

SECTION 02225 TRENCH EXCAVATING AND BACKFILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Excavating and backfilling for utilities.
- B. "Pipe zone" backfill.
- C. Trench sub-base stabilization.
- D. Removal and disposal of unsatisfactory materials.
- E. Flowable Fill
- F. Underground plastic line markers.

1.2 RELATED SECTIONS

- A. Section 02204 – Mineral Aggregate and Fill
- B. Division 15 – Mechanical

1.3 REFERENCES

- A. AASHTO T180 – Moisture-Density Relations of Soils Using a 10lb (4.54 Kg) Rammer and an 18 inch (457 mm) Drop
- B. ASTM C 136 – Method for Sieve Analysis of Fine and Coarse Aggregates
- C. ASTM D 698 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop
- D. ASTM D 1556 – Test Method for Density of Soil in Place by the Sand-Cone Method
- E. ASTM D 1557 – Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop
- F. ASTM D 1267 – Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
- G. ASTM D 2321 – Underground Installation of Flexible Thermoplastic Sewer Pipe
- H. ASTM D 2774 – Underground Installation of Thermoplastic Pressure Piping
- I. ASTM D 2922 – Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
- J. ASTM D 3017 – Test Methods for Moisture Content of Soil and Soil-Aggregate Mixtures

1.4 DEFINITIONS

- A. Utility: Any buried pipe, conduit, or cable
- B. Rigid Pipe: All concrete pipe, steel pipe, ductile iron pipe, clay tile pipe and asbestos-cement pipe
- C. Flexible Pipe: All thermoplastic pipe such as PVC, PE, ABS and composites, and corrugated metal pipe.
- D. Pipe Zone: The area 4 inches under the pipe, the trench width, and 6 inches (12 inches for pipes 24 inch diameter or larger) over the pipe.
- E. Unclassified Excavation: Includes all materials encountered regardless of their nature or the manner in which they are removed.
- F. Trench Width: The outside diameter (OD) of the pipe, not including joints, plus 12 inches each side of the pipe.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01330.
- B. Submittals are required for all "pipe zone" materials.

1.6 JOB CONDITIONS

- A. Pipeline lengths indicated on drawings are for information only. Furnish pipeline lengths as required to complete the Project.
- B. Embankment Areas: Perform no work in areas receiving fill until embankment or fill has been completed to at least two feet above the top of the pipe grade, and has been properly compacted.
- C. Do not change pipe size, material, or class without securing written approval of the Engineer.
- D. Unsuitable Weather Limitations: Do not place, spread, or roll any fill material during unsuitable weather conditions. Do not resume operations until moisture content of material is satisfactory.
- E. Weather Softened Subgrade: Remove and replace at no additional cost to Owner.
- F. Protection of Graded Areas: Protect from traffic and erosion. Keep free of trash and debris. Repair and reestablish grades in settles, eroded, and rutted areas to specified tolerances.
- G. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or unsuitable weather, scarify surface, reshape, and compact to required density prior to further construction.

PART 2 – PRODUCTS

2.1 MATERIALS FOR OVER EXCAVATING

- A. Select Fill: In accordance with Section 02204

2.2 “PIPE ZONE” MATERIALS

- A. Unclassified Excavation: Native materials encountered in trench excavating approved by Engineer for use.
- B. Select Fill: In accordance with Section 02204.

2.3 FLOWABLE FILL

- A. Cement:
 - 1. Types I or II per ASTM C 150; or
 - 2. Types IP or IS per ASTM C 595.
- B. Aggregate: Non-plastic sand or concrete aggregate.
- C. Water: Non-detrimental.
- D. Pozzolan (fly ash):
 - 1. Class C or Class F per ASTM C 618.
 - 2. Loss on ignition \leq 3 percent.
- E. Mix Design: The combination and use or non-use of components (e.g. cement, pozzolan, aggregate, water and air) in the flowable fill product is the Contractor's choice. The following is provided as a guide in the development of a mix design.
 - 1. Portland cement; 42 lbs. Cement/cubic yard.
 - 2. Pozzolan; Class C or F as needed for strength and flowability.
 - 3. Aggregate; 2200 to 2800 pounds per cubic yard.
 - 4. Mixing water; 340 to 600 pounds per cubic yard.
 - 5. Air; 4percent to 25 percent per ASTM C 173 as needed for strength and flowability.
- F. Performance requirements: Unconfined compressive strength per ASTM D 4832.
 - 1. 10 psi minimum in 24 hours.
 - 2. 60 psi maximum in 28 days.

