SECTION 206

EXCAVATION FOR STRUCTURES

206.1 Description. This work shall consist of the necessary excavation for the foundations of all structures, removal and disposal of all excavated material, backfilling around the completed structures, and all related work.

206.1.1 All removal work that might endanger the new structure shall be completed before any work on the new structure is started. Partial removals of any structure or adjustments to any utility shall be made with care to preserve the value of the retained portions. Work around any live utility shall be done in such a manner that uninterrupted service is maintained.

206.1.2 Excavated material that is unsuitable for backfill and embankments, and excess material not required for either, shall be disposed of. Excavated material shall not be dumped into the channel of a stream.

206.2 Depth of Excavation. The elevation of the bottoms of footings as shown on the plans shall be considered an approximate elevation, and the engineer by written order may make changes in plan elevations and dimensions of footings as necessary to secure a satisfactory foundation.

206.3 Foundation Stabilization and Tests.

206.3.1 The contractor shall furnish and place sand, rock, gravel or other suitable granular backfill material to replace unsuitable material encountered below box culvert slabs or below the foundation elevation of the structures.

206.3.2 The contractor shall stabilize suitable foundation material or form the bottom of pile footings, if necessary to obtain a stable foundation. The contractor shall assist in driving sounding rods or shall drill test holes to permit an adequate inspection of the foundation subgrade. The depth of the excavation, the character of the material and the condition of the foundation shall be approved by the engineer before any concrete is placed in the footing.

206.4 Construction Requirements.

206.4.1 Foundation Excavation Protection. Methods shall be used in excavating for foundations of structures that will ensure maintaining the stability of the material adjacent to the excavation. Sheeting, cribbing, timbering or bracing shall be placed by the contractor where indicated on the plans and wherever considered necessary. The contractor shall ensure the adequacy of all sheeting, cribbing, timbering or bracing used.

206.4.2 Foundation Key. Foundations for structures and retaining walls shall be free of loose material, and the footing shall be placed on undisturbed material. Footings shall be keyed no less than 6 inches (150 mm) into hard, solid rock, and no less than 18 inches (450 mm) into soft rock or shale or other suitable material specified for spread footings. Excavation in rock or shale for the key shall be made as near as practical to the size of the footing, or of the key, as shown on the plans. When placing the footing, the key portion shall be cast against the vertical, undisturbed face of the rock or shale. If side forms are necessary for footings, the forms shall be removed approximately 24 hours after placing the concrete,

and the excavation immediately backfilled to the top of the footing. All cavities or crevices shall be cleaned out and filled with concrete in accordance with Sec 703.3.3.9, or spanned with a reinforced concrete beam, as directed by the engineer.

206.4.3 Foundation Subgrade. Care shall be taken to avoid disturbing the material below the bottom of the footings where the structure is founded on material other than rock, and final removal to grade shall not be made until just prior to placing concrete. Where foundation piles are required, the excavation of each pit shall be completed before the piles are driven, and after the driving is completed, all loose and displaced material shall be removed.

206.4.4 Culverts on Rock. If rock is encountered under a portion of the bottom slab of a concrete box-type structure, the rock shall be removed to at least 6 inches (150 mm) below the bottom of the slab and curtain walls, and backfilled with material similar to that under the remainder of the structure.

206.4.5 Footing Construction. Concrete footings for structures shall be placed on foundation material that is reasonably dry in the judgment of the engineer. The contractor shall perform all draining, bailing or pumping operations, drive any sheeting, and construct any cofferdams or cribs necessary to obtain this condition. Pumping from the interior of any foundation enclosure shall be done in a manner to preclude the possibility of the movement of water, or other fluids or semi-fluids, through any fresh concrete. If necessary, the footing form shall be made watertight and shall be sealed around the bottom, and all pumping done between the footing form and the wall of the enclosure.

206.4.6 Footing Drainage. All holes, pits or sumps resulting from excavating operations shall be kept drained or pumped out until the completion of the work. No ponding of water around footings on other than rock will be permitted.

