

## SECTION 125 EXCAVATION FOR STRUCTURES

### **125-1 Description.**

Excavate for bridge foundations, box culverts, pipe culverts, storm sewers and all other pipe lines, retaining walls, headwalls for pipe culverts and drains, catch basins, drop inlets, manholes, and similar structures. Also, (1) construct and remove cofferdams, sheeting, bracing, etc.; (2) pump or otherwise dewater foundations; (3) remove and dispose of any existing structures or portions of structures not covered by other items in the Contract, including foundations, abutments, piers, wings, and all other materials, obstructions, etc., found necessary to clear the site for the proposed work; (4) backfill, dispose of surplus material, and perform final cleaning, as may be necessary for the proper execution of the work. This Section does not include excavation for bases or pavements, curbs, curb and gutter, valley gutter, ditch pavement, or rubble gutter.

**125-1.1 Trench Excavation Safety System and Shoring, Special (Trench Excavation):** When performing trench excavation in excess of 5 feet [1.5 m] in depth, comply with the Occupational Safety and Health Administration's (OSHA) trench safety standards, 29 C.F.R., s. 1926.650, Subpart P, and all subsequent revisions or updates adopted by the Department of Labor and Employment Security. Ensure that trench boxes are wide enough to accommodate compaction and density testing.

Submission of bid and subsequent execution of the Contract will serve as certification that all trench excavation in excess of 5 feet [1.5 m] in depth will be in compliance with Section 553.62, Florida Statutes.

Consider all available geotechnical information available when designing the trench excavation safety system.

Consider these and any more stringent trench safety standards as minimum Contract requirements.

### **125-2 Classification.**

Consider all materials excavated as unclassified and as excavation regardless of the material encountered.

### **125-3 Cofferdams.**

#### **125-3.1 Construction:**

**125-3.1.1 Methods:** Construct all foundations by open excavation, and shore, brace, or protect the foundation openings with cofferdams. Provide cofferdams or cribs for foundation construction below the bottom of the footings. Provide sufficient clearance in the cofferdam interiors to permit construction of forms and inspection of their exteriors, and for pumping equipment.

**125-3.1.2 Protection of Concrete:** Construct cofferdams to protect green concrete against damage from a sudden rising of the water and to prevent damage by erosion. Do not leave timber or bracing in cofferdams or cribs that extend into the substructure masonry except where permitted in writing by the Engineer.

**125-3.1.3 Placing in the Dry:** For placing footings in the dry, the Engineer may require cofferdam sheeting to be driven to an elevation 6 feet [1.8 m] below the elevation of the bottom of the footings and require sufficient pumping equipment to dewater and maintain the cofferdam in a comparatively dry condition.

**125-3.1.4 Working Drawings:** For substructure work, submit drawings showing the proposed method of cofferdam construction and other details left to choice or not fully shown on the plans. Obtain the Engineer's approval of the type and clearance of cofferdams, insofar as such details affect the character of the finished work. For other details of design that do not affect the character of the finished work, assume responsibility for the successful construction of the work. Retain a Professional Engineer, registered in the State of Florida, to prepare the above construction drawing, and keep a signed

and sealed copy on hand at the site at all times. On completion of the work, furnish the Department with as-built drawings on permanent reproducible material as noted in 5-1.4.1.

**125-3.2 Removal:** Unless otherwise provided, remove cofferdams or cribs, with all sheeting and bracing, after completion of the substructure without disturbing or marring the finished masonry.

## **125-4 Excavation.**

**125-4.1 Requirements for all Excavation:** Excavate foundation pits to permit the placing of the full widths and lengths of footings shown in the plans, with full horizontal beds. Do not round or undercut corners or edges of footings. Perform all excavation to foundation materials, satisfactory to the Engineer, regardless of the elevation shown on the plans. Perform all excavation in stream beds to a depth at least 4 feet [1.2 m] below the permanent bed of the stream, unless a firm footing can be established on solid rock before such depth is reached, and excavate to such additional depth as may be necessary to eliminate any danger of undermining. Wherever rock bottom is secured, excavate in such manner as to allow the solid rock to be exposed and prepared in horizontal beds for receiving the masonry. Remove all loose and disintegrated rock or thin strata. Have the Engineer inspect and approve all foundation excavations prior to placing masonry.