2.4 UNDERGROUND – TYPE PLASTIC LINE MARKERS

- A. Include in trenches, underground plastic line markers as per drawings.
- B. Use for all non-metallic pipe materials.

2.5 LANDSCAPED AREAS

- A. Topsoil: In accordance with Section 02204.

2.6 BACKFILL REQUIREMENTS

- A. Inorganic materials free from frozen materials, asphalt surfacing, or rocks larger than 6 inches in the backfill.
- B. No pockets of poorly graded particles.
- C. Native soils with a moisture content that is within two percentage points above optimum.

PART 3 – EXECUTION

2.6 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Protect plant life, lawns, and other features remaining as a portion of final landscaping.
- C. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.
- D. Maintain and protect above and below grade utilities that are to remain.
- E. Utilize appropriate traffic signs, markers, and procedure in all construction activities as defined in the Manual of Uniform Traffic Control Devices.
- F. Provide grading to prevent surface water from flowing into trenches or other excavations. Promptly remove any ponded water.
- G. Store all materials minimizing inconvenience to public travel. Make provisions for urgent traffic.
- H. Provide free access to all fire hydrants, water valves and meters, and leave clearance to enable free flow of storm water in all gutters, conduits, and natural water courses.
- I. Asphalt coat aluminum pipe to prevent direct contact with concrete.
- J. Insulate dissimilar metals from direct contact with each other, using neoprene gaskets or asphalt coatings.
- K. Lay pressure lines to eliminate high points in line. Notify Engineer of any unavoidable high points for possible installation of air relief valves.
- L. Lay gravity pipe upgrade, beginning at lower end.
- M. Handle pipe in accordance with accepted practices and according to manufacturer's recommendations.
- N. Do not lay pipe in water.
- O. Do not lay pipe when trench conditions or weather are unsuitable.
- P. Place circular concrete pipe that contains elliptical reinforcing so that the reference lines designating the top of the pipes will not be more than five degrees from the vertical plane through the longitudinal axis of the pipe.
- Q. Use approved equipment, as recommended by the pipe manufacturer, to cut pipe.
- R. Secure Engineer's approval to deflect pipe from true line and grade. Do not exceed deflection recommended pipe manufacturer.

2.7 EXCAVATION

- A. Excavate trenches for piped to the lines and grades called for regardless of the type of material encountered.
- B. Limit the trench width in the "pipe zone" to the defined with this Section.

- C. Backfill unauthorized over-excavation with select fill material at no expense to the Owner.
- D. Hand trim excavation, removing loose matter.

2.8 SUBGRADE PREPARATION

- A. If subgrade is not readily compatible secure authorization for extra excavation and backfill with select fill.

2.9 DEWATERING

- A. Keep trenches free from water during pipe laying and joining by methods approved by the Engineer.

2.10 SHORING AND BRACING

- A. Providing all shoring, bracing, or trench boxes as needed to protect the work, existing property utilities, pavement, etc., and to provide safe working conditions in the trench in accordance with current State and Federal (OSHA) regulations.

2.11 EXISTING UTILITIES

- A. Notify utilities according to provision of Section 01010.
- B. Accept responsibility for repair of utilities damaged during construction whether shown on the drawings or not. Damaged utilities are not to be covered until repairs are verified by utility and Engineer.

