

SECTION 401—STRUCTURE EXCAVATION

401.01—Description

This work shall consist of excavating and backfilling or disposing of material necessary for constructing substructures and superstructures of new bridges and altering existing bridges in accordance with the requirements of these specifications and in conformity with the lines and grades shown on the plans or as established by the Engineer.

401.02—Materials

- (a) **Backfill** shall be approved by the Engineer and shall be free from large or frozen lumps, wood, or rocks more than 3 inches in their greatest dimension or other extraneous material. Porous backfill shall conform to the requirements of Section 204.02(c).
- (b) **Pipe underdrains** shall conform to the requirements of Section 232.02.

401.03—Procedures

Excavated material shall generally be used for backfilling and constructing embankments over and around the structure. Surplus or unsuitable material shall be disposed of in a place and manner such that it will not affect or re-enter streams or otherwise impair the hydraulic efficiency or appearance of the structure or any part of the roadway.

Where practicable, substructures shall be constructed in open excavation and, where necessary, the excavation shall be sheeted, shored, braced, or protected by other means. If footings can be placed in the dry without the use of sheeting or cofferdams, forms may be omitted with the approval of the Engineer and the entire excavation filled with concrete to the required elevation of the top of the footing. When forms are eliminated, measurement and payment for structure excavation and concrete will be on a plan quantity basis wherein no adjustments will be made.

Unless tremie placement of concrete is specified, foundations for footings shall be kept free from standing or surface water until concrete and backfill operations have been completed. However, if the foundation is rock or the footing is supported on piles, other than for shelf abutments, dewatering need be performed only during concrete and backfill operations.

- (a) **Preserving the Channel:** Excavation shall not be performed outside caissons, cribs, cofferdams, or sheet piles. The natural streambed adjacent to the structure shall not be disturbed. Material deposited in the stream area because of the Contractor's operations shall be removed, and the stream area shall be freed from obstructions caused by the Contractor's operations.

Prior to beginning work, the Contractor shall submit a plan that shall include the specific location of temporary structures or other obstructions that will constrict the stream flow, a description of construction activities that will contribute to constricting the stream flow, the dimensions and number of temporary structures and constrictions that are to be placed in the stream at any one time, and a dimensional elevation view of the stream and proposed temporary structures and constrictions.

- (b) **Depths of Foundations:** Elevations denoting the bottom of footings shown on the plans shall be considered approximate only. Foundations shall not be considered satisfactory until approved by the Engineer.

When requested, the Contractor shall explore foundations by rod soundings or drillings to determine, to the satisfaction of the Engineer, the adequacy for the foundations to support the structure. If explorations indicate that satisfactory foundations can be obtained, variations from plan depths to foundations of open column abutments and solid or column piers shall be made only by adjusting stem lengths. Footing depths shown on the plans shall be considered minimum depths. Plan depths of concrete for footings may be increased not more than 24 inches at points of local irregularity over solid rock foundations.

Variations from plan depths to foundations of solid or deep curtain-wall abutments shall be made only by adjusting the depths of footings. Plan depths shall be considered minimum depths and shall not be exceeded by more than 3 feet.

If explorations reveal that foundations or subfoundations are inadequate for the structure, or are not within the limits of permissible variation from the bottom of footing elevations, the Engineer shall be consulted for instructions for further action or redesign.

- (c) **Preparing Foundations for Footings:** Hard foundation material shall be freed from loose material; cleaned; and cut to a firm surface, either level, stepped, or serrated as directed by the Engineer. Seams shall be cleaned out and filled with concrete as directed by the Engineer.

When concrete is to rest on an excavated surface other than rock, the bottom of the excavation shall not be disturbed. The final removal of foundation material to grade shall not be performed until just prior to concrete placement.

When the elevation of the bottom of a footing is above the level of the original ground, the footing shall not be placed until the approach embankment has been placed and compacted to the elevation of the top of the footing and excavation has been performed through the embankment to the elevation of the bottom of the footing. When a footing is to be placed over material subject to movement because of pressure from overlying or adjacent fill, the footing or piles for the footing shall not be placed until after the fill has been placed and compacted. Excavation for shelf abutment footings shall be limited to a perimeter extending not more than 18 inches outside the neat lines at the bottom of the footing.

