Advanced Geotechnical Engineering and Soil Mechanics Training Course

14 - 18 Dec 2026

Cape town

4600 € (Per Person)

Ref: #CON4380_271740

Course Introduction / Overview:

This comprehensive course provides an in-depth exploration of advanced geotechnical engineering principles and their practical application in modern construction. It delves into the complex behaviors of soil and rock mechanics, moving beyond fundamental concepts to address real-world challenges in site investigation, foundation design, and earth structure stability. Participants will gain a robust understanding of soil-structure interaction, ground improvement techniques, and the critical analysis of geotechnical data. The curriculum is structured around the pioneering work of figures like Karl von Terzaghi, whose foundational principles in his book "Erdbaumechanik" revolutionized the field. This training is designed to equip professionals with the skills to make informed, safe, and economical decisions on complex construction projects. At BIG BEN Training Center, we focus on bridging the gap between theoretical knowledge and practical application, ensuring that participants can confidently tackle geotechnical challenges, from initial site characterization to the implementation of advanced foundation systems and slope stabilization measures. The course emphasizes critical thinking and problem-solving, preparing attendees to manage geotechnical risks effectively and optimize project outcomes through sound engineering judgment and the application of cutting-edge methodologies and technologies in the field.

Target Audience / This training course is suitable for:

- Geotechnical Engineers.
- Civil and Structural Engineers.
- Construction Project Managers.
- Engineering Geologists.
- Foundation and Piling Contractors.
- Civil Engineering Consultants.
- Site Investigation Specialists.
- Public Works and Municipal Engineers.
- Infrastructure Planners and Designers.
- Construction Supervisors and Foremen.

Target Sectors and Industries:

- Heavy Construction and Infrastructure Development.
- Commercial and Residential Real Estate Development.
- Oil and Gas Exploration and Production.
- Mining and Mineral Extraction.
- Transportation (Highways, Railways, and Airports).
- Renewable Energy (Wind Farms, Solar Installations).
- Marine and Coastal Engineering.
- Governmental bodies and Public Works Agencies.
- Environmental and Waste Management.
- Consulting Engineering Firms.

Target Organizations Departments:

- Engineering and Design.
- Construction Management.
- Project Management Office (PMO).
- Site Operations and Field Services.
- Geotechnical Investigation and Surveying.
- Quality Assurance and Quality Control (QA/QC).
- Health, Safety, and Environment (HSE).
- Contracts and Procurement.
- Research and Development.
- Asset Management and Maintenance.

Course Offerings:

By the end of this course, the participants will have able to:

- Analyze complex soil behavior and properties using advanced soil mechanics principles.
- Plan and execute comprehensive geotechnical site investigation programs.
- Interpret in-situ and laboratory test results to develop accurate soil profiles.
- Design and evaluate both shallow and deep foundation systems for various structures.
- Perform detailed slope stability analysis and design effective stabilization measures.
- Analyze lateral earth pressures and design robust earth-retaining structures.
- Select and apply appropriate ground improvement techniques for challenging soil conditions.
- Assess geotechnical risks and develop mitigation strategies for construction projects.
- Utilize modern geotechnical software for analysis and design verification.
- Prepare and critically review professional geotechnical engineering reports.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, experiential, and focused on practical application. We move beyond traditional lectures to create a dynamic learning environment where participants actively engage with the material. The course heavily utilizes real-world case studies of complex geotechnical projects, allowing attendees to analyze design challenges, construction issues, and failure investigations. Collaborative group workshops and problem-solving sessions are a core component, encouraging participants to work together on practical exercises such as interpreting borehole logs, performing settlement calculations, and designing retaining walls. Interactive discussions are facilitated throughout the five days, providing a platform for sharing experiences and exploring diverse perspectives on geotechnical problems. The instructor will provide continuous feedback and guidance, ensuring that theoretical concepts are firmly linked to their practical implementation on a construction site. This hands-on, participant-centered approach ensures that attendees not only understand the principles of advanced geotechnical engineering but also develop the confidence and competence to apply them effectively in their professional roles, leading to safer and more efficient project delivery.

