Technical Bulletin

HIGH DENSITY POLYETHYLENE PIPE

HDPE Pipe Installation Practice

LANE corrugated high density polyethylene (HDPE) pipe, appropriate backfill material and proper installation practice all work together to result in a dependable drainage installation. HDPE pipe, like all flexible pipes, depends on soil-pipe interaction to develop its strength. Thus, proper installation and backfilling are essential to successful performance. This technical bulletin addresses typical installations in trench and embankment conditions. Unusual conditions may require additional investigations, including the recommendations of a qualified geotechnical or soils engineer. More detailed information on installation and backfill may be found in ASTM D2321, " Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications."

Installation practices must always comply with local, state and federal codes and safety regulations.

Material for Foundation, Bedding and Backfill

The pipe must be surrounded by compacted material to distribute vertical loads uniformly to the pipe and to provide passive resistance to pipe deflection. Material selection depends on availability and cost. Granular materials with little or no plasticity are preferred. Frozen lumps, chunks of clay, organic matter and large rock are unacceptable. Acceptable materials are summarized in Table 1 by their ASTM Class and Soil Group designation.

Classes IA, IB, and II are preferred over Class III when available because they are stiffer materials, limit pipe deflection and permit greater fill heights. Also, construction may be faster because less compactive effort is generally required. Class III material should not be used where water conditions in a trench can cause instability.

BACKFILL MATERIAL SIZE

Pipe Diameter (ID)		Max. Particle Size	
in.	mm	in.	mm
6	150	3/8	10
8-15	200-375	5/8	15
18-48	450-1200	1 1/2	40

Cement slurry and controlled low strength material (CLSM) are excellent backfill material provided they yield adequate compressive strength and the pipe is restrained to avoid flotation during installation.

Foundation and Bedding

A good foundation and bedding are critical to pipe performance and service life. They are essential to help maintain proper pipe elevation, eliminate undesirable stresses in the pipe and ensure good hydraulic performance.

The foundation material beneath the pipe must provide a uniform resistance to the loads on the pipe.

Sharp longitudinal and lateral variations in the foundation must be avoided. If rock is encountered, excavate and replace with gravel or lightly compacted material. Such cushion should have a depth of approximately ½ in. per ft. (42 mm/m) of the planned fill depth over the pipe (6 in.-150 mm minimum, 24 in.-600 mm maximum). If soft foundation material is encountered that must be removed to maintain grade, remove the material for a depth of about 2 ft. (0.6 m) and replace with suitable compacted material. The width of this material should be 2.5 diameters on either side of the pipe for pipe 12 in. (300 mm) diameter or less. For larger pipe, the width should be established by the engineer.

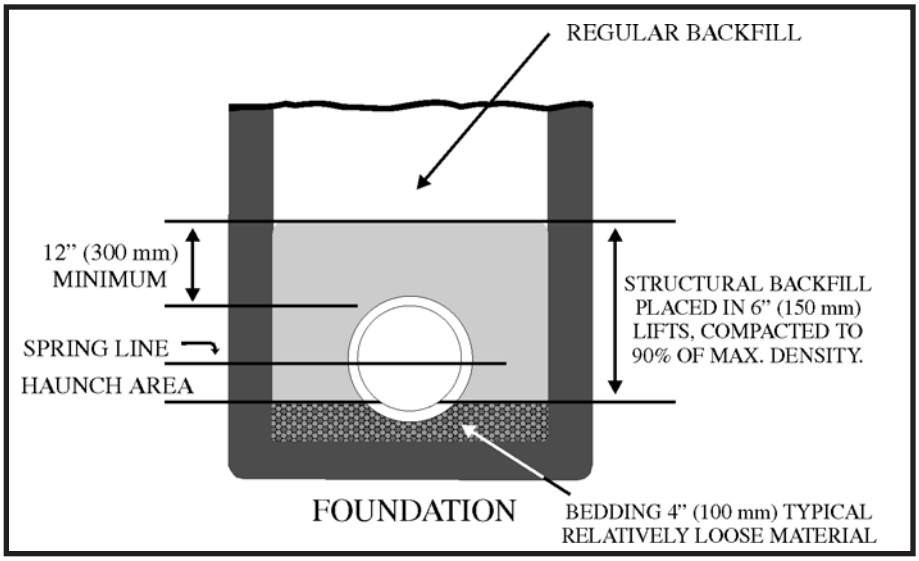
The upper 4 in. (100 mm) of the bedding should be relatively loose material so the corrugations can be seated. Frozen lumps, chunks of clay, organic matter and large rock are unacceptable. The pipe may be installed by shaping the bedding surface to conform to the pipe for a width of about one-half the diameter. A second method is to place the pipe directly on the bedding, in which case particular care must be taken to compact the backfill under the haunches of the pipe to provide uniform support.

Trench Construction

The trench should be wide enough for placement and compaction of backfill, especially the material placed beside the pipe and that in the haunch area below the spring line. Generally, the minimum trench width should not be less than the greater of (1) the pipe outside diameter plus 16 in. (400 mm), or (2) the pipe outside diameter times 1.25, plus 12 in. (300 mm).

