Section 2416. Rigid Pipe Culverts

2416.01 DESCRIPTION.

Furnish and install concrete pipe for roadway and entrance culverts.

A. Roadway culverts are defined as culverts placed on a public way, whether Primary Road, Secondary Road, city street, or other way maintained for public traffic.

B. Entrance culverts are defined as culverts for private drives such as entrances to farms, city lots, and so on, which are not maintained for public traffic.

2416.02 MATERIALS.

Meet the requirements of Section 4145 for the type and class of pipe specified in the contract documents.

2416.03 CONSTRUCTION.

A. Class 1500D (75D) pipe may be used for entrance culverts only. Use class 2000D, 3000D, or 3750D (100D, 150D, or 175D) pipes for roadway culverts, or if conditions require, for entrance culverts. Table 2416.03-1 provides minimum and maximum allowable pipe sizes.

Table 2416.03-1: Minimum and Maximum Allowable Pipe Sizes

Culvert Use	Minimum Pipe Size in. (mm)	Maximum Pipe Size in. (mm)
Roadway Culvert	18 (450)	108 (2700)
Entrance Culvert	15 (375)	108 (2700)

B. For 24 inch (600 mm) or larger diameter pipes, the number of 4 foot (1.2 m) sections is to be the minimum necessary to produce the length of culvert required.

C. Where a new fill is being constructed, place roadway pipe in a trench only when the total fill over the pipe is 5 feet (1.5 m) or less. Place embankment within the restrictions of Article 1105.14.

D. Except as indicated otherwise in the contract documents, install pipe culverts according to the following requirements:

1. Trench Width.
Ensure the trench is wide enough to permit tamping of bedding material under and around the pipes. The Contractor has the option to cut a trench wide enough to accommodate a tamping type roller on each side of the pipe.

2. Base Preparation.

a. Bring the surface upon which the pipe sections are to rest to a suitable elevation to fit the desired grade and camber. Prepare the base as shown in the contract documents. Use Class B bedding when specified. Use Class C if not specified.

1) Class B Bedding.
Class B bedding consists of a 2 inch (50 mm) cushion of sand shaped with a template to a concave saddle in compacted or natural earth to such a depth that 15% of the height of the pipe rests on the sand cushion below the adjacent ground line.

2) Class C Bedding.
Class C bedding consists of a concave saddle shaped with a template, or shaped by other means and checked with a template, in compacted or natural earth to such a depth that 10% of the height of the pipe rests below the adjacent ground line.

b. Where bedrock, shale, or very hard clay is encountered, excavate the trench below the bottom of the pipe for a depth of at least 1 foot (0.3 m). Place earth backfill material and thoroughly tamp.

c. If the bottom of the footing is of an unstable nature, the Engineer may direct that the foundation be treated by first excavating below the required elevation and then placing backfill materials consisting of one of the granular surfacing materials listed in Section 4120 or other suitable material approved by the Engineer. Place backfill material according to Article 2402.03, H, or as directed by the Engineer.

d. Unless bedding is specifically designated in the contract documents, Class C bedding will not be required for entrance pipe 24 inches (600 mm) or less in diameter. Instead, the pipe may be bedded carefully in suitable material and the backfill material compacted with a mechanical tamper to mid-height elevation of the pipe. Complete remaining backfill material placement according to Article 2416.03, D, 4.

3. Placing Pipe Sections.

a. Provide proper facilities for lowering sections into place without damage to the pipe.
b. Carefully lay pipe with hub, bell, or groove ends upstream.
c. Carefully bed and place each section in close contact with adjacent sections, with lifting holes (if provided) at the top.
d. Place pipe section to alignment and grade established or approved by the Engineer.
e. Fill lifting holes (if provided) with concrete or precast concrete plugs prior to placing backfill material.

