SECTION 310000 – EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Soil Materials
    a. Sub base Material
        1) Building porous fill
        2) Pavement sub base course
    b. Backfill and fill materials
    c. Drainage fill
    d. Impervious fill
    e. Topsoil
2. Protection
    a. Existing improvements protection
        1) Salvageable improvements
        2) Existing utilities protection
3. Site Clearing
    a. Clearing and grubbing
    b. Topsoil stripping
4. Excavation
    a. Excavation classifications
    b. Shoring, bracing, and underpinning
        1) Underpinning
        2) Shoring and bracing
    c. Dewatering
    d. New structures
    e. Pavements
    f. Ditches
    g. Pipe Trenches
5. Compaction
6. Backfill and Fill
    a. Preparation for backfill
    b. Ground surface preparation for fill
    c. Placement and compaction
7. Grading
    a. Grading at existing trees
        1) Lowering grades at existing trees
        2) Raising grades at existing trees
            a) Minor fills at existing trees
            b) Moderate fills at existing trees
    b. Grading outside building lines
    c. Grading surface of fill under building slabs

1.2 RELATED SECTIONS

A. Related work specified elsewhere includes, but is not limited to:

1. Section 311100, Clearing and Grubbing
2. Section 312323.14, Fill

B. All embankment and fill shall conform to ODOT Item 203.

1.3 SUBMITTALS

A. All submittals shall conform completely to the requirements of Section 017800, Submittals.

B. Site Plan showing:

1. Vegetation removal limits.
2. Areas for temporary construction and field offices.

C. Project Record Documents:

1. Accurately record actual locations of capped and active utilities and subsurface construction.

D. Reference Submittals

1. Material Certification

    a. Building porous fill
    b. Gravel fill
    c. Pavement sub base course
    d. Other material certification as required
2. Test Reports (if required by Engineer)
    a. General
        1) Test soil materials proposed for use in the Work and promptly submit test result reports.
        2) The Engineer may require one optimum moisture-maximum density curve for each type of soil encountered in sub grade and fills under:
            a) Building slabs
            b) Foundations
            c) Paved areas.
        3) Determine maximum densities in accordance with ASTM D698.
        4) The Engineer will determine the suitability of materials to be used as fill.
        5) For borrow materials, perform a mechanical analysis (AASHO T88), plasticity index (AASHO T91), and a moisture-density curve (AASHO T99 or ASTM DG98).
    b. Backfill and fill materials
    c. Verification of each footing sub grade
    d. Field density test reports.
    e. One optimum moisture-maximum density curve for each type of soil encountered.
    f. Other tests as required

g. If a soil testing is not performed, contractor assumes responsibility for adequate foundations for each structure.

1.4 JOB CONDITIONS

A. Minimize production of dust due to operations; do not use Water if it will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

B. Comply with other requirements specified in Section 017700.

C. Use of Explosives: The use of explosives will not be permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Soil Materials:

1. Gravel Fill: Naturally or artificially graded mixture of crushed limestone or gravel. The gradation shall conform to ASTM C33 size # 57.
2. Pavement Subbase Course: ODOT Item 304.
3. Backfill and Fill Materials:
   a. Provide soil materials for backfill and fill free of clay, debris, waste, frozen materials, vegetation and other deterious matter.
   b. Rock or gravel shall not be larger than 3" in any direction.
   c. Backfill and fill shall consist of materials classified as “SC” or coarser by ASTM D2487.
   d. Materials finer than “SC” may be used when a registered Geotechnical Engineer is engaged to analyze proposed fill material for its suitability as fill material and its ability to be compacted in accordance with this section. The material shall be such that the required compaction percentages of maximum density, listed in paragraph “Compaction” in Part 3 of this Section, can be reasonably achieved.
      1) Materials classified as “ML” or finer by ASTM D2487 shall not be permitted, except when a registered Geotechnical Engineer is engaged.
4. Alternate and Fill Material
   a. Contractor may, at his option, substitute a specially manufactured material upon approval.
   b. The material shall have a cement base and is combined with other admixtures, fly ash, or other materials specifically designed for the product.
   c. The material must have been successfully used in the completion of mass fills having a minimum of 20,000 cubic yards in the past 5 years.
   d. Similar materials must have been successfully used for at least 10 years.
   e. Material must have a minimum cast density of 30 pcf and a minimum compressive strength of 4,000 psi.
   f. Material shall be Elastize ll EF, or approved equal.

