

# Type III Exterior Walls – Practical Understanding and Design Approaches from an Engineer’s Perspective

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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



# Course Description

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*This educational session will focus on the unique design requirements of Type III construction related to required fire resistance and practical constructability for code compliance. Topics will include fire-resistance-rating requirements for the interior and exterior, the impact of fire separation distance, implications of intersecting fire walls, and primary structural frame protection within exterior walls. Attendees will also learn about new language in the 2024 International Building Code (IBC) addressing exterior wall/floor assembly interface for Type III construction and how to utilize the American Wood Council's 2024 Fire Design Specification (FDS) for Wood Construction for fire-resistance-rated assembly and intersection design.*

# Learning Objectives

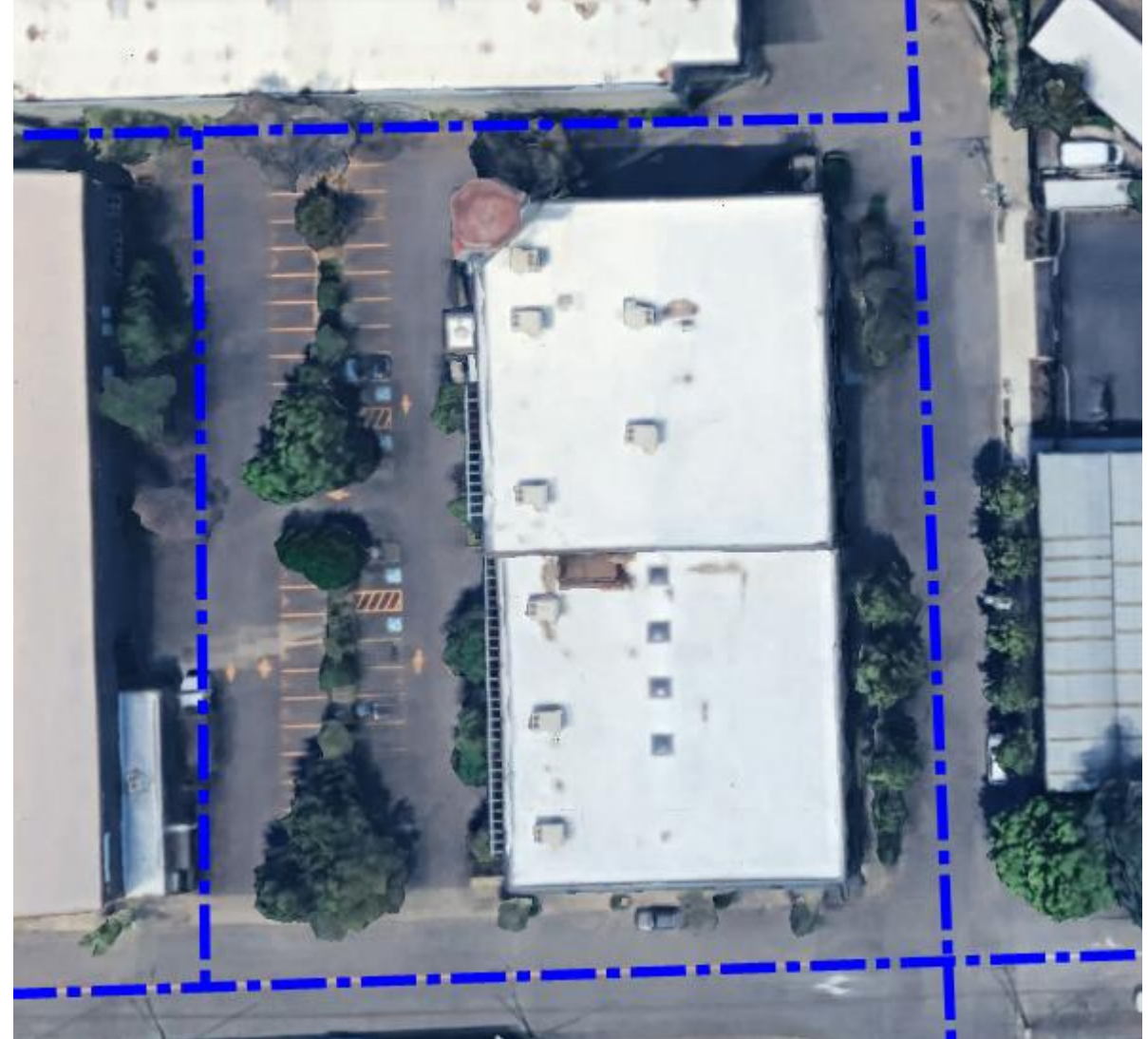
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1. Identify the fire-resistance rating requirements for Type III construction, including both interior and exterior wall assemblies, and how fire separation distance impacts these requirements.
2. Examine the constructability and code compliance challenges of exterior wall/floor assembly intersections, primary structural frame protection, and the implications of intersecting fire walls in Type III construction.
3. Learn how to utilize the American Wood Council's Fire Design Specification (FDS) for Wood Construction to perform fire-resistance calculations for wood-based assemblies.
4. Explore the new 2024 International Building Code (IBC) provisions addressing the exterior wall/floor assembly interface in Type III construction and its impact on fire safety and design practices.

# Fire Separation Distance

Fire Separation Distance is defined as the distance from the face of the building to one of the following:

- The closest interior lot line
- The centerline of a street, alley, or public way
- An imaginary line between two buildings on the same lot



# Exterior wall Fire Rating Requirement

## 705 Exterior Walls

### 705.5 Fire-Resistance Ratings

Exterior walls shall be fire-resistance rated in accordance with Table 601, based on the type of construction, and Table 705.5, based on the fire separation distance. The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet (3048 mm) 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 (3048 mm) shall be rated for exposure to fire from both sides.

Table 705.5 Occupancy Group R

<u>Fire Separation Distance</u>	<u>TYPE IIIA</u>	<u>TYPE IIIB</u>
X < 30ft	1hr	1hr
X ≥ 30ft	0hr	0hr

# Exterior wall Fire Rating Requirement

Table 601 Fire-Resistance Rating Requirements for Building Elements

<u>Building Element</u>	<u>TYPE IIIA</u>	<u>TYPE IIIB</u>
Primary Structural Frame	1hr	0hr (not relevant per following discussion)
Exterior Bearing Wall	2hr	2hr
Exterior Nonbearing Wall	Table 705.5	Table 705.5

## 707.5.1 and 708.4.2 Supporting Construction

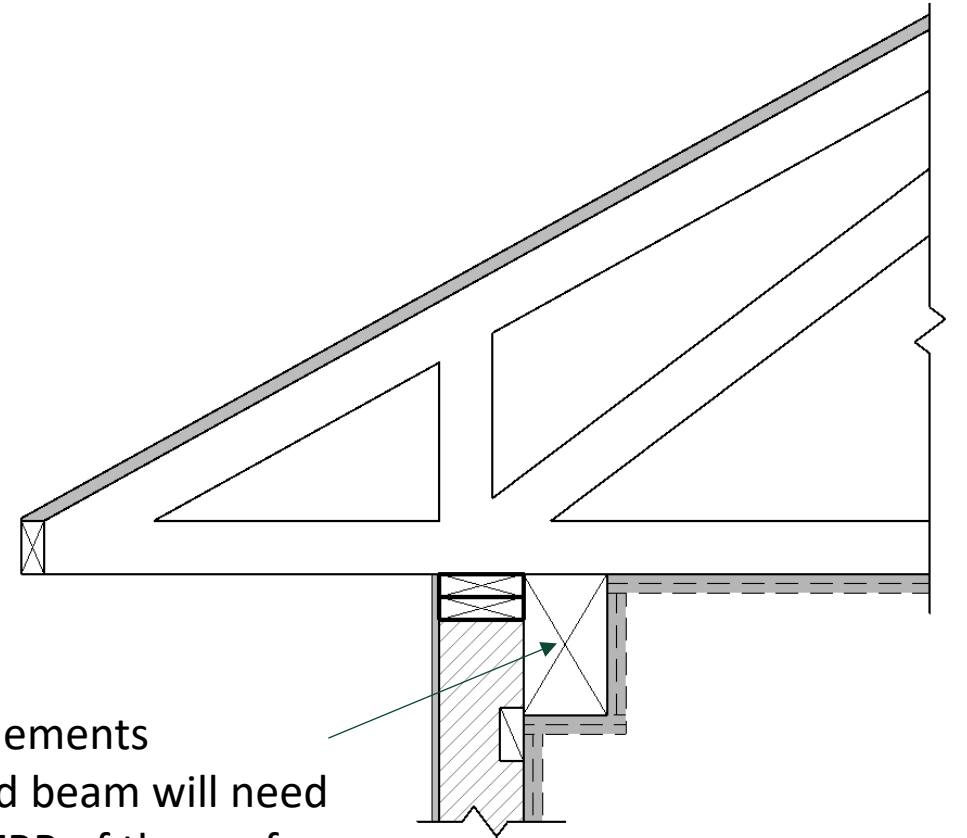
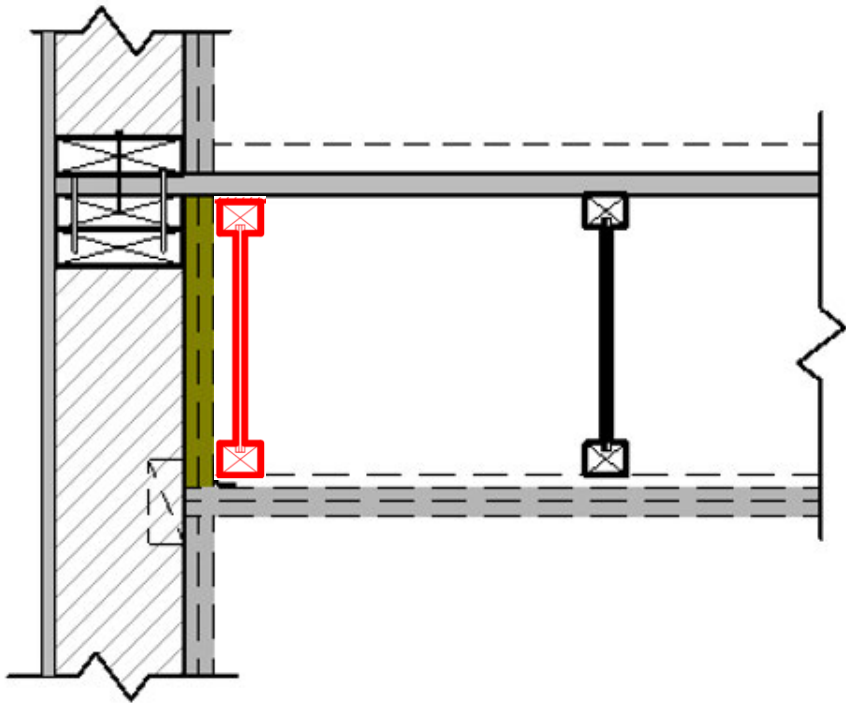
The supporting construction for a fire partition/fire barrier shall have a fire-resistance rating that is equal to or greater than the required fire-resistance rating of the supported fire partition/fire barrier.

Note that primary structural frame is not relevant for light frame construction, however the “supporting construction” code sections above is required to be met for wood wall and floor framing elements, as well as wood elements within the intersections of assemblies.

# Creating a non-bearing wall

**[BS] WALL, LOAD-BEARING.** Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.



Any studs or other elements supporting the added beam will need match the required FRR of the roof assembly

# Definitions: IBC Chapter 2

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## Primary Structural Frame:

The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. Members that are essential to the vertical stability of the primary structural frame under gravity loading.

## Light Frame Construction:

Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

# Individual Protection vs Supporting Construction:

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Excerpt from AWC Frequently Asked Questions:

Definitions for “primary structural frame” and “light-frame construction” are included in IBC Chapter 2. IBC Section 704.3 (Protection of the primary structural frame other than columns) is for systems that meet the definition of “primary structural frame,” but not heavy timber or light-frame construction. Floor joists, ceiling joists, and rafters in light-frame construction do not fall within the definition of primary structural frame. Likewise, wood beams, if required to be rated, (Type IIIA or VA building) are typically part of a light-frame system. Their fire resistance would be established by normal means, whether calculating fire resistance as an exposed wood member or protecting with other materials.

This means that for wood joists, rafters, and beams, there is no requirement for individual encasement.

Note that even though they don’t need individual encasement, if a beam is supporting a 2-hr wall above, but is fully enclosed in a 1-hr floor assembly, an additional 1-hr of protection will be required of that beam through measures such as added membranes or design for charring of the member or other strategies.

