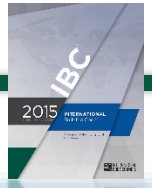
2015 IBC Mixed Occupancies

Based on the 2015 International Building Code® (IBC®)

Description

- This course provides an overview of the 2015 IBC Section 508 provisions for the application of code requirements addressing mixed occupancy buildings.
  - Other code provisions applicable to an understanding of mixed occupancies will also be addressed.



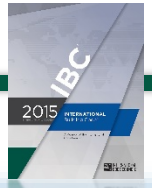
Goal

- This seminar is designed to familiarize and assist code officials in locating, describing and applying IBC requirements regarding mixed occupancies.

Objectives

After completing this seminar, you will be able to:

- Define the concept for addressing mixed-occupancy buildings.
- Identify and apply the **three options** that are available for regulating mixed-occupancy buildings.
- Describe the relationship of occupancy classification, allowable height, allowable area and occupancy separation to mixed-occupancy buildings.
- Identify **incidental uses** and understand how they differ from mixed-occupancy conditions.



Course Overview

Module 1 – Concept of Mixed Occupancies

Module 2 – Occupancy Classification

Module 3 – Incidental Uses

Module 4 – Foundations of the IBC for Mixed Occupancies

Module 5 – Application of the Mixed Occupancy Methods

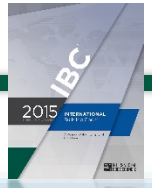
Module 6 – Non-separated Occupancies

Module 7 – Separated Occupancies

Module 8 – Accessory Occupancies

Module 9 – Allowable Height and Area for Multistory Buildings

Module 10 – Miscellaneous Applications

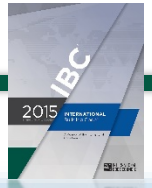


Module 1

Concept of Mixed Occupancies

Definition

- A mixed-occupancy condition occurs **where two or more** distinct occupancy classifications are determined to exist in the same building.
- Under such circumstances, the designer has available several different methodologies in **Section 508** to address the mixed-occupancy building.
- **Compliance with at least one of the methods is mandatory.**



Prescriptive vs Performance

- ***Prescriptive*** code requirements:
  - Detail how to comply.
  - Must be specifically met.

Handrail height, measured above the stair tread nosings, or finish surface of ramp slope shall be uniform, not less than 34” and not more than 38”.

- ***Performance*** code requirements:
  - Describe the intent of a provision.
  - Allow the architect to come up with a design .
  - Design must comply with the intent

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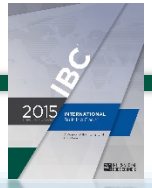
Fire walls shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of the time indicated by the required fire-resistance rating.

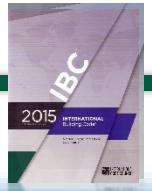
Mixed Use and Occupancy Scope

- The provisions of Section 508 address specific mixed-occupancy requirements that are to be applied in addition to the applicable provisions established throughout the IBC.
- The provisions of Section 509 address **incidental uses** as identified in Table 509.
- There is no relationship between the mixed-occupancy provisions of Section 508 and those addressing incidental uses in Section 509.
  - It is important to **identify the scope of each** of the two concepts in order to recognize the differences in their applications.



Use vs. Occupancy

- "**Use**" and "**Occupancy**" are terms that differ in meaning and application within the IBC.
- "**Use**" describes the **activity** that occurs within the space, room or building.
  - "Use" is seldom utilized in the IBC as the scoping mechanism.
  - Examples include occupant load calculation and incidental uses.
- "**Occupancy**" describes the specific **classification** a "use" is **assigned** when applying the code to a space, room or building.
  - Almost all code provisions with application only to a limited number of situations are regulated by "Occupancy".
  - Primary examples include allowable height and area, fire protection features and means of egress requirements.

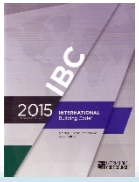


Incidental Uses Table 509

- Floor areas listed in Table 509 are designated as Incidental Uses.
- Incidental Uses are uniquely regulated for:
  - Occupancy classification.
  - Separation, fire protection or a combination of both.

TABLE 509
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptable power supplies	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.



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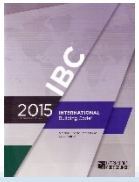
Mixed Occupancies: Location

- Provisions of Section 508 address the relationship between two individual occupancy groups adjacent to each other in a building: **vertically** or **horizontally**.



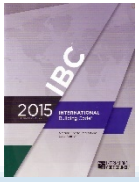
2015 IBC Mixed Occupancies

Required Separation Table 508.4

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

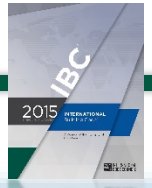
OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.



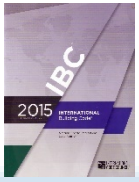
Section 508.1 – General

- **Three options** established in **Section 508** to address mixed-occupancy buildings include:
  - **Accessory Occupancies**.
  - **Non-separated Occupancies**.
  - **Separated Occupancies**.
- Methods for determining **maximum allowable size, height and area** and separations are identified for each option.
- **One of the three options must be applied to a mixed-occupancy condition.**



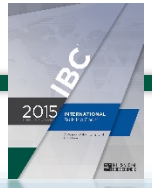
Separation: Fire Barriers – Section 707 Horizontal Assemblies – Section 712

- Separations, where required, must be:
  - **Fire barriers** constructed in accordance with Section 707. Provisions of Section 707 address:
    - Continuity.
    - Openings.
    - Penetrations.
    - Joints.
    - Ducts and air transfer openings.
    - Supporting construction.
  - **Horizontal assemblies** constructed in accordance with Section 712.



Section 508.1 – General

- **Occupancy Classification**
  - Proper occupancy classifications determined - Section 302.
  - Two or more different occupancies - Section 508.
- **Allowable Building Height and Area**
  - Final analysis for allowable building height and area cannot be done until one of the three mixed-occupancy options has been chosen.
- **Separation**
  - Separation is not required between occupancies; **or**
  - Some degree of fire-resistance-rated separation is mandated to isolate one occupancy from another.

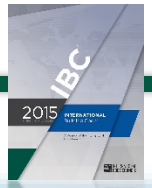


Module 2

Occupancy Classification

Section 302
Classification of Occupancies

- Classification is essential to the proper application of the IBC.
- Structure to be classified according to the function or functions for which it is intended.
- Buildings to be **classified prior** to the application of Section 508 regulating mixed-occupancy conditions.

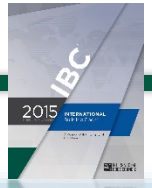


Section 302
Classification of Occupancies

- Chapter 3 provides an extensive listing of various uses and their corresponding occupancy classifications.
- There are many special cases and exceptions.
- Unsure of classification?

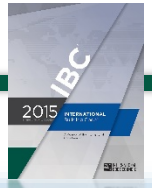
  Ask for more information.

- If two or more distinct occupancy groups are present, the provisions of Section 508 will apply.



Section 302.1 – General

- Structures are classified into one or more occupancies in accordance with their intended uses.
- If the use is not specifically identified in Chapter 3, it must be classified with the occupancy it **most nearly resembles**.



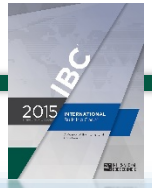
Chapter 3 Occupancy Groups

26 specific occupancy classifications organized into **10** broad groupings.

A	Assembly (5)	Section 303
B	Business	Section 304
E	Educational	Section 305
F	Factory and Industrial (2)	Section 306
H	High-hazard (5)	Section 307
I	Institutional (4)	Section 308
M	Mercantile	Section 309
R	Residential (4)	Section 310
S	Storage (2)	Section 311
U	Utility and Miscellaneous	Section 312

Occupancy Classification Overview

- Multiple uses do not necessarily create multiple occupancies.
- General occupancy classification is intended to include related support areas such as corridors, stairways, restrooms, mechanical equipment rooms, small storage areas, etc.
- Support areas of **higher hazard** are often regulated as incidental uses.



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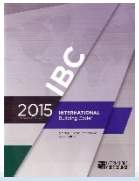


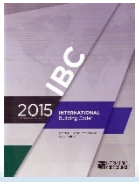
2015 IBC Mixed Occupancies

Section 302.1 General

- If the use is not specifically identified in Chapter 3, it must be classified with the occupancy it most nearly resembles.

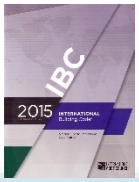
Section 302.1 General

A	Assembly
B	Business
E	Educational
F	Factory and Industrial
H	Hazardous
I	Institutional
M	Mercantile
R	Residential
S	Storage
U	Utility



Section 303.1 Assembly Group A

- **Assembly Group A** includes a gathering together for:
  - Civic functions.
  - Social activities.
  - Religious functions.
  - Food or drink consumption.
  - Awaiting transportation.



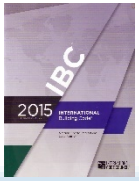
2015 IBC Mixed Occupancies

Section 303.1 Assembly Group A

- The following are general characteristics of Assembly Group A occupancies:
  - Densely occupied areas.
  - Moderate to large occupant loads.
  - Moderate fuel load.

Section 303.1 Assembly Group A

- **Group A-1**: Viewing performing arts or motion pictures.
  - Movie theaters.
  - Multiple-theater complexes.
  - Performance theaters.
  - Symphony and concert halls.



2015 IBC Mixed Occupancies

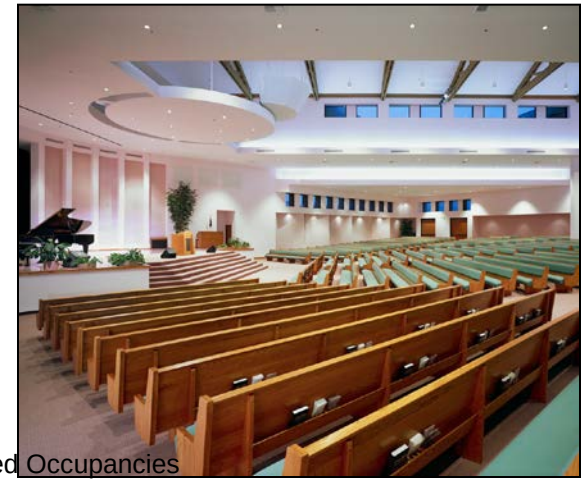
Section 303.1 Assembly Group A

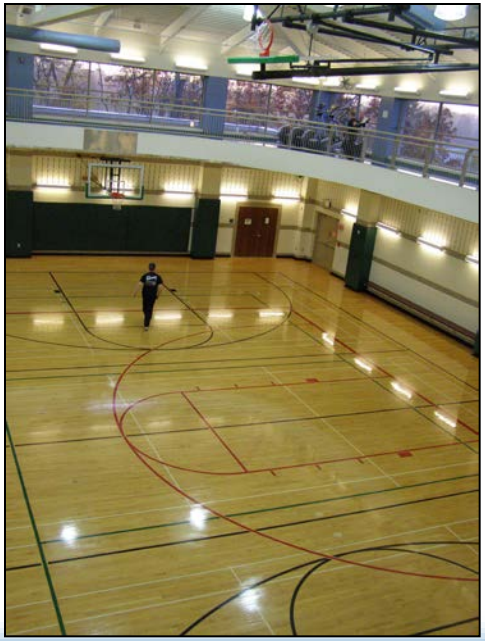
- **Group A-2**: Food or drink consumption.
  - Banquet halls.
  - Night clubs.
  - Restaurants.
  - Taverns and bars.

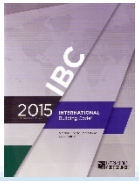
2015 IBC Mixed Occupancies

Section 303.1 Assembly Group A

- **Group A-3**: Worship, recreation or amusement and other
  assembly uses not classified elsewhere in Group A.
  - Community halls.
  - Dance halls (not including food or drink consumption).
  - Gymnasiums (without spectator seating).
  - Places of religious worship.



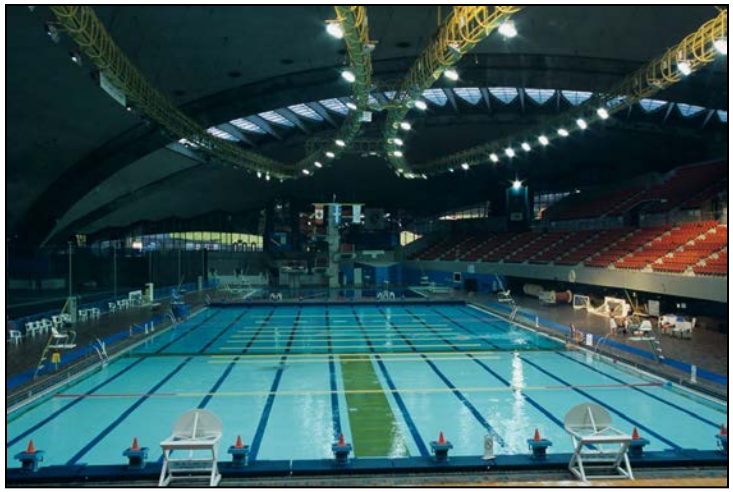


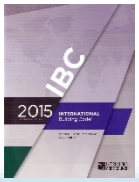


2015 IBC Mixed Occupancies

Section 303.1 Assembly Group A

- **Group A-4**: Indoors sports events and activities with spectator seating.
  - Arenas.
  - Pools.
  - Skating rinks.
  - Tennis courts.





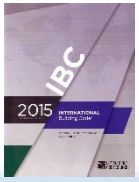
2015 IBC Mixed Occupancies

Section 303.1 Assembly Group A

- **Group A-5**: Viewing or participating in outdoor activities.
  - Amusement park structures.
  - Grandstands and bleachers.
  - Stadiums.

Section 304.1 Business Group B

- **Business Group B** occupancy includes the use of a building or structure, for office, professional or service-type transactions, including storage of records.
  - **Examples:**
    - Auto showrooms, car washes.
    - Banks.
    - Clinics, ambulatory healthcare facilities.
    - College classrooms.
    - Outpatient facilities.
    - Testing and research laboratories.

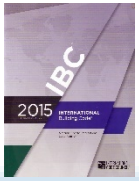


Section 305.1 Education Group E

- The occupancy of **six or more** persons at any one time for education purposes through the **12th** grade.
- The day care of toddlers and infants ages **2 ½** years and under may also be classified as a **Group E** occupancy under three conditions as established in the Exception to Section 308.5.2 (Group I-4 occupancies).

  A Group E classification is possible where:

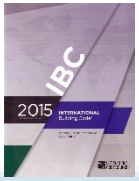
  - The number of toddlers/infants is more than **5** but no more than **200** children;
  - The rooms in which the children are being cared for are located on the level of exit discharge; **and**
  - Each of these child care rooms has an exit door **directly** to the exterior.



Section 306.1 Factory Group F

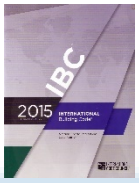
- **Group F-1**: Moderate Hazard (those uses not specifically classified as a Group F-2 Low-hazard occupancy).
  - Aircraft plant.
  - Bakeries.
  - Dry cleaners.
  - Furniture plants.
  - Printing and publishing.

- Group F-1 occupancies typically include those Factory/Industrial operations that utilize or involve combustible materials.



Section 306.1 Factory Group F

- **Group F-2**: Low Hazard (the fabrication or manufacturing of noncombustible materials not involving a significant fire hazard).
  - Foundries.
  - Glass products.
  - Gypsum.
  - Ice.
  - Metal fabrication.
  - Non-alcoholic beverages.



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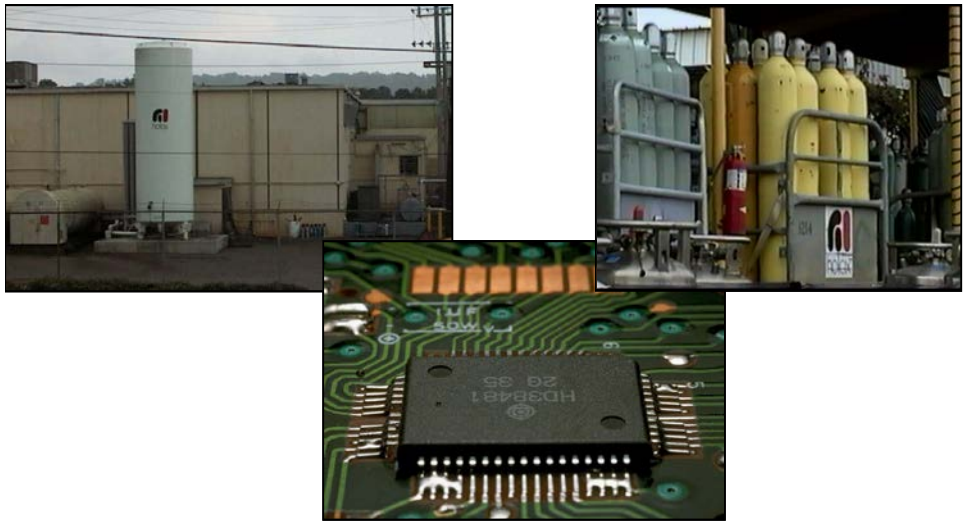
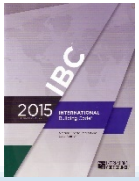
Section 307.1 High-Hazard Group H

- Typically include, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generating or storage of materials that constitute a **physical or health hazard** in quantities in excess of those allowed in control areas as set forth in Tables 307.1(1) and 307.1(2).

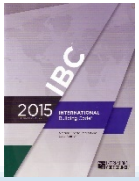




2015 IBC Mixed Occupancies

Section 307.1 High-Hazard Group H

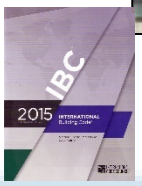
- Conditions where a Group H classification is not required:
  - Buildings used for application of flammable and combustible liquids, aerosol manufacture or storage and the storage of black powder.
  - Cleaning establishments utilizing solvents under specific conditions.
  - Closed systems housing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.



2015 IBC Mixed Occupancies

Section 307.1 High-Hazard Group H

- Conditions where a Group H classification is not required:
  - Materials for agricultural purposes on the premises.
  - Refrigeration systems.
  - Stationary batteries used for emergency power or uninterrupted power supply (UPS).

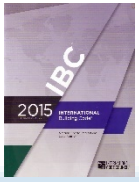


2015 IBC Mixed Occupancies

Section 307.1 High-Hazard Group H Table 307.1(1)

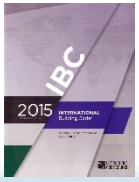
TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	NA	H-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA
Combustible fiber[q]	Loose Baled[o]	H-3	(100) (1,000)	NA	NA	(100) (1,000)	NA	NA	(20) (200)	NA
Combustible liquid[c, i]	II IIIA IIIB	H-2 or H-3 H-2 or H-3 NA	NA	120[d, e] 330[d, e] 13,200[e, f]	NA	NA	120[d] 330[d] 13,200[f]	NA	NA	30[d] 80[d] 3,300[f]
Consumer fireworks	1.4G	H-3	125[e, l]	NA	NA	NA	NA	NA	NA	NA
Cryogenic flammable	NA	H-2	NA	45[d]	NA	NA	45[d]	NA	NA	10[d]
Cryogenic inert	NA	NA	NA	NA	NL	NA	NA	NL	NA	NA
Cryogenic oxidizing	NA	H-3	NA	45[d]	NA	NA	45[d]	NA	NA	10[d]
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4G Division 1.5 Division 1.6	H-1 H-1 H-1 or H-2 H-3 H-3 H-1 H-1	1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[e, g]	(1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] NA (1)[e, g] NA	NA	0.25[g] 0.25[g] 1[g] 50[g] NA 0.25[g] NA	(0.25)[g] (0.25)[g] (1)[g] (50)[g] NA (0.25)[g] NA	NA	0.25[g] 0.25[g] 1[g] NA NA 0.25[g] NA	(0.25)[g] (0.25)[g] (1)[g] NA NA (0.25)[g] NA
Flammable gas	Gaseous Liquefied	H-2	NA	NA (150)[d, e]	1,000[d, e] NA	NA	NA (150)[d, e]	1,000[d, e] NA	NA	NA
Flammable liquid[c]	IA IB and IC	H-2 or H-3	NA	30[d, e] 120[d, e]	NA	NA	30[d] 120[d]	NA	NA	10[d] 30[d]
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120[d, e, h]	NA	NA	120[d, h]	NA	NA	30[d, h]



2015 IBC Mixed Occupancies

Section 307.1 High-Hazard Group H Table 307.1(1)

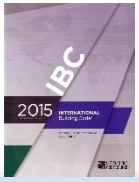


2015 IBC Mixed Occupancies

Section 307.1 High-Hazard Group H, Table 307.1(2)

[F] TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD[a, c, f, h, i]

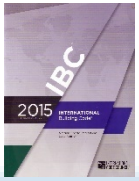
MATERIAL	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
	Solid pounds[d, e]	Liquid gallons (pounds)[d, e]	Gas cubic feet at NTP (pounds)[d]	Solid pounds[d]	Liquid gallons (pounds)[d]	Gas cubic feet at NTP (pounds)[d]	Solid pounds[d]	Liquid gallons (pounds)[d]
Corrosives	5,000	500	Gaseous 810[e] Liquefied (150)	5,000	500	Gaseous 810[e] Liquefied (150)	1,000	100
Highly Toxic	10	(10)	Gaseous 20[g] Liquefied (4)[g]	10	(10)	Gaseous 20[g] Liquefied (4)[g]	3	(3)
Toxic	500	(500)	Gaseous 810[e] Liquefied (150)[e]	500	(500)	Gaseous 810[e] Liquefied (150)[e]	125	(125)



2015 IBC Mixed Occupancies

Section 307.3 Group H-1 Structures

- Buildings and structures that contain materials that present a **detonation hazard** must be classified as **Group H-1**.
- Such materials include, but are not limited to:
  - Explosives.
  - Unclassified detonable.
  - Organic peroxide.
  - Class 4 oxidizers.
  - Class 3 detonable.
  - Class 4 unstable (reactive) materials and detonable pyrophoric materials.

