## 2015 IBC Allowable Heights and Areas


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## Course Description

- This seminar addresses the key issues of the 2015 International Building Code ${ }^{\circledR}$ (IBC ${ }^{\circledR}$ ) Chapter 5 regarding the determination of a building's allowable height and area.
- The process for correctly evaluating a building for allowable height and area relies on a systematic approach, including the determination of occupancy classification and construction type.


## Goal

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- Participants will be able to use:
- Table 504.3 to determine the allowable height in feet of a building.
- Table 504.4 to determine the allowable height in stories above grade plane of a building.
- Table 506.2, along with permitted frontage increases
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$\qquad$ of Section 506.3, to determine the allowable floor area of a building.
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## Objectives

Upon completion, participants will be better able to:

1. Describe the purpose for regulating a building's allowable height and area.
2. Identify the relationship of a building's occupancy classification(s) and type of construction to a building's allowable height and area.
3. Determine how a building's actual height, both in stories above grade plane and feet, and floor area are calculated
4. Determine how a building's allowable height, both in stories above grade plane and feet, and area are determined.
5. Apply the special provisions applicable to mixed occupancies, unlimited area buildings and horizontal building separations.

## Course Overview

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- Module I - Concept of Allowable Heights and Areas
- Module 2 - Relationship of Building Classification
- Module 3 - Calculation of Actual Building Height and Area
- Module 4 - Special Building Height and Area Provisions
- Module 5 - Determining Maximum Allowable Building Height
- Module 6 - Determining Maximum Allowable Building Area $\qquad$
- Module 7 - Additional Limitations and Allowances
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## 2015 IBC Allowable Heights and Areas

## Allowable Height and Area Introduction

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

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

Tabular Height and Area Values Tables 504.3, 504.4 and 506.2

- Tables 504.3, 504.4 and 506.2 are the foremost $\qquad$ code provisions used in establishing "equivalent risk"-offsetting a building's inherent fire hazard-represented by group-with materials
$\qquad$ and construction features.


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## Tabular Height and Area Values Tables 504.3, 504.4 and 506.2

- The application of Tables 504.3, 504.4 and 506.2 is 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 tabular values for allowable height in feet, allowable number of stories above grade plane, and allowable building floor area per story.

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Tabular Height and Area
Tables 504.3, 504.4 and 506.2

- The height and area tables provide insight to the hierarchy of occupancies and construction types.
- Tabular allowable heights and areas vary based on the degree of hazard anticipated.
- Examples for nonsprinklered buildings include:
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## Allowable Height and Area Use of Fire Walls

- One or more fire walls complying with Section 706 may be also utilized to gain compliance with allowable height and area.

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## Building Classification

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It is critical that a building be classified according to the occupancy group and the type of construction prior to determining the building's allowable height and area.

The maximum building size is based on the specific occupancy groups within the building, as well as the materials of construction and the building's degree of
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$\qquad$ fire resistance.
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## Occupancy Classification Chapter 3

Evaluate the building for use and $\qquad$ occupancy:

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

## Section 302.1

## Occupancy Groups

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

## Section 302.1

- Where a room or space is to be occupied for different types of uses at different times, all of the requirements applicable to each of the uses must be considered.
- Those buildings that contain two or more distinct occupancy classifications must comply with the provisions of Section 508 for mixed-occupancy buildings.
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## Occupancy Classification Section 302.1

- When in doubt, it is important that an occupancy classification be assigned that most nearly resembles those occupancies with similar fire safety and life safety risks.
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| Occupancy Classification Section 302.1 |  |  |
| :---: | :---: | :---: |
|  |  |  |
| Types of Use | General Occupancy Group | Occupancy SubGroups |
| Assembly | Group A | A-1, A-2, A-3, A-4, A-5 |
| Business | Group B | None |
| Educational | Group E | None |
| Factory and Industrial | Group F | F-1, F-2 |
| High Hazard | Group H | H-1, H-2, H-3, H-4, H-5 |
| Institutional | Group I | I-1, I-2, I-3, I-4 |
| Mercantile | Group M | None |
| Residential | Group R | R-1, R-2, R-3. R-4 |
| Storage | Group S | S-1, S-2 |
| Utility | Group U | None |
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## Type of Construction Chapter 6

- 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.


