CONTECH®
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CHS® Installation Guide

CHS® Installation Guide Introduction

This instruction book is for your crews. Distribute it to help them install Contech® CHS® (Culvert Headwall System). Proper installation of a corrugated metal pipe (CMP) with a prefabricated, 10-gage or 7-gage hot-dip galvanized steel headwall will ensure long-term performance and improve hydraulic capacity. All OSHA and local safety guidelines should be observed during the construction of the system and site.

Review these instructions with your supervisors and crews. It can mean a safer and better job for you and your customer. We recommend holding a preconstruction meeting with your Contech representative and all interested parties to ensure everyone involved in your project has a high level of understanding on what means and methods will be used to prepare for, install and grout the new structure(s). If you have any questions about these instructions, call your Contech Representative.

Proper Pipe Unloading, Handling & Placement

The pipe should be unloaded off the flatbed trailer with a forklift, excavator, crane or other piece of construction equipment. The pipe should never be dropped or pushed off the flatbed trailer. Nylon slings may wrap around the pipe or steel chains may be used to connect to the pipe or lifting lugs for both unloading and placement of the pipe sections.

Sometimes the pipe is lettered or numbered to show which pipe ends should be connected. This is called match marking the ends.

Large Headwall with CMP stub loaded on a flatbed trailer.

Lifting Aluminized Type 2 (ALT2) CMP with nylon slings.

Lifting CMP with prefabricated headwall with steel choker and nylon strap.

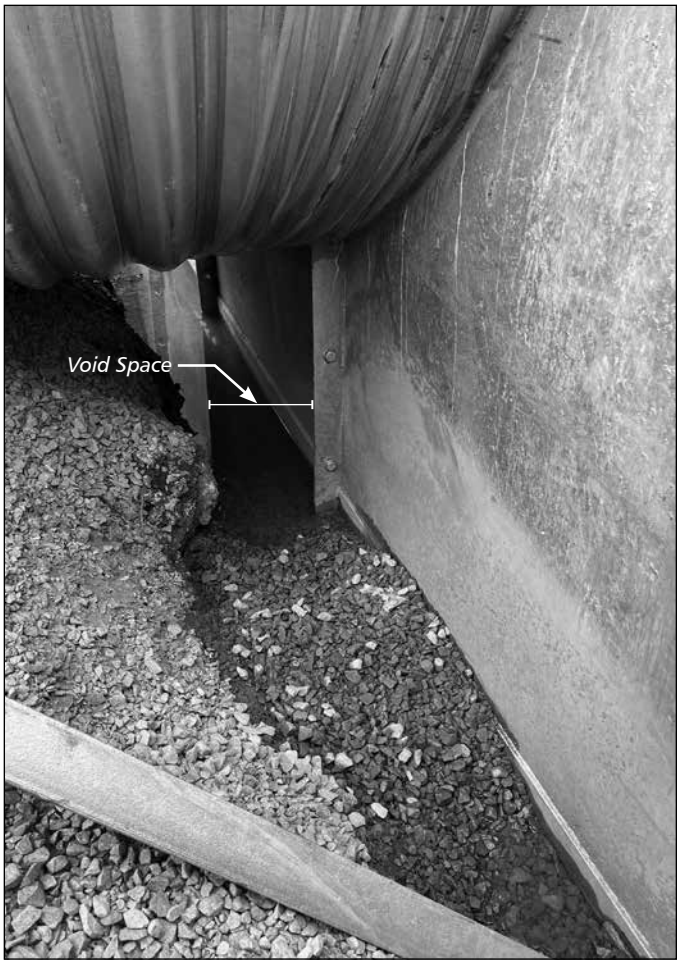
Foundation and Pipe Bedding

Construct a foundation that can support the design loading applied by the pipe and adjacent backfill weight as well as maintain its integrity during construction. If soft or unsuitable soils are encountered, remove the poor soils to a suitable depth and then replace with a competent granular material to the appropriate elevation. The granular material gradation should not allow the migration of fines, which can cause settlement of the pipe system or pavement above. If the structural fill material is not compatible with the underlying soils a geotextile fabric should be used as a separator.

