

# MEETING FIRE CODE WITH ORIENTED STRAND BOARD

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# COURSE DESCRIPTION



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

1. Describe the physical attributes, fire performance and code-compliance of fire-rated cementitious-coated oriented strand board (FRCC OSB) sheathing.
2. Explain how FRCC OSB sheathing can be used to reduce labor costs and construction time.
3. Describe fire-rated wall assemblies relevant to FRCC OSB sheathing in the context of wood-frame building design and building code requirements.
4. Describe common construction applications for FRCC OSB sheathing in Types II, III and V construction.

# WHAT IS ORIENTED STRAND BOARD (OSB) SHEATHING?

- Developed more than 30 years ago
- High-performance structural panels
- Strong, uniform, dense and workable
- Used for sub-floor, wall and roof applications
- Exposure 1 classification; can withstand exposure to moisture during normal construction delays



# WHAT IS FRCC OSB SHEATHING?

Panels consist of a proprietary, non-combustible coating, 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 reinforced with fiberglass



# 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 wood 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', and 10' 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



# CODE COMPLIANCE

- Code-compliant applications of FRCC OSB are described in ESR-1365
- 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, NFPA, UL etc.
- ESR reports specify the code-compliant applications. Code officials have the authority to permit FRCC OSB in various applications
- [www.icc-es.org/evaluation\\_reports/](http://www.icc-es.org/evaluation_reports/)

# 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**

Panel Span Rating	Performance Category**	Maximum Span (in.)		Allowable Live Loads (psf) <sup>(1)</sup>							
		With Edge Support (a)	Without Edge Support	Spacing of Supports Center-to-Center (in.)							
Rated Sheathing <sup>(1)</sup>				12	16	20	24	32	40	48	60
24/16	7/16	24	24	190	100	65	40				
32/16	15/32, 1/2	32	28	325	180	120	94	30			
40/20	19/32, 5/8	40	32	-	305	205	151	60	30		
48/24	23/32, 3/4	48	36	-	-	280	175	95	45	35	

# 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 product or material under a standard set of conditions



# FLAME SPREAD TESTING

## “Tunnel Test”

ASTM E84, or UL 723

Flame Spread Ratings (Standard 10-Minute Test)

- Class A or 1
  - Class B or 2
  - Class C or 3
- 
- Test extended to 30 minutes for certification of FRT wood
  - Burn-through resistance is not measured
  - Smoke development is measured



# CRITERIA FOR FRT WOOD (IBC SECTION 2303.2)

- Flame spread index of 25 or less in the 10-minute test
- Flame progression of less than 10.5 feet when the test is extended for 30 minutes
- Does not exceed the criteria for smoke development
- FRCC panels carry a stamp indicating that it satisfies the performance requirements of Section 2303.2 of the IBC

# BURN-THROUGH RESISTANCE

ASTM E119 (Standard Method for Fire Tests of Building Construction and Materials) is used to determine fire resistance ratings for wall and floor/ceiling assemblies.

