Aluminum Structural Plate BOX CULVERTS

TECHNICAL GUIDE

GUIDE TO THE SELECTION, SPECIFICATION AND INSTALLATION

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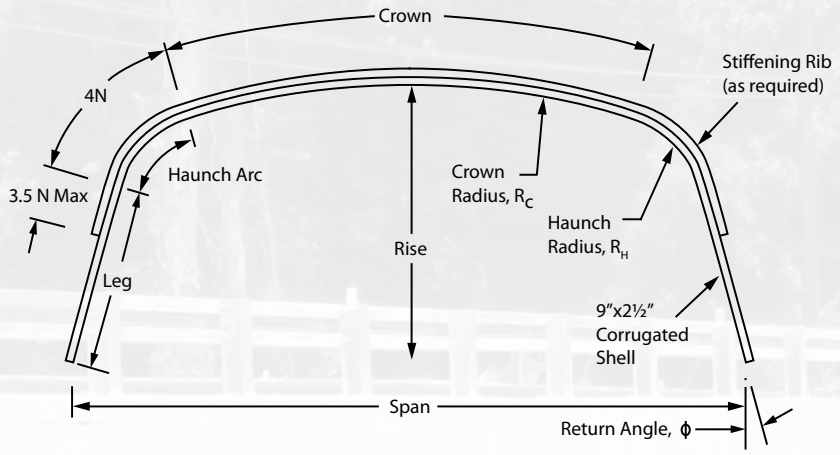
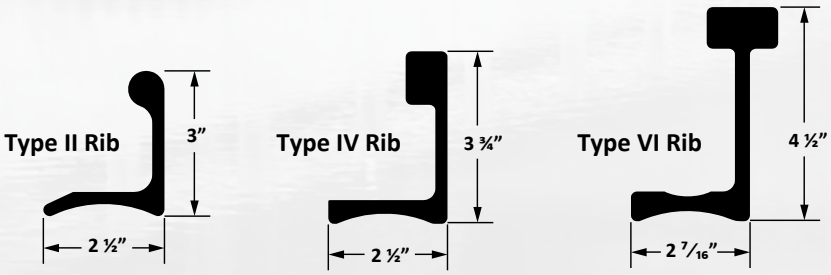


AASHTO LRFD Bridge Design Specifications, Section 12.9…structural plate box culverts are composite-reinforced rib plate structures…intended for shallow covers and low wide waterway openings…requiring special design procedures…are relatively flat at the top and require a large flexural capacity due to extreme geometry and shallow depths of cover of 5.0 ft or less.

ALUMINUM STIFFENING RIBS 6061-T6 ALLOY EXTRUSIONS

Tensile Strength F_u = 38 ksi (min.)
Yield Strength F_y = 35 ksi (min.)

Structure	R_C (in)	R_H (in)
1 - 39	297.50	30.250
40 - 87	258.75	37.380
88 - 143	310.75	43.625



See page 12 for section properties.

GENERAL SPECIFICATION

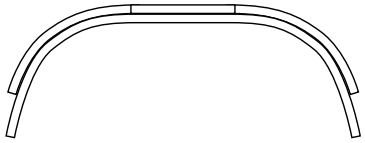
1. Material and geometric requirements shall conform to AASHTO M219 and ASTM B864. Geometric requirements shall also conform to Figure 12.9.4.1-1 and Table 12.9.4.1-1 of the AASHTO LRFD Bridge Design Specifications. Bolts and nuts shall conform to the requirements of ASTM A307 or ASTM A449 and shall be galvanized in accordance with ASTM A153.
2. Structural calculations, including the determination of footing reactions, shall be in accordance with the current version of the AASHTO LRFD Bridge Design Specifications.
3. Standard design is for square end structures. Culvert ends requiring bevels and/or skews may require additional features and design considerations. The type and extent of end treatment should be chosen and designed so as to prevent the loss of backfill in extreme flow conditions.
4. Headwall construction shall be for vertical orientation only. Any design, other than vertical orientation, must be reviewed by the manufacturer and/or design engineer.

Shell Composition Structures 1-87

					Shell				Rib Pieces		Shell Pieces	
	Span	Rise	Area	ϕ°	Crown	Haunch	Leg	Total	Crown	Haunch	Crown	Haunch
	(ft-in)	(ft-in)	(ft²)		N	N	N	N	N (short/long)	N	N	N
BC-A-1	8-9	2-6	18.4	15.40	5	4	0.5	14	3/5	5.5	0	7
BC-A-2	9-2	3-3	25.4	15.40	5	4	1.5	16	3/5	6.5	0	8
BC-A-3	9-7	4-1	32.6	15.40	5	4	2.5	18	3/5	7.5	0	9
BC-A-4	10-0	4-10	40.2	15.40	5	4	3.5	20	3/5	7	0	10
BC-A-5	10-6	5-7	48.1	15.40	5	4	4.5	22	3/5	7	0	11
BC-A-6	10-11	6-4	56.4	15.40	5	4	5.5	24	3/5	7	0	12
BC-A-7	11-4	7-2	65.0	15.40	5	4	6.5	26	3/5	7	0	13
BC-A-8	10-2	2-8	23.0	13.55	7	4	0.5	16	3/7	6.5	0	8
BC-A-9	10-7	3-5	31.1	13.55	7	4	1.5	18	3/7	7.5	0	9
BC-A-10	10-11	4-3	39.5	13.55	7	4	2.5	20	3/7	8.5	0	10
BC-A-11	11-4	5-0	48.2	13.55	7	4	3.5	22	3/7	8	0	11
BC-A-12	11-8	5-9	57.2	13.55	7	4	4.5	24	3/7	8	0	12
BC-A-13	12-1	6-7	66.4	13.55	7	4	5.5	26	3/7	8	0	13
BC-A-14	12-5	7-4	76.0	13.55	7	4	6.5	28	3/7	8	0	14
BC-A-15	11-7	2-10	28.1	11.70	9	4	0.5	18	5/9	6.5	0	9
BC-A-16	11-11	3-7	37.4	11.70	9	4	1.5	20	5/9	7.5	0	10
BC-A-17	12-3	4-5	46.9	11.70	9	4	2.5	22	5/9	8.5	0	11
BC-A-18	12-7	5-2	56.6	11.70	9	4	3.5	24	5/9	8	0	12
BC-A-19	12-11	6-0	66.6	11.70	9	4	4.5	26	5/9	8	0	13
BC-A-20	13-3	6-9	76.9	11.70	9	4	5.5	28	5/9	8	0	14
BC-A-21	13-0	3-0	33.8	9.87	11	4	0.5	20	7/11	6.5	0	10
BC-A-22	13-4	3-10	44.2	9.87	11	4	1.5	22	7/11	7.5	0	11
BC-A-23	13-7	4-7	54.8	9.87	11	4	2.5	24	7/11	8.5	0	12
BC-A-24	13-10	5-5	65.6	9.87	11	4	3.5	26	7/11	8	0	13
BC-A-25	14-1	6-2	76.6	9.87	11	4	4.5	28	7/11	8	0	14
BC-A-26	14-5	3-3	40.0	8.02	13	4	0.5	22	9/13	6.5	0	11
BC-A-27	14-8	4-1	51.5	8.02	13	4	1.5	24	9/13	7.5	8	8
BC-A-28	14-10	4-10	63.2	8.02	13	4	2.5	26	9/13	8.5	8	9
BC-A-29	15-1	5-8	75.1	8.02	13	4	3.5	28	9/13	8	8	10
BC-A-30	15-4	6-5	87.2	8.02	13	4	4.5	30	9/13	8	8	11
BC-A-31	15-6	7-3	99.4	8.02	13	4	5.5	32	9/13	8	8	12
BC-A-32	15-9	8-0	111.8	8.02	13	4	6.5	34	9/13	8	8	13
BC-A-33	15-10	3-6	46.8	6.17	15	4	0.5	24	11/15	6.5	8	8
BC-A-34	16-0	4-3	59.5	6.17	15	4	1.5	26	11/15	7.5	8	9
BC-A-35	16-2	5-1	72.3	6.17	15	4	2.5	28	11/15	8.5	8	10
BC-A-36	16-4	5-11	85.2	6.17	15	4	3.5	30	11/15	8	8	11
BC-A-37	16-6	6-8	98.3	6.17	15	4	4.5	32	11/15	8	8	12
BC-A-38	16-8	7-6	111.5	6.17	15	4	5.5	34	11/15	8	8	13
BC-A-39	16-10	8-3	124.8	6.17	15	4	6.5	36	11/15	8	8	14
BC-A-40	17-9	3-10	54.4	14.90	17	4	0.5	26	13/17	6.5	10	8
BC-A-41	18-2	4-7	68.3	14.90	17	4	1.5	28	13/17	7.5	10	9
BC-A-42	18-7	5-4	82.5	14.90	17	4	2.5	30	13/17	8.5	10	10
BC-A-43	19-0	6-1	97.1	14.90	17	4	3.5	32	13/17	9.5	10	11
BC-A-44	19-5	6-11	111.9	14.90	17	4	4.5	34	13/17	8	10	12
BC-A-45	19-10	7-8	127.1	14.90	17	4	5.5	36	13/17	8	10	13
BC-A-46	20-3	8-5	142.6	14.90	17	4	6.5	38	13/17	8	10	14
BC-A-47	19-1	4-2	63.3	12.78	19	4	0.5	28	15/19	6.5	12	8
BC-A-48	19-5	4-11	78.3	12.78	19	4	1.5	30	15/19	7.5	12	9
BC-A-49	19-9	5-8	93.6	12.78	19	4	2.5	32	15/19	8.5	12	10
BC-A-50	20-1	6-6	109.2	12.78	19	4	3.5	34	15/19	9.5	12	11
BC-A-51	20-6	7-3	125.0	12.78	19	4	4.5	36	15/19	8	12	12
BC-A-52	20-10	8-1	141.2	12.78	19	4	5.5	38	15/19	8	12	13
BC-A-53	21-2	8-10	157.6	12.78	19	4	6.5	40	15/19	8	12	14
BC-A-54	20-4	4-6	73.1	10.67	21	4	0.5	30	17/21	6.5	14	8
BC-A-55	20-7	5-3	89.2	10.67	21	4	1.5	32	17/21	7.5	14	9
BC-A-56	20-11	6-1	105.5	10.67	21	4	2.5	34	17/21	8.5	14	10
BC-A-57	21-3	6-10	122.1	10.67	21	4	3.5	36	17/21	9.5	14	11
BC-A-58	21-6	7-8	139.0	10.67	21	4	4.5	38	17/21	8	14	12
BC-A-59	21-10	8-5	156.0	10.67	21	4	5.5	40	17/21	8	14	13
BC-A-60	22-1	9-3	173.3	10.67	21	4	6.5	42	17/21	8	14	14
BC-A-61	21-7	4-11	83.8	8.53	23	4	0.5	32	19/23	6.5	14	9
BC-A-62	21-10	5-8	101.0	8.53	23	4	1.5	34	19/23	7.5	14	10
BC-A-63	22-1	6-6	118.4	8.53	23	4	2.5	36	19/23	8.5	14	11
BC-A-64	22-3	7-3	135.9	8.53	23	4	3.5	38	19/23	9.5	14	12
BC-A-65	22-6	8-1	153.7	8.53	23	4	4.5	40	19/23	8	14	13
BC-A-66	22-9	8-10	171.6	8.53	23	4	5.5	42	19/23	8	14	14
BC-A-67	23-0	9-8	189.8	8.53	23	4	6.5	44	19/23	8	14	15
BC-A-68	22-9	5-4	95.5	6.42	25	4	0.5	34	21/25	6.5	14	10
BC-A-69	23-0	6-1	113.7	6.42	25	4	1.5	36	21/25	7.5	14	11
BC-A-70	23-2	6-11	132.1	6.42	25	4	2.5	38	21/25	8.5	14	12
BC-A-71	23-4	7-8	150.6	6.42	25	4	3.5	40	21/25	8	14	13
BC-A-72	23-6	8-6	169.3	6.42	25	4	4.5	42	21/25	8	14	14
BC-A-73	23-8	9-3	188.1	6.42	25	4	5.5	44	21/25	8	14	15
BC-A-74	23-10	10-1	207.0	6.42	25	4	6.5	46	21/25	8	14	16
BC-A-75	24-0	5-9	108.2	4.30	27	4	0.5	36	23/27	6.5	16	10
BC-A-76	24-1	6-6	127.5	4.30	27	4	1.5	38	23/27	7.5	16	11
BC-A-77	24-3	7-4	146.8	4.30	27	4	2.5	40	23/27	8.5	16	12
BC-A-78	24-4	8-2	166.2	4.30	27	4	3.5	42	23/27	9.5	16	13
BC-A-79	24-5	8-11	185.7	4.30	27	4	4.5	44	23/27	8	16	14
BC-A-80	24-7	9-9	205.3	4.30	27	4	5.5	46	23/27	8	16	15
BC-A-81	24-8	10-6	225.0	4.30	27	4	6.5	48	23/27	8	16	16
BC-A-82	25-2	6-2	122.0	2.18	29	4	0.5	38	25/29	6.5	16	11
BC-A-83	25-2	7-0	142.2	2.18	29	4	1.5	40	25/29	7.5	16	12
BC-A-84	25-3	7-9	162.4	2.18	29	4	2.5	42	25/29	8.5	16	13
BC-A-85	25-4	8-7	182.6	2.18	29	4	3.5	44	25/29	9.5	16	14
BC-A-86	25-4	9-5	202.9	2.18	29	4	4.5	46	25/29	8	16	15
BC-A-87	25-5	10-2	223.3	2.18	29	4	5.5	48	25/29	8	16	16

