MID-RISE DESIGN: OPTIMIZING SIZE, DETAILING FOR FIRE & LIFE SAFETY

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

COURSE DESCRIPTION

This presentation will cover four areas of design that are essential to successful mid-rise wood-frame buildings: 1) Building size and how to maximize height and area through the use of sprinklers, open frontage, sloping sites, podiums and mezzanines; 2) Construction type and material selection, including opportunities for wood in Types III and V; 3) Common detailing issues and areas of misunderstanding related to exterior walls and their intersection with rated floor assemblies; and 4) Detailing for fire and life safety, including code compliance and rationales for approval, with an emphasis on constructability and practicality.

LEARNING OBJECTIVES

1. Discuss allowable construction types, occupancies, and building heights and areas for wood-frame mid-rise construction per the International Building Code.
2. Identify fire-resistance and protection requirements for wood-frame wall assemblies in Type III and Type V buildings.
3. Examine a variety of floor-to-exterior wall details for use in wood-frame, Type III construction and discuss code compliance paths and approval rationale for each.
4. Consider code provisions for corridor and balcony fire-resistance protection, and identify details that accommodate these requirements while maximizing wood use.

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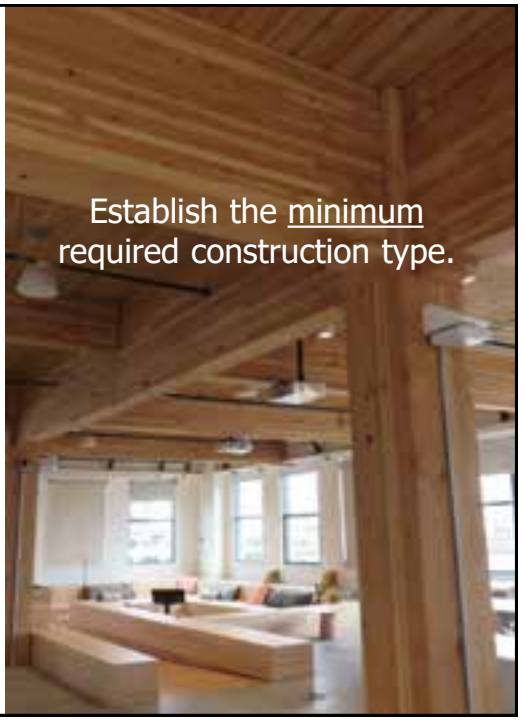
- **Outline – principles of fire resistance design**
  1. **Establish the minimum construction type**
  2. **Know the reason for the fire resistance**
  3. **Know the options for establishing fire resistance**

First principle of fire resistance:

Establish the minimum required construction type.



Code Compliant Fire-Resistance Design for Wood Construction

INTRODUCTION

The IBC:

- Controls building size
- Regulates types of materials
- Stipulates fire resistance

Code Compliant Fire-Resistance Design for Wood Construction 8

INTRODUCTION

Building size is determined by:

- Tabular values
- Factors allowing increases
  - Frontage
  - Sprinkler systems
- Special Provisions (IBC 510)

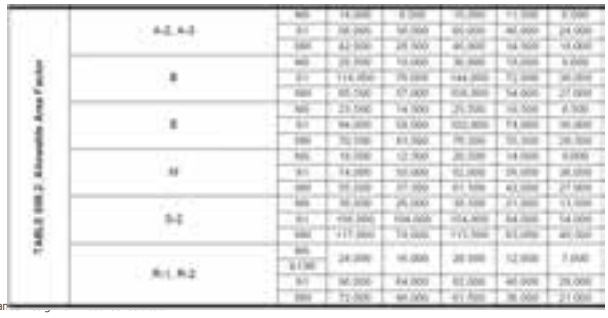
INTRODUCTION

Tabular values are based on:

Use of building (occupancy)

Type of construction

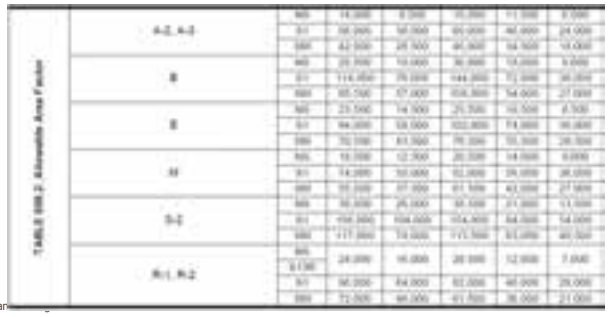
Existence of NFPA 13 sprinkler system



INTRODUCTION

Tabular values are based on:

- Use of building (occupancy)
- Type of construction
- Existence of sprinkler system



INTRODUCTION

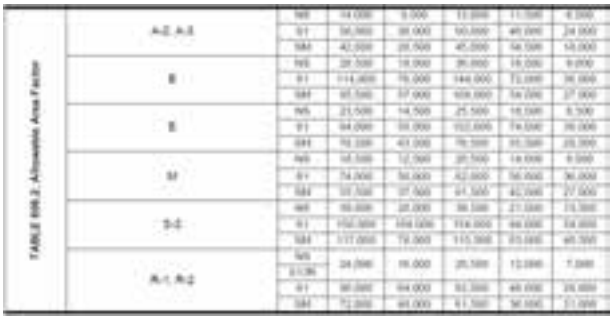
Occupancy will determine:

- Number of occupants
- Capability of occupants
- Fuel load

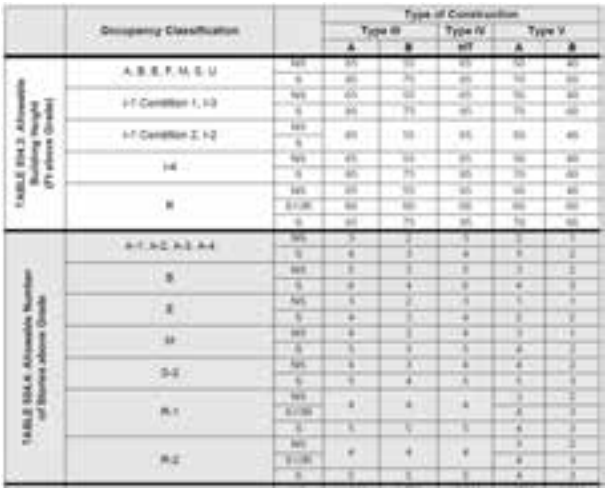
FIRST – MINIMUM CONSTRUCTION TYPE

$$A_a = [A_t + (NS \times I_f)] \times S_a \qquad \text{(Equation 5-2)}$$

$$I_f = [F / P - 0.25]\, W / 30 \qquad \text{(Equation 5-5)}$$



FIRST – MINIMUM CONSTRUCTION TYPE

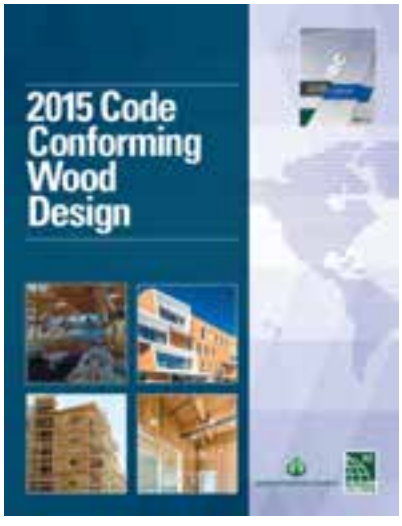


FIRST – MINIMUM CONSTRUCTION TYPE

Table 601 Fire-Resistance Rating Requirements For Building Elements (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[g] (see Section 202)	3[e]	2[e]	1	0	1	0	HT	1	0
Bearing walls, Exterior[f, g]	3	2	1	0	2	2	2	1	0
Interior	3[e]	2[e]	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions, Exterior	See Table 602								
Nonbearing walls and partitions, Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1-1/2[b]	1[b,c]	1[b,c]	0[c]	1[b,c]	0	HT	1[b,c]	0

FIRST – MINIMUM CONSTRUCTION TYPE



FIRST – MINIMUM CONSTRUCTION TYPE

Group E Nonsprinklered Buildings [a, b, c]						
# of stories	% frontage	Maximum floor area per story (sq. ft.)				
		IIIA	IIIB	IV	VA	VB
1	0-25	23,500	14,500	25,500	12,120	9,500
	50	29,370	25,370	31,870	22,500	11,870
	100	41,120	33,250	44.,620	32,370	16,620
2	0-25	23,500	14,500	25,500	NP	NP
	50	29,370	18,120	31,870	NP	NP
	100	41,120	25,370	44,620	NP	NP
3	0-25	23,500	NP	25,500	NP	
	50	29,370	NP	31,870	NP	
	100	41,120	NP	44,620	NP	

FIRST – MINIMUM CONSTRUCTION TYPE

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		IIIA	IIIB	IV	VA	VB
1	0-25	23,500	14,500	25,500	12,120	9,500
	50	29,370	25,370	31,870	22,500	11,870
	100	41,120	33,250	44.,620	32,370	16,620
2	0-25	23,500	14,500	25,500	NP	NP
	50	29,370	18,120	31,870	NP	NP
	100	41,120	25,370	44,620	NP	NP
3	0-25	23,500	NP	25,500	NP	NP
	50	29,370	NP	31,870	NP	NP
	100	41,120	NP	44,620	NP	NP

Footnotes

a. Frontage based on open space widths of 30 feet or more.

b. Interpolation permitted.

c. Sprinklers must be provided for Group E occupancies when the fire area exceeds 12,000 square feet in accordance with Section 903.2.3, or by reason of other specific conditions in that section. In lieu of sprinklers, compartmentalization of the floor area into fire areas not more than 12,000 square feet can be provided with fire-resistance-rated construction in accordance with Chapter 7.

