

206 Excavation for Structures

206.1 Description

- (1) This section describes excavating for culverts, structural plate pipe, and structural plate pipe arches, bridges, and retaining walls. It also describes removing old substructure units within the space occupied by the new structure.

206.2 Materials

- (1) Furnish backfill material of a quality acceptable to the engineer and free from frozen lumps, wood, or other extraneous or perishable material. The contractor may use engineer-approved material obtained from excavation.
- (2) If the contract specifies structure backfill, furnish material conforming to [210](#). The contractor may use material conforming to the requirements for structure backfill obtained from excavation as specified under [104.8](#).

206.3 Construction

206.3.1 General

- (1) Under the Excavation for Structures bid items, excavate material of whatever nature encountered. The department will not classify this excavation as common, rock, or marsh excavation under [205](#) or as dry or wet excavation.
- (2) Remove logs, stumps, and other materials and obstructions necessary to place the foundations and structure. Dispose of material obtained from excavation. Backfill, compact, shape, slope, and clean the site.
- (3) Construct, and subsequently remove, necessary cofferdams and cribs or well-point systems, and the necessary sheeting, shoring, bracing, draining, and pumping to allow constructing the substructure, above the seal, in the dry. Do not use stream diversions and earth dikes instead of specified cofferdams or well-point systems, unless the engineer authorizes in writing.

206.3.2 Excavation Depth

- (1) The elevation of the bottoms of footings, as the plans show, is approximate only. The engineer may order, in writing, changes in dimensions or elevation of footings necessary to secure a satisfactory foundation.

206.3.3 Cofferdams and Cribs

- (1) If providing cofferdams and cribs for foundation construction, ensure that they are safely designed and constructed, carried to adequate depths and heights, and are made watertight as necessary for the proper performance of the work. Construct cofferdams and cribs so that interior dimensions give sufficient clearance for the construction of forms and the inspection of their exteriors, and to allow pumping from sumps outside the forms. If cofferdams or cribs tilt or move laterally during the process of sinking, right, reset, or enlarge them to provide the necessary clearance. The contractor is responsible for any claims for damages resulting from the use of a well-point system.

206.3.4 Protecting Concrete

- (1) Construct cofferdams and cribs to protect fresh concrete against damage from a sudden rising of the stream and to prevent damage to the foundation by erosion. Place wales and cross braces at locations that allow construction of the substructure unit without construction joints other than those the plans show. If required to leave wales or braces in place, use only pipe, precast concrete or rolled steel sections. Do not box out with timber braces.

206.3.5 Plans Required

- (1) Submit one copy of signed and sealed plans as specified for cofferdams and cribs under [105.2](#), showing the proposed method of cofferdam or crib construction for the file. At the engineer's request, submit 2 additional copies of these plans for review. If the engineer does not find the plans submitted for review satisfactory, make the required changes. The department will not relieve the contractor of the responsibility to secure a safe and satisfactory cofferdam or crib.

206.3.6 Removal

- (1) Unless specified otherwise, remove cofferdams or cribs, including sheeting and bracing, after the completion and curing of the substructure unit. Exercise care not to disturb or otherwise injure the finished masonry.

206.3.7 Excavation

- (1) Notify the engineer sufficiently before beginning excavation for structures so the engineer may take elevations and measurements of the existing ground and substructure units before disturbance and removal.
- (2) Excavate as specified in 29 CFR Part 1926 OSHA subpart P for excavations. Slope the sides of the excavation as required by soil conditions to stabilize the sides for safe working conditions. Limit excavation to the quantity considered necessary for safety. If the plans require, shore the excavation instead of sloping the sides. If the plans do not require shoring, the contractor may elect to use, at no expense to the department, shoring rather than excavating to a slope.

