MERCURY

Geotechnical Engineering and Soil Analysis Course

26 – 30 April 2027
Barcelona (Spain)



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Geotechnical Engineering and Soil Analysis Course

Ref: 50_1082758 **Date:** 26 – 30 April 2027 **Location:** Barcelona (Spain) **Fees:** 6200 Euro

The Geotechnical Engineering and Soil Analysis Course is a one-week course for civil infrastructure engineers, structural designers, and site supervision personnel responsible for subsurface risk evaluation and earthworks verification. Working with laboratory test data, borehole logs, and foundation calculation models, you assemble a Geotechnical Investigation and Foundation Assessment Dossier. Mercury Training Center delivers this course to develop dependable ground characterization and soil mechanics analysis capabilities.

About This Course

Unrecognized subsurface variations, misinterpreted borehole logs, and inaccurate soil property estimates lead to structural settlement, foundation failures, and project delays. To follow this course, you must already understand basic civil engineering mechanics, read subsurface exploration profiles, and perform elementary soil index calculations. Through real-world calculation sheets and laboratory logs, you practice soil classification, settlement estimation, and slope evaluation.

Who It Is For

- Civil infrastructure engineers responsible for reviewing geotechnical investigation reports and selecting foundation criteria for civil works.
- Structural design engineers responsible for calculating soil-structure interaction, bearing capacities, and allowable settlement thresholds.
- Site quality and earthworks supervisors responsible for monitoring soil compaction quality, field testing compliance, and subgrade preparation.
- Project development managers responsible for evaluating ground risk, site exploration scope, and earth retaining requirements on infrastructure assets.

This course is not for drill rig operators and field technicians responsible for physical auger operation and core recovery mechanics, who require field drilling apprenticeships, nor is it for mineral exploration geologists focused on deep ore reserve modeling, who need economic geology and mining petrology courses.

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Competencies You Will Build

- Subsurface Profile Interpretation: Correlating borehole stratigraphy, standard penetration values, and groundwater levels to delineate soil strata.
- Soil Index Classification: Determining liquid limits, plastic limits, and grain size distributions in accordance with standard classification systems.
- Shear Strength Parameterization: Deriving effective cohesion and friction angles from direct shear and triaxial shear test outcomes.
- Foundation Bearing Calculation: Computing ultimate and allowable bearing pressures for shallow footings and deep pile foundations.
- Settlement Prediction Modeling: Calculating primary consolidation and immediate elastic settlements under structural foundation loadings.
- Slope Stability Assessment: Evaluating safety factors and failure surfaces for engineered embankments and deep excavations.

What You Will Be Able to Do

By the end of the course you will be able to:

- From raw laboratory index data, classify fine-grained and coarse-grained soils using the Unified Soil Classification System standard.
- Given field standard penetration and cone penetration records, determine corrected resistance numbers and estimate in-situ soil density profiles.
- Using triaxial and direct shear test records, establish Mohr-Coulomb shear strength envelopes for drained and undrained ground conditions.
- From structural column load data and stratigraphy profiles, calculate allowable bearing capacities for spread footings using established analytical models.
- Given consolidation test curves, compute pre-consolidation stress, compression indices, and total time-rate settlement for clay foundations.
- Using slope geometry and groundwater pore pressure parameters, compute factors of safety for cut slopes using limit equilibrium methods.

Course Content

Day 1: Subsurface Investigation and Soil Classification

- Field Exploration Planning and Borehole Spacing under ASTM D420 Guidelines
- Standard Penetration Testing and Energy Correction Calculations using ASTM D1586
- Cone Penetration Testing Interpretation for Stratigraphic Profiling
- Particle Size Distribution Analysis and Hydrometer Curves using ASTM D6913
- Atterberg Limits Determination and Unified Soil Classification System Mapping via ASTM D2487

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Day 2: Soil Permeability, Seepage, and Compaction Mechanics

- Constant and Falling Head Permeability Laboratory Testing under ASTM D2434
- Two-Dimensional Flow Nets and Seepage Discharge Calculations Beneath Cutoff Walls
- Proctor Compaction Characteristics and Optimum Moisture Determination using ASTM D698
- Field Nuclear Density Gauging and Sand Cone Verification under ASTM D1556
- Effective Stress Principles and Pore Water Pressure Responses during Earthworks