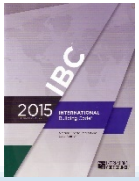


Section 307.4 Group H-2 Structures

- Buildings and structures that contain materials that present a **deflagration hazard** or a hazard from accelerated burning must be classified as **Group H-2**.
- Such materials include, but are not limited to:
  - Class I, II or IIIA flammable, or combustible liquids that are used or stored in normally open containers or systems; or in closed containers or systems pressurized at more than 15 psi.
  - Combustible dusts.
  - Flammable cryogenic liquids.
  - Flammable gases.
  - Class I organic peroxides (Capable of deflagration, not detonation).

FIRE TRIANGLE

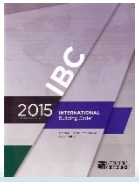
EXPLOSION PENTAGON



Section 307.4 Group H-2 Structures

- Buildings and structures that contain materials that present a **deflagration hazard** or a hazard from accelerated burning must be classified as **Group H-2**.

EXPLOSION PENTAGON

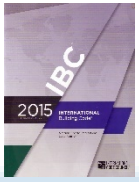


2015 IBC Mixed Occupancies

Section 307.4 Group H-2 Structures

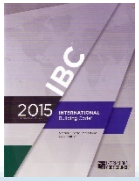
Such materials include, but are not limited to:

- Class 3 oxidizers used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 psi,
- Non-detonable pyrophoric liquids, solids and gases,
- Class 3 non-detonable unstable (reactive) materials
- Class 3 water reactive materials (React explosively with water)



Section 307.5 Group H-3 Structures

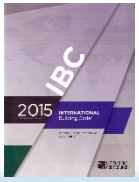
- Buildings and structures that contain **materials that support combustion or present a physical hazard**.
  - **Such materials must include, but are not limited to:**
    - Class I, II, IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at less than 15 psi;
    - Combustible fibers;
    - Consumer fire works, 1.4G (Class C, common);
    - Oxidizing cryogenic liquids;
    - Flammable solids,



Section 307.5 Group H-3 Structures

Such materials include, but are not limited to:

- Class II and III organic peroxides (Burn rapidly, Moderate reactivity hazard)
- Class 1 and 2 oxidizers (Moderate increase of combustion rate).
- Class 3 oxidizers used or stored in normally closed. containers or systems pressurized at less than 15 psi (Severe increase of combustion rate).
- Oxidizing gases (Accelerate combustion of other materials).
- Class 2 unstable (reactive) materials (Violent chemical change. Do not detonate).
- Class 2 water reactive materials (React violently with water).

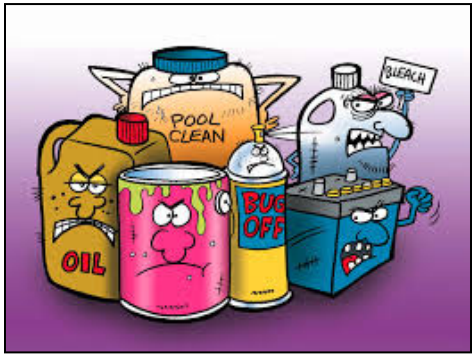


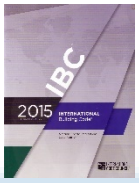
Section 307.6 Group H-4 Structures

- Buildings and structures that contain **materials that are health hazards**.

  Such materials must include, but not be limited to:

  - Corrosives.
  - Highly toxic materials.
  - Toxic materials.

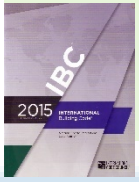




Section 307.7 Group H-5 Structures

- **Semiconductor fabrication facilities** and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials are in excess of those listed in Table 307.1(1) and 307.1(2).

- Areas must be designed and constructed in accordance with Chapter 4 (Special Detailed Requirements Based on Use and Occupancy), Section 415.8 **Group H-5** (High Hazard structures).



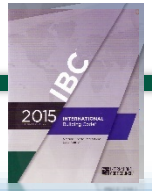
Section 307.7 Group H-5 Structures

TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD[a, j, m, n, p]

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	NA	H-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA
Combustible fiber[q]	Loose Baled[o]	H-3	(100) (1,000)	NA	NA	(100) (1,000)	NA	NA	(20) (200)	NA
Combustible liquid[c, i]	II IIIA IIIB	H-2 or H-3 H-2 or H-3 NA	NA	120[d, e] 330[d, e] 13,200[e, f]	NA	NA	120[d] 330[d] 13,200[f]	NA	NA	30[d] 80[d] 3,300[f]
Consumer fireworks	1.4G	H-3	125[e, l]	NA	NA	NA	NA	NA	NA	NA
Cryogenic flammable	NA	H-2	NA	45[d]	NA	NA	45[d]	NA	NA	10[d]
Cryogenic inert	NA	NA	NA	NA	NL	NA	NA	NL	NA	NA
Cryogenic oxidizing	NA	H-3	NA	45[d]	NA	NA	45[d]	NA	NA	10[d]
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4G Division 1.5 Division 1.6	H-1 H-1 H-1 or H-2 H-3 H-3 H-1 H-1	1[e, g] 1[e, g] 5[e, g] 50[e, g] 125[d, e, l] 1[e, g] 1[e, g]	(1)[e, g] (1)[e, g] (5)[e, g] (50)[e, g] NA (1)[e, g] NA	NA	0.25[g] 0.25[g] 1[g] 50[g] NA 0.25[g] NA	(0.25)[g] (0.25)[g] (1)[g] (50)[g] NA (0.25)[g] NA	NA	0.25[g] 0.25[g] 1[g] NA NA 0.25[g] NA	(0.25)[g] (0.25)[g] (1)[g] NA NA (0.25)[g] NA
Flammable gas	Gaseous Liquefied	H-2	NA	NA (150)[d, e]	1,000[d, e] NA	NA	NA (150)[d, e]	1,000[d, e] NA	NA	NA
Flammable liquid[c]	IA IB and IC	H-2 or H-3	NA	30[d, e] 120[d, e]	NA	NA	30[d] 120[d]	NA	NA	10[d] 30[d]
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120[d, e, h]	NA	NA	120[d, h]	NA	NA	30[d, h]

[F] TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD[a, c, f, h, i]

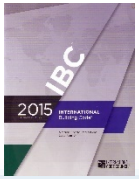
MATERIAL	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
	Solid pounds[d, e]	Liquid gallons (pounds)[d, e]	Gas cubic feet at NTP (pounds)[d]	Solid pounds[d]	Liquid gallons (pounds)[d]	Gas cubic feet at NTP (pounds)[d]	Solid pounds[d]	Liquid gallons (pounds)[d]
Corrosives	5,000	500	Gaseous 810[e] Liquefied (150)	5,000	500	Gaseous 810[e] Liquefied (150)	1,000	100
Highly Toxic	10	(10)	Gaseous 20[g] Liquefied (4)[g]	10	(10)	Gaseous 20[g] Liquefied (4)[g]	3	(3)
Toxic	500	(500)	Gaseous 810[e] Liquefied (150)[e]	500	(500)	Gaseous 810[e] Liquefied (150)[e]	125	(125)



Section 308.2 Institutional Group I-1

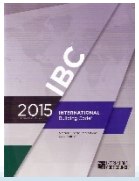
- Includes buildings, structures or parts thereof housing more than **16 persons**, on a **24-hour basis**, who live in a supervised environment that provides personal care.
- Occupants must be able to respond to an emergency situation without assistance.

  - **Examples:**
    - Assisted living facilities.
    - Drug rehabilitation facilities.
    - Convalescent facilities.
    - Group homes.
    - Halfway houses.



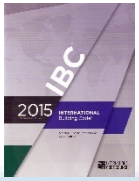
Section 308.3 Institutional Group I-2

- Includes buildings and structures used for medical, surgical and psychiatric care on a **24-hour basis** of persons who are not capable of self-preservation.
  - **Examples:**
    - 24-hour child care for more than **5** children **2½** years of age or less.
    - Detoxification facilities.
    - Hospitals.
    - Intermediate-care facilities.
    - Skilled-care nursing homes.
    - Mental hospitals.



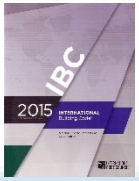
Section 308.4 Institutional Group I-3

- Includes buildings and structures that are inhibited by **5 persons under restraint** or security and incapable of self-preservation due to security reasons.
  - **Examples:**
    - Jails.
    - Prisons.
    - Reformatories.



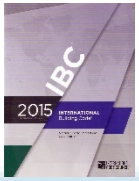
Section 308.4 Institutional Group I-3

- Buildings of **Group I-3** must be classified into one of five conditions:
  - Condition 1 – Free movement - interior/exterior - Group R.
  - Condition 2 – Free movement interior only.
  - Condition 3 – Free movement within smoke compartment.
  - Condition 4 – Limited movement - remote locks-up to **10** manual release locks.
  - Condition 5 – Restricted movement - manual release locks.



Section 308.5 Institutional Group I-4

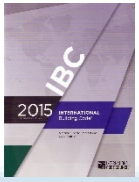
- Buildings and structures occupied by persons of any age receiving **custodial care** outside of the home **by nonfamily members** for **less than 24-hours** per day.
- **Five or fewer** persons must be classified as Group R-3 or comply with the IRC.



Section 308.5 Institutional Group I-4

- **Examples:**
  - **Adult day care:**
    - More than five persons.
    - Supervision and personal care.
    - Less than **24 hours**.

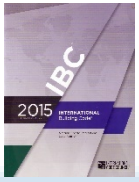
- **Child day care:**
  - More than five persons.
  - Supervision and personal care.
  - Less than **24 hours**.
  - **2½** years of age or less.



2015 IBC Mixed Occupancies

Section 308.5 Institutional Group I-4

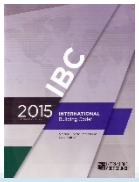
- **Child care** facilities may be classified as Group E occupancies where:
  - The number of children **2½** years of age or less exceeds **5** and is less than **100**;
  - The rooms where such children are cared for are located on the level of exit discharge; and
  - Each of these child care rooms has an exit door directly to the exterior.



2015 IBC Mixed Occupancies

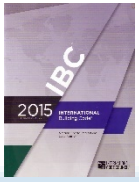
Section 309.1 Mercantile Group M

- Used for the display and sale of merchandise.
  - **Mercantile** occupancies include, but are not limited to:
    - Department stores.
    - Drug stores.
    - Markets.
    - Motor fuel-dispensing facilities (including the canopy).



Section 310.1 Residential Group R

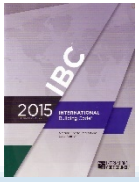
- Occupancies classified as **Group R-3** include those residential uses where the occupants are primarily permanent in nature and the use is not classified as Group R-1, R-2, R-4 or I.
  - **Group R-3** occupancies include:
    - One- and two-family dwellings that fall outside of the scope of the IRC;
    - Adult and child care facilities that accommodate **5** or less persons of **any age** for less than 24 hours;
    - Congregate living facilities **(transient)** having an occupant load of **16** or less; and
    - Congregate living facilities **(non-transient)** having an occupant load of **16** or less.



Section 310.1 Residential Group R-1

Section 310.1 Residential Group R-2

- Occupancies classified as **Group R-2** include two types of residential living arrangements where the occupants are primarily permanent in nature:
  - Apartment houses, non-transient hotels and motels, vacation timeshare properties and similar buildings having more than two dwelling units.
  - Dormitories, fraternity and sorority houses, non-transient boarding houses, convents, monasteries and similar buildings considered as congregate living facilities, live/work units.
- Where a congregate living facility (non-transient) has an occupant load of **16 or less**, it can be classified as a Group R-3 occupancy.



Section 310.1 Residential Group R-2

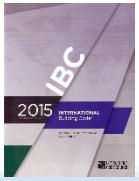
2015 IBC Mixed Occupancies

Section 310.1 Residential Group R-3

- Occupancies classified as **Group R-3** include residential living arrangements where the occupants are primarily permanent in nature:
- Examples:
  - 1- & 2- family dwellings.
  - Boarding houses.
  - Care facilities for **≤5** persons.
  - Congregate living facilities.

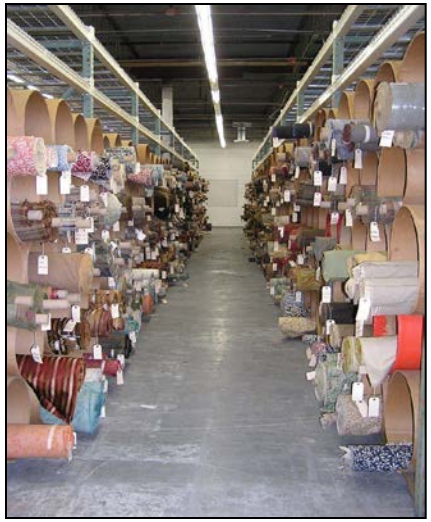
Section 310.1 Residential Group R-4

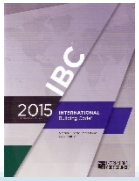
- Adult and child care facilities that are within a single-family home are permitted to comply with the IRC.
  - **Group R-4**: Residential occupancies for residential care or assisted living.
    - More than five and less than **16** occupants (excluding staff).
    - Permitted to comply with IRC provided building is sprinklered.



Section 311.2 Moderate-hazard Storage, S-1

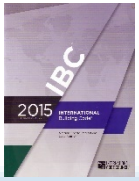
- **Group S-1**: Buildings occupied for storage uses that are not classified as Group S-2 or Group H including, but not limited to, storage of the following:
  - Aerosols, Level 2 and 3.
  - Aircraft hangers.
  - Books and paper in rolls or packs.
  - Cardboard.
  - Cloth and clothing.
  - Furniture.
  - Lumber.
  - Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials.





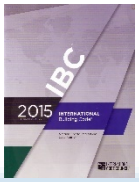
Section 311.3 Low-hazard Storage, S-2

- Buildings used for storage of non-combustible materials. Storage uses include:
  - Beverages up to 16% alcohol.
  - Cement in bags.
  - Dairy products in non-waxed coated paper containers.
  - Empty cans.
  - Glass.
  - Gypsum board.
  - Meats.
  - Metal cabinets.
  - Parking garages (open or enclosed).



Section 312.1
Utility and Miscellaneous Group U

- Buildings and structures not classified in any specific occupancy must be constructed, equipped and maintained to conform to the requirements of this code.
  - **Examples:**
    - Agricultural buildings.
    - Barns.
    - Carports (to be open on at least two sides in accordance with Section 406.1.3).
    - Fences more than **6’** high.
    - Grain silos.
    - Private garages.

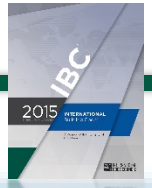


Module 3

Incidental Uses

Section 509 Incidental Uses

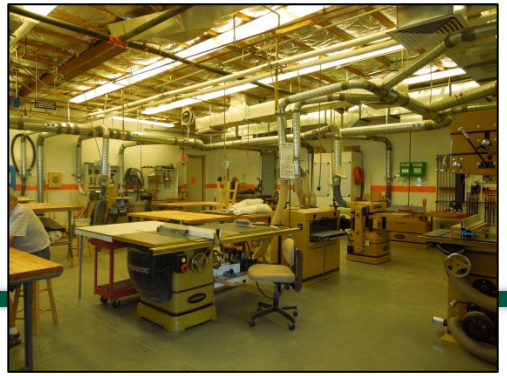
- Rooms or spaces that pose **risks** which aren't addressed by the provisions specific to a general occupancy group:
  - Presence of **combustible or hazardous material.**
  - Presence of a **hazardous activity or equipment.**
- Limited to those found in Table 509.
- Regulated according to their **hazard level**.
- Regulated as part of **primary occupancy**.
- Not regulated as accessory occupancy.
- Not regulated under mixed occupancy provisions.



Incidental Uses Identification

Uses are those listed in **Table 509**, including:

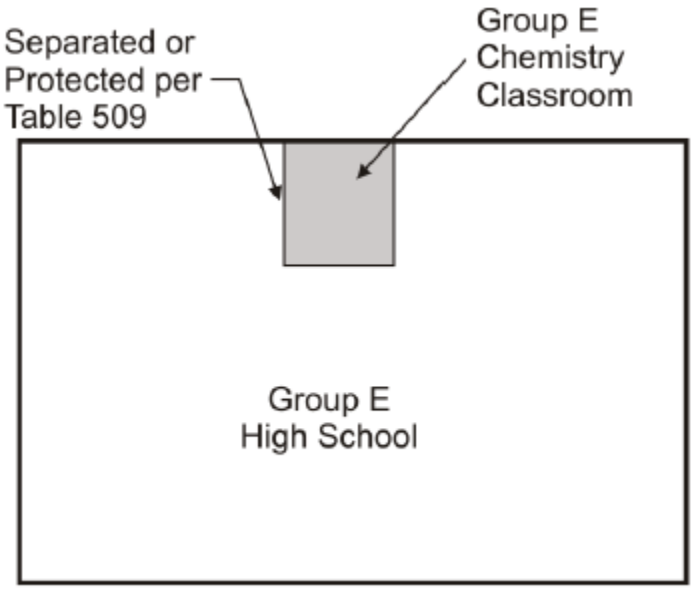
- Furnace rooms where any piece of equipment exceeds a **400,000-Btu/hour** input rating.
- Paint shops (where located in other than a Group F occupancy, and not when Group H occupancy).
- Laboratories in Group E occupancies.
- Vocational shops located in Group E occupancies.
- Laundry rooms over **100 sq.ft**.
- Physical plant maintenance shops in Group I-2 occupancies.

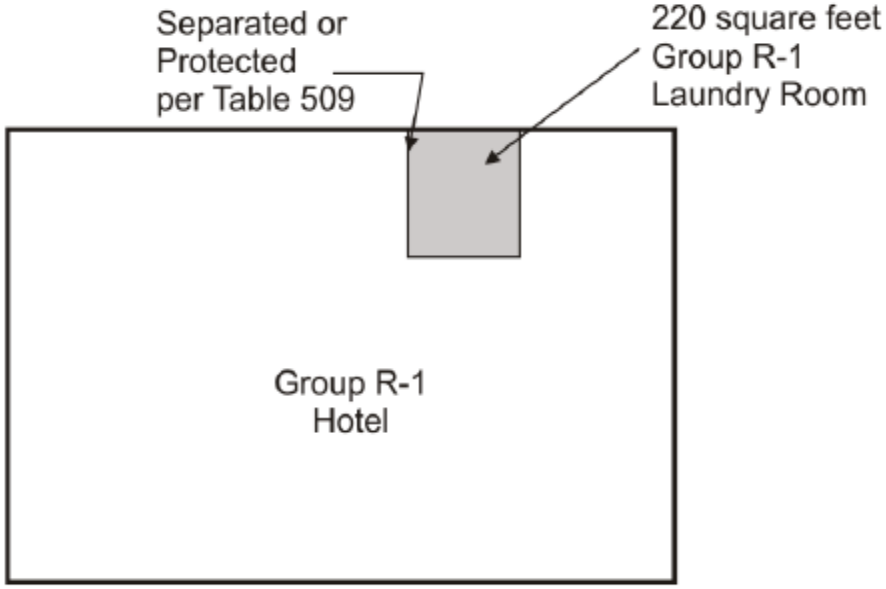


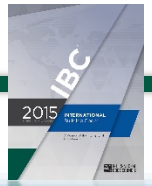
Incidental Uses Classification

- Occupancy classification is consistent with the general classification of the area of the building in which the incidental use is located.
  - A chemistry lab/classroom in a high school building. Classified as Group E occupancy.
  - A physical plant maintenance shop in a hospital. Classified as Group I-2 occupancy.

Incidental Uses Classification



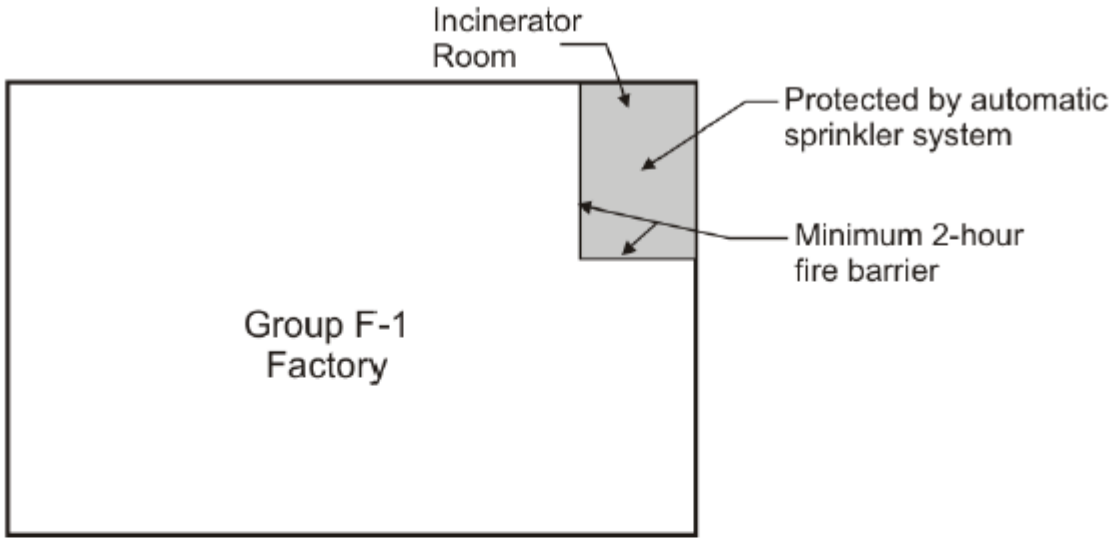


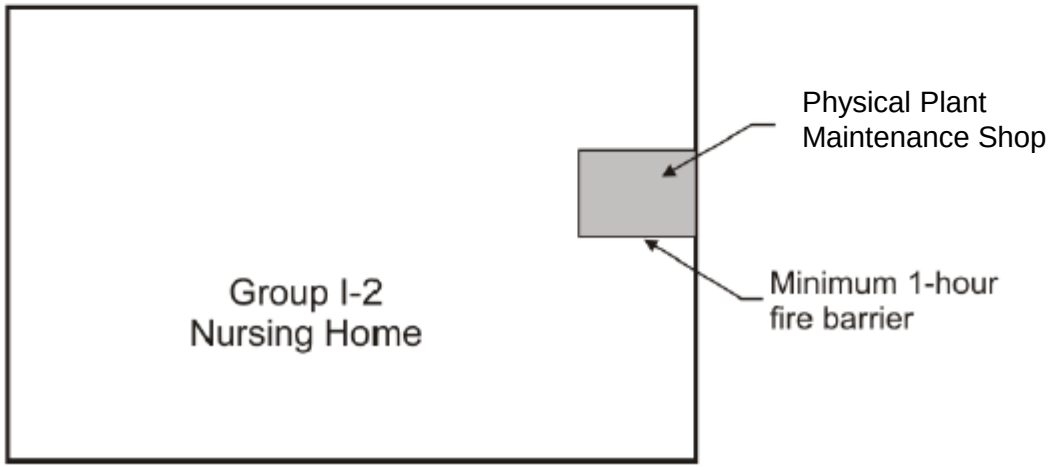


Incidental Uses Separation and Protection

- Intent is to **isolate** incidental use hazard from remainder of building, typically through use of:
  - Fire-resistance-rated separation; **or**
  - Smoke-resistant separation **plus** automatic sprinkler system.
- Under certain conditions, sprinkler option cannot be substituted for fire-resistance-rated separation.
- Both fire-resistance-rated separation and automatic sprinkler system protection are mandated in limited cases.

