Highlighted Code Considerations for Multi-Family Housing

City of Phoenix

IBC 504/506 – Height/Area Modifications

- **504 Height Modifications.**
  - NFPA 13 Sprinkler
    - +20 ft./+1 story
  - NFPA 13R Sprinkler
    - +20 ft./+1 story (max. 60 ft./4 stories)
- **506 Area Modifications**
  - 506.2 Frontage increase.
    - I_f (max. I_f = 0.75)
  - 506.3 NFPA 13 sprinkler increase.
    - I_s (max. I_s = 3 for 1 story, I_s = 2 for 2+ stories)
- Exception - Can't use Height/Area Increases **and** Table 601, Note d 1-hour fire-resistance rated construction substitution.

2

[F] 903.3.1.1 NFPA 13 sprinkler systems. Where the provisions of this code require that a building or portion thereof be equipped throughout with an *automatic sprinkler system* in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 except as provided in Section 903.3.1.1.1.

[F] 903.3.1.2 NFPA 13R sprinkler systems. *Automatic sprinkler systems* in Group R occupancies up to and including four stories in height shall be permitted to be installed throughout in accordance with NFPA 13R.

504.2 Automatic sprinkler system increase. Where a building is equipped throughout with an *approved automatic sprinkler system* in accordance with **Section 903.3.1.1**, the value specified in Table 503 for maximum *building height* is increased by 20 feet and the maximum number of *stories* is increased by one. These increases are permitted in addition to the *building area* increase in accordance with Sections 506.2 and 506.3. For **Group R buildings** equipped throughout with an *approved automatic sprinkler system* in accordance with **Section 903.3.1.2**, the value specified in Table 503 for maximum *building height* is increased by 20 feet and the maximum number of *stories* is increased by one, but **shall not exceed 60 feet or four *stories***, respectively.

Exception: The use of an *automatic sprinkler system* to increase *building heights* shall not be permitted for the following conditions:

3. Buildings where an *automatic sprinkler system* is substituted for fire-resistance rated construction in accordance with Table 601, Note d.

506.1 General. The *building areas* limited by Table 503 shall be permitted to be increased due to frontage *(If)* and *automatic sprinkler system* protection *(Is)* in accordance with Equation 5-1:

$Aa = \{At + [At \times If] + [At \times Is]\}$ **(Equation 5-1)**

where:

Aa = Allowable *building area* **per *story*** (square feet).

At = Tabular *building area* **per *story*** in accordance with Table 503 (square feet).

If = Area increase factor due to frontage as calculated in accordance with Section 506.2.

Is = Area increase factor due to sprinkler protection as calculated in accordance with Section 506.3.

506.2 Frontage increase. Every building shall adjoin or have access to a *public way* to receive a *building area* increase for frontage. Where a building has more than 25 percent of its perimeter on a *public way* or open space having a width of not less than 20 feet, the frontage increase shall be determined in accordance with Equation 5-2:

$If = [F/P - 0.25]W/30$ **(Equation 5-2)**

where:

If = Area increase due to frontage.

F = Building perimeter that fronts on a *public way* or open space having 20 feet open minimum width (feet).

P = Perimeter of entire building (feet).

W = Width of *public way* or open space (feet) in accordance with Section 506.2.1.

[A] PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

Commentary to 2012 IBC **506.2 Frontage increase**

**The allowable area of a building is permitted to be increased when it has a certain amount of frontage on streets or open spaces since this provides access to the structure by fire service personnel, a temporary refuge area for occupants as they leave the building in a fire emergency and a reduced exposure to and from adjacent structures.*

