2018 IBC® Types of Construction Classification and Application

Based on the 2018 International Building Code®

Course Description

- This seminar addresses the key issues of the 2018 International Building Code® (IBC®) regarding the proper classification of buildings for type of construction.
- The process for correctly evaluating a building for code compliance relies on a systematic approach to the determination of occupancy classification and construction type.

Introduction

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

- Type of construction classification consists of two distinct aspects:
  - Determination of the appropriate types of construction based on the building’s occupancy, height and floor area, and
  - Identification of the construction and fire-resistance-rated features associated with those appropriate types of construction as previously determined.

Goal

- Participants will be able to determine the appropriate type of construction classification(s) based on Chapters 3 and 5, and then use Chapter 6 to determine the specific features of the nine types of construction.

Objectives

Upon completion, participants will be better able to:

1. Discuss the concept behind the use of construction type to regulate a building’s design and construction.
2. Apply the process for using occupancy classification, allowable building height and allowable building area to determine the acceptable types of construction.
3. Identify the characteristics of the nine types of construction set forth in the 2018 IBC.

Course Outline

- Module 1  Concept and Process of Type of Construction Classification
- Module 2  Determination of Acceptable Types of Construction
- Module 3  Type of Construction Application
Concept and Process of Type of Construction Classification

Module 1

Concept of Building Classification

- Concepts and applications related to type of construction are focused on one simple mandate:
  - In order to build a structure bigger, it must be built better.
  - Where a building is required to have greater floor area and/or height, the materials of construction and/or fire-resistant protection of building elements are regulated to address the increased hazards inherit in larger structures.
- Type of construction provisions of Chapter 6 are directly related to allowable height and area provisions of Chapter 5.

- Provisions of Chapter 6 in regard to fire resistance are intended to address the structural integrity of the building under fire conditions.
- Unlike fire separations, whose intent is to safeguard against the spread of fire, the protection afforded by Chapter 6 is almost solely that of structural integrity.
- Some degree of vertical compartmentation is also addressed in multi-story buildings through the required protection of vertical openings and penetrations.

Concept of Building Classification

- In the design of the building, various options regarding construction type are available.
- Such options can be divided into two major categories:
  - Materials of construction
  - Fire-resistance-rated protection of building components
Concept of Building Classification

- Materials of construction that impact the building’s construction type can be divided into three general categories, with exceptions:
  - Noncombustible throughout
  - Noncombustible exterior walls, with combustible and noncombustible materials permitted within such walls
  - Combustible and noncombustible materials permitted throughout

Concept of Building Classification

- Although owner/architect would prefer that all options are available, as building becomes larger and/or more hazardous, available choices become limited.

Concept of Building Classification

- Fire-resistance-rated construction is selectively mandated for type of construction purposes, with potential ratings of:
  - 3 hours
  - 2 hours
  - 1 hour
  - Nonrated

Concept of Building Classification

- Provisions of Chapter 6 addressing type of construction primarily address structural integrity under fire conditions.
- Table 601 sets forth minimum fire protection for:
  - Primary structural frame members
  - Bearing walls
  - Floor construction
  - Roof construction
- Additional concerns relate contribution to building’s fire load
Concept of Building Classification

- Although Type I and II construction is typically of noncombustible materials, allowances are made for the selective use of fire-retardant-treated wood and other limited amounts of combustibles.

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Primary Structural Frame Members and Bearing Walls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type IA</td>
<td>3-hour</td>
</tr>
<tr>
<td>Type IB</td>
<td>2-hour</td>
</tr>
<tr>
<td>Type IIA</td>
<td>1-hour</td>
</tr>
<tr>
<td>Type IIB</td>
<td>Nonrated</td>
</tr>
</tbody>
</table>

NONCOMBUSTIBLE EXTERIOR – ANY MATERIAL INTERIOR

- Type III and IV buildings typically have noncombustible exterior walls.
- Although Type III construction may have interior elements of any materials, Type IV buildings are constructed internally with heavy timber members.

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Primary Structural Frame Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type IIIA</td>
<td>1-hour</td>
</tr>
<tr>
<td>Type IIIB</td>
<td>Nonrated</td>
</tr>
<tr>
<td>Type IV-H.T.</td>
<td>1-hour</td>
</tr>
</tbody>
</table>

Concept of Building Classification

- Type V buildings may be constructed entirely of combustible or noncombustible materials, or may be a combination of such materials.

