

SECTION 31 20 00

EARTH MOVING

PART 1 - GENERAL

1.1 DESCRIPTION

- 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. Clean Up.

1.2 DEFINITIONS

- A. Unsuitable Materials:
1. Fills, Unsatisfactory Soils, Topsoil; frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 2 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 12 respectively. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction, as defined by ASTM D1557.
 2. Existing Subgrade: Same materials as 1.2.A.1 that are not capable of direct support of crypts, slabs, pavement, and similar items with possible exception of improvement by overexcavation and recompaction, proof-rolling, or similar methods.
- B. Trench Earthwork: Trenchwork required for utility lines.
- C. Site Earthwork: Earthwork operations required in areas located within construction area with exceptions noted elsewhere in this Section.
- D. 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 presented in ASTM D1556.
- E. Fill: Satisfactory soil materials used to raise existing grades. In the Construction Documents, the term "fill" means fill or backfill as appropriate.
- F. Backfill: Soil materials or controlled low strength material used to fill an excavation.

- G. Unauthorized excavation: Removal of materials beyond indicated sub-grade elevations or indicated lines and dimensions without written authorization by the COR. No payment will be made for unauthorized excavation or remedial Work required to correct unauthorized excavation.
- H. Authorized additional excavation: Removal of additional material authorized by the COR based on the determination by the Government that unsuitable bearing materials are encountered at required sub-grade 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.
- I. Subgrade: The undisturbed earth or the compacted soil layer immediately below granular base, drainage fill, or topsoil materials.
- J. Structure: Buildings, foundations, slabs, tanks, crypts, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Borrow: Satisfactory soil imported from off-site for use as fill or backfill.
- L. Drainage course: Layer supporting slab-on-grade used to minimize capillary flow of pore water.
- M. Bedding course: Layer placed over the excavated subgrade in a trench before laying pipe. Bedding course shall extend up to the spring line of the pipe.
- N. Base Course: Layer placed between the subgrade and asphalt paving or layer placed between the subgrade and a pavement or walk.
- O. Utilities include on-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.
- P. 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, construction materials or remains thereof, tires, any solid or liquid chemicals or products stored or found in containers or spilled on the ground.
- Q. Contaminated soils: Soil that contains contaminants as defined and determined by the COR or the Government's testing agency.

1.3 RELATED WORK

- A. Safety requirements: GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.
- C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

- D. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- E. Site preparation: Section 02 41 10, DEMOLITION.
- F. Erosion Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, and Section 32 90 00, PLANTING.
- G. 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. Furnish to COR:
 - 1. Contactor shall furnish resumes with all personnel involved in the Project including Project Manager, Superintendent, and on-site Inspector or Engineer. Project Manager and Superintendent should have at least 3 years of experience on projects of similar size.
 - 2. Soil samples and the following for each type of soil or material listed in Part 2:
 - a. Classification in accordance with ASTM D2487 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - b. Laboratory compaction curve in accordance with ASTM D1557 for each on-site or borrow soil material proposed for fill, backfill, engineered fill, or structural fill.
 - c. Test reports for compliance with ASTM D2940 requirements for base material.
 - 3. Pre-excavation photographs and videotape in the vicinity of the existing structures to document existing site features, including surfaces finishes, cracks, or other structural blemishes that might be misconstrued as damage caused by earthwork operations.
 - 4. The Contractor shall submit a scale plan daily that defines the location, limits, and depths of the area excavated.

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.
- B. American Association of State Highway and Transportation Officials (AASHTO):

- T99 Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop
- T180 Moisture-Density Relations of Soils using a 4.54 kg (10 lb) Rammer and a 457 mm (18 inch) Drop
- C. American Society for Testing and Materials (ASTM):
- D448 Standard Classification for Sizes of Aggregate for Road and Bridge Construction
- D1556 Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
- D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2700 kN m/m³))
- D2487 Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)
- D2940 Standard Specifications for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- D. Society of Automotive Engineers (SAE):
- J732 Specification Definitions - Loaders
- J1179 Hydraulic Excavator and Backhoe Digging Forces

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide borrow soil material when sufficient satisfactory soil materials are not available from excavations.
- 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 2 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 12, and a maximum Liquid Limit of 40.
1. On-site soils meeting the requirements above and having an organic content of less than 3 percent by volume may be used as fills. Testing results must be submitted and approved prior to subgrade preparation or other earth moving activities.
 2. Imported fill materials shall meet the requirements above and shall have a resistivity of no less than the resistivity of the on-site soils, a pH between 6.0 and 8.5, a total water soluble chloride concentration of less than 300 ppm, and total water soluble sulfate concentration less than 500 ppm. Testing results, including all listed soils characteristics and parameters, must be submitted and approved prior to procurement.
- C. Engineered Fill (Satisfactory Soil): Naturally or artificially graded mixture of 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

Engineer 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, per ASTM D2940.

