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ENGINEERED SOLUTIONS

CMP Detention and Infiltration Installation Guide

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Proper installation of a flexible corrugated metal pipe (CMP) underground detention system will ensure long-term performance. The configuration of these systems often requires special construction practices that differ from conventional flexible pipe construction. Contech recommends scheduling a preconstruction meeting with your local Contech Representative to determine if additional measures, not covered in this guide, are appropriate for your site.

Preconstruction Meeting

It is a best practice to have a pre-construction meeting with the installation contractor and Contech personnel. Included at the end of this guide is a preconstruction checklist to review prior to installation.

Proper Pipe Unloading, Handling and Placement

The pipe should be unloaded off the flatbed trailer with a fork lift, excavator, crane or other piece of construction equipment. The pipe should never be dropped or rolled off the flatbed trailer. Nylon slings or lifting lugs should be used to lift the pipe into place.

Normally the header row pipe section is placed on the downstream end. For detention systems with a single header row on one end and pipe with bulkheads on the other end; it is a best practice to start pipe placement on the header row end.

Lifting CMP off the flatbed with a front end loader and forks.

Lifting ALT2 CMP with nylon slings.

Lowering the header pipe section into place first.

Lifting polymer-coated CMP into place with nylon slings.

Foundation and Pipe Bedding

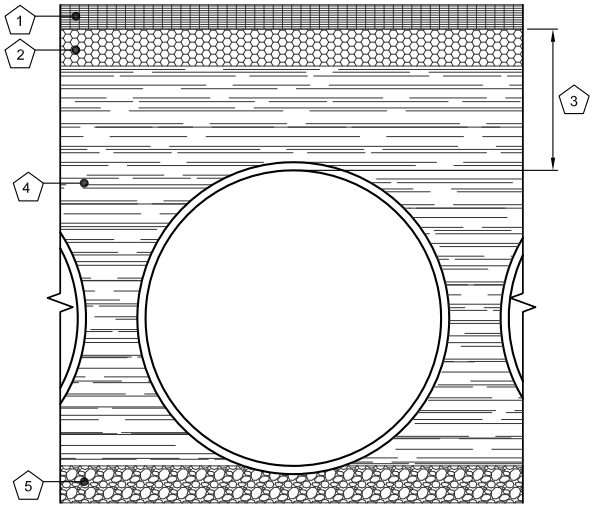
Construct a foundation that can support the design loading applied by the pipe and adjacent backfill weight as well as maintain its integrity during construction. If soft or unsuitable soils are encountered, remove the poor soils to a suitable depth and then replace with a competent granular material to the appropriate elevation. The granular material gradation should not allow the migration of fines, which can cause settlement of the detention 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 of time, it is best to slope the grade to one 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 pipe bedding. If the existing foundation is made up of a course sand or other suitable granular material, imported bedding material will not be required.

Site conditions may require 4" – 6" of imported granular material as pipe bedding.

