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Course Description

- This seminar addresses the key issues of the 2015 *International Building Code*® (IBC®) regarding the proper classification of buildings.
- The process for correctly evaluating a building for code compliance relies on a systematic approach to the determination of occupancy classification and construction type.




2015 IBC Building Classification 3

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Course Description

- Everything starts with the correct building classification!
- A clear understanding of the classification process provides the groundwork for the proper application of many other important code provisions.



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Goal

- Participants will be able to assign the appropriate occupancy classification(s) based on Chapter 3, use Table 601 to help determine type of construction classification, and gain an understanding of the varied provisions of Chapter 5 regarding allowable building heights and areas.



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Objectives

Upon completion, participants will be better able to:

1. Identify and describe the 26 specific occupancy groups established in the 2015 IBC.
2. Identify the characteristics of the nine types of construction set forth in the 2015 IBC.



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Objectives

Upon completion, participants will be better able to:

3. Determine the allowable height and area of a building based upon its occupancy classification, type of construction and special features.
4. Apply the special provisions applicable to mixed-occupancy and unlimited area buildings.



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Building Classification

It is critical that a building be classified as to *occupancy group* and *type of construction*.

Code provisions can be applied only *after* occupancy group and type of construction have been established.



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Building Classification

The scope of many code provisions is limited to specific occupancy groups and to structures based on the materials of construction and the building's degree of fire resistance.



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Occupancy Classification

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Occupancy Classification—Introduction

Evaluate the building for use and occupancy:

- How the space will be used.
- The abilities of the occupants to respond in an emergency.
- Specific requirements (levels of safety) related to the various occupancy groups.



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Occupancy Classification—General Requirements (Section 302.1)

Occupancy Groups

- Structures are to be classified into one or more of the occupancy classifications established in the code.
- The 10 general types are subdivided into 26 specific occupancies.



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Occupancy Classification—General Requirements (Section 302.1)

Occupancy Groups *(continued)*

- Where a room or space is to be occupied for different types of uses at different times, all of the requirements applicable to each of the uses must be considered.
- Those buildings that contain two or more distinct occupancy classifications must comply with the provisions of Section 508 for mixed-occupancy buildings.




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Occupancy Classification—General Requirements (Section 302.1)

Occupancy Groups *(continued)*

- When in doubt, it is important that an occupancy classification be assigned that most nearly resembles those occupancies with similar fire safety and life safety risks.




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Occupancy Classification-General Requirements (Section 302.1)

Types of Use	General Occupancy Group	Occupancy Sub-Groups
Assembly	Group A	A-1, A-2, A-3, A-4, A-5
Business	Group B	None
Educational	Group E	None
Factory and Industrial	Group F	F-1, F-2
High Hazard	Group H	H-1, H-2, H-3, H-4, H-5
Institutional	Group I	I-1, I-2, I-3, I-4
Mercantile	Group M	None
Residential	Group R	R-1, R-2, R-3, R-4
Storage	Group S	S-1, S-2
Utility	Group U	None



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Occupancy Classification—Assembly

Group A (Section 303.1)

Assembly Group A occupancies include buildings or portions of buildings where persons (usually 50 or more) gather for:

- Civic, social or religious functions.
- Recreation.
- Food and/or drink consumption.
- Awaiting transportation.
- Similar activities.

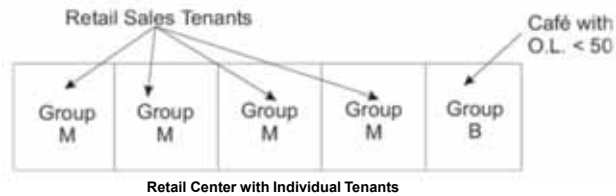


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Occupancy Classification— Assembly

Small buildings and tenant spaces (Sec. 303.1.1): Buildings or tenant spaces with an occupant load of 49 or less. The building or space is a stand-alone use and is not accessory to any other occupancy. A classification of Group B is appropriate.

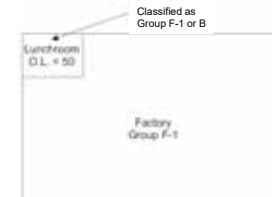


Retail Center with Individual Tenants

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Occupancy Classification— Assembly

Small assembly spaces (Sec. 303.1.2, #1): A room with an occupant load less than 50 and accessory to another occupancy is to be classified either as a part of that occupancy or as Group B.

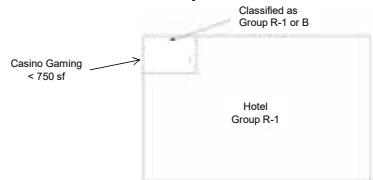


Employee Lunchroom Associated with a Factory

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Occupancy Classification— Assembly

Small assembly spaces (Sec. 303.1.2, #2): Similar to Item #1, a room or space with a floor area of less than 750 square feet (70 m²) and accessory to another occupancy is to be classified as a part of that occupancy or as Group B.

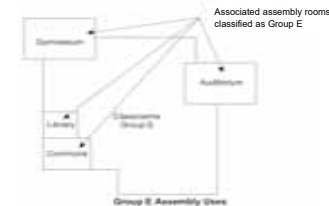


Casino Gaming Area Associated with a Hotel

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Occupancy Classification— Assembly


Associated with Group E (Sec. 303.1.3): In a Group E educational occupancy, assembly areas that are accessory to the educational portions of the building may be classified as portions of the Group E.



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Occupancy Classification— Assembly

Accessory to places of religious worship (Sec. 303.1.4): In places of religious worship, accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 need not be considered as separate occupancies.




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Occupancy Classification— Assembly

Spaces in Group A fall into two basic groups:

- Those assembly uses that occur within a building (Groups A-1, A-2, A-3 and A-4).
- Those assembly uses that occur in structures primarily open to the exterior (Group A-5).




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Occupancy Classification— Assembly

Group A-1 (Section 303.2)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ High occupant density ▪ Usually fixed seating ▪ Foyers/lobbies ▪ Stages, platforms or Projection screen ▪ Low-light conditions ▪ Sizable occupant loads 	<ul style="list-style-type: none"> ▪ Motion picture theaters ▪ Symphony/concert halls ▪ Television/radio studios ▪ Performance theaters




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Occupancy Classification— Assembly

Group A-2 (Section 303.3)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ Consumption of food and/or drink (primary characteristic) ▪ Moderate occupant density ▪ Variable lighting levels ▪ Aisles not clearly defined ▪ Movable furnishings 	<ul style="list-style-type: none"> ▪ Banquet halls ▪ Night clubs ▪ Restaurants ▪ Taverns and bars ▪ Casino gaming areas



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Occupancy Classification— Assembly

Group A-3 (Section 303.4)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Moderate occupant density ▪ Adequate lighting levels ▪ Moderate fire loading 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Art galleries ▪ Exhibition halls ▪ Libraries ▪ Museums ▪ Places of religious worship
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Occupancy Classification— Assembly

- Group A-3 is the default classification for assembly occupancies.

- If an assembly use cannot obviously be classified as one of the four other indoor Group A classifications, then it should be considered as a Group A-3 occupancy.

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Occupancy Classification— Assembly

Group A-4 (Sec. 303.5)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Lighting levels can fluctuate ▪ Some food or drink consumption ▪ Spectator seating typically fixed ▪ Medium to high density 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Arenas ▪ Skating rinks ▪ Gymnasiums
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Occupancy Classification— Assembly

Group A-5 (Sec. 303.6)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ No enclosure to contain smoke, although spectator might be protected from rain and sun ▪ Limited or no conditioned air ▪ Most seating is fixed 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Amusement park structures ▪ Bleachers and reviewing stands ▪ Grandstands ▪ Stadiums
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Occupancy Classification— Business


Group B (Section 304.1)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Many occupants are familiar with the premises ▪ Most occupants are adults capable of recognizing and effectively responding to “emergency situations” ▪ Moderate fire load 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Ambulatory care facilities ▪ Banks ▪ Barber/beauty shops ▪ Office areas ▪ Outpatient clinics ▪ Post offices ▪ Training and skill development
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Occupancy Classification— Q&A

- What is the difference between an outpatient clinic and an ambulatory care facility?
- Although both are classified as Group B, ambulatory care facilities:
 - are expected to include people within the space who are incapable of self-preservation due to the services provided.
 - are further regulated in Section 422.




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Occupancy Classification— Educational

Group E (Sections 305.1, 305.2)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Six or more occupants at a time ▪ Students younger than college age ▪ 2½ years to the 12th grade is the general default age for this classification 	<p>Examples</p> <ul style="list-style-type: none"> ▪ High schools (through 12th grade) ▪ Middle schools ▪ Elementary schools ▪ Preschools ▪ Day care facilities (more than 5 children, older than 2½ years)
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Occupancy Classification— Educational

- **Classification as Group E (Sec. 308.6.1):** A child care facility housing infants and toddlers is classified as Group E, rather than Group I-4, where:
 - More than 5, but no more than 100, children are 2½ years of age or less.
 - Rooms where such infants/toddlers are cared for are located on level of exit discharge.
 - Each of these infant/toddler care rooms has an exit door directly to the outside.



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Occupancy Classification— Educational

Group E—Day Care Facility

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Occupancy Q&A

- If there is a total of five or fewer children in an educational setting, the condition is not much different from that of a large family.
- Therefore, such small educational facilities are to be classified as Group R-3 or may be designed and constructed under the provisions of the *International Residential Code*.

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Occupancy Classification— Factory/Industrial

Group F occupancies (Sec. 306.1) are facilities where manufacturing operations and similar industrial activities occur. Operations may include assembling, fabricating, finishing, manufacturing, packaging, repair or processing work.

- F-1: where combustible materials are used in the operations.
- F-2: where all of the materials are noncombustible.

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Occupancy Classification— Factory/Industrial

Group F-1 Moderate-Hazard Factory (Sec. 306.2)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ All Group F operations that are not considered Group F-2 ▪ Production, assembling, finishing, packaging or repair of combustible products 	<ul style="list-style-type: none"> ▪ Aircraft, automobile, appliance and machine manufacturers ▪ Clothing manufacturers ▪ Furniture makers ▪ Woodworking shops


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Occupancy Classification— Factory/Industrial

Group F-2 Low-Hazard Factory (Sec. 306.3)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ Similar to Group F-1, but no combustibles other than limited amounts in finishing, packing or processing operations 	<ul style="list-style-type: none"> ▪ Ceramic products ▪ Glass products ▪ Masonry manufacturing ▪ Metal fabrication plant




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Occupancy Classification—High Hazard

Group H occupancies (307.1):

- Involve the manufacturing, processing, generation or storage of materials that constitute a physical and/or health hazard.
- Quantities of such hazardous materials exceed those permitted within control areas as regulated by Section 414.2, based on Tables 307.1(1) and/or 307.1(2).




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Occupancy Classification—High Hazard

Exceptions to Group H: There are 13 exceptions (to Section 307.1) that should be reviewed prior to assigning a classification of Group H.

Even if the structure meets one of the exceptions, the provisions of Section 414 and the *International Fire Code*® (IFC®) for such materials are still applicable.




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Occupancy Classification—High Hazard

Exceptions to Group H

- Application of flammable finishes in conformance with Section 416 of the IFC and the IBC.
- Sales and storage of flammable and combustible liquids in Group M occupancies if compliant with the IFC.



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Occupancy Classification—High Hazard

Exceptions to Group H

- Closed piping systems containing flammable or combustible liquids or gases utilized for operation of machinery or equipment.
- Dry cleaning establishments with specified safeguards.
- Liquor stores and distributors without bulk storage.
- Corrosive personal or household products in original packaging used in retail display.



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Occupancy Classification—High Hazard

Exceptions to Group H

- Commonly used corrosive building materials.
- Refrigeration systems.
- Agricultural materials only stored or utilized on the premises.
- Stationary battery systems for facility emergency power.
- Personal and household products in retail display (not considered corrosives).
- Aerosol storage in conformance with the IFC.



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Occupancy Classification—High Hazard

Exceptions to Group H

- Display and storage of nonflammable and noncombustible liquids in Group M or S occupancies where in compliance with Section 414.2.5.
- Black powder, smokeless propellant and small arms primers stored in Groups M and R-3, in accordance with the IFC.
- Storage of special industrial explosive devices in Groups B, F, M and S, in accordance with the IFC.



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Occupancy Classification—Q&A

- Refer to Section 307.1 and Tables 307.1(1) and 307.1(2) to determine if buildings, structures or materials are exempt from the Group H classification.
- In accordance with Section 307.1.1, the design of high-hazard buildings must conform to additional requirements in the IFC and Section 414 of the IBC.



