

Title: **Seismic Design in Steel: Concepts and Examples – Self-paced, Online Course**

Description: This course is intended to provide engineers with guidance so that they are ready to apply the AISC seismic design requirements correctly and efficiently on typical projects in regions of moderate or high seismicity. The course includes conceptual treatment of the principles of seismic design so that engineers understand the intent and basis of the AISC requirements, as well as a long design example that provides more specific guidance on typical application. The example is drawn from the AISC Seismic Design Manual, 2nd Ed., to allow students to explore the example in more detail.

Learning objectives: Understand the principles of seismic design of steel structures.

Understand the application of those principles to two common systems: Special Moment Frames and Buckling-Restrained Braced Frames.

Understand the application of design requirements for those systems.

Target Audience: Engineers with little or no experience with seismic design and engineers wishing to refresh their understanding of the principles underlying seismic design.

Format: Eight, 90-minute recorded sessions delivered via the web. Handouts are also provided. The first four sessions will focus on concepts, theory, and overall mechanics. The second four sessions will encompass the design of the seismic systems of a low-rise building. Each session includes a 10 question multiple choice quiz.



Sessions

Seismic Design Concepts

1. Course introduction

- Discussion of earthquakes as a significant load case
- Review of structural dynamics as related to seismic response
- Review of response spectrum as a way to characterize seismic demand
- Review of the benefits of system ductility
- Review of steel ductility and how it can be used to create system ductility
- Review of steel lateral systems steel systems

2. Moment Frames

- Presentation of moment-frame intended behavior and source of inelastic drift.
- Presentation of moment-frame analysis issues.
- Discussion of moment-frame connection testing and lessons learned after the Northridge earthquake.
- Treatment of connection design
- Discussion of member stability

3. Braced Frames

- Presentation of braced-frame configurations.
- Discussion of behavior of braced frames in earthquakes and in testing.
- Detailed treatment of brace behavior in tension and compression.
- Overview of configuration-related issues
- Discussion of the behavior of beam-column-gusset connection assemblies at large drifts and related design approaches.
- Treatment of design issues for gusset plates and connection analysis

4. Design

- Presentation of the formal relationship of codes in the US.
- Explanation of the basic concepts employed in code- seismic design, such as seismic design category, maximum considered earthquake, importance factor, etc.
- Explanation of general analysis and design requirements.
- Discussion of detailed systems (designed using the AISC Seismic Provisions) and non-detailed systems (designed using only the AISC Specification).
- Treatment of wind-vs.-seismic comparison issues.
- Discussion of irregularities
- Discussion of issues related to base plates
- Discussion of issues related to diaphragms, including the alternative design procedures in ASCE 7 2016



Application

5. Design example setup

- Presentation of design example steps
- System selection
- Configuration selection
- Base-shear determination, including wind vs seismic comparison
- Determination of Irregularities
- Presentation of load combinations, including determination of redundancy and identifying load combination extents (i.e., which elements get Omegified)

6. Building analysis/diaphragms

6.1. Analysis

- Review of analysis types and applicability
- Presentation of structural model, including moment releases and effective stiffness
- Discussion of second-order effects in the analysis
- Presentation of drift calculation and check

6.2. Diaphragms

- Determination of building-analysis forces, including via semi-rigid diaphragm modeling
- Discussion of capacity-design forces
- Design of members at diaphragm openings

7. Moment Frames

- Presentation of system/connection selection and prequalification issues
- Presentation of frame analysis
- Presentation of beam design
- Presentation of column design
- Presentation of connection design
- Presentation of base-plate design

8. Braced Frames

- Review of configuration-related issues, including load combinations and special checks
- Presentation of brace design
- Presentation of capacity design-analysis methods
- Presentation of beam design
- Presentation of column design
- Presentation of connection design at column
- Presentation of chevron connection design
- Presentation of base-plate design

