

# steel quiz

This month's Steel Quiz takes a look at the design of composite members as covered in Chapter I of the *AISC Specification*.

- 1 True or False: Designers are permitted in the *AISC Specification* to use allowable strength design (ASD) when designing a composite member.
- 2 For the axially loaded encased composite member shown in Figure 1, the area of the steel core,  $A_{sr}$ , must comprise at least \_\_\_\_ of the total composite cross section.
  - a. 1%
  - b. 3.5%
  - c. 10%
  - d. 12.5%
- 3 For the axially loaded encased composite members shown in Figure 1, the minimum reinforcement ratio for continuous longitudinal reinforcing,  $A_{sr}/A_g$  must be \_\_\_\_
  - a. 0.001
  - b. 0.004
  - c. 0.010
  - d. 0.018

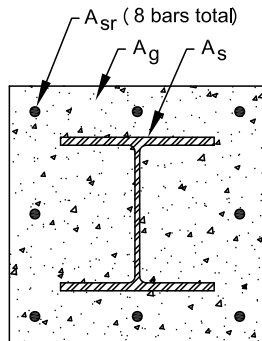


Figure 1

- 4 True or False: The required minimum longitudinal reinforcing ratio for encased composite members, as highlighted in Question 3, comes from ACI 318.
- 5 Per the *AISC Specification*, the nominal strength of composite sections can be determined via a **plastic stress distribution method** or the **strain compatibility method**. Figure 2 is representative of the \_\_\_\_ method and Figure 3 is representative of the \_\_\_\_ method.

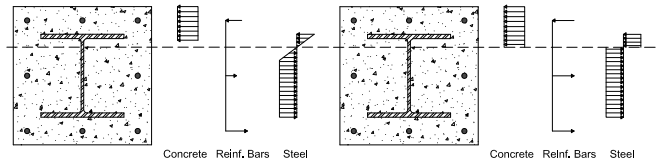


Figure 2

Figure 3

- 6 True or False: Local buckling effects need not be considered for encased composite members.

TURN PAGE FOR ANSWERS

- 1 **True.** The design basis for ACI 318 is strength design. Designers using ASD for steel design must be conscious of the different load factors between the two specifications.
- 2 **a.** 1%. In the *AISC Specification*, the use of composite compression members is applicable to a minimum steel ratio (area of steel shape divided by the gross area of the member) equal to or greater than 1%.
- 3 **b.** 0.004. A minimum amount of longitudinal reinforcing steel is prescribed to ensure that unreinforced concrete encasements are not designed with the provisions in the *AISC Specification*.
- 4 **False.** The limitation of  $0.01A_g$  in ACI 318 for the minimum longitudinal reinforcing ratio of reinforced concrete compression members is based upon the phenomena of stress transfer under service load levels from the concrete to the reinforcement due to creep and shrinkage. It is also intended for resisting incidental loading not captured in the analysis. The inclusion of an encased structural steel section meeting the requirements of Section I2.1a aids in mitigating this effect and consequently allows a reduction in minimum longitudinal reinforcing requirements.
- 5 Figure 2 is representative of the strain compatibility method, and Figure 3 is representative of the plastic stress distribution method. Both methods are permitted, but the strain compatibility method should be used to determine nominal strength for irregular sections.
- 6 **True.** In contrast, local buckling effects do need to be considered for filled composite members as defined in the *AISC Specification*.



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Everyone is welcome to submit questions and answers for Steel Quiz. If you are interested in submitting one question or an entire quiz, contact AISC's Steel Solutions Center at 866.ASK.AISC or at [solutions@aisc.org](mailto:solutions@aisc.org).