

SECTION 21 05 10 - EXCAVATION FOR FIRE SUPPRESSION CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General Conditions and other Division-21 Specification Sections, apply to this Section.

1.2 DESCRIPTION OF WORK

- A. Excavation, backfill and compaction associated with utility construction including such related features as protection of adjacent utilities and structures, maintenance and protection of traffic, cutting paved surfaces, support of excavation, control of excavated materials, de-watering, piping, bedding, disposal of excavated materials, and all work related to providing excavation, backfill and compaction for all utilities and structures in connection with the plumbing systems.

1.3 QUALITY ASSURANCE

- A. Testing Agent: Compaction testing for this Work shall be performed by the contractor's Testing Agency. Where compaction testing is specified, such compaction testing shall be performed by a soils testing agent engaged and paid for by the Contractor and approved by the Architect.
- B. Reference Standards:
  - 1. Pennsylvania Department of Transportation:
    - a. Regulations Governing Occupancy of Highways by Utilities (67 PA Code, Chapter 459)
    - b. Publication 408 Specifications Pennsylvania Test Method, PTM 106 Pennsylvania Test Method, PTM 402
    - c. Publication 203, Work Zone Traffic Control
  - 2. American Society for Testing and Materials (ASTM):
    - a. ASTM D698 Test Method for Laboratory Compaction characteristics of Soil Using Standard Effort (12,400 ft.-lbf/ft<sup>3</sup>)
    - b. ASTM D2922 Standard Test Method for Density of Soil and Soil - Aggregate in Place by Nuclear Methods (Shallow Depth).

- C. Compaction Testing:

- 1. Compaction shall be by the testing procedure contained in ASTM D2922 based on previously determined compaction curve data as established by ASTM D698.

1.4 SUBMITTALS

- A. Certificates: Submit certification attesting that the composition analysis of pipe embedment and select material stone backfill materials meet specification requirements.

1.5 JOB CONDITIONS

- A. Permits: Obtain and pay for all permits and inspections required for the work under this Section.
- B. Excavation and Rock Removal:
  - 1. Refer to Earthwork for information relative to removal of rock and classification of excavation. All requirements and classification for excavation, rock removal, earthwork, etc. specified under the Earthwork section shall be made a part of this Section.
- C. Compaction of Backfill:
  - 1. Excavations shall be backfilled with lifts which are individually compacted.
  - 2. The following compaction densities (based on standard Proctor Curve ASTM D698) shall be achieved:
    - a. Trench Backfill under asphalt and concrete paving (not including base course materials): 100%.
    - b. Trench Backfill within Unpaved Areas: 95%.
    - c. Exterior Side of Structures: 95%.
  - 3. Contractor shall maintain optimum moisture content of backfill materials to attain the required compaction density.
- D. Protection of Existing Utilities and Structures:
  - 1. Take all precautions and utilize all facilities required to protect existing utilities and structures. In compliance with Act 172 of the General Assembly of Pennsylvania, advise each Utility at least three (3) working days in advance of intent to excavate, do demolition work and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
  - 2. Advise each person in physical control of powered equipment or explosives used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
  - 3. Immediately report to the Utility and the Architect any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
  - 4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

1.6 WARRANTY

- A. All equipment, material and labor provided under this specification section shall be warranted for a period of one year after project completion.

## PART 2 - PRODUCTS

### 2.1 DETECTABLE WARNING TAPE

- A. Acid and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, including storm water, 6" wide, 4 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 directed by authorities having jurisdiction on the project or as directed by the Architect.

### 2.2 PIPE BEDDING OR EMBEDMENT MATERIAL

- A. PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications or PennDOT 2RC.

### 2.3 SLAB OR BASE MATERIAL

- A. Concrete Slab or Precast Base:
  - 1. PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.

### 2.4 BACKFILL MATERIAL FOR UTILITIES

- A. All Concrete and Asphalt Paving:
  - 1. PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.
- B. Unpaved Areas:
  - 1. PennDOT No. 2A coarse aggregate, Table C, Section 703.2, Publication 408 Specifications.

## PART 3 - EXECUTION

### 3.1 EXAMINATION AND PREPARATION

- A. Identify required lines, levels, contours and datum.
- B. Notify Architect of unexpected subsurface conditions and discontinue work in area until notified to resume work.
- C. Maintain and protect existing utilities identified by utility users within the Work area.
- D. Verify that structure walls are braced to support surcharge forces imposed by backfilling operations.

### 3.2 PROTECTION OF ADJACENT WORK

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.

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- B. Grade excavation top perimeter to prevent surface water runoff into excavation or to adjacent properties.

3.3 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to ensure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the roadway is authorized.
- B. Maintain access to all streets and private drives.
- C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.
- D. Comply with State and local Municipal codes, permits and regulations and pay for all permits and inspections that are required for the installation.

3.4 CUTTING PAVED SURFACES

- A. Where installation of pipelines, structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the edge of the excavation. Cut offsets at right angles to the edge of the excavation.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.
- C. The requirement for neat line cuts, in other than state highways, may be waived if the final paving restoration indicates overlay beyond the width of the excavation.