FIRST – MINIMUM CONSTRUCTION TYPE

The minimum construction type:

- Can be independent of materials chosen
- Allows greatest flexibility for materials use
- Should take into account the final size of building with all future expansions in mind

Second principle of fire resistance:

SECOND – REASON FOR THE FIRE RESISTANCE

Noncombustible (703.5)

≠

Fire resistant (703.2 and 703.3)

SECOND – REASON FOR THE FIRE RESISTANCE

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

SECOND – REASON FOR THE FIRE RESISTANCE

- **Building elements (walls, floors, roofs) rated per construction type (704)**
- **Exterior walls (705)**
- **Fire walls (706)**
- **Fire barriers (707)**
- **Fire partitions (708)**
- **Horizontal assemblies (711)**

SECOND – REASON FOR THE FIRE RESISTANCE

Building elements (walls, floors, roofs) rated per construction type (704):

- Have general protection requirements in 704
- Do not require opening/penetration protection
- Have ratings based on Table 601

SECOND – REASON FOR THE FIRE RESISTANCE

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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame[f] (see Section 202)	3[b]	2[b]	1	0	1	0	HT	1	0
Bearing walls Exterior[e,f] Interior	3 3[b]	2 2[b]	1 1	0 0	2 1	2 0	2 1 HT	1 1	0 0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[d]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1½[b]	1[b]	1[b]	0	1[b]	0	HT	1[b]	0

SECOND – REASON FOR THE FIRE RESISTANCE

Exterior walls (705):

- Have unique structural, continuity, and opening/penetration protection requirements
- Have material requirements based on construction type
- Have ratings based on proximity to lot lines
- Required to be rated for exposure to both sides of the wall only when FSD $\leq$10 ft. (otherwise interior side of wall is the exposed side for testing)

SECOND – REASON FOR THE FIRE RESISTANCE

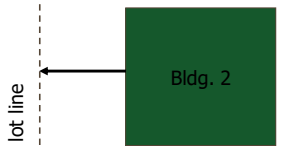
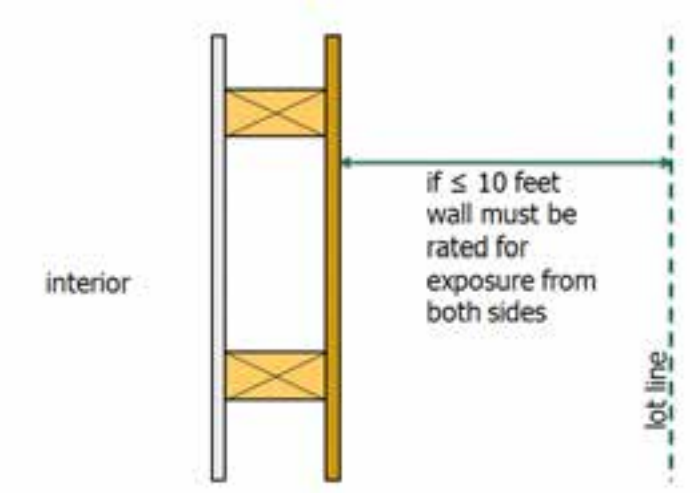


TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE[a, b, c]

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

SECOND – REASON FOR THE FIRE RESISTANCE



SECOND – REASON FOR THE FIRE RESISTANCE

Fire walls (706):

- Define separate buildings
- Have unique structural, continuity, and opening/penetration protection requirements
- Have materials requirements based on type of construction (Type V may be wood)
- Have ratings based on occupancy

SECOND – REASON FOR THE FIRE RESISTANCE

Fire barriers (707):

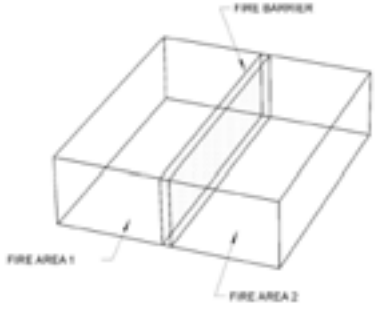
- Create fire resistant separations
- Have unique continuity and opening/penetration protection requirements
- May have any materials permitted by the construction type
- Have ratings based on function
  - shaft enclosures, exit enclosures, occupancy separations, hazardous material control areas, fire areas, atrium protection, and others

SECOND – REASON FOR THE FIRE RESISTANCE

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)

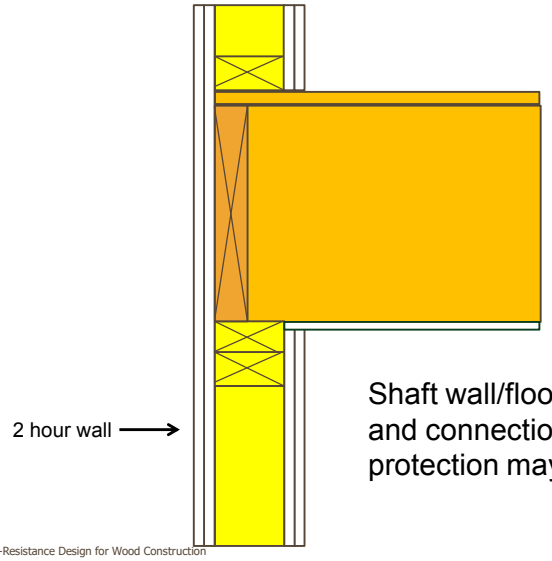
OCCUPANCY	A, E	I-1[a], I-2, I-4	I-3	R[a]	F-2, S-2[b], U	B[a], F-1, M, S-1	H-1	H-2	H-3, H-4	H-5
	S NS	S NS	S NS	S NS	S NS	S NS	S NS	S NS	S NS	S NS
A, E	N N	1 2	1 2	1[c] 2[c]	1 2	1 2	1 2	1[c] 2[c]	1 2	1[c] 2[c]
I-1[a], I-3, I-4	— —	N N	1 2	1[c] 2[c]	1 2	1 2	1 2	1[c] 2[c]	1 2	1[c] 2[c]
I-2	— —	— —	N N	1[c] 2[c]	1 2	1 2	1 2	1[c] 2[c]	1 2	1[c] 2[c]
R[a]	— —	— —	— —	1 2	1 2	1 2	1 2	1[c] 2[c]	1 2	1[c] 2[c]
F-2, S-2[b], U	— —	— —	— —	— —	N N	1 2	1 2	1[c] 2[c]	1 2	1[c] 2[c]
B[a], F-1, M, S-1	— —	— —	— —	— —	— —	N N	1 2	1[c] 2[c]	1 2	1[c] 2[c]
H-1	— —	— —	— —	— —	— —	— —	N[d] N[d]	N[d] N[d]	N[d] N[d]	N[d] N[d]
H-2	— —	— —	— —	— —	— —	— —	— —	N[d] N[d]	1 NL	1 2
H-3, H-4	— —	— —	— —	— —	— —	— —	— —	— —	1[e] 2[e]	1 2
H-5	— —	— —	— —	— —	— —	— —	— —	— —	— —	N[d] N[d]

a. Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
b. Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
c. Fire separation requirements
d. Not permitted
e. See Section 415
f. See Section 406.3.4
g. Separation is not required between occupancies of the same classification
h. See Section 422.2 for definitions. Live facilities.



BUILDING AREA = FIRE AREA 1 + FIRE AREA 2

SECOND – REASON FOR THE FIRE RESISTANCE



Shaft wall/floor intersections and connections – additional protection may be required

SECOND – REASON FOR THE FIRE RESISTANCE

Fire partitions (708):

- Create fire resistant separations
- Have unique continuity and opening/penetration protection requirements
- May have any materials permitted by the construction type
- Have ratings based on function and sprinkler protection
- Dwelling unit separation, tenant space separation, corridor walls, elevator lobby separation

SECOND – REASON FOR THE FIRE RESISTANCE

Horizontal assemblies (711):

- Have unique continuity and opening/penetration protection requirements
- Have requirements for supporting construction
- Have ratings based on function

SECOND – REASON FOR THE FIRE RESISTANCE

- Penetrations protection (714)
- Openings protection (716)
- Fire resistant joint systems (715)
- "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."

