CONTECH®
ENGINEERED SOLUTIONS
A QUIKRETE® COMPANY

Aluminum Box Culvert
Assembly & Installation Guide



CONTECH®
STRUCTURAL PLATE



Aluminum Box Culvert (ALBC) Assembly & Installation Guide

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Note to Contractor:

If at any time you have any questions, please don't hesitate to call the Winchester Plant Technical Services Team at (334) 318-9102 for assistance.

Introduction

AS WITH ANY INSTRUCTIONS, PLEASE READ THROUGH THIS INFORMATION COMPLETELY BEFORE ATTEMPTING ANY FIELD WORK OR ASSEMBLY.

The following is a guideline for the assembly and installation of a Contech ALBC structure. Prior to assembly, reference any assembly drawings provided, these guidelines, the Structural Plate Design Guide and the engineer's plans and specifications.

For each different structure shipped to the job site, a copy of the assembly drawings, the bill of materials (BOM) and these instructions are enclosed in a keg with a color coded lid. If the order calls for two or more identical structures, only one drawing will be furnished. The drawings provide the specific plate layout for each structure and must be used to guide assembly.

Safety Instructions

Review these instructions with your supervisors and crews. It is our intent you have a safe and successful project for you and your customer. Anytime a question or problem arises, contact your Contech representative before you proceed.

NOTICE: PRIOR TO ASSEMBLY, REFERENCE THE ENGINEER'S PROJECT PLANS AND SPECIFICATIONS. DURING ASSEMBLY AND INSTALLATION, ALL OSHA SAFETY REGULATIONS SHALL BE OBSERVED.

This safety alert symbol indicates important safety messages. When you see this symbol, be alert to the possibility of personal injury, and be sure you understand the message that follows.

TERMS YOU SHOULD KNOW

WARNING **Alerts you to hazards or unsafe practices that CAN result in severe personal injury or property damage.**

SAFETY INSTRUCTIONS **Messages about procedures or actions that must be followed for safe handling of ALBC.**



WARNING **Falling plates and accessories can cause severe personal injury or death. Read and follow all safety instructions before unloading ALBC and accessories.**

Unloading and handling

Plates and fasteners are typically shipped in bundles which may weigh up to 5,000 lbs. See the Bill of Materials for individual plate weights. The following equipment is recommended for unloading ALBC and accessories:

- Forklift
- Front-end loader with fork adapters
- Backhoe with fork adapters
- Cranes
- Non-metallic slings

Other unloading methods such as chains, wire rope, cinching, or hooks in the end of the bundles should not be used.

Failure to follow these instructions can result in serious injury, death and /or damage to ALBC and accessories.

1. Only trained and authorized equipment operators are to be permitted to unload the ALBC and accessories.
2. Wear approved safety hat and shoes, gloves, and eye protection.
3. Park the truck and trailer on level ground before unloading.
4. Keep all unauthorized persons clear of the area when the driver releases the binders from the trailer and during unloading.
5. Do not cut the steel strapping around the bundles until the bundles have been placed on level ground or secured, and will not be moved again as a unit. It is recommended that the steel strapping be cut with appropriate sized cutting tools. Stand to the side when cutting a strap. Always be aware that ALBC and accessories may move, roll, or fall when a strap is cut.

6. Do not lift bundles by the steel strapping around the bundles. **WARNING**

7. Know the capabilities and rated load capacities of your lifting equipment. Never exceed them.

8. Do not stand or ride on the load of ALBC and accessories while it is being unloaded. Do not stand near the ALBC and accessories while they are being unloaded. **WARNING**

9. If unloading at multiple site locations, make sure the truck driver secures the remaining load before proceeding to the next location.
10. The contractor shall be responsible for the safety of his/her employees and agents. Adequate safety indoctrination is his responsibility.
11. Safe practices on construction work as outlined in the latest edition of the "Manual of Accident Prevention in Construction," published by The Associated General Contractors, shall be used as a guide and observed.
12. The contractor shall comply with all applicable city, state, and federal safety codes in effect in the area where he is performing the work. This conformance shall include the provision of the current issue of the "OSHA Safety and Health Standards (29 CFR 1926/1910)" as published by the U.S. Department of Labor.

Assembly and installation

1. Contech recommends using non-metallic slings for lifting assembled ALBC structures.
2. Chains with hooks may be used to handle the plates and accessories, being careful to not cause damage.
3. Do not push bundles off the trailers or permit plates and accessories to drop to the ground.
4. Prior to assembly, review and understand the engineer's project plans and specifications. Quality control is the responsibility of the contractor unless otherwise provided for in the contract documents.
5. Thoroughly review and study the product catalog, assembly instructions, assembly drawings, and bill of material prepared for your order and enclosed by Contech with the shipment.
6. Observe all OSHA safety regulations and guidelines during assembly and installation.

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

8. The maximum allowable live loads and dead loads are those specified by the project engineer. The structure must be protected from unbalanced loads and from any structural loads or hydraulic forces that might bend or distort the structure. Flotation of the structure must be prevented.

Notwithstanding the instructions contained in this guide, it is the responsibility of the consignee or consignee's agent to devise safe unloading and handling procedures.

Storage

When aluminum bundles are exposed to moisture for extended time periods, a wet storage stain may occur. The purchaser should use reasonable handling and storage procedures for the materials to assure that a stain-free product is installed. See page 5 for more information.

Suggested Tool List

- ☑ Hard hat, safety glasses, gloves, hearing protection and steel toed boots
- ☑ Two (2) 2x4 timbers with length equal to width of invert
- ☑ Ladders / scaffolding as needed
- ☑ Air compressor, impact wrench, spud wrench, spud bar, sledgehammer, drill
- ☑ 7/8" reamer bit and rib socket (provided by Contech)

Review the list of tools required above. The special rib assembly socket is required for rib installation. See Appendix C "Rib Assembly Socket" details.



Special Assembly Considerations

1. Should the holes in the corrugation begin to shift off center, start in the middle of the circumferential seam and work one bolt at a time, proceeding in both directions towards the end of the plate. If you tighten the plate on the longitudinal seam first, all flexibility of the assembly is lost.
2. Should you encounter unpunched or mispunched holes, merely field drill another 7/8" diameter hole. Reference "Figure 2. Plate Markings and Details Drawing" on page 6 for proper hole position and spacing.

Crew Size

Crew size can vary from three to six persons. A four-person crew is generally the most efficient. Five and six-person crews are generally used only when time is a critical factor in assembling the structure. A three-person crew is usually less efficient since work is more easily done in pairs.

Description of Materials

One of the bolt containers accompanying each shipment is specially marked. It contains the Bill of Material and the Aluminum Box Culvert Assembly & Installation Guide and the Plate Assembly Drawing.



Plates

All plates and ribs are shipped to the jobsite pre-punched and curved in strapped, nested bundles. Each bundle will contain only plates or ribs having the same curvature. The maximum weight per bundle generally will not exceed 5,000 pounds. Therefore, unloading plate and rib bundles off the truck should be planned accordingly. If the bundles are improperly unloaded, such as pushed off the truck; the plates may be damaged and/or difficult to separate. Damaged plates may cause unnecessary work for the assembly crew.



The structural plates for aluminum structures are furnished in 4.5 ft. net lengths. Plate net widths (running around the circumference of the structure) are 8N through 19N in intervals of 1 N, where N = 9.625". This equals the spacing between circumferential bolt holes. Plates are marked with the information as follows:

CONTECH ALUM. 5052 H141 PER ASTM B-746 AASHTO M219
ALERIS 42/269 6070 01 03 21 125

- CONTECH – Manufacturer name
- ALUM. 5052 – Alloy
- H141 – Material temper
- 125 – Material thickness (inches)
- ASTM B-746 AASHTO M219 – Material specifications
- ALERIS – Supplier name
- 42/269 6070 01 03 21 – Material heat number (may vary by supplier)

All cut plates or otherwise altered plates (such as plates with hook bolt holes) will have mark numbers painted on the outside surface of the plate. If the cut plates are too narrow, a wired tag will contain the required stencil data. The plate numbers will coincide with mark numbers shown on the assembly drawing.

Reinforcing Ribs

All rib bundles are marked with numbers corresponding to the assembly drawing. Follow the assembly drawing in placing a specific rib in its proper place on the structure. There are left hand and right hand haunch reinforcing ribs. The invert corners of the haunch reinforcing ribs are painted red. The red end goes down toward the receiving channel or keyway. The haunch and crown ribs that are spliced together must be oriented the same. It is usually best to orient all ribs with the horizontal legs pointing upstream.

Reinforcing ribs are furnished for attachment to the outside of the structure. Rib splices are used to fasten together any reinforcing ribs that butt together. Reinforcing ribs are bolted to the structure on 9", 18", 27" or 54" centers, longitudinally, down the structures' length through pre-punched holes in the both the ribs and the structural plate.

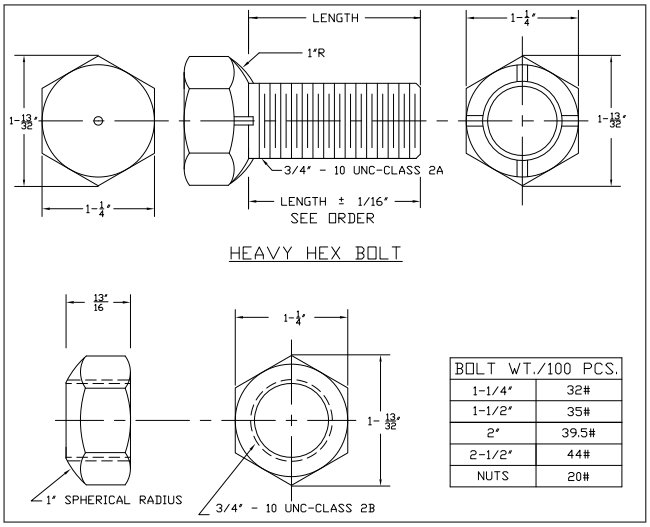


Storage

When relatively long outdoor storage is necessary, plates should be raised from the ground and separated with strip spacers to provide free access of air to all parts of the surface. They also should be inclined in a manner which will give maximum drainage. The material should also be stored under cover whenever possible. Bolts and nuts should be stored inside and periodically checked to ensure that the containers are free from moisture or condensation.

Fasteners

Hot-dipped galvanized steel (specially heat-treated) bolts meeting ASTM A307 or A449 specifications with suitable nuts are used to assemble structural plate structures. As an option, aluminum bolts and nuts are also available, if needed.



BOLT WT./100 PCS.	
1-1/4"	32#
1-1/2"	35#
2"	39.5#
2-1/2"	44#
NUTS	20#

Bolts are furnished in four lengths, 1-1/4", 1-1/2", 2" and 2-1/2". To determine the approximate number of bolts for a structure, check the structural plate bill or materials or consult the Contech Structural Plate Design Guide. All containers are stenciled with the individual bolt size. When multiple structures are shipped together, the materials for each structure are individually color coded.

Plate Layout Drawing / Material Identification

The assembly drawing will have a plan view of the structure showing the outside surface of the structure as if it were laid out flat. The various lengths of plates and special cut plates are assembled or placed in the structure in accordance with the assembly drawing as marked (see Figure 2. Plate Markings & Details). All plates with the same letter are interchangeable and may be placed in any location requiring plates of that letter.

