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## Description

- This course provides an overview of the 2015 IBC Section 705 provisions for the application of the code requirements addressing exterior wall and opening protection.
  - Other code provisions applicable to an understanding of exterior wall and opening protection will also be addressed.



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## Goal

- This seminar is designed to familiarize and assist code officials in locating, describing and applying applicable code requirements of the IBC regarding exterior wall and opening protection.



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## Objectives

- Upon completion, participants will be better able to:
  - Understand differing concepts regarding fire protection requirements for exterior walls and openings.
  - Identify conditions under which exterior walls and openings in such walls must be protected.
  - Determine appropriate fire-resistance ratings and/or fire-protection ratings based on various conditions.



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## Course Overview

- Module 1 Roles of Fire-resistance-rated Exterior Wall Protection
- Module 2 Fire-resistance-rated vs. Fire-protection-rated Elements
- Module 3 Common Conditions under which Exterior Walls are to be Protected
- Module 4 Projections and Parapets
- Module 5 Miscellaneous Conditions and Elements Related to Exterior Wall and Opening Protection



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## Exterior Wall Protection

- The required fire-resistance rating of exterior walls can be based on a variety of factors:
  - Structural integrity during a fire event
  - Radiant heat exposure to adjacent buildings and lots
  - Protection of exit paths
  - Miscellaneous protection purposes



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## Structural Integrity

- Exterior walls are regulated differently depending on their contribution to the structural integrity of the building.
- Bearing walls must be fire-resistance-rated in buildings of Types IA, IB, IIA, IIIA, IIIB, IV and VA construction.
  - Degree of fire-resistance established in Table 601.
- Nonbearing walls require no fire-resistance when solely addressing structural protection.



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## Radiant Heat Exposure

- Fire-resistance of exterior walls is required where a building's location on the lot creates concerns of radiant heat exposure to:
  - Adjacent lots
  - Other buildings on the same lot.
- Spatial separation can be substituted for fire-resistance as a means of protection based on distances established in Table 602.



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### Protection of Exit Paths

- Exterior walls sometimes require fire-resistance in order to protect exterior exit paths in:
  - Exit courts
  - Exterior exit stairways
  - Interior exit stairways
  - Exterior areas of assisted rescue.



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### Miscellaneous Protection

- Exterior wall protection is required for a variety of other purposes throughout the code
  - Continuity of fire wall separation
  - Vertical separation of openings
  - Special provisions for special building types:
    - Group H occupancies
    - Aircraft hangars
    - Unlimited area buildings
    - Opening parking garages
  - Penthouses



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### Openings in Exterior Walls

- Based on the protective role the wall plays, openings in exterior walls are regulated differently.
  - Bearing walls (opening protection not required)
  - Location on lot (opening protection may be required)
  - Protection of exitways (opening protection always required)
  - Miscellaneous locations (opening protection varies based on each specific condition)



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### Additional Exterior Wall Protection

- Joints in or between exterior walls are required by Section 705 to be fire-resistance rated to comply with Section 715.
  - Exceptions for walls permitted to have unprotected openings.
- Penetration by an air duct or air transfer opening in fire-resistance-rated exterior wall is to be provided with a fire damper where the wall is required to have protected openings.

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### Ratings for Exterior Walls and Openings

Fire protection of exterior walls and openings are typically based on the procedures set forth in:

- ASTM E119 or UL 263 for wall assemblies, including glazed wall assemblies
- NFPA 252 or UL 10C for swinging door assemblies, including glazing in doors
- NFPA 257 or UL 9 for fire window assemblies

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## Fire-resistance Ratings Section 703.2™

The fire-resistance ratings of building elements shall be determined in accordance with:

- The procedures set forth in ASTM E119 (*Test Methods of Fire Tests for Building Construction and Materials*), or UL 263 (*Standard for Fire Test of Building Construction and Materials*), or
- The alternative methods for determining fire resistance as established in Section 703.3.



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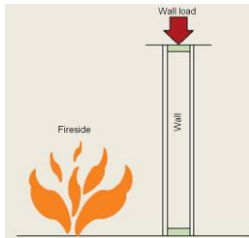
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## Wall Assembly Fire Test

### ASTM E119 Fire Test for Wall Assemblies



Assembly must:

- Sustain an applied load.
- Have no passage of flame or gas hot enough to ignite cotton waste.
- Have an average temperature rise on unexposed surface not more than 250°F (121°C) above initial temperature or more than 325°F (163°C) at any point.
- Allow no water to pass through during hose stream test.



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## Section 705.5 – Fire-resistance ratings

Exterior walls are required to be rated for exposure to fire from:

- Both sides where the separation distance is 10 feet or less.
- Only the inside where the fire separation distance exceeds 10 feet.



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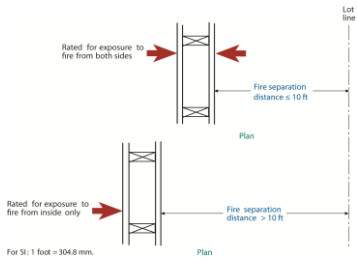
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### Section 705.5 – Fire-resistance ratings



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### Key Points

- Provisions of Section 705.5 are to be applied regardless of the reason that the exterior wall requires a fire-resistance rating.
- An exterior wall rated for exposure to fire from the inside only must be tested as a complete wall assembly.

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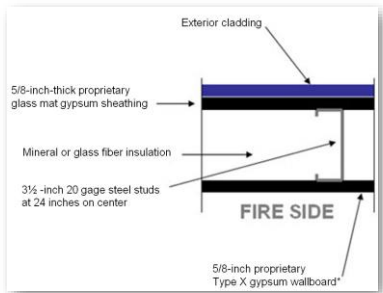
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### Section 703.2.1 – Nonsymmetrical wall construction



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### Section 722.6.2.3 – Calculation of Exterior Wall Ratings

- Calculation of fire-resistance ratings for wood-framed exterior walls permitted under the provisions of Section 722.6.2.3.
- Limited to 1-hour assemblies
- Applicable to "Fire Side"-only assemblies as well as full assemblies

**TABLE 722.6.2(1)**  
**TIME ASSIGNED TO WALLBOARD MEMBRANES<sup>a, b, c, d</sup>**

DESCRIPTION OF FINISH	TIME (minutes)
1/2-inch wood structural panel bonded with exterior glue	5
7/16-inch wood structural panel bonded with exterior glue	10
7/16-inch wood structural panel bonded with exterior glue	15
1/2-inch gypsum wallboard	10
5/8-inch gypsum wallboard	15
7/8-inch gypsum wallboard	30
1/2-inch Type X gypsum wallboard	25
1/2-inch Type X gypsum wallboard	40
Double 1/2-inch gypsum wallboard	25
1/2-inch + 1/2-inch gypsum wallboard	35
Double 7/8-inch gypsum wallboard	40

For Sl: 1 inch = 25.4 mm.  
 a. These values apply only when membranes are installed on framing members which are spaced 16 inches o.c. or less.  
 b. Gypsum wallboard installed over framing or lathing shall be installed on flat or light arc supporting members. 1/2-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported for finished.  
 c. On wood frame floor/ceiling or soffit/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.  
 d. The membrane on the non-exposed side shall not be included in determining the fire resistance of the assembly. When dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.  
 e. The time assigned is not a finished rating.

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**TABLE 722.6.2(2)**  
**TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME<sup>a, b, c</sup>**

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	10
Wood floor and roof joists 16 inches o.c.	10

For Sl: 1 inch = 25.4 mm.  
 a. This table does not apply to studs or joists spaced more than 16 inches o.c.  
 b. All studs shall be nominal 2 x 4 and all joists shall have a nominal thickness of at least 2 inches.  
 c. Allowable spans for joists shall be determined in accordance with Sections 2308.10.2 and 2308.10.3.

