

SECTION 31 20 00 EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This section specifies the requirements for furnishing all equipment, materials, labor, tools, and techniques for earthwork including, but not limited to, the following:
1. Site preparation.
 2. Excavation.
 3. Filling and backfilling.
 4. Grading.
 5. Soil Disposal.
 6. Cleanup.

1.2 DEFINITIONS

- A. Unsuitable Materials:
1. Fills: Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 3 inches; organic material, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable and any material with a liquid limit and plasticity index exceeding 40 and 15 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D698.
 2. Existing Subgrade (Except Footing Subgrade): Same materials as in Subparagraph 1.2.A.1 that are not capable of direct support of slabs, pavement, and similar items with possible exception of improvement by compaction, proofrolling, or similar methods.
 3. Existing Subgrade (Footings Only): Same as Subparagraph 1.2.A.1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to approval of the COTR.
- B. Building Earthwork: Earthwork operations required in area enclosed by a line located 5 feet outside of principal building perimeter. It also includes earthwork required for auxiliary structures and buildings.
- C. Trench Earthwork: Trenchwork required for utility lines.

- D. Site Earthwork: Earthwork operations required in area outside of a line located 5 feet outside of principal building perimeter and within new construction area with exceptions noted above.
- E. Degree of compaction: Degree of compaction is expressed as a percentage of maximum density obtained by laboratory test procedure. This percentage of maximum density is obtained through use of data provided from results of field test procedures using ASTM D1556 or other approved test methods.
- F. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- G. Backfill: Soil materials or controlled low strength material used to fill an excavation.
- H. Unauthorized excavation: Removal of materials beyond indicated subgrade elevations or indicated lines and dimensions without written authorization by the COTR. No payment will be made for unauthorized excavation or remedial work required to correct unauthorized excavation.
- I. Authorized additional excavation: Removal of additional material authorized by the COTR based on the determination by NCA's soils testing agency that unsuitable bearing materials are encountered at required subgrade elevations. Removal of unsuitable material and its replacement as directed will be paid on basis of Conditions of the Contract relative to changes in work.
- J. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, sub-base, pavement aggregate base, drainage fill, or topsoil materials.
- K. Structure: Buildings, foundations, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- L. Borrow: Satisfactory soil or granular materials imported from off-site for use as fill or backfill.
- M. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- N. Bedding course (or Bedding material): Layer placed over the excavated subgrade in a trench before laying pipe. Bedding course shall extend up to the springline of the pipe, unless otherwise shown on the Drawings.
- O. Sub-base Course: Layer placed between the subgrade and base course for asphalt paving or layer placed between the subgrade and a concrete pavement or walk.

- P. Granular fill and base: Layer of aggregate placed on prepared subgrade underneath concrete slabs.
- Q. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- R. Debris: Debris includes all materials located within the designated work area not covered in the other definitions and shall include but not be limited to items like vehicles, equipment, appliances, building materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- S. Contaminated soils: Soil that contains contaminants as defined and determined by the COTR or NCA's testing agency.

1.3 RELATED WORK

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Safety requirements: Section 01 00 01, GENERAL REQUIREMENTS.
- C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 01, GENERAL REQUIREMENTS.
- D. Subsurface Investigation: Section 01 00 01, GENERAL REQUIREMENTS.
- E. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
- F. Paving subgrade requirements: Section 32 12 16, ASPHALT PAVING.

1.4 CLASSIFICATION OF EXCAVATION

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

1.5 SUBMITTALS:

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Submit the following during work progress:
 - 1. Laboratory test reports and certifications by suppliers for proposed borrow materials showing conformance with the specifications.
 - 2. Field and laboratory test reports of all specified field quality control testing showing conformance of the constructed work with the specifications.

C. Submit the following at completion of the work:

1. As-built drawings of completed grading as specified in Section 01 00 01.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced.

Publications are referenced in text by basic designation only. Refer to the latest edition of all referenced Standards and codes unless otherwise specified.

