COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF TRANSPORTATION

BUREAU OF DESIGN
BRIDGE DIVISION

STANDARDS FOR OLD BRIDGES

(1961 TO 1965)

VOLUME 4

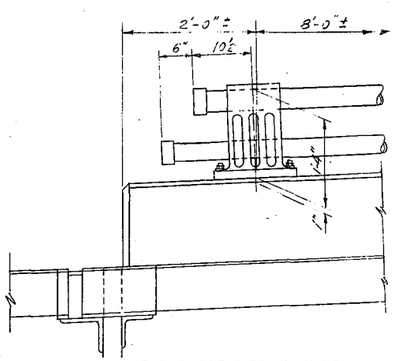
SEPTEMBER 1989

INDEX OF STANDARDS FOR OLD BRIDGES

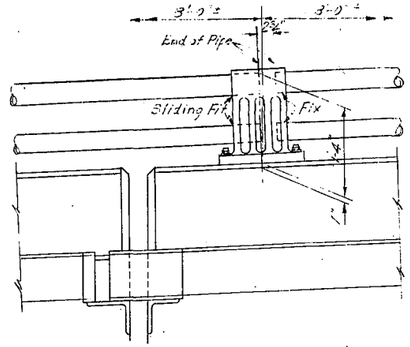
(VOLUME 4) (FROM YEAR 1961 TO 1965)

STD. DWG. NO.	NO. OF SHTS.	DATE	DESCRIPTION
S-1614-C	(2)	OCT. 17, 1962	STANDARD PARAPET & PARAPET RAILING
S-2002-A	(1)	OCT. 13, 1961	STANDARD PARAPET & PARAPET RAILING
S-2700	(1)	MARCH 1, 1961	STD. REINF. CONC. SLAB BRIDGE SKEW 90°
S-2701	(1)	MARCH 1, 1961	STD. REINF. CONC. SLAB BRIDGE SKEW 75°
S-2702	(1)	MARCH 1, 1961	STD. REINF. CONC. SLAB BRIDGE SKEW 60°
S-2703	(1)	MARCH 1, 1961	STD. REINF. CONC. SLAB BRIDGE SKEW 45°
S-2704	(1)	JULY 5, 1961	STANDARD ABUTMENTS FOR CONCRETE BRIDGES
S-2710	(1)	AUG. 2, 1963	STANDARD R.C. ABUTMENTS WITHOUT BACKWALL
S-2711	(1)	MARCH 1, 1961	STANDARD I BEAM BRIDGE 28′ ROADWAY
S-2712	(1)	MARCH 1, 1961	STANDARD I BEAM BRIDGE 32′ ROADWAY
S-2713	(1)	MARCH 1, 1961	STANDARD I BEAM BRIDGE 40′ ROADWAY
S-2714	(1)	MARCH 1, 1961	STANDARD I BEAM BRIDGE 68′ ROADWAY
S-2715	(1)	MARCH 1, 1961	STANDARD I BEAM BRIDGE 84′ ROADWAY
S-2716	(1)	MARCH 1, 1961	STANDARD COMPOSITE I BEAM BRIDGE 28′ ROADWAY
S-2717	(1)	MARCH 1, 1961	STANDARD COMPOSITE I BEAM BRIDGE 32′ ROADWAY
S-2718	(1)	MARCH 1, 1961	STANDARD COMPOSITE I BEAM BRIDGE 40′ ROADWAY
S-2719	(1)	MARCH 1, 1961	STANDARD COMPOSITE I BEAM BRIDGE 68′ ROADWAY
S-2720	(1)	MARCH 1, 1961	STANDARD COMPOSITE I BEAM BRIDGE 84′ ROADWAY
S-2721A	(1)	MARCH 1, 1961	STANDARD STEEL BEARINGS AND END DETAILS FOR SIMPLE SPAN I BEAM BRIDGES
S-2721	(2)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES BEARINGS
S-2722	(1)	MARCH 1, 1961	PLATE EXPANSION DAMS AND JOINTS FOR SIMPLE SPAN I BEAM BRIDGE
S-2723	(2)	MARCH 1, 1961	STANDARD BRIDGE DRAINAGE AND TYPE "A" SCUPPER
S-2724	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES DIAPHRAGMS
S-2725	(1)	AUG 2, 1963	STANDARD ENDWALL DETAILS FOR METAL PLATE CULVERTS SKEWS 90°-75°-60° & 45°
S-2726	(1)	AUG 2, 1963	STANDARD REINFORCED CONCRETE RETAINING WALLS
S-2727	(1)	AUG 2, 1963	STANDARD R.C. ABUTMENTS WITH BACKWALLS
S-2728	(1)	AUG 2, 1963	STD. ABUTMENTS WITH BACKWALL TYPICAL LAYOUT
S-2729	(1)	OCT 3, 1962	STANDARD REINFORCED CONCRETE BOXES
S-2730	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES 28′ ROADWAY
S-2731	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES 32′ ROADWAY
S-2732	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES 40′ ROADWAY
S-2733	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES 68′ ROADWAY
S-2734	(1)	AUG 2, 1963	STANDARD STEEL I BEAM BRIDGES 84′ ROADWAY
S-2735	(1)	AUG 2, 1963	STANDARD STEEL I-BEAM BRIDGES DETAILS
S-2736	(1)	AUG 2, 1963	STANDARD STEEL I-BEAM BRIDGES END DETAILS

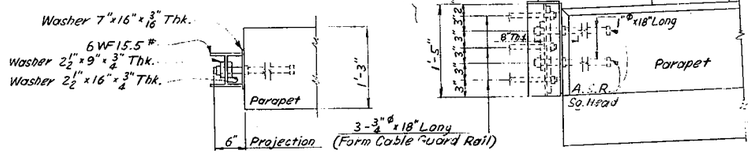
STD. DWG. NO.	NO. OF SHTS.	DATE	DESCRIPTION
S-3909	(1)	MARCH 8, 1962	PRESTRESSED CONCRETE BRIDGE STANDARDS
S-3910	(1)	MARCH 8, 1962	LAMINATED METAL SHIM NEOPRENE BEARING PAD FOR PRESTRESSED CONCRETE BRIDGES
S-3911	(1)	JULY 20, 1965	DECK JOINT FOR PREFORMED NEOPRENE COMPRESSION SEAL
S-5657	(1)	MARCH 1, 1966	STANDARD PARAPET WITH ALUMINUM CHAIN LINK FENCE AND GUARD FENCE CONNECTION
S-6409	(1)	MAY 15, 1963	FLAME-SHORTENING DETAILS FOR TIGHTENING LOOSE EYEBARS IN TRUSS BRIDGES
S-6500	(1)	JULY 10, 1963	DETAILS METAL CRIBBING
S-6500A	(1)	JULY 10, 1963	DETAILS METAL CRIBBING-COATED
ST-100	(2)	FEB. 25, 1965	STANDARD R.C. SLAB BRIDGES ROADWAY WIDTH 28′, 30′, 32′, 40′, 68′, 84′
ST-101	(7)	FEB. 25, 1965	STANDARD R.C. T-BEAM BRIDGES 28′, 30′, 32′, 40′, 68′, 84′ ROADWAY
ST-102	(7)	FEB. 25, 1965	STANDARD STEEL I-BEAM BRIDGES 28′, 30′, 32′, 40′, 68′, 84′ ROADWAY
ST-103	(6)	FEB. 25, 1965	STANDARD COMPOSITE A36 STEEL I-BEAM BRIDGES DESIGN GRAPHS
ST-110	(1)	FEB. 25, 1965	STANDARD STEEL I-BEAM BRIDGES DIAPHRAGMS
ST-111	(2)	FEB. 25, 1965	STANDARD STEEL I-BEAM BRIDGES BEARINGS
ST-112	(1)	FEB. 25, 1965	STD. STEEL I-BEAM BRIDGES PLATE EXPANSION DAM
ST-113	(1)	FEB. 25, 1965	STD. STEEL I-BEAM BRIDGES TOOTH EXPANSION DAM
ST-114	(2)	FEB. 25, 1965	STANDARD STEEL I-BEAM BRIDGES BRIDGE DRAINAGE
ST-120	(2)	FEB. 25, 1965	STANDARD R.C. ABUTMENTS LAYOUT AND DETAILS
ST-121	(2)	FEB. 25, 1965	STANDARD R.C. ABUTMENTS LAYOUT AND DETAILS WITHOUT BACKWALL
ST-122	(1)	FEB. 25, 1965	STANDARD R.C. ABUTMENTS MISCELLANEOUS DETAILS
ST-123	(1)	FEB. 25, 1965	STANDARD R.C. RETAINING WALLS
ST-130	(1)	FEB. 25, 1965	STD. END WALL DETAILS FOR METAL PLATE CULVERTS
ST-131	(1)	FEB. 25, 1965	STANDARD R.C. BOX CULVERTS GENERAL INFORMATION
ST-140	(1)	FEB. 25, 1965	STANDARD PARAPET WITH ALUMINUM BRIDGE RAILING AND GUARD FENCE CONNECTION
ST-142	(1)	FEB. 25, 1965	STANDARD METAL CRIBBING UNCOATED
ST-143	(1)	FEB. 25, 1965	STANDARD METAL CRIBBING COATED
ST-144	(2)	FEB. 25, 1965	STANDARD CONCRETE CRIBBING TYPE I & 2
ST-145	(1)	FEB. 25, 1965	STANDARD ELECTRICAL DETAILS FOR STRUCTURES
ST-146	(1)	DEC. 10, 1965	STANDARD PARAPET WITH ALUMINUM BRIDGE RAILING AND GUARD FENCE CONNECTION
ST-147	(1)	DEC. 10, 1965	STANDARD PARAPET WITH STEEL BRIDGE RAILING AND GUARD FENCE CONNECTION



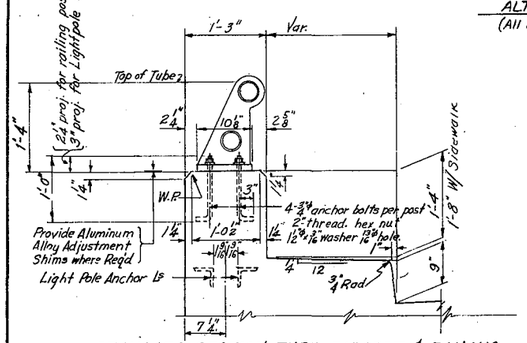
END OF RAILING AND PARAPET WITHOUT GUARD FENCE CONNECTIONS



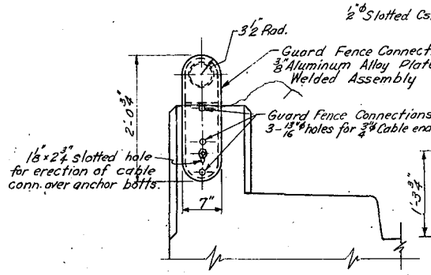
RAILING AND PARAPET AT EXPANSION JOINTS — BRIDGES WHERE MOVEMENT IS LESS THAN ±2"



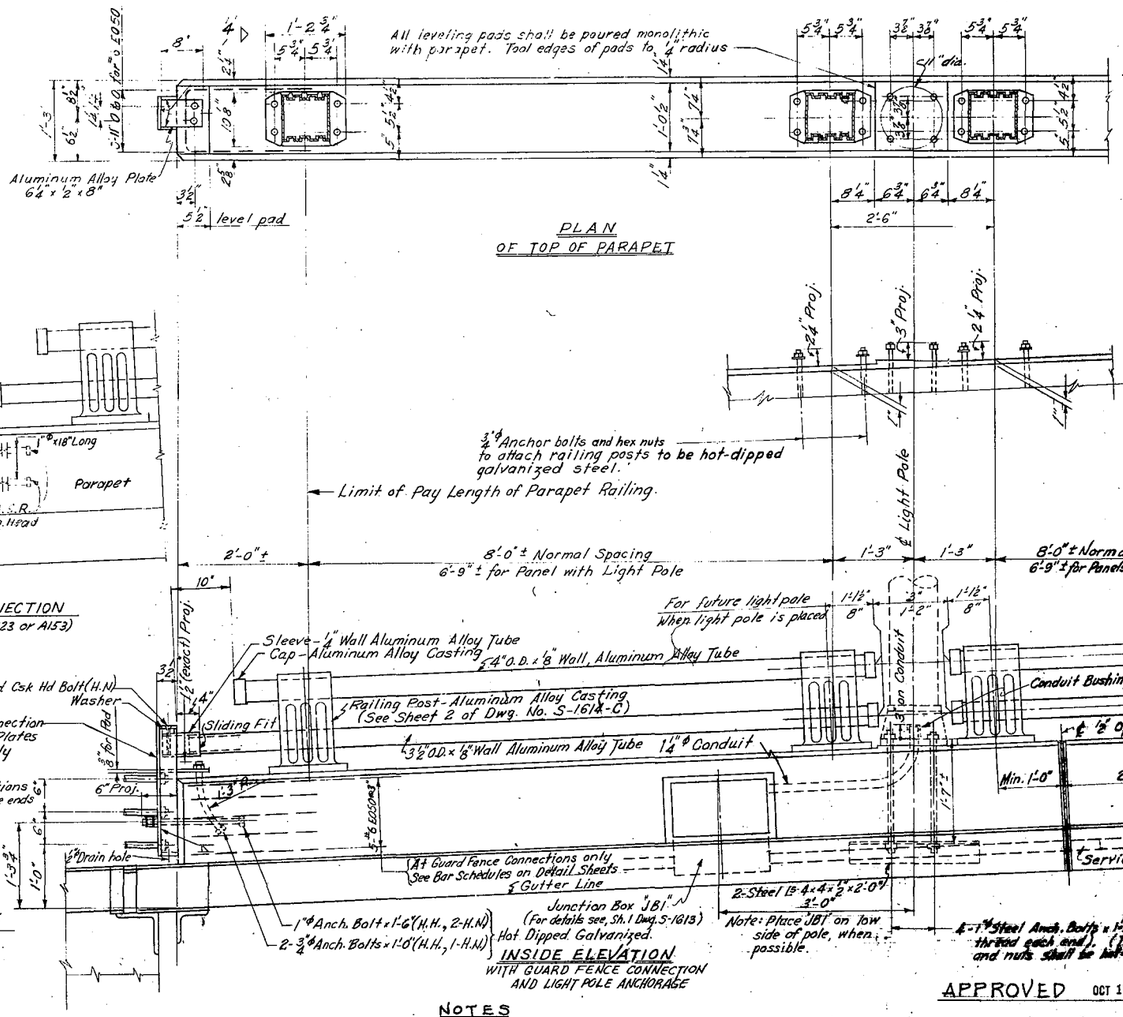
ALTERNATE ASSEMBLY OF CABLE GUARD FENCE CONNECTION
(All material to be A.S.T.M. A36 steel galvanized to A.S.T.M. A123 or A153)



STANDARD SECTION THRU PARAPET & RAILING



END VIEW



NOTES

RAILS: Parallel to grade. Normally two (2) panels long. Joints to be at ℄ of posts with 2" ± clearance (except at expansion joints) and staggered in upper and lower rails.

PARAPET: Parallel to grade. For reinforcement & construction refer to details of specific structure.

POSTS: Normal to grade. See Sheet 2 Dwg. 1614-C for large scale details. For spacing, refer to details of specific structure. ½"ø headless set screws at each post for both top & bottom rails to prevent rattling.

LIGHTPOLES: Truly vertical with bases level.

ANCHORAGE: Bases-grouted & aligned after erection to seal openings between bases & concrete. Anchor bolts for railing posts-normal to grade; for lightpoles-truly vertical.

MATERIALS: Rails, posts, shims, set screws and caps - Aluminum Alloy. Guard Fence Connections - Aluminum Alloy or Galvanized Steel.

SPECIAL TREATMENT: Guard Fence Connection Anchor Bolts & Railing Post Anchor Bolts - Hot dipped Galvanized (A153 - ASTM Specs.) Surfaces of Aluminum in contact with concrete or steel - one (1) coat Alumiplastic or equal.

PAYMENT: Parapet Railing - linear foot basis, measured continuously ℄ to ℄ of End Posts which includes all posts, rails, end closures, anchor bolts and anchor bolt ℄.

Guard Fence Connections - includes compensation for sleeves and anchor bolts.

Revision of Guard Fence Connection 12-3-62 V.V.V.

Revision of anchor bolt spacing for light pole 7-9-63 H.G.F.

APPROVED OCT 17 1962

BRIDGE ENGINEER K.H. Jensen

Commonwealth of Pennsylvania

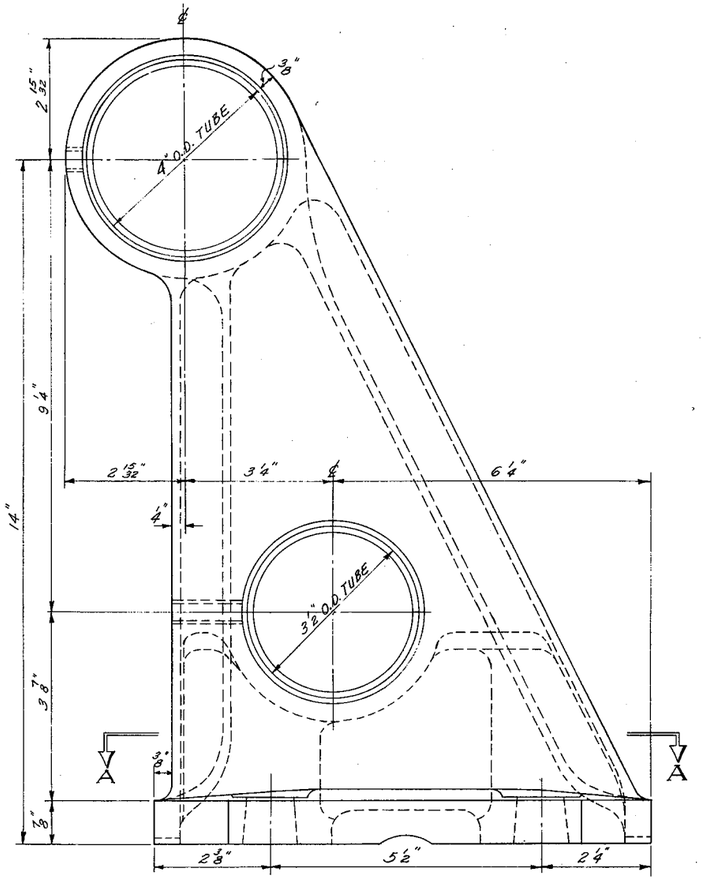
Department of Highways
BRIDGE UNIT

STANDARD PARAPET & PARAPET RAILING

SCALE: 1"=1'-0" UNLESS NOTED

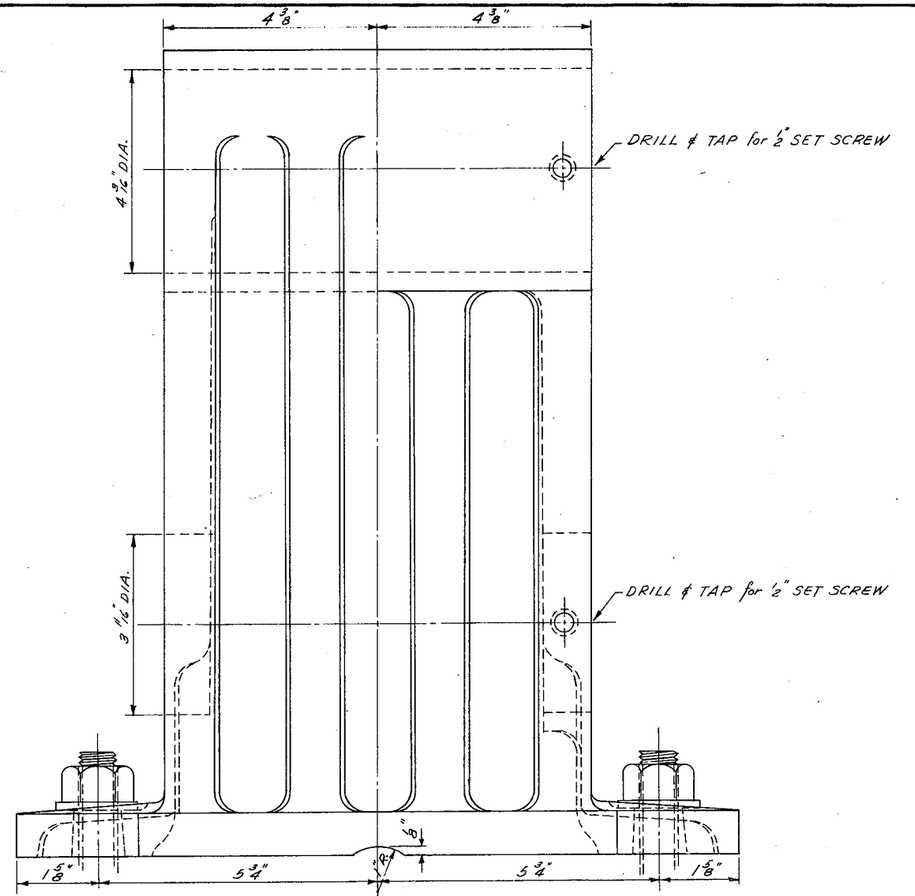
SHEET 1 OF 2 DWG S-1614-C

V.V.V. 10-16-62



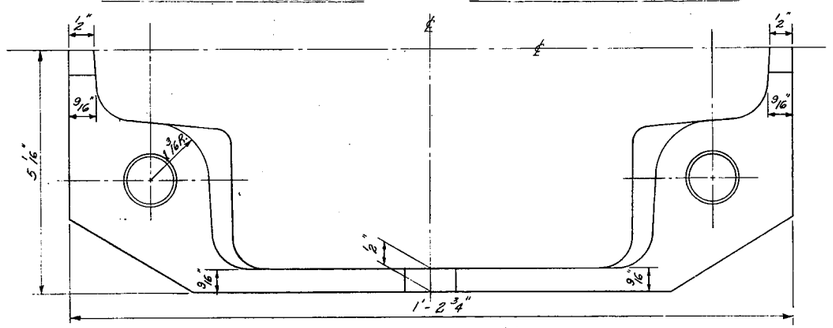
END VIEW

SECTION A-A



HALF OUTSIDE VIEW

HALF INSIDE VIEW



HALF BOTTOM VIEW

APPROVED OCT 17 1962

BRIDGE ENGINEER S.H. Jensen

NOTE: For Material and General Notes see Sheet 1 of Dwg. No. S-1614-C

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

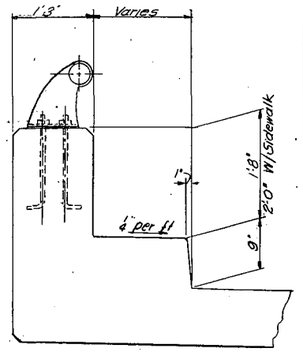
STANDARD PARAPET RAILING POST DETAILS

SCALE :- 9"= 1'-0"

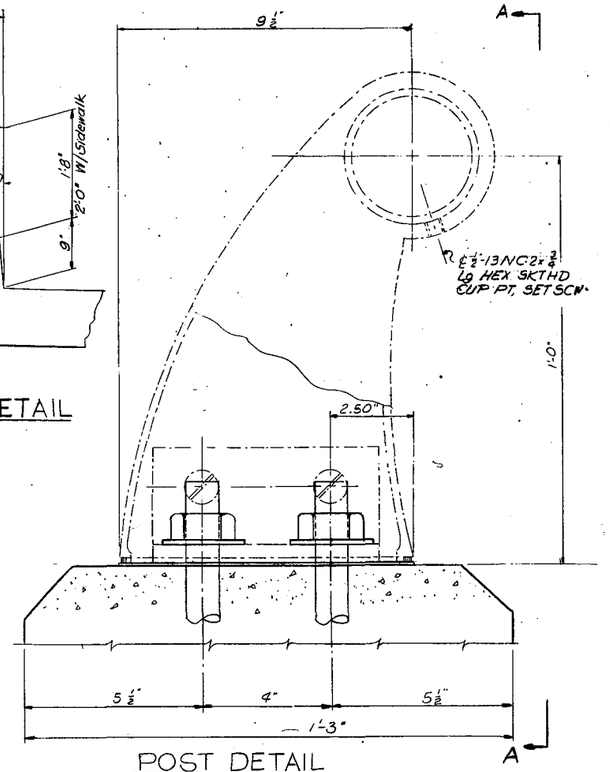
SH. 2 OF 2 DWG. NO. S-1614-C

SEPT. 5 1963

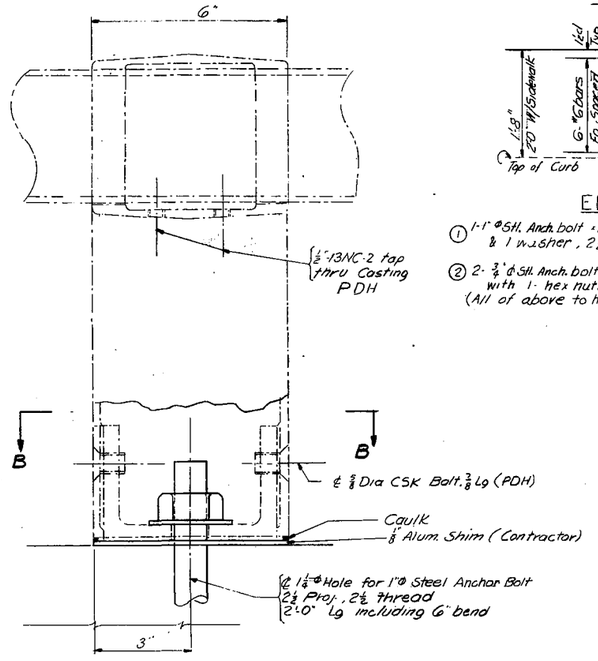
V.V.V. 10-16-62



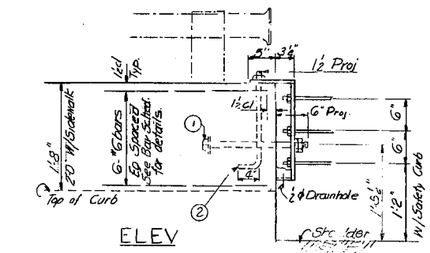
PARAPET DETAIL
Scale 1"=1'-0"



POST DETAIL
Scale 1:2

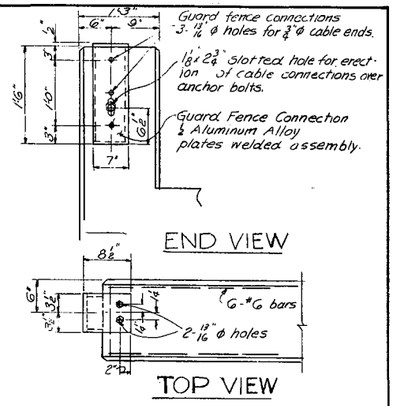


SECT A-A
Scale 1:2



① 1-1" ϕ Stl. Anch. bolt x 1'-6" lg., 3" lg thd. with 2 hex nuts & 1 washer, 2 1/2" OD, 1 3/32" ID, x #9 gage.

② 2-3/4" ϕ Stl. Anch. bolt x 1'-10" lg incl 4" bend, 1 1/2" lg thd, with 1- hex nut.
(All of above to hot dipped galv.)



GUARD FENCE CONNECTION DETAILS
Scale 1"=1'-0"

NOTES

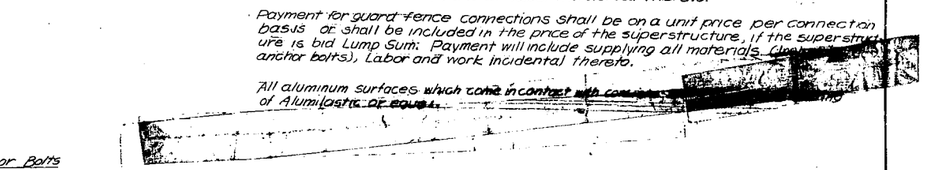
All materials (supplied by the contractor) and workmanship shall be in accordance with PDH. Forms 408-1960 and 409-1949

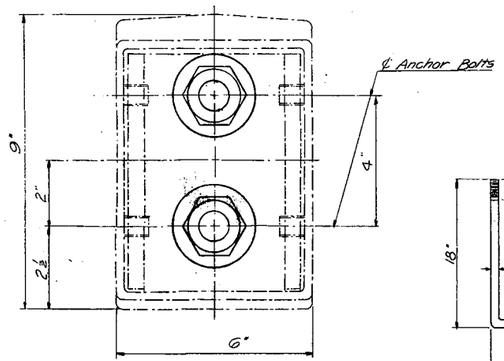
(R) The PDH has in stock the tubing & the posts at the PDH Maintenance shed at Blaine & Ruffner Streets in Phila. The Contractor shall make arrangements with the Construction Engineer and pick up the necessary materials, signing a receipt in triplicate, as to the number of posts & the length of each individual tubing received.

Payment for railing shall be on lin ft. basis measured ℄ to ℄ of end posts, or shall be included in the superstructure if the superstructure is bid lump sum. Payment will include supplying all materials specified, loading & hauling all materials received from the PDH, and all labor incidental thereto.

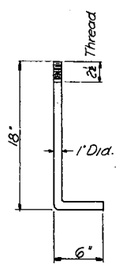
Payment for guard fence connections shall be on a unit price per connection basis or shall be included in the price of the superstructure, if the superstructure is bid Lump Sum. Payment will include supplying all materials (including anchor bolts), Labor and work incidental thereto.

All aluminum surfaces which come in contact with concrete shall be painted with two coats of Alumiplastic or equal.



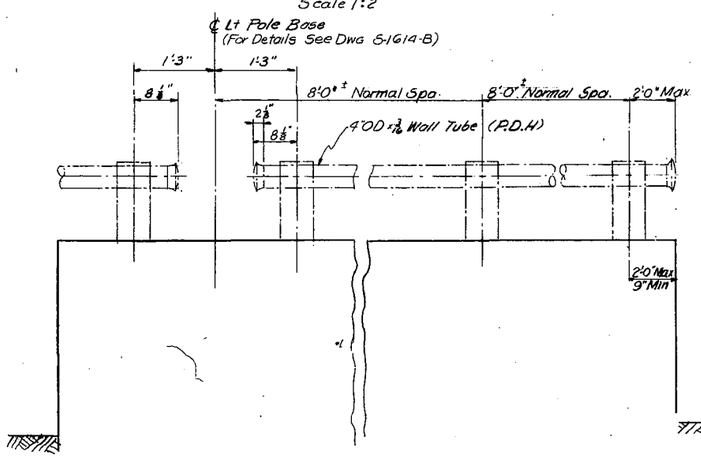


SECT B-B
Scale 1:2



ANCHOR BOLT (Contractor)
Scale 1 1/2"=1'-0"
2-Anchor Bolts per Post

NOTE
Steel Anchor Bolt Supplied with 1 Hex Nut & 1 Washer W/2 1/2 OD, 1 3/32 ID, #9 Gage. All to be HOT DIP. GALVANIZED (Contractor)



Scale 1"=1'-0"

Approved: OCT 13 1961
H.A. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

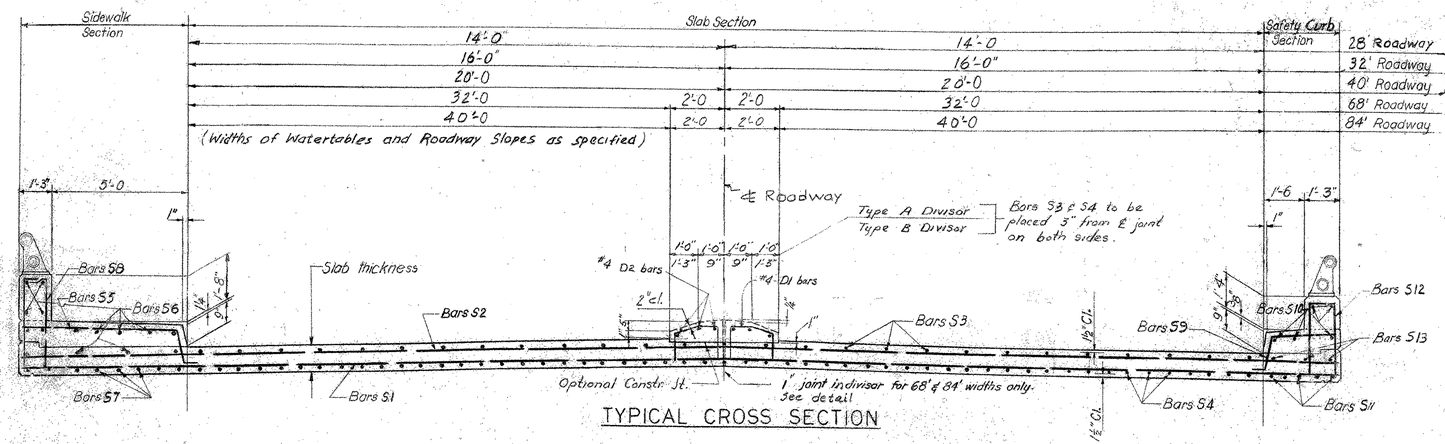
STANDARD
PARAPET & PARAPET RAILING

(R) Revision: date of Form 408 K&F - Mar. 8, 1962 H.J.

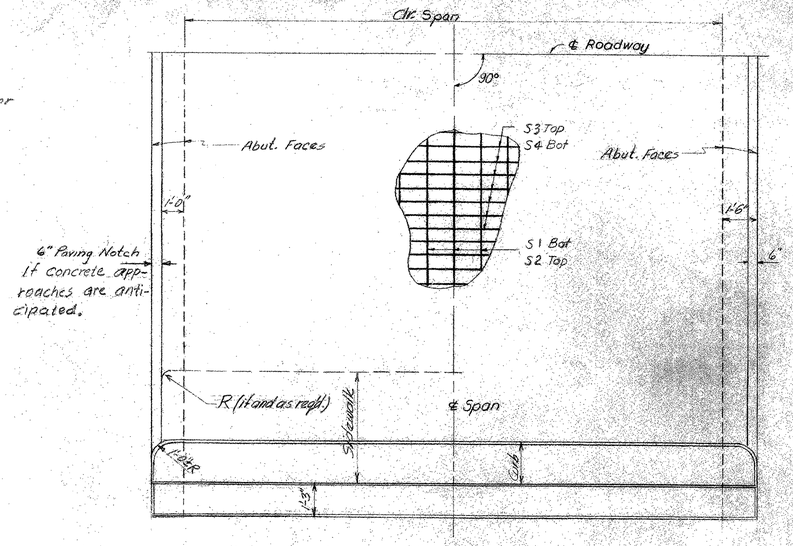
Made by Dist 6
Drawn By I.H.

Scale - as noted
SHEET 1 OF 1

S-2002-A



TYPICAL CROSS SECTION



HALF PLAN

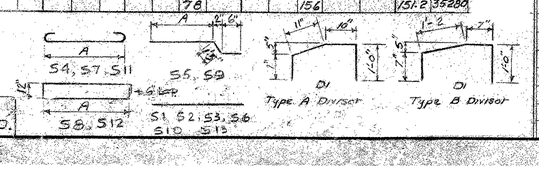
Extend Bars S3 & S4 as reqd. if paving notch is omitted.

* Includes portions of Bars S1 and S2.

SLAB SECTION

Ctr. Span	Width of Slab	Slab Thickness	REINFORCEMENT														QUANT.	
			Bars S1		Bars S2		Bars S3			Bars S4 (Bent)							Cubic Yards Class A Concrete	Reinforcement Bars-Lbs.
			Size of Bars	Spacing	No. of Bars	Size of Bars	Spacing	No. of Bars	Size of Bars	Spacing	No. of Bars	Length	Size of Bars	Spacing	No. of Bars	Length	A	
12'	28'	11"	#5	15"	#4	15"	#4	14"	25	13'-8"	#8	7"	48	15'-10"	13'-8"	13.3	3050
	40'								35				68			19.1	4360
	68'								60				116			32.5	7410
	84'								74				144			40.0	9160
14'	28'	12"	#5	17"	#4	17"	#4	12"	28	15'-8"	#8	6"	56	17'-10"	15'-8"	16.5	3860
	40'								41				89			23.6	5520
	68'								70				136			40.1	9380
	84'								86				168			49.6	11590
16'	28'	13"	#6	19"	#4	19"	#4	14"	25	17'-8"	#9	7"	48	20'-2"	17'-8"	20.2	4510
	40'								35				69			28.8	6440
	68'								60				118			49.0	10950
	84'								74				146			60.5	15220
18'	28'	14"	#6	21"	#4	21"	#4	16"	21	19'-8"	#10	8"	42	22'-6"	19'-8"	24.1	5460
	40'								31				60			34.4	7800
	68'								52				102			58.5	13260
	84'								64				126			72.3	16380
20'	28'	14½"	#6	23"	#4	23"	#4	19"	18	21'-8"	#11	9½"	36	24'-10"	21'-8"	27.8	6160
	40'								26				51			39.6	8800
	68'								44				86			67.4	14960
	84'								54				108			85.3	18480
22'	28'	16"	#6	25"	#4	25"	#4	18"	15	23'-8"	#11	9"	58	26'-10"	23'-8"	33.1	7080
	40'								27				54			47.3	10120
	68'								46				92			80.3	17200
	84'								58				112			99.2	21250
24'	28'	17½"	#6	27"	#4	27"	#4	16"	21	25'-8"	#11	8"	42	28'-10"	25'-8"	39.5	7500
	40'								31				60			56.4	10720
	68'								52				102			95.8	18220
	84'								64				126			118.5	22510
26'	28'	18½"	#6	29"	#4	29"	#4	14"	25	27'-8"	#11	7"	48	30'-10"	27'-8"	44.8	9350
	40'								35				69			64.0	13360
	68'								60				117			109.5	22710
	84'								74				146			134.5	28060
28'	28'	19½"	#6	31"	#4	31"	#4	13"	27	29'-8"	#11	6½"	52	32'-10"	29'-8"	50.4	11760
	40'								38				74			72.0	14800
	68'								64				126			122.5	28360
	84'								78				156			151.2	35280

Equally Spaced — Equally Spaced



Design'd: E.L.T.
Check'd: R.T.D.

SIDEWALK SECTION

Ctr. Span	REINFORCEMENT																QUANTITIES	
	Bars S5 (Bent)					Bars S6			Bars S7 (Bent)					Bars S8 (Bent)					Cubic Yards Class A Concrete	Reinforcement Bars-Lbs.
	Size of Bars	Spacing	No. of Bars	Length	A	Size of Bars	No. of Bars	Length	Size of Bars	Spacing	No. of Bars	Length	A	Size of Bars	Spacing	No. of Bars	Length	A		
12'	#4	12"	16	7'-9	5'-10	#4	15	14'-8	#8	7"	11	16'-10	14'-8	#4	12"	16	8'-8	3'-1"	6.48	990
14'	#4	12"	18	7-9	5'-10	#4	15	16'-8	#8	6"	12	18'-10	16'-8	#4	12"	18	8'-10	3'-2"	7.72	1170
16'	#4	12"	20	7-9	5'-10	#4	15	18'-8	#9	7"	11	21'-2	18'-8	#4	12"	20	9'-0	3'-3"	9.02	1410
18'	#4	12"	22	7-9	5'-10"	#4	15	20'-8	#10	8"	10	23'-6	20'-8	#4	12"	22	9-2	3'-4	10.44	1710
20'	#4	12"	24	7-9	5'-10	#4	15	22'-8	#11	9½"	8	25'-10	22'-8	#4	12"	24	9-4	3'-5	11.68	1860
22'	#4	12"	26	7-9	5'-10	#4	15	24'-8	#11	9"	9	27'-10	24'-8	#4	12"	26	9-6	3'-6"	13.41	2200
24'	#4	12"	28	7-9	5'-10	#4	15	26'-8	#11	8"	10	29'-10	26'-8	#4	12"	28	9'-10	3'-8"	15.31	2490
26'	#4	12"	30	7'-9	5'-10	#4	15	28'-8	#11	7"	11	31'-10	28'-8	#4	12"	30	10'-0	3'-9	17.01	2900
28'	#4	12"	32	7'-9	5'-10	#4	15	30'-8	#11	6½"	12	33'-10	30'-8	#4	12"	32	10'-2"	3'-10	18.78	3320

SAFETY CURB SECTION

Ctr. Span	REINFORCEMENT																QUANTITIES	
	Bars S9 (Bent)					Bars S10			Bars S11 (Bent)					Bars S12 (Bent)					Cubic Yards Class A Concrete	Reinforcement Bars-Lbs.
	Size of Bars	Spacing	No. of Bars	Length	A	Size of Bars	No. of Bars	Length	Size of Bars	Spacing	No. of Bars	Length	A	Size of Bars	Spacing	No. of Bars	Length	A		
12'	#4	12"	16	4'-3	2'-4	#4	5	14-8	#8	Equally Spaced	5	16-10	14-8	#4	12"	16	8'-0	2'-9	3.24	510
14'	#4	12	18	4-3	2'-4	#4	5	16'-8	#8		5	18-10	16'-8	#4	12"	18	8-2	2'-10	3.84	580
16'	#4	12"	20	4-3	2'-4	#4	5	18-8	#9		5	21-2	18-8	#4	12"	20	8-4	2'-11	4.46	710
18'	#4	12"	22	4-3	2'-4	#4	5	20-8	#10		5	23-6	20-8	#4	12"	22	8-6	3'-0	5.15	900
20'	#4	12"	24	4-3	2'-4	#4	5	22'-8	#11		5	25-10	22'-8	#4	12"	24	8'-8	3'-1	5.75	1150
22'	#4	12"	26	4'-3	2'-4	#4	5	24'-8	#11		5	27-10	24'-8	#4	12"	26	8-10	3'-2"	6.36	1260
24'	#4	12"	26	4-3"	2'-4	#4	5	26-8	#11		5	29-10	26-8	#4	12"	28	9-2	3-4	7.95	1380
26'	#4	12"	30	4-3	2'-4	#4	5	28-8	#11		5	31-10	28-8	#4	12"	30	9-4	3'-5	8.25	1560
28'	#4	12"	32	4'-3	2'-4	#4	5	30-8	#11		5	33-10	30-8	#4	12"	32	9-6	3'-6	9.12	1680

½ 4FT DIVISOR

Ctr. Span	REINFORCEMENT				QUANTITIES		Bars D2-#4	
	Bars D1 (Bent)							
	Size of Bars	Spacing	No. of Bars	Length	Cubic Yards Class A Concrete	Reinforcement Bars-Lbs	No. of Bars	Length
12'	#4	12"	16	3'-4"	0.5	65	3	14'-8
14'	#4	12"	18	3'-4"	0.6	74	3	16'-8
16'	#4	12"	20	3'-4"	0.7	82	3	18'-8
18'	#4	12"	22	3'-4"	0.7	91	3	20'-8
20'	#4	12"	24	3'-4"	0.8	99	3	22'-8
22'	#4	12"	26	3'-4"	0.9	108	3	24'-8
24'	#4	12"	28	3'-4"	0.9	116	3	26'-8
26'	#4	12"	30	3'-4"	1.0	125	3	28'-8
28'	#4	12"	32	3'-4"	1.1	133	3	30'-8

SAFETY CURB SECT.

Equally Spaced	Bars S13		
	Size of Bars	Spacing	No. of Bars	Length
	#4		3	14'-8
	#4		3	16'-8
	#4		3	18'-8
	#4		3	20'-8
	#5		3	22'-8
	#5		3	24'-8
	#6		3	26'-8
	#7		3	28'-8
	#7		3	30'-8

SLAB SECTION - 32' ROADWAY ▲

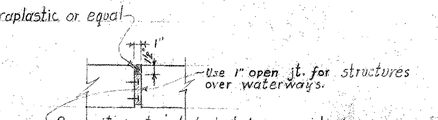
Ctr. Span	REINFORCEMENT		QUANTITIES	
	No. of S3 Bars	No. of S4 Bars	Cubic Yards Class A Conc.	Reinforcement Bars-Lbs.
12'	28	55	15.2	3370
14'	33	64	18.8	4290
16'	28	55	23.1	5020
18'	25	48	27.5	6090
20'	21	40	31.8	6730
22'	22	43	37.8	8120
24'	25	48	45.1	8490
26'	28	55	51.2	10550
28'	30	59	57.6	11900

▲ Items not listed for 32' Roadway slab section are same as for 28'-40'-68'-84' Roadway slab section.

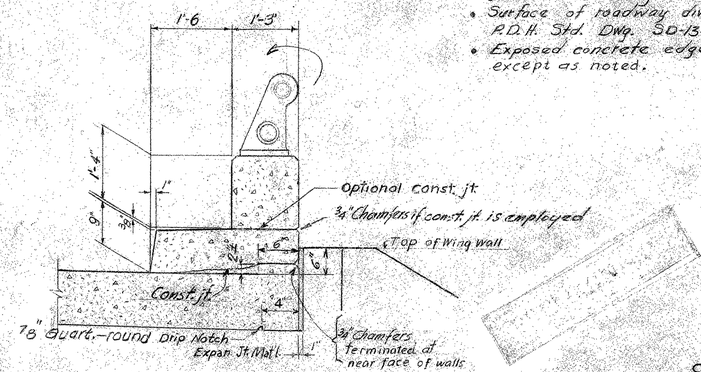
GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Form 408.
- Design Specs.: Division I of 1957 Standard specification for HWY. Bridges of the A.A.S.H.O.
- LIVE LOAD: H20-S16-44, except roadway slab which is designed for a single wheel load of 16000 lbs. for span length under 24'-0" ; and for two wheel loads of 16000 lbs. for span length 24'-0" and over.
- Dead Load: Includes 30 lbs/sq ft for future wearing surface on the roadway slab.
- Steel Reinforcement Bars are designed for f_s = 18000 psi, and detailed as per A.C.I. Code. Bars to be lapped min. 30 dia. except as noted.
- Class A Concrete shall be used in the roadway slab, divisors, curbs, sidewalks and parapets, f_c = 1200 psi.
- Provide 1½" cover on reinforcement bars except as noted.
- For parapet railing and guard fence connections, see P.D.H. Standard Drawing S-1614B or S-3361.
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. SD-13.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

Paraplastic or equal



DETAIL of DIVISOR JOINT



SAFETY CURB DETAIL

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

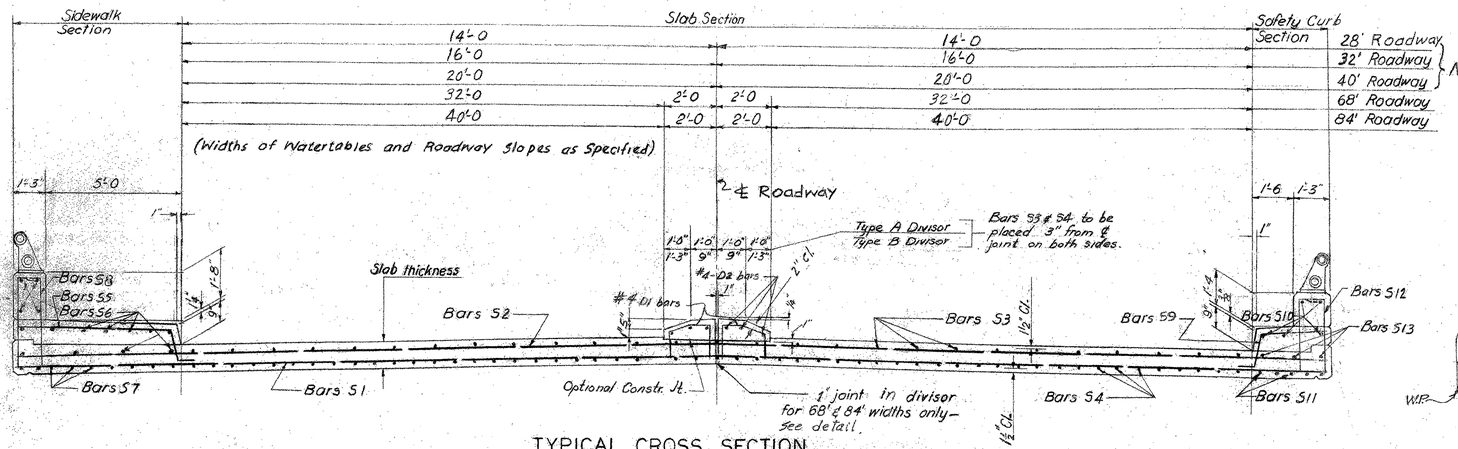
STANDARD BRIDGES

STANDARD REINFORCED CONCRETE SLAB BRIDGE SKEW 90°

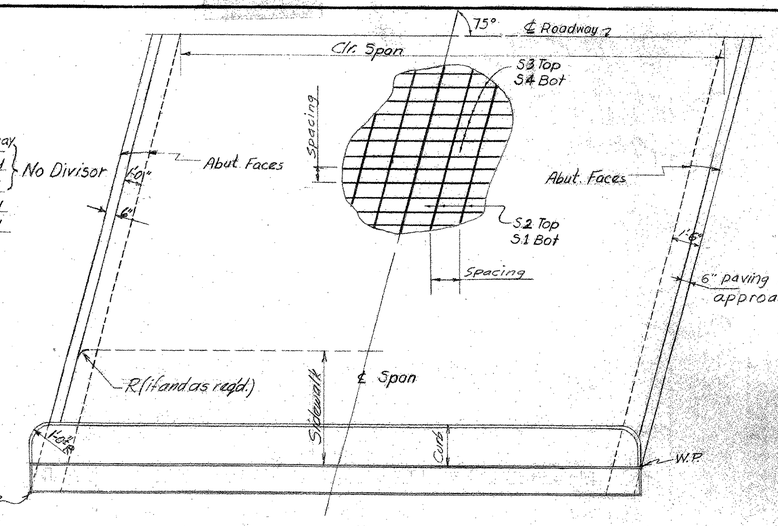
S-2700

Approved: MAR -1 1961

Bridge Engineer



TYPICAL CROSS SECTION



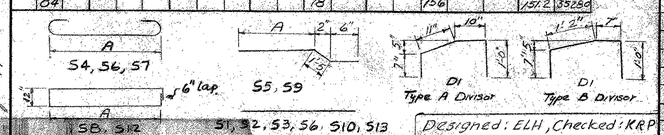
HALF PLAN

Extend Bars S3 & S4 as reqd. if paving notch is omitted.

* Includes portions of bars S1 and S2.

SLAB SECTION

Clr. Span	Slab Width	Slab Thickness	Bars S1 Size of Bars	Bars S1 Spacing	Bars S1 No. of Bars	Bars S2 Size of Bars	Bars S2 Spacing	Bars S2 No. of Bars	Bars S3 Size of Bars	Bars S3 Spacing	Bars S3 No. of Bars	Bars S3 Length	Bars S4 (Bent) Size of Bars	Bars S4 (Bent) Spacing	Bars S4 (Bent) No. of Bars	Bars S4 (Bent) Length	Bars S4 (Bent) A	QUANT. Cubic Yards Class A Conc.	QUANT. Reinforcement Bars - Lbs.
12'	28'	11"	#5	Equally Spaced	15	#4	Equally Spaced	15	#4	14"	25	13'-8	#8	7"	48	15'-10"	13'-8"	13.3	3050
	40'										35				68			19.1	4360
	68'										60				116			32.5	7410
	84'										74				144			40.0	9160
14'	28'	12"	#5	Equally Spaced	17	#4	Equally Spaced	17	#4	12"	28	15'-8	#8	6"	56	17'-10"	15'-8"	16.5	3860
	40'										41				80			23.6	5520
	68'										70				136			40.1	9380
	84'										86				168			49.6	11590
16'	28'	13"	#6	Equally Spaced	19	#4	Equally Spaced	19	#4	14"	25	17'-8	#9	7"	48	20'-2	17'-8"	20.2	4510
	40'										35				69			28.8	6440
	68'										60				118			49.0	10920
	84'										74				146			60.5	13520
18'	28'	14½"	#6	Equally Spaced	21	#4	Equally Spaced	21	#4	16"	21	19'-8	#10	8"	42	22'-6"	19'-8"	24.1	5460
	40'										31				60			34.4	7800
	68'										52				102			58.5	13260
	84'										64				126			72.3	16380
20'	28'	14½"	#6	Equally Spaced	23	#4	Equally Spaced	23	#4	19"	18	21'-8	#11	9½"	36	24'-10"	21'-8"	27.8	6160
	40'										26				51			39.6	8800
	68'										44				86			67.4	14960
	84'										54				108			83.3	18450
22'	28'	16"	#6	Equally Spaced	25	#4	Equally Spaced	25	#4	18"	19	23'-8	#11	9"	38	26'-10"	23'-8"	33.1	7080
	40'										27				54			47.3	10120
	68'										46				92			80.3	17200
	84'										58				112			99.2	21250
24'	28'	17½"	#6	Equally Spaced	27	#4	Equally Spaced	27	#4	16"	21	25'-8	#11	8"	42	28'-10"	25'-8"	39.5	7500
	40'										31				60			56.4	10720
	68'										52				102			95.8	18220
	84'										64				126			118.5	22510
26'	28'	18½"	#6	Equally Spaced	29	#4	Equally Spaced	29	#4	14"	25	27'-8	#11	7"	48	30'-10"	27'-8"	44.8	9350
	40'										35				69			64.0	13370
	68'										60				118			109.5	22710
	84'										74				146			134.5	28060
28'	28'	19½"	#6	Equally Spaced	31	#4	Equally Spaced	31	#4	13"	27	29'-8	#11	6½"	52	32'-10	29'-8"	50.4	11760
	40'										38				74			72.0	16800
	68'										64				126			122.5	28540
	84'										78				156			151.2	33280



Designed: ELH, Checked: KRP

SIDEWALK SECTION

Clr. Span	Bars S5 (Bent) Size of Bars	Bars S5 (Bent) Spacing	Bars S5 (Bent) No. of Bars	Bars S5 (Bent) Length	Bars S5 (Bent) A	Bars S6 Size of Bars	Bars S6 No. of Bars	Bars S6 Length	Bars S7 (Bent) Size of Bars	Bars S7 (Bent) Spacing	Bars S7 (Bent) No. of Bars	Bars S7 (Bent) Length	Bars S7 (Bent) A	Bars S8 (Bent) Size of Bars	Bars S8 (Bent) Spacing	Bars S8 (Bent) No. of Bars	Bars S8 (Bent) Length	Bars S8 (Bent) A	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs *
12'	#4	12"	16	7'-9	5'-10	#4	15	14'-8	#8	7"	11	16-10	14'-8	#4	12"	16	8'-8	3'-1	6.48	1000
14'	#4	12"	18	7'-9	5'-10	#4	15	16'-8	#8	6"	12	18-10	16-8	#4	12"	18	9'-10	3'-2	7.72	1180
16'	#4	12"	20	7'-9	5'-10	#4	15	18'-8	#9	7"	11	21-2	18-8	#4	12"	20	9-0	3'-3	9.02	1420
18'	#4	12"	22	7'-9	5'-10	#4	15	20'-8	#10	8"	10	23-6	20-8	#4	12"	22	9-2	3'-4	10.44	1720
20'	#4	12"	24	7'-9	5'-10	#4	15	22'-8	#11	9½"	8	25-10	22-8	#4	12"	24	9-4	3'-5	11.68	1870
22'	#4	12"	26	7'-9	5'-10	#4	15	24'-8	#11	9"	9	27-10	24-8	#4	12"	26	9-6	3'-6	13.01	2210
24'	#4	12"	28	7'-9	5'-10	#4	15	26'-8	#11	8"	10	29-10	26-8	#4	12"	28	9-10	3'-8	15.31	2500
26'	#4	12"	30	7'-9	5'-10	#4	15	28'-8	#11	7"	11	31-10	28-8	#4	12"	30	10-0	3'-9	17.01	2920
28'	#4	12"	32	7'-9	5'-10	#4	15	30'-8	#11	6½"	12	33-10	30-8	#4	12"	32	10-2	3'-10	18.78	3340

SAFETY CURB SECTION

Clr. Span	Bars S9 (Bent) Size of Bars	Bars S9 (Bent) Spacing	Bars S9 (Bent) No. of Bars	Bars S9 (Bent) Length	Bars S9 (Bent) A	Bars S10 Size of Bars	Bars S10 No. of Bars	Bars S10 Length	Bars S11 (Bent) Size of Bars	Bars S11 (Bent) Spacing	Bars S11 (Bent) No. of Bars	Bars S11 (Bent) Length	Bars S11 (Bent) A	Bars S12 (Bent) Size of Bars	Bars S12 (Bent) Spacing	Bars S12 (Bent) No. of Bars	Bars S12 (Bent) Length	Bars S12 (Bent) A	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs *
12'	#4	12"	16	4'-3	2'-4"	#4	5	14'-8	#8	Equally Spaced	5	16-10	14'-8	#4	12"	16	8'-0	2'-9"	3.28	490
14'	#4	12	18	4-3	2'-4"	#4	5	16-8	#8		5	18-10	16-8	#4	12"	18	8-2	2'-10	3.84	560
16'	#4	12'	20	4-3	2'-4"	#4	5	18-8	#9		5	21-2	18-8	#4	12"	20	8-4	2'-11	4.46	690
18'	#4	12"	22	4-3	2'-4"	#4	5	20-8	#10		5	23-6	20-8	#4	12"	22	8-6	3'-0	5.15	880
20'	#4	12	24	4-3	2'-4"	#4	5	22-8	#11		5	25-10	22-8	#4	12"	24	8-8	3'-1	5.75	1130
22'	#4	12'	26	4-3	2'-4"	#4	5	24-8	#11		5	27-10	24-8	#4	12"	26	8-10	3'-2	6.56	1230
24'	#4	12	28	4'-3	2'-4"	#4	5	26-8	#11		5	29-10	26-8	#4	12"	28	9-2	3'-4	7.45	1350
26'	#4	12	30	4-3	2'-4"	#4	5	28-8	#11		5	31-10	28-8	#4	12"	30	9-4	3'-5	8.25	1530
28'	#4	12'	32	4'-3	2'-4"	#4	5	30-8	#11		5	33-10	30-8	#4	12"	32	9-6	3'-6	9.12	1650

½ 4 FT. DIVISOR

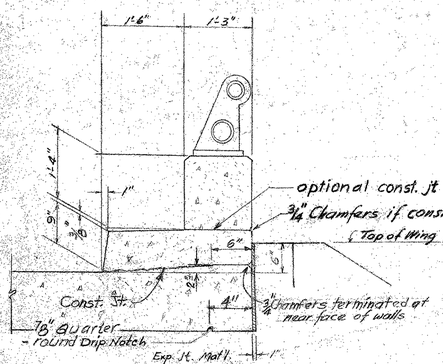
Clr. Span	REINFORCEMENT Bars D1 (Bent) Size of Bars	Spacing	No. of Bars	Length	QUANTITIES Cubic Yards Class A Conc.	Reinforcement Bars - Lbs	#4 Bars D2 No. of Bars	Length
12'	#4	1'-0"	16	3'-4"	.50	65	3	14'-8
14'	#4	1'-0"	18	3'-4"	.58	74	3	16'-8
16'	#4	1'-0"	20	3'-4"	.65	82	3	18'-8
18'	#4	1'-0"	22	3'-4"	.72	91	3	20'-8
20'	#4	1'-0"	24	3'-4"	.80	99	3	22'-8
22'	#4	1'-0"	26	3'-4"	.87	108	3	24'-8
24'	#4	1'-0"	28	3'-4"	.95	116	3	26'-8
26'	#4	1'-0"	30	3'-4"	1.02	125	3	28'-8
28'	#4	1'-0"	32	3'-4"	1.09	133	3	30'-8

SAFETY CURB SECT.

Clr. Span	Bars S13 Size of Bars	Spacing	No. of Bars	Length
12'	4	Equally Spaced	3	14'-8
14'	4		3	16'-8
16'	4		3	18'-8
18'	4		3	20'-8
20'	5		3	22'-8
22'	5		3	24'-8
24'	6		3	26'-8
26'	7		3	28'-8
28'	7		3	30'-8

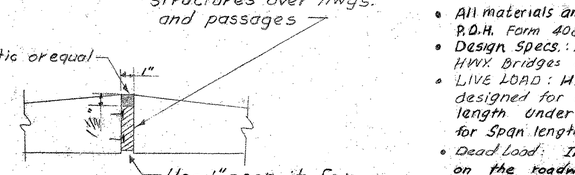
SLAB SECTION - 32' ROADWAY

Clr. Span	REINFORCEMENT No. of S3 Bars	No. of S4 Bars	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs.
12'	28	55	15.2	3370
14'	33	64	18.8	4290
16'	28	55	23.1	5020
18'	25	48	27.5	6090
20'	21	40	31.8	6730
22'	22	43	37.8	8120
24	25	48	45.1	8490
26	28	55	51.2	10550
28'	30	59	57.6	13040



SAFETY CURB DETAIL

Items not listed for 32' Roadway slab Section are same as for 28'-40' 68'-84' Roadway slab Section.



Detail of Divisor Joint

GENERAL NOTES

- All materials and workship shall be in accordance with P.D.H. Form 408.
- Design Specs.: Division I of 1957 Standard specification for HWY. Bridges of the AASHO.
- LIVE LOAD: H20-S16-44, except roadway slab which is designed for a single wheel load of 16000 lbs. for span length under 24'-0", and for two wheel loads of 16000 lbs. for span length 24'-0" and more.
- Dead Load: Includes 30 lbs/sq.ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars are designed for $f_s = 18000$ psi, and detailed as per A.C.I. Code. Bars to be lapped min. 30 dia. except as noted.
- Class A Concrete shall be used in the roadway slab, curbs, divisors sidewalks, and parapets, $f_c = 1200$ psi.
- Provide 1½" cover on reinforcement bars except as noted.
- For parapet railing and guard fence connections, see P.D.H. Standard Drawing S-1614B or S-3361.
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. SD-13.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

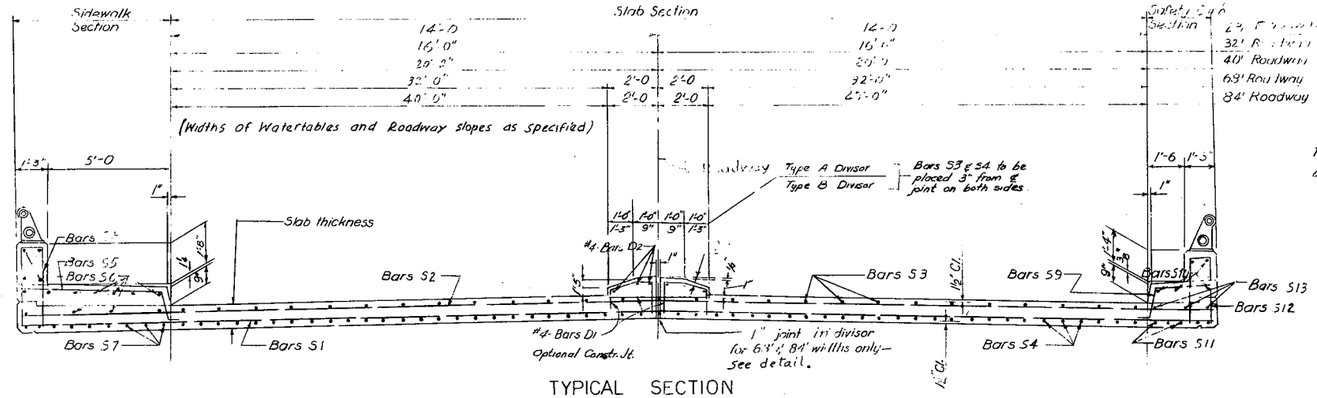
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

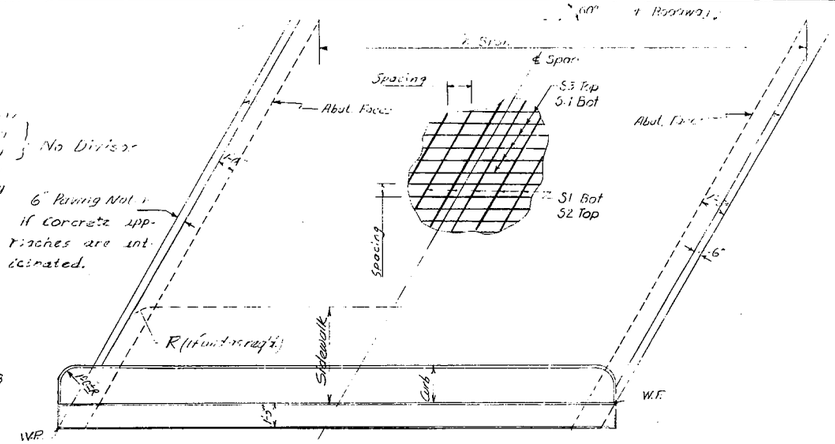
STANDARD REINFORCED CONCRETE SLAB BRIDGE SKEW 75°

S-2701

Approved: MAR - 1 1961
Bridge Engineer



TYPICAL SECTION



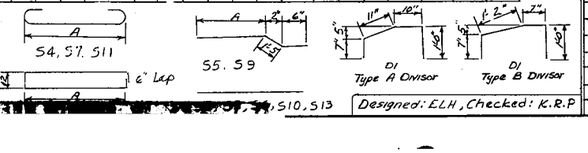
HALF PLAN

Extend Bars S3 & S4 as reqd. if paving notch is omitted.

* Includes portions of bars S1 and S2.

SLAB SECTION

Clr. Span	Width of Slab	Slab Thickness	Bars S1 Size of Bars	Bars S1 Spacing	Bars S1 No. of Bars	Bars S2 Size of Bars	Bars S2 Spacing	Bars S2 No. of Bars	Bars S3 Size of Bars	Bars S3 Spacing	Bars S3 No. of Bars	Bars S3 Length	Bars S4 (Bent) Size of Bars	Bars S4 (Bent) Spacing	Bars S4 (Bent) No. of Bars	Bars S4 (Bent) Length	Bars S4 (Bent) A	QUANT. Cubic Yards Class A Conc.	QUANT. Reinforcement Bars - Lbs
12'-0"	28'	11"	#5	Equally Spaced	19	#4	Equally Spaced	16	#4	14"	25	14'-9"	#8	7"	48	16'-2"	14'-0"	13.7	3030
	40'										35				68			19.6	4400
	68'										59				116			33.3	7480
	84'										73				144			41.2	9240
14'-0"	28'	12"	#5	Equally Spaced	18	#4	Equally Spaced	13	#4	12"	28	16'-0"	#8	6"	56	18'-2"	16'-0"	16.2	3920
	40'										41				80			24.0	5600
	68'										69				136			40.8	9520
	84'										85				168			50.4	11760
16'-0"	28'	13"	#6	Equally Spaced	22	#4	Equally Spaced	20	#4	14"	25	18'-0"	#9	7"	48	20'-6"	18'-0"	20.5	4520
	40'										35				69			29.2	6520
	68'										59				117			49.6	11080
	84'										73				145			61.4	13690
18'-0"	28'	14"	#6	Equally Spaced	22	#4	Equally Spaced	22	#4	16"	21	20'-5"	#10	8"	42	22'-6"	20'-0"	24.4	5520
	40'										31				60			34.8	7880
	68'										52				102			59.2	13400
	84'										64				126			73.0	16550
20'-0"	28'	14½"	#6	Equally Spaced	24	#4	Equally Spaced	24	#4	19"	18	22'-0"	#11	9½"	36	25'-1"	22'-0"	28.0	6230
	40'										26				51			40.0	8880
	68'										44				86			68.0	15100
	84'										54				107			84.0	18670
22'-0"	28'	16"	#6	Equally Spaced	26	#4	Equally Spaced	26	#4	18"	19	24'-0"	#11	9"	38	27'-2"	24'-0"	33.4	7140
	40'										27				54			47.6	10200
	68'										46				91			80.9	17340
	84'										57				112			100.0	21420
24'-0"	28'	17½"	#7	Equally Spaced	28	#4	Equally Spaced	28	#4	16"	21	25'-0"	#11	8"	42	29'-2"	26'-0"	39.8	7560
	40'										31				60			56.8	10800
	68'										52				102			96.6	18360
	84'										64				126			119.3	22680
26'-0"	28'	18½"	#7	Equally Spaced	30	#4	Equally Spaced	30	#4	14"	25	28'-0"	#11	7"	48	31'-2"	28'-0"	45.1	9410
	40'										35				68			64.4	13440
	68'										59				117			109.0	226 30
	84'										73				145			135.2	28220
28'-0"	28'	19½"	#7	Equally Spaced	32	#4	Equally Spaced	32	#4	13"	27	30'-0"	#11	6"	52	33'-2"	30'-0"	30.7	11800
	40'										38				74			72.4	14880
	68'										63				126			123.0	28700
	84'										78				155			152.0	35450



Designed: ELH, Checked: K.R.P

SIDEWALK SECTION

Clr. Span	Bars S5 (Bent) Size of Bars	Bars S5 (Bent) Spacing	Bars S5 (Bent) No. of Bars	Bars S5 (Bent) Length	Bars S5 (Bent) A	Bars S6 Size of Bars	Bars S6 No. of Bars	Bars S6 Length	Bars S7 (Bent) Size of Bars	Bars S7 (Bent) Spacing	Bars S7 (Bent) No. of Bars	Bars S7 (Bent) Length	Bars S7 (Bent) A	Bars S8 (Bent) Size of Bars	Bars S8 (Bent) Spacing	Bars S8 (Bent) No. of Bars	Bars S8 (Bent) Length	Bars S8 (Bent) A	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs *
12'	#4	12"	16	7'-9"	5'-10"	#4	15	15'-0"	#8	7"	11	17'-2"	15'-0"	#4	12"	16	8'-0"	6'-1"	6.64	1040
14'	#4	12"	18	7'-9"	5'-10"	#4	15	17'-0"	#8	6"	12	19'-2"	17'-0"	#4	12"	18	8'-10"	6'-2"	7.88	1220
16'	#4	12"	20	7'-9"	5'-10"	#4	15	19'-0"	#9	7"	11	21'-6"	19'-0"	#4	12"	20	9'-8"	6'-3"	9.18	1460
18'	#4	12"	22	7'-9"	5'-10"	#4	15	21'-0"	#10	8"	10	23'-10"	21'-0"	#4	12"	22	9'-2"	5'-4"	10.60	1770
20'	#4	12"	24	7'-9"	5'-10"	#4	15	23'-0"	#11	9½"	8	26'-2"	23'-0"	#4	12"	24	9'-4"	5'-5"	11.84	1980
22'	#4	12"	26	7'-9"	5'-10"	#4	15	25'-0"	#11	9"	9	24'-2"	25'-0"	#4	12"	26	9'-6"	5'-6"	13.57	2280
24'	#4	12"	28	7'-9"	5'-10"	#4	15	27'-0"	#11	8"	10	30'-2"	27'-0"	#4	12"	28	9'-10"	5'-8"	15.47	2560
26'	#4	12"	30	7'-9"	5'-10"	#4	15	29'-0"	#11	7"	11	32'-2"	29'-0"	#4	12"	30	10'-0"	5'-9"	17.11	2930
28'	#4	12"	32	7'-9"	5'-10"	#4	15	31'-0"	#11	6½"	12	34'-2"	31'-0"	#4	12"	32	10'-2"	5'-10"	18.94	3420

SAFETY CURB SECTION

Clr. Span	Bars S9 (Bent) Size of Bars	Bars S9 (Bent) Spacing	Bars S9 (Bent) No. of Bars	Bars S9 (Bent) Length	Bars S9 (Bent) A	Bars S10 Size of Bars	Bars S10 No. of Bars	Bars S10 Length	Bars S11 (Bent) Size of Bars	Bars S11 (Bent) Spacing	Bars S11 (Bent) No. of Bars	Bars S11 (Bent) Length	Bars S11 (Bent) A	Bars S12 (Bent) Size of Bars	Bars S12 (Bent) Spacing	Bars S12 (Bent) No. of Bars	Bars S12 (Bent) Length	Bars S12 (Bent) A	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs *
12'	#4	12"	16	4'-3"	3'-4"	#4	5	15'-0"	#8	Equally Spaced	5	17'-2"	15'-0"	#4	12"	16	8'-0"	2'-9"	3.34	520
14'	#4	12"	18	4'-3"	3'-4"	#4	5	17'-0"	#8		5	19'-2"	17'-0"	#4	12"	18	8'-2"	2'-8"	3.94	590
16'	#4	12"	20	4'-3"	3'-4"	#4	5	19'-0"	#9		5	21'-6"	19'-0"	#4	12"	20	8'-4"	2'-11"	4.56	730
18'	#4	12"	22	4'-3"	3'-4"	#4	5	21'-0"	#10		5	23'-10"	21'-0"	#4	12"	22	8'-6"	3'-0"	5.25	920
20'	#4	12"	24	4'-3"	3'-4"	#4	5	23'-0"	#11		5	26'-2"	23'-0"	#4	12"	24	8'-8"	3'-1"	6.85	1170
22'	#4	12"	26	4'-3"	3'-4"	#4	5	25'-0"	#11		5	28'-2"	25'-0"	#4	12"	26	8'-10"	3'-2"	6.66	1290
24'	#4	12"	28	4'-3"	3'-4"	#4	5	27'-0"	#11		5	30'-2"	27'-0"	#4	12"	28	9'-2"	3'-4"	7.55	1410
26'	#4	12"	30	4'-3"	3'-4"	#4	5	29'-0"	#11		5	32'-2"	29'-0"	#4	12"	30	9'-4"	3'-5"	8.35	1590
28'	#4	12"	32	4'-3"	3'-4"	#4	5	31'-0"	#11		5	34'-2"	31'-0"	#4	12"	32	9'-6"	3'-6"	9.22	1710

½ 4FT DIVISOR

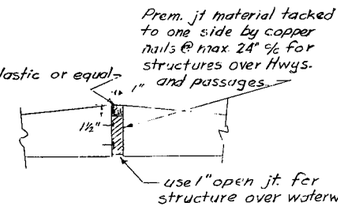
Clr. Span	Bars D1 (Bent) Size of Bars	Bars D1 (Bent) Spacing	Bars D1 (Bent) No. of Bars	Bars D1 (Bent) Length	QUANTITIES Cubic Yards Class A Conc.	QUANTITIES Reinforcement Bars - Lbs	#4 Bars D2 No. of Bars	#4 Bars D2 Length
12'	#4	1'-0"	16	3'-4"	0.5	66	3	15'-0"
14'	#4	1'-0"	18	3'-4"	0.6	75	3	17'-0"
16'	#4	1'-0"	20	3'-4"	0.7	83	3	19'-0"
18'	#4	1'-0"	22	3'-4"	0.7	92	3	21'-0"
20'	#4	1'-0"	24	3'-4"	0.8	100	3	23'-0"
22'	#4	1'-0"	26	3'-4"	0.9	109	3	25'-0"
24'	#4	1'-0"	28	3'-4"	0.9	117	3	27'-0"
26'	#4	1'-0"	30	3'-4"	1.0	126	3	29'-0"
28'	#4	1'-0"	32	3'-4"	1.0	134	3	31'-0"

SAFETY CURB SECTION

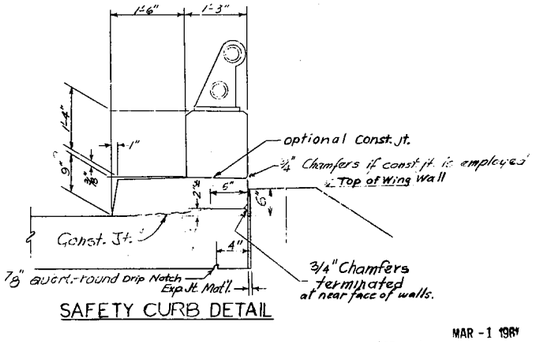
Clr. Span	Bars S13 Size of Bars	Bars S13 Spacing	Bars S13 No. of Bars	Bars S13 Length
12'	#4	Equally Spaced	3	15'-0"
14'	#4		3	17'-0"
16'	#4		3	19'-0"
18'	#4		3	21'-0"
20'	#5		3	23'-0"
22'	#5		3	25'-0"
24'	#6		3	27'-0"
26'	#7		3	29'-0"
28'	#7		3	31'-0"

SLAB SECTION 32' ROADWAY ▲

Clr. Span	Reinforcement Bars No. of S3 Bars	Reinforcement Bars No. of S4 Bars	Quantities Cubic Yards Class A Conc.	Quantities Reinforcement Bars - Lbs
12'	28	55	15.6	3410
14'	33	64	19.2	4360
16'	28	55	23.4	5090
18'	25	48	27.9	6160
20'	21	40	32.0	6600
22'	22	43	38.2	8200
24'	25	48	45.5	8560
26'	29	55	51.5	10620
28'	30	59	57.9	13110



Detail of Divisor Joint



SAFETY CURB DETAIL

▲ Items not listed for 32'-Roadway Slab Section are same as for 28'-40'-68'-84' Roadway Slab Section.

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Form 408.
- Design Specs.: Division I of 1957, Standard specification for HWY Bridges of the A.A.S.H.O.
- Live Load: H20-S16-44, except Roadway Slab which is designed for a single wheel load of 16000 lbs. for span length under 24'-0" and for two wheel loads of 16000 lbs. for span length 24'-0 and over.
- Dead Load: Includes 30 lbs./sq.ft for future wearing surface on the roadway slab.
- Steel Reinforcement Bars are designed for fs = 18000 p.s.i., and detailed as per A.C.I. Code. Bars to be lapped min. 30 dia. except as noted.
- Class A Concrete shall be used in the roadway slab, curbs, divisors sidewalks and parapets. fc = 1200 psi.
- Provide 1½" cover on reinforcement bars except as noted.
- For parapet railing and guard fence connections see P.D.H. Standard Drawing S-1618B or S-3561.
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. SD-13.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

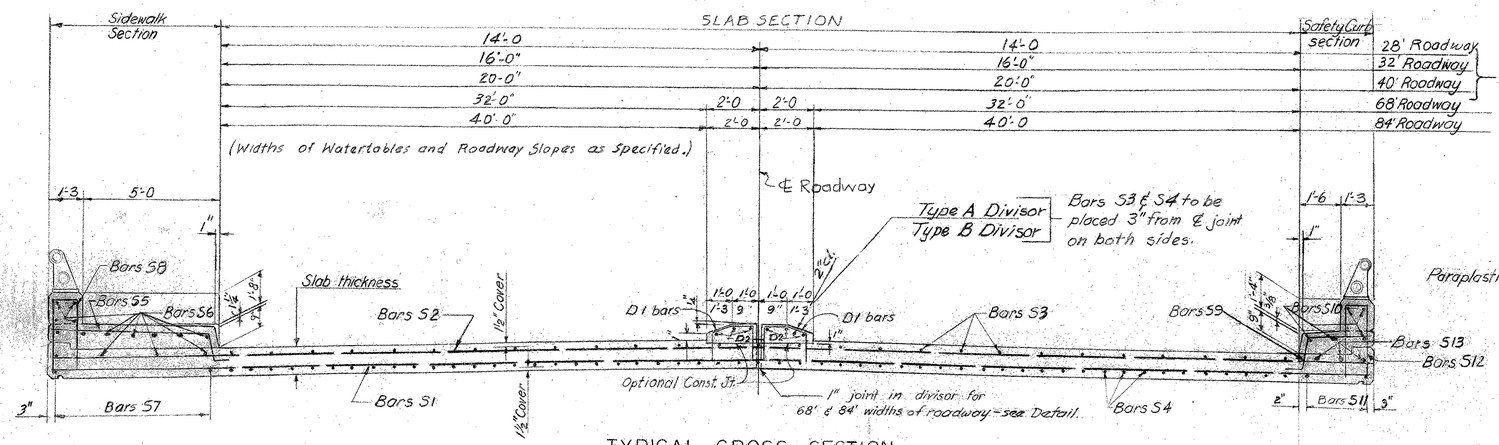
STANDARD BRIDGES

STANDARD REINFORCED CONCRETE SLAB BRIDGE SKEW 60°

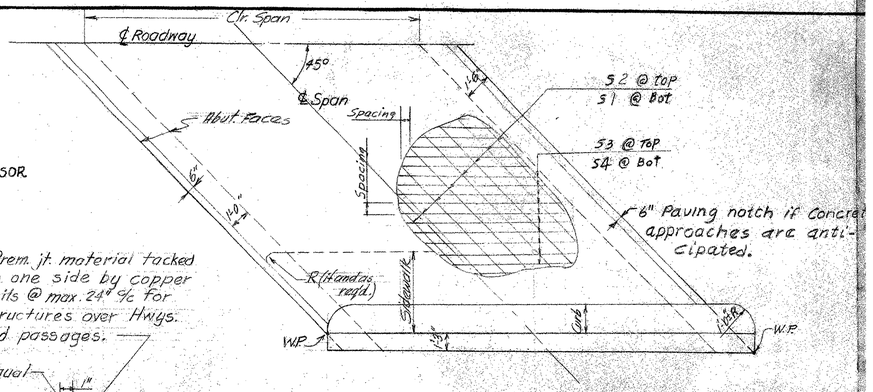
S-2702

MAR - 1 1984

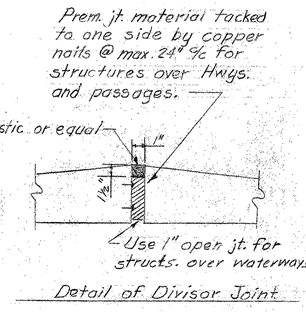
K. H. Jensen



TYPICAL CROSS SECTION



HALF PLAN



Detail of Divisor Joint

GENERAL NOTES

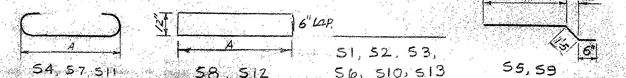
- All materials and workmanship shall be in accordance with P.D.H. Form 408.
- Design Specs.: Division I of 1957, Std. Specs. for Hwy. bridges of the A.A.S.H.O.
- Live Load: H20-S16-44, except roadway slab which is designed for a single Wheel load of 16000 lbs. for span length under 24'-0", and for two wheel loads of 16000 lbs. for span length 24'-0" and over.
- Dead Load: Includes 30 lbs/sq.ft for future wearing surface on the roadway slab.
- Steel Reinforcement Bars are designed for f_s = 18000 p.s.i and detailed as per A.C.I. Code. Bars to be lapped min. 30 dia except as noted.
- Class A Concrete shall be used in the roadway slab, curbs, divisors sidewalks, and parapets.
- Provide 1½" cover on reinforcement bars except as noted.
- For parapet railing and guard fence connections, see P.D.H. Standard Drawing S-1614B or S-3361
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. SD-13.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

Extend Bars S3 & S4 as reqd. if paving notch is omitted.

SLAB SECTION

Ch. Span	Width of slab	Slab thickness	Bars S1 Size of Bars	Bars S1 Spacing	Bars S1 No. of Bars	Bars S2 Size of Bars	Bars S2 Spacing	Bars S2 No. of Bars	Bars S3 Size of Bars	Bars S3 Spacing	Bars S3 No. of Bars	Bars S3 Length	Bars S4 (Bent) Size of Bars	Bars S4 (Bent) Spacing	Bars S4 (Bent) No. of Bars	Bars S4 (Bent) Length	Bars S4 (Bent) A	Quantities: Cubic Yards Class A Conc.	Quantities: Reinforcement Bars - Lbs.
12'	28'	11"	#5	17"	#4	17	#4	14"	25	14'-4	#8	7"	48	16'-6	14'-4			14.0	3110
	40'								35				68					20.0	4440
	68'								59				116					34.0	7550
	84'								73				144					42.0	9320
14'	28'	12"	#5	19"	#4	19	#4	12"	28	16'-4	#8	6"	56	18'-6	16'-4			17.1	3950
	40'								41				89					24.4	5640
	68'								69				136					41.5	9590
	84'								85				168					51.2	11840
16'	28'	13"	#6	21"	#4	21	#4	14"	25	18'-4	#9	7"	48	20'-10	18'-4			20.7	4590
	40'								35				69					29.6	6560
	68'								59				117					50.3	11150
	84'								73				145					62.2	13780
18'	28'	14"	#6	23"	#4	23	#4	16"	21	20'-4	#10	8"	42	23'-2	20'-4			24.6	5540
	40'								31				60					35.2	7920
	68'								52				102					59.8	13460
	84'								64				126					73.9	16630
20'	28'	14½"	#6	25"	#4	25	#4	19"	18	22'-4	#11	9½"	36	25'-6	22'-4			28.3	6240
	40'								26				51					40.4	8920
	68'								44				86					68.7	15160
	84'								54				107					84.8	18730
22'	28'	16"	#6	27"	#4	27	#4	18"	19	24'-4	#11	9"	38	27'-6	24'-4			33.6	7170
	40'								27				54					48.0	10240
	68'								46				91					81.6	17410
	84'								57				112					100.8	21500
24'	28'	17½"	#7	29"	#4	29	#4	16"	21	26'-4	#11	8"	42	29'-6	26'-4			40.0	7590
	40'								31				60					57.2	10840
	68'								52				102					97.2	18430
	84'								64				126					120.1	22760
26'	28'	18½"	#7	31"	#4	31	#4	14"	25	28'-4	#11	7"	48	31'-6	28'-4			45.4	9440
	40'								55				69					64.8	13480
	68'								59				117					110.2	22920
	84'								73				145					136.1	28310
28'	28'	19½"	#7	33"	#4	33	#4	15"	27	30'-4	#11	6½"	52	33'-6	30'-4			51.0	11840
	40'								38				74					72.8	16920
	68'								63				126					123.8	28760
	84'								78				155					152.9	35530

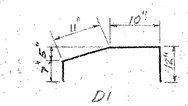
Equally spaced — Equally Spaced



SLAB SECTION - 32' ROADWAY

Ch. Span	Reinforce. No. of S3 Bars	No. of S4 Bars	Quantities: Cubic Yards Class A Conc.	Reinforcement Bars - Lbs.
12'	28	55	16.0	3450
14'	33	64	19.5	4400
16'	28	55	23.7	5120
18'	25	48	28.1	6190
20'	21	40	32.3	6830
22'	22	43	38.4	8240
24'	25	48	45.7	8600
26'	28	55	51.9	10670
28'	30	58	58.3	13140

Items not listed for 32'-Roadway slab section are Same as for 28'-40'-68'-84' Roadway slab section.



Designed: ELH, Checked: R.T.D

SIDEWALK SECTION

Ch. Span	Bars S5 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Bars S6 Size of Bars	No. of Bars	Length	Bars S7 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Bars S8 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Quantities: C.Y. Class A Concrete	Quantities: Reinf. Bars lbs./foot) *
12'	#4	12"	17	7'-9	5'-10	#4	15	15'-10	#8	7"	11	18'-0	15'-10	#4	12"	17	8'-8	3'-1	6.79	1110
14'	#4	12"	19	7'-9	5'-10	#4	15	17'-10	#8	6"	12	20'-0	17'-10	#4	12"	19	8'-10	3'-2	8.03	1310
16'	#4	12"	21	7'-9	5'-10	#4	15	19'-10	#9	7"	11	22'-4	19'-10	#4	12"	21	9'-0	3'-3	9.33	1550
18'	#4	12"	23	7'-9	5'-10	#4	15	21'-10	#10	8"	10	24'-8	21'-10	#4	12"	23	9'-2	3'-4	10.75	1870
20'	#4	12"	25	7'-9	5'-10	#4	15	23'-10	#11	9½"	8	27'-0	23'-10	#4	12"	25	9'-4	3'-5	11.95	2040
22'	#4	12"	27	7'-9	5'-10	#4	15	25'-10	#11	9"	9	29'-0	25'-10	#4	12"	27	9'-6	3'-6	13.72	2400
24'	#4	12"	29	7'-9	5'-10	#4	15	27'-10	#11	8"	10	31'-0	27'-10	#4	12"	29	9'-10	3'-8	15.62	2700
26'	#4	12"	31	7'-9	5'-10	#4	15	29'-10	#11	7"	11	33'-0	29'-10	#4	12"	31	10'-0	3'-9	17.32	3140
28'	#4	12"	33	7'-9	5'-10	#4	15	31'-10	#11	6½"	12	35'-0	31'-10	#4	12"	33	10'-2	3'-10	19.09	3620

SAFETY CURB SECTION

Ch. Span	Bars S9 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Bars S10 Size of Bars	No. of Bars	Length	Bars S11 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Bars S12 (Bent) Size of Bars	Spacing	No. of Bars	Length	A	Quantities: C.Y. Class A Concrete	Quantities: Reinf. Bars lbs. (tab)*
12'	#4	12"	17	4'-3	2'-4	#4	5	15'-10	#8	Equally Spaced	5	18'-0	15'-10	#4	12"	17	8'-0	2'-9	3.14	560
14'	#4	12"	19	4'-3	2'-9	#4	5	17'-10	#8		5	20'-0	17'-10	#4	12"	19	8'-2	2'-10	4.04	640
16'	#4	12"	21	4'-3	2'-4	#4	5	19'-10	#9		5	22'-4	19'-10	#4	12"	21	8'-4	2'-11	4.66	780
18'	#4	12"	23	4'-3	2'-4	#4	5	21'-10	#10		5	24'-8	21'-10	#4	12"	23	8'-6	3'-0	5.35	980
20'	#4	12"	25	4'-3	2'-4	#4	5	23'-10	#11		5	27'-0	23'-10	#4	12"	25	8'-8	3'-1	5.95	1230
22'	#4	12"	27	4'-3	2'-9	#4	5	25'-10	#11		5	29'-0	25'-10	#4	12"	27	8'-10	3'-2	6.76	1360
24'	#4	12"	29	4'-3	2'-4	#4	5	27'-10	#11		5	31'-0	27'-10	#4	12"	29	9'-2	3'-4	7.65	1480
26'	#4	12"	31	4'-3	2'-9	#4	5	29'-10	#11		5	33'-0	29'-10	#4	12"	31	9'-4	3'-5	8.45	1670
28'	#4	12"	33	4'-3	2'-4	#4	5	31'-10	#11		5	35'-0	31'-10	#4	12"	33	9'-6	3'-6	9.32	1800

½ of 4 FT. DIVISOR

Ch. Span	Reinforcement: Bars D1 (Bent) Size of Bars	Spacing	Length	No. of Bars	No. of Bars	#4 D2 Length	Quantities: Cubic Yards Class A Conc.	Reinforcement Bars - Lbs.
12'	#4	12"	3'-4	17	3	15'-10	0.51	67
14'	#4	12"	3'-4	19	3	17'-10	0.61	75
16'	#4	12"	3'-4	21	3	19'-10	0.71	83
18'	#4	12"	3'-4	23	3	21'-10	0.71	92
20'	#4	12"	3'-4	25	3	23'-10	0.81	100
22'	#4	12"	3'-4	27	3	25'-10	0.91	108
24'	#4	12"	3'-4	29	3	27'-10	0.91	117
26'	#4	12"	3'-4	31	3	29'-10	1.01	125
28'	#4	12"	3'-4	33	3	31'-10	1.01	133

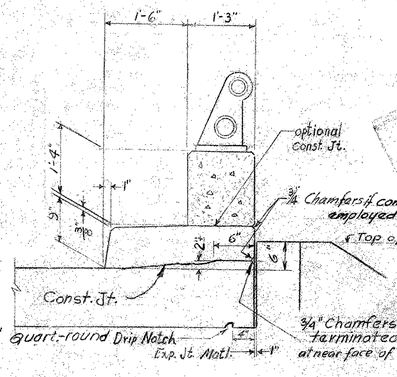
SAFETY CURB SECTION

Ch. Span	Bars S13 Size of Bars	Spacing	No. of Bars	Length
12'	#4	Equally Spaced	3	15'-10
14'	#4		3	17'-10
16'	#4		3	19'-10
18'	#4		3	21'-10
20'	#5		3	23'-10
22'	#5		3	25'-10
24'	#6		3	27'-10
26'	#7		3	29'-10
28'	#7		3	31'-10

* Includes portions of bars S1 and S2.

Approved: MAR - 1 1961

Bridge Engineer



SAFETY CURB DETAIL

Commonwealth of Pennsylvania

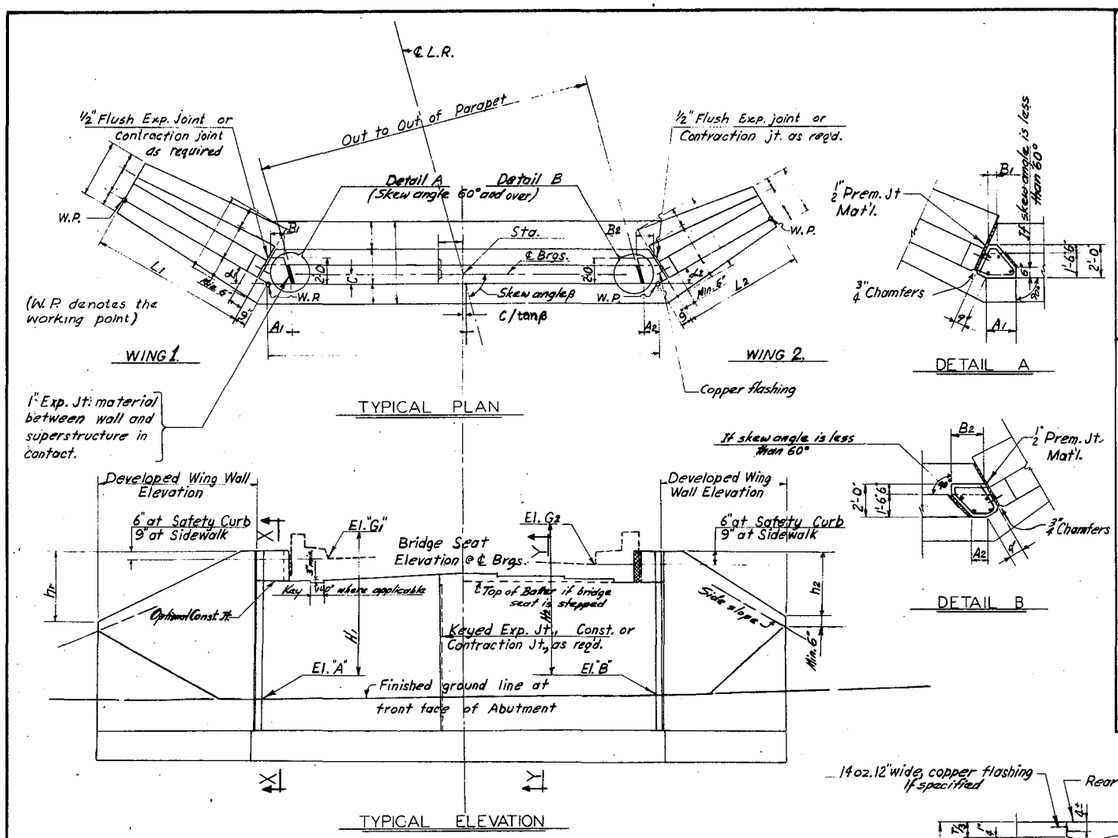
Department of Highways

BRIDGE UNIT

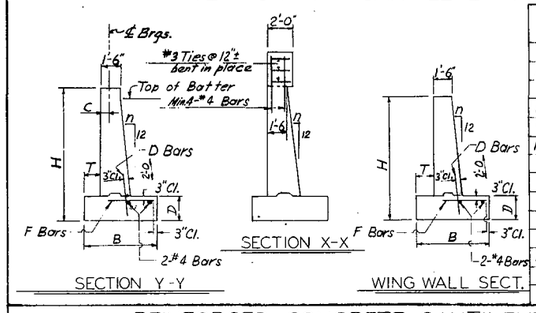
STANDARD BRIDGES

STANDARD REINFORCED CONCRETE SLAB BRIDGE SKEW 45°

S-2703



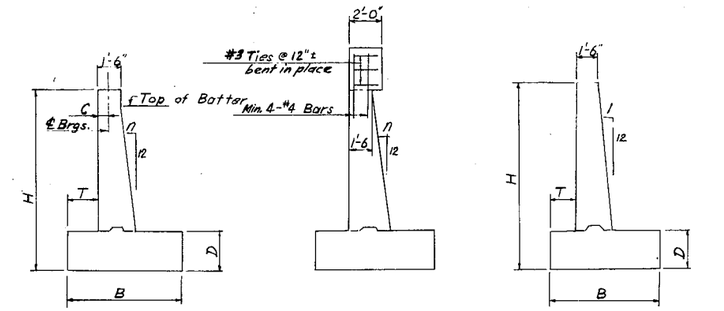
SEMI-GRAVITY CANTILEVER TYPE ABUTMENTS AND WING WALLS



H	T	n	D	B	D Bars Size	D Bars Spac.	D Bars Length	F Bars Size	F Bars Spac.	F Bars Length	Max. Design Foundation Pressure Tons/sq.ft.
ABUTMENTS											
6'-0	1'-0	0	2'-0	4'-0	#5	1'-0	3'-6"				1.80
7'-0	1'-0	0	2'-0	4'-6	#5	1'-0	3'-6				2.00
8'-0	1'-0	1	2'-0	5'-3	#5	1'-0	3'-6				2.15
9'-0	1'-0	1	2'-0	5'-9	#5	1'-0	3'-6	#5	1'-0	4'-6	2.30
10'-0	1'-0	1	2'-0	6'-3	#5	1'-0	3'-6	#5	1'-0	5'-0	2.45
WING WALLS											
6'-0	6"	0	2'-0	4'-0	#5	1'-0	3'-6"				.75
7'-0	9"	0	2'-0	4'-3	#5	1'-0	3'-6				.85
8'-0	1'-0	0	2'-0	4'-6	#5	1'-0	3'-6				.95
9'-0	1'-0	1	2'-0	5'-0	#5	1'-0	3'-6				1.05
10'-0	1'-0	1	2'-0	5'-6	#5	1'-0	3'-6				1.15
11'-0	1'-0	1	2'-0	6'-3	#5	1'-0	3'-6	#5	1'-0	4'-9	1.25
12'-0	1'-0	1	2'-0	6'-9	#5	1'-0	3'-6	#5	1'-0	5'-3	1.35

Based on 3'-0 superstructure & a total load of 2.50 Tons/ft.

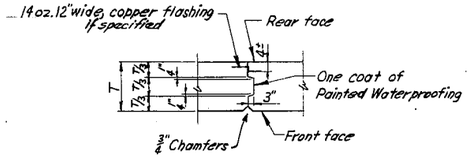
REINFORCED CONCRETE CANTILEVER TYPE ABUTMENTS AND WING WALLS



For dimensions, reinforcement, construction and expansion joints, see Std. Dwgs. S-2710 and S-2726.

Normal Roadway Fill Slope	Skew Angle β	WING 1. α_1	A_1	B_1	L_1	h_1	WING 2. α_2	A_2	B_2	L_2	h_2
1½:1	90°	30°	1'-0	$8\frac{1}{2}$"	1.10H₁-1.50	.63H₁-1.20	30°	1'-0	$8\frac{1}{2}$"	1.10H₂-1.50	.63H₂-1.20
	75°	30°	1'-6	$8\frac{5}{8}$"	1.24H₁-1.50	.59H₁-.90	30°	1'-0	1'-3"	1.02H₂-1.50	.66H₂-1.20
	60°	30°	2'-0	$6\frac{5}{8}$"	1.50H₁-1.50	.50H₁-.70	30°	1'-0	1'-$10\frac{3}{8}$"	H₂-1.50	.67H₂-1.20
	45°	$22\frac{1}{2}$°	2'-0	$5\frac{3}{4}$"	1.96H₁-1.50	.50H₁-.50	45°	1'-0	1'-$6\frac{1}{4}$"	.88H₂-1.50	.59H₂-1.20
	30°	15°	3'-0	$7\frac{3}{8}$"	2.90H₁-1.50	.50H₁-.30	60°	1'-0	1'-$7\frac{5}{8}$"	.80H₂-1.50	.54H₂-1.20
2:1	90°	30°	1'-0	$8\frac{1}{2}$"	1.46H₁-1.50	.63H₁-1.00	30°	1'-0	$8\frac{1}{2}$"	1.46H₂-1.50	.63H₂-1.00
	75°	30°	1'-6	$8\frac{5}{8}$"	1.66H₁-1.50	.59H₁-.70	30°	1'-0	1'-3"	1.36H₂-1.50	.66H₂-1.00
	60°	30°	2'-0	$6\frac{5}{8}$"	2.00H₁-1.50	.50H₁-.50	30°	1'-0	1'-$10\frac{3}{8}$"	1.33H₂-1.50	.67H₂-1.00
	45°	$22\frac{1}{2}$°	2'-0	$5\frac{3}{4}$"	2.61H₁-1.50	.50H₁-.40	45°	1'-0	1'-$6\frac{3}{4}$"	1.17H₂-1.50	.59H₂-1.00
	30°	15°	3'-0	$7\frac{1}{2}$"	3.86H₁-1.50	.50H₁-.30	60°	1'-0	1'-$7\frac{5}{8}$"	1.07H₂-1.50	.54H₂-1.00

Elevations "G1" and "G2" are at the intersection of the bearing ℄ and the gutter lines; for superstructures without defined bearing ℄ El. "G1", "G2" and bridge seat elevations shall be taken at the near face of abutments.
H_1 = El. "G1" − El. "A" H_2 = El. "G2" − El. "B"



CONTRACTION JOINT DETAIL

Flush contraction joint similar except omit key. Use contraction joints for semi-gravity cantilever type abutments and wing walls.

INSTRUCTIONS:

- Bridge seat may be sloped, stepped or keyed where applicable.
- Dimensions L_1, h_1, L_2 and h_2, are based on grades of less than 1% on the upper & lower roadways (or stream channel). Adjustments are to be made where either grade exceeds 1%.
- Reasonable modifications of details shown are permissible if condition warrants.

Approved: JUL - 5 1961
R. H. Jensen
Bridge Engineer

This Drawing supersedes Drawing S-2704 approved March 1, 1961. (GTV)

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD ABUTMENTS FOR CONCRETE BRIDGES

TYPICAL LAYOUT AND DETAILS

By: G.T.V.
Computed: K.R.P
Checked: K.L.F.

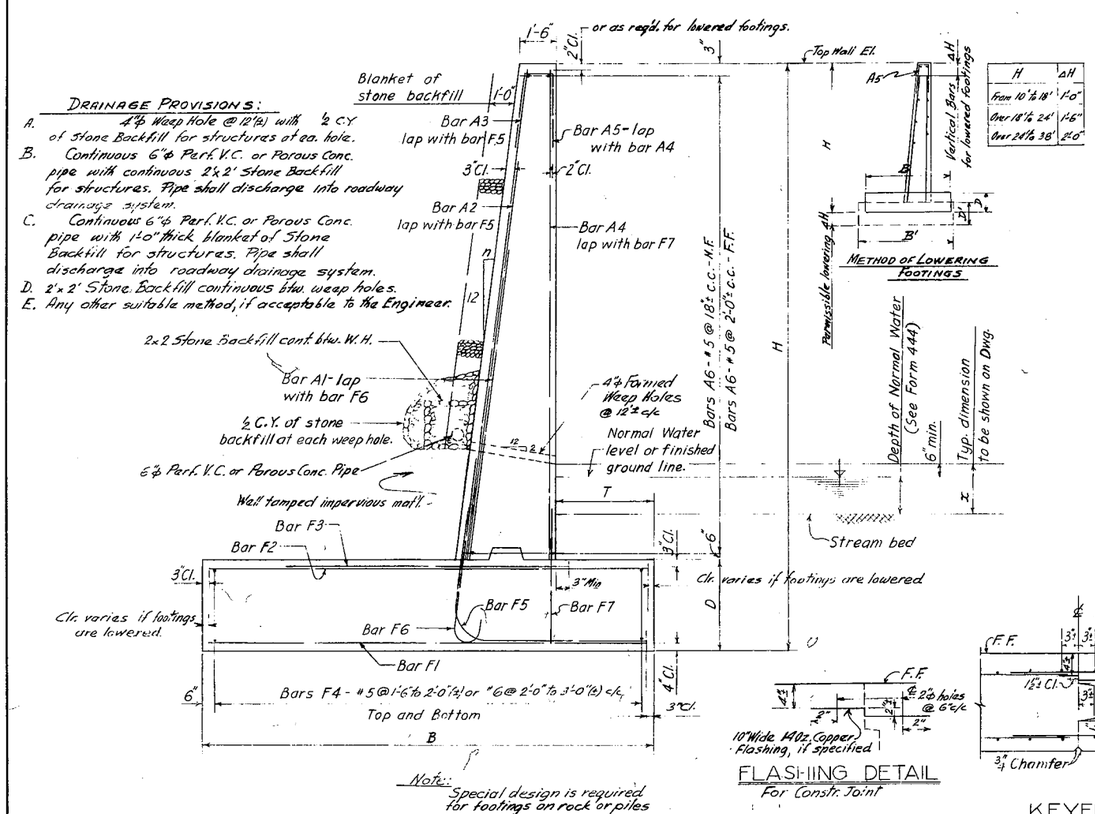
SHEET 1 OF 1

S-2704

H	m	B	T	D	Toe Pressure for Total Load Tons per Sq. Ft. — Superstructure Load Tons per Ft. 2	3	4	5	6	7	Bar F1 Size	Spac.	Length	Bar F2 Size	Spac.	Length	Bar F3 Size	Spac.	Length	Bar F4 Size	No.	Bar F5 (Bent) Size	Spac.	Length	A	B	C	D	Bar F6 (Bent) Spac.	Length	A	B	Bar A1 Size	Spac.	Length	Bar A2 Size	Spac.	Length	Bar A3 Size	Spac.	Length	Bar F7-#4 Spac.	Length	Bar AA-#4 Spac.	Length	Bar A5-#5 (Bent) Spac.	Length	Bar A6 Size	No.	Cl. B Conc. per lin. ft. of wall Cu. Yds.	Reinf. per lin. ft. of wall Lbs. (approx.)
10'	1	7'-0"	2'-0"	2'-0"	1.63	1.86	2.10	2.33	2.57	2.80	5	24"	6'-6"	5	24"	6'-6"				5	8	5	12"	7'-0"	2'-11"	10"	3'-3"	3"												4	12"	7'-10"	18"	2'-9"	18"	7'-10"	18"	7'-1"	5	11	1.06	49
12'	1	8'-3"	2'-3"	2'-0"	1.77	1.99	2.21	2.43	2.66	2.88	5	24"	7'-9"	6	18"	7'-9"				5	10	6	12"	7'-8"	3'-2"	10"	3'-8"	3'8"												5	12"	9'-10"	18"	2'-9"	18"	9'-10"	18"	7'-1"	5	13	1.32	68
14'	1	9'-6"	2'-6"	2'-0"	1.90	2.11	2.31	2.52	2.72	2.93	5	24"	9'-0"	6	12"	9'-0"				5	10	7	12"	10'-1"	5'-2"	10"	4'-1"	5'8"												5	12"	11'-10"	18"	2'-9"	18"	11'-10"	18"	7'-1"	5	15	1.59	89
16'	1	10'-9"	2'-9"	2'-3"	2.05	2.24	2.43	2.62	2.81	3.01	5	24"	10'-3"	7	12"	10'-3"				5	12	7	12"	9'-0"	3'-4"	1'-8"	4'-0"	3'3'8"	4	12"	5'-0"	4'-5"	7"	5	12"	5'-9"				5	12"	13'-7"	18"	3'-0"	18"	13'-7"	18"	7'-1"	5	17	1.95	112
18'	1	12'-0"	3'-3"	2'-6"	2.10	2.27	2.44	2.60	2.77	2.94	6	24"	11'-6"	5	12"	11'-6"	6	12"	7'-6"	5	12	7	12"	10'-5"	4'-2"	1'-8"	4'-7"	4'8"	4	12"	5'-10"	5'-2"	8"	6	12"	7'-6"	5	24"	10'-0"	5	24"	15'-4"	18"	3'-3"	18"	15'-4"	18"	7'-1"	5	19	2.34	132
20'	1	13'-3"	3'-9"	2'-9"	2.16	2.32	2.46	2.62	2.76	2.91	5	24"	12'-9"	5	12"	12'-9"	7	12"	8'-4"	5	14	8	12"	11'-5"	4'-5"	1'-8"	5'-4"	4'2"	4	12"	6'-3"	5'-5"	10"	7	12"	8'-6"	6	24"	11'-9"	5	24"	17'-1"	18"	3'-6"	18"	17'-1"	18"	7'-1"	5	21	2.77	166
22'	1	14'-6"	4'-0"	3'-0"	2.32	2.46	2.59	2.73	2.88	3.02	5	24"	14'-0"	6	12"	14'-0"	7	12"	8'-8"	5	16	8	12"	12'-7"	5'-2"	1'8"	5'-9"	5'8"	4	12"	7'-0"	6'-2"	10"	8	12"	10'-3"	6	24"	13'-6"	5	24"	18'-10"	18"	3'-9"	18"	18'-10"	18"	7'-1"	5	23	3.22	201
24'	1	16'-0"	4'-6"	3'-3"	2.35	2.47	2.60	2.73	2.86	2.99	5	24"	15'-6"	7	12"	15'-6"	7	12"	8'-7"	5	16	9	12"	12'-11"	4'-7"	2'-6"	5'-10"	4'5'8"	9	12"	7'-5"	6'-2"	1'-3"	9	12"	11'-0"	7	24"	15'-3"	5	24"	20'-7"	18"	4'-0"	16"	20'-7"	18"	7'-1"	5	25	3.74	248
26'	1	17'-6"	5'-0"	3'-6"	2.40	2.51	2.63	2.74	2.86	2.98	5	24"	17'-0"	7	12"	17'-0"	8	12"	8'-11"	5	18	10	12"	14'-6"	5'-7"	2'-6"	6'-5"	5'5'8"	9	12"	8'-5"	7'-2"	1'-3"	9	12"	11'-3"	8	24"	16'-0"	6	24"	22'-4"	18"	4'-3"	18"	22'-4"	18"	7'-1"	5	27	4.30	298
28'	1	19'-0"	5'-6"	3'-9"	2.45	2.55	2.66	2.76	2.87	2.98	5	24"	18'-6"	8	12"	18'-6"	8	12"	9'-9"	6	14	10	12"	15'-0"	5'-4"	2'-6"	7'-2"	5'3'8"	10	12"	8'-4"	6'-11"	1'-5"	10	12"	11'-6"	9	24"	17'-9"	6	24"	24'-1"	18"	4'-6"	18"	24'-1"	18"	7'-1"	5	29	4.89	351
30'	1	20'-6"	6'-0"	4'-0"	2.50	2.60	2.70	2.80	2.89	3.00	5	24"	20'-0"	8	12"	20'-0"	9	12"	10'-11"	6	16	11	12"	15'-8"	5'-4"	2'-6"	7'-10"	5'3'8"	11	12"	8'-6"	6'-11"	1'-7"	11	12"	12'-9"	10	24"	19'-6"	6	24"	25'-10"	18"	4'-9"	18"	25'-10"	18"	7'-1"	5	31	5.52	432
32'	1½	22'-0"	6'-6"	4'-3"	2.48	2.57	2.66	2.76	2.85	2.94	5	24"	21'-6"	7	12"	21'-6"	9	12"	12'-8"	6	16	11	12"	18'-2"	6'-3"	3'-4"	8'-7"	6'5'8"	10	12"	9'-10"	8'-5"	1'-5"	10	12"	13'-3"	10	24"	20'-6"	6	24"	27'-7"	18"	5'-0"	18"	27'-7"	18"	7'-1"	5	33	6.49	436
34'	1½	23'-6"	7'-3"	4'-6"	2.56	2.64	2.72	2.81	2.89	2.97	6	12"	23'-0"	9	12"	23'-0"	9	12"	11'-3"	6	18	11	12"	19'-5"	6'-6"	3'-4"	9'-7"	8'8"	11	12"	10'-3"	8'-8"	1'-7"	11	12"	15'-0"	10	24"	22'-3"	6	24"	29'-4"	18"	5'-3"	18"	29'-4"	18"	7'-1"	5	35	7.23	541
36'	1½	25'-0"	8'-0"	4'-9"	2.57	2.65	2.73	2.80	2.88	2.95	8	12"	24'-6"	8	12"	24'-6"	9	12"	12'-10"	6	18	11	12"	22'-0"	7'-5"	3'-5"	11'-2"	11'8"	10	12"	11'-1"	9'-8"	1'-5"	10	12"	15'-0"	10	24"	23'-3"	6	24"	31'-1"	18"	5'-6"	18"	31'-1"	18"	7'-1"	5	37	8.40	562
38'	1½	26'-3"	8'-6"	5'-0"	2.67	2.74	2.81	2.89	2.96	3.03	9	12"	25'-9"	9	12"	25'-9"	9	12"	12'-6"	6	20	11	12"	23'-0"	7'-8"	3'-5"	11'-11"	11'2"	11	12"	11'-6"	9'-11"	1'-7"	11	12"	16'-9"	10	24"	25'-0"	6	24"	32'-10"	18"	5'-9"	18"	32'-10"	18"	7'-1"	5	39	9.22	660

DRAINAGE PROVISIONS:

A. 4" ϕ Weep Hole @ 12'-0" c/c with ½ C.Y. of Stone Backfill for structures at ea. hole.
B. Continuous 6" ϕ Perf. V.C. or Porous Conc. pipe with continuous 2'x2' Stone Backfill for structures. Pipe shall discharge into roadway drainage system.
C. Continuous 6" ϕ Perf. V.C. or Porous Conc. pipe with 1'-0" thick blanket of Stone Backfill for structures. Pipe shall discharge into roadway drainage system.
D. 2'x2' Stone Backfill continuous btw. weep holes.
E. Any other suitable method, if acceptable to the Engineer.

