

SECTION 02250 – LATERAL EARTH SUPPORT

PART 1 - GENERAL

1.01 GENERAL

- A. Coordinate work with that of all other trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION

- A. The Work specified in this Section includes design, furnishing, and installation of temporary excavation support systems as necessary to conduct the work and protect adjacent structures.
 - 1. Unless otherwise indicated on the drawings, the excavation support systems may be comprised of soldier piles and lagging, steel or timber sheet piling or other systems designed by the CONTRACTOR and reviewed by the ENGINEER. Timber sheet piling support of excavation systems shall not be used for excavations greater than 20 ft in depth.
- B. Following construction, support of excavation system elements shall be removed in accordance with the requirements stated herein.
- C. The system shall be designed to limit the total movement of the system, including lateral deflection, specifically adjacent to the office building and parking garage elevator pits, pile caps and grade beams located in the southeast corner of the parking garage, and adjacent to the storm drain and 36-in. diameter sewer in Somerset Street. The CONTRACTOR is solely responsible for the health and safety of the work specified in this Section.
- D. Geotechnical Instrumentation shall be installed by the CONTRACTOR on the excavation support system to monitor lateral and vertical movements of the system. The CONTRACTOR is responsible for installing and surveying the reference points on the top of the support of excavation system as well as summarizing and providing data to the ENGINEER.
- E. Take all measures necessary to protect the occupants and operations of the existing facilities from dust, excess noise, vibrations or other impacts of the construction.

1.03 RELATED WORK

- A. Section 02010: Existing Subsurface Data
- B. Section 02110: Handling Contaminated Soils
- C. Section 02200: Site Preparation
- D. Section 02220: Demolition
- E. Section 02240: Dewatering
- F. Section 02300: Earthwork
- G. Section 02380: Foundation Piles

1.04 DEFINITIONS AND REFERENCES

- A. American Society of Testing and Materials (ASTM):
 - 1. A36: Standard Specification for Structural Steel.
 - 2. A416: Specification for Uncoated Seven-Wire Stress-Relieved Steel Strand for Prestressed Concrete.
 - 3. A722: Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete.
 - 4. A615: Standard Specifications for Deformed and Plain Billet- Steel Bars for Concrete Reinforcement.
- B. American Wood-Preservers Association (AWPA) Standards.
- C. American Welding Society (AWS) Code: D1.1.
- D. Federal Standard, FS TT-W-S71: Wood Preservation and Treating Practices.
- E. Occupational Safety and Health Administration (OSHA) Standards and Interpretations: Subpart P - Excavations, Trenching, and Shoring, current edition.
- G. American Concrete Institute (ACI)
 - 1. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete
- H. OWNER: BAYCO, LLC.
- I. ENGINEER: Authorized representatives of the OWNER. For the work covered under this Section, this term will include Haley & Aldrich, Inc.

1.05 JOB CONDITIONS

- A. Refer to Section 02010 for available information on existing subsurface conditions.
- B. Prior to submitting their bid, the CONTRACTOR shall review and understand the information provided herein and the information outlined in Section 02010. The subsurface information is made available to the CONTRACTOR for informational purposes only and shall not be interpreted as a warranty of subsurface conditions whether interpreted from written text, boring logs or other data.
- C. Below-Grade Utilities and Obstructions
 - 1. The CONTRACTOR is advised that the near surface, in-situ fill soils may contain cobbles, boulders and man-made structures, which may include, but are not limited to, granite blocks, cobbles, former utilities and foundations, rail lines, previous earth support systems and other structures which may interfere with support of excavation installation, excavation, pile installation and new construction, and may require removal. These items will not be considered obstructions and shall be removed as needed at no additional cost to the OWNER. Historic Sanborn Maps of the site showing locations of previous structures

on the site have been provided for CONTRACTOR consideration (see Attachment A, Section 02010).

