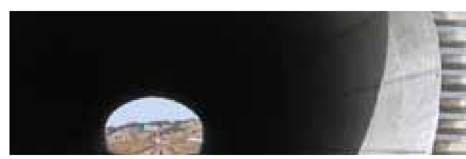
CONTECH
ENGINEERED SOLUTIONS

Aluminum Structural Plate



Aluminum Structural Plate

Time-Tested & Durable

Engineers, officials and contractors know that proper construction materials play an important part in designing efficient, economical drainage structures. This is why corrugated metal pipe has gained wide acceptance during more than 80 years of use in drainage structures under highways, railroads, airports and city streets.

Corrugated metal pipe offers definite advantages over other materials because of its lightweight, durability, ease of installation, low maintenance and adaptability to various field conditions. Logically, engineers wanted these advantages for larger waterways but were handicapped by the limitations of handling and shipping pipe in large diameters.

Large Aluminum Structures

Contech pioneered steel MULTI-PLATE® structures more than 50 years ago, providing a wider range of sizes and shapes while retaining the advantages of smaller, corrugated metal pipe.

Today, Contech also manufactures an aluminum structural plate that is durable, lightweight and easy to install. There are no forms to set or remove. No curing time is needed. Large installation crews are not necessary. No special lifting equipment is needed for small structures.

Aluminum structural plates are corrugated, curved and bolt-hole punched at the plant. Reinforcing ribs (if required by design) are also curved and bolt-hole punched to match the plate fabrication. Delivered to the job site unassembled, the plates and ribs are easily bolted together to form various shapes: round, vertical and horizontal ellipse, pipe=arch, underpass and arch.

Evidence of their dependability and economy is presented by the thousands of aluminum structural plate structures that have been installed since 1964.

Applications:

- Small bridges
- Culverts
- Stream enclosures
- Storm sewers
- Grade separations
- Conveyor covers
- Pedestrian, livestock and vehicular underpasses
- Conduits
- Aggregate reclaim tunnels
- Storage domes and magazines
- Lining for masonry or concrete conduits

.

Advantages for Bridge Replacements

- Durable
- Corrosion resistant
- Abrasion resistant
- Lightweight
- Reduced install and maintenance costs
- Easy site-adaptability
- Modular bridge design

Corrosion Resistant

The aluminum allows in aluminum structural plate have a proven history of excellent corrosion resistance. This is primarily due to a thin, tenacious, inert oxide barrier that forms on the metal surface when exposed to air.

The tough, tightly adhering oxide barrier cannot be easily removed. If damaged or affected by an aggressive environment, this oxide barrier will reform. This is referred to as a "self-healing" effect. The oxide barrier appears on the structure surface as a grayish-white coating that will build up over time.

Service-life expectancy studies on installed aluminum drainage products have been conducted since the early 1960s by state and federal agencies.

Based upon the performance and ongoing inspection of aluminum drainage structures first installed in 1959, a minimum service life of 75 years can be predicted for .10"-thick aluminum structural plate (pH between 4.0 to 9.0 and resistivity $\geq$ 500 ohm-cm). In addition, good performance may be expected in seawater environments when the structure is backfilled with a clean, granular materials.

All metal attachments such as rebar and anchor bolts and rods should be galvanized (no black steel should be in contact with the aluminum structures). Galvanized fasteners have proven to be completely compatible with aluminum structural plate. Your Contech representative can provide additional information on this subject.

This aluminum structural plate pipe has handled tidal ocean waters under U.S. Highway 1 at the Bay of Fundy in Maine since 1966.

The interior of this deteriorating stone arch bridge was relined with aluminum structural plate.

Abrasion Resistant

Aluminum's abrasion resistance has been proven through years of exposure to wet/dry abrasion-corrosion cycles. In normally abrasive runoffs, aluminum will only peen with minimum metal loss.

The Aluminum Association presented a paper to the Transportation Research Board in January 1969, reporting on more than 1,000 aluminum culverts*. (An updated report was presented in 1986**.)

Both reports included a method of predicting abrasion performance of aluminum corrugated drainage pipe, whereby peak energy curves were converted into a service-life chart. If required, the service life of structural plate can be extended by increasing the metal thickness of the structure and /or its invert.

If a proposed structure is expected to be installed in a stream with high-velocity runoff and with heavy bed load (especially angular rocks with sharp corners), it is recommended that the Aluminum Association abrasion papers be reviewed. Copies are available form Contech on request. When highly abrasive conditions are anticipated, it may also prove desirable to use arch structures on concrete fittings and remove any concern of invert damage.

* "The Mechanisms of Abrasion of Aluminum Alloy Culvert, Related Field Experiences and a Method to Predict Culvert Performance"

** "Abrasion Resistance of Aluminum Culvert Based on Long-Term Field Performance"

Handling & Design

Lightweight

Lightweight is one of the main advantages of aluminum drainage structures. Aluminum structural plate weighs approximately 1/50 as much as reinforced concrete pipe in an equivalent size. This weight factor reduces assembly and equipment costs, helps gain access to remote sites and allows handling of long preassembled structures with relative ease.

Reduced Install Costs

Unloading – Lightweight plates and reinforcing ribs arrive at the job site in strapped and nested bundles. Individual plates and ribs are generally light enough to be handled by one worker, and bundles can be handled with light duty lifting equipment.

Assembling – Most structures contain plate and rib sizes that be assembled without lifting equipment. As a quality assurance measure, at least one ring of plates for each order is plant-assembled and checked prior to shipment.

Aluminum structural plate can be manufactured into a large sections with up to three difference radii in the same plate. This capability reduces the number of joint connections and thus lowers assembly work hours.

Off-site assembly is an added feature of lightweight aluminum with obvious cost-savings. This can be at a remote assembly yard or alongside a ditch.

Structural Design

The structural performance of aluminum structural plate has been proven by the thousands of installations throughout the U.S. Contech's Aluminum structures Plate Design (tables 7-14) meets or exceeds the AASHTO Standard Specifications for Highway Bridge's Section 12 and ASTM B 790 for HS 20 loading. Call a Contech representative for design information on HS 25 and other loadings.

Like all structures, the design of structural plate products starts with the foundations. For structures with inverts, a uniform bed must be provided by the engineer. Foundation bearing strength must be adequate to both maintain the desired finished surface grade and ensure the serviceability of pavement overlays, etc. Adjacent foundations must be able to support the heavier structure sidefills so as not to settle relative to the structure. Inadequate foundation material should be replaced.

For backfill requirements see the Installation Section on Page 19. For near minimum cover structures, the roadway surface must be maintained to ensure proper cover (see HO Tables on Pages 12-15 for allowable minimum and maximum covers)

Boxed Culverts

A ribbed, corrugated aluminum box culvert structure is a specially designed aluminum structural plate product that has a wide span and a low rise needed for a low headroom, low cover installation.

Contech's box culverts combine the low profile shape of rigid box culverts with the strength and economies of flexible structures . Contech Aluminum Box Culverts are available in a wide range of standard sizes (8'9" x 2'6" to 35'3" x 13'7") and components that permit a minimum cover of 1.4' (17") for all spans.

Long Span Structures

Long span designs add both longitudinal stiffeners (thrust beams) and circumferential stiffeners (reinforcing ribs) to conventional aluminum structural plate to achieve larger sizes. Clear spans in excess of 30' and clear areas over 435 sf are achievable with long spans.

Available shapes include low profile and high profile arch horizontal ellipses. Long span structures are particularly suited for applications that require relatively low, wide openings. Heights of cover are general limited to 15'.

