SECTION 203

ROADWAY AND DRAINAGE EXCAVATION, EMBANKMENT AND COMPACTION

203.1 Description. This work shall consist of excavating, disposing of or compacting all material encountered within the limits of the work not being removed under some other item. This work shall be performed in accordance with the specifications and as shown on the plans, or directed by the engineer. All excavation will be classified as hereafter described.

203.2 Classification of Excavation.

203.2.1 Class A Excavation will consist of all roadway and drainage excavation not classified as Class C or Unclassified. Shale, fire clay, chert broken by intermittent clayey partings or clay seams (joint flint rock), stratified chert cemented with clay seams (hardpan), and plain or bituminous-bound bases or surface courses of macadam, gravel, broken stone or similar material will be considered as Class A Excavation, not Class C Excavation.

203.2.2 Class C Excavation will consist of the removal of stone, including sandstone or igneous formations, in ledges 6 inches (150 mm) thick or more. Laboratory analysis will be made, if necessary, to aid in the determination. A ledge will be considered to be a continuous deposit of rock that may or may not include thin, interbedded seams of soft material or shale. The vertical limits of each ledge will be determined by beds of soft material or shale greater than 24 inches (600 mm) thick. The beds of soft material or shale will be included in the measurement of Class A Excavation, unless the material falls within the vertical limits identified by Sec 203.8.2.3. Boulders or other detached stones, each having a volume of 2 1/2 cubic yards (2 m^3) or more, will be considered Class C Excavation.

203.2.3 Unclassified Excavation will consist of the excavation of all material not classified within the contract.

203.3 Borrow.

203.3.1 Borrow will consist of approved material required for the construction of embankment or for other portions of the work, and shall be obtained either from borrow areas shown on the plans or from areas designated or approved by the engineer. The contractor shall notify the engineer sufficiently in advance of opening any borrow areas so the necessary cross sections or measurements may be taken. Borrow will be classified in the same manner as roadway excavation.

203.3.2 Borrow areas proposed by the contractor, other than those shown on the plans or designated by the engineer, may be approved, provided:

(a) The material and area are equally satisfactory.

(b) The final cost to the Commission, including the cost of easements, is not greater than the cost as originally designated.

(c) The substitution is in the best interest of the Commission.

(d) Proper environmental clearances have been obtained for use of any alternate borrow sites, with the exception of permitted quarries and other locations that have already obtained environmental clearances in accordance with Sec 203.3.2.5.

(e) The contractor has obtained appropriate land disturbance permits from MDNR in advance of excavation, unless the site is already under permit by MDNR.

203.3.2.1 Proposed sites for contractor furnished material will be sampled and tested only after award of the contract, and after a copy of the written agreement between the property owner and the contractor authorizing use of any borrow site and access has been provided to the engineer. The agreement shall include provisions for the final condition of the borrow site and access.

203.3.2.2 The preliminary subsurface investigations to determine depth to rock, general soil characteristics, etc., shall be the sole responsibility of the bidder or contractor.

203.3.2.3 The engineer shall be notified in writing sufficiently in advance of the proposed use of a borrow site to allow six weeks for sampling under the direction of the engineer for testing.

203.3.2.4 The contractor shall furnish equipment suitable for the purpose of soil sampling, and shall make all necessary arrangements for performing the work at a time mutually agreeable to the contractor and the engineer.

203.3.2.5 Environmental clearances under applicable federal and state laws and regulations will include, but are not limited to the following: Clean Water Act, the Endangered Species Act, the National Historic Preservation Act, the Farmland Protection Act, Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act and RSMo Chapter 194, Section 194.400 *Unmarked Human Burial Sites*. Certification shall be obtained in advance of the proposed use of a borrow site and furnished to the engineer. Certification shall include clearance letters and other evidence of coordination from the appropriate regulatory agencies as attachments. Guidelines for obtaining environmental clearances for contractor furnished borrow sites may be obtained from the project contact as designated in the contract proposal.

203.3.2.6 Borrow sites that are not contiguous to MoDOT right of way will be regulated under the MDNR stormwater permit program.

203.3.2.7 After borrow material has been removed, the borrow site and access shall be finished in accordance with the agreement of the property owner.

203.4 Construction Requirements.

203.4.1 General. Prior to beginning excavation and embankment operations in any area, all necessary clearing, grubbing and stripping in that area shall have been performed. The excavation and embankment for roadway, intersections and entrances shall be made to the designated alignment, grade and cross section. Sideslopes, cuts and fills shall be finished to a reasonably smooth and uniform surface that will merge with the adjacent terrain without variations readily discernible from the road. Finishing by hand methods will not be required, except that all brush, weeds, excess mud and silt, or other debris shall be removed from culverts and channels within the scope of the work in accordance with Sec 104.11.2, even if such structures are used in place. Areas disturbed by the contractor outside the limits of construction shall be restored at the contractor's expense to a condition similar to that prior to construction operations.

