

2024 IBC Building Areas, Fire Areas and Mixed Occupancies







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Instructor: Bill Clayton, CBO, CHCO, CBCO



- Over 33 years of Code Administration and enforcement experience
- Instructor, Consultant, Inspector, Plans Examiner, RCBO
- ICC/IBC General Committee 2015 cycle
- ICC/IEBC Committee 2009 & 2012 cycle
- Instructor with CCC & Shums Coda 11+ years
- Contract 3rd party Instructor for ICC 8+ years
- CO-Author of 2024 ICC resource book "Fire Stopping, Joint Systems, and Dampers"



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What are we going to discuss?



- Building Area Calculations
 - Actual
 - Allowable
- Building Height Requirements
- Mixed Occupancies
 - Incidental Accessory Occupancies
 - Accessory Occupancies
 - Separated Occupancies
 - Nonseparated Occupancies
- Fire Areas

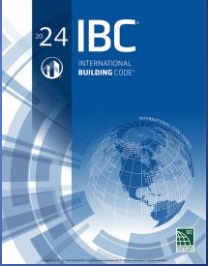


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Using the IBC

- Calculate Building Area
- Determine Occupancy Classification
- Determine Type of Construction
- Determine the Maximum Height
- Calculate Maximum Building Area
- Evaluate Mixed Occupancies




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302.1 Occupancy classification

- Structures shall be classified into one or more of the occupancy groups listed in this section based on the nature of the hazards and risks to building occupants generally associated with the intended purpose of the building or structure.

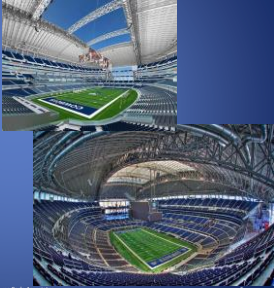


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302.1 Occupancy classification

- An area, room or space that is intended to be occupied at different times for different purposes shall comply with all applicable requirements associated with such potential multipurpose.
- Structures containing multiple occupancy groups shall comply with Section 508.




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302.1 Occupancy classification

- Where a structure is proposed for a purpose that is not specifically listed in this section, such structure shall be classified in the occupancy it most nearly resembles based on the fire safety and relative hazard.



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302.1 Occupancy classification

- Occupied roofs shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard, and shall comply with Section 503.1.4.




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Assembly Group A 303

- Gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation.




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Assembly Group A 303

- A-1
 - Fixed seating, intended for the production and viewing of the performing arts or motion pictures
- A-2
 - Intended for food and/or drink consumption w/kitchen
- A-3
 - Intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A




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Assembly Group A 303

- A-4
 - Intended for viewing of indoor sporting events and activities with spectator seating
- A-5
 - Intended for participation in or viewing outdoor activities



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Small assembly spaces 303.1.2

- The following rooms and spaces shall not be classified as Assembly occupancies:
 1. A room or space used for assembly purposes with an occupant load of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
 2. A room or space used for assembly purposes that is less than 750 square feet in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.



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Assembly Group A

- A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.
- Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 are not considered separate occupancies.



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Business Group B 304

- The use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts.



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Educational Group E 305

- The use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade.



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Group E, day care facilities 305.2



- This group includes buildings and structures or portions thereof occupied by more than five children older than 2-½ years of age who receive educational, supervision or personal care services for fewer than 24 hours per day.

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Group E, day care facilities 305.2

- Rooms and spaces within places of religious worship providing such day care during religious functions shall be classified as part of the primary occupancy.
- A facility having five or fewer children receiving such day care shall be classified as part of the primary occupancy.
- A facility such as the above within a dwelling unit and having five or fewer children receiving such day care shall be classified as a Group R-3 occupancy or shall comply with the International Residential Code.



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Factory/Industrial Group F

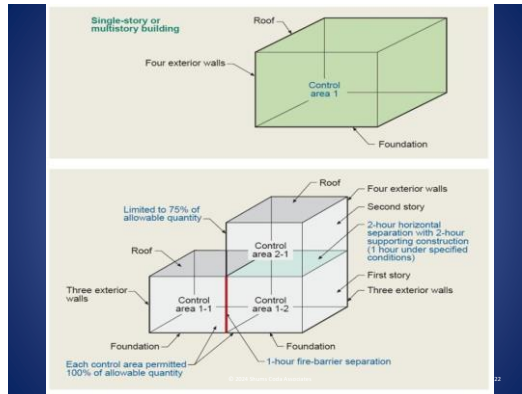
- The use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.
- F-1 Moderate Hazard
- F-2 Low-Hazard



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Hazardous materials control areas IBC Table 414.2.2

TABLE 414.2.2 (F) TABLE 414.2.2 DESIGN AND NUMBER OF CONTROL AREAS

STORY	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Higher than above grade	5	1	2
	7.5	2	2
	10	2	2
	12.5	2	2
	15	2	2
	20	2	2
Below grade (BM)	1	4	1
	1	3	1
	2	2	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 302.2.2, 304.2.2, 307.2.2, 308.2.2, 309.2.2, 310.2.2, 311.2.2, 312.2.2, 313.2.2, 314.2.2, 315.2.2, 316.2.2, 317.2.2, 318.2.2, 319.2.2, 320.2.2, 321.2.2, 322.2.2, 323.2.2, 324.2.2, 325.2.2, 326.2.2, 327.2.2, 328.2.2, 329.2.2, 330.2.2, 331.2.2, 332.2.2, 333.2.2, 334.2.2, 335.2.2, 336.2.2, 337.2.2, 338.2.2, 339.2.2, 340.2.2, 341.2.2, 342.2.2, 343.2.2, 344.2.2, 345.2.2, 346.2.2, 347.2.2, 348.2.2, 349.2.2, 350.2.2, 351.2.2, 352.2.2, 353.2.2, 354.2.2, 355.2.2, 356.2.2, 357.2.2, 358.2.2, 359.2.2, 360.2.2, 361.2.2, 362.2.2, 363.2.2, 364.2.2, 365.2.2, 366.2.2, 367.2.2, 368.2.2, 369.2.2, 370.2.2, 371.2.2, 372.2.2, 373.2.2, 374.2.2, 375.2.2, 376.2.2, 377.2.2, 378.2.2, 379.2.2, 380.2.2, 381.2.2, 382.2.2, 383.2.2, 384.2.2, 385.2.2, 386.2.2, 387.2.2, 388.2.2, 389.2.2, 390.2.2, 391.2.2, 392.2.2, 393.2.2, 394.2.2, 395.2.2, 396.2.2, 397.2.2, 398.2.2, 399.2.2, 400.2.2, 401.2.2, 402.2.2, 403.2.2, 404.2.2, 405.2.2, 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961.2.2, 962.2.2, 963.2.2, 964.2.2, 965.2.2, 966.2.2, 967.2.2, 968.2.2, 969.2.2, 970.2.2, 971.2.2, 972.2.2, 973.2.2, 974.2.2, 975.2.2, 976.2.2, 977.2.2, 978.2.2, 979.2.2, 980.2.2, 981.2.2, 982.2.2, 983.2.2, 984.2.2, 985.2.2, 986.2.2, 987.2.2, 988.2.2, 989.2.2, 990.2.2, 991.2.2, 992.2.2, 993.2.2, 994.2.2, 995.2.2, 996.2.2, 997.2.2, 998.2.2, 999.2.2, 1000.2.2

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414.2.4 Control areas fire resistance ratings

- The required fire-resistance rating for fire barriers shall be in accordance with Table 414.2.2. The floor assembly of the control area and the construction supporting the floor of the control area shall have a minimum 2-hour fire-resistance rating.

