

Technical Note

TN 2.02_C Minimum and Maximum Cover Heights for Corrugated HDPE Pipe (per ASTM F2648)

Introduction

The information in this document is designed to provide answers to general cover height questions; the data provided is not intended to be used for project design. The design procedure described in the *Structures* section (Section 2) of the Drainage Handbook provides detailed information for analyzing most common installation conditions. This procedure should be utilized for project specific designs.

The two common cover height concerns are minimum cover in areas exposed to vehicular traffic and maximum cover heights. Either may be considered “worst case” scenario from a loading perspective, depending on the project conditions.

Minimum Cover in Traffic Applications

Pipe diameters from 100-1200 mm (4”- 48”) installed in traffic areas (CHBDC CL-625 Loads, AASHTO H-25 or HS-25 loads) must have at least 0.3 m (1') of cover over the pipe crown, while 1500 mm (60”) pipe must have at least 600 mm (24”) of cover. The backfill envelope must be constructed in accordance with the *Installation* section (Section 5) of the Drainage Handbook and the requirements of applicable standards such as ASTM D2321, CSA B182.1 and/or BNQ 1809-300. The backfill envelope must be of the type and compaction listed in Appendix A-5, Table A-5-2A of the Drainage Handbook. In Table 1 below, this condition is represented by a Class II material compacted to 90% standard Proctor density, although other equivalent material (such as OPSS.1010's Granular A or BNQ 2560's CG-14 or MG-20) can provide similar strength in a pipe trench. Structural backfill material should extend to the crown of the pipe; the remaining cover should be appropriate for the installation and as specified by the design engineer. If settlement or rutting is a concern, it may be appropriate to extend the structural backfill to grade. Where pavement is involved, sub-base material can be considered in the minimum burial depth. While rigid pavements can be included in the minimum cover, the thickness of flexible pavements should not be included in the minimum cover.

Additional information that may affect the cover requirements is included in the *Installation* section (Section 5) of the Drainage Handbook. Some examples of what may need to be considered are temporary heavy equipment, construction loading, paving equipment and similar loads that are less than the design load, the potential of pipe flotation, and the type of surface treatment which will be installed over the pipe zone. Please note that Table 1 and 3 are based on the installation of N-12® and Mega Green® (per ASTM F2648) pipe under pavement using a uniform backfill type and compaction level, as depicted in Figure 1.

Table 1: Minimum Cover Requirements for N-12 and Mega Green Pipes (per ASTM F2648)
with AASHTO H-25 or HS-25 Load

Inside Diameter, ID, mm (in)	Minimum Cover m (ft)
100 (4) – 1200 (48)	0.3 (1)
1500 (60)	0.6 (2)

Note: Minimum covers presented here were calculated assuming Class II backfill material compacted to 90% standard Proctor density around the pipe and structural backfill to the crown of the pipe, as recommended in Section 5 of the Drainage Handbook, with an additional layer of compacted traffic lane sub-base for a total cover as required. In shallow traffic installations, especially where pavement is involved, a good quality compacted material to grade is required to prevent surface settlement and rutting.

Maximum Cover

Wall thrust generally governs the maximum cover a pipe can withstand and conservative maximum cover heights will result when using the information presented in the *Structures* section (Section 2) of the Drainage Handbook.

The maximum burial depth is highly influenced by the type of backfill and level of compaction around the pipe. General maximum cover limits for N-12 and Mega Green (per ASTM F2648) pipe are shown in Table 3 for a variety of backfill conditions.

Table 3 was developed assuming pipe is installed in accordance with ASTM D2321 and the *Installation* section (Section 5) of the Drainage Handbook. Additionally, the calculations assume no hydrostatic load around the pipe, incorporate the maximum safety factors represented in Structures section of the Drainage Handbook, use material properties consistent with the expected performance characteristics for N-12 and Mega Green (per ASTM F2648) materials as shown in Table 2 below, and assume the native soil (in-situ) is of adequate strength and is suitable for installation. For applications requiring fill heights greater than those shown in Table 3 or where hydrostatic pressure due to groundwater is present, contact an ADS engineering representative.