203.4.1.1 Field Stone. Before final project acceptance, all loose field stone greater than 4 inches (100 mm) in size within the limits of the right of way shall be disposed of as directed by the engineer.

203.4.1.2 Shoulders. Earth shoulders shall be constructed of suitable material to the grade and cross section shown on the plans and shall be compacted in accordance with Sec 203.5. The construction of shoulders shall start when sufficient surfacing has been completed and the surfacing has attained satisfactory strength to permit continuous shouldering operations. Equipment that will damage the surfacing will be prohibited from operating on the surfacing during shouldering operations. Surfacing and curbs shall be protected where equipment is crossing or turning.

203.4.1.3 Grading for Aggregate Type Surface Roadway. If a roadway to receive an aggregate-type surface is specified in the contract, reasonable tolerance in alignment, grade and cross section will be permitted. A reasonable tolerance in alignment will be defined as a maximum gradual deviation of 2 feet (600 mm), free from sharp breaks, made in the interest of economy and to take advantage of favorable topography. A reasonable tolerance in grade will be defined as a final grade that is uniform in appearance, free from sharp breaks or humps, and within 6 inches (150 mm) of plan grade if such tolerance results in economy to the Commission. Economy to the Commission will not refer to each individual cut, but to the entire project after due consideration has been given to the need of the material removed from cuts that are below grade and to the compensating feature of cuts that are left above grade. Loose rock on the finished subgrade over 2 inches (50 mm) in size shall be removed, picked up and disposed of as directed by the engineer.

203.4.2 Maintenance. During construction, the roadway shall be maintained by the contractor in such a condition that the roadway will be passable and well-drained at all times. Roadway ditches, channel changes, inlet and outlet ditches, and any other ditches in connection with the roadway shall be cut and maintained to the required cross section. All drainage work shall be performed in proper sequence with other operations. All ditches and channels shall be kept free of debris or obstructions. All material resulting from slides shall be removed and disposed of as directed by the engineer.

203.4.3 Removal of Oversize Material in Subgrade. The engineer may order the contractor to remove oversize material if the upper 4 inches (100 mm) of the subgrade, as tentatively completed, contains loose rock over 2 inches (50 mm) in size to make the subgrade unacceptable as a roadbed for the proposed type of surfacing in the judgment of the engineer.

203.4.4 Excavating in Rock. Excavating and undergrading in rock, that is material in accordance with the description of Class C, whether the contract calls for classified or unclassified excavation, shall be performed in a manner to produce material of such size as to permit placement in embankments in accordance with the requirements. Rock shall be removed to the limits of undergrading insofar as practical and in such manner as to leave no undrained depressions in the cut. Care shall be taken to avoid overshooting when blasting. Any loose or shattered rock, overhanging ledges and boulders above the roadbed that might dislodge shall be removed. If the contract provides a specific use for rock from roadway excavation, the work shall be performed in such order and manner as may be necessary to ensure that the desired quantity of such material may be placed as required.

203.4.4.1 Blasting Requirements. Reporting for all blasting shall be made in accordance with Sec 107.7.

203.4.4.1.1 The contractor shall submit a rock excavation blasting plan to the engineer at least 14 days before drilling operations begin. The blasting plan shall address all trenching, presplitting and production shots, and shall include, but is not limited to the following

information: powder factor per cubic yard (m^3), hole size, subdrill, stemming depth, drill pattern, type of explosives and detonators, and safety precautions. A preblast survey will be required on all uncontrolled structures within 500 feet (150 m) of planned blasting operations. A separate blasting plan will be required on all locations requiring blasting within 50 feet (15 m) of any roadway structure. Any changes to blasting plans shall be provided to the engineer for review prior to performing the work.

203.4.4.1.2 The contractor shall not exceed blasting holes larger than 4 inches (100 mm) in diameter. The powder factor shall be between 0.60 to 1.35 pounds per cubic yard (0.36 to 0.80 kg/m^3) except for presplitting or trenching. If stemming ejection becomes a problem, crushed stone stemmings shall be used. Subdrill shall be no more than 30 percent of burden. The contractor shall not drill within a radius equal to the depth of the cut of a loaded borehole. Seismic monitoring will be required when the scaled distance is less than 65 (30), where the scaled distance equals the distance, in feet (m), divided by the square root of explosive weight (mass), in pounds (kg), per 8-millisecond delay.