Day 3: Shear Strength and Consolidation Behavior

- Direct Shear Testing and Drained Strength Envelope Construction via ASTM D3080
- Unconsolidated Undrained and Consolidated Drained Triaxial Testing via ASTM D4767
- Mohr-Coulomb Failure Criteria for Cohesive and Granular Soils
- One-Dimensional Oedometer Consolidation Testing and Pre-Consolidation Stress via ASTM D2435
- Time-Rate Consolidation Settlement Estimation and Coefficient of Consolidation Calculations

Day 4: Foundation Bearing Capacity and Lateral Earth Pressures

- Terzaghi and Meyerhof Bearing Capacity Equations for Shallow Footing Design
- Immediate Elastic Settlement Evaluation across Granular and Cohesive Strata
- Rankine and Coulomb Lateral Earth Pressure Theories for Retaining Walls
- Sheet Pile Penetration Depth and Cantilever Wall Stability Calculations
- Axial Pile Capacity Estimation using Static Driving Equations and Shaft Friction Methods

Day 5: Practical Geotechnical Analysis and Dossier Assembly

- Exercise on Stratigraphic Profiling and Unified Soil Classification System Grouping
- Exercise on Oedometer Settlement Calculation for Multi-Layered Subsoils
- Exercise on Limit Equilibrium Slope Stability and Safety Factor Derivation
- Exercise on Retaining Wall Overturning and Sliding Stability Verification
- Final Assembly and Review of the Geotechnical Investigation and Foundation Assessment Dossier

Case Studies and Exercises

These suggested activities provide practical application of soil mechanics principles and foundation engineering decisions across different operating sectors:

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- Case study: A commercial building expansion in the commercial real estate sector, where you evaluate borehole logs showing compressible soft clay, derive consolidation parameters, and calculate differential settlement risks for shallow foundations.
- Case study: A highway embankment widening project in the transportation sector, where you analyze pore pressure build-up, evaluate slope stability using limit equilibrium calculations, and recommend staged construction rates.
- Exercise: A marine container terminal development in the industrial logistics sector, where you interpret cone penetration data to calculate ultimate vertical pile capacities and lateral pile deflections under crane loads.
- Exercise: A municipal utility trench excavation in the public utilities sector, where you determine lateral earth pressures, design temporary sheet pile shoring, and evaluate basal heave stability.

What You Take Back

The Geotechnical Investigation and Foundation Assessment Dossier provides standardized calculation spreadsheets, soil parameter cross-check matrices, and site report review templates to guide your engineering decisions during your first month back at work. You will use it to verify geotechnical reports, confirm foundation assumptions, and audit earthworks compaction records.

- Borehole logging correlation templates and laboratory index classification worksheets
- Consolidation settlement and shallow foundation bearing capacity calculation sheets
- Lateral earth pressure and retaining wall stability assessment checklists
- Compaction quality control and in-situ field density verification protocols

Quick Answers FAQ

What background is required before attending the Geotechnical Engineering and Soil Analysis Course?

You should have foundational civil or structural engineering knowledge, familiarity with basic soil physics terminology, and experience interpreting structural plans. You need working fluency with algebra, mechanical statics, and standard spreadsheet tools to execute the geotechnical calculations taught during the sessions.

How does this course differ from an advanced finite element geotechnical modeling course?

This course focuses on practical soil characterization, standard field exploration, laboratory test interpretation, and analytical calculation methods. Advanced modeling courses emphasize numerical continuum algorithms, constitutive finite element coding, and mesh generation software, which require prior mastery of the fundamental mechanics developed here.

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Why is laboratory soil testing essential when standard penetration data is available?

Standard penetration test numbers provide empirical field correlations that vary with hammer efficiency, overburden pressure, and soil fabric. Laboratory index, triaxial, and consolidation tests measure fundamental mechanical properties directly, eliminating correlation uncertainty when calculating structural settlement and bearing capacity.

What work product do you take back from the Geotechnical Engineering and Soil Analysis Course?

You take back the Geotechnical Investigation and Foundation Assessment Dossier. This package contains validated calculation templates for bearing capacity, settlement, and lateral earth pressures, alongside standardized checklists for evaluating external geotechnical exploration reports and earthworks field density logs.

For Your Manager

This course develops the participant's capability to evaluate subsurface investigation reports, calculate foundation bearing limits, and identify ground-related settlement risks before construction starts. The employee returns with the Geotechnical Investigation and Foundation Assessment Dossier, which will be put to immediate use during technical reviews of upcoming project foundation designs and earthworks quality audits.