UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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DIVISION 31 - EARTHWORK

SECTION 31 23 00.00 20

EXCAVATION AND FILL

02/11, CHG 2: 08/15

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-- End of Section Table of Contents --

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USACE / NAVFAC / AFCEC / NASA	**UFGS-31 23 00.00 20 (February 2011)** **Change 2 - 08/15**
Preparing Activity: NAVFAC	**Superseding** **UFGS-31 23 00.00 20 (April 2006)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 31 23 00.00 20

EXCAVATION AND FILL
02/11, CHG 2: 08/15

****
NOTE: This guide specification covers the requirements for earthwork requirements for buildings, roads, and utilities.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).
****

****
NOTE: Consult with a soils engineer while editing this section to determine specific requirements for each job.
****

****
NOTE: The following information shall be indicated on the project drawings:

1. Surface elevations, existing and new;

2. Location of underground obstructions and existing utilities;

3. Location and record of soil borings and test pits. Include ground water observations and topsoil thickness encountered in boring, soil

classifications, and properties such as moisture content and Atterberg limit determinations;

4. Soil classification(s) and properties;

5. Location of borrow and disposal area if located on Government property;

6. Clearing stripping and grubbing limits, if different from clearing limits;

7. Areas to be seeded;

8. Hydrological data where available;

9. Shoring and sheeting required (trench protection is specified in Corps of Engineers Manual EM 385-1-1);

10. Pipe trench excavation details;

11. Location and limits of hard material (rocks);

12. Details of special construction such as under railroad and highways right-of-way requirements for jacking and boring;

13. Details of sewage absorption trenches, absorption pits, and subsurface drains.

****

PART 1 GENERAL

****

NOTE: This guide specification does not include provisions for separate measurement and payment for any work specified herein. Measurement and payment paragraphs may be provided in the contract specifications when unit-price payment is more equitable for rock excavation, borrow excavation, and the removal and replacement of unsatisfactory material below grades indicated. This section includes requirements for clearing, grubbing, stripping, grading, and topsoiling. If the contract specifications contain separate sections on clearing, grubbing, grading and turf establishment, revise this section accordingly.

****

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.
****

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020) Structural Welding Code - Steel

AMERICAN WOOD PROTECTION ASSOCIATION (AWPA)

AWPA C2	(2003) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
AWPA P5	(2015) Standard for Waterborne Preservatives

ASTM INTERNATIONAL (ASTM)

ASTM A139/A139M	(2016) Standard Specification for Electric-Fusion (ARC)-Welded Steel Pipe (NPS 4 and over)
ASTM A252	(2010) Standard Specification for Welded and Seamless Steel Pipe Piles
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D422	(1963; R 2007; E 2014; E 2014) Particle-Size Analysis of Soils
ASTM D698	(2012; E 2014; E 2015) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D1140	(2017) Standard Test Methods for

	Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1883	(2016) Standard Test Method for California Bearing Ratio (CBR) of Laboratory-Compacted Soils
ASTM D2216	(2019) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2321	(2020) Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D3786/D3786M	(2018) Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4355/D4355M	(2014) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D4491/D4491M	(2017) Standard Test Methods for Water Permeability of Geotextiles by Permittivity
ASTM D4533/D4533M	(2015) Standard Test Method for Trapezoid Tearing Strength of Geotextiles
ASTM D4632/D4632M	(2015a) Grab Breaking Load and Elongation of Geotextiles
ASTM D4751	(2020) Standard Test Method for Determining Apparent Opening Size of a Geotextile
ASTM D4759	(2011; R 2018) Standard Practice for Determining the Specification Conformance of Geosynthetics

ASTM D4833/D4833M	(2007; R 2020) Standard Test Method forIndex Puncture Resistance of Geomembranes and Related Products
ASTM D5084	(2016a) Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-203	(Rev C; Notice 3) Paper, Kraft, Untreated

1.2 DEFINITIONS

****
NOTE: Delete definitions that will not be used in the specification text for a specific project.
****

1.2.1 Capillary Water Barrier

A layer of clean, poorly graded crushed rock, stone, or natural sand or gravel having a high porosity which is placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below a slab.

1.2.2 Degree of Compaction

****
NOTE: Coordinate test procedures with that specified.
****

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in [ASTM D698][ASTM D1557], for general soil types, abbreviated as percent laboratory maximum density.

1.2.3 Hard Materials

Weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" but which usually require the use of heavy excavation equipment, ripper teeth, or jack

hammers for removal.

1.2.4 Rock

Solid homogeneous interlocking crystalline material with firmly cemented, laminated, or foliated masses or conglomerate deposits, neither of which can be removed without systematic drilling and blasting, drilling and the use of expansion jacks or feather wedges, or the use of backhoe-mounted pneumatic hole punchers or rock breakers; also large boulders, buried masonry, or concrete other than pavement exceeding [0.375] [0.75] [_____] cubic meter [1/2] [1] [_____] cubic yard in volume. Removal of hard material will not be considered rock excavation because of intermittent drilling and blasting that is performed merely to increase production.

1.2.5 Pile Supported Structure

As used herein, a structure where both the foundation and floor slab are pile supported.

1.3 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

[Shoring and Sheeting Plan]

[Dewatering work plan]

[Blasting work plan]

Submit 15 days prior to starting work.

SD-06 Test Reports

Borrow Site Testing; G[, [_____]]

Fill and backfill test

Select material test

Porous fill test for capillary water barrier

Density tests

[Moisture Content Tests]

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

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 CRITERIA FOR BIDDING

****

NOTE: For most projects, the scope of earthwork can accurately be determined. However, if earthwork is approximately known, a unit price for earth work should be provided in the Bid Schedule. Unit-price items are multiplied by the approximated and stated quantity giving a sum that is then added to the price for the rest of the work. The result is a lump sum bid with automatic provision for payment or credit due to variations in earthwork within 15 percent of that shown and bid upon. Variations exceeding 15 percent of that shown and bid upon will become the subject of negotiations in accordance with FAR 52.211-18 Variation In Estimated Quantity.

****

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

[c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

][d. Ground water elevation is [_____] meter feet below existing surface elevation.

][e. Material character is indicated by the boring logs.
]

****

NOTE: Choose the following option if no boring information is available, or if the boring information is insufficient to permit a bidder to develop an accurate estimate of hard material or rock to be encountered. If hard material or rock is to be encountered, the following option should be modified to include a percent figure or an approximate depth at which hard material or rock will be encountered.

****

[f. Hard materials [and rock] [will not] [will] be encountered [in [_____] percent of the excavations] [at [_____] meter feet below existing surface elevations].
]

****

NOTE: Use statements in brackets to describe proposed source of borrow and other bedding or backfill materials if required by the project. Coordinate with submittals. The drawings should indicate the location(s) within the project site or within the boundaries of the Government property where suitable borrow may be obtained.

****

****

NOTE: Choose the types of materials to be provided as borrow. Delete the bracketed sentence that is not applicable regarding location of source. Coordinate requirements with paragraph entitled "Borrow".

****

[g. [Borrow material] [Suitable backfill] [and] [bedding material] in the quantities required [is] [is not] available [at the project site] [on Government property] [at the location[s]]
]

****

NOTE: Choose one between the two following bracketed options.

****

[h. Blasting will not be permitted. Remove material in an approved manner.

][i. Blasting will be permitted. Blasting shall be conducted in accordance

with EM 385-1-1, and Federal, State, and local safety regulations. Submit for approval a blasting plan, including calculations for overpressure and debris hazard, prepared and sealed by a registered professional engineer. Blasting mats shall be provided, and non-electric blasting caps shall be used. Notify the Contracting Officer 24 hours prior to blasting.

]1.6 REQUIREMENTS FOR OFF SITE SOIL

****

NOTE: Check with regional and local authorities as well as the activity to determine actual requirements of bracketed items. (Values shown come from the Commonwealth of Virginia).

