Meeting Fire Codes with OSB
Building code requirements related to fire and life safety can be challenging for designers, particularly when it comes to proving fire resistance and maintaining structural performance. As such, understanding the applicability of available products can be helpful for designers. This presentation will provide an overview of fire-rated cementitious-coated oriented strand board (FRCC OSB) sheathing for wall and roof sheathing applications. Topics will include its structural and fire performance, available wall assemblies, and contribution to enhancing the sustainable built environment.
Learning Objectives

At the end of this program, participants will be able to:

1. Identify the components and list the physical attributes of fire-rated cementitious coated OSB (FRCC OSB) sheathing

2. Explain how FRCC OSB sheathing can be used to meet code requirements while reducing labor costs and construction time

3. Discuss building design and code requirements, and approval and testing standards, relevant to FRCC OSB sheathing

4. Demonstrate common construction applications relevant to FRCC OSB sheathing
What Is Oriented Strand Board (OSB) Sheathing?

- Made by blending rectangular wood strands with thermosetting, water-resistant adhesives and wax
- Engineered panel is strong, uniform, dense and workable
- Used for sub-floor, wall and roof applications
- Exposure 1 Classification
What Is FRCC OSB Sheathing?

- Panels consist of a proprietary, non-combustible, fiberglass-reinforced, cementitious coating that is bonded to one or both sides of a sheet of OSB

- Coating is a layer of non-combustible magnesium oxide cement and chemically bound water
Installation Considerations

• Installs with standard fasteners

• Gapping between panels is the same as that used for OSB and plywood

• Joints do not require fire caulk

• Handling and safety requirements are the same as those for other structural panels
FRCC OSB: Panel Dimensions & Panel Weight

• 7/16", 15/32", 19/32", and 23/32" OSB performance categories in 4' x 8', 9', 10' and 12' lengths

• Struct-1 grade is available

• Coating adds approximately 0.6 lbs per square foot to a board
  • panel treated on one side = 66lbs
  • panel treated on both sides = 85lbs
  • 4' x 8' x 5/8" gypsum board (80 lbs) plus a 4' x 8', 15/32 wood sheathing panel = over 120lbs
Structural Performance

- Fiberglass reinforcement increases strength, bending stiffness, shear capacity, and impact resistance of the panels.

- Coating causes no initial or long-term loss of structural performance, nor does it increase water absorption.

- Structural design values are the same as those for wood structural panels in the same thickness category.

**Figure 1. Recommended Uniform Roof Live Loads for FRCC OSB And Rated Subfloor With Strength Axis Perpendicular To Supports**

<table>
<thead>
<tr>
<th>Panel Span Rating</th>
<th>Performance Category</th>
<th>Maximum Span (in.) With Edge Support (a)</th>
<th>Maximum Span (in.) Without Edge Support</th>
<th>Allowable Live Loads (psf)(m) Spacing of Supports Center-to-Center (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>24/16</td>
<td>7/16</td>
<td>24</td>
<td>24</td>
<td>190 100 65 40</td>
</tr>
<tr>
<td>32/16</td>
<td>15/32 1/2</td>
<td>32</td>
<td>28</td>
<td>325 180 120 94 30</td>
</tr>
<tr>
<td>40/20</td>
<td>19/32 5/8</td>
<td>40</td>
<td>32</td>
<td>- 305 205 151 60 30</td>
</tr>
<tr>
<td>48/24</td>
<td>23/32 3/4</td>
<td>48</td>
<td>36</td>
<td>- - 280 175 95 45 35</td>
</tr>
</tbody>
</table>
# Structural Performance

**FIGURE 2. ALLOWABLE SHEAR (POUNDS PER FOOT) FOR PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS-FIR, LARCH, OR SOUTHERN PINE**(a) OR WIND OR SEISMIC LOADING**(b,e.g.h.i)** (See also 2006 IBC Table 2306.4.1)

<table>
<thead>
<tr>
<th>Panel Grade</th>
<th>Performance Category</th>
<th>Minimum Nail Penetration in Framing (in.)</th>
<th>Nail Size (Common or Galvanized Box)</th>
<th>Panels Applied Direct to Framing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>8d</td>
<td>6</td>
</tr>
<tr>
<td>Structural 1 Grades</td>
<td>7/16</td>
<td>1-3/8</td>
<td></td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>15/32</td>
<td></td>
<td></td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>15/32</td>
<td>1-1/2</td>
<td>10d</td>
<td>340</td>
</tr>
<tr>
<td>Rated Sheathing</td>
<td>7/16</td>
<td>1-3/8</td>
<td>8d</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>15/32</td>
<td></td>
<td></td>
<td>260</td>
</tr>
<tr>
<td></td>
<td>15/32</td>
<td>1-1/2</td>
<td>10d</td>
<td>310</td>
</tr>
<tr>
<td></td>
<td>5/8</td>
<td></td>
<td></td>
<td>340</td>
</tr>
</tbody>
</table>
Code Compliance

- Requirements for fire-resistant construction are specified in IBC, IRC, and state and local building and safety codes.