Figure 1: N-12 and Mega Green (per ASTM F2648) Trench Detail Under Pavement

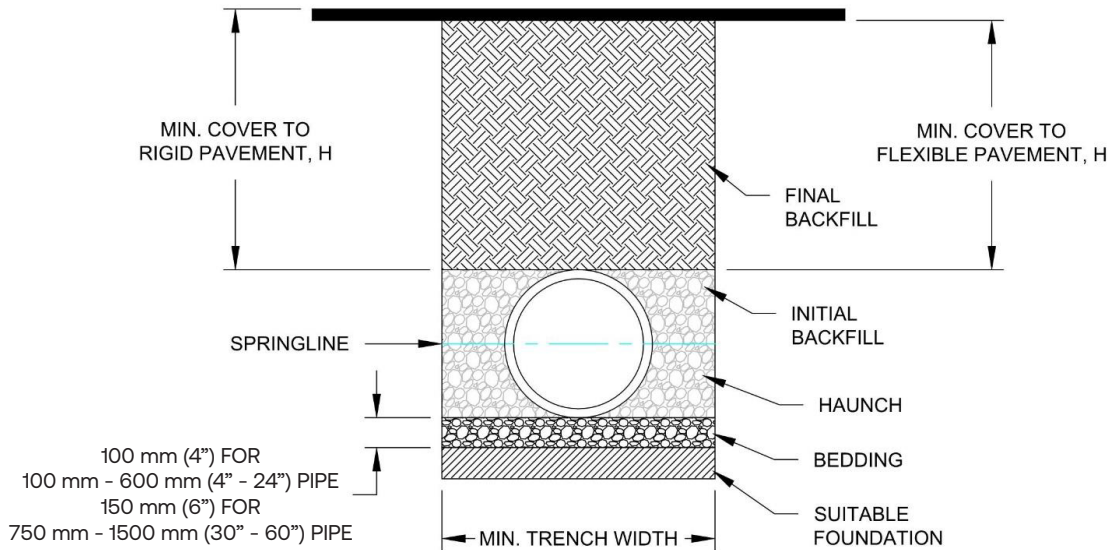


Table 2: N-12 and Mega Green (per ASTM F2648) Mechanical Properties

Cell Class	Design Compressive Strain (%)	Design Tensile Strain (%)	Initial		50-Year	
			Fu (psi)	E (psi)	Fu (psi)	E (psi)
ASTM D3350 424420C - 100 mm - 250 mm (4" - 10")	3.7	4.0	3,000	110,000	800	21,000
ASTM D3350 435420C - 300 mm - 1500 mm (12" - 60")	3.7	4.0	3,000	110,000	800	21,000

Table 3: Maximum Cover for ADS N-12 and Mega Green Pipes (per ASTM F2648), m (ft)

Diameter mm (in)	Class I		Class II		Class III
	Compacted	Dumped	95%	90%	95%
100 (4)	10.4 (34)	4.9 (16)	7.0 (23)	4.9 (16)	5.2 (17)
150 (6)	12.2 (40)	5.8 (19)	8.2 (27)	5.8 (19)	6.1 (20)
200 (8)	9.1 (30)	4.3 (14)	6.4 (21)	4.3 (14)	4.6 (15)
250 (10)	10.4 (34)	14.9 (16)	7.0 (23)	4.9 (16)	5.2 (17)
300 (12)	10.7 (35)	5.2 (17)	7.3 (24)	5.2 (17)	5.5 (18)
375 (15)	11.3 (37)	5.5 (18)	7.6 (25)	5.5 (18)	5.8 (19)
450 (18)	9.8 (32)	4.6 (15)	6.7 (22)	4.6 (15)	4.9 (16)
600 (24)	8.2 (37)	4.0 (13)	5.8 (19)	4.0 (13)	4.3 (14)
750 (30)	6.7 (22)	3.4 (11)	4.9 (16)	3.4 (11)	3.4 (11)
900 (36)	7.9 (26)	3.7 (12)	5.5 (18)	3.7 (12)	4.0 (13)
1050 (42)	7.3 (24)	3.4 (11)	5.2 (17)	3.4 (11)	3.7 (12)
1200 (48)	7.0 (23)	3.4 (11)	4.9 (16)	3.4 (11)	3.7 (12)
1500 (60)	7.9 (26)	3.7 (12)	5.5 (18)	3.7 (12)	4.0 (13)

Notes:

1. Results based on calculations shown in the Structures section of the ADS Drainage Handbook(v20.6). Calculations assume no hydrostatic pressure and a density of 18.9 kN/m³ (120 pcf) for overburden material.
2. Installation assumed to be in accordance with ASTM D2321 and the Installation section of the Drainage Handbook.
3. Material must be adequately "knifed" into haunch and in between corrugations. Compaction and backfill material is assumed uniform throughout entire backfill zone.
4. Compaction levels shown are for standard Proctor density.
5. Installations of pipe manufactured per ASTM F2648 are only applicable to the fill heights, type of embedment materials and compaction levels listed above.
6. For projects where cover exceeds the maximum values listed above, contact ADS for specific design considerations.
7. Calculations assume no hydrostatic pressure. Hydrostatic pressure will result in a reduction in allowable fill height. Reduction in allowable fill height must be assessed by the design engineer for the specific field conditions.

