Engineering Department

PORT AUTHORITY NY NJ
AIR LAND RAIL SEA

Geotechnical Design Guidelines

For External Use
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1.0 GEOTECHNICAL DISCIPLINE

1.1 OVERVIEW

These guidelines are provided as an overview of the Port Authority's design standards. Design details and associated documents outlined in these documents will be provided to the successful client.

The Guidelines shall not replace professional design analyses nor are the Guidelines intended to limit innovative design where equal performance in value, safety, and maintenance economy can be demonstrated. The design team shall be responsible for producing designs that comply with the Guidelines in addition to all applicable codes, ordinances, statutes, rules, regulations, and laws. Any conflict between the Guidelines and an applicable code, ordinance, statute, rule, regulation, and/or law shall be addressed with the respective functional chief. The use and inclusion of the Guidelines, specifications, or example drawing details as part of the Contract Documents does not alleviate the design professional from their responsibilities or legal liability for any Contract Documents they create. It is also recognized that the Guidelines are not universally applicable to every project. There may be instances where a guideline may not be appropriate. If the design professional believes that a deviation from the Guidelines is warranted, such a deviation shall be submitted in writing for approval to the respective functional chief.

The Geotechnical Design Group is responsible for the planning, investigation, and design for all projects and project items involving earth or rock engineering. Geotechnical planning would include an office project review, field reconnaissance investigation, and initial "Fatal Flaw" assessment. Investigation involves researching and assembling facility-specific data including soil profiles and subsurface issues; all followed by project design efforts.

Our goal is to provide cost-effective, safe, and appropriate engineering solutions for Port Authority of New York and New Jersey projects. Specifically, this involves subsurface investigation, design analyses, contract document preparation, and construction support. In addition, the Geotechnical Design group performs reviews of tenant design for compliance with applicable codes.

2.0 TECHNICAL AND CODE STANDARDS/REGULATIONS

The following are the Technical and Code Standards/Regulations used by the Port Authority of New York & New Jersey Geotechnical Design discipline:

- ❒ International Building Code (IBC) – New Jersey Facilities.
- ❒ New York City Building Code (NYCBC) – New York Facilities.
- ❒ American Society for Testing and Materials (ASTM).
- ❒ American Association of State Highway and Transportation Officials (AASHTO).
- ❒ New Jersey Interagency Engineering Committee (NJIEC).

3.0 DESIGN CRITERIA AND EXCEPTIONS

3.1 SUBSURFACE INVESTIGATIONS

The goal in initial planning stages is to develop an efficient investigation plan to identify existing site conditions, conceptual geotechnical designs, and any potential "fatal flaws" as soon in the project design effort as possible. The existing Port Authority of New York & New Jersey geotechnical database, from previous explorations, published geological and soil survey maps, aerial photos, old construction records, as example, are researched and reviewed. Upon completion of this comprehensive review, the appropriate investigative effort is carried out as outlined below.

A. **Scoping and Arranging for Field Investigation** – The geotechnical designer should become completely familiar with the proposed project elements before scoping out the field investigation program. Among items to be considered are size, orientation, and nature of structures; extent of potential site work, including embankments, cuts, retaining wall structures, utility interferences, etc.; and seismic design sensitivities.

   Once the field investigation program has been established, outlining the boring number, location, depths, sampling and field testing requirements, a scope memorandum from the Chief Geotechnical Engineer is sent to the Materials Engineering Unit of the Construction Management Department for implementation under call-in technical services annual agreements with boring contractors. In-house Materials Engineering Unit technical staff typically performs boring inspection and all the associated duties.

B. **Borings Near Port Authority Structures** - Borings drilled in the vicinity of Port Authority underground structures such as the PATH tubes, Holland Tunnel, or Lincoln Tunnel shall not be drilled any closer than 20 feet from the tunnel springline unless otherwise approved by the Chief Engineer or his designee.

C. **Boring Inspection** – The primary responsibility of the boring inspector is to ensure that the boring contractor carries out his work in accordance with the contract specifications and that all prescribed field testing gets performed as outlined and intended by the geotechnical engineer.

   The Port Authority of New York & New Jersey has adopted a standardized classification system in order to have uniformity in the description of soil and rock samples. In the case of soils they are sub-divided into four major groups:

   - ❒ Coarse-grained soils
   - ❒ Fine-grained soils
   - ❒ Organic soils
   - ❒ Fill

   Classification of rock involves a description of rock types and detail as to the physical nature of the samples, i.e., color, soundness, degree of weathering, bedding, jointing, etc.

   Discussions of boring inspection philosophies and procedures and soil and rock classification methods and definitions are detailed in the Port Authority of New York & New Jersey Engineering Department "Manual for Boring Inspection."

D. **Determination of Type of Data to Obtain** – Project function, constructability issues, preliminary site characteristics and site history all must be considered to determine what type of geotechnical data to obtain. This includes the total extent of field data to be gathered

as well as laboratory testing to be prescribed. The strength and engineering design properties of the subsurface materials deemed necessary must be determined by an appropriate testing program as formulated by the Geotechnical Engineer.