Typically, all of the plates in the barrel of the structure are not shown on the assembly drawing. However, enough plates are shown to establish the proper seam stagger and a repetitive pattern in the barrel. This pattern establishes the correct location of all plates. The plates must be oriented such that their location matches that shown on the assembly drawing. If you are having difficulty matching the plate and the assembly drawing, call the Winchester Plant Technical Services Team at 859-744-3339 for assistance.

There may be cut plates on one or both ends of the structure. There are numbers given to the cut plates for haunch, invert, supplemental plates or footing pads. The numbers for all cut plates are shown on the assembly drawing.

Bedding

Proper preparation of the foundation and placement of bedding material shall precede the installation of the box culvert invert. When the in-situ soil does not provide a suitable bed, a bedding blanket shall be provided with a minimum of 5 inches of loose granular material with a maximum particle size of 1.25 inches which cushions the structure invert and allows the corrugation to seat into it, thus supporting the corrugation. The proper width of the bedding material required shall conform to the project plans and specifications.

Foundation Types

- ALBC with Footing Pads
- ALBC with Full Metal Invert
- Reinforced Concrete Foundation
  - Poured-in-Place
  - Precast
- EXPRESS® Foundations - Both metal and reinforced concrete options available

ALBC with Aluminum Footing Pads

General Information

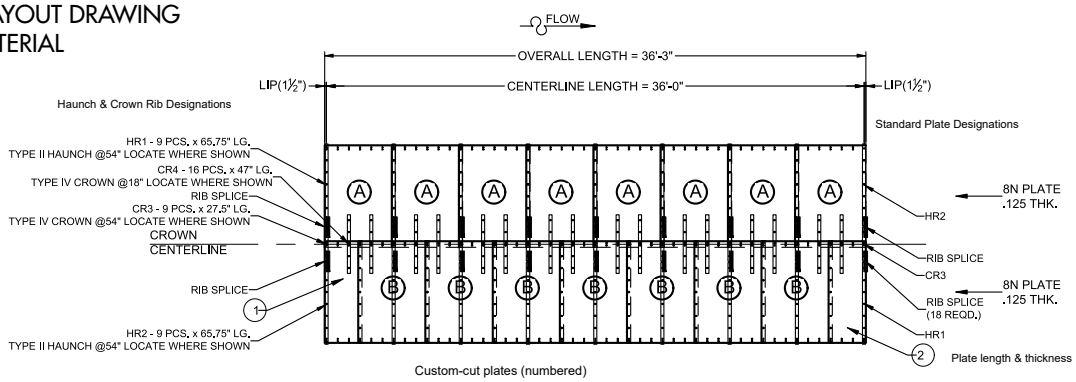
- For some structures using footing pads, straight Type IV stiffener ribs are to be bolted, 12" above the footing pad on each side for the length of the structure. See the assembly drawings for detailed information.
- The footing pad plates will have letter designations on the inside face, to match the assembly drawings.
- Scallop plates are not required on structures with footing pads since it is assumed that they will be buried below the finished grade to prevent scour.

Assembly Procedure

1. Footing pads are corrugated plates to which receiving channels are attached. Lay out the footing pad plates as shown on the assembly drawings. Space the two runs of footing pad plates apart so that their center-to-center spacing is equal to the span of the structure plus 3.5".
2. Start with the footing pad plate for one end as shown on assembly drawing. Bolt the next full footing pad plate. Continue to bolt the footing pad plates together until 5 sections (22.5 ft.) are loose bolted on both sides.
3. Use drift pins to help align the bolt holes. Bolts should be placed from the bottom to allow for torquing the nuts once all of the receiving channels are attached. Care must be taken to maintain the 18" hole spacing by using drift pins to pull the footer pad holes in alignment with receiving channel holes. And, care must be taken to insure that neither the left side nor the right side are running ahead of the other.
4. After the receiving channels are attached, tighten the footing pad bolts and the receiving channel with 100 to 150 ft.-lbs. of torque. Proceed in like manner with the next four sections of footing pads (18 ft.) and repeat this process until both footing pad runs are assembled on each side of the structure. DO NOT OVER TORQUE.
5. Follow steps in the ALBC shell assembly procedure (page 9).
6. Check the bottom span of the structure and make necessary corrections using come-alongs or struts prior to backfilling.

Note: If spreading occurs, use come-alongs and/or struts to maintain the correct span.

FIGURE 1. SAMPLE PLATE LAYOUT DRAWING AND BILL OF MATERIAL



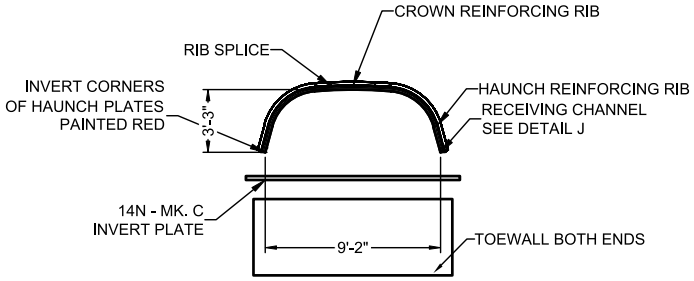
ALBC - DEVELOPED PLAN (OUTSIDE VIEW)
9'-2" SPAN x 3'-3" RISE

ALUMINUM BOX CULVERT BILL OF MATERIAL

END LENGTH : 36 REGION: PLANT ORDER 9569612
BARREL LENGTH: 0 SALES# DATE: 11/20/20
Structure# : 2A6 DWG#: 661447-010-AL-FAB-A

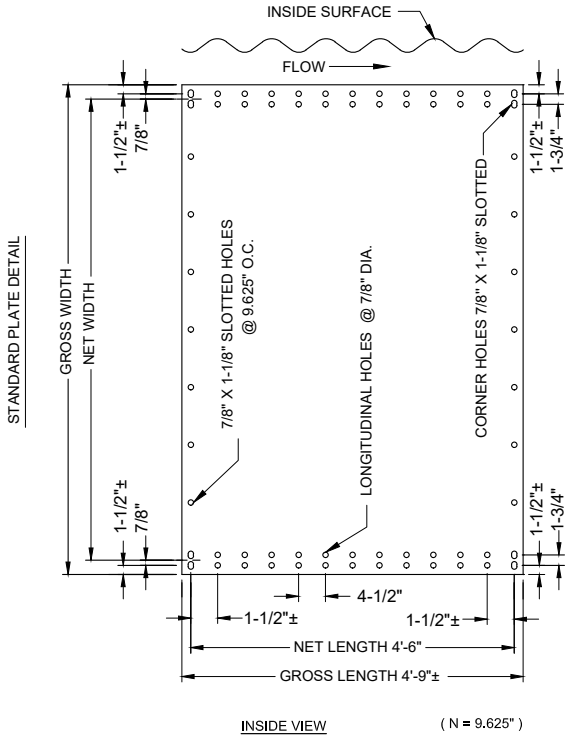
1 STRUCTURES, CONTAINING THE FOLLOWING PLATES: (pounds)

ITEM	QTY	THICK	N	RADIUS	STAMP #	STAGE	PUNCH	TYPE	UNIT WGT	ITEM WGT	MARK	PART #
1/101	2	.125	B	30.25	10103029612	C	B	HAUNCH PLATES	65.82	76	1;2	SPPAL125CB08
1/102	8	.125	B	30.25	10203029612	C	B	HAUNCH PLATES	65.82	527	A	SPPAL125CB08
1/103	7	.125	B	30.25	10303029612	C	B	HAUNCH PLATES	65.82	461	B	SPPAL125CB08
1/104	8	.100	14	Flat	10400019612	S	E	INVERT	89.85	629	C	SPPAL100SE14
1/105	2	.125		Flat	10500029612	F	N	TOEWALL PLATES	49.00	98		SATAL12512518F
1/106	9	T-2J RIB			L.H. HAUNCH		65 3/4"		11.54	104	HR1	SAETJ06534PCL
1/107	9	T-2J RIB			R.H. HAUNCH		65 3/4"		11.54	104	HR2	SAETJ06534PCR
1/108	9	T-4 RIB			SHORT CROWN		27 1/2"		6.38	58	CR3	SAET402712PC
1/109	16	T-4 RIB			LONG CROWN		47"		10.89	175	CR4	SAET4047 PC
1/110	4	RECEIVING CHANNEL					215"		30.00	120	RC1	SAERC215 PF
1/111	53	SCALLOP CLIPS							0.04	3		SAFSC
1/112	1	RIB ASSEMBLY SOCKET							2.00	2		SAFSK
1/113	1	VARIABLE BIT							2.00	2		SAFVB
1/114	18	T-4 RIB			SPLICE				3.86	70		SAERS01612PF
1/115	16	SCALLOP PLATES							1.60	26		SAESP00000NF
1/116	750	BOLT STEEL			3/4" x 1 1/4" (319)				.32	560		MPBFAGB34114
1/117	250	BOLT STEEL			3/4" x 1 1/2" (320)				.35	438		MPBFAGB34112
1/118	1000	NUT STEEL			3/4" (302)				.20	700		MPBFAGN34
1/119	1	Contech C-40 NW			FABRIC		2'x360' ROLL		36.00	36		APCGC-40NW2
1/120	125	SPRING HOLDING CLIPS (GALV.)			3/4" (444)				.01	2		SAFHC

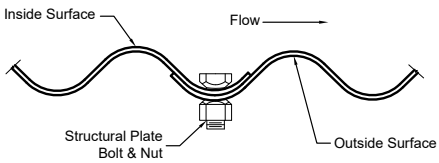


ALBC - END VIEW

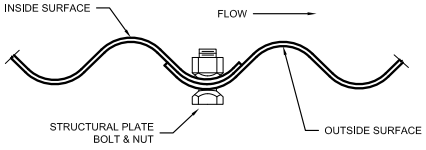
FIGURE 2. PLATE MARKINGS & DETAILS DRAWING



INSIDE VIEW (N = 9.625")



SHELL ONLY



INVERT ONLY

NOTES :
1) DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES.
2) ADDITIONAL ROWS OF CIRCUMFERENTIAL HOLES ARE FURNISHED WHEN REINFORCING RIBS ARE REQUIRED.

