

## **SECTION 312000 EARTH MOVING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Preparing subgrades for building foundation, structures, storm sewer structures, walks, pavements, piping, lawns and plantings.
  - 2. Excavating and backfilling for structures and improvements.
  - 3. Subbase course for concrete walks and pavements.
  - 4. Subbase and base course for asphalt paving.
  - 5. Subsurface drainage backfill for walls and trenches.
  - 6. Excavating and backfilling for utility trenches.
  - 7. Excavating and backfilling test pits for buried utility structures and piping.
  - 8. Excavation and backfilling for infiltration/detention basin
- B. Related Sections include the following:
  - 1. Division 01 Section, "Construction Waste Management"
  - 2. Division 31 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
  - 3. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
  - 4. Site Wide Materials Management Plan

#### **1.3 UNIT PRICES**

- A. Rock Measurement: No separate payment will be made for the removal of rock and replacement with approved material.

#### **1.4 DEFINITIONS**

- A. Backfill: Soil material used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying

- pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill. Material shall be certified clean fill meeting the requirements of the “Technical Requirements for the Site Remediation, N.J.A.C. 7:26E-1.8” as amended.
  - E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
  - F. Excavation: Removal of material encountered above subgrade elevations.
    - 1. This work shall include the removal of the existing pavement, concrete, stone, soil, rock and fill material as required to construct the proposed improvements, including the building, structures, piping, walls, utilities, foundations, roadways, sidewalk and all other structures that are constructed below existing grade.
  - G. Fill: Soil materials used to raise existing grades.
  - H. Imported Select Fill Material:
    - a. Structural fill under the building foundation and concrete slab:
      - 1) Controlled structural fill utilized in the construction areas shall consist of inorganic, readily compactable, predominantly well-graded granular soils with no more than 8% fines (material passing the No. 200 sieve), and a maximum particle size of 3 inches.
      - 2) The sandy soil shall be classified as well-graded sandy soil or silty sand (SW or SW-SM) in accordance with the Unified Soil Classification System ASTM D2487.
      - 3) The moisture content of the fill materials should be controlled to within 2% of the optimum moisture content as determined by the Modified Proctor Test (ASTM D 1557)
      - 4) Controlled fill within the construction area under the footings and concrete slab should be compacted to at least 98% and 95%, respectively, of the maximum dry density as determined by the Modified Proctor Test (ASTM D 1557)
      - 5) Backfilling against footings and grade beams should be compacted to 95% of the maximum dry density (ASTM D 1557)
    - I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. Yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without

systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
  2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general- purpose bare bucket; measured according to SAE J-732.
- J. Suitable Onsite Materials: Suitable material from excavations shall be free from objectionable quantities of organic matter, vegetation, stumps, frozen material, rubble, refuse, cinders, rock and other deleterious materials
- K. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, utility chambers, manholes, storm inlets, or other man-made stationary features constructed above or below the ground surface.
- L. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- M. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- N. Unsuitable Material:
- a. Quantities of organic matter, stumps, frozen material, clays, rubble, refuse, cinders, rock or other deleterious material shall not be used as backfill material.
  - b. Any excavated or cleared material which is not suitable for use as backfill in the building, pavement and basin areas, shall be utilized as a backfill material to raise grades in landscaped areas, only.
- O. Utilities: Underground pipes, overhead wiring, conduits, ducts, and cables, as well as underground services and structures.
- 1.5 SUBMITTALS
- A. Product Data: For the following:
1. Each type of plastic warning tape.
  2. Drainage and separation fabric.
- B. Samples: For the following:

1. One seventy-five (75) pound bag sample of each material to be used as backfill and bedding which is a composite of three sampling locations within each borrow source for every 4,000 Cubic Yards of material shall be submitted to the Soils Engineer one (1) week minimum prior to commencing fill operations. This material shall not be used as a compacted fill until approved by the Engineer. By submitting samples of this material, the Contractor agrees and guarantees that the fill material used for construction will conform with the samples (s) supplied. Final acceptance of fill material rests with the Engineer, whose decision shall be final and binding upon the Contractor. However, the acceptance of any material by the Engineer shall not relieve the Contractor of his responsibility to have the fill material used conform to the sample(s) approved by the Engineer.
  2. The Contractor shall supply data on the compaction equipment to the Engineer not less than one (1) weeks prior to the intended use of the equipment and the equipment shall be approved by the Engineer prior to commencing compaction operations.
  3. 12-by-12-inch sample of drainage fabric. - Drainage fabric to be polypropylene non-woven geotextile with a minimum tensile strength of 120 lbs. ASTM D-4632, apparent opening size 70 US Std. Sieve ASTM D-4751 and water flow rate of 110 gpm/sf ASTM D-4491.
  4. 12-by-12-inch sample of separation fabric - Separation fabric to be polypropylene non-woven geotextile with a minimum tensile strength of 120 lbs. ASTM D-4632, apparent opening size 70 US Std. Sieve ASTM D-4751 and water flow rate of 110 gpm/sf ASTM D-4491
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
1. Classification and grain size analysis according to ASTM D 2487 and ASTM D 422 of each on-site or borrow soil material proposed for fill and backfill.
  2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.
- D. Blasting will not be permitted.

1.6

#### QUALITY ASSURANCE

- A. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in specifications.

#### 1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or

others unless permitted in writing by the owner and then only after arranging to provide temporary utility services according to requirements indicated.

1. Notify owner not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Owner's written permission.
  3. Contact utility-locator service for area where Project is located 72 hours before excavating.
- B. Relocate existing underground utilities and irrigation system components in conflict with the proposed construction.
- C. Contractor to perform test pits to field locate existing utilities if present including sanitary sewer, and storm drains to confirm elevations prior to excavation.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. All imported materials shall meet the standards of the Residential Direct Contact Soil Remediation Standards or Impact to Groundwater Soil Screening Levels whichever is more stringent.
- B. Satisfactory Soils:
1. Fill Classification:
    - a. Type "S" Fill – shall be structural fill consisting of clean sand and gravel to be used in general, for the support of foundations and new structures. This fill shall be imported from off the site and shall meet the following gradation requirement.

U.S. Standard Sieve Size    Percent Finer By Weight

1 inch	100
3/8 inch	65-100
No. 10	40-85
No. 30	20-65
No. 60	10-45
No. 200	3-8

- b. Type "G" Fill – shall be a granular fill consisting of a clean sand and gravel to be used, in general, for backfilling around and between structures and underneath paved areas, pipelines and utilities. This fill shall be imported from off the site and shall meet the gradation requirements as listed below. If suitable Type "G" materials are found on the site and is accepted by the Engineer, it shall be stored for use.

U.S. Standard Sieve Size    Percent Finer By Weight

2 inch	100
1 inch	80-100
3/8 inch	70-100
No. 10	50-100
No. 30	30-85
No. 60	15-65
No. 200	5-15

- c. Type “W” Fill – shall be a structural fill consisting of clean stone conforming to New Jersey Department of Transportation coarse aggregate size No. 57, used to facilitate dewatering while providing a firm workmat subgrade onto which foundations may be constructed as well as providing a drainage blanket and pipe bedding. The fill material shall be imported from off-site and shall meet the following gradation requirements.

U.S. Standard Sieve Size                      Percent Finer By Weight

1 1/2 inch	100
1 inch	95-100
1/2 inch	25-60
No. 4	0-10
No. 8	0-5

- d. Type K-4 Sand shall have a maximum of 15% fines and maximum in-situ permeability rating of 10 inches per hour.
- e. Topsoil – Topsoil shall be free from subsoil, clay lumps, brush, objectionable weeds, and other litter, and shall be free from stones, stumps and other objects larger than 2” in any dimension, and other objectionable material.
- The topsoil shall meet the standards of the Standards for Soil Erosion and Sediment Control in New Jersey and shall have a minimum Organic content of 2.75 percent.
2. Unsatisfactory soils include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured by Pro-Line Safety Products for marking and identifying underground utilities, a minimum of 4 inches wide and 5 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to

30 inches deep; colored as per authority having jurisdiction, or as follows:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION WASTE MANAGEMENT

- A. The contractor, subcontractors, and their personnel shall follow the procedures and practices for waste separation, collection and transport as defined in the contractor's "Waste Management Plan" as required by Division 01 Section "Construction Waste Management."

#### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified under "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified under "Soil Erosion and Sediment Control", during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

#### 3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  2. Install a dewatering system, specified in Division 31 Section "Dewatering", to keep subgrades dry and convey ground water away from excavations.

Maintain until dewatering is no longer required.

### 3.4 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.5 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

### 3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services, utilities and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Storm Sewer Structures, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

### 3.7 EXCAVATION FOR WALKS, PAVEMENTS, AND LAWN AREAS

- A. Excavate surfaces under walks, pavements, and lawn areas to indicated lines, cross sections, elevations, and subgrades.

### 3.8 EXCAVATION FOR UTILITY TRENCHES

- A. All excavations shall be in accordance with OSHA requirements.
- B. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- C. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.



1. Clearance: 12 inches each side of pipe or conduit.  
  
Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
2. For pipes and conduit less than 6 inches in nominal diameter and flat-bottomed, multiple- duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
3. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.9 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 5 mph.
  2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed, without additional compensation.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

### 3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Owner.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### 3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  2. Surveying locations of underground utilities for Record Documents.
  3. Testing and inspecting underground utilities.
  4. Removing concrete formwork.
  5. Removing trash and debris.
  6. Removing temporary shoring and bracing, and sheeting.
  7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.13 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches crossing under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- D. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
  1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Backfill voids with satisfactory soil while installing and removing shoring and

bracing, and as sheeting is removed.

- F. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs or as directed by the utility company or authority having jurisdiction.

### 3.14 FILL

- A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions and deleterious materials from ground surface before placing fills.
- B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- C. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.

### 3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Compacting of prepared subgrade under Type “G”, and Type “W” Fills – after excavation to the required subgrade, the subgrade shall be compacted by approved equipment and methods to develop to a depth of at least twelve (12) inches below ground surface at least 95% of maximum dry density as determined by the Engineer in conformance with ASTM Standard D1557. Any soft or weak spots detected during the compaction operation or proof-rolling of subgrade must be removed and replaced with controlled fill as directed by the Engineer. The compaction shall be checked by the Engineer and lean concrete or fill shall not be placed until compaction of the existing subgrade is approved by the Engineer.

- B. Placement of Type “S” Fills - No backfill shall be placed until the excavation and subgrade has been approved by the Engineer and until backfill materials to be used are approved by the Engineer, and no backfill shall be placed on frozen or thawing ground. Fill shall be placed in uniform horizontal layers not more than eight (8) inches in thickness and shall be compacted with a high energy self-propelled vibratory roller. Lift thickness may be adjusted in the field by the Engineer if required soil density is not being achieved. Controlled fill within the construction area under the footings and concrete slab should be compacted to at least 98% and 95%, respectively, of the maximum dry density as determined by the Modified Proctor Test (ASTM D 1557)
- C. Placement of Type “G”, and “W” Fills – No backfill shall be placed until the excavation and subgrade has been approved by the Engineer and until backfill materials to be used are approved by the Engineer, and no backfill shall be placed on frozen or thawing ground. Fill shall be placed in uniform horizontal layers not more than eight (8) inches in loose thickness and shall be compacted with a high energy self-propelled vibratory roller. Lift thickness may be adjusted in the field by the Engineer if required soil density is not being achieved.
- D. Compaction of Type “S” Fills - the backfill shall be compacted near optimum moisture content by means of vibratory compactors to not less than 98% and 95% of the maximum density determined in accordance with ASTM Standard D1557 for areas under footings and concrete slabs respectively. The Engineer shall check the obtained in-place density of the compacted fill using the method of ASTM Standards D 1556 or D 2922 for in place density tests. Should the obtained density of the compacted fill be less than specified, the Contractor shall recompact the area until the required maximum density is reached. Only hand held compaction equipment shall be used within four (4) feet of foundation walls and structures.
- E. Compaction of Type “G”, and “W” Fills – the backfill shall be compacted near optimum moisture content by means of vibratory compactors to not less than 95% of the maximum density determined in accordance with ASTM Standard D1557. The Engineer shall check the obtained in-place density of the compacted fill using the method of ASTM Standards D 1556 or D 2922 for in place density tests. Should the obtained density of the compacted fill be less than specified, the Contractor shall recompact the area until the required maximum density is reached. Only hand held compaction equipment shall be used within four (4) feet of foundation walls and structures.
- F. Moisture Control – the moisture-density curve for the fill used shall be used as a guide in controlling moisture to achieve the required degree of compaction. If, in the opinion of the Engineer, fill material becomes too wet for the required compaction, the fill shall be dried by a method approved by the Engineer prior to commencing or continuing compaction operations. Likewise, if the opinion of the Engineer, the fill material becomes too dry for the required compaction, the fill shall be moistened by a method approved by the Engineer prior to commencing or continuing compaction operations

- G. Drainage of the Site – at all times, Contractor shall maintain and operate proper and adequate surface and subsurface drainage in order to keep the construction site dry and in such condition that placement and compaction of fill may proceed unhindered by saturation of the area.
- H. Backfill of Excavations – any excavation (e.g., utilities, walls, footings, etc.) made within the compacted fill areas shall be backfilled with the same type of fill as removed and in accordance with Specifications herein. Where compacted fill is placed adjacent to walls, if the difference in elevation of the top of the fill on either side of the wall is more than one (1) foot, the wall is to be adequately braced. Any excavation made in virgin material shall be backfilled with Type “G” fill as herein specified unless otherwise shown on the Contract Drawings or directed by the Engineer.
- I. Final Approval – immediately before the Contractor shall place foundations or floor slabs on compacted fills or virgin soil, the Engineer will inspect the foundation and floor slab subgrade. The Contractor shall remove any soft fill and replace with properly compacted material. The pouring of foundations or floor slab shall commence within twenty-four (24) hours of approval. Rain, frost and other factors (which in the opinion of the Engineer are potentially damaging to the fill or virgin material), occurring after the final approval, but before or during pouring, shall require an additional inspection of the compacted fill or virgin material for approval by the Engineer. The Contractor shall correct any deficiencies found at this time, at his own expense.
- J. Maintenance of Fills – all vehicles passing over the fill areas shall use diverse routes to insure uniform compaction of the fill.

Before shutdown of the work for any cause, and at the conclusion of work for the day, fill shall be bladed to a grade which will insure drainage away from the unfinished surface of the fill.

Excess materials shall be stored as directed by the Owner, and following completion of the work shall be removed from the site.

### 3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus 1/2 inch.
  - 3. Pavements: Plus or minus 1/2 inch

4. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.18 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
  1. Place base course material over subbase course under.
  2. Shape subbase and base course to required crown elevations and cross-slope grades.
  3. Place subbase and base course 6 inches or less in compacted thickness in a single layer, unless otherwise directed.
  4. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
- C. Pavement Shoulders: Place shoulders along edges of subbase and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs- on-grade as follows:
  1. Place drainage course 6 inches or less in compacted thickness in a single layer, unless otherwise noted.
  2. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
  3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

### 3.20 FIELD QUALITY CONTROL

- A. Testing Agency: The contractor is responsible to engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing and approval determinations as the soils engineer. The contractor is to cooperate with the soils consultant in all respects and shall provide samples of each type of fill material used so that various tests may be performed to ascertain compliance with the

specifications.

- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect/Engineer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  - 1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area, but in no case fewer than 3 tests. The spacing between test locations shall not exceed 100 linear feet in any direction.
  - 2. Foundation Backfill: At each compacted backfill layer, at least 1 test for each 50 square feet or less of foundation area, but no fewer than 2 tests. Under isolated footings (column footings) at least one test per footing location shall be performed. Testing shall be performed at the footing bottom elevation for existing as well as backfill material.
  - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 150 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained with no additional compensation from the owner.

### 3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, excess topsoil, trash, and debris, and legally dispose of it off Owner's property.
  - 1. Remove waste material, including unsatisfactory soil, excess topsoil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000