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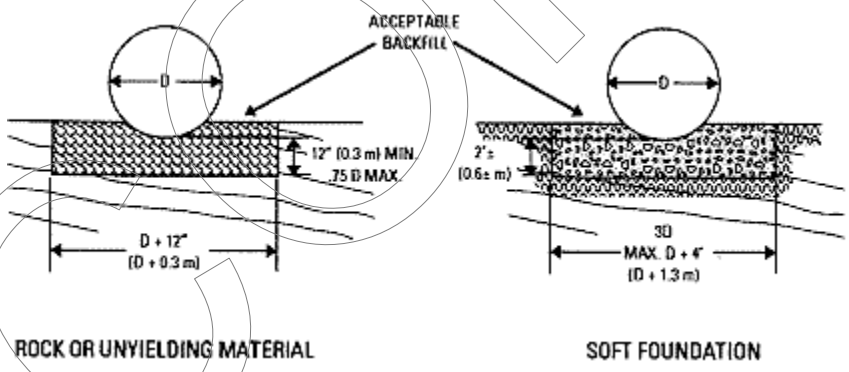
6-4 BACKFILL ENVELOPE CONSTRUCTION

Backfill Placement

Storm sewers are sometimes placed on foundations that settle and shift in a non-uniform manner. Fortunately, flexible pipe can accommodate many of these changes without detrimental effects. The best construction practices, however, involve placing the pipe on a firm foundation for maximum performance and structural integrity throughout the design life.

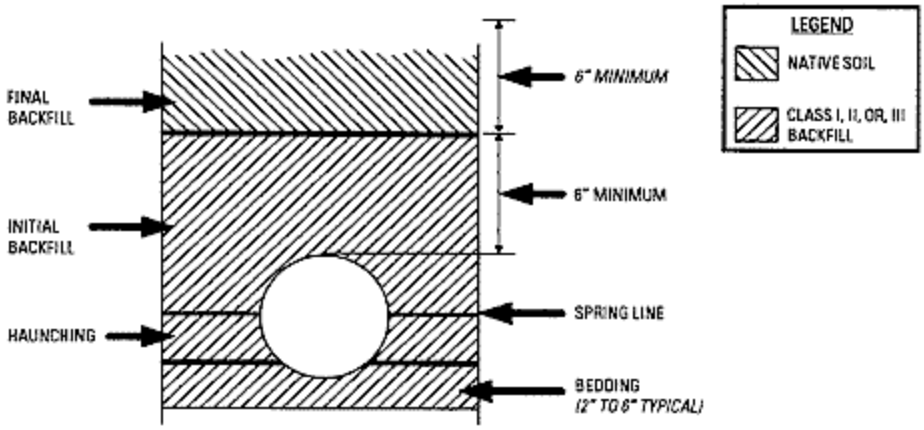
In some cases it may be necessary to perform subsurface evaluations of the soil conditions where muck, rock protrusions, or other unsuitable conditions are suspected. Zones of soft material, such as muck, allow the pipe to settle, potentially affecting the hydraulic characteristics of the system. Rock protrusions apply point loads where they contact the pipe that can affect the hydraulics or structural integrity of the system. It is recommended that unsuitable foundation material be excavated before installation of the pipe proceeds. Figure 6-1 illustrates how both soft and rocky foundation materials should be dealt with before continuing with the project.

Figure 6-1 – Construction of Acceptable Foundation



If no undesirable foundation material is found, a few inches (approximately 0.05 - 0.15m) of bedding should be placed and compacted on the foundation to equalize load distributions along the invert of the pipe. (Refer to Figure 6-2 for a pictorial description of backfill terminology.) The bedding can be shaped to conform to the outside of the pipe, although a more common practice, especially for pipe 24" (600mm) and larger, is to place the pipe on the bedding and carefully tamp or shovel the fill under the haunches to the specified compaction level.

Figure 6-2 – Typical Backfill Structure



The next layer of backfill, the haunching, is the most important since it is this layer that provides the pipe with support against the soil and traffic loadings. Haunching should be placed in lifts of about 4" - 6" (0.10 - 0.15m) for optimum construction, or, as suggested in Table 6-2, on both sides of the pipe. Tamp to achieve the specified compaction, or shovel into the area, eliminating voids, if the material doesn't require compaction. Construction of each lift should be repeated up to the spring line.

Initial backfill extends from the spring line to a minimum of six inches (0.15m) above the crown of the pipe. This area of the backfill anchors the pipe and ensures that loads are distributed as evenly as possible into the haunching. When using a material that requires compaction it is important not to use mechanical compaction equipment directly on the pipe itself.

Final backfill, which extends from the initial backfill layer to the ground surface, does not directly support the pipe. For 4" - 48" (100 - 1200mm) diameters the initial backfill shall be a minimum of six inches (0.15m) and shall be a minimum of twelve inches (0.3m) for 54" and 60" (1350mm and 1500mm) diameters. Proper compaction in this area is not nearly so critical for the pipe as in the other layers. However, if roads or drives will be crossing the pipe, a relatively high degree of compaction is needed to prevent pavement settlement. In most installations excavated materials will be of adequate quality for final backfill.

Flowable fill can be used as an alternative to compacted granular material, however special precautions are necessary for a successful installation. Flowable fill will cause the pipe to float or misalign. Therefore the pipe will need to be weighted with sandbags or held with some type of anchoring system. Alternatively, the flowable fill can be poured in layers that are allowed to cure before the next layer is poured.