**TABLE 722.6.2(3)**  
**MEMBRANE<sup>a</sup> ON EXTERIOR FACE OF WOOD STUD WALLS**

MEMBRANE	PAPER	EXTERIOR FINISH
1/2-inch 1 & 1/2 lumber		Lumber siding
1/2-inch exterior glue wood structural panel	Sheathing paper	Wood shingles and shakes
1/2-inch gypsum wallboard		1/2-inch wood structural panels-exterior type
1/2-inch gypsum wallboard		1/2-inch hardboard
1/2-inch fiberboard		Metal siding
		Sidoco on metal lath
		Masonry veneer
		Vinyl siding
None	---	1/2-inch exterior-grade wood structural panels

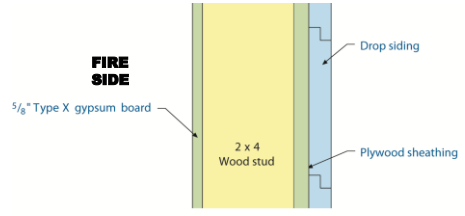
For Sl: 1 nondrinking foot = 143.008 kg/m<sup>2</sup>.  
 a. Any combination of sheathing, paper and exterior finish is permitted.

**TABLE 722.6.2(4)**  
**TIME ASSIGNED FOR ADDITIONAL PROTECTION**

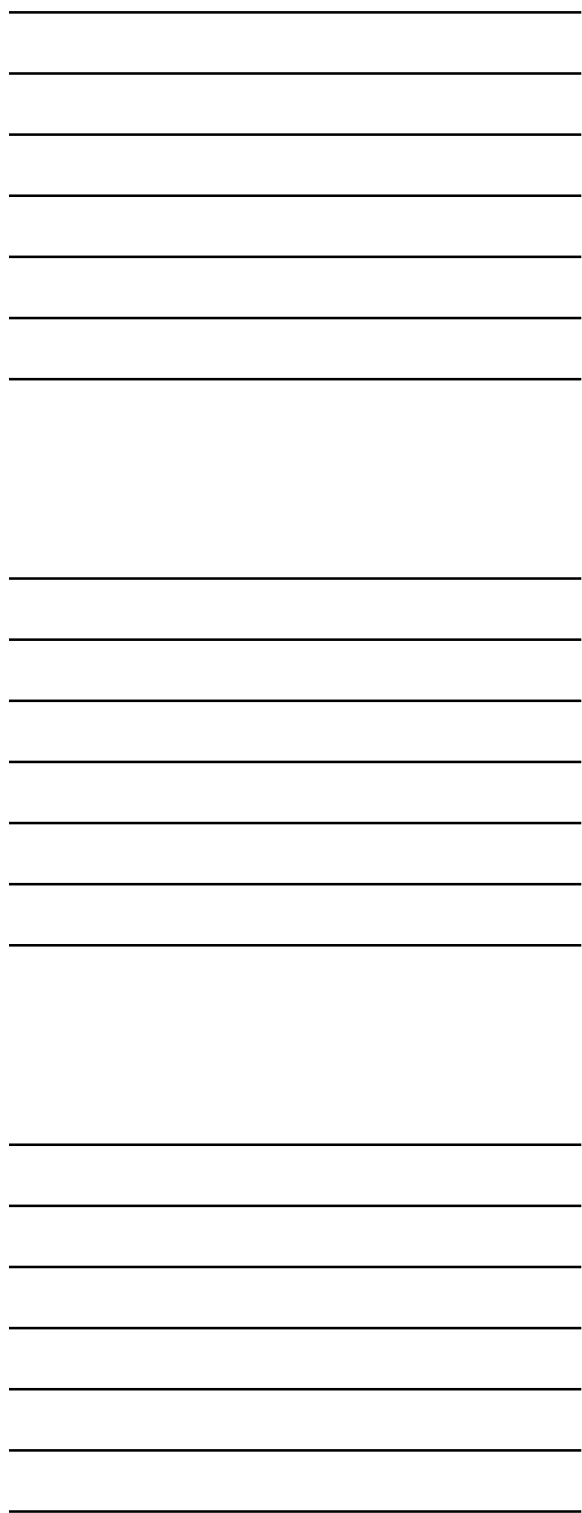
DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.0 pounds per cubic foot (1.0 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

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### Section 703.2.1 – Nonsymmetrical calculated exterior wall construction



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## Section 703.6 - Fire-resistance-rated Glazing

- Fire-resistance-rated glazing permitted for use where:
  - Tested in accordance with ASTM E119 or UL 263
  - Permanently labeled or identified per Table 716.3
  - Installed in accordance with listing

**TABLE 716.3  
MARKING FIRE-RATED GLAZING ASSEMBLIES**

FIRE TEST STANDARD	MARKING	DEFINITION OF MARKING
ASTM E 119 or UL 263	W	Meets wall assembly criteria.
NFPA 257 or UL 9	OH	Meets fire window assembly criteria including the hose stream test.
NFPA 252 or UL 10B or UL 10C	D	Meets fire door assembly criteria.
	H	Meets fire door assembly "Hose Stream" test.
	T	Meets 450°F temperature rise criteria for 30 minutes.
	XXX	The time in minutes of the fire resistance or fire protection rating of the glazing assembly.

For SI, °C = [(°F) - 32]/1.8.



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## Fire-protection-rated Door Assemblies Section 716.5

- Side-hinged or pivoting doors must comply with NFPA 252 or UL 10C.
- Fire-protection rating must comply with Table 716.5.
- Glazing in door assembly and/or adjacent to door assembly shall be further regulated.



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## Section 716.6- Fire-protection-rated Glazing

- Fire-protection-rated glazing for fire window assemblies shall meet acceptance criteria of NFPA 257 or UL 9.
- Protected openings may be required in nonfire-resistance-rated exterior walls under the provisions of Sections 705.8.5 and 705.8.6.
  - Vertical separation of openings
  - Vertical exposure
- A minimum fire-protection rating of 45 minutes shall be required for such openings.



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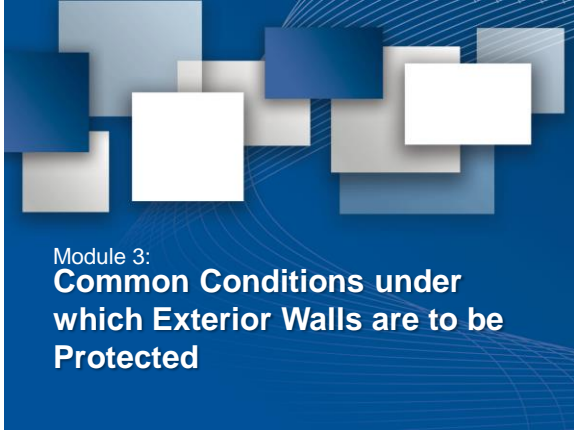
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### Where Regulated

Exterior walls are to be regulated under the following conditions:

- Type of construction (bearing walls)
- Location on lot (radiant heat transfer)
- Multiple buildings on the same lot
- Protection of exitways



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### Chapter 6 Type of Construction

- Bearing walls regulated for fire-resistance because of structural integrity conditions are addressed by Chapter 6 and Table 601.
- Nonbearing walls are not regulated for type of construction purposes
- Fire-resistance shall be required because of its:
  - Contribution to structural stability/integrity
    - Types IA, IB, IIA, IIIA, IV and VA
  - Perimeter containment/resistance under fire conditions
    - Types IIIA, IIIB and IV



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## Chapter 6 Type of Construction

Noncombustible	Exterior and interior (bearing and nonbearing) walls, floors, roofs and structural frame elements to be of noncombustible materials	I	A	B
		II	A	B
Combustible and/or noncombustible	Exterior walls to be of noncombustible materials	III	A	B
		IV	HT	
	Any materials permitted by the code	V	A	B



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## Type of Construction Section 602.1

- Exterior walls to have a fire-resistance rating not less than that specified in Table 601

Noncombustible	Exterior walls to be of noncombustible materials	I	A	B
		II	A	B
Combustible and/or noncombustible	Exterior walls to be of noncombustible materials	III	A	B
		IV	HT	
	Exterior walls to be any materials permitted by the code	V	A	B



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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame <sup>a</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls Exterior <sup>c,f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>b</sup>	2	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior <sup>d</sup>	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 <sup>e</sup>	1 <sup>1/2</sup>	1 <sup>1/2</sup>	0 <sup>f</sup>	1 <sup>1/2</sup>	0	HT	1 <sup>1/2</sup>	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. Not less than the fire-resistance rating required by other sections of this code.  
e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).  
f. Not less than the fire-resistance rating as referenced in Section 704.10.