					Shell				Rib Pieces		Shell Pieces	
	Span	Rise	Area	ϕ°	Crown	Haunch	Leg	Total	Crown	Haunch	Crown	Haunch
	(ft-in)	(ft-in)	(ft^2)		N	N	N	N	N (short/long)	N	N	N
BC-A-88	26-7	5-5	111.6	15.21	29	4	0.5	38	25/29	6.5	16	11
BC-A-89	27-0	6-3	132.4	15.21	29	4	1.5	40	25/29	7.5	16	12
BC-A-90	27-5	7-0	153.4	15.21	29	4	2.5	42	25/29	8.5	16	13
BC-A-91	27-8	7-9	174.8	15.21	29	4	3.5	44	25/29	9.5	16	14
BC-A-92	28-3	8-7	196.5	15.21	29	4	4.5	46	25/29	9.5	16	15
BC-A-93	28-8	9-4	218.6	15.21	29	4	5.5	48	25/29	9.5	16	16
BC-A-94	29-2	10-1	241.0	15.21	29	4	6.5	50	25/29	9.5	16	17
BC-A-95	27-10	5-10	125.4	13.45	31	4	0.5	40	25/31	7.5	16	12
BC-A-96	28-3	6-8	147.3	13.45	31	4	1.5	42	25/31	8.5	16	13
BC-A-97	28-7	7-5	169.4	13.45	31	4	2.5	44	25/31	9.5	16	14
BC-A-98	29-0	8-3	191.8	13.45	31	4	3.5	46	25/31	10.5	16	15
BC-A-99	29-4	9-0	214.6	13.45	31	4	4.5	48	25/31	10.5	16	16
BC-A-100	29-8	9-9	237.6	13.45	31	4	5.5	50	25/31	10.5	16	17
BC-A-101	30-0	10-7	260.9	13.45	31	4	6.5	52	25/31	10.5	16	18
BC-A-102	29-1	6-4	140.2	11.68	33	4	0.5	42	25/33	8.5	18	12
BC-A-103	29-4	7-1	163.2	11.68	33	4	1.5	44	25/33	9.5	18	13
BC-A-104	29-9	7-11	186.4	11.68	33	4	2.5	46	25/33	10.5	18	14
BC-A-105	30-0	8-8	209.8	11.68	33	4	3.5	48	25/33	11.5	18	15
BC-A-106	30-4	9-5	233.6	11.68	33	4	4.5	50	25/33	11.5	18	16
BC-A-107	30-7	10-3	257.5	11.68	33	4	5.5	52	25/33	11.5	18	17
BC-A-108	31-0	11-0	281.8	11.68	33	4	6.5	54	25/33	11.5	18	18
BC-A-109	30-3	6-9	156.1	9.91	35	4	0.5	44	27/35	8.5	18	13
BC-A-110	30-6	7-7	160.1	9.91	35	4	1.5	46	27/35	9.5	18	14
BC-A-111	30-10	8-4	204.4	9.91	35	4	2.5	48	27/35	10.5	18	15
BC-A-112	31-1	9-2	228.8	9.91	35	4	3.5	50	27/35	11.5	18	16
BC-A-113	31-4	9-11	253.5	9.91	35	4	4.5	52	27/35	11.5	18	17
BC-A-114	31-8	10-9	278.4	9.91	35	4	5.5	54	27/35	11.5	18	18
BC-A-115	31-11	11-6	303.5	9.91	35	4	6.5	56	27/35	11.5	18	19
BC-A-116	31-5	7-3	173.1	8.14	37	4	0.5	46	29/37	8.5	18	14
BC-A-117	31-8	8-0	198.2	8.14	37	4	1.5	48	29/37	9.5	18	15
BC-A-118	31-10	8-10	223.4	8.14	37	4	2.5	50	29/37	10.5	18	16
BC-A-119	32-1	9-8	248.8	8.14	37	4	3.5	52	29/37	11.5	18	17
BC-A-120	32-3	10-5	274.4	8.14	37	4	4.5	54	29/37	11.5	18	18
BC-A-121	32-7	11-3	300.1	8.14	37	4	5.5	56	29/37	11.5	18	19
BC-A-122	32-8	12-0	326.1	8.14	37	4	6.5	58	29/37	11.5	18	20
BC-A-123	32-7	7-9	191.3	6.38	39	4	0.5	48	31/39	8.5	20	14
BC-A-124	32-9	8-6	217.3	6.38	39	4	1.5	50	31/39	9.5	20	15
BC-A-125	32-11	9-4	243.4	6.38	39	4	2.5	52	31/39	10.5	20	16
BC-A-126	33-1	10-2	269.7	6.38	39	4	3.5	54	31/39	11.5	20	17
BC-A-127	33-3	10-11	296.4	6.38	39	4	4.5	56	31/39	11.5	20	18
BC-A-128	33-8	11-9	322.8	6.38	39	4	5.5	58	31/39	11.5	20	19
BC-A-129	33-8	12-6	349.5	6.38	39	4	6.5	60	31/39	11.5	20	20
BC-A-130	33-8	8-3	210.5	4.61	41	4	0.5	50	33/41	8.5	20	15
BC-A-131	33-9	9-1	237.5	4.61	41	4	1.5	52	33/41	9.5	20	16
BC-A-132	33-11	9-10	264.5	4.61	41	4	2.5	54	33/41	10.5	20	17
BC-A-133	34-1	10-8	291.7	4.61	41	4	3.5	56	33/41	11.5	20	18
BC-A-134	34-2	11-5	319.0	4.61	41	4	4.5	58	33/41	11.5	20	19
BC-A-135	34-4	12-3	346.4	4.61	41	4	5.5	60	33/41	11.5	20	20
BC-A-136	34-5	13-1	373.8	4.61	41	4	6.5	62	33/41	11.5	20	21
BC-A-137	34-9	8-9	230.9	2.84	43	4	0.5	52	35/43	8.5	20	16
BC-A-138	34-10	9-7	258.1	2.84	43	4	1.5	54	35/43	9.5	20	17
BC-A-139	34-11	10-4	286.7	2.84	43	4	2.5	56	35/43	10.5	20	18
BC-A-140	35-0	11-2	314.6	2.84	43	4	3.5	58	35/43	11.5	20	19
BC-A-141	35-1	12-0	342.7	2.84	43	4	4.5	60	35/43	11.5	20	20
BC-A-142	35-2	12-9	370.8	2.84	43	4	5.5	62	35/43	11.5	20	21
BC-A-143	35-3	13-7	399.0	2.84	43	4	6.5	64	35/43	11.5	22	21

1. The “N” nomenclature represents the distance between circumferential bolt holes and is commonly used by plate manufacturers to designate net plate lengths. For aluminum structural plate N = 9-5/8 inches or 9.625 inches.
2. The crown, haunch and leg designations are elements of the shell corresponding to one radius of curvature - large, small and straight, respectively.
3. Shell pieces are the actual elements used to construct the shell and are not limited to the strict designation described in item #2 above.



4. Structures 1-26 are two-plate shells. That is, the shell is constructed with two haunch pieces and no crown pieces.
5. Structures 27-143 are three-plate shells, constructed with two haunch pieces and one crown piece.
6. A particular corrugation may have no ribs, haunch ribs only, crown ribs only, or both haunch and crown ribs.
7. The maximum spacing between haunch ribs is 54 inches. The maximum spacing between crown ribs is 18 inches.
8. Haunch ribs, where required on a particular corrugation with or without a crown rib, extend onto the crown a net distance of 1N for structures 1-7, and 2N for structures 8-143.
9. Short crown ribs are used when a haunch rib is included on the same corrugation, otherwise a long crown rib is used.
10. Haunch and crown ribs, where required together on a particular corrugation, are spliced together to develop the full moment resistance required.

