

# steel quiz

**LOOKING FOR A CHALLENGE?** *Modern Steel Construction's* monthly Steel Quiz tests your knowledge of steel design and construction. Most answers can be found in *AISC Steel Design Guide 7: Industrial Buildings—Roofs to Anchor Rods*.

- 1 True/False: A span-to-depth ratio of 15 to 20 generally will result in economical truss design.
  - b) 25%
  - c) 50%
  - d) None of the above.
- 2 Which two documents classify cranes and crane buildings in the U.S.?
- 3 What document defines the maximum wheel loads of cranes for the design of crane supports?
- 4 How much of the suspended mass on cranes typically is considered part of the seismic weight in the evaluation of seismic loads?
  - a) None
- 5 True/False: In the design of crane runways rolled shapes are preferred over the use of built-up members.
- 6 For cyclically loaded structures what is the threshold below which evaluation of fatigue resistance is not required?
  - a) 2,000,000 cycles
  - b) 200,000 cycles
  - c) 20,000 cycles
  - d) 200 cycles
- 7 What are common ways to construct crane columns?
  - a) Bracketed
  - b) Stepped
  - c) Laced
  - d) Battened
  - e) All of the above.
- 8 True/False: The effective unbraced length of an underhung cantilevered crane beam is always equal to the length of the cantilever segment.
- 9 When designing underhung crane beams, a localized bottom flange stress occurs due to the effects of the wheel contact load. What resource is used to design for the effects of this contact stress?
- 10 True/False: AISC provides tools for the determination of effective lengths of stepped columns.

# steel quiz

ANSWERS

- 1 True. According to part 1 of AISC *Steel Design Guide 7: Industrial Buildings—Roofs to Anchor Rods*, a span-to-depth ratio of 15 to 20 generally will result in economical truss design. All AISC design guides are available as free downloads for AISC members at [www.aisc.org/ebooks](http://www.aisc.org/ebooks).
- 2 The Crane Manufacturers Association of America (CMAA) classifies cranes using service classes, while the Association for Iron and Steel Technology (AIST) Technical Report No. 13 classifies crane buildings based on frequency of loading caused by the cranes. Refer to Part Two of *Design Guide 7* for more information.
- 3 Frequently, ASCE/SEI 7 is used to define the maximum wheel loads of cranes. AIST Technical Report No. 13 also specifies allowances for vertical impact factors. See Part Two of *Design Guide 7*.
- 4 (a) None of the suspended mass on the cranes is included. The seismic mass of cranes and trolleys needs to include only the empty weight of the equipment. See Part Two of *Design Guide 7*.
- 5 True. For heavy cranes and longer spans, the use of a plate girder or other built-up member may be the only option. When possible, however, use of rolled shapes is preferred because generally they have details that offer better fatigue performance.
- 6 (c) According to Section 3.1 of Appendix 3 in the 2005 AISC *Specification*, no evaluation of fatigue resistance is required when the number of cycles of application of live load during the life of the structure is less than 20,000.
- 7 (e) All of the listed configurations are common for crane columns. Please see Fig. 20.1.1 in *Design Guide 7* for an illustration of these construction types.
- 8 False. The effective unbraced length of underhung cantilevered crane beams depends on the length of the back span, the load type and location, and the bracing present at both the support point and the tip of the cantilever. Please refer to Section 5.2.4 in the 5th edition or Section 5.2.9 in the brand-new 6th edition of the SSRC *Guide to Stability Design Criteria for Metal Structures* for more on this. Note also that, according to Section F1 in the 2005 AISC *Specification*, a  $C_b$  value of 1.0 should be used for cantilevers that have an unbraced tip. By the way, you can purchase a copy of the 6th edition SSRC *Guide* at [www.stabilitycouncil.org](http://www.stabilitycouncil.org).
- 9 The CMAA document *Specifications for Top Running and Under Running Single Girder Electric Traveling Cranes Utilizing Under Running Trolley Hoist* has a suggested design approach for the examination of the wheel contact stresses.
- 10 True. Appendix B of AISC *Design Guide 7* reproduces an *Engineering Journal* paper by Agrawal and Stafeij from the 4th Quarter 1980 issue that provides guidance for the determination of effective lengths of stepped columns.

Anyone is welcome to submit questions and answers for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or at [solutions@aisc.org](mailto:solutions@aisc.org).



Steel  
**SolutionsCenter**