Standard Specifications:

- AASHTO M219 and ASTM B 746 – conduit, pipe
- ASTM B 209 – material
- ASTM B 789 – installation
- ASTM B 790 – design
- AASHTO Standard Bridge Design Specifications Section 12 – design
- AREMA - Manual for Railway Engineering, Chapter 1, Part 4
- ASTM B 864 – box culverts

End Treatment

Proper end treatments perform both structural and hydraulic functions.

Standard end finishes available on aluminum structural plate are square ends, step bevels, skews, partial bevels, and skew bevels.

Uncut or square-end structures are the lowest in cost and are readily adaptable to road widening projects. When skewed to the roadway embankment, larger structures may require properly warped and balanced backfill to provide uniform soil loading and support perpendicular to the structure's center line.

For hydraulic structures, special attention should be given to proper reinforcement of the metal edges on the cut ends of a structure to secure them against hydraulic forces. The cut ends of a structure are no longer supported by a full ring and are less stiff than the barrel of the structure. Extreme cut ends should be avoided on any structure. Cut ends on larger structures are no longer supported by a full ring and are less stiff than the barrel of the structure. Extreme cut ends should be avoided on any structure. Cut ends on larger structures should be anchored to a reinforce concrete collar or headwall. If beveling necessary, step bevels are recommended over other designs. Care should be used when placing backfill around cut ends to avoid distortion.

Pipe-arches are especially susceptible to hydraulic forces.

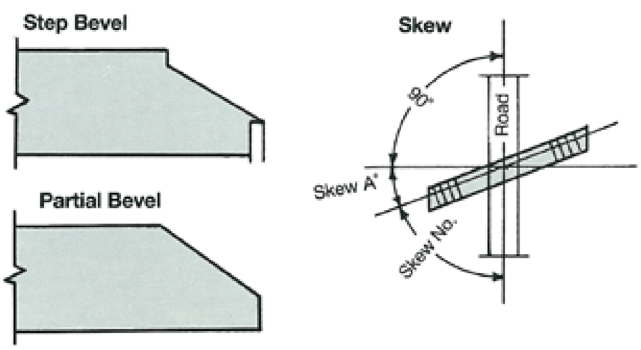
Structures designed to flow under pressure head are more vulnerable to end problems than those designed to flow less than full.

By decreasing the water infiltration under and beside the structure, hydraulic uplift (pore pressure) forces can be reduced. Full or partial reinforced concrete headwalls, grouted riprap, riprap with a geotextile and cutoff walls below and beside the structure are some of the end treatment methods that have been used to prevent uplift of the structure and control scouring of the backfill embankment.

Headwalls or other end treatments should be designed by a qualified engineer.

Appropriate end treatment design is beyond the scope of this brochure. Additional information can be obtained from the local DOT guidelines, the FHWA Circular Memo, "Plans for Culvert Inlet and Outlet Structures," Sheets G-39-66 to G-44-66, 1966 and chapters within the AISA Handbook of Steel Drainage & Highway Construction Products.

Structural Plate End Finishes



Hydraulic Nomographs

Hydraulic design nomographs for inlet and outlet control conditions have been developed by Dr. James R. Barton and Dr. A. Woodruff Miller, civil engineering professors at Brigham Young University, Provo, Utah.

They are based on research reports by John L. French and H.G. Bossy and are similar to nomographs found in FHWA Hydraulic Design Series #5. These nomographs and other hydraulic data may be obtained from any Contech Office listed on the back cover.

Plate Data

Description

Aluminum structural plate's corrugation pattern has a 9″ pitch and a 2 ½″ depth. The corrugations are at right angles to the length of the structure.

Thickness – Nominal plate thicknesses are available from 0.125″ to 0.250″ (See Table 12).

Lengths – Individual circumferential plate lengths are noted in terms of N (N = 9.625″ or 9 5/8″ or 3 pi). Standard plates are fabricated in seven net covering lengths:

- 8N (77.00″), 9N (86.63″)
- 10N (96.25″), 11N (105.88″)
- 12N (115.50″(, 13N (125.13″) and 14N (134.75″)

The N nomenclature translates circumference directly into nominal diameter in inches. For example, two 10N plates give a diameter of 60″ (2 x 10N x 3 pi); three 12N plates = 108″ (3 x 12N x 3 pi), etc. Various plates lengths structure shape and size.

Widths – All standard plates have a net width of 4′-6″ centers provide a standard 5.33 bolts per foot of longitudinal seam in two parallel rows at 1 ¾ centers.

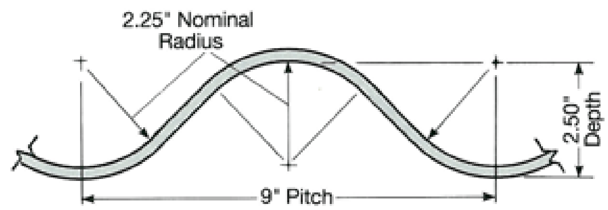
The outside crests of the end corrugations are punched for circumferential seam holes on centers of 9.625″ (or 3 pi).

Material – Plates are fabricated from an aluminum allow with material properties that conform to AASHTO M219 and ASTM B 209 specifications.

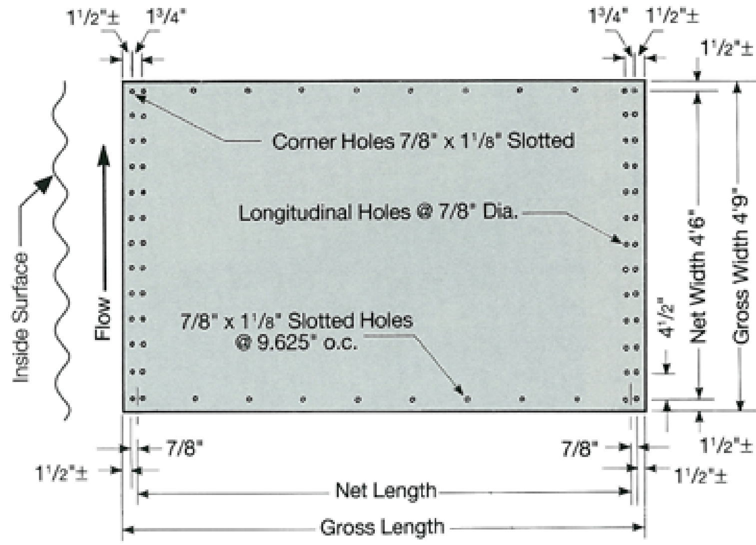
Bolts and Nuts

Hot-dipped galvanized, specially heat-treated ¾″ diameter steel bolts, meeting ASTM A 307 specifications, are used to assemble structural plate sections. The underside of the bolt head is uniformly rounded and does not require special positioning.

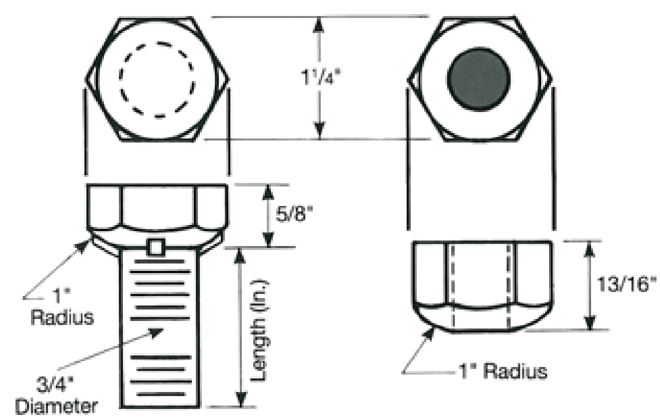
In addition, the underside of the bolt head is ribbed to prevent bolt rotation while tightening. Unlike conventional bolts, once the nut is finger tight, final tightening can usually be accomplished by one worker.