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Primary Structural Frame Members and Bearing Walls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type VA</td>
<td>1-hour</td>
</tr>
<tr>
<td>Type VB</td>
<td>Nonrated</td>
</tr>
</tbody>
</table>

Process of Building Classification

- Prior to addressing the specific details of each of the nine construction types, it is necessary to explore the process to identify how the acceptable types of construction are determined for a specific building.
- This process is primarily found in Chapter 5 dealing with allowable building heights and areas.
**Process of Building Classification**

- The initial determination in the classification of construction type is made by the designer through the identification of their preference.
- Such preference is typically Type VB construction, as it allows for the most flexibility in the design of the building due to:
  - No structural fire-resistance required
  - No limit on materials of construction

**Process of Type of Construction**

- Where Type VB construction is not acceptable due to the building’s size and occupancy, other options are available.
- Each construction type has its height and area limited based on the occupancy (occupancies) within the building.
  - The designer then selects the complying construction type that best meets their design and budgetary needs.

Once the type of construction is selected for the building, the provisions of Chapter 6 (and other applicable provisions throughout the IBC) will regulate the building’s structural fire-resistance and use of appropriate materials.
Type of Construction—General Provisions (Section 602)

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>Materials of Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>IA, IB</td>
</tr>
<tr>
<td>II</td>
<td>IIA, IIB</td>
</tr>
<tr>
<td>III</td>
<td>IIIA, IIIB</td>
</tr>
<tr>
<td>IV</td>
<td>IV, IVA</td>
</tr>
<tr>
<td>V</td>
<td>V, VA, VB</td>
</tr>
</tbody>
</table>

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

Allowable Height and Area — Introduction

- The relationship of a building’s construction type and its allowable height and area is the most important reason for correctly evaluating the type of construction.
- The permitted building size is directly related to the construction type.
  - In addition, the building’s occupancy, or occupancies, plays an important role in allowable height and area.

Determination of Acceptable Types of Construction

- One or more construction types are selectively permitted based on the building’s occupancy classification, height and floor area.
Determination of Allowable Building Size

- It is typically recognized that allowable building height and area is determined through the use of:
  - Table 504.3 Allowable Building Height in Feet AGP
  - Table 504.4 Allowable Building Height in Stories AGP
  - Table 506.2 Allowable Area Factor

- However, additional methods are provided that selectively address allowable building size in a different manner.

Alternative Approaches to Allowable Building Size

- In addition to the allowances set forth in Tables 504.3, 504.4 and 506.2, a number of other provisions provide for alternate approaches to the determination of allowable building size:
  - Fire walls  Section 503.1
  - Special industrial occupancies  Section 503.1.1
  - Buildings on the same lot  Section 503.1.2
  - Occupied roofs  Section 503.1.4
  - Mezzanines  Section 505
  - Unlimited area buildings  Section 507
  - Special provisions  Section 510

Unlimited Height and Area

- There are some buildings that do not need to undergo a numerical analysis in order to be unlimited in height, or area, or both.

- Such buildings have unique characteristics that allow for qualification as "unlimited," and include:
  - Special industrial occupancies
  - Unlimited area buildings
  - Buildings of Type I construction
Unlimited Height and Area

- It should be noted that in many cases, unlimited height or area conditions are more correctly considered as unlimited in type of construction.
- Where the maximum height and/or area is unregulated for special industrial occupancies and unlimited area buildings, it accordingly results in no limitations on a building’s type of construction.
  - In some situations, construction type may be limited to specific types, but typically fire-resistance-rated protection is not required.

Special Industrial Occupancies Section 503.1.1

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

Special Industrial Occupancies

- Some of the uses that qualify for these special allowances include:
  - Rolling mills
  - Structural metal fabrication shops
  - Foundries
  - Production and distribution of electric, gas or steam power
Type I Construction

Section 503.1.3

- Building height in feet is unlimited in Type IA construction for all occupancies.
  - Limits are placed on all occupancies when of Type IB.
- Building height in stories is unlimited in Type IA construction for all occupancies except Groups H-1 and H-5.
  - Limits are placed on all occupancies when of Type IB except Group A-5.