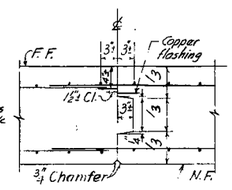


H	ΔH
From 10'-0" to 18'-0"	1'-0"
Over 18'-0" to 24'-0"	1'-6"
Over 24'-0" to 38'-0"	2'-0"

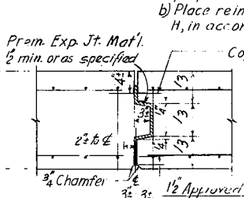
TYPICAL SECTION

Designed: R.T.D.
Checked: H.A.J.

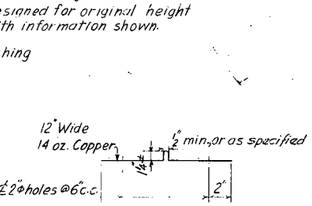
FLASHING DETAIL
For Constr. Joint



KEYED CONST. JT. DETAIL
(Copper flashing, if specified)



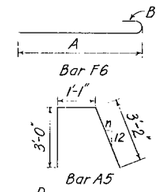
KEYED EXP. JT. DETAIL
Flush Exp. Jt. similar, omit Key only



FLASHING DETAIL
(For Exp. Jt.)

GENERAL NOTES

1. All materials and workmanship shall be in accordance with P.D.H. form 408/1960.
2. Design Specifications: Design Division of 1961-AASHO "Stand. Specifications for Highway Bridges."
3. Steel reinforcement bars designed for fs=18,000 p.s.i. and detailed as per A.C.I. code. Bars to be lapped 30 Dia.
4. Provide 2" cover on reinforcement bars except as noted.
5. Class B concrete shall be used.
6. The base of the footings may be ordered by the Engineer to be at any elevation or of any dimensions to provide a proper foundation.
7. Chamfer exposed concrete edges 1"x1" except as noted.
8. Two-coat painted waterproofing shall be applied to rear faces of walls if specified.
9. Provide Construction joints at 30' max.
10. Provide Expansion joints at 90' max.



General Information:

1. Coefficient of Friction between soil and base of footing = 0.45
2. Factor of safety against Sliding = 1.5 min.
3. Factor of safety against Overturning = 2.0 min.
4. Design is based on an average Surcharge of 6 ft. (4 ft. Superstructure and 2 ft. Live Load) above top of Wall and 35 lbs. per Cu. ft. equivalent fluid pressure.
5. Max. design foundation pressure shall be shown on the Dwg.
6. F.F. = For Face, N.F. = Near Face, E.F. = Each Face
7. Carry Keys of all Joints up to a line 1'-0" below top of wall. From that line flush jt. shall be extended to the top of wall.
8. Method of lowering Footings: a) Modify original dimensions B & D to B' & D' by proportioning to the total height of H+ΔH.
   b) Place reinf. bars, designed for original height H, in accordance with information shown.

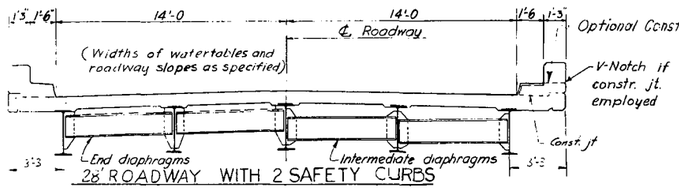
AUG - 2 1963
Approved: _____
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

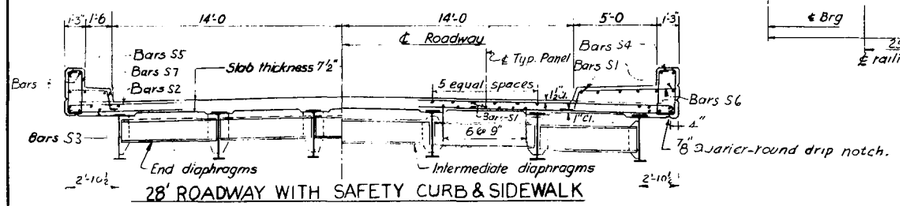
STANDARD
R.C. ABUTMENTS WITHOUT BACKWALL

SHEET 1 OF 1

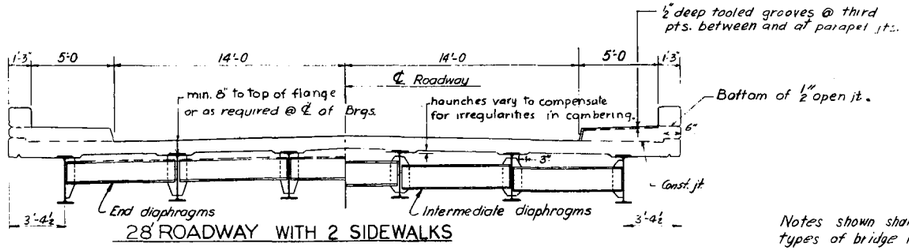
S-2710



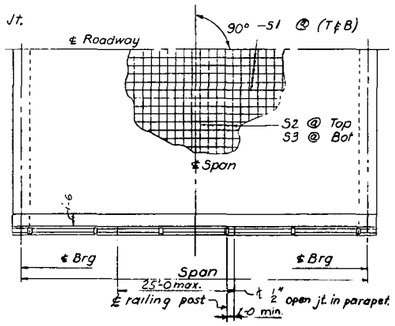
28' ROADWAY WITH 2 SAFETY CURBS

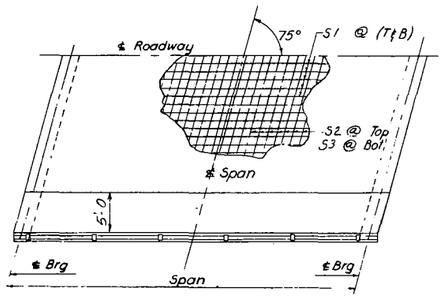


28' ROADWAY WITH SAFETY CURB & SIDEWALK

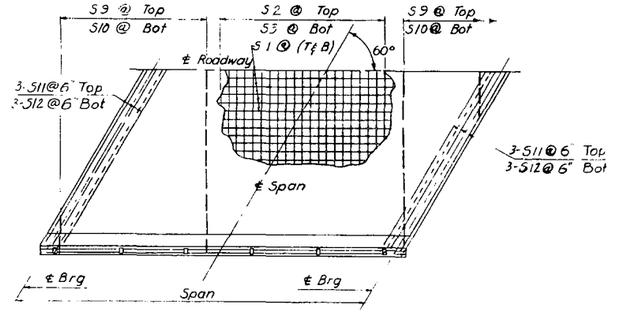


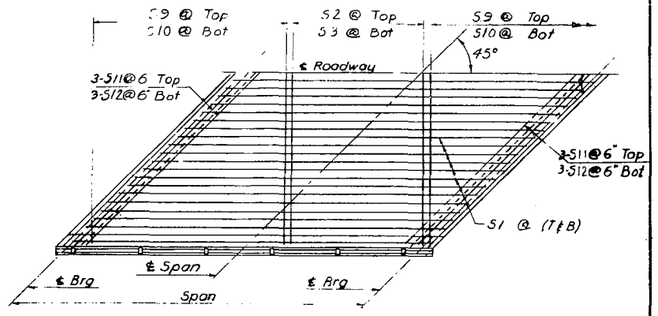
28' ROADWAY WITH 2 SIDEWALKS





PLAN LAYOUT





Vert. Curve					
D.L.	Struct. Steel				
	Concrete				
	Total				

4 equal Spaces = Span

Camber Diagram
(Ordinates to be computed)

Notes shown shall apply to all types of bridge roadways

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409.
- **Design Specs.:** Design Division of 1957 "Standard Specs. for Hwy Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs. wheel load and f_c=1,000 psi.
- Live Load: H20-S16-44.
- Dead load: Includes 30 lbs./sq. ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars designed for f_s=18,000 psi and detailed in accordance with A.C.I. code. Bars to be lapped min. 30 dia. except as noted.
- Provide 1½" cover on reinforcement bars except as noted.
- Concrete: Class A concrete.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

- Parapet railing and guard fence connections; P.D.H. Std. Dwg. S-1614-B or S-3361.
- Steel Brgs.: S-2721
- ℄ Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724

SKEW	BEAMS — BEAM SPACING \ SPAN	20'	25'	30'	35'	40'	45'	50'
90°	5 @ 6'-9"	21WF62	24WF76	27WF94	30WF116	33WF141	36WF150	36WF182
75°	〃	〃	〃	〃	〃	〃	〃	〃
60°	〃	〃	〃	〃	〃	〃	〃	〃
45°	〃	〃	〃	〃	〃	〃	〃	〃
90°	6 @ 6'-3"	21WF62	24WF76	27WF94	30WF108	33WF130	36WF150	36WF160
75°	〃	〃	〃	〃	〃	〃	〃	〃
60°	〃	〃	〃	〃	〃	〃	〃	〃
45°	〃	〃	〃	〃	〃	〃	〃	〃
90°	6 @ 6'-9"	21WF62	24WF76	27WF94	30WF116	33WF141	36WF150	36WF182
75°	〃	〃	〃	〃	〃	〃	〃	〃
60°	〃	〃	〃	〃	〃	〃	〃	〃
45°	〃	〃	〃	〃	〃	〃	〃	〃

— ROADWAY SLAB —

REINFORCEMENT																										CONCRETE
#4 S1		#5 S2		#5 S3		#5,S2+S9		#5 S3+S10		#4 S4		#4 S5		#4 S6		#4 S7		#4 S8		S1+S2+...+S13	#5 S11		#5 S12			CLASS A
No.	lbs/ft.	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	No.	lbs/ft.	lbs/ft. of Br.	No. × L	lbs	No. × L	lbs		C.Y./ft. of Br.
— 28' ROADWAY WITH TWO SAFETY CURBS —																										
65	43.42	5½"	79.2	5½"	76.7	—	—	—	—	—	—	12"	10.02	—	—	12"	5.22	4	2.67	217.23	—	—	—	—		1.08
〃	〃	〃	〃	〃	〃	—	—	—	—	—	—	〃	〃	—	—	〃	〃	〃	〃	〃	—	—	—	—		〃
〃	〃	—	—	—	—	5½"	79.2	5½"	76.7	—	—	〃	〃	—	—	〃	〃	〃	〃	〃	6×39'-2"	249	6×38'-6"	242		〃
〃	〃	—	—	—	—	〃	〃	〃	〃	—	—	〃	〃	—	—	〃	〃	〃	〃	〃	12×25'-6"	318	12×24'-5"	311		〃
— 28' ROADWAY WITH SAFETY CURB & SIDEWALK —																										
80	53.41	6"	79.75	6"	77.25	—	—	—	—	12"	5.46	12"	5.01	12"	4.98	12"	2.61	4	2.67	231.17	—	—	—	—		1.28
〃	〃	—	—	—	—	6"	79.75	6"	77.25	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	—	—	—	—		〃
〃	〃	—	—	—	—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	12×22'-9"	288	12×22'-2"	281		〃
〃	〃	—	—	—	—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	12×27'-5"	349	12×26'-10"	342		〃
— 28' ROADWAY WITH TWO SIDEWALKS —																										
83	55.04	5½"	95.5	5½"	93.0	—	—	—	—	12"	10.92	—	—	12"	9.96	—	—	4	2.67	267.19	—	—	—	—		1.47
〃	〃	〃	〃	〃	〃	—	—	—	—	〃	〃	—	—	〃	〃	—	—	〃	〃	〃	—	—	—	—		〃
〃	〃	—	—	—	—	5½"	95.5	5½"	93.0	〃	〃	—	—	〃	〃	—	—	〃	〃	〃	12×24'-9"	314	12×24'-2"	307		〃
〃	〃	—	—	—	—	〃	〃	〃	〃	〃	〃	—	—	〃	〃	—	—	〃	〃	〃	12×29'-10"	378	12×29'-3"	371		〃

S1, S3, S8, S10, S12

2'-6" S5
2'-10" S4
lap 6"

S2

S9, S11

Designed: E.L.H.
Checked: K.R.P.

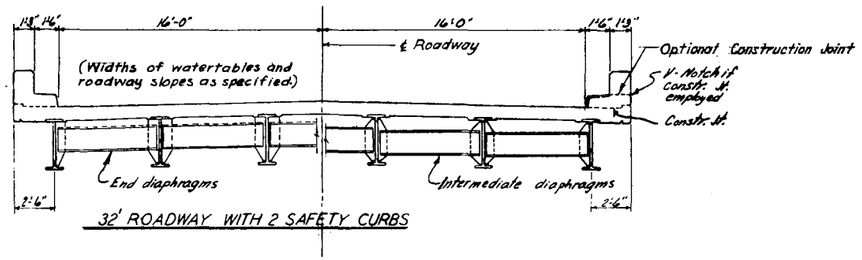
Approved: MAR - 1 1961
K. R. Peterson
Engineer of Bridges

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

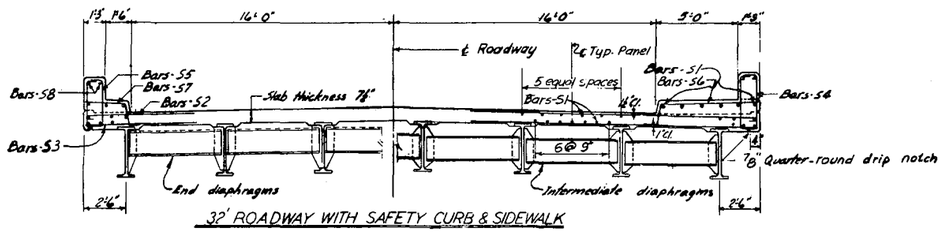
STANDARD BRIDGES

STANDARD I BEAM BRIDGE
28' ROADWAY

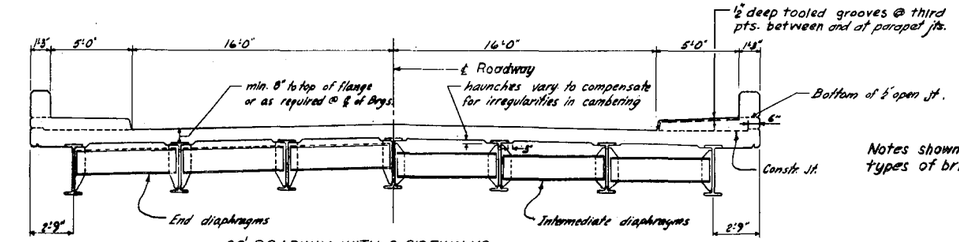
S-2711



32' ROADWAY WITH 2 SAFETY CURBS

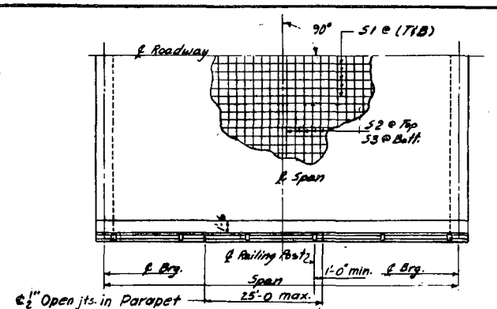


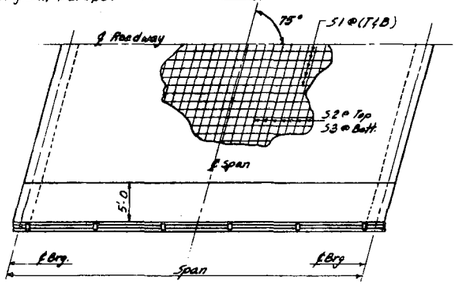
32' ROADWAY WITH SAFETY CURB & SIDEWALK

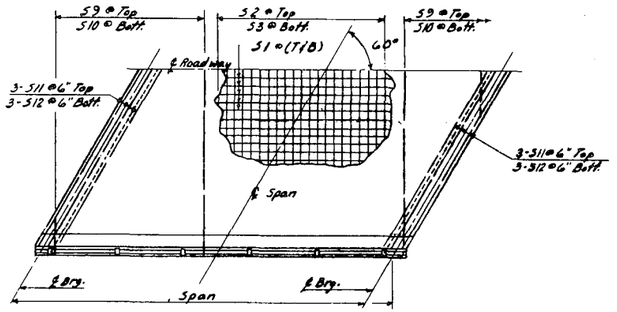


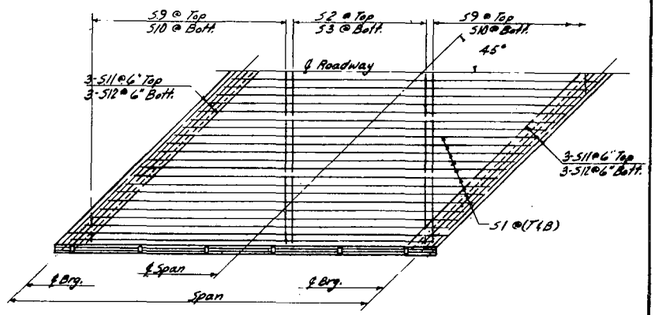
32' ROADWAY WITH 2 SIDEWALKS

Notes shown shall apply to all types of bridge roadways









PLAN LAYOUT

	Very. Curve
D.L.	Struct. Steel
	Concrete
	Total

A equal Spa. = Span

CAMBER DIAGRAM
(Ordinates to be computed)

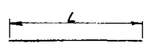
GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409.
- Design Specs: Design Division of 1957 "Standard Specs. for Highway Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs. wheel load and f_s=1,000 psi.
- Live Load: H20-S16-44
- Dead Load: Includes 30 lbs/sq.ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars designed for f_s=18,000 psi. and detailed in accordance with A.C.I. code. Bars to be lapped min. 30 dia. except as noted.
- Provide 1½" cover on reinforcement bars except as noted.
- Concrete: Class A concrete.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.

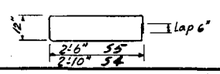
- Parapet railing & guard fence connections: P.D.H. Std. Dwg. S-1614B or S-3361
- Steel Brgs.: S-2721
- R. Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724

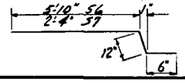
SKEW	SPAN / BEAM SPACING	BEAMS 20'	25'	30'	35'	40'	45'	50'	ROADWAY SLAB — REINFORCEMENT #4-S1 N°	Lbs/Ft.	#5-S2 Spa.	Lbs/Ft.	#5-S3 Spa.	Lbs/Ft.	#5-S2 + S9 Spa.	Lbs/Ft.	#5-S3 + S10 Spa.	Lbs/Ft.	#4-S4 Spa.	Lbs/Ft.	#4-S5 Spa.	Lbs/Ft.	#4-S6 Spa.	Lbs/Ft.	#4-S7 Spa.	Lbs/Ft.	#4-S8 N°	Lbs/Ft.	S1+S2+…+S8 Lbs/Ft. of Brg.	#5-S11 N° x L	Lbs.	#5-S12 N° x L	Lbs.	CONCRETE CLASS A C.Yd./Ft. of Brg.
32' ROADWAY WITH TWO SAFETY CURBS																																	
90°	6 @ 6'-6" c.c.	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	36 WF 150	36 WF 170	77	51.5	6"	80	6"	77.7	—	—	—	—	—	—	12"	10.02	—	—	12"	5.12	4	2.70	226.90	—	—	—	—	1.18
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	—	—	"	"	—	—	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	"	—	—	—	6"	80	6"	77.7	—	—	"	"	—	—	"	"	"	"	"	12x22'-10	286	12x22'-3	278	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	12x27'-9	347	12x27'-2	340	"
32' ROADWAY WITH SAFETY CURB & SIDEWALK																																	
90°	7 @ 6'-0" c.c.	21 WF 62	21 WF 73	24 WF 94	30 WF 108	30 WF 124	33 WF 141	36 WF 160	92	61.5	6"	90.5	6"	88.3	—	—	—	—	12"	5.46	12"	5.01	12"	4.90	12"	2.56	4	2.70	260.79	—	—	—	—	1.38
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	6"	90.5	6"	88.3	"	"	"	"	"	"	"	"	"	"	"	12x24'-11	312	12x24'-4	305	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12x30'-3	379	12x29'-8	371	"
32' ROADWAY WITH TWO SIDEWALKS																																	
90°	7 @ 6'-6" c.c.	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	36 WF 150	36 WF 170	95	63.5	6"	98.0	6"	95.5	—	—	—	—	12"	10.92	—	—	12"	9.80	—	—	4	2.70	280.28	—	—	—	—	1.58
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	—	—	"	"	—	—	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	6"	98.0	6"	95.5	"	"	—	—	"	"	—	—	"	"	"	12x26'-11	337	12x26'-4	330	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	—	—	"	"	—	—	"	"	"	12x32'-8	409	12x32'-1	402	"

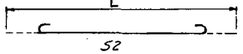
Designed: R.T.D.
Checked: K.L.F.



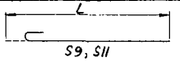
S1, S3, S8, S10, S12







S2



S9, S11

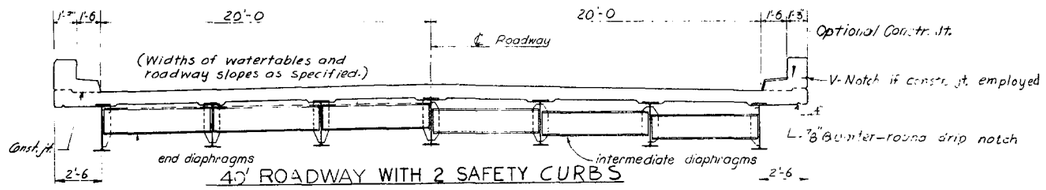
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

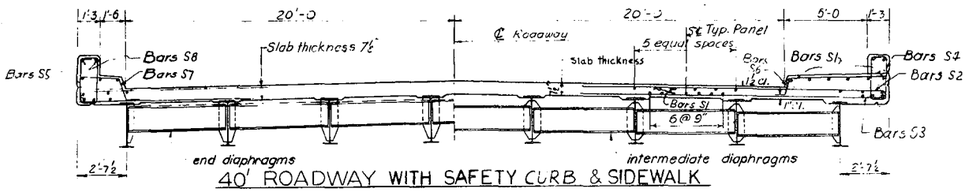
STANDARD I BEAM BRIDGE 32' ROADWAY

SHEET 1 OF 1

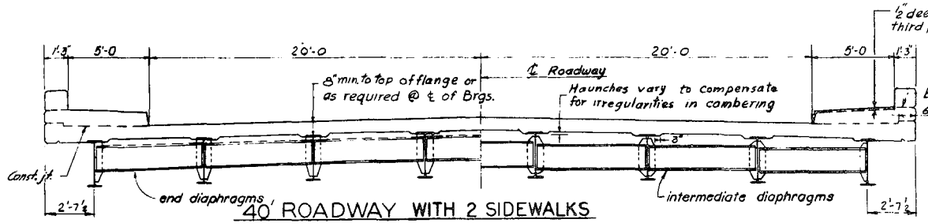
S-2712



40' ROADWAY WITH 2 SAFETY CURBS

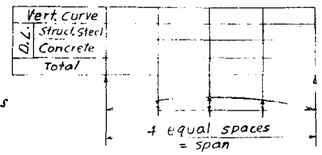


40' ROADWAY WITH SAFETY CURB & SIDEWALK

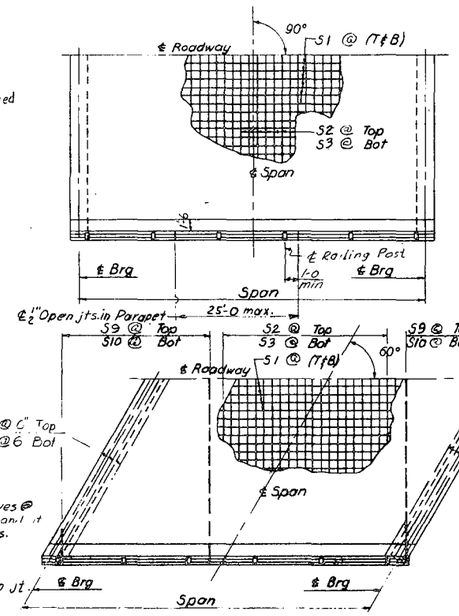


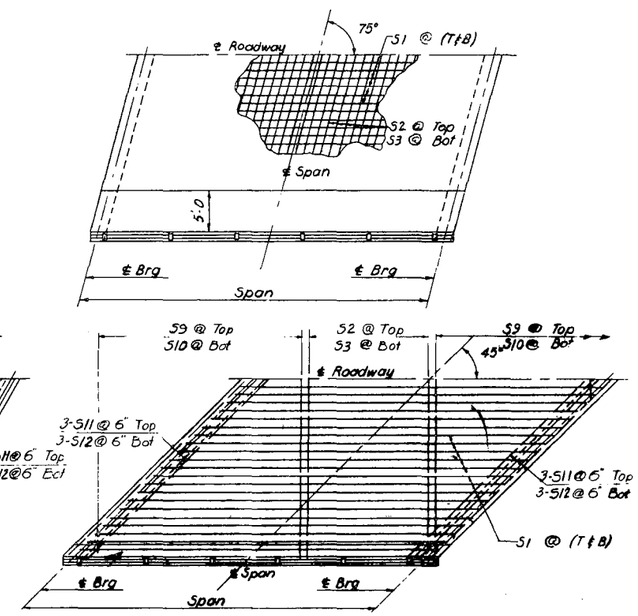
40' ROADWAY WITH 2 SIDEWALKS

Notes shown shall apply to all types of bridge roadways



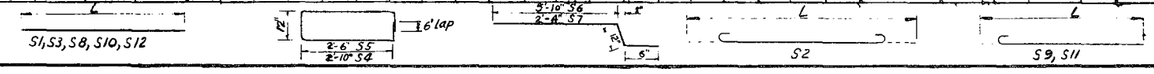
Camber Diagram
(Ordinates to be computed)





PLAN LAYOUT

SKEW	BEAMS — BEAM SPACING / SPAN	20'	25'	30'	35'	40'	45'	50'	ROADWAY SLAB — REINFORCEMENT #4 S1 No.	#4 S1 lbs/ft.	#5 S2 Spa.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5, S2+S9 Spa.	#5, S2+S9 lbs/ft.	#5, S3+S10 Spa.	#5, S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No.	#4 S8 lbs/ft.	S1+S2+···+S10 lbs/ft. of Br.	#5 S11 No. xL	#5 S11 lbs	#5 S12 No. xL	#5 S12 lbs.	CONCRETE CLASS A C.Y./ft. of Br.
40' ROADWAY WITH TWO SAFETY CURBS																																		
90°	7 @ 6'-9"	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	36 WF 150	36 WF 170	89	59.45	5½"	112	5½"	109	—	—	—	—	—	—	12"	10.02	—	—	12"	5.22	4	2.67	298.36	—	—	—	—	1.87
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	—	—	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	5½"	112	5½"	109	—	—	"	"	—	—	"	"	"	"	"	12 × 27'-8"	352	12 × 27'-1"	345	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	12 × 33'-6"	426	12 × 32'-11"	419	"
40' ROADWAY WITH SAFETY CURB & SIDEWALK																																		
90°	8 @ 6'-3"	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	33 WF 141	36 WF 160	104	69.47	6"	110	6"	107	—	—	—	—	12"	5.46	12"	5.01	12"	4.98	12"	2.61	4	2.67	307.20	—	—	—	—	1.56
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	6"	110	6"	107	"	"	"	"	"	"	"	"	"	"	"	12 × 29'-8"	378	12 × 29'-1"	371	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12 × 36'-0"	457	12 × 35'-5"	450	"
40' ROADWAY WITH TWO SIDEWALKS																																		
90°	8 @ 6'-9"	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	36 WF 150	36 WF 170	107	72.76	5½"	126.5	5½"	125.7	—	—	—	—	12"	10.92	—	—	12"	8.96	—	—	4	2.67	350.51	—	—	—	—	1.76
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	—	—	"	"	—	—	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	5½"	128.5	5½"	125.7	"	"	—	—	"	"	—	—	"	"	"	12 × 31'-6"	403	12 × 31'-1"	396	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	—	—	"	"	—	—	"	"	"	12 × 38'-5"	488	12 × 37'-10"	481	"



Designed: E.L.H.
Checked: R.T.D.

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409.
- Design Specs.: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs. wheel load and f_c = 1000 p.s.i.
- Live Load: H-20-S16-44
- Dead Load: Includes 30 lbs./sq. ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars designed for f_s = 18,000 p.s.i. and detailed in accordance with A.C.I. code. Bars to be lapped min. 30 dia. except as noted.
- Provide 1½" cover on reinforcement bars except as noted.
- Concrete: Class A concrete
- Exposed concrete edges shall be chamfered 1" × 1" except as noted.
- Parapet railing and guard fence Conn.: P.D.H. Std. Dwg. S-1614 B or S-3361.
- Steel Brgs.: S-2721
- R.Exp.Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724

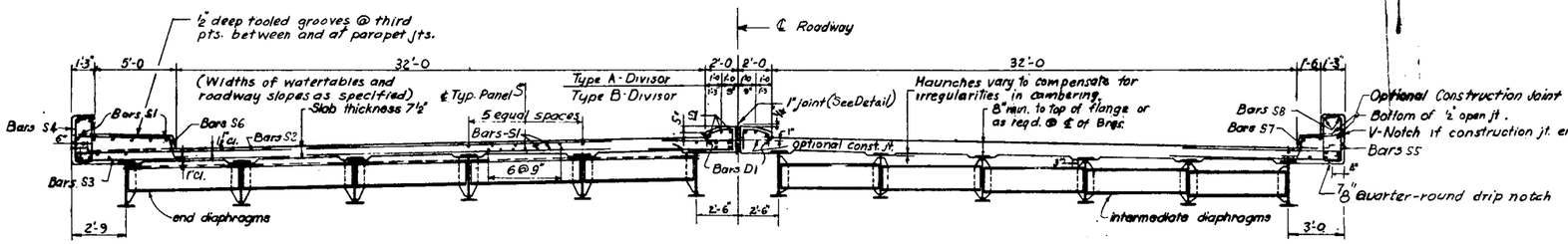
Approved: MAR - 1 1961
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

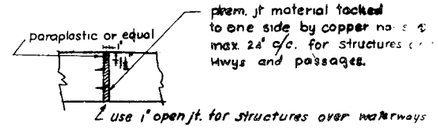
STANDARD I BEAM BRIDGE
40' ROADWAY

S-2713

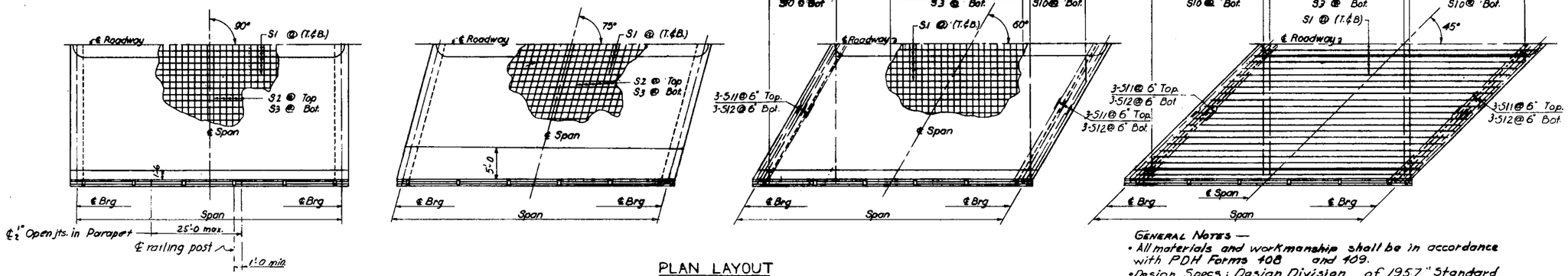


HALF ROADWAY WITH SIDEWALK

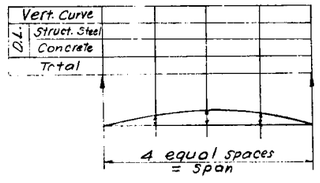
HALF ROADWAY WITH SAFETY CURB



Detail of Divisor jt.



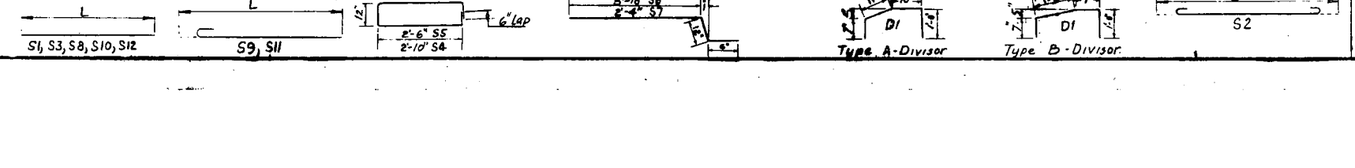
PLAN LAYOUT



Camber Diagram
(Ordinates to be computed)

Notes shown shall apply to all types of bridge roadways

SKEW	BEAMS — Beam Spacing / Span	20'	25'	30'	35'	40'	45'	50'	ROADWAY SLAB — REINFORCEMENT #4 S1 No.	#4 S1 lbs/ft.	#5 S2 Spa.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5 S2+S9 Spa.	#5 S2+S9 lbs/ft.	#5 S3+S10 Spa.	#5 S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No.	#4 S8 lbs/ft.	#4 D1 Spa.	#4 D1 lbs/ft.	S1+S2+···+S10+D1 lbs/ft. of Br.	#5 S11 No. x L	#5 S11 lbs	#5 S12 No. x L	#5 S12 lbs	CONCRETE CLASS A C.Y./ft. of Br.
HALF ROADWAY WITH SAFETY CURB																																				
90°	6 @ 6'-3"	21 WF 62	24 WF 76	27 WF 94	30 WF 108	33 WF 130	36 WF 150	36 WF 160	76	50.72	6"	79.86	6"	77.20	—	—	—	—	—	—	—	—	12"	5.01	—	—	12"	2.61	2	1.34	12"	2.23	219.26	—	—	—	—	1.05
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	—	—	—	—	"	"	—	—	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	6"	79.86	6"	77.30	—	—	"	"	—	—	"	"	—	—	"	"	"	"	"	"	12×23'-1"	293	12×21'-11"	278	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	—	—	"	"	"	"	"	"	12×27'-10"	354	12×26'-8"	340	"
HALF ROADWAY WITH SIDEWALK																																				
90°	6 @ 7'-0"	21 WF 62	24 WF 76	27 WF 94	30 WF 116	33 WF 130	36 WF 150	36 WF 182	79	52.77	5½"	95.5	5½"	92.5	—	—	—	—	12"	5.46	—	—	12"	4.98	—	—	2	1.34	12"	2.23	254.78	—	—	—	—	1.25
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	—	—	"	"	—	—	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	5½"	95.5	5½"	92.5	"	"	—	—	"	"	—	—	"	"	"	"	"	"	"	12×25'-1"	318	12×23'-11"	303	"
45°	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"	"	"	"	—	—	—	—	"	"	—	—	"	"	"	"	"	"	"	12×30'-5"	385	12×29'-1"	369	"



Designed: E.L.H.
Checked: K.R.P.

GENERAL NOTES —

- All materials and workmanship shall be in accordance with PDH Forms 408 and 409.
- Design Specs: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the AASHO except roadway slab which is designed for 16000 lbs. wheel load and f_c = 1000 psi
- Live Load: H 20-S16-44
- Dead Load: Includes 30 lbs./sq.ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars designed for f_s=18000 psi and detailed in accordance with ACI code. Bars to be lapped min. 30 dia. except as noted.
- Concrete: Class A concrete
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Parapet railing and guard fence connections: PDH Std. Dwg. S-1614 B or S-3361
- Provide 1½" cover on reinforcement bars except as noted.
- Steel Brgs.: S-2721
- ℄ Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. 50-13.

Commonwealth of Pennsylvania

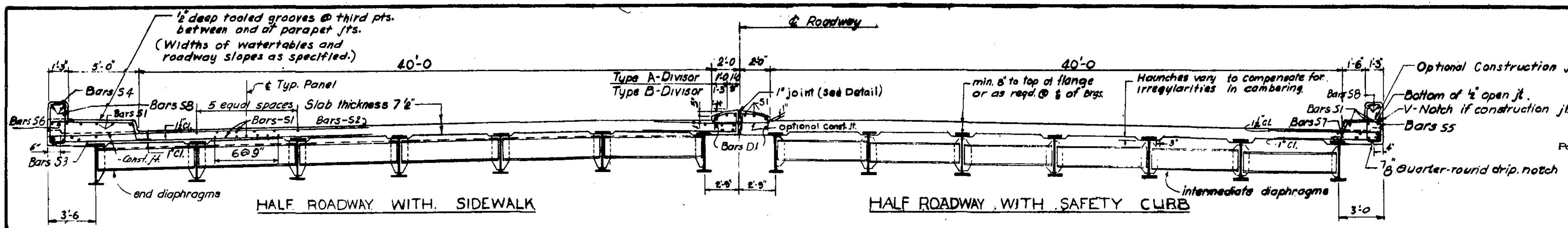
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

STANDARD I BEAM BRIDGE 68' ROADWAY

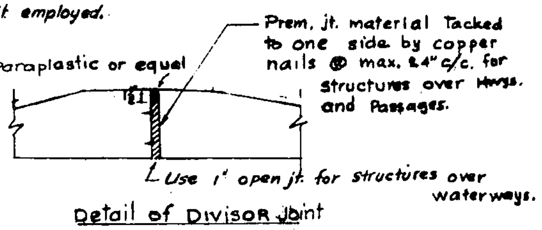
Approved MAR -1 1961
State Highway Engineer

S-2714

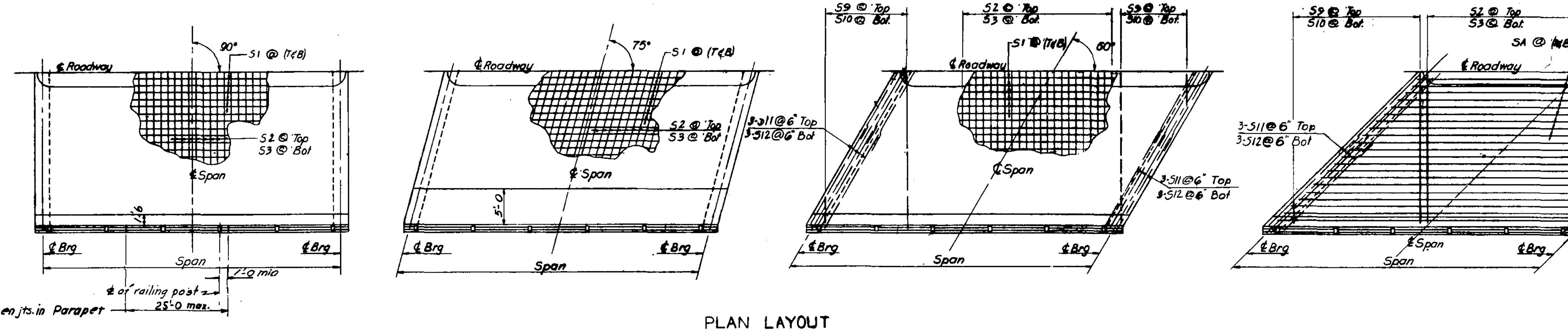


HALF ROADWAY WITH SIDEWALK

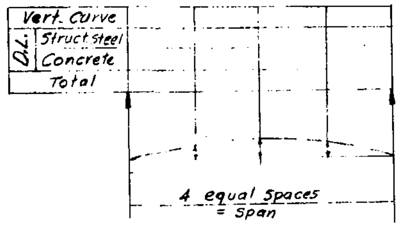
HALF ROADWAY WITH SAFETY CURB



Detail of Divisor Joint



PLAN LAYOUT



Camber Diagram
(Ordinates to be computed)

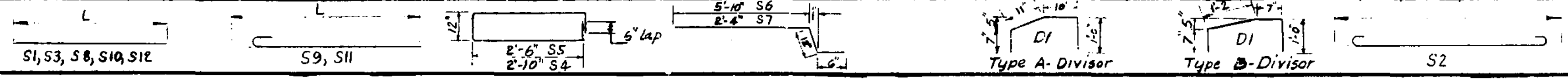
Notes shown shall apply to all types of bridge roadways

GENERAL NOTES

All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409.
Design Specs: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16000 lbs. wheel load and fc = 1000 p.s.i.
Live Load: H-20-S16-44
Dead Load: Includes 30 lbs./sq. ft. for future wearing surface on the roadway slab.
Steel Reinforcement Bars designed for fs = 18,000 p.s.i. and detailed in accordance with A.C.I. code. Bars to be lapped min. 30 dia. except as noted.
Provide 1½" cover on reinforcement bars except as noted.
Concrete: Class A Concrete
Exposed concrete edges shall be chamfered 1"×1" except as noted.

Parapet railing and guard fence Conn. : P.D.H. Std. Dwg. S-1614B or S-3361.
Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. SD-13
Steel Brgs.: S-2721
R. Exp. Dams & Jts.: S-2722
Bridge Drainage & Scuppers: S-2723
Diaphragms: S-2724

SKEW	BEAMS								ROADWAY SLAB																										
									REINFORCEMENT																									CONCRETE
	BEAM SPACING \ SPAN	20'	25'	30'	35'	40'	45'	50'	#4 S1		#5 S2		#5 S3		#5 S2+S9		#5 S3+S10		#4 S4		#4 S5		#4 S6		#4 S7		#4 S8		#4 D1		S1+S2+...+S10 +D1	#5 S11		#5 S12		CLASS A
									No.	lbs/ft	Spa	lbs/ft	Spa	lbs/ft	Spa	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	Spa.	lbs/ft	lbs/ft. of Br.	No. x L	lbs	No. x L	lbs.	C. Yd/ft. of Br.
HALF ROADWAY WITH SAFETY CURB																																			
90°	7 @ 6'-6"	21WF62	24WF76	27WF94	30WF108	33WF130	36WF150	36WF160	88	58.76	6"	101.3	6"	99.00	–	–	–	–	–	–	12"	5.01	–	–	12"	2.61	2	1.34	12"	2.23	270.27	–	–	–	–	1.24
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	–	–	–	–	–	–	"	"	–	–	"	"	"	"	"	"	"	–	–	–	–	"
60°	"	"	"	"	"	"	"	"	"	"	–	–	–	–	6"	101.3	6"	99.00	–	–	"	"	–	–	"	"	"	"	"	"	"	12×27'-10"	354	12×26'-8"	341	"
45°	"	"	"	"	"	"	"	"	"	"	–	–	–	–	"	"	"	"	–	–	"	"	–	–	"	"	"	"	"	"	"	12×33'-6"	426	12×32'-4"	412	"
HALF ROADWAY WITH SIDEWALK																																			
90°	7 @ 7'-0"	21WF62	24WF76	27WF94	30WF116	33WF130	36WF150	36WF182	91	60.79	5½"	119.3	5½"	117	–	–	–	–	12"	5.46	–	–	12"	4.98	–	–	2	1.34	12"	2.23	311.10	–	–	–	–	1.44
75°	"	"	"	"	"	"	"	"	"	"	"	"	"	"	–	–	–	–	"	"	–	–	"	"	–	–	"	"	"	"	"	–	–	–	–	"
60°	"	"	"	"	"	"	"	"	"	"	–	–	–	–	5½"	119.5	5½"	117	"	"	–	–	"	"	–	–	"	"	"	"	"	12×29'-10"	379	12×28'-8"	366	"
45°	"	"	"	"	"	"	"	"	"	"	–	–	–	–	"	"	"	"	"	"	–	–	"	"	–	–	"	"	"	"	"	12×36'-0"	458	12×34'-10"	442	"



Designed: E.L.H.
Checked: R.T.D.

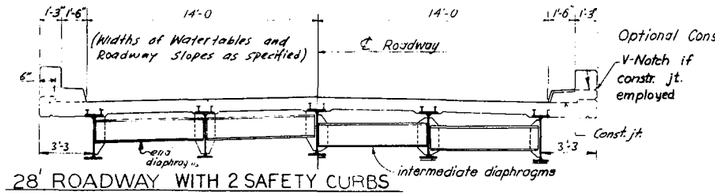
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

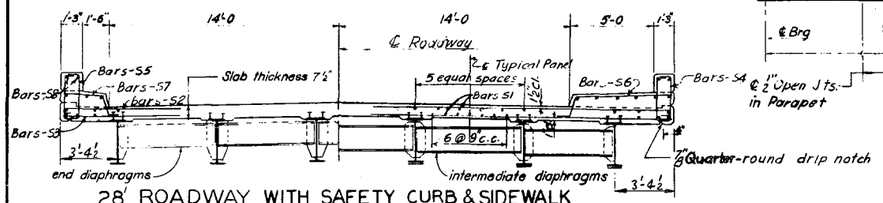
STANDARD I BEAM BRIDGE
84' ROADWAY

Approved MAR -1 1961

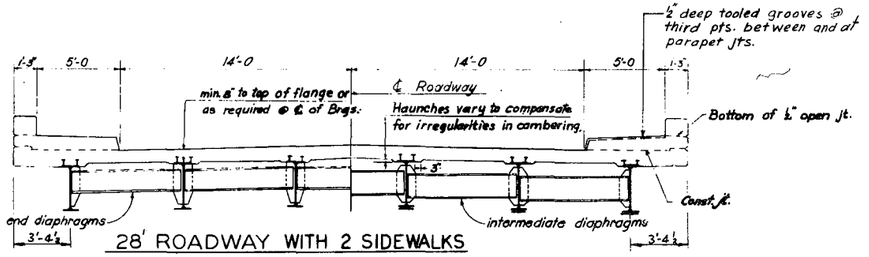
S-2715



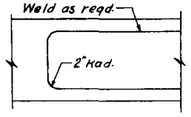
28' ROADWAY WITH 2 SAFETY CURBS



28' ROADWAY WITH SAFETY CURB & SIDEWALK

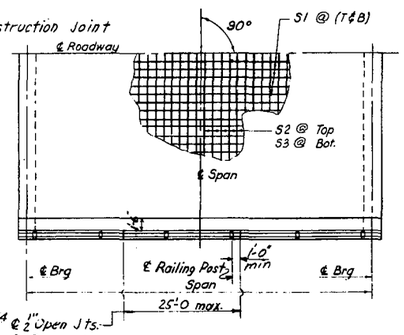


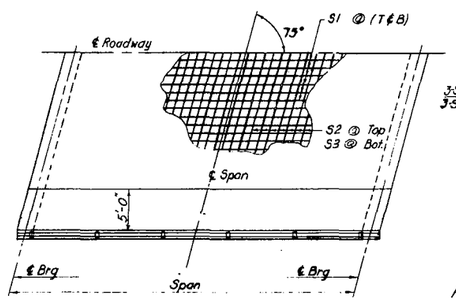
28' ROADWAY WITH 2 SIDEWALKS



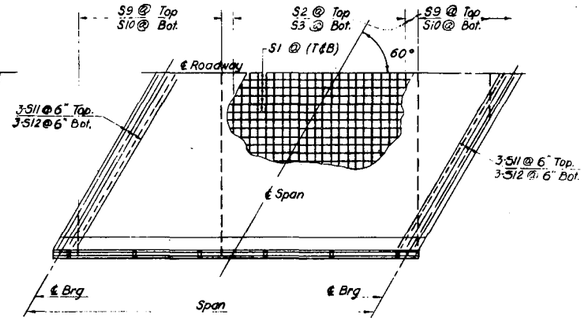
COVER ℝ. DETAIL

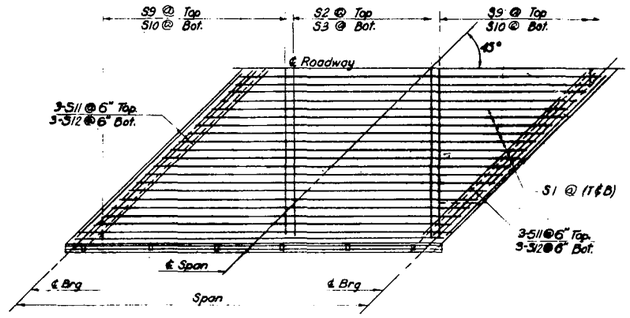
Notes shown shall apply to all types of bridge roadways





PLAN LAYOUT



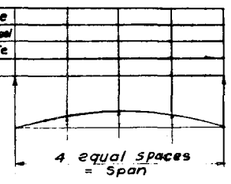


Note: Studs to be flux filled studs automatically end welded to beam with full penetration butt weld.

SPAN	SPACING OF SHEAR CONNECTORS	TYPE OF SHEAR CONN.
50-55-60	0" 8" 14" 8" 6"	4"L x 7.25 lb. 7" Long; 4-¾ dia or 3-¾ dia studs
65-70-75-80	8" 12" 18" 12" 8"	4"L x 7.25 lb. 9" Long; 5-¾ dia or 4-¾ dia studs

5 Equal spaces = Span.

Vert. curve					
D.L. Struct steel					
D.L. Concrete					
Total					



Camber Diagram
(Ordinates to be computed)

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 & 409 & 1956 Std. Specs. for Welded Hwy. Bridges of the A.W.S.
- Design Specs.: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs. wheel load and f'c=4,000 psi.
- Live Load: H20-S16-44.
- Dead Load: Includes 30 lbs./sq.ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars designed for fy=18,000 psi. and detailed in accordance with A.C.I. code. Bars to be lapped min. of 30 dia. except as noted.
- Provide 1½" cover on reinforcement bars except as noted.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Concrete: Class A concrete.
- Parapet railing and guard fence Conn.: P.D.H. Std. Dwgs. S-1614 B or S-3361.
- Steel Brgs.: S-2721
- ℄ Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724
- For Welds, the shielded metal arc may be used with electrodes conforming to A.S.T.M.-E6015 E6016, E6018 or E7016

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

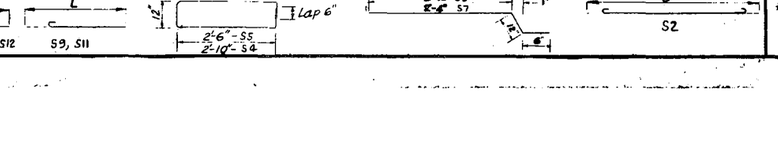
STANDARD COMPOSITE I BEAM BRIDGE 28' ROADWAY

S-2716

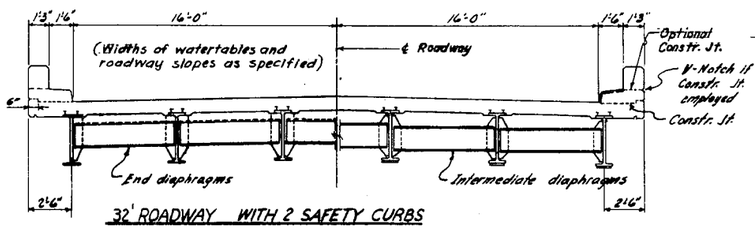
Approved: MAR - 1 1961
K H Jensen
Bridge Engineer

SKEW	BEAMS*							ROADWAY SLAB																								CONCRETE
	BEAM SPACING / SPAN	50'	55'	60'	65'	70'	75'	80'	REINFORCEMENT																							CLASS A
									#4 S1		#5 S2		#5 S3		#5 S2+S3		#5 S3+S10		#4 S4		#4 S5		#4 S6		#4 S7		#4 S8		S1+S2+---+S10	#5 S11		#5 S12		
									No.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	Spa.	lbs/ft.	No.	lbs/ft.	lbs/ft of Br.	No. x L.	lbs	No. x L.	lbs	C.Y./ft. of Br.
——— 28' ROADWAY WITH TWO SAFETY CURBS ———																																
90°	5@6'-9"	30 WF 124	30 WF 116	30 WF 108	30 WF 99	30 WF 90	30 WF 90	30 WF 90	65	42.42	5½"	73.2	5½"	76.7	—	—	—	—	—	—	12"	10.02	—	—	12"	5.22	4	2.67	217.23	—	—	—	—	1.08
75°	"	Cover ℝ. 9"x½"x37'-0	Cover ℝ. 9"x⅝"x37'-0	Cover ℝ. 9"x¾"x37'-0	Cover ℝ. 9"x⅞"x37'-0	Cover ℝ. 9"x1"x37'-0	Cover ℝ. 9"x1"x37'-0	Cover ℝ. 9"x1"x37'-0	"	"	"	"	"	"	—	—	—	—	—	—	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	33 WF 130	33 WF 130	33 WF 130	33 WF 130	33 WF 130	33 WF 130	33 WF 130	"	"	—	—	—	—	5½"	79.2	5½"	76.7	—	—	"	"	—	—	"	"	"	"	"	"	6x33'-2"	249	6x38'	342	"
45°	"	Cover ℝ. 10"x⅝"x40'-0	Cover ℝ. 10"x¾"x40'-0	Cover ℝ. 10"x⅞"x40'-0	Cover ℝ. 10"x1"x40'-0	Cover ℝ. 10"x1"x40'-0	Cover ℝ. 10"x1"x40'-0	Cover ℝ. 10"x1"x40'-0	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	"	12x25'	318	12x24'-5"	311	"
——— 28' ROADWAY WITH SAFETY CURB & SIDEWALK ———																																
90°	6@6'-3"	30 WF 116	30 WF 116	30 WF 116	30 WF 108	30 WF 99	30 WF 90	30 WF 90	80	53.44	6"	79.35	6"	77.25	—	—	—	—	—	—	12"	5.46	12"	5.01	12"	4.98	12"	2.61	4	2.67	231.17	—	—	—	—	1.28
75°	"	Cover ℝ. 9"x⅝"x37'-0	Cover ℝ. 9"x¾"x37'-0	Cover ℝ. 9"x⅞"x37'-0	Cover ℝ. 9"x1"x37'-0	Cover ℝ. 10"x½"x41'-0	Cover ℝ. 10"x½"x41'-0	Cover ℝ. 10"x½"x41'-0	"	"	"	"	"	"	—	—	—	—	—	—	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	33 WF 130	33 WF 130	33 WF 130	33 WF 141	36 WF 150	36 WF 150	36 WF 150	"	"	—	—	—	—	6"	79.78	6"	77.25	"	"	"	"	"	"	"	"	"	"	"	"	12x22'-5"	288	12x22'-2"	281	"
45°	"	Cover ℝ. 9"x⅝"x38'-0	Cover ℝ. 9"x¾"x38'-0	Cover ℝ. 9"x⅞"x38'-0	Cover ℝ. 9"x1"x38'-0	Cover ℝ. 10"x¾"x41'-0	Cover ℝ. 10"x¾"x41'-0	Cover ℝ. 10"x¾"x41'-0	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	"	12x27'-5"	349	12x24'-11"	342	"
——— 28' ROADWAY WITH TWO SIDEWALKS ———																																
90°	6@6'-9"	30 WF 124	30 WF 116	30 WF 108	30 WF 99	30 WF 90	30 WF 90	30 WF 90	83	55.04	5½"	95.5	5½"	93.0	—	—	—	—	—	—	12"	10.92	—	—	12"	9.96	—	—	4	2.67	267.09	—	—	—	—	1.47
75°	"	Cover ℝ. 9"x⅝"x37'-0	Cover ℝ. 9"x¾"x37'-0	Cover ℝ. 9"x⅞"x37'-0	Cover ℝ. 9"x1"x37'-0	Cover ℝ. 10"x½"x41'-0	Cover ℝ. 10"x½"x41'-0	Cover ℝ. 10"x½"x41'-0	"	"	"	"	"	"	—	—	—	—	—	—	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	33 WF 130	33 WF 130	33 WF 130	33 WF 141	36 WF 150	36 WF 150	36 WF 150	"	"	—	—	—	—	6"	95.5	6"	93.0	"	"	"	"	"	"	"	"	"	"	"	"	12x24'-5"	314	12x24'-2"	307	"
45°	"	Cover ℝ. 9"x⅝"x38'-0	Cover ℝ. 9"x¾"x38'-0	Cover ℝ. 9"x⅞"x38'-0	Cover ℝ. 9"x1"x38'-0	Cover ℝ. 10"x¾"x41'-0	Cover ℝ. 10"x¾"x41'-0	Cover ℝ. 10"x¾"x41'-0	"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	"	12x29'-10"	378	12x29'-5"	371	"

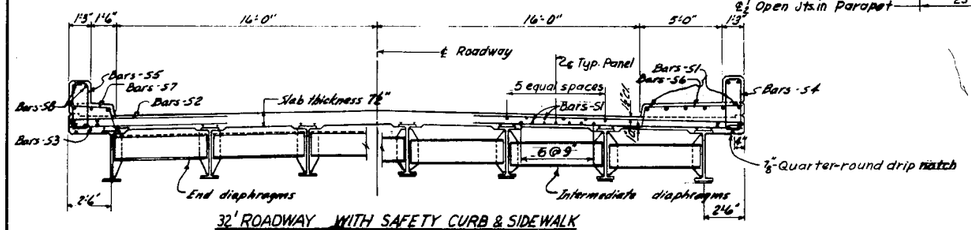
* Cover plates over ¾" thick shall be of ASTM A373 Steel.



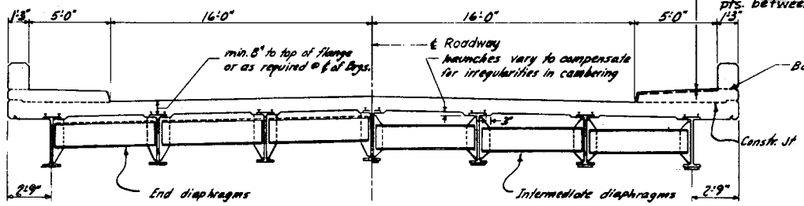
Designed: R.T.O.
Checked: K.R.P.



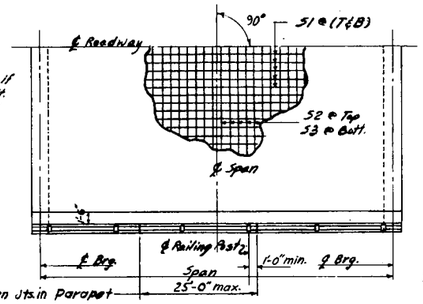
32' ROADWAY WITH 2 SAFETY CURBS

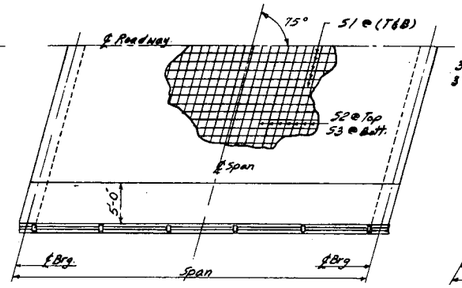


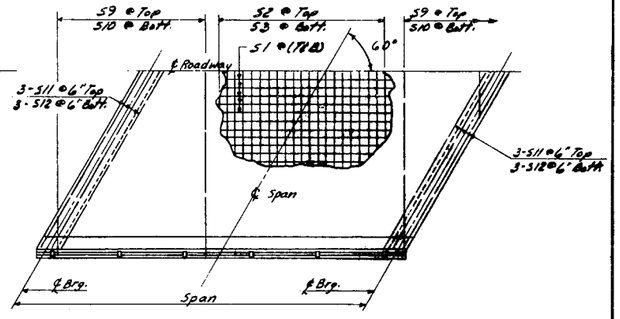
32' ROADWAY WITH SAFETY CURB & SIDEWALK



32' ROADWAY WITH 2 SIDEWALKS







PLAN LAYOUT

SPAN	SPACING OF SHEAR CONNECTORS	TYPE OF SHEAR CONN.
60'-65'-70'	6" 8" 18" 8" 6"	4"∪ 7.25 lb. 7" Long; 4-¾"ϕ or 3-⅞"ϕ studs
75'-80'	8" 12" 18" 12" 8"	4"∪ 7.25 lb. 9" Long; 5-¾"ϕ or 4-⅞"ϕ studs

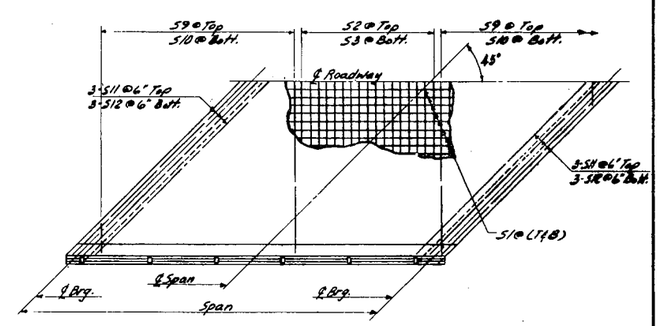
8 Equal spaces = Span

Note: Studs to be flux filled studs automatically end welded to beam with full penetration butt weld.

	Vert. Curve				
D.L.	Struct. Steel				
	Concrete				
	Total				

4 equal Spa. = Span

CAMBER DIAGRAM
(Ordinates to be computed)



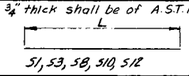
GENERAL NOTES

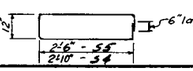
- All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409 and 1956 Std. Specs. for Welded Hwy. Bridges of the A.W.S.
- Design Specs: Design Division of 1957 "Standard Specs. for Highway Bridges of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs wheel load and f'_c = 1000 psi.
- Live Load: H20-S16-44
- Dead Load: Includes 30 lbs/sq. ft. for future wearing surface on the roadway slab.
- Steel Reinforcement bars designed for f_s = 18,000 psi and detailed in accordance with A.C.I. code. Bars to be lapped min. 30 dia. except as noted.
- Provide 1½ cover on reinforcement bars except as noted.
- Concrete: Class A concrete.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Parapet railing and guard fence conn.: P.D.H. Std. Dwg. S-1618 or S-3361
- Steel Brgs.: S-2721
- R. Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724
- For welds, the shielded metal arc may be used with electrodes, conforming to A.S.T.M. E-6015, E-6016, E-6018, or E-7016.

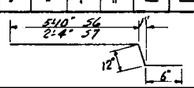
Notes shown shall apply to all types of bridge roadways

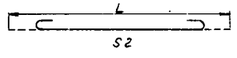
SKEW	SPAN / BEAM SPACING	BEAMS* 50'	55'	60'	65'	70'	75'	80'	ROADWAY SLAB — REINFORCEMENT: #4-S1 N°	#4-S1 lbs/ft	#5-S2 Spa.	#5-S2 lbs/ft	#5-S3 Spa.	#5-S3 lbs/ft	#5-S2+S9 Spa.	#5-S2+S9 lbs/ft	#5-S3+S10 Spa.	#5-S3+S10 lbs/ft	#4-S4 Spa.	#4-S4 lbs/ft	#4-S5 Spa.	#4-S5 lbs/ft	#4-S6 Spa.	#4-S6 lbs/ft	#4-S7 Spa.	#4-S7 lbs/ft	#4-S8 N°	#4-S8 lbs/ft	S1+S2,...,+S10 lbs/ft of Br.	#5-S11 N° x L	#5-S11 lbs.	#5-S12 N° x L	#5-S12 lbs.	CONCRETE CLASS A C.Yd./Ft of Br.
32' ROADWAY WITH TWO SAFETY CURBS																																		
90°	6 @ 6'-6"	30WF116	33WF130	33WF141	36WF150	36WF170	36WF194	36WF230	77	51.5	6"	80	6"	77.7	—	—	—	—	—	—	12"	10.02	—	—	12	5.12	4	2.70	227.04	—	—	—	—	1.18
75°	"	Cover ℙ 8½x1"	Cover ℙ 9½x1"	Cover ℙ 9½x1"	Cover ℙ 9½x1"	Cover ℙ 10½x1"	Cover ℙ 10½x1"	Cover ℙ 15½x1"	"	"	"	"	"	"	—	—	—	—	—	—	"	"	—	—	"	"	"	"	"	—	—	—	—	"
60°	"	37'-0"	37'-0"	37'-0"	37'-0"	37'-0"	37'-0"	37'-0"	"	"	"	"	"	"	6"	80	6"	77.7	—	—	"	"	—	—	"	"	"	"	"	12x22'-10"	286	12x22'-3"	278	"
45°	"								"	"	—	—	—	—	"	"	"	"	"	"	"	"	—	—	"	"	"	"	"	12x27'-9"	347	12x27'-2"	340	"
32' ROADWAY WITH SAFETY CURB & SIDEWALK																																		
90°	7 @ 6'-0"	30WF108	33WF130	33WF130	33WF130	36WF160	36WF182	36WF230	92	61.5	6"	90.50	6"	88.30	—	—	—	—	—	—	12"	5.46	12"	5.01	12"	4.90	12"	2.56	4	2.70	260.93	—	—	—	—	1.38
75°	"	Cover ℙ 8½x1"	Cover ℙ 8½x1"	Cover ℙ 8½x1"	Cover ℙ 10x1"	Cover ℙ 10½x1"	Cover ℙ 10½x1"	Cover ℙ 15½x1"	"	"	"	"	"	"	—	—	—	—	—	—	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	"	"	"	"	"	"	6"	90.50	6"	88.30	"	"	"	"	"	"	"	"	"	"	"	12x24'-11"	312	12x24'-4"	305	"
45°	"								"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12x30'-3"	379	12x29'-8"	371	"
32' ROADWAY WITH TWO SIDEWALKS																																		
90°	7 @ 6'-6"	30WF116	33WF130	33WF141	36WF150	36WF170	36WF194	36WF230	95	63.5	6"	98.00	6"	95.50	—	—	—	—	—	—	12"	10.92	—	—	12"	9.80	—	—	4	2.70	280.42	—	—	—	—	1.58
75°	"	Cover ℙ 8½x1"	Cover ℙ 9½x1"	Cover ℙ 9½x1"	Cover ℙ 9½x1"	Cover ℙ 10½x1"	Cover ℙ 10½x1"	Cover ℙ 15½x1"	"	"	"	"	"	"	—	—	—	—	—	—	"	"	—	—	"	"	—	—	"	—	—	—	—	"
60°	"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	43'-0"	"	"	"	"	"	"	6"	98.00	6"	95.50	"	"	—	—	"	"	"	"	—	—	"	12x26'-11"	337	12x26'-4"	330	"
45°	"								"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	"	—	—	"	12x32'-8"	409	12x32'-1"	402	"

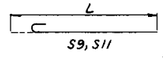
* Cover plates over ¾" thick shall be of A.S.T.M. A373 steel.

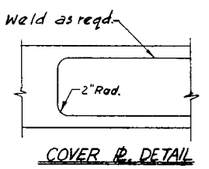












COVER ℙ DETAIL

Designed: R.T.D.
Checked: K.L.F.

Approved: MAR - 1 1961
Bridge Engineer

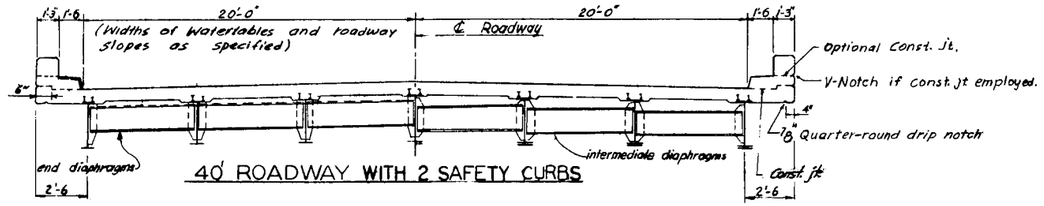
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

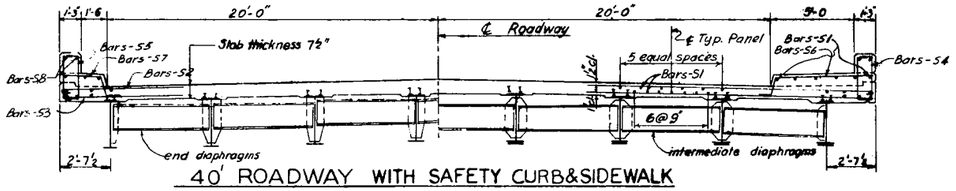
STANDARD COMPOSITE I BEAM BRIDGE 32' ROADWAY

S-2717

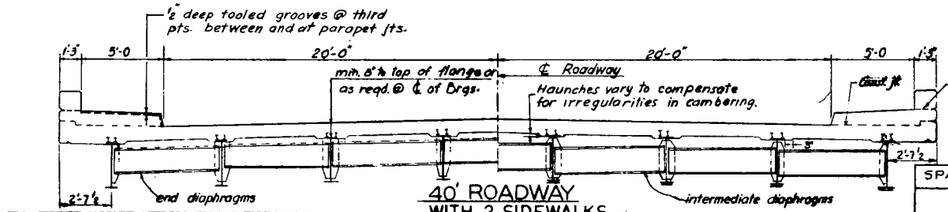
SHEET 1 OF 1



40' ROADWAY WITH 2 SAFETY CURBS



40' ROADWAY WITH SAFETY CURB&SIDEWALK



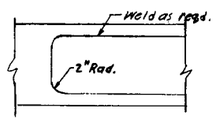
40' ROADWAY WITH 2 SIDEWALKS

Vert. Curve	
D.L.	Struct. steel
	Concrete
	Total

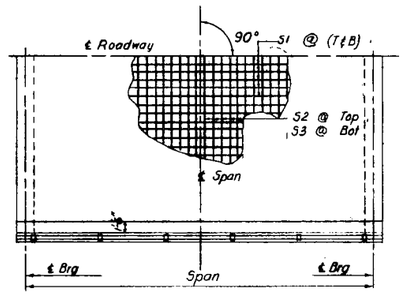
4 equal spaces = span

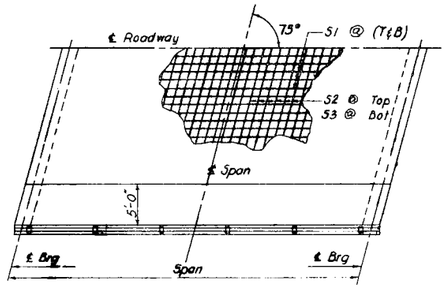
Camber Diagram (Ordinates to be computed)

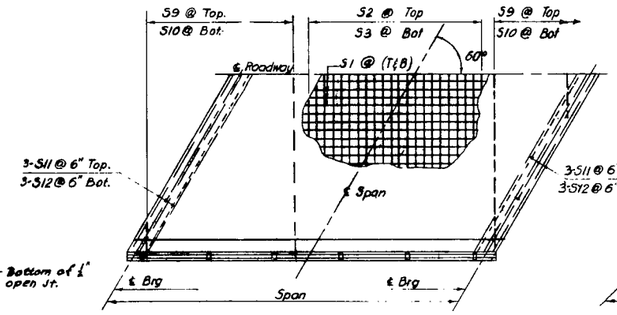
Notes shown shall apply to all types of bridge roadways.



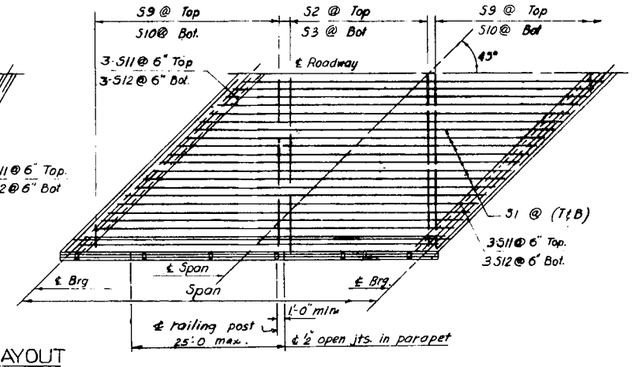
COVER PL DETAIL







Note: Studs to be flux filled studs automatically end welded to beam with full penetration butt weld.



PLAN LAYOUT

SPAN	SPACING OF SHEAR CONNECTORS	TYPE OF SHEAR CONN
50'-55'-60'	6" 8" 14" 8" 6"	4"Ø-7.25# 7"Long; 4-¾"Ø or 3-⅞"Ø studs
65'-70'-75'-80'	8" 12" 18" 12" 8"	4"Ø-7.25# 9"Long; 5-¾"Ø or 4-⅞"Ø studs

5 Equal Spaces = span

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H Forms 408 & 409 & 1956 Std. Specs. for Welded Hwy. Bridges of the A.W.S.
- Design Specs.: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16000 lbs. wheel load and f'c = 1800 psi..
- Live Load: H20-S16-44.
- Dead Load: Includes 30 lbs. p.sq.ft. for future wearing surface on the roadway slab.
- Steel Reinforcement Bars designed for fs = 18,000 psi. and detailed in accordance with A.C.I. code. Bars to be lapped min of 30 dia except as noted.
- Provide 1½" cover on reinforcement bars except as noted.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Concrete: Class A concrete.
- Parapet railing and guard fence conn.: P.D.H. Std. Dwgs. S-1614 B or S-3361.
- Steel Brgs.: S-2721
- R. Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphrams: S-2724
- For Welds, the shielded metal arc may be used with electrodes conforming to A.S.T.M. E6015, E6016, E6018 or E70.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

STANDARD COMPOSITE I BEAM BRIDGE 40' ROADWAY

Approved MAR -1 1961
Bridge Engineer

S-2718

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	7 @ 6'-9"		124 Cover Pl. 9"×1⅛"×37'-0		130 Cover Pl. 10"×1⅛"×40'-0		150 Cover Pl. 10½"×1⅛"×45'-0		160 Cover Pl. 10½"×1⅛"×49'-0
75°	"								
60°	"		30 WF 124 Cover Pl. 9"×1⅛"×37'-0		33 WF 130 Cover Pl. 10"×1⅛"×40'-0		36 WF 150 Cover Pl. 10½"×1⅛"×45'-0		36 WF 160 Cover Pl. 10½"×1⅛"×49'-0
45°	"								

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	7 @ 6'-9"		132 Cover Pl. 9½"×1⅛"×37'-0		136 Cover Pl. 10"×1⅛"×40'-0		182 Cover Pl. 10½"×1⅛"×45'-0		230 Cover Pl. 10½"×1⅛"×49'-0
75°	"								
60°	"		36 WF 132 Cover Pl. 9½"×1⅛"×37'-0		36 WF 136 Cover Pl. 10"×1⅛"×40'-0		36 WF 182 Cover Pl. 10½"×1⅛"×45'-0		36 WF 230 Cover Pl. 10½"×1⅛"×49'-0
45°	"								

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	8 @ 6'-3"		116 Cover Pl. 9"×⅞"×37'-0		120 Cover Pl. 9½"×⅞"×40'-0		141 Cover Pl. 9½"×⅞"×45'-0		160 Cover Pl. 10½"×⅞"×49'-0
75°	"								
60°	"		30 WF 116 Cover Pl. 9"×⅞"×37'-0		33 WF 120 Cover Pl. 9½"×⅞"×40'-0		33 WF 141 Cover Pl. 9½"×⅞"×45'-0		36 WF 160 Cover Pl. 10½"×⅞"×49'-0
45°	"								

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	8 @ 6'-3"		170 Cover Pl. 10"×⅞"×37'-0		174 Cover Pl. 10½"×⅞"×40'-0		174 Cover Pl. 10½"×⅞"×45'-0		230 Cover Pl. 10½"×⅞"×49'-0
75°	"								
60°	"		36 WF 170 Cover Pl. 10"×⅞"×37'-0		36 WF 174 Cover Pl. 10½"×⅞"×40'-0		36 WF 174 Cover Pl. 10½"×⅞"×45'-0		36 WF 230 Cover Pl. 10½"×⅞"×49'-0
45°	"								

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	8 @ 6'-9"		124 Cover Pl. 9"×1⅛"×37'-0		130 Cover Pl. 10"×1⅛"×40'-0		150 Cover Pl. 10½"×1⅛"×45'-0		160 Cover Pl. 10½"×1⅛"×49'-0
75°	"								
60°	"		30 WF 124 Cover Pl. 9"×1⅛"×37'-0		33 WF 130 Cover Pl. 10"×1⅛"×40'-0		36 WF 150 Cover Pl. 10½"×1⅛"×45'-0		36 WF 160 Cover Pl. 10½"×1⅛"×49'-0
45°	"								

SKEW	BEAMS * SPAN	BEAM SPACING	50'	55'	60'	65'	70'	75'	80'
90°	8 @ 6'-9"		132 Cover Pl. 9½"×1⅛"×37'-0		136 Cover Pl. 10"×1⅛"×40'-0		182 Cover Pl. 10½"×1⅛"×45'-0		230 Cover Pl. 10½"×1⅛"×49'-0
75°	"								
60°	"		36 WF 132 Cover Pl. 9½"×1⅛"×37'-0		36 WF 136 Cover Pl. 10"×1⅛"×40'-0		36 WF 182 Cover Pl. 10½"×1⅛"×45'-0		36 WF 230 Cover Pl. 10½"×1⅛"×49'-0
45°	"								

* Cover Plates over ¾" thick shall be of A.S.T.M. A 373 steel.

Designed: K.R.P.
Checked: R.T.D.

S2

S1, S3, S8, S10, S12

½ | 1 | ½ — 2'-6" S5 / 2'-10" S4 — ¼ Lap 6"

5'-10" S6 / 2'-4" S7 — 1" — 1½" — 6"

L — S9, S11

ROADWAY SLAB — REINFORCEMENT

SKEW	SPAN	BEAM SPACING	#4 S1 No.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5 S2+S9 Spa.	#5 S2+S9 lbs/ft.	#5 S3+S10 Spa.	#5 S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No	#4 S8 lbs/ft.	S1+S2+···+S10 lbs/ft. of Br.	#5 S11 No. ×L	#5 S11 lbs	#5 S12 No. ×L	#5 S12 lbs.	CONCRETE CLASS A cu. yd. of Br.
90°	50'		89	59.15	5½"	11.2	5½"	10.9	—	—	—	—	—	—	1'-8"	10.02	—	—	12"	5.22	4	2.67	298.36	—	—	—	—	1.37
75°	50'		"	"	"	"	"	"	—	—	—	—	—	—	"	"	—	—	"	"	"	"	"	—	—	—	—	"
60°	50'		"	"	—	—	—	—	5½"	11.2	5½"	10.9	—	—	"	"	—	—	"	"	"	"	"	12×21'-8"	552	12×29'-1"	345	"
45°	50'		"	"	—	—	—	—	"	"	"	"	—	—	"	"	—	—	"	"	"	"	"	12×33'-6"	457	12×32'-11"	419	"

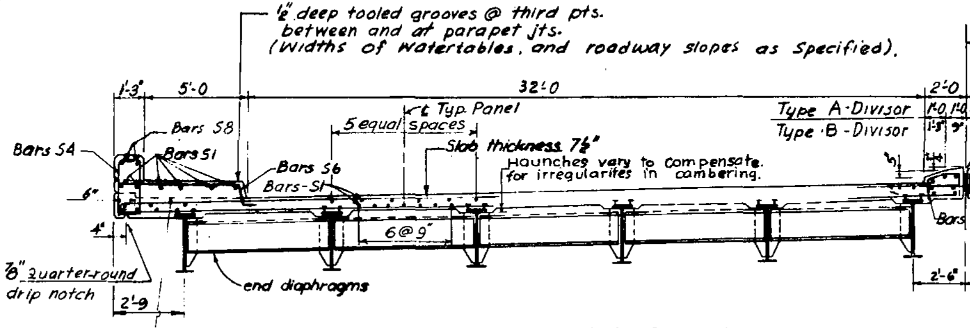
40' ROADWAY WITH TWO SAFETY CURBS

SKEW	SPAN	BEAM SPACING	#4 S1 No.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5 S2+S9 Spa.	#5 S2+S9 lbs/ft.	#5 S3+S10 Spa.	#5 S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No	#4 S8 lbs/ft.	S1+S2+···+S10 lbs/ft. of Br.	#5 S11 No. ×L	#5 S11 lbs	#5 S12 No. ×L	#5 S12 lbs.	CONCRETE CLASS A cu. yd. of Br.
90°	50'		104	69.47	6"	11.0	6"	10.7	—	—	—	—	1'-2"	5.46	1'-2"	5.01	1'-2"	4.98	12"	2.61	4	2.67	307.20	—	—	—	—	1.56
75°	50'		"	"	"	"	"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	—	—	—	—	"
60°	50'		"	"	—	—	—	—	6"	11.0	6"	10.7	"	"	"	"	"	"	"	"	"	"	"	12×29'-8"	378	12×29'-1"	371	"
45°	50'		"	"	—	—	—	—	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12×36'-0"	457	12×35'-5"	450	"

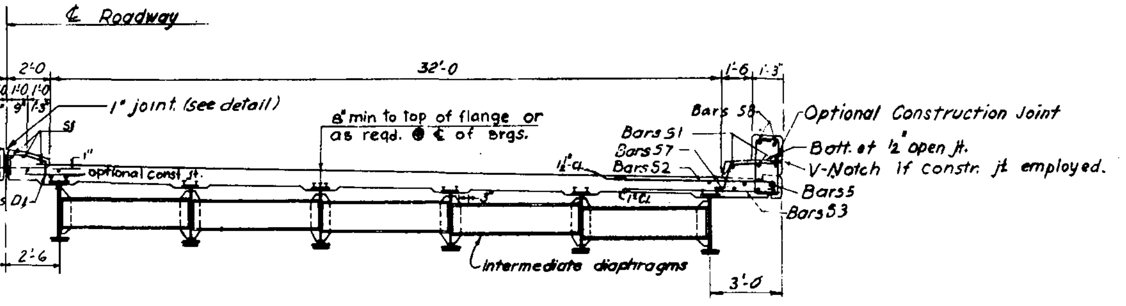
40' ROADWAY WITH SAFETY CURB & SIDEWALK

SKEW	SPAN	BEAM SPACING	#4 S1 No.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5 S2+S9 Spa.	#5 S2+S9 lbs/ft.	#5 S3+S10 Spa.	#5 S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No	#4 S8 lbs/ft.	S1+S2+···+S10 lbs/ft. of Br.	#5 S11 No. ×L	#5 S11 lbs	#5 S12 No. ×L	#5 S12 lbs.	CONCRETE CLASS A cu. yd. of Br.
90°	50'		107	77.76	5½"	12.85	5½"	12.5	—	—	—	—	1'-0"	10.92	—	—	—	—	12"	9.96	4	2.67	350.51	—	—	—	—	1.76
75°	50'		"	"	"	"	"	"	—	—	—	—	"	"	—	—	—	—	"	"	"	"	"	—	—	—	—	"
60°	50'		"	"	—	—	—	—	5½"	12.85	6½"	12.5	"	"	"	"	—	—	"	"	"	"	"	12×31'-8"	403	12×31'-1"	396	"
45°	50'		"	"	—	—	—	—	"	"	"	"	"	"	"	"	—	—	"	"	"	"	"	12×38'-5"	488	12×37'-10"	481	"

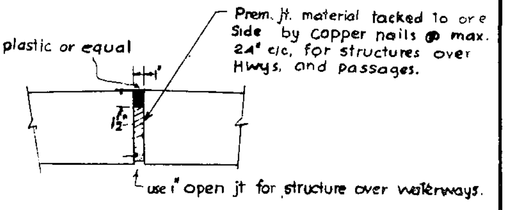
40' ROADWAY WITH TWO SIDEWALKS



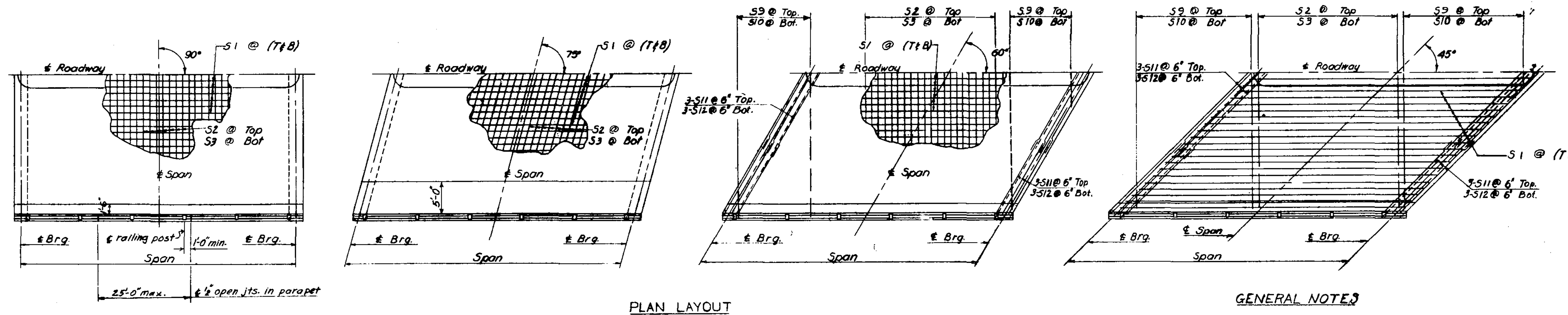
HALF ROADWAY WITH SIDEWALK



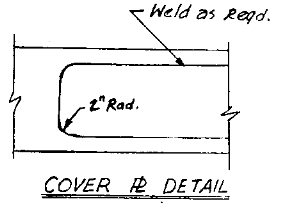
HALF ROADWAY WITH SAFETY CURB



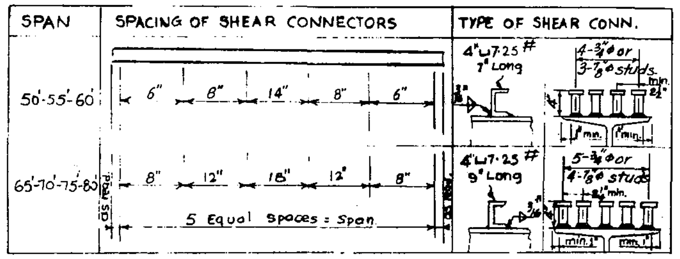
Detail of Divisor jt.



PLAN LAYOUT

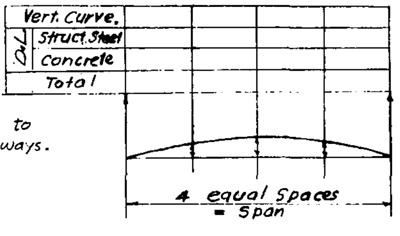


COVER PL DETAIL



Note: Studs to be flux filled studs automatically end welded to beam with full penetration butt weld.

Notes shown shall apply to all types of bridge roadways.



Camber Diagram
(ordinates to be computed)

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 & 409 & 1956 Std. Specs. for Welded Hwy. Bridges of the A.W.S.
- Design Specs.: Design division of 1957 "Standard Specs. for Hwy Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16,000 lbs. wheel load and $f_c = 1000$ psi.
- Live Load: H20-S16-44.
- Dead Load: Includes 30 lbs. p. sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars designed for $f_s = 18000$ psi. and detailed in accordance with A.C.I. code. Bars to be lapped min. of 30 dia. except as noted.
- Surface of roadway divisor shall be treated as shown on P.D.H. Std. Dwg. Sd-13.
- Provide 1½" cover on reinforcement bars except as noted.
- Exposed concrete edges shall be chamfered 1"×1" except as noted.
- Concrete: Class A concrete.
- Parapet railing and guard fence conn.: P.D.H Std. Dwgs. S-1614 B or S-3361.
- Steel Brgs.: S-2721
- Pl. Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724
- For Welds, the shielded metal arc may be used with electrodes Conforming to ASTM - E6015 E6016, E6018 or E7016.

BEAMS* / ROADWAY SLAB

SKEW	BEAM SPACING \ SPAN	50'	55'	60'	65'	70'	75'	80'	REINFORCEMENT #4 S1 No.	#4 S1 lbs/ft.	#5 S2 Spa.	#5 S2 lbs/ft.	#5 S3 Spa.	#5 S3 lbs/ft.	#5 S2+S9 Spa.	#5 S2+S9 lbs/ft.	#5 S3+S10 Spa.	#5 S3+S10 lbs/ft.	#4 S4 Spa.	#4 S4 lbs/ft.	#4 S5 Spa.	#4 S5 lbs/ft.	#4 S6 Spa.	#4 S6 lbs/ft.	#4 S7 Spa.	#4 S7 lbs/ft.	#4 S8 No.	#4 S8 lbs/ft.	#4 D1 Spa.	#4 D1 lbs/ft.	S1+S2+…+S10+D1 lbs/ft. of Br.	#5 S11 No. x L	#5 S11 lbs	#5 S12 No. x L	#5 S12 lbs	CONCRETE CLASS A C.Yd/ft. of Br.
HALF ROADWAY WITH SAFETY CURB																																				
90°	6 @ 6'-3"	30 WF 116 Cover PL 7"×⅝"×37'-0	33 WF 130 Cover PL 9"×9/16"×38'-0	33 WF 141 Cover PL 9½"×¾"×45'-0	36 WF 150 Cover PL 10½"×¾"×47'-0	36 WF 170 Cover PL 10½"×⅞"×53'-0	36 WF 194 Cover PL 10½"×1"×57'-0	36 WF 230 Cover PL 15"×⅝"×57'-0	76	50.77	6"	79.8	6"	77.50	–	–	–	–	–	–	12"	5.01	–	–	12"	2.61	2	1.34	12"	2.23	219.26	–	–	–	–	1.05
75°	"								"	"	"	"	"	"	–	–	–	–	–	–	"	"	–	–	"	"	"	"	"	"	"	–	–	–	–	"
60°	"								"	"	–	–	–	–	6"	79.8	6"	77.50	–	–	"	"	–	–	"	"	"	"	"	"	"	12×25'-1"	293	12×21'-11	278	"
45°	"								"	"	–	–	–	–	"	"	"	"	–	–	"	"	–	–	"	"	"	"	"	"	"	12×27'-10	354	12×26'-8	340	"
HALF ROADWAY WITH SIDEWALK																																				
90°	6 @ 7'-0	30 WF 124 Cover PL 9"×¾"×37'-0	33 WF 130 Cover PL 10"×¾"×40'-0	36 WF 150 Cover PL 10½"×¾"×45'-0	36 WF 170 Cover PL 10½"×⅞"×49'-0	36 WF 182 Cover PL 10½"×1"×53'-0	36 WF 194 Cover PL 10½"×1¼"×57'-0	36 WF 230 Cover PL 15"×1"×57'-0	79	52.77	5½"	95.5	5½"	92.5	–	–	–	–	12"	5.46	–	–	12"	4.98	–	–	2	1.34	12"	2.23	254.78	–	–	–	–	1.25
75°	"								"	"	"	"			–	–	–	–	"	"	–	–	"	"	–	–	"	"	"	"	"	–	–	–	–	"
60°	"								"	"	–	–	–	–	5½"	95.5	5½"	92.5	"	"	–	–	"	"	–	–	"	"	"	"	"	12×25'-1"	318	12×23'-11	303	"
45°	"								"	"	–	–	–	–	"	"	"	"	"	"	–	–	"	"	–	–	"	"	"	"	"	12×30'-3"	385	12×29'-1"	369	"

* Cover Plates over ¾" thick shall be of A.S.T.M. A373 Steel.

Designed: R.T.D.
Checked: K.R.P.

3/1/61

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

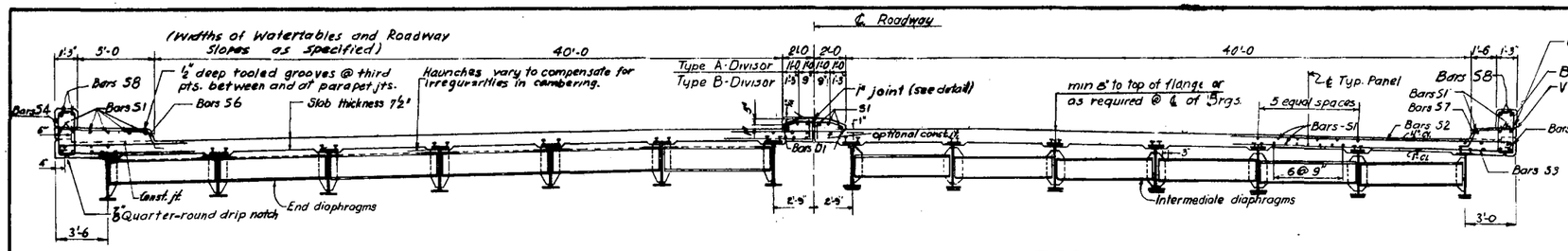
STANDARD BRIDGES

STANDARD COMPOSITE
I BEAM BRIDGE
68' ROADWAY

MAR - 1 1961
Approved

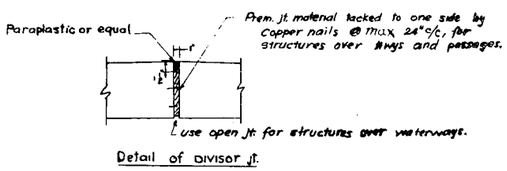
Bridge Engineer

S-2719

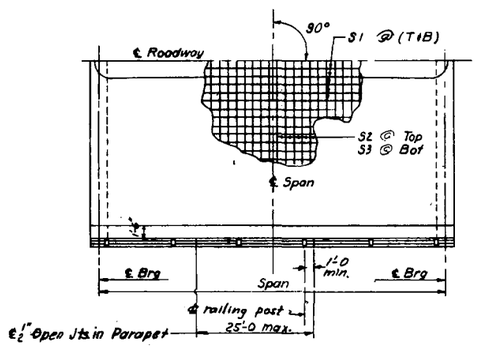


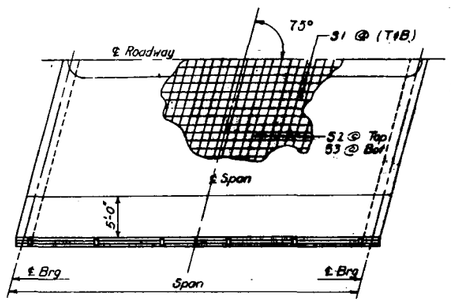
HALF ROADWAY WITH SIDEWALK

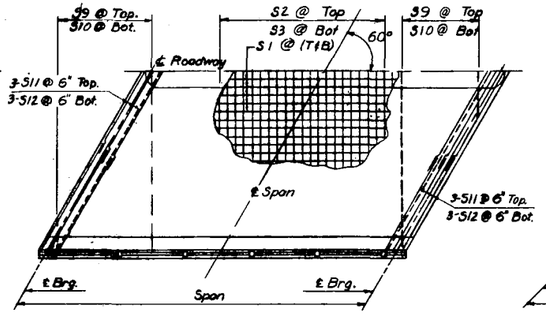
HALF ROADWAY WITH SAFETY CURB

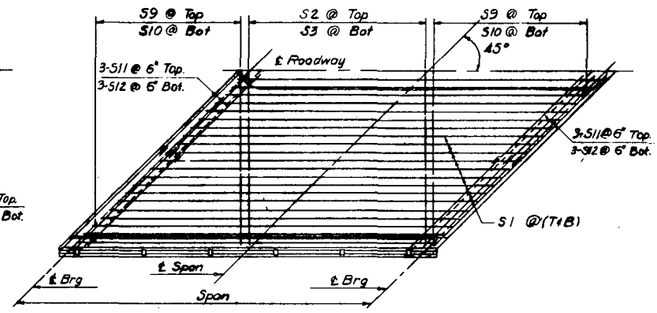


Detail of divisor jt.

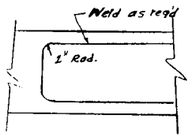








PLAN LAYOUT

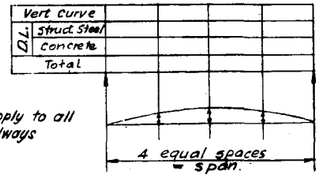


COVER ℄ DETAIL

Note: Studs to be flux filled studs automatically end welded to beam with full penetration butt weld.

SPAN	SPACING OF SHEAR CONNECTORS	TYPE OF SHEAR CONN.
50'-55'-60'	6" 8" 18" 8" 6"	4"Ls x 3.5 * 7" Long; 4-¾"ø or 3-⅞"ø studs
65'-70'-75'-80'	8" 12" 18" 12" 8" — 9 Equal spaces = span	4"Ls x 3.5 * 9" Long; 5-¾"ø or 4-⅞"ø studs

Notes shown shall apply to all types of bridge roadways



Camber Diagram
(Ordinates to be computed)

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 & 409 & 1956 Std. Specs. for Welded Hwy. Bridges of the A.W.S.
- Design Specs.: Design Division of 1957 "Standard Specs. for Hwy. Bridges" of the A.A.S.H.O. except roadway slab which is designed for 16000 lbs. wheel load and f_c=1000 psi.
- Live Load: H20-S16-44.
- Dead Load: Includes 30 lbs. p. sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars designed for f_s=18,000 psi, and detailed in accordance with A.C.I. code. Bars to be lapped min of 30 dia. except as noted.
- Surface of roadway divisor shall be treated as shown P.D.H. Std. Dwg. SD-13.
- Provide 1½" cover on reinforcement bars except as noted.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Concrete: Class A concrete.
- Parapet railing and guard fence connections: P.D.H. Std. Dwgs. S-1614 B or S-3361.
- Steel Brgs: S-2721
- R. Exp. Dams & Jts.: S-2722
- Bridge Drainage & Scuppers: S-2723
- Diaphragms: S-2724.
- For Welds, the shielded metal arc may be used with electrodes conforming to ASTM-E6015, E6016, E6018, or E7016.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES

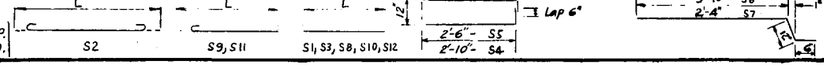
STANDARD COMPOSITE I BEAM BRIDGE 84' ROADWAY

Approved MAR - 1 1961

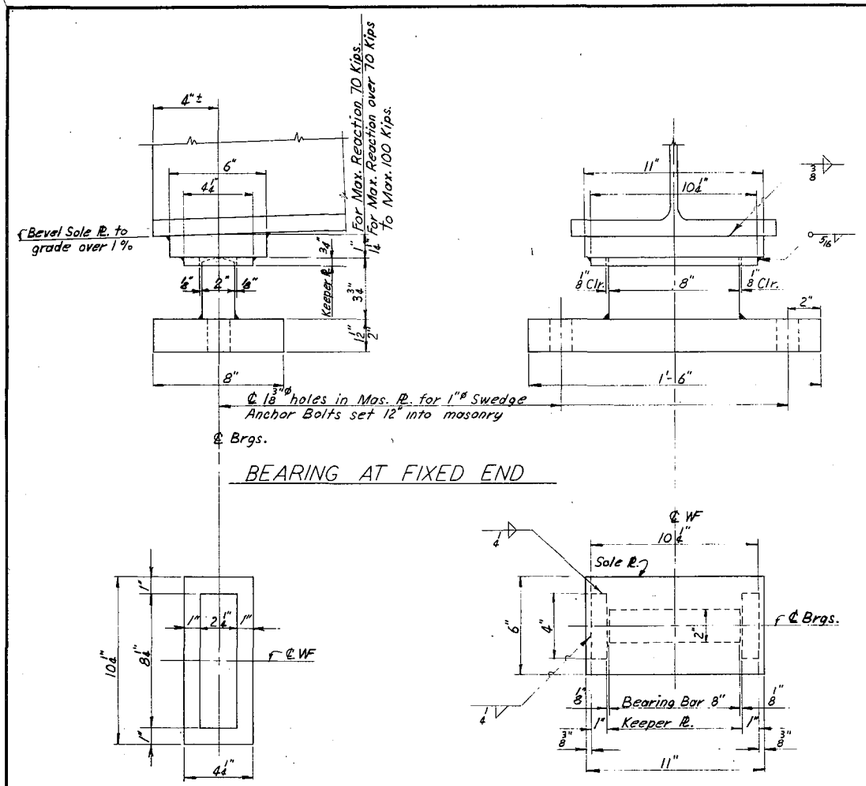
S-2720

SKEW	BEAM SPACING	SPAN	BEAMS * 50'	55'	60'	65'	70'	75'	80'	ROADWAY SLAB REINFORCEMENT #4 S1 No.	#5 S2 lbs/ft	#5 S3 Spa.	#5 S3 lbs/ft	#5 S2+S9 Spa.	#5 S3+S10 lbs/ft	#4 S4 Spa.	#4 S5 lbs/ft	#4 S6 Spa.	#4 S7 lbs/ft	#4 S8 Spa.	#4 D1 No.	lbs/ft.	Spa.	lbs/ft	S1+S2+...+S10 +D1 lbs/ft. of Br	#5 S11 No. x L	lbs.	#5 S12 No. x L	lbs.	CONCRETE CLASS A C.Y./ft. of Br
HALF ROADWAY WITH SAFETY CURB																														
90°	7 @ 6'-6"		30WF116	Cover Pl. 8"x3/4"x37'-0	33WF130	Cover Pl. 9"x3"x40'-0	33WF141	Cover Pl. 9"x3"x46'-0	36WF150	Cover Pl. 10"x1"x49'-0	36WF170	Cover Pl. 10"x1"x54'-0	36WF194	Cover Pl. 10"x1"x57'-0	36WF230	Cover Pl. 15"x3"x57'-0	88	58.78	6"	101.3	6"	99.0	-	-	-	-	-	-	12"	5.01	-	-	12"	2.61	2	1.34	12"	2.23	270.27	-	-	-	-	1.24
75°	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
60°	"		"	"	"	"	"	"	"	"	"	"	"	6"	101.3	6	99.0	-	-	"	"	"	"	"	"	"	"	12-27'-0	354	12-26'-8	341	"
45°	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12-33'-6	426	12-32'-4	412	"
HALF ROADWAY WITH SIDEWALK																														
90°	7 @ 7'-0"		30WF124	Cover Pl. 8"x3/4"x37'-0	33WF130	Cover Pl. 9"x3"x40'-0	33WF130	Cover Pl. 10"x3"x46'-0	36WF150	Cover Pl. 10"x1"x49'-0	36WF170	Cover Pl. 10"x1"x53'-0	36WF194	Cover Pl. 10"x1"x57'-4	36WF230	Cover Pl. 15"x1"x57'-0	91	60.79	5½"	119.3	5½"	117	-	-	-	-	12"	5.46	-	-	12"	4.98	-	-	2	1.34	12"	2.23	311.10	-	-	-	-	1.44
75°	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
60°	"		"	"	"	"	"	"	"	"	"	"	"	5½"	119.3	5½"	117	"	"	"	"	"	"	"	"	"	"	12-25'-6	379	12-28'-8	366	"
45°	"		"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	12-36'-0	458	12-34'-10	442	"

Designed: K.R.P.
Checked: R.T.D.



* Cover plates over ¾" thick shall be of A.S.T.M. A 373 steel



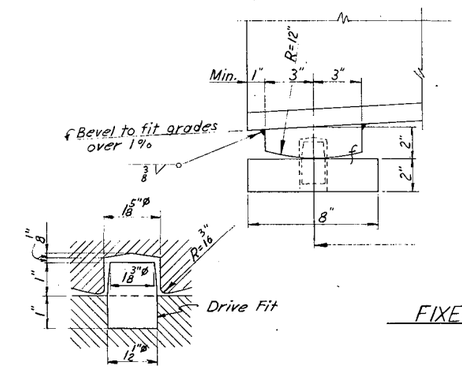
BEARING AT FIXED END

DETAIL OF KEEPER PL. AT FIXED BRG.

NOTE: Exp. Brgs. are similar to Fix. Brgs. except Keeper Pls.

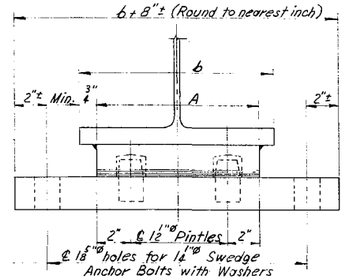
PLAN

DETAIL OF BEARING AT EXP. END

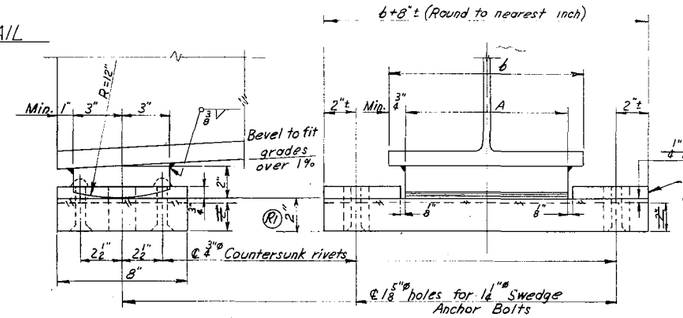


PINTLE DETAIL

BEARINGS TYPE "B"					
Max. End R (Kips)	80	100	120	140	160
Dimension A (in)	9	10	11½	13	14½



FIXED END



EXPANSION END

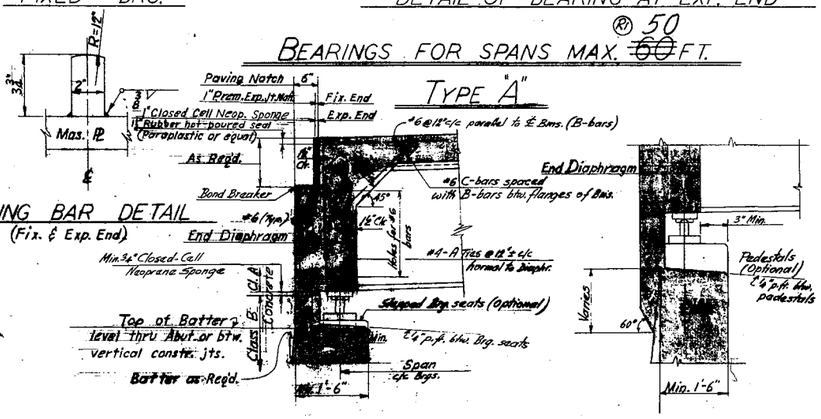
NOTES

- All materials and workmanship shall be in accordance with P.D.H. Form 409 and 1956 Std. Specs. for welded Hwy. and Railway Bridges of the A.W.S.
- All steel shall conform to A.S.T.M. A-7 designation except as noted.
- Set anchor bolts 1'-0" min. into masonry.
- Nuts of swedge anchor bolts shall be hexagon and steel washers of min. thickness ⅜".
- Bearings Type "B" to be fitted in shop to ensure free movement with pintles in place.
- Reasonable modifications of the details shown are permissible, provided they meet with the approval of the Chief Bridge Engineer.
- Alternate end details I or II may be used when condition warrants, in conjunction with Std. Dwgs. S-2710 or S-2727.
- Concrete of bearing seats shall be poured min. ¼" too high & ground or bush-hammered to elevation required.
- For details of steel plate expansion dam and joint arrangements over piers see Std. Dwg. S-2722.

