Type III Construction for Multi-Family: Best Practices and Detailing for Success

Today's Speakers :

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1430 Q, The HR Group Architects, Buehler Engineering, Greg Folkins Photography

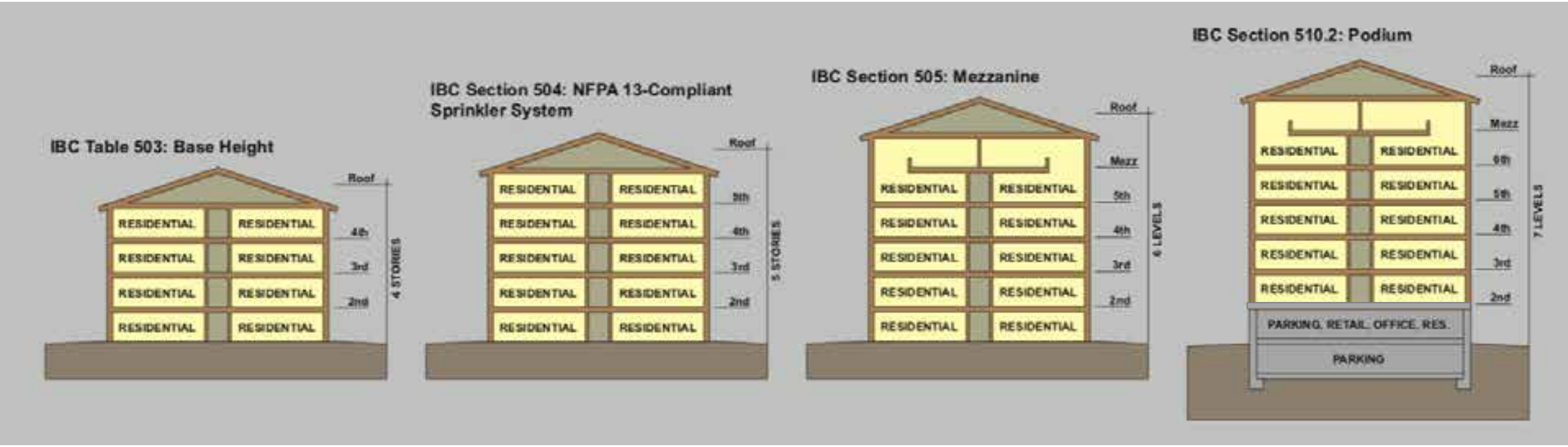
Maximizing Height & Area - How Do We Go Bigger?

Utilizing the options in IBC Chapter 5 to maximize building size

- Sprinkler Requirements
- Allowable Height
- Allowable Stories
- Basements
- Rooftop Decks
- Sloped Sites
- Basements
- Podiums
- Open Frontage Increase

Photo credit: Matt Todd & PB Architects

PRESCRIPTIVE BUILDING CODES



Sprinkler Requirements

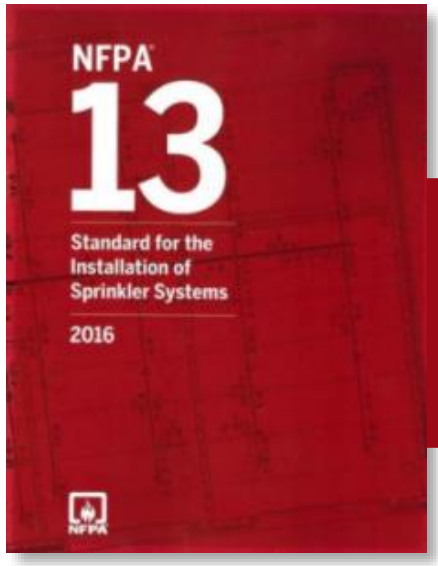
IBC 903.2

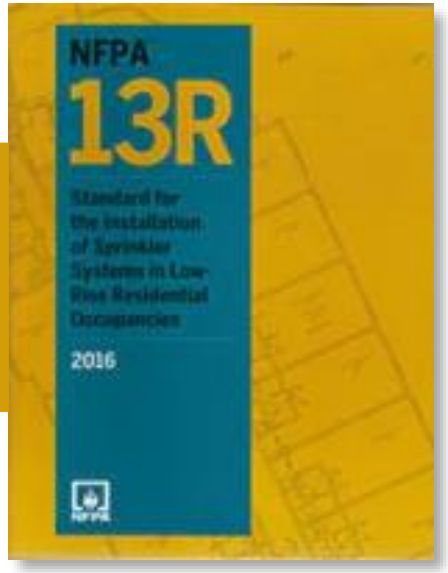
- NFPA 13 or 13R sprinkler system required in all new group R fire areas
- NFPA 13 sprinkler system required in most commercial facilities of any size regardless of construction type or materials used
- Example: Occupancy Group A-2 (restaurant, casino, banquet hall):
  - If Fire Area Exceeds 5,000 sf, or
  - If occupant load is 100 or more

Commercial Sprinkler Systems

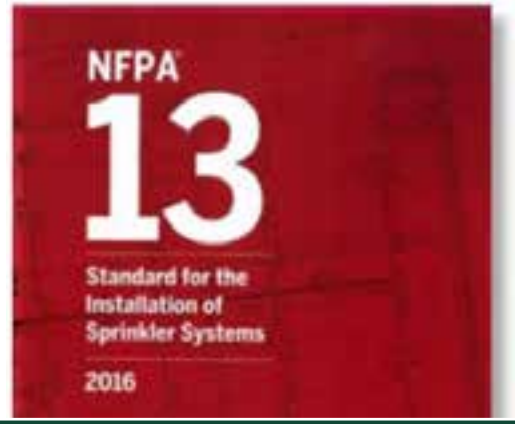
IBC 903.3.1

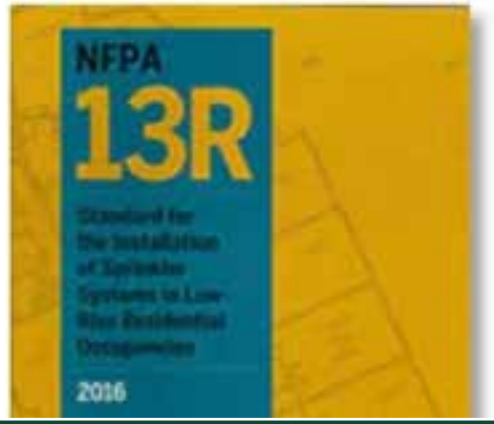
- **NFPA 13**
  Standard for Commercial Construction 903.3.1.1
- **NFPA 13R**
  Residential Occupancies (One- and Two-Family or Low-Rise Multi-Family and Commercial) 903.3.1.2
- **NFPA 13D**
  Standard for One- and Two-Family Residences (but allowed in a few commercial occupancies) 903.3.1.3





Sprinkler Differences





NFPA 13	NFPA 13R
Goal: Provide life safety and property protection	Goal: Provide life safety only
Fully sprinklered system throughout entire building even in unoccupied spaces (closets, attics)	Partially sprinklered system; unoccupied spaces often don't require sprinklers
Can cost more	Lower levels of water discharge, shorter water supply time can result in smaller pipe sizes, reduce need for storage & pumps
Permitted for many occupancies, buildings of many sizes, allows greater building size increases	Limited applications, mainly for multi-family up to 4 stories, 60 feet

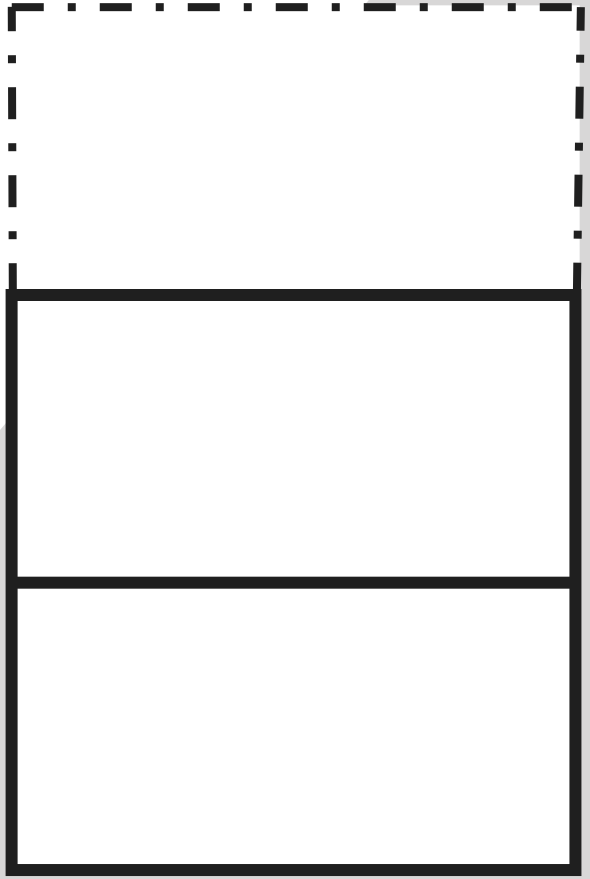
Allowable Building Height

IBC 2018 Tables 504.3 & 504.4

Building Height Increase

Buildings equipped throughout with an NFPA 13 or 13R* sprinkler system are allowed an additional **1 story and 20 ft** over nonsprinklered conditions

*NFPA 13R limited to 60 ft & 4 stories



Allowable Building Height

IBC 2018 Table 504.3

Provides base (non-sprinklered) & increased heights

TABLE 504.3[a]
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A, B, E, F, M, S, U	NS[b]	UL	160	65	55	65	55	65	50	40
	S	UL	180	85	75	85	75	85	70	60
R	NS[d, h]	UL	160	65	55	65	55	65	50	40
	S13R	60	60	60	60	60	60	60	60	60
	S	UL	180	85	75	85	75	85	70	60

NS = Buildings not equipped throughout with an automatic sprinkler system

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2 (NFPA 13R)

S13D (not shown) = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3 (NFPA 13D)

Allowable Stories

IBC 2018 Table 504.4

Provides base (non-sprinklered) & increased # of stories

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
A-2	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
A-3	NS	UL	11	3	2	3	2	3	2	1
	S	UL	12	4	3	4	3	4	3	2
B	NS	UL	11	5	3	5	3	5	3	2
	S	UL	12	6	4	6	4	6	4	3
R-1	NS[d, h]	UL	11	4	4	4	4	4	3	2
	S13R	4	4						4	3
	S	UL	12	5	5	5	5	5	4	3
R-2	NS[d, h]	UL	11	4	4	4	4	4	3	2
	S13R	4	4	4					4	3
	S	UL	12	5	5	5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	3	1
	S	UL	12	5	3	4	3	5	4	2

Summary of Building Heights

Building Heights and Stories by Building Type With NFPA 13 Sprinklers				
Occupancy	IIIA	IIIB	VA	VB
	85 ft	75 ft	70 ft	60 ft
R-1/R-2/R-4	5	5	4	3
A-2/A-3	4	3	3	2
B	6	4	4	3
M	5	3	4	2
S-2	5	4	5	3
S-1	4	3	4	2

**ASCE7 12.2-1 limits wood shear wall seismic systems to 65’ in height in SDC D,E,F

Mezzanines – 2018 IBC 505

Not counted toward building area* or number of stories if:

- Maximum 1/3 floor area of *room* or *space* where located
- Special egress provisions apply
- Must be open and unobstructed to the room in which it's located (walls ≤ 42" allowed)
  - Several exceptions
- Slightly different for equipment platforms

*Does count toward fire area with regard to fire protection in Chapter 9

Basements – 2018 IBC 506.1.3

A basement is not included in the total allowable building area if it doesn't exceed the area permitted for a building with no more than one story above grade plane.

"Basement" is defined as "not a story above grade plane" and has a finished floor surface:

- Less than 6 feet above grade plane; or
- Less than 12 feet above the finished ground level at any point

Fashion Valley, CA
AvalonBay Communities

Sloped Sites

Fashion Valley, CA
AvalonBay Communities

Seattle, WA
PB Architects

Sloped Sites – Chapter 2 Definitions

HEIGHT, BUILDING. The vertical distance from *grade plane* to the average height of the highest roof surface.

GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at *exterior walls*. Where the finished ground level slopes away from the *exterior walls*, the reference plane shall be established by the lowest points within the area between the building and the *lot line* or, where the *lot line* is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

626 Dekalb Avenue, Atlanta, GA
Matt Church - Davis Church Structural Engineers

Mid-Rise vs. High-Rise Definition – IBC 202

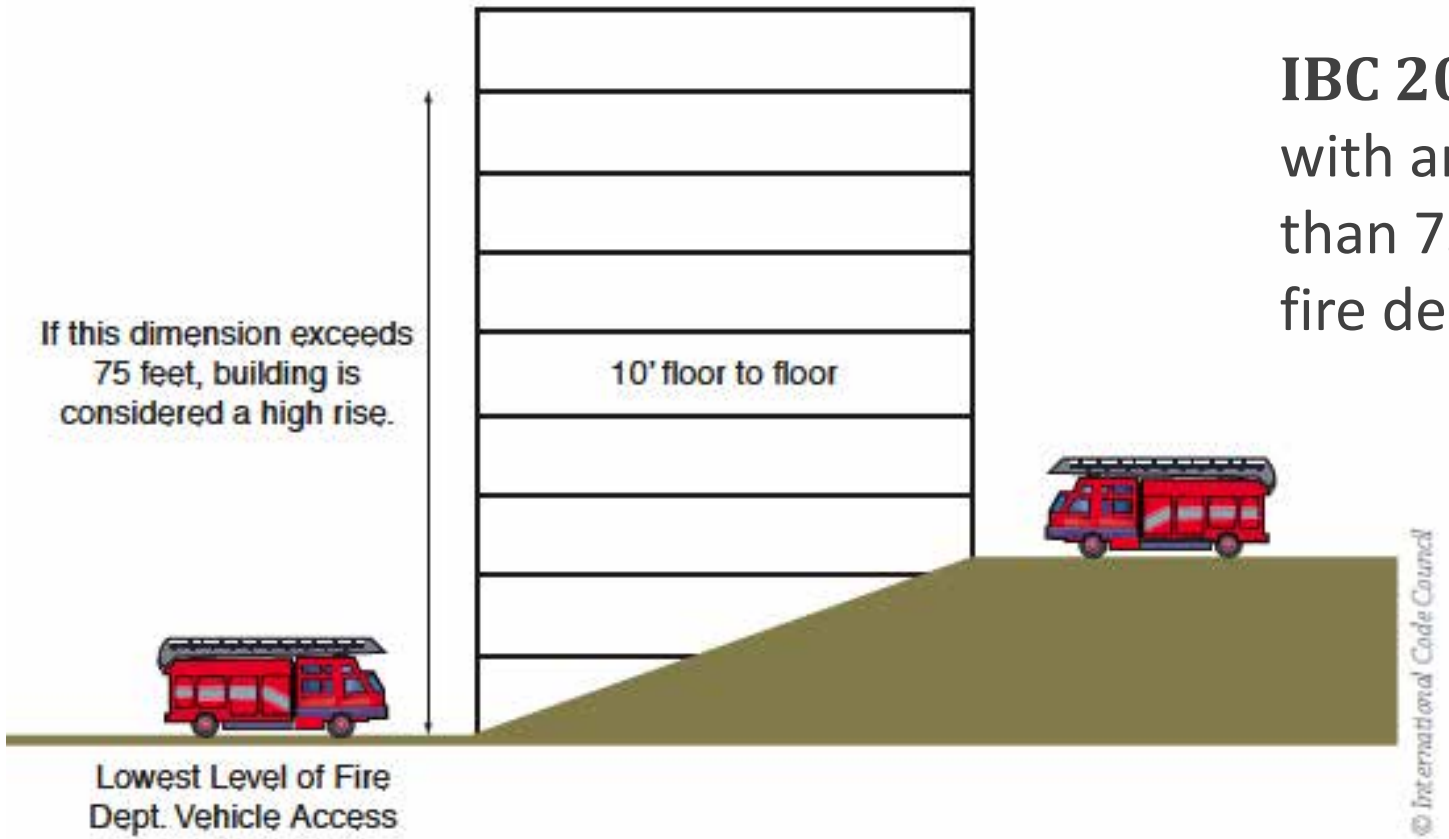
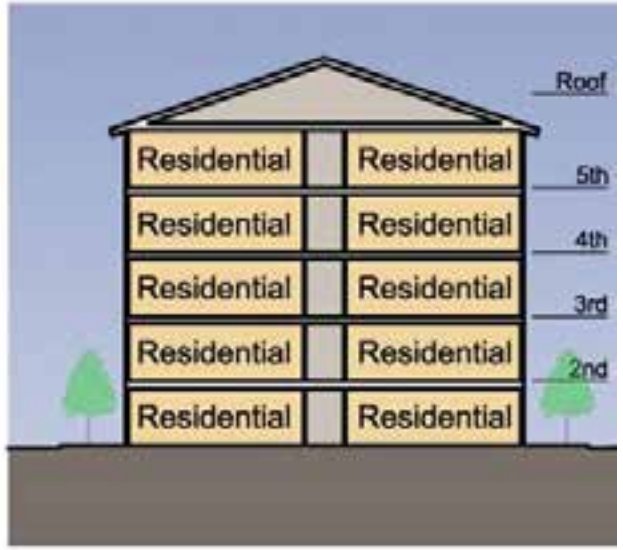


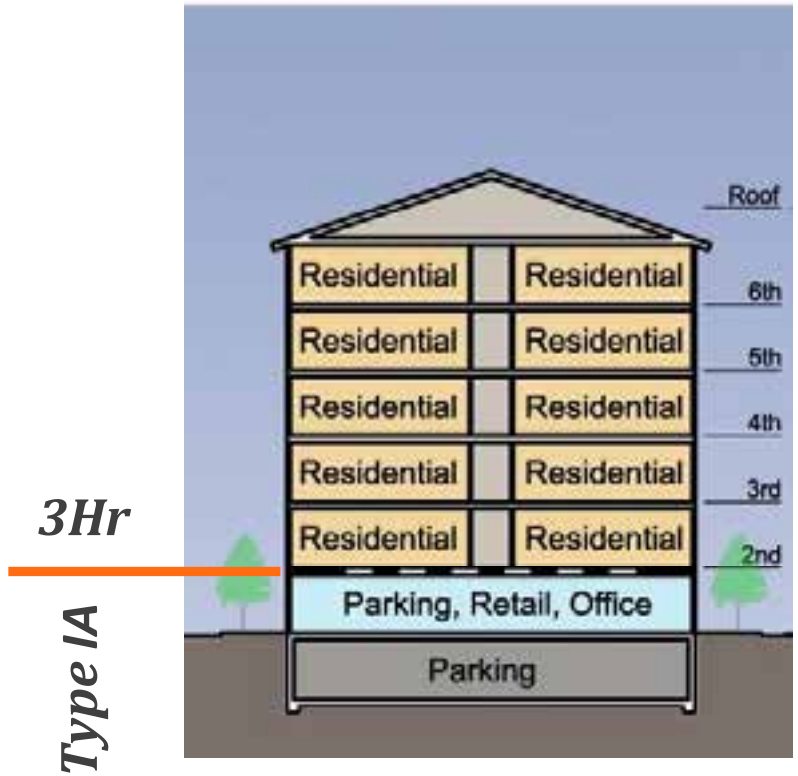
FIGURE 6-6 Determination of high-rise building

IBC 202: High-Rise Building: A building with an occupied floor located more than 75 feet above the lowest level of fire department vehicle access.

IBC Podium Provisions



5 story Type III Building



5 story Type III Building
On Top of a Type IA Podium

Special Provisions for Podiums in IBC 510.2
Increases allowable stories… not allowable building height

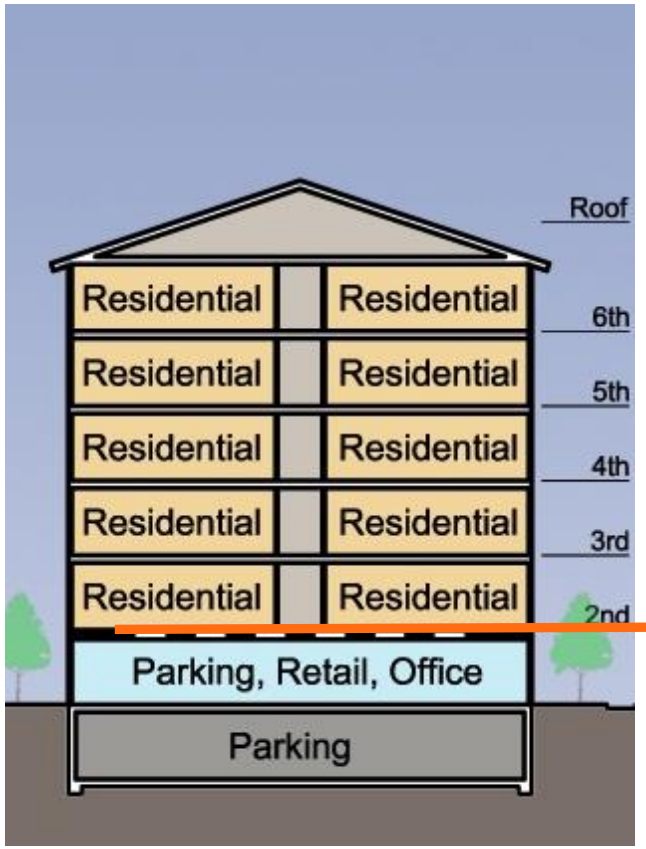
Horizontal Building Separation – 510.2

Considered separate buildings above and below for purposes of area calculations if:

- Overall height is still limited to min of either building
- 3hr rated horizontal assembly
- Building below is Type 1A with sprinklers
- Enclosures penetrating horizontal assembly are 2hr rated
- Occupancy above is A (occupant load <300), B, M, R or S
- Occupancy below is any except H

The Flats at ISU, Normal, IL
OKW Architects
Precision Builders & Associates

Evolution of IBC Mixed-Use Podium



3Hr

Type IA

IBC	2006	2009	2012	2015	2018
Section	509.2	509.2	510.2	510.2	510.2
Upper Occupancy	A, B, M, R or S				
Lower Occupancy	S-2 Parking	A, B, M, R or S-2 Parking		Any Except H	
Podium Height	1 Story			No Restriction	

IBC Provisions for mixed-use podiums have been evolving.

Starting in 2015, IBC allows multiple podium stories above grade.

Rooftop Decks

IBC 503.1

Many mixed use buildings, especially apartment buildings, are implementing occupiable roof top decks, either for individual use or as a gathering space

Historically, code didn't offer much except for basic exit provisions but several design routes have been used, plus new guidance in 2018.

Typically these spaces do not have a roof and therefore aren't classified as stories per the definition of a story (IBC 202).

Rooftop Decks

IBC 503.1

Occupied Roofs Code Development

2012 IBC section 1021 contains exit provisions for occupied roofs

2015 IBC clarified egress requirements for occupied roofs (IBC 1006.3)

2018 IBC further recognizes occupied roofs. 2018 IBC provisions:

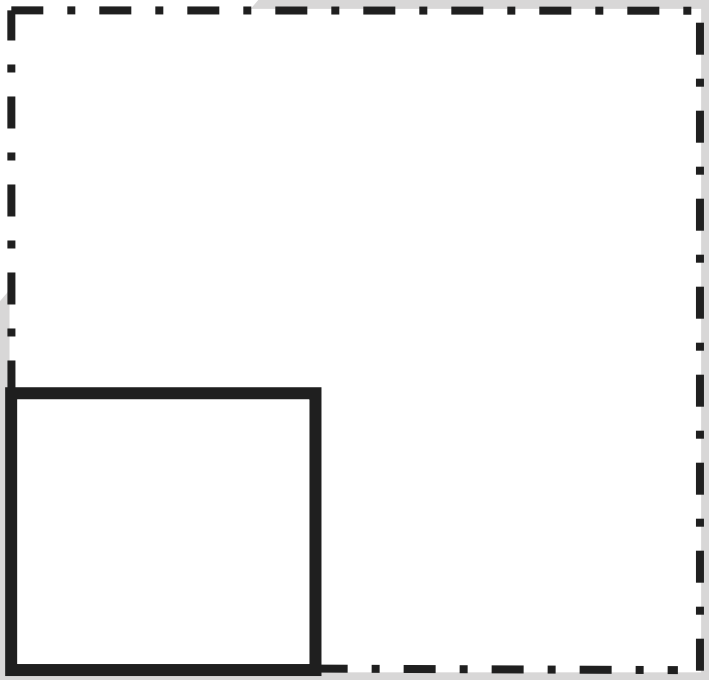
- 302.1: Occupied roof classified as occupancy it most closely resembles
- 503.1.4: Permitted to be used as an occupied roof if the occupancy of the roof is an occupancy that is permitted by code for the story immediately below the roof. Area of the occupied roofs is not required to be included in the building area. Further exceptions for sprinklered buildings exist

Allowable Story Area

IBC 2018 Table 506.2

Floor Area Increase

Buildings equipped throughout with an NFPA 13 sprinkler system can be increased **300% (single story buildings)** or **200% (multi-story buildings)** over nonsprinklered conditions



Allowable Story Area

IBC 2018 Table 506.2

Provides base (non-sprinklered) & increased areas

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET[a, b]

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
R-2[h]	NS[d]	UL	UL	24,000	16,000	24,000	16,000	20,500	12,000	7,000
	S13R									
	S1	UL	UL	96,000	64,000	96,000	64,000	82,000	48,000	28,000
	SM	UL	UL	72,000	48,000	72,000	48,000	61,500	36,000	21,000

**Can still increase these areas by the Frontage Factor of Section 506.3

NS = Buildings not equipped throughout with an automatic sprinkler system

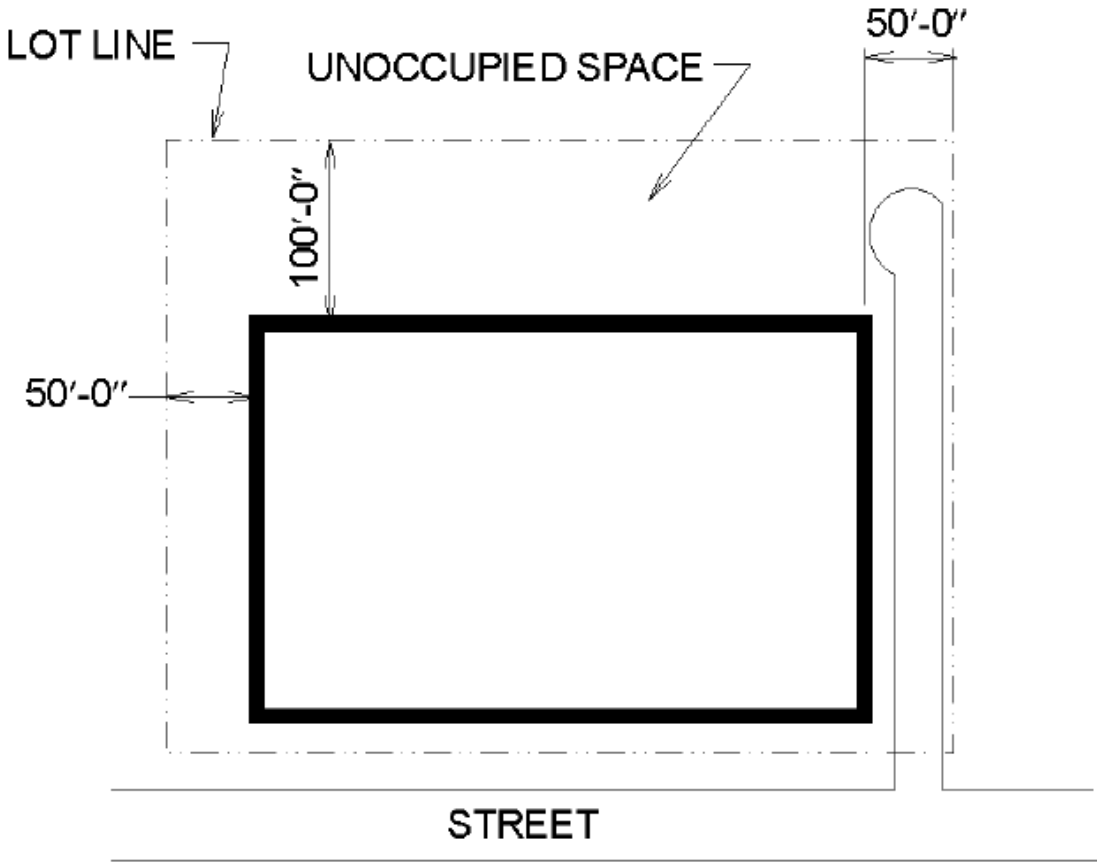
S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 (NFPA 13)

S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2 (NFPA 13R)

Area Modification – Frontage IBC 506.3

The allowable area of a building is permitted to be increased when it has a certain amount of frontage on streets (public ways) or open spaces, since this provides access to the structure by fire service personnel, a temporary refuge area for occupants as they leave the building in a fire emergency and a reduced exposure to and from adjacent structures.

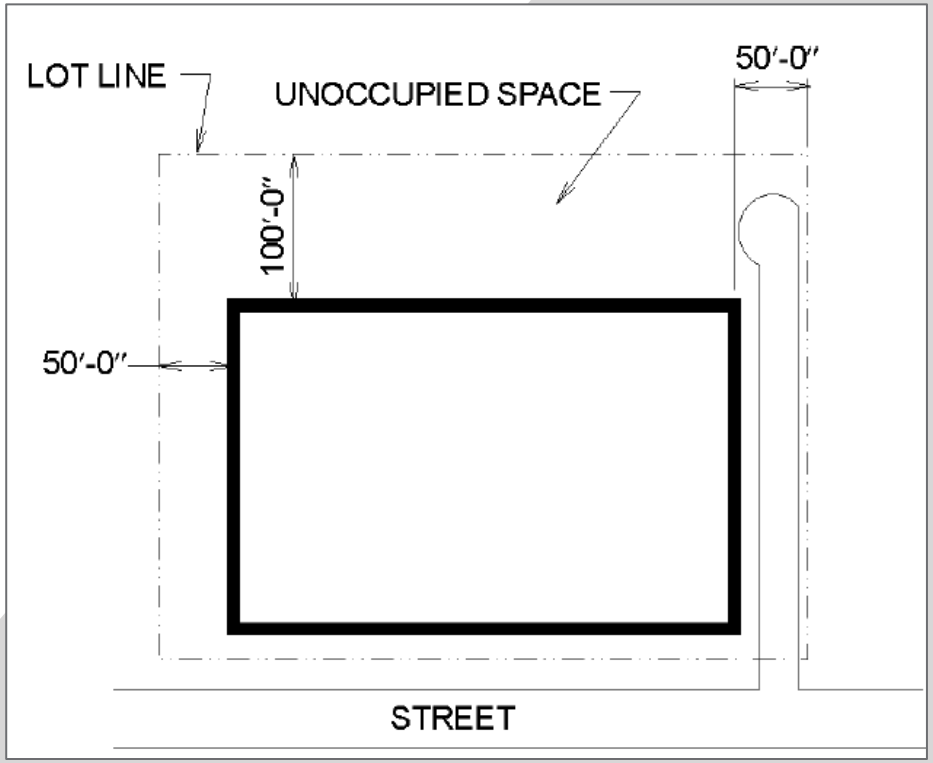


Allowable Story Area

IBC 506.3

Area Frontage Increase

Buildings with minimum levels of open frontage can add **up to 75%** of allowable nonsprinklered area to total floor area



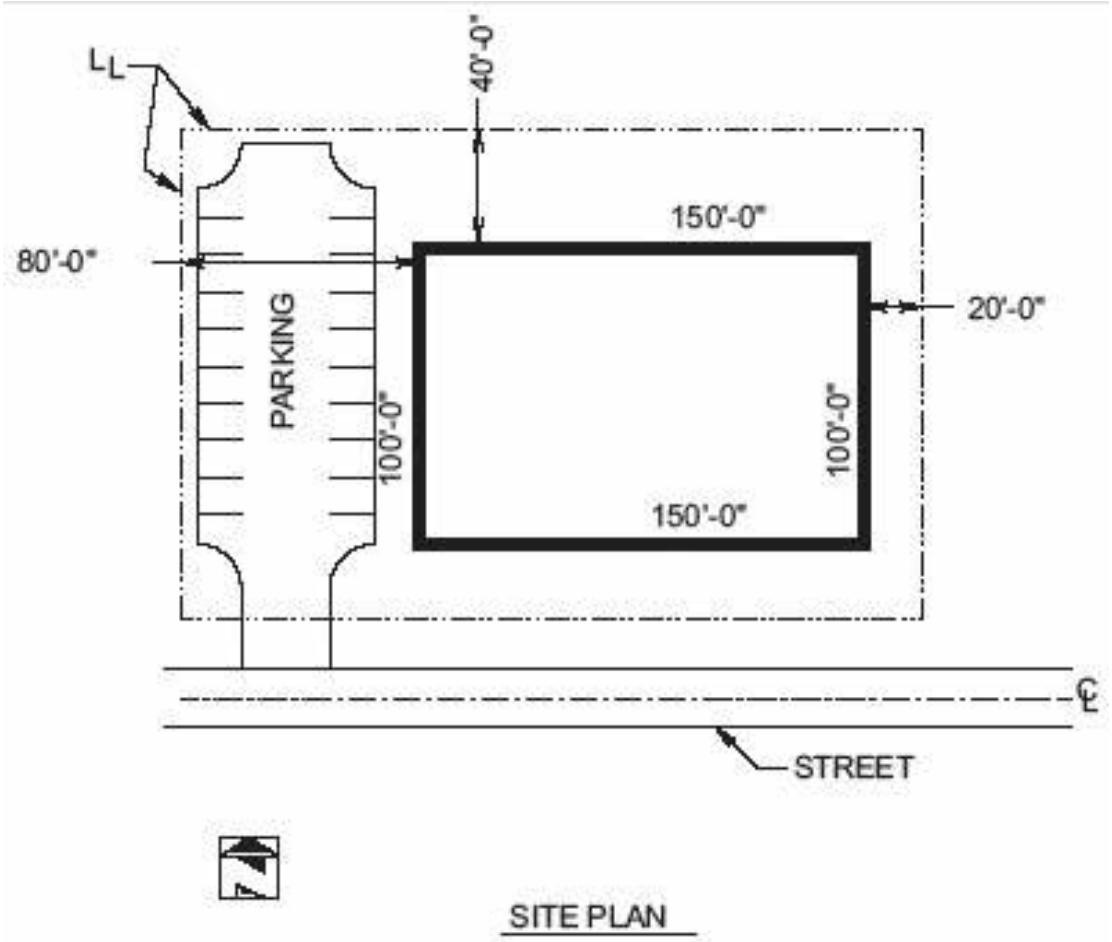
Frontage Increases – IBC 506.3.3

$$I_f = [F/P - 0.25]W/30$$

(IBC Equation 5-5)

WHERE:

- I_f = Area increase due to frontage
- F = Building perimeter that fronts on a public way or open space having 20 feet open minimum width
- P = Perimeter of entire building
- W = Width of public way or open space (feet) in accordance with section 506.3.2

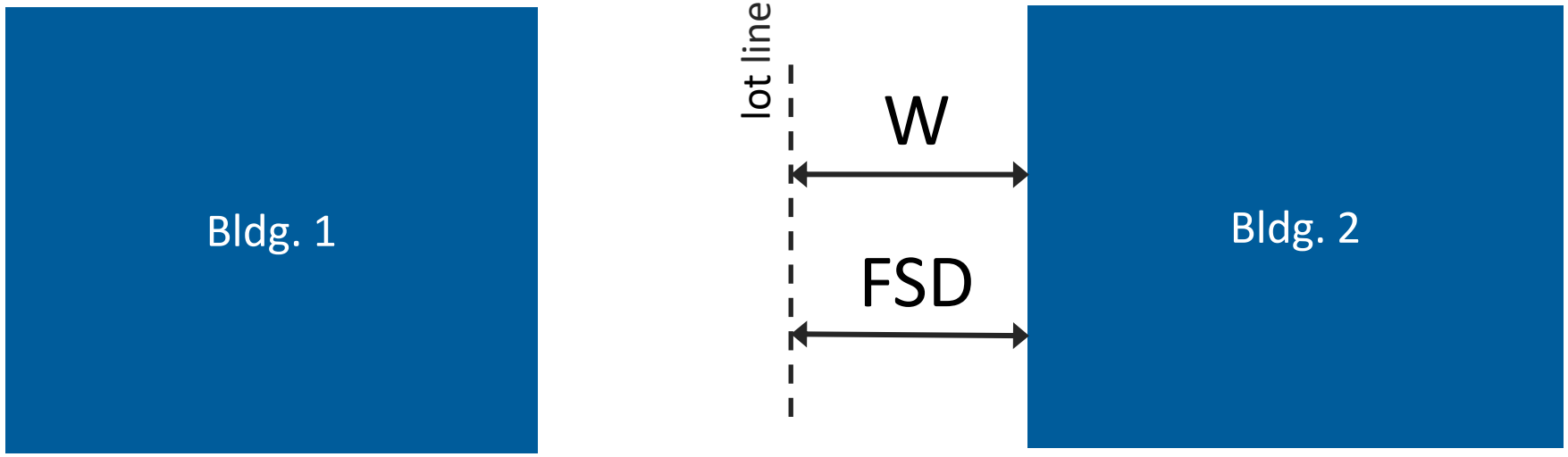


Frontage Increases – IBC 506.3.2

"W" for area increases is NOT always the same as Fire Separation Distance for purposes of fire resistance ratings of walls and openings

