

DIVISION 2 - SITE WORK

SECTION 02200 - EARTHWORK

PART 1 - GENERAL

1. **RELATED DOCUMENTS:**

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this section.

2. **DESCRIPTION OF WORK:**

The extent of earthwork is shown on the drawings. The surface of all areas of earth and other materials shall be finished to a reasonably smooth and compact surface substantially in accordance with the surface line, cross-sections, and elevations as shown on the drawings or established by the Engineer.

A. Excavation, backfilling, and compaction of utility pipeline trenches.

3. **QUALITY ASSURANCE:**

A. **Codes and Standards:** Perform excavation work in compliance with OSHA Safety and Health Standards Applicable to Construction, 29 CFR Part 1926, as amended.

B. **Testing and Inspection Service:** Owner will engage soil testing and inspection service for quality control testing during earthwork operations.

4. **SUBMITTALS:**

Test Reports-Excavating: The following reports will be submitted directly to the Engineer from the testing services, with a copy to the Contractor:

Test reports on borrow material.

Field density test reports.

5. **JOB CONDITIONS:**

A. **Existing Utilities:**

(1) Locate existing underground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

(2) Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate

with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

- (3) Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when permitted in writing by Engineer and then only after acceptable temporary utility services have been provided.
- (4) Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

B. Protection of Persons and Property:

- (1) Barricade open excavations occurring as part of this work and post with warning lights.
- (2) Operate warning lights as recommended by authorities having jurisdiction.
- (3) Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.

PART 2 - PRODUCTS

6. SOIL MATERIALS:

In general, shall be free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, frozen deleterious, or objectionable materials. Maximum particle size shall be 6 inches unless specified otherwise.

- A. General site fill and embankment material shall conform to the general requirements for soil materials above and shall be an unclassified soil material from the site or borrow, submitted for approval by the Contractor as possessing the characteristics required for compaction to the specified values of soil density herein specified for the location of intended used.
- B. Topsoil shall be material free of subsoil, stumps, rocks larger than one inch diameter, brush, weeds, toxic substances, and other material or substance detrimental to plant growth. Topsoil shall be a natural, friable soil representative of productive soils in the vicinity.
- C. Borrow shall be materials conforming to the requirements for general site fill, fill, and backfill.

PART 3 - EXECUTION

7. EXCAVATION:

Excavation consists of removal and disposal of material encountered when establishing required finish elevations.

A. Excavation Classifications: Excavation for all spaces below grade as required for all foundation work, walls, pits and other subsurface spaces indicated for the construction of these projects.

- (1) Earth excavation, unless otherwise indicated, includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed. All required excavation shall be performed on an unclassified basis.
- (2) Unclassified excavation, including but not limited to the removal and disposal of any and all types of materials including rock formations, concrete slabs, walls, sidewalks, curbs, paving materials, rubble, abandoned appliances and trash, etc.
- (3) Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.
- (4) Backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

B. Additional Excavation:

- (1) When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.
- (2) If unsuitable bearing materials are encountered at required subgrade elevations, carry excavations deeper and replace excavated material as directed by Engineer.

C. Stability of Excavations:

- (1) Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- (2) Maintain sides and slopes of excavations in safe condition until completion of backfilling.

D. Shoring and Bracing:

- (1) Provide materials for shoring and bracing, (when necessary) such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
- (2) Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
- (3) Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

E. Dewatering:

- (1) Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.
- (2) Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrades 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. Dewatering shall continue until structure is backfilled and compacted.
- (3) Convey water removed from excavations and rain water to collecting or run-off areas. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

F. Material Storage:

- (1) Stockpile satisfactory excavated materials where directed, unless required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
- (2) Locate and retain soil materials away from edge of excavations.
- (3) Dispose of excess soil material and waste materials as herein specified.

G. Salvage of Usable Materials: All material such as brick, pipe, valves, etc., removed during excavation shall be stored as directed by the Engineer. Loss or unnecessary damage to any such items shall be considered the Contractor's responsibility and the Owner shall take credit for such loss or damage when deemed advisable by the Engineer.

H. Excavation for Pavements: Cut surface under pavements to comply with cross-sections, elevations and grades as shown.

I. Excavation for Trenches:

- (1) Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room.
- (2) Excavate trenches to depth indicated or required. Carry depth of trenches for piping to establish indicated flow lines and invert elevations. Beyond building perimeter, keep bottoms of trenches sufficiently below finish grade to avoid freeze-ups.
- (3) Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6-inch layer of crushed stone or gravel prior to installation of pipe.
- (4) Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- (5) Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer. Use care in backfilling to avoid damage or displacement of pipe systems.

8. EXCAVATION FOR UTILITY TRENCHES:

- A. Excavation of Trench: Excavation of trenches for pipelines shall be done to line and grade as established by the Engineer. The width of the trenches shall be sufficient, but not greater than necessary to permit the satisfactory joining and thorough tamping of the bedding material under and around the pipe. The bedding surface shall provide a firm foundation of uniform density through the entire length of the pipe. Recesses shall be excavated where required to accommodate bells and joints. The bottom of the trench shall be carefully shaped and rounded to the shape of the lowest one fourth of the outside circular portion of the pipe for its entire length, and when necessary, shall be tamped to secure uniform firm support. Undercut areas shall be filled to trench bottom grade as provided for in paragraph on fill.
- B. Trench walls shall be restrained with adequate sheeting and shoring where unstable. A trench box or shoring box may be used as shoring where practical.
- C. Adequate dewatering including well points and other pump equipment shall be provided where required to obtain dry working conditions for pipe laying and structures. The trench bottom shall be dry and firm. When stone is used for dewatering purposes, the stone shall be brought to the springline of the pipe.
- D. Excavation and trenches in rock shall be carried to a depth of one fourth of the diameter of the pipe, but in no case less than 6 inches below the pipe bottom, and shall be made by an acceptable method, including the use of explosives under local, legal limitations.

