



# Type III Fire-Resistant Design and Detailing

for Exterior Walls, Shafts, and Intersections

PNCI, Portland, OR  
November 15, 2023

Presented by  
**Kate Carrigg, PE**, WoodWorks

# Outline

- » Context for Type III Construction
- » Definitions and Terminology
- » Fire Rating Requirements for Exterior Walls
- » Fire Rating Requirements for Shaft Walls
- » Specifying Rated Assemblies
- » Floor to Wall Intersections



Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins

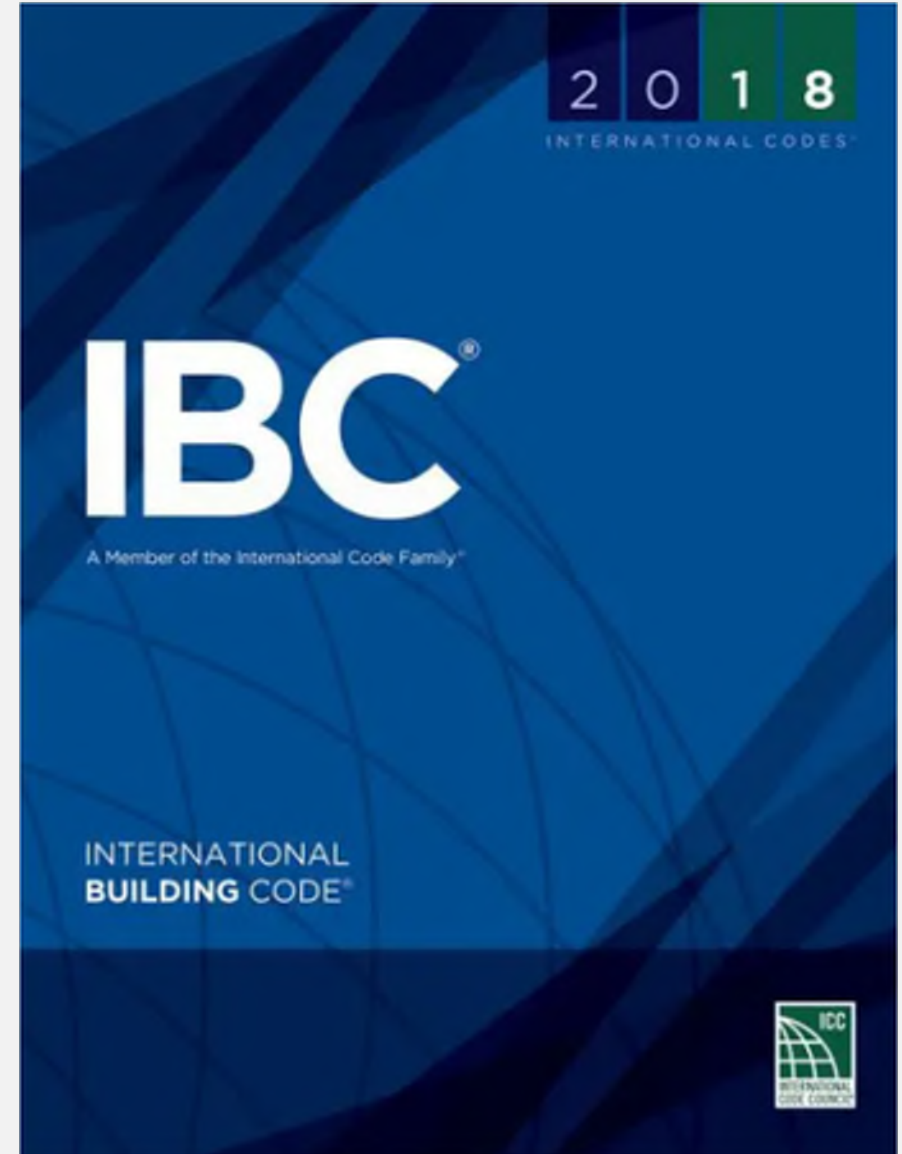
# This Presentation References:



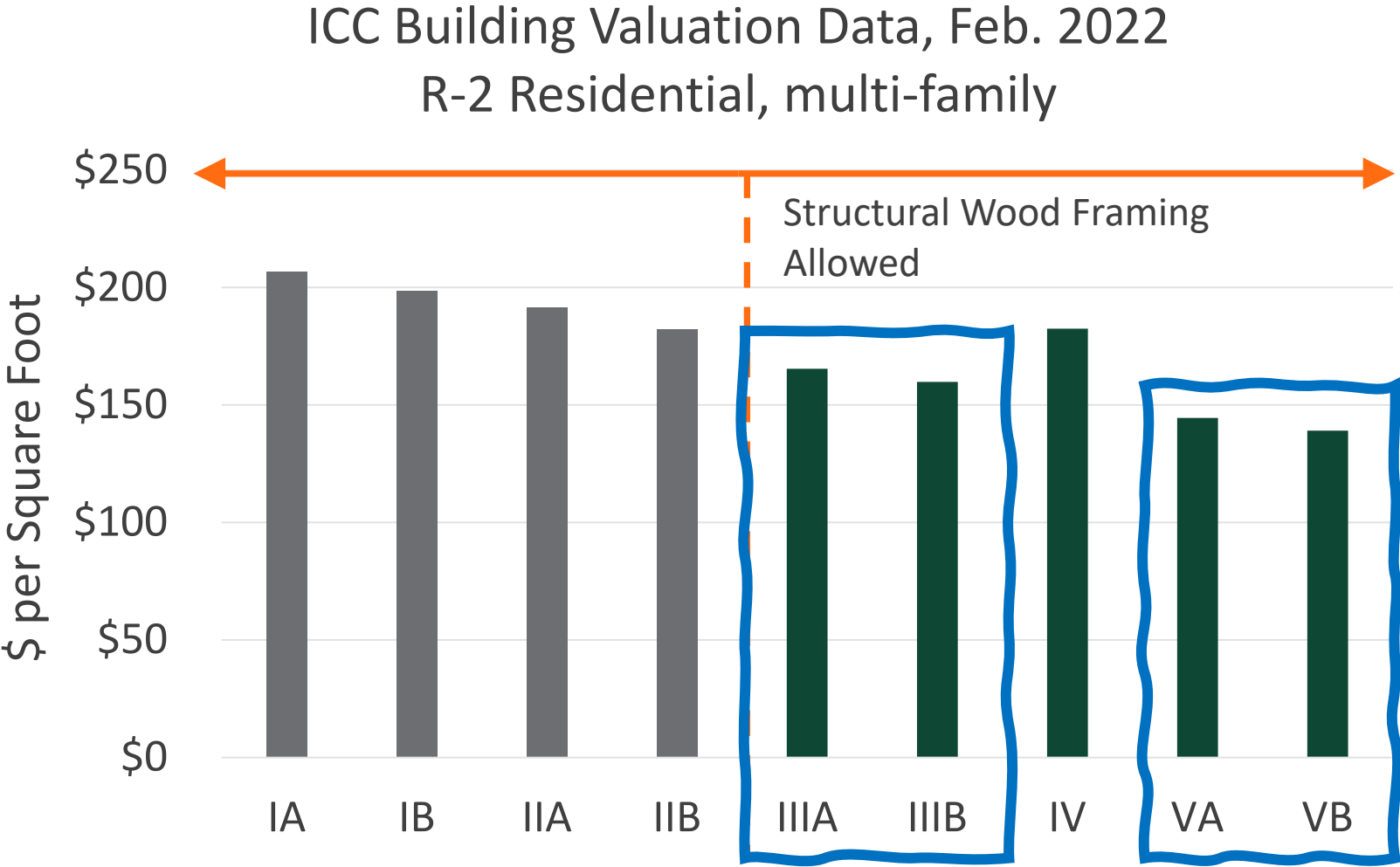
(Unless Otherwise Noted)

# Part 1: Outline

➤ Context for Type III Construction



# ICC Building Valuation Data



# IBC Building Size Limits with Sprinkler

## Residential (R1, R2, and R4) Occupancies

Type IIIA Construction Allowable Limit	NS	S13R	SM	Max Frontage
Stories	4	4	5	5
Height (ft)	65	60	85	85
Building Area/Story (ft <sup>2</sup> )	24k	24k	72k	90k
Total Building Area* (ft <sup>2</sup> )	72k	96k	216k	270k

\* Assuming max stories built per IBC 506.4

\*\* Maximum frontage increase possible

### **903.2.8 Group R**

*Automatic sprinkler systems installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area*



# Type IIIA Construction Max. Height: 85ft

+ Mezzanine

5 stories Maximum  
for Residential

+ Multi-Story (Type 1A)  
Podium



Photo credit: Matt Todd & PB Architects

# Part 1: Outline

» Context for Type III Construction

➤ Definitions and Terminology



Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins



# Fire Performance



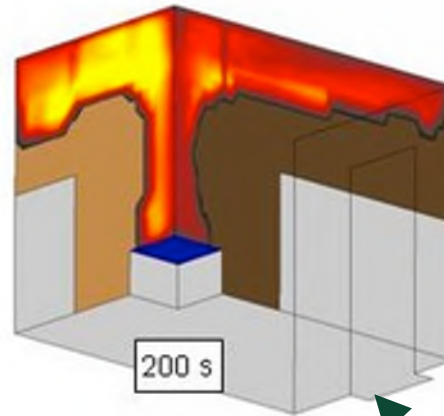
← **Combustibility**



← **Fire Resistance**



← **Fire Protection Systems**



← **Flame Spread Classification**

# Fire Resistance-Rated Assemblies

**Fire-Resistance Rating**: The *period of time* a building element, component or assembly maintains the ability to:



**Maintain Structural  
Performance**



**Provide Fire Confinement**

# Calculated Fire Resistance of Wood

## IBC to NDS code compliance path



### IBC 703.3

#### Methods for determining fire resistance

- Prescriptive designs per IBC 721.1
- **Calculations in accordance with IBC 722**
- Fire-resistance designs documented in sources
- Engineering analysis based on a comparison
- Alternate protection methods as allowed by 104.11



### IBC 722

#### Calculated Fire Resistance

"The calculated *fire resistance* of exposed wood members and wood decking shall be permitted in accordance with **Chapter 16 of ANSI/AWC National Design Specification for Wood Construction (NDS)**



### NDS Chapter 16

#### Fire Design of Wood Members

- Limited to calculating fire resistance up to 2 hours
- Char depth varies based on exposure time (i.e., fire-resistance rating), product type and lamination thickness. Equations and tables are provided.
- TR 10 and NDS commentary are helpful in implementing permitted calculations.



# Calculated Fire Resistance of Wood

For Exposed Wood Members: IBC 722.1 References AWC's NDS Chapter 16  
(AWC's TR 10 is a design aid to NDS Chapter 16)

NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION 149

## FIRE DESIGN OF WOOD MEMBERS

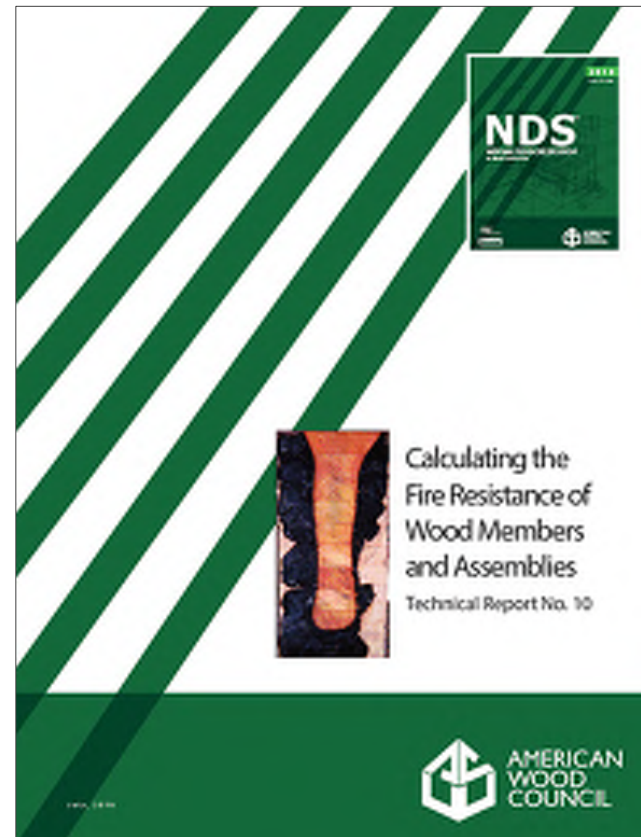
16.1 General	150
16.2 Design Procedures for Exposed Wood Members	150
16.3 Wood Connections	151

Table 16.2.1 Effective Char Rates and Char Layer Thicknesses (for  $\beta_e = 1.5 \text{ in./hr.}$ ) 150

Table 16.2.2 Adjustment Factors for Fire Design 151

16

Copyright © American Wood Council. Downloaded from www.awc.org. All rights reserved. No further reproduction authorized. AMERICAN WOOD COUNCIL





# Part 1: Outline

» Context for Type III Construction

» Definitions and Terminology

➤ Fire Rating Requirements for Exterior Walls



Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins

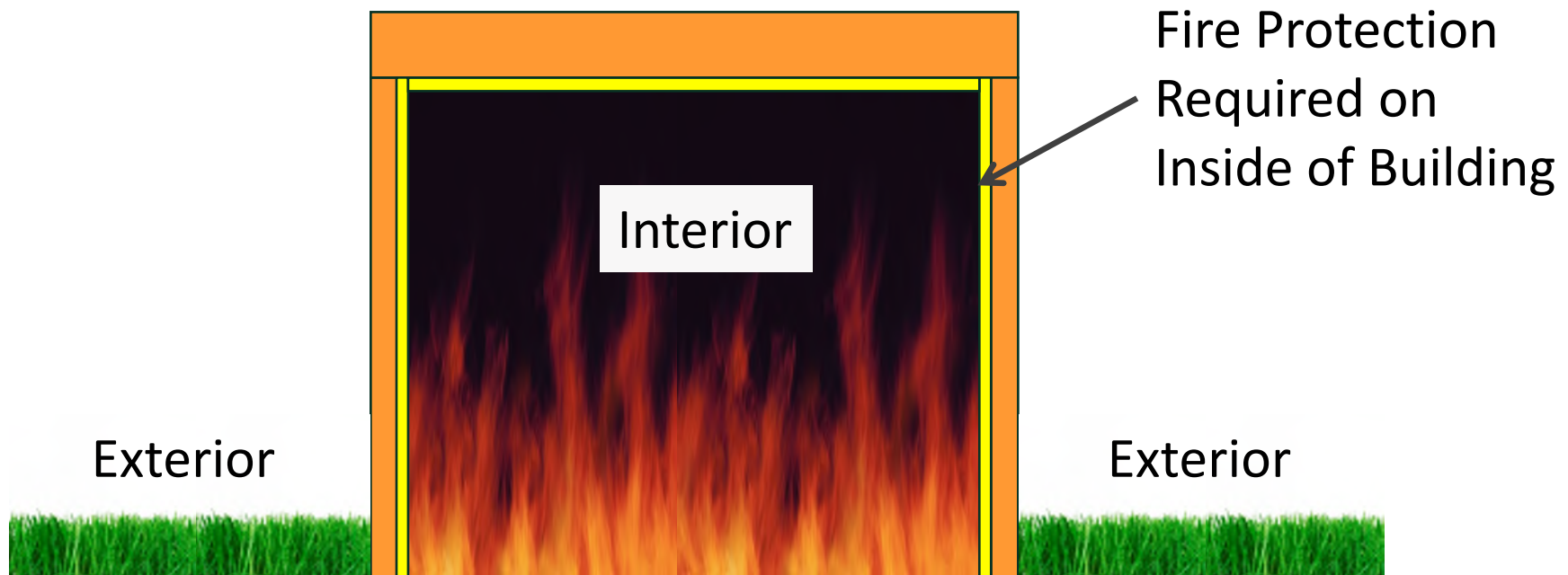
# Fire Resistance-Rated Wall Assemblies

There are four basic types of fire-resistance rated wall assemblies:

1. Exterior Walls (IBC 705)
2. Fire Walls (IBC 706)
3. Fire Barriers (IBC 707)
4. Fire Partitions (IBC 708)

# Exterior Walls – IBC 705

The basic assumption is that fires begin at the interior:



# IBC 705 - Exterior Wall Fire Resistance

**705.5 Fire Resistance Ratings:** Exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602 and this section...

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



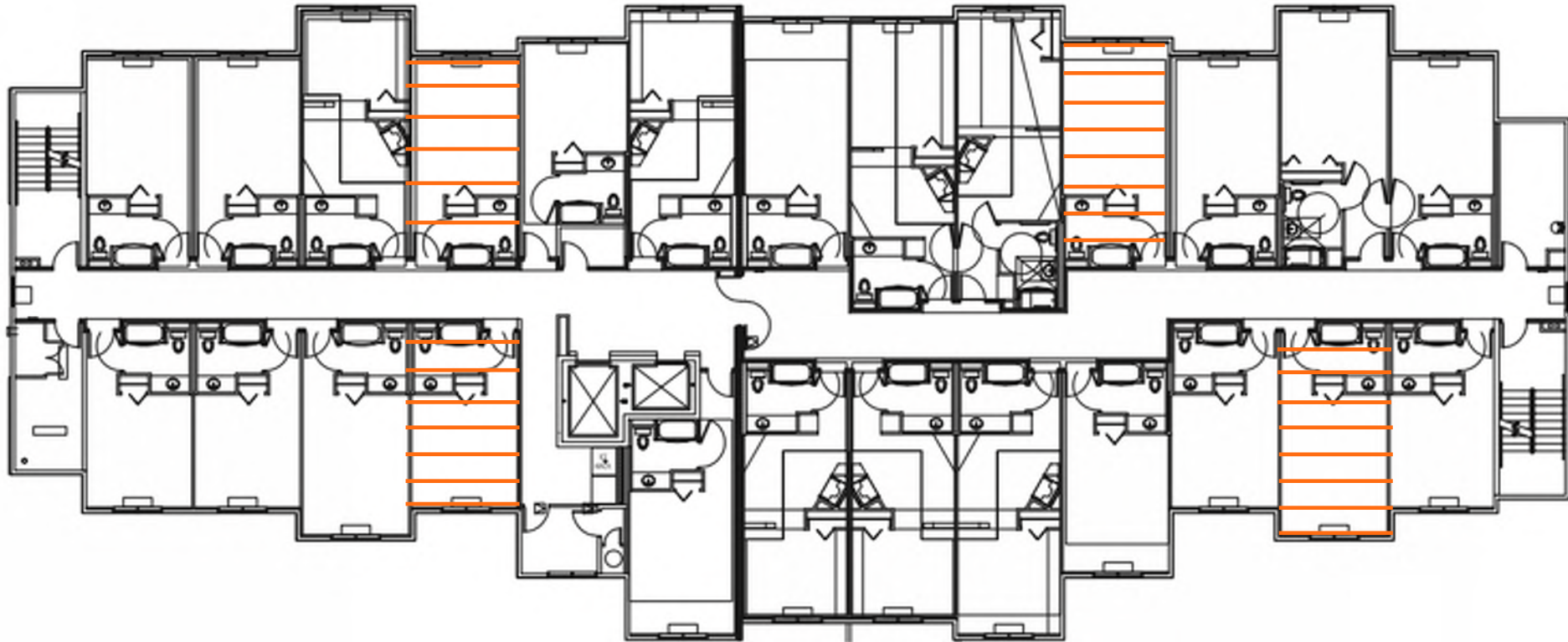
# Exterior Walls – Bearing vs. Non-Bearing

*IBC Chapter 2 definition:*

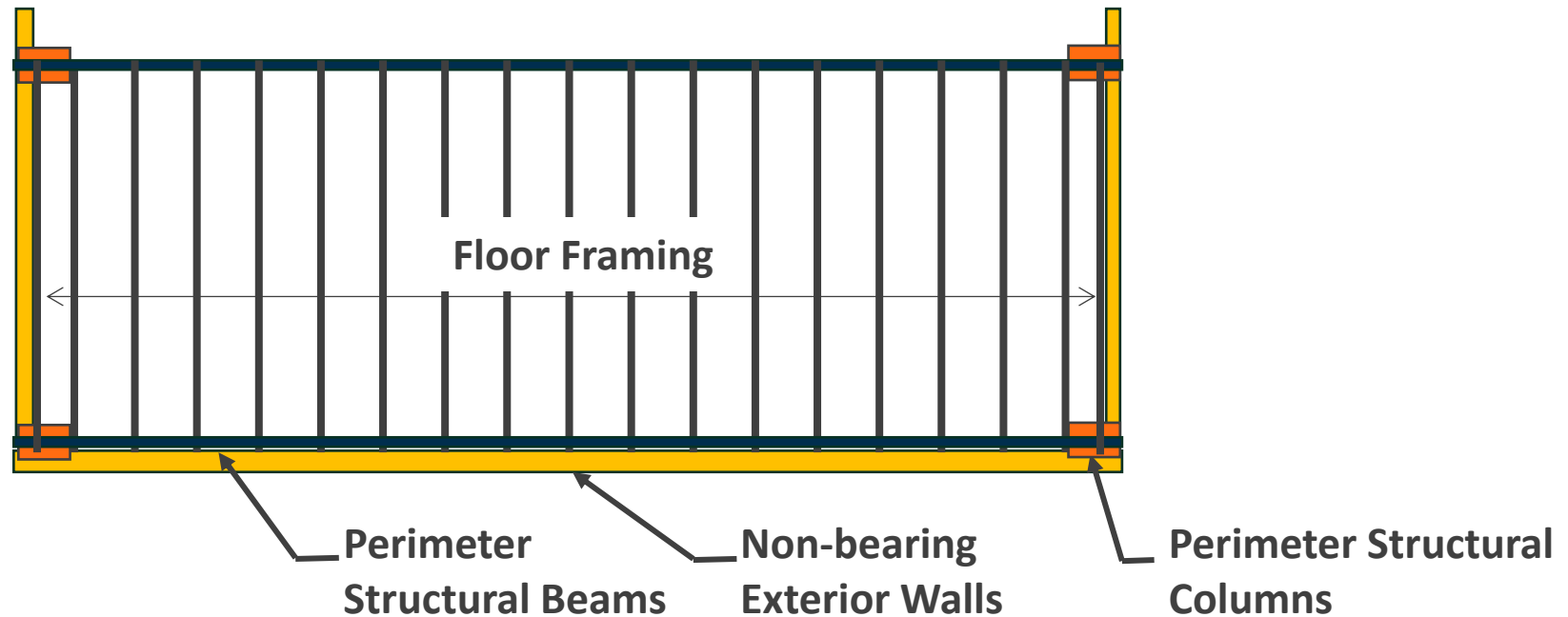
**NON-LOAD BEARING WALL:** Any wall that is not a load-bearing wall

**LOAD BEARING WALL:** Any metal or wood stud wall that supports more than 100 pounds per linear foot of vertical load in addition to its own weight.

