

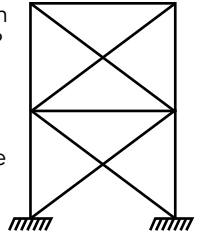
# steel quiz

The answers to this month's steel quiz can be found in the *AISC Seismic Provisions*, *AISC Seismic Manual* and *AISC Steel Design Guides*, as well as on the AISC and *Modern Steel Construction* websites.

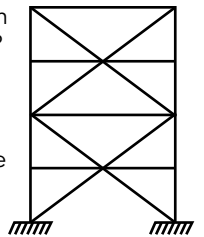
- 1 True or False: The requirements in the *AISC Seismic Provisions* sometimes apply to systems with  $R$  less than 3.
- 2 True or False: The columns in ordinary moment frames (OMFs) are required to be seismically compact just like intermediate (IMFs) and special moment frames (SMFs).
- 3 The design of structural steel high-seismic systems is based on which of the following design methodologies?
  - a) Elastic design
  - b) Capacity design
  - c) High-cycle fatigue design
  - d) Hot-spot stress design

- 4 True or False: Demand critical welds are required for all welded joints in the seismic force resisting system.
- 5 True or False: Width-thickness limits do not apply to tension-only braces in OCBF systems.
- 6 True or False: Prequalified connections are required for OCBF and SCBF gusset connections.
- 7 True or False: Cantilevered column systems are considered fixed-base systems.

- 8 The figure is which type of lateral frame?
  - a) X-braced frame
  - b) Eccentrically braced frame
  - c) Special truss frame
  - d) Two-story X-braced frame



- 9 The figure is which type of lateral frame?
  - a) X-braced frame
  - b) Eccentrically braced frame
  - c) Special truss frame
  - d) Two-story X-braced frame



- 10 True or False: There are prequalified weak-axis connections in AISC 358.

TURN PAGE FOR ANSWERS

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## ANSWERS

- 1 True. While it used to be that  $R > 3$  was the only range, more recent codes have systems with  $R$  not greater than 3 that require seismic detailing. Page 1-10 of the Second Edition of the AISC *Seismic Design Manual*, it states that "Designing to meet the seismic requirements of the AISC *Seismic Provisions* is mandatory for structures where they have been specifically referenced in Table 12.2-1 of ASCE/SEI 7. For steel structures, typically this occurs in SDC D and higher where  $R$  is greater than 3. However, there are instances where an  $R$  less than 3 is assigned to a system and the *Provisions* are required."
- 2 False. Section D1.1 in the 2010 *Seismic Provisions* provides the requirements for seismic compactness. As stated in Section E1.5a, "There are no limitations on width-to-thickness ratios of members for OMF, beyond those in the *Specification*."
- 3 b) Capacity design. Lateral systems are designed with fuses that are expected to yield. This yielding helps to dissipate energy from the earthquake and will shift the period of the structure, among other effects. The rest of the frame is then designed to support the yielding of the fuses with nominally elastic behavior.
- 4 False. Demand critical welds are only required by AISC 341 where specifically noted in the *Provisions*. Where lateral systems have demand critical weld requirements, there will be a specific section noting those requirements.
- 5 True. The width-thickness limits are for "compression" elements. By design, there are not any compression elements in a tension-only system. Technically, the braces will see some compression, but they will be so slender that they buckle elastically.
- 6 False. Connections in braced frames are not subject to prequalification, which only has relevance to connections used in intermediate and special moment frames.
- 7 True. Cantilevered column systems are lateral systems comprised of columns that cantilever from the foundation. They are fixed-base systems and the beams that frame into the columns are pinned and do not contribute to the lateral resistance. See Sections E5 and E6 and associated commentary in the AISC *Seismic Provisions*.
- 8 a) X-braced frame
- 9 d) Two-story X-braced frame
- 10 False. However, there are prequalified connections that allow for connections on multiple axes. ConXTech's ConXL Moment Connection is prequalified for multiple, orthogonal connections to a concrete-filled 16-in.-square HSS or built-up box column. AISC 358 Section 2.3.2b also permits the use of built-up column sections that allow other prequalified connections for multiple orthogonal connection conditions, including W-shape cruciform columns built-up box columns and boxed W-shape columns.