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NAVFAC IGS-02315 (MAY 2002)  
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Preparing Activity: LANTNAVFACENGCOM Based on UFGS-02315N

ITALIAN GUIDE SPECIFICATIONS

Use for ITALIAN projects only

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SECTION 02315

EXCAVATION AND FILL

05/02

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NOTE: This guide specification is issued by the Atlantic Division, Naval Facilities Engineering Command for regional use in Italy.

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NOTE: This guide specification covers earthwork requirements for buildings, roads, and utilities for normal, routine construction. Consult with a soils engineer while editing this section to determine specific requirements for each job.

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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. Location of borrow and disposal area if located on Government property;
5. Clearing stripping and grubbing limits, if different from clearing limits;
6. Areas to be seeded;
7. Hydrological data where available;

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

9. Pipe trench excavation details.

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Comments and suggestion on this specification are welcome and should be directed to the technical proponent of the specification. A listing of the technical proponents, including their organization designation and telephone number, is on the Internet.

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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PART 1 GENERAL

1.1 REFERENCES

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

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 33	(1993) Concrete Aggregates
ASTM C 136	(1996) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 698	(1991) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m))
ASTM D 1140	(1992) Amount of Material in Soils Finer Than the No. 200 (75-Micrometer) Sieve
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft (2,700 kN-m/m))
ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1996) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995; Rev. A) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ITALIAN NATIONAL INSTITUTE FOR THE UNIFICATION

UNI 5634	(1997) Identification Systems for Pipelines and Canalizations Conveying Fluids
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COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1909	Fertilizer
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ITALIAN LAWS AND DECREES

D.P.R. n. 164 - 7/1	(1956) Norms for the Prevention of Accidents in Construction Work
D.M. n. 494 - 14/8	(1996) Implementation of the Instruction 92/57/CEE Concerning the Minimum Safety and Health Requirements to be Accomplished in Temporary or Mobile Work Sites
D.P.R. n. 547 - 27/4	(1955) General Norms for the Prevention of Work Related Accidents
Law n. 319 - 10/5	(1976) Norms for the Protection of Water Against Pollution

1.2 DEFINITIONS

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**NOTE: Delete definitions that will not be used in the specification text for a specific project.**  
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1.2.1 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.

1.2.2 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] [\_\_\_\_\_] cubic meter[1/2] [\_\_\_\_\_] 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.

1.2.3 Cohesive Materials

Materials ASTM D 2487 classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesive only when the fines have a plasticity index greater than zero.

1.2.4 Cohesionless Materials

Materials ASTM D 2487 classified as GW, GP, SW, and SP. Materials classified as GM and SM will be identified as cohesionless only when the fines have a plasticity index of zero.

1.2.5 [Pile Supported Structure

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

1.3 SUBMITTALS

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**NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item is required.**

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Recommended codes for Army projects are "RE" for Resident Engineer approval, "ED" for Engineering

approval, and "AE" for Architect-Engineer approval. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

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Submit the following in accordance with section entitled "Submittal Procedures."

[SD-02 Shop Drawings

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**NOTE:** Include the following paragraph when excavations are deep, or excavation will be near adjacent structures or roads.

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Supporting system drawings

Submit drawings and calculations by a registered professional engineer. Drawings shall include material sizes and types, arrangement of members, and the sequence and method of installation and removal.]

[SD-05 Design Data

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**NOTE:** Include the following paragraph when excavations are deep, or excavation will be near adjacent structures or roads.

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Supporting system calculations

Submit drawings and calculations by a registered professional engineer. Calculations shall include data and references used.]

SD-06 Test Reports

Fill and backfill test

Select material test

Porous fill test for capillary water barrier

Density tests

SD-07 Certificates

[Supporting systems work plan]

[Dewatering work plan]

[Blasting work plan]

Submit 15 days prior to starting work.

1.4 DELIVERY, STORAGE, AND HANDLING

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

1.5 CRITERIA FOR BIDDING

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 NOTE: For most projects, the scope of earthwork can accurately be determined. However, if it is known that large quantities of unsuitable material are to be removed, specify those quantities herein.  
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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.

