SECTION 310000 - EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SCOPE OF THE WORK

A. Earthwork for building includes but is not necessarily limited to the following:

1. Excavation and filling to attain indicated grades.
2. Trenching and trench backfilling.
3. Rough grading of the site.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. ~~General Provisions – Sitework – Section 02000.~~

B. Soils Report – Appendix A – Geotechnical Engineering Report.

C. Clearing, Grubbing and Demolition – See Civil Construction Drawings.

D. Temporary Erosion Control – See Civil Construction Drawings.

E. ***Section 014000 "Quality Control."***

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1.04 CONTRACTOR'S RESPONSIBILITY

A. Reference and be familiar with the requirements of Appendix A – Geotechnical Engineering Report.

B. Be responsible for all excavation of whatever material encountered.

C. Be responsible for the disposal of all unsuitable and surplus excavated material.

D. In the event the Contractor disposes of too much excavated material, he shall replace this material as necessary and at no cost to the Commission. Material to be

replaced shall meet the requirements for suitable material as specified herein and shall be subject to the approval of the geotechnical engineer.

E. Contractor is responsible for performing his own earthwork analysis to determine excavated (cut) and fill quantities. Contractor shall be responsible for the disposal off-site of surplus material if cut material exceeds fill material quantity. Contractor shall be responsible to provide suitable material if fill material quantity exceeds cut (excavated) material quantity.

1.05 QUALITY CONTROL:

A. Reference Section ***014000*** – Quality Control. Reference paragraph 3.6 at the end of this section for required tests.

B. The Independent Testing Laboratory, retained by the ~~Construction Manager (CM)~~ ***Owner***, will provide a full time, on-site technician, equipped with a nuclear density meter, during all rough grading; subgrade compaction and proof rolling operations; embankment operations, structure and trench backfilling operations; and as otherwise required by this specification section.

1.06 DEFINITIONS

A. References: ASTM D653 - "Standard Definitions of Terms and Symbols Relating to Soil and Rock Mechanics" shall be as though reproduced in full herein.

B. Classification: for purposes of classifying on site or borrow materials AASHTO M145 - "The Classification of Soils and Soil - Aggregate Mixtures for Highway Construction Purposes" shall apply.

C. The use of blast furnace slag, open-hearth slag, basic-oxygen furnace slag or any slag will not be acceptable on this project.

D. Building area: Building area is defined as the area within the limits of the foundation walls and the area fifteen (15) feet immediately surrounding these limits.

E. Topsoil excavation: Topsoil excavation shall be defined as removal of the existing surface layer of organic material which is suitable for re-use in seeding, sodding and planting.

F. Earth excavation: Earth excavation shall be defined as removal of all material not specifically defined herein as "topsoil excavation", including muck, hard-pan, soft shale (rippable with D8 or D9), ledge rock and boulders.

G. Embankment: A structure consisting of soil, granular material, rock, or random material as described below, constructed in layers to a predetermined elevation and cross section.

1. Soil: all earth materials, organic or inorganic which have resulted from natural processes such as weathering, decay, and chemical action in which more than 35 percent by weight of the grains or particles will pass a No. 200 sieve.

   a. Maximum laboratory dry weight shall be not less than 90 pounds per cubic foot, except that soils having maximum dry weights of less than 100 pounds per cubic foot shall not be used in the top 12 inches of embankment subgrade.
   b. Soil having a liquid limit in excess of 65 or soils identified as classifications A-2-5, A-5 or A-7-5 are considered as unsuitable for use in embankment.
   c. Soils not identifiable from soils investigation reports and appearing questionable, shall be sampled and submitted to the laboratory for classification tests.

2. Granular Materials: Natural or synthetic mineral aggregate such as broken or crushed rock, gravel, or sand which can be readily incorporated in an 8-inch layer, and in which at least 65 percent by weight of the grains or particles are retained on a No. 200 sieve.

3. Rock: Sandstone, limestone, dolomite, glacial boulders, brick and old concrete which cannot readily be incorporated in an 8-inch layer.

4. Random Material: A mixture of previously defined materials suitable for use in embankment which can be readily incorporated in an 8-inch layer.

H. Borrow: Material obtained from approved sources, outside the project site required for the construction of embankments or for other portions of the work.