206.4.7 Cofferdams. In accordance with the contract, the contractor shall provide cofferdams, consisting of sheet piling, or the contractor may propose alternate methods for the construction of the bridge foundations. Alternate designs or methods may consist of, but are not limited to: the construction of cofferdams, seal courses, over excavation, well point systems, dewatering and drainage diversion. The method proposed by the contractor shall stay within the right of way limits provided in the contract. The interior dimensions of cofferdams shall provide sufficient clearance for the construction of forms, and ample room for a sump and for pumping outside the footing forms. Cofferdams that have been tilted or moved laterally during the process of sinking shall be corrected to provide the necessary clearance. Cofferdams shall be constructed to protect the work against damage from sudden rising waters and to prevent damage to the foundation by erosion. Cofferdams shall be removed after the completion of the substructure unit, unless specific authority is given for the cofferdam to remain in place. The contractor shall submit the proposed method of cofferdam construction to the engineer prior to beginning work.

206.4.8 Temporary Shoring. When temporary shoring is required by the contract documents, the contractor shall provide temporary shoring as needed, consisting of sheet piling or alternate methods for the construction of roadway fills, mechanically stabilized earth walls or structures. The contractor shall submit the proposed method of temporary shoring construction to the engineer prior to beginning work.

206.4.9 Seal Courses. Seal courses will be required if indicated on the plans or if conditions are encountered that, in the judgment of the engineer, render it impractical to dewater the foundation area. The dimensions of the seal course shall be adequate to seal the foundation area. Pumping will not be permitted while excavating, pile driving or placing the seal course, and not until, by determination of the engineer, the seal course has attained sufficient strength to withstand the hydrostatic pressure. If seal courses are shown on the plans, and the engineer

determines that the footings may be satisfactorily placed without sealing, the contractor shall dewater any completed excavation for investigation purposes. The seal course designs shown on the plans are based on the use of sheet piling in construction of the cofferdams at the indicated water elevations. If the contractor's proposed alternate method includes cofferdams that are to be constructed with seal courses, the contractor shall prepare construction plans that are properly designed for the site conditions and water elevations that may be encountered during footing construction. These plans shall be signed and sealed by a professional engineer licensed in the State of Missouri and shall be provided to the engineer for review a minimum of two weeks prior to the beginning of actual footing construction. The contractor is responsible for the safety and performance of the contractor's proposed system.

206.4.10 Backfill. Backfill material shall be free from large or frozen lumps, wood or other extraneous material. All spaces excavated and not occupied by the new structure or by porous backfill shall be refilled with earth to the original ground surface or to the finished ground lines shown on the plans. The backfill at end bents, walls or other units that fall within the limits of the roadbed shall be placed in successive 6-inch (150 mm) layers and compacted to the same density required for the adjacent roadbed. Dry footings at interior bents shall be backfilled and compacted to no less than the density of the adjacent undisturbed material. Precautions shall be taken to prevent any wedging action against the masonry. The slope bounding the excavation, if steeper than 6:1 (1:6), shall be stepped or serrated. Backfill placed around culverts and piers shall be kept at approximately the same elevation on opposing sides. Drains consisting of 5 cubic feet (0.15 m^3) of coarse aggregate shall be placed at weep holes, except where porous backfill is required. Backfill material shall not be placed against end bents of bridges, on sides of box culverts or behind retaining walls until the concrete has attained the strength specified in Sec 703.3.2.13. Backfill material shall not be placed higher behind than in front of end bents until the superstructure, including the bridge deck, is in place. Until the grade is in place, drainage shall be maintained away from the end bent backwall by constructing a 6:1 (1:6) or steeper slope away from the backwall for a minimum distance of 3 feet (1 m) and by providing a lateral path for all water to flow off the roadbed section.

206.4.11 Porous Backfill. Porous backfill, in accordance with Sec 1009, shall be placed behind abutments, wings and retaining walls where specified and shown on the plans. Porous backfill shall be placed and consolidated in successive 12-inch (300 mm) layers such that the porous backfill will not become mixed with other backfill material.

206.4.12 Flowable Backfill. Flowable backfill will be required when indicated on the plans. The contractor may, with approval from the engineer, use flowable backfill as an alternate to compacted backfill for structures, pipes or utility cuts. Flowable backfill intended for any other use by the contractor shall also be approved by the engineer. Flowable backfill shall not be used to surround drainage systems such as vertical drains or edge drains. Flowable backfill shall be in accordance with Sec 621.

