CHAPTER 11
LATERAL DRIFT AND VERTICAL DEFLECTIONS

11.1 THE MAIN ISSUES

The discussion in Chaps. 7 and 9 has already highlighted an importance of specifying correct design criteria for lateral drift and vertical deflections. This chapter is specifically devoted to this critical and controversial topic that occupies the minds of many structural engineers who specify metal building systems.

First, the definitions: *Lateral* (*story*) *drift* is the amount of sidesway between two adjacent stories of a building caused by lateral (wind and seismic) loads (Fig. 11.1). For a single-story building, lateral drift equals the amount of horizontal roof displacement. *Horizontal deflection* of a wall refers to its horizontal movement between supports under wind or earthquake loading. *Vertical deflection* of a floor or roof structural member is the amount of sag under gravity or other vertical loading.

Why is any of this controversial? Drift and deflection criteria, along with some other issues such as vibrations, deal with *serviceability,* or functional performance, of buildings under load. Model building codes have traditionally prescribed the desired levels of strength and safety, leaving the more nebulous topics of satisfying the occupants' perceptions of comfort and solidity up to the designers. The designers' criteria for achieving these goals are necessarily subjective, as the building which seems flimsy to one person may feel comfortable to another.

Various design firms tend to specify similar, although not identical, limits on horizontal and vertical building displacements for medium and high-rise structures. On the other hand, stiffness requirements for low-rise pre-engineered buildings remain a mystery to many engineers. These squat structures have been traditionally clad in flexible metal siding and roofing that could tolerate large amounts of framing movement, and their serviceability was rarely a problem.

The specifiers became concerned only when brittle wall materials such as masonry and concrete began to find their way into metal building systems. For those cases, some engineers continued to specify the same strict drift and deflection criteria used in conventional construction—only to be rebuffed by many manufacturers denouncing such rigidity requirements for metal buildings as unnecessarily expensive and impractical.

Should metal buildings with hard walls be granted special privileges?

In a similar vein, when a metal building system abuts a masonry structure (Fig. 11.2), its lateral sway should be controlled so as not to damage the brittle masonry. Alternatively, the two structures could be separated by the amount of the expected combined lateral building displacements, but the most common approach seems to be simply to jam the two structures together, or to use the hard-wall front for the metal building on the back.

What about vertical deflections? Should a structure supporting flexible metal roofing be governed by more lenient vertical deflection criteria than other lightweight structures—say, wood rafters carrying asphalt shingles? As we will see, the answer is not as straightforward as might appear at first glance.

Our journey through these emotionally charged waters will begin with topics of lateral story drift and horizontal wall displacement and will then continue to the subject of vertical deflection criteria.