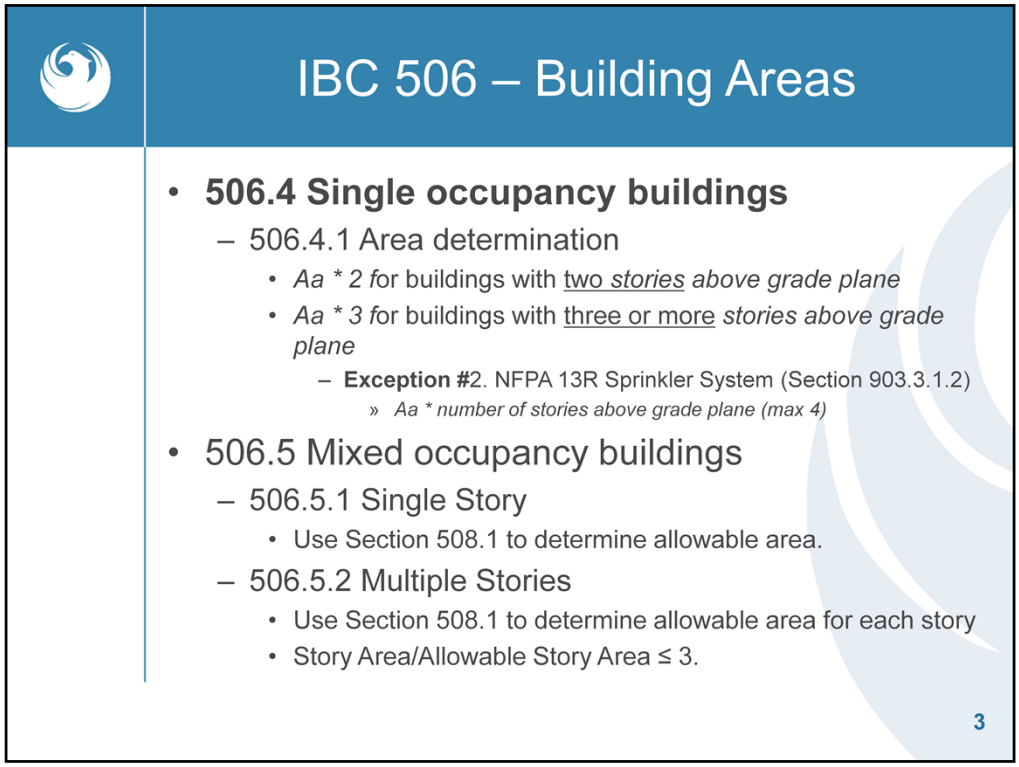
506.3 Automatic sprinkler system increase. Where a building is equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1, the *building area* limitation in Table 503 is permitted to be increased by an additional 200 percent (*I*s = 2) for buildings with more than one *story above grade plane* and an additional 300 percent (*I*s = 3) for buildings with no more than one *story above grade plane*. These increases are permitted in addition to the height and *story* increases in accordance with Section 504.2.

Exception: The use of an *automatic sprinkler system* to increase the building area limitation shall not be permitted for the following conditions:

3. Buildings where an *automatic sprinkler system* is substituted for fire-resistance rated construction in accordance with Table 601, Note d.

Commentary

Please note that under Section 504.2 Group R-2 occupancy buildings are allowed a height increase when an NFPA 13R sprinkler system, as stipulated in Section 903.3.1.2, is provided. However, such a system will not allow an area increase under the requirements of this section. To achieve both height and area increases in a Group R occupancy building, an NFPA 13 system must be installed.



506.4 Single occupancy buildings with more than one story. The total allowable *building area* of a single occupancy building with more than one *story above grade plane* shall be determined in accordance with this section. The actual aggregate *building area* at all *stories* in the building shall not exceed the total allowable *building area*.

Exception: A single *basement* need not be included in the total allowable *building area*, provided such *basement* does not exceed the area permitted for a building with no more than one *story above grade plane*.

506.4.1 Area determination. The total allowable *building area* of a single occupancy building with more than one *story above grade plane* shall be determined by multiplying the allowable *building area* per *story* (*Aa*), as determined in Section 506.1, by the number of *stories above grade plane* as listed below:

For buildings with two *stories above grade plane*, multiply by 2;

For buildings with three or more *stories above grade plane*, multiply by 3; and

No *story* shall exceed the allowable *building area* per *story* (*Aa*), as determined in Section 506.1, for the occupancies on that *story*.