2. Cobbles and boulders within the naturally deposited soils will not be considered obstructions.
3. Refer to the site civil plans for locations of utilities to remain, to be relocated, or to be removed.

1.06 QUALITY ASSURANCE

- A. Prepare design, including calculations and drawings, under the direction of a Professional Engineer licensed in the State of Maine.
- B. Qualifications of Support of Excavation System Designer:
 1. Shall be a Professional Engineer licensed in the State of Maine specializing in geotechnical construction.
 2. Support of Excavation system designer shall stamp and sign all support of excavation system calculations, details, and drawings.
- C. Install all support of excavation systems under the supervision of a specialist having the following qualifications:
 1. Not less than five (5) years experience in the design and installation of systems of similar type and equal complexity as the proposed systems.
 2. Completed five (5) successful support of excavation systems of similar type and equal complexity as the proposed system in the last five (5) years.
- E. Design support of excavation systems to withstand an additional 2 feet of excavation below proposed bottom of excavation without redesign except for the addition of lagging and/or bracing.
- F. Design support of excavation systems for stability of excavations through overburden soils and for safety during construction.
- G. Design support of excavation systems, taking into account dewatering procedures to address groundwater flows and surcharge loading to address construction equipment loading as necessary.
- H. Obtain and comply with all permits, laws, regulations and codes.
- I. All welding shall be performed in accordance with AWS D1.1.
- J. The CONTRACTOR shall install the reference points on the support of excavation (and obtain baseline readings) prior to the start of excavation within 50 ft of the support system. The CONTRACTOR shall immediately replace, at no additional cost to the OWNER, unsatisfactory instrumentation or instrumentation that is damaged during the project. This latter requirement applies to all instrumentation installed by the CONTRACTOR regardless of location, and all instrumentation damaged as a result of the Work.

1.07 DESIGN CRITERIA

- A. The excavation support system shall be designed to support earth, water, and surcharge loads (from adjacent buildings, construction equipment and stockpiles, cranes, traffic using HS20-44 loading, and other sources) imposed on the system during the construction period. The CONTRACTOR'S design shall also consider the means and methods and construction process proposed by the CONTRACTOR to install foundation piles and construct below grade structures.
- B. Minimum criteria for design of the excavation support systems are outlined below. Design calculations and drawings shall be prepared and stamped by a Professional Engineer licensed in the State of Maine, employed by the CONTRACTOR and will be reviewed by the ENGINEER.
 - 1. Design each component of the excavation support system to support the maximum combination of loading (including but not limited to loading from soil, groundwater and construction surcharges) than can occur during construction.

- 2. Design support of excavation systems using the following soil properties:

Soil	Total Unit Weight (pcf)	Phi (degrees)	S _u (psf)
Fill	125	30	not applicable
Marine Clay	115	not applicable	600

Rankine active and passive earth pressure coefficients and a static groundwater level at El. 7.0 (Portland City Datum) shall be used to design all excavation support systems.

- 3. A minimum lateral surcharge pressure of 100 psf for surcharge loads due to construction equipment shall be used for design, and distributed as a uniform pressure over the height of excavation. The CONTRACTOR shall increase the surcharge loads based on construction equipment and staging requirements.

1.08 SUBMITTALS

- A. Submit the following:
 - 1. All qualifications as listed below. Include with all job/project references the name of the project and the names, current addresses and telephone numbers of persons in charge of representing such projects' owner or the owner at the time of excavation.
 - a. Support of Excavation System Designer's qualifications.
 - b. Support of Excavation System Supervisor's qualifications.
 - 2. List of all applicable laws, regulations, rules, and codes to which support of excavation system design conforms.
 - 3. Shop Drawings:

Submit a plan showing location and details of the proposed temporary excavation support system stamped and signed by a Professional Engineer licensed in the State of Maine. The CONTRACTOR shall be solely responsible for the adequacy and safety of the means, methods and sequencing of construction. This submittal shall include the following items as a minimum:

