

# Dynamic Analysis of Reinforced Concrete Structures Training Course

27 June – 1 July 2027
Doha

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## Overview

Dynamic Analysis of Reinforced Concrete Structures Training Course is a one-week advanced course for structural, civil, facilities, reliability, mechanical-interface, and assurance functions who leave with a Dynamic Structural Analysis File. Participants model dynamic loads, mass, stiffness, damping, natural frequencies, mode shapes, resonance, soil-structure interaction, machinery foundations, transient and seismic response, reinforced-concrete demands, and vibration acceptance. The course connects analysis assumptions to verifiable design checks for industrial facilities. Agile Leaders Training Center presents reinforced-concrete structural dynamics.

## Who Should Attend

- Structural functions responsible for reinforced-concrete analysis and design checks
- Civil and geotechnical interfaces responsible for foundations and soil properties
- Mechanical interfaces responsible for equipment loads and operating criteria
- Facilities and reliability functions responsible for vibration and structural performance
- Project functions responsible for design-basis coordination and technical decisions
- Technical-assurance functions responsible for model review and acceptance evidence

The course assumes participants already apply structural mechanics, reinforced-concrete design, and engineering calculations at work, and it leaves out introductory statics, software-specific certification, concrete repair, and detailed blast design.

## Departments and Industries

The course supports departments and industries that design, operate, or assure concrete structures exposed to dynamic actions.

- Petroleum processing, storage, and production facilities
- Power generation and rotating-equipment facilities
- Industrial plants and heavy manufacturing
- Structural, civil, geotechnical, and mechanical engineering
- Asset integrity, reliability, maintenance, and technical assurance
- Engineering design, construction, and project delivery

## Learning Objectives

By the end of this course, participants will be able to:

- Build dynamic load and analysis-basis models
- Analyze natural frequencies, mode shapes, and resonance risk
- Apply response-spectrum and time-history concepts
- Evaluate soil-structure and equipment-foundation response
- Check reinforced-concrete demand, serviceability, and detailing interfaces
- Verify models and prioritize vibration acceptance actions

## Course Agenda

### Day 1: Define the Dynamic System

- Dynamic Load Source and Operating-State Register
- Single-Degree-of-Freedom Mass-Stiffness-Damping Model
- Multi-Degree-of-Freedom Idealization and Coordinate Map
- Free and Forced Vibration Response Worksheet
- Analysis Basis, Units, Sign Convention, and Assumption Log

### Day 2: Interpret Frequency and Modal Response

- Natural Frequency and Period Calculation Sheet
- Mode Shape and Modal Participation Review
- Resonance Separation and Operating-Speed Diagram
- Damping Ratio and Response-Amplification Assessment
- Modal Mass, Truncation, and Convergence Check

### Day 3: Model Loads and Supporting Media

- Rotating, Reciprocating, and Impulsive Equipment Load Matrix
- Transient, Impact, and Blast-Related Demand Screen
- Response-Spectrum Input and Modal-Combination Method
- Time-History Record, Scaling, and Integration Concept Sheet
- Soil Impedance, Radiation Damping, and Interaction Model

### Day 4: Check Concrete Structures and Foundations

- ACI PRC-351.3-18 Dynamic Equipment Foundation Review
- Rigid and Flexible Foundation Modeling Decision Tree
- ACI CODE-318-25 Strength, Serviceability, and Detailing Interface
- Equipment Anchorage, Grout, Alignment, and Load-Path Checklist
- Vibration Amplitude, Velocity, and Acceptance-Criteria Register

## Day 5: Practice Dynamic Analysis Assurance

- Suggested Exercise: Build a Mass-Stiffness-Damping Model
- Suggested Exercise: Diagnose Resonance from Frequency Results
- Suggested Exercise: Compare Spectrum and Time-History Responses
- Suggested Exercise: Verify Foundation Response and Concrete Checks
- Capstone Exercise: Complete the Dynamic Structural Analysis File

## Practical Exercises

The course uses suggested activities to connect dynamic models, reinforced-concrete checks, and operating acceptance evidence.

- Suggested activity: convert machinery, transient, and seismic information into a dynamic load and analysis-basis register.
- Suggested activity: calculate frequencies and modal participation, then identify resonance and convergence concerns.
- Suggested activity: compare foundation and soil-structure idealizations against force, displacement, and vibration response.
- Suggested activity: assemble assumptions, model checks, concrete demands, acceptance limits, findings, and actions into one file.

## FAQs

### Who suits dynamic analysis of reinforced concrete structures training, and what does it assume?

Dynamic analysis of reinforced concrete structures training suits structural, civil, facilities, reliability, mechanical-interface, project, and assurance functions. It assumes working knowledge of structural mechanics, reinforced-concrete design, and engineering calculations.

### How does reinforced-concrete dynamic analysis differ from general earthquake engineering?

Reinforced-concrete dynamic analysis addresses machinery vibration, transient and impact demand, soil-structure interaction, equipment foundations, seismic action, serviceability, and operating acceptance. General earthquake engineering concentrates primarily on seismic hazard, lateral systems, and earthquake response.

### What causes resonance in reinforced-concrete structures?

Resonance occurs when an excitation frequency approaches a structural natural frequency and damping is insufficient to control amplification. Operating-speed ranges, harmonics, stiffness, mass, soil properties, and equipment-foundation interaction therefore require coordinated review.

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## How is soil-structure interaction used in dynamic foundation analysis?

Soil-structure interaction represents foundation support through stiffness, impedance, damping, and radiation effects. The model changes predicted natural frequencies, force distribution, movement, and vibration, so geotechnical inputs and foundation idealization must be documented and tested.

## How are dynamic structural analysis models verified?

Dynamic structural analysis models are verified through independent calculations, mass and stiffness checks, mode-shape review, modal participation, convergence, sensitivity tests, equilibrium, load-path checks, response plausibility, and comparison with applicable acceptance criteria.

## Conclusion

Participants take back a Dynamic Structural Analysis File containing load sources, assumptions, idealizations, modal results, response comparisons, concrete checks, acceptance evidence, and actions. The file connects mechanical, geotechnical, and structural inputs to one review trail. It supports clearer model challenge and more traceable decisions for industrial reinforced-concrete structures.