- ICC-ES considers the performance requirements of products in construction applications and establishes test criteria.

- ICC-ES publishes acceptance criteria and ESRs.

- Test procedures are regulated by ASTM, UL etc.

- Code compliant applications of FRCC OSB are described in manufacturers’ proprietary code reports, such as ESR-1365.
Fire Ratings - Referenced & Required by IBC

Fire resistance
• Ability of a material or an assembly of materials to resist burn-through and, in load-bearing assemblies, to support a given load for a specified time period under standardized fire conditions

Flame spread
• A measure of the speed of travel of flame on the surface of a given product or material under a standard set of conditions
Flame Spread Testing

- ASTM E84, UL 723 “Tunnel Test”
- Flame Spread Ratings (Standard 10-Minute Test)
  - Class A, 0-25
  - Class B, 26-75
  - Class C, >75
- 30-minute test required by IBC 2303.2 - progression <10.5 ft
- Smoke development is measured
- Does not measure burn-through resistance
FRCC OSB Flame Spread Rating

- Flame spread index of 0 to 15 in the 10-minute test
- Flame progression of under 10.5 feet when the test is extended for 30 minutes
- Satisfies requirements for smoke development
- Panels carry a stamp indicating that it satisfies the performance requirements of Section 2303.2 of the IBC
- ESR reports specify the code-compliant applications and code officials have the authority to permit FRCC OSB in various applications
Burn-Through Resistance

- ASTM E119 test (Standard Test Methods for Fire Tests of Building Construction and Material) is used to determine fire resistance ratings for wall and floor/ceiling assemblies.
ASTM E119 Time-Temperature Curve
ASTM E119 Wall Assembly Test
## Construction Types (per IBC Table 503)

<table>
<thead>
<tr>
<th>Type of Construction</th>
<th>FRTW or FRCC OSB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I (fire-resistive)</td>
<td>Mainly non-structural*</td>
</tr>
<tr>
<td>Type II (non-combustible)</td>
<td>Roof deck, non-structural*</td>
</tr>
<tr>
<td>Type III (ordinary)</td>
<td>Throughout*</td>
</tr>
<tr>
<td>Type IV (heavy timber)</td>
<td>Throughout</td>
</tr>
<tr>
<td>Type V (wood frame)</td>
<td></td>
</tr>
</tbody>
</table>

*FRCC OSB must be treated on both faces of panel
Vertical Continuity of Fire Walls

- A common application for FRCC OSB is in roof decking on either side of a fire wall in Type V construction.

- IBC 706.6 requires a 30” parapet for walls rated up to 2 hours.

- Fire wall can terminate at roof deck if code-compliant FR decking installed on both sides.
Multi-Family Roof Deck Construction

Fire wall with the adjacent trusses and Class A-rated roof deck

Gypsum underlayment, FRT, or FRCC OSB panels
Vertical Continuity of Fire Walls in Roof Decks

- FRCC OSB, treated on one side, is code-compliant and meets vertical continuity requirements with a single panel solution, with full load/span ratings and an Exposure 1 Classification.

Condominium project, Southern California
Summary: FRCC OSB in Roof Decks

Why consider FRCC OSB in roof decks?

• Designed to withstand exposure to moisture during normal construction periods

• Lower labor and material costs as compared to gypsum option

• Panels lie flat, with no delamination

• 7/16 thickness category available
Exterior Rated Walls in the IBC

Typically, fires start within structures as opposed to outside them.

Fire Protection on Inside of Building

Fire Protection on Exterior When < 10’
What Is the Fire Separation Distance (FSD)?

• FSD is the distance measured from the building face to one of the following:
  1. The closest interior lot line
  2. The centerline of a street, an alley or public way
  3. An imaginary line between two buildings on same property

• IBC Section 705.5 – For most use and occupancy categories, walls can be rated from inside only when **FSD is 10 feet** or more.
Exterior Walls of Type III Construction
Exterior Walls Type III: 2-Hour

- Traditional assembly: 2 layers of Type X GWB on the interior, wood framing, a shear panel layer if needed, then 1 or 2 layers of exterior GWB (depending on FSD) and a non-combustible exterior wall covering.

<table>
<thead>
<tr>
<th>BUILDING ELEMENT</th>
<th>TYPE I</th>
<th>TYPE II</th>
<th>TYPE III</th>
<th>TYPE IV</th>
<th>TYPE V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing walls</td>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Exterior</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

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Fire protection required for exterior sheathing even when wall is rated only from interior

- Two layers of 5/8" Type X GWB, FRT wood studs, fiberglass insulation, and FRT plywood exterior sheathing: fails test.

