Engineered Drainage
for Railway Applications

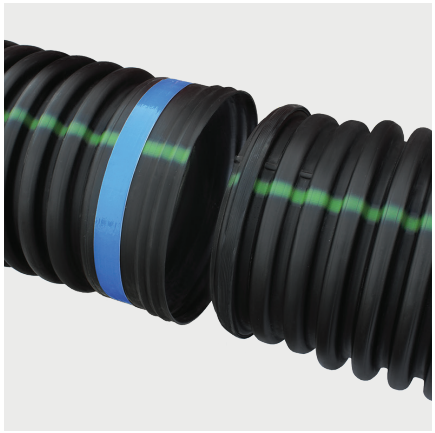
ADS™

The Standard in Drainage Pipe

N-12® HDPE and HP Storm Pipe

Advanced Drainage Systems has built a reputation for economy, durability and superior performance in gravity-flow storm drainage applications. Advances in polymer science and structural design have created a product that has outperformed and outlasted many traditional pipe products, while maintaining its cost advantage.

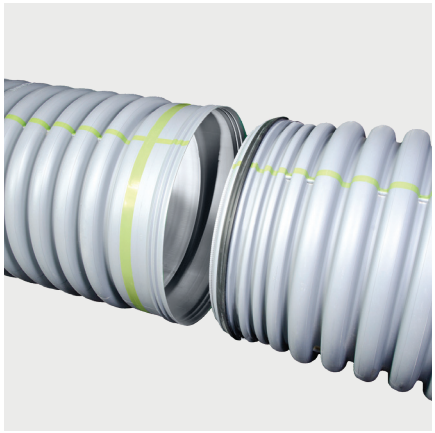
ADS introduced the first High Density Polyethylene (HDPE) drainage pipe to combine an annular corrugated exterior for strength with a smooth interior wall for maximum flow capacity. In 2007, ADS engineered higher stiffness pipe using polypropylene (PP) to enhance wall and joint performance. The quality upgrades and performance history of these systems have led to rapid acceptance of HDPE and PP pipes by contractors, engineers, municipalities and state agencies.



N-12 Pipe

Revolutionary Joining Technology

Years of research and testing have produced a fast-coupling, watertight bell-and-spigot joint. A proprietary gasket design maximizes sealing, which meets ASTM F477 standards. The gasket is factory installed into the spigot to speed installation. The result is a design that meets or exceeds ASTM D3212 lab test and ASTM F2487 watertight field test requirements. The design also fills an essential role in complying with the stricter demands of EPA guidelines.



