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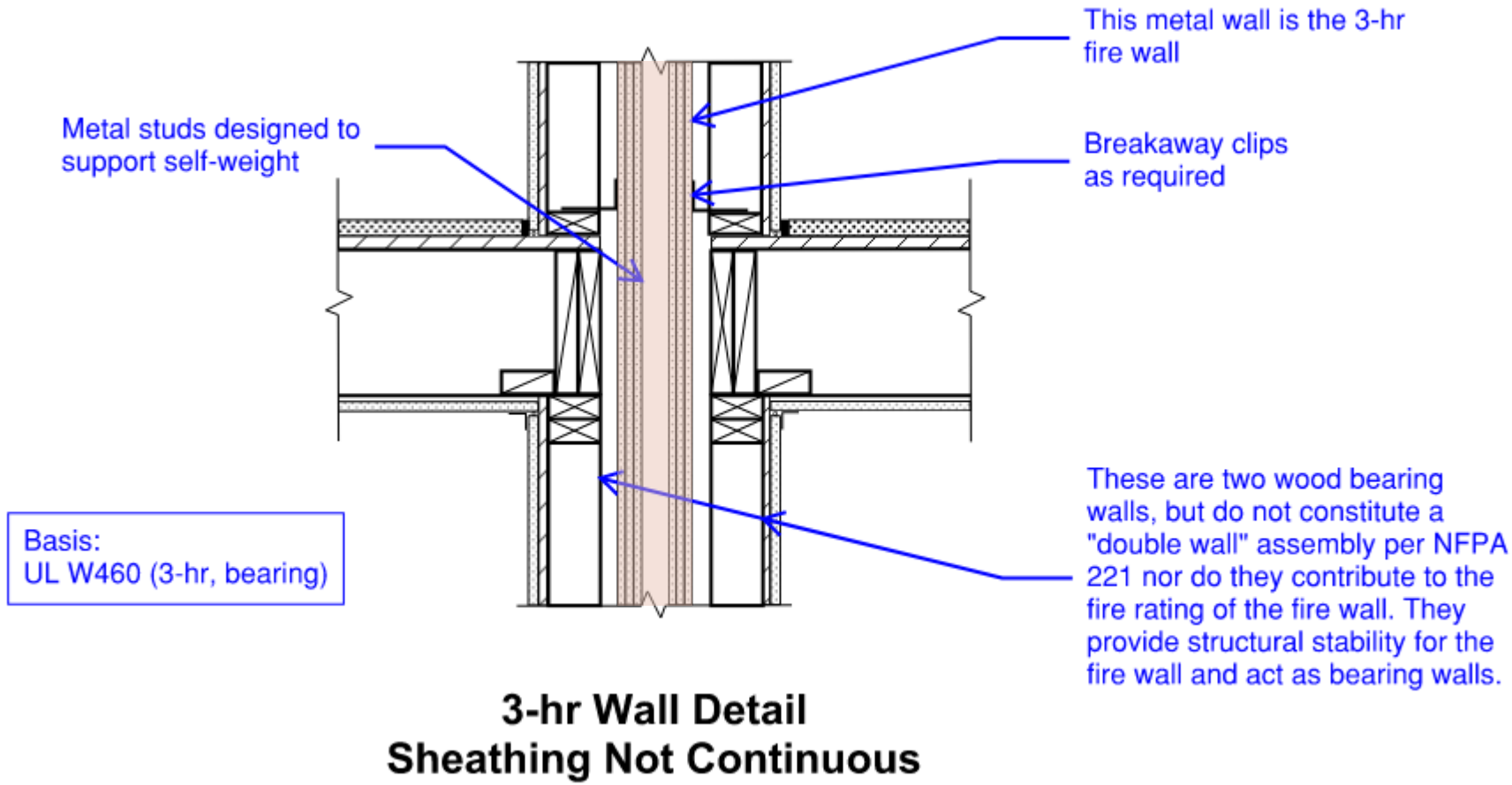
A Detailing Deep Dive: Fire Walls

Photo: Greg Folkins Photography

Fire Walls – Seismic Diaphragm Continuity



3-hr Wall Detail
Sheathing Not Continuous

Fire Walls – Seismic Diaphragm Continuity

SEAOSC

SEAoSC LIGHT-FRAMING CONSTRUCTION COMMITTEE
STRUCTURAL ENGINEERS ASSOCIATION OF SOUTHERN CALIFORNIA
SEISMOLOGY OPINION

DATE: **March 21, 2008**

Continuity of Plywood Diaphragm Sheathing in 2 hr and 3hr Fire Walls:

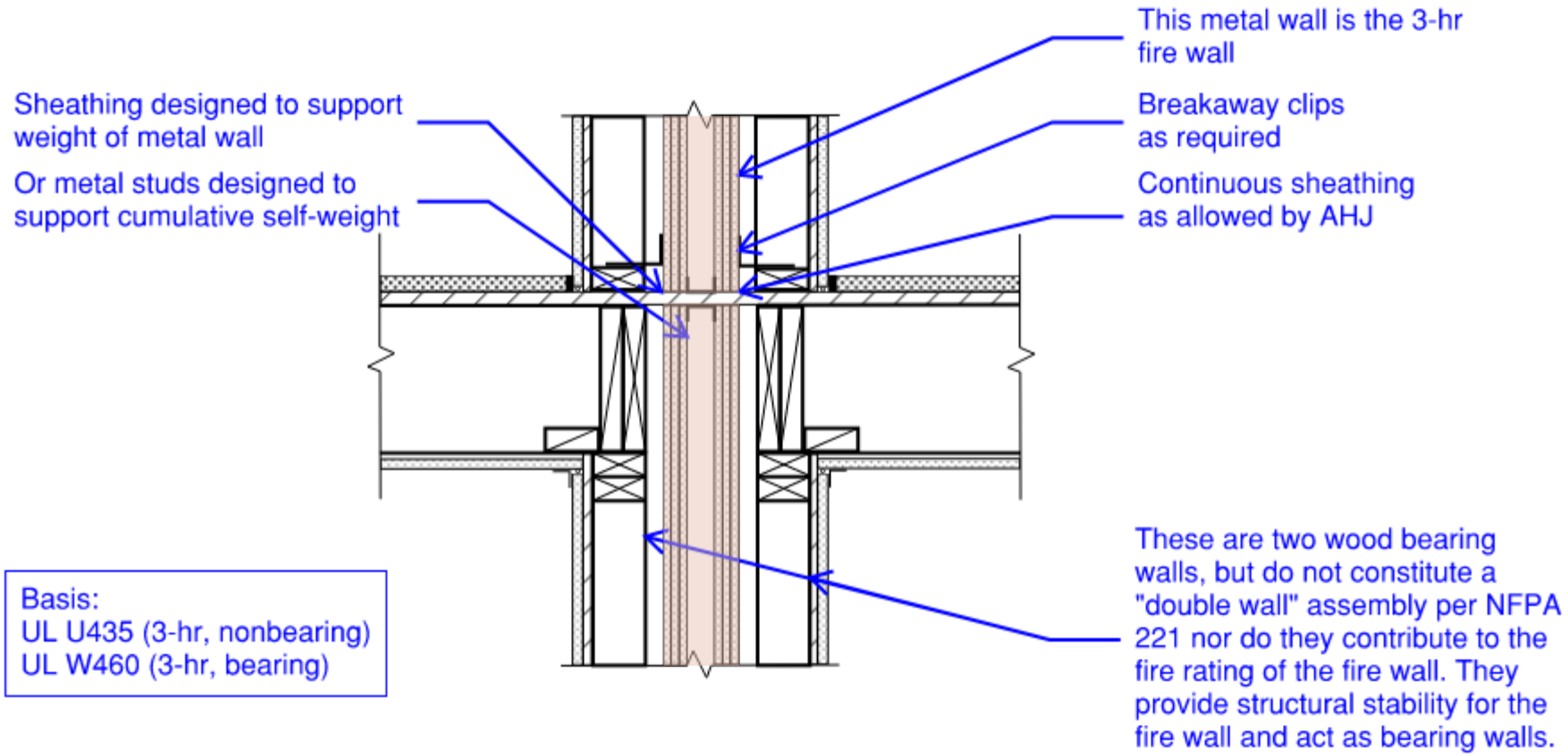
Opinion: The continuity of plywood diaphragm sheathing should be maintained across the air gap commonly encountered in double stud Firewalls of 2 or 3 hour construction. The intent is to ensure that structural continuity is not significantly reduced in the roof and floor diaphragms.

Commentary:

This opinion is prepared to address the issue of diaphragm continuity as it relates to recent changes in 2007 CBC and 2006 IBC model code. Specifically the outgoing UBC provisions for Area-Separation walls have more or less been replaced by the Fire wall provisions of the IBC. Such walls are encountered in light-frame multifamily or mixed-use construction and are often constructed as a double studwall when occurring at partywall locations. The double stud walls are typically separated by an airspace of a one to four inches.

