

Recommended Installation Procedures

Excavation

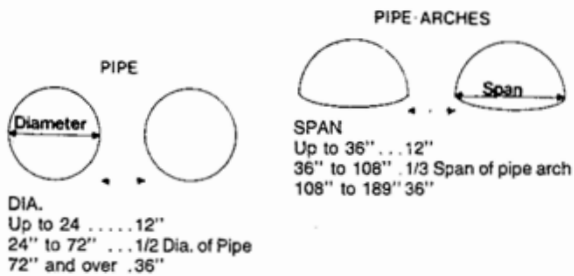
Trenches should be as narrow as possible but sufficiently wide to permit tamping the backfill. Generally, trenches 12 to 24 inches wider than the structure are satisfactory. Wide trenches not only require more excavation and backfill but increase the load on the structure. Side walls should be practically vertical to an elevation above the top of the pipe.

When two or more corrugated steel drainage structures are to be installed in parallel lines, there must be space between them.

The reason for the spacing is to allow room for tamping of the backfill and to enable the structure to develop adequate side support.

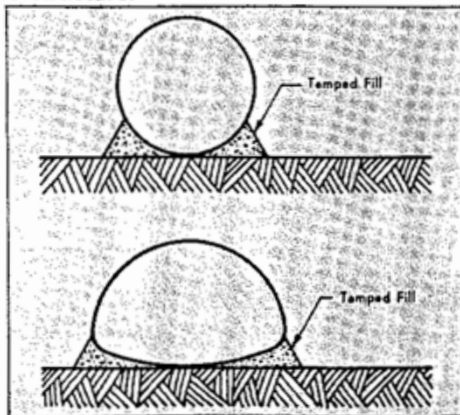
Whether the structure is large or small, keep in mind that size and room required for the tamping equipment should also be considered in determining spacing.

MINIMUM PERMISSIBLE SPACINGS FOR MULTIPLE INSTALLATIONS



Where heavy earth-moving equipment or bulldozers can be used, it is often economical to dig a wide, flat base.

With corrugated metal pipe, a satisfactory method of preparing the foundation is by excavating to a flat surface and then carefully tamping the fill under the haunches of the pipe. Good compaction can be achieved by tamping with wooden poles, 2 x 4's, or the smaller sizes of pneumatic tampers to eliminate all voids under the structure.



Methods for attaining proper compaction under haunches of corrugated metal pipe.

Bedding

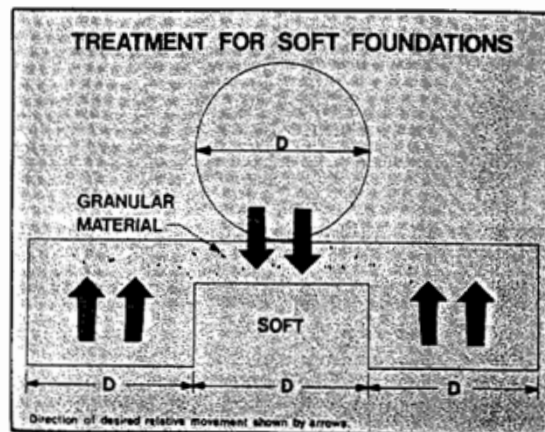
The bedding upon which the pipe is to be assembled should be to line and grade and of firm and even supporting ability. Large rocks, timbers or other foreign matter should be removed to allow a cushion of firm material—preferably granular—at least 6 inches thick to be placed and compacted above any remaining hard material. The bedding surface should be shaped to fit the pipe for enough of the pipe's bottom surface so that the compacted backfill and bedding will form a complete and uniform earth structure around the pipe. For round pipes it is sufficient to shape the bedding to approximately one quarter of the circumference. For pipe-arches the bedding should be shaped to the width of the bottom arc.

If poor or non-uniform foundations are encountered, they must be treated correctly to assure satisfactory results. The critical factor is uniformity along the pipe with a tendency to yield under the pipe in relation to alongside the pipe.

Correcting Poor Foundations

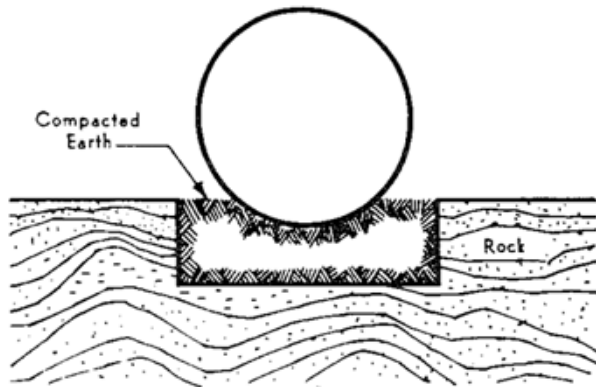
UNEVEN FOUNDATIONS: When the excavated grade line crosses soft and hard spots, foundations should be made as uniform as possible by excavating below grade and replacing with softer material. Sometimes hard spots can be excavated below grade and replaced with softer material. Sometimes it would be best to excavate the entire foundation slightly below grade line and replace it with suitable, uniform material. In any event, any abrupt changes from hard to soft foundation should be avoided.

