
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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DIVISION 02 - SITE CONSTRUCTION

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SECTION 02311

EXCAVATING, BACKFILLING, AND COMPACTING FOR STRUCTURES
06/04

NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers excavation, fill and backfill for structures within a designated area.

Drawings must include the following:

Limits of specified work indicating the distance from the building lines of each structure terminating at the site grading limits when Section 02315, "Excavation and Fill," is a part of the contract.

Data on subsurface soil conditions

Existing contours and required subgrade elevations coordinated with established bench marks; locations of bench marks

Location of existing pavements and other obstructions on the ground surface and existing underground structures and utilities that are required to be demolished and removed.

Location of footings, foundations, pavements, walks, grassed areas, and other superimposed work

Bottom elevations of footings and foundations

Foundation subdrainage system with the points of termination indicated by the distance outside building lines of each structure

Thickness after compaction of drainage fill above subgrade elevation under building slabs

Location of soil storage areas and spoil areas on Government property when disposal of excess and waste material on Government property is permitted.

Topsoil removal is specified in Section 02315, "Excavation and Fill."

Site grading the areas outside the limits of excavation, fill, and backfill for structures is specified in Section 02315, "Excavation and Fill."

Placing topsoil is specified in Section 02920, "Lawns and Grasses."

PART 1 GENERAL

1.1 REFERENCES

NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.

The publications listed below form a part of this section to the extent referenced:

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

- AASHTO M 145 (1991; R 2003) Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
- AASHTO M 218 (2003) Steel Sheet Zinc-Coated (Galvanized) for Corrugated Steel Pipe
- AASHTO T 103 (1991; R 2000) Soundness of Aggregates by Freezing and Thawing
- AASHTO T 180 (2001) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
- AASHTO T 2 (2000) Sampling of Aggregates
- AASHTO T 87 (1986; R 2000) the Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test

ASTM INTERNATIONAL (ASTM)

- ASTM C 117 (2003) Standard Test Method for Materials Finer than 75-micrometer (No. 200) Sieve in Mineral Aggregates by Washing
- ASTM C 131 (2003) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
- ASTM C 136 (2001) Standard Test Method for Sieve

Analysis of Fine and Coarse Aggregates

ASTM C 32	(1993; R 1999e1) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 33	(2003) Standard Specification for Concrete Aggregates
ASTM C 387	(2000e1) Standard Specification for Packaged, Dry, Combined Materials for Mortar and Concrete
ASTM C 412	(2003) Concrete Drain Tile
ASTM C 412M	(2003) Concrete Drain Tile (Metric)
ASTM C 700	(2002) Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 88	(1999a) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM D 1556	(2000) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2002e1) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³) (2700 kN-m/m ³)
ASTM D 2216	(1998) Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 226	(1997a) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 227	(1997a) Standard Specification for Coal-Tar-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 2922	(2001) Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3282	(1993; R 1997e1) Standard Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes
ASTM D 3740	(2001) Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction

ASTM D 422 (2002) Standard Test Method for Particle-Size Analysis of Soils
ASTM D 4318 (2000) Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926 (2001) Safety and Health Regulations for Construction

1.2 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-01 Preconstruction Submittals

Construction Equipment List shall be submitted.

Contractor shall record Existing Conditions prior to starting work in accordance with the paragraph entitle, "Existing Conditions," of this section.

SD-06 Test Reports

Test Reports shall be submitted for Soil Test results within 7 calendar days. Test reports shall be submitted according to paragraph entitled, "Quality Control Testing During Construction," of this section.

SD-07 Certificates

Certificates of Compliance for Proposed Soil Materials shall be submitted according to paragraph entitled, "Tests for Proposed Soil Materials," of this section.

Certificates of Compliance for Compost shall be submitted indicating grade and compliance with state and local regulations.

1.3 LIMITS OF CONSTRUCTION

Work in this section relates to excavation, fill, and backfill to a point 5 feet 1500 millimeter beyond the building or structure line.