Plate Rib Schedules for Cover Heights 1.4-5.0 ft Structures 1-87

	Span	Rise	H20-HS20		H25-HS25		LRFD HL93	
	(ft-in)	(ft-in)	Plate-Rib-Schedule	lb/ft	Plate-Rib-Schedule	lb/ft	Plate-Rib-Schedule	lb/ft
BC-A-1	8-9	2-6	22-24-54-18	44.34	22-26-54-18	47.99	22-24-54-18	44.34
BC-A-2	9-2	3-3	22-24-54-18	52.16	22-26-54-18	55.98	22-24-54-18	52.16
BC-A-3	9-7	4-1	22-24-54-18	56.97	22-26-54-18	60.58	22-24-54-18	56.97
BC-A-4	10-0	4-10	22-26-54-18	63.22	22-26-54-18	63.22	22-26-54-18	63.22
BC-A-5	10-6	5-7	22-26-54-18	66.84	33-26-54-18	74.65	22-24-54-18	66.84
BC-A-6	10-11	6-4	22-26-54-18	70.46	33-26-54-18	78.95	22-26-54-18	70.46
BC-A-7	11-4	7-2	22-26-54-18	74.08	33-26-54-18	83.25	22-26-54-18	74.08
BC-A-8	10-2	2-8	22-26-54-18	59.73	22-26-54-18	59.73	22-26-54-18	59.73
BC-A-9	10-7	3-5	22-26-54-18	64.33	33-26-54-18	70.78	22-24-54-18	64.33
BC-A-10	10-11	4-3	22-26-54-18	68.93	33-26-54-18	76.06	22-26-54-18	68.93
BC-A-11	11-4	5-0	22-26-54-18	78.81	22-26-27-18	83.02	22-26-54-18	78.81
BC-A-12	11-8	5-9	22-26-54-18	75.19	33-26-54-18	83.67	22-26-54-18	75.19
BC-A-13	12-1	6-7	33-26-54-18	87.98	22-26-27-18	89.44	33-26-54-18	87.98
BC-A-14	12-5	7-4	33-26-54-18	92.28	22-26-27-18	93.06	33-26-54-18	92.28
BC-A-15	11-7	2-10	22-26-54-18	67.10	33-26-54-18	73.55	22-26-54-18	67.10
BC-A-16	11-11	3-7	22-26-54-18	71.70	22-26-27-18	82.33	22-26-54-18	71.70
BC-A-17	12-3	4-5	33-26-54-18	76.61	22-26-27-18	80.41	33-26-54-18	76.61
BC-A-18	12-7	5-2	33-26-54-18	87.43	44-26-54-18	95.92	33-26-54-18	87.43
BC-A-19	12-11	6-0	33-26-54-18	91.73	33-26-27-18	102.36	33-26-54-18	91.73
BC-A-20	13-3	6-9	33-26-54-18	103.31	22-26-18-18	114.72	33-26-54-18	103.31
BC-A-21	13-0	3-0	33-26-54-18	90.51	33-26-27-18	100.16	33-26-54-18	90.51
BC-A-22	13-4	3-10	33-26-54-18	95.79	33-26-18-18	117.05	33-26-54-18	95.79
BC-A-23	13-7	4-7	22-26-27-18	104.18	33-26-18-18	124.28	22-26-27-18	104.18
BC-A-24	13-10	5-5	22-26-27-18	105.85	33-26-18-18	125.65	22-26-27-18	105.85
BC-A-25	14-1	6-2	22-26-27-18	109.47	44-26-18-18	134.82	22-26-27-18	109.47
BC-A-26	14-5	3-3	22-26-27-18	102.03	22-26-09-18	140.64	22-26-27-18	102.03
BC-A-27	14-8	4-1	22-26-18-18	110.19	23-26-09-18	156.41	22-26-18-18	110.19
BC-A-28	14-10	4-10	22-26-18-18	117.21	32-26-09-18	169.47	22-26-18-18	117.21
BC-A-29	15-1	5-8	22-26-18-18	128.87	32-26-09-18	171.02	23-26-18-18	131.75
BC-A-30	15-4	6-5	23-26-18-18	102.68	33-26-09-18	172.19	32-26-18-18	140.30
BC-A-31	15-6	7-3	24-26-18-18	141.88	42-26-09-18	184.98	33-26-18-18	147.49
BC-A-32	15-9	8-0	32-26-18-18	148.90	32-26-18-09	185.02	35-26-18-18	157.56
BC-A-33	15-10	3-6	32-26-18-18	129.85	52-26-09-18	170.35	43-26-18-18	138.50
BC-A-34	16-0	4-3	33-26-18-18	139.97	52-26-09-18	181.88	22-26-09-18	162.52
BC-A-35	16-2	5-1	34-26-18-18	150.09	32-26-18-09	185.81	22-26-09-18	172.01
BC-A-36	16-4	5-11	35-26-18-18	154.34	32-26-18-09	187.18	23-26-09-18	172.65
BC-A-37	16-6	6-8	22-26-09-18	173.38	32-26-18-09	191.48	32-26-09-18	181.87
BC-A-38	16-8	7-6	22-26-09-18	177.00	42-26-18-09	204.94	32-26-09-18	186.17
BC-A-39	16-10	8-3	22-26-09-18	180.62	22-26-09-09	222.12	33-26-09-18	189.06
BC-A-40	17-9	3-10	22-66-27-18	135.57	23-66-18-18	154.87	22-66-18-18	151.30
BC-A-41	18-2	4-7	22-66-27-18	142.78	25-66-18-18	171.02	22-66-18-18	160.30
BC-A-42	18-7	5-4	22-66-27-18	149.98	27-66-18-18	187.13	22-66-18-18	169.30
BC-A-43	19-0	6-1	22-66-18-18	168.30	27-66-18-18	196.13	25-66-18-18	188.99
BC-A-44	19-5	6-11	22-66-18-18	171.15	22-66-18-09	218.03	26-66-18-18	185.42
BC-A-45	19-10	7-8	22-66-18-18	174.78	22-66-18-09	221.65	27-66-18-18	192.61
BC-A-46	20-3	8-5	22-66-18-18	182.02	22-66-18-09	228.89	22-66-18-09	228.89
BC-A-47	19-1	4-2	22-66-18-18	156.68	27-66-18-18	174.51	22-66-18-09	208.93
BC-A-48	19-5	4-11	22-66-18-18	168.88	22-66-18-09	224.14	22-66-18-09	224.14
BC-A-49	19-9	5-8	22-66-18-18	179.73	22-66-18-09	237.95	22-66-18-09	237.95
BC-A-50	20-1	6-6	22-66-18-18	187.30	22-66-18-09	239.55	22-66-18-09	239.55
BC-A-51	20-6	7-3	22-66-18-18	189.45	22-66-18-09	241.01	22-66-18-09	241.01
BC-A-52	20-10	8-1	23-66-18-18	192.05	22-66-18-09	242.30	22-66-18-09	242.30
BC-A-53	21-2	8-10	23-66-18-18	195.94	22-66-18-09	243.27	22-66-18-09	243.27
BC-A-54	20-4	4-6	22-66-18-18	169.30	22-66-18-09	226.93	22-66-18-09	226.93
BC-A-55	20-7	5-3	22-66-18-18	176.40	22-66-18-09	231.18	22-66-18-09	231.18
BC-A-56	20-11	6-1	23-66-18-18	183.79	22-66-18-09	235.38	22-66-18-09	235.38
BC-A-57	21-3	6-10	23-66-18-18	191.12	22-66-18-09	239.48	22-66-18-09	239.48
BC-A-58	21-6	7-8	24-66-18-18	198.93	22-66-18-09	244.29	22-66-18-09	244.29
BC-A-59	21-10	8-5	25-66-18-18	206.26	22-66-18-09	248.66	22-66-18-09	248.66
BC-A-60	22-1	9-3	25-66-18-18	211.17	22-66-18-09	254.03	22-66-18-09	254.03
BC-A-61	21-7	4-11	24-66-18-18	188.15	22-66-18-09	241.31	22-66-18-09	241.31
BC-A-62	21-10	5-8	25-66-18-18	194.45	22-66-18-09	246.41	22-66-18-09	246.41
BC-A-63	22-1	6-6	25-66-18-18	200.75	22-66-18-09	251.61	22-66-18-09	251.61
BC-A-64	22-3	7-3	25-66-18-18	207.55	22-66-18-09	257.22	22-66-18-09	257.22
BC-A-65	22-6	8-1	26-66-18-18	213.75	22-66-18-09	262.52	22-66-18-09	262.52
BC-A-66	22-9	8-10	26-66-18-18	220.15	22-66-18-09	268.42	22-66-18-09	268.42
BC-A-67	23-0	9-8	26-66-18-18	228.49	22-66-18-09	271.80	22-66-18-09	271.80
BC-A-68	22-9	5-4	26-66-18-18	206.99	22-66-18-09	255.69	22-66-18-09	255.69
BC-A-69	23-0	6-1	26-66-18-18	212.19	22-66-18-09	261.99	22-66-18-09	261.99
BC-A-70	23-2	6-11	27-66-18-18	217.63	22-66-18-09	268.89	22-66-18-09	268.89
BC-A-71	23-4	7-8	27-66-18-18	223.62	22-66-18-09	271.93	22-66-18-09	271.93
BC-A-72	23-6	8-6	27-66-18-18	228.67	22-66-18-09	277.13	22-66-18-09	277.13
BC-A-73	23-8	9-3	27-66-18-18	233.76	22-66-18-09	283.03	22-66-18-09	283.03
BC-A-74	23-10	10-1	27-66-18-18	242.41	22-66-18-09	286.18	22-66-18-09	286.18
BC-A-75	24-0	5-9	27-66-18-18	239.31	22-66-18-09	282.98	22-66-18-09	282.98
BC-A-76	24-1	6-6	27-66-18-18	243.41	22-66-18-09	289.48	22-66-18-09	289.48
BC-A-77	24-3	7-4	27-66-18-18	248.21	22-66-18-09	295.58	22-66-18-09	295.58
BC-A-78	24-4	8-2	27-66-18-18	252.41	22-66-18-09	301.60	22-66-18-09	301.60
BC-A-79	24-5	8-11	27-66-18-18	257.31	22-66-18-09	307.90	22-66-18-09	307.90
BC-A-80	24-7	9-9	27-66-18-18	261.51	22-66-18-09	314.70	22-66-18-09	314.70
BC-A-81	24-8	10-6	27-66-18-18	266.18	22-66-18-09	321.85	22-66-18-09	321.85
BC-A-82	25-2	6-2	22-66-18-09	298.60	23-66-18-09	304.37	22-66-18-09	298.60
BC-A-83	25-2	7-0	22-66-18-09	304.90	23-66-18-09	308.57	22-66-18-09	304.90
BC-A-84	25-3	7-9	22-66-18-09	311.80	23-66-18-09	313.37	22-66-18-09	311.80
BC-A-85	25-4	8-7	22-66-18-09	315.91	23-66-18-09	318.27	32-66-18-09	318.60
BC-A-86	25-4	9-5	22-66-18-09	320.90	23-66-18-09	322.82	32-66-18-09	325.50
BC-A-87	25-5	10-2	22-66-18-09	325.47	23-66-18-09	331.24	32-66-18-09	336.85