4. Placing Backfill Material around Pipe Culverts.

a. Thoroughly tamp under and around the pipe in layers not to exceed 8 inches (200 mm) for the full length and width of the pipe.
b. Fill and thoroughly tamp earth around and over the culvert for its full length, according to Articles 2402.03, G and 2402.03, H. Ensure that adjacent to the pipe on each side is an embankment of thoroughly tamped or undisturbed earth.
c. Extend the embankment on both sides of the culvert from the original ground line to at least 1 foot (0.3 m) above the top of the pipe with a slope as shown in the contract documents. Ensure the width of this fill at its top is no less than the outside diameter of the culvert and extends one-half its width on each side of the culvert center line. Increase the height of fill, if necessary to accommodate construction traffic, to the nominal diameter of the pipe or 3 feet (1 m), whichever is greater.
d. When pipes are laid wholly or partly in a trench, granular backfill material may be required for backfill material as provided in Article 2402.03, H. Use compacted earth for the remainder of the fill, to at least 1 foot (0.3 m) above the top of the pipe, with slopes as outlined above.
e. If the trench is cut wide enough to permit the use of a roller, first bed the pipe and then thoroughly tamp the backfill material under and alongside the pipe to the mid-height elevation of the pipe. Place and compact the remainder of the backfill material according to Section 2107.
f. If a roadway pipe culvert is being placed after construction of an embankment and moisture control is not required, place the pipe using methods that will produce results equivalent to those required for construction of the embankment. For this situation, moisture determinations will be waived for backfill material placement completed within 48 hours after excavation.
g. When ordered by the Engineer, build approach fills to provide a roadway 10 feet (3 m) in width over the culvert with grades not steeper than 10%.

5. Concrete Pipe Joints.

a. When required by the contract documents, wrap concrete pipe joints with Engineering Fabric of the type specified.
b. Ensure joint openings on the outside or inside of the bottom half of the pipe do not exceed 1/4 inch (6 mm) for pipe with an internal diameter of 24 inches (600 mm) or less.
c. For pipe with an internal diameter of more than 24 inches (600 mm), ensure joint openings on the outside or inside of the bottom half of the pipe do not exceed 1/8 inch per foot (1 mm per 0.1 m) of internal diameter, with a maximum allowable joint opening of 5/8 inch (15 mm).
d. Fully encase larger joint openings, unless they are required for pipe camber, with a Type C-1 concrete collar. Use Class C structural concrete as specified in Section 2401. Point the collar and inner surface of the joint full and flush using sand cement mortar for the lower 75% of the pipe perimeter.

2416.04 METHOD OF MEASUREMENT.

Measurement for the items associated with rigid pipe culverts will be as follows:

A. Pipe culvert: measured length, in feet (meters), of culvert installed, excluding aprons, to the nearest foot (0.1 m) with no deductions for elbows, tees, and other fittings. Quantity will be determined

along the axis. Measurement for pipe laterals terminating at a tee will be from the point of inlet to a point 6 inches (150 mm) from the outside of the main, less the length of the apron, if any.

B. Aprons: quantity shown in the contract documents.

C. Appurtenances (elbows, tees, and other fittings): not measured for payment, but quantity will be shown on the contract documents.

D. Type C adaptors required by the contract documents or installed to correct faulty work will not be measured for payment.

E. Excavation for culverts:

1. Roadway culverts: Article 2402.04, C applies.

2. Entrance culverts: not measured for payment.

3. Sand required for Type B bedding: not measured for payment.

F. Granular Backfill (when required and furnished): Article 2402.04, E, applies.

G. Foundation treatment material (when placed at the direction of the Engineer): Article 2402.04, F, applies.

2416.05 BASIS OF PAYMENT.

Payment for the items associated with rigid pipe culverts will be the contract unit price as follows:

A. Pipe culvert: per linear foot (meter) for type and size specified.

B. Wrapping pipe joints, Type C adapters, and appurtenances: included in the contract unit price per linear foot (meter) for the pipe culvert.

C. Aprons: per unit for the size specified.

D. Payment for Type C adaptors not shown in the contract documents, but required because of changes in alignment will be as extra work according to Article 1109.03, B.

E. Excavation for culverts:

1. Roadway culverts and the quantity of extra excavation for embankments: per cubic yard (cubic meter).

2. Entrance culverts: incidental to the contract unit price for rigid pipe culvert.

3. Sand required for Class B bedding: incidental to the contract unit price for pipe culvert.

F. Granular Backfill (when required and furnished): Article 2402.05, G, applies.

G. Foundation treatment material (furnished and placed): Article 2402.05, F, applies.