1.4 SAMPLING AND TESTING

1.4.1 Soil Test and Inspection Service

[Soil testing service will be provided by the Government. Testing service will include testing soil materials proposed for use in the work and field-testing facilities for quality control testing during construction period.]

[Soil survey for satisfactory soil materials and samples of soil materials shall be furnished by the Contractor. A certified soil-testing service approved by the Contracting Officer shall be provided by the Contractor. Testing shall include soil survey for satisfactory soil materials; sampling and testing soil materials proposed for use in the work, and field-testing facilities for quality control during construction period.]

Testing agencies shall conform to the requirements of ASTM D 3740.

1.4.2 Tests For Proposed Soil Materials

Materials shall be approved by the Contracting Officer prior to start of work.

Soil materials proposed for use in the work shall be tested as follows.

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Satisfactory soil materials	Sampling	AASHTO T 2	One from each source of materials to determine conformance to definition of satisfactory soil materials;
	Preparation of samples	AASHTO T 87	additional tests whenever there is any apparent change
	Sieve analysis of fine and coarse aggregates	ASTM C 136	
	Amount of material passing No. 200 75 micrometer sieve	ASTM C 117	
	Liquid limit	ASTM D 4318	
	Plastic limit and plasticity index	ASTM D 4318	
	Mechanical analysis	ASTM D 422	
	Moisture-density relations	ASTM D 1557	As required to determine moisture-density requirement of materials from

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u> each source
	Los Angeles abrasion of coarse aggregates	ASTM C 131	One for each soil material from each source if called for in reference specification
	Freezing and thawing soundness of aggregates	AASHTO T 103	
	Magnesium Sulfate Soundness Test	ASTM C 88	

1.4.3 Quality Control Testing During Construction

Soil materials shall be tested during construction as follows:

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
Soil materials specified	Sieve analysis of fine and coarse aggregates	ASTM C 136	One daily for each soil material from each source; additional test whenever there is any apparent change
	Amount of material passing No. 200 75 micrometer sieve	ASTM C 117	
	Moisture content of subbase material	ASTM D 2216	
Soil materials prior to compaction	Moisture-density relations of soil	ASTM D 1557	One of each type of subgrade soil material except under backfill for structures; one for each backfill and fill material from each source
Soil material-	Density of soil-in-place	ASTM D 1556, Sand Cone	At least three daily for each

<u>MATERIAL</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>	<u>NUMBER OF TESTS</u>
in-place after compaction		Method or ASTM D 2922, Nuclear Method (when approved by Contracting Officer)	subgrade soil material except under backfill for structures, and for each layer and backfill and fill material; additional test whenever there is any change in moisture conditions

1.4.4 Test Reports

No soil material shall be used until test reports have been reviewed and approved.

1.4.5 Evaluation of Test Results

Results of density of soil-in-place tests shall be considered satisfactory if the average of any group of four consecutive density tests which may be selected is in each instance equal to or greater than the specified density, and if not more than one density test in five has a value more than 2 percentage points below the specified density.

1.5 CONSTRUCTION EQUIPMENT LIST

Construction Equipment List of all major equipment to be used shall be submitted.

1.6 EXISTING CONDITIONS

Existing Conditions shall be recorded, in the presence of the Contracting Officer, and shall include all structures and other facilities adjacent to areas of alteration or removal. Such records shall contain the location of existing utilities, the elevation of the top of foundation walls, the location and extent of cracks and other damage, and a description of surface conditions that exist prior to the start of work. Copies of the record shall be submitted and the conditions prior to starting work shall be verified.