TABLE 1. ALBC STRUCTURE AREA, PLATE AND RIB MAKE-UP

Box #	Inside Dimensions		Inside Flow Area	Crown Arc Length (N)	Haunch Arc Length (N)	Straight Leg Length "D" (N)	Total (N)	Plate Make-Up		Side Angle "E" (deg.)
	Span	Rise						Haunch (N)	Crown (N)	
1	8'-9"	2'-6"	18.4			.5	14	14	NA	
2	9'-2"	3'-3"	25.4			1.5	16	8		
3	9'-7"	4'-1"	32.6			2.5	18	9		
4	10'-0"	4'-10"	40.2	5	4	3.5	20	10		15.40
5	10'-6"	5'-7"	48.1			4.5	22	11		
6	10'-11"	6'-4"	56.4			5.5	24	12		
7	11'-4"	7'-2"	65.0			6.5	26	13		
8	10'-2"	2'-8"	23.0			.5	16	8		
9	10'-7"	3'-5"	31.1			1.5	18	9		
10	10'-11"	4'-3"	39.5			2.5	20	10		
11	11'-4"	5'-0"	48.2	7	4	3.5	22	11		13.55
12	11'-8"	5'-9"	57.2			4.5	24	12		
13	12'-1"	6'-7"	66.4			5.5	26	13		
14	12'-5"	7'-4"	76.0			6.5	28	14		
15	11'-7"	2'-10"	28.1			.5	18	9	TWO PLATE SHELL	
16	11'-11"	3'-7"	37.4			1.5	20	10		
17	12'-3"	4'-5"	46.9			2.5	22	11		
18	12'-7"	5'-2"	56.6	9	4	3.5	24	12		11.70
19	12'-11"	6'-0"	66.6			4.5	26	13		
20	13'-3"	6'-9"	76.9			5.5	28	14		
21	13'-0"	3'-0"	33.8			.5	20	10		
22	13'-4"	3'-10"	44.2			1.5	22	11		
23	13'-7"	4'-7"	54.8	11	4	2.5	24	12		9.87
24	13'-10"	5'-5"	65.6			3.5	26	13		
25	14'-1"	6'-2"	76.6			4.5	28	14		
26	14'-5"	3'-3"	40.0			.5	22	11		
27	14'-8"	4'-1"	51.5			1.5	24	8		
28	14'-10"	4'-10"	63.2			2.5	26	9		
29	15'-1"	5'-8"	75.1	13	4	3.5	28	10	8	8.02
30	15'-4"	6'-5"	87.2			4.5	30	11		
31	15'-6"	7'-3'	99.4			5.5	32	12		
32	15'-9"	8'-0"	111.8			6.5	34	13		
33	15'-10"	3'-6"	46.8			.5	24	8		
34	16'-0"	4'-3"	59.5			1.5	26	9		
35	16'-2"	5'-1"	72.3			2.5	28	10		
36	16'-4"	5'-11"	85.2	15	4	3.5	30	11	8	6.17
37	16'-6"	6'-8"	98.3			4.5	32	12		
38	16'-8"	7'-6'	111.5			5.5	34	13		
39	16'-10"	8'-3"	124.8			6.5	36	14		
40	17'-9"	3'-10"	54.4			.5	26	8		
41	18'-2"	4'-7"	68.3			1.5	28	9		
42	18'-7"	5'-4"	82.5			2.5	30	10		
43	19'-0"	6'-1"	97.1	17	4	3.5	32	11	10	14.90
44	19'-5"	6'-11"	111.9			4.5	34	12		
45	19'-10"	7'-8"	127.1			5.5	36	13		
46	20'-3"	8'-5"	142.6			6.5	38	14		
47	19'-1"	4'-2"	63.3			.5	28	8		
48	19'-5"	4'-11"	78.3			1.5	30	9		
49	19'-9"	5'-8"	93.6			2.5	32	10		
50	20'-1"	6'-6"	109.2	19	4	3.5	34	11	12	12.78
51	20'-6"	7'-3"	125.0			4.5	36	12		
52	20'-10"	8'-1"	141.2			5.5	38	13		
53	21'-2"	8'-10"	157.6			6.5	40	14		
54	20'-4"	4'-6"	73.1			.5	30	8		
55	20'-7"	5'-3"	89.2			1.5	32	9		
56	20'-11"	6'-1"	105.5			2.5	34	10		
57	21'-3"	6'-10"	122.1	21	4	3.5	36	11	14	10.67
58	21'-6"	7'-8"	139.0			4.5	38	12		
59	21'-10"	8'-5"	156.0			5.5	40	13		
60	22'-1"	9'-3"	173.3			6.5	42	14		
61	21'-7"	4'-11"	83.8			.5	32	9		
62	21'-10"	5'-8"	101.0			1.5	34	10		
63	22'-1"	6'-6"	118.4			2.5	36	11		
64	22'-3"	7'-3"	135.9	23	4	3.5	38	12	14	8.53
65	22'-6"	8'-1"	153.7			4.5	40	13		
66	22'-9"	8'-10'	171.6			5.5	42	14		
67	23'-0"	9'-8"	189.8			6.5	44	15		
68	22'-9"	5'-4"	95.5			.5	34	10		
69	23'-0"	6'-1"	113.7			1.5	36	11		
70	23'-2"	6'-11"	132.1			2.5	38	12		
71	23'-4"	7'-8"	150.6	25	4	3.5	40	13	14	6.42
72	23'-6"	8'-6"	169.3			4.5	42	14		
73	23'-8"	9'-3"	188.1			5.5	44	15		
74	23'-10"	10'-1"	207.0			6.5	46	16		
75	24'-0"	5'-9"	108.2			.5	36	10		
76	24'-1"	6'-6"	127.5			1.5	38	11		
77	24'-3"	7'-4"	146.8			2.5	40	12		
78	24'-4"	8'-2"	166.2	27	4	3.5	42	13	16	4.30
79	24'-5"	8'-11"	185.7			4.5	44	14		
80	24'-7"	9'-9"	205.3			5.5	46	15		
81	24'-8"	10'-6"	225.0			6.5	48	16		
82	25'-2"	6'-2"	122.0			.5	38	11		
83	25'-2"	7'-0"	142.2			1.5	40	12		
84	25'-3"	7'-9"	162.4	29	4	2.5	42	13	16	2.18
85	25'-4"	8'-7"	182.6			3.5	44	14		
86	25'-4"	9'-5"	202.9			4.5	46	15		
87	25'-5"	10'-2"	223.3			5.5	48	16		
88	26'-7"	5'-5"	111.6			.5	38	11		
89	27'-0"	6'-3"	132.4			1.5	40	12		
90	27'-5"	7'-0"	153.4			2.5	42	13		
91	27'-10"	7'-9"	174.8	29	4	3.5	44	14	16	15.22
92	28'-3"	8'-7"	196.5			4.5	46	15		
93	28'-8"	9'-4"	218.6			5.5	48	16		
94	29'-2"	10'-1"	241.0			6.5	50	17		
95	27'-10"	5'-10"	125.4			.5	40	12		
96	28'-3"	6'-8"	147.3			1.5	42	13		
97	28'-7"	7'-5"	169.4			2.5	44	14		
98	29'-0"	8'-3"	191.8	31	4	3.5	46	15	16	13.45
99	29'-4"	9'-0"	214.6			4.5	48	16		
100	29'-8"	9'-9"	237.6			5.5	50	17		
101	30'-1"	10'-7"	260.9			6.5	52	18		
102	29'-1"	6'-4"	140.2			.5	42	12		
103	29'-5"	7'-1"	163.2			1.5	44	13		
104	29'-8"	7'-11"	186.4			2.5	46	14		
105	30'-0"	8'-8"	209.8	33	4	3.5	48	15	18	11.68
106	30'-4"	9'-5"	233.6			4.5	50	16		
107	30'-8"	10'-3"	257.5			5.5	52	17		
108	31'-0"	11'-0"	281.8			6.5	54	18		
109	30'-3"	6'-9"	156.1			.5	44	13		
110	30'-6"	7'-7"	180.1			1.5	46	14		
111	30'-10"	8'-4"	204.4			2.5	48	15		
112	31'-1"	9'-2"	228.8	35	4	3.5	50	16	18	9.92
113	31'-4"	9'-11"	253.5			4.5	52	17		
114	31'-8"	10'-9"	278.4			5.5	54	18		
115	31'-11"	11'-6"	303.5			6.5	56	19		
116	31'-5"	7'-3"	173.1			.5	46	14		
117	31'-8"	8'-0"	198.2			1.5	48	15		
118	31'-10"	8'-10'	223.4			2.5	50	16		
119	32'-1"	9'-8"	248.8	37	4	3.5	52	17	18	8.15
120	32'-3"	10'-5"	274.4			4.5	54	18		
121	32'-7"	11'-3"	300.1			5.5	56	19		
122	32'-8"	12'-0"	326.1			6.5	58	20		
123	32'-7"	7'-9"	191.3			.5	48	14		
124	32'-9"	8'-6"	217.3			1.5	50	15		
125	32'-11"	9'-4"	243.4			2.5	52	16		
126	33'-1"	10'-2"	269.7	39	4	3.5	54	17	20	6.37
127	33'-3"	10'-11"	296.4			4.5	56	18		
128	33'-5"	11'-9"	322.8			5.5	58	19		
129	33'-8"	12'-6"	349.5			6.5	60	20		
130	33'-8"	8'-3"	210.5			.5	50	15		
131	33'-9"	9'-1"	237.5			1.5	52	16		
132	33'-11"	9'-10"	264.5			2.5	54	17		
133	34'-0"	10'-8"	291.7	41	4	3.5	56	18	20	4.62
134	34'-2"	11'-5"	319.0			4.5	58	19		
135	34'-3"	12'-3"	346.4			5.5	60	20		
136	34'-5"	13'-1"	373.8			6.5	62	21		
137	34'-9"	8'-9"	230.9			.5	52	16		
138	34'-10"	9'-7"	258.1			1.5	54	17		
139	34'-11"	10'-4"	286.7			2.5	56	18		
140	35'-0"	11'-2"	314.6	43	4	3.5	58	19	20	2.85
141	35'-1"	12'-0"	342.7			4.5	60	20		
142	35'-2"	12'-9"	370.8			5.5	62	21		
143	35'-3"	13'-7"	399.0			6.5	64	21		

Notes:
1. Box #1 is a one plate shell.
2. Box #2 - #26 are a two plate shell.
3. Box #27 - #143 are a three plate shell.

This table can be found on page 70 of the Structural Plate Design Guide.

ALBC with Concrete Footings

General Information

When receiving channels are used they are generally set with anchor bolts into the footings. The anchor bolts are usually set at the time the footings are poured. If the shell is placed all at once into the receiving channels and spreading occurs, use come-alongs and/or struts to maintain the correct span.

There may be cut plates on one or both ends of the structure. There are numbers given to the cut plates for haunch, invert, supplemental plates or footing pads. The numbers for all cut plates are shown on the assembly drawing (i.e. marks #1 and #2 on drawings in page 6).

Assembly Procedure

The shell of a structure installed into concrete slots, keyways or attached to concrete footings with receiving channels is assembled using the same basic procedure as those with other invert treatments.

Scallop plates are not required for structures installed in slotted keyway or into receiving channels set on concrete footings



ALBC with a Full Metal Invert

Assembly Procedure

Step 1: Preassemble the invert sections

1. Starting at the downstream end of the structure, lay out the invert plates as shown on the assembly drawing. If the invert uses two plates across the width (or span), preassemble them leaving out the double bolts on each end of the seam. Insert the bolts from the bottom side so the nuts will be on the top side of the invert. Make sure the holes for supplemental plates are positioned towards the outside of the invert (or at the top of the corrugation). Tighten these bolts.

Steps 2-3: Assemble invert starting at downstream end. Advance timber (which acts as bolt supports) as assembly progresses.

2. Lay the first invert section with the upstream edge sitting on a flat surface (a long, straight piece of lumber laid parallel to the corrugations works well). If provided, use spring clips for this process. Place 1-1/4" bolts (with the threads up) into the leading edge bolt holes. Place the second invert section over the top of the first as shown in the detail in the picture below. Finger tighten nuts onto the bolts.



3. Repeat the above procedure until 5 sections (22.5') of the invert are loose bolted. Advance the piece of lumber in order to support each new row of bolts formed below the plate edge. Each completed section lays down onto the flat surface as assembly progresses.

Steps 4-5: Place supplemental plates (if required) and first set of receiving channels onto invert. Support invert edge (one side at a time) to allow access to bolt holes.

