



2021 IBC

Chapters 3-6

Code Analysis



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Course Objectives


☐ *The intent of this course is to...*



1. To understand the minimum amount of information that should be included in a code analysis.
2. To know how to check that allowing height, number of stories, and areas are compliant with the IBC.
3. To know how to incorporate the Chapter 4 provisions into a project-specific code analysis.



Seminar Format

1. Introduction
2. IBC Chapter 3
3. IBC Chapter 6
4. IBC Chapter 5
5. IBC Chapter 4
6. Summary







PART 1


Introduction


CODE AND ZONING INFORMATION	
BUILDING CODE COMPLIANCE	
CODE:	2012 IBC, 2012 IMC, 2012 IPC, 2011 NEC, ICC/ANSI A117.1 - 2009
ADMINISTRATION / WAREHOUSE BUILDING	
CONSTRUCTION TYPE:	IB
(TABLE 503)	
BUILDING HEIGHT:	2 STORIES (3 STORIES ALLOWED)
(TABLE 503)	
FIRE PROTECTION:	FULLY SPRINKLERED: IBC 903.2.10(1)
	>30' SEPARATION
OCCUPANCY (CHAPTER 3):	B AND S2
	NO OCCUPANCY SEPARATION REQUIRED: IBC 508.3.3
ALLOWABLE AREA:	B OCCUPANCY MORE RESTRICTIVE (IBC TABLE 503)



Code Analysis

- ❑ Basis of determining if proposed building will work!
- ❑ This is where our plan review typically commences.
- ❑ Many of the basic design assumptions are often wrong!
- ❑ We need to know this information like...







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Code Analysis

- ❑ **IBC 107.2.1:**
 - Notes that plans must indicate that they “...conform to the provisions of this code and relevant laws, ordinances, rules and regulations...”
 - This requires the IBC to be referenced.
 - IBC 101.4 also requires the design to conform to the IFGC, IMC, IPC, IPMC, IFC, IEBC and IEBC.
 - In truth, all codes adopted by the State or jurisdiction should be listed.






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Code Analysis

- ❑ **Includes:**
 - Codes Considered
 - Occupancy Classification & Use
 - Type of Construction
 - Sprinklered?
 - Allowable Heights & Areas
 - Incidental Uses?
 - Special Detailed Requirements?

CODE ANALYSIS	
2022 CALIFORNIA RESIDENTIAL CODE (CRC) 2022 CALIFORNIA MECHANICAL CODE (CMC) 2022 CALIFORNIA PLUMBING CODE (CPC) 2022 CALIFORNIA ELECTRICAL CODE (CEC) 2022 CALIFORNIA FIRE CODE (CFC) 2022 CALIFORNIA ENERGY CODE (CEC) 2022 GREEN BUILDING STANDARDS CODE	
JURISDICTION: CITY OF DUBLIN	
TYPE OF CONSTRUCTION:	I-B
OCCUPANCY GROUP:	R-3
GARAGE:	U
FIRE SPRINKLERS:	NFPA 13-D
AN AUTOMATIC RESIDENTIAL FIRE SPRINKLER SYSTEM SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH NFPA 13-D IN ONE- AND TWO-FAMILY DWELLINGS.	
THIS PROJECT SHALL COMPLY WITH ALL OTHER REGULATIONS AND ORDINANCES ADOPTED BY THE LOCAL GOVERNING AGENCIES.	



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Code Analysis

CHAPTER 1: ADMINISTRATION REQUIREMENTS

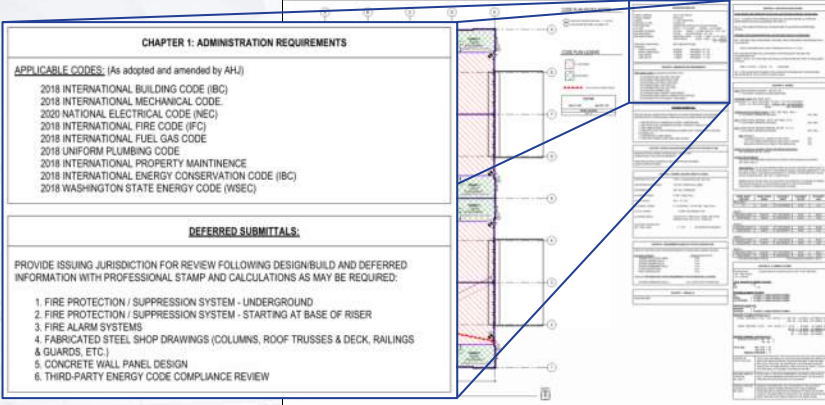
APPLICABLE CODES: (As adopted and amended by AHJ)


- 2018 INTERNATIONAL BUILDING CODE (IBC)
- 2018 INTERNATIONAL MECHANICAL CODE
- 2020 NATIONAL ELECTRICAL CODE (NEC)
- 2018 INTERNATIONAL FIRE CODE (IFC)
- 2018 INTERNATIONAL FUEL GAS CODE
- 2018 UNIFORM PLUMBING CODE
- 2018 INTERNATIONAL PROPERTY MAINTENANCE
- 2018 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)
- 2018 WASHINGTON STATE ENERGY CODE (WSEC)

DEFERRED SUBMITTALS:

PROVIDE ISSUING JURISDICTION FOR REVIEW FOLLOWING DESIGN/BUILD AND DEFERRED INFORMATION WITH PROFESSIONAL STAMP AND CALCULATIONS AS MAY BE REQUIRED:

1. FIRE PROTECTION / SUPPRESSION SYSTEM - UNDERGROUND
2. FIRE PROTECTION / SUPPRESSION SYSTEM - STARTING AT BASE OF RISER
3. FIRE ALARM SYSTEMS
4. FABRICATED STEEL SHOP DRAWINGS (COLUMNS, ROOF TRUSSES & DECK, RAILINGS & GUARDS, ETC.)
5. CONCRETE WALL PANEL DESIGN
6. THIRD-PARTY ENERGY CODE COMPLIANCE REVIEW





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CHAPTER 4: SPECIAL DETAILED REQUIREMENTS FOR OCCUPANCY & USE

HIGH-PILED STOCK OR RACK STORAGE SHALL COMPLY WITH INTERNATIONAL FIRE CODE REQUIREMENTS.
PROPOSED RACKING SYSTEM SHALL BE SUBMITTED AND REVIEWED UNDER A SEPARATE PERMIT.

CHAPTER 5: GENERAL BUILDING HEIGHTS & AREAS

CONSTRUCTION TYPE:TYPE III - B (NON RATED) (IBC SEC. 601)

FIRE SEPARATION DISTANCE:+60 FOOT YARDS ON ALL SIDES

FIRE SPRINKLERS:YES, FULLY SPRINKLED

ALLOWABLE HEIGHT:75' (IBC TABLE 504.3)

ACTUAL HEIGHT:40'-0" < 75' (OK)

ALLOWABLE STORIES:F-1 OCCUPANCY: 3 STORY (IBC TABLE 504.4)

ACTUAL STORIES:1 STORY, NO BASEMENT (OK)

ALLOWABLE AREAS:OVER 60 FOOT YARDS ON ALL SIDES, ONE STORY, SPRINKLER (IBC SEC. 507.5) = UNLIMITED

OCCUPANCY SEPARATION (IBC TABLE 508.4):F-1 TO B = NO SEPARATION REQUIRED

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CHAPTER 9: FIRE PROTECTION SYSTEMS

AN AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE PROVIDED THROUGH THIS BUILDING.

901.6.1 AUTOMATIC FIRE SPRINKLER SYSTEM SHALL BE MONITORED BY AN APPROVED SUPERVISING STATION IN ACCORDANCE WITH NFPA 72.

901.6.2 FIRE ALARM SYSTEMS SHALL BE MONITORED BY AN APPROVED SUPERVISING STATION.

PORTABLE FIRE EXTINGUISHERS SHALL BE PROVIDED THROUGH THIS BUILDING.

906.1 PORTABLE FIRE EXTINGUISHERS: PORTABLE FIRE EXTINGUISHERS ARE REQUIRED IN ALL OCCUPANCIES.
- FIRE EXTINGUISHER SHALL HAVE A MINIMUM RATING OF 2-A:10-B:C.

906.3 SIZE AND DISTRIBUTION: LOW HAZARD OCCUPANCIES MUST PROVIDE FIRE EXTINGUISHERS FOR EVERY 11,250 S.F. OF FLOOR AREA. MAX TRAVEL DISTANCE FROM ANY POINT IN THE BUILDING IS 75 FEET.
- AREA = 87,780 SF. / 11,250 SF. = 7.8: 8 REQUIRED

907.1.2 FIRE ALARM SHOP DRAWINGS: FIRE ALARM SHOP DRAWINGS ARE TO BE REVIEWED AND APPROVED BY THE AHJ PRIOR TO INSTALLATION.

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ROOM / SPACE FUNCTION	ROOM / SPACE AREAS	OCCUPANCY GROUP	OCCUPANCY FACTOR	OCCUPANCY LOAD
MECH/ELECT.				
F-1	304 SF	F-1 OCCUPANCY	100 SF	3.04
TENANT 1				
INDUSTRIAL SPACE	20,500 SF	F-1 OCCUPANCY	100 SF	205.50
OFFICE SPACE	1,500 SF	B OCCUPANCY	150 SF	10.00
TENANT 2				
INDUSTRIAL SPACE	20,188 SF	F-1 OCCUPANCY	100 SF	201.88
OFFICE SPACE	1,500 SF	B OCCUPANCY	150 SF	10.00
TENANT 3				
INDUSTRIAL SPACE	20,188 SF	F-1 OCCUPANCY	100 SF	201.88
OFFICE SPACE	1,500 SF	B OCCUPANCY	150 SF	10.00
TENANT 4				
INDUSTRIAL SPACE	20,500 SF	F-1 OCCUPANCY	100 SF	205.50
OFFICE SPACE	1,500 SF	B OCCUPANCY	150 SF	10.00
TOTAL BUILDING AREA: 87,780 SF		TOTAL BUILDING OCCUPANCY: 857.80		

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CHAPTER 10: EGRESS

PROPOSED BUILDING OCCUPANCY: (IBC SEC. 302)
F-1 OCCUPANCY: MODERATE-HAZARD INDUSTRIAL

OCCUPANT LOADS: (IBC TABLE 1004.5)
INDUSTRIAL (F-1): 100 SF/OCCUPANT = 81,780 SF / 100 = 818 OCCUPANTS
OFFICE (B): 150 SF/OCCUPANT = 1,500 SF / 150 = 10 OCCUPANTS
TOTAL: 858 OCCUPANTS

COMMON PATH OF EGRESS TRAVEL (CPET) (IBC TABLE 1006.2.1)
F-1 OCCUPANCY (SPRINKLED) BUILDING: 100 ft. MAX.

EXIT ACCESS TRAVEL DISTANCE (EATD) (IBC TABLE 1017.2)
F-1 OCCUPANCY (SPRINKLED) BUILDING: 250 ft. MAX.

EXIT ACCESS TRAVEL DISTANCE INCREASE (IBC SEC. 1017.2.2)
F-1 OCCUPANCY (SPRINKLED) BUILDING: 400 ft. MAX.

REQUIREMENTS:
- CLASSIFICATION OF F-1 LIMITED TO ONE STORY: YES
- 24 FT. MIN. HEIGHT FROM FINISH FLOOR TO BOT. OF ROOF: 30 ft.
- BUILDING EQUIPPED W/ AUTOMATIC FIRE SPRINKLERS: YES

MEANS OF EGRESS & STAIRWAY SIZING FOR SPRINKLER BUILDING (NOT REQUIRED) (IBC SEC. 1005.3)

EGRESS REQUIREMENTS:
TWO EXITS ARE REQUIRED WHERE THE OCCUPANT LOAD EXCEEDS 48 OCCUPANTS (IBC TABLE 1006.2.1)

ARRANGEMENT: EXIT ACCESS DOORWAYS MUST BE PLACED A DISTANCE APART EQUAL TO NOT LESS THAN 1/3 THE LENGTH OF THE MAXIMUM OVERALL DIAGONAL DIMENSION OF THE BUILDING OR AREA TO BE SERVED MEASURED IN A STRAIGHT LINE BETWEEN EXIT DOORS OR EXIT ACCESS DOORS. (IBC 1007.1.1 EXCEPTION 2)

MINIMUM WIDTH: PER IBC 1005.3 THE OCCUPANT LOAD SERVED BY THE MEANS OF EGRESS MUST BE MULTIPLIED BY 0.3 FOR STAIRWAYS AND BY 0.2 FOR OTHER EGRESS COMPONENTS. MINIMUM WIDTHS PER COMPONENT GOVERN.

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CHAPTER 29: PLUMBING SYSTEMS

Plumbing Fixtures
WC - Water Closets
LAV - Lavatories

Occupant loads are as determined by the code. Per IBC Table 2902.1.