The IBC has introduced language [IBC 705.4] that states fire walls must have "sufficient structural stability" under fire conditions to allow collapse of either side. Previous commentary to the UBC topic of Area Separation

Fire Walls – Seismic Diaphragm Continuity



3-hr Wall Detail
Sheathing Continuous

CAD & Revit Details: www.woodworks.org

Fire Walls – Seismic Diaphragm Continuity

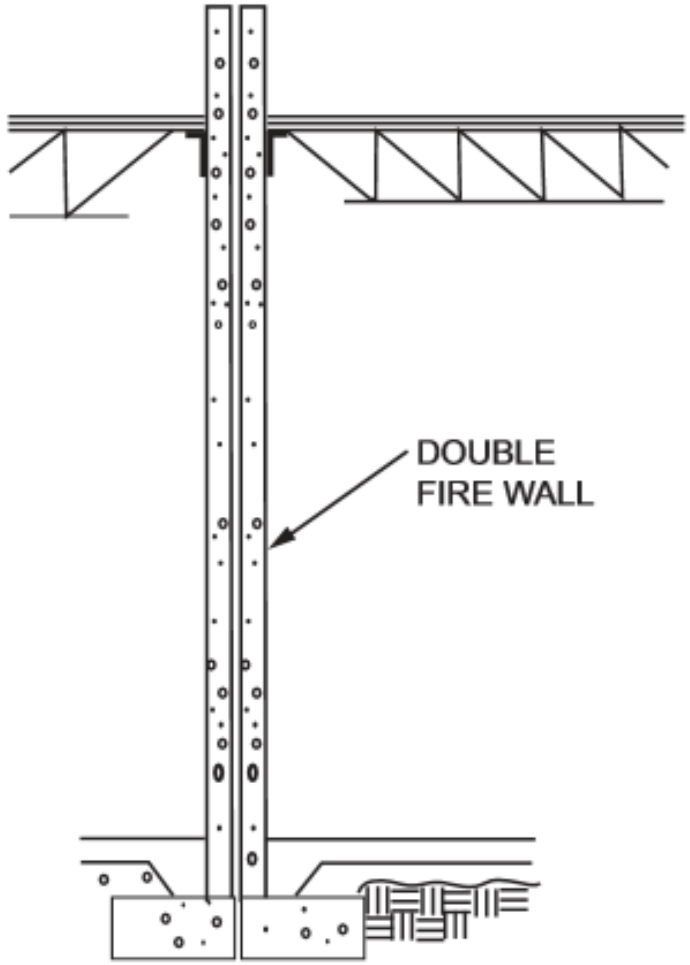
2018 IBC Provisions Allow Floor Sheathing Through Firewall under Certain Conditions

706.2 Structural stability.

Fire walls shall be designed and constructed to allow collapse of the structure on either side without collapse of the wall under fire conditions. *Fire walls* designed and constructed in accordance with NFPA 221 shall be deemed to comply with this section.

Exception: In Seismic Design Categories D through F, where double *fire walls* are used in accordance with NFPA 221, floor and roof sheathing not exceeding $^{3}/_{4}$ inch (19.05 mm) thickness shall be permitted to be continuous through the wall assemblies of light frame construction.

NFPA 221 – Double Walls



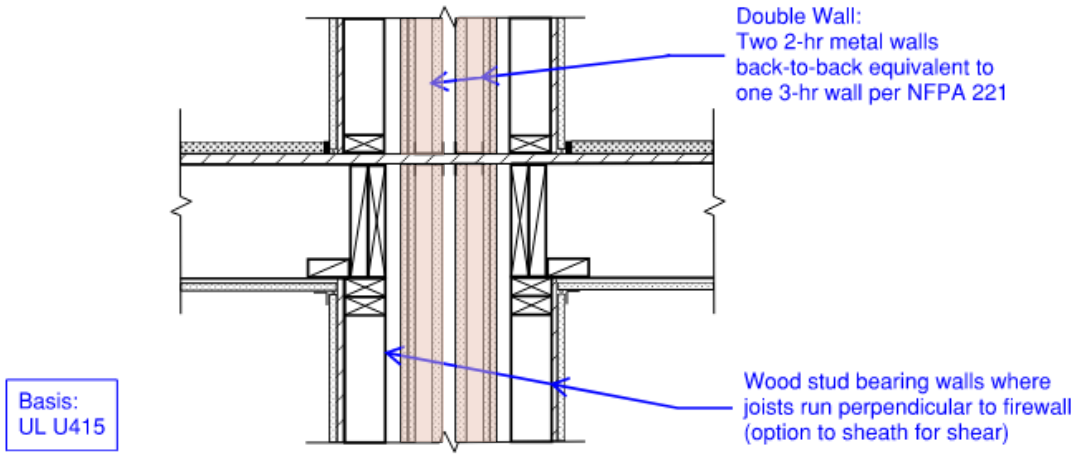
4.5* Double Wall Assemblies. Where either wall of a double wall is laterally supported by a building frame with a fire resistance rating less than that required for the wall, double wall assemblies shall be considered to have a combined assembly fire resistance rating as specified in Table 4.5.

Table 4.5 Fire Resistance Ratings for Double Wall Assemblies

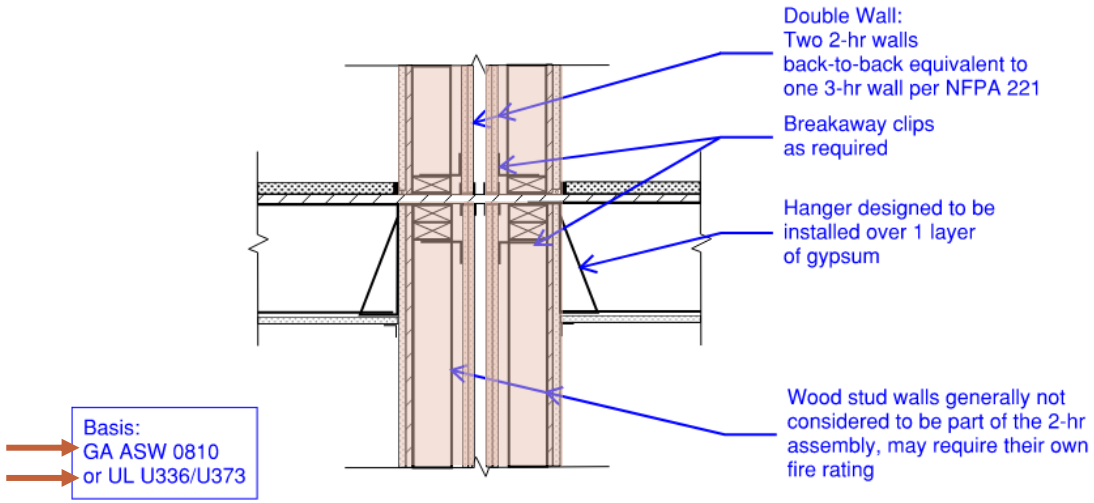
Fire Resistance Rating of Each Wall (hr)	Equivalent to Single Wall (hr)
3	4
2	3
1	2

Double Walls in Type III

Noncombustible Construction Required



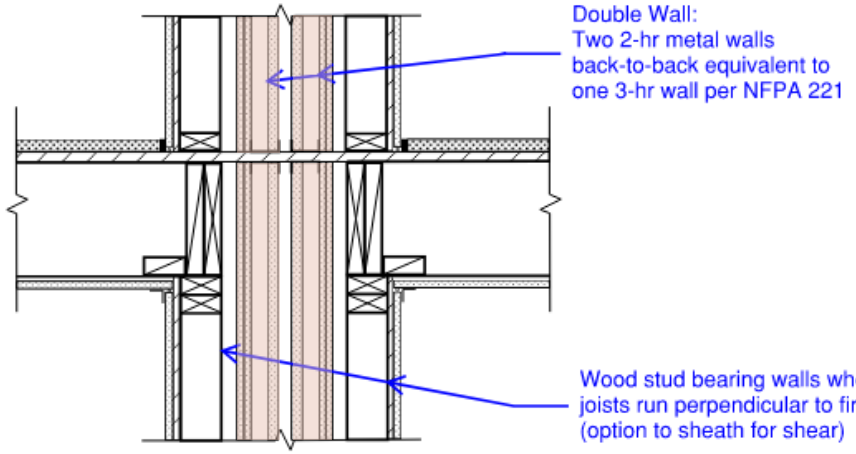
NFPA 221 Double Wall
3-hr Wall Detail for use in Type III
(noncombustible)



NFPA 221 Double Wall
3-hr Wall Detail for use in Type III
(noncombustible)