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High-Hazard Group H 307

- H-1
 - Buildings and structures containing materials that pose a detonation hazard
- H-2
 - Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning
- H-3
 - Buildings and structures containing materials that readily support combustion or that pose a physical hazard



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High-Hazard Group H 307

- H-4
 - Buildings and structures which contain materials that are health hazards
- H-5
 - Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2)




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Institutional Group I 308

- The use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self-preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted.



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24 Hour Basis Definition



Rural outpatient surgery center with "hotel" sleeping rooms available for patients prior to surgery. Mixed occupancy

- The actual time that a person is an occupant within a facility for the purpose of receiving care.
- It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

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Incapable of Self-Preservation

- Persons because of age, physical limitations, mental limitations, chemical dependency, or medical treatment who cannot respond as an individual to an emergency situation.



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Custodial Care

- Assistance with day-to-day living tasks; such as assistance with cooking, taking medication, bathing, using toilet facilities and other tasks of daily living.
- Custodial care include occupants who evacuate at a slower rate and/or who have mental and psychiatric complications.



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308.2 Institutional Group I-1

- Institutional Group I-1 occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a 24 hour basis in a supervised environment and receive *custodial care*. Buildings of Group I-1 shall be classified as one of the occupancy conditions specified in Section 308.2.1 or 308.2.2



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308.2.1 Condition 1

- This occupancy condition shall include buildings in which all persons receiving *custodial care* who, without any assistance, are capable of responding to an emergency situation to complete building evacuation.



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308.2.2 Condition 2

- This occupancy condition shall include buildings in which there are any persons receiving *custodial care* who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.




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308.2.3 - Six to sixteen persons receiving care

- A facility such as above, housing not fewer than six and not more than 16 persons receiving such care, shall be classified as Group R-4.




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308.2.4 - Five or Fewer Persons

- A facility such as the above with five or fewer persons receiving such care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or with Section P2904 of the International Residential Code.




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308.3.1 Group I-2 Occupancy conditions

- Buildings of Group I-2 shall be classified as one of the occupancy conditions specified in Section 308.3.1.1 or 308.3.1.2.



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308.3.1.1 Condition 1

- This occupancy condition shall include facilities that provide nursing and medical care but do not provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to nursing homes and foster care facilities.



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308.3.1.2 Condition 2

- This occupancy condition shall include facilities that provide nursing and medical care and could provide emergency care, surgery, obstetrics or in-patient stabilization units for psychiatric or detoxification, including but not limited to hospitals.



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308.3.2 – Five or Fewer Persons

- A facility such as the above with five or fewer persons receiving such care shall be classified as Group R-3 or shall comply with the International Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or with Section P2904 of the International Residential Code.




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Institutional Group I-3 308.4

- I-3
 - Inhabited by more than five persons who are under restraint or security.
 - An I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control.



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Institutional Group I 308.5

- I-4 Day Care Facilities
 - occupied by more than five persons of any age who receive custodial care for fewer than 24 hours per day by persons other than parents or guardians, relatives by blood, marriage or adoption, and in a place other than the home of the person cared for.
 - Adult care facilities
 - Child care facilities




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Classification as Group E 308.5.1

- A child day care facility that provides care for more than five but no more than 100 children 2 ½ years or less of age, where the rooms in which the children are cared for are located on a level of exit discharge serving such rooms and each of these child care rooms has an exit door directly to the exterior, shall be classified as Group E.



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Institutional Group I-4 308.5.2

- Rooms and spaces within places of religious worship providing such care during religious functions shall be classified as part of the primary occupancy.
- A facility having five or fewer persons receiving custodial care shall be classified as part of the primary occupancy.
- A facility such as the above within a dwelling unit and having five or fewer persons receiving custodial care shall be classified as a Group R-3 occupancy or shall comply with the International Residential Code.



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Mercantile Group M 309

- The use of a building or structure or a portion thereof, for the display and sale of merchandise and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public.



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Residential Group R 310

- The use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the International Residential Code




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Residential Group R 310

- R-1
 - Residential occupancies containing sleeping units where the occupants are primarily transient in nature
- R-2
 - Residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature




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Residential Group R 310

- R-3
 - Buildings that do not contain more than two dwelling units.
 - Care facilities that provide accommodations for five or fewer persons receiving care.
 - Congregate living facilities (nontransient) with 16 or fewer persons.
 - Congregate living facilities (transient) with 10 or fewer occupants
 - Lodging houses (transient) with five or fewer occupants.




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310.4.2 Lodging houses

- Owner-occupied lodging houses with five or fewer guest rooms shall be permitted to be constructed in accordance with the International Residential Code provided that an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the International Residential Code.




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Definitions

- **LODGING HOUSE.** A one-family dwelling where one or more occupants are primarily permanent in nature and rent is paid for guest rooms.
- **GUEST ROOM.** A room used or intended to be used by one or more guests for living or sleeping purposes.




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Residential Group R-4 310.5

- **R-4**
 - more than five but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised residential environment and receive *custodial care*.




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310.5.1 Group R-4 Condition 1

- This occupancy condition shall include buildings in which all persons receiving *custodial care*, without any assistance, are capable of responding to an emergency situation to complete building evacuation.



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310.5.2 Group R-4 Condition 2

- This occupancy condition shall include buildings in which there are any persons receiving custodial care who require limited verbal or physical assistance while responding to an emergency situation to complete building evacuation.



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Storage Group S 311

- The use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.
- S-1 – Moderate-Hazard
- S-2 – Low-Hazard



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Storage change in 2024

- ABV <20% is now classified as S-2 and Manufacturing/ Distilling is F-2. Previously it was S-1 and F-1 when >16%



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311.1.1 Accessory storage spaces

- A room or space used for storage purposes that is accessory to another occupancy shall be classified as part of that occupancy.



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Utility Group U 312

- Accessory character and miscellaneous structures not classified in any specific occupancy
- Shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy.



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Name That Occupancy

- Restaurant with occupant load of 350
- Chipotle restaurant with occupant load of 45
- Day care business inside a church
- Outpatient surgery center
- Amazon distribution center
- Antique store
- Home for mentally disabled with 14 residents
- Muffler shop


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Determine the Type of Construction 602

- Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5.
- The building elements shall have a fire-resistance rating not less than that specified in Table 601 and exterior walls shall have a fire-resistance rating not less than that specified in Table 602.




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Determine the Type of Construction 602

- Where required to have a fire-resistance rating by Table 601, building elements shall comply with the applicable provisions of Section 703.2.
- The protection of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of this code.




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Determine the Type of Construction 602

- Five Types of Construction
 - Type I
 - Type II
 - Type III
 - Type IV
 - Type V
- Subcategories A & B except in type IV- now A, B, C & HT




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Building Element 202

- A fundamental component of building construction, listed in Table 601, which may or may not be of fire-resistance-rated construction and is constructed of materials based on the building type of construction.



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Combustible vs. Noncombustible

- Types I and II construction** are those types of construction in which the building elements listed in Table 601 are of noncombustible materials,
- except as permitted in Section 603 and elsewhere in the code.




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Combustible vs. Noncombustible

- Type III construction** is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code.
- Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.