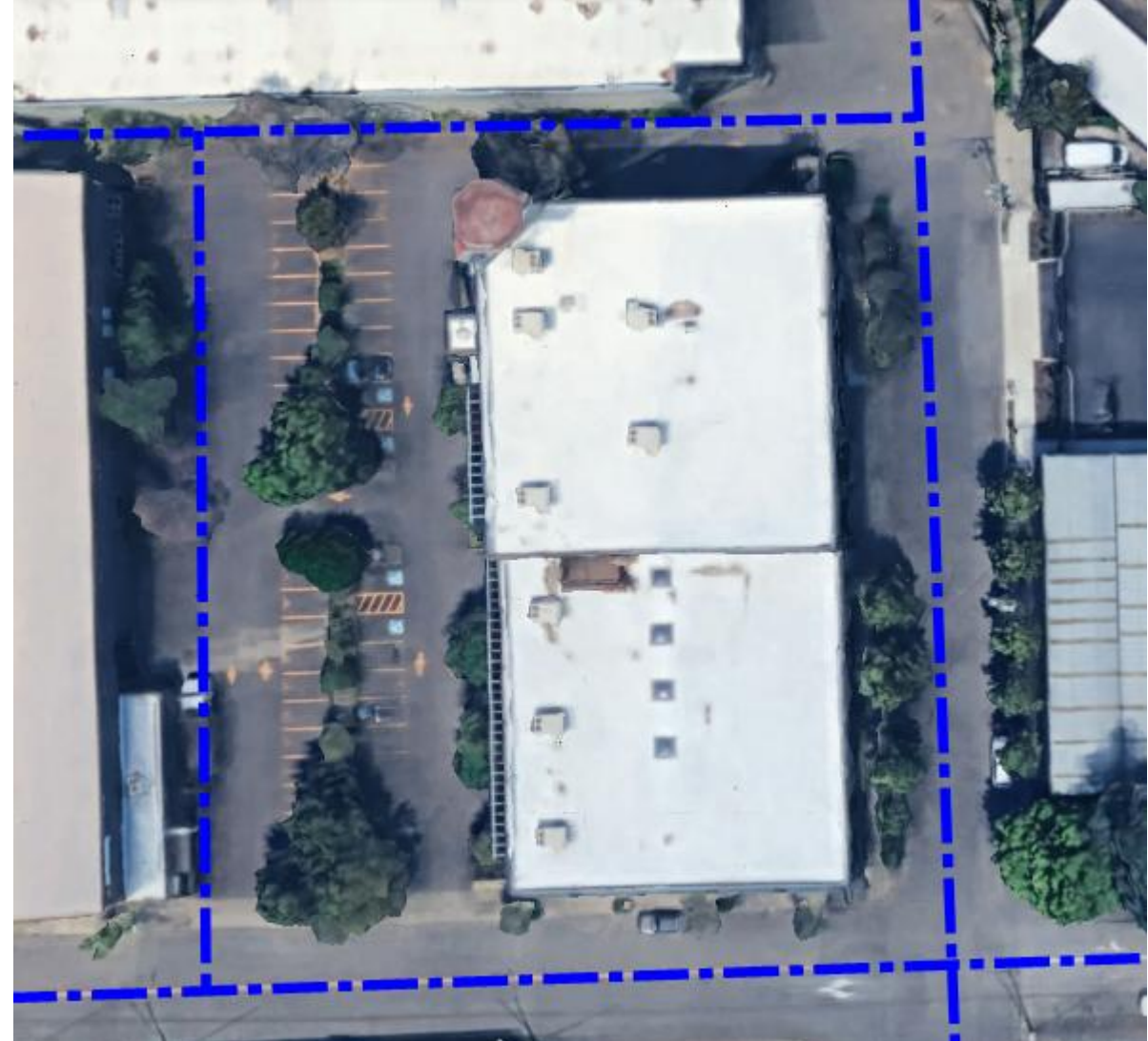
Additionally, wood studs and columns do not need individual protection so long as they don’t break the top or bottom plates. If they do break the plates, they would need individual protection for their full height. They still must meet the supporting construction requirement, so like the beam example above, if they are supporting a beam that is required to be 2-hr rated, and they are enclosed in a 1-hr wall, an additional 1-hr of protection is required.

# Fire Separation Distance

This structure has a fire separation distance of  $\geq 30\text{ft}$  on all sides, so the exterior wall and primary structural frame fire-resistance requirements are:

<u>Building Element</u>	<u>TYPE IIIA</u>	<u>TYPE IIIB</u>
Exterior Bearing Wall	2hr	2hr
Exterior Nonbearing Wall	0hr	0hr

**AND**, since the fire separation distance is greater than 10ft, the walls are rated from the inside only.

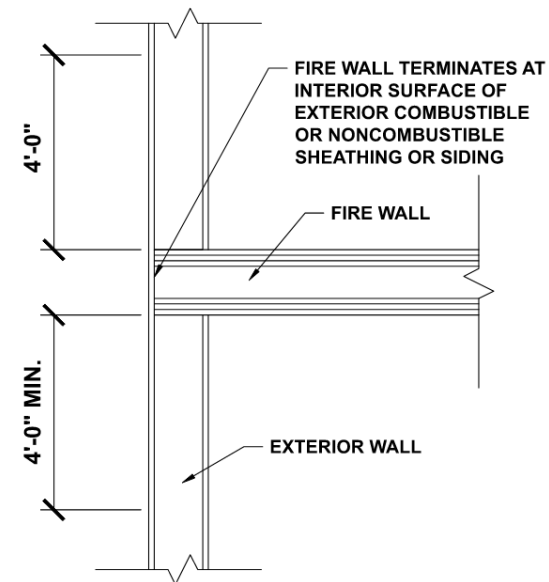
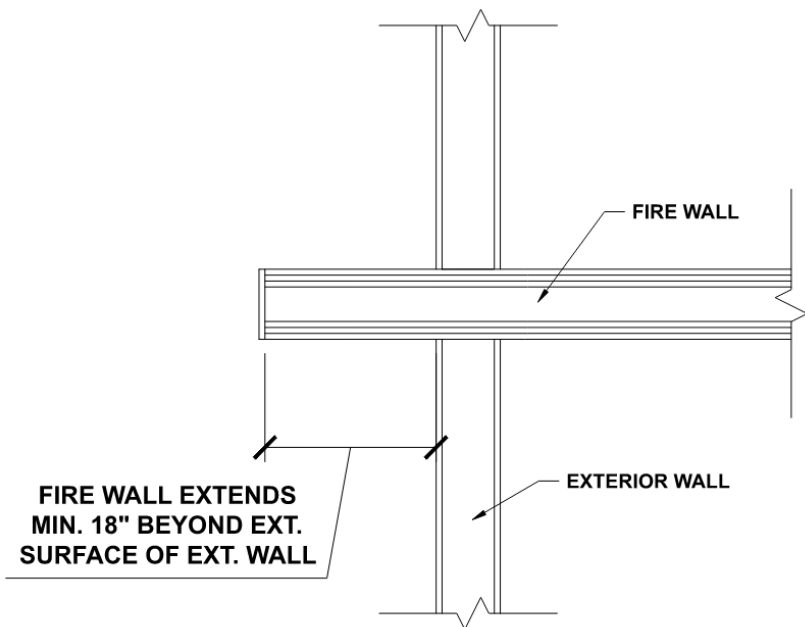


# Fire Wall Intersecting the Exterior Walls

Rating from the inside only is not allowed at the 4'-0" protection zones. If the project uses 5/8" Type X for the minimum exterior sheathing, you could fill the stud cavity with mineral wool in this zone and show by the CAM method, that the wall meets the 1-hr requirement from the exterior.

## ALTERNATIVES:

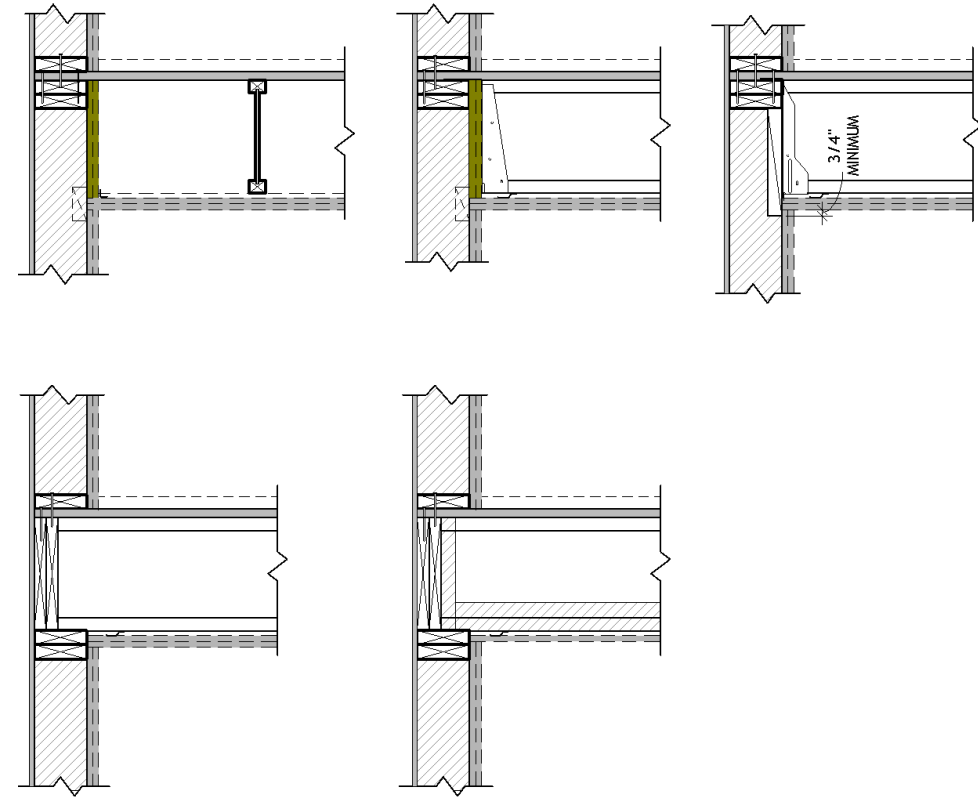
1. EXTERIOR WALL RATED FOR 1 HR MIN. 4FT EACH SIDE (OPENING PROTECTION REQ'D)
2. NONCOMBUSTIBLE SHEATHING/SIDING EXTENDS MIN. 4FT EACH SIDE
3. BUILDING ON EACH SIDE OF THE FIRE WALL IS EQUIPPED THROUGHOUT WITH AN NFPA OR NFPA 13 SPRINKLER SYSTEM



# Minimum requirements for exterior panels when rating for fire from the inside only

The primary function of the membrane on the unexposed side of the wall is to brace the structural members, hold the insulation in place, and prevent the transmission of heat through the assembly. Any combination of membranes with a total combined fire resistance time of 15min is acceptable, or prescriptively per IBC Table 722.6.2(3). Note that 1/2" wood structural panels are shown in order to accept nails from siding, but 3/8" wood structural panels are acceptable if the panels and the cladding can resist project wind loading. With the 3/8" wood structural panels, siding nails would need to align with and penetrate into the wall studs and may dictate a smaller stud spacing depending **on the siding used. Also, check to cost of moisture resistant 1/2" or 5/8" type x gypsum panels vs the FRT structural sheathing.**

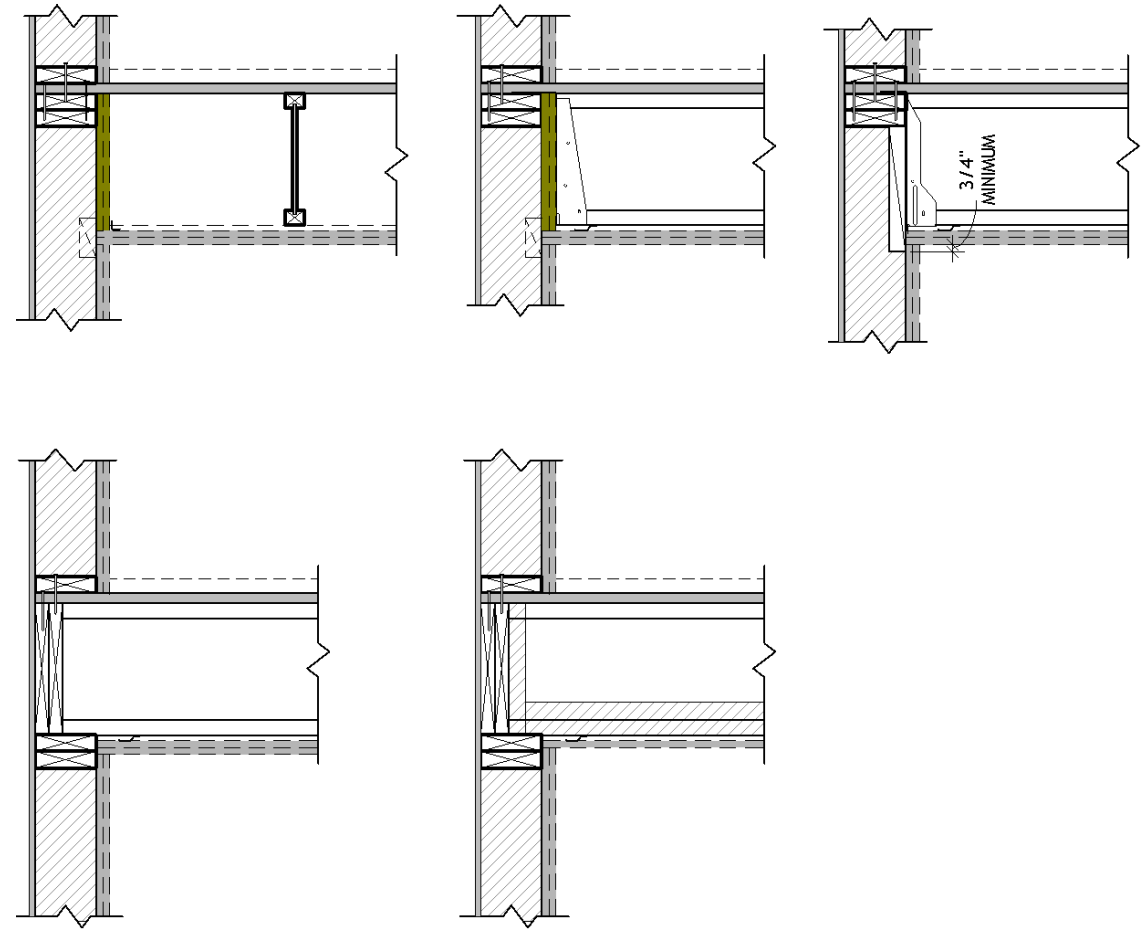
Of note, is that wall assembly fire tests require a hose stream test, which is not quantifiable in any calculation method.



