



## **SECTION 315000 – EXCAVATION SUPPORT AND PROTECTION**

### **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.

The purpose of this Section is to define the minimum acceptable criteria for excavation support and protection systems designed by the Contractor.

#### **1.2 SUMMARY**

- A. This Section includes design, installation and monitoring of excavation support, and protection systems.
- B. Related Sections include the following:
- 1) Division 33 Section: Utilities – Common Work Results.
  - 2) Division 33 Section: Location of Underground Utilities.

#### **1.3 SUBMITTALS**

- A. General: The Contractor shall prepare and submit to the Construction Manager working drawings and design calculations describing the excavation support system, or systems that will be used in their place, on the project. Geotechnical design criteria and assumed loading conditions for support of excavation design are provided in the Contract Documents. The Contractor's working drawings and design calculation shall be submitted 30 calendar days prior to the commencement of work.

The Construction Manager will review the submittal for conformance with the Contract Documents, and approve or reject the submittal. Work cannot commence until the Construction Manager has approved the submittal.

- B. Work Plan: Prior to installation of the excavation support system, provide a work plan detailing loads, materials and equipment to be used; method, sequence and timing of installation, tensioning and testing of tie-backs. The plan must show relationship of work sequences to locations of rock discontinuities.
- C. Shop Drawings: Shop drawings for excavation support and protection systems shall be prepared by or under the supervision of a qualified Professional Engineer registered in the State of California, and:
- 1) Shop drawings and calculations shall be signed and sealed by a qualified Professional Engineer registered in the State of California. Shop drawings shall include:



- a) The location and spacing of tiebacks: their size, inclination and depth with bonded and un-bonded length, and details of their composition including anchors and facing reinforcement, all supported by design calculations.
  - b) Details of soldier pile and lagging system: soldier pile dimensions, method of installation, dimensions and composition of lagging boards, all supported by design calculations.
- 2) Provide sequence of construction and maintenance of obstructed traffic.
  - 3) Indicate materials and methods of construction.
- D. Qualification Data: For firms and persons specified in the "QUALITY ASSURANCE" article, include a list of completed projects with project names and addresses, names and addresses of engineers, architects, and owners, and other information as specified.
- E. Quality Control: The Contractor shall prepare procedures for the Contractor's Quality Control Plan and Program (CQC) as defined in Part 4, and submit the CQC to the Construction Manager for approval. At minimum, the submittal shall describe in detail the procedures required to complete the elements listed in Paragraphs 1.4 and Part 4 of this section.
- F. Photographs or videotape: Document existing conditions of adjoining construction and site improvements prior to construction that might be misconstrued as damage caused by excavation support and protection systems.
- G. Product data for each type of product specified.
- H. Mill test reports signed by manufacturers certifying that their products comply with the following requirements:
- 1) Structural steel, including chemical and physical properties.
  - 2) Bolts, nuts, and washers, including mechanical properties and chemical analysis.
  - 3) Shear stud connectors.
  - 4) Shop primers.
  - 5) Non-shrink grout.
  - 6) Tiebacks anchors.
- I. The Contractor shall prepare and submit to the Construction Manager calibration data for each test jack, pressure, and master pressure gauge that will be used on the project. Calibration tests shall be performed by an independent commercial testing laboratory within 60 calendar days of the submittal date.

The Construction Manager will review the submittal for conformance with the Contract Documents, and approve or reject the submittal. Testing cannot commence until the Construction Manager has approved the submittal.

- J. The Contractor shall prepare and submit to the Construction Manager a contingency plan describing steps and actions required to stabilize the support of excavation systems and excavation if the monitoring data indicate movements exceeding the limiting values. The contingency plan shall also list contingency materials and equipment to be kept available onsite.