****

Soils brought in from off site for use as backfill shall be tested for petroleum hydrocarbons, BTEX, PCBs and HW characteristics (including toxicity, ignitability, corrosivity, and reactivity). Backfill shall not contain concentrations of these analytes above the appropriate State and/or EPA criteria, and shall pass the tests for HW characteristics. Determine petroleum hydrocarbon concentrations by using appropriate State protocols. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5035/8260B. Perform complete TCLP in accordance with EPA SW-846.3-3 Method 1311. Perform HW characteristic tests for ignitability, corrosivity, and reactivity in accordance with accepted standard methods. Perform PCB testing in accordance with accepted standard methods for sampling and analysis of bulk solid samples. Provide borrow site testing for petroleum hydrocarbons and BTEX from a grab sample of material from the area most likely to be contaminated at the borrow site (as indicated by visual or olfactory evidence), with at least one test from each borrow site. For each borrow site, provide borrow site testing for HW characteristics from a composite sample of material, collected in accordance with standard soil sampling techniques. Do not bring material onsite until tests results have been received and approved by the Contracting Officer.

1.7 QUALITY ASSURANCE

[1.7.1 Shoring and Sheeting Plan

****

NOTE: Include the following paragraph when scope of work requires excavations which are greater than 1.5 m 5 feet or when excavation complexity warrants extensive shoring and sheeting.

****

Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal. Calculations shall include data and references used.

****

NOTE: Where site conditions require extensive monitoring of excavations and water levels include the following requirement.

****

[The Contractor is required to hire a Professional Geotechnical Engineer to provide inspection of excavations and soil/groundwater conditions throughout construction. The Geotechnical Engineer shall be responsible for performing pre-construction and periodic site visits throughout construction to assess site conditions. The Geotechnical Engineer shall update the excavation, sheeting and dewatering plans as construction progresses to reflect changing conditions and shall submit an updated plan if necessary. A written report shall be submitted, at least monthly, informing the Contractor and Contracting Officer of the status of the plan and an accounting of the Contractor's adherence to the plan addressing any present or potential problems. The Geotechnical Engineer shall be available to meet with the Contracting Officer at any time throughout the contract duration.

]][1.7.2 Dewatering Work Plan

****
NOTE: Where water levels will impact excavation operations include the following paragraph.
****

Submit procedures for accomplishing dewatering work.

]1.7.3 Utilities

****
NOTE: Delete this paragraph in its entirety if no known utilities or subsurface construction is located below or adjacent to work covered in this specification.
****

Movement of construction machinery and equipment over pipes and utilities during construction shall be at the Contractor's risk. [Perform work adjacent to non-Government utilities as indicated in accordance with procedures outlined by utility company.] [Excavation made with power-driven equipment is not permitted within [600] [_____] mm [two] [_____] feet of known Government-owned utility or subsurface construction. For work immediately adjacent to or for excavations exposing a utility or other buried obstruction, excavate by hand. Start hand excavation on each side of the indicated obstruction and continue until the obstruction is uncovered or until clearance for the new grade is assured. Support uncovered lines or other existing work affected by the contract excavation until approval for backfill is granted by the Contracting Officer.] Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

****
NOTE: Use paragraphs titled "Expansive Soils" and "Nonfrost Susceptible Material" for Army projects. Use paragraphs titled "Backfill and Fill Material" and "Select Material" for Navy projects. Use all other paragraphs for both branches.
****

[2.1.1 Satisfactory Materials

****

NOTE: Satisfactory material will be defined in accordance with locally available materials, climatic and water conditions prevailing onsite, economic limitations of the project, design slopes, etc., and suitable classes, based on the geotechnical report, will be listed in the project specification in accordance with the Unified Soil Classification System, ASTM D2487.

****

Any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, [SM,] [SW-SM,] [SC,] [SW-SC,] [SP-SM,] [SP-SC,] [CL,] [ML,] [CL-ML,] [CH,] [MH] free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, and [frozen,] deleterious, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

][2.1.2 Unsatisfactory Materials

****

NOTE: Unsatisfactory material will be defined in accordance with locally available materials, design slopes, etc., and unsuitable classes will be listed in the project specifications in accordance with ASTM D2487. Normally, stones larger than 75 mm (3 inches) are considered unsatisfactory. This paragraph should be edited to delete inapplicable materials.

****

Materials which do not comply with the requirements for satisfactory materials. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than [_____] mm inches. The Contracting Officer shall be notified of any contaminated materials.

][2.1.3 Cohesionless and Cohesive Materials

****

NOTE: When classification will be necessary during construction, determination of grain size for classification will be specified to be made in conformance with ASTM C117, ASTM C136/C136M, and ASTM D422.

****

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic (plasticity index equals zero). Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity

index greater than zero.

][2.1.4 Expansive Soils

****
NOTE: Additional laboratory testing and analysis might be needed to better define site specific expansive soils. If expansive soils are anticipated at the construction site, this specification should be edited to ensure proper construction techniques are undertaken per Army TM 5-818-7.
****

Soils that have a plasticity index equal to or greater than [_____] when tested in accordance with ASTM D4318.

][2.1.5 Nonfrost Susceptible (NFS) Material

****
NOTE: Contract specifications for nonfrost-susceptible fill and backfill will follow the gradation requirements recommended in UFC 3-250-01, "Pavement Design for Roads, Streets, Walks, and Open Storage Areas". For fill under critical structures, materials with ML, MH, and CH classification will be specified as unsatisfactory (if at all feasible from an economic or material-availability standpoint). If such materials must be used, the specification will point out the critical nature of the materials and the control difficulties to be anticipated. Organic materials and topsoil having OL, OH, and Pt classification will not be used in fill or backfill.
****

A uniformly graded washed sand with a maximum particle size of [_____] mm inch and less than 5 percent passing the 0.075 mm No. 200 size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

]2.1.6 Common Fill

Approved, unclassified soil material with the characteristics required to compact to the soil density specified for the intended location.

2.1.7 Backfill and Fill Material

****
NOTE: Consult with a geotechnical engineer to determine the type of material, the classification of the material, and the particle size of the material. Never use site-excavated material without a thorough investigation. Excavated material should be of a quality that will compact, will not settle or shrink, and will not become unstable when wet. The borings or soils report will indicate properties of the native soils. Stones in backfill should generally not exceed 75 mm 3 inches in diameter.
****

ASTM D2487, classification GW, GP, GM, [GC,] SW, SP, SM, [SC] with a maximum ASTM D4318 liquid limit of [35] [_____], maximum ASTM D4318 plasticity index of [12] [_____], and a maximum of 25 percent by weight passing ASTM D1140, 75 micrometers No. 200 sieve.

2.1.8 Select Material

****

NOTE: Delete this paragraph if there is not a requirement for select material in the project. It is important to specify select material under footings and slabs to minimize settlement and to ensure stability of a structure. Consideration should be made of the sensitivity of the structure to total and/or differential settlements related to the structural design. This is particularly true of add-on structures and structures to be founded partly on fill and partly on natural ground. For crib retaining wall, not more than 10 percent by weight of the fill material shall be finer than 75 micrometers No. 200 sieve. Also, specify coefficient of permeability within the range of 0.01 to 1.0 mm per second 0.002 to 0.20 feet per minute and soil classification GW, GP, SW and SP. Indicate with cross sections or section details on the contract drawings the limits or extents of any controlled fills or backfills. Specify class of material that is acceptable in the fill or backfill giving preference to any types available at or near the site. Select appropriate values for Atterberg limits and percentage of fines and specify maximum thickness of lifts for compaction.

If suitable materials for this project are limited to materials classified as GW, GP, SW, or SP, delete the bracketed sentences of this paragraph. Coordinate requirements with a geotechnical engineer. Select fill used for structures should extend a minimum of 1.5 m 5 feet outside the building foundation lines or other building elements gaining support from the fill.

****

Provide materials classified as [GW,] [GP,] [SW,] [SP,] or [_____] by ASTM D2487 where indicated. [The liquid limit of such material shall not exceed [35] [_____] percent when tested in accordance with ASTM D4318. The plasticity index shall not be greater than [12] [_____] percent when tested in accordance with ASTM D4318, and not more than [35] [_____] percent by weight shall be finer than 75 micrometers No. 200 sieve when tested in accordance with ASTM D1140.] [Coefficient of permeability shall be a minimum of [0.01] [_____] mm per second [0.002] [_____] feet per minute when tested in accordance with ASTM D5084.]

