5-Day Cement Industry Training Course
In

STRUCTURAL DESIGN OF REINFORCED CONCRETE (SBC)

Abu Dhabi - UAE, 12 – 16 Oct. 2026

COURSE LEVEL: ADVANCED

COURSE OVERVIEW:

The structural design of reinforced concrete is the engineering discipline that ensures the safety, stability, and durability of heavy industrial assets in a cement plant. This course defines the principles of Limit State Design, focusing on the synergy between the compressive strength of concrete and the tensile strength of steel reinforcement. It provides a technical foundation for designing complex structures like silos, kiln foundations, and preheater towers according to the Saudi Building Code (SBC).

The scope of this training involves the rigorous calculation of dead loads, live loads, and the extreme dynamic loads unique to cement manufacturing. It covers the analysis of seismic and wind forces on tall structures, as well as the thermal stresses generated by the proximity to high-temperature kiln systems. Furthermore, the course addresses the "Serviceability Limit States," including deflection and crack control, which are vital for the longevity of vibrating machinery foundations.

Coverage includes detailed modules on the design of beams, columns, slabs, and deep foundations using SBC-304 (Structural Concrete) standards. Participants will explore the chemistry of "Reinforcement Corrosion" in industrial environments and the selection of appropriate concrete cover and durability measures. Through the study of structural modeling and detailing, attendees will gain the expertise to oversee the design and rehabilitation of critical reinforced concrete assets.

COURSE OBJECTIVES:

After completion of this course, the participants will be able to:

- Apply the Saudi Building Code (SBC) standards to reinforced concrete design.
- Analyze the load paths for industrial structures (Silos, Kiln Piers).
- Design reinforced concrete beams for flexure, shear, and torsion.
- Determine the requirements for "Slender Columns" in tall preheater towers.
- Calculate the reinforcement detailing for "Deep Foundations" and "Rafts."
- Assess the "Seismic Resistance" of tall structures according to SBC-301.
- Design "Circular Silos" for lateral material pressure and dynamic discharge.
- Implement "Crack Control" measures for water-retaining and heavy structures.
- Evaluate the "Thermal Stresses" in concrete near kiln and cooler areas.
- Specify the concrete mix design for "Sulfate Resistance" and "Durability."
- Perform "Structural Integrity" audits on aging reinforced concrete assets.

- Detail reinforcement for "Ductility" in high-vibration machinery zones.

TARGET AUDIENCE:

This course is intended for Structural Engineers, Civil Maintenance Managers, Project Engineers, and Construction Supervisors.

TRAINING COURSE METHODOLOGY:

A highly interactive combination of lectures, discussion sessions, and case studies will be employed to maximize the transfer of information, knowledge, and experience. The course will be intensive, practical, and highly interactive. The sessions will start by raising the most relevant questions and motivating everybody to find the right answers. The attendants will also be encouraged to raise more of their questions and to share in developing the right answers using their analysis and experience. There will also be some indoor experiential activities to enhance the learning experience. Course material will be provided in PowerPoint, with necessary animations, learning videos, and general discussions.

The course participants shall be evaluated before, during, and at the end of the course.

COURSE CERTIFICATE:

National Consultant Centre for Training LLC (NCC) will issue an Attendance Certificate to all participants completing a minimum of 80% of the total attendance time requirement.

COURSE OUTLINE / COURSE CONTENT:

MODULE 1: INTRODUCTION TO SBC AND DESIGN PHILOSOPHY

- Overview of the Saudi Building Code (SBC) for structural concrete.
- Understanding "Strength Design" (Load and Resistance Factor Design).
- Material properties: Concrete grades and Steel reinforcement.
- Factor of Safety and "Importance Factors" for industrial plants.
- Design life and durability requirements in aggressive environments.

MODULE 2: LOAD ANALYSIS FOR CEMENT PLANT STRUCTURES

- Calculating "Dead Loads" (Equipment weight) and "Live Loads."
- "Dynamic Loads" from rotating kilns and vibrating mills.
- Modeling "Wind Loads" and "Seismic Forces" on the preheater tower.
- "Thermal Loads": Expansion and contraction in high-heat zones.
- Load combinations for ultimate and serviceability limit states.

MODULE 3: DESIGN OF FLEXURAL MEMBERS (BEAMS AND SLABS)

- Rectangular and T-beam analysis for flexure.
- Reinforcement for "Shear" and "Torsion" in heavy beams.
- Deflection control and "Span-to-Depth" ratios.
- One-way and two-way slab design for industrial floors.
- Detailing of reinforcement: Development length and lap splices.

MODULE 4: COMPRESSION MEMBERS AND TALL STRUCTURES

- Design of "Short Columns" and "Slender Columns."
- Interaction diagrams: Combined axial load and bending.
- Lateral ties and "Spirals" for column confinement.
- Modeling the "Preheater Tower" as a rigid frame structure.
- SBC requirements for lateral stability and "P-Delta" effects.

MODULE 5: INDUSTRIAL SILO DESIGN

- Understanding "Janssen's Theory" for lateral pressure.
- Hoop tension and vertical wall reinforcement in circular silos.
- Design of the "Silo Cone" and discharge interface.
- Dynamic effects during "Mass Flow" and "Funnel Flow."
- Concrete durability against material abrasion.

MODULE 6: FOUNDATION ENGINEERING FOR HEAVY ASSETS

- Design of "Isolated Footings" and "Combined Footings."
- "Raft Foundations" for silos and heavy mill buildings.
- "Pile Foundation" design for poor soil conditions.
- Foundations for "Vibrating Machinery": Dynamic stiffness and mass.
- SBC-303: Soil investigation and bearing capacity requirements.

MODULE 7: KILN PIER AND SUPPORT STRUCTURES

- Designing for massive "Concentrated Loads" from kiln tires.
- Managing the "Thermal Gradient" across kiln pier foundations.
- Reinforcement for "Heavy Shear" in support blocks.
- Anchoring systems for "Hydraulic Thrust Rollers."
- Monitoring "Differential Settlement" in kiln piers.

MODULE 8: REINFORCEMENT DETAILING AND DUCTILITY

- SBC-304: Requirements for "Ductile Detailing" in seismic zones.
- Standard hooks, bends, and bar spacing rules.
- "Congestion Management" in heavily reinforced joints.
- Using "Mechanical Couplers" vs. traditional lap splices.
- Corrosion protection: Galvanized and Epoxy-coated rebar.

MODULE 9: CONCRETE DURABILITY AND REHABILITATION

- Managing "Chloride Attack" and "Carbonation" in industrial sites.
- Selecting "Sulfate-Resistant Cement" (Type V) for foundations.
- Water-Cement ratio and its impact on permeability.
- Techniques for "Structural Repair": Jacketing and Fiber-Reinforcement (FRP).
- Non-Destructive Testing (NDT) for assessing existing structures.

MODULE 10: QUALITY CONTROL AND CONSTRUCTION SUPERVISION

- Reviewing "Shop Drawings" and reinforcement placement.

- Concrete "Slump" and "Compression Testing" protocols.
- Proper "Curing" techniques for large-volume pours (Mass Concrete).
- Managing "Cold Joints" and construction sequences.