PART 3 - EXECUTION

3.1 PROTECTION

A. General

1. Protection of Persons and Property
    a. Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
    b. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

B. Existing Improvements Protection

1. General

    a. Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
    b. Protect improvements on adjoining properties and on the Owner's property.
    c. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.
2. Existing Utilities Protection
    a. Locate existing underground utilities in the areas of Work. Utilities on plans are shown to the best available information but are not warranted to be accurate. Contractor shall call the Ohio Utilities Protection Services and have utilities located 48 hours prior to any construction. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
    b. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer or Owner immediately. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Utility Owner.
    c. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Engineer or Owner and then only after acceptable temporary utility services have been provided.

3.2 SITE CLEARING

A. Clearing and Grubbing

1. Clear the Site of trees, shrubs and other vegetation, except for that indicated to be left standing.
2. Trees, Shrubs and Plants
    a. Remove all trees, shrubs and plants.
    b. Remove trees, shrubs and plants not designated to remain.
    c. Remove roots larger than 3" in diameter and matted roots existing in an area within 5' of construction.
    d. Remove larger than 3"depth to 18"below sub grade in paved areas.
    e. Remove roots larger than 3" to sub grade in turf areas.
    f. Completely remove stumps, roots, and other debris.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
    a. Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to a density equal to adjacent original ground.

B. Topsoil Stripping

1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, slay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable materials.
2. Strip topsoil to whatever depths encountered in a manner to prevent intermingling with the underlying subsoil or other objectionable material.
3. Strip topsoil to its entire depth from areas to be graded and areas to be occupied by building, roadways, parking areas, walks, etc.
4. Stockpile topsoil in storage piles. Construct storage piles to freely drain surface water. Cover storage piles to prevent windblown dust.

3.3 EXCAVATION

A. General

1. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations.
2. Unauthorized excavation consists of removal of materials beyond indicated sub grade elevation or side dimensions without the specific direction of the Engineer.
    a. Under footings, foundation bases, or retaining walls, unauthorized excavation may be filled by extending the indicated bottom elevation of the footing or base to the excavation bottom (Engineer must be notified and approval given before commencing), without altering the required top elevation. Lean concrete fill (1500 psi minimum) may be used to bring elevations to the proper position, only when acceptable to the Engineer and/or the Owner and when approval has been given.
    b. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer and/or the Owner.

B. Excavation Classifications: All excavation is unclassified.

C. Stability of Excavations

1. Slope the sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
3. The maximum slope ratio from bottom edge of foundation to the next foundation and/or any other excavation shall be one (1) vertical to two (2) horizontal, except where approved by a registered Geotechnical Engineer to be less than a 1 to 2 slope.

D. Shoring and Bracing and Underpinning

1. General

    a. Design and provide shoring and bracing and underpinning to comply with local codes and authorities having jurisdiction.

2. Shoring and Bracing
    a. Provide materials for shoring and bracing, such as sheet piling, soldier beams, stringer, rakes, whalers and cross-braces, etc., in good serviceable condition.
    b. Maintain shoring and bracing in excavations regardless of the period excavations will be open. Carry down shoring and bracing as the excavation progresses.
        1) Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit the lateral movement of soil under adjacent structures. Cut-off tops as required and leave permanently in place.
    c. Excavations shall be shored and sheeted with members of sizes and arrangement sufficient to prevent injury to persons, damage to structure, injurious caving, or erosion; shoring, sheeting and bracing shall be removed as the excavations are backfilled; care shall be exercised to prevent injurious caving during the removal of the and/or sheeting.

E. Dewatering

1. Prevent surface water and subsurface or groundwater from flowing into the excavations and flooding the Project Site and surrounding area.
2. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of sub grades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from excavations.
3. Convey water removed from excavations and rainwater to collecting or runoff areas. Provide and maintain temporary drainage ditches and other diversions outside the excavation limits for each structure. Do not use trench excavations for Site utilities as temporary drainage ditches.

F. Material Storage

1. Stockpile excavated materials classified as satisfactory soil material where indicated by the Engineer or Owner, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
2. Locate and retain fill materials away from edges of excavations.
3. Dispose of excess soil material and waste materials as specified hereinafter.

