CONST-181
Building Code Interpretation: Non-Structural

Chapter 1 & 35: Learning Objective

To obtain an understanding of the administrative provisions of the International Building Code.

- Understand the scope and purpose of the code,
- Duties of the building official
- Issuance of permits
- Inspection procedures
- Special inspections
- Existing buildings and referenced standards.

Source: 2021 IBC

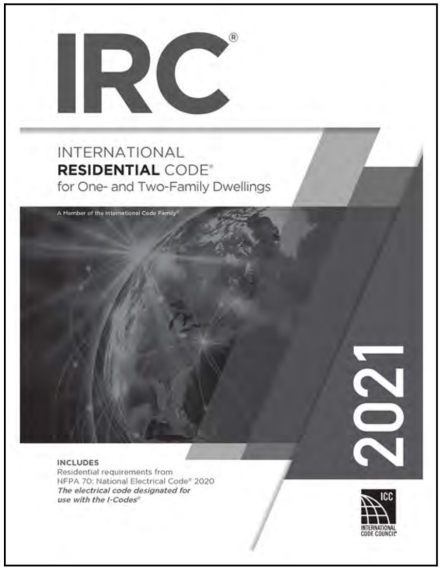
Introduction

- The provisions of the International Building Code shall apply to the *construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition* of every building or structure or any appurtenances connected or attached to such buildings or structures.

Source: 2021 IBC: IBC 101.2, Exception

Introduction: Exception

- Detached one- and two-family dwellings and multiple single-family dwellings (town- houses) not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane in height, shall comply with the IBC or the International Residential Code.



Source: 2021 IBC: IBC 101.2, Exception

Introduction: Exception

The *International Residential Code* is applicable to townhouses a maximum of _____ above grade plane in height and provided with separate means of egress.

a. 35 feet
b. 40 feet
c. three stories
d. four stories

Source: 2021 IBC: IBC 101.2, Exception

IBC Appendix

- Provisions in the appendices shall not apply unless specifically adopted.

Appendix A	**Employee Qualifications**
Appendix B	**Board of Appeals**
Appendix C	**Group U — Agricultural Buildings**
Appendix D	**Fire Districts**
Appendix E	**Supplementary Accessibility Requirements**
Appendix F	**Rodentproofing**
Appendix G	**Flood-Resistant Construction**
Appendix H	**Signs**
Appendix I	**Patio Covers**
Appendix J	**Grading**
Appendix K	**Administrative Provisions**
Appendix L	**Earthquake Recording Instrumentation**
Appendix M	**Tsunami-Generated Flood Hazard**
Appendix N	**Replicable Buildings**
Appendix O	**Performance-Based Application**

Source: 2021 IBC: **Reference:** IBC 101.2.1

Conflicts between IBC and referenced codes

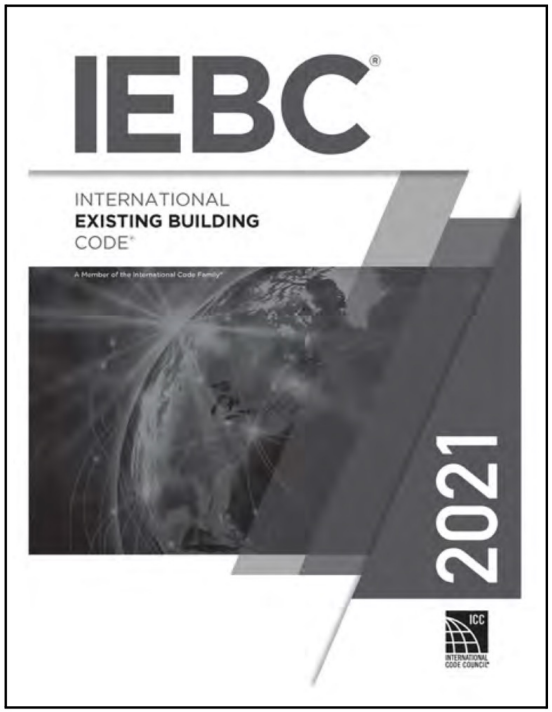
Provisions of the appendix do not apply unless _____.

a. specified in the code
b. applicable to unique conditions
c. specifically adopted
d. relevant to fire or life safety

Source: 2021 IBC **Reference:** IBC 102.4

International Existing Building Code (IEBC)

- The provisions of the International Existing Building Code shall apply to matters governing the repair, alteration, change of occupancy, addition to and relocation of existing buildings.



Source: 2021 IBC: **Reference:** IBC 101.4.7

102.4 Conflicts between IBC and referenced codes

- The codes and standards referenced in the IBC shall be considered part of the requirements.
- Where conflicts occur between provisions of the IBC and referenced codes and standards, the provisions of the IBC shall apply.

- The IBC is, for the most part, a performance-based code, relying on numerous referenced standards to assist the builder and code official in its application. Where standards are referenced in the body of the IBC, the applicable portions of the standard relating to the specific code provision under consideration are considered a part of the code. However, where a referenced standard contains requirements that parallel those in the IBC, the requirements of the IBC take precedence.

Source: 2021 IBC **Reference:** IBC 102.4

IBC Appendix

If there is a conflict in the code between a general requirement and a specific requirement, the _____ requirement shall apply.

a. general
b. specific
c. least restrictive
d. most restrictive

Source: 2021 IBC: **Reference:** IBC 101.2.1

103 Code Compliance Agency

- The building official is an appointed officer of the jurisdiction and charged with the administrative responsibilities of the department of building safety. It is not uncommon for the jurisdiction to use a different position title to identify the building official, such as Chief Building Inspector, Superintendent of Central Inspection or Director of Code Enforcement. Regardless of the jurisdictional title, the code recognizes the individual in charge as the building official.

Source: 2021 IBC: IBC 103

103 Code Compliance Agency

Inspectors, plan reviewers and other technical staff members are typically given some degree of authority to act for the building official in the decision-making process, including the making of appropriate interpretations of various provisions of the code.

Source: 2021 IBC: IBC 103

103 Code Compliance Agency

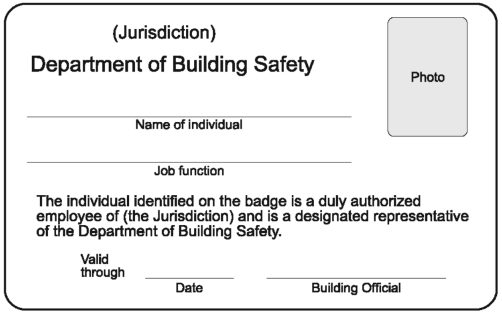
The _____ is considered by the code as the term to describe the individual in charge of the code compliance agency.

a. building official
b. code official
c. code administrator
d. chief building inspector

Source: 2021 IBC: IBC 103

104.1 Duties and Powers of Building Official

- The building official is hereby authorized and directed to enforce the provisions of the IBC. The building official shall have the authority to render interpretations of the IBC and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of the IBC. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in the IBC.



Sample of Required Identification
Section 104.5

Although the IBC gives broad authority to the building official in interpreting the code, this authority also comes with great responsibility. The building official must restrict all decisions to the intent and purpose of the code, with the waiving of any requirements being strictly prohibited.

Source: 2021 IBC: IBC 104.1

104.1 Duties and Powers of Building Official

The building official has the authority to _____ the provisions of the code.

a. ignore
b. waive
c. violate
d. interpret

Source: 2021 IBC: IBC 104.1

104.8 Duties and Powers of Building Official

- The building official, member of the board of appeals or employee charged with the enforcement of the IBC, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by the IBC or other pertinent law or ordinance, shall not thereby be civilly or criminally rendered liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

Source: 2021 IBC: IBC 104.8

104.11 Duties and Powers of Building Official

- The provisions of the IBC are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by the IBC; provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the pro- posed alternative meets all of the following:
  - The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of the IBC, and
  - Provides established equivalency to that prescribed in the IBC.

Source: 2021 IBC: IBC 104.11

104.11 Duties and Powers of Building Official

In order for an alternative material, design or method of construction to be considered acceptable, it must be equivalent to the code based on all but which of the following criteria?

a. durability
b. practicality
c. strength
d. fire resistance

Source: 2021 IBC: IBC 104.11

104.11.1 Duties and Powers of Building Official

- Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in the IBC, shall consist of valid research reports from approved sources.

ICC-ES Evaluation Report

ESR-8000

Issued January 2021

This report is subject to renewal January 2022.

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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION
Section: 07 11 00—Dampproofing
Section: 07 14 00—Fluid-Applied Waterproofing

REPORT HOLDER:

WATERPROOFING COMPANY

EVALUATION SUBJECT:

WATERPROOF PRODUCT

1.0 EVALUATION SCOPE

Compliance with the following codes:

- 2021 and 2018 International Building Code®
- 2021 and 2018 International Residential Code®

Properties evaluated:

- Foundation waterproofing
- Foundation dampproofing

2.0 USES

3.0 DESCRIPTION

4.0 INSTALLATION

5.0 CONDITIONS OF USE

The Waterproof Product described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

5.1 Installation shall comply with this report, the manufacturer's published installation instructions and the applicable code. If there is a conflict between the installation instructions and this report, this report shall govern.

5.2 The coatings are limited to applications on the exterior vertical surfaces of below-grade foundation walls.

5.3 Joints and penetrations of the walls to which the membrane is applied must be made watertight in accordance with the requirements of the applicable code.

5.4 This report is limited to an evaluation of the coatings applied to the minimum thickness stated in Section 4.0 of this report.

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SAMPLE

Although ICC Evaluation Service Reports are generally recognized nationally as valid reports developed by an approved source, the building official is the final authority on the acceptance of any research report for the purpose of accepting an alternate material, method or design.

Source: 2021 IBC: IBC 104.11.1

104.11.1 Duties and Powers of Building Official

Tests performed by _____ may be required by the building official where there is insufficient evidence of code compliance.

a. the owner
b. the contractor
c. an approved agency
d. a design professional

Source: 2021 IBC: IBC 104.11.2

105.1-2 Permits

- Any owner or owner's authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure . . . shall first make application to the building official and obtain the required permit. See thirteen exemptions where a building permit is not required. Exemptions from permit requirements of the IBC shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of the IBC or any other laws or ordinances of this jurisdiction.

Source: 2021 IBC: IBC 105.1, 105.2

105.1-2 Permits: Work exempt

Work exempt from permit:

- One-story detached accessory buildings where limited to 120 square feet in floor area
- Fences not over 7 feet high
- Oil derricks
- Retaining walls limited to 4 feet in height, unless supporting a surcharge or impounding Class I, II or III-A liquids
- Water tanks supported directly on grade, limited to capacity of 5,000 gallons and a ratio of height to diameter not exceeding 2 to 1
- Sidewalks and driveways limited to 30 inches above grade, not over any basement or story below, and not part of an accessible route
- Painting, papering, carpeting, cabinets, counter tops and similar finish work
- Temporary motion picture, television and theater stage sets and scenery
- Prefabricated swimming pools accessory to a Group R-3 occupancy when capacity is limited to 5,000 gallons, depth limited to 24 inches and installed entirely above ground
- Shade cloth structures used for nursery or agricultural purposes
- Swings and other playground equipment accessory to detached one- and two-family dwellings
- Window awnings supported by an exterior wall in Groups R-3 and U, where the maximum projection is 54 inches
- Movable fixtures, racks, cases, counters and partitions limited to 5 feet 9 inches in height

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Whether or not a building permit is required by the code, it is intended that all work be done in accordance with the code requirements. The owner is responsible for all construction being done properly and safely.

Source: 2021 IBC: IBC 105.1, 105.2

107.1 Submittal Documents

- Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted in two or more sets, or in a digital format where allowed by the building official, with each permit application. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. See the exception for projects where nature of work is such that review of construction documents is unnecessary.

Source: 2021 IBC: IBC 107.1

108 Temporary Structures and Uses

- The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

Source: 2021 IBC

108 Temporary Structures and Uses

Unless extended by the building official, what is the maximum time period allowed to be granted for a permit issued on a temporary structure?

a. 90 days

b. 180 days

c. 1 year

d. 2 years

Source: 2021 IBC

109 Permit Fees

- The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

PERMIT APPLICATION

→NOTE! INCOMPLETE OR ILLEGIBLE APPLICATIONS CANNOT BE PROCESSED.←

APPLICATION IS HEREBY MADE FOR PERMISSION TO: (PLEASE PRINT Or TYPE Detailed Description of Work To Be Done)

Has work commenced on this project? No_____ Yes_____

PROJECT NAME _____ SUBDIVISION_____

PROJECT ADDRESS_____ PARCEL _____ LOT#_____

PROJECT TYPE ☐ Residential ☐ Commercial ☐ Industrial ☐New ☐ Alteration / Remodeling ☐ Addition ☐ Demolition

APPLICANT'S VALUATION $_____ CITY'S VALUATION $_____ TOTAL SQUARE FEET_____

WATER METER SIZE:_____

PLANS SUBMITTED BY: ☐ Architect ☐ Contractor ☐ Owner ☐ Tenant ☐ Other_____

CONTACT PERSON _____ PHONE ( ) _____ FAX ( )_____

WHO IS CONTACT PERSON? ☐ Architect ☐ Contractor ☐ Owner ☐ Tenant ☐ Other_____

OWNER INFORMATION

OWNER_____ PHONE ( )_____

ADDRESS_____ CITY _____ STATE ____ ZIP _____

CONTRACTOR INFORMATION

COMPANY_____ PHONE ( )_____

ADDRESS_____ CITY _____ STATE ____ ZIP _____

LICENSE NO. _____ CLASS_____ ARIZONA STATE TAX NO._____

The Following Information is Required for Commercial, Industrial, and Multi-Family Projects Only

PROPOSED USE _____ EXISTING USE _____

PROPOSED CONSTRUCTION TYPE WALLS: ☐ Combustible ☐ Noncombustible ROOF STRUCTURE: ☐ Combustible ☐ Noncombustible

EXISTING CONSTRUCTION TYPE WALLS: ☐ Combustible ☐Noncombustible ROOF STRUCTURE: ☐ Combustible ☐Noncombustible

IF THIS IS AN EXISTING BUILDING, DOES IT HAVE A FIRE SPRINKLER SYSTEM?_____ FIRE ALARM SYSTEM?_____

OCCUPANCY LOAD:_____ IBC OCCUPANCY TYPE:_____ IBC CONSTRUCTION TYPE:_____

UNDER PENALTY OF INTENTIONAL MISREPRESENTATION AND / OR PERJURY, I DECLARE that I have examined and / or made this application and it is true and correct to the best of my knowledge and belief. I agree to construct said improvement in compliance with all provisions of the Ordinances of the City of . I realize that the information that I have stated hereon forms a basis for the issuance of the Building Permit herein applied for and approval of any plans in connection therewith shall not be construed to permit any construction upon said premises or use thereof in violation of any provision of the City Code or any other ordinance or to excuse the owner or his successors in from complying therewith. **WHERE NO WORK HAS BEEN STARTED WITHIN 180 DAYS AFTER THE ISSUANCE OF A PERMIT OR WHEN MORE THAN 180 DAYS LAPSES BETWEEN APPROVAL OF REQUIRED INSPECTIONS, SUCH PERMIT SHALL BE VOID.**

I hereby certify that I am the OWNER at this address or that, for the purposes of obtaining this approval, I am acting on behalf of the owner. All contract work on this project will be done by a contractor holding a valid privilege tax license and contractor's license issued by the State of and the City of .

APPLICANT (Please Print Name):

_____ SIGNATURE_____

ADDRESS_____ CITY_____ STATE____ ZIP_____

PHONE Home ( )_____ Office ( )_____

Amount Paid: $_____ Date:_____ Application received by:_____

Source: 2021 IBC

109 Permit Fees

The final permit valuation shall be set by the _____ .

a. owner

b. building official

c. design professional

d. general contractor

Source: 2021 IBC

110.1 Inspections

- Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain visible and able to be accessed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of the IBC or of other ordinances of the jurisdiction.

Source: 2021 IBC

110.1 Required Inspections

- Footing and foundation
- Concrete slab or under-floor
- Lowest floor elevation
- Frame
- Types IV-A, IV-B and IV-C connection protection
- Lath, gypsum board and gypsum-panel product
- Weather-exposed elevated walking surfaces waterproofing
- Fire and smoke resistant penetrations
- Energy efficiency
- Others as required by the building official
- Special inspections
- Final

Source: 2021 IBC

110.1 Required Inspections

Who is responsible for ensuring that the work is accessible and exposed for inspection purposes?

a. owner or owner's authorized agent

b. contractor

c. permit applicant or their authorized agent

d. design professional

Source: 2021 IBC

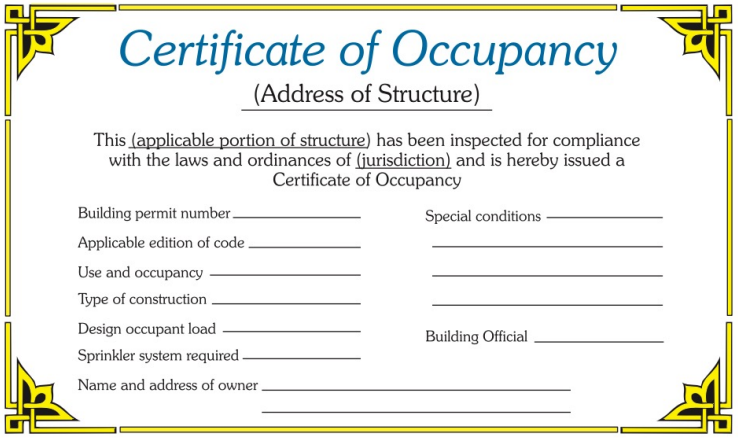
110.6 Inspections

- Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with the IBC. Any portions that do not comply shall be corrected and such portions shall not be covered or concealed until authorized by the building official.

Source: 2021 IBC

110.6 Certificate of Occupancy

- A building or structure shall not be used or occupied in whole or in part, and a change of occupancy of a building or structure or portion thereof shall not be made, until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of the IBC or of other ordinances of the jurisdiction. See the exception for work exempt from permits.



Certificate of Occupancy

(Address of Structure)

This (applicable portion of structure) has been inspected for compliance with the laws and ordinances of (jurisdiction) and is hereby issued a Certificate of Occupancy

Building permit number _____

Applicable edition of code _____

Use and occupancy _____

Type of construction _____

Design occupant load _____

Sprinkler system required _____

Name and address of owner _____

Special conditions _____

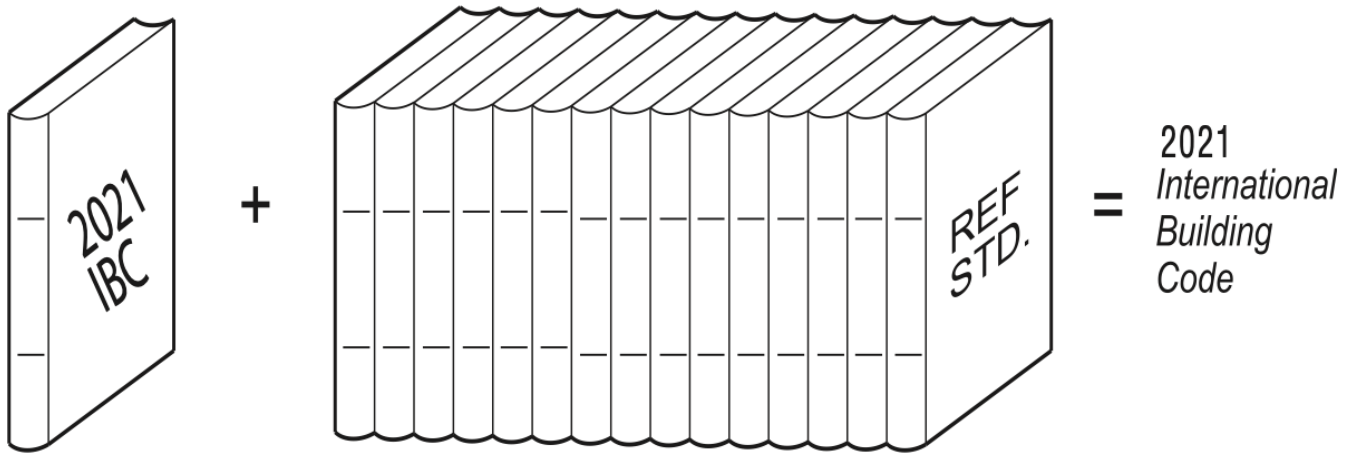
Building Official _____

Sample of Certificate of Occupancy

Source: 2021 IBC

Chapter 35 Standards

- Chapter 35 lists the standards that are referenced in various sections of the IBC. The standards are listed herein by the promulgation agency of the standard, the standard identification, the effective date and title, and the section or sections of the IBC that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.



Source: 2021 IBC

Chapter 35 Standards

The referenced standard dealing with accessible buildings is _____.

a. ASME A17.1—CSA 19/CSA B44-19

b. DOC PS 1—19

c. ICC A117.1—17

d. FEMA 4880—2017

Source: 2021 IBC

Class 2:
Chapter 3, Section 508/509:
Learning Objective

Source: 2021 IBC

Chapter 3, Section 508/509: Learning Objective

To gain an understanding of how an occupancy is classified based on its intended use and how a building with incidental uses and/or mixed occupancies is addressed.

Source: 2021 IBC

302.1 Occupancy Classification

- Occupancy classification is the formal designation of the primary purpose of the building, structure or portion thereof. Where a structure is proposed for a purpose which is not specifically listed in Section 302.1, such structure shall be classified in the occupancy it most nearly resembles, based on the fire safety and relative hazard.
- Occupancy groupings are divided into two general categories: those related to people and those related to content.
  - People-related hazards include the number and density of the occupants, their age and mobility, and their awareness of surrounding conditions.
  - Content-related hazards include the storage and use of hazardous materials, as well as the presence of large quantities of combustible materials

Source: 2021 IBC

302.1 Occupancy Classification

- Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
- Business (see Section 304): Group B.
- Educational (see Section 305): Group E.
- Factory and Industrial (see Section 306): Groups F-1 and F-2.
- High Hazard (see Section 307): Groups H-1, H-2, H- 3, H-4 and H-5.
- Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4.
- Mercantile (see Section 309): Group M.
- Residential (see Section 310): Groups R-1, R-2, R-3 and R-4.
- Storage (see Section 311): Groups S-1 and S-2.
- Utility and Miscellaneous (seeSection312):GroupU

Source: 2021 IBC

302.1 Occupancy Classification

1. An institutional occupancy is typically considered Group _____ .

a. A
b. B
c. I
d. R

Source: 2021 IBC

302.1 Occupancy Classification

2. A Group _____ occupancy is the general classification for miscellaneous and utility structures.

a. A
b. M
c. S
d. U

Source: 2021 IBC

302.1 Occupancy Classification

3. Accessory religious educational rooms need not be considered separate occupancies where the occupant load is less than _____ occupants.

a. 100
b. 150
c. 200
d. 300

Source: 2021 IBC

302.1 Occupancy Classification

- Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation. See other classification allowances for assembly buildings and assembly spaces with an occupant load of less than 50, accessory assembly spaces less than 750 square feet in floor area, and those assembly spaces associated with Group E occupancies.

Source: 2021 IBC

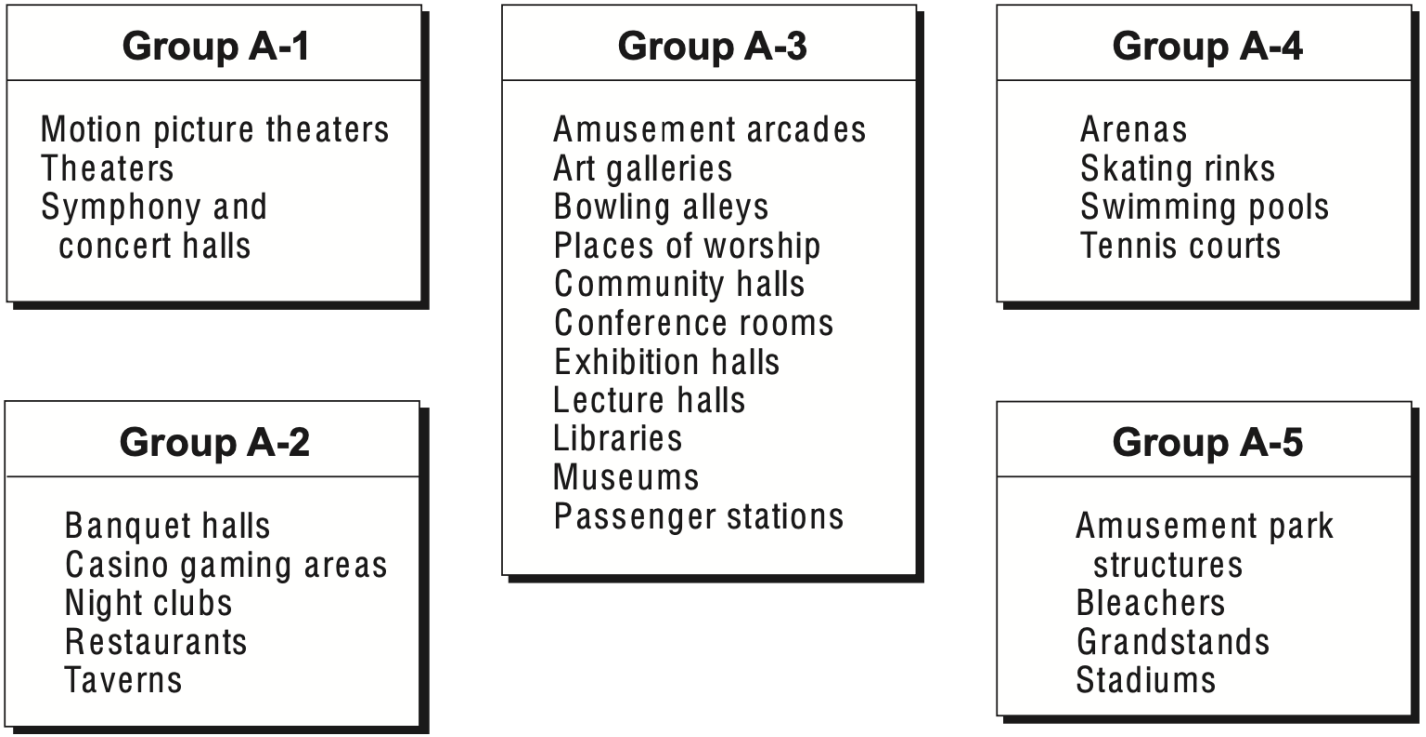
302.1 Occupancy Classification

4. An accessory assembly area may be classified as a Group B occupancy where the floor area is a maximum of _____ square feet.

a. 120
b. 399
c. 749
d. 1,000

Source: 2021 IBC

303.1 Occupancy Classification



Unique conditions are represented by the classifications of Groups A-1, A-2, A-4 and A-5. However, the category Group A-3 includes a variety of broad and diverse assembly uses. It is not uncommon to find high combustible loading in Group A-3 occupancies.

Source: 2021 IBC

303.1 Occupancy Classification A-1

- A factor involving human behavior in theaters classified as Group A-1 assembly rooms is the fact that in many cases the occupants are not familiar with their surroundings and the lighting level is usually low.

- When an emergency arises, the occupants may perceive the danger to be greater than presented, and panic may occur because of the fear of not being able to reach an exit for escape. In addition, the concentration of occupants in such uses is quite dense.

Group A-1
Motion picture theaters Theaters Symphony and concert halls

Source: 2021 IBC

303.1 Occupancy Classification A-2

- The fire record in occupancies of this type is not very good, based in part on the delay in occupant response to a fire or other emergency incident.
- Presence of loose tables and chairs, aisles are often difficult to maintain, resulting in obstructions to egress travel.
- Overcrowding conditions, low-lighting levels, and the consumption of alcoholic beverages also increase the risks associated with many of these types of occupancies.

Group A-2

Banquet halls
Casino gaming areas
Night clubs
Restaurants
Taverns

Source: 2021 IBC

303.1 Occupancy Classification A-2

The gaming floor of a large casino shall be classified as a Group _____ occupancy.

a. A-2
b. A-3
c. B
d. M

Source: 2021 IBC

303.1 Occupancy Classification A-3

Multipurpose rooms:

- Varying degrees of occupant density, numerous types and numbers of furnishings and equipment, and fire loading that can vary from low to high.
- Hazards are similar to most of those found in Group A-1 and A-2 occupancies. Where a use does not conveniently fit into one of the other four Group A classifications, a Group A-3 designation is typically appropriate.
- The classification of an assembly occupancy as a Group A-3 is also common where varying assembly uses are likely to occur at different times within the same space.
- For example, a meeting room at a hotel is typically used at differing times for various functions, including seminar presentations, dining activities, trade shows, and wedding receptions.

Group A-3

Amusement arcades
Art galleries
Bowling alleys
Places of worship
Community halls
Conference rooms
Exhibition halls
Lecture halls
Libraries
Museums
Passenger stations

Source: 2021 IBC

303.1 Occupancy Classification A-4

The combination of spectator seating and sporting events creates a condition within a building that warrants a specific occupancy classification within the Group A classification.