When the material on which a foundation is to be placed using piles is declared unsatisfactory by the Engineer, the excavation shall be undercut for a depth of 6 to 12 inches as directed and backfilled with crusher run aggregate, select borrow, or other material approved by the Engineer.

- (d) **Holes for Drilled-In Caissons:** Foundation bearing areas shall be cut to an approximately level surface except that they may be stepped or serrated on hard rock. If material is encountered that is not sufficiently cohesive to maintain the proper diameter of the hole, casing shall be used.
- (e) **Cofferdams:** Cofferdams for foundation construction shall be as watertight as practicable and carried to a depth that will allow them to function properly without displacement. The interior dimensions of cofferdams shall be such as to give sufficient clearance for the construction of forms and inspection of their exteriors and permit pumping from outside the forms. Cofferdams that are tilted or moved laterally during sinking shall be realigned to provide the required clearance.

If conditions are encountered that render it impracticable to dewater the foundation, the Contractor may be required to construct a concrete foundation seal of the dimensions necessary to ensure that the balance of the concrete can be placed in the dry. When weighted cofferdams are employed and the weight is used to overcome the hydrostatic pressure acting against the bottom of the foundation seal, anchorage, such as dowels or keys, shall be provided to transfer the entire weight of the cofferdam into the foundation seal. Cofferdams that are to remain in place shall be ported at the low water level.

Cofferdams shall be constructed in a manner to prevent damage to fresh concrete from a sudden rising of the stream and prevent damage to the foundation by erosion. Timber or bracing left in cofferdams shall not extend into the substructure concrete.

Cofferdams, including sheeting and bracing, shall be removed after completion of the substructure in a manner that will not disturb or damage the finished concrete.

- (f) **Pumping:** Pumping from the interior of a foundation enclosure shall be performed in a manner to preclude the possibility of water moving through any fresh concrete. Pumping will not be permitted during concrete placement or for at least 24 hours thereafter unless it is performed from a suitable sump separated from the concrete work.
- (g) **Protecting Existing Structures or Utilities:** When foundations are located such that excavation may endanger or interfere with an existing structure or utility, the location of bracing and method of protection shall be subject to approval by the owner of the structure or utility.
- (h) **Inspection:** After each excavation has been completed, the Contractor shall notify the Engineer and request his inspection and approval. Concrete shall not be placed until the depth of the excavation and the character of the foundation material have been approved.
- (i) **Backfilling:** Excavated spaces that are not occupied by abutments, piers, or other permanent work shall be backfilled with soil to the surface of the surrounding ground. Backfill shall be uniformly compacted, and the top surface shall be neatly graded.

The fill around the perimeter of abutments, wingwalls, and retaining walls shall be placed in horizontal layers not more than 6 inches in loose thickness and compacted at ± 20 percent of optimum moisture to a density of at least 95 percent as compared to the theoretical maximum density as defined in Division I. Tests for compliance with density requirements will be performed in accordance with the requirements of VTM-12. As the work progresses, backfill in front of units

shall be placed and compacted in horizontal layers to the same elevation as the layers behind units until the final elevation in front is reached. Backfill shall be placed in a manner to prevent wedging action against the concrete. Slopes bounding excavation for abutments, wingwalls, or retaining walls shall be destroyed by stepping or serrating. Jetting of the fill behind abutments, wingwalls, or retaining walls will not be permitted.

Fills and backfills around piers not included in the roadway prism shall be constructed in uniformly compacted layers and placed alternately to maintain a uniform elevation on both sides of the structure. However, the density requirement will be waived.

Provision shall be made for drainage of backfill. Two-inch crusher run aggregate, conforming to the requirements of Section 205, shall be placed at the back of weep holes to extend 18 inches behind the entrance to the hole, 18 inches above the elevation of the bottom of the hole, and 18 inches laterally on each side of the centerline of the hole. Where crushed glass is used as porous backfill, No. 78 and/or No. 8 aggregate an 18-inch by 18-inch swatch of drainage fabric meeting the requirements of Section 245.03(c) shall be used to cover the #4 mesh at each weep hole opening exposed directly to crushed glass, or as approved by the Engineer.

ackfill shall not be placed against abutments or wingwalls until concrete has been in place 14 days, exclusive of days on which the average high-low air temperature is below 40 degrees F in the shade or until test cylinders have attained a compressive strength equal to 93 percent of the required 28-day design compressive strength.