9" x 2 1/2" Corrugation



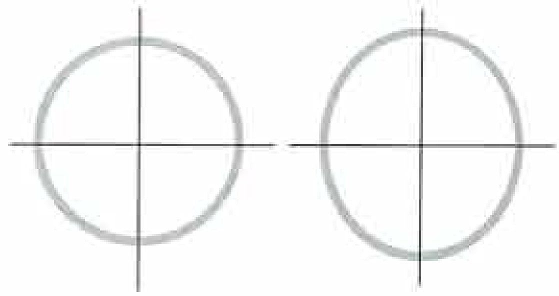
Standard Plate Detail



Bolt **Nut**

Table 1 — Round and Vertical Ellipse Pipe Details[1,2,3]					
Round Dia. (Inches)	Ellipse Dimensions (Inches)		Approx. Area[5] (Sq. Ft.)	Total N	
	Span	Rise		Structure	Rib[4]
60	56	62	18.8	20	
66	62	68	22.9	22	5
72	67	75	27.5	24	5
78	73	81	32.4	26	6
84	79	88	37.8	28	6
90	85	94	43.6	30	7
96	91	101	49.7	32	7
102	97	107	56.3	34	8
108	103	114	63.3	36	8
114	109	120	70.7	38	8
120	115	127	78.5	40	9
126	120	133	86.7	42	9
132	126	139	95.4	44	10
138	132	146	104.4	46	10
144	138	152	113.9	48	11
150	142	157	123.7	50	11
156	148	164	134.0	52	12
162	153	170	144.7	54	12
168	159	176	155.7	56	12
174	165	183	167.2	58	13
180	171	189	179.1	60	13
186	177	195	191.4	62	14
192	182	202	204.2	64	14
198	189	209	217.3	66	15
204	195	215	230.8	68	15
210	200	222	244.8	70	16
216	206	228	259.1	72	16
222	212	235	273.9	74	16
228	217	241	289.1	76	17
234	224	247	304.7	78	17

Larger sizes are available. Contact your CONTECH representative.

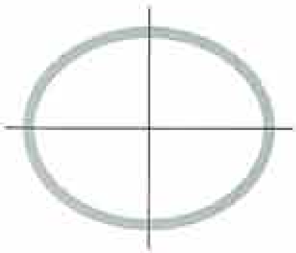


Notes
1. N = 9.625"
2. Dimensions are to inside corrugation crests and are subject to manufacturing tolerances.
3. To determine the proper gage, use information on table 7.
4. Reinforcing rib length, if required. For 66" through 96" diameter, use Type II rib only.
5. Areas as shown are for round pipe. Areas for vertical ellipses are slightly less.

This front end loader easily handles this 50' section of round pipe.

Table 2 — Horizontal Ellipse Details[1,2,4]							
Structure Number	Span Ft.-In.	Rise Ft.-In.	Approx. Area (Sq. Ft.)	R Inches	R Inches	Total N	
						Structure	Rib[3]
10E6	9-2	6-6	47.9	68	32	32	10
11E6	9-11	7-0	53.7	75	32	34	11
12E6	10-7	7-3	59.8	81	32	36	12
12E7	10-11	7-11	68.0	81	37	38	12
13E6	11-4	7-6	66.2	88	32	38	13
13E7	11-8	8-3	74.8	88	37	40	13
13E8	12-0	8-11	83.8	88	43	42	13
14E6	12-1	7-9	72.8	95	32	40	14
14E7	12-5	8-6	82.0	95	37	42	14
14E8	12-9	9-2	91.5	95	43	44	14
15E6	12-10	8-1	79.7	102	32	42	15
15E7	13-2	8-9	89.4	102	37	44	15
15E8	13-6	9-6	99.4	102	43	46	15
16E6	13-7	8-4	86.8	109	32	44	16
16E7	13-11	9-0	97.1	109	37	46	16
16E8	14-3	9-9	107.6	109	43	48	16
16E9	14-7	10-5	118.5	109	48	50	16
16E10	14-11	11-2	129.7	109	54	52	16

Larger sizes are available. Contact your CONTECH representative.



Notes
1. N = 9.625"
2. Dimensions are to inside corrugation crests and are subject to manufacturing tolerances.
3. Reinforcing rib length, if required.
4. To determine the proper gage, use information on table 9.

Pipe Arch

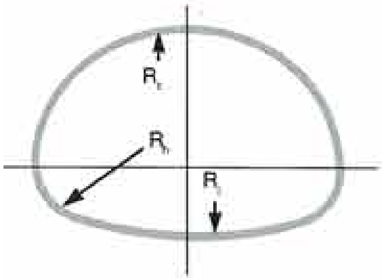


Table 3 — Pipe-Arch Details[1,2,3,5,7]

Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Inside Radius (Inches) Crown (R_t)	Inside Radius (Inches) Invert (R_b)	Arc Length N[4] Crown	Arc Length N[4] Haunch	Arc Length N[4] Invert	Total N Structure	Total N Rib[6]
6-7	5-8	29.6	41.5	69.9	8	7	3	25	6
6-11	5-9	31.9	43.7	102.9	9	7	3	26	6
7-3	5-11	34.3	45.6	188.3	10	7	3	27	8
7-9	6-0	36.8	51.6	83.8	9	7	5	28	8
8-1	6-1	39.3	53.3	106.1	10	7	5	29	8
8-5	6-3	41.9	54.9	150.1	11	7	5	30	8
8-10	6-4	44.5	63.3	93.0	10	7	7	31	10
9-3	6-5	47.1	64.4	112.6	11	7	7	32	10
9-7	6-6	49.9	65.4	141.6	12	7	7	33	10
9-11	6-8	52.7	66.4	188.7	13	7	7	34	10
10-3	6-9	55.5	67.4	278.8	14	7	7	35	11
10-9	6-10	58.4	77.5	139.6	13	7	9	36	11
11-1	7-0	61.4	77.8	172.0	14	7	9	37	11
11-5	7-1	64.4	78.2	222.0	15	7	9	38	11
11-9	7-2	67.5	78.7	309.5	16	7	9	39	13
12-3	7-3	70.5	90.8	165.2	15	7	11	40	13
12-7	7-5	73.7	90.5	200.0	16	7	11	41	13
12-11	7-8	77.0	90.4	251.7	17	7	11	42	13
13-1	8-2	83.0	88.8	143.6	18	6	13	43	13
13-1	8-4	86.8	81.7	300.8	21	6	11	44	13
13-11	8-5	90.3	100.4	132.0	18	6	15	45	13
14-0	8-7	94.2	90.3	215.1	21	6	13	46	13
13-11	9-5	101.5	86.2	159.3	23	5	14	47	13
14-3	9-7	105.7	87.2	176.3	24	5	14	48	13
14-8	9-8	109.9	90.9	166.2	24	5	15	49	13
14-11	9-10	114.2	91.8	183.0	25	5	15	50	13
15-4	10-0	118.6	95.5	173.0	25	5	16	51	14
15-7	10-2	123.1	96.4	189.6	26	5	16	52	14
16-1	10-4	127.6	100.2	179.7	26	5	17	53	14
16-4	10-6	132.3	101.0	196.1	27	5	17	54	14

Larger sizes are available. Contact your CONTECH representative.

Notes

1. N = 9.625″
2. Dimensions are to inside corrugation crests and are subject to manufacturing tolerances.
3. To determine the proper gage, use information on table 10.
4. The Arc Length N column reflects the peripheral length of a certain radius. Actual plate make-up, in a ring for a pipe-arch structure, will vary because of the multiple radii in a single plate.
5. Haunch Radius (R_h) = 37.75″
6. Reinforcing rib length, if required. For 6′7″ through 7′3″ span, use Type II rib only.
7. See side fill and foundation design.