- a. Show plan limits of proposed earth excavation support system(s), depth of proposed system(s), location and extent of differing types of support relative to existing features (including existing utilities) and the permanent structures to be constructed.
 - b. Elevations, sections and profiles showing bearing elevations, and maximum excavation levels.
 - c. Construction details including materials, sizes, dimensions, connections and methods and sequence of excavation support installation, pile installation, permanent structure installation, and excavation backfilling, and excavation support system removal.
 - d. Plan showing the location and designation of reference points to be installed at the tops of the support systems, and the location of any additional settlement points and other instrumentation proposed by the CONTRACTOR.
 - e. Provide weekly lateral and vertical survey data from the reference points installed on the top of the support systems. The data shall be provided to the ENGINEER within 48 hours of completion of each survey and shall be tabularized showing at a minimum the following information for each survey: reference point designation, date surveyed, and vertical and horizontal survey data.
4. Tolerable support of excavation system movements for each proposed support of excavation system.
 5. Complete set of stamped design calculations for all support of excavation systems including assumptions and all parameters used in design.
 6. Verification that heavy structural timber used on the job has been treated with wood preservatives.
 7. Estimates of lateral and vertical movements of existing utilities, or other structures.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Store soldier piles and bracing materials to prevent sagging which would produce permanent deformation. Keep concentrated loads which occur during stacking or lifting below the level which would produce permanent deformation of the material.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Structural steel shall conform to the current edition of "AISC Specifications for the Design and Erection of Structural Steel for Buildings". All welding shall conform to the latest addition of AWS D1.1.
- B. If used, provide timber sheeting and lagging conforming to the following requirements:
 1. Moisture content shall not exceed 19 percent.
 2. Provide sound, well-seasoned timber such as Douglas Fir, Southern Pine, Cedar or equal.

3. Preservation wood treatment in accordance with FS TT-W-571.
 4. Allowable working stress of not less than 1200 psi.
 5. Nominal thickness of not less than 3 inches.
- C. Survey Reference Points on Support of Excavation System: Chisel mark or welded survey hub on the top of the excavation support wall. Survey marks shall be clearly identified using fluorescent spray paint and the individual reference point designations shall be clearly displayed in permanent ink or paint.

PART 3 - EXECUTION

3.01 EXECUTION

- A. Perform the support of excavation program in such a manner as to prevent undermining or disturbing foundations of existing structures or of Work ongoing or previously completed.
- B. Do not begin excavation within 50 ft of any support of excavation system until all support of excavation submittals have been reviewed by the OWNER and the ENGINEER.
- C. Control surface water and groundwater.
- D. Review of the CONTRACTOR'S design by the OWNER and ENGINEER will in no way relieve the CONTRACTOR of responsibility for the successful performance of construction or any method of protection for adjoining property. The CONTRACTOR shall correct any failure, damages, subsidence, upheaval or cave-ins as a result of improper installation, maintenance, or design at no additional cost to the OWNER. The CONTRACTOR shall resolve all claims, costs and damages that arise as a result of the Work performed at no additional cost to the OWNER. Protect all existing utilities affected by construction from damage.
- E. Expose active utilities by hand, where they lie within Work area.
- F. Notify utility owners if existing utilities interfere with the support of excavation system. Modify the existing utility with the utility owner's permission or have the utility owner make the modifications at no additional cost to the OWNER.
- G. Do not splice elements of the support of excavation system.
- H. Excavations shall not proceed more than 2 feet below any bracing level prior to the installation and loading of the brace.
- I. Install survey reference points along top of the excavation support wall to monitor vertical and lateral movements of the wall. The maximum spacing between points shall not exceed 25 ft along the length of the excavation support wall.

