DIVISION 31 – EARTHWORK
SECTION 31 23 00 – EXCAVATION AND FILL

PART 1 – GENERAL

1.01 SUMMARY

A. Section Includes

1. Excavation, backfill and compaction for structure foundations.

2. Excavation, backfill and compaction for paving.

B. Related Sections

1. Section 31 23 19 – Dewatering.

2. Section 31 40 00 – Shoring and Underpinning.

1.02 REFERENCES

A. American National Standard Institute

1. ANSI/ASTM D698 – Test methods for moisture-density relations of soils and soil aggregate mixtures, using 5.5 lb rammer and 12 inch drop.

2. ANSI/ASTM D1556 – Test methods for density of soil in place by the sand-cone method.

B. American Society of Testing and Materials

1. ASTM D2167 – Test method for density and unit weight of soil in place by the rubber balloon method.

2. ASTM D2922 – Test methods for density of soil and soil-aggregate in place by nuclear methods (shallow depth).

3. ASTM D3017 – Test methods for moisture content of soil and soil-aggregate mixtures.

C. Pennsylvania Department of Transportation (PennDOT)

1. Specifications Publication 408, latest edition.

1.03 DEFINITIONS

A. Unclassified Excavation: Removal of all materials of any kind or nature encountered in completion of the Work, including rock, to the elevations required and subsequent disposal of materials removed.

B. Subgrade: Areas upon which the planned bottoms of foundations, footers, slabs, paving base courses or sidewalks shall rest; or where subbase is to be utilized, the surface upon which the subbase shall rest; or if structural fill is to be utilized, the surface upon which the structural fill shall rest.

C. Subbase: Compacted aggregate material utilized under sidewalks, manholes, and paving sections.

D. Structural Fill: Specified fill material to be utilized beneath structure foundations, where required to replace unsuitable soil or rock encountered.

E. Structure Backfill: Select, open-graded free-draining material used to backfill against structure walls, including tank walls, foundation walls, and retaining walls.

F. Random Backfill: Non-select backfill material used where special backfill is not specified.

1.04 SUBMITTALS

A. Submit in accordance with requirements of Section 01 33 00.

B. Submit qualifications of proposed independent testing agency to Authority for approval.

C. Provide testing required by Specifications.

1. Reports of independent testing laboratory shall be considered as sufficient evidence of noncompliance with specifications.

2. Authority reserves right to accept PennDOT certification from supplier of aggregate materials that the supplier is an approved PennDOT source and material conforms to PennDOT Specifications in lieu of actual material testing.

D. Submit certification from independent testing agency for all soil and aggregate materials, certifying materials to meet specified standards.

1.05 PROJECT/SITE CONDITIONS

A. Existing Utilities and Services

1. Known underground services and utilities must be indicated on Drawings, although, no guarantee can be given to completeness or accuracy. Contractor shall be responsible for verifying the location and/or depth of all utilities and services indicated within the areas of work.

2. Maintain existing utilities which must remain in service in the area of the excavation.

3. Record locations of underground utilities encountered.

C. Unclassified Excavation: No consideration will be given to the nature of materials encountered in excavating operations for structures. Therefore, as unclassified excavation, no additional payment will be made for difficulties occurring in excavating and handling of materials.

D. The Authority reserves the right to order cessation of the work during inclement weather, if, in the opinion of the Authority, the safety of the workman is endangered or if the work quality is endangered.

E. All work of this section is subject to inspection by the Authority or its representative. Full access shall be granted.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Subbase Material (Paving Areas): Coarse aggregate consisting of naturally or artificially graded mixture of natural or crushed gravel, crushed stone, or crushed slag meeting the requirements of PennDOT Publication 408 for No. 2A material.

B. Structural Fill: Select fill material meeting the requirements of PennDOT Publication 408 for No. 2A material.

C. Structure Backfill: Open-graded, free-draining coarse aggregate meeting the requirements of PennDOT Publication 408 for AASHTO No. 57.

D. Random Backfill: Suitable material conforming to the requirements of PennDOT Publication 408 Section 206.2(a) reasonably free of organic matter such as leaves, grass, roots, sod, sewage, coal or coal blossom, or other unsuitable material. Frozen material shall not be utilized.

