SECTION 520 PIPE CULVERTS

520.1 Description

(1) This section describes providing culvert pipe, cattle pass, and apron endwalls where the material used is a contractor option; providing and removing temporary culvert pipe; and cleaning existing culvert pipes.

520.2 Materials

520.2.1 Culvert Pipe

(1) Furnish culvert pipe consistent with the diameter the bid item indicates. For class III, IV, and V pipe the contractor may furnish either corrugated steel pipe of the thickness the contract designates or reinforced concrete pipe of the designated class. For class III pipe the contractor also has the option of furnishing corrugated polyethylene pipe for diameters 36 inches (914 mm) and less.

(2) For the given materials, conform to the following:

Corrugated steel pipe 521.2
Reinforced concrete pipe 522.2.2
Corrugated polyethylene pipe 530.2

(3) Under the Culvert Pipe Temporary bid items, use either new or used culvert pipe in a condition suitable for the purpose intended.

520.2.2 Pipe Cattle Pass

(1) Under the Pipe Cattle Pass bid item, if the plans do not designate a specific material, the contractor may use either corrugated steel or reinforced concrete. For the given materials, conform to the following:

Corrugated steel pipe cattle pass 521.2
Reinforced concrete pipe cattle pass 522.2.3

520.2.3 Apron Endwalls for Culvert Pipe

(1) Under the Apron Endwalls for Culvert Pipe bid items, use steel apron endwalls for corrugated steel and corrugated polyethylene pipe culvert installations, and use concrete apron endwalls with concrete pipe culvert installations. For the given materials, conform to the following:

Steel apron endwalls 521.2
Concrete apron endwalls 522.2.4

520.3 Construction

520.3.1 General

(1) Unless the engineer authorizes otherwise in writing, the contractor shall not order and deliver pipe culverts for the project until the engineer furnishes a corrected list of sizes and lengths.

(2) Provide all temporary drainage facilities necessary to protect the work and adjacent property. Maintain temporary drainage in effective operating condition, as the engineer approves, until the permanent culvert pipe installations are operational. Remove and dispose of temporary culverts after the permanent culvert pipe installations are operational.

520.3.2 Excavating and Forming Bed for Pipe Culverts

520.3.2.1 Public Highway Culvert

(1) If placing pipe culverts under any public highway in open trenches, either place them in an excavation in the existing ground, or in previously placed embankment compacted as specified for embankment in section 207. Place and compact the embankment to at least the elevation of the top of the culvert before excavating the trench. Avoid placing embankment to an elevation exceeding 2 feet (600 mm) above the top of the culvert before placing the culvert.

(2) Perform trenching and excavating according to 29 CFR part 1926, OSHA subpart P for excavations. If the height of the proposed embankment or earth cover above the top of the pipe exceeds 6 feet (1.8 m), excavate the trench below the top of the pipe as vertical as possible.

(3) For steel or concrete pipe, make the trench wide enough to allow for preparing the foundation, laying the pipe, and placing and compacting backfill as specified, except that the trench width shall not exceed the pipe's outside diameter by more than 36 inches (900 mm). For polyethylene pipe, conform to ASTM D

2321 and ensure that the trench is as wide or wider than the pipe outside diameter plus 16 inches (406 mm) or the pipe outside diameter times 1.25 plus 12 inches (25 mm) which ever is wider.

(4) For pipe culverts, unless rock is present, the contractor may lay pipe either on a shaped, firm, earth subgrade, or on a backfilled granular foundation or bed.

(5) If the pipe foundation is firm earth, shape the trench bottom to give full and continuous support to the pipe for at least the lower 1/10th of the outside height of circular pipes or pipe arches.

(6) If backfilling the pipe foundation with granular material, excavate the trench to at least 6 inches (150 mm) below the elevation established for the bottom of the pipe. Backfill this depth with granular backfill as modified in 209.2.1 for bedding under culvert pipes, or with engineer-approved graded aggregate, that passes a one-inch (25.0 mm) sieve. Before laying the pipe on the backfilled granular material, compact the material. After laying circular pipe on this foundation, place additional granular material conforming to the above requirements under and around the pipe in layers not exceeding 6 inches (150 mm). Compact this material by ramming, tamping, or vibrating to provide full and continuous support of the pipe for at least the lower 1/6th of its outside vertical diameter.

(7) If placing pipe arches, excavate and backfill the trench as specified above, except backfill the trench, compact, and trim to a height that fully and continuously supports the pipe arch for at least the lower 1/6th of its height.