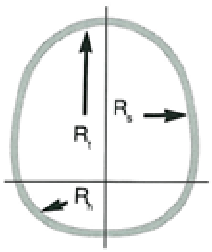
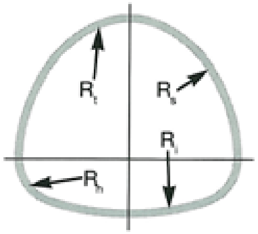


Table 4 — Pedestrian/Animal Underpass Details[1,2,3,7]											
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Inside Radius (Inches)[5]			Arc Length (Inches)[4]				Total N	
			Crown (R_t)	Side (R_s)	Haunch (R_h)	Crown	Side	Haunch	Bottom	Structure	Rib[6]
6-1	5-9	28	31.8	48.2	31.8	43.0	20.5	68.6	9.2	24	5
6-3	6-1	30	31.8	51.3	31.8	50.2	28.6	60.7	11.1	25	6
6-3	6-5	32	31.8	55.0	31.8	56.5	36.8	53.9	11.6	26	7
6-2	6-11	34	31.8	71.3	31.8	70.4	38.0	51.3	10.2	27	8
6-4	7-3	37	31.8	72.4	31.8	67.3	45.0	50.0	11.6	28	8
6-3	7-9	39	31.8	74.7	31.8	69.2	54.0	45.7	9.8	29	8
6-5	8-1	42	31.8	75.8	31.8	66.9	60.5	44.4	11.3	30	8



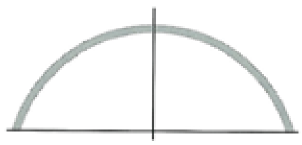
Notes

1. N = 9.625″
2. Dimensions are to inside corrugation crests and are subject to manufacturing tolerances. The designer should allow sufficient clearance for manufacturing tolerances and installation deflection.
3. To determine proper gage, use information on table 11.
4. The Arc Length N or inches column reflects the peripheral length of a certain radius. Actual plate make-up, in a ring for an under pass structure, will vary because of multiple radii in a single plate.
5. The bottoms of pedestrian/animal underpasses are nearly flat.
6. Reinforcing rib length, if required. Only Type II crown ribs can be used on a pedestrian/animal underpasses.
7. See side fill and foundation design.

Table 5 — Vehicular Underpass Details[1,2,3,7]												
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Inside Radius (Inches)				Arc Length N				Total N	
			Crown (R_t)	Side (R_s)	Haunch (R_h)	Invert (R_i)	Crown	Side	Haunch	Invert	Structure	Rib[6]
12-1	11-0	106	68.0	88.0	38.0	136.0	13	8	4	10	47	10
12-10	11-2	114	74.5	86.8	38.5	148.5	14	8	4	11	49	11
13-0	12-0	124	72.5	98.2	37.5	160.5	14	9	4	11	51	11
13-8	12-4	133	76.8	102.6	37.8	167.8	15	9	4	12	53	12
14-0	12-11	143	76.9	110.7	37.9	182.9	15	10	4	12	55	12
14-6	13-5	155	78.9	124.7	38.9	174.9	16	9	5	13	57	12
14-8	14-1	165	79.0	130.0	38.0	193.0	16	11	4	13	59	12
15-5	14-5	177	83.5	135.4	38.5	201.5	17	10	5	14	61	13
15-6	15-2	190	81.6	149.1	37.6	211.6	17	12	4	14	63	13
16-2	15-6	200	85.9	154.4	37.9	216.9	18	12	4	15	65	13
16-6	16-0	208	89.3	153.9	39.3	272.3	19	12	5	14	67	13
16-8	16-4	215	89.2	160.8	38.2	246.2	19	12	5	15	68	13

Larger sizes are available. Contact your CONTECH representative.

Arch



This 3-plate arch structure assembles nicely into the slotted concrete footing.

Table 6 — Arch Details[1,2,3,6]

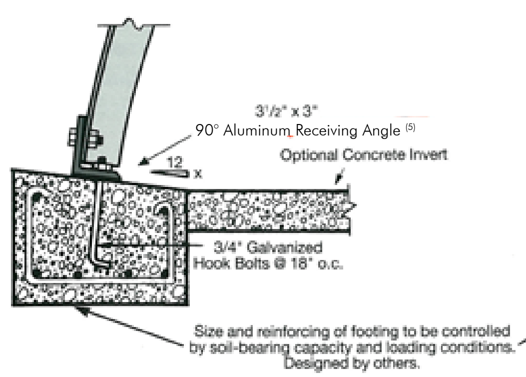
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Radius (In.)	Rise/ Span Ratio	Total N Structure	Total N Rib[4]	Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Radius (In.)	Rise/ Span Ratio	Total N Structure	Total N Rib[4]
5-0	1-9	6.5	31.75	.36	8	5	14-0	4-8	46.9	91.25	.33	22	13
	2-3	8.5	30.25	.44	9	5		5-7	58.4	86.00	.40	24	13
	2-7	10.4	30.00	.52	10	5		6-5	69.5	84.25	.46	26	13
6-0	1-10	7.8	40.50	.30	9	5		7-3	80.6	84.00	.52	28	13
	2-4	10.2	37.25	.38	10	5	15-0	4-8	50.0	100.50	.31	23	14
	2-9	12.6	36.25	.46	11	5		5-8	62.6	93.50	.38	25	14
	3-2	14.9	36.00	.52	12	5		6-7	74.7	91.00	.44	27	14
7-0	2-4	12.0	45.25	.34	11	6		7-5	86.5	90.00	.49	29	14
	2-10	14.8	43.00	.40	12	6		7-9	92.5	90.00	.52	30	14
	3-3	17.5	42.00	.46	13	6	16-0	5-3	60.0	105.00	.32	25	14
	3-8	20.3	42.00	.52	14	6		6-2	73.3	99.25	.39	27	14
8-0	2-11	17.0	50.50	.36	13	7		7-1	86.2	96.75	.44	29	14
	3-4	20.2	48.75	.42	14	7		7-11	98.9	96.00	.49	31	14
	4-2	26.4	48.00	.52	16	7		8-3	105.2	96.00	.52	32	14
9-0	2-11	19.1	59.00	.33	14	8	17-0	5-3	63.5	114.25	.31	26	16
	3-10	26.3	54.50	.43	16	8		6-3	77.9	107.00	.37	28	16
	4-8	33.4	54.00	.50	18	8		7-2	91.7	103.50	.42	30	16
10-0	3-6	25.3	64.00	.35	16	9		8-0	105.2	102.25	.47	32	16
	4-5	33.3	60.50	.44	18	9		8-10	118.7	102.00	.52	34	16
	5-2	41.2	60.00	.52	20	9	18-0	5-9	74.8	118.75	.32	28	17
11-0	3-6	27.8	72.75	.32	17	10		6-9	89.9	112.50	.38	30	17
	4-6	36.8	67.50	.41	19	10		7-8	104.5	109.25	.43	32	17
	5-8	49.8	66.00	.52	22	10		8-6	118.8	108.25	.47	34	17
12-0	4-1	35.3	77.50	.34	19	11		8-11	125.9	108.00	.50	35	17
	5-0	45.0	73.25	.42	21	11	19-0	6-4	86.9	123.50	.33	30	17
	6-3	59.3	72.00	.52	24	11		7-4	102.7	118.00	.38	32	17
13-0	4-1	38.1	86.50	.31	20	12		8-2	118.0	115.25	.43	34	17
	5-1	48.9	80.50	.39	22	12		9-0	133.2	114.25	.48	36	17
	5-11	59.3	78.25	.46	24	12		9-5	140.7	114.00	.50	37	17
	6-9	69.5	78.00	.52	26	12							

Larger sizes are available. Contact your CONTECH representative.