	Span	Rise	HS-20		HS-25		HL-93	
	(ft-in)	(ft-in)	Plate-Rib-Schedule	lb/ft	Plate-Rib-Schedule	lb/ft	Plate-Rib-Schedule	lb/ft
BC-A-88	26-7	5-5	22-66-18-09	298.60	24-66-09-09	357.33	24-66-09-09	357.33
BC-A-89	27-0	6-3	23-66-18-09	307.70	24-66-09-09	367.53	24-66-09-09	368.43
BC-A-90	27-5	7-0	23-66-18-09	317.07	24-66-09-09	378.43	24-66-09-09	380.03
BC-A-91	27-8	7-9	23-66-18-09	326.17	24-66-09-09	389.23	24-66-09-09	391.93
BC-A-92	28-3	8-7	23-66-18-09	335.47	24-66-09-09	399.78	24-66-09-09	403.13
BC-A-93	28-8	9-4	24-66-18-09	347.77	24-66-09-09	411.09	25-66-09-09	416.87
BC-A-94	29-2	10-1	24-66-18-09	351.39	25-66-09-09	420.29	25-66-09-09	420.29
BC-A-95	27-10	5-10	23-66-18-09	355.61	24-66-09-09	422.39	24-66-09-09	422.39
BC-A-96	28-3	6-8	23-66-18-09	360.53	24-66-09-09	424.89	24-66-09-09	424.89
BC-A-97	28-7	7-5	23-66-18-09	365.08	24-66-09-09	427.79	25-66-09-09	427.79
BC-A-98	29-0	8-3	24-66-18-09	369.18	24-66-09-09	429.90	25-66-09-09	429.90
BC-A-99	29-4	9-0	34-66-18-09	373.43	25-66-09-09	432.07	25-66-09-09	432.07
BC-A-100	29-8	9-9	34-66-18-09	377.62	25-66-09-09	434.18	25-66-09-09	434.18
BC-A-101	30-0	10-7	34-66-18-09	378.11	25-66-09-09	440.52	25-66-09-09	440.52
BC-A-102	29-1	6-4	24-66-18-09	335.28	25-66-09-09	398.99	25-66-09-09	398.99
BC-A-103	29-4	7-1	34-66-18-09	353.45	25-66-09-09	409.10	25-66-09-09	409.10
BC-A-104	29-9	7-11	34-66-18-09	368.10	25-66-09-09	419.32	25-66-09-09	419.32
BC-A-105	30-0	8-8	34-66-18-09	381.34	25-66-09-09	429.40	25-66-09-09	429.40
BC-A-106	30-4	9-5	34-66-18-09	394.24	25-66-09-09	440.27	25-66-09-09	440.27
BC-A-107	30-7	10-3	22-66-09-09	439.07	25-66-09-09	450.85	25-66-09-09	450.85
BC-A-108	31-0	11-0	22-66-09-09	442.69	25-66-09-09	462.04	25-66-09-09	462.04
BC-A-109	30-3	6-9	22-66-09-09	421.19	25-66-09-09	440.55	25-66-09-09	440.55
BC-A-110	30-6	7-7	22-66-09-09	430.30	25-66-09-09	449.77	25-66-09-09	449.77
BC-A-111	30-10	8-4	22-66-09-09	439.63	25-66-09-09	459.10	25-66-09-09	459.10
BC-A-112	31-1	9-2	22-66-09-09	449.27	25-66-09-09	468.38	25-66-09-09	468.38
BC-A-113	31-4	9-11	22-66-09-09	458.55	25-66-09-09	477.59	25-66-09-09	477.59
BC-A-114	31-8	10-9	22-66-09-09	467.69	25-66-09-09	487.39	25-66-09-09	487.39
BC-A-115	31-11	11-6	22-66-09-09	478.58	25-66-09-09	497.93	25-66-09-09	497.93
BC-A-116	31-5	7-3	22-66-09-09	424.81	25-66-09-09	444.17	25-66-09-09	444.17
BC-A-117	31-8	8-0	22-66-09-09	436.82	25-66-09-09	454.42	25-66-09-09	454.42
BC-A-118	31-10	8-10	22-66-09-09	449.67	25-66-09-09	465.30	25-66-09-09	465.30
BC-A-119	32-1	9-8	22-66-09-09	462.48	25-66-09-09	476.04	25-66-09-09	476.04
BC-A-120	32-3	10-5	22-66-09-09	474.96	25-66-09-09	494.31	24-66-09-09	487.86
BC-A-121	32-7	11-3	22-66-09-09	482.20	25-66-09-09	503.59	24-66-09-09	496.46
BC-A-122	32-8	12-0	22-66-09-09	489.44	25-66-09-09	512.87	24-66-09-09	505.06
BC-A-123	32-7	7-9	22-66-09-09	424.81	25-66-09-09	445.05	24-66-09-09	437.71
BC-A-124	32-9	8-6	22-66-09-09	434.93	25-66-09-09	455.16	24-66-09-09	447.81
BC-A-125	32-11	9-4	22-66-09-09	542.93	25-66-09-09	466.00	24-66-09-09	458.39
BC-A-126	33-1	10-2	22-66-09-09	552.97	25-66-09-09	476.51	24-66-09-09	468.86
BC-A-127	33-3	10-11	22-66-09-09	563.78	25-66-09-09	486.71	24-66-09-09	479.77
BC-A-128	33-8	11-9	22-66-09-09	574.19	25-66-09-09	497.62	24-66-09-09	490.61
BC-A-129	33-8	12-6	22-66-09-09	485.82	25-66-09-09	507.21	24-66-09-09	500.08
BC-A-130	33-8	8-3	22-66-09-09	435.45	25-66-09-09	456.84	24-66-09-09	449.71
BC-A-131	33-9	9-1	22-66-09-09	445.46	25-66-09-09	466.86	24-66-09-09	458.82
BC-A-132	33-11	9-10	22-66-09-09	455.71	26-66-09-09	477.60	24-66-09-09	467.85
BC-A-133	34-1	10-8	22-66-09-09	466.62	26-66-09-09	488.11	24-66-09-09	477.26
BC-A-134	34-2	11-5	22-66-09-09	476.64	26-66-09-09	498.32	24-66-09-09	487.07
BC-A-135	34-4	12-3	22-66-09-09	486.22	26-66-09-09	508.96	24-66-09-09	496.68
BC-A-136	34-5	13-1	23-66-09-09	496.57	26-66-09-09	517.96	24-66-09-09	503.70
BC-A-137	34-9	8-9	23-66-09-09	446.20	26-66-09-09	467.59	23-66-09-09	446.20
BC-A-138	34-10	9-7	23-66-09-09	455.42	26-66-09-09	476.87	23-66-09-09	455.42
BC-A-139	34-11	10-4	23-66-09-09	464.83	26-66-09-09	486.21	23-66-09-09	464.83
BC-A-140	35-0	11-2	23-66-09-09	474.11	26-66-09-09	496.02	23-66-09-09	474.11
BC-A-141	35-1	12-0	23-66-09-09	483.92	26-66-09-09	505.07	23-66-09-09	483.92
BC-A-142	35-2	12-9	23-66-09-09	493.20	26-66-09-09	514.35	23-66-09-09	493.20
BC-A-143	35-3	13-7	23-66-09-09	500.87	26-66-09-09	524.30	23-66-09-09	500.87

PLATE-RIB-SCHEDULE CODING

1st Position: Haunch Plate Thickness, Crown Plate Thickness (inches)
[2 = 0.125, 3 = 0.150, 4 = 0.175, 5 = 0.200, 6 = 0.225, 7 = 0.250]

2nd Position: Haunch Rib Type, Crown Rib Type

3rd Position: Haunch Rib Spacing (inches)

4th Position: Crown Rib Spacing (inches)

Plate-Rib-Schedules shown for each structure are structurally sufficient for the entire cover height range allowed by AASHTO for structural plate box structures (1.4 – 5.0 ft). Lighter and more cost effective structures may be developed as the minimum cover increases beyond 1.4 ft.

Cover height is taken as the burial depth above the rise of the structure, measured to the bottom of flexible pavement or the top of rigid pavement, and applicable to those portions of the structure subject to traffic loading.