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 NOTE: At the text below, anytime excavation work is required, obtain boring logs from new investigation work, or from previous projects on file in the Geotechnical and Paving Branch. If no specific subsurface information is available, specify a ground water depth representative of the area;for LANTNAVFACENGCOM jobs, specify a 1.5 meter5 foot ground water depth.  
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 NOTE: Choose one between the two following bracketed options.  
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[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 [\_\_\_\_\_] meterfeet below existing surface elevation.]

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

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NOTE: Choose one of the following three bracketed options 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.

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

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NOTE: Choose one between the two following bracketed options.

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

[h. Blasting will be permitted. Blasting shall be conducted in accordance with D.M. n. 494 - 14/8 and D.P.R. n. 164 - 7/1, 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.]

## PART 2 PRODUCTS

### 2.1 SOIL MATERIALS

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.

#### 2.1.1 Common Fill

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

#### 2.1.2 Backfill and Fill Material

ASTM D 2487, classification GW, GP, GM, [GC,] SW, SP, SM, [SC] with a maximum ASTM D 4318 liquid limit of [35] [\_\_\_\_], maximum ASTM D 4318 plasticity index of [12] [\_\_\_\_], and a maximum of 25 percent by weight passing ASTM D 1140, 75 micrometers No. 200 sieve.

#### 2.1.3 Topsoil

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NOTE: Choose one of the following options.  
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NOTE: If seeding is minor, use requirements specified herein. Otherwise, edit Section 02921, "Turf," and cover requirements therein.  
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[Provide as specified in Section 02921, "Turf."]

[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.]

#### 2.1.4 Select Material

ASTM D 2487, classification GW, GP, SW, SP.

#### 2.2 POROUS FILL FOR CAPILLARY WATER BARRIER

ASTM C 33 fine aggregate grading with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers No. 200 sieve, or coarse aggregate Size 57, 67, or 77 and conforming to the general soil material requirements specified in paragraph entitled "Soil Materials."

#### 2.3 BORROW

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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.  
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[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] [\_\_\_\_\_] 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.]

#### 2.4 BURIED WARNING AND IDENTIFICATION TAPE

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**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.**

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[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 in English and Italian. Color and printing shall be in accordance with UNI 5634 and permanent, unaffected by moisture or soil.

##### Warning Tape Color Codes

[Yellow:]	[Electric]
[Yellow:]	[Gas, Oil; Dangerous Materials]
[Orange:]	[Telephone and Other Communications]
[Green:]	[Water Systems]
[Green:]	[Sewer Systems]
[Gray:]	[Steam Systems]
[Light Blue:]	[Compressed Air]

#### 2.4.1 [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. 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.]

#### 2.4.2 [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 mm0.004 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 mm3 feet deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.]

2.5 DETECTION WIRE FOR NON-METALLIC PIPING

Detection wire shall be insulated single strand, solid copper with a minimum of 2.5 square millimeter.

2.6 [MATERIAL FOR RIP-RAP

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**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.**  
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[Bedding material] [Grout] [Filter fabric] and rock conforming to these requirements.

2.6.1 [Bedding Material

Consisting of sand, gravel, or crushed rock, well graded, [or poorly graded] with a maximum particle size of 50 mm2 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.]

2.6.2 [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.]

2.6.3 [Rock

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

PART 3 EXECUTION

3.1 SURFACE PREPARATION

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

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**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.**  
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Unless indicated otherwise, remove trees, stumps, logs, shrubs, and brush within the [clearing limits] [\_\_\_\_\_] . Remove stumps entirely. Grub out matted roots and roots over 50 mm in diameter to at least 460 mm below existing surface.

3.1.2 Stripping

Strip existing topsoil to a depth of [100] [\_\_\_\_\_] mm [4] [\_\_\_\_\_] inches without contamination by subsoil material. Stockpile topsoil separately from other excavated material and locate convenient to finish grading area.

3.1.3 Unsuitable Material

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

3.1.3.1 Proof Rolling

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**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).**  
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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 of soil. Operate the 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.]

