

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 31 23 16 – Excavation and Fill
- B. Section 31 23 23 – Trenching, Backfilling, and Compacting for Utilities
- C. Section 31 23 26 – Trenching and Backfilling for Pipelines
- D. Section 31 05 16 – Aggregate Subbase
- E. Section 31 20 00 – Earth Moving
- F. Section 33 05 13 – Utility Structures
- G. Section 31 23 00 – Excavation and Backfilling for Structures
- H. Section 01 33 00 – Submittal Procedures
- I. Section 01 45 00 – Quality Control

1.2 REFERENCES, CODES, AND STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 2. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 - 3. ASTM D2167 – Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method
 - 4. ASTM D2922 – Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods
 - 5. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
 - 6. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort
 - 7. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods
- B. Occupational Safety and Health Administration (OSHA)
 - 1. OSHA 29 CFR 1926 Subpart P – Excavations
- C. American Public Works Association (APWA)
 - 1. APWA Standard Specifications for Public Works Construction
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 70 – National Electrical Code (for trenching near electrical installations)
- E. International Code Council (ICC)
 - 1. International Building Code (IBC), latest edition
- F. Local, State, and Federal Codes
 - 1. All applicable local municipal codes and ordinances for excavation, trenching, and backfilling operations

G. U.S. Green Building Council (USGBC)

H. Other Industry Standards

1. Manual on Uniform Traffic Control Devices (MUTCD) for work zone safety

1.3 DEFINITIONS

- A. Trench: A narrow excavation made below the surface of the ground, usually deeper than it is wide, to install utilities or other infrastructure.
- B. Backfill: Material used to refill an excavation or trench after installation of utilities or structures.
- C. Bedding: The layer of material placed in the trench bottom to provide a stable base for pipes or structures.
- D. Compaction: The process of densifying soil or backfill material to reduce voids and increase strength.

1.4 QUALITY ASSURANCE

- A. Contractor Qualifications:
 - 1. Contractor shall have a minimum of five (5) years documented experience in trenching and backfilling similar in scope and complexity.
 - 2. Contractor shall maintain compliance with OSHA excavation and trenching safety requirements.
- B. Testing Laboratory:
 - 1. Engage an independent testing laboratory to perform soil compaction and moisture content tests in accordance with ASTM standards specified.
- C. Inspection and Testing:
 - 1. Soil classification, moisture content, and compaction density shall be verified and documented prior to backfilling.
 - 2. Compaction tests shall be performed at intervals not less than one test per 500 square feet or per 100 linear feet of trench, whichever is greater.
 - 3. Testing frequency and methods shall comply with ASTM standards D1556, D2922, and D6938.
- D. Safety:
 - 1. Comply with OSHA 29 CFR 1926 Subpart P for excavation and trench safety, including protective systems such as shoring, shielding, or sloping.
 - 2. Provide traffic control measures per MUTCD standards where trenching impacts public roadways or pedestrian paths.

1.5 SUBMITTALS

- 1. Action Submittals:
 - a. Product Data: Submit manufacturer's data on bedding and backfill materials including gradation, physical properties, and compaction characteristics.

- b. Project-Specific Soil Report: Submit geotechnical report including soil classification and recommendations for trenching and backfill.
 - c. Work Plan: Submit detailed trenching and backfilling sequence and safety plan including shoring methods and traffic control.
 - d. Testing Plan: Submit proposed schedule and methods for compaction and density testing.
- 2. Informational Submittals:
 - a. Test Reports: Submit compaction and density test results with location, date, and compliance verification.
 - b. Safety Documentation: Submit OSHA trenching safety compliance records and inspection logs.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Delivery:
 - a. Deliver bedding and backfill materials in dry, clean condition free from contamination, organic matter, or frozen lumps.
 - b. Deliver materials in quantities to prevent delay and excessive stockpiling on site.
- B. Storage:
 - a. Store materials on-site in designated areas protected from weather, contamination, and segregation.
 - b. Segregate different types of materials to prevent mixing and contamination.
- C. Handling:
 - a. Handle materials to prevent contamination or degradation.
 - b. Avoid mixing of materials during transport and placement.
 - c. Use equipment suitable for trenching and backfilling operations to minimize damage to installed utilities and structures.

