

steel quiz

Answers to this month's Steel Quiz can be found in the AISC *Specification*, AISC *Steel Construction Manual*, AISC *Steel Design Guides* and *Steel Bridge Design Handbook*, as well as at www.aisc.org and www.modernsteel.com.

- 1 True/False: Similar to a straight girder, the design of a concentrically loaded curved girder accounts for vertical shear and bending effects only; torsion is not a consideration.
- 2 True/False: Beam web penetrations are one way of allowing mechanical ductwork and plumbing lines to pass through structural beams and girders while maintaining a shallow ceiling and minimum floor-to-floor height.
- 3 Subdividing the building volume into similar modular units or blocks that can be largely built and finished, brought to the site on trucks and erected is which type of construction method?
 - a) Modular construction
 - b) Pre-engineered construction
 - c) Minimalized construction
 - d) None of the above
- 4 True/False: In the context of a building, robustness implies a design that is capable of resisting at least 1.5 times the code-specified loads.
- 5 _____ between the structural engineer and steel fabricator can result in significant schedule savings beyond what would normally be anticipated on a steel-framed project.
 - a) Coordination
 - b) Early involvement
 - c) Collaboration
 - d) All of the above
- 6 True/False: Although more commonly used in façades, panelization concepts can also be applied to floors and other structural elements.
- 7 True/False: In thermal calculations, R and U both measure moisture flow through building materials.
- 8 What is thermal bridging?
 - a) Energy loss
 - b) Daylighting
 - c) Moisture loss
 - d) None of the above
- 9 Which piece of equipment is a type of crane used in bridge erection?
 - a) Lattice boom crawler crane
 - b) Mobile lattice boom crane
 - c) Lattice ringer crane
 - d) All of the above
- 10 True/False: Coping and cutting are two methods to create the profile necessary to bolt a wide-flange diaphragm directly to a connection plate for bridge fabrication.

TURN PAGE FOR ANSWERS

- 1 False. The torsion in curved girders results because the center of loading (also the center of gravity) of each span in a curved girder is offset from a chord line drawn between the supports for the span. This offset represents an eccentricity that, when multiplied by a given vertical load, results in a torque on the girder.
- 2 True. Beams and girders in buildings have, by natural consequence, regions of reserve capacity. Some areas along the length of the member can tolerate the placement of a round, square or rectangular penetration—either concentrically or eccentrically placed—often without a change in the shape. AISC *Steel Design Guide 2*, available at www.aisc.org/epubs, provides guidance for the design of wide-flange beams with web openings.
- 3 a) Modular construction. The most advanced cases involve prefabricated units erected with their interior and exterior work already complete, leaving inter-unit connections, mating surfaces and minor weather sealing left to be completed on-site.
- 4 False. The term robustness implies a reserve capacity to resist loads in excess of those required in the building code; however, there is not a specific associated load level. Frequently Asked Question 12.4.3 on our website at www.aisc.org/faq provides more information. This is also discussed in the *Facts for Steel Buildings #2: Blast and Progressive Collapse*, which is available for free download at www.aisc.org/epubs.
- 5 d) All of the above. AISC has documented projects where early fabricator involvement alone has cut the schedule for steel procurement, fabrication and erection by half.
- 6 True. It is possible to frame the structural floor of an entire bay (including decking) either off-site or on the ground and then erect it as a single piece, reducing the number of lifts required for the project. This approach had been used with conventional framing, steel joist framing and proprietary alternatives such as Versa Floor. This approach can reduce cost and increase safety.
- 7 False. U is the conductivity, a measure of the ability of an assembly to transfer heat, expressed in the conventional U.S. units $\text{Btu/hr}\times\text{ft}^2\times^\circ\text{F}$. R is the resistance—the inverse of U ($U = 1/R$). The R and U for an assembly depend on the materials contained in the assembly and the geometry. Usually, this is not a function of structure, but rather of the façade system and insulation. However, when structural materials pass through the façade and/or insulation system, the details can cause thermal bridging. See Answer 8 for more information.
- 8 a) Thermal bridging refers to the loss of building energy through thermal conductivity of elements that “bridge” across the insulation of a wall or roof enclosure of a conditioned (i.e., heated or cooled) space when the outside temperature differs from the interior temperature. Steel solutions for thermal bridging are addressed in the March 2012 issue of *MSC*.
- 9 d) All of the above are typical cranes, and one more crane type is a tower crane. Cranes come in various types and sizes. Each crane has its specific advantages and disadvantages based on numerous factors. To learn more, see Chapter 13 of the *NSBA Steel Bridge Design Handbook*.
- 10 True. When coping, the fabricator cuts away the flange and a portion of the web, allowing the shape to mate flat on the stiffener. When cutting (flush), the fabricator cuts one side of the flange flush to the shape of the web. Both approaches are useful, and preference for one or the other varies among fabricators.