads.

3.14.2 Curb Loading

3.14.2.1 Curbs shall be designed to resist a lateral force of not less than 500 pounds per linear foot of curb, applied at the top of the curb, or at an elevation 10 inches above the floor if the curb is higher than 10 inches.

3.14.2.2 Where sidewalk, curb, and traffic rail form an integral system, the traffic railing loading shall be applied and stresses in curbs computed accordingly.

3.14.3 Railing Loading

For Railing Loads, see Article 2.7.1.3.

3.15 WIND LOADS

The wind load shall consist of moving uniformly distributed loads applied to the exposed area of the structure. The exposed area shall be the sum of the areas of all members, including floor system and railing, as seen in elevation at 90 degrees to the longitudinal axis of the structure. The forces and loads given herein are for a base wind velocity of 100 miles per hour. For Group II and Group V loadings, but not for Group III and Group VI loadings, they may be reduced or increased in the ratio of the square of the design wind velocity to the square of the base wind velocity provided that the maximum probable wind velocity can be ascertained with reasonable accuracy, or provided that there are permanent features of the terrain which make such changes safe and advisable. If a change in the design wind velocity is made, the design wind velocity shall be shown on the plans.

3.15.1 Superstructure Design

3.15.1.1 Group II and Group V Loadings

3.15.1.1.1 A wind load of the following intensity shall be applied horizontally at right angles to the longitudinal axis of the structure:

For trusses and arches .....75 pounds per square foot
For girders and beams .....50 pounds per square foot

3.15.1.1.2 The total force shall not be less than 300 pounds per linear foot in the plane of the windward chord and 150 pounds per linear foot in the plane of the leeward chord on truss spans, and not less than 300 pounds per linear foot on girder spans.

3.15.1.2 Group III and Group VI Loadings

Group III and Group VI loadings shall comprise the loads used for Group II and Group V loadings reduced by 70% and a load of 100 pounds per linear foot applied at right angles to the longitudinal axis of the structure and 6 feet above the deck as a wind load on a moving live load.