G. Removal of Unsatisfactory Soil Materials

1. Excavate unsatisfactory soil materials encountered that extend below the required elevations, to the additional depth as indicated by the ENGINEER or Owner.
2. Such additional excavation, provided it is not due to the fault or neglect of the Contractor, shall be measured as indicated by the ENGINEER or Owner, and paid for as a change in the Work.

H. Cold Weather Protection

1. Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 deg F.

I. Existing Improvements

1. General
   a. Remove above-grade and below-grade improvements necessary to permit construction, and other Work as indicated.
   b. Removal of abandoned underground piping or conduit interfering with construction is included under this Section.
2. Surface Structures
   a. Remove buildings, curbs, gutters, walls, fences, walks, drives, etc., where indicated.
3. Subsurface Structures
   a. Subsurface Structures Inside or Beneath New Structure.
      1) Remove during excavation where necessary to reach required elevations.
      2) Remove vertical projections and/or horizontal structures to a distance of 4'-0" below any part of new construction such as foundations, slabs, tie beams, grade beams and utilities.
      3) Existing horizontal surfaces below new construction shall be thoroughly fractured to ensure drainage.
   b. Subsurface Structures Outside of New Structure and within 3’ of New Footing Edges - Remove all horizontal and vertical structures.
   c. Subsurface Structures Beyond 3' of New Footing Edges
      1) Remove structures to a level at least 2' below new finish grades.
      2) Horizontal surfaces existing below finished grade shall be thoroughly fractured to ensure drainage.
4. Abandoned Underground Utilities
   a. Demolish and completely remove from the Site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.
   b. Any lines to be abandoned that extend beyond the excavation must be capped or plugged.
   c. Abandoned underground utilities under structures to be constructed (concrete, masonry, cast iron, ceramic clay, etc.) that are no longer in use shall be filled solid with concrete, or remove and backfill as specified herein.
   d. Close open ends of metallic conduit and pipe with threaded galvanized metal caps or plastic plugs, or other suitable method for the type of material and size of pipe. Do not use wood plugs.
   e. Close open ends of concrete and masonry utilities with not less than 8" thick brick masonry bulkheads, constructed to completely fill the opening.
   f. Wet brick before laying, and lay brick in mortar so as to form a full bed with ends and side joints in one operation and joints not more than 3/8" wide. Protect fresh masonry from freezing or from rapid drying and maintain protection until mortar has set.

J. New Structures

1. Conform to the elevations and dimensions shown on the Drawings, within a tolerance of ±0.l0', and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
2. In excavating for footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before reinforcement is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.

K. Pavements

1. Cut surface under pavements to comply with grades indicated.

L. Ditches

1. Cut ditches to cross-sections and grades as shown. Deposit excavated materials to prevent cave-ins or material falling or sliding into ditch. Keep ditches free of debris until final acceptance of the Work.

3.4 COMPACTION

A. General: Control soil compaction during construction for compliance with the percentage of maximum density specified for each area classification.

B. Percentage of Maximum Density Requirements

1. In fill areas, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, according to standard proctor ASTM D69B dry density.
   a. Structures: Compact each 8” layer of backfill or fill material at a minimum 98% density. Fill shall be in compliance with tank manufacturer requirements for structural loads.
   b. Building slabs and steps: Compact each 8” layer of backfill or fill material at 98% density
   c. All other areas: No specific density requirements are listed. Finished construction must not settle appreciably. Contractor may be required to refill any settled areas.
2. Contractor may be required, at the Engineer’s discretion, to test the soil density.

C. Moisture Control

1. Where the sub grade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface of sub grade, or layer of soil material, to prevent free water appearing on the 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.
   a. 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 dicing, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

3.5 BACKFILL AND FILL

A. General

1. Place acceptable soil material in layers to required sub grade elevations, for each area classification listed below.
   a. In all excavations: Excavated or borrow backfill and fill materials
   b. Under grassed areas: Excavated or borrow backfill and fill materials.
   c. Under walks and pavements: Approved sub base material.
2. All soil materials shall be sampled and tested for compliance with all requirements of Part 2 of this Section.