PART 3 – EXECUTION

3.01 PREPARATION

A. Install sediment and erosion control facilities.

B. Perform excavation support and protection.

C. Perform dewatering, as required.

3.02 REQUIREMENTS AND RESTRICTIONS

A. Keep excavations free from water. Build dams and all other devices necessary. If required, lower water table below excavation bottom by deep wells. Dispose of water removed from excavations in a manner that will not cause injury to the public health, to public or private property, to the work of other contractors, to any portion of the Work completed or in progress, or to produce impediment to the use of highways, roads, lanes and streets by the public. All discharges from the dewatering must comply with an approved Sediment and Erosion Control Plan.

B. Maintain sewers, drains and ditches free of debris to convey surface drainage. No damming or ponding of water in gutters or other waterways will be permitted. Do not direct flow of water across pavements except through approved pipes or properly constructed troughs. Provide pipes or troughs of such sizes and lengths as may be required. Control grading in the vicinity of excavations so the ground surface is properly pitched to prevent water from running into excavated areas.

C. Control groundwater and surface water during construction in order to maintain soil stability. Maintain the water table elevation sufficiently below the levels of excavations that slopes will remain stable and bottoms of excavations will not become loosened by flow of water. If the foundation material looses its strength due to improper dewatering techniques, over excavate the material and replace it with Structural Fill.

D. Do not perform excavating, backfilling or compacting when weather conditions or the condition of materials are such, that in the opinion of the Authority, the Work cannot be completed in accordance with the Specifications.

E. Do not use as backfill frozen materials or wet materials containing moisture in excess of the amount necessary for satisfactory compaction.

F. Prior to use, moisten dry backfill material not having sufficient moisture to obtain satisfactory placement or compaction.

G. Prevent spread of dust during performance of work by thoroughly moistening excavation areas by sprinkling or other methods approved by Engineer.

H. If the required quantity of backfill exceeds the quantity of suitable material excavated within the limits of the project site, easements, or rights-of-way, obtain sufficient material to complete the backfill at no additional cost to Authority. If borrow excavation is needed, notify Engineer sufficiently in advance of borrow excavation requirements to permit Engineer to verify the need for such borrow excavation and to view the proposed borrow pit and determine the suitability of the material to be provided. Use of borrow excavation from offsite must be approved by Engineer. Any tests required by Engineer to assist in determining suitability of the borrow materials shall be responsibility of Contractor and completed at no increase in Contract Price.

I. No right of ownership of excavated materials is granted to Contractor prior to backfilling. This provision does not relieve Contractor of his responsibility to remove and dispose of surplus excavated material.

J. Assume sole responsibility for the condition and results of excavations. Slides and cave-ins shall be removed without additional compensation at whatever time and under whatever circumstances they may occur.

K. Protect all pipes, conduits, walls, buildings and other structures or property whether above or below ground, or that may appear in the excavation. Maintain sufficient quantity of material and equipment on the site and for use as necessary for sheeting, sustaining and supporting any pipes, conduits, walls, building, structure or property.

3.03 EXCAVATION

A. General Procedures:

1. Perform excavation using machinery, except where hand excavation may be required to protect existing structures, existing sanitary sewer or force main piping, electrical conduits, utilities or private or public properties. No additional compensation will be paid for hand excavation instead of machine excavation as may be necessary from any cause whatever.

2. Perform excavation of every description and of whatever substances encountered to the elevations indicated by the Contract Drawings and as specified herein.

3. Where work space is limited, remove excavated material from the limited area and replace the material after the work has been completed. No additional compensation will be made for such removal and replacement of the excavated material.

4. Extend excavation a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for inspection.

B. Remove rock that has been shattered due to rock removal operations and in the opinion of the Authority is unfit for foundations to an elevation below subgrade. Fill to subgrade with Structural Fill those areas where shattered rock has been removed. Perform such backfilling to the satisfaction of the Authority. No separate or additional payment will be made for such removal and backfill.

C. Excavation below Planned Subgrade:

1. Do not excavate below depths indicated on the Drawings or such depths as required for the proper installation of the Work, unless otherwise directed by the Authority.

2. Excavation below depths indicated on the Drawings or as required for the proper installation of the Work through the fault of the Contractor, shall be restored to the indicated or required depths with Structural Fill.

3. If the foundation for any structure is required by the Authority to be carried lower than the planned subgrade elevation shown on the Contract Drawings, the voids

caused by this excavation shall be backfilled with Structural Fill up to subgrade elevation.

