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COURSE BROCHURE

Advanced Concrete Technology and Durability Training Course

7 – 18 December 2026
Dar es Salaam

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Registered in the United Kingdom and Saudi Arabia

Advanced Concrete Technology and Durability Training Course

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Advanced Concrete Technology and Durability is a 2-week training course for materials engineers, concrete technologists and site quality engineers, built around one work product: a concrete mix and durability specification for a real structure. Asset owners now expect longer service lives from concrete exposed to chlorides, sulfates and high temperatures, while pressure to cut cement content keeps growing. Jupiter Prime Training presents this course on concrete technology and durability.

Why Concrete Technology and Durability Matters Now

Three forces shape concrete technology and durability today: asset owners specifying longer service lives for marine, industrial and transport structures; cement producers and clients pushing lower-clinker binders to reduce embodied carbon; and harsher placing conditions as hot climates shorten setting and curing windows. Organisations that select binders, admixtures and curing deliberately avoid early cracking, premature corrosion and costly repairs, while weak decisions surface years later as spalling and loss of section. The course draws on exposure classification, performance testing and the American Concrete Institute ACI building code ACI 318 where its durability requirements meet materials choices.

Who Gains Most from Concrete Technology and Durability

- Materials engineers who select binders, aggregates and admixtures for project mixes
- Concrete technologists who run batching plants, trial mixes and production control
- Site quality engineers responsible for acceptance testing, placing and curing
- Design engineers who set exposure classes, cover and durability requirements
- Asset engineers who investigate deterioration in existing structures

Materials laboratories and site quality departments gain most when their technologists and engineers attend together and agree one approach from trial mix to acceptance.

Concrete Technology and Durability Capabilities

Participants connect cement chemistry and mix proportions to the service life a structure must achieve.

- Specify binder blends with supplementary cementitious materials for each exposure class — design engineers
- Design trial mixes by absolute volume and particle packing methods — batching plant approval
- Assess hot-weather placing risk and select curing regimes — site quality engineers
- Calculate service life from chloride diffusion and carbonation models — asset owners
- Test fresh and hardened concrete and interpret conformity results — acceptance decisions
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Communicate durability findings and mitigation choices — project managers and clients

Key Concrete Technology and Durability Terms

- Water-Binder Ratio — the mass of free water divided by the mass of all cementitious materials, the main lever on strength and permeability.
- Supplementary Cementitious Material — a pozzolanic or latent hydraulic powder such as fly ash, slag or silica fume that partly replaces Portland cement.
- Alkali-Silica Reaction — an expansive reaction between alkalis in pore solution and reactive silica in aggregates that causes map cracking.
- Chloride Threshold — the chloride concentration at the reinforcement surface above which steel corrosion can begin.
- Self-Compacting Concrete — concrete that flows and consolidates under its own weight without vibration while resisting segregation.
- Curing — control of moisture and temperature after placing so that hydration continues and surface properties develop.

Concrete Technology and Durability Day by Day

Day 1: Concrete in Today's Construction Context

- Cement Industry Carbon Pressures — Weighing Low-Clinker Binder Choices
- Asset Owner Service-Life Expectations — Setting Durability Targets Early
- Marine, Industrial and Desert Exposure Environments — Classifying Aggressive Conditions
- Failure Case Histories in Bridges and Car Parks — Tracing Root Causes to Materials
- Prescriptive and Performance Specifications — Choosing How to Specify Concrete

Day 2: Cement Chemistry and Hydration

- Portland Clinker Phases and Their Reactions — Predicting Strength Gain and Heat
- Hydration Products and Pore Structure — Linking Microstructure to Permeability
- Heat of Hydration Modelling — Controlling Thermal Cracking in Mass Pours
- Cement Types and Blended Cements — Matching Binder to Exposure Class
- Setting Time and Workability Loss — Planning Transport and Placing Windows

Day 3: Supplementary Cementitious Materials

- Fly Ash Pozzolanic Reaction — Reducing Permeability and Heat Output
- Ground Granulated Blast-Furnace Slag — Improving Chloride and Sulfate Resistance
- Silica Fume and Metakaolin — Producing Dense Low-Permeability Matrices
- Natural Pozzolans and Calcined Clays — Assessing Lower-Carbon Binder Options
- Binder Blend Optimisation — Balancing Early Strength Against Long-Term Durability

Day 4: Admixtures and Aggregates

- High-Range Water Reducers — Lowering Water-Binder Ratio Without Losing Flow
- Retarders and Accelerators — Adjusting Set Time to Site Conditions
- Air-Entraining and Shrinkage-Reducing Admixtures — Limiting Freeze-Thaw and Cracking Damage
- Aggregate Grading, Shape and Moisture Correction — Stabilising Batch Consistency
- Cement-Admixture Compatibility Trials — Avoiding Rapid Slump Loss and Retardation