A Group A-4 facility contains those occupant-related hazards found in other assembly occupancies, namely high occupant loads in concentrated areas, along with large areas having limited occupants and little, if any, fire loading conditions.

Group A-4
Arenas Skating rinks Swimming pools Tennis courts

Source: 2021 IBC

303.1 Occupancy Classification A-4

Which of the following uses is typically considered a Group A-4 occupancy?

a. restaurant with a dance floor
b. school library
c. outdoor football stadium
d. indoor hockey arena

Source: 2021 IBC

304.1 Occupancy Classification: Group B

- Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts.

- Business occupancies typically have a low to moderate fire load, a moderate density level, and occupants who are usually mobile and have a general awareness of the surrounding conditions. As such, business occupancies are grouped into a classification based upon a relatively moderate fire hazard level. Group B occupancies are not restricted by occupant load, as the number of people in a business use, such as an office, can range from one person to thousands of people.

Source: 2021 IBC

304.1 Occupancy Classification: Group B

Group B

Ambulatory care facilities
Animal hospitals, kennels and ponds
Banks
Barber and beauty shops
Car wash
Civil administration
Clinic-outpatient
Educational occupancies above the 12th grade
Food processing ≤ 2,500 sf
Laboratories; testing and research
Motor vehicle showrooms
Post offices
Print shops
Professional services
Radio and television stations
Training and skill development

Source: 2021 IBC

304.1 Occupancy Classification: Group B

Which of the following uses is not considered a Group B occupancy?

a. convenience store
b. motor vehicle showroom
c. car wash
d. ambulatory care facility

Source: 2021 IBC

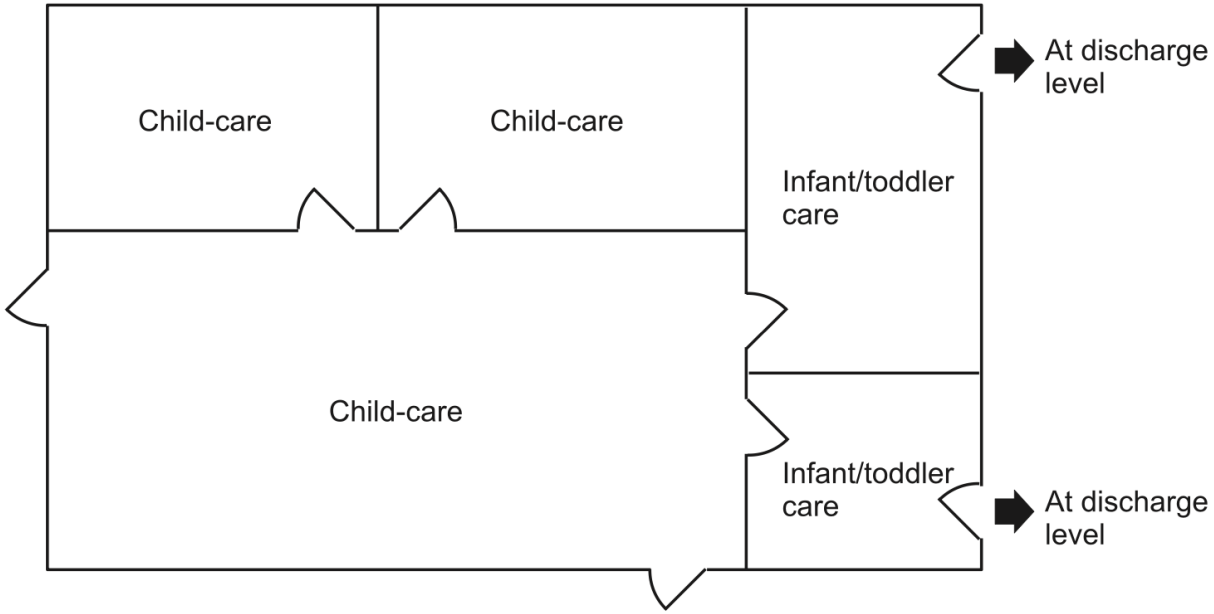
305.1 Occupancy Classification: Group E

- Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade. This group includes buildings and structures or portions thereof occupied by more than five children older than 21/2 years of age who receive educational, supervision or personal care services for fewer than 24 hours per day.
- Educational occupancies include classroom uses for students of high school age and younger.
- Education facilities limited to use by older students, such as college classrooms, are classified as Group B occupancies; however, a Group A classification should be considered for lecture halls and similar large occupant load spaces.

Source: 2021 IBC

305.1 Occupancy Classification: Group E

Entire building can be considered a Group E occupancy



Although a child-care facility that provides care for infants and toddlers (children $2^1/_2$ years of age or less) is generally considered a Group I-4 occupancy, Section 308.5.1 permits a Group E classification under specific conditions.

Source: 2021 IBC

305.1 Occupancy Classification: Group E

5. In a Group E middle school, an assembly area associated with the Group E shall be classified as what occupancy?
   a. Group E
   b. Group A-5
   c. Group I-1
   d. Group U

Source: 2021 IBC

306.1 Occupancy Classification: Group F

- Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.
- Although the potential hazard and fire severity varies among the many uses categorized as Group F occupancies, the uses still share elements in common. The occupants are adults who are awake and who generally have enough familiarity with the premises to be able to exit the building with reasonable efficiency.
- Public occupancy is usually quite limited, if at all, and most occupants are aware of the potential hazards the use creates.
- Contain some degree of hazardous material as a necessary part of the manufacturing process. However, where the amount of hazardous material does not exceed the maximum allowable quantities.

Source: 2021 IBC

306.1 Occupancy Classification: Group F

Group F-1

Aircraft
Appliances
Automobiles
Bakeries
Business machines
Carpets and rugs
Clothing
Electric generation
ESS (dedicated use)
Food processing > 2,500 sf
Furniture
Laundries
Millwork
Paper mills or products
Plastic products
Printing or publishing
Refuse incineration
Textiles
Water/sewer treatment
Woodworking

Group F-2

Brick and masonry
Ceramic products
Foundries
Glass products
Gypsum
Ice
Metal products

Classification as a Group F-2 occupancy is strictly limited because of the restrictions placed on such uses. The fabrication or manufacture of noncombustible materials, as well as their finishing, packaging or processing operations, cannot involve a significant fire hazard.

Source: 2021 IBC

307.1 Occupancy Classification: Group H

- High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, 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 complying with Section 414, based on the maximum allow- able quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2).

- There is only one fundamental type of Group H occupancy—that which is designated based solely on excessive quantities of hazardous materials contained therein. The quantities of hazardous materials that necessitate a Group H classification vary, based on the type, quantity, condition (use or storage) and environment of the materials. Where the use does not exceed the maximum allowable quantities set forth in the code, a classification other than Group H is appropriate.

Source: 2021 IBC

307.1 Occupancy Classification: Group H

Where hazardous materials and processes are involved.

Although the *International Building Code* is limited to general construction regulations and occupancy-specific requirements, the *International Fire Code*® (IFC®) sets forth special detailed provisions relating to hazardous materials and the specific conditions of their storage, use and handling.

Source: 2021 IBC

307.1 Occupancy Classification: Group H

A Group _____ occupancy classification is to be assigned to a facility where combustible dusts are generated in a manner that creates a fire or explosion hazard.

a. H-1
b. H-2
c. H-4
d. H-5

Source: 2021 IBC

307.1 Occupancy Classification: Exceptions to Group H

Four other options are available to further increase the quantities of hazardous materials in any building:

- Provide additional control areas as limited by Table 414.2.2,
- Provide one or more fire walls in conformance with Section 706,
- Apply the allowances for unlimited quantities in Section 307.1.1,
- Construct the building as required for a Group H occupancy.

Source: 2021 IBC

307.1 Occupancy Classification: Exceptions to Group H

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

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

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

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	NA	H-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA
Combustible fiber[q]	Loose	H-3	(100)	NA	NA	(100)	NA	NA	(20)	NA
	Baled[o]		(1,000)			(1,000)			(200)	
Combustible liquid[c, i]	II	H-2 or H-3	NA	120[d, e]	NA	NA	120[d]	NA	NA	30[d]
	IIIA	H-2 or H-3		330[d, e]			330[d]			80[d]
	IIIB	NA		13,200[e, f]			13,200[f]			3,300[f]

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.
NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

a. For use of control areas, see Section 414.2.
b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

ce: 2021 IBC

307.1 Occupancy Classification: Exceptions to Group H

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

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

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

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE[b]			USE-CLOSED SYSTEMS[b]			USE-OPEN SYSTEMS[b]	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Combustible dust	NA	H-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA
Combustible fiber[q]	Loose	H-3	(100)	NA	NA	(100)	NA	NA	(20)	NA
	Baled[o]		(1,000)			(1,000)			(200)	
Combustible liquid[c, i]	II	H-2 or H-3		120[d, e]			120[d]			30[d]
	IIIA	H-2 or H-3	NA	330[d, e]	NA	NA	330[d]	NA	NA	80[d]
	IIIB	NA		13,200[e, f]			13,200[f]			3,300[f]

For SI: 1 cubic foot = 0.028 m^3, 1 pound = 0.454 kg, 1 gallon = 3.785 L.
NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

a. For use of control areas, see Section 414.2.
b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

ce: 2021 IBC

307.1 Occupancy Classification: Exceptions to Group H

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

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

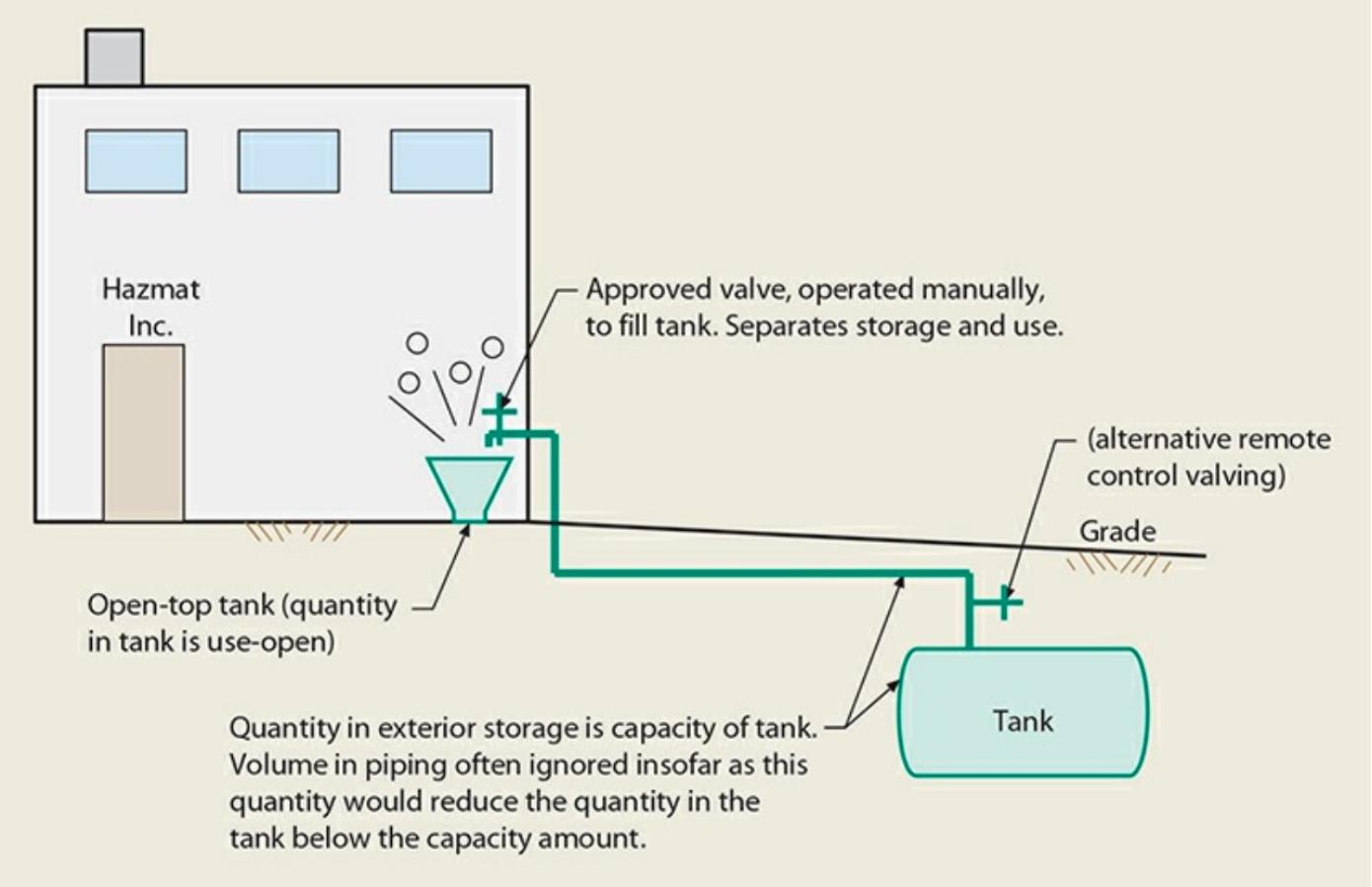
SOLUTION:

Basic MAQs per Table 307.1(1)	120 gallons
Sprinkler increase per Footnote d (100%)	+ 120 gallons
	240 gallons
Safety can increase per Footnote e (100%)	+ 240 gallons
Total of maximum permitted for Group F-1 classification	480 gallons

Source: 2021 IBC

307.1 Occupancy Classification: Storage

- The maximum allowable quantities in the code are based on three potential situations: storage, use-closed, and use-open.



Source: 2021 IBC

307.1 Occupancy Classification: Storage

Buildings containing materials that present a detonation hazard are typically considered _____ occupancies.

a. Group H-1
b. Group H-2
c. Group H-3
d. Group H-5

Source: 2021 IBC

308.1 Occupancy Classification: Group I

- Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.
- The institutional uses classified as Group I occupancies are of three broad types. The first is a facility in which care is provided for the very young, sick or injured. The second category includes those facilities in which the personal liberties of the inmates or residents are restricted. Thirdly, supervised care facilities are regulated. Though the hazard due to combustible contents is quite low in institutional uses, the occupants' lack of mobility limits their egress ability.

Source: 2021 IBC

309.1 Occupancy Classification: Group I

Group I-1

Alcohol and drug centers
Assisted living facilities
Congregate care facilities
Group homes
Halfway houses
Residential board and care facilities
Social rehabilitation facilities

Group I-2

Foster care facilities
Detoxification facilities
Hospitals
Nursing homes
Psychiatric hospitals

Group I-3

Correctional centers
Detention centers
Jails
Prerelease centers
Prisons
Reformatories

Group I-4

Adult day care
Child day care

Source: 2021 IBC

308.1 Occupancy Classification: Group I

A foster-care facility providing care on a 24-hour basis to six or more infants/toddlers ($2^1/_2$ years of age or less) is classified as a Group _____ occupancy.

a. E
b. I-1
c. I-2
d. R-4

Source: 2021 IBC

309.1 Occupancy Classification: Group M

- Mercantile Group M occupancy includes, among others, the use of a building or a structure or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and where the public has access.
- A Group M occupancy is a retail or wholesale facility, or a store. An entire building can be classified as a Group M occupancy, such as a department store, or a portion of a building can be considered a mercantile use, such as the sales room in a manufacturing facility. A service station, including a canopy over the pump islands, is also classified as a Group M occupancy. In limited instances, a sales operation is designated as a Group B occupancy, as in the case of automobile showrooms.

Source: 2021 IBC

309.1 Occupancy Classification: Group M

Group M

Department stores
Drug stores
Greenhouses (display and sale)
Markets
Motor fuel-dispensing facilities
Retail or wholesale stores
Sales rooms

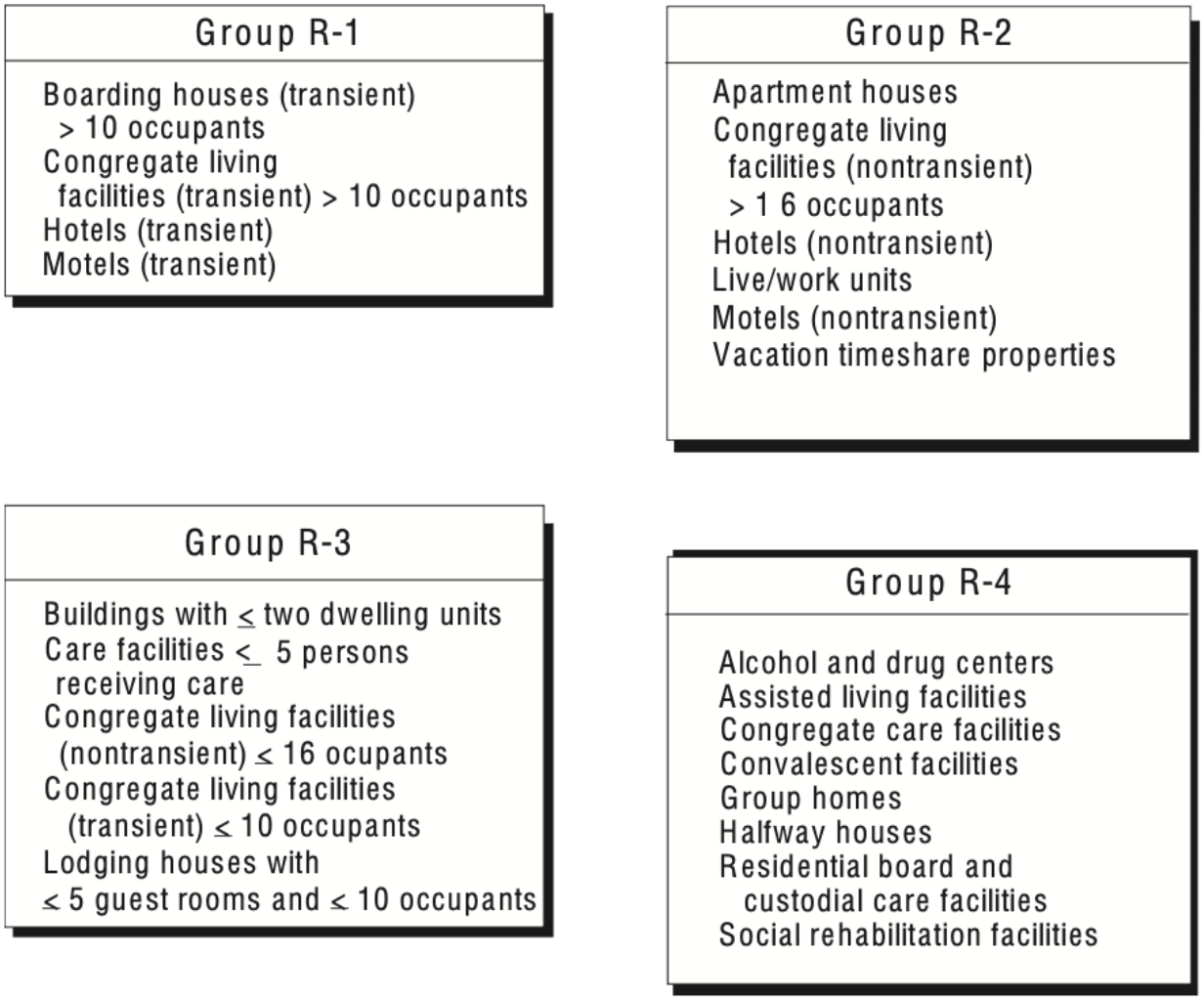
Source: 2021 IBC

310 Occupancy Classification: Group R

- Residential Group R occupancy includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the International Residential Code.
- Residential occupancies are characterized by: (1) their use by people for living and sleeping purposes, (2) a relatively low potential fire severity, and (3) the worst fire record of all structure types. Because occupants of these types of buildings spend up to one-third of each day sleeping, there is a high potential of a fire to rage out of control before the occupants awaken. After awakening, the residents will typically be disoriented for a short period of time, further decreasing the opportunity for immediate egress. A major difference between the Group R-1 and R-2 occupancy classifications is the transient nature of the use. “Transient” is defined as occupancy of a dwelling unit or sleeping unit for not more than 30 days.

Source: 2021 IBC

310 Occupancy Classification: Group R



Source: 2021 IBC

Occupancy Classification: Group R

Live/work units are to be classified as _____ occupancies.

a. Group B
b. Group R-2
c. accessory
d. mixed

Source: 2021 IBC

311 Occupancy Classification: Group S

- Storage Group S occupancy includes among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.
- Where a warehouse or other storage facility does not contain significant amounts of hazardous commodities (as determined by Section 307), it should be considered a Group S occupancy. A facility used for the storage of combustible goods is classified as Group S- 1, whereas a Group S-2 occupancy shall be used only for the storage of noncombustible materials. If it is reasonable to believe that a storage building will house combustible goods for any significant period of time, it would be appropriate to consider the structure a Group S-1 occupancy, designed and constructed accordingly. Motor-vehicle-related uses are also included in the Group S category, with repair garages classified as Group S- 1 and parking garages (both open and enclosed) as Group S-2 occupancies.

Source: 2021 IBC

311 Occupancy Classification: Group S

Group S-1

- Aerosols products
  - Level 2 and Level 3
- Aircraft repair hangar
- Bags; cloth, burlap, paper
- Belting; canvas, leather
- Books
- Paper in rolls
- Cardboard and cardboard boxes
- Clothing
- Furniture
- Grains
- Lumber
- Motor vehicle repair garages
- Self-service storage facility
- Tires, bulk storage of
- Tobacco, cigars, cigarettes
- Upholstery and mattresses

Group S-2

- Aircraft hangar
- Asbestos
- Cement in bags
- Chalk and crayons
- Dairy products
- Dry cell batteries
- Electric motors
- Food products
- Fresh fruits and vegetables
- Frozen foods
- Glass
- Gypsum board
- Meats
- Metals
- Open parking garages
- Enclosed parking garages
- Porcelain and pottery

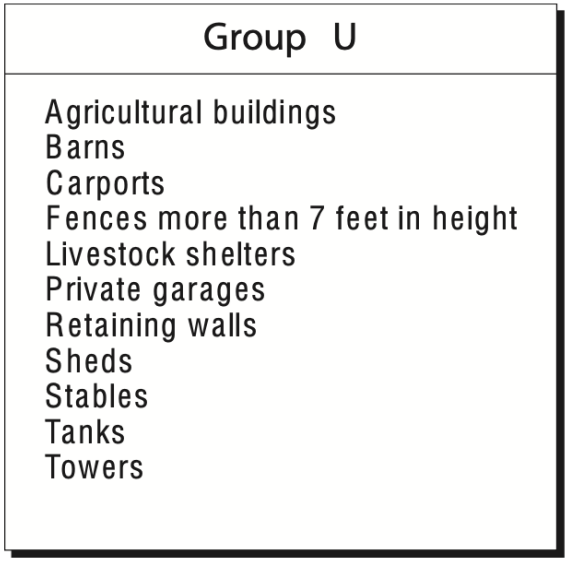
Source: 2021 IBC

312 Occupancy Classification: Group U

- Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of the IBC commensurate with the fire and life hazard incidental to their occupancy.
- Those structures not ordinarily occupied by the general public are typically classified as Group U occupancies. The fire load in these structures varies considerably but is usually not excessive. Because these types of uses are not normally occupied, the concern for fire severity is not very great, and as a group they constitute a low hazard. Several of the structures regulated as Group U occupancies are never occupied, such as fences, towers and tanks.

Source: 2021 IBC

312 Occupancy Classification: Group U



Source: 2021 IBC

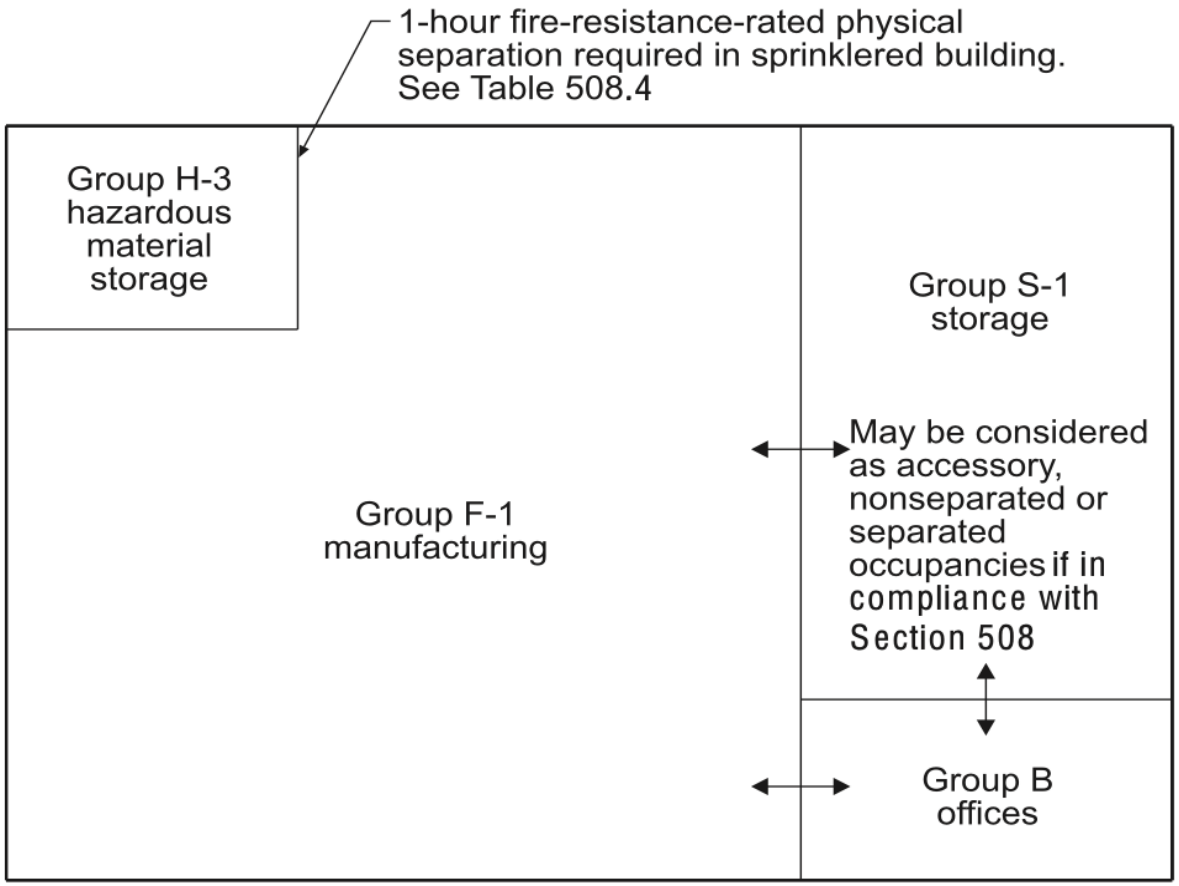
508.1 Occupancy Classification: Mixed Occupancies

- Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2 (Accessory Occupancies), 508.3 (Nonseparated Occupancies), 508.4 (Separated Occupancies), or 508.5 (Live/Work Units), or a combination of these sections. See the exceptions for: (1) occupancies separated in accordance with Section 510 (Special Provisions), and (2) Group H- 1, H-2 and H-3 occupancies required by Table 415.6.5 to be located in a separate and detached building.

- It is not uncommon for two or more distinct occupancy classifications to occur in the same building. Where such conditions exist, the code requires that such multiple occupancies be either (1) isolated from each other using fire-resistive separation elements (fire barriers and/or horizontal assemblies), or (2) imposed with special provisions that eliminate the need for such fire separations.