203.4.4.1.3 The contractor shall perform the excavation of rock cuts by the technique of presplitting, cushion blasting or air decking to produce a neat line of the proposed excavation, with the results subject to the approval of the engineer. Holes for presplitting shall be drilled to the full depth of the cut or to a pre-selected bench elevation as shown on the plans or as determined by the engineer. Presplitting shall be done according to accepted practice to produce a clean face on the excavated cut. Presplit shots shall be made prior to production shots. Production holes shall not be drilled any closer to the presplit line than 12 times the diameter of the production blast hole.

203.4.4.2 Undergrading. Regardless of whether the contract includes paving, the final surface for the backfilled undergraded areas shall be of a uniform texture and grade suitable to the engineer for paving.

203.4.4.2.1 Unless specified otherwise, the final surface shall be substantially free of exposed rock exceeding the 2 inch (50 mm) size that would interfere with the final preparation of the base for paving. Areas of required undergrading, except where an aggregate-type surface is specified, shall be backfilled with one of the following material, with preference in the order given, depending on availability:

(a) The top approximately 2 inches (50 mm) of the rock backfill shall consist of either rock fragments or spalls or a 2-inch (50 mm) granular-type material having a plasticity index not exceeding 10, and a gradation such that at least 50 percent of the material will be retained on the No. 4 (4.75 mm) sieve.

(b) A 2-inch (50 mm) maximum size granular-type material having a plasticity index not exceeding 10, and a gradation such that at least 50 percent of the material will be retained on the No. 4 (4.75 mm) sieve.

(c) A material having a low plasticity index and designated by the engineer as suitable. No material shall exceed 2 inches (50 mm) in size.

203.4.4.2.2 If a roadway to receive an aggregate type surface is specified in the contract, undergraded areas shall be backfilled with material obtained from roadway excavation, and the upper 6 inches (150 mm) shall be free of granular material larger than 4 inches (100 mm).

203.4.4.3 Overbreak. Overbreak resulting from blasting rock below the limits of undergrading shall be removed and backfilled with spalls or rock fragments at the contractor's expense. If spalls are not available and if the contractor does not elect to use rock fragments, the use of either of the following will be satisfactory.

(a) Material in accordance with Sec 1007.

(b) A granular-type material with a plasticity index not exceeding 10, and a gradation such that at least 50 percent of the material will be retained on the No. 4 (4.75 mm) sieve.

203.4.5 Unsuitable Material. Where excavation to the finished graded section results in a subgrade or slopes of unsuitable material, the engineer may require the contractor to remove the unsuitable material, and backfill to the finished graded section with approved material. The contractor shall conduct the operations in such a manner that the engineer may make the necessary measurements before the backfill is placed.

203.4.6 Borrow. Borrow material shall not be placed until after material from roadway excavation has been placed in the embankment, except as otherwise approved by the engineer. The contractor shall not excavate beyond the dimensions and elevations established, and no material shall be removed prior to staking and cross sectioning the site. If the contractor places more borrow than required, thereby causing a waste of excavation, such waste will be deducted from the borrow volume as measured in the borrow area. All borrow areas shall be bladed and left in such a shape as to permit taking the necessary cross sections after excavating has been completed. The finished borrow areas shall be approximately true to line and grade if so specified in the contract, and shall be finished, where practical, such that no water will collect or stand therein. If it is necessary to remove fencing in order to obtain borrow material, the fencing shall be replaced in as good condition as the fencing was at the time of removal. The contractor shall be responsible for confining livestock when a portion of the fence is removed. Removing and replacing such a fence or the confining of livestock shall be at the contractor's expense.

203.4.7 Roadway Obliteration. If obliteration of existing roadways or temporary construction is designated in the contract to be performed on a roadway excavation basis, such obliteration shall include all operations necessary to fill the ditches and blend the old road with the natural ground to provide a pleasing appearance. Removal of concrete pavement and concrete base course will be paid for in accordance with Sec 202.30. The earthwork for obliteration, including bituminous surfacing, will be included as roadway excavation.

203.4.8 Human, Criminal, Historical, Archaeological or Geological Remains. If the contractor encounters any remains, items, sites or artifacts that may be of criminal, historical, archaeological or geological significance, such as human remains, historic or prehistoric sites, artifacts, bones or fossils, the engineer shall be notified immediately. All excavation operations within 50 feet (15 m) of the finding shall be temporarily suspended and shall not be resumed at that location except as authorized by the engineer. The engineer will determine the disposition of the remains or items found. Such remains or items shall not be disturbed or removed, except as directed by the engineer. If directed by the engineer, the contractor shall excavate the site in such a manner as to preserve the items encountered. If a temporary suspension of work under this section lasts for an unreasonable period of time, as defined in Sec 108.15.1, and the suspension results in an actual increase in the time or cost of performance of the contract, then this condition will be deemed a suspension of the work directed by the engineer under Sec 108.15 and will be handled in accordance with that section.