****

NOTE: Where California Bearing Ratio values are needed include the following paragraph:

****

[Bearing Ratio: At 2.5 mm 0.1 inch penetration, the bearing ratio shall

be [_____] percent at 95 percent ASTM D1557 maximum density as determined in accordance with ASTM D1883 for a laboratory soaking period of not less than 4 days. [Maximum expansion shall be [_____] percent.] [The combined material shall conform to the following sieve analysis:]]

Sieve Size	Percent Passing by Weight
63 mm 2 1/2 inches	100
4.75 mm No. 4	40 - 85
2.00 mm No. 10	20 - 80
425 micrometers No. 40	10 - 60
75 micrometers No. 200	5 - 25

2.1.9 Topsoil

****
NOTE: If seeding is minor, use requirements specified herein. Otherwise, edit Section 32 92 19 SEEDING, and cover requirements (for most projects) therein.
****

[Provide as specified in Section 32 92 19SEEDING.

][Natural, friable soil representative of productive, well-drained soils in the area, free of subsoil, stumps, rocks larger than 25 mm one inch diameter, brush, weeds, toxic substances, and other material detrimental to plant growth. Amend topsoil pH range to obtain a pH of 5.5 to 7.

]2.2 POROUS FILL FOR CAPILLARY WATER BARRIER

ASTM C33/C33M fine aggregate grading with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers No. 200 sieve, [or] [37.5 mm 1-1/2 inches and no more than 2 percent by weight passing the 4.75 mm No. 4 size sieve] [or coarse aggregate Size 57, 67, or 77] and conforming to the general soil material requirements specified in paragraph entitled "Satisfactory Materials."

2.3 UTILITY BEDDING MATERIAL

Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D2321 materials as follows:

a. Class I: Angular, 6 to 40 mm 0.25 to 1.5 inches, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

b. Class II: Coarse sands and gravels with maximum particle size of 40 mm 1.5 inches, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

[2.3.1 Sand

****
NOTE: Use this section to define the requirements for sand used in normal backfill or pipe bedding. In general, any locally available fine aggregate for concrete or asphalt mixtures will suffice and may be specified by local gradation and specification number in lieu of "SW" or "SP." Drawings (details) should clearly show where sand backfill or bedding is required. Delete this paragraph if sand is not required.
****

Clean, coarse-grained sand classified as [_____ in accordance with Section [_____] [gradation [_____]] of the [DOT] [_____] State Standard] or [SW] [or] [SP] by ASTM D2487 for [bedding] [and] [backfill] [as indicated].

][2.3.2 Gravel

****
NOTE: Use this section to define the requirements for any gravel or crushed rock used in normal backfill or pipe bedding. In general, locally available coarse aggregate for concrete will suffice and may be specified by local gradation and specification number in lieu of "GW" or "GP." Maximum size of aggregate should not be more than 25 mm per 300 mm one inch per foot of pipe diameter or 75 mm 3 inches maximum. Refer to pipe manufacturer's criteria for more stringent requirements, if any, on aggregate size and gradation. On drawings (details), clearly show where gravel backfill or bedding is required.
****

Clean, coarsely graded natural gravel, crushed stone or a combination thereof [identified as [_____] in accordance with Section [_____] [gradation [_____]] of the [DOT] [_____] State Standard] or having a classification of [GW] [GP] in accordance with ASTM D2487 for [bedding] [and] [backfill] [as indicated]. [Maximum particle size shall not exceed [75] [_____] mm [3] [_____] inches.]

][2.4 SEWAGE ABSORPTION TRENCHES OR PITS

****
NOTE: Delete these paragraphs when sewage absorption trenches or pits are not included in the project. Consult a geotechnical engineer and local

standards in selecting bracketed information.
****

2.4.1 Porous Fill

Backfill material consisting of clean crushed rock or gravel having a gradation [such that 100 percent passes the 50 mm 2 inch sieve and zero percent passes the 12.5 mm 1/2 inch sieve.] [conforming to the requirements of gradation [4.75 mm] [No. 4] [_____] for coarse aggregate in ASTM C33/C33M.]

2.4.2 Cover

****
NOTE: Select appropriate bracketed information to correspond to the design indicated on the drawings.
****

[Filter fabric] [Concrete] [Kraft paper conforming to CID A-A-203, Grade B, No. 2, 22.7 kg 50 pound weight] [or a layer of straw at least 50 mm 2 inches thick] as indicated.

]2.5 BORROW

****
NOTE: Choose one of the following options. Choose the first option when borrow material has to come from off site. Choose the second option when use of a Government borrow pit is available. Edit paragraph to suit requirements for use of a Government borrow pit.
****

[Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property.

] [Obtain borrow materials required in excess of those furnished from excavations from sources outside of Government property, except that borrow materials conforming to [common fill] [and] [fill and backfill material] [satisfactory material] [_____] may be obtained from the Government borrow pit. The Government borrow pit is located [as indicated] [within a haul distance of [_____] kilometers miles from the work site]. If the Government borrow pit is used, the Contractor shall perform clearing, grubbing, and stripping required for providing access to suitable borrow material. Dispose of materials from clearing and grubbing operations [off Government property] [at the Government landfill indicated]. Strip top 300 mm 12 inches of soil material from borrow area and stockpile. After removal of borrow material, regrade borrow pit using stockpiled soil material to contours which will blend in with adjacent topography. Maximum side slopes shall be two horizontal to one vertical. Excavation and backfilling of borrow pit shall ensure proper drainage.]

[2.6 BACKFILL FOR UNDERDRAINAGE SYSTEMS

****
NOTE: Delete these paragraphs entirely when there is no subsurface drainage or where underdrainage requirements are completely described in another section. The type or types of pipe to be used will

be indicated on the drawings. Where a Contractor's option is to be permitted, the types that are acceptable will be included in the specification. Add the requirements for a specialized subsurface drain, if necessary, to what is specified in this section. Consult a geotechnical engineer to determine specific grading requirements of granular filters and backfill materials and suitability of filter fabric. Include typical cross section detail of subsurface drain type or options on contract drawings.

The thickness and gradation of granular fill material for subsurface drains will be determined by soil conditions and subsoil drainage requirements.

In Table 1, choose one of the three options for each of the three types. The gradations shown on Table 1 may be altered to fit project requirements or additional gradations may be added to fit requirements of various subsurface drains within the project. The material placed adjacent to perforated pipe and open joints (without filter fabric wrapping) will be of a size that will prevent the entrance of any of the porous material into the drain. This material shall be a minimum of 150 mm 6 inches thick on the side of the pipe where the perforations are and around all joints. Thicknesses of granular fill, especially for subsurface drains with two types of material, will be clearly shown on the drawings. Where site conditions require more than two types of granular fill for drains, the drawings will indicate the areas of different gradation and the table will expanded using additional types to show different gradations for different locations.

****

Clean sand, crushed rock, or gravel meeting the following requirements:

****

NOTE: Check gradations against size of pipe openings. Consult a geotechnical engineer if alternate gradations (Type III) of special backfill materials are desired.

****

[a. Perforated or Slotted-Wall Pipe: Backfill meeting requirements of [Type I] material as specified in Table 1.
]

****

NOTE: Open-joint pipe (drain tile) will not be used for general airfield or heliport construction, drainage systems for structures, or for drains crossing or adjacent to paved areas. Open-joint pipe will be used only for subsoil drainage for drill areas, parade grounds, athletic fields, and other areas subject to lightweight vehicle traffic only, and where conditions justify its use. Consult

the Government before use.
****

[b. Open Joint Pipe: [Type III] backfill consisting of both Type I and Type II materials as specified in Table 1.
]
****
NOTE: Consult with a geotechnical engineer to determine coarse aggregate size, which is dependent on the flow anticipated. Specify Type II gradation, if appropriate, or specify a special, Type III gradation. Make sure that detail of this type drain is included on the drawings.
****

[c. Blind or French Drains: Backfill consisting of [Type II] [Type III] material as specified in Table 1.
]
****
NOTE: Where filter fabric is used in construction of backfills, any type of pipe or drain is acceptable unless conditions dictate that only one be used. In critical applications filter fabric should not be used in subsurface drains adjacent to soils with 85 percent or more passing the 75 micrometers No. 200 sieve.
****

[d. Any Type Drain Used With Filter Fabric: [Clean gravel or crushed stone or gravel conforming to ASTM C33/C33M coarse aggregate grading size 57, 67, or 7] [fill consisting of [Type I] [or] [Type II] [Type III] material as specified in Table 1].
]
****
NOTE: Select the applicable paragraph(s) from the following.