Source: 2021 IBC

508.1 Occupancy Classification: Mixed Occupancies



Source: 2021 IBC

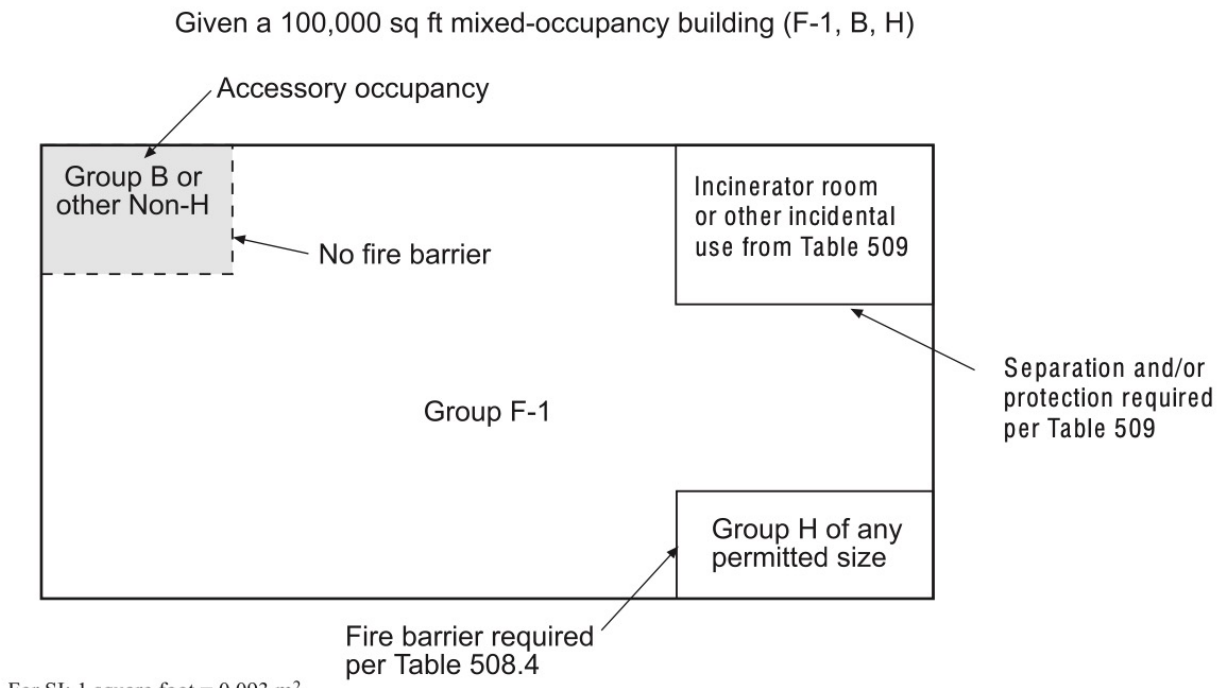
508.2/3 Accessory Occupancy

- Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Aggregate accessory occupancies shall not occupy more than 10 percent of the area of the story in which they are located and shall not exceed the tabular values for nonsprinklered buildings in Table 506.2 for each such accessory occupancy.
- The mixed-occupancy method of “Accessory Occupancies” is one of the three design options that the code provides when dealing with mixed-occupancy buildings. This approach is only applicable where one or more of the occupancies is quite small in relationship to the major occupancy in the building. The aggregate floor area of all accessory occupancies is limited to 10 percent of the floor area of the story in which the accessory occupancies are located. In addition, the aggregate floor area of the accessory occupancies cannot exceed the allowable floor area taken from Table 506.2 for a nonsprinklered building.

Source: 2021 IBC

508.2/3 Accessory Occupancy

Example:



For SI: 1 square foot = 0.093 m^2.

It is possible to have more than one space or occupancy designated an accessory occupancy. Under such circumstances, the 10 percent and tabular area limitations, per story, are to be based upon the aggregate floor area of all of the accessory occupancies.

Source: 2021 IBC

508.2.1 Nonseparated Occupancy

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	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
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2

Source: 2021 IBC

508.2.1 Nonseparated Occupancy

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	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
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2

Source: 2021 IBC

508.2.1 Nonseparated Occupancy

Example:

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

OCCUPANCY	ALLOWABLE HEIGHT[1]	ALLOWABLE AREA[2]
Group B[2]	2 stories	9,000 square feet
Group E[3]	1 story	9,500 square feet

1 Based on Table 504.4

2 Based on Table 506.2 assuming no frontage increase.

3 Most restrictive fire protection requirements of Chapter 9 also applicable to entire building.

ˆThus, for nonseparated occupancies, the maximum building size would be 1 story and 9,000 square feet.

Nonseparated Occupancies

The use of the nonseparated occupancies method is not applicable to high-hazard occupancies. Those areas or spaces classified as Group H occupancies must be isolated from other occupancies within the building by fire barriers and/or horizontal assemblies in accordance with Table 508.4 for occupancy separations.

Source: 2021 IBC

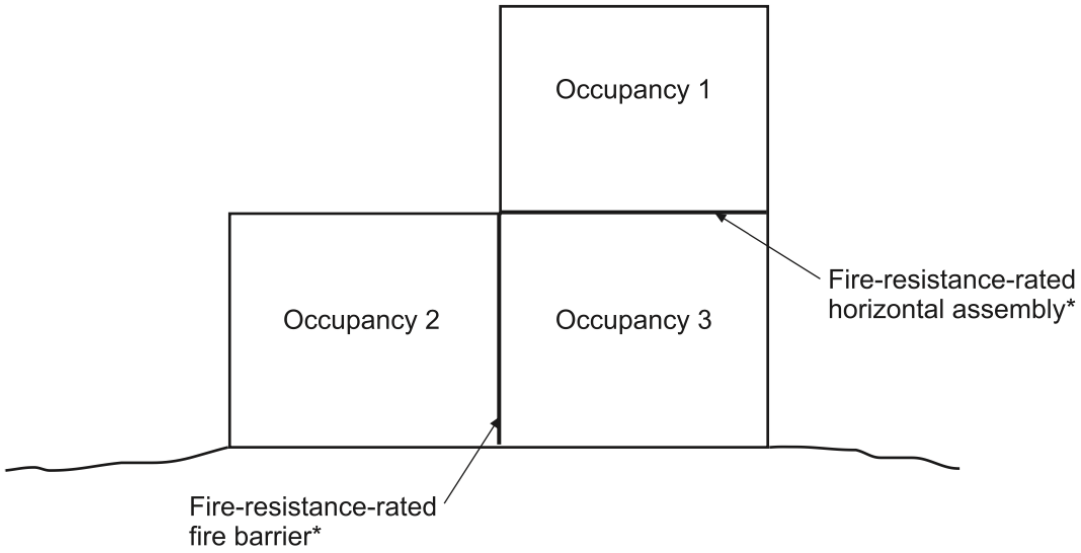
508.4 Separated Occupancy

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

- Under the provisions for “Separated Occupancies,” each of the distinct uses is to be individually classified as to occupancy. This approach is consistent with that for accessory occupancies and nonseparated occupancies. The concept of separated occupancies provides for a fire-resistance-rated separation in order to isolate the hazards associated with a specific occupancy from other portions of the building.

Source: 2021 IBC

508.4 Nonseparated Occupancy



*Minimum fire-resistance rating based on Table 508.4

For those mixed-occupancy buildings containing a Group H occupancy, the separated occupancy provisions will always need to be applied. Any Group H occupancy must be physically and fire-resistively separated from other occupancies within the same structure.

Source: 2021 IBC

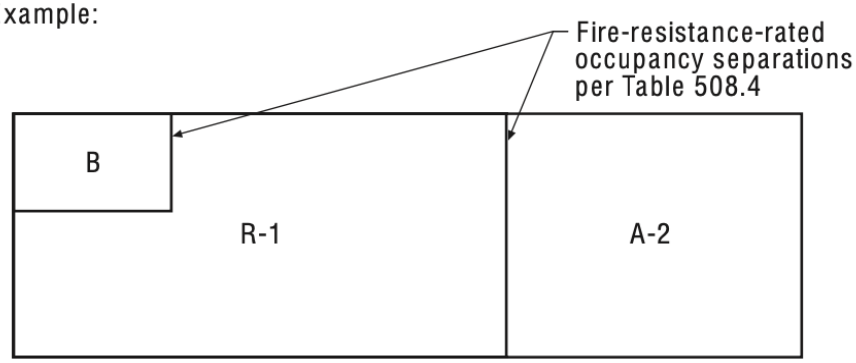
508.4.2/3 Separated Occupancy

- In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable area of each separated occupancy shall not exceed 1. Each separated occupancy shall comply with the building height limitations and story limitations based on the type of construction of the building in accordance with Section 503.1. See exception where Section 510 is applied.
- The approach to separated occupancies mandates that the ratios of the actual and allow- able floor areas be calculated in order to determine compliance. Often known as the “unity formula,” this calculation recognizes the relationship between the permitted sizes of the various occupancies involved. The unity formula is only applicable where the separated occupancy method is utilized and does not apply to accessory occupancies or non-separated occupancies.

Source: 2021 IBC

508.4.2/3 Separated Occupancy

Example:



Allowable height per Section 504 for each individual occupancy

$$\frac{\text{Actual area A-2}}{\text{Allowable area A-2}} + \frac{\text{Actual area B}}{\text{Allowable area B}} + \frac{\text{Actual area R-1}}{\text{Allowable area R-1}} \leq 1.0$$

The height limitations for separated occupancies are based upon the general provisions of Section 504. The height limit, in both feet and stories, is to be measured from the grade plane, and the measurement must include all intervening fire areas.

Source: 2021 IBC

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

Office (B)	4,500 square feet
Assembly (A-3)	1,000 square feet
Day care (E)	6,000 square feet

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = 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	
		A	B	A	B	A	B	A	B	C	HT	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												
	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	31,875	25,500	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
	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500

Source: 2021 IBC

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

Office (B)	4,500 square feet
Assembly (A-3)	1,000 square feet
Day care (E)	6,000 square feet

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = 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	
		A	B	A	B	A	B	A	B	C	HT	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												
	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	31,875	25,500	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
	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500

Source: 2021 IBC

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

Office (B)	4,500 square feet
Assembly (A-3)	1,000 square feet
Day care (E)	6,000 square feet

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

SOLUTION: In accordance with Section 508.4.2:

$$\frac{\text{Actual area of office}}{\text{Allowable area of office}} + \frac{\text{Actual area of assembly}}{\text{Allowable area of assembly}} + \frac{\text{Actual area of E}}{\text{Allowable area of E}} \le 1$$

$$\frac{4{,}500}{18{,}000} + \frac{1{,}000}{11{,}500} + \frac{6{,}000}{18{,}500} \overset{?}{\le} 1$$

$$0.25 + 0.09 + 0.32 \overset{?}{\le} 1$$

$0.66 \le 1$, therefore OK

Building is within the allowable area.

For SI: 1 square foot = 0.093 m^2.

Source: 2021 IBC

508.4.2/3 Separated Occupancy

In the determination of allowable building area for a mixed occupancy building, the _____ occupancies method requires the sum of the ratios of the actual building area of each occupancy divided by the allowable building area of each occupancy to be not greater than 1.0.

a. accessory
b. incidental
c. nonseparated
d. separated

Source: 2021 IBC

508.4.4/508.4.4.1 Separated Occupancy

- Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4. Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies.
- A matrix, Table 508.4, has been established to identify any required fire-resistance-rated separation between various occupancies. The table is based on the perceived degree of dissimilarity between the occupancies involved. Where Table 508.4 requires a level of fire-resistance between the adjoining occupancies, fire barriers and/or horizontal separations are to be used. The intended result is that the hazards associated with one occupancy be completely isolated from those present in the remainder of the building.

Source: 2021 IBC

508.4.4/508.4.4.1 Separated Occupancy

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[f]

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

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
N = No separation requirement.
NP = Not Permitted.

a. See Section 420.
b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.
c. See Sections 406.3.2 and 406.6.4.
d. Separation is not required between occupancies of the same classification.
e. See Section 422.2 for *ambulatory care facilities*.
f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

Source: 2021 IBC

509.1/3 Incidental Uses

- Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509.1. Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located. Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.
- It is common to find uses that are typical of the general occupancy classification of the building, yet which create a hazard different from the other hazards found in the occupancy. An example would be a chemistry laboratory classroom in a high school building. The code addresses such conditions by requiring incidental uses to be separated from the remainder of the building with fire-resistance-rated construction, or to be protected with an automatic sprinkler system. An incidental use should be assigned an occupancy classification consistent with the portion of the building in which it is located.

Source: 2021 IBC

509.1/3 Incidental Uses

[F]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
In Group I-2 occupancies, laboratories not classified as Group H	1 hour and provide automatic sprinkler system
In *ambulatory care facilities*, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2, laundry rooms over 100 square feet	1 hour
Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces	1 hour
In Group I-2, physical plant maintenance shops	1 hour
In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour
In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet	1 hour
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements.

For SI: 1 square foot = 0.0929 m^2, 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m^3.

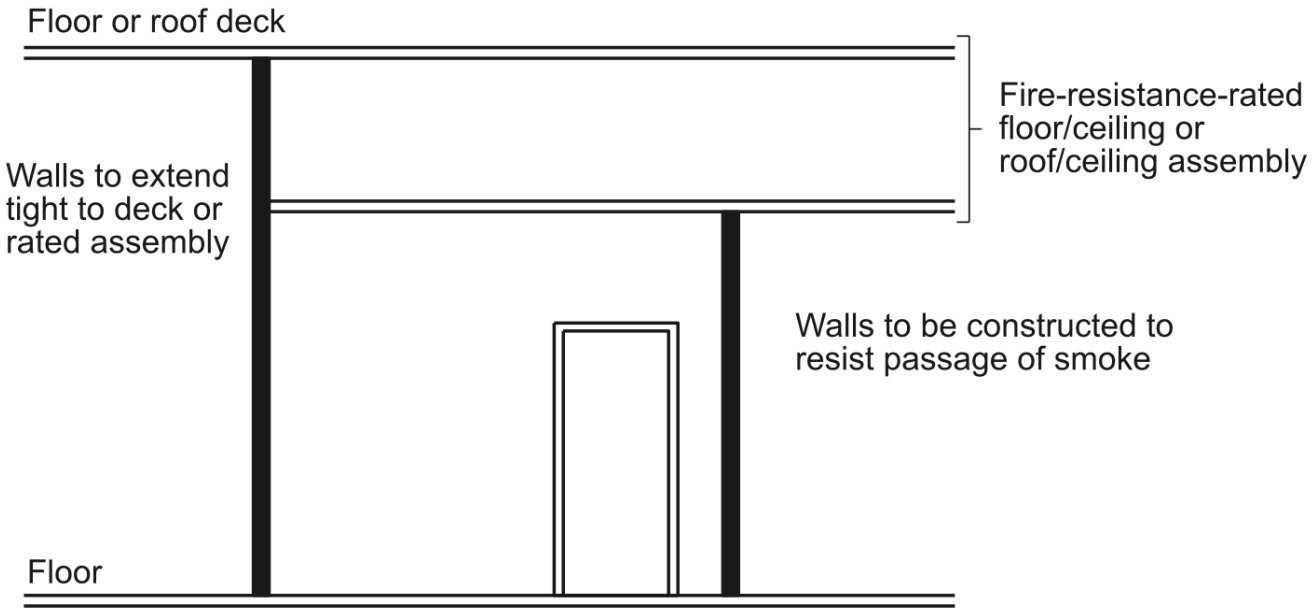
Source: 2021 IBC

509.4 Incidental Uses

- Where Table 509.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. Where Table 509.1 permits an automatic sprinkler system without a fire barrier, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke.
- In utilizing Table 509.1, it is common that two options are available for addressing rooms or areas considered incidental uses. A fire barrier may often be used to isolate the specific hazard from the remainder of the building. As an alternative, a sprinkler system may be used to limit any fire in the incidental use to that space only. By incorporating smoke containment construction, little if any smoke created would be transferred to other portions of the building.

Source: 2021 IBC

509.4 Incidental Uses



Note: Doors shall:

- be self-closing or automatic-closing upon detection of smoke
- have no air transfer openings
- have no excessive undercuts

Construction to resist the passage of smoke

Source: 2021 IBC

Class 3:
Chapter 6
Learning Objective

Source: 2021 IBC

602.1 Construction Classification

- To gain an understanding of how a building is classified as a specific type of construction, based on the construction materials and the various building elements' resistance to fire.

Source: 2021 IBC

History Building Codes ?

California Building Code Part 2 of Title 24	Effective Date	Model Code
1981	See history note appendix	UBC 1979
1985	See history note appendix	UBC 1979, 1982, 1985
1989	July 1, 1989	UBC 1988
1992	July 1, 1992	UBC 1991
1995	January 1, 1996	UBC 1994
1998	July 1, 1999	UBC 1997
2001	November 1, 2002	UBC 1997
2004	2001 CBC remains in effect	
2007	January 1, 2008	IBC 2006
2010	January 1, 2011	IBC 2009
2013	January 1, 2014	IBC 2012
2016	January 1, 2017	IBC 2015
2019	January 1, 2020	IBC 2018

History

- In order to build a structure bigger, it must be built better
- Fire-resistance requirements were developed by specifying the type and thickness of materials used.
- Herbert Hoover, then Secretary of Commerce (1921 –28)
  - Concepts in previous building codes that have carried over to today.
- Pre 1920s "The building codes of this country have not been developed on scientific data, but rather on compromise; they are not uniform in practice and in many instances involve an additional cost of construction without assuring more useful or more durable buildings."

Source: 2021 IBC

602.1 Construction Types

- Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5.
- Protected, where the major structural elements are provided with some degree of fire resistance.
- Unprotected, where no fire protection of the building elements is typically mandated. Protected construction is further distinguished in Type I buildings where the required protection for many structural elements exceeds a 1-hour fire-resistance rating.

Source: 2021 IBC

602.1 Construction Classification

Noncombustible	Exterior and interior (bearing or nonbearing) walls, floors, roofs and structural elements are to be of noncombustible materials	I	A	B		
		II	A	B		
Noncombustible or combustible	Exterior walls are to be of noncombustible materials	III	A	B		
		IV	A	B	C	HT
		V	A	B		

It is the intent of the *International Building Code* that each building be classified as a single type of construction. The construction materials and the degree to which such materials are protected determine the classification based on the criteria of Table 601 and Chapter 6.

Source: 2021 IBC

1. The Five Basic Construction Types

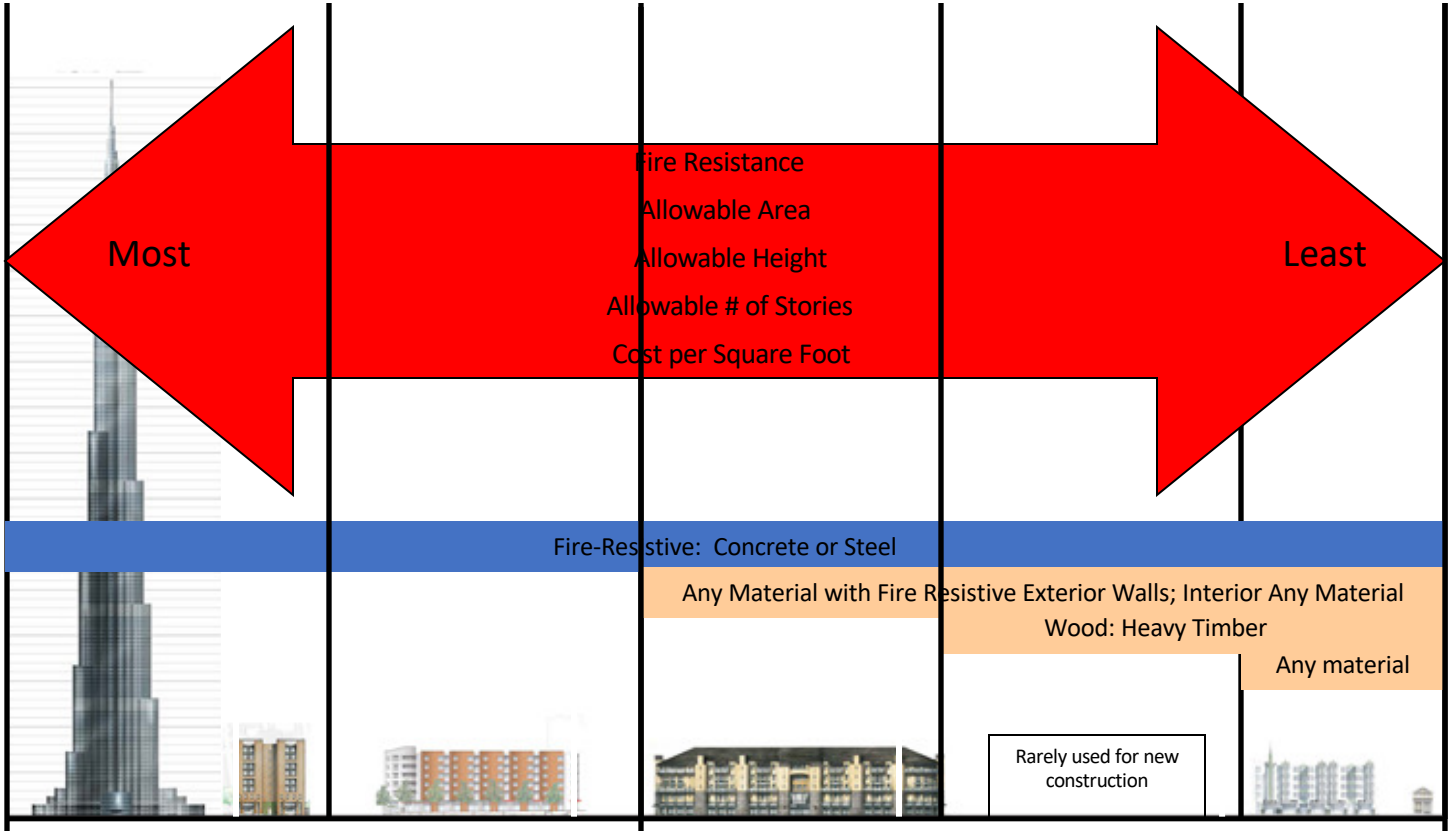
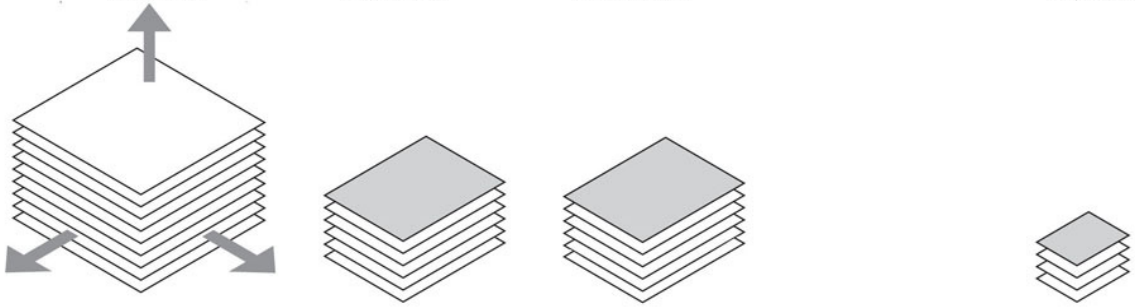


TABLE 503

Excerpt from IBC Table 503 Showing allowable building heights (with and without sprinklers) number of stories (with sprinklers) and proportionate floor areas per story)

Construction Type	Type I Fire-Resistive Construction	Type II Fire-Resistive Construction	Type III Fire-Resistive Exterior Walls Only	Type IV Heavy Timber	Type V
R-2 (Apartment)	Unlimited Unlimited	65/85 ft., 5 Stories 24,000 s.f.	65/85 ft., 5 stories 24,000 s.f.		50/70 ft., 4 stories 12,000 s.f.
Exterior Bearing Walls Rating	3 HR	1 HR	2 HR		1 HR
Fire Walls Rating	3 HR	2 HR	3 HR		2 HR



Sprinklered Buildings: + 20 ft./ 1Story, OR + Area

Allowable area may be increased depending on fire-fighting access.

Wood and hours

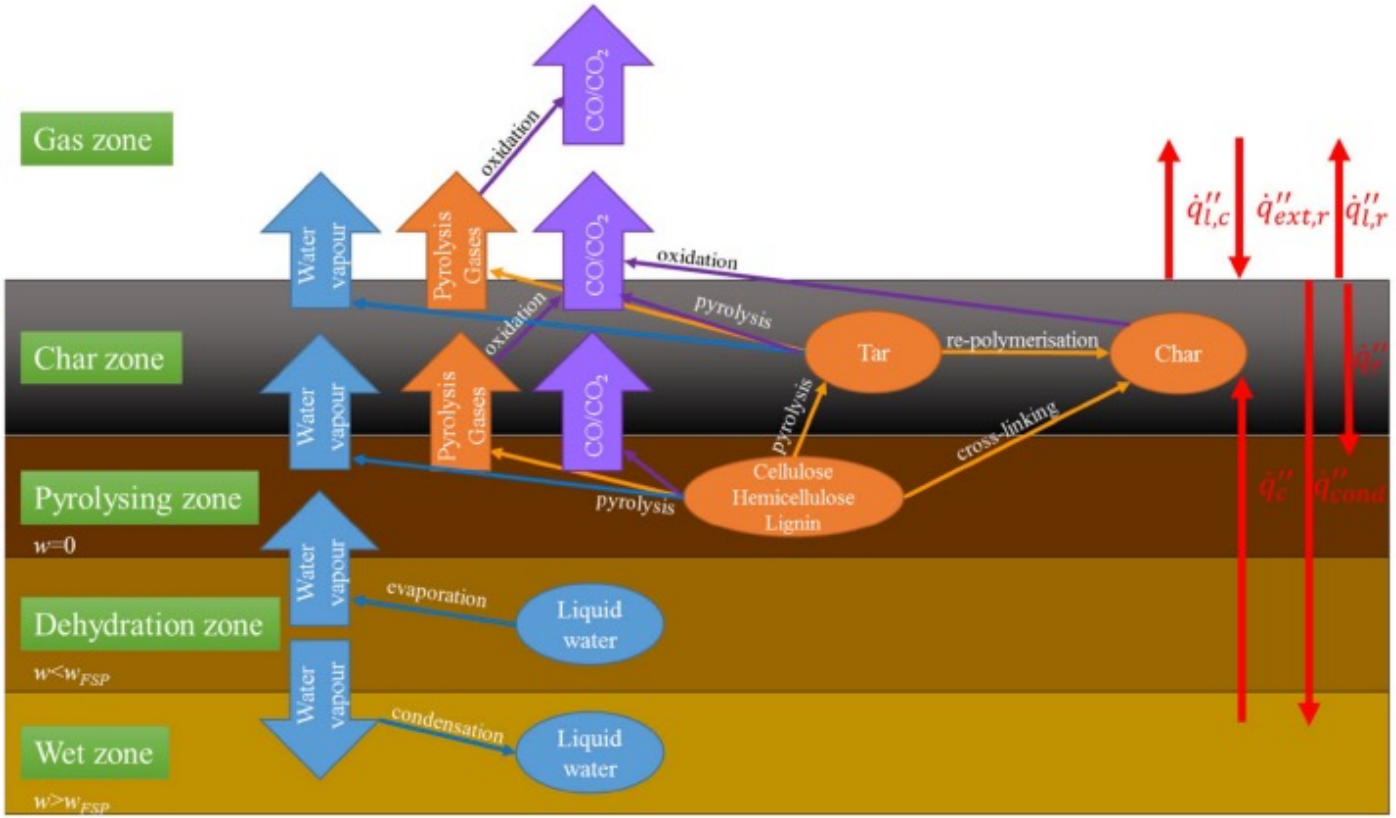


Figure 1. Chemical and physical processes within a burning timber sample; $\dot{q}''_{l,c}$ is the surface heat losses by convection, $\dot{q}''_{l,r}$ is the surface heat losses by radiation, $\dot{q}''_{ext,r}$ is the external heat flux, $\dot{q}''_r$ is in-depth radiation, $\dot{q}''_{cond}$ is conduction into the sample, and $\dot{q}''_c$ is convective heat transfer through cracks in the sample.

Source: 2021 IBC

Wood and hours

Test 1-3 compartment 3 hours and 6 minutes after ignition.
NIST

Source: 2021 IBC

RELATIVE CONSTRUCTION COSTS – Based on Construction Type

	CONSTRUCTION TYPE		# OF RES. STORIES	RELATIVE COST / SF	WHY
RESIDENTIAL FLOORS	TYPE V:	WOOD	4 MAX	1.00	
		METAL (plywood deck)		1.04	
	TYPE III: *	WOOD	5 MAX	1.03	+ fire-treated lumber framing at exterior walls
		METAL (plywood deck)		1.07	+ metal
	TYPE II:	METAL (metal deck)	5 MAX	1.10	+ metal deck w/ concrete topping
	TYPE I:	MID-RISE (concrete)	8 MAX	1.25	+ concrete frame
		HIGH-RISE (concrete)	UNLIMITED	1.30	+ fire safety features
				+ 1% per floor over 9	
GARAGE/UNFINISHED T.I. SPACE	TYPE I:	GARAGE ON GRADE (multi-level)		0.40	most efficient
		GARAGE ON GRADE (single level)		0.50	
		GARAGE BELOW GRADE		0.60	+ shoring, waterproofing

* Man lift and possibly tower crane needed for buildings over 60'. Cost per square foot varies.

