Because of the way fire endurance is tested in this country, and the way in which fire ratings are assigned based on these tests, the ratings for concrete and masonry walls are too low, and the ratings for "protected" steel and wood frame assemblies are too high. Concrete or masonry construction controls or prevents substantial fire development because it does not contribute fuel to the fire and, in fact, can actually reduce the intensity of the fire by absorbing and storing heat. Concrete or masonry construction also provides true containment: it will not support fire in concealed spaces of wall, floor, or roof assemblies; it maintains the structural integrity of the building to provide safe access and egress; and it does not produce toxic gases or contribute to smoke generation. Concrete or masonry construction, however, is underrated because of the evaluation system we use. The *ultimate* five endurance periods for brick walls listed in *Fig. 8-11* are as much as three times the maximum ratings given in building codes. Although it is not logical to give the same fire rating to one wall that suffers structural collapse as to another that experiences only a moderate rise in temperature, doing so perpetuates the misconception of the relative safety of various types of construction. The *World Trade Center Building Performance Study* issued jointly by FEMA and ASCE in May 2002 found that current fire resistance test and rating methods do not provide sufficient information on steel and drywall systems to predict actual performance in a fire.

8.4.2 Fire Resistance Ratings

Extensive fire testing has been done on masonry walls, and ratings were first listed in the National Bureau of Standards report BMS 92. Masonry fire ratings are also listed by the National Fire Protection Association in the *Fire Protection Handbook,* by the Underwriters' Laboratories in its *Fire Resistance Index,* and by the American Insurance Association in *Fire Resistance Ratings.* Model building codes list fire ratings taken from these reports or, in some instances, refer directly to the publications as reference standards. Code tables list the minimum thickness of a particular material or combination of materials required for ratings of 1, 2, 3, and 4 hours. The tables in *Figs. 8-12 through 8-15* list fire resistance ratings for clay and concrete

Ultimate Fire Resistance (hours)						
		Noncombustible Members Framed Into Wall or No Framed-In Members			Combustible Members Framed Into Wall	
Nominal Wall Thickness (in.)	Wall Type	No Plaster	Plaster on One Side§	Plaster on Two Sides§	No Plaster	Plaster on Fire Exposed Side§
4	solid	1-1/4	1-3/4	2-1/2	–	–
8	solid	5	6	7	2	2-1/2
12	solid†	10	10	12	8	9
12	solid‡	12	13	15	–	–
9 to 10	cavity	5	6	7	2	2-1/2

§ Minimum 1/2 in. plaster thickness of 1:3 gypsum sand plaster mix.
† For loadbearing walls, end point based on load failure.
‡ For non-loadbearing walls, end point based on temperature rise.

Figure 8-11 Ultimate fire resistance periods for brick walls. (*From BIA* Technical Note 16 Rev.)

Material Type	Minimum Wall Thickness (inches) for Fire Resistance Rating of§‡†			
	1-hr.	2-hr.	3-hr.	4-hr.
Solid brick of clay or shale‡	2.7	3.8	4.9	6.0
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5.0
Hollow brick or tile of clay or shale, grouted or filled with sand, pea gravel, crushed stone, slag, pumice, scoria, expanded clay, shale or fly ash, cinders, perlite, or vermiculite	3.0	4.4	5.5	6.6

§ Equivalent thickness determined by the formula

$T_E = V_n/LH$

where:

T_E = equivalent thickness of the clay masonry unit (inches)
V_n = net volume of the clay masonry unit (inch^3)
L = specified length of clay masonry unit (inches)
H = specified height of clay masonry unit (inches)

‡ Calculated fire resistance between hourly increments listed may be determined by linear interpolation.

† Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall be not less than 93% of the thickness shown.

‡ For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is at least 75% of the gross cross-sectional area measured in the same plane.

Figure 8-12 Fire resistance of loadbearing and non-loadbearing clay masonry walls. (*From* International Building Code 2003.)

	Fire Resistance Rating			
	1-hr.	2-hr.	3-hr.	4-hr.
Minimum column dimension (inches)	8	10	12	14

Figure 8-13 Fire resistance of clay masonry columns. (*From* International Building Code 2003.)

masonry walls and columns from the *International Building Code* (IBC). Ratings for brick and clay tile walls are a function of wall mass or thickness, and depend to some extent on the percent of cored area in the individual units. Units with less than 25% cored area are considered solid, and units with more than 25% cored area are classified as hollow. An 8-in. hollow tile wall contains less mass than an 8-in. solid brick wall, and it therefore offers less resistance to fire and heat transmission. For walls of a given material and design, National Bureau of Standards (NBS) testing showed that an increase of 50% in volume of solid material per unit area of wall surface resulted in a 100% increase in the fire resistance period. Although many fire tests on hollow clay masonry have been conducted, it would be impractical to test all of the possible combinations of unit size, shape, and core area. For walls made up of combinations of masonry units or masonry units and plaster for which there is no listed rating, fire resistance can also be calculated based