SOFT FOUNDATIONS: When soft, unstable material is encountered at the foundation level, it should be excavated below the flow line grade and backfilled to grade with sand-gravel crushed stone or other suitable material. The zone of select material should be 3 diameters wide and compacted.



POCKETS OF UNSTABLE SOIL: If unstable foundation material is in small pockets, it is best to excavate all of the poor foundation and replace it with suitable backfill material. Frequently, a relatively thin mat to provide a suitable foundation of granular material will provide satisfactory support, but it may be necessary to replace very soft foundations to a depth of as much as 3 feet.

ROCK FOUNDATIONS: Rock encountered in the foundation should be removed to at least 12" below the bottom of the structure, excavate wide enough to avoid any possibility of the pipe resting on rock. The excavated area is then backfilled with compacted, granular soil to cushion the pipe.



Handling

Although corrugated steel drainage structures will withstand rough handling without deformation, they should be handled with reasonable care. They should be lifted or rolled to protect the galvanized or bituminous coating. Dragging the structures at any time may damage the coatings and jeopardize durability. Also avoid striking rocks or hard objects when lowering pipe into trenches.

Since corrugated steel structures are relatively light in weight, they can be handled with simple, light equipment. Frequently a small crew can lower pipe into trenches by means of rope slings.

Coupling

Care should be used to bring the ends of pipe sections into line with each other and correctly spaced to insure well fitted couplers making tight joints.

Bands are put into position at the end of one section of pipe with the band open to receive the next section. The second section is brought against or to within about 1 inch of the first section. After checking to see that connecting parts of both band and pipe sections match, that interior of bands and exterior of pipe are free of dirt, stones, etc., bolts are inserted and tightened. Bands utilizing gaskets are commonly used in restricted leakage applications.

When installing asphalt-coated sections and couplers, brushing the mating surfaces liberally with crankcase oil or kerosene will make tightening easier.

Backfill Quality and Compaction

After the pipe has been placed on the bedding and the joint made, it can be immediately backfilled. The integrity of the embankment, the pavement, and adjacent structures as well as the alignment and cross-sectional shape of the pipe will depend on the quality and compaction of the backfill material, thus making this one of the most important phases of installation.

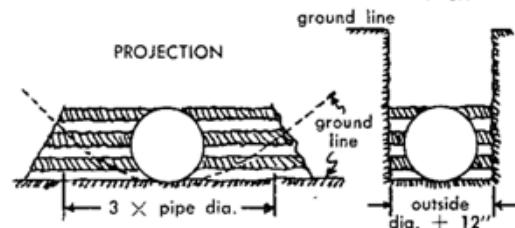
Side support must be provided for flexible pipe so that it will carry the fill and live loads without excessive deflection. Side support can only be obtained by adequate compaction of good fill material around the pipe.

Backfill of granular nature is considered best as it retains stability over a wide range of moisture content and is easily placed and compacted. If backfill material of a plastic nature must be used, careful attention should be given to insure optimum moisture content for compaction. It should be free of large rocks and hard lumps or clods larger than 2 inches in size. Granular material containing a small amount of silt or clay is ideal since it makes a dense, stable fill. This material should be used within one pipe diameter of the sides of the pipe and to one foot over the pipe. Backfill beyond the one pipe diameter limit may be regular embankment fill.

Fill material under haunches and around the structure should be placed alternately in 6 inch layers on both sides of the pipe to permit thorough tamping. The fill is placed alternately to keep it at the same elevation on both sides of the structure at all times. Compaction within 6 inches to 18 inches of the pipe is usually done with hand held tampers; heavier hand guided tampers are used for the remainder of the material out to the trench side. In wide, deep trenches, heavier tractor-powered equipment is used from about 24 inches from the pipe on out and for compaction of the fill material over the pipe, following adequate cover to avoid pipe damage.

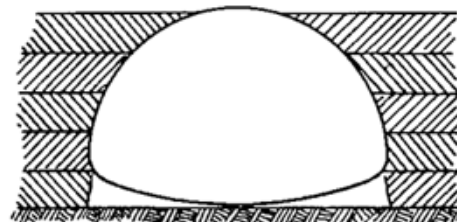
DO NOT COMPACT BY PUDDLING OR JETTING WITH WATER. These methods usually do not produce reliable backfills.

RECOMMENDED BACKFILLING PRACTICE FOR PIPE TRENCH



Notes: Place fill in uniform well tamped 6" layers.
Keep fill at same elevation on both sides of pipe.

RECOMMENDED BACKFILLING PRACTICE FOR PIPE-ARCH



Tamp fill carefully under bottom of pipe-arches.
Place fill in uniform well tamped 6" layers.
Keep fill at same elevation on both sides.