Exceptions:

1. Unlimited area buildings in accordance with Section 507.

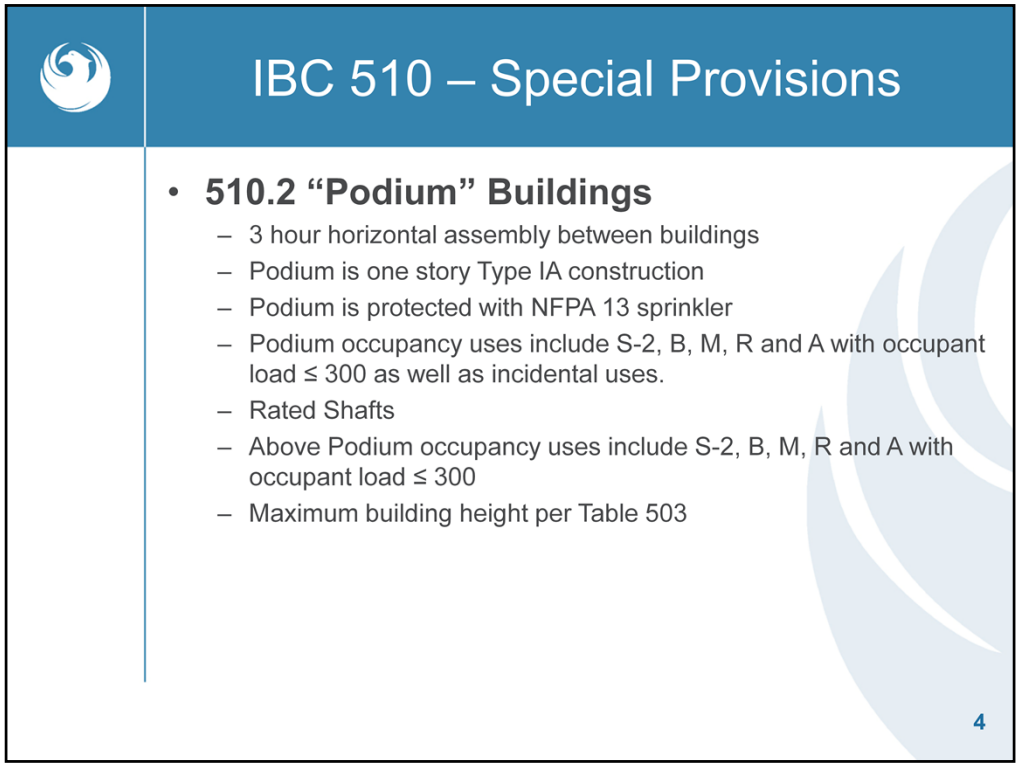
2. The maximum area of a building equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.2 shall be determined by multiplying the allowable area per *story (Aa),* as determined in Section 506.1, by the number of *stories above grade plane*.

506.5 Mixed occupancy area determination. The total allowable *building area* for buildings containing mixed occupancies shall be determined in accordance with the applicable provisions of this section. A single *basement* need not be included in the total allowable *building area*, provided such *basement* does not exceed the area permitted for a building with no more than one *story above grade plane*.

506.5.1 No more than one story above grade plane. For buildings with no more than one *story above grade plane* and containing mixed occupancies, the total *building area* shall be determined in accordance with the applicable provisions of Section 508.1.

506.5.2 More than one story above grade plane. For buildings with more than one *story above grade plane* and containing mixed occupancies, each *story* shall individually comply with the applicable requirements of Section 508.1. For buildings with more than three *stories above grade plane*, the total *building area* shall be such that the aggregate sum of the ratios of the actual area of each *story* divided by the allowable area of such *stories* based on the applicable provisions of

Section 508.1 shall not exceed 3.



510.1 General. The provisions in Sections 510.2 through 510.9 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable *building heights and areas* of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections 510.2 through 510.8 are to be considered independent and separate from each other.