TOTAL REQUIRED PLUMBING FIXTURES:
WC
LAV
= 18

PROVIDED PLUMBING FIXTURES:
WC
= FUTURE T.1 UNDER SEPARATE PERMIT
UNVAL
= FUTURE T.1 UNDER SEPARATE PERMIT
LAV PROVIDED
= FUTURE T.1 UNDER SEPARATE PERMIT

DRINKING FOUNTAINS:
REQUIRED
= 3
PROVIDED
= FUTURE T.1 UNDER SEPARATE PERMIT

REQUIRED PLUMBING FIXTURE CALCULATIONS:
8,175/sq. PROPOSED 7-1 OCC. 1,150 + 818 OCC. / 2 = 450 / 100 = 4.50 MALE 4.50 FEMALE WC
450 / 100 = 4.50 MALE 4.50 FEMALE LAV

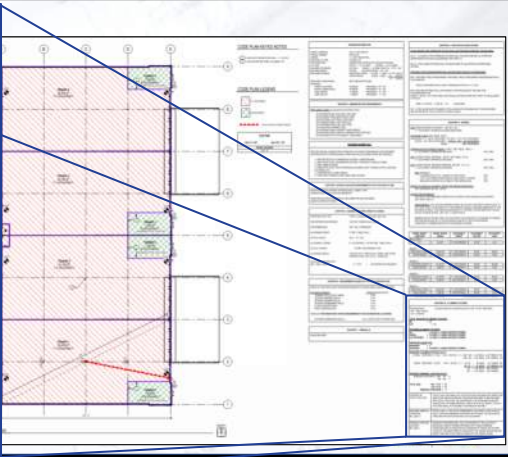
REQUIRED DRINKING FOUNTAIN CALCULATIONS:
BUILDING OCCUPANCY = 818, 1,150 = 1
750 - 800 = 1

TOTAL REQ.
WC = 9.75 = 10
LAV = 9.75 = 10
DRINKING FOUNTAINS = 3

LOCATION OF TOILET FACILITIES
TOILET FACILITIES SHALL BE LOCATED IN EACH BUILDING NOT MORE THAN ONE STORY ABOVE OR BELOW THE SPACE REQUIRED TO BE PROVIDED WITH TOILET FACILITIES OR CONVENIENTLY IN A BUILDING ADJACENT THERETO ON THE SAME PROPERTY, AND THE PATH OF TRAVEL TO SUCH FACILITIES SHALL NOT EXCEED A DISTANCE OF 300 FEET

REQUIRED DRINKING FOUNTAINS (IBC 2902.1)
PER IBC 2902.1 (ADA STATE AMENDMENTS) OCCUPANT LOADS OVER 30 SHALL HAVE ONE DRINKING FOUNTAIN FOR THE FIRST 100 OCCUPANTS, THEN ONE PER EACH ADDITIONAL 500 OCCUPANTS.

DRINKING FOUNTAIN LOCATION (IBC 2902.3)
DRINKING FOUNTAINS SHALL NOT BE REQUIRED TO BE LOCATED IN INDIVIDUAL TENANT SPACES PROVIDED THAT PUBLIC DRINKING FOUNTAINS ARE LOCATED WITHIN A DISTANCE OF TRAVEL OF 300 FEET 150' M OF THE MOST REMOTE LOCATION IN THE TENANT SPACE AND NOT MORE THAN ONE STORY ABOVE OR BELOW THE TENANT SPACE.



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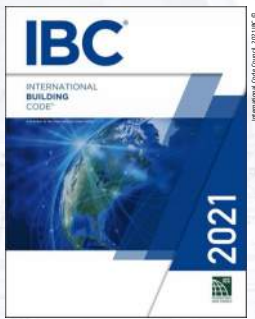
Code Analysis

- Again, the code analysis will typically include...
 - Codes Considered
 - Occupancy Classification & Use
 - Type of Construction
 - Sprinklered?
 - Allowable Heights & Areas
 - Incidental Uses?
 - Special Detailed Requirements?
- We will be covering most of this in the course today.



PART 2

IBC Chapter 3



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Occupancy Classifications & Use

- IBC Chapter 3:**
 - This chapter controls the classification of buildings in relation to occupancy.
 - Each "Use Group" is defined, and examples are provided.
 - Are all use groups noted in the code analysis?
 - Do the use groups listed appear to be correct?

DESCRIPTION	GROUP(S)
Assembly	A-1, A-2, A-3, A-4 & A-5
Business	B
Educational	E
Factory	F-1 & F-2
Hazardous	H-1, H-2, H-3, H-4 & H-5
Institutional	I-1, I-2, I-3 & I-4
Mercantile	M
Residential	R-1, R-2, R-3 & R-4
Storage	S-1 & S-2
Utility	U



Assembly (Group A)

- ❑ For the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation
- ❑ **IBC 303.1.2:** Group B if...
 - Occupant load less than 50
 - Less than 750ft² and accessory to another occupancy



Assembly (Group A)

- ❑ **Assembly Group A-1:** Production and viewing of performing arts or motions pictures...
 - Motion picture theaters
 - Symphony and concert halls
 - Television and radio studios
 - Theaters



IMAX Theater, Salt Lake City, UT



Assembly (Group A)

- ❑ **Assembly Group A-2:** Assembly uses intended for food and/or drink consumption...
 - Banquet halls
 - Casinos
 - Nightclubs
 - Restaurants, cafeterias, etc.
 - Bars



City Creek Center Cheesecake Factory, Salt Lake City, UT



Assembly (Group A)

- ❑ **Assembly Group A-3:** Assembly uses intended for worship, recreation, or amusement and other assembly uses not classified elsewhere in Group A...
 - Amusement arcades
 - Art galleries
 - Bowling alleys
 - Community halls
 - Courtrooms
 - Dance halls
 - Exhibition halls
 - Funeral parlors



2nd Floor Auditorium, Salt Lake City, UT



Assembly (Group A)

Assembly Group A-3 (cont.)

- Gymnasiums*
- Indoor swimming pools*
- Indoor tennis courts*
- Lecture halls
- Libraries
- Museums
- Places of religious worship
- Pool & billiard parlors
- Transportation waiting terminals



*(w/out spectator seating)



Assembly (Group A)

Assembly Group A-4: Assembly uses intended for viewing indoor sporting events...

- Arenas
- Skating rinks
- Swimming pools
- Tennis courts



Clarifield Aquatic Center, Orem, UT



Assembly (Group A)

Assembly Group A-5: Assembly uses intended for viewing outdoor activities...

- Amusement park structures
- Bleachers
- Grandstands
- Stadiums



Centennial at Sugar's Farmington, UT



Business (Group B)

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

- Airport traffic control towers (§412.2)
- Ambulatory care facilities (§422)
- Animal hospitals, kennels and pounds
- Banks
- Barber and beauty shops
- Car wash



Primary Children's Medical Center, Ambulatory Care Center, Salt Lake City, UT



Business (Group B) – cont.

- ❑ Civic Administration
- ❑ Clinic, outpatient
- ❑ Dry cleaning and laundries
- ❑ Educational occupancies (*students > 12th grade*)
- ❑ Electronic data processing
- ❑ Laboratories: testing/research
- ❑ Motor vehicle showrooms
- ❑ Post offices
- ❑ Print shops



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Business (Group B) – cont.

- ❑ Food processing establishments and commercial kitchens **not associated with restaurants**, cafeterias and similar dining facilities $\leq 2,500\text{ft}^2$
- ❑ If $> 2,500\text{ft}^2$ it should be classified as **Group F-1**



Papa John's Pizza, Moline, IL



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Educational (Group E)

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



National University of Science, Milwaukee, WI



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Educational (Group E) – cont.

- ❑ **Accessory** to religious worship and **<100** occupants per room or space = Group A-3
- ❑ **Daycare facilities**
 - **> 5 children** older than **2.5 years** who receive education, supervision, or personal care services for **< 24 hours** per day
 - **≤ 5 children** → same as primary occupancy
 - During religious functions → same as primary occupancy
- ❑ **Storm shelters** in Group E



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Factory (Group F)

- ❑ The use of a building or structure “for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations” that are not classified as Group H or Group S

H-Occupancy



Source: West Coast Consultants, Inc. www.wcc3.com



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Factory (Group F)

- ❑ **Moderate-Hazard, Group F-1:** Factory industrial uses that are not classified as Low-Hazard Group F-2...
 - Aircraft (manufacturing, not repair)
 - Appliances
 - Athletic equipment
 - Automobiles and other motor vehicles
 - Bakeries
 - Beverages > **16% alcohol**



ICON Health and Fitness, Logan, UT



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Factory (Group F)

- ❑ **Moderate-Hazard, Group F-1 (cont.):**

- | | |
|---------------------------------------|-------------------------|
| ▪ Construction/Agricultural machinery | ▪ Refuse incineration |
| ▪ Disinfectants | ▪ Shoes |
| ▪ Dry cleaning & dyeing | ▪ Soaps & detergents |
| ▪ Electric generation plants | ▪ Textiles |
| ▪ Electronics | ▪ Tobacco |
| ▪ Energy Storage Systems (ESS) | ▪ Trailers |
| ▪ Engines (including rebuilding) | ▪ Upholstering |
| ▪ Furniture | ▪ Water/sewer treatment |
| ▪ Hemp products | ▪ Wood: distillation |
| ▪ Recreational vehicles | ▪ Woodworking (cabinet) |



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Factory (Group F)

- ❑ **Moderate-Hazard, Group F-1 (cont.):**

- | | |
|----------------------------|-------------------------------|
| ▪ Bicycles | ▪ Machinery |
| ▪ Boats | ▪ Metals |
| ▪ Brooms and brushes | ▪ Millwork (sash and door) |
| ▪ Business machines | ▪ Motion picture & TV filming |
| ▪ Cameras/photo equipment | ▪ Musical instruments |
| ▪ Canvas or similar fabric | ▪ Optical goods |
| ▪ Carpets and rugs | ▪ Paper mills or products |
| ▪ Clothing | ▪ Photographic film |
| ▪ Jute products | ▪ Plastic products |
| ▪ Laundries | ▪ Printing & publishing |
| ▪ Leather products | |



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Factory (Group F)

- Food processing establishments and commercial kitchens **not associated with restaurants**, cafeterias and similar dining facilities > 2,500ft²



Factory (Group F)

- Low-Hazard, Group F-2:** Factory industrial uses that involved **noncombustible** materials that do not involve a significant fire hazard...

- Beverages (≤ 16% alcohol)
- Brick and masonry
- Ceramic products
- Foundries
- Glass products
- Gypsum
- Ice
- Metal products



High-Hazard (Group H)

- The use of a building or structure that “involves the manufacturing, processing, generation or storage of materials that constitute a **physical or health hazard** in quantities in excess of those allowed in control areas...”
- If stored or used on top of roofs or canopies shall be classified as outdoor storage and shall comply with the IFC.



High-Hazard (Group H)

- Group H if the quantities of materials exceed those allowed by Tables 307.1(1) and 307.1(2)

TABLE 307.1(1) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD ^{1, 2, 3, 4}											
MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ⁵			USE-CLOSED SYSTEM ⁶			USE-OPEN SYSTEM ⁷		
			Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)	Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)	Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)
Combustible dust	N/A	H-2	See Note 9	N/A	N/A	See Note 9	N/A	N/A	See Note 9	N/A	N/A
Combustible fiber ¹¹	Loose Bulk ¹²	H-3	(100) (1,000)	N/A	N/A	(100) (1,000)	N/A	N/A	(20) (200)	N/A	N/A

(2) TABLE 307.1(2) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD ^{1, 2, 3, 4}											
MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ⁵			USE-CLOSED SYSTEM ⁶			USE-OPEN SYSTEM ⁷		
			Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)	Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)	Solid ⁸ (pounds)	Liquid ⁹ (gallons)	Gas ¹⁰ (cubic feet at 100°F)
Corrosives		H-1	5,000	500	Gas toxic H-2 ¹³ Labeled (150)	5,000	500	Gas toxic H-2 ¹³ Labeled (150)	1,000	100	
Highly Toxic		H-1	10	(10)	Gas toxic H-2 ¹³ Labeled (147)	10	(10)	Gas toxic H-2 ¹³ Labeled (147)	3	(3)	
Toxic		H-2	500	(500)	Gas toxic H-2 ¹³ Labeled (150)	500	(500)	Gas toxic H-2 ¹³ Labeled (150)	125	(125)	



High-Hazard (Group H)

- Group H-1: Detonation hazard
 - Detonable pyrophoric materials
 - Explosives (Division 1.1-1.6)
 - Organic peroxides, unclassified detonable
 - Oxidizers, Class 4
 - Unstable reactive materials, Class 3 detonable & Class 4



High-Hazard (Group H)

- Group H-2: Deflagration hazard
 - Class I, II, IIIA flammable/combustible liquids (>15psi)
 - Combustible dusts
 - Cryogenic fluids, flammable
 - Flammable gases
 - Organic peroxides, Class I
 - Oxidizers, Class 3
 - Pyrophoric liquids, solids and gases, non-detonable
 - Unstable (reactive) materials, Class 3, non-detonable
 - Water-reactive materials, Class 3



High-Hazard (Group H)

- Group H-3: Materials that support combustion or pose a physical hazard
 - Class I, II, or IIIA flammable/combustible liquids (≤ 15 psi)
 - Combustible fibers
 - Consumer fireworks, 1.4G (Class C, Common)
 - Cryogenic fluids, oxidizing
 - Flammable solids
 - Organic peroxides, Class II and III
 - Oxidizers, Class 2
 - Oxidizers, Class 3 (≤ 15 psi)
 - Oxidizing gases
 - Unstable (reactive) materials, Class 2
 - Water-reactive materials, Class 2




High-Hazard (Group H)

- Group H-4: Health hazards
 - Corrosives
 - Highly toxic materials
 - Toxic materials
- IBC Commentary:
 - "The data sheets for these chemicals, which are furnished by the applicant, will need considerable subjective evaluation."




