Exterior Wall/Floor Intersections

Design No. U301
May 20, 2015
Bearing Wall Rating — 2 HR.
Finish Rating — 66 Min.

GA FILE NO. WP 4135

GYPSUM WALLBOARD, WOOD STUDS
Base layer 5/8" 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, 1 1/4" long, 0.085" shank, 1/4" heads, 24" o.c. Face layer 5/8" type X gypsum wallboard or gypsum veneer base applied at right angles to each side with 8d coated nails, 2 1/4" long, 0.100" shank, 1/4" 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)

2 Hour Wall

2 x 4's firestoppable
Exterior Wall/Floor Intersections

1 Hour Floor
Many options are available for fire-resistance tested floor and wall assemblies

No tested intersection details exist (no test ovens built for this)

We must understand the intent of the code, provide a rationale that meets the code’s intent, utilizing available information and testing results
Framing and Fire Rating Requirements

<table>
<thead>
<tr>
<th></th>
<th>IIIA</th>
<th>IIIB</th>
<th>VA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exterior wall framing</td>
<td>FRTW</td>
<td>FRTW</td>
<td>non-FRTW</td>
</tr>
<tr>
<td>Exterior bearing wall fire rating</td>
<td><strong>2-hr</strong></td>
<td><strong>2-hr</strong></td>
<td>1-hr</td>
</tr>
<tr>
<td>Floor assembly fire rating</td>
<td>1-hr</td>
<td>0-hr</td>
<td>1-hr</td>
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</tbody>
</table>

Note: FRTW = Fire Retardant Treated Wood

*IBC Table 601*
Exterior Walls – Structural Stability

IBC 705.6 Structural Stability:
Exterior walls shall extend to the height required by Section 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.
Type III Exterior Walls – FRTW Requirements

Type III Construction - IBC Section 602.3:
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.

What does this FRTW requirement include?

• Wall Framing (studs & plates) – Yes
• Wall Sheathing – Yes
• Floor Sheathing – ?
• Rim Joist – ?
• Floor Joists/Trusses – ?
AWC’s DCA3 provides exterior wall to floor intersection detailing options.

Addresses both continuity provisions (structural stability) and FRTW requirements for elements in the plane of the exterior wall.
DCA 3 Detailing Methodology – Membrane Protection for Wood Assemblies

IBC Table 722.6.2(1) provides fire protection times for various membranes

<table>
<thead>
<tr>
<th>DESCRIPTION OF FINISH</th>
<th>TIME (minutes)</th>
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</thead>
<tbody>
<tr>
<td>(\frac{3}{8})-inch wood structural panel bonded with exterior glue</td>
<td>5</td>
</tr>
<tr>
<td>(\frac{3}{32})-inch wood structural panel bonded with exterior glue</td>
<td>10</td>
</tr>
<tr>
<td>(\frac{19}{32})-inch wood structural panel bonded with exterior glue</td>
<td>15</td>
</tr>
<tr>
<td>(\frac{3}{8})-inch gypsum wallboard</td>
<td>10</td>
</tr>
<tr>
<td>(\frac{1}{2})-inch gypsum wallboard</td>
<td>15</td>
</tr>
<tr>
<td>(\frac{3}{8})-inch gypsum wallboard</td>
<td>30</td>
</tr>
<tr>
<td>(\frac{1}{2})-inch Type X gypsum wallboard</td>
<td>25</td>
</tr>
<tr>
<td>(\frac{3}{8})-inch Type X gypsum wallboard</td>
<td>40</td>
</tr>
<tr>
<td>Double (\frac{3}{8})-inch gypsum wallboard</td>
<td>25</td>
</tr>
<tr>
<td>(\frac{1}{2})-inch + (\frac{3}{8})-inch gypsum wallboard</td>
<td>35</td>
</tr>
<tr>
<td>Double (\frac{1}{2})-inch gypsum wallboard</td>
<td>40</td>
</tr>
</tbody>
</table>
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)
For a nominal char rate of 1.5 inches per hour, which has been demonstrated applicable to lumber, glulam, SCL and CLT, the equation to calculate the added fire resistance time “$t_p$” associated with a protective wood membrane of a thickness “$d$” is as follows:

$$t_p = 60 \left( \frac{d}{1.5} \right)^{1.23} \text{ minutes}$$
Platform Framing

**Structural**
- Direct bearing/no add’l hardware
- May require load transfer blocking for concentrated loads from above

**Rated Assemblies**
- Fire rating continuity of exterior walls in Type III construction questionable

**Constructability**
- Framing can be completed before drywall and insulation are installed
- Common length studs
- Overall building shrinkage may need to be considered
Semi-Balloon Framing