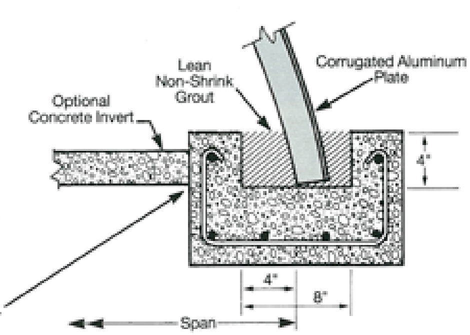
Notes

1. N = 9.625″
2. Dimensions to inside corrugation crests are subject to manufacturing tolerances.
3. To determine proper gage, use information on table 8.
4. Reinforcing rib length, if required. For 5′ through 8′ span, use Type II rib only.
5. The aluminum receiving angle is a separate item.
6. Arch shapes shown in a single radius with a rise/span ratio of 0.30 or greater. Structure with rise/span ratios less than 0.30 are not typically used due to structural considerations.

Concrete Footing with Angle



Slotted Concrete Footing

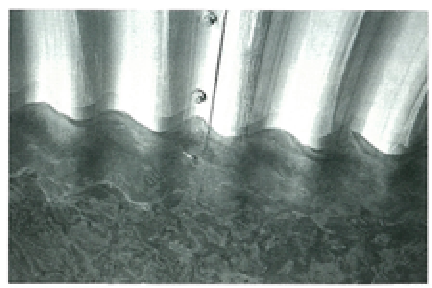


Notes

Maintain enough clearance between the rebar and aluminum to avoid galvanic corrosion.

Offering Superior Corrosion Resistance and
Many Decades of
Maintenance-Free Service Life.

Table 7 — Round Structures (HS 20 Live Load)							
Metal Thickness (In.) - Reinforcing Rib Type - Rib Spacing (In.) (Maximum Cover—Ft.)							
Diameter (Ft.-In.)	Approx. Area (Sq. Ft.)	Minimum Height-of-Cover (Feet)					
		1.00	1.50	2.00	2.50	3.00	3.50
5-0	19	.125 (45)	.125 (45)	.125 (45)	.125 (45)	.125 (45)	.125 (45)
5-6 6-0	23 28	.125-II-18 (37)	.125 (37)	.125 (37)	.125 (37)	.125 (37)	.125 (37)
6-6 7-0	32 38	.125-II-18 (32)	.125 (32)	.125 (32)	.125 (32)	.125 (32)	.125 (32)
7-6 8-0	44 50	.125-II-9 (28)	.150 (37)	.125 (28)	.125 (28)	.125 (28)	.125 (28)
8-6 9-0	56 63	.125-IV-9 (25)	.125-II-18 (25)	.125 (25)	.125 (25)	.125 (25)	.125 (25)
9-6 10-0	71 79	.125-IV-9 (22)	.125-II-18 (22)	.125 (22)	.125 (22)	.125 (22)	.125 (22)
10-6 11-0	87 95	.175-IV-9 (32)	.125-II-18 (20)	.125-II-27 (20)	.125 (20)	.125 (20)	.125 (20)
11-6 12-0	104 114		.125-IV-18 (18)	.125-II-27 (18)	.125 (18)	.125 (18)	.125 (18)
12-6 13-0	124 134		.150-IV-18 (23)	.125-II-27 (17)	.150 (23)	.125 (17)	.125 (17)
13-6 14-0	145 156		.125-IV-9 (16)	.125-IV-27 (16)	.125-II-27 (16)	.150 (21)	.150 (21)
14-6 15-0	167 179		.125-IV-9 (15)	.125-IV-27 (15)	.125-II-27 (15)	.125-II-27 (15)	.125-II-54 (15)
15-6 16-0	191 204		.150-IV-9 (18)	.125-IV-18 (14)	.125-II-27 (14)	.150-II-54 (18)	.150-II-54 (18)
16-6 17-0	217 231		.225-IV-9 (27)	.150-IV-18 (17)	.150-II-27 (17)	.150-II-27 (17)	.150-II-27 (17)
17-6 18-0	245 259			.175-IV-18 (19)	.175-II-27 (19)	.175-II-27 (19)	.175-II-27 (19)
18-6 19-0	274 289			.175-IV-9 (18)	.175-IV-27 (18)	.175-II-27 (18)	.175-II-27 (18)
19-6	305			.200-IV-9 (20)	.200-IV-27 (20)	.200-II-27 (20)	.200-II-27 (20)



Aluminum structural plate structures offer superior corrosion resistance and many decades of maintenance-free service life.

Table 8 — Arch Structures (HS 20 Live Load)								
Metal Thickness (In.) - Reinforcing Rib Type - Rib Spacing (In.) (Maximum Cover—Ft.)								
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Minimum Height-of-Cover (Feet)					
			1.00	1.50	2.00	2.50	3.00	3.50
5-0	1-9 2-3 2-7	7 9 10	.125 (45)	.125 (45)	.125 (45)	.125 (45)	.125 (45)	.125 (45)
6-0	1-10 2-4 2-9 3-2	8 10 13 15	.125-II-18 (37)	.125 (37)	.125 (37)	.125 (37)	.125 (37)	.125 (37)
7-0	2-4 2-10 3-3 3-8	12 15 18 20	.125-II-18 (32)	.125 (32)	.125 (32)	.125 (32)	.125 (32)	.125 (32)
8-0	2-11 3-4 4-2	17 20 26	.125-II-9 (28)	.150 (37)	.125 (28)	.125 (28)	.125 (28)	.125 (28)
9-0	2-11 3-10 4-8	19 26 33	.125-IV-9 (25)	.125-II-18 (25)	.125 (25)	.125 (25)	.125 (25)	.125 (25)
10-0	3-6 4-5 5-2	25 33 41	.125-IV-9 (22)	.125-II-18 (22)	.125 (22)	.125 (22)	.125 (22)	.125 (22)
11-0	3-6 4-6 5-8	28 37 50	.175-IV-9 (32)	.125-II-18 (20)	.125-II-27 (20)	.125 (20)	.125 (20)	.125 (20)
12-0	4-1 5-0 6-3	35 45 59		.125-IV-18 (18)	.125-II-27 (18)	.125 (18)	.125 (18)	.125 (18)
13-0	4-1 5-1 5-11 6-9	38 49 59 70		.150-IV-18 (23)	.125-II-27 (17)	.150 (23)	.125 (17)	.125 (17)
14-0	4-8 5-7 6-5 7-3	47 58 70 81		.125-IV-9 (16)	.125-IV-27 (16)	.125-II-27 (16)	.125 (16)	.125 (16)
15-0	4-8 5-8 6-7 7-5 7-9	50 63 75 87 93		.125-IV-9 (15)	.125-IV-27 (15)	.125-II-27 (15)	.125 (15)	.125 (15)
16-0	5-3 6-2 7-1 7-11 8-3	60 73 86 99 105		.150-IV-9 (18)	.125-IV-18 (14)	.125-II-27 (14)	.150 (18)	.125 (14)
17-0	5-3 6-3 7-2 8-0 8-10	64 78 92 105 119		.225-IV-9 (27)	.150-IV-18 (17)	.125-II-27 (13)	.175 (20)	.150 (17)
18-0	5-9 6-9 7-8 8-6 8-11	75 90 105 119 126			.175-IV-18 (19)	.125-IV-27 (12)	.200 (22)	.175 (19)
19-0	6-4 7-4 8-2 9-0 9-5	87 103 118 133 141			.125-IV-9 (11)	.125-IV-27 (11)	.125-IV-54 (11)	.125-IV-54 (11)

Notes

1. The tables are presented for the designer's convenience in selecting metal thickness, reinforcing rib type and rib spacing for minimum cover applications. For structures with maximum covers greater than those shown in the table, heavier plate may possibly be used. Consult your Contech representative.
2. Allowable cover (minimum and maximum) is measured from the outside valley of the crown plate to the top of rigid pavement. Minimum cover is measured at the lowest fill area subjected to possible wheel loads (typically at the roadway shoulder). Minimum cover must be maintained in unpaved areas. Maximum cover is measured at the highest fill and/or the highest pavement elevation.
3. To find the minimum materials requirements for the aluminum structural plate structure.
   a. Design specifications: Section 12 of AASHTO's Standard Specifications for Highway Bridges and ASTM B 790.
   b. Standard HS 20 wheel loads. Consult a Contech representative for special loading conditions.
   c. AASHTO M145 backfill materials classified as A-1, A-2 or A-3 compacted to 90% density per AASHTO T99. Unit weight of soil: 120 lb/cf
   d. Yield point of aluminum: 24,000 psi for plate, 35,000 psi for reinforcing ribs.