Incidental Uses: Separation and Protection

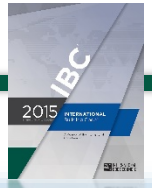




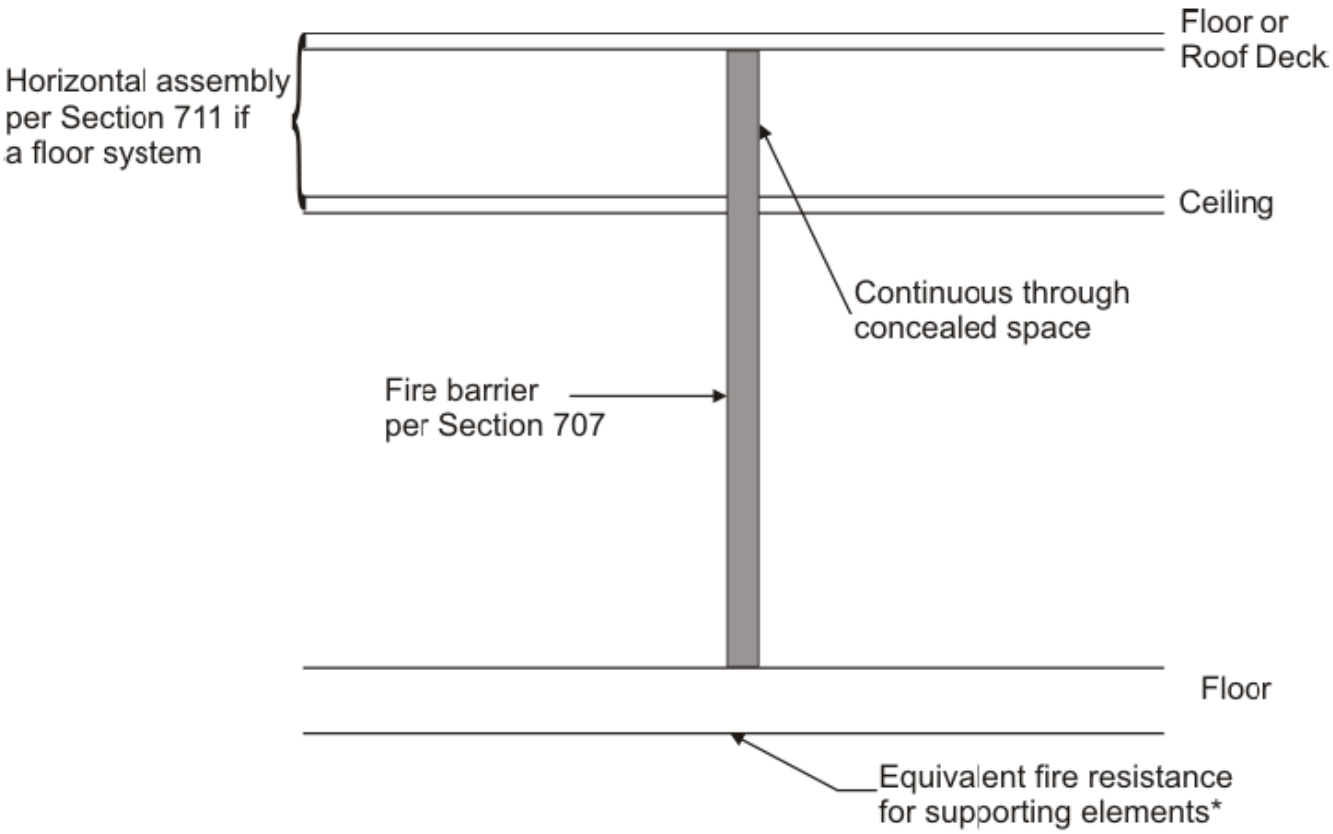
Incidental Uses Table 509

TABLE 509
INCIDENTAL USES

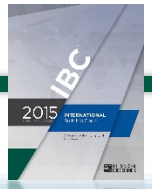
ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptable power supplies	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.



Section 509.4.1 Separation

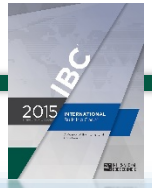


*Not required for 1-hour fire barriers
in Type IIB, IIIB or VB construction

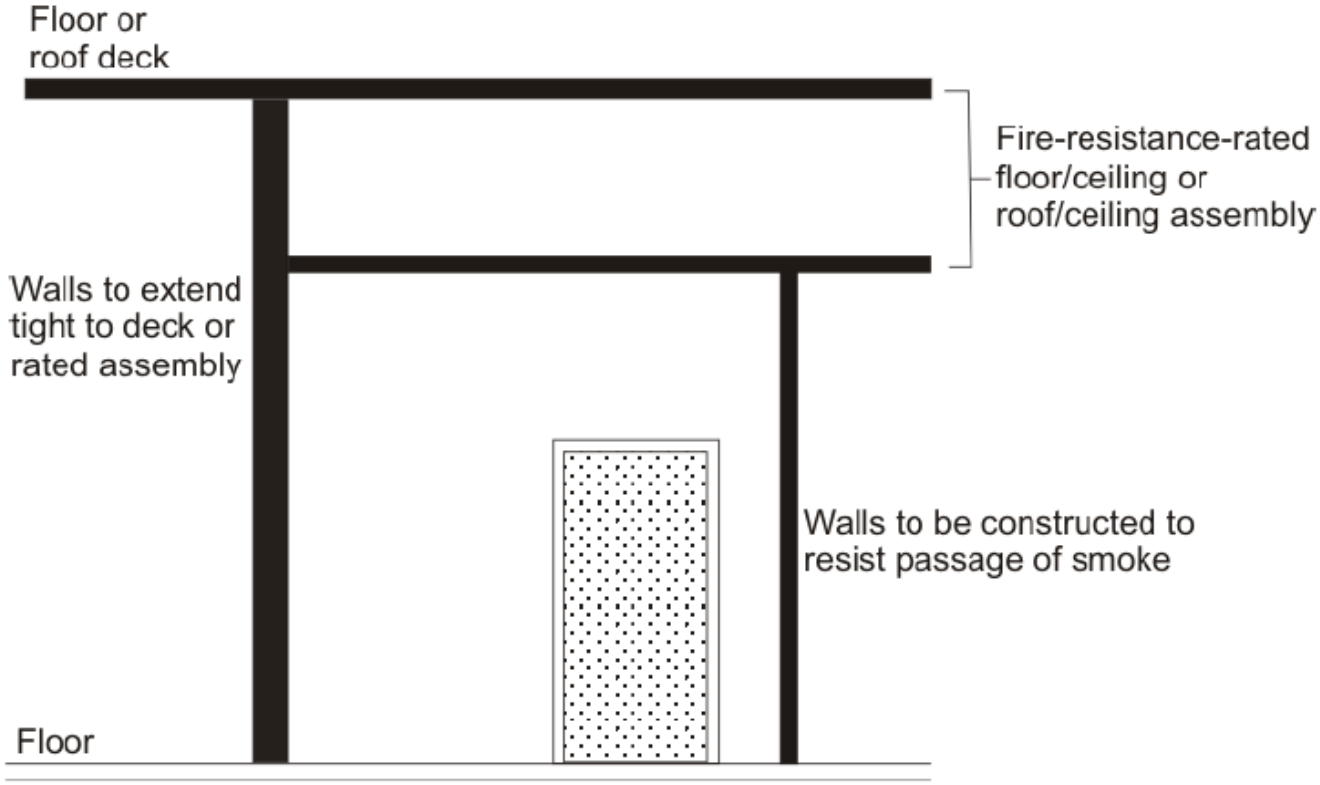


Section 509.4.2 – Fire Protection

- Table 509 allows for the installation of an automatic sprinkler system provided the incidental use:
  - Is separated by construction capable of resisting passage of smoke.
  - Has doors that are automatic or self closing (no openings).
  - Has smoke dampers on air transfer openings in walls.
- Other:
  - Need not be fire-resistance rated.
  - Not required to be built as smoke partition (Section 710).



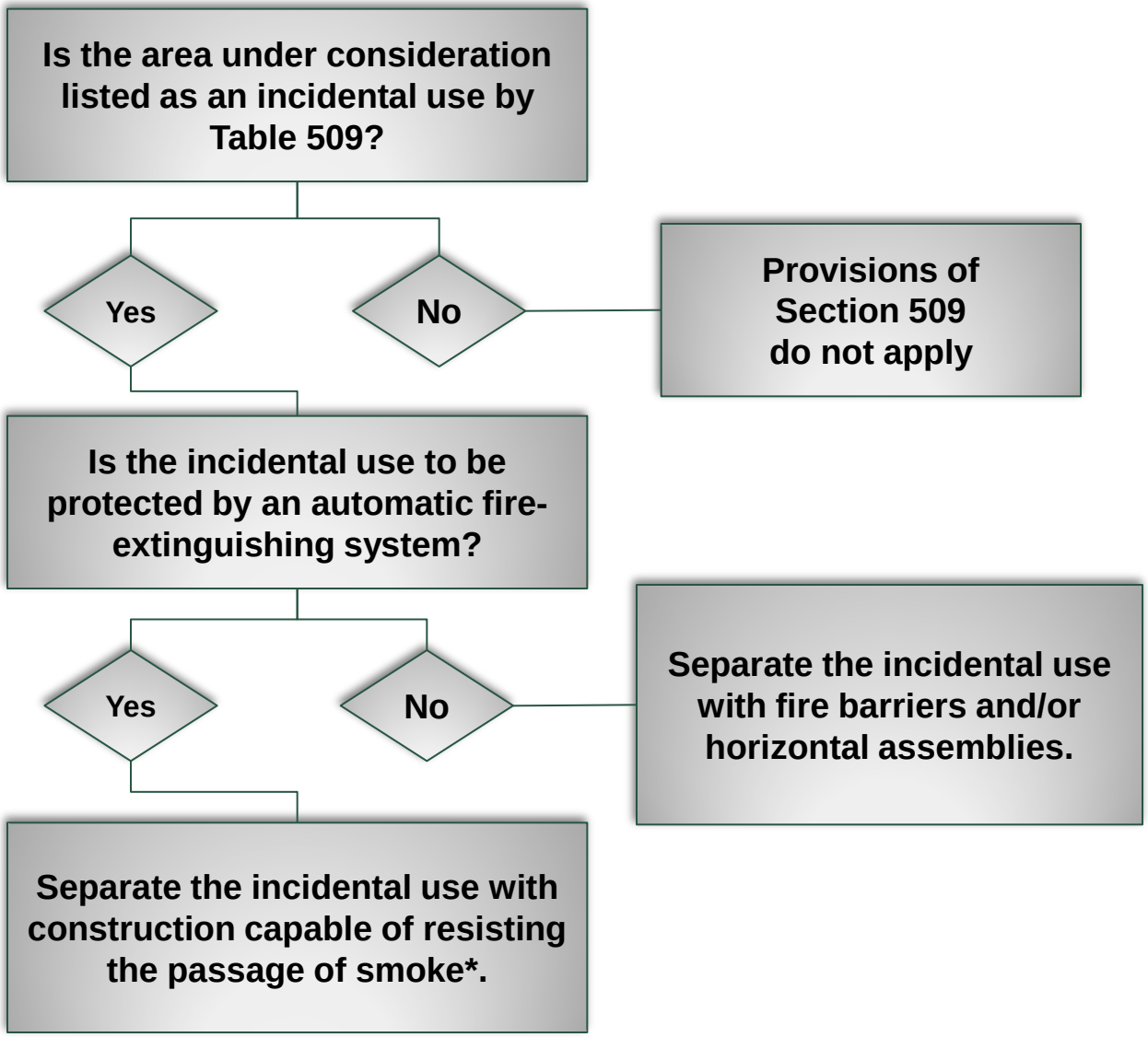
Incidental Uses: Section 509.4.2 Protection

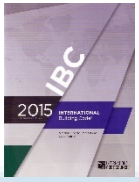


Note: Doors shall:

- Be self-closing or automatic closing by smoke.
- Have no air transfer openings.
- Have no excessive undercuts.

Incidental Uses: The Process



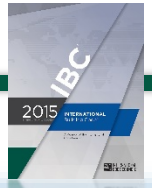


Module 4

Foundations of the IBC for Mixed Occupancies

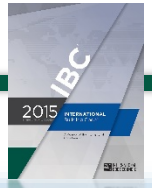
Foundation: Classification, Height, Area and Separations

- Application of mixed-occupancy provisions rely on appropriate application of:
  - Occupancy Classification (Chapter 3).
  - Allowable Building Height (Chapter 5).
  - Allowable Building Area (Chapter 5).
  - Construction of fire-resistant separations (Chapter 7).



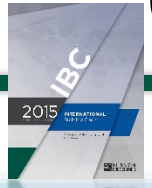
Chapter 3
Occupancy Classification

- As previously addressed, **occupancy classification** is first required.
- Mixed-occupancy conditions occur where **two or more** distinct occupancy classifications occur in a building.
- Occupancy classification for all three mixed-occupancy methods is based on **individual classification** per Section 302.1.



Chapter 5
Building Heights and Areas

- Chapter 5 provides basic limits for each building:
  - Maximum height.
  - Maximum number of stories.
  - Allowable area.
- Limits are set according to type of construction and the occupancy.
  - **Tables 504.3, 504.4 and 506.2.**
  - Allowable increases.
- Allowable height and area cannot be determined until choice of mixed occupancy method is first determined.



Chapter 5
Building Heights and Areas

- Determination of which method applies.
- Differences in how the allowable height is regulated.
- Provisions related to allowable height and area be understood.

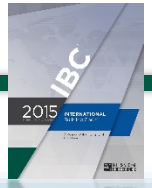
Chapter 5
Building Heights and Areas

TABLE 503
ALLOWABLE BUILDING HEIGHTS AND AREAS[a]
Building height limitations shown in feet above grade plane. Story limitations shown as stories above grade plane.
Building area limitations shown in square feet, as determined by the definition of "Area, building," per story

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	HEIGHT(feet)	UL	160	65	55	65	55	65	50	40
		STORIES(S) AREA (A)								
A-1	S	UL	5	3	2	3	2	3	2	1
	A	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500
A-2	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-3	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-4	S	UL	11	3	2	3	2	3	2	1
	A	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000
A-5	S	UL	UL	UL	UL	UL	UL	UL	UL	UL
	A	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	S	UL	11	5	3	5	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
E	S	UL	5	3	2	3	2	3	1	1
	A	UL	UL	26,500	14,500	23,500	14,500	25,500	18,500	9,500
F-1	S	UL	11	4	2	3	2	4	2	1
	A	UL	UL	25,000	15,500	19,000	12,000	33,500	14,000	8,500
F-2	S	UL	11	5	3	4	3	5	3	2
	A	UL	UL	37,500	23,000	28,500	18,000	50,500	21,000	13,000
H-1	S	1	1	1	1	1	1	1	1	NP
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	NP
H-2[d]	S	UL	3	2	1	2	1	2	1	1
	A	21,000	16,500	11,000	7,000	9,500	7,000	10,500	7,500	3,000
H-3[d]	S	UL	6	4	2	4	2	4	2	1
	A	UL	60,000	26,500	14,000	17,500	13,000	25,500	10,000	5,000
H-4	S	UL	7	5	3	5	3	5	3	2
	A	UL	UL	37,500	17,500	28,500	17,500	36,000	18,000	6,500
H-5	S	4	4	3	3	3	3	3	3	2
	A	UL	UL	37,500	23,000	28,500	19,000	36,000	18,000	9,000
I-1	S	UL	9	4	3	4	3	4	3	2
	A	UL	55,000	19,000	10,000	16,500	10,000	18,000	10,500	4,500
I-2	S	UL	4	2	1	1	NP	1	1	NP
	A	UL	UL	15,000	11,000	12,000	NP	12,000	9,500	NP

Section 707
Separation: Fire Barriers

- Section 508 specifies requirements.
- Not required for:
  - Accessory occupancies.
  - Non-separated occupancies.
  - Certain combinations under separated occupancies.
- Required for:
  - Group H occupancies in mixed-occupancy buildings.
  - Certain combinations under separated occupancies as specified in Table 508.4.



Section 707 Separation: Fire Barriers

Area Separation

- FIRE WALL - fire-resistance-rated wall, having protected openings, that extends continuously from foundation to or through roof, with sufficient structural stability under fire conditions to allow collapse on either side without collapse of wall

Occupancy Separation

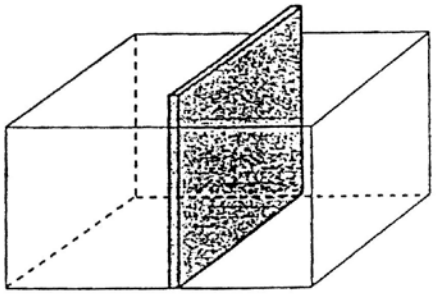
- FIRE BARRIER - fire-resistance-rated vertical or horizontal assembly of materials designed to restrict the spread of fire and in which openings are protected

Corridor Walls

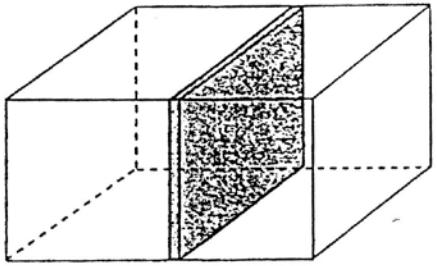
- FIRE PARTITION - vertical fire separation with protected openings and limited to a maximum rating of one hour

Compartments

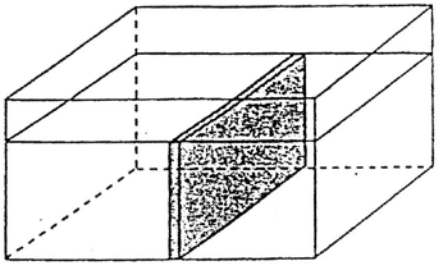
- FIRE AREA - aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or fire-rated horizontal assemblies



Fire wall
2, 3 or 4 Ho
Vertical



Fire Barrier
1, 2, 3 or 4 I
Vertical and
Horizontal



Fire partition
1 Hour Vertic

Separation: Fire Barriers – Section 707 Horizontal Assemblies – Section 711

- Separations, where required, must be:
  - Fire barriers constructed in accordance with Section 707. Provisions of Section 707 address:
    - Continuity.
    - Openings.
    - Penetrations.
    - Joints.
    - Ducts and air transfer openings.
    - Supporting construction.

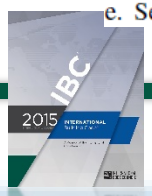
  - Horizontal assemblies constructed in accordance with Section 711.

Separation: Fire Barriers Table 508.4

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.

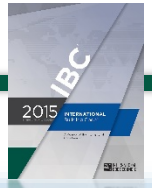


Module 5

Application of the Mixed Occupancy Methods

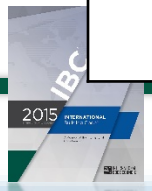
Mixed Occupancies: Overview - Section 508.1

- There are **four key components** that regulate mixed-occupancy buildings:
  - Occupancy classification.
  - Allowable height.
  - Allowable area.
  - Separation.
- The **three** mixed-occupancy **options** differ from each other based on one or more of these four components.



