Steel Quiz

Steel Quiz, a monthly feature in *Modern Steel Construction*, allows you to test your knowledge of steel design and construction. Answers can generally be found in the *LRFD Manual of Steel Construction*, 2nd edition, but other industry standards are often referenced.

If you or your firm are interested in submitting a *Steel Quiz* question or column, please contact:

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The questions and answers for this month's Steel Quiz were contributed by the **Structural Department of OWP&P Architects, Inc., Chicago, IL.**

Questions

1. What is the maximum diameter of a shear stud that is not located directly over the web of a composite beam?

2. A full penetration weld is utilized in a structural steel member identified as AESS on the project documents. The weld is identified as B-U4a type joint or similar and uses a backing bar. Is the backing bar to be removed, back gouged and ground smooth since it is noted as an AESS member, or are special notes required on the plans to identify this requirement?

3. Does the specified yield stress have an impact on whether design by plastic analysis is permitted?

4. What is a "batten plate"?

5. What is St. Venant torsion?

6. To qualify as a composite column, which of the following limitations must be met?

   a) The cross-sectional area of the steel shape, pipe, or tubing shall comprise at least four percent of the total composite cross section.
   b) Concrete shall have a specified compressive strength f'c of not less than 3 ksi nor more than 8 ksi for normal weight concrete and not less than 4 ksi for light weight concrete.
   c) The specified minimum yield stress of structural steel and reinforcing bars used in calculating the strength of a composite column shall not exceed 55 ksi.
   d) All of the above.

7. What is the limiting laterally unbraced length for full plastic bending capacity of an HSS6x0.28, ASTM A53-Grade B?

8. What is the approximate strength in kips/inch of a 1/4" fillet weld (E70XX electrodes), LRFD Specification?

9. Which of the following are not considered "Structural Steel," and are not typically included within the fabricator's scope of work (even if such items are shown on the structural engineer's contract documents)?

   a) Field installed shear connectors
   b) Lintels
   c) Joist girders
   d) Suspension system cables

10. Even if strength requirements do not dictate the larger weld size, why is it not appropriate to use a smaller fillet weld size than shown in Table J2.4 - Minimum Size of Fillet Welds?

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Answers

1. 2.5 times the thickness of the flange to which they are welded.

2. Special notes must be added to the project plans identifying these requirements.

3. Yes—according to Section A5.1 in the LRFD Specification, design by plastic analysis is only permitted for steels with specified yield stresses not exceeding 65 ksi.

4. A batten plate is a plate element used to rigidly join two parallel components of a built-up column, girder, etc. designed to transfer shear between each component

5. It is the portion of the torsion in a member that induces only shear stresses in the member.

6. d, All of the above (Section I2.1 in the LRFD Specification)

7. The lateral-torsional buckling limit state is not applicable to square or circular shapes, therefore $\phi M_n = \phi M_p$

8. $\phi R_n = 0.75 \times 0.60 \times 70 \times 0.707 \times 1/4 = 5.57$ kips/inch

9. None of the items are considered "Structural Steel" as defined in Section 2 of the AISC *Code of Standard Practice.*

10. The minimum weld sizes are based on the quench effect of thick material on small welds. Rapid cooling of welds may reduce ductility and also result in weld cracking. It should be noted that for plates thicker than ¾", the minimum size 5/16" weld may not be adequate without further considerations. Preheating may be necessary to prevent weld cracking and loss of weld ductility. AWS D1.1 identifies the preheating criteria.