PART 2 PRODUCTS

2.1 BACKFILL AND FILL MATERIALS

Materials for backfill and fill shall be free of clay clods, rock or gravel larger than 2 inches 50 millimeter in any dimension, debris, waste, frozen materials, and other deleterious matter and shall be satisfactory soil materials as follows:

<u>AREA CLASSIFICATION</u>	<u>BACKFILL OR FILL MATERIALS</u>
In excavations, unless otherwise specified	Excavated or borrow material that has been sampled, tested, and approved as

AREA CLASSIFICATION

BACKFILL OR FILL MATERIALS

Against face of structures where footing drains from top of porous fill for footing drains to indicated elevation, and from face of structure a distance equal to three footing drain diameters

Filtering material

Against surfaces having applied waterproofing for a distance of at least 6 inches 150 millimeter from surface

Sand

In foundation subdrain trenches over porous fill drain pipe

Filtering material

Under grassed areas

Excavated or borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material"

Under walks, steps, and paved areas

Subbase material or excavated or borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material"

Under building slabs

Drainage fill

2.1.1 Satisfactory Materials

Satisfactory materials shall mean AASHTO M 145, (ASTM D 3282) Soil Classification Groups A-1, A-2-4, A-2-5, and A-3.

2.1.2 Unsatisfactory Materials

Unsatisfactory soil materials shall mean AASHTO M 145, Soil Classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7, peat and other highly organic soil, and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

2.2 TOPSOIL

Topsoil shall be any soil removed from the project site which consists of clay or sandy loam.

The topsoil shall be reasonably free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones,

stumps, roots, and other objectionable materials larger than 2 inches 50 millimeter in any dimension.

2.3 COMPOST

NOTE: Insert grade or class of compost suitable for the surface required. Insert local or state regulation defining class or grade of compost. Where local or state regulations do not define grade or class, insert requirements for screening to limit particle size.

Compost shall be yard trimmings or yard waste compost processed and graded according to state and local regulations. Compost shall be grade [_____] as defined by [_____].

2.4 TOPSOIL BLEND

Where insufficient topsoil is removed from the project site the topsoil removed shall be stockpiled and blended with compost at the site to achieve the required volume.

2.5 COHESIONLESS MATERIALS

Cohesionless soil materials include gravels, gravel-sand mixtures, sands, and gravelly-sands. Moisture-density relations of compacted cohesionless soils, when plotted on graphs, will show straight lines or reverse-shaped moisture density curves.

2.6 COHESIVE MATERIALS

Cohesive soil materials include clayey and silty gravels, sand-clay mixtures, gravel-silt mixtures, clayey and silty sands, sand-silt mixtures, clays, silts, and very fine sands. Moisture-density relations of compacted cohesive soils, when plotted on graphs, will show normal moisture-density curves.

2.7 SUBBASE MATERIAL

Subbase material shall be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, or sand.

2.8 DRAINAGE FILL

Drainage fill shall be a washed, uniformly graded mixture of crushed stone or crushed or uncrushed gravel, with 100 percent passing 1-1/2-inch 37.5 millimeter sieve and not more than 5 percent passing No. 4 4.75 millimeter sieve.

2.9 FILTERING MATERIAL

Filtering material shall conform to ASTM C 33 and shall be a uniformly graded mixture of natural or crushed gravel, crushed stone, and natural sand, with 100 percent passing 3/8-inch 9.5 millimeter sieve and 2 to 10 percent passing a No. 100 150 micrometer sieve.

2.10 SAND

Sand shall be natural sand.

2.11 DRAINAGE PIPE AND FITTINGS

[Drainage pipe shall be extra-strength perforated clay pipe, ceramic glazed, of size indicated, with self-centering lugs in bell ends, and shall conform to ASTM C 700.]

[Drainage pipe shall be standard strength, perforated, nonreinforced-concrete, underdrainage pipe of size indicated, and shall conform to ASTM C 412 ASTM C 412M.]

[Drainage pipe shall be perforated, corrugated metal pipe underdrains, helically or circumferentially corrugated with welded longitudinal seams, hot-dip galvanized after fabrication, not less than 6 inches 150 millimeter in diameter, with coupling bands hot-dip galvanized after fabrication, and shall conform to AASHTO M 218.]

Fittings shall be of corresponding weight and quality as drainage pipe.

2.12 SEWER BRICK AND MORTAR MATERIALS

Sewer brick shall be standard brick size and shall conform to ASTM C 32, Grade MM.

Mortar materials shall be dry packaged, proportioned for Type M unit masonry mortar, and shall conform to ASTM C 387.

