Fire Walls – Seismic Diaphragm Continuity

This metal wall is the 3-hr fire wall.

Breakaway clips as required.

Metal studs designed to support self-weight.

These are two wood bearing walls, but do not constitute a "double wall" assembly per NFPA 221 nor do they contribute to the fire rating of the fire wall. They provide structural stability for the fire wall and act as bearing walls.

Basis: UL W460 (3-hr, bearing)

3-hr Wall Detail
Sheathing Not Continuous
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 Specifically the outgoing UBC provisions for Area-Separation walls have more or less been replaced by the Fire wall provisions of the IBC.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

Sheathing designed to support weight of metal wall
Or metal studs designed to support cumulative self-weight

This metal wall is the 3-hr fire wall
Breakaway clips as required
Continuous sheathing as allowed by AHJ

Basis:
UL U435 (3-hr, nonbearing)
UL W460 (3-hr, bearing)

These are two wood bearing walls, but do not constitute a "double wall" assembly per NFPA 221 nor do they contribute to the fire rating of the fire wall. They provide structural stability for the fire wall and act as bearing walls.

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 $\frac{3}{4}$ 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

<table>
<thead>
<tr>
<th>Fire Resistance Rating of Each Wall (hr)</th>
<th>Equivalent to Single Wall (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Double Walls in Type III

Noncombustible Construction Required

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

Double Wall:
Two 2-hr metal walls
back-to-back equivalent to
one 3-hr wall per NFPA 221

Wood stud bearing walls where
joists run perpendicular to firewall
(option to sheath for sheath)

Basis:
UL U415

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

Double Wall:
Two 2-hr walls
back-to-back equivalent to
one 3-hr wall per NFPA 221

Breakaway clips
as required

Hanger designed to be
installed over 1 layer
of gypsum

Basis:
GA ASW 0810
or UL U336/U373

Wood stud walls generally not
considered to be part of the 2-hr
assembly, may require their own
fire rating
Double Walls in Type III

Noncombustible Construction Required

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

Double Wall: Two 1-hr walls back-to-back equivalent to one 2-hr wall per NFPA 221

Hanger designed to be installed over 1 layer of gypsum

First wall built in place

Second wall built on ground with inside gypsum installed, then tilted up into place. Depending on the assembly*, if gypsum panels are oriented vertically and with all edges supported by studs, finishing may not be required.

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

Double Wall: Two 1-hr walls back-to-back equivalent to one 2-hr wall per NFPA 221

Breakaway clips as required

Hanger designed to be installed over 1 layer of gypsum

First wall built in place, traditional wall assembly

Second wall uses shaftliner assembly, allowing it to also be built in place (2-hr)

Basis:
*IBC Table 722.6.2(1) footnote b
UL U361

Basis:
GA ASW 0810
or UL U366/U373
A Detailing Deep Dive: Shaft Walls
Shaft Walls that are also Exterior Walls

Structural Considerations
Stairway Shaft Enclosures & Framing

When Stair Shaft Wall is Exterior Wall

**Wall Plates at Typical Floor Elevation** – Creates Potential “Hinge”

- **Intermediate Stair Landing**
  - 2x10 ledger fasted to each wall stud with (3) 16d nails

**Splice Exterior Wall Studs at Stairwells at Standard Floor Elevations.**
2x6 plates shall be continuous for the full length of the stair opening and shall extend 2'-0" beyond the opening. Overlap plates at corner and nail to each plate to the plate below with (4) 10d nails.
Shaft Walls that are also Exterior Walls

Floor Diaphragm
Braces Wall Joint

Wind Loads on
Exterior Wall

No Floor at Shaft to Brace Wall Joint

Wind Loads on Exterior Wall

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
Stairway Shaft Enclosures & Framing
Stairway Shaft Enclosures & Framing

Intermediate Stair Landing

Exterior Wall Plate Elevations Shifted Down to Intermediate Landing Elevation

- Eliminates Hinge Effect
- Avoids Interference with Landing Windows

When Stair Shaft Wall is Exterior Wall

2x10 Ledger fasted to each wall stud with (3) 16d nails

LU210 Face Mount Hanger
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) DansGlass 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
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.

Source: Clarkdietrich
**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

<table>
<thead>
<tr>
<th>System No.</th>
<th>System Height Limitation</th>
<th>Attachment Clip Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23 ft</td>
<td>10 ft o.c.</td>
</tr>
<tr>
<td>2</td>
<td>44 ft</td>
<td>Base to 20 ft: 5 ft o.c.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20 ft to 44 ft: 10 ft o.c.</td>
</tr>
<tr>
<td>3</td>
<td>66 ft</td>
<td>Base to 22 ft: 3’-4” o.c.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22 ft to 42 ft: 5 ft o.c.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42 ft to 66 ft: 10 ft o.c.</td>
</tr>
</tbody>
</table>
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
Questions?

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This concludes The American Institute of Architects Continuing Education Systems Course

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