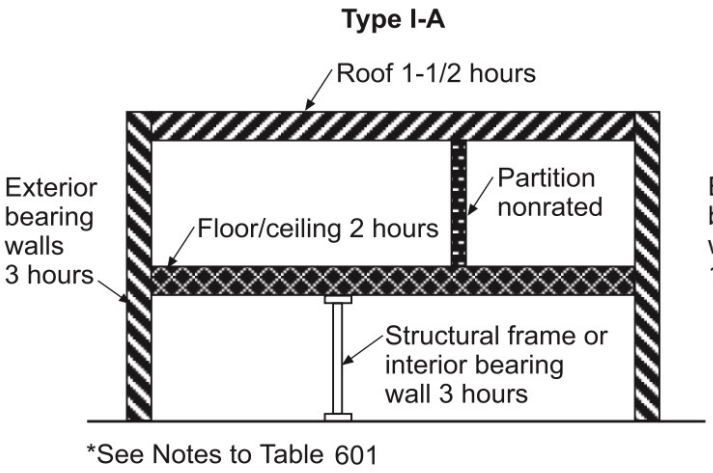
Relative costs courtesy of Scott Smith of the James E. Roberts-Obayashi Corporation

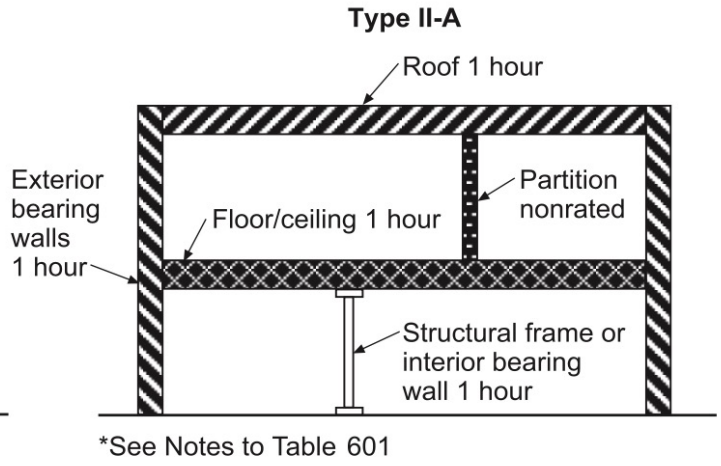
602.2 Types I and II Construction

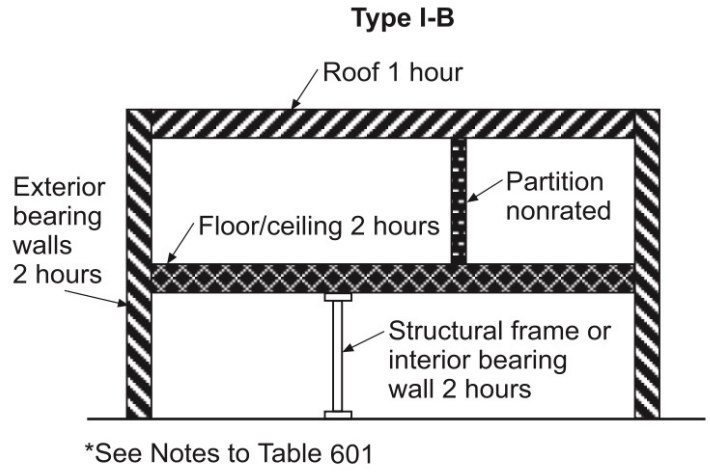
- Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in the IBC.
- Type I buildings are noncombustible, and the building elements are also provided with a mandated degree of fire resistance. This type of construction requires the highest level of fire protection specified in the code. Type II buildings are also of noncombustible construction; however, the level of fire resistance is usually less than that required for Type I structures. Buildings of Type II construction may have a limited degree of fire resistance (Type IIA) or no fire resistance whatsoever (Type IIB). There are limited allowances for the use of fire-retardant-treated wood in nonbearing partitions, nonbearing exterior walls and roof construction.

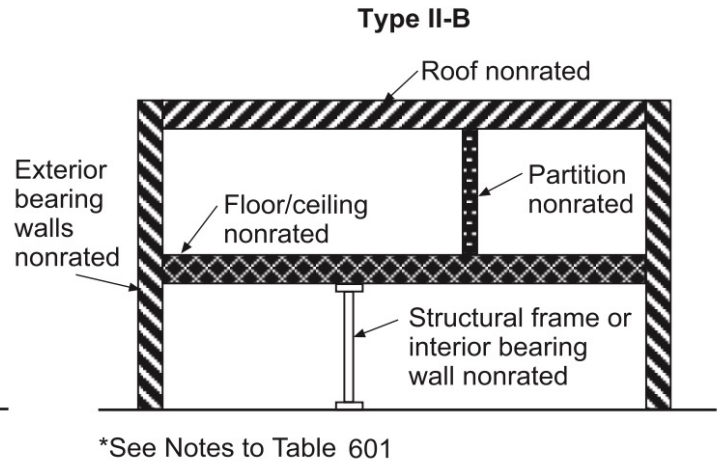
Source: 2021 IBC

602.2 Types I and II Construction Difference









Steel, iron, concrete, masonry and aluminum are considered those types of noncombustible materials used as building elements or components of building elements in Type I or II buildings. Section 703.5.2 also recognizes gypsum board as a noncombustible material.

Source: 2021 IBC

602.2 Types I and II Construction Difference

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

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[f] (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[e, f]	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[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	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

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings 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-retardant-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.

Source: 2021 IBC

601 Construction

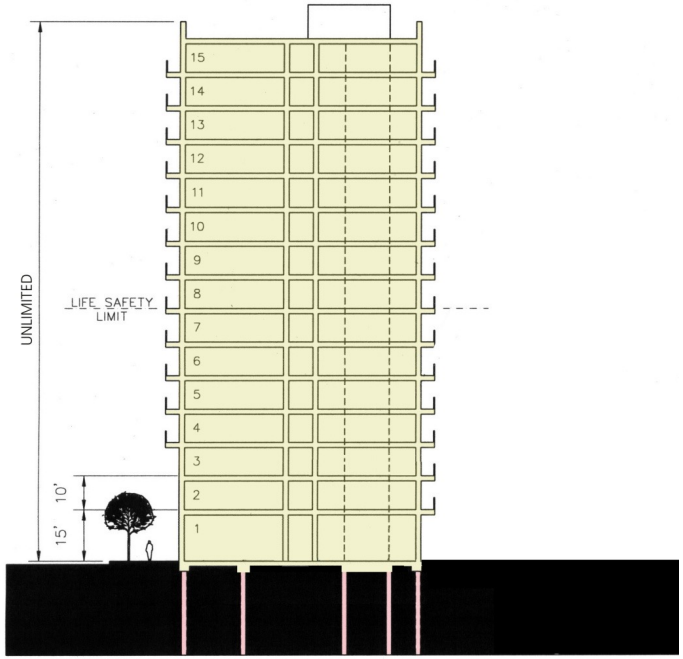
9. In a building of Type IB construction, what is the minimum required fire-resistance rating of the floor construction?

   a. 3 hours
   b. 2 hours
   c. 1 hour
   d. 0 hours (no rating required)

Source: 2021 IBC

TYPICAL CONFIGURATIONS

Type I High-rise



International Hotel

Herman Coliver Locus Architecture

New Tech : Type I High-rise

The Lake Mjøsa Skyscraper in Brumunddal, Norway

602.3 Type III Construction

1. What types of construction are considered “noncombustible”?

   a. I, II
   b. I, II, III, IV
   c. III, IV
   d. III, IV, V

Source: 2021 IBC

602.3 Type III Construction

1. What types of construction are considered “noncombustible”?

   a. I, II
   b. I, II, III, IV
   c. III, IV
   d. III, IV, V

Source: 2021 IBC

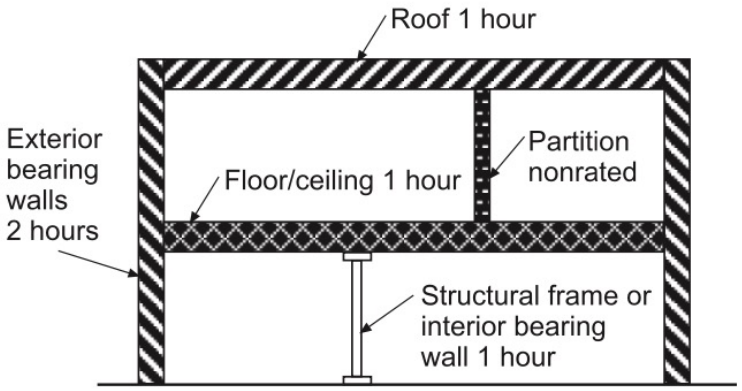
602.3 Type III Construction

- Type III construction is that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of any material permitted by the IBC. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.
- Type III buildings are considered combustible buildings and are either protected or unprotected. This building type was developed out of the necessity to prevent conflagrations in heavily built-up areas where buildings were erected side-by-side in congested downtown business districts. To limit the spread of fire from building to building, exterior walls were required to be of both noncombustible and fire-resistant construction.

Source: 2021 IBC

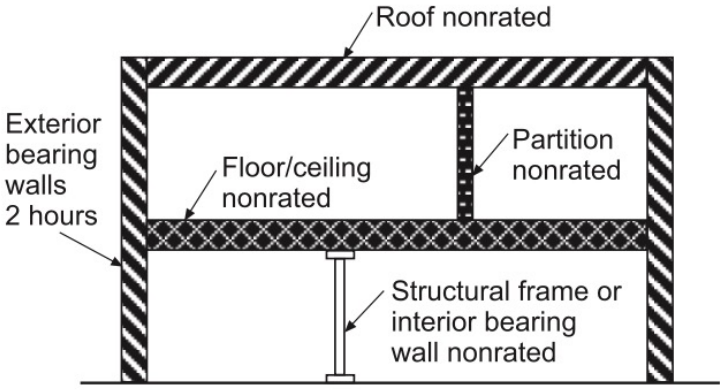
602.3 Type III Construction

Type III-A



*See Notes to Table 601

Type III-B



*See Notes to Table 601

A-211

Source: 2021 IBC

Historically referred to as “ordinary masonry construction,” Type III buildings usually consist of concrete or masonry exterior walls with wood floor and roof systems. However, the IBC permits such walls to contain fire-retardant-treated wood as an element of the exterior wall construction.

Table 601

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

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[f] (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[e, f]	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[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	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

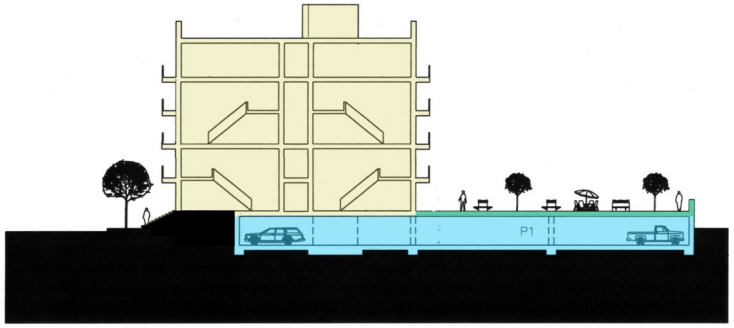
For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings 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-retardant-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.

Source: 2021 IBC

TYPICAL CONFIGURATIONS

TYPE II or Type III over TYPE I PODIUM



101 San Fernando

602.3 Type III Construction

2. Type III buildings are constructed with _____ or fire-retardant-treated wood exterior walls and interior elements _____.
    a. fire-resistant, of noncombustible materials
    b. noncombustible, of noncombustible materials
    c. noncombustible, of any material permitted by the code
    d. fire-resistant, of any material permitted by the code

Source: 2021 IBC

602.3 Type III Construction

2. Type III buildings are constructed with _____ or fire-retardant-treated wood exterior walls and interior elements _____.
    a. fire-resistant, of noncombustible materials
    b. noncombustible, of noncombustible materials
    c. noncombustible, of any material permitted by the code
    d. fire-resistant, of any material permitted by the code

Source: 2021 IBC

602.3 Type III Construction

4. In buildings of Type III construction, under what condition is fire-retardant-treated wood framing permitted within an exterior wall assembly?
    a. the wall has a 2-hour rating or less
    b. the fire separation distance exceeds 10 feet
    c. wood columns of heavy-timber sizes are used
    d. the wall is a nonbearing element

Source: 2021 IBC

602.3 Type III Construction

4. In buildings of Type III construction, under what condition is fire-retardant-treated wood framing permitted within an exterior wall assembly?

   a. the wall has a 2-hour rating or less
   b. the fire separation distance exceeds 10 feet
   c. wood columns of heavy-timber sizes are used
   d. the wall is a nonbearing element

Source: 2021 IBC

602.3 Type IV Construction

- Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire-resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire-resistance rating requirements of Section 602.4 based on either the fire-resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2.
- Mass timber is defined as those structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction. The term “mass timber” represents the large wood building elements permitted for heavy timber (Type IV-HT) construction and is deemed to meet fire-resistance requirements based solely on the required minimum dimensions of the wood element. It also represents construction Types IV-A, IV-B and IV-C, which are required to have a fire-resistance rating, in many cases provided by both the mass timber element itself and noncombustible protection applied to the mass timber element.

Source: 2021 IBC

602.1 Construction Types

While mass timber can be fully exposed in Type IV-C construction and partially exposed in Type IV-B construction, it must in other cases be protected with a noncombustible material, such as gypsum board. It must also have a protection time assigned based on testing that is prescribed elsewhere in the code.

Source: 2021 IBC

602.4.1 Type IV-A Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.

   a. I
   b. III
   c. IV
   d. V

Source: 2021 IBC

602.4.1 Type IV-A Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.

a. I
b. III
c. IV
d. V

Source: 2021 IBC

Type IVA Table 601

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

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[f] (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[e, f]	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[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	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

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings 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-retardant-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.

Source: 2021 IBC

602.4.1 Type IV-A Construction

- The outside face of exterior walls of mass timber construction shall be protect with non-combustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3. The floor assembly shall contain a noncombustible materials not less than 1 inch (25 mm) in thickness above the mass timber. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2 (consistent with protection of interior walls).

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

REQUIRED FIRE-RESISTANCE RATING OF BUILDING ELEMENT PER TABLE 601 AND TABLE 705.5 (hours)	MINIMUM PROTECTION REQUIRED FROM NONCOMBUSTIBLE PROTECTION (minutes)
1	40
2	80
3 or more	120

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

NONCOMBUSTIBLE PROTECTION	PROTECTION CONTRIBUTION (minutes)
$^1/_2$-inch Type X gypsum board	25
$^5/_8$-inch Type X gypsum board	40

Source: 2021 IBC

602.4.1 Type IV-A Construction

- The outside face of exterior walls of mass timber construction shall be protect with non-combustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3. The floor assembly shall contain a noncombustible materials not less than 1 inch (25 mm) in thickness above the mass timber. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2 (consistent with protection of interior walls).
- Type IV-A construction is composed of mass timber elements that are completely protected with noncombustible materials. The contribution of the noncombustible protection to the overall fire-resistance rating of a mass timber member or assembly is established through a performance path set forth in Section 703.6. In addition, noncombustible assemblies such as those of light-gage steel are also permitted. However, light-frame combustible assemblies, including those consisting of wood studs, joists or furring, are specifically prohibited.

Source: 2021 IBC

Wood and hours

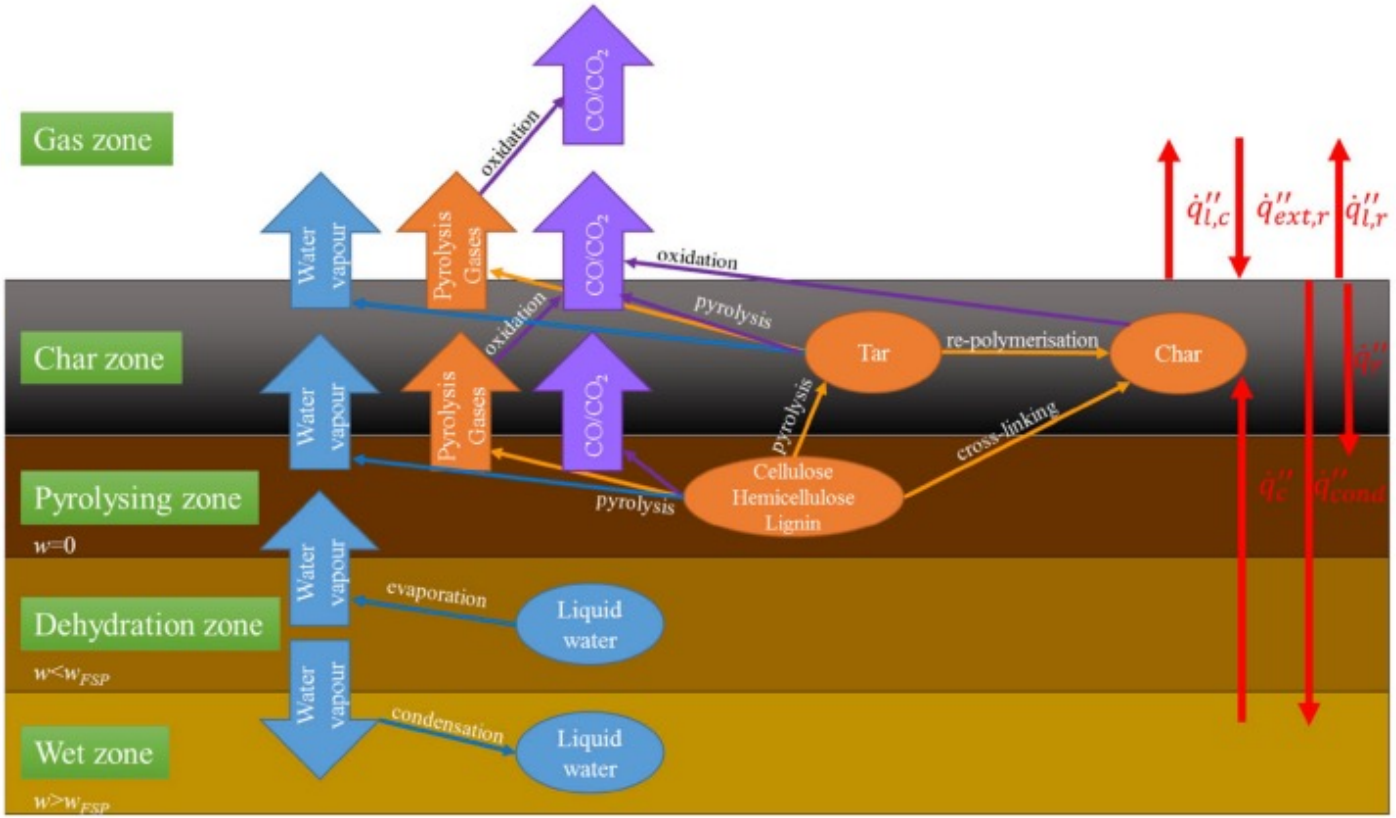


Figure 1. Chemical and physical processes within a burning timber sample; $\dot{q}''_{l,c}$ is the surface heat losses by convection, $\dot{q}''_{l,r}$ is the surface heat losses by radiation, $\dot{q}''_{ext,r}$ is the external heat flux, $\dot{q}''_r$ is in-depth radiation, $\dot{q}''_{cond}$ is conduction into the sample, and $\dot{q}''_c$ is convective heat transfer through cracks in the sample.

Source: 2021 IBC

602.4 Construction Type

3. The type of construction where building elements are mass timber or noncombustible is _____.

a. Type I
b. Type II
c. Type III
d. Type IV

Source: 2021 IBC

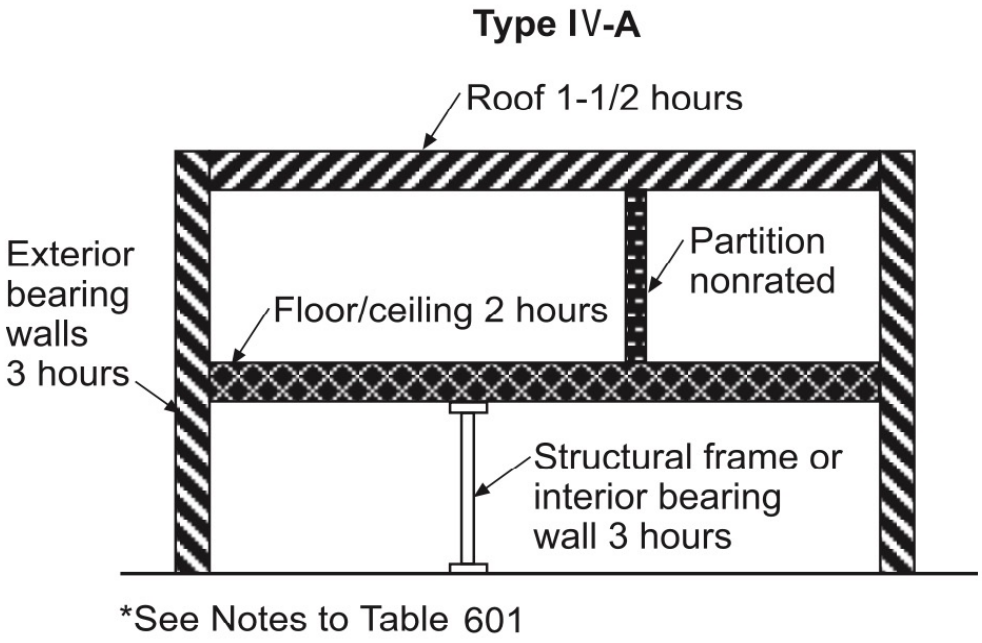
602.4 Construction Type

3. The type of construction where building elements are mass timber or noncombustible is _____.

a. Type I
b. Type II
c. Type III
d. Type IV

Source: 2021 IBC

602.4.1 Type IV-A Construction



Construction adhesive or other sealant is required at joint and intersections to prevent air flow. Where a wall or horizontal assembly serves as the separation between two atmospheres, it is necessary to properly seal any voids that could serve as a conduit for air movement during a fire.

Source: 2021 IBC

602.4.2/3 Type IV-B/C Construction

- In Type IV-B construction, interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected, as required by Section 602.4.2.2, with materials complying with Section 707.3. Unprotected portions of mass timber ceilings and walls are permitted when complying with Section 602.4.2.2.4 (separation distance between unprotected mass timber elements) and the following: [see allowances for unprotected portions of mass timber ceilings (limited to 20 percent of floor area in any dwelling unit or fire area) and mass timber walls (limited to 40 percent of floor area in any dwelling unit or fire area)]. In Type IV-C construction, mass timber elements (interior walls, ceilings, columns and beams) are permitted to be unprotected.
- Type IV-B construction permits portions of interior mass timber surfaces to be exposed. The amount of exposed surface permitted, as well as the required separation between unprotected portions, is regulated to limit potential contribution of the structure to an interior fire. Type IV-C construction permits fully exposed mass timber on the interior of the building except in specific areas such as concealed spaces, shafts, elevator hoistways and interior exit stairway enclosures.

Source: 2021 IBC

602.4.2/3 Type IV-B/C Construction

707.3 Fire-resistance rating. The *fire-resistance rating* of *fire barriers* shall comply with this section.

707.3.1 Shaft enclosures. The *fire-resistance rating* of the *fire barrier* separating building areas from a *shaft* shall comply with Section 713.4.

707.3.2 Interior exit stairway and ramp construction. The *fire-resistance rating* of the *fire barrier* separating building areas from an *interior exit stairway* or *ramp* shall comply with Section 1023.1.

707.3.3 Enclosures for exit access stairways. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit access stairway* or *ramp* shall comply with Section 713.4.

707.3.4 Exit passageway. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit passageway* shall comply with Section 1024.3.

707.3.5 Horizontal exit. The *fire-resistance rating* of the separation between building areas connected by a *horizontal exit* shall comply with Section 1026.1.

Source: 2021 IBC

707.3.6 Atriums. The *fire-resistance rating* of the *fire barrier* separating *atriums* shall comply with Section 404.6.

707.3.7 Incidental uses. The *fire barrier* separating incidental uses from other spaces in the building shall have a *fire-resistance rating* of not less than that indicated in Table 509.1.

707.3.8 Control areas. *Fire barriers* separating *control areas* shall have a *fire-resistance rating* of not less than that required in Section 414.2.4.

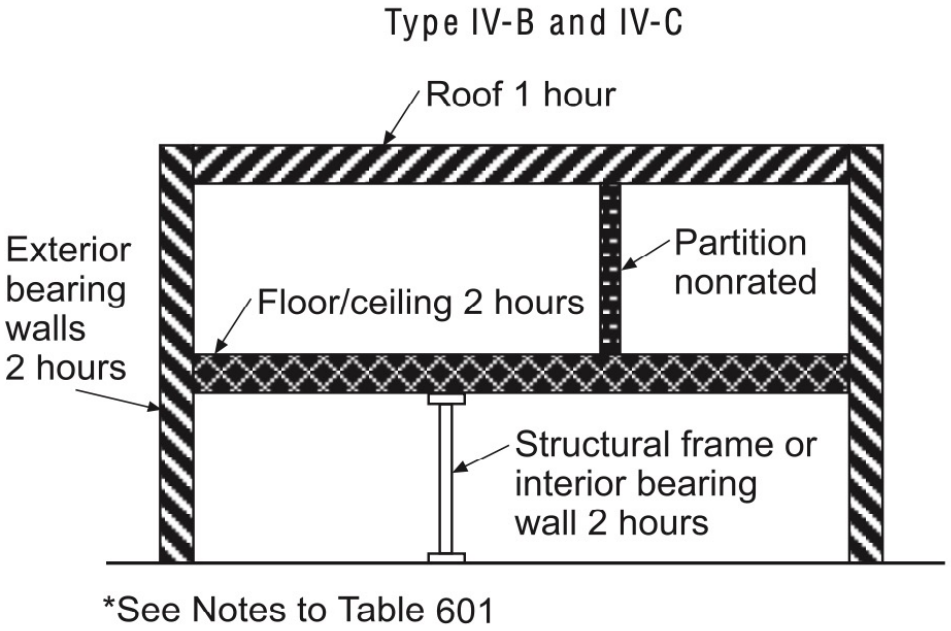
707.3.9 Separated occupancies. Where the provisions of Section 508.4 are applicable, the *fire barrier* separating mixed occupancies shall have a *fire-resistance rating* of not less than that indicated in Table 508.4 based on the occupancies being separated.

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

TABLE 707.3.10
FIRE-RESISTANCE-RATING REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

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

602.4.2/3 Type IV-B/C Construction



Exterior walls are required to be protected in the same manner for Types IV-A, IV-B and IV-C construction, which requires noncombustible protection of at least 40 minutes on the exterior side of exterior mass timber walls and prohibits all combustible materials on the exterior side of mass timber walls other than the water-resistive barrier.

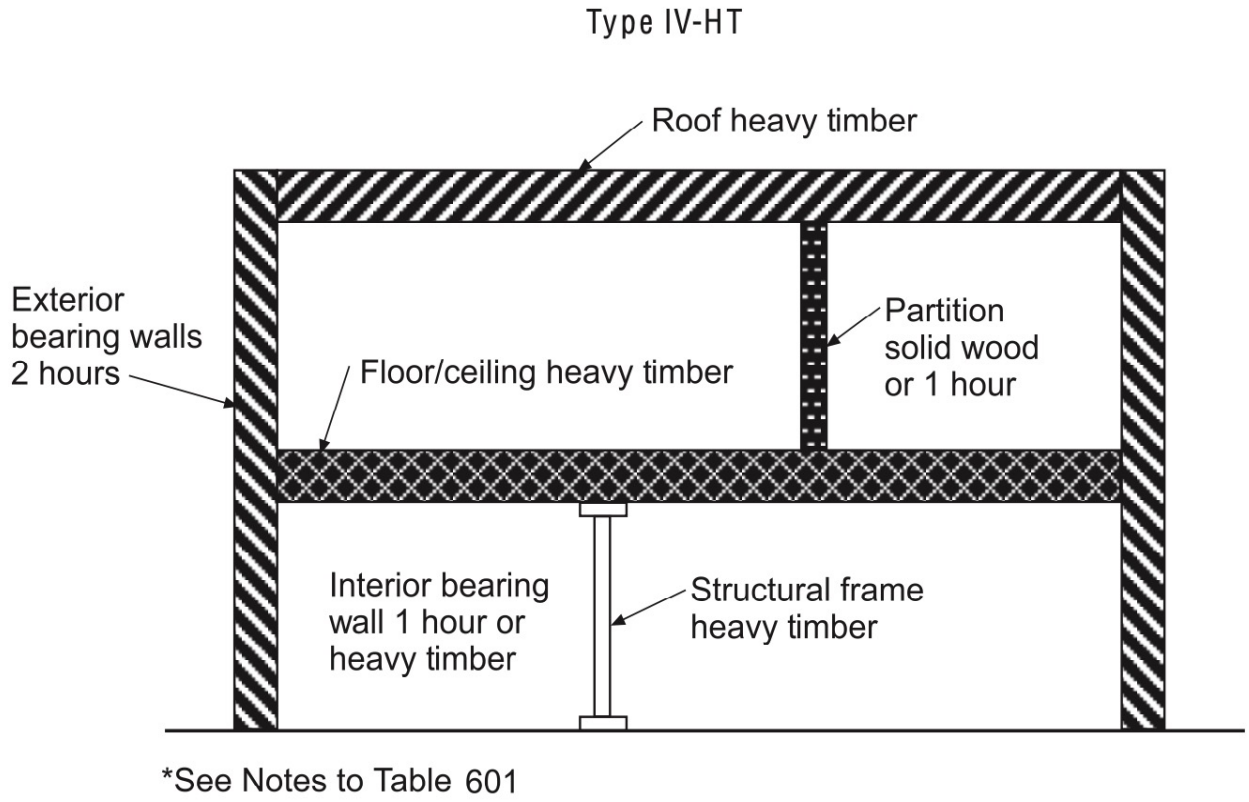
Source: 2021 IBC

602.4.4 Type IV-HT Construction

- Type IV-HT (Heavy Timber) construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated heavy timber or structural composite lumber (SCL), without concealed spaces or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials shall comply with the provisions of Section 602.3.3 and Section 2304.11. Exterior walls complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rated or heavy timber conforming to Section 2304.11.2.2 shall be permitted.
- Historically referred to as “heavy-timber,” buildings of Type IV-HT construction are essentially Type III buildings with an interior of wood members of significant mass. To conform to Type IV-HT construction, building members must be of substantial thickness. Given the characteristics of massive wood members, there is little chance for sudden structural collapse during or after a fire.