# A few exterior wall to floor details

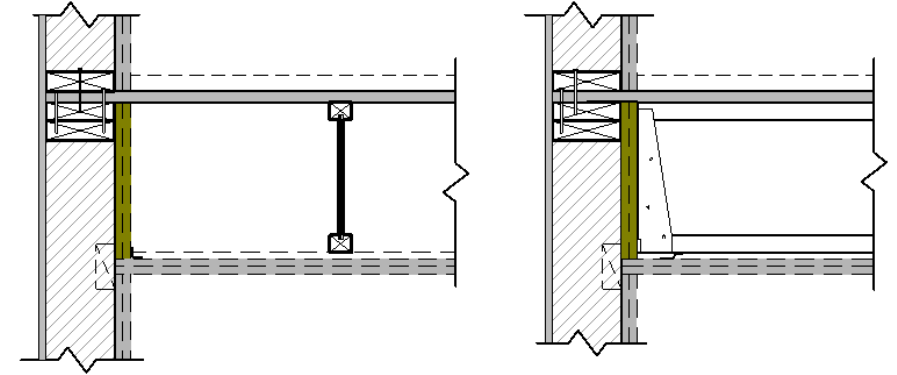
1. Modified Balloon – Joists Parallel
2. Modified Balloon – Joists Perpendicular
3. Modified Balloon – Joists Perpendicular with blocking
4. Platform – (2) layers 5/8" Type X at ceiling
5. Platform – (1) layer 5/8" Type X at ceiling

Other joists such as solid sawn, light metal plate connected trusses, and open web trusses with wood flanges and steel webs are not shown, but the same theories can be applied to those intersections



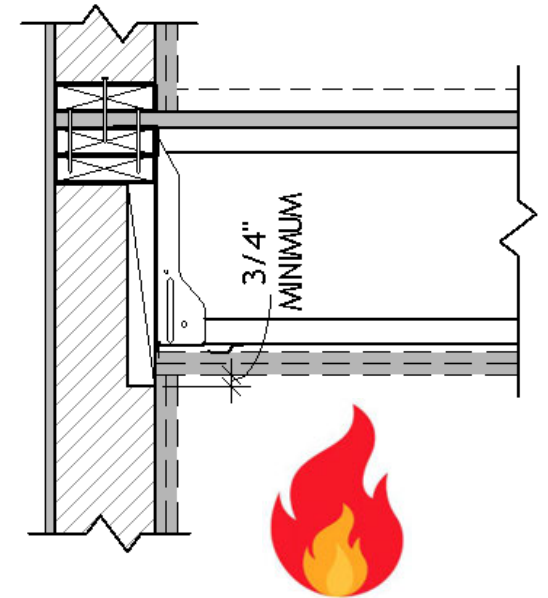
# Modified balloon – continuous gypsum wall panels

1. This detail does not constitute an intersection that needs any calculations. The gypsum wall panels are blocked at the ceiling joint, creating continuity between top and bottom wall plates.
2. No other blocking is required for stability, draft stopping, or fireblocking, which minimizes labor and materials, and maximizes the insulation in the exterior walls.
3. Note that the gypsum ceiling panels bear on top of the gypsum wall panels, which is required per IBC Table 2508.1 via GA-216 4.6.1 as well as FDS 1.7.8.1. If this does not occur, the joint at the edge of the ceiling would need to be a tested joint, or designed for thermal separation and burn through per FDS 2.5.1



# Modified Balloon – discontinuous gypsum wall panels

1. The discontinuous gypsum panels create an intersection that can be designed with the IBC and the FDS.
2. No other blocking is required for stability, draft stopping, or fireblocking, which minimizes labor and materials, and maximizes the insulation in the exterior walls.
3. Note that the gypsum ceiling panels bear on top of the gypsum wall panels, which is required per IBC Table 2508.1 via GA-216 4.6.1 as well as FDS 1.7.8.1. If this does not occur, the joint at the edge of the ceiling would need to be a tested joint, or designed per the IBC, or the FDS if allowed by the AHJ.



# How the FDS is referenced in the 2024 IBC

## 2024 IBC

- Chapter 35 Referenced Standards
  - ANSI/AWC NDS-2024
    - Chapter 16 – Fire Design of Wood Members

### **16.1 General**

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Chapter 16 establishes fire resistance provisions for use where the required fire resistance of wood construction covered under this Specification is established by calculation. Reference design values and specific design provisions applicable to particular wood products or connections to be used with the provisions of this chapter are given in other chapters of this

Specification. Reduced cross-sectional dimensions shall be determined in accordance with 16.3 based on char depth in accordance with 16.2. Where determinations of thermal separation and burn-through resistance are required, calculations shall be in accordance with the *Fire Design Specification for Wood Construction* (FDS).

### **16.3 Structural Fire Resistance of Exposed Wood Members**

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Design provisions for exposed wood members herein are limited to fire resistance calculations not exceeding 2 hours.

### **16.4 Structural Fire Resistance of Protected Wood Members**

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Where protective materials are used to increase the fire resistance of structural wood members, the calculations shall be in accordance with the FDS.



### **16.5 Wood Connections**

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Structural wood connections, including connectors, fasteners, and portions of wood members included in the connection design, shall be protected from fire exposure for the required fire resistance time in accordance with the FDS. Protection shall be provided by wood, fire-rated gypsum board, other approved materials, or a combination thereof. Fasteners attaching wood protection shall not be required to be protected.

# FDS Structural Fire Resistance Time (SFRT)

## 3.4.2 Protection by Type X Gypsum Panel Products

**Table 3.9.1.2b Added Protection Time Assigned to Type X Gypsum Panel Membrane**

Description of Gypsum Panel Membrane <sup>1, 2, 3, 4, 5</sup>	Max. Framing Spacing (in.)	Max. Fastener Spacing (in.)	Time, minutes
1/2-inch Type X gypsum panel product	16	12	30 <sup>6</sup>
	24	8	
5/8-inch Type X gypsum panel product	16	12	40 <sup>7</sup>
	24	8	

<sup>1</sup> Each gypsum panel layer shall be attached with fasteners of sufficient length to penetrate the wood member at least 1 inch or be attached to steel channels capable of supporting the weight of the gypsum panel.

<sup>2</sup> Panel edges of the gypsum panel face layer shall be taped and finished with joint compound and fastener heads shall be covered with joint compound.

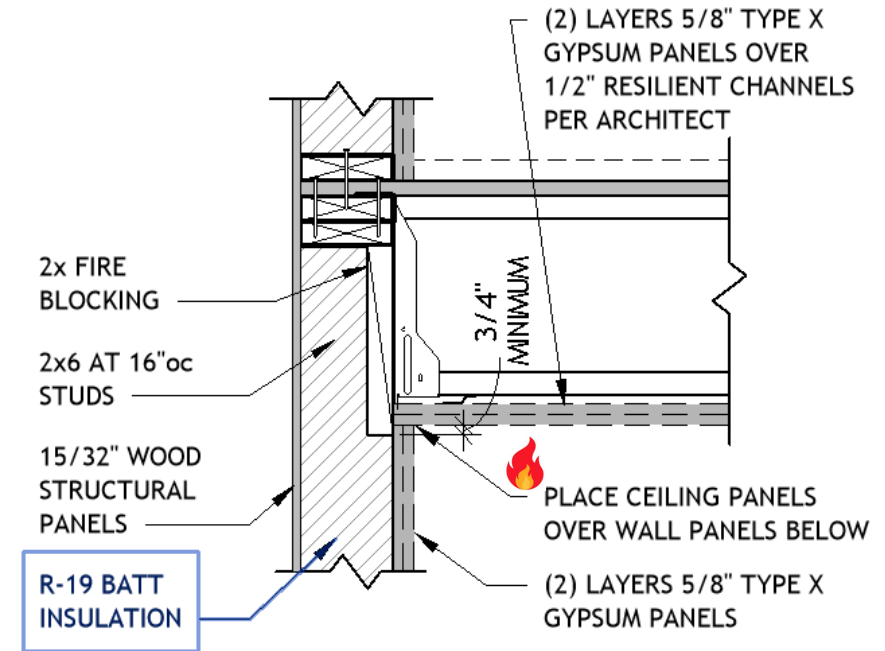
<sup>3</sup> Where multiple layers of gypsum panel are required, adjoining panel edges occurring over framing shall be staggered at least one framing spacing from those of the adjacent underlying layer and attached to framing with fasteners offset at least 4 inches from the fasteners in all underlying layers. Unbacked adjoining panel edges shall be offset by at least 12 inches from those of the adjacent underlying layer.

<sup>4</sup> At wall-to-ceiling intersections, the gypsum panel membrane shall be installed such that the ceiling gypsum panel membrane is installed first, followed by the wall gypsum panel membrane to ensure that the ceiling gypsum panel membrane is supported by each layer of the wall gypsum panel membrane.

<sup>5</sup> At wall-to-wall intersections, each layer of gypsum panel membrane shall be installed such that the gypsum panel membrane on the wall with a greater fire-resistance rating is installed first, followed by the gypsum panel membrane on the intersecting wall.

<sup>6</sup> For wood-frame walls with studs spaced 16 inches on center or less, the protection time,  $t_p$ , for 1/2" Type X gypsum panel with 2-1/4" Type S drywall screws spaced at 7 inches on center or less shall be permitted to be increased to 33 minutes for a single layer or a base layer of 1/2" Type X gypsum panel. Additional layers of 1/2" Type X gypsum panel are limited to 30 minutes/layer.

<sup>7</sup> For wood-frame walls with studs spaced 24 inches on center or less, the protection time,  $t_p$ , for 5/8" Type X gypsum panel with 2-1/4" Type S drywall screws spaced at 7 inches on center or less shall be permitted to be increased to 48 minutes for a single layer or a base layer of 5/8" Type X gypsum panel. Additional layers of 5/8" Type X gypsum panel are limited to 40 minutes/layer.



**(2) Layers 5/8" Type X Gypsum Ceiling Panels = 2 x 40 = 80 minutes**

### 3.4.1 Protection by Wood

Wood cover shall be permitted as protection to increase fire resistance of structural wood members and assemblies.