The thickness and gradation of granular fill material for subsurface drains will be determined by soil conditions and subsoil drainage requirements.

In Table 1, choose one of the three options for each of the three types. The gradations shown on Table 1 may be altered to fit project requirements or additional gradations may be added to fit requirements of various subsurface drains within the project. The material placed adjacent to perforated pipe and open joints (without filter fabric wrapping) will be of a size that will prevent the entrance of any of the porous material into the drain. This material shall be a minimum of 150 mm 6 inches thick on the side of the pipe where the perforations are and around all joints. Thicknesses of granular fill, especially for subsurface drains with two types of material, will be clearly shown on the drawings. Where site conditions require more than two types of granular fill for drains, the drawings will indicate the areas of different gradation and the table will expanded using

additional types to show different gradations for different locations.

****

TABLE 1			
	[Type I [Gradation E 11 ASTM C33/C33M]]	[Type II [Gradation 57 ASTM C33/C33M]]	[Type III [Gradation [_____]] [_____]]
[ASTM D422 Sieve Size]	[Percent Passing]	[Percent Passing]	[Percent Passing]
[37.5 mm] [1.5 inches]	[--]	[100]	[[_____]]
[25.0 mm] [1 inch]	[--]	[90 - 100]	[[_____]]
[9.5 mm] [3/8 inch]	[100]	[25 - 60]	[[_____]]
[4.75 mm] [No. 4]	[95 - 100]	[5 - 40]	[[_____]]
[2.36 mm] [No. 8]	[--]	[0 - 20]	[[_____]]
[1.18 mm] [No. 16]	[45 - 80]	[--]	[[_____]]
[300 micrometers] [No. 50]	[10 - 30]	[--]	[[_____]]
[150 micrometers] [No. 100]	[0 - 10]	[--]	[[_____]]

]2.7 FILTER FABRIC

****

NOTE: Where filter fabric is used in construction of backfills, any type of pipe or drain is acceptable unless conditions dictate that only one be used. In critical applications Filter fabric should be used with caution in subsurface drains adjacent to soils with 85 percent or more fines passing the 75 micrometers No. 200 sieve. Values stated below are absolute minimums for the class indicated.

Delete this paragraph when filter fabric will not be used on the project. Adjust information in brackets to fit the needs of the project. Class A material is usually specified when material being compacted

has very coarse sharp angular edges and requires a compaction percentage greater than 95 percent ASTM D698, or when trenches are more than 3 m 10 feet deep. Class B is specified with smooth graded surfaces having no sharp angular projections, no sharp angular aggregate, and when compaction requirements are less than 95 percent ASTM D698. Where fabric will not be covered or where it will exposed to direct sunlight, such as when it is, used for silt dams, include the requirement for ultraviolet resistance. Where fabric is used for different applications, the AOS requirement or strength may vary. Drawings should indicate specific requirements for different applications. Specify cloth that retains the soil being protected, yet that has openings large enough to permit drainage and prevent clogging. The standard wording in the guide specification concerning Apparent Opening Size will be suitable for all projects except in critical areas. However, in critical areas select the "apparent opening sizes" (AOS) and "percent open area" based on the following criteria:

1. Filter cloth adjacent to granular materials containing 50 percent or less by weight fines (materials passing 75 micrometers No. 200 sieve):

a. The nearest opening size of AOS sieve (nearest U.S. Standard Sieve) divided by the 85-percent size of the soil, is equal to or greater than two or three.

b. Open area not to exceed 36 percent.

In critical areas to reduce the chance of clogging, no cloth should be specified with an open area less than 4 percent or an AOS with openings smaller than the openings of a U.S. Standard Sieve Size 150 micrometers No. 100.

****

Provide a pervious sheet of polyester, nylon, glass or polypropylene [, ultraviolet resistant] filaments woven, spun bonded, fused, or otherwise manufactured into a nonraveling fabric with uniform thickness and strength. Fabric shall have the following manufacturer certified minimum average roll properties as determined by ASTM D4759:

	Class A	Class B
a. Grab tensile strength (ASTM D4632/D4632M) machine and transversed direction	min. [800]	[356] N
b. Grab elongation (ASTM D4632/D4632M) machine and transverse direction	min. [15]	[15] percent

	Class A	Class B
c. Puncture resistance (ASTM D4833/D4833M)	min. [356]	[111] N
d. Mullen burst strength (ASTM D3786/D3786M)	min. [2,000]	[896] kPa
e. Trapezoidal Tear (ASTM D4533/D4533M)	min. [222]	[111] N
[f. Apparent Opening Size (ASTM D4751)]	[[_____]]	[[_____]]
[f. Apparent Opening Size (ASTM D4751)]	[See Criteria Below]	
[(1) Soil with 50 percent or less particles by weight passing 75 micrometers Sieve, AOS less than 0.6 mm (greater than 600 micrometers Sieve)]		
[(2) Soil with more than 50 percent particles by weight passing 75 micrometers Sieve, AOS less than 0.297 mm (greater than 300 micrometers Sieve)]		
g. Permeability (ASTM D4491/D4491M)	[k fabric greater than k Soil]	
[h. Ultraviolet Degradation (ASTM D4355/D4355M)]	[70 percent Strength retained at 150 hours]	

	Class A	Class B
a. Grab tensile strength (ASTM D4632/D4632M) machine and transversed direction	min. [180]	[80] lbs.
b. Grab elongation (ASTM D4632/D4632M) machine and transverse direction	min. [15]	[15] percent
c. Puncture resistance (ASTM D4833/D4833M)	min. [80]	[25] lbs.
d. Mullen burst strength (ASTM D3786/D3786M)	min. [290]	[130] psi
e. Trapezoidal Tear (ASTM D4533/D4533M)	min. [50]	[25] lbs.
[f. Apparent Opening Size (ASTM D4751)]	[[_____]]	[[_____]]

	Class A	Class B
[f. Apparent Opening Size (ASTM D4751)]	[See Criteria Below]	
[(1) Soil with 50 percent or less particles by weight passing US No. 200 Sieve, AOS less than 0.6 mm (greater than #30 US Std. Sieve)]		
[(2) Soil with more than 50 percent particles by weight passing US No. 200 Sieve, AOS less than 0.297 mm (greater than #50 US Std. Sieve)]		
g. Permeability (ASTM D4491/D4491M)	[k fabric greater than k Soil]	
[h. Ultraviolet Degradation (ASTM D4355/D4355M)]	[70 percent Strength retained at 150 hours]	

[2.8 MATERIAL FOR PIPE CASING

****

NOTE: Indicate on the contract drawings all construction requirements conforming to the standards of the railroad or highway owner. Indicate limits of right-of-way and any other site requirements or dimensions. Where traffic can be interrupted, trenching in a pipeline casing is more economical with the same advantages of allowing future work without interruption of traffic.

****

2.8.1 Casing Pipe

ASTM A139/A139M, Grade B, or ASTM A252, Grade 2, smooth wall pipe. Casing size shall be of the outside diameter and wall thickness as indicated. Protective coating is not required on casing pipe.

2.8.2 Wood Supports

Treated Yellow Pine or Douglas Fir, rough, structural grade. Provide wood with nonleaching water-borne pressure preservative (ACA or CCA) and treatment conforming to AWPA P5 and AWPA C2, respectively. Secure wood supports to carrier pipe with stainless steel or zinc-coated steel bands.

]2.9 MATERIAL FOR RIP-RAP

****

NOTE: Make sure there is no duplication of rip-rap requirements between this and other specification sections. In paragraph entitled "Material for Rip-Rap," refer to standard specifications for rip-rap if local specifications are satisfactory and available.

****

[[Bedding material] [Grout] [Filter fabric] and rock conforming to [these requirements] [DOT] [_____] State Standard] for construction indicated.

[2.9.1 Bedding Material

Consisting of sand, gravel, or crushed rock, well graded, [or poorly graded] with a maximum particle size of 50 mm 2 inches. Material shall be composed of tough, durable particles. Fines passing the 75 micrometers No. 200 standard sieve shall have a plasticity index less than six.