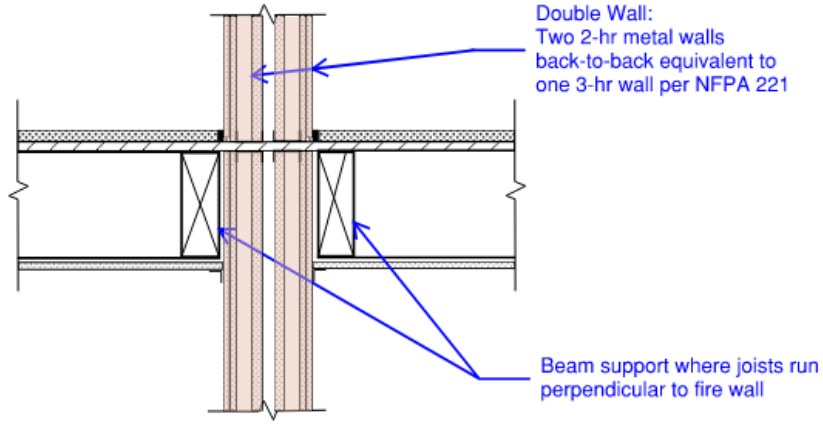
Double Walls in Type III

Noncombustible Construction Required



Basis:
UL U415

NFPA 221 Double Wall
3-hr Wall Detail for use in Type III
(noncombustible)

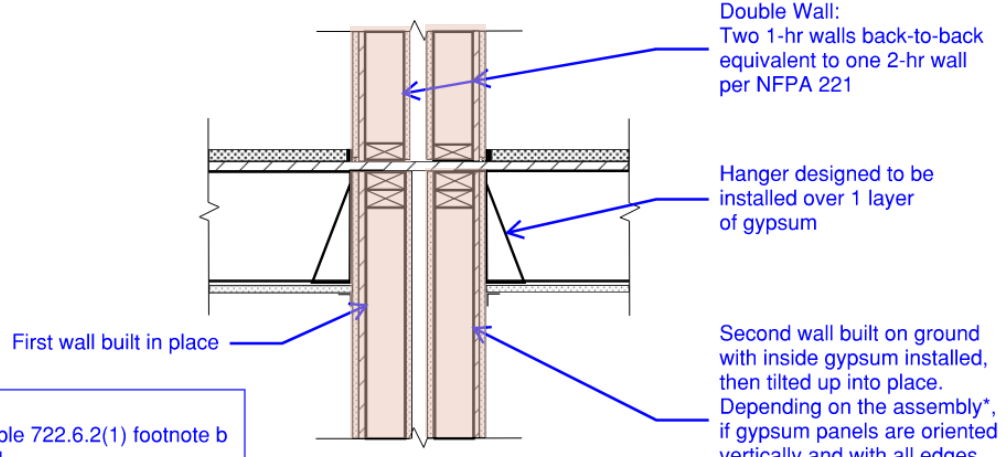


Basis:
UL U415

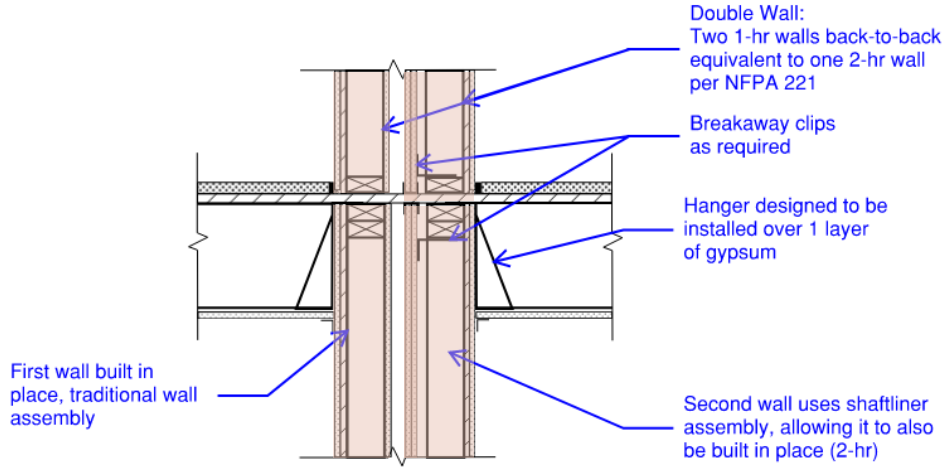
NFPA 221 Double Wall
3-hr Wall Detail for use in Type III
(noncombustible)

Double Walls in Type V

Combustible Construction Allowed



NFPA 221 Double Wall
2-hr Wall Detail for use in Type V



NFPA 221 Double Wall
2-hr Wall Detail for use in Type V

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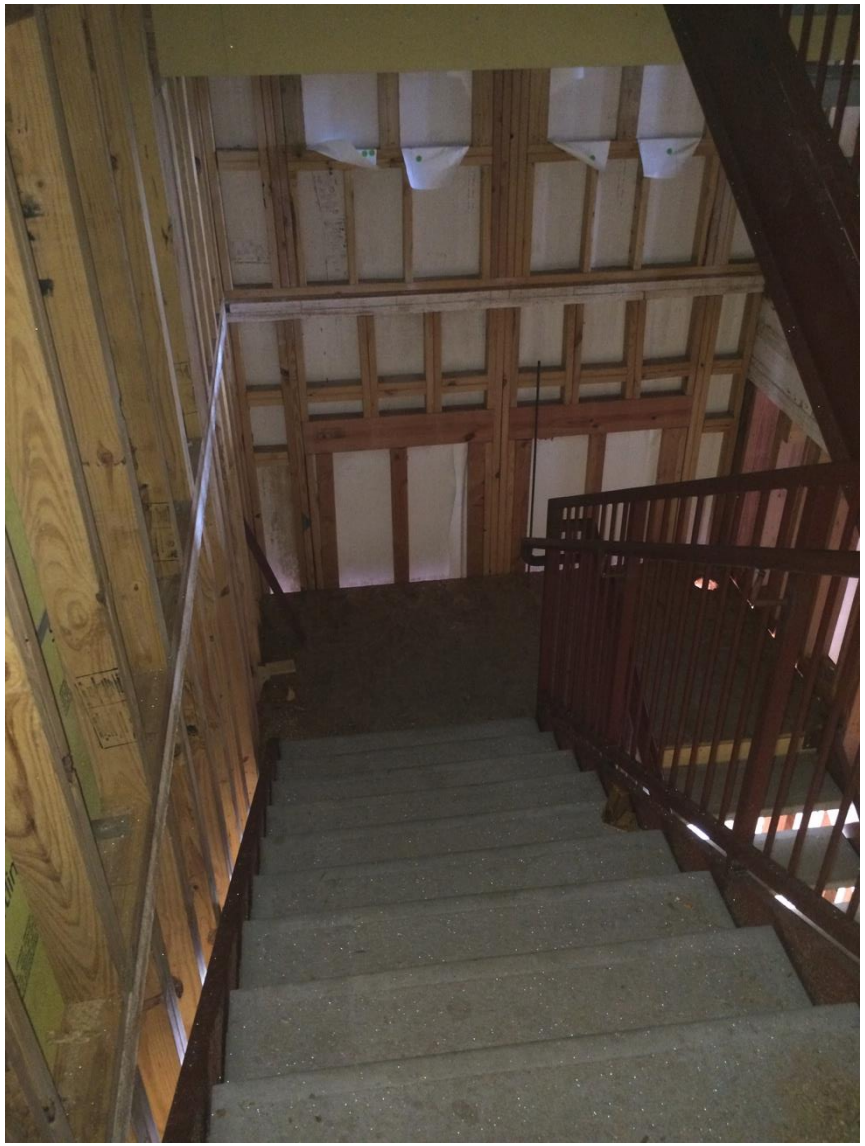
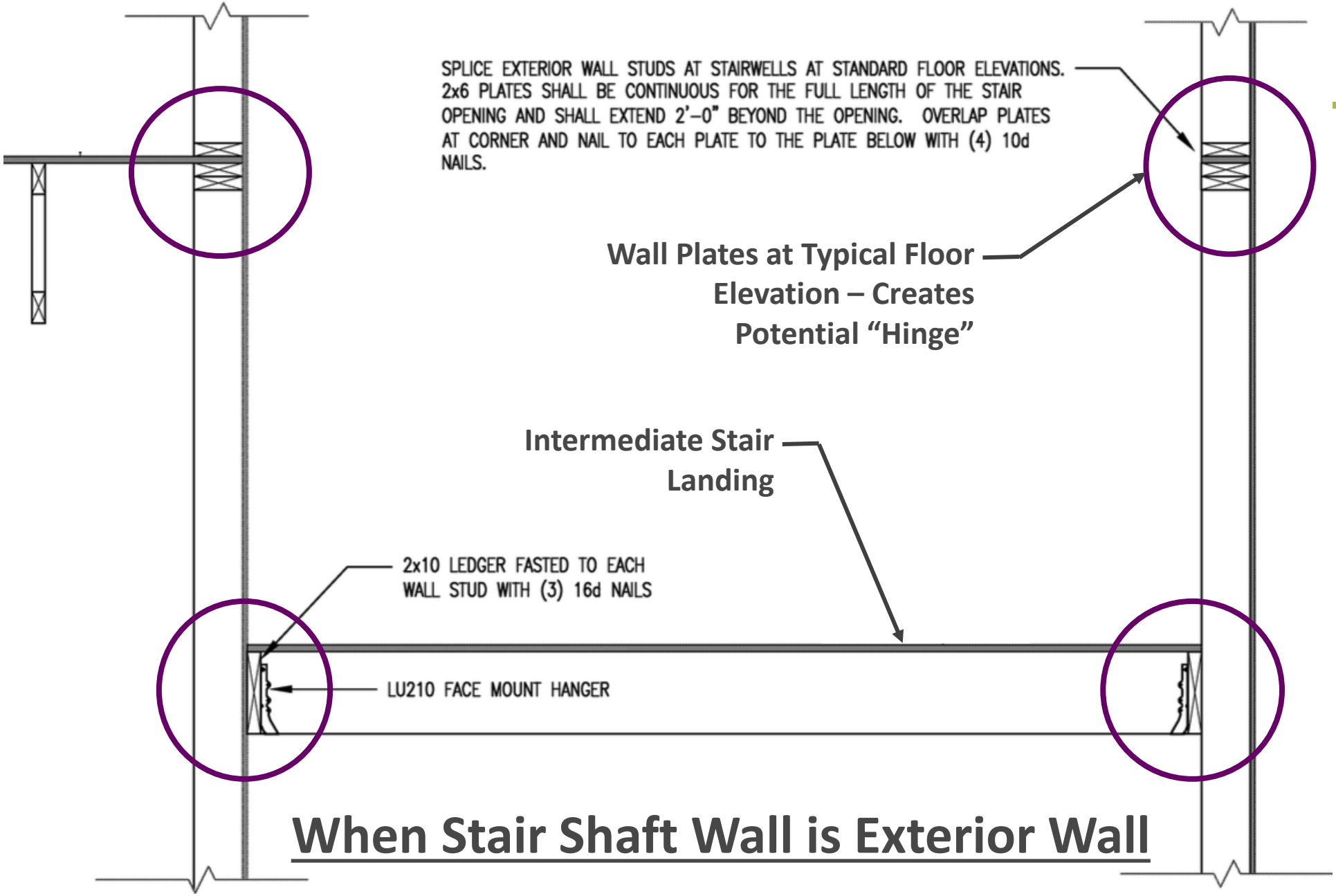
A Detailing Deep Dive: Shaft Walls

Photo: Greg Folkins Photography

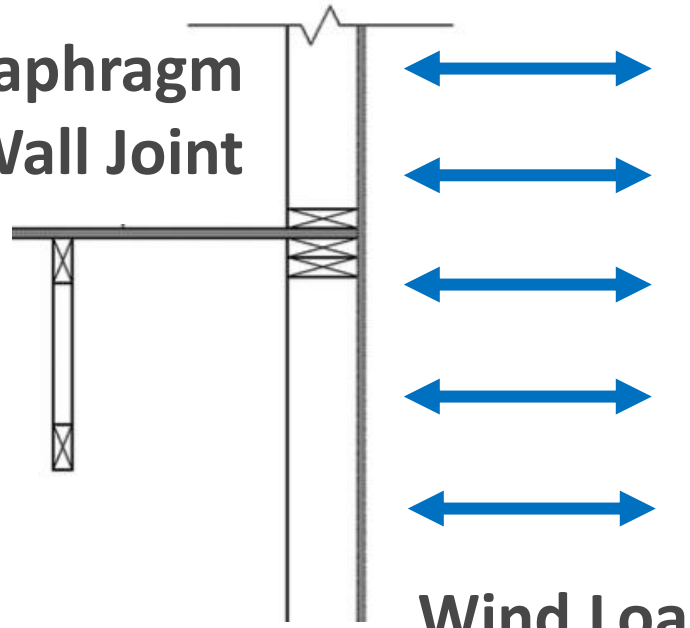
Shaft Walls that are also Exterior Walls