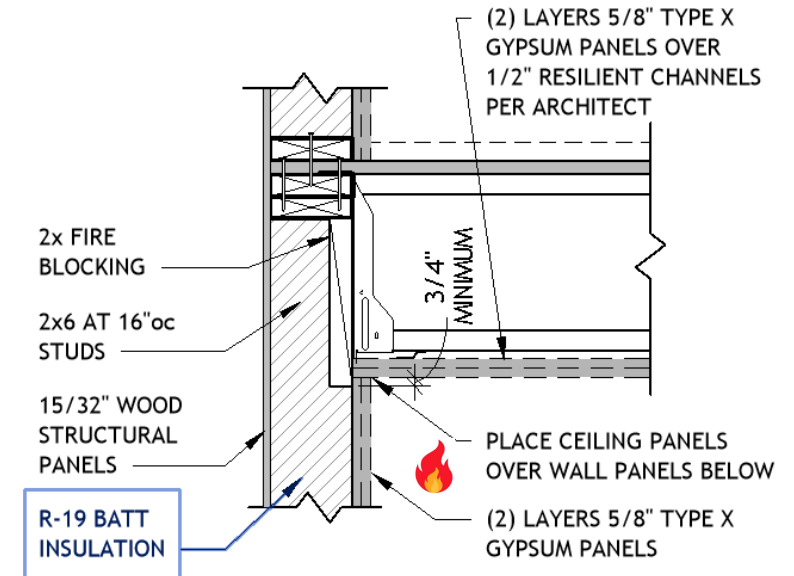
3.4.1.1 *Wood cover in contact with protected member:* The protection time,  $t_p$ , provided by each layer of wood cover that is in contact with either the protected member or another underlying layer of protection shall be calculated as:

$$t_p = 60 \left( \frac{d_p}{1.5} \right)^{1.23} \text{ minutes} \quad (\text{Eq. 3.4-2})$$

where:

$d_p$  = thickness of the protective layer of wood (in.)

$\beta_t$  = non-linear char rate constant (in./hr<sup>0.813</sup>)



2x (1.5") blocking:  
 $t_p = 60 \times (1.5"/1.5")^{1.23} = 60 \text{ minutes}$

**Table 3.9.1.1.1 Structural Fire Resistance Times Assigned to Sawn Lumber or LVL, PSL, or LSL Studs**

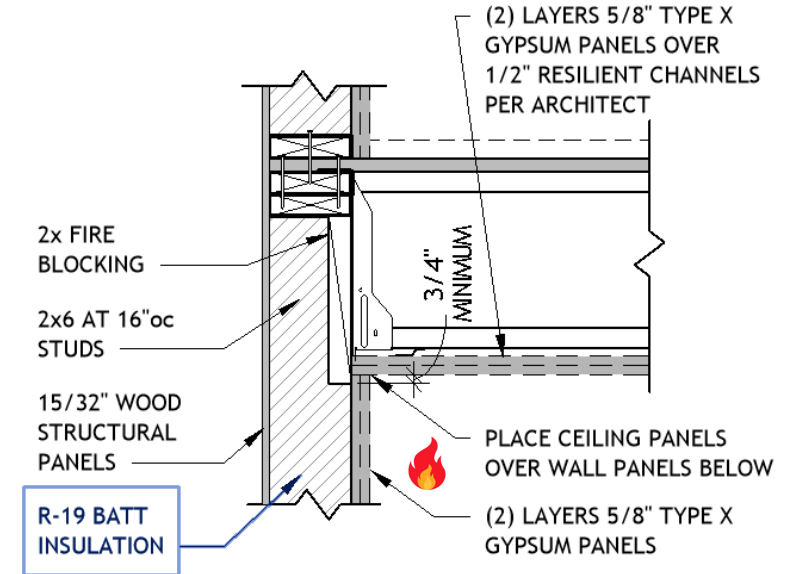
Stud Size	Maximum Bearing Stress Ratio <sup>1</sup> ( $f_c / F_{c\perp}$ )	Maximum Axial Compression Stress Ratio <sup>2,3</sup> ( $f_c / F_{c\parallel}$ )		Assigned Fire Resistance Time for Studs (minutes)		
		$K_e=1.0$ <sup>2</sup>	$K_e=0.7$ <sup>3</sup>	No Insulation	Mineral Wool <sup>4</sup> (min. 2.5 pcf)	Fiberglass <sup>4</sup> (min. R-13)
2x4	78%	100%	54%	10	23	12
	61%	78%	42%	12	26	14
2x6	100%	61%	42%	14	30	16

<sup>1</sup> The maximum Bearing Stress Ratio limits the allowable load on 2x6 studs as a result of the calculated compression perpendicular-to-grain stress,  $F_{c\perp}$ .

<sup>2</sup> The maximum Axial Compression Stress Ratio for  $K_e=1.0$  limits the allowable load on 2x4 studs as a result of the calculated compression parallel-to-grain stress,  $F_{c\parallel}$ , assuming concentric loading and pinned-end reactions at each end of studs.

<sup>3</sup> The Axial Compression Stress Ratio for  $K_e=0.7$  is the basis of the calculated fire resistance times and is based on the calculated compression parallel-to-grain stress,  $F_{c\parallel}$ , assuming concentric loading and square-end bearing reactions at each end of studs.

<sup>4</sup> Cavity between studs shall be filled completely with insulation.



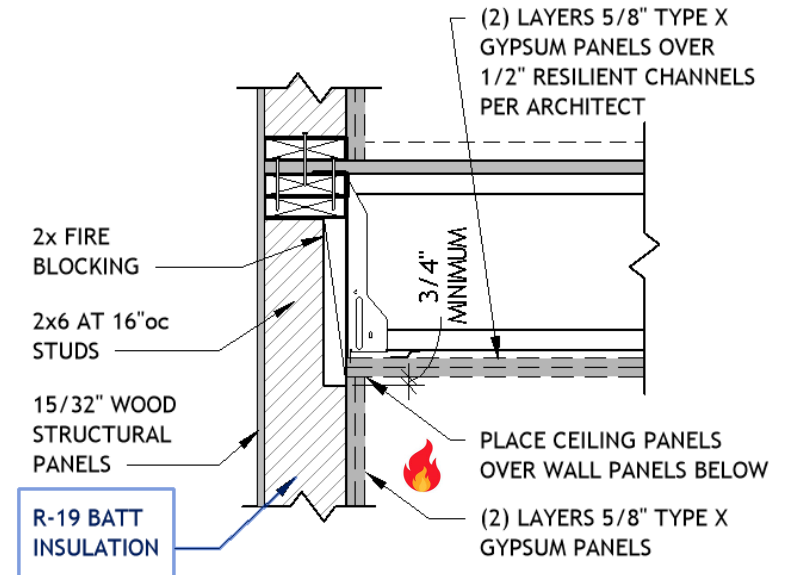
2x6 studs with Fiberglass insulation completely filling stud bays = 16 minutes

# Structural Fire Resistance Time (SFRT)

Gypsum Ceiling Panels = 80 minutes  
2x wood blocking = 60 minutes  
Studs and insulation = 16 minutes

Total SFRT of intersection = 156 minutes  
Required SFRT = 120 minutes

Remember that we don't use the membrane on the non-fire exposed side of the wall to determine SFRT. That membrane is used for TST and BTT.



# Thermal Separation Time (TST)

## 3.6.2 Thermal Separation Time Provided by Type X Gypsum Panel Products

3.6.2.1 *Gypsum panel cover or membranes:* The contribution of Type X gypsum panel layers to the thermal separation time shall be equal to the sum of protection times assigned to each layer, determined in 3.4.2, except where a single layer of Type X gypsum panel is used to provide thermal separation or where the final layer on the unexposed side of the thermal separation is Type X gypsum panel, the time assigned to that Type X gypsum panel layer, determined in 3.4.2, shall be multiplied by 0.50.

**Table 3.9.1.2b Added Protection Time Assigned to Type X Gypsum Panel Membrane**

Description of Gypsum Panel Membrane <sup>1, 2, 3, 4, 5</sup>	Max. Framing Spacing (in.)	Max. Fastener Spacing (in.)	Time, minutes
1/2-inch Type X gypsum panel product	16	12	30 <sup>6</sup>
	24	8	
5/8-inch Type X gypsum panel product	16	12	40 <sup>7</sup>
	24	8	

<sup>1</sup> Each gypsum panel layer shall be attached with fasteners of sufficient length to penetrate the wood member at least 1 inch or be attached to steel channels capable of supporting the weight of the gypsum panel.

<sup>2</sup> Panel edges of the gypsum panel face layer shall be taped and finished with joint compound and fastener heads shall be covered with joint compound.

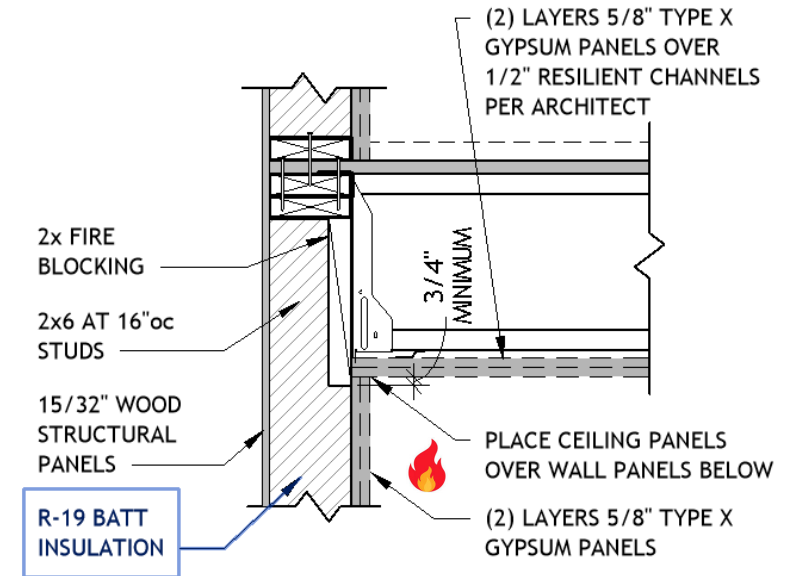
<sup>3</sup> Where multiple layers of gypsum panel are required, adjoining panel edges occurring over framing shall be staggered at least one framing spacing from those of the adjacent underlying layer and attached to framing with fasteners offset at least 4 inches from the fasteners in all underlying layers. Unbacked adjoining panel edges shall be offset by at least 12 inches from those of the adjacent underlying layer.

<sup>4</sup> At wall-to-ceiling intersections, the gypsum panel membrane shall be installed such that the ceiling gypsum panel membrane is installed first, followed by the wall gypsum panel membrane to ensure that the ceiling gypsum panel membrane is supported by each layer of the wall gypsum panel membrane.

<sup>5</sup> At wall-to-wall intersections, each layer of gypsum panel membrane shall be installed such that the gypsum panel membrane on the wall with a greater fire-resistance rating is installed first, followed by the gypsum panel membrane on the intersecting wall.

<sup>6</sup> For wood-frame walls with studs spaced 16 inches on center or less, the protection time,  $t_p$ , for 1/2" Type X gypsum panel with 2-1/4" Type S drywall screws spaced at 7 inches on center or less shall be permitted to be increased to 33 minutes for a single layer or a base layer of 1/2" Type X gypsum panel. Additional layers of 1/2" Type X gypsum panel are limited to 30 minutes/layer.

<sup>7</sup> For wood-frame walls with studs spaced 24 inches on center or less, the protection time,  $t_p$ , for 5/8" Type X gypsum panel with 2-1/4" Type S drywall screws spaced at 7 inches on center or less shall be permitted to be increased to 48 minutes for a single layer or a base layer of 5/8" Type X gypsum panel. Additional layers of 5/8" Type X gypsum panel are limited to 40 minutes/layer.



(2) Layers 5/8" Type X Gypsum Ceiling Panels = 2 x 40 = 80 minutes

(no reduction for final layer on unexposed side)

# Thermal Separation Time (TST)

## 3.6.1 Thermal Separation Time Provided by Wood Layers

3.6.1.1 *Wood cover or membranes:* The contribution of wood layers to the thermal separation time shall be equal to the sum of protection times assigned to each layer, determined in 3.4.1, except where a single layer of wood is used to provide thermal separation or where the final layer on the unexposed side of the thermal separation is wood, the time assigned to that wood layer, as determined in 3.4.1, shall be multiplied by 0.85.

## 3.4.1 Protection by Wood

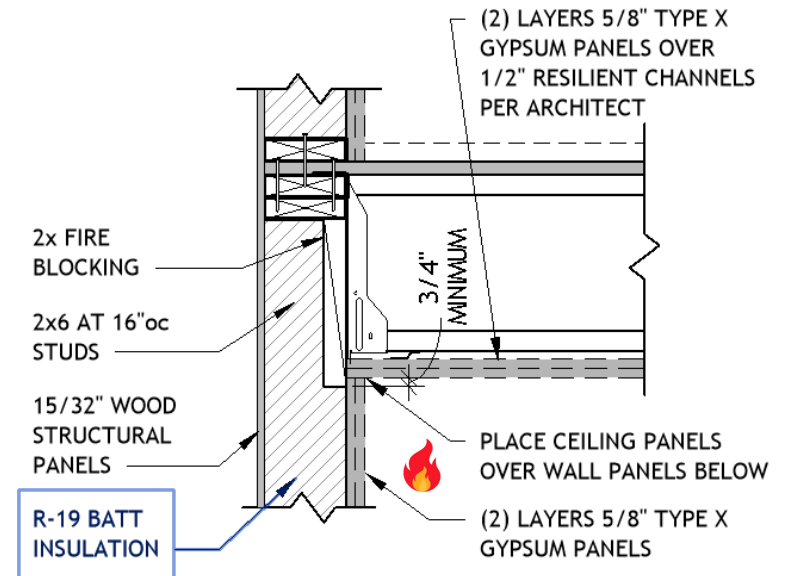
Wood cover shall be permitted as protection to increase fire resistance of structural wood members and assemblies.

3.4.1.1 *Wood cover in contact with protected member:* The protection time,  $t_p$ , provided by each layer of wood cover that is in contact with either the protected member or another underlying layer of protection shall be calculated as:

$$t_p = 60 \left( \frac{d_p}{1.5} \right)^{1.23} \text{ minutes} \quad (\text{Eq. 3.4-2})$$

where:

- $d_p$  = thickness of the protective layer of wood (in.)
- $\beta_t$  = non-linear char rate constant (in./hr<sup>0.813</sup>)



2x (1.5") blocking:  
 $t_p = 60 \times (1.5"/1.5")^{1.23} = 60 \text{ minutes}$

(no reduction for final layer on unexposed side)

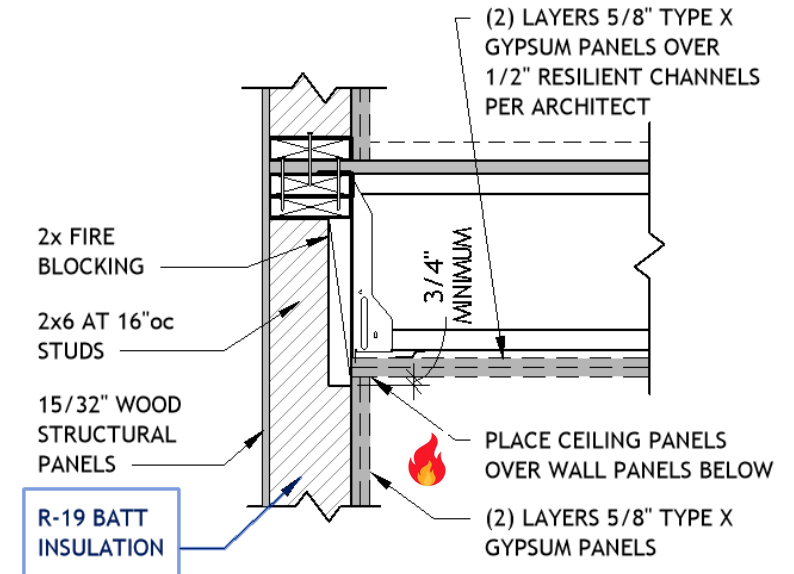
# Thermal Separation Time (TST)

## 3.6.3 Thermal Separation Time Provided by Insulation

3.6.3.1 *Insulation protection time:* Where insulation is used to provide a portion of the thermal separation, the protection time,  $t_p$ , determined in 3.4.3, shall be permitted to be added. Protection times specified in Table 3.3.3.1 shall not be additive with each other and shall not be increased for additional insulation thickness, density, or R-value.

**Table 3.9.2.2 Added Protection Time Assigned to Insulation Membrane**

Insulation Description	Minimum Thickness (in.)	Time, (minutes)
Mineral wool insulation (minimum nominal density: 2.5 pcf)	3.5	19
	1.5	15
Fiberglass insulation (minimum R-13)	3.5	3



Fiberglass insulation  
(minimum R-13) = 3 minutes

# Thermal Separation Time (TST)

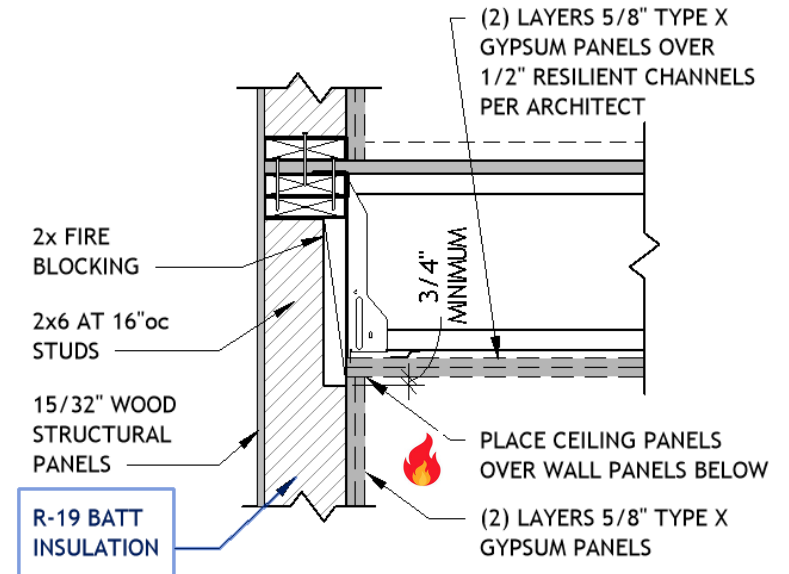
## 3.6.1 Thermal Separation Time Provided by Wood Layers

3.6.1.1 *Wood cover or membranes:* The contribution of wood layers to the thermal separation time shall be equal to the sum of protection times assigned to each layer, determined in 3.4.1, except where a single layer of wood is used to provide thermal separation or where the final layer on the unexposed side of the thermal separation is wood, the time assigned to that wood layer, as determined in 3.4.1, shall be multiplied by 0.85.

**Table 3.9.1.2a Added Protection Time Assigned to Wood Membrane**

Description of Wood Membrane	Max. Framing Spacing (in.)	Max. Fastener Spacing		Time (minutes)
		Panel Edge (in.)	Panel Field (in.)	
3/8-inch Wood Structural Panels	24	6	12	10
1/2-inch Wood Structural Panels	24	6	12	14
5/8-inch Wood Structural Panels	24	6	12	17
23/32-inch Wood Structural Panels	24	6	12	19

Interpolation shall be permitted based on panel thickness.



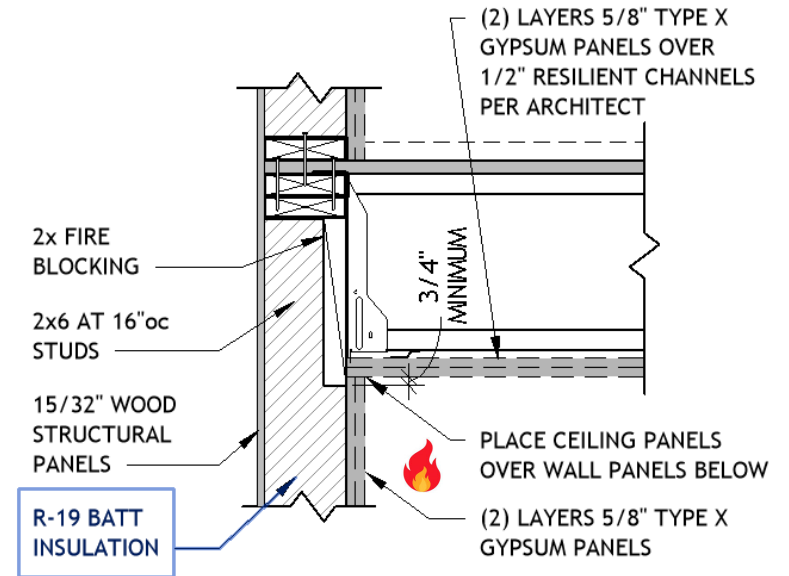
$$15/32'' \sim 1/2'' = 0.85 \times 14 = 11.9 \text{ minutes}$$

Since the wood structural panel is the final membrane on the unexposed side, we applied the 0.85 factor

# Thermal Separation Time (TST)

Gypsum Ceiling Panels = 80 minutes  
2x wood blocking = 60 minutes  
Insulation = 3 minutes  
Wood Structural Panel = 11.9 minutes  
Total TST of intersection = 155 minutes  
Required SFRT = 120 minutes

Since we don't need the wood structural panel on the unexposed side for either the SFRT or TST, you should not need to worry about blocking the gaps at the unsupported panels edges, although certain areas of walls may need blocking if used as shearwalls.



# Thank You!

---

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Continuing.....



# Type III Exterior Walls:

PRACTICAL UNDERSTANDING AND DESIGN  
APPROACHES FROM AN ENGINEER'S PERSPECTIVE

**Bruce Lindsey**

Senior Technical Director

WoodWorks – Wood Products Council

# IBC 2024 Changes: Exterior Floor to Wall Intersections

Two key additions to the code language were included in the 2024 IBC to help clarify platform framed floor-to-exterior wall details, particularly Type III construction.

## 705.6 CONTINUITY:

The addition of code language specifically addressing continuity of the fire-resistance rating of exterior walls was added as section 705.6

## 705.7.1 FLOOR ASSEMBLIES IN TYPE III CONSTRUCTION:

The addition of code language specifically addressing fire-resistance ratings for portions of floor assemblies intersecting exterior walls in Type III construction and the material allowed for intersecting structure.

# IBC 2024 Addition: 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.

Parapets shall be provided as required by Section 705.12.

## Example 2:

Type VA Construction, Group R-2

1 hour FRR exterior wall, supported by 1 hour FRR floor.

If the FRR rating of the floor is equal or greater than the FRR supported exterior wall, then the wall is only required to extend to the underside of the rated floor/ceiling assembly



# IBC 2024 Addition: 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.

Parapets shall be provided as required by Section 705.12.

## Example 1:

Type IIIA Construction, Group R-2

2 hour FRR exterior wall, supported by 1 hour FRR floor

If the FRR of the floor assembly is less than the FRR rating of the exterior wall assembly, then the fire resistance rating of the wall must continue to the underside of the floor sheathing, roof sheathing, deck or slab above.



# IBC 2024 Additions: Continuity

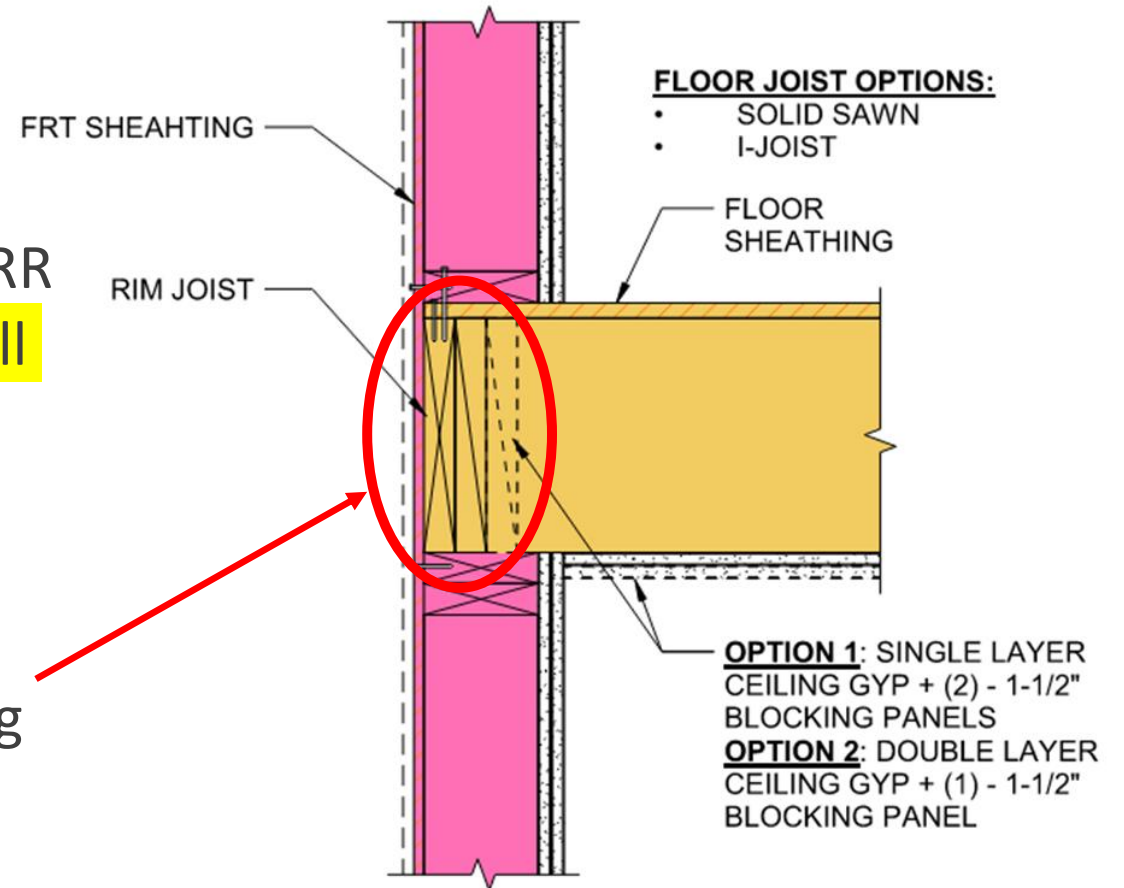
## Continuity of Fire Resistance Without Membrane

Type IIIA Construction, Group R-2

2 hour FRR exterior wall, 1 hour FRR floor

Since FRR of the exterior wall is greater than FRR of the floor, the fire resistance rating of the wall must be continuous to the underside of the floor/roof sheathing.

