

## CHS<sup>™</sup> 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. It is suggested to schedule a preconstruction meeting with your local Sales Engineer to determine if additional measures, not covered in this guide, are appropriate for your site. 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 pipe attached lifting lugs for both unloading and placement of the pipe sections.

Pipe installation typically starts at the downstream end and progresses upstream. 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

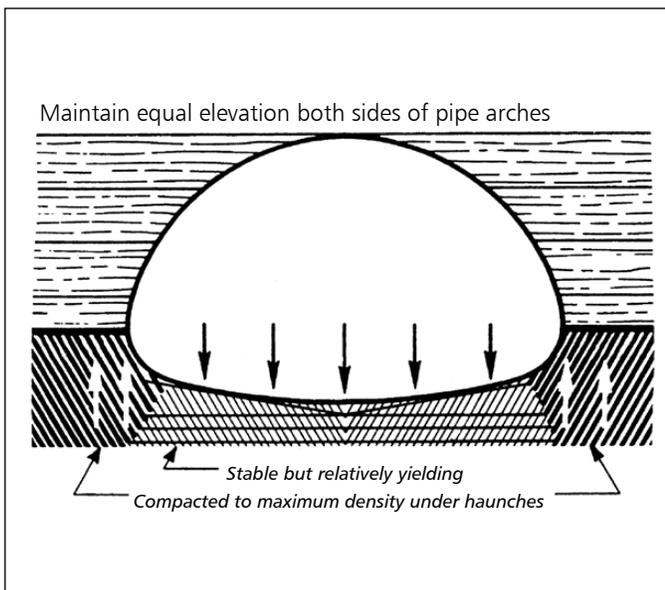
Construct a foundation that can support the design loading applied by the pipe and adjacent backfill weight as well as maintain its integrity during construction. If soft or unsuitable soils are encountered, remove the poor soils to a suitable depth and then replace with a competent granular material 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.

Grade 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.

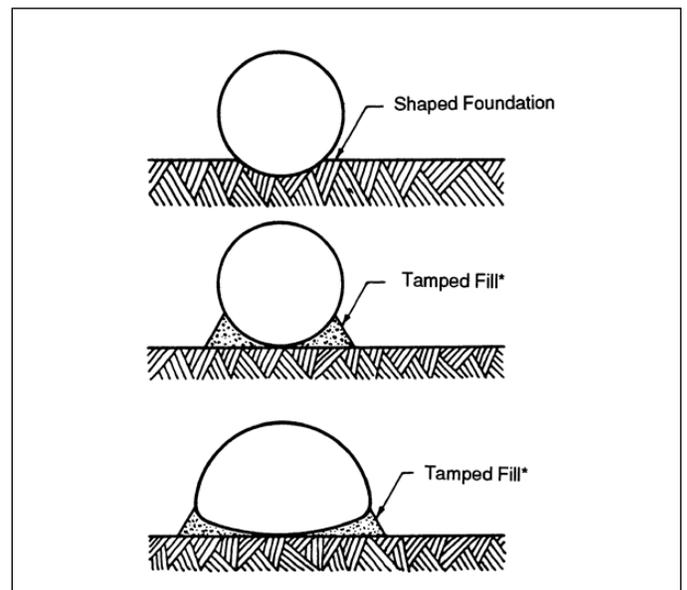
A 4" – 6" thick, well-graded granular material is preferred for the pipe bedding. If the existing foundation is made up of a coarse sand or other suitable granular material, imported bedding material may not be required. If poor subgrade soils are present, the engineer of record (EOR) or project owner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



Aggregate bedding material placed under this twin culvert pipe.



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. Perform a simple soil pressure check using the applied loads to determine the limits of excavation beyond the spring line of the outer most pipes. 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. Infiltration pipe systems have a pipe perforation sized of 3/8" diameter. An open graded stone, with a particle size of 1/2" – 2 1/2" 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*

## 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 large systems, conveyor systems, 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. Your local Sales Engineer can help determine an appropriate lift thickness.