][2.9.2 Grout

Composed of cement, water, an air-entraining admixture, and sand mixed in proportions of one part portland cement to [two] [_____] parts of sand, sufficient water to produce a workable mixture, and an amount of admixture which will entrain sufficient air to produce durable grout, as determined by the Contracting Officer. Mix grout in a concrete mixer. Mixing time shall be sufficient to produce a mixture having a consistency permitting gravity flow into the interstices of the rip-rap with limited spading and brooming.

][2.9.3 Rock

****
NOTE: Adjust weights in brackets to fit application. Take local practice into consideration.
****

Rock fragments sufficiently durable to ensure permanence in the structure and the environment in which it is to be used. Rock fragments shall be free from cracks, seams, and other defects that would increase the risk of deterioration from natural causes. The size of the fragments shall be such that no individual fragment exceeds a weight of [68] [_____] kg [150] [_____] pounds and that no more than 10 percent of the mixture, by weight, consists of fragments weighing 0.91 kg 2 pounds or less each. Specific gravity of the rock shall be a minimum of [2.50] [_____]. The inclusion of more than trace [1 percent] [_____] quantities of dirt, sand, clay, and rock fines will not be permitted.

]2.10 BURIED WARNING AND IDENTIFICATION TAPE

****
NOTE: Delete paragraph if tape is not required in the project. The use of a plastic warning tape for identification is mandatory for buried hazardous utilities such as electrical conduit, gas lines, fuel lines, high pressure nitrogen, high pressure water and steam lines, domestic sewage force mains, industrial waste force mains and industrial sewers carrying hazardous, explosive, or toxic waste. Coordinate color codes with other specification sections and conform, if possible, to local practice for identifying buried utilities.
****

[Polyethylene plastic] [and] [metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic] warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 75 mm 3 inch minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape

length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing shall be permanent, unaffected by moisture or soil.

Warning Tape Color Codes	
[Red:]	[Electric]
[Yellow:]	[Gas, Oil; Dangerous Materials]
[Orange:]	[Telephone and Other Communications]
[Blue:]	[Potable Water Systems]
[Green:]	[Sewer Systems]
[White:]	[Steam Systems]
[Gray:]	[Compressed Air]
[Purple:]	[Non Potable, Reclaimed Water, Irrigation and Slurry lines]

2.10.1 [Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.08 mm 0.003 inch. Tape shall have a minimum strength of 10.3 MPa 1500 psi lengthwise, and 8.6 MPa 1250 psi crosswise, with a maximum 350 percent elongation.

][2.10.2 Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.10 mm 0.004 inch. Tape shall have a minimum strength of 10.3 MPa 1500 psi lengthwise and 8.6 MPa 1250 psi crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 920 mm 3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

]2.11 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Shoring and Sheeting

****

NOTE: The Contractor will have the responsibility of designing the trench shoring and sheeting system or obtaining a suitable trench box on all trench

excavations over 1.5 m 5 feet deep or where it is known that in-situ soils lack the stability to hold near vertical faces. Where sufficient room is available, the Contractor may slope back trench walls rather than having to use a shoring system. The Government is responsible for supplying the designer with any historic subsurface soil data that might be available. All such historical or new subsurface soil data demonstrating soil characteristics, stability, etc., will be included on the contract drawings.

****

Provide shoring [bracing] [cribbing] [trench boxes] [underpinning] [and] [sheeting] where indicated. In addition to Section 25 A and B of EM 385-1-1 [and other requirements set forth in this contract], include provisions in the shoring and sheeting plan that will accomplish the following:

a. Prevent undermining of pavements, foundations and slabs.

****

NOTE: The Contractor should not be given the opportunity to slope the faces of excavations in lieu of providing shoring unless all the following conditions are met:

1. The excavation is less than 6 m 20 feet in depth.

2. There are no adjacent structures, roads, or pavements that will affect the excavation.

3. No equipment, stored material, or overlying material will affect the excavation.

4. Vibration from equipment, traffic, or blasting will not affect the excavation.

5. There will be no ground water problems.

6. Surcharges will not affect the excavation.

7. Station operational considerations permit laying back the slopes of the excavation.

****

b. Prevent slippage or movement in banks or slopes adjacent to the excavation.

[c. Allow for the abandonment of shoring and sheeting materials in place in critical areas as the work is completed. In these areas, backfill the excavation to [the elevation indicated] [within 900 mm 3 feet of the finished grade] [_____] and remove the remaining exposed portion of the shoring before completing the backfill.

]3.1.2 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction.

3.1.2.1 Drainage

So that construction operations progress successfully, completely drain construction site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish/construct storm drainage features (ponds/basins) at the earliest stages of site development, and throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and/or provide temporary ditches, [dikes,] swales, and other drainage features and equipment as required to maintain dry soils[, prevent erosion and undermining of foundations]. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

3.1.2.2 Dewatering

****

NOTE: Check depth of proposed utilities and foundations relative to the existing ground water elevation prior to editing. Revise as needed when specific methods of dewatering are required.

****

Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m 3 feet of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, the water level shall be maintained continuously, at least [_____] m feet below the working level.

[Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.] [Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system.] [Relieve hydrostatic head in previous zones below subgrade elevation in layered soils to prevent uplift.]

3.1.3 Underground Utilities

Location of the existing utilities indicated is approximate. The Contractor shall physically verify the location and elevation of the existing utilities indicated prior to starting construction. [The Contractor shall contact the [Public Works Department] [_____] for assistance in locating existing utilities.] [The Contractor shall scan the construction site with electromagnetic and sonic equipment and mark

the surface of the ground where existing underground utilities are discovered.]

3.1.4 Machinery and Equipment

Movement of construction machinery and equipment over pipes during construction shall be at the Contractor's risk. Repair, or remove and provide new pipe for existing or newly installed pipe that has been displaced or damaged.

3.2 SURFACE PREPARATION

****
NOTE: If special site preparation notes are indicated, they should be referenced here.
****

3.2.1 Clearing and Grubbing

****
NOTE: If selective clearing is required, the maximum or minimum tree diameter should be specified, measured at 1.5 m 4 1/2 feet from the existing ground. If merchantable timber is requested by the station, insert and edit the following paragraph:

"Cut merchantable timber into (logs) (cord wood) and store on site where directed. Merchantable timber will remain the property of the Government."
****

Unless indicated otherwise, remove trees, stumps, logs, shrubs, brush and vegetation and other items that would interfere with construction operations within the [clearing limits] [within lines 1.5 m 5 feet outside of each building and structure line] [_____]. Remove stumps entirely. Grub out matted roots and roots over 50 mm 2 inches in diameter to at least 460 mm 18 inches below existing surface.

3.2.2 Stripping

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil [shall be wasted] [shall be stockpiled and used for backfilling]. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.2.3 Unsuitable Material

Remove vegetation, debris, decayed vegetable matter, sod, mulch, and rubbish underneath paved areas or concrete slabs.

3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material

type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be [removed as directed]. Refill with [backfill and fill material] [satisfactory material] [select material] [porous fill] and compact to [95] [_____] percent of [ASTM D698] [ASTM D1557] maximum density. Unless specified otherwise, refill excavations cut below indicated depth with [backfill and fill material] [satisfactory material] [select material] [porous fill] and compact to [95] [_____] percent of [ASTM D698] [ASTM D1557] maximum density. Satisfactory material removed below the depths indicated, without specific direction of the Contracting Officer, shall be replaced with satisfactory materials to the indicated excavation grade; except as specified for spread footings. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

3.3.1 Structures With Spread Footings

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

3.3.2 Pile Cap Excavation and Backfilling

Excavate to bottom of pile cap prior to placing or driving piles, unless authorized otherwise by the Contracting Officer. Backfill and compact overexcavations and changes in grade due to pile driving operations to 95 percent of ASTM D698 maximum density.

3.3.3 Pipe Trenches

Excavate to the dimension indicated. Grade bottom of trenches to provide uniform support for each section of pipe after pipe bedding placement. Tamp if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm 6 inches below the bottom of the pipe.

[3.3.4 Hard Material [and Rock] Excavation

****

NOTE: Where rock excavation is planned, foundation section details or typical grading or trench cross sections on plans should show the required limits of rock excavation and any special refill or bedding requirements.