## Type of Construction Section 602.1

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

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## 2015 IBC Allowable Heights and Areas

## Actual Building Height and Area Introduction

- The IBC establishes a specific approach to $\qquad$ establishing a building's actual:
- Height in feet
- Height in stories above grade plane
- Floor area
- This determination may not necessarily be consistent with the height and area established by zoning regulations, real estate terminology, and other uses.


## General Building Area Limitations Section 503

- The area of a building is limited to that established by Table 506.2, along with any permitted increase due to the presence of significant exterior open space at the building's perimeter.
- Before calculating the maximum allowable area, it is necessary to determine the actual floor area of the building on a story-by-story basis. $\qquad$
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## Building Area

## Section 202

- For that portion of the building not surrounded by exterior walls, the building area is considered the floor area within the horizontal projection of the roof or floor above.



## General Building Height Limitations Section 503

- The height of a building is limited to that established by Tables 504.3 and 504.4.
- Before calculating the maximum allowable height (in both feet and stories above grade plane), it is necessary to determine the actual height of the building.
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## Building Height (in feet)

## Section 202

- Building height (in feet): Defined as the $\qquad$ 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. $\qquad$
- Grade plane is established by definition as the average of finished ground level adjoining the building.
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## Building Height

## Section 202

- Building height is not measured to the top of a parapet wall.

Height of building is the vertical distance above grade plane measured to:

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## Building Height (in stories) <br> Table 504.4

- The allowable height limitations on stories based on Table 504.4 are only applicable to stories considered as "stories above grade plane."
- Unlike the limitation on height in feet, the limits on allowable stories above grade plane vary significantly based on the occupancy classification of the building.


## Story Above Grade Plane

## 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.

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## Special Provisions Introduction

- It is important that all special allowances and $\qquad$ limitations in the determination of allowable building height and area be reviewed for application. $\qquad$
- Key special provisions include:
- Special industrial occupancies $\qquad$
- Buildings on the same lot
- Mezzanines $\qquad$
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## Special Industrial Occupancies Section 503.1.1

- Buildings containing special industrial processes that require large floor areas and/or unusual heights are exempt from the height and area limitations of Sections 504 and 506.
- The allowance is limited to low-hazard and moderate-hazard occupancies housing manufacturing and energy-producing uses (typically classified as Groups F-1 and F-2).
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## Special Industrial Occupancies <br> Section 503.1.1

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

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

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## Buildings on the Same Lot Section 705.3

- If viewed as separate buildings, an imaginary $\qquad$ line (location 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 $\qquad$ buildings on adjacent lots insofar as fire separation distance is concerned. $\qquad$
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## Buildings on Same Lot Example 1

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Note: Imaginary line may be located to take best advantage of provisions. For St 1 foot $=304.8 \mathrm{~mm}$.

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## Buildings on Same Lot <br> Example 2



## Mezzanines <br> 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, because an intermediate floor level can also be considered an additional story.
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## Mezzanines <br> Section 505

The use of mezzanine provisions focuses on the fact that:

- Mezzanines do not contribute to the number of stories in the building
- Mezzanines do not contribute to the building area.



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## Mezzanine Openness

## Section 505.2.3

- A mezzanine is intended to be open and unobstructed to the room in which the mezzanine is located.
- A variety of exceptions allow for the mezzanine to be enclosed.

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## Allowable Building Height Introduction

- Once the actual building height is determined, in both feet and stories above grade plane, it cannot exceed the allowable height as determined by $\qquad$ Section 504 based on:
- Occupancy classification $\qquad$
- Type of construction
- Where towers, steeples, spires and other rooftop structures are provided, specific provisions are to be applied.