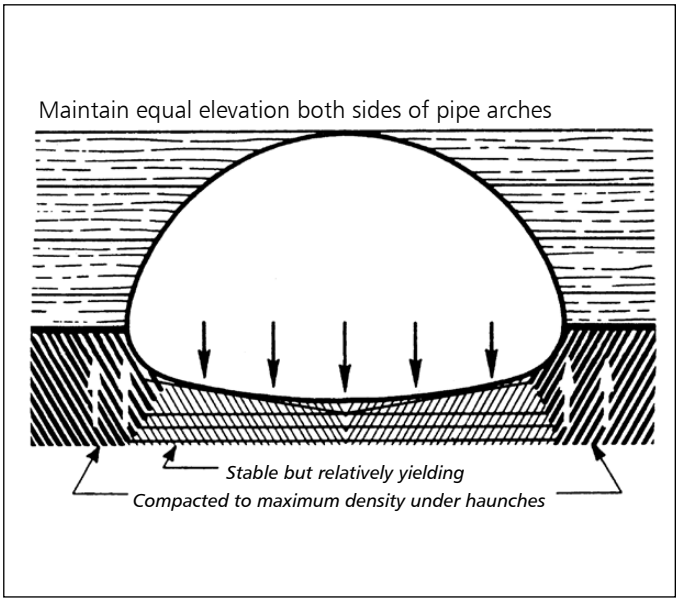
Install the foundation subgrade to a uniform or slightly sloping grade. If the subgrade is clay or relatively non-porous and the construction sequence will last for an extended period, it is best to slope the grade to the outlet end of the system. This will allow excess water to drain quickly, preventing saturation of the subgrade.

A 4" – 6" thick, well-graded granular material is preferred for the pipe bedding. If the existing foundation is made up of a coarse sand or other suitable granular material, imported bedding material may not be required. If poor subgrade soils are present, the engineer of record (EOR) or project owner shall approve any foundation enhancements.

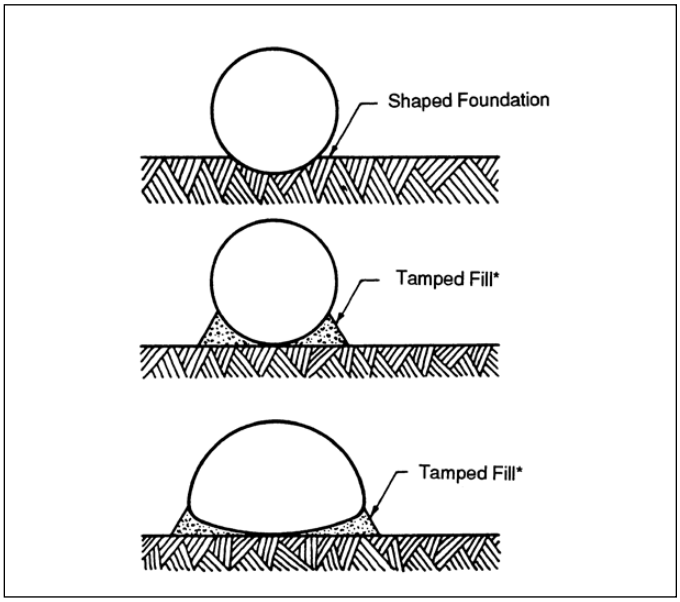
It is important to make sure the aggregate bedding directly under the pipe at the headwall connection is compacted with no voids. A void maybe present under the pipe if there is over excavation in the toe wall area of the headwall



Void space under pipe needs to be filled with aggregate bedding material and compacted.



Recommended backfilling practice for larger pipe arch, using a vee-shaped bed.



Methods for attaining proper compaction under haunches of CMP and pipe-arch.

Connecting Bands

There are various types of connecting bands for connecting CMP. HUGGER® bands and corrugated bands are the most common. Flat gaskets or O-ring gaskets can also be used in conjunction with connecting bands to reduce leakage in the joints

Installing a HUGGER® band on a perforated CMP.

Tightening bolts on a corrugated band.

Placement of flat neoprene basket on end of CMP.

Installation of corrugated band with flat neoprene gasket.

In-Situ Trench Wall

If excavation is required, the trench wall needs to be capable of supporting the load that the pipe sheds as the system is loaded. If the existing soil is not capable of supporting these loads, the pipe can deflect. The Engineer of Record (EOR) shall determine the suitability of the trench wall to support pipe and soil loads. Maintain a safe work environment while working near the trench wall.

Backfill Material

Corrugated Steel Pipe is a flexible pipe. All buried flexible pipes are dependent on quality backfill material for structural support. AASHTO refers to these pipe systems as, "Soil-Corrugated Metal Structure Interaction Systems". The best backfill material is an angular, well-graded, granular fill meeting the requirements of AASHTO A-1, A-2, or A-3. Aggregate materials that are free draining and compact easily such as crushed aggregate, crushed aggregate with fines, gravely sand, and coarse sand make good backfill. The aggregate particle size shall not exceed 3" in diameter.