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Occupancy Classification—High Hazard

Tables 307.1(1) and 307.1(2)

- Use Table 307.1(1) for the maximum allowable quantities of materials posing a physical hazard.
- Use Table 307.1(2) for materials posing a health hazard.

If the quantity of hazardous materials does not exceed the calculated amount, then the use is not considered a Group H occupancy.



**TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD⁽¹⁾⁻⁽⁵⁾**

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED ⁽¹⁾	STORAGE ⁽²⁾		USE-CLOSED SYSTEMS ⁽³⁾		USE-OPEN SYSTEMS ⁽⁴⁾	
			Solid pounds (metric tons)	Liquid gallons (metric tons)	Gas cubic feet at NTP	Solid pounds (metric tons)	Liquid gallons (metric tons)	Gas cubic feet at NTP
Combustible dust	NA	H-2	See Note g	NA	NA	See Note g	NA	NA
Combustible fiber ⁽⁵⁾	Loose Bulk ⁽⁵⁾	H-3	(100)	NA	NA	(100)	NA	(200)
Combustible liquid ⁽⁵⁾	H	H-2 or H-3	NA	120 ⁽⁶⁾	NA	NA	120 ⁽⁶⁾	30 ⁽⁶⁾
	HIA	H-2 or H-3	NA	330 ⁽⁶⁾	NA	NA	330 ⁽⁶⁾	80 ⁽⁶⁾
	IBB	NA	NA	13,200 ⁽⁶⁾	NA	NA	13,200 ⁽⁶⁾	3,300 ⁽⁶⁾
Consumer fireworks	L-6G	H-3	125 ⁽⁷⁾	NA	NA	NA	NA	NA
Cryogenic flammable	NA	H-2	NA	45 ⁽⁸⁾	NA	NA	45 ⁽⁸⁾	10 ⁽⁸⁾
Cryogenic inert	NA	NA	NA	NA	NA	NA	NA	NA
Cryogenic oxidizing	NA	H-3	NA	45 ⁽⁸⁾	NA	NA	45 ⁽⁸⁾	10 ⁽⁸⁾
Explosives	Division 1.1	H-1	1 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	0.25 ⁽⁹⁾
	Division 1.2	H-1	1 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	
	Division 1.3	H-1 or H-2	1 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	
	Division 1.4	H-3	30 ⁽⁹⁾	(30) ⁽⁹⁾	NA	NA	NA	
	Division 1.6G	H-3	125 ⁽⁹⁾	NA	NA	NA	NA	
	Division 1.5	H-1	1 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	(1) ⁽⁹⁾	0.25 ⁽⁹⁾	
Division 1.6	H-1	1 ⁽⁹⁾	NA	NA	NA	NA		
Flammable gas	Gasous	H-2	NA	NA	1,000 ⁽¹⁰⁾	NA	NA	1,000 ⁽¹⁰⁾
	Liquid ⁽¹¹⁾	H-2	NA	NA	(150) ⁽¹¹⁾	NA	NA	(150) ⁽¹¹⁾
Flammable liquid ⁽¹²⁾	IA	H-2	30 ⁽¹²⁾	NA	NA	30 ⁽¹²⁾	NA	
	IB and IC	H-2 or H-3	NA	120 ⁽¹²⁾	NA	NA	120 ⁽¹²⁾	
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ⁽¹²⁾	NA	NA	120 ⁽¹²⁾	

(continued)



- For use of control areas, see Section 414.2.
- The aggregate quantity in one and storage shall not exceed the quantity listed for storage.
- The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.5 gallons. In retail and wholesale sales occupancies, the quantities of medicines, health/first aid or consumer products, and cosmetics containing not more than 30 percent by volume of water-soluble liquids with the remainder of the solution not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.5 gallons.
- Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note 4 also applies, the increase for both notes shall be applied accumulatively.
- Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas systems or exhausted enclosures or in fixed safety cans in accordance with Section 903.3.10 of the International Fire Code. Where Note 4 also applies, the increase for both notes shall be applied accumulatively.
- Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.
- The maximum allowable quantity shall not apply to fuel of storage complying with Section 603.5.2 of the International Fire Code.
- Quantities in parentheses indicate quantity limits in parentheses at the head of each column.
- A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed where such materials are necessary for maintenance purposes, operation or sanitation of equipment when the storage containers and the manner of storage are approved.
- Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.
- For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 503.1.2 of the International Fire Code.
- For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5(1) and 414.2.5(2).
- Directly packed fuel cell systems that comply with the packing requirements of 29CFR 1915 shall not be included in this material class.
- The following shall not be included in determining the maximum allowable quantities:
 - Liquid or gaseous fuel in fuel tanks on vehicles.
 - Liquid or gaseous fuel in fuel tanks on mechanical equipment operated in accordance with the International Fire Code.
 - Gasoline fuels in piping systems and fixed appliances regulated by the International Fuel Gas Code.
 - Liquid fuels in piping systems and fixed appliances regulated by the International Mechanical Code.
 - Alcohol-based hand rubs classified as Class 1 or II liquids in dispensers that are installed in accordance with Section 5705.5.1 of the International Fire Code. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the construction documents.
- Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.5.



**(F) TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL POSING A HEALTH HAZARD⁽¹⁾⁻⁽⁵⁾**

MATERIAL	STORAGE ⁽²⁾			USE-CLOSED SYSTEMS ⁽³⁾		USE-OPEN SYSTEMS ⁽⁴⁾	
	Solid pounds ⁽⁶⁾	Liquid gallons (pounds) ⁽⁷⁾	Gas cubic feet at NTP (pounds) ⁽⁸⁾	Solid pounds ⁽⁶⁾	Liquid gallons (pounds) ⁽⁷⁾	Gas cubic feet at NTP (pounds) ⁽⁸⁾	Liquid gallons (pounds) ⁽⁷⁾
Corrosives	5,000	500	Gasous: 810 ⁽⁹⁾ Liquid: (150)	5,000	500	Gasous: 810 ⁽⁹⁾ Liquid: (150)	1,000 / 100
Highly Toxic	10	(10)	Gasous: 20 ⁽⁹⁾ Liquid: (4) ⁽⁹⁾	10	(10)	Gasous: 20 ⁽⁹⁾ Liquid: (4) ⁽⁹⁾	3 / (3)
Toxic	500	(500)	Gasous: 810 ⁽⁹⁾ Liquid: (150) ⁽⁹⁾	500	(500)	Gasous: 810 ⁽⁹⁾ Liquid: (150) ⁽⁹⁾	125 / (125)

For SI: 1 cubic foot = 0.028 m³; 1 pound = 0.454 kg; 1 gallon = 3.785 L.
 1. For use of control areas, see Section 414.2.
 2. The aggregate quantity in one and storage shall not exceed the quantity listed for storage.
 3. In retail and wholesale sales occupancies, the quantities of medicines, health/first aid or consumer products, and cosmetics containing not more than 30 percent by volume of water-soluble liquids and with the remainder of the solution not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.5 gallons.
 4. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note 4 also applies, the increase for both notes shall be applied accumulatively.
 5. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the International Fire Code. Where Note 4 also applies, the increase for both notes shall be applied accumulatively.
 6. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
 7. Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures as specified in the International Fire Code.
 8. Quantities in parentheses indicate quantity limits in parentheses at the head of each column.
 9. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 503.1.2 of the International Fire Code.



FOR EXAMPLE

Occupancy Classification—Example

GIVEN: A fully sprinklered Group F-1 storage building housing Class II combustible liquids. The Class II liquids are all stored in approved safety cans. The entire building is in a single control area.

DETERMINE: The maximum allowable quantity of the Class II liquids in storage in order to maintain the Group F-1 classification.

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FOR EXAMPLE

Occupancy Classification—Example

SOLUTION:

Basic MAQs in accordance with Table 307.1(1)	120 gallons
Sprinkler increase in accordance with Note d (100%)	<u>120 gallons</u>
	240 gallons
Safety can increase in accordance with Note e (100%)	<u>240 gallons</u>
Total of maximum quantity permitted for Group F-1 classification	480 gallons

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Occupancy Classification—High Hazard

Control Areas (Section 414.2)

If the amount of hazardous materials exceeds that provided by Table 307.1(1) or 307.1(2), it is still possible that a Group H occupancy does not exist.

Additional quantities are permitted in non-Group H buildings if they are properly distributed in control areas complying with Section 414.2.

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Occupancy Classification—High Hazard

Control Areas (Section 414.2)

Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled.

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Occupancy Classification—High Hazard

Control areas:

- Must be separated from each other by fire barriers and/or horizontal assemblies.
- Are limited to a specified percentage of maximum allowable quantities based on the floor level under consideration (see Table 414.2.2).



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Occupancy Classification—High Hazard

Control areas:

- Are limited to a maximum number per floor as established by Table 414.2.2.
- Shall be separated with the minimum degree of fire resistance as established in Table 414.2.2 and Section 414.2.4.



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Occupancy Classification—High Hazard

(F) TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER FLOOR	FIRE RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 7	5	1	1
	7-6	5	1	1
	6	12.5	1	1
	5	12.5	1	1
	4	12.5	1	1
	3	50	1	1
Below grade plane	2	75	1	1
	1	100	4	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

^a Percentages shall be of the maximum allowable quantity per control area shown in Tables NF 111 and NF 112, with all increases allowed in the notes to those tables.

^b Fire barriers shall include walls and floors as necessary to provide separation from other portions of the building.



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Occupancy Classification—High Hazard

Where the amount of hazardous materials exceeds those permitted in complying control areas, and is such that none of the exceptions to Section 307.1 are applicable, then the use is classified as a Group H occupancy.

There are 5 categories of Group H to address the hazards more directly.




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Occupancy Classification—High Hazard

Types of Materials by Group
Group H-1 (Section 307.3)

- Explosives
- Detonable pyrophoric materials
- Organic peroxides, unclassified detonable
- Oxidizers, Class 4
- Unstable (reactive) materials, Class 3 detonable and Class 4




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Occupancy Classification—High Hazard

Types of Materials by Group
Group H-2 (Section 307.4)

- Combustible dust
- Flammable and combustible liquids (Class I, II and IIIA) in open systems
- Cryogenic fluids, flammable
- Organic peroxides, Class I
- Flammable gases
- Oxidizers, Class 3, in open systems
- Pyrophoric materials, nondetonable
- Unstable (reactive) materials, Class 3, nondetonable
- Water-reactive materials, Class 3




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Occupancy Classification—High Hazard

Types of Materials by Group
Group H-3 (Section 307.5)

- Combustible fibers
- Flammable and combustible liquids (Class I, II and IIIA) in closed systems
- Flammable solids
- Organic peroxides, Classes II and III
- Oxidizers, Class 2
- Oxidizers, Class 3, in closed systems
- Oxidizing gases
- Unstable (reactive) materials, Class 2
- Water-reactive materials, Class 2
- Cryogenic fluids, oxidizing
- Consumer fireworks, 1.4G (Class C, Common)




2015 IBC Building Classification 59

59

Occupancy Classification—High Hazard

Types of Materials by Group

<p>Group H-4 (Section 307.6)</p> <ul style="list-style-type: none"> ▪ Corrosives ▪ Toxic materials ▪ Highly toxic materials 	<p>Group H-5 (Section 307.7)</p> <ul style="list-style-type: none"> ▪ Semiconductor fabrication facilities and comparable research and development areas
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2015 IBC Building Classification 60

60

Occupancy Classification— Institutional

- Group I—Characteristics
 - People are cared for or live in a supervised environment.
 - People with physical limitations because of health or age are harbored for medical treatment or other care/treatment.
 - People who are detained for penal or correctional purposes or in which the liberty of the occupants is restricted.




2015 IBC Building Classification 61

61

Occupancy Classification— Institutional

Group I-1 (Section 308.3)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ More than 16 occupants (not including staff). ▪ Residents—aware and ambulatory. ▪ Housed on a 24-hour basis. ▪ Supervised for counseling and general assistance purposes. ▪ Occupants capable of self-preservation. 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Group homes ▪ Rehabilitation facilities ▪ Convalescent facilities ▪ Assisted living facilities
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2015 IBC Building Classification 62

62

Occupancy Classification— Institutional

Group I-1 (Section 308.3)

- Group I-1, Condition 1
 - All persons receiving custodial care are capable, without assistance, of responding to an emergency situation to complete building evacuation or relocation.
- Group I-1, Condition 2
 - Any persons receiving custodial care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation or relocation.