B. Preparation for Backfill

1. Backfill excavations as promptly as the Work permits, but not until completion of the following:
   a. Acceptance by ENGINEER or Owner of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation
   b. Inspection, testing, approval, and recording locations of underground utilities
   c. Removal of concrete formwork
   d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in a manner to prevent settlement of the structure or utilities, or leave in place if required.
   e. Removal of trash and debris
   f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
   g. Do not backfill against walls until slab on grade and first framed floor is complete and concrete has attained its design strength.

C. Placement and Compaction

1. Place backfill and fill materials in layers not more than 8" in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Pipe backfill: Roadways, Sidewalks and Drive; 100% Standard Proctor compaction; lawn areas; 95% Standard Proctor compaction. Contractor shall place backfill materials evenly adjacent to structures, to the required elevations. Contractor shall take care to prevent wedging action and unequal horizontal pressures of the backfill against structures by placing the material uniformly on all sides of the structure to approximately the same elevation in each lift (±1’-0”).
3. Where utility facilities and structures are supported in place, use special equipment and techniques as required to achieve the specified compaction under and around them.

D. Alternate Backfill and Fill Material

1. The installer shall be certified by the manufacturer of the material and approved by the Engineer.
2. All equipment used in batching, mixing, and placement must be approved by the manufacturer.
3. A representative of the manufacturer must be on site for the initial placement of materials and make any appropriate changes in operations.
4. Five (5) samples will be taken for testing from each 200 cubic yards of material placed. Testing will be conducted in accordance with Section 01400.

3.6 GRADING

A. General: Uniformly grade areas within the limits of grading under this Section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines

1. Grade areas outside building lines to drain away from structures and to prevent ponding of water. Compact as specified.
2. Finish the surfaces free from irregular surface changes, and as follows:
   a. Grassed Areas: Finish areas to receive topsoil to within not more than 0.10' above or below the required sub grade elevations.
   b. Walks: Shape the surface of areas under walks to line, grade and cross-section, with the finish surface not more than 0.10' above or below the required sub grade elevation.
   c. Pavements: Shape the surface of areas under pavement to line, grade and cross-section indicated, with the finish surface not more than 1/2" above or below the required sub grade elevation, and graded to prevent ponding of water after rains. Include such operations as plowing, dicing, and any moisture or aerating required to provide the optimum moisture content for compaction. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material.
   d. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform and smooth cross-section.

C. Grading Surface Under Building Slabs

1. Grade the surface of fill under building slabs smooth and even, free of voids, compacted a specified, and to required elevation.
2. Provide final grades within a tolerance of 1/4" when tested with a 10' straightedge; the maximum out-of-level tolerance for the entire length of grade for slabs in either direction shall be ±2".

3.7 FIELD QUALITY CONTROL

A. Compact each 8” layer of backfill to levels stated previously or fill material at 98% density Quality Control Testing Construction

1. Testing service, if required by the Engineer, must inspect, and the Geotechnical Engineer must approve, existing ground surface, fill layers and sub grades before further construction Work is performed thereon. Tests will be taken as follows:
    a. Footing Sub grade: For each stratum of existing soil on which footings will be placed, provide visual verification and any tests that are required to verify that design bearing capacities have been met. This verification shall be made by a qualified Soil Engineer. The Engineer or Owner reserves the right to order more or fewer inspection tests as required.
    b. Paved Areas and Building Slab Subgrade: Make at least one field density test of the subgrade surface in cut areas for every 2,000 sq. ft. of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case less than three tests. The Engineer or Owner reserves the right to order more or less inspection tests as required.
2. If, in the opinion of the Engineer or Owner, based on reports of the testing service and inspection, the subgrade or fills, which have been placed, are below the specified density, provide additional compaction and testing at no additional expense to the Owner.
    a. The results of the density tests shall be equal to or greater than the specified density except that 1 density test out of 5 consecutive density tests for the same area being tested may have a test result of 2% below specified density.

3.8 MAINTENANCE

A. Protection of Graded Areas

1. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.
2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Reconditioning Compacted Areas

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction. Use hand tamping for recompaction over underground utilities and under floor sub drains, if any.

3.9 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Burning on Owner's Property: Not permitted.

B. Removal from Owner's Property: Remove all waste materials, including excavated material classified as unsatisfactory soil material, trash and debris, from the Owner's property and legally dispose of it.

END OF SECTION 310000