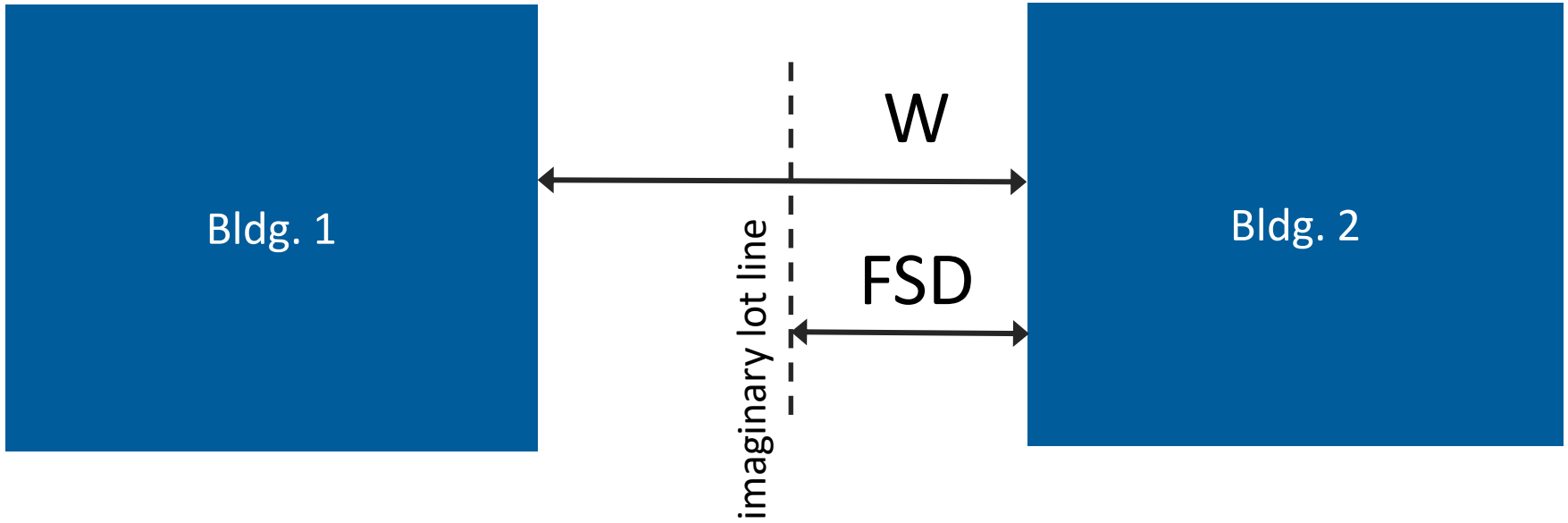
Frontage Increases – IBC 506.3.2

For two buildings on DIFFERENT lots



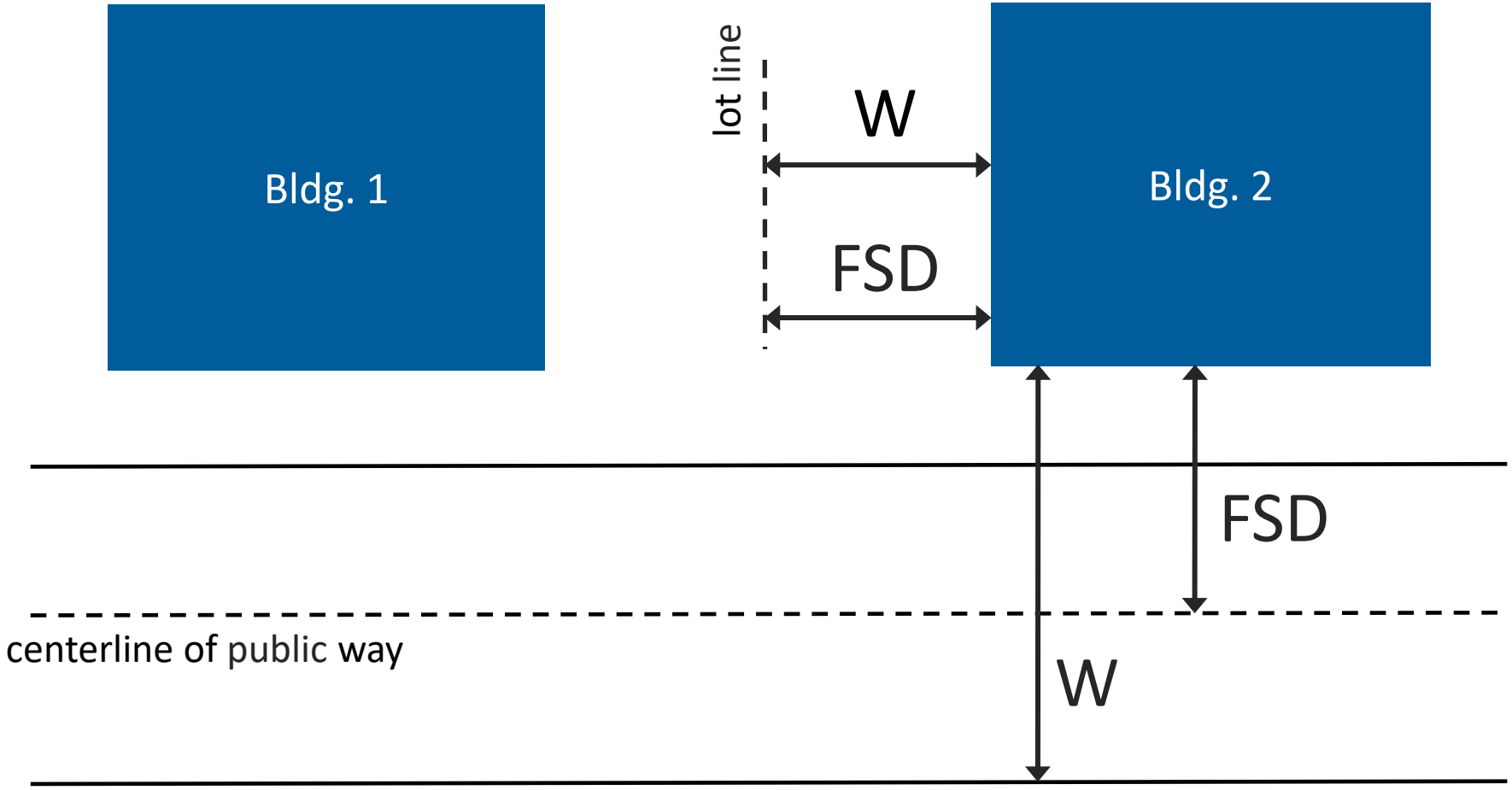
Frontage Increases – IBC 506.3.2

For two buildings on DIFFERENT lots



Frontage Increases – IBC 506.3.2

Buildings near public right of ways:



Frontage Increases – IBC 506.3.3

$$W = [(L_1 \times w_1) + (L_2 \times w_2) + (L_3 \times w_3)....]/F$$

(IBC Equation 5-4)

WHERE:

W = Calculated Width (weighted average) of public way or open space (feet)

$\mathbf{L_n}$ = Length of a portion of the exterior perimeter wall

$\mathbf{w_n}$ = Width (≥ 20 ft) of public way or open space associated with that portion of the exterior perimeter wall

F = Building perimeter that fronts on a public way or open space having 20 feet open minimum width

Area Modification – Frontage IBC 506.3

MINIMUM QUALIFICATIONS

25% min of building perimeter is on a public way or open space 20' min distance from building face to:

- Closest interior lot line
- Entire width of public way
- Exterior face of adjacent building

EXCEPTIONS

Where building meets Unlimited requirements of IBC 507

And W > 30'

W_{max} = 60'

Single Occupancy, 1 Story – 506.2.3

$$A_a = A_t + [NS \times I_f]$$

(Equation 5-1)

A_a = Allowable area per story (sq. ft.)

A_t = Tabular allowable area per story per Table 506.2 for NS, S1 or S13R (sq. ft.)

NS = Tabular allowable area per story per Table 506.2 for non-sprinklered building (sprinklered or not)

I_f = Area increase factor due to frontage per 506.3
$I_{f,\ max} = 0.75$

Allowable Building Size

IBC 506.2.3

Total Building Area

Total building allowable area = allowable area per floor times:

2 for 2 story building

3 for 3 or more story buildings

Total Building Area – 2018 IBC 506.2.3

$$A_a = [A_t + (NS \times I_f)] \times S_a$$

(Equation 5-2)

A_a = Allowable area per story (sq. ft.)

A_t = Tabular allowable area per story per Table 506.2 for NS, S1 or S13R (sq. ft.)

NS = Tabular allowable area per story per Table 506.2 for non-sprinklered building (sprinklered or not)

I_f = Area increase factor due to frontage per 506.3
I_f, max = 0.75

S_a = Actual number of building stories above grade

$S_{a,\ max}$ = Not to exceed 3 for non-sprinklered buildings and those w/ NFPA13

$S_{a,\ max}$ = Not to exceed 4 for buildings w/ NFPA 13R

Mixed Occupancy, Multi-story

Story Area: $\Sigma A/[A_t + (NS \times I_f] \leq 1$

(Described in 508.4.2)

Total Building Area: $\Sigma A/[A_t + (NS \times I_f)] \leq S_a$

(Described in 506.2.4)

A = Actual area per story (sq. ft.)

A_t = Tabular allowable area per story per Table 506.2 for NS, S1 or S13R (sq. ft.)

NS = Tabular allowable area per story per Table 506.2 for non-sprinklered building (sprinklered or not)

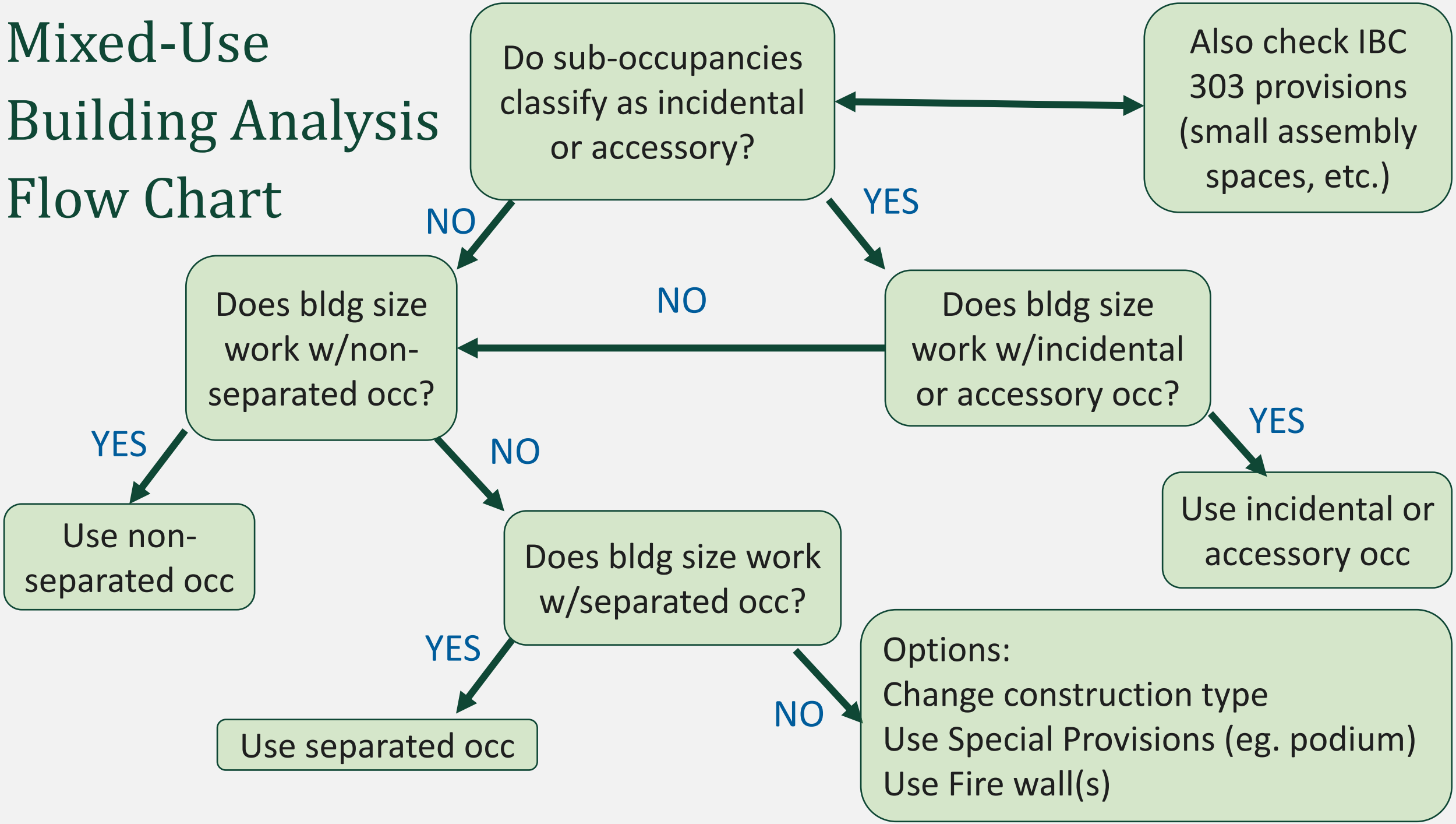
I_f = Area increase factor due to frontage per 506.3
I_f, max = 0.75