Vertical Footing Reactions R (kips/ft) Structures 1-87

	Span	Rise	H20-HS20, Cover Heights (ft)					H25-HS25, Cover Heights (ft)					HL93, Cover Heights (ft)				
	(ft-in)	(ft-in)	1.4	2.0	3.0	4.0	5.0	1.4	2.0	3.0	4.0	5.0	1.4	2.0	3.0	4.0	5.0
1	8-9	2-6	2.88	3.05	3.36	3.72	4.09	3.37	3.50	3.77	4.08	4.43	3.98	4.07	4.28	4.54	4.85
2	9-2	3-3	2.77	2.97	3.34	3.74	4.15	3.21	3.39	3.71	4.08	4.47	3.77	3.91	4.19	4.51	4.86
3	9-7	4-1	2.67	2.90	3.32	3.76	4.22	3.07	3.29	3.67	4.08	4.51	3.58	3.76	4.10	4.48	4.88
4	10-0	4-10	2.61	2.87	3.33	3.81	4.30	2.98	3.23	3.65	4.11	4.58	3.45	3.67	4.06	4.48	4.92
5	10-6	5-7	2.57	2.87	3.37	3.88	4.41	2.92	3.20	3.67	4.17	4.68	3.36	3.61	4.06	4.52	5.01
6	10-11	6-4	2.54	2.86	3.40	3.95	4.51	2.87	3.17	3.69	4.22	4.76	3.28	3.56	4.05	4.55	5.07
7	11-4	7-2	2.52	2.85	3.43	4.01	4.60	2.82	3.15	3.70	4.27	4.84	3.21	3.51	4.04	4.58	5.14
8	10-2	2-8	3.06	3.28	3.69	4.13	4.60	3.54	3.73	4.09	4.50	4.93	4.14	4.29	4.59	4.95	5.35
9	10-7	3-5	2.96	3.21	3.67	4.16	4.67	3.40	3.63	4.05	4.50	4.98	3.95	4.14	4.51	4.92	5.37
10	10-11	4-3	2.85	3.14	3.64	4.16	4.71	3.25	3.52	3.99	4.48	5.00	3.76	3.99	4.42	4.88	5.37
11	11-4	5-0	2.80	3.11	3.65	4.22	4.79	3.17	3.46	3.98	4.51	5.07	3.64	3.91	4.38	4.89	5.42
12	11-8	5-9	2.74	3.08	3.66	4.25	4.85	3.09	3.41	3.96	4.53	5.12	3.53	3.83	4.34	4.89	5.45
13	12-1	6-7	2.71	3.07	3.69	4.31	4.95	3.04	3.38	3.97	4.58	5.20	3.44	3.77	4.33	4.91	5.51
14	12-5	7-4	2.69	3.06	3.71	4.36	5.02	2.99	3.36	3.98	4.61	5.26	3.37	3.72	4.32	4.93	5.56
15	11-7	2-10	3.25	3.53	4.03	4.56	5.12	3.73	3.97	4.43	4.92	5.45	4.32	4.53	4.93	5.38	5.87
16	11-11	3-7	3.14	3.45	4.00	4.57	5.16	3.58	3.86	4.37	4.91	5.47	4.12	4.37	4.83	5.33	5.86
17	12-3	4-5	3.04	3.38	3.97	4.58	5.21	3.44	3.76	4.32	4.90	5.50	3.94	4.23	4.74	5.29	5.86
18	12-7	5-2	2.98	3.35	3.97	4.61	5.27	3.35	3.70	4.29	4.91	5.54	3.82	4.14	4.70	5.28	5.89
19	12-11	6-0	2.93	3.31	3.97	4.64	5.33	3.27	3.64	4.27	4.92	5.59	3.70	4.05	4.65	5.27	5.92
20	13-3	6-9	2.90	3.30	3.99	4.69	5.40	3.22	3.61	4.28	4.96	5.65	3.62	3.99	4.63	5.29	5.96
21	13-0	3-0	3.45	3.79	4.38	5.01	5.66	3.92	4.23	4.78	5.36	5.98	4.51	4.77	5.27	5.81	6.39
22	13-4	3-10	3.34	3.70	4.34	5.01	5.69	3.76	4.11	4.71	5.34	6.00	4.30	4.61	5.16	5.76	6.39
23	13-7	4-7	3.25	3.64	4.31	5.01	5.72	3.64	4.01	4.66	5.32	6.01	4.14	4.48	5.08	5.71	6.37
24	13-10	5-5	3.17	3.58	4.29	5.01	5.75	3.53	3.93	4.61	5.31	6.02	3.99	4.36	5.00	5.67	6.36
25	14-1	6-2	3.11	3.55	4.28	5.03	5.79	3.46	3.87	4.58	5.31	6.05	3.88	4.28	4.95	5.65	6.37
26	14-5	3-3	3.65	4.04	4.73	5.45	6.19	4.11	4.47	5.12	5.80	6.52	4.68	5.01	5.60	6.24	6.92
27	14-8	4-1	3.53	3.95	4.68	5.44	6.21	3.95	4.35	5.04	5.76	6.51	4.47	4.84	5.49	6.17	6.89
28	14-10	4-10	3.44	3.88	4.64	5.41	6.21	3.82	4.24	4.97	5.72	6.49	4.31	4.70	5.39	6.11	6.85
29	15-1	5-8	3.36	3.83	4.62	5.42	6.24	3.72	4.17	4.93	5.71	6.51	4.17	4.59	5.32	6.07	6.84
30	15-4	6-5	3.31	3.80	4.61	5.44	6.28	3.65	4.12	4.91	5.72	6.54	4.07	4.51	5.28	6.06	6.86
31	15-6	7-3	3.26	3.75	4.59	5.44	6.29	3.57	4.05	4.87	5.70	6.54	3.96	4.42	5.21	6.02	6.84
32	15-9	8-0	3.23	3.74	4.60	5.47	6.35	3.52	4.02	4.86	5.72	6.58	3.89	4.38	5.19	6.03	6.87
33	15-10	3-6	3.86	4.31	5.10	5.91	6.74	4.30	4.73	5.47	6.25	7.06	4.86	5.25	5.95	6.69	7.46
34	16-0	4-3	3.75	4.22	5.04	5.88	6.74	4.16	4.61	5.39	6.20	7.04	4.68	5.10	5.84	6.61	7.41
35	16-2	5-1	3.65	4.14	4.99	5.85	6.73	4.03	4.50	5.32	6.16	7.01	4.50	4.95	5.73	6.54	7.37
36	16-4	5-11	3.57	4.08	4.95	5.84	6.73	3.92	4.41	5.26	6.12	7.00	4.36	4.83	5.64	6.48	7.33
37	16-6	6-8	3.51	4.04	4.93	5.83	6.75	3.84	4.35	5.22	6.10	7.00	4.25	4.74	5.58	6.44	7.32
38	16-8	7-6	3.45	4.00	4.91	5.83	6.76	3.76	4.29	5.18	6.09	7.00	4.15	4.66	5.53	6.41	7.31
39	16-10	8-3	3.42	3.97	4.90	5.84	6.79	3.71	4.25	5.16	6.09	7.02	4.07	4.60	5.49	6.39	7.31
40	17-9	3-10	4.03	4.54	5.43	6.34	7.26	4.45	4.94	5.79	6.66	7.57	4.97	5.43	6.23	7.07	7.94
41	18-2	4-7	3.98	4.52	5.45	6.40	7.36	4.37	4.89	5.79	6.71	7.65	4.85	5.35	6.20	7.09	8.00
42	18-7	5-4	3.95	4.52	5.49	6.47	7.47	4.31	4.86	5.80	6.76	7.74	4.76	5.29	6.19	7.12	8.07
43	19-0	6-1	3.94	4.53	5.53	6.55	7.58	4.27	4.85	5.83	6.83	7.84	4.69	5.25	6.20	7.17	8.16
44	19-5	6-11	3.92	4.54	5.58	6.63	7.69	4.24	4.84	5.86	6.89	7.94	4.63	5.22	6.21	7.22	8.24
45	19-10	7-8	3.93	4.57	5.64	6.73	7.82	4.23	4.85	5.91	6.97	8.05	4.60	5.21	6.24	7.28	8.34
46	20-3	8-5	3.95	4.61	5.71	6.83	7.95	4.23	4.88	5.96	7.06	8.17	4.58	5.21	6.28	7.36	8.45
47	19-1	4-2	4.25	4.82	5.80	6.81	7.83	4.65	5.20	6.15	7.12	8.12	5.16	5.68	6.58	7.52	8.49
48	19-5	4-11	4.21	4.80	5.82	6.86	7.90	4.58	5.16	6.15	7.16	8.19	5.06	5.61	6.56	7.54	8.54
49	19-9	5-8	4.17	4.79	5.84	6.91	7.98	4.52	5.12	6.15	7.19	8.25	4.96	5.54	6.53	7.55	8.58
50	20-1	6-6	4.14	4.78	5.86	6.96	8.06	4.46	5.09	6.15	7.23	8.31	4.87	5.48	6.51	7.56	8.63
51	20-6	7-3	4.14	4.81	5.92	7.05	8.19	4.45	5.10	6.20	7.31	8.43	4.84	5.47	6.54	7.63	8.73
52	20-10	8-1	4.13	4.82	5.96	7.12	8.28	4.42	5.09	6.22	7.36	8.51	4.78	5.44	6.54	7.66	8.79
53	21-2	8-10	4.14	4.84	6.01	7.19	8.38	4.42	5.10	6.26	7.42	8.60	4.76	5.43	6.57	7.71	8.87
54	20-4	4-6	4.49	5.11	6.18	7.27	8.38	4.88	5.49	6.52	7.59	8.67	5.38	5.96	6.95	7.98	9.03
55	20-7	5-3	4.42	5.07	6.17	7.29	8.42	4.79	5.42	6.49	7.59	8.70	5.25	5.86	6.90	7.96	9.04
56	20-11	6-1	4.39	5.06	6.19	7.34	8.50	4.73	5.38	6.49	7.62	8.76	5.16	5.79	6.87	7.97	9.09
57	21-3	6-10	4.37	5.06	6.23	7.40	8.59	4.69	5.37	6.51	7.67	8.84	5.09	5.75	6.87	8.00	9.15
58	21-6	7-8	4.34	5.05	6.24	7.44	8.64	4.64	5.34	6.51	7.69	8.88	5.02	5.70	6.84	8.00	9.18
59	21-10	8-5	4.35	5.07	6.29	7.51	8.74	4.63	5.34	6.54	7.75	8.97	4.99	5.68	6.86	8.05	9.25
60	22-1	9-3	4.33	5.07	6.31	7.56	8.81	4.60	5.33	6.55	7.79	9.03	4.94	5.65	6.86	8.07	9.29
61	21-7	4-11	4.71	5.39	6.55	7.73	8.92	5.09	5.76	6.88	8.04	9.21	5.57	6.21	7.30	8.42	9.56
62	21-10	5-8	4.66	5.36	6.55	7.75	8.97	5.02	5.70	6.86	8.04	9.24	5.46	6.12	7.25	8.41	9.58
63	22-1	6-6	4.61	5.33	6.55	7.78	9.02	4.94	5.65	6.84	8.05	9.27	5.36	6.05	7.21	8.39	9.59
64	22-3	7-3	4.57	5.30	6.54	7.79	9.04	4.88	5.60	6.82	8.05	9.29	5.27	5.98	7.16	8.37	9.59
65	22-6	8-1	4.54	5.30	6.56	7.83	9.10	4.84	5.58	6.82	8.07	9.34	5.20	5.93	7.15	8.38	9.62
66	22-9	8-10	4.54	5.30	6.58	7.88	9.17	4.81	5.57	6.83	8.11	9.39	5.16	5.90	7.15	8.40	9.67
67	23-0	9-8	4.53	5.31	6.61	7.92	9.24	4.79	5.56	6.85	8.15	9.45	5.12	5.88	7.15	8.43	9.72
68	22-9	5-4	4.92	5.66	6.90	8.16	9.43	5.29	6.01	7.22	8.46	9.71	5.76	6.45	7.63	8.83	10.06
69	23-0	6-1	4.88	5.64	6.91	8.19	9.49	5.23	5.96	7.21	8.47	9.75	5.66	6.38	7.59	8.83	10.08
70	23-2	6-11	4.82	5.59	6.89	8.19	9.51	5.15	5.90	7.17	8.46	9.76	5.55	6.29	7.53	8.79	10.07
71	23-4	7-8	4.79	5.57	6.88	8.20	9.53	5.09	5.86	7.15	8.46	9.77	5.47	6.22	7.49	8.77	10.07
72	23-6	8-6	4.75	5.55	6.88	8.21	9.56	5.04	5.82	7.13	8.46	9.79	5.40	6.16	7.45	8.76	10.07
73	23-8	9-3	4.73	5.53	6.88	8.24	9.60	5.00	5.80	7.13	8.47	9.81	5.34	6.12	7.43	8.75	10.09
74	23-10	10-1	4.71	5.52	6.89	8.26	9.63	4.97	5.77	7.12	8.48	9.84	5.29	6.08	7.41	8.75	10.10
75	24-0	5-9	5.16	5.95	7.28	8.63	9.98	5.52	6.29	7.60	8.92	10.25	5.97	6.72	7.99	9.28	10.59
76	24-1	6-6	5.09	5.89	7.24	8.60	9.97	5.43	6.21	7.54	8.87	10.23	5.85	6.61	7.90	9.22	10.55
77	24-3	7-4	5.04	5.86	7.23	8.60	9.99	5.36	6.16	7.50	8.86	10.23	5.75	6.53	7.85	9.19	10.54
78	24-4	8-2	4.99	5.81	7.19	8.58	9.98	5.28	6.09	7.45	8.83	10.21	5.65	6.44	7.78	9.14	10.50
79	24-5	8-11	4.94	5.77	7.17	8.57	9.98	5.22	6.04	7.42	8.81	10.20	5.57	6.38	7.73	9.10	10.48
80	24-7	9-9	4.92	5.76	7.17	8.59	10.01	5.18	6.02	7.41	8.81	10.23	5.51	6.33	7.71	9.10	10.49
81	24-8	10-6	4.89	5.74	7.16	8.59	10.02	5.14	5.98	7.39	8.80	10.22	5.45	6.28	7.67	9.07	10.48
82	25-2	6-2	5.39	6.23	7.64	9.06	10.50	5.74	6.56	7.94	9.35	10.76	6.17	6.97	8.32	9.70	11.09
83	25-2	7-0	5.30	6.15	7.57	9.00	10.44	5.62	6.45	7.85	9.27	10.69	6.03	6.84	8.21	9.60	11.00
84	25-3	7-9	5.25	6.10	7.54	8.98	10.44	5.55	6.39	7.81	9.24	10.67	5.93	6.76	8.15	9.55	10.97
85	25-4	8-7	5.19	6.06	7.51	8.96	10.43	5.48	6.33	7.76	9.20	10.66	5.84	6.67	8.08	9.51	10.94
86	25-4	9-5	5.13	6.00	7.45	8.92	10.39	5.40	6.26	7.70	9.15	10.60	5.74	6.58	8.00	9.43	10.87
87	25-5	10-2	5.10	5.97	7.44	8.91	10.39	5.35	6.22	7.67	9.13	10.60	5.67	6.53	7.96	9.41	10.86

