



TechNotes

Editor - Roland Asp, CET

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This issue of TechNotes was written by Andrew Bevis, CBO, MCP, Codes and Standards Specialist at the NFSA (National Fire Sprinkler Association).

Mixed Use, Mixed Standards

This statement will not come as a surprise, but a single building will commonly have multiple uses. Architects design in this way to provide an efficient means to construct buildings that will service the needs of multiple tenants. This type of construction provides a profitable model for developers and building owners. However, a huge question arises. How does one properly protect the occupancies that are present in the structure? Each occupancy type has a completely different list of requirements. Some of these requirements include egress, fire resistance ratings, occupant loads, and most importantly fire protection. The International Building Code (IBC) recognizes this construction path and provides requirements to guide the design of this common method of construction and architecture. Each occupancy presents its own distinct hazards; however, the IBC recognizes that many of the hazards are similar in nature. This recognition permits the varied uses to be grouped into categories of common issues, referred to as occupancy groups in the IBC. These occupancy groups can be viewed in Chapter 3 of the IBC. Where two or more of these groups exist in the same building, it becomes necessary to evaluate their relationship with each other. This condition is called a mixed-occupancy condition. The IBC provides various methods to address such relationships.

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Accessory Occupancies

The first category of this mixed-use discussion are accessory occupancies. Accessory uses are considered minor uses to the overall occupancy of the building. These uses are often necessary or complimentary to the function of the building's predominate use. The accessory occupancy is assigned to the occupancy based on its own unique characteristics. There are two considerations to consider when accessory uses are present. These two considerations are allowable building height

and allowable building area. While there are a few requirements that accessory uses must follow, they are still subject to permissible building heights and areas of Section 504 of the 2021 IBC. Additionally, the allowable area of the building is based on the applicable provisions of Section 506 of the IBC. However, the allowable aggregate area of the accessory use is not permitted to occupy more than 10% of the floor area of the story where they are located, while at the same time not exceeding the tabular values for non-sprinklered buildings in Table 506.2. Finally, there is no fire separation required between the accessory use and main occupancy except for a couple of exceptions.

How are accessory uses protected? There is one sentence in Section 508.2.1 that provides the protection requirements. It simply says that all the other requirements of this code (2021 IBC) apply to each portion of the building based on the classification of that space. This means the protection requirements of the accessory use only applies to that space and the requirements of the major use only apply to the major use portion. Chapter 9 of the 2021 IBC will lay out the fire protection requirements of each space accordingly. In most cases only one type of sprinkler system would apply and thus one standard. Often, a NPFA 13 system would be applied to all the areas of the mixed-use building.



Nonseparated Occupancies

The next category of a mixed-use building is nonseparated occupancies. Under this specific category of a mixed-use building, the fundamental concept behind this provision assumes that the building is designed to address the most restrictive and most hazardous conditions that are expected to occur based on the occupancies contained in the building. Under this methodology, no fire-resistance-rated separation is required. The nonseparated occupancies are individually classified and the requirements of the IBC are applied to each portion of the building based on the classification of that space, except for allowable height, stories, area, and fire protection. However, in high-rises, certain conditions of Group I occupancies, and R-1 through R-4 occupancies, the most restrictive of the Chapter 4 special detail requirements based on the occupancy apply. The specific requirements of these occupancies may require separation and careful attention must be taken with these specific occupancies.

When it comes to the permissible height, stories, area, and fire protection the most restrictive of the occupancy requirements apply throughout, meaning, each occupancy must be examined for the most restrictive requirements which would be applied to the entire building. Chapter 9 would be consulted

to determine the most restrictive sprinkler requirements for the building. Once again, only one type of sprinkler system would be required, although it would be the most restrictive. A good example can be found in Figure 1 below.

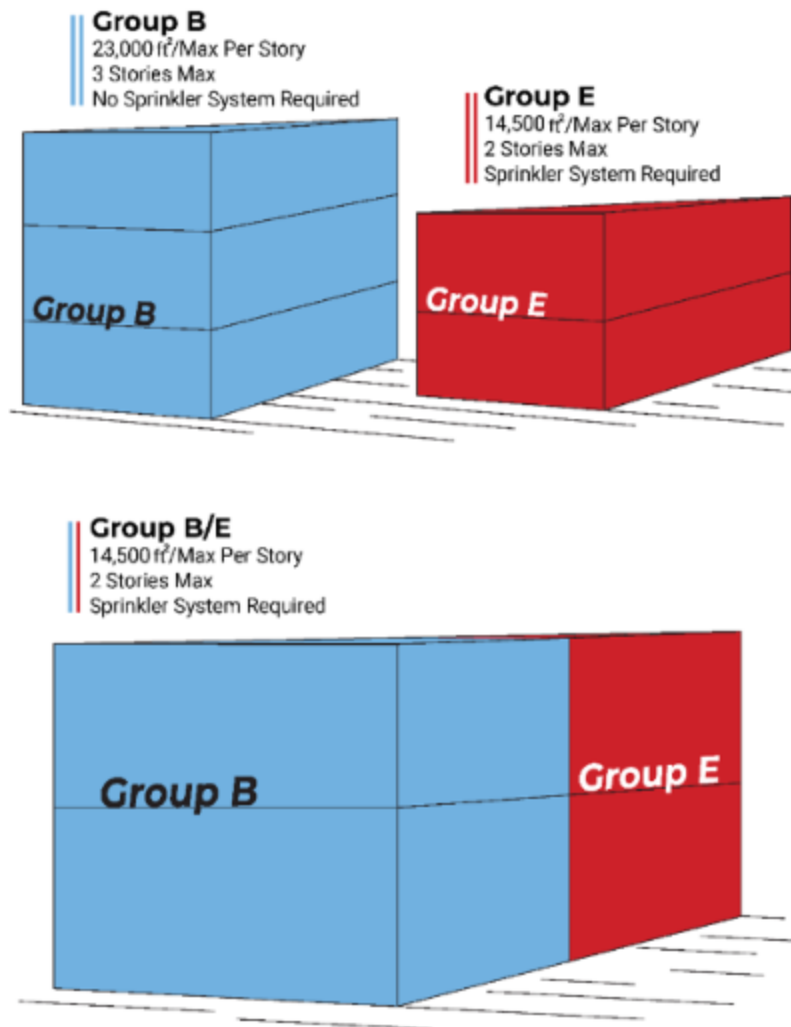


Figure 1: Nonseparated Mix Use Building

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Separated Occupancies

Possibly the most complex of the mixed-use construction methodologies are separated occupancies.

