Culvert Characteristics

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Chapter 3
CULVERTS

Description

A culvert is a closed conduit used to convey water from one area to another, usually from one side of a road to the other side.

Importance to Maintenance & Water Quality

Disposal of runoff from roadway ditches will help preserve the roadbed, ditches, and banks. Strategically placed culverts, along with road ditch turnouts, will help maintain a stable velocity and the proper flow capacity for the road ditches by timely outleting water from them. This will help alleviate roadway flooding, reduce erosion, and thus reduce maintenance problems. In addition, strategically placed culverts help distribute roadway runoff over a larger riparian filtering area. Culverts preserve the road base by draining water from ditches along the road, keeping the sub-base dry.

Culvert Profile

General

Culverts can be divided into two functional types: *Stream Crossing* and *Runoff Management*. The first culvert type, *stream crossing culvert*, is self-defining. A culvert is required where the roadway crosses a stream channel to allow water to pass downstream. The second type culvert, *runoff management culvert*, is one which is strategically placed to manage and route roadway runoff along, under, and away from the roadway. Many times, these culverts are used to transport upland runoff, accumulated in road ditches on the upland side of the roadway, to the lower side for disposal. These culverts are commonly called *cross-drains*.

Installation, modification, and improvements of culverts should be done when stream flows and expectancy of rain are low. Ideally, the entire installation process, from beginning to end, should be completed before the next rain event. All existing and/or reasonable potential stream flows should be diverted while the culvert is being installed. This will help reduce or avoid sedimentation below the installation site.

Culverts For Stream Crossings

When installing culverts (and bridges) for stream crossings, seek to maintain the original and natural full bank capacity (cross-sectional area) of the channel. Constrictions at these points are contributing factors in costly bridge and culvert "blow-outs" which generate a large volume of sediment deposited directly into the stream. Align and center the culvert with the existing stream channel whenever possible. As a minimum, align the culvert with the center of the channel immediately downstream of the outlet. If channel excavation is required to help align the culvert, it is frequently best to excavate the upstream channel to fit the culvert entrance and align the outlet with the existing natural channel. Minimal disturbance of the channel at the culvert outlet should be the priority consideration. Inasmuch as possible, the grade of culverts should be determined by the grade of the existing channel, but usually not less than 0.5% nor more than 1%. The outlet should discharge at the existing channel bottom. A professional engineer, experienced in hydrology and culvert hydraulics, should be consulted for determination of actual culvert grades when dealing with peculiar alignment or laying conditions, and upon any deviation from normal and usual installation procedures. Keep disturbance of the channel bottom, sides, adjacent land, and surrounding natural landscape to a minimum during installation. Install energy dissipating structures and/or armor at the outlet where scour and erosion are likely to occur from high exit velocity due to steep culvert installation, near proximity to channel banks, drops at the end of the culvert, etc. (See Chapter 4 on OUTLET STRUCTURES). Establish and maintain at least one foot of roadbed cover over all culverts. Two feet or more cover is the desired optimum.

Culverts For Runoff Management

Where cross-drains are needed in conjunction with "turnouts", it is ideal to place culverts no more than 500 feet apart along the roadway to control the volume and velocity of flow within road ditches. Steeper road slopes may require closer spacing to discharge accumulated runoff in excess of ditch capacity and/or to keep velocities down. Inasmuch as possible in non-stream crossing locations, a "turn-out" ("tail-ditch") should coincide with the outlet location of a cross-drain culvert to "dump" transported and accumulated water from the receiving ditch. Where private roads and driveways intersect public roadways, install culverts to maintain continuity of flow within the ditch while allowing access across the ditch. In cases of no head wall, install enough culvert to extend each end at least two (2) feet past the toes of the road bank slopes. Install energy dissipating structures and/or armor at the outlet where scour and erosion are likely to occur from high exit velocity due to steep culvert installation, near proximity to ditch banks, drops at the end of the culvert, etc. (See Chapter 4 on OUTLET STRUCTURES). Establish and maintain at least one foot of roadbed cover over all culverts. Two feet or more cover is the desired optimum.

Exhibit 3.1a - Culverts for Stream Crossing

Exhibit 3.1b - Culverts for Crossing Natural Drains

Exhibit 3.1 - Culverts for Crossing Natural Streams and Water Courses

Major Cross Drains

These usually facilitate large drainage areas which may include a network of roadway ditches, field drains, etc. and often discharge at a point in or near a natural stream or drainage.

Intermittent Cross Drains

These usually connect road ditches on the upland side of a roadway to road ditches on the opposite side, or convey water to discharge points on the opposite side of a roadway.

Miscellaneous Cross Drains

These maintain continuity of flow by connecting or re-connecting road ditches which have been crossed by an intersecting road or driveway, or simply provide for drainage under roads and driveways. Also, note the need for scour protection at the outlets. This is a significant source of sedimentation.

Exhibit 3.2 - Runoff Management Culverts

Purchase this course to see the remainder of the technical materials.