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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame <sup>a</sup> (see Section 202)	3 <sup>b</sup>	2 <sup>b</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>c,f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>b</sup>	2 <sup>b</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Interior <sup>d</sup>	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)	1½ <sup>e</sup>	1 <sup>h</sup>	1 <sup>h</sup>	0 <sup>f</sup>	1 <sup>h</sup>	0	HT	1 <sup>h</sup>	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. Not less than the fire-resistance rating required by other sections of this code.  
 e. Not less than the fire-resistance rating based on fire separation distance (see Table 602).  
 f. Not less than the fire-resistance rating as referenced in Section 704.10.

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## Openings in Bearing Walls Section 602.1

- Openings in exterior walls require no fire-resistance-rated or fire-protection-rated protection where wall rating only required per Table 601.
- Opening protection may be required by other provisions of the code, such as Table 602 regulating its location on the lot.
  - Most restrictive provisions apply

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## Lot Line Concept

- Use of the lot line as controlling factor based on the concern that control is only possible on own lot
- Lot line concept is used as means of protecting one building from another as far as exposure is concerned
  - Exposure is deemed as a potential for heat to be transmitted from one building to another during fire conditions
- Radiation is considered a primary means of heat transfer
- Lot line concept is also utilized where multiple buildings are located on the same lot

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## Exterior Wall Ratings Chapter 6

- Section 602.1 and Table 602 regulate fire resistance of exterior walls because of proximity to adjacent lot lines or other buildings on the same lot
- Fire separation distance is determined to be “distance measured from building face to closest interior lot line, to centerline of street, alley or public way, or to imaginary line between two buildings on lot. Distance to be measured at right angles from face of wall”



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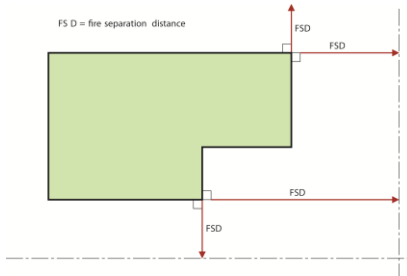
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## Fire Separation Distance



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## Fire Ratings of Exterior Walls Table 602

TABLE 602  
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE<sup>a, b, c, d</sup>

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP 1 <sup>e</sup>	OCCUPANCY GROUP F-1, M, S-1 <sup>f</sup>	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U <sup>g</sup>
X < 5 <sup>h</sup>	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1 <sup>i</sup>
	IIA, VIB	1	0	0
	Others	1	1	1 <sup>i</sup>
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.  
 a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.  
 b. See Section 706.1.1 for party walls.  
 c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.  
 d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.  
 e. For special requirements for Group H occupancies, see Section 413.6.  
 f. For special requirements for Group S aircraft hangars, see Section 412.4.1.  
 g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.  
 h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1525 mm) or greater.



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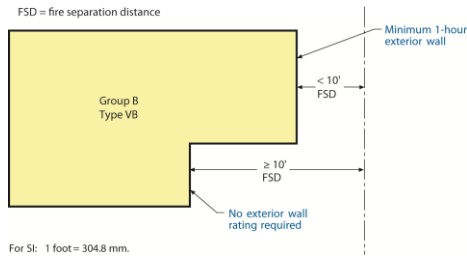
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### Fire Ratings of Exterior Walls Table 602



For SI: 1 foot = 304.8 mm.

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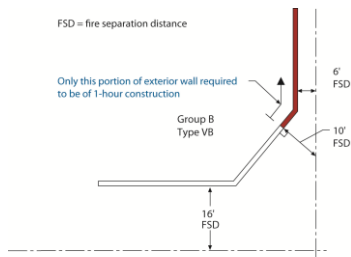
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### Fire Ratings of Exterior Walls Table 602



For SI: 1 foot = 304.8 mm.

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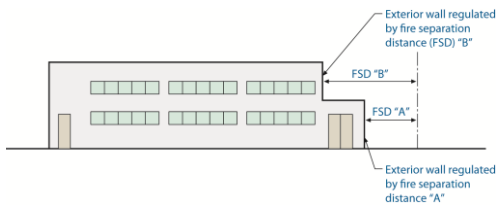
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### Fire Ratings of Exterior Walls Table 602



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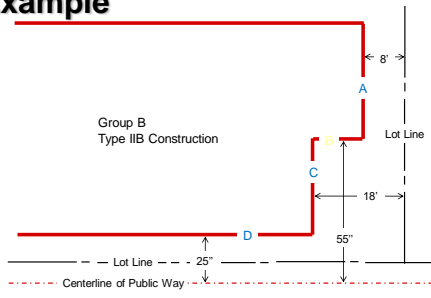
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### Fire Ratings of Exterior Walls Example




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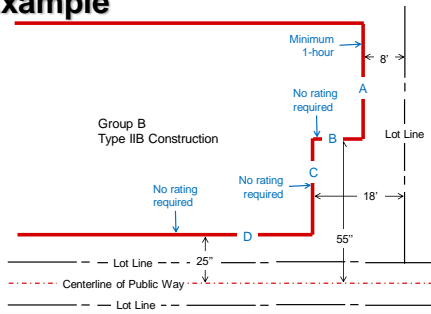
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### Fire Ratings of Exterior Walls Example




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### Structural Frame Members Section 704.10

- Structural frame members in exterior wall shall be provided with highest fire-resistance rating in accordance with:
  - Table 601 Structural Frame
  - Table 601 Exterior Bearing Wall
  - Table 602 for Fire Separation Distance

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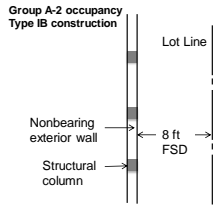
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## Structural Frame Members Example

Minimum Fire-resistance Rating for Load-bearing Structural Members within Nonbearing Exterior Wall



	Structural Members	Nonbearing Wall
Table 601 Structural Frame	2 hours	Not applicable
Table 601 Exterior Bearing Wall	2 hours	Not applicable
Table 602 Fire Separation Distance	1 hour	1 hour

Therefore, columns and other primary structural frame members shall be minimum 2-hour fire-resistance-rated. Nonbearing exterior wall to be minimum 1-hour fire-resistance-rated because of FSD.