HP Storm Pipe

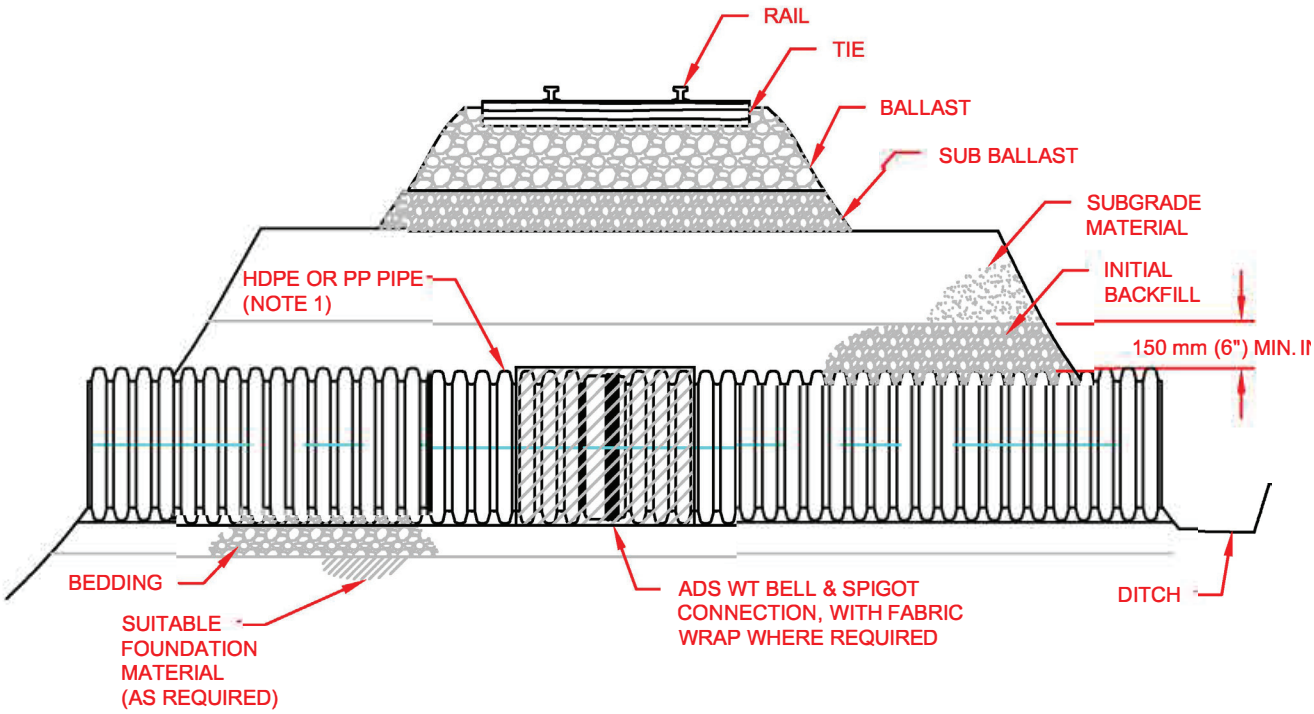
Applications

N-12 pipe meets the requirements of CSA B182.8 or BNQ 3624-120 or ASTM F2306 or AASHTO M252 or AASHTO M294. HP Storm meets the requirements of CSA B182.12 or ASTM F2811. SaniTite HP meets the requirements of CSA B182.13 or ASTM F2764. These products have been specified under railroads, airports, highways and defense projects for culverts, storm drains and sanitary applications.

Structural Strength

As a flexible conduit, high density polyethylene and polypropylene pipes withstand vertical pressure by transferring most of the load to the surrounding soil. N-12 and HP Storm pipes will support Cooper E-80 live loads with as little as 600 mm (24”) of cover for 600 mm (24”) and smaller diameter pipe, 900 mm (36”) of cover for 750 mm (30”) and 900 mm (36”) diameter pipe and 1200 mm (48”) of cover for 1200 mm (48”) and larger diameter pipes. Field research done in Ohio and Pennsylvania has placed high density polyethylene pipe and polypropylene pipes under more than 12 m (40') of fill. Even under harsh climatic and soil conditions, high density polyethylene and polypropylene pipes have continued to give outstanding performance. Testing at Transportation Technology Center, Inc. (TTCI) in Pueblo, Colorado and design calculations support engineered loading conditions.

Railway Installation Typical Trench Detail STD-107C



NOTES;

1. HIGH DENSITY POLYETHYLENE PIPE SHALL MEET CSA B182.8 and BNQ 3624-120. POLYPROPYLENE PIPE SHALL MEET CSA B182.12, CSA B182.13 and BNQ 3624-120..

2. ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST ADDITION.

3. MEASURES SHOULD BE TAKEN TO PREVENT MIGRATION OF NATIVE FINES INTO BACKFILL MATERIAL, WHEN REQUIRED. ALL OPEN-GRADED (POORLY GRADED) BACKFILL SHALL BE WRAPPED WITH 226 g (8 OZ.) (MINIMUM) WOVEN GEOTEXTILE FABRIC AND MEETS ENGINEER'S RECOMMENDATIONS.

4. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE UNSUITABLE MATERIAL TO THE REQUIRED DEPTH AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE DESIGN ENGINEER. DEPTH OF FOUNDATION IMPROVEMENT MAY BE REDUCED BY USE OF GEOTEXTILE FABRIC AND GRID. REQUIRED TRENCH WIDTH MAY INCREASE WHEN FOUNDATION MATERIAL IS MODIFIED.

