

# 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 the 2005 *Specification for Structural Steel Buildings*, available as a free download from AISC's web site, [www.aisc.org/2005spec](http://www.aisc.org/2005spec). Where appropriate, other industry standards are also referenced.

This month's Steel Quiz was developed by AISC's Steel Solutions Center. Sharpen your pencils and go!

- 1 **True/False:** Thermal cutting of Structural Steel by hand-guided means is not permitted.
- 2 American Standard Channels (C-shapes) and Standard Beams (S-shapes) have a slope along each inner flange of:
  - a. 1:12
  - b. 2:12
  - c. 3:12
  - d. 4:12
- 3 The 2005 AISC specification requires a minimum concrete cover over installed shear studs of:
  - a. no cover required
  - b.  $\frac{1}{4}$  in.
  - c.  $\frac{1}{2}$  in.
  - d.  $\frac{3}{4}$  in.
- 4 What does the phrase *available strength* mean?
  - a. allowable strength
  - b. design strength
  - c. nominal strength
  - d. required strength
- 5 The 13th edition AISC manual lists a nominal tensile stress of 90 ksi for ASTM A325 high-strength bolts. What is the allowable strength given that  $\phi = 0.75$  and  $\Omega = 2.00$  when the nominal bolt area is 0.442 in.<sup>2</sup>?
  - a.  $(90 \times 0.442) = 39.8$  kips
  - b.  $(90 \times 0.442) / 2.00 = 19.9$  kips
  - c.  $0.75 (90 \times 0.442) = 29.8$  kips
  - d.  $0.75 (90 \times 0.442) / 2.00 = 14.9$  kips
- 6 **True/False:** The 13th edition AISC manual lists newer wide-flange shapes not found in previous ASD and LRFD manuals.
- 7 Which ASTM standard covers twist-off type tension-controlled A490 high-strength bolt assemblies?
  - a. ASTM F959
  - b. ASTM F1554
  - c. ASTM F1852
  - d. ASTM F2280
- 8 In the 2005 AISC *Seismic Provisions*, what does  $R_t$  represent?
  - a. Ratio of specified minimum yield stress to expected yield stress
  - b. Ratio of specified minimum tensile stress to expected tensile stress
  - c. Ratio of expected yield stress to specified minimum yield stress
  - d. Ratio of expected tensile stress to specified minimum tensile stress
- 9 **True/False:** Ordinary Concentrically Braced Frames (OCBF) may be used for designs involving tension-only bracing.
- 10 What does a notional load represent in the Direct Analysis Method (Appendix 7 of the 2005 AISC Specification)?

TURN PAGE FOR ANSWERS

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## ANSWERS

**1 False.** According to Section 6.2.1 of the 2005 AISC *Code of Standard Practice* (a free download from [www.aisc.org/code](http://www.aisc.org/code)), thermal cutting of structural steel is permitted by hand-guided or mechanically guided means.

**2** The answer is **b**. Notice that a 2:12 slope is 2/12, or 0.167. Hence the slope is 16<sup>2</sup>/<sub>3</sub> percent, as specified by Sections 3.1.2.5 and 3.1.2.7 of the ASTM A6-05a standard. This slope is discussed in Chapter 1 of the 13th edition AISC manual, which may be ordered from [www.aisc.org/bookstore](http://www.aisc.org/bookstore).

**3** The answer is **c**. To guard against shear studs from protruding through a cast-in place elevated concrete slab, a ½ inch minimum concrete cover over the installed shear studs is mandated per Section I3.2c(1)(b) of the 2005 AISC specification (a free download from [www.aisc.org/2005spec](http://www.aisc.org/2005spec)).

**4** The answers are **a** and **b**. The available strength is the same as allowable strength in ASD or design strength in LRFD. Hence available strength is equal to the nominal structural capacity of a member or element, divided by the  $\Omega$  (for ASD) or multiplied by the  $\phi$  (for LRFD), as defined by the Specification.

**5** The answer is **b**, or 19.9 kips. For those transitioning from the old

ASD to the current ASD, note that  $\Omega$  are factors of safety, which are listed in the 2005 AISC specification. Hence to convert any nominal strength expression found in the *Specification* to allowable strength, simply divide by the appropriate  $\Omega$ . For those that prefer LRFD, answer **c** provides the equivalent design strength for LRFD.

**6 True.** The latest ASTM A6 standard includes several new, heavier wide-flange shapes. This means that older AISC manuals, such as the 3rd edition LRFD or 9th edition ASD manuals, no longer contain the latest available shapes. Shapes can change with each new edition of the applicable ASTM standards, so it is always good practice to verify shape availability before actually specifying. To do so, simply visit [www.aisc.org/availability](http://www.aisc.org/availability).

**7** The answer is **d**. Recently, the ASTM F2280 standard was released, and provides a standard similar to the existing ASTM F1852, which covers TC bolts with a strength level equivalent to that of A325 high-strength bolts. The new ASTM F2280 standard covers TC bolts with a strength level equivalent to that of A490 high-strength bolts.

**8** The answer is **d**. Analogous to  $R_y$  for yield strength in the 2005 AISC seismic provisions (a free download from

[www.aisc.org/2005seismic](http://www.aisc.org/2005seismic)),  $R_t$  is a measure of the ratio of the expected (actual) tensile stress to the specified minimum tensile stress. Both  $R_y$  and  $R_t$  will always be greater than one, as structural steel members and elements generally are produced to higher yield and tensile strengths than the minimum specified by ASTM.

**9 True.** According to Section 14.2 of the 2005 AISC seismic provisions, bracing members that are not in K, V or inverted-V configuration are not required to meet any  $Kl/r$  slenderness requirements. Hence tension-only bracing may be used.

**10** A notional load is a fictitious lateral load applied in a structural analysis as a means to account for destabilizing effects of gravity loads that are not otherwise accounted for in design provisions. In the direct analysis method as covered in Appendix 7 of the *Specification*, notional loads are applied to the lateral framing system to account for the effects of geometric imperfections, inelasticity, or both. Notional loads are lateral loads that are applied at each framing level and specified in terms of the gravity loads applied at that level.

Anyone is welcome to submit questions 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).



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