203.4.9 Excavated Material Stockpile. During the process of excavating cuts, the engineer may order specific excavated material placed in stockpiles in order to have suitable material available to complete the upper portion of embankments and to backfill portions of undergraded cuts.

203.4.10 Embankment Construction. Embankment construction shall consist of constructing roadway embankments, including preparation of the area upon which the embankment is to be placed, constructing dikes and berms, placing and compacting approved material within roadway areas where unsuitable material has been removed, and placing and compacting embankment material in holes, pits and other depressions within the roadway area. Only approved material free of trees, stumps, rubbish and any other deleterious material shall be used in the construction of embankments and backfills. Rocks, broken concrete or other solid material shall not be placed in embankment areas where piling is to be placed or driven.

203.4.10.1 Embankments requiring surcharges, restricted loading rates, embankment control stakes or pore pressure measurement devices shall be constructed to the design template progressively for the full height. Failure of embankments or embankment foundations, or damage to structures that occurs when the contractor fails to observe restricted loading rates, or fails to construct slopes initially to the design template shall be repaired as directed by the engineer at the contractor's expense.

203.4.10.2 Construction of embankments shall not be started on foundation soil or partially completed embankments having more than 0.2 foot (60 mm) of frozen soil, nor shall embankment be built of frozen material. Frozen soil layers in partially completed embankments shall be at least 18 inches (450 mm) apart. No material shall be placed on frozen soil layers encountered within 12 inches (300 mm) of the top of the proposed grading section. Frozen material on foundation soil or partially completed embankment not meeting the above requirements shall be removed before placing material for the embankment. The removal of frozen material from the foundation of an embankment or from any layer of the embankment and the replacement with satisfactory material shall be at the contractor’s expense.

203.4.11 Embankment on Hillsides or Against Existing Embankment. Where embankment is to be placed on hillsides or where new embankment is to be constructed against existing embankments, existing slopes steeper than six horizontal to one vertical measured at a right angle to the roadway shall be continuously benched in no less than 12-inch (300 mm) rises over those areas as required, as the work is brought up in layers. Benching shall be of sufficient width to permit placing and compacting operations. Each horizontal cut shall begin at the intersection of the ground line and the vertical side of the previous bench. Existing slopes shall also be stepped to prevent any wedging action of the embankment against structures. The material thus cut out or compacted along with the new embankment material will be at the contractor’s expense.

203.4.12 Scalping. Scalping shall be performed in accordance with Sec 201.2.3. Where an embankment less than 4 feet (1.2 m) high is to be constructed, all sod and vegetative material shall be removed from the surface upon which the embankment is to be placed, and the cleared surface completely broken up by plowing, scarifying or stepping to a minimum depth of 6 inches (150 mm). This area shall be compacted in the same manner as that required for the embankment placed on the area. Sod not requiring removal shall be thoroughly disked before construction of embankment. Where an embankment less than 3 feet (900 mm) high is to be constructed over a compacted road surface containing bituminous or granular material, the old road surface shall be scarified to a depth of at least 6 inches (150 mm). This scarified material shall be recompacted.

203.4.13 Embankment Against Existing Structures. If embankment is deposited on one side only of abutments, wingwalls, piers or culvert headwalls, care shall be taken that the area immediately adjacent to the structure is not compacted to the extent that the compaction will cause overturning of or excessive pressure against the structure. Equipment of such weight (mass) as may cause damage to culverts or other structures will not be permitted to work over or immediately adjacent to such structures. The embankment adjacent to the end bent of a

bridge shall not be placed higher behind than in front of end bents until the superstructure is in place. If embankment is to be placed on both sides of a concrete wall or box-type structure, operations shall be conducted such that the embankment is kept at approximately the same elevation on each side.

203.4.14 Surcharged Embankments. Surcharged embankments shall be built in accordance with the plans and shall remain in place for such time as in accordance with the contract. The requirements for placing and compacting will be waived on the surcharge material above the specified compacted area.

203.4.15 Excess or Unsuitable Material. All excess or unsuitable excavated material, including rock and boulders that cannot be used in embankments, may be placed on the sideslopes of the nearest embankment in a satisfactory manner or shall be disposed of off the right of way in areas secured by the contractor. Rock or boulders greater than 24 inches (600 mm) shall not be used routinely in constructing sideslope embankments. A distinct shoulder line shall be maintained by keeping all such waste material at least 24 inches (600 mm) below the finished shoulder elevation, and specific density control will not be required.

203.4.16 Placement of Embankment. Roadway embankment shall be placed in layers not exceeding 8 inches (200 mm), an uncompacted measurement, and shall be compacted as specified before the next layer is placed. The layers shall be placed approximately parallel to both the proposed profile grade and to the finished roadbed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compacting. Continuous leveling and manipulating will be required during compacting operations. Construction equipment shall be routed uniformly over the entire surface of each layer. Occasional rocks and boulders greater than 24 inches (600 mm) shall be dispersed to allow for uniform compaction between them.