5. BEDDING: SUITABLE MATERIAL SHALL BE ASTM D2321 CLASS I OR II. MINIMUM BEDDING THICKNESS SHALL BE 100 mm (4") FOR 300-600 mm (12"-24"); 150 mm (6") FOR 750-1500 mm (30"-60"). THE MIDDLE THIRD OF THE BEDDING SHALL BE LOOSE AND UNIFORM IN DEPTH AND CONSISTANCY. AFTER PIPE IS IN PLACE, COMPACT BEDDING TO INITIAL BACKFILL STANDARDS.

6. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE ASTM D2321 CLASS I OR II UNLESS STATED OTHERWISE BY THE DESIGN ENGINEER. MINIMUM COMPACTION SHALL BE:

   CLASS I, COMPACT IN PLACE, 200 mm (8") LOOSE LIFTS WITH JUMPING JACK OR SMALL VIBRATORY COMPACTOR

   CLASS II, COMPACT IN PLACE, 200 mm (8") LOOSE LIFTS TO MIN. 95% STANDARD PROCTOR DENSITY

7. THE CONTRACTOR SHOULD PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATIONS TO DESIGN ENGINEER.

8. AS BACKFILL IS BEING PLACED, WORK BACKFILL INTO HAUNCH ZONE BY SHOVELING IN PLACE AND DIAGONALLY WALKING (STOMPING) THE SOIL INTO THE HAUNCH ZONE. THIS EFFORT WILL MAKE VERTICAL COMPACTION MORE EFFECTIVE.