Source: 2021 IBC

602.4.4 Type IV-HT Construction

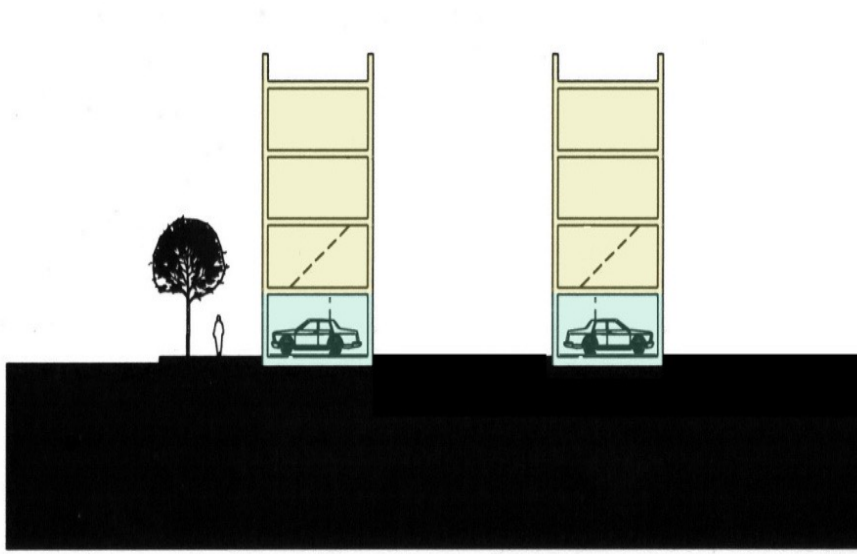


Although it is generally viewed that heavy-timber construction and 1-hour fire-resistance-rated construction are equivalent, they are typically not interchangeable. Although heavy-timber roof construction is permitted in Type IB, II, III and VA buildings, 1-hour construction can only be substituted for heavy-timber construction in interior bearing walls of Type IV buildings.

Source: 2021 IBC

TYPICAL CONFIGURATIONS

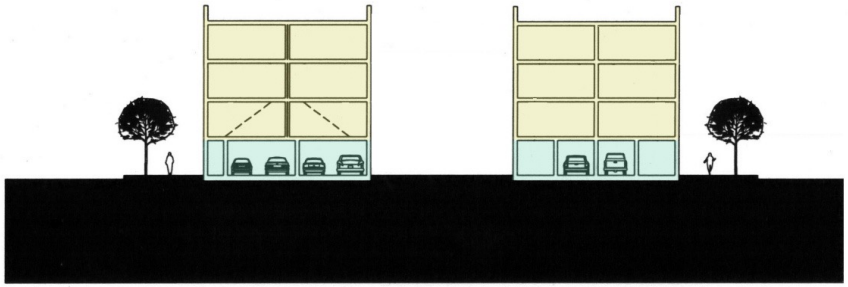
TYPE V



Fulton Grove

TYPICAL CONFIGURATIONS

TYPE V



Del Carlo Court

2304.11 Heavy-Timber Construction

5. Where supporting floor loads, solid sawn wood columns of Type IV-HT construction shall be of what minimum nominal size?

   a. 5 inches by 5 inches
   b. 6 inches by 6 inches
   c. 6 inches by 8 inches
   d. 8 inches by 8 inches

TABLE 2304.11
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

		MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	$6^{3}/_{4}$	$8^{1}/_{4}$	7	$7^{1}/_{2}$
	Wood beams and girders	6	10	5	$10^{1}/_{2}$	$5^{1}/_{4}$	$9^{1}/_{2}$
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	$8^{1}/_{4}$	$5^{1}/_{4}$	$7^{1}/_{2}$
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	$5^{1}/_{4}$	$5^{1}/_{2}$
	Framed timber trusses and other roof framing;[a] Framed or glued-laminated arches that spring from the top of walls or wall abutments	4[b]	6	3[b]	$6^{7}/_{8}$	$3^{1}/_{2}$[b]	$5^{1}/_{2}$

For SI: 1 inch = 25.4 mm.

a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.

b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

Source: 2021 IBC

2304.11 Heavy-Timber Construction

5. Where supporting floor loads, solid sawn wood columns of Type IV-HT construction shall be of what minimum nominal size?

   a. 5 inches by 5 inches
   b. 6 inches by 6 inches
   c. 6 inches by 8 inches
   d. 8 inches by 8 inches

Source: 2021 IBC

2304.11 Heavy-Timber Construction

6. Where used in floor framing, solid sawn wood beams of Type IV-HT construction shall be of what minimum nominal size?

   a. 4 inches by 8 inches
   b. 4 inches by 10 inches
   c. 6 inches by 10 inches
   d. 8 inches by 10 inches

TABLE 2304.11
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS

		MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	$6^{3}/_{4}$	$8^{1}/_{4}$	7	$7^{1}/_{2}$
	Wood beams and girders	6	10	5	$10^{1}/_{2}$	$5^{1}/_{4}$	$9^{1}/_{2}$
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	$8^{1}/_{4}$	$5^{1}/_{4}$	$7^{1}/_{2}$
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	$5^{1}/_{4}$	$5^{1}/_{2}$
	Framed timber trusses and other roof framing;[a] Framed or glued-laminated arches that spring from the top of walls or wall abutments	4[b]	6	3[b]	$6^{7}/_{8}$	$3^{1}/_{2}$[b]	$5^{1}/_{2}$

For SI: 1 inch = 25.4 mm.

a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.

b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width

Source: 2021 IBC

2304.11 Heavy-Timber Construction

6. Where used in floor framing, solid sawn wood beams of Type IV-HT construction shall be of what minimum nominal size?

a. 4 inches by 8 inches
b. 4 inches by 10 inches
c. 6 inches by 10 inches
d. 8 inches by 10 inches

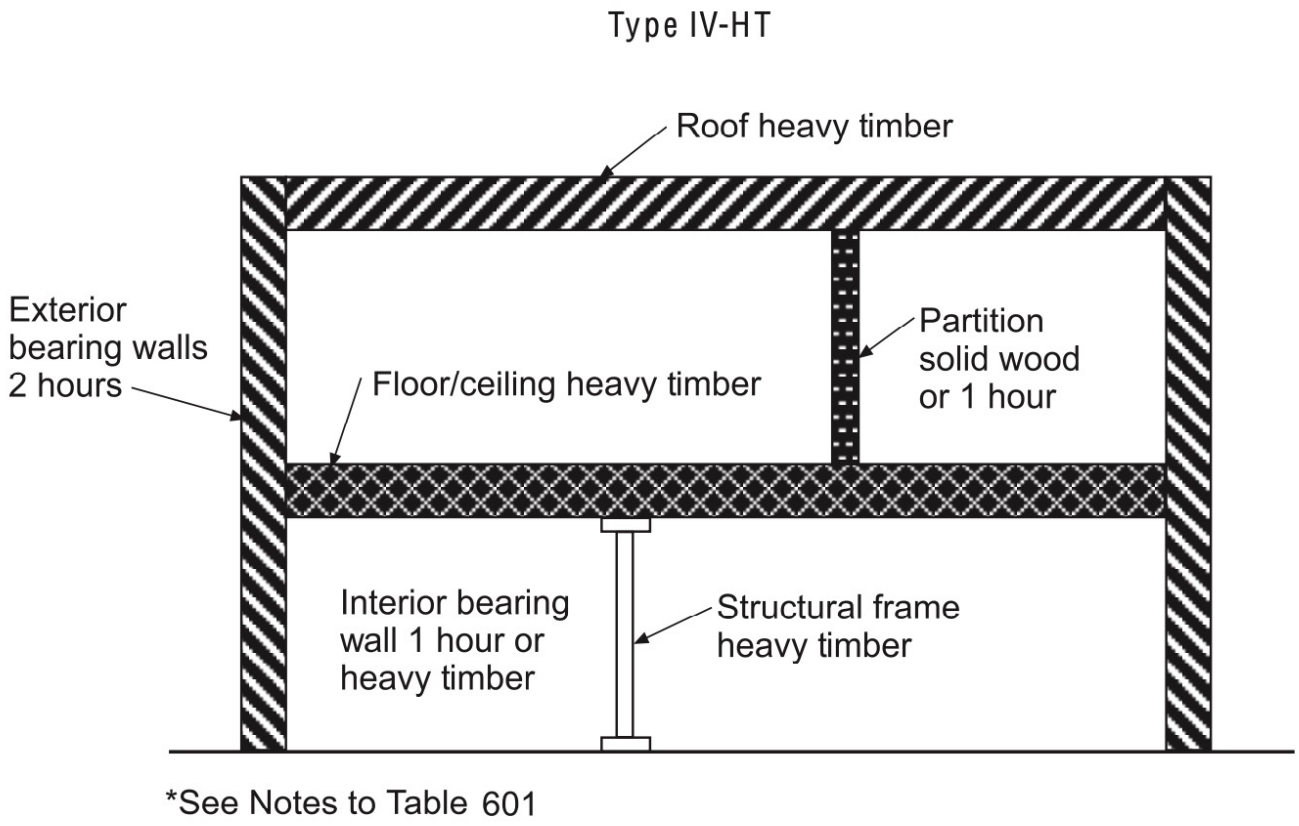
Source: 2021 IBC

2304.11 Heavy-Timber Construction

- Where a structure, portion thereof or individual structural elements are required by provisions of the IBC to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4.
- Solid-sawn wood members, glued-laminated timbers and structural composite lumber are manufactured with different methods and procedures: therefore, they do not have the same dimensions. However, they both have the same inherent fire-resistive capability that has been long recognized in the code.

Source: 2021 IBC

2304.11 Heavy-Timber Construction



Although it is generally viewed that heavy-timber construction and 1-hour fire-resistance-rated construction are equivalent, they are typically not interchangeable. Although heavy-timber roof construction is permitted in Type IB, II, III and VA buildings, 1-hour construction can only be substituted for heavy-timber construction in interior bearing walls of Type IV buildings.

Source: 2021 IBC

602.4.4.2 / 2304.11 Cross – Laminate Timer

- Cross-laminated timber (CLT) not less than 4 inches (102 mm) in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber and heavy timber elements are protected by (1) fire-retardant-treated wood not less than 15/32 inch (12 mm) thick, (2) gypsum board not less than 1/2 inch (12.7 mm) thick, or (3) a noncombustible material. Cross-laminated timber floors shall be not less than 4 inches (102 mm) in actual thickness. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness.
- Cross-laminated timber (CLT) is a prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element. First developed in Europe, CLT has been used extensively there for a large section of structural lumber. When of the specified size, it is considered as Type IV heavy-timber construction.

Source: 2021 IBC

602.4.4.2 / 2304.11 Cross – Laminate Timer

Cross-laminated timber floors regulated as Type IV heavy-timber construction must be continuous from support to support and mechanically fastened to one another. Unlike sawn or glued-laminated plank floors, CLT is permitted to be connected to walls without a shrinkage gap if swelling or shrinking is considered in the design.

: 2021 IBC

602.5 Cross – Type V Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.

   a. I
   b. III
   c. IV
   d. V

Source: 2021 IBC

602.5 Cross – Type V Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.

a. I
b. III
c. IV
d. V

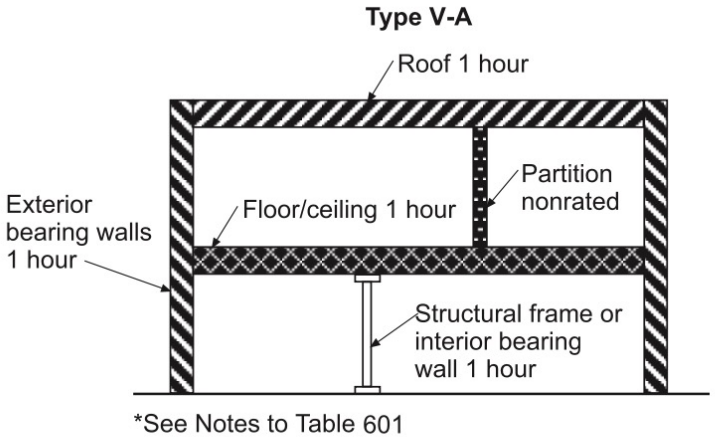
Source: 2021 IBC

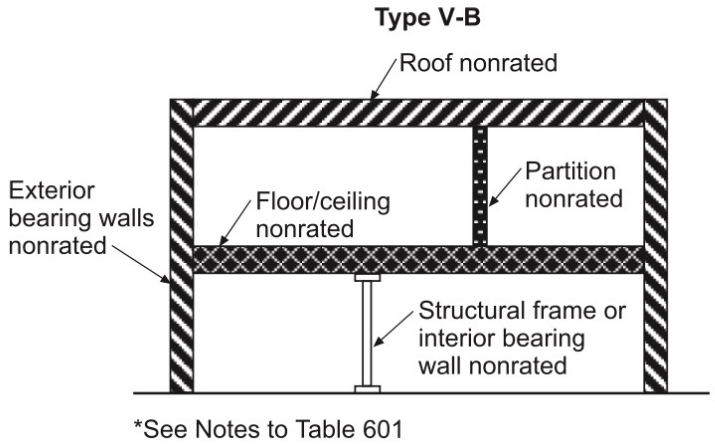
602.5 Cross – Type V Construction

- Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by the IBC.
- Type V buildings are essentially construction systems that will not fit into any of the other higher types of construction specified by the IBC. Although the construction normally considered Type V is the conventional light-frame wood building, any combination of approved materials can be considered Type V construction. Section 602.1.1 indicates that a building is not required to conform to the details of a type of construction higher than the type that meets the minimum requirements based on occupancy, even though certain features of such a building actually conform to a higher construction type.

Source: 2021 IBC

602.5 Cross – Type V Construction





In the design and review of a building for type of construction requirements, it is wise to determine first if the structure can be built as a Type VB building, based on occupancy, location on the lot, height and floor area. If so, any other building type is also permitted.

Source: 2021 IBC

602.1 Fire-Resistance Ratings

8. Which of the following materials is permitted in a building of Type VB construction?

   a. wood
   b. steel
   c. masonry
   d. all of the above

Source: 2021 IBC

602.1 Fire-Resistance Ratings

8. Which of the following materials is permitted in a building of Type VB construction?

a. wood
b. steel
c. masonry
d. all of the above

Source: 2021 IBC

602.1 Fire-Resistance Ratings

- The building elements shall have a fire-resistance rating not less than that specified in Table 601. The protection of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of the IBC.
- The building elements regulated by Table 601 for types of construction include primary structural frame members, such as columns, girders and trusses; bearing walls, both interior and exterior; floor construction, including supporting beams and joists; and roof construction, consisting of supporting beams, joists, rafters and other members. The required fire-resistance rating for each of these elements is based on the specific type of construction assigned to the building. The required fire-resistance rating can be as high as a 3-hour or as little as a 0-hour (no fire-resistance rating required).

Source: 2021 IBC

602.1 Fire-Resistance Ratings

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

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[f] (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[e, f]	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[g]	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior[d]	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

For SI: 1 foot = 304.8 mm.

a. Roof supports: Fire-resistance ratings 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-retardant-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.

Where a structure is separated by one or more fire walls, the code treats those individual compartments created by the fire walls as separate buildings for the purpose of classification by type of construction.

Source: 2021 IBC

T601, 202 Primary Structural Frames

- The primary structural frame shall include all of the following structural members: (1) the columns; (2) structural members having direct connections to the columns, including girders, beams, trusses and spandrels; (3) members of the floor construction and roof construction having direct connections to the columns; and (4) members that are essential to the vertical stability of the primary structural frame under gravity loading.
- To maintain stability of the building as a whole, the major structural elements are regulated for endurance when subjected to a fire. In addition to the columns, beams and girders, both interior bearing walls and exterior bearing walls are regulated to a level of fire resistance equal to or greater than that of other structural elements. Secondary members, such as floor joists, roof joists or rafters, are protected within the rated floor-ceiling or roof-ceiling assemblies.

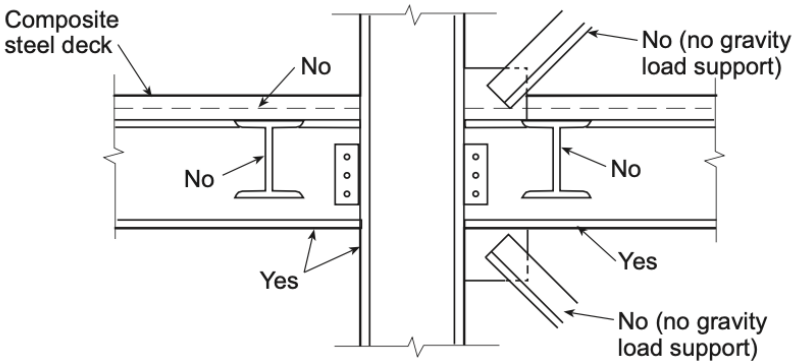
Source: 2021 IBC

T601, 202 Primary Structural Frames

- **Columns**
- **Girders**
- **Beams**
- **Trusses**
- **Spandrels**
- **Floor Construction**
- **Roof Construction**

Having direct connection to the columns

- **Members essential to vertical stability of primary structural frame under gravity loading**

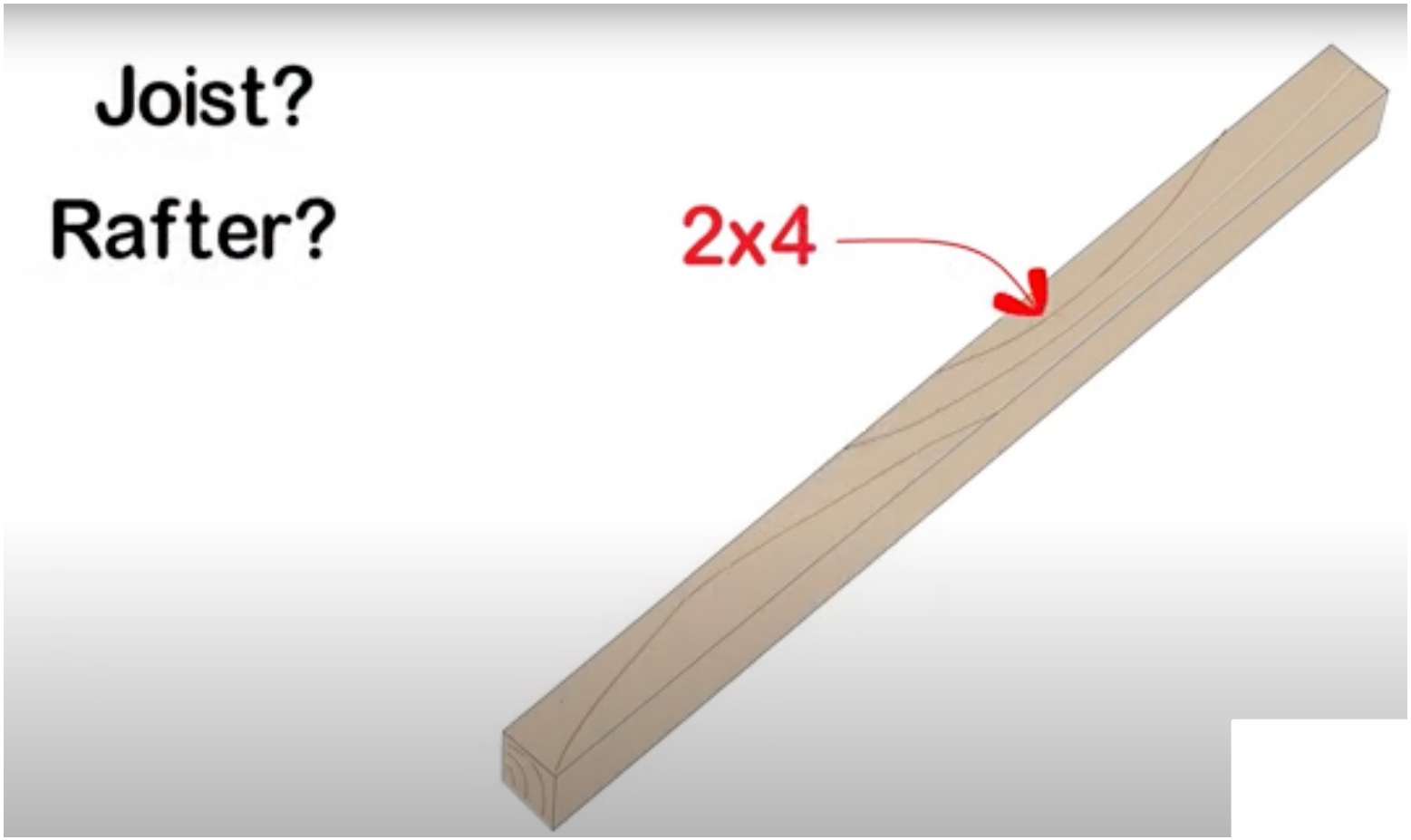


Components of primary structural frame

Lateral force bracing is not considered part of the structural frame where it serves no other purpose than to resist the lateral loads. For example, lateral load bracing within exterior nonbearing walls or interior partitions would be protected by the wall or partition construction. Such bracing elements would be considered secondary members.