### **125-4.2 Earth Excavation:**

**125-4.2.1 Foundation Material other than Rock:** When masonry is to rest on an excavated surface other than rock, take special care to avoid disturbing the bottom of the excavation, and do not remove the final foundation material to grade until just before placing the masonry. In case the foundation material is soft or mucky, the Engineer may require excavation to a greater depth and to backfill to grade with approved material.

**125-4.2.2 Foundation Piles:** Where foundation piles are used, complete the excavation of each pit before driving the piles. After the driving is completed, remove all loose and displaced material, leaving a smooth, solid, and level bed to receive the masonry.

**125-4.2.3 Removal of Obstructions:** Remove boulders, logs, or any unforeseen obstacles encountered in excavating. Compensation will be in accordance with the requirements of 4-3.4.

**125-4.3 Rock Excavation:** Clean all rock and other hard foundation material, remove all loose material, and cut all rock to a firm surface. Either level, step vertically and horizontally, or serrate the rock, as may be directed by the Engineer. Clean out all seams, and fill them with concrete or mortar.

**125-4.4 Pipe Trench Excavation:** Excavate trenches for pipe culverts and storm sewers to the elevation of the bottom of the pipe and to a width sufficient to provide adequate working room. Remove soil not meeting the classification specified as suitable backfill material in 125-8.3.2.2, to a depth of 4 inches [100 mm] below the bottom of the pipe elevation. Remove rock, boulders or other hard lumpy or unyielding material to a depth of 12 inches [300 mm] below the bottom of the pipe elevation. Remove muck or other soft material to a depth necessary to establish a firm foundation. Where the soils permit, ensure that the trench sides are vertical up to at least the mid-point of the pipe.

For pipe lines placed above the natural ground line, place and compact the embankment, prior to excavation of the trench, to an elevation at least 2 feet [0.6 m] above the top of the pipe and to a width equal to four pipe diameters, and then excavate the trench to the required grade.

## **125-5 Preservation of Channel.**

**125-5.1 General:** unless shown on the plans, do not excavate outside of caissons, cribs, cofferdams, or sheet piling, and do not disturb the natural stream bed adjacent to the structure. If excavating or dredging at the site of the structure before sinking caissons, cribs, or cofferdams, complete the foundation and backfill all such excavations to the original ground surface or other required elevation, with material satisfactory to the Engineer.

**125-5.2 Removal of Excavated Materials:** Do not allow materials that are deposited adjacent to the stream area to infiltrate the water areas. Leave the stream in its original condition.

## **125-6 Disposal of Surplus.**

Use suitable excavated materials for backfilling over or around the structure. Dispose of unsuitable materials. Meet the disposal requirements pertaining to water pollution contained in Section 104 and in 7-1.1.

## **125-7 Pumping.**

Pump from the interior of any foundation enclosure in such manner as to preclude the possibility of any portion of the concrete materials being carried away. Do not pump while placing concrete, or for a period of at least 24 hours thereafter, unless using a suitable pump separated from the concrete work by a watertight wall.

## **125-8 Backfilling.**

### **125-8.1 Requirements for all Structures:**

**125-8.1.1 General:** Backfill in the Dry whenever normal dewatering equipment and methods can accomplish the needed dewatering.

**125-8.1.2 Equipment and Methods:** Provide normal dewatering equipment including, but not limited to, surface pumps, sump pumps, wellpoints and header pipe and trenching/digging machinery. Provide normal dewatering methods including, but not limited to, constructing shallow surface drainage trenches/ditches, using sand blankets, perforated pipe drains, sumps and siphons.

**125-8.1.3 Backfill Materials:** Backfill to the original ground surface or subgrade surface of openings made for structures, with a sufficient allowance for settlement. The Engineer may require that the material used for this backfill be obtained from a source entirely apart from the structure. Use only material accepted by the Engineer.

Do not allow heavy construction equipment to cross over culvert or storm sewer pipes until placing and compacting backfill material to the finished earthwork grade or to an elevation at least 4 feet [1.2 m] above the crown of the pipe.

**125-8.1.4 Use of A-7 Material:** In the backfilling of trenches, A-7 material may be used from a point 12 inches [300 mm] above the top of the pipe up to the elevation shown on the Design Standards as the elevation for undercutting of A-7 material.