Revision (R) Jan. 30, 1962 (GTV)

BEARINGS FOR SPANS MAX. ~~60~~ 50 (R) FT.

TYPE "A"

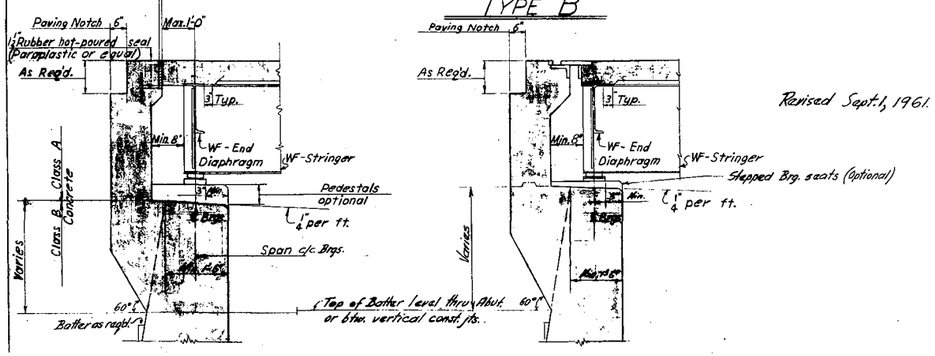


Fixed or Exp. End: Spans max. 60'

ALTERNATE END DETAILS "I"

BEARINGS FOR SPANS OVER ~~60~~ 50 FT. TO MAX. 75 FT. (R)

TYPE "B"



Fixed End: Spans over 60' and
Exp. End: Spans max. 70'

Exp. End: Spans over 70'

ALTERNATE END DETAILS "II"

Revised Sept. 1, 1961. (GTV)

Approved: MAR - 1 1961

K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

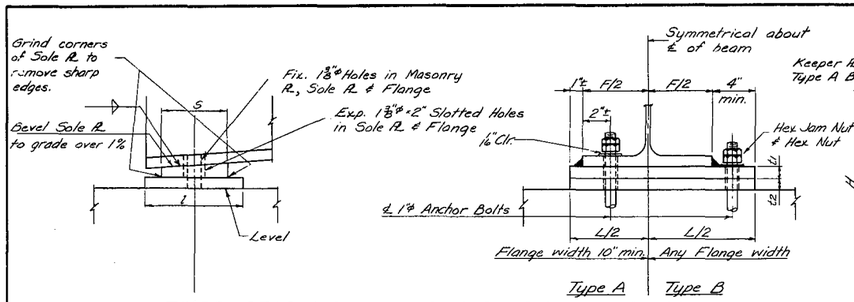
Department of Highways
BRIDGE UNIT

STANDARD STEEL BEARINGS & END DETAILS FOR SIMPLE SPAN I-BEAM BRIDGES

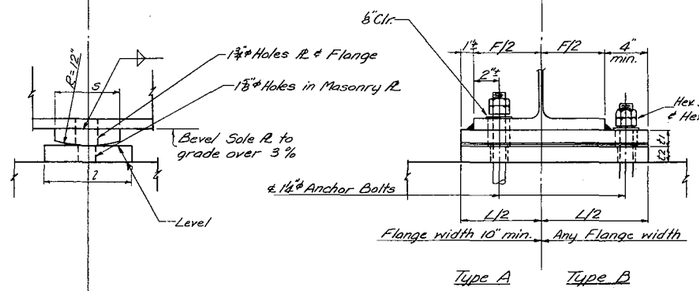
BY: G.T.V.
CHECKED: F.K.

SHEET 1 OF 1

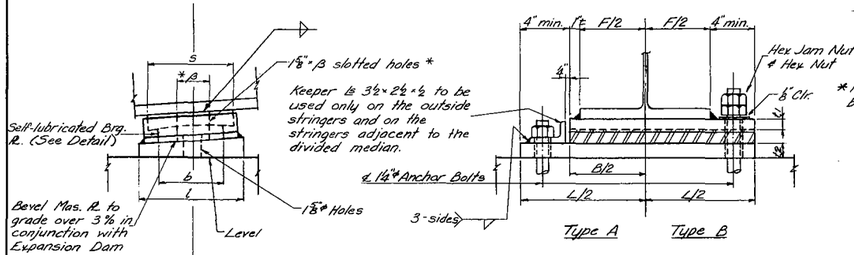
S-2721 A



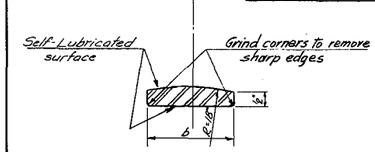
FIXED BEARINGS - IF AND EXPANSION BEARINGS - IE



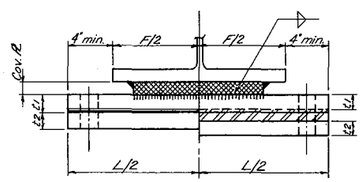
FIXED BEARINGS - IIF



EXPANSION BEARINGS IIIE



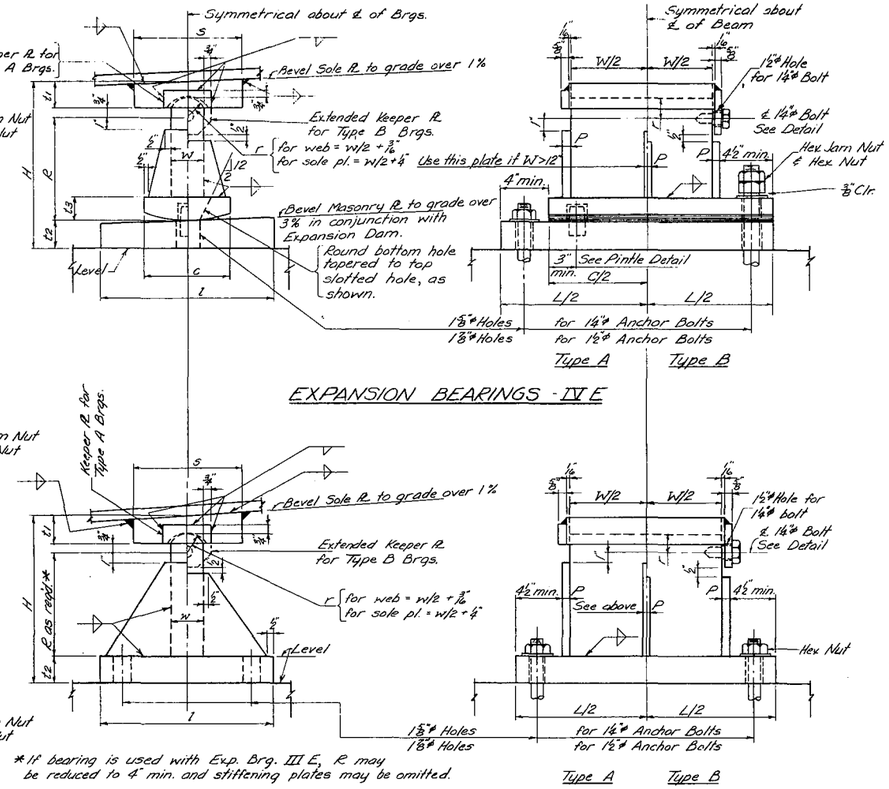
BRONZE BEARING PLATE DETAIL



BEARINGS IIF BEARINGS IIIE

STRINGERS WITH COVER PLATES
(OVER INTERMEDIATE SUPPORTS)

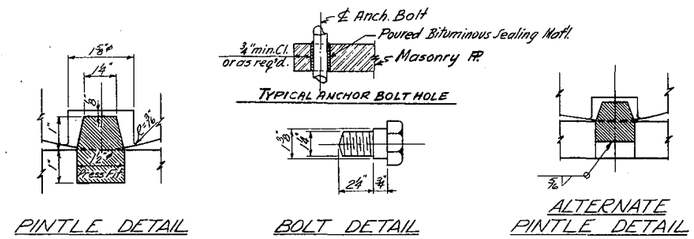
*Long size of slotted hole: β = (Bolt Dia. + ⅜") plus ⅛" for each 10 feet of expansion length.



EXPANSION BEARINGS - IIE

*If bearing is used with Exp. Brg. IIIE, R may be reduced to 4" min. and stiffening plates may be omitted.

FIXED BEARINGS - IIIF



PINTLE DETAIL BOLT DETAIL

ALTERNATE PINTLE DETAIL

DESIGN INFORMATION

Allowable Design Stresses:

Tension and compression due to bending	20,000 p.s.i.
Bearing on flat parts in contact	29,500 p.s.i.
Bearing on rounded web plate	13,000 p.s.i.
Bearing on rocker plate, Pounds per lin. inch	1,380 R
Friction coefficient steel on steel	0.30
The longitudinal force due to friction of Expansion Bearing IVE: F = 0.3 ⅔ (Dead Load reaction)	
Bearing on self-lubricated bronze plate	1,000 p.s.i.
Bearing on concrete masonry:	
Bridge Bearings I & III	700 p.s.i.
Bridge Bearings II & IV	1,000 p.s.i.
Friction coefficient of self-lubricated Brg. R. on steel	0.12

Minimum size of fillet welds:
- 5/16" if thickness of thicker plate does not exceed 1½"
- ⅜" if thickness of thicker plate does not exceed 2¼"
- ½" if thickness of thicker plate exceeds 2¼"

INSTRUCTIONS AND NOTES

(Pertinent information in accordance with present policy of Department, shall be included in General Notes or shown on corresponding sheet of drawing.)

- All materials and workmanship shall be in accordance with P.D.H. Forms 408/60 and 409/149.
- Design Specifications: Design Division of 1961 "Standard Specifications for Highway Bridges" of the AASHO and latest "Standard Specifications for Welded Highway and Railway Bridges" of A.W.S.
- All Steel shall conform to A.S.T.M. A36-62T, unless otherwise directed.
- The Bronze Alloy self-lubricated Bearing Plates shall meet the ASTM Specifications B22-52 Alloy D except that a maximum of up to 2½% lead will be allowed. The lubricated area shall comprise approximately 25% of the bearing surface.
- All Bearing materials, Anchor Bolts, Nuts and Washers shall be included in the weight of Fabricated Structural Steel.
- Type B Bearings IIIE, IVE & IVF to be used only on the outside Stringers and on the Stringers adjacent to the Divided Median, where uplift exists.
- For Bearing Tables, Suggested Bearing, Joint Arrangements and Pedestal Details, see Sheet #2.
- Fixed Bearings shall be placed at the low end of Span whenever it is possible.
- Rockers shall be shop assembled and match marked to insure free movement of rockers with pintles in place.
- Finish of contact surfaces shall conform to ASA 125-B46.1.
- Thicknesses shown are of ℄ Bearings.
- ℄ Of all Bearings shall be truly vertical at temperature 68° F. under full dead load.
- Holes in Masonry Plates shall be filled with bituminous sealing material after anchor bolts are set and deck slab has been poured.
- Anchor Bolts shall be swedge or approved type and to be set a minimum 12" into masonry. All round and cut Washers shall be ⅜ thick.
- Anchor Bolts may be set by template or other suitable means before concrete is placed, or may be set into preformed holes and grouted with non-shrink mortar.
- Pedestals shall be used under Bearings I, II & III where practical.
- Pedestals shall be poured integrally with abutment stem or pier cap and shall be reinforced with U-Type grillage bars.
- Bearing areas for shoes shall be finished at least ¼" high, and after curing ground to a true plane and elevation over an area extending min. 1" beyond the contact surface.
- Reasonable modifications of details shown may be required to meet special conditions.

Approved: AUG - 2 1963
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT
STANDARD
STEEL I-BEAM BRIDGES

BEARINGS

By: GH
VBJK

RD NO. 184

SHEET 1 OF 2

S-2721

FIXED BEARINGS - IF AND EXPANSION BEARINGS - IE

TYPE A AND B

Reaction Kips	Mark	s	l	L	t_1	t_2	Wt. (lbs)
50	R50	6	8	12	1½	1½	83
60	R60	6	8	14	1½	1½	95
70	R70	6	8	16	1½	1½	107
80	R80	6	8	18	1½	1½	119
90	R90	6	8	20	1¾	1¾	151
100	R100	6	8	22	2	2	187

FIXED BEARINGS - IIF

Reaction Kips	Mark	TYPE A s	l	L	t_1	t_2	Wt.(lbs)	TYPES B AND C s	l	L	t_1	t_2	Wt.(lbs)
50	R50	5	6	10	1½	1½	57	—	—	—	—	—	—
60	R60	5	6	12	1½	1½	66	—	—	—	—	—	—
70	R70	6	7	12	1½	1½	75	—	—	—	—	—	—
80	R80	6	7	13	1½	1½	81	—	—	—	—	—	—
90	R90	6	8	13	1½	1½	86	—	—	—	—	—	—
100	R100	6	8	14	1½	1½	92	6	8	18	1½	1½	115
120	R120	6	8	16	1½	1½	103	6	8	18	1½	1½	115
140	R140	6	8	18	1½	1½	115	6	8	19	1½	1½	121
160	R160	—	—	—	—	—	—	7	9	20	1½	1½	142
180	R180	—	—	—	—	—	—	8	10	20	1¾	1¾	172
200	R200	—	—	—	—	—	—	9	11	20	2	2	221
220	R220	—	—	—	—	—	—	10	12	20	2	2¼	259
240	R240	—	—	—	—	—	—	10	12	21	2	2¼	271
260	R260	—	—	—	—	—	—	10	12	23	2¼	2¼	312
280	R280	—	—	—	—	—	—	10	12	25	2¼	2¼	339
300	R300	—	—	—	—	—	—	10	12	27	2¼	2¼	365
320	R320	—	—	—	—	—	—	11	13	27	2¼	2½	410
340	R340	—	—	—	—	—	—	11	13	27	2¼	2½	410
360	R360	—	—	—	—	—	—	11	13	28	2¼	2½	425
380	R380	—	—	—	—	—	—	11	13	30	2¼	2½	465
400	R400	—	—	—	—	—	—	11	14	30	2½	2¾	530

EXPANSION BEARINGS - IIIE

Reaction Kips	Mark	TYPE A b	B	l	L	s	t_1	t_2	Wt.(lbs)	TYPES B AND C b	l	L	s	t_1	t_2	Wt.(lbs)
50	R50	5	11	7	19	6½	1½	1½	110	—	—	—	—	—	—	—
60	R60	5	12	7	20	6½	1½	1½	118	—	—	—	—	—	—	—
70	R70	6	12	8	20	7½	1½	1½	135	—	—	—	—	—	—	—
80	R80	6	14	8	22	7½	1½	1½	150	—	—	—	—	—	—	—
90	R90	6½	14	9	22	8½	1½	1½	168	—	—	—	—	—	—	—
100	R100	7½	14	10	22	9½	1½	1½	195	7½	10½	20	9½	1½	1½	230
120	R120	7½	16	10½	24	9½	1½	1½	222	7½	11½	21	9½	1½	1½	250
140	R140	7½	19	11	27	9½	1½	1½	260	7½	12½	22	9½	1½	1½	270
160	R160	8	20	11½	28	10	1½	1¾	310	8	13½	23	10	1½	1½	300
180	R180	8½	21	12	29	10½	1½	1¾	335	8½	14	24	10½	1½	1½	325
200	R200	9	22	13	30	11	1½	1¾	375	9	14½	25	11	1½	1¾	385
220	R220	9½	23	14	31	11½	1¾	1¾	430	9½	15½	26	11½	2	2	490
240	R240	10	24	14½	32	12	2	2	532	10	16	27	12	2¼	2¼	585

EXPANSION BEARINGS - IIIE

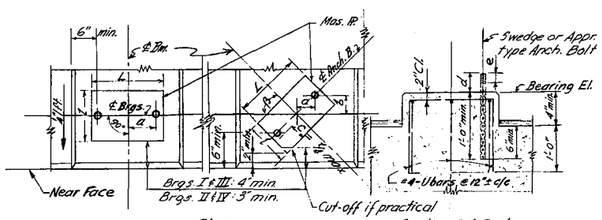
Reaction Kips	Mark	s	W	w	c	C	L	l	*Eccentricity	R	t_1	t_2	t_3	H	P	Wt. (lbs)
TYPE A																
75	R75	6	9	3	6	11	20	8	1½	8	2	2	2	12¾	5⅝	237
100	R100	6	10	3	6	12½	22	9		8	2	2	2	12¾		275
150	R150	7	10	3	7	15½	25	10		9	2	2	2	13¾		334
200	R200	7	11	3	7	18	28	11		10	2¼	2	2	15		410
250	R250	8	12	3	8	20	32	12		11	2¼	2¼	2	16¼		535
300	R300	8	13	3	8	22½	33	14		12	2¼	2½	2¼	17½		660
350	R350	9	14	3	9	23	35	15		13	2½	2¾	2¼	19		830
400	R400	9	16	3	9	24½	38	16		14	2½	3	2¼	20¼		990
TYPE B																
75	R75	6	9	3	6	—	20	8	1½	8	2	2	2	12¾	5⅝	275
100	R100	6	10	3	6	—	22	9		8	2	2	2	12¾		310
150	R150	7	10	3	7	—	25	10		9	2	2	2	13¾		380
200	R200	7	11	3	7	—	28	11		10	2¼	2	2	15		455
250	R250	8	12	3	8	—	32	12		11	2¼	2¼	2	16¼		595
300	R300	8	13	3	8	—	33	14		12	2¼	2½	2¼	17½		720
350	R350	9	14	3	9	—	35	15		13	2½	2¾	2¼	19		905
400	R400	9	16	3	9	—	38	16		14	2½	3	2¼	20¼		1075

* For eccentricities larger than 1½" the bearings shall be modified.

FIXED BEARINGS - IVF

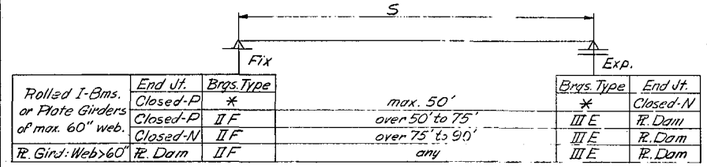
Reaction Kips	Mark	s	W	w	L	l	t_1	t_2	R	H	P	Wt. (lbs.) Type A	Type B
75	R75	6	8	3	18	8	2	2	6	10¾	5⅝	204	206
100	R100	6	8	3	18	9	2	2	6	10¾		216	218
150	R150	7	9	3	19	10	2	2	7	11¾		254	256
200	R200	7	9	3	20	11	2¼	2	7	12		280	282
250	R250	8	10	3	22	12	2¼	2	8	13		330	332
300	R300	8	11	3	24	13	2¼	2¼	8	13¾		395	397
350	R350	9	12	3	26	14	2½	2½	9	14¾		495	497
400	R400	9	13	3	28	15	2½	2¾	9	15		585	587

All dimensions are in inches.



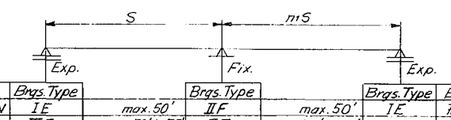
LAY-OUT AND DETAILS OF PEDESTALS

Skew angles and dimensions: l/2, l/2, a, b, c, d, e, and Brg El. shall be shown on the drawing.



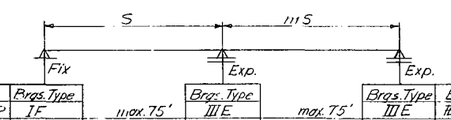
Rolled I-Bms. or Plate Girders of max. 60" web.	End Jt.	Brgs. Type		Brgs. Type	End Jt.
	Closed-P	*	max. 50'	*	Closed-N
	Closed-P	IIF	over 50' to 75'	IIIE	R. Dam
	Closed-N	IIF	over 75' to 90'	IIIE	R. Dam
R. Gird: Web > 60"	R. Dam	IIF	any	IIIE	R. Dam

SCHEME 1



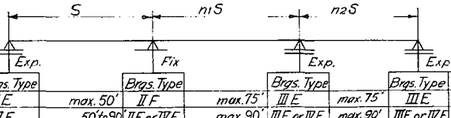
Rolled I-Bms. or Plate Girders of max. 60" web.	End Jt.	Brgs. Type		Brgs. Type		Brgs. Type	End Jt.
	Closed-N	IE	max. 50'	IIF	max. 50'	IE	R. Dam
	R. Dam	IIIE	50' to 75'	IIF	50' to 75'	IIIE	R. Dam
	R. Dam	IIIE	75' to 90'	IIF or IVF	75' to 90'	IIIE	R. Dam
R. Gird: Web > 60"	R. Dam	IIIE	any	IIF or IVF	any	IIIE or IVE	R. Dam

SCHEME 2



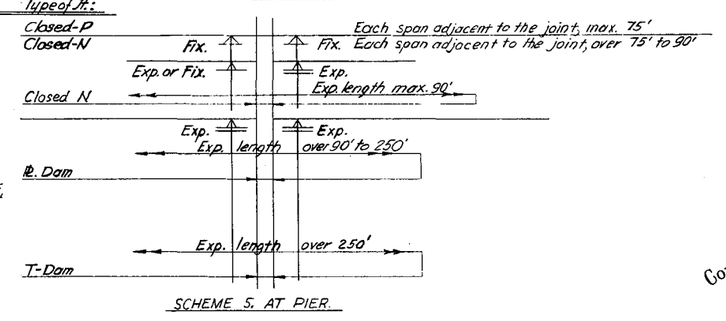
Rolled I-Bms. or Plate Girders of max. 60" web.	End Jt.	Brgs. Type		Brgs. Type		Brgs. Type	End Jt.
	Closed-P	IF	111 max. 75'	IIIE	max. 75'	IIIE	R. Dam
	Closed-N	IIF	75' to 90'	IIIE	75' to 90'	IIIE	R. Dam
R. Gird: Web > 60"	R. Dam	IIF	any	IIIE or IVE	any	IIIE	Rem. T-Dam

SCHEME 3



Rolled I-Bms. or R. Girders of max. 60" web.	End Jt.	Brgs. Type		Brgs. Type		Brgs. Type		Brgs. Type	End Jt.
	Closed-N	IE	max. 50'	IIF	max. 75'	IIIE	max. 75'	IIIE	R. Dam
	R. Dam	IIIE	50' to 90	IIF or IVF	max. 90'	IIIE or IVE	max. 90'	IIIE or IVE	R. Dam
R. Gird: Web > 60	R. Dam	IIIE	any	IIF or IVF	any	IIIE or IVE	any	IIIE or IVE	R. or T-Dam

SCHEME 4



SCHEME 5. AT PIER.

LEGEND:
S = Span c. to c. Brgs.
Closed-P = 1" Prem. Exp. Jt Mat'l.
Closed-N = 1" Closed-cell Neoprene Sponge
R. Dam = Sliding R. Exp. Dam } Std. Dwg. S-2722
T-Dam = Toothed Exp. Dam }
n1, n2 = 0.8 to 1.3
* Concrete End Diaphragm shown on Std. Dwg. S-2736

INSTRUCTIONS:

- Weights shown are approximate, include anchor bolts, nuts, and round or cut washers.
- For greater reactions, the bearings shown shall be modified or special designs shall be provided.
- Web stiffeners shall be provided for beams at bearings when the unit shear exceeds 75% of allowable shear or when the web crippling stress exceeds 25,000 psi.
- Plate Exp. Dam shall be used for total expansion length of max. 250 ft. unless otherwise directed.
- Toothed Exp. Dam shall be used for total expansion length over 250 ft. unless otherwise directed.
- For End Details see Std. Dwg. S-2736.
- In multi-simple span bridges, there shall be at least one expansion dam, preferably at a pier.

Approved: AUG - 2 1963
N. H. Jensen
Bridge Engineer

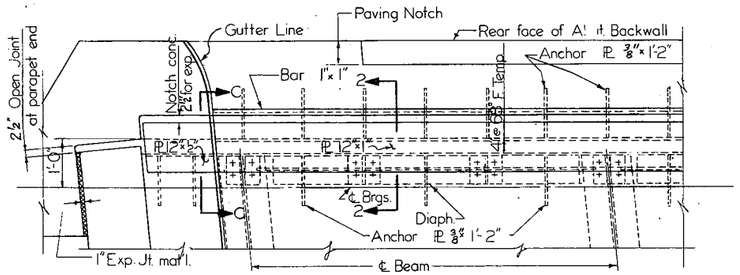
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD STEEL I-BEAM BRIDGES

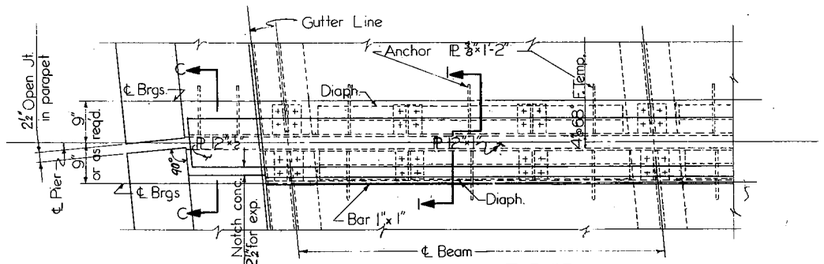
BEARINGS AND SLAB JOINT ARRANGEMENTS

SHEET 2 OF 2 S-2721

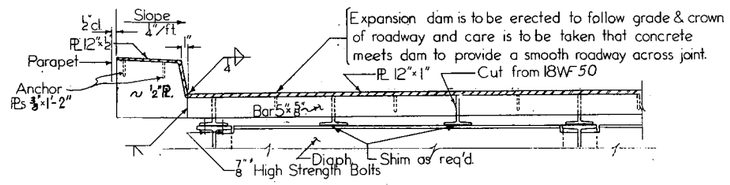
PENNDOT NO. 164 KRF



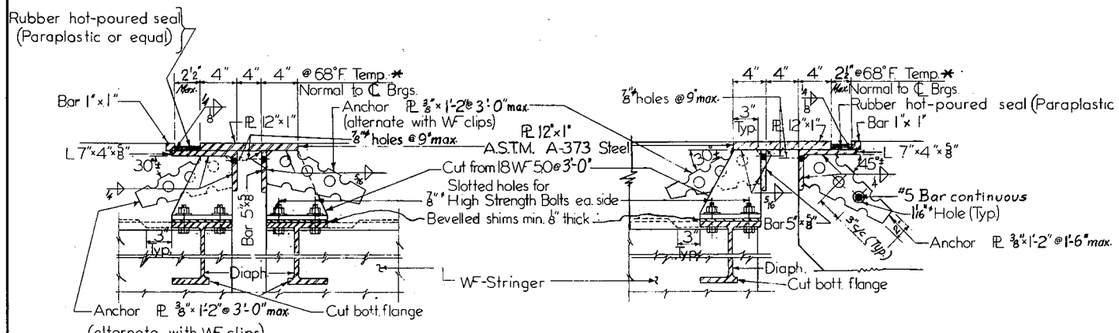
PLAN OF DAM AT ABUT.



PLAN OF DAM AT PIER



TYPICAL DAM ELEVATION



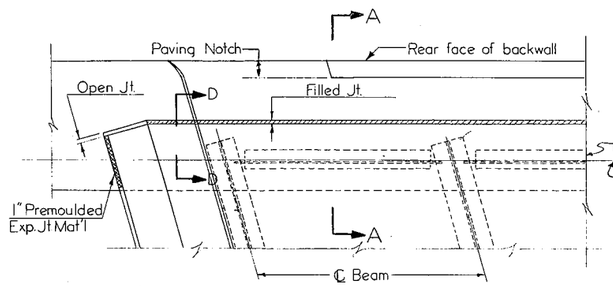
EXP. DAM AT PIER
SECTION 1-1

This type of Exp. Dam shall be used for total expansion lengths of 120 ft. to max. 200 ft.

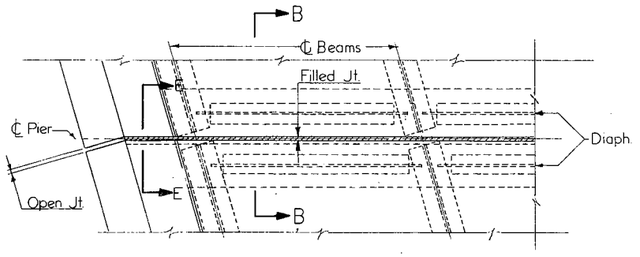
EXP. DAM AT ABUT.
SECTION 2-2

This type of Exp. Dam shall be used for expansion lengths over 70 ft.

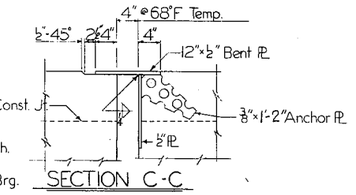
* Adjust dam materials as expansion required.



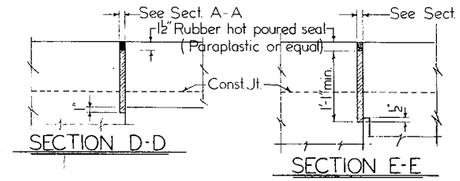
PLAN OF JOINT AT ABUT.



PLAN OF JOINT AT PIER



SECTION C-C

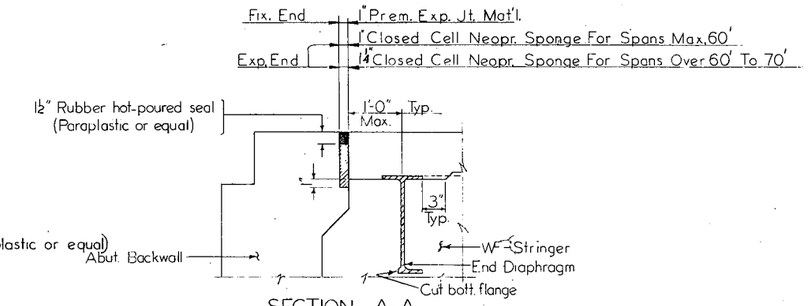


SECTION D-D

SECTION E-E

NOTES:

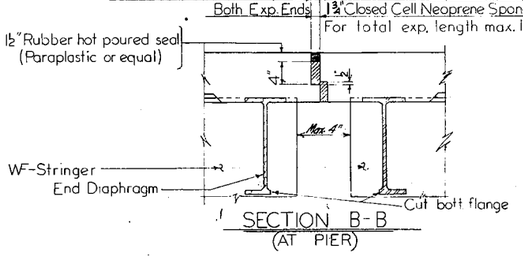
All materials and workmanship shall be in accordance with P.D.H. Form 409 & 1956 Std. Specs. for Welded Highway & Railway Bridges of the A.W.S.
All steel shall conform to A.S.T.M. - A7 designation, except as noted.
Reasonable modifications of the details shown are permissible, provided they meet with the approval of the Chief Bridge Engineer.
Provision shall be made to fasten both elements of the dam together at max. 5'-0" % for erection purposes. These fasteners must be removed not later than two hours after concrete has set.
Steel in contact with concrete shall not be painted.



SECTION A-A
(AT ABUT.)

Both Fixed Ends	1" Prem Exp Jt Mat'l
One Fixed End & One Exp End	1¼" Closed Cell Neoprene Sponge For Span Max. 70'
Both Exp. Ends	1¾" Closed Cell Neoprene Sponge

For total exp. length max. 120 ft.



SECTION B-B
(AT PIER)

Approved: MAR - 1 1961
H. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

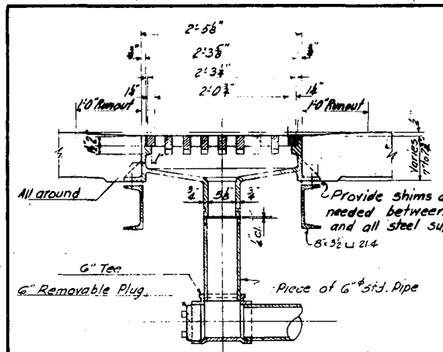
STANDARD

PL. EXP. DAMS & JOINTS FOR SIMPLE-SPAN I-BEAM BRIDGES

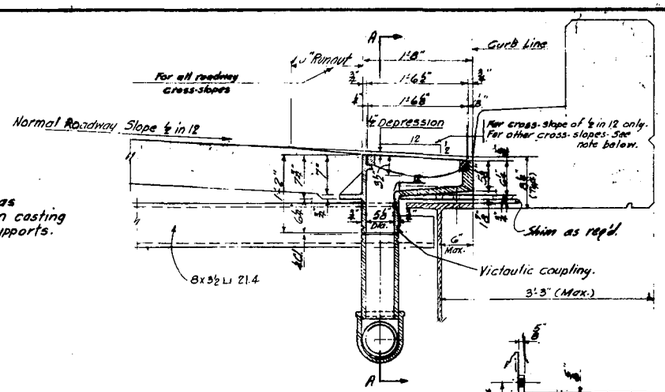
SHEET 1 OF 1

S-2722

MADE: I.C.P.
CHECKED: B.F.K.

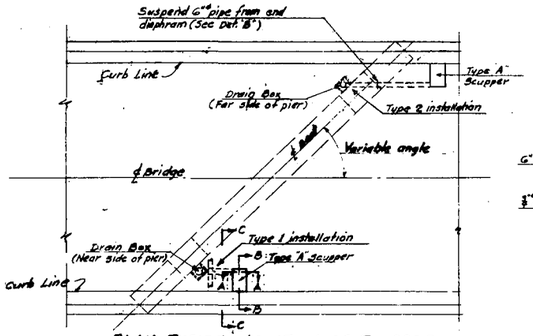


SECTION "A-A"

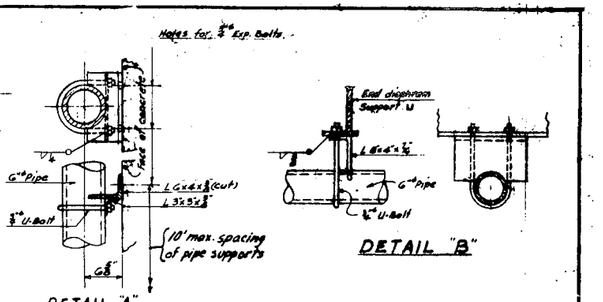


SECTION "B-B"

Section shown for normal roadway cross-slope of ¼ in 12.
Note: For other cross-slopes, raise or lower the roadway side of scupper to align with the cross-slope of the roadway and adjust the supporting D and shims.

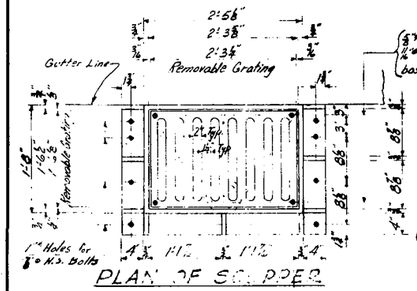


PLAN-TYPICAL LOCATION OF SCUPPER

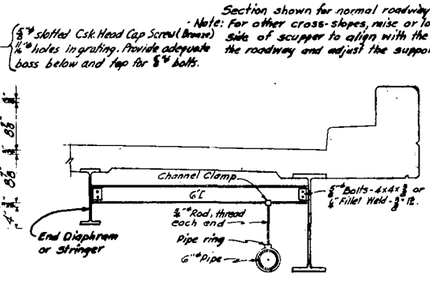


DETAIL "A"

DETAIL "B"

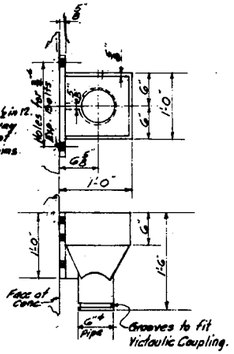


PLAN OF SCUPPER

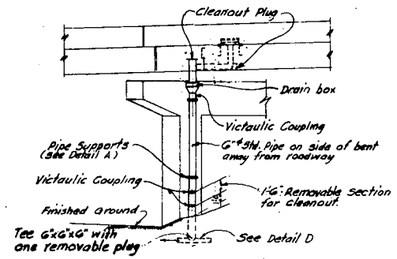


SECTION "C-C"

Note: Frame G"u from stringer to stringer if possible, otherwise frame to end diaphram.



DRAIN BOX



ELEVATION

Showing Type 1 Installation
Type 2 Installation Similar

NOTES:

All materials and workmanship shall be in accordance with P.D.H. Form 409 & 1956 Std. Specs. for Welded Highway & Railway Bridges of the A.W.S.
All pipes shall be standard 6" wrought iron*. All pipe fittings shall be either welded wrought iron or screwed malleable iron. All couplings shall be victaulic or equal.

Scupper, drain box and grating material shall be malleable iron or cast steel, or nodular cast iron ASTM-A339-55 Grade 60-45-10 unless welded construction is used.

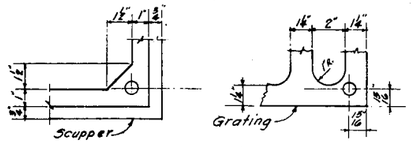
Welded construction may be used for scupper, drain box and grating at no additional cost to the Pennsylvania Department of Highways, in which case wrought iron* shall be used.

Payment for pipe, fittings, scuppers, drain boxes, grating and pipe supports shall be included in the fabricated structural steel item.

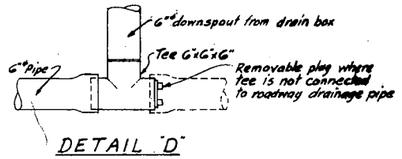
Pay weight for scupper Type A = 460*
Pay weight for grating = 180*
Pay weight for drain box = 195*

Reasonable modifications of the details shown are permissible, provided they meet with the approval of the Chief Bridge Engineer.

* or approved equal.



DETAIL "C"



DETAIL "D"

Approved: MAR - 1 1961
R. H. Jansen
Bridge Engineer

SCUPPER DESIGN CRITERIA

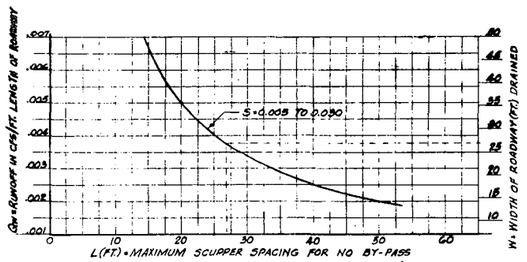
Five-minute storm; 25 year cycle; 6.57 in./hr. rainfall intensity.
Scupper SIZE: See details of Type "A" Scupper (above)
Roadway grades S = 0.005 to 0.030
Gutter cross-slope - ¼, ½, ¾ and 1" per ft.
Inlet grating depressed ½".

DETERMINATION OF SCUPPER SPACING FROM CHARTS

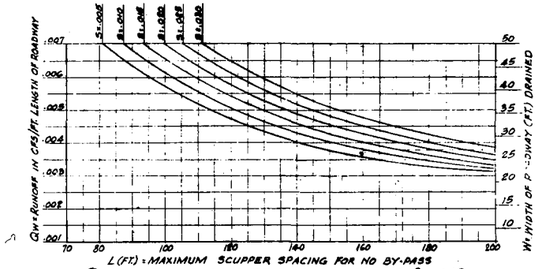
LEGEND: Qw = Run-off in cfs./ft of length of roadway width (W)
W = Width of roadway drained by scupper - includes section of roadway slab plus side walk or safety curb.
L(ft) = Maximum spacing for scupper to intercept all water between scuppers with no by-pass.

Example on how to use charts:
Follow dashed lines to find spacing "L" of scuppers from problems below

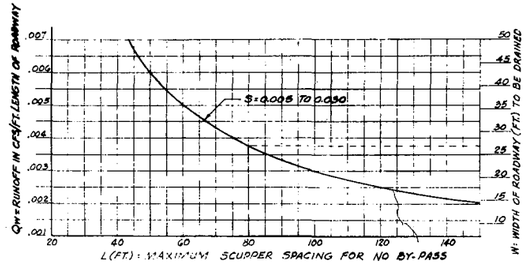
Given				
Gutter cross-slope	Roadway Grade S	Roadway width (W)	Refer to Chart No.	Find (L)
¼ in 12	.005 to 0.035	27'	1	27'
½ in 12	.005 to 030	27'	2	80'
¾ in 12	.015	27'	3	172'
1 in 12	.005	44'	4	142'



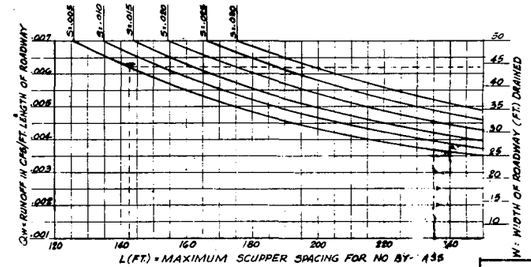
① FOR ROADWAY CROSS-SLOPE OF ¼ IN 12



③ FOR ROADWAY CROSS-SLOPE OF ⅜ IN 12



② FOR ROADWAY CROSS-SLOPE OF ½ IN 12



④ FOR ROADWAY CROSS-SLOPE OF 1 IN 12

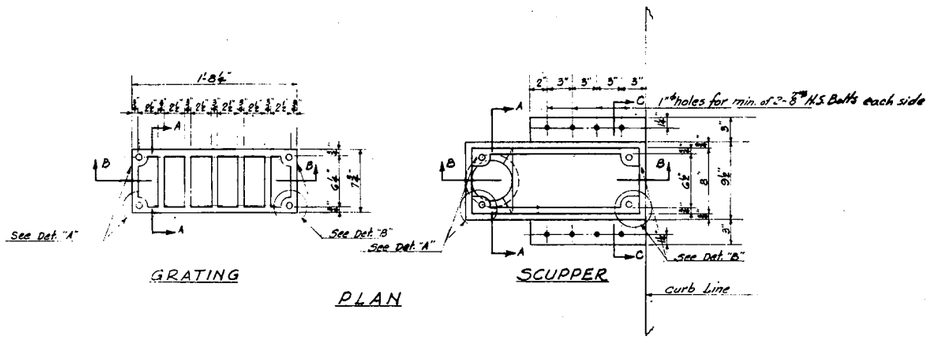
DESIGNED: S.S.S.
CHECKED: J.A.B. : B.F.K.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES
STANDARD BRIDGE DRAINAGE AND TYPE "A" SCUPPER

SHEET 1 OF 2

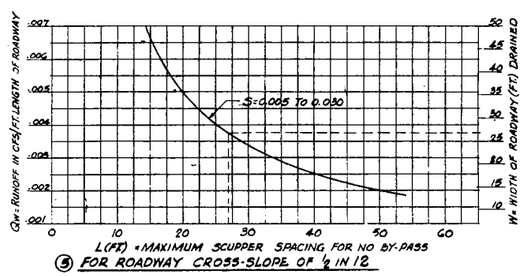
S-2723



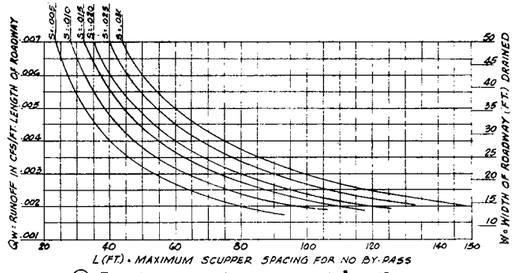
GRATING

PLAN

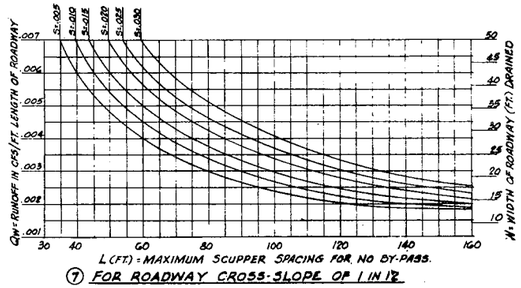
SCUPPER



⑤ FOR ROADWAY CROSS-SLOPE OF ½ IN 12

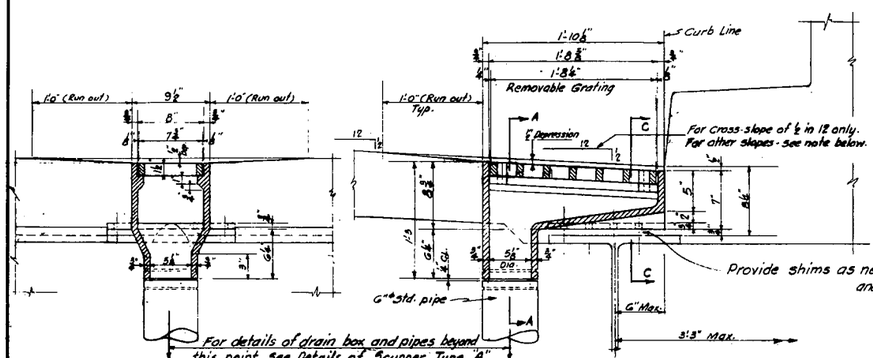


⑥ FOR ROADWAY CROSS-SLOPE OF ¾ IN 12



⑦ FOR ROADWAY CROSS-SLOPE OF 1 IN 12

NOTE
For "Scupper design criteria" and "Determination of scupper spacing from charts", see sh. 1 of 2.
No chart was drawn for spacing of Type "B" scupper for a roadway cross-slope of ½ in 12, since the spacing "L" for no by-pass, is so small as to make its use impractical for this cross-slope.

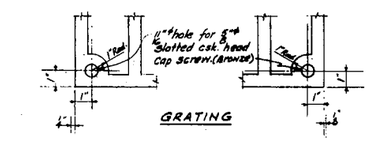


SECTION "A-A"

SECTION "B-B"

SECTION "C-C"

NOTE: Section shown for normal roadway cross-slope of ½ in 12. For other cross-slopes, raise or lower the roadway side of Scupper to align with the cross-slope of the roadway and adjust shims as required.



DETAIL "A"

DETAIL "B"

Approved: MAR - 1 1961
T.K. Jenkins
Bridge Engineer

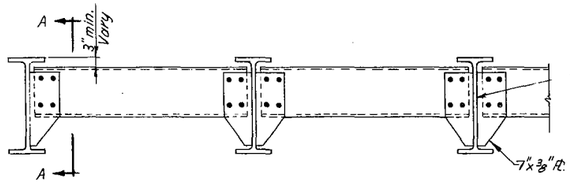
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD BRIDGES
STANDARD BRIDGE DRAINAGE
AND
TYPE "B" SCUPPER

S-2723

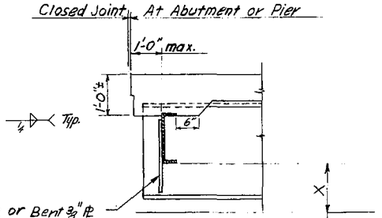
DESIGNED: S.S.S.
CHECKED: J.A.B. & B.R.K.

SHEET 2 OF 2



END DIAPHRAGM AT CLOSED JOINT

Closed Joint At Abutment or Pier

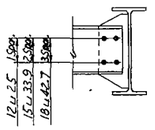


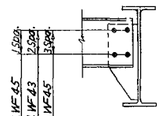
SECTION A-A

(For reinforcement, see std. Dwg. S-2736)

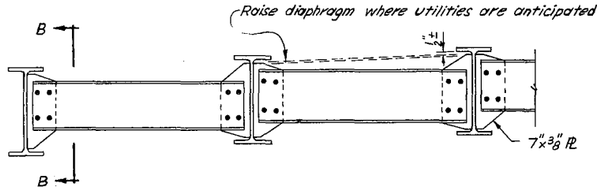
If "X" is less than 1'-0", bearings shall be placed on pedestals (See Std. Dwg. S-2721)

Stringer	Diaphragms	
	Intermediate and at End Closed Joint	At Exp. * Dam and Constr. Joint
21WF	12 ∪ 25	12 WF 45
24WF	12 ∪ 25	12 WF 45
27WF	15 ∪ 33.9	14 WF 43
30WF	15 ∪ 33.9	14 WF 43
33WF	18 ∪ 42.7	18 WF 45
36WF	18 ∪ 42.7	18 WF 45

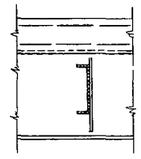




* For other details of End Diaphragm at Exp. Dam see Std. Dwg. S-2722.

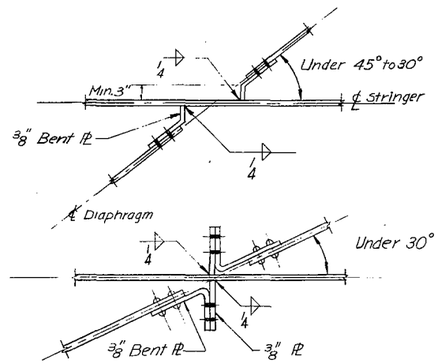


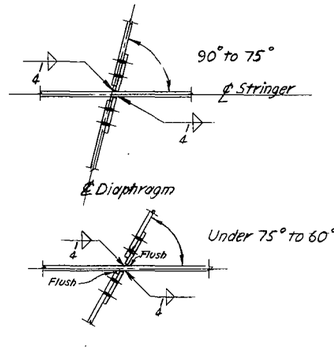
INTERMEDIATE DIAPHRAGM

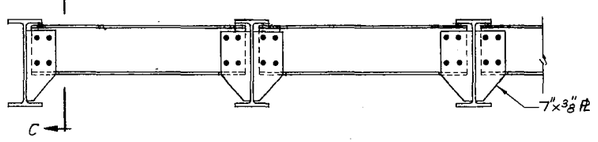


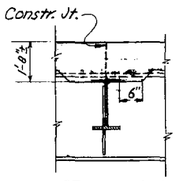
SECTION B-B

DIAPHRAGM SIZE AND RIVET GROUPING





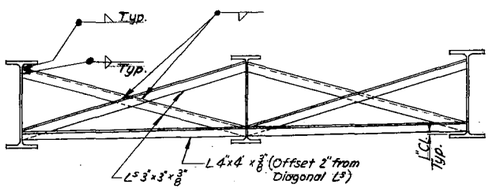




SECTION C-C

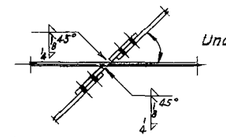
(For reinforcement, see std. Dwg. S-2736)

DIAPHRAGM AT SLAB CONSTRUCTION JOINTS



ALTERNATE INTERMEDIATE DIAPHRAGM

All welds 1/4" Fillet



Under 60° to 45°

DIAPHRAGM TO BEAM CONNECTION DETAILS

NOTES:

- Diaphragm spacing shall not exceed 25 ft.
- All rivets 7/8" ø, 7/8" High Strength Bolts may be substituted in field connections, in which case, compensation will be made for rivet heads.
- For skew angles greater than 75° intermediate diaphragm may placed parallel to ℄ Brgs.
- For skew angles less than 75° intermediate diaphragm shall be placed normal to stringers and staggered where practical.
- All materials and workmanship shall be in accordance with P.D.H. Form 409/49.
- Steel shall conform to A.S.T.M. A36.-62T.
- Reasonable modifications of the details shown may be permitted to meet special conditions.

Approved: AUG - 2 1963

K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

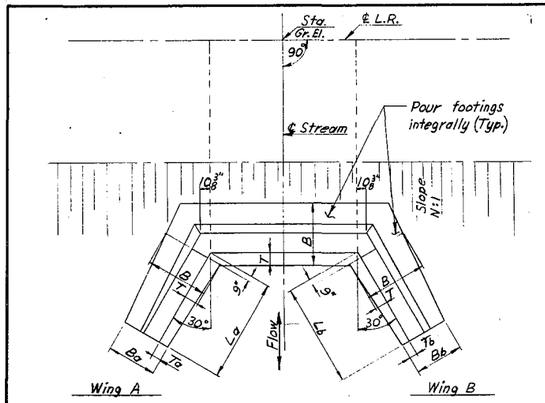
STANDARD
STEEL I-BEAM BRIDGES

DIAPHRAGMS

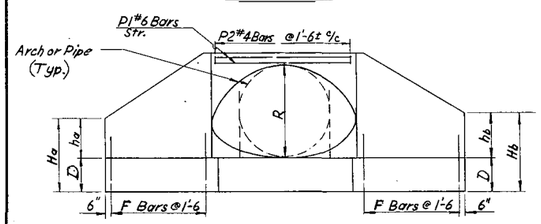
BY: BFK
CK: SRS

SHEET 1 OF 1

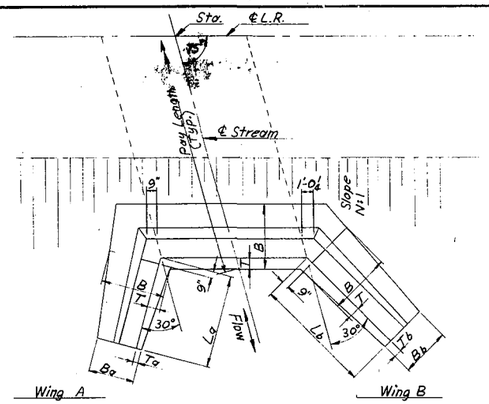
S-2724



PLAN



DEVELOPED ELEVATION



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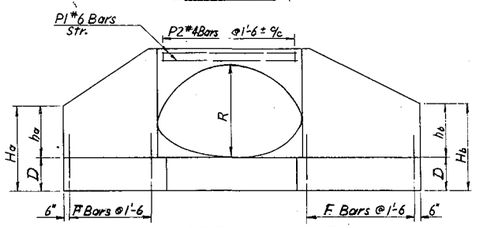

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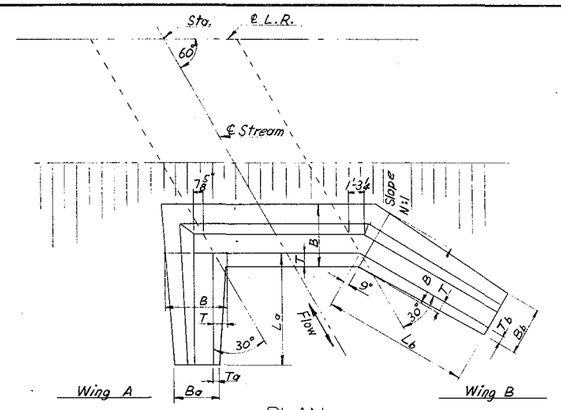

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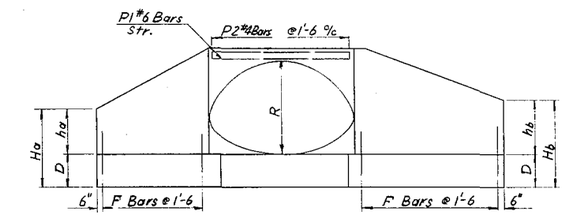


DEVELOPED ELEVATION

H Ha Hb	A	D	T Ta Tb	B Ba Bb	F Bars			Max. Design Found. Pressure
					Size	Spc. ℄	Lgth "a"	
4'	0	2'-0	6"	3'-6	#4	1'-6	3'-0"	.55 T/a'
5'	0	2'-0	6"	3'-9	#4	1'-6	3'-0"	.65
6'	0	2'-0	6"	4'-0	#4	1'-6	3'-6	.75
7'	0	2'-0	9"	4'-3	#4	1'-6	3'-6	.85
8'	0	2'-0	9"	4'-6	#4	1'-6	3'-6	.95
9'	0	2'-0	1'-0	5'-0	#4	1'-6	3'-6	1.05
10'	1	2'-6	1'-0	5'-6	#5	1'-6	4'-0	1.15
11'	1	2'-6	1'-3	6'-3	#5	1'-6	4'-0	1.25
12'	1	2'-6	1'-3	7'-0	#5	1'-6	4'-6	1.35
13'	2	2'-6	1'-3	7'-6	#5	1'-6	4'-6	1.45
14'	2	2'-6	1'-6	8'-0	#5	1'-6	4'-6	1.65
15'	2	3'-0	1'-6	8'-6	#6	1'-6	5'-0	1.75
16'	3	3'-0	1'-9	9'-0	#6	1'-6	5'-0	1.80
17'	3	3'-0	1'-9	9'-6	#6	1'-6	5'-0	1.90
18'	3	3'-0	2'-0	10'-0	#6	1'-6	5'-0	2.00
19'	3	3'-0	2'-0	10'-9	#6	1'-6	5'-0	2.15
20'	3	3'-0	2'-0	11'-6	#6	1'-6	5'-0	2.30 T/a'

TABLE I

Normal Roadway Fill Slope N:1	Skew Angle	Wing A La	Wing A ha	Wing B Lb	Wing B hb
1½:1	90°	1.10R - .55	.37R + .82	1.10R - .55	.37R + .82
	75°	1.02R - .51	.34R + .58	1.24R - .62	.41R + 1.00
	60°	R - .50	.33R + .33	1.50R - .75	.50R + 1.12
	45°	.88R - .44	.41R + .29	1.96R - .98	.50R + 1.17
2:1	90°	1.46R - .37	.37R + .78	1.46R - .37	.37R + .78
	75°	1.36R - .34	.34R + .61	1.66R - .41	.41R + .93
	60°	1.33R - .33	.33R + .42	2.00R - .50	.50R + 1.02
	45°	1.17R - .29	.41R + .40	2.61R - .65	.50R + 1.07

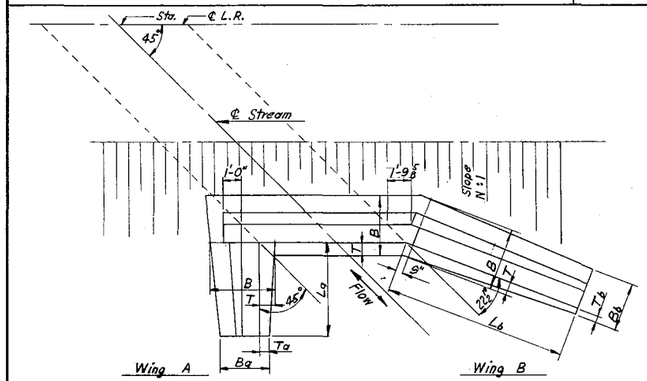
TABLE II

NOTES:

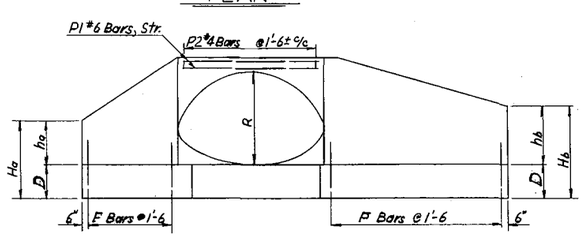
- All materials and workmanship shall be in accordance with P.D.H. form 408/60.
- Design Specs.: Design Division of 1961-AASHO "Standard Specs. for Hwy. Bridges."
- All concrete shall be Class B.
- Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- Chamfer exposed concrete edges 1" x 1" except as noted.
- Steel reinforcement bars designed for fs = 18,000 psi. and detailed as per A.C.I. Code.

Approved: AUG - 2 1963

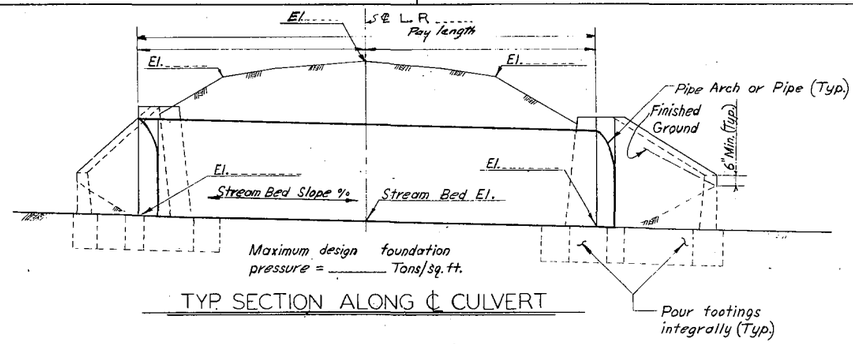
H. H. Jensen
Bridge Engineer



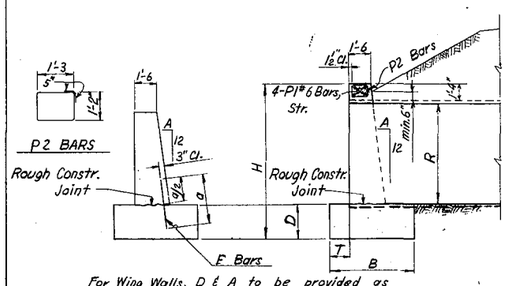
PLAN



DEVELOPED ELEVATION



TYP. SECTION ALONG ℄ CULVERT



For Wing Walls, D & A to be provided as determined for Head Wall "H"

TYP. WING WALL SECTION

TYP. HEAD WALL SECTION

INSTRUCTIONS FOR LAY-OUT

1. Establish H and determine A, B, D, and T from table I.
2. Establish La, ha, Lb, hb, from table II.
3. Make Ha = ha + D, Hb = hb + D and determine Ba, Bd, Ta, & Tb from table I.
4. Reasonable modifications of the details shown may be required to meet special conditions. For culverts on skew, the pipes may be cut square, if directed by the Engineer.
5. If bearing capacity of foundation is less than max. design foundation pressure shown in table I, revise footing as required and check stability of wall.
6. Gage of plate shall be indicated.
7. Downstream End-Wall may be omitted if directed by the Engineer.

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

STANDARD

END-WALL DETAILS FOR METAL PLATE CULVERTS

SKEWS: 90°-75°-60° & 45°

MADE: G.T.V. & K.R.P.
CHECKED: I.J

SHEET 1 OF 1

S-2725

TYPE 1 RETAINING WALL FOR LEVEL FILL

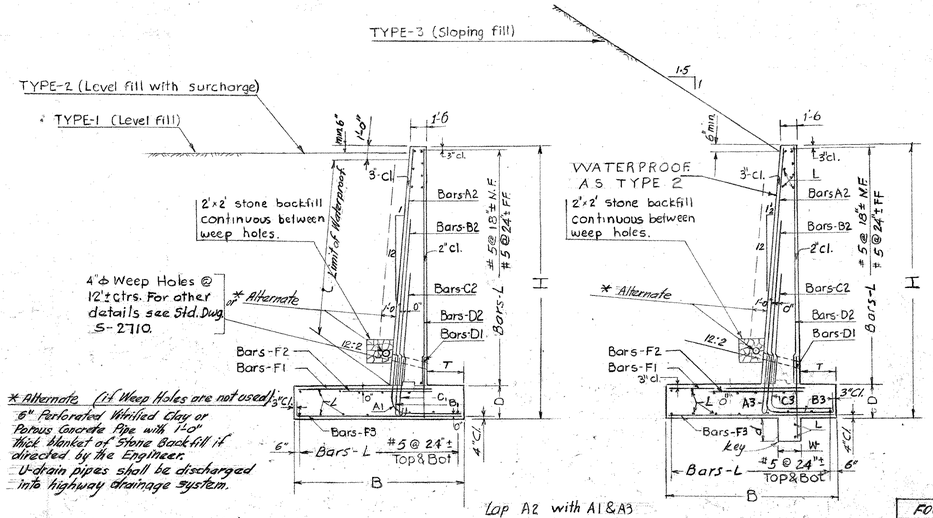
H	B	T	D	Toe press kips per sq. ft.	Bars-A1 (Bent) Size	Space	A	B	C	Length	Wt per ft.	Bars-B1 (Bent) Size	Space	A	C	Length	Wt per ft.	Bars-C1 (Bent) Size	Space	A	C	Length	Wt per ft.	Bars-A2 Size	Space	Length	Wt per ft.	Bars-B2 Size	Space	Length	Wt per ft.	Bars-C2 Size	Space	Length	Wt per ft.	Bars-D1 Size	Space	Length	Wt per ft.	Bars-D2 Size	Space	Length	Wt per ft.	Bars-F1 Size	Space	Length	Wt per ft.	Bars-F2 Size	Space	Length	Wt per ft.	Bars-F3 Size	Space	Length	Wt per ft.	Bars-L #5 No bars	Bars-L #5 Wt per ft.	Lbs. Reinf. per ft. of wall	C.Y. concrete per lin. ft. of wall: Stem	C.Y. concrete per lin. ft. of wall: Footing
10'	5'-3	1'-0	2'-0	1.86	4	12"	9'-0	9"	6"	10'-4	6.92																									4	18"	9'-9	4.35					4	12"	4'-0	2.68					4	12"	4'-9	3.18	18	16.7	33.83	0.54	0.39
12'	6'-6	1'-3	2'-0	1.92	5	12"	11'-0	11"	6"	12'-4	12.9																									4	18"	11'-9	5.24					4	12"	5'-0	5.21					4	12"	6'-0	4.00	22	18.7	46.05	0.71	0.48
14'	7'-6	1'-3	2'-0	2.72	5	12"	3'-4	3 3/4"	6"	4'-8	5.0													5	12"	11'-9	12.30									4	18"	3'-0	1.34	4	18"	11'-9	5.25	5	12"	5'-0	6.25					4	12"	7'-0	4.68	25	22.0	56.82	0.89	0.56
16'	8'-6	1'-6	2'-0	2.86	4	12"	2'-11	2 7/8"	6"	5'-1	2.84	4	12"	8'-3	6"	8'-9	5.84							4	12"	13'-9	9.20									4	18"	3'-0	1.34	4	18"	13'-9	6.12	5	12"	6'-9	7.05	5	12"	5'-6	5.75	4	12"	8'-0	5.35	28	25.4	68.89	1.08	0.63
18'	9'-6	1'-6	2'-6	3.64	4	12"	3'-5	3 3/8"	6"	5'-7	3.18	5	12"	10'-0	7"	10'-7	11.1							4	12"	15'-3	10.20									4	18"	3'-6	1.56	4	18"	15'-3	6.80	5	9"	7'-9	10.8	4	9"	6'-0	5.32	4	12"	9'-0	6.00	31	26.7	81.66	1.23	0.88
20'	10'-6	1'-6	2'-6	4.15	5	18"	3'-10	3 5/8"	6"	6'-0	3.60	5	18"	4'-4	7"	4'-11	3.44	5	9"	7'-9	7"	8'-4	11.60	5	18"	17'-3	12.0	5	18"	9'-6	6.61					4	18"	3'-6	1.56	4	18"	17'-3	7.70	6	9"	8'-9	17.5	4	9"	7'-0	6.22	5	18"	10'-0	6.95	34	30.8	107.98	1.44	0.97
22'	11'-9	1'-9	2'-9	4.20	5	18"	4'-1	4 1/8"	6"	6'-3	3.78	5	18"	4'-7	7"	5'-2	3.61	6	9"	8'-9	8"	9'-5	18.9	5	18"	19'-0	13.3	5	18"	11'-3	7.85					4	18"	3'-9	1.67	4	18"	19'-0	8.45	6	9"	9'-9	19.6	4	9"	8'-0	7.10	5	18"	11'-3	7.82	38	34.1	126.19	1.64	1.20
24'	12'-6	1'-9	2'-9	5.10	5	18"	4'-1	4 1/8"	6"	7'-1	3.78	6	18"	5'-0	8"	5'-8	5.67	7	9"	10'-3	10"	11'-1	30.2	5	18"	21'-0	14.7	6	18"	13'-3	13.25					4	18"	3'-9	1.67	4	18"	21'-0	9.35	7	9"	10'-6	28.6	6	9"	8'-6	17.1	5	18"	12'-0	8.34	42	36.1	168.78	1.88	1.27
26'	13'-9	2'-0	3'-0	5.23	5	18"	4'-4	4 3/8"	6"	7'-4	3.96	7	18"	5'-8	10"	6'-6	8.85	7	9"	5'-8	10"	6'-6	17.75	5	18"	22'-9	15.9	7	18"	15'-0	20.4	7	9"	9'-6	25.8	4	18"	4'-0	1.78	4	18"	22'-9	10.20	8	9"	11'-6	41.0	7	9"	8'-9	23.9	5	18	13'-3	9.21	47	39.4	218.15	2.09	1.53
28'	14'-9	2'-3	3'-0	5.60	5	18"	4'-4	4 3/8"	4'-3	11'-1	6.57	8	18"	6'-1	1'-1	7'-2	12.80	8	9"	6'-1	1'-1	7'-2	25.5	6	18"	24'-9	17.3	8	18"	17'-0	30.2	8	9"	10'-0	35.6	4	18"	4'-0	1.78	4	18"	24'-9	11.0	8	9"	12'-3	43.6	7	9"	9'-0	24.6	5	18	14'-3	9.95	51	42.7	261.60	2.35	1.64
30'	16'-6	2'-9	3'-0	5.70	6	18"	4'-9	4 3/4"	5'-6	12'-9	11.1	8	18"	6'-1	1'-1	7'-2	12.80	9	9"	6'-6	1'-3	7'-9	35.1	6	18"	26'-9	26.83	8	18"	19'-0	38.7	9	9"	11'-0	50.0	4	18"	4'-0	1.78	4	18"	26'-9	11.90	9	9"	13'-6	61.2	9	9"	9'-6	43.2	5	18	16'-0	11.15	54	46.1	349.86	2.63	1.83

TYPE 2 RETAINING WALL FOR LEVEL FILL WITH 240 PSF SURCHARGE

H	B	T	D	Toe press kips per sq. ft.	Bars-A1 (Bent) Size	Space	A	B	C	Length	Wt per ft.	Bars-B1 (Bent) Size	Space	A	C	Length	Wt per ft.	Bars-C1 (Bent) Size	Space	A	C	Length	Wt per ft.	Bars-A2 Size	Space	Length	Wt per ft.	Bars-B2 Size	Space	Length	Wt per ft.	Bars-C2 Size	Space	Length	Wt per ft.	Bars-D1 Size	Space	Length	Wt per ft.	Bars-D2 Size	Space	Length	Wt per ft.	Bars-F1 Size	Space	Length	Wt per ft.	Bars-F2 Size	Space	Length	Wt per ft.	Bars-F3 Size	Space	Length	Wt per ft.	Bars-L #5 No bars	Bars-L #5 Wt per ft.	Lbs Reinf. per ft. of wall	C.Y. concrete per lin. ft. of wall: Stem	C.Y. concrete per lin. ft. of wall: Footing
10'	6'-3	1'-0	2'-0	1.91	4	12"	9'-0	9"	6"	10'-4	6.92																									4	18"	9'-9	4.35					4	12"	5'-0	3.34					4	12"	5'-9	3.84	20	18.1	36.55	0.54	0.46
12'	7'-6	1'-3	2'-0	2.12	5	12"	11'-0	11"	6"	12'-4	12.90																									4	18"	11'-9	5.24					5	12"	6'-0	6.27					4	12"	7'-0	4.67	24	20.1	49.18	0.71	0.55
14'	8'-6	1'-3	2'-0	3.02	4	12"	3'-0	3"	6"	4'-4	2.90	4	12"	6'-3	6"	7'-7	5.06							4	12"	11'-9	7.85									4	18"	3'-0	1.34	4	18"	11'-9	5.25	6	12"	7'-0	10.5					4	12"	8'-0	5.34	27	23.4	61.64	0.89	0.63
16'	9'-6	1'-6	2'-0	3.22	4	12"	3'-0	3"	6"	5'-2	2.90	5	12"	8'-6	7"	9'-10	9.5							4	12"	13'-9	9.20									4	18"	3'-0	1.34	4	18"	13'-9	6.12	5	12"	7'-9	8.10	5	12"	6'-0	6.25	4	12"	9'-0	6.01	30	26.7	76.12	1.08	0.70
18'	10'-6	1'-6	2'-6	4.00	5	12"	3'-10	3 5/8"	6"	6'-0	5.40	6	12"	10.6	8"	11'-2	16.8							5	12"	15'-3	15.90									4	18"	3'-6	1.56	4	18"	15'-3	6.80	7	12"	8'-9	17.9	6	12"	6'-6	9.76	4	12"	10'-0	6.68	33	28.1	108.90	1.23	0.97
20'	11'-6	1'-6	2'-6	4.50	5	18"	3'-10	3 5/8"	6"	6'-0	3.60	5	18"	4'-4	7"	4'-11	3.44	6	9"	8'-0	8"	8'-8	17.4	5	18"	17'-3	12.0	5	18"	12'-6	8.70					4	18"	3'-6	1.56	4	18"	17'-3	7.70	7	9"	9'-9	26.4	6	9"	7'-6	15.0	5	18"	11'-0	7.65	36	32.1	135.55	1.44	1.06
22'	12'-9	1'-9	2'-9	5.00	5	18"	4'-1	4 1/8"	6"	6'-3	3.77	6	18"	5'-0	8"	5'-8	5.67	7	9"	10.0	10"	10'-10	29.6	5	18"	19'-0	13.3	6	18"	14'-6	14.5					4	18"	3'-9	1.67	4	18"	21'-0	9.35	8	9"	10'-9	38.3	6	9"	8'-6	17.0	5	18"	12'-3	8.52	40	35.4	176.18	1.64	1.30
24'	13'-6	1'-9	2'-9	5.40	5	18"	4'-1	4 1/8"	6"	7'-1	3.77	7	18"	5'-5	10"	6'-3	8.50	7	9"	5'-5	10"	6'-3	17.0	5	18"	21'-0	14.7	7	18"	16'-6	22.4	7	9"	10'-6	28.7	4	18"	3'-9	1.67	4	18"	21'-0	9.35	8	9"	11'-6	41.0	7	9"	9'-0	24.6	5	18"	13'-0	9.04	44	37.4	218.13	1.88	1.38
26'	14'-9	2'-0	3'-0	5.65	5	18"	4'-4	4 3/8"	4'-5	11'-3	6.66	8	18"	6'-1	1'-1	7'-2	12.75	8	9"	6'-1	1'-1	7'-2	25.5	5	18"	22'-9	15.9	8	18"	18'-0	32.0	8	9"	12'-6	44.6	4	18"	4'-1.0	1.78	4	18"	22'-9	10.20	8	9"	13'-9	44.5	8	9"	9'-3	32.9	5	18"	14'-3	9.94	49	40.8	272.53	2.09	1.64
28'	16'-0	2'-6	3'-0	6.00	6	18"	4'-9	4 3/4"	5'-1	12'-4	10.67	8	18"	6'-1	1'-1	7'-2	12.75	9	9"	6'-6	1'-3"	7'-9	35.1	6	18"	24'-9	24.83	8	18"	18'-6	32.9	9	9"	11'-9	53.5	4	18"	4'-0	1.78	4	18"	24'-9	11.0	10	9"	13'-6	77.6	8	9"	9'-3	33.8	5	18"	15'-6	10.8	53	44.1	348.83	2.35	1.78
30'	17'-9	3'-0	3'-0"	6.06	6	18"	4'-9	4 3/4"	5'-9	13'-0	11.33	8	18"	6'-1	1'-1	7'-2	12.75	10	9"	6'-11	1'-5"	8'-4	48.0	6	18"	26'-9	26.83	8	18"	20'-6	36.4	10	9"	13'-9	79.0	4	18"	4'-0	1.78	4	18"	26'-9	11.9	10	9"	14'-9	84.6	8	9"	10'-0	36.6	5	18"	17'-3	12'-0	56	47.5	488.69	2.63	1.97

TYPE 3 RETAINING WALL FOR SLOPING BANK — 1½ : 1

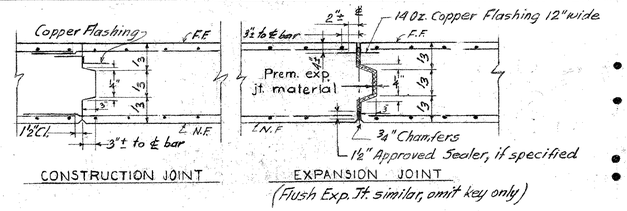
H	B	T	D	Toe press Kips per sq. ft.	Bars-A3 Size	Space	A	C	Length	Wt per ft.	Bars-B3 Size	Space	A	B	C	Length	Wt per ft.	Bars-C3 Size	Space	A	B	C	Length	Wt per ft.	Bars-A2 Size	Space	Length	Wt per ft.	Bars-B2 Size	Space	Length	Wt per ft.	Bars-C2 Size	Space	Length	Wt per ft.	Bars-D1 Size	Space	Length	Wt per ft.	Bars-D2 Size	Space	Length	Wt per ft.	Bars-F1 Size	Space	Length	Wt per ft.	Bars-F2 Size	Space	Length	Wt per ft.	Bars-F3 Size	Space	Length	Wt per ft.	Bars-L #5 No bars	Bars-L #5 Wt per ft.	Lbs Reinf. per ft. of wall	C.Y. concrete per lin. ft. of wall: Stem	C.Y. concrete per lin. ft. of wall: Footing
10'	6'-9	1'-3"	2'-0	3.00	4	12"	9'-6	6"	10'-0	6.68																										4	18"	10'-9	4.79					5	12"	5'-6	5.74					4	12"	6'-3	4.17	24	20.04	41.42	0.59	0.57
12'	8'-0	1'-6	2'-0	3.50	5	12"	11'-6	7"	12'-1	19.35																										4	18"	12'-9	5.68					6	12"	6'-6	9.76					4	12"	7'-6	5.01	28	22.04	61.84	0.79	0.66
14'	9'-6	1'-9	2'-0	4.25	5	12"	3'-10	7"	4'-5	4.61	5	12"	7'-6	11"	6"	9'-10	9.21							5	12"	11'-9	12.30									4	18"	4'-3	1.89	4	18"	11'-9	5.25	7	12"	7'-9	15.84					4	12"	9'-0	6.01	31	25.38	80.49	1.11	0.78
16'	10'-9	2'-0	2'-0	4.75	5	12"	3'-10	7"	4'-5	4.61	6	12"	9'-6	1'-2	6"	11'-8"	16.27							5	12"	13'-9	14.40									4	18"	4'-3	1.89	4	18"	13'-9	6.12	8	12"	8'-9	23.96					5	12"	10'-3	10.69	34	28.72	106.06	1.38	0.91
18'	12'-3	2'-6	2'-6	5.50	5	18"	4'-4	7"	4'-11	3.42	5	18"	3'-10	6"	4'-9	10'-3"	6.55	6	9"	8'-0	1'-0	6"	10'-2	18.69	5	18"	15'-3	10.60	5	18"	10'-6	7.33					4	18"	4'-9	2.12	4	18"	15'-3	6.80	7	9"	9'-9	26.57	7	9"	7'-0	19.08	5	18"	11'-9	8.17	37	30.73	140.06	1.60	1.25
20'	13'-9	2'-9	2'-6	6.00	5	18"	4'-4	7"	4'-11	3.42	6	18"	4'-3	6"	5'-3	11'-2	10.35	6	9"	9'-6	1'-2	6"	11'-8	21.69	5	18"	17'-3	12.0	6	18"	12'-6	12.5					4	18"	5'-3	2.34	4	18"	17'-3	7.70	8	9"	11'-0	39.16	7	9"	8'-0	21.80	5	18"	13'-3	9.12	40	34.07	174.15	1.91	1.46
22'	15'-0	3'-0	2'-9	6.50	5	18"	5'-0	7"	5'-7	3.88	6	18"	4'-6	6 3/4"	5'-6	11'-8	10.85	7	9"	5'-0	1 1/2"	5'-6	12'-2	30.89	5	18"	19'-0	13.21	6	18"	13'-6	13.52	7	9"	9'-0	24.53	4	18"	5'-6	2.45	4	18"	19'-0	8.45	8	9"	12'-0	42.72	8	9"	9'-0	32.03	5	18	14'-6	10.06	44	37.41	230.02	2.21	1.71
24'	16'-3	3'-6	2'-9	7.25	6	18"	5'-0	8"	5'-8	5.67	7	18"	5'-0	7 1/2"	6'-0	13'-6	16.13	8	9"	5'-6	6 1/4"	6'-0	13'-11	43.90	6	18"	21'-0	24.1	7	18"	15'-6	21.1	8	9"	10'-0	35.60	4	18"	5'-6	2.45	4	18"	21'-0	9.35	9	9"	12'-9	57.80	8	9"	10'-0	35.59	5	18	15'-9	10.95	48	39.41	299.05	2.58	1.84
26'	17'-6	4'-0	3'-0	7.75	6	18"	5'-3	8"	5'-11	5.93	7	18"	5'-8	8 1/2"	7'-0	15'-2	18.40	9	9"	6'-0	9"	7'-0	15'-6	62.71	6	18"	22'-9	22.83	7	18"	17'-6	23.8	9	9"	9'-6	43.06	4	18"	5'-9	2.56	4	18"	22'-9	10.2	9	9"	13'-6	61.20	8	9"	10'-6	37.38	5	18"	17'-0	11.82	53	43.42	343.31	2.91	2.13
28'	18'-9	4'-6	3'-0	8.50	7	18"	5'-8	10"	6'-6	8.86	9	18"	6'-0	9"	7'-6	16'-0	32.49	10	9"	6'-5	9 3/4"	7'-6	16'-5	84.62	7	18"	24'-9	34.0	9	18"	16'-6	37.4	10	9"	9'-6	54.6	4	18"	5'-9	2.56	4	18"	24'-9	11.0	9	9"	14'-3	64.60	9	9"	11'-0	49.86	5	18"	18'-3	12.69	57	46.76	439.48	3.31	2.27
30'	20'-0	5'-0	3'-0	9.00	7	18"	5'-8	10"	6'-6	8.86	9	18"	6'-0	9"	8'-0	16'-6	33.62	11	9"	6'-10	10 3/4"	8'-0	17'-4	111.0	7	18"	26'-9	36.6	9	18"	17'-6	39.6	11	9"	9'-6	61.3	4	18"	5'-9	2.56	4	18"	26'-9	11.9	10	9"	15'-0	86.05	9	9"	11'-6	52.13	5	18"	19'-6	13.56	60	50.10	513.28	3.76	2.41



TYPICAL - SECTIONS

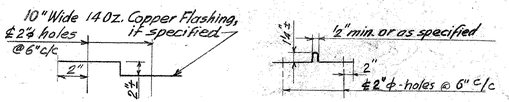
Note: Special design is required for footings on rock or piles.

* Alternate (If Weep Holes are not used) 6" Perforated Vitrified Clay or Porous Concrete Pipe with 1'-0" thick blanket of Stone Backfill if directed by the Engineer. U-drain pipes shall be discharged into highway drainage system.



N.F. = Near Face F.F. = Far Face

Keys of construction and expansion jts. shall be carried up to a line one foot below top of wall. From that line butt jts. shall be extended to the top of wall.



DETAILS OF COPPER FLASHINGS

For Construction Jt. For Expansion Jt.

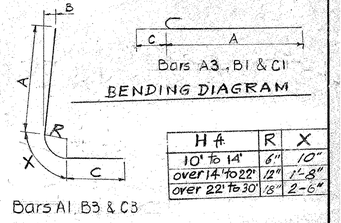
FOOTING KEY		
H	W	d
10'-12'	18"	15"
14'-18'	24"	18"
20'-30'	30"	24"

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Form 408/1960.
- Steel reinforcement bars designed for f_s=18,000 psi. and detailed as per A.C.I. code. Bars to be lapped min. 30 Dia.
- Concrete: Class B concrete.
- The base of the footings may be ordered by the Eng. to be at any elevation or of any dimensions to provide a proper foundation.
- Two-Coat painted waterproofing shall be applied to rear faces of the walls within limits shown, if specified.
- Provide 2" cover on reinforcement bars, except as noted.
- Exposed concrete edges shall be chamfered 1"x1", except as noted.
- Provide expansion jts. @ 90' max.
- Provide construction jts. @ 30' max.
- Design Spcs.: Design Division of 1961-AASHO "Std. Specifications for Highway Bridges."

Design Data:

Coeff. of Friction between soil and base = 0.45
Factor against sliding = 1.5 min.
Factor against overturning = 2.0 min.
Earth Pressure: Equivalent fluid pressure of 35 #/Cu. ft.



H ft.	R	X
10' to 14'	6"	10"
over 14' to 22'	12"	1'-8"
over 22' to 30'	18"	2'-6"

Commonwealth of Pennsylvania

Department of Highways
BRIDGE UNIT

Approved: AUG - 2 1963
H. H. Jensen
Bridge Engineer

STANDARD REINFORCED CONCRETE RETAINING WALLS

Designed: K.R.P.
Checked: E.L.H.

SHEET 1 OF 1

S-2726

ABUTMENT TYPE I

H	B	T	D	Toe pressure in tons/s.f. for total load — Superstructure Load K/ft. 5	7	9	11	Bars A-1 Size	Space	Length	Wt/Ft.	Bars A-2 Size	Space	Length	Wt/Ft.	#4 Bars A-3 No.	Wt/Ft.	Bars A-4 (Bent) Size	Space	A	Length	Wt/Ft.
10'	6'-0	1'-0	2'-0	1.65	1.90	2.20	2.50	5	18"	5'-6	3.82					7	6.0	5	18"	4'-6	5'-1	3.53
12'	7'-0	1'-3	2'-0	1.82	2.07	2.32	2.62	5	18"	6'-6	4.51					8	7.35	5	18"	6'-6	7'-1	4.92
14'	8'-0	1'-6	2'-0	1.88	2.08	2.25	2.63	5	18"	7'-6	5.21	4	18"	3'-0	1.33	9	7.35	6	18"	8'-6	9'-2	9.16
16'	9'-0	1'-9	2'-0	2.16	2.30	2.55	2.80	5	18"	8'-6	5.90	4	18"	3'-6	1.56	10	8.7	7	18"	4'-6	5'-4	7.26

H	Bars A-5 Size	Space	Length	Wt/Ft.	Bars A-6 Size	Space	Length	Wt/Ft.	Bars A-7 Size	Space	Length	Wt/Ft.	Bars A-8 Size	Space	Length	Wt/Ft.	Bars A-9 No.	Wt/Ft.	Bars A-10 (Bent) Size	Space	Length	Wt/Ft.
10'	4	18"	4'-6	2.00	4	12"	4'-9	3.17	-	-	-	-	-	-	-	-	8	6.68	4	18"	4'-8"	2.08
12'	4	18"	6'-6	2.89	5	12"	6'-6	5.74	-	-	-	-	-	-	-	-	10	8.68	4	18"	4'-8	2.08
14'	4	18"	8'-6	3.78	5	12"	6'-3	6.52	-	-	-	-	-	-	-	-	14	12.02	4	18"	4'-8	2.08
16'	4	18"	2'-9	1.22	5	12"	7'-0	7.30	7	18"	8'-10	12.04	4	18"	8'-10	3.93	16	14.03	4	18"	4'-8	2.08

H	Bars A-11 (Bent) Size	Space	A	B	C	Length	Wt/Ft.	Bars A-12 Size	Space	Length	Wt/Ft.	Bars A-13 Size	Space	Length	Wt/Ft.	#4 Bars AA (Bent) Nos	Wt/Ft.	Reinforcement in lbs. per lineal foot	C.Y. of concrete per foot Class AA	Class B
10'	5	18"	1'-0	5'-0	-	6'-0	4.00	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	46.40	0.27	0.89
12'	5	18"	1'-0	5'-0	-	6'-0	4.00	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	55.39	0.27	1.26
14'	5	18"	1'-0	5'-0	-	6'-0	4.00	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	66.57	0.27	1.63
16'	5	18"	1'-0	5'-0	-	6'-0	4.00	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	83.14	0.27	2.00

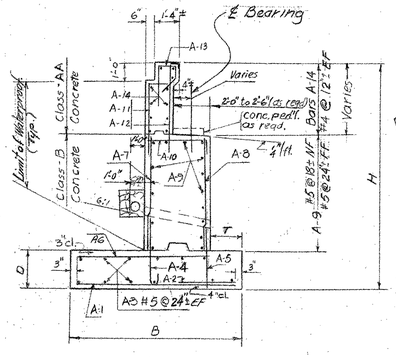
ABUTMENT TYPE II

H	B	T	D	Toe pressure in tons/s.f. for total load — Superstructure Load K/ft. 5.0	7.0	9.0	11.0	Bars A-1 Size	Space	Length	Wt/Ft.	Bars A-2 Size	Space	Length	Wt/Ft.	#4 Bars A-3 Nos	Wt/Ft.	Bars A-4 (Bent) Size	Space	A	Length	Wt/Ft.
18'	10'-0	2'-0	2'-0	2.18	2.32	2.53	2.72	5	18"	9'-6	6.60	5	18"	4'-0	2.78	11	9.4	7	9"	4'-8	5'-6	14.98
20'	12'-0	2'-0	2'-0	2.33	2.55	2.72	2.92	5	18"	11'-6	7.99	5	18"	4'-0	2.78	12	10.1	8	9"	4'-11	6'-0	21.35
22'	13'-0	2'-3	2'-6	2.47	2.67	2.85	3.02	5	18"	12'-6	8.69	5	18	4'-0	2.78	14	12.02	8	18	5'-5	6'-6	11.56
24'	14'-0	2'-9	2'-6	1.94	2.63	2.83	3.01	5	18"	13'-6	9.38	7	18"	5'-0	6.81	15	12.73	8	18"	5'-5	6'-6	11.56
26'	15'-6	3'-0	3'-0	2.12	2.27	2.90	3.14	5	18"	15'-0	10.43	7	18"	5'-6	7.49	16	13.4	9	18"	6'-6	7'-9	17.55
28'	16'-6	3'-6	3'-0	2.75	2.84	2.99	3.13	5	18"	16'-0	11.12	9	18"	7'-0	15.85	17	14.07	10	18"	7'-1	8'-6	24.36
30'	18'-0	4'-0	3'-0	2.75	2.84	3.00	3.13	5	18"	17'-6	12.16	10	18"	7'-6	21.49	18	14.74	11	18"	7'-5	9'-0	31.85

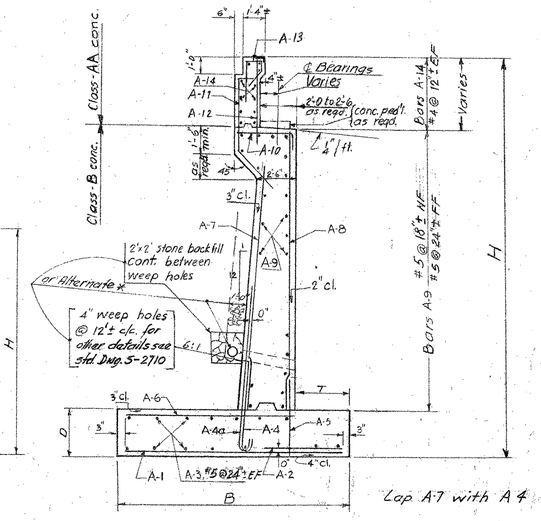
H	Bars A-4a (Bent) Size	Space	A	Length	Wt/Ft.	Bars A-5 Size	Space	Length	Wt/Ft.	Bars A-6 Size	Space	Length	Wt/Ft.	Bars A-7 Size	Space	Length	Wt/Ft.	Bars A-8 Size	Space	Length	Wt/Ft.
18'	-	-	-	-	-	4	18"	3'-0	1.34	6	9"	7'-9	15.52	7	9"	9'-0	24.52	4	18"	10'-9	4.78
20'	-	-	-	-	-	4	18"	3'-0	1.34	8	9"	9'-9	34.70	8	9"	11'-0	39.15	4	18"	12'-9	5.67
22'	9	18"	11'-6	12'-9	28.87	4	18"	3'-6	1.56	9	9"	10'-6	47.58	8	18"	12'-6	22.23	4	18"	14'-3	6.34
24'	10	18"	12'-5	14'-0	40.12	4	18"	3'-6	1.56	10	9"	11'-0	63.09	8	18"	12'-6	25.28	4	18"	16'-3	7.23
26'	11	18"	13'-1	15'-6	54.74	4	18"	4'-0	1.78	9	6"	12'-3	83.30	9	18"	16'-0	36.23	4	18"	17'-9	7.90
28'	11	18"	13'-11	15'-6	54.74	4	18"	4'-0	1.78	10	6"	12'-9	109.65	10	18"	18'-0	51.58	4	18"	19'-9	8.79
30'	11	18"	14'-11	16'-6	58.38	4	18"	4'-0	1.78	11	6"	13'-9	146.11	11	18"	20'-0	70.77	4	18"	21'-9	9.68

H	Bars A-9 Nos	Wt/Ft.	Bars A-10 (Bent) Size	Space	Length	Wt/Ft.	Bars A-11 (Bent) Size	Space	A	B	C	Length	Wt/Ft.	Bars A-12 Size	Space	Length	Wt/Ft.	Bars A-13 Size	Space	Length	Wt/Ft.	#4 Bars AA (Bent) Nos	Wt/Ft.	Reinforcement in lbs. per lineal foot	C.Y. of concrete per foot Class AA	Class B
18'	19	16.70	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	120.07	0.27	1.98
20'	21	18.70	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	155.23	0.27	2.37
22'	23	20.70	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	185.78	0.27	2.92
24'	26	22.71	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	223.92	0.27	3.23
26'	29	25.38	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	281.65	0.27	3.86
28'	31	27.39	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	342.24	0.27	4.26
30'	34	30.06	4	18"	4'-8	2.08	5	18"	1'-0	5'-0	3'-0	9'-0	6.25	5	18"	6'-0	4.17	5	18"	5'-2"	3.60	11	7.35	420.47	0.27	4.72

Quantities above based on 5'-back wall.



ABUTMENT TYPE I

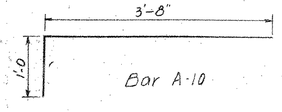


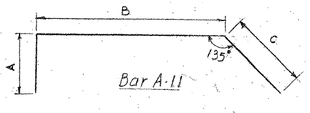
ABUTMENT TYPE II

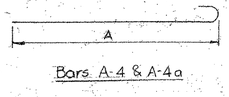
Lap A-7 with A-4

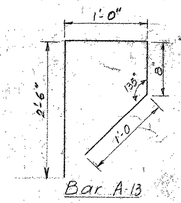
NF denotes Near Face
FF denotes Far Face
EF denotes Each Face

* Alternate (If Weep Holes are not used)
6" Perforated Vitrified Clay or Porous Concrete Pipe with 1'-0" thick blanket of Stone Backfill if directed by the Engineer. U-drain pipes shall be discharged into highway drainage system.









BENDING DIAGRAMS

GENERAL NOTES

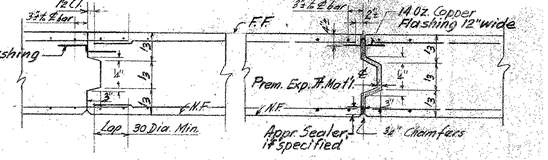
- All material and workmanship shall be in accordance with P.D.H Form 408/1960.
- Steel reinforcement bars designed for f_s=18,000 psi and detailed as per A.C.I. Code. Bars to be lapped min. 30 Dia.
- The base of the footings may be ordered by the Eng. to be at any elevation or of any dimensions to provide proper foundation.
- Backwalls shall not be poured until after structural steel and dams have been erected and deck slab has been poured.
- Two coat painted water proofing shall be applied to rear faces of the walls within limits shown if specified.
- Provide 2" cover on reinforcement bars except as noted.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- Concrete: as noted.
- Design Specs: Design Division of 1961-AASHO "Std. Specifications for Highway Bridges."

DESIGN DATA

Earth Pressure: Equivalent fluid pressure 35#/cu. ft.
Friction between soil and base = 0.45
Factor against overturning = 2.00 min.
Factor against sliding = 1.5 min.

Notes:

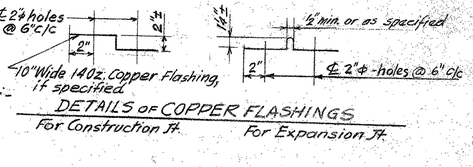
Special design is required for footings on rock or piles.
For Typical Layout of Abutments with Backwall see Std. Dwg. S-2728.



CONSTRUCTION JOINT — EXPANSION JOINT

Flush Exp. Jt. similar, omit Key only.

Keys of construction and expansion jts. shall be carried up to a line one foot below top of wall. From that line butt jts. shall be extended to the top of wall.



DETAILS OF COPPER FLASHINGS

For Construction Jt. — For Expansion Jt.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

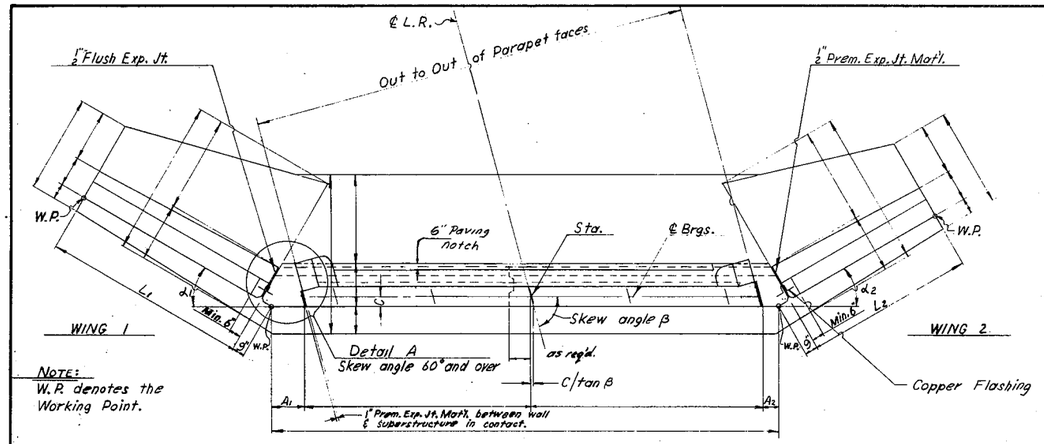
Approved AUG - 2 1963
R. H. Jensen
Bridge Engineer

STANDARD R.C. ABUTMENTS WITH BACKWALL

Designed: E.L.H.
Checked: K.R.P.

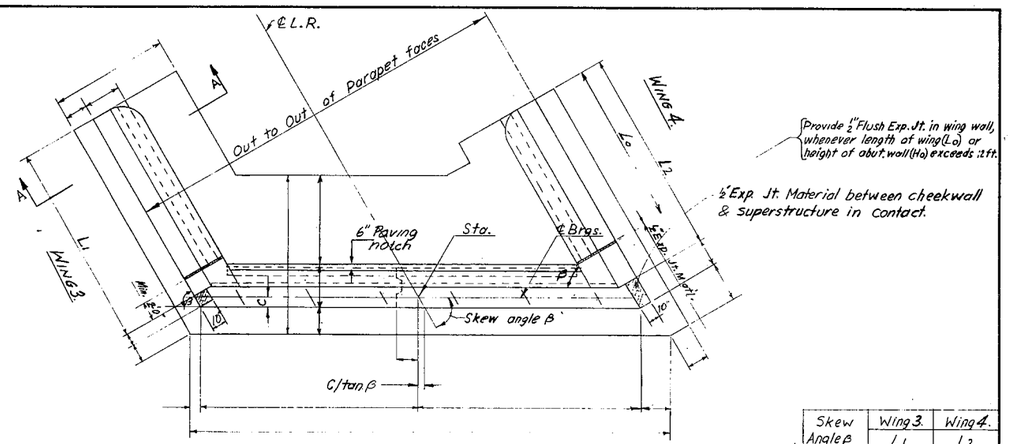
SHEET 1 OF 1

S-2727



NOTE:
W.P. denotes the Working Point.

TYPICAL PLAN
(Angled-Type Wings)

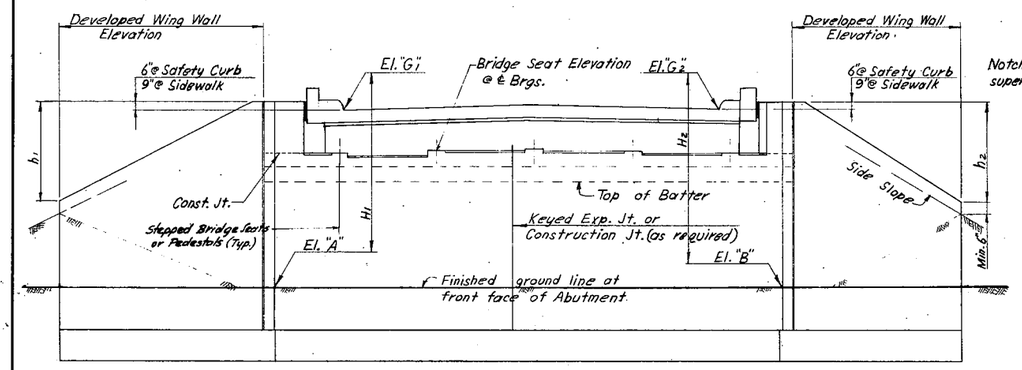


Provide ½" Flush Exp. Jt. in wing wall, whenever length of wing (Lo) or height of abut. wall (Ho) exceeds 12 ft.

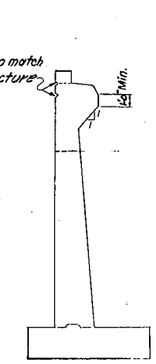
½ Exp. Jt. Material between cheekwall & superstructure in contact.

TYPICAL PLAN
(U-Type Wings)

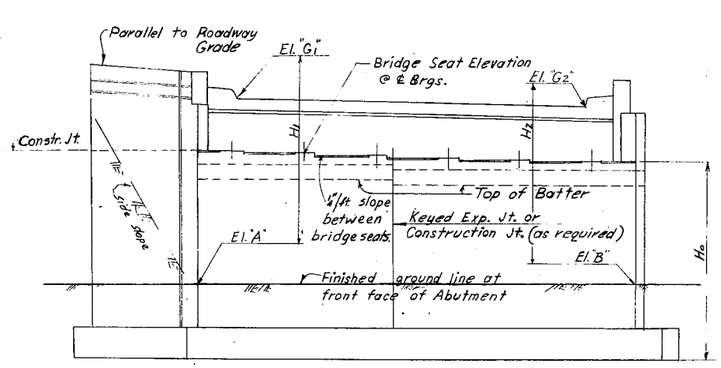
Normal Roadway Fill Slope		Skew Angle β	Wing 3. L1	Wing 4. L2
2:1	1½:1	90	1.5 H1	1.5 H2
		75	1.55 H1	1.55 H2
		60	1.73 H1	1.73 H2
		45	2.12 H1	2.12 H2
		30	3.00 H1	3.00 H2
	2:1	90	2.00 H1	2.00 H2
		75	2.07 H1	2.07 H2
		60	2.31 H1	2.31 H2
		45	2.83 H1	2.83 H2
		30	4.00 H1	4.00 H2



TYPICAL ELEVATION



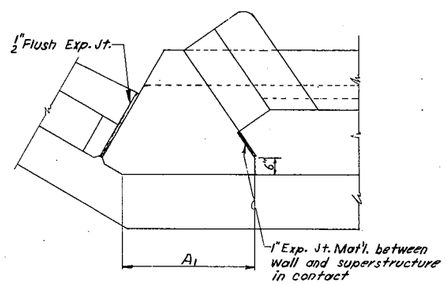
SECTION AA
WING WALLS



TYPICAL ELEVATION

Normal Roadway Fill Slope		Skew Angle β	WING 1 d1	A1	L1	h1	WING 2 d2	A2	L2	h2
2:1	1½:1	90°	30°	2'-0	1.10 H1 - 1.50	.63 H1 - 1.00	30°	2'-0	1.10 H2 - 1.50	.63 H2 - 1.00
		75°	30°	3'-0	1.24 H1 - 3.25	.59 H1 - .75	30°	1'-6	1.02 H2 - 1.00	.66 H2 - 1.25
		60°	30°	4'-0	1.50 H1 - 3.75	.50 H1 - .50	30°	1'-0	H2 - .25	.67 H2 - 1.50
		45°	22½°	5'-0	1.96 H1 - 4.75	.50 H1 - .25	45°	1'-0	.88 H2	.59 H2 - 1.50
		30°	15°	6'-0	2.90 H1 - 6.25	.50 H1	60°	1'-0	.80 H2	.54 H2 - 1.50
	2:1	90°	30°	2'-0	1.46 H1 - 1.50	.63 H1 - 1.00	30°	2'-0	1.46 H2 - 1.50	.63 H2 - 1.00
		75°	30°	3'-0	1.66 H1 - 3.25	.59 H1 - .75	30°	1'-6	1.36 H2 - 1.00	.66 H2 - 1.25
		60°	30°	4'-0	2.00 H1 - 3.75	.50 H1 - .50	30°	1'-0	1.33 H2 - .25	.67 H2 - 1.50
		45°	22½°	5'-0	2.61 H1 - 4.75	.50 H1 - .25	45°	1'-0	1.17 H2	.59 H2 - 1.50
		30°	15°	6'-0	3.86 H1 - 6.75	.50 H1	60°	1'-0	1.07 H2	.54 H2 - 1.50

Elevations "G1" and "G2" are at the intersection of the bearing ℄ and the gutter lines; for superstructures without defined bearing ℄, El. "G1", "G2" and bridge seat elevations shall be taken at the near face of abutments.
H1 = El. "G1" - El. "A" H2 = El. "G2" - El. "B"



Detail A
Skew angle 60° and under

Notes:
- Bridge seat may be stepped or pedestals may be provided as required.
- For Abutments, Wing walls and jt. details, see Standard Drawings No. S-2726 and S-2727.
- Dimensions L1, h1, L2 & h2 are based on a grade of less then 1% on the overpassing roadway. Adjustments are to be made where the grade exceeds 1%.
- Reasonable modifications of details shown may be required to meet special conditions.

Approved: AUG - 2 1963
R. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

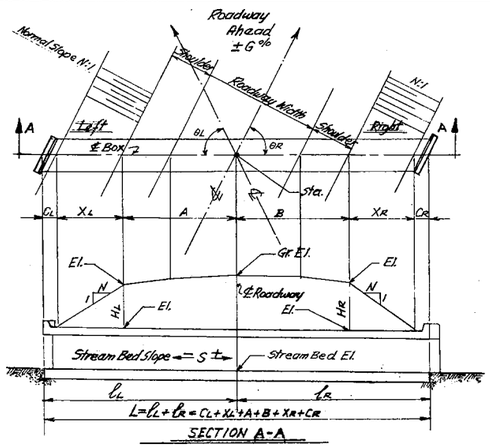
STANDARD ABUTMENTS WITH BACKWALL

TYPICAL LAYOUT

By: GTH
Compt'd: K.R.P
Chk'd : E.L.H

SHEET 1 OF 1

S-2728



SECTION A-A

LENGTH OF CULVERT

To compute the length (L), it is necessary to find the dimensions X_L and X_R. All other dimensions are easy to establish from the given information: Str. Bed El., Gr. El., Skew angle θ, Grade slope of roadway G, Normal slope of fill N:1, Stream Bed slope S, and roadway dimensions.

+G = Grade slope up-ahead.
-G = " " down-ahead.
Use value of G with the proper sign. (Example: G=+0.85%=+0.0085)
S-is negative if stream bed slopes down toward the left, and positive if stream bed slopes down toward the right. (Example: ±S=+1.45%=+0.0145)

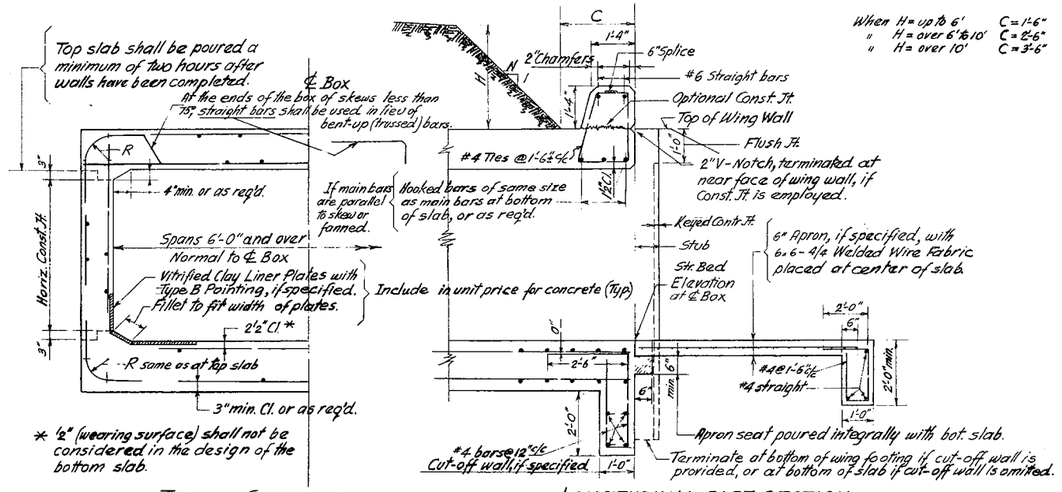
For θ_L: $X_L = \frac{N.H_L}{\sin.\theta_L - G.N\cos.\theta_L + S.N}$

$X_R = \frac{N.H_R}{\sin.\theta_L + G.N\cos.\theta_L - S.N}$

For θ_R $X_L = \frac{N.H_L}{\sin.\theta_R + G.N\cos.\theta_R + S.N}$

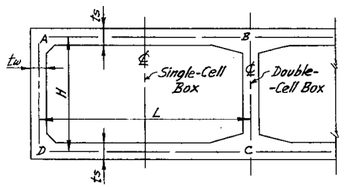
$X_R = \frac{N.H_R}{\sin.\theta_R - G.N\cos.\theta_R - S.N}$

NOTE: Dimensions l_L, l_R and Grade, Shoulder and Stream Bed elevations shall be shown on the design drawing.