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## Openings in Exterior Walls Section 705.8.1

- Area of protected and unprotected openings permitted in exterior wall in any story are limited by Table 705.8
- Openings prohibited where limited or no fire separation distance is provided
- As fire separation distance increases, openings are permitted in increasing amounts



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## Maximum Area of Exterior Openings Table 705.8

TABLE 705.8  
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON  
FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA <sup>a</sup>
0 to less than 3 <sup>b-c</sup>	Unprotected, Nonsprinklered (U.P., NS)	Not Permitted <sup>d</sup>
	Unprotected, Sprinklered (U.P., S)	Not Permitted <sup>d</sup>
	Protected (P)	Not Permitted <sup>d</sup>
3 to less than 5 <sup>e-f</sup>	Unprotected, Nonsprinklered (U.P., NS)	Not Permitted
	Unprotected, Sprinklered (U.P., S)	15%
	Protected (P)	15%
5 to less than 10 <sup>g-h</sup>	Unprotected, Nonsprinklered (U.P., NS)	10% <sup>b</sup>
	Unprotected, Sprinklered (U.P., S)	25%
	Protected (P)	25%
10 to less than 15 <sup>i-j,k</sup>	Unprotected, Nonsprinklered (U.P., NS)	15% <sup>b</sup>
	Unprotected, Sprinklered (U.P., S)	45%
	Protected (P)	45%
15 to less than 20 <sup>l,m</sup>	Unprotected, Nonsprinklered (U.P., NS)	25%
	Unprotected, Sprinklered (U.P., S)	75%
	Protected (P)	75%

(continued)



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(continuation of Table 705.8)

20 to less than 25 <sup>a, j</sup>	Unprotected, Nonsprinklered (UP, NS)	45%
	Unprotected, Sprinklered (UP, S)	No Limit
	Protected (P)	No Limit
25 to less than 30 <sup>a, j</sup>	Unprotected, Nonsprinklered (UP, NS)	70%
	Unprotected, Sprinklered (UP, S)	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (UP, NS)	No Limit
	Unprotected, Sprinklered (UP, S)	No Limit
	Protected (P)	No Limit

- For SI: 1 foot = 304.8 mm.  
 UP, NS = Unprotected openings in buildings not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.  
 UP, S = Unprotected openings in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.  
 P = Openings protected with an opening protective assembly in accordance with Section 705.8.2.  
 a. Values indicated are the percentage of the area of the exterior wall, per story.  
 b. For the requirements for fire walls of buildings with differing heights, see Section 706.6.1.  
 c. For openings in a fire wall for buildings on the same lot, see Section 706.8.  
 d. The maximum percentage of unprotected and protected openings shall be 25 percent for Group R-3 occupancies.  
 e. Unprotected openings shall not be permitted for openings with a fire separation distance of less than 15 feet for Group H-2 and H-3 occupancies.  
 f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies, with a fire separation distance of 5 feet or greater.  
 g. The area of openings in an open parking structure with a fire separation distance of 10 feet or greater shall not be limited.  
 h. Includes buildings accessory to Group R-3.  
 i. Not applicable to Group H-1, H-2 and H-3 occupancies.  
 j. The area of openings in a building containing only a Group U occupancy private garage or carport with a fire separation distance of 5 feet (1523 mm) or greater shall not be limited.  
 k. For openings between S-2 parking garage and Group R-2 building, see Section 705.3, Exception 2.

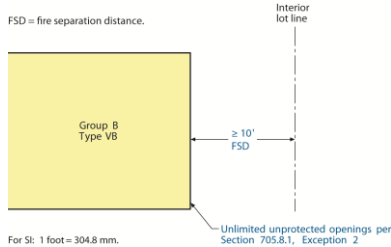
49

## Openings in Exterior Walls Section 705.8.1, Exception 2

- Buildings whose exterior wall, exterior nonbearing wall and exterior structural frame are not required to be fire-resistance rated (by Table 705.8) are permitted to have unlimited unprotected openings.

50

## Openings in Exterior Walls Section 705.8.1, Exception 2



51

## Openings in Exterior Walls Example

Given: A Type IIB Group M building with its west wall having a fire separation distance of 18 feet.  
 Determine: The type and amount of permitted openings.



Solution: Per Table 601, for Type IIB, no rating is required for the exterior wall.

Per Table 602 with a fire separation distance of 18 feet, no rating is required for the exterior wall.

Therefore, there is no limit to the amount of openings permitted in the west wall and the openings are not required to have a fire-protection rating.



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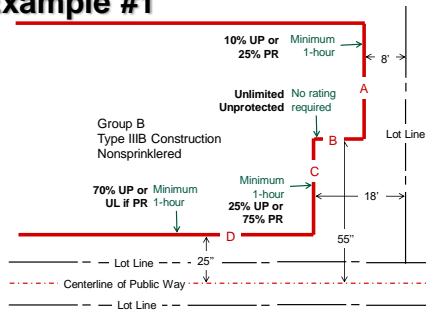
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## Openings in Exterior Walls Example #1



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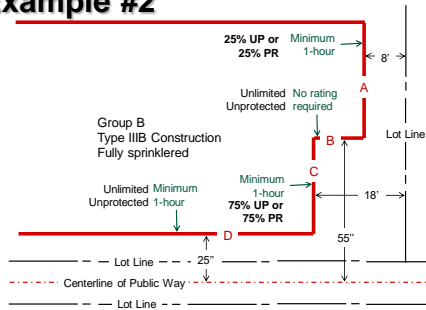
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## Openings in Exterior Walls Example #2



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### Openings in Exterior Walls Section 705.8.1, Exception 1

- In other than Group H, unlimited unprotected openings are permitted in the first story of exterior walls facing:
  - A street with fire separation distance > 15 feet
  - An unoccupied space ≥ 30 feet in width

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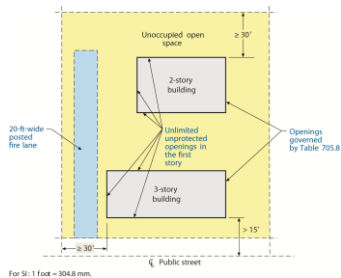
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### Openings in Exterior Walls Section 705.8.1, Exception 1



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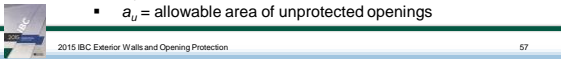
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### Mixed Openings in Exterior Walls Section 705.8.4

- Where both protected and unprotected openings are located in an exterior wall in any story, total area of openings shall comply with the following formula (only applicable to nonsprinklered buildings):

$$(A_p/a_p) + (A_u/a_u) \leq 1.0$$

- where:
  - $A_p$  = actual area of protected openings
  - $a_p$  = allowable area of protected openings
  - $A_u$  = actual area of unprotected openings
  - $a_u$  = allowable area of unprotected openings



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### Mixed Openings in Exterior Walls Example

**Given:** A nonsprinklered Group S-1 building of Type IIIB construction. The exterior wall shown is located 12 feet from an interior lot line.  
**Determine:** The maximum area permitted for unprotected openings.

**Solution:**

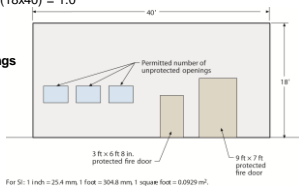
$$(A_u/a_u) + (A_p/a_p) \leq 1.0$$

$$83/(45\%)(18 \times 40) + (15\%)(18 \times 40) = 1.0$$

$$83/324 + A_u/108 = 1.0$$

$$0.25 + A_u/108 = 1.0$$

Up to 81 sf of unprotected openings are permitted.



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### Section 705.8.3 Unprotected Openings

- Where unprotected openings are permitted, windows and doors shall be constructed of any approved materials.
- Glazing shall conform with Chapters 24 and 26



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### Protected Openings Section 705.8.3

- Where openings are required to be protected, fire doors, fire shutters and fire windows to comply with Section 716.
- Opening protectives not required where:
  - Building is provided with sprinkler system throughout, and
  - Exterior openings are protected by water curtain.
- Use of exception not applicable to Table 705.8
  - Allowance applicable where other provisions require protected openings, such as:
    - Exterior areas of assisted rescue
    - Exterior exit stairway protection
    - Egress courts



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## Section 716.5 Fire Door and Shutter Assemblies

- Table 716.5 identifies minimum fire door and fire shutter assembly ratings based on
  - Type of wall assembly where the door/shutter is located
  - Required wall assembly rating
- Table also identifies:
  - Door vision panel size
  - Fire-rated glazing marking of door vision panels
  - Minimum sidelight/transom assembly rating
  - Fire-rated glazing marking of sidelight/transom panel



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## Fire Door Assemblies Table 716.5

**TABLE 716.5—continued  
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE <sup>a</sup>	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELIGHT/TRANSOM PANEL		
				Fire protection	Fire resistance	Fire protection	Fire resistance	
Exterior walls	3	1½	100 sq. in. <sup>b</sup>	≤100 sq. in. = D-H-90	Not Permitted	3	Not Permitted	W-180
				>100 sq. in. = D-H-W-90	Not Permitted	2	Not Permitted	W-120
	1	½	Maximum size tested	D-H-45	½		D-H-45	
Smoke barriers	1	½	Maximum size tested	D-20	½		D-H-OH-45	

<sup>a</sup> For 1/2 square inch = 645.2 mm.  
<sup>b</sup> Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.  
<sup>c</sup> Fire-resistance-rated glazing tested to ASTM E119 in accordance with Section 716.2 shall be permitted, in the maximum size tested.  
<sup>d</sup> Except where the building is equipped throughout with an automatic sprinkler and the fire-rated glazing meets the criteria established in Section 716.5.5.  
<sup>e</sup> Under the column heading "Fire-rated glazing marking door vision panels," W refers to the fire-resistance rating of the glazing, not the frame.  
<sup>f</sup> See Section 716.5.8.1.2.1.



