

# Fire Engineering®

## Construction Concerns: Fire-Resistive Floor-Ceiling Assemblies

Article and photos by Gregory Havel

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Walls and floor-ceiling assemblies with fire resistance rated in hours are required between sections of commercial, industrial, and multifamily residential buildings. There are a number of ways to arrive at the required fire resistance ratings, as shown in the Underwriters Laboratories (UL) On-line Fire Resistance Directory at <http://ul.com/code-authorities/building-code/fire-resistance-and-smoke-protection> and <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/fireessrch.html>. The tests of **structural** assemblies are outlined in detail in National Fire Protection Association (NFPA) 251, *Standard Methods of Tests of Fire Resistance of Building Construction and Materials*, 2006 edition, also listed as UL 263 and American Society for Testing and Materials (ASTM) E-119.

Walls rated for fire resistance can be built of poured-in-place **concrete**, precast concrete wall panels, concrete masonry units, brick, layers of gypsum drywall board supported by steel studs, and layers of gypsum drywall board supported by wood studs. Other methods and materials have also been tested and rated for fire resistance.

Floor-ceiling assemblies rated for fire resistance can be built of poured-in-place reinforced concrete; hollow-core, precast concrete panels; concrete poured on **metal** form panels supported by steel bar joists and structural steel; layers of gypsum drywall board supported by steel joists; and layers of gypsum drywall board supported by wood trusses or I-joists. Other methods and materials have also been tested and rated for fire resistance.

Photo 1 shows a 172-unit apartment building with four floors of apartments and a parking **garage** at ground level. The parking garage is of noncombustible (Type II) construction separated from the rest of the building by hollow-core, precast concrete panels topped with concrete and is protected by a NFPA 13, Standard

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for the Installation of Sprinkler Systems-compliant automatic fire sprinkler system. Photo 2 (from the UL On-Line Fire Resistance Directory) shows an example of the construction of this type of floor-ceiling assembly. The four upper floors of apartments are of wood frame and wood truss construction supported by structural steel girders and columns protected by a NFPA 13R-compliant automatic fire sprinkler system, which protects only the occupied spaces within the building.



(1)



(2)

Photo 3 shows a 24-unit apartment building with two floors of apartments and a parking garage at ground level. The parking garage is of ordinary (Type III) construction and is separated from the rest of the building by a floor-ceiling assembly of oriented strand board supported by wood trusses and supporting multiple layers of 5/8-inch gypsum drywall board, which provides most of the fire resistance for the assembly. This parking garage is protected by an NFPA 13-compliant automatic fire sprinkler system, which protects only the garage space, and not the concealed space between the garage ceiling and the floor of the apartments above. Document 1, from the UL On-Line Fire Resistance Directory, shows an example of the construction of this type of assembly.

Click [HERE](#) for Document 1

Document 2 shows that the two upper floors of apartments are of wood frame and wood truss construction, are supported by structural steel girders and columns, and are protected by an NFPA 13R-compliant automatic fire sprinkler system, which protects only the occupied spaces within the building.

Click [HERE](#) for Document 2

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(3)

Although the ceiling assemblies in the garages for the apartment buildings in these documents meet current building and fire codes and were built to specifications that should achieve a two-hour fire resistance rating, a vehicle or other fire in the garage in Photo 1 will be less likely to cause structural damage than a vehicle or other fire in the garage in Photo 2 because of the noncombustible materials used to enclose the garage in Photo 1 when compared to the layers of gypsum drywall board used to protect the combustible floor trusses and subfloor in the garage in the building in Photo 3 and Document 1.

The choice of construction materials and methods for code compliance is often based only on initial cost. However, some developers and building owners select noncombustible construction materials and methods even though the initial cost is higher, and they plan to recover these costs through savings in property insurance throughout the life of the building as well as through use of these points in marketing to prospective tenants.

This difference in construction methods on two similar buildings located across the street from each other rates a note on our preincident plans for these buildings. A fire in the garage with the combustible ceiling supports exposes firefighters to greater hazards and requires risk management that differs from the risk management for the fire in the noncombustible garage.

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