CHAPTER 5

PIPE INSTALLATION

Pipe Handling

Care should be taken in storage, handling, and installation to avoid damage to the pipe and joint surface. Consult your pipe manufacturer for further information.

A visual inspection of the pipe, just prior to installation, should be performed by the installer.

Figure 22: *Constructing a bell hole during pipe laying*

Bell or Coupling Holes

Pipe are generally installed with the bells pointing upgrade. Bell or coupling holes must be carefully excavated so that the bells or couplings support no part of the load. The pipe barrel is designed to support the trench load and must rest firmly and evenly on the trench bottom or bedding material. Bell or coupling holes must be dug to ensure the pipe barrel and not the bells or couplings support the trench load as shown in Figure 23.

When properly installed, there should be room to slide a hand around the lower half of the bell or coupling before the next pipe is installed.

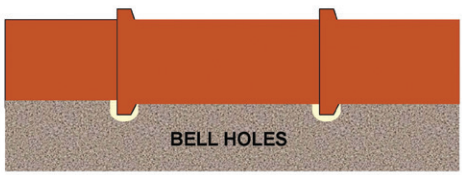

Figure 23: *Bell hole illustration; the pipe barrel supports the trench load*

If a trench box is used within the limits of the pipe zone, re-excavation of the bell hole may be necessary on the last pipe laid if the bell hole is filled with bedding material during box advancement.

Pipe Joining

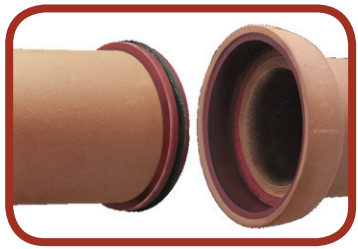

Figure 24: *VCP flexible compression joint*

Compression joints should be assembled in strict accordance with the manufacturer's recommendations.

Particular care should be taken to keep foreign materials from interfering with proper joint assembly. The mating surfaces of the joint should be wiped clean and lubricated prior to assembly following the manufacturer's recommendations.

All compression joints are manufactured in accordance with ASTM C425 *Compression Joints for Vitrified Clay Pipe and Fittings.*

Lubricate both joint surfaces, line up the bell and spigot and shove the pipe together with a steady pressure. Pipe should be in straight alignment during assembly.

For small diameter pipe, joint assembly can be done by hand or with a bar as an aid. When using a bar, care should be taken not to damage the lip of the bell or coupling. A wood block may be used to cushion the bar pressure.

For larger sizes, a nylon sling, cable, or other approved device used to lower the pipe can be used as an aid in the assembly of the compression joint.

Care must be taken to ensure that the joint is completely assembled.

Bedding and Haunching

After laying the pipe, the bedding material is placed to the height specified by the class of bedding.

The bedding or initial backfill should be shovel sliced in the "haunches" of the pipe to fill the voids and consolidate the material in this area. This assures uniform support of the pipe barrel and achieves the required load factor. Shovel slicing should be done when the bedding material is no higher than about one-fourth of the pipe diameter.

Shovel-slicing the bedding material in the haunch areas is critical. It takes little time, maintains grade, eliminates voids beneath the pipe and in the haunch areas, consolidates the bedding, and adds little or nothing to the cost of the installation.

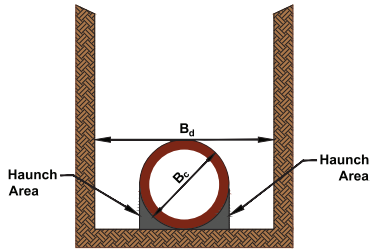

Figure 25: *Terminology*

B_c = the outside diameter of the pipe.
B_d = the design trench width measured at the horizontal plane at the top of the pipe barrel.

Figure 26: *Shovel slicing the pipe haunches*

Shovel slicing is required to achieve the desired load factor.

Good haunch support:

- Significantly increases the load carrying capacity of buried pipe
- Requires compacting the soil in the haunch area using a shovel, spade, or other suitable tool
- Can be attained by using CLSM (flowable fill) with the proper flowability

- Is not attained by dumping gravels and crushed rock beside the pipe
- Can be aided by pipe settling into uncompacted bedding to mobilize the strength of the haunch soil

Initial Backfill

The initial backfill is then carefully placed to a minimum height of 12" above the top of the pipe. This is done to maintain pipe alignment and protect the pipe from damage during final backfilling. The initial backfill should be free from large material and conform to Allowable Bedding Material & Initial Backfill per Bedding Class table in the reference section.

Final Backfill

The final backfill extends from the initial backfill to the top of the trench. Final backfill shall be placed in lifts or stages not to exceed 10 feet when using water or as required by designated methods of mechanical compaction.

Final backfill shall have no rock or stones having a dimension larger than 6 inches within 2 feet of the top of the initial backfill. Selected backfill material may be required for the top foot or more as specified by the engineer.

Compaction

Compaction of the backfill material is usually required to prevent settlement of the ground surface or to support paving or structures. In areas where support of the pavement over a trench is required, compaction of part or all of the backfill material may be specified. When it is necessary to achieve a high degree of compaction, it may be advisable for the design engineer or contractor to consult a geotechnical engineer.

Trench backfill specifications generally require mechanical compaction in layers, referred to as lifts, but may allow compaction using water. Most soil materials may be compacted by mechanical means in lifts. However, in order to obtain the desired compaction with normal effort, the field moisture content of the soil needs to be optimal.

Cohesive soils (Class III, IV, V) are best compacted using pressure, impact, or kneading. Cohesionless soils (Class I or II) are best compacted using vibration. Water settling methods such as flooding, ponding, jetting, or puddling may reduce the soil volume but do not result in very high densities. In the book *Pipeline Installation 2.0*, Amster Howard describes the various methods of compaction, appropriate equipment, and testing procedures applicable for different types of soils. See www.pipeline-installation.com for more information.

Figure 27: *Hoe mounted sheepsfoot roller compacting final backfill*

To achieve the specified compaction with the lowest risk and cost, the correct selection of compaction equipment and methods are necessary. Depending upon the soil type and compaction requirements, wide choices of compaction equipment are available.

Extreme care should be taken when using heavy mechanical compaction equipment. There should be a minimum of 5 feet of cover over the top of the pipe before any heavy mechanical compaction equipment is employed. This will tend to reduce dangerous impact loads on the pipeline. Walk behind and hand-held, light compaction equipment within the trench can be used at cover depths less than 5 feet.

Compaction Abuse

The selection and use of suitable compaction equipment must be made with care so that the pipe will not be disturbed or damaged. A pavement breaking type of falling weight “stomper” or drop hammer, should never be used for compacting, even with a substantial cover over the pipe. These impact devices can damage the pipe and/or force it out of alignment.

The foundation must remain firm and unyielding during all backfill and compactive efforts. Testing should be performed at the beginning of every project to ensure the compaction method utilized does not damage the pipeline.

The selection and use of suitable compaction equipment must be made with care so that the pipe will not be disturbed or damaged.

Figure 28: *Close-up shot of a sheepsfoot roller*