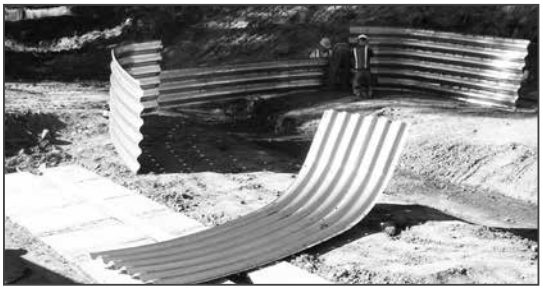
4. When supplemental plates are furnished, they should be placed onto the invert along its outside edges and aligned with the bolt holes in the invert plates. Reference the assembly drawing.
5. Place the first set of receiving channels onto both sides of the invert according to the assembly drawing. These should be oriented so that the taller, curved leg is facing the inside of the structure. Use drift pins to help align the bolts holes. Bolts should be placed from the bottom to allow for torquing the nuts once all of the receiving channels are attached. The invert can be supported one side at a time to allow better access to the bolt holes. Maintain the 18" hole spacing by using drift pins to pull the invert holes in alignment with receiving channels holes. Ensure that neither side is running ahead of the other and that the receiving channels are square with each other in their alignment.
6. After the receiving channels are attached, tighten the invert and the receiving channel to 100 to 150 ft.-lbs. of torque. Proceed in like manner until the entire invert is assembled.



ALBC Shell

The invert end of the haunch plates have their corners painted red. Place the haunch plates outside of the receiving channel with the cut plates positioned as shown on the assembly drawing.

1. Starting at the upstream end, fasten the first ring of plates together while they lay on their sides. Only place and tighten those bolts that do not get a rib attached to it. Then tilt up this first ring and place the painted legs into the receiving channel.



2. Fasten both plates to the receiving channel or place in slotted footing on both sides of the first complete shell ring. Use drift pins to bring the holes into alignment (if required).



3. Place the next ring of shell plates and fasten those longitudinal seam bolts that do not get a rib attached to them.
4. Begin placement of ribs. See the assembly drawing for locations.
5. Attach the haunch ribs at the first bolted circumferential seam. The haunch ribs are also painted red at the ends facing the invert. The horizontal leg orientation of the ribs should be kept consistent along the length of the structure. Typically, it is easiest to install the haunch ribs by bolting from top or bottom of the rib and working towards the opposite end. Lightly torque the nuts so the plates and ribs can be adjusted until all the bolts are in place. After everything is in place, you can completely tighten the nuts at this seam to their design torque. The nuts should be on the outside of the shell.
6. Place the next ring of shell plates that make up the third shell ring by setting them into the receiving channel (outside of the previous shell ring). Fasten the longitudinal seam bolts except those that get a rib attached to them.
7. Repeat steps 2 through 6 until the shell is fastened with ribs at the bolted circumferential seams.
8. Bolt remaining haunch ribs and all crown ribs onto shell in accordance with assembly drawing. The orientation of the crown ribs should match the haunch ribs.
9. When all the ribs are attached, join all haunch and crown ribs that butt together with a rib splice.
10. Next, confirm that the whole shell has been tightened with 100 to 150 ft.-lbs. of torque. Then, confirm that all crown ribs, haunch ribs and rib splices have been properly tightened. DO NOT OVER TORQUE. A good plate fit is far better than high torque.





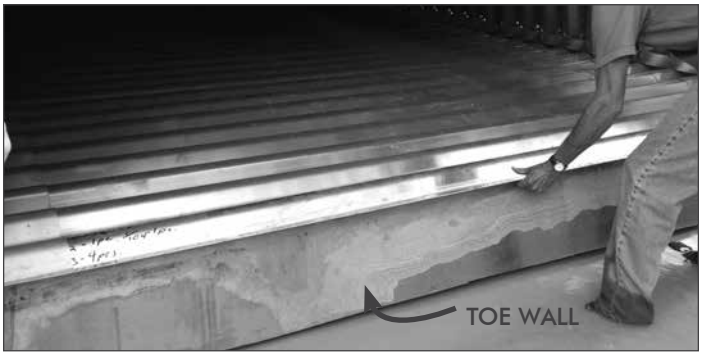
Caution: In the event that the ribs do not fit perfectly onto the plates, it may be necessary to draw the ribs and the plates together using care not to pull the bolt heads through the plate. If the rib radius is larger than the plate radius, begin installing the rib bolts at the crown proceeding toward the haunches. If the rib radius is smaller than the plate radius, begin installing the bolts on both ends of the haunch ribs and proceed toward the middle of the haunch, one bolt at a time. When torquing these bolts, if the rib stands off of the plate significantly, it is best to work back and forth, partially tightening 2 to 4 adjacent bolts to achieve full torque.

Note: Many of these steps can occur concurrently based on crew size and experience provided each step is coordinated to allow adequate working space.

Caution: Do not attempt any loading of a box culvert structure (including lifting a pre-assembling structure into place) prior to attachment of stiffener ribs and the torquing of all nuts.

Toe Walls

Toe walls are provided for both ends of the structure using a full invert to help prevent water from undermining the structure. There are two options for these toe walls; please see appendix H, page 22 for proper assembly and installation guidance.



Aluminum Toe Wall



Polymer Toe Wall



Scallop Plates

Attach the scallop plates to the outside of the receiving channels using the scallop plate clips provided on 18" centers. It is not necessary to place a bolt in the threaded opening of the clip. The clips' spring action provides enough clamping force to hold the scallop plates in place. The scallop plates, along with the provided geotextile, help prevent migration of backfill material into the structure.



Next, place the geotextile fabric on the outside of the structure, along both sides, as shown in the picture below. Attach the fabric to the plate by using duck tape, or some other means. Fabric that is approximately 1.25 times the structure length is needed on each side. Place the geotextile loosely so that during backfill it will lay into the corrugations of the invert and the outside of the shell. (see Appendix G).

ALBC Headwalls / Wingwalls General

1. Typically, beveled wingwall panels, headwall and wingwall caps, and elbow caps are trimmed at the plant to permit proper assembly. Field beveling of the panels can be done. However, appropriate modifications to the caps and elbows must be made. Caps and elbows must be cut, trimmed and rewelded such that they fit properly onto the panels.
2. Hydrostatic pressure shall be alleviated through one or both of the methods listed below or as approved by the Engineer of Record:
    - Field drill 2" diameter weep holes at the center of every 54" wingwall panel. Holes shall be approximately 3-6 inches above the finished grade line near the base of the wingwall to minimize hydrostatic pressure. A minimum of a 4 ounce filter fabric shall be placed behind the weep holes to maintain a soil-tight system.
    - Underdrains shall be installed per the Engineer of Record's recommendations.
3. The top of the headwall and wingwalls are at the same elevation unless otherwise shown on the drawings.



ALBC with headwall and wingwalls.



Proper installation of toewall when invert and headwall are utilized.



Once the headwall is installed, install fabric behind the headwall where any gapping occurs.