Table 9 — Horizontal Ellipse Structures (HS 20 Live Load)								
Metal Thickness (In.) - Reinforcing Rib Type - Rib Spacing (In.) (Maximum Cover—Ft.)								
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Minimum Height-of-Cover (Feet)					
			1.00	1.50	2.00	2.50	3.00	3.50
9-2 9-11	6-8 7-0	48 54	.125-IV-9 (14)	.125-II-18 (14)	.125 (14)	.125 (14)	.125 (14)	.125 (14)
10-7 10-11	7-3 7-11	60 68	.175-IV-9 (13)	.125-II-18 (13)	.125-II-27 (13)	.125 (13)	.125 (13)	.125 (13)
11-4 11-8 12-0 12-1	7-6 8-3 8-11 7-9	66 75 84 73		.125-IV-18 (11)	.125-II-27 (11)	.125 (11)	.125 (11)	.125 (11)
12-5 12-9 12-10	8-6 9-2 8-1	82 92 80		.150-IV-18 (10)	.125-II-27 (10)	.150 (10)	.125 (10)	.125 (10)
13-2 13-6 13-7 13-11	8-9 9-6 8-4 9-0	89 99 87 97		.125-IV-9 (9)	.125-IV-27 (9)	.125-II-27 (9)	.125 (9)	.125 (9)
14-3 14-7 14-11	9-9 10-5 11-2	108 119 130		.125-IV-9 (11)	.125-IV-27 (11)	.125-II-27 (11)	.125 (11)	.125 (11)

Notes: Maximum cover based on allowable corner bearing pressure of approximately 4,000 psi (2 tsf).

Table 10 — Pipe-Arch Structures (HS 20 Live Load)								
Metal Thickness (In.) - Reinforcing Rib Type - Rib Spacing (In.) (Maximum Cover—Ft.)								
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Minimum Height-of-Cover (Feet)					
			1.00	1.50	2.00	2.50	3.00	3.50
6-7 6-11	5-8 5-9	30 32	.125-II-18 (24)	.125 (24)	.125 (24)	.125 (24)	.125 (24)	.125 (24)
7-3 7-9 8-1	5-11 6-0 6-1	34 37 39	.125-IV-18 (19)	.150 (19)	.125 (19)	.125 (19)	.125 (19)	.125 (19)
8-5 8-10	6-3 6-4	42 45	.125-IV-9 (16)	.125-II-18 (16)	.125 (16)	.125 (16)	.125 (16)	.125 (16)
9-3 9-7 9-11	6-5 6-6 6-8	47 50 53	.125-IV-9 (15)	.125-II-18 (15)	.125 (15)	.125 (15)	.125 (15)	.125 (15)
10-3 10-9 11-1	6-9 6-10 7-0	56 58 61	.175-IV-9 (13)	.125-II-18 (13)	.125-II-27 (13)	.125 (13)	.125 (13)	.125 (13)
11-5 11-9	7-1 7-2	64 68		.125-IV-18 (13)	.125-II-27 (13)	.125 (13)	.125 (13)	.125 (13)
12-3 12-7 12-11 13-1 13-1	7-3 7-5 7-6 8-2 8-4	71 74 77 83 87		.150-IV-18 (11)	.125-II-27 (11)	.150 (11)	.125 (11)	.125 (11)
13-11 14-0 13-11	8-5 8-7 9-5	90 94 102		.125-IV-9 (10)	.125-IV-27 (10)	.125-II-27 (10)	.125 (10)	.125 (10)
14-3 14-8 14-11	9-7 9-8 9-10	106 110 114		.125-IV-9 (11)	.125-IV-27 (11)	.125-II-27 (11)	.125 (11)	.125 (11)
15-4 15-7 16-1	10-0 10-2 10-4	119 123 128		.150-IV-9 (10)	.125-IV-18 (10)	.125-II-27 (10)	.125-II-54 (10)	.125 (10)
16-4	10-6	132		.225-IV-9 (10)	.150-IV-18 (10)	.125-II-27 (10)	.125-II-54 (10)	.125-II-54 (10)

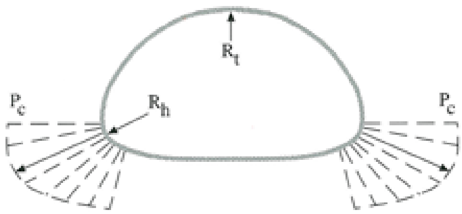
Notes: Maximum cover based on allowable corner bearing pressure of approximately 4,000 psi (2 tsf).

Table 11 — Underpass Structures (HS 20 Live Load)								
Metal Thickness (In.) - Reinforcing Rib Type - Rib Spacing (In.) (Maximum Cover—Ft.)								
Span (Ft.-In.)	Rise (Ft.-In.)	Approx. Area (Sq. Ft.)	Minimum Height-of-Cover (Feet)					
			1.00	1.50	2.00	2.50	3.00	3.50
6-1	5-9	28	.125-II-18 (33)	.125 (33)	.125 (33)	.125 (33)	.125 (33)	.125 (33)
6-3 6-3 6-2 6-4 6-3 6-5	6-1 6-5 6-11 7-3 7-9 8-1	30 32 34 37 39 42	.125-II-18 (33)	.125 (33)	.125 (33)	.125 (33)	.125 (33)	.125 (33)
12-1	11-0	106		.125-IV-18 (18)	.125-II-27 (18)	.125 (18)	.125 (18)	.125 (18)
12-10 13-0	11-2 12-0	114 124		.150-IV-18 (17)	.125-II-27 (17)	.150 (17)	.125 (17)	.125 (17)
13-8 14-0	12-4 12-11	133 143		.125-IV-9 (16)	.125-IV-27 (16)	.125-II-27 (16)	.125-II-54 (16)	.125-II-54 (16)
14-6 14-8	13-5 14-1	155 165		.125-IV-9 (16)	.125-IV-27 (16)	.125-II-27 (16)	.125-II-54 (16)	.125-II-54 (16)
15-5 15-6	14-5 15-2	177 190		.150-IV-9 (15)	.125-IV-18 (15)	.125-II-27 (15)	.150-II-54 (15)	.150-II-54 (15)
16-2 16-6 16-8	15-6 16-0 16-4	200 208 215		.225-IV-9 (14)	.150-IV-18 (14)	.150-II-27 (14)	.150-II-27 (14)	.150-II-27 (14)

Notes: Maximum cover based on allowable corner bearing pressure of approximately 4,000 psi (2 tsf).