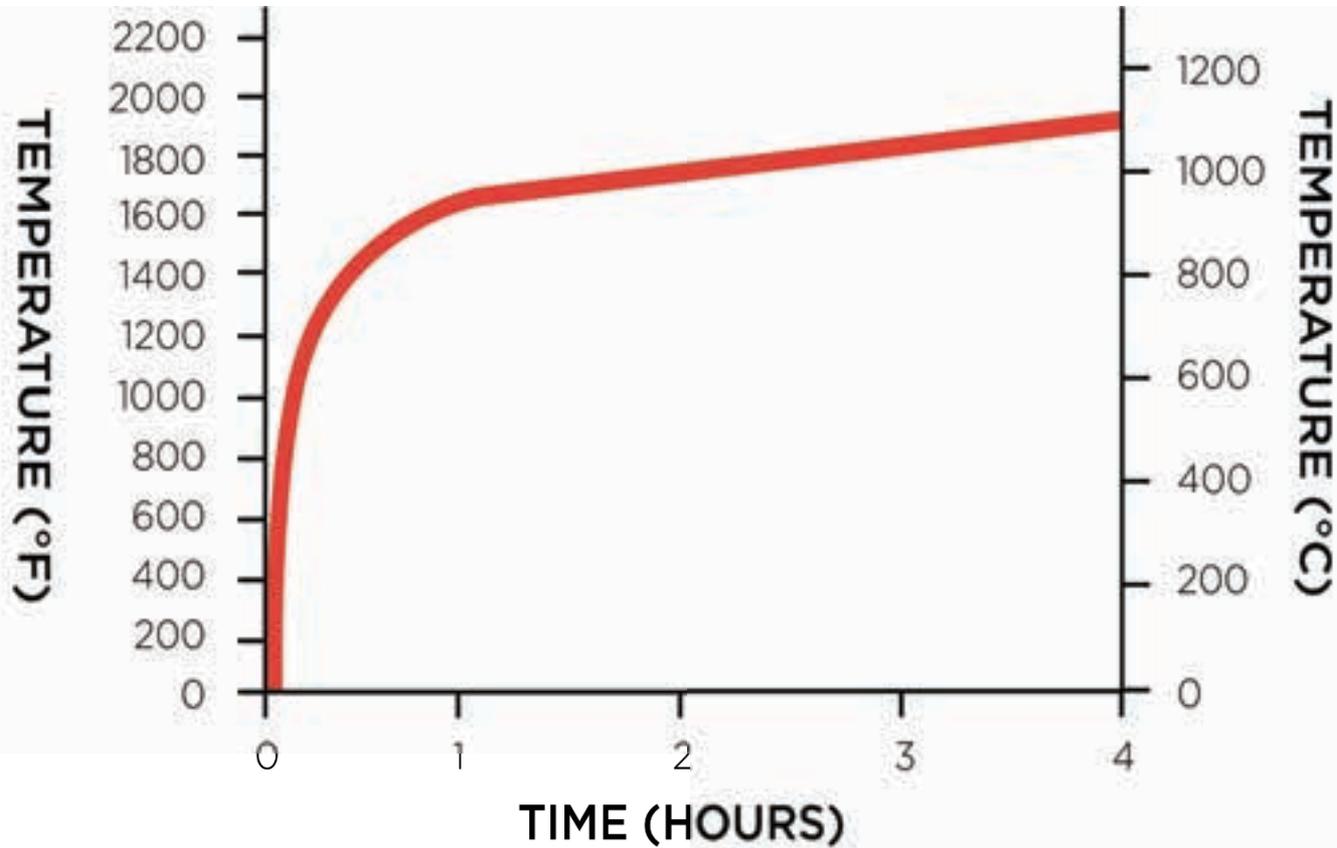


Wall Test Furnace



Wall Assembly Test

# ASTM E119 TIME-TEMPERATURE CURVE



# ASTM E119 WALL ASSEMBLY TEST



# CONSTRUCTION TYPES (PER IBC TABLE 504.3 & 504.4)

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