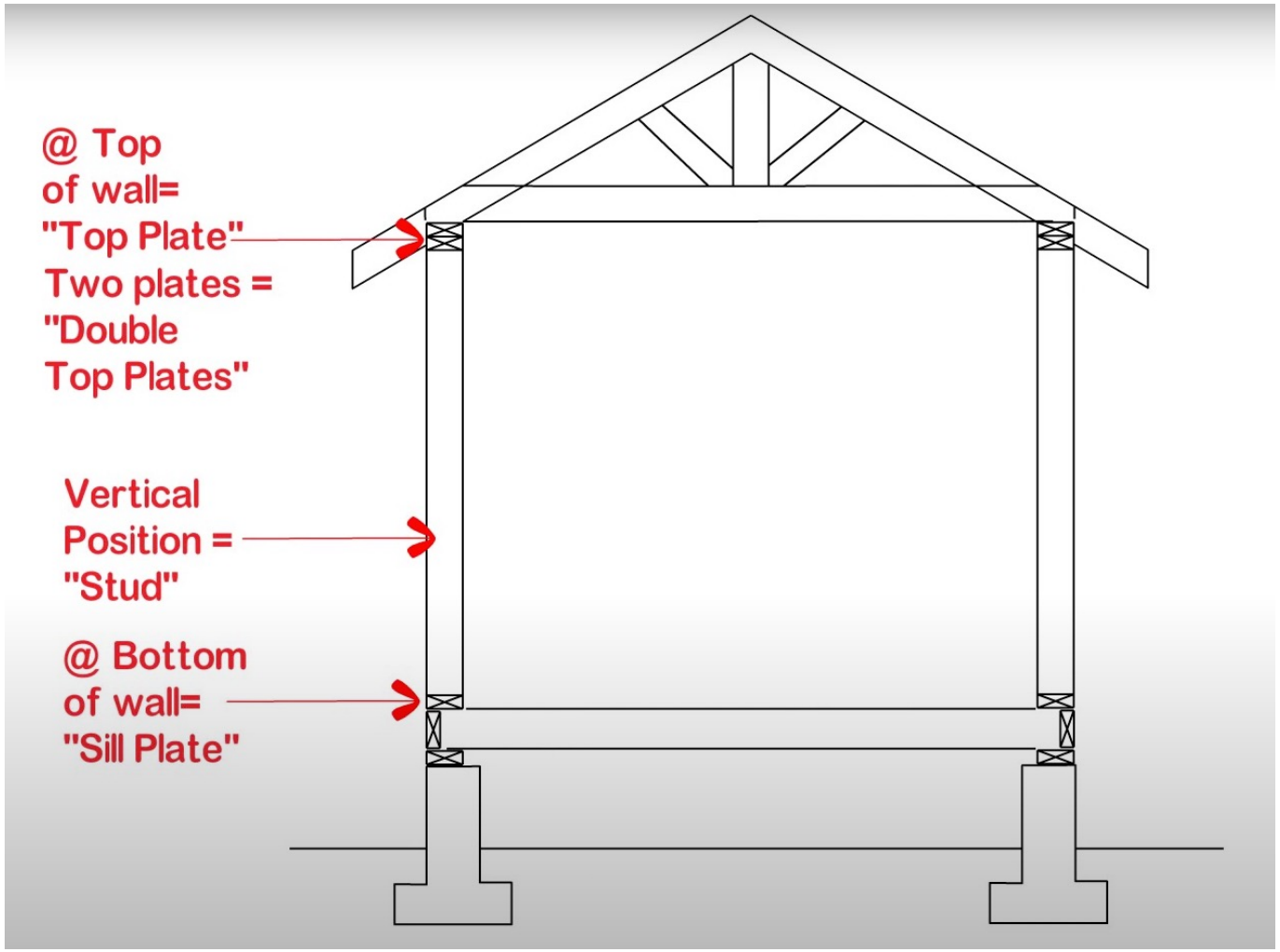
Source: 2021 IBC

T601, 202 Primary Structural Frames



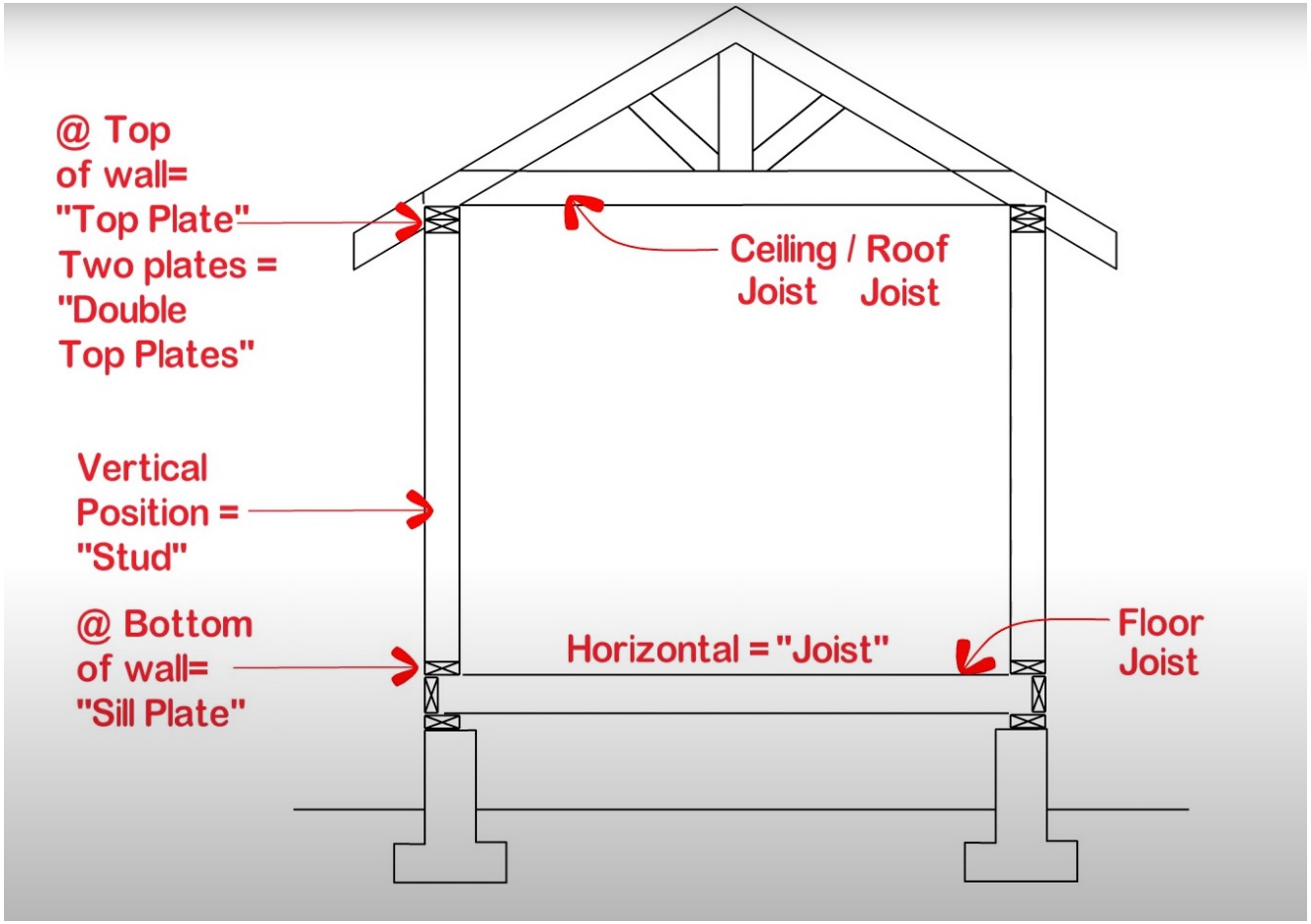
Source: 2021 IBC

T601, 202 Primary Structural Frames



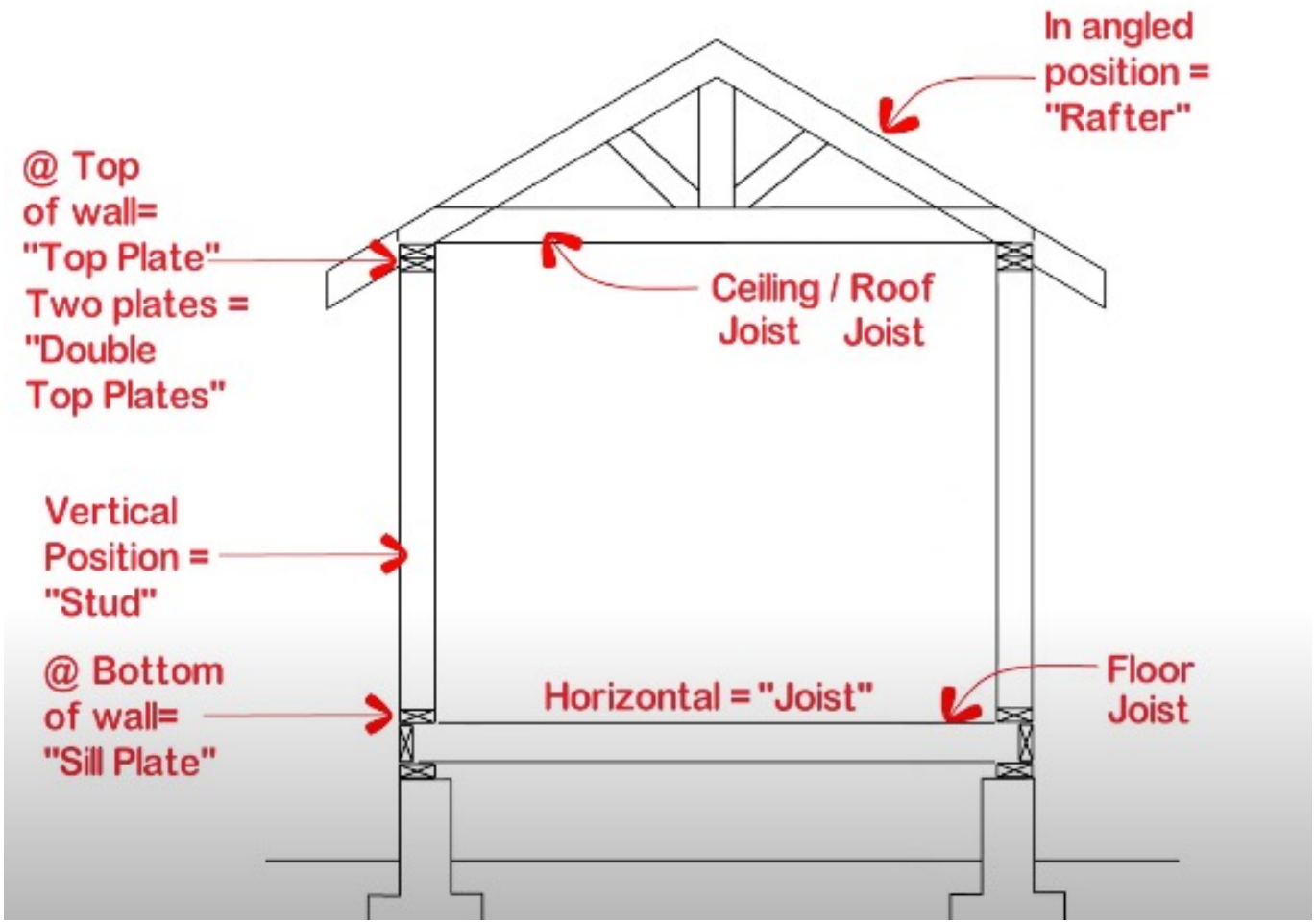
Source: 2021 IBC

T601, 202 Primary Structural Frames



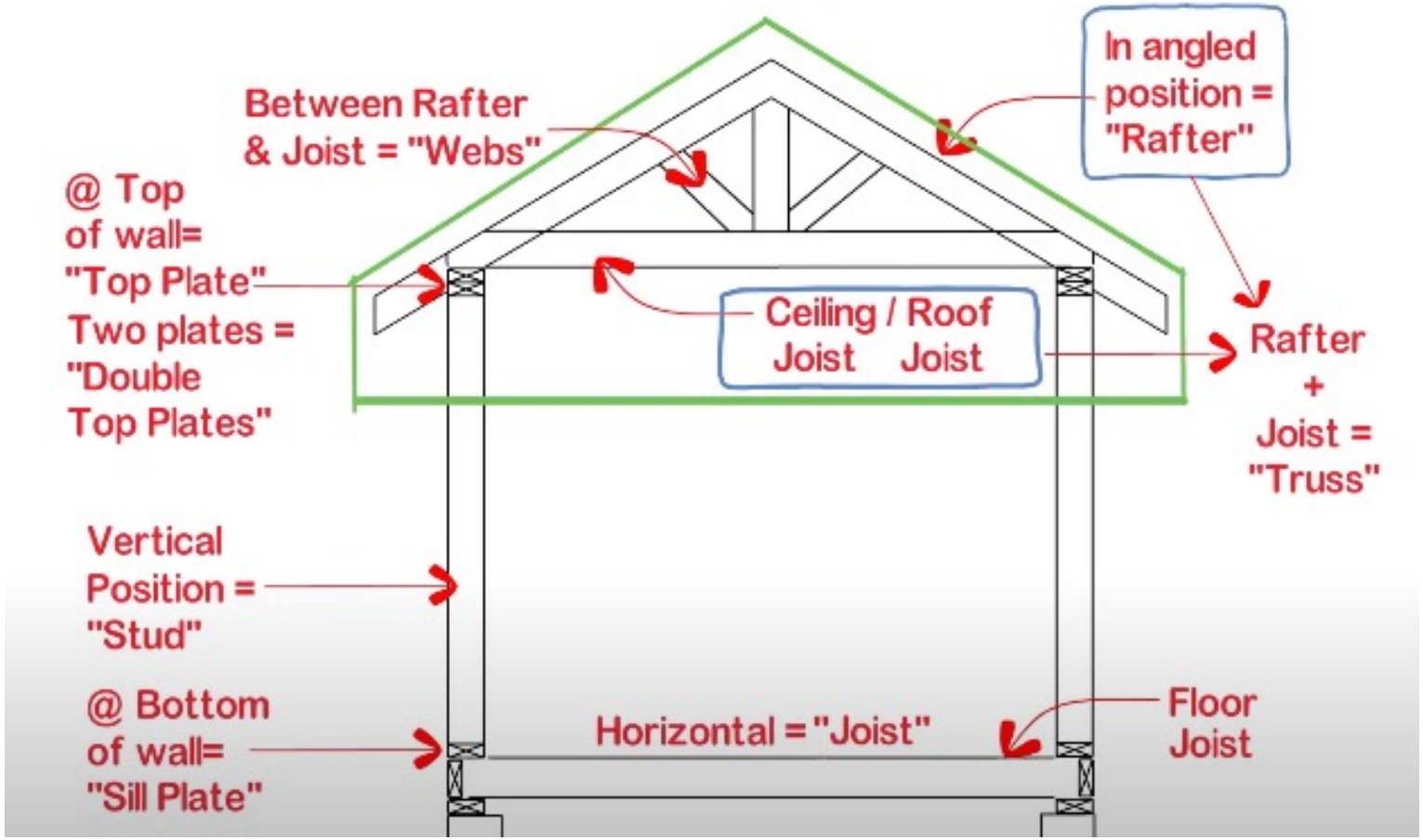
Source: 2021 IBC

T601, 202 Primary Structural Frames



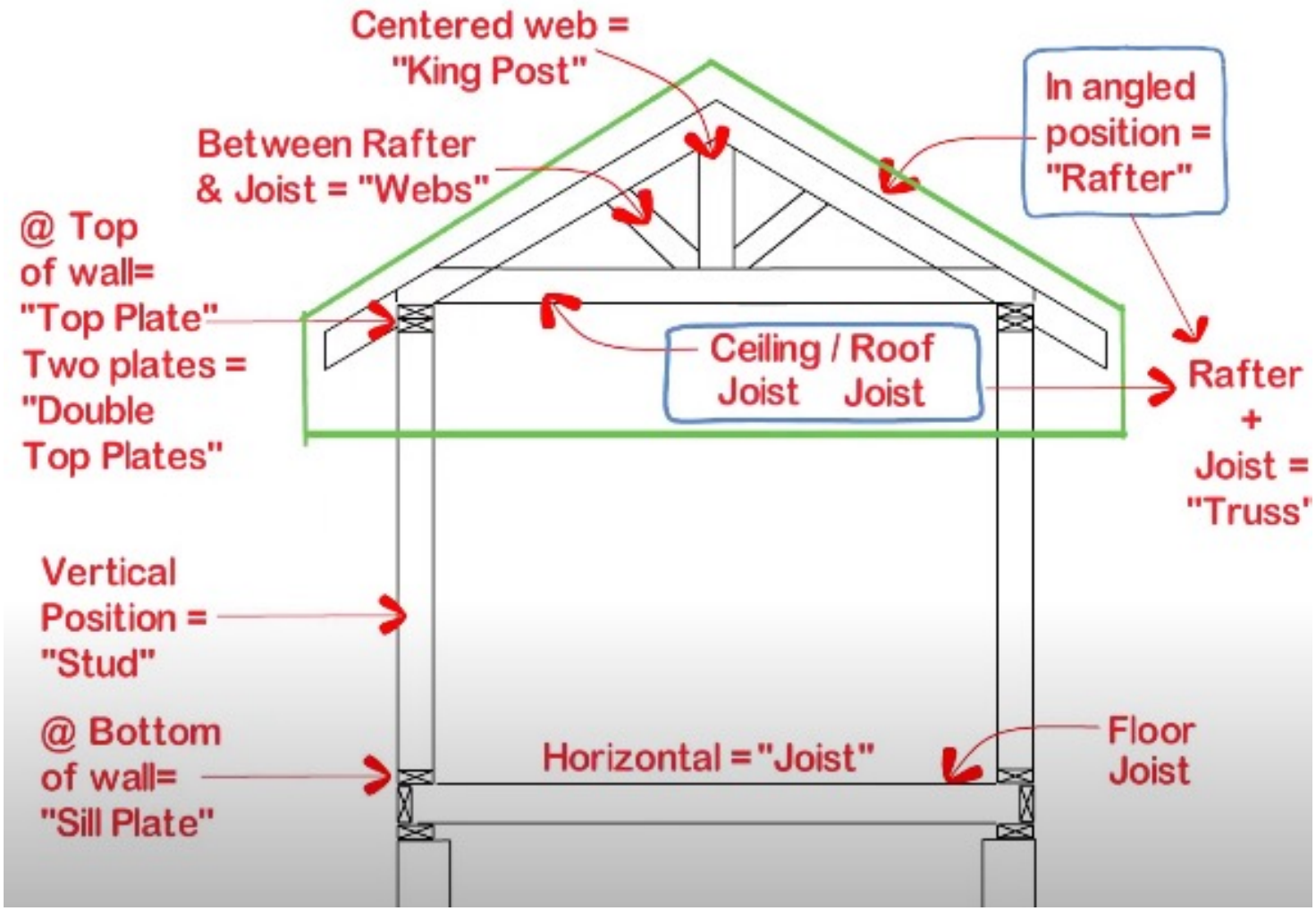
Source: 2021 IBC

T601, 202 Primary Structural Frames



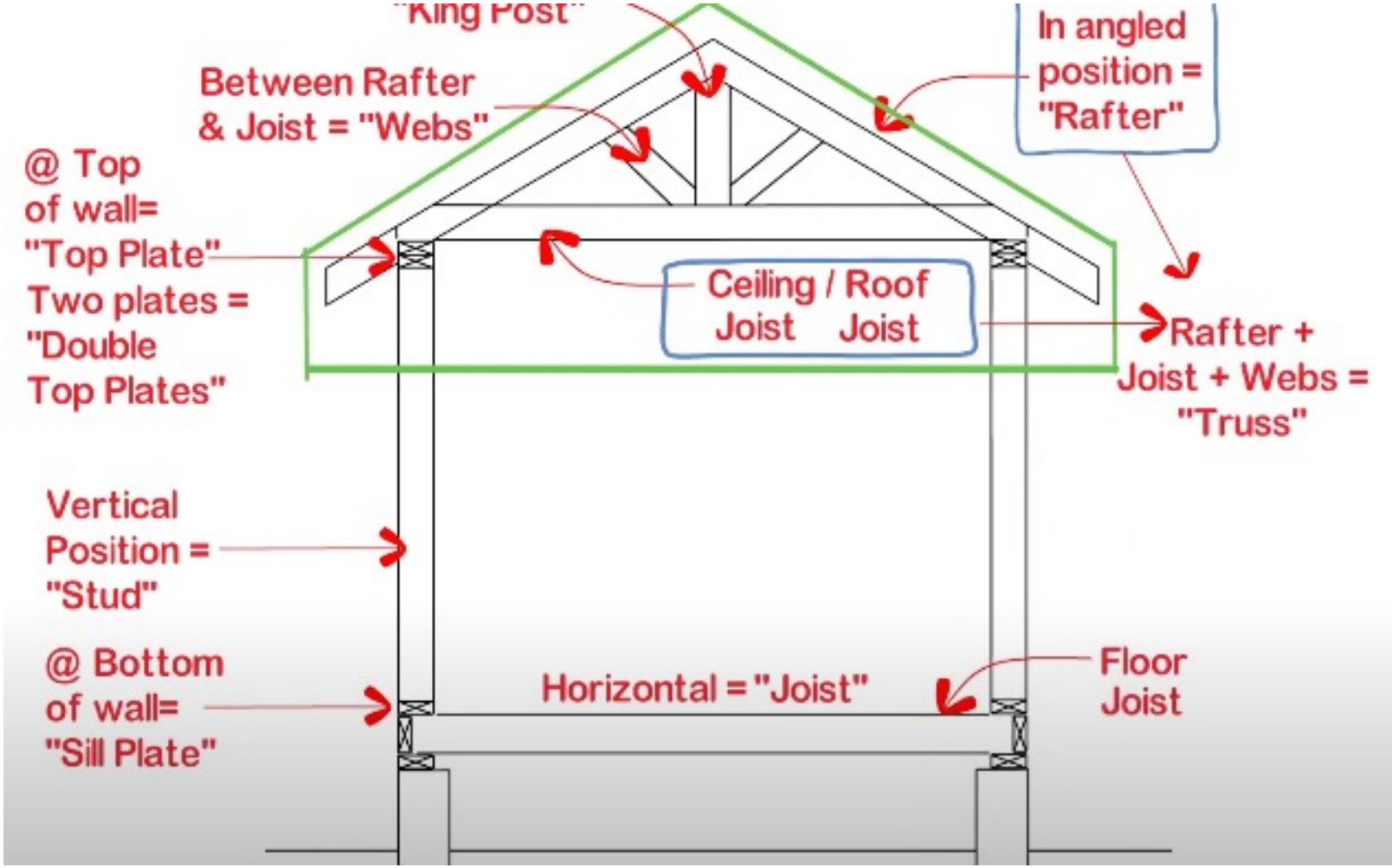
Source: 2021 IBC

T601, 202 Primary Structural Frames



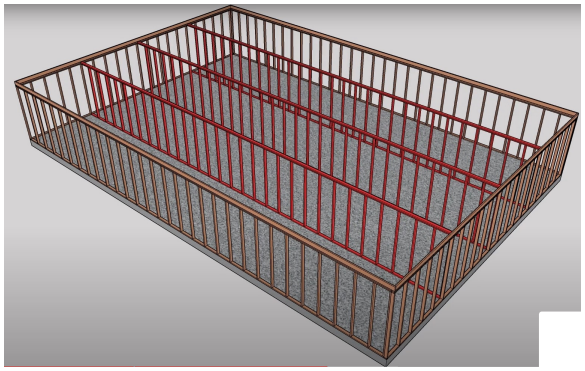
Source: 2021 IBC

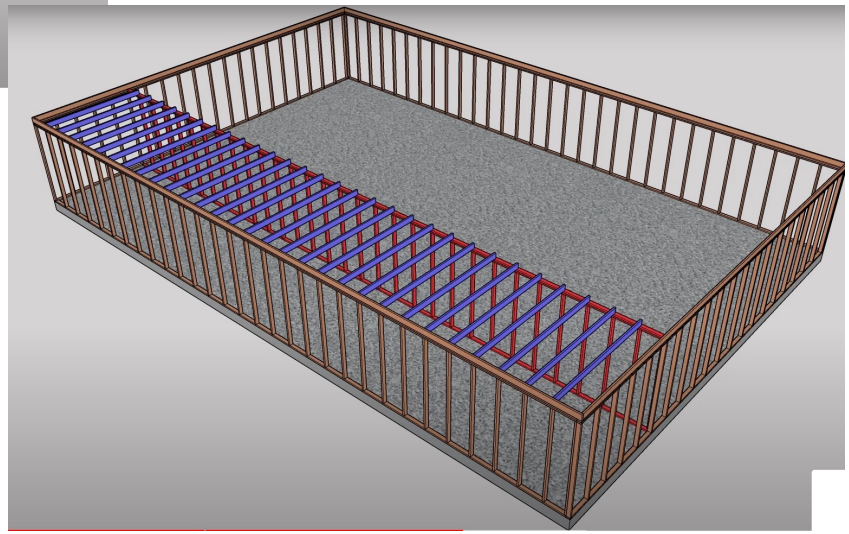
T601, 202 Primary Structural Frames



Source: 2021 IBC

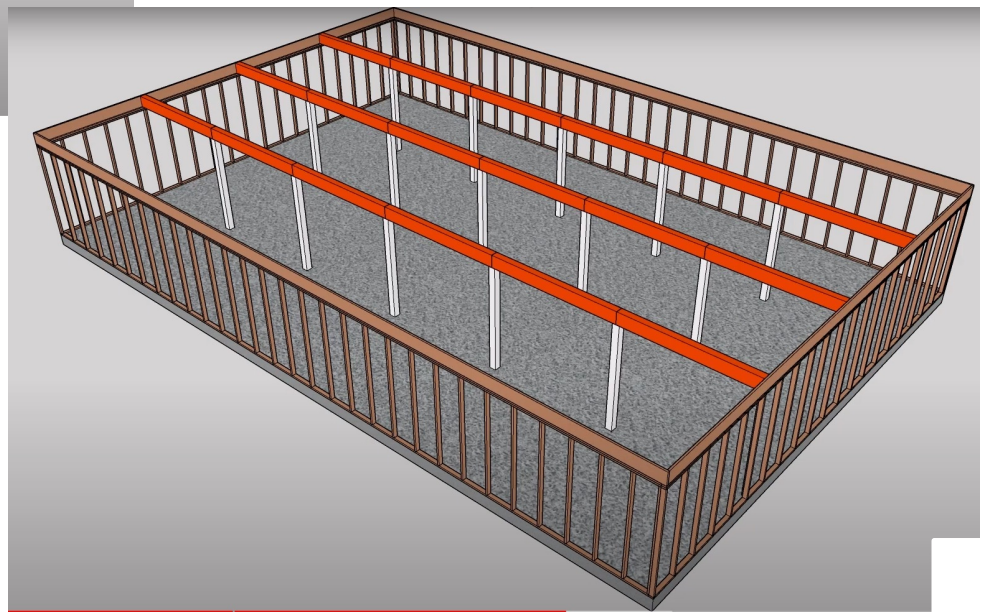
T601, 202 Primary Structural Frames (joist - wall)





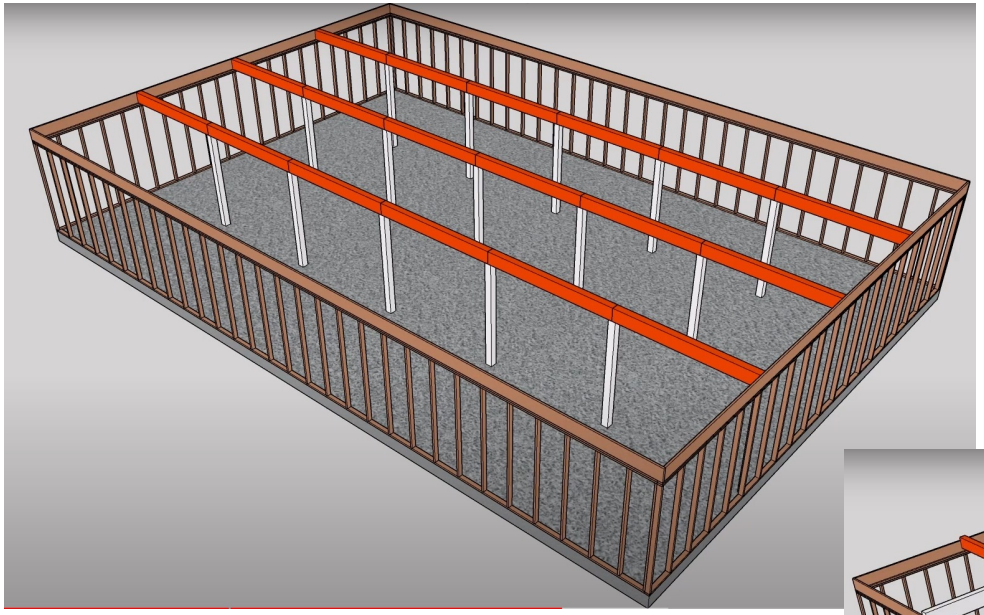
Source: 2021 IBC

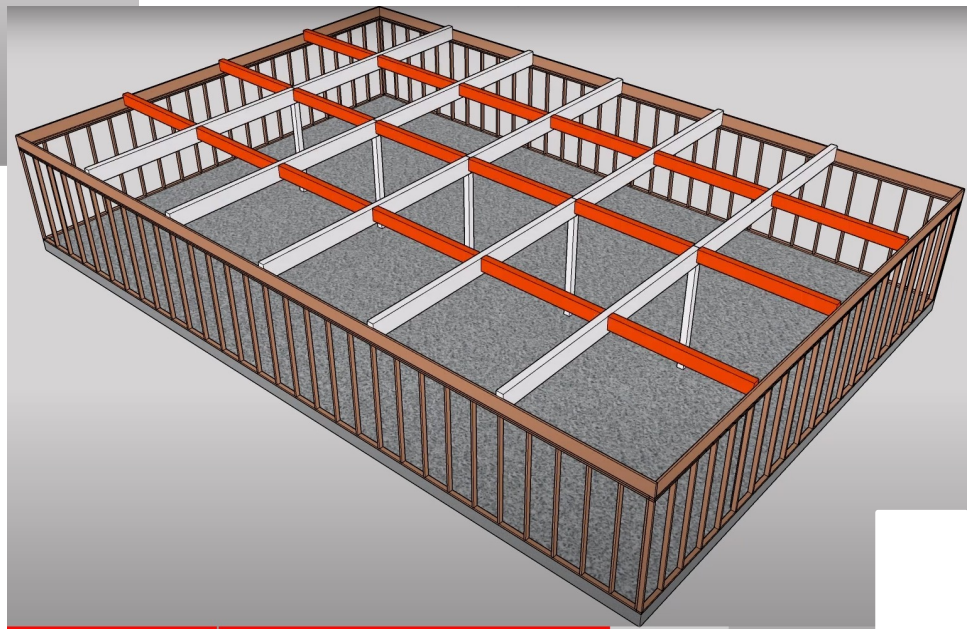
T601, 202 Primary Structural Frames (Walls = Beams –Column)



Source: 2021 IBC

T601, 202 Primary Structural Frames (Beams –Girders – Column)





T601, 202 Primary Structural Frames

10. Which one of the following members is not considered to be a part of the primary structural frame?

    a. columns supporting only a roof load

    b. girders supporting no more than a floor and a roof

    c. members essential to the vertical stability of the frame under gravity loads

    d. floor joists not having direct connections to the columns

Source: 2021 IBC

T601, 202 Primary Structural Frames

10. Which one of the following members is not considered to be a part of the primary structural frame?

    a. columns supporting only a roof load

    b. girders supporting no more than a floor and a roof

    c. members essential to the vertical stability of the frame under gravity loads

    d. floor joists not having direct connections to the columns

Source: 2021 IBC

601, Note b Roof Construction

- Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members 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-retardant-treated wood members shall be allowed to be used for such unprotected members.
- Where there is limited potential for a fire to be of a severe nature at the roof structure due to its height above the floor below, an elimination of the required fire-resistance rating of the roof construction is permitted in construction of Types I, IIA, IIIA and VA. Elimination of the required fire resistance is not allowed where combustible or hazardous materials are located adjacent to the roof.

Source: 2021 IBC

202 Primary Structural Frames

11. In a building of Type IIB construction, what is the minimum required fire-resistance rating of the roof construction?

    a. 0 hours (no rating required) b. 1 hour

    c. $1^{1}/_{2}$ hours d. 2 hours

Source: 2021 IBC

202 Primary Structural Frames

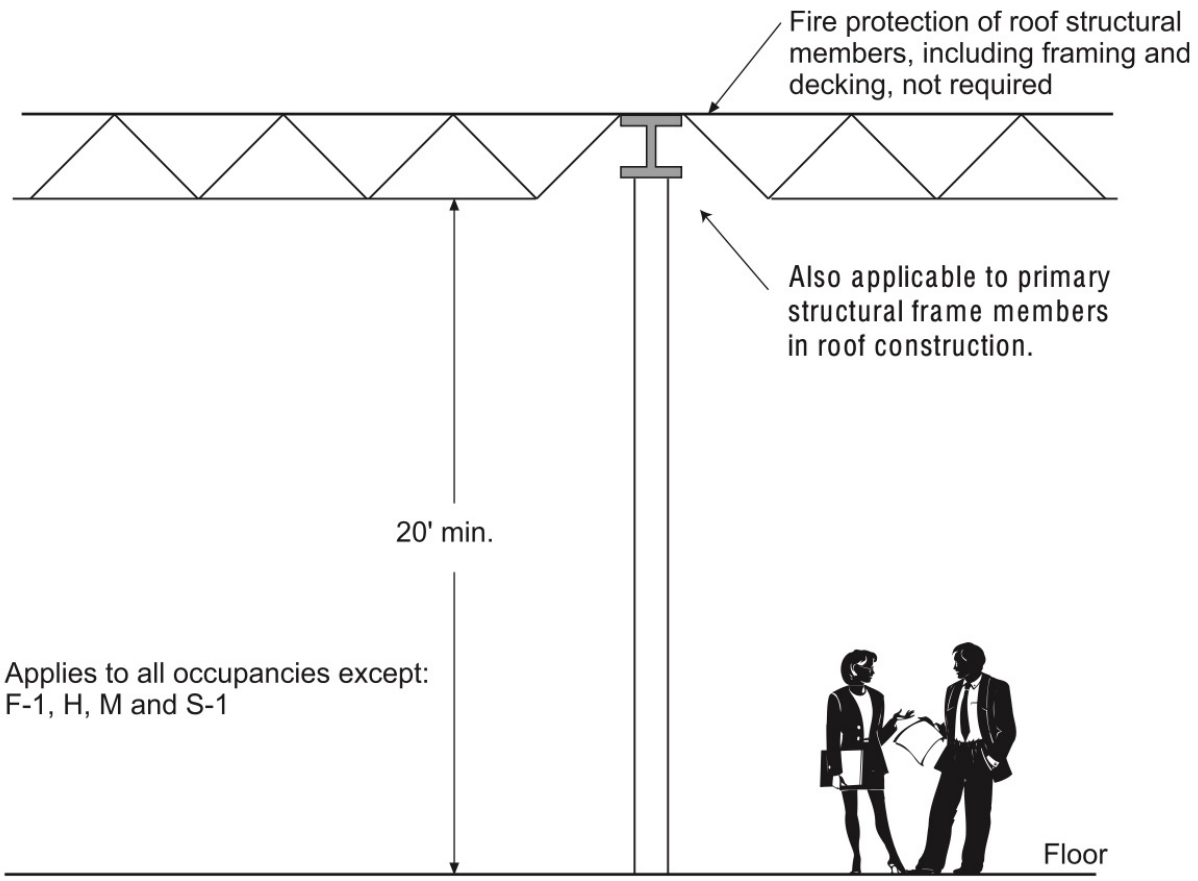
11. In a building of Type IIB construction, what is the minimum required fire-resistance rating of the roof construction?

a. 0 hours (no rating required) b. 1 hour

c. $1^1/_2$ hours d. 2 hours

Source: 2021 IBC

601, Note b Roof Construction



For SI: 1 foot = 304.8 mm.