B. ASTM International (ASTM):

- D448 Standard Classification for Sizes of Aggregate for Road
and Bridge Construction
- D698 Standard Test Methods for Laboratory Compaction
Characteristics of Soil Using Standard Effort
- D1556..... Standard Test Method for Density and Unit Weight of Soil
in Place by the Sand-Cone Method
- D2216..... Standard Test Methods for Laboratory Determination of
Water (Moisture) Content of Soil and Rock by Mass
- D2487..... Standard Practice for Classification of Soils for
Engineering Purposes (Unified Soil Classification System)
- D2937..... Standard Test Method for Density of Soil in Place by the
Drive-Cylinder Method
- D2940..... Standard Specification for Graded Aggregate Material for
Bases or Subbases for Highways or Airports
- D4959..... Standard Test Method for Determination of Water
(Moisture) Content of Soil By Direct Heating
- D6938..... Standard Test Method for In-Place Density and Water
Content of Soil and Soil-Aggregate by Nuclear Methods
(Shallow Depth)

PART 2 - PRODUCTS

2.1 SOURCE QUALITY CONTROL

- A. Proposed materials and source of supply shall be approved by the COTR as specified, prior to delivery and use in the construction.
- B. Contractor's quality control testing firm shall perform the following testing of proposed materials:

1. Fills, Engineered Fill, Pipe Bedding and Initial Trench Backfill, and Granular Fill: Soil classification (ASTM D2487), minimum of one test for each visible change in material.
2. Final Trench Backfill: Moisture-density curve (ASTM D698), minimum of one test for each visible change in material.

2.2 MATERIALS

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations. Granular fill and granular base shall be obtained from approved off-site borrow source(s).
- B. Fills: Material in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter. Material approved from on-site or off-site sources having a minimum dry density of 110 pcf, a maximum Plasticity Index of 15, and a maximum Liquid Limit of 40.
- C. Engineered Fill: Naturally or artificially graded mixture of soil in compliance with ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, SM, SC, and ML, or any combination of these groups, or as approved by the COTR, or material with at least 90 percent passing a 1 1/2-inch sieve and not more than 12 percent passing a No. 200 sieve in accordance with ASTM D2940.
- D. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100 percent passing a 1 1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- E. Final Trench Backfill: Soil obtained from excavations for installation of piping, drop inlets and manholes, provided that it is substantially free of material which may be compressible or which cannot be compacted properly.
- E. Granular Fill:
 1. Under concrete slabs, crushed stone or gravel graded from 1 inch to No. 4) in accordance with ASTM D2940.
 2. Bedding and initial trench backfill for sanitary and storm sewer pipe shall consist of crushed stone or gravel graded from 1/2 inch to No 4.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Clearing: Clear within limits of earthwork operations as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from NCA property.
- B. Grubbing: Remove stumps and roots 3 inches and larger diameter. Undisturbed sound stumps, roots up to 3 inches) diameter, and nonperishable solid objects a minimum of 3 feet below subgrade or finished embankment may be left. Do not leave material within burial profile up to 8 feet below finished grade.
- C. Trees and Shrubs: Trees and shrubs not shown for removal may be removed from areas within 15 feet of new construction and 7.5 feet of utility lines when removal is approved in advance by the COTR. Remove materials from NCA property. Immediately repair damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Do not store building materials closer than farthest extension of the limbs of trees and shrubs, that are to remain.
- D. Stripping Topsoil: Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by COTR. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 1/2 cubic foot in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 2 inches in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed. Test the soil for chemicals, pesticides and fertilizers if topsoil is to be removed from lands formerly utilized as farmland, to verify suitability for use as topsoil in the cemetery where new lawn areas are to be established.
- E. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 12 inches on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from NCA property.

- F. Lines and Grades: Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 01, shall establish lines and grades.
1. Grades shall conform to elevations indicated on the Drawings within the tolerances herein specified. Generally grades shall be established to provide a smooth surface, free from irregular surface changes. Grading shall comply with compaction requirements and grade cross sections, lines, and elevations indicated. Where spot grades are indicated the grade shall be established based on interpolation of the elevations between the spot grades while maintaining appropriate transition at structures and paving and uninterrupted drainage flow into inlets.
 2. Locations of existing and proposed elevations indicated on the Drawings are from a site survey that measured spot elevations and subsequently generated existing contours and spot elevations. Proposed spot elevations and contour lines have been developed utilizing the existing conditions survey and developed contour lines and may be approximate. Contractor is responsible to notify COTR of any differences between existing elevations shown on the Drawings and those encountered on site by Surveyor/Engineer described above. Notify the COTR of any differences between existing or constructed grades, as compared to those shown on the Drawings.
 3. Subsequent to establishment of lines and grades, Contractor will be responsible for any additional cut and/or fill required to ensure that the site is graded to conform to elevations indicated on the Drawings.
- G. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION

- A. Shoring, Sheet piling and Bracing: Sides of excavations shall be shored, braced, or sloped in conformance with applicable Federal, State and local regulations (including 29CFR 1926, Subpart P – Excavations) to protect workers, adjacent paving, structures, and utilities.
1. Design of the temporary support of excavation system is the responsibility of the Contractor.
 2. Construction of the excavation support system shall not interfere with the permanent structure and may begin only after a review by the COTR.

3. Extend shoring and bracing to a minimum of 5 feet below the bottom of excavation. Shore excavations that are carried below elevations of adjacent existing foundations (if applicable).
 4. If bearing material of any foundation is disturbed by excavating, improper shoring or removal of existing or temporary shoring, placing of backfill, and similar operations, the Contractor shall place and compact backfill material or perform other required stabilization measures as approved by the COTR , at no additional cost to the NCA. Do not remove shoring until permanent work in excavation has been inspected and approved by the COTR.
- B. Excavation Drainage: Operate pumping equipment and/or provide other materials, means and equipment as required to keep excavation free of water and subgrade dry, firm, and undisturbed until approval of permanent work has been received from the COTR. Approval by the COTR is also required before placement of the permanent work on all subgrades.
- C. Subgrade Protection: Protect subgrades from softening, undermining, washout, or damage by rain or water accumulation. Reroute surface water runoff from excavated areas and not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. When subgrade for foundations has been disturbed by water, remove disturbed material to firm undisturbed material after water is brought under control. Replace disturbed subgrade in trenches with concrete or material approved by the COTR.
- D. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under buildings and pavements, proofroll exposed subgrade with a fully loaded dump truck to check for pockets of soft material.
 2. Proofrolling shall consist of at least two complete passes with one pass being in a direction perpendicular to preceding one. Remove any areas that deflect, rut, or pump excessively during proof rolling, or that fail to consolidate after successive passes to suitable soils and replaced with compacted fill. Maintain subgrade until succeeding operation has been accomplished.
- E. Building Earthwork:
1. Excavation shall be accomplished as required by the Drawings and Specifications.
 2. Excavate foundation excavations to solid undisturbed subgrade.
 3. Remove loose or soft materials to a solid bottom.

4. Fill excess cut under footings or foundations with 2000 psi concrete poured separately from the footings.
 5. Do not tamp earth for backfilling in footing bottoms, except as specified.
 6. Slope grades to direct water away from excavations and to prevent ponding.
- F. Trench Earthwork:
1. Utility trenches (except sanitary and storm sewer):
 - a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.
 - b. Grade bottom of trenches with bell holes scooped out to provide a uniform bearing.
 - c. Support piping on undisturbed earth unless a mechanical support is shown.
 - d. Length of open trench in advance of pipe laying shall not be greater than is authorized by the COTR.
 2. Sanitary and storm sewer trenches:
 - a. Unless otherwise indicated on the Drawings, excavated trench width below a point 6 inches above top of pipe shall be 24 inches maximum for pipe up to and including 12 inches diameter, and four-thirds diameter of pipe plus 8 inches for pipe larger than 12 inches. Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.
 - b. Bed bottom quadrant of pipe on undisturbed soil or granular fill. Depth of fill shall be a minimum of 3 inches plus one sixth of pipe diameter below pipe to 12 inches above top of pipe. Place and tamp fill material by hand.
 - c. Place and compact as specified remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.
 - d. Use granular fill for bedding where rock or rocky materials are excavated.
- G. Site Earthwork: Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation. Excavation shall be accomplished as required by drawings and specifications. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, complying with OSHA requirements, and for inspections. Remove subgrade materials that are determined by the COTR as unsuitable, and replace with acceptable material. If

there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COTR, and the materials shall be examined by an independent testing laboratory for soil classification to determine whether it is unsuitable or not. When unsuitable material is encountered and removed, contract price and time may be adjusted as applicable. Adjustments to be based on volume in cut section only.

