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.*
- *Typical burial depths only vary from a minimum of about 3 feet to a maximum of about 10 feet.*
- *Municipal pressure pipe (DR 18 / PC 235 or DR 14 / PC 305) 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: DR 18 PVC pipe*
- *Live load: HS20 truck loading*
- *Deflections (External Load Design Calculator)*

Burial Depth	4 ft	6 ft	8 ft	10 ft
Percent Vertical Pipe Deflection	1.57%	1.41%	1.50%	1.70%

- *Even for an inferior backfill (dumped silt/clay), deflections are very much less than the allowable of 7.50%.*
- *Note that at 4-feet depth vehicle load dominates, but at 8-feet 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 DR 18 pipe deflections of considerably less than 1%. For pipes with thinner walls (such as DR 41 and DR 51), backfill does become a design factor.

BOTTOM LINE: Special backfill is not required for DR 14 & DR 18 PVC pressure pipe. See *Proper Bedding for PVC Pressure Pipe* for more information.

GRAVITY SEWER PIPE – BACKFILL A DESIGN REQUIREMENT

Design of gravity sewer pipe is governed by external loads (since there is no 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 C605, Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings; AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In. (100 mm Through 1,500 mm); Handbook of PVC Pipe Design and Construction, PVC Pipe Association