Notes

1. The tables are presented for the designer's convenience in selecting metal thickness, reinforcing rib type, and rib spacing for minimum cover applications. For structures with maximum covers greater than those shown in the table, heavier plate may possibly be used. Call your Contech Representative.
2. Allowable cover (minimum and maximum) is measured from the outside valley of the crown plate to the bottom of flexible pavement or from the outside valley of the crown plate to the top of rigid pavement
3. To find the minimum materials requirements for the aluminum structural plate structure.
   a. Design specifications: Section 12 of AASHTO's Standard Specifications for Highway Bridges and ASTM B 790.
   b. Standard HS 20 wheel loads. Consult a Contech representative for special loading conditions.
   c. AASHTO M145 backfill materials classified as A-1, A-2 or A-3 compacted to 90% density per AASHTO T99. Unit weight of soil: 120 lb/cf
   d. Yield point of aluminum: 24,000 psi for plate, 35,000 psi for reinforcing ribs.



Handling Weight

Total N	Nominal Thickness (Inches)						Bolts per Foot of Structure	Plates per Ring in a Structure
	.125	.150	.175	.200	.225	.250		
8	19	23	26	29	32	35	6.9	1
9	21	25	28	32	35	39	7.1	1
10	23	27	31	35	38	43	7.3	1
11	25	30	34	38	42	46	7.6	1
12	27	32	37	41	45	50	7.8	1
13	29	34	39	44	49	54	8.0	1
14	31	37	42	47	52	58	8.2	1
15	36	43	49	54	60	66	13.6	2
16	38	45	52	57	63	70	13.8	2
17	40	48	54	60	67	74	14.0	2
18	42	50	57	63	70	77	14.2	2
19	44	52	60	66	73	81	14.4	2
20	46	55	62	70	77	85	14.7	2
21	48	57	65	73	80	89	14.9	2
22	50	59	68	76	83	93	15.1	2
23	52	62	70	79	87	96	15.3	2
24	54	64	73	82	90	100	15.6	2
25	56	66	76	85	94	104	15.8	2
26	58	69	79	88	97	108	16.0	2
27	59	71	81	91	100	112	16.2	2
28	61	73	84	94	104	115	16.4	2
29	67	80	91	101	112	124	21.8	3
30	69	82	93	104	115	128	22.0	3
31	71	84	96	107	118	132	22.2	3
32	73	87	99	110	122	135	22.7	3
33	75	89	102	113	125	139	22.7	3
34	77	91	104	116	129	143	22.9	3
35	79	94	107	120	132	146	23.1	3
36	80	96	110	123	135	150	23.3	3
37	82	98	112	126	139	154	23.6	3
38	84	101	115	129	142	158	23.8	3
39	86	103	118	132	146	162	24.0	3
40	88	105	121	135	149	165	24.2	3
41	90	108	123	138	152	169	24.4	3
42	92	110	126	141	156	173	24.7	3
43	98	116	133	148	164	181	30.0	4
44	100	118	135	151	167	185	30.2	4
45	102	121	138	154	170	189	30.4	4
46	103	123	141	157	174	193	30.7	4
47	105	125	144	160	177	197	30.9	4
48	107	128	146	163	180	200	31.1	4
49	109	130	149	166	184	204	31.3	4
50	111	133	152	169	187	208	31.6	4
51	113	135	154	173	191	212	31.8	4
52	115	137	157	176	194	215	32.0	4
53	117	140	160	179	197	219	32.2	4
54	119	142	163	182	201	223	32.4	4
55	121	144	165	185	204	227	32.7	4
56	123	147	168	188	208	231	32.9	4
57	128	153	175	195	215	239	38.2	5
58	130	155	177	198	219	243	38.4	5
59	132	157	180	201	222	247	38.7	5
60	134	160	183	204	226	250	38.9	5
61	136	162	186	207	229	254	39.1	5
62	138	164	188	210	232	258	39.3	5
63	140	167	191	213	236	262	39.6	5
64	142	169	194	216	239	266	39.8	5
65	144	171	196	219	243	269	40.0	5
66	146	174	199	223	246	273	40.2	5
67	148	176	202	226	249	277	40.4	5
68	150	178	205	229	253	281	40.7	5
69	151	181	207	232	256	285	40.9	5
70	153	183	210	235	260	288	41.1	5
71	159	189	217	242	267	297	46.4	6
72	161	192	219	245	271	300	46.7	6
73	163	194	222	248	274	304	46.9	6
74	165	196	225	251	278	308	47.1	6
75	167	199	228	254	281	312	47.3	6
76	169	201	230	257	284	316	47.6	6
77		203	233	260	288	319	47.8	6
78		206	236	263	291	323	48.0	6

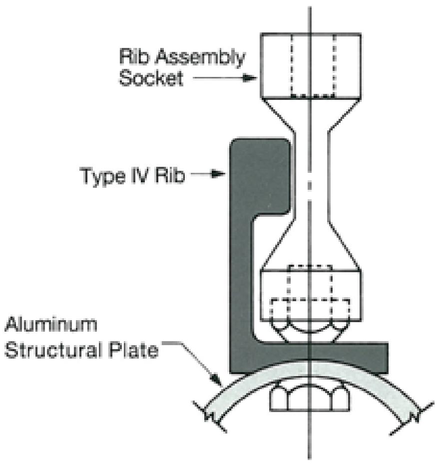
Table 12 — Approximate Handling Weight of Structure (Pounds Per Foot)

Individual plates are generally light enough to be handled by one worker.

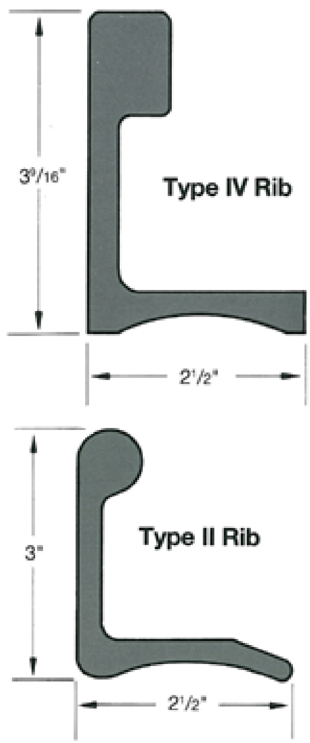
In-place structure assembly often negates the need for conventional lifting equipment.

Notes

1. Handling weights are approximate and include bolts and nuts.
2. To obtain the estimated total weight and bolt count per foot of the structure, use the Total N value of a structure (see Tables 1 through 6).
3. If a structure has reinforcing ribs, see Tables 13 or 14 on Page 17 for additional weight and bolt count.
4. For an arch, deduct 5.33 bolts per foot from column titled "Bolts per Foot of Structure."
5. On an arch, bolts and nuts for receiving angles are not included above.
6. Values in the column titled "Plates per Ring in a Structure" will be furnished unless noted otherwise on the assembly drawings.



The socket is specially shaped to fit around the top "bulb" of the reinforcing rib. This is a six-point socket for 1-1/4" nuts and with a 3/4" drive. This socket will work on both Type II and Type IV ribs. Contech offers this socket as a construction aid.



Rib Cross Sections

Reinforcing Rib Design

When circumferential ribs are used with aluminum structural plate, they are reinforce the structure to reduce minimum cover and provide added stiffness. These circumferential ribs are bolted to the structure's crown at spacing of 9", 18", 27": or 54" centers.

Notes

1. Bolts and nuts are included in the column titled "Weight per Ft. (Lb.)"
2. See table 12 for the handling weight of a structure without ribs.
3. For Total N of rib on a structure, see tables 1 and 6.