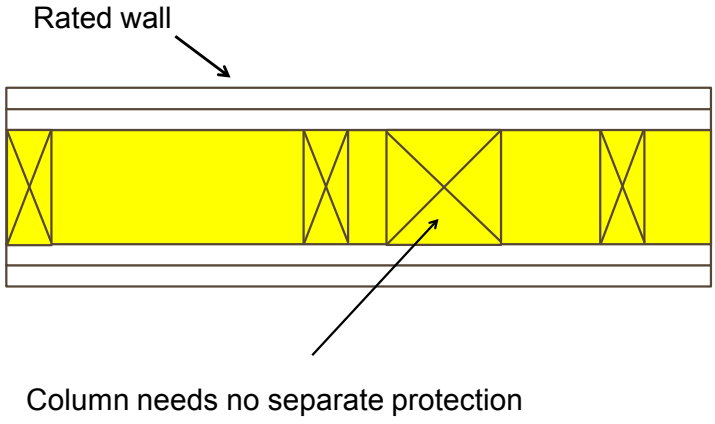
SECOND – REASON FOR THE FIRE RESISTANCE

- Structural connections and building element intersections not always regulated by the code
- Supporting construction fire resistance requirements may apply

SECOND – REASON FOR THE FIRE RESISTANCE

- **704.2 Column protection (IBC 2018 text)**
  - "Exception: Columns that meet the limitations of Section 704.4.1"
- **704.4.1 Light-frame construction (IBC 2018 text)**
  - "Studs, columns, and boundary elements that are integral elements in walls of light-frame construction, and are located entirely between the top and bottom plates or tracks shall be permitted to have required fire-resistance ratings provided by the membrane protection provided for the wall."

SECOND – REASON FOR THE FIRE RESISTANCE



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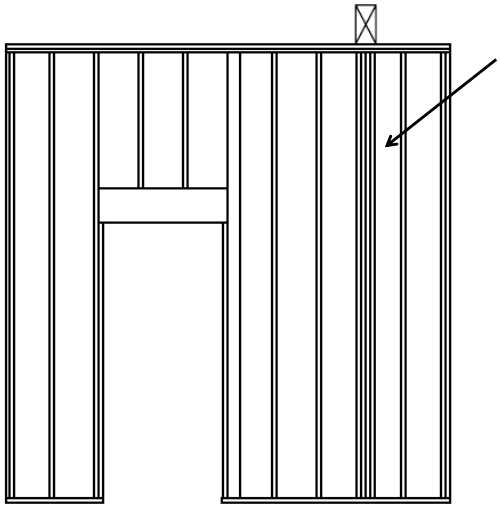

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4. **Consider code provisions for corridor and balcony fire-resistance protection, and identify details that accommodate these requirements while maximizing wood use.**

Intersection of Assemblies - Ratings

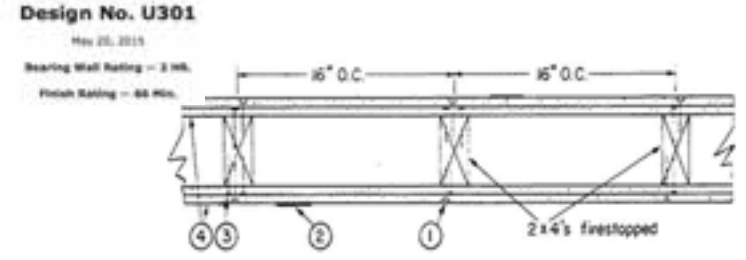
Key Differences in Fire Ratings for Construction Types			
	IIIA	IIIB	VA
Exterior (bearing) wall framing	FRT	FRT	non-FRT
Exterior wall fire rating	2 hr	2 hr	1 hr
Floor assembly fire rating	1 hr	0 hr	1 hr

IBC Tables 601 & 706.4

Note: FRT = Fire Retardant Treated

Intersection of Tested Assemblies

2 Hour Wall

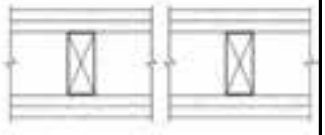


GA FILE NO. WP 4135	GENERIC	2 HOUR FIRE	40 to 44 STC SOUND

GYPSUM WALLBOARD, WOOD STUDS

Base layer ¼" type X gypsum wallboard or gypsum veneer base applied at right angles to each side of 2 x 4 wood studs 24" o.c. with 6d coated nails, 1⅞" long, 0.085" shank, ¼" heads, 24" o.c. **Face** layer ⅝" type X gypsum wallboard or gypsum veneer base applied at right angles to each side with 8d coated nails, 2⅜" long, 0.100" shank, ¼" heads, 8" o.c.

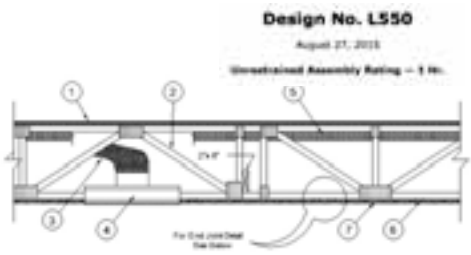
Joints staggered 24" each layer and side. Sound tested with studs 16" o.c. and with nails for **base** layer spaced 6" o.c. **(LOAD-BEARING)**



Thickness:	6⅛"
Approx. Weight:	12 psf
Fire Test:	FM WP 360, 9-27-74
Sound Test:	NGC 2363, 4-1-70

Intersection of Tested Assemblies

1 Hour Floor



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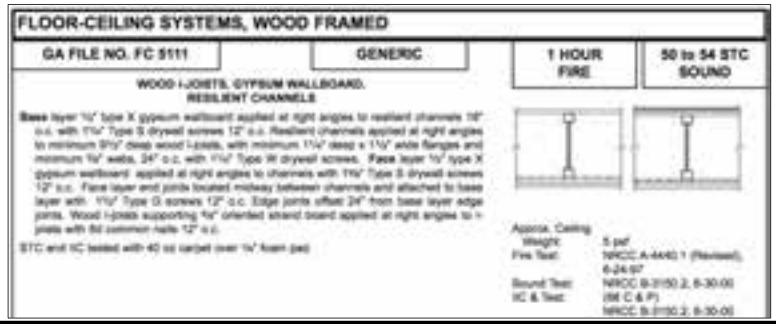


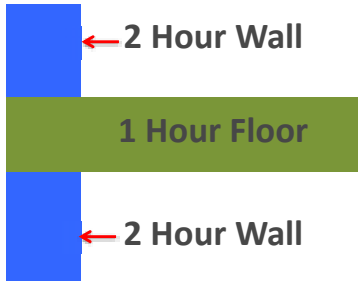
FLOOR-CEILING SYSTEMS, WOOD FRAMED

GA FILE NO. FC 5111	GENERIC	1 HOUR FIRE	50 to 54 STC SOUND

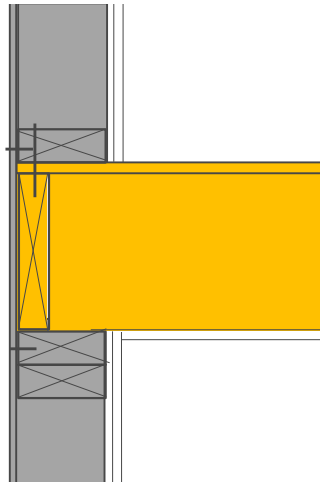
WOOD I-JOISTS, GYPSUM WALLBOARD, RESILIENT CHANNELS

Intersection of Tested Assemblies

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



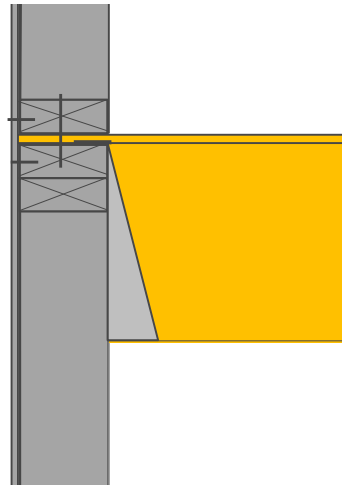
Platform Framing



Structural
- Direct bearing/ no add'l hardware
- May require load transfer blocking for concentrated loads from above
- Wall sole plate and floor sheathing crushing may need to be considered

Constructability
- Framing can be completed before drywall and insulation are installed
- Common length studs

Semi-balloon Framing



Structural
- Additional hardware/no direct bearing
- No load transfer blocking req'd

Rated Assemblies
- May accommodate continuity in exterior walls in Type III construction

Constructability
- Framing can be completed before drywall and insulation are installed
- Custom length studs
- Can help minimize building shrinkage

Type III Exterior Walls – FRT

Type III and IV Construction - IBC Section 602.3:
Fire-retardant-treated wood framing 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 - ?
- Rim Joist- ?
- Floor Joists- ?

Exterior Walls – Intersecting Floors

Some have interpreted the allowance of FRT framing in exterior walls of type III construction as not including FRT wall sheathing. The inclusion of wall sheathing is intended in the allowance of FRT framing.

Changes to the 2018 IBC clarify this.

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

602.4 Type IV.
Type IV construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated wood, heavy timber (HT) or structural composite lumber (SCL) without concealed spaces. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, structural composite lumber (SCL), and cross-laminated timber and details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.1 or 602.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rating or heavy timber complying with Section 2304.11.2.2 shall be permitted.

602.4.1 Fire-retardant-treated wood in exterior walls.
Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies not less than 6 inches (152 mm) in thickness with a 2-hour rating or less.