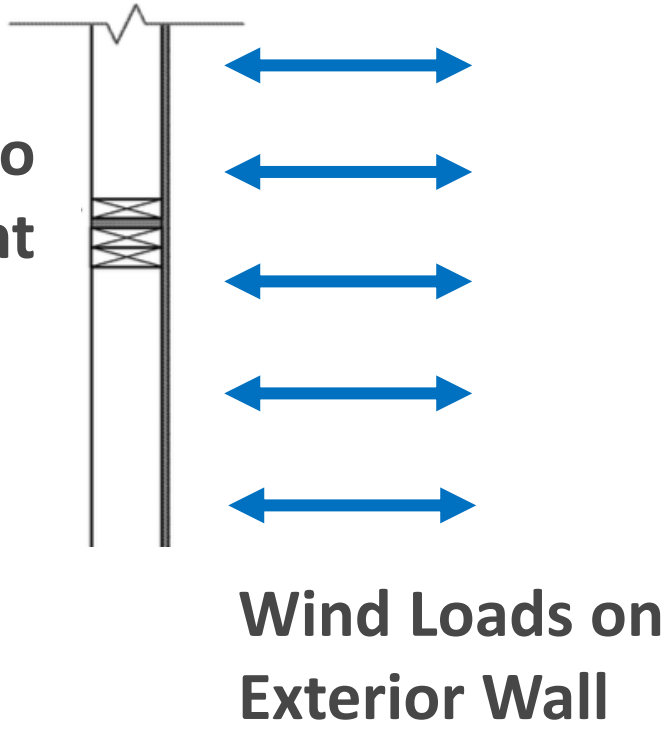


When Stair Shaft Wall is Exterior Wall

Shaft Walls that are also Exterior Walls

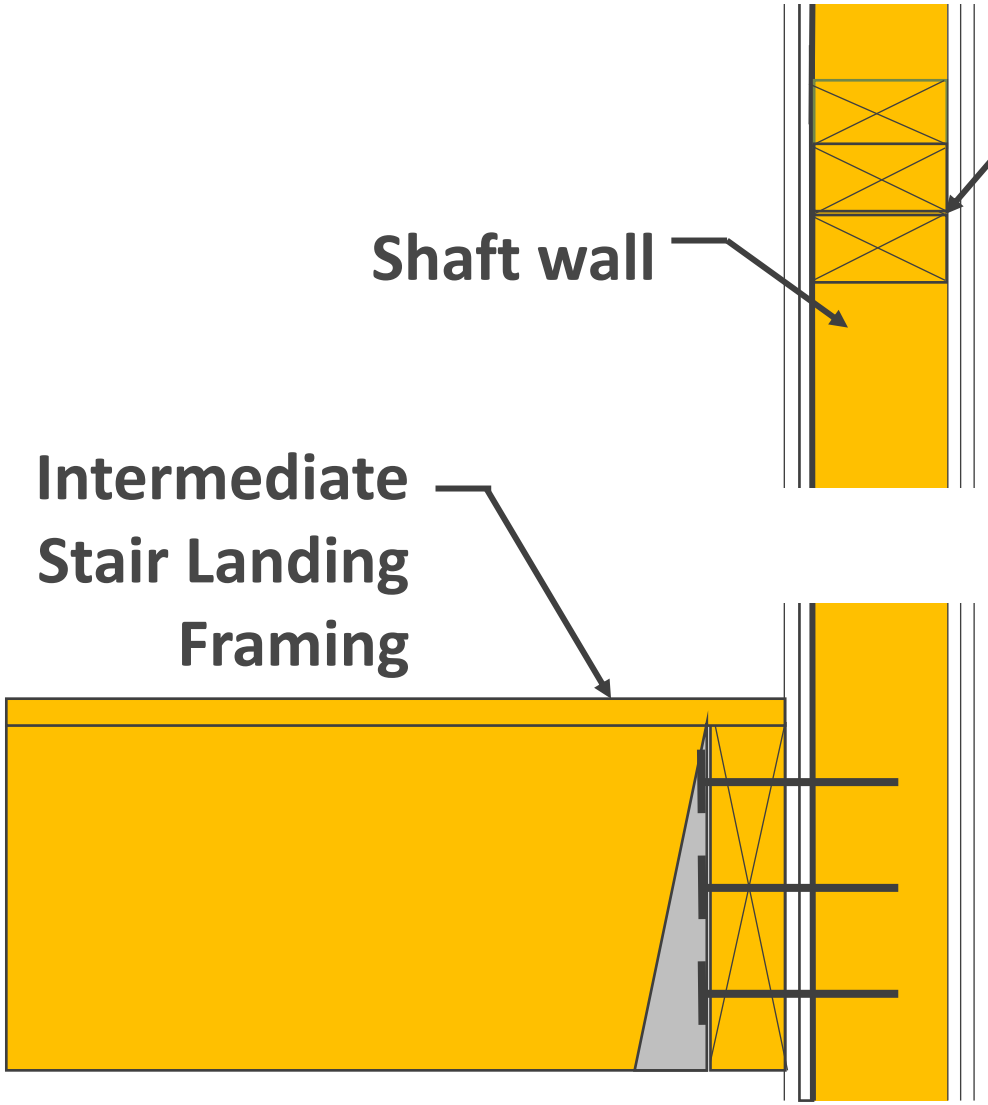


Typical Exterior Wall Condition



Exterior Wall That is Shaft Wall

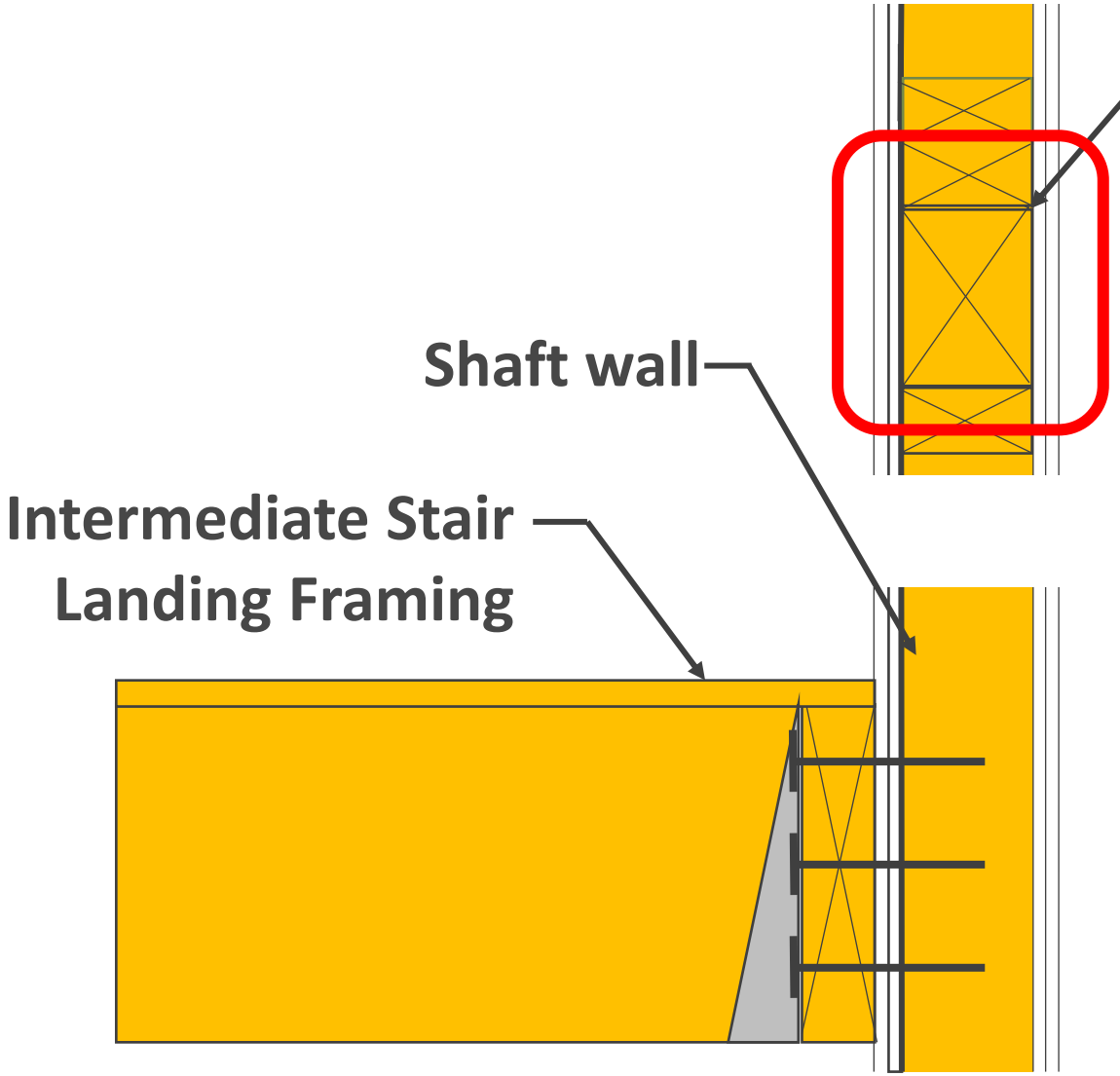
Shaft Walls that are also Exterior Walls



Consider “Hinge” at wall plates for out-of-plane wind & seismic loads due to lack of adjacent floor:

- Span plates horizontally

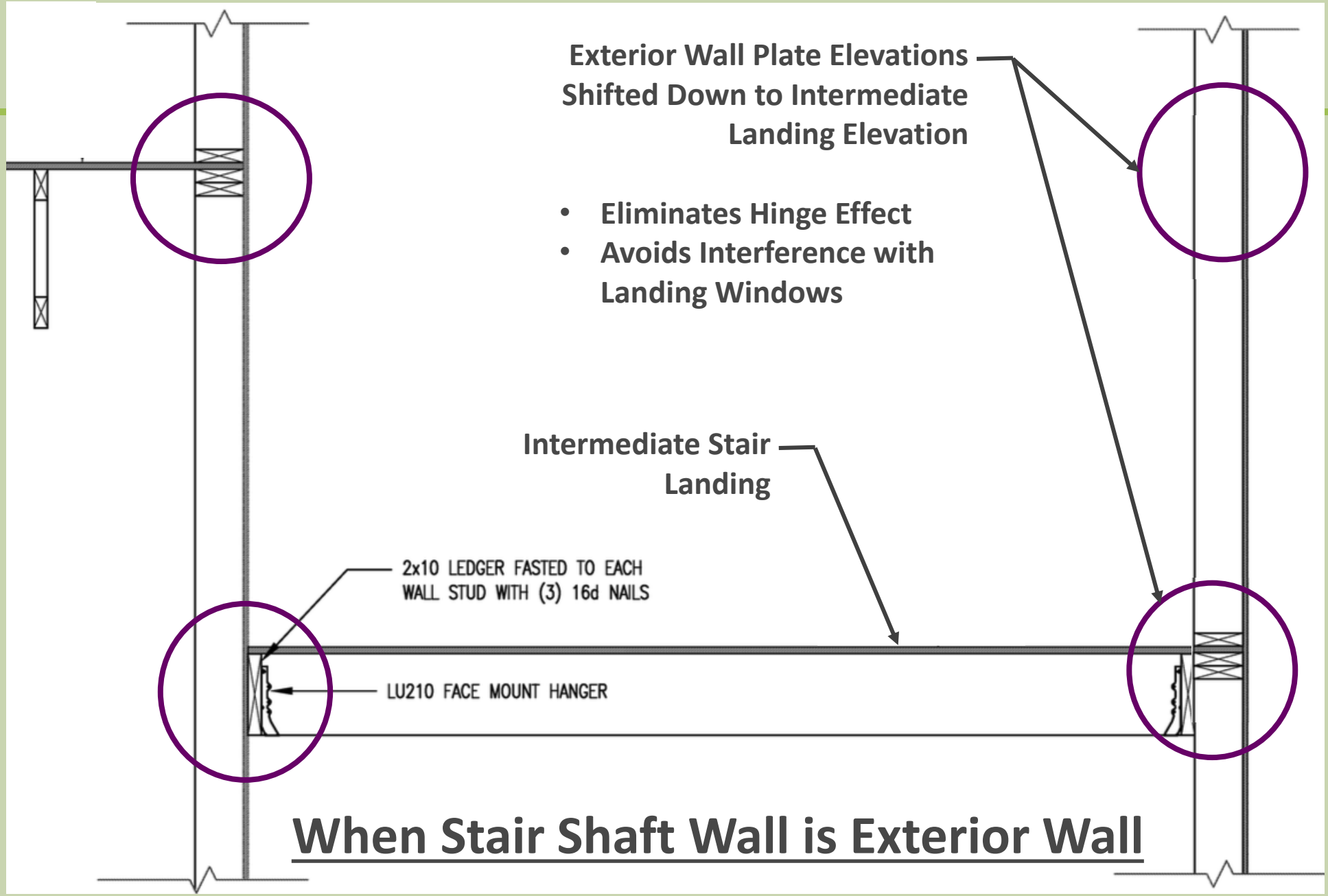
Shaft Walls that are also Exterior Walls



Consider “Hinge” at wall plates for out-of-plane wind & seismic loads due to lack of adjacent floor:

- Install additional member (rim) to span horizontally


See www.gp.c



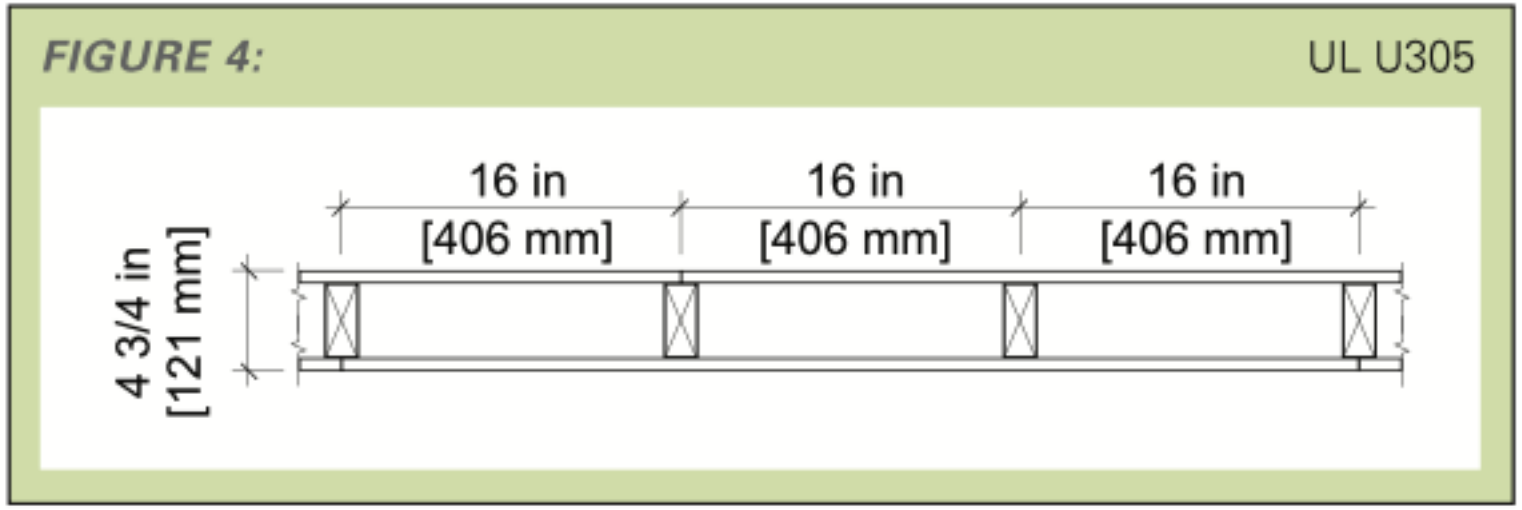
When Stair Shaft Wall is Exterior Wall

Shaft Wall Assemblies

Assembly selection considerations

- Fire resistance rating requirement (1 hr or 2 hr)
- Size and height of shaft
- Structural needs (gravity & lateral loads)
- Acoustics
- Space available for wall (allowed thickness)

Shaft Wall Assemblies



1-Hour Single Wall

- UL U305
- GA WP 3510
- UL U311
- IBC 2012 Table 721.1(2), Item 14-1.3
- UL U332

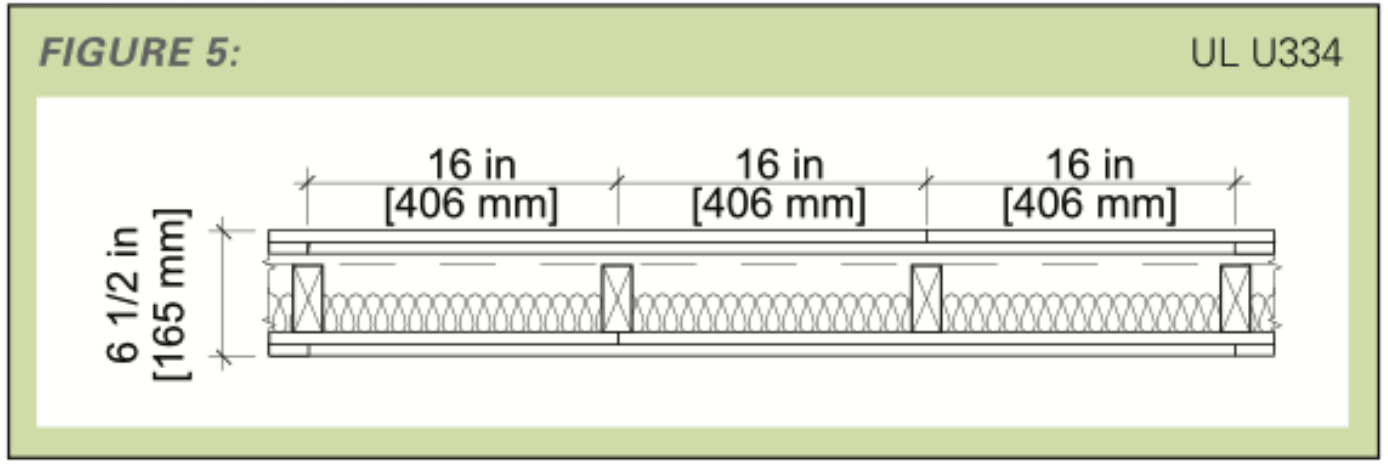
1-Hour Double Wall

- UL U341

1-Hour Wall with Shaftliner

- UL V455
- UL V433

Shaft Wall Assemblies



2-Hour Single wall

- UL U301
- UL U334
- IBC 2012 Table 721.1(2) Item Number 14-1.5
- IBC 2012 Table 721.1(2) Item Number 15-1.16

2-Hour Double Wall

- UL U342
- UL U370
- GA WP 3820

2-Hour Wall with Shaftliner

- UL U336
- UL U373
- UL U375
- UL V455
- UL V433
- GA ASW 1000

Shaft Wall Assemblies W/Shaftliner

Shaftliner Unique Considerations

- Common for “party walls” in townhouse construction
- Many tested assemblies available for 1 hr and 2 hr applications
- May allow installation from one side only – useful in small MEP shafts where finishing from inside isn’t possible
- Some have height limitations, both per story and overall system
- Not structural, require back-up wood wall

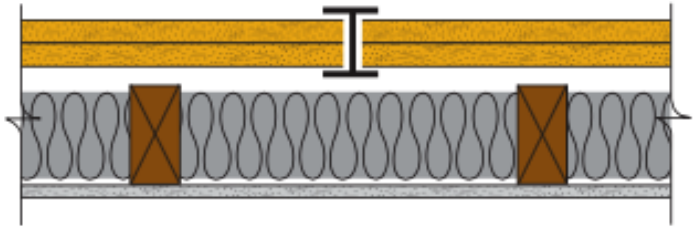
FIGURE 6: Shaftliner Wall Assembly with Wood Wall Each Side

Credit: ClarkDietrich

Shaft Wall Assemblies W/Shaftliner

2-Hour Fire Rating

Design Reference: UL U373, ULC W312, WHI GP/WA 120-03, cUL U373



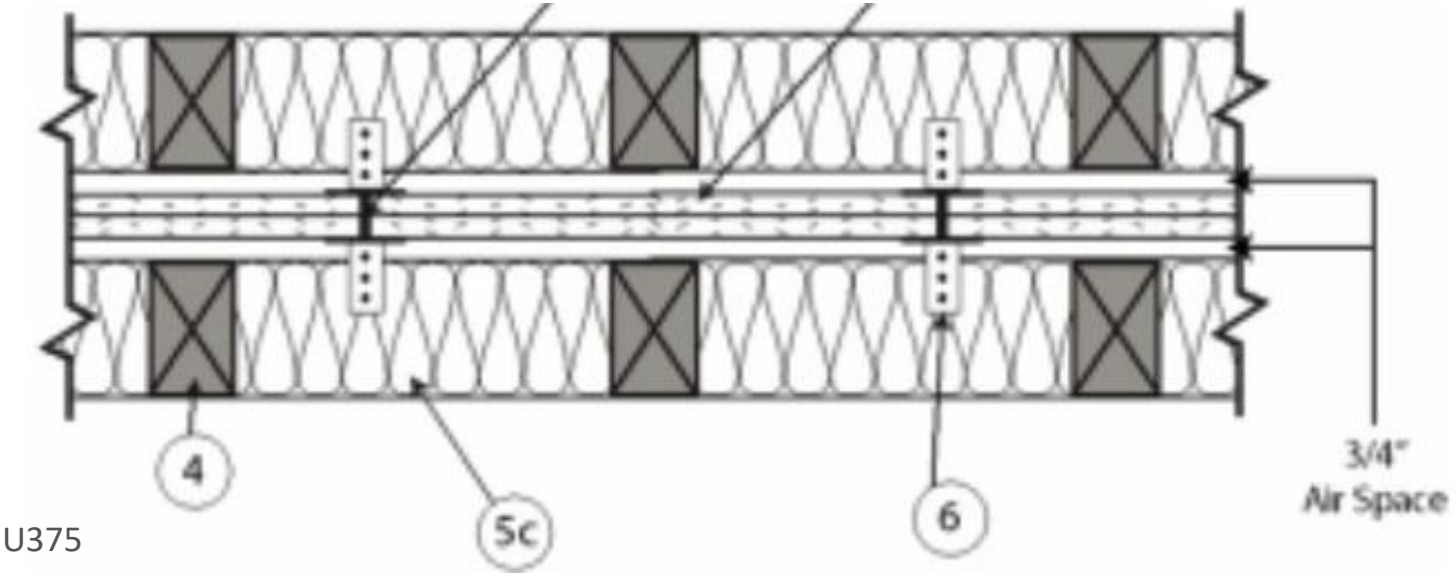
59 STC Sound Trans.

