

Crosspipe Installation: This technical bulletin deals with techniques for the installation of traditional road drainage culverts (not stream pipes). Traditional crosspipes rely on road surface elevation to determine pipe depth. A related technical bulletin includes details of a “Shallow Crosspipe Installation.”

Pipe Elevation

Adhere to minimum cover requirements and attempt to outlet pipes at the elevation of the natural ground, where possible. This will eliminate the need for long “tail ditches” at pipe outlets, which are an on-going source of maintenance and erosion. More information on pipe elevation can be found in the “Shallow Crosspipe Installation” Tech Bulletin.

Pipe Length and Angle

On roads with linear grade, install crosspipes at an angle, to line up with natural drainage patterns and to more efficiently move water through the road (*Figure 1*). This has advantages over installing pipes straight across a road:

- Reduces erosion around pipe inlet and outlet that results when water “turns” to enter or exit the pipe.
- Pipe efficiency is increased when water does not have to turn 90° to enter the inlet.
- Traffic loading on the pipe is decreased, since only one vehicle tire at a time is directly over the pipe.
- Angled pipes tend to “self clean,” and collect less sediment and debris in the pipe and at the inlet.

Bedding/Fill Material

When selecting a material for use as bedding and fill around a crosspipe, compaction and frost action are the two most important concerns. When possible, use the material that is excavated out of the pipe trench. However, if the material contains a lot of large rocks it will not compact properly and new material must be imported. Keep in mind the following when selecting a bedding material:

- Imported bedding and fill should be as similar as possible to existing road material. This will insure that the entire road will react in the same way to cycles of freeze and thaw.
- Bedding and fill material must be moist to achieve the best compaction. Compaction is crucial beneath, beside, and above the pipe to provide proper pipe support and avoid pipe flexing. A ribbed pipe gets its structural strength when properly compacted into the road bed.
- Some common fill materials include crushed bank run gravel, shale, and PENNDOT 2RC aggregate.

Other Considerations

- When raising the road, fill should be placed and compacted prior to pipe installation. After road fill is in place, excavate the pipe trench and proceed with installation.
- Ensure that all crosspipes have effective fall (shoot for 2%+ and no less than 1%).
- Pipes require headwalls and endwalls to reduce erosion, improve function, and protect the pipe inlet/outlet.
- Drop-inlets (grates like on storm sewers) are not recommended for use on unpaved roads.



Photo 1. A plastic crosspipe is shown during installation. Notice the pipe bedding material, endwall, and stone at outlet.

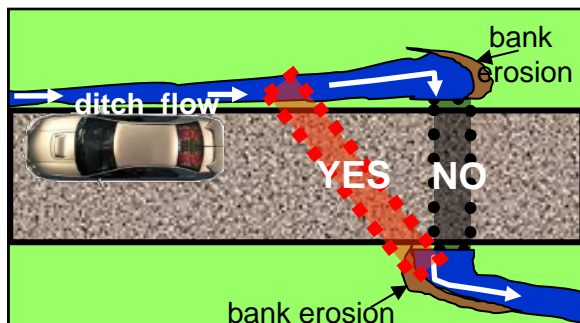


Figure 1. The crosspipe shown in black is improperly aligned straight across the road. The red pipe indicates a better pipe placement that will carry more water, cause less erosion, and will better resist crushing.

Crosspipe Installation

1. **Excavate Pipe Trench:** Trench should be wide enough to fit compaction device (*shown in "D"*) on both sides of pipe. Trench depth will depend on outlet elevation. Ideally, outlet pipe at natural ground elevation to eliminate the need for a tail-ditch. Bottom of pipe inlet should be at the same elevation as the upslope ditch. Use a level to ensure fall in the pipe trench (see photo A). If needed, use fill to adjust the elevation of the upslope ditch and the road surface to ensure pipe has fall and proper cover. *Consider a Shallow Crosspipe where appropriate.*
2. **Place Pipe Bedding:** Once the trench is complete, some bedding material may be needed. Use bedding to smooth trench bottom for pipe support and to achieve proper fall. Some shovel and rake work is usually required to spread bedding evenly. Use a level to find any uneven spots and double-check slope (See *photo B*). Compact bedding material before pipe placement.
3. **Place Pipe in Trench:** Place and align first section of pipe in trench. Pipe inlet should be located in the existing ditch line, with room between the pipe and the bank for a headwall. Inlets that are too close to the road pose traffic hazards. Inlets that are too far off the road can cause unnecessary bank erosion. Align additional pipe sections and secure together with collars or by seating the attached gasket. Look for uniform support in the pipe bedding. Voids under the pipe will cause sagging upon compaction. Headwalls and endwalls can be constructed at this time or after the pipe installation is complete. Either way, the fill behind headwalls and endwalls must be placed and compacted in shallow lifts (3 min) and should tie the wall into the road bed.
4. **Place and compact fill material around pipe:** Place the first lift of fill material around pipe until approximately 8" of material is on each side of pipe. Pipe must be held in place so fill material does not move or lift pipe (See *photo C*). Use an upright tamper to compact fill on both sides of pipe. Compaction of the first layer of fill material is crucial because it fills voids and packs material around the base of the pipe for support (See *photo D*). The importance of compaction cannot be overstated! HDPE pipes (plastic pipes) get their structural strength from the material compacted tightly around them and into the ribs. Care should be taken not to damage the pipe with the foot of the tamper while compacting. Continue to fill and compact in stages, or lifts, placing approximately 8" of fill before compaction. If too much fill is placed at once, proper compaction cannot be achieved. Continue to fill and compact overtop of pipe (See *photo E*). Be sure to provide adequate compacted cover over the pipe. Adequate cover varies with pipe size and construction. Most plastic pipes, up to 48" in diameter, require a minimum of 12" of compacted cover.
5. **Never allow truck traffic over partially installed crosspipes without at least 12" of compacted cover for protection.**