High-Hazard (Group H)

- Group H-5:** Hazardous production materials
 - Semiconductor fabrication
 - Research and development
- IBC Commentary:**
 - "It is intended that the quantities of materials permitted in Table 415.11.1.1.1 will take precedence over Tables 307.1(1) and 307.1(2)."



HAZARD CATEGORY	SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ 10°F/square foot)
Combustible dust	Not Applicable	Not Applicable	Not Applicable
Combustible fiber	Loose Baled Note b Notes b and c	Not Applicable	Not Applicable


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Institutional (Group I)

- Buildings or structures in which “**care or supervision** is provided to persons who are not capable of self-preservation... or in which persons are **detained** for penal or correctional purposes”




https://unplash.com/photos/daw6J228v07dtn_source=unsplash&utm_medium=referral&utm_content=credit3&urlLink



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Institutional (Group I)

- Group I-1:** More than 16 persons, excluding staff, who reside on a 24-hour basis
 - Alcohol and drug centers
 - Assisted living facilities
 - Congregate care facilities
 - Group homes
 - Halfway houses
 - Residential board and care facilities
 - Social rehabilitation facilities



DEER TRAIL ASSISTED LIVING
2500 Reagan Avenue


Deer Trail Assisted Living, Reno, NV



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Institutional (Group I)

- Group I-1 Conditions:**
 - Condition 1:** Persons receiving custodial care that are capable of responding to an emergency situation without any assistance.
 - Condition 2:** Persons receiving custodial care require limited verbal or physical assistance in an emergency situation.
- Exceptions to Group I-1:**
 - 6 – 16 Persons:** Receiving custodial care – Group R-4 Occupancy
 - Five or Less Persons:** Receiving custodial care – Group R-3 Occupancy



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Institutional (Group I)

- ❑ **Group I-2:** Medical care on a 24-hour basis to more than 5 persons who are incapable of self-preservation.
 - Foster care facilities
 - Detoxification facilities
 - Hospitals
 - Nursing homes
 - Psychiatric hospitals



Institutional (Group I)

- ❑ **Group I-2 Conditions:**
 - **Condition 1:** Nursing and medical care but not emergency care, surgery, obstetrics or in-patient stabilization units.
 - **Condition 2:** Includes emergency care, surgery, obstetrics or in-patient stabilization units.
- ❑ **Exceptions to Group I-2:**
 - 5 or Less Persons, receiving medical care:
 - Group R-3 (IBC), or...
 - Comply with the IRC → sprinklered per IBC 903.3.1.3 or IRC P2904



Institutional (Group I)

- ❑ **Group I-3:** More than 5 persons under restraint or security
 - Correctional centers
 - Detention centers
 - Jails
 - Prerelease centers
 - Prisons
 - Reformatories



Institutional (Group I)

- ❑ **Group I-3 Conditions:**
 - **Condition 1:** Free movement allowed from sleeping areas and other spaces and access to the exterior is permitted.
 - **Condition 2:** Free movement allowed from sleeping areas and other spaces but egress to the exterior is impeded by locked exits.
 - **Condition 3:** Free movement is allowed within individual compartments, such as sleeping areas and group activity spaces, but egress is impeded.
 - **Condition 4:** Free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement.
 - **Condition 5:** Free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement.



Institutional (Group I)

- ❑ **Group I-4:** More than 5 persons who receive custodial care for fewer than 24 hours
 - Adult daycare
 - Child daycare



Institutional (Group I)

- ❑ **Group I-4 Day Care Facilities:**
 - **Group E:** > 5 but not > 100 children 2.5 years of age or less and...
 - Rooms are located on level of exit discharge, and...
 - Rooms have an exit door directly to exterior.
 - Same as **Primary Occupancy** if...
 - Within a religious facility and care is provided during religious functions, or...
 - ≤ 5 persons receiving custodial care
 - **Group R-3:** ≤ 5 persons receiving custodial care and located within a dwelling unit.



Mercantile (Group M)

- ❑ The use of a building or structure for the **display and sale** of merchandise, and involves stocks of goods... incidental to such purposes and accessible to the public”
 - Department stores
 - Retail or wholesale stores
 - Drug stores
 - Markets
 - Motor fuel-dispensing
 - Sales rooms
 - Greenhouses for display & sale of plants that provide public access



Residential (Group R)

- ❑ The use of a building or structure for “sleeping purposes when not classified as a Group I”



Residential (Group R)

- Group R-1: Primarily transient in nature
 - Boarding houses (transient) with > 10 occupants
 - Congregate living (transient) with > 10 occupants
 - Hotels (transient)
 - Motels (transient)



Hotel Garden Inn, Ogden, UT



Residential (Group R)

- Group R-2: More than 2 dwelling units and primarily permanent in nature
 - Apartment houses
 - Congregate living (non-transient) with > 16 occupants
 - Boarding houses (non-transient)
 - Convents/monasteries
 - Dormitories
 - Fraternities/sororities
 - Hotels/motels (non-transient)
 - Live/work units
 - Vacation timeshare properties



Stokell Apartments, Murray, UT



Residential (Group R)

- Group R-3: Primarily permanent in nature and not classified as R-1, R-2, R-4 or I-occupancy
 - No more than 2 dwelling units
 - Boarding houses (non-transient) ≤ 16 or fewer occupants
 - Congregate living, boarding houses or lodging houses (transient) with ≤ 10 occupants



1500 S. 1000 E., Provo, UT 84601



Residential (Group R)

- Group R-3:
 - Congregate living (non-transient) with ≤ 16 occupants
 - Boarding houses (non-transient)
 - Convents/monasteries
 - Dormitories
 - Fraternities/sororities



Residential (Group R)

- ❑ **Group R-4:** > 5 but ≤ 16 persons who reside on a 24-hour basis in a supervised residential environment
 - Alcohol and drug centers
 - Assisted living facilities
 - Congregate care
 - Group homes
 - Halfway houses
 - Residential board and care facilities
 - Social rehabilitation facilities



Residential (Group R)

- ❑ **Group R-4 Conditions:**
 - **Condition 1:** Persons receiving custodial care are capable of responding to an emergency situation without any assistance.
 - **Condition 2:** Persons receiving custodial care require limited verbal or physical assistance in an emergency situation.



<https://www.housingnews.com/2020/06/03/broader-is-better-covid-19-primes-senior-living-for-rise-small-house-models/>



Storage (Group S)

- ❑ The use of a building or structure for “**storage** that is not classified as a hazardous occupancy”
- ❑ **Accessory Spaces:** Room or space used for storage that is accessory to another occupancy – classified as part of the main occupancy.
- ❑ **Combustible Storage:** High-piled, rack, attic, underfloor, and concealed space storage of combustibles shall comply with IBC 413.



Storage (Group S)


- ❑ **Group S-1:** Not classified as S-2
 - Aerosols, Levels 2 and 3
 - Aircraft hanger
 - Bags: cloth, burlap and paper
 - Bamboos and rattan
 - Baskets
 - Belting: canvas and leather
 - Beverages (>16% alcohol)
 - Books and paper in rolls or packs
 - Boots and shoes
 - Buttons, pearl or bone



Storage (Group S)

Group S-1 (cont.):

- Cardboard & cardboard boxes
- Clothing, woolen wearing apparel
- Cordage
- Dry boat storage (indoor)
- Furniture
- Furs
- Glues, mucilage, pastes & size
- Grains
- Horns and combs (other than celluloid)
- Leather
- Linoleum
- Lumber
- Motor vehicle repair (< MAQs)
- Photo engravings
- Resilient flooring
- Self-service storage
- Silks
- Soaps
- Sugar
- Tires, bulk storage
- Tobacco, cigars, cigarettes and snuff
- Upholstery and mattresses
- Wax candles



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Storage (Group S)

Group S-2: Noncombustible materials

- Asbestos
- Beverages (≤ 16% alcohol)
- Cement in bags
- Chalk and crayons
- Dairy products
- Dry cell batteries
- Electrical coils
- Electrical motors
- Empty cans
- Food products

Pay attention to containers!



Universal Line Company, Portland, Oregon, Santa Clara, CA




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Storage (Group S)

Group S-2 (cont.):

- Foods
- Fresh fruits & vegetables
- Frozen foods
- Glass
- Glass bottles, empty or filled w/ noncombustible liquids
- Gypsum board
- Inert pigments
- Ivory
- Meats
- Metal cabinets
- Metal desks w/ plastic tops/trim
- Metal parts
- Metals
- Mirrors
- Transformers
- Public parking garages
- Porcelain and pottery
- Stoves
- Talc & soap stones
- Washers & dryers

Pay attention to containers!




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Utility (Group U)

Buildings and structures of an “accessory character and miscellaneous structures not classified in any specific occupancy”

- Agricultural buildings
- Aircraft hangars
- Barns
- Carports
- Fences > 7-feet
- Grain silos
- Livestock shelters
- Private garages
- Retaining walls
- Sheds
- Stables
- Tanks
- Towers
- Greenhouses (not classified as another occupancy)



Southwest Airports, California, California



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PART 3

IBC Chapter 6



Types of Construction



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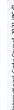
IBC Chapter 6



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Table 60I: Required Rated Construction

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame ^a (see Section 202)	3 ^{a,b}	2 ^{a,b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	3 ^a	2 ^a	2 ^a	HT	1 ^{b,c}	0
Bearing walls												
Exterior ^{c,d}	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	3	2	2	1/HT ^e	1	0
Nonbearing walls and partitions												
Exterior	See Table 705.5											
Nonbearing walls and partitions												
Interior ^e	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 ^{1/2} ^b	1 ^{b,c}	1 ^{b,c}	0 ^c	1 ^{b,c}	0	1 ^{1/2}	1	1	HT	1 ^{b,c}	0



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Table 60I: Required Rated Construction

❑ Beware of the Footnotes!

- a. Roof supports: Fire-resistance rating of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retarded treated wood members shall be allowed to be used for such unprotected members.
- c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
- d. Not less than the fire-resistance rating required by other sections of this code.
- e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).
- f. Not less than the fire-resistance rating as referenced in Section 704.10.
- g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.





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Construction Type

Primary Structural Frame – Includes:

- The columns
- Structural members having direct connections to the columns, including; girders, beams, trusses, and spandrels
- Members of the floor and roof construction having direct connection to the columns
- Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading


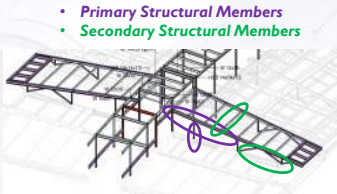


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Construction Type

Secondary Members - Include:

- Structural members not directly connected to columns
- Floor & roof members without direct connection to columns
- Bracing members that are not part of the primary structural frame or bearing wall



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Construction Type

Bearing Wall:

- Metal or wood stud wall that supports more than 100 pounds per linear foot of vertical load in addition to its own weight
- Any masonry or concrete wall that supports more than 200 pounds per linear foot of vertical load in addition to its own weight.