Type I Construction

Section 503.1.3

- Buildings of Type I construction permitted to be of unlimited tabular building heights and areas as set forth in Tables 504.3, 504.4 and 506.2 are not subject to the special requirements that allow:
  - Unlimited area buildings in Section 507, and
  - Unlimited building height in Sections 503.1 (special industrial occupancies) and 504.3 (rooftop structures)

- Building area is unlimited in Type IA construction for all occupancies except Groups H-1 and H-2.
- Building area is also unlimited in Type IB construction for all occupancies except Groups H-1, H-2, H-3, I-1, I-4, S-1, S-2 and U.
Unlimited Area Buildings Section 507

- The provisions of Section 507 allow for buildings with large floor areas to be constructed with no requirement for:
  - Fire-resistance-rated construction, or
  - Fire walls.
- Risks have been addressed to the point that the regulation for allowable area is unnecessary.

Unlimited Area Buildings Section 507.1

- Use of Section 507 is limited to the occupancies and configurations specified within the provisions.
- Basements are permitted where not more than one story below grade plane.
- Allowance is made for other occupancies provided they comply with the provisions of Section 508.1.1 for accessory occupancies.
Unlimited Area Buildings—Open Space
- Open space of at least 60 feet must be provided around complying unlimited area buildings. The minimum 60-foot width is typically permitted to be reduced to 40 feet provided:
  - The reduced open space applies to a maximum of 75 percent of the building’s perimeter, and
  - A minimum 3-hour fire-resistance rating is required for any exterior wall facing the reduced open space, and
  - Openings in the exterior wall facing the reduced open space have a minimum fire protection rating of 3 hours.

Unlimited Area Buildings—Any Type of Construction Permitted
- Group F-2 and S-2 buildings
  - One-story
  - Minimum 60-foot open space
- Group B, F-1, M and S-1 buildings
  - One-story and two-stories above grade plane
  - Fully sprinklered
  - Minimum 60-foot open space

Unlimited Area Buildings—Other Than Type V Permitted
- Group A-4 buildings
  - One-story above grade plane
  - Fully-sprinklered
  - Minimum 6-foot open space

Unlimited Area Buildings—Only Type II Construction Permitted
- Group A-3
  - One-story
  - Fully-sprinklered
  - Minimum 60-foot open space
  - No stage (platform permitted)
  - Used as place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or indoor tennis court
Unlimited Area Buildings—Only Type II Permitted (continued)

- Group H-5 (with B, F, M and/or S occupancies)
  - One-story and two-stories above grade plane
  - Fully-sprinklered
  - Minimum 60-foot open space
  - Fire barrier separations required where Group H exceeds maximum allowable area
- Motion picture theaters
  - Located on first story above grade plane
  - Fully-sprinklered
  - Minimum 60-foot open space

Unlimited Area Buildings—Only Types III and IV Permitted

- Group A-3
  - One-story
  - Fully-sprinklered
  - Minimum 60-foot open space
  - No stage (platform permitted)
  - Used as place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or indoor tennis court
  - Assembly floor located at or within 21 inches of street or grade level
    - All exits provided with ramps to street or grade level

Unlimited Area Buildings—Only Type I and II Permitted

- Group H-2 aircraft paint hangar
  - One-story above grade plane
  - Surrounded and adjoined by open space not less in width than one and one-half times the building height
  - Provided with fire suppression per NFPA 409

Unlimited Area Buildings—Only Types II, IIIA and IV Permitted

- Group E
  - One-story above grade plane
  - Fully-sprinklered
  - Minimum 60-foot open space
  - Each classroom to have minimum of two means of egress with one being a direct exit to the outside
Allowable Height and Area—Sidebar

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

Determination of Allowable Height and Area—Introduction

- Although a number of buildings can be evaluated quickly as unlimited in area, it is typically a bit more complex to verify compliance with the height and area limitations.
- In most cases, it is necessary to utilize the allowable height and area tables (along with permitted increases) to determine the limitations on building size.
  - This determination identifies those types of construction permissible for the building under consideration.

Allowable Height and Area Tables 504.3, 504.4 and 506.2

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

- The application of Tables 504.3, 504.4 and 506.2 are accomplished by:
  1. Identifying the group classification of the building in question along the left column.
  2. Identifying the building’s type of construction across the top of the table.
  3. The cell at the intersection of the occupancy classification and type of construction establishes the:
     - allowable building height in feet above grade plane.
     - allowable building height in stories above grade plane.
     - allowable area factor (per story) in square feet.