206.4.13 Excavation Classification. Unless otherwise shown on the plans, excavation for structures will be classified as Class 1 Excavation, Class 1 Excavation in Rock, Class 2 Excavation, Class 2 Excavation in Rock, Class 3 Excavation, Class 3 Excavation in Rock, Class 4 Excavation and Class 4 Excavation in Rock. In general, Class 1 Excavation and Class 2 Excavation will apply to excavation for bridges and large retaining walls. Class 3 Excavation will apply to excavation for pipe installations, such as utilities, retrofit pipe culverts, drop inlets or manholes. Class 4 Excavation will apply to excavation for box culverts, small retaining walls and other miscellaneous structures. Class 1 Excavation will include all excavation above a specified elevation indicated on the plans while Class 2 Excavation will include all excavation below this specified elevation. The classification of excavation for all structures will be shown on the plans.

206.5 Method of Measurement.

206.5.1 Measurement of Class 1 and Class 2 Excavation will be made to the nearest 1/2 cubic yard (0.5 m^3) for each structure of that volume of material actually removed from within the limits established in this section. The volume measured will be limited by vertical planes 18 inches (450 mm) outside of and parallel with the neat lines of footings, tie beams or overhangs of structures classed as bridges or retaining walls. The upper limits of the volume measured will be the existing ground line or the lower limits of the roadway, drainage or channel excavation, including any allowable overbreak, whichever is lower. Where roadway spill fills are required to be placed and compacted before driving piles or before constructing bridge substructure units, any required additional excavation for the substructure units will be measured from the spill slope. For stream crossings, the measured volume will not include water, but will include mud, muck and other semi-solids. The lower limits of the volume measured will be the bottom of the footings, bottom of seal courses, or 18 inches (450 mm) below the bottom of tie beams and overhangs. Excavation for columns above drilled shafts will be Class 1 Excavation, with measurement made of the volume of material actually removed above the top of the drilled shaft. The volume measured will not exceed that of a cylinder having a diameter 36 inches (900 mm) greater than that of the column above the drilled shaft. No measurement will be made of the material excavated for the drilled shaft below the bottom of the column.

206.5.2 Final measurement of Class 3 Excavation for utilities, retrofit pipe culverts, drop inlets or manholes will not be made unless there is an authorized change from plan location resulting in a different quantity or there is an authorized change averaging more than 6 inches (150 mm) in the foundation elevation. If a revision is made or an appreciable error is found in the contract quantity, the revision or correction will be computed and added to or deducted from the contract quantity. Measurement of Class 3 Excavation will be made to the nearest cubic yard (m^3) for each structure of that volume of material actually removed from within the area bounded by vertical planes 18 inches (450 mm) outside of the outer walls of the structure. The upper limits of the volume measured, will be the existing ground line, or the lower limits of the roadway excavation, whichever is lower. The lower limits of the volume measured will include excavation necessary for pipe bedding.

206.5.3 Measurement of Class 4 Excavation for box culverts classified as bridges will be made to the nearest cubic yard (m^3) for each structure of that volume of material actually removed from within the area bounded by vertical planes 18 inches (450 mm) outside of the outer walls of box culverts with bottom slabs. The upper limits of the volume measured will be the existing ground line, or the lower limits of the roadway excavation, whichever is lower. Class 4 Excavation under embankments and in channel changes will be measured from the original ground surface unless otherwise designated on the plans. For box culverts without bottom slabs, measurement will be made as above except no material below plan flow line will be included that is outside of the area bounded by vertical planes 18 inches (450 mm) each side of and parallel with the neat lines of the walls or footings. Final measurement of Class 4 Excavation for box culverts not classified as bridges, small retaining walls and miscellaneous structures will not be made unless there is an authorized change from plan location resulting in a different quantity or there is an authorized change averaging more than 6 inches (150 mm) in the foundation elevation. If a revision is made or an appreciable error is found in the contract quantity, the revision or correction will be computed and added to or deducted from the contract quantity. Excavation classification will not change if a substitution of a drainage structure type is approved.

206.5.4 Where concrete in footings or walls is cast against the vertical faces of the excavation, the neat lines of the concrete footings will be considered the limits of excavation for that depth in which the concrete is in contact with the excavation, and no measurement will be made of any excavation or overbreak beyond the neat footing lines.