http://www.dol.gov/dol/cfr/title_29/

206.3.8 Preparing Foundation for Footings

- (1) Free rock or other hard foundation material of loose material. Clean and cut this material to a firm surface, either level, or stepped, or serrated. Clean out and fill seams with cement mortar or grout.
- (2) If masonry is to rest on an excavated surface other than rock, exercise special care not to disturb the bottom of the excavation. Do not make the final removal of the foundation material to grade until just before placing the masonry. Protect surfaces from freezing after excavation and before placing concrete for the footing. Do not place concrete on frozen subgrade.
- (3) If using foundation piles, substantially complete the excavation of each pit before beginning pile-driving operations in the pit. After completing pile-driving operations in a given pit, remove loose and displaced material in the pit to the elevation of the bottom of the footings.
- (4) If the contractor can place footings in dry foundation pits, it may omit footing forms, with the engineer's approval. In this case, fill the entire excavation with concrete to the elevation of the top of the footing.
- (5) For footings founded on sound rock, key them into the rock as the plans require. If required, conform the keyway to plan dimensions. For footing excavations in sound rock, fill the footing with concrete to the elevation of the top of the rock or the top of the footing, whichever is lower.

206.3.9 Dewatering

- (1) If possible, dewater foundation excavations before depositing masonry within.
- (2) Pump from the interior of foundation enclosures in a manner to preclude, if practicable, removing foundation material or concrete ingredients.
- (3) Do not pump from the interior of a foundation enclosure while placing concrete in the enclosure or for at least 24 hours afterwards, unless done from a suitable sump outside the forms. Do not pump from within any foundation enclosure while depositing concrete under water in the enclosure. Do not begin pumping to dewater a sealed cofferdam until the seal has set sufficiently to withstand the hydrostatic pressure, or until at least 3 days have elapsed since placing the seal.

206.3.10 Subfoundation Course

206.3.10.1 Bridges and Retaining Walls

- (1) If placing masonry on a soft, muddy, or muck-covered surface that will not dry out and harden if the excavation is kept dewatered for a reasonable length of time, furnish and place a subfoundation course if the engineer directs. Construct a subfoundation course of structure backfill conforming to [210](#), or other engineer-approved materials. Place the subfoundation course directly below the elevation of the bottom of the footings to the depth the engineer designates.

206.3.10.2 Culverts

- (1) Place a 6-inch subfoundation course of structure backfill conforming to [210](#), or other engineer-approved materials, directly below the elevation of the bottom of the slab between the cutoff walls of culverts.

206.3.10.3 Structural Plate Pipe and Pipe Arches

- (1) Place subfoundation courses, including bedding courses, for structural plate pipe and pipe arches as specified for erection in [527.3.2](#).

206.3.11 Foundation Seal

- (1) If the contractor encounters conditions that make it impracticable to dewater the foundation excavation before placing the masonry, the engineer may require construction of a concrete foundation seal of necessary dimensions. After the seal sets, dewater the foundation excavation and place the balance of the masonry in the dry. Place foundation seals the plans do not show below the bottom of the footing unless authorized otherwise. Place concrete in foundation seals as specified for depositing concrete underwater in [502.3.5.3](#).

206.3.12 Inspection

- (1) Do not place any masonry or erect any form or structural plate pipe or pipe arch in any excavation until the engineer approves the depth of the excavation and the character of the foundation material.