203.4.16.1 Occasional stones or rock fragments exceeding the thickness of the 8-inch (200 mm) layer shall be disposed of by being incorporated into the embankment outside the limits of the proposed surfaced traffic lanes. The thickness of the layer in these areas may be increased if necessary to accommodate the stones, but shall not exceed 12 inches (300 mm), an uncompacted measurement. The stones or rock fragments shall be placed such that there is no nesting.

203.4.16.2 Lifts may be increased to a maximum of 12 inches (300 mm), an uncompacted measurement, for berms, filling of old channels, waste or similar areas, and any roadway or approach for which a granular-type surface is proposed. These areas shall be compacted by uniformly distributing all equipment movements over the entire area, and specific density control will not be required. Compaction performed in these areas will be at the contractor's expense.

203.4.17 Rock Embankment. If the excavated material consists predominantly of rock fragments of such a size that the material cannot be placed in layers of the prescribed thickness, such material shall be placed in the embankment in layers having a thickness of the approximate average size of the larger rocks but not exceeding 24 inches (600 mm). Rocks or boulders too large to permit placing in a 24-inch (600 mm) layer shall be reduced in size as necessary to permit this placement. Rock shall not be dumped in place, but shall be distributed by blading or dozing in a manner to ensure proper placement in final position in the embankment. Construction equipment shall be routed uniformly over the entire surface of each layer. The spalls and smaller stone fragments shall be left on the surface of each layer as formed.

203.4.18 Rigid or Flexible Pavements. If the specified or proposed surfacing consists of a rigid or flexible-type pavement, the top consolidated rock layer for the full width between roadbed slopes shall be finished to the same limits as shown on the plans for undergrading in rock cuts. If rigid pavement is to be constructed without an aggregate base, the material requirements of Sec 203.4.4.2.1 (a) or (b) shall govern the construction of the area between the bottom of the pavement and the top of the top consolidated rock layer. Any embankment necessary outside the limits of the pavement shall be constructed of suitable earth or as otherwise specified in the contract.

203.5 Compaction of Embankment and Treatment of Cut Areas with Moisture and Density Control. AASHTO T 99, Method C, replacing any material retained on a 3/4-inch (19.0 mm) sieve, as provided therein, or MoDOT Test Method TM 40 will be used as the Standard Compaction Test for determining the moisture density relations of soils. The optimum moisture as determined by the Standard Compaction Test may be used as a guide in determining the proper moisture content at which each soil type should be compacted. Water shall be added or removed as necessary to permit obtaining the required density and moisture control. The field density of the embankment after compaction will be determined in accordance with AASHTO T 191 or T 205, using the total material or T 238, Method B Direct Transmission, for wet density. The volume of the test hole may be reduced as necessary to accommodate available testing equipment. If nuclear density methods are used, moisture content will be determined in accordance with AASHTO T 239, except that a moisture correction factor will be determined for each soil in accordance with MoDOT Test Method TM 35. The calculated density obtained in a field density test will be compared with the maximum density as directed by the Standard Compaction Test to determine the percent of compaction attained.

203.5.1 Maximum Density Compaction Requirements. If payment of Compacting Embankment or Embankment in Place is specified as a contract pay item, compaction to at least 90 percent of maximum density, as determined by the Standard Compaction Test, will be required in the following areas:

(a) All roadway embankments except as otherwise provided in the following sections: Secs 203.4.14, 203.4.15, 203.4.16.2, 203.5.3, 203.5.4, 203.5.5 and 203.5.7

(b) All backfilled undergraded cuts, except as modified by Sec 203.5.3.

(c) Certain portions of the roadbed in cuts specified in Sec 203.5.8, except as modified in Sec 203.5.3.

203.5.2 Moisture Control. The moisture content of the soil at the time of compaction shall be as specified herein.

203.5.2.1 When necessary to eliminate a rubbery condition of the embankment, it may be required that some soils have a moisture content below the optimum during compacting work, except that Class A material having a liquid limit of 40 or more, where placed in embankments within 5 feet (1.5 m) of the top of the finished subgrade or where encountered in areas of cut compaction, shall be compacted at no less than the optimum moisture content. The liquid limit determination will be in accordance with AASHTO T 89. Some Class A material, including heavy clays and material commonly known as shales and fireclays, shall require breaking down such that the moisture can be uniformly distributed.