I. Suitable Material: Granular materials, rock and random materials free of organic material, rubble, or other deleterious material as defined above which are suitable for use in embankment. Soil is suitable for use in embankment provided it has the following characteristics:

1. Maximum laboratory dry weight shall be not less than 90 pounds per cubic foot, except that soils having maximum dry weights of less than 100 pounds per cubic foot shall not be used in the top 12 inches of embankment subgrade.
2. Soil, in addition to the above requirements, shall have a liquid limit of not to exceed 65, and the minimum plasticity index number of soil with liquid

limits between 40 and 65 shall be not less than that determined by the formula liquid limit minus 30.

J. Unsuitable Material: Unsuitable material shall be defined as any materials not meeting the requirements for suitable material, or containing vegetation or organic matter. Certain man-made deposits such as landfill may also be determined to be unsuitable material. Unsuitable materials shall be disposed by the Contractor.

K. Porous fill under exterior walks, pavements, and curbs: reference details on Contract Drawings.

L. Utility trench, bedding and backfilling: reference details on contract drawings.

M. Sand fill or sand bedding: natural sand or sand manufactured from stone meeting the following gradation:

TOTAL % PASSING

SIEVE SIZE	NATURAL SAND	MANUFACTURED SAND
3/8 INCH	100	
NO. 4	95-100	100
NO. 8	70-100	90-100
NO. 16	45-80	50-75
NO. 30	25-60	30-60
NO. 50	5-30	14-30
NO. 100	1-10	4-12
NO. 200	0-4	0-5

1.07 CLASSIFICATION

A. Classification of all materials excavated will be made by the geotechnical engineer or testing laboratory whose decision shall be final and binding upon the Contractor.

B. Unclassified material: should the Contractor encounter unclassified material, he shall immediately notify the geotechnical engineer or testing laboratory, who will examine the material, classify it and advise the Contractor as to the method of handling. Unauthorized removal of material before it has been classified is done at the Contractor's risk.

PART 2 - PRODUCTS

2.01 TRENCH BEDDING AND BACKFILL

A. Granular material required for bedding, pipe cover or premium backfill of pipe trenches shall be as detailed on the Contract Drawings.

B. The Contractor shall submit certification by the supplier that the material for use as pipe bedding, cover and backfill meets the specifications stated above.

2.02 STRUCTURAL BACKFILL

A. Backfill under this item shall be considered as all replaced excavation or new embankment adjacent to structures or in proposed building areas as designated on the Contract Drawings. Backfill shall be of materials meeting the requirements of ~~Specification Section 02200, 1.06, I - "Suitable Materials", (noted above)~~ ***ODOT requirements*** unless otherwise indicated by the Contract Drawings.

B. In general, it shall be the responsibility of the Contractor to reserve the more desirable materials, as interpreted by the geotechnical engineer, resulting from the contract excavations for use in backfilling for the various structures. In the event the Contractor is unable to find on the site, or fails to reserve sufficient suitable material to fulfill the backfilling requirements of this contract, he shall be required to furnish, at no added cost to the Commission, the additional material required, unless the shortage is due to an unforeseen site condition.

2.03 SITE EMBANKMENT

A. Site embankment materials shall include all materials used to raise the grade of the site to finish subgrade elevation and shall conform to the requirements of "Suitable Materials" noted above.

PART 3 - EXECUTION

3.01 GENERAL

A. The following specification shall be considered as general criteria for earth work operations. In those instances where field conditions arise which are not adequately covered by these criteria, instructions for that specific condition will be issued by the geotechnical engineer.

B. Dust Control:

1. Use all means necessary to control dust on and near the work and on and near all off-site borrow areas if such dust is caused by the Contractor's

operations during performance of the work or if resulting from the condition in which the Contractor leaves the site.

2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other work on the site.

C. Perform grading operations in such a manner as to direct and control storm water runoff so that no damage or erosion occurs. Saturation of cut and fill areas shall be prevented by directing storm water runoff and not allowing ponding to occur. Fills are to be crowned as required to maintain drainage at the end of each work day. Existing drainage routes shall not be choked or obstructed until new ones are available. Temporary culverts, pumps or other equipment shall be used to facilitate drainage of fills during construction. Failure to drain storm water shall not be grounds for delay of this contract due to saturated site conditions. Remove and dispose of saturated materials in excess of allowable moisture content at time of compaction and maintain the project schedule at all times.