510.2 Horizontal building separation allowance. 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:

The buildings are separated with a *horizontal assembly* having a *fire-resistance rating* of not less than 3 hours.

The building below the *horizontal assembly* is not greater than one *story above grade plane*.

The building below the *horizontal assembly* is of Type IA construction.

Shaft, *stairway*, *ramp* and escalator enclosures through the *horizontal assembly* shall have not less than a 2-hour *fire-resistance rating* with opening protectives in accordance with Section 716.5.

Exception: Where the enclosure walls below the *horizontal assembly* have not less than a 3-hour *fireresistance rating* with opening protectives in accordance with Section 716.5, the enclosure walls extending above the *horizontal assembly* shall be permitted to have a 1-hour *fire-resistance rating*, provided:

The building above the *horizontal assembly* is not required to be of Type I construction;

The enclosure connects fewer than four *stories*; and

The enclosure opening protectives above the *horizontal assembly* have a *fire protection rating* of not less than 1 hour.

The building or buildings above the *horizontal assembly* shall be permitted to have multiple Group A occupancy uses, each with an *occupant load* of less 300, or Group B, M, R or S occupancies.

The building below the *horizontal assembly* shall be protected throughout by an *approved automatic sprinkler system* in accordance with Section 903.3.1.1, and shall be permitted to be any of the following occupancies:

6.1. Group S-2 parking garage used for the parking and storage of private motor vehicles;

6.2. Multiple Group A, each with an *occupant load* of less than 300;

6.3. Group B;

6.4. Group M;

6.5. Group R; and

6.6. Uses incidental to the operation of the building (including entry lobbies, mechanical rooms, storage areas and similar uses).

The maximum *building height* in feet (mm) shall not exceed the limits set forth in Section 503 for the building having the smaller allowable height as measured from the *grade plane*.

Table 601 – Fire-Resistance for Building Elements

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[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] (see Section 202)	3[a]	2[a]	1	0	1	0	HT	1	0
Bearing walls Exterior[e, f] Interior	3 3[a]	2 2[a]	1 1	0 0	2 1	2 0	2 1/HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	$1^1/_2$[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	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 shall not be required, including protection of 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 shall be allowed where a 1-hour or less fire-resistance rating is required.

d. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be allowed to be substituted for 1-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of the code or used for an allowable area increase in accordance with Section 506.3 or an allowable height increase in accordance with Section 504.2. The 1-hour substitution for the fire resistance of exterior walls shall not be permitted.

e. Not less than the fire-resistance rating required by other sections of this code.

f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

g. Not less than the fire-resistance rating as referenced in Section 704.10

6-2 2012 INTERNATIONAL BUILDING CODE® COMMENTARY

5

PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

The columns;

Structural members having direct connections to the columns, including girders, beams, trusses and spandrels;

Members of the floor construction and roof construction having direct connections to the columns; and

Bracing members that are essential to the vertical stability of the primary structural frame under gravity loading shall be considered part of the primary structural frame whether or not the bracing member carries gravity *loads.*

Commentary

**The primary structural frame and secondary members must meet different standards of design and protection as specified in Chapters 6 and 7. The definitions of these two terms spell out which elements of a structure's framing system are part of the primary structural framing system essential to carrying the gravity loads of the building. Such elements are generally required to have greater fire-resistance protection (see commentary, Table 601 and Section 704).*

SECONDARY MEMBERS. The following structural members shall be considered secondary

members and not part of the *primary structural frame*:

Structural members not having direct connections to the columns;