- D. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; meeting the requirements for Caltrans Class 2 permeable material.
 - 1. Use sand per ASTM C33 for irrigation trenches.
- E. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 67; with 100 percent passing a 1 inch sieve and 0 to 5 percent passing a No. 8 sieve.
- F. Granular Fill:
 - 1. Under concrete slab, crushed stone or gravel graded from 1 inch to No. 4, per ASTM D2940.
 - 2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 1/2 inch to No. 4, per ASTM D2940.
- G. Pea Gravel (Flowable Fill): Install an approved pea gravel (rounded) fill per gradation into gaps between preplaced crypts leaving no voids. No sand allowed.
 - 1. Provide angular stone fill to same gradation between lids.

Aggregate Size No	Grading Requirements - Amounts finer than Each Sieve (Square Openings), Mass Percent					
	1/2"	3/8"	No. 4	No. 8	No. 16	No. 50
8	100	85 to 100	10 to 30	0 to 10	0 to 5	
89	100	90 to 100	20 to 55	5 to 30	0 to 10	0 to 5

- H. Crushed Gravel Subbase:
- I. Gravel Mulch Topdressing: Inert Mulch as defined in Section 32 90 00, PLANTING.
- J. Trench Plug: On-site clays, low strength concrete, or sand /cement slurry.
- K. Slope Protection/Erosion Control Rip Rap: Stone for riprap shall be field stone or rough unhewn quarry stone. The stone shall be round, tough, dense, resistant to the action of air and water, and suitable in all other respects for the purpose intended. The size of an individual stone particle will be determined by measuring its long dimension. Conforming to the following gradation:

Rip Rap Required Stone Size (in)	
Minimum	2
Midrange	4
Maximum	6

1. No more than 5% of the material furnished can be less than the minimum size and no more than 10% of the material furnished can exceed the maximum material size specified.

PART 3 - EXECUTION

3.1 SITE PREPARATION

- A. Clearing: Clear within limits of construction as shown. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash, and other obstructions. Remove materials from Cemetery property.
- B. Grubbing: Remove stumps and roots 2 inch and larger diameter. Undisturbed sound stumps, roots up to 2 inch 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 or subgrade.
- C. Trees and Shrubs: Trees and shrubs, not shown for removal, must be protected in place. These items may be removed from areas within 7.5 feet of new construction and of utility lines if requested in writing, with justification of removal, and if removal is approved in advance by COR. These items will be replaced with vegetation of similar species and size, approved by the COR, at Contractor's sole expense. Remove materials from Cemetery property. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semiannually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus, and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until conclusion of Contract. Box with orange fencing, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in construction area. 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 construction materials closer to trees and shrubs that are to remain than farthest extension of their limbs.
- 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 COR. 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 for reuse on-site; dispose of excess topsoil off of Cemetery property. 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 or drilled seed 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 Cemetery property.
- F. Lines and Grades: A Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS, shall establish lines and grades.
 - 1. Grades shall conform to elevations indicated on 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 elevations indicated on plans are approximate based on 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 COR of any differences between existing elevations shown on plans and those encountered on site by Surveyor/Engineer described above. Notify COR 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 site is graded to conform to elevations indicated on Drawings.
 - 4. Finish grading is specified in Section 32 90 00, PLANTING.
- 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.

3.2 EXCAVATION

- A. Do not proceed with subgrade preparation, excavation, and/or fill operations during wet weather conditions.
- B. Shoring, Sheet piling and Bracing: Shore, brace, or slope, to its angle of repose or to an angle considered acceptable by the COR, banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities.
 - 1. Design of the temporary support of excavation system is the responsibility of the Contractor.

