

# PVC PIPE ASSOCIATION TECHNICAL BRIEF

## BACKFILL REQUIREMENTS FOR PVC PRESSURE AND GRAVITY PIPES

PVC pressure pipe can be installed without special backfill, since external loads are not design-limiting. For PVC gravity sewer pipe, on the other hand, backfill material and compaction are key components of design.

### PVC – A FLEXIBLE PIPE

A “flexible” pipe is one that withstands 2% deflection without damage. Flexible pipe works with the surrounding soil to form a pipe/soil structure that is so strong that properly backfilled flexible pipe can withstand much higher loads than rigid pipe.

### PRESSURE PIPE – NO SPECIAL BACKFILL REQUIRED

Backfill is not a design consideration for PVC pressure pipe (except under roads, where pavement backfill specifications take precedence). Native materials are often used, since PVC pipe does not require coatings or encasements to resist corrosion.

- Design is controlled by internal pressure. For comparison, 20 psi of internal pressure is equivalent to 24 feet of cover.
- Pipeline profiles follow the lay of the land, with minimum cover usually governed by frost depth.
- Burial varies in a very tight range from a minimum of about 3 feet to a maximum of about 10 feet.
- Municipal pressure pipe (DR14 PC305 psi and DR18 PC235 psi) has much thicker walls than sewer pipe.

Resistance to external loads is governed by “pipe deflection” – slight ovalization under load. For AWWA C900 pipe, the design limit is 7.5% deflection. A very conservative design example shows how well PVC pressure pipe performs under external loads:

- Backfill: Class IV dumped backfill material (uncompacted silt/clay) with  $E' = 50$  psi
- Pipe: DR18 PVC pipe
- Live load: H20 truck loading
- Deflections (Table 7.4, *Handbook of PVC Pipe*)

| Depth of Burial | 2'    | 4'    | 6'    | 8'    |
|-----------------|-------|-------|-------|-------|
| Pipe Deflection | 1.26% | 1.07% | 1.11% | 1.28% |

- Even for an inferior backfill (dumped silt/clay), deflections are very much less than the allowable of 7.50%.
- Note that at 2' depth vehicle load dominates, but at 8' depth vehicle load has dissipated and soil load has taken over. Minimum combined load occurs about 5 feet deep, which is a typical depth for pressure pipe.

Typical specifications include better backfill materials and some level of compaction. The soil component of the pipe/soil structure provides more strength, resulting in DR18 pipe deflections of considerably less than 1%. For pipes with thinner walls (such as DR41 and DR51), backfill does become a design factor.

**BOTTOM LINE:** Special backfill is not required for DR14 & DR18 PVC pressure pipe. [Click here](#) for more information.

### GRAVITY SEWER PIPE – BACKFILL A DESIGN REQUIREMENT

Design of gravity sewer pipe is governed by external loads (since there is minimal internal pressure). Pipeline profiles are determined by the slope required for flow, so burial depths can range from:

- Very shallow – as little as one foot, where vehicle loads govern
- Very deep – more than 50 feet, where earth load comprises the entire load

For gravity pipe subjected to high loads, backfill material and compaction are critical components to develop the design strength of the pipe/soil structural system.

References: AWWA standards C605 and C900; *Handbook of PVC Pipe*