

PVC PRESSURE PIPE UNDER ROADS

Some pressure pipe designers and owners are not comfortable with the use of PVC pressure pipes under roadways due to concerns about traffic loads. These concerns are based on misinformation propagated by competitive pipe materials. The reality is, PVC pipe has been used successfully under roads for over 50 years.

DESIGN CONSIDERATIONS FOR ALL PIPE UNDER ROADS

- Granular materials specified for road subgrade have a very high soil modulus and offer excellent side support for flexible pipes.
- Construction loadings should be considered.
- Pipes should be buried deep enough to prevent disturbance during future road realignment/regrading.
- Minimum depths of cover should be maintained.
- Proper compaction techniques should be used.

DESIGNING WITH PVC PRESSURE PIPE

PVC pipes can be installed under roads in either the longitudinal or transverse direction. Wall thickness needed for pressure design provides sufficient pipe stiffness to prevent excess deflection under typical loading conditions.

PVC PIPE DESIGN EXAMPLES PROVE THE POINT: HIGH SAFETY FACTOR

With proper design methods and installation techniques, all PVC pipe pressure classes (PCs) are suitable under roadways. Below are typical design examples that use the same loadings and soil types but different burial depths. Pipe deflections for AWWA C900 PVC DR51 PC80, DR25 PC165 and DR18 PC235 pipes are compared. The deflection values for the three pressure class pipes at burial depths of 1 foot, 4 feet, and 12 feet are shown in the tables below.

All of the calculations were done using the modified Iowa equation with the following parameters ([click here](#) for on-line calculator):

- Live load: HS20 truck load
- Soil modulus (E') of native soil $\geq 3,000$ psi
- Embedment soil (road base): compacted crushed stone (E'=3,000 psi)
- Pipe size: 12 in.
- Unpressurized pipe
- Allowable Deflection is 7.5% per AWWA C605

DR51 PC80			
Burial Depth (ft.)	Deflection (%)	Allowable Deflection (%)	Safety Factor
1	0.74	7.5	10.1
4	0.34	7.5	22.1
12	0.54	7.5	13.9

DR25 PC165			
Burial Depth (ft.)	Deflection (%)	Allowable Deflection (%)	Safety Factor
1	0.67	7.5	11.2
4	0.31	7.5	24.2
12	0.49	7.5	15.3

DR18 PC235			
Burial Depth (ft.)	Deflection (%)	Allowable Deflection (%)	Safety Factor
1	0.57	7.5	13.2
4	0.27	7.5	27.8
12	0.42	7.5	17.9

The results show that there is not a significant reduction in pipe deflection with thicker-walled PVC pipe and all PVC pressure pipes are well-suited for use under roads in a multitude of soil conditions. For all scenarios, the safety factor is very large.

PVC PRESSURE PIPE: WELL SUITED FOR UNDER ROADS

PVC pressure pipe has performed successfully under roads for more than five decades. Even the thinnest-walled AWWA C900 PVC pipe is not subject to over deflection in typical loading conditions encountered in roadways. PVC pipe is also immune to salt damage and not affected by internal or external corrosion. In addition, PVC pipe has a 100-year plus life expectancy, the lowest break rate of all pipe materials, and leak free joints. Utilities should feel confident in using PVC for their pressure pipelines under roads.

References: Standard C605 "Underground Installation of PVC and PVC Pressure Pipe and Fittings," American Water Works Association (2013); "Life Cycle Assessment of PVC Water and Sewer Pipe and Comparative Sustainability Analysis of Pipe Materials," Sustainable Solutions Corporation (2017); "Water Main Break Rates In the USA and Canada: A Comprehensive Study," S. Folkman (2012); "PVC Pipe Longevity Report: Affordability & The 100+ Year Benchmark Standard. A Comprehensive Study on PVC Pipe Excavation's, Testing & Life Cycle Analysis," Utah State University Buried Structures Laboratory (2014); "Below Ground Installation - PVC Pipes Under Roads," Vinidex website, accessed January 31, 2018, www.vinidex.com.au