Replacement of fiberglass with 3lb mineral wool results in UL Design V314, a viable assembly.
2-Hour Exterior Wall Assemblies with FRCC OSB

- UL U349
- UL W408

- 2 layers of Type X GWB on interior side
- 1 layer of FRCC OSB on exterior side of studs
- FRCC OSB must be treated on both sides
- 2 hours from interior, 0 or 1 hour from exterior
UL Design W408 Variations, supported by Engineering Evaluations

- 2hr/2hr rating can be achieved by adding 1 layer of 5/8” exterior gypsum

- 2hr/1hr rating with fiberglass insulation where standard brick is exterior facing

- 2hr/2hr rating where 7/8”, 3-coat stucco is exterior facing
Code-Compliance in Type III Exterior Walls

- Code Compliance of FRCC OSB in bearing and non-bearing exterior walls of Type III buildings, in accordance with IBC Section 602.3, is described in ESR-1365

2-hour rated wall assembly with FRCC OSB in Type III construction
(Student housing, College Park, MD)
Park Crest Project, Lynchburg, VA
Advantages of Using FRCC OSB in Type III Construction

• Labor savings
• Reduced dead load
• Reduced wall thickness
• Better substrate for fastening of exterior cladding
FRCC OSB in 1-Hour Rated Exterior Walls
Example: Common 1-Hour Exterior Wall

• UL Generic Design U305: Load-bearing assembly with 5/8" Type X GWB on each side

• Rated for 1 hour from both sides

• Structural panel may be added without compromising fire resistance
BTC/WA-60-01:1-Hour Wall Assembly, FRCC OSB

- 5/8" Type X GWB on interior side
- 2” x 6” framing
- 5.5" mineral wool insulation
- FRCC OSB against studs with cementitious side facing exterior
- Wood, fiber cement, steel, or stucco as exterior wall covering
- 2145 pounds per stud load limitation
Advantages: 1-Hour Exterior Walls with FRCC OSB

- Labor savings
- Reduced dead load
- Reduced wall thickness
- Better substrate for fastening of exterior cladding

1-Hour Wall Along Property Line

1-Hour Walls – Multi-Family Project
New 1-hour wall option

- UL Design No. V311
- Similar to previous, but allows fiberglass insulation
- Uses enhanced type of FRCC OSB, available later in 2016.
- Requires fire-caulking of joints
- Brick, stucco, steel, fiber cement facings
Partition Walls between Living Spaces

Red Leaf Townhomes, Seattle, WA
BXUV U350 2-Hr Party Wall Assembly
Revisions to 2015 IRC Impact Town Home Partition Walls

• The requirement for separate, 1-hour-rated, structurally-independent walls in R302.1 have been removed, in favor of the common wall provisions of R302.2.

• Wall must be rated from both sides, for 1 hour with sprinkler system, 2 hours without sprinklers.

• No plumbing, mechanical, ducts, or vents are permitted in the common separation wall. Electrical penetrations are required to be in accordance with R302.4.
Partition Walls b/w Living Spaces (cont)

- STC ratings of 56-62, depending on the configuration
- Floor - ceiling connections must maintain continuity
- Several options for floor-wall connections
FRCC OSB in Type I and Type II Buildings

• IBC Section 603.1. describes areas where combustible materials are allowed in Type I and Type II buildings

FRT wood is permitted in:
• 25.1: Non-bearing partition walls rated 2-hours or less
• 25.2: Non-bearing exterior walls where no fire rating is required
• 25.3: Roof construction, including girders, trusses, framing, and decking (Except in most IA buildings above 2 stories)
Additional Applications

- Return ducts and plenums
- Commercial roof decks
- SIPs
Wildfire Zones

• California Building Code (CBC) requires that building materials and products used in the Wildland Urban Interface (WUI) zones meet certain ignition resistance and fire standards

• Recognizes FRCC OSB sheathing as an approved component of certain wall assemblies meeting the requirements of the California 12-7A-1 fire test for exterior walls

• CAL-FIRE Listings 8140 2027: 0005 and 0006
California 12-7A-1 Wall Test
WUI Zones

- Under-eave construction
- Closed soffit construction, CAL-FIRE Listing 8140 2027:0007
Course Summary

- FRCC OSB sheathing consists of a sheet of OSB with a non-combustible, fiberglass-reinforced magnesium oxide coating
  - Designed to resist ignition, inhibit the spread of flames and slow the rate of heat transfer through the panel
  - Applications: Fire-resistance-rated wall assemblies, roof decking (to satisfy vertical continuity of fire wall requirements), assemblies meeting California WUI fire hazard zone requirements, roof decks in Type II construction, SIP panels, and applications requiring a 15-minute thermal barrier
- Code-compliant or fire-rated materials must pass tests which measure strength and stiffness, bond durability and water resistance, flame spread, and fire resistance
Questions and Comments?

Thank You for Attending!

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