**125-8.1.5 Time of Placing Backfill:** Do not place backfill against any masonry or concrete abutment, wingwall, or culvert until permission has been given by the Engineer, and in no case until the masonry or concrete has been in place seven days or until the specified 28-day compressive strength occurs.

### **125-8.2 Requirements for Structures Other than Pipe Culverts and Storm Sewers:**

**125-8.2.1 Density:** Place the material in horizontal layers not exceeding 8 inches [200 mm] in depth above water level, behind abutments, wingwalls and end bents or end rest piers, and around box culverts and structures other than pipe culverts, and compact it to a density of at least 100% of the maximum density as determined by AASHTO T 99. Where the backfill material is deposited in water, obtain a 12 inch [300 mm] layer of comparatively dry material, thoroughly compacted by tamping, before verifying the layer and density requirements.

**125-8.2.2 Box Culverts:** For box culverts over which pavement is to be constructed, compact around the structure to an elevation not less than 12 inches [300 mm] above the top of the structure, using rapid-striking mechanical tampers.

**125-8.2.3 Other Limited Areas:** Compact in other limited areas using mechanical tampers or approved hand tampers, until the cover over the structure is at least 12 inches [300 mm] thick. When hand tampers are used, deposit the materials in layers not more than 4 inches [100 mm] thick using hand tampers suitable for this purpose with a face area of not more than 100 in<sup>2</sup> [64,500 mm<sup>2</sup>]. Take special precautions to prevent any wedging action against the masonry, and step or terrace the slope bounding the excavation for abutments and wingwalls if required by the Engineer.

**125-8.2.4 Culverts and Piers:** Backfill around culverts and piers on both sides simultaneously to approximately the same elevation.

**125-8.2.5 Compaction Under Wet Conditions:** Where wet conditions do not permit the use of mechanical tampers, compact using hand tampers. Use only A-3 material for the hand tamped portions of the backfill. When the backfill has reached an elevation and condition such as to make the use of the mechanical tampers practical, perform mechanical tamping in such manner and to such extent as to transfer the compaction force into the sections previously tamped by hand.

**125-8.3 Requirements for Pipe Culverts and Storm Sewers:**

**125-8.3.1 General:** Trenches for pipe may have up to four zones that must be backfilled.

**Lowest Zone:** The lowest zone is backfilled for deep undercuts up to within 4 inches [100 mm] of the bottom of the pipe.

**Bedding Zone:** The zone above the Lowest Zone is the Bedding Zone. Usually it will be the backfill which is the 4 inches [100 mm] of soil below the bottom of the pipe. When rock or other hard material has been removed to place the pipe, the Bedding Zone will be the 12 inches [300 mm] of soil below the bottom of the pipe.

**Cover Zone:** The next zone is backfill that is placed after the pipe has been laid and will be called the Cover Zone. This zone extends to 12 inches [300 mm] above the top of the pipe. The Cover Zone and the Bedding Zone are considered the Soil Envelope for the pipe.

**Top Zone:** The Top Zone extends from 12 inches [300 mm] above the top of the pipe to the base or final grade.

**125-8.3.2 Material:**

**125-8.3.2.1 Lowest Zone:** Backfill areas undercut below the Bedding Zone of a pipe with coarse sand, or other suitable granular material, obtained from the grading operations on the project, or a commercial material if no suitable material is available.

**125-8.3.2.2 Soil Envelope:** In both the Bedding Zone and the Cover Zone of the pipe, backfill with materials classified as A-1, A-2, or A-3. Material classified as A-4 may be used if the pipe is concrete pipe.

**125-8.3.2.3 Top Zone:** Backfill the area of the trench above the soil envelope of the pipe with materials allowed on Roadway and Traffic Design Standard, Index No. 505.

**125-8.3.3 Compaction:**

**125-8.3.3.1 Lowest Zone:** Compact the soil in the Lowest Zone to approximately match the density of the soil in which the trench was cut.

**125-8.3.3.2 Bedding Zone:** If the trench was not undercut below the bottom of the pipe, loosen the soil in the bottom of the trench immediately below the approximate middle third of the outside diameter of the pipe.

