Advanced Concrete Waterproofing & Durability Engineering
12-Hour Course Program (General Audience)

This course provides a comprehensive overview of concrete durability, moisture transport mechanisms, comparative waterproofing technologies, and the role of Enzymatic TechCrete Technology (ETT) in enhancing long-term performance. The program is structured for a general professional audience including contractors, engineers, consultants, and infrastructure stakeholders.

Module 1 – Fundamentals of Concrete Deterioration (1.5 Hours)

This module introduces the fundamental behavior of concrete as a porous composite material. Participants will learn how interconnected capillary pores allow the migration of water and dissolved salts, leading to deterioration mechanisms such as corrosion, freeze-thaw damage, and sulfate attack. The discussion establishes why permeability control is critical for long-term durability.

- Concrete as a porous composite material
- Capillary pore structure & permeability
- Mechanisms of moisture transport:
  - Capillary suction
  - Diffusion
  - Hydrostatic pressure
- Chloride ingress & corrosion initiation
- Freeze-thaw + sulfate attack basics
- Why surface-only solutions often fail

Goal: Build scientific foundation before introducing ETT.

Module 2 – Comparative Waterproofing Technologies (2 Hours)

This session compares commonly used waterproofing systems, including crystalline technologies, coatings, and membrane systems. Participants will examine how these systems function, their strengths and limitations, and common causes of failure such as delamination, puncture, or wear. The module positions permeability reduction within the concrete matrix as a distinct engineering approach.

(Use AIA content: Crystalline vs ETT / Coatings vs ETT)

2A: Crystalline Technology vs ETT

- Chemical reaction mechanism
- Self-sealing claims
- Limitations in dynamic cracking
- Performance over time
- Testing comparison (ASTM references where applicable)

2B: Coatings & Membranes vs ETT

- Film-forming systems
- Adhesion dependency
- Puncture/delamination risk
- UV & wear exposure
- Life-cycle maintenance cycles

Interactive element:
Ask participants to evaluate system selection based on project type.

Module 3 – Chemistry and Mechanism of ETT (1.5 Hours)

This module explains the scientific basis of Enzymatic TechCrete Technology (ETT). The discussion focuses on how ETT interacts within the concrete matrix to reduce permeability and limit internal moisture transport. Visual diagrams and simplified chemical explanations are used to support understanding for a general audience.

- Enzyme-based catalytic mechanism (non-crystalline)
- Interaction with cement hydration byproducts
- Subsurface gel formation concept
- Pore refinement vs pore blocking
- Why ETT does not rely on surface membrane

Keep this scientific but visual — diagrams are essential here.

Module 4 – Surface Preparation and Application Engineering (2 Hours)

Participants will review proper surface preparation methods, substrate conditions, and application procedures. The session includes discussion of cleaning standards, application rates, spray versus roller methods, and detailing around joints, penetrations, and repairs. Practical guidance ensures correct field implementation.

- Surface preparation standards
    - Cleaning methods
    - Moisture conditions
    - ASTM D4285 discussion (compressed air cleanliness)
- Application rates
- Spray vs roller
- Saturation principles
- Recoat timing
- Detailing:
    - Cold joints
    - Pipe penetrations
    - Construction joints
    - Tie holes
- Integration with repair mortars

Add CAD detail slides.

Module 5 – Case Studies and Field Performance (2 Hours)

Real-world case studies from bridge decks, marine structures, foundations, and water containment systems are presented. Each case highlights environmental exposure conditions, project challenges, application process, and observed performance outcomes. Emphasis is placed on durability in aggressive environments.

- Bridge decks (chloride environments)
- Marine exposure
- Potable water structures
- Foundations / below grade
- Harsh environmental exposure (LatAm examples)

Structure each case study:

1. Problem
2. Environmental condition
3. Why chosen
4. Application process
5. Performance outcome

Module 6 – Sustainability and Life-Cycle Performance (1 Hour)

This module connects durability with sustainability. Participants explore how reducing permeability and extending service life lowers maintenance frequency, material consumption, and environmental impact. The concept of life-cycle cost analysis (LCCA) is introduced in simplified terms for a general audience.

- Life-cycle cost analysis (LCCA)
- Intervention frequency comparison
- Carbon implications of premature repair
- Durability as sustainability
- 50-year performance positioning

This will resonate strongly in Mexico infrastructure discussions.

Module 7 – Specification and Project Integration (1 Hour)

The session explains how internal waterproofing systems can be incorporated into project specifications. Participants will review performance-based criteria, documentation requirements, and warranty considerations. The objective is to help stakeholders understand where and how such systems fit within construction workflows.

- Where ETT fits in CSI specs
- Integration in design phase
- Performance-based vs prescriptive specs
- Testing & documentation
- Warranty structure

Module 8 – Workshop, Discussion, and Q&A (1 Hour)

The course concludes with an interactive workshop where participants evaluate hypothetical project scenarios and discuss system selection strategies. The open discussion reinforces key learning objectives and clarifies practical implementation questions.

- "Design waterproofing strategy for a coastal bridge."
- "Choose system for underground parking structure."

Make them think like specifiers.