# Exterior Walls – Bearing vs. Non-Bearing



# Exterior Walls – Bearing vs. Non-Bearing



**Note:** Beams & Columns will most likely be considered “Primary Structural Frame” & require individual encasement per IBC 704

# IBC 705 - 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 <sup>f</sup> (see Section 202)	3 <sup>a, b</sup>	2 <sup>a, b</sup>	1 <sup>b</sup>	0	1 <sup>b</sup>	0	HT	1 <sup>b</sup>	0
Bearing walls									
Exterior <sup>c, f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions							See		
Interior <sup>d</sup>	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 <sup>b</sup>	1 <sup>b, c</sup>	1 <sup>b, c</sup>	0 <sup>c</sup>	1 <sup>b, c</sup>	0	HT	1 <sup>b, c</sup>	0

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

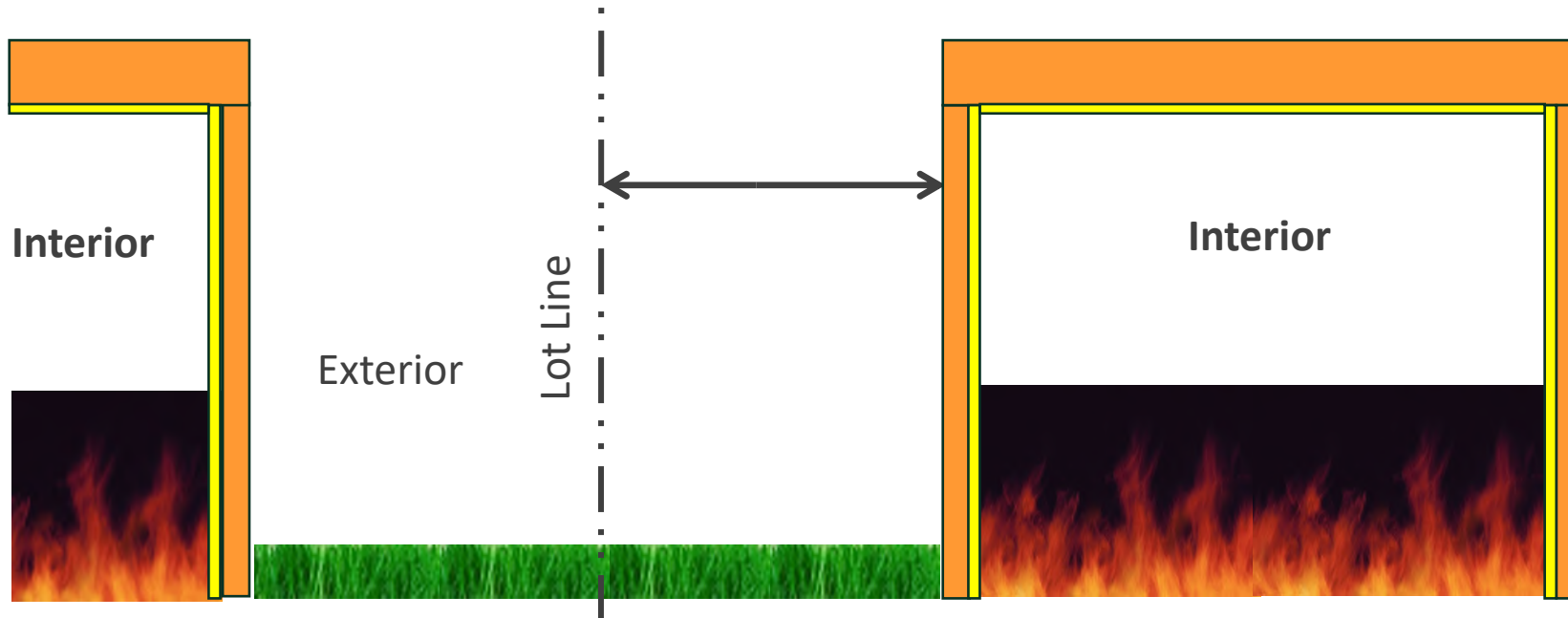
FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H <sup>a</sup>	OCCUPANCY GROUP F-1, M, S-1 <sup>f</sup>	OCCUPANCY GROUP A, B, E, F-2, I, R, S-2, U <sup>b</sup>
X < 5 <sup>b</sup>	All	3	2	1
5 ≤ X < 10	IA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB	2	1	1 <sup>c</sup>
	IIB, VB	1	0	0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

(2021 IBC  
Table 705.5)



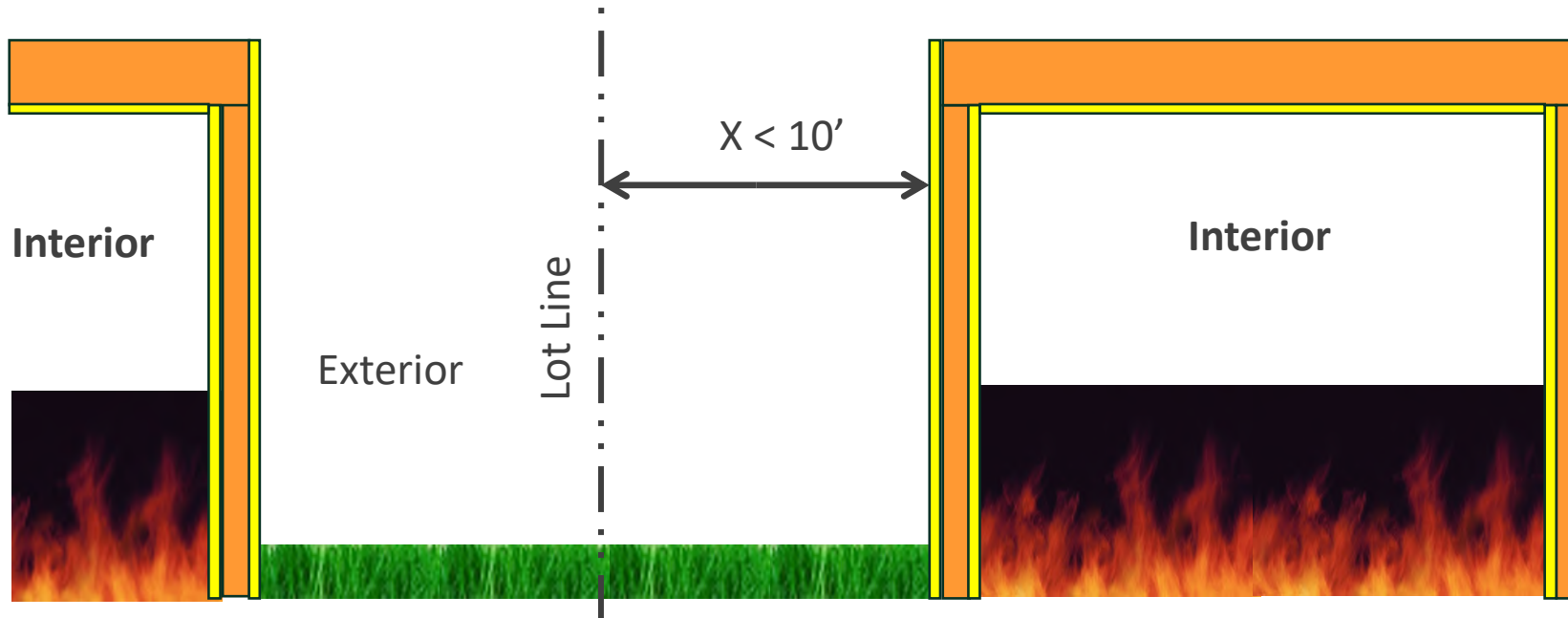
# Exterior Walls – Fire Separation Distance

**705.5 Fire Resistance Ratings:** ...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.



# Exterior Walls – Fire Separation Distance

**705.5 Fire Resistance Ratings:** ...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.



# Type III Exterior Walls: Fire Rating Requirements

Fire Rating of Structural Elements	IIIA		IIIB	
For occupancy groups A, B, E, F-2, I, R, S-2, U	Int. face of wall	Ext. face of wall	Int. face of wall	Ext. face of wall
<b>FSD ≥ 30 ft</b>				
Exterior bearing walls (hrs)	2	0	2	0
Exterior Nonbearing walls (hrs)	0	0	0	0
<b>10 ft &lt; FSD &lt; 30 ft</b>				
Exterior bearing walls (hrs)	2	0	2	0
Exterior Nonbearing walls (hrs)	1	0	0	0
<b>FSD ≤ 10 ft</b>				
Exterior bearing walls (hrs)	2	2	2	2
Exterior Nonbearing walls (hrs)	1	1	1	1

# Part 1: Outline

- » Context for Type III Construction
- » Definitions and Terminology
- » Fire Rating Requirements for Exterior Walls
- Fire Rating Requirements for Shaft Walls



Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins



# Types of Shaft Walls

1. Elevator
2. Stair
3. Mechanical

*Some points of shaft wall construction and detailing apply to all types of shafts, while some are unique to each type of shaft.*

# Shaft Walls



## Shaft Walls Form Shaft Enclosures

“The purpose of shafts is to confine a fire to the floor of origin and to prevent the fire or the products of the fire (smoke, heat and hot gases) from spreading to other levels.”

*Source: IBC Commentary to Section 713.1*

# Defining Shaft Wall Requirements

Code requirements for shaft enclosures contained in IBC Section 713:

## **SECTION 713 SHAFT ENCLOSURES**

- » **IBC 713.1:** The provisions of this section shall apply to shafts required to protect opening and penetrations through floor ceilings and roof assemblies. Interior exit stair-ways and ramps shall be enclosed in accordance with Section 1023.
- » **IBC 713.2:** Shaft Walls shall be constructed as **Fire Barriers**

# Fire Resistance-Rated Wall Assemblies

There are four basic types of fire-resistance rated wall assemblies:

1. Exterior Walls (IBC 705)
2. Fire Walls (IBC 706)
3. **Fire Barriers (IBC 707)**
4. Fire Partitions (IBC 708)

# Shaft Walls that are also Exterior Walls

Stair and elevator shaft enclosures are commonly placed along the **exterior** of the building

When a shaft wall also serves as the exterior wall of a building, unique provisions exist





# Shaft Walls that are also Exterior Walls

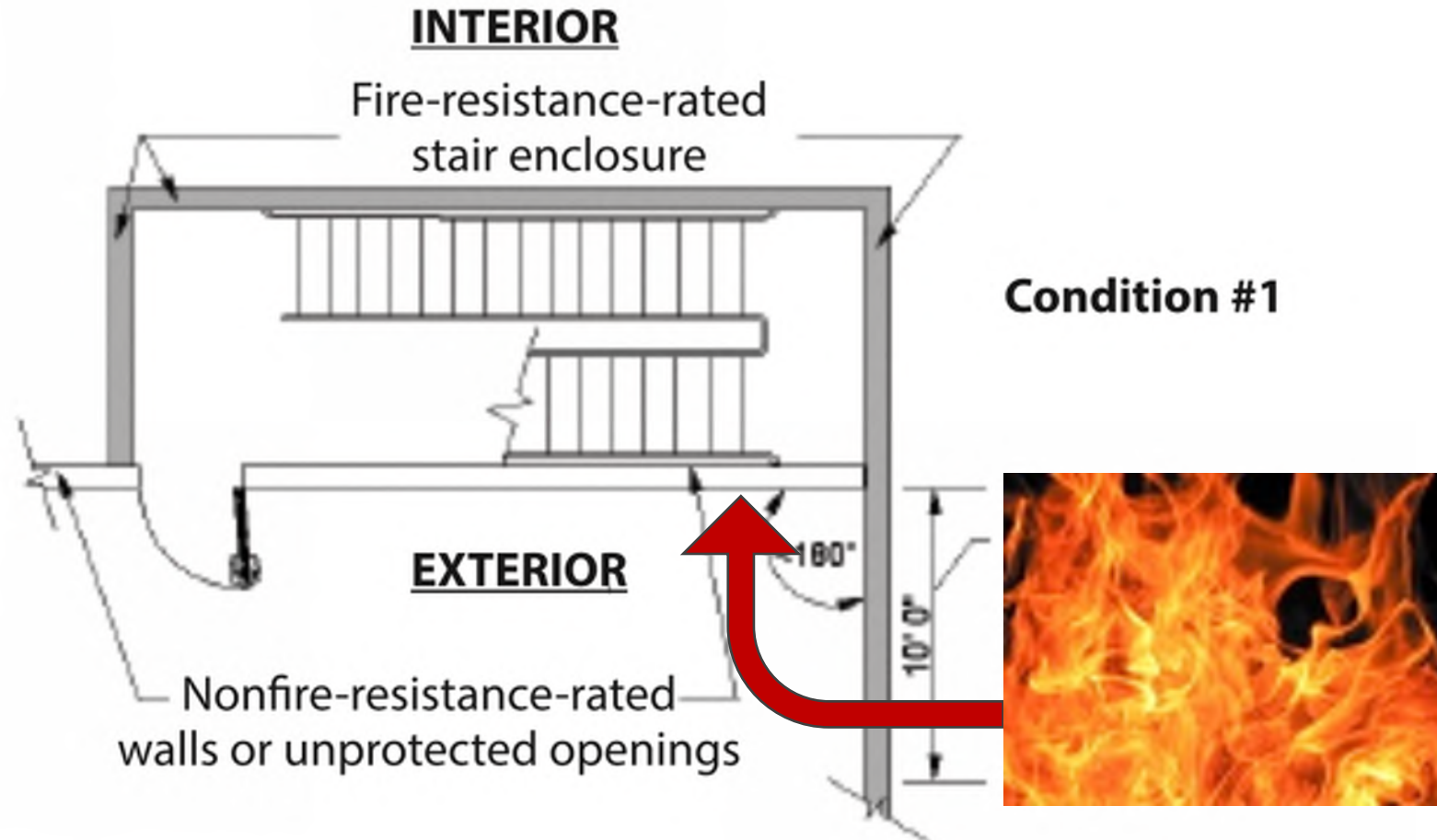
## Section 713: Shaft Enclosures

### *713.6 Exterior walls.*

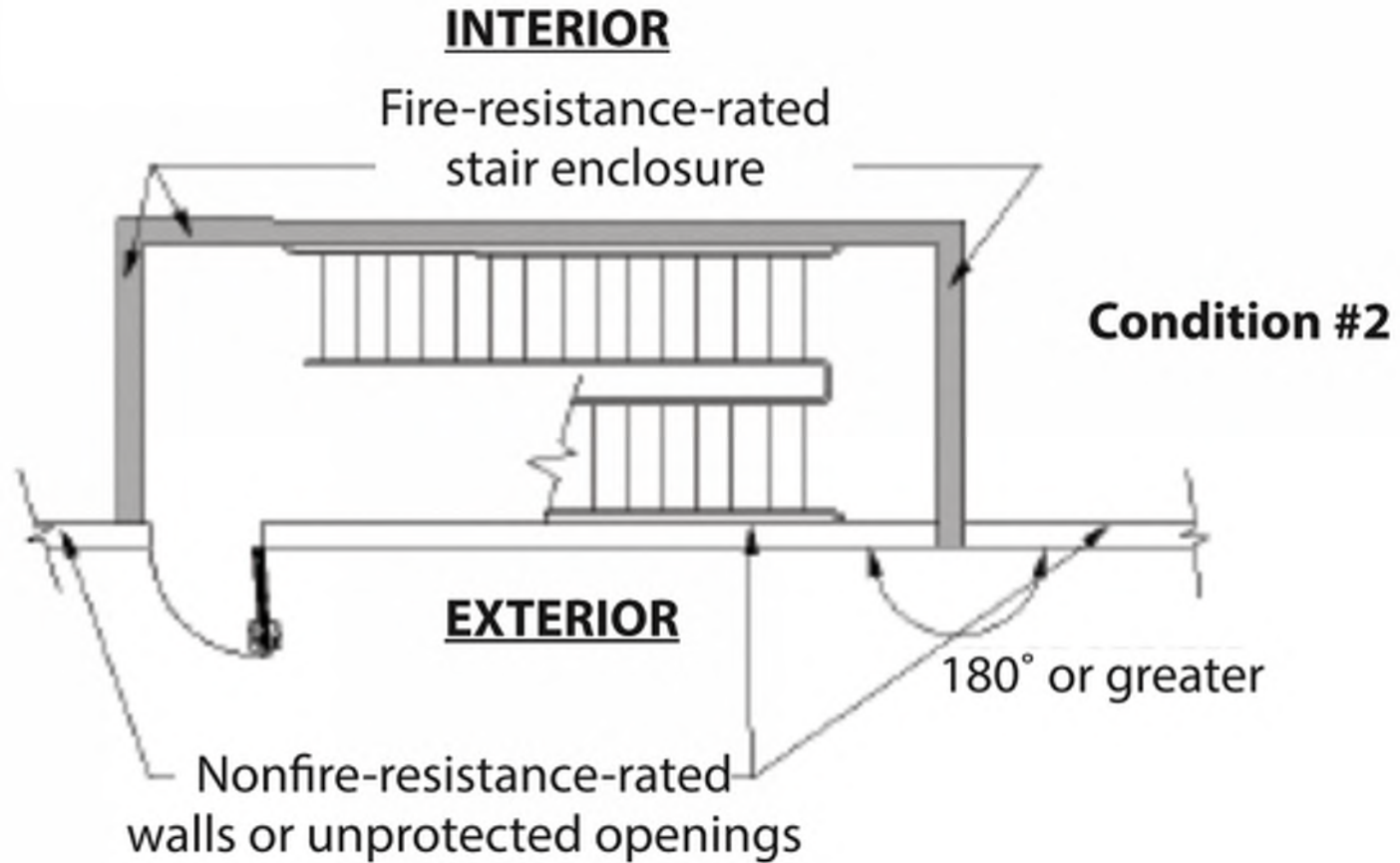
Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the requirements of Section 705 for exterior walls and the fire resistance-rated enclosure requirements shall not apply.

**Exception:** Exterior walls required to be fire-resistance rated in accordance with Section 1021.2 for exterior egress balconies, Section 1023.7 for interior exit stairways and ramps and Section 1027.6 for exterior exit stairways and ramps.

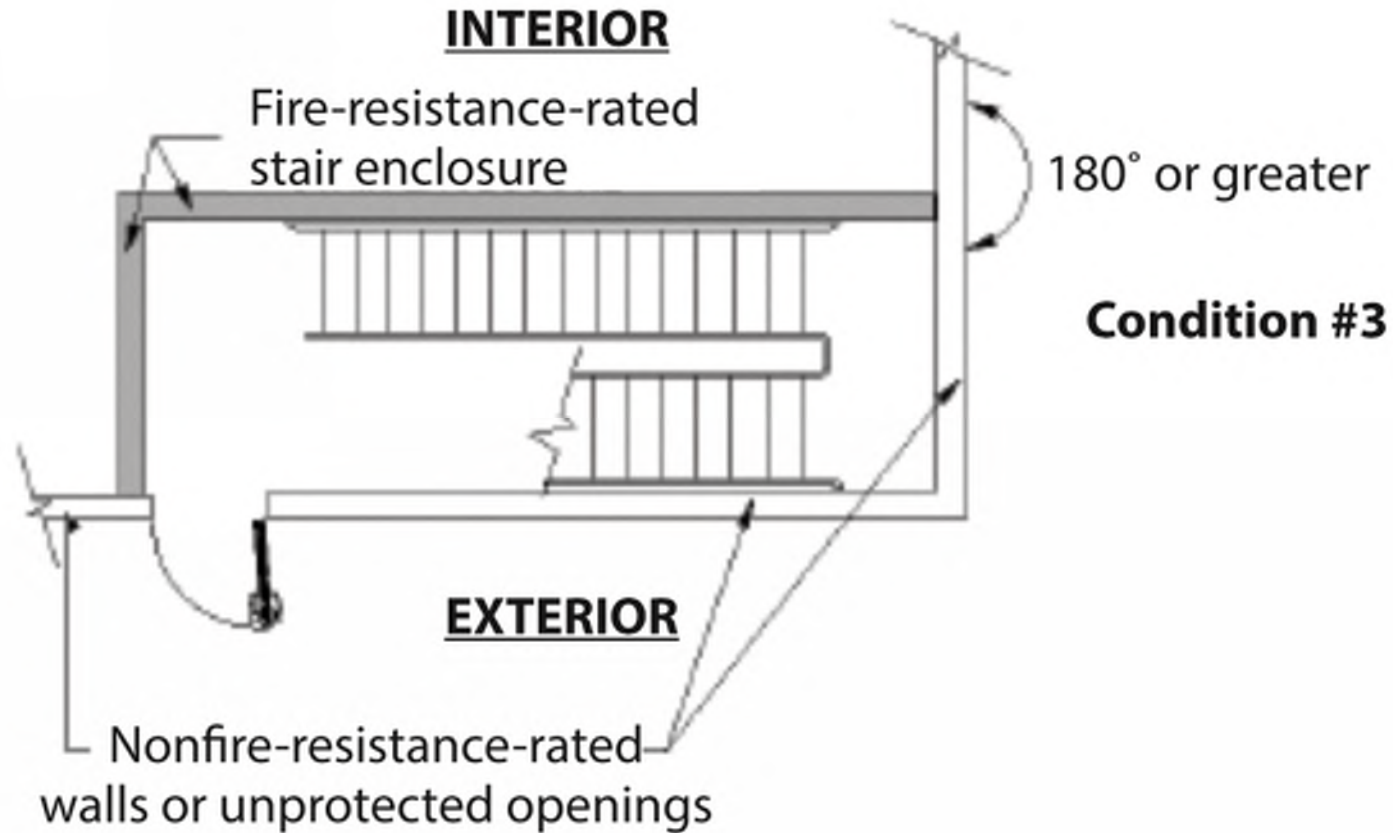
# Shaft Walls that are also Exterior Walls – IBC 1023.7