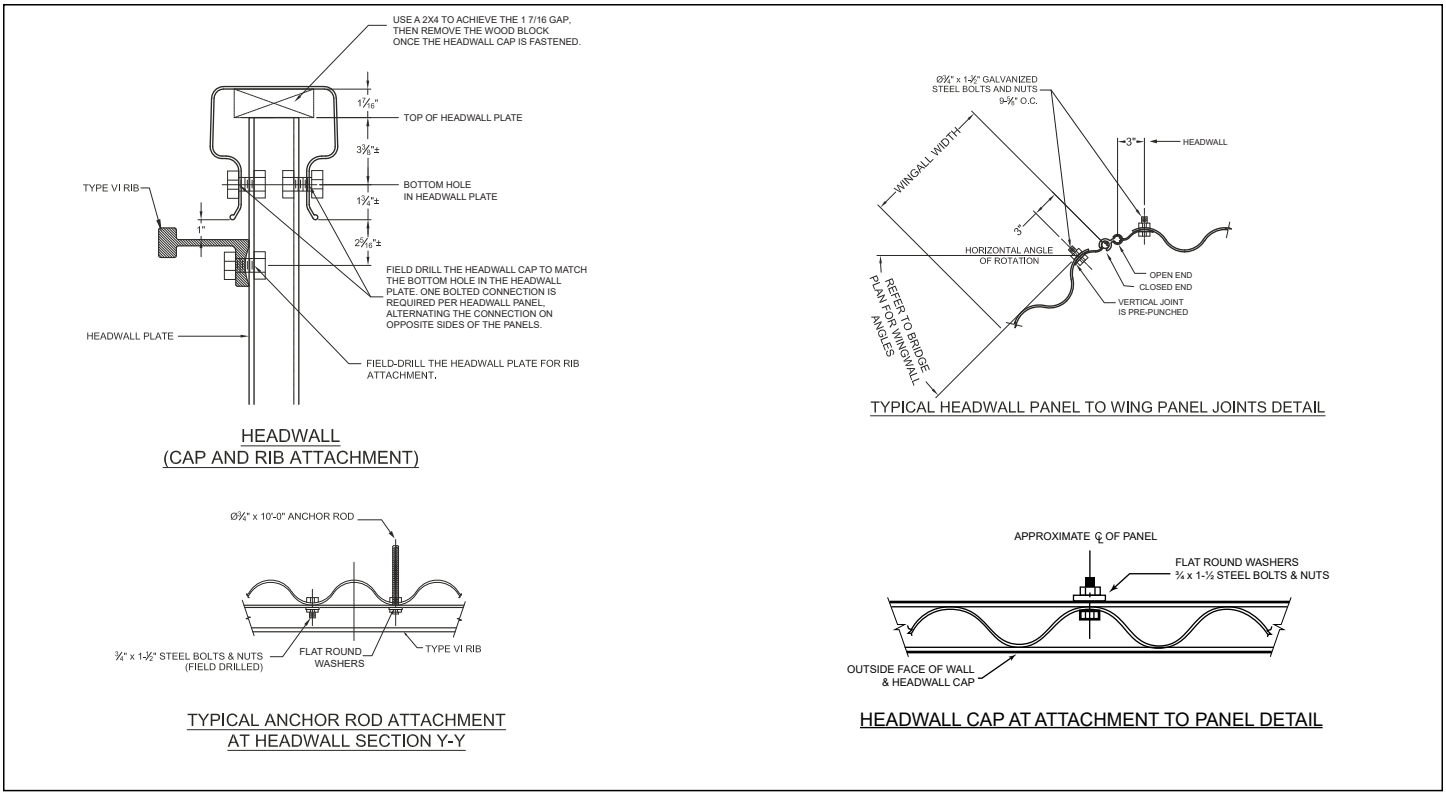


Figure 3. Headwall Attachment Details

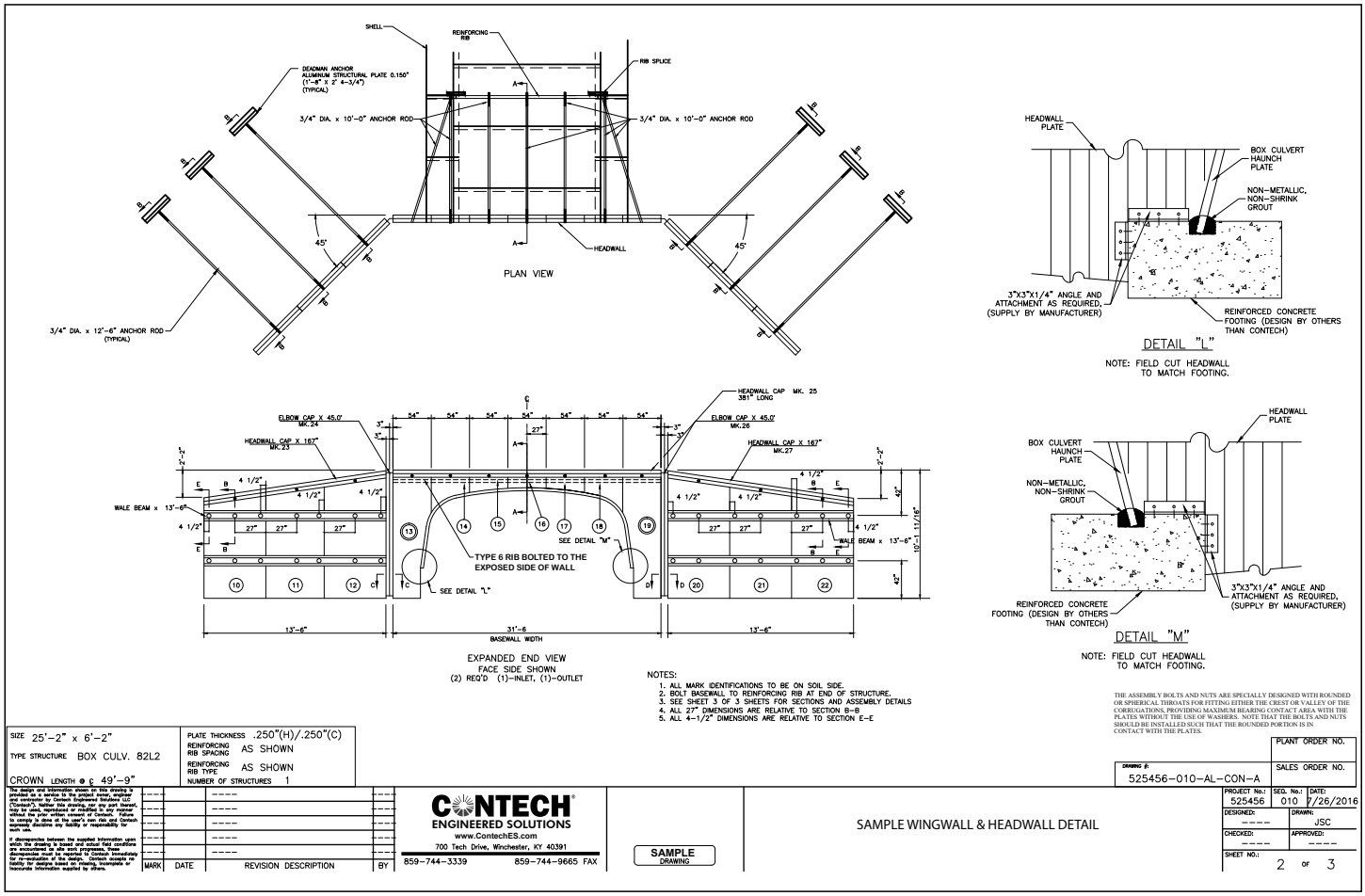
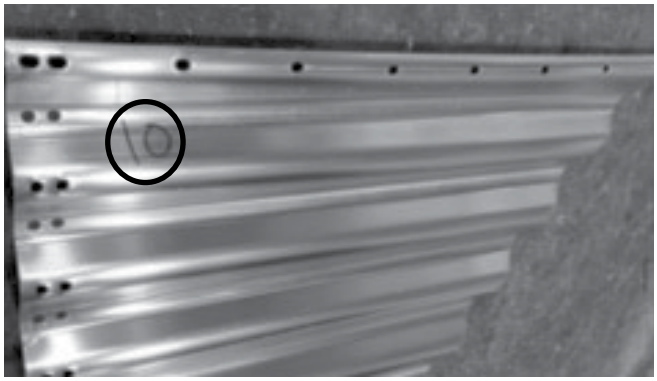


Figure 4. Sample Wingwall & Headwall Detail

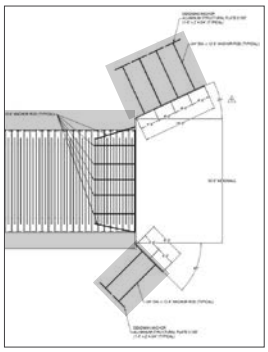
Assembly Procedure

1. Start with a completely assembled and torqued box culvert shell. Recheck the span and rise dimensions when full inverts are not used. Make any corrections using come-alongs and/or struts.
2. Lay out the pre-cut headwall and wingwall panels, vertical joints, headwall caps and other miscellaneous parts as shown on the assembly drawing. Be sure all the parts are laid out as specified because some special cuts and/or panel lengths may be located in only one specific position. All headwall panels are marked on soil side. Be sure to orient the panels accordingly. Please see the circled number in the picture below and the circled numbers in the sample drawing on page 11.



3. The headwall assembly is installed after the structure has been set into final position. The only preliminary steps that can be taken are:
   - Bolting ribs at each end of the structure to later receive field drilling for headwall attachment. The ribs at each end of the structure must be oriented such that the base of the angle is facing outward, providing a flat, vertical face on the inside for the headwalls to bolt to. No splice ribs are used at the end rib locations.
   - Leveling, field drilling and attachment of the headwall center panels to the end ribs.
   - Bolting the female corner joint to the headwall end panel and bolting the male corner joint to the corner panel (if required).
4. Before any further assembly can be done, make sure the foundation has been trenched to receive the headwall and wingwall panels. All headwall and wingwall panels must be trenched approximately two feet into the existing ground or as directed by the project engineer/ owner. If a stable rock foundation is encountered, these panels may be trimmed and placed into a concrete-grouted keyway in the bedrock. Make sure the excavation extends beyond the limits of the wingwall dead man anchors. Dead man anchors are designed to be entirely embedded in structural backfill material.





5. Now, start setting the headwall into position. Begin by attaching the interior, center panels to the end ribs. The panels can be bolted together at the vertical seams where they overlap. Center the panels on top of the structure and ensure they are level before bolting to the end rib. The connection of the headwall panels to the end rib requires field drilling through both parts.

Contech furnishes a step drill bit with the structure for this purpose. Beginning at the crown of the structure where the outside crest of the panel makes contact with the rib, drill a 7/8" diameter hole through the center of the end rib and the wall panel.





Use a 1-1/2" bolt to connect the two pieces. Use of a non-petroleum based lubricant when drilling will expedite the process and extend the life of the reamer bit. Continue to field drill and bolt the end ribs and panels together along the perimeter of the arch. Connections should be spaced at a minimum of every other corrugation.





6. Next, bolt the headwall end panels to the center panels and secure them to the structure in the same way, by field-drilling through the end rib. The end panel will slide in between the toe wall and the notch cut in the invert plate. The cut portion of the outside headwall panels (panels 13 & 19 on page 11) shall be bolted where the plate corrugation and the end rib meet each other.



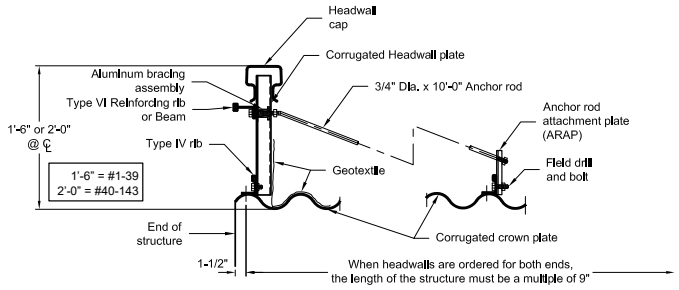
7. Connect the 3-piece, hinged corner joint to the headwall end panel. The corner joint consists of open and closed tabs that bolt to the wall panels and a central splice that connects the two together. The open portion should be bolted directly to the end panel using 1-1/2" long bolts. The closed portion is bolted to the wingwall corner panel. These permit the wingwalls to rotate up to a maximum of 130 degrees.



8. Set and bolt the headwall cap in place. Headwall caps are secured to the wall panels with one bolted connection at the approximate center of each panel, and alternating the connection on opposite sides (soil vs. exposed) of each panel. The holes for these connections are field drilled through the caps and the wall panels (see detail on page 11). Then, set the elbow cap on top of the vertical joints (if required). One end of the elbow cap will slide inside the headwall cap. In some cases headwall pieces will require a two piece headwall cap connection. Please be sure to place the headwall cap with the shop welded splice near the center of the headwall, then place the second headwall cap over the splice.



9. On standard headwalls, a type VI rib is provided to secure anchor rods just below the headwall cap. The rib is pre-punched with holes for bolting directly to the wall panels and for anchor rod connections. Field drill holes through the headwall panels on a maximum of 18" center spacing. Secure the wall panel connections with 1-1/2 long bolts.



For anchor rod attachments, thread a nut 6" onto one end of the anchor rod and insert it through a hole that is 4.5" from either side of the center of the panel. Secure the anchor rod to the rib with a nut on the front face and then tighten the nut on the back side to complete the attachment. Lay the attached rod 90° to the headwall with the anchor rod attachment piece (ARAP) loosely bolted with two nuts to the other end of the rod.



Then, determine which crown rib is closest to the end of the anchor rod. Field drill a hole in the rib at this location and attach the ARAP to the rib with a bolt and nut. Use a nut to tighten the threaded anchor rod onto the ARAP such that the anchor rod is straight and has some tension on it. Repeat for all remaining rods. Be sure that the headwall is kept plumb and perpendicular to the box culvert shell and that the anchor rod is straight and taut. Caution: For Type IV ribs, the reinforcing rib must be positioned (oriented) such that the toe is pointing toward the headwall and the ARAP is on the flat side away from the headwall.



10. Wingwall panel assembly: Corner panels are 4′-9″ wide and are the wingwall panels closest to the headwall. Orient the corner panel to the angle shown on the plans and bolt it to the corner joint. Bolt on additional wingwall panels as required using 1-1/2″ Bolts at the vertical seams between panels. Brace walls as required to maintain a vertical orientation and proper angle with respect to the headwall. (If the wingwalls are not angled and extend straight out from the headwall, no corner joint is required. Simply overlap and bolt the wingwall panels directly to the headwall end panel.)



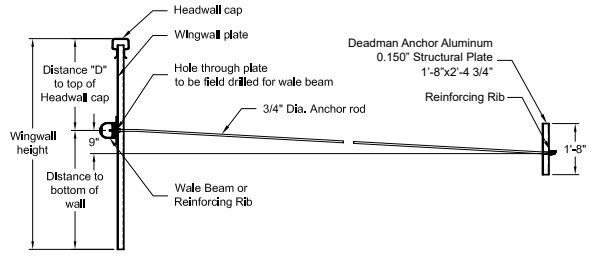
11. Wale beams are used to reinforce wingwall panels and provide a means for attaching dead man anchors. The assembly drawings will dimension where the wale beams are to be attached to the structure. Holes for the attachment hardware must be field drilled in the wall panels at the locations shown on the plans. The shaded circles on the plans indicate holes for anchor rod connections while the open circles indicate bolted connections between the wale beam and wingwall. All wale beam connections are made with threaded wale nuts that slide into the channel formed inside of the wale beam. Slide all wale nuts into their approximate location before bolting on the wale beam. Use 2″ bolts to attach the wale beam to the wingwall panels near the ends of each panel.





