SECTION 31 50 00 – excavation support and protection

1. General
   1. SUMMARY
      1. Section includes temporary excavation support and protection systems.
      2. Related Requirements:
         1. Section 31 20 00 – Earth Moving for excavating and backfilling, for controlling surface-water runoff and ponding, and for dewatering excavations.
   2. PREINSTALLATION MEETINGS

Retain "Preinstallation Conference" Paragraph below if Work of this Section is extensive or complex enough to justify a conference.

* + 1. Preinstallation Conference: Conduct pre-excavation conference at Project site.

If needed, insert list of conference participants not mentioned in Section 01 31 00 – Project Management and Coordination.

Retain one or more subparagraphs below if additional agenda items specific to Project are required but not mentioned in Section 01 31 00 – Project Management and Coordination; revise to suit Project.

* + - 1. Review geotechnical report.
      2. Review existing utilities and subsurface conditions.
      3. Review coordination for interruption, shutoff, capping, and continuation of utility services.
      4. Review proposed excavations.
      5. Review proposed equipment.
      6. Review monitoring of excavation support and protection system.
      7. Review coordination with waterproofing.
      8. Review abandonment or removal of excavation support and protection system.
  1. ACTION submittals

Delete "Product Data" Paragraph below if Contractor designs temporary excavation support and protection. Retain paragraph if the design responsibility for excavation support and protection remains with the design professional, such as for permanent installations or if the design professional imposes important product requirements. Revise to suit Project.

* + 1. Product Data: For each type of product.
       1. Include construction details, material descriptions, performance properties, and dimensions of individual components and profiles, and calculations for excavation support and protection system.

Delete "Shop Drawings" Paragraph below if Contractor designs the excavation support and protection system.

* + 1. Shop Drawings: For excavation support and protection system, prepared by or under the supervision of a qualified professional engineer.
       1. Include plans, elevations, sections, and details.
       2. Show arrangement, locations, and details of soldier piles, piling, lagging, tiebacks, bracing, and other components of excavation support and protection system according to engineering design.
       3. Indicate type and location of waterproofing.
       4. Include a written plan for excavation support and protection, including sequence of construction of support and protection coordinated with progress of excavation.

Retain "Delegated-Design Submittal" Paragraph below if design services have been delegated to Contractor and if excavations exceed 5 feet (1.524 m) in depth.

* + 1. Delegated-Design Submittal: For excavation support and protection systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  1. INFORMATIONAL SUBMITTALS

Coordinate "Qualification Data" Paragraph below with qualification requirements in Section 01 40 00 – Quality Requirements.

* + 1. Qualification Data: For the following:
       1. Land surveyor.

Retain subparagraph below if design services have been delegated to Contractor and if excavations exceed 5 feet (1.524 m) in depth.

* + - 1. Professional Engineer: Experience with providing delegated-design engineering services of the type indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.

Retain "Contractor Calculations" Paragraph below if design services have been delegated to Contractor and if excavations exceed 5 feet (1.524 m) in depth. Delete paragraph if Owner's design professional designs the excavation support and protection system, which is less common.

* + 1. Contractor Calculations: For excavation support and protection system. Include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

Usually retain "Existing Conditions" Paragraph below for determining the effect of excavation support and protection system on permanent construction.

* + 1. Existing Conditions: Using photographs or video recordings, showing existing conditions of adjacent construction and site improvements that might be misconstrued as damage caused by inadequate performance of excavation support and protection systems. Submit before Work begins.
  1. CLOSEOUT SUBMITTALS

Revise "Record Drawings" Paragraph below to suit Project. Coordinate with Section 01 77 00 – Closeout Procedures.

* + 1. Record Drawings: Identify locations and depths of capped utilities, abandoned-in-place support, and protection systems, and other subsurface structural, electrical, or mechanical conditions.
  1. FIELD CONDITIONS

Retain "Interruption of Existing Utilities" Paragraph below if interruption of existing utility service is required.

* + 1. Interruption of Existing Utilities: Do not interrupt any utility-serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
       1. Notify Consultant and Owner no fewer than three (3) days in advance of proposed interruption of utility.
       2. Do not proceed with interruption of utility without Consultant's written permission.
    2. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. Products
   1. PERFORMANCE REQUIREMENTS

Revise this article according to requirements of authorities having jurisdiction and customary practice in Project's location.

Retain "Delegated Design" Paragraph below if Contractor is required to assume responsibility for design.

* + 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 – Quality Requirements, to design excavation support and protection systems to resist all lateral loading and surcharge, including but not limited to, retained soil, groundwater pressure, adjacent building loads, adjacent traffic loads, construction traffic loads, material stockpile loads, and seismic loads, based on the following:
       1. Compliance with OSHA Standards and interpretations, 29 CFR 1926, Subpart P.
       2. Compliance with requirements of authorities having jurisdiction.
       3. Compliance with utility company requirements.
       4. Compliance with railroad requirements.
  1. MATERIALS

Retain one or more paragraphs in this article if prescribing excavation support and protection system requirements or for permanent installations; insert other requirements if required. Delete article if Contractor designs temporary excavation support and protection.