- E. Width of trenches shall provide adequate space for workmen to place and joint the pipe properly, but in every case the trench wall shall be held to a maximum slope of three (3) feet vertically to one (1) foot horizontally.
- F. Cold Weather Protection: Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F (one degree C).

9. COMPACTION:

- A. General: Control soil compaction during construction providing minimum percentage of density specified for each area classification.
- B. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density as determined in accordance with ASTM D 698 (Standard Proctor).
- C. Lawn or Unpaved Areas: Compact top 6 inches of subgrade and each layer of backfill or fill material at 85 percent maximum density for cohesive soils and 90 percent for cohesionless soils.
- D. Walkways: Compact top 6 inches of subgrade and each layer of backfill or fill material at 90 percent maximum density for cohesive material or 95 percent for cohesionless material.
- E. Utility Trenches:
 - (1) All trenches shall be backfilled immediately after pipe is laid therein, unless other protection of the pipeline is directed.
 - (2) For backfill up to a level of two (2) feet over the top of the pipe, compact each layer of fill at 92 percent maximum density for cohesive material or 98 percent for cohesionless material. Each side should be filled and compacted evenly so as to eliminate the possibility of lateral displacement.
 - (3) For backfill under pavements, grass plazas, unsurfaced roadways, or other improved areas from two feet above the pipe and to the top 12 inches of subgrade, place and compact in six to twelve inch layers at 90 percent compaction for cohesive soils and 95 percent for cohesionless soils. Compact the top 12 inches of subgrade to 95 percent compaction for cohesive soils and 98 percent for cohesionless soils.
 - (4) For backfill in unimproved areas above two (2) feet above the pipe, backfill uniformly in layers compacted to 85 percent of cohesive soils and 90 percent for cohesionless soils.

F. Moisture Control:

- (1) Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
- (2) Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
- (3) Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

10. BACKFILL AND FILL:

- A. General: Place in acceptable soil material in layers to required subgrade elevations, for each area classification listed below.
- B. In excavations, use satisfactory excavated or borrow material.
- C. Under grassed areas, use satisfactory excavated or borrow material.
- D. Under walks and pavements, use fill material, or satisfactory excavated or borrow material, or combination of both.
- E. Under steps, use fill material.
- F. Backfill excavations as promptly as work permits, but not until completion of the following:
 - (1) Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
 - (2) Inspection, testing, approval, and recording locations of underground utilities.
 - (3) Removal of concrete formwork.
 - (4) Removal of trash and debris.
- G. Ground Surface Preparation:
 - (1) 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 one vertical to 4 horizontal so that fill material will bond with existing surface.

- (2) 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. Proof roll exposed subgrade with a rubber tired roller making two passes in each direction. Remove any soil that pumps or ruts excessively.

H. Placement and Compaction:

- (1) Place backfill and fill materials in layers not more than 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.
- (2) Before compaction, moisten or aerate each layer as necessary to provide 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.

I. Backfill Utility Trench Excavations as Follows:

- (1) Use satisfactory excavated or borrow material.
- (2) All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless other protection of the pipelines is directed.
- (3) For backfill up to a level of two (2) feet over the top of the pipe, only selected materials shall be used and shall be placed in uniform layers not exceeding 6 inches in depth up each side.
- (4) Debris or earth with an exceptionally high void content shall not be used for backfilling.
- (5) Backfill procedure including material used, water content and equipment used shall be performed as required by the nature of the soil. Surplus excavated materials shall be used wherever required to supplement or replace unsuitable materials, including hauling where necessary.

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 shown, or between such points and existing grades.

- B. Finish surfaces free from irregular surface changes, and as follows:
- (1) Average of all finish grades shall be within 0.05 feet of all grades shown.
 - (2) Lawn or Unpaved Areas: Finish areas to receive topsoil to within not more than 0.10 feet above or below required subgrade elevations.
 - (3) Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 feet above or below required subgrade elevation.
 - (4) Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2-inch above or below required subgrade elevation.
- C. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

12. PAVEMENT SUBBASE COURSE:

- A. General: Subbase course consists of preparation, shaping, and compaction of that portion of the roadbed upon which base or pavement, including base and paving for shoulders, is to be placed. Subbase material placed in layers of specified thickness over subgrade surface to support a pavement base course shall be compacted and protected in conformity with Section 500 and 510 as set forth in North Carolina Department of Transportation Standard Specifications dated January, 1990 except as may be noted otherwise herein. Contractor shall keep a copy at the job site for reference. See other Division 2 sections for paving specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of shoulder simultaneously with compacting and rolling of each layer of subbase course.
- D. Placing:
- (1) Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.
 - (2) When a compacted subbase course is shown to be 6 inches thick or less, place material in a single layer. When shown to be more than 6 inches thick, place material in equal layers, except no single layer shall be more than 6 inches or less than 3 inches in thickness when compacted.

13. FIELD QUALITY CONTROL:

- A. Quality Control Testing During Construction: Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.
 - (1) Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2167 (rubber balloon method), as applicable.
- B. If in opinion of Engineer, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, the Contractor shall provide additional compaction and testing at no additional expense to the Owner.

14. MAINTENANCE:

- A. Protection of Graded Areas: Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish 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.

END OF SECTION 02200