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Combustible vs. Noncombustible

- **Type IV construction (Heavy Timber, HT and in 2021 IV A, B,C)** is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid or laminated wood without concealed spaces.
- Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies with a 2-hour rating or less.
- Minimum solid sawn nominal dimensions are required for structures built using Type IV construction (HT).



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Combustible vs. Noncombustible

MASS TIMBER Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction

TABLE 2004.11 MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWS SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LAMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns/Framed sawn or glued-laminated timber arches that spring from the floor line/Frameed timber trusses	8	8	6 1/4	6 1/4	7	7 1/2
	Wood beams and girders	8	10	6	10 1/2	6 1/4	9 1/2
Roof loads only	Columns/roof and ceiling loads, Lower half of wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	6	6 1/4	6 1/4	7 1/2
	Upper half of wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	6	6	6 1/4	6 1/2
	Frameed timber trusses and other roof framing? Frameed or glued-laminated arches that spring from the top of walls or wall assemblies	6 1/2	6	6 1/2	6 1/4	6 1/2	6 1/2

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Combustible vs. Noncombustible



- **Type V construction** is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by the code.


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Chapter 5 Building Height and Area

- Unless otherwise specifically modified in Chapter 4 and this chapter, building height, number of stories and building area shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter.
- Building height, number of stories and building area provisions shall be applied independently.



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503.1.4 Occupied roofs

- A roof level or portion thereof shall be permitted to be used as an occupied roof provided the occupancy of the roof is an occupancy that is permitted by Table 504.4 for the story immediately below the roof.
- The area of the occupied roofs shall not be included in the building area as regulated by Section 506.
- An occupied roof shall not be included in the building height or number of stories as regulated by Section 504, provided that the penthouses and other enclosed rooftop structures comply with Section 1511.




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503.1.4 Occupiable roofs

Exceptions:

- 1. The occupancy located on an occupied roof shall not be limited to the occupancies allowed on the story immediately below the roof where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and occupant notification in accordance with Section 907.5.2.1 and 907.5.2.3 is provided in the area of the occupied roof.



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503.1.4 Occupied roofs

- 2. Assembly occupancies shall be permitted on roofs of open parking spaces of Type I or Type II construction, in accordance with the exception to Section 903.2.1.6.



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503.1.4.1 Enclosures over occupied roof areas

- Elements or structures enclosing the occupied roof areas shall not extend more than 48 inches above the surface of the occupied roof.
- Exception:
- Penthouses constructed in accordance with Section 1510.2 and towers, domes, spires and cupolas constructed in accordance with Section 1510.5.



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Enclosure over Occupiable roof areas

- Exception 2>
- Elements or structures enclosing the occupiable roof area where the roof deck is located more than 75' above the lowest level of Fire department vehicle access.



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Determine the Maximum Height 504.1



- The height, in feet, and the number of stories of a building shall be determined based on the type of construction, occupancy classification and whether there is an automatic sprinkler system installed throughout the building.
 - Feet above grade plane
 - Stories above grade plane

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504.2 Mixed occupancy

- In a building containing mixed occupancies in accordance with Section 508, no individual occupancy shall exceed the height and number of story limits specified in this section for the applicable occupancies.




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202 Height, Building (feet)

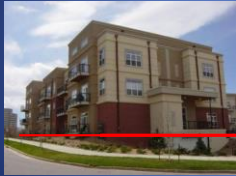
- The vertical distance from **grade plane** to the average height of the highest roof surface.



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202 Grade Plane



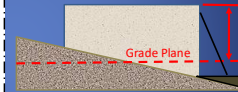
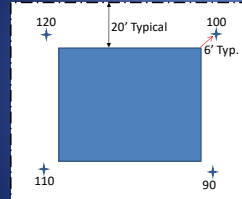
- A reference plane representing the average of finished ground level adjoining the building at exterior walls.
- Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or,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

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Problem #1



Grade Plane Calculation
 $(120 + 110 + 100 + 90) / 4$
 $420 / 4 = 105$

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202 Story

- That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (see "Basement," "Building height," "Grade plane" and "Mezzanine").
- A story is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.



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Story Above Grade Plane 202

- Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:
 - More than 6 feet above grade plane; or

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Story Above Grade Plane 202

- More than 12 feet above the finished ground level at any point.

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Problem #2 Office Building

Determine:

- Grade Plane
- Lowest level a basement?
- Number of stories above grade plane
- Building height

Grade Plane = 108
 Lowest level is a basement
 Four stories above grade plane
 Height = 62 feet

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504.3 Height in feet

- The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3.

TABLE 504.3 ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE*

OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV		Type V			
		A	B	A	B	A	B	A	B	C	HT		
A, B, E, F, M, S, U	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	75	50	75	200	100	50	50	70	60
H, L, H-2, H-3, H-4	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	50	50	50	50	50	50	50	50	40
H4	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	75	50	75	100	100	50	50	70	60
I-1 Corridor 1, I-2	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	75	50	75	100	100	50	50	70	60
I-1 Corridor 2, I-2	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	50	50	50	50	50	50	50	50	40
I-4	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	75	50	75	100	100	50	50	70	60
I-5	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	50	50	50	50	50	50	50	50	40
I-6	NF ^a	UL	160	50	50	50	50	50	50	50	50	50	40
	S	UL	160	50	75	50	75	200	100	50	50	70	60

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504.4 Number of stories

- The maximum number of stories of a building shall not exceed the limits specified in Table 504.4.

TABLE 504.4 ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE**

OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV		Type V			
		A	B	A	B	A	B	A	B	C	HT		
A-1	NO	UL	5	3	2	3	2	3	3	3	3	2	1
	S	UL	5	4	3	4	3	3	3	3	3	2	2
A-2	NO	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	3	3	3	3	2	2
A-3	NO	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	3	3	3	3	2	2
A-4	NO	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	3	3	3	3	2	2
A-5	NO	UL	6	3	2	3	2	3	3	3	3	2	1
	S	UL	6	4	3	4	3	3	3	3	3	2	2
B	NO	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	3	3	3	3	2	2
E	NO	UL	6	4	3	4	3	3	3	3	3	2	1
	S	UL	6	4	3	4	3	3	3	3	3	2	2
F-1	NO	UL	11	4	3	3	2	3	3	3	3	2	1
	S	UL	12	5	3	4	3	3	3	3	3	2	2
F-2	NO	UL	11	3	2	3	2	3	3	3	3	2	1
	S	UL	12	4	3	4	3	3	3	3	3	2	2

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Mezzanines 505

- A mezzanine or mezzanines in compliance with Section 505.2 shall be considered a portion of the story in which it is contained.
- Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1.
- The area of the mezzanine shall be included in determining the fire area defined in Section 902.
- The clear height above and below the mezzanine floor construction shall not be less than 7 feet

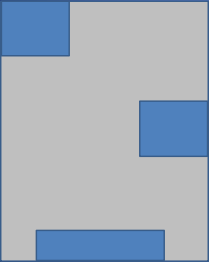


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Mezzanine Area Limitation 505.2



- The aggregate area of a mezzanine or mezzanines within a room shall not exceed one-third of the floor area of that room or space in which they are located.
- The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located.
- In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the floor area of the room.

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Mezzanine Area Limitation 505.2

- Exceptions
 1. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section 503.1.1 shall not exceed **two-thirds** of the floor area of the room.
 2. The aggregate area of mezzanines in buildings and structures of Type I or II construction shall not exceed **one-half** of the floor area of the room in buildings and structures equipped throughout with an approved NFPA 13 automatic sprinkler system and an approved emergency voice/alarm communication system.

