

SECTION 31 23 00 EXCAVATION AND FILL

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Excavation and fill for:
 - 1. Building pads and foundations.
 - 2. Embankment areas.
 - 3. Waterways and ditches (including inlet structures and outlet ditches).

1.02 RELATED WORK

- A. Section 01 45 29 Testing Laboratory Services
- B. Section 31 11 00 Clearing and Grubbing
- C. Section 31 22 19.13 Spreading and Grading Topsoil

1.03 DEFINITIONS

- A. Excavation consists of removal of material encountered to sub-grade elevations indicated and subsequent disposal of materials removed.
- B. Unauthorized excavation consists of removal of materials beyond indicated sub-grade elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's expense.
- C. Additional Excavation: When excavation has reached required sub-grade elevations, notify Geotechnical Engineer, who will make an inspection of conditions. If Geotechnical Engineer determines that bearing materials at required sub-grade elevations are unsuitable, continue excavation until suitable bearing materials are encountered. The Contract Sum maybe adjusted by an appropriate Contract Modification.
- D. Sub-grade: The undisturbed earth or the compacted soil immediately below granular sub-base, drainage fill, or topsoil materials.
- E. Structure: Buildings, foundations, slabs, tanks, curbs or other man-made stationary features occurring above or below ground surfaces.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.
- B. Testing and Inspection Service: Owner will employ and pay qualified independent geotechnical testing and inspection laboratories to perform soil testing and inspection service during earth operations.

1.05 EXISTING CONDITIONS

- A. Known underground, surface and aerial utility lines, and buried objects as indicated on the Drawings.
- B. Do not interrupt existing utilities service to facilities occupied and used by the Owner or others, except when permitted in writing, by Owner's Representative and then only after temporary utility services have been provided.

1.06 PROTECTION

- A. Protect trees, shrubs and lawns, rock outcroppings and other features remaining as part of final landscaping.
- B. Protect benchmarks, existing structures, fences, roads, sidewalks, paving, and curbs against damage from equipment and vehicular traffic.
- C. Protect aerial, surface, or underground utility lines and appurtenances which are to remain.
- D. Repair damages.
- E. Erosion control must be maintained. Refer to notes on demolition, fencing and/or grading plans.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Provide for surface drainage during the period of construction in a manner to avoid creating a nuisance to adjacent areas. Keep excavation free of water during the entire progress of the work, regardless of the case, source, or nature of the water.
- B. Trees shall be left undisturbed, as shown on drawings.

1.08 SEDIMENT AND EROSION CONTROL

- A. Protect newly graded areas from erosion. Where necessary, temporarily seed disturbed areas with annual rye grass at a rate of 4 lbs/1000 sq. ft. If seeding is necessary in summer months, contact the Owner's Representative for an approved seeding application.
- B. Repair settlement and erosion which occurs prior to acceptance of work.
- C. Temporary Ditch Checks: Place two unbroken straw bales in a "V" formation, with open end upstream in ditches as directed by Owner Representative. Place ditch check at 50 foot intervals for ditches, with slopes between 1.0 percent and 3.0 percent. For ditches steeper than 3.0 percent, place at 25 foot intervals and stake each bale firmly with a 2"x4" wood stake or other means as directed by the Owner's Representative.
- D. Leave straw bale ditch checks in place throughout construction except when ditches are fine graded, and seeded or sodded.
- E. Perform periodic maintenance on ditch checks to remove sediment and replace straw bales as necessary so as not to inhibit flow or runoff.

1.09 REFERENCE STANDARDS

- A. Determine soil's maximum dry density and optimum moisture in accordance with ASTM D698.
- B. Rock borings or soundings, if provided, are:
 - 1. For information purposes only.
 - 2. No guarantee of existing conditions.
 - 3. No substitute for investigations deemed necessary by Contractor.

PART 2 – PRODUCTS

2.01 SOIL MATERIALS

- A. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups, GW, GP, GM, SM, SW, and SP, and approved by the testing agency.
- B. Unsatisfactory soil materials are defined as those complying with ASTM D2387 soil classifications groups GC, SC, ML, MH, CL, CH, OL, OH, and PT, or those rejected by the testing agency.
- C. Drainage Fill: Washed, evenly graded mixture or crushed stone, or crushed or uncrushed gravel, with 100% passing with a 1-1/2 inch sieve and not more than 5% passing a No. 4 sieve.
- D. Backfill and Fill Materials: Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.

Fill material should have a liquid limit less than 38 and a plasticity index more than 4 but less than 18.

- E. Topsoil: Excavated material from the construction site if approved by University Landscape Architect, graded free of roots, subsoil, debris, large weeds, toxic substances, and rocks greater than 1 inch. If topsoil from construction site is unavailable or unsuitable, topsoil as specified in Section 31 22 19.13 Spreading and Grading Topsoil shall be brought to site.