2. Construction of the support of excavation system shall not interfere with the permanent structure and may begin only after a review by the COR.
 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.
 4. Provide all required safety and egress measures for excavations.
- C. 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 COR. Approval by the COR is also required before placement of the permanent Work on all subgrades.
1. Do not discharge excavation drainage / dewatering directly to a drainage conveyance. Water must be filtered before discharge in accordance with the requirements of the NPDES Construction General Permit.
- D. Overexcavate at crypt footprint and at paving areas to a depth of 3 feet below existing grade or subgrade, whichever is deeper, and 3 feet laterally from edges of crypt or paving. Scarify overexcavation subgrade to a depth of 12 inches, moisture condition to between 3 to 5 percent over optimum water content, and recompact per Geotechnical Report recommendations.
- E. 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 COR.
1. Subgrade that becomes unsuitable due to excess moisture because it was not properly safeguarded shall be remediated at no expense to the Government.
- F. Blasting: Blasting is not permitted.
- G. Proofrolling:
1. After rough grade has been established in cut areas and prior to placement of fill in fill areas under building 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.
- H. Crypt Earthwork:
1. Excavation shall be accomplished as required by Drawings and Specifications.
 2. Excavate to solid undisturbed subgrade.

3. Overexcavate, scarify, moisture condition, and recompact as required by the Geotechnical Report recommendations as described in other paragraphs of this Section.
4. Remove loose or soft materials to a solid bottom.
5. Slope grades to direct water away from excavations and to prevent ponding.

I. 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 sand bedding unless a mechanical support is shown.
 - d. Length of open trench in advance of piping laying shall not be greater than is authorized by COR.
2. Sanitary and storm sewer trenches:
 - a. 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.
 - 1) 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.

- J. 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. 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 COR 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 COR, 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 will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES SUPPLEMENT of the GENERAL CONDITIONS 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 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 1/4 inch.
 - 3) Pavements: Plus or minus 1/2 inch.

3.3 FILLING AND BACKFILLING

- 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. Borrow will be supplied at no additional cost to the Government. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, foundation drainage, and pipes coming in contact with backfill have been installed and Work inspected and approved by COR.
- B. Placing: Place 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 and then compacted. 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 with approved tamping rollers, sheepfoot rollers, pneumatic tired rollers, steel wheeled rollers, vibrator compactors, or other approved equipment (hand or mechanized) well suited to soil being compacted. Do not operate mechanized vibratory compaction equipment within 10 feet of crypt field perimeter once crypts have been installed. Moisten or aerate material as necessary to provide moisture content that will readily facilitate obtaining specified compaction with equipment used (3 to 5 percent above optimum). Compact soil to not less than the following percentages of maximum dry density, according to ASTM D1557 as specified below:
 - 1. Under crypts and paved areas, scarify, moisture condition, and recompact top 12 inches of existing subgrade and each layer of backfill or fill material in accordance with ASTM D1557, 95 percent.
 - 2. Curbs, curbs and gutters, ASTM D1557, 95 percent.
 - 3. Under Sidewalks, scarify and recompact top 12 inches below subgrade and compact each layer of backfill or fill material in accordance with ASTM D1557, 95 percent.
 - 4. Landscaped areas, top 16 inches, ASTM D1557, 88 percent.
 - 5. Landscaped areas, below 16 inches of finished grade, ASTM D1557, 90 percent.

3.4 GRADING

- A. General: Uniformly grade the areas within the limits of this Section, 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. Cut rough or sloping rock to level beds for foundations. In pipe spaces or other unfinished areas, fill low spots and level off with coarse sand or fine gravel.
- C. Finish grade earth floors in pipe basements as shown to a level, uniform slope and leave clean.
- D. Finished grade shall be at least 6 inches below bottom line of window or other building wall openings unless greater depth is shown.
- E. Place crushed stone or gravel fill under concrete slabs on grade, tamped, and leveled. Thickness of fill shall be 6 inches unless otherwise shown.
- F. Finish subgrade in a condition acceptable to COR 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.
- G. Grading for Paved Areas: Provide final grades for both subgrade and base course to 0.25 inches of indicated grades.

3.5 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 Cemetery 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 COR from all other excavated soils, and stockpile on site on two 0.15 mm (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.

3.6 CLEAN UP

- A. Upon completion of earthwork operations, clean areas within Contract limits, and areas outside of the Contract limits which are disturbed in the execution of the Contract Work, 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 Cemetery Property.

END OF SECTION