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Mezzanine Area Limitation 505.2

- 3. The aggregate area of a mezzanine within a dwelling unit that is located in a building equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 shall not be greater than one-half of the floor area of the room, provided that:
 - 3.1. Except for enclosed closets and bathrooms, the mezzanine shall be open to the room in which such mezzanine is located;
 - 3.2. The opening to the room shall be unobstructed except for walls not more than 42 inches in height, columns and posts; and
 - 3.3. Exceptions to Section 505.2.3 shall not be permitted.

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505.2.3 Openness

- A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches in height, columns and posts.

Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the occupant load of the aggregate area of the enclosed space is not greater than 10.
2. A mezzanine having two or more exits or access to exits is not required to be open to the room in which the mezzanine is located.



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505.2.3 Openness

3. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the mezzanine area.
4. In industrial facilities, mezzanines used for control equipment are permitted to be glazed on all sides.



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505.2.3 Openness

5. In occupancies other than Groups H and I, that are no more than two stories above grade plane and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a mezzanine having two or more means of exits or access to exits shall not be required to be open to the room in which the mezzanine is located.



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Equipment Platforms 505.3

- Equipment platforms in buildings shall not be considered as a portion of the floor below.
- Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section 503.1.
- The area of the equipment platform shall not be included in determining the fire area in accordance with Section 903.
- Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairs, alternating tread devices and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.



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Equipment Platform Area 505.3.1

- The aggregate area of all equipment platforms within a room shall not exceed two-thirds of the area of the room in which they are located.
- Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section 505.2 and the combined aggregate area of the equipment platforms and mezzanines shall not exceed two-thirds of the room in which they are located.




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Determine the Maximum Building Area 506.1

- The floor area of a building shall be determined based on the type of construction, occupancy classification, whether there is an automatic sprinkler system installed throughout the building and the amount of building frontage on public way or open space.




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Building Area

- The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts.
- Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.




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506.1.3 Basements

- Basements need not be included in the total allowable floor area of a building provided the total area of such basements does not exceed the area permitted for a one-story above grade plane building.




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506.2 Allowable area determination


- The allowable area of a building shall be determined in accordance with the applicable provisions of Sections 506.2.1 through 506.2.2 and Section 506.3.



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506.2.1 Single-occupancy




- The total allowable area of a single-occupancy building more than three stories above grade plane shall be determined in accordance with Equation 5-2:
- $A_a = [A_t + (NS \times I_f)] \times S_a$
where:
- A_a = Allowable area (square feet).
- A_t = Tabular allowable area factor (NS, S1, S13R or S13D 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 the building is sprinklered).
- I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.
- $S_a = 3$ where the actual number of stories above grade plane exceeds three, or
- $S_a = 4$ where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2.
- The actual area of any individual floor shall not exceed the allowable area per Equation 5-2.

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Frontage Increase 506.3




Every building shall adjoin or have access to a public way to receive an area factor increase based on frontage. Area factor increase shall be determined in accordance with Sections 506.3.1 through 506.3.3.

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Minimum percentage of perimeter 506.3.1



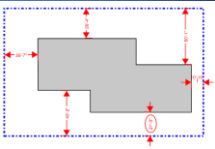
To qualify for an area factor increase based on frontage, a building shall have not less than 25 percent of its perimeter on a public way or open space. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved fire lane.

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506.3.2 Minimum frontage distance

- The frontage increase shall be based on the smallest public way or open space that is 20 feet or greater, and the percentage of building perimeter having a minimum 20 feet public way or open space.
- Measure from face of building to closest interior lot line
- Entire width of street or alley
- The exterior face of an adjacent building on the same lot



Perimeter with > 20' yard = 364'
Total Perimeter = 406'
364/406 = 90%
Smallest Yard = 21' 3"

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506.3.3 Amount of increase

- The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (ft)			
	0 to less than 20	20 to less than 25	25 to less than 30	30 or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.50	0.63	0.75

90% Building Perimeter
Yard Dimension = 21' 3"
Frontage Increase = 50%

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506.3.3.1 Section 507 buildings

- Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot public way or yard requirement, the area factor increase based on frontage shall be determined in accordance with Table 506.3.3.1.

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (ft)					
	30 to less than 35	35 to less than 40	40 to less than 45	45 to less than 50	50 to less than 55	55 to less than 60
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.50
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75 to 100	0.88	1.00	1.13	1.25	1.38	1.50

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Buildings with Fire Walls

- Section 503.1
 - For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more fire walls complying with Section 706 shall be considered to be a separate building.
 - Separate calculations for each building

30 ft. yards all around

Two-Story Group M Type IIA Fully sprinklered 250' x 200'

Fire Wall

Two-Story Group M Type IIA Fully sprinklered 250' x 200'

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Buildings with Fire Walls Example

30 ft. yards all around

Two-Story Group M Type IIA Fully sprinklered 250' x 200'

Two-Story Group M Type IIA Fully sprinklered 250' x 200'

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$700/900 = .77$
 $I_f = 0.75$
 $A_a = 64,500 + [21,500 \times 0.75]$
 $A_a = 64,500 + 16,125$
 $A_a = 80,625 \text{ sq. ft.}$
 Actual Area per story per building = 50,000 sq. ft.

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Two Buildings on the Same Lot 503.1.2

30 ft. yards all around property

One-Story Group M Type VB 150' x 75'

15 ft. between buildings

One-Story Group M Type VB 150' x 75'

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- Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building where the building height, number of stories of each building and the aggregate building area of the buildings are within the limitations specified in Sections 504 and 506.
- The provisions of this code applicable to the aggregate building shall be applicable to each building.

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Two Buildings on the Same Lot Example

- Separate Buildings
 $400/650 = 0.61$
 $I_f = 0.50$
 $A_a = 9,000 + [9,000 \times 0.50]$
 $A_a = 9,000 + 4,500$
 $A_a = 13,500 \text{ sq. ft.}$

Actual Area per building = 18,750 sq. ft.

30 ft. yards all around property

One-Story Group M Type VB 250' x 75'

15 ft. between buildings

One-Story Group M Type VB 250' x 75'

One-hour exterior walls required

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Two Buildings on the Same Lot Example

- Considered One Building
 $400/650 = 0.61$
 $A_a = 36000 + [9,000 \times 0.50]$
 $A_a = 36,000 + 4,500$
 $A_a = 40,500 \text{ sq. ft.}$

Actual Area of both buildings = 37,500 sq. ft.

30 ft. yards all around property

One-Story Group M Type VB Fully Sprinklered 250' x 75'

15 ft. between buildings

One-Story Group M Type VB Fully Sprinklered 250' x 75'

Exterior walls not required to be rated

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507.1 Unlimited Area Buildings

- The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.12 shall not be limited. Basements not more than one story below grade plane shall be permitted.

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507.1.1 Accessory occupancies

- Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.2 through 507.12 shall be applied, where applicable.



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Reduced Open Space 507.2.1

- The public ways or yards of 60 feet in width required in Sections 507.3, 507.4, 507.5, 507.6 and 507.12 shall be permitted to be reduced to not less than 40 feet in width provided all of the following requirements are met:
 - The reduced width shall not be allowed for more than 75 percent of the perimeter of the building.
 - The exterior walls facing the reduced width shall have a minimum fire-resistance rating of 3 hours.
 - Openings in the exterior walls facing the reduced width shall have opening protectives with a minimum fire protection rating of 3 hours.



