

## SECTION 312005 TRENCHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Excavating and backfilling trenches for utilities and pits for buried utility structures.

- B. Related Sections:

- 1. Division 01 Section "Temporary Environmental Controls" for temporary controls, utilities, and support facilities; also for temporary site fencing if not in another Section.
  - 2. Division 26 and 33 Sections as applicable for installing underground plumbing and electrical utilities.
  - 3. Division 31 Section "Earthwork" for soil types and earth moving.

#### 1.3 DEFINITIONS

- A. Utility: Any buried or above ground piping, conduit, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of the following manufactured products required:

- 1. Warning tapes.

## 1.5 PROJECT CONDITIONS

- A. Existing Utilities: A diligent attempt has been made to indicate on the Drawings the locations of utilities which may affect the Work. Utility locations are based on information provided by the Owner and limited above grade site observation. The locations of indicated utilities shall be considered approximate only until exposed by the Contractor.
  - 1. Maintain existing utilities in constant service during construction of the Work.
  - 2. Utility Locator Service: Notify utility locator service for area where Project is located before beginning trenching operations.
- B. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during trenching operations.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- C. Do not commence trenching operations until temporary erosion and sedimentation control measures are in place.
- D. Do not commence earth moving operations until plant and landscape protection measures are in place.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. The acceptance of borrowed soil materials shall be subject to review and approval by the architect.
- B. Satisfactory Soils:
  - 1. Soil Type S1: Excavated and re-used material, graded, free of lumps larger than 3 inches, rocks larger than 2 inches, and debris.
  - 2. Soil Type S2: Excavated and reused material, graded, free of roots, lumps greater than one inch, rocks larger than ½ inch, debris, weeds and foreign matter.
  - 3. Soil Type S3: Imported topsoil, friable loam; reasonably free of roots, rocks larger than ½ inch, debris, weeds, and foreign matter.
  - 4. Soil Type S4: Imported borrow, suitable for purposes intended, free of vegetable matter and other unsatisfactory material, with minimum R value of 10.
- C. Sand: ASTM C 33; fine aggregate.

## 2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.
  - 1. Detectable Warning Tape: Provided detectable warning tape for underground utilities that would otherwise not be detectable by above ground utility locating methods. Detectable warning tape shall include metallic core encased in a protective jacket for corrosion protection and be detectable by a metal detector when tape is buried up to 30 inches deep.
  - 2. Colors: Warning tape shall be colored as follows:
    - a. Red: Electric.
    - b. Yellow: Gas.
    - c. Orange: Telephone and other communications.
    - d. Blue: Water systems.
    - e. Green: Sewer systems.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by trenching operations.
- B. Locate, identify, and mark existing underground utilities.
- C. Protect plant life, lawns, trees, shrubs, and other features not authorized for removal.
- D. Protect and maintain erosion and sedimentation controls during trenching operations.
- E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.
- F. Comply with all provisions of the Construction Safety Orders and General Safety Orders of the California Division of Industrial Safety, as well as all other applicable regulations as they pertain to the protection of workers from the hazard of caving ground in excavations.
- G. Prevent surface water and ground water from entering excavations and from flooding Project site and surrounding area. Protect excavations from softening and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

### 3.2 EXCAVATION FOR UTILITY TRENCHES

- A. Provide protection for all open excavations, backfill trenches on same day in which excavation occurs to avoid leaving excavations open overnight.
- B. Excavate trenches to lines, depths, and widths required for installation of utilities.
- C. Cut trenches just wide enough to enable installation of utilities and proper backfill, and to allow inspection.
- D. Employ equipment and methods appropriate to the work site. Small mechanical excavators may be used only in areas where there is sufficient space so as not to damage adjacent improvements, and where the locations of all existing utilities have been determined.
- E. Use hand excavation methods to locate and expose existing utilities along the route of the new work prior to using any mechanical equipment. If mechanical equipment is allowed at a particular location, it may only be used after the completion by the Contractor of a successful exhaustive search by hand methods to locate all existing facilities as indicated on the plans, and as indicated on the ground by utility locating service or Owner.
- F. When excavating through tree roots, perform work by hand and cut roots, where authorized, with a saw.
- G. Excavate trenches to provide not less than the minimum cover required.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. Hand trim excavations for bell and spigot pipe joints. Remove loose matter.
- J. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- K. Excavate trenches, pits or holes bottoming in hardpan to a minimum of 6 inches below the grade for the bottom of the pipe and any couplings, and then backfill to the pipe grade with satisfactory soil material, thoroughly compacted. No additional payment will be made for such over-excavation and refill.
- L. In trenches where a firm foundation is not encountered, such as soft, spongy, or otherwise unsuitable material, remove the material to a minimum of 12 inches below the bottom of the proposed pipe or structure, or to a depth determined by the Engineer, and backfill the space with satisfactory soil material containing sufficient moisture to produce maximum compaction. No additional payment will be made for such additional excavation or backfill.
- M. Stockpile excavated material to be returned to trench adjacent to trench in location which will not be detrimental to existing improvements, trees, or pedestrian or vehicular

traffic. Cover to prevent windblown dust. Remove unsuitable or excess material not being used, from site.

### 3.3 BACKFILL FOR UTILITY TRENCHES

- A. Prior to placing backfill in excavations, complete the following:
  - 1. Survey locations of underground utilities for Record Documents.
  - 2. Test and inspect underground utilities.
  - 3. Remove trash and debris.
  - 4. Remove temporary shoring and bracing.
- B. Backfilling and Compaction: Carefully place and compact backfill of satisfactory soil materials as follows:
  - 1. Initial Backfill: Place initial backfill of satisfactory soil free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit. Carefully compact initial backfill evenly on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit.
  - 2. Subsequent Backfill: Place backfill of satisfactory soil material in layers not more than 8 inches in loose depth and carefully compact.
  - 3. Final Backfill: Place final backfill in thickness required, but not more than 8 inches, to achieve final subgrade elevation after compaction and as required for grading.
  - 4. Compaction: Compact soil using hand operated tampers or lightweight power operated tamping equipment that will not damage or displace installed utilities. Compact each layer of backfill to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
    - a. Turf or Unpaved Areas: 85%.
    - b. Areas Under Paving: 93% for the top 24 inches below the subgrade elevation, 85% for depths over 24 inches below the subgrade elevation.
- C. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Division 03 Section "Cast-in-Place Concrete."
- D. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.
- E. Soil Moisture Control: Uniformly moisten or aerate soil materials before compaction to within 2 percent of optimum moisture content.
  - 1. Do not over moisten or flood trenches to move or settle soil materials.
  - 2. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

3. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.
- F. Grading: Uniformly grade areas to be smooth and flush with adjacent grade free of irregular or abrupt surface changes. Provide final grading in turf or landscaped areas where no further grading will occur.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test each fill or backfill layer. Proceed with subsequent Work only after test results for previously completed work comply with requirements.
- C. Testing agency will test compaction of soils in place according to ASTM D 1557. Tests will be performed at the following locations and frequencies:
  1. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length, but no fewer than two tests.
- D. When testing agency reports that backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

### 3.5 PROTECTION

- A. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION