

Zero Lot Line Buildings and Wrap-Around Structures: Detailing Walls



Presented by
WoodWorks
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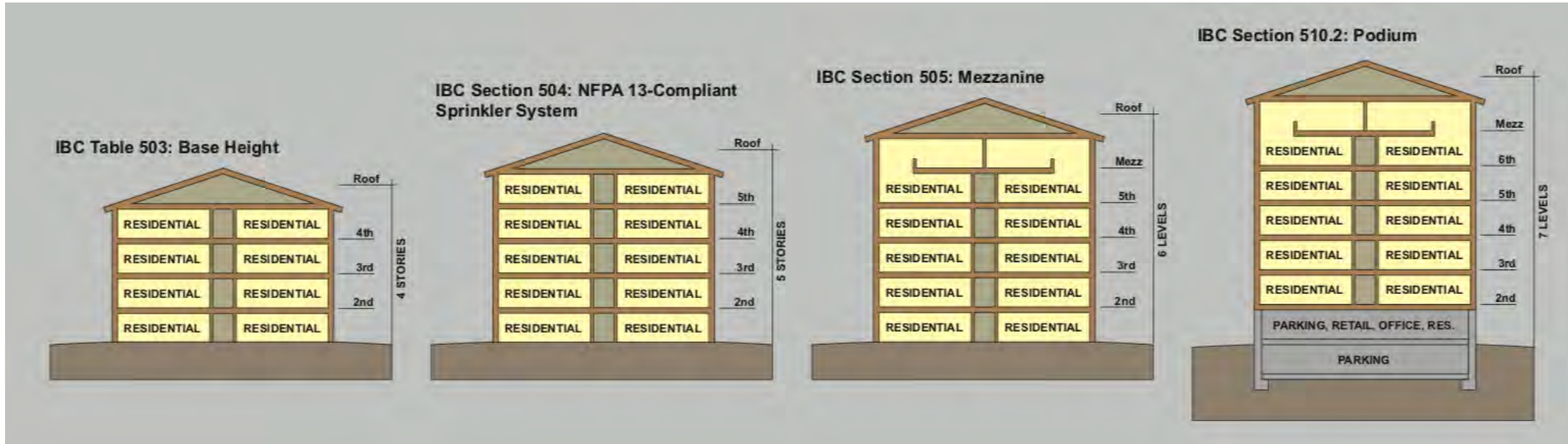
Economist, OZ Architecture, photo Black Bike Productions

Brief Review:



Exterior Wall Fire- Resistance: Ratings, Assemblies & Components

Evolution of Multi-Family Mid-Rise in the US



Type V → Type III → + Mezzanines → + Podiums

Fire Resistance Ratings

Key Differences in Fire Ratings for Construction Types			
	IIIA	IIIB	VA
Exterior wall framing	FRT	FRT	non-FRT
Exterior bearing wall fire rating	2 hr	2 hr	1 hr
Interior bearing wall fire rating	1 hr	0 hr	1 hr
Interior non-bearing wall fire rating	0 hr	0 hr	0 hr
Floor assembly fire rating	1 hr	0 hr	1 hr
Fire wall rating	3 hr	3 hr	2 hr

IBC Tables 601 & 706.4

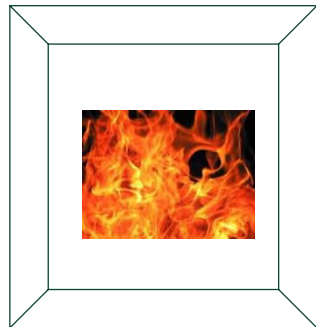
Note: FRT = Fire Retardant Treated

Fire-Resistance Rated Wall Assemblies

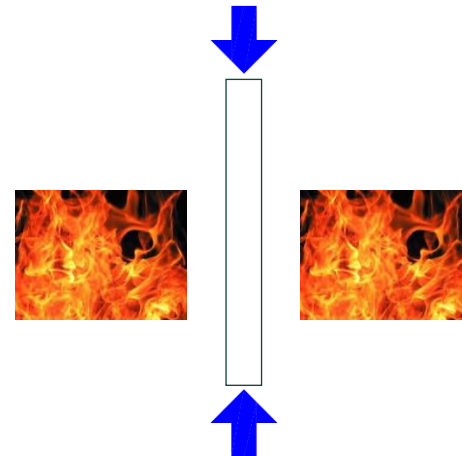
Fire-Resistance Rating: The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

Tested under a standardized test fire exposure for a given duration to:

1. Prevent the passage of flame and temperature rise from one side to the other
2. Continue to provide vertical structural support when exposed to fire and elevated temperatures



Fire Confinement



Structural Performance

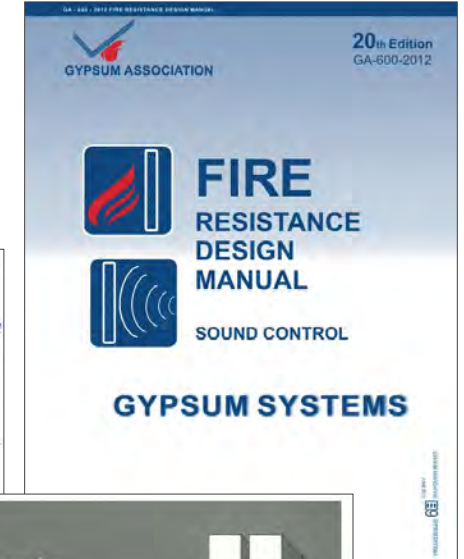
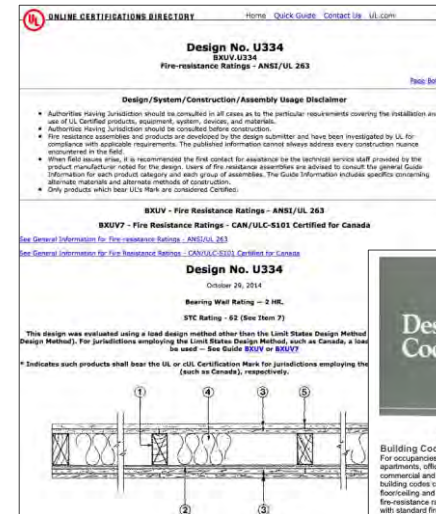
Choosing Fire Rated Assemblies

Common tested assemblies (ASTM E119) per IBC 703.2:

- » UL Listings
- » Gypsum Catalog
- » Proprietary Manufacturer Tests
- » Industry Documents: such as AWC's DCA3

Alternate Methods per IBC 703.3

- » Prescriptive designs per IBC 721.1
- » Calculated Fire Resistance per IBC 722
- » Fire-resistance designs documented in sources
- » Engineering analysis based on a comparison
- » Fire-resistance designs certified by an approved agency



Exterior Walls – FRTW

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing and sheathing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.

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For a Type III or Type IV building, can non-treated studs and sheathing in a fire-tested assembly for exterior walls be replaced with fire retardant-treated studs and sheathing?

Yes, wall assemblies that were tested with untreated wood studs may instead use fire retardant-treated wood studs. The [UL Fire Design Information Section](#), Part VI: Walls and Partitions, Sub-section 1: Wood Stud Walls, states the following:

"Wood stud walls may contain fire retardant-treated studs as well as untreated wood studs. The use of fire retardant-treated plywood (wood structural panels) may be used in designs that contain use of untreated plywood when all other specified attributes are equivalent to the wood structural panel used in the design."



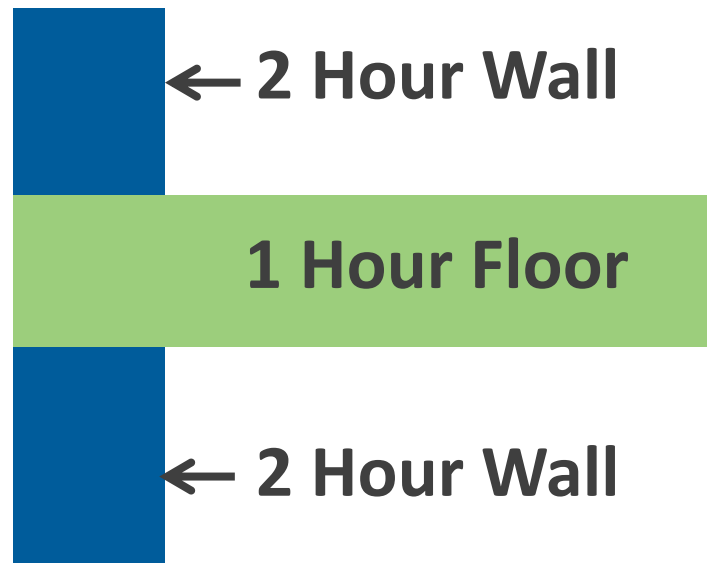
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Intersection of Tested Assemblies

- » Many options are available for fire resistance tested floor assemblies and wall assemblies
- » No tested intersection details exist
- » We must understand the intent of the code, provide a rationale that meets the code's intent, and utilize available information and testing results



Exterior Walls – Intersecting Floors

AWC's DCA3 provides floor to wall intersection detailing options

Addresses both continuity provisions and requirements for FRT elements in exterior wall plane



Fire-Resistance-Rated Wood-Frame Wall and Floor/Ceiling Assemblies

Building Code Requirements

For occupancies such as stores, apartments, offices, and other commercial and industrial uses, building codes commonly require floor/ceiling and wall assemblies to be fire-resistance rated in accordance with standard fire tests. This document is intended to aid in the design of various wood-frame walls and wood-frame floor/ceiling assemblies, where such assemblies are required by code to be fire-resistance-rated.

Depending on the application, wall assemblies may need to be fire-resistance-rated for exposure from either one side or both sides. Exterior walls are required to be rated for both interior and exterior fire exposure where the wall has a fire separation distance of 10 feet or less. For exterior walls with a fire separation distance of greater than 10 feet, the required fire-resistance-rating applies only to exposure from the interior. The designer should note that some state and local building code amendments may require fire resistance rating for exposure from both sides of exterior walls, regardless of fire separation distance; however, the solutions and example details provided in this doc-

Fire Tested Assemblies

Fire-resistance-rated wood-frame assemblies can be found in a number of sources including the *International Building Code (IBC)*, Underwriters Laboratories (UL) *Fire Resistance Directory*, Intertek Testing Services' *Directory of Listed Products*, and the Gypsum Association's *Fire Resistance Design Manual* (GA 600). The American Wood Council (AWC) and its members have tested a number of wood-frame fire-resistance-rated assemblies (see photos). Descriptions of successfully tested lumber wall assemblies are provided in [Table 1](#) for one-hour fire-resistance-rated wall assemblies and [Table 2](#) for two-hour fire-resistance-rated wall assemblies. Lumber shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with the *American Softwood Lumber Standard (PS 20)*. The fire-resistance-rated assemblies described in this document, as well as those listed in other sources are not species- or grade-specific unless specifically noted as such.

Descriptions of successfully tested I-joist floor as-

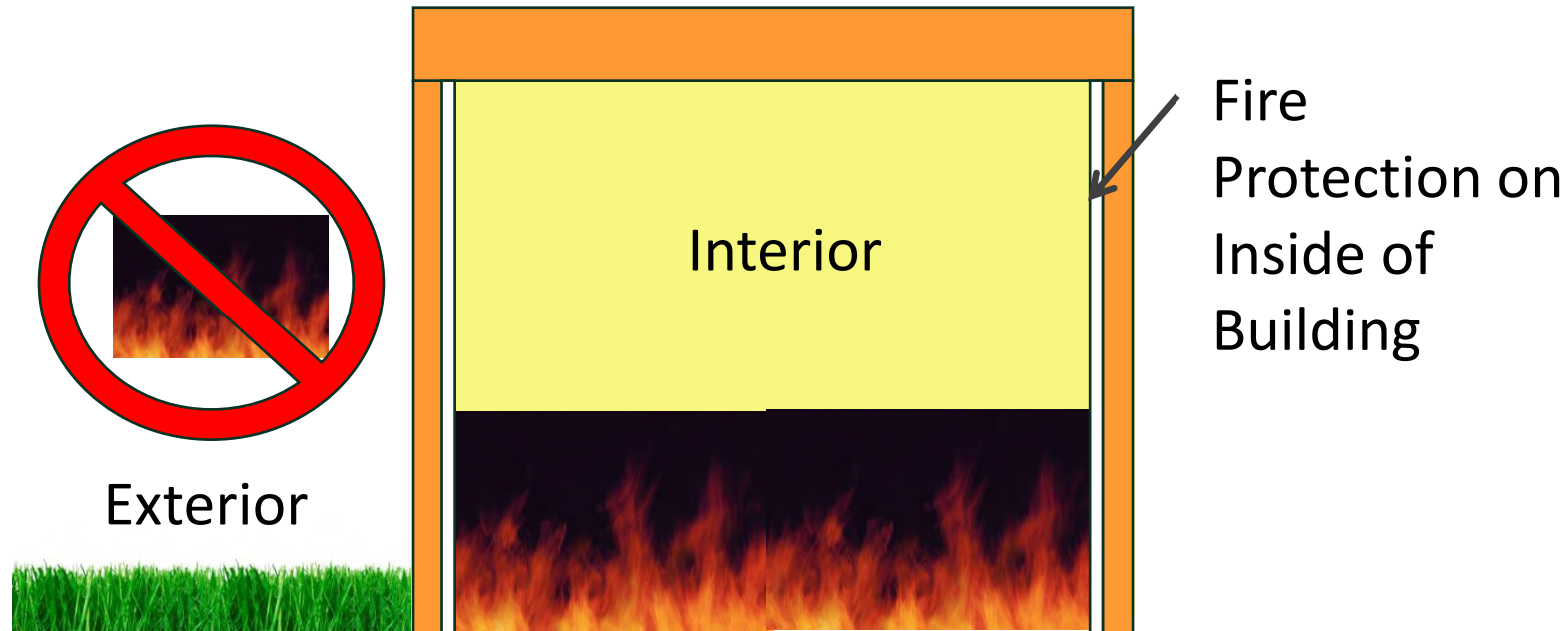


Zero Lot Line and Party Walls

Chelsea Drenick, Regional Director | CA-North, NV, UT

Exterior Walls – IBC 705

Basic assumption is that fires begin at the interior and rated wall assemblies are not required *from* the exterior unless close to another structure.



Exterior Walls – Fire Separation Distance (FSD)

705.5 Fire Resistance Ratings: Exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602 and this section. The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet shall be rated for exposure to fire from the inside. The required fire-resistance rating of exterior walls with a fire separation distance of less than or equal to 10 feet shall be rated for exposure to fire from both sides.

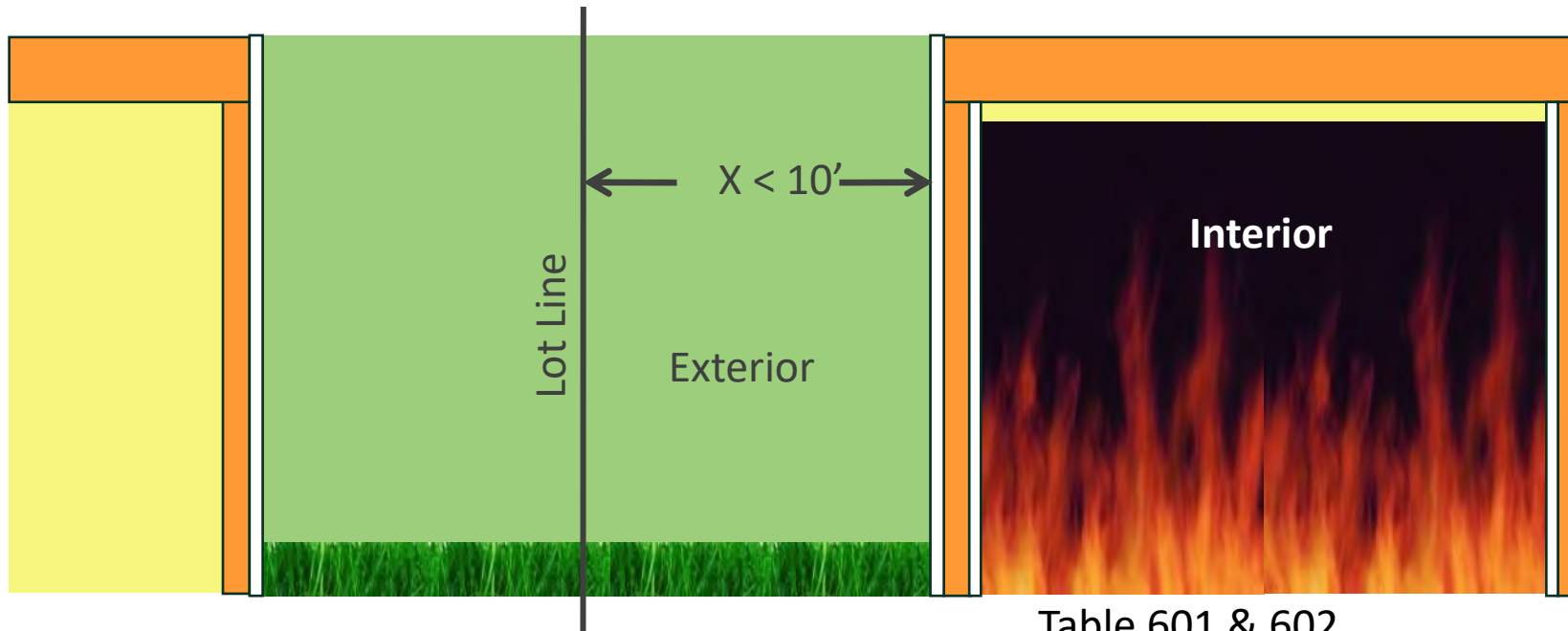


Table 601 & 602

Exterior Wall Fire Resistance

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 ^f (see Section 202)	3 ^{a, b}	2 ^{a, b}	1 ^b	0	1 ^b	0	HT	1 ^b	0
Bearing walls									
Exterior ^{c, f}	3	2	1	0	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions							See		
Interior ^d	0	0	0	0	0	0	Section	0	0
							2304.11.2		
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

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^{a, d, g}

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H ^e	OCCUPANCY GROUP F-1, M, S-1 ^f	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U ^h
X < 5 ^b	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1 ^c
	IIB, VB	1	0	0
	Others	1	1	1 ^c
X ≥ 30	All	0	0	0

Type III Exterior Walls: Fire Rating Requirements

Fire Rating of Structural Elements	IIIA		IIIB	
	Int. face of wall	Ext. face of wall	Int. face of wall	Ext. face of wall
FSD ≥ 30 ft				
Exterior bearing walls (hrs)	2	0	2	0
Exterior Nonbearing walls (hrs)	0	0	0	0
10 ft < FSD < 30 ft				
Exterior bearing walls (hrs)	2	0	2	0
Exterior Nonbearing walls (hrs)	1	0	0	0
FSD ≤ 10 ft				
Exterior bearing walls (hrs)	2	2	2	2
Exterior Nonbearing walls (hrs)	1	1	1	1

Type V Exterior Walls: Fire Rating Requirements

Fire Rating of Structural Elements	VA		VB	
	Int. face of wall	Ext. face of wall	Int. face of wall	Ext. face of wall
FSD ≥ 30 ft				
Exterior bearing walls (hrs)	1	0	0	0
Exterior Nonbearing walls (hrs)	0	0	0	0
10 ft < FSD < 30 ft				
Exterior bearing walls (hrs)	1	0	0	0
Exterior Nonbearing walls (hrs)	1	0	0	0
FSD ≤ 10 ft				
Exterior bearing walls (hrs)	1	1	1	1
Exterior Nonbearing walls (hrs)	1	1	1	1

