CHAPTER 3
THE BASICS

3.1 STRUCTURAL LOADS

In this chapter we review the structural basics of metal building systems. We begin with a brief discussion of the structural loads (or loads, for simplicity) that the systems typically must carry, the methods of combining these loads, and the methods of analysis. We then discuss how metal building systems work structurally and what their competition is, and examine the process of system selection. Our goal is to show how and when to make an informed judgment about suitability of preengineered framing for a particular project.

3.1.1 Dead and Collateral Loads

Dead load is the weight of all permanent construction materials, such as roofing, framing, and other structural elements. Being well defined and known in advance, dead load is assigned a relatively low factor of safety in the ultimate (load factor) design.

Collateral or *superimposed dead load* is a specific type of dead load that includes the weight of any materials other than the permanent construction. It may account for the weight of mechanical ducts, pipes, sprinklers, electrical work, future ceilings, and reroofing.

How much do these components weigh? The *MBMA Manual*[1] suggests the following typical values:

- Ceilings: 1 to 3 psf
- Lighting: 0.1 to 1 psf
- Heating, ventilating, air conditioning (HVAC) ducts (office/commercial occupancy): 1 psf
- Sprinklers: 1.5 psf for dry systems, 3 psf for wet systems

Adding up the numbers, a commercial or industrial building with sprinklers, lights, and mechanical ducts—but without ceiling—could be designed for the collateral load of at least 5 psf. In theory, this 5-psf collateral load is sufficient to account for the effect of most hanging pipes, lights, and even small fans. But in practice, the weight of these elements is not applied in a uniform fashion, and a larger amount of collateral load may need to be specified. However, the manufacturers tend to dislike such artificially high (in their opinion) levels of collateral load, as further discussed in Chap. 10.

The *equipment load,* which accounts for the weight of each specific piece of equipment supported by the roof or floor, should be specified separately. The weight of any HVAC rooftop unit heavier than 200 lb, for example, is best represented by a concentrated downward force in the design of the supporting purlins. The equipment load could be "averaged out"—converted to a uniform collateral load—for the main framing design.