Allowable Height in Feet Above Grade Plane (Table 504.3)

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Type of Construction</th>
<th>See Footnote</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>NS</td>
<td>UL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A-2</td>
<td>NS</td>
<td>UL</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A-3</td>
<td>NS</td>
<td>UL</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.

Allowable Height in Stories Above Grade Plane (Table 504.4)

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Type of Construction</th>
<th>See Footnote</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>NS</td>
<td>UL</td>
<td>15,000</td>
<td>14,000</td>
<td>13,500</td>
<td>13,000</td>
<td>12,500</td>
</tr>
<tr>
<td>A-2</td>
<td>NS</td>
<td>UL</td>
<td>13,500</td>
<td>14,000</td>
<td>13,500</td>
<td>12,500</td>
<td>12,000</td>
</tr>
<tr>
<td>A-3</td>
<td>NS</td>
<td>UL</td>
<td>12,000</td>
<td>12,500</td>
<td>12,000</td>
<td>11,500</td>
<td>11,000</td>
</tr>
</tbody>
</table>

Only a portion of Table 504.4 is shown above.

Allowable Area Factor in Square Feet (Table 506.2)

<table>
<thead>
<tr>
<th>Occupancy Classification</th>
<th>Type of Construction</th>
<th>See Footnote</th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-1</td>
<td>NS</td>
<td>UL</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>A-2</td>
<td>NS</td>
<td>UL</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>A-3</td>
<td>NS</td>
<td>UL</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Note: UL = Unlimited; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.

Only a portion of Table 506.2 is shown above.
**Allowable Building Height Section 504**

- When starting the process of determining a building’s allowable height and area, it is often more efficient to first look at the building’s height.
- If the building complies with both the allowable height in feet and the allowable height in stories, then the evaluation of allowable building area can be undertaken.
- The building is deemed compliant only if all three limitations on building size are not exceeded.

**Grade Plane Section 202**

- In the determination of allowable building height in both feet and number of stories, it is necessary to identify the grade plane.
- Grade plane is relatively simple to calculate if the land adjoining a building is relatively flat.

**Allowable Building Height Section 504**

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

**Grade Plane Section 202**

- In the case of sloping ground, grade is the lowest ground elevation within 6 feet of an exterior wall or, if the lot line is within that 6 feet, the lowest ground elevation between the wall and the lot line.
Building Height
Section 202

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

---

**Building Height**

**Section 202**

**Story:** That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

---

**Building Height**

**Section 202**

**Story Above Grade Plane:** Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:
1. More than 6 feet above grade plane, or
2. More than 12 feet above the finished ground level at any point.
Allowable Height and Area—Story Above Grade Plane (Section 202)

Example:
Given: A building with two floor levels as shown. The grade plane has been established as 100.0'.
Determine: The number of stories above grade plane.

<table>
<thead>
<tr>
<th>Floor</th>
<th>FF (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>105.0'</td>
</tr>
<tr>
<td>Level 2</td>
<td>110.0'</td>
</tr>
</tbody>
</table>

Solution: Since it is not more than 6 feet from grade plane to the floor surface above, Level 1 is still considered a story above grade plane (assuming no point exceeds 12 feet between the established grade and the floor surface. Thus, Level 2 is reclassified as a story above grade plane. Level 1 is considered as a treatment plane.

Building Height

- Special allowances in building height are provided for:
  - Roof structures
  - Occupied roofs
  - Mezzanines

Building Height

- The main reason to make the story above grade plane calculation is to determine the number of stories above grade plane as regulated by Table 504.4.
- Additional provisions throughout the code are selectively based on the:
  - Number of stories, or
  - Number of stories above grade plane.

Roof Structures

Section 504.3

- The height limitations for towers, spires, steeples and other roof structures are found in:
  - Exception to Section 504.3 regulates such roof structures in regard to the contribution to the overall height of the building.
  - Section 1510 deals more with rooftop structures as independent elements.
Occupied Roofs
Section 503.1.4

- A roof level is permitted to be used as an occupied roof provided the rooftop occupancy is permitted by Table 504.4 to be located on the story immediately below the roof.
  - Exceptions permitted for sprinklered buildings with occupant notification extended to roof area, and for Type I or II open parking garages.
- In addition, area of occupied roofs are not to be included in building area regulated by Section 506.