2015 IBC Building Classification 63

63

Occupancy Classification— Institutional

Group I-2 (Section 308.4)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Used for medical, surgical, psychiatric, nursing or custodial care. ▪ Receive 24-hour care. ▪ May be semi-aware or semi-ambulatory, but not capable of self-preservation. 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Hospitals ▪ Detoxification facilities ▪ Nursing homes ▪ 24-hour child care facilities (Section 308.3.1)
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2015 IBC Building Classification 64

64

Occupancy Classification— Institutional

Group I-2 (Section 308.4)

- Group I-2, Condition 1
 - Nursing homes, foster care facilities and similar uses that provide nursing and medical care but do not provide emergency care, surgery and obstetrics.
- Group I-2, Condition 2
 - Hospitals and similar facilities that provide nursing and medical care, and could also provide emergency care, surgery and obstetrics.



65



Occupancy Classification - Q&A

- Are convalescent facilities still considered as Group I-1 if the residents are incapable of self-preservation for some period of time?
- How are alcohol and drug centers to be classified if lockdown of the residents is possible?



66

Occupancy Classification— Institutional

Group I-3 (Section 308.5)

Characteristics

- More than 5 occupants (not including staff).
- Supervised.
- Physically restricted from evacuating the building.
- Further classified into 5 occupancy conditions based on capability of free movement within facility.

Examples

- Detention centers
- Jails
- Prerelease centers
- Prisons



67



Occupancy Classification— Q&A

- What is a facility classified that has 5 or fewer individuals restrained or secured, such as a drunk tank at a sports arena or a viewing room in a jewelry store?




68

Occupancy Classification— Institutional

Group I-4 (Section 308.6)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ More than 5 occupants. ▪ Any age. ▪ Receive custodial care for less than 24 hours a day. ▪ Occupants incapable of self preservation. 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Adult care facilities ▪ Child care facilities
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2015 IBC Building Classification 69

69

Occupancy Classification— Institutional

Group I-4 (Section 308.6.1)

- **NOTE:** Child day care facilities are classified as Group E if all of the following apply:
 - More than 5 but not more than 100 children, 2½ years of age or less.
 - Rooms where such children are located are on the level of exit discharge.
 - Each such room has an exit door directly to the outside.




2015 IBC Building Classification 70

70

Occupancy Classification— Mercantile

Group M (Section 309.1)

<p>Characteristics</p> <ul style="list-style-type: none"> ▪ Display, sell and stock merchandise. ▪ If merchandise is hazardous, see Table 414.2.5(1) for quantity limits. 	<p>Examples</p> <ul style="list-style-type: none"> ▪ Retail stores ▪ Motor fuel-dispensing facilities
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2015 IBC Building Classification 71

71

Occupancy Classification— Mercantile

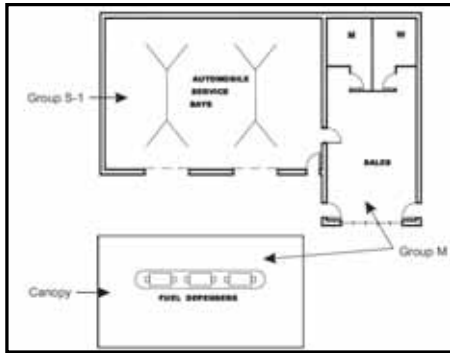
- Motor vehicle service stations
 - Group M applies to buildings that provide fuel and/or retail facilities only, and not to areas having facilities for vehicle repair.
 - Structures with facilities for vehicle service and/or repair are to be classified as Group S-1 (Section 311.2).



2015 IBC Building Classification 72

72

Occupancy Classification— Mercantile



Group M—Service Station with Group S-1 Repair Facility

73

Occupancy Classification— Residential

- Residential occupancies fall into two categories:
 - Transient (Group R-1)
 - Nontransient (Groups R-2, R-3 and R-4)

Transient—Occupancy of a dwelling unit or sleeping unit for not more than 30 days.

74

Occupancy Classification— Residential

Group R-1 (Section 310.3)

Characteristics

- Occupants are primarily transient.
- Includes sleeping units and/or dwelling units.

Examples

- Hotels
- Motels
- Boarding houses (transient)*
- Bed and breakfast establishments*


75

Occupancy Classification— Residential

Group R-1 (Section 310.3)

- * Congregate living facilities for transient occupants are classified as Group R-3 occupancies where the occupant load is 10 or less.

76



Occupancy Classification Discussion Q&A

- What is the classification of a transient residential occupancy (hotel) composed of individual detached dwelling units, such as 20 cabins rented out on a per-night basis?

2015 IBC Building Classification 77

77

Occupancy Classification—Residential

Group R-2 (Section 310.4)

Characteristics	Examples
<ul style="list-style-type: none"> Occupants are primarily permanent. Consists of congregate living facilities or apartment buildings (3 or more dwelling units). 	<ul style="list-style-type: none"> Apartment houses Dormitories* Fraternities and sororities* Monasteries and convents*

2015 IBC Building Classification 78

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Occupancy Classification—Residential

Group R-2 (Section 310.4)

* Congregate living facilities (nontransient) with 16 or fewer occupants are classified as Group R-3 occupancies.

2015 IBC Building Classification 79

79

Occupancy Classification—Residential

Group R-3 (Section 310.5)

Characteristics	Examples
<ul style="list-style-type: none"> Occupants not transient in nature. Typically small occupant loads. 	<ul style="list-style-type: none"> One- and two-family dwellings outside the scope of the IRC.* Smaller congregate living facilities. Adult care and child care facilities for 5 or fewer persons for less than 24 hours.


2015 IBC Building Classification 80

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Occupancy Classification—Residential

- **Group R-3 (Section 310.5)**

*Detached one- and two-family dwellings and multiple single-family dwellings (townhouses) not more than three stories in height with separate means of egress are typically regulated by the IRC, so the IBC is not applicable.



2015 IBC Building Classification
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Occupancy Classification—Q&A

- Group R-3 occupancies also include:
 - Care facilities providing accommodations for 5 or fewer persons receiving care,
 - Congregate living facilities (transient) with 10 or fewer occupants,
 - Congregate living facilities (nontransient) with 16 or fewer occupants,
 - Lodging houses (such as bed-and-breakfasts) with 5 or fewer guest rooms,
 - Owner-occupied lodging houses with 5 or fewer guest rooms permitted to be constructed per the IRC.



2015 IBC Building Classification
82

82

Occupancy Classification—Residential

Group R-4 (Section 310.6)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ Care facilities have more than 5 but not more than 16 occupants, excluding staff. 	<ul style="list-style-type: none"> ▪ Residential care facilities ▪ Assisted living facilities



2015 IBC Building Classification
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83

Occupancy Classification—Residential

Group R-4 (Section 310.6)


- Group R-4, Condition 1
 - All persons receiving custodial care are capable, without assistance, of responding to an emergency situation to complete building evacuation or relocation.
- Group R-4, Condition 2
 - Any persons receiving custodial care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation or relocation.


2015 IBC Building Classification
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84

Occupancy Classification—Residential

- Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided; or shall comply with the IRC, provided the building is sprinklered throughout.




2015 IBC Building Classification 85

85

Occupancy Classification—Storage

- Group S classifications are similar to those in the Group F categories.
- Those storage occupancies classified as Group S-1 typically contain some degree of combustible materials.
- No storage of combustible materials is anticipated in Group S-2 occupancies.




2015 IBC Building Classification 86

86

Occupancy Classification—Storage

Group S-1, Moderate Hazard (Section 311.2)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ Storage of primarily combustible materials that do not qualify as hazardous materials beyond the exempt amount permitted (see Section 307). 	<ul style="list-style-type: none"> ▪ Clothing, woolen wearing apparel, silks ▪ Furniture storage ▪ Motor vehicle repair garages ▪ Paper products ▪ Tires, bulk storage




2015 IBC Building Classification 87

87

Occupancy Classification—Storage

Group S-2, Low Hazard (Section 311.3)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ Storage of noncombustibles, with a minimal amount of combustibles present such as plastic knobs, wood pallets, and some paper or cardboard boxing. 	<ul style="list-style-type: none"> ▪ Food product storage ▪ Glass storage ▪ Metal storage ▪ Parking garages (open or closed) ▪ Pottery storage



2015 IBC Building Classification 88

88

Occupancy Classification— Utility and Miscellaneous

Group U (Section 312.1)

Characteristics	Examples
<ul style="list-style-type: none"> ▪ No public occupancy ▪ Limited or no occupant load ▪ Limited floor area ▪ Little fire hazard 	<ul style="list-style-type: none"> ▪ Agricultural buildings ▪ Barns ▪ Carports ▪ Greenhouses ▪ Livestock shelters ▪ Private garages ▪ Stables

2015 IBC Building Classification 89

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QUESTION & ANSWER Occupancy Classification— Q&A

- What is the classification of an agricultural building that has occasional public use, such as a livestock show or equestrian lessons?

2015 IBC Building Classification 90

90

Incidental Uses

91

91

Incidental Uses (Section 509)


- An incidental use area is a room that is an extension of the primary use and that poses a risk that is inconsistent with the main occupancy.
- Only those rooms listed on Table 509 are designated as incidental use areas. The intent is that an incidental use area be classified as a part of the occupancy in which it is located.

2015 IBC Building Classification 92

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Mixed Use and Occupancy—Sidebar


- Incidental use areas can occur in both single-occupancy and mixed-occupancy buildings.



2015 IBC Building Classification 93

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ROOM OR AREA	SEPARATION AND/OR PROTECTION
Storage rooms where any piece of equipment is over 600,000 lbs per floor total	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
Refrigeration machinery rooms	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group H, F, M, S and U occupancies; 2 hours in Group A, E, F and W occupancies.
Incinerator rooms	2 hours or provide automatic sprinkler system
Plant shops, not classified as Group H, located in occupancies other than Group H	2 hours, or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and recreational 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 200 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 200 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 uninterruptible power supplies	1 hour in Group H, F, M, S and U occupancies; 2 hours in Group A, E, F and W occupancies.




2015 IBC Building Classification 94

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Incidental Uses (Section 509)

- Two methods of protection have been established to address the additional hazards posed by rooms identified as incidental accessory occupancies:
 - Fire-resistance separation of the incidental accessory occupancy from the remainder of the building through the use of fire barriers and/or horizontal assemblies.
 - Protection by an automatic fire extinguishing system in the incidental accessory occupancy.




2015 IBC Building Classification 95

95

Incidental Uses (Section 509)

- Based on Table 509, the extent of separation and/or protection varies depending on the expected hazard level.
- The table usually allows the use of either a fire separation or a fire-extinguishing system. In some cases, a fire separation is mandated, or both the fire separation and fire-extinguishing system are required.



2015 IBC Building Classification 96

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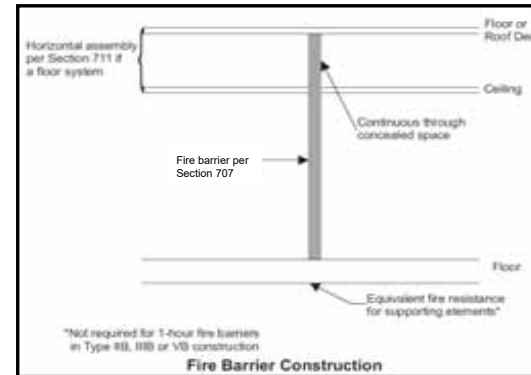
Fire-resistance-rated Separation (Section 509.4.1)

- The fire-resistance-rated separations required by Table 509 are to be fire barriers and/or horizontal assemblies, typically having a fire-resistance rating of 1 hour. This fully isolates that incidental use area from other portions of the building.



97

Fire-resistance-rated Separation (Section 509.4.1)



98

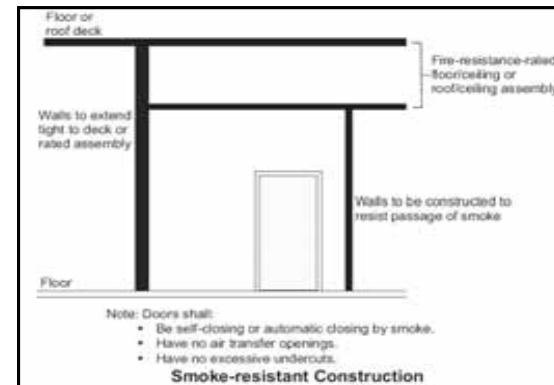
Fire Protection (Section 509.4.2)

- The installation of an automatic fire-extinguishing system can substitute for the fire-resistant separation of incidental accessory occupancy.
- The incidental accessory occupancy must also be separated from the remainder of the building with construction capable of resisting the passage of smoke.

