# Flowable Fill For BOSS HDPE Pipe

## INTRODUCTION

Successful installation of High Density Polyethylene (HDPE) pipe requires a stable and permanent support through the compaction of proper bedding and backfill materials. Materials used for foundation, embedment and backfill are classified into types according to ASTM D2321 and they include natural, manufactured and processed aggregate. An alternative to these materials is known as flowable fill or Controlled Low Strength Material (CLSM). As the name implies, flowable fill is typically flowable and self-leveling. It is comprised of a mixture of sand, cement, fly ash and water. More information about CLSM can be found in ASTM D4832 *"Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders"*.

## Flowable Fill Properties

Flowable fill can be used as an alternative material when access and cost of soil and aggregates is prohibitive. Flowable fill has the advantage of being easily placed, ensuring proper support distribution around the pipe. It can be mixed on-site using native silty sands when available. Trench width for a flowable fill installation is also narrower so there is less excavation and disturbance to surrounding soils, and backfill compaction is not necessary.

One of the main disadvantages of using flowable fill is the potential for pipe flotation during installation. Proper care must be taken to secure the pipe with anchoring systems or to pour the flowable fill in lifts. Watertight joints are also recommended to prevent infiltration into the pipe system. The mix itself requires specialized delivery and cannot be stored on-site. Proper mix design including selection and proportioning of the constituent materials is vital to providing adequate strength whilst retaining the option for future excavation if required. This can be tested by measuring the 28 days compressive strength since the mechanical strength of CLSM develops with time.

## Installation

Flowable fill should not be used in temperatures below 4°C as it is not designed to resist the freeze-thaw cycle. Flowable fill is typically delivered by a ready mixed concrete truck mixer or mixed onsite. The mix should be tested prior to installation in addition to field batch testing. The trench bottom needs to be stable and free of protruding rocks, therefore over-excavation and replacement with suitable bedding material is recommended to ensure proper pipe support.

With flowable fill backfill, AASHTO Section 30 permits a reduction in trench width compared to standard backfill to a minimum of the outside diameter plus 300 mm (12 in) (Ref. CPPA Design Manual). The on-site soil must be adequately load bearing and not soft. There must be adequate access to properly compact the fill in the haunch area. Table 1 lists recommended trench widths for flowable fill backfill (ref. ASSHTO LRFD Section C12.6.6.1, 2014).

**TABLE 1:** Recommended trench widths for flowable backfill

| Nominal Pipe Diameter (mm) | Minimum Trench Width (m) |
|---|---|
| 300 | 0.6 |
| 375 | 0.7 |
| 450 | 0.8 |
| 600 | 1.0 |
| 750 | 1.3 |
| 900 | 1.5 |

Complete installation guidelines and procedures can be found in CSA Group Standard B182.11 "*Recommended Practices for Installation of Thermoplastic Drain, Storm and Sewer Pipe and Fittings"* or BNQ 1809-300 *Construction - General Technical Clauses - Water and Sewer Pipes*. Care should be taken to ensure fill is placed evenly on both sides of the pipe to prevent misalignment. Flowable fill should be placed in lifts as recommended by the design engineer. The mix supplier should be consulted to determine the recommended waiting period between lifts. Anchoring systems are recommended to prevent pipe flotation and should also be determined by the design engineer. Further information on pipe flotation can be found in Armtec **Technical Bulletin B2.31.1 *BOSS HDPE Pipe Flotation*.**

**Figure 1:** Typical trench layout