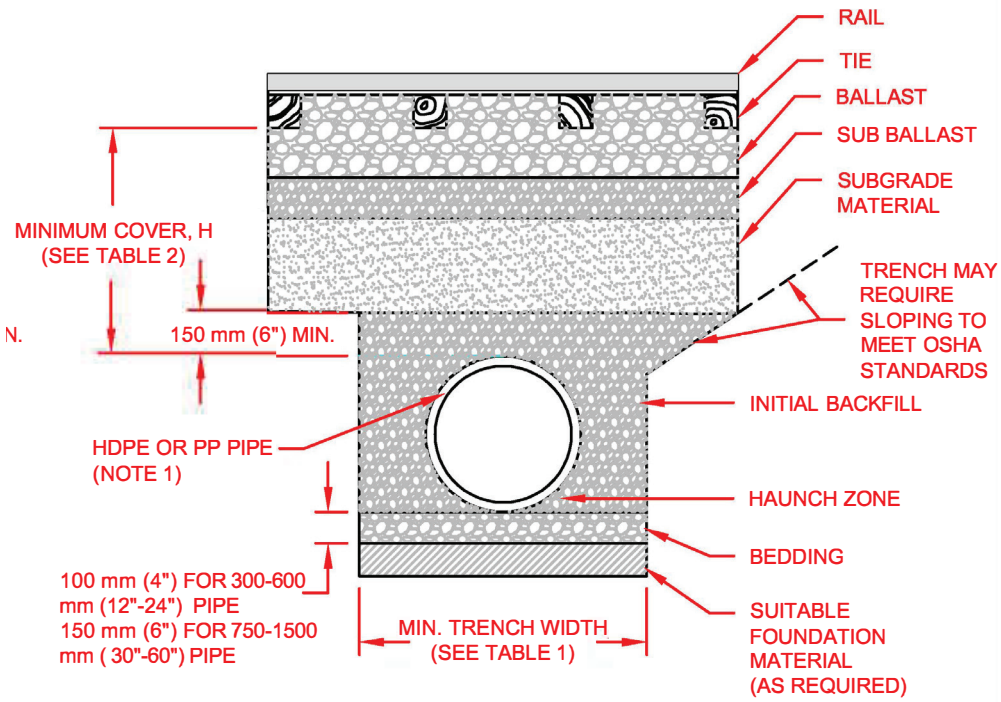


TABLE 1
RECOMMENDED MINIMUM TRENCH WIDTHS

PIPE DIAM.	MIN. TRENCH WIDTH
100 mm (4")	533 mm (21")
150 mm (6")	584 mm 23"
200 mm (8")	660 mm 26"
250 mm (10")	711 mm 28"
300 mm (12")	762 mm 30"
375 mm (15")	864 mm 34"
450 mm (18")	991 mm 39"
600 mm (24")	1219 mm 48"
750 mm (30")	1422 mm 56"
900 mm (36")	1626 mm 64"
1050 mm (42")	1829 mm 72"
1200 mm (48")	2032 mm 80"
1500 mm (60")	2438 mm (96")

100-250mm(4"-10") ONLY

TABLE 2
MINIMUM RECOMMENDED COVER[1,3] BASED ON RAILWAY LOADING CONDITIONS

PIPE DIAM.	COOPER E-80[2]
UP TO 600 mm (24")	610 mm (24")
750-900 mm (30" - 36")	914 mm (36")
1050-1500 mm (42" - 60")	1219 mm (48")

1. COVER IS MEASURED FROM TOP OF PIPE TO BOTTOM OF RAILWAY TIE.
2. LOADS GREATER THAN E-80 LOAD MAY REQUIRE ADDITIONAL COVER.
3. MINIMUM COVER MAY BE INCREASED TO PREVENT PIPE DAMAGE DUE TO ROUTINE TRACK MAINTENANCE.

Superior Pipe Materials

Durability

High density polyethylene and polypropylene pipes are extremely tough materials that can easily withstand the normal impacts involved in shipping, installation and service. Both are highly resistant to corrosion and chemical attack and are unaffected by soils or effluents with pH ranges from 1.5 to 14. (Please refer to Technical Note 4.01 and 4.02 for chemical resistance charts of the materials. Technical Notes found on the ADS website at www.adspipe.ca in the Technical Notes section under the Drainage Handbook menu.) Also, since high density polyethylene and polypropylene materials are not conductive, N-12, HP Storm, and SaniTite HP remain unaffected by electrochemical corrosion or stray electrical currents that may otherwise adversely affect other pipe materials.

High density polyethylene's and polypropylene's ductility and molecular structure result in excellent resistance to abrasion. Polyethylene and polypropylene pipes show less than 20% material loss when compared to competing materials in abrasive environments, and is often specified for harsh mine slurries and as a slip liner for deteriorated culverts.

Hydraulic Efficiency

The smooth interior of N-12, HP Storm, and SaniTite HP pipes provide superior flow characteristics. Laboratory tests show that a Manning's roughness coefficient of 0.012 is appropriate when designing with N-12, HP Storm, and SaniTite HP pipes.

Lightweight

High density polyethylene and polypropylene pipes are lighter than traditional pipes, making it far easier to transport and handle. On-site labor and equipment requirements are reduced, with a corresponding reduction in the potential risk of injury.