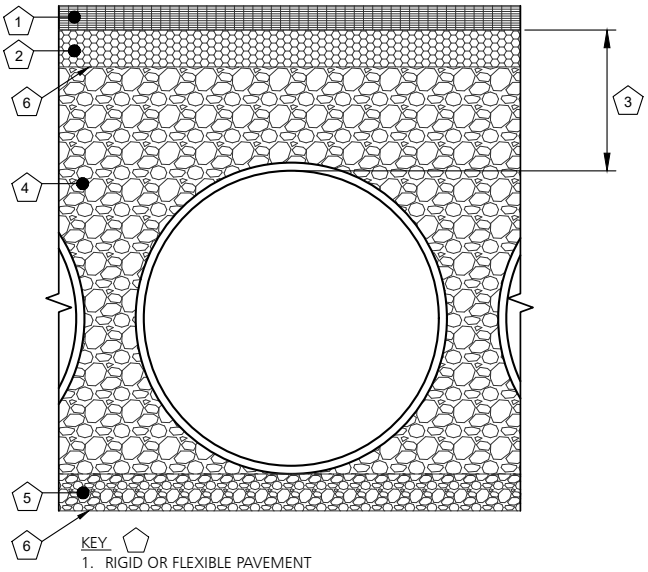
SOLIDWALL BACKFILL DETAIL



KEY ⬠

1. RIGID OR FLEXIBLE PAVEMENT
2. GRANULAR ROAD BASE
3. 12" MIN. FOR DIAMETERS THROUGH 96"
   18" MIN. FOR DIAMETERS FROM 102" AND LARGER MEASURED TO TOP OF RIGID OR BOTTOM OF FLEXIBLE PAVEMENT.
4. SELECT GRANULAR FILL PER AASHTO M145 A1, A2 OR A3 OR APPROVED EQUAL. PLACED IN 8" LIFTS (COMPACTED TO MIN. 90% STANDARD DENSITY PER AASHTO T99)
5. GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4" TO 6" IN DEPTH.

PERFORATED BACKFILL DETAIL



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4. FREE DRAINING ANGULAR WASHED STONE 3/4" - 2" MIN. PARTICLE SIZE.
5. GRANULAR BEDDING, ROUGHLY SHAPED TO FIT THE BOTTOM OF PIPE, 4" TO 6" IN DEPTH.
6. NON WOVEN GEOTEXTILE (IF REQUIRED), WRAPPING TRENCH ONLY. CONSULT GEOTECHNICAL EOR FOR PROJECT SPECIFIC BACKFILL REQUIREMENTS.

Connecting Bands

There are various types of connecting bands for connecting CMP. Hugger 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 pipe.

Tightening bolts on a corrugated band.

Installation of band with flat neoprene gasket.

Some jobs may require special bands, such as rod and lug connection, flat bands, or dimple bands.

Geomembrane Barrier

When indicated on the Contech contract drawings or the project plans, an HDPE membrane liner will be placed on the crown of each pipe to help protect the system from environmental changes that may adversely affect the system over time. The liner should extend beyond the 8 and 4 o'clock positions (crown) of the pipe. Please refer to Contech's CMP Detention Design Guide or Contech contract drawings for additional technical details.

An HDPE liner is rolled out over the crown of the pipe prior to backfilling around the pipe.

For large diameter pipes, the liner is shipped in rolls that are folded in half. The liner is rolled out over the crown of the pipe, unfolded, and covered over the pipe from the eight and four o'clock positions.

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 soils are 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.

In most cases, the requirements for a safe work environment and proper backfill placement and compaction take care of the concern. The contractor is responsible for the safety of his/her employees and agents.

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. The contractor shall comply with all applicable city, state, and federal safety codes in effect in the area where work is being performed. This conformance shall include the provisions of the current issue of the "OSHA Safety and Health Standards (29 CFR 1926/1910)" as published by the U.S. Department of Labor.

Backfill Material

Corrugated Steel Pipe is a flexible pipe. All buried flexible pipes are dependent on a 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 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

Course Sand

Crushed Limestone

Crushed Granite

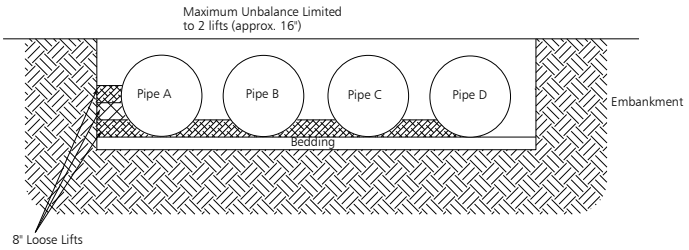
Crushed River Gravel

Backfill Placement

The backfill shall be placed in 8" +/- loose lifts and compacted 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.