For solid pipe, well graded or open graded granular material can be used as backfill. An open graded stone, with a particle size of ½" – 2 ½" diameter is recommended for backfill around perforated pipe. Backfill using controlled low-strength material (CLSM, "flash fill", or "flowable fill") when the spacing between the pipes will not allow for placement and adequate compaction of the backfill.

Examples of Acceptable Backfill Material

Coarse Sand.

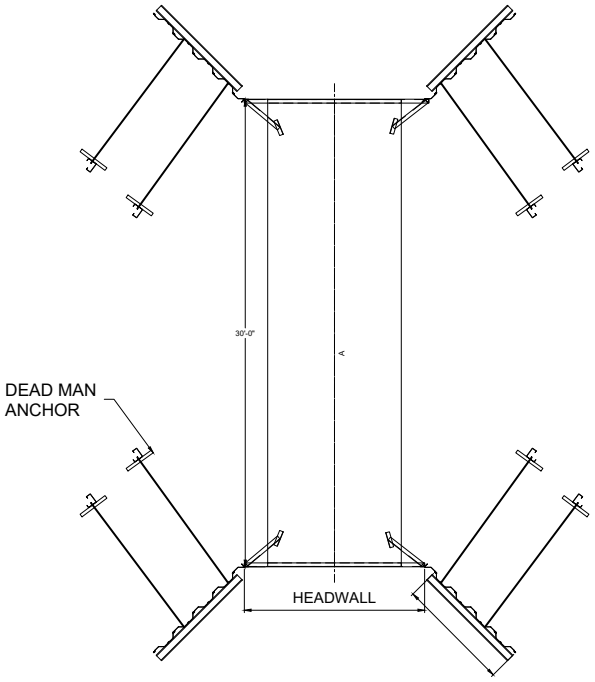
Crushed Limestone.

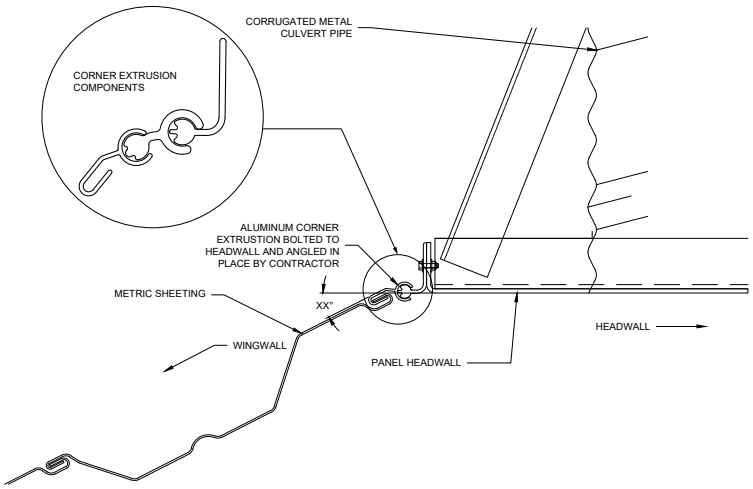
Dense Graded Aggregate (DGA).

Crushed River Gravel.

Installation of Wing Walls

Standard wing walls, as shown on drawings, are manufactured from hot-dip galvanized steel sheeting. The starter section of sheeting is bolted to the headwall, usually by the contractor. The next sections of wing walls are interlocked with the starter section and driven to the appropriate depth. Typically, the depth of the wing walls should match or be driven slightly below the depth of the head wall. Deadman tiebacks may be required depending on the height of the sheeting wing wall.





WINGWALL TO HEADWALL ATTACHMENT DETAIL
NOT TO SCALE

Wale beam shown in front of the wall.

Close up of wale beam shown in front of the wall.

Wingwall Dead Man Anchors

The first section of wing wall (starter piece) is a modified piece of sheeting that has a flange. This flange is bolted to the headwall with bolts. After the starter piece is bolted to the headwall, then additional sheeting sections can be slid into place.

For wing walls, a wale beam with deadman tiebacks are used to hold the wing wall in place. The wale beams will be pre-drilled with holes where the threaded tie rods will fit. The sheeting pieces will need to field drilled for the placement of the tie rods." For shorter wing walls one wale beam is required. For taller wing walls two wale beams are required. Check the fabrication drawings for your individual project.