* + 1. Provide materials that are either new or in serviceable condition.

Paragraphs below are examples of materials commonly used; revise to suit Project.

* + 1. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.
    2. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

Before retaining, verify availability, with sheet piling manufacturer, of second option in "Corners" Subparagraph below.

* + - 1. Corners: [Site-fabricated mechanical interlock] [Roll-formed corner shape with continuous interlock].
    1. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of [size and strength required for application] [3 inches (75 mm)] [4 inches (100 mm)] <Insert dimension>.

Retain "Shotcrete" Paragraph below if using shotcrete as lagging between soldier piles.

* + 1. Shotcrete: Comply with Section 03 37 13 – Shotcrete for shotcrete materials and mixes, reinforcement, and shotcrete application.

Retain "Cast-in-Place Concrete" and "Reinforcing Bars" paragraphs below if miscellaneous concrete is required for structural-steel soldier-pile toe and bracing heel blocks.

* + 1. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.
    2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

Retain one of two "Tiebacks" paragraphs below for tieback materials.

* + 1. Tiebacks: Steel bars, ASTM A 722/A 722M.
    2. Tiebacks: Steel strand, ASTM A 416/A 416M.

1. Execution
   1. preparation
      1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.
         1. Shore, support, and protect utilities encountered.
   2. INSTALLATION - GENERAL
      1. Locate excavation support and protection systems clear of permanent construction, so that construction and finishing of other work is not impeded.
      2. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
         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 authorities having jurisdiction.
      3. Install excavation support and protection systems without damaging existing buildings, structures, and site improvements adjacent to excavation.
   3. SOLDIER PILES AND LAGGING
      1. Install steel soldier piles before starting excavation.
         1. Extend soldier piles below excavation grade level to depths adequate to prevent lateral movement.
         2. Space soldier piles at regular intervals not to exceed allowable flexural strength of wood lagging.
         3. Accurately align exposed faces of flanges to vary not more than [2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment] <Insert tolerances>.
      2. Install wood lagging within flanges of soldier piles as excavation proceeds.
         1. Trim excavation as required to install lagging.
         2. Fill voids behind lagging with soil, and compact.
      3. Install wales horizontally at locations indicated on Drawings and secure to soldier piles.
   4. SHEET PILING

Retain this article if driven sheet piling is required.

* + 1. Before starting excavation, install one-piece sheet piling lengths and tightly interlock vertical edges to form a continuous barrier.
    2. Accurately place the piling using templates and guide frames unless otherwise recommended in writing by the sheet piling manufacturer.
       1. Limit vertical offset of adjacent sheet piling to 60 inches (1500 mm).
       2. Accurately align exposed faces of sheet piling to vary not more than [2 inches (50 mm) from a horizontal line and not more than 1:120 out of vertical alignment] <Insert tolerances>.
    3. Cut tops of sheet piling to uniform elevation at top of excavation.
  1. TIEBACKS

Most tieback systems are proprietary. Insert material requirements in Part 2 if a particular tieback is required. If tiebacks are permanent, consider requiring corrosion protection of tendons and anchorage connections.

* + 1. Drill, install, grout, and tension tiebacks.
    2. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.
       1. Have test loading observed by a qualified professional engineer responsible for design of excavation support and protection system.
    3. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.
  1. BRACING

Bracing of wales may be required for soldier piles and lagging systems and for sheet piling.

* + 1. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.
       1. Do not place bracing where it will be cast into or included in permanent concrete work unless otherwise approved by Consultant.
       2. Install internal bracing if required to prevent spreading or distortion of braced frames.
       3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.
  1. MAINTENANCE
     1. Monitor and maintain excavation support and protection system.
     2. Prevent surface water from entering excavations by grading, dikes, or other means.
     3. Continuously monitor vibrations, settlements, and movements to ensure stability of excavations and constructed slopes and to ensure that damage to permanent structures is prevented.
  2. FIELD QUALITY CONTROL
     1. Survey-Work Benchmarks: Resurvey benchmarks weekly during installation of excavation support and protection systems, excavation progress, and for as long as excavation remains open.
        1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.
        2. Promptly notify Consultant if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.
     2. Promptly correct detected bulges, breakage, or other evidence of movement to ensure that excavation support and protection system remains stable.
     3. Promptly repair damages to adjacent facilities caused by installation or faulty performance of excavation support and protection systems.
  3. REMOVAL AND REPAIRS

Retain first paragraph below if removal of excavation support and protection systems is required.

* + 1. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and earth and hydrostatic pressures.
       1. Remove in stages to avoid disturbing underlying soils and rock or damaging structures, pavements, facilities, and utilities.
       2. Fill voids immediately with approved backfill compacted to density specified in Section 31 20 00 – Earth Moving.
       3. Repair or replace, as approved by Consultant, adjacent work damaged or displaced by removing excavation support and protection systems.

Retain paragraph below if excavation support and protection system will be left in place.

* + 1. Leave excavation support and protection systems permanently in place.

END OF SECTION