Fast Installation

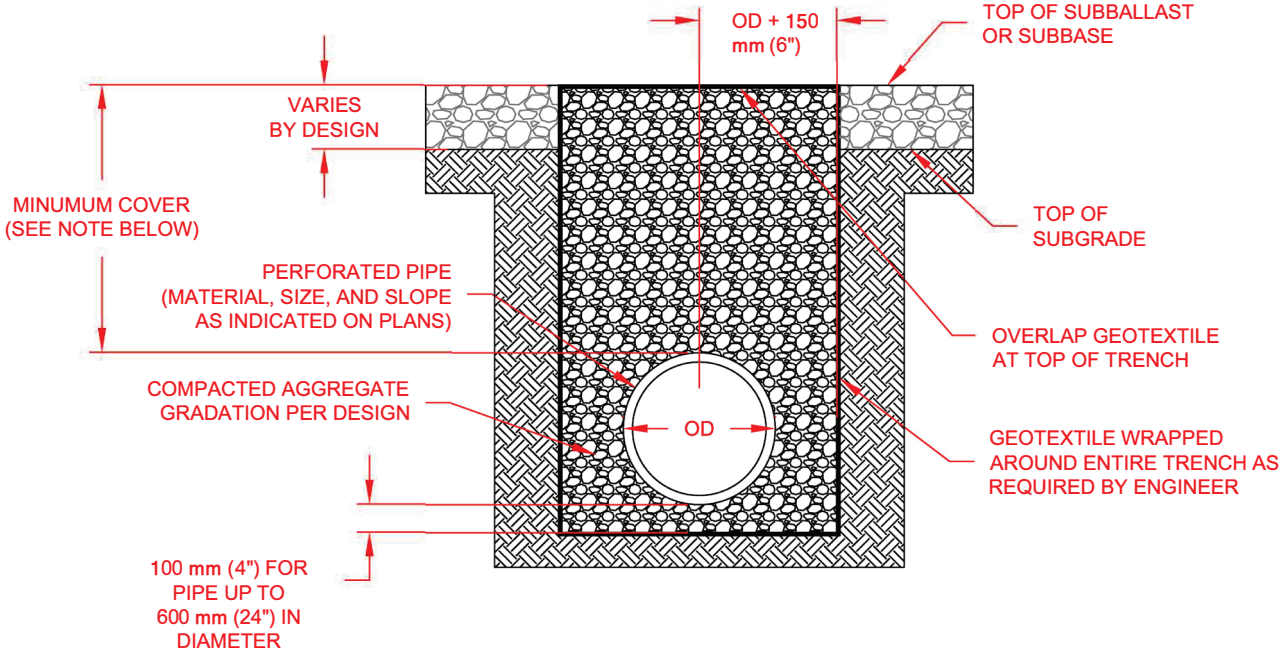
Polyethylene and polypropylene pipes have been installed up to 2x faster than pipe made from competitive materials. The lightweight nature of the pipe, 6 m (20') long sections, gasketed inline bell and spigot joints which are easily assembled and cuts that can be made quickly add up to quality and fast installations. As with all pipes it is important to properly place and use backfill material that will produce a pipe-soil interaction system capable of withstanding the applied loads. Instructions for underground installation of plastic drainage pipe are contained in CSA B182.11, BNQ 1809-300 and in ASTM D2321. Specific supplemental instructions for N-12, HP Storm and SaniTite HP pipes in railroad applications are found in this brochure.

Fittings

For underdrain applications, 100-300 (4"-12") injection molded fittings are approved for under track (Cooper E-80) applications. Larger diameter fittings are available for both polyethylene (HDPE) and polypropylene (PP) pipe for non-track applications. Please consult an ADS Engineering Representative if fittings greater than 300 mm (12") diameter are required under track applications to ensure suitability.

Under Drains

Polyethylene and propylene pipes with Class II perforations per CSA B182.8, BNQ 3624-120, AASHTO M252, M294 and M330, when backfilled with ASTM D2321 Class I (walking or yard ballast), provide an exceptional underdrain system. Pipes with a Type “S” profile provide a smooth interior, which minimizes siltation and facilitates cleaning. The 6 m (20’) sections aid in setting pipes to proper line and grade. In areas where rodents may nest in pipes, rodent protection is suggested at the end of all outlet pipes. Guidance for underdrains in trench applications is shown below.



NOTE: COOPER E-80 LOADING HAS A MINIMUM COVER REQUIREMENT OF 600 mm (24") FROM CROWN OF PIPE TO BOTTOM OF RAILROAD TIE. SEE ADS STANDARDS FOR MINIMUM COVER REQUIREMENTS IN NON-COOPER E-80 LOADING APPLICATIONS.

NOTE: SEE TABLE 2 FOR MINIMUM COVER REQUIREMENTS FOR COOPER E-80 LOAD APPLICATIONS. SEE ADS STANDARDS FOR MINIMUM COVER REQUIREMENTS IN NON-COOPER E-80 LOADING APPLICATIONS.

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