Exterior Walls – Intersecting Floors

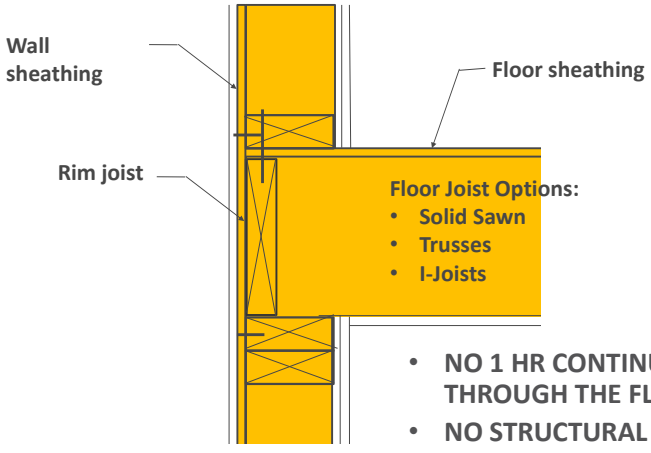
Please note that the following details are examples of what we have seen used on projects and do not necessarily represent details that will be accepted and applicable in all jurisdictions and to all projects.

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

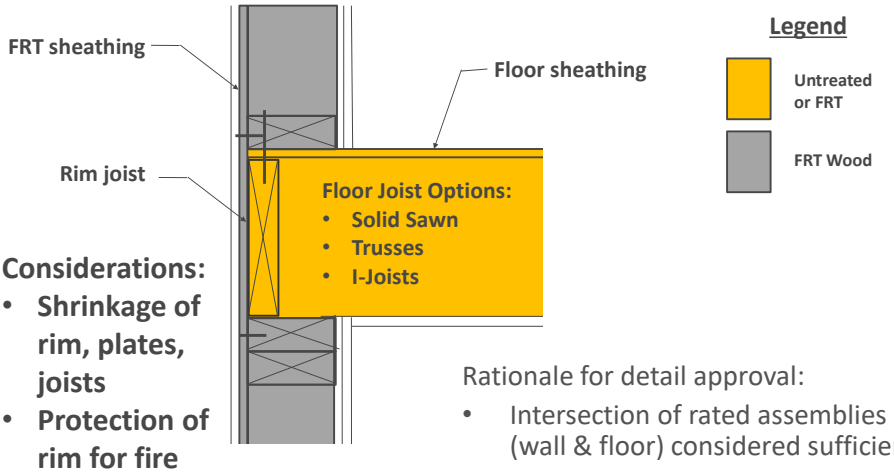
Type V Construction – 1 HR Wall, 1 HR Floor
Typical Platform Framing



- NO 1 HR CONTINUITY REQUIRED THROUGH THE FLOOR CAVITY
- NO STRUCTURAL STABLITY CONCERNS

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Typical Platform Framing

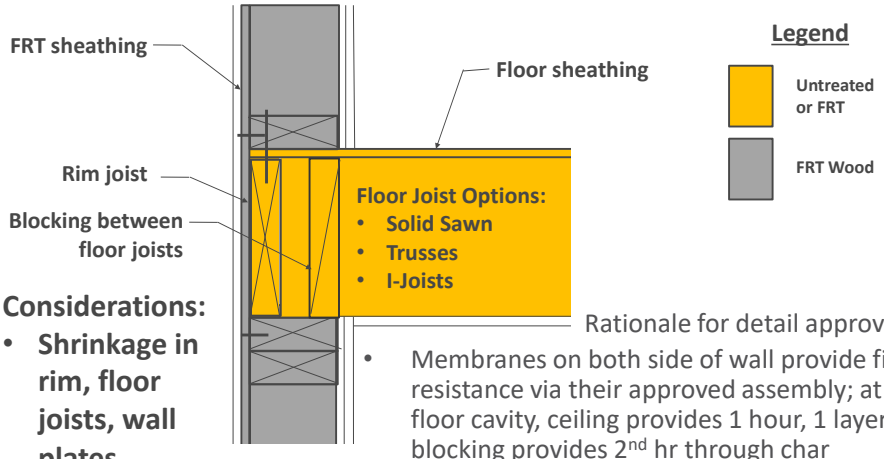


Considerations:
- **Shrinkage of rim, plates, joists**
- **Protection of rim for fire**

Rationale for detail approval:
- Intersection of rated assemblies (wall & floor) considered sufficient

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Typical Platform Framing

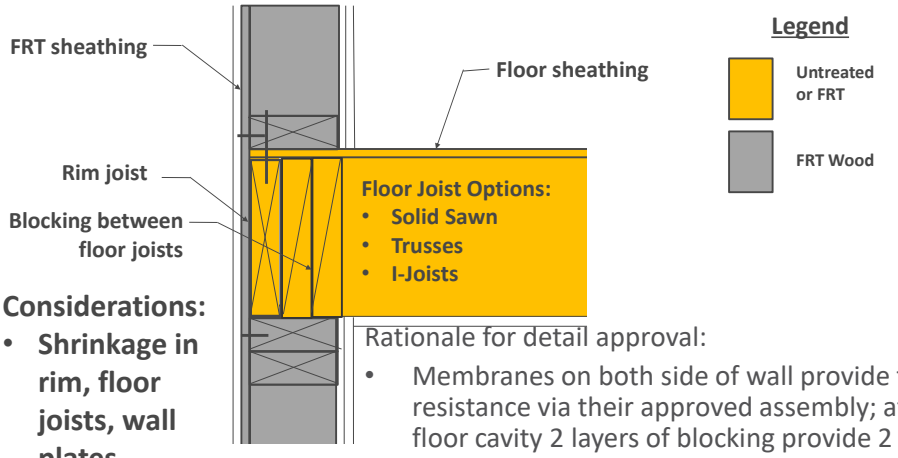


Considerations:
- **Shrinkage in rim, floor joists, wall plates**

Rationale for detail approval:
- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity, ceiling provides 1 hour, 1 layer of blocking provides 2nd hr through char calculations

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Typical Platform Framing



Considerations:

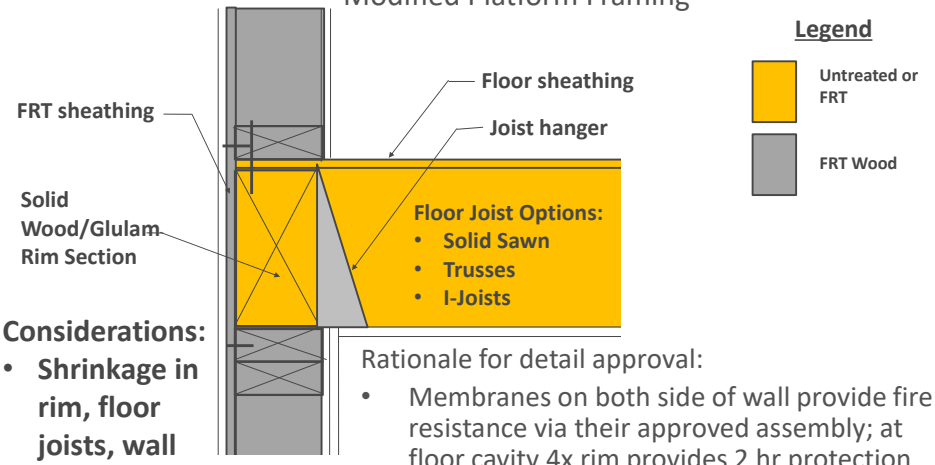
- **Shrinkage in rim, floor joists, wall plates**

Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity 2 layers of blocking provide 2 hr protection through char calculations

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Modified Platform Framing



Considerations:

- **Shrinkage in rim, floor joists, wall plates**

Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity 4x rim provides 2 hr protection through char calculations

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


Design for Code Acceptance 3

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

Building Code Requirements

Fire Tested Assemblies

Exterior Walls – Intersecting Floors

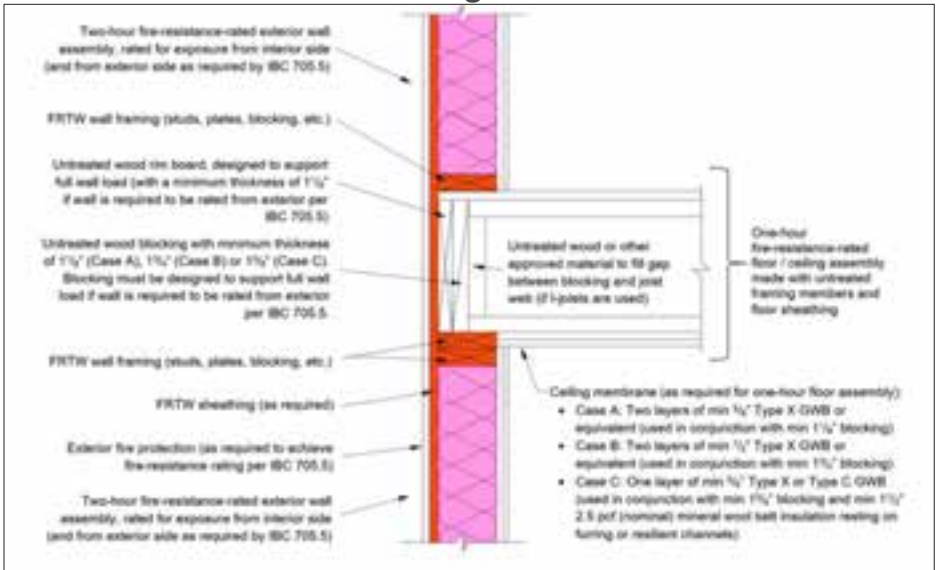
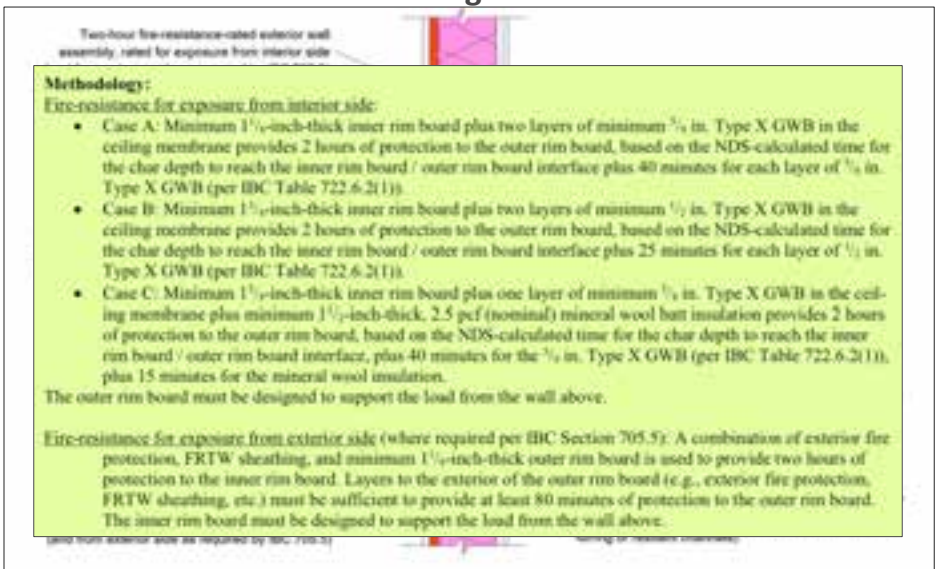