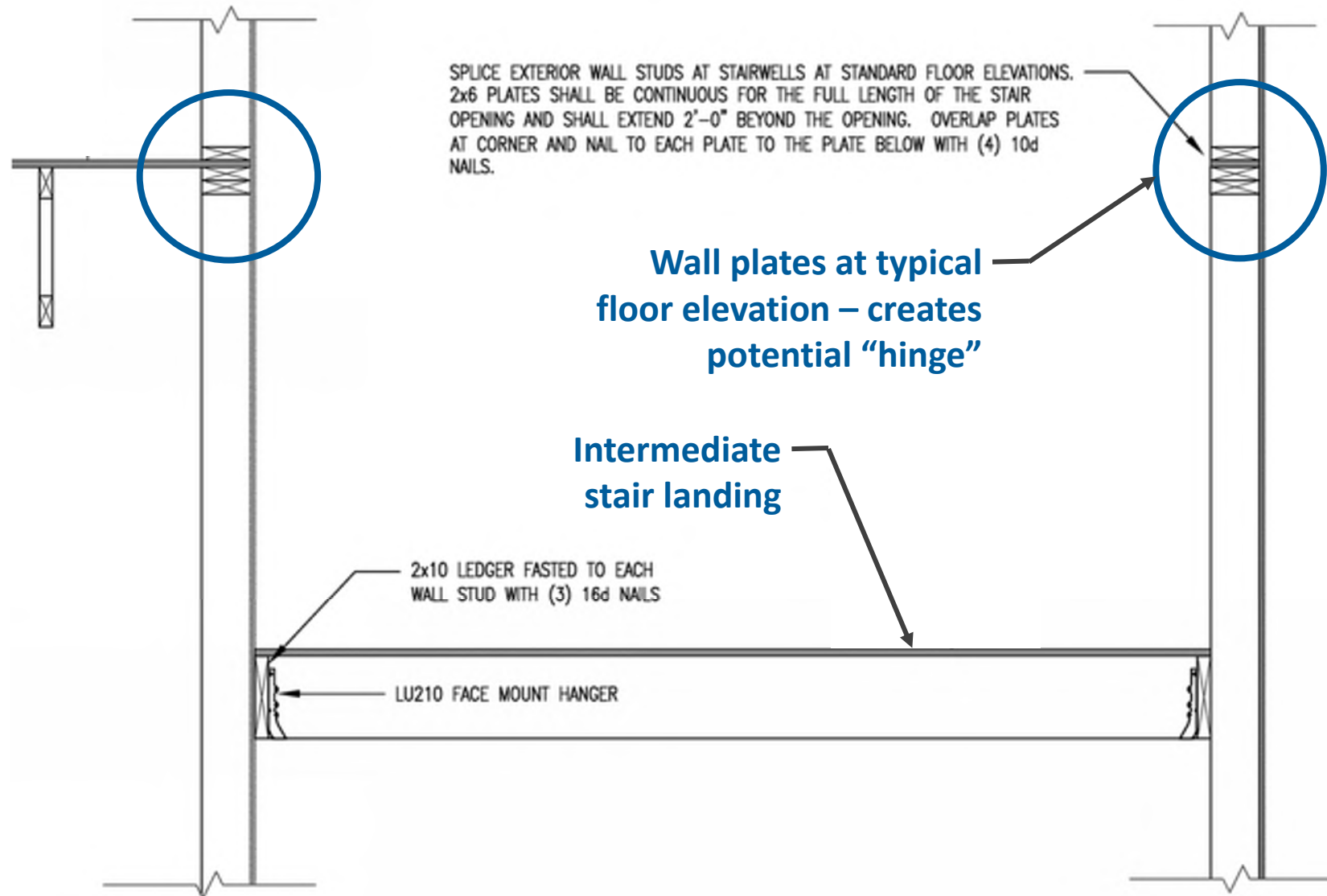
# Shaft Walls that are also Exterior Walls – IBC 1023.7



# Shaft Walls that are also Exterior Walls – IBC 1023.7



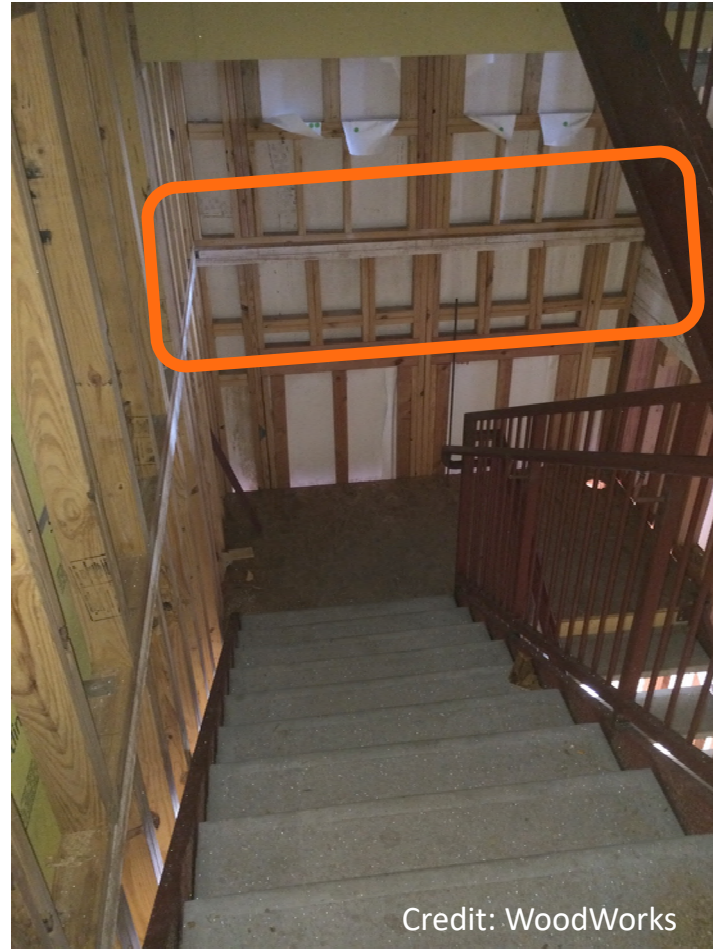
# Shaft Walls that are also Exterior Walls



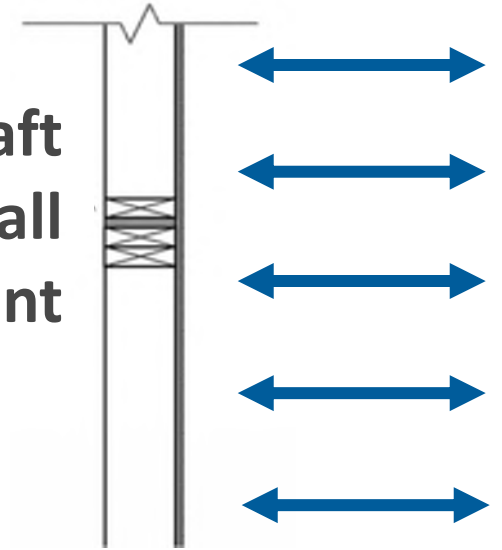


# Shaft Walls that are also Exterior Walls

## Structural Considerations



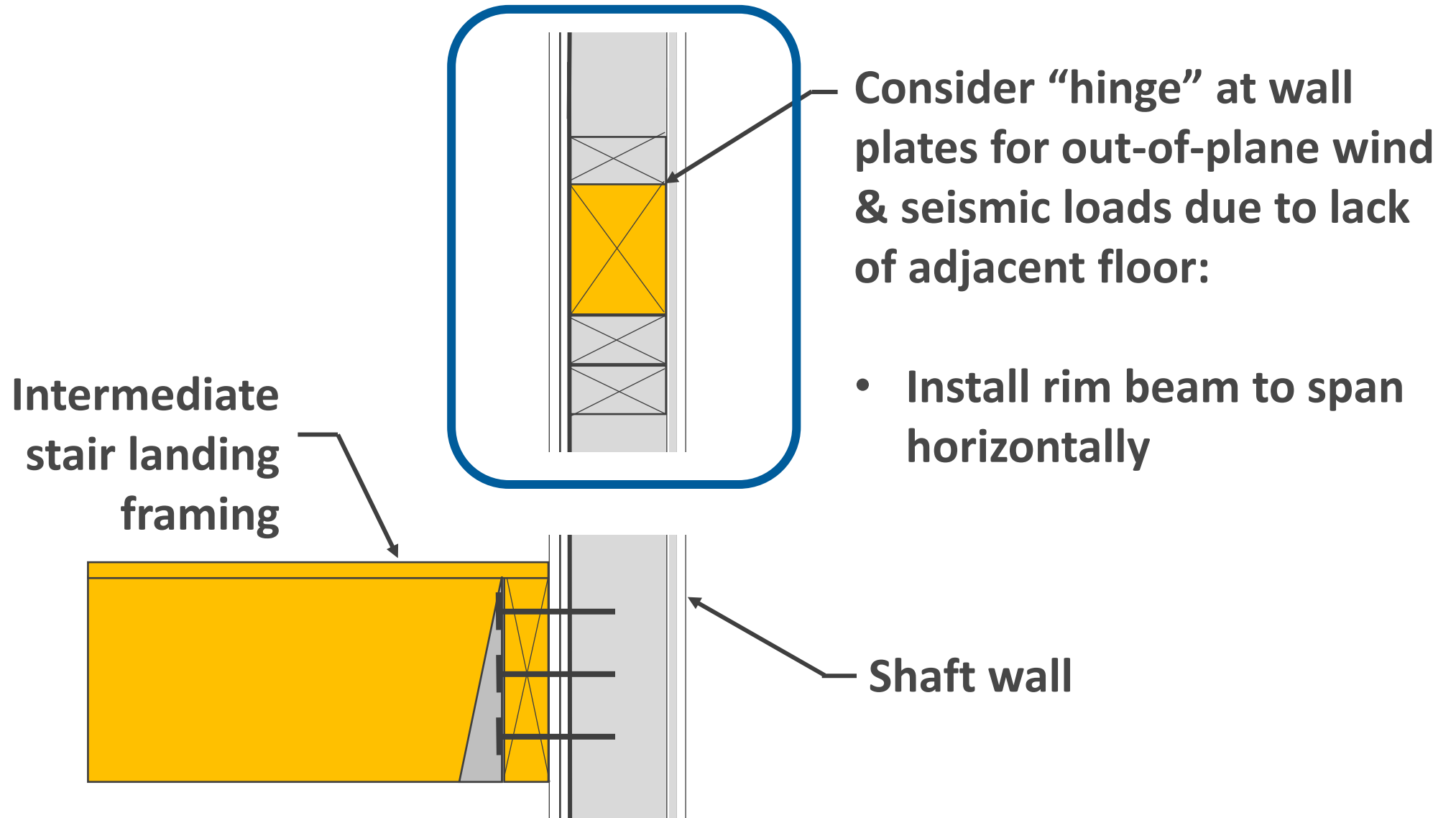
No floor at shaft  
to brace wall  
joint



Wind/Seismic loads  
on exterior wall

Credit: WoodWorks

# Shaft Walls that are also Exterior Walls





# Interior Shaft Wall Hourly Rating

## Section 713: Shaft Enclosures

### *713.4: Fire-Resistance Rating*

- » **2 hours** when connecting 4 stories or more
- » **1 hour** when connecting less than 4 stories
  - » Number of connected stories includes basement but not mezzanine
- » Fire rating of shaft walls shall not be less than floor assembly penetrated, but need **not exceed 2 hours**\*
  - » \*Except where specifically required per code.

# Shaft Wall Materials

707.2 Materials.

*Fire barriers shall be of materials permitted by the building type of construction.*

	Type III	Type IV-HT	Type V
Interior Shaft Walls	Any code-permitted wood framing	Heavy timber or any code-permitted, 1-hr wood framing	Any code-permitted wood framing
Exterior Shaft Walls	Fire-retardant treated wood	Fire-retardant treated wood or CLT	Any code-permitted wood framing



# Shaft Wall Materials – Light-Frame Wood

- » Cost
- » Construction Schedule
- » Material Compatibility  
(movement & lateral load resistance)



Credit: WoodWorks

# Part 1: Outline

- » Context for Type III Construction
- » Definitions and Terminology
- » Fire Rating Requirements for Exterior Walls
- » Fire Rating Requirements for Shaft Walls
- Specifying Rated Assemblies



Photo: Avesta Housing

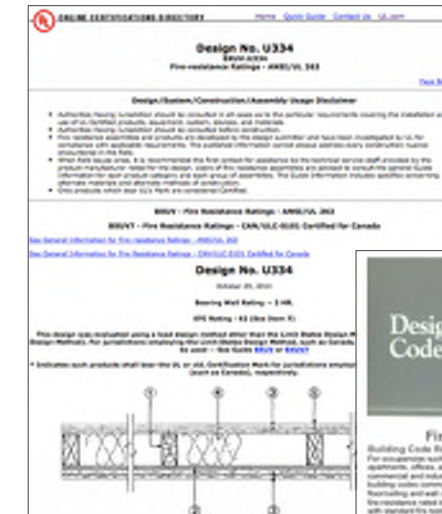
# Choosing Fire Rated Assemblies

## Common tested assemblies (ASTM E119) per IBC 703.2:

- » UL Listings
- » Gypsum Catalog
- » Proprietary Manufacturer Tests
- » Industry Documents: such as AWC's DCA3/DCA4

## 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



**How do we specify an asymmetric  
assembly?**



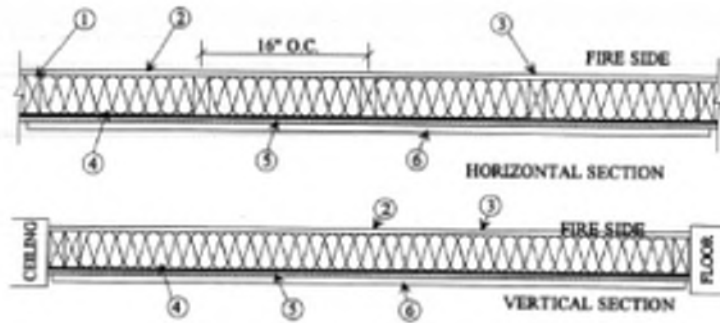
# Exterior Walls – 1-hr Int; 0-hr Ext

IBC Table 721.1(2)

16. Exterior walls rated for fire resistance from the inside only in accordance with Section 705.5.	16-1.1 <sup>a</sup>	2" × 4" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4" wide, applied horizontally unblocked, and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with $\frac{3}{8}$ " wood structural panels, applied vertically, horizontal joints blocked and fastened with 6d common nails (bright) — 12" on center in the field, and 6" on center panel edges. Cavity to be filled with $3\frac{1}{2}$ " mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4 $\frac{1}{2}$
	16-1.2 <sup>a</sup>	2" × 6" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4" wide, applied horizontally or vertically with vertical joints over studs and fastened with $2\frac{1}{4}$ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound, exterior side covered with $\frac{7}{16}$ " wood structural panels fastened with 6d common nails (bright) spaced 12" on center in the field and 6" on center along the panel edges. Cavity to be filled with $5\frac{1}{2}$ " mineral wool insulation. Rating established from the gypsum-covered side only.	—	—	—	6 $\frac{9}{16}$
	16-1.3 <sup>a</sup>	2" × 6" wood studs at 16" centers with double top plates, single bottom plates; interior side covered with $\frac{5}{8}$ " Type X gypsum wallboard, 4" wide, applied vertically with all joints over framing or blocking and fastened with $2\frac{1}{4}$ " Type S drywall screws spaced 7" on center. Joints to be covered with tape and joint compound. Exterior covered with $\frac{3}{8}$ " wood structural panels, applied vertically with edges over framing or blocking and fastened with 6d common nails (bright) at 12" on center in the field and 6" on center on panel edges. R-19 mineral fiber insulation installed in stud cavity. Rating established from the gypsum-covered side only.	—	—	—	6 $\frac{1}{2}$



# Exterior Walls – 1-hr Int; 0-hr Ext



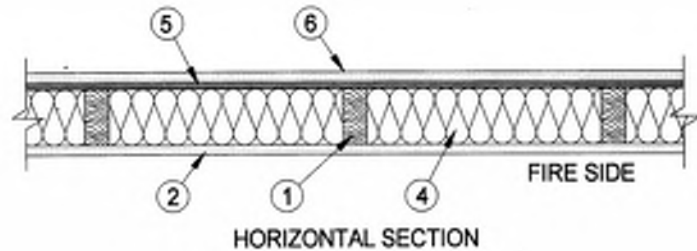
## Design No. U348

April 01, 2013

Bearing Wall Rating — 1 Hr

(EXPOSED TO FIRE ON INTERIOR FACE ONLY)

Finish Rating — 23 min



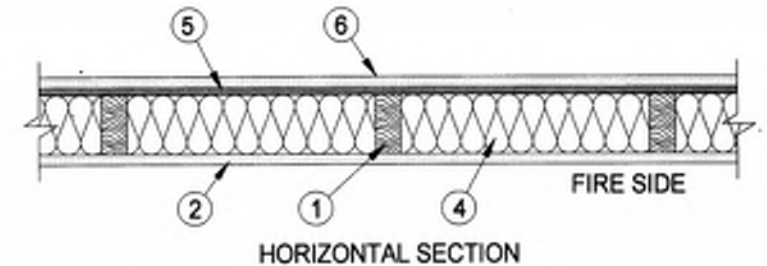
## Design No. U356

September 21, 2015

(Exposed to Fire on Interior Face Only)

Bearing Wall Rating — 1 Hr

Finish Rating — 23 Min or 25 Min (See Item 2C)



## Design No. U356

September 21, 2015

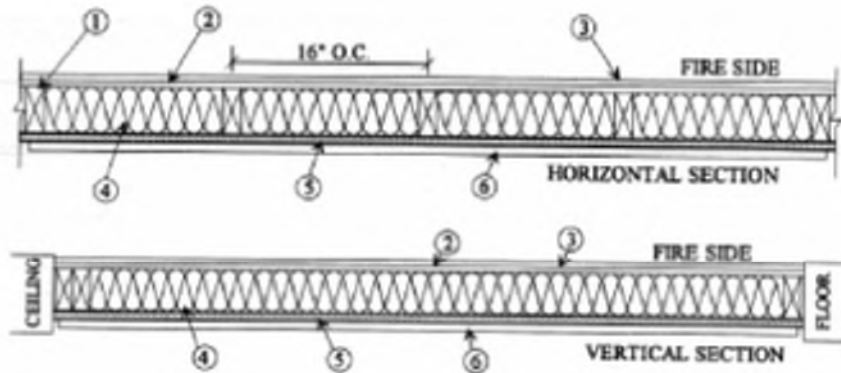
(Exposed to Fire on Interior Face Only)

Bearing Wall Rating — 1 Hr

Finish Rating — 23 Min or 25 Min (See Item 2C)

Examples, ONLY! Use current listings from UL.

# Exterior Walls – 2-hr Int; 0-hr Ext



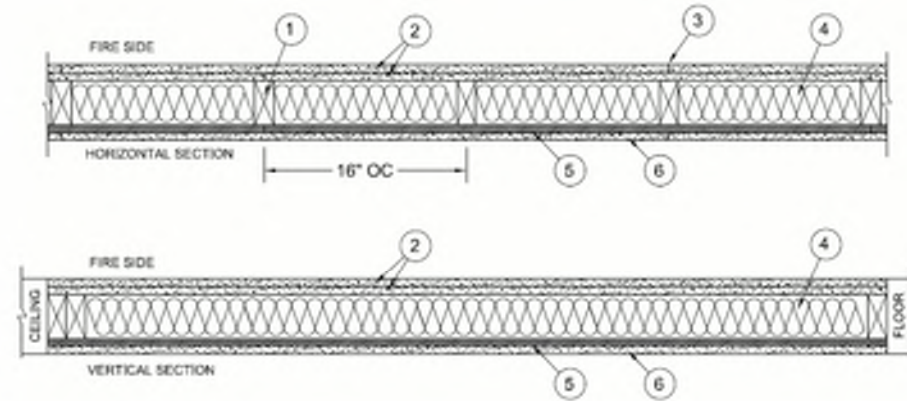
## Design No. U349

August 21, 2013

**Bearing Wall Rating — 2 Hr**

**(EXPOSED TO FIRE ON INTERIOR FACE ONLY)**

**For Wood Studs, Finish Rating — 55 min**



## Design No. V314

March 13, 2020

**Bearing Wall Rating - 1 Hr Rating Exposed to Fire on Exterior Face (See Item 8)**

**Bearing Wall Rating - 2 Hr Rating Exposed to Fire on Interior Face**

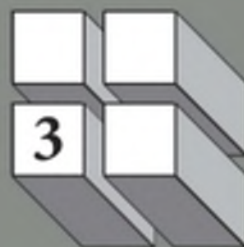
**Finish Rating — 42 min (Exposed to Fire on Interior Face)**

**Loaded Per 2012 NDS Supplement, ASD Method, Wall Braced Mid-Height**

**Examples, ONLY! Use current listings from UL.**



## Design for Code Acceptance



### 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 document are based on compliance with national model building codes.

Code recognition of one and two-hour wood-frame wall systems is also predicated on successful fire and hose stream testing in accordance with ASTM E119, *Standard Test Methods for Fire Tests of Building Construction Materials*.

#### 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 assemblies are provided in [Table 3](#) for one-hour fire-resistance-rated floor/ceiling assemblies and [Table 4](#) for two-hour fire-resistance-rated floor/ceiling assemblies. I-joists are required to comply with ASTM D5055, *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists*. Where resilient channels are specified, single-leg (RC-1) resilient channels shall be used. Alternatively, two-leg

## Code Acceptance



### Component Additive Method (CAM) for Calculating and Demonstrating Assembly Fire Resistance

Wood-frame walls and floors offer designers a unique opportunity to provide structures with economy as well as proven energy performance. Where these assemblies are required by the building codes to achieve a minimum fire resistance rating, a wide range of options for design exists.

#### Building Code Requirements

For both new and existing construction, many building codes require structural elements such as exterior walls, load bearing partitions, floor/ceiling assemblies and roofs to achieve a minimum fire resistance rating. Historically, these assemblies have been tested in accordance with ASTM E119 *Standard Test Methods for Fire Tests of Building Construction and Materials* or UL 263 *Standard for Fire Tests of Building Construction and Materials*, and assigned an hourly fire resistance rating based on assembly performance. Many sources are available for obtaining information on the fire resistance of assemblies: The 2012 *International Building Code-Table 721*; the American Wood Council's *Fire Rated Wood Floor and Wall Assemblies (DCA3)*, Gypsum Association's *GA 600 Fire Resistance Design Manual*; and Underwriters' Laboratories *Ultimate Fire Wizard*, to name a few.

Building codes include both tested assemblies as well as methods for calculating fire resistance, de-

veloped from conducting a series of fire resistance tests. The Component Additive Method (CAM) provides for calculating the fire resistance of load bearing and non-load bearing floor, wall, ceiling and roof assemblies. The calculated fire resistance provisions within Section 722.6 of the *International Building Code® (IBC)* were developed using CAM.



# Adding Wood Structural Panels?

- » **AWC's DCA4 (Rule 2)**: The fire endurance of a construction does not decrease with the addition of further layers such as wallboard or other panel materials, regardless of how many layers are added or where they are located within the assembly.
- » **ESR 2586**: Structural-use panels may be installed between the fire protection and the wood studs on either the interior or exterior side of fire-resistance-rated ... assemblies ... provided the length of fasteners is adjusted for the added panel thickness.
- » **Gypsum Association Manual**: When not specified as a component of a fire-resistance rated wall or partition system, wood structural panels shall be permitted to be added to one or both sides.

# Part 1: Outline

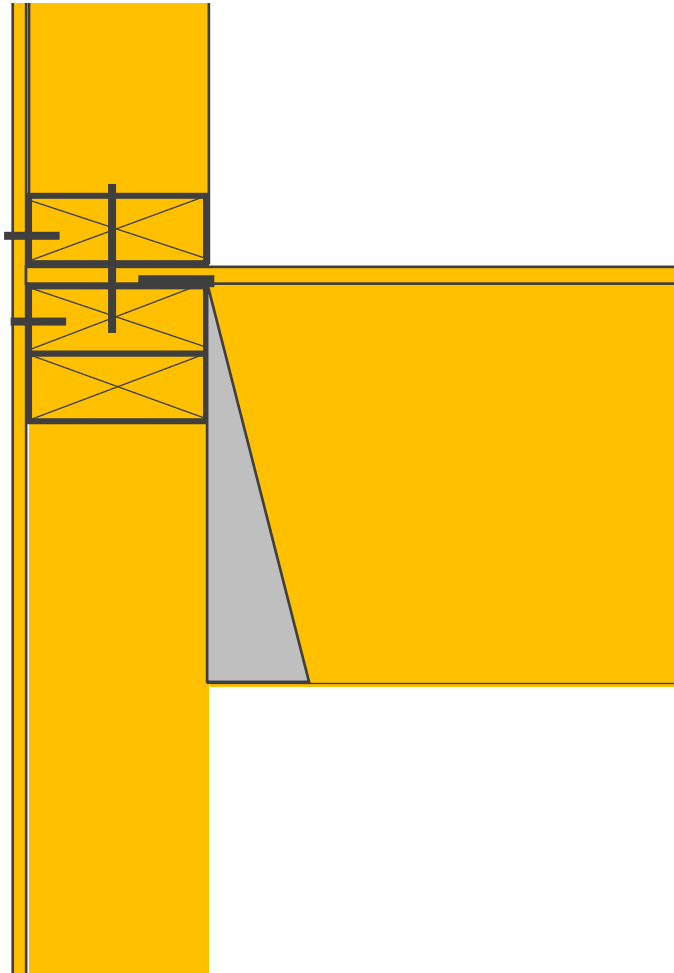
- » Context for Type III Construction
- » Definitions and Terminology
- » Fire Rating Requirements for Exterior Walls
- » Fire Rating Requirements for Shaft Walls
- » Specifying Rated Assemblies
- Floor to Wall Intersections



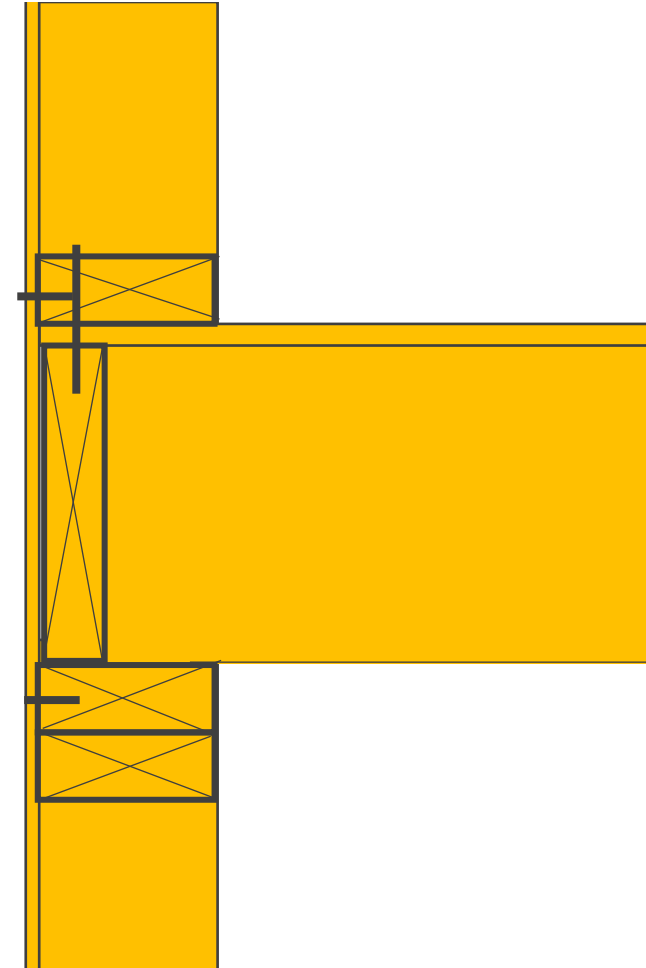
Landing Apartments, Russell Scott Steedle & Capione Architects, photo Gregory Folkins



# Floor to Wall Detailing



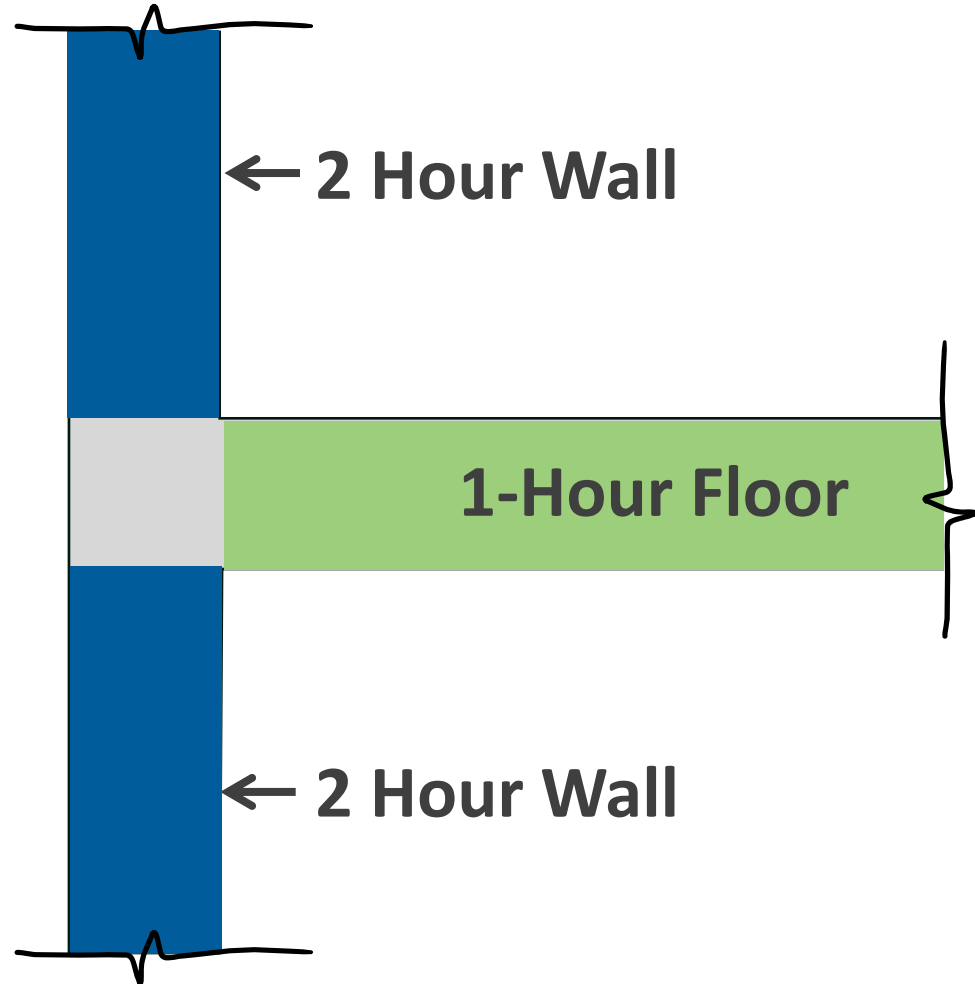
**Semi-Balloon Framing**



**Platform Framing**

# Intersection of Tested Assemblies

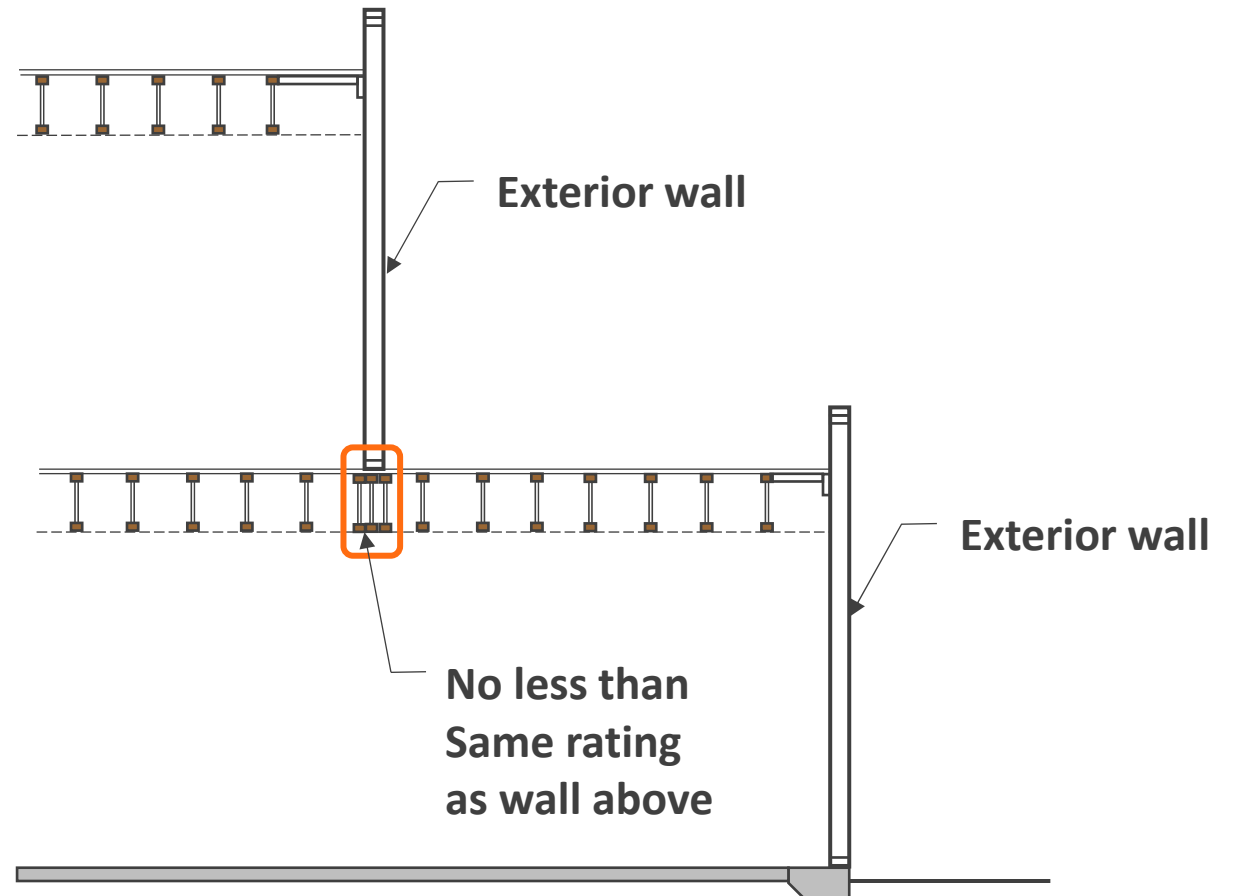
- » Many options are available for fire resistance tested floor assemblies and wall assemblies
- » No tested intersection details exist



# Exterior Walls – Supporting Construction

There is no requirement for an exterior wall to extend to the foundation in a stepped building.

**Structural members, that support a rated wall must be fire-resistance rated not less than the rating of the supported wall (IBC 704.1)**



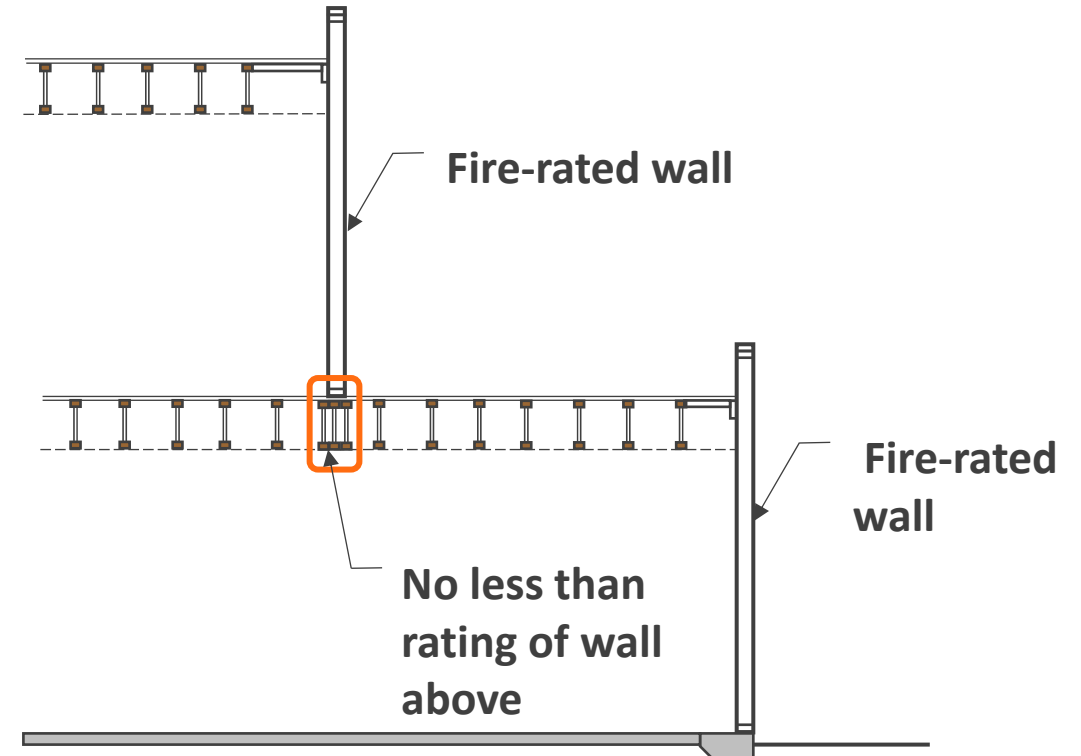
# Shaft Walls - Supporting Construction

## Section 707: Fire Barriers

### *707.5.1 Supporting Construction:*

The supporting construction for a fire barrier shall be protected to afford the required fire-resistance rating of the fire barrier supported.

Ex., shaft walls that are not continuous to lowest level



# IBC 2018 - Exterior Walls: Structural Stability

## **IBC 705.6 Structural Stability:** (Relocated to 705.7 in 2024 IBC)

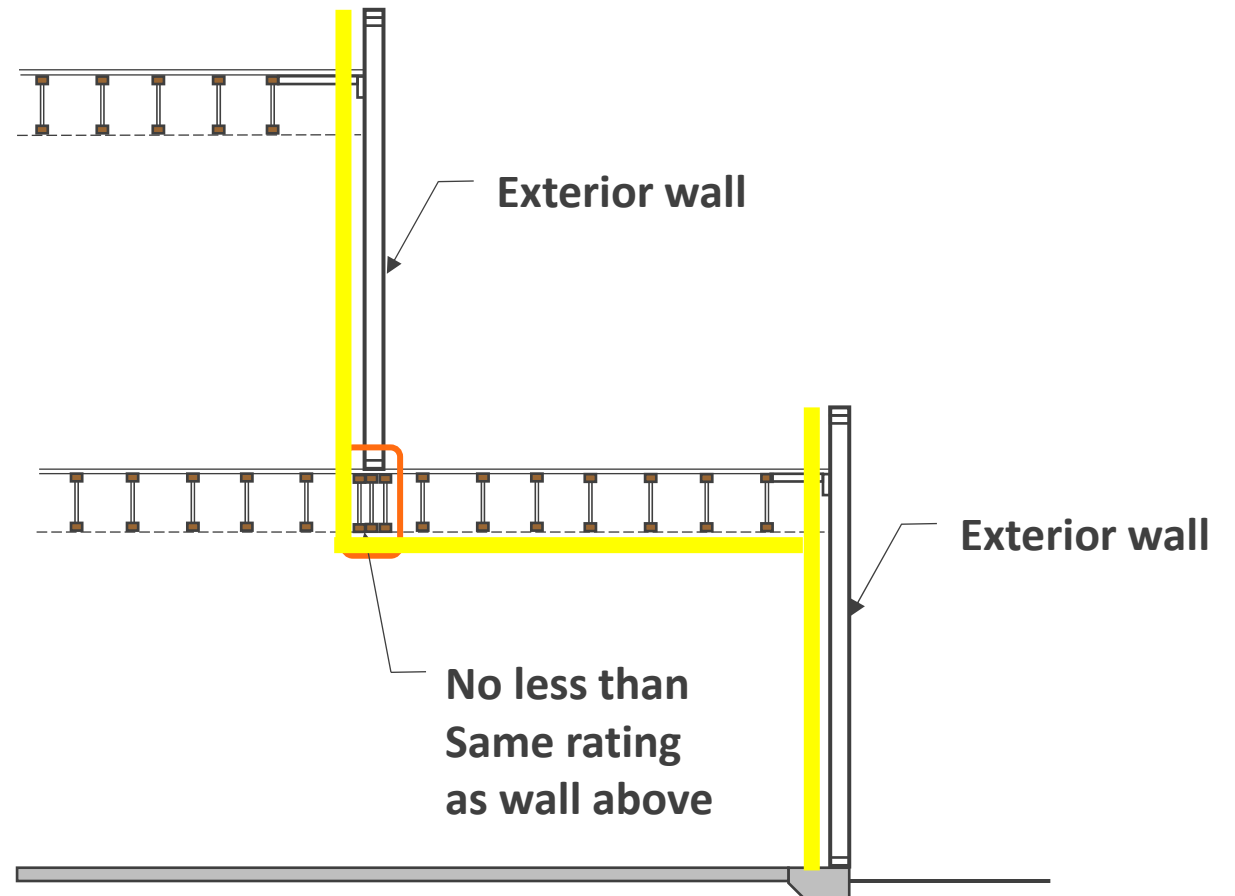
Exterior walls shall extend to the height required by 705.11. Interior structural elements that brace the exterior wall but that are not located within the plane of the exterior wall shall have the minimum fire resistance rating required in Table 601 for that structural element.

Structural elements that brace the exterior wall but are located outside of the exterior wall or within the plane of the exterior wall shall have the minimum fire resistance rating required in Tables 601 or 602 for the exterior wall.

# Exterior Walls – Supporting Construction

There is no requirement for an exterior wall to extend to the foundation in a stepped building.

**Structural members, that support a rated wall must be fire-resistance rated not less than the rating of the supported wall (IBC 704.1)**





# IBC 2024: Exterior Wall to Floor Intersections

## 705.7.1 Floor assemblies in Type III construction.

In Type III construction where a floor assembly supports gravity loads from an *exterior wall*, the *fire-resistance rating* of the portion of the floor assembly that supports the *exterior wall* shall be not less than the *fire-resistance rating* required for the *exterior wall* in Table 601. The *fire-resistance rating* provided by the portion of the floor assembly supporting and within the plane of the *exterior wall* shall be permitted to include the contribution of the ceiling membrane when considering exposure to fire from the inside. Where a floor assembly supports gravity loads from an *exterior wall*, the *building elements* of the floor construction within the plane of the *exterior wall*, including but not limited to rim joists, rim boards and blocking, shall be in accordance with the requirements for interior *building elements* of Type III construction.

# IBC 2024: Exterior Wall to Floor Intersections

## 705.7.1 Floor assemblies in Type III construction.

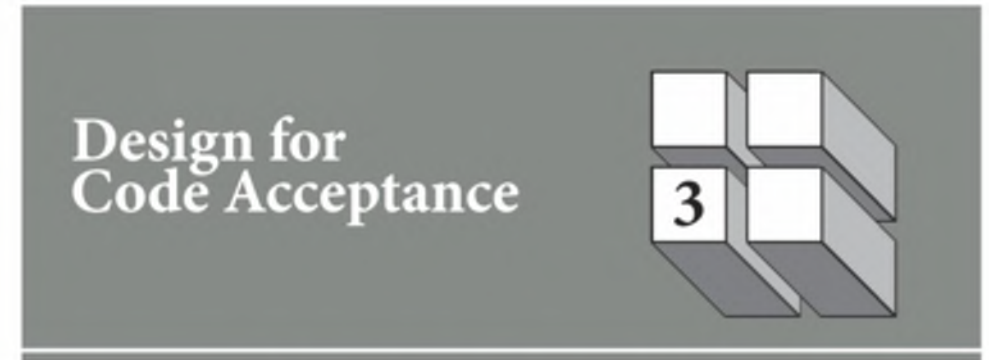
In Type III construction where a floor assembly supports gravity loads from an *exterior wall*, the *fire-resistance rating* of the portion of the floor assembly that supports the *exterior wall* shall be not less than the *fire-resistance rating* required for the *exterior wall* in Table 601. The *fire-resistance rating* provided by the portion of the floor assembly supporting and within the plane of the *exterior wall* shall be permitted to include the contribution of the ceiling membrane when considering exposure to fire from the inside. Where a floor assembly supports gravity loads from an *exterior wall*, the *building elements* of the floor construction within the plane of the *exterior wall*, including but not limited to rim joists, rim boards and blocking, shall be in accordance with the requirements for interior *building elements* of Type III construction.

**Interior building elements (floor construction)  
in Type III are not required to be FRTW**

# 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 document are for exposure from one side only.

### 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 Listed floor as-

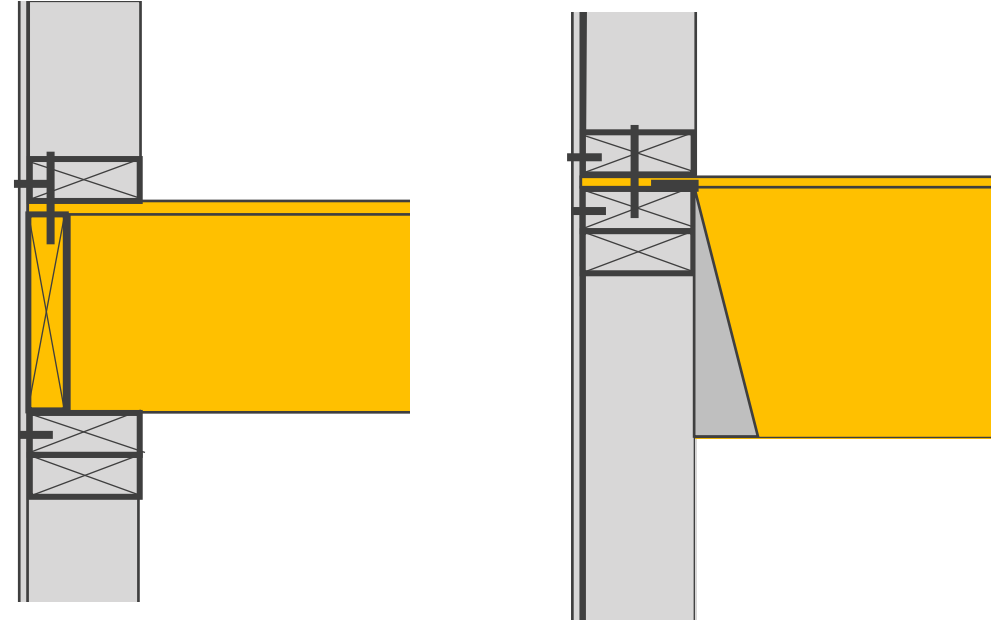
# Type III Exterior Walls – FRT

## Type III and IV Construction - IBC Section 602.3:

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

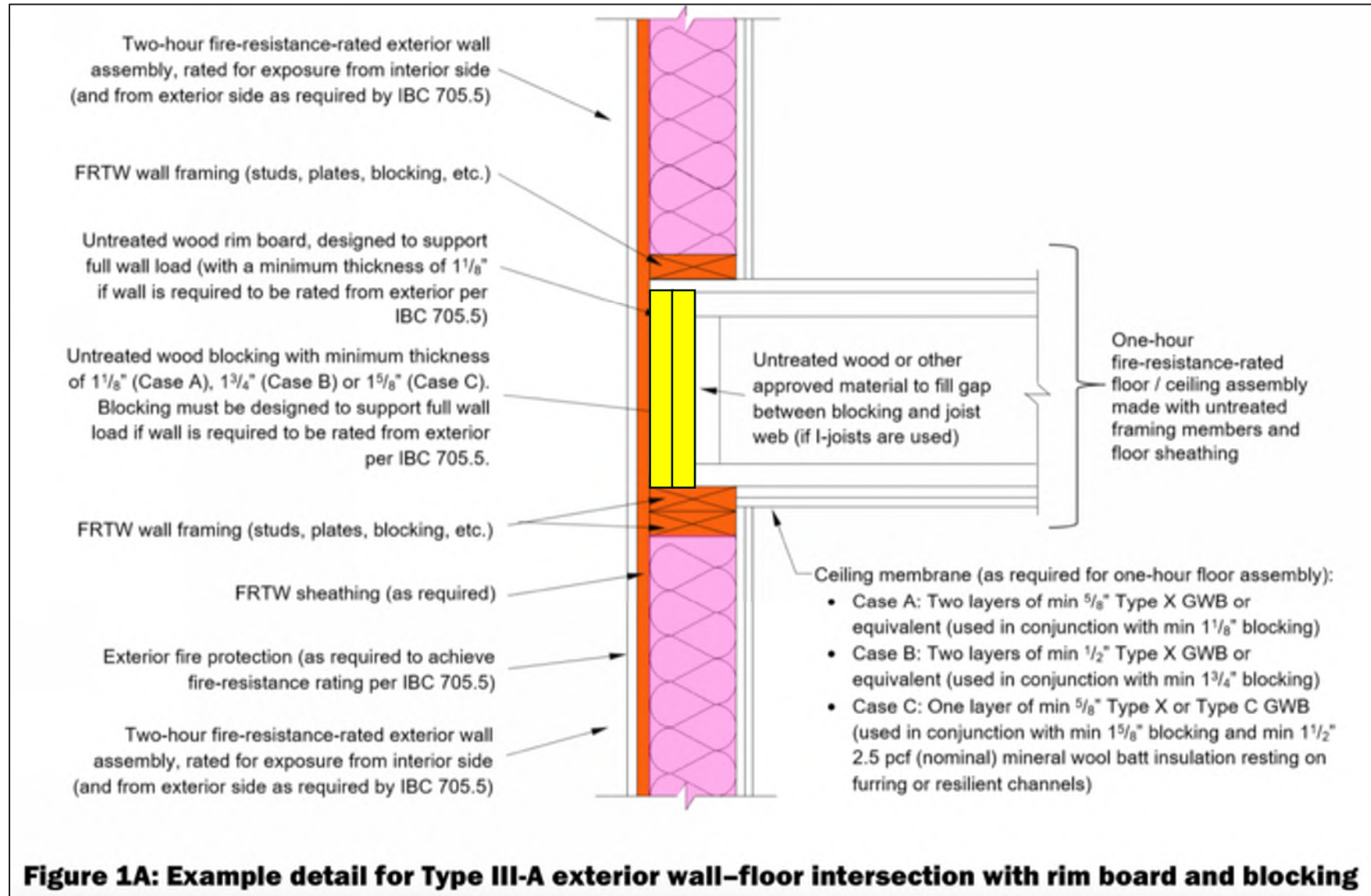
What does this FRTW requirement include?

- » Wall Framing (Studs & Plates) – **Yes**
- » Wall Sheathing – **Yes**
- » Floor sheathing - **No**
- » Rim Joist- **No**
- » Floor Joists- **No**





# Exterior Walls – Intersecting Floors (AWC's DCA3)





# Exterior Walls – Intersecting Floors

## **Methodology:**

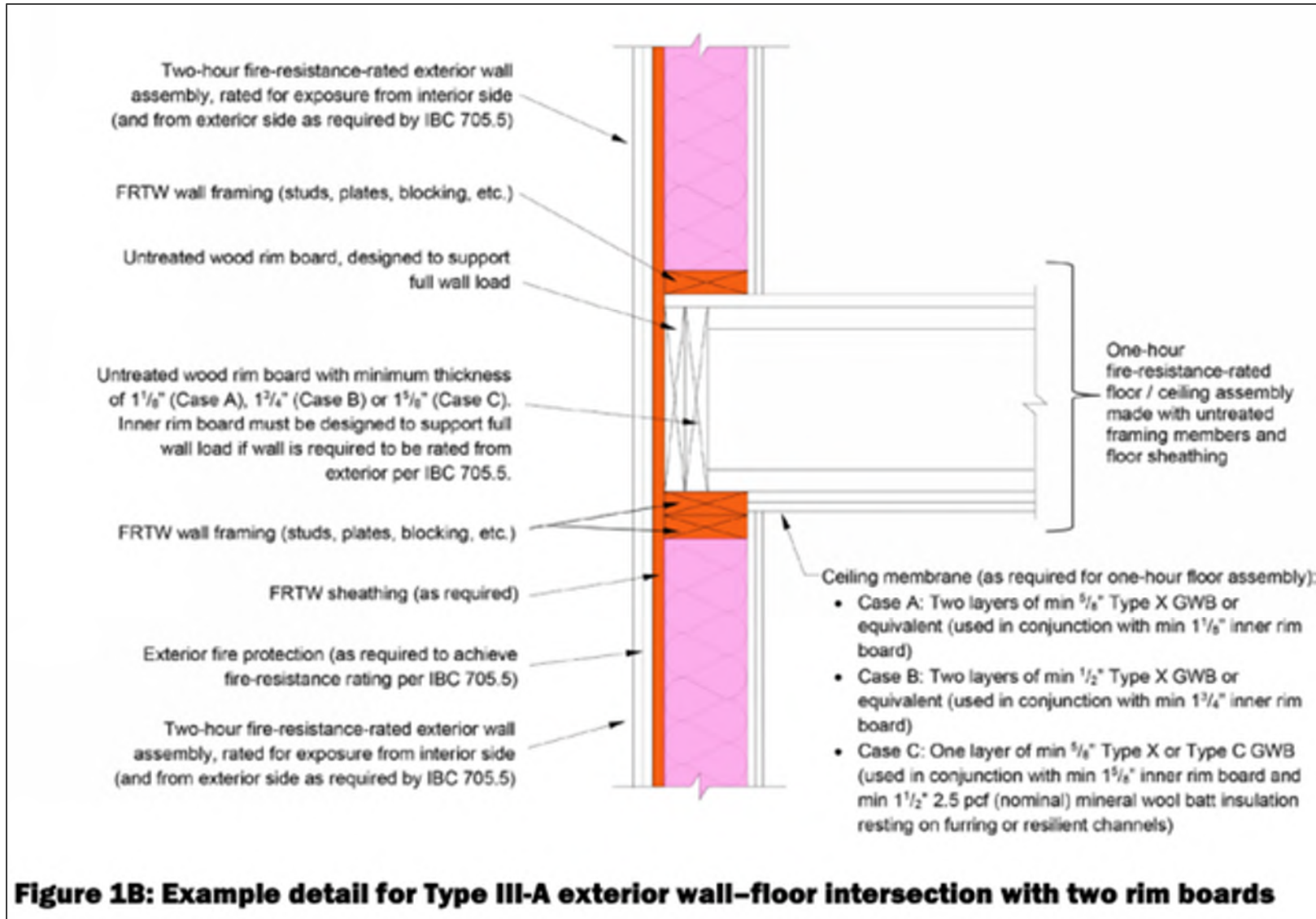
### Fire-resistance for exposure from interior side:

- Case A: Minimum  $1\frac{1}{8}$ -inch-thick inner rim board plus two layers of minimum  $\frac{5}{8}$  in. Type X GWB in the ceiling membrane provides 2 hours of protection to the outer rim board, based on the NDS-calculated time for the char depth to reach the inner rim board / outer rim board interface plus 40 minutes for each layer of  $\frac{5}{8}$  in. Type X GWB (per IBC Table 722.6.2(1)).
- Case B: Minimum  $1\frac{3}{4}$ -inch-thick inner rim board plus two layers of minimum  $\frac{1}{2}$  in. Type X GWB in the ceiling membrane provides 2 hours of protection to the outer rim board, based on the NDS-calculated time for the char depth to reach the inner rim board / outer rim board interface plus 25 minutes for each layer of  $\frac{1}{2}$  in. Type X GWB (per IBC Table 722.6.2(1)).
- Case C: Minimum  $1\frac{5}{8}$ -inch-thick inner rim board plus one layer of minimum  $\frac{5}{8}$  in. Type X GWB in the ceiling membrane plus minimum  $1\frac{1}{2}$ -inch-thick, 2.5 pcf (nominal) mineral wool batt insulation provides 2 hours of protection to the outer rim board, based on the NDS-calculated time for the char depth to reach the inner rim board / outer rim board interface, plus 40 minutes for the  $\frac{5}{8}$  in. Type X GWB (per IBC Table 722.6.2(1)), plus 15 minutes for the mineral wool insulation.

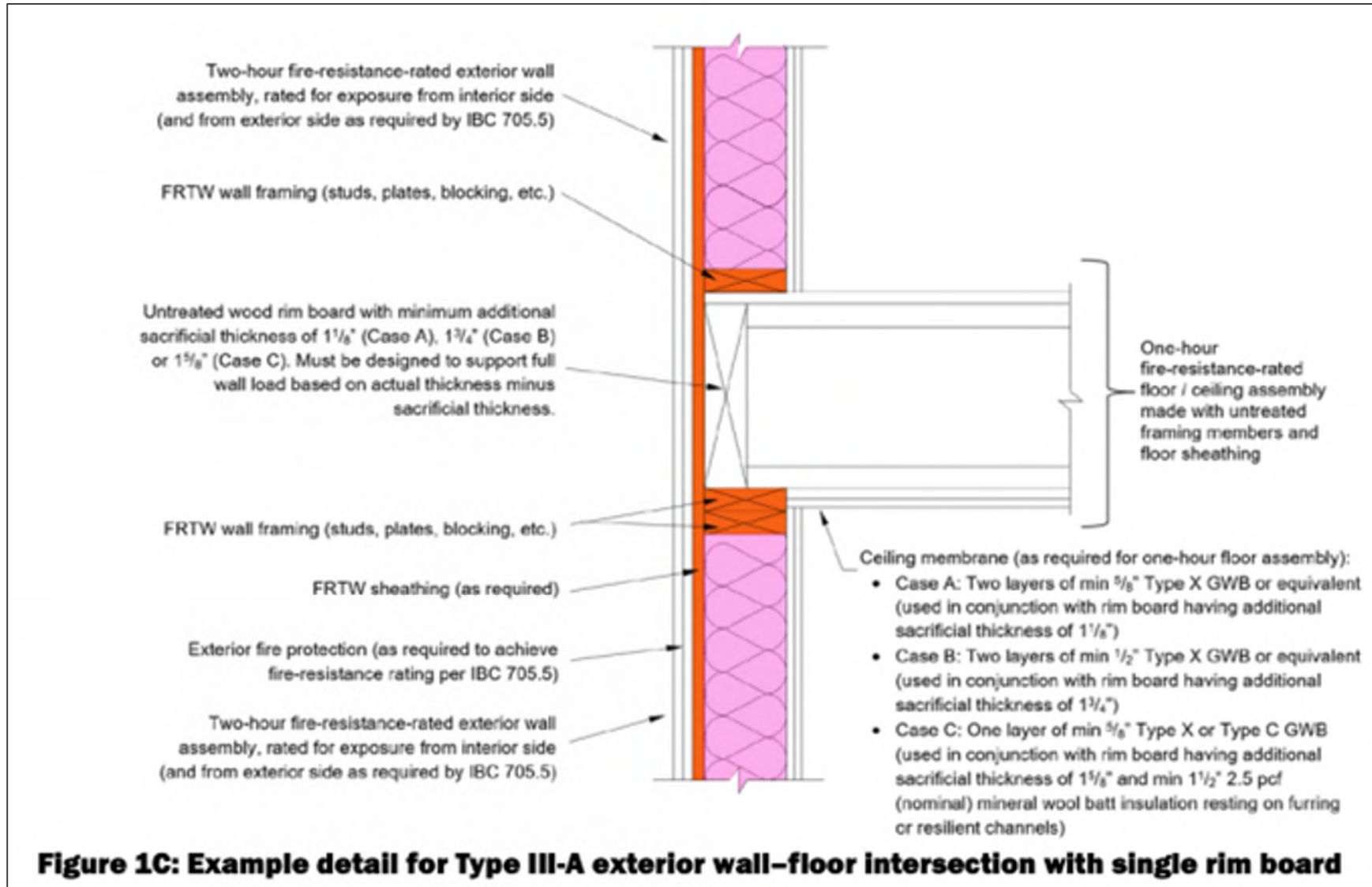
The outer rim board must be designed to support the load from the wall above.

Fire-resistance for exposure from exterior side (where required per IBC Section 705.5): A combination of exterior fire protection, FRTW sheathing, and minimum  $1\frac{1}{8}$ -inch-thick outer rim board is used to provide two hours of protection to the inner rim board. Layers to the exterior of the outer rim board (e.g., exterior fire protection, FRTW sheathing, etc.) must be sufficient to provide at least 80 minutes of protection to the outer rim board. The inner rim board must be designed to support the load from the wall above.

# Exterior Walls – Intersecting Floors

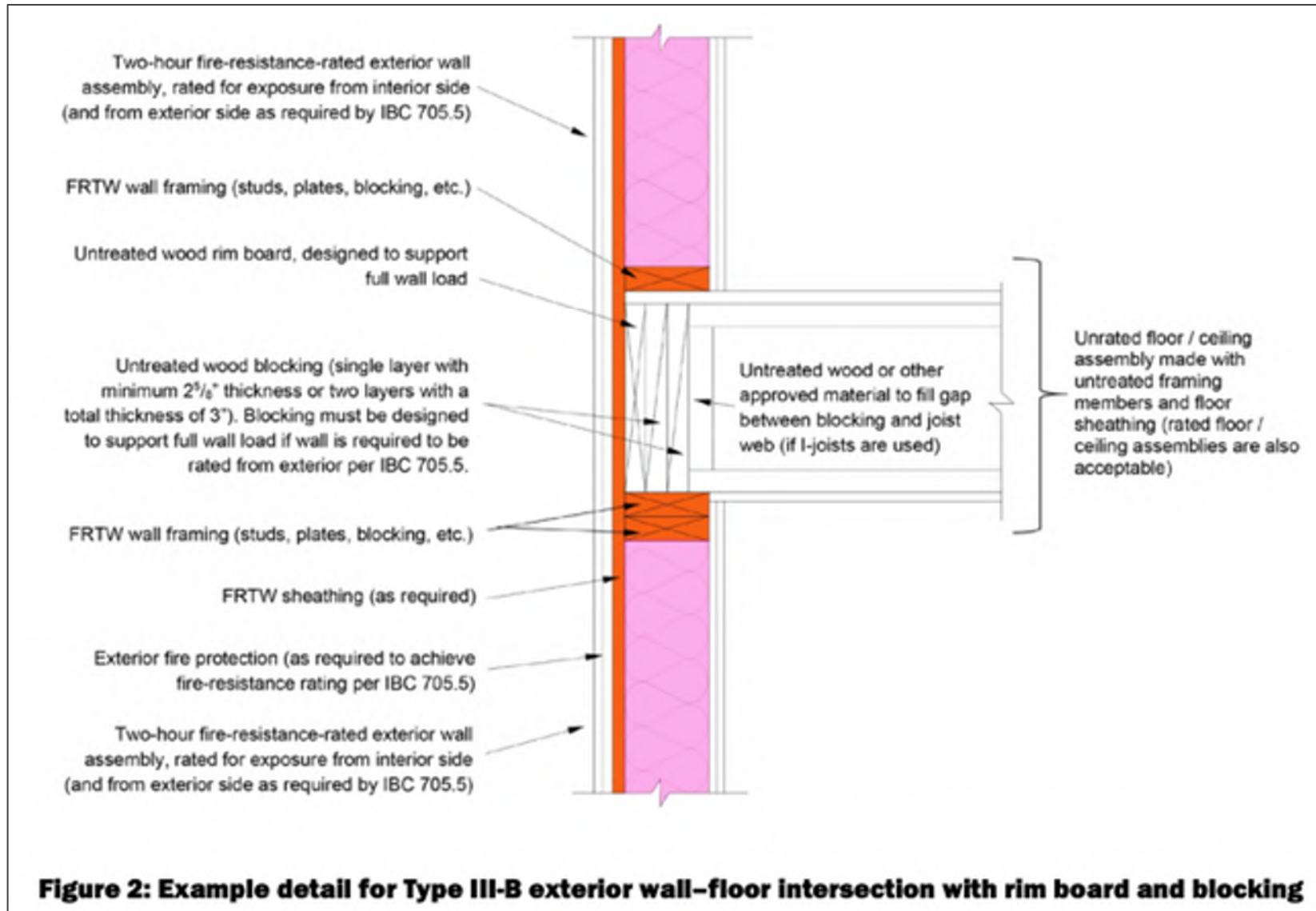


# Exterior Walls – Intersecting Floors





# Exterior Walls – Intersecting Floors



# IBC 2024: Exterior Wall Continuity

## 705.6 Continuity.

The *fire-resistance rating* of exterior walls shall extend from the top of the foundation or floor/ceiling assembly below to one of the following:

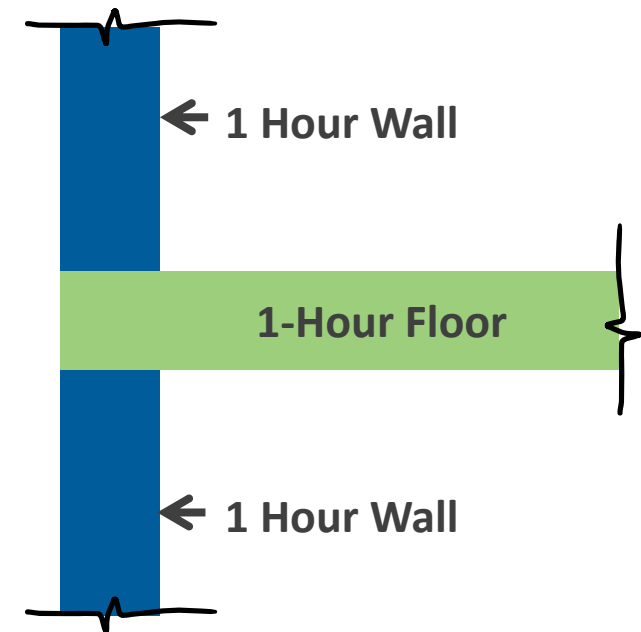
1. The underside of the floor sheathing, roof sheathing, deck or slab above.
2. The underside of a floor/ceiling or roof/ceiling assembly having a *fire-resistance rating* equal to or greater than the exterior wall and the *fire separation distance* is greater than 10 feet.

## 705.7 Structural stability. (Relocated)

### Example 1:

### Type VA Construction, Group R-2

1 hour exterior wall, 1 hour floor





# IBC 2024: Exterior Wall Continuity

## 705.6 Continuity.

The *fire-resistance rating* of exterior walls shall extend from the top of the foundation or floor/ceiling assembly below to one of the following:

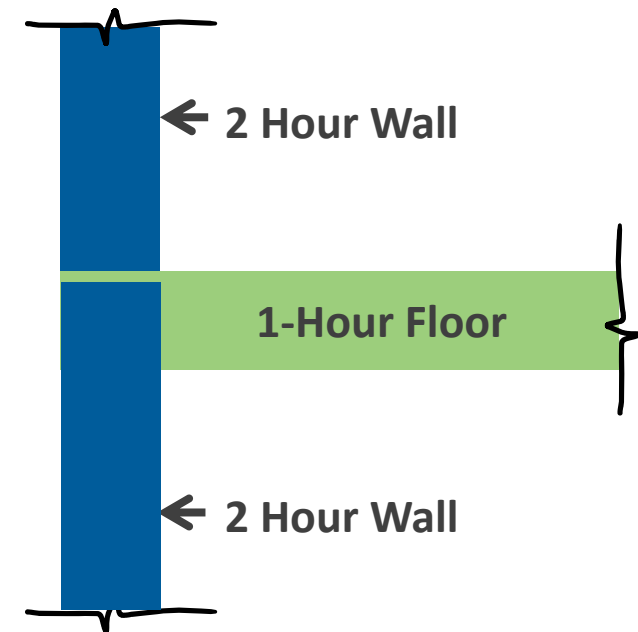
1. The underside of the floor sheathing, roof sheathing, deck or slab above.
2. The underside of a floor/ceiling or roof/ceiling assembly having a *fire-resistance rating* equal to or greater than the *exterior wall* and the *fire separation distance* is greater than 10 feet.

## 705.7 Structural stability. (Relocated)

### Example 2:

### Type IIIA Construction, Group R-2

2 hour exterior wall, 1 hour floor



# Shaft Walls – Continuity Provisions

## Section 713: Shaft Enclosures

### *713.5 Continuity.*

Shaft enclosures shall have continuity in accordance with 707.5 for fire barriers.

## Section 707: Fire Barriers

### *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.

# Shaft Walls – Joints

## *707.5 Continuity.*

Joints and voids at intersections shall comply with Sections 707.8 and 707.9.

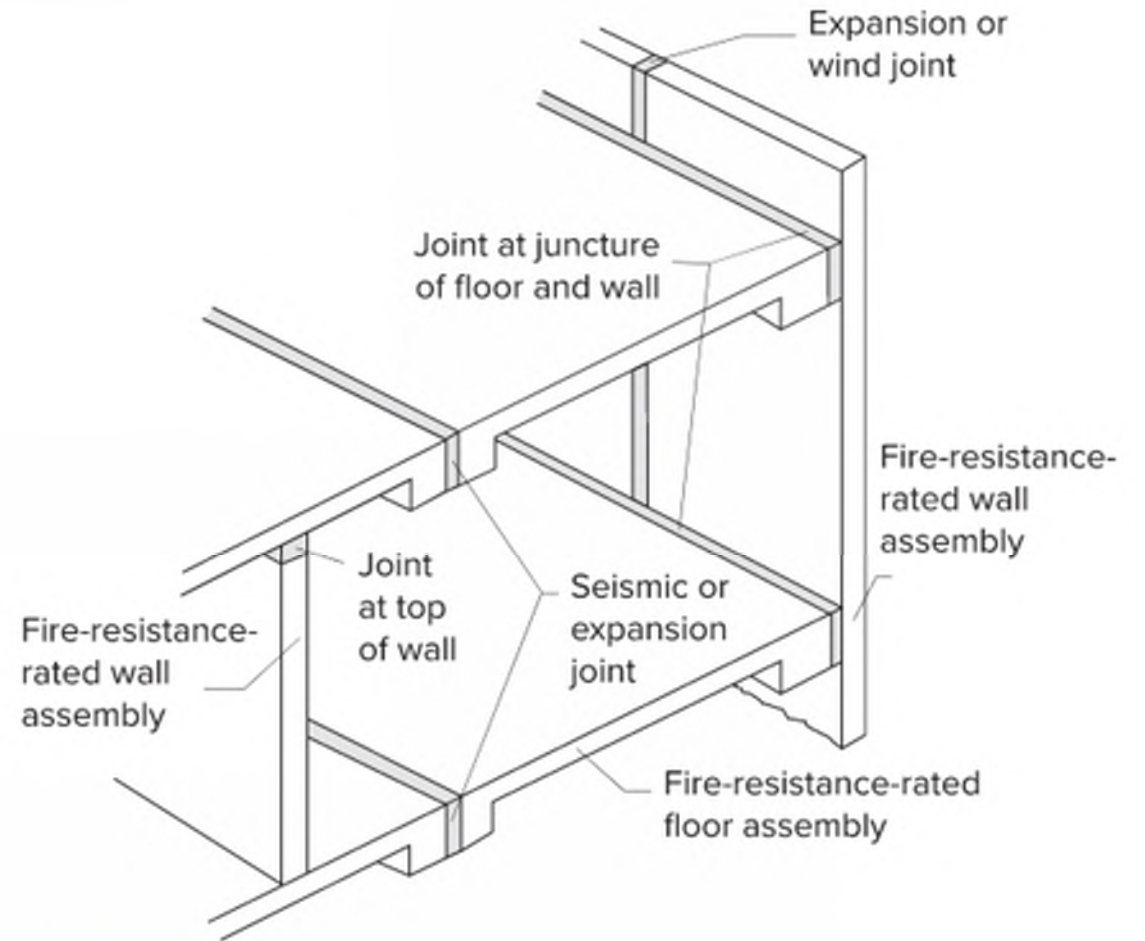
## *707.8 Joints.*

Joints made in or between fire barriers, and joints made at the intersection of fire barriers with underside of a fire resistance-rated floor or roof sheathing, slab or deck above, and the exterior vertical wall intersection shall comply with Section 715.

# Joints

## Section 202: Definitions

**Joint.** The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.



**FIGURE 2:** IBC Commentary Figure 715.1 – Examples of joint locations

Assembly intersections that are in **direct contact  
and securely attached** are not considered joints.



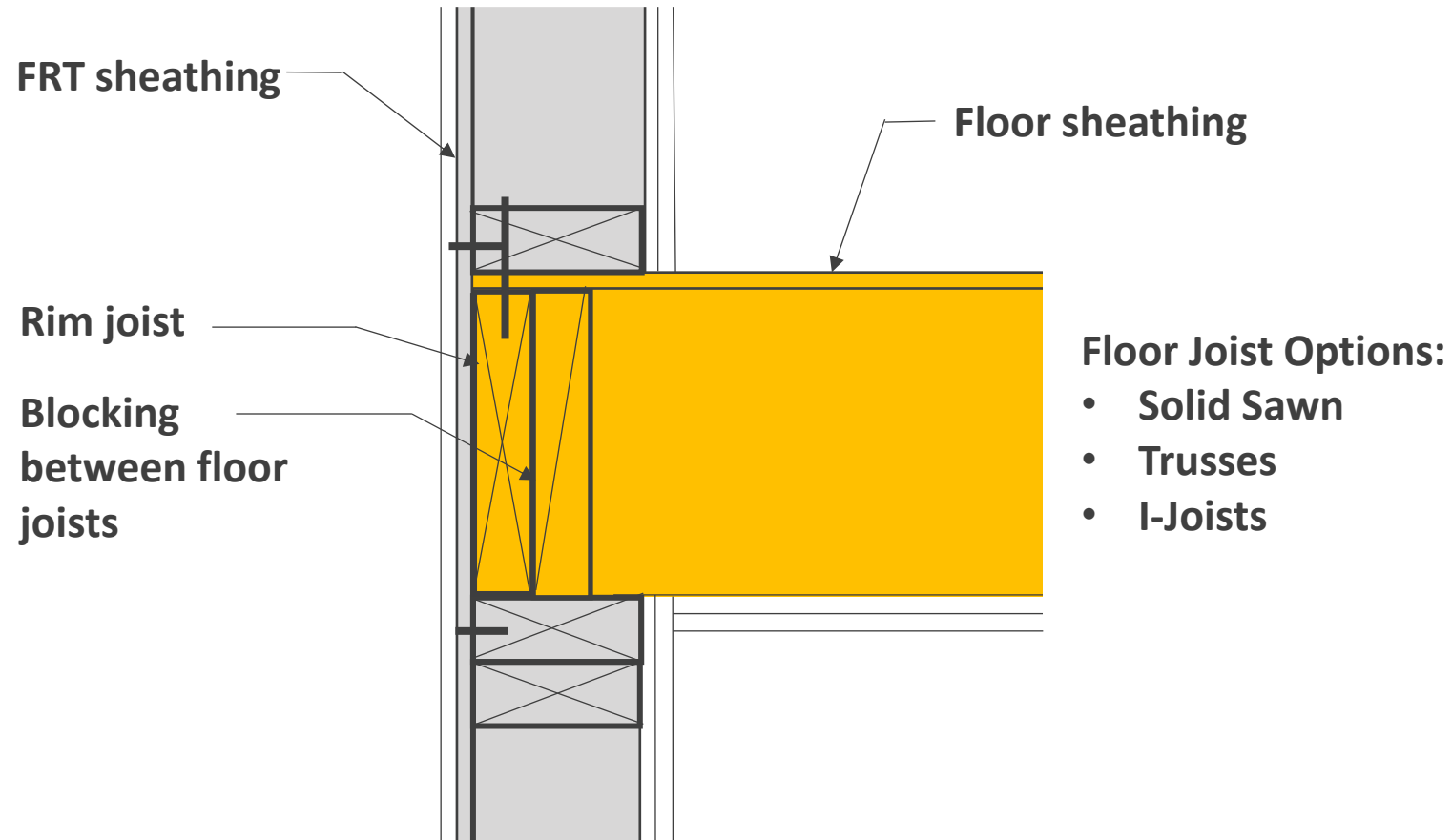
# Intersecting Floors: **DISCLAIMER**

Please note that the following details are examples of what we have seen used on projects and do not necessarily represent details that will be accepted and applicable in all jurisdictions and to all projects.

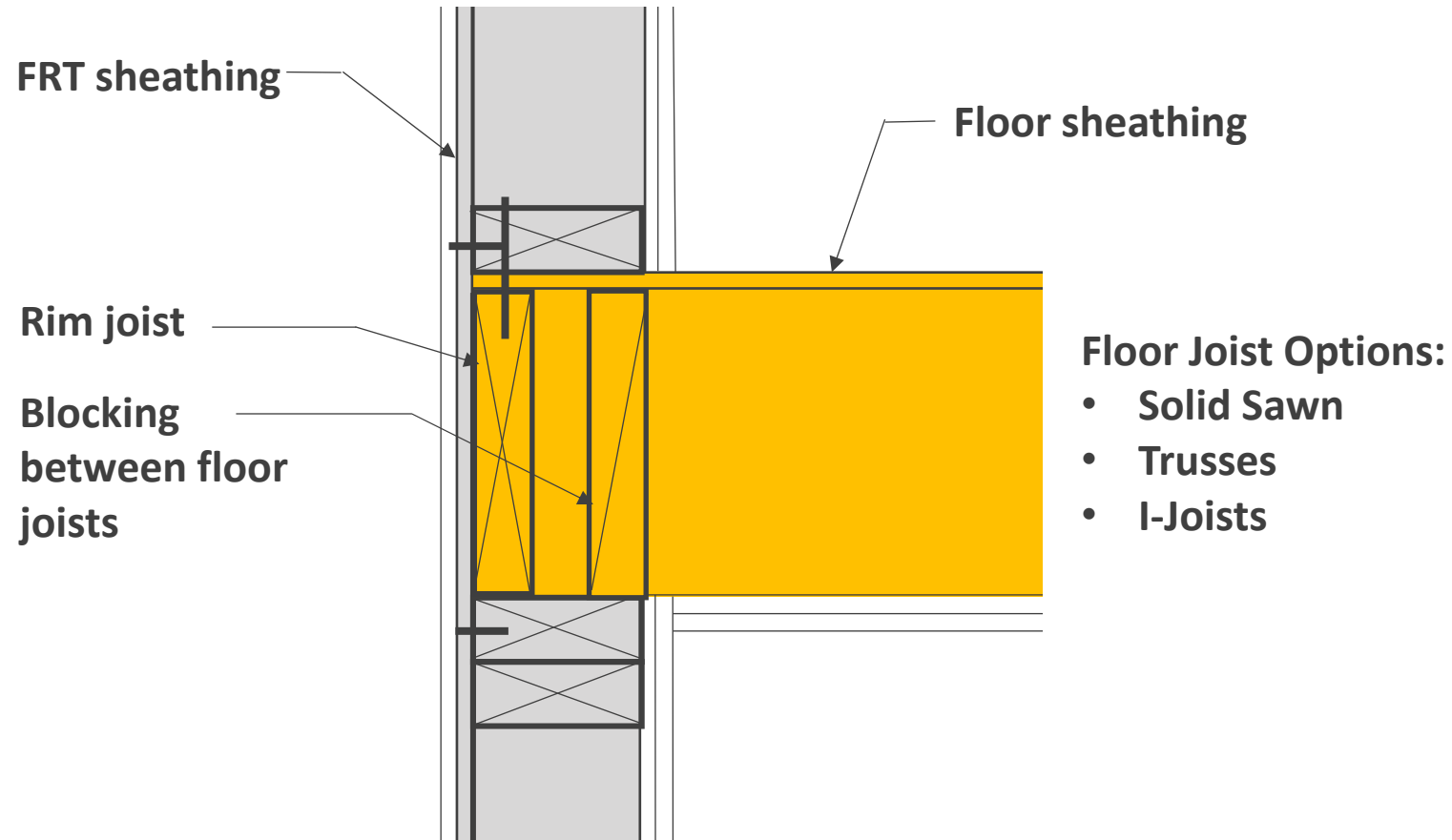
These details are not intended as recommendations for universally accepted details. Local product availability and manufacturer specifications should also be considered for each project.

The Architect of Record and Engineer of Record should verify acceptance of the details used on their project with all provisions of the building code, including local amendments, with the local Authority Having Jurisdiction.

