Building Enclosure Design and Detailing to Account for Wood Shrinkage

Tammy Siliznoff, M.S., P.E. (CA), LEED AP
Associate, Senior Project Manager
RDH Building Science

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Shrinkage of Wood During Construction

→ Wood-frame Shrinkage
  → Total shrinkage dependant on amount of tangential/radial grain wood and initial moisture content
  → Differential movement is a real concern when detailing, especially for taller wood-frame buildings

→ Cumulative shrinkage for 6-story wood-frame building at roof eave.

<table>
<thead>
<tr>
<th>Case</th>
<th>Estimated Shrinkage at Eave</th>
<th>(mm)</th>
<th>(inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 – S-GRN joists and S-GRN plates</td>
<td></td>
<td>146</td>
<td>5½”</td>
</tr>
<tr>
<td>#2 – S-DRY joists and S-DRY plates</td>
<td></td>
<td>74</td>
<td>3”</td>
</tr>
<tr>
<td>#3 – Dried S-DRY joists and dried S-DRY plates</td>
<td></td>
<td>46</td>
<td>1¾”</td>
</tr>
<tr>
<td>#4 – SCL joists and S-DRY plates</td>
<td></td>
<td>42</td>
<td>1½”</td>
</tr>
</tbody>
</table>
Building Enclosure Detailing – Control Functions and Critical Barriers

Control Functions
- Water
- Air
- Heat
- Vapour
- Sound
- Fire

Critical Barriers
- Water Shedding Surface
- Water Resistive Barrier
- Air Barrier System
- Thermal Insulation
- Vapour Retarder/Barrier
- Building Form & Features

Primary Relationship
Secondary Relationship
Building Enclosure Design and Detailing Goals

- Continuity of control layers within and between assemblies:
  - Water shedding surface
  - Water resistive barrier (WRB)
  - Air barrier
  - Thermal layer
  - Vapor barrier (if appropriate)

- Allowing for movement, maintaining fireproofing, accommodating structural requirements and aesthetics
Allowing for Wood-Frame Shrinkage
Allowing for Wood-frame Shrinkage
Detailing for Differential Shrinkage
Lessons Learned from Wood-frame Shrinkage
Window Sill Detail – Sealant Joint Method
Window Sill Detail – Two-Piece Flashing Method
Window Sill Detail – Sliding Flashing Method
Masonry Wall Interfaces

- Elevator walls
- Fire walls
- Zero lot line walls
- Chimneys
Masonry Walls
Masonry Walls
Firewall Detail Locations

1. Roof at firewall parapet
2. Exterior wall perpendicular to firewall
3. Interface between these two
CMU Firewall Example Detail - Roof

1. Roof assembly
   - Roof membrane
   - Protection board
   - 2 layers 50 mm (2 in.) rigid insulation
   - Tapered rigid insulation to provide slope
   - Self-adhered membrane
   - Sheathing
   - Wood roof framing
   - Gypsum board

2. Pre-finished metal flashing with standing seam joints & hook strips
3. Intermittent flashing attachment clips
4. Liquid-applied noncombustible waterproof coating over top of firewall & onto transition membrane/strip
5. Rigid insulation under cap flashing
6. Mortar to provide slope
7. Foil-faced self-adhered transition membrane
8. Pre-cured flexible silicone transition strip sealed at top & bottom edge to foil-faced membranes
9. Foil-faced self-adhered transition membrane on sloped metal support flashing
10. Batt insulation in framed roof curb
11. Termination bar on self-adhered membrane on firewall with excess membrane draped below
12. Semi-rigid mineral wool insulation
13. Firewall as required
14. Vertically sliding breakaway firewall anchor
15. Structural wall as required with insulation 600 mm (24 in.) down from top of wall & as required acoustically
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10. Batt insulation in framed roof curb
11. Termination bar on self-adhered membrane on fireplace with excess membrane draped below
12. Semi-rigid mineral wool insulation
13. Firewall as required
14. Vertically sliding breakaway firewall anchor
15. Structural wall as required with insulation 600 mm (24 in.) down from top of wall & as required acoustically
CMU Firewall Example Detail - Wall

1. Wall Assembly
   Cladding (fibre cement siding)
   19mm (3/4") wood furring (p.t.)
   Vapour permeable sheathing membrane
   Sheathing
   Wood framing 38x140mm (2x6)
   Batt insulation
   Polyethylene
   Gypsum board