PART 3 – EXECUTION

3.01 GENERAL SITE EXCAVATION

- A. All excavation is unclassified.
- B. Do not excavate wet subsoil materials.
- C. Excavate subsoil required to allow placement of compacted backfill under paving and site structures, and to accommodate construction operations.
- D. Machine slope banks to angle of repose or less until shored.
- E. Removed lumped subsoil, boulders and rock.
- F. Completely remove stumps, roots over 1 inch in diameter and similar on-grade and below-grade obstructions within the area to be covered new construction and for a distance of 10 feet beyond area in all directions. In other areas disturbed by grading, remove such obstructions to a depth of 2 feet below sub-grade.
- G. Correct unauthorized excavation, including areas over-excavated by error, at no extra cost to the Owner.
- H. Stockpile excavated material in designated area on site to a dept not exceeding 8 feet and protect from erosion. Remove excess material not being reused from site. Stockpile areas not to be identified during a pre-construction meeting of the jobsite.
- I. If existing basements, cellars, cisterns, wells, septic tanks, drain fields, cesspools, catch basins, sink holes, manholes and similar items are encountered, remove to solid sub-grade and break up masonry and/or concrete bottoms so that no pieces remain over 12 inches in the longest dimension.

3.02 REMOVAL OF TOPSOIL

- A. Remove topsoil of horticultural value from areas to be excavated and regarded, and stockpile in designated area.
- B. Do not permit topsoil to be mixed with subsoil.
- C. Do not strip topsoil when wet.

3.03 STABILITY OF EXCAVATIONS

- A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.
- B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.04 DEWATERING

- A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footing, and soil changes detrimental to stability of sub-grades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or runoff areas. Do not use trench excavations as temporary drainage ditches.

3.05 EXCAVATION FOR STRUCTURES

- A. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, and other construction and for inspection.
- B. Excavations for grade beams and foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is place. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.06 COLD WEATHER PROTECTION

- A. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.07 PREPARATION OF NATURAL GROUND

- A. Proof-Roll areas to be covered by construction with loaded rubber-tired dump truck having a single axle weight of approximately 30,000 lbs., or similar equipment. Owner's Representative is to identify any unstable areas.
- B. Unsuitable sub-grades identified by the testing agency may attempt to be stabilized by scarifying, aerating and re-compaction, if these procedures are approved by the geotechnical representative. Scarify at an effective depth of 12 inches and re-compact.
- C. If, after scarification, aeration and re-compaction operations are completed, any exposed sub-grades are determined by the testing agency as incapable of being stabilized in-place; perform remedial work as specified below.

3.08 REMEDIAL WORK

- A. If, after scarification, aeration and re-compaction operations specified above are completed, any exposed sub-grades are determined by the testing agency as incapable of being stabilized in-place, undercut to a depth identified by the testing agency and backfill.
 1. Notify the Architect to obtain approval prior to beginning undercutting operations.
 2. Keep records of material quantities removed and replace as specified in Division 1 and have materials verified by the testing agency.
- B. If required, excavate shallow temporary drainage ditches to facilitate removal of excess moisture from sub-grade areas.

3.09 BACKFILL AND FILL

- A. General: Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials specified in Part 2 of this Section.
 1. In crawlspace, use drainage fill material.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.

3. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall piers and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent piers.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
 1. Acceptance of construction below finish grade including, where acceptable, damproofing, waterproofing, and perimeter insulation.
 2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
 3. Removal of concrete formwork.
 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 5. Removal of trash and debris from excavation.
 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.10 PLACEMENT AND COMPACTION

- A. Ground Surface Preparation: Remove vegetation debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
 1. When existing ground surface has a density less than that specified under "Compaction" for particular area classification break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- B. Place backfill and fill materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment.
- C. Edges of compacted fill should extend at least 10 feet beyond the building prior to sloping.
- D. Before compaction, moisten or aerate each layer as necessary to be within a range 1% below or 3% above optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- E. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.
- F. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.
 1. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 698.
 - a. Under structures, building slabs and steps, and pavements, compact top 8 inches of sub-grade and each layer of backfill or fill material at 95% maximum density.
 2. Moisture Control: Where sub-grade or layer of fill material must be moisture conditioned before compaction, uniformly apply water to surface of sub-grade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
 - a. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

- b. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

3.11 GRADING

- A. General: Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes and as follows:
- C. Compaction: After grading, compact sub-grade surfaces to the depth and indicated percentage of maximum or relative density for each area classification.

3.12 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve each sub-grade and fill layer before further backfill or construction work is performed.
 - 1. Perform field density tests in accordance with ASTM D 698.
 - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, the calibration curves furnished with the moisture gauges in accordance with ASTM D 3017.
 - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as directed by Architect.
 - 2. Foundation Wall Backfill: Perform at least two field density tests at locations and elevations as directed
 - 3. If in opinion of the Architect, based in testing service reports and inspection, sub-grade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.13 EROSION CONTROL

- A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.

3.14 MAINTENANCE

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction, operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.15 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Removal from Owner's property: Remove waste materials, including unacceptable excavated material, trash, and debris, and dispose of it off Owner's property.

END OF SECTION

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