TYPICAL SECTION

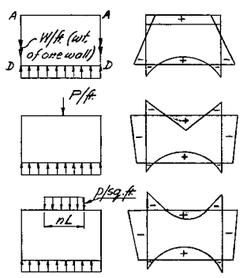
LONGITUDINAL PART-SECTION



Is = Moment of inertia of cross section of top and bottom slabs considered alike.

Iw = Moment of inertia of cross section of side walls considered alike.

$R = \frac{I_S H}{I_W L} = \left(\frac{t_S}{t_W}\right)^3 \frac{H}{L}$



$M_A = +\frac{WL}{6}\frac{R}{(R+3)(R+1)}$

$M_D = -\frac{WL}{6}\frac{3+2R}{(R+3)(R+1)}$

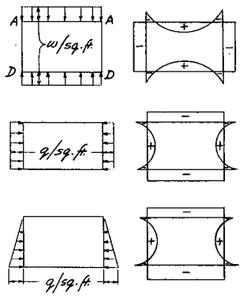
$M_A = -\frac{PL}{12}\frac{2R+4.5}{(R+3)(R+1)}$

$M_D = -\frac{PL}{24}\frac{R+6}{(R+3)(R+1)}$

$M_A = -\frac{PnL^2}{24}\frac{(2R+3)(3-n^2)-2R}{(R+3)(R+1)}$

$M_D = -\frac{PnL^2}{24}\frac{2(2R+3)-(3-n^2)R}{(R+3)(R+1)}$

SINGLE-CELL BOX MOMENT DIAGRAMS.



$M_A = -\frac{wL^2}{12}\frac{1}{1+R} = M_D$

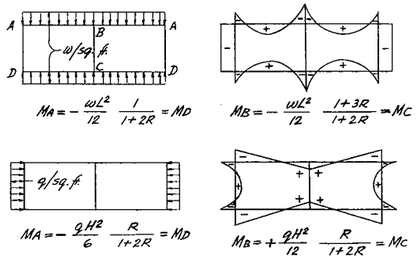
$M_A = -\frac{qH^2}{12}\frac{R}{1+R} = M_D$

$M_A = -\frac{qH^2}{60}\frac{R(2R+7)}{(R+3)(R+1)}$

$M_D = -\frac{qH^2}{60}\frac{R(3R+8)}{(R+3)(R+1)}$

SINGLE-CELL BOX MOMENT DIAGRAMS.

(Reference: Kleinlogel, Rigid Frame Formulas.)



$M_A = -\frac{wL^2}{12}\frac{1}{1+2R} = M_D$

$M_B = -\frac{wL^2}{12}\frac{1+3R}{1+2R} = M_C$

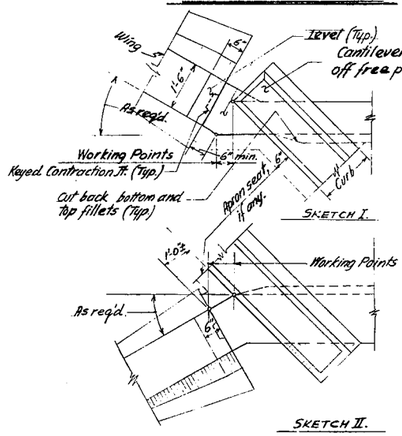
$M_A = -\frac{qH^2}{6}\frac{R}{1+2R} = M_D$

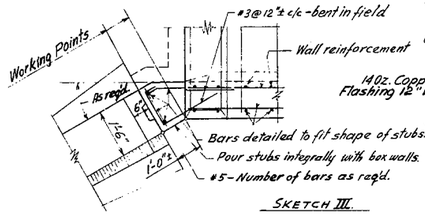
$M_B = +\frac{qH^2}{12}\frac{R}{1+2R} = M_C$

DOUBLE-CELL BOX MOMENT DIAGRAMS.

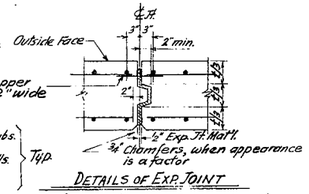
(Reference: AREA Manual of Recommended Practice - 1960)

Notes: Any other recognized method of analysis is acceptable.
+ Indicates tension at inside face.
- " " at outside face.



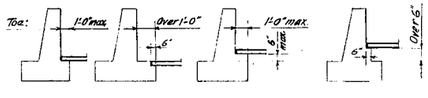


END DETAILS AND LAYOUT OF WINGS



DETAILS OF EXP. JOINT

(Contraction and Construction Jts. are similar except omit Exp. Jt. Matl. and apply one coat of asphaltic paint to Contr. Jt., and run bars thru the Const. Jt.)



APRON SEATS

DESIGN INFORMATION

Boxes shall be designed in accordance with current P.D.H. policy.
In general, boxes of span less than 6'-0" are not recommended, except in special cases (extension of existing boxes, box conduits, etc.) as directed.
If practical, sections of various thickness shall be designed for boxes under fill, unless otherwise directed.
Slab reinforcement bars may be placed parallel to skew in culverts on skew angles of 75° and more. On skew angles less than 75° bars shall be placed normal to ℄ of box. At end of box, bars may be cut and anchored into edges of the top and bottom slabs, designed to carry the superimposed loading, or fanned.
Class AA Concrete shall be used in the top slab, parapets and curbs for boxes at grade.
Class A Concrete shall be used in entire box under fill.
Class B Concrete shall be used in wings and apron.
Vertical Construction or contraction joints to be approx. 30' and expansion joints 90' apart. These joints shall be keyed all around. No waterstops are required, unless leakage would be objectionable (underpasses, etc.).
Thickness of slabs and walls shall be 10" min. for boxes of normal span 6'-0" and over, and 8" min. for normal span under 6'-0". Clear bars 2" from concrete face except as noted.
For Semi-Gravity and R.C. Cantilever Wing Walls refer to Std. Dwgs. S-2704 and S-2726. For bar arrangement refer to Sketch L-1045.
Reasonable modifications of the details shown may be required to meet special conditions.

Approved: OCT - 3 1962
Bridge Engineer

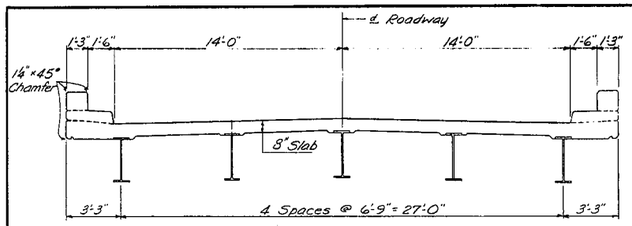
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD
REINFORCED CONCRETE
BOXES

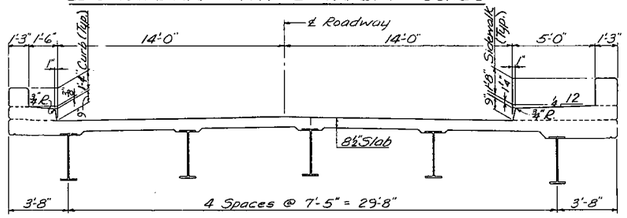
Ay: GHH
Bak

SHEET 1 OF 1

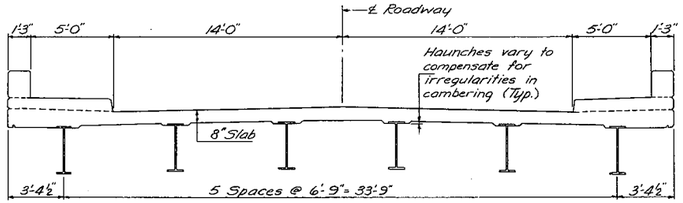
S-2729



28'-0" ROADWAY WITH 2 SAFETY CURBS



28'-0" ROADWAY WITH SAFETY CURB and SIDEWALK



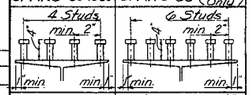
28'-0" ROADWAY WITH 2 SIDEWALKS

SPACING of ⅞"Ø STUDS ℄ 4" C SHEAR CONNECTORS-6'-9" BEAM SPACING							
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	5'-0"	6'-6"	8'-0"	4'-6"	1'-0"	⅛"	¾"
55	1'-6"	8'-9"	10'-0"	5'-0"	2'-3"	⅛"	1 1/16"
60	2'-6"	9'-0"	14'-6"	5'-0"	2'-6"	3/16"	⅞"
65	0	9'-9"	11'-9"	6'-9"	4'-3"	¼"	1"
70	0	10'-6"	12'-6"	7'-6"	4'-6"	5/16"	1¼"
75	0	10'-6"	13'-3"	8'-3"	5'-6"	⅜"	1⅜"
80	0	11'-0"	13'-6"	9'-6"	6'-0"	½"	1½"

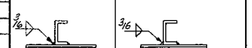
SPACING of ⅞"Ø STUDS ℄ 4" C SHEAR CONNECTORS-7'-5" BEAM SPACING							
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	7'-3"	5'-9"	7'-9"	4'-3"	0	⅛"	1 3/16"
55	6'-3"	6'-9"	9'-0"	5'-6"	0	⅛"	1 3/16"
60	4'-0"	8'-6"	10'-6"	5'-9"	1'-3"	3/16"	1"
65	3'-6"	9'-6"	11'-9"	6'-0"	1'-9"	3/16"	1¼"
70	3'-9"	10'-0"	12'-9"	6'-6"	2'-0"	¼"	1⅜"
75	3'-0"	11'-3"	13'-9"	7'-0"	2'-6"	⅜"	1⅜"
80	0	0	13'-6"	10'-9"	15'-9"	½"	1⅝"

TYPE of SHEAR CONN.

SPANS 50' to 80' (7'-5" Spcg. Only)

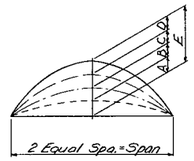


4 L 7.25 *



SPANS 80' (7'-5" Spcg. Only)

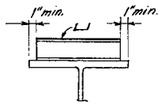
4 L 7.25 x 14½"



CAMBER DIAGRAM

A = Camber due to Steel
B = Camber due to Concrete
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber

Camber shall be a parabolic curve. Where total camber is less than minimum that can be maintained in beam, no camber will be required, but any residual camber shall be up.



CHANNEL SHEAR CONNECTOR

Note:

Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°.
Equivalent number of ¾"Ø studs may be used in lieu of ⅞"Ø studs.
Shear capacity of 1-⅞"Ø Stud = 3450#
Shear capacity of 1-¾"Ø Stud = 2540#
Spacing for ¾"Ø Studs shall be reduced to 73.5 % of that shown for ⅞"Ø Studs.

* 10" long for 36WF
9½" long for 33WF with 97% of spacing shown in Tables.
8½" long for 30WF with 87% of spacing shown in Tables.

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49.
- Design Specifications: Design division of 1961 "Standard Specifications for Highway Bridges" of the AASHO except roadway slab is designed for an allowable compressive concrete stress of 1000 psi.
- Live Load: H20-S16-44 and/or Alternate Interstate Loading.
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars are designed for f_s = 18000 psi and detailed in accordance with A.C.I. Code. Bars shall be lapped 30 diameters.
- Concrete: Class AA.
- Structural Steel: ASTM A36-62T Designation.
- Exposed concrete edges shall be chamfered 1"×1" except as noted.
- For parapet railing and guard fence connections, refer to PDH Std. Dwg. S-1614-C or S-3361.
- For Bearing details, refer to PDH Std. Dwg. S-2721.
- For expansion dams and joints, refer to PDH Std. Dwg. S-2722.
- For Bridge drainage and scuppers, refer to PDH Std. Dwg. S-2723.
- For diaphragms and connections, refer to PDH Std. Dwg. S-2724.
- For deck slab details, refer to PDH Std. Dwg. S-2735.
- All welding shall be in accordance with "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society. For welds, submerged arc process OR shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-7016, or E-7018 shall be used.
- For end details, refer to PDH Std. Dwg. S-2736.

BEAM SPACING	No. of BMS	NONCOMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS) SPAN CENTER TO CENTER OF BEARINGS (FEET) 20'	25'	30'	35'	40'	45'	50'
28' ROADWAY WITH TWO SAFETY CURBS								
6'-9"	5	21WF55 (21WF62)	24WF68 (24WF76)	27WF84 (27WF94)	30WF108 (30WF108)	33WF118	36WF135	36WF160
REACTION		46.0	51.0	56.5	62.5	67.5	71.5	76.0
28' ROADWAY WITH SAFETY CURB AND SIDEWALK								
7'-5"	5	21WF62 (21WF68)	24WF76 (24WF84)	27WF94 (30WF99)	30WF116 (30WF116)	33WF130	36WF150	36WF170
REACTION		51.5	57.0	63.5	70.0	75.5	81.0	85.5
28' ROADWAY WITH TWO SIDEWALKS								
6'-9"	6	21WF55 (21WF62)	24WF68 (24WF76)	27WF84 (27WF94)	30WF108 (30WF108)	33WF130	36WF150	36WF160
REACTION		43.0	47.5	53.0	59.0	64.0	68.5	73.0

*Beam sizes in Parenthesis are shown for Alternate Interstate Loading (For Spans under 38'-0" in length)

BEAM SPACING	No. of BMS	COMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS) SPAN CENTER TO CENTER OF BEARINGS (FEET) 50'	55'	60'	65'	70'	75'	80'
28' ROADWAY WITH TWO SAFETY CURBS								
6'-9"	5	30WF99 Cov. PL 9×⅜×35'-0"	33WF118 Cov. PL 10×⅝×35'-0"	33WF118 Cov. PL 10×⅝×42'-0"	36WF135 Cov. PL 10×⅝×43'-0"	36WF150 Cov. PL 10×1×48'-0"	36WF182 Cov. PL 10×1×46'-0"	36WF194 Cov. PL 11×1⅛×52'-0"
REACTION		77.0	81.0	85.0	90.0	93.0	98.0	102.0
28' ROADWAY WITH SAFETY CURB AND SIDEWALK								
7'-5"	5	30WF108 Cov. PL 9×⅝×35'-0"	33WF118 Cov. PL 10×⅞×38'-0"	36WF135 Cov. PL 10×1×39'-0"	36WF150 Cov. PL 10×1×43'-0"	36WF160 Cov. PL 10×1⅛×47'-0"	36WF182 Cov. PL 10×1⅛×50'-0"	36WF230 Cov. PL 14×¾×47'-0"
REACTION		86.0	90.0	95.0	100.0	105.0	110.0	115.0
28' ROADWAY WITH TWO SIDEWALKS								
6'-9"	6	30WF99 Cov. PL 9×⅝×35'-0"	33WF118 Cov. PL 10×⅝×35'-0"	33WF118 Cov. PL 10×1×42'-0"	36WF135 Cov. PL 10×1×43'-0"	36WF150 Cov. PL 10×1⅛×48'-0"	36WF182 Cov. PL 10×1⅛×46'-0"	36WF194 Cov. PL 11×1⅛×52'-0"
REACTION		77.0	81.0	85.0	90.0	93.0	98.0	102.0

SUMMARY OF DECK QUANTITIES {INCLUDES PARAPETS, CURBS AND/OR SIDEWALKS

ROADWAY SLAB WITH	REINFORCEMENT BARS - lbs./lin. Ft.	CLASS AA CONCRETE Cu. Yds./lin. Ft.
TWO SAFETY CURBS	218.81	1.10
SAFETY CURB & SIDEWALK	250.28	1.36
TWO SIDEWALKS	275.75	1.53

Approved: AUG - 2 1963
K. H. Jensen, Bridge Engineer

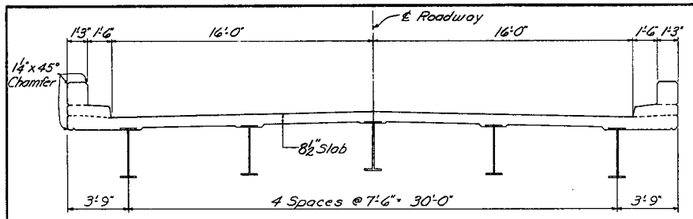
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD STEEL I-BEAM BRIDGES
28' ROADWAY

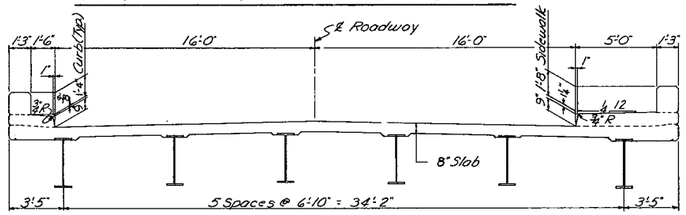
SHEET 1 OF 1

S-2730

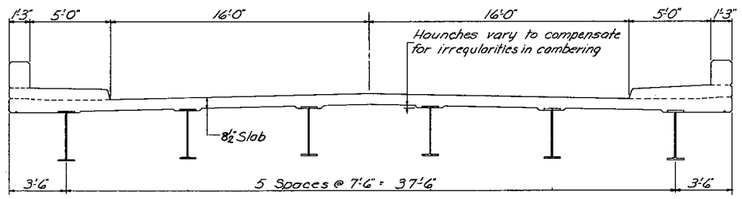
NO. 184 REP



32' ROADWAY WITH 2 SAFETY CURBS

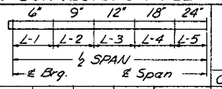


32' ROADWAY WITH SAFETY CURB and SIDEWALK



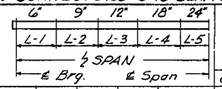
32' ROADWAY WITH 2 SIDEWALKS

SPACING of 8 7"ø STUDS ℔4" C SHEAR CONNECTORS-7'-6" BEAM SPACING



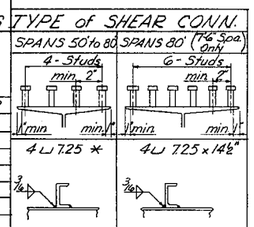
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	7'-3"	5'-9"	7'-9"	4'-3"	0	1/8"	13/16"
55	6'-3"	6'-9"	9'-0"	5'-6"	0	1/8"	13/16"
60	4'-0"	8'-6"	10'-6"	5'-9"	1'-3"	3/16"	1"
65	3'-6"	9'-6"	11'-9"	6'-0"	1'-9"	3/16"	1¼"
70	3'-9"	10'-0"	12'-9"	6'-6"	2'-0"	5/16"	1½"
75	3'-0"	11'-3"	13'-9"	7'-0"	2'-6"	5/16"	1½"
80	0	0	13'-6"	10'-9"	15'-9"	2"	1⅞"

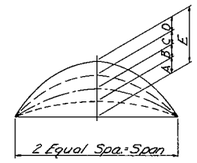
SPACING of 8 7"ø STUDS ℔4" C SHEAR CONNECTORS-6'-10" BEAM SPACING



SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	5'-0"	6'-6"	8'-0"	4'-6"	1'-0"	1/8"	3/4"
50	1'-6"	8'-9"	10'-0"	5'-0"	2'-3"	1/8"	13/16"
60	2'-6"	9'-0"	11'-0"	5'-0"	2'-6"	3/16"	1/8"
65	0	9'-9"	11'-9"	6'-9"	4'-3"	1/4"	1"
70	0	10'-6"	12'-6"	7'-6"	4'-6"	3/16"	1¼"
75	0	10'-6"	13'-3"	8'-3"	5'-6"	3/8"	1½"
80	0	11'-0"	13'-0"	9'-6"	6'-0"	1/2"	1⅞"

TYPE of SHEAR CONN.

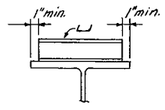




CAMBER DIAGRAM

A = Camber due to Steel
B = Camber due to Concrete
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber

Camber shall be a parabolic curve. Where total camber is less than minimum that can be maintained in beam, no camber will be required, but any residual camber shall be up.



CHANNEL SHEAR CONNECTOR

Note:
Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°.
Equivalent number of ¾"ø studs may be used in lieu of ⅞"ø studs, if conditions warrant.
Shear capacity of 1-⅞"ø stud = 3450#
Shear capacity of 1-¾"ø stud = 2540#
Spacing for ¾"ø studs shall be reduced to 73.5% of that shown for ⅞"ø studs.

* 10" long for 36WF
9½" long for 33WF with 97% of spacing shown in Tables.
8½" long for 30WF with 87% of spacing shown in Tables.

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408/60 and 409/49.
- Design Specifications: Design division of 1961 "Standard Specifications for Highway Bridges" of the AASHO except roadway slab is designed for an allowable compressive concrete stress of 1000 psi.
- Live Load: H20-S16-44 and/or Alternate Interstate Loading.
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars are designed for fs = 18000psi. and detailed in accordance with ACI Code. Bars shall be lapped 30 diameters.
- Concrete: Class AA
- Structural Steel: ASTM A36-62T Designation.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- For parapet railing and guard fence connections, refer to PDH Std. Dwg. S-16140 or S-3361.
- For Bearing details refer to PDH Std. Dwg. S-2721.
- For expansion dams and joints, refer to P.D.H. Std. Dwg. S-2722.
- For Bridge drainage and scuppers, refer to P.D.H. Std. Dwg. S-2723.
- For diaphragms and connections, refer to PDH Std. Dwg. S-2724.
- For deck slab details, refer to P.D.H. Std. Dwg. S-2735.
- All welding shall be in accordance with "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society. For welds, submerged arc process OR shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-7016 or E-7018 shall be used.
- For end details, refer to PDH Std. Dwg. S-2736.

NONCOMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)
SPAN CENTER TO CENTER OF BEARINGS (FEET)

BEAM SPACING	No. of BMS	20'	25'	30'	35'	40'	45'	50'
32' ROADWAY WITH TWO SAFETY CURBS								
7'-6"	5	21WF 62 (24WF 68)	24WF 76 (27WF 84)	27WF 94 (30WF 99)	30WF 116 (30WF 116)	33WF 130	36WF 150	36WF 170
REACTION		51.5	57.0	63.0	69.5	75.0	80.5	85.0
32' ROADWAY WITH SAFETY CURB AND SIDEWALK								
6'-10"	6	21WF 55 (21WF 62)	24WF 68 (24WF 76)	27WF 84 (27WF 94)	30WF 108 (30WF 108)	33WF 118	36WF 135	36WF 160
REACTION		47.0	51.5	57.5	63.5	68.5	73.1	77.5
32' ROADWAY WITH TWO SIDEWALKS								
7'-6"	6	21WF 62 (24WF 68)	24WF 76 (27WF 84)	27WF 94 (30WF 99)	30WF 116 (30WF 116)	33WF 130	36WF 150	36WF 182
REACTION		52.0	58.0	64.0	71.0	76.5	82.0	87.0

*Beam sizes in Parenthesis are shown for Alternate Interstate Loading (For Spans under 38'-0" in length)

COMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)
SPAN CENTER TO CENTER OF BEARINGS (FEET)

BEAM SPACING	No. of BMS	50'	55'	60'	65'	70'	75'	80'
32' ROADWAY WITH TWO SAFETY CURBS								
7'-6"	5	30WF 108 C.P. 9x⅞x35'0"	33WF 118 C.P. 10x¾x38'0"	33WF 135 C.P. 10x¾x39'0"	36WF 150 C.P. 10x1x43'0"	36WF 160 C.P. 10x1¼x47'0"	36WF 182 C.P. 10x1⅜x50'0"	36WF 230 C.P. 14x¾x47'0"
REACTION		86.0	90.0	95.0	100.0	105.0	110.0	115.0
32' ROADWAY WITH SAFETY CURB AND SIDEWALK								
6'-10"	6	30WF 99 C.P. 9x⅞x35'0"	33WF 118 C.P. 10x¾x35'0"	33WF 118 C.P. 10x1x42'0"	36WF 135 C.P. 10x1x43'0"	36WF 150 C.P. 10x1⅛x46'0"	36WF 182 C.P. 10x1⅜x46'0"	36WF 194 C.P. 11x1¼x52'0"
REACTION		77.0	81.0	85.0	90.0	93.0	98.0	102.0
32' ROADWAY WITH TWO SIDEWALKS								
7'-6"	6	30WF 108 C.P. 9x⅞x35'0"	33WF 118 C.P. 10x¾x38'0"	36WF 135 C.P. 10x¾x39'0"	36WF 150 C.P. 10x1x43'0"	36WF 160 C.P. 10x1¼x47'0"	36WF 182 C.P. 10x1⅜x50'0"	36WF 230 C.P. 14x¾x47'0"
REACTION		86.0	90.0	95.0	100.0	105.0	110.0	115.0

SUMMARY OF DECK QUANTITIES	INCLUDES PARAPETS, CURBS AND/OR SIDEWALKS	
ROADWAY SLAB WITH	REINFORCEMENT BARS - lbs./lin.ft.	CLASS AA CONCRETE Cu Yds./lin.ft.
TWO SAFETY CURBS	246.29	1.24
SAFETY CURB & SIDEWALK	280.30	1.41
TWO SIDEWALKS	301.00	1.67

Approved: AUG - 2 1963
E. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

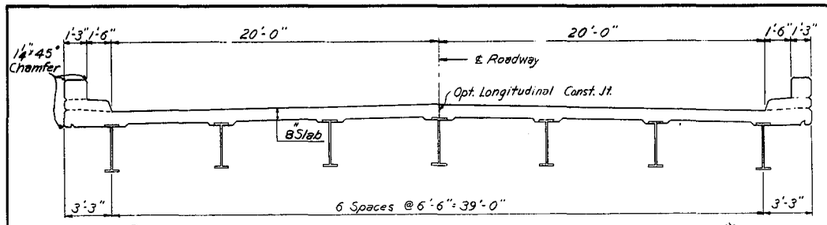
STANDARD STEEL I-BEAM BRIDGES

32' ROADWAY

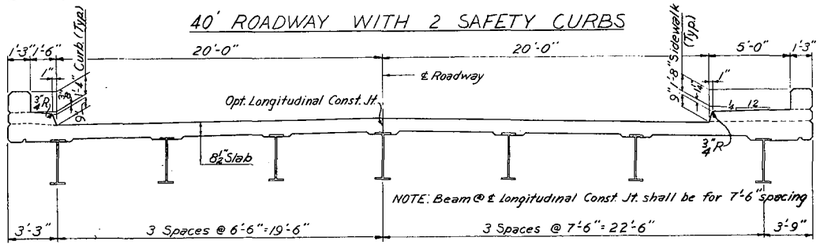
SHEET 1 OF 1

S-2731

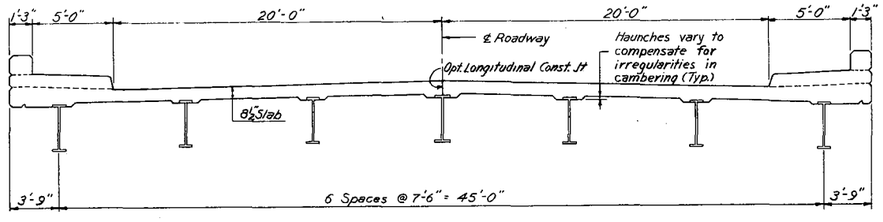
BRD NO. 184 L.R.P.



40' ROADWAY WITH 2 SAFETY CURBS



40' ROADWAY WITH SAFETY CURB and SIDEWALK



40' ROADWAY WITH 2 SIDEWALKS

BEAM SPACING	No. of BMS.	NONCOMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)						
		SPAN CENTER TO CENTER OF BEARINGS (FEET)						
		20'	25'	30'	35'	40'	45'	50'
		40' ROADWAY WITH 2 SAFETY CURBS						
6'-6"	7	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 84)	30 WF 99 (30 WF 108)	33 WF 118	36 WF 135	36 WF 150
REACTION		44.0	48.3	53.6	59.1	64.1	67.8	72.1
		40' ROADWAY WITH SAFETY CURB AND SIDEWALK						
6'-6"	3	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 99 (30 WF 108)	33 WF 118	36 WF 135	36 WF 150
REACTION		44.0	49.2	54.5	60.2	65.3	69.0	73.5
7'-6"	4	21 WF 62 (24 WF 68)	24 WF 76 (27 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	33 WF 130	36 WF 150	36 WF 170
REACTION		51.2	56.6	62.7	68.9	74.6	79.3	84.4
		40' ROADWAY WITH 2 SIDEWALKS						
7'-6"	7	21 WF 62 (24 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	36 WF 135	36 WF 150	36 WF 182
REACTION		51.7	57.3	63.5	70.0	75.8	80.8	86.0

* Beam sizes in Parenthesis are shown for Alternate Interstate Loading (For Spans under 38'-0" in length)

BEAM SPACING	No. of BMS.	COMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)						
		SPAN CENTER TO CENTER OF BEARINGS (FEET)						
		50'	55'	60'	65'	70'	75'	80'
		40' ROADWAY WITH 2 SAFETY CURBS AND 40' ROADWAY WITH SAFETY CURB AND SIDEWALK (6'-6" SPA.)						
6'-6"	7 3*	30 WF 99 C.P. 9 × 5/16 × 33'-0"	33 WF 118 C.P. 10 × 1/2 × 33'-0"	33 WF 118 C.P. 10 × 3/4 × 41'-0"	36 WF 135 C.P. 10 × 3/4 × 42'-0"	36 WF 150 C.P. 10 × 7/8 × 44'-0"	36 WF 182 C.P. 10 × 7/8 × 45'-0"	36 WF 194 C.P. 11 × 1 × 50'-0"
REACTION		72.0	76.0	79.0	84.0	87.0	92.0	96.0
		40' ROADWAY WITH TWO SIDEWALKS AND 40' ROADWAY WITH SAFETY CURB AND SIDEWALK (7'-6" SPA.)						
7'-6"	7 4*	30 WF 108 C.P. 9 × 5/8 × 35'-0"	33 WF 118 C.P. 10 × 3/4 × 38'-0"	36 WF 135 C.P. 10 × 3/4 × 39'-0"	36 WF 150 C.P. 10 × 1 × 43'-0"	36 WF 160 C.P. 10 × 1 1/4 × 47'-0"	36 WF 182 C.P. 10 × 1 3/8 × 50'-0"	36 WF 230 C.P. 14 × 3/4 × 47'-0"
REACTION		86.0	90.0	95.0	100.0	105.0	110.0	115.0

* 40' Roadway with safety curb and sidewalk is composed of 3 beams for 6'-6" spacing and 4 beams for 7'-6" spacing. Beam @ ℄ Longitudinal Const. Jt. shall be for 7'-6" spacing.

SUMMARY OF DECK QUANTITIES	INCLUDES PARAPETS, CURBS AND/OR SIDEWALKS	
ROADWAY SLAB WITH	REINFORCEMENT BARS - lbs./lin. ft.	CLASS AA CONCRETE Cu. Yds./lin. ft.
TWO SAFETY CURBS	296.02	1.38
SAFETY CURB & SIDEWALK	321.86	1.66
TWO SIDEWALKS	347.69	1.88

SPACING of 3/4" ø STUDS @ 4"C SHEAR CONNECTORS-T-G BEAM SPACING

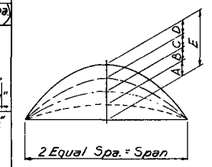
	6"	9"	12"	18"	24"		
	L-1	L-2	L-3	L-4	L-5		
	½ SPAN						
	℄ Brgs.			℄ Span		CAMBER	
SPAN	L-1	L-2	L-3	L-4	L-5	A	B
50	4'-0"	6'-6"	8'-6"	6'-0"	0	1/8"	3/4"
55	0	9'-0"	11'-0"	5'-6"	2'-0"	1/8"	3/4"
60	0	10'-0"	11'-0"	6'-0"	3'-0"	1/4"	1"
65	0	9'-3"	11'-6"	7'-3"	4'-6"	1/4"	1 1/16"
70	0	9'-3"	12'-6"	8'-6"	4'-9"	5/16"	1 5/16"
75	0	8'-0"	14'-0"	9'-0"	6'-6"	3/8"	1 7/16"
80	0	8'-0"	15'-0"	9'-6"	7'-6"	1/2"	1 11/16"

SPACING of 3/4" ø STUDS @ 4"C SHEAR CONNECTORS-T-G BEAM SPACING

	6"	9"	12"	18"	24"		
	L-1	L-2	L-3	L-4	L-5		
	½ SPAN						
	℄ Brgs.			℄ Span		CAMBER	
SPAN	L-1	L-2	L-3	L-4	L-5	A	B
50	7'-3"	5'-9"	7'-9"	4'-3"	0	1/8"	13/16"
55	6'-3"	6'-9"	9'-0"	5'-6"	0	1/8"	15/16"
60	4'-0"	8'-6"	10'-6"	5'-9"	1'-3"	3/16"	1"
65	3'-6"	9'-6"	11'-9"	6'-0"	1'-9"	1/8"	1 1/4"
70	3'-9"	10'-0"	12'-9"	6'-6"	2'-0"	5/16"	1 1/16"
75	3'-0"	11'-3"	13'-9"	7'-0"	2'-6"	5/16"	1 11/16"
80	0	0	13'-6"	10'-9"	15'-9"	1/2"	1 7/8"

TYPE of SHEAR CONN.

SPANS 50' to 80'	SPANS 80' (7'-6" Spa. Only)
4 Studs, min 2"	6 Studs, min 2"
4 U 7.25 *	4 U 7.25 x 14"



CAMBER DIAGRAM

A = Camber due to Steel
B = Camber due to Concrete
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber

Camber shall be a parabolic curve Where total camber is less than minimum that can be maintained in beam, no camber will be required, but any residual camber shall be up.

Note:

Studs used as shear connectors shall be automatically end welded to beam by use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°.
Equivalent number of 3/4" ø Studs may be used in lieu of 7/8" ø studs, if conditions warrant.
Shear capacity of 1-7/8" ø stud = 3450#
Shear capacity of 1-3/4" ø stud = 2540#
Spacing for 3/4" ø studs shall be reduced to 73.5% of that shown for 7/8" ø Studs.
For spacing of studs at Longitudinal Construction Joint see Sheet 1 of 1 S-2735.
* 10" long for 36 WF
9½" long for 33 WF with 97% of spacing shown in Tables.
8½" long for 30 WF with 87% of spacing shown in Tables.

CHANNEL SHEAR CONNECTOR

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/40 and 409/49.
- Design Specifications: Design division of 1961 "Standard Specifications for Highway Bridges" of the AASHO except roadway slab is designed for an allowable compressive concrete stress of 1000 p.s.i.
- Live Load: H20-S16-44 and/or Alternate Interstate Loading.
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars are designed for f_s 18000 p.s.i. and detailed in accordance with ACI Code. Bars shall be lapped 30 diameters.
- Provide 1½ cover on reinforcement bars except for 1" cover on bottom of slab.
- Concrete: Class AA
- Structural Steel: ASTM A36-62T Designation.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- For parapet railing and guard fence connections, refer to PDH Std. Dwg. S-1614C or S-3361.
- For Bearing details, refer to PDH Std. Dwg. S-2721.
- For expansion dams and joints, refer to PDH Std. Dwg. S-2722.
- For Bridge drainage and scuppers, refer to PDH Std. Dwg. S-2723.
- For diaphragms and connections, refer to PDH Std. Dwg. S-2724.
- For Deck slab details, refer to PDH Std. Dwg. S-2735.
- All welding shall be in accordance with "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society. For welds, submerged arc process OR shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-7016 or E-7018 shall be used.
- For end details, refer to PDH Std. Dwg. S-2736.

Approved: AUG - 2 1963
K H Jensen
Bridge Engineer

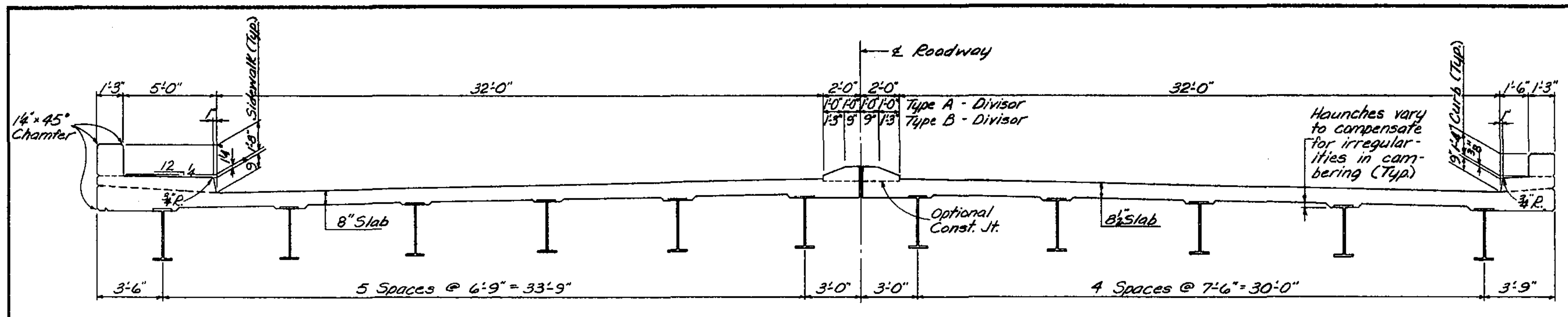
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD STEEL I-BEAM BRIDGES

40' ROADWAY

SHEET 1 OF 1

S-2732



HALF ROADWAY WITH SIDEWALK

HALF ROADWAY WITH SAFETY CURB

SPACING of 7/8"φ STUDS & 4" [SHEAR CONNECTORS - 7'-6" BEAM SPACING

(6" 9" 12" 18" 24" — L-1 L-2 L-3 L-4 L-5 — ½ SPAN — ℄ Brg. ℄ Span)

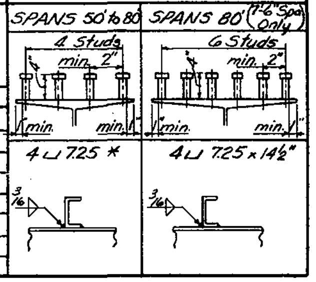
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	7'-3"	5'-9"	7'-9"	4'-3"	0	1/8"	13/16"
55	6'-3"	6'-9"	9'-0"	5'-6"	0	1/8"	13/16"
60	4'-0"	8'-6"	10'-6"	5'-9"	1'-3"	3/16"	1"
65	3'-6"	9'-6"	11'-9"	6'-0"	1'-9"	3/16"	1 1/4"
70	3'-9"	10'-0"	12'-9"	6'-6"	2'-0"	5/16"	1 7/16"
75	3'-0"	11'-3"	13'-9"	7'-0"	2'-6"	3/8"	1 11/16"
80	0	0	13'-6"	10'-9"	15'-9"	1/2"	1 7/8"

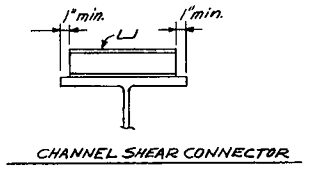
SPACING of 7/8"φ STUDS & 4" [SHEAR CONNECTORS - 6'-9" BEAM SPACING

(6" 9" 12" 18" 24" — L-1 L-2 L-3 L-4 L-5 — ½ SPAN — ℄ Brg. ℄ Span)

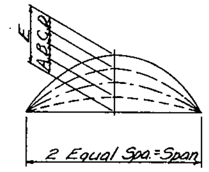
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	5'-0"	6'-6"	8'-0"	4'-6"	1'-0"	1/8"	3/4"
55	1'-6"	8'-9"	10'-0"	5'-0"	2'-3"	1/8"	13/16"
60	2'-6"	9'-0"	11'-0"	5'-0"	2'-6"	3/16"	7/8"
65	0	9'-9"	11'-9"	6'-9"	4'-3"	1/4"	1"
70	0	10'-6"	12'-6"	7'-6"	4'-6"	5/16"	1 1/4"
75	0	10'-6"	13'-3"	8'-3"	5'-6"	3/8"	1 1/2"
80	0	11'-0"	13'-6"	9'-6"	6'-0"	1/2"	1 3/4"

TYPE of SHEAR CONN.





CHANNEL SHEAR CONNECTOR



CAMBER DIAGRAM

A = Camber due to Steel
B = Camber due to Concrete
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber

Camber shall be a parabolic curve. Where total camber is less than minimum that can be maintained in beam, no camber will be required, but any residual camber shall be up.

Note:

Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°.
Equivalent number of 3/4"φ studs may be used in lieu of 7/8"φ studs, if conditions warrant.
Shear capacity of 1-7/8"φ Stud = 3450#
Shear capacity of 1-3/4"φ Stud = 2540#
Spacing for 3/4"φ Studs shall be reduced to 73.5 % of that shown for 7/8"φ Studs.

* 10" long for 36 WF
9½" long for 33 WF with 97% of spacing shown in Tables.
8½" long for 30 WF with 87% of spacing shown in Tables.

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49.
- Design Specifications: Design division of 1961 "Standard Specifications for Highway Bridges" of the AASHO except roadway slab is designed for an allowable compressive concrete stress of 1000 psi.
- Live Load: H20-S16-44, and/or Alternate Interstate Loading.
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars are designed for fs = 18000 psi and detailed in accordance with ACI Code. Bars shall be lapped 30 diameters.
- Provide 1½" cover on reinforcement bars except for 1" cover on bottom of slab.
- Concrete: Class AA.
- Structural Steel: ASTM A36-62T Designation.
- Exposed concrete edges shall be chamfered 1"×1" except as noted.
- For parapet railing and guard fence connections, refer to PDH Std. Dwg. S-1614-C or S-3361.
- For Bearing details, refer to PDH Std. Dwg. S-2721.
- For expansion dams and joints, refer to PDH Std. Dwg. S-2722.
- For Bridge drainage and scuppers, refer to PDH Std. Dwg. S-2723.
- For diaphragms and connections, refer to PDH Std. Dwg. S-2724.
- For deck slab details, refer to PDH Std. Dwg. S-2735.
- All welding shall be in accordance with "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society. For welds, submerged arc process OR shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-7016, or E-7018 shall be used.
- For end details, refer to PDH Std. Dwg. S-2736.

NONCOMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)

BEAM SPACING	No. of BMS.	SPAN CENTER TO CENTER OF BEARINGS (FEET) 20'	25'	30'	35'	40'	45'	50'
HALF ROADWAY WITH SAFETY CURB								
7'-6"	5	21WF62 (21WF68)	24WF76 (27WF84)	27WF94 (30WF99)	30WF116 (30WF116)	33WF130	36WF150	36WF170
REACTION		51.1	56.4	62.6	68.6	74.3	79.5	83.8
HALF ROADWAY WITH SIDEWALK								
6'-9"	6	21WF55 (21WF62)	24WF68 (24WF76)	27WF84 (27WF94)	30WF108 (30WF108)	33WF118	36WF135	36WF160
REACTION		46.2	50.9	56.3	62.0	67.0	71.3	75.7

* Beam sizes in Parenthesis are shown for Alternate Interstate Loading (For Spans under 38'-0" in length)

COMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)

BEAM SPACING	No. of BMS.	SPAN CENTER TO CENTER OF BEARINGS (FEET) 50'	55'	60'	65'	70'	75'	80'
HALF ROADWAY WITH SAFETY CURB								
7'-6"	5	30WF108 C.P. 9×7/8×35'-0"	33WF118 C.P. 10×3/4×38'-0"	36WF135 C.P. 10×3/4×39'-0"	36WF150 C.P. 10×1×43'-0"	36WF160 C.P. 10×1 1/4×47'-0"	36WF182 C.P. 10×1 3/8×50'-0"	36WF230 C.P. 14×3/4×47'-0"
REACTION		86.0	90.0	95.0	100.0	105.0	110.0	115.0
HALF ROADWAY WITH SIDEWALK								
6'-9"	6	30WF99 C.P. 9×3/4×35'-0"	33WF118 C.P. 10×5/8×35'-0"	33WF118 C.P. 10×7/8×42'-0"	36WF135 C.P. 10×7/8×43'-0"	36WF150 C.P. 10×1×48'-0"	36WF182 C.P. 10×1×46'-0"	36WF194 C.P. 11×1 1/8×52'-0"
REACTION		77.0	81.0	85.0	90.0	93'-0"	98.0	102.0

SUMMARY OF DECK QUANTITIES {INCLUDES PARAPETS, CURBS AND/OR SIDEWALKS

HALF ROADWAY SLAB WITH	REINFORCEMENT BARS - lbs/lin. ft.	CLASS AA CONCRETE Cu. Yds./lin. ft.
SAFETY CURB & DIVISOR	235.67	1.11
SIDEWALK & DIVISOR	261.15	1.28

Approved: AUG - 2 1963

K H Jensen
Bridge Engineer

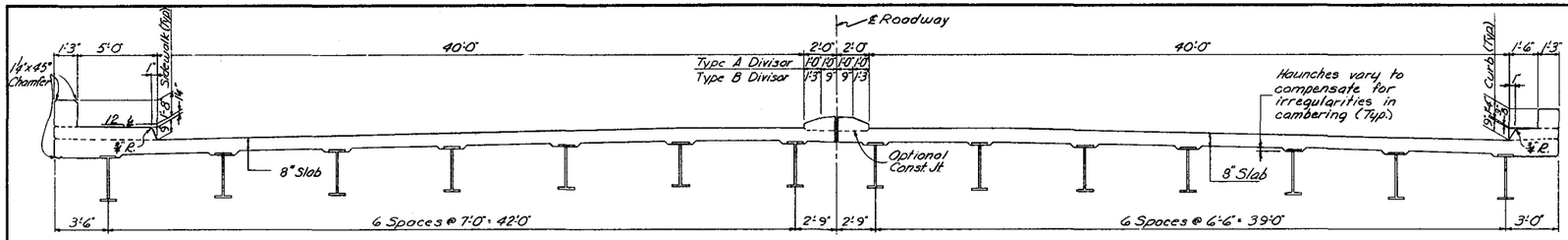
Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

STANDARD
STEEL I-BEAM BRIDGES
68' ROADWAY

SHEET 1 OF 1

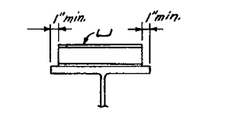
S-2733

NO. 184
KRP



HALF ROADWAY WITH SIDEWALK

HALF ROADWAY WITH SAFETY CURB



CHANNEL SHEAR CONNECTOR

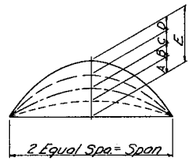
SPACING of ⅞" STUDS @ 4" ℄ SHEAR CONNECTORS-6'-6" BEAM SPACING							
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	4'-0"	6'-6"	8'-6"	6'-0"	0	½"	¾"
55	0	9'-0"	11'-0"	5'-6"	2'-0"	½"	¾"
60	0	10'-0"	11'-0"	6'-0"	3'-0"	¼"	1"
65	0	9'-3"	11'-6"	7'-3"	4'-6"	¼"	1⅛"
70	0	9'-3"	12'-6"	8'-6"	4'-9"	5/16"	1 1/16"
75	0	8'-0"	14'-0"	9'-0"	6'-6"	3/16"	1 1/16"
80	0	8'-0"	15'-0"	9'-6"	7'-6"	0"	1 1/16"

SPACING of ⅞" STUDS @ 4" ℄ SHEAR CONNECTORS-7'-0" BEAM SPACING							
SPAN	L-1	L-2	L-3	L-4	L-5	CAMBER A	CAMBER B
50	5'-0"	6'-9"	8'-0"	5'-3"	0	½"	1"
55	1'-6"	8'-9"	10'-3"	7'-0"	0	½"	¾"
60	0	10'-3"	11'-0"	6'-0"	2'-9"	3/16"	15/16"
65	0	9'-9"	12'-6"	7'-0"	3'-3"	¼"	15/16"
70	0	10'-3"	13'-3"	7'-6"	4'-0"	5/16"	1 1/16"
75	0	10'-3"	13'-9"	8'-9"	4'-9"	5/16"	1 3/8"
80	0	10'-9"	14'-3"	9'-6"	5'-6"	¼"	1 3/16"

TYPE of SHEAR CONN.

SPANS 50 to 80 — 4 Studs min. 2" — 4 ⌴ 7.25 *

SPANS 80 (1-10' Span Only) — 6 Studs — 5 ⌴ 9.0 **



CAMBER DIAGRAM

A = Camber due to Steel
B = Camber due to Concrete
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber

Camber shall be a parabolic curve. Where total camber is less than minimum that can be maintained in beam, no camber will be required, but any residual camber shall be up.

Note:
Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°.
Equivalent number of ¾" studs may be used in lieu of ⅞" studs, if conditions warrant.
Shear capacity of 1-⅞" Stud = 3450#
Shear capacity of 1-¾" Stud = 2540#
Spacing for ¾" studs shall be reduced to 73.5% of that shown for ⅞" studs.

* 10" long for 36WF.
9½" long for 33WF with 97% of spacing shown in Tables.
8½" long for 30WF with 87% of spacing shown in Tables.

** 10" long with 73% of spacing shown in Table.

GENERAL NOTES

- All materials and workmanship shall be in accordance with P.D.H. Forms 408/60 and 409/49.
- Design Specifications: Design division of 1961 "Standard Specifications for Highway Bridges" of the AASHO except roadway slab is designed for an allowable compressive concrete stress of 1000 psi.
- Live Load: H20-S16-44 and/or Alternate Interstate Loading.

  Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the roadway slab.
- Steel reinforcement bars are designed for f_s = 18000 psi and detailed in accordance with ACI Code. Bars shall be lapped 30 diameters.
- Provide 1½" cover on reinforcement bars except for 1" cover on bottom of slab.
- Concrete: Class AA.
- Structural Steel: AST M A36-62T Designation.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- For Parapet railing and guard fence connections, refer to P.D.H. Std. Dwg. S-1614-C or S-3361.
- For Bearing details, refer to P.D.H. Std. Dwg. S-2721.
- For expansion dams and joints, refer to P.D.H. Std. Dwg. S-2722.
- For Bridge drainage and scuppers, refer to P.D.H. Std. Dwg. S-2723.
- For diaphragms and connections, refer to P.D.H. Std. Dwg. S-2724.
- For deck slab details, refer to P.D.H. Std. Dwg. S-2735.
- All welding shall be in accordance with "Standard Specifications for Welded Highway and Railway Bridges" of the American Welding Society. For welds, submerged arc process OR shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-7016, or E-7018 shall be used.
- For end details, refer to PDH Std. Dwg. S-2736.

BEAM SPACING	No. of BMS	NONCOMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)						
		SPAN CENTER TO CENTER OF BEARINGS (FEET)						
		20'	25'	30'	35'	40'	45'	50'
		HALF ROADWAY WITH SAFETY CURB						
6'-6"	7	21WF55 (21WF62)	24WF68 (24WF76)	27WF84 (27WF84)	30WF99 (30WF108)	33WF118	36WF135	36WF150
REACTION		41.6	47.8	53.0	58.3	63.1	66.9	71.0
		HALF ROADWAY WITH SIDEWALK						
7'-0"	7	21WF55 (21WF62)	24WF68 (24WF76)	27WF84 (27WF94)	30WF108 (30WF108)	33WF130	36WF135	36WF160
REACTION		45.2	52.2	57.9	63.8	68.8	73.7	78.8

*Beam sizes in Parenthesis are shown for Alternate Interstate Loading (For Spans under 38'-0" in length)

BEAM SPACING	No. of BMS	COMPOSITE SIMPLE BEAM SIZES and MAXIMUM REACTIONS (KIPS)						
		SPAN CENTER TO CENTER OF BEARINGS (FEET)						
		50'	55'	60'	65'	70'	75'	80'
		HALF ROADWAY WITH SAFETY CURB						
6'-6"	7	30WF99 C.P. 9x⅞x33'-0"	33WF118 C.P. 10x⅞x33'-0"	33WF118 C.P. 10x⅞x41'-0"	36WF135 C.P. 10x¾x42'-0"	36WF150 C.P. 10x⅞x44'-0"	36WF182 C.P. 10x⅞x45'-0"	36WF194 C.P. 11x1x50'-0"
REACTION		72.0	76.0	79.0	84.0	87.0	92.0	96.0
		HALF ROADWAY WITH SIDEWALK						
7'-0"	7	30WF99 C.P. 9x⅞x35'-0"	33WF118 C.P. 10x⅞x33'-0"	36WF135 C.P. 10x⅞x35'-0"	36WF150 C.P. 10x¾x40'-0"	36WF160 C.P. 10x1x44'-0"	36WF182 C.P. 10x1⅛x47'-0"	36WF194 C.P. 11x1¼x52'-0"
REACTION		75.0	79.0	83.0	87.0	91.0	95.0	98.0

SUMMARY OF DECK QUANTITIES	INCLUDES PARAPETS, CURBS AND/OR SIDEWALKS	
HALF ROADWAY SLAB WITH	REINFORCEMENT BARS - lbs/lin ft.	CLASS AA CONCRETE Cu. Yds./lin. ft.
SAFETY CURB & DIVISOR	285.50	1.25
SIDEWALK & DIVISOR	316.30	1.47

Approved: AUG - 2 1963
R. J. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

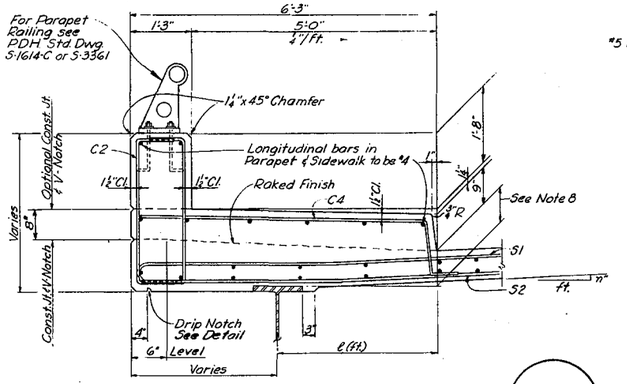
STANDARD STEEL I-BEAM BRIDGES

84' ROADWAY

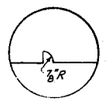
SHEET 1 OF 1

S-2734

NO. 184 E.R.P



STANDARD SIDEWALK DETAIL
Scale ¾"=1'-0"



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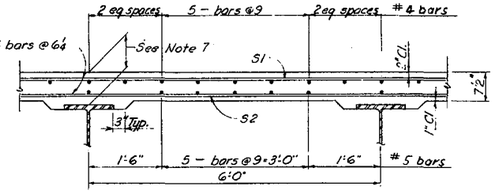
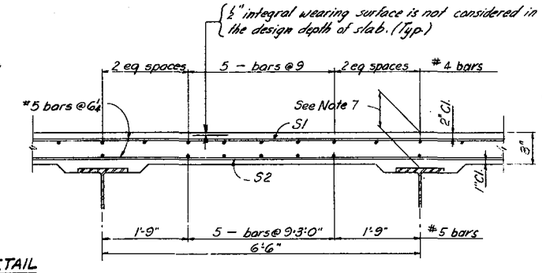
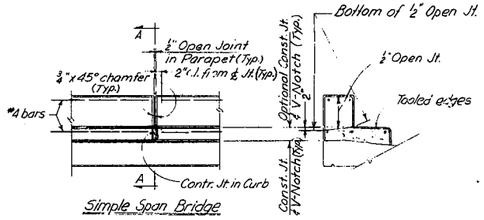
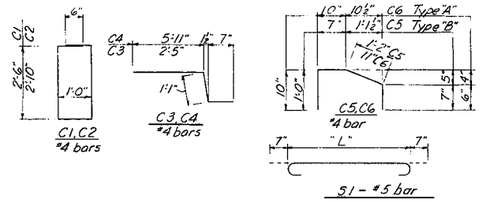


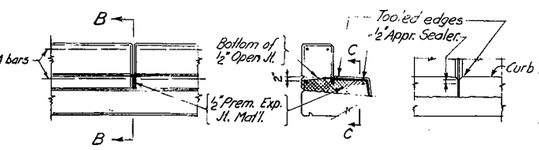




ELEVATION

SECTION A-A





Continuous Bridge, or combined Simple & continuous spans.

ELEVATION

SECTION B-B

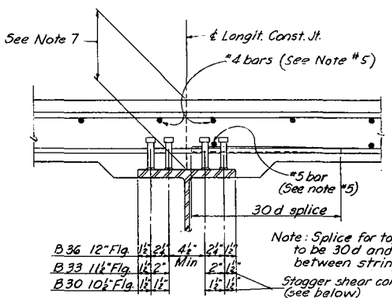
SECTION C-C

OPEN JOINT DETAILS
Scale ⅜"=1'-0"

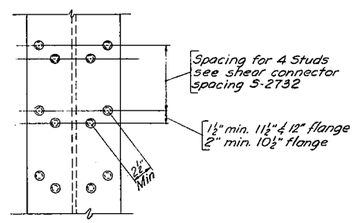
BAR BENDING DIAGRAMS
All dimensions are out to out.

NOTES and REINFORCEMENT BAR INSTRUCTIONS

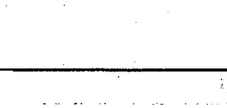
1. Place transverse reinforcement in deck slab parallel to ℄ Brgs for skew angles 75° and more. The spacing of bars shall be measured along center line of roadway. For skews less than 75° the bars shall be placed normal to centerline of roadway and length cut to fit.
2. A one-half inch open joint in parapet shall be provided at two to three times the spacing of the railing posts. Joints shall be located at not less than 1'-0" from centerline of railing post.
3. Steel reinforcement bars designed for fs = 18,000 psi and detailed per A.C.I. code. Bars shall be spliced 30d except as noted.
4. All Concrete in Slab, Curb, Sidewalk, Divisor and Parapet shall be Class AA Concrete.
5. At a longitudinal construction joint, **the top and bottom** longitudinal bars, directly over the stringer, shall be placed as shown.
6. Bars C_1, C_2, C_3 and C_4 to be spaced at 12" ± c.c. Bars C_2 and C_4 to be spaced at double spacing of transverse bars S_1 and S_2.
7. Min. distance Top of Slab to Top of Flange at ℄ Bearings = Depth of Slab plus ½" for camber up to 2", or Depth of Slab plus ¾" for camber over 2".
8. Min. distance Top of Slab at Gutter to Top of Flange at ℄ Bearings = Depth of Slab plus n x ℄ (allowance for slab cross slope) plus allowance for camber as in Note 7.



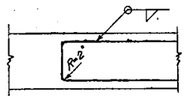
STUD SPACING AT LONGITUDINAL CONSTRUCTION JOINT
Scale 1½"=1'-0"



PLAN
Scale 1½"=1'-0"

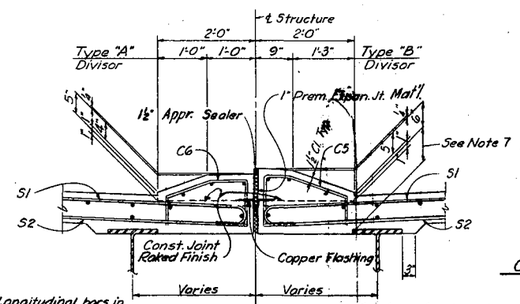


V-NOTCH DETAIL



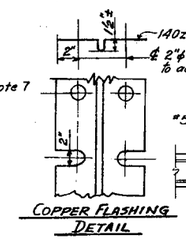
Max. thickness of Cov. Pl.	Size of weld
½"	3/16"
⅝"	¼"
1½"	5/16"

COVER PLATE WELDS.

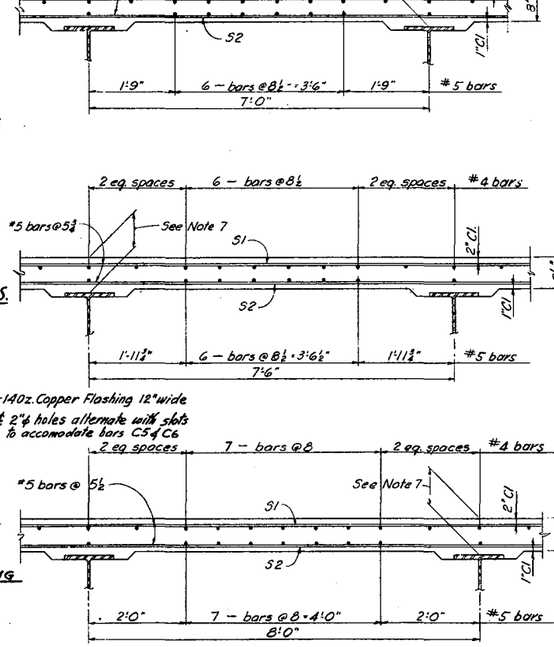


STANDARD DIVISOR DETAIL
Scale ¾"=1'-0"

Surface treated as shown on Std. Dwg. SD-13



COPPER FLASHING DETAIL



STANDARD SLAB REINFORCEMENT
Scale ¾"=1'-0"

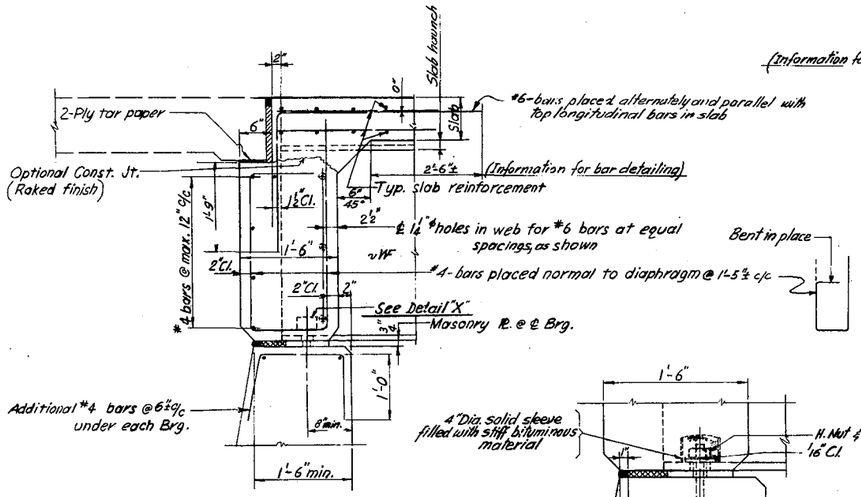
AUG - 2 1963
Approved:
R. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

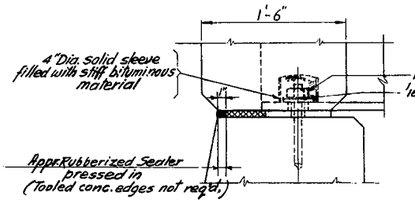
STANDARD STEEL I-BEAM BRIDGES DETAILS

SHEET 1 OF 1

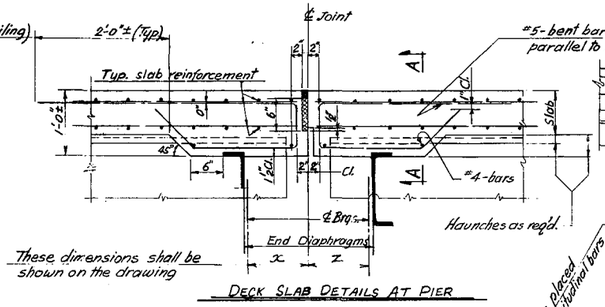
S-2735



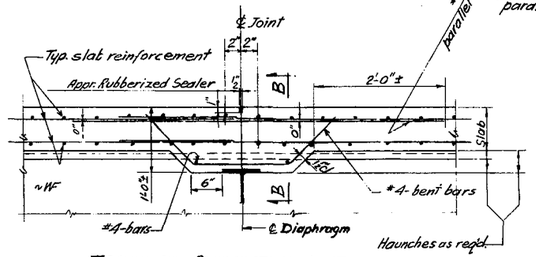
TYPICAL SECTION
(Normal to Diaphragm)



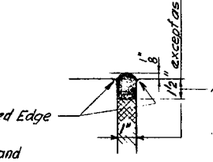
DETAIL "X"
(Exp. and Fix. Ends)



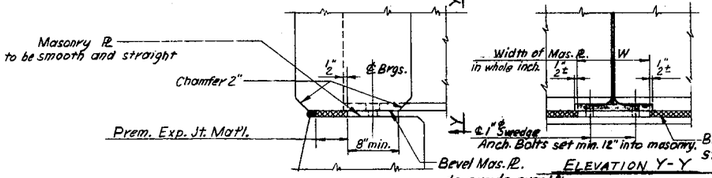
DECK SLAB DETAILS AT PIER



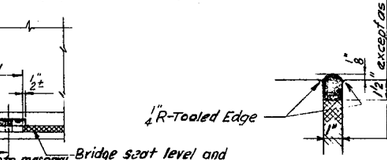
TRANSVERSE CONSTRUCTION JOINT



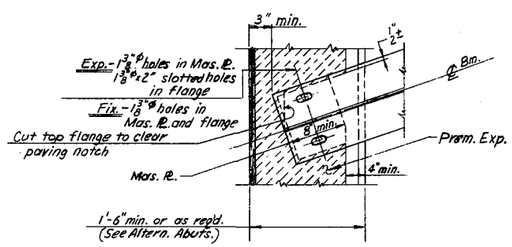
CLOSED JT. DETAIL



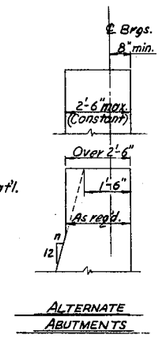
SECTION PARALLEL TO ℄ BEAM



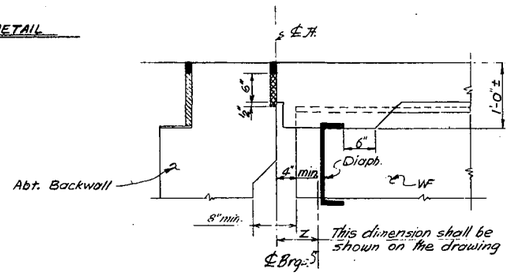
ELEVATION Y-Y



PLAN
(End Diaphr. not shown)



ALTERNATE ABUTMENTS



ABUTMENT END

For slab reinforcement see Deck Slab Details at Pier, shown above.

NOTE:
For type and application of joints see Std. Dwg. S-2721, Sheet 2.

END CONCRETE DIAPHRAGM AT ABUTMENTS

Simple-Span Bridges: Fix. and Exp. Brgs. for spans max. 50 Ft.

By: G.T.V.
Ck: A.E.K.

Approved: AUG - 2 1963
K. H. Dennison
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE UNIT

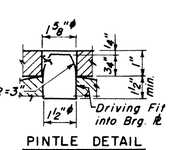
STANDARD STEEL I-BEAM BRIDGES END DETAILS

SHEET 1 OF 1

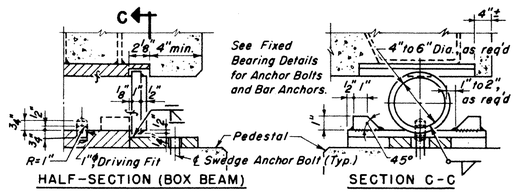
S-2736

DETAILS

A — PINTLE DETAIL (for Fixed Bearing)

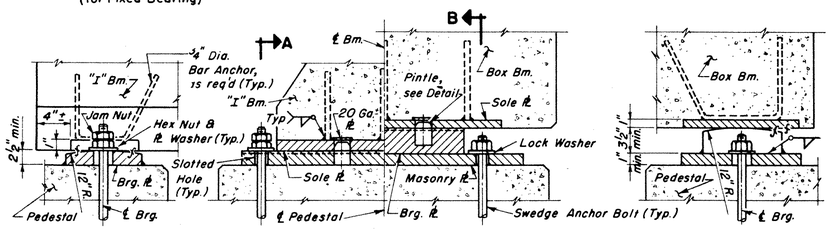


EXPANSION BEARING



HALF-SECTION (BOX BEAM) — SECTION C-C

FIXED BEARINGS



SECTION A-A — HALF-SECTION ("I" BM.) — HALF-SECTION (BOX BEAM) — SECTION B-B

CRITERIA:

STEEL BEARINGS, AS SHOWN, ARE REQUIRED:

- AT EXPANSION ENDS OF "I" BMS. GREATER THAN 95'-0".
- UNDER ANY TYPE BM. USING METAL ℄ DAMS: EXCEPTION--IF SPAN IS BETWEEN 80'-0" & 95'-0", TYPE B STEEL BRG. OF S-2721 MAY BE USED.
- AT FIXED END OF ANY TYPE BM., IF A NEOPRENE (PLAIN OR SHIM TYPE) BEARING PAD CAN NOT MEET THE DESIGN CRITERIA SET FORTH UNDER NOTE 7.

NOTES:

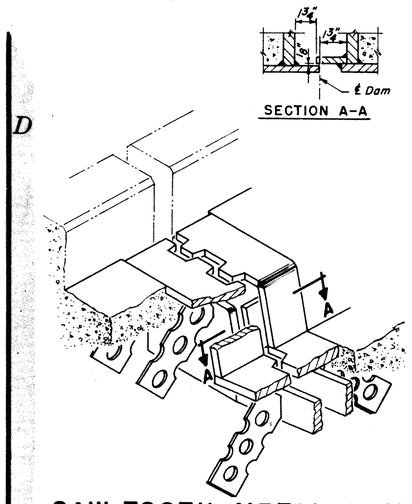
- MATERIAL: CORROSION RESISTANT STEEL, ASTM A242 OR EQUAL (MAYARI-R, COR-TEN OR YOLOY)
- SPECIFY PREPARATION OF BRG. AREA IN ACCORDANCE WITH FORM 409.

INSTRUCTIONS:

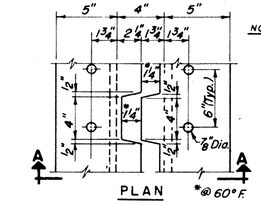
- DETAILS, AS SHOWN, TO BE MODIFIED FOR SKEWS AND BEAM SPACING.
- SHOW COMPLETE DETAILS FOR STEEL BRGS. ON DESIGN & FABRICATOR SHOP DRAWINGS.
- DETAILS SHOWN TO BE USED AS GUIDE ONLY.
- DETAIL BAR ANCHORS TO CLEAR PRESTRESSING STRANDS.
- BRGS. SHALL BE 90° TO ℄ OF BMS.
- BM.-OVERHANG SHOWN FOR EXP. BRG. ABOVE TO BE MODIFIED FOR "I" BMS. THIS SUPERSEDES TYP. BRG. DETAIL ON SH.#1, S-3908.

STEEL BEARINGS

D — SAW-TOOTH METAL DAM (over SAFETY CURB & DIVISOR)



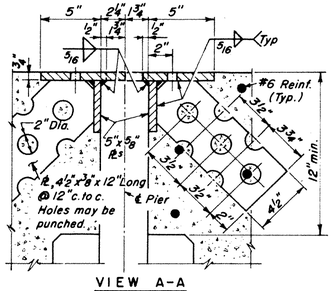
B — SAW-TOOTH METAL DAM



PLAN *@ 60° F.

NOTES:

- CONCRETE SHALL BE PLACED UNDER METAL DAM AND VIBRATED UNTIL IT IS FORCED THRU THE ¾" HOLES. STRIKE OFF EXCESS CONCRETE. AFTER CONCRETE HAS CURED, THE ¾" HOLES SHALL BE INSPECTED AND ALL UNSOUND CONCRETE REMOVED. CLEAN THE HOLES WITH AN AIR JET AND FILL WITH AN APPROVED SEALER.
- FOR WELDING, THE SHIELDED METAL ARC PROCESS SHALL BE USED. ELECTRODES SHALL CONFORM TO ASTM E6015, E6016, E7016 & E7018.



VIEW A-A

INSTRUCTIONS:

- DAM SHALL EXTEND OVER TOP OF CURB OR DIVISOR. SEE DETAIL D. DAM OVER SIDEWALK REQUIRES SPECIAL DESIGN.
- DETAILS, ADAPTED TO GIVEN SKEW ARE TO BE SHOWN ON DESIGN PLANS.
- COMPLETE DETAILS TO BE SHOWN ON FABRICATOR'S SHOP DRAWINGS.
- DETAILS AT ABUTMENT ARE SIMILAR.

CRITERIA:

- WHERE EXPANSION DAMS ARE REQUIRED, SAW TOOTH METAL DAMS MAY BE USED IF DRAINAGE IS NOT OBJECTIONABLE AND IF NEOPRENE BEARING PADS CAN BE USED.

SAW-TOOTH METAL DAM

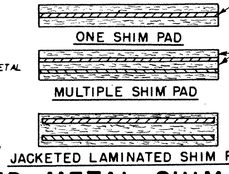
C — LAMINATED METAL SHIM NEOPRENE BEARING PADS

NOTE:

- PADS TO BE IN ACCORDANCE WITH S-3910, DATED MARCH 8, 1962.

CRITERIA:

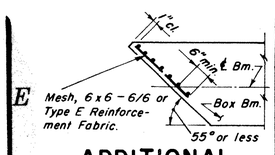
- IF STEEL ℄ DAMS ARE NOT USED, LAMINATED METAL SHIM NEOPRENE BEARING PADS SHALL BE USED WITH:
  - ANY BOX BEAM WHEN:
    - REQUIRED BY DESIGN OR
    - THICKNESS OF A SINGLE PAD IS GREATER THAN 1½".
  - "I" BMS. FOR SPANS FROM 80'-0" TO 95'-0"



ONE SHIM PAD — MULTIPLE SHIM PAD — JACKETED LAMINATED SHIM PAD

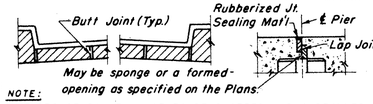
LAMINATED METAL SHIM NEOPRENE BEARING PADS

E — ADDITIONAL END REINFORCING



ADDITIONAL END REINFORCING

F — SPONGE FILLER JOINT

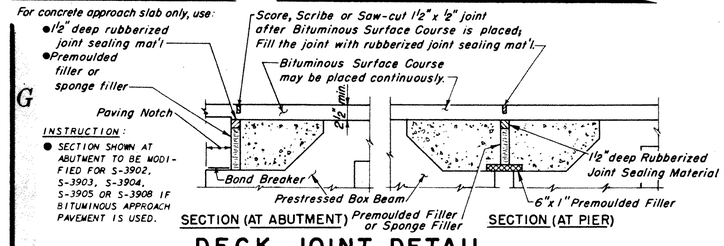


NOTE:

- SPONGE FILLER UNIT TO BE SHIPPED AND INSTALLED IN ONE CONTINUOUS PIECE. SPLICING TO BE MADE IN THE SPONGE FABRICATOR'S SHOP USING AN APPROVED NEOPRENE ADHESIVE CONTAINING 26±2% NEOPRENE SOLIDS OR EQUAL.
- FIELD SPLICING WILL NOT BE PERMITTED UNLESS OTHERWISE SPECIFIED ON THE PLANS.

SPONGE FILLER JOINT

G — DECK JOINT DETAIL



INSTRUCTION:

- SECTION SHOWN AT ABUTMENT TO BE MODIFIED FOR S-3902, S-3903, S-3904, S-3905 OR S-3908 IF BITUMINOUS APPROACH PAVEMENT IS USED.

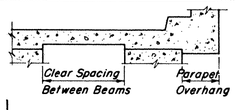
SECTION (AT ABUTMENT) — SECTION (AT PIER)

DECK JOINT DETAIL

H — BEAM SPACING & OVERHANG

INSTRUCTIONS:

- CLEAR SPACING BETWEEN BEAMS AND/OR PARAPET OVERHANG AS SHOWN IN CROSS-SECTION, SH.#3, SHALL BE MODIFIED AS FOLLOWS:



CRITERIA:

	Clear Spacing	Parapet Overhang	
S-3908	18" min. to 7'-6" max.	18" to 30"	
S-3904 S-3905	6" min. to 7'-6" max.	12" to 18"	
S-3902 S-3903	——	7" min. 1'-0" Preferred	Combinations of 3'-0" and 4'-0" wide Beams may be used.
S-3906 S-3907	——	6" min. for 8 Beams in Cross-Section	

BEAM SPACING & OVERHANG

PREPARED BY DIVISON OF BRIDGE ENGINEERING, P.D.H.

NOTES & INSTRUCTIONS

1. *PRESTRESSING STEEL IN PRETENSIONED OR PRE-POST-TENSIONED BEAMS-(SH.#4, DESIGN NOTES):* NUMBER OF STRANDS SELECTED FROM THE CURVES FOR BEAMS SHALL BE CHECKED TO PROVIDE MINIMUM CROSS-SECTIONAL AREA OF PRESTRESSING STEEL OF NOT LESS THAN 0.3% OF THE BASIC CROSS-SECTIONAL AREA OF THE MEMBER.
2. *SHEAR KEY IN BEAM -(SH.#5):* SHALL NOT BE SHOWN NOR FABRICATED INTO OUTSIDE FACE OF FASCIA BOX BEAM.
3. *HIGH STRENGTH STEEL FOR BEARINGS-(SH.#1):* SHALL BE CORROSION RESISTANT ASTM A242 STEEL OR EQUAL (MAYARI-R, COR-TEN OR YOLOY).
4. *WATERPROOFING AT ABUTMENT-(SH.#1):* INSTEAD OF NEOPRENE TUBE AS SHOWN, SPECIFY CLOSED-CELLULAR NEOPRENE SPONGE CONTINUOUS STRIP: 2" x (¼" + THICKNESS OF BEARING PAD) x FULL LENGTH OF ABUTMENT BRIDGE SEAT.
5. *AT ABUTMENT CHEEK WALL-(SH.#2):* INSTEAD OF PREMOULDED JOINT MATERIAL AS SHOWN AGAINST BEAM AND SUPERSTRUCTURE, SPECIFY CLOSED-CELLULAR NEOPRENE SPONGE FOR FULL APPLICATION AREA.
6. *BALANCE OF HORIZONTAL FORCES:*

   GIVE SPECIAL ATTENTION TO:
   - ESTABLISHMENT OF THE FIXED AND EXPANSION ARRANGEMENT (PROVIDE OPPOSING MOVEMENT AT PIERS, IF POSSIBLE).
   - SELECTION OF TYPE BEARINGS;
     - STEEL BEARINGS (CONSIDER DESIGN REQUIREMENTS).
     - BEARING PADS (CONSIDER SHAPE FACTOR AND HARDNESS).
7. *NEOPRENE BEARING PADS-(SH.#1):*
   - 50, 60 OR 70 DUROMETER BEARING PADS MAY BE USED. THE MATERIAL FOR 50 DUROMETER PADS SHALL MEET THE REQUIREMENTS FOR 60 DUROMETER PADS AS LISTED IN SUPPLEMENT 6.24.2 OR 6.14.2 EXCEPT THE FOLLOWING SUBSTITUTIONS:
     UNDER (A) DUROMETER HARDNESS, 50±5
     (F) TEAR TEST REQUIRMENT, 225#/50.IN.
     (G) SHEAR MODULUS TEST REQUIREMENT, 110±12 P.S.I.
   - DESIGN CRITERIA; ITEM (5): FOR 50, 60 & 70 DUROMETER PADS.
     - THE POSITIVE OR NEGATIVE MOVEMENT CAUSED BY ANTICIPATED TEMPERATURE CHANGE SHALL NOT EXCEED 25% OF THE THICKNESS OF THE PAD. (TO COMPUTE THE MOVEMENT IN ONE DIRECTION ASSUME MAX. CHANGE IN TEMPERATURE OF CONCRETE FROM TIME OF PAD INSTALLATION TO BE 50°F.).
     - PAD THICKNESS = 0.0144 x BEAM LENGTH IN FEET (MAX. ℄ = 1¼").
     - THE TABLE ON SH.#1 (DIMENSIONS OF PADS) IS TO BE REVISED TO MEET THE ABOVE REQUIREMENTS.
8. *ABUTMENT STEM STEEL (FRONT FACE):* #5 VERTICAL REINFORCING BARS @ 18" ARE MANDATORY.
9. *TIEBARS IN CHEEKWALLS-(SH.#2):* SHALL BE MODIFIED TO #3 BARS AT 6" MAXIMUM SPACING.
10. *PROTRUDING STRANDS:* WHEN EXTENDED STRANDS ARE SPECIFIED, NOTE ON SHOP DRAWING "DO NOT PAINT END OF BEAM WITH BITUMASTIC MATERIAL".
11. *DRAINAGE:* ALL PIPES TO BE STANDARD 6" ϕ W.I. OR APPROVED EQUAL.
12. *JOINT MATERIAL:* IF PREMOULDED JOINT FILLER OR PREMOULDED FILLER IS SPECIFIED IN THE STANDARDS, PREMOULDED CORK JOINT MATERIAL SHALL BE SPECIFIED ON THE CONTRACT PLANS.
13. *ALTERNATING FULL DEPTH DIAPHRAGMS FOR PIERS — S-3904 AND S-3905 (SH.#1):* REFER TO SECT. C-C, SH.#3 OF S-3908.
14. *ALUMINUM DRAIN, S-3902 THRU S-3908* 2 ALUMINUM BU 4.25; 2 STEEL BU 11.5; OR 8" x 4" RECTANGULAR SECTION FABRICATED WITH ⅜ PLATES MAY BE SUBSTITUTED FOR THE CHANNELS SHOWN. ALL STEEL DRAINS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A-123 AFTER WELDING.
15. *SECTION B-B--(SH. 3):* INTERMEDIATE DIAPHRAGMS, BETWEEN BEAMS, ARE NOT REQUIRED FOR SPREAD BOX OR "I" BEAM SUPERSTRUCTURES WITH SPANS LESS THAN 60'-0".
16. *PEDESTALS:*
    - "I" BMS. AND SPREAD BOX BMS.:
      WHEN THE BRIDGE SEAT IS NOT UNIFORM OR WHERE STEEL SHOES ARE USED, IT IS MANDATORY THAT CONCRETE PEDESTALS BE USED AS THE BEAM BEARING SEATS. THE PEDESTALS SHALL VARY IN HEIGHT AND BE SET ON A UNIFORMLY SLOPED OR LEVELED TOP OF SUBSTRUCTURE (PIER OR ABUTMENT WITH BACK WALL).
    - ADJACENT BOX BEAM:
      UNDER SPECIAL CONDITIONS PEDESTALS FOR BEAM BEARING SEATS MAY BE REQUIRED.
17. *BEARING PADS, THICKNESS-(SH.#1):* FOR SPAN 80'-0" OR LONGER, THE THICKNESS OF BEARING PADS AT FIXED END SHALL BE 1" OR MAY BE OF SAME THICKNESS AS PADS AT EXPANSION END.
18. *DRAINAGE-S-3902 THRU S-3907 (SH.#6), S-3908 (SH.#10):*
    - STRUCTURE OVER A STREAM: SCUPPERS AND DRAINAGE PIPES MAY BE OF A TYPE AS SHOWN ON THE STANDARDS, PROVIDED THE DRAINAGE CAPACITY IS EQUIVALENT TO THAT SHOWN IN THE ORIGINAL BRIDGE DESIGN.
    - STRUCTURE OVER A ROADWAY OR RAILROAD: SCUPPERS AND DRAINAGE UNIT SHALL BE AS SHOWN ON THE ORIGINAL BRIDGE DESIGN. MINOR MODIFICATIONS, NECESSARY FOR FITTING THE UNIT TO THE TYPE OF SUPERSTRUCTURE SELECTED, WILL BE PERMITTED.
19. *PAY ITEMS, "U" WINGS-(SH.#2):* THE SECTION, AS SHOWN, APPLIES TO ORIGINAL BRIDGE DESIGN. FOR ALTERNATE BRIDGE DESIGN, THE LIMIT FOR SUBSTRUCTURE AND SUPERSTRUCTURE WILL BE CHANGED TO FIT THE INDIVIDUAL DESIGN AND AS LISTED IN THE PROPOSAL.
20. *DECK SLAB THICKNESS FOR ALTERNATE BRIDGE DESIGN-(SH.#3):* THICKNESS OF 7½" MIN. AS REQUIRED BY THESE STANDARDS MAY BE MODIFIED TO THAT AS SHOWN ON ORIGINAL BRIDGE DESIGN, IF DESIGN COMPUTATIONS ARE SUBMITTED AND APPROVED BY THE BRIDGE ENGINEER IN THE CENTRAL OFFICE.
21. *BEAM DEPTH:* MAY BE VARIED IN 3" INCREMENTS (FROM 21" TO 48" FOR BOX BEAMS AND FROM 30" TO 60" FOR "I" BEAMS) PROVIDED THAT THE DESIGN AND DETAILS CONFORM TO THE CRITERIA AND SECTIONS SHOWN ON THE REFERRED STANDARD DRAWINGS.

*FOR ALTERNATE BRIDGE DESIGN

DETAILS & NOTES & INSTRUCTIONS

	ADJACENT BOX BEAMS (Composite)		SPREAD BOX BEAMS (Composite)		ADJACENT BOX BEAMS (Bituminous Surface Course)		I-BEAMS (Comp.)
	S-3902	S-3903	S-3904	S-3905	S-3906	S-3907	S-3908
DETAILS A	✓	✓	✓	✓	✓	✓	✓
DETAILS B			✓	✓			✓
DETAILS C	✓	✓	✓	✓	✓	✓	✓
DETAILS D			✓	✓			✓
DETAILS E	✓	✓	✓	✓	✓	✓	
DETAILS F	✓	✓	✓	✓	✓	✓	✓
DETAILS G	✓	✓	✓	✓	✓	✓	✓
DETAILS H	✓	✓	✓	✓	✓	✓	✓
NOTES & INSTRUCTIONS 1	✓	✓	✓	✓	✓	✓	✓
2	✓	✓	✓	✓	✓	✓	
3							✓
4	✓	✓			✓	✓	
5	✓	✓	✓	✓	✓	✓	✓
6	✓	✓	✓	✓	✓	✓	✓
7	✓	✓	✓	✓	✓	✓	✓
8	✓	✓	✓	✓	✓	✓	✓
9	✓	✓	✓	✓	✓	✓	✓
10			✓	✓			✓
11	✓	✓	✓	✓	✓	✓	✓
12	✓	✓	✓	✓	✓	✓	✓
13			✓	✓			
14	✓	✓	✓	✓	✓	✓	✓
15			✓	✓			✓
16	✓	✓	✓	✓	✓	✓	✓
17	✓	✓	✓	✓	✓	✓	✓
18	✓	✓	✓	✓	✓	✓	✓
19	✓	✓	✓	✓	✓	✓	✓
20			✓	✓			✓
21	✓	✓	✓	✓	✓	✓	✓

NOTE:

DETAILS AND ***NOTES & INSTRUCTIONS*** AS CHECKED ABOVE FOR EACH S-NO.-SERIES ARE TO AMEND, SUPERSEDE AND/OR SUPPLEMENT THE DATA SUPPLIED IN THE INDIVIDUAL S-NO.-SERIES LISTED.

Approved: MAR 8 1962

J. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

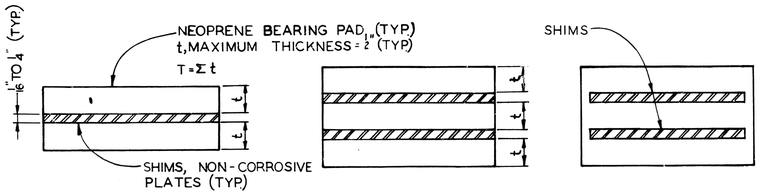
Department of Highways
BRIDGE UNIT

PRESTRESSED CONCRETE BRIDGE STANDARDS

ADDENDUM

SHEET 1 OF 1

S-3909



ONE SHIM PAD | MULTIPLE SHIM PAD | JACKETED LAMINATED SHIM PAD (OPTIONAL)

NOTE
PINS AND PLATE SUPPORTS SHALL BE SHOWN ON FABRICATOR'S' SHOP DRAWINGS.

LAMINATED SHIM BEARING PADS

DESIGN CRITERIA

1- (A) 2C% MAXIMUM SHEAR STRAIN.
(B) MAXIMUM CHANGE IN TEMP. OF CONCRETE 50°F.
(C) THERMAL COEFFICIENT OF CONCRETE C.COCOO6.
(D) NEOPRENE TO BE 50, 60 OR 70 DUROMETER.
T, TOTAL THICKNESS OF NEOPRENE MATERIAL, (IN.) = C.C1C (BEAM LENGTH IN FT.)
$T = \Sigma t$

2- D.L.+L.L. BEARING PRESSURE: 700PSI MAXIMUM FOR MOULDED PADS.
600PSI MAXIMUM FOR PADS CUT TO SIZE AFTER FABRICATION

INSTRUCTIONS: L=LENGTH(IN.); W=WIDTH(IN.); T=THICKNESS (IN.); (D.L)=DEAD LOAD(LB.); (L.L)=LIVE LOAD(LB.)

1. CHECK FOR BEARING HARDNESS:

COMP. STRESS (P.S.I.) $= \frac{(D.L)+(L.L)}{L\ W}$

SHAPE FACTOR $= \frac{L\ W}{2(L+W)(t)}$ THIS SHAPE FACTOR NOT TO EXCEED 7.0

COMP. STRAIN SHALL NOT EXCEED 15%.

2- CHECK SLIPPAGE:

BEAM TRAVEL PAD CAN ABSORB WITHOUT SLIP (IN.) $= \frac{(DL)T}{5\ L\ W} \times \frac{1.8}{K}$

$K = \begin{cases} 110 (\text{HARDNESS OF } 50) \\ 160 (\text{HARDNESS OF } 60) \\ 215 (\text{HARDNESS OF } 70) \end{cases}$

BEAM TRAVEL THAT WILL OCCUR (IN) = C.OC5C4 (BEAM LENGTH IN FT.)
A. TEMPERATURE RANGE FOR CONCRETE 70°F.
B. LOWEST TEMPERATURE FOR SHEAR MODULUS OF NEOPRENE 0°F.
BEAM TRAVEL THAT WILL OCCUR MUST BE LESS THAN THE AMOUNT PAD CAN ABSORB.

3- MAX. SHIM THICKNESS TO BE 50% OF A SINGLE NEOPRENE LAYER.

4- SELECTION OF NEOPRENE MATERIAL, NUMBER OF SHIMS AND GENERAL PAD DESIGNS SHALL BE MADE TO PROVIDE THE LEAST AMOUNT OF HORIZONTAL FORCE EXERTED BY THE BEARING TO THE SUBSTRUCTURE. COMPUTATIONS VERIFYING THAT THIS CONDITION IS MET OR SHOWING THAT HORIZONTAL FORCE TRANSMITTED TO THE SUBSTRUCTURE IS NOT EXCESSIVE, SHALL BE SUBMITTED WITH EACH PAD DESIGN. DESIGNS SHALL BE APPROVED BY THE BRIDGE ENGINEER.

DATA:

1- FOR COMPRESSIVE STRESS/STRAIN CURVES & SHAPE FACTOR INFORMATION, REFER TO MANUFACTURERS' RECOMMENDATIONS.

2- STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 1961 EDITION BY A.A.S.H.O.

SPECIFICATIONS

1. DESCRIPTION: LAMINATED METAL SHIM NEOPRENE BEARING PADS SHALL BE FABRICATED TO THE DIMENSIONS AS SHOWN ON THE DESIGN DRAWINGS AND/OR APPROVED SHOP DRAWINGS AND MUST CONFORM TO THE REQUIREMENTS OF THE PROPOSAL.
FOR THE PURPOSE OF THESE SPECIFICATIONS THE BRIDGE ENGINEER SHALL MEAN THE CHIEF BRIDGE ENGINEER IN THE CENTRAL OFFICE.

2. DESIGN: COMPUTATIONS WILL BE REQUIRED FOR PAD DESIGNS. DESIGNS SHALL BE IN ACCORDANCE WITH THE DESIGN CRITERIA AND OTHER *INSTRUCTIONS*

3. SHOP DRAWINGS: THE CONTRACTOR SHALL SUBMIT TWO SETS OF SHOP DRAWINGS AND COMPUTATIONS TO THE BRIDGE ENGINEER FOR APPROVAL AND NINE *SETS OF PRINTS* AND ONE SET OF TRACINGS ON CLOTH OR EQUAL OF THE APPROVED DRAWINGS MUST BE FURNISHED TO THE BRIDGE ENGINEER FOR HIS FILE AND DISTRIBUTION. THE CONTRACTOR SHALL NOT PROCEED WITH THE MANUFACTURE OF THE PADS UNTIL THE FINAL SHOP DRAWINGS HAVE BEEN APPROVED. THE PROCESS OF FABRICATION USED FOR THE SHIM PADS SHALL BE DESCRIBED ON THE SHOP DRAWINGS.

4. MATERIALS: UNLESS OTHERWISE SPECIFIED MATERIALS SHALL CONFORM TO THE FOLLOWING REQUIREMENTS:
A. NON-CORROSIVE PLATES
1. STEEL ASTM A-242. (COLD ROLLED)
2. STAINLESS STEEL ASTM 167 OR ASTM 176
3. ALUMINUM ASTM B209-ALLOY 6061A TEMPER T6.
B. PLATES FOR JACKETED SHIM PADS
1. ALL MATERIAL CONFORMING TO ITEMS 4.A. 1T03
2. CARBON STEEL 1010-1020
C. NEOPRENE BEARING PADS IN ACCORDANCE WITH SECTION 6.4.2 DATED NOV. 1, 1960 OF FORM 408/60 OR SUBSEQUENT REVISIONS.
D. TYPES OF VULCANIZING ADHESIVES TO BE APPROVED BY THE BRIDGE ENGINEER

5. MANUFACTURE OF LAMINATED METAL SHIM NEOPRENE BEARING PADS:
A. GENERAL:
PADS MAY BE MOULDED IN ACCORDANCE WITH DESIGN DIMENSIONS OR FABRICATED IN LARGE PIECES AND CUT TO SPECIFIED SIZE. PADS SHALL BE ASSEMBLED USING UNCURED NEOPRENE AS SPECIFIED ON THE SHOP DRAWINGS AND FULLY MOULDED IN ONE OPERATION STARTING WITH UNCURED STOCK (NEOPRENE) AND VULCANIZING BETWEEN BONDED SURFACES.
B. CUTTING OF METAL PLATES:
METAL PLATES FOR PADS ASSEMBLED WITH UNCURED NEOPRENE MAY BE CUT WITH SHEARS. CUT EDGES SHALL BE SMOOTH AND BURR REMOVED. ALL DEFORMATIONS OR ROUGH EDGES CAUSED BY CUTTING SHALL BE REMOVED.
C. PREPARATION AND POSITIONING OF METAL PLATES:
METAL SURFACES SHOULD BE CLEANED OF ALL OIL, GREASE, RUST, SCALE, DIRT OR OTHER CONTAMINANTS THRU GRIT BLASTING AND DEGREASED BEFORE AND AFTER GRIT BLASTING.
ALUMINUM SURFACES SHALL, IN ADDITION TO BLASTING, BE PREPARED CHEMICALLY BY THE USE OF COMMERCIALLY AVAILABLE CONVERSION COATINGS. THE TYPE OF COATING TO BE LISTED ON THE SHOP DRAWING.
THE SHIMS AND UNCURED NEOPRENE LAYERS SHALL BE POSITIONED ACCURATELY BY SUPPORTING-PINS OR ANY OTHER APPROVED METHODS AS SHOWN ON THE SHOP DRAWINGS. WHEN PIN SUPPORTS ARE USED, FOR MULTIPLE SHIM PADS, THE INTERMEDIATE SHIM PLATES SHALL BE SUPPORTED BY PINS ON SIDES OF THE PAD. INTERIOR PINS SHALL NOT BE USED. THE HOLES FORMED IN THE FINISHED OUTER NEOPRENE BEARING PADS SHALL BE FILLED, AFTER CURING AND REMOVAL OF PINS, WITH A NEOPRENE COMPOUND CONTAINING A MINIMUM OF 50% NEOPRENE SOLIDS. THE SOLIDS SHALL BE OF THE SAME MATERIAL AS THE NEOPRENE BEARING PADS. OTHER METHODS OF FABRICATION MAY BE USED IF SHOWN ON APPROVED SHOP PLANS.
D. APPLICATION OF ADHESIVE:
APPLICATION SHALL BE MADE IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. WHEN SPRAYING OF ADHESIVES IT IS NECESSARY TO HAVE THE ADHESIVE REACH THE METAL PART WET.
E. DRYING OF ADHESIVES, HANDLING OF CEMENTED PARTS AND PREPARATION OF UNCURED NEOPRENE COMPOUND:
THIS SHALL BE IN ACCORDANCE WITH GOOD PRACTICE AND AS RECOMMENDED BY THE MANUFACTURER OF THE VULCANIZING ADHESIVE.
F. FABRICATION OF PADS:
PREPARED LAYERS OF NEOPRENE AND METAL SHIMS SHALL BE PLACED IN A PRESS AND SUBJECTED TO SUFFICIENT PRESSURE AND TEMP. TO MAINTAIN INTIMATE CONTACT OF THE ENTIRE SURFACE DURING VULCANIZING VULCANIZATION SHALL CONFORM TO THE PREVAILING PRACTICE. CURED NEOPRENE SHALL CONFORM TO THE REQUIREMENTS OF ITEM 4C.
G. FINISHING OF PADS:
THE FINISHED CUT PADS SHALL BE MACHINED SMOOTH AND BUFFED TO REMOVE ALL NICKS AND CUT MARKS CAUSED BY THE CUTTING OR THE FABRICATION PROCESS ON NEOPRENE PAD. THE FINAL PRODUCT SHALL HAVE A NEAT AND SMOOTH APPEARANCE. PADS FULLY MOULDED IN ONE OPERATION WITH NEAT AND SMOOTH EDGES AND SIDES, NEED NOT BE MACHINED.
PADS SHOWING UNBONDED SURFACES AT ANY PLACE SHALL BE REJECTED UNLESS THEY ARE REBONDED THROUGH VULCANIZING.
H. FABRICATION TOLERANCES:
PAD THICKNESS MAY VARY $\pm \frac{1}{16}$ OF TOTAL DEPTH. PAD LENGTH AND WIDTH MAY VARY $\pm \frac{1}{4}$" FOR TOTAL DIMENSIONS. NEOPRENE EDGES OF THE CUT PAD SHALL BE SMOOTH AND SHALL NOT SHOW NICKS OR CUTS.

6. NOTICE OF FABRICATION: PENNSYLVANIA DEPARTMENT OF HIGHWAYS, DIVISION OF BRIDGE ENGINEERING O.R. 23C-1E AND CENTRAL TESTING LABORATORY, HARRISBURG, PENNA. SHALL BE NOTIFIED IN WRITING TEN (10) DAYS IN ADVANCE OF THE SCHEDULED FABRICATION (GIVING ESTIMATED TIME AND DATE, PLACE AND COMPLETION DATE OF THE FABRICATION.)

7. CERTIFICATION: ALL SHIPMENTS OF THIS MATERIAL MUST BE ACCOMPANIED BY A NOTARIZED COPY OF THE CERTIFICATE OF COMPLIANCE EXECUTED ON FORM 480 (AVAILABLE AT PENNSYLVANIA DEPARTMENT OF HIGHWAYS, NORTH OFFICE BUILDING, HARRISBURG, PENNA.) AND SHALL BE GIVEN TO THE ENGINEER UPON ARRIVAL AT THE POINT OF DELIVERY. THREE (3) COPIES OF THIS CERTIFICATE MUST BE FORWARDED TO THE PENNSYLVANIA DEPARTMENT OF HIGHWAYS LABORATORY, 1118 STATE STREET, HARRISBURG, PENNA.
FORM 480 SHALL BE AMENDED WITH THE FOLLOWING STATEMENTS; "PADS ARE FABRICATED IN STRICT ACCORDANCE WITH THE APPROVED SHOP DRAWING #_____ IN THE PERIOD FROM_____TO_____"
"SHIMS USED ARE CONFORMING TO A.S.T.M._____"

8. INSPECTION: ALL PADS MAY BE INSPECTED BY THE ENGINEER AT THE FABRICATOR'S PLANT; HOWEVER, FINAL ACCEPTANCE MAY BE MADE AT THE BRIDGE SITE PRIOR TO PLACING THE PADS IN THEIR PERMANENT POSITION. THE DEPARTMENT RESERVES THE RIGHT TO INSPECT THE COMPLETE PROCESS COVERING MANUFACTURE OF PADS.
A. NEOPRENE BEARING TEST PADS OF THE SAME MATERIAL USED IN THE FABRICATION OF THE BRIDGE PADS, SHALL BE SUBMITTED TO THE DEPARTMENT IN ORDER THAT A.S.T.M. TEST SAMPLES AS REQUIRED MAY BE CUT FROM THESE PADS. TWO (2) NEOPRENE BEARING TEST PADS (12"X12"X½") AND LAMINATED METAL SHIM NEOPRENE BEARING PADS OF 6"X6" MINIMUM SIZE WILL BE REQUIRED FOR EVERY TWENTY (20) SHIM PADS OR FRACTION THEREOF DELIVERED FOR EACH BRIDGE PROJECT. THE FABRICATOR SHALL CERTIFY IN WRITING THAT THE NEOPRENE FOR THE ABOVE SAMPLES ARE FROM THE SAME BATCH-LOT AS THE NEOPRENE USED FOR THE BRIDGE BEARING PADS. ALL SAMPLES SHALL BE SUPPLIED AT NO COST TO THE DEPARTMENT.
B. APPROVAL OF PLANT:
TO QUALIFY FOR APPROVAL THE PLANT DESIRING TO FABRICATE LAMINATED METAL SHIM BEARING PADS WILL HAVE TO SUBMIT A WRITTEN OUTLINE OF THEIR FABRICATION AND QUALITY CONTROL METHODS USED.
SAMPLES AND CERTIFICATION WILL BE REQUIRED FOR TESTING AND APPROVAL IN ACCORDANCE WITH ITEMS 7, 8A AND 9.
PADS WILL BE SUBJECT TO REJECTION IF THEY SHOW ANY SEPARATION OR FAIL TO MEET THE REQUIREMENTS OF THESE SPECIFICATIONS.

9. TESTS: BOND TESTS MAY BE MADE ON RANDOMLY SELECTED FIELD SAMPLES OR ON SAMPLES AS SPECIFIED ON THE SHOP DRAWING OR, IF REQUESTED, TESTS TO BE ASTM D429-58 METHOD B.
BOND TEST IN FIELD CONSISTS OF CUTTING THE SAMPLES THROUGH THE RUBBER SECTIONS AND THEN STRIPPING THE RUBBER FROM THE METAL. AN INTERFACE BREAK CONSISTING OF 90% RUBBER FAILURE WILL BE ACCEPTED AS SATISFACTORY BOND.

APPROVED MAR 8 1962
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
BRIDGE UNIT
PRESTRESSED CONCRETE BRIDGE STANDARDS

LAMINATED METAL SHIM NEOPRENE BEARING PAD FOR PRESTRESSED CONCRETE BRIDGES

No	DESCRIPTION	BY	CHK'D	DATE
1	Design Criteria, Instructions 1-Change 4 T to Σt	JCE	HPK	9.11.64

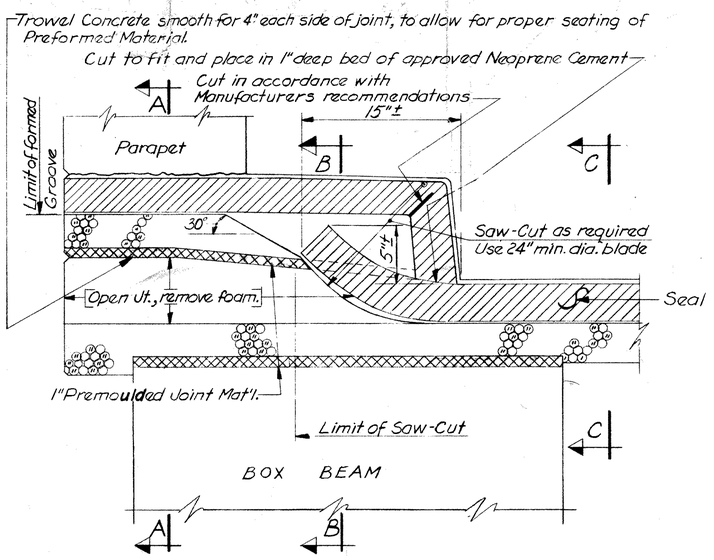
REVISIONS

DESIGNED: H.P.K. & J.C.P.
DRAWN: R.L.A. & F.C.F.
CHECKED: H.P.K. & J.C.P.
DATE: 11/61

PREPARED BY DIVISION OF BRIDGE ENGINEERING

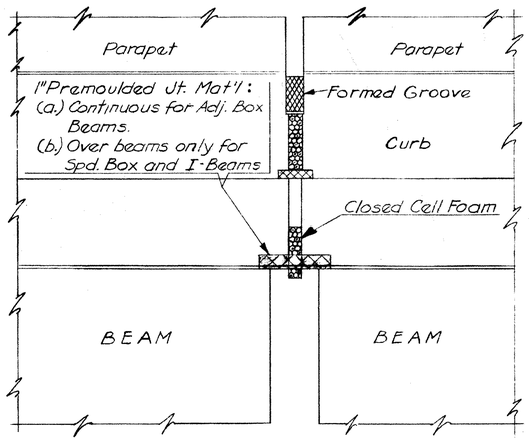
SHEET 1 OF 1

S-3910

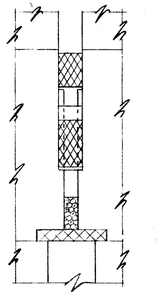


SECTION THRU JOINT

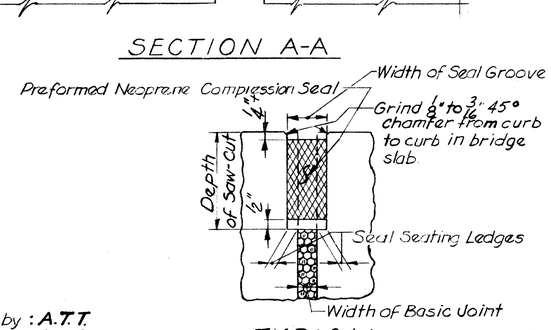
(Details of Joint for Spread Box Beam Bridge, Adj. Box Beam and I-Beam Bridges Similar)



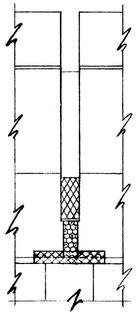
SECTION A-A



SECTION B-B



TYPICAL JOINT



SECTION C-C

Designed by : A.T.T.
Drawn by : C.E.F.
Traced by : C.E.F.
Checked by : H.R.K., F.C.S., E.S.H., H.L.S.

PREFORMED NEOPRENE COMPRESSION SEALS FOR BRIDGE-JOINTS

A - GENERAL INFORMATION

- A COMPRESSION SEAL FOR WATERPROOFING A BRIDGE-JOINT AND SEALING AGAINST INCOMPRESSIBLE MATERIALS IS EFFECTIVE IF IT SUSTAINS A POSITIVE PRESSURE AGAINST THE WALLS OF THE JOINT. THE SEAL MUST BE UNDER COMPRESSION AT ALL TIMES.
- THE POTENTIAL OF THE PREFORMED NEOPRENE COMPRESSION SEALS IS LIMITED BY THE FACTORS *1 AND *2. A DESIGN ENGINEER, WHEN COMPUTING THE SEAL-GROOVE WIDTH, MUST CONSIDER THESE 2 FACTORS IN RELATION TO THE WIDTH OF THE SEALS.

*1-MINIMUM SEAL-GROOVE WIDTH MUST BE GREATER THAN THE WIDTH AT WHICH THE COMPRESSED SEAL WOULD EXTRUDE. (THE COMPRESSED SEAL WIDTH, WITHOUT EXTRUSION, IS THE SUM OF THE WALLS AND WEBS OF THE SEAL.)

*2-MAXIMUM SEAL-GROOVE WIDTH MUST BE LESS THAN THE NOMINAL SEAL WIDTH. ALLOW FOR APPROXIMATELY 25% PERMANENT SET IN THE SEAL.

3-SEAL-GROOVE WIDTH (AT TIME OF SEAL INSTALLATION) IS RECOMMENDED TO BE AT LEAST 60% OF THE NOMINAL SEAL WIDTH. THIS FACTOR HAS BEEN USED IN COMPUTING THE VALUES GIVEN IN COLUMN 8, TABLE 1.

B - DESIGN

1-SELECT WIDTH OF BASIC-JOINT AND SHAPE OF SEAL FROM TABLE 1.

2-SHOW DETAILS ON THE CONSTRUCTION DRAWINGS OF THE BASIC-JOINT, THE SAW-CUT SEAL-GROOVE, THE FORMED SEAL-GROOVE AND THE SEAL.

C - DESCRIPTION: THE SEALED-JOINT CONSISTS OF THE BASIC-JOINT, THE SEAL-GROOVE (SAW-CUT IN THE SLAB AND FORMED AT THE CURB OR SIDEWALK) AND THE INSTALLED SEAL. THE SEALED-JOINT IS CONSTRUCTED AT VARIOUS STAGES OF DECK CONSTRUCTION; THEREFORE ALL OPERATIONS MUST BE PRECISELY CONTROLLED.