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## Fire Window Assemblies Table 716.6

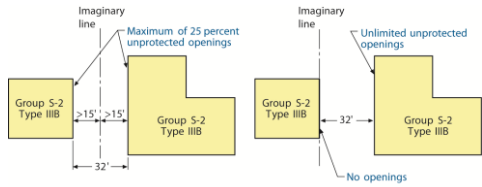
- Table 716.6 identifies minimum fire window assembly ratings based on
  - Type of wall assembly where door/shutter located
  - Required wall assembly rating
- Table also identifies:
  - Fire-rated glazing marking of fire windows



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### Buildings on the Same Lot Section 705.3



Note: Imaginary line may be located to take best advantage of provisions.  
 For St: 1 foot = 304.8 mm.

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### Buildings on the Same Lot Section 705.3

- Where a new building is erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building to be such that the exterior wall and opening protection of the existing building comply.

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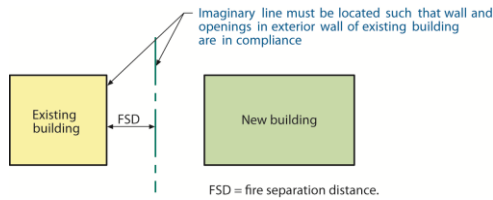
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### Buildings on the Same Lot Section 705.3



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### Buildings on the Same Lot Section 705.3, Exception 1

- As an alternative, multiple buildings on the same lot are permitted to be considered as portions of a single building if the aggregate area of such buildings are within limits specified in Chapter 5 for single building.
- Where buildings contain different occupancy groups or are of different types of construction, areas shall be that allowed for the most restrictive occupancy or construction.
- Provisions of the IBC applicable to aggregate building shall be applicable to each building (Section 503.1.2).



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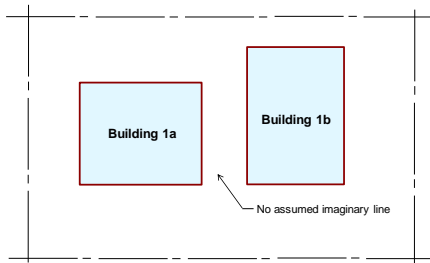
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### Buildings on the Same Lot Example #2



Buildings 1 and 2 regulated as portions of a single building



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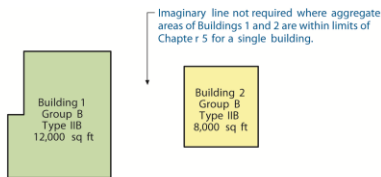
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### Buildings on the Same Lot Section 705.3



Note: Section 503.1.2 indicates that all provisions of IBC applicable to the aggregate building are applicable to each individual building.

For SI: 1 square foot = 0.093 m<sup>2</sup>.



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### Buildings on the Same Lot Section 705.3, Exception 2

- Special provisions for exterior wall openings are available for a Type I or IIA Group S-2 parking garage on the same lot as a Group R-2 building.
- Adjoining exterior walls between buildings are permitted to have occupant use openings in accordance with Section 706.8.



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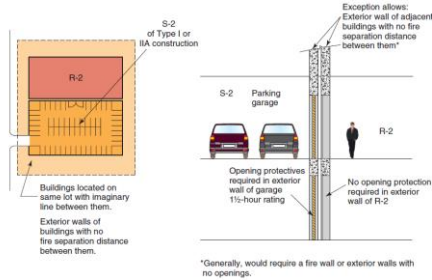
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### Buildings on the Same Lot Section 705.3, Exception 2



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### Interior Exit Stairway Exterior Walls Section 1023.7

- Exterior walls of interior exit stairways and ramps shall:
  - Comply with Section 705
- Where nonrated walls or unprotected openings enclose the exterior of the stairway, protection shall be provided at adjacent walls and openings where exposed at less than 180 degrees.



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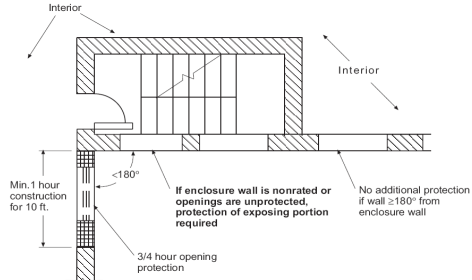
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### Interior Exit Stairway Exterior Walls Section 1023.7



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### Exterior Stairway and Ramp Protection Section 1027.6

- Exterior stairways and ramps shall be separated from the interior of the building per Section 1023.2.
- Openings limited to those necessary for egress from normally occupied spaces.
- Exceptions include where:
  - Stairway serves two stories maximum (not R-1 or R-2)
  - Access to 2<sup>nd</sup> exit is provided
  - Complying open-ended corridors are provided

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### Exterior Stairway and Ramp Protection Section 1027.6

- Exterior stairways and ramps shall be separated from the interior and comply with provisions for interior exit stairways and ramps (Section 1027.3).
- Separation to be:
  - Minimum 1-hour where a stairway/ramp serves three or fewer stories
  - Minimum 2-hour where a stairway/ramp serves four or more stories

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### Exterior Stairway and Ramp Protection Section 1027.6

- In addition to protection required in an exterior wall common to an exterior stairway/ramp, additional projection is required in walls adjacent to a stairway.



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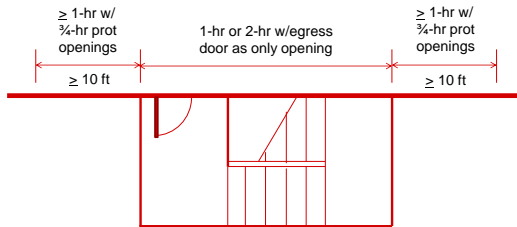
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### Exterior Ramp and Stairway Protection Section 1027.6



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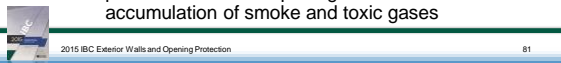
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### Open-ended Corridors Section 1027.6, Exception 3

- Separation from the interior of building is not required where exterior stairways/ramps are connected to open-ended corridors, provided:
  - Building is fully sprinklered
  - Open-ended corridors comply with Section 1020
  - Open-ended corridors connect to complying exterior exit stairways/ramps
  - Exterior walls and openings adjacent to an exterior stairway/ramp comply with Section 1023.7
  - Changes in direction of open-ended corridors are provided with clear openings to minimize accumulation of smoke and toxic gases



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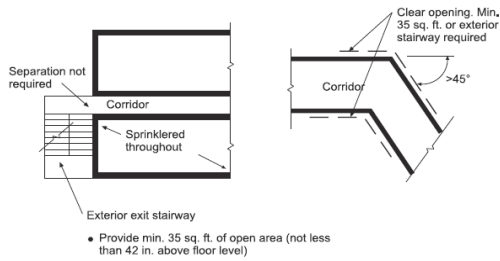
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### Open-ended Corridors Section 1027.6, Exception 3