## Height Increase for Sprinklers Section 504.1

- The tabular limits on height in both feet and stories are typically greater where the building is protected by an automatic sprinkler system.
- Tables 504.3 and 504.4 identify the type of sprinkler system required to receive any sprinkler increase.
- S = buildings equipped throughout with an NFPA 13 system $\qquad$
- S13R = buildings equipped throughout with an NFPA 13R system $\qquad$
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## Allowable Height Increase Section 504.2

- A building with an NFPA 13 sprinkler system $\qquad$ throughout is typically permitted to be 20 feet and 1 story higher than allowed for a similar nonsprinklered building.
- This increased height is permitted in addition to that for allowable area as indicated in Table 506.2.

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## Group R Occupancies

Tables 504.3 and 504.4

- If the building is a Group R occupancy sprinklered with an NFPA 13R system, the 1story and 20 -foot increases are also applied; however, the building cannot exceed a total of 4 stories or 60 feet in height as reflected in the tables.
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## Group R Occupancies <br> Example 2

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- Solution:

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## Allowable Height Increase <br> Tables 504.3 and 504.4

- Occupancies where the installation of an automatic sprinkler system does not provide for an increase in allowable height include:
- Group I-2 occupancies in Type IIB, III, IV and V buildings.
- Group $\mathrm{H}-1, \mathrm{H}-2, \mathrm{H}-3$ and $\mathrm{H}-5$ occupancies.
- In these high-hazard occupancies, sprinkler protection is such an integral part of the building's overall protection package that no additional benefit is granted. $\qquad$
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## Roof Structures

## Section 504.3, Exception

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

- Exception to Section 504.3, which 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.

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## Allowable Building Area Section 506

- Building area is limited to that established by Table 506.2, along with any permitted increase due to 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.
- The allowable area of each story must be determined, and then the entire building must be analyzed for compliance.
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## Automatic Sprinkler System Increase

 Table 506.2- The presence of a sprinkler system can provide $\qquad$ 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:
- an increase of 300 percent for one-story buildings
- an increase of 200 percent for multistory buildings
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## Automatic Sprinkler System Increase Table 506.2

- The allowable area increase reflected in Table $\qquad$ 506.2 for the installation of an automatic sprinkler system is only applicable where an $\qquad$ NFPA 13 system is provided throughout the building.
- In addition, Table 506.2 does not provide for a $\qquad$ sprinkler increase for:
- Group H-1 occupancies $\qquad$
- Portions of buildings classified as Group $\mathrm{H}-2$ or $\mathrm{H}-3$

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## 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 $\left(I_{f}\right)$ for allowable area purposes:

$$
I_{f}=[F / P-0.25] W / 30
$$

$I_{f} \quad=\quad$ Area factor increase due to frontage
$F \quad=\quad$ Building perimeter that fronts on a public way or open space having 20 feet open minimum distance
$P \quad=\quad$ Perimeter of entire building
$W \quad=\quad$ Width of public way or open space per Section 506.3.2 $\qquad$
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)
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## Width Limits <br> Section 506.3.2, Exception

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

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## Open Space Limits

## Section 506.3.1

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

 Section 506.3.1
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## Open Space Availability Introduction

- Three issues to consider when evaluating potential yards for use as open space in the determination of a frontage increase:

1. What type of public and common spaces are permitted to be utilized for frontage increases?
2. How is the frontage increase calculated for a common yard shared by two buildings on the same lot?
3. Does the presence of a fire wall affect the allowable area calculation for a frontage increase?

## Open Space Availability Introduction

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



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## Open Space Availability Section 506.3.2

- The entire open space between two buildings on the same lot is available for a potential frontage increase for both buildings.
- For the purpose of determining the width of the yard, no imaginary line between the buildings is assumed.
- The entire width of the yard can be used by both buildings.
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## Open Space Availability <br> Section 506.3.2, Item 3

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

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## Allowable Area Determination

 Section 506.2- Determination of the allowable area of a building
$\qquad$ 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
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## 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:

$$
A_{a}=A_{t}+\left(N S \times l_{f}\right)
$$

$\qquad$
$A_{a}=$ Allowable building area
$A_{t}=$ Tabular allowable area factor (NS, S1, or S13R value, as applicable) in Tabular allowable area factor
accordance with Table 506.2 $\qquad$
$N S=$ Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether building is sprinklered) $=$ Area factor increase due to frontage in accordance with Section 506.3

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## Allowable Area Determination Mixed-Occupancy, One-Story Section 506.2.2

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

$$
A_{a}=A_{t}+\left(N S \times I_{t}\right)
$$

- The determination shall comply with the applicable provisions of Section 508.1 for each applicable occupancy. Refer to discussion of Section 508.