Mezzanines
Section 505

- A mezzanine is a complying intermediate floor level placed between the floor and ceiling of a story.
- The use of the mezzanine provisions is a design option, as an intermediate floor level can also be considered an additional story if desired by the designer.
  - Where compliant, it is typically a benefit to consider a floor level as a mezzanine.
- A mezzanine does not contribute to:
  - Number of stories in the building
  - Building area

Mezzanines
Section 505

Conditions to qualify as a mezzanine include:

- Aggregate area of mezzanines limited to one-third of floor area of room where located (2 exceptions allow for greater percentages).
- Mezzanines to be open and unobstructed to room where located (5 exceptions allow for partial or full enclosure or mezzanine area).
- Mezzanines contribute to floor area for fire area size determination.
Mezzanines  
Section 505

- For 5,000 square feet building as shown with 2,000 square feet mezzanine, building area is 7,000 square feet. Building is one-story in height and floor area is 35,000 square feet.

Allowable Height Increase for Sprinklers—Example

- As an example of the use of Tables 504.3 and 504.4, a Group B occupancy of Type VB is permitted an additional one story and 20 feet in height increase where the building is fully sprinklered.

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

Height Increase for Sprinklers

- Occupancies where the installation of an automatic sprinkler system does not provide for an increase in allowable height:
  - Group I-2 occupancies in Type IIB, III, IV and V buildings.
  - Group H-1, H-2, H-3 and H-5 occupancies.
**Allowable Building Area Section 506**

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

**Automatic Sprinkler System Increase Table 506.2**

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

**Allowable Area Factors Table 506.2**

- The allowable area increase reflected in Table 506.2 for the installation of an automatic sprinkler system is only applicable where an NFPA 13 system is provided throughout the building.
- In addition, Table 506.2 does not provide for a sprinkler increase for:
  - Group H-1 occupancies
  - Portions of buildings classified as Group H-2 or H-3
Basements
Section 506.1.3
- Basements do not need to be included in the total allowable area, provided the aggregate area of the basements do not exceed the area permitted for a single-story building.
- In addition, as previously addressed, the following building areas are not to be included in the determination of allowable area:
  - Occupied roofs
  - Mezzanines

Frontage Increase
Section 506.3
- An increase in allowable area is permitted for buildings that have substantial open space adjacent to the exterior walls (to facilitate fire department access). Open space greatly limits the potential for exterior materials to contribute to a fire within the building.
- To qualify, the yard or public way must have a minimum width of 20 feet. No allowable area increase is given unless more than 25% of the building’s perimeter has complying frontage.

Frontage Increase
Section 506.3.3
- Formula to calculate the frontage increase ($I_f$) for allowable area purposes:

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

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

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

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

Solution:

\[ l_f = \frac{F - 0.25}{P} \frac{W}{30} \]

- \( F = 220 \text{ feet} \)
- \( P = 360 \text{ feet} \)
- \( W = 40 \text{ feet} \)

\[ l_f = \left( \frac{220 - 0.25}{360} \right) \frac{30}{30} \]

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

\[ = [0.61 - 0.25] \times 1.0 \]

\[ = 0.36 \]

Open Space Limits Section 506.3.1

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

Open Space Availability Overview

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

Allowable Area Determination Section 506.2

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

- The allowable area of a single-occupancy building with no more than one story above grade plane shall be determined by the following equation:
  \[ A_a = A_t + (NS \times I_f) \]

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

Total Allowable Area Example

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

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

The building is limited to 76,500 sf.

Mixed-occupancy and/or Multi-story Buildings

- Where the building has multiple occupancies and/or more than one story above grade plane, additional provisions must be applied.
- The basic provisions for a single-occupancy, single-story building will be used to address these more complex conditions.
Mixed Occupancy Area Determination
Section 506.5

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

Alternative Application of Allowable Heights and Areas

- The following conditions allow the allowable height and area to be applied to portions of buildings through the provisions addressing:
  - Fire walls
  - Horizontal building separations (podium buildings)
  - Two or more buildings on the same lot
Fire Walls
Section 503.1

- Each portion of a building separated by one or more complying fire walls to be considered a separate building for:
  - Building area limitations
  - Building height limitations
  - Type of construction classification

Fire Walls
Sections 706.2-706.4

- Fire walls shall be designed and constructed to allow collapse of the structure on either side without collapse of the wall under fire conditions.
- Fire walls shall be constructed of noncombustible materials
  - Except in buildings of Type V construction.
- Fire walls shall have a minimum fire-resistance rating per Table 706.4.

