JUPITER PRIME

Consulting • Training • Advisory

جوبيتر برايم للاستشارات والتدريب

COURSE BROCHURE

Advanced Reinforced Concrete Design to ACI 318 Training Course

jupiterprime.uk

info@jupiterprime.uk

Registered in the United Kingdom and Saudi Arabia

Advanced Reinforced Concrete Design to ACI 318 Training Course

Advanced Reinforced Concrete Design to ACI 318 is a 2-week training course for structural engineers and design checkers, built around one work product: a reinforced concrete design and detailing calculation set for a multi-storey frame. Slimmer members, higher-strength materials and stricter checking now expose weaknesses in shear, detailing and serviceability that older rules of thumb hide. Jupiter Prime Training presents this course on reinforced concrete design to ACI 318.

Why Reinforced Concrete Design to ACI 318 Matters Now

Three pressures shape reinforced concrete design to ACI 318 today: owners and architects asking for longer spans and thinner slabs, independent checking engineers who trace every bar back to a governing calculation, and seismic and robustness expectations that put ductile detailing at the centre of design. Offices that apply strength, serviceability and detailing provisions consistently avoid congested cages, excessive deflection and brittle failure modes, while shortcuts surface as cracking, rework or rejected submissions. The course rests on the Building Code Requirements for Structural Concrete issued by the American Concrete Institute ACI, known as ACI 318, together with strut-and-tie and limit state principles.

Who Gains Most from Reinforced Concrete Design to ACI 318

- Structural engineers who size and reinforce beams, slabs, columns and walls
- Design checkers who verify calculations and reinforcement drawings against the code
- Bridge and infrastructure engineers who design transfer girders, pier caps and corbels
- Industrial engineers who design equipment foundations and pipe rack frames
- Detailers responsible for anchorage, laps and bar arrangements

Structural consultancies and design-and-build contractors gain most when designers and checkers attend together and agree one interpretation of the code provisions.

Reinforced Concrete Design to ACI 318 Capabilities

Participants trace each reinforcement decision from load effect through section capacity to a buildable bar arrangement.

- Calculate flexural, shear and torsional capacity of beams and girders — member sizing decisions
- Design slender columns with moment magnification — frame stability reviews
- Apply direct design and equivalent frame methods to two-way slabs — floor system choices
- Build strut-and-tie models for deep beams, corbels and openings — disturbed region design
- Specify development lengths, splices and seismic confinement — detailers and site teams

- Assess deflection and crack control for serviceability — clients and building owners

Key Reinforced Concrete Design to ACI 318 Terms

- Strength Reduction Factor — a factor below one applied to nominal capacity to reflect material, workmanship and failure-mode uncertainty.
- Moment Magnification — the increase of column end moments to account for second-order effects in slender members.
- Strut-and-Tie Model — a truss idealisation of compression struts, tension ties and nodes used to design disturbed regions.
- Development Length — the embedded bar length needed to transfer its full yield force into surrounding concrete.
- Punching Shear — a two-way shear failure around a column where a slab is supported directly without beams.
- Special Moment Frame — a frame detailed for high ductility with strong-column weak-beam rules and confinement reinforcement.

Reinforced Concrete Design to ACI 318 Day by Day

Day 1: Design Philosophy and Code Structure

- ACI 318 Organisation by Member Type — Navigating Provisions Efficiently
- Load Factors and Strength Reduction Factors — Setting the Safety Format
- Material Properties for Concrete and Reinforcement — Choosing Design Strengths
- Building and Bridge Case Structures — Framing Design Scenarios
- Calculation Set Standards — Preparing Traceable Submissions for Checkers

Day 2: Flexure and Section Analysis

- Rectangular Stress Block Method — Calculating Nominal Moment Capacity
- Tension-Controlled and Compression-Controlled Sections — Assigning Strength Reduction Factors
- Doubly Reinforced and Flanged Sections — Designing T-Beams and Compression Steel
- Minimum and Maximum Reinforcement Limits — Avoiding Brittle Behaviour
- Moment Redistribution in Continuous Beams — Balancing Support and Span Steel

Day 3: Shear and Torsion

- Concrete and Stirrup Shear Contributions — Sizing Transverse Reinforcement
- Shear Design Near Supports and Concentrated Loads — Locating Critical Sections
- Equilibrium and Compatibility Torsion — Deciding When Torsion Must Be Designed
- Combined Shear and Torsion Reinforcement — Detailing Closed Stirrups and Longitudinal Bars
- Shear Friction at Interfaces — Designing Construction Joints and Brackets