D - CONSTRUCTION

1-BASIC-JOINT IN SLAB: PLACE TWO STRIPS OF PREMOULDED CLOSED-CELL FOAM, OR APPROVED EQUAL, TO FORM THE BASIC-JOINT AS SPECIFIED ON THE CONSTRUCTION DRAWINGS. THE DEPTH OF THE UPPER STRIP IS EQUAL TO THE DEPTH OF THE SPECIFIED SEAL, PLUS 3/4". THIS UPPER STRIP WILL BE REMOVED LATER. AT THE TIME OF CASTING CONCRETE ADJACENT TO THE JOINT, THE AMBIENT TEMPERATURE MUST BE BETWEEN 35° MINIMUM AND 90° MAXIMUM.

2-SEAL-GROOVE, SAW-CUT IN SLAB:

a - THE SEAL-GROOVE WIDTH IS THE AVERAGE WIDTH, TO THE NEAREST 1/16", OF THE BASIC-JOINT WIDTH (USE AT LEAST 5 MEASUREMENTS ALONG THE ENTIRE LENGTH) PLUS THE TWO SEAL-SEATING-LEDGE WIDTHS. (SEE TYP. JT. DETAIL). PROCEED WITH SAW-CUTTING, AS SOON AS PRACTICAL, AFTER THE SEAL-GROOVE WIDTH HAS BEEN DETERMINED. COMPLETE SAW-CUTTING IN ONE CONTINUOUS OPERATION.

b - USE A HEAVY-DUTY, DOUBLE DIAMOND-BLADED, SELF-PROPELLED CONCRETE SAW TO CUT THE SEAL-GROOVE DEPTH IN THE SLAB. (THE SEAL-GROOVE IN THE CURB OR SIDEWALK WILL BE FORMED LATER, WHEN THESE ARE CAST.) BEGIN EACH SAW-CUT AT THE CENTERLINE OF BRIDGE. STOP 12"± BEYOND THE GUTTER LINE.

c - TO ACHIEVE SMOOTH AND EVEN SEAL-SEATING-LEDGES, INSERT A 3" MINIMUM WIDE CHISEL IN THE SAW-CUT, AND USE THE CHISEL AS A LEVER TO BREAK THE CONCRETE AT THE LEDGES. REMOVE THE UPPER STRIP OF FOAM AND THE BROKEN CONCRETE.

3-SEAL-GROOVE, FORMED IN CURB OR SIDEWALK:

a - INSTALL PREMOULDED MATERIAL AND FOAM IN CURB OR SIDEWALK AS SHOWN ON THE CONSTRUCTION DRAWINGS.

b - CAST CURB OR SIDEWALK WITH FORMED SEAL-GROOVE AS SHOWN ON THE CONSTRUCTION DRAWINGS.

E - INSTALLATION OF SEAL ("TOP" OF SEAL IS MARKED).

1-AFTER CURB OR SIDEWALK CONCRETE IS CURED, REMOVE ALL FOREIGN MATERIAL, INCLUDING ANY SURPLUS (REMNANTS OF) CONCRETE FROM THE GROOVE. USE A STIFF BROOM OR COMPRESSED AIR TO THOROUGHLY CLEAN THE SEAL-GROOVE IN BOTH SLAB AND CURB OR SIDEWALK. THE GROOVE SHOULD BE DRY OR DAMP-DRY.

2-SWAB A LUBRICANT-ADHESIVE ON THE FACES OF THE GROOVE. COMPLY WITH ALL INSTRUCTIONS SPECIFIED BY THE ADHESIVE MANUFACTURER (EXAMPLE: TEMPERATURE LIMITATIONS).

3-WHILE THE ADHESIVE IS WET, INSTALL THE SEAL. USE MANUFACTURERS RECOMMENDED HAND OR POWER DRIVEN TOOLS TO THOROUGHLY INSERT THE SEAL. (ASCERTAIN THAT THE ADHESIVE COVERS BOTH FACES OF THE GROOVE AND THAT THE FULL LENGTH OF THE SEAL IS IN CONTACT WITH THE FACES OF THE GROOVE.)

a - FOR CURB OR SIDEWALK INSTALLATION, SEALS MAY BE NOTCHED ON THE BOTTOM SURFACE TO PERMIT BENDING. THE TOP SURFACE OF THE SEAL MUST BE CONTINUOUS.

b - IF COMPRESSION TOOLS ARE USED, THE SURFACE OF THE TOOLS MAY BE LUBRICATED WITH A SOAP-SUDS SOLUTION. DO NOT ALLOW LARGE AMOUNTS OF THE SUDS TO PENETRATE THE FRESHLY SWABBED GROOVE.

c - DO NOT STRETCH THE SEAL DURING INSTALLATION. THIS WOULD CAUSE CONTRACTION LATER AND A TENDENCY TO PULL LOOSE FROM THE GROOVE FACE.

d - ASCERTAIN THAT THE INSTALLED SEAL IS IN A SUBSTANTIALLY COMPRESSED CONDITION, THAT THE TOP OF THE SEAL IS 1/4" MIN., 1/2" MAX. BELOW THE PAVEMENT SURFACE, AND THAT THE INTERSECTION OF THE VERTICAL AND THE HORIZONTAL SEALS AT THE GUTTER LINE IS WATERPROOF.

NOTE: IF MORE PRACTICAL, INSTALL THE SEAL IN TWO STAGES.

1-AFTER SEAL-GROOVE IN THE SLAB HAS BEEN SAW-CUT, FINISHED AND CLEANED, INSTALL THE SEAL. COMPLY WITH ALL INSTRUCTIONS CONCERNING CLEANING THE GROOVE, APPLYING THE ADHESIVE, AND INSTALLING THE SEAL.

2-INSTALL PREMOULDED MATERIAL AND FOAM IN THE CURB OR SIDEWALK AS SHOWN ON THE CONSTRUCTION DRAWINGS.

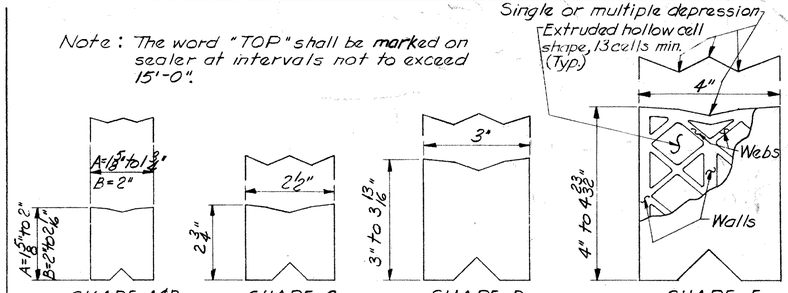
3-CAST THE CURB OR SIDEWALK, WITH THE FORMED SEAL-GROOVE, AS SHOWN ON THE CONSTRUCTION DRAWINGS.

4-AFTER THE CONCRETE IS CURED, CLEAN THE FORMED SEAL-GROOVE, APPLY THE ADHESIVE AND INSTALL THE SEAL.

GENERAL INSTRUCTIONS

- The Seal shall be of a type and size as specified on this sheet and meet the current specifications for Preformed Neoprene Compression Seals.
- Use of other shapes and/or special designs shall be approved by the Chief Bridge Engineer in the Central Office.
- Tolerances for outside and inside dimensions, wall and web thicknesses are given in the specifications.
- Select Shape of Seal as listed in the table for Joints at Piers or at Abutments utilizing either approach slabs or backwalls.
- Do not select shapes or basic joints which require the joint width to be larger than 1½" at normal temperature or 2¼" at minimum temperature.

Note: The word "TOP" shall be marked on sealer at intervals not to exceed 15'-0".



PREFORMED NEOPRENE COMPRESSION SEALS

TABLE #1

Limit for 2¼" Maximum opening of Groove

TYPE OF JOINT (1.)	EXP. LENGTH (2.)	WIDTH OF BASIC JT. @ CONSTR. TIME (3.)	THEOR'L. WIDTH OF LEDGES (4.)	SEAL-GROOVE (WIDTH OF SAW-CUT) (5.)	SHAPE OF SEAL (6.)	MIN. VOIDS % (7.)	* (8.)
Fix	———	½"	2×¼=½"	Equal to width of Basic Jt. at time of Saw-Cutting, plus (+) width of Ledges.	A	57.2	1"
Exp.	Up to 50'	½"	2×¼=½"		A	57.2	1"
Exp.	50' to 57'	¾"	2×⅜=¾"		B	62.5	1¼"
Exp.	57' to 69'	1"	2×3/32=3/16"		C	62.5	1½"
Exp.	69' to 86'	1¼"	2×⅝=¼"		D	64.6	1¾"
Exp.	86' to 119'	1½"	2×⅜=¾"		E	58.2	2¾"

* Recommended min. width of Saw-Cut Seal Groove at time of installation of Sealer.

VALUES IN TABLE ARE BASED ON THE FOLLOWING DATA AND ASSUMPTIONS:

- Total expansion length as given in column ②.
- Temperature at time of placing concrete adjacent to Basic Joint, (+35° to +90°). Groove width computed for assumed temperature range of 0° to 100°. (10° min. Rise, 65° max. rise; 35° min fall, 90° max. fall).
- Assumed 75% compressibility of Foam if left in Basic Joint.
- Assumed 25% permanent set based on nominal width of Seal.
- Minimum width of Seal fully compressed to be the maximum number of webs in any cross-section. (Top and Bottom walls not considered).
- Fabrication tolerances of the Neoprene Seal as described in the current specifications
- No allowances have been made for Construction tolerances.
- Seals having a minimum percent (%) of voids as given in column ⑦.
- Seals designed with a pattern of voids which allows almost complete closure of voids without over-straining the solid material (walls & webs) and also prevents upward protrusion of the Seal.
- Table prepared for 90° skew bridges. (For other skews, the width of Joints becomes less critical).

APPROVED: JUL 20 1965

K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

DECK JOINT FOR PREFORMED NEOPRENE COMPRESSION SEAL

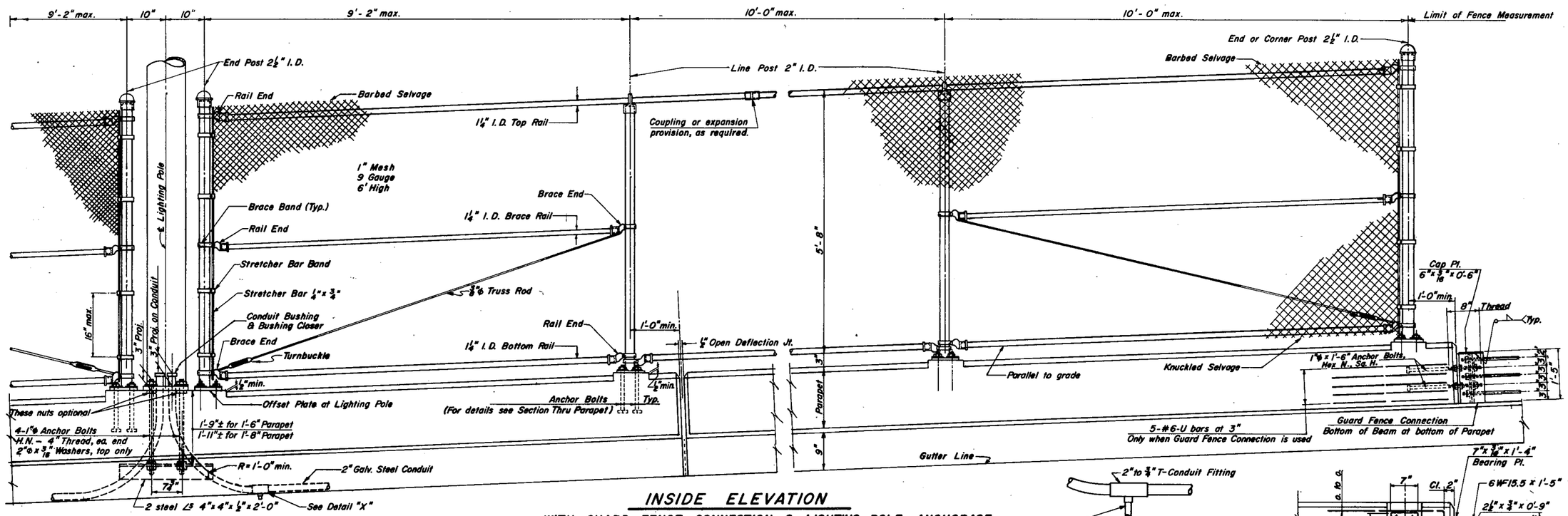
PRESTRESSED
CONCRETE BRIDGES

SHEET 1 OF 1

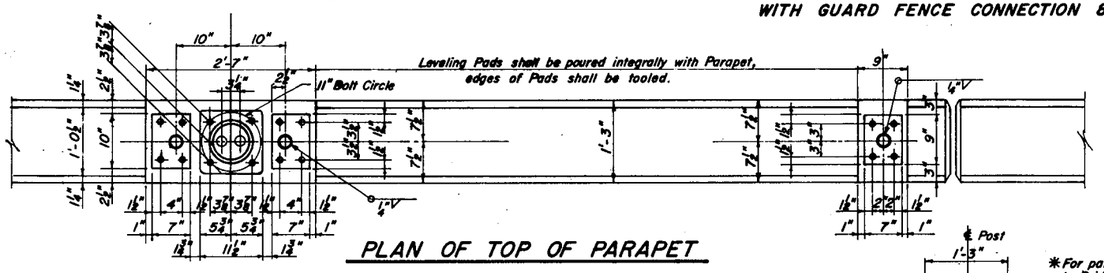
S - 3911

Designed By: Division Of Bridge Engineering, Central Office, P.D.H.

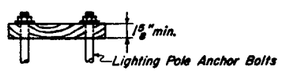
Do not use as Standard Drawing HLS



INSIDE ELEVATION
WITH GUARD FENCE CONNECTION & LIGHTING POLE ANCHORAGE

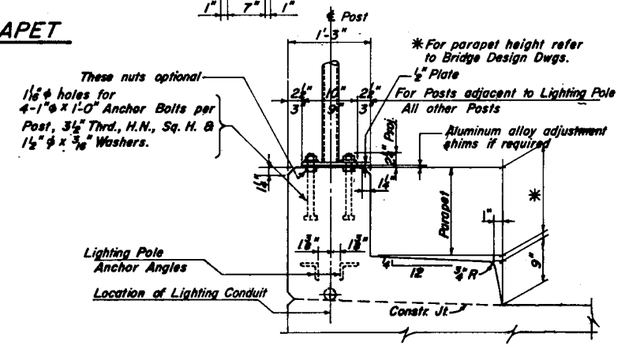


PLAN OF TOP OF PARAPET

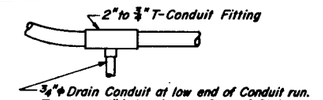


PROTECTIVE WOOD BLOCK
Hardwood 11⅝" square

- For future lighting: Conduit, lighting pole anchor bolts, nuts and washers above concrete shall be heavily coated with an approved bitumastic compound. Protective wood blocks shall then be placed and firmly secured.
- Protective wood blocks, with holes bored to fit bolt spacing and protruding conduits, shall be painted with two coats of Aluminum Paint before installation.



SECTION THRU PARAPET

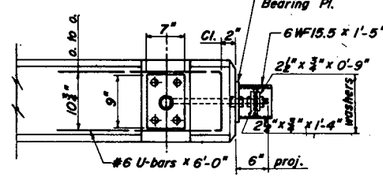


DETAIL "X"

NOTES:

- All materials and workmanship shall be in accordance with P.D.H. Forms 408 and 409, and special provisions.
- All Chain Link Fence materials shall be of aluminum alloy except anchor bolts & lighting pole anchor angles.
- All anchor materials and Guard Fence Connections shall conform to ASTM-A36, and shall be galvanized conforming to ASTM-123 or 153, as applicable, except anchor angles shall not be galvanized.
- Fence posts and anchor bolts shall be truly vertical and spaced as shown on the specific structural drawing.
- Rails shall be parallel to grade.
- Aluminum surfaces in contact with concrete or steel shall be thoroughly coated with caulking compound conforming to Federal Specifications TT-C598(2).
- Material shall not be painted.
- Guard Fence Connection, when specified, shall include 6WF15.5 beam, cap, bearing plate, anchor bolts, washers and nuts.
- Lighting poles shall be used only when specified and shall be truly vertical with bases level. For electrical details not shown, refer to P.D.H. Std. Dwg. ST-145. .
- If lighting poles are not installed, gaps shall be closed with a separate piece of fabric. At bridge expansion joints the fabric and rails shall be free to expand or contract.

  Chain Link Fence shall be measured horizontally continuously between end posts, including gaps at lighting poles, and shall include all fence posts, rails, anchor bolts with washers and nuts for fence posts & lighting poles, lighting pole anchor angles, protective wood blocks, fabric, truss rods, etc.
- Place corner posts at angle points in horizontal and vertical alignment of fence.
- After erection and alignment, openings between metal surfaces and concrete shall be sealed with Caulking Compound.



END PLAN
WITH GUARD FENCE CONNECTION

Approved: MAR. 1, 1966

K.H. Jensen
Bridge Engineer

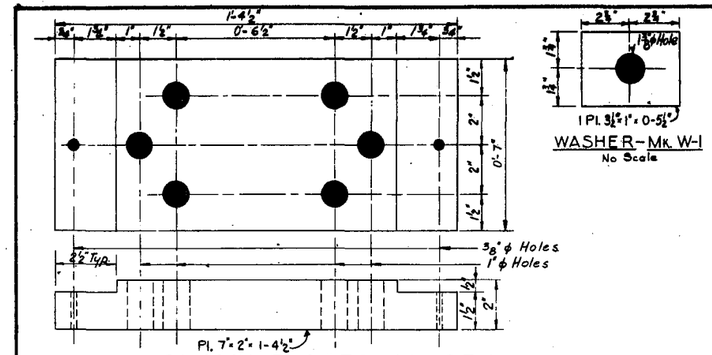
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
PARAPET WITH
ALUMINUM CHAIN LINK FENCE
AND
GUARD FENCE CONNECTION

Rev.	G.T.V.
Trc.	F.F.F.
Ckd.	BFK/HJ

SHEET 1 OF 1

S-5657

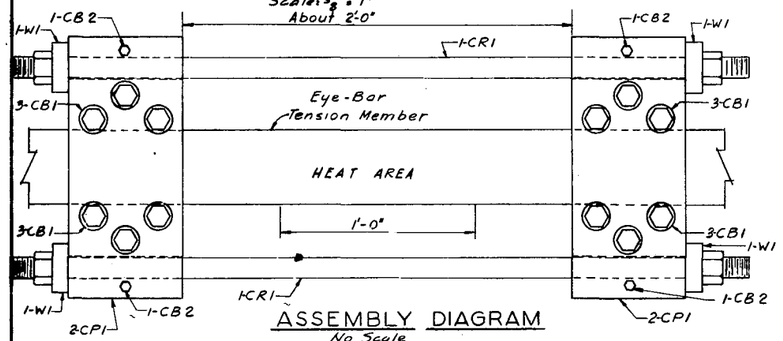


CLAMP PLATES - MK. CP-1

Scale: ⅜" = 1"

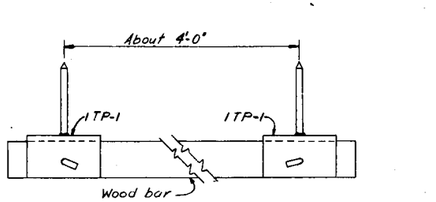
WASHER - MK. W-1

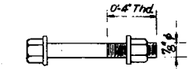
No Scale



ASSEMBLY DIAGRAM

No Scale

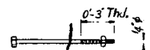




⅞" ϕ x 0'-8" High-Strength Bolt, Hex Head.
⅞" ϕ Hex. Nut; Hardened W'shr's. (6 per bolt)

CLAMP BOLT MK. CB-1

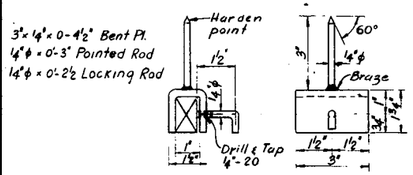
Scale: 1½" = 1"



¼" ϕ x 0'-7" Bolt. Hex. Head & Nut

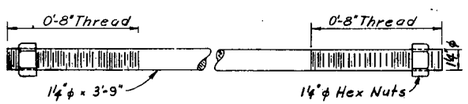
CLAMP BOLT MK. CB-2

Scale: 1½" = 1"



TRAMMEL POINTS MK. TP-1

Scale: ⅜" = 1"



CLAMP RODS - MK CR-1

Scale: 1½" = 1"

REQUIRED LIST		
No.	Description	MK.
4	Clamp Plates	CP-1
12	Clamp Bolts	CB-1
4	Clamp Bolts	CB-2
2	Clamp Rods	CR-1
4	Washers	W-1
2	Trammel Points	TP-1
1	Wood bar 7⅞" - 1½" x 4'-6"	—

DETAILS OF CLAMP ASSEMBLY

E.B. | J.L.S. | 4-63

J. R. WEIL CO., CINCINNATI

GENERAL PROCEDURE FOR FLAME-SHORTENING L.P. EYEBARS

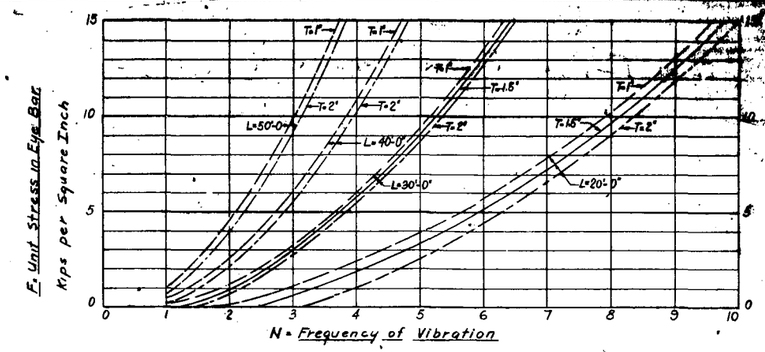
- Remove paint from bar where clamp plates will be fastened, and from 12"± length between clamp-plate areas, where heat will be applied.
- Bolt clamp-plates to bar, allowing ample thread below nuts of clamp-rods for movement during upsetting operations. Clamp-bolts shall be tightened ½-turn beyond snug-tight condition to insure proper clamping force on plates. Clamp-rod nuts shall be run up finger-tight prior to heating eyebar.
- On inclined eyebars, install block and falls lines about 6 feet above clamp plate to eliminate sag during and after heating and upsetting operations. Do not provide excess uplift.
- Traffic lanes contributing the majority of Live Load stresses to the bar being shortened, should be closed during heating, upsetting and cooling operations, and restricted speed limits should be enforced for all traffic on the span during these periods.
- Simultaneously heat both sides of the bar, for a length of 12 inches midway between the clamp-plates, to a Cherry-Red color (1600°F to 1800°F) applying heat uniformly on both sides. An Oxweld #150 tip, or one with equal flame flare, is used when Oxygen with Acetylene or other suitable gas is used. Provide wind shields to protect the heated areas, when required.
- Continue application of heat as directed by the Engineer, so that the interior of the bar becomes thoroughly and uniformly heated. Do not heat beyond Orange-Red color (2010°F±) except as directed by the Engineer.
- Shortening of eyebar by upsetting shall be performed in increments of approximately ¼" for each heating. The trammel shall be used to measure these increments, through use of punch marks or scratches on the bar, outside the clamp-plates.
- When heated areas are at proper temperature, the nuts on clamp-rods shall be tightened simultaneously, upsetting the rod in the heated area. Nuts on both rods must be tightened the same amount to prevent kinking of the bar.
- Buckling tendencies shall be corrected by C-clamping beam or channel sections on each side of the bar between the clamp plates, striking with a maul, if necessary, to straighten the bar. By side push on the bar close to the pin-head, it can be determined if the heads are tight against the pins.
- If it is desired to keep the initial or dead-load stress in the eyebar low, the No. 150 tips shall be quickly replaced by No. 60 tips, and a 3 or 4 inch length of the bar in the middle of the 12 inch heated area maintained at a Cherry-Red color for 3 or 4 minutes. This short heated section will allow elongation in this area while the remainder of the heated area is cooling and contracting. Quenching with water may be permitted when the temp. of the bar has dropped to 1000°F. or below (Red heat).
- Normal traffic may be resumed on the bridge after the heated area has cooled to 300°F.* Successive applications of the method to a given bar should also be delayed until bar has cooled to the satisfaction of the Engineer, clamp-plates being moved to a new position or retained at the same location as directed by the Engineer.
- Approximately one hour should be allowed for each shortening operation (heating, upsetting and cooling)
- Unit stress in eyebars can be determined with reasonabe accuracy through use of the graph and data given on this sheet. Shortening shall be continued to the satisfaction of the Engineer. On paired eyebars, frequencies of vibration should be essentially equal at the conclusion of the operations.
- The Contractor shall have available at the site, sufficient forces and equipment as to satisfactorily perform all necessary and incidental operations during the course of the work. Minimum required equipment will include: two torches, nozzles, fuel tanks, strong-back beams (L~1'-9"), maul, wrenches, assorted C-clamps, pry-bars, block & falls assy, etc.

JUDGING HIGH TEMPERATURES BY COLOR

Temp., °F	Color of Heat
975 ±	Red Heat, visible in the daylight
1075 ±	Red Heat, visible in the sunlight
1290 ±	Dark Red
1470 ±	Dull Cherry-Red
1650 ±	Cherry-Red
1830 ±	Bright Cherry-Red
2010 ±	Orange-Red
2190 ±	Orange-Yellow
2370 ±	Yellow-White

* 50-50 solder (50% lead & 50% tin) starts melting at 360°F and is completely molten at 420°F.

Note: Flame-shortening methods set forth on this sheet may be applied to structural members of bridges only with the authorization of the Chief Bridge Engineer, and under the supervision of his designated representative.



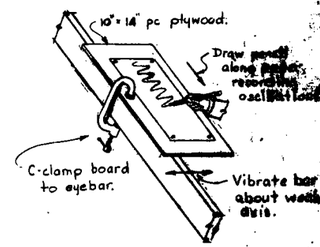
Frequency of Vibration and Unit Stress Curves for Eyebar Tension Members.

Equation: $F = 0.00293\,N^2L^2 - 24{,}700{,}000(I)^2$

Where: F = Unit Stress in kips per square inch. L = Length of eye-bar in inches.
N = Frequency of Vibration (Number of complete oscillations per second)
T = Thickness of eye-bar in inches.

The frequency of vibration of the eyebar or the number of complete oscillations per second can be measured in the following manner: (Refer to sketch, below.)

1. Remove the clamp plates and bolts.
2. Clip a sheet of paper or cardboard to a 10"x 14" pc. of plywood clamped to the edge of the eye bar.
3. Vibrate the bar by hand about its weak axis.
4. Hold a pencil on the paper or cardboard and then draw the pencil lengthwise along the eyebar for a definite interval of time, say a 10-sec. interval. The pencil will then record the number of oscillations for this interval of time.



FREQUENCY MEASUREMENT & STRESS DETERMINATION

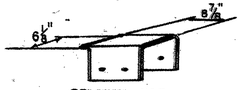
Approved: May 15, 1963
R. H. Jensen
State Engineer

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
BRIDGE UNIT

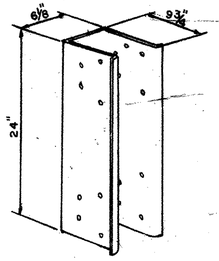
FLAME-SHORTENING DETAILS FOR TIGHTENING LOOSE EYEBARS IN TRUSS BRIDGES

SHEET 1 OF 1

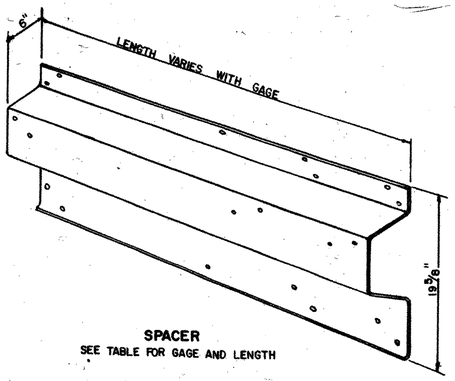
S-6409



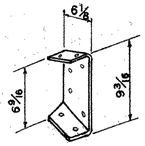
COLUMN CAP
12 GA.



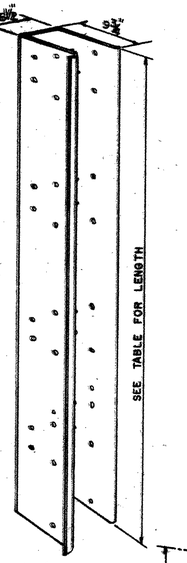
COLUMN SPLICE PLATE
10 GA.

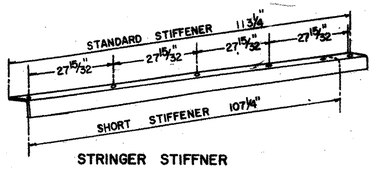


SPACER
SEE TABLE FOR GAGE AND LENGTH

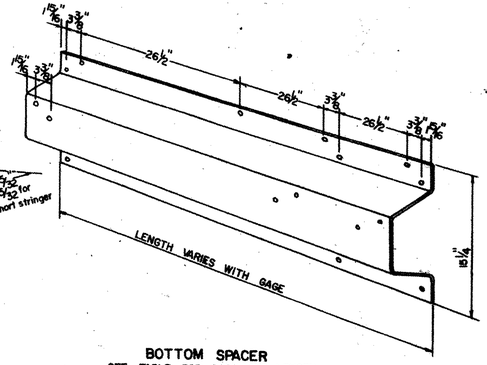


CONNECTING CHANNEL
8 GA.

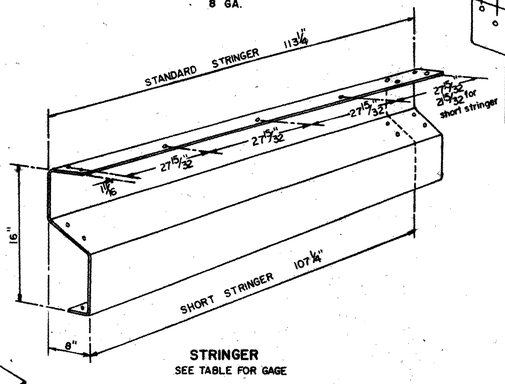




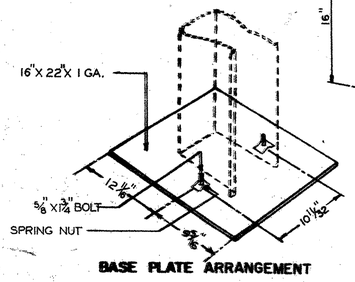
STRINGER STIFFNER
8 GA.



BOTTOM SPACER
SEE TABLE FOR GAGE AND LENGTH

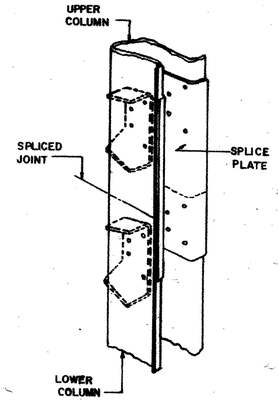


STRINGER
SEE TABLE FOR GAGE

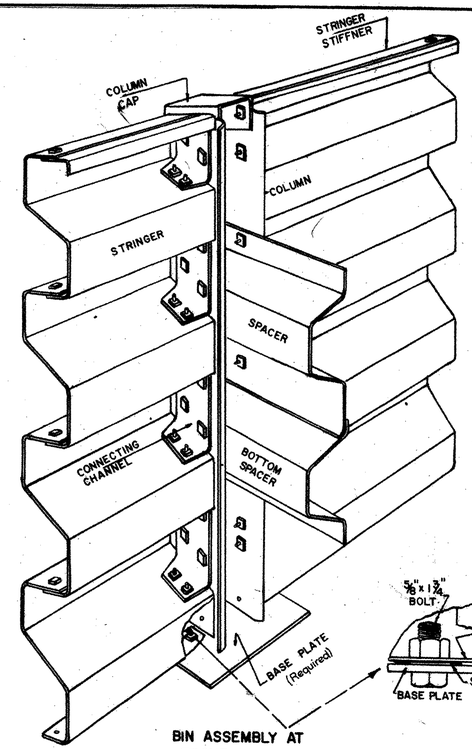


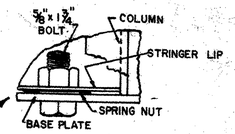
BASE PLATE ARRANGEMENT

DETAIL OF SPACERS					
DESIGN	A	B	C	D	E
GAGE	16	16	14	12	12
LENGTH	5.2'	7.4'	9.6'	11.8'	14.0'



ASSEMBLY AT COLUMN SPLICE

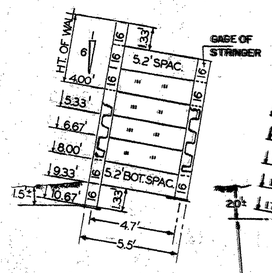




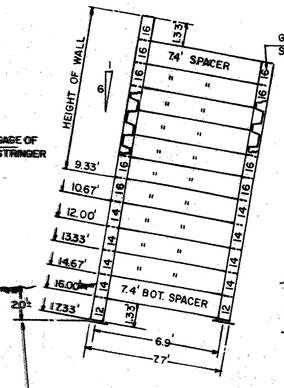
BIN ASSEMBLY AT FRONT COLUMN
(SIMILAR AT REAR COLUMN)

NOTE

All crib members shall be galvanized in accordance with Section 6.29.2(2) of Form 408, 1960.

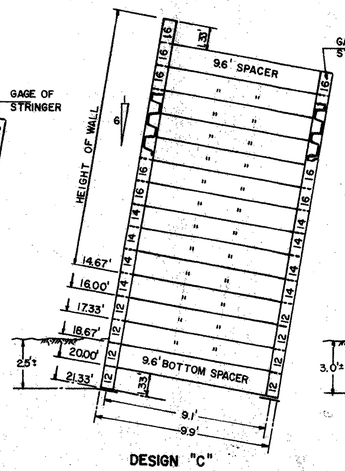


DESIGN "A"



DESIGN "B"

NOTE : THESE DEPTHS MAY VARY TO SUIT CONDITIONS



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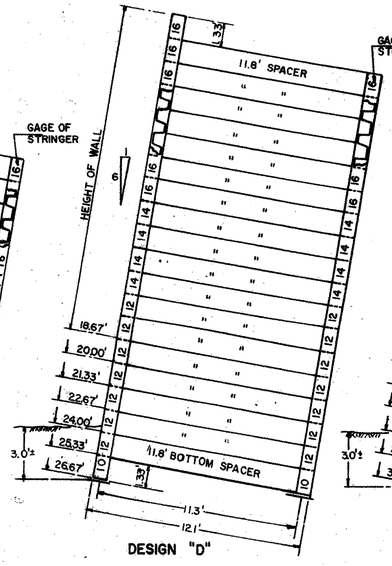

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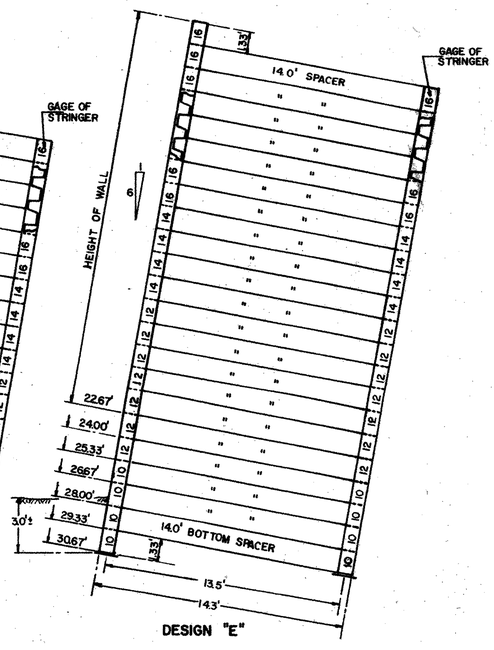


DESIGN "E"

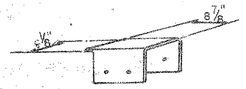
Approved: July 10, 1963
K. H. Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
BRIDGE UNIT

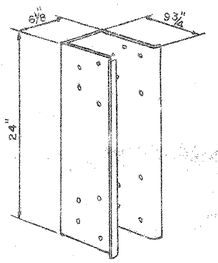
DETAILS METAL CRIBBING

SHEET 1 OF 1

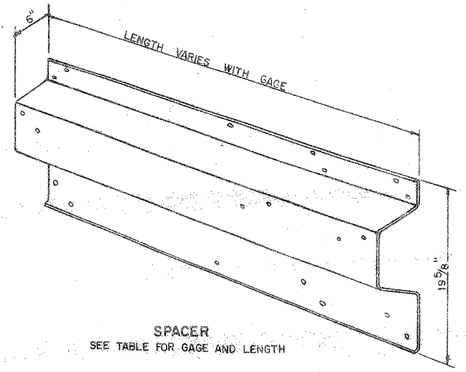
S-6500



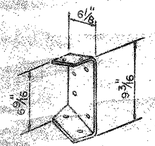
COLUMN CAP
12 GA.



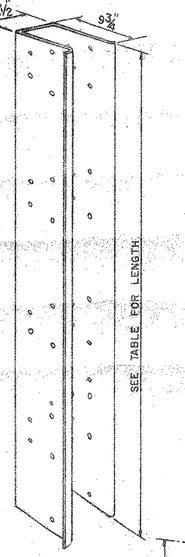
COLUMN SPLICE PLATE
10 GA.

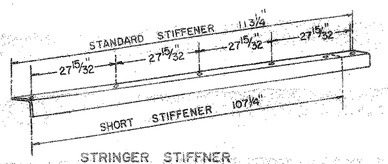


SPACER
SEE TABLE FOR GAGE AND LENGTH

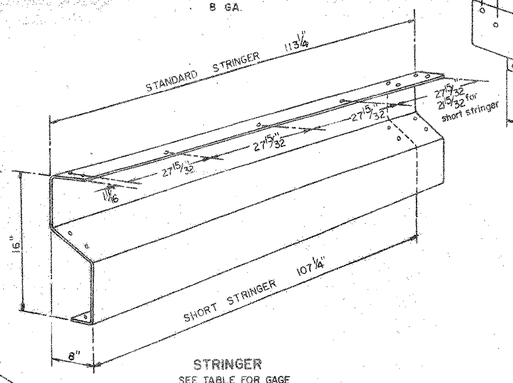


CONNECTING CHANNEL
8 GA

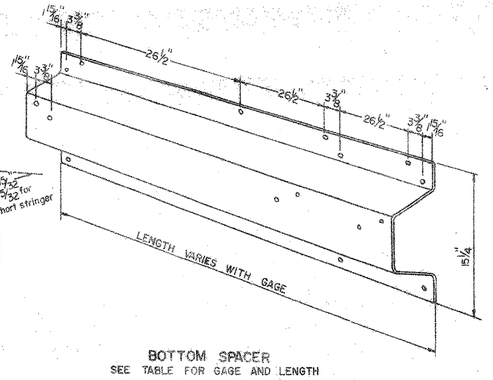




STRINGER STIFFNER
8 GA.

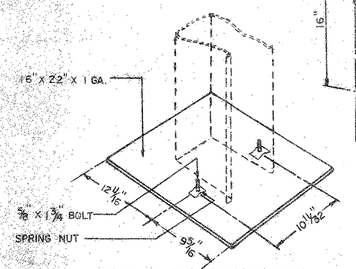


STRINGER
SEE TABLE FOR GAGE

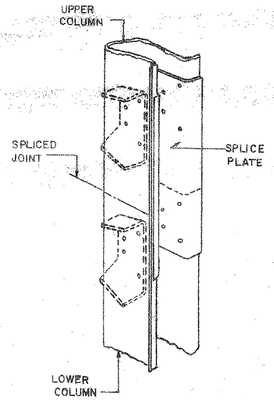


BOTTOM SPACER
SEE TABLE FOR GAGE AND LENGTH

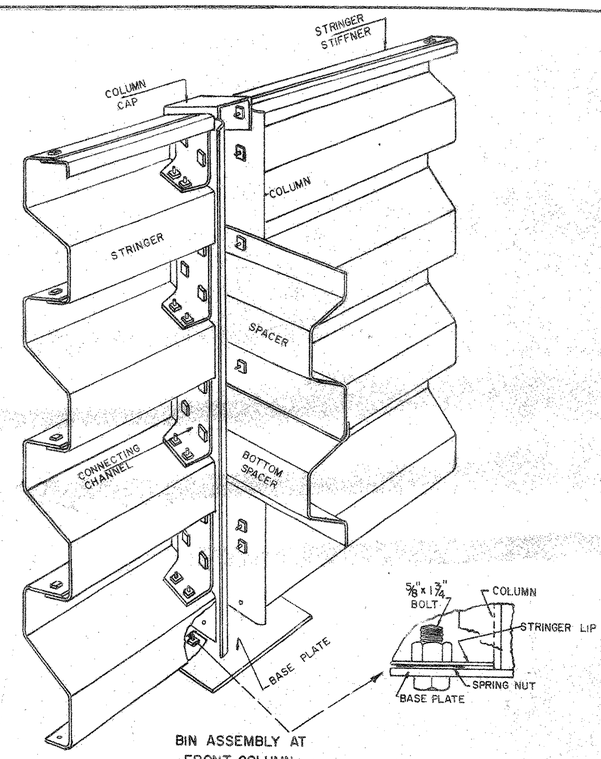
DETAIL OF SPACERS					
DESIGN	A	B	C	D	E
GAGE	16	16	14	12	12
LENGTH	5.2'	7.4'	8.6'	11.8'	14.0'



BASE PLATE ARRANGEMENT



ASSEMBLY AT COLUMN SPLICE



BIN ASSEMBLY AT FRONT COLUMN
(SIMILAR AT REAR COLUMN)

GENERAL NOTES

Metal base plates will be required.

All exposed interior and exterior metal sheets used to form the members of the closed face metal cribbing shall be coated by (A) or (B), when specified for Metal Cribbing - Coated.

(A) Coated on both sides with a layer of asbestos fibers applied in a sheet form by pressing it into a molten metalic bonding medium. Immediately after the metalic bond has solidified, the asbestos fibers shall be thoughly saturated with a bituminous saturant. The finished sheets shall be of first class commercial quality free from blister and unsaturated spots.

(B) Galvanized on both sides by the hot dip process as specified in Section 6.29.2 (2) of form 408, and field coated with bitumastic materials. Immediately prior to application of coatings, galvanized surfaces are to be either sand blasted to lightly etch surfaces and to remove any greasy film present by blasting in accordance with Field Structures Painting Council Specification №7, brush off blast cleaning or saturate all surfaces with vinegar (acetic acid) and when dry wipe off any bloom which has formed.

Apply two (2) coats of coal tar based paint (Federal Specification MIL-C-18480). To be applied at the rate of 55-70 square feet per gallon per coat One Coat of Coal Tar Emulsion to conform to Federal Specification MIL-C-15203 at the rate of 60 square feet per gallon. Twenty Four hours drying time to be allowed between all coats.

(C) All crib members shall be galvanized in accordance with Section 6.29.2 (2) of Form 408, 1960.

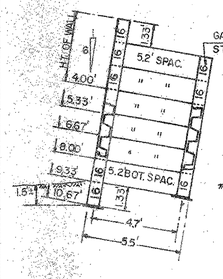
Approved: July 10, 1963

K. H. Jensen
Bridge Engineer

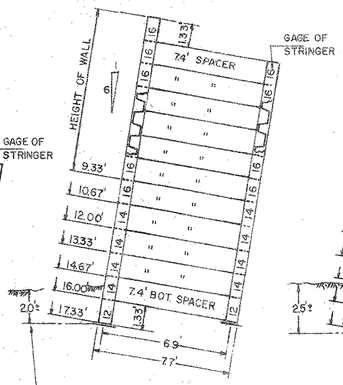
COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE UNIT

DETAILS
METAL CRIBBING - COATED

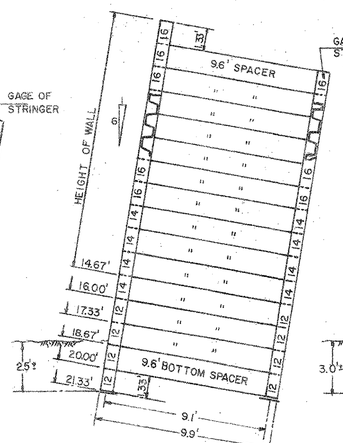


DESIGN "A"

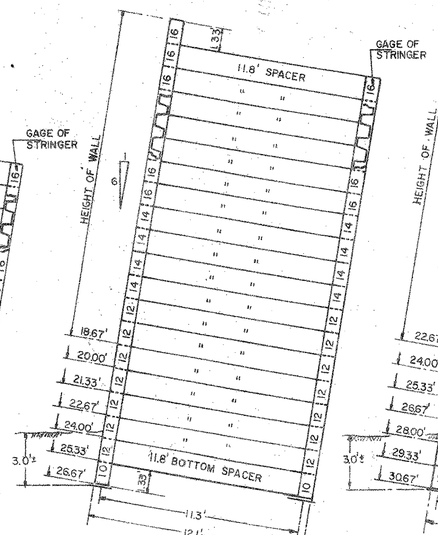


DESIGN "B"

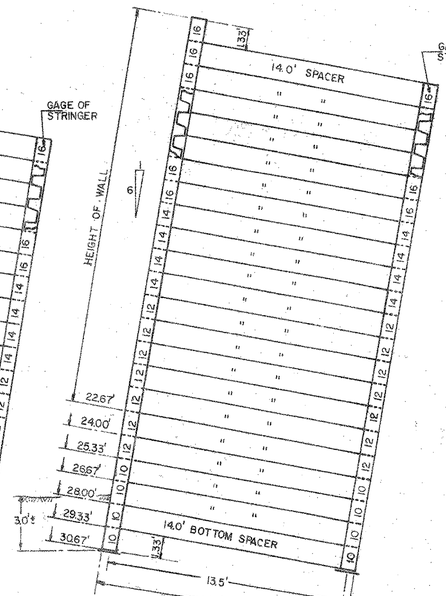
NOTE : THESE DEPTHS MAY VARY TO SUIT CONDITIONS



DESIGN "C"



DESIGN "D"



DESIGN "E"

S-6500A

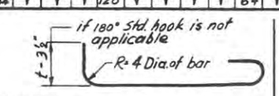
ROADWAY with TWO SAFETY CURBS (1'-6" wide)

REINFORCEMENT BARS

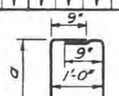
Design Span, Ft.	Roadway Width, Ft.	Slab Thickness t, In.	S1 Size of Bars	S1 c.c. Spacing, In.	S1 No. of Bars	S2 or S7 Size of Bars	S2 or S7 c.c. Spacing, In.	S3 Size of Bars	S3 c.c. Spacing, In.	S3 No. of Bars	S4 or S8 Size of Bars	S4 or S8 c.c. Spacing, In.	S5 Size of Bars	S5 c.c. Spacing, In.	S5 No. of Bars	S6 Size of Bars	S6 c.c. Spacing, In.	S6 No. of Bars	C1 Size of Bars	C1 c.c. Spacing, In.	C1 No. of Bars	C1 Length	C1 "a"	C2 Size of Bars	C2 c.c. Spacing, In.	C2 Length	C3 Size of Bars	C3 No. of Bars	S9 Size of Bars	S9 c.c. Spacing, In.	S9 No. of Bars	S10 Size of Bars	S10 c.c. Spacing, In.	S10 No. of Bars	C7 Size of Bars	C7 c.c. Spacing, In.	C7 Length	C8 Size of Bars	C8 No. of Bars	Approximate Quantities - Per Ft. Length: Class AA Conc., Cu. Yd.	Reinforcement Bars, Lbs.	Dimension 'A', In.	Dimension 'B', In.
	28	11	#8	8½	40	#5	9	#4	15	22	#4	15	#8		8	#4	6	6	#5	15				#4	15		#4	10													1.42	234	2¼	10½
	30				43					24																															1.48	246	1½	7½
	32				46					25																															1.55	259	⅜	12
10	40				57					32																															1.82	307	2	7½
	68				92					50																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	2.83	501	⅝	12
	84				114					64																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	3.38	597	2	7½
	28	12	#8	8	42	#5	9	#4	15	22	#4	15	#8		10	#4	6	6	#5	15				#4	15		#4	10													1.52	244	4	10½
	30				45					24																															1.59	257	4	7½
	32				48					25																															1.67	269	4	12
12	40				60					32																															1.96	320	4	7½
	68				96					50																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	3.06	516	4	12
	84				120					64																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	3.65	618	4	7½
	28	12½	#8	7	48	#5	9	#4	15	22	#4	15	#8		10	#4	6	6	#5	15				#4	15		#4	10													1.57	260	3½	10½
	30				52					24																															1.65	276	1½	7½
	32				55					25																															1.73	288	3	12
14	40				69					32																															2.04	344	2	7½
	68				110					50																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	3.18	554	3	12
	84				158					64																		#8	6	8	#4	9	6	#4	15	3'-4"	#4	4	3.79	666	2	7½
	28	13½	#9	8	42	#6	12	#4	15	22	#4	15	#9		10	#5	6	6	#5	15				#4	15		#4	10													1.67	287	4	10½
	30				45					24																															1.76	302	4	7½
	32				48					25																															1.84	317	4	12
16	40				60					32																															2.17	378	4	7½
	68				96					50																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	3.40	612	4	12
	84				120					64																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	4.07	734	4	7½
	28	14½	#9	7½	45	#6	12	#4	15	22	#4	15	#9		10	#5	6	6	#5	15				#4	15		#4	10													1.78	297	3	10½
	30				48					24																															1.87	312	3⅜	7½
	32				52					25																															1.96	331	⅜	12
18	40				64					32																															2.32	392	3⅜	7½
	68				104					50																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	3.63	640	⅜	12
	84				128					64																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	4.34	761	3⅜	7½
	28	15	#9	7	48	#6	12	#4	15	22	#4	15	#9		12	#6	6	6	#5	15				#4	15		#4	10													1.83	314	3½	10½
	30				52					24																															1.92	333	½	7½
	32				55					25																															2.02	348	3	12
20	40				69					32																															2.39	415	2	7½
	68				110					50																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	3.74	667	3	12
	84				138					64																		#9	6	8	#5	9	6	#4	15	3'-4"	#4	4	4.48	803	2	7½
	28	16	#10	8½	40	#7	15	#4	15	22	#4	15	#10		10	#6	6	6	#5	15				#4	15		#4	10													1.93	332	2¼	10½
	30				43					24																															2.03	350	½	7½
	32				46					25																															2.13	368	¾	12
22	40				57					32																															2.52	437	2	7½
	68				92					50																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	3.97	714	¾	12
	84				114					64																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	4.76	852	2	7½
	28	17	#10	8	42	#7	15	#4	15	22	#4	15	#10		10	#6	6	6	#5	15				#4	15		#4	10													2.04	350	4	10½
	30				45					24																															2.14	368	4	7½
	32				48					25																															2.25	387	4	12
24	40				60					32																															2.67	459	4	7½
	68				96					50																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	4.19	741	4	12
	84				120					64																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	5.03	886	4	7½
	28	18	#10	7	48	#7	15	#4	15	22	#4	15	#10		12	#7	6	6	#5	15				#4	15		#4	10													2.14	375	3½	10½
	30				52					24																															2.25	397	1½	7½
	32				55					25																															2.36	416	3	12
26	40				69					32																															2.81	498	2	7½
	68				110					50																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	4.42	800	3	12
	84				138					64																		#10	6	8	#6	9	6	#4	15	3'-4"	#4	4	5.31	963	2	7½
	28	19½	#11	8½	40	#8	18	#4	15	22	#4	15	#11		10	#7	6	6	#5	15				#4	15		#4	10													2.30	391	2¼	10½
	30				43					24																															2.41	413	1½	7½
	32				46					25																															2.53	433	¾	12
28	40				57					32																															3.01	516	2	7½
	68				92					50																		#11	6	8	#6	9	6	#4	15	3'-4"	#4	4	4.76	836	¾	12
	84				114					64																		#11	6	8	#6	9	6	#4	15	3'-5"	#4	4	5.72	999	2	7½
	28	21	#11	7½	45	#8	18	#4	15	22	#4	15	#11		12	#7	6	6	#5	15				#4	15		#4	10													2.45	429	3	10½
	30				48					24																															2.58	451	3⅜	7½
	32				52					25																															2.71	475	¾	12
30	40				64					32																															3.23	563	3¾	7½
	68				104					50																		#11	6	8	#6	9	6	#4	15	3'-4"	#4	4	5.10	913	¾	12
	84				128					64																		#11	6	8	#6	9	6	#4	15	3'-4"	#4	4	6.14	1085	3¾	7½

EQUALLY SPACED AS SHOWN — REQUIRED — REQUIRED — REQUIRED

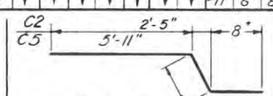
BENDING DIAGRAMS



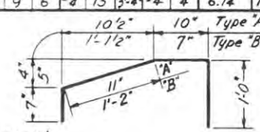
S1, S5 & S9 Bars



C1 & C4 Bars



C2 & C5 Bars

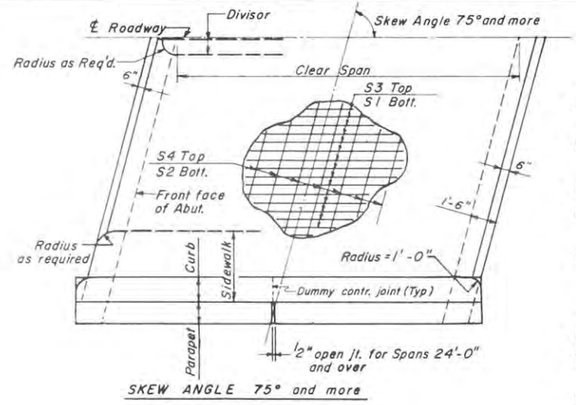


C7 Bars

NOTE: All other Bars are straight.

Des.	K.R.P.
Trc.	JCE/DAS
Ckd.	E.L.H.

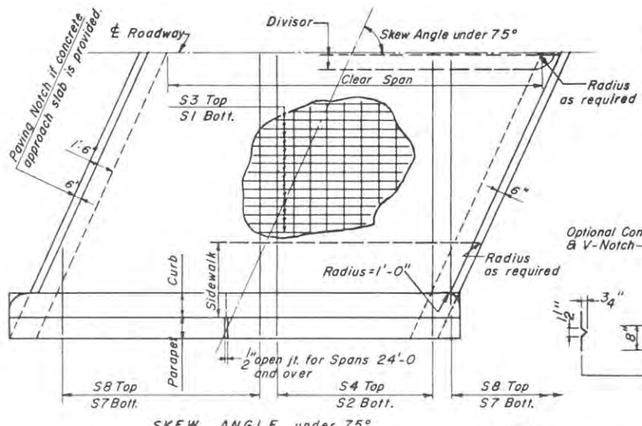
J. E. WEIL CO., CHERRYVILLE



SKEW ANGLE 75° and more

GENERAL NOTES

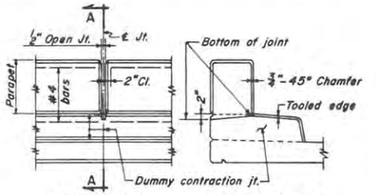
- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49.
- Design Specifications: Design Division of 1961 - AASHO "Standard Specifications for Highway Bridges".
- Live Load: HS20-44
- Dead Load includes 30 lbs./sq. ft. for future wearing surface on the deck slab.
- Reinforcement bars shall be intermediate or hard grade or rail steel, designed for fs = 20,000 p.s.i. and detailed in accordance with A.C.I. Code. Minimum lap shall be 30 dia. and minimum cover shall be 1½", except as noted.
- Concrete in Superstructure shall be Class AA.
- For Bridge Railing and Guard Fence Connection, refer to Std. Dwgs. ST-140 & ST-141.
- Exposed concrete edges shall be chamfered 1" x 1" except as noted.



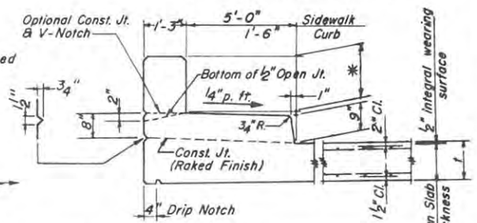
SKEW ANGLE under 75°

TYPICAL HALF-PLANS

For reinforcement bars in parapet, curb, sidewalk and divisor see "REINFORCEMENT" on sheet 2.



OPEN JOINT DETAIL



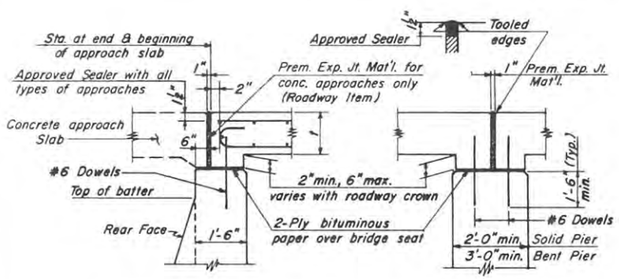
PARAPET, SIDEWALK & CURB DETAILS

*For parapet height refer to Std. Dwg. ST-140.

DRIP NOTCH DETAIL

Approved: FEB. 25, 1965

K. H. Jensen
Bridge Engineer



SECTION AT ABUTMENT — SECTION AT PIER

NOTE: Design Span = distance center to center of support, but not to exceed Clear Span plus thickness of Slab.

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD
R.C. SLAB BRIDGES

28', 30', 32', 40', 68', 84'
ROADWAY WIDTHS

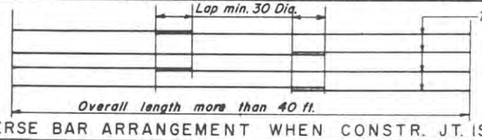
ST-100

ROADWAY with TWO SIDEWALKS (5'-0" wide)

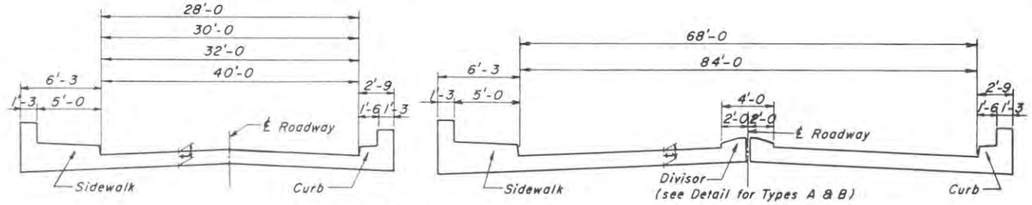
REINFORCEMENT BARS

Design Span, Ft.	Roadway Width, Ft.	Slab Thickness t, In.	S1 Size of Bars	S1 c.c. Spacing, In.	S1 No. of Bars	S2 or S7 Size of Bars	S2 or S7 c.c. Spacing, In.	S3 Size of Bars	S3 c.c. Spacing, In.	S4 or S8 Size of Bars	S4 or S8 c.c. Spacing, In.	S5 Size of Bars	S5 c.c. Spacing, In.	S6 No. of Bars	S6 Size of Bars	S6 c.c. Spacing, In.	C4 No. of Bars	C4 Size of Bars	C4 c.c. Spacing, In.	C4 Length	C4 "a"	C5 Size of Bars	C5 c.c. Spacing, In.	C5 Length	C6 Size of Bars	C6 No. of Bars	S9 Size of Bars	S9 c.c. Spacing, In.	S9 No. of Bars	S10 Size of Bars	S10 c.c. Spacing, In.	S10 No. of Bars	C7 Size of Bars	C7 c.c. Spacing, In.	C7 Length	C8 Size of Bars	C8 No. of Bars	Approximate Quantities Per Ft. Length: Class AA Conc., Cu. Yd.	Approximate Quantities Per Ft. Length: Reinforcement Bars, Lbs.	Dimension 'A', In.	Dimension 'B', In.
10	28	11	#8	6½	40	#5	9	#4	15	22	#4	15	#8		18	#4		8	#5	15			#4	15		#4	16												1.91	283	2¼	10½
	30				45					24																												1.97	296	1½	7½
	32				46					25																												2.04	309	¼	12
	40				57					32																												2.32	357	2	7½
	68				92					50																				#8	6	8	#4	9	6	#4	15	3'-4	#4	4	3.32	552	¾	12
	84	↑	↑	↑	114	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#8	6	8	#4	9	6	#4	15	3'-4	#4	4	3.87	648	2	7½
12	28	12	#8	8	42	#5	9	#4	15	22	#4	15	#8		20	#4		8	#5	15			#4	15		#4	16												2.03	295	4	10½
	30				45					24																												2.10	308	4	7½
	32				48					25																												2.18	320	4	12
	40				60					32																												2.48	371	4	7½
	68				90					50																				#8	6	8	#4	9	6	#4	15	3'-4	#4	4	3.57	567	4	12
	84	↑	↑	↑	120	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#8	6	8	#4	9	6	#4	15	3'-4	#4	4	4.17	689	4	7½
14	28	12½	#8	7	48	#5	9	#4	15	22	#4	15	#8		24	#4		8	#5	15			#4	15		#4	16												2.09	321	3½	10½
	30				52					24																												2.17	337	1½	7½
	32				55					25																												2.25	350	3	12
	40				69					32																												2.56	406	2	7½
	68				110					50																				#8	6	8	#4	9	6	#4	15	3'-4	#4	4	3.69	616	3	12
	84	↑	↑	↑	138	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#8	6	8	#4	9	6	#4	15	3'-4	#4	4	4.32	728	2	7½
16	28	13½	#9	8	42	#6	12	#4	15	22	#4	15	#9		20	#5		8	#5	15			#4	15		#4	16												2.21	347	4	10½
	30				45					24																												2.30	362	4	7½
	32				48					25																												2.39	377	4	12
	40				60					32																												2.72	438	4	7½
	68				96					50																				#9	6	8	#5	9	6	#4	15	3'-4	#4	4	3.94	672	4	12
	84	↑	↑	↑	120	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#9	6	8	#5	9	6	#4	15	3'-4	#4	4	4.62	794	4	7½
18	28	14½	#9	7½	45	#6	12	#4	15	22	#4	15	#9		22	#5		8	#5	15			#4	15		#4	16												2.33	364	3	10½
	30				48					24																												2.43	379	3¼	7½
	32				52					25																												2.53	398	¾	12
	40				64					32																												2.88	459	3¼	7½
	68				104					50																				#9	6	8	#5	9	6	#4	15	3'-4	#4	4	4.19	706	¾	12
	84	↑	↑	↑	128	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#9	6	8	#5	9	6	#4	15	3'-4	#4	4	4.92	888	3¾	7½
20	28	15	#9	7	48	#6	12	#4	15	22	#4	15	#9		24	#5		8	#5	15			#4	15		#4	16												2.39	380	3½	10½
	30				52					24																												2.50	400	1½	7½
	32				55					25																												2.60	414	3	12
	40				69					32																												2.96	481	2	7½
	68				110					50																				#9	6	8	#5	9	6	#4	15	3'-4	#4	4	4.31	733	3	12
	84	↑	↑	↑	138	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#9	6	8	#5	9	6	#4	15	3'-4	#4	4	5.07	869	2	7½
22	28	16	#10	8½	40	#7	15	#4	15	22	#4	15	#10		18	#6		8	#5	15			#4	15		#4	16												2.51	394	2¼	10½
	30				43					24																												2.63	412	1½	7½
	32				46					25																												2.74	430	¾	12
	40				57					32																												3.12	499	2	7½
	68				92					50																				#10	6	8	#6	9	6	#4	15	3'-4	#4	4	4.36	776	¾	12
	84	↑	↑	↑	114	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#10	6	8	#6	9	6	#4	15	3'-4	#4	4	5.37	914	2	7½
24	28	17	#10	8	42	#7	15	#4	15	22	#4	15	#10		20	#6		8	#5	15			#4	15		#4	16												2.63	411	4	10½
	30				45					24																												2.76	429	4	7½
	32				48					25																												2.88	448	4	12
	40				60					32																												3.28	520	4	7½
	68				96					50																				#10	6	8	#6	9	6	#4	15	3'-4	#4	4	4.81	803	4	12
	84	↑	↑	↑	120	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#10	6	8	#6	9	6	#4	15	3'-4	#4	4	5.67	948	4	7½
26	28	18	#10	7	48	#7	15	#4	15	22	#4	15	#10		24	#6		8	#5	15			#4	15		#4	16												2.75	434	3½	10½
	30				52					24																												2.89	476	1½	7½
	32				55					25																												3.02	495	3	12
	40				69					32																												3.44	577	2	7½
	68				110					50																				#10	6	8	#6	9	6	#4	15	3'-4	#4	4	5.06	880	3	12
	84	↑	↑	↑	138	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#10	6	8	#6	9	6	#4	15	3'-4	#4	4	5.95	1043	2	7½
28	28	19½	#11	8½	40	#8	18	#4	15	22	#4	15	#11		18	#7		8	#5	15			#4	15		#4	16												2.94	463	2¼	10½
	30				43					24																												3.09	485	1½	7½
	32				46					25																												3.23	505	¾	12
	40				57					32																												3.68	588	2	7½
	68				92					50																				#11	6	8	#6	9	6	#4	15	3'-4	#4	4	5.43	908	¾	12
	84	↑	↑	↑	114	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#11	6	8	#6	9	6	#4	15	3'-4	#4	4	6.40	1071	2	7½
30	28	21	#11	7½	45	#8	18	#4	15	22	#4	15	#11		22	#7		8	#5	15			#4	15		#4	16												3.12	512	3	10½
	30				48					24																												3.29	534	3¾	7½
	32				52					25																												3.44	558	¾	12
	40				64					32																												3.92	646	3¾	7½
	68				104					50																				#11	6	8	#6	9	6	#4	15	3'-4	#4	4	5.80	996	¾	12
	84	↑	↑	↑	128	↑	↑	↑	↑	64	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	↑	#11	6	8	#6	9	6	#4	15	3'-4	#4	4	6.85	1168	3¾	7½

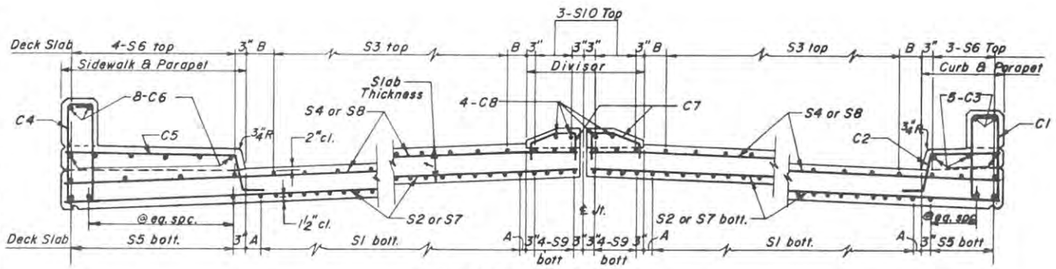
SPACED AS SHOWN — EQUALLY SPACED — AS REQUIRED — AS REQUIRED — AS REQUIRED



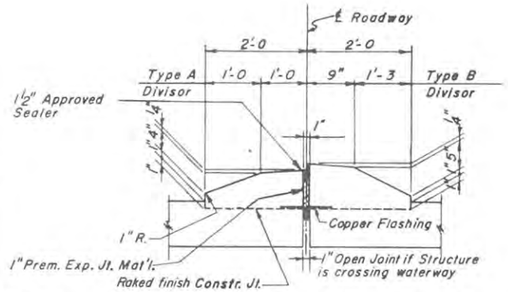
TRANSVERSE BAR ARRANGEMENT WHEN CONSTR. JT. IS NOT EMPLOYED



TYPICAL SECTIONS

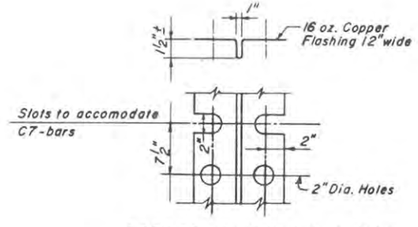


REINFORCEMENT

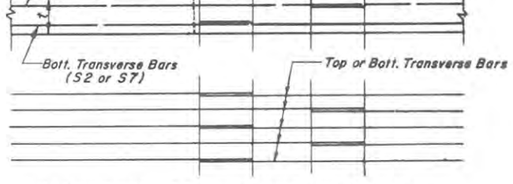


NOTE: Surface of Divisor shall be treated as shown on Std. Dwg. SD-13.

DIVISOR DETAIL



COPPER FLASHING DETAIL



TRANSVERSE BAR ARRANGEMENT AT CONSTRUCTION JOINT

Approved: FEB. 25, 1965

K H Jensen
Bridge Engineer

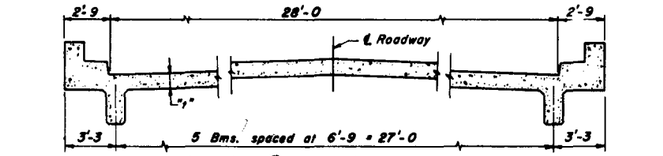
Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

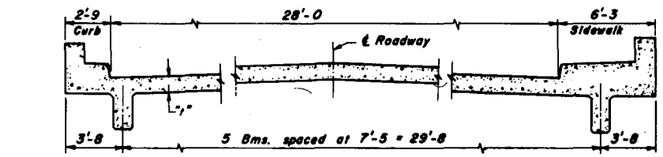
STANDARD R.C. SLAB BRIDGES

28', 30', 32', 40', 68', 84' ROADWAY WIDTHS

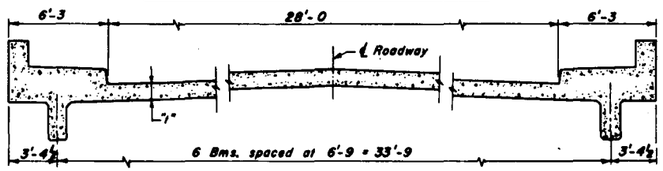
ST-100



RDWY with TWO SAFETY CURBS



RDWY with SAFETY CURB & SIDEWALK



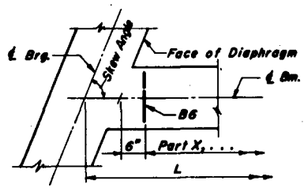
RDWY with TWO SIDEWALKS

ROADWAY SECTIONS showing BEAM SPACINGS

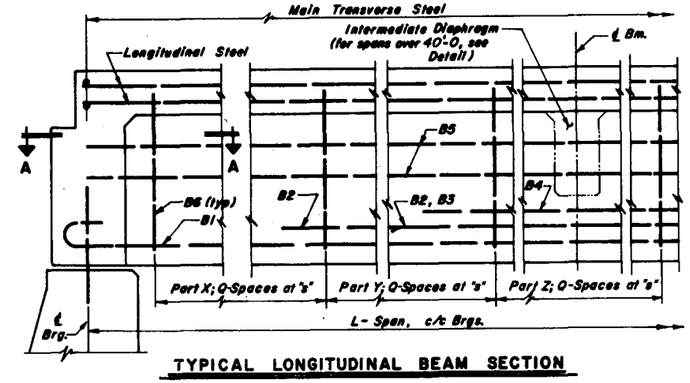
TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 length	B5 (#5) No.	B5 (#5) length	B6 (#4) A	B6 (#4) B	B6 (#4) length	Stirrups part X Q	Stirrups part X s	Stirrups part Y Q	Stirrups part Y s	Stirrups part Z Q	Stirrups part Z s	No.	Type of Beam Cross Section
28' ROADWAY WITH TWO CURBS																													
28	6'-9	5	16"	26"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	2	28'-0	1'-1	1'-10½	5'-8	9	5"	5	9"	8		37	I
30				28			30'-11	34'-6		10	22'-9		10	15'-3	—	—		30'-0		2'-0½	6'-0	9	5	6	9	8		39	
32				29½			32'-11	36'-6		11	25'-6		11	17'-9	—	—		32'-0		8'-2	6'-3	9	5	6	10	8		39	
34				32			34'-11	38'-6			27'-9			22'-3	2	#6 11'-9		34'-0		2'-8½	6'-8	9	5	7	10	8		41	
36				33½			36'-11	40'-6			29'-0			23'-9		7 13'-6		36'-0		2'-6	6'-11	10	6	6	12	9		41	
38				36			38'-11	42'-6			31'-0			25'-6		9 17'-0		38'-0		2'-8½	7'-4	10	6	6	12	9		42	
40			↓	38	↓	↓	40'-11	44'-6	↓	↓	33'-3	↓	↓	28'-0	↓	10 19'-0	↓	40'-0	↓	2'-10½	7'-8	9	6	7	12	9	↓	42	↓
42			16"	40	4		42'-11	46'-6	2		35'-3			29'-9	2	11 21'-6	2	42'-0	1'-1	3'-0½	8'-0	9	6	7	12	10		43	I
44			19½"	41	5		44'-11	48'-6	3		34'-3			23'-9	—	—	4	44'-0	1'-4½	3'-1½	8'-5½	4	9	3	18	12		27	II
46				43			46'-11	50'-6			36'-6			26'-6	2	6 14'-6		46'-0		3'-3½	6'-9½	5	9	3	18	12		29	
48				43½			48'-11	52'-6			38'-5			28'-0	2	7 16'-6		48'-0		3'-6	9'-2½	5	10	3	20	12		29	
50	6'-9	5	19½"	46"	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-9	2	#8 18'-6	4	50'-0	1'-4½	3'-5½	9'-7½	5	10"	3	20"	12		29	II
28' ROADWAY WITH CURB AND SIDEWALK																													
28	7'-5	5	16"	29½"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-0	—	—	2	28'-0	1'-1	2'-2	6'-3	6	6"	6	10"	8		33	I
30				31½			30'-11	34'-6		10	22'-6		9	16'-9	—	—		30'-0		2'-4	6'-7	6	6	6	10	8		33	
32				33			32'-11	36'-6		11	25'-0		10	18'-6	—	—		32'-0		2'-5½	6'-10	6	6	7	10	8		35	
34				34½			34'-11	38'-6			27'-6		11	22'-3	2	#6 11'-9		34'-0		2'-7	7'-1	6	6	7	10	8		35	
36				36½			36'-11	40'-6			29'-0			23'-6		7 13'-6		36'-0		2'-9	7'-5	9	6	6	12	8		39	
38			↓	39	↓	↓	38'-11	42'-6	↓	↓	31'-3	↓	↓	26'-0	↓	9 17'-6	↓	38'-0	↓	2'-11½	7'-10	10	6	6	12	8	↓	41	↓
40			16"	41	4		40'-11	44'-6	2		33'-6			28'-3	2	11 20'-9	2	40'-0	1'-1	3'-1½	8'-2	10	6	6	12	8		41	I
42			19½"	42	5		42'-11	46'-6	3		32'-9			22'-9	—	—	4	42'-0	1'-4½	3'-2½	8'-7½	4	9	4	18	10		27	II
44				43½			44'-11	48'-6			34'-6			25'-3	2	6 14'-0		44'-0		3'-4	8'-10½	4	9	4	18	10		27	
46				45½			46'-11	50'-6			37'-0			27'-6		8 15'-6		46'-0		3'-6	9'-2½	5	9	4	18	10		29	
48			↓	47	↓	↓	48'-11	52'-6	↓	↓	39'-0	↓	↓	29'-9	↓	10 20'-9	↓	48'-0	↓	3'-7½	9'-5½	5	9	4	18	11	↓	30	↓
50	7'-5	5	19½"	49½	5	#11	50'-11	54'-6	3	#11	41'-0	2	#11	32'-3	2	#11 23'-6	4	50'-0	1'-4½	3'-10	9'-10½	5	9"	4	18"	11		30	II
28' ROADWAY WITH TWO SIDEWALKS																													
28	6'-9	6	16"	29"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	2	28'-0	1'-1	1'-11½	5'-10	9	5"	5	9"	8		37	I
30				29			30'-11	34'-6		10	22'-9		10	15'-3	—	—		30'-0		2'-4½	6'-2	9	5	6	9	8		39	
32				30½			32'-11	36'-6		11	25'-6		11	19'-9	—	—		32'-0		2'-3	6'-5	9	5	6	10	8		39	
34				33			34'-11	38'-6			27'-9			22'-3	2	#6 11'-9		34'-0		2'-5½	6'-10	9	5	7	10	8		41	
36				34½			36'-11	40'-6			29'-0			23'-9		7 13'-6		36'-0		2'-7	7'-1	10	6	6	12	9		41	
38				37			38'-11	42'-6			31'-0			25'-6		9 17'-0		38'-0		2'-9½	7'-6	10	6	6	12	9		42	
40			↓	39	↓	↓	40'-11	44'-6	↓	↓	33'-3	↓	↓	28'-0	↓	10 19'-0	↓	40'-0	↓	2'-11½	7'-10	9	6	7	12	9	↓	42	↓
42			16"	41	4		42'-11	46'-6	2		35'-3			29'-9	2	11 21'-6	2	42'-0	1'-1	3'-1½	8'-2	9	6	7	12	10		43	I
44			19½"	42	5		44'-11	48'-6	3		36'-3			25'-9	—	—	4	44'-0	1'-4½	3'-2½	8'-7½	4	9	3	18	12		27	II
46				44			46'-11	50'-6			36'-6			26'-6	2	6 14'-6		46'-0		3'-4½	8'-11½	5	9	3	18	12		29	
48			↓	46½	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-0	↓	2 7 16'-6	↓	48'-0	↓	3'-7	9'-4½	5	10	3	20	12		29	
50	6'-9	6	19½"	49	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-9	2	#8 18'-6	4	50'-0	1'-4½	3'-9½	9'-9½	5	10"	3	20"	12		29	II

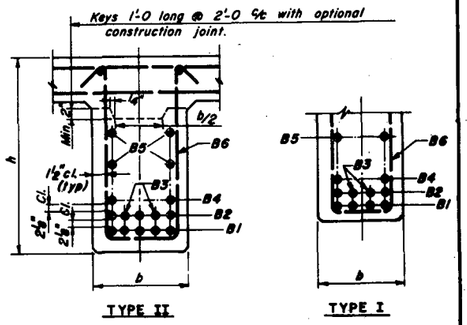
Des.	K.R.P.
Trc.	C.E.F.
Ckd.	E.W.H/N.W.J



SECTION A-A

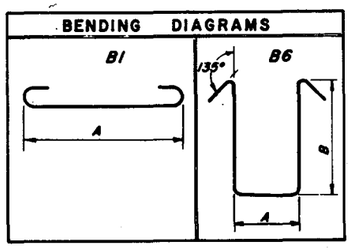


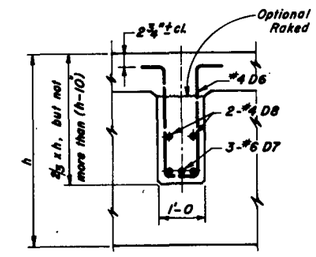
TYPICAL LONGITUDINAL BEAM SECTION



TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75°, place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.
- Design Specifications: Design Division of 1961 - AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.
- Live Load: HS20-44
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the deck slab.
- Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for f_s = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 1½ except as noted.
- For Deck Slab and other details, refer to sheet 7.
- Class AA Concrete shall be used in the Superstructure.
- For Bridge Railing and Guard Fence Connection, refer to Std. Dwgs. ST-140 & ST-141.
- Exposed concrete edges shall be chamfered 1" x 1", except as noted.

Approved: FEB. 25, 1965

R. H. Jansen
Bridge Engineer

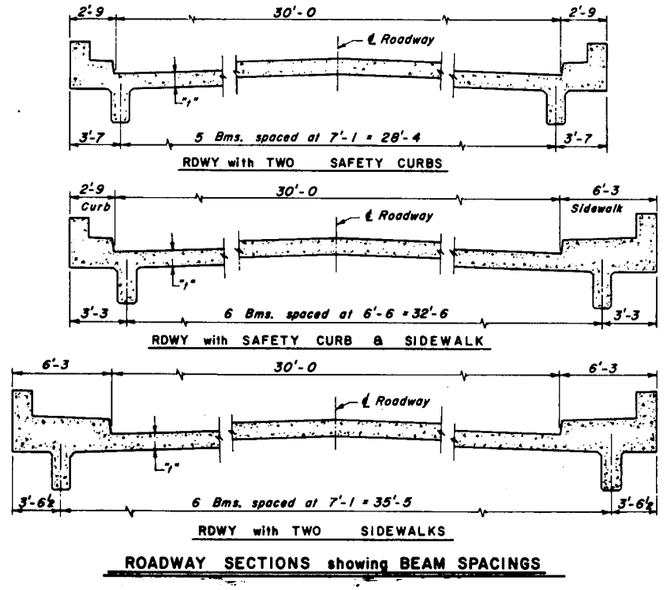
Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

STANDARD R. C. T-BEAM BRIDGES

28'-0 Roadway

ST-101

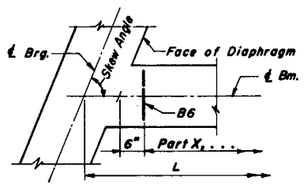


ROADWAY SECTIONS showing BEAM SPACINGS

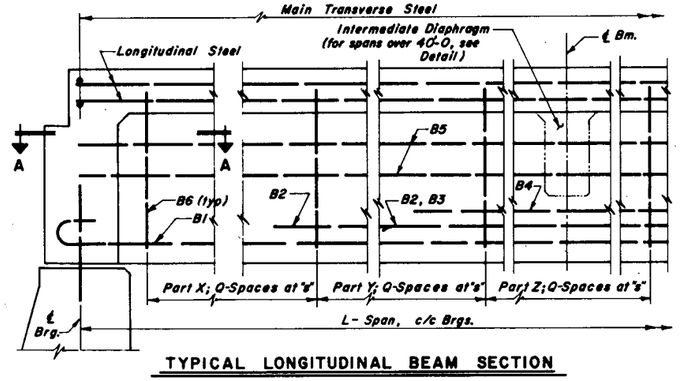
TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 (#5) No.	B5 length	B6 (#4) A	B6 (#4) B	B6 (#4) length	Stirrups part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s	No.	Type of Beam Cross Section
30' ROADWAY WITH TWO CURBS																														
28	7'-1	5	16"	27"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-11½	5'-10	7	5"	5	9"	8		37	I
30				29			30'-11	34'-6		10	22'-0		10	15'-3	—	—	—		30'-0		2'-4½	6'-2	9	5	6	9	8		39	
32				30½			32'-11	36'-6		11	25'-6		11	19'-9	—	—	—		32'-0		2'-3	6'-5	9	5	6	10	8		39	
34				33			34'-11	38'-6			27'-9			22'-3	2	#6	11'-9		34'-0		2'-5½	6'-10	9	5	7	10	8		41	
36				34½			36'-11	40'-6			29'-0			23'-9		7	13'-6		36'-0		2'-7	7'-1	10	6	6	12	9		41	
38				37			38'-11	42'-6			31'-0			25'-6		9	17'-0		38'-0		2'-9½	7'-6	10	6	6	12	9		42	
40			↓	39½	↓	↓	40'-11	44'-6	↓	↓	33'-3	↓	↓	28'-0	↓	10	19'-0	↓	40'-0	↓	3'-0	7'-11	9	6	7	12	9	↓	42	↓
42			16"	41½	4		42'-11	46'-6	2		35'-3			29'-9	2	11	21'-6	2	42'-0	1'-1	3'-2	8'-3	9	6	7	12	10		43	I
44			19½"	42½	5		44'-11	48'-6	3		34'-3			23'-9	—	—	—	4	44'-0	1'-4½	3'-3	8'-8½	4	9	3	18	12		27	II
46				44½			46'-11	50'-6			36'-6			26'-6	2	6	14'-6		46'-0		3'-5	9'-0½	5	9	3	18	12		29	
48	↓	↓	↓	47	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-0	2	7	16'-6	↓	48'-0	↓	3'-7½	9'-5½	5	10	3	20	12	↓	29	↓
50	7'-1	5	19½"	49½	5	#11	50'-11	54'-6	3	#11	40'-3	2	#11	29'-9	2	#8	18'-6	4	50'-0	1'-4½	3'-10	9'-10½	5	10"	3	20"	12	Equal Spaces	29	II
30' ROADWAY WITH CURB AND SIDEWALK																														
28	6'-6	6	16"	27"	4	#11	28'-11	32'-6	2	#9	20'-3	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-11½	5'-10	7	6"	5	10"	8		33	I
30				28½			30'-11	34'-6		10	22'-3		9	16'-9	—	—	—		30'-0		2'-1	6'-0	7	6	6	10	8		35	
32				30			32'-11	36'-6		11	24'-9		10	18'-6	—	—	—		32'-0		2'-2½	6'-4	7	6	7	10	8		37	
34				32			34'-11	38'-6			26'-3		11	20'-9	—	—	—		34'-0		2'-4½	6'-8	7	6	7	10	8		37	
36				34			36'-11	40'-6			29'-0			23'-0	2	#6	12'-6		36'-0		2'-6½	7'-0	9	6	6	12	9		40	
38				36			38'-11	42'-6			30'-6			24'-3		7	14'-3		38'-0		2'-8½	7'-4	10	6	6	12	9		42	
40			↓	38	↓	↓	40'-11	44'-6	↓	↓	32'-9	↓	↓	27'-0	↓	9	17'-6	↓	40'-0	↓	2'-10½	7'-8	10	6	6	12	9	↓	42	↓
42			16"	39½	4		42'-11	46'-6	2		35'-0			29'-6	2	11	21'-0	2	42'-0	1'-1	3'-0	7'-11	10	6	6	12	9		42	I
44			19½"	41	5		44'-11	48'-6	3		34'-3			23'-9	—	—	—	4	44'-0	1'-4½	3'-1½	8'-5½	4	9	4	18	11		28	II
46				42½			46'-11	50'-6			36'-3			26'-3	2	6	14'-6		46'-0		3'-3	8'-8½	5	9	4	18	11		30	
48	↓	↓	↓	44½	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-9	2	8	16'-3	↓	48'-0	↓	3'-5	9'-0½	5	9	4	18	12	↓	31	↓
50	6'-6	6	19½"	46½"	5	#11	50'-11	54'-6	3	#11	40'-3	2	#11	30'-6	2	#10	19'-9	4	50'-0	1'-4½	3'-7	9'-4½	5	9"	4	18"	12	Equal Spaces	31	II
30' ROADWAY WITH TWO SIDEWALKS																														
28	7'-1	6	16"	27½"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	—	2	28'-0	1'-1	2'-0	5'-11	9	5"	5	9"	8		37	I
30				29½			30'-11	34'-6		10	22'-9		10	15'-3	—	—	—		30'-0		2'-2	6'-3	9	5	6	9	8		39	
32				31			32'-11	36'-6		11	25'-6		11	19'-9	—	—	—		32'-0		2'-3½	6'-6	9	5	6	10	8		39	
34				33½			34'-11	38'-6			27'-9			22'-3	2	#6	11'-9		34'-0		2'-6	6'-11	9	5	7	10	8		41	
36				35			36'-11	40'-6			29'-0			23'-9		7	13'-6		36'-0		2'-7½	7'-2	10	6	6	12	9		41	
38			↓	37½	↓	↓	38'-11	42'-6	↓	↓	31'-0	↓	↓	25'-6	↓	9	17'-0	↓	38'-0	↓	2'-10	7'-7	10	6	6	12	9	↓	42	↓
40			16"	40	4		40'-11	44'-6	2		33'-3			28'-0	2	11	19'-9	2	40'-0	1'-1	3'-0½	8'-0	9	6	7	12	9		42	I
42			19½"	42	5		42'-11	46'-6	3		32'-3			21'-6	—	—	—	4	42'-0	1'-4½	3'-2½	8'-7½	4	9	3	18	12		27	II
44				43			44'-11	48'-6			34'-3			23'-9	2	6	13'-3		44'-0		3'-3½	8'-9½	4	9	3	18	12		27	
46				45			46'-11	50'-6			36'-6			26'-6		7	15'-3		46'-0		3'-5½	9'-1½	5	9	3	18	12		29	
48	↓	↓	↓	47½	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-0	↓	8	17'-3	↓	48'-0	↓	3'-8	9'-5½	5	10	3	20	12	↓	29	↓
50	7'-1	6	19½"	50	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-9	2	9	19'-3	4	50'-0	1'-4½	3'-10½	9'-9½	5	10	3	20"	12	Equal Spaces	29	II

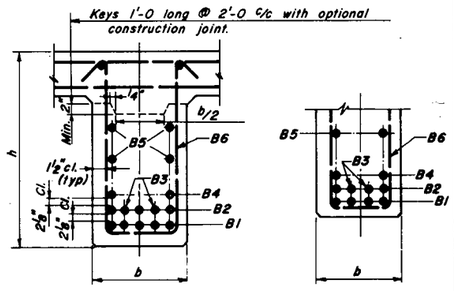
Des.	K.R.P.
Trc.	C.E.F.
Ckd.	ELH/NHU



SECTION A-A

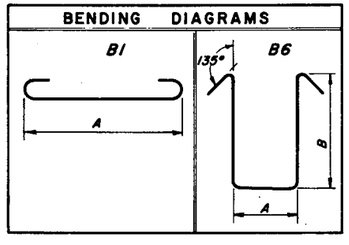


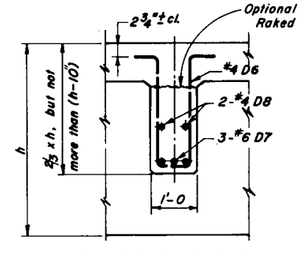
TYPICAL LONGITUDINAL BEAM SECTION



TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75°, place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

GENERAL NOTES

- *All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.*
- *Design Specifications: Design Division of 1961 - AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.*
- *Live Load: HS20-44*
- *Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the deck slab.*
- *Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for f_s = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 1½" except as noted.*
- *For Deck Slab and other details, refer to sheet 7.*
- *Class AA Concrete shall be used in the Superstructure.*
- *For Bridge Railing and Guard Fence Connection, refer to Std. Dwgs. ST-140 & ST-141.*
- *Exposed concrete edges shall be chamfered 1" x 1", except as noted.*

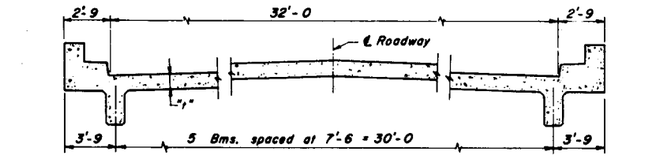
Approved: FEB. 25, 1965
K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

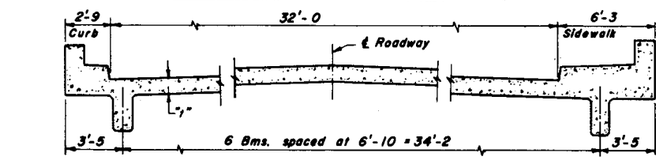
STANDARD R. C. T-BEAM BRIDGES

30'-0 Roadway

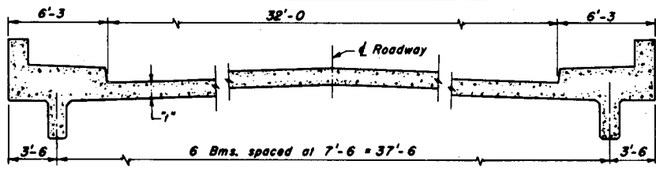
ST-101



RDWY with TWO SAFETY CURBS



RDWY with SAFETY CURB & SIDEWALK



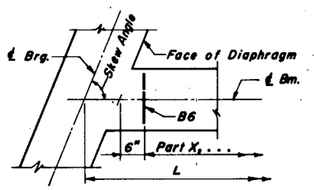
RDWY with TWO SIDEWALKS

ROADWAY SECTIONS showing BEAM SPACINGS

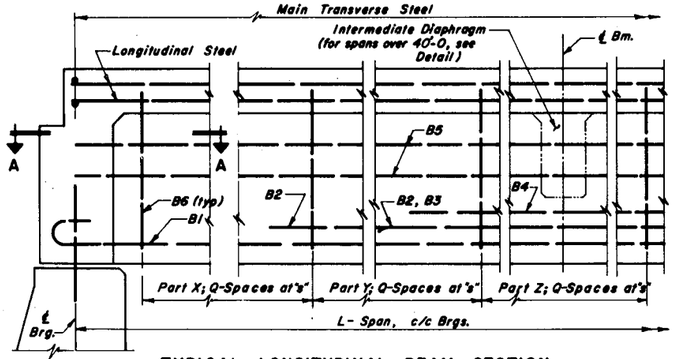
TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 (#5) No.	B5 length	B6 (#4) Stirrups A	B	length	part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s	No.	Type of Beam Cross Section
32' ROADWAY WITH TWO CURBS																														
28	7'-6	5	16"	29"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-0	—	—	—	2	28'-0	1'-1	2'-1¼	6'-2	6	6"	6	10"	8	Equal Spaces	33	I
30				31"			30'-11	34'-6	10		22'-6	9		16'-9	—	—	—		30'-0		2'-3¼	6'-6	6	6	6	10	8		33	
32				32½			32'-11	36'-6	11		25'-0	10		18'-6	—	—	—		32'-0		2'-5	6'-9	6	6	7	10	8		35	
34				34			34'-11	38'-6			27'-6	11		22'-3	2	#6	11'-9		34'-0		2'-6½	7'-0	6	6	7	10	8		35	
36				36			36'-11	40'-6			29'-0			23' 6	1	7	13'-6		36'-0		2'-8½	7'-4	9	6	6	12	8		39	
38			↓	38½	↓	↓	38'-11	42'-6	↓	↓	31'-3	↓	↓	26'-0	1	9	17'-6	↓	38'-0	↓	2'-11	7'-9	10	6	6	12	8		41	↓
40			16"	40½	4		40'-11	44'-6	2		33'-6			28'-3	2	11	20'-9	2	40'-0	1'-1	3'-1	8'-1	10	6	6	12	8		41	I
42			19½	41½	5		42'-11	46'-6	3		32'-9			28'-9	—	—	—	4	42'-0	1'-4½	3'-2	8'-6½	4	9	4	18	10		27	II
44				43			44'-11	48'-6			34'-6			25'-3	2	6	18'-0		44'-0		3'-3½	8'-9½	4	9	4	18	10		27	
46				45			46'-11	50'-6			37'-0			27'-6	1	8	17'-6		46'-0		3'-5½	9'-1½	5	9	4	18	10		29	
48			↓	46½	↓	↓	48'-11	52'-6	↓	↓	39'-0	↓	↓	29'-9	1	10	20'-9	↓	48'-0	↓	3'-7	9'-4½	5	9	4	18	11		30	↓
50	7'-6	5	19½	49	5	#11	50'-11	54'-6	3	#11	41'-0	2	#11	32'-3	2	#11	23'-6	4	50'-0	1'-4½	3'-9½	9'-9½	5	9"	4	18"	11		30	II
32' ROADWAY WITH CURB AND SIDEWALK																														
28	6'-10	6	16"	26½"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-11	5'-9	9	5"	5	9"	8	Equal Spaces	37	I
30				28½			30'-11	34'-6		10	22'-9		10	15'-3	—	—	—		30'-0		2'-1	6'-1	9	5	6	9	8		39	
32				30			32'-11	36'-6		11	25'-6		11	19'-9	—	—	—		32'-0		2'-2½	6'-4	9	5	6	10	8		39	
34				32½			34'-11	38'-6			27'-9			22'-3	2	#6	11'-9		34'-0		2'-5	6'-9	9	5	7	10	8		41	
36				34			36'-11	40'-6			29'-0			23'-9	1	7	13'-6		36'-0		2'-6½	7'-0	10	6	6	12	9		41	
38				36½			38'-11	42'-6			31'-0			25'-6	1	9	17'-0		38'-0		2'-9	7'-5	10	6	6	18	9		42	
40			↓	38½	↓	↓	40'-11	44'-6	↓	↓	33'-3	↓	↓	28'-0	1	10	19'-0	↓	40'-0	↓	2'-11	7'-9	9	6	7	12	9		42	↓
42			16	40½	4		42'-11	46'-6	2		35'-3			29'-9	2	11	21'-6	2	42'-0	1'-1	3'-1	8'-1	9	6	7	12	10		43	I
44			19½	41½	5		44'-11	48'-6	3		34'-3			23'-9	—	—	—	4	44'-0	1'-4½	3'-2	8'-6½	4	9	3	18	12		27	II
46				43½			46'-11	50'-6			36'-6			26'-6	2	6	14'-6		46'-0		3'-4	8'-10½	5	9	3	18	12		29	
48			↓	46	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-0	2	7	16'-6	↓	48'-0	↓	3'-6½	9'-3½	5	10	3	20	12		29	↓
50	6'-10	6	19½"	48½"	5	#11	50'-11	54'-6	3	11	40'-0	2	#11	29'-9	2	8	18'-6	4	50'-0	1'-4½	3'-9	9'-8½	5	10"	3	20"	12		29	II
32' ROADWAY WITH TWO SIDEWALKS																														
28	7'-6	6	16"	30"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-0	—	—	—	2	28'-0	1'-1	2'-2½	6'-4	6	6"	6	10"	8	Equal Spaces	33	I
30				32			30'-11	34'-6		10	22'-6		9	16'-9	—	—	—		30'-0		2'-4½	6'-8	6	6	6	10	8		33	
32				33½			32'-11	36'-6		11	25'-0		10	18'-6	—	—	—		32'-0		2'-6	6'-11	6	6	7	10	8		35	
34				35			34'-11	38'-6			27'-6		11	22'-3	2	#6	11'-9		34'-0		2-7½	7'-2	6	6	7	10	8		35	
36				37			36'-11	40'-6			29'-0			23'-6	1	7	13'-6		36'-0		2'-9½	7'-6	9	6	6	12	8		39	
38			↓	39½	↓	↓	38'-11	42'-6	↓	↓	31'-3	↓	↓	26'-0	1	9	17'-6	↓	38'-0	↓	3'-0	7'-11	10	6	6	12	8		41	↓
40			16"	41½	4		40'-11	44'-6	2		33'-6			28'-3	2	11	20'-9	2	40'-0	1'-1	3'-2	8'-3	10	6	6	12	8		41	I
42			19½"	42½	5		42'-11	46'-6	3		32'-9			28'-9	—	—	—	4	42'-0	1'-4½	3'-3	8'-8½	4	9	4	18	10		27	II
44				44			44'-11	48'-6			34'-6			25'-3	2	6	18'-0		44'-0		3'-4½	8'-11½	4	9	4	18	10		27	
46				46			46'-11	50'-6			37'-0			27'-6	1	8	17'-6		46'-0		3'-6½	9'-3½	5	9	4	18	10		29	
48			↓	47½	↓	↓	48'-11	52'-6	↓	↓	39'-0	↓	↓	29'-9	1	10	20'-9	↓	48'-0	↓	3'-8	9'-6½	5	9	4	18	11		30	↓
50	7'-6	6	19½"	50"	5	#11	50'-11	54'-6	3	11	41'-0	2	#11	32'-3	2	#11	23'-6	4	50'-0	1'-4½	3'-10½	9'-11½	5	9"	4	18"	11		30	II

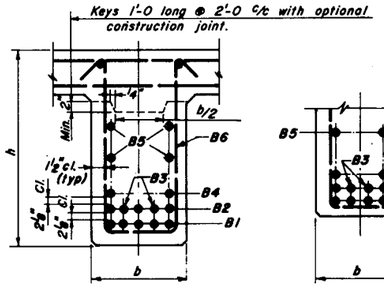
Des.	K.R.P.
Trc.	C.E.F.
Ckd.	ELH/NWU



SECTION A-A

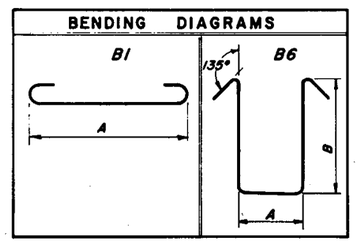


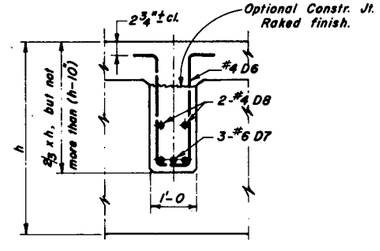
TYPICAL LONGITUDINAL BEAM SECTION



TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM.

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75° place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.
- Design Specifications: Design Division of 1961 - AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.
- Live Load: HS20 - 44
- Dead Load includes 30 lbs. per sq. ft for future wearing surface on the deck slab.
- Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for f_s = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 1½" except as noted.
- For Deck Slab and other details, refer to sheet 7.
- Class AA Concrete shall be used in the Superstructure.
- For Bridge Railing and Guard Fence Connection, refer to Std. Dwgs. ST-140 & ST-141.
- Exposed concrete edges shall be chamfered 1" x 1", except as noted.

Approved: FEB. 25, 1965

R. H. Jensen
Bridge Engineer

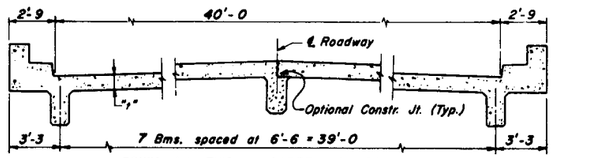
Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

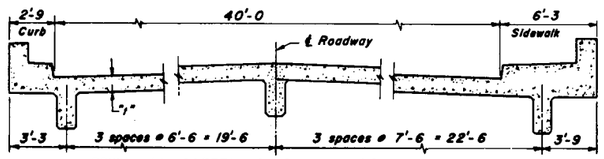
STANDARD
R. C. T-BEAM BRIDGES

32'-0 Roadway

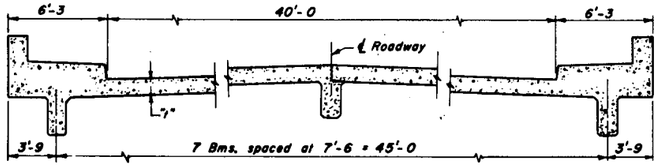
ST-101



RDWY with TWO SAFETY CURBS



RDWY with SAFETY CURB & SIDEWALK



RDWY with TWO SIDEWALKS

ROADWAY SECTIONS showing BEAM SPACINGS

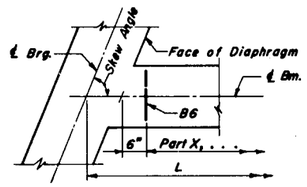
TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 (#3) No.	B5 (#3) length	B6 (#4) A	B6 (#4) B	B6 (#4) length	Stirrups part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s	No.	Type of Beam Cross Section
40' ROADWAY WITH TWO CURBS																														
28	6'-6	7	16"	26"	4	#11	28'-11	32'-6	2	#9	20'-3	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-10½	5'-8	7	6"	5	10"	8	Equal Spaces	33	I
30				27½			30'-11	34'-6			18 22'-3			9 16'-9	—	—	—		30'-0			5'-11	7	6	6	10	8		35	
32				29			32'-11	36'-6			11 24'-9			10 18'-6	—	—	—		32'-0			6'-2	7	6	7	10	8		37	
34				31			34'-11	38'-6			26'-3			11 20'-9	—	—	—		34'-0			6'-6	7	6	7	10	8		37	
36				33			36'-11	40'-6			29'-0			23'-0	2	#6	12'-6		36'-0			6'-10	9	6	6	12	9		40	
38				35			38'-11	42'-6			30'-6			24'-3	1	7	14'-3		38'-0			7'-2	10	6	6	12	9		42	
40				37			40'-11	44'-6			32'-9			27'-0	2	9	17'-6		40'-0			7'-6	10	6	6	12	9		42	
42			16"	38½	4		42'-11	46'-6	2		35'-0			29'-6	2	11	21'-0	2	42'-0	1'-1	2'-4½	7'-9	10	6	6	12	9		42	I
44			19½"	40	5		44'-11	48'-6	3		34'-3			23'-9				4	44'-0	1'-4½	3'-0½	8'-3½	4	9	4	18	11		28	II
46				41½			46'-11	50'-6			36'-3			26'-3	2	6	14'-6		46'-0		3'-2	8'-4½	5	9	4	18	11		30	
48				43½			48'-11	52'-6			38'-3			28'-9	2	7	16'-3		48'-0		3'-4	8'-10½	5	9	4	18	12		31	
50	6'-6	7	19½"	45½	5	#11	50'-11	54'-6	3	#11	40'-3	2	#11	30'-6	2	9	19'-9	4	50'-0	1'-4½	3'-6	7'-2½	5	9"	4	18"	12		31	II
40' ROADWAY WITH CURB AND SIDEWALK																														
28																														
30																														
32																														
34																														
36																														
38																														
40																														
42																														
44																														
46																														
48																														
50																														

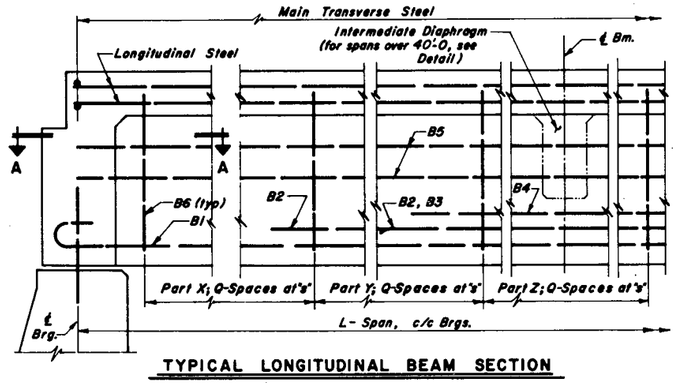
Use Upper Table for beams spaced at 6'-6".
Use Lower Table for beams spaced at 7'-6" and for beam at Construction Joint.