3.02 SOLDIER PILES AND LAGGING

- A. Install pile tips to embedment elevations shown on accepted shop drawings.
- B. Install lagging with openings (gaps) between boards to retain the material type encountered in the excavation while allowing free draining of water. As the installation progresses, backpack the voids between the excavation face and the lagging with sandpack or existing fill to establish a tight contact. Pack openings between lagging with hay or other porous material to allow free draining for water without loss of retained soil or sandpack. A maximum height of unlagged face

shall not exceed 3 ft. Coordinate the excavation with lagging placement. Reduce the maximum height of unlagged face if water is flowing from the face of the excavation, or if soil to be retained moves toward the excavation.

- C. If running sand and silt is encountered, secure the lagging to the soldier piles to avoid shifting or movement of the lagging and pack opening between lagging with additional porous material to contain the leaking material.
- D. If very fine sand and/or silt are encountered, take measures to retain the material in place and prevent loss of ground and/or movements which may cause damage to adjacent buildings, structures or utilities.

3.03 STEEL AND TIMBER SHEET PILES

- A. Limit sheetpile-driving induced ground vibrations (maximum peak particle velocity) to less than the values provided below at all nearby fresh concrete, as measured by the ENGINEER.

Concrete Age (days)	Maximum Peak Particle Velocity (in./sec)
0 to 1 day old	0.5
1 to 7 days old	2.0
Greater than 7 days old	3.0

- B. Drive sheetpiling in plumb position such that each pile installed is continuously interlocked with adjacent piles along the entire length. Use templates or other temporary alignment facilities to maintain sheeting on line.
- C. Drive sheeting to the depths shown on shop drawings. Do not overdrive sheeting or otherwise cause damage to sheetpile (tops, tips, or interlocks).
- D. After driving, sheeting shall be in direct contact with material to be retained.

3.04 MAINTENANCE OF SOIL SUPPORTS

- A. Maintain steel members for bracing and replacement lagging on hand throughout lagging and bracing Work and other support of excavation operations to protect the Work and for use in case of accident or emergency.
- B. Seal leaks uncovered in the walls as excavation progress.

3.05 REMOVAL OF SUPPORT OF EXCAVATION SYSTEM

- A. Remove the support of excavation system without endangering the construction, under this or other Contracts, other structures, utilities, or property. The CONTRACTOR shall remove all excavation support system elements unless approved by the OWNER.
- B. Immediately backfill all voids left or caused by withdrawal of support of excavation systems with crushed stone, granular fill, or flowable fill as specified in Section 02300 by tamping with tools specifically adapted for that purpose.
- C. If approved by the OWNER, support of excavation system elements that are to remain in place shall be cutoff to a minimum depth of 5 ft below finished site grades.

- D. Conduct survey of the locations and final cut-off elevations of the top of all support of excavation systems left in place and submit to the OWNER.

3.06 MOVEMENT CONTROL

- A. Maintain the lateral movement of the excavation support system below the tolerable movements as provided in the support system submittal.
- B. Adjacent above and below-grade site improvements are sensitive to ground movement and settlement. Adjacent structures will be influenced by the performance of the CONTRACTOR'S excavation support system
- C. The CONTRACTOR shall notify the ENGINEER if measured movements exceed anticipated tolerable movements. The CONTRACTOR shall take immediate steps to control further movement by revising their procedures, providing supplemental bracing or other measures (working 24 hours per day and temporarily terminating work in the area of movement if necessary).
- D. If movement of the excavation support system reaches or exceeds the anticipated tolerable value, the ENGINEER, based on their judgment and review of the movement monitoring data, may require that the CONTRACTOR temporarily terminate the work in the area where such movement is occurring and implement all necessary mitigation measures which are satisfactory to the ENGINEER to arrest the movements at no additional cost to the OWNER, including backfilling of the excavation.
- E. These criteria are intended to establish a minimum basis for the CONTRACTOR'S design and procedures and in no way relieve the CONTRACTOR of their sole responsibility for preventing detrimental movements and damage to adjacent existing and new site improvements.

End of Section