2.12 "PIPE ZONE" CONSTRUCTION

- A. General
 1. Backfill trench after completed installation has been approved by Engineer.
 2. Trench backfill in the "pipe zone" is termed bedding.
 3. Changes in bedding can only occur with written approval by Engineer.
 4. Protect pipe during bedding.
 5. Allowable pipe deflections limits from manufacturers will be enforced.
 6. Round bottom of "pipe zone" so that at least the bottom quadrant of the pie rests firmly on compacted bedding for the entire length of barrel.
 7. Place bedding material evenly on each side of pipe in lifts not exceeding compacted 6 inches, compact to at least 90 percent of the laboratory density as determined by ASTM D 698. Continue to top of "pipe zone".
- B. Bedding Materials
 1. Use native materials in the "pipe zone" consisting of sands, silts, and gravel with oversized rock removed.
 2. When excavated native material is not suitable for bedding, provide select fill materials according to Section 02204 and the following size limitations:
 - a) Ductile Iron Pipe and steel cylinder pipes (non-tape wrapped) and concrete pipe: Rocks no larger than 1-1/2 inch diameter, or larger than the pipe wall thickness, whichever is greater. Select fill materials specified in Section 02204 are acceptable, however same size limits apply.
 - b) Tape wrapped steel cylinder pipe and asbestos concrete pipe: Rocks no larger than 3/4 inch diameter, or larger than the pipe wall thickness, whichever is greater. Select fill material specified in Section 02204 are acceptable, however same size limits apply.
 - c) Slotted or perforated pipe: Use select fill sewer rock gradation.
 - d) Install Ductile Iron Pipe according to AWWA C600 types. Flexible Pipe Materials.
 - e) Plastic pipes: Rocks no larger than 3/4 inch diameter. Select fill material specified in Section 02204 are acceptable, however same size limits apply.

- f) Corrugated metal pipe: Rocks no larger than 1-1/2 inch diameter. Select fill materials specified in Section 02204 are acceptable, however same size limits apply.

2.13 BACKFILL

- A. Class "A" Backfill
 - 1. All trenches under roadways, driveways, and other paved areas, or when required.
 - 2. Backfill the trench above the "pipe zone" with approved excavated trench materials. Place in 6 inch layers and compact by means of mechanical tampers or vibratory compactors to a minimum of 96 percent average with nothing less than 92 percent of maximum dry density.
 - 3. Backfill trenches under structural element in accordance with this Section.
- B. Class "B" Backfill
 - 1. Mechanically Compacted Alternative. Backfill the trench above the "pipe zone" with approved excavated trench materials. Place in layers not more than 12 inches thick, compacting each layer by means of mechanical tampers or vibratory compactors to a minimum of 92 percent average with nothing less than 90 percent of maximum dry density.
- C. Class "C" Backfill
 - 1. Backfill all trenches in landscaped or framed areas, or when required.
 - 2. Backfill the trench above the "pipe zone" with approved trench materials. Place in 12 inch layers and compact by means of mechanical tampers or vibratory compactors to a minimum of 90 percent average with nothing less than 88 percent of maximum dry density.
- D. Class "D" Backfill
 - 1. Backfill all trenches as required.
 - 2. Backfill entire trench with suitable material to a point above the existing ground surface or the finish grade.
 - 3. Compact by wheel rolling as backfilling proceeds, and leave mounded for settlement. Rake or blade to match the ground surface adjacent to the trench after completion of compaction.
 - 4. Maintain the surface of the backfilled trench level with the existing grade by additions of topsoil, as directed, until final surface is completed, or the entire project is accepted.

3.9 RESTORING OF LANDSCAPED AREAS

- A. Replace sod, shrubs, fences, or other items removed from within the landscaped areas to pre-construction conditions and remove rocks, dirt, or any debris that remain from the construction.
- B. In lieu of removing and replacing the sod, obtain an agreement with the property owner to have him replace the landscaping or pay the property owner to replant the landscaping. Document such agreements in a final letter of release from the property owner.
- C. Maintain all vegetation planted until release by the Engineer.

END OF SECTION