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Unlimited Area Buildings 507.3

- Non-sprinklered Building
 - The area of a one-story, Group F-2 or S-2 building is not be limited when building is surrounded and adjoined by public ways or yards not less than 60 feet in width.




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Unlimited Area Buildings 507.4

- Sprinklered, one-story
 - The area of a Group A-4 building no more than one story above grade plane of other than Type V construction, or the area of a Group B, F, M or S building no more than one story above grade plane of any construction type, shall not be limited where the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet in width.



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Unlimited Area Buildings 507.4

Exceptions:


- 1. Buildings and structures of Type I or II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.3 and 903.3.1.1 and Chapter 32 of the International Fire Code.
- 2. The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that both of the following criteria are met:
 - 2.1 Exit doors directly to the outside are provided for occupants of the participant sports areas.
 - 2.2 The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.
 - 2.3 An automatic sprinkler system is provided in storage rooms, press boxes, concession booths or other spaces ancillary to the sport activity space.

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Mixed occupancy buildings with Groups A-1 and A-2 507.4.1

- Group A-1 and A-2 Occupancies of other than Type V Construction
 - Assembly occupancies separated from other spaces as required in 508.4.4 without sprinkler reduction
 - Assembly area cannot exceed allowable area
 - All exit doors shall discharge directly to the exterior




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Two-Story Buildings 507.5

- Sprinklered, two-story
 - The area of a Group B, F, M or S building no more than two stories above grade plane shall not be limited when the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
 - and is surrounded and adjoined by public ways or yards not less than 60 feet in width.




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Group A-3 Buildings 507.6

- The area of a Group A-3 building no more than one story above grade plane, used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction, shall not be limited when all of the following criteria are met:
 1. The building shall not have a stage other than a platform.
 2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
 3. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet in width.



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Group A-3 Buildings of Types III and IV Construction - 507.7

- The area of a Group A-3 building no more than one story above grade plane, used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type III or IV construction, shall not be limited when all of the following criteria are met:
 1. The building shall not have a stage other than a platform.
 2. The building shall be equipped throughout with an NFPA 13 automatic sprinkler system.
 3. The assembly floor shall be located at or within 21 inches of street or grade level and all exits are provided with ramps complying with Section 1010.1 to the street or grade level.
 4. The building shall be surrounded and adjoined by public ways or yards not less than 60 in width.

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Group H Occupancies 507.8



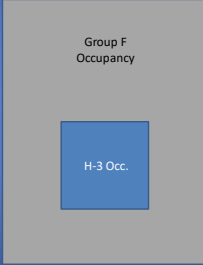
- Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F and S occupancies in accordance with Sections 507.3 and 507.4 and the provisions of Sections 507.8.1 through 507.8.4.
- The aggregate floor area of Group H occupancies located in an unlimited area building shall not exceed 10 percent of the area of the building nor the area limitations for the Group H occupancies as specified in Table 503 as modified by Section 506.2 based upon the perimeter of each Group H floor area that fronts on a public way or open space.

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Group H Occupancies 507.8.1.1

- The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25 percent of the area limitations for the Group H occupancies as specified in Table 503.



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Group H Occupancies 507.8.1.1



- Liquid use, dispensing and mixing rooms having a floor area of not more than 500 square feet need not be located on the outer perimeter of the building where they are in accordance with the International Fire Code and NFPA 30.
- Liquid storage rooms having a floor area of not more than 1,000 square feet need not be located on the outer perimeter where they are in accordance with the International Fire Code and NFPA 30.
- Spray paint booths that comply with the International Fire Code need not be located on the outer perimeter.

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Located on building perimeter 507.8.2

- Except as provided for in Section 507.8.1.1, Group H occupancies shall be located on the perimeter of the building. In Group H-2 and H-3 occupancies, not less than 25 percent of the perimeter of such occupancies shall be an exterior wall.



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Occupancy separations 507.8.3

- Group H occupancies shall be separated from the remainder of the unlimited area building and from each other in accordance with Table 508.4.



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Group H Occupancies 507.8.4

- For two-story unlimited area buildings, the Group H occupancies shall not be located more than one story above grade plane unless permitted by the allowable height in stories and feet as set forth in section 504 based on the type of construction of the unlimited area building.



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507.9 Unlimited mixed occupancy buildings with Group H-5

- The area of a Group B, F, H-5, M or S building no more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and is surrounded and adjoined by public ways or yards not less than 60 feet in width, provided all of the following criteria are met:
 - Buildings containing Group H-5 occupancy shall be of Type I or II construction.
 - Each area used for Group H-5 occupancy shall be separated from other occupancies as required in Sections 415.11 and 508.4.
 - Each area used for Group H-5 occupancy shall not exceed the maximum allowable area permitted for such occupancies in Section 503.1 including modifications of Section 506.
- Exception: Where the Group H-5 occupancy exceeds the maximum allowable area, the Group H-5 shall be subdivided into areas that are separated by 2-hour fire barriers.



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Aircraft Paint Hangar 507.10

- Group H-2 aircraft paint hangar no more than one story above grade plane
- Where such aircraft paint hangar complies with the provisions of Section 412.5; and
- Is surrounded and adjoined by public ways or yards not less in width than one and one-half times the building height




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Group E Buildings 507.11

- The area of a Group E building no more than one story above grade plane, of Type II, IIIA or IV construction, shall not be limited when all of the following criteria are met:
 - Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building complying with Section 1020.
 - The building is equipped throughout with an NFPA 13 automatic sprinkler system.
 - The building is surrounded and adjoined by public ways or yards not less than 60 feet in width.




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Motion Picture Theaters 507.12

- **Type II construction,**
- Motion picture theater located on the first story above grade plane
- Building is provided with an NFPA 13 automatic sprinkler system throughout and;
- Is surrounded and adjoined by public ways or yards not less than 60 feet in width.



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Covered Mall Buildings and Anchor Stores - 507.13



- The area of covered mall buildings and anchor stores not exceeding three stories in height that comply with Section 402.6 shall not be limited.

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Mixed Use and Occupancy 508

- Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 or 508.4, or a combination of these sections.
 - 508.2
 - Accessory Occupancies
 - 508.3
 - Nonseparated Occupancies
 - 508.4
 - Separated Occupancies
 - 508.5
 - Live Work Units
 - (Buildings separated by Fire Walls)

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Mixed Use and Occupancy 508

- Exceptions
 1. Occupancies separated in accordance with Section 510.
 2. Where required by Table 415.6.2, areas of Group H-1, H-2 and H-3 occupancies shall be located in a detached building or structure.



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Accessory Occupancies 508.2



- Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof.

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Accessory Occupancy Classification 508.2.1

- Accessory occupancies shall be individually classified in accordance with Section 302.1.
- The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space.
- Break Room classified as Group A-3 occupancy

Break Room

- Group M

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Allowable Building Height 508.2.2

- The allowable height and number of stories of the building containing accessory occupancies shall be in accordance with Section 504 for the main occupancy of the building.

Break Room

- Group M

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Allowable building area 508.2.3

- The allowable area of the building shall be based on the applicable provisions of Section 506 for the main occupancy of the building.
- Aggregate accessory occupancies shall not occupy more than 10 percent of the floor area of the story in which they are located and shall not exceed the tabular values for nonsprinklered buildings in Table 506.2 for each such accessory occupancy.

EXAMPLE:

- Type IIB Const
- Group M = 100,000 s.f. UL area building
- Break Room limited to 9,500 square feet (Table 506.2)

Break Room

Group M

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Separation of Occupancies 508.2.4

- No separation is required between accessory occupancies and the main occupancy.