3.02 EXCAVATION

A. Rough Grading:

1. Site clearing and grubbing shall be done prior to any rough grading. All debris and deleterious material shall be removed from areas to be filled or backfilled.
2. Dispose of excess excavated material or supply additional suitable material as necessary to complete the rough grading to the required elevations.
3. The finished subgrade surface shall be reasonably smooth and free from irregular surface changes and shall be no more than one tenth (0.1) of a foot above or below the approved subgrade elevation.
4. Protect newly graded areas from the action of the elements. Any damage that may occur as a result of natural causes or any construction activities, prior to the acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.
5. During the performance of rough grading operations, examine subgrade critically and any areas discovered which are soft and unstable or exhibit other unusual conditions, shall be immediately pointed out to the geotechnical engineer or testing laboratory. Upon the direction of the geotechnical engineer and the CM, excavate these areas to such depths as may be necessary to insure satisfactory supporting properties. These areas of excavation shall be backfilled immediately and shall be brought to the elevation of the surrounding area with suitable material in accordance with the embankment construction procedure.
6. In general, subgrade shall be established at the following levels:

   a. For pavement areas: Finish grade less the thickness of pavement and base material (reference details on drawings).

b. For structures: Finish floor elevation less the thickness of the slab and any porous fill.
c. For lawn areas: Four inches (4") below finish grade.

B. Compaction and Proof Rolling of Subgrade:

1. Proof roll all subgrade surfaces to locate and permit timely correction of the subgrade deficiencies. Reference the subsurface investigation report in Appendix A -Soils Report or Section 204 of the ODOT CMS for proof rolling procedure.
2. In cut sections, proof roll the subgrade surface to determine the location and extent of areas below subgrade surface that may require subgrade undercutting. Should any portion of the cut subgrade surface fail to provide satisfactory support for the proof rolling operation, the geotechnical engineer or testing laboratory may order corrective undercut and backfill work done.
3. In embankment sections, prior to placing the embankment, proof roll the subgrade surface to determine the uniformity of the compaction below the subgrade and any deficiencies requiring corrective work. Any deficiencies discovered during proof rolling operations shall be corrected in a manner satisfactory to the geotechnical engineer or testing laboratory. After all corrective work has been completed, the surface shall be proof rolled again. Corrective work shall not be considered complete and acceptable until the embankment shows satisfactory and uniform response to the proof rolling operations.
4. The upper twelve (12) inches of subgrade beneath structures shall be compacted to 100% of the maximum dry density as determined by ASTM D-698 and 100% when beneath pavements.

C. Embankment:

1. After clearing, grubbing, and proof rolling of the existing subgrade has been completed, scarify the surface of the area to be filled to a depth of four (4) to six (6) inches. An initial three (3) inch layer of fill material shall then be spread over the scarified surface and the entire area compacted as specified below.
2. Compact each layer of fill material until its density is not less than 100% percent of the maximum dry density as determined by the standard moisture density relationship test, ASTM D-698.
3. Areas requiring fill shall be filled and backfilled using suitable materials compacted in layers not to exceed the following (all thicknesses are loose thicknesses):

   a. 8 inches

4. The moisture content of placed material shall not deviate from the optimum by more than two percent (+/- 2%). The Contractor shall note that the on-site soils are the type which are susceptible to pumping at moisture contents generally over 3 to 4 percent above their optimum value. It is imperative that the moisture content of the material be adjusted prior to compaction and that proper drainage be maintained during fill placement to prevent trapping of water within the fill material. Moisture content of any material which displays pronounced deformation under construction equipment shall not exceed the optimum. Drying of wet soil shall be performed by the use of plows, discs, harrows, or other approved methods. If additional water is required, it should be uniformly distributed through the use of approved water wagons and shall be thoroughly incorporated into the material by means of discs or other suitable mixing equipment. Care shall be taken to avoid trapping water within the fill.
5. Maintain the embankment and borrow areas in a freely draining condition at all times. Proper drainage should be provided for any water or springs which may be encountered.
6. When the embankment meets the natural grade of a slope, cut a bench in the existing slope. These cuts are to serve as keys to connect the existing grade with the newly placed fill.
7. Frozen fill material nor any suitable fill shall not be placed on frozen or snow covered surfaces.
8. If soft, yielding material is encountered in embankments as a result of trapping water, and cannot be satisfactorily stabilized by moisture control and compaction, excavate unstable material to the depth required by the geotechnical engineer or testing laboratory. Fill the excavation with suitable material and compacted in accordance with the requirements outlined above.