Mixed Occupancies: Overview - Section 508.1

	Accessory Occupancies Section 508.2	Non-separated Occupancies Section 508.3	Separated Occupancies Section 508.4
Occupancy Classification	Individually classified	Individually classified	Individually classified
Allowable Area	For accessory occupancy, based on allowable area of main occupancy	For building, based on most restrictive of occupancies under consideration	For building, determined such that the sum of the ratios of actual area divided by allowable area cannot exceed 1.0
Allowable Height	For accessory occupancy, based on tabular values of Table 503	For building, based on most restrictive of occupancies under consideration	For building, based on general provisions of Section 503.1
Separation	No separation required between occupancies except for incidental accessory occupancies	No separation required between occupancies	Fire-resistance-rated separation as required by Table 508.4

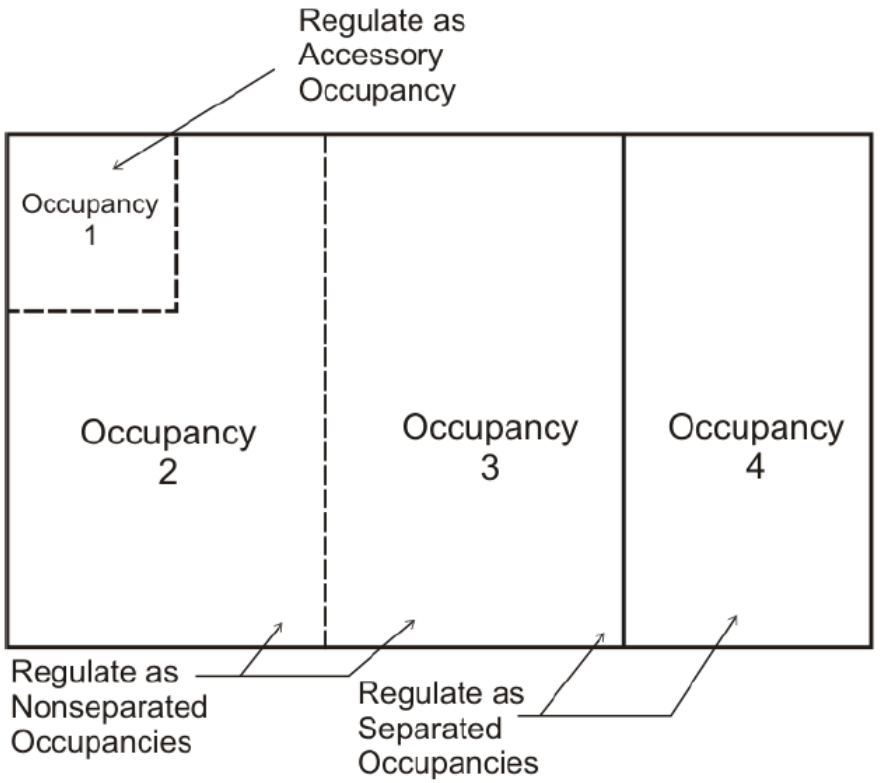


Mixed Occupancies: Three Options - Section 508.1

- Section 508.1 mandates that one of the three options must be applied where a mixed occupancy exists.
  - **Determination** of the option depends on the owner/designer.
    - Building function.
    - Construction costs.
    - Design flexibility.
  - Compliance with at least one of the three options to be **verified** by building official.

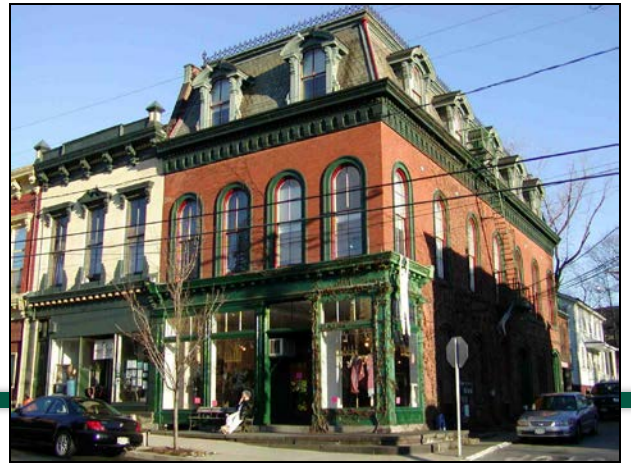
Mixed Occupancies: Use of Multiple Options - Section 508.1

- Owner/designer may choose to use more than one option within same building.
- Under separated occupancies option, relationship between multiple pairs of occupancies should be individually analyzed.



Mixed Occupancies: Section 508.1, Exceptions

- There are three conditions under which the provisions of Section 508 do not apply:
  - Occupancies regulated under the special provisions height and area provisions of Section 510.
  - Group H-1, H-2 and H-3 occupancies where required to be in a detached building by Table 415.6.2.
  - Uses within live/work units in accordance with Section 419 (not considered as separate occupancies).

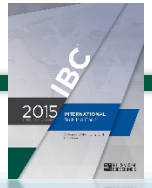


Module 6

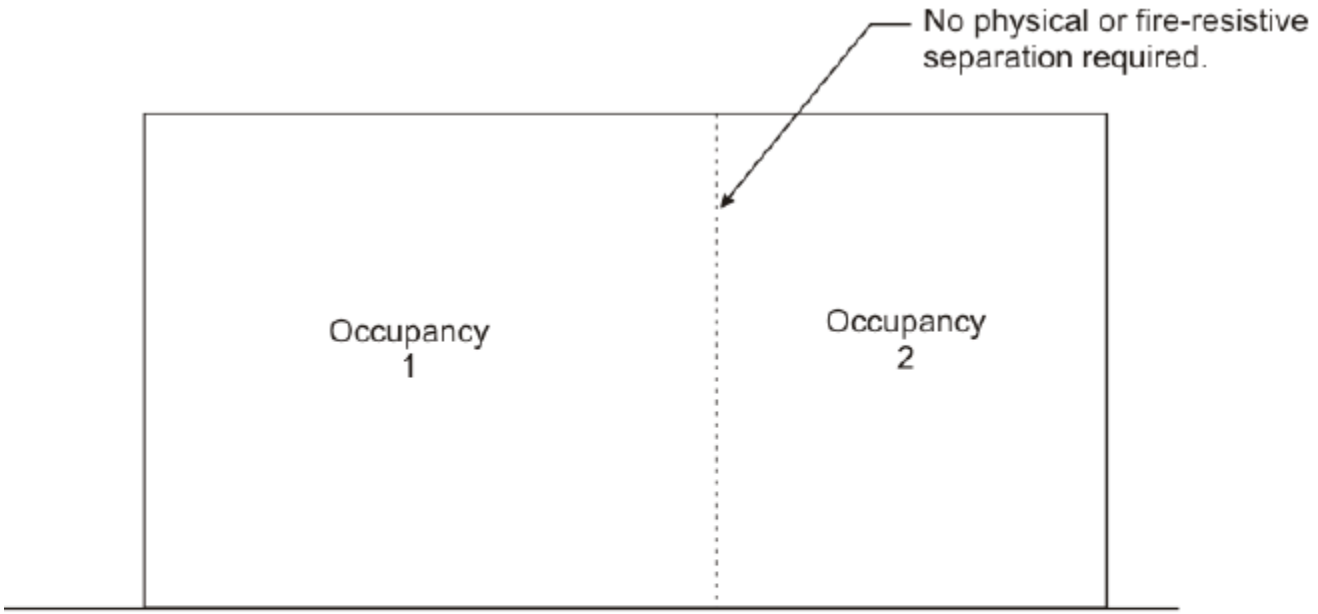
Non-separated Occupancies

Non-separated Occupancies Overview

- "**Non-separated occupancies**" method considers **most restrictive** requirements for fire protection and allowable height/area for occupancies involved.
- This method beneficial to designer due to:
  - No requirement to separate occupancies
  - Flexibility allowed by application of "worst-case" approach to fire protection and building size.
- No requirements for a fire-resistance-rated separation between adjacent occupancies.
- Non-separated occupancies method is most common of methods utilized.



Section 508.3
Non-separated Occupancies



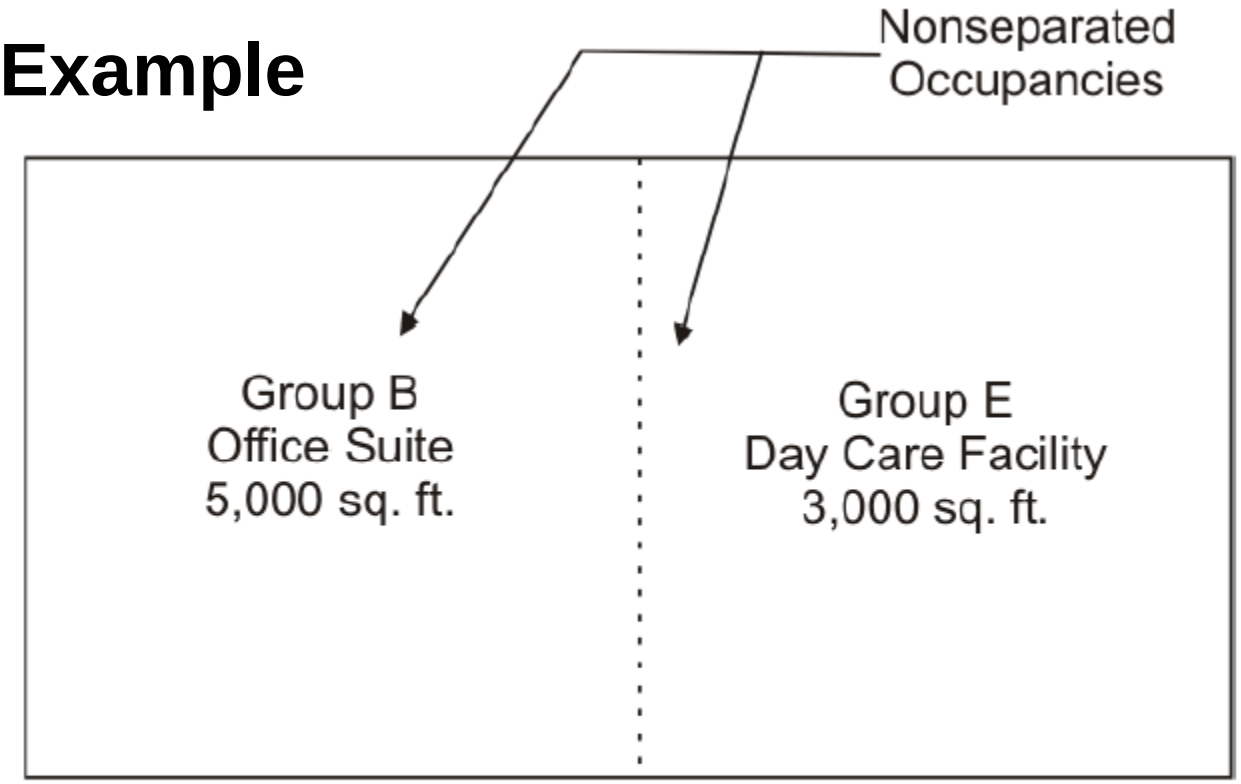
- Minimum type of construction based upon the most restrictive allowable heights and areas of Occupancies 1 and 2.
- Most restrictive fire protection requirements of Chapter 9 for Occupancies 1 and 2 applied to entire building.

Non-separated Occupancies: Section 508.3.1 Classifications

- Occupancy classification based on the general provisions of Section 302.1.
- Individually classified based on the use of space.
- Most restrictive applicable provisions of Chapter 9 regulating fire-protection systems apply to the entire building, not just the specific occupancy:
  - Automatic sprinkler systems.
  - Fire alarms.

Non-separated Occupancies: Section 508.3.1 Fire Protection

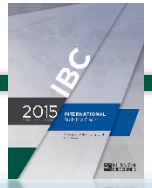
Example



- Manual fire alarm system required in Group E occupancy by Section 907.2.3 required throughout entire building.

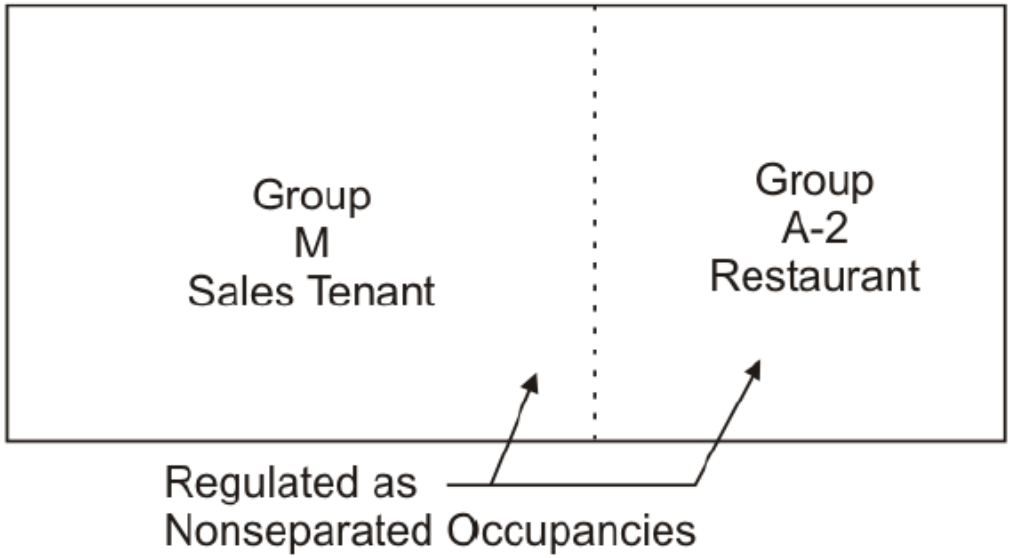
Non-separated Occupancies: Section 508.3.2 Allowable Area & Height

- The maximum allowable height and area of building is based on the **most restrictive** allowances for the occupancy groups under consideration.
- The most restrictive allowable area is applied to the entire building.
- Same limitation is applied to the building's height.



Non-separated Occupancies: Section 508.3.2 Allowable Area & Height

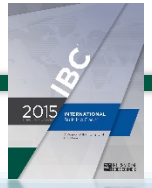
Example: Building is to be multistory, fully sprinklered and of Type VB construction. Frontage increase of 30 percent available.
1st story contains Group M and A-2 occupancies as shown with Group B occupancy above.



Non-separated Occupancies: Section 508.3.2 Allowable Area & Height

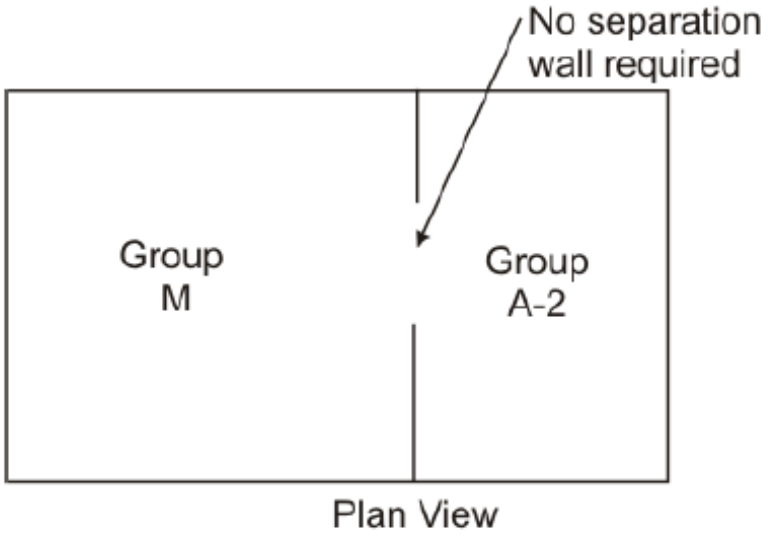
	Group M	Group A-2	Group B
Allowable Area (square feet)	29,700	19,800	29,700
Allowable Height (number of stories)	2	2	3

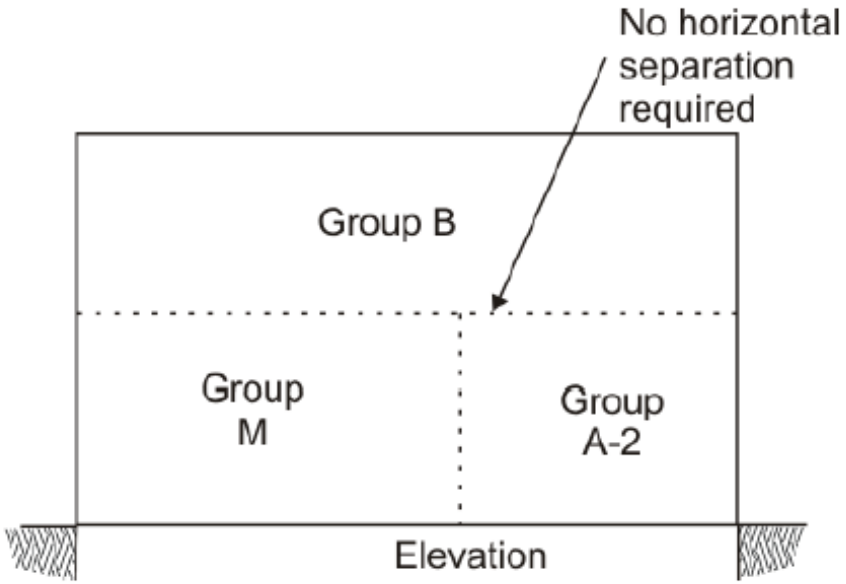
Result: Building is limited to 2 stories and 19,800 sf per story to comply with Non-separated Occupancies method.



Non-separated Occupancies: Section 508.3.3 Separations

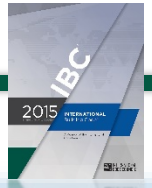
- Application of this option will result in no physical or fire-resistance-rated separation between the non-separated occupancies.





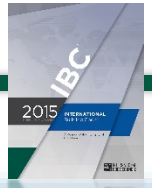
Non-separated Occupancies Section 508.3.3, Exceptions

- Group H-2, H-3, H-4 and H-5 occupancies must be separated from all other occupancies per **Section 508.4** (separated occupancies).
- Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units must be separated from each other and from all other occupancies contiguous to them per **Section 420**.



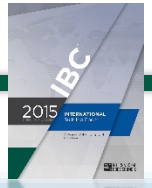
Non-separated Occupancies: A Four-Step Process

1. **Determine** the occupancies present in the building.
2. **Determine** the maximum allowable height and area for each occupancy. Apply the **most restrictive** to the entire building.
3. **Apply** the **most restrictive** fire protection requirements of Chapter 9 to the entire building.
4. **Apply** all other code requirements to **each portion** of the building based on the occupancy classification of that portion.



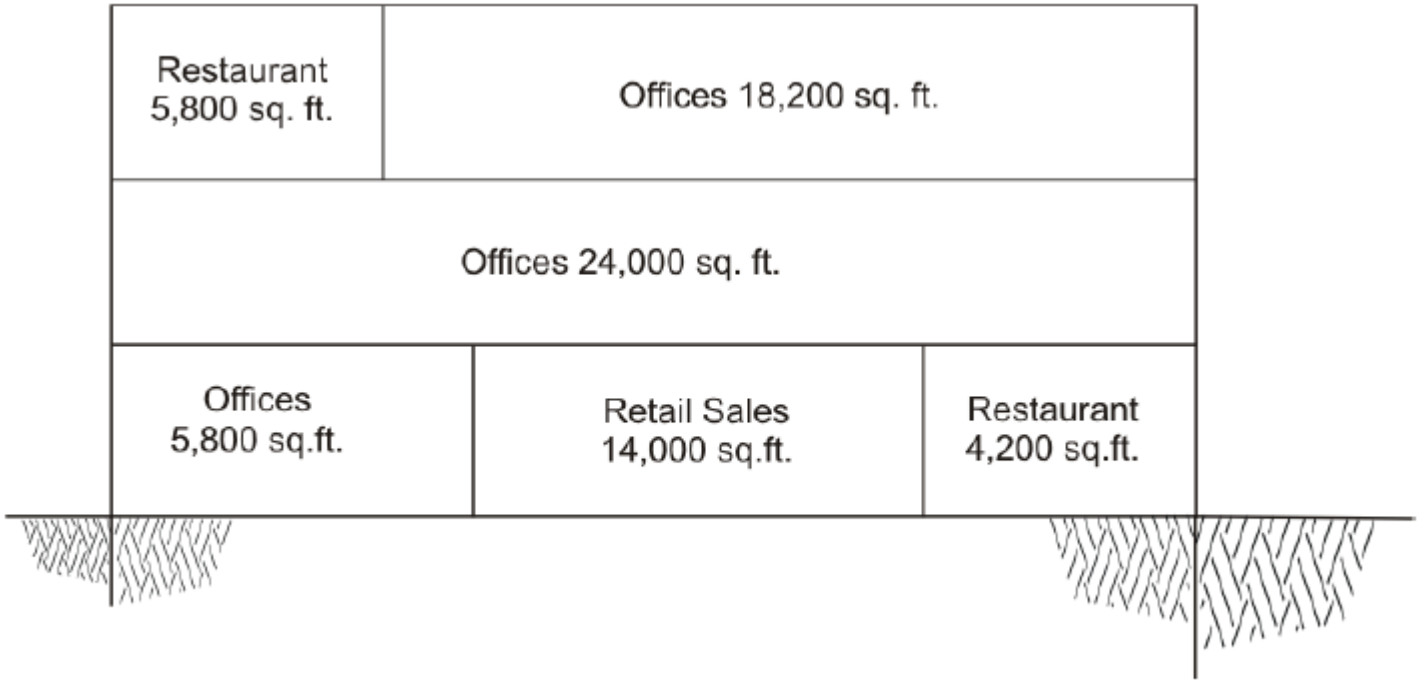
Non-separated Occupancies: Applying the Process

- **Given:** A three-story, Type IIB building containing assembly, business and mercantile uses. The building is fully sprinklered and does not qualify for any frontage increase for allowable area purposes. Each story is 24,000 sq.ft. in floor area.



Non-separated Occupancies: Applying the Process

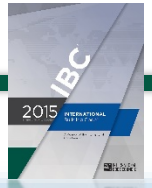
- **Determine:** Does the building comply with the non-separated mixed occupancy option?



Non-separated Occupancies: Applying the Process

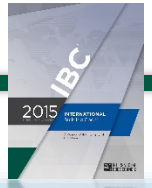
- Solution:
  1. Determine the occupancies in the building.

  2. Determine the maximum allowable height and area for each occupancy. Apply the most restrictive to the entire building.



Non-separated Occupancies: Applying the Process

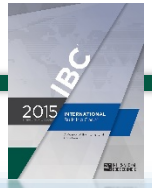
	Group A-2	Group B	Group M
Allowable Height (number of stories)	3	4	3
Allowable Area per Story (square feet)	28,500	69,000	37,500
Allowable Building Area (square feet)	85,500	207,000	112,500



Non-separated Occupancies: Applying the Process

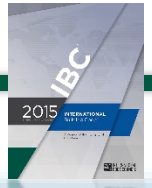
3. Apply the most restrictive fire protection requirements of Chapter 9 to the entire building.

4. Apply all other code requirements to each portion of the building based on the occupancy classification of that portion.