Test Reference: RAL TL 10-290

Two layers 1" (25.4 mm) DensGlass Shaftliner inserted in H-Studs 24" (610 mm) o.c. Min. 3/4" (19 mm) air space between liner panels and adjacent wood or metal framing.

Sound Tested with 2"x 4" stud wall with 1/2" (12.7 mm) ToughRock® wallboard or DensArmor Plus® interior panels and 3-1/2" (89 mm) fiberglass insulation in stud space.

Source: Georgia Pacific



Source: UL U375

Shaft Wall Assemblies W/Shaftliner

CT STUD LIMITING HEIGHTS (INTERIOR NONLOAD-BEARING)

Member	Deflection	5 PSF	7.5 PSF	10 PSF	15 PSF
2-1/2" 25ga	L/120	16'-10"	13'-8"	11'-10"*	8'-6"*
	L/240	11'-10"	9'-10"	8'-8"	7'-3"
	L/360	9'-10"	8'-3"	7'-3"	6'-2"

Source: Clarkdietrich

Some wall manufacturers will list a total system height limitation. If this is not a requirement of the tested assembly (i.e. UL or sim. requirement) can also perform a structural analysis of the walls, especially when stacking multiple stories, to verify adequacy

Shaft Wall Assemblies W/Shaftliner

Attachment Clips: Aluminum or steel angles, usually 14 – 16 gauge, 2” wide with 2” to 2-1/2” long legs. Attaches to wall framing and H-studs

H-Stud

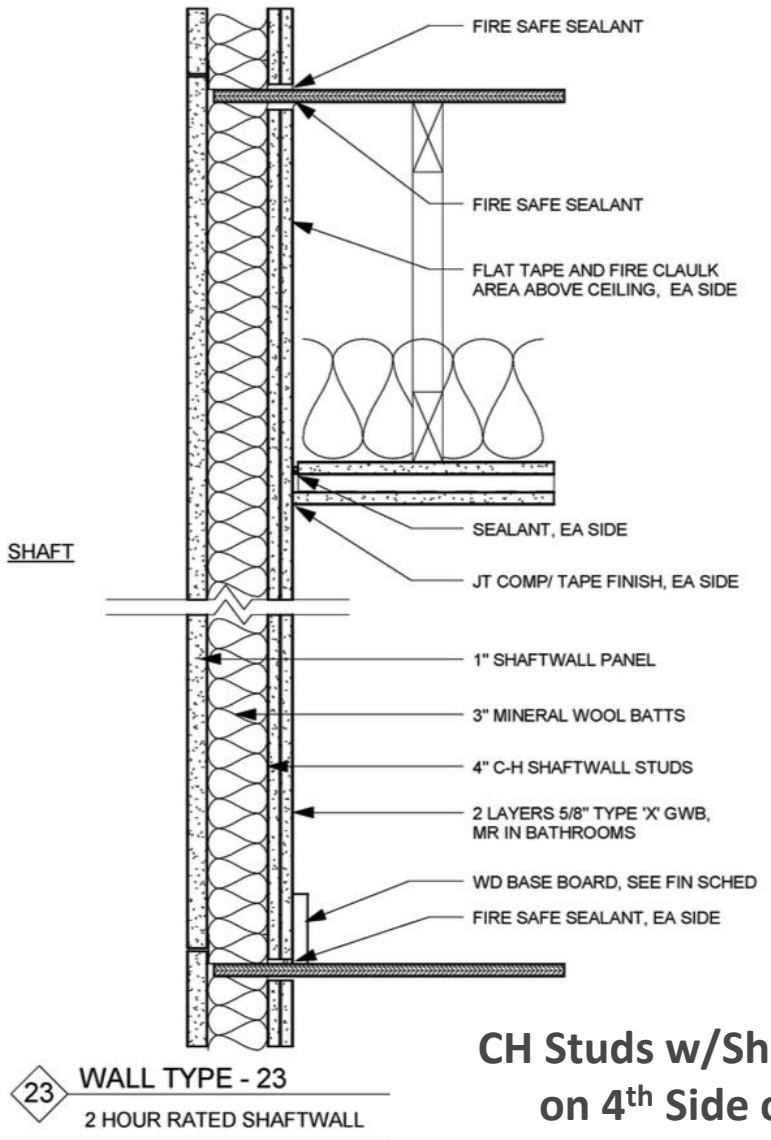
Source: Clarkdietrich

Example Shaftliner Clip Attachment Schedule per UL U375		
System No.	System Height Limitation	Attachment Clip Schedule
1	23 ft	10 ft o.c.
2	44 ft	Base to 20 ft: 5 ft o.c. 20 ft to 44 ft: 10 ft o.c.
3	66 ft	Base to 22 ft: 3’-4” o.c. 22 ft to 42 ft: 5 ft o.c. 42 ft to 66 ft: 10 ft o.c.

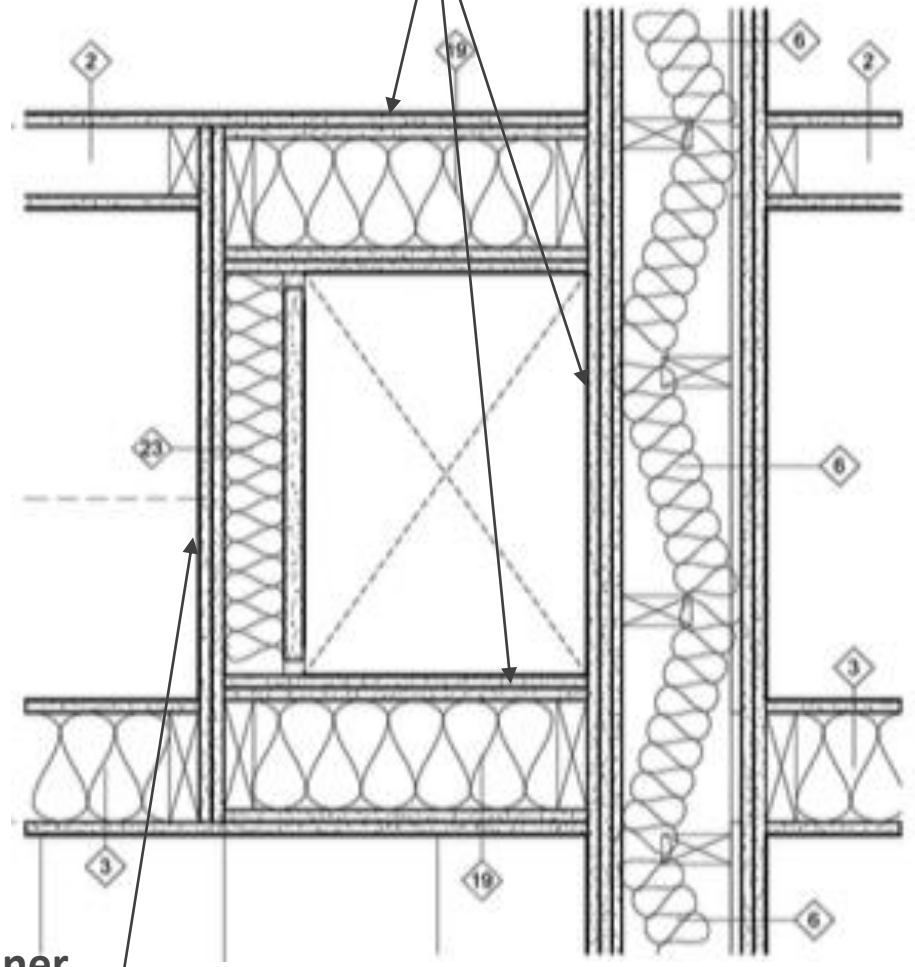
Shaft Wall Assemblies W/Shaftliner

Can also utilize wood framed shaft walls on 3 sides and CH studs with shaftliner on 4th side