Using this method of addressing a mixed-occupancy building, the IBC directs that each portion of the building housing a separate occupancy be individually classified and comply with the requirements for that specific occupancy. The allowable number of stories and height for each occupancy is independently regulated based on Section 504.4 of the IBC according to the type of construction. The allowable floor area is a little more complicated. The IBC uses a formula for the calculation of the allowable building area for each floor. The formula essentially prorates the areas of the various occupancies so that the sum of percentages must not exceed 100 percent. As stated in the name, the occupancies are required to be separated. Table 508.4 of the IBC provides the required fire-rated separations between the occupancies. These separations are required to be constructed as fire barriers. It is important to note that Table 508.4 contains sprinkler tradeoffs. When sprinkler systems are present many of the fire-resistance ratings are reduced by an hour or not required at all.




Mixed Use Buildings and Mixed Standards

In protecting these types of buildings is where mixed uses and mixed standards come into play. As stated, each occupancy is evaluated for its own fire protection requirements. The best example of this type of building is a pedestal style building in Section 510.2. These types of buildings are extremely common. Typically, types of buildings will contain a ground floor of mercantile or assembly spaces (shops and restaurants) with several floors of residential (apartments) above. According to the requirements for pedestal buildings, the ground floor (and below) occupancies are separated from the residential above by a rated horizontal assembly. Additionally, if there are multiple occupancy types on the ground floor, those would be required to be separated as well according to Table 508.4. The ground floor (and below) is required to be protected by a NFPA 13 system and the residential floors would be permitted to be protected by a NFPA 13R system. This is a case where a “single” building will use two separate sprinkler standards. Each occupancy is evaluated as an individual building, but sprinklers are applied to the occupancy group as listed in Chapter 3. This provides a much more economical way of protecting a building without sacrificing levels of protection. Each standard’s requirements only apply to the area it is protecting and when evaluated individually it is easier to understand. Essentially, in the case of a pedestal building, two individual buildings are being protected and the applicable standards apply separately.

Understanding the principles of each category of mixed-use buildings is vital to understanding how to protect them properly. When the details of each are understood properly, it can help provide potential clients with the most cost-effective proposal without sacrificing the required level of protection. Use the model codes as a tool to effectively provide the highest level of service to customers.

	Accessory Occupancies (Section 508.2)	Nonseparated Occupancies (Section 508.3)	Separated Occupancies (Section 508.4)
Occupancy Classification	Individually classified	Individually classified	Individually classified
Allowable Area	Based on allowable area of main occupancy. Aggregate area \leq 10% of story. Aggregate area \leq value in Table 506.2 for non-sprinklered buildings.	Based on most restrictive of occupancies within building	Determined such that sum of the ratios cannot exceed 1.0
Allowable Height	Based on allowable height of main occupancy	Based on most restrictive of occupancies within building	Based on general provisions of Section 504
Separation	No separation required	No separation required	Separation as required by Table 508.4
Sprinkler Protection	The individual occupancy provisions of Chapter 9 apply to each occupancy group	Most restrictive provisions of Chapter 9 apply to the entire building.	The individual occupancy provisions of Chapter 9 apply to each occupancy group
Special Conditions	<ol style="list-style-type: none"> 1. Subsidiary to main occupancy 2. Not applicable to Groups H-2, H-3, H-4, and H-5. 3. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units are still required to be separated per Section 420 	<ol style="list-style-type: none"> 1. Not applicable to Groups H-2, H-3, H-4, and H-5. 2. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units are still required to be separated per Section 420 	



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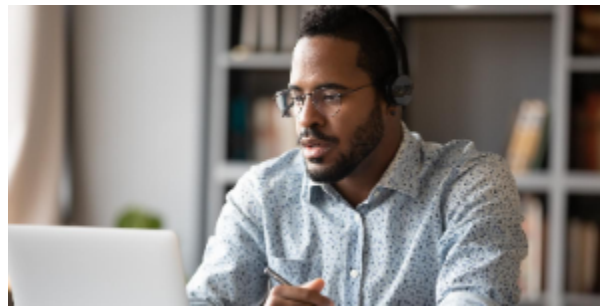
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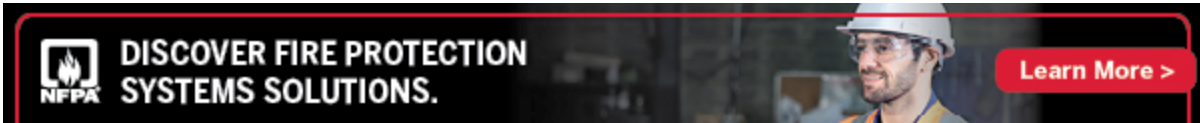
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New EOD Process

Starting on July 15, 2020, the NFSA has a new EOD process where members can submit questions, track the progress, and view their EOD cases. The step by step process is detailed in [TechNotes #442](#).

National Fire Sprinkler Association

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