Mixed Occupancies Practice 2

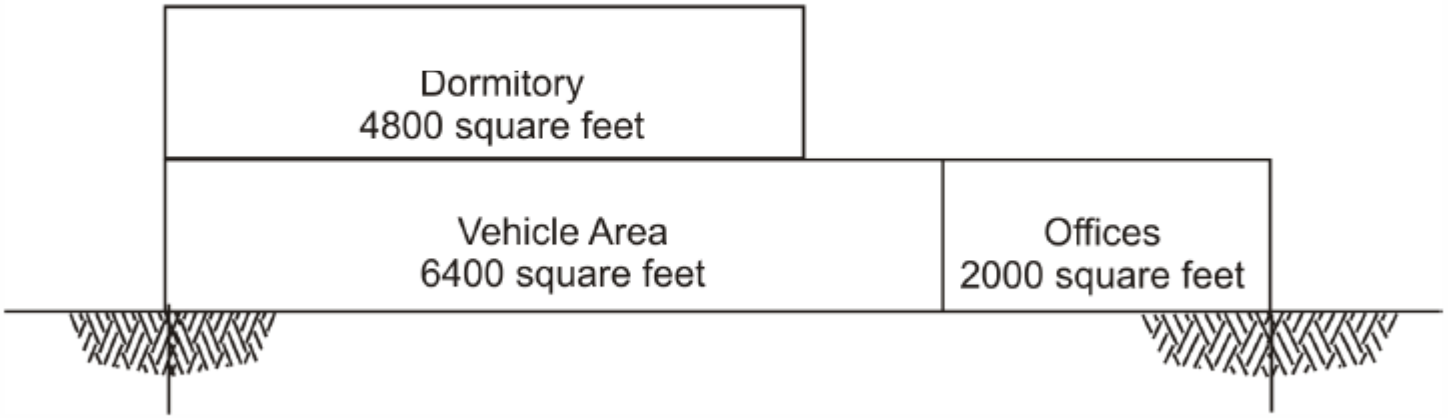
- **Given:** A two-story district fire station contains Group B, R-2 and S-1 occupancies as shown. The building is fully sprinklered, constructed of Type VB construction and has open frontage allowing for a 75% as redundant area increase.



Mixed Occupancies Practice 2

- **Determine:** Can the building be constructed under the non-separated occupancies provisions for mixed-occupancy buildings?

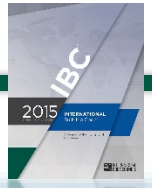
Type VB Construction, Fire Station



For SI: 1 square foot = 0.0929 m^2.

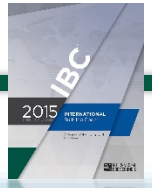
Solution

Classification of Occupancies	B – Offices R-2 - Dormitory S-1 – Vehicle Area
Identify maximum allowable height	Given: Type VB construction – fully sprinklered R-2 – 2 + 1 = 3 S-1 – 1 + 1 = 2 B – 2 +1 = 3 Most restrictive is **Group S-1** for 2 stories
Identify maximum allowable area	Given: Type VB; fully sprinklered; 75% increase for frontage From Table 503: R-2 – 7,000 square feet allowable S-1 – 9,000 square feet B – 9,000 square feet **Group R-2** is the most restrictive tabular value Equation 5-1: $A_a = 21,000 + (0.75 \times 7,000)$ A_a = 26,250 sq. ft. per story allowed.



Solution

Verify most restrictive fire protection features	Given: Fully spinklered. Fire Alarms: R-2 – Manual fire alarm – not required; smoke alarms required S-1 – No specific requirement B – Manual fire alarm where occupant load in excess of 500
Solution	Most restrictive provisions: S-1 – 2 stories maximum – complies R-2 – 26,250 maximum floor area – complies Fully sprinklered – complies Alarms – smoke alarms required in Group R-2 only

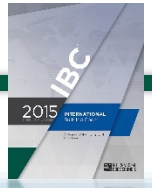


Module 7

Separated Occupancies

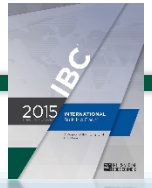
Separated Occupancies Overview

- “Separated occupancies” method uses a **balanced** approach to regulating mixed occupancy conditions.
- This method is typically applied where non-separated occupancies method is impractical, undesirable or unavailable.
- Separated occupancies method must be applied to Group H-2, H-3, H-4 and H-5 occupancies.



Section 508.4
Separated Occupancies

- Only one of the three options where a fire-resistance-rated occupancy separation is required under mixed-occupancy conditions.
- Table **508.4** is referenced to determine the degree of fire resistance that is mandated for separations.
- Separations may not be required where occupancies are considered to be of same level of hazard.

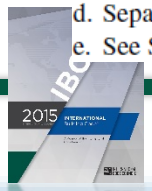


Section 508.4
Separated Occupancies

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

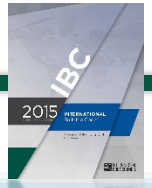
OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.



Section 508.4 Separated Occupancies

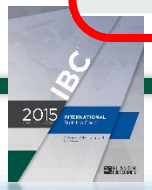
- This option differs from the other options in three ways:
  - The fire protection requirements of Chapter 9 are to be applied **individually** in each portion of the building based on the occupancies in each portion.
  - The allowable height for each occupancy within the building is based on **Section 503.1**.
  - The allowable area of the building is based on the **sum of the ratios** where the actual floor area of each occupancy divided by the allowable floor area of each occupancy is **not to exceed 1.0 (unity formula).**



Section 508.4
Separated Occupancies

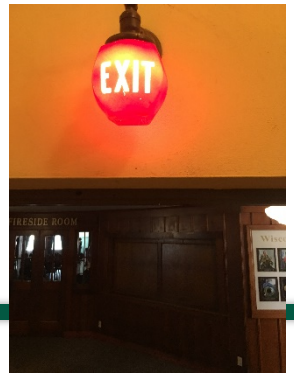
Table 508.4
Required Separation of Occupancies (hours)

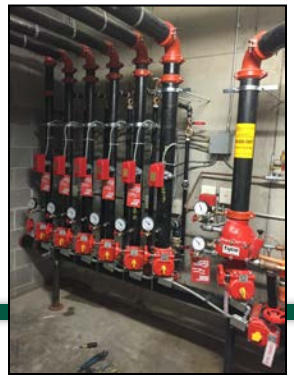
Occupancy	A[d], E		I-1, I-3, I-4		I-2		R		F-2, S-2[b], U		B, F-1, M, S-1		H-1		H-2		H-3, H-4, H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A[d], E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3[a]
I-1, I-3, I-4	–	–	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
I-2	–	–	–	–	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP
R	–	–	–	–	–	–	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP
F-2, S-2[b], U	–	–	–	–	–	–	–	–	N	N	1	2	NP	NP	3	4	2	3[a]
B, F-1, M, S-1	–	–	–	–	–	–	–	–	–	–	N	N	NP	NP	2	3	1	2[a]
H-1	–	–	–	–	–	–	–	–	–	–	–	–	N	N	NP	NP	NP	NP
H-2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	N	N	1	NP
H-3, H-4, H-5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1[e,f]	NP

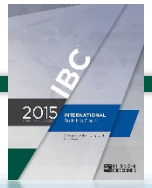


Separated Occupancies: Section 508.4.1 Occupancy Classifications

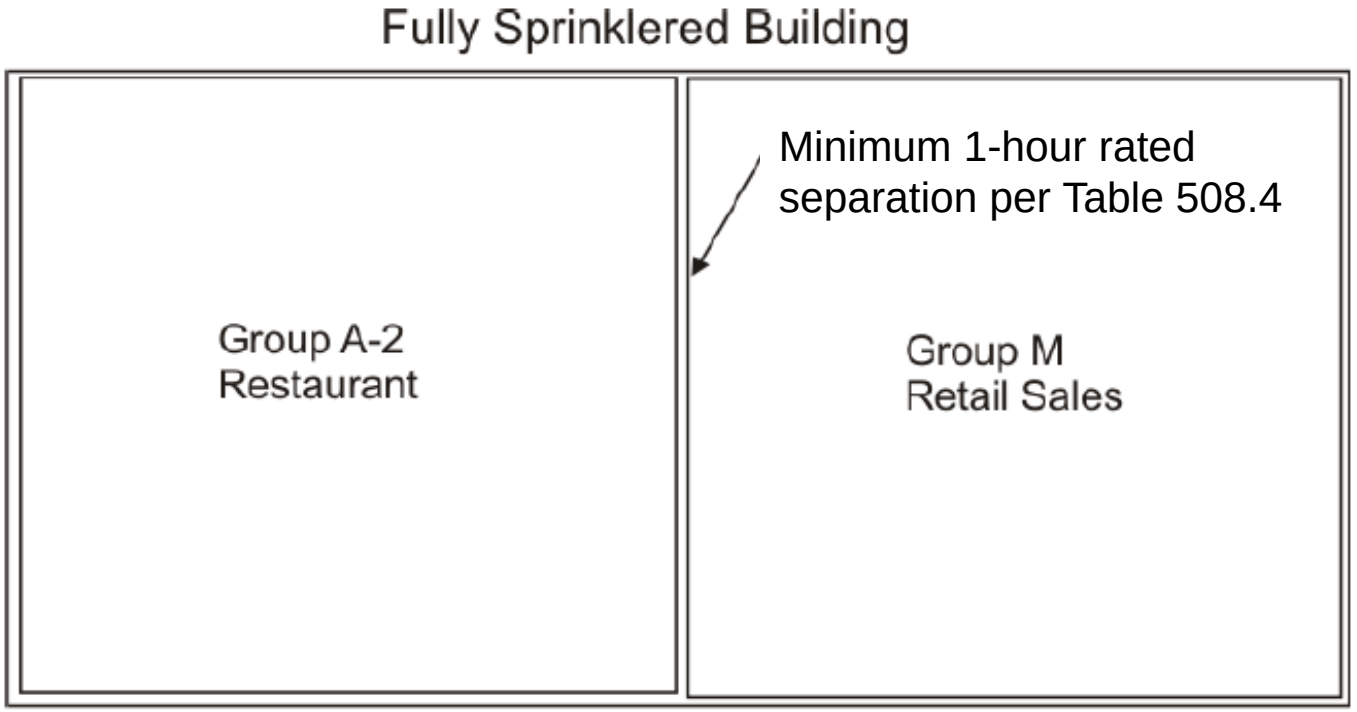
- This option requires that the occupancies be classified individually based on their specific functions.
- Requirements for means of egress, automatic sprinkler systems, fire alarm systems, plumbing facilities and all other provisions are to be applied individually to the various occupancies in the building.







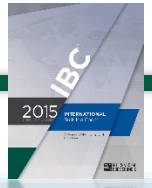
Separated Occupancies: Section 508.4.1 Occupancy Classifications



- Group A-2 portion to be regulated by Group A-2 requirements.
- Group M portion to be regulated by Group M requirements.

Separated Occupancies: Section 508.4.2 Allowable Area

- When a mixed-occupancy building is regulated under the provisions of Section 508.4 for separated occupancies, the **unity formula is used** in the determination of allowable area per story.
- Compliance for allowable area can only be achieved where the sum of the ratios of actual floor area divided by allowable floor areas for each of the occupancies involved **does not exceed 1**.

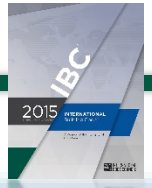


Separated Occupancies: Section 508.4.2 Allowable Area

- The formula can be expressed as:

$$\frac{a_1}{A_1} + \frac{a_2}{A_2} + \frac{a_3}{A_3} + \ldots \leq 1.0$$

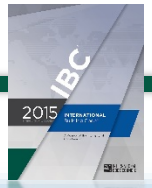
  - a_1, a_2 and a_3 represent the actual floor areas for the individual occupancies.
  - A_1, A_2 and A_3 represent the maximum allowable areas for the same respective occupancies.
- Calculation applied regardless of any required separation.
- Applicable frontage increase for entire building applied to each of the occupancies.
- Sprinkler increase applied on a “per occupancy” basis.



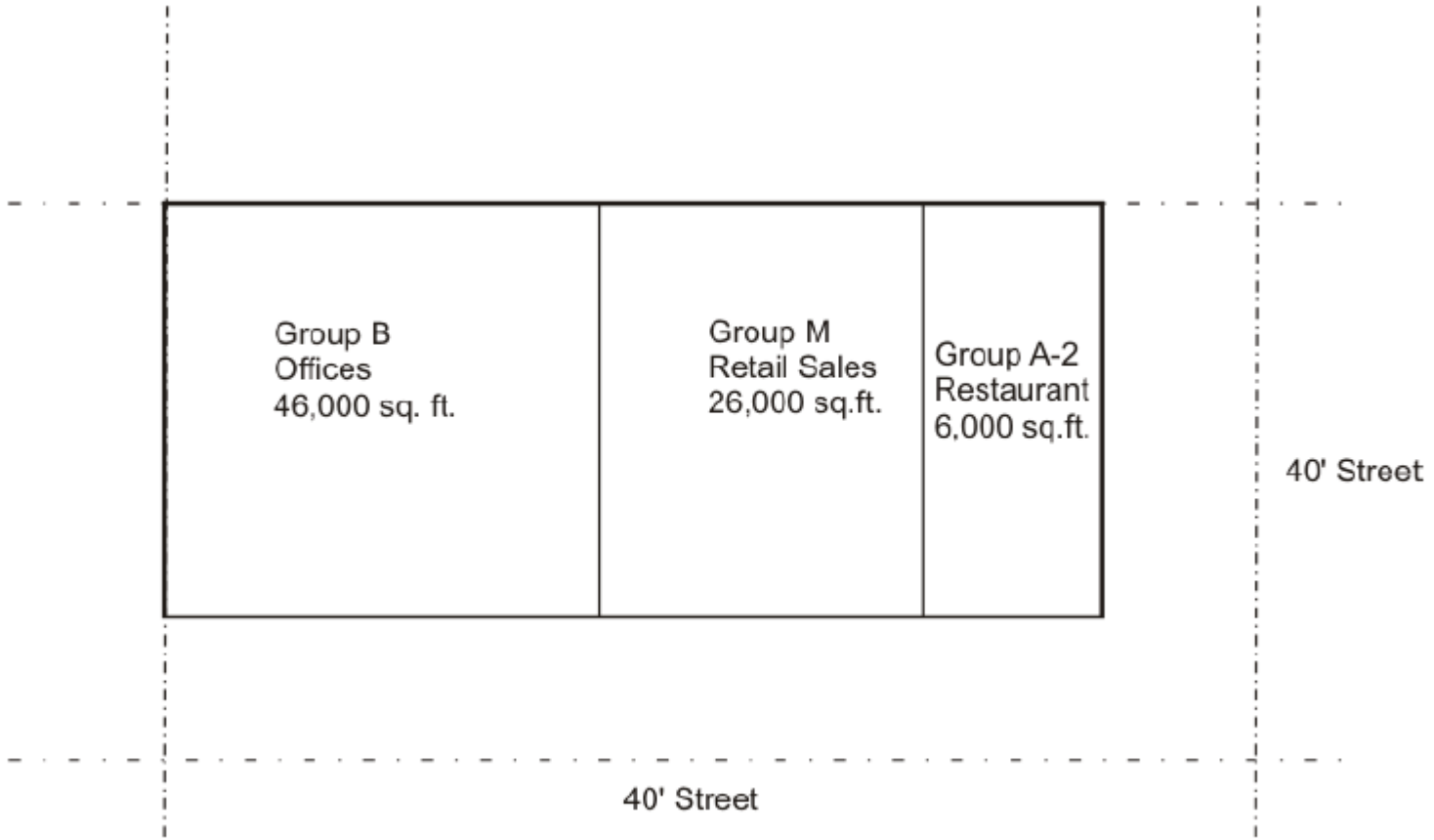
Separated Occupancies: Section 508.4.2 Allowable Area

- **Given:** A one-story, 78,000 sq.ft., fully sprinklered building with three occupancy groups as shown. The building is of Type IIB construction and adjoins two public ways that qualify for a 25% frontage increase.
- **Determine:** Does the building comply with the allowable area limitations based on separated occupancies?

$$a_B/A_B + a_M/A_M + a_{A-2}/A_{A-2} \leq 1.0\,?$$



Separated Occupancies: Section 508.4.2 Allowable Area



For SI: 1 square foot = 0.0929 m^2.

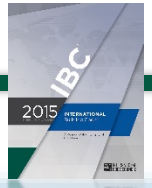
Separated Occupancies: Section 508.4.2 Allowable Area

- Solution:

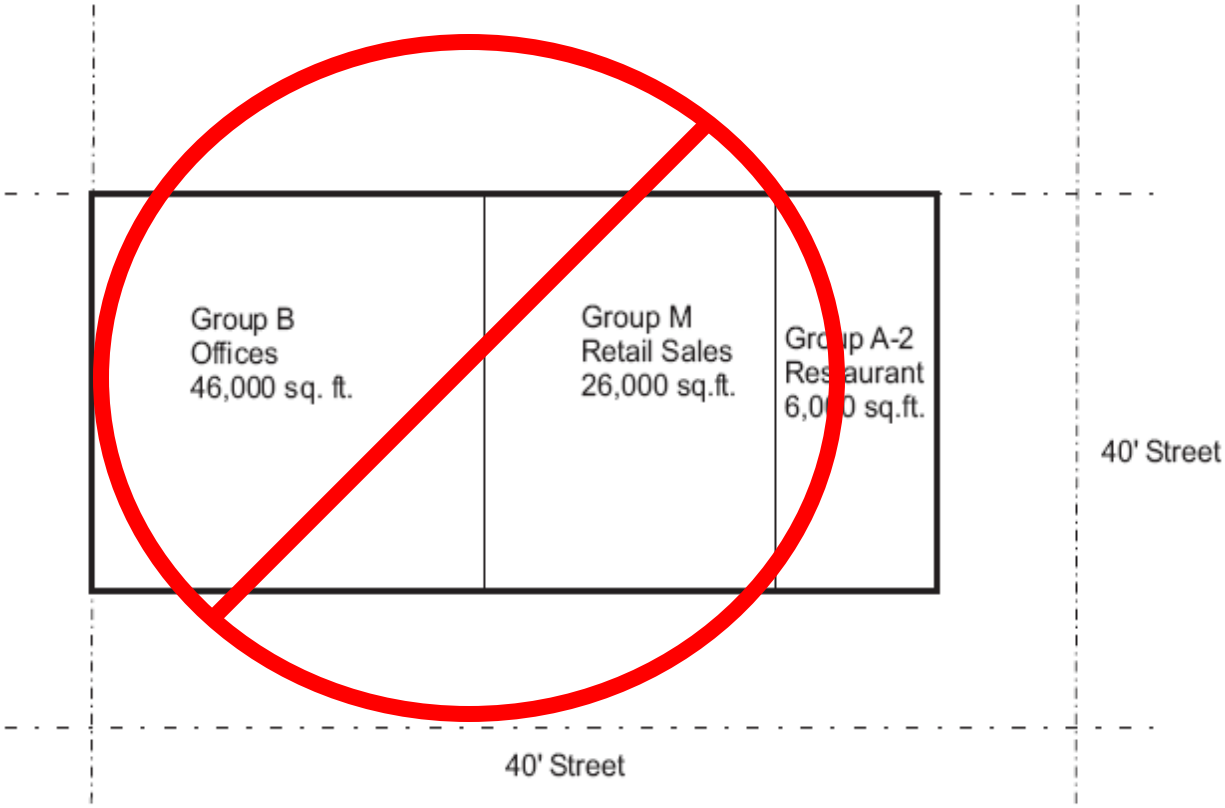
$a_B = 46{,}000$ $\quad A_B = 92{,}000 + 0.25(23{,}000) = 97{,}750$

$a_M = 26{,}000$ $\quad A_M = 50{,}000 + 0.25(12{,}500) = 53{,}125$

$a_{A\text{-}2} = 6{,}000$ $\quad A_{A\text{-}2} = 38{,}000 + 0.25(9{,}500) = 40{,}375$



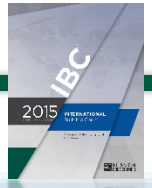
Separated Occupancies: Section 508.4.2 Allowable Area



