

Course No. 1538

Advanced Structural Analysis & Design Training Course

CIVIL & STRUCTURAL ENGINEERING
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Advanced Structural Analysis & Design Training Course is a specialized professional program designed to develop advanced technical capabilities in structural analysis, engineering design, and the evaluation of complex structural systems. The course focuses on strengthening participants' ability to understand structural behavior under different loading conditions, assess structural response, and make technically sound design decisions that support safety, durability, serviceability, constructability, and cost-effective project delivery.

The program provides an integrated understanding of advanced structural analysis principles, including structural modeling, load assessment, load combinations, internal forces, deflections, stability, and structural response. Participants examine how structural members and systems behave under gravity loads, lateral loads, wind actions, seismic effects, and other relevant operational conditions, enabling them to develop more reliable and technically justified structural solutions.

The course also addresses advanced design considerations for reinforced concrete and structural steel systems, including beams, columns, slabs, shear walls, foundations, frames, and structural connections. Emphasis is placed on selecting appropriate structural systems, sizing members, evaluating resistance and serviceability, and developing practical structural details while considering material efficiency and constructability.

A significant component of the program focuses on computer-assisted structural modeling and analysis. Participants learn how to develop reliable analytical models, review assumptions and input parameters, interpret analysis results, and identify potential modeling errors. The course emphasizes engineering judgment and verification rather than relying solely on software outputs, helping professionals make informed decisions when dealing with complex structural models and design requirements.

Through practical exercises, engineering case studies, and integrated design activities, participants develop a structured approach to structural engineering projects from initial load assessment and system selection through analysis, design, review, documentation, and technical verification. The course is particularly valuable for professionals involved in buildings, infrastructure, industrial facilities, energy projects, oil and gas facilities, and major public and private developments.

Objectives

- Analyze structural behavior under gravity, lateral, wind, seismic, and operational loading conditions throughout the training program.
- Evaluate alternative structural systems and select appropriate solutions based on project requirements and engineering constraints.
- Apply advanced methods for determining structural loads, load cases, and load combinations used in engineering analysis and design.
- Develop reliable structural models that appropriately represent the behavior and characteristics of the structural system.
- Assess internal forces, reactions, deflections, deformations, and stability conditions within structural elements and systems.
- Design reinforced concrete members in accordance with applicable strength, serviceability, durability, and detailing requirements.
- Design structural steel members and connections while considering strength, stability, constructability, and material efficiency.
- Evaluate the structural effects of wind and seismic actions and determine suitable lateral load-resisting systems.
- Interpret structural analysis results and verify the engineering validity of assumptions, inputs, outputs, and model behavior.
- Improve structural designs by balancing safety, performance, material utilization, constructability, and project requirements.
- Apply systematic methods for identifying and correcting common errors in structural models, calculations, and design details.
- Develop practical recommendations for improving the quality, reliability, and efficiency of structural analysis and design processes.

Who Should Attend

This course is designed for civil and structural engineers involved in structural analysis, engineering design, construction, and project delivery. It is particularly suitable for structural design engineers, project engineers, structural consultants, engineering office professionals, construction engineers, technical office engineers, design reviewers, and engineers responsible for preparing or reviewing structural calculations, drawings, specifications, and technical documentation.

The program is also relevant to reinforced concrete engineers, structural steel engineers, foundation engineers, infrastructure engineers, bridge and special-structure professionals, engineering consultants, design managers, project managers, engineering managers, technical supervisors, and professionals involved in structural assessment and asset management. It can also benefit professionals working for contractors, engineering consultancies, government authorities, project owners, and organizations responsible for major construction and infrastructure programs.

The course is particularly suitable for managers and decision makers who oversee engineering design quality, technical reviews, structural risk, project compliance, and construction performance. It is applicable across building construction, infrastructure, industrial facilities, oil and gas projects, power and energy facilities, transportation projects, public-sector developments, and other projects requiring advanced structural analysis and design capabilities.