Special Provisions
Section 510.1

- Section 510 allows for modifications or exceptions to the general requirements for building areas and heights, taking precedence over any general provisions that may apply.
- Because Section 510 permits, rather than requires the use of its special conditions, the provisions are optional.
Special Provisions—Sidebar

- Conformance with Section 510 is only required where the designer intends to take advantage of the special allowances that are available.

Horizontal Building Separation Section 510.2

- The benefit of Section 510.2 is the ability to create two separate buildings, one above the other, for the purpose of applying several specific code provisions independently to each building.
- The allowance is similar in application to the use of a fire wall, but in a vertical arrangement rather than horizontal.

Horizontal Building Separation Section 510.2

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

- Determination of allowable area limits.
- Continuity of fire walls.
- Limitation on number of stories.
  - Allowable height in feet measured from grade plane.
- Type of construction.
Horizontal Building Separation Section 510.2 (continued)

- Building above horizontal assembly limited to Group A with individual occupant loads less than 300, B, M, R and/or S.
- Building below horizontal assembly to be any occupancies other than Group H.
- Maximum building height in feet based on most restrictive height of the upper and lower buildings.

Parking Beneath Group R Section 510.4

- Where parking is limited to the first story, the number of stories used in the determination of the minimum type of construction may be measured from the floor above the garage.

The singular benefit provided by Section 510.4 is the allowance for an additional story above grade plane without requiring a higher type of construction.

Group R-1 and R-2 Buildings of Type IIA and IIIA Construction Sections 510.5 and 510.6

- The height limitations for Group R-1 and R-2 buildings of Type IIA and IIIA construction are permitted to be increased if special conditions are met.
**Type IIIA Buildings Sections 510.5**

- Type IIIA buildings (Groups R-1 and R-2) — the maximum height is increased to 6 stories and 75 feet, if:
  - The floor construction above a basement, if applicable, is fire-resistance rated a minimum of 3 hours.
  - The floor area is subdivided into maximum 3,000 square foot areas by minimum 2-hour fire-resistance-rated fire walls.

**Type IIA Buildings Sections 510.6**

- Type IIA buildings (Groups R-1 and R-2) — the maximum height is increased to 9 stories and 100 feet, if:
  - The building is separated at least 50 feet from lot lines and from other buildings on the lot.
  - The floor construction above a basement, if applicable, is fire-resistance rated a minimum of 1½ hours.
  - The exits are segregated in an area enclosed by a minimum 2-hour fire-resistance-rated fire wall.

**Open Parking Garage Beneath Groups A, I, B, M and R Section 510.7**

- Applies to open parking garages only.
- If in compliance, the areas above and below the horizontal separation are permitted to be regulated for allowable height and area as separate buildings.
- Specific fire separation and means of egress requirements have been established to address any reduction in construction type.

**Group B or M with an Open Parking Garage Above Section 510.8**

- Special provisions address a condition where an open parking garage is located above Group B or M occupancies—representing a desire to have offices and/or retail stores on the first floor of open parking garages.
  - The benefit provides for a potential reduction in the building’s type of construction by permitting the evaluation of allowable floor areas independently for the open parking garage and the occupancy.
Buildings on the Same Lot

Section 503.1.2

If two or more buildings are located on the same lot, they must be:
- Regulated as separate buildings in accordance with Section 705.3, or
- Considered as portions of one building.

- If viewed as separate buildings, an imaginary line (determined by the designer) must be assumed between the buildings to determine exterior wall and opening protection.
  - This approach is consistent with the regulation of buildings on adjacent lots insofar as fire separation distance is concerned.
  - Under this approach, allowable height, allowable area and type of construction are addressed independently for each building.
Buildings on the Same Lot
Section 503.1.2

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

Type of Construction—Introduction

- Once a type of construction has been chosen, and such construction type complies with the IBC for allowable height and area based on the occupancy or occupancies within the building, the building elements shall comply with the requirements of Chapter 6.
- Additional provisions located throughout the code may also be selectively applied as directed by Chapter 6.
Type of Construction
Section 602.1

- A building shall be assigned a type of construction as defined in Sections 602.2 through 602.5 addressing five general types of construction:
  - Type I
  - Type II
  - Type III
  - Type IV
  - Type V

In addition, the building elements shall have a fire-resistance rating not less than that established in Table 601.