If the trench was undercut, place the bedding material and leave it in a loose condition below the middle third of the outside diameter of the pipe. Compact the outer portions to a minimum of 100% of the maximum density as determined by AASHTO T 99. Place the material in lifts no greater than 6 inches [150 mm] (compacted thickness).

**125-8.3.3.3 Cover Zone:** Before placing the Cover Zone material, lay pipe according to Section 430. Excavate for pipe bells before laying pipe. Place the material in 6 inch [150 mm] layers (compacted thickness), evenly deposited on both sides of the pipe, and compact with mechanical tampers suitable for this purpose. Hand tamp material below the pipe haunch that cannot be reached by mechanical tampers. For concrete pipe, compact the backfill to a density of at least 100% of the maximum density as determined by AASHTO T 99, Method C. For metal and plastic pipe, compact the backfill to a density of at least 95% of the maximum density as determined by AASHTO T 99, Method C.

**125-8.3.3.4 Top Zone:** Place the material in layers not to exceed 12 inches [300 mm] in compacted thickness. Compact with appropriate equipment to a density of at least 100% of the maximum density as determined by AASHTO T 99, Method C, except as provided below.

In locations outside the plane described by a two (horizontal) to one (vertical) slope downward from the roadway shoulder line or the back of curb as applicable and along storm sewer outfall lines where no vehicular traffic will pass over the pipe, compact the backfill to a firmness approximately equal to that of the soil next to the pipe trench.

**125-8.3.4 Backfill Under Wet Conditions:** Where wet conditions are such that dewatering by normal pumping methods would not be effective, the procedure outlined below may be used when specifically authorized by the Engineer in writing. The Department will pay for any select material which is not available from the grading as Unforeseeable Work. The Department will not pay for select material that might be used by the Contractor for his own convenience instead of dewatering.

The Department will permit the use of granular material below the elevation at which mechanical tampers would be effective, but only material classified as A-3. Place and compact the material using timbers or hand tampers until the backfill reaches an elevation such that its moisture content will permit the use of mechanical tampers. When the backfill has reached such elevation, use normally acceptable backfill material. Compact the material using mechanical tampers in such manner and to such extent as to transfer the compacting force into the material previously tamped by hand.

The Department will permit the use of coarse aggregate below the elevation at which mechanical tampers would be effective. Use coarse aggregate as specified in Section 901 for Aggregate Size Number 89, 8, 78, 7, 68, 6, or 57. Place the coarse aggregate such that it will be stable and firm. Fully wrap the aggregate with a layer of Type D-4 filter fabric, as specified on Roadway and Traffic Design Standard, Index No. 199. Do not place coarse aggregate within 4 feet [1.2 m] of the ends of the trench or ditch. Use normally accepted backfill material at the ends.

**125-8.4 Requirements for Thick Lift Compaction in Granular Materials:** If it is demonstrated that the required density can be obtained in thicker lifts than permitted above, the Engineer may permit placement of granular material of soil groups A-1, A-2, or A-3 in lifts up to a maximum of 3 foot [0.9 m] compacted thickness. In such cases, furnish equipment and labor to excavate and backfill test pits to be dug for the performance of density tests.

Use of thick lift compaction procedures will not be allowed for backfilling the soil envelope of pipe culverts and storm sewers.

### **125-9 Replacing Pavement.**

Where existing pavement, curb, curb and gutter, sidewalk or valley gutter is removed only for the purpose of constructing or removing box culverts, pipe culverts, storm sewers, inlets, manholes, etc., replace or restore those items to the Engineer's satisfaction, without direct compensation.

### **125-10 Cleaning Up.**

Upon completion of the work, leave the structure and all adjacent areas in a neat and presentable condition, clear up all temporary structures, rubbish and surplus material and leave the space under the structure unobstructed and in such shape that drift will not collect nor scour be induced. Pile all material from existing structures that have been removed neatly on the bank, unless otherwise directed by the Engineer. Pull falsework piling unless the Engineer permits it to cut or broken off, in which case it will be cut or broken off at least 2 feet [0.6 m] below the ground line or stream bed.

