

**SECTION 31 20 00.02**  
**EARTH MOVING (Trenching, Backfilling and Compacting)**

**PART 1 GENERAL**

**1.1 DESCRIPTION**

- A. The work of this section includes, but is not limited to:
1. Cutting paved surfaces
  2. Blasting
  3. Trench excavation, backfill and compaction
  4. Support of excavation
  5. Pipe bedding requirements
  6. Control of excavated material
  7. Rough Grading
  8. Restoration of unpaved surfaces
- B. Related work specified elsewhere:
1. Soil Erosion and Sedimentation Controls: Section 31 25 00
- C. Definitions: NONE
- D. Applicable Standard Details:
- As shown on the Contract Drawings, in accordance with Publication 408 Specifications.

**1.2 QUALITY ASSURANCE**

- A. Reference Standards:
1. Pennsylvania Department of Transportation (PennDOT), Latest Revisions:  
Publication 408, Specifications  
Publication 213, Temporary Traffic Control Guidelines  
Publication 72M, Standards for Roadway Construction  
Publication 19, Field Test Manual
    - PTM No. 106 - Moisture-Density Relations of Soils (using 5.5 lb. Rammer and 12 inch drop)
    - PTM No. 402 - Determining In-Place Density and Moisture Content of Construction Materials by Use of Nuclear Gauges
  2. American Society for Testing and Materials (ASTM):  
C33 Specifications for Concrete Aggregates  
D698 Test Method of Laboratory Compaction Characteristics of Soil Using Standard Effort  
D2922 Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods
  3. Pennsylvania Code  
Title 67, Transportation, Chapter 459, Occupancy of Highways by Utilities
- B. Testing Agency:
1. Compaction testing shall be performed by an approved Soils Testing Laboratory engaged and paid for by the CONTRACTOR and approved by the ENGINEER.
- C. Compaction Testing:
1. Conduct compaction tests at locations as directed by the ENGINEER during backfilling operations.

2. Determine compaction in state highways and shoulders by the testing procedure contained in PTM No. 106, Method B or PTM No. 402.
3. Determine compaction in areas other than state highways and shoulders by the testing procedure contained in ASTM D698 or ASTM D2922.

### **1.3 SUBMITTALS**

- A. Certificates:
  1. Submit certification from aggregate suppliers attesting that the pipe bedding and select material stone backfill materials conform to the specifications herein.
- B. Compaction Equipment List:
  1. Submit a list of all equipment to be utilized for compacting, including manufacturers' lift thickness limitations.

### **1.4 JOB CONDITIONS**

- A. Classification of Excavation:
  1. All excavation work performed under this contract is UNCLASSIFIED, and includes excavation and removal of all soil, shale, rock, boulders, fill, and all other materials encountered of whatever nature.
- B. Compaction of Backfill:
  1. Compact backfill per Section 32 13 13.02.
- C. Control of Traffic:
  1. Employ traffic control measures in accordance with Publication 213, "Temporary Traffic Control Guidelines".
- D. Protection of Existing Utilities and Structures:
  1. Take all precautions and utilize all facilities required to protect existing utilities and structures. Comply with the requirements of the Pennsylvania Underground Utility Protection Law. 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 ENGINEER 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.
- E. Site Inspections:
  1. Prior to entering upon any private property, the CONTRACTOR shall have arranged for and completed a site inspection of each property with the ENGINEER, at which time the ENGINEER will advise the CONTRACTOR as to what area is available for work; as to the trees, planting, and improvements which may be removed or disturbed during the work; and as to any special condition or requirements which shall govern the work on each property.

**PART 2 PRODUCTS****2.1 PIPE BEDDING MATERIAL**

- A. Sanitary Sewer and Water Pipe Bedding Material:
  - 1. AASHTO No. 8 coarse aggregate.
- B. Storm Sewer Pipe Bedding:
  - 1. AASHTO No. 57 coarse aggregate.

