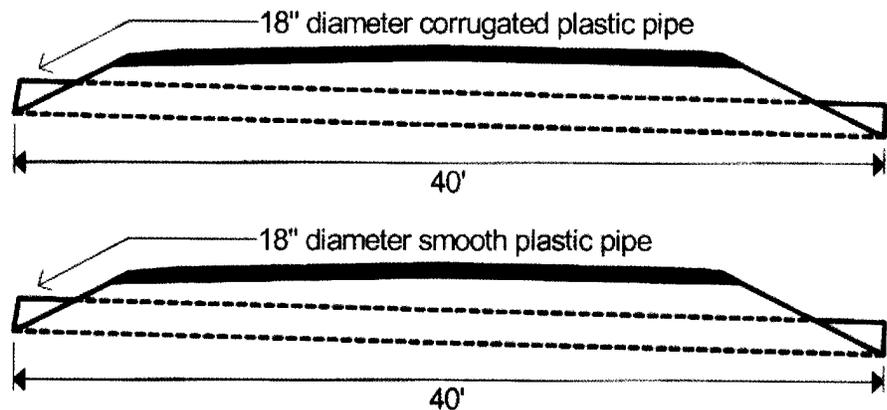


Test Your Culvert Design Knowledge

One culvert is corrugated plastic and the other smooth plastic pipe. They are otherwise the same in the following details:

- The flow is with inlet control, in that no part of either pipe flows full.
- Diameter: 18 inches
- Length: 40 feet
- Projecting Inlet
- Maximum Allowable Headwater Depth: 2.5 feet
- Slope: 2.5% (1 foot fall over the 40 foot length)



Q Which culvert has a great capacity to carry water?

A. Both pipes carry the same amount of water! At the maximum allowable headwater, both pipes carry about 10 cubic feet per second (4,000 gallons per minute).

Q. Why?

A. “Flow with inlet control” means that the discharge capacity is controlled at the culvert entrance. Although each entrance is submerged, the culvert edges restrict or contract flow into each barrel. From the entrance to the exit, no part of the pipe flows full. Capacity for flow with inlet control depends on headwater depth, the barrel cross-section area, and the shape and type of inlet edge. These are same for each culvert, so their capacities are equal.

Q. Are there other differences in performance?

A. Yes, the outlet velocities will differ. The corrugated pipe outlet velocity is 6 feet per second (ft/sec); the smooth pipe outlet velocity is over 9 ft/sec. Grass will adequately protect the corrugated pipe outlet. Some riprap is needed to prevent erosion at the smooth pipe outlet.

Q. Which is the better installation?

A. The agency must determine whether flow is with inlet or outlet control. Flow with outlet control occurs when the headwater depth is greater than the “Maximum Allowable Headwater.” The barrel then flows full for part or all of its length. The higher the headwater, the greater the potential for road damage. The best pipe, then, is the one with the highest capacity. Capacity with outlet control involves additional factors, including roughness. Other factors being equal with outlet control, smooth plastic pipe would carry more water than corrugated. Smooth pipe would therefore be better, with riprap to prevent erosion at the outlet

If the agency can be sure that the inlet control will always occur, the best installation depends on relative cost. The smooth pipe may need rip-rap, but may be less likely to plug with debris. The corrugated pipe, in this instance, needs only grass for erosion control. It might, however, be harder to install due to its increased flexibility.

Sources

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