

STEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction. Unless otherwise noted, all answers can be found in the *LRFD Manual of Steel Construction*. To receive a free catalog of AISC publications, circle #10 on the reader service card in the back of this magazine.

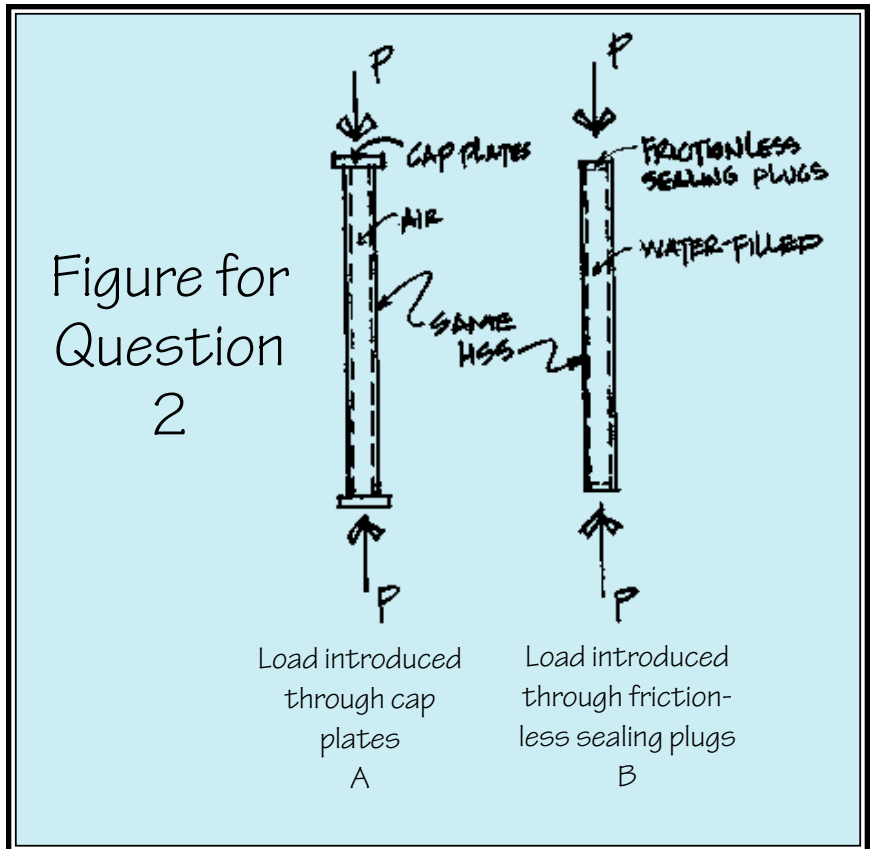
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Kudos to all who caught my simplistic (and embarrassing) mathematical goof in Question #9 in the April 1997 Steel Quiz. For the solution given, the correct force in cable B is 10.5 kips. The error generated quite a volume of response and showed us just how many people read the Steel Quiz. Thanks for your interest, I'll sharpen my pencil.

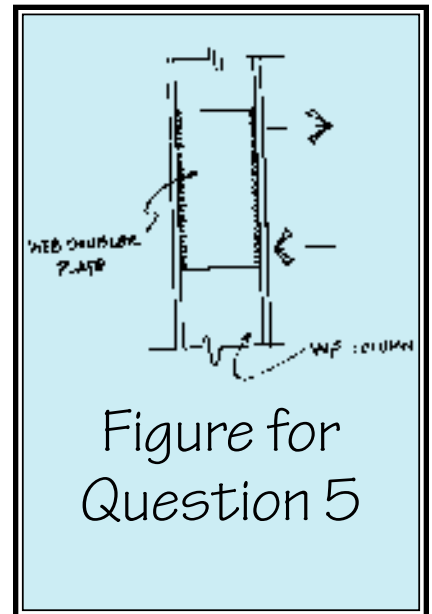
QUESTIONS

1. Seismic beam-to-column moment connections that use either reinforcement, such as ribs or coverplates, or reduced beam sections (dog-bones) are generally configured to shift the plastic hinge location away from the column face. When the hinge forms in the beam at a distance a from the column face, what is the moment that must be transferred at the column face?
2. Assuming pinned ends, how many times higher is the buckling load for column B than for column A?
3. In seismic moment frame design, a strong-column/weak-beam design requirement is often imposed. What does this mean?
4. What is a column tree?
5. For the doubler plate illustrated, the edges along the



column flanges have been welded to develop the strength of the doubler plate. What welding is required along the top and bottom edges?

6. Is lateral-torsional buckling a limit-state for weak-axis flexure of a wide-flange beam? Why?
7. For fully tensioned ASTM A325 bolts, the minimum installed tension for a 1-in. diameter (51 kips) is 82 percent higher than that for a $\frac{3}{4}$ -in. diameter (28 kips). Why is this when the diameter is only 33 percent higher?
8. There are at least six methods that are used to cut steel. How many can you name?
9. LRFD Specification Commentary Section M3 indicates that corrosion does not progress on steel that is enclosed by building finish. Why doesn't it?



10. What percentage carbon is normally present in structural steel shapes?

ANSWERS:

1. The plastic moment at the hinge location is $F_y Z$, where Z is the plastic section modulus at the hinge location. This is amplified by the transfer of the associated shear force V back to the column face and the resulting moment at the column face is $F_y Z + Va$.
2. These columns buckle at the same load. Although the load is introduced differently, the tendency of the HSS in **A** and the column of water in **B** to buckle is identical because the member providing restraint to buckling is identical. *Thanks to T.M. Murray for this question and answer.*
3. The selection of a strong column and weak beam means that inelastic deformations will occur in the beam(s) and the column will remain essentially elastic.
4. A column tree is a fabricated assembly that has a column or columns with girders and/or girder stubs attached to it in the fabrication shop. This approach can be used in some cases to shift labor from the field into the shop and reduce overall cost.
5. For the detail shown, minimum-size fillet welds per LRFD Specification Table J2.4 are used, primarily to restrain the doubler from buckling. The concentrated forces are dispersed through the panel zone in shear, delivered entirely to the column flanges through the welds along the vertical edges, and subsequently equilibrated by flexure in the column. Thus, the top and bottom welds do not participate in the direct force transfer.
6. No. When a beam is bent about its weak axis, it is already in its lowest energy position, so it can only yield or buckle locally.
7. For fully tensioned installation, the minimum installed tension is proportional to the square of the diameter. This is one reason why larger diameter bolts are increasingly difficult to fully tension.
8. Six possible answers are: friction sawing, cold sawing (rotary, hack, band), flame cutting, plasma cutting, laser cutting, and shearing.
9. For corrosion to progress, oxygen and moisture must be present. Once sealed in building finish, there is generally insufficient reintroduction of moisture to allow corrosion to progress, except in special cases such as beachfront exposure.
10. In ASTM A572 grade 50 structural shapes, carbon content is limited to 0.23 percent. For ASTM A36 structural shapes, the limit is 0.26 percent. It makes you wonder why we call it carbon steel! *Thanks to G.G. Deierlein for this question and answer.*