## Allowable Area Determination Mixed-Occupancy, One-Story Example

- Given: A one-story, 78,000-square foot, fully sprinklered building with three occupancy groups as shown. The building is of Type IIB construction and adjoins two public ways that qualify for a 25 -percent frontage increase.
- Determine: Does the building comply with the allowable area limitations based on separated occupancies?

$$
a_{B} / A_{B}+a_{M} / A_{M}+a_{A-2} / A_{A-2} \leq 1.0 ?
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## Allowable Area Determination Single-Occupancy, Multistory Section 506.2.3

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

$$
A_{a}=\left[A_{t}+\left(N S \times I_{f}\right)\right] \times S_{a}
$$

$A_{a}=$ Allowable building area
$A_{t}=$ Tabular allowable area factor (NS, S1, or S13R value, as applicable) in accordance with Table 506.2
NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether building is sprinklered) $I_{f}=$ Area factor increase due to frontage in accordance with Section 506.3
$S_{a}=$ Actual number of building stories above grade plane, not to exceed Actual number of building stories above grade plane, no
three. (not to exceed four for 13R sprinklered buildings)
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## Allowable Area Determination Single-Occupancy, Multistory Section 506.2.3

- No individual story shall exceed the allowable area $\left(A_{a}\right)$ as determined by the equation:

$$
A_{a}=\left[A_{t}+\left(N S \times I_{t}\right)\right] \times S_{a}
$$

- Using the value of $S_{a}=1$ $\qquad$
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## Example 2

- Solution: $A_{a}=\left[A_{t}+\left(N S \times I_{f}\right)\right] \times S_{a}$

| Tabular area $\left(A_{t}\right):$ | $72,000 \mathrm{sf}$ | S1, T506.2 |
| :--- | :---: | :--- |
| Frontage increase $\left(N S \times I_{f}\right):$ | $\underline{4,500 \mathrm{sf}}$ | $18,000 \times 0.25$ |
|  | $76,500 \mathrm{sf}$ | Additive |
| Multistory increase $\left(S_{a}\right)$ | $\frac{\mathrm{x} \mathrm{2}}{}$ | 2 stories AGP |
| Total allowable area $\left(A_{a}\right):$ | $153,000 \mathrm{sf}$ |  |

The building is limited to $153,000 \mathrm{sf}$, and no single story is permitted to exceed 76,500 sf.
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| Allowable Area Determination |  |  |
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| Single-Occupancy, Multistory |  |  |
| Example 3 |  |  |
| Solution: $A_{a}=\left[A_{t}+\left(N S \times I_{f}\right)\right] \times S_{a}$ |  |  |
| Tabular area $\left(A_{t}\right)$ : | 72,000 sf | S1, T506.2 |
| Frontage increase ( $N S \times I_{f}$ ): | 4,500 sf | 18,000 x 0.25 |
|  | 76,500 sf |  |
| Multistory increase ( $S_{a}$ ) | ¢ 3* | Limit on stories |
| Total allowable area ( $A_{a}$ ): | 229,500 sf |  |
| The building is limited to $229,500 \mathrm{sf}$, and no single story is permitted to exceed 76,500 sf. If all stories have the same floor area, it would result in a maximum of 57,375 sf per story. |  |  |
| 20.5 BeC Alowabie Heghts and Areas |  |  |

