
Culvert Excavation and Backfill

Design Manual
Chapter 5
Earthwork

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This section discusses excavation and backfill for pipe culverts, box culverts, and livestock passes installed under pavement. Pipe culverts installed under pavement are placed according to [DR-101](#). Contractors may elect to install rigid pipes using the fill installation method; however, trench installation is more common. Flexible pipe requires trench installation. Regardless of pipe type, quantities will be based on a bedding thickness of 4 inches below the pipe.

Excavation

Reinforced Concrete Pipe

In fill areas, assume the contractor will use the fill installation shown on [DR-101](#). If the pipe is located in an area that will require a partial cut, see Figure 1, calculate the quantity of Class 20 as described in Article [2402.04, B, 3](#) of the Standard Specifications. Remember to account for the thickness of the pipe and the 4 inch bedding.

In cut areas, the trench installation shown on [DR-101](#) is used. Trench installation may also be used in partial fill areas. Refer to DR-101 for a cross section of the trench.

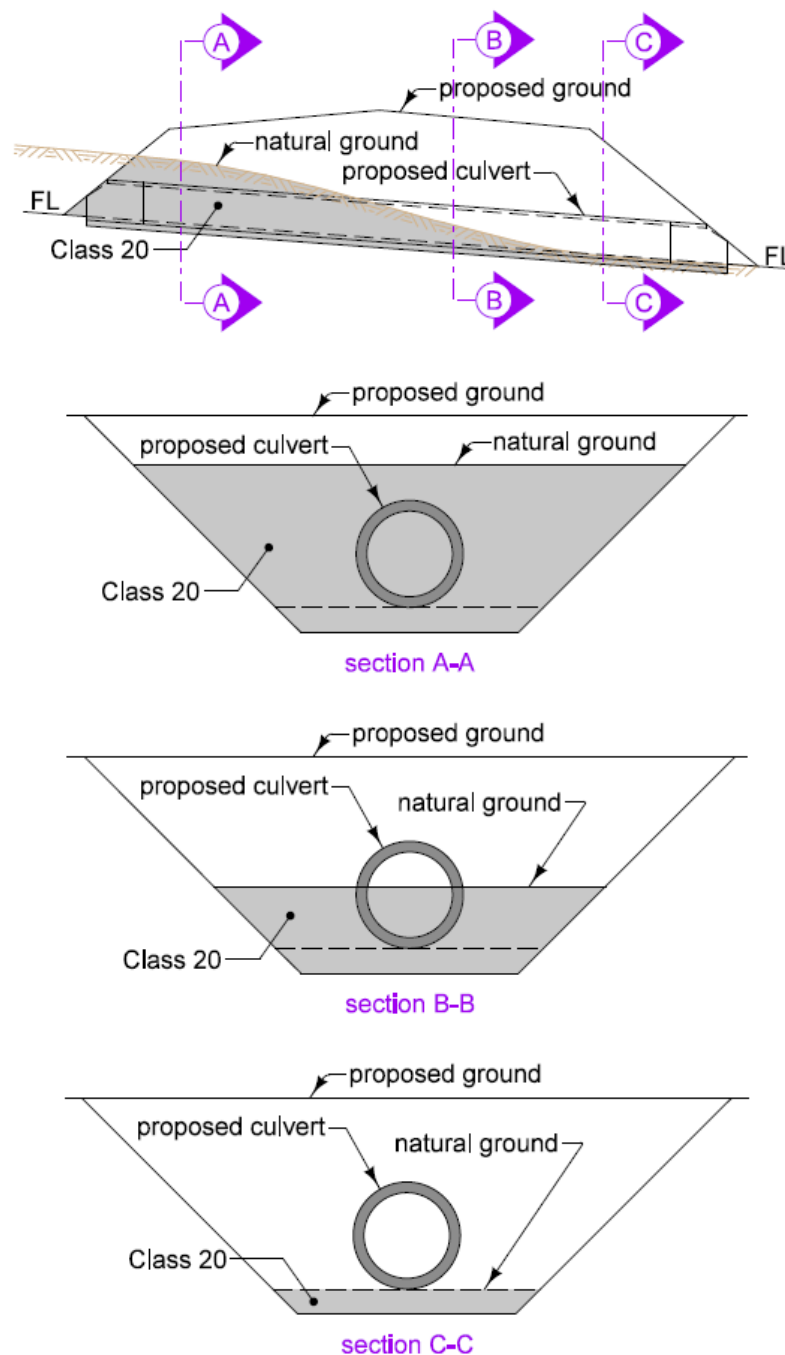


Figure 1: Rigid pipe installation with partial cut.

