



SC010: Steel Structure Design, Construction, Inspection, Maintenance & Durability



Training Description:

This intensive training course covers the proper use of techniques and procedures on design, inspection, maintenance and durability of steel structures; the properties of steel and the tension members; the various types of structural fasteners and emphasize the common welding processes used in steel structures; the scope of the compression members and explain the features and functions of laterally supported beams.

The course will also cover the torsion, lateral torsional buckling of beams, continuous beams and plate girders and employ their practical application in steel structures; the types of connections used in steel structures and differentiate braced and unbraced frames; the methodological practical applications on structural steel and bolting inspection. Moreover, it will assist the delegates to execute the maintenance procedures of steel structures and emphasize the sustainability of steel framed buildings and the different approaches used in maintaining the durability of steel structures.

Training Objectives:

By the end of the training, participants will be able to:

- ✓ Apply proper techniques and procedures on the design, construction, inspection, maintenance and durability of steel structures
- ✓ Identify the properties of steel and the tension members
- ✓ Enumerate the various types of structural fasteners and emphasize the common welding processes used in steel structures
- ✓ Recognize the scope of the compression members and explain the features and functions of laterally supported beams
- ✓ Discuss torsion, lateral-torsional buckling of beams, continuous beams and plate girders and employ their practical application in steel structures
- ✓ Determine the types of connections used in steel structures and differentiate braced and unbraced frames
- ✓ Implement the methodological practical applications on structural steel and bolting inspection
- ✓ Carryout the maintenance procedures of steel structures and emphasize the sustainability of steel-framed buildings
- ✓ Employ the different approaches used in maintaining the durability of steel structures

Training Designed for:

This course is intended for civil engineers, mechanical engineers, structural engineers, architects, contractors, managers, maintenance managers and inspection engineers.

Training Program:

DAY ONE:

- ❖ PRE-TEST
- ❖ Introduction to Steel Structures
 - Structural Design, Principles of Design, Historical Background of Steel, Structures, Loads, Types of Structural Steel Members, Steel Structures, Specifications and Building Codes, Philosophies of Design, Factors of Safety – ASD and LRFD Compared, Why Should LRFD be





Used? Analysis of the Structure

❖ **Steels and Properties**

- Structural Steels, Fastener Steels, Weld Electrode and Filler Material, Stress-Strain, Behavior (Tension Test) at Atmospheric Temperatures, Material Toughness, Yield Strength for Multiaxial States of Stress, High Temperature Behavior, Cold Work and Strain Hardening, Brittle Fracture, Lamellar Tearing, Fatigue Strength, Corrosion Resistance and Weathering Steels,

❖ **Tension Members**

- Nominal Strength, Net Area, Effect of Staggered Holes and Net Area, Effective Net Area, Tearing Failure at Bolt Holes, Stiffness as a Design, Criterion, Load Transfer at Connections, Load and Resistance Factor, Design – Tension members, Tension Rods, Allowable Stress Design, Tension Members

❖ **Structural Fasteners**

- Types of Fasteners, Historical Background of High-Strength Bolts, Causes of Rivet, Obsolescence, Details of High-Strength Bolts, Installation Procedures, Nominal Strength of Individual Fasteners, Load and Resistance Factor Design – Fasteners, Examples – Tension Member Bearing-Type Connections – LRFD, Slip-Critical Joints, Allowable Stress Design – Fasteners, Examples – Tension Members Using Allowable Stress Design, Eccentric Shear, Fasteners acting in Axial Tension, Combined Shear and Tension, Shear and Tension from eccentric Loading

DAY TWO:

❖ **Welding**

- Basic Processes, Weldability of Structural Steel, Types of Joints, Types of Welds, Welding Symbols, Factors Affecting the Quality of Welded Connections, Possible Defects in Welds, Inspection and Control, Economics of Welded Built-Up Members and Connections, Size and Length Limitations for Fillet Welds, Effective Areas of Welds, Nominal Strength of Welds, Load and Resistance Factor Design – Welds, Allowable Stress Design – Welds, Welds Connecting Members Subject to Direct Axial Load, Eccentric Shear Connections – Strength Analysis, Eccentric Shear Connections – Elastic (Vector) Analysis, Loads Applied Eccentric to the Plane of Welds

❖ **Compression Members**

- Basic Column Strength, Inelastic Buckling, Residual Stress, Development of Column Strength Curves Including Residual Stress, Structural Stability Research Council (SSRC) Strength Curves, Load and Resistance Factor Design, Effective Length, Load and Resistance Factor Design of Rolled Shapes (W.S. and M) Subject to Axial Compression, Allowable Stress Design, Shear Effect, Design of Latticed Members, Strength of Plates under Uniform Edge Compression
- AISC Width/Thickness Limits
 - to Achieve Yield Stress Without Local Plate Buckling
- AISC Width/Thickness Limits
 - to Achieve Significant Plastic Deformation
- AISC Provisions to Account for the Buckling and Post-Buckling Strengths of Plate Elements, Design of Compression Members as Affected by Local Buckling Provisions





❖ **Beams: Laterally Supported**

- Simple Bending of Symmetrical Shapes, Behavior of Laterally Stable Beams, Laterally Supported Beams – Load and Resistance Factor Design, Laterally Supported Beams – Allowable Stress Design, Serviceability of Beams, Shear on Rolled Beams, Concentrated Loads Applied to Rolled Beams, Holes in Beams, General Flexural Theory, Biaxial Bending of Symmetric Sections