Figure 1A: Example detail for Type III-A exterior wall–floor intersection with rim board and blocking

Exterior Walls – Intersecting Floors



Two-hour fire-resistance-rated exterior wall assembly, rated for exposure from interior side

Methodology:

Fire-resistance for exposure from interior side:

- Case A: Minimum 1½-inch-thick inner rim board plus two layers of minimum ⅝ 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 ⅝ in. Type X GWB (per IBC Table 722.6.2(1)).
- Case B: Minimum 1½-inch-thick inner rim board plus two layers of minimum ½ 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 ½ in. Type X GWB (per IBC Table 722.6.2(1)).
- Case C: Minimum 1½-inch-thick inner rim board plus one layer of minimum ⅝ in. Type X GWB in the ceiling membrane plus minimum 3½-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 ⅝ 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 1½-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.

(and from exterior side as required by IBC 705.5)

Figure 1A: Example detail for Type III-A exterior wall–floor intersection with rim board and blocking

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)

Equations for Calculating Fire Endurance

- Assumptions
  - Nominal assumed char rate = 1.5”/hr.
  - Uses ultimate strength for design check
- Structurally spanning members: reduced section checked for capacity vs. demand

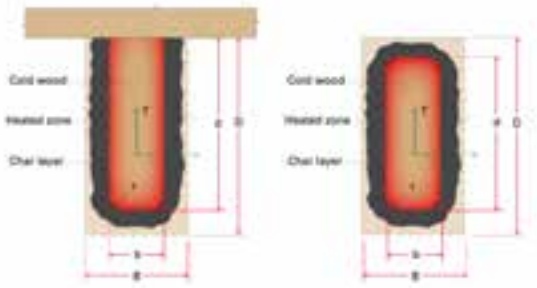


Figure 1-1 Reduction in member breadth and depth over time, t

Source: AWC’s TR 10

Equations for Calculating Fire Endurance

ACCOUNTS FOR NON-CHARRED STRENGTH RED’N

$$\beta_{eff} = \frac{1.2\beta_n}{t^{0.187}}$$

CHAR SLOWS WITH TIME- NON LINEAR

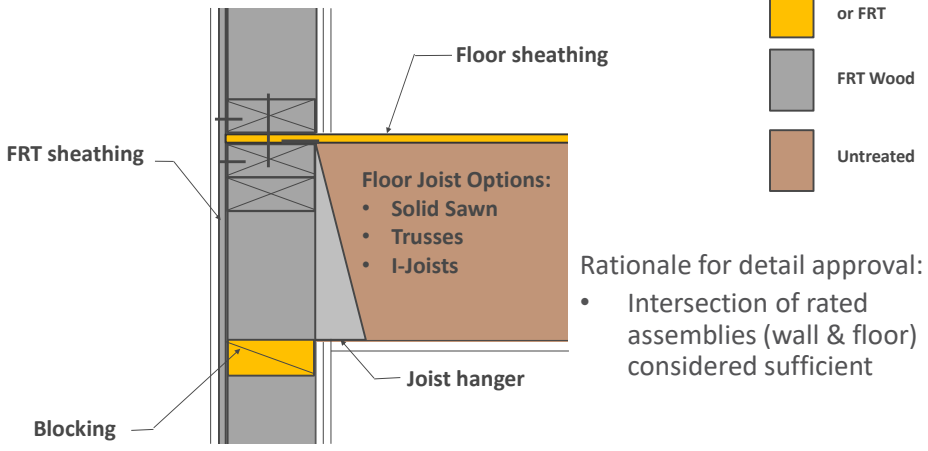
β_{eff} = Effective char rate (in/hr), adjusted for exposure time, t

β_n = Nominal char rate (in/hr), linear char rate based on a 1-hour exposure (1.5”/hr.)

t = Exposure time (hrs)

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing

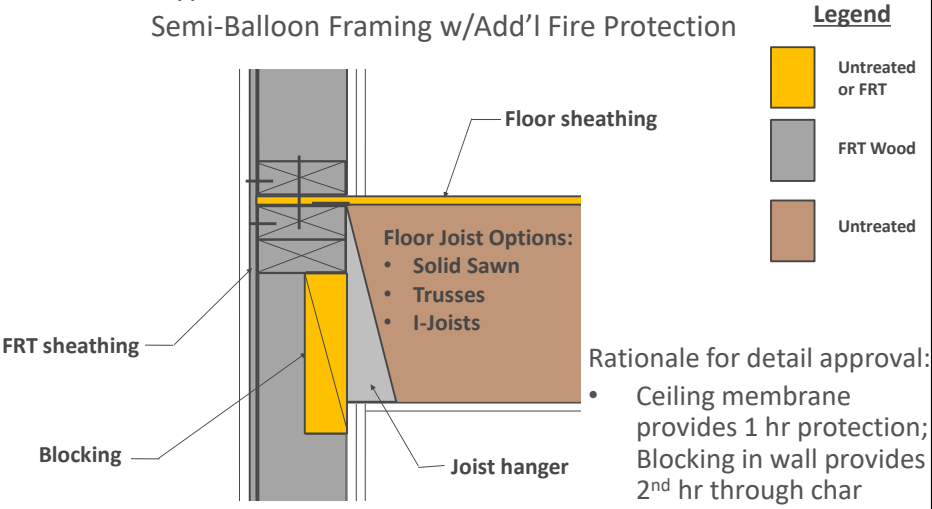


Rationale for detail approval:

- Intersection of rated assemblies (wall & floor) considered sufficient

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Add'l Fire Protection

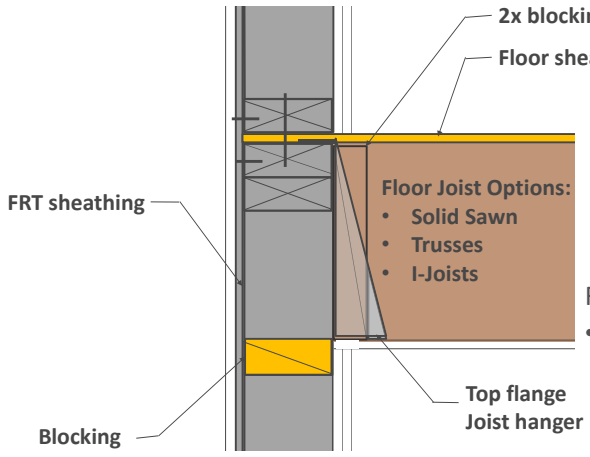


Rationale for detail approval:

- Ceiling membrane provides 1 hr protection; Blocking in wall provides 2nd hr through char calculations

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Add'l Fire Protection

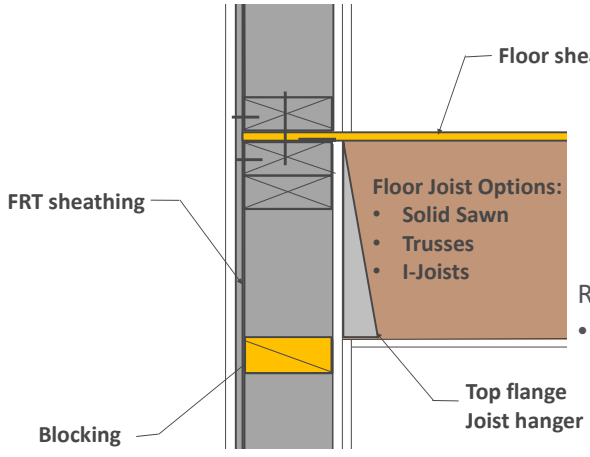


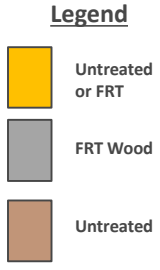
Rationale for detail approval:

- Ceiling membrane provides 1 hr protection; Blocking between joists provides 2nd hr through char calculations