- K. Daily Reports: The Contractor shall submit a daily report to the Construction Manager within 24 hours of completion of each day's work for tieback installation. The daily report shall contain the following information:
- 1) Detailed drilling records including depth to rock and quality of rock.
  - 2) Grouting records indicating the cement type and quantity injected.
  - 3) Load test results and graphs.
  - 4) Sketch showing locations and lengths of tiebacks installed, and identifying any deviations from the approved shop drawings.
  - 5) Other information as requested by the Construction Manager.
- L. Summary Report: The Contractor shall submit a report to the Construction Manager within 14 calendar days after completion of tieback installation. The report shall contain the following information:
- 1) As-built drawings showing the locations and lengths of all tiebacks installed, and any deviations from the approved shop drawings.
  - 2) Steel manufacturer's mill test reports for the steel components incorporated in the installation performance requirements.
- M. Design, provide, install, monitor, and maintain an excavation support and protection system capable of resisting soil and hydrostatic pressure. Unless provisions for drainage are made, surcharge loads from airport traffic, construction equipment, or existing structures, and supporting sidewalls of excavations shown on the Contract Drawings.
- 1) Work includes removing excavation support and protection systems when no longer needed as approved by the Construction Manager.
  - 2) Prevent surface water from entering excavations by grading, dikes, localized pumping or other means approved by the Construction Manager.
  - 3) Install excavation support and protection systems without damaging existing buildings, utilities, pavements, and other improvements adjacent to excavation.
- N. Structural design shall be governed by the current editions of the following codes, and other applicable codes:
- 1) AISC Manual of Steel Construction, Allowable Stress Design, 9<sup>th</sup> Edition, 1989, including Supplement No. 1, 2001.
  - 2) AWS; D1.1, Structural Welding Code - Steel, 2000 Edition.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer—with a minimum of 5 years documented experience—to assume engineering responsibility and perform work described in this Section. Installer must have specialized experience with installing excavation support and protection systems similar to those required for this Project and with a record of successful in-service performance.
- B. Professional Engineer Qualifications: Professional Engineer must be legally qualified to practice in the State of California, and experienced in providing engineering services for



designing excavation support and protection systems similar to those indicated for this Project in material, design, and extent.

- 1) **Engineering Responsibility:** Engage a qualified Professional Engineer to prepare or supervise the preparation of data for the excavation support and protection system. This includes drawings and comprehensive engineering analysis that shows the system's compliance with specified requirements.
- C. **Geotechnical Engineer/Engineering Geologist Qualifications:** The Contractor shall retain a Geotechnical Engineer/Engineering Geologist, licensed in the State of California, having the following qualifications and responsibilities:
- 1) **Education:** Graduate engineer from an accredited U.S. College, university or foreign equivalent.
  - 2) **Experience:** Minimum 5 years combined field and design experience in soft ground and rock utilizing cut-and-cover techniques for excavation and support and excavation support techniques as specified herein.
  - 3) **Construction Manager** must approve Geotechnical Engineer/Engineering Geologist in writing before fieldwork commences.
  - 4) **Duties include:**
    - a) Supervising cut-and-cover excavation to ensure safety and quality of construction.
    - b) Devising and implementing additional local support measures as required by ground conditions or directed by the Construction Manager; coordinating remedial measures when ground instability occurs, or when appears likely.
    - c) Daily assessment of ground condition; adequacy of the excavation and support system; and written records for Construction Manager review. If unexpected serious conditions are encountered, report immediately, including suggested additional measures for Construction Manager approval. Report in writing on conditions encountered and actions taken by the end of shift.
    - d) Submitting daily reports on geologic conditions as encountered during excavation, including record of daily discussion. The geologic report shall include geologic mapping of the face. The excavation walls shall be mapped daily. All unusual or unexpected geologic features and occurrences shall be mapped and reported to the Construction Manager by end of shift, and no later than 8 hours.
    - e) The Geotechnical Engineer/Engineering Geologist shall inspect, determine, and record the following information, pertaining to the excavation walls upon completion of excavation of each lift or section, but before installation of support measures:
      - i. Type of soil or rock strata encountered.
      - ii. Location of lift or section identified by station and elevation.
      - iii. General degree of weathering of rock mass, if encountered.
      - iv. Any water inflows, estimated by flow rate timed containers.
      - v. Over-breaks.
      - vi. Any other geological structures or features that may be significant.