

4.3 Culvert Shapes

4.3.1 General

A wide variety of standard shapes and sizes are available for most culvert materials. Since equivalent openings can be provided by a number of standard shapes, the selection of shape may not be critical in terms of hydraulic performance. Shape selection is often governed by factors such as depth of cover or limited headwater elevation. In such cases a low profile shape may be needed. Other factors such as the potential for clogging by debris, the need for a natural stream bottom, or structural and hydraulic requirements may influence the selection of culvert shape. Each of the common culvert shapes is discussed in the following paragraphs. More details are included in the section on materials.

4.3.2 Circular Pipes

The circular shape is the most common shape manufactured for pipe culverts. It is hydraulically and structurally efficient under most conditions. Possible hydraulic drawbacks are that circular pipe generally causes some reduction in stream width during low flows. It may also be more prone to clogging than some other shapes due to the diminishing free surface as the pipe fills beyond the midpoint. With very large diameter corrugated metal pipes, the flexibility of the structure dictates that special care be taken during backfill construction to maintain uniform curvature.

4.3.3 Pipe Arch and Elliptical Shapes

Pipe arch and elliptical shapes are often used instead of circular pipe when distance from channel invert to pavement surface is limited or when a wider section is desirable for low flow levels. These shapes may also be prone to clogging as the depth of flow increases and the free surface diminishes. Pipe arch and elliptical shapes are not as structurally efficient as a circular shape. They are normally used in areas with limited vertical clearance and low cover conditions.

4.3.4 Arches

Arch culverts have no culvert barrel material at the bottom and offer less of an obstruction to the waterway than pipe arches and can be used to provide a natural stream bottom where the stream bottom is naturally erosion and abrasion resistant. The structure should also meet scour design requirements.

4.3.5 Box Sections

Rectangular or square cross section culverts are easily adaptable to a wide range of site conditions, including sites that require low profile structures. Due to the angular corners, boxes are not as structurally and hydraulically efficient as other culvert shapes.

4.3.6 Multiple Barrels

Multiple barrels are used to obtain adequate hydraulic capacity under low embankments or for wide waterways. In some locations they may be prone to clogging as the area between the barrels tends to catch debris and sediment. When a channel is artificially widened, multiple barrels placed beyond the dominant channel are subject to excessive sedimentation. **The span or opening length of multiple barrel culverts includes the distance between barrels as long as that distance is less than half the opening length of the adjacent barrels.**