Non-Bearing wall

- Not a bearing wall



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Construction Type

Types I and II (602.2)

- Noncombustible

Type III (602.3)

- Exterior walls:
 - Noncombustible
 - Fire-retardant-treated wood exterior wall
 - 2-hour rating or less
- Interior elements
 - Any material permitted



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Construction Type

Type IV (602.4)

- Mass timber or noncombustible
- Type IV-HT (Heavy Timber) → up to 85-feet → IBC Table 2304.1.1
- Cross-laminated Timber (CLT) – labeled per ANSI/APA PRG 320
 - Type IV-A → up to 270-feet → protected per IBC 602.4.1
 - Type IV-B → up to 180-feet → protected per IBC 602.4.2
 - Type IV-C → up to 85-feet → protected per IBC 602.4.3



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Construction Type

Type V (602.5)

- Any material permitted



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IBC 603: Combustibles

Allowable Materials (603.1)

- Fire-Retardant-Treated Wood
 - Nonbearing partitions
 - Fire-resistance rating < 2 hours.
 - Nonbearing exterior walls
 - Non-fire-rated
 - Roof construction
 - Exception:
 - ✓ Type IA
 - ✓ > 2 stories
 - ✓ < 20 feet AFF



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IBC 603: Combustibles

Allowable Materials (cont.):


- Insulation (FSI < 25)
- Trim & Finishes (see Chapter 8)
- Millwork
- 6 ft. partitions
- Stages/Platforms
- Exterior wall coverings
- Blocking
- Plastics (see Chapter 26)
- Sealants (ext. wall)
- Furring strips (see Chapter 8)
- Heavy Timber
- Materials used for fire protection
- Concealed spaces (IBC 718.5)
- Materials in Plenums
- Freezers < 1,000 ft2
- Ducts/piping/electrical





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PART 4

IBC Chapter 5





General Building
Heights & Areas



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Applicability


- IBC 501.1 – Applies to **new structures** and **additions to existing** structures.
- IEBC 502.1 – **Prescriptive Compliance Method** – “An existing building together with its additions shall comply with the height and area provisions of Chapter 5 of the (IBC).”
- IEBC 1102.1 – **Work Area Compliance Method** – “An addition shall not increase the height of an existing building beyond that permitted under the applicable provisions of Chapter 5 of the (IBC) for new buildings.”





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Applicability

- In reference to the IEBC, it also requires changes in occupancy to comply with Chapter 5 of the IBC.
- IEBC 506.1 – **Prescriptive Compliance Method** – “A change of occupancy shall not be made in any building unless that building is made to comply with the requirements of the (IBC) for the use or occupancy.”
- IEBC 1011.6.1 – **Work Area Method** – “...shall comply with the requirements of Chapter 5 of the (IBC) for the new occupancy.”








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Building Identification

- IBC 502.1 – Buildings shall be provided with address identification
 - Characters that contrast with background
 - Arabic numbers and/or alphabetic letters
 - 4-inches high
 - Addresses not visible from public way → provide with monument





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Fire Walls

IBC 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... shall be considered to be a separate building.”

IBC 202:

- “A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.”



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Exemptions

Exemptions from IBC 503 include...

- Special industrial occupancies** → If they “...require unusual building heights to accommodate crane ways or special machinery and equipment...”
- Buildings on the same lot** → Can be considered one building or separate buildings
- Type I construction** → Those with unlimited building heights and areas do not apply
- Occupied roofs** → see next slide



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Occupied Roofs

IBC 503.1.4: Roof level or portion of the roof can be considered an occupied roof.

- The occupancy of the occupied roof will need to be **identified** per Chapter 3.
- The occupancy is permitted by Table 504.4 for the **story immediately below the roof**.
- The occupied roof is not considered in the allowable area, number of stories or height criteria.



LDS Conference Center, Salt Lake City, UT



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Occupied Roofs

IBC 503.1.4, Exceptions:

- Exception 1** – occupancy on roof is not limited to that of the story immediately below the roof where the building is sprinklered **and** an emergency voice/alarm communication system is provided at the occupied roof.
- Exception 2** – Open parking garages of Type I or II construction permit assembly occupancies at the roof.



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Sprinklered?

- ❑ Will the building be sprinklered?
- ❑ If so, what type of system?
 - NFPA 13 (SI/SM)
 - NFPA 13R (SI3R)
 - NFPA 13D (SI3D)
- ❑ This information is needed prior to verifying the allowable height, # of stories, and area for the building.



Allowable Heights & Areas

- ❑ **Key Definitions:**
 - **Building Area**
 - Area within exterior walls & fire walls
 - Area below roof & floor projections
 - **Building Height**
 - From grade plane to average height of the highest roof surface.



Allowable Heights & Areas

- ❑ **Key Definitions (cont.):**
 - **Story Above Grade Plane**
 - Finished floor 100% above grade plane
 - Floor above is:
 - > 6 feet above grade plane; or
 - > 12 feet above finished grade at any point



Example – Grade Plane & Story Above Grade Plane



Allowable Heights & Areas

- IBC 504.2: No occupancy shall exceed the limits specified.
- IBC 504.3: The maximum height shall not exceed Table 504.3 (NFPA 13R = NS)
- IBC 504.4: The maximum number of stories per Table 504.4 (NFPA 13R = NS)



Allowable Heights & Areas

- Allowable Height & Stories → IBC Tables 504.3 and 504.4
 - NS – Entire building not sprinklered
 - S – Entire building NFPA 13 Sprinklers
 - S13R – Entire building NFPA 13R Sprinklers
 - S13D – Entire building NFPA 13D Sprinklers
 - UL – Unlimited
- Towers, spires, and steeples
 - No habitation or storage
 - Non-combustible – No Limit
 - Combustible – 20 feet higher than Table (see IBC 1511)



Example: Type V-B sprinklered restaurant (Group A-2) having 8,500ft²

TABLE 504.3 ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE ^a													
OCCUPANCY CLASSIFICATION	See Footnotes	TYPE OF CONSTRUCTION										Type V	
		Type I		Type II		Type III		Type IV		HT			
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS ^a	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
H-1, H-2, H-3, H-5	NS ^{a,d}	UL	160	65	55	65	55	120	90	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
H-4	NS ^{a,d}	UL	160	65	55	65	55	65	65	65	65	50	40
I-1 Condition 1, I-3	NS ^{a,e}	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-1 Condition 2, I-2	NS ^{a,f}	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
I-4	NS ^{a,g}	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	180	120	85	85	70	60
R ^h	NS ⁱ	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	60	60	60	60	60	60	60	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60

Allowable Height = 60-feet



Example: Type V-B sprinklered restaurant (Group A-2) having 8,500ft²

TABLE 504.4 ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE ^{a, b}														
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	
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1	
	S	UL	6	4	3	4	3	9	6	4	4	3	2	
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1	
	S	UL	12	4	3	4	3	18	12	6	4	3	2	
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1	
	S	UL	12	4	3	4	3	18	12	6	4	3	2	
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1	
	S	UL	12	4	3	4	3	18	12	6	4	3	2	
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL	
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2	
	S	UL	12	6	4	6	4	18	12	9	6	4	3	

Allowable # of Stories = 2



Allowable Heights & Areas

❑ Allowable Area:

1. Single-Occupancy, ≤ 3 stories

- $A_a = A_t + [NS \times I_f]$ (Eq. 5-1)
- A_a = Allowable building area
- A_t = Tabular Area (Table 506.2)
- I_f = Frontage increase factor (we will address later)
- NS = Tabular area for non-sprinklered building



Example: Type V-B sprinklered restaurant (Group A-2) having 8,500ft²

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET^a

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION										Type V	
		Type I		Type II		Type III		Type IV			HT		
		A	B	A	B	A	B	A	B	C		A	B
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	SM	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL

Allowable Area = 24,000ft² per story

This appears to work for height, # of stories, and allowable area!

International Code Council, 2021 IBC ©



Example: Type V-A, 3-story apartment building, NFPA 13R sprinklers

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET^a

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION										Type V	
		Type I		Type II		Type III		Type IV			HT		
		A	B	A	B	A	B	A	B	C		A	B
R-1 ^b	NS ^c	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	S1	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2 ^b	NS ^c	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	S1	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3 ^b	NS ^c	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13D	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13R	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S1	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
R-4 ^b	NS ^c	UL	UL	24,000	16,000	24,000	16,000	64,000	246,000	164,000	102,500	82,000	48,000
	S13D	UL	UL	24,000	16,000	24,000	16,000	64,000	246,000	164,000	102,500	82,000	48,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000

Allowable Area = 12,000ft² per story
→ 36,000ft² total (But no floor shall be larger than 12,000ft²)



Allowable Heights & Areas

❑ Allowable Area (cont.):

2. Single-Occupancy, > 3 stories

- $A_a = A_t + [NS \times I_f] \times S_a$ (Eq. 5-2)
- A_a = Allowable building area
- A_t = Tabular Area (Table 506.2)
- I_f = Frontage increase factor (we will address later)
- NS = Tabular area for non-sprinklered building
- $S_a = 3$ (4 if NFPA 13R sprinklers)



Example: Type II-B, 5-story office building, NFPA 13 sprinklers

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
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000
A-5	NS												
	S1	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	SM												
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,250	23,500	18,500	9,500
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000
	SM	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500

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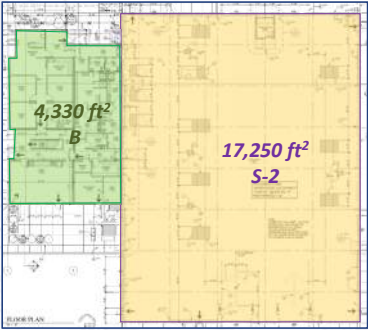
Allowable Area = 69,000ft² per story
Total Allowable = 69,000 * 3 = 207,000ft²
➔ 207,000ft² total (But no floor shall be larger than 69,000ft²)

Allowable Heights & Areas

- **Allowable Area (cont.):**
 - The previous two examples were for single-occupancy buildings.
 - For mixed-use we need to first discuss “**Separated vs. Nonseparated**”.
- **Nonseparated**
 - Use Groups not separated by fire rated construction
 - Most stringent requirement applies to whole building
 - Chapter 9 – Fire sprinklers or alarms
 - Chapter 5 – Height and area
 - Section 403 High rise buildings
 - Different Use Groups may control for different Sections

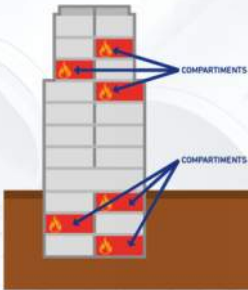
Example: Nonseparated

- **Building Info:**
 - Total area = 21,580
 - Type II-B
 - B = 2 stories
- **Table 506.2**
 - Use Group B
 - NS = 23,000
 - Use Group S-2
 - NS = 26,000
- **21,580 < 23,000**
 - GOOD!



Allowable Heights & Areas

- **Allowable Area (cont.):**
- **Separated Use Groups (Table 508.4)**
 - Different Use Groups separated by:
 - Fire Barriers
 - Horizontal assemblies
 - Allowable Area
 - Determined for each Use
 - Sum of ratio actual/allowable < 1.0



Allowable Heights & Areas

- IBC 508.4:

Use previous example → Mixed B & S-2, unsprinklered
- Separation = fire barrier or horizontal assembly

TABLE 508.4 REQUIRED SEPARATION OF OCCUPANCIES (HOURS) ^a																		
OCCUPANCY	A, E		I-1, I-3, I-4		I-2		R ^a		F-2, S-2, U		S ^a , F-1, M, S-1		H-1		H-2		H-3, H-4	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	1	2	2	NP	1	2	N	1	1	2	NP	NP	3	4	2	3
I-1, I-3, I-4	1	2	N	N	2	NP	1	NP	1	2	1	2	NP	NP	3	NP	2	NP
I-2	2	NP	2	NP	N	N	2	NP	2	NP	2	NP	NP	NP	3	NP	2	NP
R ^a	1	2	1	NP	2	NP	N	N	1 ^a	2 ^a	1	2	NP	NP	3	NP	2	NP
F-2, S-2, U	N	1	1	2	2	NP	1 ^a	2 ^a	N	N	1	2	NP	NP	3	4	2	3
S ^a , F-1, M, S-1	1	2	1	2	2	NP	1	2	1	2	N	N	NP	NP	2	3	1	2
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP
H-2	3	4	3	NP	3	NP	3	4	2	3	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP	2	NP	2	3	1	2	NP	NP	1	NP	1	NP
H-5	2	NP	2	NP	2	NP	2	NP	2	NP	1	NP	NP	NP	1	NP	N	NP

Example: Type III-B, 5-story hotel with restaurant & conference areas, NFPA 13

TABLE 506.2 ALLOWABLE AREA FACTOR (A _a = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET ^{a, b}														
OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION												
		Type I		Type II		Type III		Type IV			Type V		HT	
		A	B	A	B	A	B	A	B	C	A	B		
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500	
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000	
	SM	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500	
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000						
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000						
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000						
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	Conference (Group A) Allowable Area = 28.5
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000	
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000	
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000	
	SM	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000	

Conference (Group A-3)
Allowable Area = 28,500ft²

Allowable Heights & Areas

□ Type III-B, 5-story hotel, restaurant & conference, NFPA 13

- Let's assume "Nonseparated"
- Hotel (Group R-1) → 48,000ft² per story
- Restaurant (Group A-2) → A_a = 28,500ft² per story ← Most Stringent Controls
- Conference Areas (Group A-3) → A_a = 28,500ft² per story
- Total Area = 28,500ft² x 3 stories = 85,500ft² (But no floor > 28,500ft²)

Allowable Heights & Areas

□ Type III-B, 5-story hotel, restaurant & conference, NFPA 13

- Now let's assume "Separated"
- Assume Groups A-2 and A-3 are only located on 1st floor.
- 1st floor breakdown:
 - Group R-1 = 15,000ft²
 - Group A-2 = 2,500ft²
 - Group A-3 = 6,500ft²
- Unity formula is as follows:

The unity formula is repeated at each level and aggregate sum of the ratios for all levels cannot exceed 3.0.

$$\frac{15,000ft^2}{48,000ft^2} + \frac{2,500ft^2}{28,500ft^2} + \frac{6,500ft^2}{28,500ft^2} = 0.3125 + 0.087 + 0.228 = 0.6275 < 1.0, \text{ Okay!}$$

Allowable Heights & Areas

A-3 19,181 ft ²	R-2 21,357 ft ²	A-2 19,762 ft ²	0.33 + 0.24 + 0.34 = 0.91
R-1 30,150 ft ²	R-2 30,150 ft ²		0.335 + 0.335 = 0.67
B 20,150 ft ²	M 20,200 ft ²	R-1 20,000 ft ²	0.14 + 0.25 + 0.22 = 0.61
B 20,300 ft ²	M 40,000 ft ²		0.14 + 0.5 = 0.64
			0.91 + 0.67 + 0.61 + 0.64 = 2.83 OK ≤ 3

Allowable Heights & Areas

- Frontage Increase:

Big change in the 2022 IBC!