(8) If the existing granular foundation material for at least 6 inches (150 mm) below the pipe bottom conforms to the above requirements for granular backfill, as the engineer determines, and if no rock exists within the specified depth for granular cushion, the contractor may omit excavation and backfill beneath the pipe, and may omit shaping the bed for circular pipe.

(9) If rock, hardpan, or fragmented material exists, excavate the trench below the pipe to an amount equal to 1/2 inch per foot (13 mm per 300 mm) of proposed embankment above the top of the pipe, but not less than 6 inches (150 mm), and backfill with material conforming to the above requirements to produce a granular cushion. Place additional granular material under and around the pipe as specified above.

(10) Excavate recesses to receive bells if necessary.

(11) If the plans show bedding types other than described above, conform to the plan details.

520.3.2.2 Private Entrance and Temporary Culverts

(1) Shape the earth foundation for the pipe culverts for private entrances, and temporary installations to fit the pipe exterior with reasonable closeness for a height of at least 10 percent of the pipe's overall diameter.

(2) If rock, hard pan, boulders, or fragmented material exist, bed the pipe on an earth, or granular cushion, compacted and shaped similarly to the above, for no less than 6 inches (150 mm) below the pipe.

520.3.3 Laying Pipe

(1) Do not place any pipe culvert until the engineer approves the foundation. Additionally, do not place pipe culverts in cuts until completing the rough grading.

(2) Unless the plans show otherwise, if laying 2 or more pipes next to each other, separate them by a distance equal to at least 1/2 the pipe diameter, with a minimum distance of 18 inches (450 mm). For pipes with attached apron endwalls, separate them by a distance that provides a minimum of 6 inches (150 mm) between the apron endwalls. For cast-in-place concrete or other alternate endwall installations, space pipes as the plans show.

(3) Lay concrete pipe with bells or grooves up grade and with spigot or tongue ends fully inserted in the bells or grooves. Protect each joint against backfill infiltration by providing a full circumferential wrap of geotextile fabric extending one foot (300 mm) or more on each side of each joint and securing the wrap in place. The geotextile shall conform to 645.2.4, schedule A.

(4) The contractor may use sealers conforming to 607.2 instead of the geotextile fabric joint wrap. Construction methods for sealing joints with these sealers shall conform to 607.3.4.

(5) Furnish and install joint ties for reinforced concrete culvert pipe and reinforced concrete pipe cattle pass conforming to plan details, if required.

(6) Lay riveted or spot-welded corrugated steel pipe so that flow is over the lap of the sheets, except for beveled end sections where the contractor may reverse the lap at the outlet end. Make field joints by

joining the metal pipe sections together with a band bolted firmly in place. If elongation of the vertical diameter is specified, provide an appropriately modified prefabricated section.

(7) Ensure that joints for polyethylene pipe are soil tight according to AASHTO M 294.

(8) Lay all pipes true to the designated line, grade, and required camber. Fit and match them to form a smooth and uniform invert.

(9) Carefully fit the sections of pipe together to keep the size of joint openings to a minimum.

(10) Clean sockets carefully before lowering pipes into trenches. Lower the pipes in a manner that avoids unnecessary handling in the trench.

520.3.4 Backfilling

520.3.4.1 Public Highway Culverts

(1) Backfill permanent pipe culvert installations under any public highway with selected material from excavation that is free of large lumps, clods, or rock. If the contract or engineer specifies, backfill with granular backfill conforming to 209.2. If granular backfill contains 3-inch (75 mm) or larger rocks, place so that the rocks do not contact the pipe during compaction.

(2) Place backfill in the trench over the top of the earth, granular foundation, or bed. Carefully place and thoroughly ram, tamp, or vibrate around the pipe in layers no greater than 6 inches (150 mm) deep, to the top of the pipe. Compact the entire length of each layer before placing the next layer.

(3) Place and compact backfill material above the pipe in layers no more than 12 inches (300 mm) deep, to the top of the trench. Compact to the same degree as the material next to the trench.

(4) Immediately after backfilling, cushion the installation as necessary by placing compacted earth embankment over the pipe for at least the trench width. Provide 2 feet (600 mm) or more cover, including backfill depth, above the pipe. Maintain this cushion during subsequent construction operations.

(5) Place the remaining portion of the embankment, if any, above the top of the trench as specified for the adjacent embankment.

(6) If the plans show the extent of excavation and backfill requirements for pipe culverts, conform to those plan details.

520.3.4.2 Private Entrance and Temporary Culverts

(1) Carefully backfill private entrance and temporary culverts, then ram and tamp material to completely fill all spaces under and next to the pipe.

