



Advanced Onshore Foundations

Course Introduction:

This course is designed to provide professionals in the civil engineering and construction industries with a deep understanding of advanced techniques and methodologies used in the design and construction of onshore foundation systems. This 5-day theoretical course will focus on a variety of foundation types, including deep foundations (piles and caissons), shallow foundations (spread footings, mats), and specialized systems used for complex, high-load, or challenging soil conditions. The course will also delve into advanced soil mechanics, geotechnical considerations, and modern technologies that influence the construction of stable and durable foundation systems.

Throughout this training, participants will be exposed to cutting-edge techniques in foundation design, soil testing, and analysis, with an emphasis on cost-effective, sustainable solutions that are compliant with international standards and local regulations. By the end of the course, attendees will have a comprehensive understanding of the factors affecting foundation design, as well as strategies for overcoming challenges related to ground conditions, load-bearing capacities, and construction sequencing. This training is intended to equip engineers and construction managers with the knowledge to tackle complex foundation projects and ensure safety, efficiency, and long-term structural integrity.

Course Objectives:

By the end of the training, participants will be able to:

- Understand the advanced principles and methodologies used in the design of onshore foundation systems.
- Learn about the different types of foundations, including deep and shallow foundations, and their applications.
- Gain knowledge of geotechnical engineering principles and soil-structure interaction for foundation design.
- Master advanced techniques in soil testing, site investigation, and foundation analysis.
- Understand the impact of environmental, regulatory, and site-specific conditions on foundation design and construction.
- Develop the ability to manage complex foundation projects, considering factors such as sequencing, materials, and cost-effectiveness.

- Explore modern technologies and innovations in foundation construction, including sustainability considerations and risk management.

Who Should Attend?

This course is designed for all:

- Civil Engineers and Structural Engineers
- Geotechnical Engineers
- Construction Project Managers
- Foundation Design and Construction Specialists
- Contractors and Subcontractors in Foundation Works
- Site Investigators and Geotechnical Consultants
- Urban Planners and Building Designers
- Regulators and Compliance Officers in Construction

Course Outline:

Day 1: Introduction to Onshore Foundations and Soil Mechanics

- **Overview of Onshore Foundations**
 - Types of foundations: Shallow foundations (spread footings, mats) vs. deep foundations (piles, caissons).
 - Factors influencing foundation design: Load, soil conditions, environment, and cost.
 - Importance of geotechnical studies in foundation design.
- **Soil Mechanics and Foundation Performance**
 - Basic soil properties: Cohesion, friction angle, compaction, and permeability.
 - Soil classification and its impact on foundation type selection.
 - Soil-structure interaction: Settlement analysis and bearing capacity.
- **Geotechnical Site Investigation**
 - Methods of site investigation: Borehole drilling, test pits, and geophysical surveys.
 - Geotechnical testing: Standard Penetration Test (SPT), Cone Penetration Test (CPT), laboratory testing.
 - Interpreting soil reports and data for foundation design.

Day 2: Shallow Foundations: Design, Construction, and Applications

- **Shallow Foundation Systems**

- Types of shallow foundations: Spread footings, slab-on-grade, mat foundations.
- Design considerations for shallow foundations: Bearing capacity, settlement, and soil conditions.
- Sizing and layout: Load distribution, depth, and geometry.
- **Design and Construction of Spread Footings**
 - Determining foundation depth and size based on soil properties and load-bearing requirements.
 - Construction techniques for spread footings in different soil conditions.
 - Methods for dealing with problematic soils (e.g., expansive clays, loose sands).
- **Mat Foundations and Applications**
 - Design of mat foundations: When and why to use mats over other foundation types.
 - Load distribution, reinforcement strategies, and construction sequencing.
 - Case studies of large structures requiring mat foundations.

Day 3: Deep Foundations: Design, Construction, and Specialized Systems

- **Introduction to Deep Foundations**
 - Types of deep foundations: Piles (bored, driven, screw) and caissons.
 - Applications of deep foundations: High-rise buildings, bridges, industrial structures, and coastal areas.
 - Design considerations for deep foundations: Load transfer mechanisms, settlement, and soil-structure interaction.
- **Pile Foundations**
 - Types of piles: End-bearing piles, friction piles, and combination piles.
 - Pile design: Load testing, axial and lateral load analysis, pile driving techniques.
 - Factors influencing pile selection: Soil properties, cost, construction methods, and environmental concerns.
- **Caissons and Specialized Deep Foundations**
 - Design and construction of caissons: Use in marine environments, bridges, and large infrastructure projects.
 - Innovative deep foundation techniques: Micro-piles, auger-cast piles, and diaphragm walls.
 - Geotechnical considerations for specialized foundations.

Day 4: Advanced Foundation Analysis and Geotechnical Challenges

- **Advanced Foundation Analysis Techniques**
 - Finite element analysis (FEA) in foundation design.
 - Numerical modeling of soil-structure interaction.
 - Predicting settlement and deformation in complex conditions.

- **Geotechnical Challenges in Foundation Design**
 - Managing challenging soil conditions: Expansive clays, soft soils, high water tables, and liquefaction zones.
 - Mitigating risks of foundation settlement, tilting, and failure.
 - Case histories of foundation failures and lessons learned.
- **Ground Improvement and Foundation Strengthening**
 - Techniques for improving soil strength: Soil stabilization, compaction, grouting, and deep soil mixing.
 - Underpinning and foundation strengthening methods.
 - Geosynthetics in foundation design: Reinforcement and drainage solutions.

Day 5: Foundation Construction, Sustainability, and Project Management

- **Construction Methods for Onshore Foundations**
 - Sequencing and logistics for foundation construction.
 - Use of advanced construction equipment: Pile drivers, drilling rigs, concrete pumps, and cranes.
 - Managing risks during construction: Soil testing during construction, monitoring techniques, and troubleshooting.
- **Sustainability in Foundation Design**
 - Sustainable foundation practices: Recyclable materials, energy-efficient design, and minimizing environmental impact.
 - Innovations in foundation construction for low-carbon footprints.
 - Regulatory frameworks for sustainable construction practices.
- **Project Management and Cost Considerations**
 - Managing time, cost, and resources in foundation construction projects.
 - Cost-benefit analysis: Optimizing foundation design for cost efficiency.
 - Monitoring and controlling foundation construction: Quality assurance, safety standards, and regulatory compliance.

Course Methodology:

A variety of methodologies will be used during the course that including:

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods

- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

Course Certificate:

International Center for Training & Development (ICTD) will award an internationally recognized certificate(s) for each delegate on completion of training.

Course Fees:

To be advised as per course location. This rate includes participant's manual, Hand-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Timings:

Daily Course Timings:

08:00 - 08:20	Morning Coffee / Tea
08:20 - 10:00	First Session
10:00 - 10:20	Coffee / Tea / Snacks
10:20 - 12:20	Second Session
12:20 - 13:30	Lunch Break & Prayer Break
13:30 - 15:00	Last Session