The nine types of construction set forth in the code are defined by a combination of:
- The construction details set forth for Type I, II, III, IV and V construction, and
- The fire-resistance ratings set forth in Table 601.

General Provisions
Section 602

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

Table 601

- Building elements addressed in Table 601 for fire-resistance include:
  - Primary structural frame members
  - Bearing walls (both interior and exterior)
  - Floor construction
  - Roof construction

Type of Construction

Section 602

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

- However, limitations on the use of combustible materials do apply to nonbearing walls and partitions (both interior and exterior).

Primary Structural Frame

Section 202

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

Secondary Members

Section 202

- All other members are considered as secondary members and are only regulated for fire resistance for the building element in which they are located, including:
  - Bracing members other than those that are a part of the primary structural frame.
  - Members of the floor construction not having direct connections to the columns.
  - Structural members and members of the floor construction that do not have direct connections to the columns.
**Type of Construction
Section 602.1**

- Protection of openings, such as door and window assemblies, ducts and air transfer openings in building elements not required unless mandated by other provisions of IBC.

**Type of Construction
Section 602.1.1**

- The building cannot be required to conform to details higher than the type which meets the minimum requirements, even though certain features of such a building actually conform to a higher type of construction.

**Types I and II Construction
Section 602.2**

- In buildings of Types I and II construction, elements listed in Table 601 are required to be noncombustible (except as permitted in Section 603 and elsewhere in code).
  - For Types IA, IB and IIA, building elements are to be fire-resistance rated.
  - For Type IIB, building elements may be unprotected unless required elsewhere in code.

**Type III Construction
Section 602.3**

- In Type III construction, exterior walls must be constructed of noncombustible materials.
  - FRT wood framing and sheathing permitted within exterior walls assemblies of 2-hour rating or less.
  - The interior structural elements may be combustible and/or noncombustible.
Type III Construction
Section 602.3

- IIIA: Elements are protected (fire-resistance rated) in accordance with Table 601.
- IIIB: Elements, other than exterior bearing walls, are not required to be protected.

Type IV Construction
Section 602.4

- Exterior walls of Type IV buildings to be constructed of noncombustible materials.
  - FRT wood framing and sheathing permitted within exterior walls assemblies of 2-hour rating or less.
  - The interior building elements are constructed of solid wood, laminated wood, heavy timber (HT) or structural composite lumber (SLC) without concealed spaces.
    - Materials are unprotected, relying on their mass for a considerable degree of fire resistance.

Type IV Construction
Section 602.4.2

- Cross-laminated timber (CLT) also permitted for use in exterior walls of Type IV buildings where:
  - Minimum of 6 inches in thickness
  - Rating of exterior wall is 2 hours or less
- In addition, the exterior surface of the CLT is to be protected by:
  - FRT wood sheathing at least 15/32-inch thick, or
  - Gypsum board at least ½-inch in thickness, or
  - A noncombustible material.
Type V Construction
Section 602.5

- Typically, the structural members and exterior walls of a Type V building are standard wood-frame construction.
- For Type VA construction, building elements are to be protected minimum 1 hour in accordance with Table 601.
- For Type VB construction, building elements are not required to be protected.

Notes to Table 601
Note a

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

Notes to Table 601
Note b

- For those buildings that require fire-resistance-rated roof construction, including primary structural frame members, such protection is not required if every part of the roof is at least 20 feet above the floor below.
- The elimination of the required fire resistance is not permitted in Group F-1, H, M and S-1 occupancies due to the possible extensive fire loading and the potential for such combustible loading to be located close to the roof height.
Notes to Table 601
Note b

- Unprotected roof at minimum 20-foot height
- Fire protection of roof structural members including framing and decking, not required
- Applies to all occupancies except Groups P-1, R, M, and S-1
- Applicable to all protected construction types
- For SI: 1 foot = 304.8 mm

Notes to Table 601
Note c

- In other than Type IA construction, the roof is permitted to be of heavy timber construction as specified in:
  - Section 2304.11.3 for roof framing.
  - Section 2304.11.4 for roof decks.

Notes to Table 601
Note d

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

Notes to Table 601
Note e

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

- Where load-bearing structural members are located within the exterior walls or on the outside of a building or structure, the provisions of Section 704.10 shall comply.

Final Reflection

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

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