The *membrane* (typically gypsum) need not be continuous to the underside of the floor/ceiling sheathing as long as the FRR of the wall /floor meets or exceeds the FRR of the exterior wall.



# IBC 2024 Addition: Floor Assemblies in Type III Construction

The addition of new code language specifically addressing fire-resistance ratings for portions of floor assemblies intersecting exterior walls in Type III construction.

**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.

The highlighted text states that the fire resistance of the floor assembly elements supporting, and within the plane of the exterior wall, shall be permitted to include the contribution of the ceiling membrane (typically gypsum) within the calculated fire resistance.

# IBC 2024 Addition: Floor Assemblies in Type III Construction

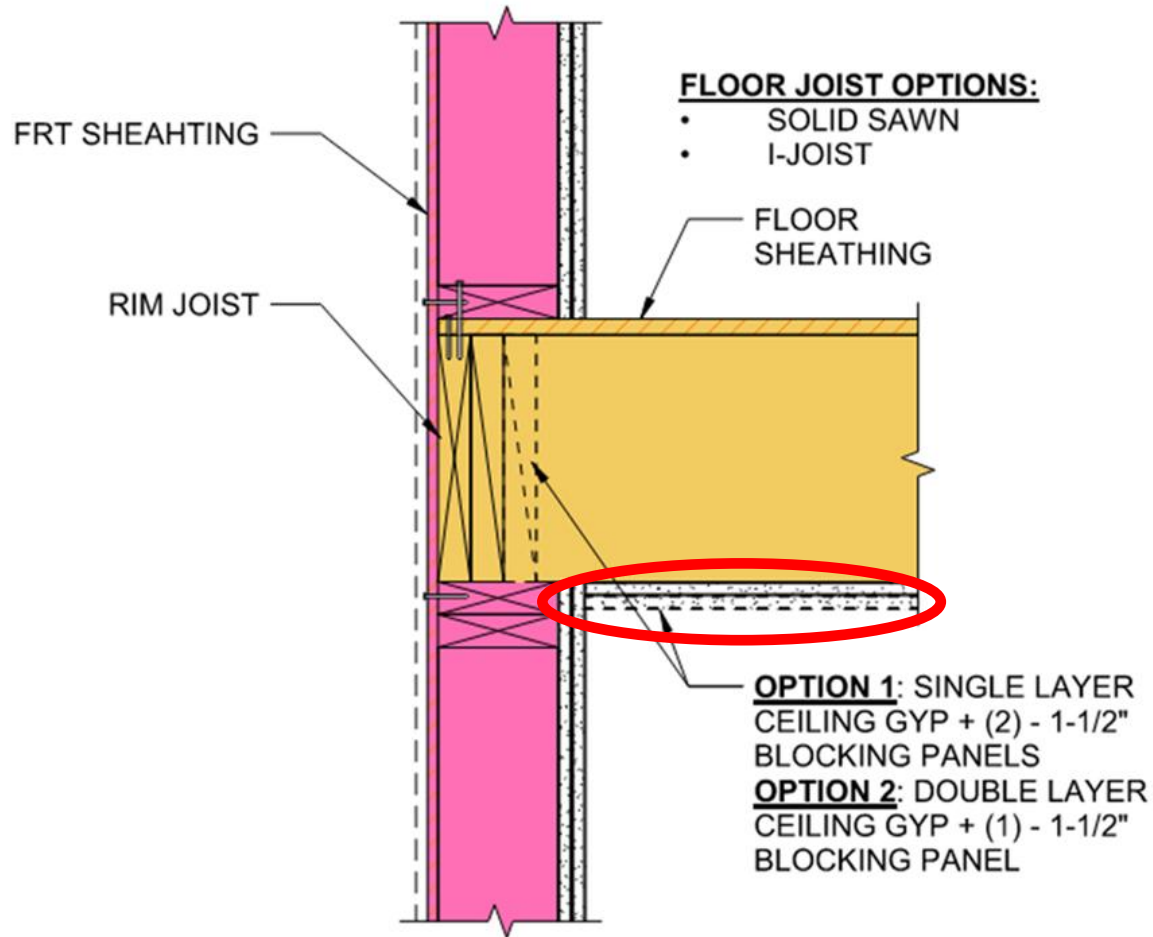


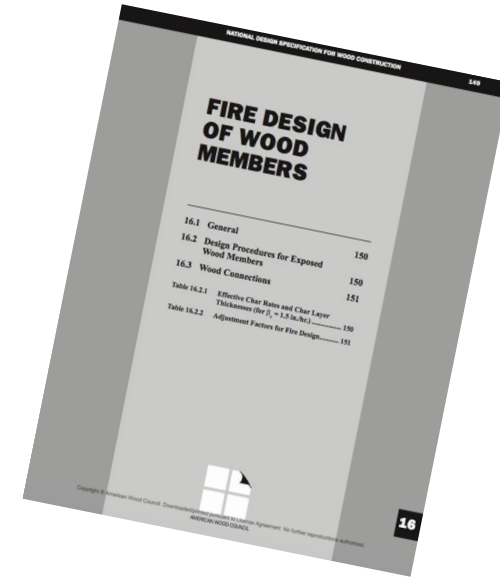
Table 722.6.2(1) [excerpt]

## TIME ASSIGNED TO FINISH MATERIALS ON FIRE- EXPOSED SIDE OF WALL

3/8" Gypsum Wallboard	10 min.
1/2" Gypsum Wallboard	15 min.
5/8" Gypsum Wallboard	20 min.
2 layers of 3/8" Wallboard	25 min.
2 layers of 1/2" Wallboard	40 min.
1/2" Type X Gypsum Wallboard	25 min.
5/8" Type X Gypsum Wallboard	40 min.

# Contribution of the Ceiling Membrane

To establish the required minimum fire resistance rating for the building elements supporting or within the plane of the exterior wall, the IBC designates the use of Chapter 16 of the National Design Standard for calculation of fire resistance for wood building elements in section 722.



## SECTION 722—CALCULATED FIRE RESISTANCE

**722.1 General.** The provisions of this section contain procedures by which the *fire resistance* of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used. The calculated *fire resistance* of specific materials or combinations of materials shall be established by one of the following:

1. *Concrete*, *concrete masonry* and *clay masonry* assemblies shall be permitted in accordance with ACI 216.1/TMS 0216.
2. Precast and precast, prestressed *concrete* assemblies shall be permitted in accordance with PCI 124.
3. Steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29.
4. Exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANSI/AWC NDS.

# Calculating FRR of Floor Elements

Chapter 16 of the 2024 NDS references the Fire Design Specification for Wood Construction

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 $\beta_e = 1.5$ in./hr.)	150
Table 16.2.2 Adjustment Factors for Fire Design	151

16

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## 2024 NDS - 16.1 General

Where determinations of thermal separation and burn-through resistance are required, calculations shall be in accordance with the *Fire Design Specification for Wood Construction*



# Calculating the FRR of Floor Elements

The 2021 FDS provides guidance for calculating the contribution of the ceiling membrane toward the fire resistance rating of the building elements supporting or within the plane of the exterior wall.



## 3.8.1 Calculating the Structural Fire Resistance Time

The structural fire resistance time of a wood assembly shall be equal to the sum of the structural fire resistance times assigned to the wood members in 3.8.1.1 and the protection times assigned protective membrane on the fire-exposed side in accordance with 3.8.1.2. The membrane on the unexposed side shall not be included in determining the structural fire resistance time of the assembly.

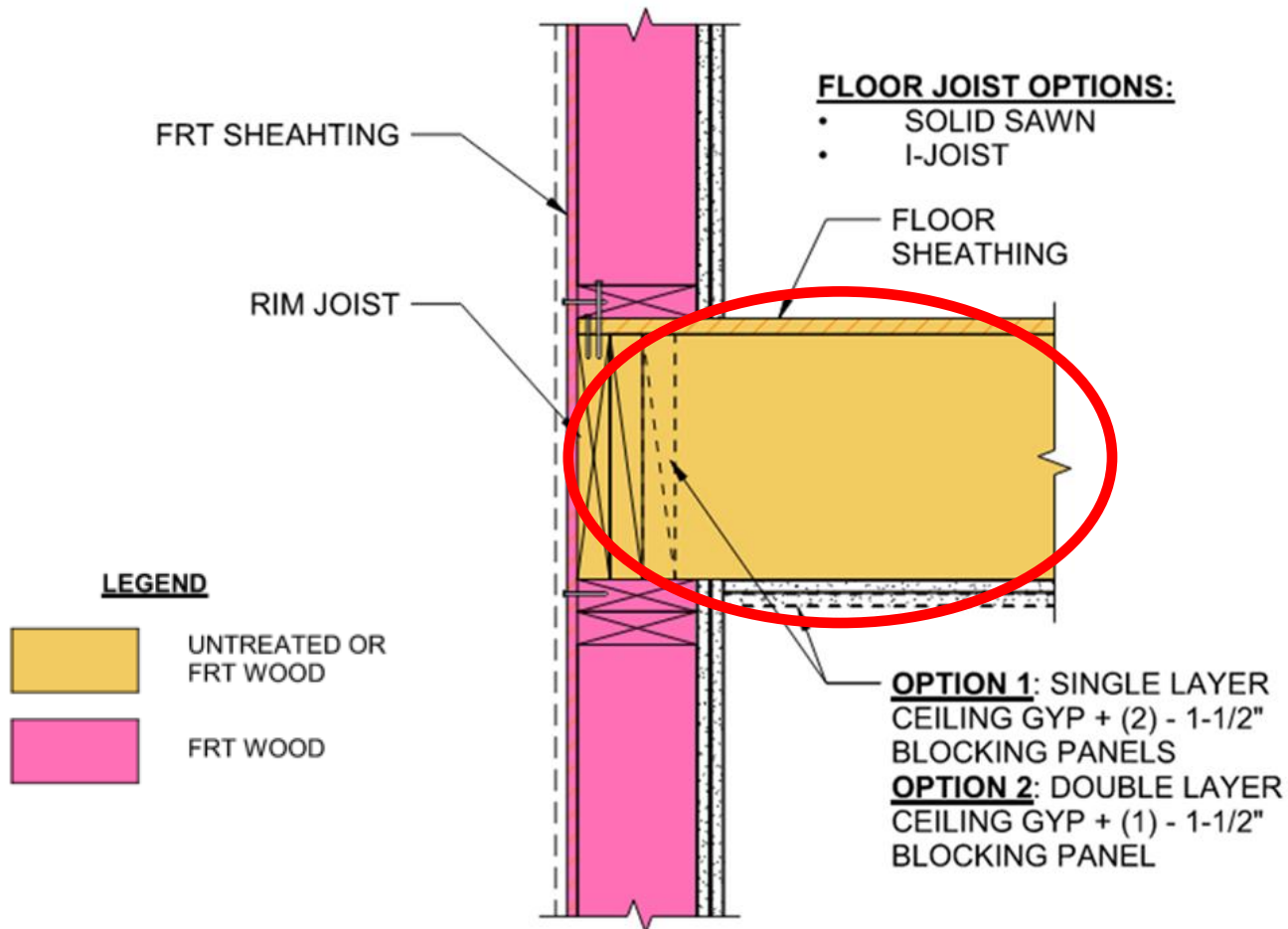
# IBC 2024 Addition: Floor Assemblies in Type III Construction

The addition of new code language specifically addressing fire-resistance ratings for portions of floor assemblies intersecting exterior walls in Type III construction.

**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.**

The highlighted text states that the building elements of the floor construction within the plane of the exterior wall shall be in accordance with the requirements for interior elements of type III construction. Rim joists, rim boards, and blocking (including, but not limited to) need not be constructed of fire-retardant-treated material.

# IBC 2024 Addition: Where is FRT required?



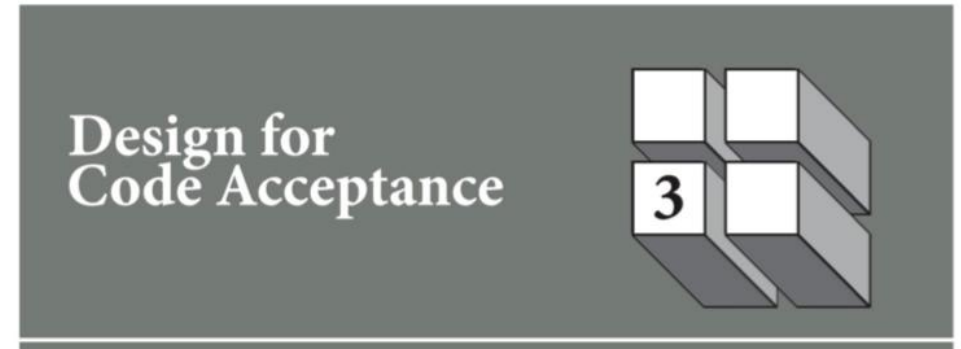
The 2024 language of 705.7.1 clarifies that the building elements of the floor construction, supporting and within the plane of the exterior wall, shall be in accordance with the requirements for interior building elements. Accordingly, those building elements do not typically require the use of Fire-Retardant Treated materials in Type III Construction.

