

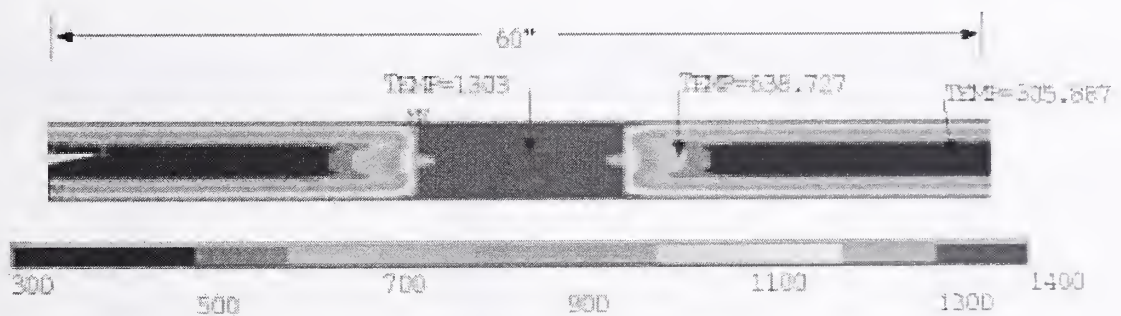
Table 5–1. Times (h) at which modeled columns reached target temperatures.

Insulation Thickness (in.)	Furnace Temperature/Final Steel Temperature, °C		
	700 °C/650 °C	900 °C/700 °C	1,100 °C/700 °C
	1,292 °F/1,202 °F	1,653 °F/1,292 °F	2,012 °F/1,292 °F
0	0.3	0.2	0.1
0.5	6.0	3.2	2.0
1.125	10.0	7.4	4.6
1.125, with 20 % Damage	6.6	4.5	2.2

Similar simulations with heavier columns resulted in significantly longer heating times. This was due to the larger mass of steel that had to be heated.

For both types of columns, the presence of even a thin layer of insulation led to heating times that were significantly longer than the times over which the towers remained standing after impact. The absence of SFRM led to heating times that were below the duration of fire exposure on September 11 (Chapter 6).

In another set of simulations, a 60 in. wide, 1 in. thick steel plate was inserted into a furnace at 1,100 °C. The thickness of the insulation was varied between 0 in. and 2.0 in. in ¼ in. increments; the standard deviation of the thickness was varied from 0 in. to 1.0 in., and a gap in the insulation was varied from 0 in. to 30 in. in 6 in. increments. Figure 5–2 shows the edge of the plate before and in the midst of the simulation. Figure 5–3 shows the rates of temperature rise at a location 6 in. from the right end of the plate. A dashed line at 600 °C is included in each plot for reference. For such a plate (which is as thick as the rods in the floor trusses), large variance in thickness and/or large gaps in the application led to short times to reach temperatures at which structural strength would have been compromised.

**Figure 5–2. Temperature rise (K) in a plate with a 12 in. gap in the thermal insulation.**