**2.2 BACKFILL MATERIAL**

- A. Select Material Backfill:
  - 1. Crushed stone or gravel aggregate conforming to Select Granular Material (2RC), Section 703.3, Publication 408 Specifications. Do not use slag or cinders.
- B. Flowable Backfill Material:
  - 1. Material conforming to PennDOT Special Provision S94 (S2060130), Type A or B as shown in Table 1.
  - 2. Flowable backfill inside casing pipe shall be Type D.
- C. Suitable Backfill Material (Highways, driveways, and shoulders):
  - 1. From top of pipe bedding material to subgrade elevation:
    - a. Select Material Backfill
    - b. Flowable Backfill Material – Where directed or approved
- D. Suitable Backfill Material (Other than highways, driveways, and shoulders):
  - 1. From top of pipe bedding material to 24" over top of pipe:
    - a. Material excavated from the trench if free of stones larger than 6" in size and free of wet, frozen, or organic materials.
  - 2. From 24" above pipe to subgrade elevation:
    - a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

**Table 1 - Flowable Fill**

Properties & Criteria	Type A	Type B	Type C	Type D
Mix Design ( /cy)				
PART 1 - Cement (lbs)*	100	50	150-200	300-700
PART 2 - Fly Ash (lbs)*	2000	300	300	100-400
PART 3 - Bottom Ash (lbs)* or Coarse Aggregate or Fine Aggregate	0	2600	2600	**
Flow Cone (seconds) ASTM C939	30-60	–	–	30-60****
Slump (inches) PTM No. 600	–	7-11	7-11	7-11****
Density (pcf) PTM No. 613	95-110***	120-135***	125 min. ***	30-70 or as specified ***
Water Absorption of Aggregate, PTM No. 506	–	–	–	20 (max %)

Compressive Strength (psi) PTM No. 604					
PART 4 -	3 days (minimum	25	25	300	40
PART 5 -	28 days (range)	50-125	50-125	800 min.	90-400

- \* Quantities may be varied or alternate designs submitted to adapt mix to meet density and strength requirements or to adapt to specific site conditions.
- \*\* Requires the use of suitable lightweight aggregate or air entraining admixture. Provide a mix design that achieves the specified strength and density requirements.
- \*\*\* Approximate Value. Use of air entraining agent may reduce these values.
- \*\*\*\* As appropriate depending on whether lightweight aggregate or air entraining admixture is used to obtain lightweight properties.

### **PART 3 EXECUTION**

#### **3.1 MAINTENANCE AND PROTECTION OF TRAFFIC**

- A. Maintain traffic in one or more unobstructed lanes and provide access to all streets and private drives.
- B. Provide and maintain protective devices as required by state and local codes, permits, and regulations.

#### **3.2 CUTTING PAVED SURFACES PRIOR TO TRENCHING**

- A. Where installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench.
- 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 trench width.

#### **3.3 BLASTING**

- A. Blasting is prohibited.

#### **3.4 TRENCH EXCAVATION**

- A. Depth of Excavation:
  - 1. Gravity Pipelines:
    - a. Excavate mainline trenches to the required depth and grade for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
    - b. Excavation for laterals shall provide a straight uniform grade from the main pipeline to the right-of-way line, plus that excavation necessary for placement of pipe bedding material.
  - 2. Pressure Pipelines:
    - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide a minimum of 42" from the top of the pipe to the finished ground elevation, except where specific depths are otherwise shown on the Contract Drawings.
    - b. Avoid the creation of unvented high points for pressure pipelines.
  - 3. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be

established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.

4. Where the CONTRACTOR, by error or intent, excavates beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.
- B. Width of Excavation:
1. Excavate trenches, including laterals, to a width necessary for placement and jointing of the pipe, and for placing and compacting pipe bedding and trench backfill around the pipe, but not less than 16" or more than 24" plus the pipe outside diameter from the bottom of the trench to a point 12" above the crown of the pipe.
  2. Shape trench walls completely vertical from trench bottom to at least 2' above the top of the pipe. Trench walls from 2' above the top of the pipe to grade to be benched and sloped, or shaved, to comply with Federal and State laws and codes.
  3. 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.

### **3.5 SUPPORT OF EXCAVATION**

- A. The adequacy of the design of sheeting, shoring and bracing installations relative to the nature of the material to be encountered and retained is the sole responsibility of the CONTRACTOR and no duty is assumed or to be exercised by OWNER or ENGINEER relative thereto.
- B. Support excavations with sheeting, shoring, and bracing or a "trench box" as required to comply with Federal and State laws and codes.
- C. Install adequate excavation supports to prevent ground movement or settlement of adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the CONTRACTOR in any other manner, shall be repaired at the CONTRACTOR's expense.
- D. Removal of sheeting, shoring and bracing as backfilling proceeds is the CONTRACTOR's responsibility.