Structural Wood Panels on the exterior are required to be Fire-Retardant Treated as they are not considered part of the floor assembly.

# Exterior Walls – Intersecting Floors – AWC DCA3

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.

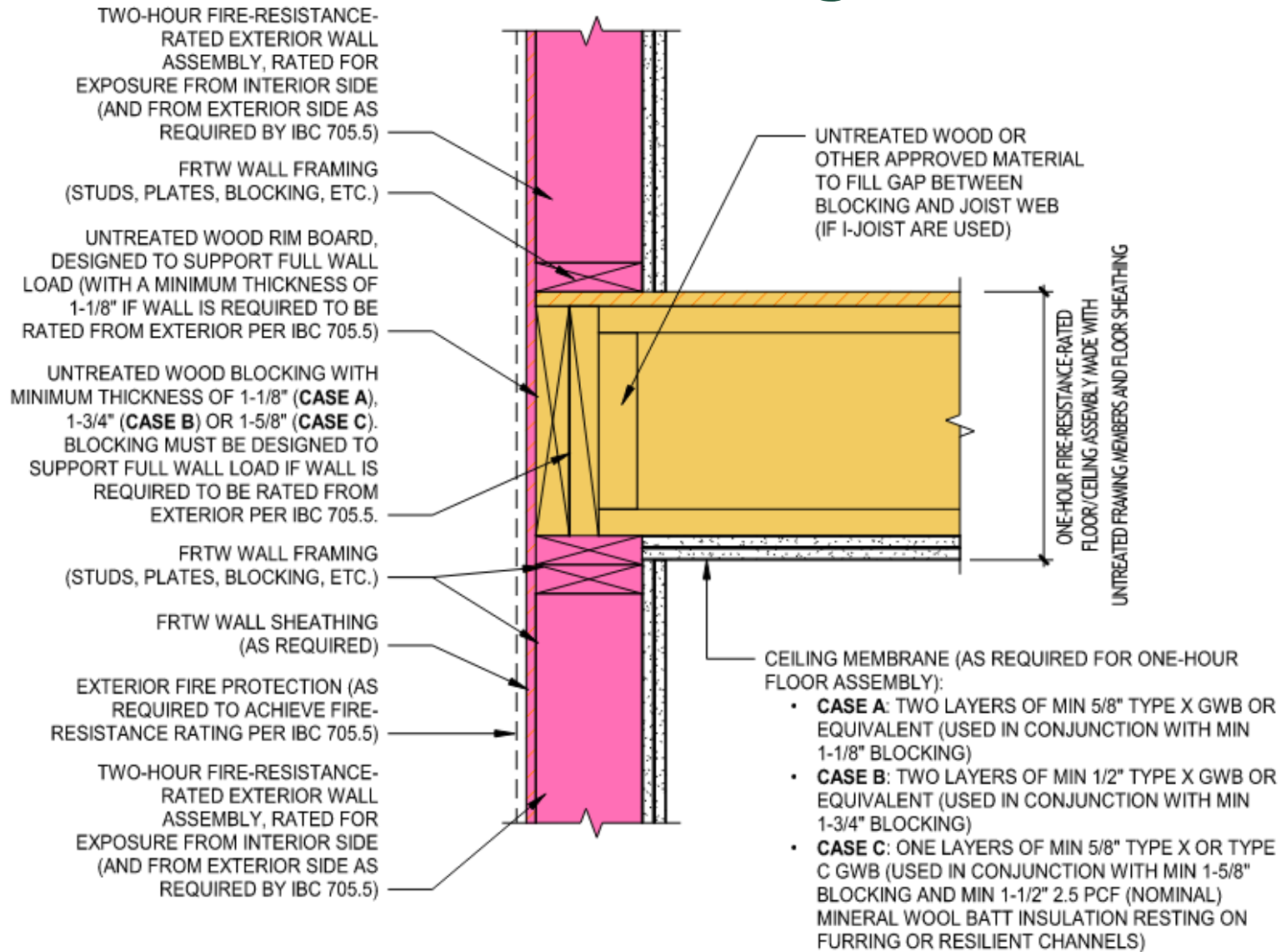
Depending on the application, wall assemblies may need to be fire-resistance-rated for exposure from either one side or both sides. Exterior walls are required to be rated for both interior and exterior fire exposure where the wall has a fire separation distance of 10 feet or less. For exterior walls 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-joint floor as-

# Exterior Walls – Intersecting Floors



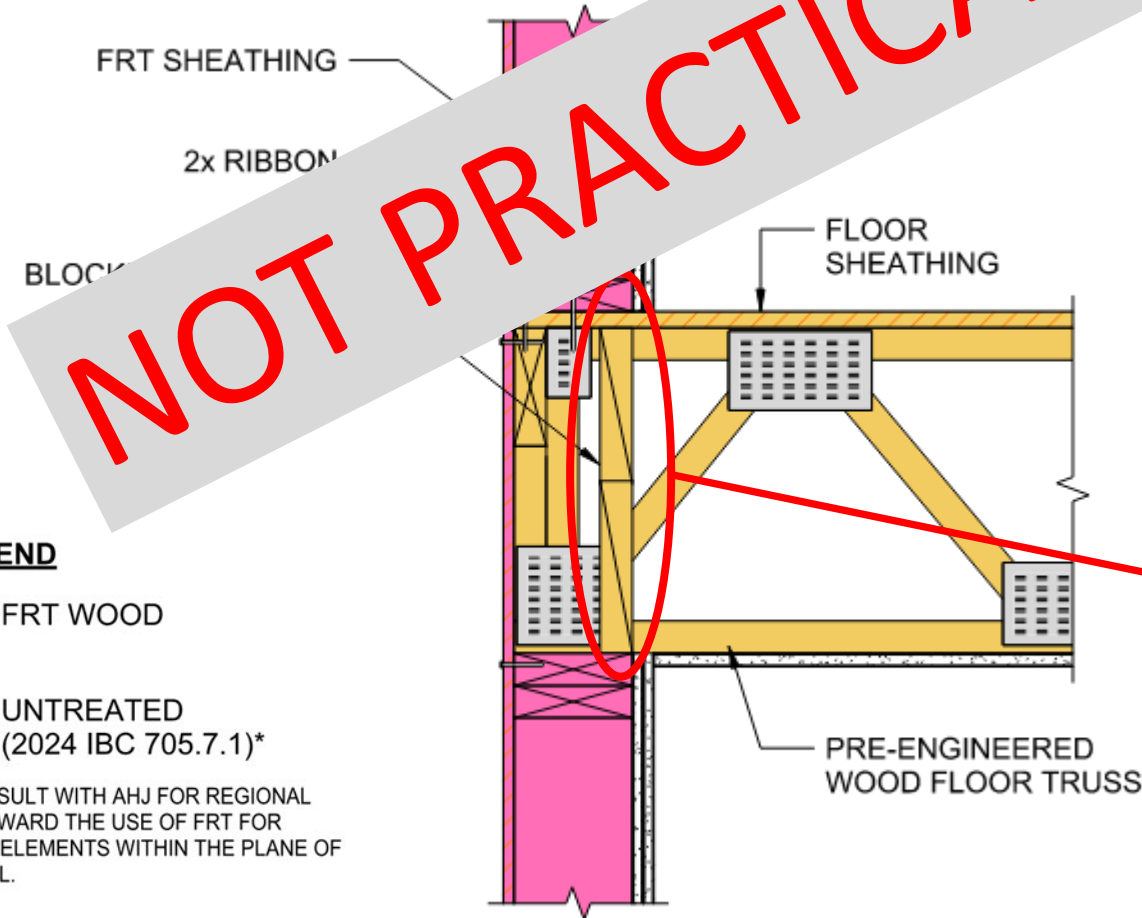
DCA3 Figure 1a: Example Detail for Type IIIA Exterior Wall-Floor Intersection with Rim Board and Blocking



# Exterior Walls – Details Matter!

## Geometric Interference Components

Type III Construction: 2-hr Wall, 1-hr Floor  
Platform Framing w/ Bottom Chord



### Rationale for detail approval:

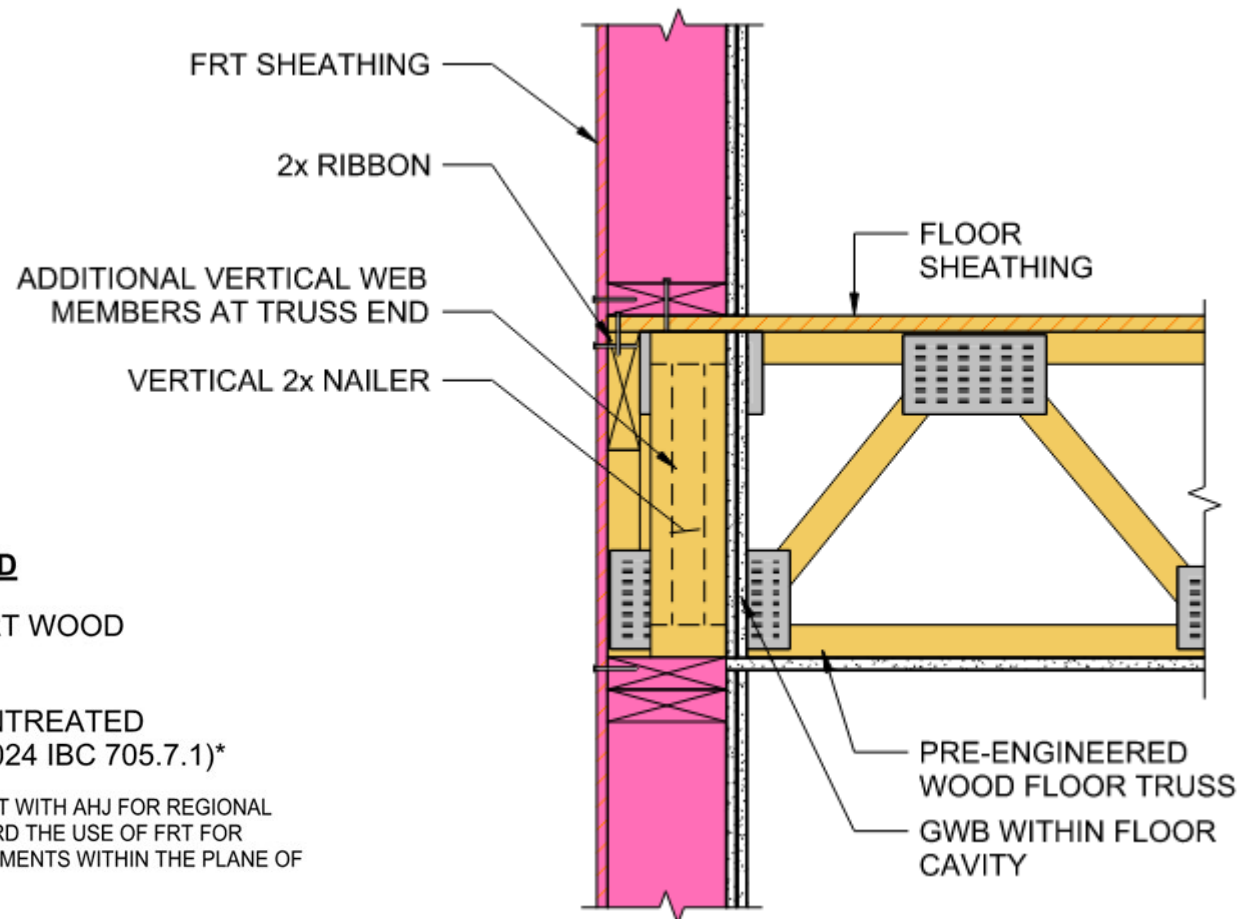
- » Membranes on both side of wall provide fire resistance via their approved assembly
- » Combined floor assembly, membrane and blocking provide 2 hours of fire resistance

### Constructability Challenges:

- » Blocking support needed
- » Joints may require fire caulk
- » Geometry of truss webs conflictive with blocking

# Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor  
Platform Framing w/ Bottom Chord Bearing



## Rationale for detail approval:

- » Membranes on both side of wall provide fire resistance via their approved assembly
- » Combined floor assembly, membrane and blocking provide additional fire resistance

