

CHAPTER 1 PROBLEM SOLUTIONS (SECOND EDITION)

1. Where could one find information about the provisions of the 1961 AISC Specification? (See Section 1.2)

The CD, AISC Specifications, 1923-2005

2. What resource would be most likely to assist in the determination of properties of a steel member found in a building built in 1954? (See Section 1.2)

AISC Design Guide 15; AISC Rehabilitation and Retrofit Guide

3. List and define the three basic goals of a design team for the design of any building. (See Section 1.5)

Safety – the building must be safe for its occupants and must neither fail locally nor overall

Function – the building must serve the owner in the best way possible and meet all functional criteria

Economy – The design, construction, and use of the building should be Cost effective

4. All structures are composed of some or all of five basic structural types. List these five basic structural components and provide an example of each. (See Section 1.6)

- a. *Tension members – web and chord members in a truss*
- b. *Compression members – column*
- c. *Bending members – floor beam or girder*
- d. *Combined force members – beam-column*
- e. *Connections – bolted or welded connection in a steel frame*

5. Provide an example of each of the following types of construction. To the extent possible, identify specific buildings in your own locale. (See Section 1.7)

- a. *Bearing wall – school*
- b. *Beam-and-column – shopping center*
- c. *Long-span – warehouse*
- d. *High-rise – skyscraper office building*
- e. *Single-story – pre-engineered building*

6. What type of structural system uses the combined properties of two or more different types of materials to resist the applied loads? (See Section 1.7)

Composite Construction

7. List and describe two types of lateral bracing systems commonly used in high-rise buildings. (See Section 1.7)

- f. *Moment Frame – resists lateral loads through the use of moment resisting connections*

g. *Braced Frames – resist lateral loads using some configuration of bracing elements*

8. In designing a steel structure, what must be the primary concern of the design engineer? (See Section 1.8)

Safety

9. Provide a simple definition of structural design. (See Section 1.8)

The determination of structural member sizes and connections that will result in a structure that is strong enough to resist the loads that it will experience and stiff enough to provide a serviceable structure.

10. Describe the difference between a strength limit state of a structure and a serviceability limit state. (See Section 1.8)

The ultimate limit state is a strength limit state and is associated with the collapse of the structure if exceeded. A serviceability limit state is a failure of the structure to meet certain predetermined criteria for deflection, vibration, etc.

11. Give a description of both the LRFD and ASD design approaches. (See Sections 1.9 and 1.10)

Allowable strength design (ASD) is based on the requirement that the required strength of a structure under the ASD load combinations is not to exceed the allowable strength. This allowable strength is the nominal strength of the structure divided by a factor of safety, Ω . Load and resistance factor design (LRFD) is based on the requirement that the required strength of the structure under the LRFD load combinations is not to exceed the design strength. The design strength is the nominal strength of the structure multiplied by the resistance factor, ϕ .

12. Provide an example of three strength limit states. (See Section 1.13)

Yielding, rupture, buckling

13. Provide an example of three serviceability limit states. (See Section 1.13)

Deflection, vibration, drift