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Add'l Fire Protection



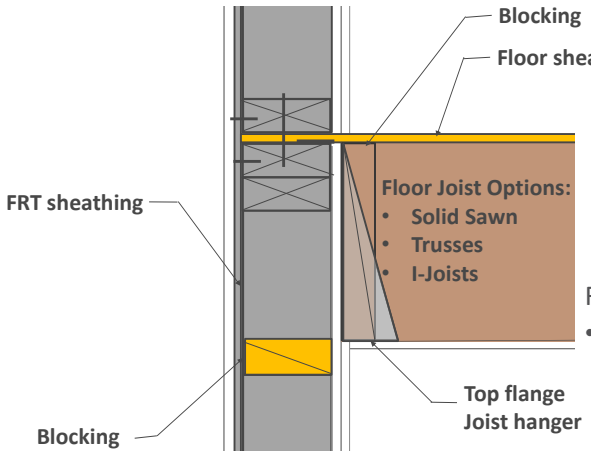


Rationale for detail approval:

- Ceiling membrane provides 1 hr protection; 1 layer of wall membrane provides 2nd hr

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Add'l Fire Protection

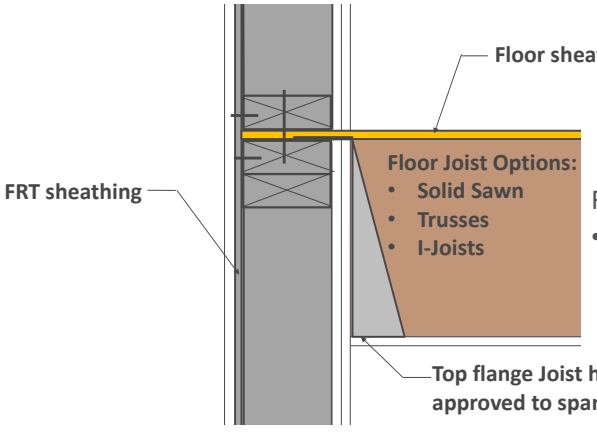


Rationale for detail approval:

- 1 layer of wall membrane provides 1 hr protection; blocking between joists provides 2nd hr through char calculations

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Add'l Fire Protection

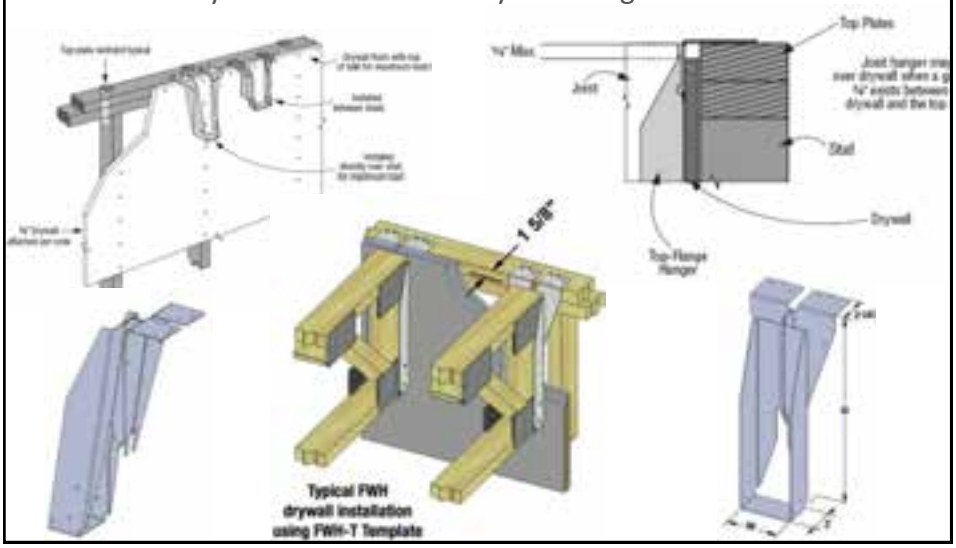


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly

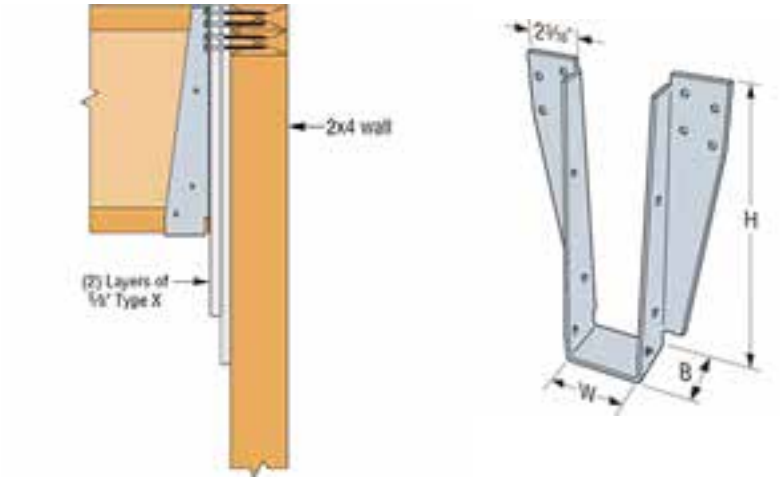
Over Gypsum Hangers

Commonly called Fire Wall or Drywall Hangers



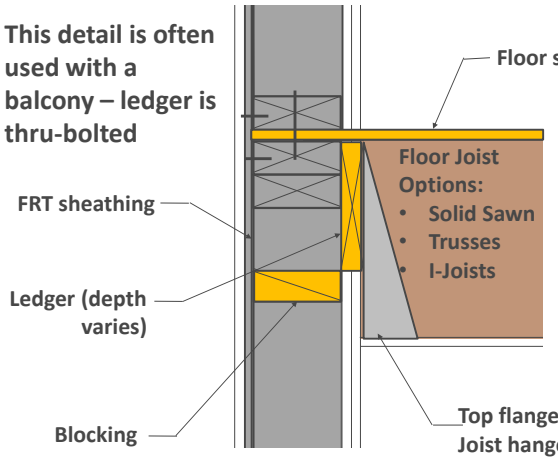
Over Gypsum Hangers

Top Flange Hangers & Face Mount Hangers Available



Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Semi-Balloon Framing w/Ledger

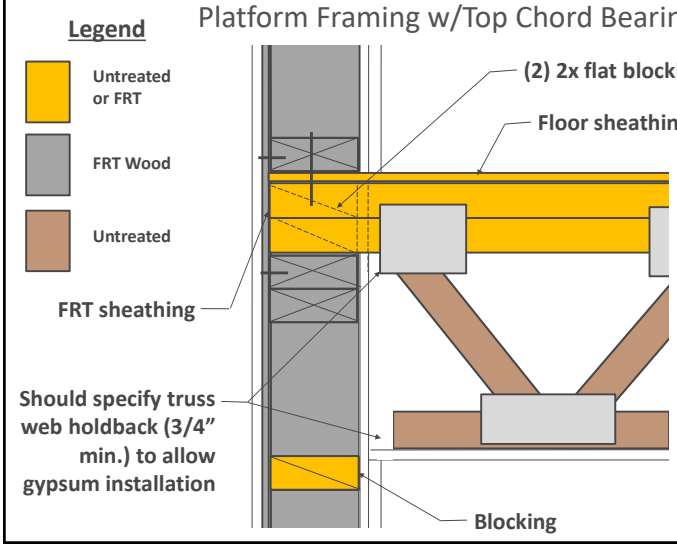


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor ceiling membrane provides 1 hr; blocking provides 2nd hr & maintains FRT continuity

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

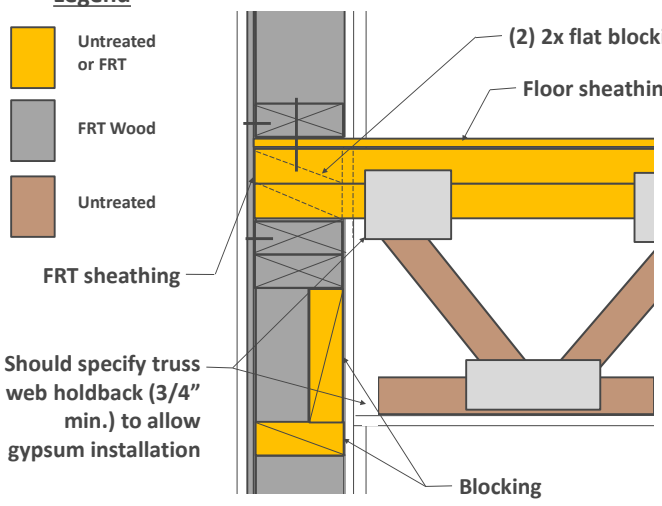


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity ceiling membrane provides 1 hr; 1 layer of wall membrane provides 2nd hr

