

Section 30- Deep Excavation Support Systems

I. Introduction

The intent of this section is to provide excavation support guidance to engineers, design-builders, and contractors for incorporation into projects. This section neither replaces professional design analyses nor limits innovative design where equal performance in value, safety, and maintenance economy can be demonstrated. It also does not eliminate the designer's requirement to follow applicable codes, ordinances, statutes, rules, regulations, and laws. Any conflict between this language and an applicable code, ordinance, statute, rule, regulation, and/or law shall be addressed with HRSD's Project Manager. The use and inclusion of language from this section does not alleviate the design professional from their responsibilities or legal liability for any contract documents they create. It is also recognized that this section is not universally applicable to every project.

II. Technical Codes, Standards, and Regulations

Compliance with state and federal laws, codes, and regulations is essential for the successful development and delivery of projects. The project scope and funding will determine the specific laws, codes, and regulations that must be addressed during design and construction. The following presents the most routinely applicable codes and regulations. Local government codes, ordinances, and regulations, including Site Plan approval, may be required on leased sites. This list is not comprehensive and applicable codes should ultimately be determined by the Contractor at the time of project award. All codes, standards, and regulation references refer to the most current adopted version unless otherwise noted.

- Occupational Safety and Health Administration (OSHA) 29 CFR 1926, Subpart P, Excavations
- Portland Cement Association (PCA) standards
- USS Steel Sheet Piling Manual
- AISC Steel Construction Manual
- AASHTO LRFD Bridge Construction Specifications
- AASHTO LRFD Bridge Design Specifications
- Virginia 811
- California Trenching and Shoring Manual
- ASCE 37 Design Loads on Structures During Construction
- ASCE 7 Minimum Design Loads for Buildings and Other Structures
- ACI 318 Building Code Requirements for Structural Concrete
- Horizontal control datum – Virginia State Plane Coordinate System - South Zone, North
- American Datum of 1983 (NAD 83) (2011) in feet
- Vertical control datum –NAVD88 in feet

III. Excavation Support System Design

The following requirements are provided for general use on excavation support projects.

- A. Earth Pressures. Proposed wall geometry and properties of soil materials behind and in front of the excavation support walls are to be submitted by the Contractor for review by the FIRM or HRSD's designee. If cohesive soils are present, both short-term undrained properties and long-term drained properties are to be provided by the designer or geotechnical engineer of record prior to the design of excavation support systems.
- B. Calculations. Calculations for all excavation support system submittals that are deferred to the Contractor shall be submitted by the Contractor for review by the FIRM or HRSD's designee. Contractor submittals shall be sealed by a Professional Engineer registered within the Commonwealth of Virginia. The factor of safety on excavation support system designs shall be a minimum of 2.5.
- C. Record Drawings. Record Drawings for excavation support systems left in place after the completion of construction shall be submitted to HRSD as part of the normal record drawing process. The Record Drawings shall be signed and sealed by a Surveyor licensed in the Commonwealth of Virginia and in accordance with the latest version of HRSD's Design and Construction Standards. The drawings shall demonstrate that the system has been accurately located (surface and subsurface) in its entirety (including but not limited to dimensions, annotations, coordinates, elevations, and reference(s) to structures visible from the surface), such that the item can be located in the future.
- D. Concrete. Specific requirements for concrete within excavation support systems shall be specified by the FIRM for use by the contractor. When concrete is placed in an excavation, provide forms for all vertical surfaces unless otherwise permitted. Where forms are provided for high, thin walls, ports shall be also be provided to permit thorough cleaning before placing concrete. Do not place forms or falsework supports on recently constructed footings or pile caps until the concrete has attained 80% of the required 28-day compressive strength. If, in the opinion of the Contractor, it is impossible or inadvisable due to prevailing conditions to dewater excavations before the placement of concrete, the Contractor shall propose alternate means that adhere to the governing regulations.
- E. Tie-Back Systems:
 - Design of tie-back systems shall not rely on soil strength in organic strata.
 - Design of tie-back systems shall assume that the soil behind the excavation support walls is fully saturated.
 - Tie-back systems that cross multiple strata shall utilize the soil properties of the weakest layer.

- Tie-back systems shall not encroach within 15 feet of property limits at any time.
- A minimum of 25% of all tie rods along each excavation face shall be tested to 200% of the design strength.
- Tie rod installation angle shall not exceed 15%.
- For pump stations, tie rods shall not be installed within the first 10 feet below the top of the excavation to allow for future wet well service connections.

IV. Miscellaneous

The following guidance is provided for general use on excavation support projects.

- A. Subgrade Stabilization. Subgrade stabilization will be required for soils found to be unsuitable to provide a stable subgrade for pavement construction. Unsuitable soils shall be defined based on the California Bearing Ratio (CBR) values, soil types, subgrade soil strength properties, and soil index properties. Subgrade stabilization may include over-excavation and replacement with suitable material, over-excavation and replacement with geotextile and suitable material, or in-situ subgrade stabilization. Unless previously prescribed in the contract documents, the stabilization approach shall be submitted by the Contractor for review by the FIRM before application.
- B. Inspection. After each excavation is completed, the Contractor shall provide notification to HRSD. The Contractor shall not place materials therein until the depth of excavation and the character of the foundation material have been approved by HRSD or their designee. Dewater wet excavations for inspection and for construction of foundations unless otherwise provided.
- C. Bedding and Backfill. HRSD or designated representative shall track the following required verifications related to bedding and backfill. The items included below are the minimum requirements that shall be specified in the Contract Documents by the FIRM:
- Advanced written authorization is required for additional excavation of unsuitable materials.
 - Review of Contractor's disposal plan for unsuitable excavated materials (dispose to approved sites and not in environmentally sensitive areas).
 - Documentation that any and all materials meet the contract specifications.
 - Documentation of proper backfill compaction in specified lifts and compaction testing where required.
- D. Well Points. The FIRM shall include requirements within the Contract Documents. At a minimum, the Contractor shall submit calculations for well points used for dewatering during construction for review by the FIRM

or HRSD's designee. Piezometers shall be installed at least 1 per side, a maximum of 50 feet apart, and monitored daily. Readings shall be monitored by the Contractor and submitted to HRSD for review.

End of Section