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**. 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 What is defined as a panel-zone in the AISC *Specification*?
  a. hot-rolled steel plate
  b. light-gauge steel panel
  c. area between transverse stiffeners in a plate girder
  d. column web adjacent to a beam-to-column moment connection

2 What is the upper length limit for cold cambering?
  a. 20-30 ft.
  b. 30-40 ft.
  c. 40-50 ft.
  d. 50-60 ft.

3 The flexural yielding limit state for a single-angle member is given in the 2005 AISC *Specification* as $M_n = 1.5M_y$. What is the allowable stress based on yielding if $\Omega = 1.67$?
  a. $0.90F_y$
  b. F_y
  c. $1.11F_y$
  d. $2.50F_y$

4 **True/False:** The AISC *Specification* uses the nominal area rather than the tensile stress area when determining the available strength of a bolt.

5 Tension members (L, LL and WT sections) must have connections proportioned such that the shear lag factor, U, is equal to or greater than:
  a. 0.50
  b. 0.60
  c. 0.75
  d. 0.90

6 Which is not a valid approach for determining the reduction of available strength in eccentrically loaded weld groups?
  a. moment-rotation method
  b. instantaneous center of rotation method
  c. ultimate strength method
  d. elastic method

7 The 2005 AISC *Seismic Provisions* introduced which two new seismic load resisting systems?
  a. SMF and SCBF
  b. OMF and C-OMF
  c. SPSW and BRBF
  d. C-PRMF and C-SPW

8 **True/False:** The ratio of actual-to-minimum specified yield strength (R_y) is larger for ASTM A36 than for ASTM A992 W-shapes.

9 The 2006 *International Building Code* references which of the following standards?
  a. 2005 AISC *Specification* (ANSI/AISC 360-05)
  b. 2005 AISC *Seismic Provisions* (ANSI/AISC 341-05)
  c. 1999 AISC LRFD *Specification*
  d. 1989 AISC ASD *Specification* w/supplement no. 1

10 The effective width of concrete slab on each side of a composite beam is limited to which of the following?
  a. ⅛ of the beam span, center-to-center of supports
  b. ½ the distance to the centerline of the adjacent beam
  c. the distance to the edge of the slab
  d. 48 times the depth of the steel section

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1 **d**. The *Specification*-defined **panel zone** is located in the column web and is delineated by the extension of beam and column flanges through the connection, transmitting moment through a shear panel. Refer to the glossary of the 13th edition AISC manual (www.aisc.org/bookstore) for the definition.

2 **c**. A length limit of 40 to 50 ft is perhaps the maximum length that can be accommodated in a practical manner by most cold cambering machines. There are additional limitations as well. Refer to page 2-29 of the 13th edition AISC manual for details.

3 **a**. Two concepts are illustrated here. First, allowable stresses are easily obtained from allowable strengths by separating out the applicable section property. Second, by deduction, it is obvious that the remaining choices do not satisfy the allowable strength requirements for yielding. That is, the allowable strength for the limit state of yielding must always be less than F_y. To arrive at the allowable strength (ASD), we simply divide the nominal strength, M_n, by the applicable section property (S in this case) and factor of safety, Ω. Hence $1.5F_y/1.67 = 0.90F_y$.

4 **True**. It might appear that use of the nominal area does not account for the reduction in diameter in the threaded portion of the fastener, which will reduce the area. However, the AISC *Specification* (www.aisc.org/2005spec) Table J2.5 values for available bolt tension and shear stress already include a "knock-down" factor to account for this nominal area basis. In this manner, one does not need to calculate the tensile stress area at the threads, which is a much more involved calculation. For further information on the subject, see the November 2006 Steel Interchange (www.aisc.org/steelinterchange).

5 **b**. According to section D3.3 of the 2005 AISC *Specification*, L, LL, and WT tension member connections are proportioned such that *U* is equal to or greater than 0.60. A lesser value of *U* is permitted if these members are designed for combined tension and flexure due to the effect of eccentricity in accordance with H1.2 or H2.

6 **a**. The AISC manual describes two methods: the instantaneous center of rotation method and the elastic method. The instantaneous center of rotation method has also been referred to as the ultimate strength method. For additional information, refer to page 8-9 (eccentrically loaded weld groups) in the 13th edition AISC manual.

7 **c**. The 2005 AISC *Seismic Provisions* (www.aisc.org/2005seismic) introduced the special plate shear wall (SPSW) and buckling-restrained braced frame (BRBF) seismic load resisting systems. Refer to sections 16 and 17 in Part I of the current *Seismic Provisions*.

8 **True**. For W-shapes, R_y for ASTM A36 is 1.5, whereas for ASTM A992, it is 1.1. Hence ASTM A36 has a greater ratio of actual-to-minimum specified yield strength than ASTM A992. Refer to Table I-6-1 in the 2005 AISC seismic provisions for a listing of R_y and R_t values.

9 **a** and **b**. For additional information, refer to Chapter 35 of the 2006 *IBC* (www.iccsafe.org).

10 **a**, **b**, and **c**. The effective width of a composite beam slab on each side is no longer a function of the slab depth (nor the depth of the steel section). Refer to section I3.1a of the AISC *Specification* for requirements.