PWPipe

TECHNICAL BULLETIN

DESIGN **TB-D43**

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Deflection Testing of PVC Sewer Pipe

Flexible Pipe Deflection

Flexible pipes such as PVC sewer pipe tend to ovalize slightly due to live loads (e.g. highway) and soil loads. This is called "diametric deflection," or simply "deflection." For flexible pipes, some deflection during and after installation is necessary. As a flexible pipe deflects in response to loads, it creates reaction forces in the embedment soil as the pipe walls attempt to compress the soil. The ring stiffness of the pipe and particularly the stiffness of the soil determine the amount of deflection that will occur with a given soil load and live load. This is why it is important to have well compacted, supportive embedment soil.

Research and field experience has shown that PVC pipes can continue to support loads well past a 30% diametric deflection. Therefore, a conservative limit for deflection of PVC sewer pipe has been established at 7.5%, providing a minimum factor of safety of 4:1.

The base inside diameter of the PVC sewer pipe is used as the reference for a state of no deflection. Table 1 on the back of this bulletin, contains the base inside diameters of all PWPipe sewer pipes. The base inside diameter incorporates factors for manufacturing tolerances and storage effects.

Deflection Testing

In normal circumstances in which accepted installation practices are followed and proper embedment material has been selected and compacted, deflection testing of PVC sewer pipe is not required. When adverse conditions such as unstable trench walls, difficulty in attaining compaction, high ground water levels, and/or very deep burials are encountered, it may be advisable to conduct random deflection tests. If excessive deflection is encountered, the pipe should be rebedded or replaced.

Equipment used for determining pipe deflection includes deflectometers, television or photography equipment, and most commonly, properly-sized deflection mandrels.

Deflection mandrels function as "go/no go" gauges. Deflection mandrels are sized to be a pre-determined percentage smaller than the base ID of the pipe. In most cases, this means that the OD of the mandrel would be 7.5% less than the base ID of the sewer pipe. Deflection mandrels should be shaped such that the maximum mandrel OD occurs over a very short distance (<1") so that the mandrel can travel through sweeps without "bridging".

Deflection mandrels are pulled through an installed sewer pipe by means of a rope or cable. If the mandrel can be pulled through the tested section, then the pipe ID has not deflected to the size of the mandrel OD. If the mandrel cannot be pulled through the pipe, there are a few possibilities as to the reason. First, the pipe ID may have deflected beyond the OD of the deflection mandrel. Second, the mandrel may have been caught in a fitting, perhaps due to a tight radius direction change. Third, debris may be blocking the path of the mandrel. Other reasons than these are possible. The cause of the mandrel blockage should always be ascertained.

Table 1 ***Inside Diameters and 7½% Deflection Mandrel Dimensions For PWPipe Sewer Pipes***

Product Type and Size		Base ID (inches)	7½% Deflection Mandrel OD (inches)
ASTM D 3034, SDR 35	6”	5.742	5.31
	8”	7.665	7.09
	10”	9.563	8.84
	12”	11.361	10.51
	15”	13.898	12.86
ASTM F 679, SDR 35	18”	16.976	15.70
	21”	20.004	18.50
	24”	22.480	20.80
ASTM F 794, AASHTO M 304 (PWRib)	8”	7.637	7.06
	10”	9.529	8.81
	12”	11.322	10.47
	15”	13.849	12.81