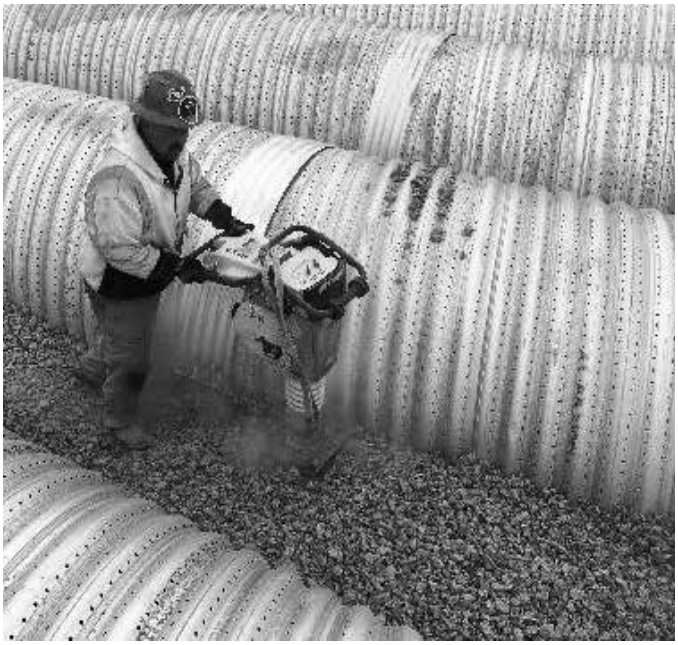
It is important to keep the elevation of backfill between pipes and side embankment evenly. As a rule of thumb, do not allow for backfill to exceed the elevation of one side of pipe to another pipe or one side of pipe to the outside trench/embankment by more than 24".



Material stockpiles on top of the backfilled detention system should be limited to 9' +/- high and must provide balanced loading across all barrels. To determine the proper minimum cover over the pipes to allow the movement of construction equipment, contact your local Contech Sales Engineer.

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.

Placing backfill with a conveyor.



Compaction with vibratory equipment.

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. 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 pre-construction meeting.

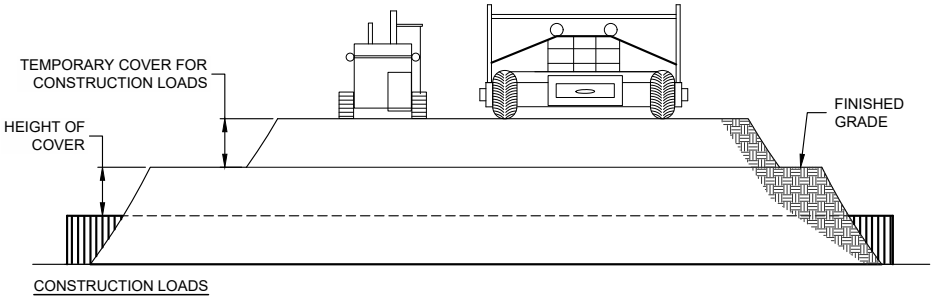
Minimum Height of Cover Requirements for Tracked Equipment
HEL-COR® Corrugated Steel Pipe[1]

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	6.9	6.2
	1.5	24	17	14	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 – 102	1.0	3.2	2.5	2.1	1.9
	1.5	8.8	6.2	5	4.4
	2.0	16	11.1	8.8	7.5
	2.5	24	15	12	10.1
	3.0	32	20	15	12.9
	4.0	56	34	25	20
108 – 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	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	4.3	3.5	3
	2.0	12	8	6.4	5.4
	2.5	21	14	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.

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.



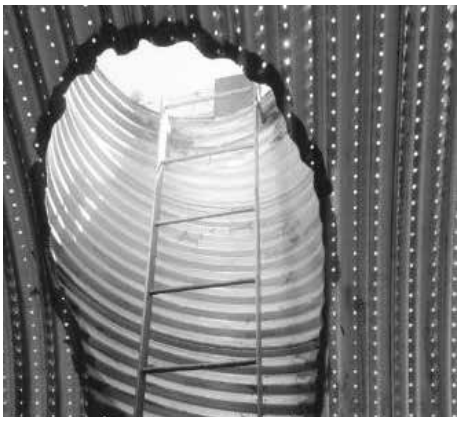
FOR TEMPORARY CONSTRUCTION VEHICLE LOADS, AN EXTRA AMOUNT OF COMPACTED COVER MAY BE REQUIRED OVER THE TOP OF THE PIPE. THE HEIGHT-OF-COVER SHALL MEET THE MINIMUM REQUIREMENTS SHOWN IN THE TABLE BELOW. THE USE OF HEAVY CONSTRUCTION EQUIPMENT NECESSITATES GREATER PROTECTION FOR THE PIPE THAN FINISHED GRADE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