Day 5: Mix Proportioning Methods

- Absolute Volume Mix Design Method — Proportioning Trial Batches Systematically
- Target Mean Strength and Standard Deviation — Setting Margins From Production Records
- Water-Binder Ratio and Paste Volume — Trading Strength, Shrinkage and Cost
- Particle Packing Models — Reducing Paste Demand and Improving Stability
- Trial Mix Programmes — Confirming Fresh and Hardened Properties Before Approval

Day 6: High-Performance and Self-Compacting Concrete

- High-Strength Concrete Proportioning — Meeting Column and Tall-Building Demands
- Self-Compacting Concrete Flow, Passing and Segregation — Specifying Congested Element Pours
- Fibre-Reinforced Concrete — Controlling Cracking in Slabs and Tunnel Linings
- Ultra-High-Performance Concrete — Weighing Cost Against Slender Durable Sections
- Formwork Pressure and Pumping Behaviour — Planning Placement of Fluid Mixes

Day 7: Hot-Weather Placing and Curing

- Chilled Water and Ice Temperature Control — Limiting Concrete Placing Temperature
- Evaporation Rate Assessment — Deciding When to Protect Against Plastic Shrinkage
- Curing Compounds, Wet Curing and Membranes — Selecting Curing for Each Element
- Thermal Control Plans for Mass Concrete — Managing Core-to-Surface Temperature Differentials
- Placement Sequencing and Cold Joint Prevention — Coordinating Batching, Transport and Finishing

Day 8: Durability Mechanisms

- Chloride Ingress and Reinforcement Corrosion — Setting Cover and Binder Requirements
- Carbonation Depth Prediction — Estimating Time to Steel Depassivation
- Alkali-Silica Reaction Screening — Testing Aggregates and Specifying Mitigation Measures
- Sulfate Attack and Delayed Ettringite Formation — Choosing Resistant Binders and Curing Temperatures
- Service-Life Modelling With Diffusion Coefficients — Justifying Cover and Mix Choices

Day 9: Testing Fresh and Hardened Concrete

- Slump, Slump Flow and Air Content Tests — Accepting Concrete at Delivery
- Compressive Strength Conformity Assessment — Approving or Rejecting Production Lots
- Chloride Permeability and Water Penetration Tests — Verifying Durability Performance
- Core Testing and Rebound Hammer Surveys — Investigating Doubtful In-Place Strength
- Non-Conformance Investigation — Deciding Between Acceptance, Repair or Removal

Day 10: Practising the Concrete Specification

- Exposure Classification of a Case Structure — Applying Environment Assessment Skills
- Binder and Admixture Selection Exercise — Rehearsing Mix Design Trade-Offs
- Hot-Weather Placing and Curing Method Statement — Testing Site Readiness
- Durability Test Acceptance Criteria — Linking Testing to Service-Life Targets
- Concrete Mix and Durability Specification — Completing the Project Work Product

Applying Concrete Technology and Durability After the Course

- Run a trial mix comparison of two binder blends for a current element and present strength, heat and permeability results to the design engineer.
- Prepare a hot-weather placing and curing checklist for the next large pour, using evaporation rate assessment and temperature control methods from the course.

Concrete Technology and Durability Questions FAQ

What is concrete technology and durability and why does it matter now?

Concrete technology and durability is the science of choosing materials, proportions, placing and curing so concrete reaches its intended service life. It matters now because owners demand longer lives in aggressive environments while lower-carbon binders change how mixes behave.

Which roles gain most from concrete technology and durability training?

Materials engineers, concrete technologists and site quality engineers gain most, followed by design and asset engineers. Each makes choices about binders, mixes, placing or testing that decide whether a structure resists chlorides, sulfates and cracking over its life.

How does concrete technology and durability differ from a reinforced concrete design course?

Concrete technology and durability concerns the material itself rather than structural member sizing. A reinforced concrete design course calculates flexure, shear and reinforcement, whereas concrete technology and durability covers cement chemistry, mix proportioning, admixtures, curing, deterioration mechanisms and testing.

What do you bring back from concrete technology and durability training?

You bring back a concrete mix and durability specification for a real structure, with binder choices, trial mix targets, curing requirements and acceptance tests that your laboratory and site teams can apply on the next pour.

Concrete Technology and Durability: The Way Forward

The concrete mix and durability specification first informs the binder and cover decision for the next structure, then guides trial mixes, placing method statements and acceptance testing. Materials engineers, technologists and site quality teams use it as a shared reference. After its first use, compare measured permeability and early-age cracking with the targets and refine binder blends and curing durations accordingly.