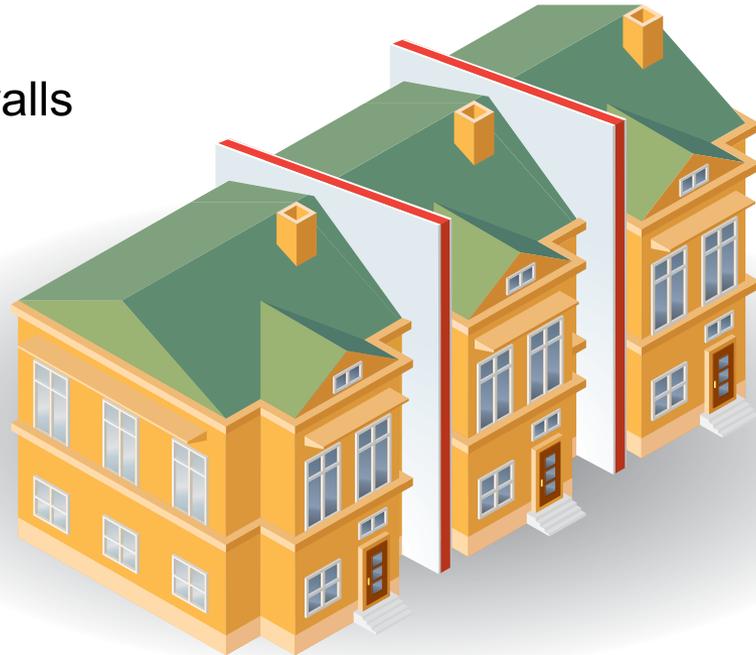
\*FRCC OSB must be treated on both faces of panel

# 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

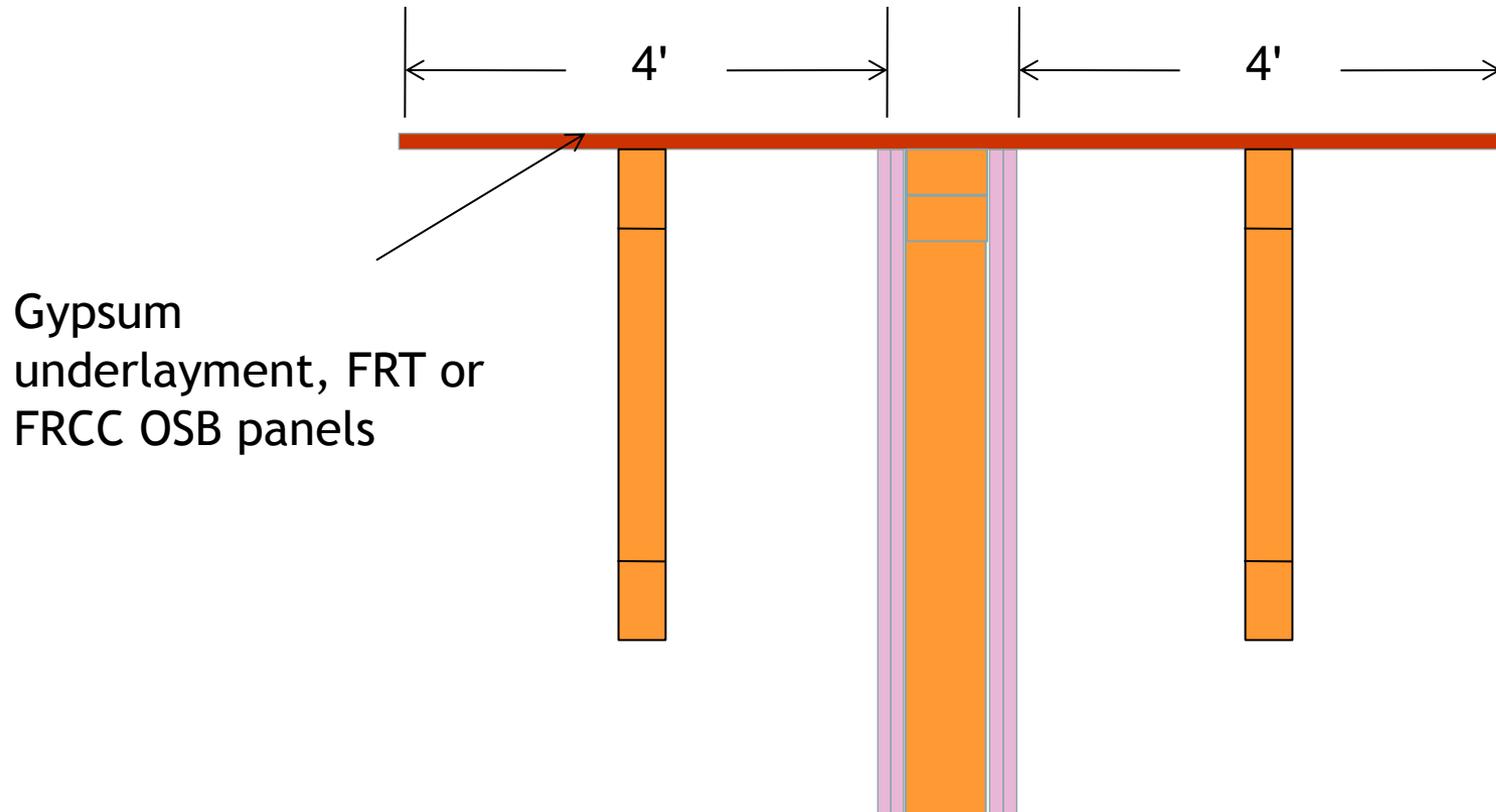
IBC 706.6 requires a 30" parapet for walls rated up to 2 hours