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### Exit Discharge Section 1028

- Egress court less than 10 feet in width to be separated from building with:
  - Walls with minimum 1-hour fire-resistance-rated construction to a minimum height of 10 feet
  - Openings protected a minimum ¾-hour
  - Exceptions for egress courts serving:
    - Occupant load of less than 10, or
    - Group R-3 occupancies

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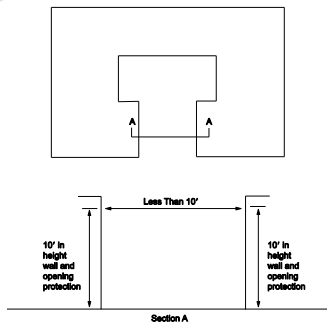
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### Exit Discharge Section 1028



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### Inaccessible Exit Discharge Section 1009.7.2

- If exit discharge is not accessible, one of the following components must be provided:
  - Interior area of refuge, or
  - Exterior area of rescue assistance.
- No exceptions for sprinklered buildings

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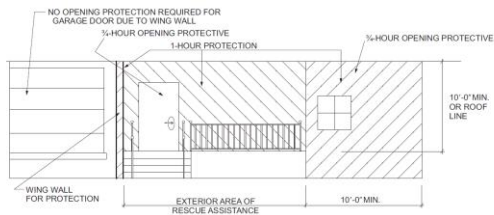
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### Exterior Area of Assisted Rescue Section 1009.7.2



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.



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### Section 706 Fire Walls

- Fire walls separate a single building into two or more buildings as a design choice.
- Among other requirements, fire walls are regulated for:
  - Horizontal continuity
  - Conditions where the intersection of the fire wall and exterior wall is less than 180 degrees
  - Horizontal projecting elements

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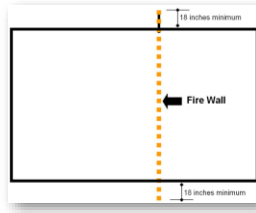
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### Fire Wall Horizontal Continuity Section 706.5

- Fire walls shall extend a minimum of 18 inches beyond the exterior surface of exterior walls.
- Several exceptions allow for an alternative means of protection.



For SI: 1 inch = 25.4 mm.

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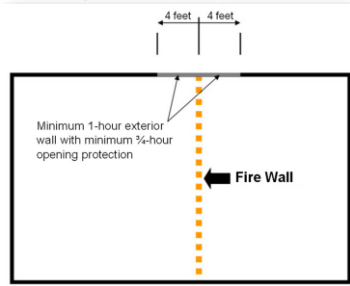
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### Fire Wall Horizontal Continuity Section 706.5, Exc. 1



For SI: 1 foot = 304.8 mm.

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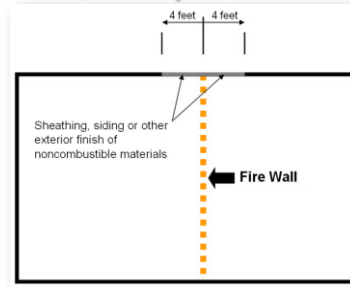
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### Fire Wall Horizontal Continuity Section 706.5, Exception 2



For SI: 1 foot = 304.8 mm.

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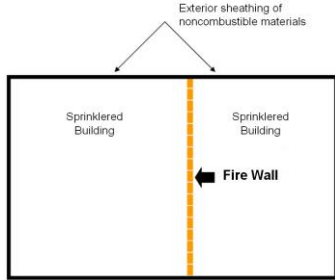
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### Fire Wall Horizontal Continuity Section 706.5, Exception 3



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### Fire Walls at Exterior Walls Section 706.5.1

- Where a fire wall intersects exterior walls and an angle of less than 180 degrees is formed, fire-resistance rating and opening protection of exterior walls shall meet one of two conditions:
  - Protection of wall and openings for distance on each side of intersection, or
  - Assumption of imaginary lot line at fire wall and extending beyond the exterior of the fire wall
    - Regulated in similar manner to that used for two or more buildings on the same lot

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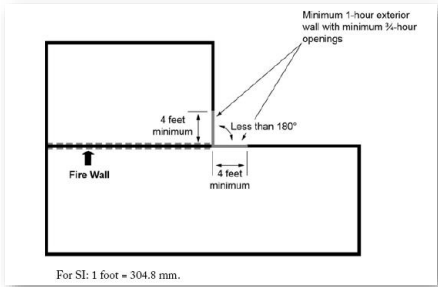
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### Fire Walls at Exterior Walls Section 706.5.1



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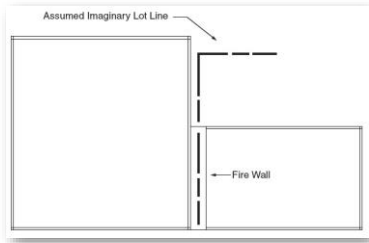
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### Fire Walls at Exterior Walls Section 706.5.1



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### Horizontal Projecting Elements Section 706.5.2

- Fire walls to extend to outer edge of horizontal projecting elements that are within 4 feet of fire wall
- Intent is to restrict fire spread around the fire wall at exterior wall surface
- Three exceptions establish alternative means of protection

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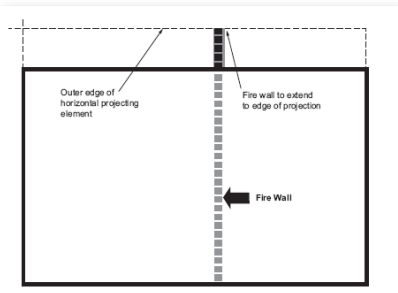
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### Horizontal Projecting Elements Section 706.5.2



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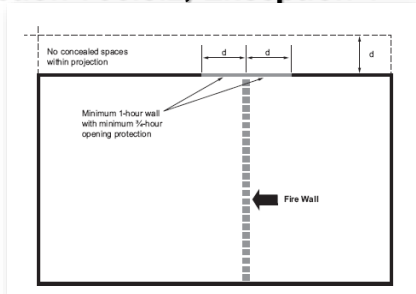
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### Horizontal Projecting Elements Section 706.5.2, Exception 1



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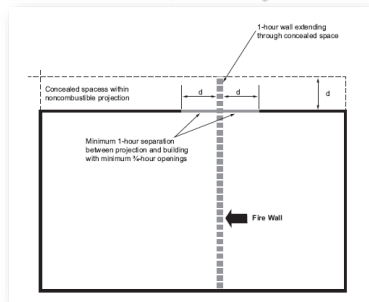
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### Horizontal Projecting Elements Section 706.5.2, Exception 2



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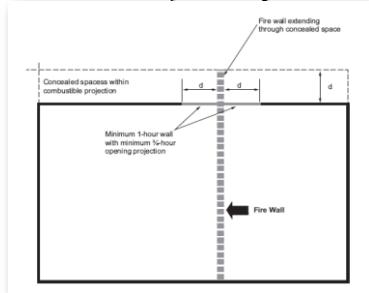
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### Horizontal Projecting Elements Section 706.5.2, Exception 3



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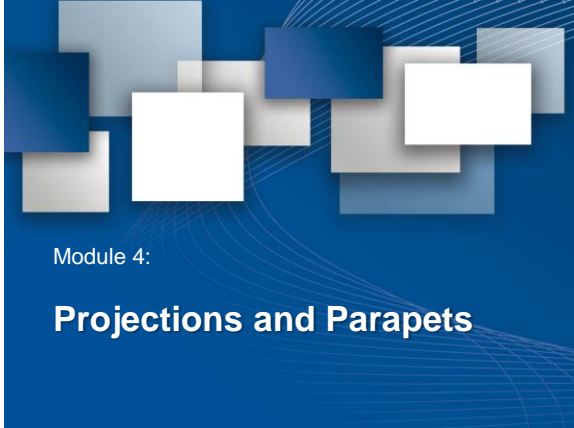
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### Projections and Parapets Sections 705.2 and 705.11

- While projections are only regulated where they are provided at exterior walls, parapets may be required based on varying conditions.
- Projections are regulated to the increased hazard they may pose because of their proximity to a lot line or another building on the same lot.
- Parapets are mandated in those cases where roof protection is required because of proximity to a lot line or another building on the same lot.