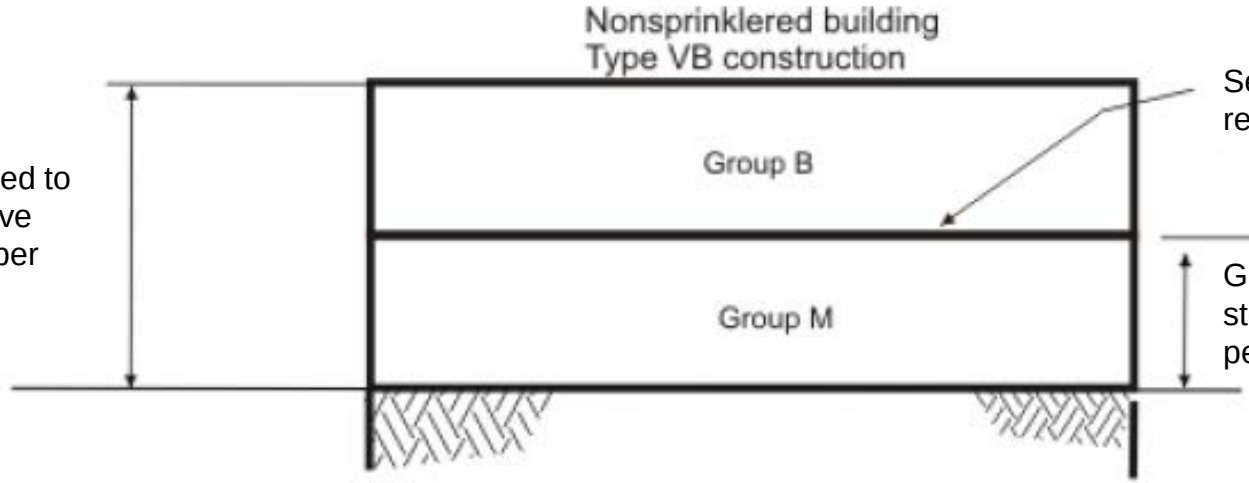
Allowable Area of Separated Occupancies

Separated Occupancies: Section 508.4.3 Allowable Height

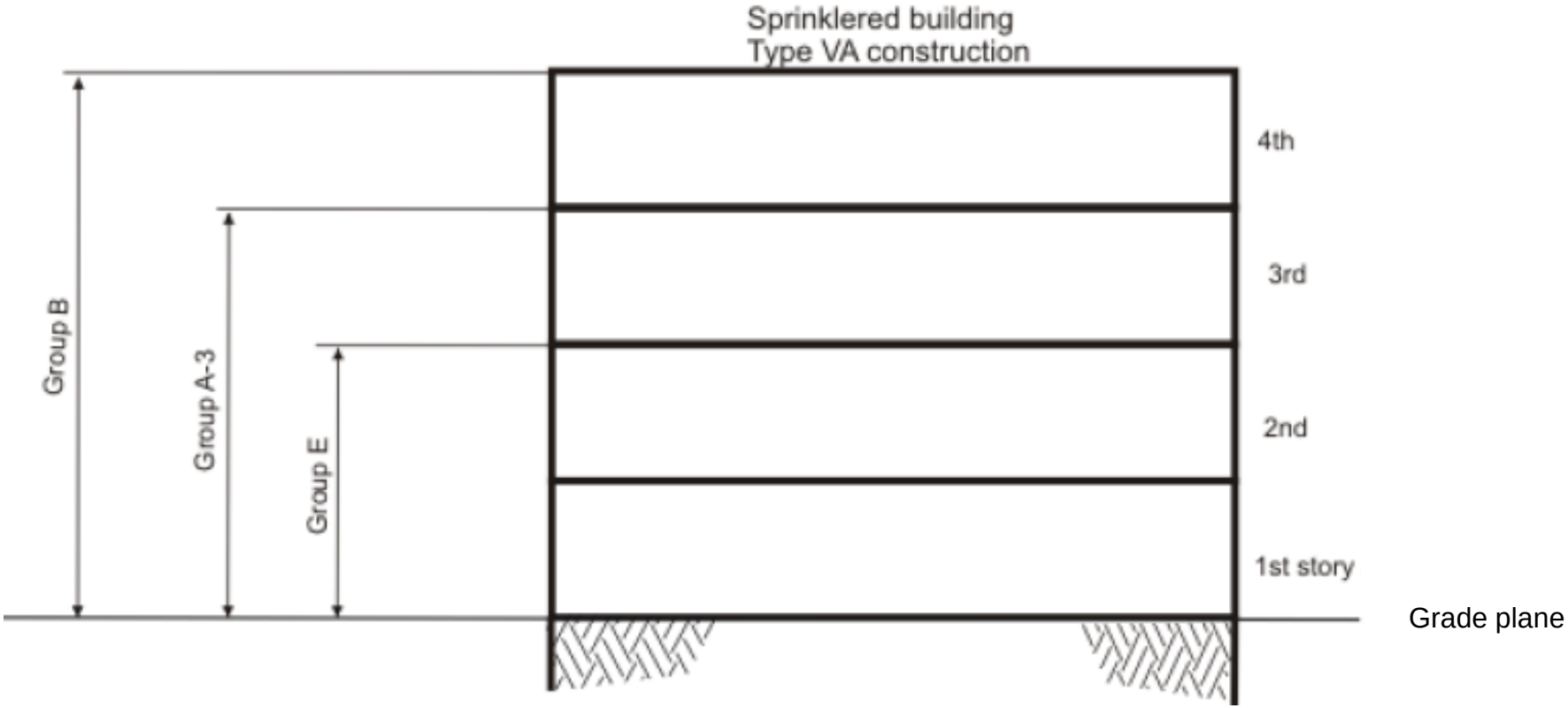
- Each individual occupancy in a multiple-story, mixed-occupancy building is regulated for height independently based on Section 503.1.
- Maximum **height** for each occupancy is limited by the type of construction in **Section 503.1**.
  - Measured from the grade plane.
  - If a building has an automatic sprinkler system, an increase of one story and 20’ is selectively available as reflected in Tables 504.3 and 504.4.
  - Based on type of construction.



Separated Occupancies: Section 508.4.3 Allowable Height

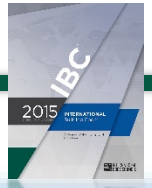


Separated Occupancies: Section 508.4.3 Allowable Height



Separated Occupancies: Separations – Section 508.4.4

- The requirements for a fire-resistance-rated separation between adjacent occupancies vary.
- The requirements are established in **Table 508.4**.
- Fire barriers and horizontal assemblies are to be utilized in the **complete separation** of adjacent occupancies with different levels of hazard.
- Table 508.4 allows for some occupancy pairs to be adjacent with no required fire-resistive or physical separation.



Separated Occupancies: Section 508.4.3 Allowable Height

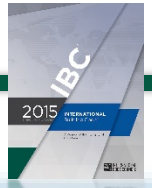
TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.

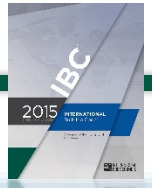
Separated Occupancies: A Five-Step Process

1. **Determine** the various occupancies that occur within the building.
2. **Determine** the minimum required fire-resistance rating between adjacent occupancies.
3. **Verify** that the building does not exceed the maximum allowable area for the type of construction involved.
4. **Verify** that the locations of the occupancies do not exceed their maximum allowable height based on the building's type of construction.
5. **Apply** all other code requirements to each portion of the building based on the occupancy of that portion.



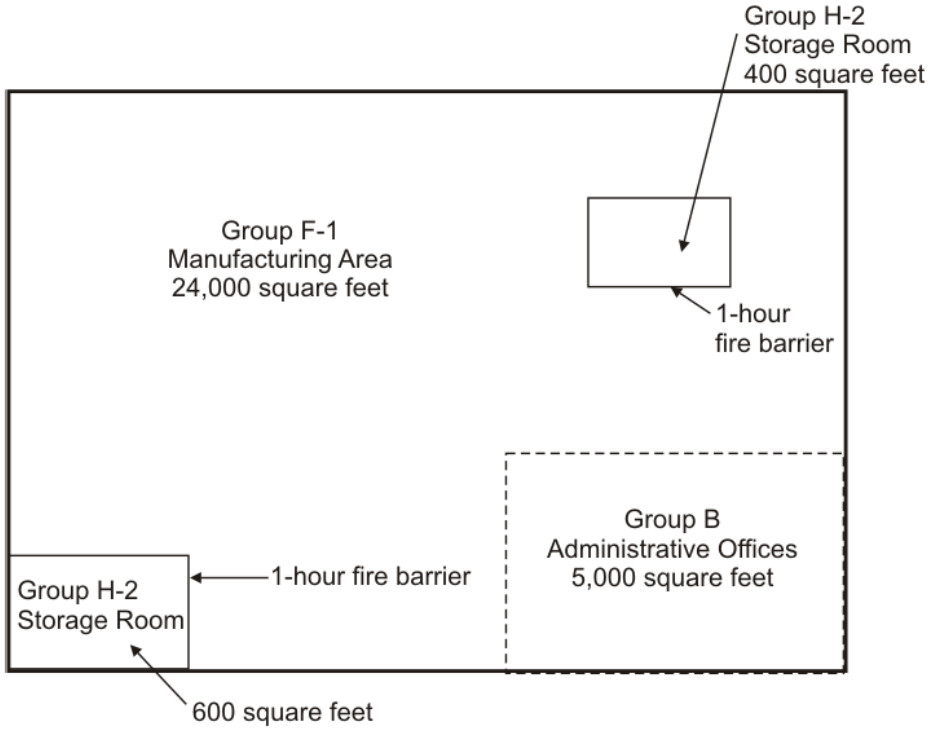
Separated Occupancies: Applying the Process

- **Given:** A 30,000 sq.ft., one-story building of Type VB construction contains offices, manufacturing operations and flammable gas storage rooms (Group H-2) as shown on the following slide. The building is fully sprinklered and qualifies for a 50% allowable area increase for frontage. There is no fire-resistant separation between the office area and the manufacturing area. 1-hour fire barriers separate the hazardous storage rooms from other areas of the building.



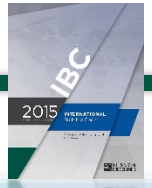
Separated Occupancies: Applying the Process

- **Determine:** Does the building comply with the provisions for separated occupancies?



Separated Occupancies: Applying the Process

- Solution:
  1. Determine the various occupancies that occur within the building.



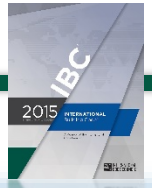
Separated Occupancies: Applying the Process

2. Determine the minimum required fire-resistance rating between adjacent occupancies.

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

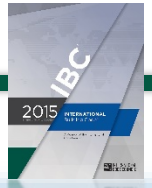
OCCUPANCY	A, E		I-1[a], I-3, I-4		I-2		R[a]		F-2, S-2[b], U		B[e], F-1, M, S-1		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3	2	NP
I-1[a], I-3, I-4	—	—	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP	2	NP
I-2	—	—	—	—	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP	2	NP
R[a]	—	—	—	—	—	—	N	N	1[c]	2[c]	1	2	NP	NP	3	NP	2	NP	2	NP
F-2, S-2[b], U	—	—	—	—	—	—	—	—	N	N	1	2	NP	NP	3	4	2	3	2	NP
B[e], F-1, M, S-1	—	—	—	—	—	—	—	—	—	—	N	N	NP	NP	2	3	1	2	1	NP
H-1	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1[d]	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not permitted.
a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Section 406.3.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for ambulatory care facilities.



Separated Occupancies: Applying the Process

3. Verify that the building does not exceed the maximum allowable area for the type of construction involved.



Separated Occupancies: Applying the Process

$$\frac{a_{F-1}}{A_{F-1}} + \frac{a_B}{A_B} + \frac{a_{H-2}}{A_{H-2}} \leq 1.0?$$

$a_{F-1} = 24{,}000$
$a_B = 5{,}000$
$a_{H-2} = 1{,}000$

A_{H-2}

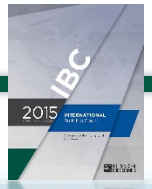
= 3,000	T506.2	
+ 1,500	Frontage	
= 4,500	Total Allowable	

A_{F-1}

= 34,000	T506.2	
+ 4,250	Frontage	
= 38,250	Total Allowable	

A_B

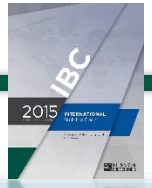
= 36,000	T506.2	
+ 4,500	Frontage	
= 40,500	Total Allowable	



Separated Occupancies: Applying the Process

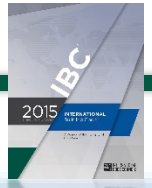
4. Verify that the location of the occupancies do not exceed their maximum allowable height based on the building's type of construction.

5. Apply all other code requirements to each portion of the building based on the occupancy of that portion.



Mixed Occupancies Practice 3

- **Given:** A one-story, multiple-tenant retail center containing Group A-2, A-3, B and M occupancies as shown. The 52,000 sq.ft. building is fully sprinklered, of Type IIB construction and has adequate frontage for a 60% allowable area increase.



Mixed Occupancies Practice 3

- **Determine:** Does this building comply with Section 508.4 for separated occupancies?

Type IIB construction
Fully sprinklered, Retail Center

Group A-2 6,000 square feet	Group M 10,000 square feet	Group M 10,000 square feet	Group B Group M 10,000 square feet	Group A-3 Group B 10,000 square feet
Group A-2 6,000 square feet				

One-hour fire barriers provide separation between all tenant spaces.

Mixed Occupancies Practice 3 Solution

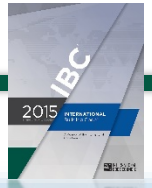
Minimum occupancy separation	Since building is fully sprinklered: A-2 /A-2 none required A-2 /M: 1-hour M/M: none required M/B: none required B/A-3 1-hour
Allowable Height	Building is single story.
Allowable Area	A-2: 38,000 + 5,700 = 43,700 sf A-3: same as A-2 B: 92,000 + 13,800 = 105,800 sf M: 50,000 + 7,500 = 57,500 sf 12,000/43,700 + 10,000/43,700 + 10,000/105,800 + 20,000/57,500 $\leq$ 1 0.27 + 0.23 + 0.09 + 0.35 = 0.94

Module 8

Accessory Occupancies

Accessory Occupancies Overview

- “Accessory occupancies” method is only applicable where **support occupancies** are **relatively small** compared to major occupancy.
- This method beneficial to designer due to:
  - No requirement to separate accessory occupancies from major occupancy.
  - In determination of allowable building area, allowable area based considering accessory occupancy as part of major occupancy.
- Accessory occupancies method has limited application.

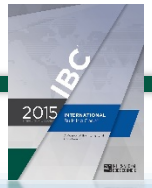


Section 508.2 Accessory Occupancies

- Must be **subsidiary** to the main occupancy of the building or to a portion of the building.
  - Examples of occupancies that may be considered as subsidiary to the main occupancy:
    - Group A-2 employee lunchroom within a Group S-1 warehouse.
    - Group A-3 training room in a Group B office building.
    - Group M showroom within a Group F-1 manufacturing building.
    - Group R-3 manager's dwelling unit within a Group S-1 self-storage facility.

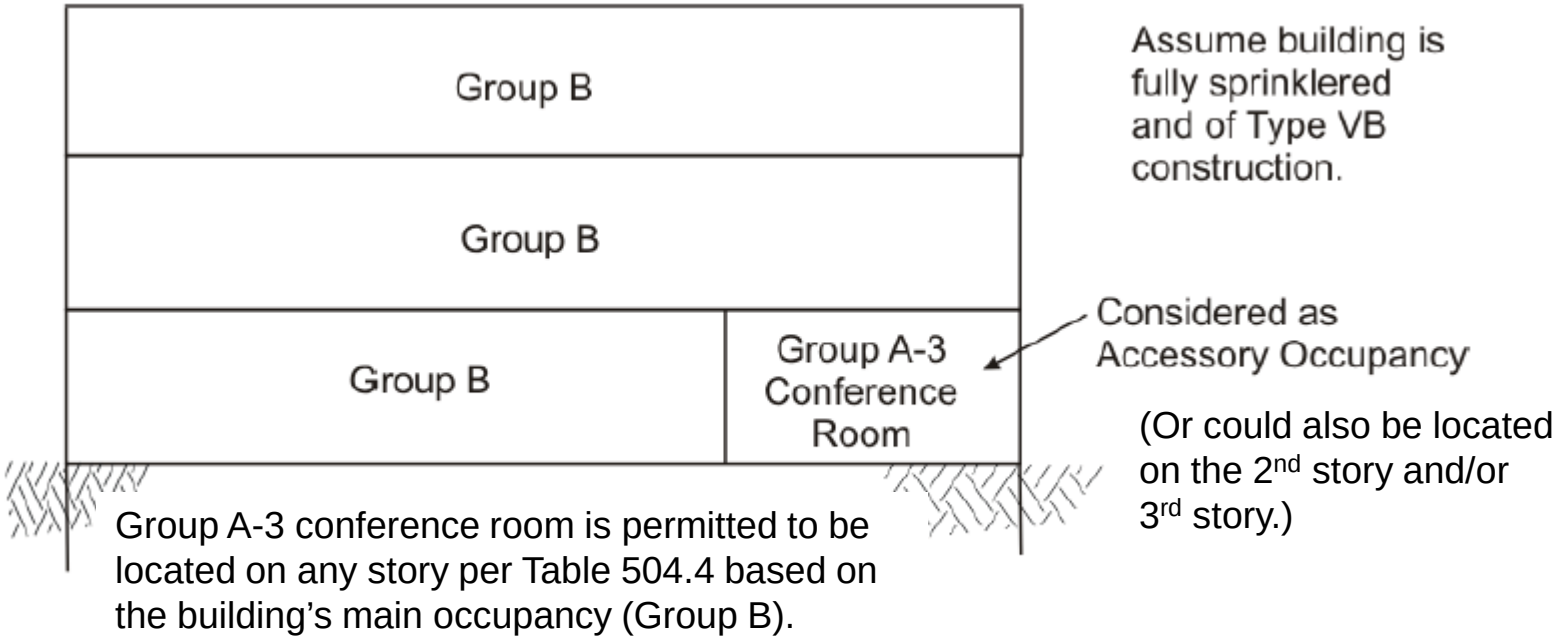
Accessory Occupancies: Section 508.2.1 Occupancy Classification

- Must be assigned to an occupancy group established in Chapter 3 based on unique characteristics.
- The spaces of the building considered as accessory occupancies must meet all code requirements applicable to the specific to the accessory occupancy classification, not that of the main occupancy, including:
  - Means of egress requirements.
  - Fire protection requirements.



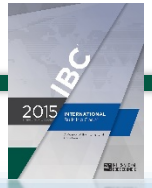
Accessory Occupancies: Section 508.2.2 Allowable Building Height

- Allowable height and number of stories are limited to that set forth in Section 504 for the main occupancy.

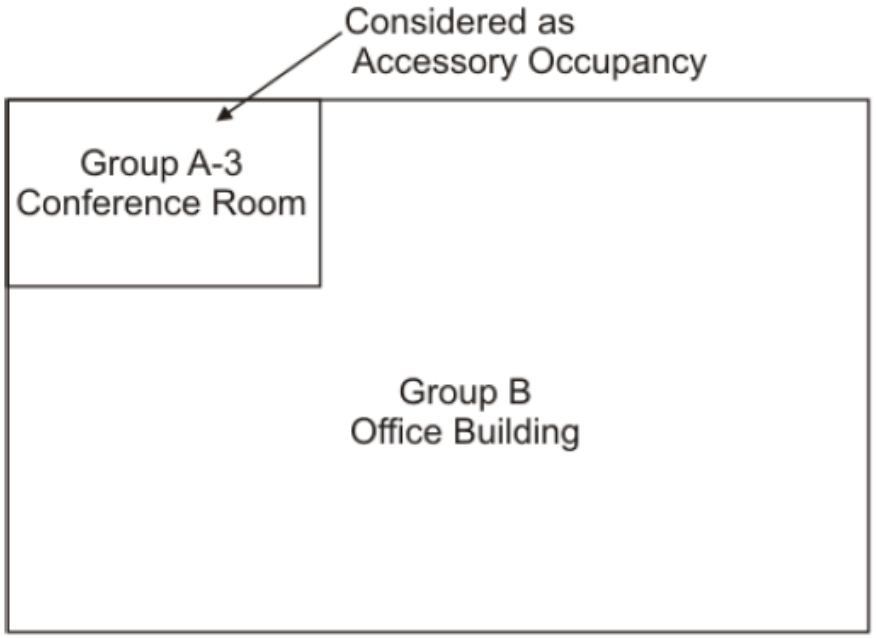


Accessory Occupancies: Section 508.2.3 Allowable Building Area

- Allowable area of building is based on the **main occupancy**.
- Combined area of the main occupancy and accessory occupancy cannot exceed that permitted by Section 503.1 for the main occupancy.



Accessory Occupancies: Section 508.2.3 Allowable Building Area

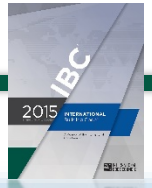


Assume building is fully sprinklered and qualifies for a 25 percent frontage increase.

It is of Type IIB construction and one story in height.

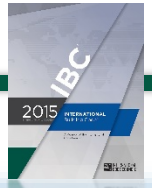
Maximum floor area of building is based totally upon that of the Group B occupancy.

92,000	Table 506.2
5,750	Frontage increase
97,750	Total allowable area in square feet

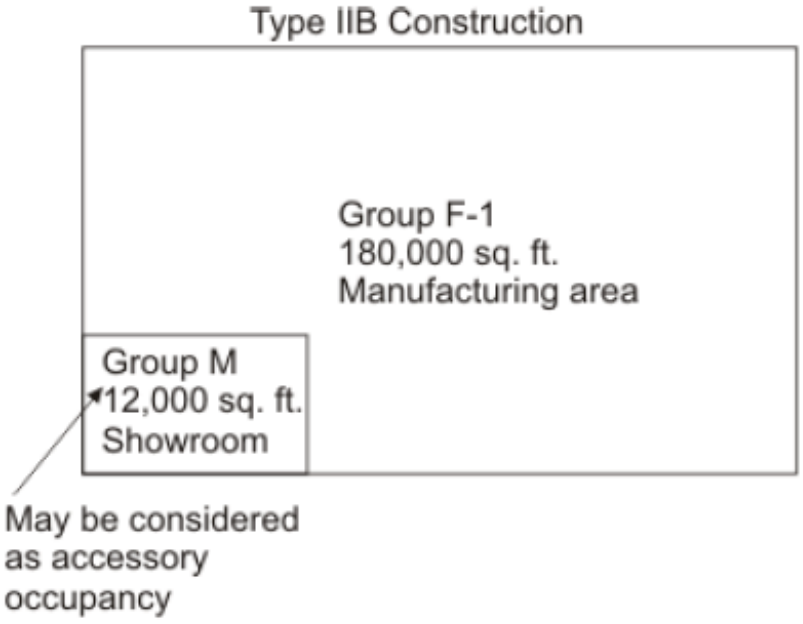


Accessory Occupancies: Section 508.2.3 Allowable Building Area

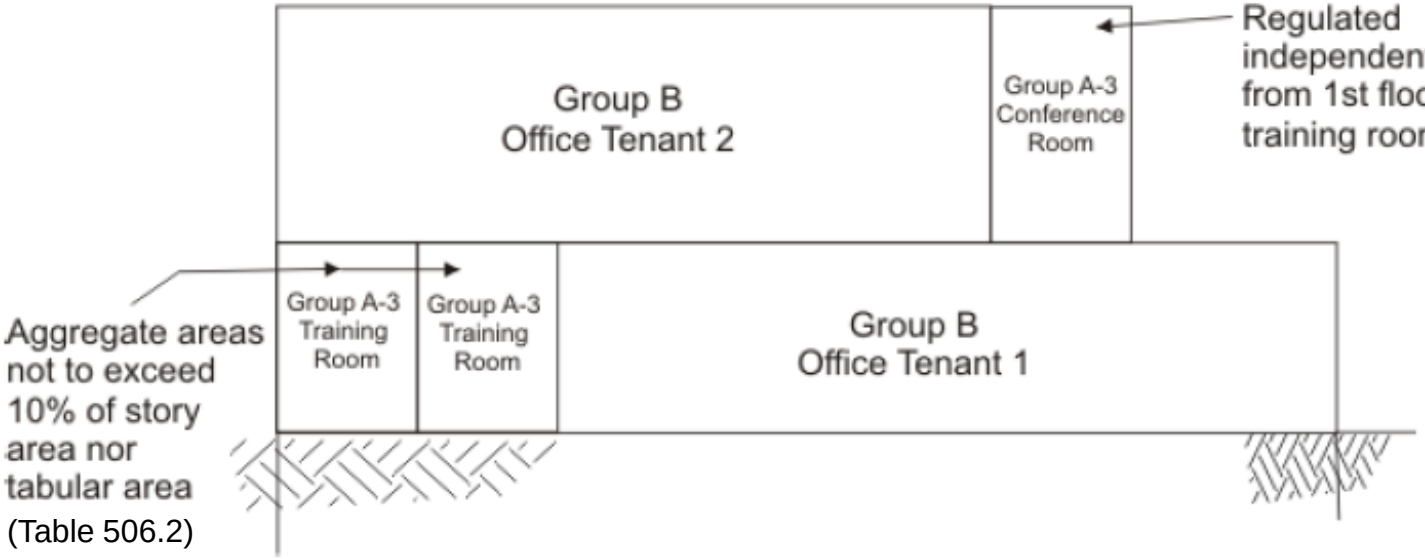
- Limited to **10 %** of the floor area of the story located.
  - When more than one accessory occupancy is under consideration, the **aggregate area** of such occupancies are used to determine compliance.
- Floor area **cannot exceed the tabular values** for non-sprinklered buildings established by **Table 506.2** for each accessory occupancy.