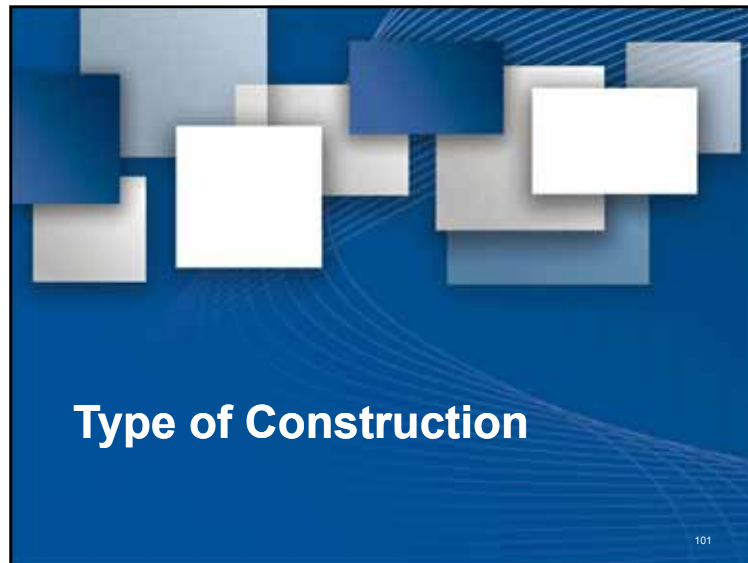


99

Fire Protection (Section 509.4.2)



100



101

Type of Construction— Introduction

- Equally as important as occupancy designation, the determination of a building's type of construction describes its resistance to fire by addressing whether:
 - The materials of construction that make up the building's key elements are combustible or noncombustible.
 - These same key elements are protected from fire by a recognized level of fire resistance.



2015 IBC Building Classification

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Type of Construction— Introduction

- The relationship of a building's construction type and its allowable height and area is the most important reason for correctly evaluating the type of construction.
- The permitted building size is directly related to the construction type.



2015 IBC Building Classification

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Type of Construction—Sidebar

- One or more construction types are selectively permitted based on the building's occupancy classification, height and floor area.



2015 IBC Building Classification

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Type of Construction— General Provisions (Section 602)

Type of Construction		Materials of Construction
I	IA IB	Exterior and interior walls, floors, roof and structural elements to be of noncombustible materials.
II	IIA IIB	
III	IIIA IIIB	Exterior walls to be of noncombustible materials.
IV	H,T	Interior elements permitted to be of combustible materials.
V	VA VB	Combustible materials permitted throughout.

NOTE: The classification of the building for construction type is based on the elements of the building itself and not on what minimum type of construction is permitted because of its height and area.



105

Type of Construction—Table 601

- Types of building elements regulated for fire-resistance-rated construction, based on Table 601:
 - Structural frame
 - Interior and exterior bearing walls
 - Floor construction
 - Roof construction

All building elements must meet or exceed the fire-resistance requirements of the table.



106

Type of Construction—Sidebar

- Since the provisions for type of construction address the structural integrity of building elements under fire conditions, nonbearing walls are not regulated for fire resistance because of construction type.



107

Type of Construction—Table 601

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV		TYPE V	
	R	W	R	W	R	W	R	W	R	W
Primary structural frame ^a (see Section 202)	2	2	1	1	1	1	0	0	0	0
Bearing walls: Exterior ^b Interior	2 2	2 2	1 1	1 1	1 1	1 1	0 0	0 0	0 0	0 0
Nonbearing walls and partitions: Exterior	See Table 602									
Nonbearing walls and partitions: Interior	0	0	0	0	0	0	0	0	0	0
Floor construction and secondary members (see Section 202)	2	2	1	1	1	1	0	0	0	0
Roof construction and secondary members (see Section 202)	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	1 1/2	0	0	0	0

Fig. 101. 1 foot = 304.8 mm.
 a. Roof supports. Fire-resistance ratings of primary structural frames and bearing walls are permitted to be reduced by 1 hour when supporting a roof only.
 b. Except in Group F-1, B, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. This reduction toward wood members shall be allowed to be used for each occupancies section.
 c. In all occupancies, heavy timber shall be allowed subject to 4-hour or less fire-resistance rating is required.
 d. An approved automatic fire sprinkler system in accordance with Section 907.5.2.1 shall be allowed for the reduction for 1-hour fire-resistance-rated construction and rated structural members in non-occupancies required by other provisions of the code or specified in an authority having jurisdiction with Section 708.1.3 in all allowable height increases in accordance with Section 704.2. The 1-hour reduction for the fire-resistance of exterior walls shall not be permitted.
 e. Not less than the fire-resistance rating required by other sections of the code.
 f. Not less than the fire-resistance rating based on the separation distance (see Table 602).
 g. Not less than the fire-resistance rating as referenced in Section 708.2(1).



108

Type of Construction—Table 601

- A building must be classified as a single type of construction only.
- Unlike mixed-occupancy conditions where multiple uses occur, the type of construction must be established based on full compliance with the minimum requirements for the intended construction type.



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Type of Construction—Types I and II Construction (Section 602.2)

- Elements listed in Table 601 are required to be noncombustible.
- For Types IA, IB and IIA, building elements are to be fire-resistance rated.
- For Type IIB, building elements may be unprotected unless required elsewhere in code.



2015 IBC Building Classification

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Type of Construction—Type III Construction (Section 602.3)

- Exterior walls are constructed of noncombustible materials. The interior structural elements may be combustible or noncombustible.
- IIIA: Elements are protected (fire-resistance rated) in accordance with Table 601.
- IIIB: Elements other than exterior bearing walls are not protected.



2015 IBC Building Classification

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111

Type of Construction—Sidebar

- If the interior walls and/or floors are wood framing, the building must be classified as Type III, IV or V construction.



2015 IBC Building Classification

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Type of Construction—Type IV Construction (Section 602.4)

- Exterior walls are constructed of noncombustible materials and the interior building elements are constructed of solid or laminated wood without concealed spaces.
- Materials are unprotected.



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113

Type of Construction—Type IV Construction (Section 602.4)

All elements must meet the conditions of Section 602.4, including a minimum:

- 8" x 8" columns where supporting floor loads.
- 6" x 8" columns where supporting only roof and ceiling loads.
- 6" x 10" beams and girders.
- 6" x 8" for roof supports.
- 3" thick sawn or plank floors.
- 2" thick sawn or plank roof decks.



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Type of Construction—Type V Construction (Section 602.5)

- Typically, the structural members and exterior walls of a Type V building are standard wood-frame construction.
- VA: Elements are protected minimum 1 hour in accordance with Table 601.
- VB: Elements are unprotected.



2015 IBC Building Classification

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Type of Construction—Primary Structural Frame (Section 202)

- Where the fire resistance of primary structural frame elements is required by Table 601, it is important to identify which structural members fall into that category. The primary structural frame is:
 - Columns.
 - Girders, beams, trusses and spandrels connecting directly to the columns.
 - Bracing members essential to the vertical stability of the primary structural frame under gravity loading.



2015 IBC Building Classification

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Type of Construction—Secondary Members (Section 202)

- All other members are considered as secondary members and are only regulated for fire resistance for the building element in which they are located, including:
 - Bracing members other than those that are a part of the primary structural frame.
 - Members of the floor construction not having direct connections to the columns.
 - Structural members and members of the floor construction that do not have direct connections to the columns.

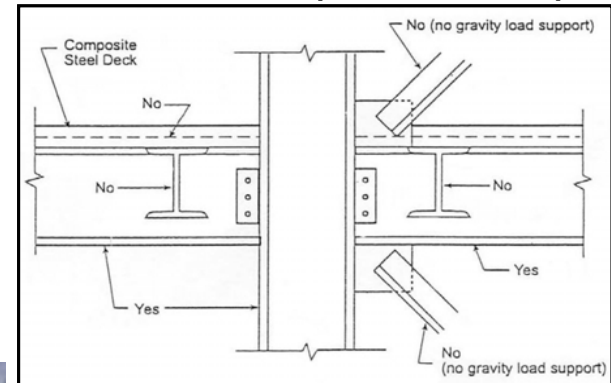


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Type of Construction—Structural Frame Elements (Section 202)



2015 IBC Building Classification

Structural Frame Elements

118

118

Type of Construction—Notes to Table 601

- The fundamental requirements for construction type are classified and modified by the Notes to Table 601.



2015 IBC Building Classification

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Type of Construction—Notes to Table 601

- **Note a**
- In buildings of Type IA and IB construction, the required fire-resistance ratings of structural frame members and interior bearing walls is permitted to be reduced by 1 hour if only supporting a roof. This allowance does not apply to exterior bearing walls.



2015 IBC Building Classification

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120

Type of Construction—Notes to Table 601

- **Note b**
- For those buildings that require fire-resistance-rated roof construction, such protection is not required if every part of the roof is at least 20 feet above the floor below. The elimination of the required fire resistance is not permitted in Group F-1, H, M and S-1 occupancies due to the possible extensive fire loading and the potential for such combustible loading to be located close to the roof height.

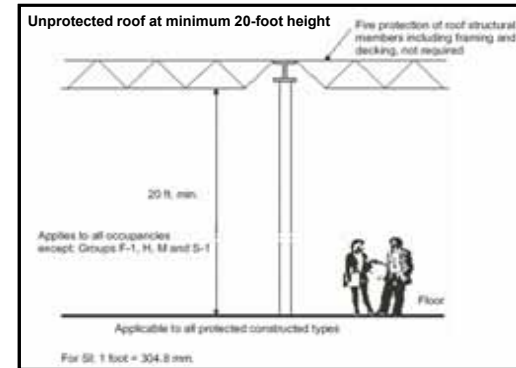


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121

Type of Construction—Notes to Table 601



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Type of Construction—Notes to Table 601

- **Note c**
- In other than Type IA construction, the roof is permitted to be of heavy timber construction as specified in:
 - Section 602.4.5 for roof framing.
 - Section 602.4.7 for roof decks.



2015 IBC Building Classification

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Type of Construction—Notes to Table 601

- **Note d**
- It must always be remembered that other sections of the IBC may require the fire resistance of building elements.
- In such instances, the most restrictive provisions shall apply.



2015 IBC Building Classification

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Type of Construction—Notes to Table 601

- **Note e**
- Exterior bearing walls must be evaluated for fire-resistance-rated protection based on both Table 601 and Table 602.
- The most restrictive requirement will regulate the minimum required rating of the exterior bearing wall.



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Type of Construction—Notes to Table 601

- **Note f**
- Where load-bearing structural members are located within the exterior walls or on the outside of a building or structure, the provisions of Section 704.10 will apply.



2015 IBC Building Classification

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126

Combustible Material in Types I and II Construction (Section 603)

- Allowances have been made for small amounts of combustibles that will not effectively increase the fire load.
- Such allowances include, with some limitations:
 - Fire-retardant-treated wood
 - Foam plastics
 - Roof coverings
 - Wall, ceiling and floor finishes
 - Millwork such as doors, windows and their frames
 - Additional applications as permitted by Section 603



2015 IBC Building Classification

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Location on Lot — Table 602

- Reference is made to Table 602 for both exterior bearing walls and exterior nonbearing walls. Table 602 regulates the minimum required fire-resistance ratings for exterior walls based on fire separation distance.



2015 IBC Building Classification

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Location on Lot — Table 602

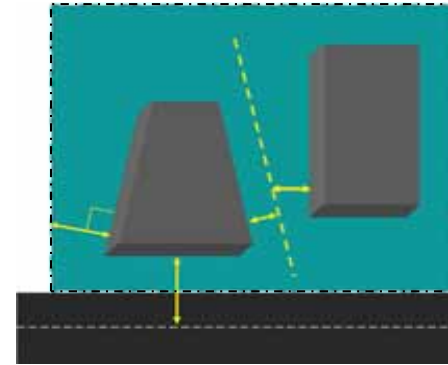
Fire separation distance is measured at a right angle from the building face to one of the following:

- The closest interior lot line.
- The centerline of a street, an alley or a public way.
- An imaginary line between two buildings on the same lot.