Applicable to all construction types

It is important to note that the entire roof construction must be located at a height of at least 20 feet above the floor in order for the provision to apply. It is not intended that only those portions of a sloping roof less than 20 feet above the floor be protected.

Source: 2021 IBC

603.1 Allowable Uses

- Combustible materials shall be permitted in buildings of Type I and II construction in the following applications: (27 applications listed).
- Materials used in the construction of buildings classified as either Type I or Type II are intended to be noncombustible, thereby not increasing the potential fire loading (fuel contribution). There are, however, a number of applications where the presence of combustible building materials is desirable in otherwise noncombustible structures. Such materials are typically permitted where they are adequately protected, limited in use or amount, or installed in accordance with the International Fire Code, International Mechanical Code®, or other provisions of the International Building Code.

Source: 2021 IBC

603.1 Allowable Uses

Combustible materials permitted in buildings of Type I and Type II construction in the following applications:

- Fire-retardant-treated wood in
  - Roof construction of most buildings.
  - Nonbearing partitions with fire-resistance rating ≤ 2 hours.
  - Nonbearing exterior walls requiring no fire rating.
- Thermal and acoustical insulation with limited flame spread.
- Foam plastics per Chapter 26.
- A, B or C roof coverings.
- Interior floor finish, trim, millwork such as, doors, frames, etc.
- Stages and platforms per Section 410.
- Blocking for handrails, fixtures, windows and door frames, etc.
- Light-transmitting plastics per Chapter 26.
- Nailing or furring strips per Section 803.15.
- Heavy timber for specific components.
- Additional applications as specified.

In Type I and II construction, the use of fire-retardant-treated wood is permitted in roof construction of all Type IB and II buildings and those buildings of Type IA construction that do not exceed two stories or have a top-story height of at least 20 feet.

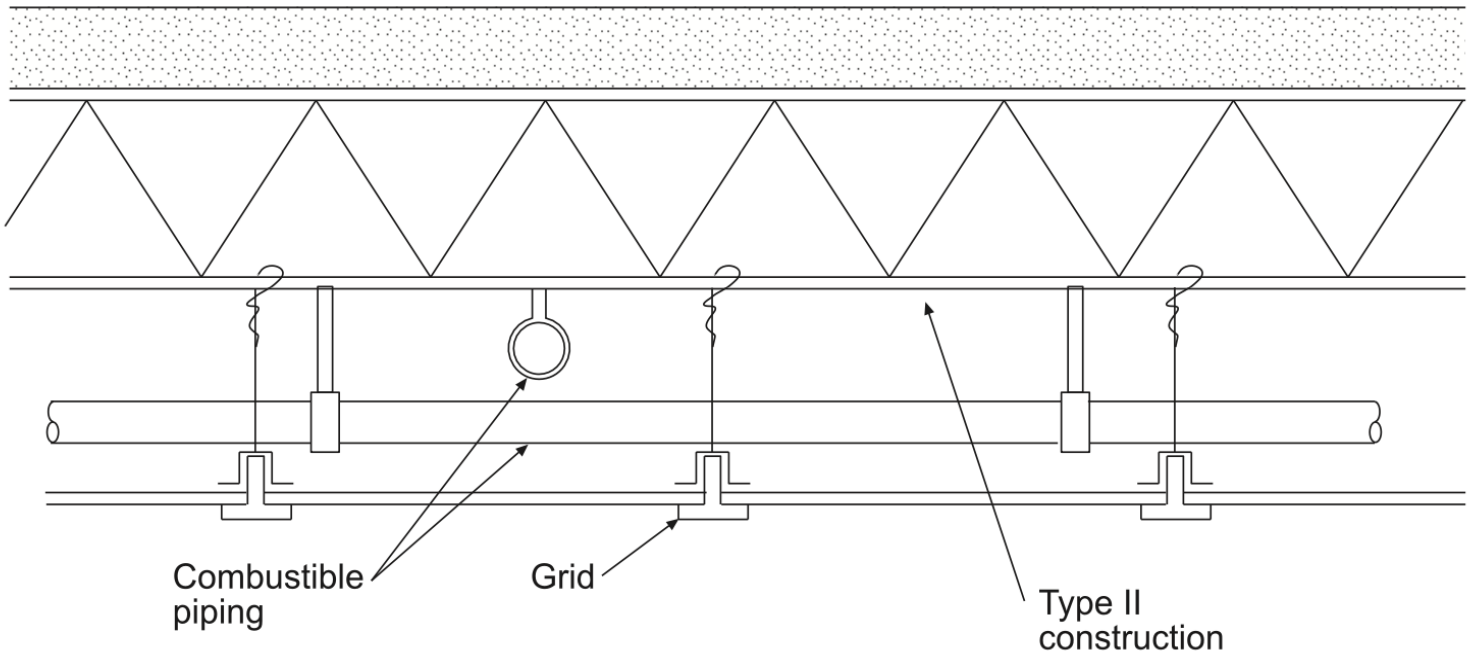
Source: 2021 IBC

603.1.1/3 Ducts, Piping and Electrical

- Combustible materials shall be permitted in buildings of Type I or II construction in accordance with Sections 603.1.1 through 603.1.3. The use of nonmetallic ducts shall be permitted when installed in accordance with the limitations of the International Mechanical Code. The use of combustible piping materials shall be permitted when installed in accordance with the limitations of the International Mechanical Code and the International Plumbing Code. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted when installed in accordance with the limitations of the IBC.
- The IMC contains requirements for nonmetallic ducts that address the issues of flammability, flame spread and smoke development. The IPC regulates the use of combustible piping materials, such as plastic, and also addresses those same characteristics applicable to nonmetallic ducts. Similar regulations apply to combustible wiring materials. These provisions in Chapter 6 clarify that such combustible materials are acceptable for installation in buildings of Type I and II construction, provided they meet the limitations set forth in the appropriate code.

Source: 2021 IBC

603.1.1/3 Ducts, Piping and Electrical



Additional allowances for combustible mechanical and plumbing materials in Type I and II buildings are established by Exception 24 of Section 603. Specified combustible materials are permitted in concealed spaces under the provisions of Section 718.5.

Source: 2021 IBC

Class 4:
Chapter 5, General Building Heights and Areas

Source: 2021 IBC

602.1 General Building Heights and Areas

- To gain an understanding of how a building is classified and regulated based on its floor area, height and number of stories.

Source: 2021 IBC

502.1 Address Identification

- *New and existing buildings shall be provided with approved address identification. Each character shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of 1/2 inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure. Address identification shall be maintained.*
- Buildings must be provided with plainly visible and legible address numbers posted on the building or in such a place on the property that the building may be identified by emergency services such as fire, medical and police.

Source: 2021 IBC

502.1 Address Identification

As a fundamental requirement, the approved street numbers are to be placed in a location readily visible from the street fronting the property. The fire code official has the authority to require that the address numbers be posted in more than one location to help eliminate any confusion or delay in identifying the location of the emergency.

Source: 2021 IBC

502.1 Address Identification

1. Premises must be identified by numbers or addresses visible from the street, with a minimum character height of at least _____ inches.

   a. three
   b. four
   c. six
   d. eight

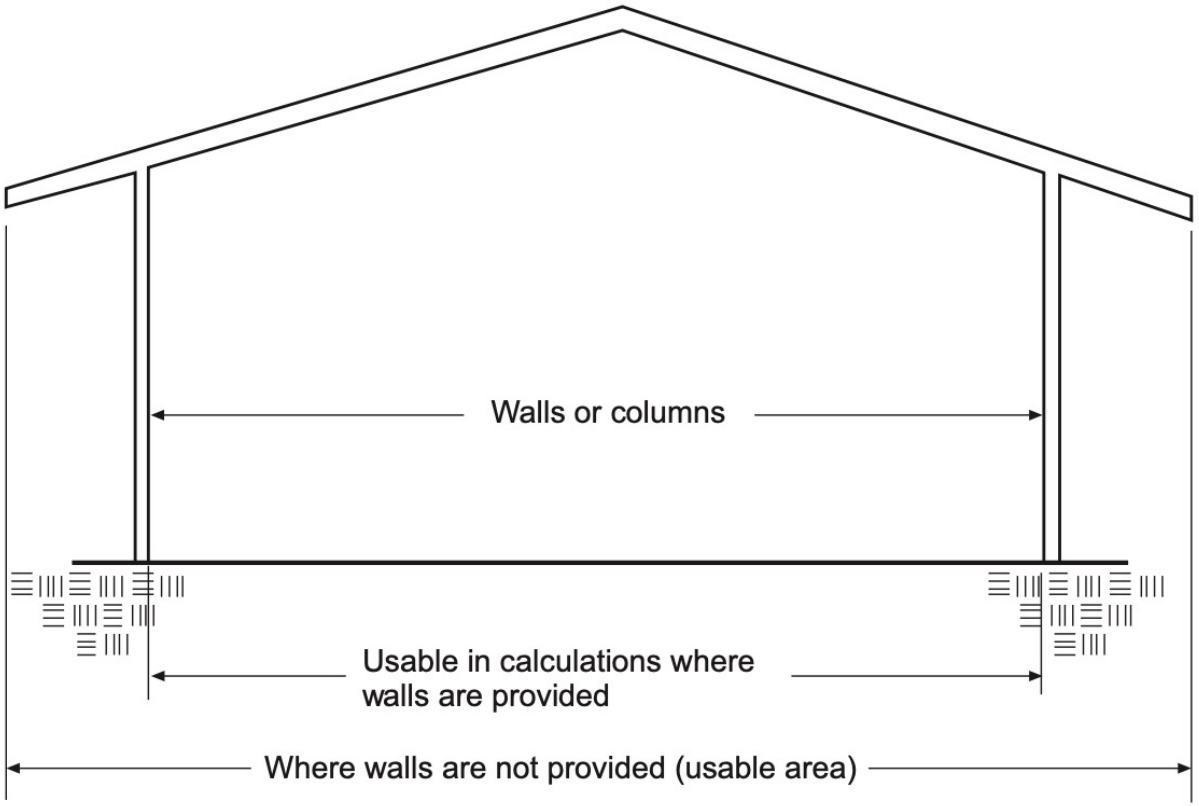
Source: 2021 IBC

503.1, 202 Building Area

- *Building area is the area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.*
- The building area must be determined in order to verify that it does not exceed the maximum allowable area as determined by Section 503.1. The building area is considered, in very general terms, the “footprint” of the building, excluding those unroofed areas and any projections that may extend beyond the exterior walls. Where complying mezzanines are located within a building, they are not assumed to contribute to the building area.

Source: 2021 IBC

503.1, 202 Building Area



Do not include vent shafts or courts

Definition of Building Area

Basements are usually considered to be unoccupied spaces and, as such, do not pose a high degree of hazard. Therefore, under all conditions, a single basement does not contribute to a building's allowable height or area. However, it cannot exceed the size permitted for a one-story above grade plane building.

Source: 2021 IBC

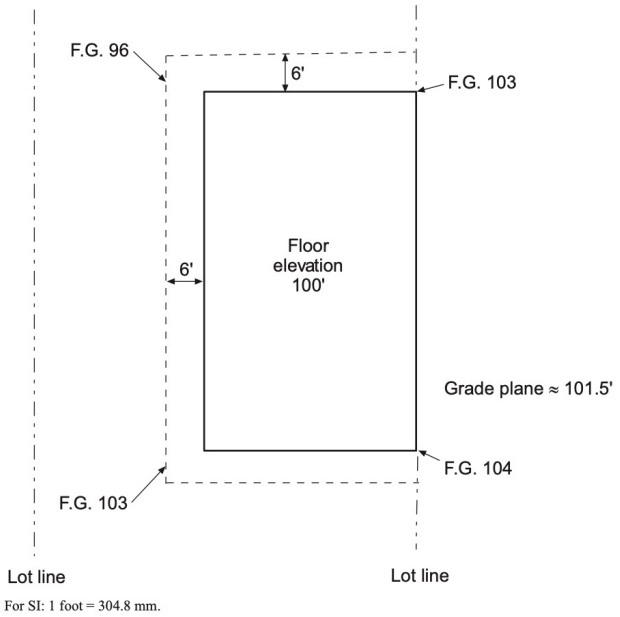
503.1, 202 Story Above Grade/Basement

- *A "story above grade plane" is any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is (1) more than 6 feet (1829 mm) above grade plane, or (2) more than 12 feet (3658 mm) above the finished ground level at any point. A "basement" is a story that is not a story above grade plane.*
- A number of provisions in the IBC are applicable based on the location of the floor under consideration, relative to the exterior ground level. Therefore, it is necessary to define specifically the circumstances under which a floor level is considered a story above grade plane.

Source: 2021 IBC

503.1, 202 Story Above Grade/Basement

- *A “story above grade plane” is any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is (1) more than 6 feet (1829 mm) above grade plane, or (2) more than 12 feet (3658 mm) above the finished ground level at any point. A “basement” is a story that is not a story above grade plane.*



The “grade plane” is defined as a reference plane representing the average of finished ground level adjoining the building at exterior walls. It is measured at the lowest point between the building and the lot line, though never more than 6 feet from the building.

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

5. Basements do not need to be included in the total allowable area of a single-occupancy building, provided the total area of such basements do not exceed _____.

    a. one-third the floor area permitted for any single story

    b. the area permitted for a one-story above grade plane building

    c. twice the area permitted for a single story

    d. the tabular area based on construction type and occupancy group

Source: 2021 IBC

503.1, 202 Story Above Grade/Basement

2. Building height is measured to the _____.
    a. average height of the highest roof surface
    b. highest point of the highest roof surface
    c. average height of all of the roof surfaces
    d. highest point of the lowest roof surface

Source: 2021 IBC

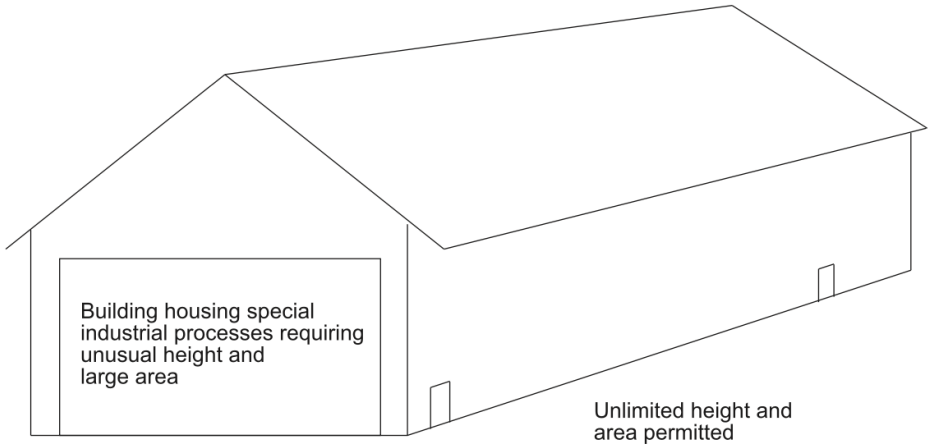
503.1.1 Special Industrial Occupancies

- *Buildings and structures designed to house special industrial processes that require large areas and unusual building heights to accommodate craneways or special machinery and equipment, including among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the building height, number of stories and building area limitations specified in Sections 504 and 506.*
- A limited number of buildings that house special industrial processes need extensive heights and/or areas for their operations. The activities that occur are generally of moderate to low hazard, and the buildings are not typically accessible to the public. Therefore, it has been deemed appropriate that no type of construction limitations should be placed on these unique structures.

Source: 2021 IBC

503.1.1 Special Industrial Occupancies

- *Buildings and structures designed to house special industrial processes that require large areas and unusual building heights to accommodate craneways or special machinery and equipment, including among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the building height, number of stories and building area limitations specified in Sections 504 and 506.*



The special processes addressed by this provision are limited to those having a low or moderate degree of hazard, commonly designated as Group F-1 or S-1 occupancies. Where the processes under consideration would necessitate a Group H classification because of the high hazards involved, the application of this provision is inappropriate.

Source: 2021 IBC

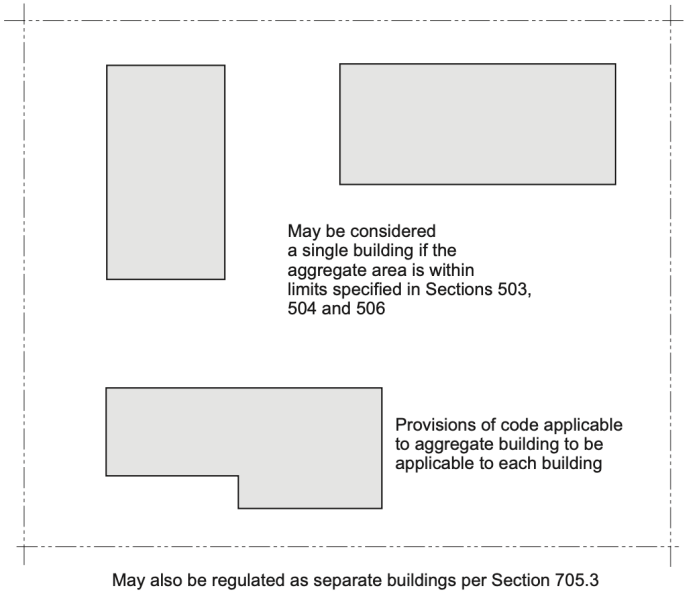
503.1.2 Buildings on the Same Lot

- *Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building where the building height, number of stories of each building and the aggregate building area of the buildings are within the limitations specified in Sections 504 and 506. The provisions of the IBC applicable to the aggregate building shall be applicable to each building.*
- In general, the provisions of Section 705.3 require an assumed imaginary line to be located between two buildings on the same site to regulate exterior wall and opening protection, as well as projection and roof-covering requirements. This method would provide protection equivalent to that of buildings on adjoining lots.

Source: 2021 IBC

503.1.2 Buildings on the Same Lot

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



If the multiple buildings can be constructed as a single facility under one roof and can meet the height and area requirements based on occupancy and type of construction, then an imaginary line need not be assumed. The buildings will simply be regulated as a single structure.

Source: 2021 IBC

504.3, Table 504.3 Allowable Height Determination

- *The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3. See the exception for towers, spires, steeples and other roof structures.*
- The allowable height of a building in feet is based on three fundamental aspects of building classification and fire protection: occupancy classification, type of construction classification and the presence of an automatic sprinkler system. The limitation on building height recognizes the concern of property damage, along with the concerns of dealing with egress and fire department access. Table 504.3 typically reflects an increased allowable height for sprinklered buildings of 20 feet over the height permitted for nonsprinklered buildings. Also reflected in the table is the allowance for unlimited height in most buildings of Type IA construction.

Source: 2021 IBC

504.3, Table 504.3 Allowable Height Determination

- *The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3. See the exception for towers, spires, steeples and other roof structures*

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

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, B, E, F, M, S, U	NS[b]	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[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, 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[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									
I-4	NS[d, 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[d]	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	60	60
	S	UL	180	85	75	85	75	270	180	85	85	70	60

For SI: 1 foot = 304.8 mm.
UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.
a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
d. The NS value is only for use in evaluation of existing building height in accordance with the *International Existing Building Code*.
e. New Group I-1 and I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6. For new Group I-1 occupancies Condition 1, see Exception 1 of Section 903.2.6.
f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6 and Section 1103.5 of the *International Fire Code*.
g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.

Where an NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low Rise Residential Occupancies*, sprinkler system is installed in a residential building, the table reflects a maximum building height of 60 feet, regardless of the building's type of construction.

Source: 2021 IBC

504.3, Table 504.3 Allowable Height Determination

8. What is the maximum allowable height in feet above grade plane for a fully sprinklered single-occupancy Type IIA building housing a Group A-2 occupancy?

   a. 55 feet
   b. 65 feet
   c. 75 feet
   d. 85 feet

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	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[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

- The maximum number of stories of a building shall not exceed the limits specified in Table 504.4.
- The maximum number of stories permitted in a building is generally represented in Table 504.4. However, the table only regulates the number of stories that are considered above grade plane. Basements are selectively permitted under various provisions throughout the code and regulated accordingly. The conditions that affect the allowable number of stories are consistent with those for the allowable height in feet: occupancy classification, type of construction classification and sprinkler protection. Table 504.4 typically reflects an increased allowable number of stories for sprinklered buildings of one story above the number permitted for nonsprinklered buildings. Also reflected in the table is the allowance for an unlimited number of stories in most buildings of Type IA construction.

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

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

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	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
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2
F-1	NS	UL	11	4	2	3	2	3	3	3	4	2	1
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	12	8	6	6	4	3
H-1	NS[c, d]	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS[c, d]	UL	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS[c, d]	UL	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS[c, d]	UL	7	5	3	5	3	5	5	5	5	3	2
	S	UL	8	6	4	6	4	8	7	6	6	4	3
H-5	NS[c, d]	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-1 Condition 1	NS[d, e]	UL	9	4	3	4	3	4	4	4	4	3	2
	S	UL	10	5	4	5	4	10	7	5	5	4	3
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				10	6	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				7	5	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	7	5	3	3	3	2
I-4	NS[d, g]	UL	5	3	2	3	2	3	3	3	3	1	1
	S	UL	6	4	3	4	3	9	6	4	4	2	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	12	8	6	5	4	2

(continued)

Where an NFPA 13R, *Standard for the Installation of Sprinkler Systems in Low Rise Residential Occupancies*, sprinkler system is installed in a residential building, the table reflects an allowable number of stories above grade plane of four or less for buildings of any occupancy classification and construction type.

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

9. What is the maximum allowable number of stories above grade plane for a fully-sprinklered single-occupancy IIIB building housing a Group I-2 occupancy?

   a. 0, it is not permitted b. 1

   c. 2 d. 3

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	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
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				10	6	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				7	5	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	7	5	3	3	3	2

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

3. The tabular allowable building height for a fully-sprinklered single-occupancy Type IB building housing a Group I-2 occupancy is _____ stories and _____ feet.

   a. 4, 160
   b. 3, 85
   c. 5, 180
   d. unlimited, unlimited

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE[a, b]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	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
I-1 Condition 2	NS[d, e]	UL	9	4	3	4	3	3	3	3	4	3	2
	S	UL	10	5				10	6	4			
I-2	NS[d, f]	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S	UL	5	3				7	5	1			
I-3	NS[d, e]	UL	4	2	1	2	1	2	2	2	2	2	1
	S	UL	5	3	2	3	2	7	5	3	3	3	2

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

3. The tabular allowable building height for a fully-sprinklered single-occupancy Type IB building housing a Group I-2 occupancy is _____ stories and _____ feet.

   a. 4, 160
   b. 3, 85
   c. 5, 180
   d. unlimited, unlimited

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	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[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, 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[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									

Source: 2021 IBC

504.4, Table 504.4 Allowable Height in Stories

4. What is the tabular allowable height, in feet, for a single-occupancy nonsprinklered Group B building of Type IIA construction?

   a. 50 b. 55

   c. 65 d. 85

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE[a]

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A, B, E, F, M, S, U	NS[b]	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[c, d]	UL	160	65	55	65	55	120	90	65	65	50	40
	S												
H-4	NS[c, d]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	140	100	85	85	70	60
I-1 Condition 1, I-3	NS[d, 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[d, e, f]	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85									

Source: 2021 IBC

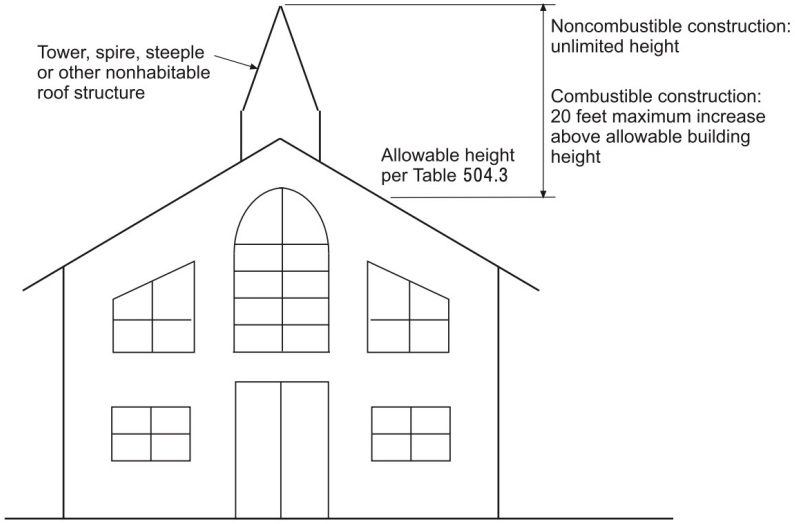
504.3, Exception Roof Structures

- Towers, spires, steeples and other roof structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1511.2.4. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height if of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable building height if of combustible materials (see Chapter 15 for additional requirements).
- The types of structures addressed by this provision are intended to be unoccupied with no significant fire loading. It would seem logical that the height of such structures could be increased over that required for typical buildings. The only limitation occurs where the structure is of combustible materials, which would create a higher hazard.

Source: 2021 IBC

504.3, Exception Roof Structures

- Towers, spires, steeples and other roof structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1511.2.4. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height if of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable building height if of combustible materials (see Chapter 15 for additional requirements).



For SI: 1 foot = 304.8 mm.

The provisions of Section 1511 regulate the type of construction for towers, spires and similar rooftop structures based on the height above the roof surface, the height above grade and the largest cross-sectional dimension. Penthouses and equipment screening are also addressed.

Source: 2021 IBC

504.3, Exception Roof Structures

10. Combustible steeples are limited to a maximum height of _____ feet above the allowable building height.

    a. 15
    b. 20
    c. 30
    d. 40

Source: 2021 IBC

505.2.1, 202 Mezzanines Definition

- A mezzanine is an intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505. The aggregate area of a mezzanine or mezzanines within a room shall not exceed one-third of the floor area of that room or space in which they are located. See the exceptions that allow for increased mezzanine sizes in (1) special industrial occupancies of Type I or II construction, (2) fully sprinklered Type I or II buildings provided with an approved emergency voice/alarm communication system, and (3) dwelling units.
- Because of size limitation and openness (a mezzanine is open to the room in which it is located, with exceptions), an intermediate floor level within a room adds minimal hazard to the building and its occupants. The occupants of the mezzanine by means of sight, smell or hearing will be able to determine if there is some emergency or fire taking place either on the mezzanine or in the room in which the mezzanine is located.

Source: 2021 IBC

505.2.1, 202 Mezzanines Definition

Source: 2021 IBC

505.2.1, 202 Mezzanines Definition

6. A story is considered a story above grade plane where the finished surface of the floor above is more than _____ feet above grade plane.

   a. 3
   b. 4
   c. 5
   d. 6

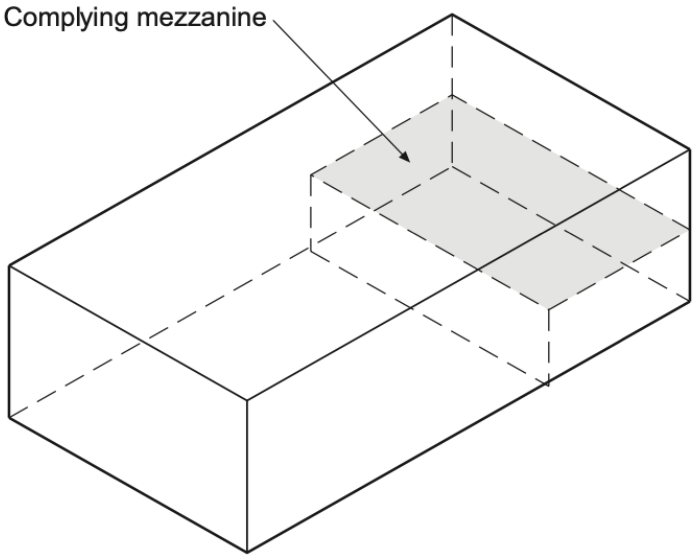
Source: 2021 IBC

505.2 Mezzanines Scope

- A mezzanine or mezzanines in compliance with Section 505.2 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1. The area of a mezzanine shall be included in determining the fire area.
- There are two distinct benefits derived from the qualification of a floor level as a mezzanine. One, the mezzanine is not considered in the allowable number of stories, and two, for allowable area purposes, the mezzanine floor area does not increase the building area of the story in which it is located. However, in the determination of fire area size for sprinkler requirements, the floor area must be considered. The requirements for sprinkler systems are generally based on the fire load expected in an occupancy; thus, an increased floor area would increase the potential fire loading.