1.7 WARRANTIES

- A. Contractor shall warrant trenching and backfilling work against defective workmanship and materials for a period of one (1) year from date of Substantial Completion.
- B. Warranty shall include repair or replacement of settled backfill areas, improperly compacted zones, or other defects resulting from trenching and backfilling operations.
- C. Provide manufacturer's warranty for any proprietary backfill or bedding materials incorporated, if applicable.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Bedding Material:

1. Clean, uniformly graded sand or granular material conforming to ASTM C33 or project-specific gradation requirements.
 2. Particle size distribution shall ensure proper pipe support and prevent pipe movement.
- B. Backfill Material:
1. Select suitable native soil free from organic material, debris, frozen lumps, and rocks larger than 2 inches unless otherwise specified.
 2. Imported backfill shall meet project gradation and compaction requirements, conforming to ASTM D2487 classifications SC, SM, or GW as applicable.
 3. Controlled low-strength material (flowable fill) may be used in specified trench zones as directed.
- C. Controlled Low-Strength Material (CLSM):
1. CLSM shall be a flowable, self-compacting mixture of cement, fly ash, sand, and water with compressive strength between 50 and 150 psi.
 2. Mix design must be submitted for approval prior to use.
- D. Geotextiles and Filters:
1. Use non-woven geotextiles for separation and filtration where indicated.
 2. Conform to ASTM D3786 and project-specific strength and permeability requirements.

2.2 MANUFACTURERS

- A. Bedding and Backfill Materials Suppliers:
1. Vulcan Materials Company
 2. Martin Marietta Materials
 3. CEMEX Inc.
 4. LafargeHolcim
 5. Local approved aggregate producers meeting specification requirements
- B. Controlled Low-Strength Material (CLSM) Providers:
1. US Concrete
 2. Oldcastle Materials
 3. Holcim (US) Inc.
- C. Geotextile Manufacturers:
1. TenCate Geosynthetics
 2. Huesker, Inc.
 3. Propex Operating Company, LLC
 4. Nilex Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify trench dimensions and alignment comply with contract drawings and specifications before excavation.
- B. Inspect site conditions, including existing utilities and obstructions, and verify location and depth.
- C. Confirm soil conditions and moisture content are suitable for trenching and backfilling.
- D. Notify Architect/Engineer of unsatisfactory conditions prior to proceeding.

3.2 PREPARATION

- A. Locate and protect existing utilities and structures adjacent to trenching activities.
- B. Establish traffic control and safety barriers per MUTCD and OSHA requirements.

3.3 TRENCH EXCAVATION

- A. Excavate trenches to required depth, width, and alignment to accommodate utilities and bedding materials.
- B. Excavation shall be performed in accordance with OSHA protective system requirements to ensure worker safety.
- C. Remove unsuitable or unstable material encountered in the trench bottom and replace with approved bedding or structural fill.
- D. Maintain trench bottom in a smooth, uniform plane to provide continuous support.

3.4 BEDDING INSTALLATION

- A. Place bedding material in trench bottom to minimum thickness specified or as recommended by Engineer.
- B. Compact bedding material lightly to provide uniform support without damaging utilities.
- C. Maintain moisture content of bedding material within 2% of optimum moisture for compaction.

3.5 UTILITY INSTALLATION

- A. Install utility pipes, conduits, or structures in trench in accordance with manufacturers' recommendations and project drawings.
- B. Verify invert elevations and alignment prior to backfilling.
- C. Protect installed utilities from damage during backfilling operations.

3.6 BACKFILLING

- A. Backfill trenches with approved material placed in layers not exceeding 8 inches loose thickness.
- B. Compact each layer to at least 95% of maximum dry density as determined by ASTM D698 or project-specific compaction criteria.

- C. Maintain moisture content within 2% of optimum for compaction for each lift.
- D. Do not operate heavy equipment directly on freshly backfilled trenches until adequate compaction and curing have been achieved.
- E. Where specified, use CLSM in lieu of conventional backfill and allow curing to required strength before load application.
- F. Install geotextile separators or filters as indicated or directed.

3.7 FIELD QUALITY CONTROL

- A. Perform in-place density testing at frequencies specified in Part 1.4.3.
- B. Re-compact or replace backfill material failing to meet compaction or moisture requirements.
- C. Document all testing results and corrective actions.

3.8 PROTECTION

- A. Protect completed trench backfill from erosion, settlement, or damage until final surface restoration.
- B. Maintain erosion control measures throughout construction period.
- C. Repair or replace any damaged backfill or surfaces caused by settlement or construction activity.

3.9 CLEANING

- A. Remove excess materials, debris, and equipment from trenching and backfilling operations.
- B. Leave site in a neat and orderly condition.

END OF SECTION 31 23 33