
Concrete Member Design and Detailing

Course: Flexure, Shear, Columns and Slabs

1 – 5 August 2027
Amman





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Programme Summary

Concrete member design and detailing is the subject of this one-week training course for senior structural engineers, design managers and engineering leads, ending in a member design review pack for one concrete building. Strength checks that look sound on a printout can hide thin shear capacity, congested bars or a slab column joint nobody tested. The programme works from design basis to flexure, shear, columns and slabs, then to bar layout, using the participant's own project as test material. Mars Training Centre UK delivers this programme on concrete member design and detailing to mixed-organisation cohorts.

The Business Case

In concrete design, a missing load case, an under-reinforced support or a bar layout that cannot be built can pass through several hands before anyone questions it. Engineering leads who check capacity by hand, read the detailing against the calculation and challenge slab and column joints before drawings are issued can correct faults while a change is still cheap.

- Design Error Exposure: Falls as member capacities are cross-checked against simple hand calculations.
- Rework On Site: Falls as bar layouts are tested for spacing, cover and buildability before issue.
- Material Efficiency: Improves as section sizes and reinforcement ratios are tuned instead of defaulted.

Principles and Evidence Base

- ACI 318: The programme applies its strength design approach to flexure, shear and column checks in Sessions 2 and 3.
- Eurocode 2: The programme compares its member resistance logic with ACI 318 so reviewers can read designs prepared to either basis in Session 2.
- ACI 421.1R: The programme uses its guidance on shear reinforcement in slabs to frame the punching shear work in Session 3.
- Strength design and serviceability checks: Factoring actions, checking resistance and limiting deflection and cracking structure the design basis work in Session 1.



Intended Participants

- Senior structural engineers who sign off concrete calculations and reinforcement drawings.
- Design managers who review structural packages before issue to contractors.
- Contractor engineers who assess the buildability of reinforcement layouts.
- Owner-side engineers who must challenge consultants on concrete design.
- Technical authority holders who set checking standards for concrete members.

Typical functions include building design consultancies, general contractors, industrial facilities owners and infrastructure authorities.

Learning Outcomes

1. Participants will be able to construct a design basis and load combination table for a reinforced concrete building.
2. Participants will be able to evaluate beam capacity in flexure and shear against stated demand.
3. Participants will be able to diagnose weaknesses in column and slab column joints using interaction and punching checks.
4. Participants will be able to prioritise reinforcement details for congestion, anchorage and cover.
5. Participants will be able to design a review routine that finds faults before drawings are issued.
6. Participants will be able to justify member design decisions to clients, checkers and contractors.

Programme Structure

Day 1: Concrete Member Design Basis and Load Paths

How do loads travel through a concrete frame, and what must each member resist?

- Design Basis Statement
- Load Combination Table
- Load Path Diagram
- Material and Cover Schedule
- Section Sizing Matrix

Day 2: Beams: Flexure and Shear Capacity

Which checks decide the depth and reinforcement of a beam?

- Flexure Capacity Check
- Shear Capacity Check
- Flexure and Shear Capacity Table
- Deflection and Cracking Limits
- Beam Hand Calculation Cross-Check



Day 3: Columns, Slabs and Punching Shear

How are columns and slab column joints proved safe?

- Column Interaction Chart
- Slenderness Review
- One-Way Slab Check
- Two-Way Slab Review
- Punching Shear Check

Day 4: Reinforcement Detailing and Design Review

How are bars laid out, anchored and challenged before drawings are issued?

- Reinforcement Detailing Schedule
- Anchorage and Lap Check
- Spacing and Congestion Review
- Joint Detail Sketch Review
- Design Review Comment Log

Day 5: Applying the Tools to One Member Design Review Pack

Do the basis, capacity, joint and detail tools form one working design review?

- Applying the Session 1 Load Combination Table
- Using the Session 2 Beam Hand Calculation Cross-Check
- Testing the Session 3 Punching Shear Check
- Checking the Session 4 Reinforcement Detailing Schedule
- Completing the Member Design Review Pack

Methodology

The programme uses a structured exercise method built on anonymised calculation extracts, bar schedules, drawing sections and joint sketches from commercial, industrial and public buildings. Participants work in peer groups on a shared structure and receive written facilitator feedback on every exercise set.

- Suggested activity: Finding the deliberate error in a beam calculation that looks plausible.
- Suggested activity: Comparing a slab reinforcement drawing with the calculation behind it.
- Suggested activity: Reviewing a column joint sketch and listing the checks it still needs.



Capstone Output

Each participant completes a member design review pack for one concrete building. It holds a design basis statement, a load combination table, a flexure and shear capacity table, a punching shear check and a reinforcement detailing schedule. The pack is used at work to brief the design team, challenge a consultant's package and release drawings with open points closed.

Frequently Asked Questions

Is concrete member design suitable for engineers who rely on software output?

Yes. Concrete member design assumes structural training and some design experience, and shows how to verify software results by hand, step by step.

Which standards does concrete member design rest on?

Concrete member design here rests on ACI 318 and Eurocode 2, with ACI 421.1R guidance on slab shear reinforcement, applied to your own building.

How is the review pack from concrete member design used at work?

You use the member design review pack to brief the design team, challenge consultant calculations, agree open points and release drawings with confidence.

How does concrete member design differ from steel building frame design training?

Concrete member design centres on reinforcement, cracking and concrete sections. Steel building frame design training centres on steel members, stability and bolted or welded joints.