Technical Note

TN 2.01_C Minimum and Maximum Burial Depth for Corrugated HDPE Pipe per CSA B182.8

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.

Fill heights presented in this technical note are applicable to open profile 100 mm - 1500 mm (4” - 60”) ADS N-12®, N-12 ST, and N-12 WT pipe manufactured in accordance with CSA B182.8.

Minimum Cover in Traffic Applications

Pipe diameters from 100 mm - 1200 mm (4”- 48”) installed in traffic areas (CSA S6 CL-625 loads) must have at least 300 mm (12”) of cover over the pipe crown, while 1500 mm (60”) pipes 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 CSA B182.11 and ASTM D2321. The backfill envelope must be of the type and compaction listed in Appendix A-5, Table A-5-2 of the Installation section (Section 5) of the Drainage Handbook. In Table 1 below, this condition is represented by a Class III material compacted to a minimum of 95% or a Class II material compacted to a minimum of 90% standard Proctor density, although other material can provide similar strength at slightly lower levels of compaction. 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 Table 1 and Table 3 are based on the installation of ADS HDPE pipe under pavement using a uniform backfill type and compaction level, as depicted in Figure 1.

Table 1: Minimum Cover Requirements for ADS N-12, N-12 ST, and N-12 WT Pipe per CSA B182.8

Traffic Loading Case:	CSA S6 CL-625 or AASHTO HL-93	CSA S6 CL-800
Minimum Cover, m (ft) for Nominal Diameter 100 mm – 1200 mm (4" - 48"):	0.3 (1)	0.3 (1)
Minimum Cover, m (ft) for Nominal Diameter 1500 mm (60"):	0.6 (2)	0.6 (2)
Acceptable Backfill Type & Compaction:	Class I (dumped), or Class II at 90% SPD, or Class III at 95% SPD	Class I (dumped), or Class II at 95% SPD

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. Table 2 below shows the material properties consistent with the expected performance characteristics for ADS HDPE dual wall pipe materials per CSA B182.8 for a 75-year design life.

The maximum burial depth is highly influenced by the type of backfill and level of compaction around the pipe. General maximum cover limits for 100 mm (4") through 1500 mm (60") ADS N-12, N-12 ST, N-12 WT ADS HDPE dual wall pipe per CSA B182.8 are shown in Table 3 for a variety of backfill conditions.

Table 3 was developed assuming pipe is installed in accordance with CSA B182.11, ASTM D2321, and the Installation section (Section 5) of the Drainage Handbook. Additionally, the calculations assume zero 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 ADS HDPE dual wall pipe materials per CSA B182.8 as shown in Table 2 below, and assume the native soil 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: ADS N-12, N-12 ST, and N-12 WT Pipe per CSA B182.8 Trench Detail Under Pavement

