

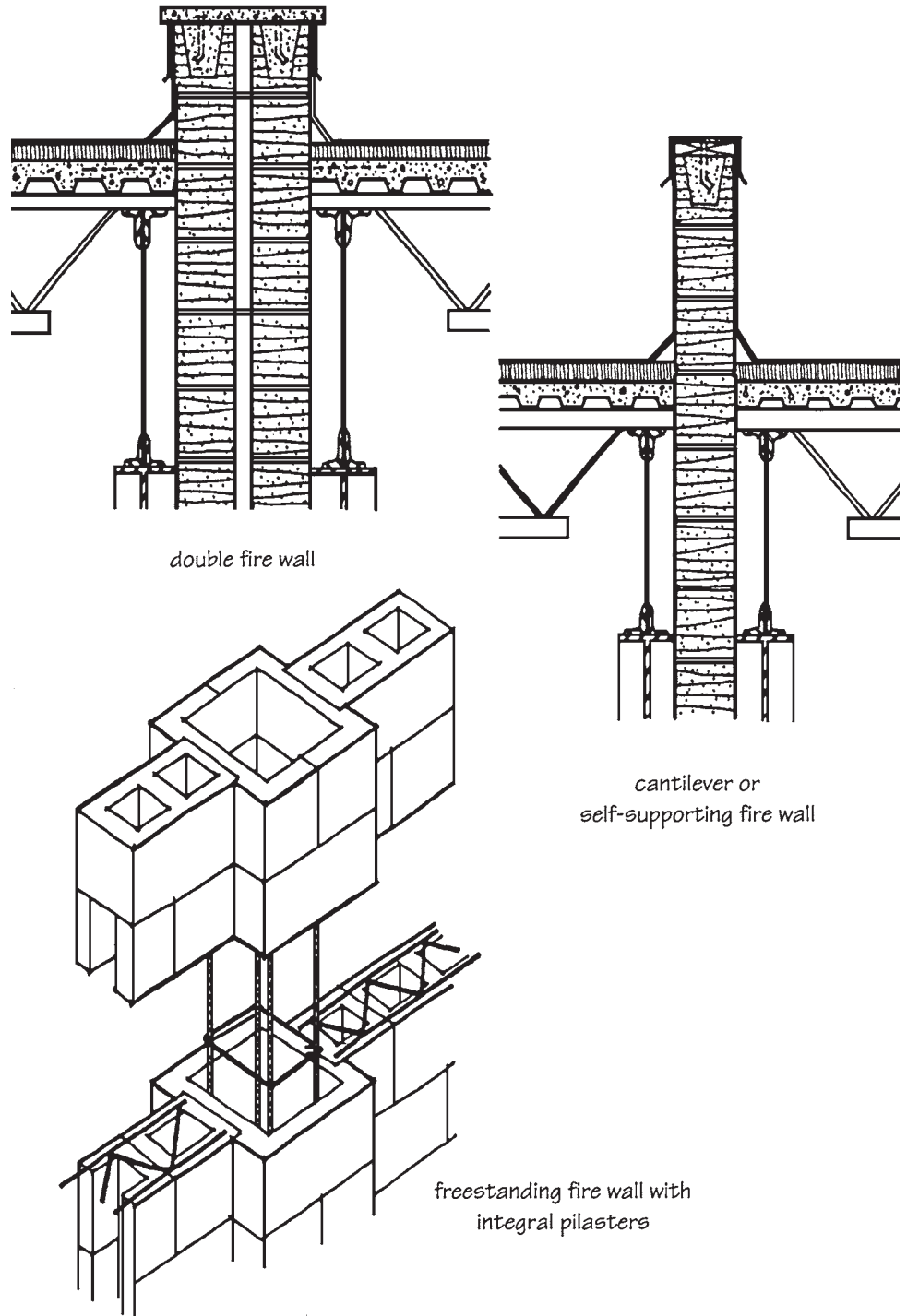
used to fireproof steel columns and beams. Hollow structural clay tile units were originally manufactured for this purpose in the late nineteenth century. They offer effective and relatively lightweight protection. Fire test results from the National Bureau of Standards form the basis of modern code requirements for protection of steel structural elements. The table in Fig. 8-18 is taken from the *International Building Code* to show protective masonry coverings that are acceptable for various fire ratings. The FEMA/ASCE *World Trade Center Building Performance Study* noted that on older peripheral buildings around the WTC site, concrete and masonry fireproofing of iron and steel frames “performed well” in both fire endurance and impact resistance, even though it was nearly 100 years old.

**8.4.5 Compartmentation**

A key element in fire control and balanced fire protection is compartmentation of a building to contain fire and smoke. Codes require that a building be subdivided by fire walls into areas related in size to the danger and severity of fire hazard involved. Fire walls must be constructed of non-combustible materials, have a minimum fire rating of 4 hours, and have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall. Masonry fire walls may be designed as continuously reinforced cantilevered sections. They are self-supporting, without depending on connections to adjacent structural framing. For additional lateral stability, free-standing cantilever walls may be stiffened by integral masonry pilasters with vertical reinforcing steel (see Fig. 8-19). Double fire walls can also be used, so that if the building frame on one side collapses,

Minimum Protection of Structural Parts Based on Timer Periods for Various Noncombustible Insulating Materials						
Structural Parts to be Protected	Item Number	Insulating Material Used	Minimum Thickness of Insulating Material for the Following Fire-Resistance Periods (Inches)			
			4 Hour	3 Hour	2 Hour	1 Hour
Steel columns and all of primary trusses	1-2.1	Clay or shale brick with and mortar fill	3-3/4			2-1/4
	1-3.1	4" hollow clay tile in two 2" layers; 1/2" mortar between tile and column; 3/8" metal mesh 0.046" wire diameter in horizontal joints; tile fill	4			
	1-3.2	2" hollow clay tile; 3/4" mortar between tile and column; 3/8" metal mesh 0.046" wire diameter in horizontal joints; limestone concrete fill; plastered with 3/4" gypsum plaster	3			
	1-3.3	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile or 3/8" metal mesh 0.046" diameter wire in horizontal joints; limestone or trap-rock concrete fill extending 1" outside column on all sides			3	
	1-3.4	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile with or without concrete fill; 3/4" mortar between column and tile				2

**Figure 8-18** Masonry fire protection for steel columns. (From International Building Code 2003.)



**Figure 8-19** Concrete masonry fire walls. (From *National Concrete Masonry Association, TEK Bulletin 95, NCMA, Herndon, VA.*)

half the wall can be pulled over while the other half still protects adjacent areas. Masonry walls also provide a barrier against the spread of smoke and toxic gases.

Fire walls are not used extensively in low-rise multi-family units. Low-rise multi-family buildings (apartments, nursing homes, motels, condomini-