206.5.5 Final measurement of the porous backfill will not be made except for authorized changes during construction, or where appreciable errors are found in the contract quantity. Where required, the volume of porous backfill will be computed to the nearest cubic yard (m^3) at each structure from dimensions on the plans. Any porous backfill material placed outside the neat lines shown on the plans shall be placed at the contractor's expense. The revision or correction will be computed and added to or deducted from the contract quantity.

206.6 Basis of Payment.

206.6.1 Payment for additional Class 1 and Class 2 Excavation required to carry footings a maximum of 8 feet (2.5 m) below elevations shown on the plans will be made at 125 percent of the contract unit price for that additional excavation within the limits of Class 1, and at 150 percent of the contract unit price for that additional excavation within the limits of Class 2 Excavation. Additional excavation required to carry footings a depth of more than 8 feet (2.5 m) below plan elevations will be considered changes in the work, and will be paid for in accordance with Sec 104.3.

206.6.2 Payment for drilling test holes for foundation tests will be made per foot (m) of hole drilled at the fixed contract unit price specified in Sec 109.

206.6.3 Payment will not be made for removal or replacement of foundation material that became unsuitable because of improper methods of construction by the contractor. Payment for removal of inherently unsound material for foundation stabilization will be made at the contract unit price for excavation for structures. No payment will be made for any costs involved in replacing the volume below the foundations, except that the contractor will be reimbursed for the delivered cost of the granular backfill when directed by the engineer.

206.6.3.1 If Class C Excavation material, as defined in Sec 203, is encountered in Class 1 Excavation, and no pay item for Class 1 Excavation in Rock is included in the contract, payment for that material will be made per cubic yard (m^3) at the fixed contract unit price specified in Sec 109.

206.6.3.2 If Class C Excavation material, as defined in Sec 203, is encountered in Class 2 Excavation and no pay item for Class 2 Excavation in Rock is included in the contract, payment for that material will be made per cubic yard (m^3) at the fixed contract unit price specified in Sec 109.

206.6.3.3 If Class C Excavation material, as defined in Sec 203, is encountered in Class 3 Excavation and no pay item for Class 3 Excavation in Rock is included in the contract, payment for that material will be made per cubic yard (m^3) at the fixed contract unit price specified in Sec 109.

206.6.3.4 If Class C Excavation material, as defined in Sec 203, is encountered in Class 4 Excavation and no pay item for Class 4 Excavation in Rock is included in the contract, payment for that material will be made per cubic yard (m^3) at the fixed unit price specified in Sec 109.

206.6.4 No direct payment will be made for placing porous backfill at weepholes in accordance with Sec 206.4.11, or for backfilling the structure.

206.6.5 The accepted quantities of excavation for structures and porous backfill will be paid for at the contract unit price for each of the pay items included in the contract.

206.6.6 All costs for furnishing material, labor or equipment, construction, dewatering, drainage, and any other incidental work necessary to complete cofferdam construction; and subsequent removal of any cofferdams, berms, diversions, and any other features constructed for cofferdams as identified by the engineer will be considered completely covered in the contract unit price per lump sum per bent, regardless of construction method. Payment for Class 1 Excavation and/or Class 2 Excavation will be limited to the volume defined in Sec 206.5. No additional payment for excavation will be made for a contractor proposed method of cofferdam construction.

206.6.7 All costs for furnishing material, labor, equipment, construction, drainage and other incidental work necessary to complete temporary shoring construction; and subsequent removal of any temporary shoring, berms, diversions, and any other features as identified by the engineer will be considered completely covered in the contract unit price per lump sum regardless of construction method.

206.6.8 No direct payment will be made for removing existing structures within the limits of excavation for structures. Existing headwalls or culvert concrete to be removed will be paid for as removal of improvements for roadway culverts or partial removal of culvert concrete for bridge culverts.

206.6.9 Payment for seal courses other than those on the plans will be made only with written authorization from the engineer.

206.6.10 Any material excavated in cleaning out culverts to be used in place will be paid for at the contract unit price per each structure. However, only the initial excavation will be paid for, and any subsequent cleaning required prior to final acceptance shall be done at the contractor's expense.