3.5 EXCAVATION

- A. Depth of Excavation:
  - 1. Pipelines: Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
  - 2. Where unsuitable bearing material including shattered rock due to drilling or other operations is encountered in the bottom of the excavation, discontinue excavation until the unsuitable material is observed by the Architect or the Owner's representative.
  - 3. Where contractor, by error or intent, excavates beyond the minimum required depth, backfill the excavation to the required depth with pipe bedding/embedment or slab/base material as appropriate without any change in the Contract Price.
- B. Width of Excavation:
  - 1. Pipelines: Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe embedment under, around and over the pipe. Shape trench walls completely vertical from trench bottom to at least two (2) feet above the top of the pipe. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
  - 2. Structures: Excavate to the minimum distance necessary for placement/installation of the footings, concrete slab, walls or prefabricated structures and to permit proper backfill procedures to be performed.

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C. Length of Open Trench:

1. Do not advance trenching operations more than 200' ahead of completed pipeline.

3.6 SUPPORT OF EXCAVATION

- A. Support excavations with sheeting, shoring, and bracing or in the case of pipeline construction, a "trench box" as required to comply with Federal, State, and local laws and codes.
- B. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of contractor in any other manner, shall be repaired at contractor's expense.
- C. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Architect.
- D. The neglect, failure or refusal of the Architect to order the use of bracing or sheeting, or a better quality, grade, or section, or larger sizes of steel or timber, or to order sheeting, bracing, struts, or shoring to be left in place, or the giving or failure to give orders or directions as to the manner or methods of placing or driving sheetings, bracing, jacks, wales, stringers, etc., shall not in any way or to any extent relieve Contractor of any responsibility concerning the condition of excavation or of any of his obligations under the Contract, nor shall any delay, whether caused by any action or want of action on the part of Contractor, or by any act of Owner and Architect or their agents, or employees, resulting in the keeping of an excavation open longer than would otherwise have been necessary, relieve contractor from the necessity of properly and adequately protecting the excavation from caving or slipping, nor from any of their obligations under the Contract relating to injury of persons or property, nor entitle them to any claim for extra compensation.

3.7 CONTROL OF EXCAVATED MATERIAL

- A. Keep the ground surface, within a minimum of 2' of the sides of the excavation free of excavated material.
- B. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.
- C. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes, fire and police call boxes, and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural water courses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- D. In areas where excavations parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course.

3.8 DEWATERING

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.

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- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control.

3.9 PIPE LAYING

- A. Provide required pipe bedding placed in accordance with the Drawings and Specifications. A minimum bedding of 6" shall be provided.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.
- C. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

3.10 BACKFILLING EXCAVATIONS

- A. Pipeline Trench:
  - 1. After pipe installation and inspection, provide material to complete the pipe embedment in accordance with the Drawings and Specifications.
  - 2. Unless otherwise shown on the Drawings, the following bedding or embedment requirements using the material indicated:
    - a. Storm Sewers: Pipe embedment to 12" above the crown of the pipe.
    - b. Potable Water: Pipe embedment to one-half ( $\frac{1}{2}$ ) the outside diameter of the pipe.
  - 3. The material shall be hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material in accordance with the Drawings and any relevant permit conditions. Employ a placement method so not to disturb or damage the utility line in the trench. Use of a Hydra-hammer or jumping-jack type compaction device is not permitted. A vibratory plate type compaction device is acceptable. Any settlement which occurs because of consolidation of the backfill during the construction period or during the one (1) year maintenance period shall be completely corrected by contractor at his expense.
  - 4. Provide warning tape approximately 12" below finished grades and above all piping.
- B. Lift Thickness Limitations:
  - 1. Lift thicknesses shall be limited to four (4) inches for pipe embedment, eight (8) inches maximum for pipeline trenches within paved areas and twelve (12) inches maximum for pipeline trenches in non-paved areas and for structure excavations. Lift thicknesses shall also comply with requirements imposed by any State Highway Occupancy Permit. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations for the compaction equipment to be utilized. Compaction equipment shall not be used over the pipe until sufficient backfill has been placed to ensure that such equipment will not damage or disturb the pipe.
  - 2. Lift thickness limitations specified for State highways, shoulders, or embankments govern over the compaction equipment manufacturer's recommendations.
- C. Unsuitable Backfill Material:
  - 1. Where the Architect determines backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with suitable backfill material. Unsuitable material shall be legally disposed of, off-site by the contractor.

3.11 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: Contractor shall obtain and pay for a testing laboratory to inspect and approve each subgrade and fill layer before further backfill or 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.
    - a. Field density tests may also be performed by the nuclear method in accordance with ASTM D 2922, providing that calibration curves are periodically checked and adjusted to correlate to tests performed using ASTM D 1556. In conjunction with each density calibration check, check the calibration curves furnished with the moisture gages in accordance with ASTM D 3017.
    - b. If field tests are performed using nuclear methods, make calibration checks of both density and moisture gages at beginning of work, on each different type of material encountered, and at intervals as directed by the Architect.
  - 2. Perform one test at each structure and one test for each 150 lineal feet of pipe or fractions thereof per foot of backfill.
  - 3. If in opinion of Architect, based on testing service reports and inspection, subgrade or fills that have been placed are below specified density, perform additional compaction and testing until specified density is obtained.

3.12 DISPOSAL OF EXCAVATED MATERIAL

- A. Excavated material remaining after completion of backfilling shall remain the property of contractor, removed from the construction area, and disposed of legally, off-site. However, in the event the excavated material can be used in filling and rough grading on the site as determined by the Architect, it shall remain on the site and be used for grading and filling.

END OF SECTION 21 05 10