203.5.2.2 Loessial soils shall have moisture controlled so as not to exceed optimum plus 3 percentage points when placed in embankments less than 30 feet (9 m) high. When placed in embankments 30 feet (9 m) high or more, such soils shall have moisture controlled such that the optimum moisture is not exceeded. If wet foundation conditions contribute to the

embankment moisture while compacting, the engineer may waive this specified moisture content for a height not to exceed 3 feet (1 m) above the embankment foundation. In the event of conflict of provisions of this section with provisions in Sec 203.5.2.1, Sec 203.5.2.1 shall govern.

203.5.3 Top Lift Thicknesses The upper 18 inches (450 mm) of the earth subgrade extending the full width between roadbed slopes shall be compacted to at least 95 percent of maximum density.

203.5.4 Structure Approach. Roadway embankment within 100 feet (30 m) of each end of a structure on which the top slab or deck is to be used as the riding surface and the spill fill under such a structure shall be compacted to no less than 95 percent of maximum density.

203.5.5 Rocky Fill. Density requirements will not apply to portions of embankments constructed of material so rocky that the embankment cannot be satisfactorily tested in accordance with AASHTO T 191 or T 205. Material of a gradation having more than approximately 20 percent retained on a 3/4-inch (19.0 mm) sieve will generally be considered too rocky for satisfactory density testing. In lieu thereof, the compactive effort on rocky material shall consist of making four complete passes on each layer with a tamping-type roller or two complete passes on each layer with a vibratory roller. The tamping-type roller shall have tampers or feet protruding no less than 6 inches (150 mm) from the surface of the drum and shall have a minimum load on each tamper of 250 psi (1700 kPa) of tamping area. The vibratory roller shall have a manufacturer's rating of 16 to 20 tons (14 to 18 Mg) compacting power. During compaction, each layer shall have the moisture content controlled such that, in the judgment of the engineer, any silt and clay fraction is in a plastic state. Simple diagnostic tests to establish such a plastic state will include ability to indent with a thumb or heel or to roll a short thread of soil between the hands. Material that crumbles under pressure will be considered too dry.

203.5.6 Lift Consistency. Each layer shall be wetted or dried as necessary, and shall be compacted to the required density. Regardless of the type of equipment used, the roadway shall be compacted uniformly and the surface kept reasonably smooth at all times. If large pieces of heavy clay are encountered, the material shall be broken down by suitable manipulation to permit satisfactory embankment construction. If shale is encountered, the shale shall be broken down as much as practical and compacted at or above optimum moisture.

203.5.7 Deep Fills. Compaction to at least 95 percent of maximum density will be required for that portion of any embankment below an elevation 50 feet (15 m) below the top of the finished subgrade. If, because of embankment foundation conditions, the 95 percent maximum density cannot be obtained after reasonable compactive effort has been expended, the engineer may waive the 95 percent requirement for a height not exceeding 3 feet (1 m) above the embankment foundation.

203.5.8 Compacting in Cut. Cut compaction shall be performed in all Class A material areas after removal of the roadway excavation material to the required section. A surface parallel to the pavement slope, 12 inches (300 mm) below the bottom of the pavement or lowest base course, shall be temporarily exposed for the full width between roadway inslopes. The exposed material shall be manipulated and compacted to no less than the required density to a depth of 6 inches (150 mm). The material above this compacted plane shall be spread in layers not exceeding 8-inch (200 mm) loose thickness, each layer being wetted or dried as necessary and compacted to the specified density. The entire volume of material so handled and compacted, including the 6-inch (150 mm) layer compacted in place, will be considered as Compacting in Cut. All Class A material having a liquid limit of 40 or more, including the 6-

inch (150 mm) layer compacted in place, shall be compacted at no less than the optimum moisture content.

203.5.8.1 Cut compaction shall be performed to an additional depth of 12 inches (300 mm) for 50 feet (15 m) on each side of the intersection of the natural ground and the top of the subgrade, then uniformly graded for 30 feet (9 m) to meet the depth requirements of Sec 203.5.8 and, if necessary, Sec 203.5.8.2.

203.5.8.2 The existing ground for the full width between roadway slopes under embankments less than 18 inches (450 mm) high shall be treated in accordance with Sec 203.5.8 to only such depth as to ensure having 18 inches (450 mm) of material of the required density and moisture below the top of the finished subgrade.

203.5.9 Field Laboratory. When authorized by the engineer, the contractor shall provide a Type 2 field laboratory in accordance with Sec 601.

203.6 Compaction of Embankment not Constructed with Density or Moisture and Density Control. If compaction of embankment is a requirement of the contract but has not been specified as a pay item, the compactive effort on each layer shall consist of distributing all equipment movements over the entire embankment area and of at least three complete passes with a tamping-type roller over the entire area to be compacted. The tamping-type roller shall have tampers or feet projecting no less than 6 inches (150 mm) from the surface of the drum and shall have a minimum load on each tamper of 250 psi (1700 kPa) of tamping area. Compactive efforts shall be continued, if necessary, until the tamping feet penetrate no more than 2 inches (50 mm) into the layer of material being compacted. Continuous leveling and manipulating will be required during compacting operations and the moisture content shall be adjusted as necessary, in the judgment of the engineer, to permit proper consolidation.