Mixing water for mortar shall be potable.

PART 3 EXECUTION

3.1 PREPARATION

Before earthwork is started, the location of underground utilities shall be carefully verified by hand methods. Utilities to be left in place shall be protected from damage.

3.2 UNAUTHORIZED EXCAVATION

Unauthorized excavation shall consist of removal of materials beyond indicated subgrade elevations or side dimensions specified without specific direction and shall be replaced as specified at no additional cost to the Government.

Unauthorized excavation under foundations or retaining walls shall be filled by lowering the bottom elevation of the footing or base to the excavation bottom without altering the approved top elevation.

Elsewhere unauthorized excavations shall be backfilled and compacted as specified for authorized excavations of the same classification.

3.3 SHORING AND BRACING

Shoring and bracing in excavations shall be maintained regardless of the length of time excavations will be open. Shoring and bracing shall be carried down with the excavation.

Wherever subsequent removal of sheet piling could permit the lateral movement of soil under adjacent structures, steel sheet piling or pressure-creosoted timber sheet piling shall be used and left permanently in place, cut off as required.

3.4 WATER REMOVAL

NOTE: Additional specifications may be needed where more elaborate dewatering systems are necessary such as may be required to reduce hydrostatic pressures, lowering level of watertable to specific elevations, etc.

Water shall not be permitted to accumulate in excavations, or flood the site and surrounding area. Dewatering systems shall be provided by the Contractor to convey water away from excavations so that softening of foundation bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be approved by the Contracting Officer.

Dewatering shall be continued until construction subject to water pressure has obtained full specified strength and backfill is completed.

Water removal from excavations shall be conveyed to approved collecting or runoff areas. Temporary drainage ditches and other diversions as necessary shall be provided and maintained outside of excavation limits.

Trench excavations for utilities shall not be used for temporary drainage ditches.

3.5 MATERIAL STORAGE

Excavated materials classified as satisfactory soil material shall be stockpiled, where directed, until required for backfill or fill. Stockpiles shall be placed, graded, and shaped for proper drainage.

Materials required in the work shall be located and retained a sufficient distance from the edge of excavations to prevent such material falling or sliding back into the excavations and to prevent cave-ins.

3.6 EXCAVATION FOR STRUCTURES

Excavation for structures shall conform to the dimensions and elevations indicated within a tolerance of plus or minus 0.10 foot 30 millimeter and shall extend a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services and other construction indicated, and for inspection.

In excavating for footings and foundations, care shall be taken not to disturb the bottom of the excavation. Excavation to final grade shall be done just before concrete is placed. Bottoms shall be trimmed to the required lines and grades to leave a solid bed to receive concrete.

For pile foundations, excavation shall stop at an elevation of from 6 to 12 inches 150 to 300 millimeter above the bottom of the footing before piles are driven. After pile driving has been completed, loose and displaced

material shall be removed and excavation to final grade shall be done, leaving a solid bed to receive concrete.

3.7 EXCAVATION FOR FOUNDATION SUBDRAINAGE SYSTEM

Contractor shall adhere to and enforce precautions as outlined in OSHA Regulations, 29 CFR 1926.

Excavation for foundation subdrainage system, except for footing drains located in the excavations for footings and foundations, shall have vertical sides for a vertical dimension above the bottom of the trench not less than two times the outside dimension of the drain pipe, and shall have a clear horizontal distance between the drain pipe barrel and the trench wall, on both sides, of not less than 6 inches 150 millimeter nor more than 9 inches 225 millimeter. Bottom of the trench excavations shall be graded to obtain the required slope and shall be tamped to provide a firm bed for the drain pipe bedding material.

3.8 REMOVAL OF UNSATISFACTORY SOIL MATERIALS

Unsatisfactory soil materials encountered that extend below the required elevations shall be excavated to the depth directed.

3.9 REMOVAL OF EXISTING UNDERGROUND UTILITIES

Existing underground utilities indicated to be removed shall be demolished and completely removed from the excavation.