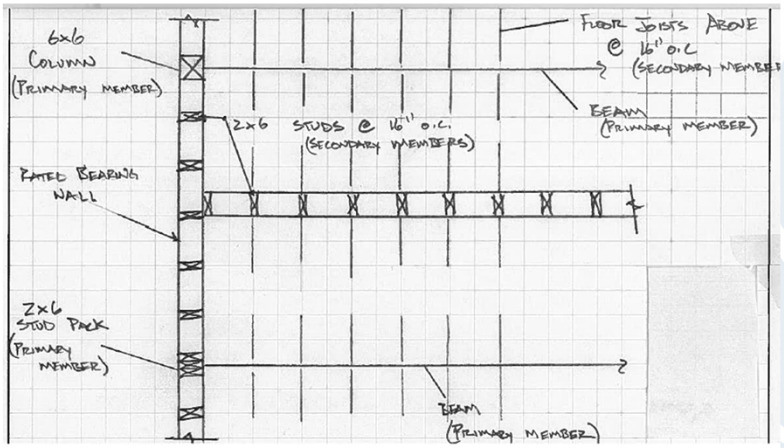
Members of the floor construction and roof construction not having direct connections to the columns; and

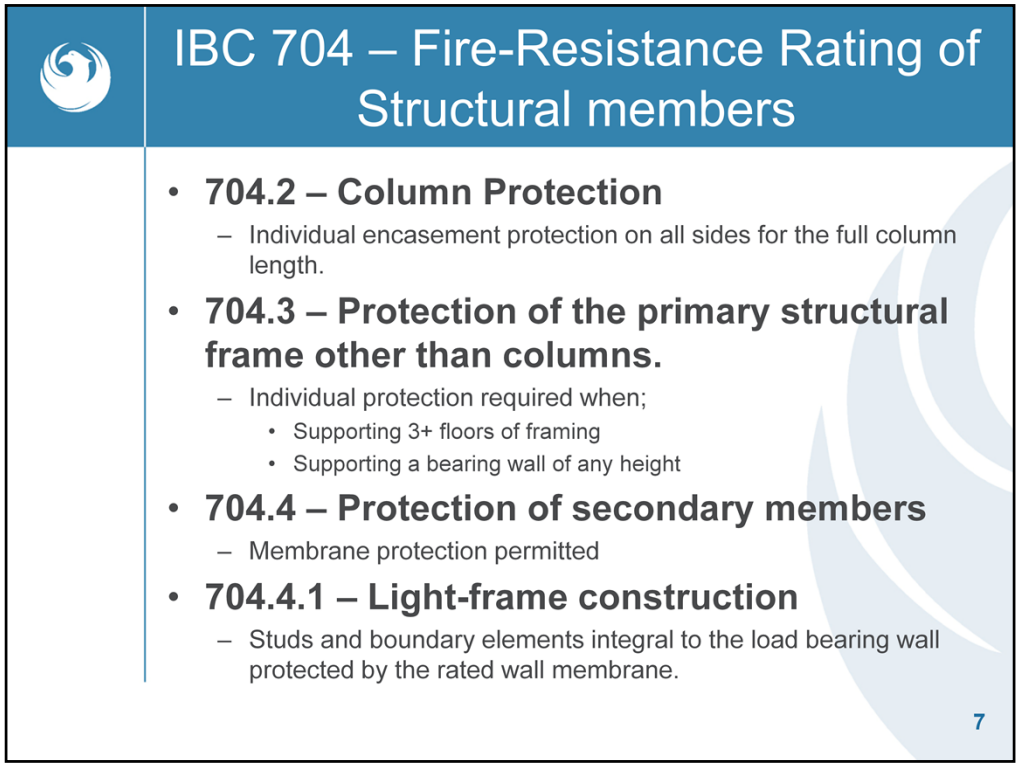
Bracing members other than those that are part of the *primary structural frame*.

Commentary

**This term works in conjunction with the term "primary structural frame" to distinguish which elements of a building's structure needs to receive various levels of fire-resistance protection. These requirements are found in Table 601 and Sections 704.*

What is a Column?