Table 13 — Added Handling Weight and Additional Bolts Per Foot of Structure for Type II Reinforcing Rib

Total N of Rib	Rib Spacing (O.C.) 9in. Weight per Ft. (Lb.)	9in. Bolts per Ft. (Each)	18in. Weight per Ft. (Lb.)	18in. Bolts per Ft. (Each)	27in. Weight per Ft. (Lb.)	27in. Bolts per Ft. (Each)	54in. Weight per Ft. (Lb.)	54in. Bolts per Ft. (Each)
5	17.0	6.7	8.2	2.7	5.2	1.3	2.2	0.0
6	19.9	7.8	9.5	3.1	6.1	1.6	2.6	0.0
7	22.7	8.9	10.9	3.6	6.9	1.8	3.0	0.0
8	25.6	10.0	12.2	4.0	7.8	2.0	3.4	0.0
9	28.4	11.1	13.6	4.4	8.7	2.2	3.7	0.0
10	31.3	12.2	15.0	4.9	9.5	2.4	4.1	0.0
11	34.1	13.3	16.3	5.3	10.4	2.7	4.5	0.0
12	37.0	14.4	17.7	5.8	11.3	2.9	4.9	0.0
13	39.8	15.6	19.1	6.2	12.1	3.1	5.2	0.0
14	42.7	16.7	20.4	6.7	13.0	3.3	5.6	0.0
15	45.5	17.8	21.8	7.1	13.9	3.6	6.0	0.0
16	48.3	18.9	23.2	7.6	14.8	3.8	6.4	0.0
17	51.2	20.0	24.5	8.0	15.6	4.0	6.7	0.0

Table 14 — Added Handling Weight and Additional Bolts Per Foot of Structure for Type IV Reinforcing Rib

Total N of Rib	Rib Spacing (O.C.) 9in. Weight per Ft. (Lb.)	9in. Bolts per Ft. (Each)	18in. Weight per Ft. (Lb.)	18in. Bolts per Ft. (Each)	27in. Weight per Ft. (Lb.)	27in. Bolts per Ft. (Each)	54in. Weight per Ft. (Lb.)	54in. Bolts per Ft. (Each)
5	21.5	6.7	10.4	2.7	6.7	1.3	3.0	0.0
6	25.1	7.8	12.1	3.1	7.8	1.6	3.5	0.0
7	28.7	8.9	13.9	3.6	8.9	1.8	4.0	0.0
8	32.3	10.0	15.6	4.0	10.0	2.0	4.5	0.0
9	35.9	11.1	17.3	4.4	11.2	2.2	5.0	0.0
10	39.5	12.2	19.1	4.9	12.3	2.4	5.5	0.0
11	43.1	13.3	20.8	5.3	13.4	2.7	6.0	0.0
12	46.7	14.4	22.6	5.8	14.5	2.9	6.5	0.0
13	50.3	15.6	24.3	6.2	15.6	3.1	7.0	0.0
14	53.9	16.7	26.0	6.7	16.8	3.3	7.5	0.0
15	57.5	17.8	27.8	7.1	17.9	3.6	8.0	0.0
16	61.1	18.9	29.5	7.6	19.0	3.8	8.5	0.0
17	64.6	20.0	31.2	8.0	20.1	4.0	9.0	0.0

Specification

Specification for Aluminum Structural Plate

Plates are positioned by hand are ready for assembly.

Scope
This specification covers the manufacture and installation of the aluminum structural plate structure detailed in the plans.

Material
The aluminum structural plate structure shall consist of plates and appurtenant items as shown on the plans and shall conform to the requirements of the AASHTO M219 and ASTM B 746. The corrugated plate (and ribs if required) shall be curved and bolt hole punched at the plant. Plate thickness and rib spacings shall be as indicated on the site plans.

Bolts and nuts shall conform to the requirements of ASTM A 307 or ASTM A 449 and shall be galvanized in accordance with ASTM A 153.

Assembly
The structure shall be assembled in accordance with the shop drawings provided by the manufacturer and per the manufacturer's recommendations. Bolts shall be tightened using an applied torque of between 100 and 150 foot pounds.

Installation
The structure shall be installed in accordance with the plans and specifications, the manufacturer's recommendations, and the AASHTO Standard Specification for Highway Bridges, Section 26 (Division II).

Bedding
The bedding should be constructed to a uniform line and grade using material outlined in the back fill section. The foundation and haunch support areas must be capable of providing a bearing capacity of at least two tons per square foot.

Backfill
The structure shall be backfilled using clean, well-graded granular material that meets the requirements of AASHTO M145 for soil classifications A-1, A-2 or A-3. Backfill must be placed symmetrically on each side of the structure in 6" to 8" lifts. Each shall be compacted to a minimum of 90% density per AASHTO T99.

Required Elements
Satisfactory site preparation, trench excavation, bedding and backfill operations are essential to develop the strength of any flexible conduit. IN order to obtain proper strength while preventing settlement, it is necessary that the soil envelope around the structure be of good granular material, properly placed and carefully compacted.

Horizontal ellipse, pipe-arch and underpass shapes pose special installation problems not found in other shapes. These shapes will generate high corner bearing pressures against the sidefill and foundation (see the Corner Bearing Pressure equation). Therefore, special installation care must be implemented to achieve a composite aluminum/soil structure.

A qualified engineer should be engaged to design a proper foundation, adequate bedding and backfill.

Trench Excavation
If the adjacent embankment material is structurally adequate, the trench requires only a bottom clear width of the structure' span plus sufficient room for compaction equipment.

Bedding
Bedding preparation is critical to both structure performance and service life. The bed should be constructed to uniform line an grade to avoid distortions that may create undesirable stresses in the structure and/or rapid deterioration of the roadway. The bed should be free of rock formations, protruding stones, frozen lumps, roots and other foreign matter that may cause unequal settlement.

It is recommended that the bedding be a stable, well graded granular materials. Placing the structure on the bedding surface is generally accomplished by one of two methods to ensure satisfactory compaction beneath the haunches. One method is shaping the bedding surface to conform to the lower section of the structure. The other is carefully tamping a granular or select material beneath the haunches to achieve a well compacted condition.

Assembly

Assembly drawings and detailed assembly instructions are shipped with each order.

Structure can be preassembled and lifted into place all at once or in sections, allowing for staged construction. If the site conditions allow, structures can be assembled in place. A qualified engineer should be engaged to determine the most appropriate construction method based on specific site conditions. For additional information, please contact your Contech representative.

Backfill

Satisfactory backfill material, proper placement and compaction are key factors in obtaining maximum strength and stability.

The backfill material should be free or rocks, frozen lumps and foreign material that could cause hard spots or decompose to create voids. Backfill material should be well graded granular material that meets the requirements of AASHTO M145 for soil classifications A-1, A-2 or A-3. Backfill must be placed symmetrically on each side of the structure in 6” to 8” loose lifts. Each lift is to be compacted to a minimum of 90% density per AASHTO T99.

A high percentage of silt or fine sand in the native soils suggests the need for a well graded granular backfill material to prevent soil migration. Alternately, a geotextile separator may be used.

During backfill, only small tracked vehicles (D-4 or smaller) should be near the structure as fill progresses above the crown and to finished grade. The engineer and contractor are cautioned that the minimum cover may need to be increased to handle temporary construction vehicle loads (larger than a D-4).

Saltwater Installation

In salt water installations, the bedding and backfill around the structure must be clean granular material. If the backfill is subject to possible infiltration by the adjacent native soil, the clean granular backfill should be wrapped in a geotextile.

Pavement

For minimum cover applications, Contech recommends that a properly designed flexible or rigid pavement be provided above the structure to distribute that live loads and maintain cover.

Precautions

During installation and prior to the construction of permanent erosion control and end treatment protection, special precautions may be necessary.

The structure must be protected from unbalanced loads and from any structural loads or hydraulic forces that might bend or distort the unsupported ends of the structure.

Erosion or washout of previously placed soil support must be prevented to ensure that the structure maintains its load capacity.

Contech Engineered Solutions provides site solutions for the civil engineering industry. Contech's portfolio includes bridges, drainage, retaining walls, sanitary sewer, stormwater, erosion control and soil stabilization products.

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