Advanced Concrete Technology and Structural Integrity Training Course

16 - 20 Nov 2026

Cape town

4600 € (Per Person)

Ref: #CON5861_271691

Course Introduction / Overview:

This comprehensive course provides an in-depth exploration of advanced concrete technology and its critical application in structural integrity management. In an era where infrastructure is aging and performance demands are increasing, a profound understanding of concrete behavior, durability, and assessment is paramount. This program moves beyond fundamental principles to cover the latest innovations in high-performance concrete, sustainable materials, and advanced diagnostic techniques. Drawing upon the foundational work of experts like P. Kumar Mehta, author of "Concrete: Microstructure, Properties, and Materials," the curriculum integrates material science with practical engineering applications. Participants will learn to analyze complex degradation mechanisms, implement effective non-destructive testing, and design robust repair and rehabilitation strategies. BIG BEN Training Center has designed this course to empower professionals with the predictive and preventative skills necessary to ensure the long-term safety, serviceability, and resilience of concrete structures, ultimately extending their life cycle and optimizing asset value. This training is essential for anyone committed to mastering the complexities of modern concrete infrastructure.

Target Audience / This training course is suitable for:

- Civil Engineers.
- Structural Engineers.
- Materials Engineers.
- Construction Managers.
- Project Engineers.
- Quality Control and Assurance Managers.
- Asset Integrity Managers.
- Facility and Maintenance Managers.
- Geotechnical Engineers.
- Consulting Engineers.
- Research and Development Professionals.
- Government and Public Works Officials.

Target Sectors and Industries:

- Construction and Civil Engineering.
- Infrastructure Development and Management.
- Oil and Gas.
- Power Generation and Utilities.
- Transportation (Highways, Bridges, Airports, and Ports).
- Real Estate and Property Management.
- Consulting Engineering Firms.
- Materials Testing and Laboratory Services.
- Governmental bodies including Municipalities, Public Works, and Housing Authorities.
- Mining and Heavy Industrial sectors.

Target Organizations Departments:

- Engineering and Design.
- Construction and Project Management.
- Operations and Maintenance.
- Asset Management and Integrity.
- Quality Assurance and Quality Control (QA/QC).
- Research and Development.
- Technical Services.
- Facilities Management.
- Inspection and Testing.
- Health, Safety, and Environment (HSE).

Course Offerings:

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

- Analyze the properties and performance of advanced and special concretes.
- Design durable concrete mixes for specific environmental exposures and performance requirements.
- Identify and diagnose various concrete degradation and failure mechanisms.
- Implement a range of non-destructive testing (NDT) techniques for structural assessment.
- Evaluate the structural integrity of existing concrete elements and systems.
- Develop effective strategies for concrete repair, rehabilitation, and retrofitting.
- Apply life cycle assessment principles to manage concrete infrastructure assets.
- Integrate sustainable materials and practices into concrete technology.
- Understand and apply relevant international codes and standards (e.g., ACI, ASTM).
- Formulate comprehensive structural integrity management plans.

Course Methodology:

The training methodology at BIG BEN Training Center is designed to be highly interactive, engaging, and practical, ensuring that participants can directly apply the learned concepts to their professional roles. This course blends expert-led presentations with collaborative learning activities. Mornings will typically focus on theoretical principles, covering the science behind advanced concrete and structural analysis. Afternoons are dedicated to practical application through a series of case studies based on real-world structural failures and successful rehabilitation projects. Participants will work in teams to analyze diagnostic data, debate repair options, and develop management strategies. Interactive workshops will provide hands-on experience with virtual NDT data interpretation and mix design simulations. Open forum discussions and Q&A sessions are integrated throughout the five days to encourage knowledge sharing and address specific challenges faced by participants in their industries. The learning environment is built on a foundation of continuous feedback and peer-to-peer review, fostering a deep and lasting understanding of the subject matter.

Course Agenda (Course Units):

Unit One Fundamentals of Concrete Science and Durability

- Introduction to Concrete Microstructure and Properties.
- Cement Chemistry and Hydration Processes.
- Role of Aggregates in Concrete Performance.
- Principles of Concrete Mix Design and Proportioning.
- Water-Cement Ratio and its Impact on Strength and Durability.
- Understanding Concrete Permeability and Porosity.
- Key Mechanisms of Concrete Deterioration.

Unit Two Advanced Concrete Materials and Technologies

- High-Performance Concrete (HPC) and Ultra-High Performance Concrete (UHPC).
- Self-Compacting Concrete (SCC): Principles and Applications.
- Fiber-Reinforced Concrete (FRC) for Enhanced Toughness.
- Chemical Admixtures: Plasticizers, Accelerators, and Retarders.
- Supplementary Cementitious Materials (SCMs): Fly Ash, Slag, and Silica Fume.
- Geopolymer and Other Novel Cementitious Binders.
- Lightweight and Heavyweight Concrete Applications.

Unit Three Degradation, Corrosion, and Failure Analysis

- Corrosion of Steel Reinforcement: Mechanisms and Prevention.
- Chloride-Induced and Carbonation-Induced Corrosion.
- Sulfate Attack and Alkali-Silica Reaction (ASR).
- Freeze-Thaw Damage and Scaling.
- Chemical Attack and Abrasion Resistance.
- Structural Cracking: Causes, Types, and Significance.
- Case Studies of Structural Failures due to Material Degradation.

Unit Four Structural Assessment and Non-Destructive Testing (NDT)

- Visual Inspection and Condition Survey Methodologies.
- Rebound Hammer and Ultrasonic Pulse Velocity (UPV) Testing.
- Half-Cell Potential and Resistivity for Corrosion Assessment.
- Ground Penetrating Radar (GPR) for Rebar Mapping.
- Impact-Echo and Infrared Thermography for Delamination Detection.
- Core Sampling and Laboratory Testing for Compressive Strength.
- Integrating NDT Results for a Comprehensive Structural Diagnosis.

Unit Five Repair, Rehabilitation, and Integrity Management

- Principles of Concrete Repair and Material Selection.
- Surface Preparation Techniques for Effective Bonding.
- Crack Injection and Sealing Methods.
- Patch Repair, Overlays, and Shotcrete Applications.
- Structural Strengthening: FRP Composites and Section Enlargement.
- Cathodic Protection and Corrosion Inhibition Systems.
- Developing a Long-Term Structural Integrity Management Plan.

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 demand for sustainable construction and the aging of global infrastructure, how might the principles of structural integrity management evolve to prioritize material circularity and climate resilience over traditional strength-based design?

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

This course distinguishes itself by holistically integrating the two critical fields of material science and structural asset management. While many programs focus on either advanced concrete technology or structural assessment, this training bridges the gap, providing a seamless understanding of how material-level decisions directly impact long-term structural integrity and life cycle cost. It moves beyond prescriptive code-based design to a performance-based and predictive approach. Participants will not only learn the "what" and "how" of NDT and repair techniques but also the fundamental "why" rooted in concrete microstructure and degradation science. The curriculum is uniquely focused on proactive management, emphasizing durability design and predictive maintenance over reactive repair. By analyzing complex, real-world case studies of both failures and successes, the course provides practical insights that are immediately applicable, empowering engineers and managers to make more informed, sustainable, and economically sound decisions for the critical infrastructure under their stewardship.