****

Remove hard material [and rock] to elevations indicated in a manner that will leave foundation material in an unshattered and solid condition. Roughen level surfaces and cut sloped surfaces into benches for bond with concrete. Protect shale from conditions causing decomposition along joints or cleavage planes and other types of erosion. Removal of hard material [and rock] beyond lines and grades indicated will not be grounds for a claim for additional payment unless previously authorized by the Contracting Officer. Excavation of the material claimed as rock shall not

be performed until the material has been cross sectioned by the Contractor and approved by the Contracting Officer. Common excavation shall consist of all excavation not classified as rock excavation.

]3.3.5 Excavated Materials

****

NOTE: When spoil areas or borrow areas are within the limits of Government-controlled land, additional requirements based on the following, and as appropriate for the project, will be included in the contract document. Locations of areas will be indicated, or the approximate distances from the project site will be specified. Generally, unburned vegetative material and surplus excavated material will be disposed of in inconspicuous spoil areas where no future construction is planned. If economically justifiable, surplus suitable excavated material may be stockpiled or may be disposed of in areas where future construction is planned and where fill will be required. Spoil materials will be so placed and the worked portions of spoil areas and borrow areas will be so graded and shaped as to minimize soil erosion, siltation of drainage channels, and damage to existing vegetation. The degree of compaction will be specified.

****

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Paragraph "DISPOSITION OF SURPLUS MATERIAL."

3.3.6 Final Grade of Surfaces to Support Concrete

Excavation to final grade shall not be made until just before concrete is to be placed. [For pile foundations, the excavation shall be stopped at an elevation 150 to 300 mm 6 to 12 inches above the bottom of the footing before driving piles. After pile driving has been completed, the remainder of the excavation shall be completed to the elevations shown.] Only excavation methods that will leave the foundation rock in a solid and unshattered condition shall be used. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

3.4 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm 6 inches before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm 6 inches, pulverized, and compacted

to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm 12 inches and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Material shall be moistened or aerated as necessary [to plus or minus [_____] percent of optimum moisture] [to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used]. Minimum subgrade density shall be as specified herein.

3.4.1 Proof Rolling

****

NOTE: Specify proof rolling when the quality of the existing subgrade is questionable. Proof rolling can be used to verify that no unsatisfactory material is present (no bid quantity required, location shown or specified) or to locate suspected unsatisfactory material (indicate a bid quantity to be removed).

****

Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. [After stripping,] proof roll the existing subgrade of the [building] [_____] with six passes of a [dump truck loaded with 6 cubic meters 212 cubic feet of soil] [13.6 meter ton 15 ton, pneumatic-tired roller.] Operate the [roller] [truck] in a systematic manner to ensure the number of passes over all areas, and at speeds between 4 to 5.5 kilometers per hour 2 1/2 to 3 1/2 miles per hour. [When proof rolling under buildings, the building subgrade shall be considered to extend 1.5 m 5 feet beyond the building lines, and one-half of the passes made with the roller shall be in a direction perpendicular to the other passes.] Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the Contracting Officer. Rutting or pumping of material shall be undercut [as directed by the Contracting Officer] [to a depth of [_____] mm inches] and replaced with [fill and backfill] [select] material. [Bids shall be based on replacing approximately [_____] square meters square yards, with an average depth of [_____] mm inches at various locations.]

3.5 SUBGRADE FILTER FABRIC

****

NOTE: Delete this paragraph in its entirety if filter fabric is not used for subgrade stabilization. Vegetation such as grass may remain when no other subgrade preparation is indicated. Overlap length may be adjusted to fit design requirements. Drawings should indicate location and extent of filter fabric in typical cross sections.

****

Place synthetic fiber filter fabric as indicated directly on prepared subgrade free of [vegetation,] stumps, rocks larger than [50 mm] [2 inches] [_____] diameter and other debris which may puncture or otherwise damage

the fabric. Repair damaged fabric by placing an additional layer of fabric to cover the damaged area a minimum of [0.9 m] [3 feet][_____] overlap in all directions. Overlap fabric at joints a minimum of 0.9 m 3 feet. Obtain approval of filter fabric installation before placing fill or backfill. Place fill or backfill on fabric in the direction of overlaps and compact as specified herein. Follow manufacturer's recommended installation procedures.

3.6 FILLING AND BACKFILLING

Fill and backfill to contours, elevations, and dimensions indicated. Compact each lift before placing overlaying lift.

[3.6.1 Common Fill Placement

****
NOTE: Delete bracketed item when a pile-supported structure is not in the job.
****

Provide for general site [and under [porous fill of] pile-supported structures].[Use satisfactory materials.] Place in [150] [_____] mm [6] [_____] inch lifts. Compact areas not accessible to rollers or compactors with mechanical hand tampers. Aerate material excessively moistened by rain to a satisfactory moisture content. Finish to a smooth surface by blading, rolling with a smooth roller, or both.

]3.6.2 [Backfill and Fill Material Placement

Provide for paved areas and under concrete slabs, except where select material is provided. Place in [150] [_____] mm [6] [_____] inch lifts. Do not place over wet or frozen areas. Place backfill material adjacent to structures as the structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against the structure.

][3.6.3 Select Material Placement

Provide under [porous fill of] structures not pile supported. Place in [150] [_____] mm [6] [_____] inch lifts. Do not place over wet or frozen areas. Backfill adjacent to structures shall be placed as structural elements are completed and accepted. Backfill against concrete only when approved. Place and compact material to avoid loading upon or against structure.

]3.6.4 [Backfill and Fill Material Placement Over Pipes and at Walls

Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade [and shall include backfill for outside grease interceptors and underground fuel tanks]. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm 2 feet above sewer lines and 300 mm 1 foot above other utility lines shall be free from stones larger than 25 mm 1 inch in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more

than 100 mm 4 inches in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall.

]3.6.5 Porous Fill Placement

****
NOTE: The compacted thickness of capillary water barrier will be indicated and will not be less than 100 mm (4 inches). The paragraph will be deleted where site conditions make the barrier unnecessary.
****

Provide under floor and area-way slabs on a compacted subgrade. Place in [100] [_____] mm [4] [_____] inch lifts with a minimum of two passes of a hand-operated plate-type vibratory compactor.

3.6.6 Trench Backfilling

Backfill as rapidly as construction, testing, and acceptance of work permits. Place and compact backfill under structures and paved areas in [150] [_____] mm [6] [_____] inch lifts to top of trench and in [150] [_____] mm [6] [_____] inch lifts to 300 mm one foot over pipe outside structures and paved areas.

3.7 BORROW

****
NOTE: Coordinate this paragraph with the requirements in Part 2 Products.
****

Where satisfactory materials are not available in sufficient quantity from required excavations, approved borrow materials shall be obtained as specified herein.

3.8 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Bury tape 300 mm 12 inches below finished grade; under pavements and slabs, bury tape 150 mm 6 inches below top of subgrade.

3.9 BURIED DETECTION WIRE

Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm 12 inches above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m 3 feet of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, the wire shall terminate in the valve pit at the pump station end of the pipe.

3.10 COMPACTION

****
NOTE: Use 90 percent of ASTM D698 or ASTM D1557 for General Site Compaction of cohesionless materials on Army projects and 85 percent of same for Navy projects.
****

****
ARMY NOTE: See UFC 3-201-02, "Landscape Architecture" and UFC 3-230-01, "Water Storage, Distribution, and Transmission" for criteria and design guidelines.
****

****
NOTE: Specify most jobs using ASTM D698 compaction, except for roads, airfields, and other heavily loaded areas, which should use ASTM D1557 compaction. Specify compaction in terms of one compaction effort (ASTM D698 or ASTM D1557), if possible.
****

Determine in-place density of existing subgrade; if required density exists, no compaction of existing subgrade will be required. [Density requirements specified herein are for cohesionless materials. When cohesive materials are encountered or used, density requirements may be reduced by 5 percent.]

3.10.1 General Site

Compact underneath areas designated for vegetation and areas outside the 1.5 meter 5 foot line of the paved area or structure to [85] [90] [_____] percent of [ASTM D698] [ASTM D1557]. [Compact expansive materials to not less than [_____] percent nor more than [_____] percent.]