129

Location on Lot — Table 602



Measurement of Fire Separation Distance



130

Type of Construction — Table 602

- “Fire separation distance” is based on radiant heat transfer through the air.
- Where a building is located near an adjoining lot, the exterior walls may require a fire-resistance rating to reduce the potential exposure of one building to another during a fire. As the distance increases away from the adjoining lot, the rating may not be required due to sufficient open space that reduces such exposure.



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Location of Lot — Table 602

**TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^{a, b, c}**

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H ^d	OCCUPANCY GROUP F-1, M, S-1 ^e	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U ^f
X < 5 ^g	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, III	2	1	1 ^h
	III, VI	1	0	0
	Others	1	1	1 ^h
X ≥ 30	All	0	0	0

- For SI, 1 foot = 304.8 mm.
- Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
 - See Section 706.1.1 for party walls.
 - Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
 - The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
 - For special requirements for Group H occupancies, see Section 415.6.
 - For special requirements for Group B aircraft hangars, see Section 412.4.1.
 - Where Table 705.8 permits reinforcing exterior walls with unobstructed areas of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
 - For a building containing only a Group U occupancy garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1525 mm) or greater.



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FOR EXAMPLE

Structural Frame Rating — Section 704.10

- The provisions of Section 704.10 must also be consulted if there are load-bearing structural members located within, or on the outside of the exterior walls. The structural frame members shall have a minimum fire-resistance rating based on the highest rating of the following:
 - Structural framing rating in accordance with Table 601 based on type of construction.
 - Exterior bearing wall rating in accordance with Table 601 based on type of construction.
 - Exterior wall rating in accordance with Table 602 based on fire separation distance.

2015 IBC Building Classification 133

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FOR EXAMPLE

Type of Construction— Example

- Structural frame members in exterior wall A-B would require a minimum 2-hour fire-resistance rating.

	Table 601	Table 602
Bearing wall	2 hours	1 hour
Nonbearing wall	None	1 hour

Bearing wall: Minimum of 2 hours
Nonbearing wall: Minimum of 1 hour

2015 IBC Building Classification 134

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Allowable Building Height and Area

2015 IBC Building Classification 135

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Allowable Height and Area—Introduction

- After determining a building's occupancy and type of construction, the next step in the classification process is to verify compliance with the height and area limitations.
- Building occupancy, building type of construction and allowable building height and area must simultaneously be met to achieve code compliance.

2015 IBC Building Classification 136

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Allowable Height and Area—Introduction

- Consequences of ignoring building height and area:
 - The building may be too large to safely accommodate the occupancy.
 - The structural components of the building may be prematurely affected from exposure to a fire condition.



2015 IBC Building Classification

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Allowable Height and Area—Sidebar

- As the size of the building increases, either in height or area, the number of acceptable construction types is reduced.
- Conversely, where a higher type of construction is provided, the building size may be increased.



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Allowable Height and Area (Tables 504.3, 504.4 and 506.2)

- Tables 504.3, 504.4 and 506.2 are used in establishing “equivalent risk”—offsetting a building’s inherent fire hazard—represented by group—with materials and construction features.



2015 IBC Building Classification

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Allowable Height and Area (Tables 504.3, 504.4 and 506.2)

- The application of Tables 504.3, 504.4 and 506.2 are accomplished by:
 1. Identifying the group classification of the building in question along the left column.
 2. Identifying the building’s type of construction across the top of the table.



2015 IBC Building Classification


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Allowable Height and Area (Tables 504.3, 504.4 and 506.2)

3. The cell at the intersection of the occupancy classification and type of construction establishes the:


- allowable building height in feet above grade plane.
- allowable building height in stories above grade plane.
- allowable area factor (per story) in square feet.



2015 IBC Building Classification 141

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Allowable Height in Feet Above Grade Plane (Table 504.3)



Occupancy Classification	See Footnotes	Type of Construction									
		Type I		Type II		Type III		Type IV	Type V		
		A	B	A	B	A	B	HT	A	B	
A,B,E,F,M,S,U	NS ¹	UL	100	65	55	65	55	65	50	40	
	S	UL	150	85	75	85	75	85	70	60	
H-1, H-2, H-3, H-5	NS ²	UL	100	65	55	65	55	65	50	40	
	S	UL	150	85	75	85	75	85	70	60	

Note: UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1


Only a portion of Table 504.3 is shown above



2015 IBC Building Classification 142

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Allowable Height in Stories Above Grade Plane (Table 504.4)



Occupancy Classification	See Foot-Notes	Type of Construction									
		Type I		Type II		Type III		Type IV	Type V		
		A	B	A	B	A	B	HT	A	B	
A-1	NS	UL	5	2	3	2	3	2	1	1	
	S	UL	8	3	4	3	4	3	2	2	
A-2	NS	UL	11	3	3	2	3	2	1	1	
	S	UL	12	3	3	3	3	3	2	2	
A-3	NS	UL	11	3	2	3	2	3	2	1	
	S	UL	12	3	3	3	3	3	2	2	

Note: UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1


Only a portion of Table 504.4 is shown above



2015 IBC Building Classification 143


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Allowable Area Factor in Square Feet (Table 506.2)



Occupancy Classification	See Footnotes	Type of Construction									
		Type I		Type II		Type III		Type IV	Type V		
		A	B	A	B	A	B	HT	A	B	
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	15,000	11,500	5,500	
	S1	UL	UL	62,000	24,000	26,000	24,000	60,000	40,000	22,000	
	SM	UL	UL	46,500	23,500	42,000	23,500	45,000	24,500	16,500	
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	30,000	28,000	60,000	40,000	24,000	
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	24,500	18,000	
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	30,000	28,000	60,000	40,000	24,000	
	SM	UL	UL	46,500	28,500	42,000	28,500	45,000	24,500	18,000	

Only a portion of Table 506.2 is shown above



2015 IBC Building Classification 144

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Special Industrial Occupancies (Section 503.1.1)

- Buildings containing special industrial processes that require large floor areas and/or unusual heights are exempt from the height and area limitations of Sections 504 and 506.
- The allowance is limited to low-hazard and moderate-hazard occupancies (typically classified as Group F-1 or F-2).



2015 IBC Building Classification

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Special Industrial Occupancies (Section 503.1.1)

Some of the uses that qualify for these special allowances include:

- Rolling mills
- Structural metal fabrication shops
- Foundries
- Production and distribution of electric, gas or steam power



2015 IBC Building Classification

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Special Industrial Occupancies (Section 503.1.1)



2015 IBC Building Classification

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Buildings on the Same Lot (Section 503.1.2)

If two or more buildings are located on the same lot, they must be:

- Regulated as separate buildings in accordance with Section 705.3, or
- Considered as portions of one building.



2015 IBC Building Classification

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Buildings on the Same Lot (Section 503.1.2)

- If viewed as separate buildings, an imaginary line (determined by the designer) must be assumed between the buildings to determine exterior wall and opening protection.
- This approach is consistent with the regulation of buildings on adjacent lots insofar as fire separation distance is concerned.

2015 IBC Building Classification 149

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Buildings on the Same Lot (Section 503.1.2)

Assumed Imaginary Line Between Two Buildings on the Same Lot

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Buildings on the Same Lot (Section 503.1.2)

- If considered as a single building, the height of each building and the aggregate area of the buildings must not exceed the limitations of Sections 504 and 506.
- Other provisions of the code applicable to the aggregate building shall also apply to each building individually.

2015 IBC Building Classification 151

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Buildings on the Same Lot (Section 503.1.2)

Two Buildings on the Same Lot Regulated as a Single Building

2015 IBC Building Classification 152

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Allowable Building Height (Section 504)

- The height of a building is limited to that established by Tables 504.3 and 504.4, based on occupancy classification, type of construction, and whether or not the building is fully sprinklered.
- Before calculating the maximum allowable height (in both feet and stories), it is necessary to determine the actual height of the building.



2015 IBC Building Classification

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Allowable Height and Area— Building Height (Section 202)

- **Building height:** The vertical distance from grade plane to the average height of the highest roof surface.
- Average height for a sloping roof is the midway point between the extremes of the sloping roof.
- While the allowable floor area is normally the controlling factor in limiting building size, the building height in both stories and feet must also be checked for compliance.



2015 IBC Building Classification

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Allowable Height and Area— Sidebar

- Parapet height is not included in the determination of building height.

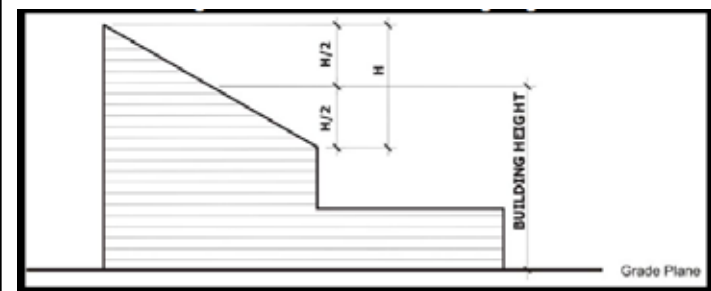


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Allowable Height and Area— Building Height (Section 502.1)



Determination of Building Height



2015 IBC Building Classification

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Allowable Height and Area— Grade Plane (Section 502.1)

- Grade plane is easy to calculate if the land adjoining a building is relatively flat.

- In the case of sloping ground, grade is the lowest ground elevation within 6 feet of an exterior wall or, if the lot line is within that 6 feet, the lowest ground elevation between the wall and the lot line.



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Allowable Height and Area— Sidebar

- **Grade Plane:** A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more that 6 feet from the building, between the building and a point 6 feet from the building.

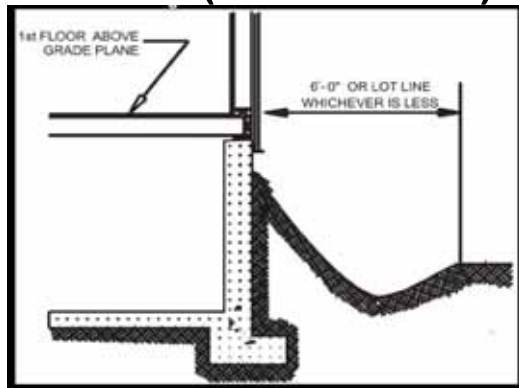


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Allowable Height and Area— Grade Plane (Section 502.1)



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Allowable Height and Area— Sidebar

Story Above Grade Plane: Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet above grade plane, or
2. More than 12 feet above the finished ground level at any point.




2015 IBC Building Classification

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Allowable Height and Area—Sidebar

- The main reason to make the story above grade plane calculation is to determine the number of stories above grade plane as regulated by Table 504.4.



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Allowable Height and Area—Story Above Grade Plane (Section 202)

Example:
Given: A building with two floor levels as shown. The grade plane has been established as 104.8'.
Determine: The number of stories above grade plane.

Solution: Since it is not more than 6 feet from grade plane to the floor surface above, Level 1 is **not** considered a story above grade plane (assuming no point exceeds 12 feet between the established grade and the floor surface). Thus, Level 2 is regulated as a story above grade plane. Level 1 is considered as a basement (see Section 502.1).

Story above Grade Plane




2015 IBC Building Classification 162

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FOR EXAMPLE

Allowable Height Increase for Sprinklers—Example

- GIVEN:** A Type VB building classified as a Group B occupancy.
- DETERMINE:** The maximum allowable height in feet and stories if the building is not sprinklered and if the building is sprinklered.



2015 IBC Building Classification 163


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FOR EXAMPLE

Allowable Height Increase for Sprinklers—Example

- SOLUTION:**

Height Increases for Sprinklers



2015 IBC Building Classification 164

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FOR EXAMPLE

Allowable Height Increase for Sprinklers—Example

- If the building is a Group R occupancy sprinklered with an NFPA 13R system, the 1-story and 20-foot increases are also reflected in the tables; however, the building cannot exceed a total of 4 stories or 60 feet.

2015 IBC Building Classification 165

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Allowable Height Increase for Sprinklers (Tables 504.3 and 504.4)

Occupancies where the installation of an automatic sprinkler system does not provide for an increase in allowable height:

- Group I-2 occupancies in Type IIB, III, IV and V buildings.
- Group H-1, H-2, H-3 and H-5 occupancies.

2015 IBC Building Classification 166

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Allowable Height and Area—Roof Structures (Section 504.3)

The height limitations for towers, spires, steeples and other roof structures are found in:

- Exception to Section 504.3 regulates such roof structures in regard to the contribution to the overall height of the building.
- Section 1510 deals more with rooftop structures as independent elements.

2015 IBC Building Classification 167

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Allowable Height and Area—Sidebar

- Section 1510.5 mandates that any spire or steeple that exceeds 85 feet in height above grade plane be of noncombustible construction.