Make sure the front toe of the sheeting is securely buried before backfilling with aggregate behind the wing wall. Keep heavy equipment off the backside of the sheeting during installation. A best practice is to proceed with even lifts of backfill behind the wing wall until the elevation of deadman placement is reached. The 10′ long or 12.5′ long threaded tie rods will be attached to the dead man anchors that are extended in the backfill. There is a double nut on the rod to hold the deadman anchors in place. The dead man should be properly tensioned.

Threaded tie rods are bundled with metric sheeting.

Backfill Placement

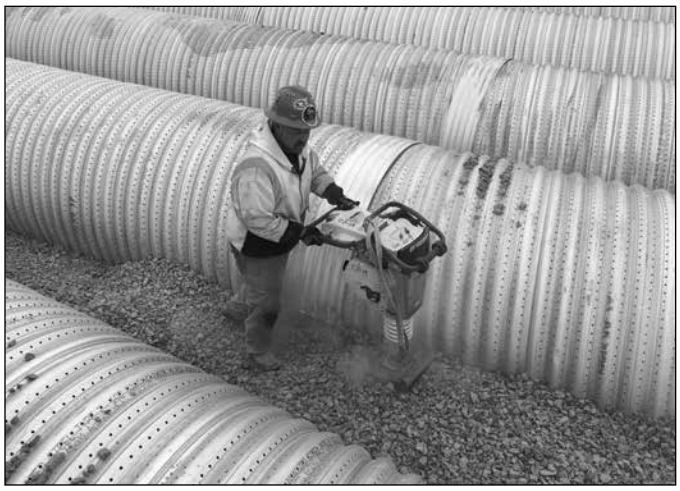
The backfill shall be placed in 8" +/- loose lifts and compact to 90% AASHTO T99 standard proctor density. Material shall be worked into the pipe haunches by means of shovel-slicing, rodding, vibratory packer, or other effective methods. If AASHTO T99 procedures are determined infeasible by the geotechnical engineer of record, compaction is considered adequate when no further yielding of the material is observed under the compactor, or under foot, and the geotechnical engineer of record (or representative thereof) is satisfied with the level of compaction.

For longer pipe lengths, conveyor systems or backhoes with long reaches may be used to place backfill. Once minimum cover for the construction loading across the entire width of the system is reached, advance the equipment to the end of the recently placed fill, and begin the sequence again until the system is completely backfilled. This type of construction sequence provides room for stockpiled backfill directly behind the backhoe, as well as the movement of construction traffic.

It is important to keep the elevation of backfill between pipes evenly. As a rule of thumb, do not allow for backfill to exceed the elevation of one side of pipe to the other by more than 24".

If CLSM or "flowable fill" is used as backfill, pipe flotation needs to be prevented. Typically, small lifts are placed between the pipes and then allowed to set-up prior to the placement of the next lift. The allowable thickness of the CLSM lift is a function of a proper balance between the uplift force of the CLSM, the opposing weight of the pipe, and the effect of other restraining measures. The Engineer of Record can assist in determining appropriate lift thicknesses if CLSM is used.

A CLSM or open grade aggregate material may be helpful in ensuring proper backfill compaction directly behind the CHS® headwall.



Examples of compaction with vibratory equipment around the culvert pipe.

Ensure proper compaction of backfill behind the headwall and under the pipe at the headwall connection.

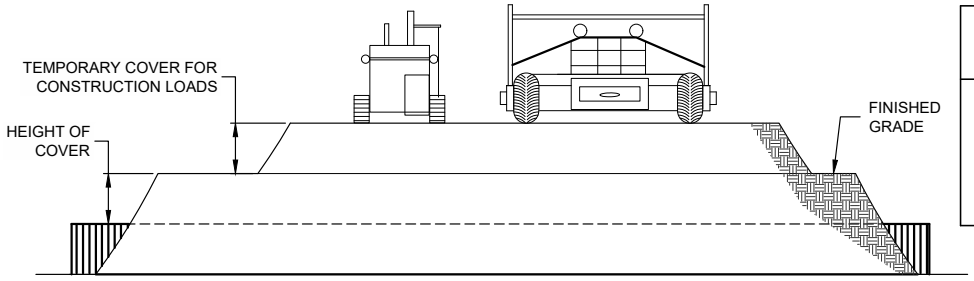
Placing a dense graded aggregate (DGA) behind the headwall.

Final Cover Placement and Construction Loading

The minimum cover specified for a project normally assumes H-20 highway live loading. Backfill must be placed and fully compacted to the minimum cover level over the structure before the pipe is subjected to design loads. The minimum cover for AASHTO H-20 Live Loading per design section 12, is span of the pipe divided by eight plus asphalt pavement.

