

Steel Quiz, a monthly feature in *Modern Steel Construction*, allows you to test your knowledge of steel design and construction. All references to LRFD specifications pertain to the 1999 LRFD Specification for Structural Steel Buildings, available as a free download at

www.aisc.org/lrfdspec

ASD references pertain to the 1989 ASD Specification for Structural Steel Buildings. Where appropriate, other industry standards are also referenced.

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February's *Steel Quiz* was contributed by David Eckmann, S.E., AIA, and the Structural Group of OWP/P Structures, Chicago, IL.

1. For a wide-flange shape that is torsionally simply supported at its ends and subject to torsion along its span, what are the primary types of stress that develop, and where are they maximum along the span and cross section?
2. In steel design, what is the Q factor and what does it typically address?
3. Which of the following, as defined in Section 2.1 of the *Code of Standard Practice*, is not considered to be structural steel?
 - a. relieving angles, if attached to the structural steel frame
 - b. purlins, if made from standard structural shapes
 - c. steel joist girders
 - d. leveling plates
4. What two properties must be addressed in the design of a member that serves as a brace for a compression member or flexural member?
5. In reference to the design of slip-critical connections, what are the definitions of Class A, Class B, and Class C surfaces?
6. Whether stiffened or not, a recommended upper limit on the height of a rectangular beam-web penetration, h_v is
 - a. $0.5 \times$ beam depth, d
 - b. $0.7 \times$ beam depth, d
 - c. $0.75 \times$ beam depth, d
 - d. $0.8 \times$ beam depth, d
7. What is the minimum design-factored load for truss connections?
8. According to Section 10 of the AISC *Code of Standard Practice*, which of the following is acceptable to remain on Architecturally Exposed Structural Steel (AESS):
 - a. weld show-through
 - b. stamped or raised manufacturer's identification marks
 - c. welded seams on HSS
 - d. all of the above
9. Which of the following is the LRFD criterion for deflection of structural steel members?
 - a. total deflection $< L/240$
 - b. live load deflection $< L/360$
 - c. both a and b
 - d. none of the above
10. Which term, according to the LRFD *Specification*, describes the phenomenon whereby a perfectly straight member under compression might either assume a deflected position or remain undeflected, or a beam under flexure might either deflect and twist out of plane or remain in its in-plane deflected position?
 - a. bifurcation
 - b. batten buckling
 - c. ductility
 - d. Euler load

TURN PAGE FOR ANSWERS

STEEL QUIZ

ANSWERS

1. There are three types of stresses induced: warping axial stresses, which are oriented along the axis of the member and are maximum at the tips of the flanges at the member mid-span; St. Venant shear stresses, which are maximum at the ends of the span and in the thinnest part of the cross section; and warping shear stresses, which are maximum at the member mid-span in the flanges. See *AISC Design Guide No. 9: Torsional Analysis of Steel Members* for further information.
2. Q is a factor applied to compression members with slender elements subject to local buckling, and addresses the reduced capacity of such members.
3. c.
4. Strength and stiffness. The 3rd edition *LRFD Manual* is the first manual to address both properties.
5. Refer to the 3rd Edition *LRFD Manual* for the 2000 *RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts*, which is also available for free download from www.boltcouncil.org. In Section 5.4.1, class A surfaces are surfaces with a mean slip coefficient of not less than 0.33 (uncoated, clean mill-scale steel surfaces or surfaces with Class A coatings on blast-cleaned steel); Class B surfaces are surfaces with a mean slip coefficient of not less than 0.50 (uncoated blast-cleaned surfaces or surfaces with Class B coatings on blast-cleaned steel); and Class C surfaces are surfaces with a mean slip coefficient of not less than 0.35 (roughened hot-dip galvanized surfaces).
6. b. Per *AISC Design Guide No. 2: Steel and Composite Beams with Web Penetrations*, the height of a rectangular web penetration should be limited to $0.7 \times$ the beam depth, d .
7. 10 kips. See *LRFD Specification* Section J1.7.
8. d, unless the contract specifically addresses an alternative treatment of such items.
9. d. Neither the *ASD Specification* nor the *LRFD Specification* address such limits, which can vary with application. Instead, *LRFD Specification* Section L3.1 indicates that "Deformations in structural members and structural systems due to service loads shall not impair the serviceability of the structure."
- 10.a.