2015 IBC Building Classification 168

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Allowable Height — Roof Structures (Section 504.3)

Height Limits of Roof Structures

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Mezzanines (Section 505)

- A mezzanine is a complying intermediate floor level placed between the floor and ceiling of a story.
- The use of the mezzanine provisions is a design option, since an intermediate floor level can also be considered an additional story.

2015 IBC Building Classification 170

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Mezzanines (Section 505.2)

The use of mezzanine provisions focuses on:

- Mezzanines do not contribute to the number of stories in the building.
- Mezzanines do not contribute to the building area.
- Mezzanines are not regulated as stories for means of egress purposes.

2015 IBC Building Classification 171

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Allowable Height and Area— Mezzanines (Section 505)

Conditions to qualify as a mezzanine include:

- Aggregate area of mezzanines limited to one-third of floor area of room where located (2 exceptions allow for greater percentages).
- Mezzanines to be open and unobstructed to room where located (5 exceptions allow for partial or full enclosure or mezzanine area).
- Mezzanines contribute to floor area for fire area size determination.

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Mezzanines (Section 505)

Mezzanine Limitations

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Mezzanine Means of Egress – (Section 505.2.2)

- The means of egress requirements for a mezzanine are fully consistent with those for a room, space or area as regulated by Chapter 10.

2015 IBC Building Classification
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Allowable Building Area Section 506

- Building area is limited to that established by Table 506.2, along with any permitted increase because of the presence of significant frontage on open space.
- The table addresses the presence of an automatic sprinkler system, as well as multistory conditions, where applicable.
- Both the allowable area of each story and the entire building must be analyzed for compliance.

2015 IBC Building Classification
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Automatic Sprinkler System Increase (Table 506.2)

- The presence of a sprinkler system can provide for a significant increase in allowable area in most buildings.
- The area limitations of Table 506.2 represent the following increases where a sprinkler system is installed in the building:
 - (S1) an increase of 300 percent for one-story buildings
 - (SM) an increase of 200 percent for multistory buildings

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Frontage Increase (Section 506.3.3)

- Formula to calculate the frontage increase (I_f) for allowable area purposes:

$$I_f = [F/P - 0.25] W/30$$

I_f = Area factor increase due to frontage
 F = Building perimeter that fronts on a public way or open space having 20 feet open minimum distance
 P = Perimeter of entire building
 W = Width of public way or open space per Section 506.3.2

The value of W must be a minimum of 20 feet. Where W exceeds 30 feet, a value of 30 feet is to be used. (Section 506.3.2)

2015 IBC Building Classification 181

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FOR EXAMPLE

Frontage Increase Example

- Given:** Yards as shown, and two 60-foot streets.
- Determine:** Percentage of frontage increase for allowable area.

2015 IBC Building Classification 182

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FOR EXAMPLE

Frontage Increase Example

- Solution:**

$$I_f = \left[\frac{F}{P} - 0.25 \right] \frac{W}{30}$$

F = 220 feet
 P = 360 feet
 W = 40 feet

$$= \left[\frac{220}{360} - 0.25 \right] \frac{30^*}{30}$$

*Value of 30' to be used as all yards $\geq 20'$ are also $\geq 30'$

$$= [0.61 - 0.25] 1.0$$

$$= [0.36] 1.0$$

$$I_f = 0.36$$

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Width Limits (Section 506.3.2)

- Formula to calculate "weighted average" (W) for frontage increase purposes:

$$W = (L_1 \times w_1 + L_2 \times w_2 + L_3 \times w_3 \dots) / F$$

W = (Width: weighted average) = Calculated width of open space
 L_n = Length of a portion of the exterior perimeter wall
 w_n = Width of open space associated with that portion of the exterior perimeter wall
 F = Building perimeter that fronts on a public way or open space having a width of 20 feet or more

The value of w_n cannot exceed 30 feet.

2015 IBC Building Classification 184

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FOR EXAMPLE

Weighted Average Example

- **Given:** A building fronted by a 60-foot street and three yards, as shown.
- **Determine:** The factor, W , to be used in the calculation of I_f (area increase due to frontage).

2015 IBC Building Classification 185

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FOR EXAMPLE

Weighted Average Example

- **Solution:**

2015 IBC Building Classification 186

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Width Limits (Section 506.3.2, Exception)

- An exception to Section 506.3.2 provides credit in special cases for those open spaces that are greater than 30 feet (9144 mm) in width.
- The quantity of W divided by 30 is permitted to be a maximum of 2 if the building meets all the criteria for unlimited area buildings in Section 507 except for compliance with the open space requirements.

2015 IBC Building Classification 187

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FOR EXAMPLE

Extended Frontage Example

- **Given:** A one-story, fully-sprinklered retail sales building with yards and street, as shown.
- **Determine:** The percentage frontage increase, I_f , for allowable area purposes.

2015 IBC Building Classification 188

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FOR EXAMPLE

Extended Frontage Example

▪ **Solution:**

$L_f = \left[\frac{F}{P} - 0.25 \right] \frac{W}{30}$	$W = \frac{150(60') + 80(35') + 80(60')}{310}$	
$F = 310$ ft		
$P = 460$ ft		
$W = 35$ ft	$W = 53.22$	
$L_f = \left[\frac{310}{460} - 0.25 \right] \frac{35}{30}$	$L_f = \left[\frac{310}{460} - 0.25 \right] \frac{53.22}{30}$	
$= [0.67 - 0.25] \cdot 1.17$	$= [0.42] \cdot 1.77$	
$= 0.42$	$= 0.74$	
$L_f = 0.49$		

*Cannot exceed 2.0 per Section 506.2.1

Frontage Increase Calculation

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Open Space Limits (Section 506.3.1)

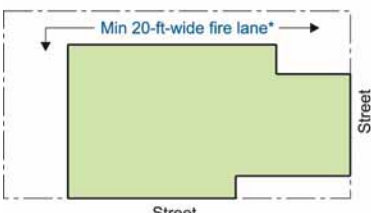
- Section 506.3.1 mandates that the open space used for a frontage increase must be on the same lot as the building or dedicated for public use.
- This ensures that the space will remain open and available. Fire personnel must also be able to access the open space from a street or fire lane.

2015 IBC Building Classification 190

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Open Space Limits (Section 506.3.1)

Entire perimeter considered for frontage increase



Min 20-ft-wide fire lane*

Open space to be on same lot or dedicated for public use and accessed from a street or approved fire lane

* Fire lane need only be provided to within 150 feet of exterior wall per Section 503.1.1 of the IFC

Street

Street

For SI: 1 foot = 304.8 mm.

2015 IBC Building Classification 191

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Open Space Availability Introduction

- Three issues to consider when evaluating potential yards for use as open space in the determination of a frontage increase:
 1. What type of public and common spaces are permitted to be utilized for frontage increases?
 2. How is the frontage increase calculated for a common yard shared by two buildings on the same lot?
 3. Does the presence of a fire wall affect the allowable area calculation for a frontage increase?

2015 IBC Building Classification 192

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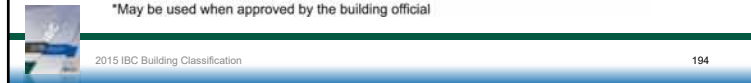
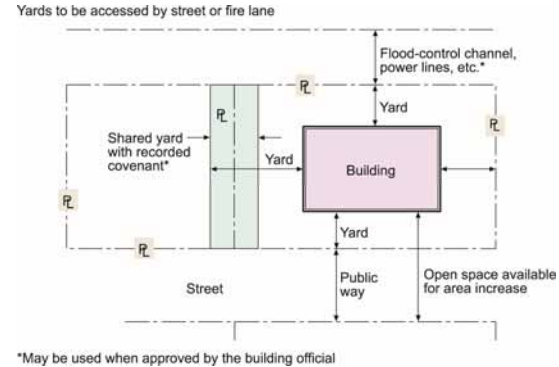
Open Space Availability Introduction

- Yards, public ways and other types of open spaces are expected to be open and relatively unobstructed from the ground to the sky.
- The decision as to what types of uses are permitted within the designated open space is left to the building official.
- Parking lots, low level landscaping, light standards and similar features are often permitted to occupy open space.
- Conversely, the storage and/or display of goods and similar uses would typically be prohibited.
- The intent is provide effective fire department access and to maintain building separation from site hazards.



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Open Space Availability (Section 506.3.1)



194

Open Space Availability (Section 506.3.2)

- The entire open space between two buildings on the same lot is available for a potential frontage increase for both buildings.
- For the purpose of determining the width of the yard, no imaginary line between the buildings is assumed.
- The entire width of the yard can be used by both buildings.



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FOR EXAMPLE Open Space Availability Example

- **Given:** Buildings 1 and 2, as shown.
- **Determine:** The percentage frontage increase for each building.




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FOR EXAMPLE

Open Space Availability Example

- **Solution:** Because both buildings are located on the same lot, both buildings may use the 30-foot yard that separates them for area increase. Each building may use the total perimeter for area increase, provided access is available in accordance with Section 506.3.2, Item #2.




2015 IBC Building Classification 197

197

Open Space Availability (Section 506.3.2, Item #3)

- A fire wall separates a single structure into two buildings. In this case, the use of the fire wall prohibits the use of the 50-foot yard for a frontage increase for Building A.

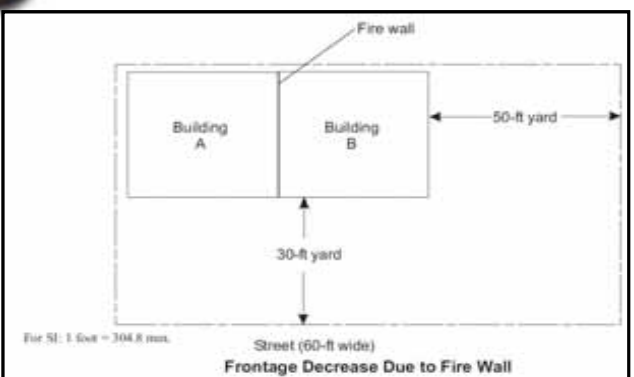


2015 IBC Building Classification 198


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FOR EXAMPLE

Open Space Availability Example



Fire SI: 1 Exe = 304.8 max.
Street (60-ft wide)
Frontage Decrease Due to Fire Wall




2015 IBC Building Classification 199

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Allowable Area Determination (Section 506.2)

- Determination of the allowable area of a building differs depending on the conditions presented:
 - Single-occupancy, one-story building 506.2.1
 - Mixed-occupancy, one-story building 506.2.2
 - Single-occupancy, multistory building 506.2.3
 - Mixed-occupancy, multistory building 506.2.4



2015 IBC Building Classification 200

200

Allowable Area Determination Single-Occupancy, One-Story (Section 506.2.1)

- The allowable area of a single-occupancy building with no more than one story above grade plane shall be determined by the following equation:

$$A_a = A_t + (NS \times I_f)$$

A_a = Allowable building area
 A_t = Tabular allowable area factor (NS, S1, or S13R value, as applicable) in accordance with Table 506.2
 NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether building is sprinklered)
 I_f = Area factor increase due to frontage in accordance with Section 506.3

2015 IBC Building Classification 201

201

FOR EXAMPLE

Total Allowable Area Example #1

- Given:** A one-story, Type VA building housing a Group B occupancy.
- Determine:** The maximum allowable area if the building is fully sprinklered (include frontage increase).

Diagram showing a building footprint with dimensions: 200' wide, 35' deep, and 18' from the street edge. The street is labeled '40 Street'.

2015 IBC Building Classification 202

202

FOR EXAMPLE

Total Allowable Area Example #1

- Solution:** $A_a = A_t + (NS \times I_f)$

Tabular area (A_t):	72,000 sf	S1, T506.2
Frontage increase ($NS \times I_f$):	<u>4,500 sf</u>	18,000 x 0.25
Total allowable area (A_a):	76,500 sf	Additive

The building is limited to 76,500 sf.

2015 IBC Building Classification 203

203

Allowable Area Determination Mixed-Occupancy, One-Story (Section 506.2.2)

- The allowable area of a mixed-occupancy building with no more than one story above grade plane shall be determined by the following equation:

$$A_a = A_t + (NS \times I_f)$$

- The determination shall comply with the applicable provisions of Section 508.1 for each applicable occupancy as established in Section 508.

2015 IBC Building Classification 204

204

FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, One-Story Separated Occupancies Example

- **Given:** A one-story, 78,000-square foot, 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-percent frontage increase.
- **Determine:** Does the building comply with the allowable area limitations based on separated occupancies?