D. Storage of Approved Materials:

1. Store on site all unused approved materials.

2. Do not mix unused approved materials of differing types.

3. Do not mix unused approved materials with unapproved materials.

3.04 SUBGRADE PREPARATION

A. General Procedures:

1. Where subgrade consists of an excavated soil surface, thoroughly machine-tamp or proof-roll the existing material. Compact the exposed soils until no movement is observed or as directed by the Authority. Remove and replace soft, loose, and disturbed zones disclosed by the tamping or proof-rolling. Overexcavate to the depth directed by the Authority and replace with Structural Fill; compact as indicated in these specifications.

2. Where subgrade consists of an excavated rock surface, thoroughly inspect the bedrock bearing surfaces, and clean any exposed soil-filled seams with water jets or compressed air to a minimum depth of two (2) times the seam width. Fill the open joints with concrete during placement of the structure foundation.

3. Do not place fill materials on surfaces that are muddy, frozen, or contain frost.

4. Trim bottoms to indicated lines and grades to leave solid base to receive other work.

5. Place geotextile material on the subgrade prior to placing fill materials.

3.05 STRUCTURAL FILL

A. Placement and Compaction:

1. Spread material uniformly without segregation of coarse and fine material.

2. Place material in 8-inch maximum loose lifts if full-size compaction equipment will be used, and 6-inch maximum loose lifts if hand compaction equipment will be used.

3. Maintain the moisture content of the material within 2% plus or minus of the optimum moisture content as determined by the Standard Compaction Test, ASTM D698.

4. Compact the material to at least 100% of the maximum dry density as

determined by ASTM D698.

3.06 SUBBASE

A. General:

1. Do not place subbase material on soft, muddy or frozen subgrades. Satisfactorily correct irregularities or soft zones in the prepared area.

B. Placement and Compaction:

1. Place subbase material in maximum 8" lifts. When using PennDOT No. 2A material, compact to 100% of the maximum dry-weight density. When using PennDOT No. OGS material, satisfactory compaction will be based on non-movement of the material.

3.07 BACKFILLING

A. General Procedures:

1. Perform backfilling using machinery, except where hand backfilling is required to prevent damage to walls, foundations, utilities, electrical conduits, sanitary sewer or force main piping. No additional compensation will be paid where backfilling by hand is required.

2. Clean excavation free of trash and debris prior to backfilling.

3. Do not place backfill material prior to seven days after completion of structure walls, and then only if the concrete has achieved 80% of the specified 28-day compressive strength.

4. Do not place backfill material on wet or frozen areas.

5. Do not operate heavy equipment closer to walls than a distance equal to the height of backfill material above the top of the structure footing.

6. Do not place backfill material against exterior walls until supporting floors, other reinforcing or supporting members, or slabs at top of walls are in place.

7. Do not place backfill material against water-containing concrete structures or manholes until water testing has been satisfactorily completed.

8. Perform compaction using power driven tampers or compactors suitable for material being placed.

B. Random Backfill:

1. Use random backfill where structure backfill is not required or specified. Use of structure backfill in lieu of random backfill is allowed.

2. Place backfill in loose, uniform horizontal layers not exceeding eight inches in depth.

3. Maintain moisture content of backfill at compaction within 2% plus or minus of optimum moisture as determined by ASTM D698.

4. Compact backfill to at least 95% of the maximum dry density based on ASTM D698.

C. Structure Backfill:

1. Place structure backfill behind structure walls. Place structure backfill in 12-inch lifts and thoroughly compact each lift with a vibratory compactor to the satisfaction of Engineer.

3.08 FIELD QUALITY CONTROL

A. Testing

1. All testing to be completed by independent testing agency and paid for by Contractor.

2. Pre-cast concrete structures subgrade: Make at least one field density test of subgrade for every 500 sq. ft. of liner area or structure base, but in no case less than 3 tests.

B. Corrective Measures:

1. Whenever tests indicate that the field moisture or density does not meet specified requirements, take corrective action as approved by the Authority.

2. Corrective measures may include loosening the soil and wetting or drying it prior to recompaction, additional compaction, or removing and replacing the material.

3. Retest material that did not meet the moisture and density requirements after corrective measures have been performed.

C. Retesting: The Authority may at any time require retesting of any material, whether in stockpiles or being placed, if it appears that the material differs from that which has previously been approved for use.

END OF SECTION