### **LEGEND**

-  FRT WOOD
-  UNTREATED (2024 IBC 705.7.1)\*

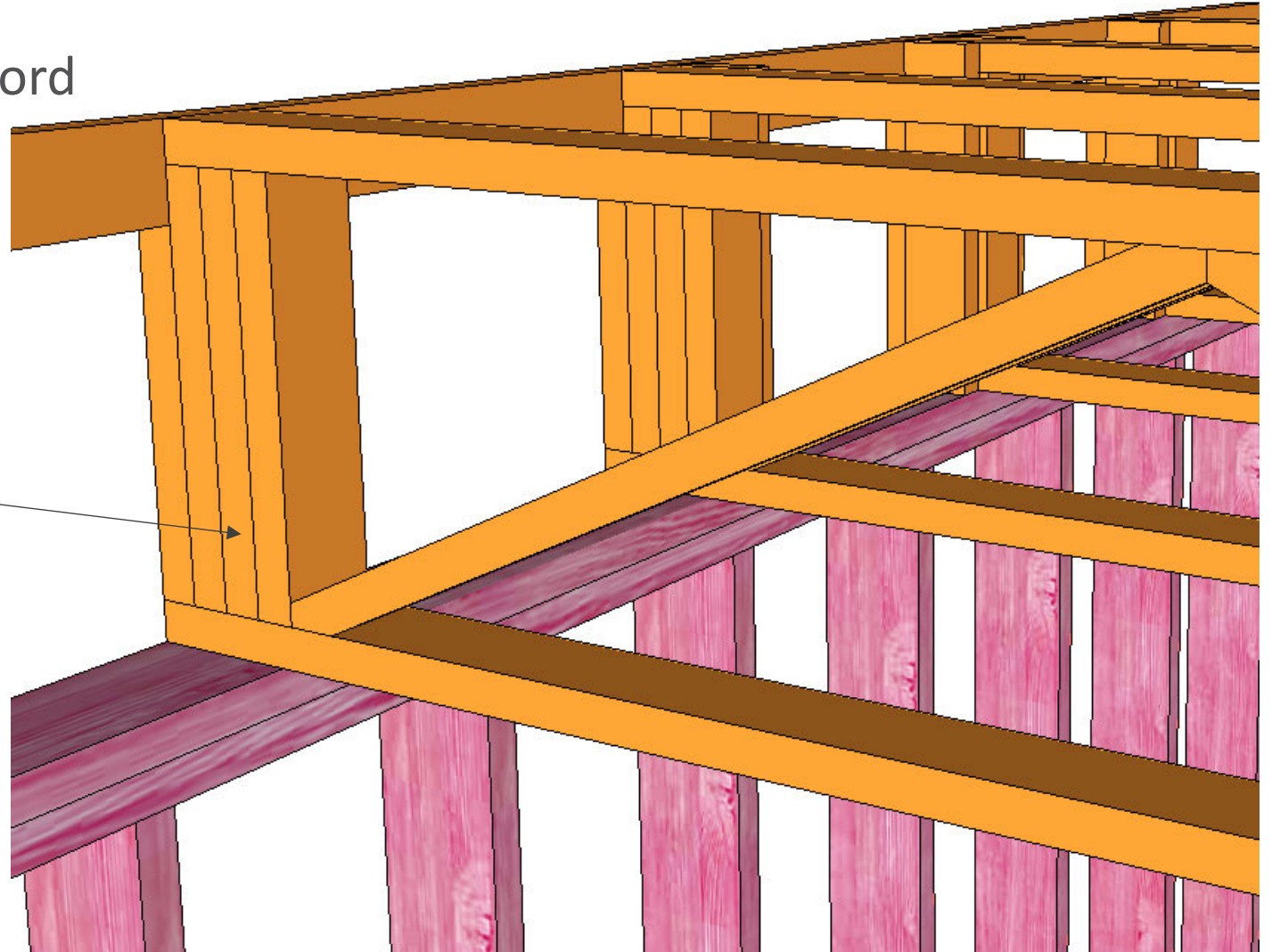
\*PRE-2024 IBC: CONSULT WITH AHJ FOR REGIONAL REQUIREMENTS TOWARD THE USE OF FRT FOR SPECIFIC BUILDING ELEMENTS WITHIN THE PLANE OF THE EXTERIOR WALL.

# Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor

Platform Framing w/ Bottom Chord Bearing Truss

Designed with two or more additional verticals at the exterior wall to provide enhanced FRR based upon charring calculations in NDS Chapter 16 and solid edges for WSP or GWB penetration or transition

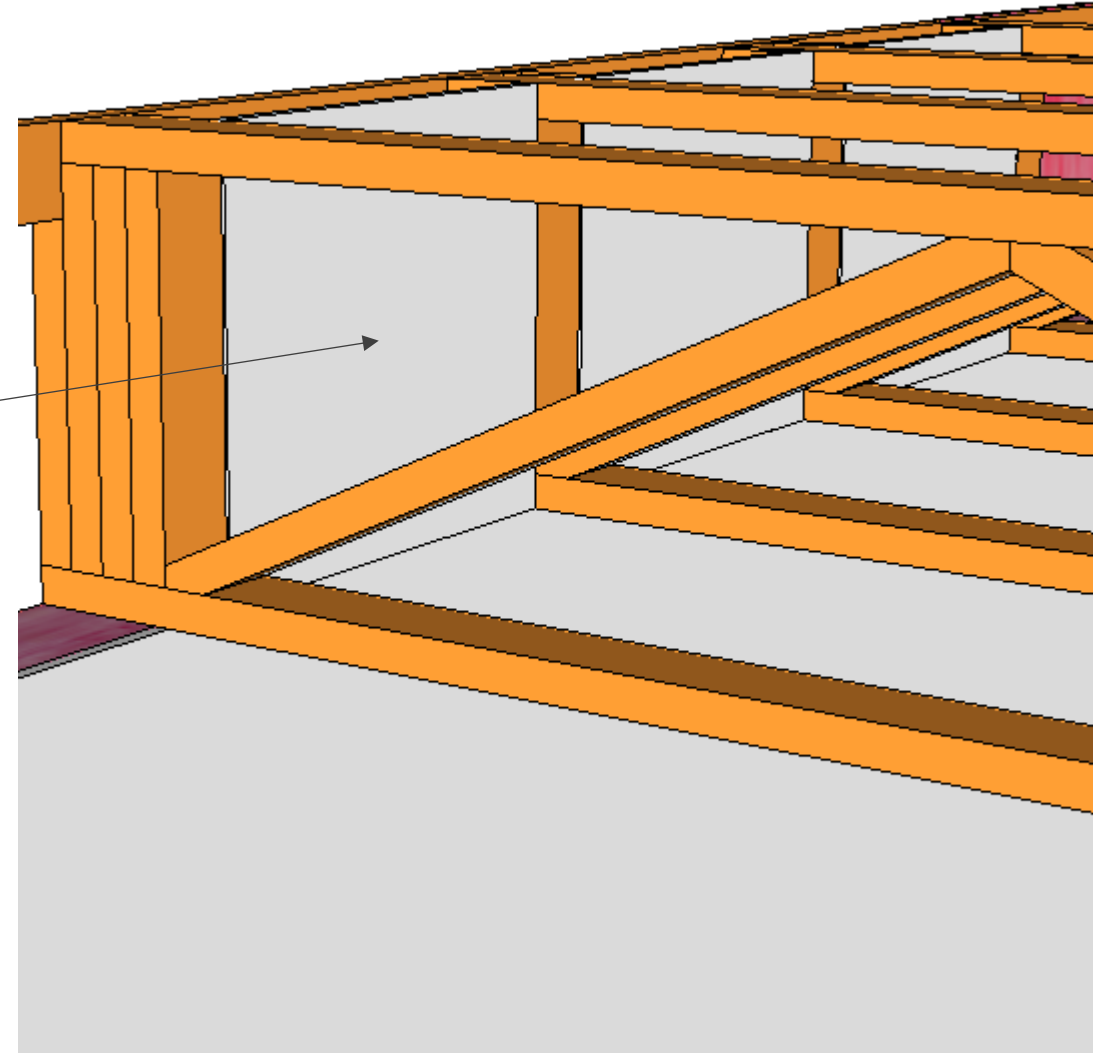


# Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor

Platform Framing w/ Bottom Chord Bearing Truss

Gypsum wall panels installed as required between trusses to maintain FRR of building elements supporting or in the plane of the exterior wall (ceiling gypsum omitted in illustration for clarity)



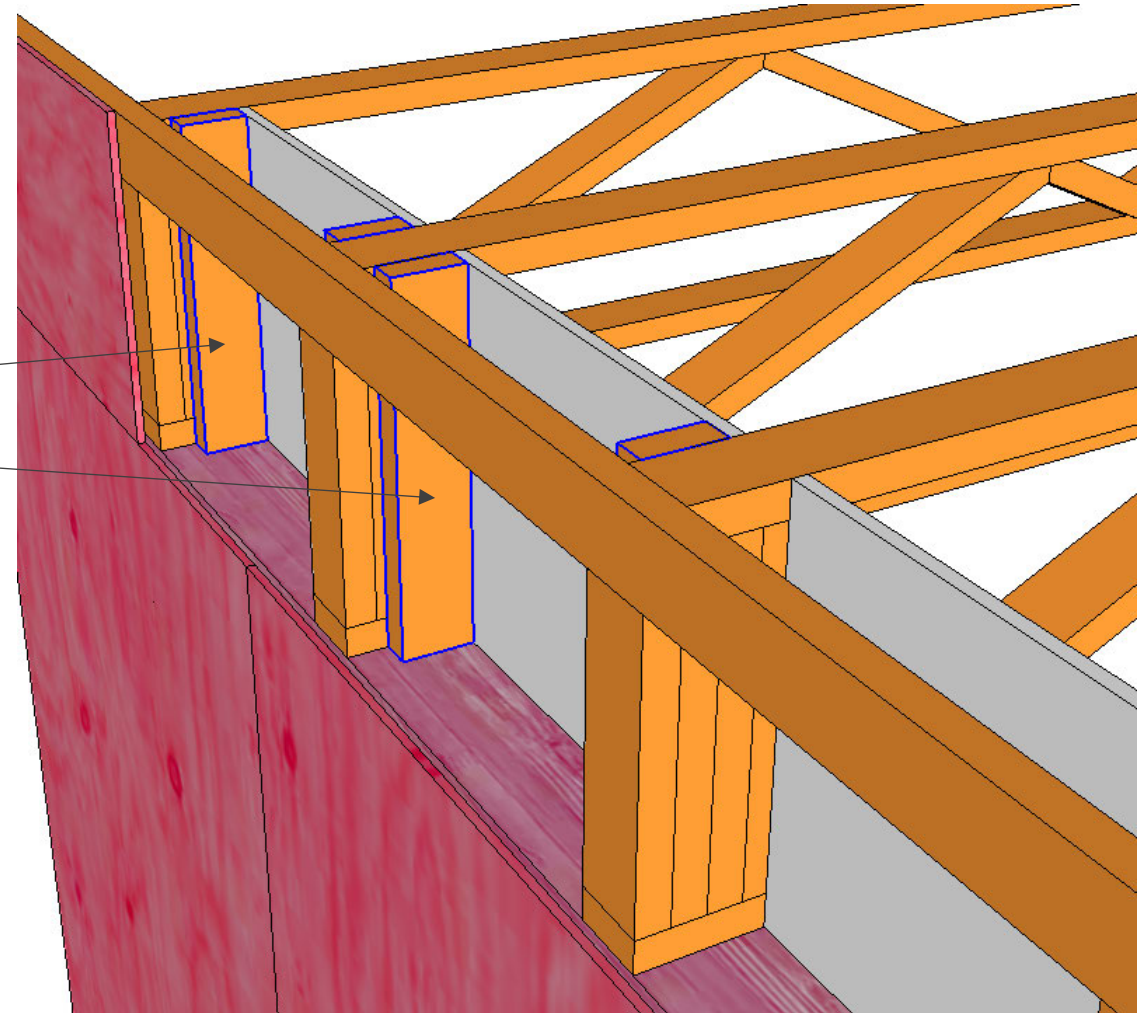
# Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor

Platform Framing w/ Bottom Chord Bearing Truss

Add vertical blocking each side of truss (highlighted blue) to provide nailing base for gypsum panels between trusses

The extra vertical truss members, vertical blocking members, and gypsum wallboard panels combine with ceiling membrane to provide req'd fire resistance rating for building members supporting or within the plane of the exterior wall



# Type III Construction Detail Examples

What is being enforced in jurisdictions you are working in?



# QUESTIONS?

This concludes The American  
Institute of Architects Continuing  
Education Systems Course

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*Funding provided in part by the Softwood Lumber Board*

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