203.6.1 Dumping and rolling areas shall be kept separate, and no lift shall be covered by another until compaction complying with these requirements has been attained. Unstable areas in the embankment shall be removed and replaced with suitable material at the contractor's expense.

203.6.2 Each layer of embankment constructed of rock or rocky material shall also be compacted by three complete passes of the tamping-type roller. A vibratory roller may be used if approved by the engineer.

203.7 Compaction of Embankment Without Specified Compaction Results or Specified Compaction Equipment. If compaction of embankment is not designated by the contract, compaction will not be required other than that attained by distributing equipment movements over the entire embankment area.

203.8 Method Of Measurement.

203.8.1 Contract Quantity Payment. The quantities of excavation , compacting embankment, and embankment in place for which payment will be made will be those shown in the contract for the various items, provided the project is constructed essentially to the lines and grades shown on the plans. A partial check of existing ground elevations will be made at the time slope stakes are set, and of the finished work for deviations in the grade, width or slope from the authorized grade or typical section.

203.8.1.1 Final measurement will not be made of Class A Excavation, Unclassified Excavation , Compacting Embankment, and Embankment in Place except when:

(a) Appreciable errors are found in the original computations.

(b) An original cross section is found to have an average deviation from the true elevation in excess of one foot (300 mm).

(c) An authorized change in grade, slope or typical section is made.

(d) Unauthorized deviations decrease the quantities on the plans.

(e) Class C excavation is encountered, unless the contract calls for unclassified excavation. If this condition is encountered, corrections or revisions will be computed and added to or deducted from the contract quantity.

(f) Quantities are determined by measurement as specified in Sec 203.8.2.

203.8.1.2 If the plans have been altered or when disagreement exists between the contractor and the engineer as to the accuracy of the plan quantities of any balance, or the entire project, either party has the right to request a recomputation of contract quantities of excavation within any area by written notice to the other party. The written notice will contain evidence that an error exists in the original groundline elevation or in the original computations that will materially affect the final payment quantity. If such final measurement will be required, measurement will be made from the latest available ground surface and the design section.

203.8.2 Measured Quantities. If payment of excavation is to be made on a measured quantity basis, volumes of authorized excavation will be computed from cross section measurements by the average end area method. When not attributable to carelessness of the contractor, slides in Class A Excavation and in Unclassified Excavation will be included in such measurements. Authorized excavation of rock, shale, muck or other unsuitable material will also be included.

203.8.2.1 Authorized excavation of rock, shale, muck or other unsuitable material below grade shall consist of that excavation necessary to provide the designated depth of undergrading. No measurement or payment will be made of any material removed and replaced below the design limits of undergrading. No measurement will be made for overbreak or for the disposal of the same if such material is obtained from outside the neat lines of the proposed backslopes in rock excavation, except that such overbreak will be measured as Class A Excavation or Unclassified Excavation, as applicable, when all suitable authorized excavation has been used and the overbreak material will be required for completion of the embankment. A maximum tolerance of one foot (300 mm) will be permitted for rock protruding or extending within the neat lines of the proposed backslopes.

203.8.2.2 While work involving classified excavation is in progress, the engineer will fix points of elevation and stationing as required to establish the lines of demarcation between material of different classification. These top points will be determined before any Class C, sandstone or igneous rock excavation is removed, and the contractor shall notify the engineer before removing any such material. Any excavation removed before the engineer has been notified and given 24 hours to establish lines of demarcation will be included in the measurement of Class A Excavation only.

203.8.2.3 Excavation may be encountered in which lines of demarcation between material of different classifications are impractical to establish. The quantity of material classified as other than Class A Excavation may be determined by the engineer on a percentage basis as the work progresses after the limits of determinate classification material have been established. Where vertical or near vertical excavation limits are indicated by the plans, all Class A Excavation material encountered within the actual Class C vertical excavation limits will be included with Class C Excavation quantities.

203.8.2.4 Measured quantities of excavation will be used where the ground elevations shown on the plans are found to be erroneous. No revision of contract quantities will be made if the actual ground elevations are considered to agree generally with the ground line shown on the plans. Where the engineer authorizes a change in grade, slope or typical section affecting the volume of excavation allowed for payment in that particular balance or area, the revised volume will be determined by the average end area method on the basis of the revised grade, slope or typical section. Where unauthorized deviations result in a decrease in the contract quantities, the deviations will be measured and deducted from the contract quantity.

