
Concrete Structure Rehabilitation: Damage Diagnosis, Repair and Strengthening Course

2 – 6 May 2027
Kuala Lumpur





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Programme Summary

Concrete structure rehabilitation, from damage diagnosis to repair and strengthening, is the subject of this one-week training course for engineering heads and asset owners at advanced level, culminating in a rehabilitation strategy for a structure in their portfolio. Ageing bridges, buildings, marine works and plant structures now need decisions on whether to repair, strengthen, restrict or replace. The approach moves from deterioration mechanisms and assessment, through structural evaluation and repair design, to specification, quality control and life-extension choices. Mars Training Centre UK delivers this programme in concrete structure rehabilitation.

The Business Case

Repairs chosen without a proper diagnosis often fail within only a few years, while unnecessary demolition wastes capital that a targeted strengthening scheme could have saved. Leaders who commission the right investigation, read its findings critically and approve repairs against a recognised code keep assets in service longer, avoid premature replacement and spend maintenance budgets where they most reduce risk.

- Asset Service Life: Extends as repairs address the cause of deterioration rather than its symptoms.
- Repeat Repair Spend: Falls as material selection, surface preparation and workmanship are specified and checked.
- Structural Safety Exposure: Reduces as load capacity is evaluated and restrictions or strengthening are decided on evidence.

Principles and Evidence Base

- ACI CODE-562: The code for assessment, repair and rehabilitation of existing concrete structures frames the evaluation and repair design decisions in Sessions 2 and 3.
- ACI 318: Structural concrete requirements provide the capacity checks applied when existing members are re-evaluated in Session 2.
- ACI 440.2R: The guide for externally bonded FRP systems shapes the strengthening design review in Session 3.
- ACI 301: Construction specification practice informs the repair specification and acceptance work in Session 4.



Intended Participants

- Leaders who decide whether ageing concrete assets are repaired, strengthened or replaced.
- Engineering heads who commission condition surveys and review consultant findings.
- Asset and facilities directors who prioritise rehabilitation budgets across a portfolio.
- Senior structural engineers who approve repair and strengthening designs.

The programme serves transport infrastructure, utilities, industrial plants, ports and public building estates.

Learning Outcomes

1. Participants will be able to diagnose the causes of cracking, spalling and reinforcement corrosion from survey and test evidence.
2. Participants will be able to evaluate the remaining capacity of existing members against current structural requirements.
3. Participants will be able to select repair materials and methods suited to the cause and exposure of the damage.
4. Participants will be able to justify FRP strengthening or alternative schemes on capacity, durability and cost.
5. Participants will be able to construct a repair specification with quality control and acceptance criteria.
6. Participants will be able to prioritise rehabilitation actions across a portfolio of concrete assets.

Programme Structure

Day 1: Deterioration Mechanisms and Concrete Structure Condition

Why is the structure deteriorating, and how serious is it?

- Chloride and Carbonation Induced Reinforcement Corrosion
- Alkali-Silica Reaction, Sulphate Attack and Freeze-Thaw Damage
- Structural Versus Non-Structural Cracking Patterns
- Visual Condition Survey Methods and Defect Mapping
- Condition Rating Scales for Concrete Assets

Day 2: Investigation, Testing and Structural Evaluation

What does the evidence say about the structure's remaining capacity?

- Non-Destructive Testing: Rebound, Ultrasonic Pulse Velocity and Cover Surveys
- Half-Cell Potential and Core Sampling Programmes
- Evaluation of Existing Members Under ACI CODE-562
- Capacity Checks Using ACI 318 Provisions
- Load Testing and Load Rating Decisions



Day 3: Repair and Strengthening Design

Which repair or strengthening scheme fits the cause, the load and the exposure?

- Repair Material Selection: Mortars, Overlays and Injection Resins
- Cathodic Protection and Corrosion Inhibitor Options
- Externally Bonded FRP Design Review Using ACI 440.2R
- Section Enlargement, Jacketing and External Post-Tensioning
- Repair Versus Replace Whole-Life Cost Comparison

Day 4: Repair Specification, Execution and Quality Control

How is the repair specified, built and accepted so that it lasts?

- Repair Specifications Drawing on ACI 301 Practice
- Surface Preparation and Substrate Acceptance
- Inspection and Test Plans for Repair Works
- Bond Pull-Off Testing and Acceptance Criteria
- Contractor Method Statements and Hold Points

Day 5: Applying the Concrete Structure Rehabilitation Strategy

Is the rehabilitation strategy for a real asset ready for approval?

- Applying Day 1 Condition Ratings to a Portfolio Ranking
- Using Day 2 Evaluation Results to Set Load Restrictions
- Matching Day 3 Schemes to Asset Priorities and Budgets
- Monitoring and Maintenance Plans After Repair
- Completing the Concrete Structure Rehabilitation Strategy

Methodology

The programme uses case analysis of rehabilitation projects on bridges, car parks, marine structures and industrial plants. Participants interpret real survey and test data, challenge consultant conclusions and compare repair options on capacity, durability and whole-life cost. Peer challenge of each other's strategies tests the reasoning before it reaches a funding committee.

- Suggested activity: Diagnosing the cause of corrosion damage from half-cell and chloride results.
- Suggested activity: Reviewing an FRP strengthening proposal for a deficient beam.
- Suggested activity: Drafting acceptance criteria for a patch repair contract.



Capstone Output

Each participant completes a concrete structure rehabilitation strategy for an asset they manage. It contains a condition and cause summary, an evaluation of capacity, a recommended repair or strengthening scheme with its cost comparison, a specification outline and a monitoring plan. It supports funding requests and contractor briefs.

Frequently Asked Questions

Is concrete structure rehabilitation training suitable for senior engineering leaders?

Yes. It is set at advanced level for leaders and senior engineers who commission or approve assessments and repairs, and assumes a working knowledge of reinforced concrete.

Which codes does the concrete structure rehabilitation programme rest on?

It rests on ACI CODE-562 for existing structures, ACI 318 for structural requirements, ACI 440.2R for FRP strengthening and ACI 301 for construction specifications.

How is the concrete structure rehabilitation strategy used at work?

You can use it to justify repair budgets, brief consultants and contractors, set load restrictions and plan monitoring after the works.