206.3.13 Backfilling

206.3.13.1 General

- (1) Backfill spaces excavated and not occupied by the new structure to the elevation and section existing before excavation. Do not place backfill above the required section for the finished work. If placing backfill, provide allowance for settlement.
- (2) Do not backfill substructure units, except as required for the safety of workers, until clearing the area involved of falsework, sheet piling, cribbing, shoring, bracing, forms, and rubbish. Backfill the cofferdams before removing the sheeting, unless the engineer allows otherwise.
- (3) If required for the safety of workers, and with the engineer's approval, the contractor may remove sheet piling, cribbing, shoring, and bracing as backfilling progresses.
- (4) Perform backfilling to prevent wedging action against the structure. Step, terrace, or treat existing slopes as necessary to prevent slipping and wedging of the backfill.
- (5) Unless specified otherwise, place backfill in continuous horizontal layers no more than 8 inches thick. If practicable, uniformly raise layers on all sides of each substructure unit or culvert. Surround the stone used in backfilling by finer material. Compact each layer, before placing the next layer, by using engineer-approved rollers or portable mechanical or pneumatic tampers or vibrators.
- (6) If there is water in an excavation, backfill to displace the water but not trap it within the excavation. Do not use water to expedite backfill settlement except with the engineer's written approval. However, the engineer will not require the contractor to dewater the excavation before placing backfill. If allowed to use water, keep the entire excavation inundated while placing backfill, except if jetting.
- (7) Conduct backfilling operations to avoid damage or deflecting any portion of the structure out of alignment. Gradually deposit the backfilling material transported in trucks or other vehicles instead of dumping the entire contents as one mass. Lower clams, dippers, and similar backfill containers to within 5 feet of previously deposited backfill, or of the water surface, before dumping.
- (8) The contractor may end dump backfill from the structure or approach embankment if it intends to spread and place the end-dumped material in the above-described 8-inch horizontal layers. Do not place backfill in or from narrow ramps or driveways up to or from the structure.
- (9) Perform backfilling around structural plate pipe and pipe arches as specified for backfilling around pipe and pipe arches under [527.3.3](#).
- (10) Extend the backfill along the front face of abutments, retaining walls, and wing walls to within 6 inches of the weep holes, unless designated otherwise.
- (11) If weep holes are designated on the plans for culverts, abutments, and retaining walls, deposit coarse gravel or crushed stone behind the culvert, abutment, or retaining wall at the level of the weep holes according to dimensions the plans show.
- (12) Do not place backfill against any portion of any substructure unit until completing the required curing, surface preparation, dampproofing, and waterproofing of the work to be backfilled.

206.3.13.2 Self-Supported Abutments and Retaining Walls

206.3.13.2.1 General

- (1) Allow self supported structures to develop sufficient strength before backfilling.

206.3.13.2.2 Backfill on One Side of the Structure

- (1) The contractor may backfill structures that have attained the specified compressive strength or upon expiration of the minimum time periods tabulated below:

STRUCTURE TYPE ^[1]	GENERAL PURPOSE	HIGH EARLY STRENGTH	COMPRESSIVE
	CONCRETE in days ^[2]	CONCRETE in days ^[2]	STRENGTH in psi
Abutment type A1, A2, A5 ^[4]	2	1	2000
Abutment type A3 ^[3]	2	1	2000
Abutment type A4	14	7	3000
Full retaining abutments	14	7	3000
Box culverts ^[5]	14	7	3000
Retaining walls and end walls	14	7	3000

[1] Abutment types:

A1: Body about 5 feet tall with one row of piles.

A2: Body about 5 feet tall with 2 rows of piles.

A3: Body about 5 feet tall with backwall and 2 rows of piles

A4: Body about 13 feet tall with backwall and 2 or more rows of piles.

A5: Body about 10 feet tall with one row of piles extending to within 2 feet of abutment top.

Full retaining: Body extending from lower roadway/river elevation to beam seats.

[2] Only count days where the concrete temperature did not fall below 40 F.

[3] Upon obtaining the required compressive strength, the contractor may backfill the body of A3 abutments before placing the backwall.

[4] Place and cure the superstructure before backfilling A5 abutments as specified in [206.3.13.3](#).

[5] Place and cure the top before backfilling except as allowed under [206.3.13.3](#).

206.3.13.2.3 Backfill on Both Sides of the Structure

- (1) The contractor may backfill footings to the top of the footings; sill abutments to the berm elevation; and retaining walls and piers uniformly and simultaneously on both sides to the elevation of the front ground surface immediately upon removing the forms.

206.3.13.3 Rigid Frame Structures

- (1) Do not place backfill against an abutment or wall designed to gain support from a superstructure until placing and curing that superstructure.
- (2) The contractor may backfill 1/4 of the total wall height of a box culvert after attaining a wall compressive strength of 2000 psi. Do not complete the backfill until the top is placed and conforms to [206.3.13.2.2](#).