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

2015 IBC Building Classification 205

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FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, One-Story Separated Occupancies Example

For SI: 1 square foot = 0.0929 m².

2015 IBC Building Classification 206

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FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, One-Story Separated Occupancies Example

- **Solution:**

$a_B = 46,000$	$A_B = 92,000 + 0.25(23,000) = 97,750$
$a_M = 26,000$	$A_M = 50,000 + 0.25(12,500) = 53,125$
$a_{A-2} = 6,000$	$A_{A-2} = 38,000 + 0.25(9,500) = 40,375$

$$\frac{46,000}{97,750} + \frac{26,000}{53,125} + \frac{6,000}{40,375} \leq 1.0??$$

$$0.47 + 0.49 + 0.15 = 1.11 > 1.0$$

Conclusion: Building area exceeds allowable area as shown ❌

2015 IBC Building Classification 207

207

Allowable Area Determination Single-Occupancy, Multistory (Section 506.2.3)

- The allowable area of a single-occupancy building with more than one story above grade plane shall be determined by the following equation:

$$A_a = [A_t + (NS \times I_f)] \times S_a$$

A_a = Allowable building area
 A_t = Tabular allowable area factor (NS, S1, or S13R value, as applicable) in accordance with Table 506.2
 NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether building is sprinklered)
 I_f = Area factor increase due to frontage in accordance with Section 506.3
 S_a = Actual number of building stories above grade plane, not to exceed three (not to exceed four for 13R sprinklered buildings)

2015 IBC Building Classification 208


208

Allowable Area Determination Single-Occupancy, Multistory (Section 506.2.3)

- No individual story shall exceed the allowable area (A_a) as determined by the equation:

$$A_a = [A_t + (NS \times I_f)] \times S_a$$

- Using the value of $S_a = 1$



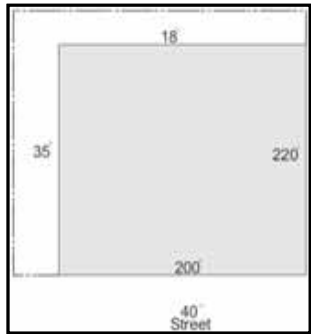

2015 IBC Building Classification 209

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FOR EXAMPLE

Total Allowable Area Example #2

- Given:** A two-story, Type VA building housing a Group B occupancy.
- Determine:** The maximum allowable area if the building is fully sprinklered (include frontage increase).

2015 IBC Building Classification 210

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FOR EXAMPLE

Total Allowable Area Example #2

- Solution:** $A_a = [A_t + (NS \times I_f)] \times S_a$

Tabular area (A_t):	72,000 sf	S1, T506.2
Frontage increase ($NS \times I_f$):	<u>4,500 sf</u>	18,000 x 0.25
	76,500 sf	Additive
Multistory increase (S_a):	<u> x 2</u>	2 stories AGP
Total allowable area (A_a):	153,000 sf	

The building is limited to 153,000 sf, and no single story is permitted to exceed 76,500 sf.



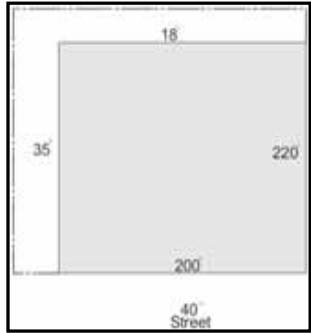

2015 IBC Building Classification 211

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FOR EXAMPLE

Allowable Area Determination Single Occupancy Multistory Example #3

- Given:** A four-story, Type VA building housing a Group B occupancy.
- Determine:** The maximum allowable area if the building is fully sprinklered (include frontage increase).

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**Allowable Area Determination
Single-Occupancy, Multistory
Example #3**

Solution: $A_a = [A_t + (NS \times I_f)] \times S_a$

Tabular area (A_t):	72,000 sf	S1, T506.2
Frontage increase ($NS \times I_f$):	$\frac{4,500 \text{ sf}}{76,500 \text{ sf}}$	18,000 x 0.25
Multistory increase (S_a)	$\frac{\quad}{\quad} \times 3^*$	Limit on stories
Total allowable area (A_a):	229,500 sf	

The building is limited to 229,500 sf, and no single story is permitted to exceed 76,500 sf. If all stories have the same floor area, it would result in a maximum of 57,375 sf per story.




2015 IBC Building Classification 213

213

**Allowable Area Determination
Mixed-Occupancy, Multistory
(Section 506.2.4)**

- Each story of a mixed-occupancy building with more than one story above grade plane shall individually comply with the applicable requirements of Section 508.1.
- In addition, for those buildings four or more stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories does not exceed three.




2015 IBC Building Classification 214

214

**Allowable Area Determination
Mixed-Occupancy, Multistory
(Section 506.2.4)**

- Determining compliance with allowable area is more complicated in multistory mixed-occupancy buildings.
- Where the building is no more than 3 stories above grade plane, each floor must be evaluated independently and comply with the applicable provisions of Section 508.1. No additional determination of building floor area is necessary.




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215

**Allowable Area Determination
Mixed-Occupancy, Multistory
(Section 506.2.4)**

- However, where there are 4 or more stories above grade plane, each individual story must comply, as well as the aggregate floor area of all stories.
 - In such situations, the total building area is limited such that the sum of the ratios of the actual area of each story divided by the allowable area of each story, based on the applicable mixed occupancy provisions of Section 508.1, is not to exceed 3.




2015 IBC Building Classification 216

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FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, Multistory Example

- **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?



2015 IBC Building Classification 217

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FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, Multistory Separated Occupancies Example

A-2 8,000 square feet	R-1 38,000 square feet	
R-1 46,000 square feet		
R-1 46,000 square feet		
A-3 24,000 square feet	R-1 8,000 square feet	M 14,000 square feet

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

For SI: 1 square foot = 0.0929 m².



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FOR EXAMPLE


Allowable Area Determination Mixed-Occupancy, Multistory Separated Occupancies Example

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



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FOR EXAMPLE

Allowable Area Determination Mixed-Occupancy, Multistory Separated Occupancies Example

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.



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Mixed Occupancy Area Determination (Section 506.5)

- Further information required to evaluate allowable building area, as well as height, is provided in Section 508.
- The evaluation of height and area varies depending on which of the following options is chosen by the designer:
 - Accessory occupancies
 - Nonseparated occupancies
 - Separated occupancies



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Unlimited Area Buildings (Section 507)

- The provisions of Section 507 allow for buildings with large floor areas to be constructed with no requirement for:
 - Fire-resistance-rated construction, or
 - Fire walls.

Risks have been addressed to the point that the regulation for allowable area is unnecessary.



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Unlimited Area Buildings (Section 507.1)

- Use of Section 507 is limited to the occupancies and configurations specified within the provisions.
- Basements are permitted where not more than one story below grade plane.
- Allowance is made for other occupancies provided they comply with the provisions of Section 508.1.1 for accessory occupancies.



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Unlimited Area Buildings— Open Space (Section 507.2)

- Open space of at least 60 feet (18 288 mm) must be provided around complying unlimited area buildings. The minimum 60-foot width is permitted to be reduced to 40 feet provided:
 - The reduced open space applies to a maximum of 75 percent of the building's perimeter, and



225

Unlimited Area Buildings— Reduced Open Space (Section 507.2.1)

- A minimum 3-hour fire-resistance rating is required for any exterior wall facing the reduced open space, and
- Openings in the exterior wall facing the reduced open space have a minimum fire protection rating of 3 hours.



226

Unlimited Area Buildings— Reduced Open Space (Section 507.2.1)

- The allowance for reducing the required open space from 60 feet (18 288 mm) to 40 feet (12 192 mm) is only permitted for the following unlimited area buildings:
 - One-story nonsprinklered Groups F-2 and S-2 (Section 507.3).
 - One-story sprinklered Groups B, F, M, S and A-4 (Section 507.4).



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Unlimited Area Buildings— Reduced Open Space (Section 507.2.1)

- Two-story sprinklered Groups B, F, M and S (Section 507.5).
- One-story sprinklered Group A-3 (Sections 507.6 and 507.7).
- One-story sprinklered motion picture theaters (Section 507.12).



228

One-story Nonsprinklered Buildings (Section 507.3)

- A one-story building housing a Group F-2 and/or S-2 occupancy is permitted to be unlimited in area if it is completely surrounded by minimum 60-foot (18 288 mm) public ways and/or yards.
- An automatic sprinkler system is not required in order to obtain unlimited area status since the occupancies involved are not expected to have any significant fire loading.



229

One- and Two-story Sprinklered Buildings (Sections 507.4, 507.5)

- A building of no more than two stories is permitted to be unlimited in area where:
 - The building houses only Group B, F, M, and/or S occupancies.
 - The building is protected with a sprinkler system throughout.
 - Open space and/or public ways at least 60 feet (18 288 mm) in width adjoin and surround the building.



230

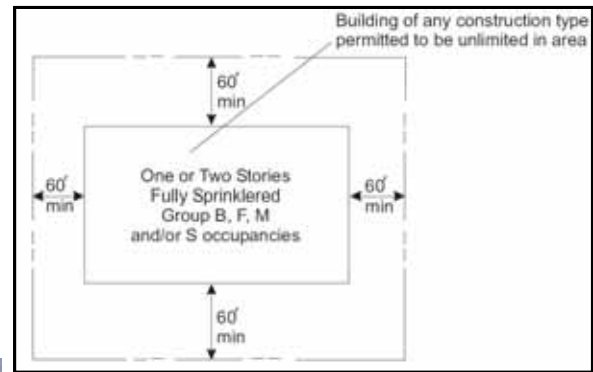
One- and Two-story Sprinklered Buildings (Sections 507.4, 507.5)

- The combination of limited height, low-to-moderate hazard uses, full sprinkler protection and significant fire department access from the exterior severely reduces the potential fire severity to a level that the allowance for unlimited area is reasonable.



231

One- and Two-story Sprinklered Buildings (Sections 507.4, 507.5)



232

Allowable Height and Area—Sidebar

- Although the allowance for unlimited floor area typically permits the building to be of any construction type, the actual type of construction will be important in the application of other code provisions.



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One-story Group A-4 Occupancies (Section 507.4)

- Group A-4 occupancies are granted unlimited area in a manner consistent with that for B, F, M and S occupancies with two exceptions:
 - The Group A-4 building can be only one story in height.
 - The building's construction must be of Type I, II, III or IV.



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Group A-1 and A-2 Occupancies (Section 507.4.1)

- In complying unlimited area buildings housing Group A-4, B, F, M and/or S occupancies, it is permissible to include a limited amount of Group A-1 and A-2 occupancies within the building. The following conditions exist:
 - The type of construction of the building must be Type I, II, III or IV.



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Group A-1 and A-2 Occupancies (Section 507.4.1)

- The Group A-1 and A-2 occupancies shall be separated from other spaces as required by Section 508.4.4 for separated occupancies with no reduced rating allowed for sprinkler protection. This will result in a minimum 2-hour fire-resistance-rated separation.



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Group A-1 and A-2 Occupancies (Section 507.4.1)

- The floor area of each Group A-1 and A-2 occupancy cannot exceed the maximum allowable area established in Section 503.1, which includes applicable frontage and sprinkler increases.
- All required exits from Group A-1 and A-2 occupancies must discharge directly to the exterior of the building.



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Unlimited Area Group A-3 Buildings (Sections 507.6 and 507.7)

The area of a Group A-3 occupancy is permitted to be unlimited under the following conditions:

- Maximum of one story in height.
- Used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court.
- Type II, III or IV construction.



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Unlimited Area Group A-3 Buildings (Sections 507.6 and 507.7)

- No stage, but may contain a platform.
- Fully sprinklered.
- Surrounded and adjoined by minimum 60-foot (18 288 mm) yards and/or public ways.
- Assembly floor located within 21 inches (533 mm) of street or grade level with egress provided by ramps rather than stairs, where applicable (only required where building is Type III or IV construction).



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Unlimited Area Buildings— Group H Occupancies (Section 507.8)

- Although very limited in unlimited area buildings, hazardous materials may be found in greater quantities in manufacturing and storage facilities. Group H-2, H-3 and H-4 occupancies are permitted to be located in unlimited area buildings containing Group F and S occupancies with the following limitations:
 - Compliance with the unlimited area provisions of Sections 507.4 and 507.5 for Group F and S occupancies.