Flexible or Unclassified Pipe

Flexible (metal or plastic) pipe is always installed using the trench installation shown on [DR-101](#). Refer to DR-101 for a cross section of the trench. Calculate Class 20 up to existing ground or to 2 feet above top of pipe (or the minimum pipe cover shown on [DR-104](#) if greater than 2 feet) for the length of trench, see Figure 2. Remember to account for the thickness of the pipe and the 4 inch bedding.

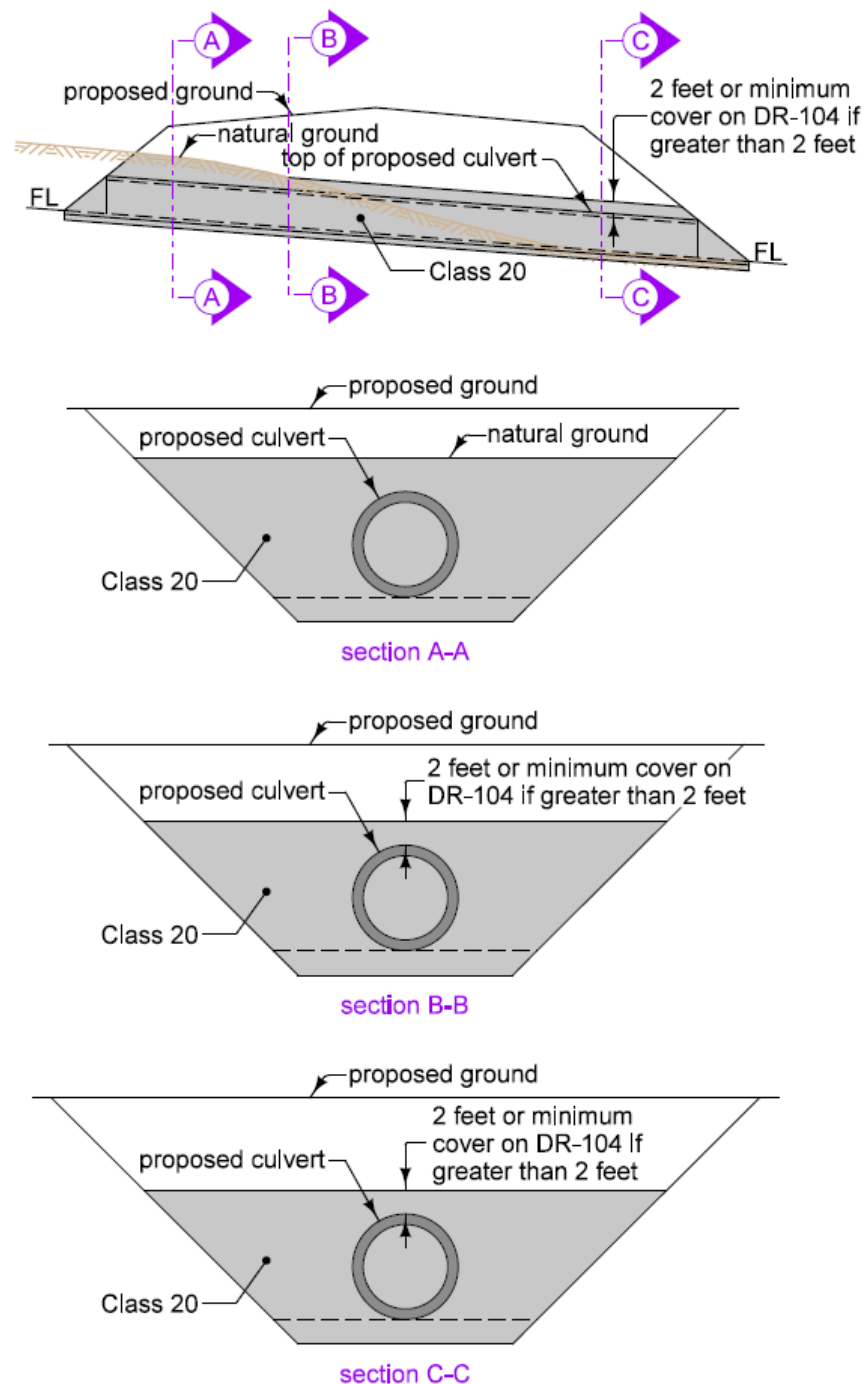


Figure 2: Class 20 for flexible or unclassified pipe installations.