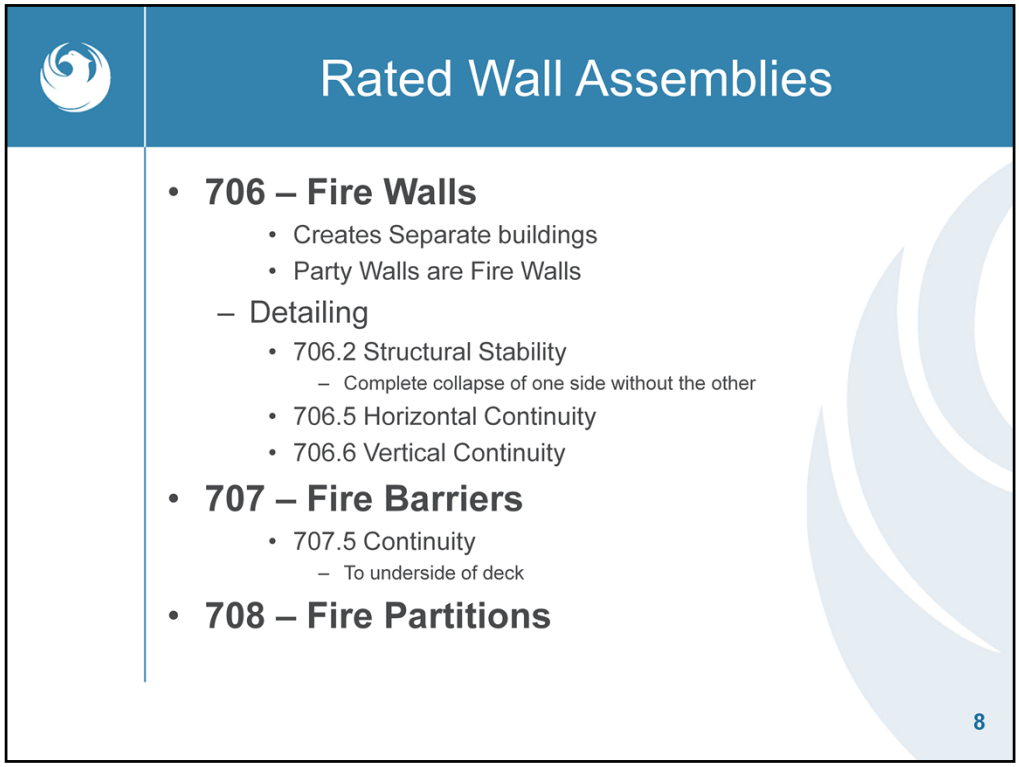


704.2 Column protection. Where columns are required to have protection to be fire-resistance rated, the entire column shall be provided individual encasement protection by protecting it on all sides for the full column length, including connections to other structural members, with materials having the required fire-resistance rating. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

704.3 Protection of the primary structural frame other than columns. Members of the primary structural frame other than columns that are required to have protection to achieve a fire-resistance rating and support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required fire-resistance rating.

704.4 Protection of secondary members. Secondary members that are required to have a *fire-resistance rating* shall be protected by individual encasement protection, by the membrane or ceiling of a *horizontal assembly* in accordance with Section 711, or by a combination of both.

704.4.1 Light-frame construction. King studs and boundary elements that are integral elements in *load-bearing walls* of light-frame construction shall be permitted to have required *fire-resistance ratings* provided by the membrane protection provided for the *load-bearing wall*.



SECTION 706 FIRE WALLS

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

706.1.1 Party walls. Any wall located on a *lot line* between adjacent buildings, which is used or adapted for joint service between the two buildings, shall be constructed as a *fire wall* in accordance with Section 706. Party walls shall be constructed without openings and shall create separate buildings.

706.2 Structural stability. Fire walls shall have sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall for the duration of time indicated by the required *fire-resistance rating* or shall be constructed as double fire walls in accordance with NFPA 221.

706.5 Horizontal continuity. *Fire walls* shall be continuous from *exterior wall* to *exterior wall* and shall extend at least 18 inches (457 mm) beyond the exterior surface of *exterior*

walls.

706.6 Vertical continuity. *Fire walls* shall extend from the foundation to a termination point at least 30 inches above both adjacent roofs.