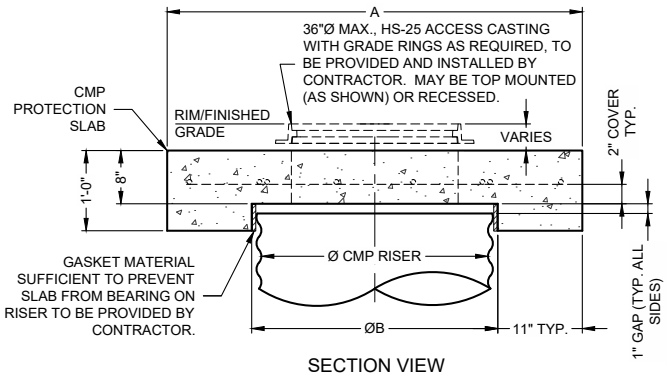
Minimum Height of Cover Requirements for Rubber-Tired Equipment Over HEL-COR® CSP

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

CMP Manhole Risers

CMP manhole risers allow easy access for future maintenance of the system. If the system is installed under a parking lot or road way subject to live loads, care must be taken to ensure loads are not applied directly to the riser structure. A pre-cast or cast-in-place slab should be installed above the riser. The manhole lid and frame should not rest directly on the CMP riser.





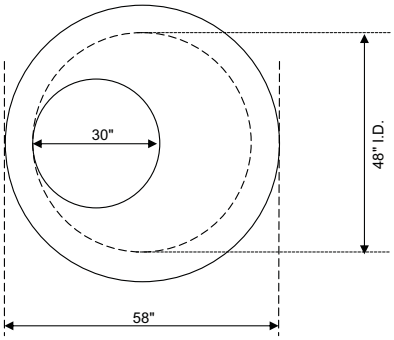
SECTION VIEW

Reinforcing Table				
Ø CMP Riser	A	ØB	Reinforcing	Bearing Pressure** (psf)
24	4′Ø 4′ x 4′	26″	#5 @ 10″ OCEW #5 @ 10″ OCEW	2,540 1,900
30″	4′-6″Ø 4′-6″ x 4′-6″	32″	#5 @ 10″ OCEW #5 @ 9″ OCEW	2,260 1,670
36″	5′Ø 5′ x 5′	38″	#5 @ 9″ OCEW #5 @ 8″ OCEW	2,060 1,500
42″	5′-6″Ø 5′-6″ x 5′-6″	44″	#5 @ 8″ OCEW #5 @ 8″ OCEW	1,490 1,370
48″	6′Ø 6′ x 6′	50″	#5 @ 7″ OCEW #5 @ 7″ OCEW	1,210 1,270

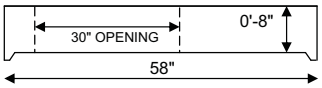
*** Assumed soil bearing capacity.*

Precast Option for Manhole Riser Caps

PLAN VIEW



SECTION



NOTES:

A.) 4000 P.S.I. CONCRETE

B.) GRADE 60 REINFORCING PER ASTM A-615

C.) BUTYL SEALANT IN JOINTS

Additional Considerations

Because most systems are constructed below-grade, rainfall can rapidly fill the excavation; potentially causing floatation and movement of the previously placed pipes. To help mitigate potential problems, it is best to start the installation at the downstream end with the outlet already constructed to allow a route for the water to escape. Temporary diversion measures may be required for high flows due to the restricted nature of the outlet pipe.

CMP 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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