Construction loads often exceed design highway loading. During construction, keep heavy construction equipment that exceeds legal highway loads off the pipe. Light construction equipment on tracks such as a D-3 dozer (or lighter weight) may cross over the pipe when a minimum of 12" of compacted backfill is over pipe. When construction equipment that exceeds legal highway loads must cross over pipe, an additional thickness of compacted fill, beyond that required for planned cover is required. Since construction equipment varies from job to job, it is best to address equipment specific minimum cover requirements with your local Contech Sales Engineer during your preconstruction meeting.

Examples of heavy construction equipment that may require additional minimal cover. Contech can help evaluate minimum cover for the installation contractor for all the equipment on the site.



CONSTRUCTION LOADS

FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE COVER MINIMUMS FOR NORMAL HIGHWAY TRAFFIC.

Minimum Height of Cover Requirements for Rubber-Tired Equipment Over HEL-COR® CSP

PIPE SPAN, INCHES	AXLE LOADS (kips)			
	18-50	50-75	75-110	110-150
	MINIMUM COVER (FT)			
12-42	2.0	2.5	3.0	3.0
48-72	3.0	3.0	3.5	4.0
78-120	3.0	3.5	4.0	4.0
126-144	3.5	4.0	4.5	4.5

Preconstruction Meeting

It is a best practice to have a preconstruction meeting with the installation contractor and Contech personnel. Included is a preconstruction checklist of issues to review prior to installation.

Minimum Height of Cover Requirements for Tracked Equipment HEL-COR® Corrugated Steel Pipe[1]					
Diameter (inches)	Minimum Cover (Ft)	Track Width (inches) Maximum Track Pressure at Surface (psi)			
		12	18	24	30
12 – 42	1.0	29	22	18	17
	1.5	58	41	34	30
	2.0	95	65	51	44
	2.5	138	91	70	59
	3.0	189	120	91	75
	4.0	321	195	143	115
48 – 66	1.0	10.6	8.0	6.9	6.2
	1.5	24	17	14.0	12.2
	2.0	39	26	21	18
	2.5	56	37	28	24
	3.0	77	49	37	30
	4.0	132	80	59	47
72 – 96	1.0	3.2	2.5	2.1	1.9
	1.5	8.8	6.2	5.0	4.4
	2.0	16	11.1	8.8	7.5
	2.5	24	15.0	12.0	10.1
	3.0	32	20	15	12.9
	4.0	56	34	25	20
102 – 120	1.0	2.8	2.1	1.7	1.6
	1.5	6.9	4.9	3.9	3.4
	2.0	14.8	10.1	8.0	6.7
	2.5	21	14.2	10.9	9.1
	3.0	29	18	14.1	11.6
	4.0	51	31	22	18
126 – 144	1.0	2.8	2.1	1.7	1.5
	1.5	6.0	4.3	3.5	3.0
	2.0	12.0	8.0	6.4	5.4
	2.5	21	14.0	10.6	8.9
	3.0	29	18	13.9	11.4
	4.0	50	30	22	18

1 The values in this table represent the maximum ground pressure permitted when performing reasonable work over the pipes, using the manufacture's published equipment specifications. (Ground pressure for track equipment is the vehicle operating weight divided by the total ground contact area for both tracks.) This table is to be used as a guide. Talk to your Contech representative if you have questions about the equipment you plan on operating over the pipes. Care should be taken to maintain adequate cover depth during construction activities.

Examples of light, tracked, construction equipment used to place final cover over the pipe system. Keep a minimum of 12" of cover over the pipe prior to operating lightweight track equipment. Additional minimum cover maybe required for larger equipment.

CHS® Preconstruction Checklist

Contech Field Contact and Phone: _____

Contech Plant Contact and Phone: _____

Contractor Contact and Phone: _____

Project Name: _____

Site Address: _____

Pre-con Attendees: _____

Topics to Review:

- ☐ Truck access and pipe storage availability/expectation
- ☐ Pipe unloading and handling safety, equipment and procedures
- ☐ System layout and shop drawing review
- ☐ Shipping schedule and installation sequence
- ☐ Joint configuration and assembly
- ☐ Connection with unlike storm sewer materials
- ☐ Backfill material selection and placement strategy
- ☐ Backfill sequence, lift thickness and balanced loading
- ☐ Compaction requirement (90%) and equipment
- ☐ Additional cover requirements for heavy construction loads
- ☐ CMP riser concrete cap installation

Notes:

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