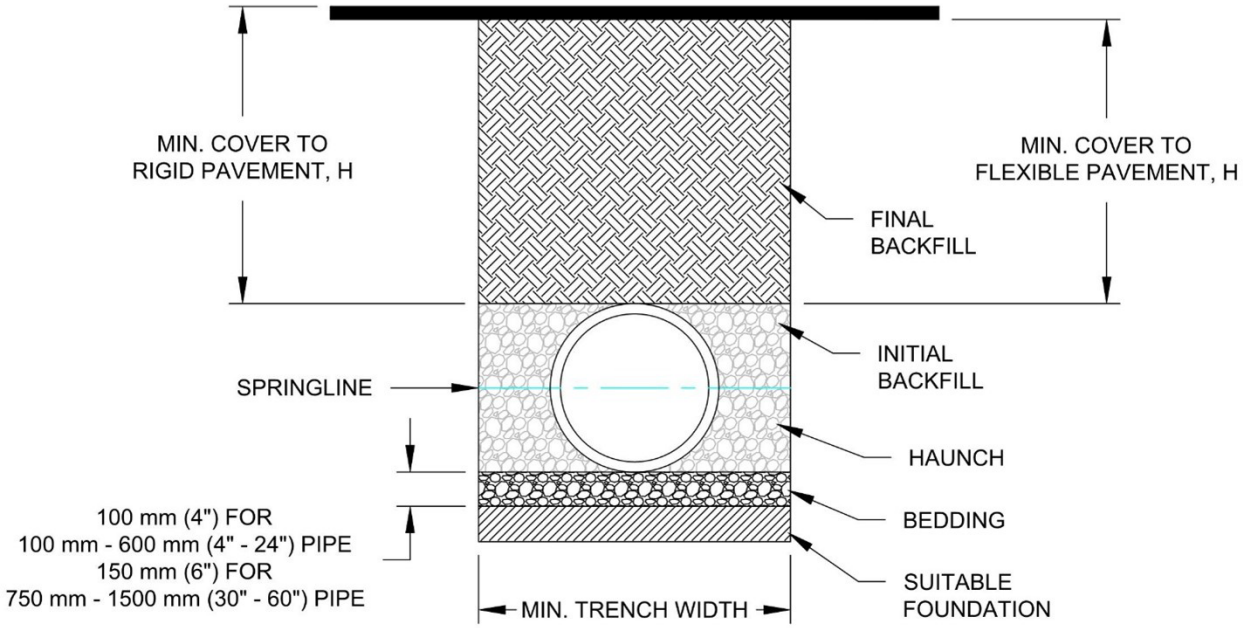

Table 2: ADS HDPE Pipe per CSA B182.8 Mechanical Properties

Cell Class (ASTM D3350)	Allowable Long Term Compressive Strain	Allowable Long Term Tensile Strain	Initial		75-Year	
			Fu (Mpa)	E (Mpa)	Fu (Mpa)	E (Mpa)
435400C	4.1%	5.0%	20.7	758.4	6.2	144.8

Table 3: Maximum Cover for 100-1500 mm (4-60") ADS N-12, N-12 ST, and N-12 WT HDPE dual wall pipe per CSA B182.8, m (ft)

Diameter mm (in)	Class I		Class II		Class III	
	Compacted m (ft)	Dumped m (ft)	95% m (ft)	90% m (ft)	95% m (ft)	90% m (ft)
100 (4)	11.6 (38)	5.5 (18)	7.9 (26)	5.5 (18)	5.5 (18)	4.0 (13)
150 (6)	13.4 (44)	6.1 (20)	8.8 (29)	6.1 (20)	6.4 (21)	4.6 (15)
200 (8)	10.1 (33)	4.6 (15)	6.7 (22)	4.6 (15)	4.9 (16)	3.4 (11)
250 (10)	11.9 (39)	5.5 (18)	7.9 (26)	5.5 (18)	5.5 (18)	4.0 (13)
300 (12)	12.8 (42)	6.1 (20)	8.5 (28)	6.1 (20)	6.1 (20)	4.6 (15)
375 (15)	11.3 (37)	5.2 (17)	7.6 (25)	5.2 (17)	5.5 (18)	4.0 (13)
450 (18)	11.6 (38)	5.5 (18)	7.9 (26)	5.5 (18)	5.5 (18)	4.0 (13)
525 (21)	10.7 (35)	5.2 (17)	7.3 (24)	5.2 (17)	5.5 (18)	3.7 (12)
600 (24)	12.5 (41)	5.5 (18)	8.2 (27)	5.5 (18)	5.8 (19)	4.3 (14)
750 (30)	11.6 (38)	5.2 (17)	7.6 (25)	5.2 (17)	5.5 (18)	4.0 (13)
900 (36)	10.4 (34)	4.9 (16)	7.0 (23)	4.9 (16)	5.2 (17)	3.7 (12)
1050 (42)	7.0 (23)	3.4 (11)	4.9 (16)	3.4 (11)	3.4 (11)	2.1 (7)
1200 (48)	7.6 (25)	3.4 (11)	5.2 (17)	3.4 (11)	3.7 (12)	2.1 (7)

Notes:

1. *Results based on calculations shown in the Structures section of the ADS Drainage Handbook (v20.2). Calculations assume no hydrostatic pressure, a density of 1926 kg/m3 (120 pcf) for overburden material, and a 75 year service life.*
2. *Installation assumed to be in accordance with CSA B182.11, ASTM D2321, and the Installation section of the Drainage Handbook.*
3. *For installations using lower quality backfill materials or lower compaction efforts, pipe deflection may exceed the 5% design limit; however controlled deflection may not be a structurally limiting factor for the pipe. For installations where deflection is critical, pipe placement techniques or periodic deflection measurements may be required to ensure satisfactory pipe installation.*
4. *Backfill materials and compaction levels not shown in the table may also be acceptable. Contact ADS for further detail.*
5. *Material must be adequately "knifed" into haunch and in between corrugations. Compaction and backfill material is assumed uniform throughout entire backfill zone.*
6. *Compaction levels shown are for standard Proctor density.*
7. *For projects where cover exceeds the maximum values listed above, contact ADS for specific design considerations.*
8. *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.*
9. *Fill height for dumped Class I mateial incorporates an additional degree of conservatism that is difficult to assess due to the large degree of variation in the consolidation of this material as it is dumped. There is limited analytical data on its performance. For this reason, values as shown are estimated to be conservatively equivalent to Class II, 90% SP*