

south half of the floor had a poured 0.2 m (8 in.) slab, and the north half had an 0.2 m (8 in.) total slab thickness on a 76 mm (3 in.) deep metal deck. The floor slabs were supported by the structural floor framing shown in Figure 1–5. The floor beams were connected to the concrete deck by shear studs, which caused the floor beams and concrete slab to act together, or compositely. This type of floor system is thus referred to as a composite floor. The floor beams were framed into (connected to) girders with a variety of types of shear connectors¹, through which the floor beams transferred gravity loads from the floors to the girders. The girders also framed into the columns with a variety of types of shear connectors and transferred the gravity loads to the columns. Interior columns were connected with splice plates, welds and bolts. The exterior frame had moment connections in each face of the building.

1.2.4 Fire Protection

There were both passive and active fire protection systems in WTC 7 (NIST NCSTAR 1-9, Chapter 4). The former was in the form of sprayed fire-resistive material (SFRM) applied to the structural steel and to the underside of the metal floor decking. The latter comprised fire sensors and alarms, notification systems, automatic fire sprinklers, water supplies, and smoke management.

According to the 1968 version of the NYCBC and Local Law 16 (1984), a fully sprinklered high-rise building could follow the fire resistance requirements for Type 1C construction. For this construction category, columns were required to have a 2 h rating as established by the Standard Fire Test (ASTM E 119); beams were required to have a 1½ h rating. The instructions to the bidders for the WTC 7 job were to bid on a 3 h rating for the columns and a 2 h rating for the metal deck and floor support steel, which corresponded to the more stringent fire resistance requirements for Type 1B (unsprinklered) construction. These ratings were to be achieved by application of Monokote MK-5, a gypsum-based SFRM that contained a vermiculite aggregate. According to the Underwriters Laboratories (UL) Fire Resistance Directory (1983), these ratings required a thickness of 22 mm (7/8 in.) of Monokote MK-5 to be applied to the heavy columns, 48 mm (1 7/8 in.) to be applied to the lighter columns, 13 mm (1/2 in.) to be applied to the beams, and 10 mm (3/8 in.) to be applied to the bottom of the metal deck. Private inspectors found that the applied SFRM thicknesses were consistent with these values.

Within the building was an array of smoke detectors which, when triggered, would sound alarms on the floor of detection and the floor above, provide an alarm and signal location to the Fire Command Station in the 3rd floor lobby, and transmit a signal to the fire department. There were barriers to smoke spread (in the form of walls and smoke dampers), as well as air movement equipment to exhaust the smoke.

WTC 7 contained a three-zone system of sprinklers and standpipes.

- Water to the low zone (1st floor through the 20th floor) came from the water main. The backup water also came from the water main via a supplemental pump.
- Water to the mid-level zone (21st floor through the 39th floor) was supplied from two large storage tanks located on the 46th floor. Backup water could be pumped from the water main.

¹ Shear connections are designed to transfer only vertical gravity loads, whereas moment connections are designed to transfer loads and moments (forces resulting from bending of a beam) induced by both (vertical) gravity and (horizontal) wind loads.