Exterior Walls vs Party Walls

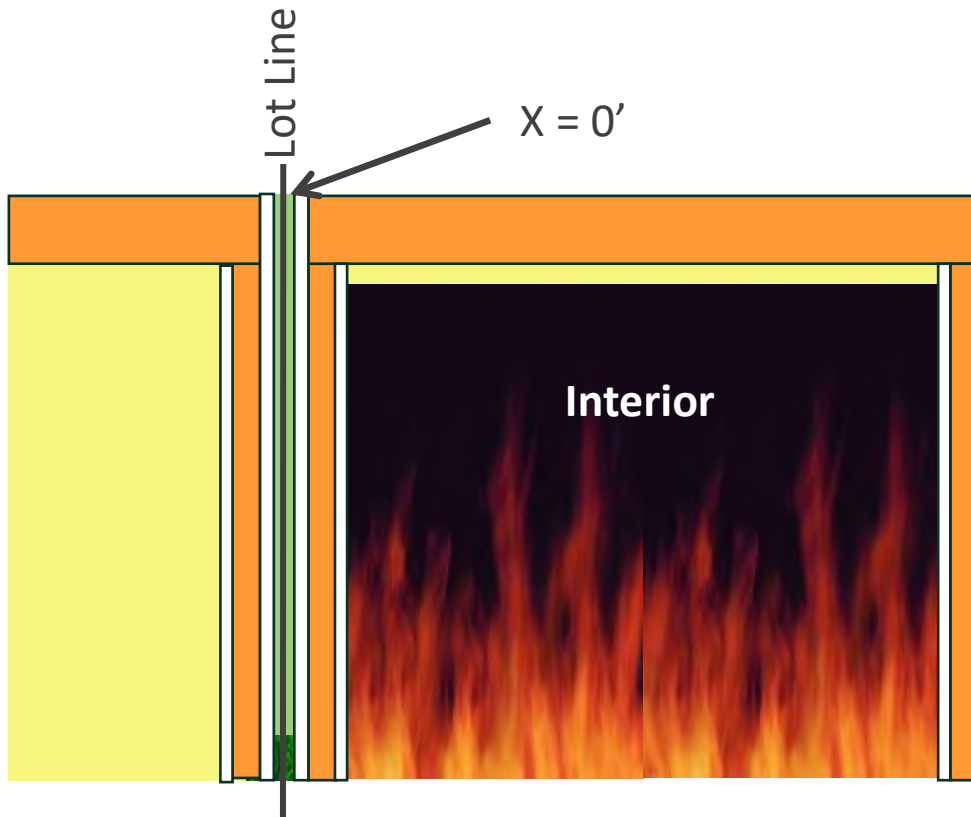
Table 602: footnote b. See Section 706.1.1 for party walls.

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.

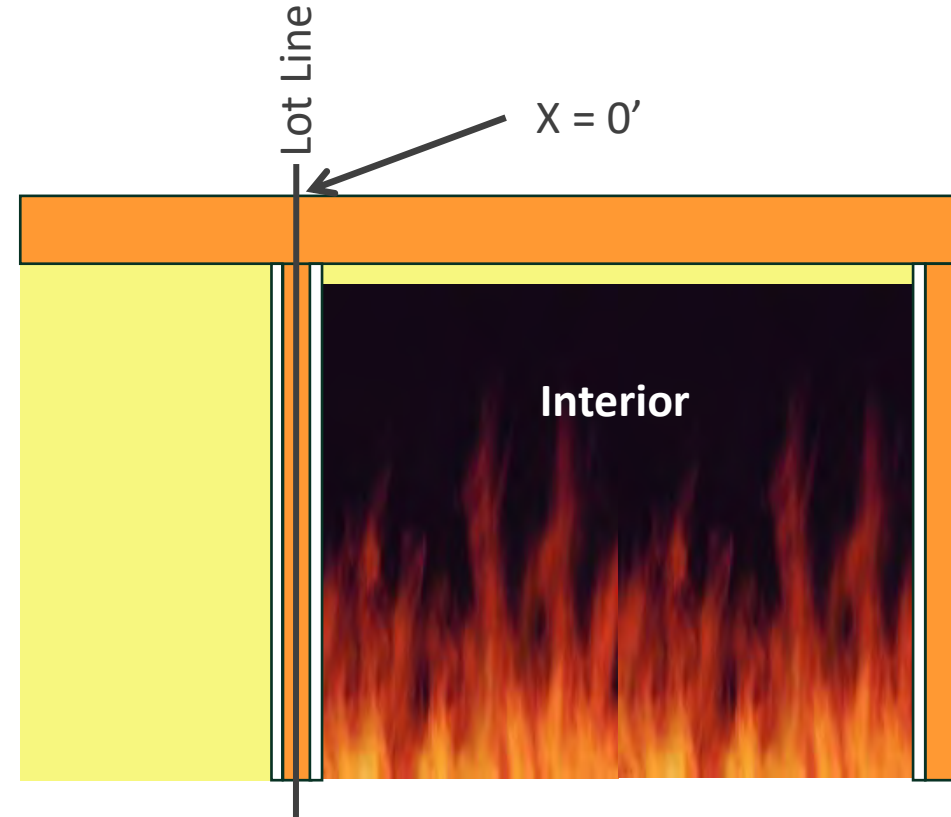
- Commentary clarifies: A party wall is a fire wall on an interior lot line, adapted for joint use by both buildings. It is distinguished from other fire walls in that it is on the property line and serves to separate buildings usually owned by two separate parties. When two separate structures are built up to the property line, the designer has the option of using two separate exterior walls with zero FSD or a party wall.

Exterior Walls vs Party Walls

Option 1: (2) 0'-FSD Walls



Option 2: (1) Party Wall



Fire Walls – Ratings & Materials

TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS

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

- a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.
- b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.6 and 415.7.

IBC 706.3 – Fire walls shall be of any approved noncombustible materials.
Exception: Buildings of type V construction

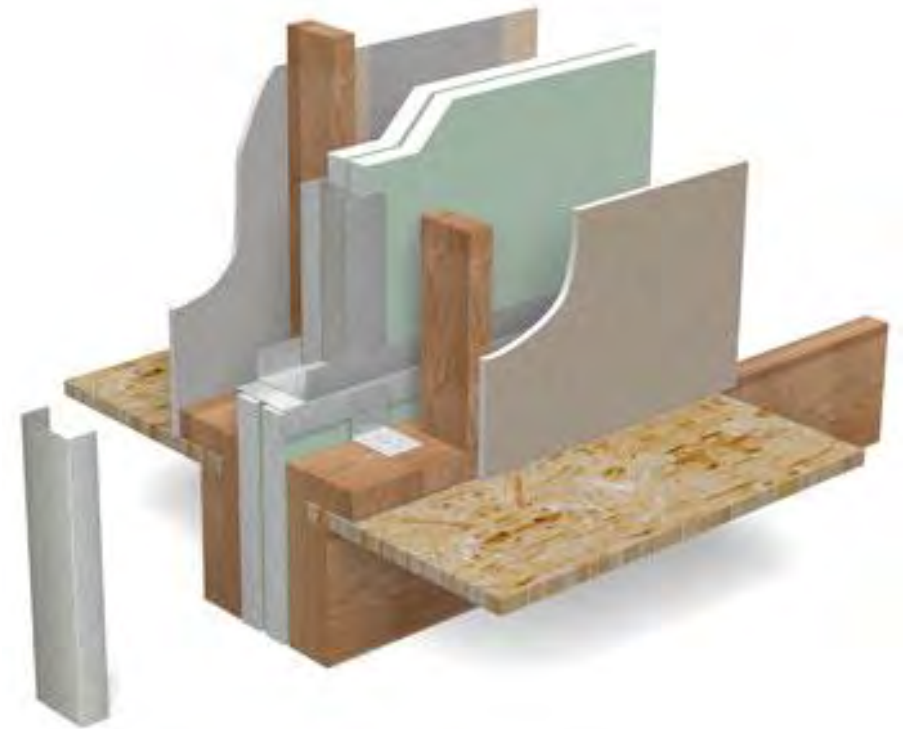
Fire Walls – Ratings & Materials

Opportunity for Wood Framed Fire Walls:

- » Permitted in type V construction
- » Fire Walls in type V construction of A, B, E, R and several other occupancies may be 2-hr

Fire Walls in type III and IV construction are required to be constructed of noncombustible materials

- » Opportunity for wood frame bearing walls on each side of fire wall to meet structural stability requirements



Exterior Walls vs Party Walls

0' Fire Separation Distance: Wall openings are not permitted per 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*
0 to less than 3 ^{b, c, k}	Unprotected, Nonsprinklered (UP, NS)	Not Permitted ^k
	Unprotected, Sprinklered (UP, S) ^l	Not Permitted ^k
	Protected (P)	Not Permitted ^k

k. For openings between S-2 parking garage and Group R-2 building, see Section 705.3, Exception 2.

Party Walls: Wall openings are not permitted per 706.1.1

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.