## Allowable Area Determination Mixed-Occupancy, Multistory Section 506.2.4

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


## Allowable Area Determination Mixed-Occupancy, Multistory Section 506.2.4

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


## 2015 IBC Allowable Heights and Areas

## Allowable Area Determination Mixed-Occupancy, Multistory Section 506.2.4

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


## Allowable Area Determination Mixed-Occupancy, Multistory Example

- Given: A fully sprinklered, four-story, Type IIA hotel, containing a Group A-2 restaurant, Group A-3 meeting rooms and Group M retail stores. The floor areas of each occupancy are as shown in the following slide. Inadequate frontage provides for no area increase.
- Determine: Does the building comply with the allowable height and area provisions of Chapter 5 using the "separated occupancies" method?
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F 2015 IBC Allowable Heights and Areas $\qquad$

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## 2015 IBC Allowable Heights and Areas


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## Mixed Occupancy Area Determination Section 506.5

- Further information required to evaluate $\qquad$ 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 $\qquad$ chosen by the designer:
$\qquad$
- Nonseparated occupancies
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- Separated occupancies
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## 2015 IBC Allowable Heights and Areas


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## Unlimited Area Buildings <br> Section 507

- The provisions of Section 507 allow for buildings $\qquad$ with large floor areas to be constructed with no requirement for:
- Fire-resistance-rated construction, or
- Fire walls.
- The area limitations of Sections 503 and 506 are not applicable where compliance with Section 507 is achieved. $\qquad$
- Risks have been addressed to the point that the regulation for allowable area is unnecessary. $\qquad$
$\qquad$


## Unlimited Area Buildings

Section 507

- Concept based on four main criteria:
- Limited height
- Moderate-hazard and low-hazard occupancies
- Significant open frontage
- Sprinkler protection
- This section provides alternative approach to regulating building size
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## 2015 IBC Allowable Heights and Areas

## Unlimited Area Buildings Section 507

- Although the allowance for unlimited floor area typically permits the building to be of any construction type, the actual type of construction will be important in the application of other code provisions, such as:
- Accessory occupancies
- Group H occupancies in unlimited area Group F and S occupancies
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## Unlimited Area Buildings Section 507.1.1

- The use of the unlimited area provisions is limited to those occupancies specifically addressed in Section 507, but other occupancies are permitted where in compliance with Section 508.2 (Accessory Occupancies). $\qquad$
Example:



## Reduced Open Space

Section 507.2.1

- Open space of at least 60 feet ( 18288 mm ) must be provided around complying unlimited area buildings. The minimum 60 -foot width is permitted to be reduced to 40 feet provided:
$\qquad$
- The reduced open space applies to a maximum of 75 percent of the building's perimeter, and $\qquad$
- A minimum 3-hour fire-resistance rating is required for any exterior wall facing the reduced open space, and $\qquad$
- Openings in the exterior wall facing the reduced open
$\qquad$ hours.
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## 2015 IBC Allowable Heights and Areas



## Reduced Open Space <br> Section 507.2.1

- The allowance for reducing the required open space from 60 feet to 40 feet is only permitted for the following unlimited area buildings:
- One-story nonsprinklered Groups F-2 and S-2 (507.3).
- One-story sprinklered Groups B, F, M, S and A-4 (507.4)
- Two-story sprinklered Groups B, F, M and S (507.5).
- One-story sprinklered Group A-3 (507.6 and 507.7).
- One-story sprinklered motion picture theaters (507.12). $\qquad$
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$\qquad$


## One-story Nonsprinklered Buildings

 Section 507.3- A one-story building housing a Group F-2 and/or $\qquad$ S-2 occupancy is permitted to be unlimited in area if it is completely surrounded by minimum $\qquad$ 60 -foot public ways and/or yards. $\qquad$ order to obtain unlimited area status because
$\qquad$ the occupancies involved are not expected to have any significant fire loading.
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## 2015 IBC Allowable Heights and Areas

## One- and Two-story Sprinklered Buildings Sections 507.4 and 507.5

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


## One-story Group A-4 Occupancies

 Section 507.4- Group A-4 occupancies are granted unlimited area in a manner consistent with that for B, F, M and S occupancies with two exceptions:
- The Group A-4 building can be only one story in height.
- The building's construction must be of Type I, II, III or IV.