Till now we have calculated allowable area without a frontage increase.

To qualify, a building must have 25% of perimeter on public way/open space.

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

To be considered, public way/open space must be ≥ 20-feet measured at right angles from building face to...

Closest interior lot line, or...

Entire width of street, alley or public way, or...

Exterior face of adjacent building on same property.

Allowable Heights & Areas

- Frontage Increase (cont.):

Based on **smallest** public way/open space that is ≥ 20-feet, and...

The % of building perimeter having ≥ 20-feet to public way/open space.

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)			
	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

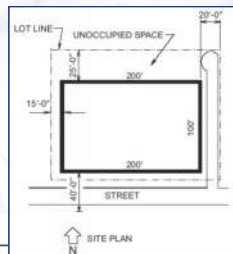
- Example:
- Based on smallest open space ≥ 20-feet

Per image that is East side of building = 20-feet

% of perimeter ≥ 20-feet?

600-feet total, 500-feet complying → 83%

Per IBC Table 506.3.3 → 0.50



PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)			
	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

Example: Type V-A, 3-story apartment building, NFPA 13R sprinklers

TABLE S06.2—continued													
ALLOWABLE AREA FACTOR (A = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET ^{a,b}													
OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION										Type V	
		Type I		Type II		Type III		Type IV		HT			
		A	B	A	B	A	B	A	B	C			
R-1 ^c	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-2 ^e	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-3 ^f	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
R-4 ^g	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
R-5 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000

Allowable Area = 12,000ft² per story

→ 36,000ft² total (But no floor shall be larger than 12,000ft²)

With Frontage Increase = 0.50

Allowable Area = 18,000ft² per story

→ 54,000ft² total (But no floor shall be larger than 18,000ft²)

IBC 507: Unlimited Area

- ❑ **60 Ft Open on all Sides**
 - Non Sprinklered, 1 story → F-2 or S-2
 - Sprinklered, 1 story → A-4 (not Type V), B, F, M or S
 - Sprinklered, 2 story → B, F, M or S
 - A-3, 1 story → Type II, III or IV; Sprinklered & No Stage
 - Area of Movie Theaters → Type II; Sprinklered
- ❑ **40 Ft permitted if...**
 - < 75% perimeter
 - 3-hr rated wall and openings



It worked originally, but...



IBC 507: Unlimited Area

- ❑ **Mixed Use with A-1 and A-2**
 - Sprinklered, 1 story
 - A-1/A-2 areas are fire separated
 - Each area < IBC 503.1
 - Exit doors to exterior
- ❑ **Mixed Use with H-2, H-3, H-4**
 - Permitted in unlimited Group F or S (IBC 507.8)
- ❑ **Mixed Use with H-5**
 - Type I or II
 - Permitted in unlimited Group B, F, M or S (IBC 507.8)
 - Sprinklered and up to 2 stories



IBC 507: Unlimited Area

- ❑ **Aircraft Paint Hangar (507.9)**
- ❑ **Group E**
 - 1 story, sprinklered
 - Type II, IIIA or IV
 - Classrooms (2) Exits → (1) to exterior
 - 60-foot yards → Not reducible
- ❑ **Covered and Open Mall Buildings and Anchor Buildings**
 - Can be unlimited → must comply with IBC 402
 - Up to three stories



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IBC 507: Unlimited Area

Frontage Increase:

- If a building complies with IBC 507 unlimited area provisions, except...
- It does not meet the 60-foot public way or yard requirement...
- The frontage increase can be calculated using IBC Table 506.3.3.1

Starts at <30-feet

TABLE 506.3.3.1
SECTION 507 BUILDINGS*

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)					
	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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Accessory Occupancies

Accessory Areas (IBC 508.2)

- Ancillary to main occupancy
- Shall be individually classified
- Are not required to be separated from main occupancy
 - Except: H-2, H-3, H-4 & H-5 ...or... I-1, R-2, R-2 & R-3 dwelling units
- Allowable height & stories → Per Main Occupancy
- Allowable area → Per Main Occupancy
- Must meet two criteria...
 - Aggregate accessory occupancies ≤ 10% of floor area
 - Aggregate accessory occupancies ≤ NS Area of Table 506.2



Example: Accessory

Section 508.2

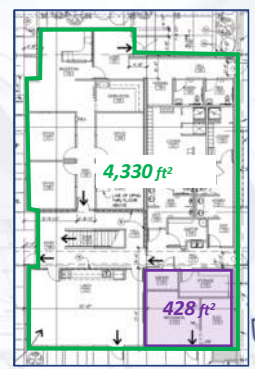
Green (Main Occupancy)

- Use Group B

Purple (Ancillary)

- Use Group S-2

- Step 1: $428 \text{ ft}^2 \div 4,330 \text{ ft}^2 < 9.88\%$ 🟡
- Step 2: Table 506.2, Nonsprinklered
 - For example, assume Type V-B 🟡
 - Group S-2 ≤ $13,500 \text{ ft}^2 > 424 \text{ ft}^2$ 🟡



Incidental Uses

IBC 509:

- Ancillary functions that pose a greater level of risk.
- Shall not occupy more than 10% of story area

(TABLE 509.1
INCIDENTAL USES)

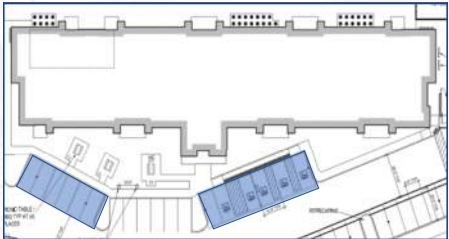
ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system

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Buildings on Same Lot

- IBC 503.1.2:
 - Separate Buildings, or
 - Same building



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Mezzanines

- Mezzanines (IBC 505.2)
 - Part of story below
 - Not part of building area or stories
 - Part of fire area
 - Requirements:
 - 7-foot clear height (above & below)
 - 1/3 Area room located in
 - Do not include enclosed portions of room
 - Do not include mezzanine in floor area
 - 1/2 Area of room if...
 - Type I and II Construction w/ NFPA 13 and Voice Alarm, or...
 - Within dwelling unit, open except closets or bathrooms



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Mezzanine Example

- Openness
 - Open to room
 - Walls < 42 high
- Exceptions to Openness
 - < 10 occupants
 - At least 2 means of egress
 - < 10% enclosed
 - NFPA 13 w/ (2) means of egress



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Equipment Platforms

- Equipment Platform (505.3)
 - Not included in:
 - Building Area
 - Fire Area
 - Number of stories
 - Not part of a mezzanine
 - Access independent of building egress
 - Limitations
 - Two-thirds Area of room
 - Includes area of Mezzanines
- In sprinkled buildings
 - Provide above and below
- Guards required



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Special Provisions

Podiums (510.2)

3-hr horizontal "lid"

Building height

- Measured from grade plane
- Smaller of above and below

Building area:

- Above and below separate buildings

Above "Lid":


- Use groups limited to:
 - A with < 300 occupants each
 - B, M, R, or S

Below "Lid":

- Type I-A construction
- Any Use Group except H
- NFPA Sprinkler

2-hr shafts through "lid"

- Exception 3-hr below and 1-hr above if:
 - Building above not Type I
 - < 4 stories connected
 - Openings above 1-hr rated (not 45 min.)



Special Provisions

Parking Beneath Open Parking (510.3)

Enclosed Parking Below


- 1 story above grade
- Considered a separate building
- Type of Construction – I or II
- Limited to private vehicles
- Office, toilet, lobby < 1,000 SF (allowed)

Open Parking Above

- Allowable Area per IBC Table 406.5.4.

Floor Separation

- Comply with Construction Type of building below
- Horizontal Openings between buildings not required to be protected
 - Except for Exit stairs



Special Provisions

Parking Beneath Group R (510.4)

S-2 Parking

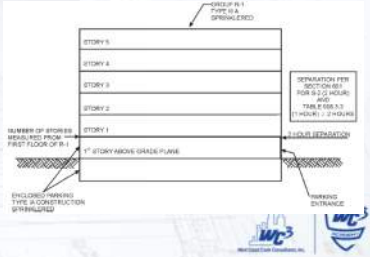
- Open or enclosed
- 1 story above grade
- Type I or IV

Group R

- Any construction type
- Only count stories above

Floor between buildings

- Same construction type as garage
- Minimum Fire Rating per IBC 508.4



Special Provisions

Groups R-1 & R-2 of Type IIIA (510.5)

6-stories maximum

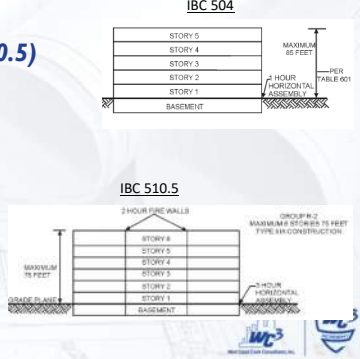
75-feet max height

First floor above basement:

- 3-hr fire rated

Floor area limited:

- 3,000 ft² per area
- Separated by 2-hour Fire Wall



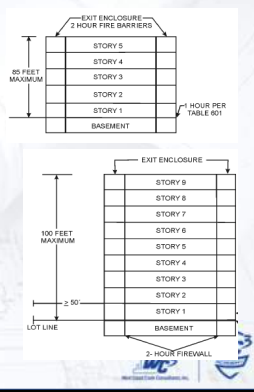
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Special Provisions

Groups R-1 & R-2 of Type IIA (510.6)

- 100-foot max height
- Max 9-stories
- 50-foot separation from
 - Lot Lines
 - Other buildings
- Exits separated by 2-hour rated Fire Walls
- First floor assembly is 1-1/2-hour rated

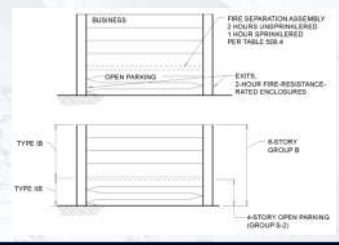


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Special Provisions

Open Parking Beneath Groups A, I, B, M & R (510.7)

- Open Parking Garage → Height & area per 406.5
- Building above → per Section 503
 - Height and stories include parking
- Separation:
 - Per 508.4
 - Separate construction types
 - Means of egress from building above
 - Separated by 2-hour fire barrier from parking
 - Openings to be 2-hour rated (not 90-minute)

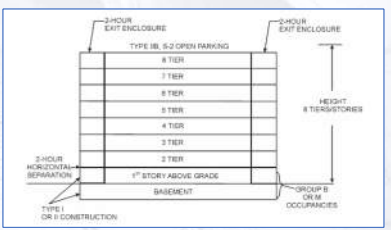


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Special Provisions

Group B or M with Open Parking Above (510.8)

- Can Be Different Construction Types
- Separated w/ 2-hr Horizontal Assembly
- Building below
 - Limited to B or M
 - Type I-A Construction
 - Height and area limited by 503
- Building Above
 - Open Parking Garage (S-2)
 - May be of lower construction type
 - Height and area per IBC Table 406.5
 - Count stories from building below
 - Exits separated w/2-hour fire rating



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Special Provisions

Multiple Buildings Above Podium (510.9)

- Limited to 510.2, 510.3, or 510.8
- Multiple buildings permitted above ...
 - Separated with Fire Walls per 503.1
 - Separated w/ Exterior walls and FSD
 - Comply with all provisions of code as applicable



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Malls

▣ **Definitions (IBC 202)**

- **Mall:** “A roofed or covered common pedestrian area...that serves as access for two or more tenants and not to exceed three levels that are open to each other.”
- **Open Mall:** “An unroofed common pedestrian way serving a number of tenants not exceeding three levels.”
- **Open Mall Building:** “Several structures housing a number of tenants... wherein two tenants have a main entrance into one or more open malls.”