Exceptions:

- Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
- Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from accessory occupancies contiguous to them in accordance with the requirements of Section 420.



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Accessory occupancies 507.1.1

- Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.3 through 507.13 shall be applied, where applicable.



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Accessory Occupancy Example

Office/Conf. Rm.
5,500 sq. ft.
Accessory

Furniture Warehouse
60,000 sq. ft.

Type IIB Construction
Fully Sprinklered
One-story

No separation required


- Group B Area = 9.2% of building area (<10%)
- Tabular Area Group B = 23,000 sq. ft.
- Offices are accessory occupancies
- Maximum Height Group S-1 = 3 stories
- Total Allowable Building Area based on Group S-1 Occupancy
 - A₁ = 70,000 with sprinkler increase.

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Nonseparated Occupancies 508.3.1

- Nonseparated occupancies shall be individually classified in accordance with Section 302.1.
- The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space.



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Nonseparated Occupancies 508.3.1

- In addition, the most restrictive provisions of Chapter 9 that apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area.
 - Automatic Sprinklers
 - Fire Alarms



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508.3.1.1 High-rise buildings

- Where nonseparated occupancies occur in a high-rise building, the most restrictive requirements of Section 403 that apply to the nonseparated occupancies shall apply throughout the high-rise building.




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508.3.2 - Allowable building area, height and number of stories

- The allowable building area, height and number of stories of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with [Section 503.1](#).



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Nonseparated Occupancy Example

One-story
Office, Warehouse
Parking Garage
Type IIB Construction
Fully Sprinklered
80,000 sq. ft.
40' + yards around building

- Occupancy Classifications
 - Office = Group B
 - Warehouse = S-1
 - Auto Storage = S-2
- Tabular Areas/Max. Ht.
 - Group B = 92,000/4
 - Group S-1 = 70,000/3
 - Group S-2 = 104,000/4
- Most Restrictive = Group S-1
- Area calculation based on S-1
 - $A_s = A_t + [NS \times I]$
 - $A_s = 70,000 + [17,500 \times 0.75]$
 - $A_s = 70,000 + 13,125$
 - $A_s = 83,125$ sq. ft.

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(Non-Separated building)Separation 508.3.3

- No separation is required between nonseparated occupancies.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group I-1, R-1, R-2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from other occupancies contiguous to them in accordance with the requirements of Section 420.



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Mixed-occupancy buildings 506.2.2

- The allowable area of each story of a mixed-occupancy building shall be determined in accordance with the applicable provisions of Section 508.3.2 for nonseparated occupancies and Section 508.4.2 for separated occupancies.



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Problem

- Given:
 - Shell Building – Retail Center as shown
- Determine:
 - Total Allowable Building Area
- Possible Occupancies?
- Most Restrictive?

40' Yards all sides

Shell Building – Retail Center
Two-Story
Fully sprinklered
Type IIIB Construction
35,000 sq. ft. per story

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Problem

- A-2 most restrictive
 - $A_s = 28,500 + [9,500 \times 0.75]$
 - $A_s = 28,500 + 7,125$
 - $A_a = 35,625$ sq. ft. per story

40' Yards all sides

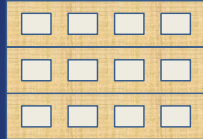
Shell Building – Retail Center
Two-story
Fully sprinklered
Type IIIB Construction
35,000 sq. ft.

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Multi-Story Mixed Occupancies Example

- Given
 - 3 story building as shown
 - 30,000 sq. ft. per story
 - Type VA Construction
 - NFPA 13 Sprinklers
 - No yard increase
- Solution
 - $A_a (M) = 42,000$
 - $A_a (B) = 54,000$ sq. ft.
 - $A_a (R-2) = 36,000$ sq. ft.



R-2

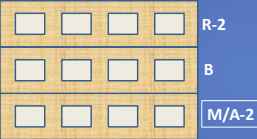
B

M

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Multi-Story Mixed Occupancies Example




- Given
 - 3 story building as shown
 - 30,000 sq. ft. per story
 - Type VA Construction
 - NFPA 13 Sprinklers
 - No yard increase
- Solution
 - Aa (A-2) = 34,500
 - Aa (B) = 54,000 sq. ft.
 - Aa (R-2) = 36,000 sq. ft.

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Mixed-occupancy buildings 506.2.2



- For buildings with more than three 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, determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed three.
- Equation 5-3
 - $A_3 = A_1 + (NS \times I_1)$

Type VA Construction, sprinklered, Nonseparated Occ.

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Mixed-occupancy buildings Sum of the Ratios 506.2.2

Floor	Occupancy	Actual Area	Allowable Area	Ratio
First	M	25,000	42,000	0.60
Second	A-2	25,000	35,400	0.71
Third	R-2	25,000	36,000	0.69
Fourth	R-2	25,000	36,000	0.69

$0.60 + 0.71 + 0.69 + 0.69 = 2.69 < 3 = \text{OK}$

No yard increase used

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Mixed-occupancy buildings 506.2.2

Exception:
For buildings designed as separated occupancies under Section 508.4 and equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2, (NFPA 13R) 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 determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed four.

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Separated Occupancies 508.4.1

- Separated occupancies shall be individually classified in accordance with Section 302.1.
- Each separated space shall comply with this code based on the occupancy classification of that portion of the building.

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Separated Occupancies 508.4.1

- The most restrictive provisions of Chapter 9 that apply to the separate occupancies shall apply to the total non-fire-barrier-separated occupancy areas.
- Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring a fire protection system shall also comply with Section 901.7.

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Allowable Building Area 508.4.2

- In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1.

One-story
Mixed Use
Type VB Const.
Fully Sprinklered

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Separated Occupancy Example

Occ.	Actual Area	A _s	Ratio
R-2	10,500	28,000	0.38
B	8,500	36,000	0.24
S-2	14,500	54,000	0.27
Total	33,500		0.89 < 1

One-story
Mixed Use
Type VB Const.
Fully Sprinklered

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Problem

- Given:
 - One-story
 - Mixed use as shown
 - Type IIA Construction
 - Fully Sprinklered
 - No yards or open space
- Determine Compliance

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Problem (cont.)

Apartments 25,000 sq. ft.	Retail 25,000 sq. ft.		
Offices 25,000 sq. ft.	Restaurant(s) 25,000 sq. ft.		

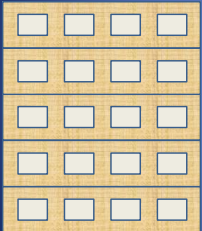
Occ.	Actual Area	A_p	Ratio
R-2	25,000	96,000	0.26
B	25,000	150,000	0.17
M	25,000	86,000	0.29
A-2	25,000	62,000	0.40
Total	100,000		1.12 > 1

Now What?

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Multi-Story Mixed Occupancies Example



- Given
 - 5 story building as shown
 - 35,000 sq. ft. per story
 - Type IIA Construction
 - NFPA 13 Sprinklers
 - No yard increase
- Solution
 - A_a (M) = 64,500
 - A_a (B) = 112,500 sq. ft.
 - A_a (R-2) = 72,000 sq. ft.

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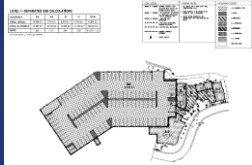
Multi-Story Mixed Occupancies Example (cont.)