Unclassified pipe may be either flexible or rigid depending on the contractor's choice. Designers should assume flexible pipe and calculate Class 20 the same as for flexible pipe. Since the pipe thickness isn't known, use concrete pipe thickness to be conservative.

Reinforced Concrete Box Culvert and Livestock Pass

Calculate Class 20 as described in Article [2402.04, B, 4](#) of the Standard Specifications. Refer to [DR-111](#) for a cross section of the trench.

Backfill

Pipe Culverts Installed Under Pavement

The quantity of flooded backfill is equal to floodable backfill plus porous backfill, see Tabulation [104-3](#).

H in [DR-101](#) is defined as the cover over the pipe. Because of the slopes of the pipe and pavement, this depth can vary along the pipe. For these calculations, focus on the depth under the pavement area. If any depth of cover under the pavement is less than or equal to 4 feet, include the flowable mortar quantity. Two quantities will need to be determined: flooded backfill and flowable mortar.

Quantities for Flooded Backfill are calculated using the proposed ground. Where the proposed ground is greater than 5 feet above the top of pipe, use top of pipe plus 5 feet as the maximum trench depth (see Note 8 of [DR-101](#)). This maximum is based on Article [2416.03, C](#) of the Standard Specifications. To ensure competitive bidding for fill versus trenched installation, this item will be paid as plan quantity. Care should be taken to estimate Flooded Backfill as accurately as possible.

For letdown structures, use Class C bedding under the letdown portion and Class B bedding on the portion of the pipe under the roadway. Flooded backfill quantity should be calculated as if the pipe continued to the foreslope at the same slope as the cross road portion.

A gap will exist between the top of the flowable mortar and the normal top of subgrade, see Figure 3. If this gap exceeds 6 inches (e.g. superelevated curves), fill the area with Special Backfill or Modified Subbase. If it is 6 inches or less, fill the area with Granular Subbase or Modified Subbase.

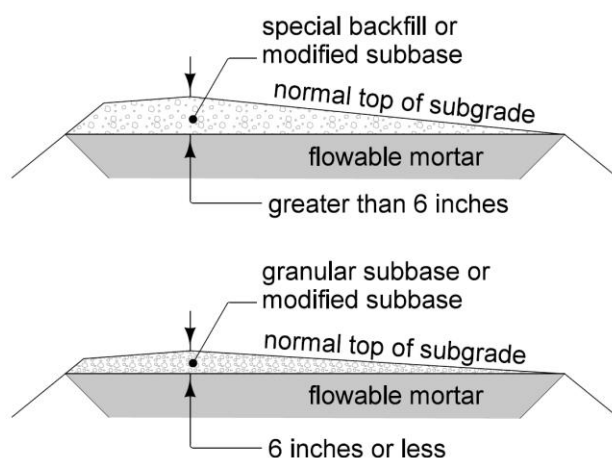


Figure 3: Gap between flowable mortar and normal top of subgrade.

Pipe Culverts Installed outside of Pavement

For roadway pipe culverts not installed under pavements, bedding and backfill (if excavated material) is incidental to pipe culvert and pipe excavation, respectively.

For entrance pipe culverts, excavation is included in other quantities.

Box Culverts and Livestock Passes Installed under Pavement

Backfill consists of two components: floodable backfill and suitable soil. Floodable backfill is placed to a height of 5 feet. The remaining backfill is suitable soil. Refer to [DR-111](#) for a cross section.

Box Culverts and Livestock Passes Installed outside of Pavement

For roadway box culverts not installed under pavements, backfill is placed according to Article [2402.03, H](#) of the Standard Specifications.

Chronology of Changes to Design Manual Section:

005A-005 Culvert Excavation and Backfill

8/5/2016	VOID Void. Material has moved to Section 5B-2
7/2/2015	Revised Corrected Figure 1 (section C-C was labeled as section B-B) and removed reference to Article 2402.05, B of the specs, which has been deleted. M & D control not needed since flooded backfill extends 6 feet beyond outside of structure.
1/22/2015	Revised Update references to renumbered standards. Revised Figures 1 and 2 to show cross sections. Added Figure 3 for fill above flowable mortar.
5/15/2014	Revised Rewrote to reflect changes associated with flooded backfill.