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.*



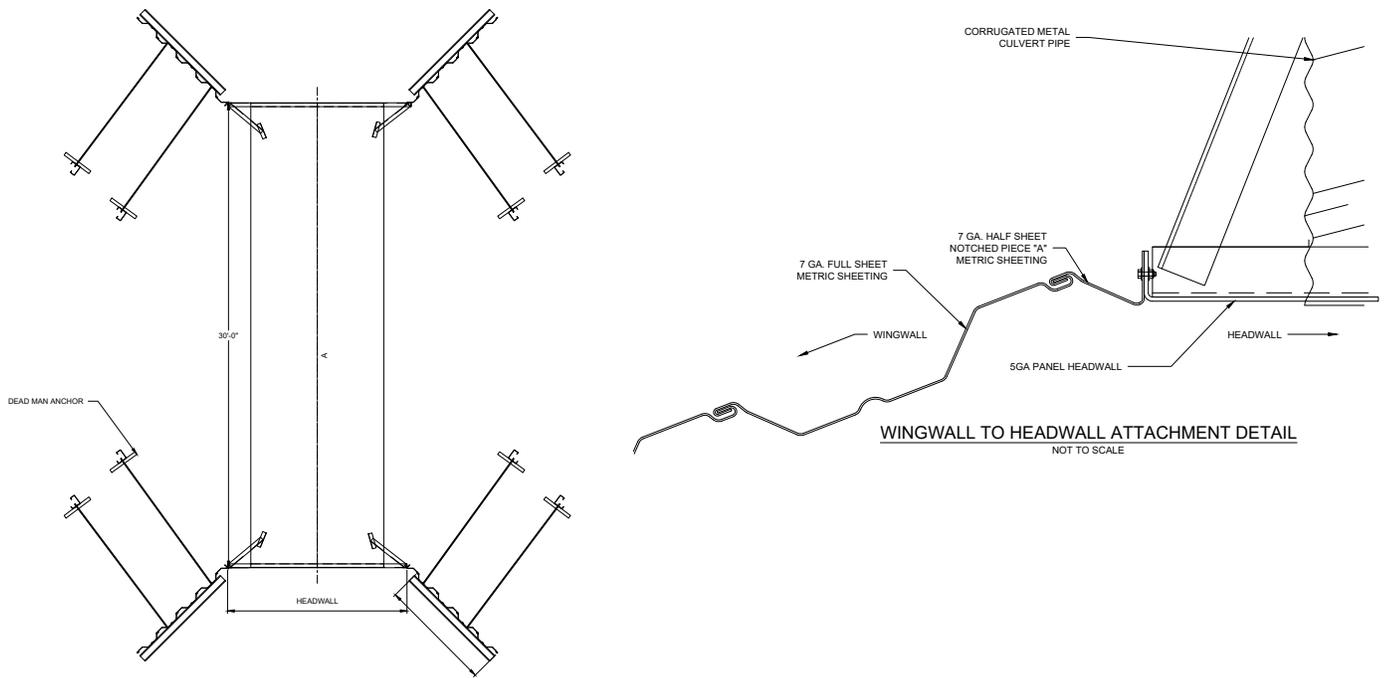
*Ensure proper compaction of backfill behind the headwall and under the pipe at the headwall connection.*



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

# Installation of Wing Walls

Standard wing walls are manufactured from 10-gage or 7-gage hot-dip galvanized steel sheeting. The starter section of sheeting is bolted to the headwall. The next sections of wing walls are driven to the adjacent headwall. Typically, depths of the wingwalls match are slightly below the depth of the headwall. Deadman tiebacks may be required depending on the length of the sheeting wing wall.



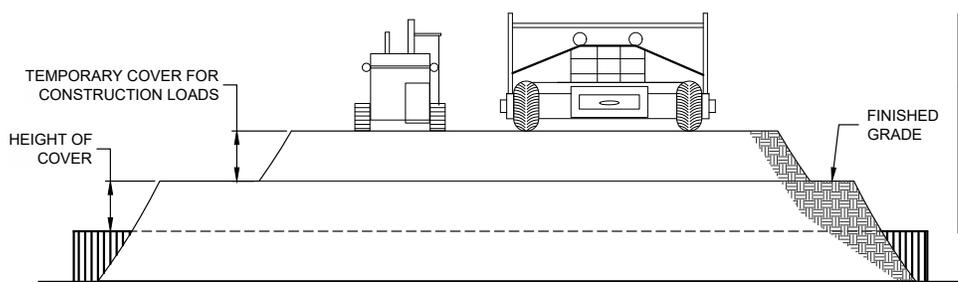
# Final Cover Placement and Construction Loading

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.



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

**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 Tracked Equipment  
HEL-COR® Corrugated Steel Pipe<sup>1</sup>**

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

<sup>1</sup> 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.

## Additional Considerations

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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. 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.

## 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.







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