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 (#3) No.	B5 (#3) length	B6 (#4) A	B6 (#4) B	B6 (#4) length	Stirrups part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s	No.	Type of Beam Cross Section
40' ROADWAY WITH TWO SIDEWALKS																														
28	7'-6	7	16"	29½"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-0	—	—	—	2	28'-0	1'-1	2'-2	6'-3	6	6"	6	10"	8	Equal Spaces	33	I
30				31½			30'-11	34'-6			10 22'-6			9 16'-9	—	—	—		30'-0		2'-4	6'-7	6	6	6	10	8		33	
32				33			32'-11	36'-6			11 25'-0			10 18'-6	—	—	—		32'-0		2'-5½	6'-10	6	6	7	10	8		35	
34				34½			34'-11	38'-6			27'-6			11 22'-3	2	#6	11'-9		34'-0		2'-7	7'-1	6	6	7	10	8		35	
36				36½			36'-11	40'-6			29'-0			23'-6	1	7	13'-6		36'-0		2'-9	7'-5	9	6	6	12	8		39	
38				39			38'-11	42'-6			31'-3			26'-0	2	9	17'-6		38'-0		2'-11½	7'-10	10	6	6	12	8		41	
40			16"	41	4		40'-11	44'-6	2		33'-6			28'-3	2	11	20'-9	2	40'-0	1'-1	3'-1½	8'-2	10	6	6	12	8		41	I
42			19½"	42	5		42'-11	46'-6	3		32'-9			22'-9	—	—	—	4	42'-0	1'-4½	3'-5½	8'-7½	4	9	4	18	10		27	II
44				43½			44'-11	48'-6			34'-6			25'-3	2	6	14'-0		44'-0		3'-4	8'-10½	4	9	4	18	10		27	
46				45½			46'-11	50'-6			37'-0			27'-6	1	8	17'-6		46'-0		3'-6	9'-2½	5	9	4	18	10		29	
48				47			48'-11	52'-6			39'-0			29'-9	2	10	20'-9		48'-0		3'-7½	9'-5½	5	9	4	18	11		30	
50	7'-6	7	19½"	49½	5	#11	50'-11	54'-6	3	#11	41'-0	2	11	32'-3	2	#11	23'-6	4	50'-0	1'-4½	3'-10	9'-10½	5	9"	4	18"	11		30	II

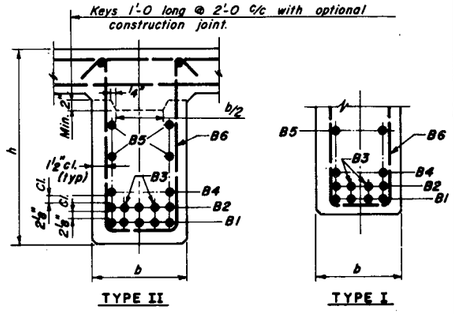
Des.	K.R.P.
Trc.	C.E.F.
Ckd.	ELH/NRU



SECTION A-A



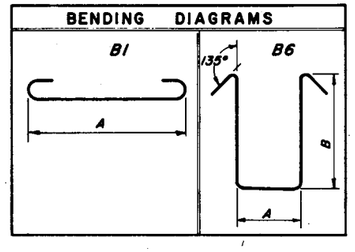
TYPICAL LONGITUDINAL BEAM SECTION

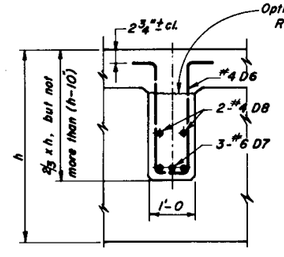


TYPE II **TYPE I**

TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75°, place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

GENERAL NOTES

- *All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.*
- *Design Specifications: Design Division of 1961 - AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.*
- *Live Load: HS20-44*
- *Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the deck slab.*
- *Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for f_s = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 1½" except as noted.*
- *For Deck Slab and other details, refer to sheet 7.*
- *Class AA Concrete shall be used in the Superstructure.*
- *For Bridge Railing and Guard Fence Connection, refer to Std. Dwgs. ST-140 & ST-141.*
- *Exposed concrete edges shall be chamfered 1" x 1", except as noted.*

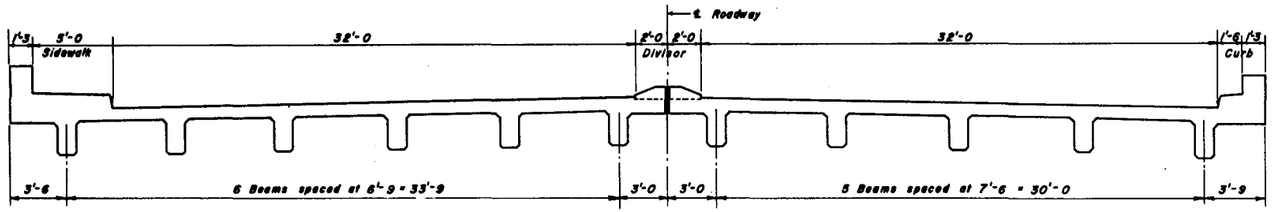
Approved: FEB. 25, 1965
R. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
R. C. T-BEAM BRIDGES

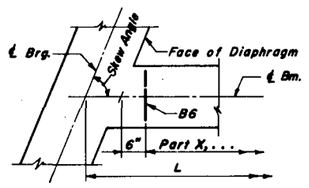
40'-0 Roadway

ST-101



HALF ROADWAY WITH SIDEWALK

HALF ROADWAY WITH CURB



SECTION A-A

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.
- Design Specifications: Design Division of 1961-AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.
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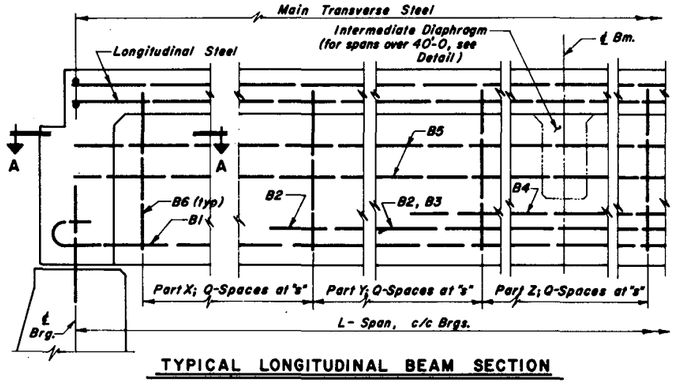
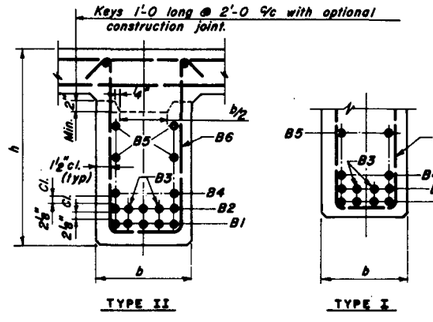
TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 ($^{\#}$5) No.	B5 ($^{\#}$5) length	B6 ($^{\#}$4) Stirrups A	B	length	part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s		No.	Type of Beam Cross Section
HALF ROADWAY WITH CURB																															
28	7'-6	5	16"	28½"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-0	—	—	—	2	28'-0	1'-1	2'-1	6'-1	6	6"	6	10"	8		33	I
30				30½			30'-11	34'-6			22'-6			16'-9	—	—	—		30'-0		2'-3	6'-5	6	6	6	10	8		33	
32				32			32'-11	36'-6		11	25'-0		10	18'-6	—	—	—		32'-0		2'-4½	6'-8	6	6	7	10	8		35	
34				33½			34'-11	38'-6			27'-6		11	22'-3	2	#6	11'-9		34'-0		2'-6	6'-11	6	6	7	10	8		35	
36				35½			36'-11	40'-6			29'-0			23'-6		7	13'-6		36'-0		2'-8	7'-3	9	6	6	12	8		39	
38				37½			38'-11	42'-6			31'-3			24'-0		9	17'-6		38'-0		2'-10	7'-7	10	6	6	12	8		41	
40			16"	39½	4		40'-11	44'-6	2		33'-6			28'-3	2	11	20'-9	2	40'-0	1'-1	3'-0	7'-11	10	6	6	12	8	Equal Spaces	41	I
42			19½"	40½	5		42'-11	46'-6	3		32'-9			22'-9	—	—	—	4	42'-0	1'-6½	3'-1	8'-4½	4	9	4	18	10		27	II
44				42			44'-11	48'-6			34'-6			25'-3	2	6	14'-0		44'-0		3'-2½	8'-7½	4	9	4	18	10		27	
46				44			46'-11	50'-6			37'-0			27'-6		8	17'-6		46'-0		3'-4½	8'-11½	5	9	4	18	10		29	
48				45½			48'-11	52'-6			39'-0			29'-9		10	20'-9		48'-0		3'-6	9'-2½	5	9	4	18	11		30	
50	7'-6	5	19½"	48	5	#11	50'-11	54'-6	3	#11	41'-0	2	#11	32'-3	2	#11	23'-6	4	50'-0	1'-6½	3'-5½	9'-7½	5	9"	4	18"	11		30	II
HALF ROADWAY WITH SIDEWALK																															
28	6'-9	5	16"	26"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-10½	5'-8	9	5"	5	9"	8		37	I
30				28			30'-11	34'-6		10	22'-9		10	15'-3	—	—	—		30'-0		2'-0½	6'-0	9	5	6	9	8		39	
32				29½			32'-11	36'-6		11	25'-6		11	19'-9	—	—	—		32'-0		2'-2	6'-3	9	5	6	10	8		39	
34				32			34'-11	38'-6			27'-9			22'-3	2	#6	11'-9		34'-0		2'-4½	6'-8	9	5	7	10	8		41	
36				33½			36'-11	40'-6			29'-0			23'-9		7	13'-6		36'-0		2'-6	6'-11	10	6	6	12	9		41	
38				36			38'-11	42'-6			31'-0			25'-6		9	17'-0		38'-0		2'-8½	7'-4	10	6	6	12	9		42	
40				38			40'-11	44'-6			33'-3			28'-0		10	19'-0		40'-0		2'-10½	7'-8	9	6	7	12	9		42	
42			16"	40	4		42'-11	46'-6	2		35'-3			29'-9	2	11	21'-6	2	42'-0	1'-1	3'-0½	8'-0	9	6	7	12	10		43	I
44			19½"	41	5		44'-11	48'-6	3		36'-3			23'-9	—	—	—	4	44'-0	1'-6½	3'-1½	8'-3½	4	9	3	18	12		27	II
46				43			46'-11	50'-6			36'-3			26'-6	2	6	14'-6		46'-0		3'-3½	8'-9½	5	9	3	18	12		29	
48				45½			48'-11	52'-6			38'-3			28'-0	2	7	16'-6		48'-0		3'-6	9'-2½	5	10	3	20	12		29	
50	6'-9	5	19½"	48"	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-9	2	#8	18'-6	4	50'-0	1'-6½	3'-5½	9'-7½	5	10"	3	20	12		29	II

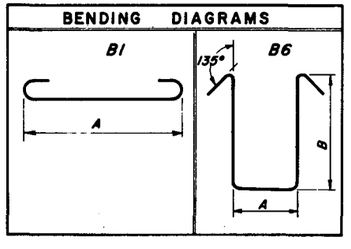


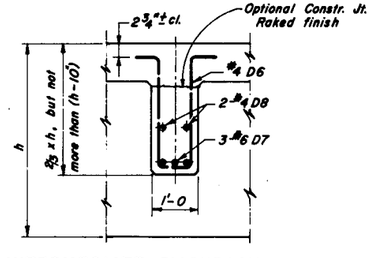
TYPICAL LONGITUDINAL BEAM SECTION



TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75°, place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

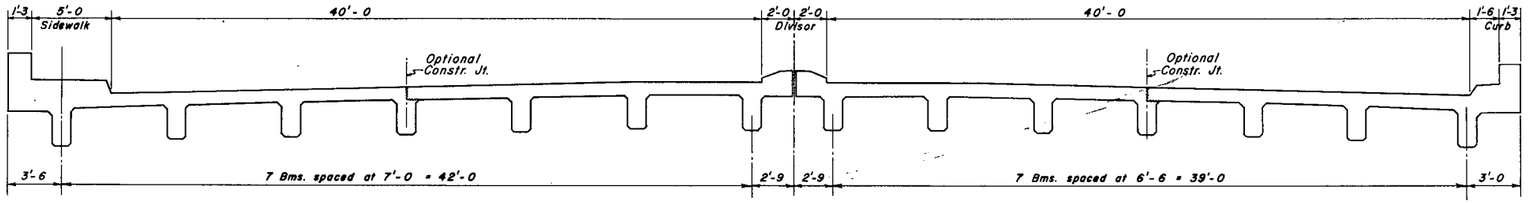
Approved: FEB. 25, 1965
J. J. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
R. C. T-BEAM BRIDGES

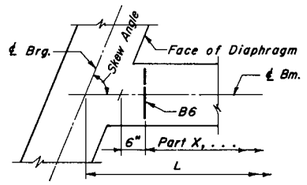
68'-0 Roadway

Des.	K.R.P.
Trc.	C.E.F.
Ckd.	R.H./W.W.



HALF ROADWAY WITH SIDEWALK

HALF ROADWAY WITH CURB



SECTION A-A

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60 and Form 409/49.
- Design Specifications: Design Division of 1961 - AASHO "Standard Specs. for Highway Bridges", except for the deck slab which is designed for f_c = 1,000 psi.
- Live Load: HS20-44
- Dead Load includes 30 lbs. per sq. ft. for future wearing surface on the deck slab.
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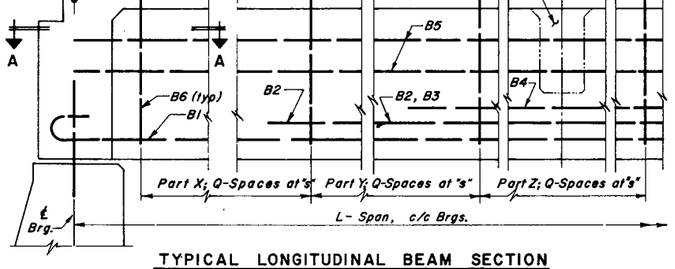
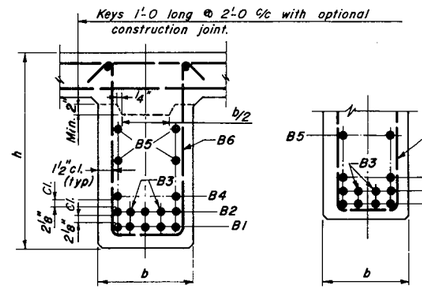
- Exposed concrete edges shall be chamfered 1" x 1", except as noted.

TABLE of BEAM DIMENSIONS & REINFORCEMENT BARS

Span L, ft.	Bm. Spacing	No. Bms.	Beam Dimensions b	Beam Dimensions h	Longitudinal Bars B1 No.	B1 size	B1 A	B1 length	B2 No.	B2 size	B2 length	B3 No.	B3 size	B3 length	B4 No.	B4 size	B4 length	B5 (#5) No.	B5 (#5) length	B6 (#4) A	B6 (#4) B	B6 (#4) length	Stirrups part X Q	part X s	part Y Q	part Y s	part Z Q	part Z s	Equal Spaces No.	Type of Beam Cross Section
HALF ROADWAY WITH CURB																														
28	6'-6	7	16"	25½"	4	#11	28'-11	32'-6	2	#9	20'-6	2	#9	16'-3	—	—	—	2	28'-0	1'-1	1'-10	5'-7	6	6"	6	9"	9	9	34	I
30				27½			30'-11	34'-6		10	23'-3		9	17'-3	—	—	—		30'-0		2'-0	5'-11	6	6	7	9	9	9	36	
32				29			32'-11	36'-6		10	24'-3		10	19'-0	—	—	—		32'-0		2'-1½	6'-2	6	6	8	9	9	9	38	
34				30½			34'-11	38'-6		11	26'-9		11	19'-6	—	—	—		34'-0		2'-3	6'-5	6	6	8	9	9	9	38	
36				32½			36'-11	40'-6			28'-9			22'-9	2	#6	11'-9		36'-0		2'-5	6'-9	6	6	9	9	9	9	40	
38				34½			38'-11	42'-6			30'-6			25'-0		8	14'-9		38'-0		2'-7	7'-1	6	6	9	10	9	9	40	
40			↓	36	↓	↓	40'-11	44'-6	↓	↓	33'-0	↓	↓	28'-0	↓	10	19'-0	↓	40'-0	↓	2'-8½	7'-4	6	6	10	10	9	↓	42	↓
42			16"	38	4		42'-11	46'-6	2		35'-3			29'-6	2	11	21'-0	2	42'-0	1'-1	2'-10½	7'-8	6	6	10	10	9	42	I
44			19½"	39½	5		44'-11	48'-6	3		38'-3			29'-0	—	—	—	4	44'-0	1'-4½	3'-0	8'-2½	4	10	4	16	12		29	II
46				41½			46'-11	50'-6			36'-6			26'-6	2	6	15'-6		46'-0		3'-2	8'-6½	4	10	4	18	12		29	
48	↓	↓	↓	43	↓	↓	48'-11	52'-6	↓	↓	37'-9	↓	↓	28'-9	2	7	16'-6	↓	48'-0	↓	3'-3½	8'-9½	4	10	4	18	12	↓	29	↓
50	6'-6	7	19½"	45"	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-6	2	#8	18'-6	4	50'-0	1'-4½	3'-5½	9'-1½	4	10"	4	18	12		29	II
HALF ROADWAY WITH SIDEWALK																														
28	7'-0	7	16"	26"	4	#11	28'-11	32'-6	2	#10	21'-0	2	#9	15'-9	—	—	—	2	28'-0	1'-1	1'-10½	5'-8	9	5"	5	9"	8		37	I
30				28			30'-11	34'-6		10	22'-9		10	15'-3	—	—	—		30'-0		2'-0½	6'-0	9	5	6	9	8		39	
32				29½			32'-11	36'-6		11	25'-6		11	19'-9	—	—	—		32'-0		2'-2	6'-3	9	5	6	10	8		39	
34				32			34'-11	38'-6			27'-9			22'-3	2	#6	11'-9		34'-0		2'-4½	6'-8	9	5	7	10	8		41	
36				33½			36'-11	40'-6			29'-0			23'-9		7	13'-6		36'-0		2'-6	6'-11	10	6	6	12	9		41	
38				36			38'-11	42'-6			31'-0			25'-6		9	17'-0		38'-0		2'-8½	7'-4	10	6	6	12	9		42	
40			↓	38½	↓	↓	40'-11	44'-6	↓	↓	33'-3	↓	↓	28'-0	↓	10	19'-0	↓	40'-0	↓	2'-11	7'-9	9	6	7	12	9		42	↓
42			16"	40½	4		42'-11	46'-6	2		35'-3			29'-9	2	11	21'-6	2	42'-0	1'-1	3'-1	8'-1,	9	6	7	12	10		43	I
44			19½"	41½	5		44'-11	48'-6	3		38'-3			23'-9	—	—	—	4	44'-0	1'-4½	3'-2	8'-6½	4	9	3	18	12		27	II
46				43½			46'-11	50'-6			36'-6			26'-6	2	6	14'-6		46'-0		3'-4	8'-10½	5	9	3	18	12		29	
48	↓	↓	↓	46	↓	↓	48'-11	52'-6	↓	↓	38'-3	↓	↓	28'-0	2	7	16'-6	↓	48'-0	↓	3'-6½	9'-3½	5	10	3	20	12		29	
50	7'-0	7	19½"	48½	5	#11	50'-11	54'-6	3	#11	40'-0	2	#11	29'-9	2	#8	18'-6	4	50'-0	1'-4½	3'-9	9'-8½	5	10"	3	20'	12		29	II



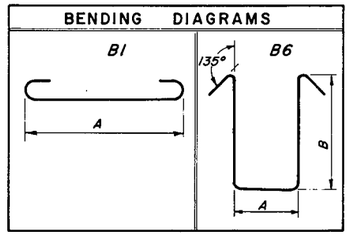
TYPICAL LONGITUDINAL BEAM SECTION

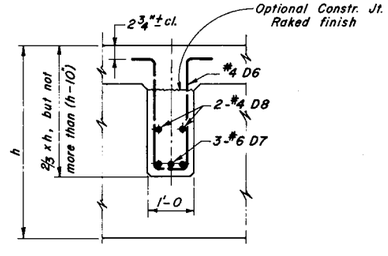


TYPE II TYPE I

TYPICAL BEAM CROSS-SECTIONS

BENDING DIAGRAMS





INTERMEDIATE DIAPHRAGM

NOTE: For skew angles 75° to 90°, place diaphragms parallel to abutments; For angles less than 75°, place diaphragms normal to ℄ Bms., and stagger. Spacing of diaphragms shall not exceed 25'-0.

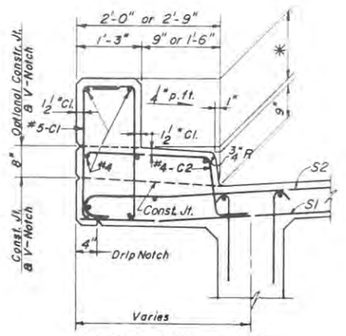
Approved: FEB. 25, 1965
H. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

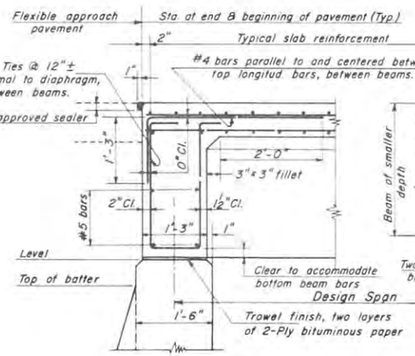
STANDARD R. C. T-BEAM BRIDGES

84'-0 Roadway

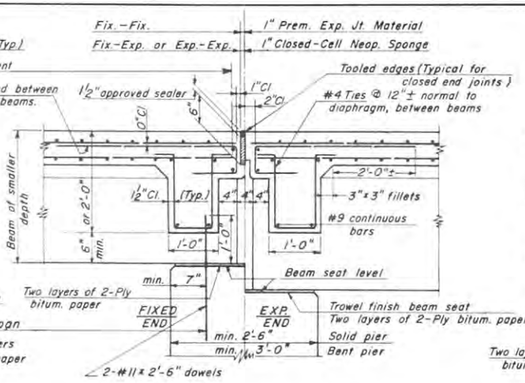
Des.	K.R.P.
Trc.	C.E.F.
Ckd.	ELH/NHU



SAFETY CURB DETAIL

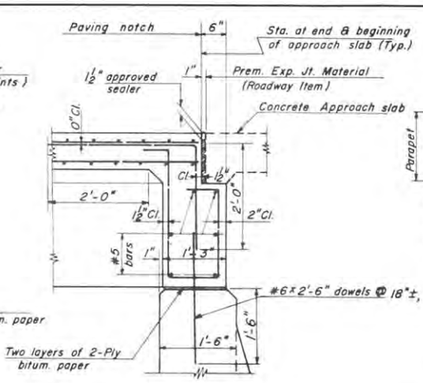


ABUTMENT SECTION
EXPANSION END

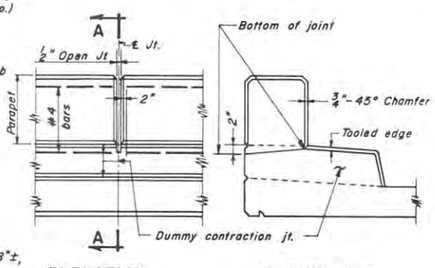


PIER SECTION

Both ends at pier should preferably be fixed or expansion.

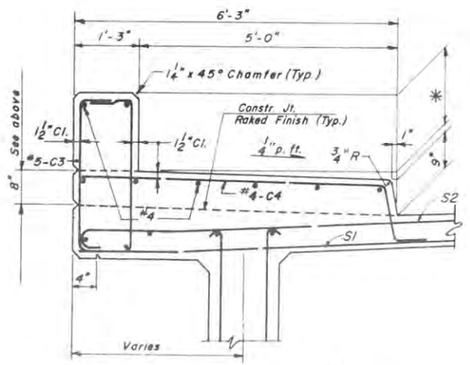


ABUTMENT SECTION
FIXED END

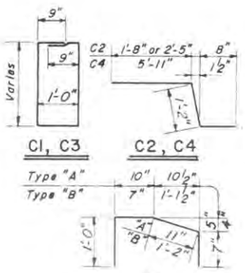


OPEN JOINT DETAIL

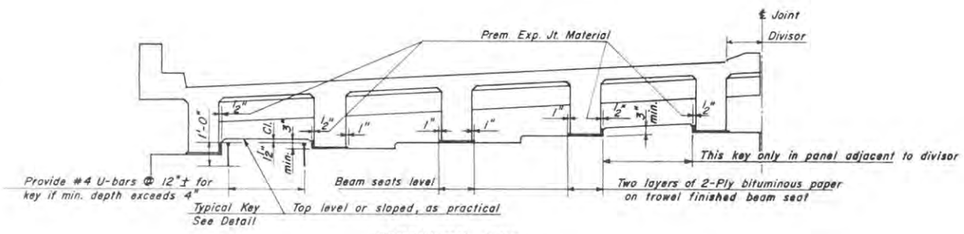
* For parapet height refer to Std. Dwg. ST-140.



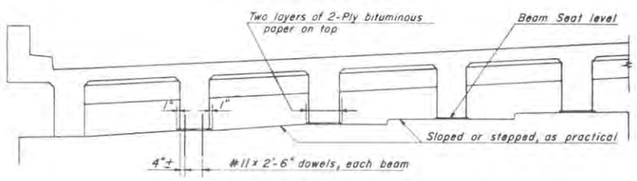
SIDEWALK DETAIL



BENDING DIAGRAMS



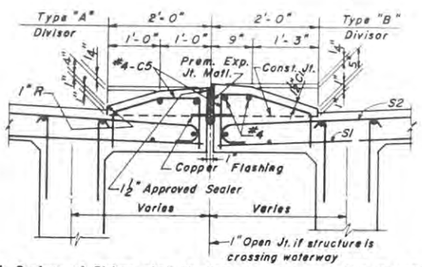
EXPANSION END



FIXED END

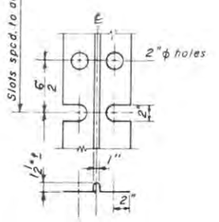
SECTIONS NEAR PIER

Span length Max. 50 ft.

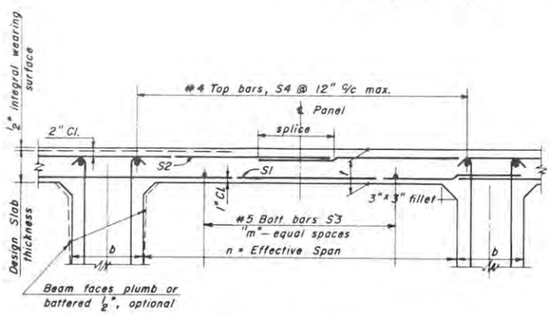


NOTE: Surface of Divisor shall be treated as shown on Std. Dwg. SD-13.

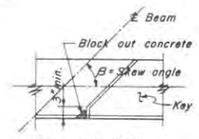
DIVISOR DETAIL



16 OZ. COPPER FLASHING
12" WIDE
DETAIL



TYPICAL SLAB PANEL



DETAIL OF KEY
At Skew Angle under 60°
PLAN

SLAB REINFORCEMENT

n	t	Bars S1 & S2 (See Instrs. 3 and 4)	Bars S3 "m"	Bars S3 Spac.
4'-3	7 1/2"	#5 @ 8 1/2" = 0.44 □"	3	12"
4'-7		#5 @ 8" = 0.47 □"	3	11"
4'-11		#5 @ 7 1/2" = 0.50 □"	4	11"
5'-3		#5 @ 7" = 0.53 □"	4	10"
5'-5	↓	#5 @ 6 1/2" = 0.57 □"	5	9"
5'-7	7 1/2"	#5 @ 6" = 0.62 □"	5	9"
5'-10	8"	#5 @ 7" = 0.53 □"	5	10"
6'-4		#5 @ 6 1/2" = 0.57 □"	6	9"
6'-7	↓	#5 @ 6" = 0.62 □"	7	9"
6'-10	8"	#5 @ 5 1/2" = 0.68 □"	8	8"

Note: Bars S3 & S4 to be spaced symmetrically about ℄ Panel.

n = Max. Normal Effective Span permitted for given reinforcement bars S1 and S2.

INSTRUCTIONS

1. Concrete in superstructure shall be Class AA.
2. Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for fs = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia.
3. To determine the required area of bars S1 & S2:
   (a). For values of skew angles β less than 75°, use the area of the bars shown in table.
   (b). For values of skew angles β, 75° and greater, increase the area of bars by Cosec. β.
4. Place transverse reinforcement in deck slab parallel to ℄ Brgs. for skew angles 75° and more. The spacing of bars shall be measured along ℄ of bridge. For skew angles less than 75° the bars shall be placed normal to ℄ of bridge and length cut to fit.
5. A 1/2 inch open joint in parapet shall be provided at two to three times the spacing of the bridge railing posts. ℄ of posts shall be located min. 1'-0" from ℄ of joint.
6. Chamfer exposed concrete edges 1"x1", except as noted.
7. For Abutments and Miscellaneous Details, refer to Std. Dwgs. ST-121 and ST-122.
8. For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.

APPROVED: FEB. 25, 1965
D. H. Jensen
Bridge Engineer

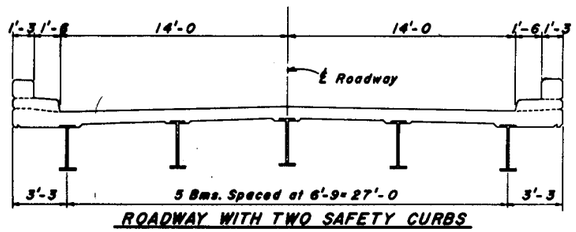
Commonwealth of Pennsylvania
DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD R.C. T-BEAM BRIDGES DETAILS

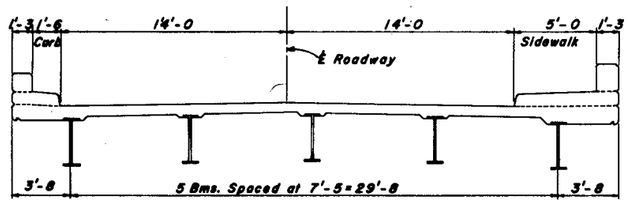
Des.	K.R.P.
Trc.	F.F.F
Ckd.	ELH/NHU

SHEET 7 OF 7

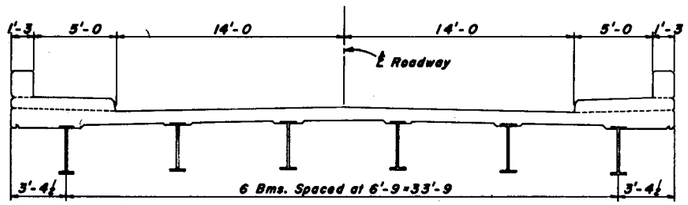
ST-101



ROADWAY WITH TWO SAFETY CURBS



ROADWAY WITH SAFETY CURB & SIDEWALK



ROADWAY WITH TWO SIDEWALKS

ROADWAY SECTIONS SHOWING BEAM SPACING

SPACING OF SHEAR CONNECTORS — $\frac{7}{8}$"ϕ STUDS OR 4"C 7.25

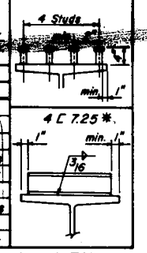
BEAMS SPACED AT 6'-9

SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6½	8½	11	14½	20	3/16	1
55	7	9½	12	15	21	3/16	1 1/16
60	7	9	12	15	21	5/16	1 7/16
65	7½	10	12½	16½	22½	5/16	1 7/16
70	8	10½	13½	17	24	3/8	1 5/8
75	8	10½	13½	17½	24	1/2	1 5/8
80	8½	11	14	17½	24	5/16	2
85	9	11	14	18½	24	11/16	2 3/16
90	9	11½	14½	18½	24	7/8	2 3/8

BEAMS SPACED AT 7'-5

SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6	8	10½	13½	18	3/16	1 1/16
55	6½	8½	11	14	19½	3/16	1 1/16
60	7	9½	12	15	20½	1/4	1 1/4
65	7	9	11½	15	20½	5/16	1 9/16
70	7½	9½	12½	16	21½	3/8	1 5/8
75	7½	10	12½	16	22	7/16	1 7/8
80	7½	10	13	16	22½	5/16	2 1/16
85	8	10½	13	16½	23	11/16	2 1/4
90	—	—	—	—	—	—	—

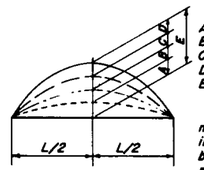
TYPE OF SHEAR CONNECTORS



* 10" long for 36WF, 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spc. shown in Tables.

NOTES

- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°.
- Equivalent number of ¾"ϕ studs may be used in lieu of $\frac{7}{8}$"ϕ studs.
- Shear capacity of 1-$\frac{7}{8}$"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5% of that shown for $\frac{7}{8}$"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



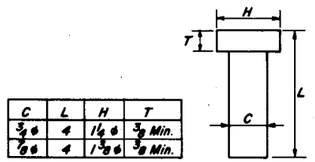
A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM

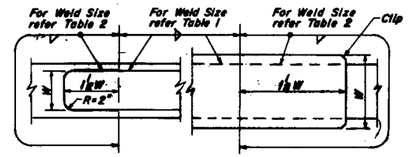
GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-6028, E-7016, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division of 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc = 1000 psi.
- Live Load: HS 20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs./sq. ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.



C	L	H	T
3/8 ϕ	4	1¼ ϕ	3/8 Min.
7/8 ϕ	4	1 3/8 ϕ	3/8 Min.

STUD SHEAR CONNECTOR DETAIL



COVER PLATE DETAIL

TABLE 2. SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs., ft. 50	55	60	65	70	75	80	85	90
Two Curbs	¼"	¼"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"
Curb & Sidewalk	5/16"	5/16"	¼"	5/16"	5/16"	5/16"	5/16"	⅜"	—
Two Sidewalks	¼"	¼"	5/16"	5/16"	5/16"	5/16"	5/16"	⅜"	5/16"

TABLE 1. SIZE OF WELD

Max. thickness of C.P. or Flange	Size of Weld
½"	3/16"
¾"	¼"
1½"	5/16"
2¼"	⅜"

NONCOMPOSITE BEAMS

ROADWAY SLAB With:		Bm. Spc.	No. Bms.		SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 20	25	30	35	40	45	50
	Two Curbs	6'-9	5	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 118	36 WF 135	36 WF 160
				R	51.0	57.6	63.6	69.6	74.8	79.4	84.0
	Curb & Sidewalk	7'-5	5	Bm. size	21 WF 62 (21 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	33 WF 130	36 WF 150	36 WF 170
				R	56.2	63.7	70.5	77.1	83.0	88.3	94.4
	Two Sidewalks	6'-9	6	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 130	36 WF 150	36 WF 160
				R	52.0	58.9	65.2	71.4	77.1	82.1	86.6

COMPOSITE BEAMS

ROADWAY SLAB With:	SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 50	55	60	65	70	75	80	85	90
Two Curbs	27WF84 C.P. 15"×5/8"×39'-0	30WF99 C.P. 14"×3/4"×41'-6	30WF99 C.P. 14½"×1"×48'-0	33WF118 C.P. 15"×5/8"×49'-0	36WF135 C.P. 16½"×7/8"×51'-0	36WF135 C.P. 17"×1"×58'-0	36WF160 C.P. 17½"×1"×59'-3	36WF194 C.P. 18"×1"×60'-3	36WF230 C.P. 20"×1"×59'-9
	83.2	87.4	91.3	95.5	99.6	103.7	108.1	112.8	118.0
Curb & Sidewalk	27WF84 C.P. 15"×5/8"×41'-3	30WF99 C.P. 15"×5/8"×43'-9	33WF118 C.P. 16"×5/8"×45'-3	33WF118 C.P. 16½"×1"×52'-0	36WF135 C.P. 17"×1"×54'-3	36WF150 C.P. 17"×1¼"×57'-9	36WF182 C.P. 17½"×1¼"×59'-3	36WF230 C.P. 16½"×1¼"×56'-3	—
	93.6	98.5	103.2	107.8	112.7	117.7	123.1	128.6	—
Two Sidewalks	27WF84 C.P. 14½"×5/8"×39'-9	30WF99 C.P. 15"×5/8"×42'-3	30WF99 C.P. 15½"×1"×49'-0	33WF118 C.P. 16½"×5/8"×50'-3	36WF135 C.P. 16"×5/8"×52'-0	36WF150 C.P. 16"×1"×55'-6	36WF170 C.P. 18"×1"×58'-9	36WF230 C.P. 14½"×1"×52'-6	36WF230 C.P. 21½"×5/8"×62'-0
	85.9	90.3	94.6	99.0	103.4	107.9	112.7	118.2	122.8

R = REACTION (kips)

NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks)

ROADWAY SLAB With:	REINFORCING BARS lbs./lin. ft.	CLASS AA CONCRETE cu. yds./lin. ft.
Two Curbs	205	1.14
Curb & Sidewalk	230	1.40
Two Sidewalks	255	1.56

Approved: FEB. 25 1965

Bridge Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

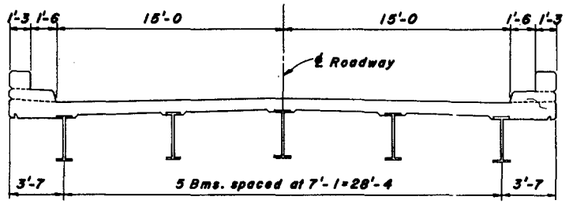
STANDARD STEEL I-BEAM BRIDGES 28' ROADWAY

Des.	K.R.P.
Trc.	F.F.F.
Ckd.	G.T.V.

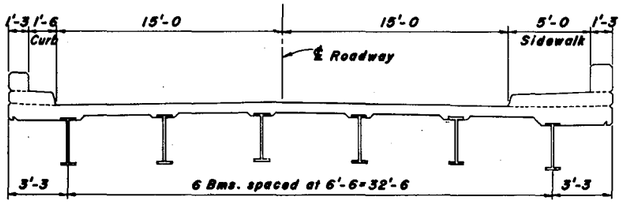
IBM Program 31.2.100

SHEET 1 OF 7

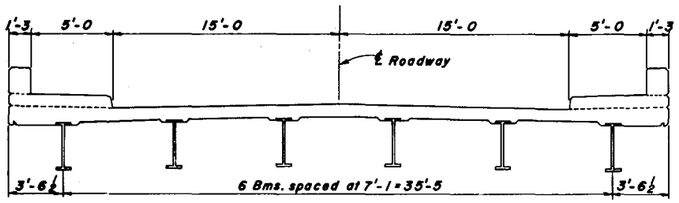
ST-102



ROADWAY WITH TWO SAFETY CURBS



ROADWAY WITH SAFETY CURB & SIDEWALK

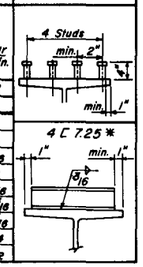


ROADWAY WITH TWO SIDEWALKS

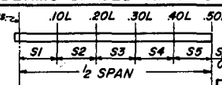
ROADWAY SECTIONS SHOWING BEAM SPACING

SPACING OF SHEAR CONNECTORS — ⅞"ϕ STUDS OR 4"C 7.25

TYPE OF SHEAR CONNECTORS

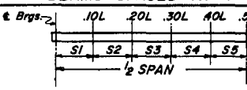


BEAMS SPACED AT 6'-6



SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7	9½	12	15	20½	3/16	1
55	7½	10	12½	16	22	1/4	1 1/16
60	7½	9½	12½	16	21½	5/16	1 3/16
65	8	10½	13½	17	23½	5/16	1 1/16
70	8½	11½	14½	18	24	3/8	1 1/2
75	8½	11	14½	18	24	1/2	1 7/8
80	9	11½	14½	18½	24	5/16	2
85	9	12	15	19	24	11/16	2 3/16
90	9½	12	15½	19½	24	7/8	2 7/16

BEAMS SPACED AT 7'-1

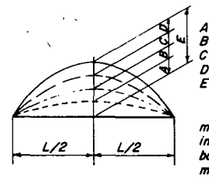


SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6½	8½	10½	14	19	3/16	1
55	7	9	11½	14½	20	1/4	1 1/8
60	6½	9	11½	14½	20	5/16	1 7/16
65	7	9½	12	15½	21½	5/16	1 1/2
70	7½	10	13	16½	22½	3/8	1 9/16
75	8	10	13	16½	23	7/16	1 13/16
80	8	10½	13½	17	23½	3/16	2 1/16
85	8½	10½	13	17½	24	11/16	2 1/4
90	9	11½	14	18	24	7/8	2 1/2

* 10" long for 36WF, 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spc. shown in Tables.

NOTES

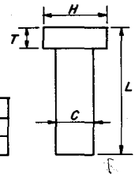
- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°
- Equivalent number of ¾"ϕ studs may be used in lieu of ⅞"ϕ studs.
- Shear capacity of 1-⅞"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5% of that shown for ⅞"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

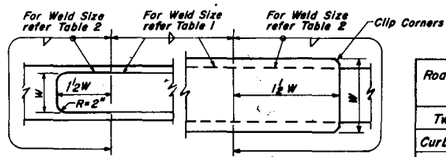
When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM



C	L	H	T
⅞ϕ	4	1⅛ ϕ	⅜ Min.
⅞ϕ	4	1⅜ ϕ	⅜ Min.

STUD SHEAR CONNECTOR DETAIL



COVER PLATE DETAIL

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-6028, E-7016, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division of 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc=1090 psi.
- Live Load: HS20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs/sq. ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.

TABLE 2. SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs., ft. 50	55	60	65	70	75	80	85	90
Two Curbs	1/4"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"
Curb & Sidewalk	1/4"	1/4"	5/16"	1/4"	5/16"	5/16"	5/16"	1/2"	5/16"
Two Sidewalks	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	—

TABLE 1. SIZE OF WELD

Max. thickness of C.R or Flange	Size of Weld
½"	5/16"
¾"	¼"
1½"	3/16"
2¼"	⅜"

	Bm. Spc.	No. Bms.		NONCOMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 20	25	30	35	40	45	50
ROADWAY SLAB with: Two Curbs	7-1	5	Bm. size	21 WF 62 (21 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 130	36 WF 150	36 WF 170
			R	53.2	60.3	66.5	72.5	78.1	83.1	87.7
Curb & Sidewalk	6-6	6	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 99 (30 WF 108)	33 WF 118	36 WF 135	36 WF 160
			R	49.4	55.9	61.8	67.6	72.6	77.2	81.7
Two Sidewalks	7-1	6	Bm. size	21 WF 62 (21 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 130	36 WF 150	36 WF 170
			R	54.2	61.5	67.9	74.2	80.0	85.3	90.1

COMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 50	55	60	65	70	75	80	85	90
27WF84 C.R.14⅛x⅝x40'-0	30WF99 C.R.15x⅜x42'-6	30WF99 C.R.15½x1x49'-0	33WF118 C.R.16½x⅞x50'-3	36WF135 C.R.16x⅞x52'-0	36WF150 C.R.16x1x55'-6	36WF170 C.R.18x1x58'-9	36WF194 C.R.16x1¼x61'-0	36WF230 C.R.21½x⅞x62'-0
86.9	91.2	95.3	99.6	104.0	108.3	113.0	117.8	122.9
27WF84 C.R.13x⅝x38'-6	30WF99 C.R.13½x⅜x40'-9	30WF99 C.R.15½x⅞x48'-0	33WF118 C.R.16x¾x48'-9	36WF135 C.R.16½x⅝x50'-6	36WF135 C.R.16½x1x57'-3	36WF160 C.R.17x1x58'-9	36WF194 C.R.10x1⅜x57'-6	36WF230 C.R.21x¾x59'-3
81.3	85.4	89.4	93.5	97.3	101.5	106.2	110.9	116.0
27WF84 C.R.13½x⅝x40'-3	30WF99 C.R.14x⅞x43'-0	30WF99 C.R.16½x1x49'-9	33WF118 C.R.15½x1x50'-9	36WF135 C.R.17x⅞x53'-3	36WF150 C.R.17½x1x56'-9	36WF170 C.R.14½x1⅛x59'-3	36WF230 C.R.21x⅝x56'-0	———
89.5	94.1	98.7	103.1	107.7	112.3	117.4	122.9	———

R = REACTION (kips)

NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks)

ROADWAY SLAB WITH	REINFORC'NT BARS lbs./lin. ft.	CLASS AA CONCRETE cu. yds./lin. ft.
Two Curbs	251	1.19
Curb & Sidewalk	243	1.40
Two Sidewalks	295	1.61

Approved FEB. 25 1965
K H Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

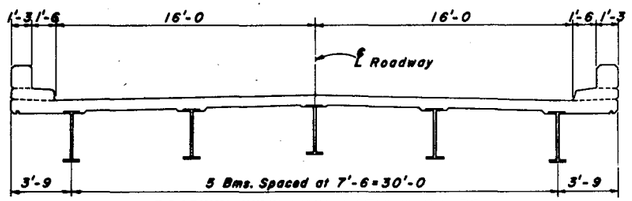
STANDARD STEEL I-BEAM BRIDGES 30' ROADWAY

Des.	K.R.P.
Trc.	F.F.F.
Ckd.	G.T.V.

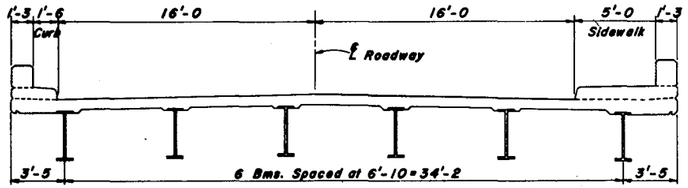
IBM Program 31.2.100

SHEET 2 OF 7

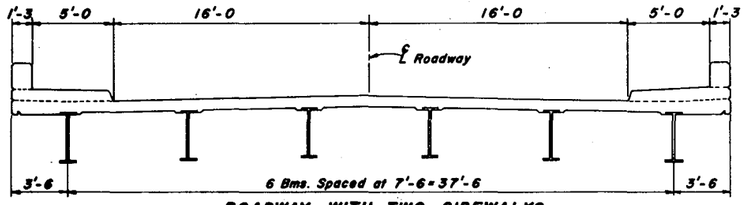
ST-102



ROADWAY WITH TWO SAFETY CURBS



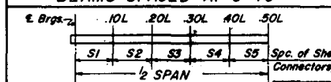
ROADWAY WITH SAFETY CURB & SIDEWALK



ROADWAY WITH TWO SIDEWALKS

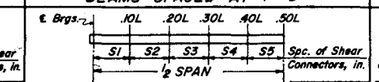
ROADWAY SECTIONS SHOWING BEAM SPACINGS

SPACING OF SHEAR CONNECTORS — 7/8" ϕ STUDS OR 4" C 7.25



BEAMS SPACED AT 6'-10

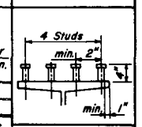
SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7	9	11½	14½	19½	3/16	1
55	7	9½	12	15½	21	3/16	1 1/16
60	7	9½	12	15	20½	5/16	1 3/16
65	7½	10	13	16½	22½	5/16	1 1/16
70	8½	10½	13½	17½	23½	5/16	1½
75	8½	11	14	17½	24	7/16	1 3/4
80	8½	11	14	18	24	9/16	2
85	8½	11	14	18	24	11/16	2 1/4
90	9	11½	14½	18½	24	7/8	2½



BEAMS SPACED AT 7'-6

SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6	8	10	13	18	3/16	1 1/16
55	6½	8½	11	14	19	1/4	1 3/16
60	7	9	11½	15	20½	1/4	1 3/16
65	7	9	11½	14½	20	5/16	1 3/16
70	7½	9½	12	15½	21½	3/8	1 11/16
75	7½	9½	12½	16	22	7/16	1 7/8
80	7½	10	12½	16	22	9/16	2 1/8
85	8	10	13	16½	22½	11/16	2 1/4
90	—	—	—	—	—	—	—

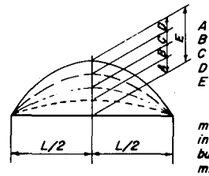
TYPE OF SHEAR CONNECTORS



* 10" long for 36WF; 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spa. shown in Tables.

NOTES

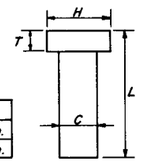
- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°
- Equivalent number of ¾"ϕ studs may be used in lieu of ⅞"ϕ studs.
- Shear capacity of 1-⅞"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5% of that shown for ⅞"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

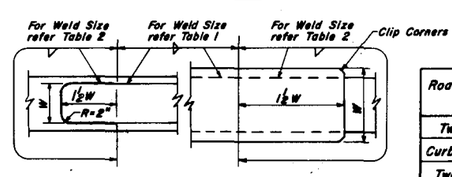
When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM



C	L	H	T
3/4 ϕ	4	1¼ ϕ	3/8 Min.
7/8 ϕ	4	1 3/8 ϕ	3/8 Min.

STUD SHEAR CONNECTOR DETAIL



COVER PLATE DETAIL

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-6028, ~~E-7016~~, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division of 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc = 1000 psi.
- Live Load: HS 20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs./sq. ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.

TABLE 2. SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs., ft. 50	55	60	65	70	75	80	85	90
Two Curbs	5/16"	5/16"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"	—
Curb & Sidewalk	1/4"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	3/8"
Two Sidewalks	5/16"	5/16"	5/16"	5/16"	5/16"	3/8"	5/16"	5/16"	—

TABLE 1. SIZE OF WELD

Max. thickness of C.P. or Flange	Size of Weld
½"	3/16"
¾"	¼"
1½"	5/16"
2¼"	3/8"

ROADWAY SLAB With:	Bm. Spc.	No. Bms.		NONCOMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 20	25	30	35	40	45	50
Two Curbs	7'-6	5	Bm. size	21 WF 62 (24 WF 68)	24 WF 76 (27 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	33 WF 130	36 WF 150	36 WF 170
			R	56.1	63.4	70.0	76.4	81.8	87.4	93.4
Curb & Sidewalk	6'-10	6	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 118	36 WF 135	36 WF 160
			R	52.0	58.8	65.1	71.1	76.4	81.2	85.9
Two Sidewalks	7'-6	6	Bm. size	21 WF 62 (24 WF 68)	24 WF 76 (27 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	33 WF 130	36 WF 150	36 WF 182
			R	57.1	64.6	71.5	78.2	84.2	89.6	96.4

ROADWAY SLAB With:	COMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 50	55	60	65	70	75	80	85	90
Two Curbs	27WF84 C.P. 14½ x 7/8 x 41'-0	30WF99 C.P. 14½ x 7/8 x 43'-6	33WF118 C.P. 16 x 3/4 x 44'-9	33WF118 C.P. 16 x 1 x 51'-6	36WF135 C.P. 16 x 1 x 53'-6	36WF150 C.P. 18 x 1 x 57'-6	36WF182 C.P. 18 x 1 x 58'-6	36WF230 C.P. 20 x 7/8 x 56'-6	—
	92.5	97.0	101.7	106.1	110.7	115.1	120.8	126.3	—
Curb & Sidewalk	27WF84 C.P. 14½ x 7/8 x 39'-9	30WF99 C.P. 14½ x 7/8 x 42'-0	30WF99 C.P. 15 x 1 x 46'-6	33WF118 C.P. 16 x 7/8 x 49'-9	36WF135 C.P. 15½ x 7/8 x 51'-6	36WF150 C.P. 17 x 7/8 x 55'-0	36WF170 C.P. 17 x 1 x 58'-0	36WF194 C.P. 18 x 1 x 61'-0	36WF230 C.P. 18½ x 1 x 59'-6
	85.0	89.3	93.5	97.6	102.1	106.4	111.1	115.7	120.7
Two Sidewalks	27WF84 C.P. 15 x 7/8 x 41'-6	30WF99 C.P. 15½ x 7/8 x 44'-3	33WF118 C.P. 15 x 7/8 x 45'-6	33WF118 C.P. 17½ x 1 x 52'-6	36WF135 C.P. 17½ x 1 x 54'-9	36WF160 C.P. 18 x 1 x 56'-6	36WF182 C.P. 18 x 1 1/8 x 59'-9	36WF230 C.P. 21½ x 7/8 x 58'-6	—
	94.9	99.9	104.8	109.6	114.3	119.6	124.9	130.7	—

R = REACTION (kips)

NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks)

ROADWAY SLAB With:	REINFORC'NT BARS lbs. / lin. ft.	CLASS AA CONCRETE cu. yds. / lin. ft.
Two Curbs	235	1.30
Curb & Sidewalk	267	1.45
Two Sidewalks	286	1.73

Approved: FEB. 25 1965

P. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

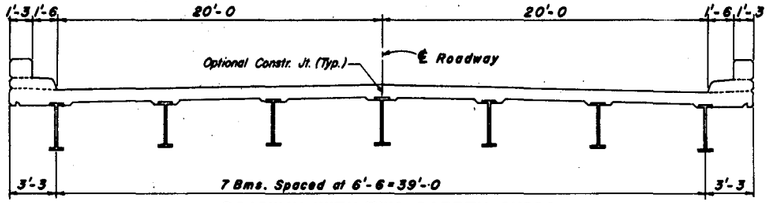
STANDARD STEEL I-BEAM BRIDGES 32' ROADWAY

Des.	K.R.P.
Trc.	F.F.F.
Chd.	G.T.V.

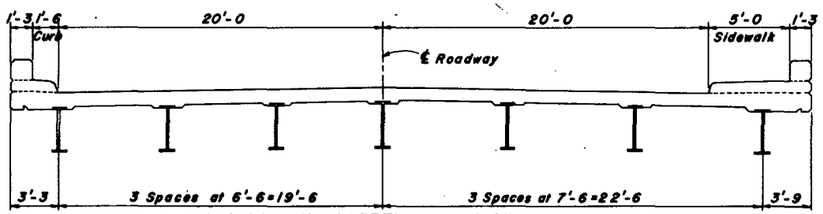
IBM Program 31.2.100

SHEET 3 OF 7

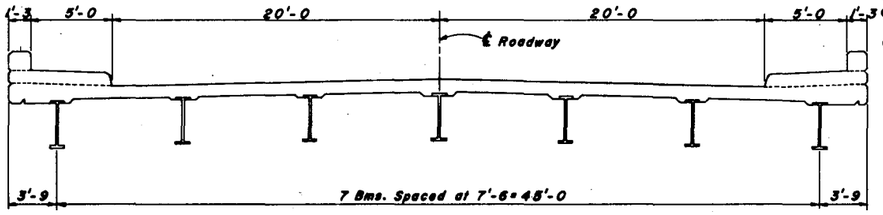
ST-102



ROADWAY WITH TWO SAFETY CURBS



ROADWAY WITH SAFETY CURB & SIDEWALK

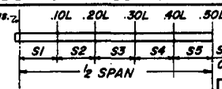


ROADWAY WITH TWO SIDEWALKS

ROADWAY SECTIONS SHOWING BEAM SPACING

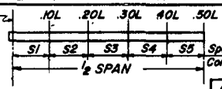
SPACING OF SHEAR CONNECTORS — $\frac{7}{8}\phi$ STUDS OR 4" C 7.25

BEAMS SPACED AT 6'-6



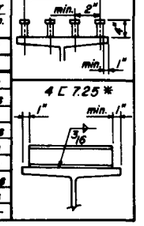
SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7½	9½	12	15¼	21	3/16	15/16
55	7	9½	12	15	20½	¼	1¼
60	7½	10	13	16	22	5/16	1 15/16
65	8½	11	14	17½	23½	5/16	1 15/16
70	8½	11	14	17½	23½	7/16	1 11/16
75	9	11½	15	18½	24	½	1 15/16
80	9	12	15	19	24	5/8	2
85	9½	12	15½	19½	24	11/16	2 3/16
90	10	12½	15½	20	24	¾	2 5/16

BEAMS SPACED AT 7'-6



SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6	8	10½	13	18	3/16	1 1/16
55	6½	8½	11	14	19	3/16	1 3/16
60	7	9	11½	15	20½	¼	1 ¼
65	7	9	11½	15	20½	5/16	1 5/16
70	7½	9½	12½	15½	21½	5/16	1 5/16
75	7½	10	12½	16	21½	7/16	1 7/16
80	7½	10	12½	16	22	5/8	2 1/16
85	8	10½	13	16½	22½	11/16	2 ¼
90	—	—	—	—	—	—	—

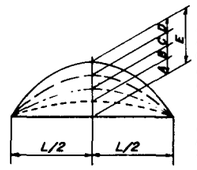
TYPE OF SHEAR CONNECTORS



* 10" long for 36WF, 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spc. shown in Tables.

NOTES

- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°.
- Equivalent number of ¾"ϕ studs may be used in lieu of ⅞"ϕ studs.
- Shear capacity of 1-⅞"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5% of that shown for ⅞"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



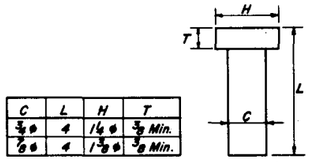
A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM

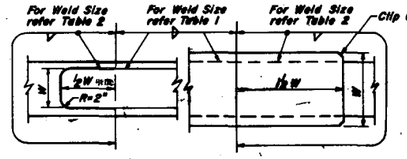
GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-6028, E-7016, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division of 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc = 1000 psi.
- Live Load: HS 20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs./sq. ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.



C	L	H	T
¾ϕ	4	1¼ϕ	⅜ Min.
⅞ϕ	4	1⅜ϕ	⅜ Min.

STUD SHEAR CONNECTOR DETAIL



COVER PLATE DETAIL

TABLE 2 SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs, ft. 50	55	60	65	70	75	80	85	90
Two Curbs	1/4"	5/16"	5/16"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"
Curb & Sidewalk	Use upper portion for Beams spaced @ 6'-6 and use lower portion for Bms. spaced @ 7'-6 @ Bm. @ Const. Jt.								
Two Sidewalks	5/16"	5/16"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"	—

NONCOMPOSITE BEAMS — COMPOSITE BEAMS

SPAN, CENTER TO CENTER OF BEARINGS, (ft.)

ROADWAY SLAB WITH:		Bm. Spc.	No. Bms.		20	25	30	35	40	45	50
	Two Curbs	6'-6	7	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 84)	30 WF 99 (30 WF 108)	33 WF 118	36 WF 135	36 WF 150
				R	48.3	55.1	60.6	66.3	71.2	75.6	79.7
	Curb & Sidewalk			Bm. size	Use Upper Table for Beams spaces at 6'-6. Use Lower Table for Beams spaced at 7'-6 and for Beam at Construction Joint.						
				R							
	Two Sidewalks	7'-6	7	Bm. size	21 WF 62 (24 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	36 WF 135	36 WF 150	36 WF 182
				R	56.6	64.1	70.9	77.5	83.4	88.7	95.4

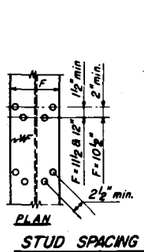
ROADWAY SLAB WITH:	50	55	60	65	70	75	80	85	90
Two Curbs	27WF84 C.R.12½ = ⅜ = 39'-0	27WF84 C.R.14½ = 7/16 = 44'-9	30WF99 C.R.14½ = ½ = 47'-0	33WF118 C.R.15½ = ⅝ = 47'-9	33WF118 C.R.15½ = 1 = 54'-3	36WF135 C.R.17 = ⅝ = 56'-3	36WF150 C.R.17 = 1 = 59'-6	36WF182 C.R.17 = 1 = 60'-0	36WF230 C.R.14½ = 1 = 55'-9
	79.0	82.8	86.5	90.4	94.0	98.1	102.1	106.8	111.4
Curb & Sidewalk	Use Upper Table for Beams spaces at 6'-6. Use Lower Table for Beams spaced at 7'-6 and for Beam at Construction Joint.								
Two Sidewalks	27WF84 C.R.15 = ⅜ = 41'-3	30WF99 C.R.15 = ⅜ = 44'-0	33WF118 C.R.16 = ½ = 45'-3	33WF118 C.R.17 = 1 = 52'-0	36WF135 C.R.17 = 1 = 54'-3	36WF150 C.R.17 = ⅝ = 57'-9	36WF182 C.R.17½ = ⅝ = 59'-0	36WF230 C.R.14½ = ⅝ = 56'-3	
	93.9	98.8	103.5	108.0	112.9	117.9	123.3	128.7	

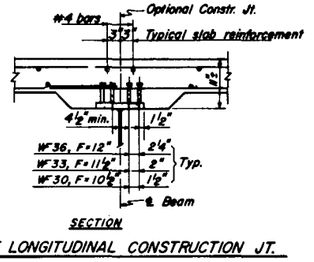
R = REACTION (kips)

NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks)

ROADWAY SLAB WITH:	REINFORC'NT BARS lbs. / lin. ft.	CLASS AA CONCRETE cu. yds. / lin. ft.
Two Curbs	275	1.43
Curb & Sidewalk	305	1.71
Two Sidewalks	325	1.94





STUD SPACING AT LONGITUDINAL CONSTRUCTION JT.

TABLE 1. SIZE OF WELD

Max. thickness of C.P. or Flange	Size of Weld
½"	3/16"
¾"	¼"
1¼"	5/16
2¼"	⅜"

Approved: FEB. 25 1965

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

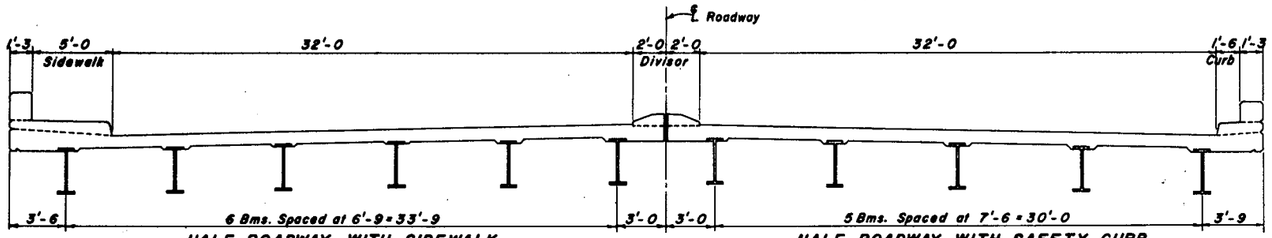
STANDARD STEEL I-BEAM BRIDGES 40' ROADWAY

Des.	K.R.P.
Trc.	F.F.F.
Chd.	G.T.V.

IBM Program 31.2.100

SHEET 4 OF 7

ST-102



HALF ROADWAY WITH SIDEWALK — HALF ROADWAY WITH SAFETY CURB

ROADWAY SECTION SHOWING BEAM SPACING

SPACING OF SHEAR CONNECTORS — 7/8" ϕ STUDS OR 4" C 7.25

BEAMS SPACED AT 6'-9

℄ Brgs.	.10L	.20L	.30L	.40L	.50L
S1	S2	S3	S4	S5	Spc. of Shear Connectors, in.

½ SPAN

SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7	9	11½	15	20	3/16	1 1/16
55	7½	10	12½	15½	21½	3/16	1 1/16
60	7½	9½	12½	15½	21	5/16	1 1/16
65	8	10½	13½	16½	22½	5/16	1 1/16
70	8½	11	14	18	24	5/16	1 1/16
75	8½	11	14	18	24	1/4	1 15/16
80	8	11½	14½	18½	24	5/16	2 1/16
85	9	12	15	19	24	5/16	2 1/16
90	9½	11½	14½	19	24	7/16	2 1/16

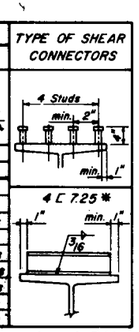
BEAMS SPACED AT 7'-6

℄ Brgs.	.10L	.20L	.30L	.40L	.50L
S1	S2	S3	S4	S5	Spc. of Shear Connectors, in.

½ SPAN

SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	6½	8½	11	13½	18	3/16	1 1/16
55	7	9	11½	14½	19½	3/16	1 1/16
60	7	9	11½	14	19	5/16	1 1/16
65	7½	9½	12	15½	20½	5/16	1 1/16
70	8	10½	13	16	21½	5/16	1 1/16
75	8	10½	13	16½	22	7/16	1 15/16
80	8	10½	13½	16½	22	5/16	2 1/16
85	9	10½	13½	17	23	1/16	2 1/16
90	8½	11	14	17	23	7/16	2 1/16

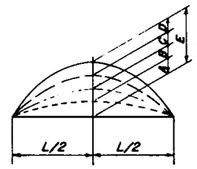
TYPE OF SHEAR CONNECTORS



* 10" long for 36WF, 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spc. shown in Tables.

NOTES

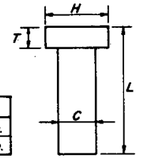
- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent @ 30°
- Equivalent number of ¾"ϕ studs may be used in lieu of 7/8"ϕ studs.
- Shear capacity of 1-7/8"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5 % of that shown for 7/8"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

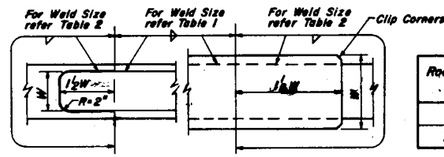
When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM



C	L	H	T
7/8 ϕ	4	1¼ ϕ	3/8 Min.
7/8 ϕ	4	1 5/8 ϕ	5/8 Min.

STUD SHEAR CONNECTOR DETAIL



COVER PLATE DETAIL

TABLE 2 SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs., ft. 50	55	60	65	70	75	80	85	90
Curb	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"
Sidewalk	1/4"	1/4"	5/16"	1/4"	5/16"	5/16"	5/16"	1/2"	5/16"

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6015, E-6018, E-6028, E-7016, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division or 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc = 1000 psi.
- Live Load: HS20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs./sq. ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.

HALF ROADWAY SLAB with:		Bm. Spc.	No. Bms.		NONCOMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 20	25	30	35	40	45	50
	Curb	7'-6	5	Bm. size	21 WF 62 (21 WF 68)	24 WF 76 (24 WF 84)	27 WF 94 (30 WF 99)	30 WF 116 (30 WF 116)	33 WF 130	36 WF 150	36 WF 170
				R	55.1	62.2	68.6	74.8	80.3	85.3	91.1
	Sidewalk	6'-9	6	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 118	36 WF 135	36 WF 160
				R	50.6	57.2	63.1	68.8	74.0	78.6	83.1

COMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 50	55	60	65	70	75	80	85	90
27WF94 C.R.13½ x 5/16 x 40'-3	30WF99 C.R.14 x 5/16 x 42'-9	30WF99 C.R.16 x 1 x 49'-6	33WF118 C.R.16½ x 7/16 x 51'-0	36WF135 C.R.17 x 5/16 x 53'-0	36WF150 C.R.17 x 1 x 56'-3	36WF170 C.R.18 x 1 x 59'-6	36WF230 C.R.20½ x ¾ x 55'-0	36WF230 C.R.20½ x 1 x 62'-9
90.0	94.4	98.8	102.9	107.4	111.8	116.5	122.0	126.5
27WF84 C.R.13½ x 5/16 x 38'-0	30WF99 C.R.13½ x 5/16 x 41'-0	30WF99 C.R.15½ x 5/16 x 48'-0	33WF118 C.R.16 x ½ x 48'-9	36WF135 C.R.16½ x 5/16 x 50'-6	36WF135 C.R.16½ x 1 x 57'-3	36WF160 C.R.17 x 1 x 58'-9	36WF194 C.R.10 x 1½ x 57'-6	36WF230 C.R.21 x ¾ x 59'-3
82.2	86.3	90.1	94.1	97.9	101.9	106.5	110.8	115.9

R = REACTION (kips)
NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

TABLE 1. SIZE OF WELD

Max. thickness of C.R. or Flange	Size of Weld
4"	3/16"
3/4"	1/4"
1½"	5/16"
2¼"	3/8"

Approved: FEB. 25 1965
K.H. Jensen
Bridge Engineer

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks) HALF ROADWAY SLAB With:	REINFORC'NT BARS lbs. / lin. ft.	CLASS AA CONCRETE cu. yds. / lin. ft.
Safety Curb	235	1.18
Sidewalk	250	1.32

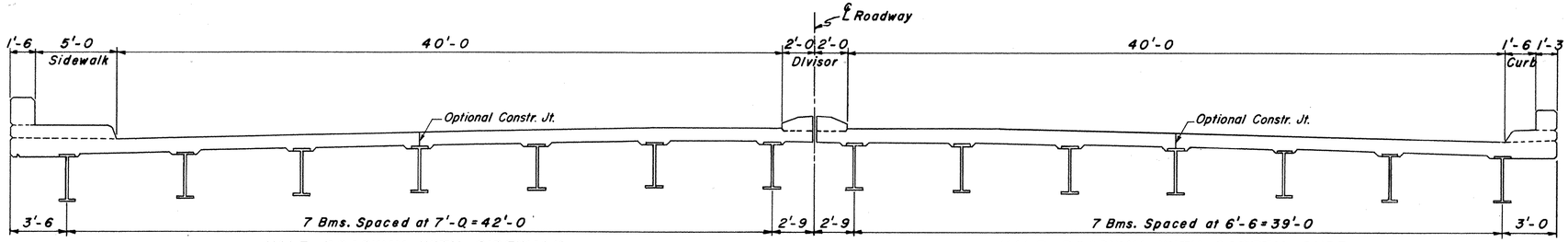
Des.	K.R.P
Trc.	E.F.F.
Ckd.	G.T.V. IBM Program 31.2.100

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD STEEL I-BEAM BRIDGES 68' ROADWAY

SHEET 5 OF 7

ST-102

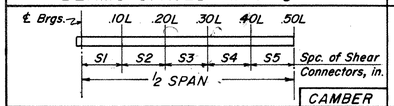


HALF ROADWAY WITH SIDEWALK — HALF ROADWAY WITH SAFETY CURB

ROADWAY SECTION SHOWING BEAM SPACINGS

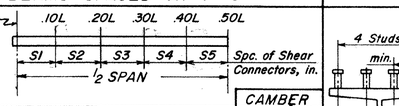
SPACING OF SHEAR CONNECTORS — $\frac{7}{8}$"ϕ STUDS OR 4"℄ 7.25

BEAMS SPACED AT 6'-6



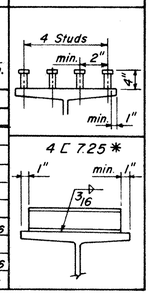
SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7½	10	12½	15½	20½	3/16	15/16
55	7½	9½	12½	15½	20½	1/4	1 1/16
60	8	10½	13	16½	22	5/16	15/16
65	9	11½	14½	18	23½	5/16	1 5/16
70	8½	11½	14½	17½	23½	7/16	1 11/16
75	9½	12	15	19	24	1/2	1 3/4
80	9½	12½	15½	19	24	5/8	2
85	10	12½	16	19½	24	3/4	2 3/16
90	10½	13	16	20½	24	7/8	2 1/4

BEAMS SPACED AT 7'-0



SPAN	S1	S2	S3	S4	S5	CAMBER A	CAMBER B
50	7	9	11½	14½	19½	3/16	1
55	7½	9½	12	15	20½	1/4	1 1/16
60	7	9½	12	15	20½	5/16	1 3/8
65	8	10½	13	16½	22	5/16	1 3/8
70	8½	11	14	17	23	3/8	1½
75	8½	11	14	17½	23	1/2	1 13/16
80	8½	11	14	17½	23½	9/16	2
85	9	11½	14½	18	24	11/16	2 3/16
90	9½	12	15	18½	24	7/8	2 3/8

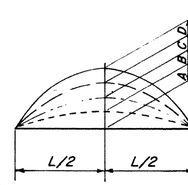
TYPE OF SHEAR CONNECTORS



* 10" long for 36WF, 9½" long for 33WF with 97% of spc. shown in Tables, 8½" long for 30WF with 87% of spc. shown in Tables.

NOTES

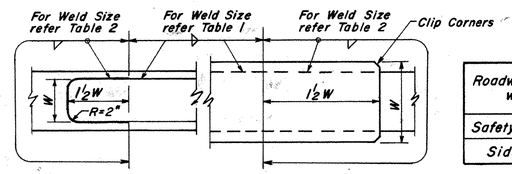
- Studs used as shear connectors shall be automatically end welded to beam by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°.
- Equivalent number of ¾"ϕ studs may be used in lieu of ⅞"ϕ studs.
- Shear capacity of 1-⅞"ϕ Stud = 3450 lbs.
- Shear capacity of 1-¾"ϕ Stud = 2540 lbs.
- Spacing for ¾"ϕ Studs shall be reduced to 73.5% of that shown for ⅞"ϕ Studs.
- Flanges of Channel Shear Connectors shall point toward bearings.



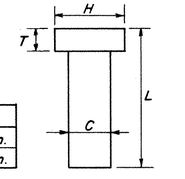
A = Camber due to Steel Weight
B = Camber due to Concrete Weight
C = Camber due to Vertical Curve
D = Camber due to Superelevation
E = Total Camber (Algebraically)

When total camber is less than minimum that can be maintained in a beam, no camber is required, but beam shall be placed with any mill camber up.

CAMBER DIAGRAM



COVER PLATE DETAIL



C	L	H	T
¾ϕ	4	1¼ϕ	⅜ Min.
⅞ϕ	4	1⅜ϕ	⅜ Min.

STUD SHEAR CONNECTOR DETAIL

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49, and 1963 AWS "Standard Specifications for Welded Highway and Railway Bridges."
- For welds, shielded metal arc process with electrodes conforming to ASTM designation E-6016, E-6018, E-6028, E-7016, E-7018 or E-7028 OR submerged arc process shall be used.
- Design Specifications: Design Division of 1961-AASHO "Standard Specifications for Highway Bridges," except for deck slab which is designed for fc = 1000 psi.
- Live Load: HS20-44 OR Alternate Interstate Loading, when applicable.
- Dead Load includes 30 lbs/sq ft. for future wearing surface on the deck slab.
- All concrete shall be Class AA.
- Structural Steel shall conform to ASTM A36 Designation, except studs shall conform to ASTM A108.
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dam, refer to Std. Dwg. ST-112.
- For Bridge Drainage, refer to Std. Dwg. ST-114.
- For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141.
- For Deck Slab Details, refer to Sheet 7.

TABLE 2. SIZE OF END WELD

Roadway Slab with	Span, center to center of Brgs, ft. 50	55	60	65	70	75	80	85	90
Safety Curb	1/4"	5/16"	5/16"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"
Sidewalk	1/4"	1/4"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"	5/16"

		Bm. Spc.	No. Bms.		NONCOMPOSITE BEAMS SPAN, CENTER TO CENTER OF BEARINGS, (ft.) 20	25	30	35	40	45	50	COMPOSITE BEAMS 50	55	60	65	70	75	80	85	90
HALF ROADWAY SLAB with:	Curb	6-6	7	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 84)	30 WF 99 (30 WF 108)	33 WF 118	36 WF 135	36 WF 150	27WF84 C.PL 13½ x ⅜ x 37'-9	27WF84 C.PL 14 x ⅞ x 44'-3	30WF99 C.PL 14 x ⅞ x 46'-3	33WF118 C.PL 14½ x ¾ x 46'-9	33WF118 C.PL 16½ x ⅞ x 54'-0	36WF135 C.PL 16 x ⅞ x 55'-3	36WF150 C.PL 17 x ⅞ x 58'-6	36WF170 C.PL 17 x 1 x 61'-3	36WF230 C.PL 14½ x ⅞ x 54'-0
				R	47.6	54.2	59.6	65.1	69.8	74.1	78.1	77.3	80.9	84.5	88.1	91.7	95.4	99.3	103.4	108.3
	Sidewalk	7-0	7	Bm. size	21 WF 55 (21 WF 62)	24 WF 68 (24 WF 76)	27 WF 84 (27 WF 94)	30 WF 108 (30 WF 108)	33 WF 130	36 WF 135	36 WF 160	27WF84 C.PL 14 x ¾ x 39'-6	30WF99 C.PL 14 x ¾ x 41'-6	30WF99 C.PL 14½ x 1 x 48'-3	33WF118 C.PL 15 x ⅞ x 49'-0	36WF135 C.PL 16½ x ⅞ x 51'-0	36WF135 C.PL 17 x 1 x 58'-0	36WF160 C.PL 17½ x 1 x 59'-6	36WF194 C.PL 18 x 1 x 60'-3	36WF230 C.PL 20 x ⅞ x 60'-0
				R	52.1	58.9	64.9	70.8	76.2	80.6	85.2	84.3	88.4	92.4	96.3	100.4	104.4	108.7	113.6	118.4

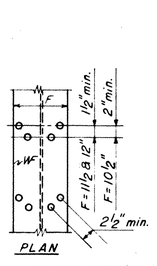
R = REACTION (kips)
NOTE: Beam sizes shown in ( ) are for Alternate Interstate Loading for bridges carrying Interstate Highway traffic only. (For Spans under 38'-0 in length.)

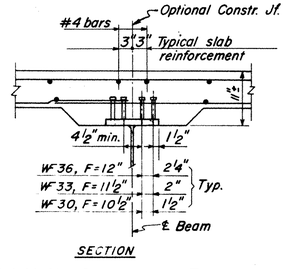
TABLE 1. SIZE OF WELD

Max. thickness of C.P. or Flange	Size of Weld
½"	3/16"
¾"	1/4"
1½"	5/16"
2¼"	3/8"

SUMMARY of DECK QUANTITIES (includes Parapets, Curbs and/or Sidewalks)

HALF ROADWAY SLAB With:	REINFORC'NT BARS lbs. / lin. ft.	CLASS AA CONCRETE cu. yds. / lin. ft.
Safety Curb	265	1.30
Sidewalk	305	1.51





STUD SPACING AT LONGITUDINAL CONSTRUCTION JT.

Approved: FEB. 25 1965
F. H. Jensen
Bridge Engineer

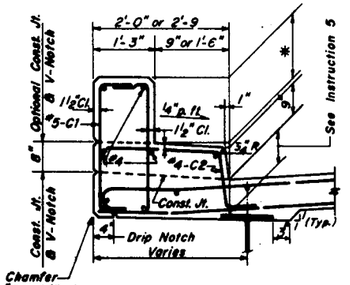
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD STEEL I-BEAM BRIDGES 84' ROADWAY

Des.	K.R.P.
Trc.	F.F.F.
Ckd.	G.T.V.

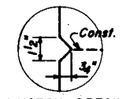
IBM Program 31.2.100

ST-102

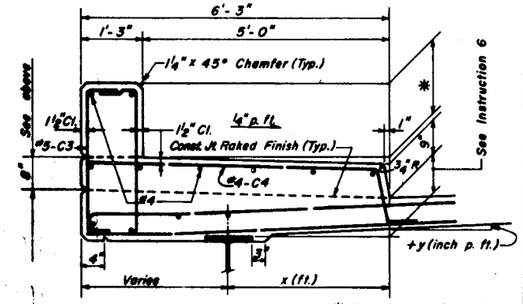


SAFETY CURB DETAIL

DRIP NOTCH DETAIL

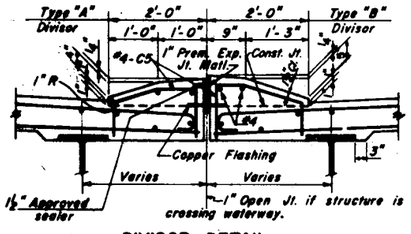


V-NOTCH DETAIL



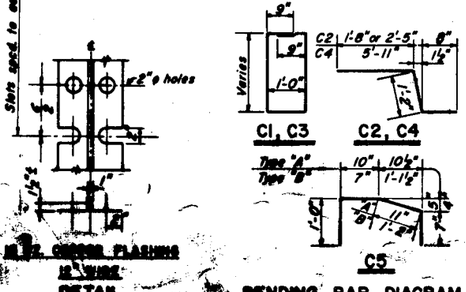
SIDEWALK DETAIL

* For parapet height refer to Std. Dwg. ST-140.



DIVISOR DETAIL

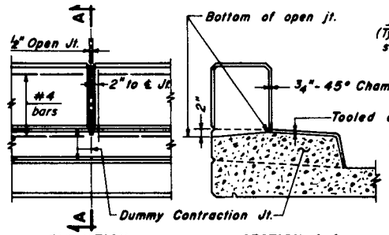
Note: Surface of Divisor shall be treated as shown on Std. Dwg. SD-13.



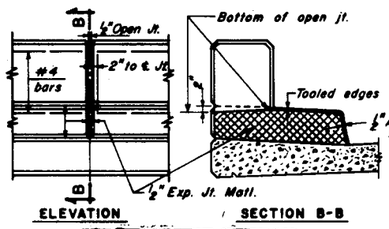
BEND DETAIL

BENDING BAR DIAGRAM

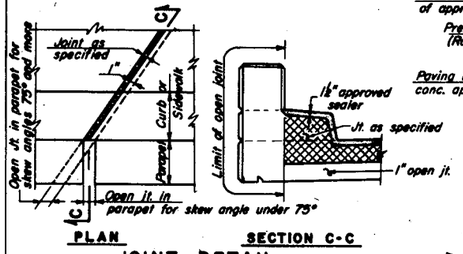
Note: For Bridge Railing, refer to Std. Dwgs. ST-140 & ST-141. For hanging top bars C2, C4 and C5 in curb, sidewalk and parapet shall be 2 or 3 times the spacing of S1 or S2 bars, but not more than 18", and spacing for bars C1 and C3 in parapet, not more than 15".



OPEN JOINT DETAIL FOR SIMPLE SPAN BRIDGES



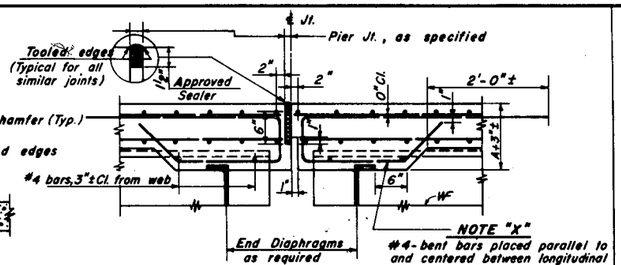
OPEN JOINT DETAIL FOR CONTINUOUS BRIDGES



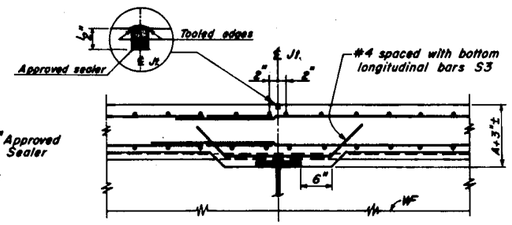
JOINT DETAIL

n	t	Bars S1 & S2 (Instrs. 2 & 7)	Bars S3	
			"m"	Spcs.
5'-5"	7½"	#5 @ 6½" = 0.57"	5	9"
5'-7"	7½"	#5 @ 6" = 0.62"	5	9"
5'-10"	8"	#5 @ 7" = 0.53"	5	10"
6'-4"	8"	#5 @ 6½" = 0.57"	6	9"
6'-7"	8"	#5 @ 6" = 0.62"	7	9"
6'-10"	8"	#5 @ 5½" = 0.68"	8	8"
7'-0"	8½"	#5 @ 6½" = 0.57"	7	9"
7'-7"	8½"	#5 @ 6" = 0.62"	8	9"

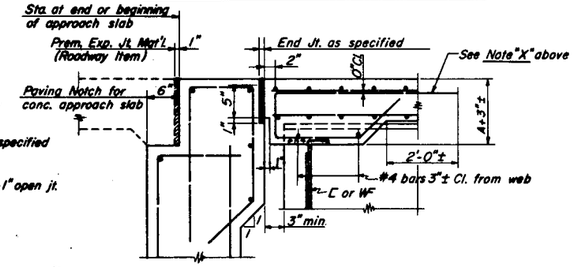
SLAB REINFORCEMENT



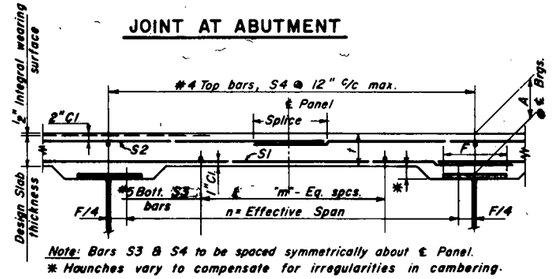
JOINT AT PIER



TRANSVERSE CONSTR. JT. DETAIL



JOINT AT ABUTMENT



Note: Bars S3 & S4 to be spaced symmetrically about ℄ Panel.

* Haunches vary to compensate for irregularities in cambering.

TYPICAL SLAB PANEL

INSTRUCTIONS I.

1. All concrete in entire superstructure shall be Class AA.
2. Place transverse reinforcement in deck slab parallel to ℄ Brgs. for skew angles 75° and more. The spacing of bars shall be measured along ℄ of bridge. For skew angles less than 75° the bars shall be placed normal to ℄ of bridge and length cut to fit.
3. A one-half inch open joint in parapet shall be provided at two to three times the spacing of the bridge railing posts. ℄ of posts shall be located min 1'-0" from ℄ jt.
4. Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for fs= 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia., and minimum cover shall be ½" except as noted.
5. Minimum distance Top of Slab to Top of Flange at ℄ Brgs. = Depth of Slab plus ½" for camber up to 2", OR Depth of Slab plus ¾" for camber over 2".
6. Min. distance Top of Slab at Gutter to Top of Flange at ℄ Brgs. = Depth of Slab ± (x·y) (allowance for slab transverse slope) plus allowance for camber as in Instruction 5.
7. To determine the required area of bars S1 & S2:
   (a.) For values of Skew Angles (β, less than 75°, use area of bars shown in table.
   (b.) For values of Skew Angles (β, 75° and greater, increase area of bars by Cosec (β.
   n= Max. Normal Effective Span permitted for given reinf'nt. bars S1 & S2.
8. On Skew Angles under 75°, a minimum of 3-#5 transverse bars @ 6"±, shall be placed parallel to abutment or pier joint, in the top and bottom of the deck slab.

JOINT ARRANGEMENTS

JOINT DETAILS AT ABUTMENTS

SIMPLE SPANS

SPAN LENGTH	JOINT	
	Fixed End	Exp. End
Max. 55'	1"-P	1"-N
Over 55' to 70'	1"-P	1½"-N
Over 70' to 90'	1"-P	~~1½"-N~~
Over 90' to 125'	1"-N	Pl. Dam
Over 125'	Pl. Dam	Pl. Dam

CONTINUOUS SPANS

FIXED END		EXP. END	
End Span	Joint	Total Exp. Length	Joint
Max. 55'	1"-P	Max. 55'	1"-N
Over 55' to 90'	1"-P	Over 55' to 90'	1½"-N
Over 90' to 125'	1"-N	Over 90' to 250'	Pl. Dam
Over 125'	Pl. Dam	Over 250'	T-Dam

JOINT DETAILS AT PIER

℄ Pier

Total Exp. Length ← Left	Diaphragm at Pier	Brgs. △	Joint at Pier	△ Brgs.	Diaphragm at Pier	Total Exp. Length Right →
Max. 55'	Steel	Exp.	1"-N	Fix.	Steel	Max. 90'
Over 55' to 90'	"	Exp.	1½"-N	Fix.	"	Max. 90'
Max. 90'	"	Fix.	1"-P	Fix.	"	Max. 90'
Over 90'	"	Fix.	Pl. Dam	Fix.	"	any
Max. 125'	"	Exp.	Pl. Dam*	Exp.	"	~~Max. 125'~~
Max. 90'	"	Exp.	Pl. Dam	Fix.	"	Over 90'
Over 90' to 250'	"	Exp.	Pl. Dam	Fix.	"	any
any	"	Exp.	T-Dam	Exp.	"	Over 125'
Over 250'	Steel	Exp.	T-Dam	Fix.	Steel	any

* (a) 1"-N Joint shall be used for a total exp. length (left + right) of over 55' to 90'.
(b) 1½"-N Joint shall be used for a total exp. length (left + right) of over 55' to max. 90'.

LEGEND

P= Premolded Expansion Jt. Mat'l.
N= Closed Cell Neoprene Sponge
Pl. Dam = Sliding Plate Exp. Dam
T-Dam = Tooth Expansion Dam

INSTRUCTIONS II

- Joint arrangements shown above may be applied to Plate Girder Stringers of web depth max. 54".
- For Diaphragms, refer to Std. Dwg. ST-110.
- For Bearings, refer to Std. Dwg. ST-111.
- For Expansion Dams, refer to Std. Dwgs. ST-112 and ST-113.

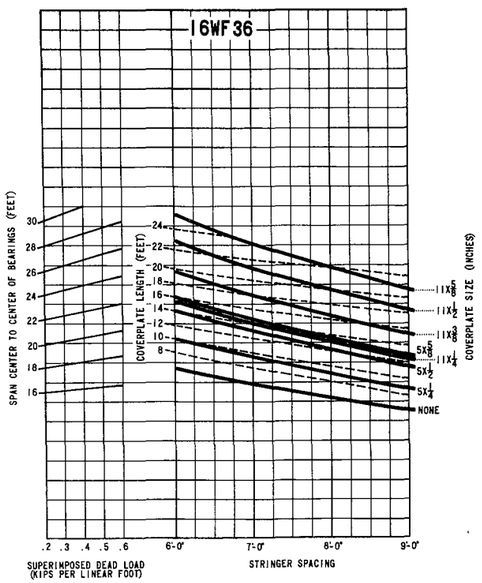
Approved: FEB. 25, 1965
K.R. Jensen
Bridge Engineer

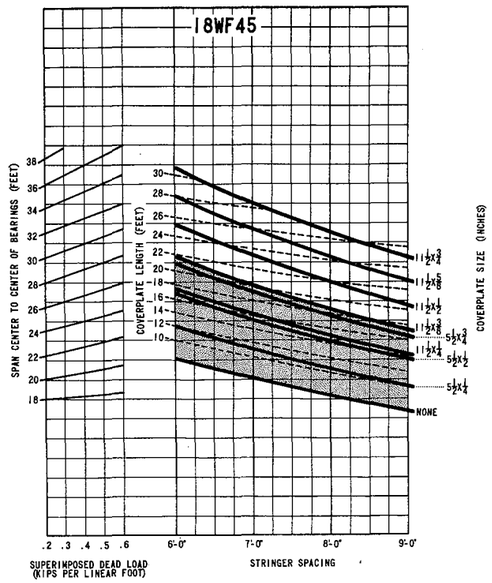
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

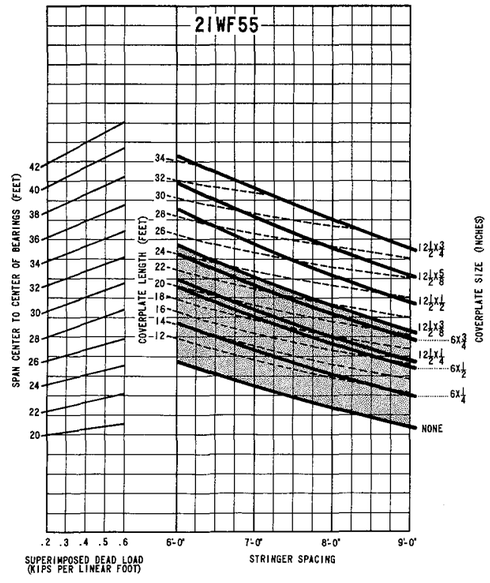
STANDARD
STEEL I-BEAM BRIDGES
SUPERSTRUCTURE DETAILS

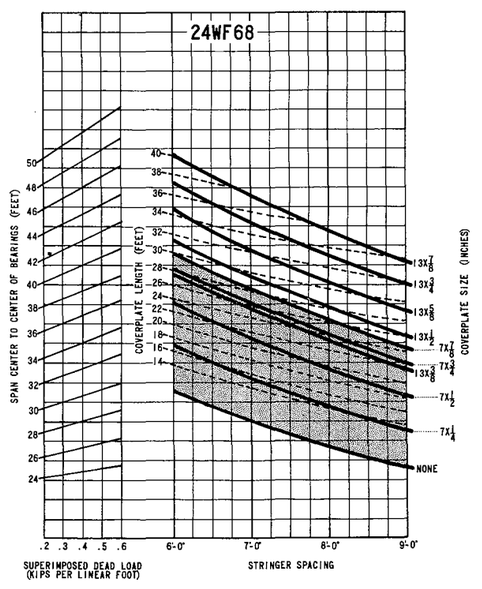
SHEET 7 OF 7

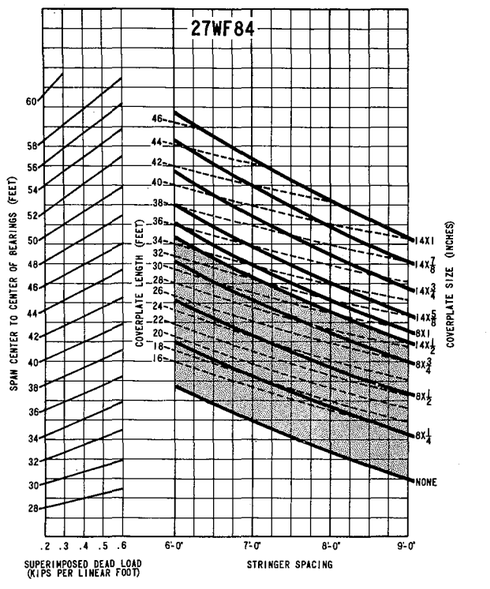
ST-102

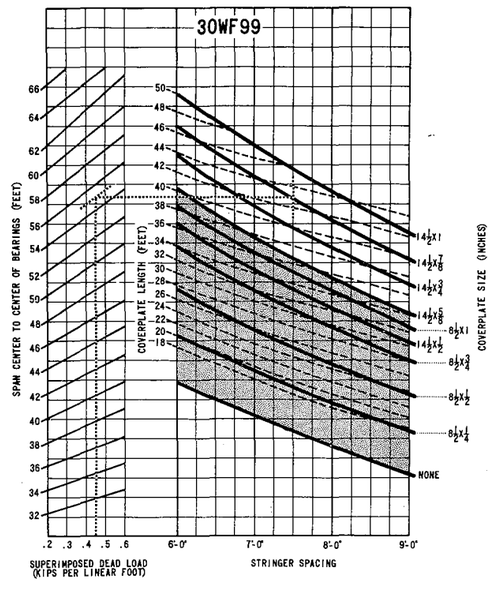












NOTE: SHADED AREAS INDICATE THAT LIGHTER BEAM AND COVERPLATE COMBINATIONS ARE AVAILABLE ELSEWHERE IN THE CHARTS.

INSTRUCTIONS

- For general notes and details, refer to Sfd. Dwg. ST-102.
- Standard drawings ST-103 may be used for design of stringers when roadway width, span length or stringer spacings are different from those shown on Std. Dwg. ST-102.
- For selection of the most apparant economical beam, refer to sheet 4.
- Superimposed dead load includes:
  Future wearing surface, (Not applicable if deck slab is designed with bituminous wearing surface or to structures under fill.)
  Weight of railings, parapets, curbs or sidewalks and any other dead load applied after deck slab has been cured, distributed equally to all stringers, in Kips per lin. ft.
- Cover plate less than $\frac{3}{8}$" thick shall not be used.
- Distance between the lines of fillet welds connecting cover plates to stringer flanges, in a direction transverse to the longitudinal axis of the stringer, shall not exceed 24 times the thickness of cover plate.

Approved: FEB. 25, 1965
H. J. Jensen
Bridge Engineer

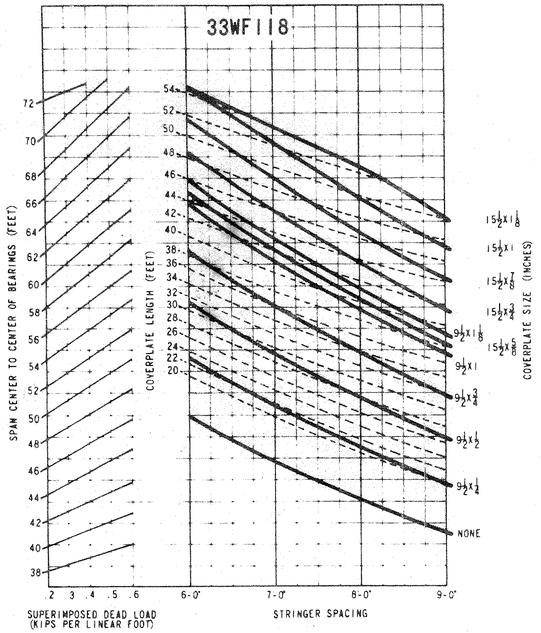
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

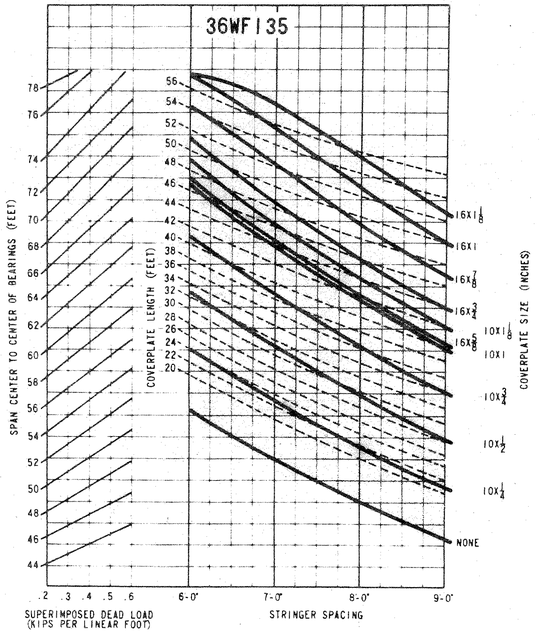
STANDARD
COMPOSITE A36 STEEL I-BEAM BRIDGES

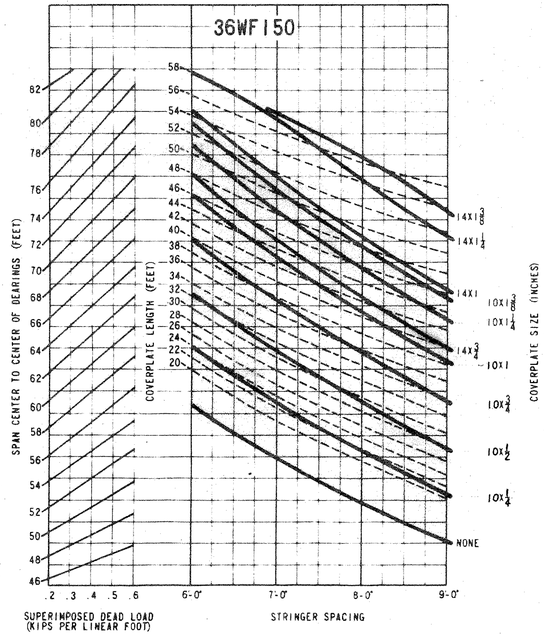
DESIGN GRAPHS

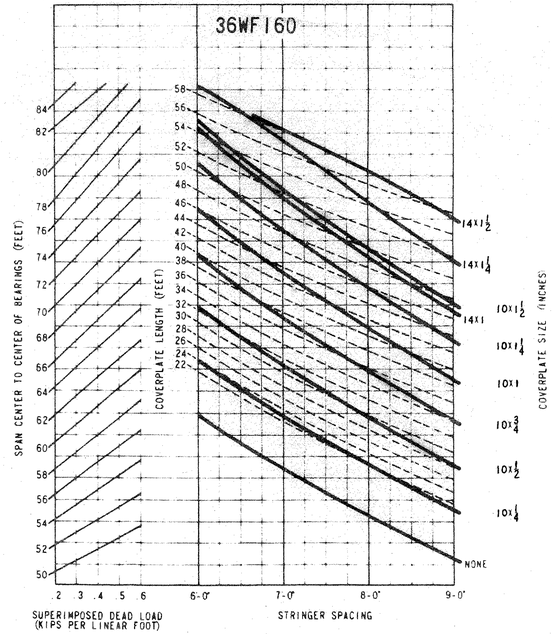
ST-103

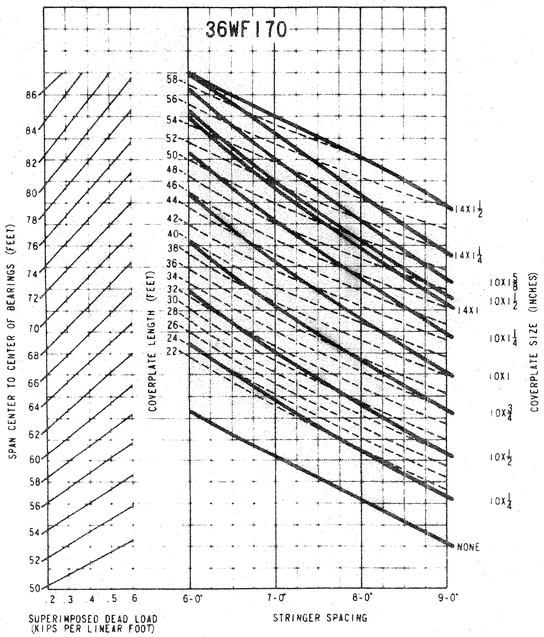
PREPARED BY BETHLEHEM STEEL CORPORATION IN COOPERATION WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION FOR THE PENNSYLVANIA DEPARTMENT OF HIGHWAYS.

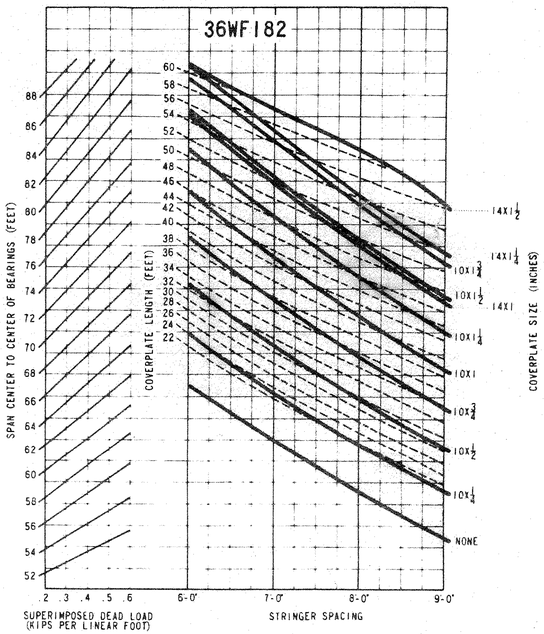


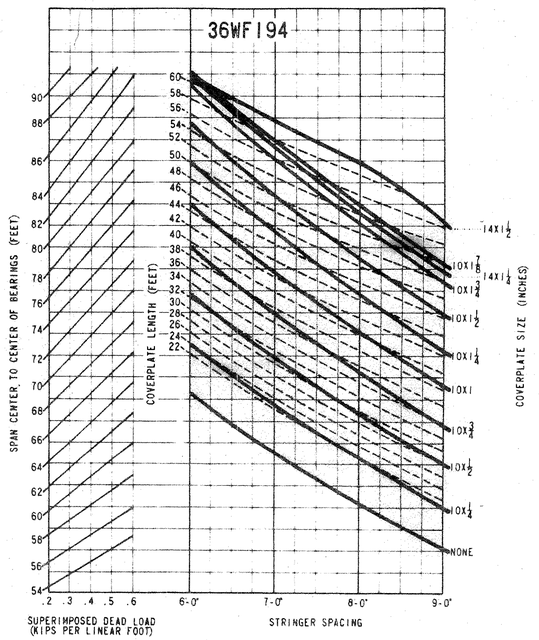












NOTE: SHADED AREAS INDICATE THAT LIGHTER BEAM AND COVERPLATE COMBINATIONS ARE AVAILABLE ELSEWHERE IN THE CHARTS.

Approved: FEB. 25, 1965

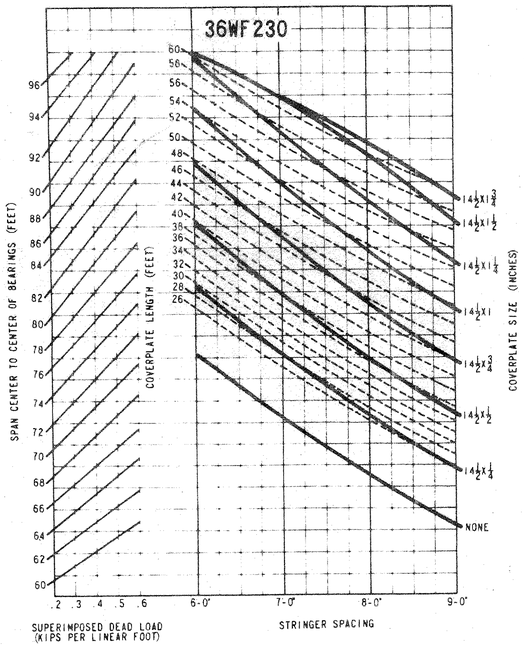
K. H. Jensen
Bridge Engineer

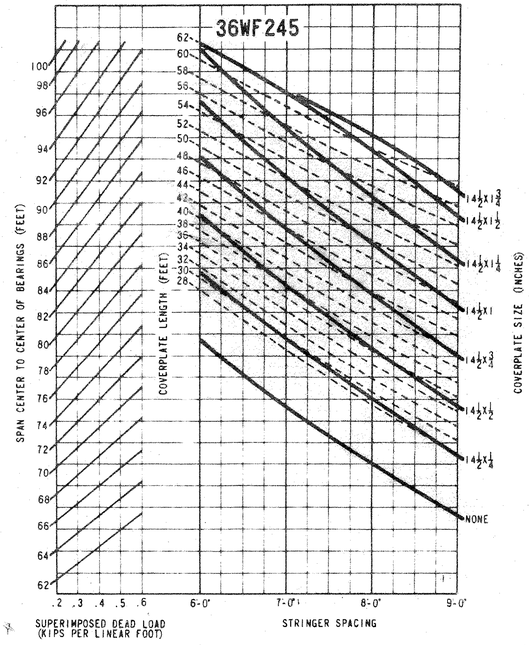
Commonwealth of Pennsylvania

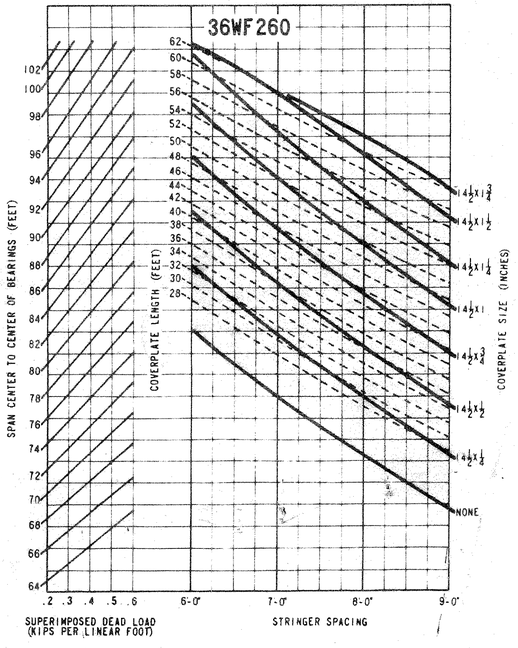
Department of Highways
BRIDGE DIVISION

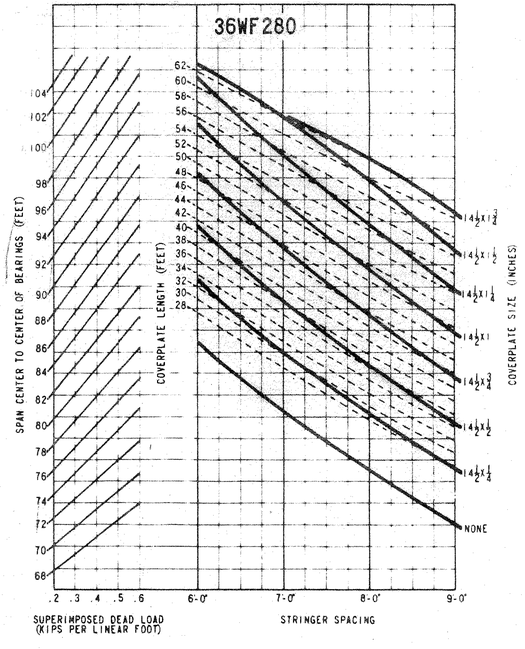
STANDARD
COMPOSITE A36 STEEL I-BEAM BRIDGES

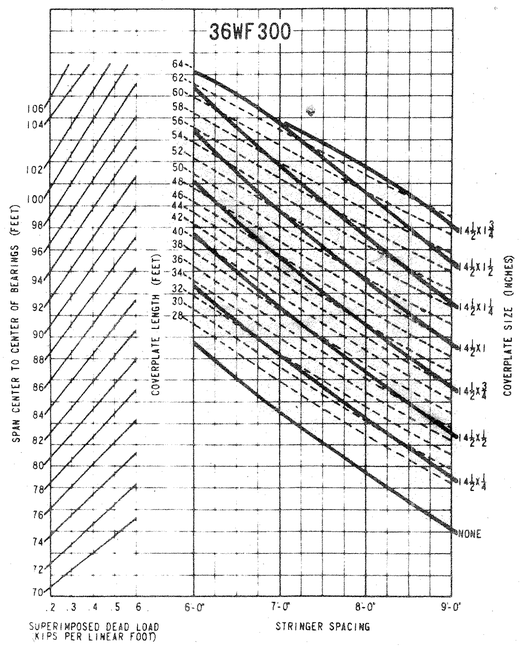
DESIGN GRAPHS











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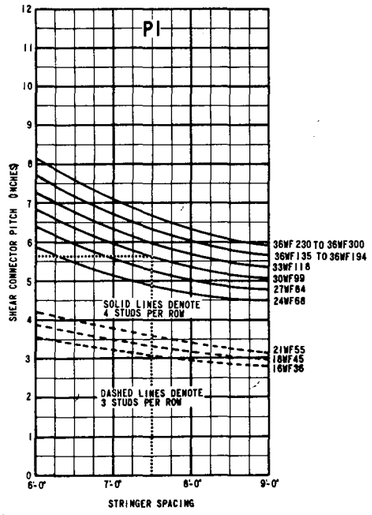
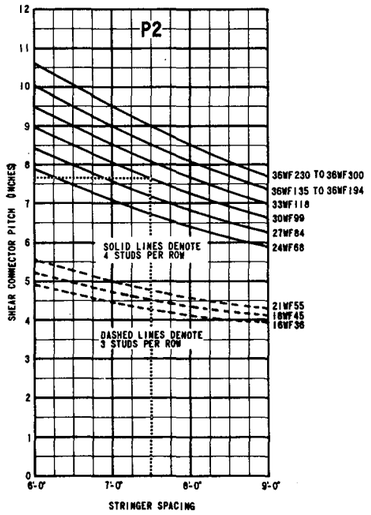
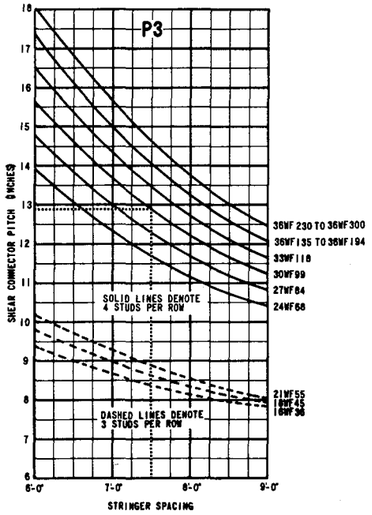
COMPOSITE A36 STEEL I-BEAM BRIDGES

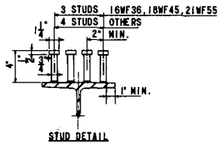
DESIGN GRAPHS

SHEAR CONNECTOR PITCHES

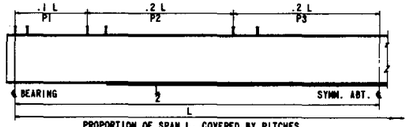




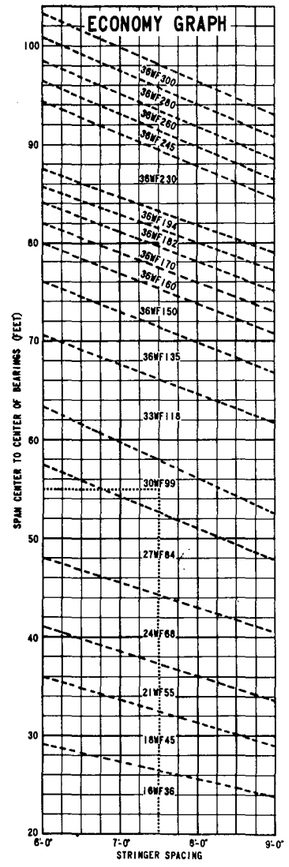




STUD DETAIL



PROPORTION OF SPAN L COVERED BY PITCHES DENOTED IN GRAPHS P1, P2 AND P3



SAMPLE DESIGN PROBLEM

1. THE FOLLOWING INFORMATION IS KNOWN:
   A. SPAN CENTER TO CENTER OF BEARINGS=55 FEET.
   B. STRINGER SPACING=7'-6".
   C. SUPERIMPOSED DEAD LOAD=0.45 KIPS PER LINEAR FOOT OF BEAM.
2. REFERRING TO THE ECONOMY GRAPH, IT IS FOUND THAT THE 30WF99 GRAPH WILL PROBABLY YIELD THE MOST ECONOMICAL DESIGN.
3. ENTER THE 30WF99 GRAPH AT 0.45 KIPS PER LINEAR FOOT OF BEAM AND MOVE VERTICALLY TO THE 55-FOOT SPAN. MOVING FROM THIS POINT HORIZONTALLY TO THE 7'-6" STRINGER SPACING, IT IS SEEN THAT THE COVERPLATE IS $14\frac{1}{2}" \times \frac{7}{8}" \times 43'-0"$ LONG. NOTE THAT IF THE SPAN HAD BEEN 48 FEET THE DESIGN WOULD HAVE BEEN IN THE SHADED UNECONOMICAL PORTION OF THE GRAPH, INDICATING THAT A LIGHTER BEAM AND COVERPLATE COULD HAVE BEEN USED.
4. SHEAR CONNECTOR PITCHES ARE FOUND ON GRAPHS P1, P2 AND P3. THE ACCOMPANYING DRAWING SHOWS THE PORTION OF THE BEAM TO WHICH EACH PITCH APPLIES. REQUIRED STUD SIZE AND NUMBER OF STUDS PER ROW ARE SHOWN IN THE STUD DETAIL SKETCH. THE FOLLOWING PITCHES ARE FOUND FOR A 30WF99 AT A 7'-6" STRINGER SPACING:

   "P1" 5.7" USE $5\frac{1}{2}"$ $\frac{0.1 \times 55' \times 12}{5.5} = 12$ SPACES AT $5\frac{1}{2}" = 66"$

   "P2" 7.7" USE $7\frac{1}{2}"$ $\frac{0.2 \times 55' \times 12}{7.5} = 19$ SPACES AT $7\frac{1}{2}" = 143"$

   "P3" 12.8" USE $12\frac{1}{2}"$ $\frac{0.2 \times 55' \times 12}{12.5} = 10$ SPACES AT $12\frac{1}{2}" = 125"$

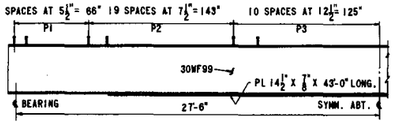
   $\frac{12 \times 55'}{2} = 330"$ SAY OK. TOTAL 334"
5. MOMENT OF INERTIA OF THE BEAM AND COVERPLATE SECTION (I_1) IS FOUND BY ENTERING THE 30WF99 MOMENT OF INERTIA GRAPH WITH A COVERPLATE AREA OF $14.5 \times .875 = 12.7$ SQUARE INCHES. MOVE UP TO $\frac{A}{N} = 0$ LINE (ZERO SLAB AREA). $I_1 = 6000$ IN.^{4}
6. MOMENT OF INERTIA OF THE COMPOSITE SECTION (I_2) IS FOUND BY MOVING UP TO $\frac{A}{N} = 24$ WHERE:
   A = AREA OF STRUCTURAL PORTION OF SLAB
   $= 8" \times 7.5' \times 12" = 720$ IN.^{2}
   N = 30 FOR SUPERIMPOSED DEAD LOADS
   $\frac{A}{N} = \frac{720}{30} = 24$
   $I_2 = 14300$ IN.^{4}
7. DEAD LOAD DEFLECTIONS ARE CALCULATED USING THESE MOMENTS OF INERTIA AND COMPUTED DEAD LOADS PER FOOT OF BEAM IN THE EQUATION

$$\Delta = .000775 L^4 \left(\frac{W_1}{I_1} + \frac{W_2}{I_2} \right)$$

   WHERE:
   Δ = TOTAL DEAD LOAD DEFLECTION AT ℄ OF BEAM (INCHES)
   W_1 = COMPUTED WEIGHT OF SLAB AND STEEL (KIPS PER LINEAR FOOT OF BEAM)
   $= \frac{8.5" \times 7.5'}{12} \times .150$ KIPS/FT.^{3} (SLAB) + .025 KIPS/FT. (HAUNCH) + .099 KIPS/FT. (BEAM) + .043 KIPS/FT. (COVERPLATE)
   = .962 KIPS/FT.
   W_2 = SUPERIMPOSED DEAD LOAD (KIPS PER LINEAR FOOT OF BEAM)
   = .450 KIPS/FT.
   I_1 AND I_2 = MOMENTS OF INERTIA AS FOUND IN STEPS 5 AND 6.

$$\Delta = .000775 \times 55^4 \left(\frac{.962}{6000} + \frac{.450}{14300} \right) = 1.35"$$

   SAY: $1\frac{3}{8}"$
8. LIVE LOAD DEFLECTIONS DO NOT GOVERN ANY OF THESE DESIGNS AND NEED NOT BE CALCULATED.
9. FINAL DESIGN:



Approved: FEB. 25, 1965

K. H. Jensen
Bridges Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

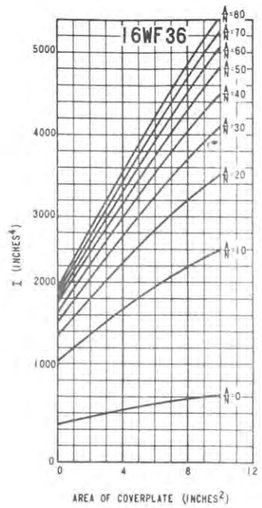
STANDARD
COMPOSITE A36 STEEL I-BEAM BRIDGES

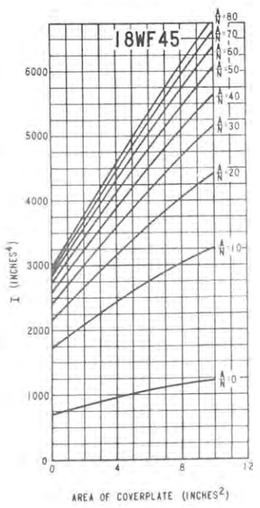
SHEAR CONNECTORS AND SAMPLE DESIGN PROBLEM

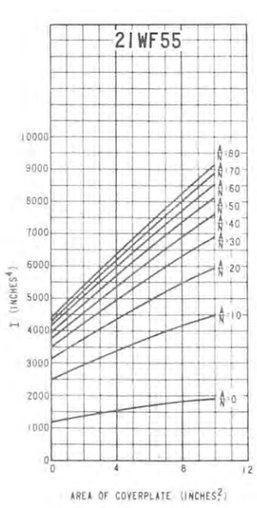
SHEET 4 OF 6

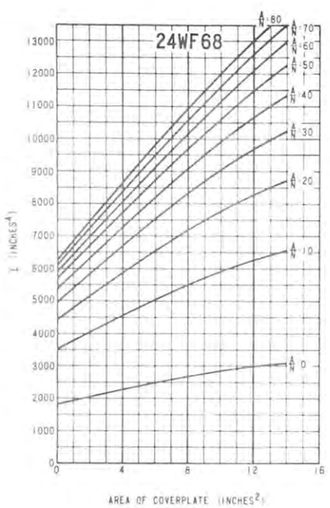
ST-103

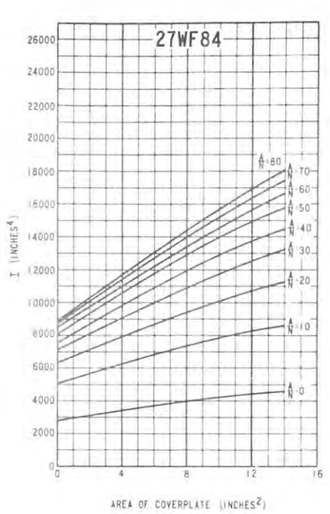
PREPARED BY BETHLEHEM STEEL CORPORATION IN COOPERATION WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION FOR THE PENNSYLVANIA DEPARTMENT OF HIGHWAYS.