1. Site Grading:

- a. Provide a smooth transition between adjacent existing grades and new grades.
- b. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- c. Slope grades to direct water away from buildings and to prevent ponds from forming where not designed. Finish subgrades to required elevations within the following tolerances:
 - 1) Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2) Walks: Plus or minus 1 inch.
 - 3) Pavements: Plus or minus 1 inch.
- d. Grading Inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.3 FILLING AND BACKFILLING FOR STRUCTURES AND PAVEMENTS

- A. General: Do not fill or backfill until all debris, water, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from excavation. For fill and backfill, use excavated materials and borrow meeting the criteria specified herein, as applicable. Do not use unsuitable excavated materials. Do not backfill until: foundation walls have been completed above grade and adequately braced; waterproofing or dampproofing has been applied; foundation drainage and pipes coming in contact with backfill have been installed; and work has been inspected and approved by the COTR.
- B. Placing: Place and compact materials in horizontal layers not exceeding 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure. Place no material on surfaces that are muddy, frozen, or contain frost.
- C. Compaction: Compact fill and backfill with rollers, vibrator compactors, or other equipment (hand or mechanized) suitable for the soil being compacted. Do not operate

mechanized vibratory compaction equipment within 10 feet of new or existing building walls without prior approval of the COTR. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used. Compact soil to not less than the following percentages of maximum dry density, according to ASTM D698 as specified below:

1. Under proposed structures, building slabs, and paved areas, scarify and re-compact top 12 inches of existing subgrade and each 12-inch layer of backfill or fill material to a minimum of 98 percent of the material's maximum dry density as determined by ASTM D698.
2. Under curbs, gutters and sidewalks, compact top 6 inches of existing subgrade and each 8-inch layer of backfill or fill material to 95 percent of the material's maximum dry density as determined by ASTM D698.
3. In lawn areas, compact top 16 inches to 85 percent of the material's maximum dry density as determined by ASTM D698.
4. In lawn areas greater than 16 inches beneath finished grade, compact to 90 percent of the material's maximum dry density as determined by ASTM D698.

3.4 GRADING

- A. General: Uniformly grade the areas within the limits of construction, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Slope backfill outside building away from building walls for a minimum distance of 6 feet.
- C. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 6 inches unless otherwise shown.
- D. Finish subgrade in a condition acceptable to the COTR at least one day in advance of paving operations. Maintain finished subgrade in a smooth and compacted condition until succeeding operation has been accomplished. Scarify, compact, and grade subgrade prior to further construction when approved compacted subgrade is disturbed by Contractor's subsequent operations or adverse weather.
- E. Grading for Paved Areas: Provide final grades for both subgrade and base course within +/- 1/4 inch of indicated grades.

3.5 FIELD QUALITY CONTROL

- A. The following tests shall be performed during placement of soil backfill in pipe trenches and other excavations:
 - 1. In-Place Density (using ASTM D1556, ASTM D2937, or ASTM D6938), minimum of one test for every three lifts of backfill placed at each structure and for every 200 linear feet of trench.
 - 2. Moisture Content (using ASTM D2216 or ASTM D6938), minimum of one test for every three lifts of backfill placed at each structure and for every 200 linear feet of trench.
- B. The following tests shall be performed during placement of road subgrade materials:
 - 1. In-Place Density (using ASTM D6938 or ASTM D1556), minimum of one test for each six-inch thick layer and 500 square feet of backfill placed.
 - 2. Moisture Content (using ASTM D4959 or ASTM D6938), minimum of one test for each six-inch thick layer and 500 square feet of backfill placed.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off NCA property.
- B. Place excess excavated materials suitable for fill and/or backfill on-site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.
- D. Segregate all excavated contaminated soil designated by the COTR from all other excavated soils, and stockpile on the site on two 6 mil polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEANUP

- A. Upon completion of earthwork operations, clean areas within the limits of construction, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove all debris, rubbish, and excess material from NCA property.

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