12. Wingwalls are supported by dead man anchors embedded in the structural backfill. The dead man anchors will be pre-fabricated with a reinforcing angle welded to one side and drilled to accept the anchor rod. At the wall panel, anchor rods are secured to wale nuts previously inserted in the wale beam channel. Thread a nut approximately 6″ onto one end of the anchor rod and insert it through the previously drilled hole in the center of the wingwall panel. Thread the anchor rod into the wale nut and then tighten the nut onto the wingwall panel to complete the anchor rod connection to the wale beam. On the opposite end, make sure the dead man anchor is oriented such that the reinforcing angle is facing away from the wall panel. Thread a nut about 3 inches onto the anchor rod, then insert the anchor rod through the deadman assembly and thread a second nut onto the anchor rod securing the deadman anchor in place. The elevation of the wingwall anchor should be set as shown on the assembly drawings. For some installations, where the fill slope is nearly level, a dual deadman assembly may be used. See the Structural Plate Design Guide and the assembly drawings.





Wingwall caps slide over the wall panels and cover the other end of the elbow cap. Attach the wingwall caps at the center of each wall panel, similar to the headwall cap (Please see detail on page 11). End caps slide into the end of the wingwall caps. These are not bolted.



13. Torque all bolts and rods to 100 to 150 ft.-lbs. cut off any excess anchor rod that protrudes from the headwall. Do not over torque.

14. Finally, place the geotextile provided along the headwall/structure seams as shown in the assembly drawings (see Appendix G).

Out of Trench Assembly

Because aluminum is lightweight, the assembled structure can often be lifted with light duty equipment (see Appendix B for more detail). See the structural plate load slip, the Contech product catalog or contact a Contech representative for the handling weight of the structure. It may be advantageous to preassemble the structure. For example, removing the existing bridge and preparing the footing while the structure is being assembled may be the most effective approach to the project. Setting the structure into place all at once minimizes the risk of damage that can occur due to sudden exposure to hydraulic forces. Review the "Precautions" section of the Structural Plate Design Guide. Review the "Special Assembly Considerations" and "Lifting" sections of these instructions.

Where full inverts are not used, spreaders or ties may be required across the bottom of the structure. These help maintain the proper shape and dimensions of the structure during handling and lifting. They must be removed after the installation is complete.

Check to make sure that no unused bolt holes remain in the structure except along the bottom edge. These are covered by the geotextile provided.

Headwalls on smaller structures up to 20 ft. spans, may be preassembled and set in place at one time. The field drilling and bolting process is the same as described before, when the headwall is preassembled.

Wingwalls may also be preassembled with the wale beams attached and connected to the headwall as shown previously. Please contact your Contech representative for additional information.

Area Needed

The assembly area must be fairly flat and free of large brush, stumps, or tress. Out of trench assembly should be as close to the installation site as possible. Utilize the roadway for an assembly area when practical. In those cases where there are no level places to assemble the structure, make arrangements to level an area for assembly. The assembly area required is the width of the structure (span) + 15′ by the length of the structure. The additional 15′ may be needed to layout plates and to provide the necessary working area.

Lifting

Lifting preassembled sections of structures or entire structures is a proven and fairly common method of installation. However, attention must be given to proper techniques and safety measures. Structure must be lifted carefully in a controlled and balanced fashion. Many structures have been lifted into place using lifting shackles. The capacity of lifting shackles will depend upon the size, length and weight of the structure.

The use of a spreader bar with multiple lifting points is desirable since this serves to control distortions and better distribute lifting loads. Additionally, these loads are transmitted vertically to the structure, minimizing excessive bending and the eccentric forces on the lift assemblies.

The contractor must review any lifting procedure to ensure that an adequate safety factor has been provided. The contractor must lift the structure into place in such a manner as to not damage the structure (see Appendix B for additional details). Review all applicable safety guidelines.

Caution: Do not attempt any loading of a structure (including lifting of pre-assembled structure into place) prior to the attachment of reinforcing ribs and the torquing of all nuts. For structures without full inverts, come-alongs, ties and/or struts will be required to maintain span dimensions.



Lifting


Assembly

Heavy Construction Load Considerations

The addition of temporary soil cover for heavy construction loads is not feasible or permissible for ALBC structures. By design, these structures are limited in the range of permissible fill heights and live loads. For additional questions, contact your local Contech representative about permissible live loads and allowable soil cover heights (minimum and maximum) for ALBC.

Standard highway loads that meet the permissible design load limits for an ALBC are not allowed until it is backfilled completely, and the road surface is in place. See the design information specific to the project for the allowable live load and the permissible range of cover.

Backfill

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

The backfill material should be free of rocks, frozen lumps and foreign material that could cause hard spots or decompose to create voids. A free draining granular backfill provides some alleviation of hydrostatic pressure. Backfill material should be well graded granular material that meets the requirements of AASHTO M 145 for soil classifications A-1, A-2, or A-3* (see Table 2). Particles shall be no larger than 3". Backfill must be placed symmetrically on each side of the structure in 8-inch uncompacted lifts. Each lift is to be compacted to a minimum of 90% compaction per AASHTO T 180. Make sure to maintain balanced fill placement and loading during all phases of installation, keeping fill height differential side to side to a 2' maximum amount.

During backfill, only small tracked vehicles (D4 or smaller) should be near the structure as fill progresses above the crown and to the finished grade.

Salt Water Installation

In salt water installations, the bedding and backfill around the structure must be clean, free draining, granular material. If the backfill is subject to possible infiltration by the adjacent native soil, the free draining material should be wrapped in a geotextile. Aluminum fasteners are available for salt water applications if specified.

Precautions

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

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 or hydraulic forces that might bend or distort the unsupported ends of the structure.



TABLE 2 - BACKFILL SOIL CLASSIFICATIONS

GROUP CLASSIFICATION	A-1-a	A-1-b	A-2-4	A-2-5	A-3* *(Applies only to structure numbers 1 - 87)*
Sieve Analysis Percent Passing					
No. 10 (2.000 mm)	50 max.	----	----	----	----
No. 40 (0.425 mm)	30 max.	50 max.	----	----	51 max.
No. 100 (0.150 mm)	----	----	50 max.	50 max.	----
No. 200 (0.075 mm)	15 max.	25 max.	20 max.	20 max.	10 max.
Atterberg Limits for Fraction Passing No., 40 (0.425 mm)					
Liquid Limits	----	----	40 max.	41 max.	----
Plasticity Index	6 max.	6 max.	10 max.	10 max.	Non Plastic
Usual Materials	Stone Fragment, Gravel and Sand		Silty or Clayey Gravel and Sand		Sand *(may not contain fine beach sands, windblown sands, stream deposits sand etc. exhibiting fine, rounded particles.*

Backfill Sequence

Foundation must provide 4,000 lbs per square foot allowable bearing capacity, or as designed by project engineer. See Appendix A for additional detail.



Loosely placed geotextile over scallop plate and exterior of invert plate.



Backfill material is placed carefully before 8″ lifts are spread evenly and compacted.



Granular material placed in balanced manner.



Small tracked vehicles are okay once sufficient cover is placed and compacted.



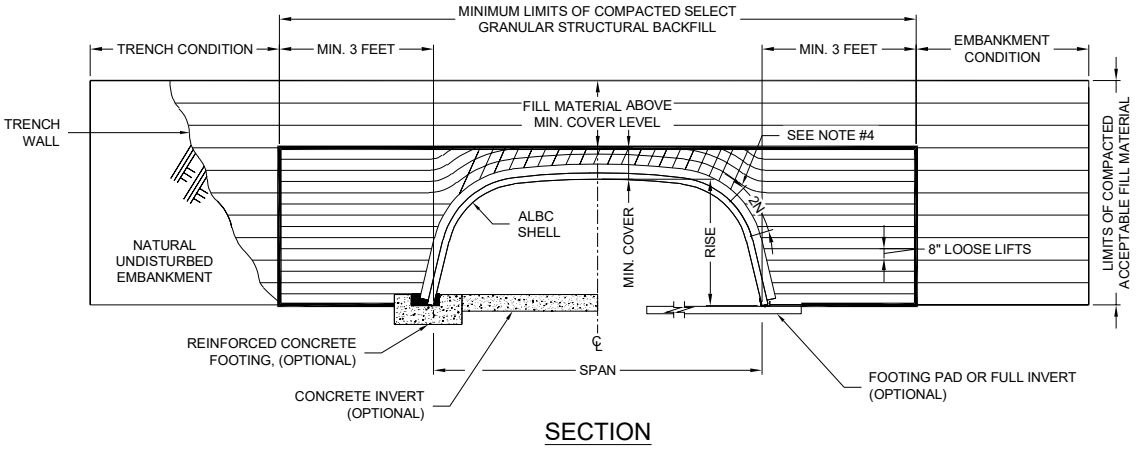
Backfill material is placed and spread from a distance with an excavator.



Compact material with a vibratory plate compactor.

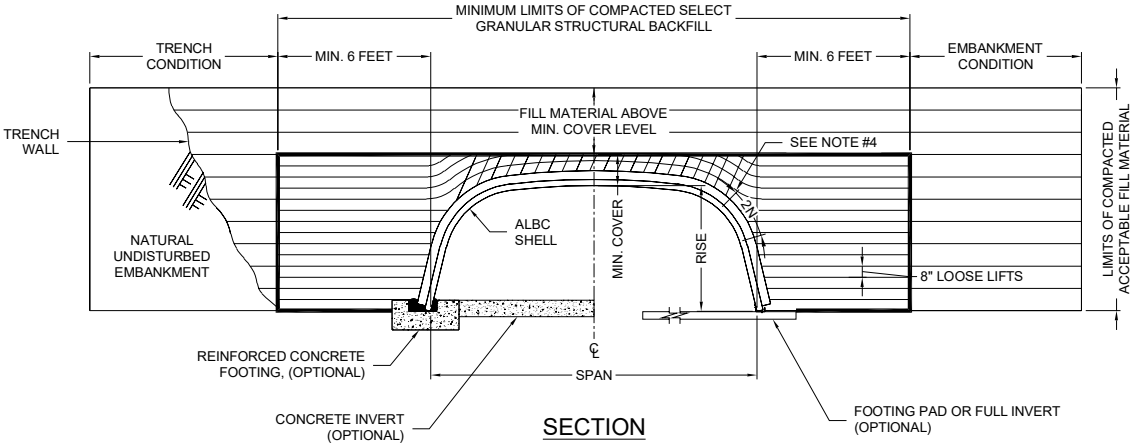
Appendix A - Typical Backfill Cross Section

STRUCTURES #1-87



SECTION

STRUCTURES #88-143



SECTION

SELECT GRANULAR STRUCTURAL BACKFILL LIMITS.

INITIAL LIFTS OVER CROWN OF STRUCTURE AS INDICATED BY SHADED AREA TO BE COMPACTED TO REQUIRED DENSITY WITH HAND OPERATED EQUIPMENT OR WITH SMALL TRACTOR (D-4 OR SMALLER) DRAWN EQUIPMENT.