### **125-11 Method of Measurement.**

When direct payment for Excavation for Structures is provided in the proposal, and such payment is on a unit basis, such excavation will be measured in its original position by the cross-section method to determine the amount of material. The cubic yard [cubic meter] volume of excavation used as a basis of payment will then be that material actually removed below the original ground line or stream bed, but not including that shown on the plans to be paid for either as Regular Excavation, Subsoil Excavation, Lateral Ditch Excavation or Channel Excavation, or which is included in the item for Grading, and except that no payment will be made for material removed in excavating for footings or foundations outside of an area

which is bounded by vertical planes 12 inches [300 mm] outside of the limits of the footing and parallel thereto. For pipe trenches the width used to be in the calculation shall be the diameter of the pipe, plus 24 inches [600 mm].

## **125-12 Basis of Payment.**

**125-12.1 When No Direct Payment Provided:** When direct payment for Excavation for Structures is not provided for in the proposal, all work specified in this Section, other than as specified in 125-12.3 through 125-12.7, shall be included in the Contract price for the concrete or for other items covering the applicable structure.

**125-12.2 Direct Payment:** When direct payment for work under this Section is provided, the Contract price per cubic yard [cubic meter] (measured as provided in 125-11), as shown in the proposal, shall be full compensation for all the work specified in this Section, except such work as is specifically stipulated to be paid for separately, in 125-12.3 through 125-12.7.

**125-12.3 Excavation Below Plan Grade:** When excavation of material below plan grade is called for in the plans or authorized by the Engineer, and payment for Excavation for Structures is on a cubic yard [cubic meter] basis, the material excavated below plan grade will be included in the measurement for this item.

Payment for the material used for the backfill will be made as specified in 125-12.7.

**125-12.4 Strengthening Foundations:** The work of strengthening the foundations (as provided in 125-4.2) shall be paid for as provided in 4-4, unless such work is covered by a bid item.

**125-12.5 Backfilling for Additional Support:** The work of providing additional support by backfilling with sand or other satisfactory material, where called for by the Engineer (as specified in 125-8), shall be paid for as provided in 4-4.

**125-12.6 Removal and Replacement of Existing Pavement:** For pavement, curb, etc., which is removed only in order to construct pipe culverts or storm sewers, as specified in 125-9, all costs of such removal and replacement shall be included in the costs of the pipe or other structure for which it is removed, unless otherwise provided for in the contract.

**125-12.7 Removal and Replacement of Material Unsuitable for Backfill:** When it cannot reasonably be anticipated from information contained in the plans, that material excavated for the structure will be unsuitable for use as backfill, and such material proves to be unsuitable for this use, the work of disposing of such material away from the site will be paid for as unforeseeable work, and the work of bringing in substitute material for the backfill will be paid for as specified for the particular case shown below:

(a) No additional payment will be made for backfill materials obtained from surplus material available from the normal excavation or grading operations.

(b) When the necessary material is not available from the normal excavation or grading operations, and the Contract includes an item for Borrow Excavation, backfill material authorized to be obtained from designated borrow areas will be included in the volume of Borrow Excavation to be paid for.

(c) When the necessary material is not available from the normal excavation or grading operations and no separate item for Borrow Excavation is included in the Contract, any backfill material obtained by increasing the volume of excavation within the roadway right of way will be measured and paid for as regular excavation subject to the provisions of 9-3.2.2.

(d) When authorization is given for obtaining the material from outside the right of way and from other than designated borrow areas, such excavation will be paid for as unforeseeable work.

(e) Where pipe bedding is provided, as specified in 125-8, by the use of select granular material, the quantity of such select material obtained either as commercial material or from material from the grading operations other than in the immediate vicinity of the pipe to be bedded, as authorized by the Engineer, will be paid for at the Contract price per cubic yard [cubic meter] for Select Bedding Material. No payment for this material will be made for material available from the excavation for the pipe culvert

or from other material available from the grading operations at a location not sufficiently remote as to require loading on trucks.

**125-12.8 Pay Items:** Payment for the work under this Section, when provided for directly, shall be made under:

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| Item No. 125-  | 1- | Excavation for Structures - per cubic yard.  |
| Item No. 2125- | 1- | Excavation for Structures - per cubic meter. |
| Item No. 125-  | 3- | Select Bedding Material - per cubic yard.    |
| Item No. 2125- | 3- | Select Bedding Material - per cubic meter.   |