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Unlimited Area Buildings— Group H Occupancies (Section 507.8)

- Aggregate floor area of Group H occupancies located at the building's perimeter limited to 10 percent of the actual building area or Group H allowable area per Section 506 with any applicable frontage increase.
- Aggregate floor area of Group H occupancies not located on perimeter of building limited to 25 percent of Group H area limits in Section 506.



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Group H in Unlimited Area Buildings—Example

- GIVEN:** A 130,000 square foot Group F-1 of Type IIB construction having unlimited area under the provisions of Section 507.4. One H-3 storage room is located on the building's perimeter. Multiple H-3 storage rooms are located such that they are not located along an exterior wall.
- DETERMINE:** The maximum allowable floor areas for the H-3 storage rooms.



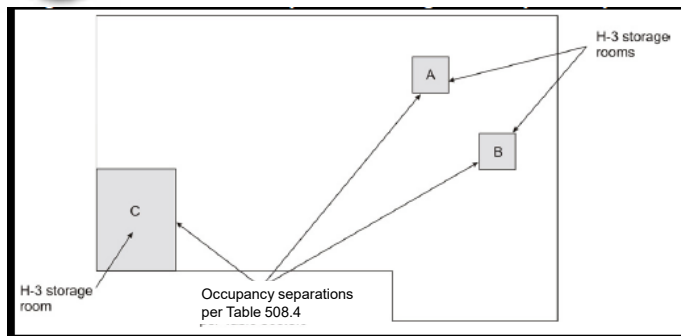
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Group H in Unlimited Area Buildings—Example



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Group H in Unlimited Area Buildings—Example

- SOLUTION:**

Aggregate area of Group H to be lesser of:	
Maximum 10% of area of building:	13,000 sf
Area limitations of Table 506.2 as modified: (Based on 14,000 + 3,500 frontage increase)	17,500 sf
Total Group H permitted	13,000 sf
Aggregate area not located at perimeter:	
Limited to 25% of Group H limits of Table 506.2:	3,500 sf
Remainder must be located at perimeter:	9,500 sf



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Other Unlimited Area Buildings (Sections 507.9 through 507.13)

The following occupancies are permitted to be unlimited in floor area subject to the specific requirements:

- Unlimited Group B/F/M/S building with Group H-5 (Sec. 507.9)
- Group H-2 aircraft paint hangars (Sec. 507.10)
- Group E educational buildings (Sec. 507.11)
- Group A-1 motion picture theaters (Sec. 507.12)
- Covered/open mall buildings and anchor buildings (Sec. 507.13)



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Mixed Use and Occupancy— Mixed Occupancies (Section 508)

Where two or more distinct occupancies are located within a building, the provisions of Section 508 must be applied.

The scope of Section 508 is limited to:

- Occupancy classification.
- Allowable building height.
- Allowable building area.
- Separation.



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Mixed Use and Occupancy— Mixed Occupancies (Section 508)

Three methods established in Section 508 address mixed-occupancy conditions:

- Accessory Occupancies.
- Nonseparated Occupancies.
- Separated Occupancies.

Construction cost and design flexibility are contributing factors to the preference of one method over another.



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**Mixed Use and Occupancy—
Mixed Occupancies (Section 508.1)**

- In a mixed-occupancy building, the applicable provisions of Section 508 must be met:
 - 508.2 Accessory occupancies
 - 508.3 Nonseparated occupancies
 - 508.4 Separated occupancies
- A combination of these methods may also be used where appropriate.



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**Mixed Use and Occupancy—
Mixed Occupancies (Section 508.1)**

Exceptions to the use of Section 508 include:

- Section 510 Special Provisions
- Group H-1 occupancies, as well as Group H-2 and H-3 occupancies in detached buildings, cannot be located in a mixed-occupancy building
- Live/work units complying with Section 419 are not considered as mixed-occupancy units



250

**Accessory Occupancies
(Section 508.2)**

A complying accessory occupancy:

- Must be subsidiary to the main occupancy of the building or portion of a building.
- Aggregate accessory occupancies are limited to 10 percent of the floor area on the story on which they are located.



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**Accessory Occupancies
(Section 508.2)**

- The aggregate floor area of accessory occupancies cannot exceed the tabular allowable floor area values established by Table 506.2 for nonsprinklered buildings.
- If all of these conditions are met, then the use of the accessory occupancies provisions is acceptable.



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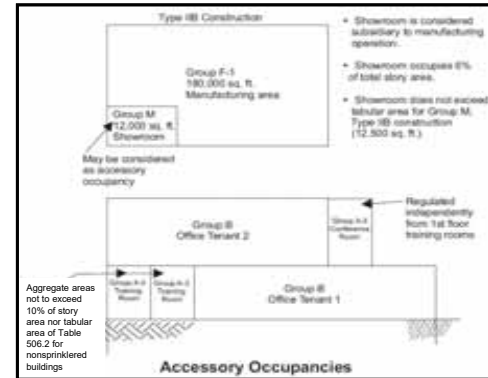
Accessory Occupancies (Section 508.2)

- Examples of uses that may be considered as accessory occupancies include:
 - 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.



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Accessory Occupancies (Section 508.2)



254

Accessory Occupancies (Section 508.2)

Occupancy classification

- Accessory occupancies must be assigned to an occupancy group based on their own unique characteristics.
- The spaces in the building must meet all of the code requirements applicable to the specific occupancy classification.



255

Accessory Occupancies (Section 508.2)

Allowable Area and Allowable Height

- The allowable height and area of any accessory occupancy is to be based on that of the main occupancy.



256

Accessory Occupancies (Section 508.2)

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

23,000	Table 503
+ 5,750	Frontage increase
+ 69,000	Sprinkler increase
97,750 sq. ft.	Total allowable floor area

Allowable Area of Accessory Occupancy

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Accessory Occupancies (Section 508.2)

Allowable Height of Accessory Occupancy

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Accessory Occupancies (Section 508.2) Separation

- The application of the accessory occupancy method will result in no physical or fire-resistance-rated separation being required between the main occupancy and the accessory occupancy.

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Nonseparated Occupancies (Section 508.3)

- Occupancies are not required to be separated if they are in compliance with the provisions of Section 508.3. If the building is designed in part to address the most restrictive and most hazardous conditions that are expected to occur, a fire-resistance-rated separation is not necessary.
- The worst-case application of the provisions eliminates the need for any separation.

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Mixed Use and Occupancy— Sidebar

- The nonseparated occupancies method is the most common method utilized in the regulation of a mixed-occupancy building.



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Nonseparated Occupancies (Section 508.3)

Occupancy classification

- Each occupancy must be individually classified based on the use of the space, following the general provisions of Section 302.1.
- The areas of the building regulated as nonseparated occupancies must meet all of the code requirements applicable to the specific occupancy classification under consideration.



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Nonseparated Occupancies (Section 508.3)

Occupancy classification

- However, the most restrictive applicable provisions of Chapter 9 shall apply to the entire building, not just the specific occupancy where they are required.



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Nonseparated Occupancies (Section 508.3)

Allowable Area and Allowable Height

- Based on the most restrictive allowances for the occupancies involved.
- Based on the building's type of construction, each occupancy is individually evaluated for height and area in accordance with Section 503.1.



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Nonseparated Occupancies (Section 508.3)

Allowable Area and Allowable Height

- Increases established for allowable height and area are permitted for open space and sprinkler protection, where applicable.
- The most restrictive height and area of the occupancies under consideration is then applied to the entire building.



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Nonseparated Occupancies (Section 508.3)

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

Allowable Height and Area of Nonseparated Occupancies


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Nonseparated Occupancies (Section 508.3.2)

	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

Using the nonseparated occupancies method, the maximum allowable area is 19,800 square feet per story with a maximum of two stories in the building.

The most restrictive fire protection requirements (typically sprinkler and alarm systems) for each occupancy to be applied to entire building.



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Nonseparated Occupancies (Section 508.3)

Separation

- If the nonseparated occupancies method is used, no physical or fire-resistance-rated separation is required between the occupancies.


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**Separated Occupancies
(Section 508.4)**

- The only method that potentially requires a fire-resistance-rated separation between adjacent occupancies.
- Table 508.4 establishes the degree of fire resistance that is mandated.
- It is also possible that no separation is required.



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**Separated Occupancies
(Section 508.4)**

Occupancy classification

- Consistent with the other two methods, the occupancies must be classified based on their specific functions.
- Each area of the building shall meet all of the code requirements for the occupancies involved.



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**Separated Occupancies
(Section 508.4)**

Allowable area

- The unity formula is used to determine allowable area per story. This provides a weighted average of the allowable areas for the different occupancies located on each story.



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**Separated Occupancies
(Section 508.4)**

Allowable area

- Compliance is achieved where the sum of the ratios of the actual floor area divided by the allowable floor area for each of the occupancies involved do not exceed 1.



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Separated Occupancies (Section 508.4)

Allowable area

The formula is:

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

Where a_1 , a_2 and a_3 represent the actual floor areas of the individual occupancies, and A_1 , A_2 and A_3 represent the maximum allowable floor areas.



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Separated Occupancies (Section 508.4)

Allowable area

Increases for sprinkler protection and open frontage are permitted, where applicable:

- Sprinkler increase—requires installation of an NFPA 13 sprinkler system.
- Frontage increase—based on the open perimeter of the entire building, not just that of the occupancy.




2015 IBC Building Classification 274

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FOR EXAMPLE

Mixed Use and Occupancy—Example

- GIVEN:** A one-story, 66,000 square foot, 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 percent frontage increase.
- DETERMINE:** If the building complies with the allowable area limitations based on separated occupancies.



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FOR EXAMPLE

Mixed Use and Occupancy—Example

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Mixed Use and Occupancy—Example

▪ SOLUTION:

$$\frac{a_B}{A_B} + \frac{a_M}{A_M} + \frac{a_{J-2}}{A_{J-2}} \leq 1.0?$$

$$a_B = 34,000 \quad A_B = 92,000 + 0.25(23,000) = 97,750$$

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

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

$$\frac{34,000}{97,750} + \frac{26,000}{53,125} + \frac{6,000}{40,375} \leq 1.0$$

$$0.35 + 0.49 + 0.15 = 0.99 > 1.0$$

∴ Building complies for allowable area as shown.

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Separated Occupancies (Section 508.4)

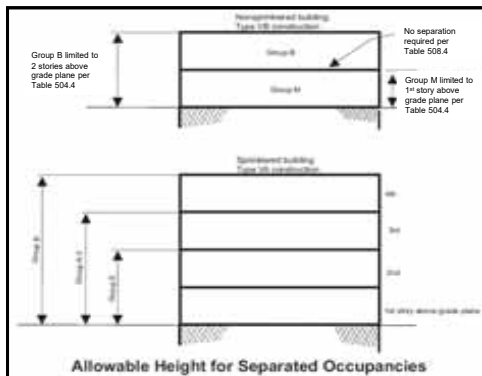
Allowable height

The maximum allowable height of each occupancy is regulated independently based on the building's type of construction.

An occupancy cannot be located higher than that permitted by Tables 504.3 and 504.4, if applicable.

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Separated Occupancies (Section 508.4)



279

Separated Occupancies (Section 508.4)

Separation


The requirement for a fire-resistance-rated separation between occupancies is based on Table 508.4.

Requirements range from no separation to anywhere from 1 hour to 4 hours. Fire barriers and horizontal assemblies are to be used to provide a complete separation between occupancies.

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Horizontal Building Separation Allowance (Section 510.2)

- The benefit of Section 510.2 is the ability to create two separate buildings, one above the other, for the purpose of applying several specific code provisions independently to each building.




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Horizontal Building Separation Allowance (Section 510.2)

Referred to as “podium” or “pedestal” buildings, they may be viewed as separate buildings above and below the required fire separation for these purposes:

- Determination of allowable area limits.
- Continuity of fire walls.
- Limitation on number of stories.
- Type of construction.




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Horizontal Building Separation Allowance (Section 510.2)

Requirements to be considered as separate and distinct buildings:

- Lower building of Type IA construction.
- Lower building separated from building above with horizontal assembly having a minimum fire-resistance rating of 3 hours.




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Horizontal Building Separation Allowance (Section 510.2)

- Vertical enclosures through horizontal assembly to have a minimum fire-resistance rating of 2 hours (see exception for 3-hour/1-hour allowance).
- Building above horizontal assembly limited to Group A with individual occupant loads less than 300, B, M, R and/or S.
- Building below horizontal assembly to be any occupancies other than Group H.
- Maximum building height in feet based on most restrictive height of the upper and lower buildings.



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