As an exception, fire walls can terminate at roof deck if code-compliant FR sheathing is installed for 4 feet along the wall



# MULTI-FAMILY ROOF DECK CONSTRUCTION

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



# EXTERIOR WALLS OF TYPE III CONSTRUCTION

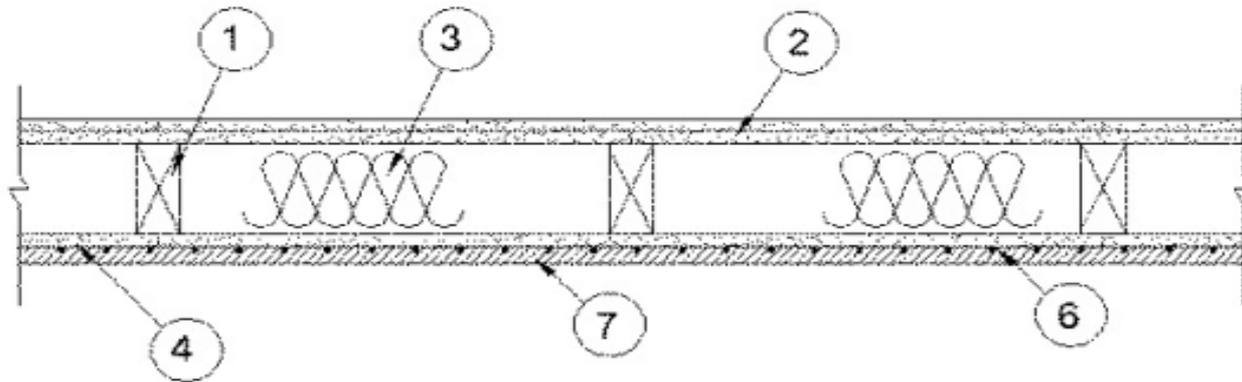


# EXTERIOR WALLS TYPE III: 2-HOUR

TABLE 601

FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Bearing walls									
Exterior	3	2	1	0	2	2	2	1	0



Traditional approach: 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 and a non-combustible exterior wall covering