**Structural**
- Additional hardware/no direct bearing
- No load transfer blocking req.’d

**Rated Assemblies**
- May better accommodate fire rating continuity of exterior walls in Type III construction

**Constructability**
- Framing can sometimes be completed before drywall and insulation are installed
- Custom length studs
- Can help minimize building shrinkage
Exterior Wall/Floor Intersections

Type VA Construction: 1-hr Wall, 1-hr Floor
Typical Platform Framing

Wall sheathing

Floor sheathing

Rim joist

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

- Wall assembly has same rating as floor assembly; no continuity (structural stability) concerns
DCA 3 Detailing

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

Two-hour fire-resistance-rated exterior wall assembly, rated for exposure from interior side (and from exterior side as required by IBC 705.5)

FRTW wall framing (studs, plates, blocking, etc.)

Untreated wood rim board, designed to support full wall load (with a minimum thickness of 1 1/2" if wall is required to be rated from exterior per IBC 705.5).

FRTW wall sheathing (as required)

Untreated wood blocking with minimum thickness of 1 1/8" (Case A), 1 1/2" (Case B) or 1 1/8" (Case C). Blocking must be designed to support full wall load if wall is required to be rated from exterior per IBC 705.5.

FRTW wall framing (studs, plates, blocking, etc.)

Exterior fire protection (as required to achieve fire-resistance rating per IBC 705.5)

Two-hour fire-resistance-rated exterior wall assembly, rated for exposure from interior side (and from exterior side as required by IBC 705.5)

One-hour fire-resistance-rated floor/ceiling assembly made with untreated framing members and floor sheathing.

Ceiling membrane (as required for one-hour floor assembly):
- Case A: Two layers of min 5/8" Type X GWB or equivalent (used in conjunction with min 1 1/4" blocking)
- Case B: Two layers of min 1/2" Type X GWB or equivalent (used in conjunction with min 1 1/4" blocking)
- Case C: One layer of min 5/8" Type X or Type C GWB (used in conjunction with min 1 1/8" blocking and min 1 1/2" 2.5pcf (nominal) mineral wool batt insulation resting on furring or resilient channels)
DCA 3 Detailing

Methodology:
Fire-resistance for exposure from interior side:

- Case A: Minimum 1\(\frac{1}{8}\)-inch-thick inner rim board plus two layers of minimum \(\frac{5}{8}\) 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 \(\frac{5}{8}\) in. Type X GWB (per IBC Table 722.6.2(1)).

- Case B: Minimum 1\(\frac{3}{4}\)-inch-thick inner rim board plus two layers of minimum \(\frac{1}{2}\) 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 \(\frac{1}{2}\) in. Type X GWB (per IBC Table 722.6.2(1)).

- Case C: Minimum 1\(\frac{5}{8}\)-inch-thick inner rim board plus one layer of minimum \(\frac{5}{8}\) in. Type X GWB in the ceiling membrane plus minimum 1\(\frac{1}{2}\)-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 \(\frac{5}{8}\) 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 1\(\frac{1}{8}\)-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.
Exterior Wall/Floor Intersections

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 based on the DCA 3 detailing approach and 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 Wall/Floor Intersections

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

Rationale for detail approval (fire exposure from inside):
- Ceiling membrane(s) provide initial fire protection, add’l blocking provides remaining protection of structural rim joist through char calculations
Exterior Wall/Floor Intersections

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

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

Rationale for detail approval (fire exposure from outside):
• Wall membrane(s) provide initial fire protection, rim joist provides remaining protection of structural blocking through char calculations

Legend
- Untreated Wood
- FRT Wood
Exterior Wall/Floor Intersections

Type III B Construction: 2-hr Wall, 0-hr Floor
Typical Platform Framing

Rationale for detail approval (fire exposure from inside):

- Ceiling membrane(s) provide initial fire protection, add’l blocking provides remaining protection of structural rim joist through char calculations.
Exterior Wall/Floor Intersections

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

Legend
- Untreated wood
- FRT Wood

Rationale for detail approval (fire exposure from inside):
- Ceiling membrane(s) provide initial fire protection, inner side of rim joist provides remaining protection through char calculations (un-charred portion adequate for vertical load)
Exterior Wall/Floor Intersections

Type IIIB Construction: 2-hr Wall, 0-hr Floor
Semi-Balloon Framing

Legend
- Untreated wood
- FRT Wood

Rationale for detail approval (fire exposure from either side):
• Membrane fire protection neglected, entire protection provided by rated wall assembly
Hangers Installed Over GWB

Commonly called Fire Wall or Drywall Hangers
Hangers Installed Over GWB

Top Flange Hangers & Face Mount Hangers Available
QUESTIONS?

This concludes The American Institute of Architects Continuing Education Systems Course

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