520.3.5 Placing Apron Endwalls

(1) Excavate the bed for the apron endwall to the required width and grade. For metal aprons with toe plates, excavate a trench to allow placing the toe plate against the inner face of the trench if the apron is in its final position. After securing the apron to the pipe, backfill and firmly compact the trench.

(2) Place the concrete apron endwall with its tongue or groove fully entered in the groove or tongue of the pipe.

(3) Use the same backfill for the apron as required for the culvert pipe unless the engineer directs otherwise.

520.3.6 Cleaning Culvert Pipes

(1) Clean the existing culvert pipes of all dirt and vegetation. Use all suitable materials removed from the culvert pipes in other areas requiring fill material within the project limits as the engineer directs. Dispose of surplus and unsuitable material as specified in 205.3.12.

520.3.7 Deflection Testing

(1) The department accepts polyethylene pipe based on testing with a department-approved mandrel. Test pipe as the engineer directs after installation but before paving or finish grading.

(2) Provide a mandrel with a diameter equal to 95 percent of the nominal diameter of the pipe and having cable attachment points on each end of the core. Ensure that the mandrel has nine fins or legs permanently marked to designate the pipe size and the allowable percent deflection.

(3) The engineer will designate at least 10 percent of the installed length of pipe for testing The mandrel must pass through the entire section in one pass when pulled by hand without using excessive force. If the designated length of pipe fails, engineer may require additional testing.

(4) Relay or replace pipe with deflection greater than 5 percent. Retest all relayed or replaced pipe.

520.3.8 Protection After Laying

(1) Protect all culvert pipes until final acceptance of the work. The contractor shall replace any pipe damaged, either through its operations, or through its failure to protect the installation.

520.4 Measurement

(1) The department will measure the Culvert Pipe bid items and Pipe Cattle Pass by the linear foot acceptably completed, determined by multiplying the number of units in the pipe culvert by their commercial laying length. The department will measure pipes with skewed or beveled ends by multiplying the number of regular units by their commercial laying length and adding the length of each skewed or beveled end section measured on the centerline of the structure along the flow line of the section. The department will measure elbows on the centerline and along the flow line of the elbow.

(2) The department will measure the Apron Endwalls for Culvert Pipe bid items as each individual unit acceptably completed.

(3) The department will measure Cleaning Culvert Pipes as each individual unit acceptably completed.

520.5 Payment

(1) The department will pay for measured quantities at the contract unit price under the following bid items:

ITEM NUMBER	DESCRIPTION	UNIT
520.0100 - 0299	Culvert Pipe Class III (size)	LF
520.0300 - 0599	Culvert Pipe Class IV (size)	LF
520.0600 - 0899	Culvert Pipe Class V (size)	LF
520.1000 - 1199	Apron Endwalls for Culvert Pipe (size)	EACH
520.4000 - 4199	Culvert Pipe Temporary (size)	LF
520.5000	Pipe Cattle Pass	LF
520.7000	Cleaning Culvert Pipes	EACH

(2) The department will make no additional compensation to the contractor for using sealers instead of geotextile fabric as allowed under 520.3.3.

(3) Payment for the Culvert Pipe bid items and Pipe Cattle Pass is full compensation for providing, hauling, and placing the pipe, including bands, geotextile joint wrap if required, and joint tie if required; for all excavating, including foundation or bed, and any associated dewatering; for providing and placing granular backfill or graded aggregate for granular foundation or cushion; for backfilling unless granular backfill is specified; for maintaining temporary drainage; and for replacing damaged installations. The department will pay separately for cast-in-place concrete and alternate endwall installations under the Concrete Masonry Endwalls bid item as specified in 504.5 and other associated bid items.

(4) Payment for Culvert Pipe Temporary also includes removing and disposing of the temporary culverts.

(5) Payment for the Apron Endwalls for Culvert Pipe bid items is full compensation for providing, transporting, and installing the apron endwalls, including bands or connectors; for all excavating, including forming bed; and for backfilling unless granular backfill is specified.

(6) If the contract specifies or the engineer directs backfilling with granular backfill, the department will pay for that backfilling as follows:

- If the contract contains the Backfill Granular bid item; the department will pay separately under the Backfill Granular bid item as specified in 209.5.
- If the contract as bid requires granular backfill but does not contain the Backfill Granular bid item, backfilling with granular backfill is incidental to the work.
- If the contract as bid does not require granular backfill and does not contain the Backfill Granular bid item, backfilling with granular backfill is extra work.

(7) Payment for Cleaning Culvert Pipes is full compensation for cleaning the culvert pipe and for disposing of excess material.