3.10 CLOSING ENDS OF ABANDONED UNDERGROUND UTILITIES

Open ends of abandoned underground utilities to remain shall be closed to prevent water that may accumulate in such utilities from flowing into excavated areas. Closures shall withstand any hydrostatic or earth pressure that may result after ends of the abandoned utilities have been closed.

Open ends of abandoned underground utilities to remain shall have brick masonry bulkheads constructed to completely close the openings.

Mortar shall be mixed with water for workability by methods that can be controlled and accurately maintained during work progress. Retempering of mortar will not be permitted. Mortar mixing and conveying equipment shall be kept clean. Mortar shall not be deposited or permitted to contact the ground.

Brick shall be wet when laid. Brick shall be laid in mortar so as to form full bed with ends and side joints in one operation and with joints not more than 3/8-inch 10 millimeter wide. Fresh masonry work shall be protected from freezing and from too rapid drying from effects of sun and wind. Protection shall be maintained until mortar has set.

Open ends of metallic conduit and pipe shall be closed with threaded galvanized metal caps or plastic plugs or other approved method suitable for the type of material and size of pipe. Wood plugs will not be permitted.

3.11 FOUNDATION SUBDRAINAGE SYSTEM

Foundation subdrainage system outlets shall drain by gravity to free

outfall until connected to the storm-drainage system.

3.11.1 Impervious Fill At Footings

After concrete footings have been cured as specified, impervious fill at least 6 inches 150 millimeter in depth and 12 inches 300 millimeter in width shall be placed on the subgrade adjacent to the bottom of footing and shall be compacted at optimum moisture content by means of hand tampers to not less than the density specified for cohesive material. Impervious fill shall be clayey soil material conforming to AASHTO M 145, Soil Classification Groups A-2-6 and A-2-7.

3.11.2 Laying Drain Pipe

Drain pipe shall be laid with the perforations down and firmly bedded in specified drainage fill material, with each pipe section having full bearing throughout its length to true grades and alignment and continuous fall in the direction of flow. One-eighth bends shall be used for changes in direction; Y-fittings shall be used at intersections. Drain pipe joints shall be closed.

**NOTE: Delete the following paragraph when
corrugated metal pipe underdrains are specified.**

[Recesses in the excavation bottom shall be excavated to receive bells for drain pipe having bell and spigot ends. Such pipe shall be laid with bells facing up the slope and with spigot end entered fully into the adjacent bell.]

3.11.3 Testing Drain Lines

Drain lines shall be tested with water before backfilling to ensure free flow. Any obstruction encountered shall be removed, damaged components replaced, and system retested until satisfactory.

3.11.4 Porous Fill Over Drain Pipe

After drain lines have been tested, drain pipe shall be backfilled to a width of at least 4 inches 100 millimeter on sides and 12-inches 300 millimeter above the top of pipe with specified drainage fill material. Fill material shall be placed in layers not exceeding 3 inches 75 millimeter in loose depth and compacted with not less than two passes of a hand-operated platetype vibrating compactor. Fill material shall be overlaid with one layer of 15-pound per 100 square foot 0.7 newton per 10 square meter asphalt or tar-saturated felt conforming to ASTM D 226 or ASTM D 227, respectively.

3.12 FILLING AND BACKFILLING

3.12.1 Preparations Prior to Backfill Placement

Excavations shall be backfilled as promptly as the work permits but not until completion of the following:

Approval of construction below finish grade

Inspection, testing, approval, and recording location of underground

utilities

Removal of concrete formwork

Removal of shoring and bracing; backfilling of voids with satisfactory soil material; temporary sheet piling driven below bottom of structures; and cutting off and removing of utilities in a manner that prevents settlement of the structure or utilities

Removal of trash and debris

Completion of concrete waterproofing

3.12.2 Preparation of Ground Surface to Receive Fill

Vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials shall be removed from ground surface prior to the placement of fills. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stripped, or broken up in such manner that fill material will bond with the existing material.

When the ground surface has a density less than that specified for the particular area classification, the ground surface shall be broken up, pulverized, moisture-conditioned to near optimum moisture content of the soil material, and compacted to the required depth and percentage of maximum density.