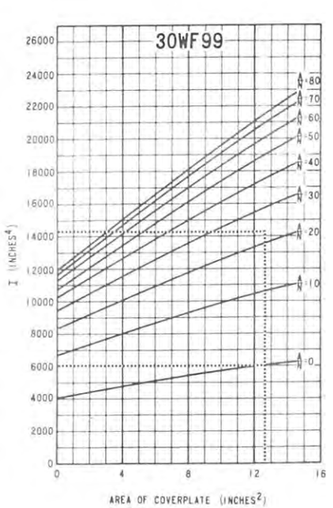


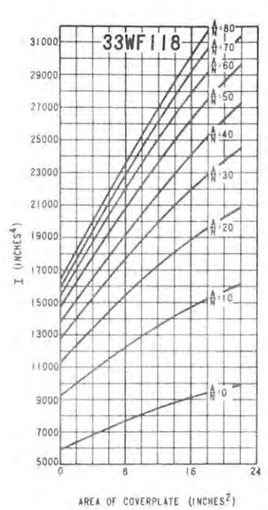












NOTE: A = AREA OF STRUCTURAL PORTION OF SLAB

N = $\frac{\text{MODULUS OF ELASTICITY FOR STEEL}}{\text{MODULUS OF ELASTICITY FOR CONCRETE}}$

Approved: FEB. 25, 1965

K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

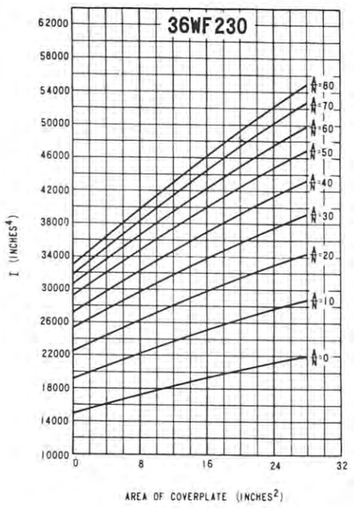
STANDARD
COMPOSITE STEEL I BEAM BRIDGES

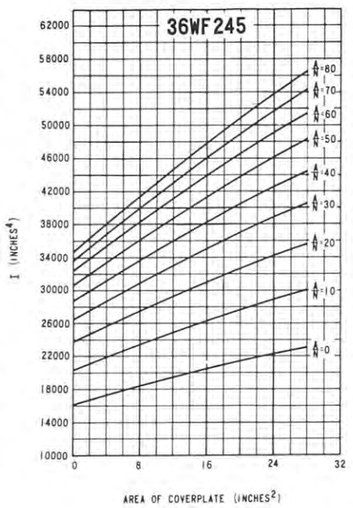
MOMENT OF INERTIA GRAPHS

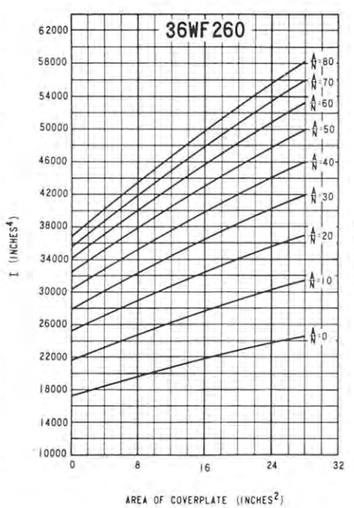
SHEET 5 OF 6

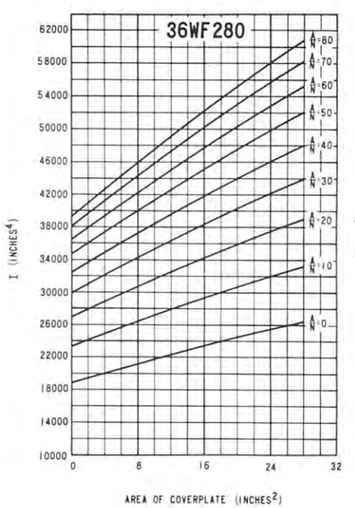
ST-103

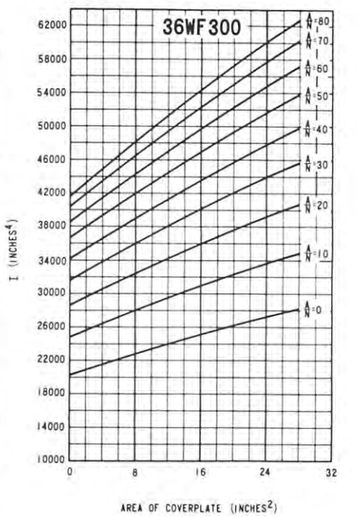
PREPARED BY BETHLEHEM STEEL CORPORATION IN COOPERATION WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION FOR THE PENNSYLVANIA DEPARTMENT OF HIGHWAYS.











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$N = \frac{\text{MODULUS OF ELASTICITY FOR STEEL}}{\text{MODULUS OF ELASTICITY FOR CONCRETE}}$

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STANDARD

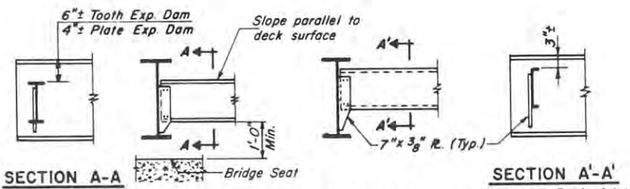
COMPOSITE STEEL I BEAM BRIDGES

MOMENT OF INERTIA GRAPHS

SHEET 6 OF 6

ST-103

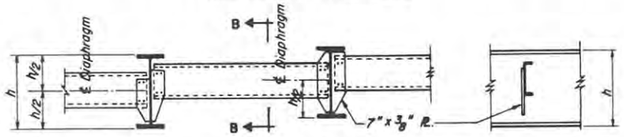
PREPARED BY BETHLEHEM STEEL CORPORATION IN COOPERATION WITH THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION FOR THE PENNSYLVANIA DEPARTMENT OF HIGHWAYS



SECTION A-A
At Expansion Dam

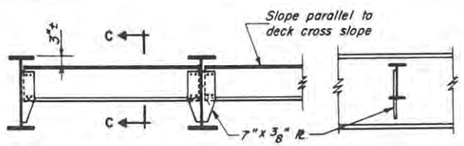
SECTION A'-A'
At Closed Deck Joint

END DIAPHRAGMS



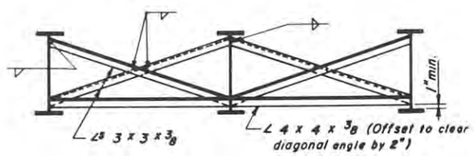
INTERMEDIATE DIAPHRAGM

SECTION B-B



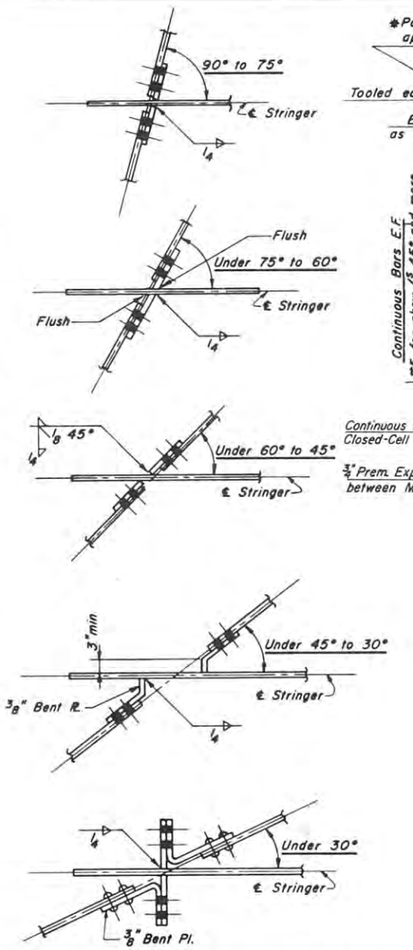
DIAPHRAGM AT SLAB CONSTRUCTION JOINT

SECTION C-C

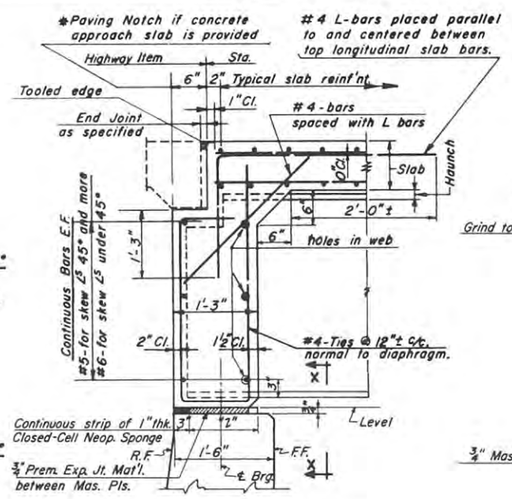


ALTERNATE INTERMEDIATE DIAPHRAGM

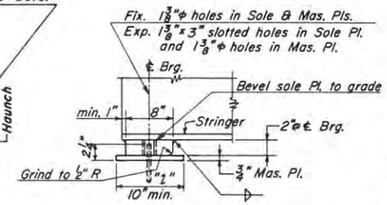
Weld both sides of vertical leg and one side of horizontal leg to stringer web. All welds 1/4" continuous fillets.



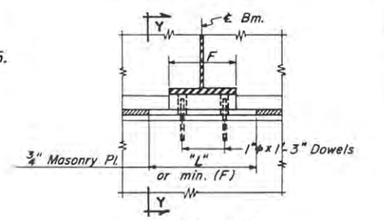
DIAPHRAGM TO BEAM CONNECTION DETAILS



TYPICAL SECTION



SECTION Y-Y

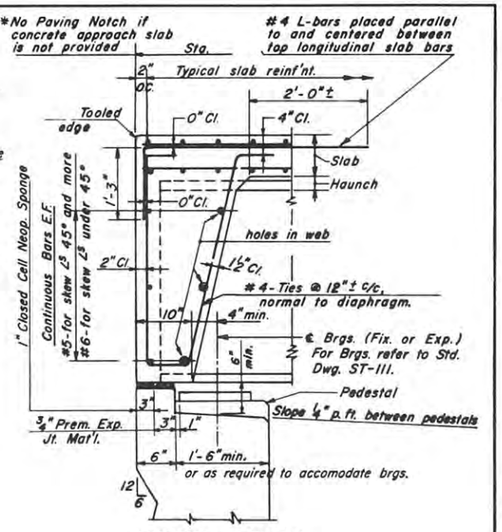


SECTION X-X

IA. CONCRETE DIAPHRAGM AT ABUTMENT

For Span up to 55 ft. c/c Brgs.

** The details shall be modified when Paving Notch is not required*

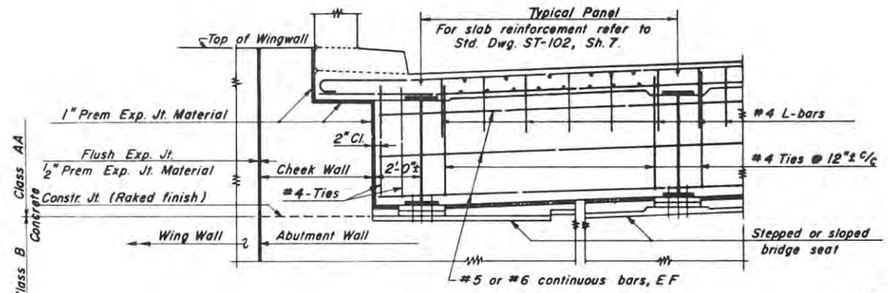


TYPICAL SECTION

IB. CONCRETE DIAPHRAGM AT ABUTMENT

For Span up to 70 ft. c/c Brgs.

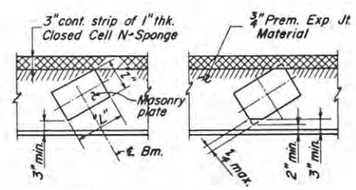
*** The details shall be modified when Paving Notch is required*



SECTION NEAR ABUTMENT
(For IB Concrete Diaphragm)

LEGEND

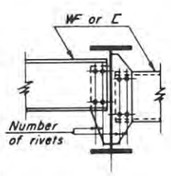
F.F. = Front Face
R.F. = Rear Face
E.F. = Each Face



PLAN - MASONRY PLATE
(For IA Concrete Diaphragm)

NOTE: Use Type IB arrangement when this is not suitable.

Stringers	DIAPHRAGMS on SKEW ANGLES from 90° to 30°					
	Intermediate		At Construction Jt. & Pl. Exp. Dam		At Closed Deck Jt.	
	Shape	No. of rivets	Shape	No. of rivets	Shape	No. of rivets
24 WF	12 C 25	4	12 WF 40	6	15 C 40	6
27 WF	15 C 33.9	6	14 WF 43	6	15 C 40	6
30 WF	15 C 33.9	6	14 WF 43	6	18 C 42.7	8
33 WF	18 C 42.7	8	18 WF 45	8	18 C 42.7	8
36 WF	18 C 42.7	8	18 WF 45	8	18 C 42.7	8



INSTRUCTIONS I.

- Diaphragm spacing shall not exceed 25 ft.
- For skew angles 75° and more, intermediate diaphragms may be placed parallel to ℄ Brgs. For skew angles under 75°, intermediate diaphragms shall be placed normal to stringers and staggered where practical.
- Size of diaphragms on skew angles under 30° shall be determined.
- All rivets 7/8"ϕ. High Strength Bolts may be substituted in field connections, in which case compensation will be made for rivet heads.
- Use pedestal to provide clearance of minimum 12" between bottom flange of end diaphragm and the bridge seat.

STEEL DIAPHRAGMS

Des.	B.F.K.
Trc.	F.F.F.
Ckd.	G.T.V.

APPROVED: FEB. 25, 1965

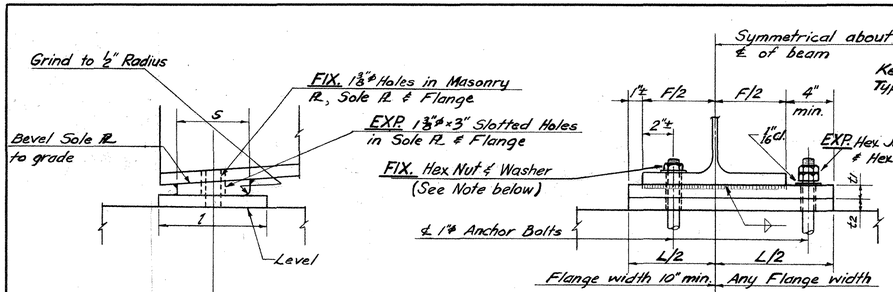
R. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD STEEL I-BEAM BRIDGES DIAPHRAGMS

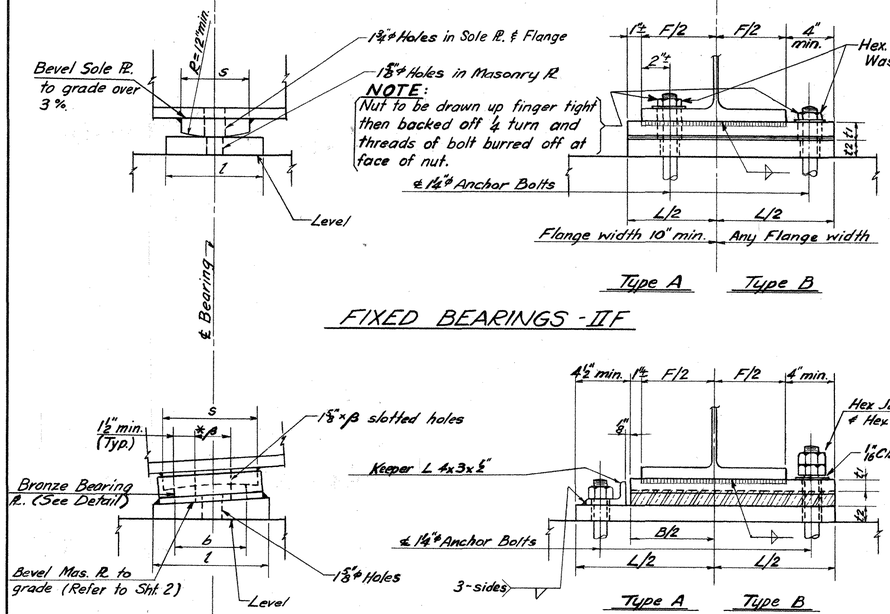
SHEET 1 OF 1

ST-110



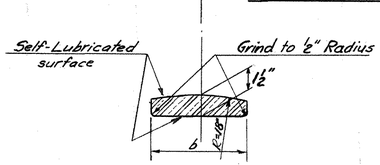
FIXED BEARINGS - IF AND EXPANSION BEARINGS - IE

(For max. exponded length of 55 ft.)

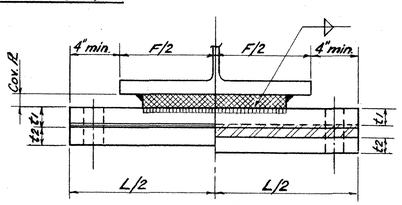


FIXED BEARINGS - IIF

EXPANSION BEARINGS - IIIE



BRONZE BEARING PLATE DETAIL

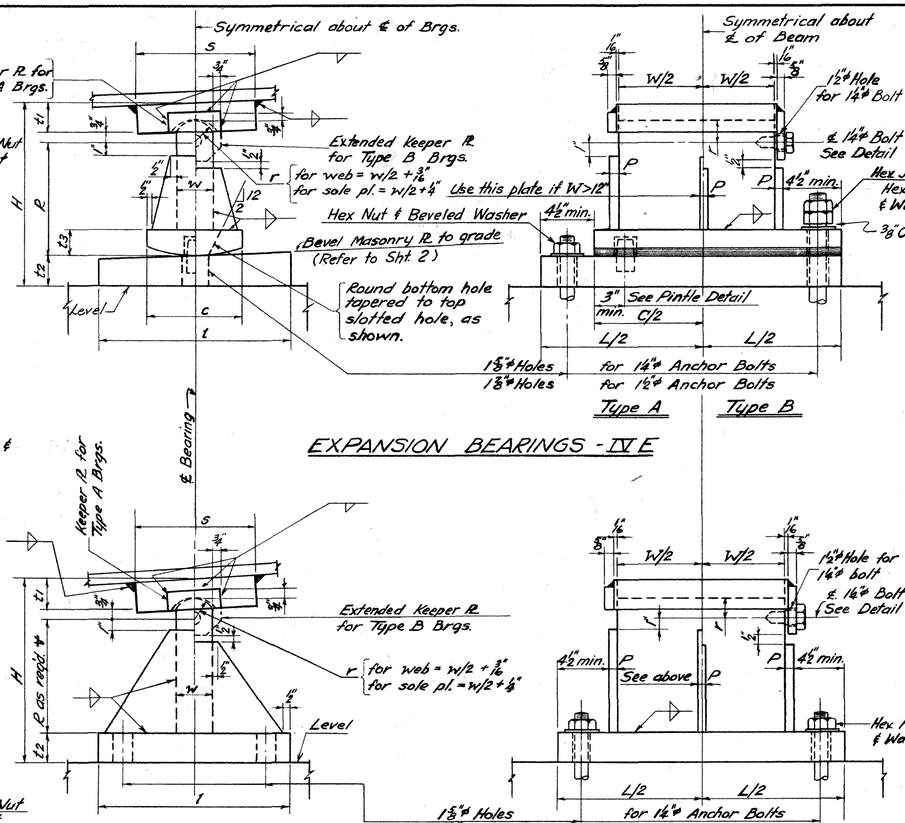


BEARINGS-IIF BEARINGS-IIIE

STRINGERS WITH COVER PLATES

(OVER INTERMEDIATE SUPPORTS)

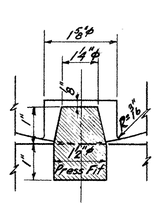
* β = (Bolt dia. + ⅜" + ⅛" per 10 ft. of expanded length) but not less than 3."



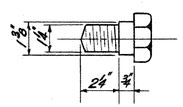
EXPANSION BEARINGS - IVE

* If bearing is used with Exp. Brg. IIIE, R may be reduced to 4" min. and stiffening plates may be omitted.

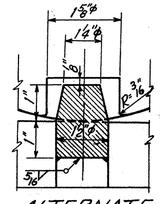
FIXED BEARINGS - IVF



PINTLE DETAIL



BOLT DETAIL



ALTERNATE PINTLE DETAIL

DESIGN INFORMATION

Allowable Design Stresses in Steel:

Tension and compression due to bending	20,000 p.s.i.
Bearing on flat parts in contact	29,500 p.s.i.
Bearing on rounded web plate	26,000 p.s.i.
Bearing on rocker plate (Lb. / lin. inch)	1,380 R
Bearing on self-lubricated bronze plate	1,000 p.s.i.
Bearing on Concrete Masonry:	
Bearings I and III	700 p.s.i.
Bearings II and IV	1,000 p.s.i.

The longitudinal force due to friction at expansion bearing IVE: $F = 0.3 \frac{F_D}{n} x$ (dead load reaction)

Friction coefficient steel on steel 0.30
Friction coefficient of steel on self-lub bronze plate ... 0.12

Max. Thickness of Plate	Size of Weld
¾"	3/16"
3"	¼"
4"	5/16"
1½"	⅜"
2½"	½"
6"	⅝"

NOTES

- All materials and workmanship shall be in accordance with PDH Forms 408/60 and 409/49.
- Design Specifications: Design Division of 1961 "Standard Specifications for Highway Bridges" of the A.A.S.H.O. and current "Standard Specifications for Welded Highway and Railway Bridges" of A.W.S.
- All Steel shall conform to A.S.T.M. A-36 unless otherwise directed.
- The Bronze Alloy self-lubricated Bearing Plates shall meet the A.S.T.M. Specifications B22 Alloy D except that a maximum of up to 2½% lead will be allowed. The lubricated area shall comprise approximately 25% of the bearing surface.
- Rockers shall be shop assembled and match marked to insure free movement of rockers with pintles in place.
- Finish of contact surface shall conform to A.A.S.H.O. Art. 2.10.25.
- ℄ of all Bearings shall be truly vertical at temperature 68°F under full dead load.
- Anchor Bolts shall be swedge or approved type and to be set a minimum 12" into masonry.
- Anchor Bolts may be set by template or other suitable means before concrete is placed, or may be set into preformed holes and grouted with non-shrink mortar.
- At each bearing, an area extending 1" beyond masonary plate shall be poured at least ¼" high and after curing ground to a true plane and elevation. This area shall be thoroughly swabbed with red lead paint, and three layers of 12oz. duck shall be placed therean, each layer's top surface having been thoroughly swabbed with red lead paint. The shoes shall be set while the paint is wet.

TYPICAL ANCHOR BOLT HOLE

Approved: FEB. 25, 1965

K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

STANDARD STEEL I-BEAM BRIDGES BEARINGS

Des.	G.T.V.
Trc.	F.F.F.
Ckd.	B.F.K.

PENNDOT NO. 184

SHEET 1 OF 2

ST-111

FIXED BEARINGS - IF AND EXPANSION BEARINGS - IE

Reaction Kips	Mark	TYPE A AND B					
		s	l	L	t_1	t_2	Wt. (lbs)
50	R50	6	8	12	1½	1½	83
60	R60	6	8	14	1½	1½	95
70	R70	6	8	16	1½	1½	107
80	R80	6	8	18	1½	1½	119
90	R90	6	8	20	1¾	1¾	151
100	R100	6	8	22	2	2	187

FIXED BEARINGS - IIF

Reaction Kips	Mark	TYPE A						TYPES B AND C					
		s	l	L	t_1	t_2	Wt.(lbs)	s	l	L	t_1	t_2	Wt.(lbs)
50	R50	5	6	10	1½	1½	57	—	—	—	—	—	—
60	R60	5	6	12	1½	1½	66	—	—	—	—	—	—
70	R70	6	7	12	1½	1½	75	—	—	—	—	—	—
80	R80	6	7	13	1½	1½	81	—	—	—	—	—	—
90	R90	6	8	13	1½	1½	86	—	—	—	—	—	—
100	R100	6	8	14	1½	1½	92	6	8	18	1½	1½	115
120	R120	6	8	16	1½	1½	103	6	8	18	1½	1½	115
140	R140	6	8	18	1½	1½	115	6	8	19	1½	1½	121
160	R160	—	—	—	—	—	—	7	9	20	1½	1½	142
180	R180	—	—	—	—	—	—	8	10	20	1¾	1¾	172
200	R200	—	—	—	—	—	—	9	11	20	2	2	221
220	R220	—	—	—	—	—	—	10	12	20	2	2¼	259
240	R240	—	—	—	—	—	—	10	12	21	2	2¼	271
260	R260	—	—	—	—	—	—	10	12	23	2¼	2¼	312
280	R280	—	—	—	—	—	—	10	12	25	2¼	2¼	339
300	R300	—	—	—	—	—	—	10	12	27	2¼	2¼	365
320	R320	—	—	—	—	—	—	11	13	27	2¼	2½	410
340	R340	—	—	—	—	—	—	11	13	27	2¼	2½	410
360	R360	—	—	—	—	—	—	11	13	28	2¼	2½	425
380	R380	—	—	—	—	—	—	11	13	30	2¼	2½	465
400	R400	—	—	—	—	—	—	11	14	30	2½	2¾	530

EXPANSION BEARINGS - IIIE *

Reaction Kips	Mark	TYPE A							TYPES B AND C						
		b	B	t	L	s	t_1	t_2	wt.(lbs)	b	t	L	s	t_1	t_2	Wt.(lbs)
50	R50	6	11	7	19	7½	1½	1½	112	—	—	—	—	—	—	—
60	R60	6	12	7	20	7½	1½	1½	120	—	—	—	—	—	—	—
70	R70	6	12	8	20	7½	1½	1½	135	—	—	—	—	—	—	—
80	R80	6	14	8	22	7½	1½	1½	150	—	—	—	—	—	—	—
90	R90	6½	14	9	22	8½	1½	1½	168	—	—	—	—	—	—	—
100	R100	7½	14	10	22	9½	1½	1½	195	7½	10½	20	9½	1½	1½	230
120	R120	7½	16	10½	24	9½	1½	1½	222	7½	11½	21	9½	1½	1½	250
140	R140	7½	19	11	27	9½	1½	1½	260	7½	12½	22	9½	1½	1½	270
160	R160	8	20	11½	28	10	1½	1¾	310	8	13½	23	10	1½	1½	300
180	R180	8½	21	12	29	10½	1½	1¾	335	8½	14	24	10½	1½	1½	325
200	R200	9	22	13	30	11	1½	1¾	375	9	14½	25	11	1¾	1¾	335
220	R220	9½	23	14	31	11½	1¾	1¾	430	9½	15½	26	11½	2	2	490
240	R240	10	24	14½	32	12	2	2	532	10	16	27	12	2¼	2¼	585

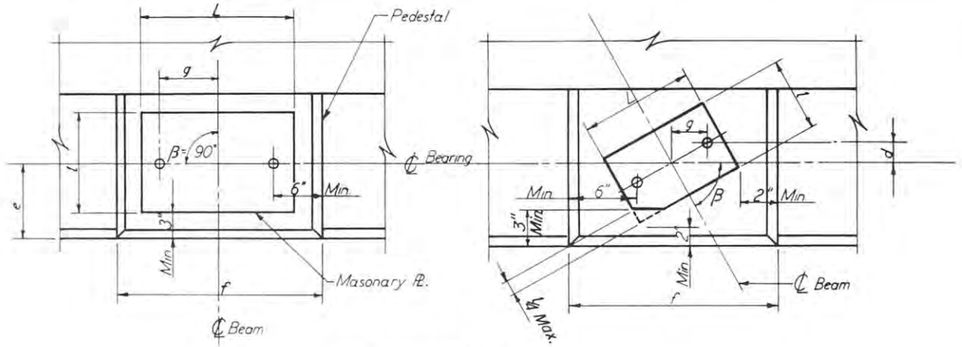
* Bearings are designed for max. eccentricity of 1½ inches. For larger eccentricity, special design is required.

EXPANSION BEARINGS - IVE

Reaction Kips	Mark	s	W	w	c	C	L	l	e**	R	t_1	t_2	t_3	H	P	Wt. (lbs.)
TYPE A																
75	R75	6	9	3	6	11	20	8	2	8	2	2	2	12¾	5/8	237
100	R100	6	10	3	6	13	22	9		8	2	2	2	12¾		275
150	R150	7	10	3	7	16	25	10½		9	2	2	2	13¾		334
200	R200	7	11	3	7	18	27	12		10	2¼	2¼	2	15		410
250	R250	8	12	3	8	20	29	13½		11	2¼	2½	2	16¼		535
300	R300	8	13	3	8	22	31	14		12	2¼	2¾	2¼	17½		660
350	R350	9	14	3	9	23	32	15½		13	2½	3	2¼	19		830
400	R400	9	16	3	9	24	34	16½		14	2½	3¼	2¼	20¼		990
TYPE B																
75	R75	6	9	3	6	—	20	8	2	8	2	2	2	12¾	5/8	275
100	R100	6	10	3	6	—	22	9		8	2	2	2	12¾		310
150	R150	7	10	3	7	—	25	10½		9	2	2	2	13¾		380
200	R200	7	11	3	7	—	27	12		10	2¼	2¼	2	15		455
250	R250	8	12	3	8	—	29	13½		11	2¼	2½	2	16¼		595
300	R300	8	13	3	8	—	31	14		12	2¼	2¾	2¼	17½		720
350	R350	9	14	3	9	—	32	15½		13	2½	3	2¼	19		905
400	R400	9	16	3	9	—	34	16½		14	2½	3¼	2¼	20¼		1075

FIXED BEARINGS - IVF

Reaction Kips	Mark	s	W	w	L	l	t_1	t_2	R	H	P	Wt. (lbs.)	
												Type A	Type B
75	R75	6	8	3	18	8	2	2	6	10⅞	5/8	204	206
100	R100	6	8	3	18	9	2	2	6	10⅞		216	218
150	R150	7	9	3	19	10	2	2	7	11¾		254	256
200	R200	7	9	3	20	11	2¼	2	7	12		280	282
250	R250	8	10	3	22	12	2¼	2	8	13		330	332
300	R300	8	11	3	24	13	2¼	2¼	8	13¾		395	397
350	R350	9	12	3	26	14	2½	2½	9	14⅞		495	497
400	R400	9	13	3	28	15	2½	2¾	9	15		585	587



BRIDGE SEAT PLAN

INSTRUCTIONS

- Weights shown include anchor bolts, nuts and washers.
- Web stiffeners shall be provided for beam at bearings when the unit shear exceeds 75% of allowable shear, or when the web crippling stress exceeds 25,000 psi.
- Where uplift exists, Type B bearings IIIE, IVE and IVF shall be used only for outside stringers and for the stringers adjacent to the divided median.
- Fixed bearings shall be placed at low end of span whenever it is possible.
- Thicknesses shown are at ℄ bearings.
- Dimensions given in tables are in inches.

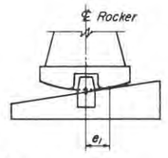
** EXPANSION BEARINGS IVE

For total Eccentricity $e = e_1 + e_2$, greater than 2", Special design is required.

e_1 = eccentricity at 68°F.

e_2 = .00437 L for temp. rise and −.00813 L for temp. fall.

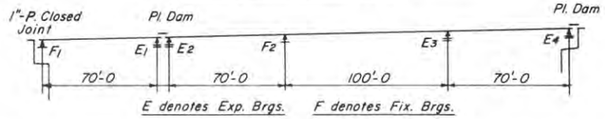
L = expanded length in feet.



- Beveled masonry plate shall be used only with plate expansion dam, when roadway grade G exceeds the value K, where K = (2.68 − .009 L) %, in which L = total (left + right) expanded length, ft. (see Example).

EXAMPLE

Roadway Grade G = 1.30 %



E denotes Exp. Brgs. F denotes Fix. Brgs.

	E denotes Exp. Brgs.	F denotes Fix. Brgs.
Total Expanded Length, L	L = 70 + 70 = 140 ft.	L = 100 + 70 = 170 ft.
From Equation	K = (2.68 − .009 × 140) % = 1.42 %	K = (2.68 − .009 × 170) % = 1.15 %
	Since G < K Do not bevel masonry plates of bearings E1 & E2	Since G > K Bevel masonry plates of bearings E3 & E4

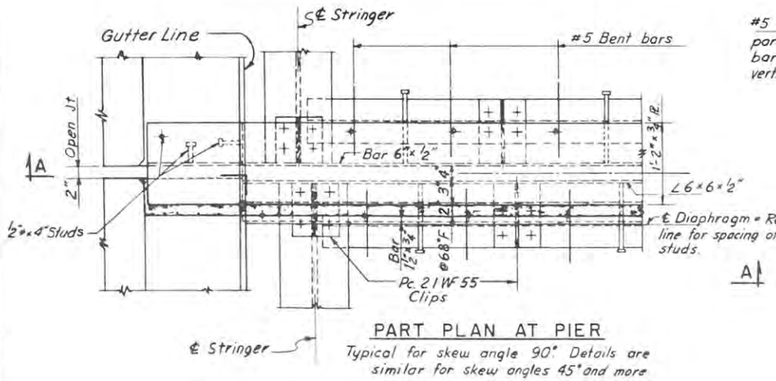
Approved: FEB. 25, 1965
K. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD STEEL I-BEAM BRIDGES BEARINGS

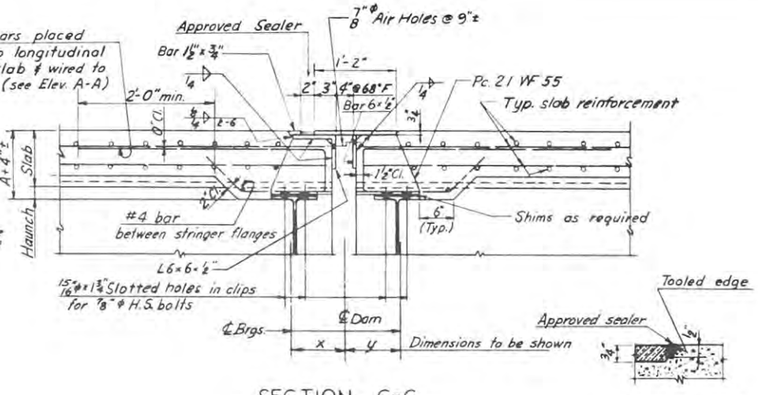
Des.	G.T.V.
Trc.	F.F.F.
Ckd.	B.F.K.

ST-111



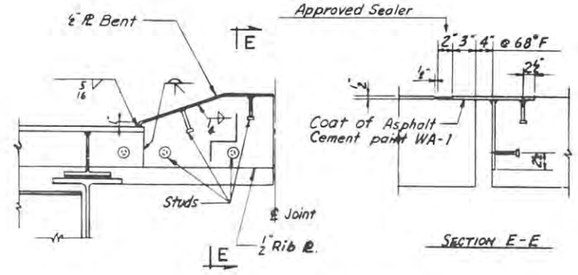
PART PLAN AT PIER

Typical for skew angle 90° Details are similar for skew angles 45° and more



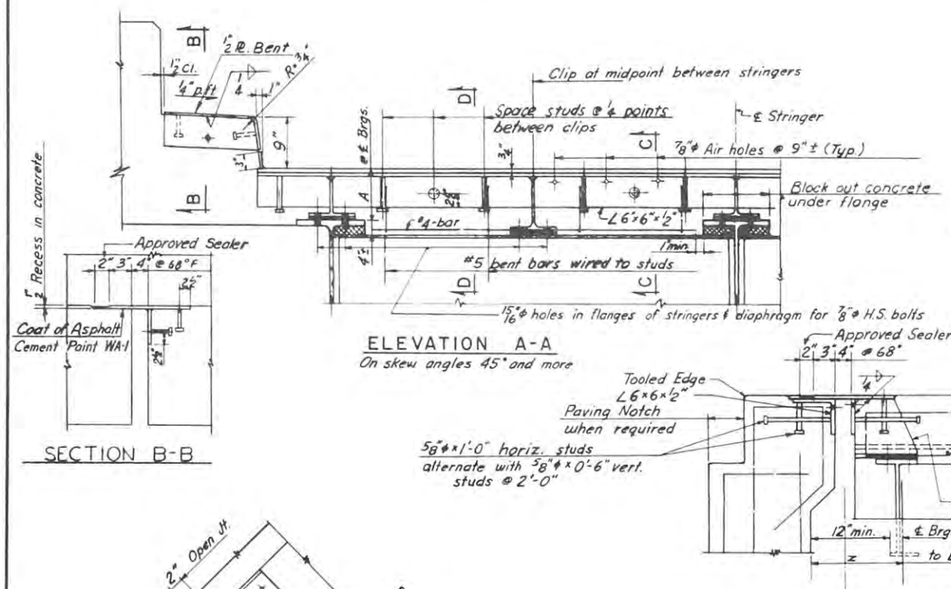
SECTION C-C

DETAIL -"S"



DIVISOR DETAILS

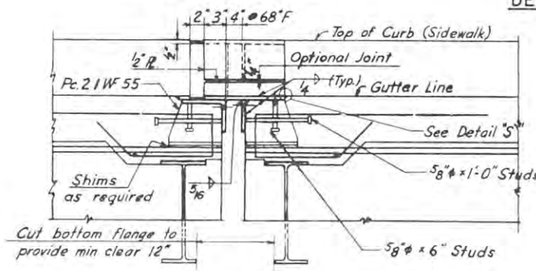
Armored expansion dam over divisor shall be used where deck drainage will collect along the divisor. If deck slab slopes downward from divisor to curb, rounded concrete divisor shall be terminated approx. 5" each side of dam.



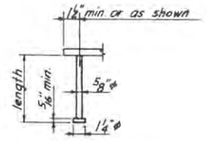
ELEVATION A-A

On skew angles 45° and more

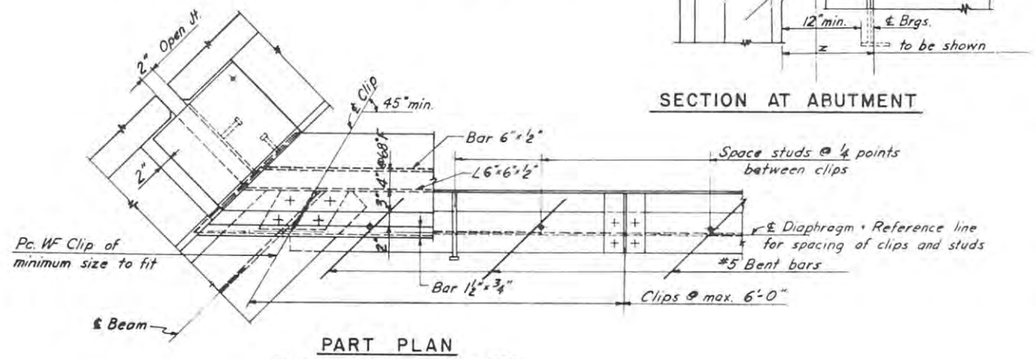
SECTION B-B



SECTION D-D

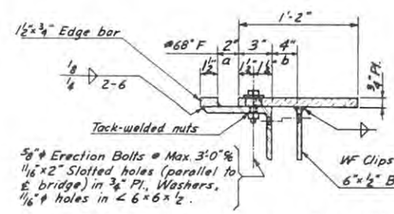


SECTION AT ABUTMENT



PART PLAN

On skew angles less than 45°



DETAIL OF TEMPORARY ATTACHMENT

FOR SHIPPING AND ERECTION OF DAM

The dimensions "a" and "b" as shown are for a normal temperature of 68°F. For other temperature "T" at time of dam erection, these dimensions shall be adjusted as follows:

a (inches) = 2.00 - 12 E (T-68) L

b (inches) = 4.00 - 12 E (T-68) L

in which E = thermal coefficient = 0.0000065

L = total expanded length in feet.

Example 1.
T = 30°, L = 100 ft.
a = 2.00-12 (.0000065)(30-68)100
= 2.00-12 (-.0247)
= 2.30", Say 2¼"

Example 2.
T = 106°, L = 100 ft.
a = 2.00-12 (.0000065)(106-68)100
= 2.00 - .30
= 1.70" Say 1¾"

ANCHOR STUD DETAIL

NOTES

- *All materials and workmanship shall be in accordance with PDH Form 409/49*
- *Structural steel shall conform to ASTM-A36, except concrete anchor studs which shall conform to ASTM-A108.*
- *Anchor studs shall be automatically end welded by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°*
- *Provisions shall be made to fasten both elements of the dam together with bolts for shipping and erection purposes. After erection and adjustment bolts shall be tightened to snug fit then released one-half turn. Remove bolts not later than two hours after concrete has been poured. Holes shall be filled with approved sealer. See Detail of Temporary Attachment.*
- *Expansion dam is to be erected to follow roadway grade and crown*
- *Special care shall be used to place and vibrate concrete under the dam to secure full bearing against steel and eliminate air pockets*
- *Steel surfaces in contact with concrete shall not be painted*

INSTRUCTIONS

- *Wherever practical, WF-Clips shall be equally spaced between stringers. Spacing shall be as close to the maximum indicated as possible*
- *A = distance from top of slab to top of beam @ ℄ Bearings.*
- *For end diaphragms refer to Std. Dwg. ST-110.*

Approved: FEB. 25, 1965

K H Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD
STEEL I-BEAM BRIDGES
PLATE EXPANSION DAM

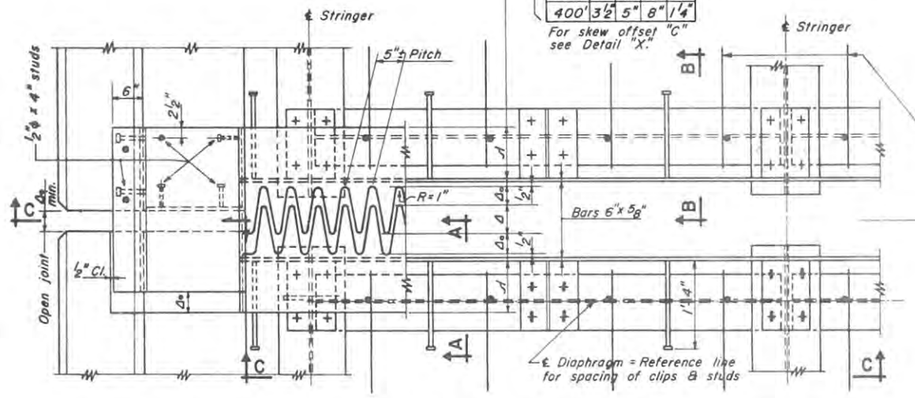
Des.	G.T.V.
Trc.	F.F.F.
Ckd.	B.F.K.

A. S. WEIL CO., CHERRYVILLE

ST-112

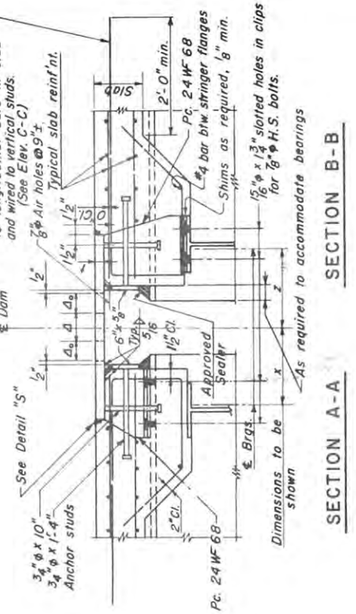
Max. L	Δ_o	Δ	A	t
300'	2½"	4"	7"	1"
350'	3"	4½"	7½"	1'-⅛"
400'	3½"	5"	8"	1'-¼"

For skew offset "C" see Detail "X".



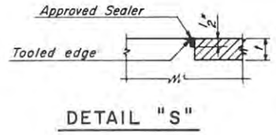
PART PLAN AT PIER

Typical for 90° skew angle. Details are similar for skew angles 45° and more.

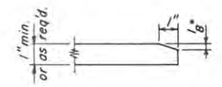


SECTION A-A

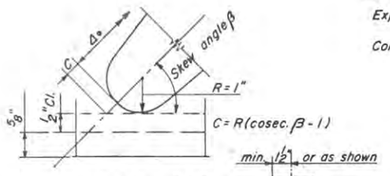
SECTION B-B



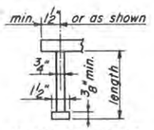
DETAIL "S"



TOOTH DETAIL



DETAIL "X"



ANCHOR STUD DETAIL

NOTES

- All materials and workmanship shall be in accordance with PDH Form 409/49.
- Structural steel shall conform to ASTM-A36, except concrete anchor studs which shall conform to ASTM-A108.
- Anchor studs shall be automatically end welded by the use of a stud welding gun. The welds shall be of sufficient strength to permit the studs to be bent 30°.
- Temporary L's 4x3x½ at maximum 5'-0" c/c to be placed and welded in shop. After erection and adjustment, bolts shall be tightened to snug fit then released one-half turn. After concrete has set, angles are to be removed by Chipping connection welds and grinding surfaces smooth, see Detail of Temporary Attachment.
- Expansion dam is to be erected to follow roadway grade and crown.
- Special care shall be used to place and vibrate concrete under the dams to secure full bearing against steel and eliminate air pockets.
- Steel surfaces in contact with concrete shall not be painted.

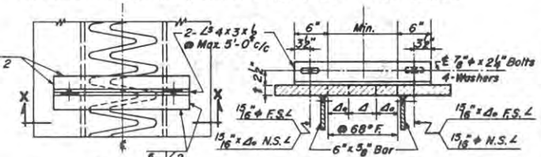
DESIGN INFORMATION

Expansion: Min. $\Delta_o = \sigma' + \frac{L\times(110-68)}{10\times8\times120} = \sigma' + 0.00437\ L\ (\text{inch})$

Contraction: Min. $\Delta = \sigma' + \frac{L\times(68+10)}{10\times8\times120} = \sigma' + 0.00813\ L\ (\text{inch})$

} at 68° F.

L = Expanded length in ft.
Temperature range from -10°F to +110°F.
Normal temperature @ 68°F.
Minimum design Live Load = 100 psi + 60 % Impact = 160 psi on tooth area.
σ' = Allowance of 1" for each 250 ft. of expanded length, but not less than 1".
t = Design length of tooth = $\Delta_o + \Delta - 1$".
Deflection of tooth shall not exceed 1/300.
For types other than stringer bridges, for expanded length over 400 ft., and for dams in hinged spans, special design of dam will be required.



DETAIL OF TEMPORARY ATTACHMENT

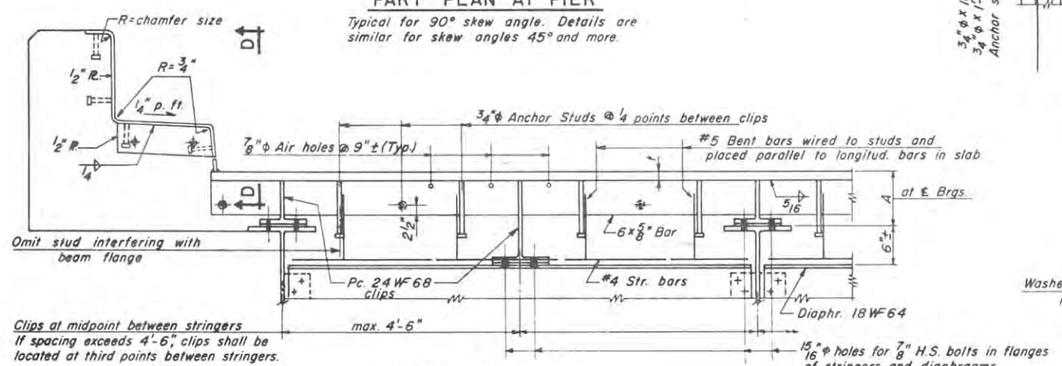
FOR SHIPPING AND ERECTION OF DAM

The value of Δ_o for temperature at time of dam erection other than 68°F is given below.

$$\Delta_o(T)(\text{inches}) = \Delta_o(68) - 12\,\xi\,(T-68)\,L$$

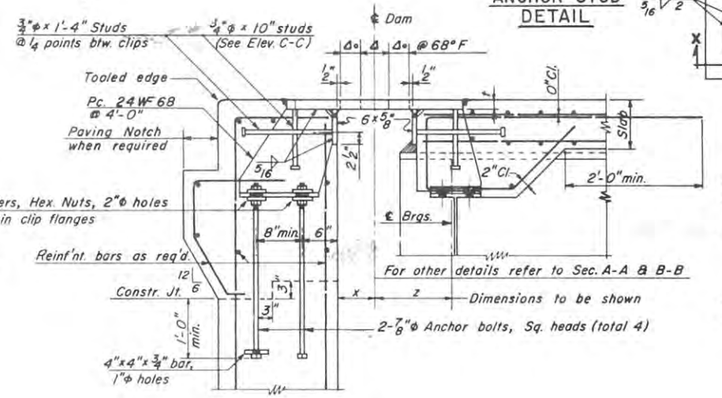
in which $\Delta_o(T)$(inches) = Δ_o for T°F temperature at time of dam erection.
$\Delta_o(68)$(inches) = Δ_o for 68°F normal temperature as shown on plan.
ξ = thermal coefficient = 0.0000065
L = total expanded length in feet.

For example, L = 300 ft., T = 30°F and Δ_o = 3" (shown on plan), the required Δ_o for 30°F temperature at time of dam erection will be 3⅞" approx.

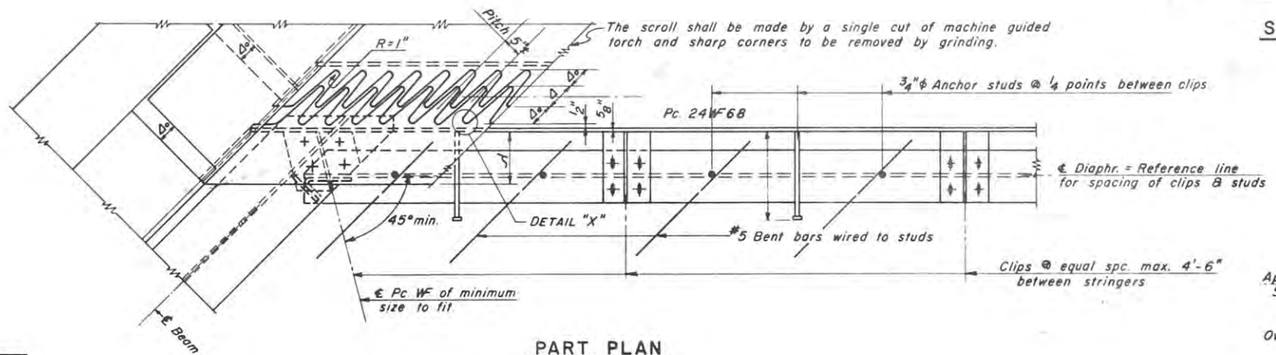


ELEVATION C-C

On skew angles 45° and more



SECTION AT ABUTMENT

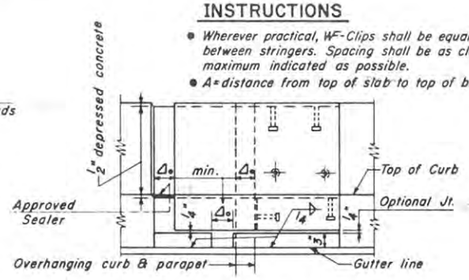


PART PLAN

On skew angles less than 45°

INSTRUCTIONS

- Wherever practical, WF-Clips shall be equally spaced between stringers. Spacing shall be as close to the maximum indicated as possible.
- A = distance from top of slab to top of beam at ℄ Brgs.



SECTION D-D

Approved: FEB. 25, 1965
R. H. Jensen
Bridge Engineer

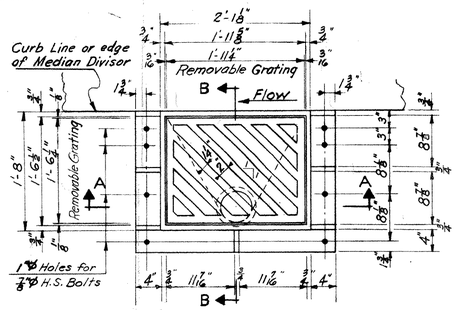
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
STEEL I-BEAM BRIDGES
TOOTH EXPANSION DAM

Des.	G.T.V.
Trc.	F.F.F.
Ckd.	B.F.K.

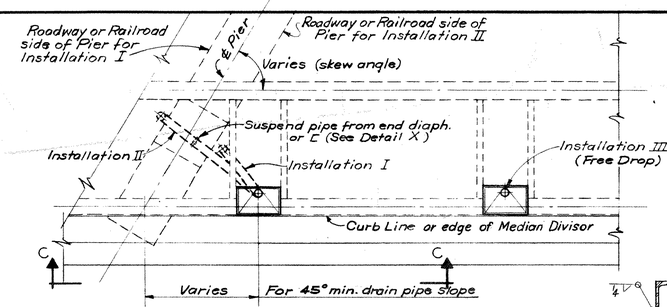
SHEET 1 OF 1

ST-113



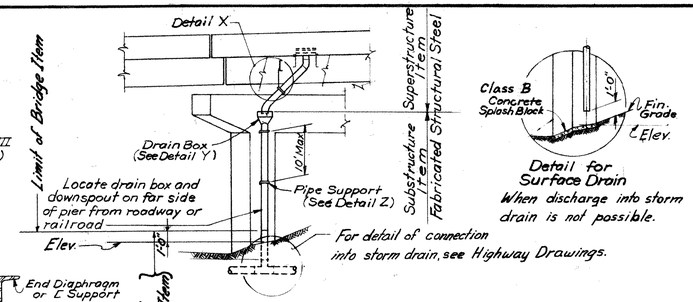
PLAN - TYPE A SCUPPER

Note: Openings in grating must point downgrade toward curb.



TYPICAL LOCATION PLAN OF TYPE A, D OR E SCUPPER

For choice of installation - See Instruction Note 1.



ELEVATION C - C

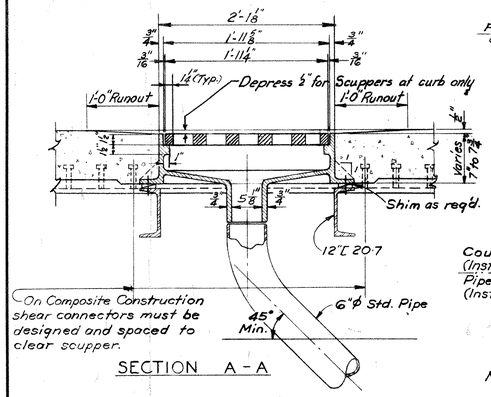
Installation I shown.
Installation II similar except downspout is on opposite side of pier column.

Detail for Surface Drain

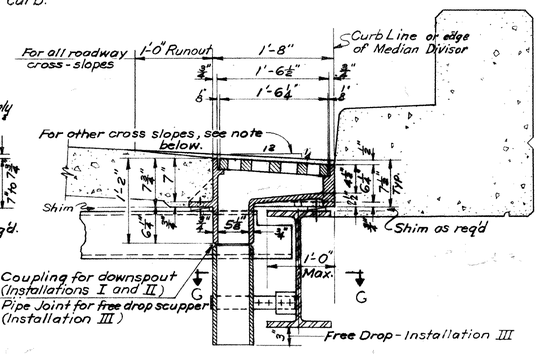
When discharge into storm drain is not possible.

NOTES:

- All materials and workmanship shall comply with PDH Form 409/49 and the current A.W.S. Standard Specifications for Welded Highway and Railway Bridges.
- All pipes shall be standard 6"ϕ steel pipes. All pipe fittings shall be screwed malleable iron (ASTM A338) or steel welding fittings (ASTM A234) except at field connection, shown on Sect. B-B, where victaulic coupling, (or approved equal), is specified. Scupper, drain box, and grating material shall be malleable iron, cast steel, or ductile iron (ASTM A339 Grade 60-45-10) unless welded construction is used, in which case, structural steel (ASTM A36) shall be used. All materials shall be galvanized. Areas upon which the galvanizing has been damaged shall be cleaned and painted with an approved aluminum paint.
- Weight of scuppers, pipe, fittings, couplings, and pipe supports above drain box shall be included in the Fabricated Structural Steel Item for Superstructure quantities. Weight of drain boxes, pipe, fittings, couplings, and pipe supports below drain box shall be included in the Fabricated Structural Steel item for the various units of the substructures.

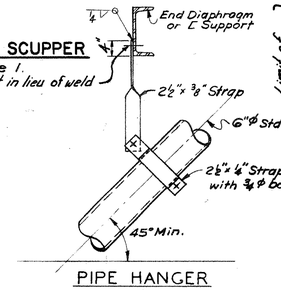


SECTION A - A

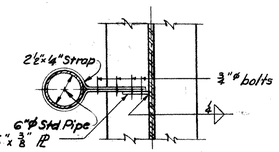


SECTION B - B

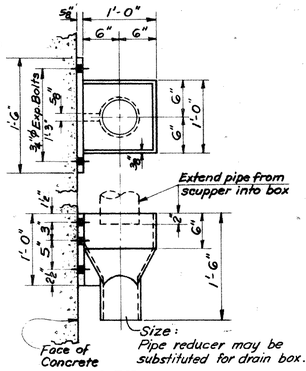
Note: For cross-slopes other than ½ in 12 raise or lower roadway side of scupper to align with cross-slope of roadway and adjust supporting channels and shims.



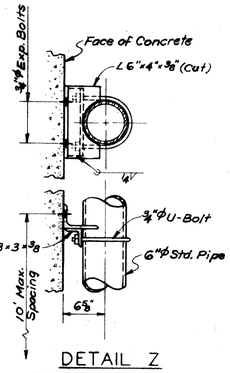
PIPE HANGER DETAIL X



SECTION G-G



DETAIL Y DRAIN BOX



DETAIL Z PIPE SUPPORTS

INSTRUCTIONS:

1. Type A, D and E Scuppers:
   Use on all steel framed superstructures in accordance with requirements shown on Scupper Spacing Chart and use on steel framed superstructure alternate to Prestressed Concrete superstructure in lieu of Scupper-Type Drain shown on P.D.H. Prestressed Concrete Bridge Standards.

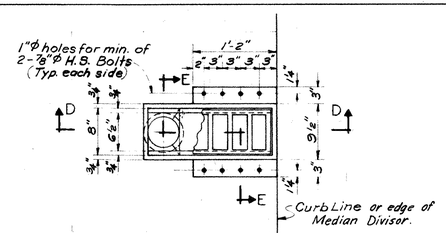
   Installation I of scupper and downspout should be located on far side of pier column from roadway or railroad, except that Installation II must be used where the far side is downgrade from a toothed expansion dam.

   Installation II may be used in lieu of Installation I if slope of pipe between scupper and downspout can be held to 45° or more and the far side is downgrade from a sliding plate dam.

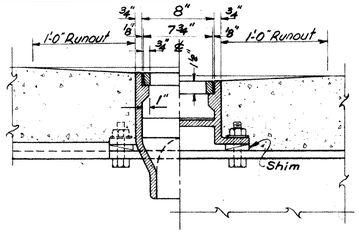
   Installation III (free drop) may be used in spans over waterways and over any ground where discharge would not be objectionable.

2. Type B and C Scuppers:
   Use on steel framed superstructure alternate to Prestressed Concrete superstructure in lieu of aluminum or steel drains shown on P.D.H. Prestressed Concrete Bridge Standards. Type B Scupper must be used where the beam flange would obstruct Type C or where Type C would be exposed on the outside of the fascia beam.

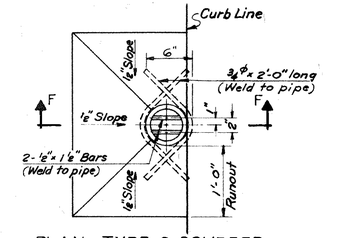
   Type C may be modified for use on Reinforced Concrete Slab and Reinforced Concrete T-Beam Bridges where required. Type B may be used adjacent to a divisor, to drain a narrow water table, where Type A or D would not be economical.
3. For larger dimensions, scupper shall be modified to fit.
4. For Installations I and II, downspout may be connected to Storm Drain, if practical, and details of the connection shall be included on Highway Drawings. If connection to storm drain is impractical, downspout shall discharge onto Splash Block
5. Roadway inlets should be placed off the bridge at the low end, in lieu of scuppers in end span(s), These inlets shall be shown on bridge plans as well as on roadway plans.
6. For Details of Type D and E Scuppers, See Sheet 2.



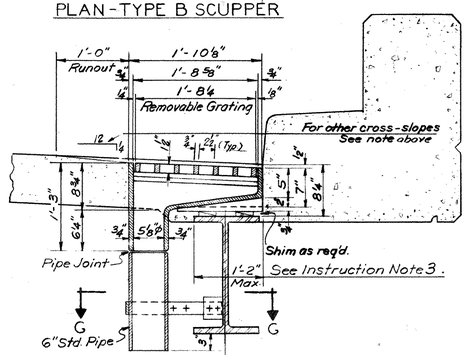
PLAN - TYPE B SCUPPER



SECTION E - E



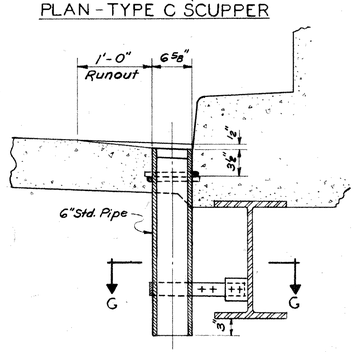
PLAN - TYPE C SCUPPER



SECTION D - D

SCUPPER TYPE "B" & TYPE "C"

To be used on steel alternates to original prestressed concrete design. (See Instruction Note 2.)



SECTION F - F

Approved: FEB. 25, 1965

T. H. Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD
STEEL I-BEAM BRIDGES

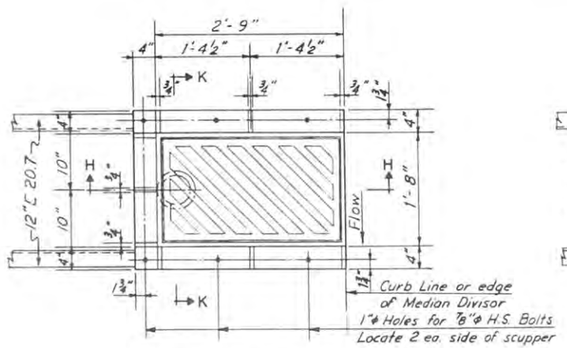
BRIDGE DRAINAGE

Des.	S.S.S.
Trc.	D.A.S.
Ckd.	B.F.K.

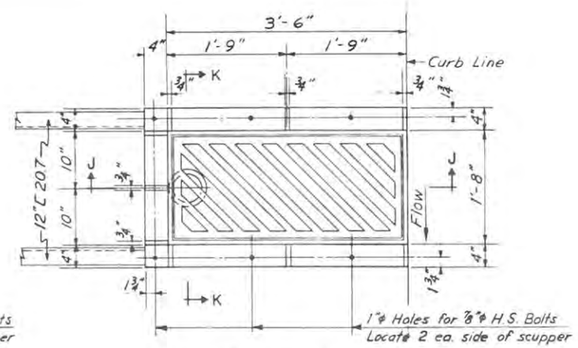
J. N. WEIL CO., CROMAPLEX

SHEET 1 OF 2

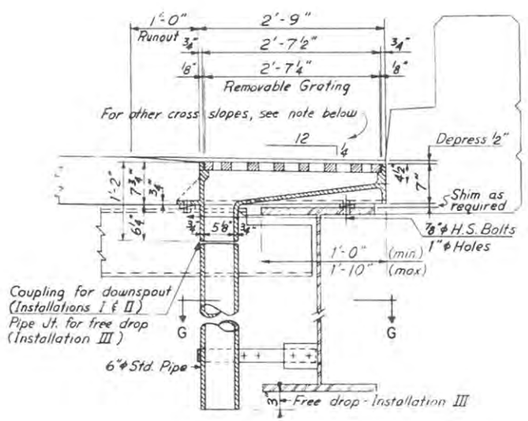
ST-114



PLAN - TYPE D SCUPPER

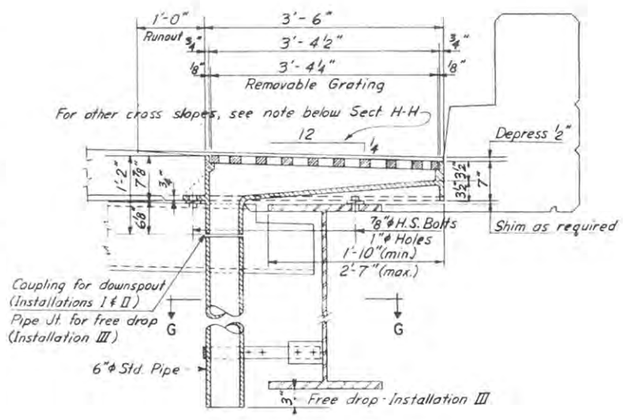


PLAN - TYPE E SCUPPER

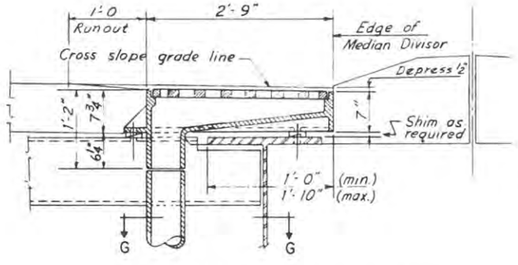


SECTION H-H (AT CURB)

Note: For cross slopes other than ¼ in 12, raise or lower roadway side of scupper to align with cross-slope of roadway and adjust supporting channels and shims.

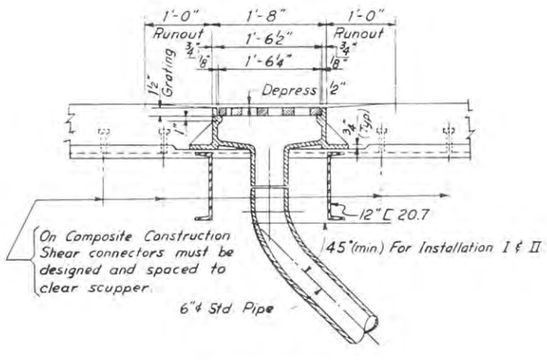


SECTION J-J (AT CURB)

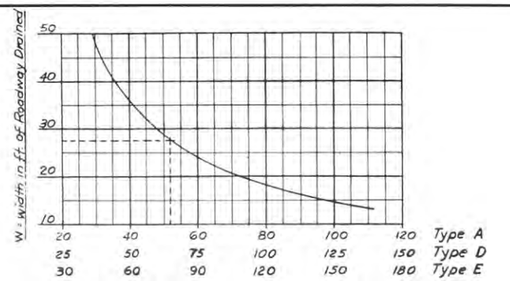


SECTION H-H (AT MEDIAN DIVISOR)

Note: Details & Dimensions not shown are similar to Section H-H (At Curb).



SECTION K-K



L (ft) = Max. allowable scupper spacing.
Spacing shown for Gutter cross slope of ¼ in 12.

For Gutter cross slope ½ in 12 — Multiply above spacing by 2.
For Gutter cross slope ¾ in 12 — Multiply above spacing by 4.
For Gutter cross slope 1 in 12 — Multiply above spacing by 6.

DETERMINATION OF SCUPPER SPACING FROM CHART

Example of how to use chart:
Follow dash line to find spacing "L" of Scupper Type A from problem below:

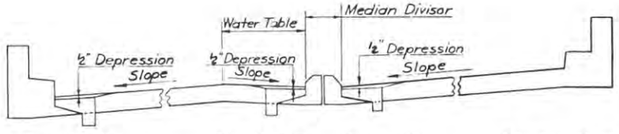
GIVEN

Gutter Cross slope	Roadway width (w)	"L" from Chart	Max. Allowable Spacing
¼ in 12	27.50	52'	52'
½ in 12	27.50	52' × 2	= 104'
¾ in 12	27.50	52' × 4	= 208'
1 in 12	27.50	52' × 6	= 312'

SPACING OF TYPE B OR C SCUPPER

L (ft.) = Approximate allowable Scupper spacing
= 500 / w

NOTE: w (ft.) = width of roadway drained by Scuppers — includes Section of roadway slab plus Sidewalk or Safety curb.



Type A,D,E
Type A,B,C,D,E

Type A,B,D
Type A,D

Type A,D
Type A,D

Original Design
Alternate to P/S Design

Note: ½" Depression shall be eliminated where scupper extends into traffic lane.

TYPICAL SCUPPER APPLICATION

Approved: FEB. 25, 1965
T. H. Jenson
Bridge Engineer

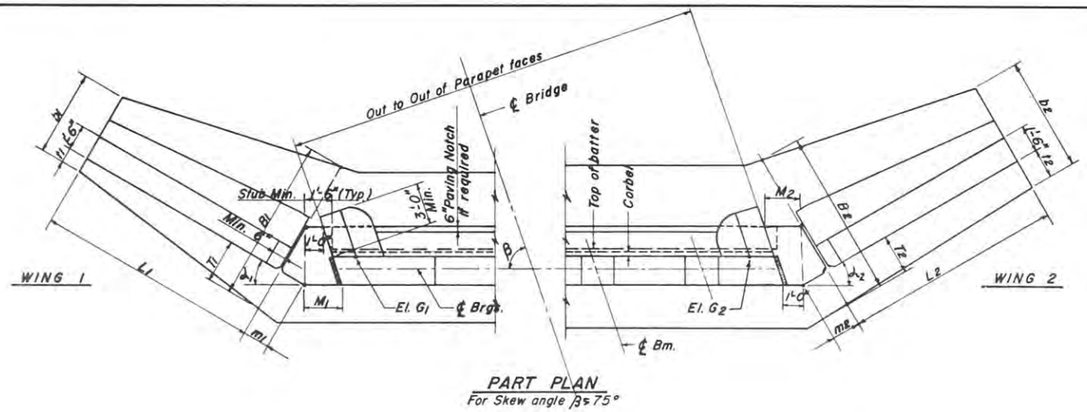
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
STEEL I-BEAM BRIDGES
BRIDGE DRAINAGE

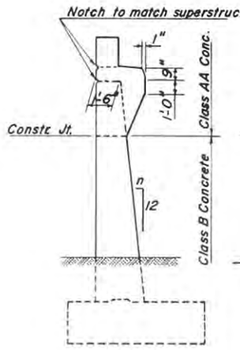
MADE BY: S.S.S.
CHECKED: B.F.K.
DRAWN: F.F.P.

SHEET 2 OF 2

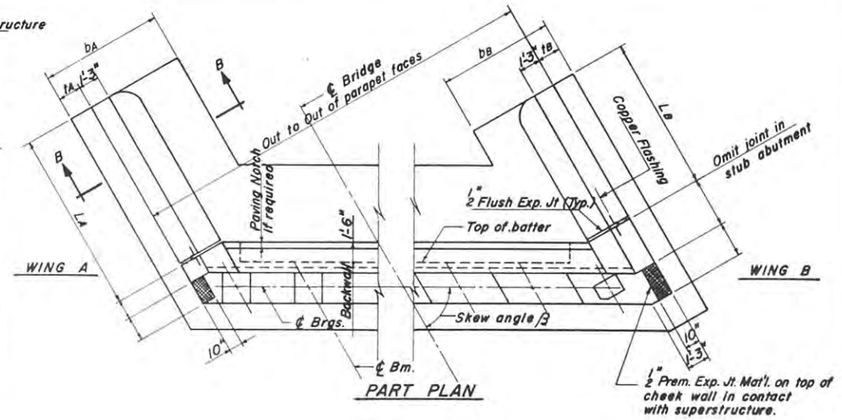
ST-114



PART PLAN
For Skew angle β ≥ 75°

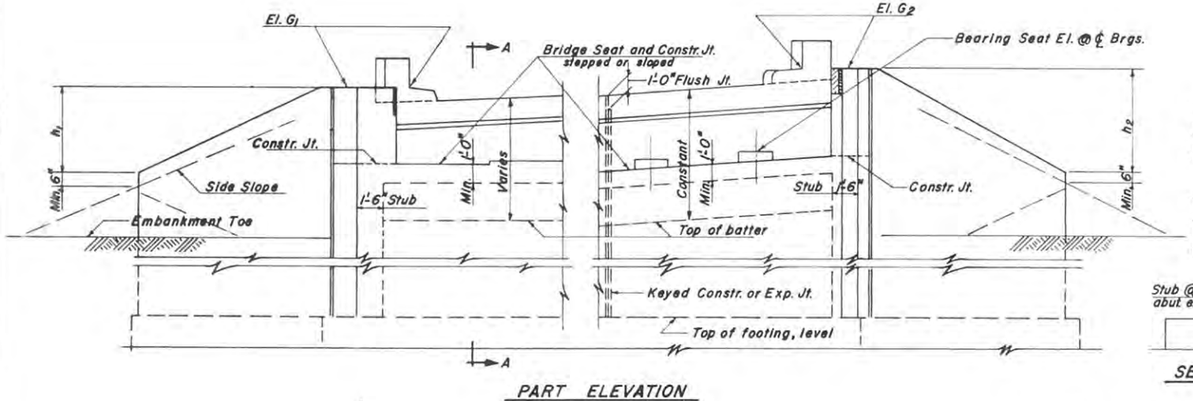


SECTION B-B

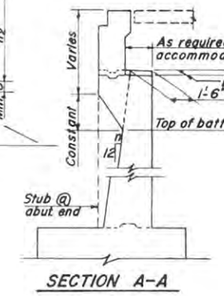


PART PLAN

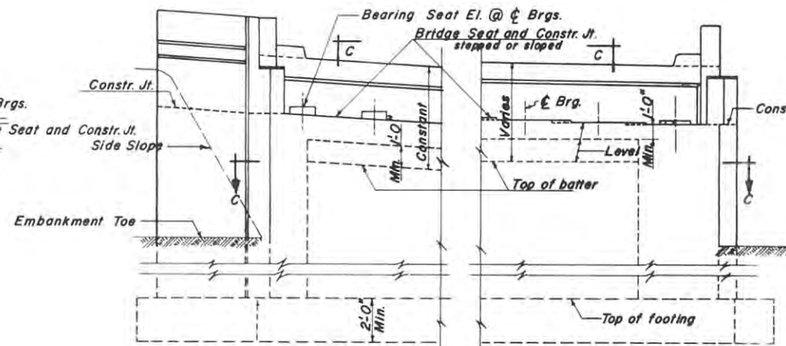
½" Prem. Exp. Jt. Mat'l. on top of cheek wall in contact with superstructure.



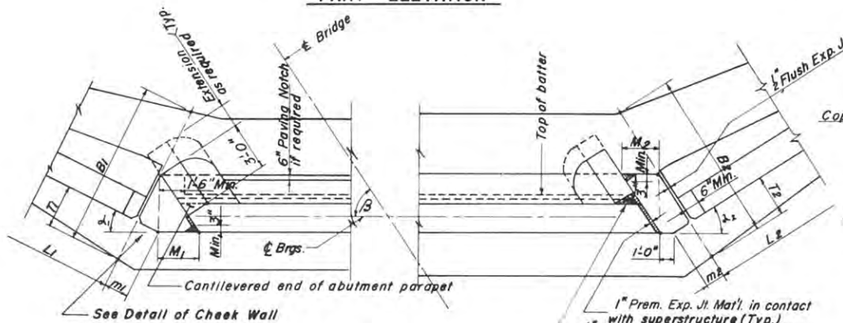
PART ELEVATION



SECTION A-A



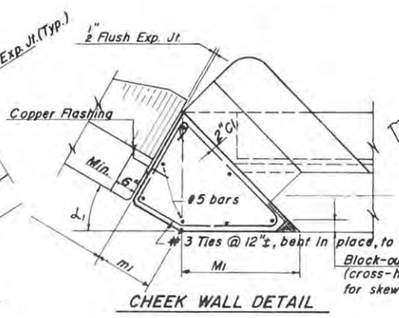
PART ELEVATION



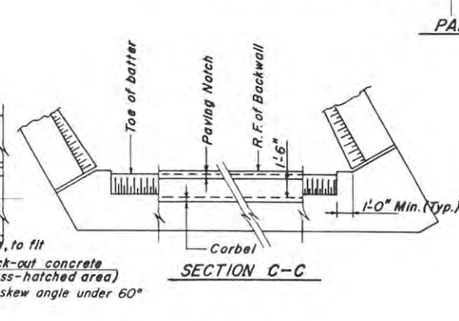
PART PLAN
For Skew angle β < 75°

FLARED WINGS

1" Prem. Exp. Jt. Mat'l. in contact with superstructure (Typ.)
½" Prem. Exp. Jt. Mat'l. on top of abutment for cantilevered end of deck parapet.



CHEEK WALL DETAIL



SECTION C-C

U-WINGS

INSTRUCTIONS

- For miscellanous details refer to Std. Dwg. ST-122
- For Wing Walls, Retaining Walls Type II shown on Std. Dwg. ST-123, may be used, when applicable.

By	K.R.P.
Trc.	K.G.F.
Ck'd.	N.H.U.

Approved: FEB. 25, 1965
F. H. Jenon
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
R.C. ABUTMENTS
WITH BACKWALL

LAYOUT AND DETAILS

SHEET 1 OF 2

ST-120

REINFORCED CONCRETE ABUTMENTS WITH BACKWALL

Abutment Type	Height, H, Ft	Batter n	Base B Ft	Toe T Ft	Footing Thickness D Ft	Maximum Design Foundation Pressure Tons Per Sq Ft				REINFORCEMENT BARS																		
						Total Superstructure Load (DL+L.L.) Kips/Ft				F1			F2				F3					F4				F5		
						5.0	7.0	9.0	11.0	Size	Spacing c/c	Length	Size	Spacing c/c	Length	K	Size	Spacing c/c	Length	K	M	Size	Spacing c/c	Length	K	Size	Spacing c/c	Length
I	10	—	6'-0	1'-0	2'-0	1.76	2.10	2.42	2.76	#5	18"	5'-8	#5	18"	6'-9	6'-2	—	—	—	—	—	—	—	—	—	#5	18"	4'-6
	12	—	7'-0	1'-3	2'-0	1.89	2.18	2.48	2.78	│	│	6'-8	#5	18"	8'-9	8'-2	—	—	—	—	—	—	—	—	—	│	│	6'-6
	14	—	8'-0	1'-6	2'-0	2.03	2.29	2.55	2.82	↓	↓	7'-8	#6	18"	11'-0	10'-4	—	—	—	—	—	—	—	—	—	↓	↓	8'-6
	16	—	9'-0	1'-9	2'-0	2.16	2.40	2.64	2.90	#5	18"	8'-8	#5	18"	4'-0	3'-5	#5	18"	10'-3	3'-3	6'-2	—	—	—	—	#5	18"	3'-3
II	18	1	10'-0	2'-0	2'-3	2.33	2.55	2.78	3.00	#6	24"	9'-8	#6	24"	4'-6	3'-10	#6	24"	7'-6	3'-2	2'-8	#7	12"	9'-6	8'-8	#6	24"	4'-0
	20	│	11'-3	2'-3	2'-3	2.46	2.68	2.85	3.05	│	│	10'-11	#6	│	4'-6	3'-10	#7	│	8'-0	3'-7	2'-9	#8	│	5'-6	4'-5	│	│	4'-0
	22	│	12'-9	2'-3	2'-6	2.56	2.75	2.92	3.10	↓	│	12'-5	#6	│	4'-9	4'-1	#8	│	8'-9	3'-11	3'-2	#9	│	6'-3	5'-0	│	│	4'-0
	24	│	14'-0	2'-6	2'-6	2.64	2.78	2.93	3.12	#6	│	13'-8	#7	│	5'-3	4'-5	#8	│	9'-0	3'-8	2'-10	#9	│	6'-3	5'-0	│	│	4'-0
	26	│	15'-3	3'-0	2'-9	2.70	2.81	2.94	3.13	#7	│	14'-11	#7	│	5'-6	4'-8	#9	│	10'-0	4'-4	3'-2	#10	│	7'-0	5'-7	│	│	4'-0
	28	↓	16'-9	3'-6	2'-9	2.74	2.85	3.01	3.15	#7	↓	16'-5	#8	↓	6'-0	4'-11	#10	↓	11'-3	5'-0	3'-9	#10	↓	7'-0	5'-7	↓	↓	4'-0
	30	1	18'-0	4'-0	3'-0	2.78	2.90	3.04	3.17	#8	24"	17'-8	#9	24"	6'-6	5'-3	#10	24"	12'-6	5'-8	4'-4	#11	12"	7'-9	6'-2	#6	24"	4'-0

Abutment Type	Height, H, Ft	REINFORCEMENT BARS																													Approximate Quantities per Ft. Length	
		F6		F7			F8			W1			W2			W3			W4			W5			W6			W10		W11			
		Size	No of Bars	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Approx. Length	Size	No of Bars	Size	No of Bars	Class B Concrete Cu. Yds	Reinforcement Bars Lbs.
I	10	#5	10	#5	18"	5'-8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	#5	18"	6'-0	—	—	—	#4	5	#5	3	0.83	38
	12	│	10	#5	│	6'-8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	│	│	│	—	—	—	│	6	│	4	1.17	44
	14	↓	12	#6	↓	7'-8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	↓	↓	↓	—	—	—	↓	7	↓	5	1.50	53
	16	#5	14	#7	18"	8'-8	—	—	—	#5	18"	10'-6	—	—	—	—	—	—	#5	18"	8'-9	#5	18"	6'-0	—	—	—	#4	9	#5	7	1.83	75
II	18	#5	14	#5	12"	9'-8	#5	12"	6'-0	#6	24"	10'-0	#5	24"	8'-6	—	—	—	#6	24"	10'-6	#6	24"	6'-0	#6	24"	6'-0	#4	10	#5	8	1.73	113
	20	│	16	#5	│	10'-11	#7	│	7'-9	#6	│	12'-0	#5	│	10'-6	#8	12"	8'-9	│	│	12'-6	│	│	│	│	│	│	│	11	│	9	2.00	154
	22	│	18	#5	│	12'-5	#8	│	8'-6	#6	│	13'-9	#6	│	12'-3	#9	│	9'-6	│	│	14'-3	│	│	│	│	│	│	│	12	│	10	2.40	193
	24	│	20	#6	│	13'-8	#9	│	8'-9	#7	│	15'-9	#7	│	13'-3	#9	│	10'-0	│	│	16'-3	│	│	│	│	│	│	│	14	│	12	2.71	229
	26	│	22	#7	│	14'-11	#9	│	9'-0	#7	│	17'-6	#7	│	16'-0	#10	│	12'-0	│	│	18'-0	│	│	│	│	│	│	│	15	│	13	3.15	287
	28	↓	24	#7	↓	16'-5	#10	↓	9'-9	#8	↓	19'-6	#9	↓	16'-6	#10	↓	11'-3	↓	↓	20'-0	↓	↓	↓	↓	↓	↓	↓	16	↓	14	3.79	337
	30	#5	24	#8	12"	17'-8	#10	12"	10'-6	#9	24"	21'-3	#10	24"	18'-6	#11	12"	11'-9	#6	24"	21'-9	#6	24"	6'-0	#6	24"	6'-0	#4	17	#5	15	4.31	406

BACKWALL (5'-0")

Abutment Type	REINFORCEMENT BARS												Approximate Quantities per Ft. Length	
	W7			W8			W9			W10		W11			
	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	No of Bars	Size	No of Bars	Class A A Concrete Cu. Yds	Reinforcement Bars Lbs.
I	#5	18"	6'-0	#5	18"	4'-6	#5	18"	4'-6	#4	5	#5	5	0.28	19
II	#6	24"	6'-0	#6	24"	4'-6	#6	24"	4'-6	#4	5	#5	5	0.28	20

INSTRUCTIONS

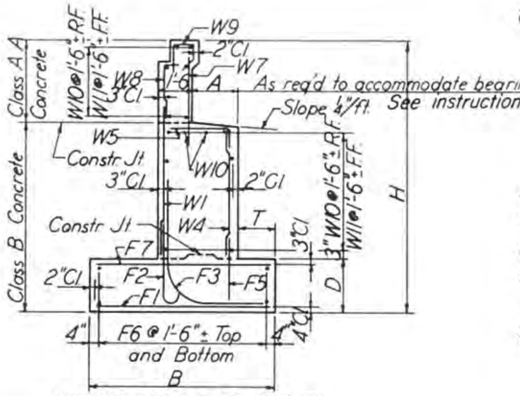
- ○ Maximum Design Foundation Pressure shall be shown on the plan.
- ○ Special design is required for footing on rock, piles or pedestals or for design data other than shown.
- ○ Reinforcement bar details and Quantities are computed using A=2'-0".
- ○ F.F. = Front Face, R.F. = Rear Face, E.F. = Each Face.

DESIGN DATA

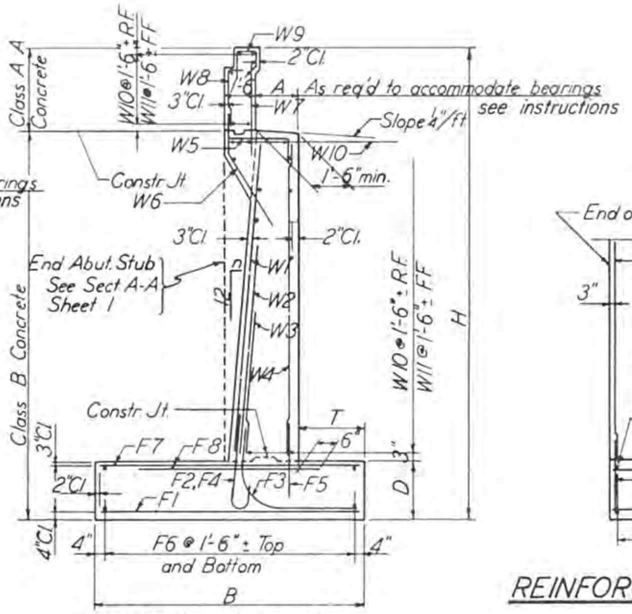
- ○ Coefficient of friction between soil and base = 0.45
- ○ Factor of safety against sliding = 1.50 min.
- ○ Factor of safety against overturning = 2.00 min.
- ○ Weight of backfill material = 120 lbs/cu.ft.
- ○ Weight of concrete = 150 lbs./cu.ft.
- ○ Equivalent fluid earth pressure = 35 lbs./sq.ft. per ft. of depth
- ○ Liveload Surcharge = 2'-0" equivalent fill height.
- ○ Height of Backwall = 5'-0"
- ○ Total horizontal force (traction, friction, wind etc.) per linear ft. of Abutment, applied at bridge seat elevation = 2.25 Kips.

GENERAL NOTES

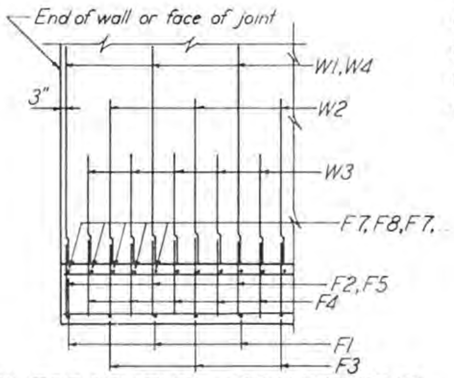
- ○ All materials and workmanship shall be in accordance with PDH Form 408/60.
- ○ Design Specifications: Design Division of 1961 - AASHO "Standard Specifications For Highway Bridges".
- ○ Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for fs=20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 2" except as noted.
- ○ Class AA Concrete shall be used in the backwall. All other concrete shall be Class B, except as noted.
- ○ Abutment backwalls shall not be placed until after Structural Steel and Dams have been erected and deck slab has been placed.
- ○ The Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- ○ Exposed concrete edges shall be chamfered 1"×1" except as noted.
- ○ For miscellaneous details, refer to Std. Dwg. ST-122.



ABUTMENT TYPE I



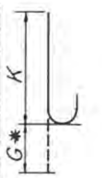
ABUTMENT TYPE II



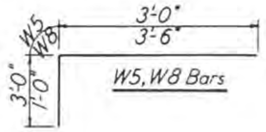
REINFORCEMENT ARRANGEMENT

*Provide hooks when embedment length is less than 30 dia.

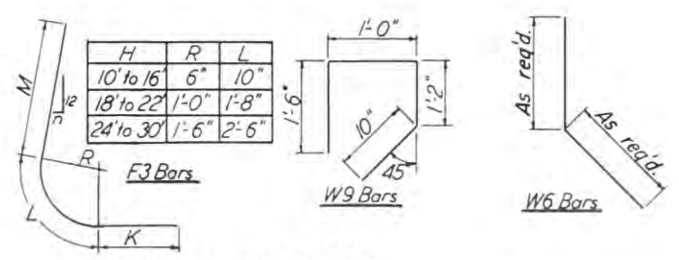
Size	G
#5	7"
#6	8"
#7	10"
#8	1'-1"
#9	1'-3"
#10	1'-7½"
#11	1'-9½"



F2, F4 Dowels



W5, W8 Bars



H	R	L
10' to 16'	6"	10"
18' to 22'	1'-0"	1'-8"
24' to 30'	1'-6"	2'-6"

F3 Bars

W9 Bars

W6 Bars

BENDING DIAGRAMS

Des.	K.R.P.
Trc.	K.G.F.
Ckd.	N.H.U.

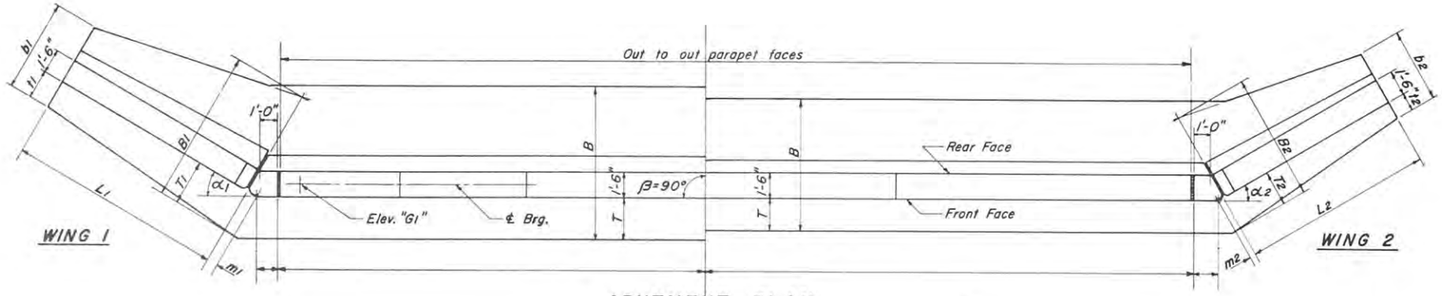
Approved: FEB. 25, 1965
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

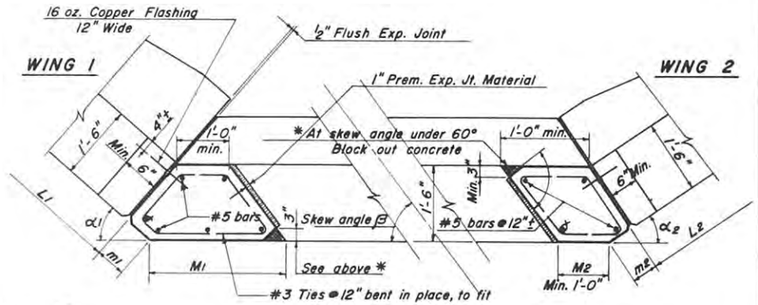
STANDARD

R.C. ABUTMENTS
WITH BACKWALL

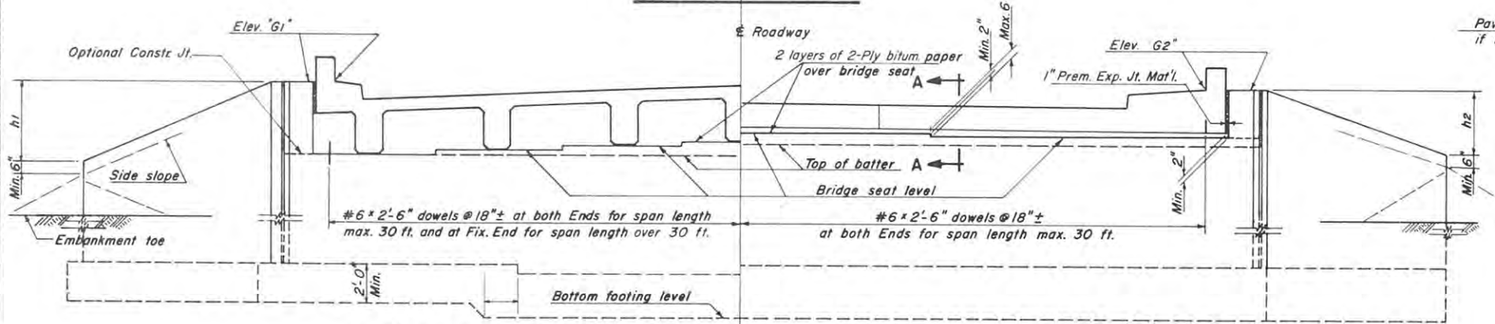
REINFORCEMENT AND DETAILS
SHEET 2 OF 2
ST-120



ABUTMENT PLAN

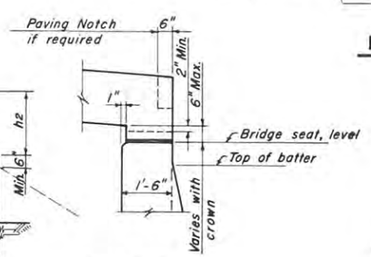


DETAIL OF CHEEK WALLS



R. C. T-BEAM

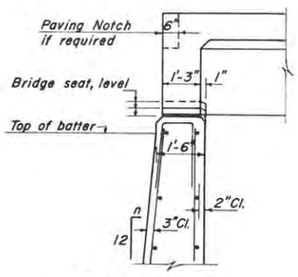
R. C. SLAB



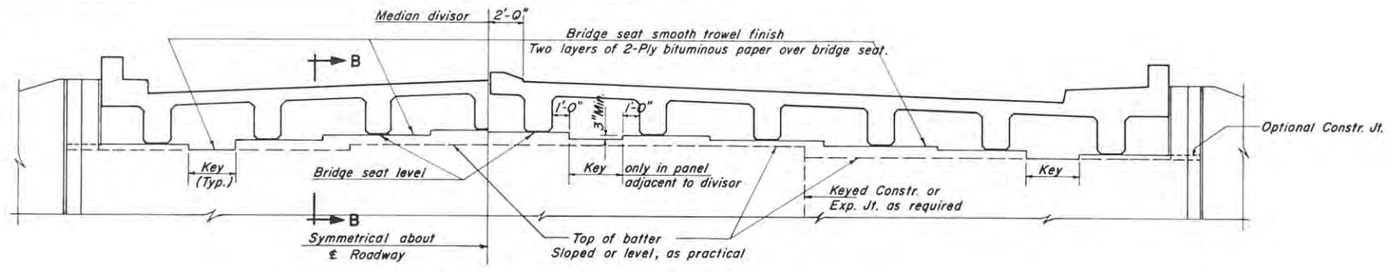
SECTION A-A

INSTRUCTIONS:

- For Miscellaneous Details refer to Standard Drawing ST-122.
- For Wing Walls, Retaining Walls Type II shown on Standard Drawing ST-123, may be used.

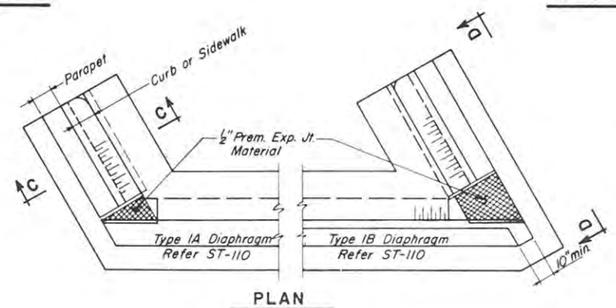


SECTION B-B

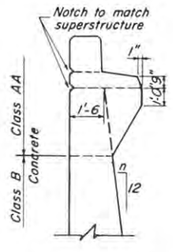


R. C. T-BEAM Expansion End for span length over 30 ft.

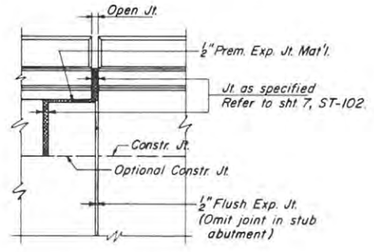
SECTION NEAR ABUTMENT



PLAN
U-WINGS



SECTION C-C



VIEW D-D

By	G.T.V.
Trc.	K.G.F.
Ckd.	K.R.P.

Approved: FEB. 25, 1965

P. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania

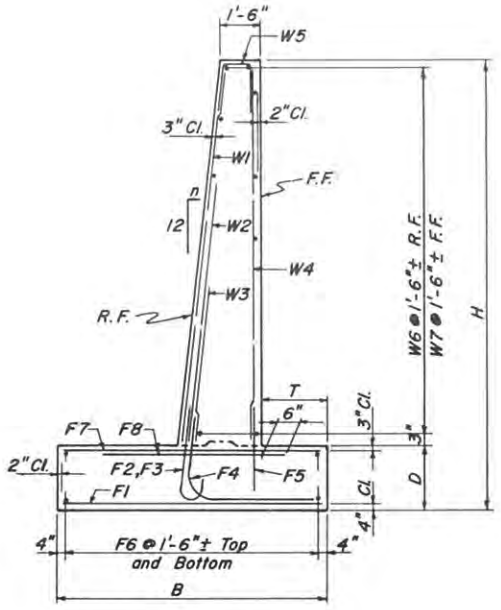
Department of Highways
BRIDGE DIVISION

STANDARD
R. C. ABUTMENTS
WITHOUT BACKWALL
LAYOUT AND DETAILS

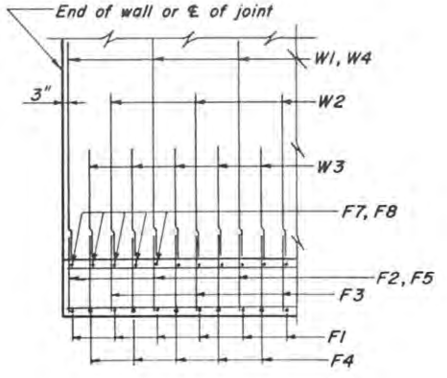
ST-121

Height H, Ft.	Batter n	Base B, Ft.	Toe T, Ft.	Footing Thickness D, Ft.	Maximum Design Foundation Pressure Tons per Sq. Ft.				REINFORCEMENT BARS															
					Total Superstructure load (D.L.+L.L.) Kips/Ft.				F1			F2				F3				F4				
					5.0	7.0	9.0	11.0	Size	Spacing c/c	Length	Size	Spacing c/c	Length	K	Size	Spacing c/c	Length	K	Size	Spacing c/c	Length	K	M
10	1	7-9	1-9	2-0	1.68	1.95	2.22	2.48	#5	18"	7-5	#6	18"	10-0	9-5	#6	18"	7-3	6-7	—	—	—	—	—
12		8-9	2-0	2-0	1.90	2.15	2.40	2.72	#6	18"	8-5	#6	18"	4-3	3-7	#7	18"	9-6	8-8	—	—	—	—	—
14		9-6	2-0	2-0	2.12	2.34	2.59	2.83	#7	18"	9-2	#7	18"	4-9	3-11	#8	18"	9-9	8-8	—	—	—	—	—
16		10-3	2-3	2-0	2.42	2.65	2.88	3.10	#7	18"	9-11	#7	18"	5-3	4-2	#9	18"	5-3	4-2	—	—	—	—	—
18		11-6	2-6	2-3	2.43	2.63	2.33	3.03	#5	12"	11-2	#9	24"	6-9	5-6	#9	24"	6-0	4-9	#5	12"	11-3	3-9	5-10
20		12-9	3-0	2-3	2.65	2.84	3.00	3.15			12-5	#9		6-9	5-6	#10		6-9	5-4	#6		13-3	4-5	7-2
22		13-9	3-6	2-6	2.85	3.00	3.16	3.31			13-5	#10		7-9	6-4	#10		7-0	5-7	#7		16-0	5-1	9-3
24		15-3	4-0	2-6	2.83	2.96	3.10	3.25			14-11	#10		7-9	6-4	#10		7-0	5-7	#8		11-0	5-3	3-3
26		16-6	4-6	2-9	2.80	2.92	3.05	3.18			16-2	#10		8-0	6-7	#10		7-3	5-10	#9		12-3	5-11	3-10
28	↓	17-9	5-0	2-9	2.75	2.87	2.98	3.10	↓	↓	17-5	#10	↓	8-0	6-7	#10	↓	7-3	5-10	#10	↓	13-6	6-7	4-5
30	1	19-0	5-6	3-0	2.70	2.81	2.91	3.02	#5	12"	18-8	#10	24"	8-3	6-10	#11	24"	7-9	6-2	#11	12"	14-6	7-3	4-9

Height H, Ft.	REINFORCEMENT BARS																														Approximate Quantities per Ft. Length	
	F5			F6		F7			F8			W1			W2			W3			W4			W5			W6		W7			
	Size	Spacing c/c	Length	Size	No. of Bars	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	Spacing c/c	Length	Size	No. of Bars	Size	No. of Bars	Class B Concrete Cu. Yds.	Reinforcement bars lbs.
10	#5	18"	9-6	#5	12	#5	18"	7-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	#5	18"	7-1	#4	6	#5	6	1.12	62
12	#5	18"	3-3		12	#6	18"	8-5	—	—	—	#6	18"	9-9	—	—	—	—	—	—	#5	18"	9-9		18"			7		7	1.36	82
14	#5	18"	3-3		14	#5	18"	9-2	#6	18"	6-0	#7	18"	11-9	—	—	—	—	—	—	#5	18"	11-9	↓	18"			9		9	1.59	110
16	#5	18"	3-3		14	#6	18"	9-11	#6	18"	6-3	#7	18"	13-9	#9	18"	9-3	—	—	—	#5	18"	13-9	#5	18"			10		10	1.84	132
18	#6	24"	4-0		16	#6	12"	11-2	#6	12"	6-9	#8	24"	15-6	#9	24"	11-3	—	—	—	#6	24"	15-6	#6	24"			11		11	2.21	167
20			4-0		18	#6		12-5	#7		7-3			17-6	#10		13-6	—	—	—			17-6					12		12	2.53	205
22			4-0		20	#6		13-5	#7		8-0			19-3	#10		15-3	—	—	—			19-3					14		14	2.94	241
24			4-0		22	#8		14-11	#8		8-3			21-3	#10		17-3	#8	12"	10-0			21-3					15		15	3.32	303
26			4-0		22	#8		16-2	#9		8-9			23-0	#10		19-0	#9		12-0			23-0					16		16	3.80	353
28	↓	↓	4-0	↓	24	#9	↓	17-5	#10	↓	8-9	↓	↓	25-0	#10	↓	21-0	#10	↓	14-3	↓	↓	25-0	↓	↓	↓	↓	17	↓	17	4.19	427
30	#6	24"	4-0	#5	26	#10	12"	18-8	#10	12"	9-0	#8	24"	26-9	#11	24"	22-9	#11	12"	14-6	#6	24"	26'-9	#6	24"	7-1	#4	19	#5	19	4.73	510



TYPICAL SECTION



REINFORCEMENT ARRANGEMENT

DESIGN DATA

- Coefficient of friction between soil and base = 0.45.
- Factor of safety against sliding = 1.50 minimum.
- Factor of safety against overturning = 2.00 minimum.
- Weight of backfill material = 120 lbs./cu. ft.
- Weight of concrete = 150 lbs./cu. ft.
- Equivalent fluid earth pressure = 35 lbs./sq. ft. per foot of depth.
- Depth of Surcharge = 5'-0" (3 ft. Superstructure and 2 ft. live load Surcharge).
- Total horizontal force (traction, friction, wind, etc.) per linear ft. of Abutment, applied at bridge seat elevation = 2.25 Kips.