NOTES:

1. ALL SELECT GRANULAR BACKFILL TO BE PLACED IN A BALANCED FASHION IN THIN LIFTS (8" LOOSE TYPICALLY) AND COMPACTED TO 90% MODIFIED MINIMUM DENSITY PER AASHTO T-180.
2. COMPLETE AND REGULAR MONITORING OF THE ALUMINUM BOX CULVERT SHAPE IS NECESSARY DURING ALL BACKFILLING OF THE STRUCTURE.
3. PREVENT DISTORTION OF SHAPE AS NECESSARY BY VARYING COMPACTION METHODS AND EQUIPMENT. TRENCH WIDTH OTHER THAN 3-ft. or 6.ft (AS SHOWN ABOVE) SHALL BE BY DIRECTION OF THE ENGINEER OF RECORD. WHEN USING ALUMINUM HEADWALLS AND WINGWALLS, BRACE WALLS AS REQUIRED TO MAINTAIN A VERTICAL ORIENTATION AND PROPER ANGLE.
4. SWITCH TO PLACING SELECT GRANULAR BACKFILL IN RADIAL LIFTS AT APPROXIMATELY 75% OF THE RISE OF THE STRUCTURE.

ADDITIONAL SELECT GRANULAR STRUCTURAL BACKFILL NOTES:

SATISFACTORY BACKFILL MATERIAL, PROPER PLACEMENT, AND COMPACTION ARE KEY FACTORS IN OBTAINING MAXIMUM STRENGTH AND STABILITY.

THE BACKFILL MATERIAL SHOULD BE FREE OF 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 M-145 FOR SOIL CLASSIFICATIONS AS NOTED ON PAGE 16 OF THIS DOCUMENT.

BACKFILL MUST BE PLACED SYMMETRICALLY ON EACH SIDE OF THE STRUCTURE IN 8" LOOSE LIFTS. EACH LIFT IS TO BE COMPACTED TO A MINIMUM 90% COMPACTION PER AASHTO T-180.

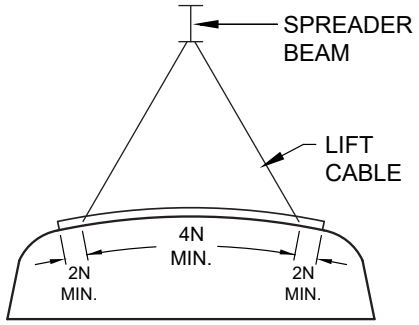
A HIGH PERCENTAGE OF SILT OR FINE SAND IN THE NATIVE SOILS SUGGESTS THE NEED FOR A WELL GRADED GRANULAR BACKFILL MATERIAL TO PREVENT SOIL MIGRATION.

DURING BACKFILL, ONLY LIGHTWEIGHT TRACKED VEHICLES (D-4 OR LIGHTER) SHOULD BE NEAR THE STRUCTURE AS FILL PROGRESSES ABOVE THE CROWN AND TO THE FINISHED GRADE.

THESE ARE SUGGESTED GUIDELINES ONLY. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LIFTING PROCEDURE. IT IS RECOMMENDED THAT A QUALIFIED ENGINEER BE ENGAGED TO DETAIL THE PROCEDURE.

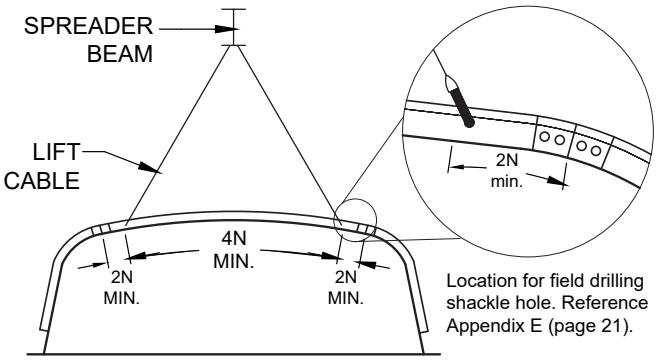
- Determine the number of lifting points (n) and the appropriate spacing (D) based on the shackle capacities and the method.[1]
- Boxes 1-25 should be lifted from the LONG Crown Ribs (Crown Ribs that are not spliced to Haunch Ribs) or from the Haunch Ribs.
- Boxes 26-143 must always be lifted from the Crown Ribs (preferably ones spliced to Haunch Ribs.)
- Lift Shackles need to be at least 2N (19.25") from a Rib Splice, at least 4N (38.5") from each other, and at least 2N from the end of a rib.
- Lift Shackles should be no greater than 8'-3" from the ends of the structure (E). Distance between connections (D) should not exceed 18'.

Lifting Structures 1-25



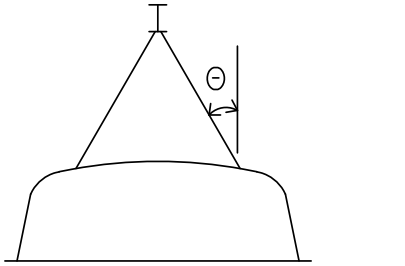
LIFTING FROM THE LONG CROWN RIB

Lifting Structures 26-143



Location for field drilling shackle hole. Reference Appendix E (page 21).

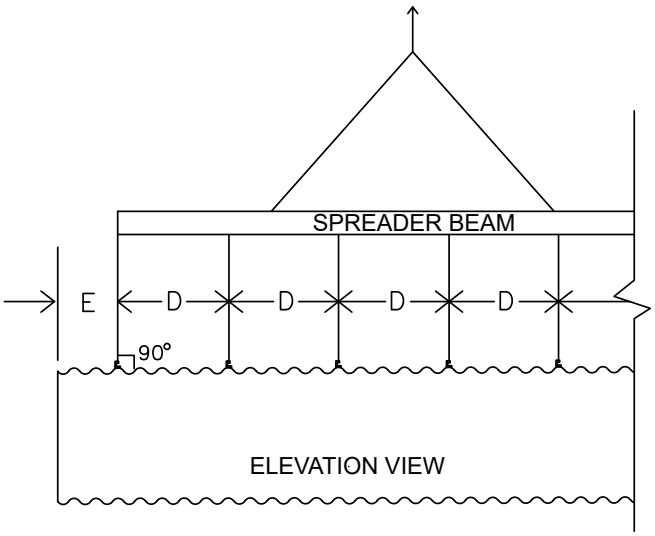
LIFTING FROM THE SHORT CROWN RIB



LIFTING CABLE ORIENTATION

ANGLE Θ (DEGREES)	
15	SUGGESTED
45	MAXIMUM*

**See detail on page 19. V = 4,150 lbs. minimum*

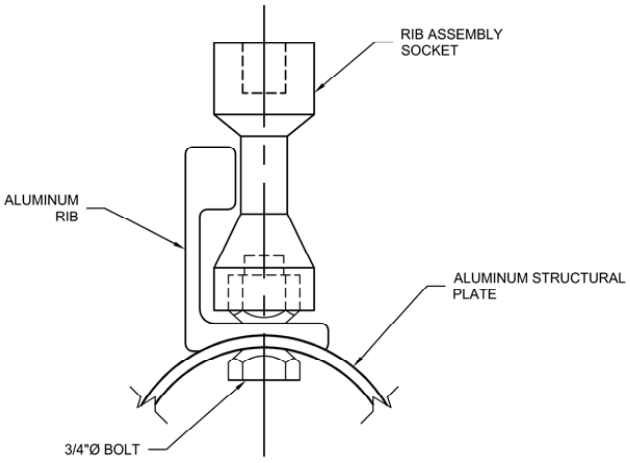


NOTES

1. Prior to lifting, be sure the box is free of dirt, mud, or other foreign matter that may increase the weight of the structure.
2. Do not jerk the box when lifting.
3. Do not allow lifted box to hit other material or be abused in any manner.
4. No person should be beneath or near a lifted box.
5. One "N" increment is 9.625".
6. See page 21 for lifting shackle detail.
7. If further information is needed, please call your local Contech representative.

CONTECH® STRUCTURAL PLATE

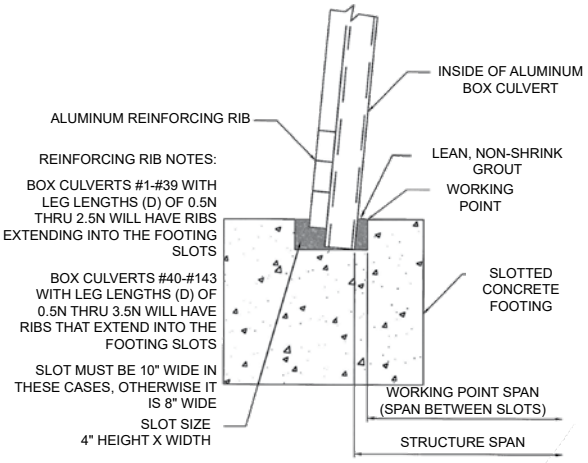
Appendix C - Rib Assembly Socket



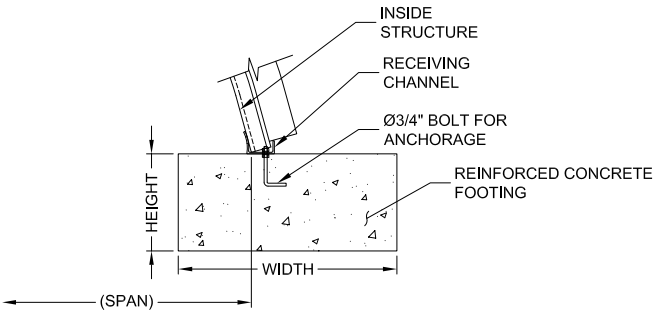
RIB ASSEMBLY SOCKET

NOTE:
THE RIB ASSEMBLY SOCKET IS USED FOR THE INSTALLATION OF REINFORCING RIBS ON ALUMINUM STRUCTURAL PLATE PRODUCTS. THIS IS A 6 POINT SOCKET FOR 1-1/4" NUTS AND HAS 3/4" DRIVE.