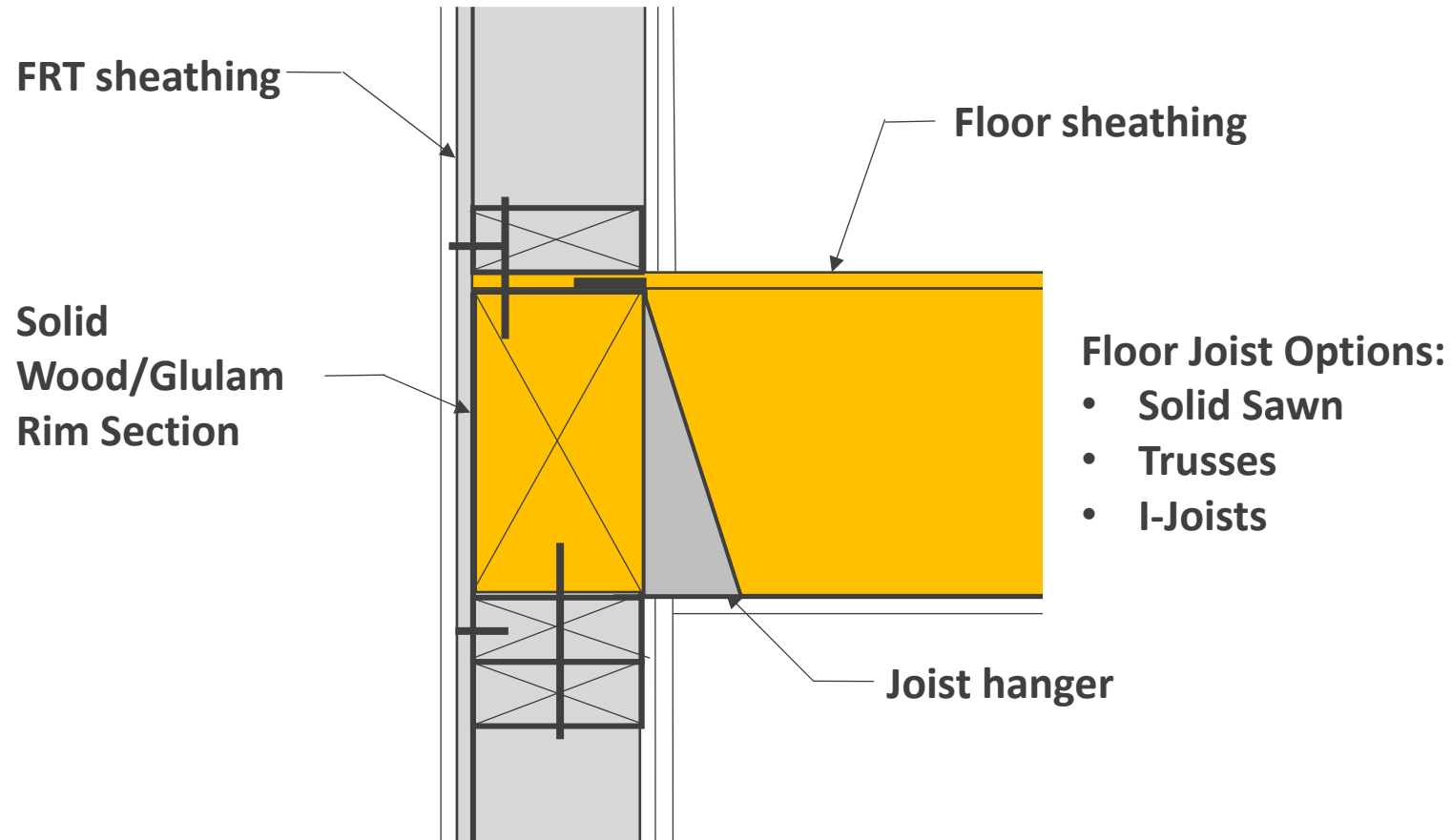
# Exterior Walls – Intersecting Floors



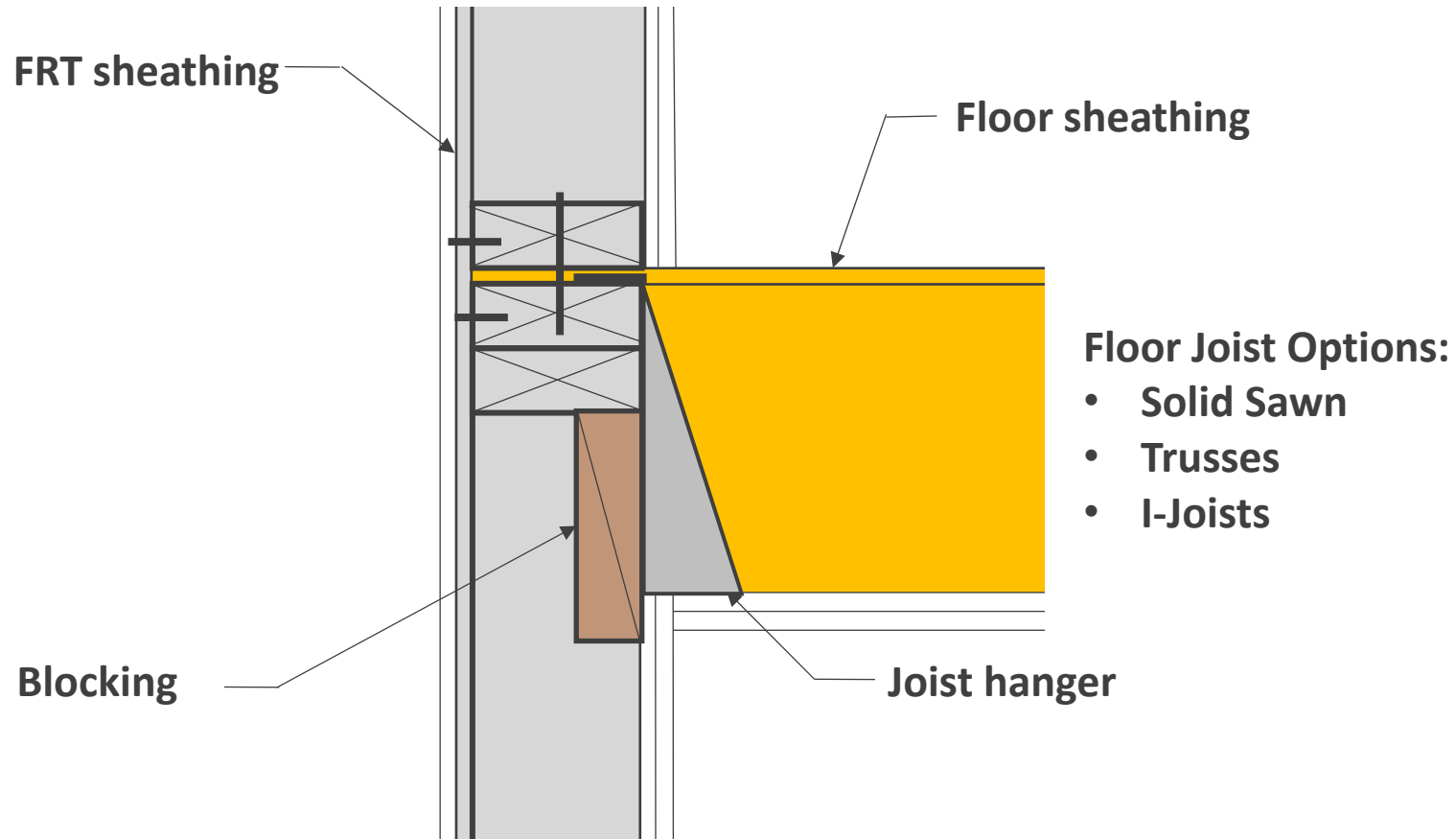
# Exterior Walls – Intersecting Floors



# Exterior Walls – Intersecting Floors

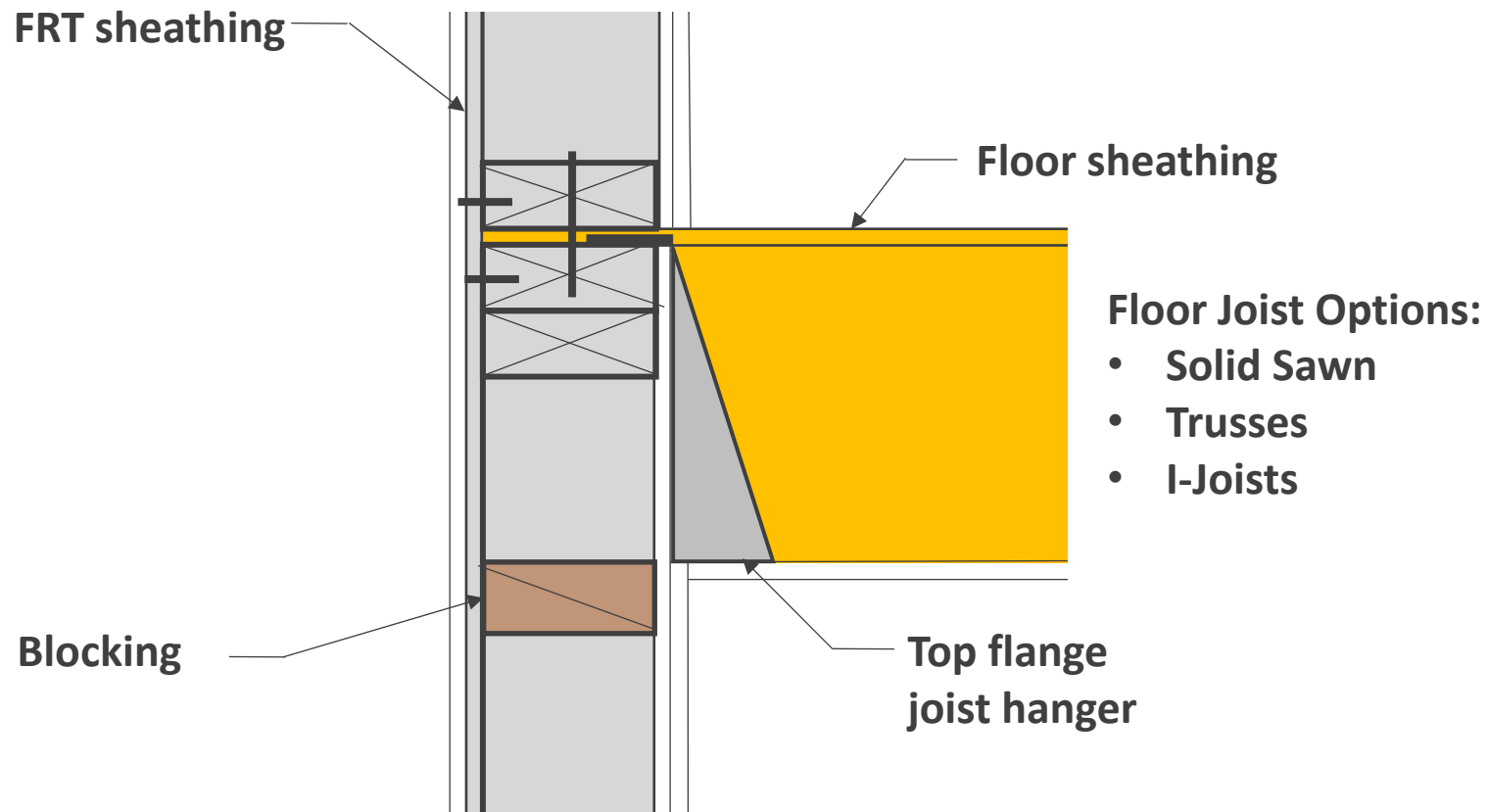


# Exterior Walls – Intersecting Floors

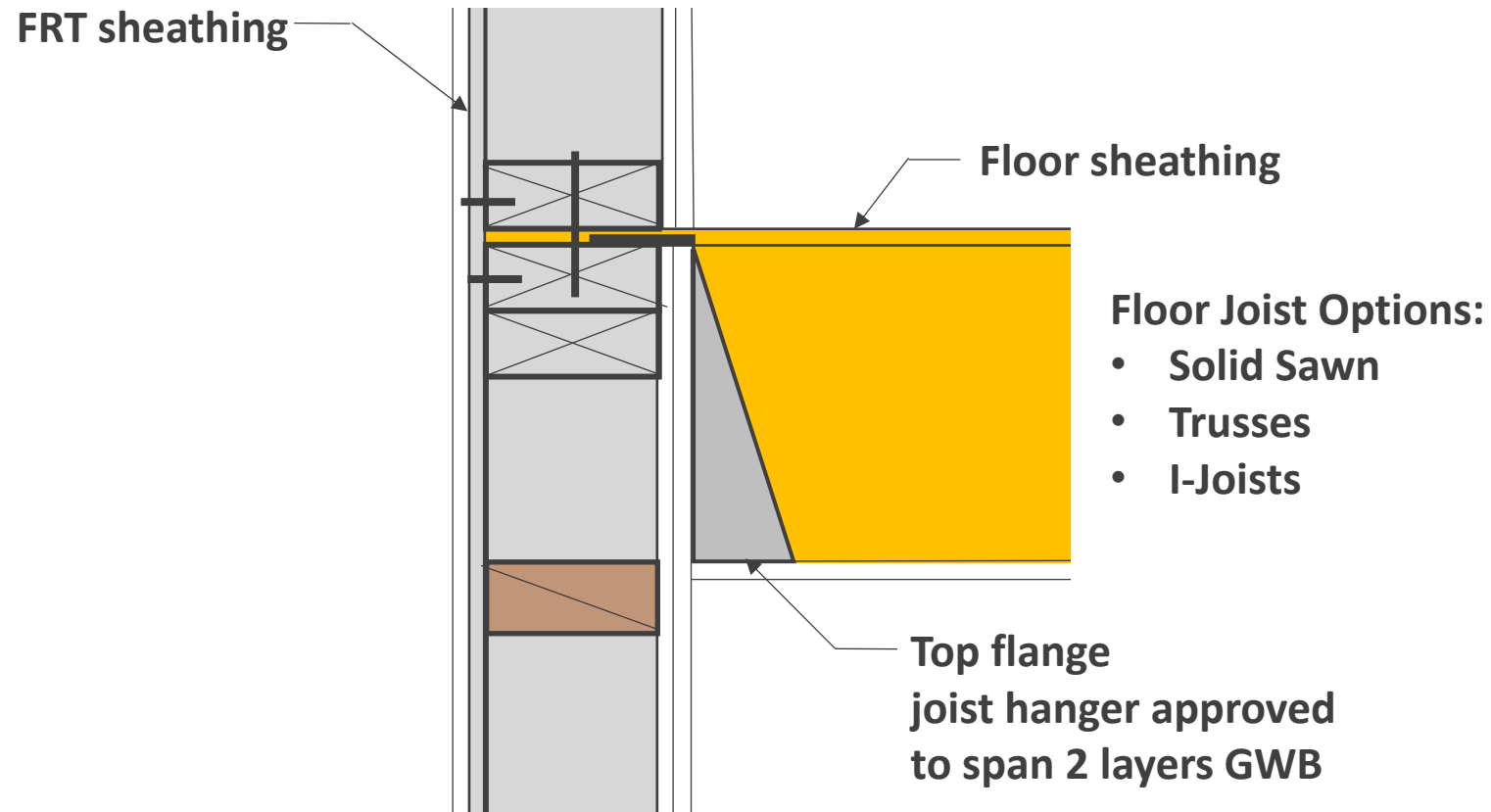




# Exterior Walls – Intersecting Floors

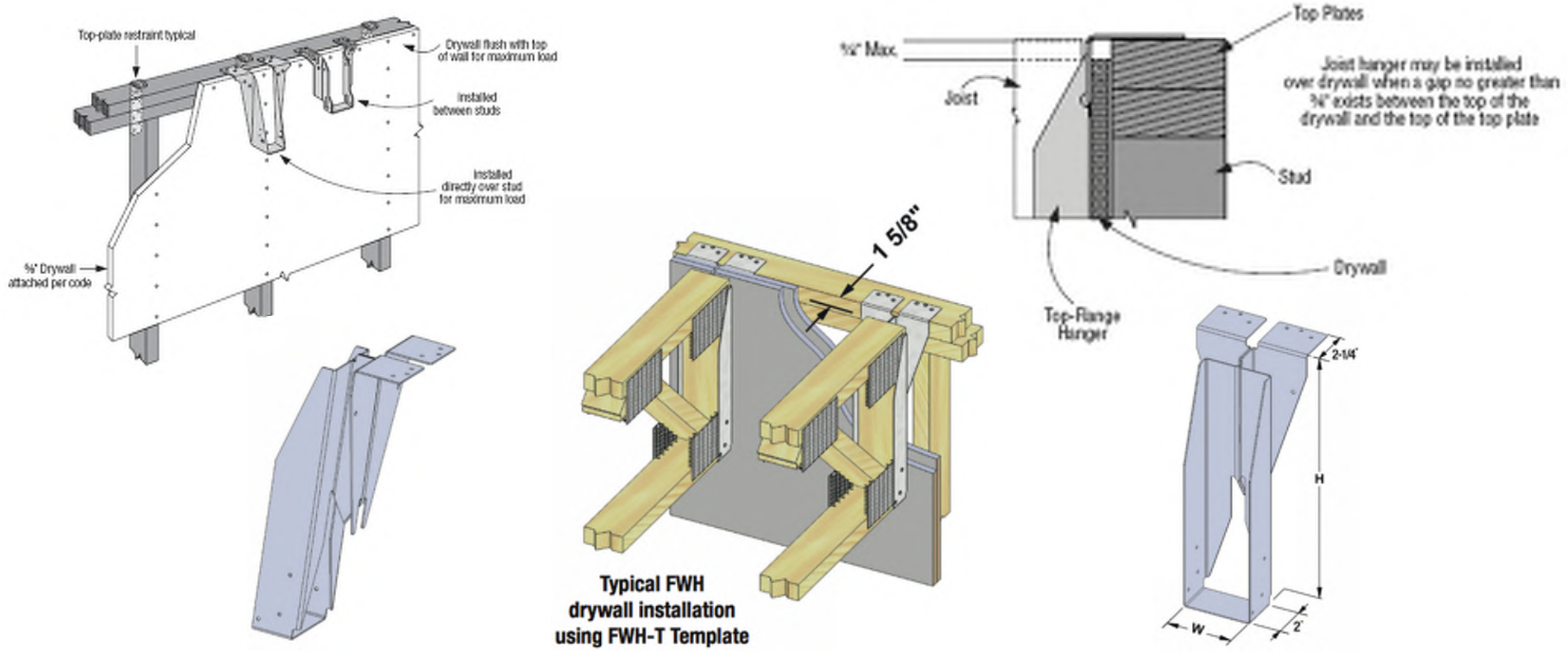


# Exterior Walls – Intersecting Floors



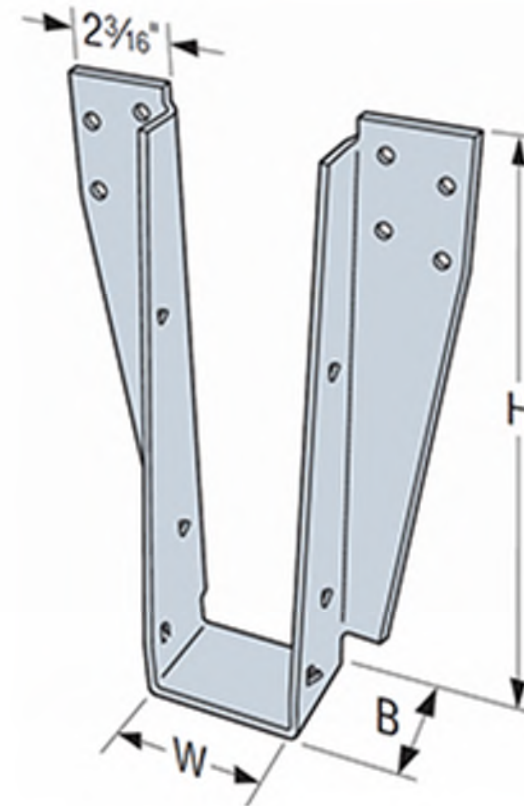
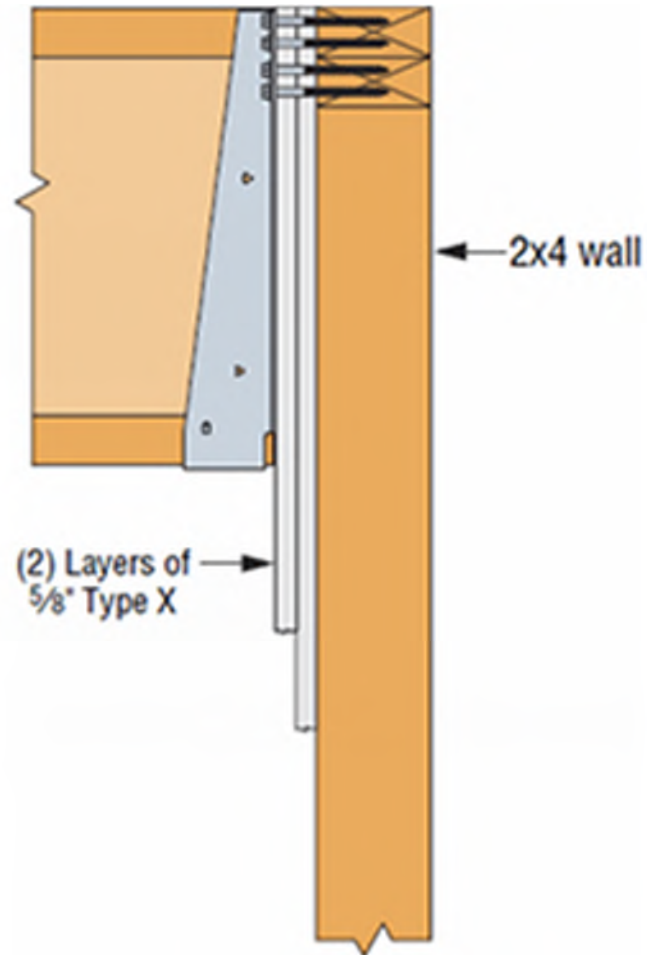
# Over Gypsum Hangers

Commonly called Fire Wall or Drywall Hangers

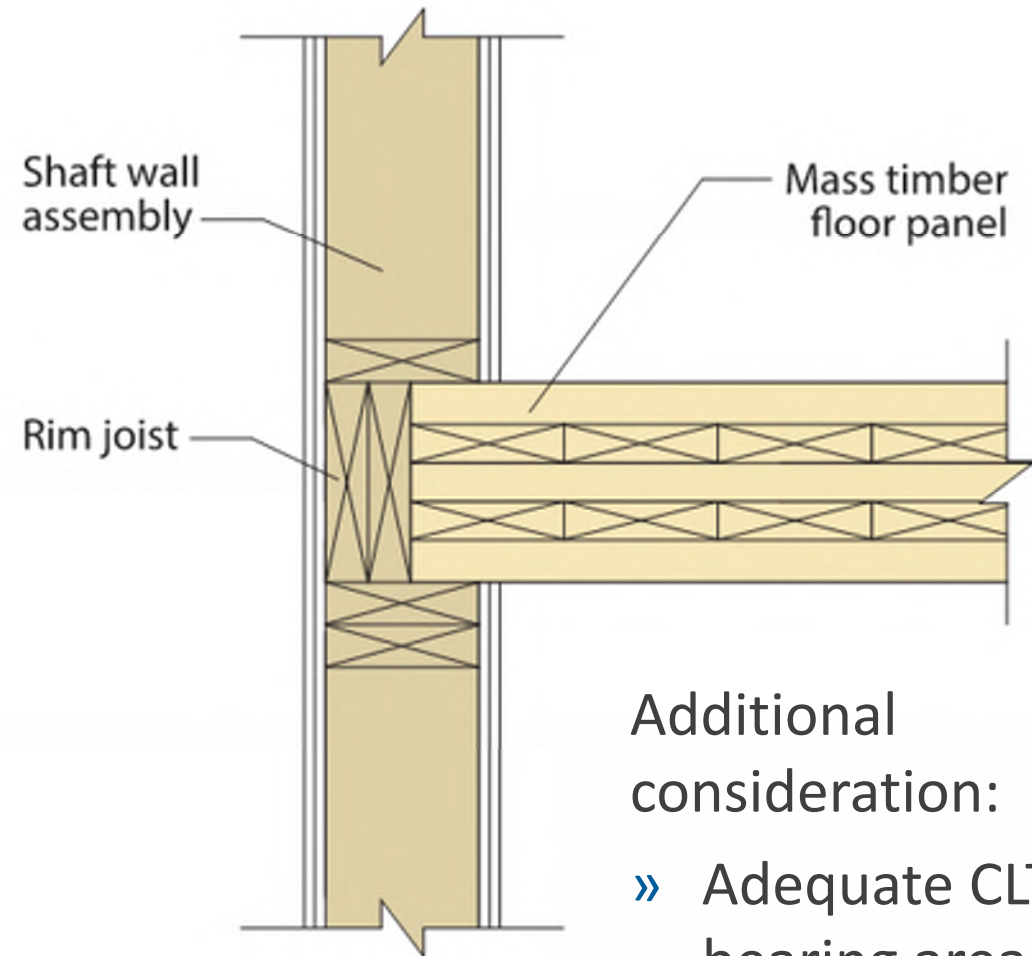
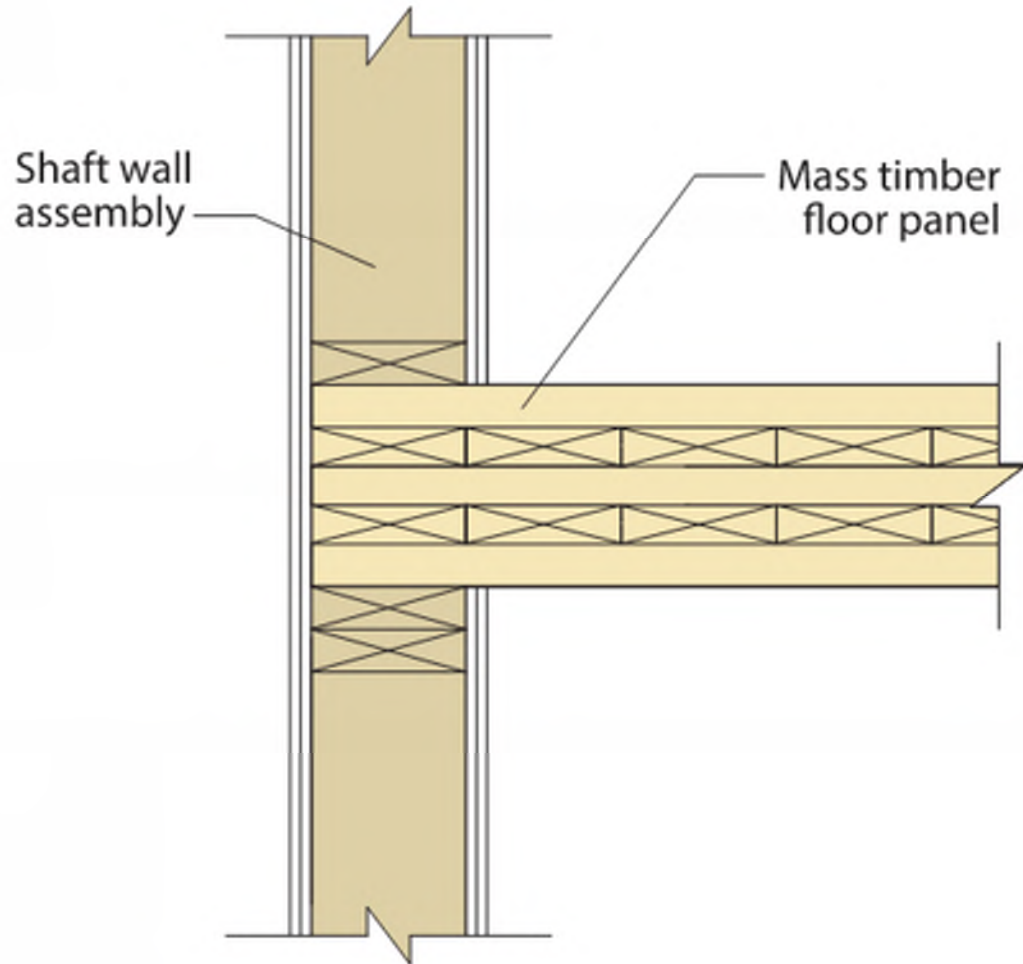


