THE PORT AUTHORITY OF NY & NJ

Engineering Department

Geotechnical Design Guidelines

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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 DETAILS, NOTES, AND CUSTOM SPECIFICATIONS

4.1 DETAILS

4.1.1 STANDARD GEOTECHNICAL DETAILS

- Drilled Mini Pile (1)
- Tapertube Pile (2)
- Pile Load Test (3)
- Caisson Load Test (4)
- Settlement Plate (5)
- Slope Indicator (6)
- Magnetic Extensometer (7)
- Typical Tieback Anchor (8)

4.1.2 PROJECT SPECIFIC DETAILS

Project -specific details are those that are unique to a particular job scope or site situation. These details might only be used on a one-time basis and would be kept in a database separate from the standard details for a shorter amount of time.

4.2 STANDARD NOTES

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

4.3 SPECIFICATIONS

4.3.1 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.

4.3.2 LIST OF STANDARD SPECIFICATIONS

Specification Number	Specification Title
310812	Pile Load Test - Static Axial Compressive
310813	Pile Load Test – Static Axial Tensile
310814	Dynamic Pile Testing
310816	Pile Load Test – Lateral Loads
312316	Rock Excavation
312319	Dewatering
312323	Excavation, Backfilling and Filling
312325	Rock Dowels
312388	Excavation, Backfilling and Filling (Narrow scope)
313220	High Strength Geotextile
313223	Pressure Grouting
314100	Instrumentation for Settlement and Ground Water Observations
314175	Hydraulic Fill
315600	Slurry Walls
316213	Monotube Piles
316216	Steel H Piles
316217	Steel Sheet Piling
316219	Timber Piles
316223	Steel Pipe Piles
316250	Protective Coating for Steel Piling
316265	Zine-Rich Epoxy/Coal Tar Epoxy Coating System for Steel Piling
316333	Drilled Minipiles
316400	Caissons (Drilled Shafts)
316450	Vertical Wick Drains
316813	Prestressed Soil and Rock Anchors
352023	Dredging
352099	Dredging (Narrow scope)

4.3.3 MODIFICATION OF STANDARD SPECIFICATIONS

Occasionally a unique project design component, project site characteristic, or unique construction restraint may necessitate either the modification of one of a standard specification or the preparation of a completely original specification. This results in the creation of the Custom or “C” specification. “C” specifications are project-specific technical documents that might only be used on a one-time basis.

5.0 REFERENCE MATERIALS

- Available Site and Subsurface Data
  - Soil Log (SL) Drawings
  - Equis Database
  - Soil Boring Sector Maps
- Contract Drawings (Previous PA Contracts)
- Property Maps
- Survey Documents
- PATH documents
  - "Pass-Through" Drawings
  - Tunnel Alignments and Profiles
- Internet Sites
  - Port Authority of New York & New Jersey Web Sites
  - External Web Sites (Industry or Government Agencies)
- Quality Assurance Division Documents (TAA Drawings, Reports, Calculations)

6.0 REFERENCE LINKS

1. *[Online] https://panynj.sharepoint.com/sites/Engineering/_layouts/15/DocIdRedir.aspx?ID=ENGDEPT-387386333-3.*
2. *[Online] https://panynj.sharepoint.com/sites/Engineering/_layouts/15/DocIdRedir.aspx?ID=ENGDEPT-387386333-8.*
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