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

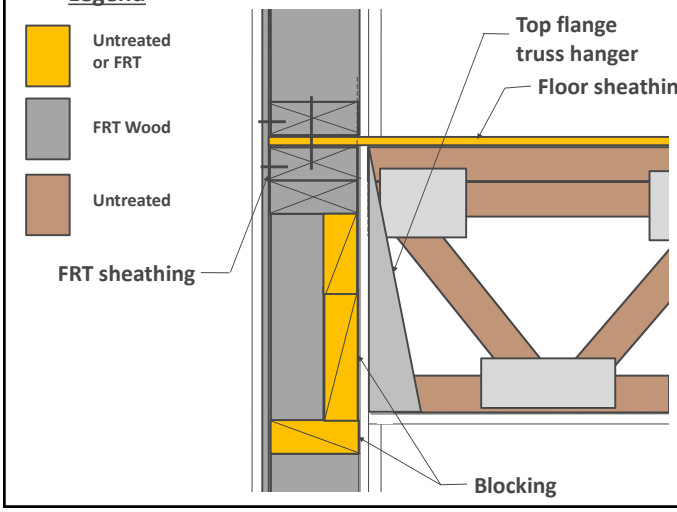


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity blocking in wall provides 1 hr; 1 layer of wall membrane provides 2nd hr

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

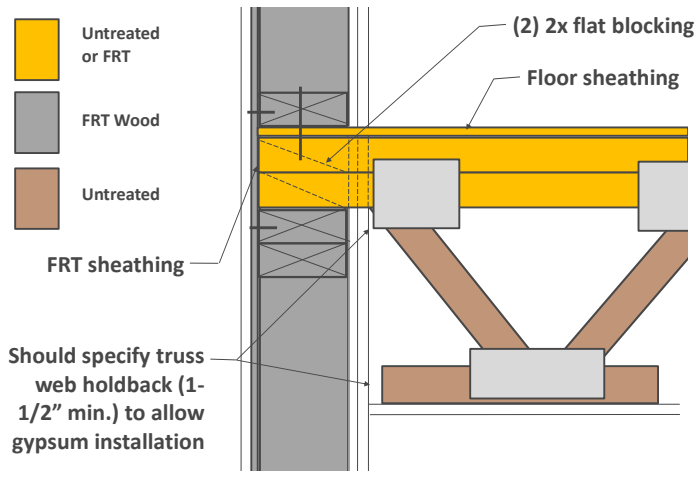


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity blocking in wall provides 1 hr; 1 layer of wall membrane provides 2nd hr

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

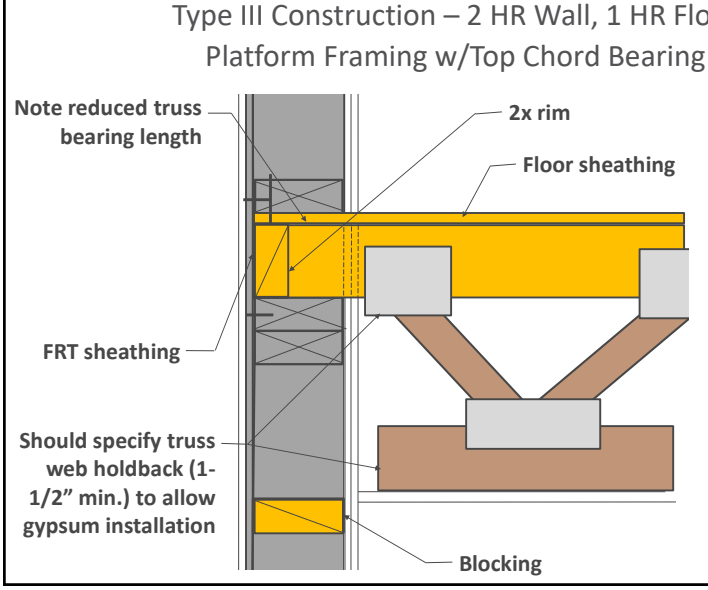


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing



Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly

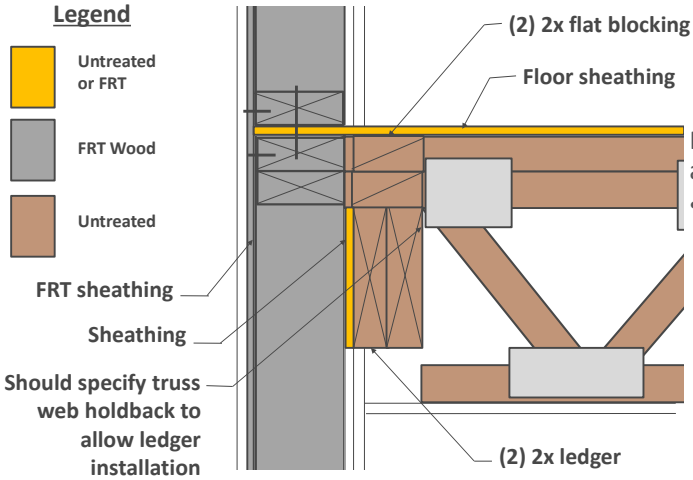
Exterior Walls – Intersecting Floors

Exterior Walls – Intersecting Floors

Gaps btwn end of truss members and wall to allow gypsum install after

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing/Ledger

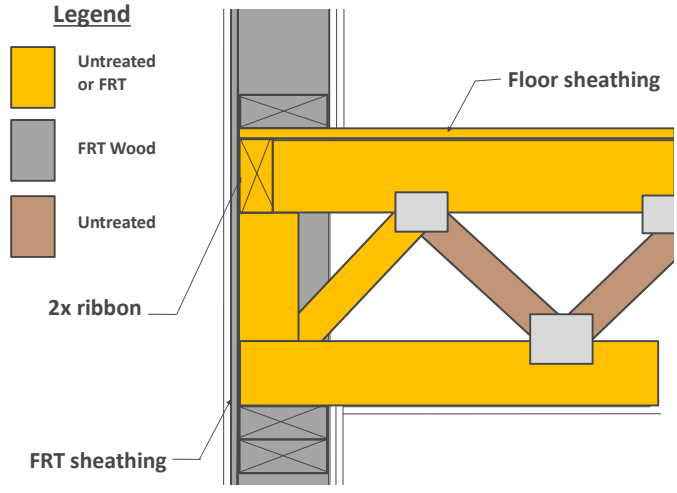


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at top chords, ledger & sheathing provide continuity

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

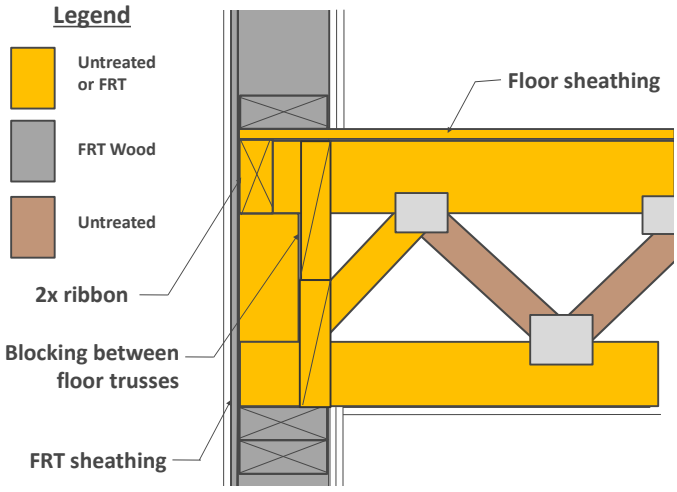


Rationale for detail approval:

- Intersection of rated assemblies (wall & floor) considered sufficient

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing

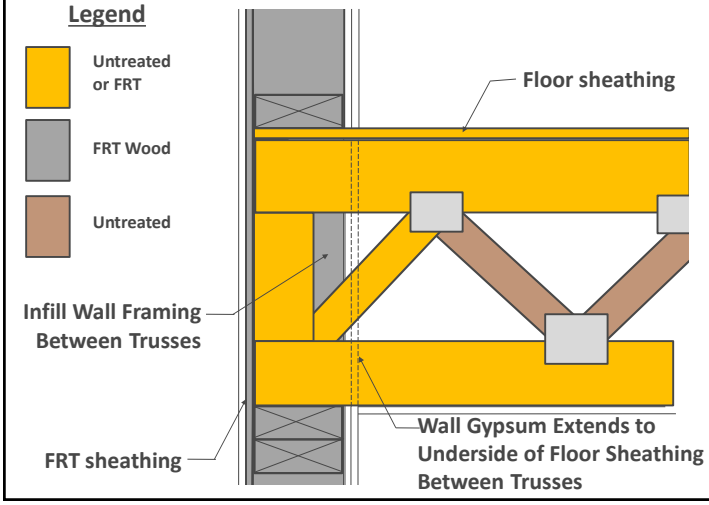


Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly; at floor cavity blocking in wall provides 1 hr; ceiling provides 2nd hr

Exterior Walls – Intersecting Floors

Type III Construction – 2 HR Wall, 1 HR Floor
Platform Framing w/Top Chord Bearing



Rationale for detail approval:

- Membranes on both side of wall provide fire resistance via their approved assembly

Exterior Walls – Intersecting Floors

Learning Objectives

1. Discuss allowable construction types, occupancies, and building heights and areas for wood-frame mid-rise construction per the International Building Code.
2. Identify fire-resistance and protection requirements for wood-frame wall assemblies in Type III and Type V buildings.
3. Examine a variety of floor-to-exterior wall details for use in wood-frame, Type III construction and discuss code compliance paths and approval rationale for each.
4. **Consider code provisions for corridor and balcony fire-resistance protection, and identify details that accommodate these requirements while maximizing wood use.**

Balconies – IBC 1406.3

Balconies of combustible construction and not FRT shall be:

- Rated in accordance w/ Table 601 for floors
- Or be of Type IV
- And shall not exceed 50% of bldg perimeter