S_a = Actual number of building stories above grade

$S_{a,\ max}$ = 3 for non-sprinklered buildings and those w/ NFPA13

$S_{a,\ max}$ = 4 for buildings w/ NFPA 13R

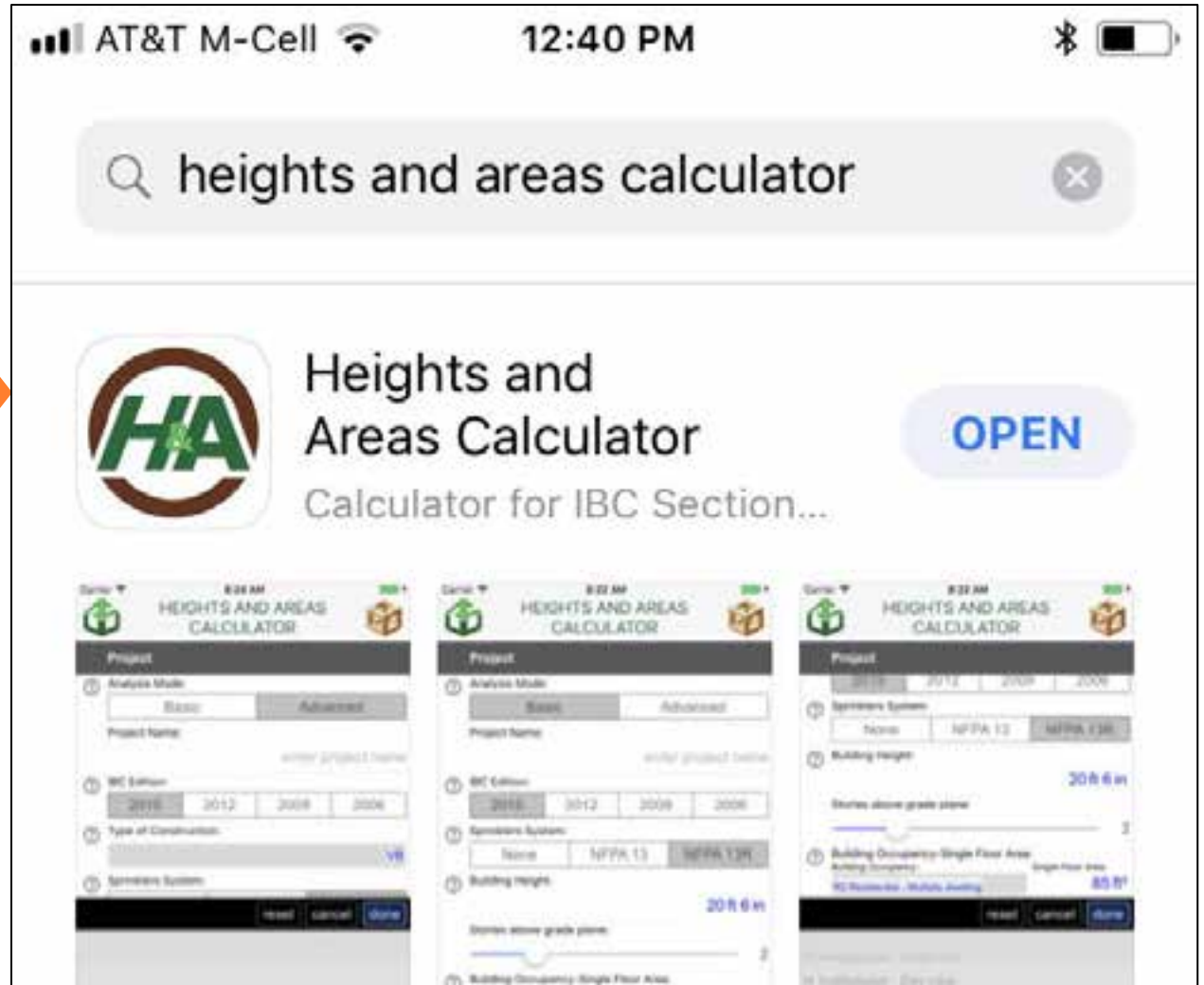
Mixed-Use Building Analysis Flow Chart



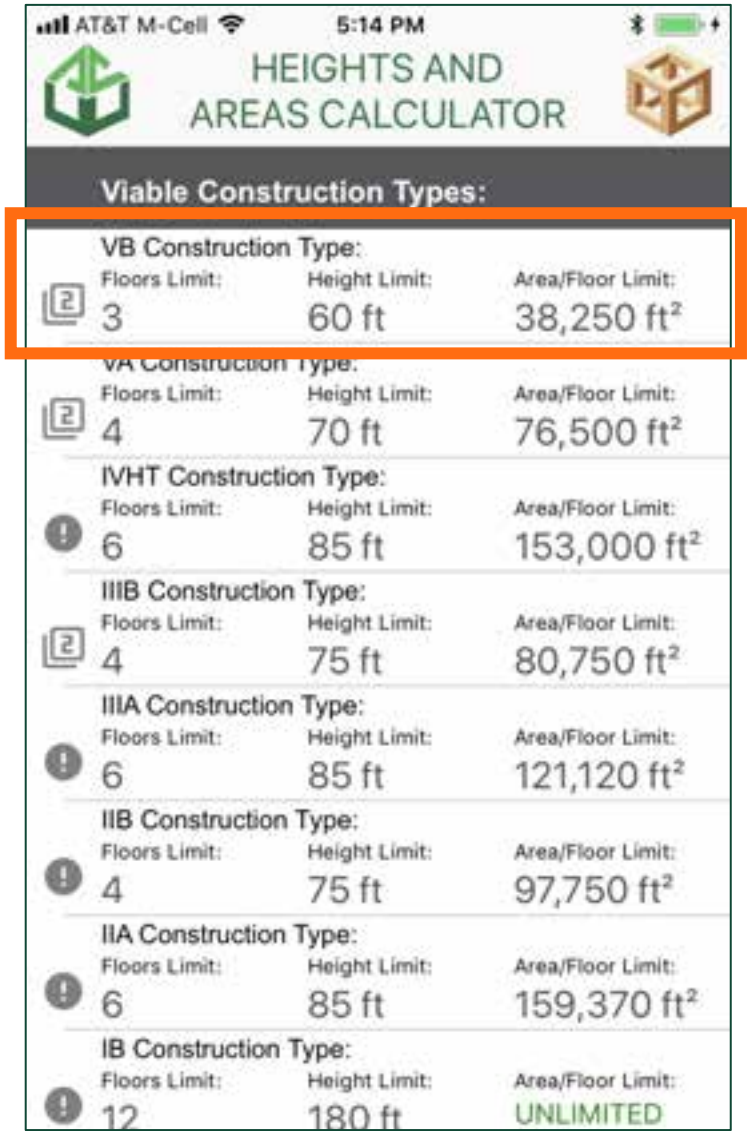
Mixed Use Occupancy – Design Aid

WoodWorks/AWC Heights & Areas Calculator App

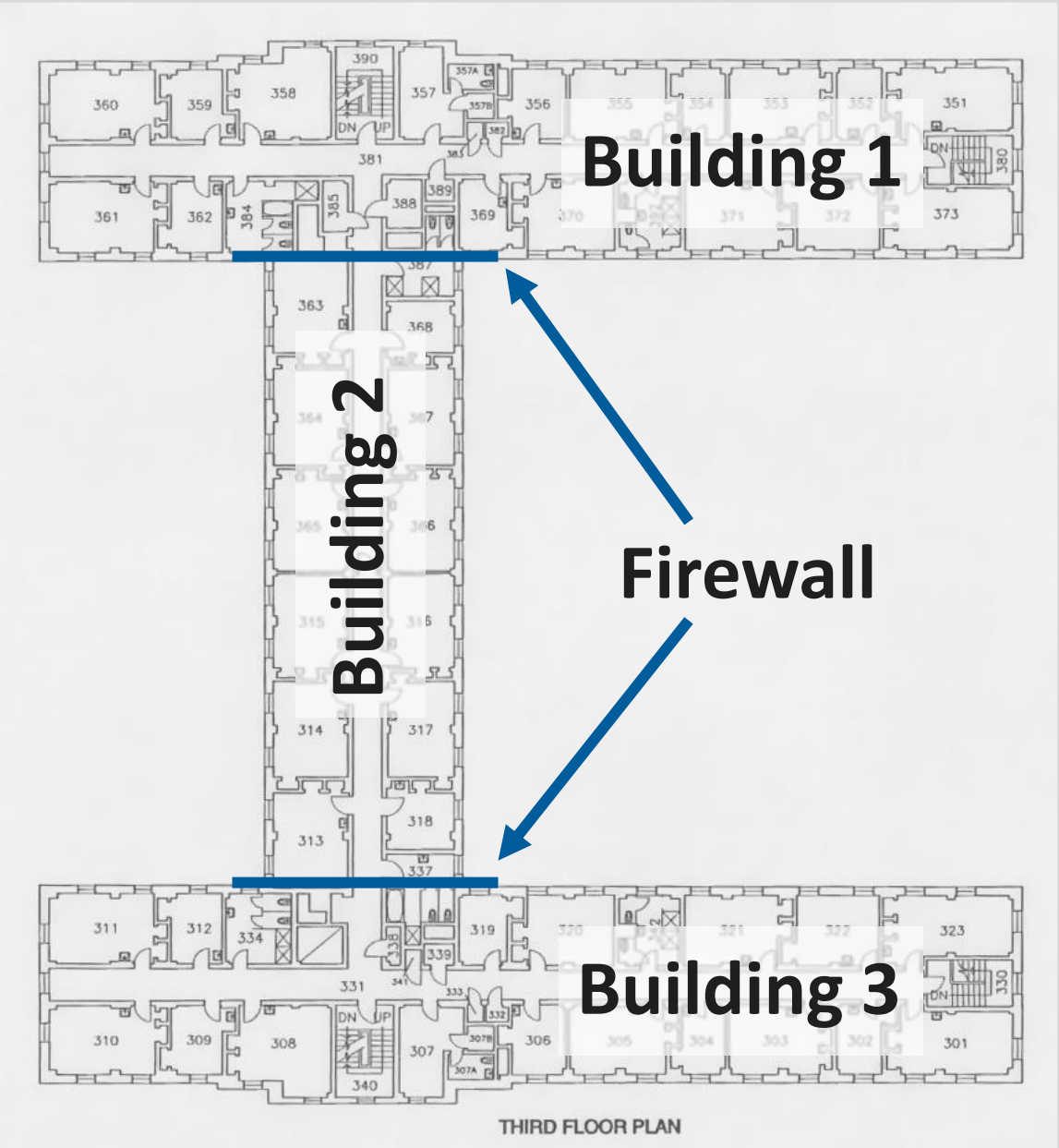
Based on 2015 IBC
Available for FREE at
woodworks.org



Frontage Calculation – Design Aid



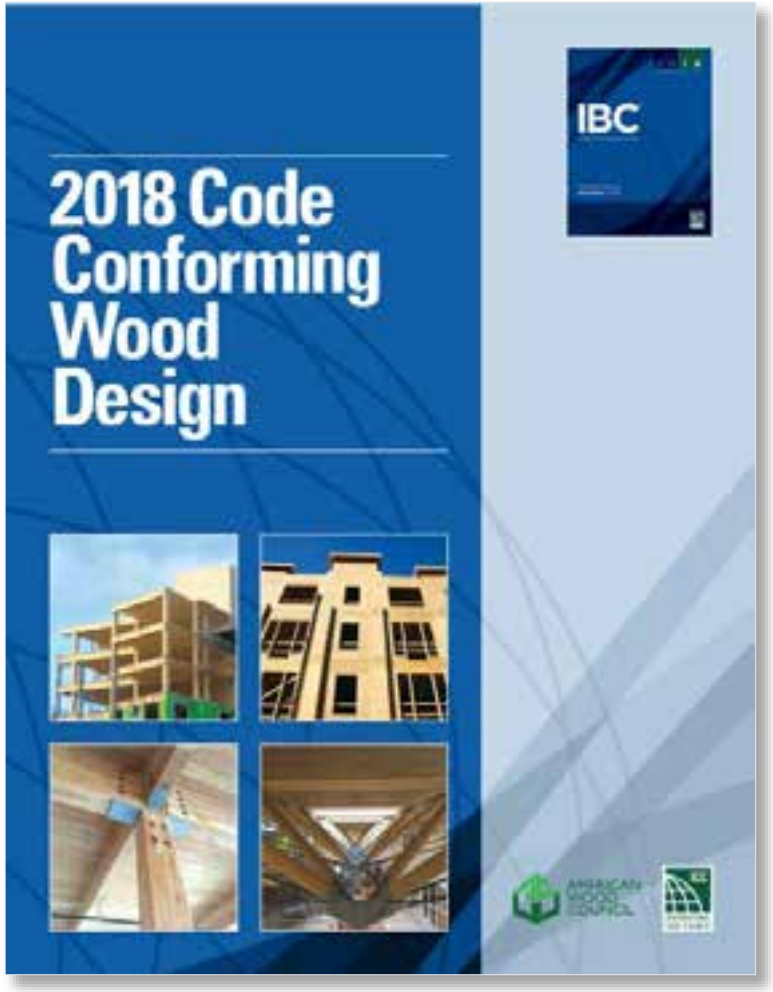
Building Configuration Options



These building configurations may lend themselves well to use of firewalls at building intersections.

Minimize length/impact of firewall while maximizing allowable building area may allow lower construction type (i.e. type IIIB instead of IIIA)

2018 Code Conforming Wood



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Available for Free Download: www.awc.org

Shrinkage Design Considerations

Designing and detailing to accommodate shrinkage is a design criteria but it doesn't need to be difficult.

With proper calculations, detailing & an understanding of how and why wood shrinks, it simply becomes a very approachable design topic

Join us on February 7th for WoodWorks Webinar: Shrinkage and Vertical Movement in Multi-Story Wood Frame Structures

Exterior Wall – Bearing vs. Non-Bearing

Non-loading-bearing exterior walls may have lower fire resistance rating requirements than bearing walls in certain situations. IBC Chapter 2 defines load bearing walls as:

[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.

[BS] **WALL, NONLOAD-BEARING.** Any wall that is not a *load-bearing wall*.

Exterior Wall – Bearing vs. Non-Bearing

Why is this important? **Fire-Resistance Ratings and $**

Fire Rating of Structural Elements	IIA	IIB	IIIA	IIIB	IV	VB
IBC Table 601						
• Exterior bearing walls *(hours)*	1	0	2	2	2	0
• Interior bearing walls *(hours)*	1	0	1	0	1	0
• All other elements *(hours)*	1	0	1	0	HT	0
IBC Table 602						
• X < 10 feet	1	1	1	1	1	1
• 10 ft ≤ X < 30 feet	1	0	1	0	1	0
• X ≥ 30 feet	0	0	0	0	HT	0

Credit: WoodWorks

Type III:

Exterior Bearing Wall = **2-hours**

Exterior non-Bearing Wall = varies but often **0-hours**

Type III Exterior Walls – FRT

Type III 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

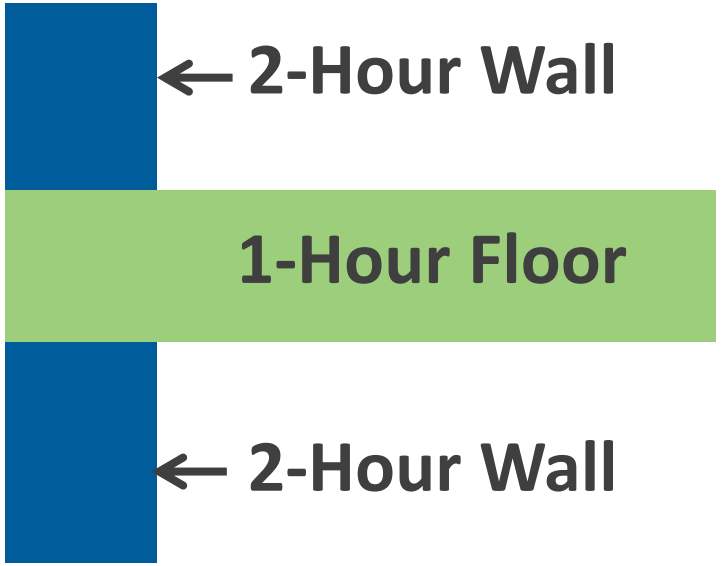
What does this FRTW requirement include?

- Wall Framing (Studs & Plates) – Yes
- Headers – Yes
- Wall Sheathing – Yes
- Floor sheathing - ?
- Rim Joist- ?
- Floor Joists- ?


Credit: WoodWorks

Intersection of Tested Assemblies

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



Exterior Walls – Intersecting Floors

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.

Relocated

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 – Structural Stability

IBC 705.6 Structural Stability:

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.

Code Commentary - 2018 IBC 705.6

❖ Structural stability of fire-resistance-rated construction is an important concern. Section 705.6 requires elements providing bracing support to be fi
tance rated for the same duration of time as t
rior wall. In light-frame platform construction,
require that the band joist or beam suppor
floor and the wall above to also be of fire-
construction. Although the floor constructi
may not be required to be of fire-resistan
construction in Type IIB and VB constructio
effort must be made to ensure that the floor
least at the exterior wall, are of fire-resista
construction. Although the floor framing acts
eral support for the exterior wall, this section
require that the entire floor system be of fi
tance-rated construction. To state otherwise would prohibit Type IIB and VB buildings with an FSD of less than 10 feet (3048 mm). Only the structural element within the floor system that supports the vertical load of the wall must be of fire-resistance-rated construction.

"In light-frame platform construction, this will require that the **band joist or beam supporting the floor and the wall above to also be of fire-resistant construction**…. Although the floor framing acts as a lateral support for the exterior wall, **this section does not require that the entire floor system be of fire-resistance rated construction**."

IBC 2024 Changes: Floor to Wall Intersections

Two key changes that have been approved for inclusion in the 2024 IBC clarify platform framed floor to wall details

Code change 1: clarifies fire-resistance continuity requirements for exterior walls:

2021 International Building Code

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

IBC 2024 Changes: Floor to Wall Intersections

2021 International Building Code

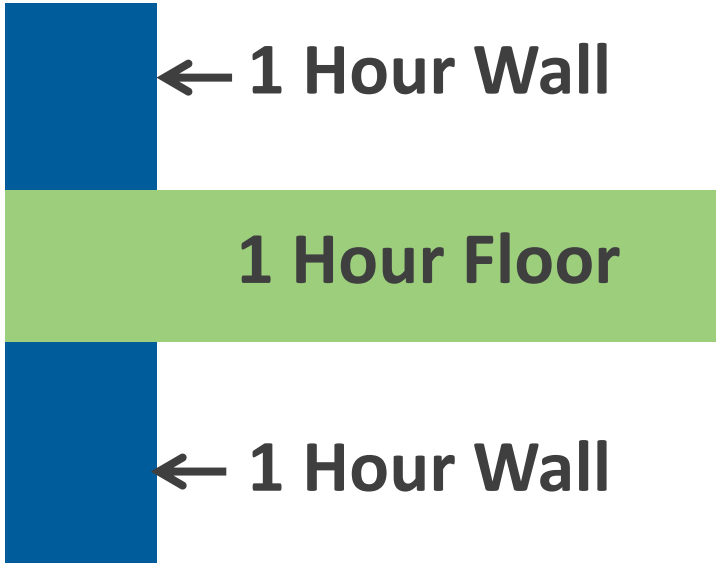
705.6 Continuity . The fire-resistance rating of exterior walls shall extend from the top of the foundation or floor/ceiling assembly below to one of the following:

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

Example 1: Type VA Construction, Group R-2

1-hour exterior wall, 1-hour floor

Fire-resistance rating extends from the top of the floor/ceiling assembly below to the underside of an assembly having a fire-resistance rating equal to the exterior wall



IBC 2024 Changes: Floor to Wall Intersections

2021 International Building Code

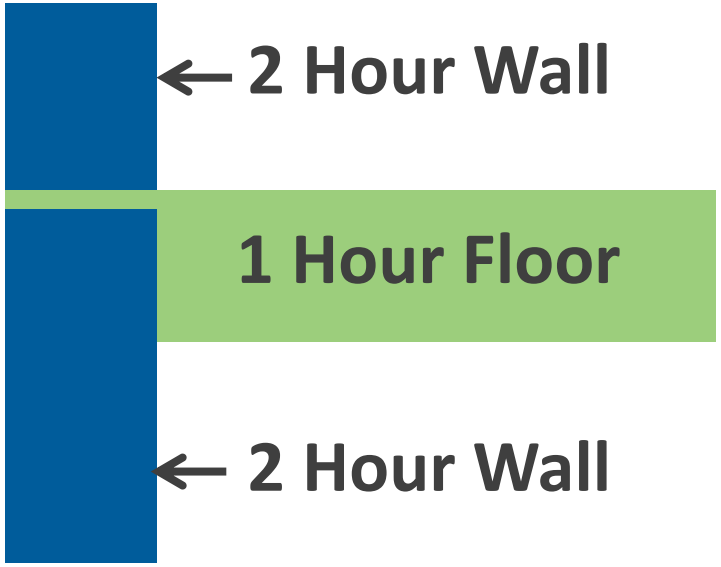
705.6 Continuity . The fire-resistance rating of exterior walls shall extend from the top of the foundation or floor/ceiling assembly below to one of the following:

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

Example 2: Type IIIA Construction, Group R-2

2-hour exterior wall, 1-hour floor

Fire-resistance rating extends from the top of the floor/ceiling assembly below to the underside of the floor sheathing above

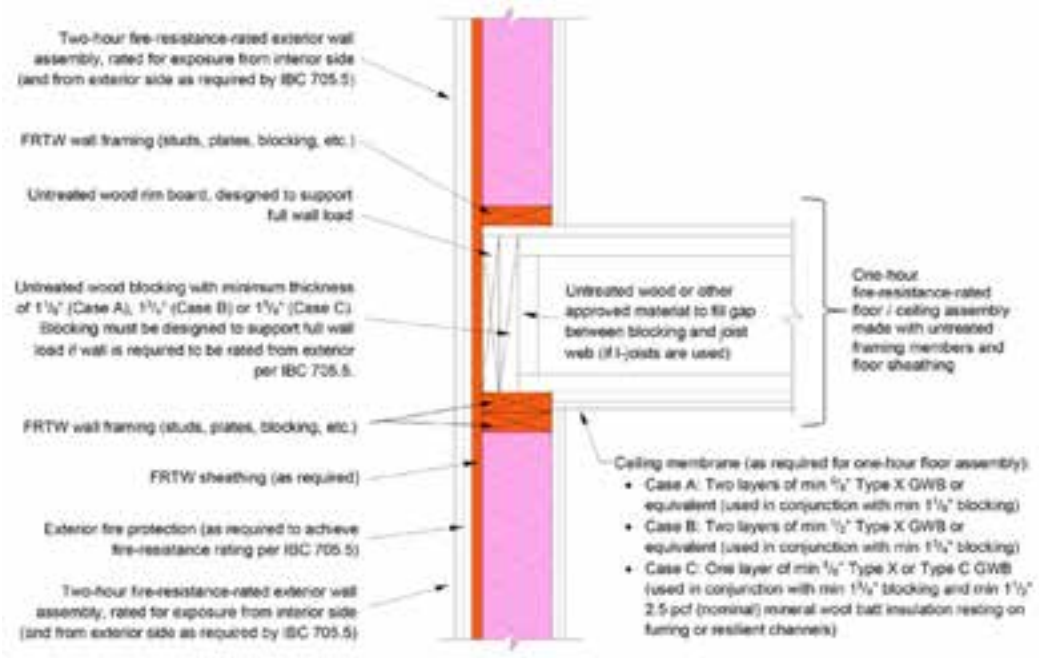


IBC 2024 Changes: Floor to Wall Intersections

Example 3: Type IIIA Construction, Group R-2

2-hour exterior wall, 1-hour floor

Since FRR of exterior wall is greater than FRR of floor, the exterior wall's FRR must extend to the underside of the floor sheathing. As noted previously, this doesn't mean that the wall needs to fully bypass the floor, but we do need to demonstrate the wall's 2-hour FRR through the depth of the floor.



IBC 2024 Changes: Floor to Wall Intersections

Two key changes that have been approved for inclusion in the 2024 IBC clarify platform framed floor to wall details.

Code change 2: clarifies material requirements for floor construction at exterior walls intersections (i.e. does floor sheathing, joists, rim board at exterior walls in Type III Construction need to be FRTW?):

705.6.1 ~~Supporting construction~~ Floor Assemblies in Type III Construction . ~~Construction that~~ In Type III construction where a floor assembly supports gravity loads from ~~fire-resistance-rated exterior walls shall have a fire-resistance rating that is equal to or greater than the required fire resistance rating of the supported wall. For achieving the required fire resistance rating for exposure from the interior of the building, ceiling materials shall be permitted to contribute to the required fire-resistance of the supporting construction.~~ an exterior wall, the fire-resistance rating of the portion of the floor assembly that supports the exterior wall shall not be 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 Changes: Floor to Wall Intersections

705.6.1 ~~Supporting construction~~ Floor Assemblies in Type III Construction . ~~Construction that~~ In Type III construction where a floor assembly supports gravity loads from ~~fire-resistance-rated exterior walls shall have a fire-resistance rating that is equal to or greater than the required fire resistance rating of the supported wall. For achieving the required fire resistance rating for exposure from the interior of the building, ceiling materials shall be permitted to contribute to the required fire-resistance of the supporting construction.~~ an exterior wall, the fire-resistance rating of the portion of the floor assembly that supports the exterior wall shall not be 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.

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.