3.10.2 Structures, Spread Footings, and Concrete Slabs

Compact top 300 mm 12 inches of subgrades to [95] [_____] percent of [ASTM D698] [ASTM D1557]. Compact [common fill] [fill and backfill material] [select material] to [95] [_____] percent of [ASTM D698] [ASTM D1557].

3.10.3 Adjacent Area

Compact areas within 1.5 m 5 feet of structures to [90] [_____] percent of [ASTM D698] [ASTM D1557].

3.10.4 Paved Areas

Compact top 300 mm 12 inches of subgrades to [95] [_____] percent of [ASTM D698] [ASTM D1557]. Compact fill and backfill materials to 95 percent of [ASTM D698] [ASTM D1557].

[3.10.5 Airfield Pavements

Compact top 600 mm 24 inches below finished pavement or top 300 mm 12

inches of subgrades, whichever is greater, to [100] [_____] percent of ASTM D1557; compact fill and backfill material to [100] [_____] percent of ASTM D1557.

][3.11 PIPELINE CASING UNDER [RAILROAD] [AND] [PAVEMENT]

****
NOTE: Indicate on the contract drawings all construction requirements conforming to the standards of the railroad or highway owner. Indicate limits of right-of-way and any other site requirements or dimensions. Where traffic can be interrupted, trenching in a pipeline casing is more economical with the same advantages of allowing future work without interruption of traffic.
****

Provide new smooth wall steel pipeline casing under [new] [existing] [railroad] [and] [pavement] [in a trench] [by the boring and jacking method of installation]. Provide each new pipeline casing, where indicated and to the lengths and dimensions shown, complete and suitable for use with the new piped utility as indicated.

3.11.1 Earthwork for Pipeline Casings

Provide excavation, sheet piling, shoring, dewatering, and backfilling for pipeline casings under this section.

3.11.2 Steel Cased Pipelines

****
NOTE: Indicate on the contract drawings all construction requirements conforming to the standards of the railroad or highway owner. Indicate limits of right-of-way and any other site requirements or dimensions. Where traffic can be interrupted, trenching in a pipeline casing is more economical with the same advantages of allowing future work without interruption of traffic.
****

[Excavate and place bedding and backfill as indicated.] [Install pipeline casing by dry boring and jacking method as follows:]

3.11.2.1 Hole for Pipeline Casing

Mechanically bore holes and case through the soil with a cutting head on a continuous auger mounted inside the casing pipe. Weld lengths of pipe together in accordance with AWS D1.1/D1.1M. Do not use water or other fluids in connection with the boring operation.

3.11.2.2 Cleaning

Clean inside of the pipeline casing of dirt, weld splatters, and other foreign matter which would interfere with insertion of the piped utilities by attaching a pipe cleaning plug to the boring rig and passing it through the pipe.

3.11.2.3 Piped Utilities

Provide in casing using wood supports adjusted to obtained grades and elevations indicated.

3.11.2.4 End Seals

After installation of piped utilities in pipeline casing, provide watertight end seals at each end of pipeline casing between pipeline casing and piping utilities. Provide watertight [end seals as indicated.] [segmented elastomeric end seals.]

][3.12 SPECIAL EARTHWORK REQUIREMENTS FOR SUBSURFACE DRAINS

****

NOTE: Open-joint pipe (drain tile) will not be used for general airfield or heliport construction, drainage systems for structures, or for drains crossing or adjacent to paved areas. Open-joint pipe will be used only for subsoil drainage for drill areas, parade grounds, athletic fields, and other areas subject to lightweight vehicle traffic only, and where conditions justify its use.

Delete these paragraphs entirely when there is no subsurface drainage or where underdrainage requirements are completely described in another section. The type or types of pipe to be used will be indicated on the drawings. Where a Contractor's option is to be permitted, the types that are acceptable will be included in the specification. Add the requirements for a specialized subsurface drain, if necessary, to what is specified in this section. Consult a geotechnical engineer to determine specific grading requirements of granular filters and backfill materials and suitability of filter fabric. Include typical cross section detail of subsurface drain type or options on contract drawings.

The thickness and gradation of granular fill material for subsurface drains will be determined by soil conditions and subsoil drainage requirements.

At Table 1, choose one of the three options for each of the three types. The gradations shown on Table 1 may be altered to fit project requirements or additional gradations may be added to fit requirements of various subsurface drains within the project. The material placed adjacent to perforated pipe and open joints (without filter fabric wrapping) will be of a size that will prevent the entrance of any of the porous material into the drain. This material shall be a minimum of 150 mm 6 inches thick on the side of the pipe where the perforations are and around all joints. Thicknesses of granular fill, especially for subsurface drains with two types of material, will be clearly shown on the drawings. Where site conditions require more

than two types of granular fill for drains, the drawings will indicate the areas of different gradation and the table will expanded using additional types to show different gradations for different locations.

****

Excavate to dimensions indicated. Provide a bedding surface of no more than 25 mm one inch of [sand] [gravel] [Type I subdrain backfill material] and place on compacted [native soil] [impermeable material] as indicated. Backfill [blind or french drains] [around and over the pipes after pipe installation has been approved]. Place special granular filter material in 150 mm 6 inch lifts and compact with mechanical, vibrating plate tampers or rammers until no further consolidation can be achieved. Compact backfill overlying the special granular filter material as specified for adjacent or overlying work.

3.12.1 Granular Backfill Without Filter Fabric

****

NOTE: Coordinate with material specifications in Part 2. Consult a geotechnical engineer to determine optimum thickness of granular filter material and modify information in brackets if necessary. Indicate on drawings where different types of drains are to be used. Delete requirements for types of drains that are not included in the project.

****

3.12.1.1 Perforated or Slotted Wall Pipe

Place granular material as pipe is laid and extend fit for a minimum of [one] pipe diameter on each side of and 450 mm 18 inches above the top of the pipe. Place a layer of [kraft paper] [_____,] on top of granular filter before continuing with the backfill.

3.12.1.2 Open-Joint Pipe

Place both types of granular material specified as pipe is laid forming an aggregate filter around the pipe. Provide [Type II] material to envelope the pipe a minimum of one-half the pipe diameter or twice the maximum aggregate size, whichever is larger, on each side and on top of the pipe. Place [Type I] material next to and on top of the [Type II] material to provide a total fill extending at least [one] pipe diameter on each side of and 450 mm 18 inches above the top of the pipe. Place a layer of [kraft paper] [_____,] on top of the granular filter before continuing with the backfill.

3.12.2 Granular Backfill Using Filter Fabric

****

NOTE: Coordinate with material specifications in Part 2. Consult soils engineer to determine optimum thickness of granular filter material and modify information in brackets if necessary. Indicate on drawings where different types of drains are to be used. Delete requirements for types of drains that are not included in the project.

****

3.12.2.1 Perforated or Slotted Wall Pipes

Wrap one layer of filter fabric around pipe in such a manner that longitudinal overlaps are in unperforated or unslotted quadrants of the pipe. Overlap fabric a minimum of 50 mm 2 inches. Secure fabric to pipe so that backfill material does not infiltrate through overlaps. Place granular material and extend it for [one] pipe diameter, minimum of 150 mm 6 inches on each side of and 450 mm 18 inches above top of pipe. Place a layer of filter fabric on top of granular filter before continuing with backfill.

3.12.2.2 Open-Joint Pipe

Wrap one layer of filter fabric around pipe joints overlapping a minimum of 50 mm 2 inches in the longitudinal direction and extending at least 150 mm 6 inches on both sides of the joint. Secure fabric to pipe so that backfill material does not infiltrate through overlaps. Place granular material specified and extend it for a minimum of [one] pipe diameter on each side of and 450 mm 18 inches above top of pipe. Place a layer of filter fabric on top of granular filter before continuing with backfill.

3.12.2.3 Blind or French Drains

Install filter cloth in trenches with smoothly graded sides and bottom, free of cavities or projecting rocks. Lay the cloth flat but not stretched [and secure with anchor pins]. Place filter cloth so that drain water must pass through the cloth into the specified granular filter material. Overlap ends at least of 300 mm 12 inches. Place backfill on filter cloth in the direction of overlaps. Where fabric is damaged, place a new piece of filter cloth over damaged area and overlap at least of 300 mm 12 inches in every direction.