Course Agenda (Course Units):

Unit One: Advanced Soil Mechanics and Constitutive Modeling

- Fundamentals of the effective stress principle and its applications.
- Shear strength of soils and advanced testing methods (triaxial tests).
- Consolidation theory and settlement analysis for clays and silts.
- Critical State Soil Mechanics concepts and applications.
- Permeability, seepage analysis, and flow net construction.
- Soil classification systems (USCS, AASHTO) and index properties.
- Stress paths and their significance in geotechnical analysis.

Unit Two: Geotechnical Site Investigation and Characterization

- Planning and management of a comprehensive site investigation program.
- In-situ testing techniques (SPT, CPT, DMT, VST).
- Advanced geophysical methods for subsurface exploration.
- Sampling techniques and handling for undisturbed and disturbed samples.
- Laboratory testing programs for strength, compressibility, and permeability.
- Interpretation of geotechnical data and development of design parameters.
- Writing and reviewing a thorough geotechnical investigation report.

Unit Three: Design of Shallow and Deep Foundation Systems

- Bearing capacity theories for shallow foundations (Terzaghi, Meyerhof, Hansen).
- Analysis and calculation of immediate and consolidation settlement.
- Design of isolated footings, combined footings, and mat foundations.
- Types of deep foundations (piles, piers, caissons).
- Axial and lateral load capacity of single piles and pile groups.
- Analysis of pile group settlement and efficiency.
- Addressing challenges in problematic soils for foundation design.

Unit Four: Slope Stability and Earth Retaining Structures

- Methods of slope stability analysis (Method of Slices, Bishop, Janbu).
- Factors influencing slope stability and failure mechanisms.
- Design of slope stabilization and reinforcement techniques.
- Lateral earth pressure theories (Rankine and Coulomb).
- Design of gravity, cantilever, and anchored retaining walls.
- Analysis and design of mechanically stabilized earth (MSE) walls.
- Dewatering and drainage systems for slopes and retaining structures.

Unit Five: Ground Improvement and Advanced Geotechnical Topics

- Principles and applications of various ground improvement techniques.
- Soil modification using compaction, vibroflotation, and dynamic compaction.
- Grouting, soil mixing, and the use of geosynthetics.
- Introduction to geotechnical earthquake engineering and liquefaction analysis.
- Soil-structure interaction principles and modeling.
- Application of numerical methods (Finite Element Method) in geotechnical design.
- Geotechnical risk assessment and management in construction projects.

FAQ:

Qualifications required for registering to this course?

There are no requirements.

How long is each daily session, and what is the total number of training hours for the course?

This training course spans five days, with daily sessions ranging between 4 to 5 hours, including breaks and interactive activities, bringing the total duration to 20 - 25 training hours.

Something to think about:

Considering the increasing frequency of extreme weather events, how must traditional geotechnical design principles evolve to incorporate climate change resilience and long-term sustainability?

What unique qualities does this course offer compared to other courses?

This course distinguishes itself by moving beyond standard textbook theories to focus on the practical judgment and decision-making skills essential for modern geotechnical engineering. While other courses may focus solely on calculation methods, we emphasize the interpretation of complex and often incomplete site data, the selection of appropriate design parameters, and the management of inherent geotechnical uncertainties. The curriculum is built around a series of integrated case studies drawn from real-world projects, challenging participants to solve problems where the "right" answer is not immediately obvious. We delve deeply into the "why" behind the "how," exploring the limitations of different analytical models and the critical importance of engineering geology in developing a robust ground model. Furthermore, the course dedicates significant time to contemporary challenges such as seismic geotechnics, sustainable ground improvement techniques, and the application of numerical modeling as a verification tool rather than a black box. The focus is on developing a holistic understanding that enables participants to design solutions that are not only technically sound but also constructible, economical, and resilient over the long term.