Source: 2021 IBC

505.2 Mezzanines Scope



Mezzanine:

- Does not contribute to floor area for maximum allowable area
- Does not contribute as an additional story
- Does contribute to floor area for fire area size determination

Example:
For 8,000 sq ft first floor as shown with 2,000 sq ft mezzanine, building area is 8,000 sq ft, building is one story in height, and fire area is 10,000 sq ft

For SI: 1 square foot = 0.093 m^2

Although it is quite possible that an individual floor level within a building can meet all of the provisions of the IBC and qualify as a mezzanine, its actual designation is the choice of the designer. It may be more advantageous to treat the floor level simply as an additional story.

Source: 2021 IBC

505.2 Mezzanines Scope

11. The area of a mezzanine is not to be included in the determination of the _____.

a. fire area
b. building area
c. occupant load
d. plumbing fixture count

Source: 2021 IBC

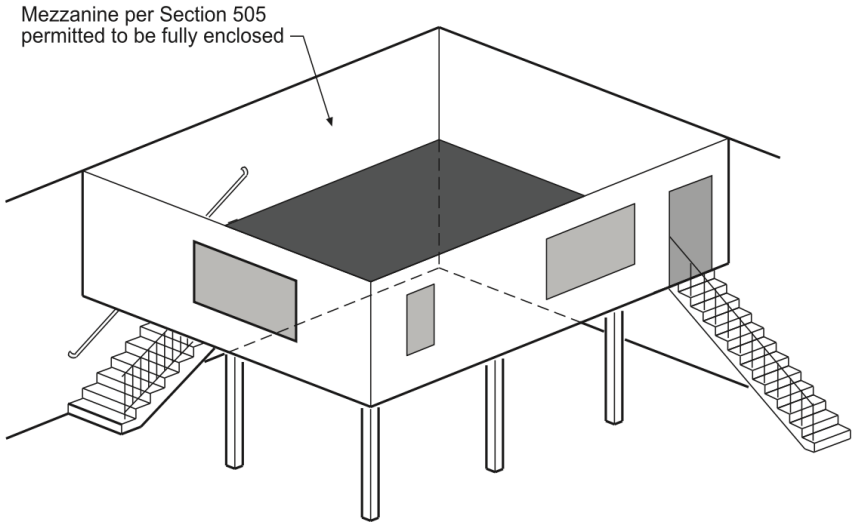
505.2.3 Mezzanines Openness

- A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches high, columns and posts. See the exceptions addressing mezzanines, including (1) where the enclosed area has a maximum occupant load of 10, (2) having two or more means of egress, (3) where the aggregate floor area of the enclosed space does not exceed 10 percent of the mezzanine area, and (4) in industrial facilities.
- By definition, a mezzanine is intended to be open to the room or space below. This common environment allows individuals on either floor level to be aware of the conditions and hazards that may affect their safety. The IBC, through the application of one of the exceptions, permits the mezzanine to be enclosed when it has been determined that the enclosure creates little, if any concern.

Source: 2021 IBC

505.2.3 Mezzanines Openness

- A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches high, columns and posts. See the exceptions addressing mezzanines, including (1) where the enclosed area has a maximum occupant load of 10, (2) having two or more means of egress, (3) where the aggregate floor area of the enclosed space does not exceed 10 percent of the mezzanine area. and (4) in industrial facilities.



A common exception used to permit the enclosing of a mezzanine is based on egress conditions. If a minimum of two means of egress are provided from the mezzanine level, then the mezzanine is not required to be open to the room or space below.

Source: 2021 IBC

505.2.3 Mezzanines Openness

14. Portions of a mezzanine need not be open to the room in which the mezzanine is located, provided the enclosed space is limited in size to a maximum of _____ of the mezzanine area.

a. 10 percent
b. 25 percent
c. $33^{1}/_{3}$ percent
d. 50 percent

Source: 2021 IBC

506.2.1 Single-occupancy Buildings

The allowable area of each story of a single-occupancy building shall be determined in accordance with Equation 5-1:

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

A_a = *Allowable area (square feet)*

A_t = *Tabular allowable area factor (NS, S1, S13R or S13D value, as applicable) in accordance with Table 506.2.*

NS = *Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether the building is sprinklered).*

I_f = *Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.*

The allowable building areas determined in accordance with Section 506.2 are based on the allowable area factors of Table 506.2, along with any available frontage increase as calculated by Section 506.3. The presence of sufficient open space adjacent to a building provides for an increase above the tabular value. The protection afforded by an automatic sprinkler system, as addressed in Table 506.2, justifies a significant allowable area increase.

Source: 2021 IBC

506.2.1 Single-occupancy Buildings

GIVEN: A fully sprinklered Group A-2 restaurant in a building of Type VB construction. Building has two stories above grade plane with 8,500 square feet per story. A 25% increase is permited due to open frontage.

DETERMINE: If in compliance with maximum allowable building area.

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

A_a = *Allowable area (square feet)*

A_t = *Tabular allowable area factor (NS, S1, S13R or S13D value, as applicable) in accordance with Table 506.2.*

NS = *Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether the building is sprinklered).*

I_f = *Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.*

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = 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	
		A	B	A	B	A	B	A	B	C	HT	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

Source: 2021 IBC

506.2.1 Single-occupancy Buildings

EXAMPLE:

GIVEN: A fully sprinklered Group A-2 restaurant in a building of Type VB construction. Building has two stories above grade plane with 8,500 square feet per story. A 25% increase is permited due to open frontage.

DETERMINE: If in compliance with maximum allowable building area.

2021 IBC Procedure for Determining Allowable Area and Compliance Review:

Step 1: Review and apply applicable provisions of Section 503 for general building area determination.

Step 2: Review and apply applicable provisions of Section 506 regarding the determination of allowable area.

Step 3: Determine allowable building area factor (A_t) as established in Table 506.2, based upon SM value (sprinklered, multi-story condition).

Allowable area factor in square feet from Table 506.2: $A_t = 18{,}000$ square feet

Step 4: Determine applicable allowable area frontage increase as established in Section 506.3.

Frontage increased based on example: $I_f = 0.25$

Step 5: Determine maximum building allowable area using Equation 5-2, $A_a = [A_t + (NS \times I_f)] \times S_a$

$[18{,}000 + (6{,}000 \times 0.25)] \times 2 = (18{,}000 + 1{,}500) \times 2 = 39{,}000$ square feet OK

Step 6: Determine maximum allowable area per story using Equation 5-2, with $S_a = 1$

$[18{,}000 + (6{,}000 \times 0.25)] \times 1 = (18{,}000 + 1{,}500) \times 1 = 19{,}500$ square feet OK

Specific methods of determining allowable area are also established for mixed-occupancy buildings.

Source: 2021 IBC

506.3 Frontage Increase

- Every building shall adjoin or have access to a public way to receive an area factor increase based on frontage. The area factor increase based on frontage shall be determined in accordance with Sections 506.3.1 through 506.3.3. The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.
- The frontage increase is based on the smallest public way or open space that is 20 feet or greater, as well as the percentage of the building perimeter having a minimum 20-foot public way or open space.

Source: 2021 IBC

506.3 Frontage Increase

- Every building shall adjoin or have access to a public way to receive an area factor increase based on frontage. The area factor increase based on frontage shall be determined in accordance with Sections 506.3.1 through 506.3.3. The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.
- It is assumed that every building will adjoin a street, alley or yard on at least one side. Therefore, no frontage increase is given where less than 25 percent of a building's perimeter is open. Credit is provided, however, where additional frontage is considered open (20 feet or more in width). The benefit of increased allowable building area is accrued based on better access for the fire department, as well as decreased exposure to adjoining properties. The frontage increase is based on the smallest public way or open space that is 20 feet or greater, as well as the percentage of the building perimeter having a minimum 20-foot public way or open space.

Source: 2021 IBC

506.3 Frontage Increase

16. An allowable area increase for frontage is not permitted unless a minimum of _____ of the building perimeter is sufficiently open.

a. 10 percent
b. 25 percent
c. $33^{1}/_{3}$ percent
d. 40 percent

Source: 2021 IBC

506.3 Frontage Increase

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

TABLE 506.3.3
FRONTAGE INCREASE FACTOR[a]

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

TABLE 506.3.3.1
SECTION 507 BUILDINGS[a]

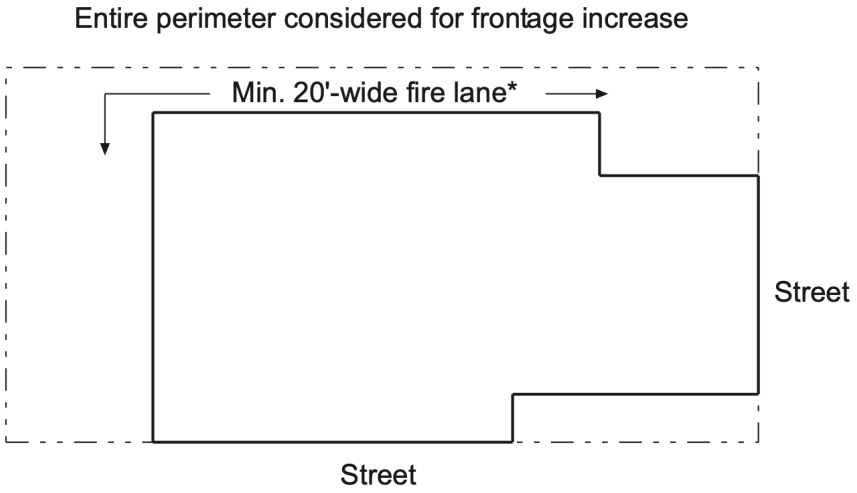
PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)					
	30 to less than 35	35 to less than 40	40 to less than 45	45 to less than 50	50 to less than 55	55 to less than 60
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.50
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75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

a. Interpolation is permitted.

Source: 2021 IBC

506.3 Frontage Increase

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



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

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

Access must be provided from a street or an approved fire lane for any open space that is used for a frontage increase in allowable floor area. The *International Fire Code* mandates that a fire lane for fire apparatus be maintained with an unobstructed width of at least 20 feet.

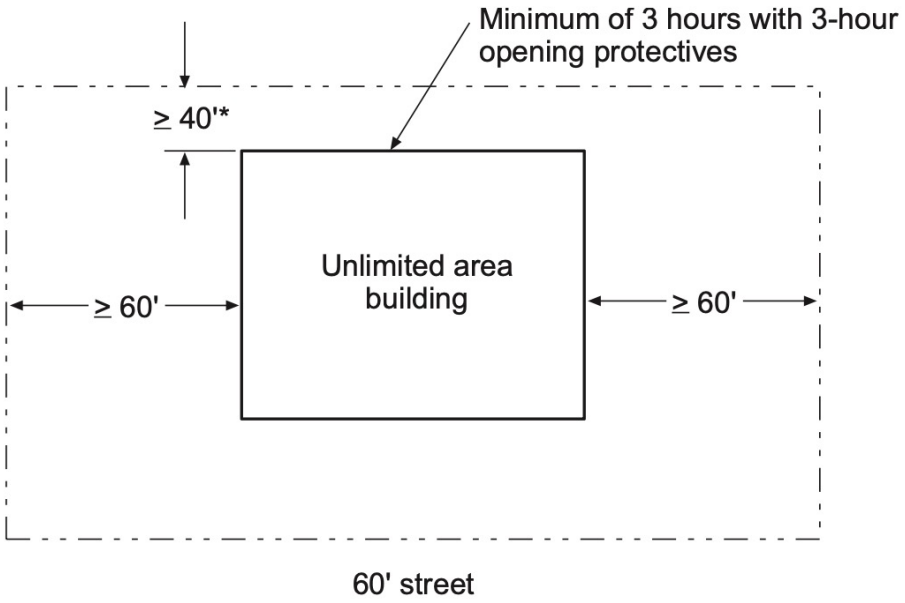
Source: 2021 IBC

507.2.1 Reduced Open Space

- The public ways or yards of 60 feet (18 288 mm) in width required in Sections 507.3, 507.4, 507.5, 507.6 and 507.12 shall be permitted to be reduced to not less than 40 feet (12 192 mm) in width provided all of the following requirements are met: (1) the reduced open space shall not be allowed for more than 75 percent of the perimeter of the building, (2) the exterior walls facing the reduced open space shall have a minimum fire-resistance rating of not less than 3 hours, and (3) openings in the exterior walls facing the reduced open space shall have opening protectives with a minimum fire-resistance rating of not less than 3 hours.
- When it is necessary or desirable to reduce the open space around the perimeter of an unlimited area building, the code provides an alternative. An equivalent level of protection can be provided by increasing the level of exterior wall and opening protection.

Source: 2021 IBC

507.2.1 Reduced Open Space



*Reduced open space permitted:

- Up to 75% of building perimeter
- Where exterior wall facing reduced open space has minimum 3-hour fire-resistance rating
- Openings in such walls are protected for 3 hours

For SI: 1 foot = 304.8 mm.

This provision is designed for warehouses, factories, retail stores, office buildings, Group A-3 uses and movie theaters where fire resistance at the exterior wall is easily accomplished. The reduction does not apply to other buildings permitted to be unlimited in area, such as educational uses and aircraft paint hangars.

Source: 2021 IBC

507.4 One-Story, Sprinklered Buildings

- The area of a Group A-4 building no more than one story above grade plane of other than Type V construction, or the area of a Group B, F, M or S building no more than one story above grade plane of any construction type, shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1, and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width. Provisions also apply to two-story buildings of such occupancies other than Group A-4.
- It is often beneficial to have very large, undivided floor areas for facilities such as arenas, office buildings, factories, retail centers and warehouses. The unlimited area provisions allow for an alternative to the higher types of construction that would normally be required. The installation of a sprinkler system and sufficient open space around the building reduce the potential fire severity to a reasonable level in these moderate-hazard occupancies.

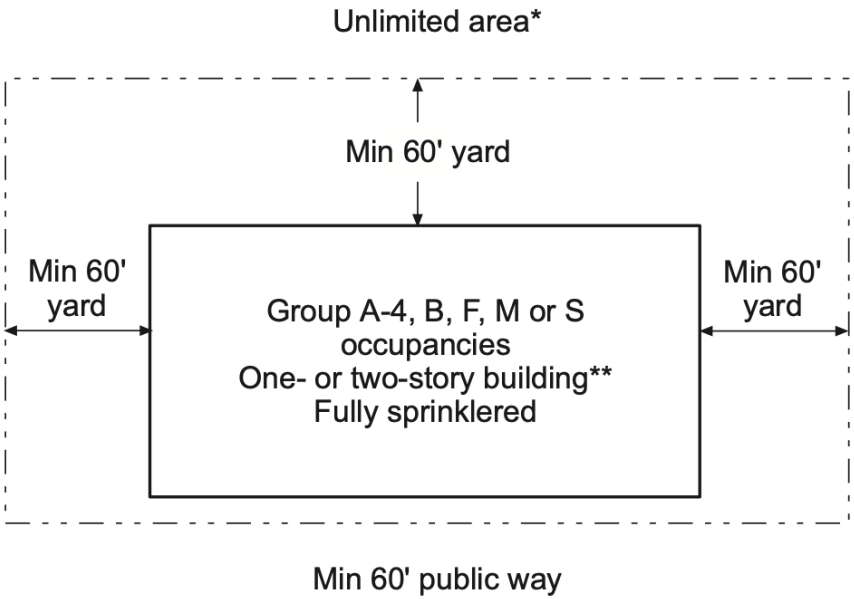
Source: 2021 IBC

507.4 One-Story, Sprinklered Buildings (Exception)

- Buildings and structures of Type I or II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.4 and 903.3.1.1 and Chapter 32 of the International Fire Code.
- The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that the following criteria are met:
  - Exit doors directly to the outside are provided for occupants of the participant sports areas.
  - The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.
  - An automatic sprinkler system is provided in storage rooms, press boxes, concession booths or other spaces ancillary to the sport activity space.

Source: 2021 IBC

507.4 One-Story, Sprinklered Buildings



*Any type of construction permitted (other than Type V for Group A-4)

**Limited to one story for Group A-4

For SI: 1 foot = 304.8 mm.

Low-hazard manufacturing and storage occupancies of any construction type are permitted to be unlimited in area where they are only one story in height and are provided on all sides with public ways or yards at least 60 feet in width. Installation of an automatic sprinkler system is not required.

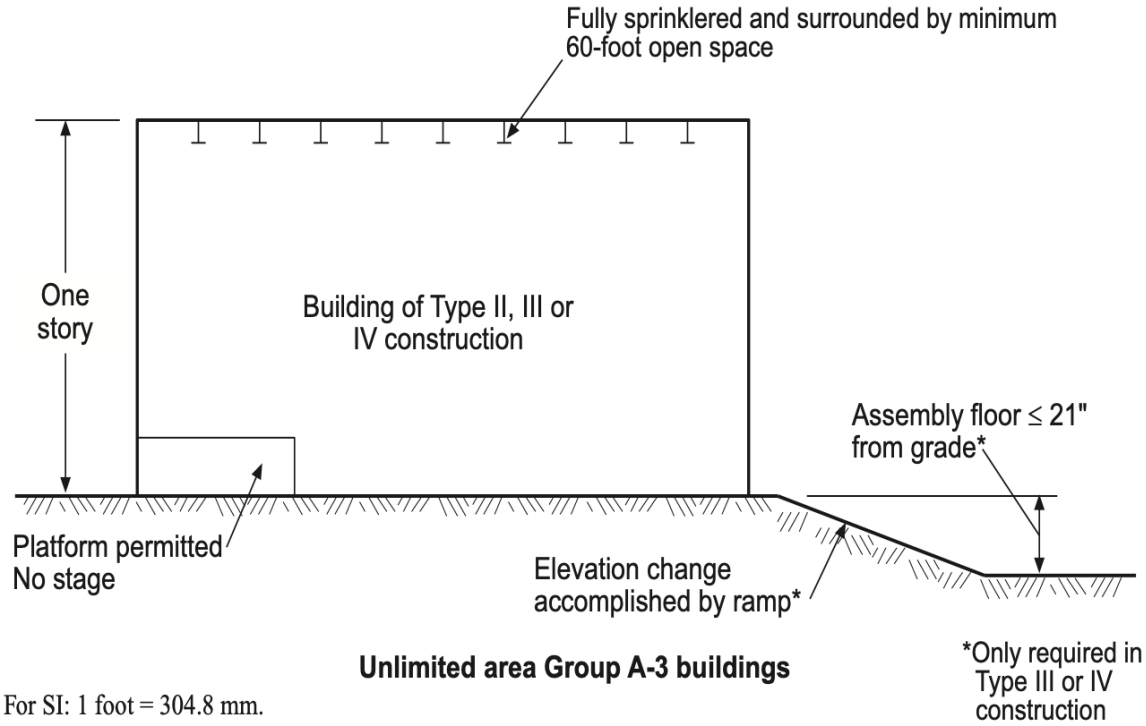
Source: 2021 IBC

507.6, 507.7 Group A-3 Buildings

- The area of a Group A-3 building no more than one story above grade plane used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction, shall not be limited when all of the following criteria are met: See three conditions for allowance of unlimited area. The provisions are also applicable to buildings of Type III and IV construction, provided four conditions are met.
  - The building shall not have a stage other than a platform.
  - The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
  - The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.
- The Group A-3 occupancy classification includes the most diverse types of assembly uses assigned by the code. Traditionally, the allowable area of Group A occupancies is greatly limited as compared to most other occupancy groups. However, those assembly uses expected to have a relatively low fire load are permitted in unlimited area buildings subject to the special conditions prescribed by the code.

Source: 2021 IBC

507.6, 507.7 Group A-3 Buildings



Unlimited area Group A-3 buildings

For SI: 1 foot = 304.8 mm.

As the primary concern in a Group A occupancy is the high number and concentration of occupants, it is important that egress be accomplished in an efficient and unobstructed manner. The requirement for only flat or limited ramp travel in Type III and IV buildings assists in gaining an effective egress system.

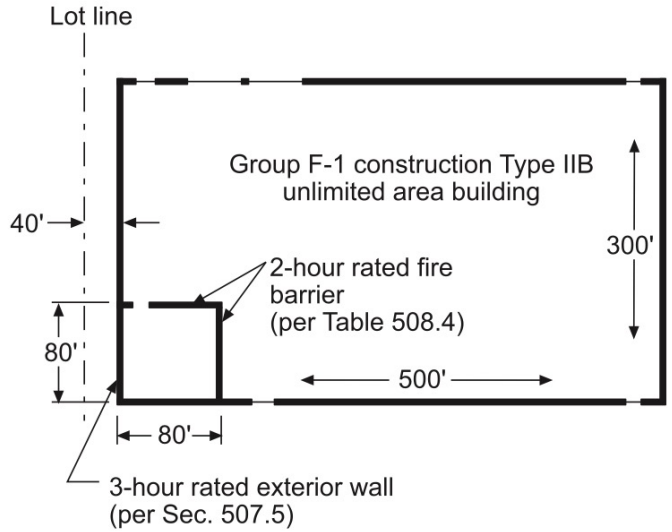
Source: 2021 IBC

507.8 High-Hazard Occupancies

- Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F or S occupancies, in accordance with Sections 507.4 and 507.5 and the provisions of Sections 507.8.1 through 507.8.4. The aggregate floor area of the Group H occupancies located in an unlimited area building shall not exceed 10 percent of the area of the building or the area limitations for the Group H occupancies as specified in Section 506, based upon the perimeter of each Group H floor area that fronts on a public way or open space. The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25 percent of the area limitations for the Group H occupancies as specified in Section 506.
- The aggregate allowable area of the permitted Group H occupancies in a factory or warehouse regulated as an unlimited area building is dependent on the type of construction of the building and the location of the Group H occupancies in the building.

Source: 2021 IBC

507.8 High-Hazard Occupancies



For **SI:** 1 inch = 25.4 mm, 1 foot = 304.8 mm
1 square foot = 0.0929 m^2

- Group H-2
- Per Table 506.3.3
  50% of perimeter
  Open space of 40'
  I_f = 0.50
- Allowable area for H-2 = 7,000 + (0.50)(7,000)
  = 10,500 sq ft
- Check 10% of floor area criterium:
  (500)(300) = 150,000 sq ft
  150,000/10 = 15,000 sq ft
  15,000 >10,500, ∴ 10,500 maximum allowable
- Actual area = 6,400, which is less than 10,500, therefore OK

Group H-2 at the corner of an unlimited area Group F or S building

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More ready access to the Group H from the exterior of the building provides the fire department with an opportunity to respond more effectively to an incident. As such, the allowable floor area of the Group H can be far greater than where completely surrounded by the Group F or S use.

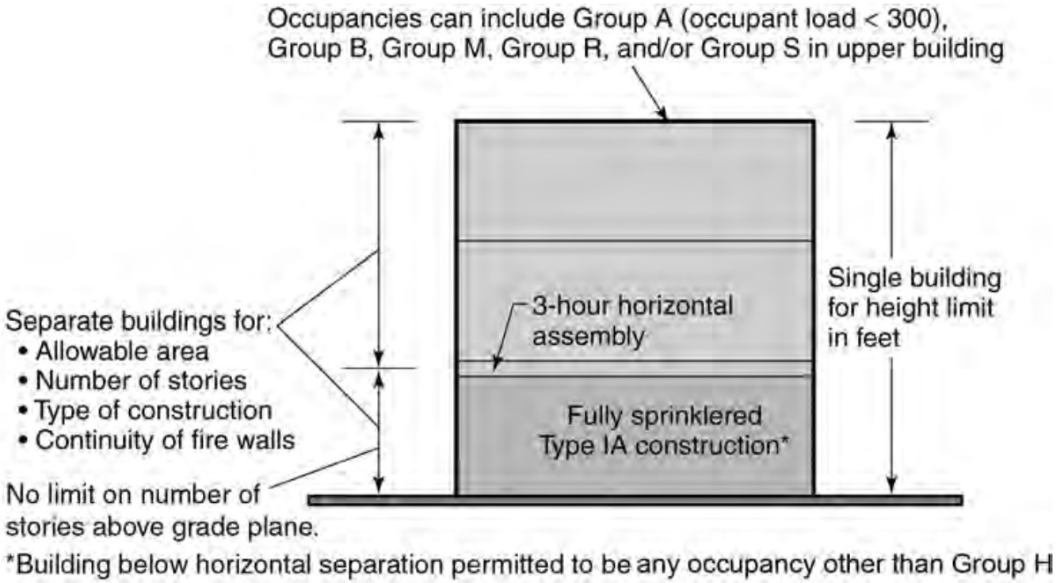
Source: 2021 IBC

510.2 Horizontal Building Separation

- A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction where all of the following conditions are met: See the list of seven criteria.
- The special provisions of Section 510 are intended to modify the specific requirements of Chapter 5 regarding allowable heights and areas of buildings. The allowances granted in Section 510.2 address those structures typically referred to as “podium” or “pedestal” buildings. Compliance with the multiple conditions results in consideration of the structure as two separate and distinct buildings for four distinct issues. Similar provisions are established in Sections 510.3, 510.4, 510.7 and 510.8 where complying horizontal separations, along with other requirements, permit modifications to the general allowable height and area limitations.

Source: 2021 IBC

510.2 Horizontal Building Separation



Although this provision is often utilized where the lower building contains a parking garage, such parking facilities are not required to take advantage of the benefits. A variety of uses are permitted both above and below the fire-resistance-rated horizontal separation.

Source: 2021 IBC

510.2 Horizontal Building Separation

Where using the special provisions of Section 510.2 for the horizontal building separation allowance, the horizontal separation between buildings shall be provided with a horizontal assembly having a minimum _____ fire-resistance rating.

a. 1-hour
b. 2-hour
c. 3-hour
d. 4-hour

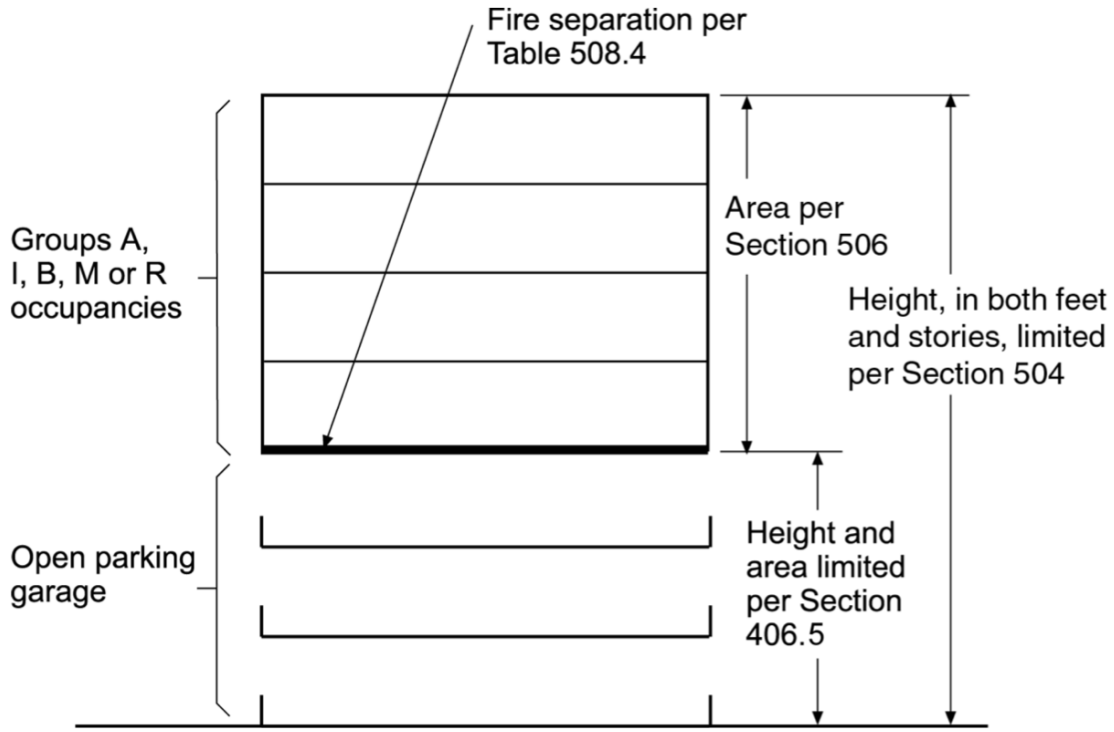
Source: 2021 IBC

510.7 Open Parking Garages

- Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.5. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.
- In the more common types of occupancies, it is desirable at times to provide tiers of parking below the major use of the building. In this special mixed-use condition, two different types of construction are permitted for determining the maximum allowable height and area. This special allowance is just one of several special provisions established in Section 510 that modify the general requirements of the code.

Source: 2021 IBC

510.7 Open Parking Garages



It is important to address the appropriate fire separation issues when using this provision. In addition, the structural members supporting the upper occupancy must be protected by the more restrictive fire-resistant assemblies of all of the occupancies involved.

Source: 2021 IBC