3.03 EXCAVATION AND BACKFILL FOR STRUCTURES

A. Excavation:

1. Materials of every nature encountered in the performance of this Contract shall be excavated to indicated lines, elevations and grades.
2. Excavate properly to provide sufficient work space to permit the placing, inspection, and completion of the work embraced in the contract. Excavations shall be made to elevations and dimensions indicated on the Drawings, and shall include the removal of unusable earth and debris. All pumping, drainage, bailing and shoring where such is required, shall be included.
3. Refill all space beneath structures, resulting from unauthorized or over excavations or from slides or cave-ins, with suitable material to the level as directed.

4. If soil upon which structures are to rest is found in such condition that the Contractor or the testing laboratory judge that it will cause damage to, or will not support the superimposed loads, he shall notify the geotechnical engineer immediately. The unsuitable materials shall be removed to the depth as directed by the geotechnical engineer and replaced with suitable fill material.
5. Remove rock or other unyielding material encountered below the designated structure subgrade for a depth of not less than six (6") inches. This extra depth excavation shall be backfilled with sand bedding.
6. Remove excavated materials not required or not suitable for backfilling and rough grading, and all unusable debris, from the site.

B. Backfilling:

1. Backfill as soon as permanent work has been completed and walls have attained sufficient set and strength.
2. Except where otherwise specified, backfilling shall be done with suitable materials and done promptly so as to protect the foundation from frost.
3. Backfilling materials shall be free from trash, lumber, other foreign materials, or frozen materials. Place backfill in 8" layers. Compact using mechanical compactor to the required density before placing succeeding layers. When sheeting, bracing or shoring is removed, fill voids.
4. Exercise extreme care in backfilling against newly placed walls. Walls with fill on one side shall be properly supported laterally, either with the designed structure or by temporary means. Walls with fill on both sides shall have fill placed in alternate layers on each side of the wall. Place no more than eight (8) inches at a time.
5. Compact backfill to 100% maximum dry density (ASTM D-698).
6. Any trenches or embedments caused by other trades shall be restored by those trade to the level and state of compaction specified herein.

C. Undercutting of Adjacent Work:

1. In no case permit the undercutting of the foundations of facilities adjacent to that for which an excavation is being made. Should it be probable that this situation might occur, either directly as the result of the sloping of the sides of an excavation in progress, or as the result of sloughing of an excavation left open, the Contractor shall provide such sheeting or other protection as required to insure the earth in the immediate vicinity of the adjacent foundation shall remain undisturbed.
2. Failure on the part of the Contractor to fulfill this obligation may result in the necessity of the redesign of the affected foundation. In the event this occurs the Contractor shall install the redesigned foundations as directed by the CM or Architect at no increase in cost to the Commission and also reimburse all engineering and design costs to the Commission.

3.04 TRENCH EXCAVATION AND BACKFILL

A. The work under this section shall include the excavation and backfill of all pipe trenches. The entire cost of any sheeting, shoring, timbering, stabilization, and dewatering, if required, shall be borne by the Contractor. The width of the trench shall be as indicated on the Drawings.

B. Whenever allowable width of trench is exceeded for any reason, except as provided for in the drawings and specification, or by the written direction of the CM or Architect, the CM or Architect may require, at his discretion, that the Contractor cradles and/or encase the pipe in concrete with all the additional cost being borne by the Contractor.

C. Maximum length of open trench: except by permission of the CM or Architect, only that amount of uncompleted pipe construction shall be permitted, including excavation, construction of pipeline, and backfill as can be completed in one day.

