SECTION 31 23 06

EXCAVATION, EMBANKMENT, AND PREPARATION OF SUBGRADE FOR ROADWAYS AND PARKING LOTS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Unless specified otherwise, the current edition of reference will be used.

1.1.1 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	Particle-Size Analysis of Soils
ASTM D 698	Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1140	Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve
ASTM D 2487	Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.2 SUBMITTALS

Government approval is required for all submittals. The following shall be submitted in accordance with SECTION 01 33 00 SUBMITTAL PROCEDURES:

SD-09 Reports

Copies of all laboratory and field test reports shall be submitted within 24 hours of the completion of the test.

1.3 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698, abbreviated as percent laboratory maximum density.

1.4 CLASSIFICATION OF EXCAVATION

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.5 BLASTING

Blasting will not be permitted.

1.6 UTILIZATION OF EXCAVATED MATERIALS

All unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding as backfill, and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory materials, which are authorized to be wasted, shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. No excavated material shall be disposed of in such a manner as to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, SW, SP, or local excavated and borrow materials are satisfactory for preparation of subgrade and embankments, except organic material, trash, etc. and materials containing excessive moisture which do not readily compact or support construction equipment.

2.1.2 Unsatisfactory Materials

Unsatisfactory materials shall comprise any materials classified by ASTM D 2487 as PT, OH, MH, CH, and OL.

2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are non-plastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Where indicated, topsoil shall be stripped to a depth of 6-inches. Topsoil shall be spread on areas already graded and prepared for topsoil, or when so specified topsoil shall be transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 2-inches in diameter, and other materials that would interfere with planting and maintenance operations.

3.2 EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project, to the lines, grades, and elevations indicated and as specified herein. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph 3.1 FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as approved by the Contracting officer. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified herein.

3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades,

and elevations shown. Care shall be taken not to excavate ditches and gutters below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory thoroughly compacted material or with suitable stone or cobble to grades shown at no additional cost to the Government. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 4 feet from the edge of a ditch. The Contractor shall maintain all excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Drainage Structures

Excavations shall be made accurately to the lines, grades, and elevations shown. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm surface level, stepped, or serrated, as shown. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas shown or from other approved sources, either private or within the limits of the project site, selected by the Contractor. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay all royalties and other charges involved, and bear all expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation and shall be performed by the Contractor at no additional cost to the Government.

3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

Except as otherwise permitted, borrow pits and other excavation areas shall be excavated in such manner as will afford adequate

drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as approved by the Contracting officer. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall insure that excavation of any area, operation of borrows pits, or dumping of spoils material, results in minimum detrimental effects on natural environmental conditions.

3.5 GRADING AREAS

When so provided and where indicated, work under contract will be divided into grading areas, within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 95 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials, in such a manner as to prevent wedging action or eccentric loading upon or against any structure. Refer to Section 31 23 1; EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. Ground surface on which backfill is to be placed shall be prepared as specified in Paragraph 3.7, PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of Paragraph 3.7, PREPARATION OF GROUND SURFACE FOR EMBANKMENTS; Paragraph 3.8, EARTH EMBANKMENTS; and Paragraph 3.9, SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted.

3.7 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the material being compacted. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

3.8 EARTH EMBANKMENTS

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. The material shall be placed in successive horizontal layers of loose material not more than 6-inches in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary and scarified or otherwise broken up in such a manner that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 95 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in Paragraph 3.9, SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted.

3.9 SUBGRADE PREPARATION

3.9.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required obtaining specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material. Rock encountered in the cut section shall be excavated to a depth of 6 inches below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. The elevation of the finished subgrade shall not vary more than 0.05 foot from the established grade and cross section.

3.9.2 Compaction

3.9.2.1 Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted.

3.9.2.2 Subgrade for pavements shall be compacted to at least 95-percentage laboratory maximum density for the depth below the surface of the pavement shown.

3.10 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow materials or as otherwise shown or specified herein. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in Paragraph 3.9, SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment well suited to the type of material being compacted. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

3.11 FINISHING

The surface of all excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for all graded areas shall be within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in Paragraph 3.9, SUBGRADE PREPARATION above. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to smoothness suitable for the application of turf materials.

3.12 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained in such a manner as to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

3.13 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. An approved commercial testing laboratory shall perform testing. Field in-place density shall be determined in accordance with ASTM D 2922. Within 24 hours of conclusion of physical tests, 2 copies of test results shall be furnished to the Contracting Officer. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced, and re-compacted to meet specification requirements, at no additional expense to the Government. Tests on re-compacted areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.13.1 Fill and Backfill Material Gradation

One test per 500 cubic yards stockpiled or in-place source material shall be taken. Gradation of fill and backfill material shall be determined in accordance with ASTM D 422.

3.13.2 In-Place Densities

3.13.2.1 One test per 10,000 square feet, or fraction thereof, per lift of fill or backfill area compacted by other than hand-operated machines.

3.13.2.2 One test per 1,000 square feet, or fraction thereof, per lift of fill or backfill area compacted by hand-operated machines.

3.13.2.3 One test per 500 linear feet, or fraction thereof, per lift of embankment or backfill for roads.

3.13.3 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in Paragraph 3.9, SUBGRADE PREPARATION shall be made during construction of the subgrades.

- End of Section -