Backfill shall be placed as soon as practicable following attainment of the required compressive strength but not later than 30 days after concrete placement. Excavation openings shall be maintained as dry as practicable at the time of backfilling. Backfill shall be placed in a manner to deter impoundment of water and facilitate existing drainage.

- (j) **Filled Spandrel Arches:** Fill for spandrel arches within 1 1/2 times the height of the arch shall be placed in a manner to load the ring uniformly and symmetrically. Fill material shall be homogeneous soil and shall be placed in horizontal layers not more than 6 inches in loose thickness, compacted in accordance with the requirements of Section 303.04(h), and brought up simultaneously from both haunches. Wedge-shaped sections of fill material against spandrels, wings, or abutments will not be permitted.
- (k) **Approach Embankment:** Approach embankment shall be constructed in accordance with the requirements of Section 303.04(h).

401.04—Measurement and Payment

Structure excavation will be measured in cubic yards of material removed from the limits of vertical planes within 18 inches outside the neat lines of footings or of neat work that does not have footings directly beneath it, such as curtain walls or cantilevered wingwalls. It will be measured from the surface of the original ground or approach roadway down to the bottom of the foundation shown on the plans or such foundation as the Engineer may approve, down to 18 inches below the bottom of the neat work not directly over footings, or to the top of existing concrete where excavation is to permit placing new concrete over existing concrete.

When specified on the plans, structure excavation will include material removed outside the limits specified for the substructure, in the vicinity of the substructure on which a superstructure rests, and to a depth of 18 inches below the lowest beam or bottom of the slab of the superstructure or to such depth as shown on the plans. The width of such excavation shall be limited to 18 inches outside the exterior beams or edges of the slab or as shown on the plans.

Excavation above the bottom of a proposed channel change or roadway template or an overpassed road will not be included as structure excavation.

Structure excavation will be paid for at the contract unit price per cubic yard. This price shall include clearing and grubbing, sheeting, shoring, bracing, placing and compacting backfill, dewatering, furnishing and placing aggregate for weep holes, disposing of unsuitable or surplus material, and clearing the channel of obstructions caused by construction operations.

Excavation for drilled-in caissons will be measured in linear feet of drilled hole from the existing ground to the bottom of the finished hole as measured along the centerline of the hole and will be paid for at the contract unit price per linear foot. This price shall include drilling, under reaming, casing, and preparing the hole.

Furnishing and placing backfill will be included in the price for structure excavation and will not be measured for separate payment unless specific material is required by the Engineer and no suitable material is available within the construction limits. When specific material is required for backfill by the Engineer,

measurement and payment will be in accordance with the requirements of Section 104.03.

Porous backfill, when a pay item, will be measured in cubic yards of material within the limits shown on the plans or as otherwise directed by the Engineer and will be paid for at the contract unit price per cubic yard.

Pipe underdrains, when a pay item, will be measured in linear feet and will be paid for at the contract unit price per linear foot.

Unsuitable materials removed below the plan foundation will be measured and paid for as structure excavation.

Foundation seals required by the Engineer and that are properly placed for structural adequacy as a part of the planned footing will be accepted as part of the permanent footing. Measurement and payment will be in accordance with the requirements of Section 404.08. Foundation seals that are not required by the Engineer will be included in the price for structure excavation.

Clearing and grubbing within the area defined by lines connecting the extremities of the substructure units, regardless of whether excavation is involved, shall be included in the price for structure excavation unless otherwise specified in the Contract.

Cofferdams will be measured in units of each per foundation and will be paid for at the contract unit price per each. This price shall include furnishing, erecting, maintaining, and removing.

Payment will be made under:

Pay Item	Pay Unit
Structure excavation	Cubic yard
Drilled holes	Linear foot
Porous backfill	Cubic yard
Pipe underdrain (Size)	Linear foot
Cofferdams	Each