However, if special equipment is available to provide a quality installation with a narrow trench, the minimum width can be reduced. If material such as CLSM is used that requires no compaction, the trench width can be as little as the pipe outside diameter, plus 6 in. (150 mm).

The trench must be filled with material, placed and compacted in layers to form a "structural backfill" surrounding the pipe. The backfill must be compacted to a minimum of 90 percent of maximum density as determined by ASTM D698 or AASHTO T99. The envelope should extend to 12 in. (300 mm) above the top of the pipe before the remainder of the fill is placed in the trench. The trench wall is assumed to have a stiffness at least that of the compacted backfill. If soft trench walls are encountered, additional excavation may be required.



Excavate trenches to ensure the trench walls are stable under all conditions. Slope the walls or provide support in conformance with safety standards. All appropriate safety practices and regulations must be followed to avoid trench collapse. If high ground water is encountered, dewatering may be required to achieve a safe installation that meets requirements.

Embankment Construction

In embankment construction, the compacted envelope of "structural backfill" must surround the pipe with a width adequate to resist forces caused by construction equipment. The width of this zone on each side of the pipe should be one diameter, with a minimum of 12 in. (300 mm) and a maximum of 24 in. (600 mm). The envelope should extend to 12 in. (300 mm) above the top of the pipe before normal embankment material is placed.

Backfill Placement

In either trench or embankment construction, the backfill material must be placed in layers and compacted to a minimum of 90 percent of maximum density as determined by ASTM D698 or ASSHTO T99. The maximum thickness of the layers or lifts should not exceed 6 in. (150 mm). The lift thickness, placement technique and compaction method must be such that compaction under the haunches is obtained.

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TABLE 1
Recommended Backfill Materials

ASTM D2321 Class	Type	ASTM D2487 Soil Group	Description	Similar AASHTO Type
IA	Manufactured Aggregates; open-graded, clean.	——	Angular, crushed stone or rock, crushed gravel, broken coral, crushed slag, cinders or shells; large void content, contain little or no fines.	——
IB	Manufactured Processed Aggregates; dense-graded, clean.	——	Angular, crushed stone (or other Class 1A materials) and stone/sand mixtures with gradations selected to minimize migration of adjacent soils; contain little or no fines.	——
II	Coarse-Grained Soils; clean.	GW	Well-graded gravels and gravel/sand mixtures, little or no fines.	A1, A3
		GP	Poorly graded gravels and gravel/sand mixtures, little or no fines.	
		SW	Well-graded sands and gravelly sands, little or no fines.	
		SP	Poorly-graded sands and gravelly sands, little or no fines.	
	Coarse-Grained Soils; borderline clean to with fines.	e.g. GW GC SP SM	Sands which are borderline between clean and with fines.	
III	Coarse-Grained Soils with Fines.	GM	Silty gravels, gravel-sand-silt mixtures.	A2
		GC	Clayey gravels, gravel-sand-clay mixtures.	
		SM	Silty sands, sand-clay mixtures	
		SC	Clayey sands, sand/clay mixtures.	

Note: Compact backfill material to minimum of 90% of maximum density per ASTM D698 or AASHTO T99.
Table adapted from ASTM D2321.

Each layer must be compacted before the next lift is placed. Backfill must proceed evenly on each side of the pipe. Care must be taken to avoid pipe distortion or excessive local or general deflection. Such unacceptable deformations can result from either excessive or inadequate compaction or from construction equipment. Do not allow compaction or other equipment to contact and damage the pipe. Compaction techniques must be compatible with the backfill materials used, and the width of the area being compacted.

Mechanical compaction is generally used. However, water consolidation methods can be used on free-draining backfill material if care is taken to prevent flotation. Conditions must be controlled and approved by the engineer.

Construction Loads

It is important to protect the pipe from equipment loads during construction. Heavy equipment must not be allowed close to or over buried pipe unless provisions are made to accommodate the resultant loads. Depending on the size of the equipment and class of fill material, a minimum cover from 2 ft. (0.6 m) to 4 ft. (1.2 m), or more for exceptional loads, may be required. (see table 2) For shallow installations, it may be necessary to mound and compact material over the pipe to provide the minimum cover. The mound can be removed and final grade established after construction.

TABLE 2
COVER FOR CONSTRUCTION LOADS

	Minimum Cover, in., for indicated Axle Loads, kips			
Nominal Pipe Diameter, ft	18.0-50.0	50.0-75.0	75.0-110.0	110.0-150.0
2.0-3.0	24.0	30.0	36.0	36.0
3.5-4.0	36.0	36.0	42.0	48.0
4.5-5.0	36.0	36.0	42.0	48.0
Minimum cover shall be measured from the top of the pipe to the top of the maintained construction roadway surface. If unpaved, the surface shall be maintained.				

Multiple Pipes

When two or more pipes are installed in adjacent parallel lines, sufficient space must be provided between the pipes to provide for adequate compaction of the structural backfill. One rule-of-thumb is to use a spacing between pipes equal to 12 in. (300 mm), or one-half the nominal pipe diameter, whichever is greater. This can be increased if necessary to accommodate compaction.

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