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### Projections Sections 705.2 and 1406

- Cornices, eave overhangs, exterior balconies and similar projections extending beyond the floor area shall conform to the requirements of Sections 705.2 and 1406.



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## Projection Limits at Exterior Walls Section 705.2

- Projections beyond exterior walls are strictly limited where such walls are in close proximity to adjacent lot lines.
- Some degree of open space to the sky is required between the edge of the projection and the line used to establish fire separation distance.



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## Projection Limits at Exterior Walls Section 705.2

- Table 705.2 sets forth the limitations regarding the permitted extent of projections.
- Assuming a projection adjacent to an interior lot line, no projection beyond the building's exterior wall is permitted where the exterior wall is less than 2 feet from the lot line.



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2015 IBC  
Table 705.2  
Page 120

## Projection Limits at Exterior Walls Table 705.2

TABLE 705.2  
MINIMUM DISTANCE OF PROJECTION

FIRE SEPARATION DISTANCE (FSD)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 feet to 2 feet	Projections not permitted
Greater than 2 feet to 3 feet	24 inches
Greater than 3 feet to less than 30 feet	24 inches plus 8 inches for every foot of FSD beyond 3 feet or fraction thereof
30 feet or greater	20 feet

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.



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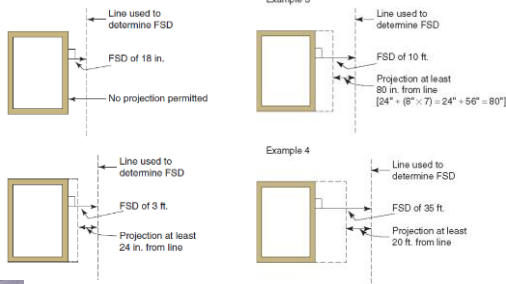
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## Projections Section 705.2



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## Projections Section 705.2

- Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials where allowed by Sections 1406.3 and 1406.4
- Projections from walls of Type III, IV or V construction shall be of any approved material
- Combustible projections located where protection of some openings is required shall be:
  - 1-hour fire-resistance-rated construction, or
  - Type IV heavy-timber construction,
  - Fire-retardant-treated wood, or
  - As required by Section 1406.3

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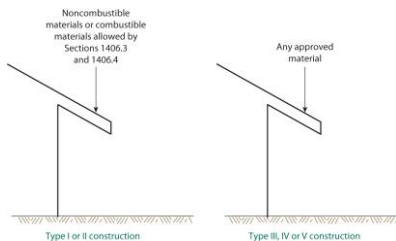
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## Combustible Projections Section 705.2.3



For SI: 1 foot = 304.8 mm.

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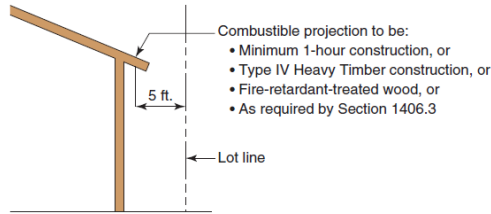
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### Combustible Projections Section 705.2.3



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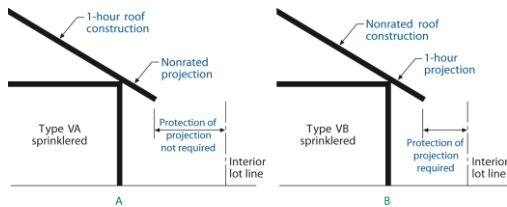
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### Protection of Projections vs. Roof Construction



For Sl: 1 foot = 304.8 mm.



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### Projections; Combustible Materials on the Exterior Side of Exterior Walls Sections 705.2 and 1406

- Section 1406 regulates combustible materials on the exterior side of exterior walls, including balconies and similar projections such as porches, decks and exterior stairways.
- Combustible balconies and similar projections to be of FRT wood, Type IV materials, or fire-resistance rated per Table 601 for floor construction (with exceptions).



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## Parapets

### Section 705.11

- Parapet wall is defined as “a part of any wall completely above the roof line.”
- As a base requirement, parapets shall be provided on all exterior walls unless specifically exempted.
- Multiple exceptions eliminate the mandate for parapets.
- Where one or more exceptions are met, the provisions of Section 705.11 do not apply.



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## Parapet Exceptions

### Section 705.11 – Exceptions 1-3

- Parapets need not be provided on exterior walls of buildings where any of the following conditions exist:
  1. The wall is not required to be fire-resistance rated in accordance with Table 602 because of fire separation distance.
  2. The building has an area of not more than 1,000 square feet (93 m<sup>2</sup>) on any floor.
  3. Walls that terminate at roofs of not less than 2-hour fire-resistance-rated construction or where the roof, including the deck and supporting construction, is constructed entirely of noncombustible materials.



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## Parapet Exceptions

### Section 705.11, Exception 4

- Parapets are not required on one-hour exterior walls that terminate at underside of roof sheathing, deck or slab, where:
  - Roof has minimum Class B roof covering, are
  - Openings in roof do not occur within 10 feet of exterior wall (5 feet in Groups R and U), and
  - Where roof/ceiling framing elements are of minimum 1-hour construction for minimum:
    - 10 feet (4 feet in Groups R and U) where framing is parallel to exterior wall
    - Full span where framing not parallel to exterior wall



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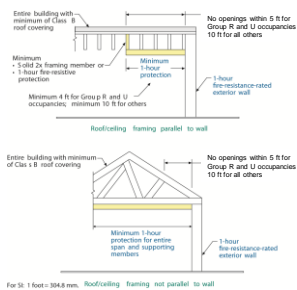
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## Parapet Exceptions Section 705.11, Exception 4



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## Parapet Exceptions Section 705.11, Exception 5

- Parapets to be provided on exterior walls of Group R-2 and R-3 buildings, except where:
  - Roof has minimum Class C roof covering;
  - Walls terminate at roof deck, and
  - Building is of Type III, IV or V construction; and
  - Roof deck is of noncombustible materials or fire-retardant-treated wood, for a distance of 4 feet; or
  - Roof protected with  $\frac{5}{8}$ -inch Type X gypsum board directly beneath underside of deck, for a distance of 4 feet.



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## Parapet Exceptions Section 705.11, Exception 6

Where the wall is permitted to have at least 25 percent unprotected openings based on fire separation distance in accordance with Table 705.8

- For fully sprinklered buildings, this distance would be 5 feet (1524 mm) or greater.
- For nonsprinklered buildings, this distance would be 15 feet (4572 mm) or greater.



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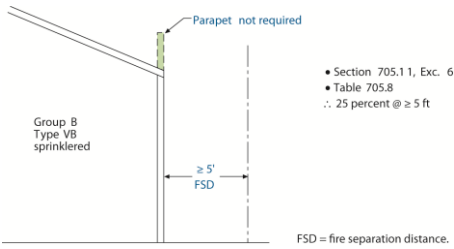
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### Parapet Exceptions Section 705.11 – Exception 6



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### Parapet Construction Section 705.11.1

- Parapets shall have the same fire-resistance rating as required for supporting wall.
- Noncombustible faces for the uppermost 18 inches.
- Minimum height of 30 inches.