	Span	Rise	H20-HS20, Cover Heights (ft)					H25-HS25, Cover Heights (ft)					HL93, Cover Heights (ft)				
	(ft-in)	(ft-in)	1.4	2.0	3.0	4.0	5.0	1.4	2.0	3.0	4.0	5.0	1.4	2.0	3.0	4.0	5.0
88	26-7	5-5	5.63	6.48	7.91	9.35	10.81	5.98	6.81	8.22	9.64	11.08	6.43	7.24	8.61	10.00	11.41
89	27-0	6-3	5.62	6.50	7.97	9.45	10.94	5.96	6.81	8.26	9.72	11.19	6.37	7.21	8.62	10.06	11.51
90	27-5	7-0	5.64	6.54	8.04	9.55	11.08	5.95	6.84	8.32	9.81	11.32	6.34	7.21	8.66	10.13	11.62
91	27-8	7-9	5.63	6.54	8.07	9.60	11.15	5.93	6.82	8.33	9.85	11.38	6.29	7.17	8.66	10.15	11.67
92	28-3	8-7	5.70	6.64	8.21	9.78	11.37	5.98	6.90	8.46	10.02	11.59	6.33	7.24	8.77	10.31	11.86
93	28-8	9-4	5.75	6.71	8.30	9.91	11.52	6.01	6.96	8.54	10.13	11.73	6.34	7.27	8.84	10.41	11.99
94	29-2	10-1	5.82	6.80	8.43	10.07	11.72	6.07	7.04	8.66	10.28	11.92	6.38	7.34	8.94	10.55	12.17
95	27-10	5-10	5.92	6.82	8.35	9.88	11.43	6.27	7.15	8.65	10.16	11.69	6.70	7.56	9.03	10.51	12.02
96	28-3	6-8	5.93	6.85	8.41	9.98	11.56	6.25	7.16	8.70	10.25	11.81	6.65	7.55	9.05	10.58	12.12
97	28-7	7-5	5.93	6.88	8.47	10.07	11.67	6.24	7.17	8.74	10.32	11.91	6.62	7.53	9.07	10.63	12.20
98	29-0	8-3	5.96	6.93	8.55	10.18	11.82	6.25	7.20	8.81	10.42	12.04	6.60	7.54	9.13	10.72	12.32
99	29-4	9-0	5.99	6.97	8.62	10.27	11.93	6.26	7.23	8.86	10.50	12.15	6.60	7.55	9.17	10.79	12.42
100	29-8	9-9	6.02	7.02	8.69	10.37	12.05	6.28	7.27	8.92	10.59	12.26	6.60	7.57	9.21	10.86	12.52
101	30-0	10-7	6.05	7.07	8.76	10.47	12.17	6.29	7.30	8.98	10.68	12.37	6.60	7.59	9.26	10.94	12.62
102	29-1	6-4	6.21	7.17	8.79	10.41	12.05	6.55	7.49	9.08	10.69	12.31	6.96	7.89	9.45	11.03	12.63
103	29-4	7-1	6.20	7.17	8.81	10.46	12.12	6.51	7.47	9.09	10.72	12.36	6.90	7.85	9.44	11.05	12.67
104	29-9	7-11	6.22	7.22	8.89	10.58	12.27	6.52	7.50	9.16	10.82	12.50	6.89	7.86	9.49	11.13	12.79
105	30-0	8-8	6.23	7.24	8.93	10.64	12.34	6.50	7.50	9.18	10.87	12.57	6.85	7.84	9.49	11.16	12.84
106	30-4	9-5	6.26	7.28	9.00	10.73	12.47	6.52	7.54	9.24	10.96	12.68	6.85	7.86	9.54	11.24	12.94
107	30-7	10-3	6.26	7.31	9.05	10.79	12.55	6.52	7.55	9.27	11.01	12.75	6.83	7.85	9.56	11.28	13.00
108	31-0	11-0	6.33	7.39	9.16	10.93	12.71	6.57	7.62	9.38	11.14	12.91	6.87	7.91	9.65	11.40	13.15
109	30-3	6-9	6.50	7.52	9.21	10.92	12.64	6.83	7.83	9.50	11.19	12.89	7.23	8.21	9.86	11.53	13.21
110	30-6	7-7	6.49	7.51	9.24	10.97	12.71	6.79	7.80	9.51	11.22	12.95	7.17	8.17	9.85	11.54	13.25
111	30-10	8-4	6.51	7.55	9.30	11.06	12.83	6.80	7.83	9.56	11.31	13.06	7.15	8.17	9.88	11.61	13.34
112	31-1	9-2	6.51	7.57	9.34	11.12	12.91	6.78	7.83	9.59	11.35	13.13	7.12	8.15	9.89	11.64	13.40
113	31-4	9-11	6.52	7.60	9.39	11.19	12.99	6.78	7.84	9.62	11.41	13.20	7.10	8.15	9.91	11.68	13.46
114	31-8	10-9	6.56	7.65	9.47	11.29	13.12	6.80	7.88	9.69	11.50	13.32	7.11	8.18	9.97	11.76	13.57
115	31-11	11-6	6.58	7.68	9.52	11.36	13.21	6.82	7.91	9.73	11.57	13.40	7.11	8.19	10.00	11.82	13.64
116	31-5	7-3	6.80	7.86	9.64	11.43	13.24	7.11	8.16	9.92	11.69	13.48	7.50	8.53	10.27	12.02	13.78
117	31-8	8-0	6.79	7.87	9.68	11.49	13.31	7.09	8.15	9.94	11.74	13.55	7.46	8.51	10.27	12.05	13.84
118	31-10	8-10	6.77	7.86	9.68	11.51	13.35	7.05	8.13	9.93	11.75	13.57	7.40	8.46	10.24	12.04	13.85
119	32-1	9-8	6.78	7.88	9.72	11.58	13.43	7.04	8.13	9.96	11.80	13.65	7.37	8.45	10.26	12.08	13.91
120	32-3	10-5	6.77	7.88	9.74	11.61	13.48	7.02	8.13	9.97	11.83	13.69	7.34	8.43	10.26	12.09	13.94
121	32-7	11-3	6.81	7.94	9.83	11.72	13.61	7.05	8.17	10.04	11.92	13.81	7.35	8.46	10.31	12.18	14.05
122	32-8	12-0	6.80	7.93	9.82	11.72	13.62	7.02	8.15	10.03	11.92	13.81	7.31	8.42	10.29	12.17	14.05
123	32-7	7-9	7.09	8.21	10.07	11.95	13.83	7.40	8.50	10.34	12.20	14.07	7.77	8.86	10.68	12.51	14.36
124	32-9	8-6	7.08	8.20	10.08	11.97	13.87	7.36	8.47	10.34	12.21	14.10	7.72	8.82	10.66	12.51	14.38
125	32-11	9-4	7.06	8.19	10.09	12.00	13.91	7.33	8.45	10.34	12.23	14.13	7.66	8.78	10.64	12.51	14.40
126	33-1	10-2	7.05	8.19	10.11	12.03	13.96	7.30	8.44	10.34	12.25	14.16	7.62	8.75	10.63	12.52	14.42
127	33-3	10-11	7.05	8.20	10.13	12.07	14.01	7.29	8.44	10.35	12.28	14.21	7.59	8.73	10.63	12.54	14.46
128	33-8	11-9	7.12	8.29	10.25	12.21	14.18	7.35	8.51	10.46	12.42	14.37	7.64	8.79	10.73	12.67	14.61
129	33-8	12-6	7.08	8.25	10.22	12.18	14.16	7.30	8.47	10.42	12.38	14.34	7.58	8.74	10.68	12.62	14.57
130	33-8	8-3	7.38	8.54	10.48	12.42	14.38	7.67	8.82	10.74	12.67	14.61	8.03	9.16	11.06	12.98	14.90
131	33-9	9-1	7.33	8.50	10.45	12.41	14.38	7.61	8.76	10.70	12.65	14.60	7.95	9.10	11.01	12.94	14.88
132	33-11	9-10	7.33	8.50	10.47	12.45	14.43	7.59	8.76	10.71	12.67	14.64	7.92	9.07	11.01	12.95	14.91
133	34-1	10-8	7.32	8.51	10.49	12.48	14.48	7.57	8.75	10.72	12.70	14.68	7.88	9.05	11.00	12.96	14.93
134	34-2	11-5	7.30	8.49	10.49	12.49	14.49	7.54	8.72	10.70	12.69	14.68	7.83	9.01	10.97	12.95	14.93
135	34-4	12-3	7.30	8.51	10.51	12.53	14.54	7.53	8.72	10.72	12.72	14.73	7.81	9.00	10.98	12.97	14.96
136	34-5	13-1	7.29	8.49	10.51	12.53	14.56	7.50	8.70	10.71	12.72	14.74	7.77	8.96	10.96	12.96	14.96
137	34-9	8-9	7.66	8.87	10.88	12.90	14.93	7.95	9.14	11.13	13.14	15.16	8.30	9.48	11.45	13.44	15.44
138	34-10	9-7	7.62	8.84	10.86	12.89	14.93	7.89	9.09	11.10	13.12	15.15	8.22	9.41	11.40	13.41	15.42
139	34-11	10-4	7.60	8.82	10.85	12.89	14.94	7.85	9.06	11.08	13.11	15.15	8.17	9.37	11.37	13.38	15.41
140	35-0	11-2	7.57	8.80	10.84	12.89	14.95	7.81	9.03	11.06	13.10	15.15	8.11	9.32	11.34	13.36	15.40
141	35-1	12-0	7.55	8.78	10.84	12.90	14.96	7.78	9.00	11.05	13.10	15.15	8.07	9.28	11.31	13.35	15.39
142	35-2	12-9	7.54	8.77	10.84	12.91	14.98	7.76	8.99	11.04	13.10	15.16	8.03	9.25	11.29	13.34	15.39
143	35-3	13-7	7.52	8.76	10.84	12.91	14.99	7.73	8.97	11.03	13.10	15.17	8.00	9.22	11.27	13.33	15.39

Cover height is taken as the burial depth above the rise of the structure, measured to the bottom of flexible pavement or to the top of rigid pavement.

Vertical footing reactions shown may be used for footing design. The equation below may be used to calculate reactions for intermediate cover heights.

H = cover height (ft)
S = box culvert span (ft)
R = box culvert rise (ft)
ϕ = leg angle
γ_s = backfill weight (0.120 kcf)
A_L = design axle load (kips)

H20-HS20 (A_L = 32k)
single 32k axle

H25-HS25 (A_L = 40k)
single 40k axle

HL93 (A_L = 50k)
tandem 25k axles

$$\text{Unfactored Vertical Footing Reaction, R (k/ft)} = \left[\gamma_s\left(\frac{H\,S}{2} + \frac{S^2}{40}\right) + \frac{A_L}{8 + 2\,(H + R)}\right]\cos\phi$$

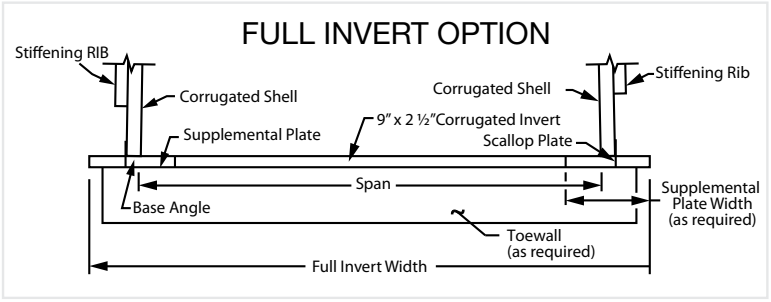
Structures with full inverts or open bottom structures with footer plates require special design when cover heights exceed 4.0 ft. Alternatively, concrete footings could be designed using vertical reactions tabulated herein.

Full Invert & Footer Plates Structures 1-143

Invert Table

	Plate	Width	Weight		Plate	Width	Weight		Plate	Width	Weight		Plate	Width	Weight		Plate	Width	Weight
	(in)	(N)	(lb/ft)		(in)	(N)	(lb/ft)		(in)	(N)	(lb/ft)		(in)	(N)	(lb/ft)		(in)	(N)	(lb/ft)
1	0.100	13	22.34	30	0.100	22	38.80	59	0.100	31	55.26	88	0.125	37	77.15	117	0.125	46	96.84
2	0.100	14	23.81	31	0.100	22	38.80	60	0.100	31	55.26	89	0.125	38	78.96	118	0.125	46	96.84
3	0.100	14	23.81	32	0.100	22	38.80	61	0.100	30	53.79	90	0.125	38	78.96	119	0.125	46	96.84
4	0.100	15	28.51	33	0.100	22	38.80	62	0.100	31	55.26	91	0.125	39	80.77	120	0.125	47	98.65
5	0.100	16	29.98	34	0.100	22	38.80	63	0.100	31	55.26	92	0.125	40	82.58	121	0.125	47	98.65
6	0.100	16	29.98	35	0.100	23	40.27	64	0.100	31	56.73	93	0.125	40	82.58	122	0.125	47	98.65
7	0.100	17	31.45	36	0.100	23	40.27	65	0.100	32	56.73	94	0.125	40	82.58	123	0.125	47	98.65
8	0.100	15	28.51	37	0.100	23	40.27	66	0.100	32	56.73	95	0.125	39	80.77	124	0.125	47	98.65
9	0.100	16	29.98	38	0.100	23	40.27	67	0.100	32	56.73	96	0.125	39	80.77	125	0.125	47	98.65
10	0.100	16	29.98	39	0.100	24	41.74	68	0.100	32	56.73	97	0.125	40	82.58	126	0.125	48	100.46
11	0.100	17	31.45	40	0.100	26	44.68	69	0.100	32	56.73	98	0.125	40	82.58	127	0.125	48	100.46
12	0.100	17	31.45	41	0.100	26	44.68	70	0.100	32	56.73	99	0.125	41	84.39	128	0.125	48	100.46
13	0.100	18	32.92	42	0.100	27	46.15	71	0.100	33	58.20	100	0.125	41	84.39	129	0.125	48	100.46
14	0.100	18	32.92	43	0.100	27	46.15	72	0.100	33	58.20	101	0.125	42	86.20	130	0.125	48	100.46
15	0.100	17	31.45	44	0.100	28	47.62	73	0.100	33	58.20	102	0.125	40	82.58	131	0.125	48	100.46
16	0.100	17	31.45	45	0.100	28	47.62	74	0.100	33	58.20	103	0.125	41	84.39	132	0.125	49	102.27
17	0.100	18	32.92	46	0.100	29	52.32	75	0.100	33	58.20	104	0.125	41	84.39	133	0.125	49	102.27
18	0.100	18	32.92	47	0.100	27	46.15	76	0.100	34	59.67	105	0.125	42	86.20	134	0.125	49	102.27
19	0.100	19	34.39	48	0.100	28	47.62	77	0.100	34	59.67	106	0.125	44	93.22	135	0.125	49	102.27
20	0.100	19	34.39	49	0.100	28	47.62	78	0.100	34	59.67	107	0.125	45	95.03	136	0.125	49	102.27
21	0.100	19	34.39	50	0.100	29	52.32	79	0.100	34	59.67	108	0.125	45	95.03	137	0.125	49	102.27
22	0.100	19	34.39	51	0.100	29	52.32	80	0.100	34	59.67	109	0.125	44	93.22	138	0.125	50	104.07
23	0.100	19	34.39	52	0.100	29	52.32	81	0.100	34	59.67	110	0.125	44	93.22	139	0.125	50	104.07
24	0.100	20	35.86	53	0.100	30	53.79	82	0.100	35	61.14	111	0.125	45	95.03	140	0.125	50	104.07
25	0.100	20	35.86	54	0.100	29	52.32	83	0.100	35	61.14	112	0.125	45	95.03	141	0.125	50	104.07
26	0.100	20	35.86	55	0.100	29	52.32	84	0.100	35	61.14	113	0.125	45	95.03	142	0.125	50	104.07
27	0.100	21	37.33	56	0.100	30	53.79	85	0.100	36	62.61	114	0.125	46	96.84	143	0.125	50	104.07
28	0.100	21	37.33	57	0.100	30	53.79	86	0.100	36	62.61	115	0.125	46	96.84				
29	0.100	21	37.33	58	0.100	30	53.79	87	0.100	36	62.61	116	0.125	45	95.03				