Accessory Occupancies Examples

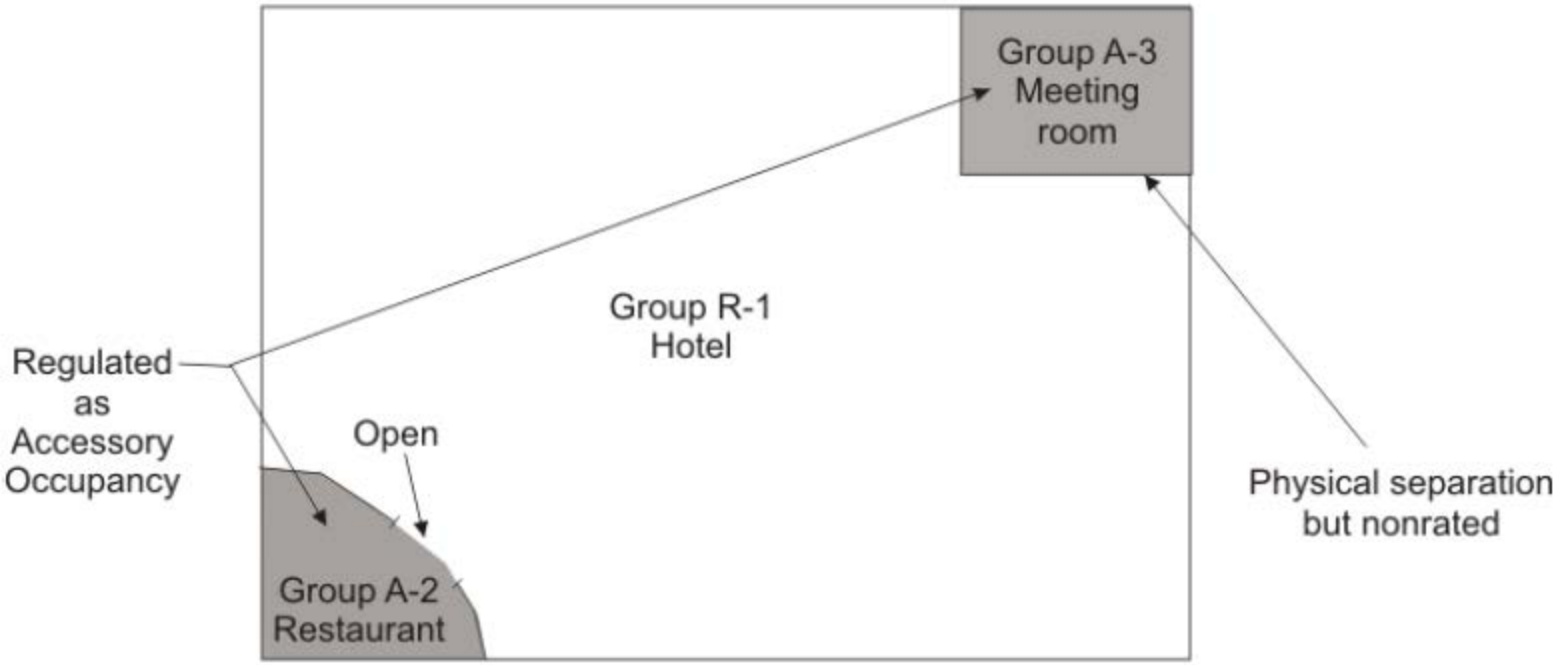


- Showroom is considered subsidiary to manufacturing operation.
- Showroom occupies 6% of total story area.
- Showroom does not exceed tabular area for Group M, Type IIB construction (12,500 sq. ft.).



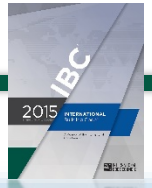
Accessory Occupancies: Section 508.2.4 Separation

- Application of the accessory occupancy option will result in no physical or fire-resistance-rated separation being mandated.



Accessory Occupancies: Section 508.2.4, Exceptions

- Group H-2, H-3, H-4 and H-5 occupancies to be separated from all other occupancies per **Section 508.4** (separated occupancies).
- Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units to be separated from each other and from accessory occupancies contiguous to them per **Section 420**.

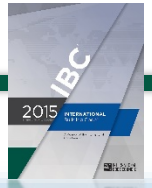


Accessory Occupancies: A Seven-Step Process

1. **Determine** the various occupancy classifications that are found within the building.

2. **Verify** that any occupancy group under consideration as an accessory occupancy is subsidiary to the major occupancy of the building.

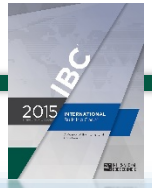
3. **Verify** that the floor area of the accessory occupancy does not exceed **10%** of the floor area of the story in which it is located.



Accessory Occupancies: A Seven-Step Process

4. **Verify** that the floor area of the accessory occupancy does not exceed the tabular values for non-sprinklered buildings set forth in Table 506.2 for the building's type of construction.

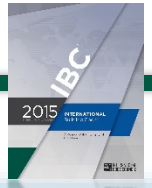
5. **Limit** the building's floor area to the allowable floor area based on the allowable area for the main occupancy.



Accessory Occupancies: A Seven-Step Process

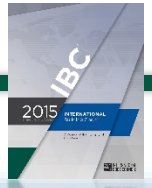
6. **Limit** the maximum allowable height of the occupancy based on Section 504.

7. **Apply** all other code requirements to each portion of the building based on the individual occupancy classification of the space.



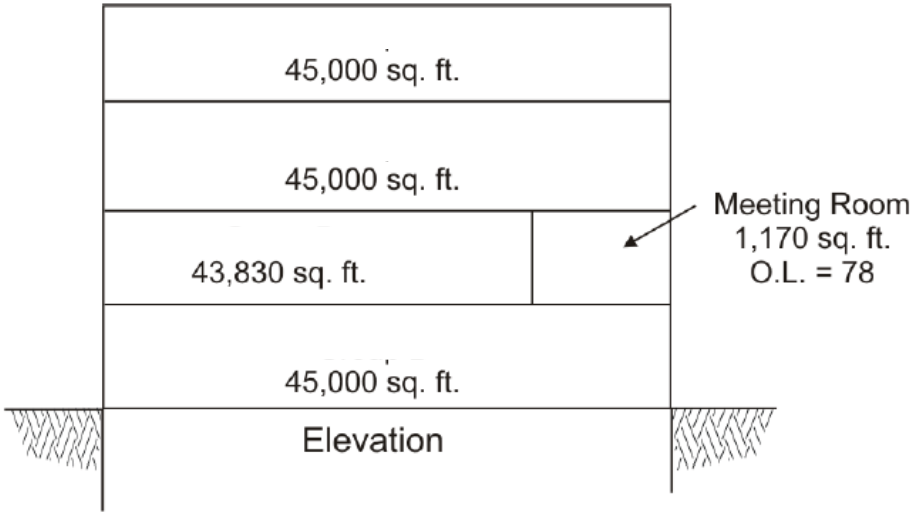
Accessory Occupancies: Applying the Process

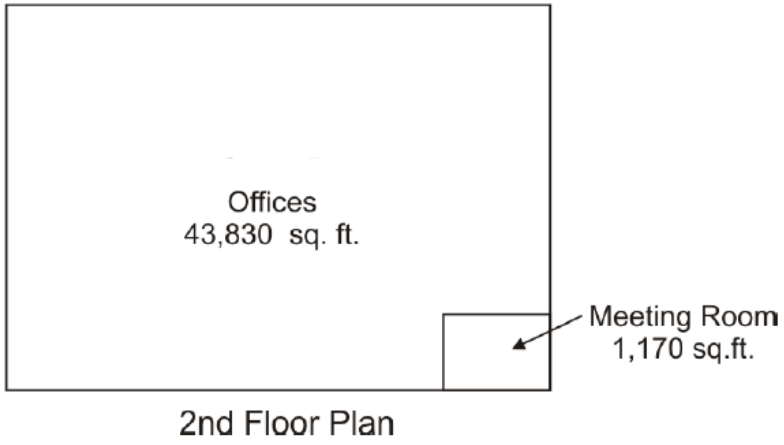
- **Given:** A four-story office building with a large meeting room (occupant load of 78) on the second floor. The building is fully sprinklered; is Type IIB construction and qualifies for a 75% frontage increase for allowable area. Each story of the building contains 45,000 sq.ft. and the floor area of the meeting room is 1,170 sq.ft. It is intended that no fire-resistant occupancy separation be provided between the meeting room and the remainder of the building.



Accessory Occupancies: Applying the Process

- **Determine:** Do the mixed-occupancy conditions comply with the requirements for accessory occupancies?

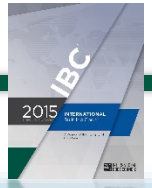




Accessory Occupancies: Applying the Process

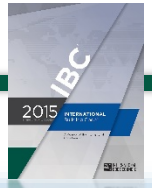
- **Solution:**
  1. Determine the various occupancy classifications that are found within the building.

  2. Verify that any occupancy group under consideration as an accessory occupancy is subsidiary to the occupancy of the building.



Accessory Occupancies: Applying the Process

3. Verify that the floor area of the accessory occupancy does not exceed **10 %** of the floor area of the story in which it is located.

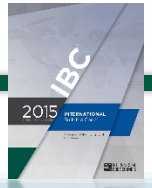


Accessory Occupancies: Applying the Process

4. Verify that the floor area of the accessory occupancy does not exceed the tabular floor area (without area increases of Section 506) set forth in Table 503 for the building's type of construction.

Accessory Occupancies: Applying the Process

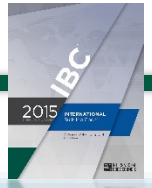
5. Limit the building's floor area to the allowable floor area based on the allowable area for the main occupancy.



Accessory Occupancies: Applying the Process

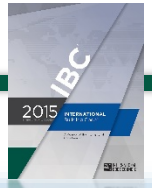
6. Limit the maximum allowable height of the accessory occupancy based on Section 504.

7. Apply all other code requirements to each portion of the building based on the individual occupancy classification of the space.



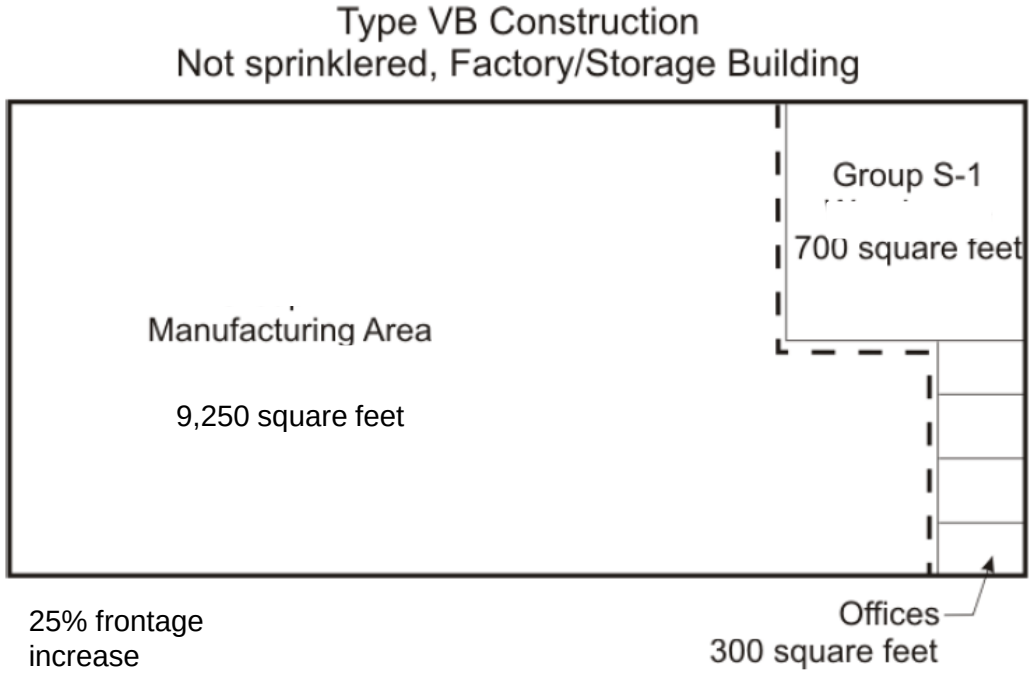
Practice Exercise 1

- **Given:** A 10,250 sq.ft., single-story musical instrument manufacturing building with storage room and offices. The storage room is 700 sq.ft. The offices are 300 sq.ft. The building is not sprinklered, but has open frontage allowing 25% increase in allowable area. The building is of Type VB construction.



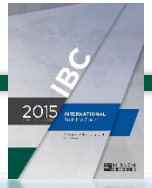
Practice Exercise 1

- **Determine:** Do the mixed occupancy conditions comply with the requirements for accessory occupancies?



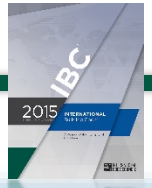
Solution

Classification of occupancies	Groups: F-1 manufacturing S-2 storage B offices
Verify accessory occupancies are subsidiary to major occupancy.	Storage is used for holding materials used in the manufacturing process as well as the finished instruments. The offices are for managers, human resources staff, accounting and payroll staff.
Verify accessory occupancies do not exceed 10% of floor area.	Storage – 700 sq. ft. – Less than 10% Offices – 300 sq. ft. – Less than 10% Aggregate of accessory areas – 1,000 square feet Maximum allowed accessory area is 10% of 10,250 square feet = 1,025 square feet



Solution

Verify accessory occupancies do not exceed tabular area per Table 503	Group B – 9,000 sq. ft. Group S-1 – 9,000 sq. ft.
Limit floor area to maximum allowable floor area of building based on main use	Principal use: Group F-1 Allowable area for Type VB building of Group F-1 8,500 sq. ft. (Table 503) 25% increase for frontage: 2,125 sq. ft. Maximum allowable building area: 8,500 + 2,125 = 10,625 sq. ft
Limit allowable height of accessory occupancies to that of Section 503	Allowed height for Type VB buildings: Group B – 2 stories Group S-1 – 1 story
Apply all other code provisions	As applicable.

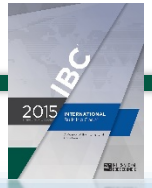


Module 9

Allowable Height and Area for Multiple-story Buildings

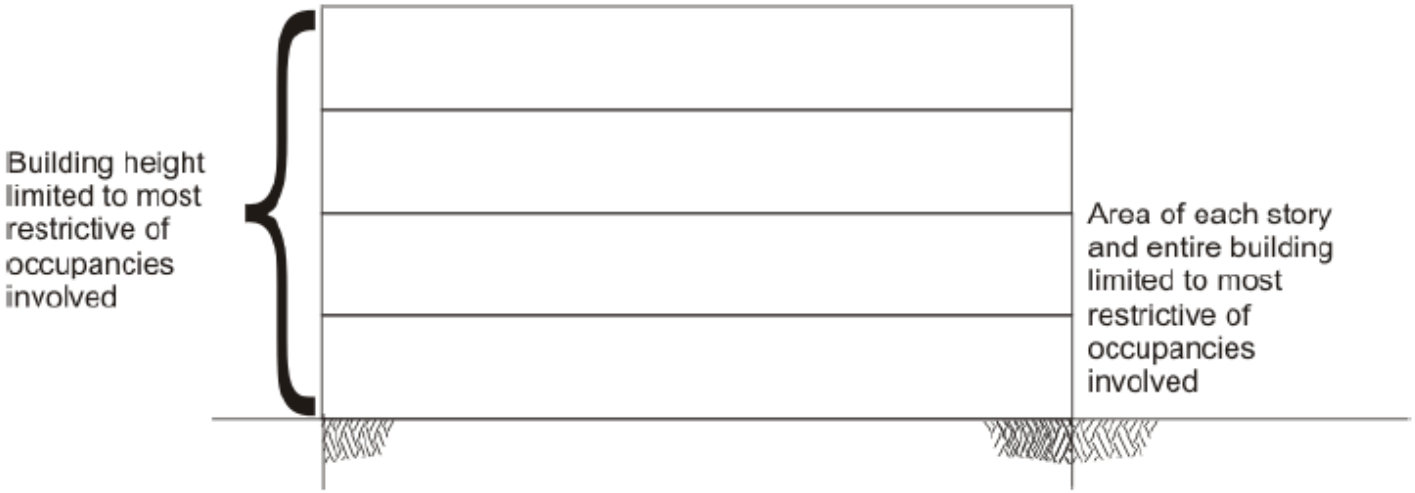
Mixed Occupancies: Allowable Height and Area for Multistory Buildings

- Application of Section 508 for mixed-occupancy is **consistent** for both single-story and multiple-story buildings.
- Multiple-story, mixed-occupancy building:
  - All three options available.
  - Evaluation of the mixed-occupancy conditions is expanded.
  - Each story evaluated **individually** for compliance.



Non-separated Occupancies

- The maximum allowable height and area of the building will be based on the **most restrictive** allowances for the occupancies under consideration.
- General height and area limitations of Chapter 5 will apply.

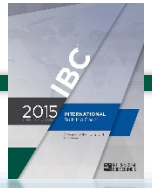


Separated Occupancies

- An occupancy shall not be located higher than permitted by Tables 504.3 and 504.4.
- A variation of the unity formula of Section 508.4.2 that is applied on a **per-story basis** is applied to the total building.

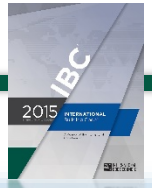
$$a_1/A_1 + a_2/A_2 + a_3/A_3 + \ldots \leq 1.0$$

a = actual building area
A = allowable building area



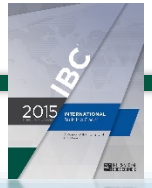
Section 506.2.4
Separated Occupancies

- Where “separated occupancies” building is **3 stories or less** in height, if each story complies, then the building complies.
- Where “separated occupancies” building is **4 or more stories** in height, then each story must comply for allowable area **and** entire building must comply.
  - **Sum of ratios** for all stories above grade plane **not to exceed 3.0**.

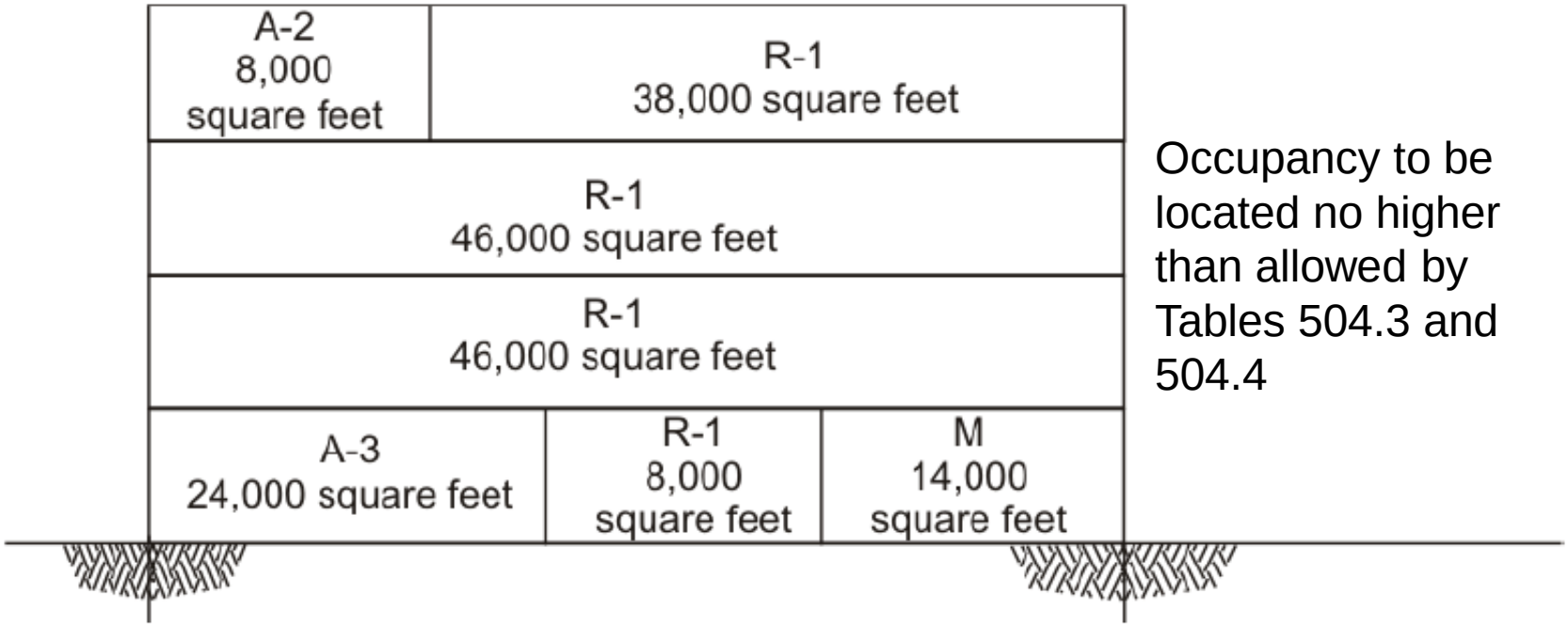


Separated Occupancies

- **Given:** A fully sprinklered, four-story, Type IIA hotel, containing a Group A-2 restaurant, Group A-3 meeting rooms and Group M retail stores. The floor areas of each occupancy are as shown in the following slide. Inadequate frontage provides for no area increase.
- **Determine:** Does the building comply with the allowable height and area provisions of Chapter 5 using the “separated occupancies” method?