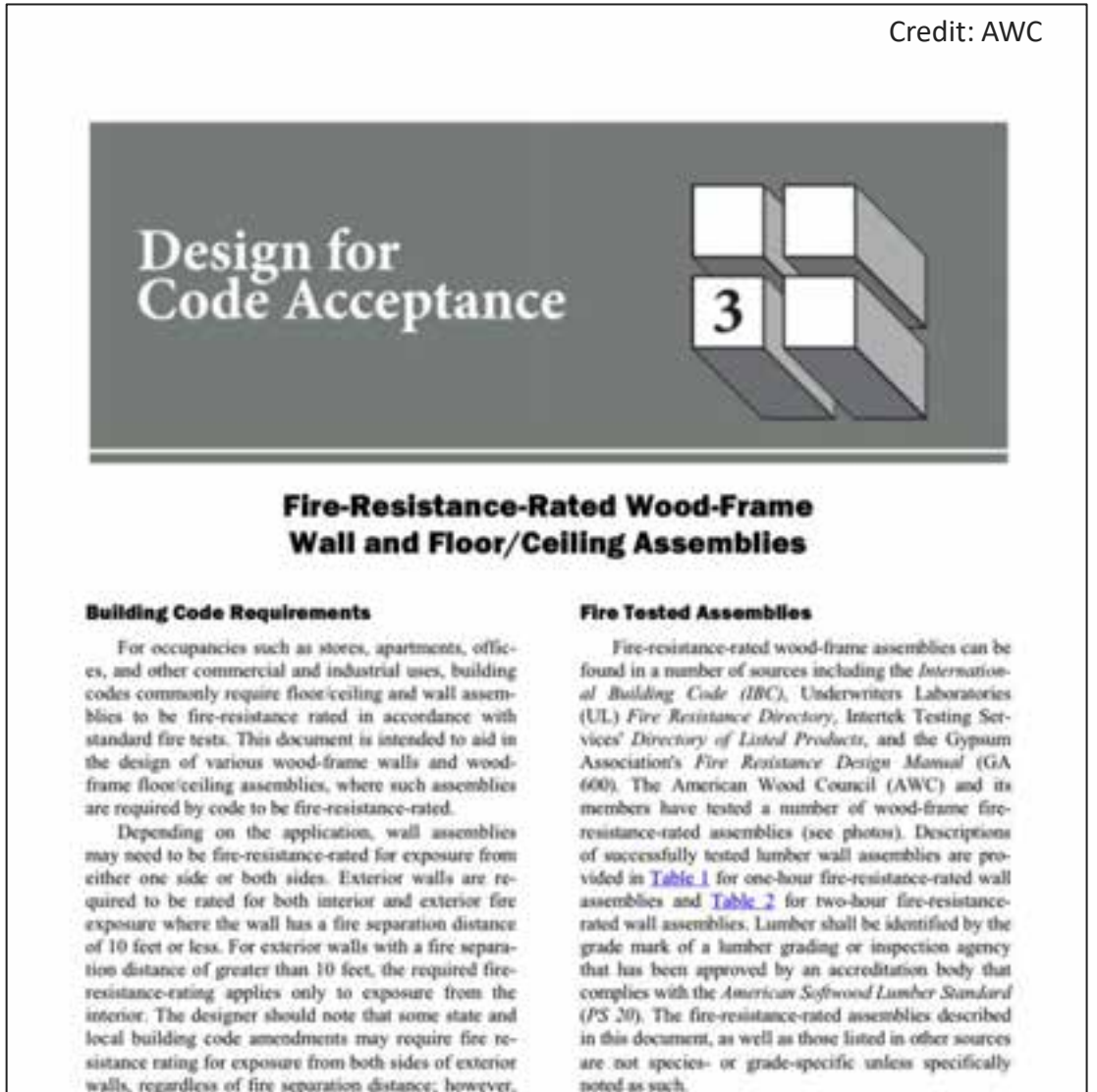
Interior building elements (floor construction) in Type III is not required to be FRTW

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

Credit: AWC



Design for Code Acceptance

3

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,

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.

Exterior Walls – Intersecting Floors

Credit: AWC

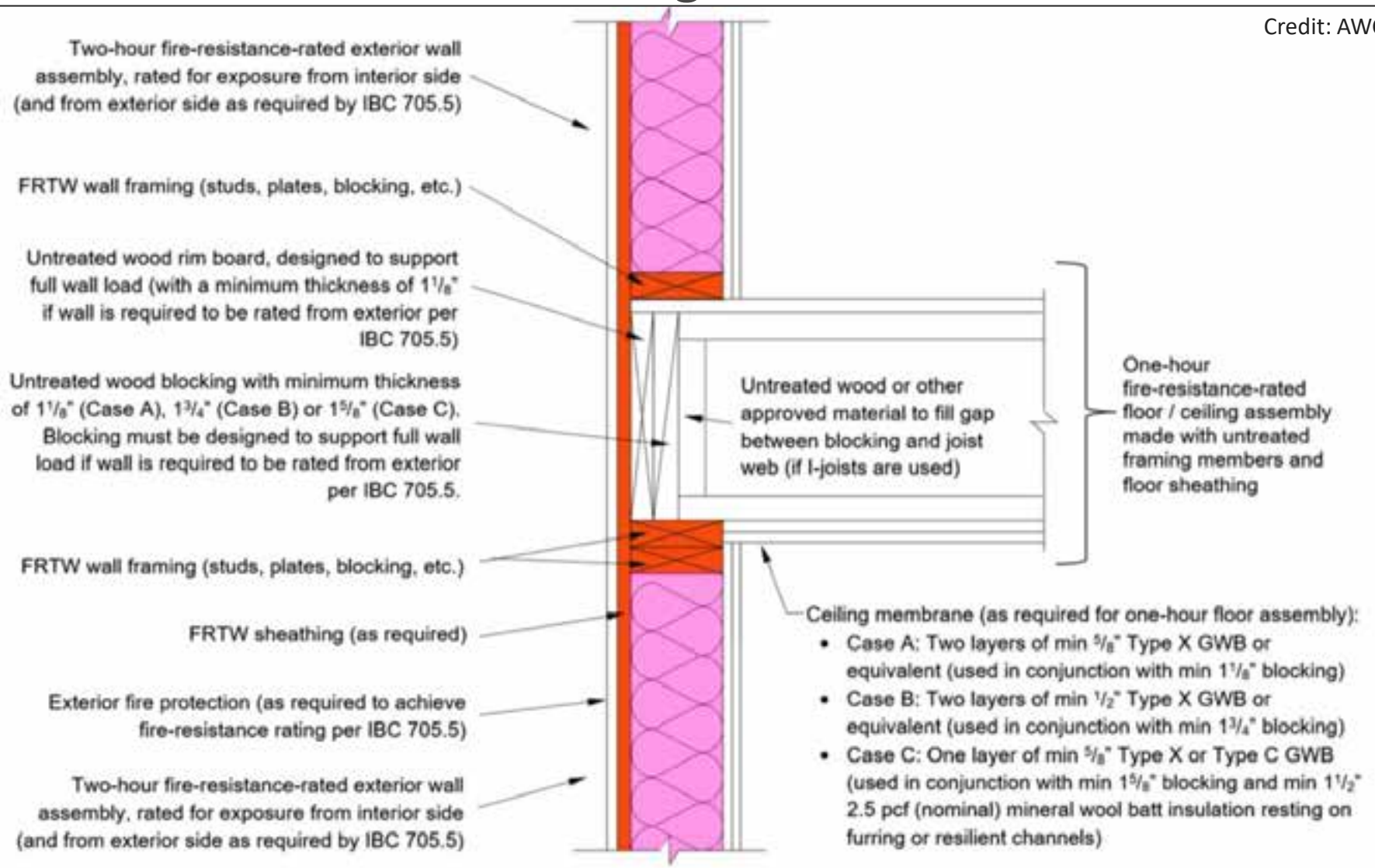


Figure 1A: Example detail for Type III-A exterior wall–floor intersection with rim board and blocking

Exterior Walls – Intersecting Floors

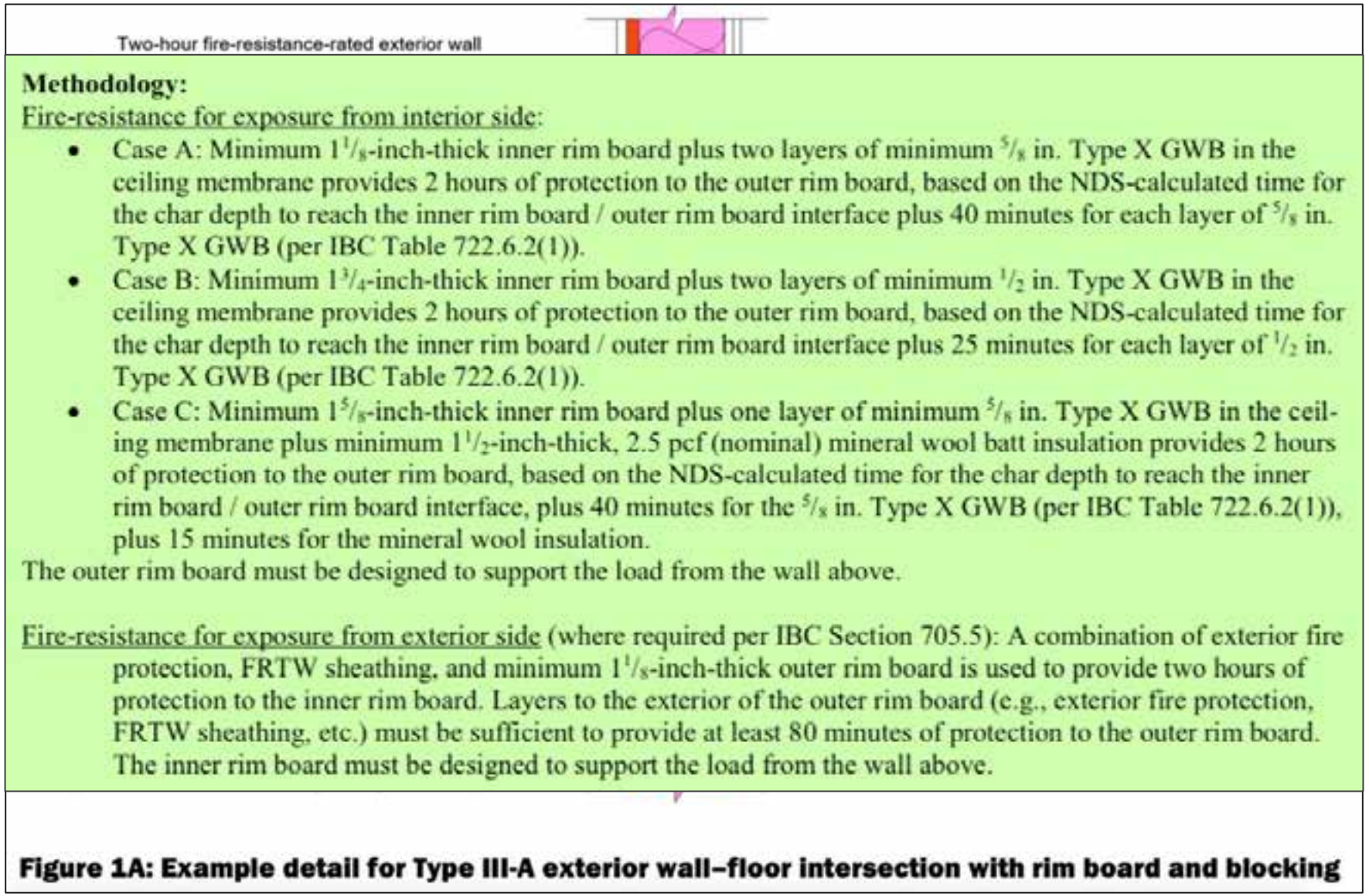
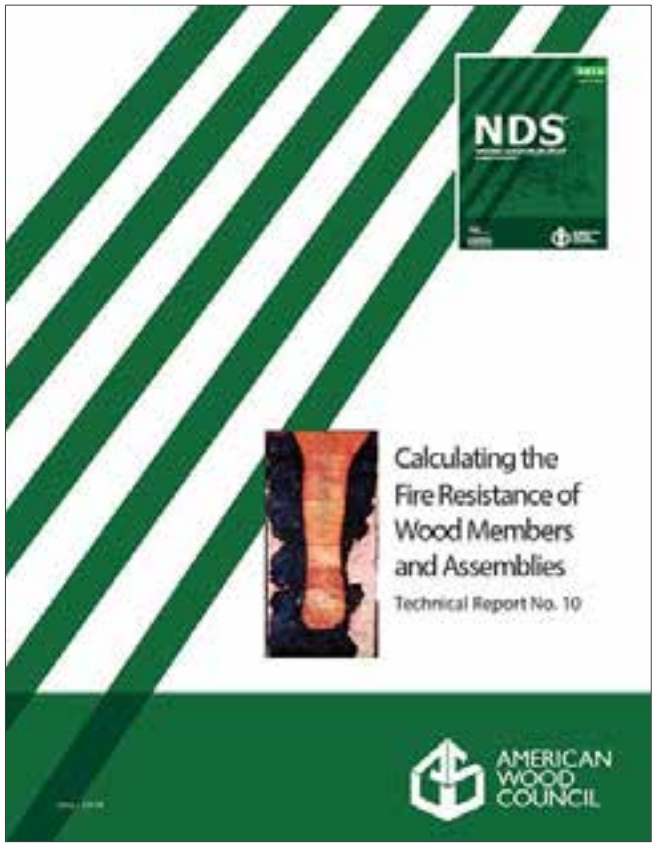


Figure 1A: Example detail for Type III-A exterior wall–floor intersection with rim board and blocking

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

ACCOUNTS FOR NON-CHARRED STRENGTH RED'N

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

CHAR SLOWS WITH TIME: NONLINEAR

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)

Sectional Examples:
Exterior Walls – Intersecting Floors

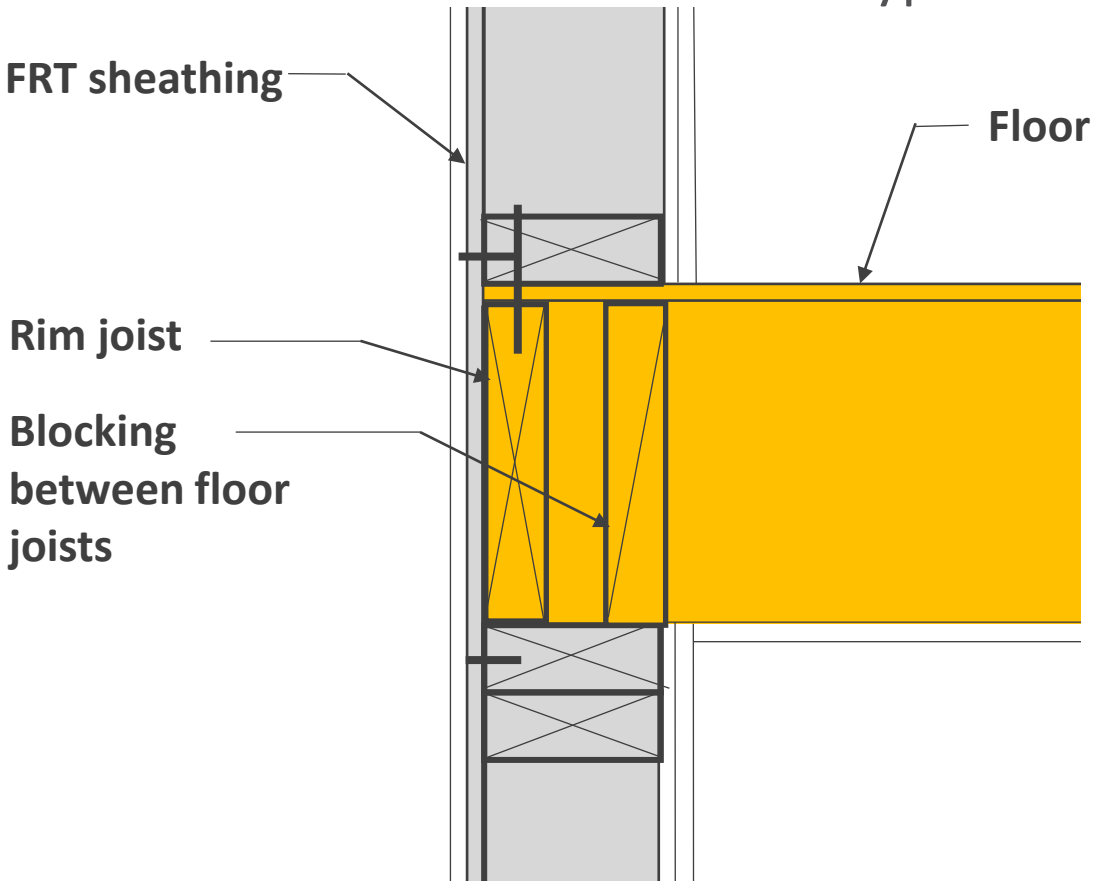
Please note that the following details are examples of what we have seen used on projects and do not necessarily represent details that will be accepted and applicable in all jurisdictions and to all projects.

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 III Construction: 2-hr Wall, 1-hr Floor
Typical Platform Framing