D. Trench side slopes: remove loose cobbles or boulders from the sides of the trenches before allowing workmen into the excavation, or protect trench slopes with screening or other methods reviewed by the Geotechnical Engineer. Keep trench side slopes moist during construction to prevent local sloughing and raveling; moistening of the trench slopes shall be done in a manner and amount approved by the Geotechnical Engineer.

E. Over-Excavation of Trench Bottoms:

1. Except for trenches specifically delineated otherwise, all pipeline trenches shall be over-excavated (to a depth as shown on the Drawings) below the bottom of the outside of the pipe and backfilled with bedding material.
2. Any excavation carried below the grades shown on the Drawings, specified herein, or directed by the Architect shall be refilled with compacted bedding material at the expense of the Contractor.

F. Trench Backfill:

1. Backfilling of the pipe zone shall be granular material specified in paragraph 2.1 of this section. The pipe zone shall be considered to include pipe bedding and pipe cover as detailed on the Drawings.
2. Backfilling above the pipe zone shall be as detailed on the Drawings.

G. Placement and compaction of trench backfill: the placement and compaction of all trench backfill shall conform to the following method: mechanically compacted backfill: mechanically compact backfill by means of tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers to

100% maximum dry density (ASTM D-698) compaction. All such equipment shall be of size and type approved by the Geotechnical Engineer. Impact-type pavement breakers (stompers) will not be permitted over clay, ductile iron, or concrete pipe. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the contract. The Contractor shall make his own determination in this regard.

3.05 DEWATERING

A. All excavation, construction and backfill of pipes or other facilities to be constructed under this contract shall be constructed under dry conditions. Constantly maintain all excavations in a dewatered, workable condition, and be responsible for installing, operating, maintaining and removing such dewatering systems as are required. The evaluation of the sufficiency of the condition shall be made by the Geotechnical Engineer and his decision shall be binding upon the Contractor. If the Geotechnical Engineer determines that dewatering is inadequate, the Contractor shall modify his methods until such time as the Geotechnical Engineer then agrees with the adequacy of the operating condition.

3.06 REQUIRED TESTS

A. A full time Geotechnical Engineer and Testing Laboratory qualified in soils testing and evaluation***, provided by the Owner,*** will observe the site grading, placement of fill and the excavation and backfill for the building, site drainage system and site utilities. ***Refer to Section 014000 "Quality Control" for additional requirements.***

B. The Testing Laboratory will analyze all native or imported fill and backfill material and top soil proposed for use to determine the suitability for use and compliance with the contract documents.

1. Fill and backfill material will be examined as to soil classification and tested to determine the plasticity index, optimum moisture content and dry density.
2. After rough grading and prior to spreading of topsoil, the topsoil in lawn areas and the topsoil and subgrade in planting beds will be examined for organic content, acidity and soil composition.

C. All natural grades to be retained, all areas of cut and all areas of controlled fill or backfill will be field tested by the Testing Laboratory for moisture content and percent of compaction for compliance with specified values.

1. The number of tests performed will be at the discretion of the Testing Laboratory, except that the number of field tests performed will not be less than the minimum described below.

   a. Within the building area perform one (1) test for every 500 cubic yards of fill and backfill or in areas of natural grade or cut one (1) test for every 5,000 square feet, <u>except</u> that such tests must be located as to give equal coverage to all portions of the building subgrade.
   b. Within the paved areas of the site, except trench excavations and highway construction perform one (1) test for every 1,000 cubic yards of fill or in areas of natural grade or cut one (1) test for every 20,000 square feet.
   c. Within trench excavations or highway construction provide one (1) test for every 500 cubic yards or 100 lineal feet of fill or backfill.

D. Building foundation excavation and subgrade preparation will be observed by the Testing Laboratory. The Testing Laboratory will confirm the size, depth and suitability of the excavated areas and <u>test and verify</u> the <u>soil bearing capacity</u> for compliance with the specified values. Porous fill will be examined for soils classification, depth and percent of compaction.

   l. Test and verify <u>soil bearing capacity</u> of each column footing and every forty (40) lineal feet of wall foundation. Test results <u>must</u> indicate in-place <u>soil bearing capacity</u>.

E. The Testing Laboratory will submit two (2) copies of all soils analyses and test results to the CM and one (1) copy to the Contractor.

END OF SECTION 310000
EARTHWORK