Story	Occ.	Actual Area	A_p	Ratio
1	M	35,000	64,500	0.54
2	B	35,000	112,500	0.31
3	R-2	35,000	72,000	0.49
4	R-2	35,000	72,000	0.49
5	R-2	35,000	72,000	0.49
Totals		175,000		2.31

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508.4.3 Allowable building height and number of stories



- Each separated occupancy shall comply with the building height limitations and story limitations based on the type of construction of the building in accordance with Section 503.1.
 - Exception: Special provisions permitted by Section 510.

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Separation 508.4.4

Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

OCCUPANCY	A, E	1, 2, 3, 4	12	U ^a	F, 2, 3, 2, U	U ^a , 1, 2, 3, 4	H1	H2	H3, H4	H5
A, E	0	0	0	0	0	0	0	0	0	0
1, 2, 3, 4	0	0	0	0	0	0	0	0	0	0
U ^a	0	0	0	0	0	0	0	0	0	0
F, 2, 3, 2, U	0	0	0	0	0	0	0	0	0	0
U ^a , 1, 2, 3, 4	0	0	0	0	0	0	0	0	0	0
H1	0	0	0	0	0	0	0	0	0	0
H2	0	0	0	0	0	0	0	0	0	0
H3, H4	0	0	0	0	0	0	0	0	0	0
H5	0	0	0	0	0	0	0	0	0	0

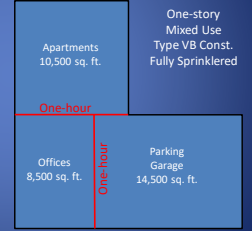
- See Section 420.
- The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
- See Section 406.3.4.
- Separation is not required between occupancies of the same classification.
- See Section 422.2 for ambulatory care facilities.

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Construction 508.4.4.1

- Required separations shall be fire barriers or horizontal assemblies, or both, so as to completely separate adjacent occupancies.



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Combination Mixed Occupancy

- Section 508.1
 - Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3, 508.4, and 508.5 or a combination of these sections.



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Combination Mixed Occupancy Example

Swimming Pool 3,500 sq. ft.	Guestrooms
Dining Room 1,000 sq. ft.	Lobby 1,000 sq. ft.
Guestrooms	Guestrooms

- Given:
 - 1st story of multi-story hotel
 - Type VA Construction
 - Fully Sprinklered w/30' yards
 - Total Floor Area = 44,000 sq. ft.
- Determine Compliance
 - Non separated occupancy
 - Separated occupancy
 - Combination

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Combination Mixed Occupancy Example (cont.)

Swimming Pool 3,500 sq. ft.	Guestrooms
Dining Room 1,000 sq. ft.	Lobby 1,000 sq. ft.
Guestrooms	Guestrooms

- Nonseparated Occupancy
 - A-2 Governs Areas
 - $A_2 = 43,125$ sq. ft.
 - Actual Area 44,000 sq. ft. exceeds A_2

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Combination Mixed Occupancy Example (cont.)

Swimming Pool 3,500 sq. ft.
 Dining Room 1,000 sq. ft.
 Lobby 1,000 sq. ft.
 Guestrooms

- Separated Occupancy
 - R-1 Ratio = 0.86
 - A-2 Ratio = 0.02
 - A-3 Ratio = 0.08
 - B Ratio = 0.05
 - Total Ratio = 1.01 > 1

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Combination Mixed Occupancy Example (cont.)

Swimming Pool 3,500 sq. ft.
 Dining Room 1,000 sq. ft.
 Lobby 1,000 sq. ft.
 Guestrooms

- Combination Nonseparated/Separated Occupancy
 - R-1 Ratio = 0.86
 - A-2 Ratio = 0.13
 - Total Ratio = 0.99 < 1

Separate guestrooms from other occupancies by one-hour fire barriers

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Incidental Use Areas 509

- Incidental uses located within single occupancy or mixed occupancy buildings shall comply with the provisions of this section.
- Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509.
- Exception: Incidental uses within and serving a dwelling unit are not required to comply with this section.

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Separation 509.4.1

- Where Table 509 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier or a horizontal assembly, or both.
- Construction supporting 1-hour fire barriers or horizontal assemblies used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.




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Protection 509.4.2

- Where Table 509 permits an automatic sprinkler system without a fire barrier, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke.
- The walls shall extend from the top of the foundation or floor assembly below to the underside of the ceiling that is a component of a fire-resistance-rated floor assembly or roof assembly above or to the underside of the floor or roof sheathing, deck or slab above.




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Protection 509.4.2


- Doors shall be self- or automatic-closing upon detection of smoke in accordance with Section 716.5.9.3.
- Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80.
- Walls surrounding the incidental use shall not have air transfer openings unless provided with smoke dampers in accordance with Section 710.7.



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Protection Limitations 509.4.2.1

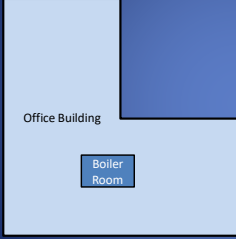


- Where an automatic sprinkler system is provided in accordance with Table 509, only the space occupied by the incidental use need be equipped with such a system.

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Incidental Use Area Example




- Given:
 - Office Building
 - No fire sprinklers
 - Boiler room with 1,000,000 Btu Boiler
- Required
 - One-hour fire barrier separation
 - Limited to 10% of story

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Special Provisions 510.1

- The provisions in this section shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code.
- The provisions of Sections 510.2 through 510.8 are to be considered independent and separate from each other.



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Horizontal Building Separation Allowance 510.2

- A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction where all of the following conditions are met:
 - Six Requirements




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Horizontal Building Separation Allowance 510.2

1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 3 hours. Where vertical offsets are provided as part of a horizontal assembly, the vertical offset and the structure supporting the vertical offset shall have a fire-resistance rating of not less than 3 hours.
2. The building below the horizontal assembly is of Type IA construction.



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Horizontal Building Separation Allowance - 510.2

3. Shaft, stairway, ramp and escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Section 715.4.

Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire-resistance rating with opening protectives in accordance with Section 715.4, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided:

1. The building above the horizontal assembly is not required to be of Type I construction;
2. The enclosure connects less than four stories; and
3. The enclosure opening protectives above the horizontal assembly have a minimum 1-hour fire protection rating.

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Horizontal Building Separation Allowance - 510.2

4. Interior exit stairways located within the Type IA building are permitted to be of combustibile materials where the following requirements are met:

4.1. The building above the Type IA building is of Type III, IV, or V construction.

4.2. The stairway located in the Type IA building is enclosed by 3-hour fire-resistance-rated construction with opening protectives in accordance with Section 716.

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Horizontal Building Separation Allowance - 510.2

5. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A, B, M, R or S occupancies.



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Horizontal Building Separation Allowance 510.2

6. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.



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Horizontal building Separation 510.2

- #7 The maximum building height in feet shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane



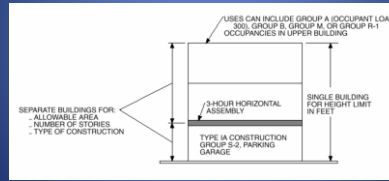
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Horizontal Building Separation Allowance - 510.2

- 7. The maximum building height in feet shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane.



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Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

- A Group S-2 enclosed parking garage with no more than one story above grade plane and located below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction where all of the following conditions are met:
 - Five Conditions



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Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

1. The allowable area of the building shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage .
3. The height and the number of tiers of the Group S-2 open parking garage shall be limited as specified in Table 406.5.4.

