

The building codes also prescribe the minimum requirements for life safety if a fire occurs. The prescribed fire safety features are intended to limit the fire threat and safeguard those in the building. Prime among these features are the egress and emergency notification (alarm) requirements.

Particularly in high-rise buildings, fire safety requirements are prescribed to maintain the integrity of the structure by controlling the intensity of fire and providing adequate structural strength during fires. In modern building codes, this is accomplished through a three-step approach:

- The first line of defense is the automatic sprinkler protection designed to control fires in their early stage of development and either extinguish them or hold the fire in check for the arrival of the fire department. Sprinklers are not normally capable of controlling fires that are of large size before the sprinklers can operate. Such was the case in the WTC towers.
- The second line of defense is manual firefighting by the fire department or fire brigades. The building is provided with standpipes, emergency control of elevators, special emergency communication systems, control centers, and other features to enable effective firefighting above the levels that can be attacked from the exterior. It was this line of defense that successfully controlled the 1975 fire. In the September 11 incident, the damage done to the elevators and the height of the fires precluded the fire department from being able to directly attack the fire. Even if they had reached the fire floors, they would have been faced with a fire situation possibly beyond even the excellent capabilities of the FDNY.
- The final line is the fire resistance of the building and its elements, including the building frame, the floors, partitions, shaft enclosures, and other elements that compartmentalize the building and structurally support it. Most important of these are the requirements for the structural frame (including columns, girders, and trusses). See Section 1.5.3 for a discussion of fire resistance ratings.

All three of these lines of defense were present, but were overwhelmed by the magnitude of the events of September 11, 2001.

For life safety and egress, stairways must have minimum widths based on the maximum number of occupants who may be in the building. Stairs must be separated from the remainder of the building by a minimum 1- or 2-hour fire resistant barrier to provide a level of safety while occupants traverse the stairs. At least two stairways must be provided with widely separated entry points. In most jurisdictions, elevators are designed to automatically return to the lobby level during a fire alarm to be controlled by firefighters. In many high-rise buildings, the elevator shafts and exit stairs are pressurized to keep out smoke and heat. The use of elevators is discouraged for emergency egress because of the potential for elevator failure and the likelihood of the elevator shaft acting like a chimney, carrying heat, smoke, and toxic gases throughout the building.

Fire protection systems (sprinklers, fire alarms, and special-hazard protection) are required to provide early notification and fire control until the fire department can arrive and begin manual suppression efforts. Smoke management systems are intended to aid emergency evacuation of building occupants and operations of emergency personnel. Manual suppression efforts by emergency personnel are aided by the presence of standpipe systems.

1.5.2 Unusual Building Loads

In planning a new building, an owner may request enhanced requirements in its design for events that are not anticipated by the building codes. In some cases, where unusual hazards such as explosive or toxic materials exist, the building codes prescribe special life safety and fire protection features. In most non-hazardous occupancies, these are not required. Only a very small percentage of buildings have extraordinary