Shaft Wall Assemblies W/Shaftliner



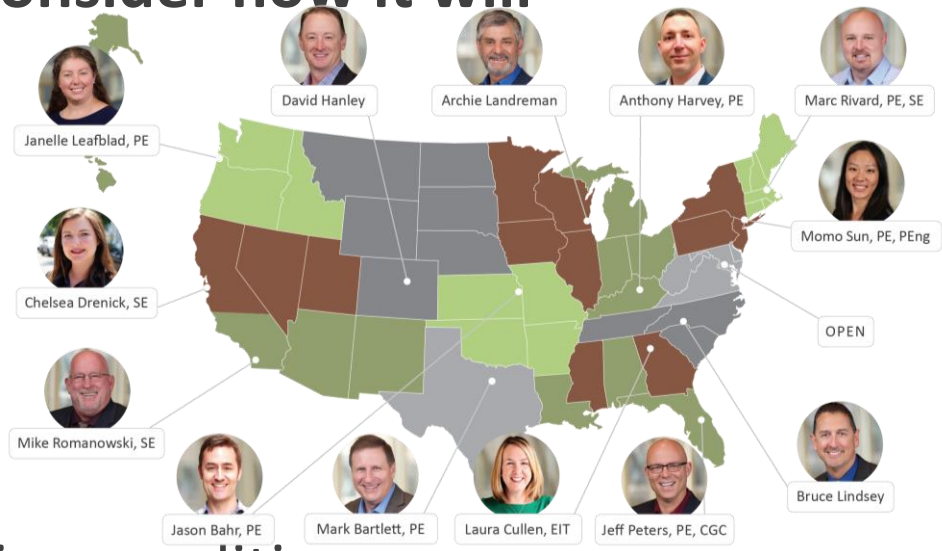
Wood Framed Wall on 3 Sides of Shaft



CH Studs w/Shaftliner on 4th Side of Shaft

Floor to Shaft Wall Detailing

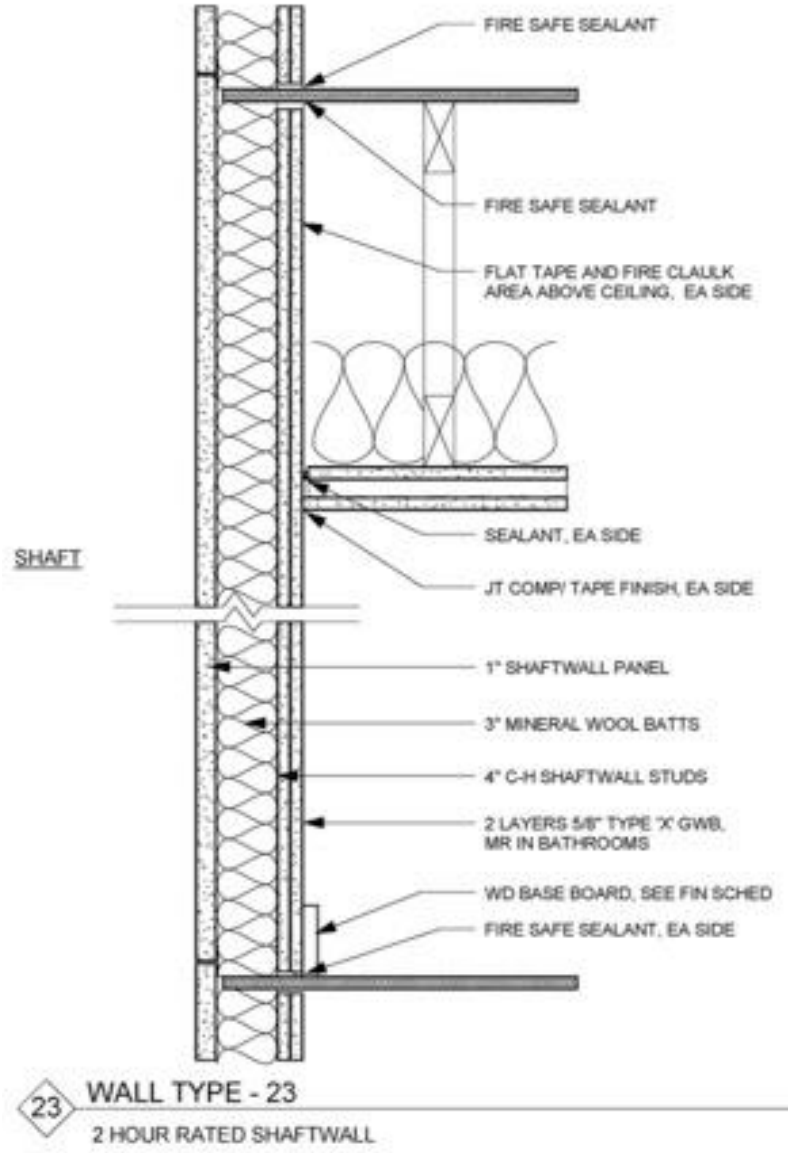
After shaft wall assembly is selected, need to consider how it will interface with floors and roof it intersects

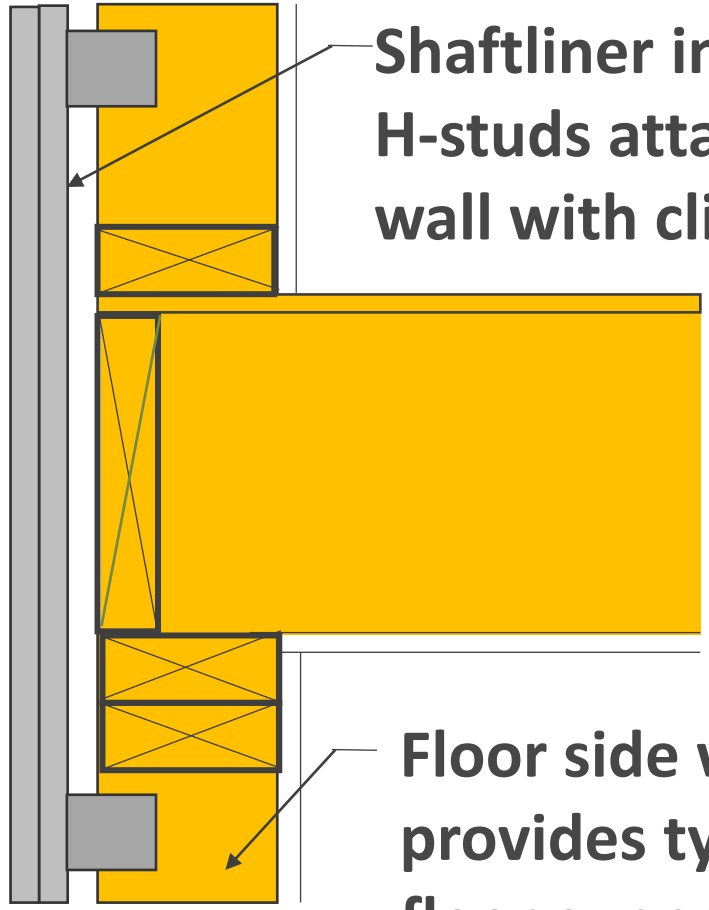


Some key considerations are:

- Supporting Construction
- Continuity and Hourly Ratings
- Joints and Penetrations
- Depends on floor joist/truss type used, bearing condition
- No tested intersections exist; discuss desired detail and rationale with building official
- The following are just a few options - Contact local WoodWorks Regional Director for regional preferences, providing rationale, other insight

Floor to Shaft Wall Detailing





Shaftliner in H-studs attached to wall with clips

Floor side wall provides typical floor support

Shaft Wall Resource

Code provisions, detailing options, project examples and more for light-frame wood and mass timber shaft walls

Free resource at woodworks.org

WoodWorks™
WOOD PRODUCTS COUNCIL

Shaft Wall Solutions For Wood-Frame Buildings

Richard McLain, MS, PE, SE • Technical Director • WoodWorks

Wood shaft walls can reduce costs and shorten the construction schedule.

It is fairly common for light wood-frame commercial and multi-family buildings to include shaft walls made from other materials. However, with the heavy use of wood structure in mid-rise construction, many designers and contractors have come to realize that wood-frame shaft walls are in fact a code-compliant means of reducing cost and shortening construction schedule.

A shaft is defined in Section 202 of the 2012 International Building Code (IBC) as "*an enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.*" Therefore, shaft enclosure requirements apply to stairs, elevators, and MEP chases in multi-story buildings. While these applications might be similar in their fire design requirements, they often have different construction constraints and scenarios where assemblies and detailing may also differ.

This paper provides an overview of design considerations, requirements, and options for wood-frame shaft walls under the 2012 IBC. While some of the IBC-referenced section numbers may be different in different editions, none of the main shaft wall provisions have been modified in the 2015 IBC.

Questions?

This concludes The American Institute of Architects Continuing Education Systems Course

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Photo: Greg Folkins Photography