Day 4: Columns and Slenderness

- Interaction Diagrams for Axial Load and Moment — Checking Column Capacity
- Biaxial Bending Methods — Designing Corner and Edge Columns
- Slenderness Limits and Effective Length — Identifying Slender Columns
- Moment Magnifier Method for Sway and Non-Sway Frames — Capturing Second-Order Effects
- Tie and Spiral Requirements — Confining Longitudinal Bars

Day 5: Two-Way Slab Systems

- Direct Design Method — Distributing Static Moments to Strips
- Equivalent Frame Method — Analysing Irregular Slab Layouts
- Punching Shear at Columns — Sizing Drop Panels and Shear Reinforcement
- Openings and Edge Conditions in Flat Plates — Adjusting Critical Perimeters
- Post-Tensioned Slab Considerations — Comparing With Conventional Reinforcement

Day 6: Strut-and-Tie and Disturbed Regions

- B-Regions and D-Regions — Recognising Where Beam Theory Fails
- Strut, Tie and Node Strength Checks — Verifying Truss Models
- Deep Beam and Transfer Girder Design — Carrying Heavy Column Loads
- Corbels, Brackets and Dapped Ends — Detailing Load Transfer
- Pile Caps and Openings in Walls — Applying Strut-and-Tie to Foundations

Day 7: Walls, Foundations and Special Members

- Bearing and Shear Wall Design — Resisting Gravity and Lateral Loads
- Coupling Beams With Diagonal Reinforcement — Linking Wall Piers
- Isolated and Combined Footing Design — Checking Bearing, Shear and Flexure
- Mat Foundation Strip Design — Reinforcing Raft Slabs
- Retaining Wall Stem and Base Design — Resisting Earth Pressure

Day 8: Serviceability and Durability

- Immediate and Long-Term Deflection Calculation — Using Effective Moment of Inertia
- Crack Control by Bar Spacing — Limiting Surface Crack Widths
- Concrete Cover and Exposure Categories — Protecting Reinforcement From Corrosion
- Minimum Thickness Tables for Slabs and Beams — Avoiding Detailed Deflection Checks
- Shrinkage and Temperature Reinforcement — Controlling Restraint Cracking

Day 9: Detailing and Seismic Provisions

- Development Length and Hooks — Anchoring Bars at Supports
- Lap Splices and Mechanical Couplers — Locating Splices Away From Peak Stress
- Bar Arrangement and Congestion Checks — Keeping Cages Buildable
- Special Moment Frame Detailing — Applying Strong-Column Weak-Beam Rules
- Confinement and Boundary Elements — Providing Ductility in Walls and Columns

Day 10: Practising the Design Calculation Set

- Frame Load Effects for a Case Building — Applying Earlier Analysis Inputs
- Beam, Column and Slab Design Exercise — Rehearsing Member Sizing
- Transfer Girder Strut-and-Tie Model — Testing Disturbed Region Design
- Seismic Detailing and Bar Schedule Review — Checking Buildability and Ductility
- Reinforced Concrete Design and Detailing Calculation Set — Completing the Checker-Ready Work Product

Applying Reinforced Concrete Design to ACI 318 After the Course

- Recheck one live transfer girder or pile cap with a strut-and-tie model and compare the reinforcement with the existing beam-theory design.
- Audit the development lengths, lap locations and confinement on a current set of reinforcement drawings and issue a short detailing checklist to the design office.

Reinforced Concrete Design to ACI 318 Questions FAQ

What is reinforced concrete design to ACI 318 and why does it matter now?

Reinforced concrete design to ACI 318 is the sizing and detailing of concrete members using the American Concrete Institute building code. It matters now because longer spans, slimmer members and stricter checking expose shear, serviceability and detailing weaknesses quickly.

Which roles gain most from reinforced concrete design to ACI 318 training?

Structural engineers and design checkers gain most, along with bridge, industrial and foundation engineers and senior detailers. Each makes or verifies decisions on member sizes, reinforcement and detailing that determine safety, buildability and approval.

How does reinforced concrete design to ACI 318 training differ from a structural analysis software course?

Reinforced concrete design to ACI 318 training centres on code-based member design and detailing rather than building analysis models. A software course teaches modelling and running analyses; this training covers section capacity, slenderness, slabs, strut-and-tie models, serviceability and seismic detailing.

What do you bring back from reinforced concrete design to ACI 318 training?

You bring back a reinforced concrete design and detailing calculation set for a multi-storey frame, with beam, column, slab and transfer girder designs, serviceability checks and a detailing checklist your office can reuse.

Reinforced Concrete Design to ACI 318: The Way Forward

The reinforced concrete design and detailing calculation set first informs member sizing and bar arrangement on the next design submission. Designers, checkers and detailers use it as one reference for interpreting code provisions. After its first use, compare checker comments and site congestion issues with the calculations and refine detailing rules and slab thickness choices for the following project.