SECTION 707 FIRE BARRIERS

707.1 General. *Fire barriers* installed as required elsewhere in this code or the *International Fire Code* shall comply with this section.

707.5 Continuity. *Fire barriers* shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such *fire barriers* shall be continuous through concealed space, such as the space above a suspended ceiling. Joints and voids at intersections shall comply with Sections 707.8 and 707.9

SECTION 708 FIRE PARTITIONS

708.1 General. The following wall assemblies shall comply with this section.

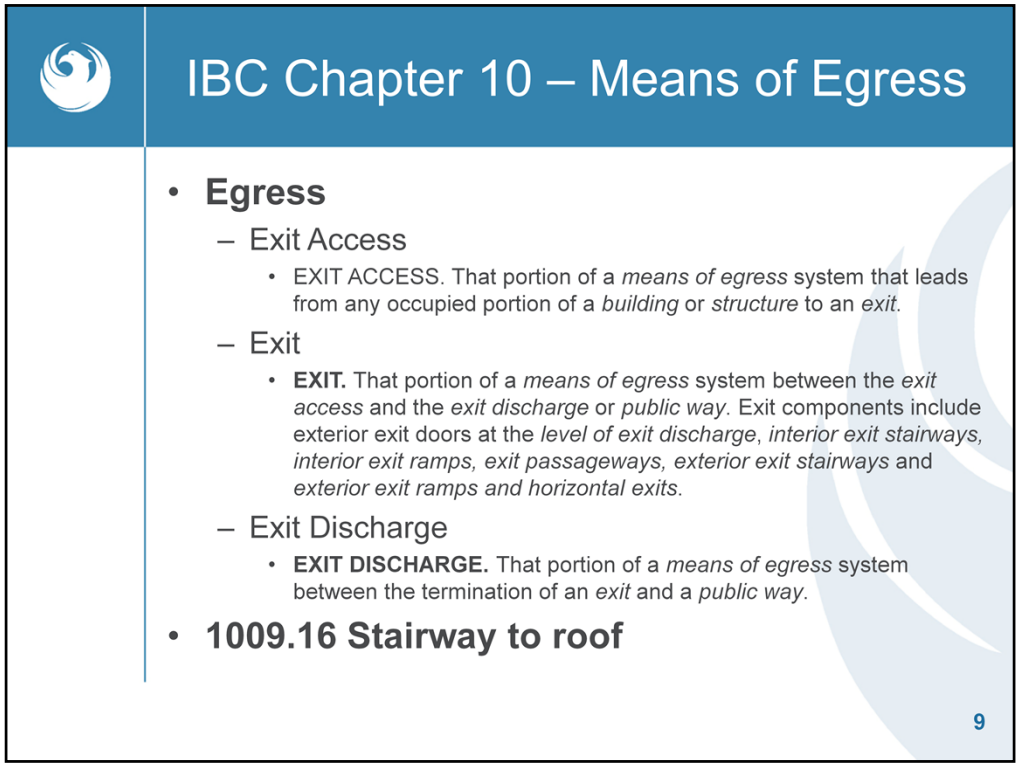
Walls separating *dwelling units* in the same building as required by Section 420.2.

Walls separating *sleeping units* in the same building as required by Section 420.2.

Walls separating tenant spaces in *covered and open mall buildings* as required by Section 402.4.2.1.

Corridor walls as required by Section 1018.1.

Elevator lobby separation as required by Section 713.14.1.



MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a *public way*. A means of egress consists of three separate and distinct parts: the *exit access*, the *exit* and the *exit discharge*.

EXIT ACCESS. That portion of a *means of egress* system that leads from any occupied portion of a *building* or *structure* to an *exit*.