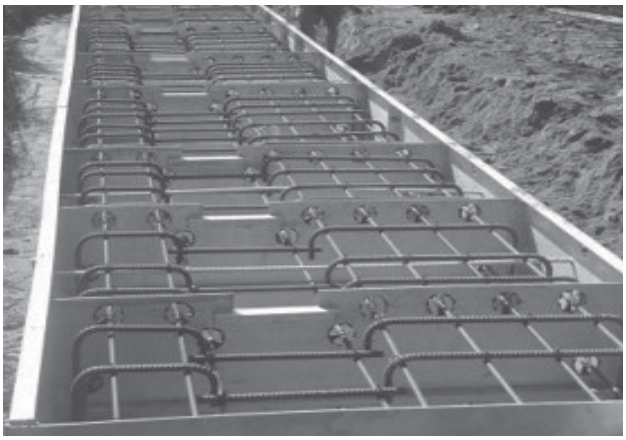
Appendix D - Footing Options



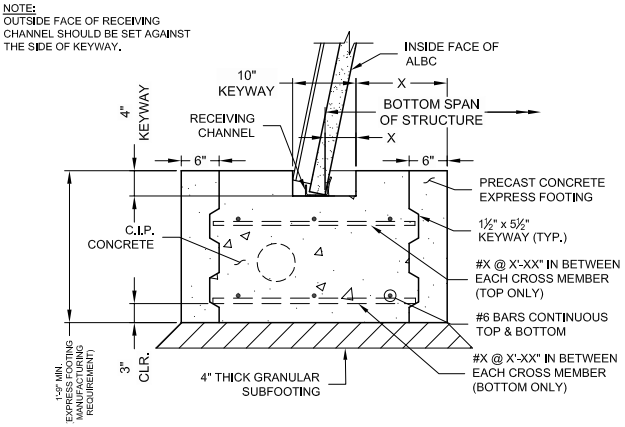
Slotted Concrete Footing Option



Receiving Channel Footing Option



Steel EXPRESS® Foundation



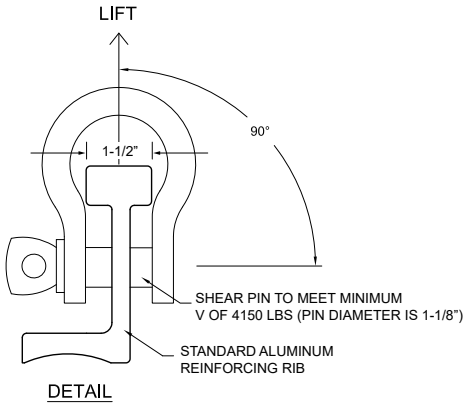
Precast EXPRESS® Foundations Option
(both metal and reinforced concrete available)

Appendix E - Lifting Shackle Detail

STEEL
LIFTING SHACKLE

NOTES:

1. THE LIFTING FORCE MUST BE APPLIED PERPENDICULAR TO THE PIN AS SHOWN.
2. LIFTING SHACKLE CAN BE SUPPLIED BY CONTECH OR OTHERS.
3. REFER TO PAGE 17 FOR MORE LIFTING INFORMATION.
4. CONTECH SUPPLIES A 7/8" DIAMETER VARI-BIT FOR FIELD DRILLING HOLES IN PLATES. A LARGE DIAMETER REAMER IS NEEDED TO DRILL THESE RIBS FOR THE SHACKLE PIN.

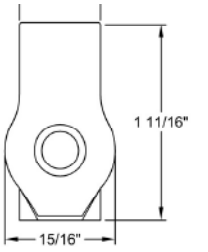


DETAIL

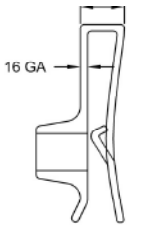
CONTECH SPECIFICATION:

THE SHACKLE SHOWN IS MANUFACTURED FROM FORGED STEEL ALLOY STEEL. PINS ARE HEAT-TREATED AND TEMPERED. SCACKLES SHALL MEET THE REQUIREMENTS OF FEDERAL SPECIFICATION: RR-C-271D.

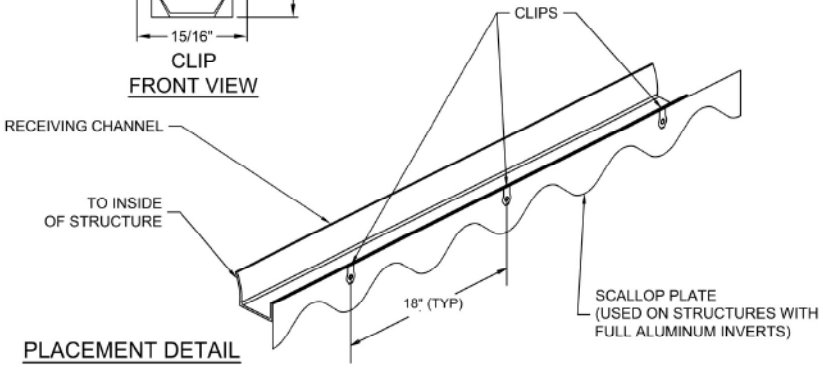
Appendix F - Scallop Detail



CLIP
FRONT VIEW



CLIP
SIDE VIEW



PLACEMENT DETAIL
(NOT TO SCALE)

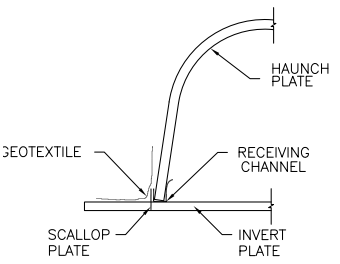
NOTE: THIS CLIP HAS MANY DIFFERENT USES. WHEN USED AS A "PUSH-ON" RETAINER FOR THE SCALLOP PLATE, THE THREADED PORTION IS NOT UTILIZED.
BOLTS ARE NOT SUPPLIED AND ARE NOT NECESSARY.

Appendix G - Geotextile with Scallop Detail

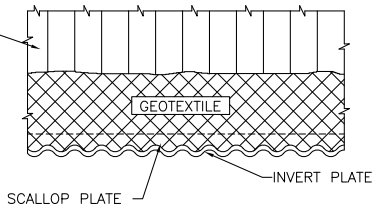
ALUMINUM BOX CULVERTS WITH FULL INVERTS REQUIRE THE PLACEMENT OF A GEOTEXTILE ALONG THE SCALLOP PLATE. THE USE OF THE GEOTEXTILE PREVENTS THE INFILTRATION OF THE BACKFILL THROUGH THE UNFILLED BOLT HOLES AND THE SPACE BETWEEN THE INVERT PLATE AND THE SCALLOP PLATE. A ROLL OF GEOTEXTILE IS PROVIDED FOR THIS PURPOSE.

THE GEOTEXTILE SHOULD BE PLACED ALONG THE OUTSIDE OF THE HAUNCH PLATE AND HELD IN PLACE WHILE THE FIRST LIFT OF BACKFILL MATERIAL IS PLACED BY HAND. CARE SHOULD BE TAKEN TO ENSURE THAT THE GEOTEXTILE REMAINS IN CONTACT WITH THE HAUNCH, SCALLOP AND INVERT PLATE, AS SHOWN BELOW, DURING BACKFILL. THE LENGTH OF GEOTEXTILE REQUIRED ON EACH SIDE OF THE STRUCTURE IS EQUAL TO 1.25 TIMES THE STRUCTURE LENGTH. THIS ALLOWS THE GEOTEXTILE TO BE SEATED INTO THE CORRUGATIONS OF THE INVERT AND HAUNCH PLATES.

OTHER METHODS OF PLACEMENT ARE ACCEPTABLE PROVIDED THAT SUFFICIENT COVERAGE OF THE UNFILLED BOLT HOLES AND THE SPACE BETWEEN THE SCALLOP PLATE AND THE INVERT PLATE IS ACCOMPLISHED.



END VIEW

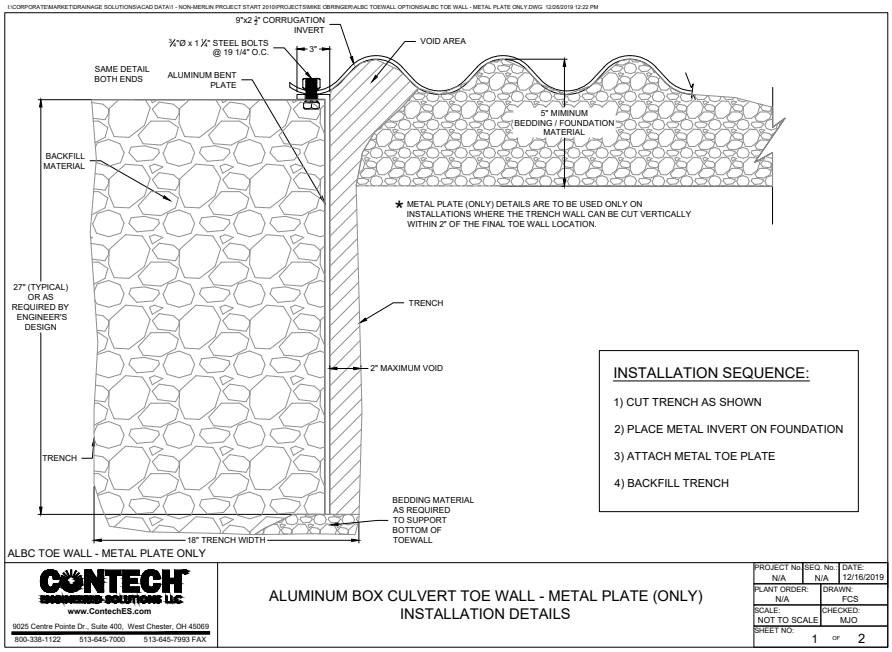


SIDE VIEW

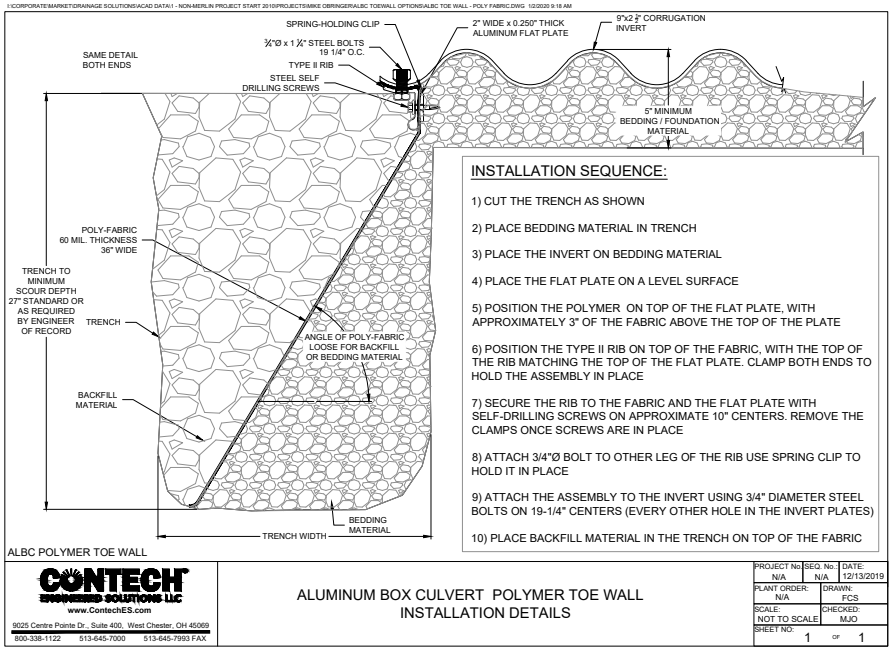
Appendix H - Toe Wall Detail

Aluminum Toe Walls are 27" deep x 4" 'L' shaped un-corrugated plates that are pre-punched for attachment to the underside of invert. The toe wall is bolted to the invert plates at the end row of bolt holes with the short horizontal leg pointing outward. To install toe walls, trench out an area on both ends of the structure to accommodate them. Trial fit the toe walls in the trench and determine if voids are present behind the toe wall. If so, lean the toe wall forward and hand place and tamp backfill material behind and in front of the toe wall while working them into final position from the bottom up. Any voids that exist after the final positioning of the toe plate should be grouted. Place bolts from the bottom then attach nuts and tighten to 100 to 150 ft-lbs of torque.

Toe walls can be pre-attached to the invert of a preassembled ALBC if the foundation material can be trenched accurately with no sloughing of material behind the toe walls. If sloughing of the foundation material occurs, detach the toe walls and follow the procedure in the previous paragraph.



Polymer Toe Walls are made of 60 mil thick HDPE material, which can be positioned to fit adjacent to the cut trench wall to minimize any voids. Please refer to the detail below for the method to install this toe wall option.



NOTES



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