3.1.3.2 [Building Site Preparation

Perform building site preparation as indicated.]

3.2 PROTECTION

3.2.1 Protection Systems

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

1. The excavation is less than 3 m 20 feet in depth;
2. Adjacent structures, roads, or pavements will not affect the excavation;
3. Equipment or stored material will not 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; and
7. Station operational considerations allow laying back the slopes of the excavation.

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Provide shoring, bracing, [cribbing,] [underpinning,] and sheeting in accordance with D.M. n. 494 - 14/8, D.P.R. n. 547 - 27/4, D.P.R. n. 164 -

7/1, Law n. 319 - 10/5 [, except that banks may be sloped only when approved by the Contracting Officer]. [Provide additional supporting systems where indicated.]

### 3.2.2 Drainage and Dewatering

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

#### 3.2.2.1 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, swales, and other drainage features and equipment as required to maintain dry soils. 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 groundwater conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

#### 3.2.2.2 Dewatering

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**NOTE: Check depth of proposed utilities and foundations relative to the existing ground water elevation prior to editing.**  
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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 and in accordance with Law n. 319 - 10/5. 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 pervious zones below subgrade elevation in layered soils to prevent uplift.]

### 3.2.3 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.]

### 3.2.4 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.

### 3.3 EXCAVATION

Excavate to contours, elevation, and dimensions indicated in accordance with D.M. n. 494 - 14/8, D.P.R. n. 547 - 27/4, Law n. 319 - 10/5, D.P.R. n. 164 - 7/1. 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. Refill with [backfill and fill material] [select material] [porous fill] and compact to [95] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557] maximum density. Unless specified otherwise, refill excavations cut below indicated depth with [backfill and fill material] [select material] [porous fill] and compact to [95] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557] maximum density.

#### 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 overexcavations 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 D 698 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.

#### 3.3.4 [Hard Material [and Rock] Excavation

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**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.

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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 unless previously authorized by the Contracting Officer will not be grounds for a claim for additional payment.]

### 3.4 FILLING AND BACKFILLING

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

#### 3.4.1 Common Fill Placement

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

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Provide for general site [and under [porous fill of] pile-supported structures]. 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.

#### 3.4.2 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. 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.

#### 3.4.3 Select Material Placement

Provide under [porous fill of] structures not pile supported. Place in [150] [\_\_\_\_\_] mm [6] [\_\_\_\_\_] inch lifts. 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.

#### 3.4.4 Porous Fill Placement

Provide under floor slab on a compacted subgrade. Place in [100] [\_\_\_\_\_] mm -[4] [\_\_\_\_\_] inch lifts.

### 3.4.5 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 footover pipe outside structures and paved areas.

#### 3.4.5.1 Bedding Requirements

Except as specified otherwise in the individual piping section, provide bedding for buried piping in sand, gravel or crushed stone to a depth of 1/8 pipe diameter 100 mm minimum, except as specified herein. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide ASTM D 2321 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 D 2487.

### 3.5 BURIED WARNING AND IDENTIFICATION TAPE

Provide buried utility lines with utility identification tape. Color in accordance with UNI 5634. Bury tape 300 mm 12 inches below finished grade; under pavements and slabs, bury tape 150 mm 6 inches below top of subgrade.

### 3.6 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.

### 3.7 COMPACTION

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**NOTE: Delete bracketed sentences concerning  
cohesive and cohesionless material if only  
cohesionless material will be encountered.**  
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NOTE: Specify most jobs using ASTM D 698  
compaction, except for roads, airfields, and other  
heavily loaded areas, which should use ASTM D 1557  
compaction. Specify compaction in terms of one  
compaction effort (ASTM D 698 or ASTM D 1557), if  
possible.  
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Expressed as a percentage of maximum density. 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.]

### 3.7.1 General Site

Compact underneath areas designated for vegetation and areas outside the 1.5 meter 5 foot line of the structure to [85] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557].

### 3.7.2 Structures, Spread Footings, and Concrete Slabs

Compact top 300 mm 12 inches of subgrades to [95] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557]. Compact [common fill] [fill and backfill material] [select material] to [95] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557].

