

25. Standard Specifications for Open Web Steel Joists, K-Series, Steel Joist Institute, Myrtle Beach, SC, 2002.
26. *Design Manual*, Steelox Systems Inc., Mason, OH, May 1992.
27. Alexander Newman, "The Answer in 'Steel Interchange,'" *Modern Steel Construction*, AISC, Chicago, IL, September 1994, p. 10.

## REVIEW QUESTIONS

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- 1 Why is purlin bracing required?
- 2 Select a preliminary size of continuous purlins spanning 25 ft and supporting the roof live load of 20 psf and the collateral load of 5 psf. Assume the dead load of purlins and roofing is 2 psf. The maximum vertical deflection should not exceed  $L/240$ . Use LGSI Z sections.
- 3 Name two methods of bracing the interior flange of cold-formed girts.
- 4 What are the three roles of the eave member?
- 5 Explain the concept of effective design width in cold-formed sections.
- 6 List three methods of increasing flexural capacity of purlins in the end spans. Why might it be needed?
- 7 What does the base test measure?
- 8 What is the function of antiroll clips? What is purlin roll?
- 9 Can the standing-seam roofing with concealed clips be considered lateral bracing for open-web joists? If yes, why? If not, what can be?
- 10 Explain the difference between a wind column and a wind post.

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# CHAPTER 6

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# METAL ROOFING

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## 6.1 INTRODUCTION

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A roof's function goes far beyond protecting the interior from the weather. Architecturally, a roof complements and accentuates the color and texture of the building and plays a major role in establishing its character and appearance. Structurally, roof covering may resist wind and live loads and may serve as bracing for roof purlins.

Metal roofing is among the most attractive features pre-engineered buildings have to offer, having contributed mightily to the growing popularity of metal building systems. This chapter examines the available metal roofing materials and discusses specifying metal roofing for new construction. Some special challenges of reroofing applications are outlined in Chap. 14.

Metal roofing has been used in Europe, and later in this country, for centuries. Traditionally, it was formed into pans by hand for subsequent manual crimping or seaming. The glorious golden dome covering the Massachusetts State House was fabricated and installed by none other than Paul Revere.<sup>1</sup> Designed by Charles Bulfinch and completed in 1797, this edifice is still considered to be one of the five best buildings in Boston.

Some popular turn-of-the-century roofing materials included terne roofs, made of steel coated with an alloy of 4 parts lead and 1 part tin. Unfortunately, those early terne roofs eventually rusted and had to be painted over.

Contemporary metal roofing is a far cry from its predecessors. Today's products offer long, largely maintenance-free service lives, reflected in 20-year warranties; the best may last for half a century with some periodic maintenance and spot repairs. For the last few years, metal roofing was installed at an annual rate of about 2 billion ft<sup>2</sup> (Ref. 2).

Occasionally, pre-engineered buildings are covered with nonmetal roofs—built-up or membrane. This fact could reflect many reasons ranging from the architect's desire to fit into the surrounding environment, where metal roofing might be out of character, to the owner's prosaic preference to avoid hearing the rain noise amplified by metal. Built-up or membrane roofs are easier to incorporate into the buildings which already deviate from the one-trade concept, such as those framed with bar joists or hot-rolled purlins and steel roof deck. Design guidelines for nonmetal roofing are widely available and are not repeated here.

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## 6.2 MAIN TYPES OF METAL ROOFS

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### 6.2.1 "Waterproof" versus "Water-Shedding" Roofing

Fundamentally, metal roofing can be classified by the way it resists water intrusion. *Water-shedding* or "hydrokinetic" roofing is functionally similar to roof shingles—it relies on steep slope to rapidly shed rainwater. As with shingles, the minimum slope required by this type of roofing is 4:12, although a 3:12 pitch is often considered acceptable. Water-shedding roofing is normally installed on top of