Effective footings for structures with full plate inverts are developed by adding additional plates with a prescribed width beneath the box culvert leg. The additional plates (i.e. Supplemental Plates) are bolted between the invert plate and the base angle to accommodate the magnitude of the vertical reaction, R. Plate footings for structures without plate inverts (open bottom structures) are more simply referred to as footer plates. **Use the narrowest supplemental or footer plate that accommodates the design vertical reaction.**



Tables below assume that the foundation has previously carried the design overburden. Where footings extend beyond the span of the structure and the foundation has not previously carried the design overburden (i.e. embankment installations), the weight of the soil above this portion of the footing may need to be included in the footing design.

All tables based on an allowable soil bearing capacity of 4.0 ksf and are applicable for cover heights ≤ 4.0-ft. Special supplemental or footer plate designs are required for cover heights between 4.0 and 5.0-ft.

Full Invert Supplemental Plates Structures 1-87

SPW	Qty	SPT	R	W
w/o supplemental plates			5.39	
2N	1	0.100	6.25	7.49
2.5N	1	0.100	7.54	8.97
3N	1	0.125	7.83	12.05
3N	1	0.150	8.38	12.05
3N	1	0.175	8.79	12.05
3.5N	1	0.200	8.85	13.52
3.5N	1	0.225	9.31	13.52
3.5N	1	0.250	9.75	13.52

Full Invert Supplemental Plates Structures 88-143

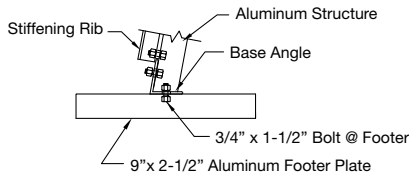
SPW	Qty	SPT	R	W
w/o supplemental plates			6.15	
2N	1	0.100	6.26	7.49
3N	1	0.100	7.83	12.05
3N	1	0.150	8.79	16.46
4N	1	0.250	9.66	32.30
4N	2	0.150	10.37	41.52
4N	2	0.175	11.00	47.30
4N	2	0.225	11.26	58.84
6N	2	0.250	11.42	92.68
6N	3	0.175	11.60	100.80
6N	3	0.200	12.22	113.55
6N	3	0.225	12.81	126.27
6N	3	0.250	13.38	139.02
6N	4	0.200	13.71	151.40

Open Bottom Footer Plates Structures 1-143

FPW	Qty	FPT	R	W
2N	1	0.100	5.39	7.49
2N	1	0.125	6.15	8.94
3N	1	0.175	6.71	18.67
3N	1	0.200	7.29	20.87
3N	1	0.225	7.86	23.08
3N	1	0.250	8.42	25.29
3N	2	0.150	8.85	32.92
4N	2	0.175	9.27	47.30
4N	2	0.200	10.03	53.06
4N	2	0.225	10.76	58.84
4N	2	0.250	11.08	64.60
4N	3	0.200	11.31	79.59
5N	3	0.200	11.67	96.57
5N	3	0.225	12.43	107.28
5N	3	0.250	12.87	117.96
5N	4	0.225	13.26	143.04
6N	4	0.225	13.55	168.36

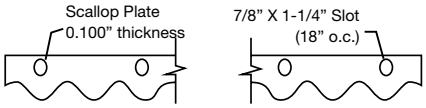
Supplemental Plate Width, SPW (inches)
Supplemental Plate Thickness, SPT (inches)
Footer Plate Width, FPW (inches)
Footer Plate Thickness, FPT (inches)
Maximum Allowable Vertical Reaction, R (kips/ft)
Weight per foot, W (lb/ft)

FOOTER PLATE OPTION



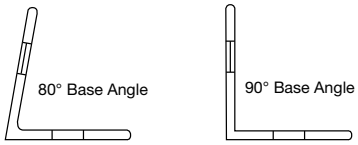
SCALLOP PLATE ENCLOSURE

(FULL INVERT ONLY)



3004-H34 ALUMINUM

BASE ANGLES

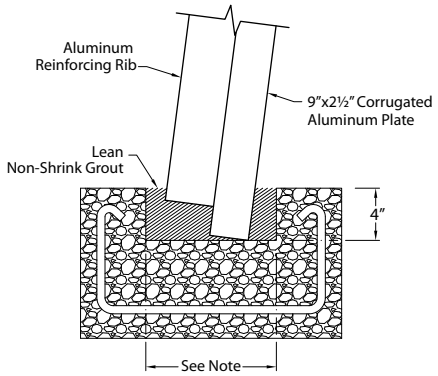


Structures 1-25, 40-60, 88-115

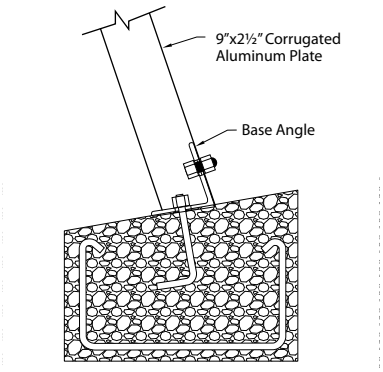
Structures 26-39, 61-87, 116-143

Aluminum Angles	3-3/4" x 3-1/2" x 1/4"
Slotted Holes	7/8" x 1-1/4" (18" O.C.)

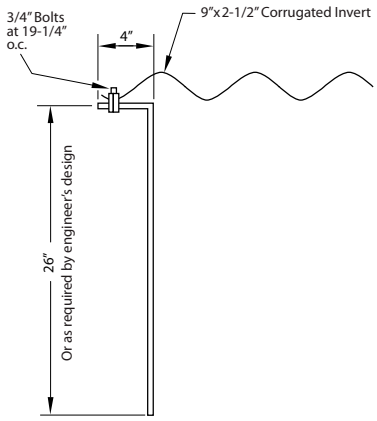
CONCRETE FOOTING WITH KEYWAY



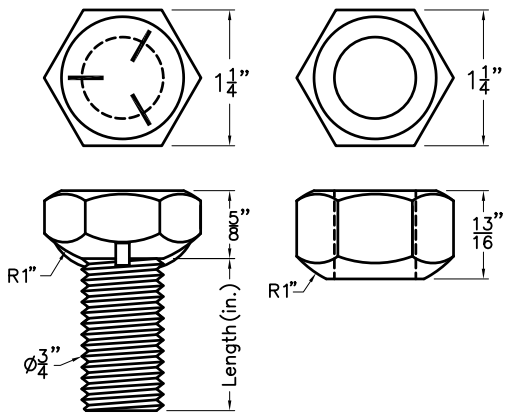
CONCRETE FOOTING WITH ANCHORED BASE ANGLE



ALUMINUM BENT SHEET TOEWALL



NOTE: Structures No. 1-39 (leg lengths 0.5N through 2.5N) and Structures No. 40-143 (leg lengths 0.5N through 3.5N) have ribs that will extend into the keyway. In these cases the keyway width shall be 10 inches, otherwise a standard keyway width of 8 inches shall be sufficient.



Bolts and nuts required to join corrugated plates together, or to join corrugated plates to the stiffeners or other structural members shall conform to the requirements of ASTM B 746 for hot-dip galvanized steel bolts and nuts.

Bolt Lengths Required for Various Connections

Plate (in)	1-Plate	2-Plate Lap	3-Plate Rib
0.100 - 0.125		1¼"	1½"
0.150 - 0.200		1½"	1¾"
0.225 - 0.250		1½"	1¾"
0.100 - 0.175 (w/rib)	1½"	1¾"	2"
0.200 - 0.250 (w/rib)	1¾"	2"	2"

A General Guide to Assembly & Installation

A. STRUCTURE ASSEMBLY

1. The box culvert shall be assembled in accordance with the manufacturer's shop drawings and instructions.
2. Plate laps must be properly mated in a tangent fashion using proper alignment techniques and adequate bolt torque to seat the corrugation. The recommended bolt torque for aluminum box culverts is 90–115 ft-lbs for invert plates and 100–150 ft-lbs for all other components.
3. Bolting shall be done with the curved surface of the nut against the plate.

B. STRUCTURAL BACKFILL

1. Structural backfill shall be a well-graded granular material meeting the AASHTO M145 material requirements for A-1, A-3, A-2-4, or A-2-5.
2. For A-2 materials, moisture content must be between -3% to +2% of optimum as defined by AASHTO T180.
3. Structural backfill shall be free of organic material, frozen lumps and rock fragments or other protruding material larger than three inches.

Sieve Analysis, Percent Passing

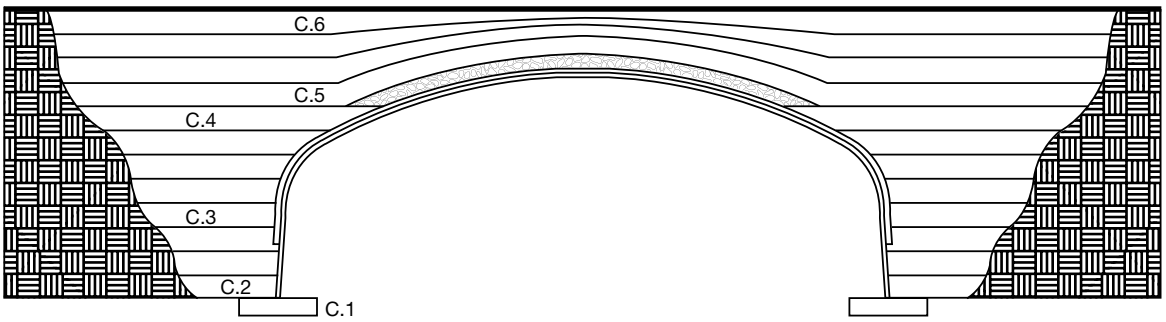
Group Classification	A-1	A-3	A-2-4	A-2-5
No. 10 (2.00 mm)	—	—	—	—
No. 40 (0.425 mm)	50 max	51 max	—	—
No. 100 (0.150 mm)	—	—	50 max	50 max
No. 200 (0.075 mm)	25 max	10 max	20 max	20 max

Characteristics of fraction passing No. 40 (0.425 mm)

Liquid Limit	—	—	40 max	41 max
Plasticity Index	6 max	Non-plastic	10 max	10 max
Typical Constituent Materials	Stone Fragment, Gravel and Sand	Sand	Silty or Clayey Gravel and Sand	

C. INSTALLATION

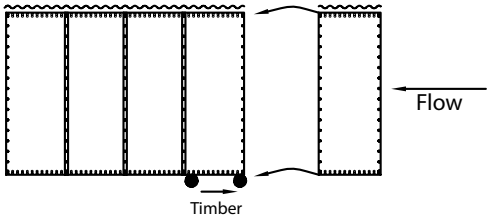
1. When concrete strip footings are used they shall be constructed in accordance with the project plans and engineering design (by others). Structures using full inverts or footer plates shall be installed on 6 inches of a well-graded granular bedding.
2. Sufficient width shall be provided between the base of the culvert and the undisturbed soil of the trench excavation to facilitate compaction passes parallel to the structure using standard equipment. If less than 3 ft of space is available, a concrete grout or a flowable fill may be required to ensure compaction against undisturbed soil.
3. Structural backfill shall be placed symmetrically on each side of the structure in maximum 8 inches loose lifts and compacted to a minimum of 90% modified density per AASHTO T180.
4. Symmetrical lift construction proceeds parallel with the structure to a point above the haunch where a transition to a transverse operation occurs. The structural backfill zone below this point is referred to as the critical backfill zone as it receives the greatest pressure demands from the installation.
5. The transition to a transverse lift construction operation is facilitated by the placement of a 12 inches stone layer over the crown of the structure to provide a cushion against low ground pressure spreading equipment (e.g. CAT D-4 Dozer) and hand operated compaction equipment.
6. Construction equipment traversing the structure shall be limited to the equipment noted above for the duration of the backfilling operation. Cover may need to be increased temporarily for heavier construction vehicles but shall not exceed the maximum allowable cover for the box culvert design.