Buildings on the Same Lot – IBC 705.3

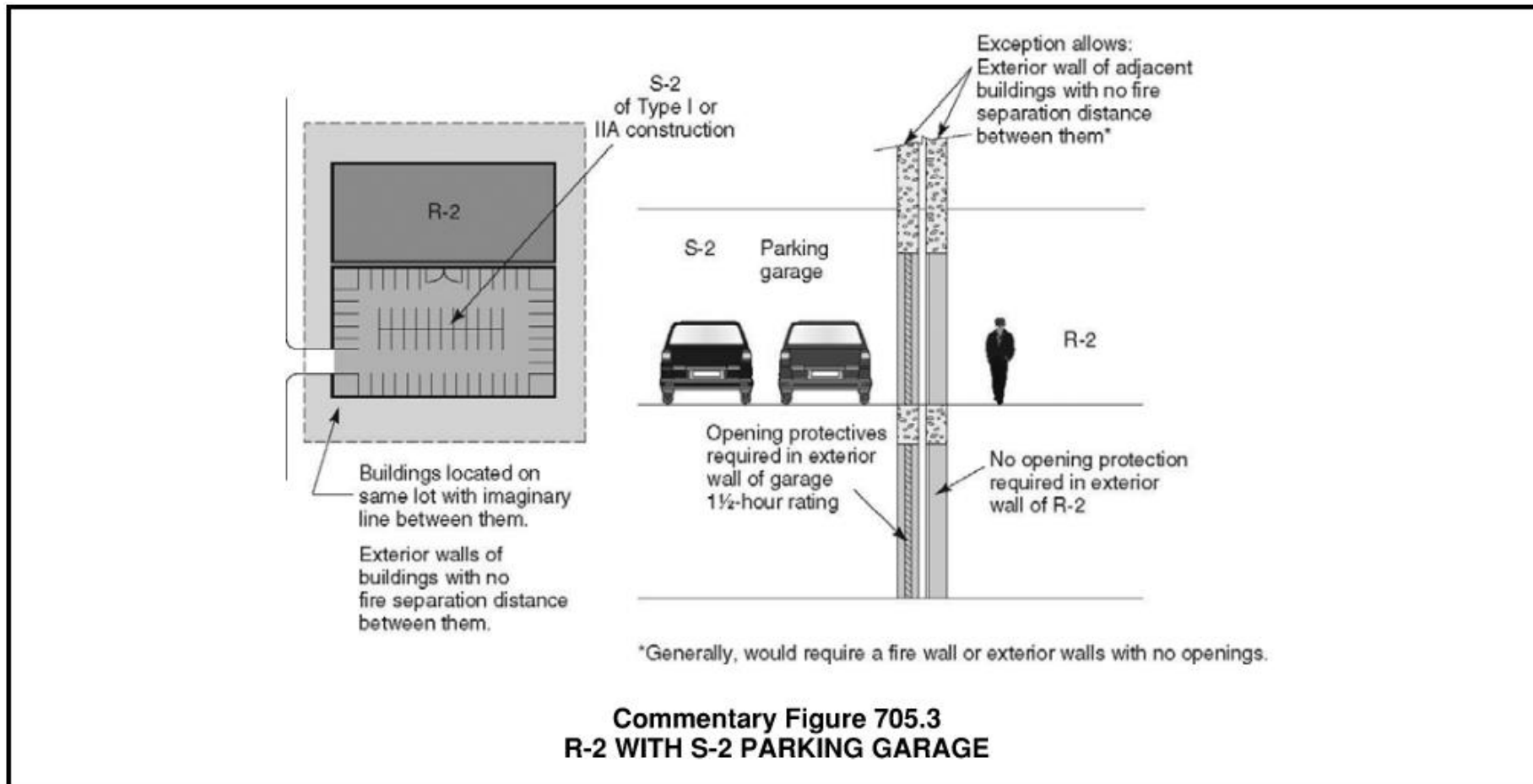
705.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection... buildings on the same lot shall be assumed to have an imaginary line between them.

Exceptions:

1. If treated as a single building, the aggregate area is within the heights and areas limitations of Chapter 5
2. S-2 parking garage of type I or II-A construction next to R-2 building

Buildings on the Same Lot – IBC 705.3

Exception for S-2 parking of construction type I or IIA erected adjacent to R-2 building (no limit on construction type)





Thank You