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Malls




▣ **Definitions (IBC 202)**

- **Covered Mall Building:** “A single building enclosing a number of tenants and occupants... wherein two or more tenants have a main entrance into one or more malls.”
 - This term includes open mall buildings.
- **Anchor Building:** “An exterior perimeter building... having direct access to a covered or open mall building but having required means of egress independent of the mall.”
 - Not considered part of covered or open mall buildings.



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Malls



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Malls

❑ Story Limitation (IBC 402.1)

- 3 stories above grade plane
- 3 floor levels at any point
- Open mall **perimeter line** required

❑ Open Space (IBC 402.2)

- 60-foot yards on all sides
- Required around perimeter of attached open & covered mall buildings, anchor buildings and parking garages



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Malls

❑ Area & Type of Construction (IBC 402.4.1)

- No Type V construction
- Allowable area:
 - Mall – Unlimited
 - Anchor Building – per Chapter 5
 - Parking Garage – IBC 406



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Malls

❑ Fire-Resistance-Rated Separation (IBC 402.4.2)

- Tenant/Mall: No separation
- Tenant/Tenant: **1-hour** Fire Partition
- Parking/Mall Building: **2-hour** fire barrier or horizontal assembly
- Parking/Anchor Building: **2-hour** fire barrier or horizontal assembly
- Anchor /Mall Building: Fire Wall (**typically 3-hour**)
 - **Exception #1** allows 2-hour fire barriers if < 4 stories
 - **Exception #2** exterior walls adjacent to open mall buildings & per Table 602
 - (Type I or II) Unprotected openings from Anchor to Mall



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Malls

❑ Open Mall Construction (IBC 402.4.3)

- Floor assemblies shall be open to the atmosphere for **≥ 20-feet**
- Pedestrian walkways connecting balconies shall be located **≥ 20-feet** from other pedestrian walkways.



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Malls

- ❑ **Shall be Fire Sprinklered (IBC 402.5)**
- ❑ **Class B Interior Finish (IBC 402.6.1)**
- ❑ **Emergency Systems (IBC 402.7)**
 - Standpipes (see IFC 905.3.3)
 - Atrium? → smoke control required
 - > 50,000 ft² → emergency voice/alarm communication system and emergency power to serve this system



Malls

- ❑ **Kiosks (IBC 402.6.2)**
 - Non-combustible or..
 - FRT Wood
 - Foam Plastics per UL 1975
 - Aluminum Composite Materials (ACM)
 - Fire Sprinklers and Detection Devices
 - 20 feet separation
 - Groupings allowed.
 - Kiosk or Grouping limited to 300 SF.



Malls

- ❑ **Means of Egress (IBC 402.8)**
 - Within the Mall
 - 10-feet wide by 8-feet tall
 - 20-feet minimum total width
 - Occupant load
 - Per Chapter 10 for tenant spaces
 - For Mall per 402.8.2
 - Does not include Anchor building
 - Food Courts per Chapter 10 (included in mall load)
 - Occupant Load Factor (OLF) = 0.00007*Gross Leasable Area + 25



Malls

- ❑ **Means of Egress (IBC 402.8)**
 - Two means of egress for Tenants spaces if...
 - > 75 feet travel distance to mall, or...
 - > 50 occupants
 - Mall cannot exit through Anchor Building
 - Travel distance
 - Tenant Space – 200-feet to mall or Exit
 - Mall – 200-feet to Exit





High-Rise Buildings

IBC 403

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High-Rise Buildings

□ Definition (IBC 202)

- **High-Rise Structure:** “A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.”
- Occupied floor
 - Includes occupied roofs
- Lowest level of fire department Vehicle Access
 - Typically, street elevation

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High-Rise Buildings

□ Applicability (IBC 403.1)

- High-rise structures
- Does not include:
 - Air traffic control towers
 - Open parking garages
 - A-5 Use Groups
 - Special Industrial Buildings
 - Use Groups H-1, H-2, or H-3



151

High-Rise Buildings

□ Fire-Resistance Reductions (IBC 403.2.1)

- Allowed if sprinkler control valves at each floor that have both supervisory and water-flow initiating devices.
- ≤ 420-feet: Type IA → reduced to Type IB requirements
 - Reductions does not apply to **Primary Structural Frame**
- Shaft enclosures can reduce to **1-hour** if sprinklered top & intermediate floors
- **Other than F-1, H-2, H-3, H-5, M & S-1:** Type IB → reduced to Type IIA requirements

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High-Rise Buildings

Seismic Provisions (IBC 403.2.2)

- Requires compliance with seismic provisions of Chapter 16
- IBC 1613 → General seismic provisions for all buildings
- IBC 1616 → Structural Integrity
 - Applies to Risk Category III or IV high-rise buildings
 - Separate provisions for “frame” or “bearing wall” structures

Structural Integrity (IBC 403.2.3)

- Additional requirements for exit stairways & elevator hoistways



153

High-Rise Buildings

Automatic Sprinkler System (IBC 403.3)

- Required throughout
 - Except open parking garages & telecommunication
- Secondary water supply for **30-minute** duration
- > 420-feet: Minimum of two risers
- > 420-feet: Two water mains to fire pumps
- IV-A & IV-B 0 → >120-feet: Two water mains
- SDC C-F: On-site water supply
- Fire pumps shall be located per IBC 913.2.1

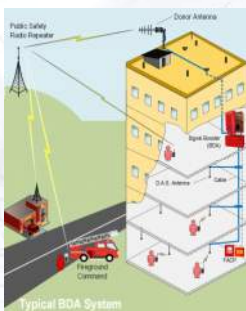


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High-Rise Buildings

Emergency Systems (IBC 403.4)

- Smoke detection (IBC 907.2.12.1)
- Fire alarms (IBC 907.2.12)
- Standpipes (IBC 905.3)
- Emergency voice/alarm (IBC 907.5.2.2)
- ERCC (IFC 510)
- Fire command center (IBC 911)
- Smoke removal (IBC 909)
- Standby & emergency power (IBC 403.4.8)
- Fuel line piping protection (IBC 403.4.8.2)



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High-Rise Buildings

Means of Egress (IBC 403.5)

- Exit stairways separated by **≥ 30-feet**, or...
 - ≥ **1/4** the overall diagonal, whichever is less.
- If 3 or more exit stairways, not less than 2 shall comply.
- If **> 420-feet**, one additional exit stairway required
 - Except for Group R-2
- Smokeproof enclosures per IBC 403.5.4
- Luminous egress path markings per IBC 1025



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High-Rise Buildings


Elevators (IBC 403.6)



▪ Shall comply with CBC Chapter 30

▪ Floors > 120-feet: 2 fire service access elevator required

- Require a capacity of 3,500# min.
- Must comply with CBC 3007

▪ Occupant evacuation elevators are allowed per CBC 3008





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Atriums

IBC 404





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Atriums

Definitions (IBC 202)

▪ 2018 IBC → “An opening connecting two or more stories other than enclosed stairways, elevators, hoistways, escalators, plumbing, electrical, air-conditioning or other equipment, which is closed at the top and not defined as a mall. Stories, as used in this definition, do not include balconies within assembly groups or mezzanines that comply with Section 505.”

▪ 2021 IBC → “A vertical space that is closed at the top, connecting two or more stories in Group I-2 and I-3 occupancies or **three or more** stories in all other occupancies.”



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Atriums

Does not apply to Group H

Use (IBC 404.2)

▪ Floor can only have low fire hazard uses, and...

▪ Only approved materials & decorations per IFC

▪ These limitations do not apply if space is sprinklered

▪ These items must be considered in the smoke control rational analysis (IBC 909)





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Atriums

Special Requirements

- Sprinklers (404.3)
- Fire alarm (404.4)
- Smoke control (404.5)
- 1-hour separation (404.6)
- Standby power (404.7)
- Class B finish (404.8)
- Exit access travel distance (404.9 – per IBC 1017)
- Exit stairways in an atrium (404.10)
- Interior exit stairway discharge (404.11)

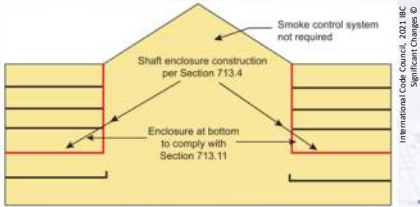


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Atriums

IBC 404.5: Smoke Control – Exception #2 (New to 2021 IBC)

- Only two lowest stories are open to atrium, and...
- All stories above are protected from the atrium per IBC 713.4 (shaft construction).



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Atriums

IBC 404.6: Enclosure of Atriums (New to 2021 IBC)

- **Exception #5:**
 - No need for horizontal assembly between atrium and escalator openings protected per IBC 712.1.3.
- **Exception #6:**
 - No need for horizontal assembly between atrium and exit access stairways and ramps compliant with IBC 1019.3, Item 4.



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Atriums

IBC 404.10: Exit Stairways in an Atrium (New to 2021 IBC)

- Clarifies that interior exit stairways within an atrium must conform to the following:
 - Entry is measured from the edge of the closest riser.
 - Entry must have access from a minimum of two directions.
 - The distance from an entry to an exit stairway open to the atrium and the entrance to an enclosed exit stairway shall comply with IBC 107.1.1.
 - Exit access travel distance is measured to the closest riser of the exit access stairway.
 - Not more than 50% of exit stairways can be located within the same atrium.



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Motor-Vehicles

IBC 406

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Motor-Vehicles

□ **General (IBC 406.1)**

- All must comply with IBC 406.2.
- Private garages & carports → IBC 406.3
- Open public parking garages → IBC 406.4 & 406.5
- Enclosed public parking garages → IBC 406.4 & 406.6
- Motor fuel-dispensing → IBC 406.7
- Repair garages → IBC 406.8

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Motor-Vehicles

□ **Design (IBC 406.2)**

- **7-foot** clear height (IBC 406.2.2)
 - Exception for mechanical-access garages
- Non-combustible & nonabsorbent sloped floor (IBC 406.2.4)
 - Asphalt allowed for carports or ground floor of parking garages.
- Shall not enter directly into sleeping rooms (IBC 406.2.5)
- EV charging stations (IBC 406.2.7)
 - Installed per NFPA 70
 - Equipment listed & labeled per UL 2202
 - Supply equipment listed & labeled per UL 2594
 - Accessibility per IBC 1108

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Motor-Vehicles

□ **Equipment & Appliances (IBC 406.2.9)**

- Shall comply with IMC, IFGC & NEC
- Elevation of ignition sources:
 - Source of ignition **18-inches** above finished floor, or...
 - Parking garages separated from rooms with such appliances by vestibule
- Appliances in public garages, motor fuel-dispensing or repair garages shall be located **≥ 8-feet**, or **≥ 1-foot** above tallest garage door opening
 - For private garages **≥ 6-feet** above floor

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Motor-Vehicles

Private Garages (IBC 406.3)

- Where motor vehicles used by the tenant of a building are stored.
- Limited to **1,000 ft²** (IBC 406.3.1)
 - Multiple garages in single building allowed with **1-hour** separation
 - Group U → Allowable area per Chapter 5
 - Exception: If accessory to Group R-3 ≤ **3,000 ft²**



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Motor-Vehicles

Private Garages (IBC 406.3)

- Separation from dwelling units per IBC 406.3.2
 - 1/2" Gyp. between garage and residence or attic.
 - 5/8" Type X Gyp. between dwelling spaces above
 - 1/2" gypsum on supporting construction
 - 1-3/8" Solid wood or steel doors (or 20-min. rated)
 - Self closing and self latching
 - No openings directly into sleeping rooms
 - Ducts in garage or penetrating walls
 - .0019 inches thick, no opening into garage



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Motor-Vehicles

Carports (IBC 406.3.3)

- Open on two sides
- Allowable area per Chapter 5
- No separation required between carport and R-3



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Motor-Vehicles

Public Garages (IBC 406.4)

- Either Open or Enclosed
- 2'-9" Vehicle barriers
 - Shall comply with IBC 1607.9
- Ramps – not allowed as exits unless pedestrian facilities provided.
 - If used, slope ≤ 1:15



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Motor-Vehicles

Open Parking Garages (IBC 406.5)

- Construction Types I, II, or IV
- Uniform openings on 2 sides
 - 20% of total perimeter area per tier
 - 40% of total perimeter length per tier
 - Interior walls ≥ 20% open
- Opening below grade → Width of clear space = 1.5 * depth



Motor-Vehicles

Open Parking Garages (IBC 406.5)

- Area & height per Chapter 5
- Exception: If exclusively for parking, may comply with Table 406.5.4 & increases from IBC 406.5.5.
 - 406.5.5 increases based on additional perimeter openings & type of const.