Separated Occupancies



Occupancy to be located no higher than allowed by Tables 504.3 and 504.4

Separated Occupancies

Height Limitations:

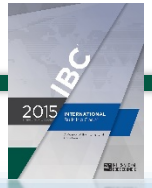
Groups A-2 and A-3 3+1 4 stories max.

Groups R-1 and M 4+1 5 stories max.

Height limits are not exceeded.

Solution for Total Building Area:

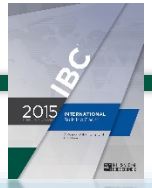
Allowable Area per Occupancy		Allowable Area per Occupancy Based on Table 506.2	
A-2:	8,000 sf	A-2:	46,500 sf
A-3:	24,000 sf	A-3:	46,500 sf
M:	14,000 sf	M:	64,500 sf
R-1:	138,000 sf	R-1:	72,000 sf



Separated Occupancies

1st story	24,000/46,500 + 8,000/72,000 + 14,000/64,500 = 0.85	OK
2nd story	46,000/72,000 = 0.64	OK
3rd story	46,000/72,000 = 0.64	OK
4th story	8,000/46,500 + 38,000/72,000 = 0.70	OK
Aggregate for building	0.85 + 0.64 + 0.64 + 0.70 = 2.83 < 3	OK

Note: Each floor is analyzed for compliance on a floor-by-floor basis, plus the building as a whole must also comply.

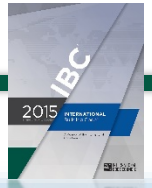


Module 10

Miscellaneous Applications

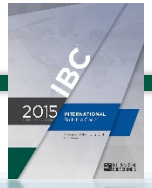
Discussion Points

- How are two or all of the mixed-occupancy methods applied within the same building?
- Do occupancy separations establish separate fire areas?
- If one of two separated occupancies requires the installation of automatic sprinklers, does the other occupancy have to be provided with sprinklers?
- If an accessory occupancy requires sprinklers, can the system just cover the accessory occupancy?



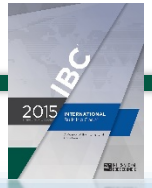
Discussion Points

- Can the means of egress pathway continue across a fire barrier separating different occupancies?
  - If it can, do the requirements for the means of egress pathway change?
- How do the provisions for accessory occupancies apply where there are multiple tenant spaces?
- Do mixed occupancy provisions of Section 508 apply to unlimited area buildings in Section 507?



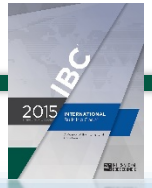
Multiple Options Used in a Single Building – Section 508.1

- Section 508.1 allows **four** combinations:
  1. Accessory and non-separated occupancies.
  2. Accessory and separated occupancies.
  3. Non-separated and separated occupancies.
  4. All three options in the same building.



Section 901.7 – Fire Areas

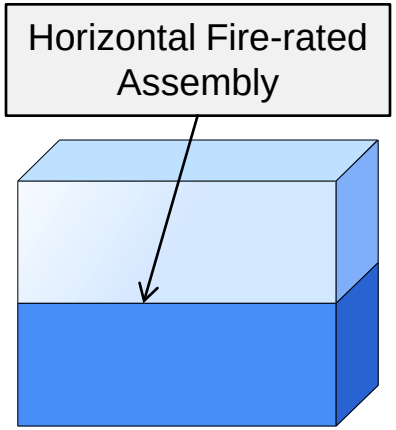
- Based on time-tested approach to limiting the spread of fire in a building.
  - Created through use of fire walls, fire barriers and/or horizontal assemblies.
  - Limited to alternative approach to automatic sprinkler system requirements.
  - Where two occupancies are separated under the separated occupancies method of Section 508.4, fire areas may not necessarily be created in regard to the provisions of Chapter 9.



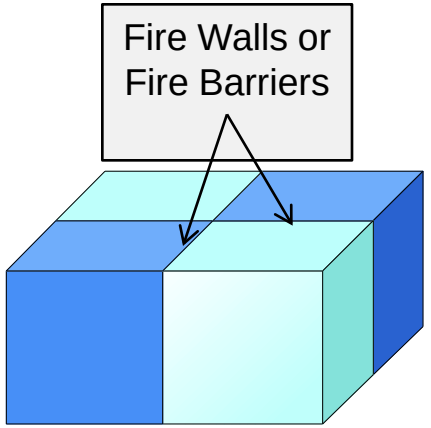
Section 901.7 – Fire Areas

- Any floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building.

Every building is at least 1 Fire Area



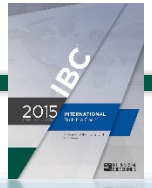
2 Fire Areas created by horizontal assembly



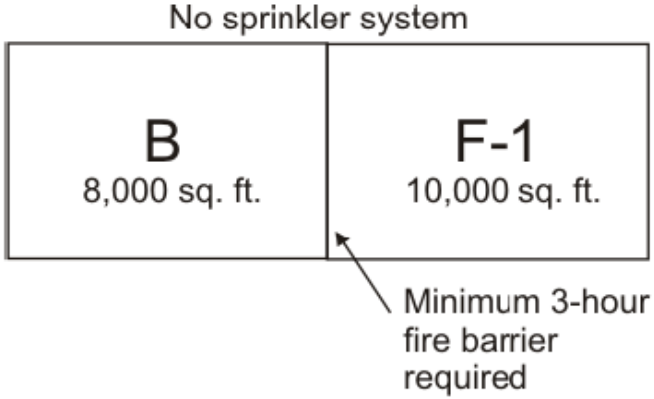
4 Fire Areas created by fire walls or fire barriers

Section 901.7 Fire Areas

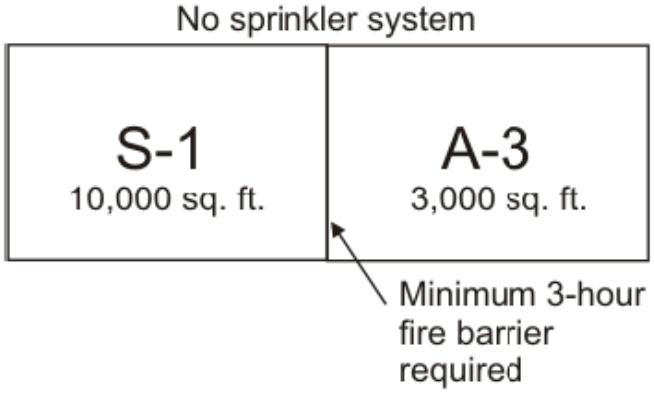
- Fire-resistance rating of fire barriers creating fire areas based on Table 707.3.10.
- Fire-resistance rating of fire barriers used to separate occupancies based on Table 508.4.
- Where both conditions occur, the higher of the two required fire-resistance ratings to be applied.
- For example, where Table 707.3.10 requires greater fire-resistance than Table 508.4, complying with Table 508.4 will not establish separate fire areas.



Section 901.7 Fire Areas



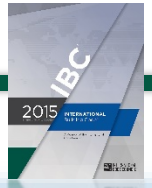
- Occupancy separation not required per separated occupancies and Table 508.4.
- Fire area separation of 3 hours required by Section 903.2.4 and Table 707.3.10.



- Occupancy separation of 2 hours required per separated occupancies and Table 508.4.
- Fire area separation of 3 hours required by Sections 903.2.1.3 and 903.2.9 and Table 707.3.10.

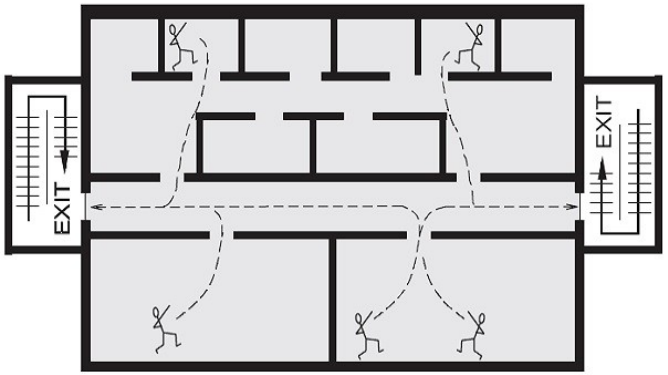
Chapter 10 Means of Egress

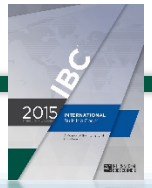
- Can the means of egress (**MOE**) path for one occupancy travel through other occupancies in the building?
  - **Yes**, Section 1016.2 anticipates this to a great extent.
- Where the MOE path travels from one occupancy to another, which occupancy's egress requirements prevail?
  - The requirements for **both occupancies** should be applied, which typically results in the application of the **most stringent** provisions.



Chapter 10 Means of Egress

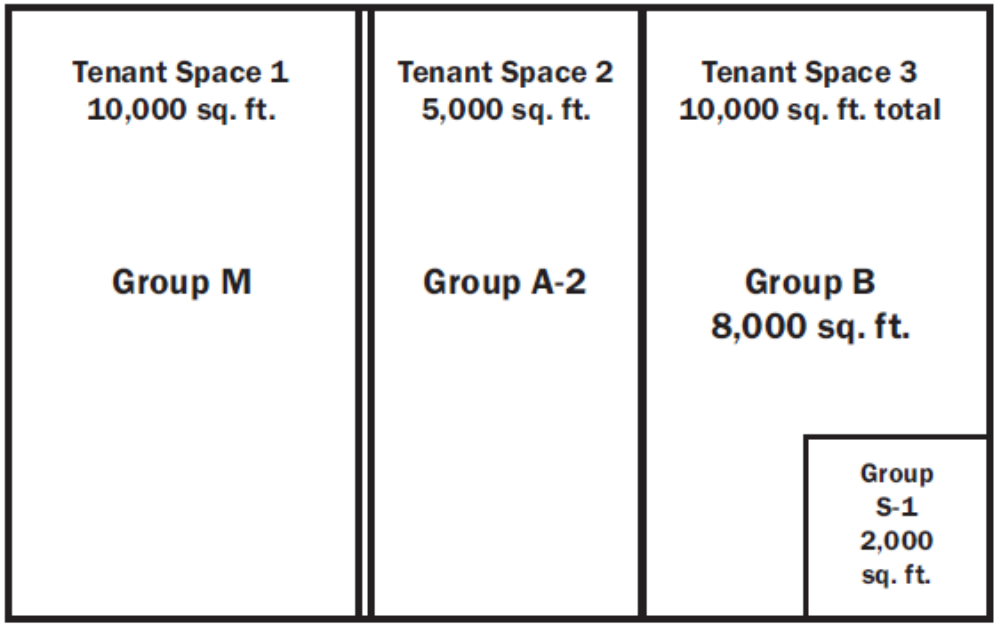
- Common occupancy-related MOE requirements:
  - Occupant load factor (function based) – Table 1004.1.2.
  - Common path of travel – Section 1006.2.1.
  - Threshold for two means of egress – Section 1006.2.1.
  - Single-exit stories – Section 1006.3.2.
  - Panic hardware – Section 1010.1.10.
  - Travel distance – Section 1017.2.
  - Corridor construction – Section 1020.1.





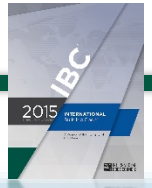
Accessory Occupancies and Tenant Spaces

- Accessory occupancy provisions to be applied on a tenant-by-tenant basis.



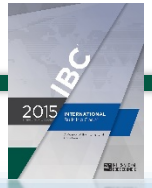
Section 507 Unlimited Area Buildings (UAB)

- Unlimited area buildings permitted under the provisions of Section 507 may contain the occupancies and configurations specified in Sections 507.1 through 507.12.
  - Other occupancies are permitted in unlimited area buildings when in compliance with the provisions of Section 508.2 (Accessory Occupancies).
- Any or all of the mixed occupancy methods are permitted subject to the limitations of Section 508.



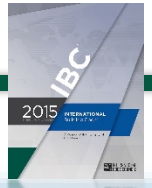
Practice Exercise 4

- **Given:** A fully-sprinklered, five-story hotel of Type IIA construction contains the following occupancies located as shown:
- **First story:** Lobby (Group A-3), Restaurant (Group A-2), Administrative offices (Group B), Retail sales tenants (Group M) and Hotel guest rooms (Group R-1).
- **Second story:** Meeting/Conference rooms (Group A-3) and Hotel guest rooms (Group R-1).
- **Third and fifth stories:** Hotel guest rooms (Group R-1).
- **Fourth story:** Restaurant (Group A-3) and Hotel guest rooms (Group R-1).



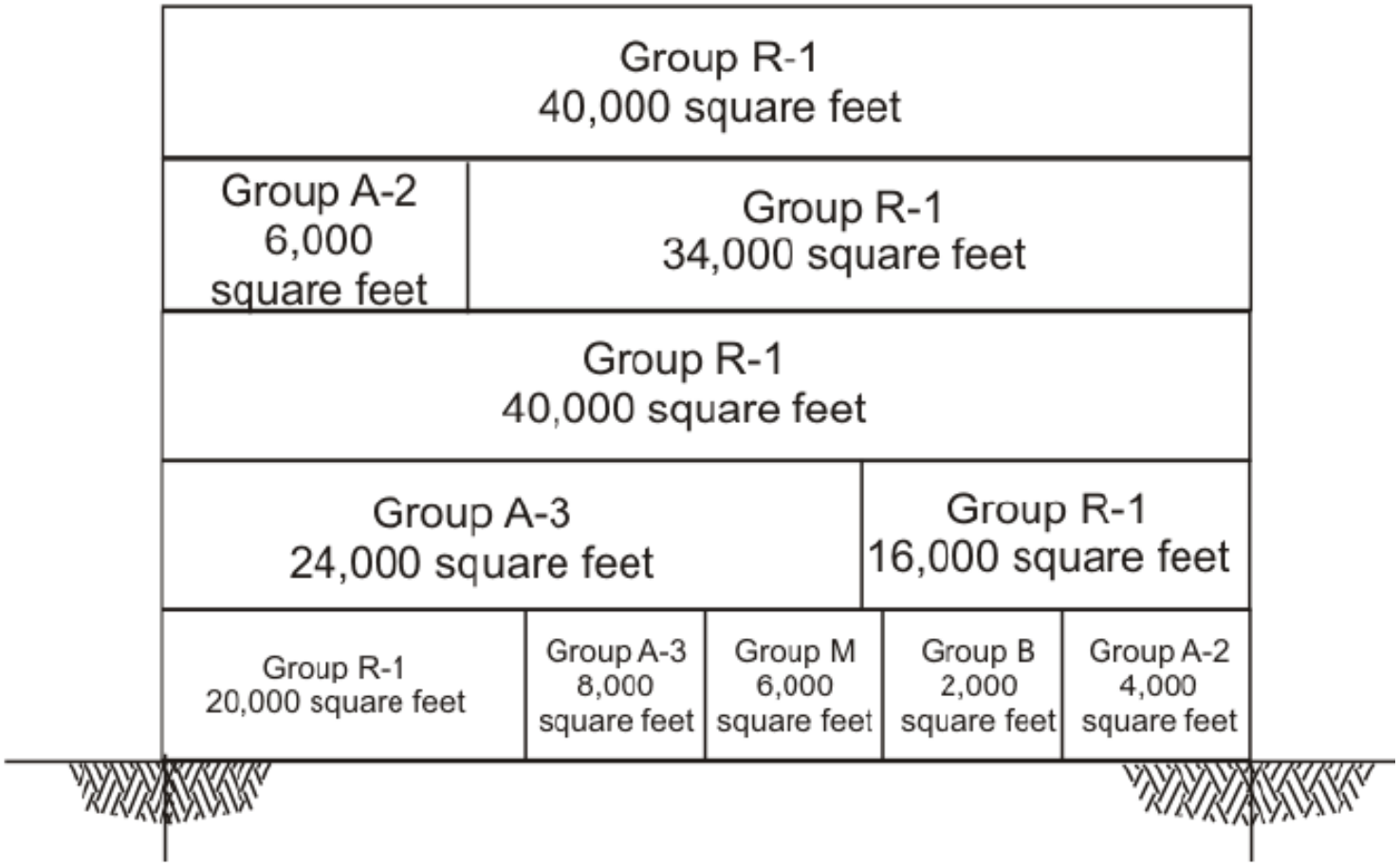
Practice Exercise 4

- The floor areas of each occupancy are as indicated. Other than a 1-hour fire-resistant separation of the hotel guest room portion, no fire-resistant separations are provided between occupancies on the first floor. Streets on two sides provide for a 25% frontage increase for allowable area.
- **Determine:** Does the building below comply with the provisions of Section 508.1 regulating mixed-occupancy buildings?



ACTIVITY

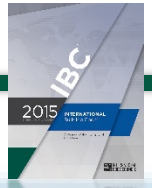
Type IIA Construction
Fully sprinklered NFPA 13



Practice 4 Solution

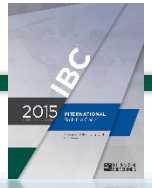
Non-separated Occupancies	This method may not be used for the entire building as Group A-2 limits building height to four stories. It may be utilized on the first story without applying to other stories.
Fire Protection	The building is fully sprinklered and has a fire alarm system in accordance with Section 907.2.8.
Allowable Height	Four-story limitation based on Group A-2 is not met for building.
Allowable Area	Groups A-2 and A-3 have the most restrictive allowance of 50,375 square feet (46,500 + 3,875). Since the aggregate building area of all stories is 200,000 square feet (40,000 times five stories) which exceeds the allowable building area of 151,125 square feet (three times 50,375), the building is not in compliance for allowable area.

Building does not comply. Both the allowable height and allowable area provisions must be in compliance, and **neither complies**.



Practice 4 Solution

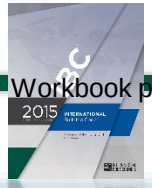
Separated Occupancies Separation per Table 508.4	This method is used throughout the building except for the non-Group-1 portion of the 1st story. There is a minimum 1-hour fire-resistant separation required between the Group R-1 occupancy and all other occupancy groups. The required 1-hour separation is already provided horizontally due to the 1-hour floor construction required in a Type IIA building.
Allowable Height	Group R-1 occupancies are not permitted above the fifth story. Group A-2 and A-3 occupancies shall not be located above the fourth story.
Allowable Area	For allowable area purposes based on individual stories, the various occupancies on the first story, other than the Group R-1, will be evaluated under the non-separated occupancies provisions of Section 508.3. Stories two through five, as well as the Group R-1 portions of the 1st story, will be evaluated as separated occupancies in accordance with Section 508.4.



Practice 4 Solution

Allowable Area per Occupancy:

- A-2 50,375 sq.ft.
- A-3: 50,375 sq.ft.
- B: 121,875 sq.ft.
- M: 69,875 sq.ft.
- R-1: 78,000 sq.ft.



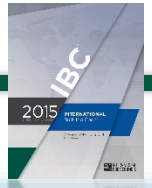
Workbook page 89

Practice 4 Solution

Allowable Area per Occupancy:

- 1st story*
  20,000/50,375 + 20,000/78,000 = 0.66 **OK**

*All portions of first story other than Group R-1 regulated as non-separated occupancies, limited by allowable areas of Group A-2/A-3 occupancies. As a whole including the Group R-2 portion, first story then regulated as separated occupancies.

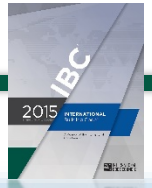


Practice 4 Solution

Allowable Area per Occupancy:

- 2nd story
  24,000/50,375 + 16,000/78,000 = 0.69 **OK**
- 3rd story
  40,000/78,000 = 0.51 **OK**
- 4th story

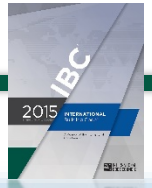
  6,000/50,375 + 34,000/78,000 = 0.56 **OK**



Practice 4 Solution

Allowable Area per Occupancy:

- 5th story
  40,000/78,000 = 0.51 **OK**
- All stories
  0.66 + 0.69 + 0.51 + 0.56 + 0.51 = 2.93
  $\leq$ 3 **OK**



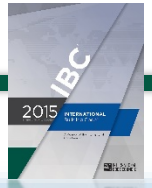
Questions?

Thank You for your Attendance!

Final Reflection

This slide will help the learner to reflect on the day and what they will take back to the job and apply.

- **What?** What happened and what was observed in the training?
- **So what?** What did you learn and what difference did this training make?
- **Now what?** How will you do things differently back on the job as a result of this training?



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