Exceptions

- Balconies in Type III, IV and V can be of type V const and shall not have fire resistance rating if sprinkler protection provided
- Untreated wood is permitted for rails and guardrails

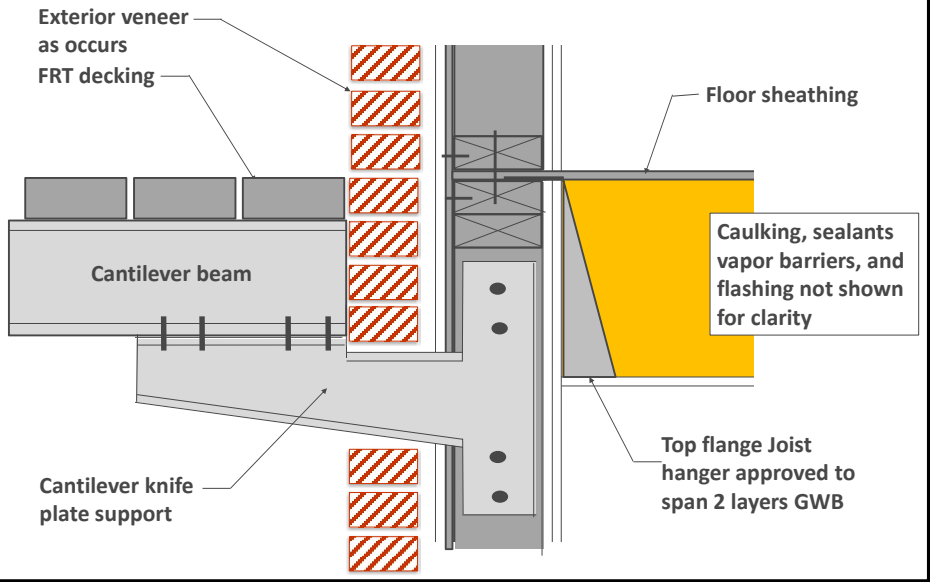
Balconies – IBC 1406.3

So….

For Type III or V balcony options are:

1. Non-combustible – no sprinklers/no fire rating
2. FRT – no fire sprinklers/no fire rating
3. Type IV– no fire sprinklers/no fire rating
4. Non treated – fire sprinkler/no fire rating
5. Non treated – fire rated per 601 & 602/ no sprinkler

Balconies – Exterior Wall Penetration



Corridors – Fire Resistance Ratings

Corridors – Fire Resistance Ratings

Check requirements of IBC Tables 601 and 1020.1 for Corridor Wall and Floor/Ceiling Fire-Resistance Ratings

TABLE 1018.1 CORRIDOR FIRE-RESISTANCE RATING

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system[c]
H-1, H-2, H-3	All	Not Permitted	1
H-4, H-5	Greater than 30	Not Permitted	1
A, B, E, F, M, S, U	Greater than 30	1	0
R	Greater than 10	Not Permitted	0.5
I-2[a], I-4	All	Not Permitted	0
I-1, I-3	All	Not Permitted	1[b]

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

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Primary structural frame[f] (see Section 202)	3[e]	2[e]	1	0	1	0	HT	1	0
Bearing walls									
Exterior[d, f]	3	2	1	0	2	2	2	1	0
Interior	3[e]	2[e]	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See Section 602.4.6	0	0
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0

Corridor Walls

IBC 1020.1: Corridor walls required to be fire-resistance rated shall comply with Section 708 for fire partitions.

708.3 Fire-resistance rating.

Fire partitions shall have a fire-resistance rating of not less than 1 hour.

Exception: Corridor walls permitted to have a $^1/_2$ hour fire-resistance rating by Table 1018.1 (applies to R occupancies with sprinkler systems)

Corridor Walls

708.4 Continuity.

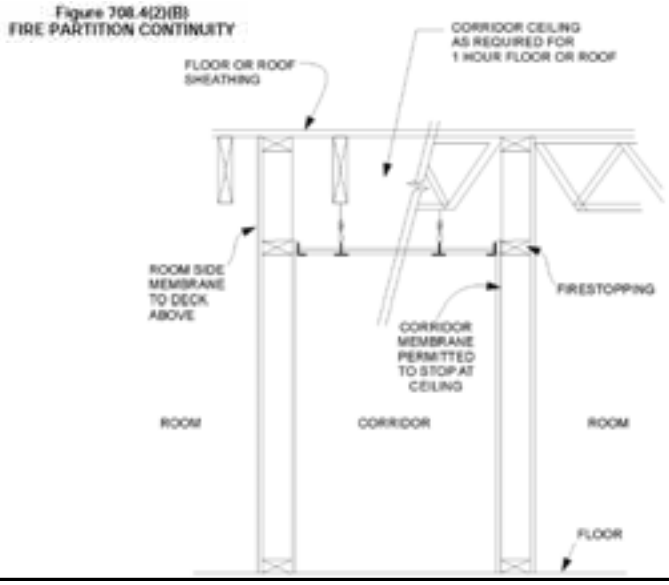
Fire partitions shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above or to the fire-resistance-rated floor/ceiling or roof/ceiling assembly above, and shall be securely attached thereto.

Exceptions:

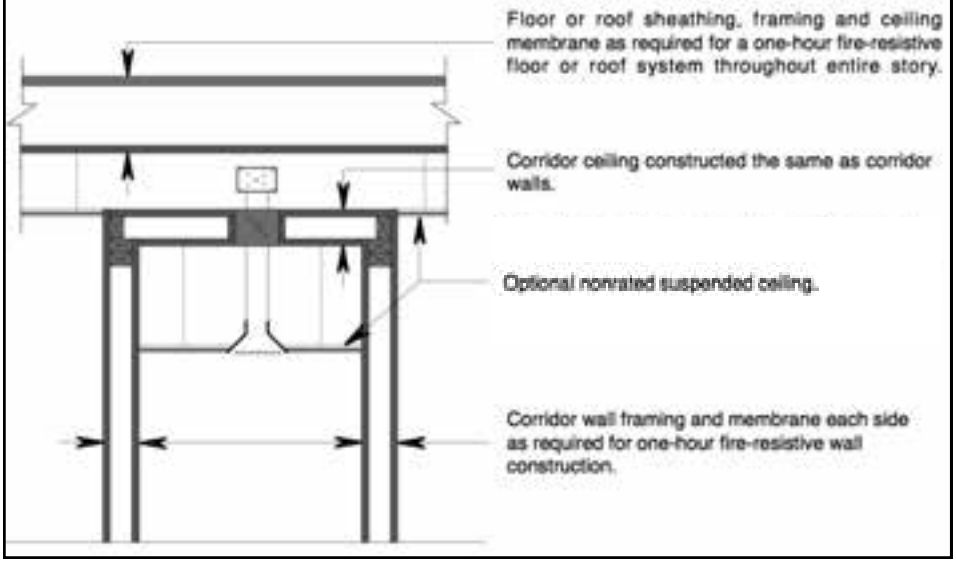
2. Where the room-side fire-resistance-rated membrane of the *corridor* is carried through to the underside of the floor or roof sheathing, deck or slab of a fire-resistance-rated floor or roof above, the ceiling of the *corridor* shall be permitted to be protected by the use of ceiling materials as required for a 1-hour fire-resistance-rated floor or roof system.

3. Where the *corridor* ceiling is constructed as required for the *corridor* walls, the walls shall be permitted to terminate at the upper membrane of such ceiling assembly.

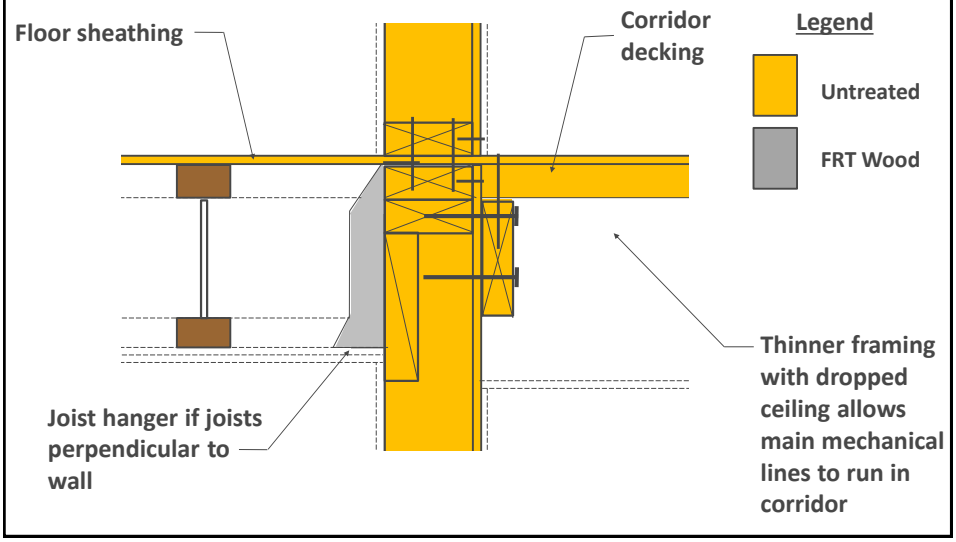
Corridor Walls – 708.4 Exception 2



Corridor Walls – 708.4 Exception 3



Corridors - 1hr Floor



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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