## Group A-1 and A-2 Occupancies

 Section 507.4.1- In complying unlimited area buildings housing Group A-4, B, F, M and/or S occupancies, it is permissible to include a limited amount of Group A-1 and A-2 occupancies within the building.
- The type of construction of the building must be Type I, II, III or IV.
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## 2015 IBC Allowable Heights and Areas

## Group A-1 and A-2 Occupancies Section 507.3.1 (continued)

- The Group A-1 and A-2 occupancies shall be separated from other spaces as required by Section 508.4 .4 for separated occupancies with no reduced rating allowed for sprinkler protection. This will result in a minimum 2-hour fire-resistance-rated separation.
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## Group A-1 and A-2 Occupancies Section 507.4.1 (continued)

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


## Group A-3 Buildings

Sections 507.6 and 507.7
The area of a Group A-3 occupancy is permitted to $\qquad$ be unlimited under the following conditions:

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


## 2015 IBC Allowable Heights and Areas

## Group A-3 Buildings

Sections 507.6 and 507.7 (continued)

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


## Group H Occupancies Section 507.8

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


## Group H Occupancies Section 507.8

- Aggregate floor area of Group H occupancies located at the building's perimeter limited to 10 percent of the actual building area or Group H allowable area per Section 506 with any applicable frontage increase.
- Aggregate floor area of Group H occupancies not located on perimeter of building are limited to 25 percent of Group H area limits as specified $\qquad$ in Section 506.
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## 2015 IBC Allowable Heights and Areas

## Other Unlimited Area Buildings Sections 507.9 through 507.13

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

- Mixed-occupancy buildings with Group H-5 (507.9)
- Group H-2 aircraft paint hangars (507.10)
- Group E educational buildings (507.11)
- Group A-1 motion picture theaters (507.12)
- Covered mall buildings and anchor stores (507.13)


## Mixed Occupancies

## Section 508

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

The scope of Section 508 is limited to:

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


## Mixed Occupancies

Section 508

- Three design options for compliance in mixedoccupancy buildings are established:
- Accessory occupancies
- Nonseparated occupancies
- Separated occupancies
- Each design option varies in its approach to allowable building height and area


## 2015 IBC Allowable Heights and Areas

## Accessory Occupancies

## Section 508.2

- Must be subsidiary to the main occupancy of the building or portion of a building.
- Aggregate accessory occupancies are limited to 10 percent of the floor area on the story on which they are located.
- The floor area of accessory occupancies cannot exceed the tabular values established by Table 506.2 for nonsprinklered buildings for each such accessory occupancy.
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## Accessory Occupancies <br> Section 508.2 <br> Allowable Area and Allowable Height

- The allowable area of any accessory occupancy is to be based on that of the main occupancy. $\qquad$
- The allowable height and number of stories of the building shall comply with Section 504 for the main occupancy of the building.
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## 2015 IBC Allowable Heights and Areas

## Accessory Occupancies

## Section 508.2



## Nonseparated Occupancies Section 508.3

- Occupancies are not required to be separated if they are in compliance with the provisions of Section 508.3. If the building is designed in part to $\qquad$ address the most restrictive and most hazardous conditions that are expected to occur, a fire-resistance-rated separation is not necessary.
- The worst-case application of the type of construction (allowable height and area) and fire protection provisions forms the basis for this option.
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## Nonseparated Occupancies

## Section 508.3

Allowable Area and Allowable Height is:

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


## 2015 IBC Allowable Heights and Areas

## Nonseparated Occupancies Section 508.3

- Frontage increases to Table 506.2 are permitted for open space and sprinkler protection, where applicable.
- The most restrictive height and area allowance of the occupancies under consideration is then applied to the entire building.
- Most restrictive type of construction is applied

$\qquad$


## Nonseparated Occupancies

Section 508.3.2

|  | Group M | Group A-2 | Group B |
| :--- | :---: | :---: | :---: |
| Allowable Area <br> (square feet) | 29,700 | 19,800 | 29,700 |
| Allowable Height <br> (number of stories) | 2 | 2 | 3 |