### 3.7.3 Porous Fill for Capillary Water Barrier

Compact with two passes of a hand-operated, plate type vibratory compactor.

### 3.7.4 Adjacent Area

Compact areas within 1.5 m 5 feet of structures to [90] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557].

### 3.7.5 Paved Areas

Compact top 300 mm 12 inches of subgrades to [95] [\_\_\_\_\_] percent of [ASTM D 698] [ASTM D 1557]. Compact fill and backfill materials to 95 percent of [ASTM D 698] [ASTM D 1557].

### 3.7.6 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 D 1557 ; compact fill and backfill material to [100] [\_\_\_\_\_] percent of ASTM D 1557.

## 3.8 FINISH OPERATIONS

### 3.8.1 Grading

Finish grades as indicated within 30 mm. one-tenth of one foot Grade areas

to drain water away from structures. For existing grades that will remain but which were disturbed by Contractor's operations, grade as directed.

### 3.8.2 Seed

\*\*\*\*\*  
**NOTE: Choose one of the following options.**  
\*\*\*\*\*

\*\*\*\*\*  
**NOTE: If seeding is minor, use requirements specified herein. Otherwise, edit Section 02921, "Turf," and cover requirements therein.**  
\*\*\*\*\*

[Provide as specified in Section 02921, "Turf."]

[Scarify existing subgrade. Provide 100 mm 4 inches of topsoil for newly graded finish earth surfaces and areas disturbed by the Contractor. [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 CID A-A-1909, Type I, Class 2, 10-10-10 analysis fertilizer at 12.2 kg per 100 square meters. 25 pounds per 1000 square feet. Provide commercial agricultural limestone of 94-80-14 analysis at 34.2 kg per 100 square meters.] 70 pounds per 1000 square feet Provide mulch and water to establish an acceptable stand of grass.]

### 3.8.3 Protection of Surfaces

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

### 3.9 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.]

### 3.10 FIELD QUALITY CONTROL

#### 3.10.1 Sampling

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

#### 3.10.2 Testing

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

##### 3.10.2.1 Fill and Backfill Material Testing

Test fill and backfill material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the 75 micrometers No. 200 sieve; ASTM D 4318 for liquid limit and for plastic limit; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

3.10.2.2 Select Material Testing

Test select material in accordance with ASTM C 136 for conformance to ASTM D 2487 gradation limits; ASTM D 1140 for material finer than the 75 micrometers No. 200 sieve; ASTM D 698 or ASTM D 1557 for moisture density relations, as applicable.

3.10.2.3 Porous Fill Testing

Test porous fill in accordance with ASTM C 136 for conformance to gradation specified in ASTM C 33.

3.10.2.4 Density Tests

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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:

<u>Material Type</u>	<u>Location of Material</u>	<u>Test Frequency</u>
Undisturbed native soil	Structures	Two random tests in 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
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

<u>Material Type</u>	<u>Location of Material</u>	<u>Test Frequency</u>
		cubic m placed.

\*\*\*\*\*

Test density in accordance with ASTM D 1556, or ASTM D 2922 and ASTM D 3017. When ASTM D 2922 and ASTM D 3017 density tests are used, verify density test results by performing an ASTM D 1556 density test at a location already ASTM D 2922 and ASTM D 3017 tested as specified herein. Perform an ASTM D 1556 density test at the start of the job, and for every 10 ASTM D 2922 and ASTM D 3017 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.

\*\*\*\*\*

**NOTE:** Suggestions for improvement of this specification will be welcomed using the Navy "Change Request Forms" subdirectory located in SPECSINTACT in Jobs or Masters under "Forms/Documents" directory or DD Form 1426. Suggestions should be forwarded to:

Commanding Officer  
 Naval Construction Battalion Center  
 NAVFAC 15G/CESO 158  
 1000 23rd Avenue  
 Port Hueneme, CA 93043-4301

**FAX:** (805) 985-6465/982-5196 or DSN 551-5196

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-- End of Section --