][3.13 EARTHWORK REQUIREMENTS FOR SEWAGE ABSORPTION [TRENCHES] [PITS]

****

NOTE: Delete these paragraphs when sewage absorption trenches or pits are not included in the project. Consult geotechnical engineer and local standards in selecting bracketed information in paragraph entitled "Earthwork Requirements for Sewage Absorption [Trenches] [Pits]" to conform with design indicated on the drawings. Coordinate with requirements for exterior sanitary sewer systems. Provide details on drawings indicating specific construction requirements as suggested by Sketch 02302-1.

****

Provide sewage absorption [trench] [pit] as indicated. [Grade trenches uniformly downward to ends of laterals.] [Place [pre-cast concrete base ring] [concrete footing] for pit sections at the elevation indicated. Assemble succeeding sections as indicated and as recommended by manufacturer.] Place porous fill [around and over pipe] [around absorption pit] as indicated. Take special care to prevent displacement of or damage to [pipe] [pit walls]. Cover porous fill with [kraft paper] [filter fabric] [_____] [a concrete cover] as indicated before continuing with backfill for adjacent or overlying work.

][3.14 RIP-RAP CONSTRUCTION

****
NOTE: Make sure there is no duplication of rip-rap requirements between this and other specification sections. In paragraph entitled "Material for Rip-Rap," refer to standard specifications for rip-rap if local specifications are satisfactory and available.
****

****
NOTE: Select information in brackets to best describe rip-rap construction. Provide detail or typical section through rip-rap on drawings as well as all dimensions necessary for estimating and construction. If DOT standard specifications are referenced for rip-rap construction, paragraphs entitled "Preparation" through "Grouting" may be deleted.
****

Construct rip-rap [on bedding material] [on filter fabric] [with grout] [in accordance with [DOT] [_____] State Standard, paragraph [_____]] in the areas indicated.

3.14.1 Preparation

Trim and dress indicated areas to conform to cross sections, lines and grades shown within a tolerance of 30 mm 0.1 foot.

3.14.2 Bedding Placement

Spread [filter fabric] bedding material uniformly to a thickness of at least [75] [_____] mm [3] [_____] inches on prepared subgrade as indicated. [Compaction of bedding is not required. Finish bedding to present even surface free from mounds and windrows.]

3.14.3 Stone Placement

Place rock for rip-rap on prepared bedding material to produce a well graded mass with the minimum practicable percentage of voids in conformance with lines and grades indicated. Distribute larger rock fragments, with dimensions extending the full depth of the rip-rap throughout the entire mass and eliminate "pockets" of small rock fragments. Rearrange individual pieces by mechanical equipment or by hand as necessary to obtain the distribution of fragment sizes specified above. [For grouted rip-rap, hand-place surface rock with open joints to facilitate grouting and do not fill smaller spaces between surface rock with finer material. Provide at least one "weep hole" through grouted rip-rap for every 4.65 square meters 50 square feet of finished surface. Weep holes shall consist of columns of bedding material, 100 mm 4 inches in diameter, extending up to the rip-rap surface without grout.]

3.14.4 Grouting

[Prior to grouting, wet rip-rap surfaces. Grout rip-rap in successive longitudinal strips, approximately 3 m 10 feet in width, commencing at the

lowest strip and working up the slope. Distribute grout to place of final deposit and work into place between stones with brooms, spades, trowels, or vibrating equipment. Take precautions to prevent grout from penetrating bedding layer. Protect and cure surface for a minimum of 7 days.

]]3.15 FINISH OPERATIONS

3.15.1 Grading

Finish grades as indicated within 30 mm one-tenth of one foot. Grade areas to drain water away from structures. Maintain areas free of trash and debris. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

3.15.2 Topsoil and Seed

****
NOTE: If seeding is minor, use requirements specified herein. Check with the locate Agriculture County Extension Service Office for Recommended Fertilizer Mixture for local conditions. Otherwise, edit Section 32 92 19 and cover requirements therein.
****

[Provide as specified in Section 32 92 19 SEEDING.

] [Scarify existing subgrade. Provide 100 mm 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading. [Additional topsoil will not be required if work is performed in compliance with stripping and stockpiling requirements.] [If there is insufficient on-site topsoil meeting specified requirements for topsoil, provide topsoil required in excess of that available.] Seed shall match existing vegetation. Provide seed at 2.5 kg per 100 square meters 5 pounds per 1000 square feet. Provide granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

[_____] percent available nitrogen
[_____] percent available phosphorus
[_____] percent available potassium
[_____] percent sulfur
[[_____] percent iron]

Provide mulch and water to establish an acceptable stand of grass.]

3.15.3 Protection of Surfaces

Protect newly backfilled, graded, and topsoiled areas from traffic, erosion, and settlements that may occur. Repair or reestablish damaged grades, elevations, or slopes.

3.16 DISPOSITION OF SURPLUS MATERIAL

[Waste in Government disposal area [indicated] [which is located within a haul distance of [_____] kilometers miles.] [Remove from Government property] surplus or other soil material not required or suitable for

filling or backfilling, and brush, refuse, stumps, roots, and timber.]

3.17 FIELD QUALITY CONTROL

3.17.1 Sampling

Take the number and size of samples required to perform the following tests.

3.17.2 Testing

Perform one of each of the following tests for each material used. Provide additional tests for each source change.

3.17.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the 75 micrometers No. 200 sieve; ASTM D4318 for liquid limit and for plastic limit; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.17.2.2 Select Material Testing

Test select material in accordance with ASTM C136/C136M for conformance to ASTM D2487 gradation limits; ASTM D1140 for material finer than the 75 micrometers No. 200 sieve; ASTM D698 or ASTM D1557 for moisture density relations, as applicable.

3.17.2.3 Porous Fill Testing

Test porous fill in accordance with ASTM C136/C136M for conformance to gradation specified in ASTM C33/C33M.

3.17.2.4 Density Tests

****

NOTE: Density test frequency can vary from one test per 10 square meter 100 square feet for small areas up to one test per 900 square meter 10,000 square feet. The following table will also help establish test frequency for various situations:

Material Type	Location of Material	Test Frequency
Undisturbed native soil	Structures	Two random tests in native soil building footings and two tests on subgrade within building line.
Fills and backfills	Structures (adjacent to)	One test per structure per 200 sq. m taken 300 mm below finished grade.
Subgrades	Site (except airfields)	One test per lift per 250 sq. m

Material Type	Location of Material	Test Frequency
Embankments or borrow	Any	One test per lift per 400 cubic m placed.
Native soil subgrade other than structures and parking	Any	One test or one test per 900 sq. m whichever is greater.
Borrow	Any	One test per lift per 400 cubic m placed.

Material Type	Location of Material	Test Frequency
Undisturbed native soil	Structures	Two random tests in native soil building footings and two tests on subgrade within building line.
Fills and backfills	Structures (adjacent to)	One test per structure per 2,000 sq. ft taken 12 inches below finished grade.
Subgrades	Site (except airfields)	One test per lift per 2,500 sq. ft
Embankments or borrow	Any	One test per lift per 500 cubic yds placed.
Native soil subgrade other than structures and parking	Any	One test or one test per 10,000 sq. ft whichever is greater.
Borrow	Any	One test per lift per 500 cubic yds placed.

****

Test density in accordance with ASTM D1556/D1556M, or ASTM D6938. When ASTM D6938 density tests are used, verify density test results by performing an ASTM D1556/D1556M density test at a location already ASTM D6938 tested as specified herein. Perform an ASTM D1556/D1556M density test at the start of the job, and for every 10 ASTM D6938 density tests thereafter. Test each lift at randomly selected locations every [200] [_____] square meters [2000] [_____] square feet of existing grade in fills for structures and concrete slabs, and every [250] [_____] square meters [2500] [_____] square feet for other fill areas and every [200] [_____] square meters [2000] [_____] square feet of subgrade in cut. Include density test results in daily report.

[Bedding and backfill in trenches: One test per [15] [_____] meters [50] [_____] linear feet in each lift.

][3.17.2.5 Moisture Content Tests

****
NOTE: Include moisture content test requirements in Army projects.
****

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D2216. Include moisture content test results in daily report.

] -- End of Section --