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

## 2015 IBC Allowable Heights and Areas

## Separated Occupancies Section 508.4

- This is the only method that potentially requires a fire-resistance-rated separation between adjacent occupancies.
- Table 508.4 establishes the degree of fire resistance that is mandated.
- It is also possible that no separation is required.
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## Separated Occupancies <br> Section 508.4

## Allowable area

- The unity formula is used to determine allowable area per story. This provides a weighted average of the allowable areas for the different occupancies located on each story.
- Compliance is achieved where the sum of the ratios of the actual floor area divided by the allowable floor area for each of the occupancies $\qquad$ involved does not exceed 1.


## Separated Occupancies Section 508.4

## Allowable area

- The formula is:

$$
\mathrm{a}_{1} / \mathrm{A}_{1}+\mathrm{a}_{2} / \mathrm{A}_{2}+\mathrm{a}_{3} / \mathrm{A}_{3}+\ldots \leq 1.0
$$

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Where $a_{1}, a_{2}$ and $a_{3}$ represent the actual floor areas of the individual occupancies, and $A_{1}, A_{2}$ and $A_{3}$ represent the maximum allowable floor $\qquad$ areas
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## 2015 IBC Allowable Heights and Areas


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## 2015 IBC Allowable Heights and Areas

## Separated Occupancies Section 508.4 <br> Allowable height

- The maximum allowable height of each occupancy is regulated independently based on
$\qquad$ the building's type of construction.
- An occupancy cannot be located higher than that permitted by Section 503.1.


## Separated Occupancies <br> Section 508.4



## Special Provisions <br> 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 $\qquad$ provisions are optional.


## 2015 IBC Allowable Heights and Areas

## Special Provisions <br> Section 510

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

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## 2015 IBC Allowable Heights and Areas

## Horizontal Building Separation Allowance Section 510.2

- Vertical enclosures through horizontal assembly to have a minimum fire-resistance rating of 2 hours (see exception for 3-hour/1-hour allowance).
- Building above horizontal assembly limited to Group A with individual occupant loads less than 300, B, M, R and/or S .
- Building below horizontal assembly to be any occupancy other than Group H.
- Maximum building height in feet based on most restrictive height of the upper and lower buildings.
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## Horizontal Building Separation Allowance Section 510.2

Requirements to be considered as separate and distinct buildings:

- Lower building of Type IA construction.
- Lower building separated from building above with horizontal assembly having a minimum fire-resistance rating of 3 hours. $\qquad$
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## 2015 IBC Allowable Heights and Areas

## Parking Beneath Group R <br> Section 510.4

- Special provisions are provided where a Group S-2 enclosed parking garage is located below a Group S-2 open parking garage.





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## 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. $\qquad$
- 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. $\qquad$
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## 2015 IBC Allowable Heights and Areas


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## Buildings of Type IIA and IIIA Construction Sections 510.5, 510.6

For example, in Type IIA buildings the height limitation may be increased to 9 stories and 100 feet, where:

- The building is separated by at least 50 feet from any other building on the lot and from lot lines.
- The exits are segregated in an area enclosed by a minimum 2-hour fire-resistance-rated fire wall.
- The first floor construction has a minimum fire-resistance rating of $11 / 2$ hours. $\qquad$
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## 2015 IBC Allowable Heights and Areas

## 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 lower level(s) 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.


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

Exits from open parking garage to discharge directly to public way and separated from
Exits from open parking garage to discharge directiy to pubbic way and separated fro
basement of first story by minimum 2 -hour fire bariers and/or horizontal assemblies

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## Multiple Buildings Above <br> Group S-2 Parking Garages <br> Section 510.9

- Where the varying provisions of Section 509 are used to create separate buildings above and below a complying horizontal separation, it is permissible to have multiple buildings above the separation. $\qquad$
- This allowance is limited to those cases where there is a single open or enclosed parking $\qquad$ garage below the horizontal separation.
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## 2015 IBC Allowable Heights and Areas


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## 2015 IBC Allowable Heights and Areas