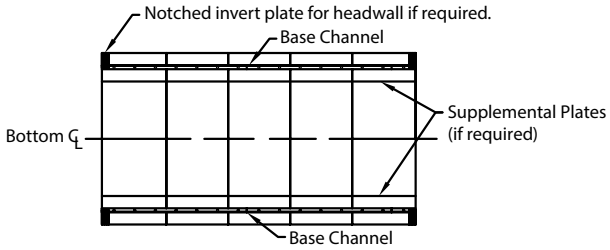
Step 01: Review shop drawings and product details.

Step 02: Assemble invert plates if more than one plate is required for width.

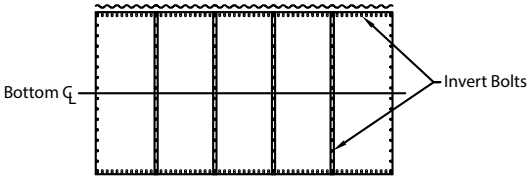
Step 03: Start assembly of invert at the downstream end making sure the plate is oriented as shown on the assembly drawing. (Refer to the shop drawing for this step). Lift -upstream end of plate and block with timbers,lapping the next panel over and bolting hand tight.



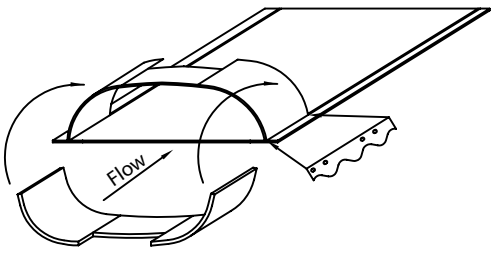
Step 04: Layout supplemental plates (if required), then layout the base angle and hand tighten nuts.



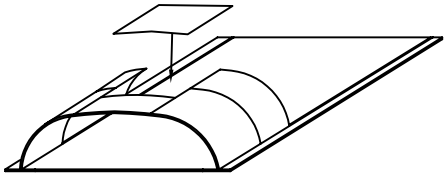
Step 05: After loose assembly of invert, tighten all nuts to proper torque.



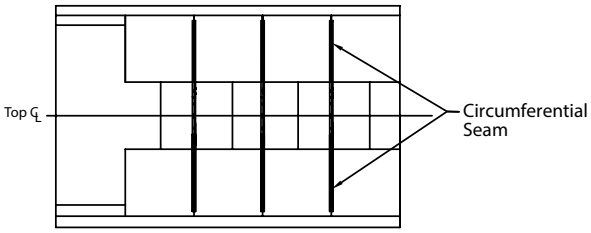
Step 06: Start assembly of shell at -upstream end with panels required to establish stagger pattern. Do not put bolts into holes that will be used for reinforcing rib bolts. Hand tighten, then flip first ring into place on to the invert. Place the scallop closure plates on vertical leg of base angle.



Step 07: Place next ring of plates, place bolts and hand tighten the longitudinal plate seams. Place bolts and nuts into arch and vertical angle leg and hand tighten.

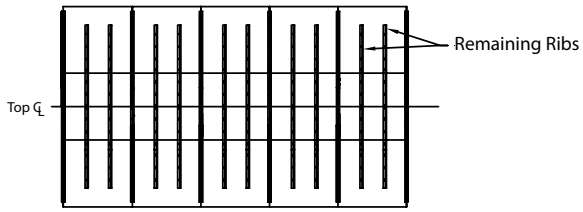


Step 08: Place both haunch ribs and crown ribs at the circumferential plate seam laps .



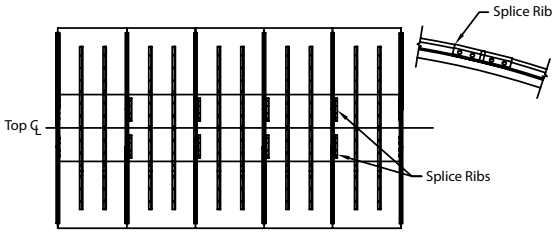
Step 09: Repeat steps 6 and 7 to the end of structure.

Step 10: Place and bolt remaining ribs in-between ribs already placed in step 7.

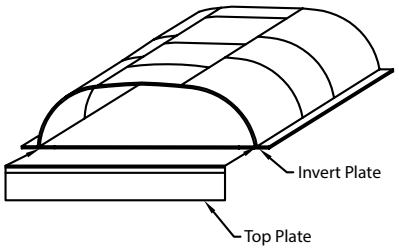


Step 11: Tighten all shell and rib nuts to proper torque.

Step 12: Attach splice ribs and tighten.



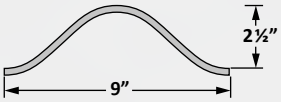
Step 13: Attach toe plates.



Aluminum Structural Plate & Rib Section Properties

ALUMINUM STRUCTURAL PLATE PER AASHTO M219 (ASTM B746)[1]

Plate Thickness (in)	Moment of Inertia (in^4/ft)	Section Modulus (in^3/ft)	Radius of Gyration (in)	Wall Area (in^2/ft)	Seam Strength (kip/ft)	Plastic Moment Capacity (kip-ft/ft)
0.100[2]	0.997	0.767	0.8438	1.404	28.0	n/a
0.125	1.248	0.951	0.8444	1.750	41.0	2.65
0.150	1.499	1.131	0.8449	2.100	54.1	3.18
0.175	1.751	1.309	0.8454	2.449	63.7	3.71
0.200	2.004	1.484	0.8460	2.799	73.4	4.24
0.225	2.258	1.658	0.8468	3.149	83.2	4.77
0.250	2.513	1.827	0.8473	3.501	93.1	5.30



Corrugated aluminum structural plate. See table to left for section properties.

[1] Alloy 5052. The minimum yield stress is 24 ksi and the modulus of elasticity is 10,000 ksi.
[2] The 0.100 plate thickness cannot be curved and is used for invert plate only.

PLATE-RIB COMPOSITE PLASTIC MOMENT CAPACITIES (KIP-FT/FT)

Rib	Spacing	0.125"	0.150"	0.175"	0.200"	0.225"	0.250"
Type II	54"	4.62	5.46	6.04	6.61	7.17	7.74
	27"	6.18	7.25	7.94	8.60	9.25	9.87
	18"	7.41	8.66	9.48	10.26	11.00	11.71
	9"	10.63	12.13	13.08	14.05	15.03	16.02
Type IV	54"	5.87	6.82	7.43	8.04	8.63	9.21
	27"	8.32	9.59	10.39	11.14	11.85	12.55
	18"	10.42	11.90	12.84	13.72	14.57	15.39
	9"	16.45	18.46	19.41	20.38	21.37	22.37
Type VI	54"	8.74	9.51	10.24	10.95	11.64	12.32
	27"	13.76	14.33	15.16	16.19	17.36	17.48
	18"	20.09	20.56	20.79	21.30	21.74	22.58
	9"	32.24	34.35	36.46	38.54	39.88	40.63

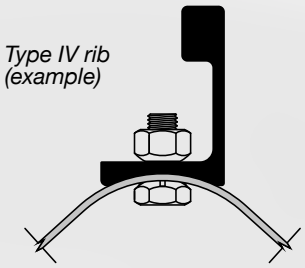


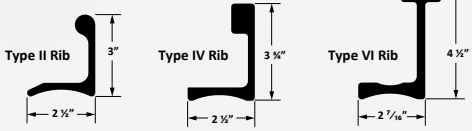
Plate-Rib Composite. See table to left for section properties.

STIFFENING RIB

	Type II	Type IV	Type VI
Area	1.75 in^2	2.37 in^2	3.58 in^2
Moment of Inertia	1.748 in^4	3.814 in^4	9.732 in^4
Centroid[1], Y_c	1.22 in	1.70 in	2.19 in
Section Modulus	0.982 in^3	1.858 in^3	4.210 in^3
Plastic Modulus	1.548 in^3	2.822 in^3	5.546 in^3
Plastic Moment	4.52 kip-ft	8.23 kip-ft	16.18 kip-ft
Radius of Gyration	1.001 in	1.269 in	1.648 in
Weight	2.095 lbs/ft	2.844 lbs/ft	4.300 lbs/ft

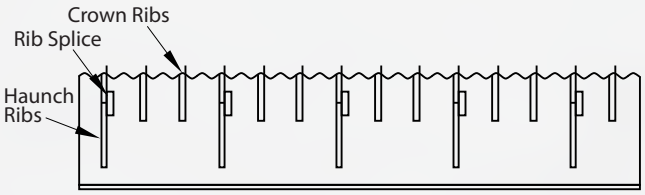
ALUMINUM STIFFENING RIBS 6061-T6 ALLOY EXTRUSIONS

Tensile Strength F_u = 38 ksi (min.)
Yield Strength F_y = 35 ksi (min.)

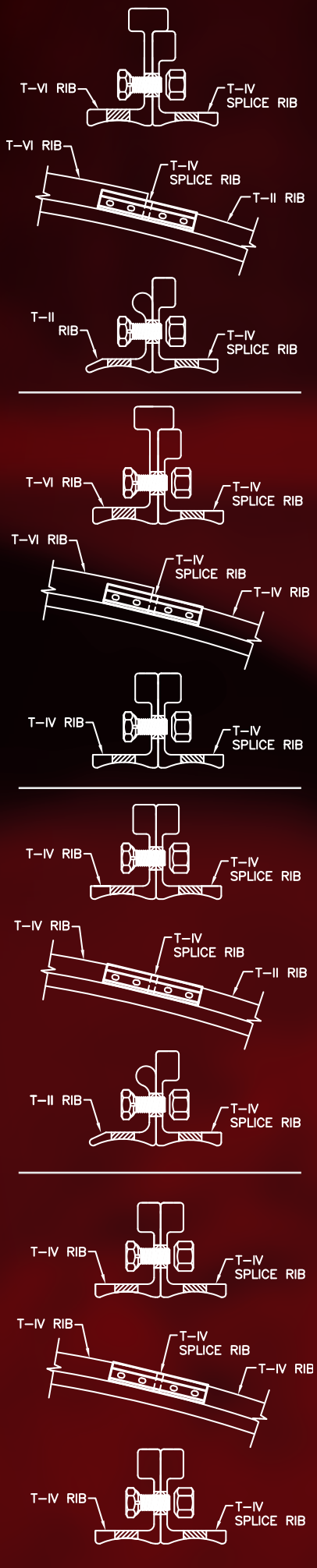


[1]Centroid measured from bottom extremity of rib.

Illustration shows haunch ribs spaced at 54 inches and crown ribs spaced at 18 inches. Rib splices between the haunch and crown ribs develop the full bending resistance required of the section.



SPLICE RIB DETAILS



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