Floor Joist Options:
- **Solid Sawn**
- **Trusses**
- **I-Joists**

Legend

Untreated or FRT

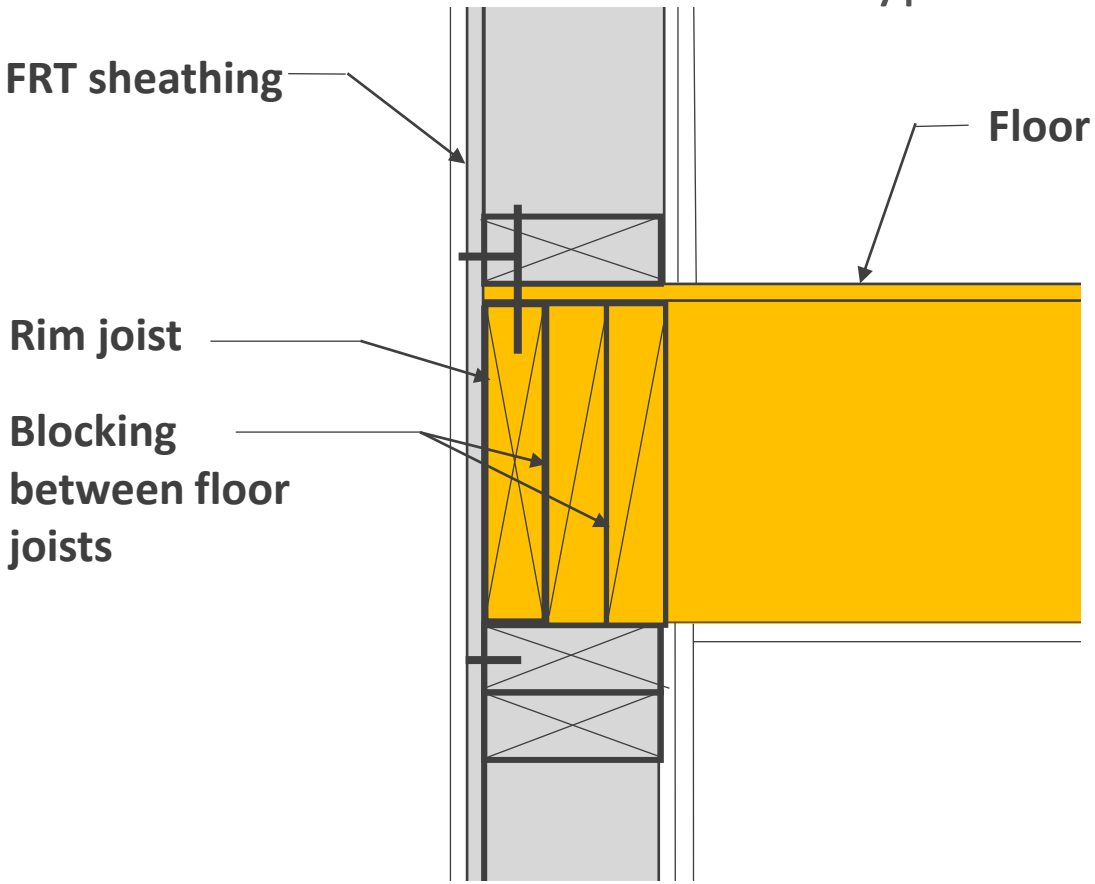
FRT Wood

Considerations:
- Shrinkage of rim, plates, joists

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



Floor Joist Options:
- **Solid Sawn**
- **Trusses**
- **I-Joists**

Legend

Untreated or FRT

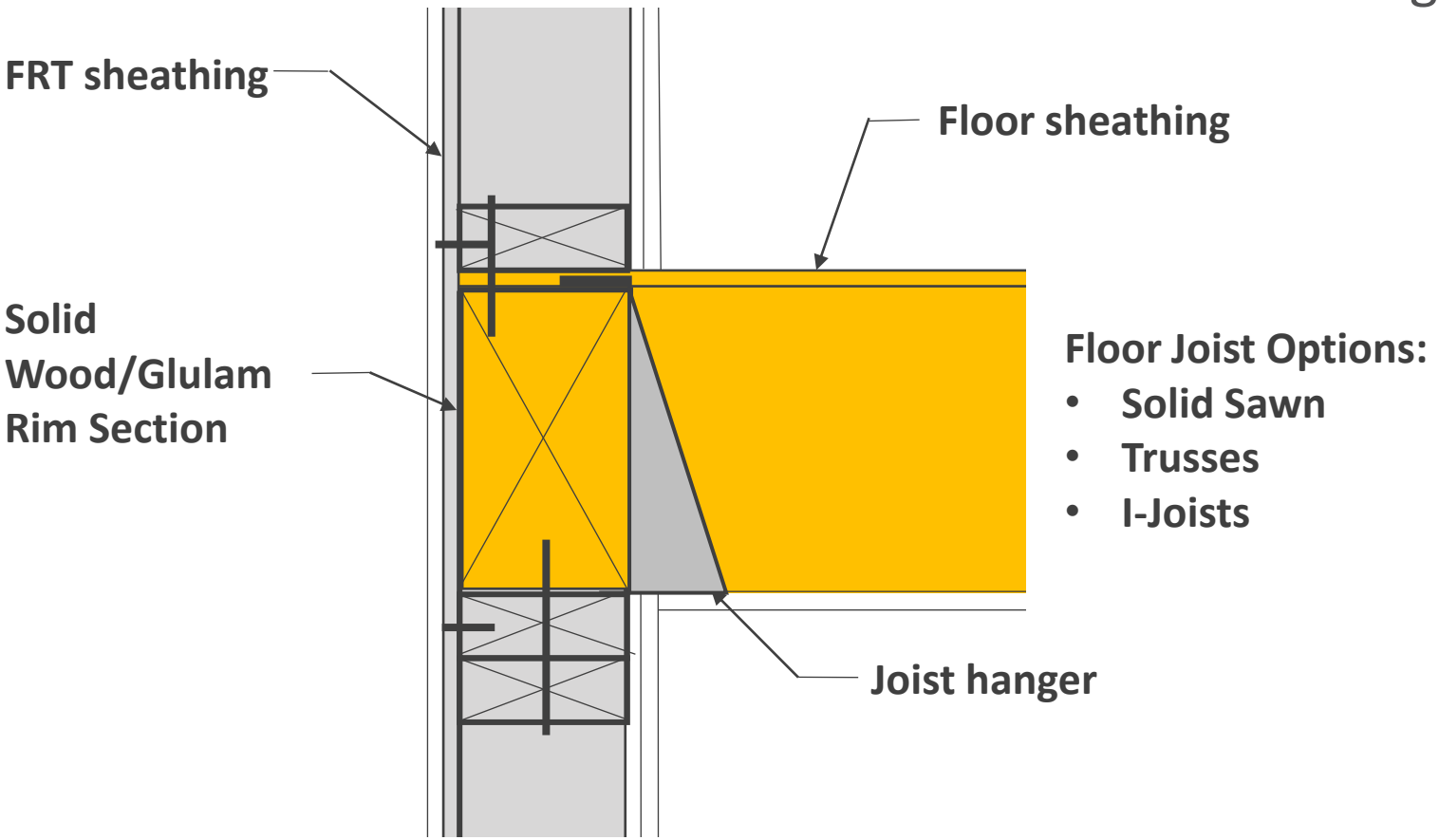
FRT Wood

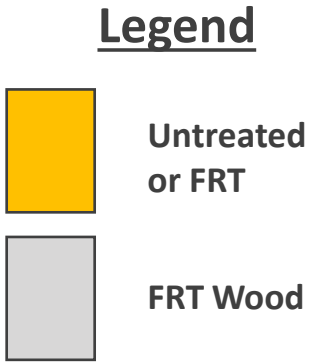
Considerations:
- Shrinkage of rim, plates, joists

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 of rim, plates, joists

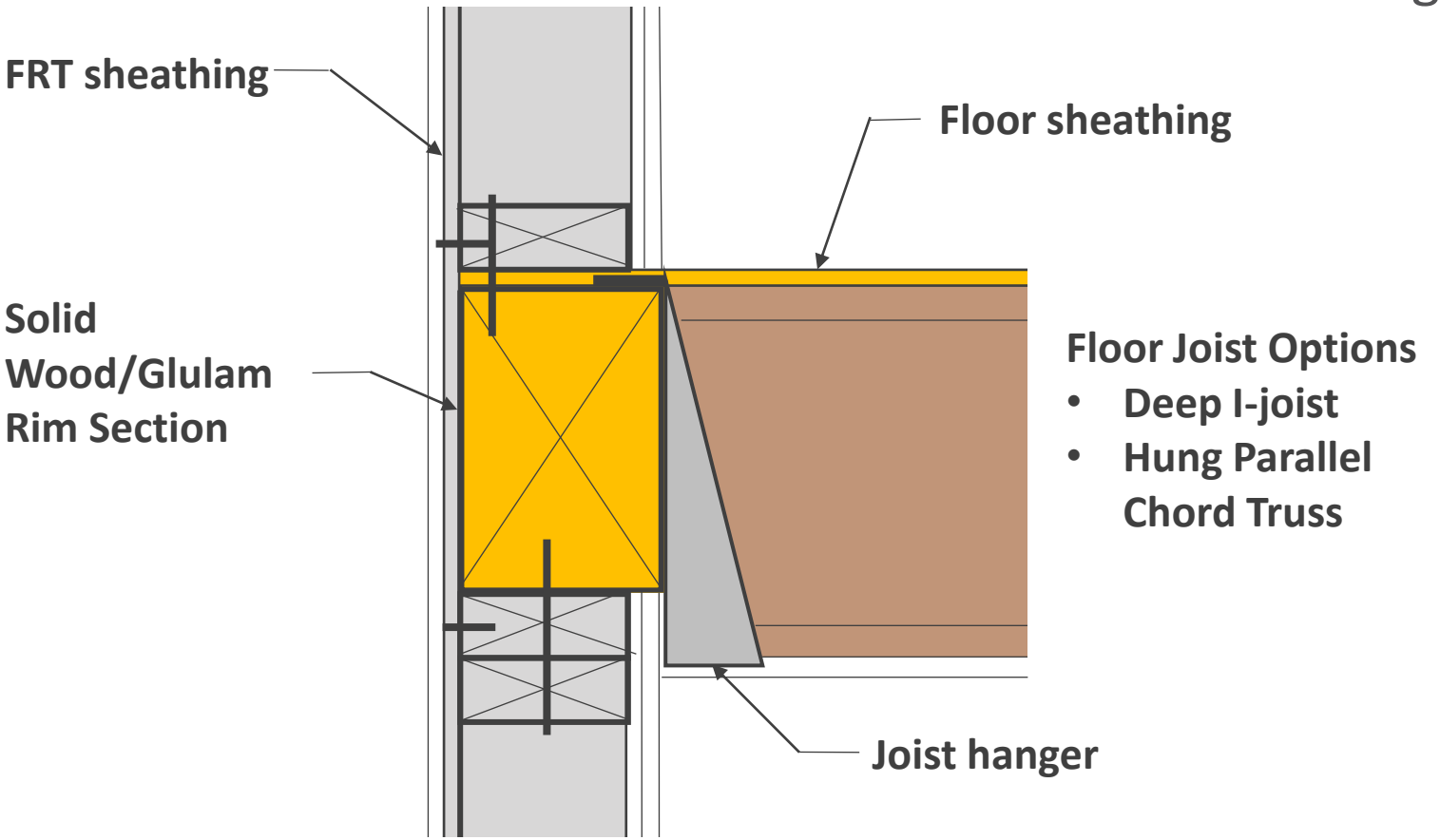
Rationale for detail approval:

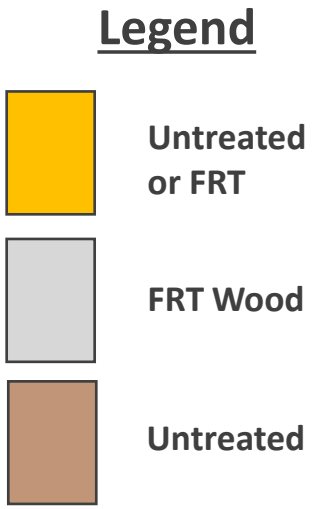
» Membranes on both side of wall provide fire resistance via their approved assembly

» At floor cavity, 4x rim provides 2-hr protection through char calculations

Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor
Modified Platform Framing



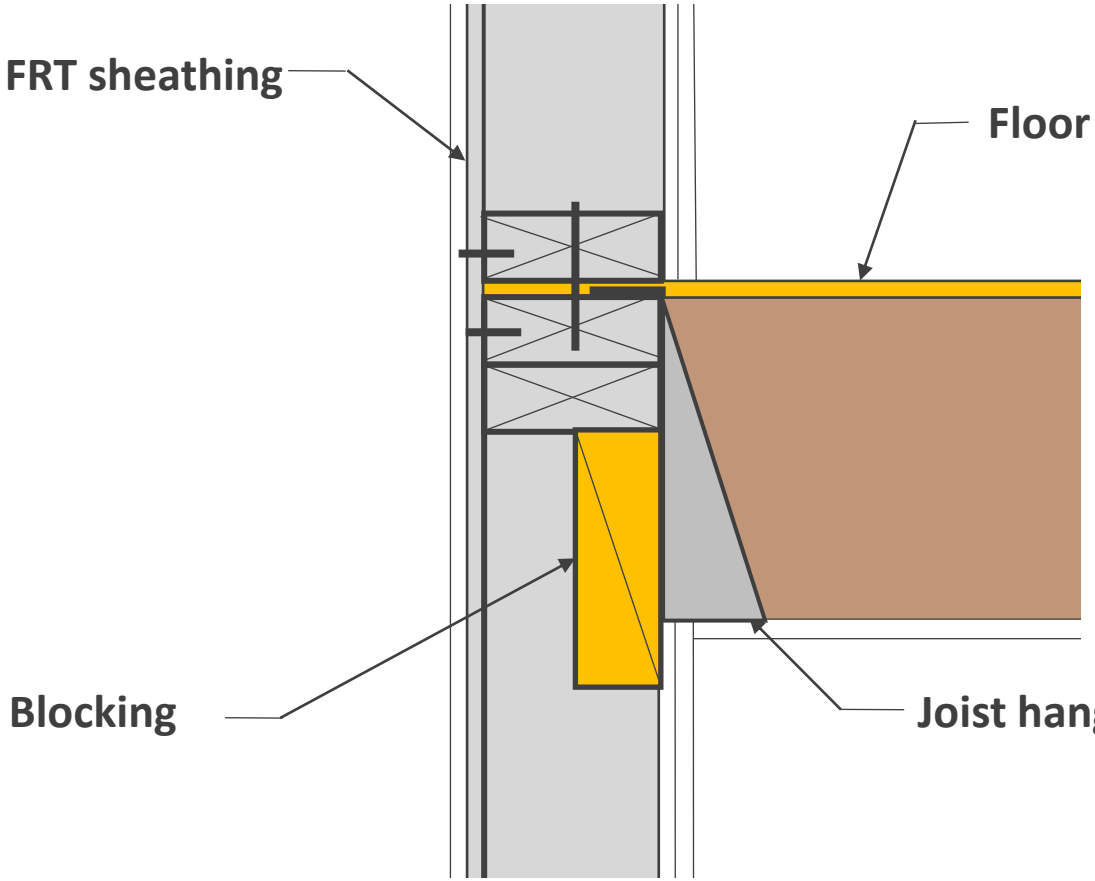


Rationale for detail approval:

- 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

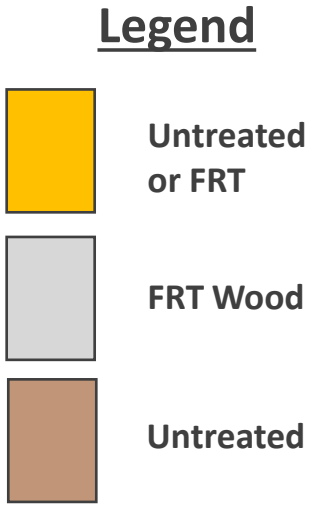
Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor
Semi-Balloon Framing



Floor Joist Options:

- **Solid Sawn**
- **Trusses**
- **I-Joists**

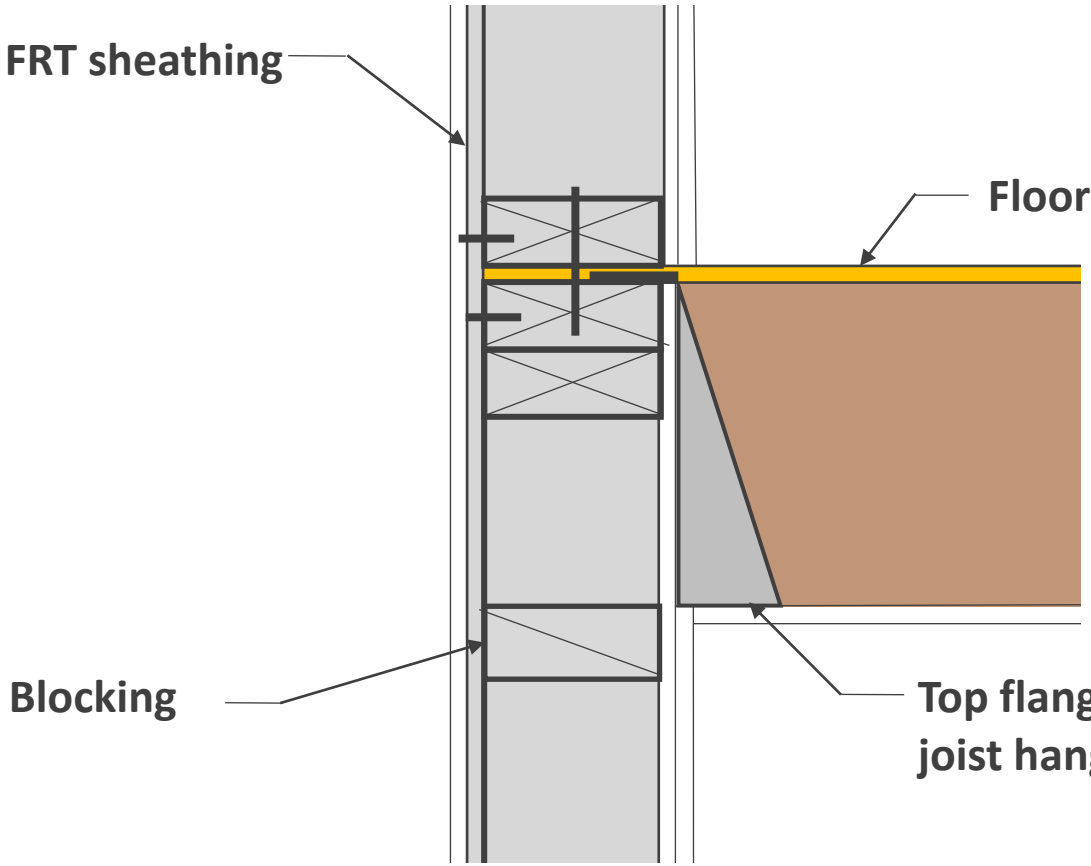


Rationale for detail approval:

- 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



Floor Joist Options:

- **Solid Sawn**
- **Trusses**
- **I-Joists**

Legend

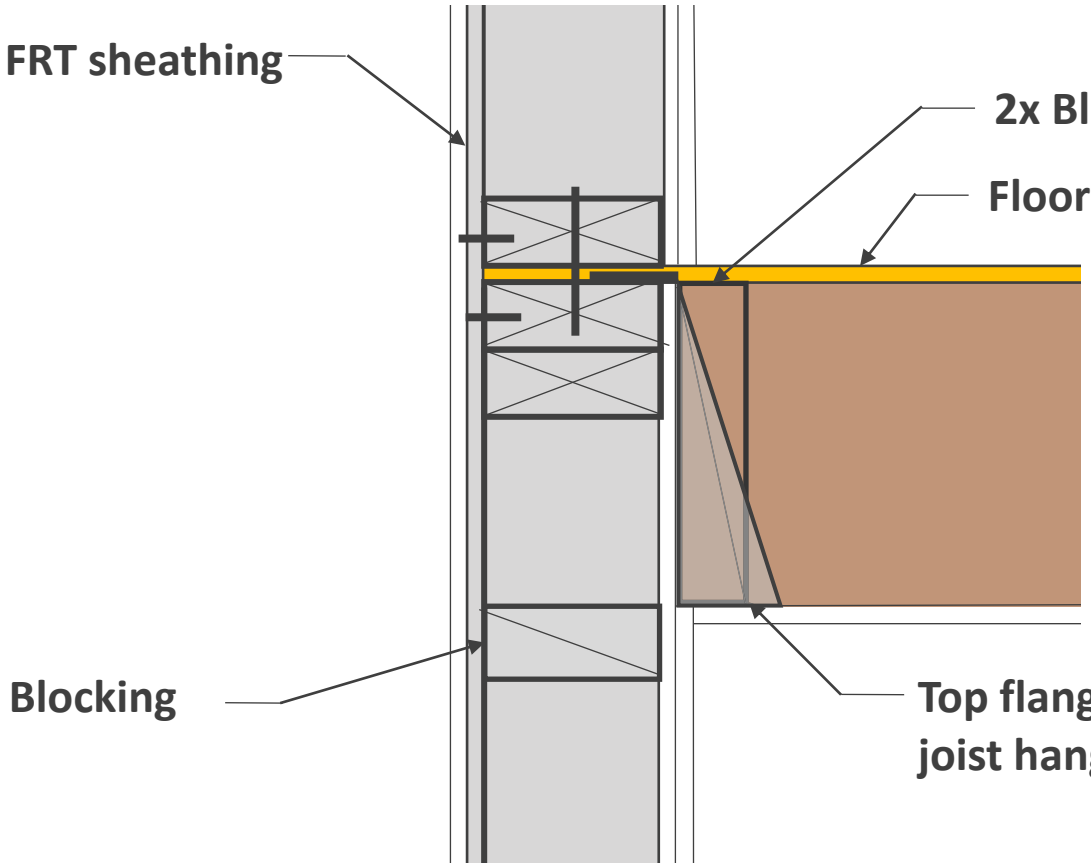
- Untreated or FRT
- FRT Wood
- Untreated

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



Floor Joist Options:

- **Solid Sawn**
- **Trusses**
- **I-Joists**

Legend

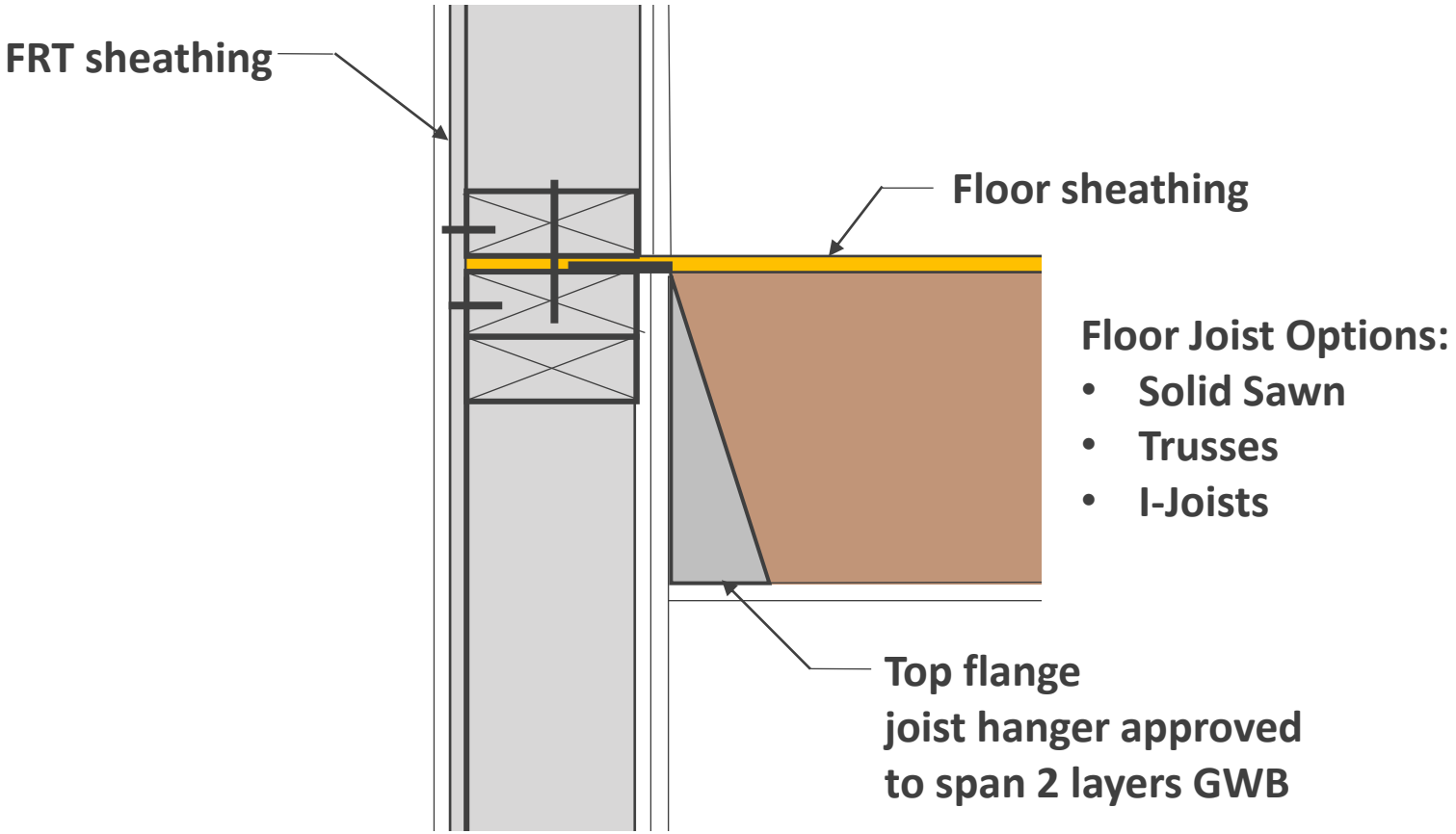
- Untreated or FRT
- FRT Wood
- Untreated

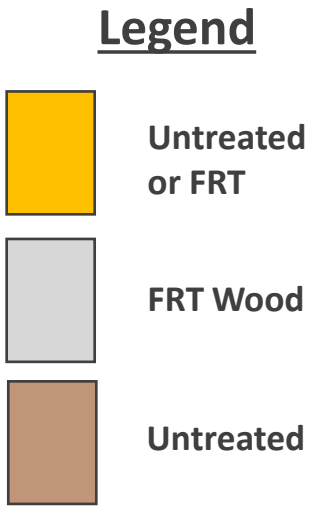
Rationale for detail approval:

- 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



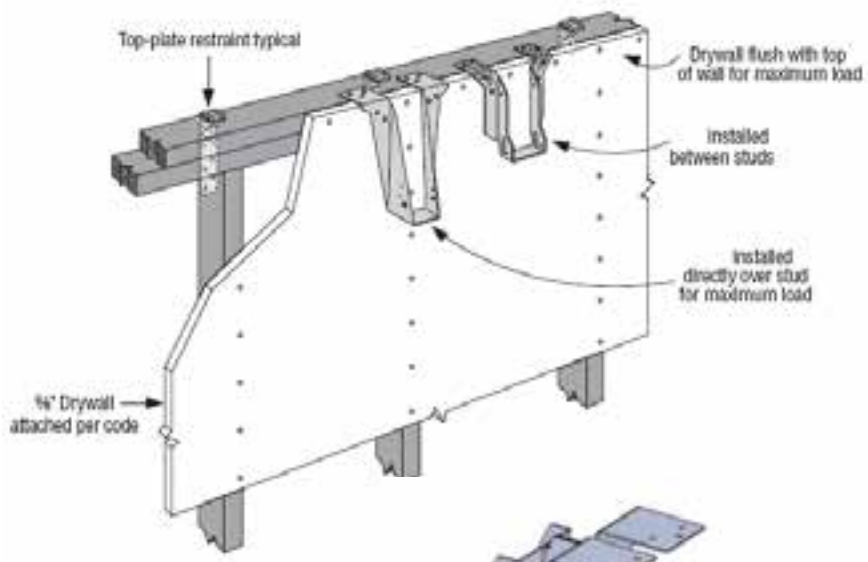


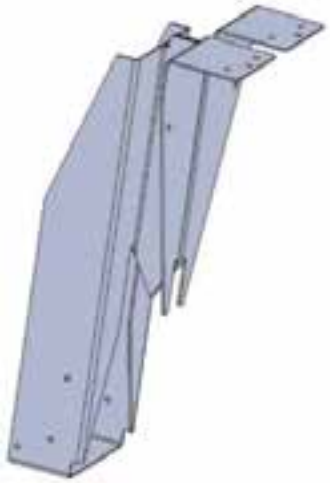
Rationale for detail approval:

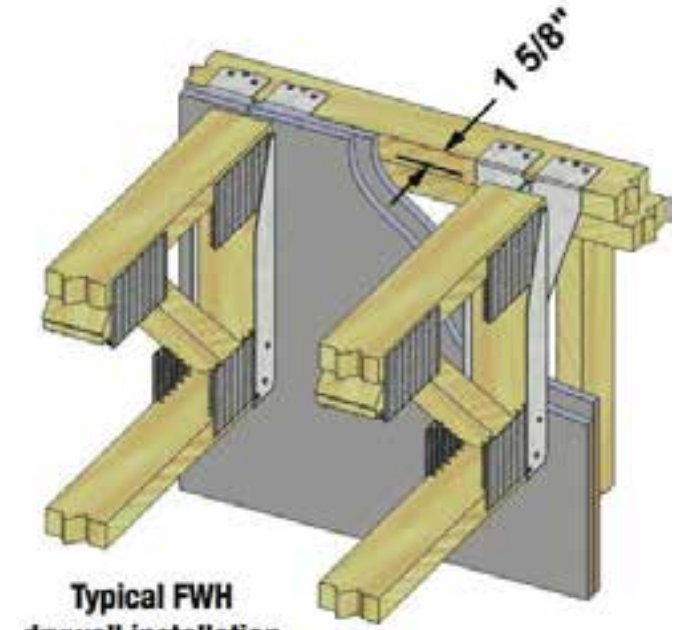
» Membranes on both side of wall provide fire resistance via their approved assembly

Over Gypsum Hangers

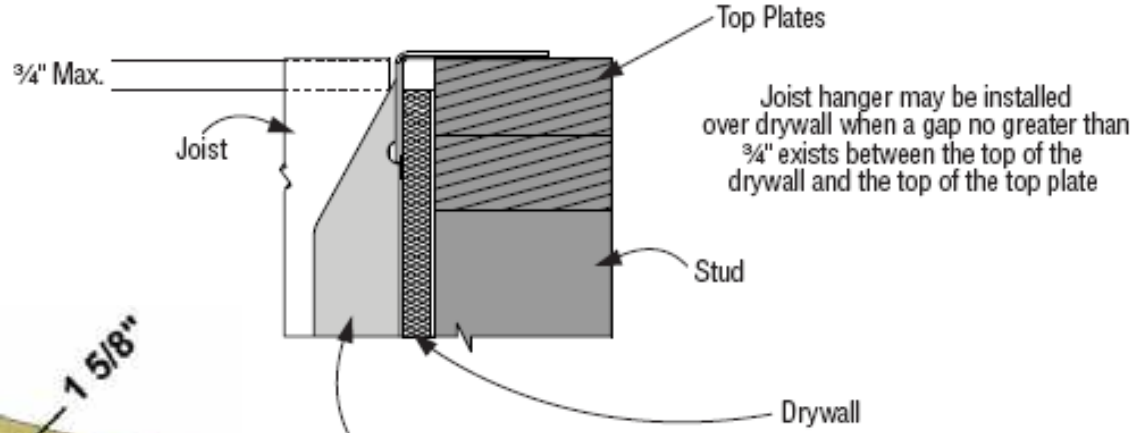
Commonly called Fire Wall or Drywall Hangers

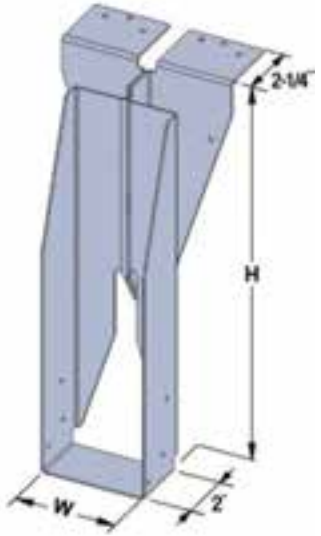






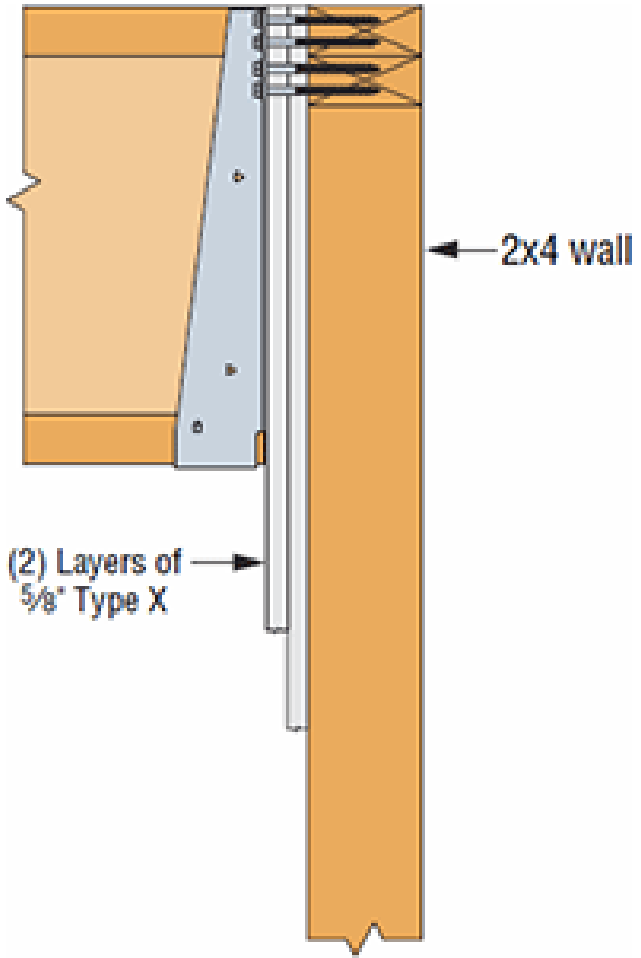
Typical FWH drywall installation using FWH-T Template

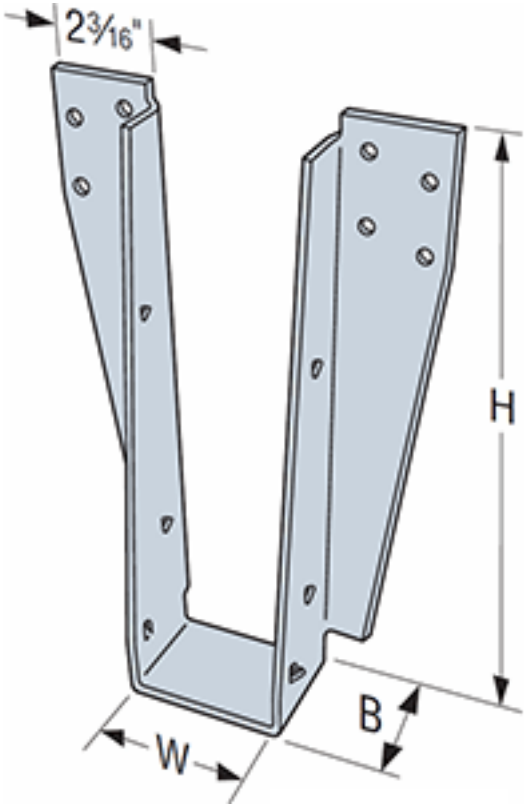




Over Gypsum Hangers

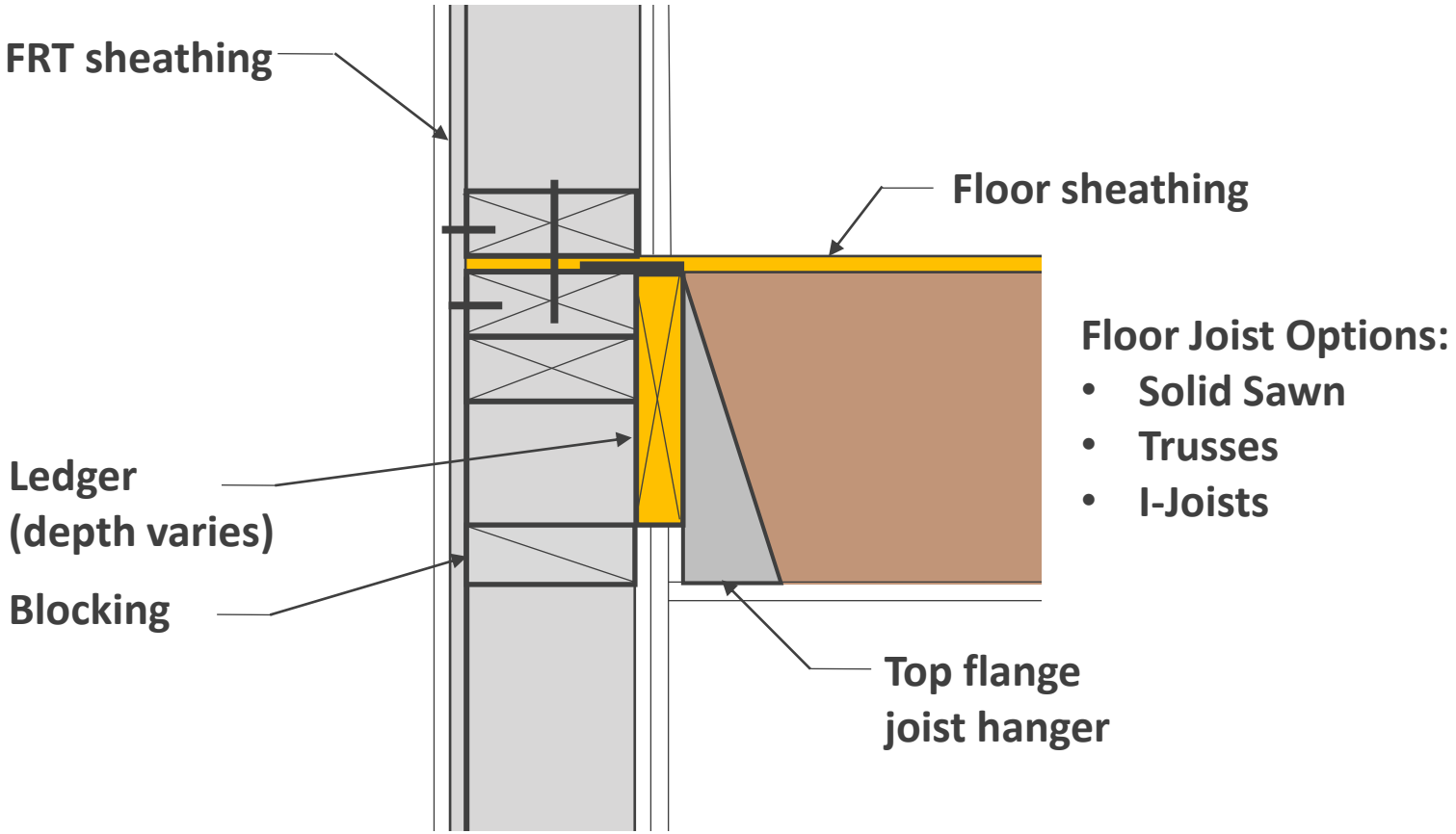
Top Flange Hangers & Face Mount Hangers Available

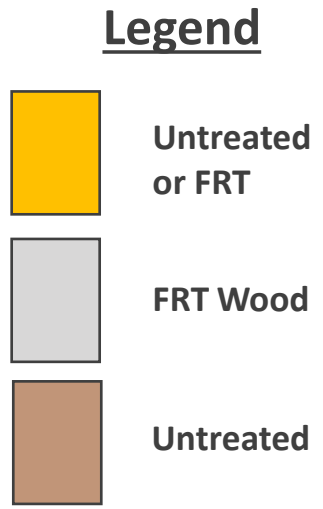




Exterior Walls – Intersecting Floors

Type III Construction: 2-hr Wall, 1-hr Floor
Semi-Balloon Framing w/ Ledger





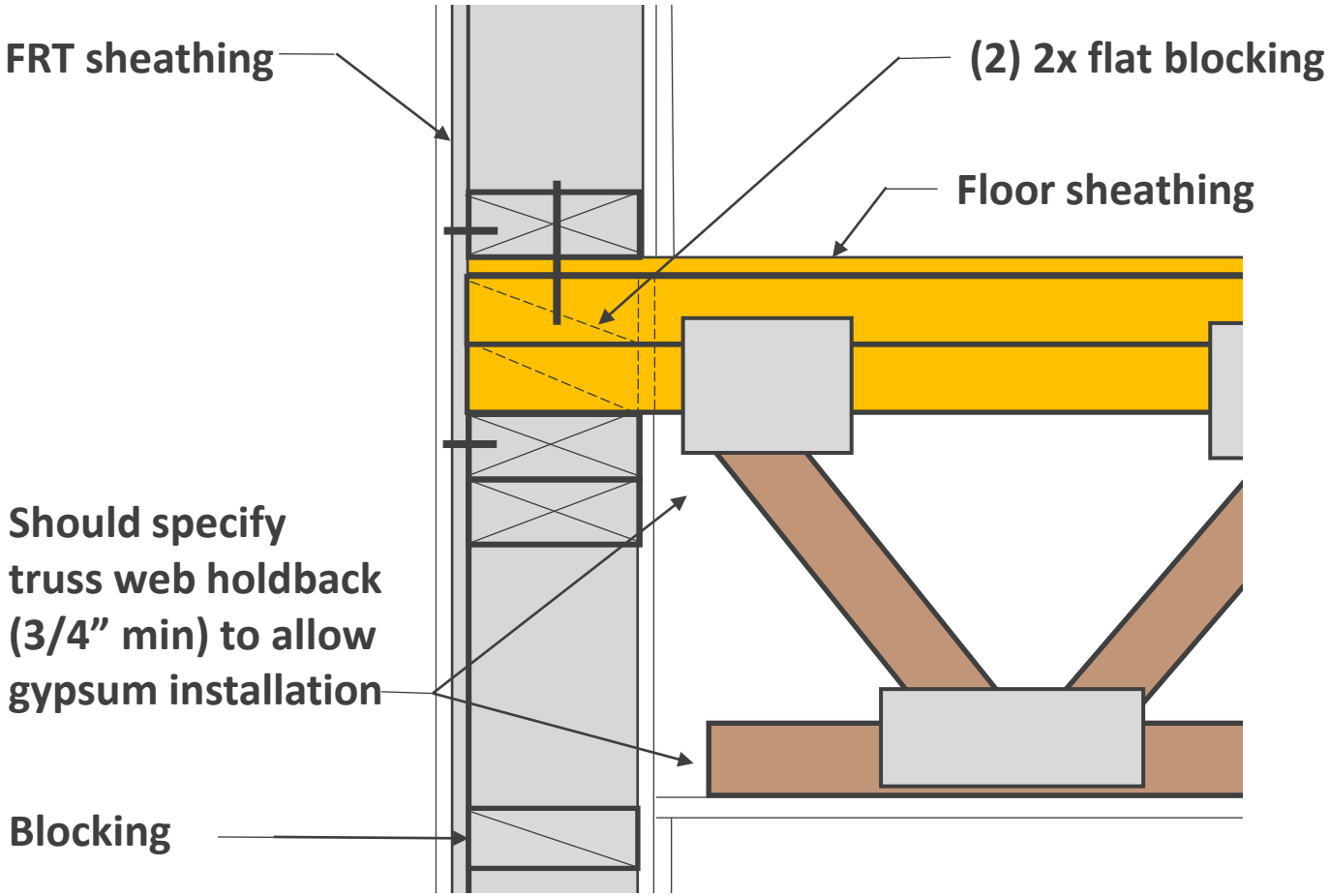
This detail is often used with a balcony; ledger is thru-bolted