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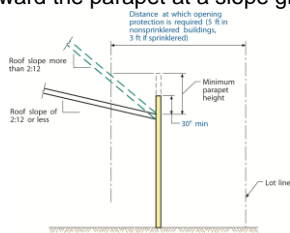
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### Parapet Construction Section 705.11.1

Additional parapet height may be required for roofs sloping toward the parapet at a slope greater than 2:12



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### Miscellaneous Conditions

- Vertical separation of openings
- Vertical exposure
- Group H occupancies
- Aircraft hangars
- Unlimited area buildings, covered mall buildings
- Open parking garages
- Penthouses



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### Section 705.8.5 Vertical Separation of Openings

- Openings in adjacent stories to be separated vertically to restrict exterior fire spread from story to story
- Applies where:
  - openings are within 5 feet of each other horizontally, and
  - opening in lower story does not have a minimum ¾-hour fire protection rating



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### Vertical Separation of Openings Section 705.8.5

- Two methods available to restrict the spread of fire:
  - Vertical separation of 3 feet minimum with spandrel construction of at least 1-hour construction, or
  - Horizontal flame barriers of at least 1-hour construction that extend a minimum of 30 inches beyond exterior wall
- Vertical separation not required for:
  - Buildings no more than three stories in height above grade plane
  - Fully-sprinklered buildings
  - Open parking garages



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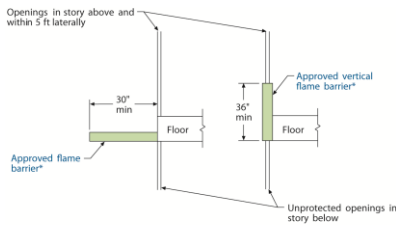
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### Vertical Separation of Openings Section 705.8.5



\* Barriers not less than 1-hour rated. Flame barriers not required in sprinklered buildings, in buildings three stories or less in height, or in open parking garages.  
 For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.



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### Vertical Exposure Section 705.8.6

- For buildings of different roof heights located on the same lot, minimum ¾-hour fire protection rating, opening shall be for openings in exterior wall of building adjacent to a lower building where the:
  - openings in the taller wall are less than 15 feet above roof of the lower building
  - fire separation distance is less than 15 feet.



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### Vertical Exposure Section 705.8.6

- Requirements do not apply where:
  - Buildings are regulated as portions of a single building per Section 705.3, or where
  - Roof assembly of the lower building has a minimum 1-hour fire-resistance rating.



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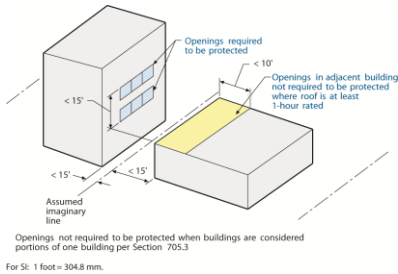
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### Vertical Exposure Section 705.8.6



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### Group H Occupancies Section 415.6.1

- Regardless of any other provisions, buildings containing Group H occupancies shall be set back a minimum fire separation as set forth in Sections 415.5.1.1 through 415.5.1.4.
  - Group H-1 75 feet minimum
  - Group H-2 30 feet minimum (where Group H-2 exceeds 1000 sf)
    - 50 feet if a detached building\*
  - Group H-3 50 feet if a detached building\*

\*no wall and opening protection required based on fire separation distance



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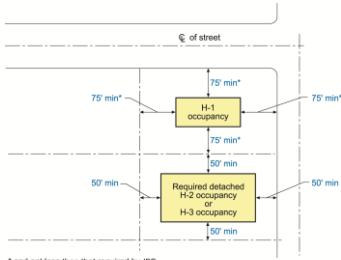
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### Group H Occupancies Section 415.6.1



\* and not less than that required by IFC  
For SI: 1 foot = 304.8 mm.

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### Aircraft Hangars Section 412.4.1

- Exterior walls shall have a minimum 2-hour fire-resistance rating where located less than 30 feet from lot lines or a public way
  - Measurement not necessarily related to fire separation distance
  - Provision not applicable to opposing walls of hangars where two or more hangars occur on same lot.
  - Other applicable provisions still apply:
    - NFPA 409 addresses clusters of hangars
    - IBC Sections 503.1.2 and 705.3 address multiple hangars on the same lot

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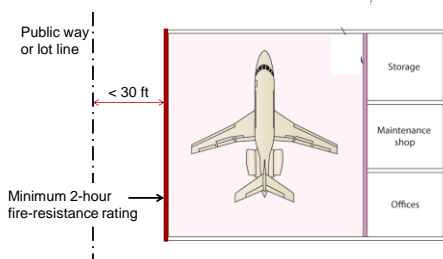
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### Aircraft Hangars Section 412.4.1



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## Unlimited Area Buildings Section 507.2.1

- Reduction in the required open space surrounding the perimeter of unlimited area buildings is permitted provided:
  - Exterior walls have a minimum 3-hour fire-resistance rating, and
  - Openings in exterior walls have a minimum 3-hour fire-resistance rating.
- The base requirement of a minimum of 60 feet of open space may be reduced to not less than 40 feet for a maximum of 75 percent of the perimeter.



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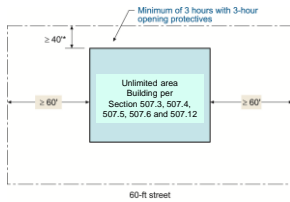
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## Unlimited Area Buildings Section 507.2.1



\*Reduced open space permitted:

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

For SI: 1 foot = 304.8 mm.



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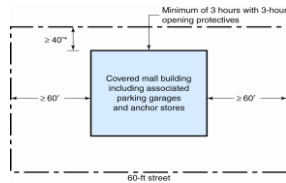
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## Covered and Open Mall Buildings Section 402.1.1

- Reduction in required open space also permitted in a similar manner for covered mall buildings and open mall buildings



\*Reduced open space permitted:

- Up to 75% of building perimeter
- Where exterior wall facing reduced open space has minimum 3-hour fire-resistance rating
- Openings in such walls are protected for minimum 3 hours
- Not applicable for Group E, H, I, and R occupancies.

Reduced open space



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### Open Parking Garages Section 406

- Based on Note c to Table 602, exterior walls of open parking garages are not required to have a fire-resistance rating based on fire separation where such distance is 10 feet or more.
- Unlimited unprotected openings are permitted where fire separation distance is at least 10 feet.
- Provisions are applicable to all construction types.



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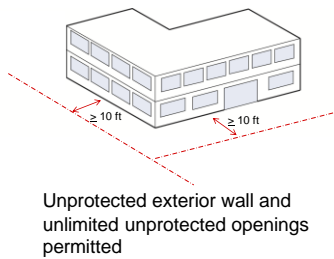
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### Open Parking Garages Section 406



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### Penthouses Section 1510.2.5

- General provisions require penthouse exterior walls to be constructed consistent with the type of construction of the building
- Exceptions address three conditions:
  - Type I buildings
  - Type I buildings no more than two stories in height and all Type II buildings
  - Type III, IV and V buildings
- Exceptions only need be applied where other provisions mandate a higher degree of protection



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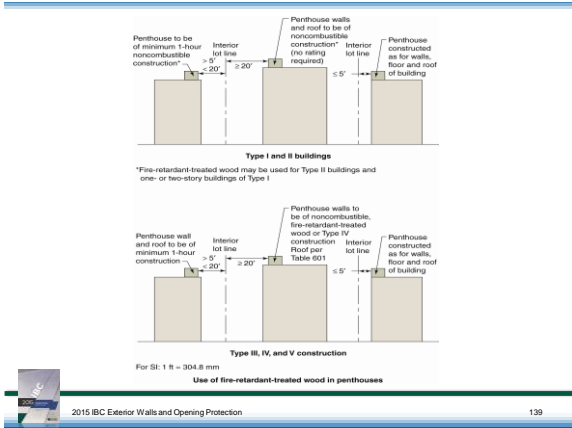
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## Conclusion

- This concludes the presentation addressing exterior wall and opening protection.
- The fire-resistance requirements are intended to address a variety of hazards and concerns, including:
  - Structural integrity
  - Radiant heat transfer to adjoining lots and buildings
  - Protection of exitways
  - Miscellaneous conditions



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**FINAL REFLECTION**

## 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?

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