203.8.2.5 The quantity of Class C Excavation will be computed on a measured quantity basis. The volume of Class A Excavation allowed for payment in roadway balances involving rock excavation will be determined by one of the following methods, whichever in the judgment of the engineer is more applicable:

(a) Measuring and computing both the Class A Excavation and the Class C Excavation within the limits affected or as defined by Sec 203.8.2.3.

(b) Deducting the volume of Class C, sandstone or igneous rock excavation from the total adjusted volume of roadway excavation, regardless of classification, within the limits affected or as defined by Sec 203.8.2.3.

203.8.2.6 Measurement will be made for unsuitable material actually excavated and removed to permit proper compaction in cut sections and in foundations for embankment sections. No measurement will be made of the suitable material temporarily removed and replaced to facilitate compaction in cuts or under shallow embankments.

203.8.2.7 Borrow quantities will be determined by measuring the borrow area before and after excavating.

203.8.2.8 Excavated material stockpiled in accordance with Sec 203.4.9 will be measured in the stockpile by the average end area method.

203.8.2.9 Only that material placed in accordance with Sec 203.5 will be included in the measurement of Compacting Embankment and Embankment in Place. If an error has been found in the original computations or ground elevations, or if there has been an authorized change in grade, slope or typical section, the plan quantity for Compacting Embankment and Embankment in Place for those areas or balances affected will be adjusted for final payment. All required compaction above the original ground line and all compacting of material placed in undergraded cut sections will be considered as Compacting Embankment and Embankment in Place.

203.8.2.10 Compacting in cuts will be measured to the nearest 1/10 station (5 m) along the centerline of each roadbed regardless of width, and will include any required compaction of the original ground under shallow embankments. For the purpose of measurement, a divided highway will be considered as having two roadbeds. Measurement of ramps will be made from or to the ramp's gore point. Final measurement will not be made except for authorized changes during construction or where appreciable errors are found in the contract quantity. The revision or correction will be computed and added to or deducted from the contract quantity.

203.8.2.11 Measurement of roadway and drainage excavation, compacting embankments and embankments in place will be made to the nearest cubic yard (m^3).

203.9 Basis of Payment. Roadway and drainage excavation will be paid for at the contract unit price per cubic yard (m^3) and will be considered full compensation for the following:

(a) Excavating.

(b) Hauling any distance.

(c) Placing and forming embankments.

(d) Preparation of subgrade.

(e) Shouldering, rounding slopes, obliterating existing roadbeds or temporary construction, finishing of graded earth roadway, picking up and disposing of field stone and other rock.

(f) Disposal of excess excavation.

(g) Any work noted on the plans to be included in the contract unit price for excavation.

203.9.1 No payment will be made for any material used for purposes other than those designated, except as approved by the engineer.

203.9.2 Payment will be made at the contract unit price per cubic yard (m^3) for the applicable item of Class A Excavation or Unclassified Excavation for each handling of stockpiled excavation approved by the engineer.

203.9.3 No payment will be made for rock overbreak or for backfilling overbreak areas below the undergrading limits. Payment for the material for backfilling required undergraded areas will be made under an applicable excavation item. No direct payment will be made for backfilling around structures, the excavation for which has been paid for as roadway excavation.

203.9.4 If the contract does not contain a contract unit price for Class C Excavation and such material is encountered during construction, unless the project is let on an unclassified excavation basis, payment will be made per cubic yard (m^3) at the fixed contract unit price specified in Sec 109.

203.9.5 No direct payment will be made for water required in compaction work. Any costs involved in reducing the moisture content in soils will be at the contractor's expense.

203.9.6 Payment for finishing a graded earth roadway will be considered completely covered by the contract unit price for the various classes of excavation except as otherwise specifically noted under Sec 104.11.2 in regard to material excavated in cleaning channels and culverts used in place.

203.9.7 When removal of unsuitable material is directed by the engineer, the contractor will be reimbursed for excavation of the unsuitable material and the excavation of the suitable replacement material. Payment will be made for each operation at the contract unit price of Class A Excavation or Unclassified Excavation. Payment for placement of the suitable material will be paid for at the contract unit price of Compacting Embankment.

203.9.8 Embankment in Place will be paid for at the contract unit price per cubic yard (m^3), and will be considered full compensation for:

(a) Furnishing and transporting material from stockpile sites or from a contractor-provided source.

(b) Placing and forming embankments.

(c) Compacting embankment or for adding or reducing the water content of the embankment.

(d) Any excavation required to provide the embankment material included under the item of embankment in place, including mulching and seeding a borrow site.

(e) Any work noted on the plans to be included in the contract unit price for embankment in place.

203.9.9 Payment will be made at the contract unit price for each of the pay items included in the contract.