3.12.3 Placement and Compaction

Backfill and fill materials shall be placed in layers not more than 6 inches 150 millimeter in loose depth. Before compaction, each layer of backfill or fill material shall be moistened or aerated as necessary to provide the optimum moisture content of the soil material and shall then be compacted to the percentage of maximum density for each area classification as specified. Backfill or fill material shall not be placed on surfaces that are muddy, frozen, icy, or contain frost.

Backfill and fill materials adjacent to structures shall be brought up evenly around structures and shall be carried up to the indicated elevations.

Compaction adjacent to structures, within a horizontal distance from the face of the structure equal to the depth of backfill or fill material (measured from the bottom of footing or bottom of foundation or retaining wall) to final grade, shall be done with power-driven hand tampers.

3.13 COMPACTION

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure in AASHTO T 180, Methods B or D.

3.13.1 Percentage of Maximum Density Requirements

Actual density of each layer of soil material-in-place shall be not less than the following percentages of the maximum density of the same soil material determined by the moisture-density test specified.

<u>AREA CLASSIFICATION</u>	PERCENT MAXIMUM DENSITY	
	<u>COHESIONLESS SOIL MATERIAL</u>	<u>COHESIVE SOIL MATERIAL</u>
Structures		
Each layer of back- fill material	[_____]	[_____]
Building slabs and steps		
Top 12 inches 300 millimeter of subgrade and each layer of backfill material	[_____]	[_____]

3.13.2 Moisture Control

Moisture content in soil material at time of compaction shall be within limits specified.

Where the moisture content of a layer of soil material is below optimum before compaction, the required amount of water shall be uniformly applied to the surface of the layer of soil material and the layer of soil disked or otherwise mixed until a uniform moisture content is reached.

Moisture of a layer of soil material that is above optimum shall be removed by drying.

3.14 GRADING

Areas within the limits of grading under this section, including adjacent transition areas, shall be uniformly graded. Finished surface shall be smooth within the specified tolerances, compacted, and with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.

3.14.1 Grading Outside Building Lines

Areas outside the building lines for each structure shall be hand-graded to drain away from the structure and to prevent ponding of water after rains. Finished surface shall be within the tolerance specified below for each area classification, compacted as specified, and free from irregular surface changes.

Grassed or planted areas:

 Finished surface of areas to receive topsoil blend shall be not more than 0.10 foot 30 millimeter above or below the indicated finish elevations.

Walks:

 Surface of areas under walks shall be shaped to line, grade, and cross section; finished surface shall be not more than 0.0 foot millimeter above or 0.10 foot 30 millimeter below the indicated finish elevation.

Pavements:

Surface of areas under pavements shall be shaped to line, grade, and cross section; the finished surface shall be not more than 1-inch 25 millimeter above or below the indicated finish elevation when tested with a 10-foot 3000 millimeter straightedge applied both parallel with and at right angles to the centerline of the area. Finished surface shall vary no more than 1 inch 25 millimeter.

3.14.2 Grading Surface of Fill Under Structures

Surface of fill under building slabs shall be smooth and even, free of voids, compacted as specified and to indicated grade within the specified tolerances. When tested with a 10-foot 3000 millimeter straightedge, parallel with and at right angles to the building lines, the finished surface shall show no deviation in excess of 1 inch 25 millimeter.

3.15 MAINTENANCE

3.15.1 Protection of Graded Areas

Newly graded areas shall be protected from traffic and erosion and shall be maintained free of trash and debris.

3.15.2 Reconditioning Compacted Areas

Where approved compacted areas are disturbed by subsequent construction operations or adverse weather, the surface shall be scarified, reshaped, and compacted as specified to the required density prior to further construction.

3.16 DISPOSAL OF EXCESS AND WASTE MATERIALS

Excess excavated satisfactory materials shall be [transported to and disposed in designated storage areas on Government property] [removed from Government property].

Waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris, shall be [removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor] [transported to, and disposed in, designated spoil areas on Government property].

-- End of Section --