INSTRUCTIONS

- Maximum Design Foundation Pressure shall be shown on the plan.
- Special design is required for footing on rock, piles or pedestals or for design data other than shown.
- F.F. = Front Face, R.F. = Rear Face, E.F. = Each Face.

GENERAL NOTES

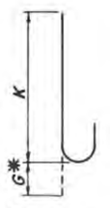
- All materials and workmanship shall be in accordance with PDH Form 408/60.
- Design Specifications: Design Division of 1961 - AASHO "Standard Specification For Highway Bridges."
- Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for fs = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 2" except as noted.
- All Concrete shall be Class B.
- The Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- For miscellaneous details, refer to Standard Drawing ST-122.

Approved: FEB. 25, 1965
K H Jensen
Bridge Engineer

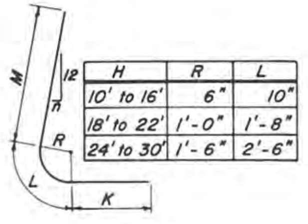
BENDING DIAGRAMS

✱ Provide hooks when embedment length is less than 30 Dia.

Size	G
#5	7"
#6	8"
#7	10"
#8	1'-1"
#9	1'-3"
#10	1'-7½"
#11	1'-9½"

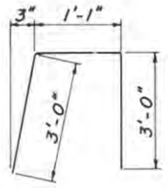


F2, F3 DOWELS



H	R	L
10' to 16'	6"	10"
18' to 22'	1'-0"	1'-8"
24' to 30'	1'-6"	2'-6"

F4 BARS



W5 BARS

Des.	N.H.U.
Trc.	K.G.F.
Ckd.	K.R.P.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

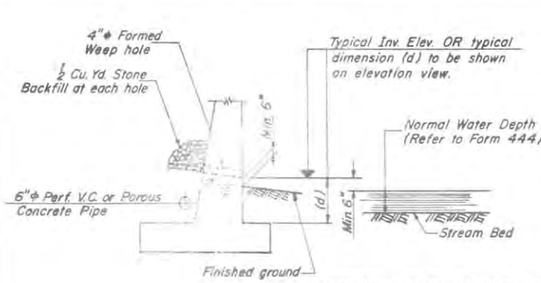
STANDARD

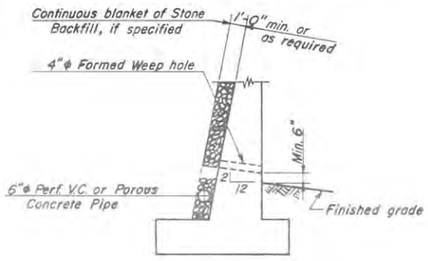
R.C. ABUTMENTS
WITHOUT BACKWALL
REINFORCEMENT AND DETAILS

SHEET 2 OF 2

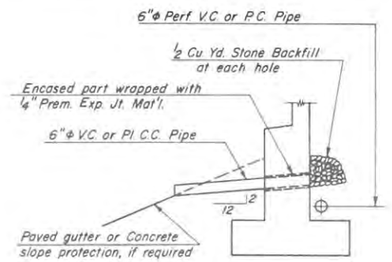
ST-121

SUBSTRUCTURE DRAINAGE





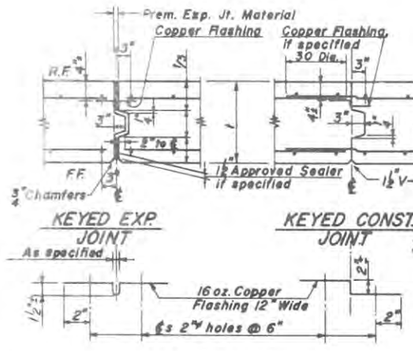
ABUTMENT, WING & RETAINING WALLS

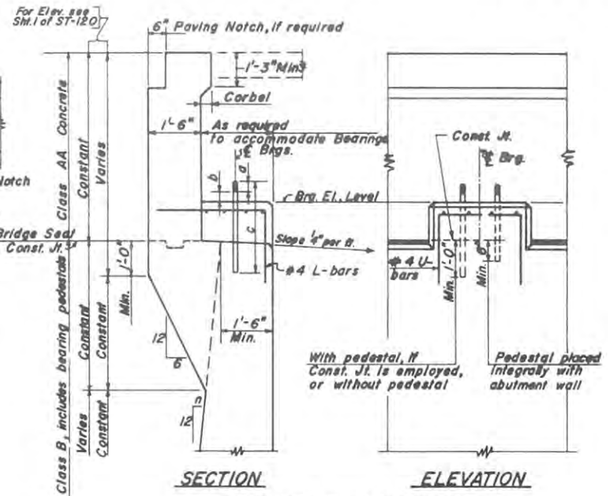


STUB ABUTMENT IN CUT

INSTRUCTION I

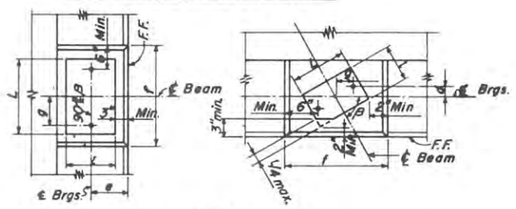
- Weep holes shall be used if discharge at front of wall is not objectionable, otherwise pipe shall be used.
- Spacing of weep holes shall not exceed fifteen (15) feet.
- Continuous blankets of stone backfill may be used in conjunction with weep holes or pipes when applicable (surface drainage, railroad bridges, etc).
- Pipe shall be sloped minimum ⅛" per foot.
- Pipes when used to collect water at the rear of abutments, wing walls and retaining walls, shall be shown on a plan view of the bridge drawings, and the quantity shall appear in the Estimated Bridge Quantities.
  Pipes (Underdrain Outlets) from limits (face or end of wall) of structures, carrying drainage collected from the rear of abutments, wing walls and retaining walls, to highway drainage system shall be shown on a plan view of the bridge drawings and also on the roadway plans. These pipes shall be identified on the bridge drawings as a Roadway Pay Item. For details see Sketch "X" below.
  However, pipes encased in concrete walls or extending beyond the front face of stub abutments and discharging into a ditch or onto a paved slope shall be included in the Estimated Bridge Quantities.
- 6"ϕ Perf. V.C. or P.C. Pipe = 6"ϕ Perforated Vitrified Clay or Porous Concrete Pipe.
- 6"ϕ V.C. or Pl. C.C. Pipe = 6"ϕ Vitrified Clay or Plain Cement Concrete Pipe.





SECTION ELEVATION

ABUTMENT WITH BACKWALL



BRIDGE SEAT PLAN

INSTRUCTION II

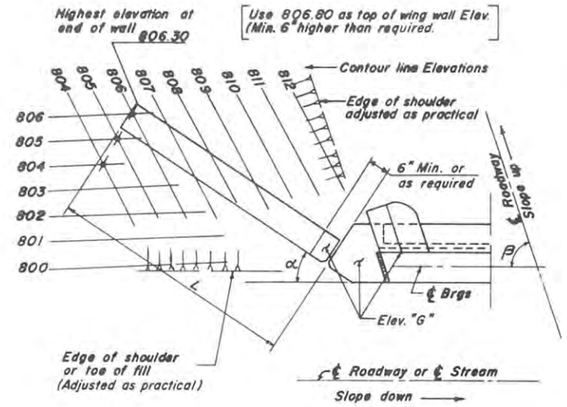
- Keyed joints in top of exposed wall shall be flush to a depth of one foot.
- Provide Construction Joints at approx. 30 ft.
- Provide Expansion Joints at approx. 90 ft.
- Flush Expansion Joint similar to Keyed Expansion Joint, except omit key.
- Copper flashing shall be stopped one foot from top of wall.
- Provide slots in copper flashing when necessary to accomodate reinforcement bars.

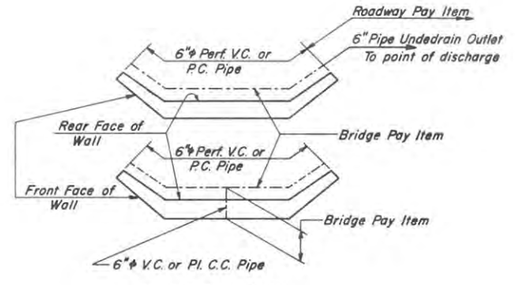
INSTRUCTION III

- Skew angle (β), dimensions a, b, c, d, e, f, g, L and l shall be shown on the plans.
- Concrete in Bearing Pedestals may be Class AA, but shall be paid for as Class B.
- Bearing Pedestals of depth over 4" shall be provided with grillage reinforcement, as shown above.
- Bridge seat may be stepped or sloped, as practical.

LENGTH OF WING WALLS

In general, wing walls shall be of sufficient length to retain the roadway embankment to the required extent and to furnish protection against erosion. Wing wall lengths shall be computed using the actual condition at the site. The following method is proposed here to compute the required lengths.





SKETCH "X"

Approved: FEB. 25 1965

F. H. Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD R.C. ABUTMENTS

MISCELLANEOUS DETAILS

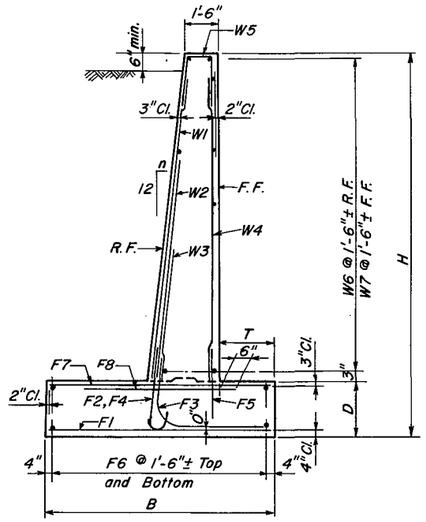
Des.	G.T.V.
Trc.	F.F.F.
Ckd.	KRP/SSS

SHEET 1 OF 1

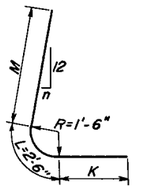
ST-122

REINFORCED CONCRETE RETAINING WALLS

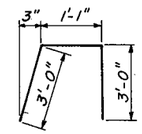
Height H, Ft.	Batter n	Base B, Ft.	Toe T, Ft.	Footing Thickness D, Ft.	Maximum Design Foundation Pressure, T/sf.	REINFORCEMENT BARS F1 Size	F1 Spacing c/c	F1 Length	F2 Size	F2 Spacing c/c	F2 Length	F2 K	F3 Size	F3 Spacing c/c	F3 Length	F3 K	F3 M	F4 Size	F4 Spacing c/c	F4 Length	F4 K	F5 Size	F5 Spacing c/c	F5 Length	F6 No. of Bars	F7 Size	F7 Spacing c/c	F7 Length	F8 Size	F8 Spacing c/c	F8 Length	W1 Size	W1 Spacing c/c	W1 Length	W2 Size	W2 Spacing c/c	W2 Length	W3 Size	W3 Spacing c/c	W3 Length	W4 Size	W4 Spacing c/c	W4 Length	W5 Size	W5 Spacing c/c	W5 Length	W6 No. of Bars	W7 No. of Bars	Approximate Quantities per Lin. Ft. of Wall: Class B Concrete Cu. Yds.	Reinforcement bars lbs.
TYPE I RETAINING WALLS FOR LEVEL FILL																																																		
10	1	5-3	1-0	2-0	1.03	#5	18"	4-11	#5	18"	9-5	9-5	—	—	—	—	—	—	—	—	—	#5	18"	9-5	#5	8	#5	18"	4-11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	#5	18"	7-1	#4	6	#5	6	0.93	44
12		6-6	1-3	2-0	1.20			6-2	#5		3-3	3-3	—	—	—	—	—	—	—	—	—			3-3	10	#5		6-2	—	—	—	—	—	—	#5	18"	9-9									7		7	1.19	54
14		7-6	1-3	2-0	1.38			7-2	#5		3-3	3-3	—	—	—	—	—	—	—	—	—			3-3	12	#5		7-2	#5	18"	4-6			11-9	—	—	—	—	—	—	#5	18"	9-9						9		9	1.44	67
16		8-6	1-6	2-0	1.59			8-2	#6		4-3	3-7	—	—	—	—	—	—	—	—	—			3-3	12	#5		8-2	#5		5-6			13-9	—	—	—	—	—	—			13-9						10		10	1.71	75
18		9-6	1-6	2-3	1.80			9-2	#5		3-3	3-3	—	—	—	—	—	#5	18"	6-2	6-2			3-3	14	#5		9-2	#6		6-6			15-6	—	—	—	—	—	—			15-6						11		11	2.05	92
20		10-3	1-6	2-3	2.07			9-11	#5		3-3	3-3	—	—	—	—	—	#7		9-6	8-8			3-3	14	#6		9-11	#7		7-6			17-6	—	—	—	—	—	—			17-6						12		12	2.23	110
22		11-3	1-9	2-6	2.35			10-11	#5		3-3	3-3	—	—	—	—	—	#8		11-6	10-5			3-3	16	#6		10-11	#8		8-3			19-3	—	—	—	—	—	—			19-3						14		14	2.71	132
24		12-3	1-9	2-6	2.61	#5	18"	11-11	#5	18"	3-3	3-3	—	—	—	—	—	#9	18"	6-3	5-0	#5	18"	3-3	18	#8	18"	11-11	#9	18"	8-9	#5	18"	21-3	#9	18"	10-6	—	—	—	—	—	—	#5	18"	21-3	#5	18"			15		15	3.04	172
26		13-6	2-0	2-9	2.78	#6	24"	13-2	#6	24"	4-0	4-0	#5	24"	8-6	3-6	2-6	#8	12"	6-0	4-11	#6	24"	4-0	18	#6	12"	13-2	#8	12"	9-3	#6	24"	23-0	#5	24"	12-3	#8	12"	9-0	#6	24"	23-0	#5	24"			16		16	3.50	198
28		14-9	2-3	2-9	2.92	#6	24"	14-5	#6	24"	4-0	4-0	#5	24"	9-0	4-0	2-6	#9	12"	6-6	5-3	#6	24"	4-0	20	#8	12"	14-5	#9	12"	9-9	#6	24"	25-0	#5	24"	14-3	#9	12"	11-3	#6	24"	25-0	#5	24"			17		17	3.88	255
30	1	16-0	2-6	3-0	2.98	#6	24"	15-8	#6	24"	4-0	4-0	#5	24"	9-6	4-3	2-9	#10	12"	7-6	6-1	#6	24"	4-0	#5	22	#8	12"	15-8	#10	12"	10-6	#6	24"	26-9	#5	24"	16-0	#10	12"	13-3	#6	24"	26-9	#5	24"	7-1	#4	19	#5	19	4.40	310
TYPE II RETAINING WALLS FOR LEVEL FILL WITH 2 FOOT SURCHARGE																																																		
10	1	6-3	1-0	2-0	1.13	#5	18"	5-11	#5	18"	9-5	9-5	—	—	—	—	—	—	—	—	—	#5	18"	9-5	#5	10	#5	18"	5-11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	#5	18"	7-1	#4	6	#5	6	1.00	47
12		7-3	1-3	2-0	1.26			6-11	#5		3-3	3-3	—	—	—	—	—	—	—	—	—			3-3	12	#5		6-11	—	—	—	—	—	—	#5	18"	9-9	—	—	—	—	—	—	#5	18"	9-9			7		7	1.25	57
14		8-6	1-3	2-0	1.45			8-2	#6		4-3	3-7	—	—	—	—	—	—	—	—	—			3-3	12	#5		8-2	#5	18"	5-3			11-9	—	—	—	—	—	—			11-9						9		9	1.52	70
16		9-6	1-6	2-0	1.70			9-2	#5		3-3	3-3	—	—	—	—	—	#6	18"	6-9	6-1.			3-3	14	#5		9-2	#7		6-3			13-9	—	—	—	—	—	—			13-9						10		10	1.78	89
18		10-6	1-6	2-3	2.05			10-2	#5		3-3	3-3	—	—	—	—	—	#7		9-3	8-5			3-3	16	#5		10-2	#8		7-0			15-6	—	—	—	—	—	—			15-6						11		11	2.13	107
20		11-6	1-6	2-3	2.33			11-2	#6		4-0	4-0	—	—	—	—	—	#8		11-6	10-5			3-3	16	#7		11-2	#9		7-9	#5		17-6	—	—	—	—	—	—			17-6						12		12	2.43	135
22		12-6	1-9	2-6	2.55			12-2	#6		4-0	4-0	—	—	—	—	—	#9		6-3	5-0			3-3	1?	#7		12-2	#10		8-6	#6		19-3	#9	18"	10-3	—	—	—	—	—	—			19-3						14		14	2.82	174
24		13-6	1-9	2-6	2.70	#5	18"	13-2	#7	18"	5-3	4-5	—	—	—	—	—	#10	18"	7-0	5-7	#5	18"	3-3	1?	#9	18"	13-2	#11	18"	9-0	#6	18"	21-3	#10	18"	12-9	—	—	—	—	—	—	#5	18"	21-3	#5	18"			15		15	3.16	223
26		14-9	2-0	2-9	2.83	#6	24"	14-5	#6	24"	4-0	4-0	#6	24"	9-0	3-6	3-0	#9	12"	6-6	5-3	#6	24"	4-0	2?	#8	12"	14-5	#9	12"	9-9	#6	24"	23-0	#6	24"	13-9	#9	12"	11-3	#6	24"	23-0	#5	24"			16		16	3.62	272
28		16-0	2-6	2-9	2.90	#6	24"	15-8	#6	24"	4-0	4-0	#6	24"	9-9	4-3	3-0	#10	12"	7-3	5-10	#6	24"	4-0	2?	#9	12"	15-8	#10	12"	10-3	#6	24"	25-0	#6	24"	15-9	#10	12"	13-3	#6	24"	25-0	#5	24"			17		17	4.01	318
30	1	17-6	2-9	3-0	2.97	#6	24"	17-2	#6	24"	4-0	4-0	#7	24"	10-6	4-6	3-6	#11	12"	8-0	6-5	#6	24"	4-0	#5	24	#9	12"	17-2	#11	12"	11-0	#6	24"	26-9	#7	24"	17-9	#11	12"	13-9	#6	24"	26-9	#5	24"	7-1	#4	19	#5	19	4.56	384



TYPICAL SECTION

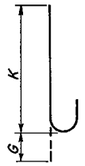


F3 Bars



W5 Bars

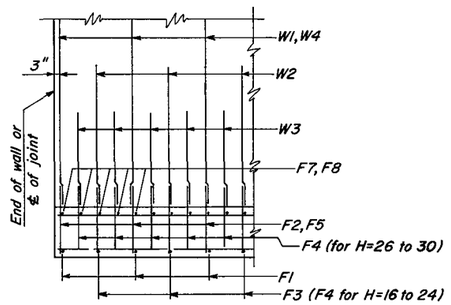
Size	G
#6	8"
#7	10"
#8	1'-1"
#9	1'-3"
#10	1'-7½"
#11	1'-9½"



Provide hooks when embedment length is less than 30 diameters.

F2, F4 Dowels

BENDING DIAGRAMS



REINFORCEMENT ARRANGEMENT

DESIGN DATA

- Coefficient of friction between soil and base = 0.45
- Factor of safety against sliding = 1.50 min.
- Factor of safety against overturning = 2.00 min.
- Weight of backfill material = 120 lbs./cu. ft.
- Weight of concrete = 150 lbs./cu. ft.
- Equivalent fluid earth pressure = 35 lbs./sq. ft. per foot of depth.

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60.
- Design Specifications: Design Division of 1961-AASHO "Standard Specification For Highway Bridges."
- Reinforcement bars shall be of intermediate or hard grade or rail steel, designed for fs = 20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 Dia. and minimum cover shall be 2" except as noted.
- All Concrete shall be Class B.
- The Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- Exposed concrete edges shall be chamfered 1"x1" except as noted.
- For miscellaneous details, refer to Std. Dwg. ST-122.

INSTRUCTIONS

- Maximum Design Foundation Pressure shall be shown on the plan.
- Special design is required for footing on rock, piles or pedestals or for design data other than shown.
- Type II wall may be used for wing walls if conditions are similar.
- F.F. = Front Face, R.F. = Rear Face, E.F. = Each Face.

Approved: FEB. 25, 1965
K H Jensen
Bridge Engineer

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD

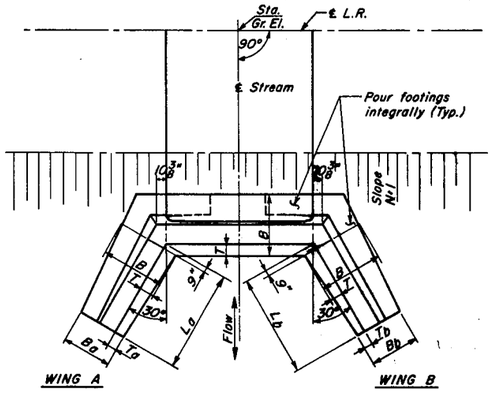
R.C. RETAINING WALLS

Des.	E.L.H.
Trc.	F.F.F.
Ckd.	K.R.P.

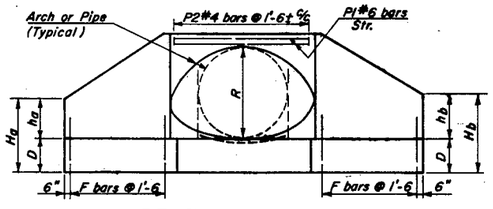
PRD NO. 124

SHEET 1 OF 1

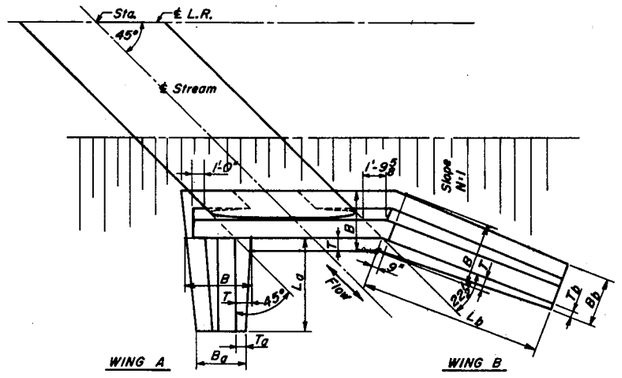
ST-123



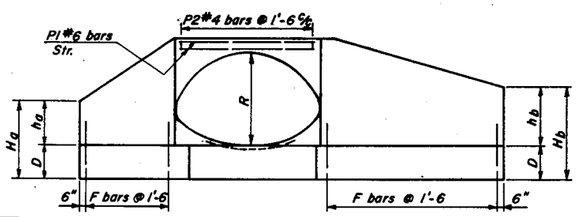
PLAN



DEVELOPED ELEVATION

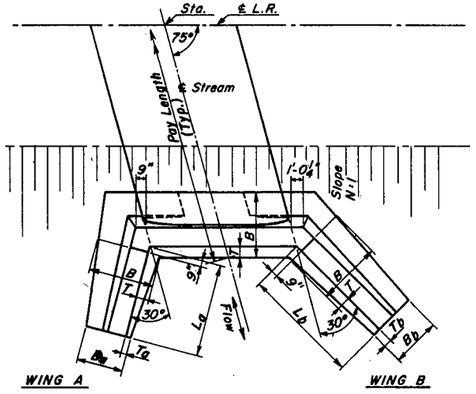


PLAN

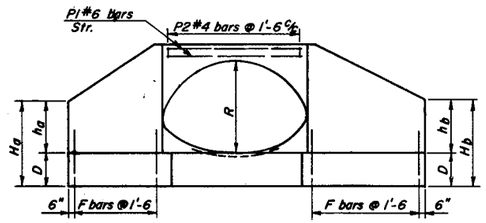


DEVELOPED ELEVATION

Des.	G.T.V.
Trc.	F.F.F.
Ckd.	K.R.P.



PLAN



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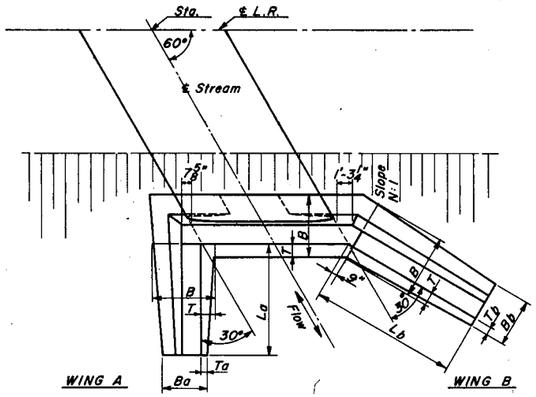
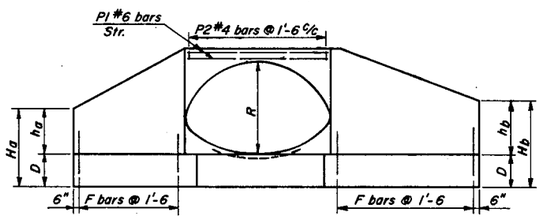
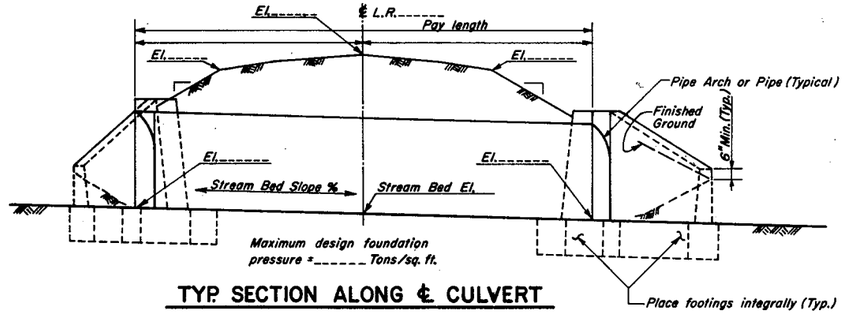


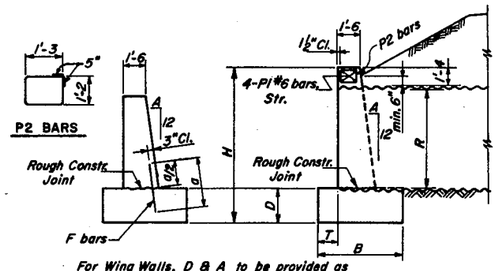
PLAN



DEVELOPED ELEVATION



TYP. SECTION ALONG ℄ CULVERT



For Wing Walls, D & A to be provided as determined for Head Wall "H"

TYP. WING WALL SECTION

TYP. HEAD WALL SECTION

TABLE I

H Ha Hb	A	D	T Ta Tb	B Ba Bb	F - bars Size	F - bars Spc. % Lgth. "a"	Maximum Design Found. Pressure
4'	0	2'-0	6"	3'-6	#5	1'-6 / 3'-6	.55 T/□'
5'			6"	3'-9			.65
6'			6"	4'-0			.75
7'			9"	4'-3			.85
8'			9"	4'-6			.95
9'	0		1'-0	5'-0			1.05
10'	1	2'-0	1'-0	6'-3		3'-6	1.15
11'	1	2'-6	1'-3	6'-9		4'-6	1.20
12'	1		1'-3	7'-3	#5		1.26
13'	2		1'-3	7'-6	#6		1.35
14'	2		1'-3	8'-6			1.45
15'	2	2'-6	1'-6	9'-0		4'-6	1.60
16'	3	3'-0	1'-6	9'-6		5'-0	1.70
17'			1'-6	10'-0			1.90
18'			1'-6	10'-6			2.00
19'			1'-6	11'-0			2.15
20'	3	3'-0	1'-6	11'-6	#6	1'-6 / 5'-0	2.30 T/□'

TABLE II

Normal Roadway Fill Slope N:1	Skew Angle	WING A La	WING A ha	WING B Lb	WING B hb
½:1	90°	1.10 R-.55	.37 R+.82	1.10 R-.55	.37 R+.82
	75°	1.02 R-.51	.34 R+.58	1.24 R-.62	.41 R+1.00
	60°	R-.50	.33 R+.33	1.50 R-.75	.50 R+1.12
	45°	.88 R-.44	.41 R+.29	1.96 R-.98	.50 R+1.17
2:1	90°	1.46 R-.37	.37 R+.78	1.46 R-.37	.37 R+.78
	75°	1.36 R-.34	.34 R+.61	1.66 R-.41	.41 R+.93
	60°	1.33 R-.33	.33 R+.42	2.00 R-.50	.50 R+1.02
	45°	1.17 R-.29	.41 R+.40	2.61 R-.65	.50 R+1.07

GENERAL NOTES

- All materials and workmanship shall be in accordance with PDH Form 408/60.
- Design Specifications: Design Division of 1961- AASHO "Standard Specifications for Highway Bridges.
- Live Load : HS20-44.
- Reinforcement bars shall be of intermediate or hard grade or rail steel designed for fs = 20,000 p.s.i. and detailed in accordance with ACI Code.
- All concrete shall be Class B.
- Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- Chamfer exposed concrete edges 1" x 1" except as noted.

Approved: FEB. 25, 1965

K H Jensen
Bridge Engineer

INSTRUCTIONS

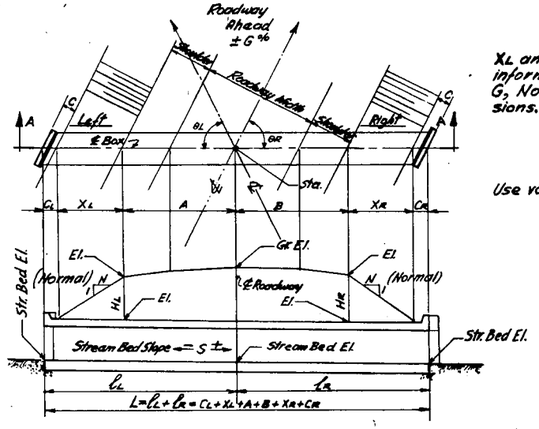
1. Establish H and determine A, B, D and T from table I.
2. Establish La, ha, Lb, hb from table II.
3. Make Ha = ha + D, Hb = hb + D and determine Ba, Bb, Ta and Tb from table I.
4. If bearing capacity of foundation is less than maximum design foundation pressure shown in table I, revise footing as required and check stability of wall.
5. Downstream End-Wall may be omitted if directed by the Engineer.

Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD
END-WALL DETAILS FOR METAL PLATE CULVERTS
SKEWS: 90°-75°-60° & 45°

SHEET 1 OF 1

ST-130



SECTION A-A

To compute the length (L), it is necessary to find the dimensions X_L and X_R. All other dimensions are easy to establish from the following information: Str. Bed El., Gr. El., Skew angle θ, Grade slope of roadway G, Normal slope of fill N:1, Stream Bed slope S, and roadway dimensions.

+G = Grade slope up-ahead
-G = " " down-ahead
+S = Stream bed slope down-toward the right
-S = " " " " " left

Use value of G or S with the proper sign. (Example: G = ± 0.85% ± 0.0085)

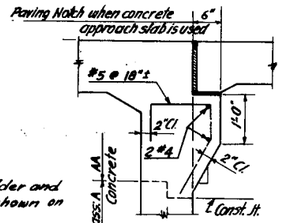
For θ_L: $X_L = \dfrac{N.H_L}{\sin.\theta_L - G.N.\cos.\theta_L + S.N}$

$X_R = \dfrac{N.H_R}{\sin.\theta_L + G.N.\cos.\theta_L - S.N}$

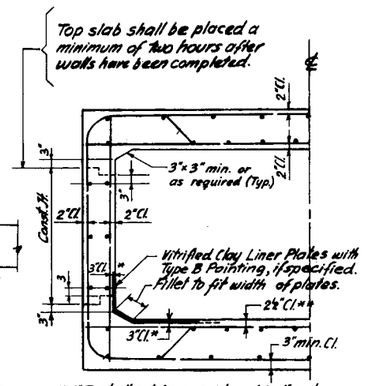
For θ_R: $X_L = \dfrac{N.H_L}{\sin.\theta_R + G.N.\cos.\theta_R + S.N}$

$X_R = \dfrac{N.H_R}{\sin.\theta_R - G.N.\cos.\theta_R - S.N}$

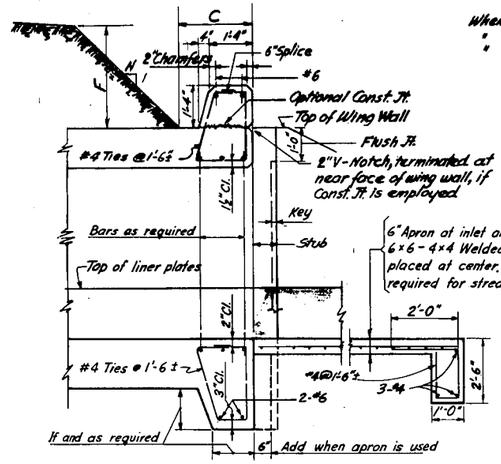
NOTES:
- Dimensions l_L, l_R and Grade, Shoulder and Stream Bed elevations shall be shown on the design drawing.
- The above equations for length are not applicable for culvert under roadway on vertical or horizontal curve.



DETAIL OF BOX AT GRADE

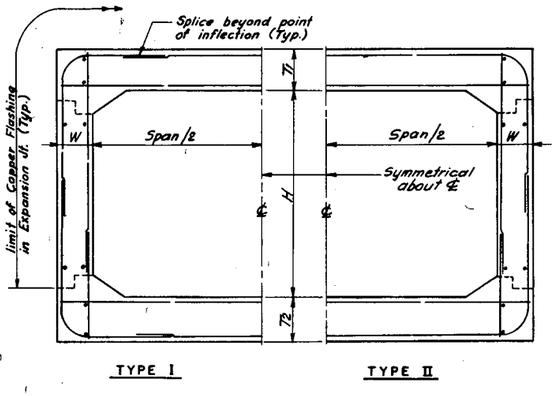


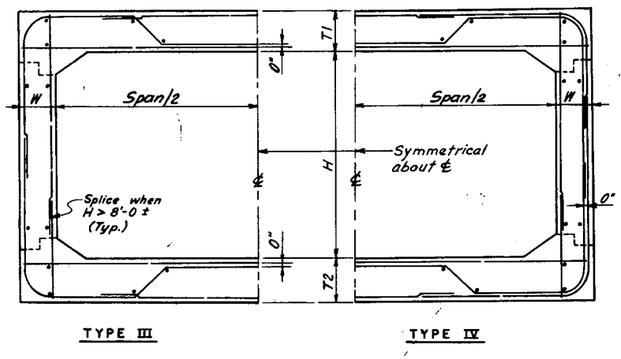
* 1" R shall not be considered in the design of bottom slab and walls.
** ½" (wearing surface) shall not be considered in the design of bottom slab.

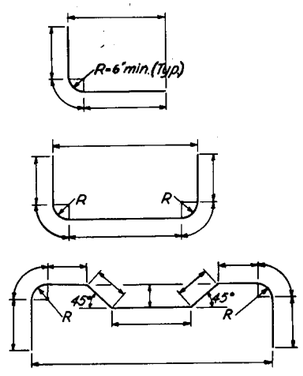


TYPICAL SECTIONS

LENGTH OF CULVERT







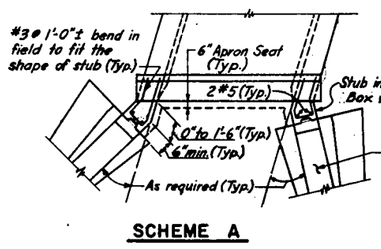
BENDING DIAGRAMS

GENERAL NOTES

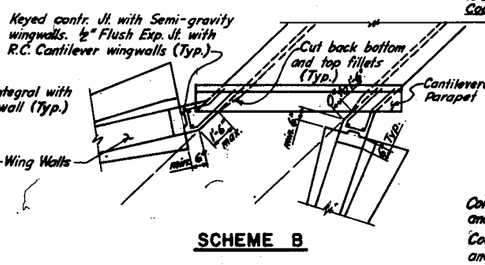
- All materials and workmanship shall be in accordance with PDH Form 408/60.
- Design Specifications: Design Division of 1961 AASHO "Standard Specifications for Highway Bridges."
- Live Load: HS20-44.
- Dead Load includes 30 lbs./sq.ft. for future wearing surface on the top slab of box (For boxes at grade only).
- Reinforcement bars shall be intermediate or hard grade or rail steel designed for f_s=20,000 psi and detailed in accordance with ACI Code. Minimum lap shall be 30 dia. and minimum cover shall be 2" except as noted.
- Class A concrete shall be used in entire box and parapets except Class AA concrete shall be used in top slab (for boxes at grade). Class B concrete shall be used in wingwalls and aprons.
- During placing of the backfill, at no time shall the difference in fill elevation on the sides be greater than two feet.
- During compaction of the backfill, the wheels of roller shall not come closer than one foot from the face of structure.
- Exposed Concrete edges shall be chamfered 1"×1", except as noted.

TYPICAL ARRANGEMENT OF REINFORCEMENT BARS

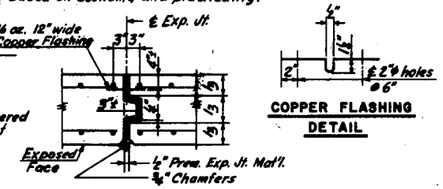
NOTE: Type or combination of types of bar arrangement shown shall be selected based on economy and practicality.



SCHEME A



SCHEME B

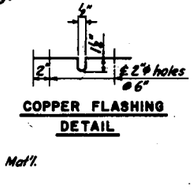


EXPANSION JT. DETAIL

Construction Joint similar, except omit Exp. Jt. Material and Copper Flashing and run bars thru joint.

Contraction Joint similar, except omit Exp. Jt. Material, and Copper Flashing and apply one coat of painted waterproofing to prior pour.

Flush Exp. Jt. similar, except omit key.



COPPER FLASHING DETAIL

INSTRUCTIONS

- The minimum thickness of sidewalls shall be 10" for boxes of vertical clearance up to 5 ft. and 12" for boxes over 5 ft. The minimum thickness of slabs shall be 10".
- Place main reinforcement bars parallel to ℄ roadway for skew angles 75° and more. The spacing of bars shall be measured along ℄ culvert. For skew angles less than 75°, the bars shall be placed normal to ℄ culvert and lengths cut to fit and anchored into edges of top and bottom slabs.
- Provide construction and expansion joints in box approximately at 30' and 90' respectively.
- Semi-gravity wing walls (Std. Dwg. ST-130) shall be used if maximum height (top of wall to bottom of footing) is 12 feet or less. Otherwise R.C. Cantilever wing walls (Std. Dwg. ST-129 Type II Retaining Walls) shall be used.
- Trussed bars shall be used when required to resist diagonal tension if and when economical.

Approved: FEB. 25, 1965

Chief Engineer

Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

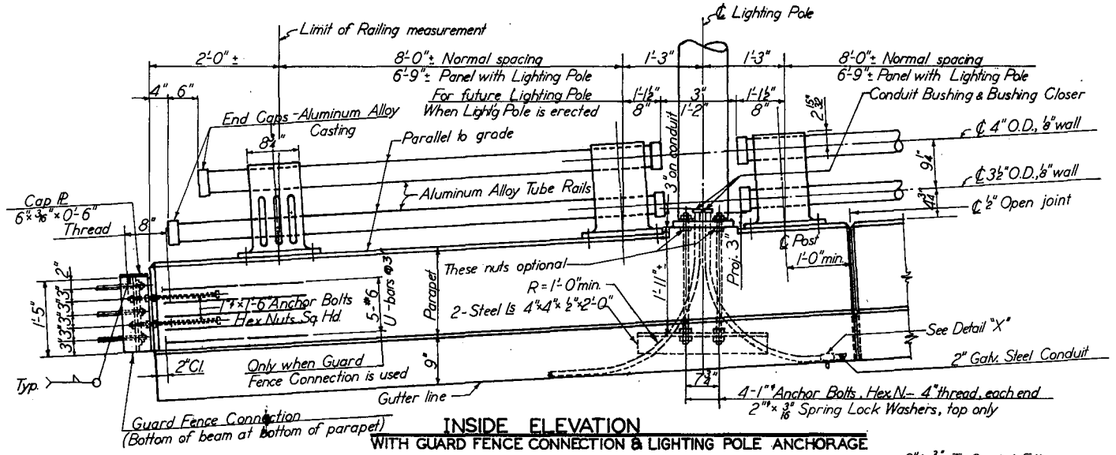
STANDARD
R. C. BOX CULVERTS
GENERAL INFORMATION

DES.	GTV/KRP
TRCD.	F.F.F.
CKD.	B.F.K.

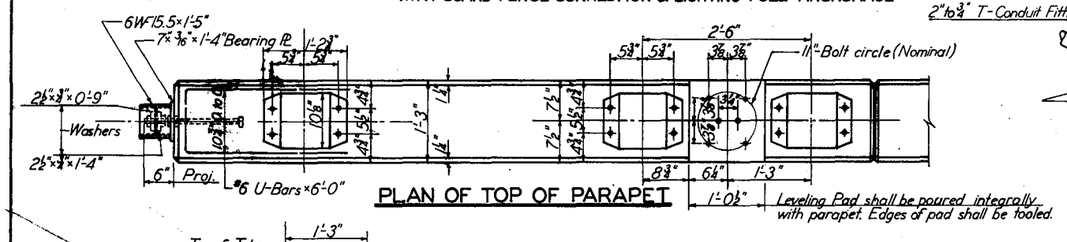
END DETAILS & LAYOUT OF WINGS

SHEET 1 OF 1

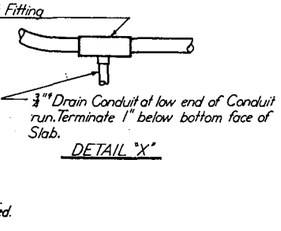
ST-131



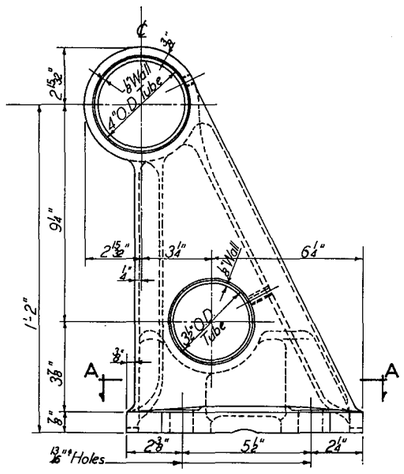
INSIDE ELEVATION
WITH GUARD FENCE CONNECTION & LIGHTING POLE ANCHORAGE



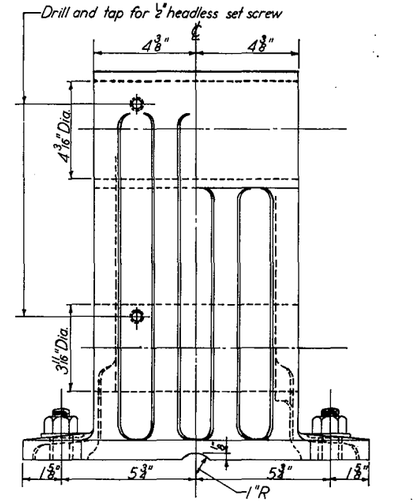
PLAN OF TOP OF PARAPET
Leveling Pad shall be poured integrally with parapet. Edges of pad shall be tooled.



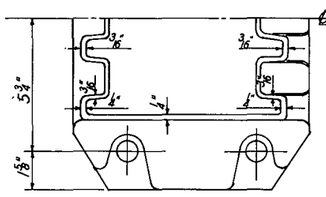
DETAIL "X"



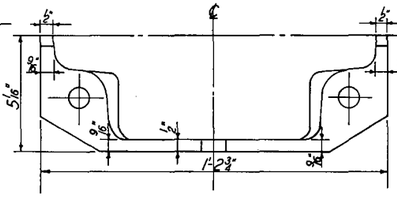
END VIEW



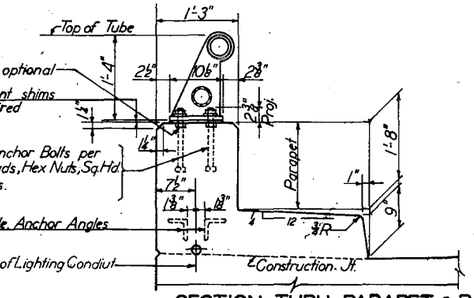
HALF-OUTSIDE VIEW HALF-INSIDE VIEW



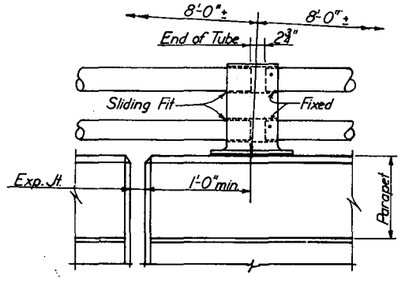
HALF-SECTION A-A



HALF-BOTTOM VIEW



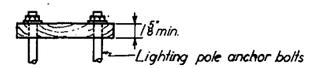
SECTION THRU PARAPET & RAILING



RAILING AT BRIDGE EXPANSION JOINT
FOR EXPANSION MOVEMENT OF MAX. 2"

NOTES

- Materials and workmanship shall be in accordance with PDH Forms 408 and 409.
- Rails, posts, shims, end-caps and set screws shall be Aluminum Alloy.
- Rails shall be parallel to grade and normally two (2) panels long. Joints shall be at centerline of posts with 2" ± clearance, except at expansion joints, and staggered in upper and lower rails.
- Posts and post anchor bolts shall be normal to grade. For spacing of posts and for details of parapet, refer to the specific structural drawings.
- ½" headless set screws at each post for top and bottom rails shall be set to prevent rattling.
- Light'g Poles shall be used only when specified and shall be truly vertical with bases level.
- Materials shall not be painted, except protective wood blocks.
- Aluminum surfaces in contact with concrete or steel shall be thoroughly coated with Caulking Compound conforming to Federal Specification TT-C-598(2).
- Railing shall be measured continuously between centers of end posts and shall include all railing posts, tubes, end caps, anchor bolts with washers and nuts for railing posts and lighting poles, lighting pole anchor angles and protective wood blocks.
- Guard fence connection, when specified, shall include 6WF15.5 beam, cap, bearing plate, anchor bolts, washers and nuts.
- Guard fence connection, railing post anchor materials & lighting pole anchor materials shall conform to ASTM-A36, and shall be galvanized conforming to ASTM-A123 or A153 as applicable, except anchor angles shall not be galvanized.
- After erection and alignment, openings between metal surfaces and concrete shall be sealed with Caulking Compound.
- For future lighting: Conduit, lighting pole anchor bolts, nuts and washers above concrete shall be heavily coated with an approved bituminastic compound and protective wood blocks placed and firmly secured.
- For electrical details not shown, refer to Std. Dwg. ST-145.



PROTECTIVE WOOD BLOCK
Hardwood 11⅞" square

- Protective wood blocks, with holes bored to fit bolt spacing and conduit, shall be painted with two coats of Aluminum paint before installation.

Approved: FEB 25 1965
F. H. Jensen
Bridge Engineer

Approved: FEB 25 1965
L. B. Curtis
Electrical Engineer

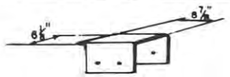
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

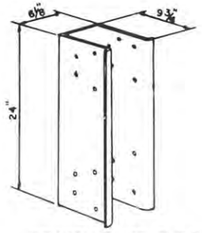
STANDARD
PARAPET WITH
ALUMINUM BRIDGE RAILING
AND
GUARD FENCE CONNECTION

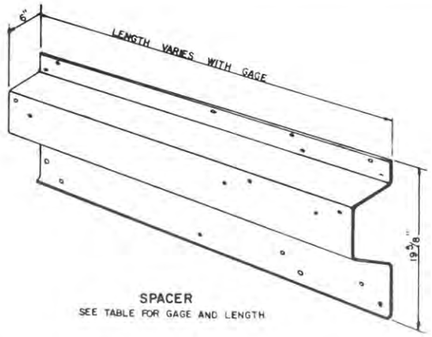
SHEET 1 OF 1

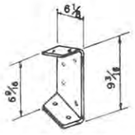
ST-140

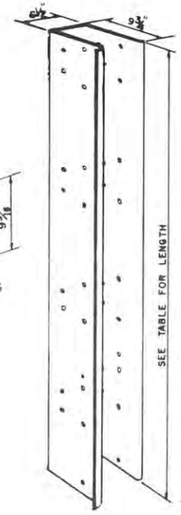
Rev.	G.T.K.
Trcd	K.G.F.
Ckd	B.F.K.

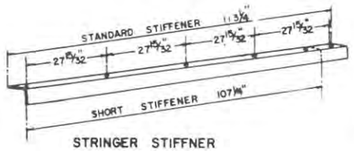


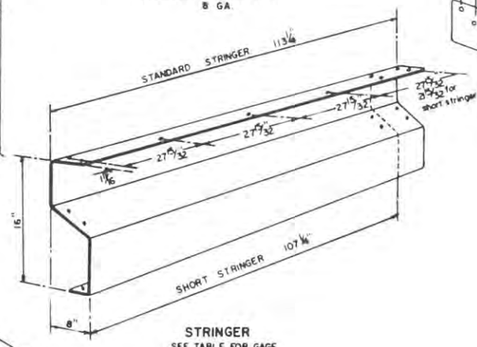


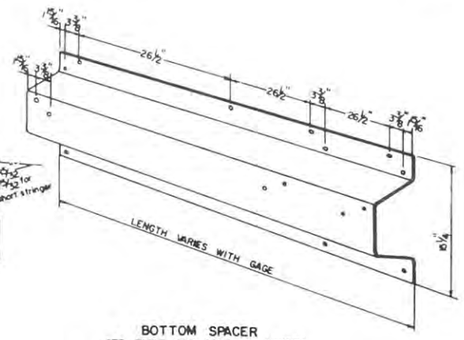


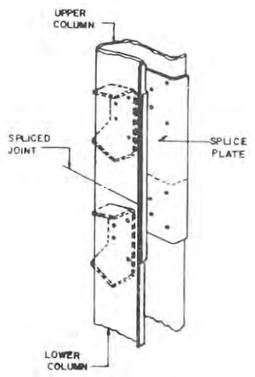


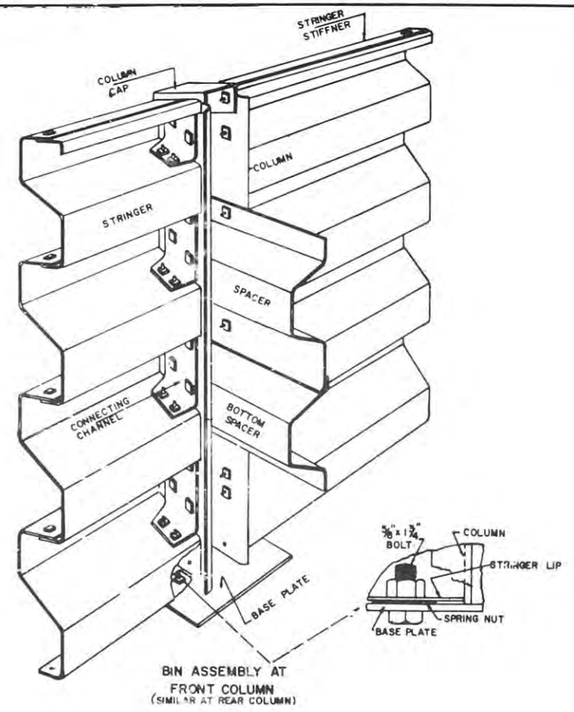


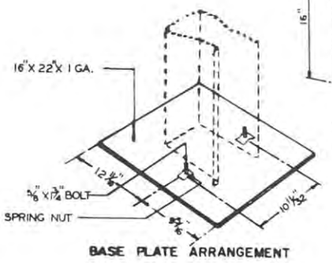




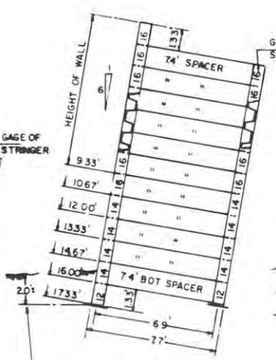


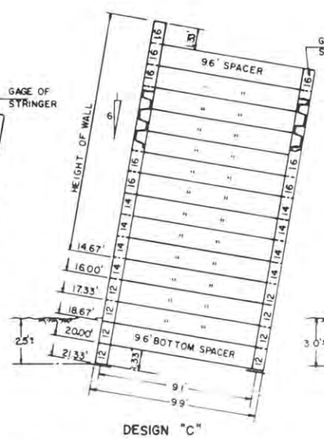


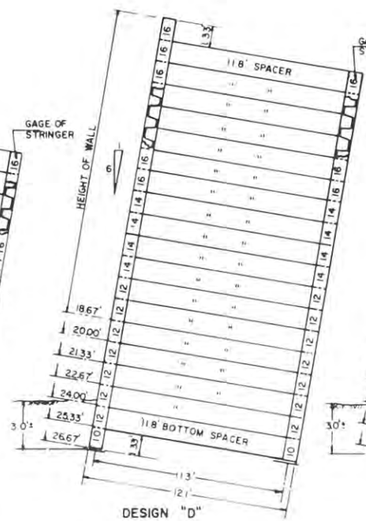


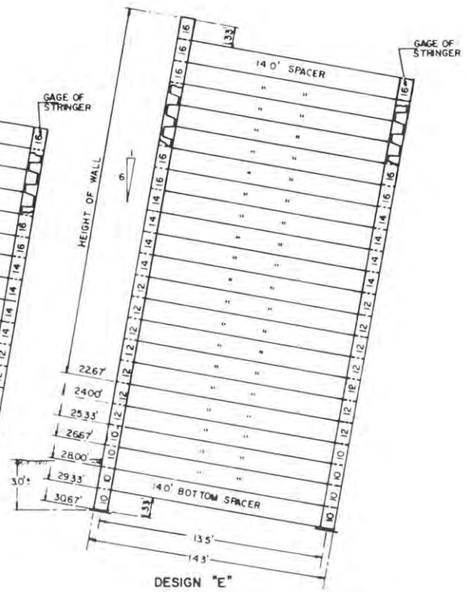


DETAIL OF SPACERS					
DESIGN	A	B	C	D	E
GAGE	16	16	14	12	12
LENGTH	5.2'	7.4'	9.6'	11.8'	14.0'









NOTE : THESE DEPTHS MAY VARY TO SUIT CONDITIONS

GENERAL NOTES:

- All materials and workmanship shall be in accordance with PDH Form 408, Sec. 6.29.
- Metal base plates will be required.

Approved: FEB. 25, 1965

K. H. Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD

METAL CRIBBING-UNCOATED

Rev.	G.T.V.
Trc.	K.G.F.
Ckd.	BFK/HJ

SHEET 1 OF 1

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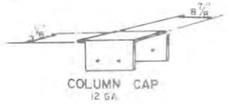
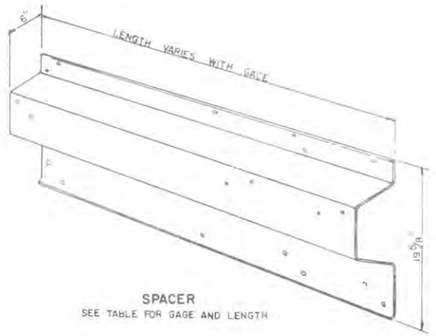
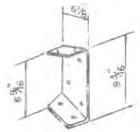
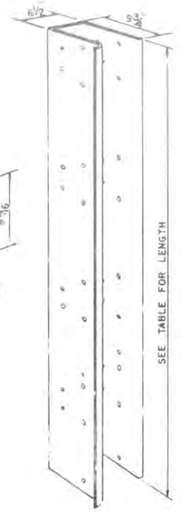
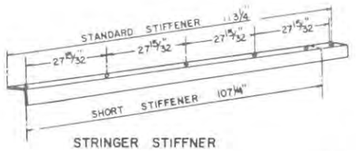
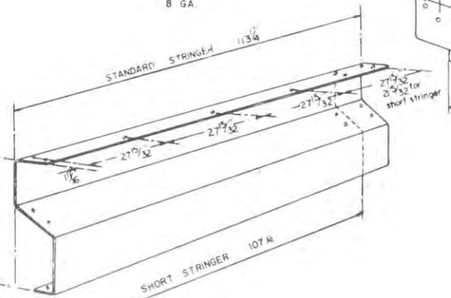


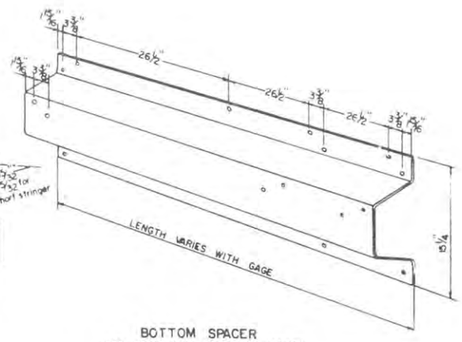


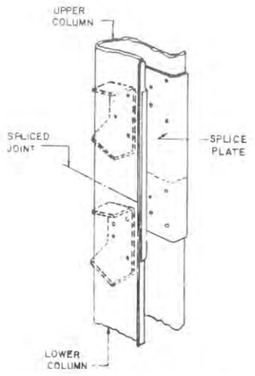


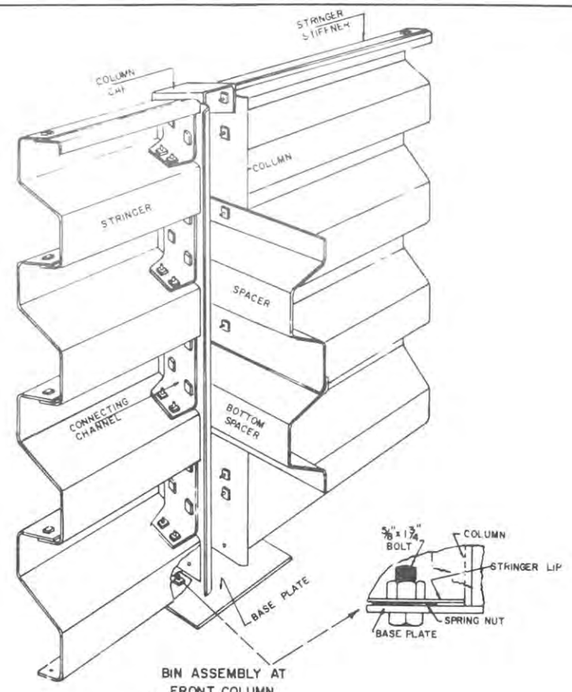


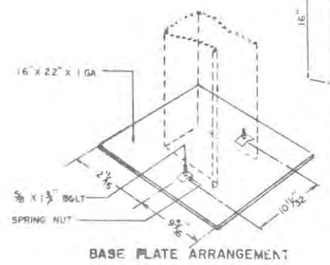




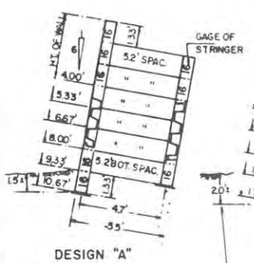


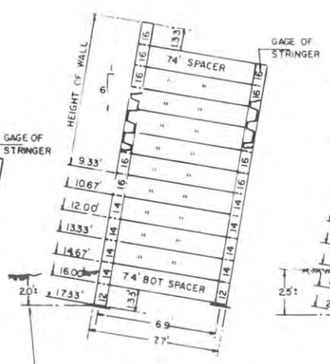


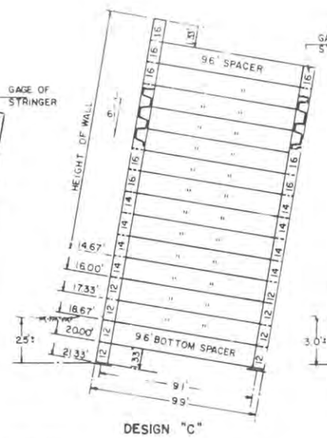


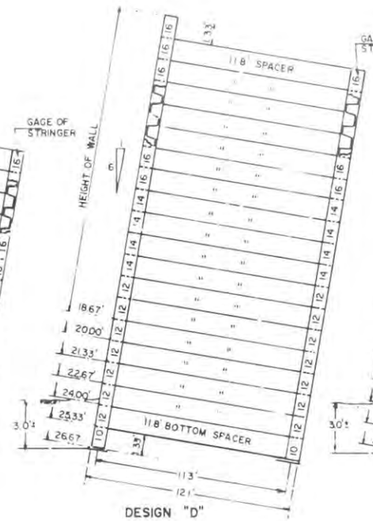


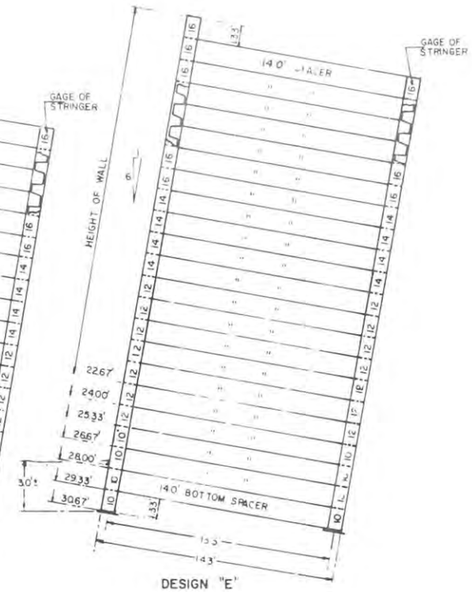
DETAIL OF SPACERS					
DESIGN	A	B	C	D	E
GAGE	16	16	14	12	12
LENGTH	5.2'	7.4	9.6	11.8	14.0











NOTE: THESE DEPTHS MAY VARY TO SUIT CONDITIONS

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Trc.	K.G.F.
Ckd.	BFK/HJ

J. H. WEIL CO., CONSHOHOCKEN

GENERAL NOTES:

- All materials and workmanship shall be in accordance with PDH Form 408, Sec. 6.29
- All exposed interior and exterior metal sheets used to form the members of the closed face metal cribbing shall be coated by (A) or (B), when specified for Metal Cribbing - Coated:

  (A) Coated on both sides with a layer of asbestos fibers applied in a sheet form by pressing it into a molten metallic bonding medium. Immediately after the metallic bond has solidified, the asbestos fibers shall be thoroughly saturated with a bituminous saturant. The finished sheets shall be of first class commercial quality free from blister and unsaturated spots.

  (B) Galvanized on both sides by the hot dip process as specified in Section 6.29.2 (2) of Form 408, and field coated with bituminous materials. Immediately prior to application of coating, galvanized surfaces are to be either sand blasted to lightly etch surfaces and to remove any greasy film present by blasting in accordance with Field Structures Painting Council Specification No. 7, brush off blast cleaning or saturate all surfaces with vinegar (acetic acid) and when dry wipe off any bloom which has formed.
- Apply two (2) coats of coal tar based paint (Federal Specification MIL-18480). To be applied at the rate of 55-70 square feet per gallon per coat. One coat of Coal Tar Emulsion to conform to Federal Specification MIL-C-15203 at the rate of 60 square feet per gallon. Twenty Four hours drying time to be allowed between coats.
- Metal base plates will be required.

Approved: FEB. 25, 1965

K. H. Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD

METAL CRIBBING-COATED

SHEET 1 OF 1

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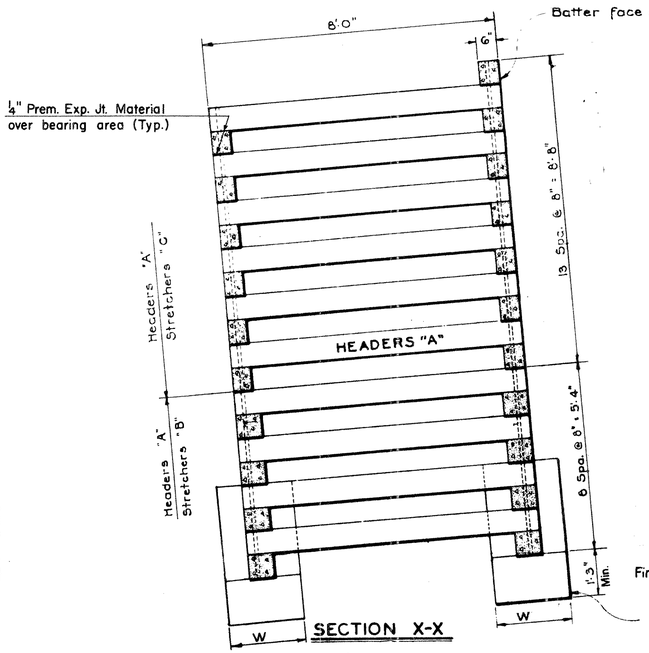
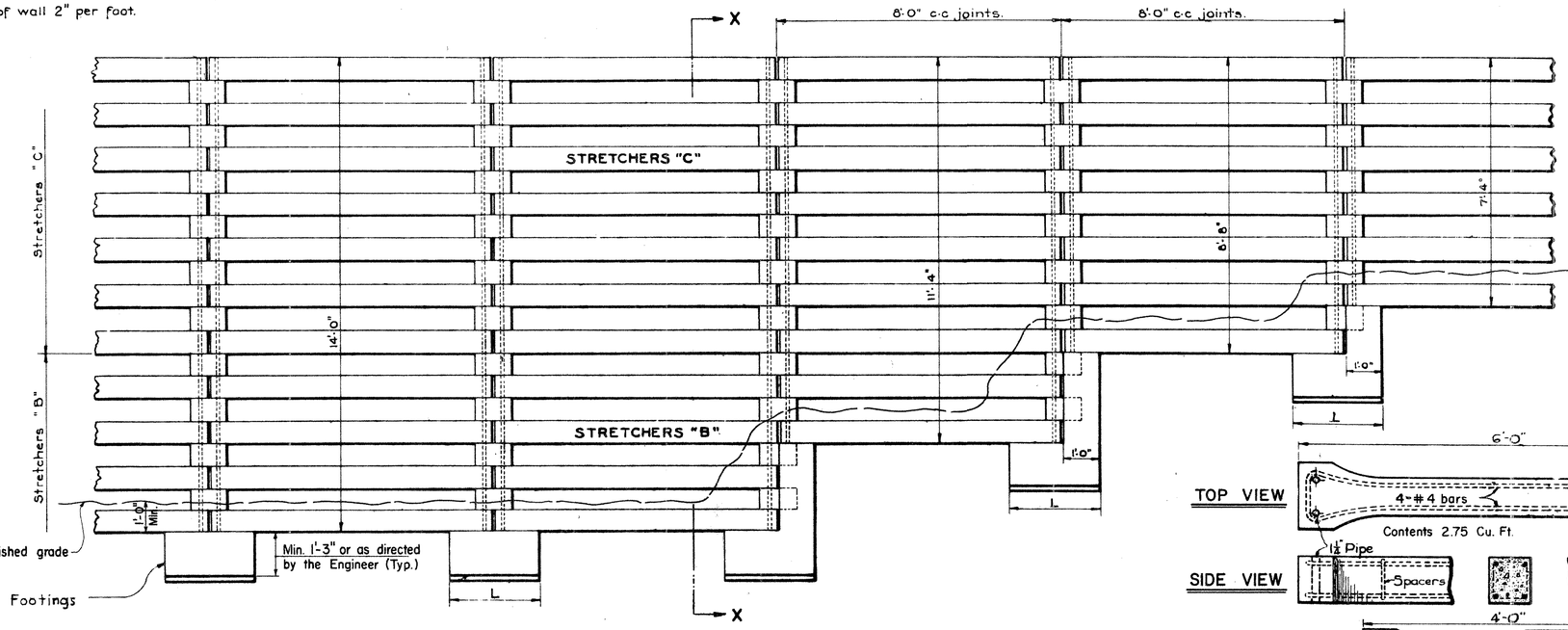
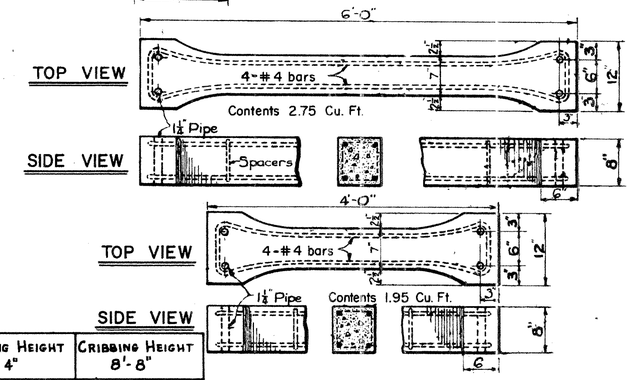
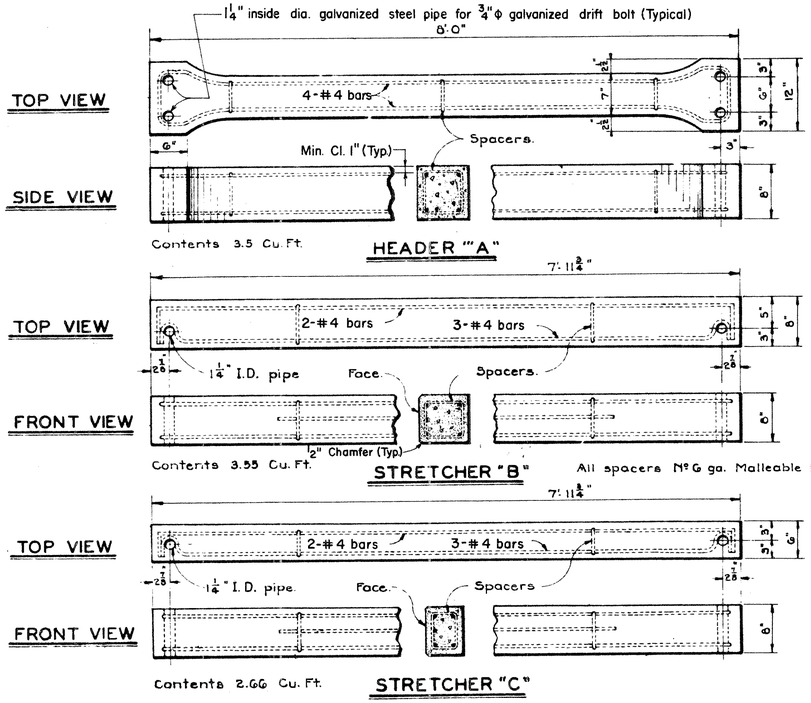




TYPICAL ELEVATION



HEADERS "A"



GENERAL NOTES:

- All Materials and Workmanship shall be in accordance with PD H Form 408, Section 6.29.
- Concrete Crib members shall be Class "A" Concrete.
- Footings shall be Class "B" Concrete.
- Where total height of cribbing is not more than 5'-4" use headers 4 ft. long, and where total height of cribbing is between 6'-0" and 11'-4" use headers 6 ft. long. For heights between 12'-0 and 15'-4" use headers 8 ft. long. Higher cribbing walls to be of special design.
- All stretchers to have letter "F" plainly impressed in the face to indicate the exposed surface in the finished wall.
- Batter of wall other than 2" in 12" subject to approval by the Engineer.
- If approved by the Engineer, other types of Concrete Cribbing design may be used.
- Footings may be ordered by the Engineer to be at any elevation or of any dimensions necessary to provide a proper foundation.
- Reinforcement bars shall be of intermediate or hard grade or rail steel designed for fs=20,000 psi and detailed in accordance with ACI Code.

Type Of Soil	Safe Bearing Pressure Tons/sq.ft.	Cribbing Height 14'-0" Footing Size Front (W x L)	Cribbing Height 14'-0" Footing Size Rear (W x L)	Cribbing Height 11'-4" Footing Size Front (W x L)	Cribbing Height 11'-4" Footing Size Rear (W = L)	Cribbing Height 8'-8" Footing Size Front (W x L)	Cribbing Height 8'-8" Footing Size Rear (W x L)
Rock	20	None	None	None	None	None	None
Shale	10	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0 x 2'-6"	"
Gravel	8	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"
Clay (Dry)	5	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"
Clay (Moist)	2	2'-0" x 8'-0"	3'-0" x 3'-6" or 1'-4" x 8'-0"	3'-0" x 4'-0" or 1'-6" x 8'-0"	3'-0" x 3'-0"	2'-6" x 2'-6"	"
Clay (Soft)	1	3'-9" x 8'-0"	2'-6" x 8'-0"	2'-9" x 8'-0"	2'-0" x 8'-0"	3'-0" x 4'-0" or 1'-6" x 8'-0"	3'-0" x 3'-0"
Loam	1	3'-9" x 8'-0"	2'-6" x 8'-0"	2'-9" x 8'-0"	2'-0" x 8'-0"	"	3'-0" x 3'-0"

Approved: FEB. 25, 1965

H. H. Jensen
Bridge Engineer

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD CONCRETE CRIBBING TYPE I

Rev.	G.T.V.
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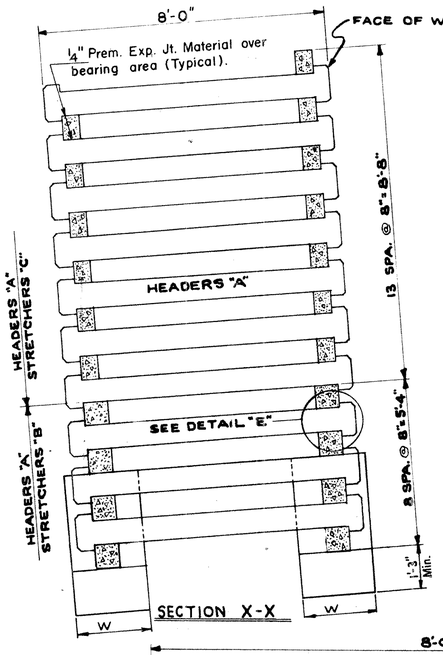
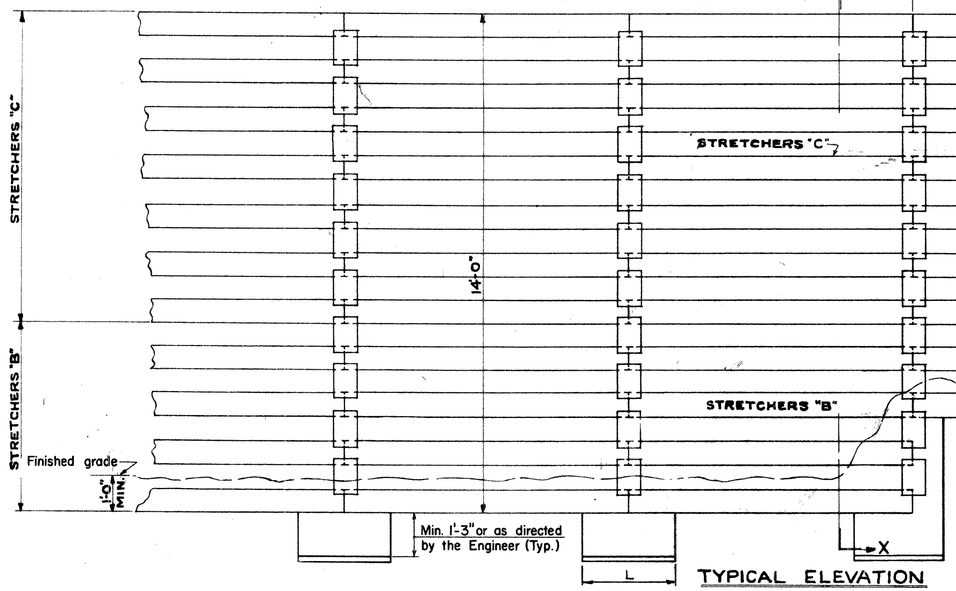
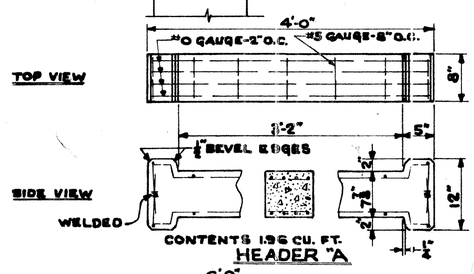
Ckd.	BFK/HJ



SECTION X-X

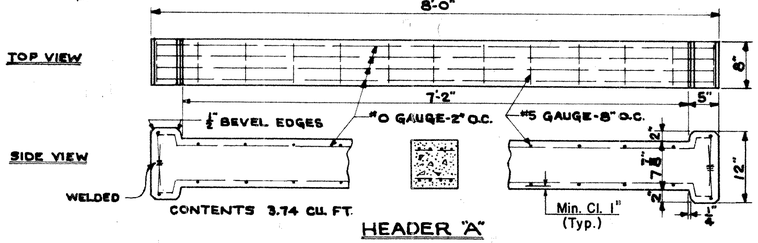


TYPICAL ELEVATION



CONTENTS 1.96 CU. FT.

HEADER "A"

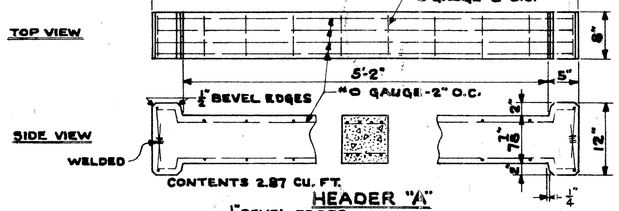


CONTENTS 3.74 CU. FT.

HEADER "A"

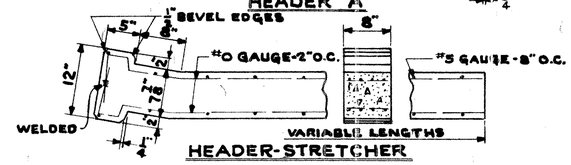
NOTES:

- For General Notes refer to Sheet 1.
- Closed face cribbing wall shall be used only if specified.
- Steel wire reinforcement shall conform to ASTM Designation A82

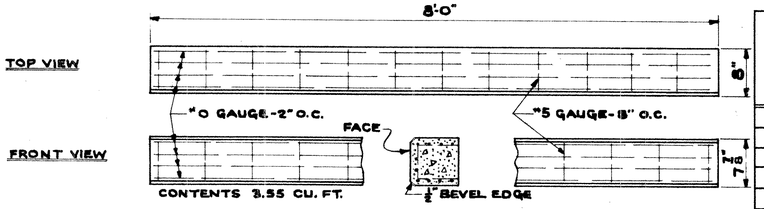


CONTENTS 2.87 CU. FT.

HEADER "A"



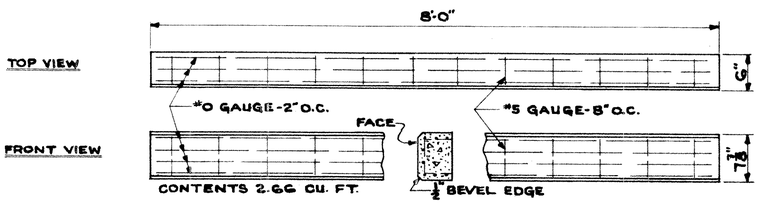
HEADER-STRETCHER



STRETCHER "B"

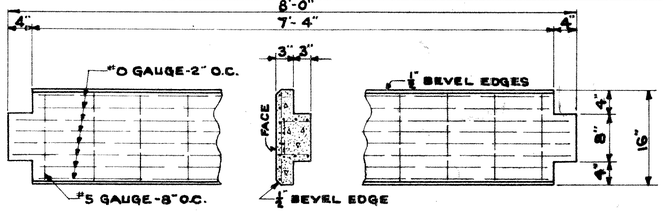
FOR OPEN FACE CRIBBING

TYPE OF SOIL	SAFE BEARING PRESSURE TONS/SQ.FT.	CRIBBING HEIGHT 14'-0" FOOTING SIZE FRONT (W x L)	CRIBBING HEIGHT 14'-0" FOOTING SIZE REAR (W x L)	CRIBBING HEIGHT 11'-4" FOOTING SIZE FRONT (W x L)	CRIBBING HEIGHT 11'-4" FOOTING SIZE REAR (W x L)	CRIBBING HEIGHT 8'-8" FOOTING SIZE FRONT (W x L)	CRIBBING HEIGHT 8'-8" FOOTING SIZE REAR (W x L)
ROCK	20	NONE	NONE	NONE	NONE	NONE	NONE
SHALE	10	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"
GRAVEL	8	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"
CLAY (DRY)	5	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"	2'-0" x 2'-6"	"
CLAY (MOIST)	2	2'-0" x 8'-0"	3'-0" x 3'-6" OR 1'-4" x 8'-0"	3'-0" x 4'-0" OR 1'-6" x 8'-0"	3'-0" x 3'-0"	2'-6" x 2'-6"	"
CLAY (SOFT)	1	3'-9" x 8'-0"	2'-6" x 8'-0"	2'-9" x 8'-0"	2'-0" x 8'-0"	3'-0" x 4'-0" OR 1'-6" x 8'-0"	3'-0" x 3'-0"
LOAM	1	3'-9" x 8'-0"	2'-6" x 8'-0"	2'-9" x 8'-0"	2'-0" x 8'-0"	3'-0" x 4'-0" OR 1'-6" x 8'-0"	3'-0" x 3'-0"



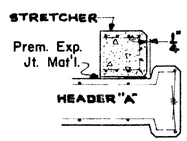
STRETCHER "C"

FOR OPEN FACE CRIBBING



STRETCHER "D"

FOR CLOSED FACE CRIBBING



DETAIL "E"

Approved: FEB. 25, 1965

R. H. Jansen
Bridge Engineer

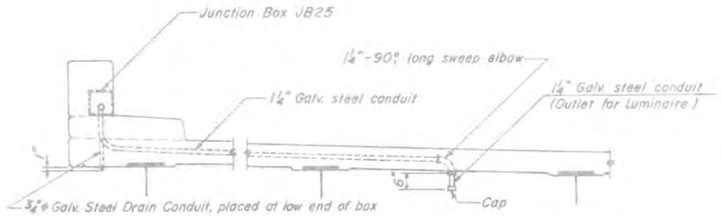
Commonwealth of Pennsylvania

Department of Highways
BRIDGE DIVISION

STANDARD CONCRETE CRIBBING TYPE II

Rev.	G.T.V.
Trc.	F.F.F.
Ckd.	BFK/HJ

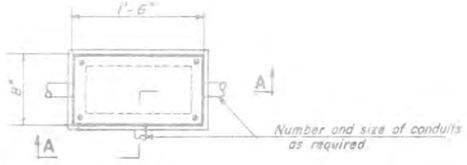
ST-144



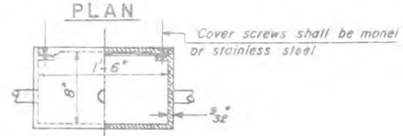
TYPICAL INSTALLATION OF JUNCTION BOX JB25

CONDUITS & FITTINGS FOR UNDERBRIDGE LIGHTING

* Refer to structure drawing for location of outlets for future Luminaires.

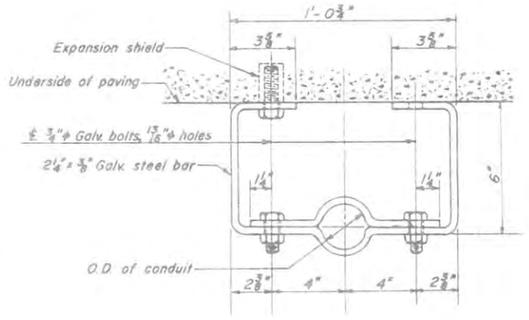


PLAN

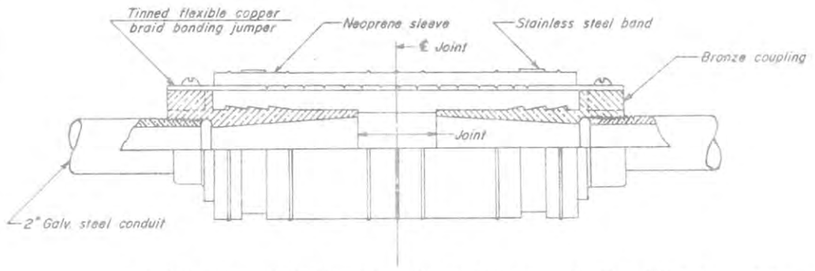


ELEVATION SECTION A-A

JUNCTION BOX JB25 *

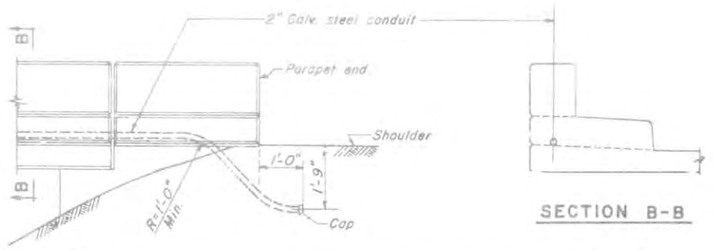


CONDUIT HANGER



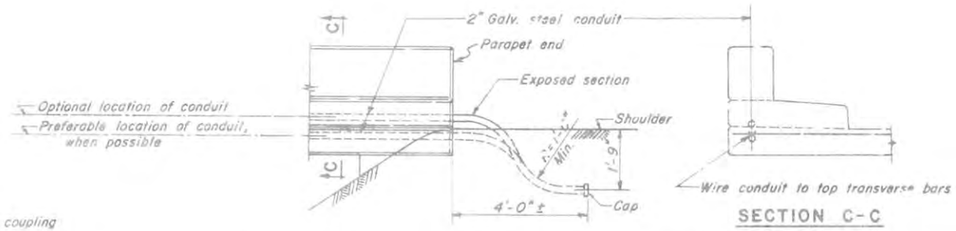
CONDUIT EXPANSION AND DEFLECTION JOINT FITTING **

* For total expansion of more than 1½" special fittings shall be used.



SECTION B-B

CASE 1. Length of parapet is sufficient to accommodate bent end of Conduit.



SECTION C-C

CASE 2. Length of parapet is not sufficient to accommodate bent end of Conduit.

DETAILS OF CONDUIT AT ENDS OF BRIDGE

* Conduit beyond concrete shall be coated in accordance with Lighting Specification.

NOTE: For Lighting Pole Anchorage detail refer to Std. Dwg. ST-146 or ST-147.

Approved: DEC. 10, 1965
K. H. Jensen
Bridge Engineer

* { O-Z Electrical Mfg. Co., Inc. — O-Z Cat. No. YUI80808,
Hope Electrical Products Co. — Type H6200,
Spring City Electrical Mfg. Co. — Type IR,
OR APPROVED EQUAL.

** { O-Z Electrical Mfg. Co. Inc. — Types AX and EX,
Appleton Electric Co. — Type XJ,
Spring City Electrical Mfg. Co. — Types AF and EF,
OR APPROVED EQUAL.

Revision	Date	By	Ckd.

Approved DEC. 10, 1965
L. B. Curtis
Electrical Engineer

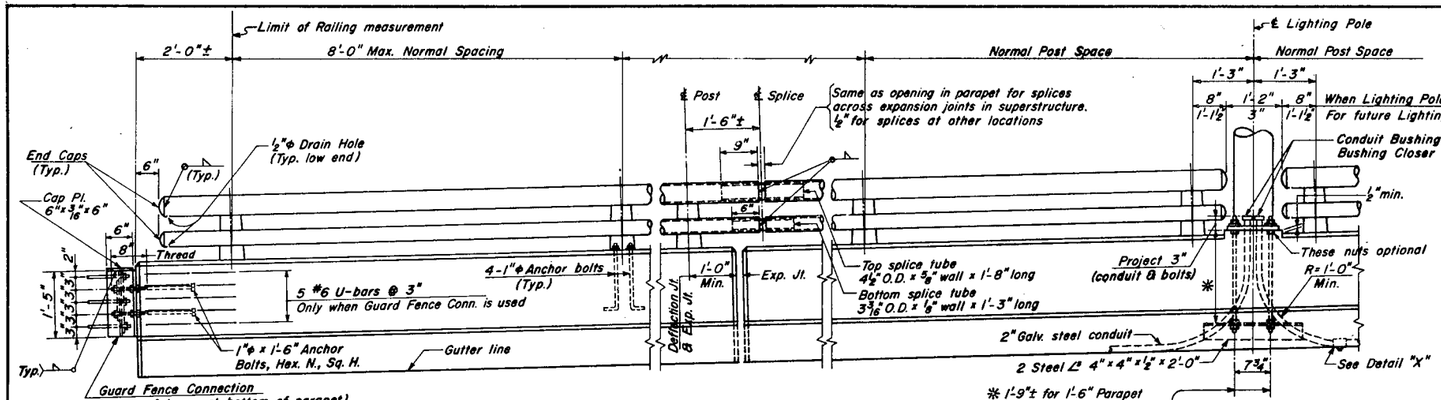
Commonwealth of Pennsylvania
Department of Highways
BRIDGE DIVISION

STANDARD ELECTRICAL DETAILS FOR STRUCTURES

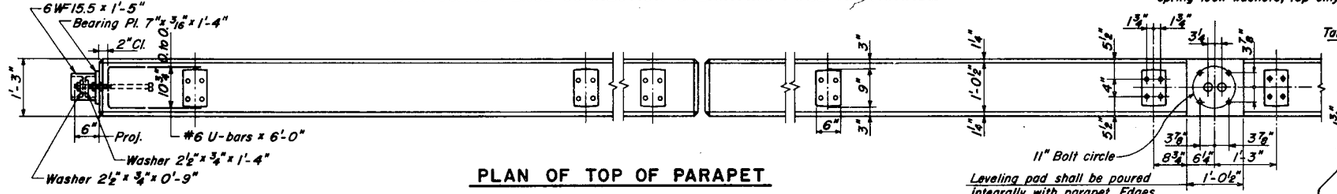
Rev.	G.T.V.
Trcd.	F.F.F.
Ckd.	L.B.C.

SHEET 1 OF 1

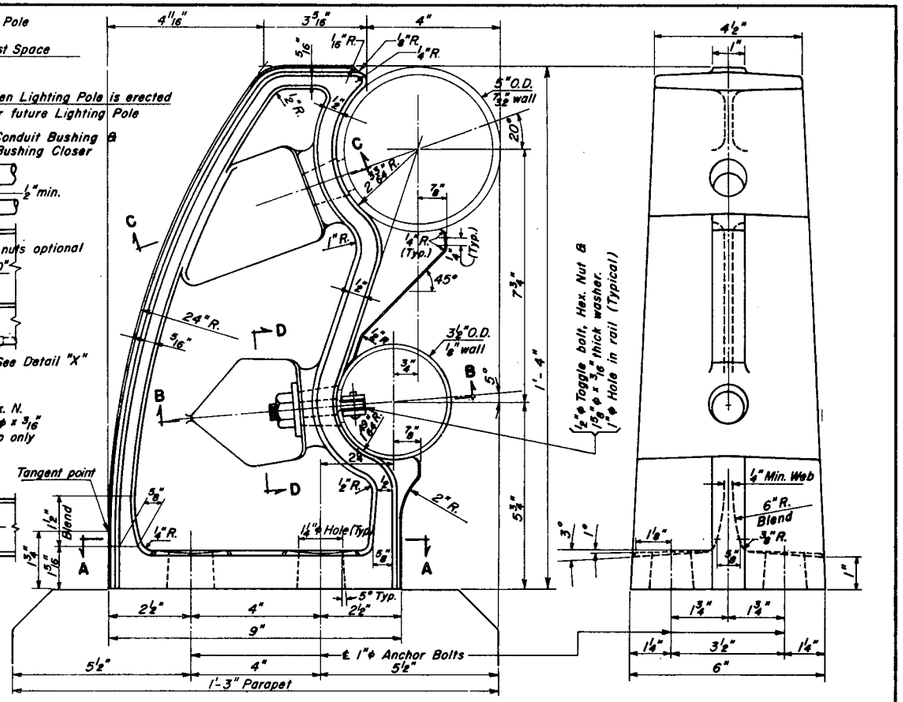
ST-145



INSIDE ELEVATION
WITH GUARD FENCE CONNECTION & LIGHTING POLE ANCHORAGE



PLAN OF TOP OF PARAPET



SIDE VIEW OF POST

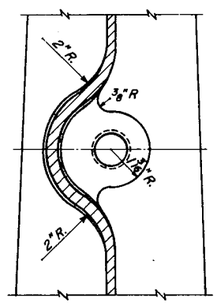
FRONT VIEW OF POST

DETAIL "X"

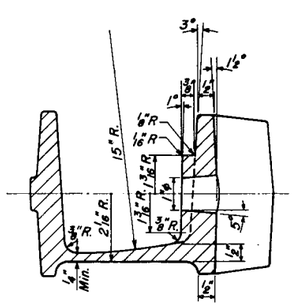
PROTECTIVE WOOD BLOCK

Hardwood 11⅝" square

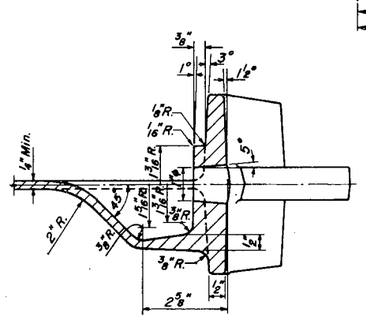
Protective wood blocks, with holes bored to fit bolt spacing and conduit, shall be painted with two coats of Aluminum paint before installation. Wood blocks must be in place before rails are installed.



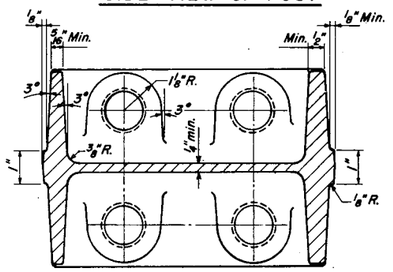
SECTION D-D



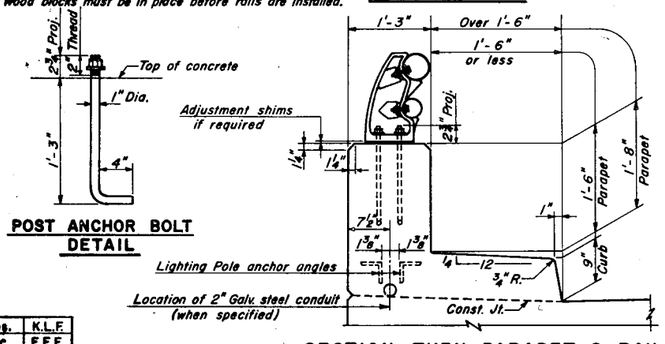
SECTION C-C



SECTION B-B



SECTION A-A



POST ANCHOR BOLT DETAIL

SECTION THRU PARAPET & RAILING

Des.	K.L.F.
Trc.	F.F.F.
Chk.	JS/BFK

NOTES

- *Materials and workmanship shall be in accordance with PDH Forms 408 and 409.*
- *Design Specifications: 1964 Interim Specifications developed by AASHO Committee on Bridges and Structures.*
- *Rails and splice tubes shall be Aluminum Alloy 6061-T6 or 6062-T6.*
- *Posts shall be Aluminum Alloy A344-T4.*
- *Shims and end caps shall be an approved aluminum alloy. Shims shall be flush with base of post and end caps shall be flush with rails.*
- *Guard fence connection, railing post anchor materials and lighting pole anchor materials shall conform to ASTM-A36.*
- *Toggle bolts shall be an approved type capable of supporting a 9,000 pound load in tension, before rupture, when tested through a 1"ϕ hole.*
- *All steel shall be galvanized conforming to ASTM-A123 or A153 as applicable, except anchor angles shall not be galvanized.*
- *Surfaces of post in contact with concrete or steel, and surfaces of guard fence connection in contact with concrete shall be thoroughly coated with Caulking Compound conforming to Federal Specifications TT-C598(2). After erection and alignment, openings between metal surfaces and concrete shall be sealed with this compound.*
- *Rail splices shall be located between posts at expansion joints and at other locations where necessary. Rail tubes shall be as long as practical, with a minimum of three posts between splices, unless otherwise required for expansion.*
- *Posts and post anchor bolts shall be normal to grade and rails shall be parallel to grade.*
- *Lighting pole anchorages shall be used only when lighting poles or future lighting poles are specified. Poles shall be truly vertical with bases level.*
- *Railing shall be measured continuously between centers of end posts and shall include all railing posts, rails, end caps, toggle bolts, anchor bolts with washers and nuts for railing posts and lighting poles, lighting pole anchor angles and protective wood blocks.*
- *Guard fence connection, when specified, shall include 6WF15.5 beam, cap, bearing plate, anchor bolts, washers and nuts.*
- *Materials shall not be painted, except protective wood blocks.*
- *For future lighting: Conduit, lighting pole anchor bolts, nuts and washers above concrete shall be heavily coated with an approved bitumastic compound and protective wood blocks placed and firmly secured.*
- *For Electrical Details not shown, refer to Standard Drawing ST-145.*
- *For spacing of posts & details of parapet, refer to specific structure drawing.*

APPROVED: DEC. 10, 1965
R. H. Jensen
Bridge Engineer

APPROVED: DEC. 10, 1965
L. B. Curtis
Electrical Engineer

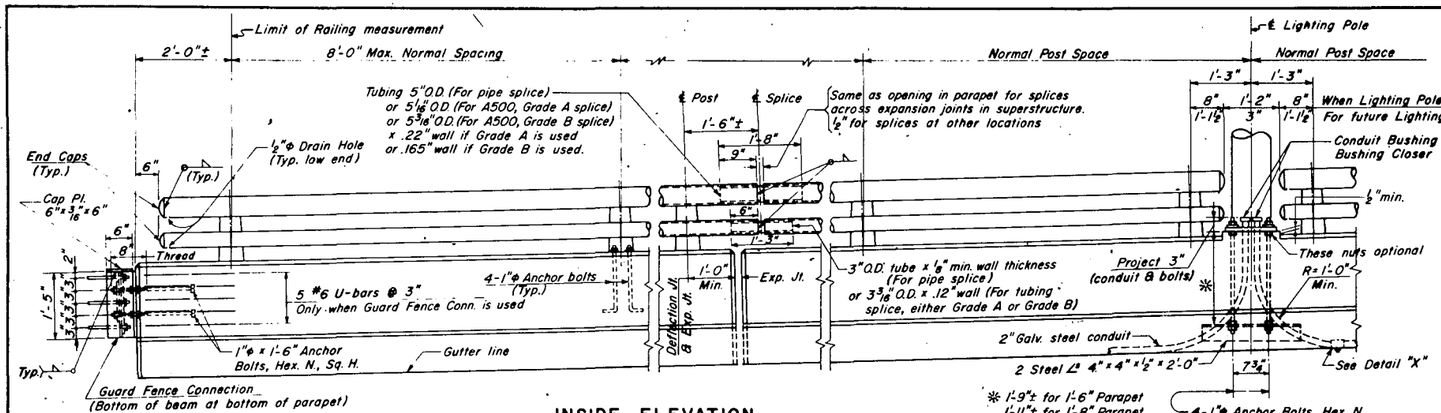
Commonwealth of Pennsylvania

DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

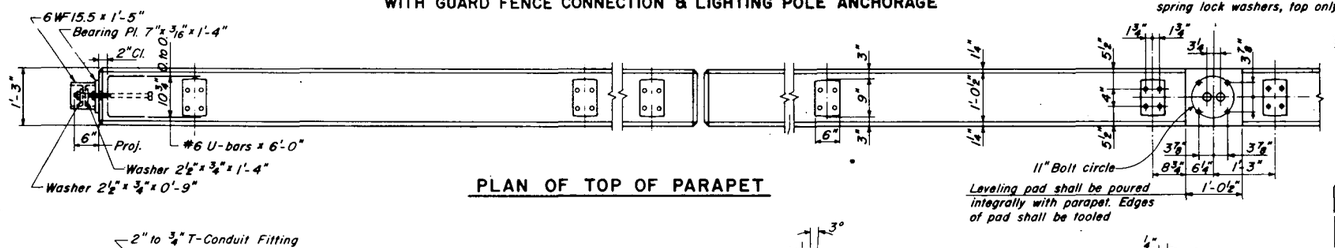
STANDARD
PARAPET WITH
ALUMINUM BRIDGE RAILING
AND
GUARD FENCE CONNECTION

SHEET 1 OF 1

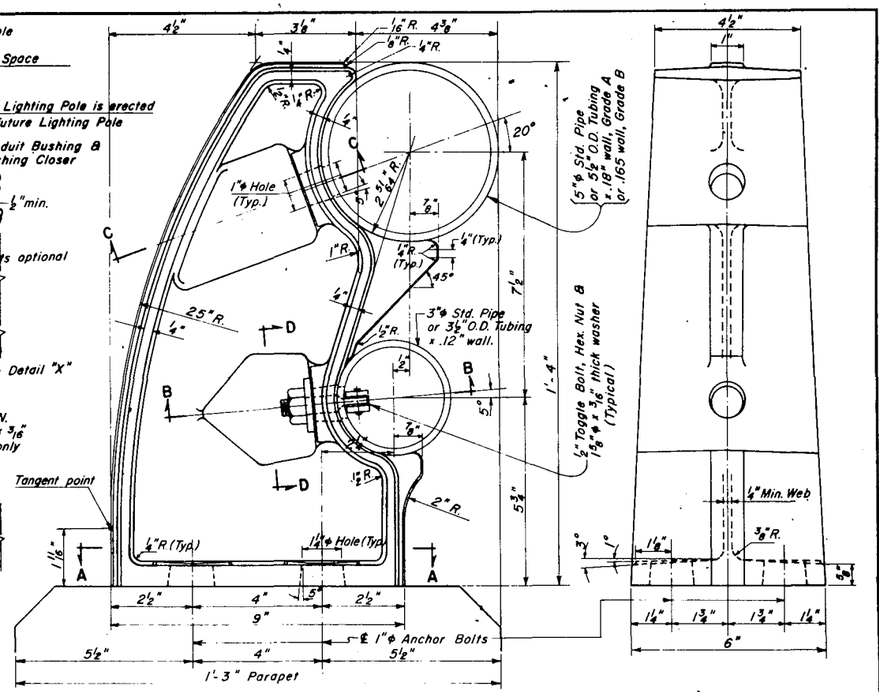
ST-146



INSIDE ELEVATION
WITH GUARD FENCE CONNECTION & LIGHTING POLE ANCHORAGE

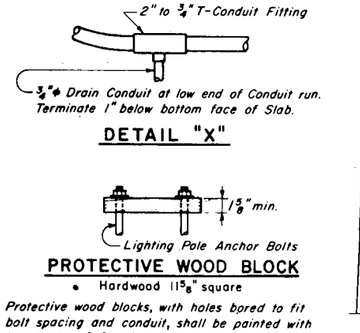


PLAN OF TOP OF PARAPET



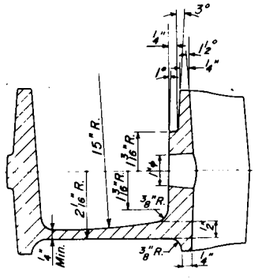
SIDE VIEW OF POST

FRONT VIEW OF POST

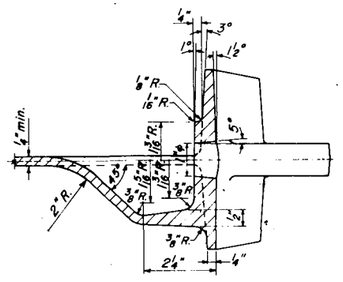


DETAIL "X"

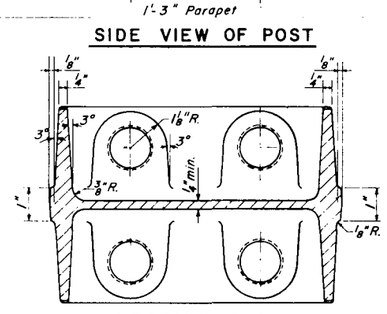
SECTION D-D



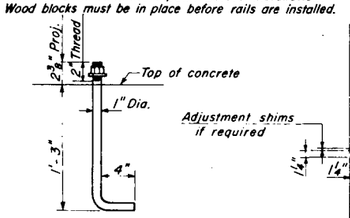
SECTION C-C



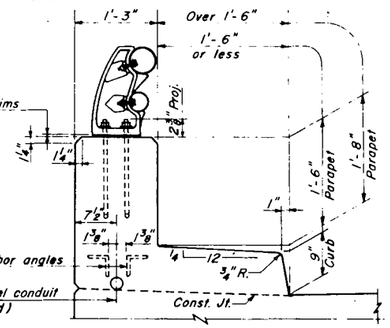
SECTION B-B



SECTION A-A



POST ANCHOR BOLT DETAIL



SECTION THRU PARAPET & RAILING

PROTECTIVE WOOD BLOCK

- Hardwood 11 5/8" square

Protective wood blocks, with holes bored to fit bolt spacing and conduit, shall be painted with two coats of Aluminum paint before installation. Wood blocks must be in place before rails are installed.

NOTES

- *Materials and workmanship shall be in accordance with PDH Forms 408 and 409.*
- *Design Specifications: 1964 Interim Specifications developed by AASHO Committe on Bridges and Structures.*
- *Rails may be either Pipe or Tubing.*
- *Pipe shall conform to ASTM-A53, Type E or S, Grade B. The steel shall be made by one or more of the following processes: Open hearth, basic oxygen, or electric furnace. The pipe shall be made by a seamless or furnace butt welding process.*
- *Tubing shall conform to ASTM-A500.*
- *Railing Posts shall conform to ASTM-A47, Grade 35018 or A339, Grade 60-45-10.*
- *Toggle bolts shall be an approved type-capable of supporting a 9,000 pound load in tension, before rupture, when tested through a one inch round hole.*
- *Shims and End Caps shall be made of an approved steel. Shims shall be flush with base of post and end caps shall be flush with rails.*
- *Surfaces of post and guard fence connection in contact with concrete shall be thoroughly coated with caulking compound conforming to Federal Specification TT-C598(2). After erection and alignment, openings between metal surfaces and concrete shall be sealed with this compound.*
- *All steel shall be galvanized conforming to ASTM-A123 or A153 as applicable, except anchor angles shall not be galvanized.*
- *Guard fence connection, railing post anchor materials and lighting pole anchor materials shall conform to ASTM-A36.*
- *Rail splices shall be located between posts at expansion joints and at other locations where necessary. Rail tubes shall be as long as practical, with a minimum of three posts between splices, unless otherwise required for expansion.*
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- *For Electrical Details not shown, refer to Standard Drawing ST-145.*
- *For spacing of posts & details of parapet, refer to specific structure drawing.*

Des.	K.L.F.
Trc.	F.F.F.
Ckd.	JS/BFK

61288 PEL-X

APPROVED: DEC. 10, 1965
R. H. Jensen
Bridge Engineer

APPROVED: DEC. 10, 1965
L. B. Curtis
Electrical Engineer

Commonwealth of Pennsylvania
DEPARTMENT OF HIGHWAYS
BRIDGE DIVISION

STANDARD
PARAPET WITH
STEEL BRIDGE RAILING
AND
GUARD FENCE CONNECTION

SHEET 1 OF 1

ST-147