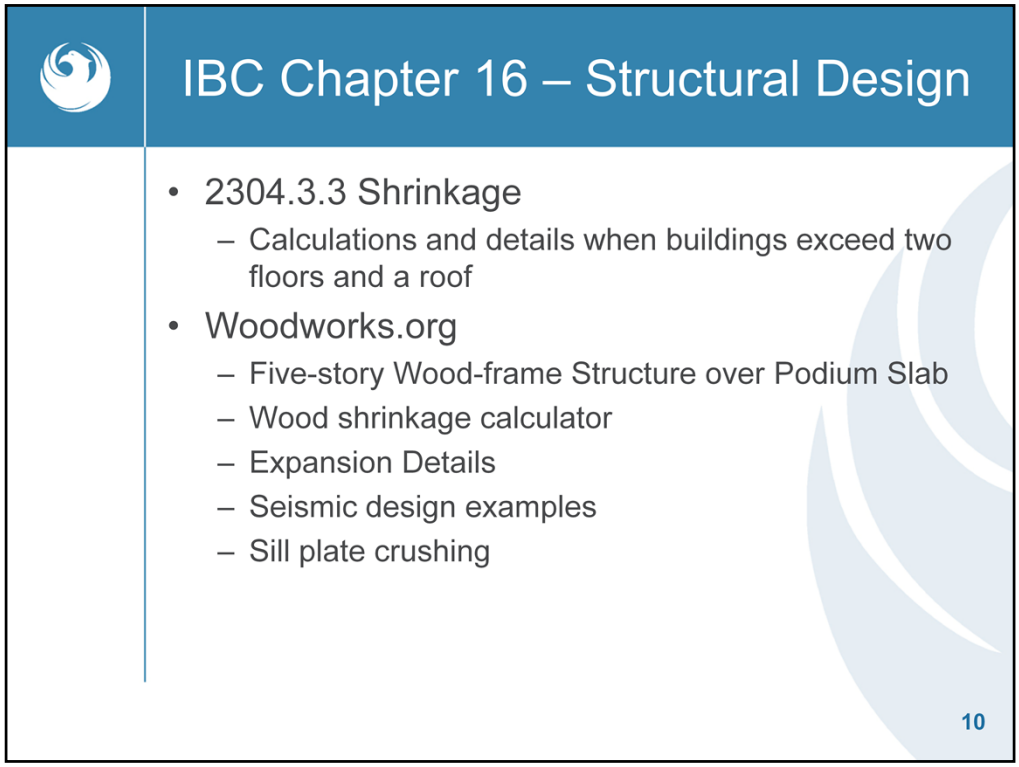
EXIT. That portion of a *means of egress* system between the *exit access* and the *exit discharge* or *public way*. Exit components include exterior exit doors at the *level of exit discharge*, *interior exit stairways, interior exit ramps, exit passageways, exterior exit stairways* and *exterior exit ramps and horizontal exits*.

EXIT DISCHARGE. That portion of a *means of egress* system between the termination of an *exit* and a *public way*.

1009.16 Stairway to roof. In buildings four or more stories above *grade plane*, one *stairway* shall extend to the roof surface, unless the roof has a slope steeper than four units vertical in 12 units horizontal (33-percent slope). In buildings without an occupied roof, access to the roof from the top story shall be permitted to be by an *alternating tread device*.

Commentary

In buildings four or more stories high, roofs that are not used for habitable purposes must be provided with ready access by conventional stairways or by an alternating tread device (see Section 1009.13). If this stair is also to provide access to an elevator penthouse on the roof, see additional requirements in Section 1009.17. Two reasons for this are access for roof or rooftop equipment repair and fire department access during a fire event.



2304.3.3 Shrinkage. Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the *building official* shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems, or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall also show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

Commentary

The adverse effects of wood shrinkage are greatest in multistory buildings having nonstructural components and supported equipment that may not be able to tolerate significant differential movements caused by shrinkage. This section states conditions under which shrinkage of the wood framing must be considered in the construction of wood-framed wall systems. An analysis of this phenomenon is required in order to determine the effect of shrinkage on the building system that is supported by the wall below.

Another example of the adverse effects of shrinkage is the impact it can have on shear wall performance. Shrinkage has been recognized as a factor in loose hold-down anchor bolt nuts in earthquake-damaged buildings.

QUESTIONS ?

11