2. Semi-rigid mineral wool insulation

3. Flexible noncombustible membrane

4. Metal breakshape cover
   (or other non-combustible cladding)

5. Backer rod & sealant

6. Vertically sliding breakaway firewall anchor

7. Structural interior wall as required with insulation minimum 600mm (24") in from exterior face of exterior wall

8. Firewall as required

9. Polyethylene sealed to face of firewall
Zero Lot Line Construction - Vertical Joint

**RHa:** Terminate cover at same height in both SK-06 and SK-07.

**Silicone Sealant Filler (Aesthetic):**

**Drainage:** From horizontal, extend out above.

**Provide dimension:** Coordinate desired closure trim with Arch.

**RHa:** Per SMACNA, increase to 9 inches to allow 3" movement plus 1" at all gaps.
Zero Lot Line Construction

- DENSGLASS SHEETING ON WALL PANEL
- BUILDING WRAP WEATHER BARRIER - TYPE 2, Lap O FOIL FACE SAW AND SHEET METAL, PLACED BELOW
- FIBER CEMENT Siding PCS-3

3' 1/3" GUTTER SLOPED TO DRAIN @ 1" PER FT., 24 GA. MIN. BONDERIZED GUTTER PAINT TO MATCH CLADDING. PROVIDE DOWNSPOUT @ ENDS PER RFI. BS. 56-01

RDH: 12 inch backer plate per SMACNA. Set in 2 rows of sealant both sides of butt joints.

RDH: 3 inch sheet silicone over butt joint. Or 6 inch cover plate set in 2 rows of sealant both sides.

RDH: If these drawings are being considered as shop drawings, then need to submit all fastener types and lengths, etc.

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- BUILDING WRAP WEATHER BARRIER - TYPE 2, Lap O FOIL FACE SAW AND SHEET METAL, PLACED BELOW
- FIBER CEMENT Siding PCS-3

24 GA. BONDERIZED RIDGE FLASHING, PAINT TO MATCH ADJACENT SHEET METAL TRIM

RDH: 4 inch

16 GA. BONDERIZED FIELD FASTENERS OR PRE-COATED EXPANSION JOINT COVER PROVIDER BONDERIZED PLATES AT SPICE JOINTS AND IN COLOR MATCHED PREFORMED SILICONE TAPE OR SPLICE JOINTS

6 GA. SCM CONTINUOUS EXPANSION JOINT COVER SUPPORT, EXPANSION JOINT COVER TO SLIDE FREELY OVER SUPPORT

- DENSGLASS SHEETING ON WALL PANEL
- BUILDING WRAP WEATHER BARRIER - TYPE 2, Lap O FOIL FACE SAW AND SHEET METAL, PLACED BELOW
- FIBER CEMENT Siding PCS-3

24 GA. BONDERIZED ROLL FLASHING, PAINT TO MATCH ADJACENT SHEET METAL TRIM

LOW MODULUS SILICONE SEALANT O BONDERIZED ROD

6 GA. BONDERIZED BL30 PARAPET WALL
Zero Lot Line Construction
Steel Columns

→ Horizontal wood members shrink while vertical members do not.
Steel Columns

Figure 2-16 Mitigated steel-column-related differential shrinkage

Figure 2-17 Steel-column-related differential shrinkage
Strategies to Accommodate Wood Shrinkage

→ Size sealant joints appropriately
→ Lap metal flashings for movement
→ Provide bellows in air/water barrier membranes
→ Include elastic membranes that can accommodate movement
→ Provide additional slope at horizontal flashings to account for shrinkage
→ Leave space for movement of materials
Balconies & Slope

- Backslope is created
- Horizontal wood members within exterior wall shrink
- Steel columns run full height and do not shrink

- Initial slope - Shrinkage - Final slope
  - +1" - $\frac{3}{4}$" = 0"
  - +2" - $\frac{3}{4}$" = 1¼"
  - +1¼" - $\frac{1}{2}$" = 1¼"
  - +1½" - $\frac{1}{4}$" = 1¼"
Strategies for Balconies

→ Match the balcony construction with that of the building for uniform shrinkage
→ Increase the initial slope to account for shrinkage
→ Cantilevered balconies
→ Bolt-on balconies - architectural component, but not part of building enclosure
  → Simplifies detailing – no saddles
  → Continuous water, air, thermal layers
BUILDING ENCLOSURE DESIGN AND DETAILING TO ACCOUNT FOR WOOD SHRINKAGE

Discussion + Questions

tsiliznoff@rdh.com

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