TABLE 406.5.4 OPEN PARKING GARAGES AREA AND HEIGHT				
TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	Ramp access	HEIGHT (in tiers)	
			Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

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Motor-Vehicles

Open Parking Garages (IBC 406.5)

- Means of egress → Chapter 10
 - If unoccupied (except for attendants) → Min. of two 36-inch exit stairways
- Standpipe system required (IBC 406.5.8)
- No enclosure required for vertical openings
- The following are prohibited:
 - Vehicle repair
 - Fuel dispensing
 - Commercial vehicles
 - Closing of openings by tarp



Motor-Vehicles

Enclosed Garages (IBC 406.6)

- Height & area → Chapter 5 (roof parking permitted)
- Ventilation per IMC
- Automatic fire sprinklers throughout



Motor Vehicles

Mechanical-Access Enclosed Parking Garages (IBC 406.6.4)

- New definition in IBC 202
- 2-hour separation from other occupancies
 - Fire barriers in accordance with Section 707
 - Horizontal assemblies in accordance with Section 711
- A mechanical smoke removal system is required in accordance with Section 910.4.
- Fire control equipment room is required
 - Equipment consisting of fire alarm control unit, mechanical ventilation controls and emergency shut down switch with the room not less than 50 square feet in a location approved by fire code official.
 - Mechanical parking system to have manual shut down switch for use by emergency personnel and clearly identified.
- Fire Department access doors provided per IBC 3206.7 of the IFC



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Motor Vehicles

Motor Fuel-Dispensing (IBC 406.7)

- Shall comply with the IFC
- Fueling pad → noncoated concrete
- Canopies:
 - Clear height ≥ 13'-6"
 - Noncombustible materials (or 1-hour)
 - Special provisions if gaseous hydrogen is located on roof of canopy



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Motor Vehicles

Repair Garages (IBC 406.8)

- Shall comply with the IFC
- Mechanical ventilation required per IMC
- If vehicles are fueled by non-odorized gases...
 - A [gas detection system](#) per IBC 406.8.2 is required
 - Examples include hydrogen & non-odorized LNG
- Automatic fire sprinklers if required by IBC 903.2.9.1



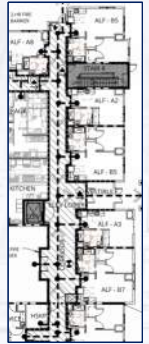
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Group I-2 IBC 407



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Group I-2



- IBC 407.2: Corridor continuity
 - Continuous to Exits
 - IBC 1020.6 continuous to an Exit
 - Separated with Smoke Partitions (407.4.4.2)
 - Areas allowed to be open to corridors:
 - Waiting areas, **public-use, group meeting** (407.2.1)
 - No sleeping rooms, fire detection system, unobstructed
 - Care provider stations (407.2.2)
 - Psychiatric treatment areas <1,500 ft² (407.2.3)
 - Gift shops <500 ft² (407.2.4)
 - Nursing home housing units (407.2.5)
 - Nursing home cooking facilities (407.2.6)**



Group I-2

- IBC 407.2.5: Nursing Home Housing Units
 - Nursing Homes of Condition I
 - Shared living spaces, group meeting, therapeutic spaces
 - Constructed as corridors
 - Automatic fire detection System
 - Corridor in same smoke compartment
 - Automatic Fire Detection, or...
 - Quick response through smoke compartment
 - Arranged to not obstruct egress



Group I-2

- IBC 407.2.6: Nursing home cooking
 - Nursing Homes of Condition I
 - ≤ 30** served or in smoke compartment
 - One (1) cooking facility per smoke compartment
 - Corridor clearly marked (construction, tile, or color) and unobstructed
 - Space containing appliances shall not obstruct access to required exit
 - Cooking appliances shall conform to IBC 407.2.7



Group I-2

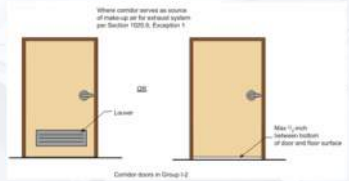
- IBC 407.2.7: Domestic Cooking Appliances
 - Cooking appliances in domestic cooking facilities shall...
 - Be limited to ovens, cooktops, ranges, warmers and microwaves
 - Have domestic hoods provided over cooktops and ranges per IMC 505.
 - Be protected per IBC 904.14 (Extinguishing & Ignition prevention)
 - Have a shut-off for fuel and electrical power provided in a location where only staff has access.
 - Have a timer that automatically deactivates appliances within a period not more than 120 minutes
 - Have a portable fire extinguisher within 30 feet of appliance(s).



Group I-2

Corridors (407.3)

- Walls – Smoke Partitions per IBC 710
- Corridor Doors
 - Fire protection – not required
 - Self closing
 - Effective barrier against smoke
 - Positive latching
- Door Construction
 - Solid doors shall have close-fitting operational tolerances, head and jamb stops.
 - Dutch-style doors shall have an interlocking edge and latching hardware
 - Doors are permitted to have louvers or a 2/3-inch clearance at the bottom if make-up air from the corridor is required per IBC 1020.7, Exception 1.



Group I-2

Means of Egress (407.4)

- Walls – Smoke Partitions per IBC 710
- Direct access to corridor
 - Except rooms with exterior access, or...
 - Care Suites
- Locking devices can't prevent egress from bedroom
- 50 feet travel distance sleeping room to corridor



Group I-2

I-2, Condition 1 → Corridor Projections (407.4.3)

- Only applies to corridors < 96" wide
- Furniture fixed in place
- 72-inch clear width
- Furniture on one side only
- 50 Sq. Ft. max per area
- 10 feet between arrangements
- Furniture must be shown on fire and safety egress plans
 - Exit plans permanently posted on walls



Group I-2

Care Suites (407.4.4)

- Rooms are areas grouped together to create a single "suite" with corridor access.
- Egress not permitted through care suite
- Separated from other spaces smoke partitions
- Corridor access
 - Every care suite to have door leading to exit access corridor or a horizontal exit, and...
 - Movement from habitable rooms within the care suite will not require more than 100-feet of travel with the suite to a door leading to the exit access corridor or a horizontal exit, and...
 - Where a care suite requires more than one exit access door, the additional door shall lead directly to an exit access corridor, exit, or an adjacent suite.



Group I-2

Care Suites w/ Sleeping Units (407.4.4.5)

- Limited to one of the following:
 - Exit access for ≤ 8 beds
 - Arranged for direct and constant visual supervision
 - Automatic Smoke Detection (NFPA 72)
- Limited to 7,500 SF
 - 10,000 SF with smoke detection per NFPA 72
- Exit access suites > 1,000 SF
 - 2 means of egress



Group I-2

Care Suites w/out Sleeping Units (407.4.4.5)

- Limited to 12,500 SF
 - 15,000 SF with smoke detection per NFPA 72
- Exit access suites > 2,500 SF
 - 2 means of egress



Group I-2

Smoke Barriers (IBC 407.5)

- 2 areas per story for:
 - Stories with care areas, or
 - Stories with > 50 occupants
- Condition 1: 22,500 ft²
- Condition 2: 40,000 ft² (only if...)
 - Contains single sleeping rooms, or
 - No sleeping rooms
- Max travel distance **200 feet**
- Independent egress.
 - Exit in each or access to 2 separate smoke compartments.



Group I-2

Refuge Area (407.5.3)


- Each smoke compartment (SC) shall contain refuge area
- Area sized to accommodate adjoining SC
 - Where 2 or more adjoining
 - Sized for largest adjoining
- Size of refuge area
 - 30 SF/occupant in bed
 - 6 SF/ambulatory occupant
- Located in low hazard area



Group I-2

❑ **Miscellaneous Items:**

- Automatic-closing doors (IBC 407.6)
- Fire sprinklers (IBC 407.7)
- Fire alarms (IBC 407.8)
- Automatic fire detection (IBC 407.9)
- Secured yards (IBC 407.10)
- Electrical systems (IBC 407.11)



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Special Amusement Areas

IBC 411



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Amusement Areas

❑ **General Items**

- **Use Group** (IBC 411.1)
 - Occupant Load $\geq 50 \rightarrow$ Group A
 - Occupant Load $< 50 \rightarrow$ Group B
- **Exit Marking** (IBC 411.6)
 - IBC 1013 & this section
 - Approved & listed low-level exit signs & listed directional path markings shall be provided
 - Visible in emergency & activated by smoke detection & sprinkler systems
- Interior Finish \rightarrow Class A





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Amusement Buildings

❑ **Fire Prevention Items**

- Fire sprinklers required throughout (IBC 411.2)
 - If temporary amusement area \rightarrow still required by an approved means
 - Exception: Temporary \leq less than 1,000 ft² $\&$ exit access travel distance < 50 -feet
- Fire alarms required (IBC 411.3)
- Emergency voice/alarm communication (IBC 411.4)







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Amusement Buildings

- Puzzle Rooms (411.5)**
 - This is new to the 2021 IBC
 - Definition** (IBC 202): "A puzzle room is a type of special amusement area in which occupants are encouraged to solve a challenge to escape from a room or series of rooms."
 - Puzzle Room Exiting** (IBC 411.5)
 - Exiting per Chapter 10, or ...
 - An alternative design approved by B.O., or ...
 - Open automatically with sprinkler, or ...
 - Manual control from monitored location



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Hazardous Materials

IBC 414

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Hazardous Materials

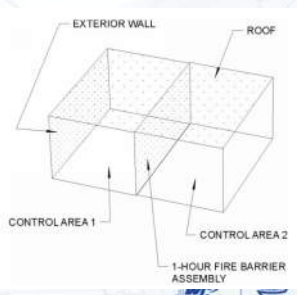
- Scope:** Manufacturing, processing, dispensing, use or storage of Haz-Mat
- Group "H":** Must comply with both IBC 414 and 415
- Report (IBC 414.1.3):** Report clarifying...
 - Expected quantities of Haz-Mat, and...
 - Stored, open- or closed-system, and...
 - Specify Haz-Mat classification categories, and...
 - Methods of protection.




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Hazardous Materials

- Control Areas (IBC 414.2)**
 - Construction:** Separated by fire barriers or horizontal assemblies.
 - IBC Table 414.2.2:** Percentage of MAQ, max. number of control areas, and fire-resistance ratings.
 - 1-hour fire resistance allowed if Type IIA, IIIA, IV or VA construction, and...
 - Fire sprinklers (NFPA 13), and...
 - The buildings is ≤ 3 stories above grade.



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Hazardous Materials

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

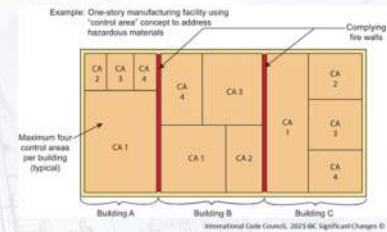
STORY		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA*	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS*
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
Below grade plane	1	100	4	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed



Hazardous Materials

IBC 414.2.3: Control Areas

- “...each portion of a building separated by one or more fire walls complying with Section 706 shall be considered a separate building.”



Hazardous Materials

Group M & Group S (IBC 414.2.5)

- IBC Section 414.2.5.1 allows the MAQ to be exceeded for **nonflammable and noncombustible** solid and liquid Haz-Mat located within Group M and Group S.
 - Must comply with IBC Table 414.2.5(1)
 - Added footnote 'k' → solid toxics can now be increased from 1,000 to 10,000 pounds
- IBC Section 414.2.5 applies to **flammable or combustible liquids** in M or S occupancies
 - Must comply with IBC Table 414.2.5(2)



Hazardous Materials

Ventilation (IBC 414.3)

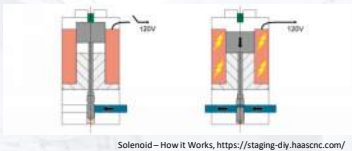
- All areas having explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases shall be mechanically ventilated.



Hazardous Materials

☐ Systems (IBC 414.4)

- Suitable for intended application
- Controls shall prevent materials from entering or leaving at other than the intended time, rate or path.
- Controls shall be fail-safe.



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Hazardous Materials

☐ Inside Storage or Use (IBC 414.5)

- **Explosion control:** Per IBC Table 414.5.1
- **Spill control:** Solid or liquid Haz-Mat shall be provided with spill control that either provides containment or approved drainage.
- **Emergency or standby power:** Required for mechanical ventilation, treatment systems, temperature control, alarms, detection or other electrically operated systems.



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Hazardous Materials

☐ Inside Storage or Use (cont.)

- **Emergency or standby power:** IBC Section 414.5.2 lists several exceptions...
 - Storage of IB or IC flammable or combustible liquids in containers ≤ 6.5 gallons.
 - Storage of Class I or 2 oxidizers.
 - Storage of Class II, III, IV, and V organic peroxides.
 - Storage of asphyxiant, irritant or radioactive gases.
 - Fail-safe engineered systems.