❖ **Torsion**

- Pure Torsion of Homogeneous Sections, Shear Stresses Due to Bending of Thin-Wall Open Cross-Sections, Shear Center, Torsional Stresses in I Shaped Steel Sections, Analogy Between Torsion and Plane Bending, Practical Situations of Torsional Loading, Load and Resistance Factor Design for Torsion – Laterally Stable Beams, Allowable Stress Design for Torsion – Laterally Stable Beams, Torsion in Closed Thin-Wall Sections, Torsion in Sections with Open and Closed Parts, Torsional Buckling

DAY THREE:

❖ **Lateral-Torsional Buckling of Beams**

- Rational Analogy to Pure Columns, Lateral Support, Strength of I-Shape, Beams Under Uniform Moment, Elastic Lateral-Torsional Buckling, Inelastic Lateral-Torsional Buckling, Load and Resistance Factor Design – I Shaped Beams Subjected to Strong-Axis Bending, Allowable Stress Design – I-Shaped Beams Subjected to Strong-Axis Bending
- Effective Laterally Unbraced Length, Examples: Load and Resistance Factor Design, Examples: Allowable Stress Design, Weak-Axis Bending of I Shaped Sections, Lateral Buckling of Channels, Zees, Monosymmetric I Shaped Sections and Tees, Lateral Bracing Design, Biaxial Bending of Doubly Symmetric I-Shaped Sections

❖ **Continuous Beams**

- Plastic Strength of a Statically Indeterminate Beam, Plastic Analysis – Load and Resistance Factor Design Examples, Elastic Analysis – Load and Resistance Factor Design Examples, Elastic Analysis – Allowable Stress Design Examples, Splices

❖ **Plate Girders**

- Difference Between Beam and Plate Girder, Vertical Flange Buckling Limit State, Nominal Moment Strength – load and Resistance Factor Design, Moment Strength – Allowable Stress Design, Moment Strength Reduction, Due to Bend-Buckling of the Web, Nominal Moment Strength – Hybrid, Girders, Nominal Shear Strength – Elastic and Inelastic Buckling, Nominal Shear Strength – Including Tension-Field Action, Strength in Combined Bending and Shear, Intermediate Transverse Stiffeners, Bearing Stiffener Design, Longitudinal Web Stiffeners, Proportioning the Section, Plate Girder Design Example – LRFD

DAY FOUR:

❖ **Connections**

- Types of Connections Simple Shear Connections, Seated Beam Connections – Unstiffened, Stiffened Seat Connections, Triangular Bracket Plates, Continuous Beam-To-Column Connections, Continuous Beam-To-Beam, Connections, Rigid-Frame Knees, Column Base Plates, Beam Splices

❖ **Frames-Braced and Unbraced**



- Elastic Buckling of Frames, General Procedures for Effective Length, Stability of Frames under Primary Bending Moments, Bracing Requirements – Braced Frames, Overall Stability When Plastic Hinges Form
- ❖ **Structural Steel and Bolting Inspection**
 - International Building Code Provisions, Structural Steels, Fabricated Steel, Steel Erection, Approved Fabricators, High-Strength Bolting

❖ **Practical Sessions/Site Visit**

DAY FIVE:

- ❖ **Maintenance of Steel Structures**
 - Maintenance Plan, Bridge Diagnosis Technology, Monitoring, Retrofitting
- ❖ **Sustainability of Steel-Framed Buildings**
 - Steel Construction Sustainability, Sustainability and Construction
 - Sustainability and Steel Construction, Specification of Key Issues
- ❖ **Durability of Steel Structures**
 - Listing of Deterioration Mechanisms and Effects, Approaches to Design for, Service Life, Probabilistic Approach to Service Life Design, Redundancy and Over Design, Maintenance Strategies, Life Cycle Cost, Environmental Life Cycle
- ❖ **Course Conclusion**
- ❖ **POST-TEST and EVALUATION**

Training Requirement:

“Hand’s on practical sessions, equipment and software will be applied during the course if required and as per the client’s request”.

Please note that the above topics can be amended as per client’s learning needs and objectives. Further, it should be forwarded to us a month prior to the course dates.

Training Methodology:

This interactive training course includes the following training methodologies as a percentage of the total tuition hours:-

- 30% Lectures, Concepts, Role Play
- 70% Workshops & Work Presentations, Techniques, Based on Case Studies & Practical Exercises, Software & General Discussions
- Pre and Post Test

Training Certificate(s):

Internationally recognized certificate(s) will be issued to each participant who completed the course.

Training Fees:

As per the course location - This rate includes participant’s manual, hand-outs, buffet lunch, coffee/tea on arrival, morning & afternoon - of each day.

Note: The 5% VAT (Value Added Tax), will be effective starting 01st of January 2018 as per the new regulation from the UAE Government. The VAT applies for all quotation both for local and abroad.





Training Timings:

Daily Timings:

07:45 - 08:00	Morning Coffee / Tea
08:00 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Prayer Break & Lunch)
13:30 - 15:00	Last Session

For training registrations or in-house enquiries, please contact:

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Training & Career Development Department