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Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage , except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet, and mechanical equipment rooms incidental to the operation of the building.

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Parking beneath Group R 510.4

- Where a maximum one story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area.
- The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section 508.4.



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Group R-1 and R-2 Buildings of Type IIIA Construction - 510.5



- For buildings of Type IIIA construction in Groups R-1 and R-2, the maximum allowable height in Table 504.3 shall be increased by 10 feet and the maximum allowable number of stories in Table 504.4 shall be increased by one where the first-floor assembly above the basement has a fire-resistance rating of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated fire walls into areas of not more than 3,000 square feet.

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Group R-1 and R-2 Buildings of Type IIA Construction - 510.6

- The height limitation for buildings of Type IIA construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet where the building is separated by not less than 50 feet from any other building on the lot and from lot lines, the exits are segregated in an area enclosed by a 2-hour fire-resistance-rated fire wall and the first floor assembly has a fire-resistance rating of not less than 1 ½ hours.

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Open Parking Garage Beneath Groups A, I, B, M And R - 510.7

- Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.3. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy.
- The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

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Fire Separation 510.7.1

- Fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table 508.4 for the uses involved.
- Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having at least a 2-hour fire-resistance rating as required by Section 706 with self-closing doors complying with Section 716 or horizontal assemblies having at least a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 716. Means of egress from the open parking garage shall comply with Section 406.5.

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Fire Separation 510.7.1

- The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601.

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Fire Separation 510.7.1

- Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having at least a 2-hour fire-resistance rating as required by Section 707 with self-closing doors complying with Section 716 or horizontal assemblies having at least a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 716. Means of egress from the open parking garage shall comply with Section 406.5.

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Group B or M with Group S-2 Open Parking Garage - 510.8

- Group B or M occupancies located below a group S-2 open parking garage of a lesser type of construction shall be considered a separate and distinct building for the purpose of determining the type of construction where all of the following conditions are met:
 - Seven Conditions



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Group B or M with Group S-2 Open Parking Garage - 510.8

1. The buildings are separated with a horizontal assembly having a minimum 2-hour fire-resistance rating .
2. The occupancies in the building below the horizontal assembly are limited to Groups B and M.
3. The occupancy above the horizontal assembly is limited to a Group S-2 open parking garage .



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Group B or M with Group S-2 Open Parking Garage - 510.8

4. The building below the horizontal assembly is of Type I or II construction but not less than the type of construction required for the Group S-2 open parking garage above.
5. The height and area of the building below the horizontal assembly does not exceed the limits set forth in Section 503.



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Group B or M with Group S-2 Open Parking Garage - 510.8

6. The height and area of the Group S-2 open parking garage does not exceed the limits set forth in Section 406.5. The height, in both feet and stories, of the Group S-2 open parking garage shall be measured from grade plane and shall include the building below the horizontal assembly .



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Group B or M with Group S-2 Open Parking Garage - 510.8

7. Exits serving the Group S-2 open parking garage discharge at grade and directly to a street or public way and are separated from the building below the horizontal assembly by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

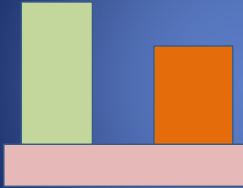


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Multiple Buildings Above Group S-2 Parking Garages - 510.9

• Where two or more buildings are provided above the horizontal assembly separating a Group S-2 parking garage or building below from the buildings above in accordance with the special provisions in Sections 510.2, 510.3 or 510.8, the buildings above the horizontal assembly shall be regarded as separate and distinct buildings from each other and shall comply with all other provisions of this code as applicable to each separate and distinct building.

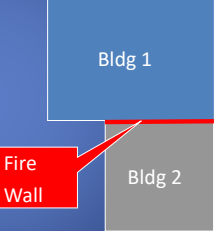


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Mixed Occupancies with Fire Walls 706

- Each portion of a building separated by one or more fire walls that comply with the provisions of this section shall be considered a separate building.
- The extent and location of such fire walls shall provide a complete separation.
- Where a fire wall also separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply.



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Private Garages/Carports 406.3.1

- Private garages and carports shall be classified as Group U occupancies. Each private garage shall be not greater than 1,000 square feet in area.
- Multiple private garages are permitted in a building where each private garage is separated from the other private garages by 1-hour fire barriers, or 1-hour horizontal assemblies, or both.



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Separation 406.3.2

- The private garage shall be separated from the dwelling unit and its attic area
 - 1/2-inch gypsum board applied to the garage side.
 - Garages beneath habitable rooms separated by 5/8-inch Type X gypsum board or equivalent.



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Separation 406.3.2

- Door openings
 - 1 3/8" solid wood doors
 - 1 3/8" solid or honeycomb core steel doors
 - 20 minute door assemblies
- Doors shall be self-closing and self-latching.

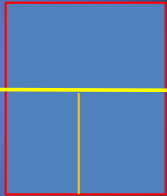


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Fire Area

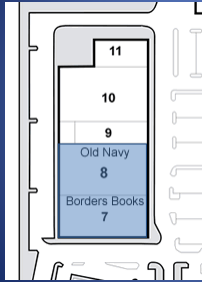
- The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building.
- Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.



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Fire Area



- Used to determine when automatic fire sprinklers are required
- Creates compartmentation within a building
- Mitigates the spread of fire in a building

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Fire Barriers to Dividing Fire Areas 707.3.10

- The fire barriers or horizontal assemblies, or both, separating a single occupancy into different fire areas shall have a fire-resistance rating of not less than that indicated in Table 707.3.10.
- The fire barriers or horizontal assemblies, or both, separating fire areas of mixed occupancies shall have a fire-resistance rating of not less than the highest value indicated in Table 707.3.10 for the occupancies under consideration.

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, M, R, S-2	2
U	1

Don't forget Table 508.4

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Group A-2 903.2.1.2

- An automatic sprinkler system shall be provided for Group A-2 occupancies where one of the following conditions exists:
 - The fire area exceeds 5,000 square feet;
 - The fire area has an occupant load of 100 or more; or
 - The fire area is located on a floor other than a level of exit discharge serving such occupancies.



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Group F

- F-1 fire area > 12,000 SF
- > 3 stories above grade plane
- Combined FA >24,000 SF
- Manufacture lithium ion or lithium Metal batteries
- Manufacture vehicles, energy storage systems or equipment containing lithium ion or lithium metal batteries where the batteries are installed as part of manf process
- Manf of distilled spirits >20% ABV
- Woodworking >2500 SF



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903.2.7 Group M

- An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:
 - 1. A Group M fire area exceeds 12,000 square feet.
 - 2. A Group M fire area is located more than three stories above grade plane.
 - 3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet.
 - 4. A Group M occupancy used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet.



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903.2.8 Group R

- An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.



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Group S

- S-1 fire area exceeds 12,000 SF
- >3 stories above grade plane
- Combined fire areas > 24,000 SF
- Storage of motor vehicles >5000 SF
- Fire area used for storage of Lithium Ion or Lithium metal powered vehicles where the fire area > 500 SF
- S-2: fire area of an enclosed parking garage in accordance with 406.6 > 12,000 SF
- Where the enclosed parking garage is located below other groups except R-3
- Open parking garage e> 48,000 SF

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Shums Coda Associates

4610 S Ulster, Suite 150
Denver, CO 80237

Ph. 303-400-6564
Fax 303-693-0630

www.shumscoda.com
Bill.clayton@shumscoda.com




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