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Hazardous Materials

☐ Outdoor Storage or Use (IBC 414.6)

- IBC 414.6 only applies if outdoor Haz-Mat storage or use areas are sheltered for weather protection. If so...
 - **Walls:** Walls for weather protection shall not obstruct more than one side (25% exception)
 - **Separation distance:** As required by the CFC.
 - **Noncombustible:** Noncombustible materials with a max. area of 1,500 ft²



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Group H

IBC 415

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Group H

IBC 415:

- Only applies to H-occupancies
- Applies to both storage & use of Haz-Mat
- Must also comply with IBC 414 and the IFC


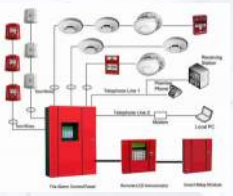


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Group H

Fire Prevention (IBC 415)

- Automatic fire detection (IBC 907.2)
- Automatic sprinkler system (IBC 903.2.5)
- Emergency alarms (IBC 415.5)
 - Differs for storage or use




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Group H

Detached Building (IBC 415.6.2, 415.7 & 415.8)

- If H-1 → detached building required
- If H-2 or H-3 and > Table 415.6.2 → detached building
- IBC 202:
 - "A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures."
- Floors shall be liquid-tight if storing organic peroxides, pyrophoric materials or unstable (reactive) materials.

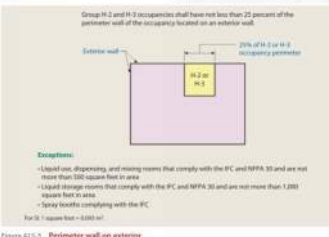


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Group H

Fire Separation Distance (IBC 415.6)

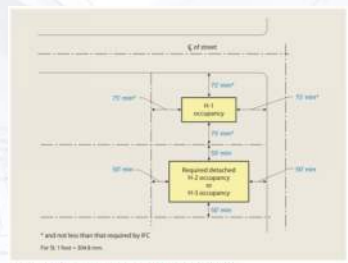
- **H-2 & H-3:** ≥ 25% of perimeter wall shall be an exterior wall.
- Not required for spray booths compliant with the IFC.
- Not required for...
 - Small mixing or dispensing rooms under 500 ft².
 - Not required for liquid storage rooms under 1,000 ft².



Group H

Fire Separation Distance (IBC 415.6.1)

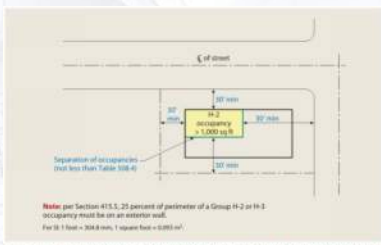
- **H-1:** 75-feet
- **H-2 & H-3:** 50-feet
- If contain materials with explosive characteristics → separated as required by IFC or per a technical report.



Group H

Fire Separation Distance (IBC 415.6.1)

- If H-2, and...
- > 1,000 ft², and...
- Not required to be detached...
- **30-feet**




Group H

TABLE 508.4 REQUIRED SEPARATION OF OCCUPANCIES (HOURS) ^a																									
OCCUPANCY	A, E		I-4, R-2.1		I-2, I-2.1		I-3		R-1, R-2, R-2.1, R-3, R-3.1, R-4		F-2, S-2, U		B, F-1 ^b , M, S-1		L		H-1		H-2		H-3, H-4		H-5		
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	
A, E	N	N	2	2	2	NP	2	NP	1	2	N	1	1	2	2	NP	NP	NP	3	4	2	3	2	NP	
I-4, R-2.1	—	—	F	NP	2	NP	2	NP	1	NP	1	2	1	2	2	NP	NP	NP	4	NP	2	NP	2	NP	
I-2, I-2.1	—	—	—	—	N	NP	2	NP	2	NP	2	NP	2	NP	2	NP	NP	NP	4	NP	2	NP	2	NP	
I-3	—	—	—	—	—	N	NP	2	NP	2	2	2	2	2	2	NP	NP	NP	4	NP	—	—	—	—	
R-1, R-2, R-2.1, R-3, R-3.1, R-4	—	—	—	—	—	—	—	N	N	1 ^c	2 ^c	1	2	4	NP	NP	NP	3	NP	2	NP	2	NP	—	
F-2, S-2, U	—	—	—	—	—	—	—	—	N	N	1	2	1	NP	NP	NP	NP	3	4	2	3	2	NP	—	
B, F-1, M, S-1	—	—	—	—	—	—	—	—	—	N	N	1	NP	NP	NP	NP	NP	NP	3	4	2	3	2	NP	
L	—	—	—	—	—	—	—	—	—	—	—	—	1	NP	NP	NP	NP	2	NP	—	—	—	—	—	
H-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	NP	NP	NP	NP	NP	NP	—	
H-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	1	NP	1	NP	1	NP	
H-3, H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1 ^d	NP	1	NP	1 ^d	NP	1	NP
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	N	NP	—	—	—	—	

Group H

- Miscellaneous Items
 - Separation of incompatible materials
 - Liquid-tight floors
 - Areas having water-reactives shall be resistant to water penetration
 - Spill control & secondary containment may be required
 - Explosion venting may be needed
 - Electrical to comply with hazardous locations
 - And much more!



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Artificial Decorative Vegetation

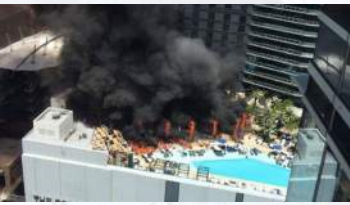
IBC 419



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Live/Work

- IBC 419: Previously “Live/Work Units” → moved to IBC 508
- IBC 419: Now “Artificial Decorative Vegetation”
 - Applies if...
 - It is > 6-feet, and...
 - Located outdoors within 5-feet of building, or...
 - Is located on the roof of a building.
 - Requires compliance with IFC 321
 - Flame retardant and tested to NFPA 701 or NFPA 289



Las Vegas, Cosmopolitan Hotel Fire, July 2, 2015

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Group I-I & R

IBC 420



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Groups I-1 & R

Residential Occupancies (IBC 420)

- Walls separating units
 - Fire partitions
- Floor assemblies separating units
 - Per Section 711
- Automatic Sprinkler System Required
 - NFPA 13 or NFPA 13R
- Fire and smoke alarms required (I-1, R-1 or R-2)
- Single- or multi-station smoke alarms (I-1, R-2, R-3 & R-4)



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Groups I-1 & R

Group I-1, Condition 2

- Smoke Barriers split stories for ...
 - Stories > 50 persons
- Smoke compartments
 - Limited to 22,500 SF.
 - 200 ft travel distance
- Smoke Barriers comply with IBC 709
- Refuge area
 - 15 SF / care recipient
 - 6 SF / other occupant



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Groups I-1 & R

Group I-1 assisted living housing units

- Where a fire-resistance corridor is provided, and...
- Residents share living spaces, group meeting or multipurpose therapeutic spaces open to the corridor...
 - Walls & ceilings constructed as corridors
 - Cannot include sleeping rooms, treatment rooms, incidental uses, or hazardous uses
 - Protected by fire sprinklers
 - Space is arranged so as not to obstruct exit access

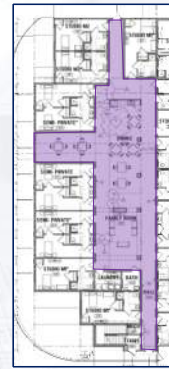


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Groups I-1 & R

- Group I-1 : Cooking facilities with domestic cooking appliances can be open to the corridor provided all the following are met:

- Condition 1: ≤ 30 served
- Condition 2: ≤ 30 served and in smoke compartment
- Corridor clear and unobstructed
- Appliances conform to IBC 420.9



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Group I-1 & R

IBC 420.9: Domestic Cooking Appliances

- Cooking appliances in domestic cooking facilities shall...
 - Be limited to ovens, cooktops, ranges, warmers and microwaves
 - Have domestic hoods provided over cooktops and ranges per IMC 505.
 - Be protected per IBC 904.14 (Extinguishing & Ignition prevention)
 - Have a shut-off for fuel and electrical power provided in a location where only staff has access.
 - Have a timer that automatically deactivates appliances within a period not more than 120 minutes
 - Have a portable fire extinguisher within 30 feet of appliance(s).



Groups I-1 & R

Group R Cooking Facilities

- Adds reference to IMC 917.2.
- Appliances in residences are required to be listed for domestic use.



Groups I-1 & R

IBC 420.10: Group R-2 → Dormitory Cooking Facilities

- The installation and use of domestic cooking appliances are now regulated in both common areas and sleeping rooms of Group R-2 college dormitories.
 - Approved Locations
 - Domestic hood required
 - Protected per IBC 904.14
 - Limited to:
 - Microwaves
 - Ranges
 - Ovens
 - Cooktops
 - Coffee Makers




Medical Gas IBC 427



Medical Gas

IBC 427: Medical Gas Systems

In order to provide a more comprehensive and efficient compilation of construction regulations, those IFC medical gas system requirements related directly to building construction have now been replicated in the IBC.



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Higher Education Labs

IBC 428

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Higher Education

IBC 428: Higher Education Laboratories

Can exceed the MAQ in some instances and still be considered Group B.

Requires “lab suite” separation from other labs and non-lab spaces

Fire Barriers and Horizontal Assemblies

1-hour up to 6th Floor

2-hours above 6th floor

Not less than Table 508.4

Limitation on number of lab suites per floor → see IBC table 428.3

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Higher Education

(F) TABLE 428.3
DESIGN AND NUMBER OF LABORATORY SUITES PER FLOOR

FLOOR LEVEL	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER LAB SUITE ^a	NUMBER OF LAB SUITES PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above Grade Plane	21+	Not Permitted	Not Permitted
	16-20	1	2 ^c
	11-15	1	2 ^c
	7-10	2	2 ^c
	4-6	4	1
	3	4	1
	1-2	6	1
	1	4	1
Below Grade Plane	2	2	1
	Lower than 2	Not Allowed	Not Allowed

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PART 6

Summary

SUMMARY

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Code Analysis

Remember... this is the basis of determining if proposed building will work!

This is where our plan review typically commences.

Many of the basic design assumptions are often wrong!

We need to know this information like...

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Code Analysis

It should include...

Codes Considered (IBC 107.2.1)

Occupancy Classification & Use (IBC Chapter 3)

Type of Construction (IBC Chapter 6)

Sprinklered? (IBC Chapter 5 & IBC 903)

Allowable Heights & Areas (IBC Chapter 5)

Incidental Uses (IBC 509)

Special Detailed Requirements (IBC Chapter 4)

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Code Item Reference	Code Requirement	Actual Building	Comments
Occupancy	B/S-1/S-2/F-1/F-2	B/S-1/S-2/F-1/F-2	Office, Warehouse, Industrial
Chapter 3			
Construction Type	I-B	I-B	
Table 504.3			
Allowable Height	75	44-75	OK
Table 504.3			
Allowable Stories	3	2	OK
Table 504.3			
Allowable Area	Unlimited	674,657 SF	OK
Section 902.4.1			
Frontage Increase	NA	NA	NA
Section 902.4.2			
Use of Area	NA	NA	Non-separated use per 509.3
Section 509			
Use Area of Ext. Wall	No Limit	No Limit	OK
Table 509.3			
Automatic Sprinkler	Yes	Yes	NA/PA-13 (ESR)
Section 903			
Use Floor Area	Load Factors	Preliminary occupant load: 103,078/150 = 688	Notes: actual occupant load to be determined with each future tenant improvement.
Table 1004.1.2			
Min. Number of Exits	4	47	OK
Section 1006			
Common Path	B: 100' max S: 100' max F: 100' max	Less than maximum See plan	OK
Table 1006.2.1			
Exit Access Travel	S-1, F-1: 400' S-2, F-2: 400' B: 300'	Less than maximum See plan	Section 1017.2.2: S-1, F-1 increase
Table 1017.2			
Accessibility	Chapter 11		OK
Ventilation, Temperature, Lighting	Chapter 12 and Mechanical code		OK
Min. Holding Class	C		OK
Table 1008.1			
Plumbing Facilities	Notes: Actual plumbing fixture count to be determined with each future tenant improvement.	Notes: Actual plumbing fixture count to be determined with each future tenant improvement.	B/S
Table 2002.1			
Water Closets			1:25 first 50, 1:50 / 1:100
Urinals			1:40 first 50, 1:80 / 1:100
Drinking Fountain			1:100 / 1:1,500
Table 2002.1			
Fire Extinguishers			Per Fire Marshal
Energy Efficiency	Chapter 13	International Energy Conservation Code	OK

Is this a complete “Code Analysis”?

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Any Questions?

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