Learning Outcomes

- Explain advanced principles of structural analysis and the behavior of different structural systems under various loading conditions.
- Determine appropriate structural loads, load cases, and load combinations for analysis and design applications.
- Develop structural models that represent the intended structural behavior with appropriate engineering assumptions.
- Analyze internal forces, reactions, deflections, and deformations resulting from different loading scenarios.
- Evaluate structural stability and recognize the effects of slenderness, buckling, and excessive deformation on structural performance.
- Design reinforced concrete beams, columns, slabs, shear walls, and foundations based on relevant engineering requirements.
- Design structural steel members and connections while evaluating strength, stability, and serviceability.
- Assess the effects of wind and seismic loading on structural systems and evaluate appropriate lateral resistance strategies.
- Interpret structural analysis software results and verify whether the outputs are consistent with expected engineering behavior.
- Identify potential errors in structural models, assumptions, loading conditions, design parameters, and analysis results.

- Optimize structural designs by considering safety, material efficiency, serviceability, constructability, and project requirements.
- Conduct a structured technical review of a structural analysis and design package and develop recommendations for improvement.

Course Outline

DAY 01

Advanced Structural Analysis Principles and Structural Modeling

- Advanced principles of structural analysis and structural behavior
- Classification of structural systems and selection of appropriate structural schemes
- Identification of gravity, lateral, operational, and environmental loads
- Load cases, load combinations, and analysis requirements
- Structural modeling of members, supports, restraints, and connections
- Material properties, section properties, and their influence on structural response
- Analysis of reactions, internal forces, displacements, and deformations
- Structural stability and sources of instability in analytical models
- Principles of linear and nonlinear structural analysis

PRACTICAL APPLICATION

Develop and analyze a structural model of a multi-story building under different loading conditions

DAY 02

Advanced Analysis of Lateral and Dynamic Loads

- Principles of lateral load analysis and structural response
- Wind loading and its effects on buildings and tall structures
- Fundamentals of seismic analysis and structural response to earthquakes
- Structural systems for resisting lateral forces
- Moment-resisting frames, braced frames, and structural wall systems

DAY 02 — CONTINUED

- Distribution of lateral forces throughout structural systems
- Evaluation of story drift and lateral deformation
- Fundamentals of dynamic structural analysis
- Structural response to varying and cyclic loading
- Evaluation of overall structural stability under lateral loading

PRACTICAL APPLICATION

Analyze a structural model subjected to wind and lateral loads and evaluate its structural response

DAY 03

Advanced Reinforced Concrete Structural Design

- Advanced principles of reinforced concrete structural design
- Design of reinforced concrete beams for flexure and shear
- Design of columns subjected to axial loads and bending moments
- Design of slabs and reinforced concrete floor systems
- Design of structural walls and lateral load-resisting components
- Reinforcement requirements and structural detailing
- Evaluation of cracking, deflection, and serviceability performance
- Design of structural members under combined loading conditions
- Foundation design and interaction with the superstructure
- Evaluation of load transfer between structural elements

PRACTICAL APPLICATION

Design selected reinforced concrete members and verify their strength and serviceability performance

DAY 04

Advanced Structural Steel Design and Stability Assessment

- Properties and structural behavior of steel under different loading conditions
- Design of beams, axial members, and combined-action members
- Design of steel columns and evaluation of buckling behavior
- Lateral stability, local buckling, and overall member stability
- Design of bolted and welded structural connections
- Selection of steel sections based on strength, stability, and efficiency
- Analysis of steel frames and multi-story structural systems
- Evaluation of deflections, deformations, and serviceability requirements
- Principles of material optimization in structural steel design
- Review of structural detailing and its relationship to fabrication and construction

PRACTICAL APPLICATION

Design steel members and structural connections and evaluate their strength and stability

DAY 05

Structural Design Review, Computer-Based Analysis, and Performance Optimization

- Application of structural analysis software for modeling, analysis, and design
- Verification of assumptions and input parameters before running structural models
- Interpretation of analysis results and comparison with expected structural behavior
- Review of forces, reactions, displacements, and deformations
- Identification and correction of common structural modeling errors
- Structural design verification for strength, stability, and serviceability
- Optimization of structural systems and material utilization
- Coordination between structural, architectural, mechanical, and other engineering disciplines
- Documentation of calculations, assumptions, analysis results, and technical recommendations
- Development of structural design quality-control and technical-review checklists

DAY 05 — CONTINUED

FINAL WORKSHOP

Complete an integrated structural analysis and design case study, review the model and results, and develop an engineering improvement and verification plan

Register or Request More Information

Course page: <https://quest-training.com/courses/advanced-structural-analysis-design-training-course>

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