E. **Port Authority of New York & New Jersey Soils Laboratory Testing Capabilities** – Within the Materials Engineering Unit of the Construction Management Division, the Port Authority of New York & New Jersey maintains a full service, AASHTO- and ASTM-certified soils testing laboratory for determining the engineering properties of the sampled subsurface materials.

F. **Surveying -** A survey of boring locations and a site location plan with site features needs to be developed.

G. **Data Presentation** - Presentation of test boring/field test data should be developed in both tabular and graphic format. Preparation of Soil Log Boring Presentation drawings, (see attached example) shall be prepared. The Authority uses a standard Excel spreadsheet for tabulation of the data from each boring. The spreadsheet is formatted to allow batch input of boring data to the Equis Database.

3.2 DESIGN DEVELOPMENT

A. **Design Issues to Consider at Each Site** – As a project progresses, depending on the anticipated structure types and functions, design issues such as the magnitude of tolerable settlement (both total and differential) must be considered. Additionally, any known or discovered constraints that could potentially affect the foundation design, such as utility interferences, existing structures or restricting site features, and anticipated constructability issues for examples, must be considered as issues in the design process.

B. **Design Methodologies** – The expected project requirements should be considered to determine the basics of the design process or methodology to be employed. A typical design flow path would be as follows:

- ❒ In response to Stage I requests by the lead engineering discipline, Geotechnical Design provides preliminary conceptual foundation design recommendations.
- ❒ Geotechnical Design searches existing subsurface information, assesses site conditions, and outlines the necessary investigation program (field and laboratory).
- ❒ Supervise implementation of investigatory efforts and analyze the results to determine geotechnical design parameters.
- ❒ Prepare Geotechnical Report, revisit preliminary foundation design concepts, obtain final loads and service conditions (Stage II and III) from appropriate disciplines, and begin final foundation design.
- ❒ Upon completion of final design, prepare drawings, specifications, and cost estimates related to geotechnical discipline, and circulate for Port Authority of New York & New Jersey internal review. Solicit feedback with respect to constructability, interferences, cost anomalies, or potential schedule glitches.
- ❒ After receiving the last rounds of project team feedback, finalize all Geotechnical Design contract documents as listed above.

C. **Climate Change** – As an important step in the design development, the effects of climate change on local rising sea levels along with the consequential long term effects on the ground water levels must be considered.

3.3 DESIGN CRITERIA AND EXCEPTIONS (SPECIAL REQUIREMENTS)

- ❒ Minimum Factors of Safety for Static and Seismic Conditions
- ❒ Temporary vs. Long-Term Conditions
- ❒ Design Earthquake Motions
- ❒ Allowable Bearing Capacity/Pile Capacity
- ❒ Ground Water Levels as affected by Climate Change Sea Level Rise

3.4 STAGE IV ACTIVITIES

- ❒ Pile Load Test Procedures
- ❒ Field Monitoring
- ❒ Review of Shop Drawing Submittals
- ❒ Design Changes/PACCs

4.0 NOTES AND CUSTOM SPECIFICATIONS

4.1 STANDARD NOTES

- Earthwork
- Piles
- Pile Dynamic Testing
- Tieback Installation and Testing
- Instrumentation

4.2 SPECIFICATIONS

4.2.1 USE OF STANDARD SPECIFICATIONS

Whenever possible, the preferred choice for use in design and for inclusion in the contract documents would be Port Authority of New York New Jersey standard specifications, geotechnical or otherwise. This helps produce consistency in design procedures and enables uniformity in the construction of all Port Authority of New York & New Jersey projects.

4.2.2 LIST OF STANDARD SPECIFICATIONS

Specification Number	Specification Title
310812	Pile Load Test - Static Axial Compressive
310813	Pile Load Test - Static Axial Tensile (Uplift)
310814	Dynamic Pile Testing
310816	Pile Load Test - Lateral Loads
310913	Geotechnical Instrumentation and Monitoring
310914	Instrumentation For Settlement and Groundwater Observations
312215	Jet Grouting
312316	Rock Excavation
312319	Dewatering
312323	Excavation, Backfilling and Filling
313219	Geogrids And Geotextiles
313220	High Strength Geotextiles
313224	Permeation Grouting
313250	Vertical Wick Drains
313313	Rock Bolts
313325	Flowable Fill
314175	Hydraulic Fill
315600	Slurry Walls
316216	Steel H-Piles
316217	Steel Sheet Piles
316219	Timber Piles
316223	Steel Pipe Piles
316250	Protective Coating Systems for Steel Piling
316319	Drilled Open End Steel Pipe Piles
316333	Micropiles
316400	Drilled Shafts
316616	Mechanically Stabilized Earth (MSE) Retaining Walls
316617	Prefabricated Concrete Modular Walls
316620	Driven Open End Steel Pipe Piles
316813	Prestressed Soil and Rock Anchors
350552	Dredging - Berth Maintenance No Barge Overflow Permitted
350553	Dredging - Berth Deepening Barge Overflow Permitted