# Over Gypsum Hangers

Top Flange Hangers & Face Mount Hangers Available



# Floor to Shaft Wall Detailing

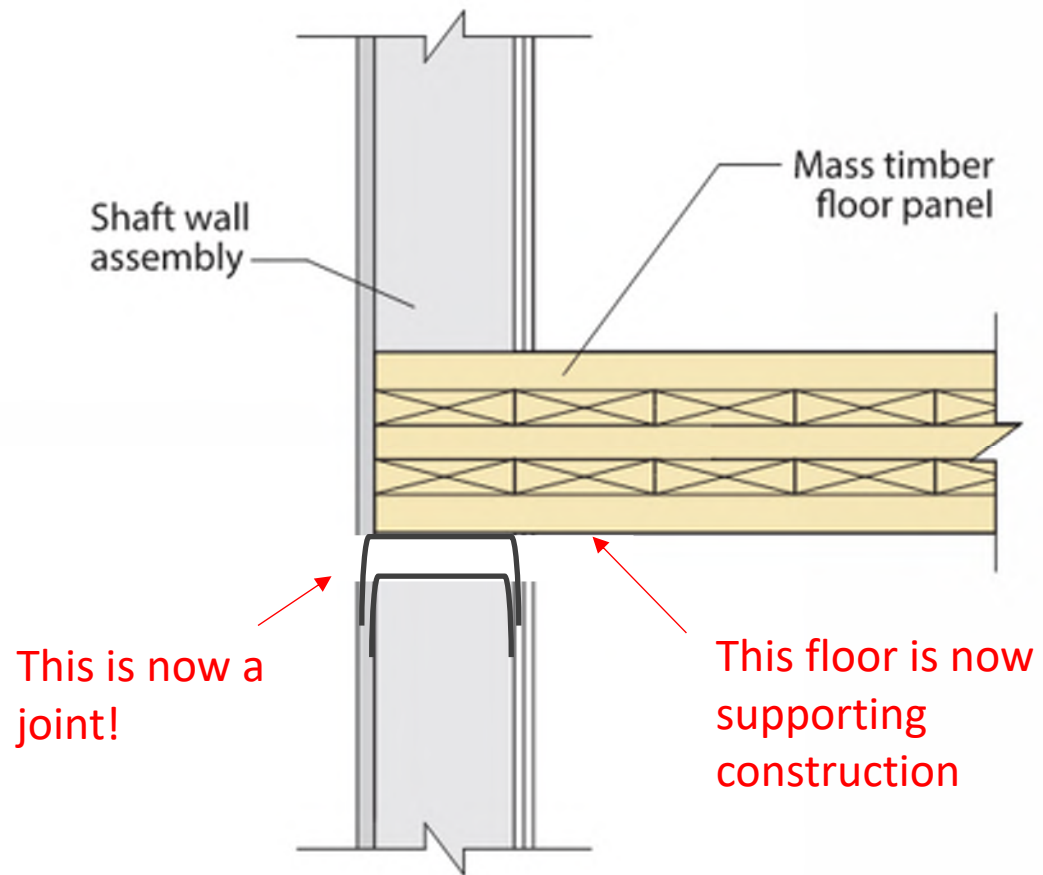


Additional consideration:

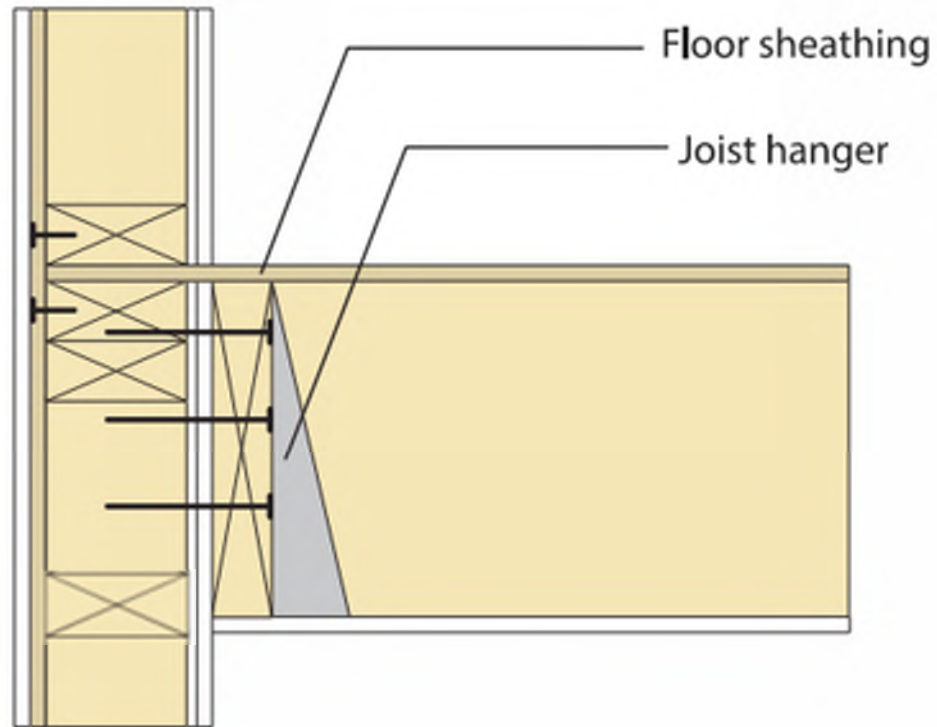
- » Adequate CLT bearing area



# Floor to Shaft Wall Detailing



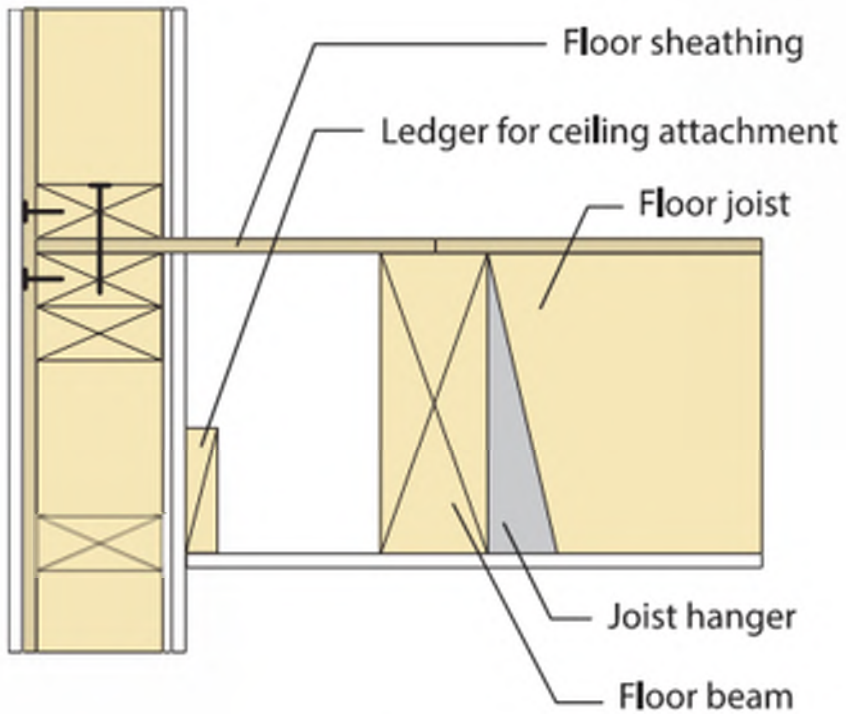
# Floor to Shaft Wall Detailing



**FIGURE 15:** Floor framing ledger attached to shaft wall through two layers of gypsum

- » Structurally to make fasteners work
- » Scheduling and sequencing considerations
- » Allows use of standard face mount hangers
- » A common situation at stair shaft intermediate framing

# Floor to Shaft Wall Detailing



**FIGURE 13:** Floor-to-shaft wall intersection with supporting beam just inboard of wall

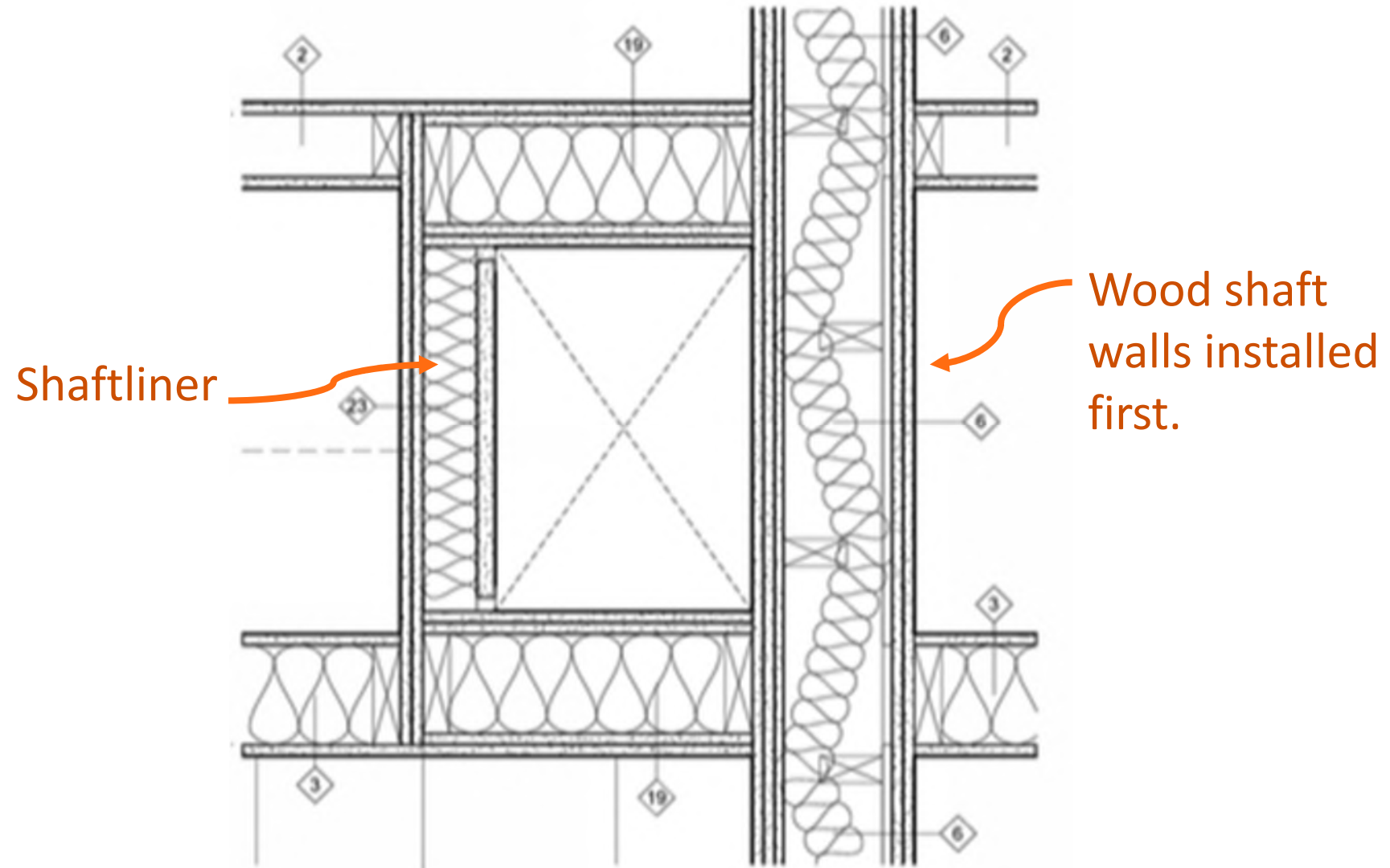


Credit: WoodWorks

# Shaftliner Systems

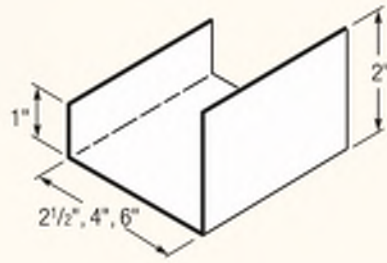
## Limitations

- Some have height limitations, both per story and overall system
- Not structural, may require back-up wood wall



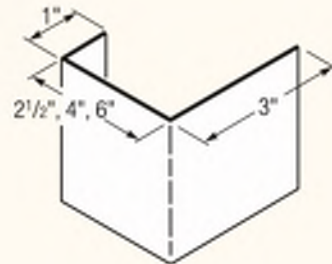
# Shaftliner Systems – Configuration Options

USG Steel J-Runner (JR)



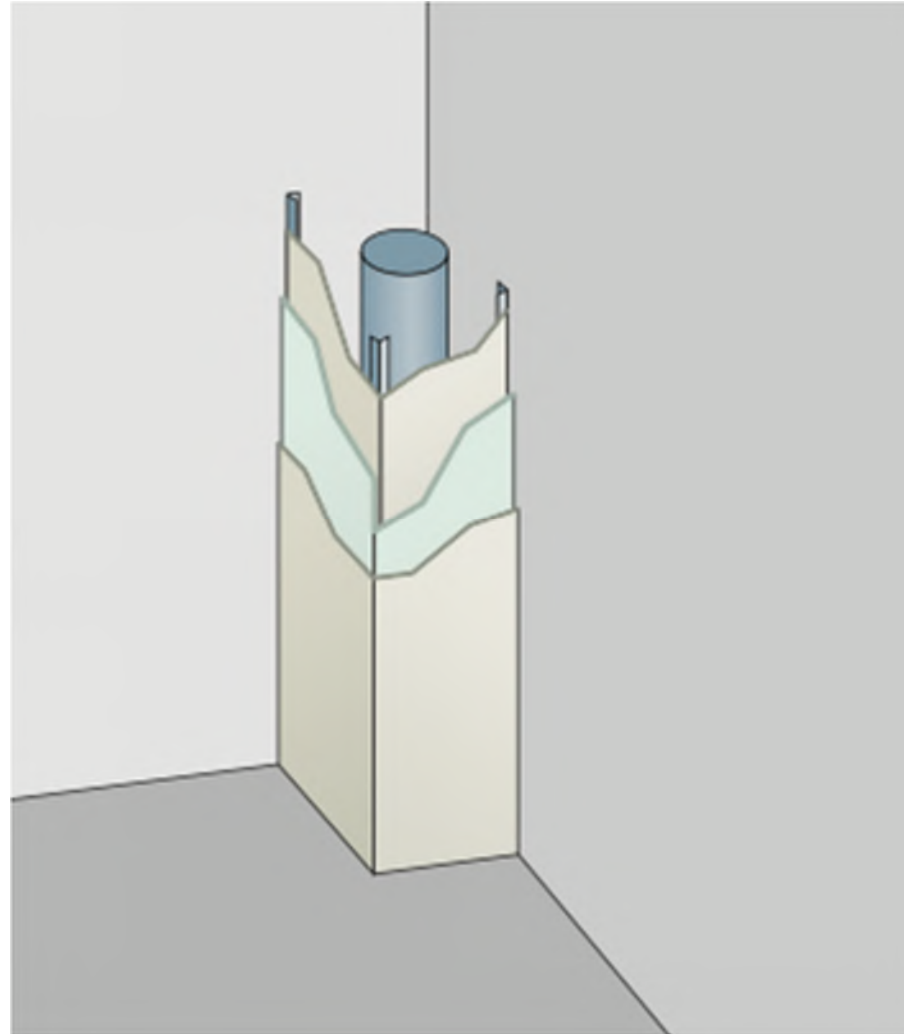
J-Runner (JR)

USG Steel Jamb-Strut (JS)



Source: USG

Jamb-Strut (JS)



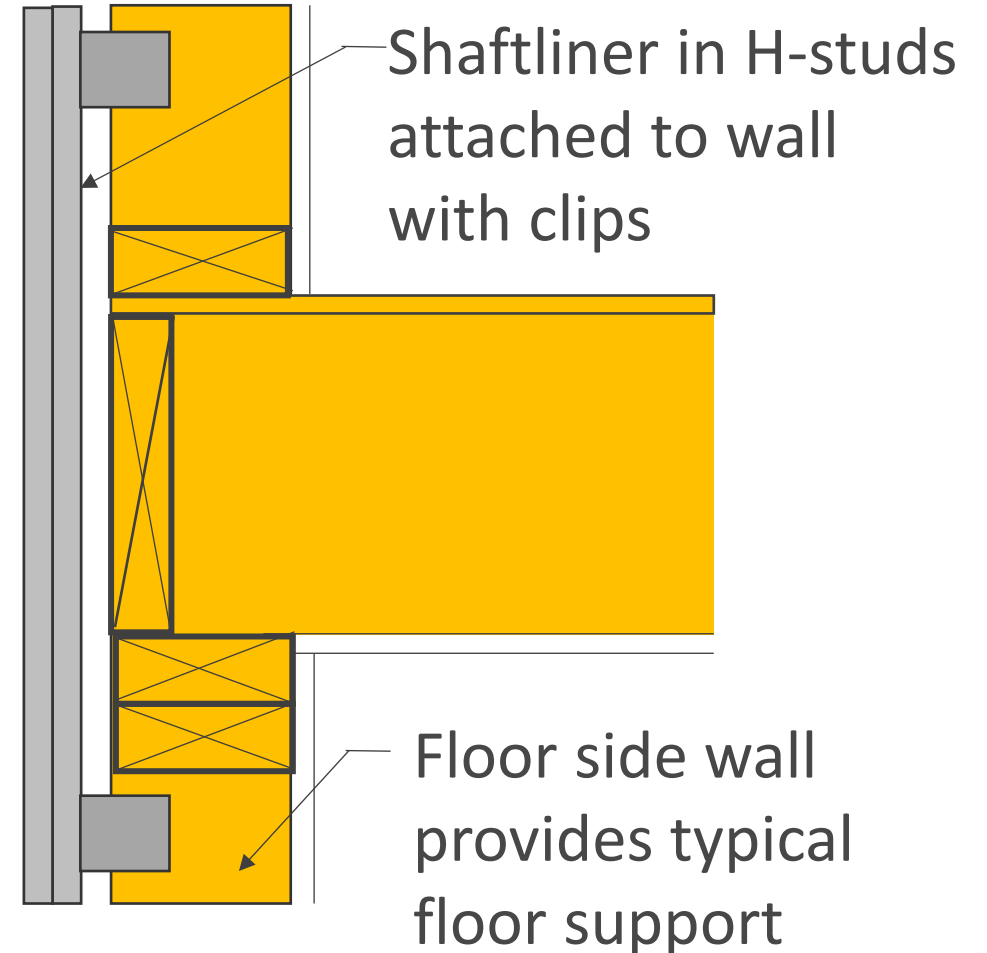
# Shaftliner Systems – Configuration Options



Source: Clark Dietrich

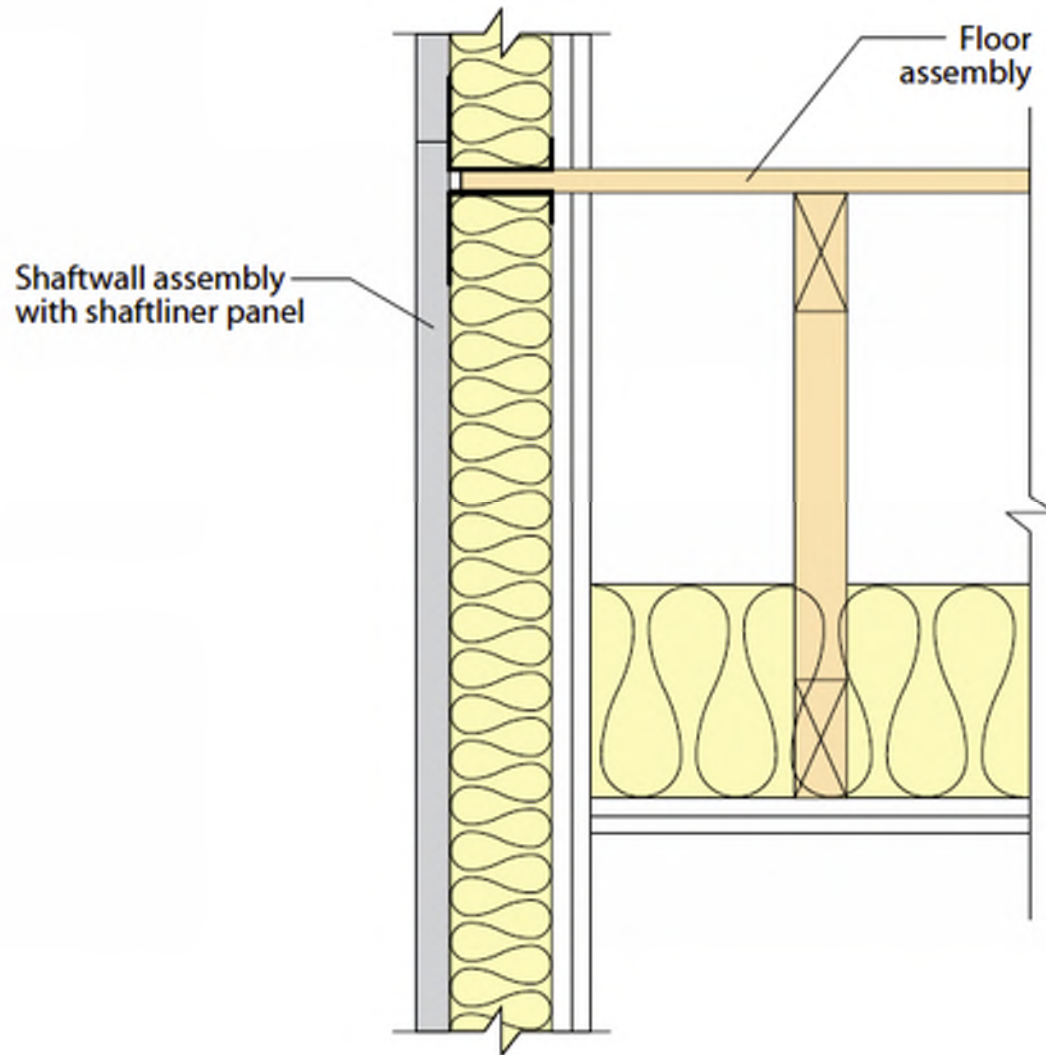
## H-studs are non-structural

Can only resist nominal horizontal pressures and self weight (but limited on self weight capacity)





# Shaftliner Systems – Configuration Options



Source: Clark Dietrich

CH-Stud Option



# Shaftliner Systems – Configuration Options





What is being enforced in jurisdictions you are working in?

# Questions? Ask us anything.



## **Kate Carrigg, PE**

Regional Director | OR, ID-South, HI

(303) 902-3151

[kate.carrigg@woodworks.org](mailto:kate.carrigg@woodworks.org)

## **Eric Gu, PhD, PE**

Regional Director | WA, ID-North, AK

(509)227-9886

[eric.gu@woodworks.org](mailto:eric.gu@woodworks.org)



## **Ron Nuttall**

Engineered Wood Specialist

(720) 930-2621

[ron.nuttall@apawood.org](mailto:ron.nuttall@apawood.org)