206.3.14 Incorporating or Disposing of Excavated Material

- (1) Incorporate excavated material in the work to the extent practicable. Use materials with suitable engineering properties for riprap or backfill. If the contract contains the Excavation Common or Borrow bid items and embankment material is needed at the time of disposal, use the balance of the excavated material, with suitable engineering properties, in the embankment.
- (2) Dispose of surplus or unsuitable material as specified in [205.3.12](#).

206.3.15 Preserving Channels and Waterways

- (1) Unless otherwise allowed, do not excavate outside caissons, cribs, cofferdams, or sheet piling, and do not disturb the natural streambed next to the structure. If performing any excavation or dredging at the site of the structure before caissons, cribs, or cofferdams are sunk in place, backfill these excavations to the original ground surface or stream bed with material satisfactory to the engineer after placing the foundation.
- (2) After completing work within cofferdams, cribs, or sheet piling, backfill excavated areas within the cofferdams to the stream bed elevation, unless specified otherwise.
- (3) Remove excavated material and debris resulting from the contractor's operations from stream channels, ditch lines, or waterways to the level of the finished streambed or ground line at no expense to the department.

206.4 Measurement

- (1) The department will measure the Excavation for Structures and Cofferdams bid items as each individual structure acceptably completed.

206.5 Payment

206.5.1 General

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

<u>ITEM NUMBER</u>	<u>DESCRIPTION</u>	<u>UNIT</u>
206.1001	Excavation for Structures Bridges (structure)	EACH
206.2001	Excavation for Structures Culverts (structure)	EACH
206.3001	Excavation for Structures Retaining Walls (structure)	EACH
206.4001	Excavation for Structures Structural Plate Pipe or Pipe Arches (structure)	EACH
206.5001	Cofferdams (structure)	EACH

- (2) The department will pay for material excavated under this section and used in embankments at the contract unit price for Borrow, or absent the Borrow bid item, at the contract unit price for Excavation Common. The department will measure material as specified for excavation in [205.4.1](#).

- (3) The department will pay separately for foundation seals, the plans show or the engineer directs, under the Concrete Masonry Seal bid item as specified in [502.5](#).
- (4) The department will pay separately for excavating unforeseen structures found within the limits of the Excavation for Structures bid items. Unforeseen structures are man-made structures not visible when visiting the construction site and that the plans do not list or show. The department will pay for removing all or part of a culvert or bridge as specified in [203.5](#). The department will pay for excavating other unforeseen structures as extra work. Other removals visible when visiting the construction site or that the plans list or show are incidental to the work.

206.5.2 Excavation for Structures

- (1) Payment for the Excavation for Structures bid items is full compensation for removing excavation, including excavating for seals, girders, projections, and subfoundation courses; for preparing foundation; and for backfilling and compacting space excavated and not occupied by the new structure, including subfoundation course.
- (2) Payment also includes providing cofferdams, cribs, sheeting, shoring, bracing, pumping, and dewatering except, if the contract contains the applicable bid items, the department will pay separately for this work.
- (3) Payment is full compensation for excavation, removed to an elevation between planes one foot above and below the plan elevation of the bottom of the footings or floor of culverts, or the invert of structural plate pipe or pipe arches as the plans show for the specific units.
- (4) If the footing is stepped, or on a slope, payment is full compensation for excavation to an elevation between planes lying one foot above and below the plan elevation of the bottom of the footing, for each stepped section; or excavation between planes lying one foot above, below, and parallel to the slope established by the plan elevations for the bottom of the footing.
- (5) If the engineer orders any excavation be performed to elevations in excess of one foot above or below the elevation of the bottom of the footings or floor or invert as indicated on the plans, the department will pay for this excavation as extra work.
- (6) The department will pay separately for necessary clearing and grubbing under the Clearing and Grubbing bid items as specified in [201.5](#).
- (7) The department will pay separately for structure backfill, if specified, under the Backfill Structure bid item as specified in [210.5](#).

206.5.3 Cofferdams

- (1) Payment for the Cofferdams bid items is full compensation for providing cofferdams and cribs, including well-point systems, sheeting, shoring, and bracing; for constructing, maintaining, backfilling, and removing cofferdams and cribs; and for pumping and dewatering.