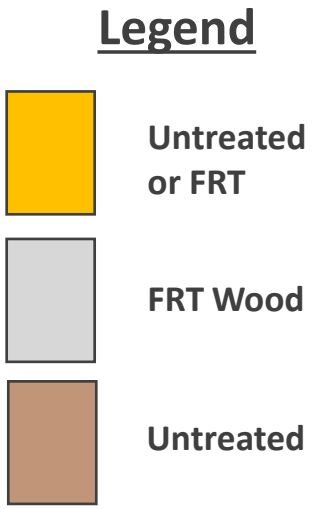
Rationale for detail approval:

- 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



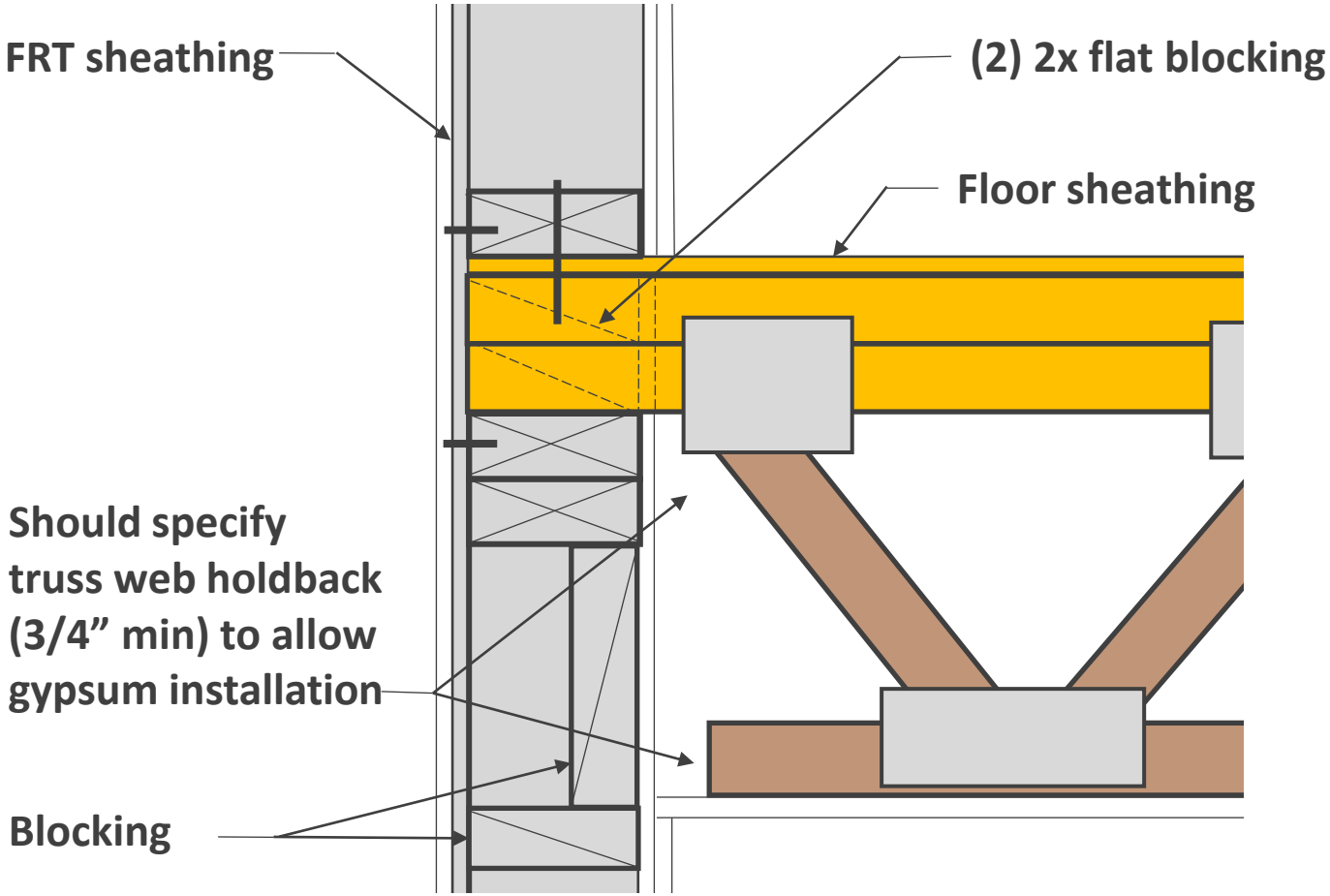


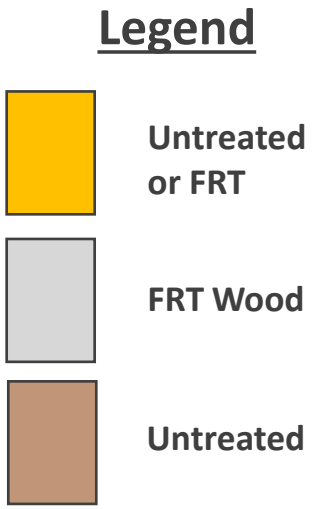
Rationale for detail approval:

- 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



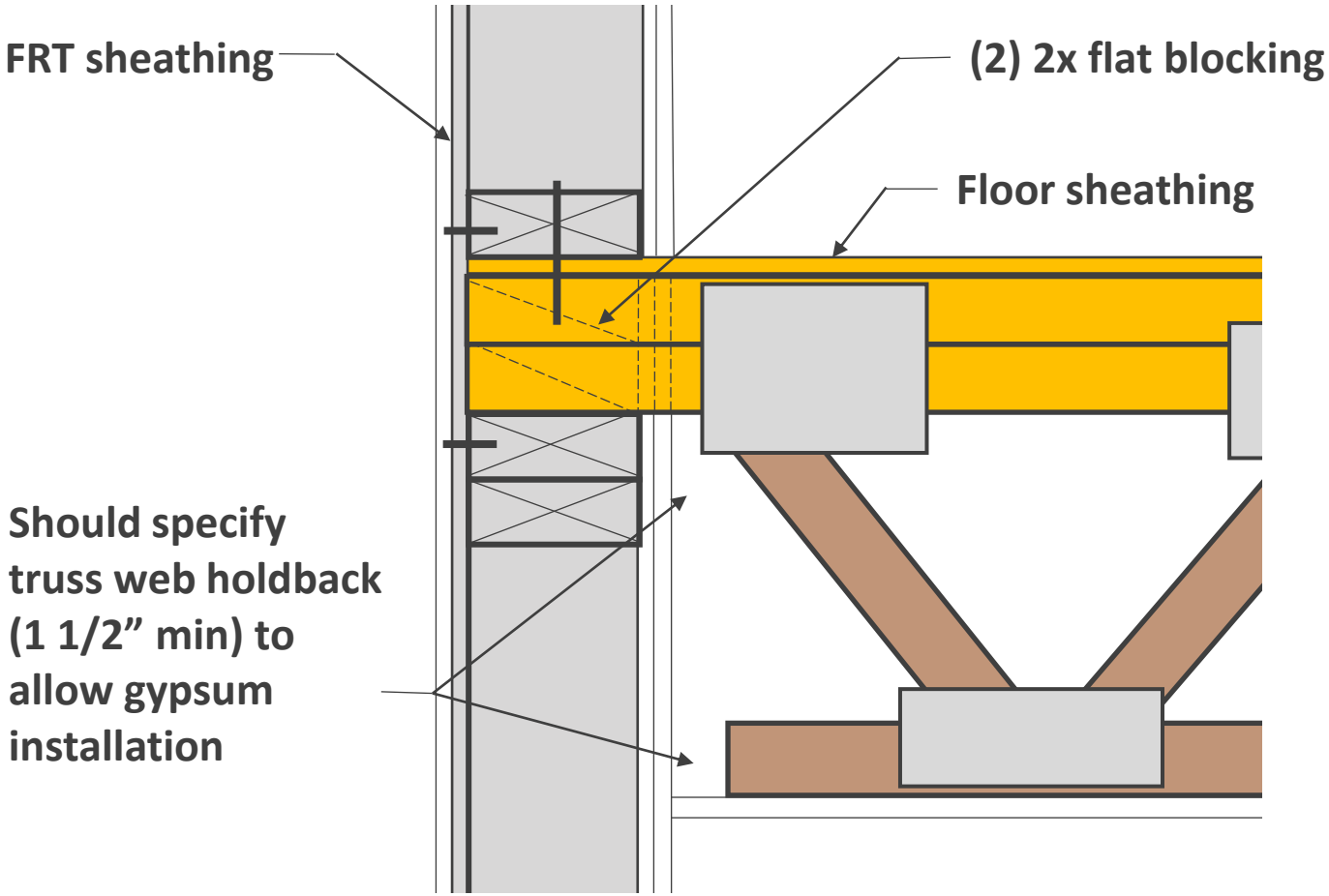


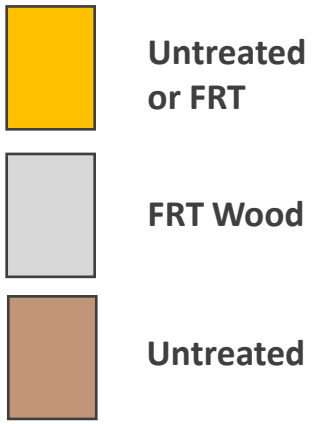
Rationale for detail approval:

- 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



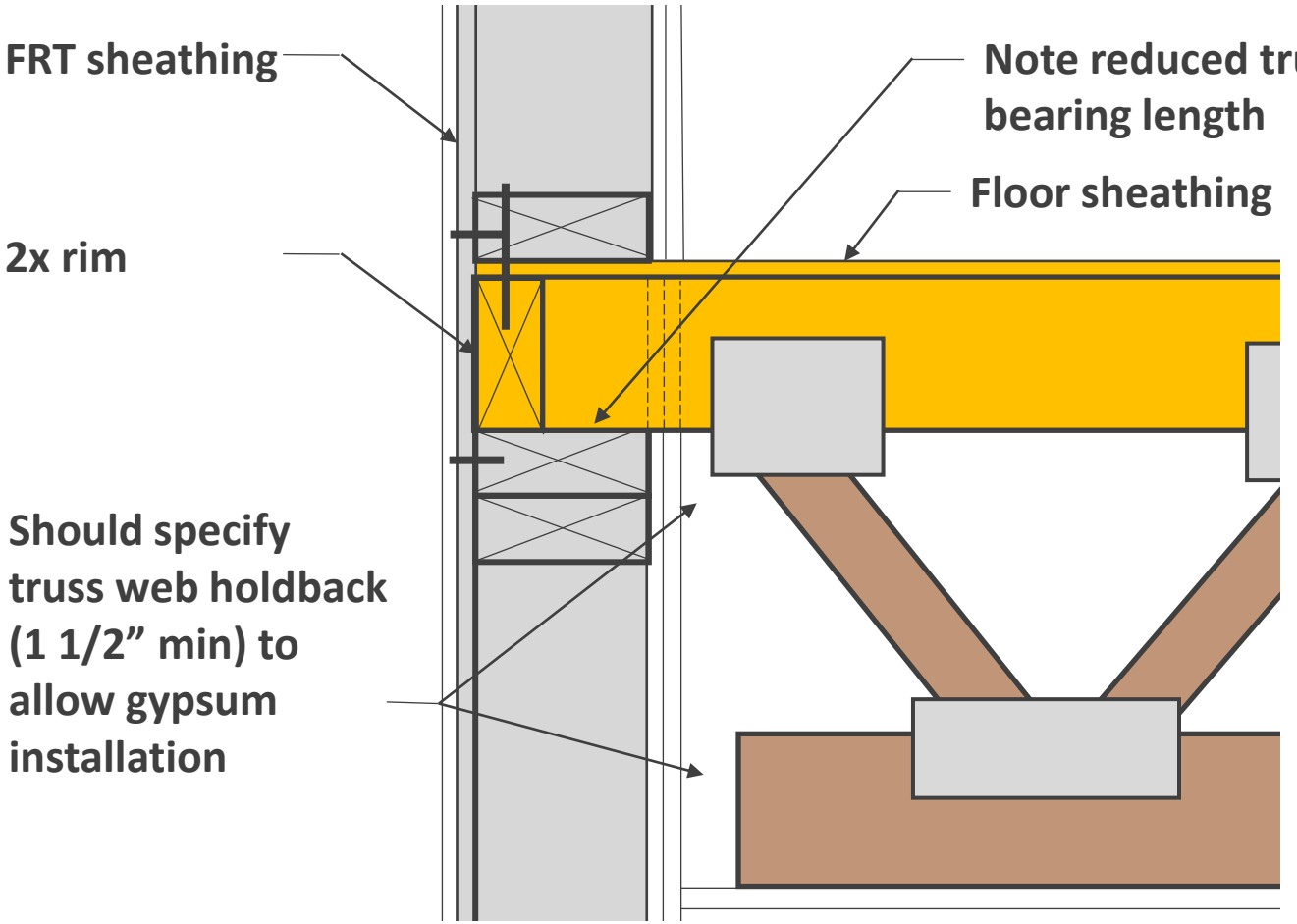


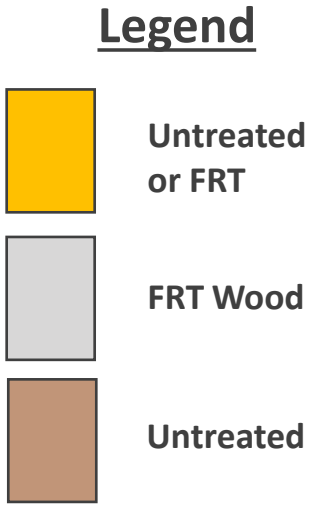
Rationale for detail approval:

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

Exterior Walls – Intersecting Roof

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

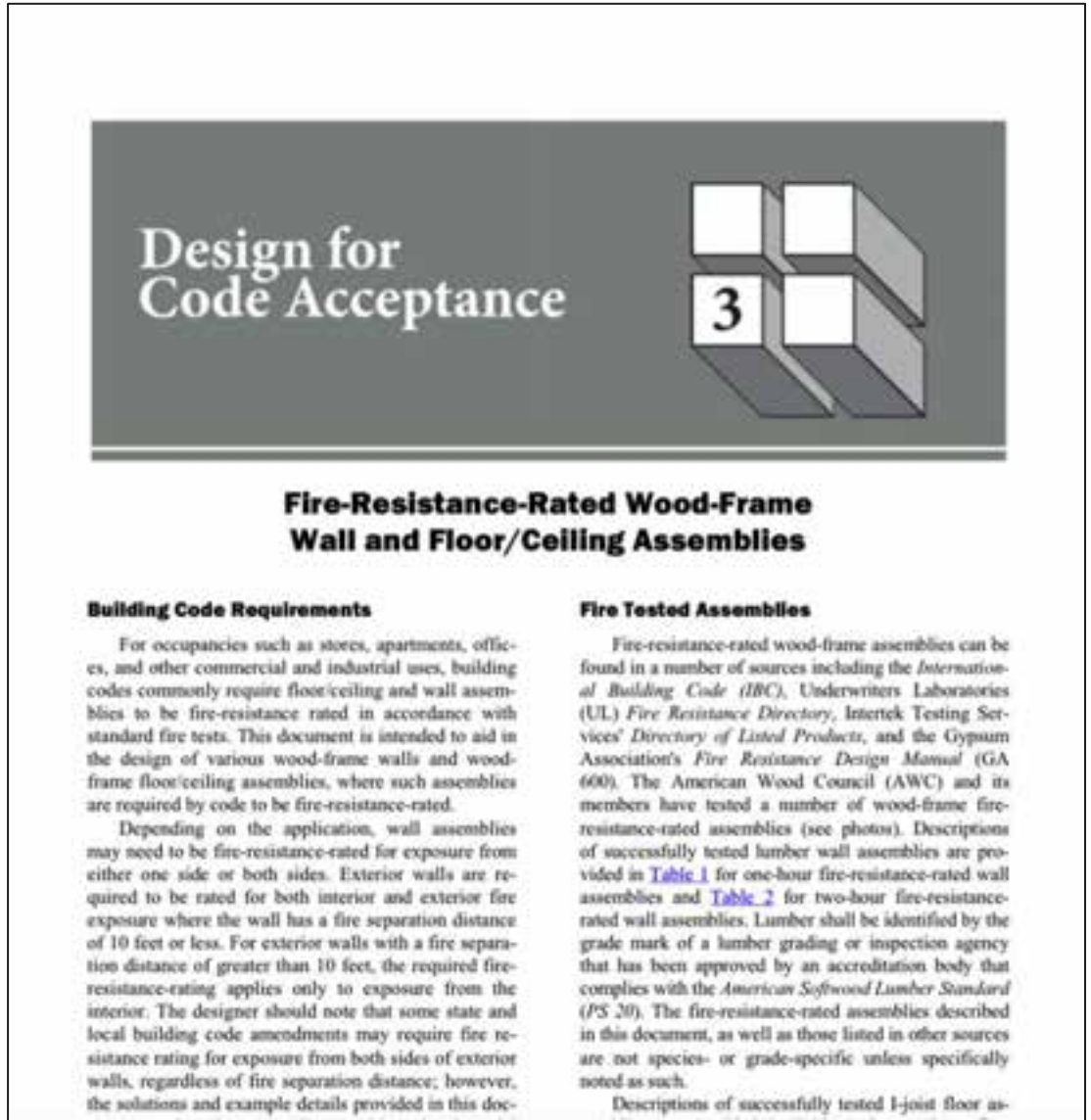
Gaps between end of truss members and wall to allow gypsum install after

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

Avaliable at www.awc.org



Design for Code Acceptance 3

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

Building Code Requirements

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

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

Fire Tested Assemblies

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

Descriptions of successfully tested I-joist floor as-

Panel Discussion / Q&A

Today's Speakers :

- **Kathryn Carrigg** **PE**
  Regional Director OR, ID South, HI
  WoodWorks – Wood Products Council
  kathryn.carrigg@woodworks.org

- **Jon Hall** **AIA, LEED AP BD+C Homes**
  Principal
  GGLO Architecture
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- **Jeff Peters** **PE, CGC**
  Regional Director FL, AL, LA
  WoodWorks – Wood Products Council
  jeff.peters@woodworks.org

1430 Q, The HR Group Architects, Buehler Engineering, Greg Folkins Photography