### **3.6 CONTROL OF EXCAVATED MATERIAL**

- A. Keep the ground surface on both sides of the excavation free of excavated material to comply with Federal and State laws and codes.
- 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 pipelines parallel or cross streams, ensure that no material slides, is washed, or is dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.
- E. Comply with Section 31 25 00 - Soil Erosion and Sedimentation Control.

### **3.7 DEWATERING**

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work. Comply with Section 31 25 00 - Soil Erosion and Sedimentation Control.

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

### **3.8 PIPE BEDDING REQUIREMENTS**

- A. Depth of pipe bedding aggregate as shown on the Contract Drawings and in accordance with Publication 408 Specifications.
- B. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant (under “haunches”) and the pipe bottom for the entire length of the barrel. Fill all voids below the pipe.
- C. Pipe embedment material shall be placed, worked by hand or compacted until a minimum density of 90% in yards and 95% under driveways, shoulders, roadways and sidewalks is achieved (at optimum moisture content,  $\pm 2\%$ , standard proctor).

### **3.9 PIPE LAYING**

- A. Provide required pipe bedding placed in accordance with the Contract Drawings.
- B. Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

### **3.10 THRUST RESTRAINT**

- A. All joints of pressure pipe shall be mechanically-restrained, Mechanical Joint. Restraints shall be EBAA MEGALUG or equal approved by the ENGINEER. The use of concrete thrust blocks shall not be allowed as the sole or primary means of thrust restraint.

### **3.11 BACKFILLING TRENCHES**

- A. After pipe installation and inspection, backfill trenches to 12" above the crown of the pipe with specified backfill material, placed and carefully compact with approved compaction equipment in layers of suitable thickness to provide specified compaction. Backfill and compact the remainder of the trench with specified backfill material. Refer to the Contract Drawings and in accordance with Publication 408 Specifications, for trench backfill material and compaction requirements at each specific location.
- B. Lift Thickness Limitations:
  - 1. Submit a list of the compaction equipment to be utilized on the project, the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified compaction is not obtained, the CONTRACTOR shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compaction.
  - 2. Lift thickness limitations specified for state highways, shoulders, or embankments shall govern over the compaction equipment manufacturer's recommendations.

- C. Jetting:
  - 1. When approved by the ENGINEER in writing, jetting methods may be used to consolidate backfill. Quality assurance methods to verify adequate compaction will be a condition of the approval by the ENGINEER.
- D. Uncompacted Backfill:
  - 1. Where uncompacted backfill is indicated on the Contract Drawings, backfill the trench from one foot above the pipe to the top of the trench with material excavated from the trench, crowned over the trench to a sufficient height to allow for settlement to grade after consolidation, providing for surface water drainage.
- E. Unsuitable Backfill Material:
  - 1. Where the ENGINEER deems 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 select material backfill.

**3.12 DISPOSAL OF EXCAVATED MATERIAL**

- A. Excavated material remaining after completion of backfilling shall remain the property of the CONTRACTOR, removed from the construction area, and legally disposed of.

**3.13 ROUGH GRADING**

- A. Rough subgrade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, and lawns.
- B. Grade areas to be paved to depths required where placing subbase and paving materials.
- C. Rough grade areas to be topsoiled and seeded to 4" below indicated finish contours.

**3.14 RESTORATION OF UNPAVED SURFACES**

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.

**3.15 LIMITS OF WORK**

- A. All disturbances shall be confined to OWNER's property, street rights-of-way, permanent easements, and temporary construction easements shown on the Contract Drawings.
- B. The CONTRACTOR shall not permit trucks and equipment to enter private driveways.
- C. All work shall be confined to the Municipal or state highway rights-of-way and permanent rights-of-way on temporary construction rights-of-way shown on the Contract Drawings.
- D. The CONTRACTOR shall not permit trucks and equipment to enter private property except where easements are provided or prior written permission from the OWNER has been obtained by the CONTRACTOR.

**END OF SECTION**