# ASTM E119 2-HOUR WALL ASSEMBLY TEST

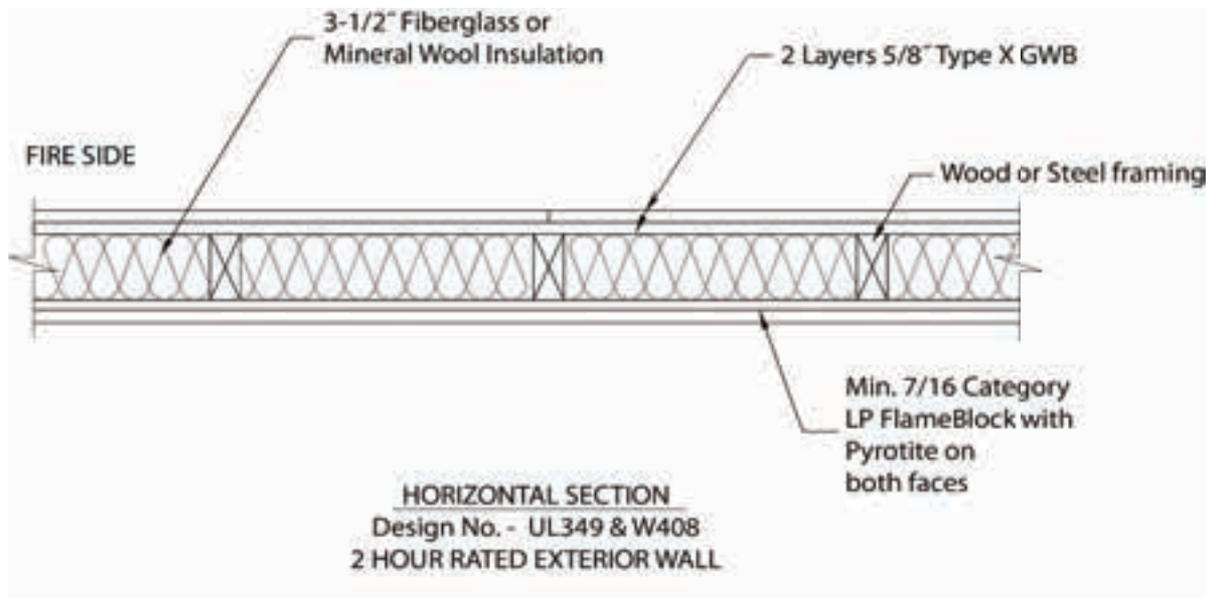
- Two layers of 5/8" Type X GWB, FRT wood studs, fiberglass insulation, and FRT plywood exterior sheathing
- Replacement of fiberglass with 3pcf mineral wool results in UL Design V314, a UL-listed assembly.



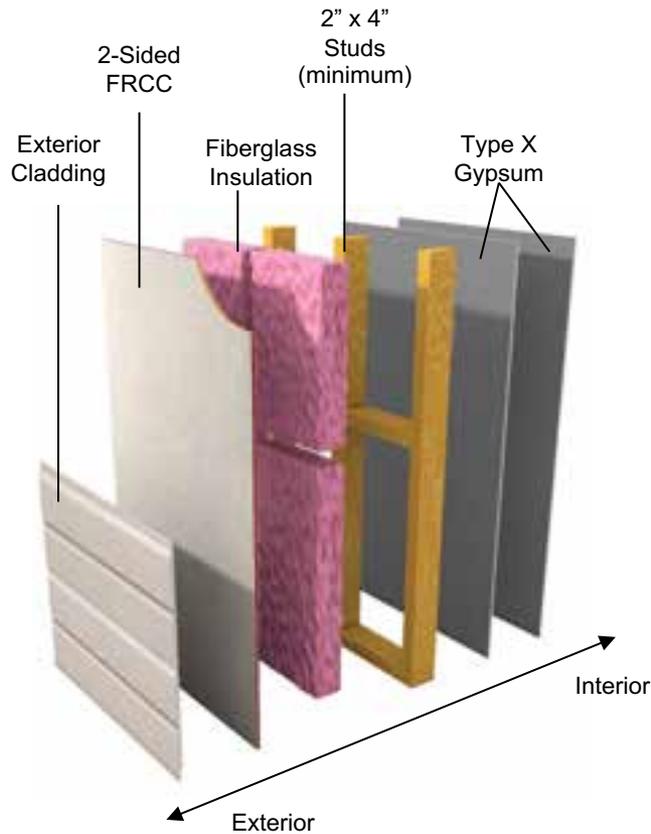
# 2-HOUR EXTERIOR WALL ASSEMBLIES WITH FRCC OSB

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

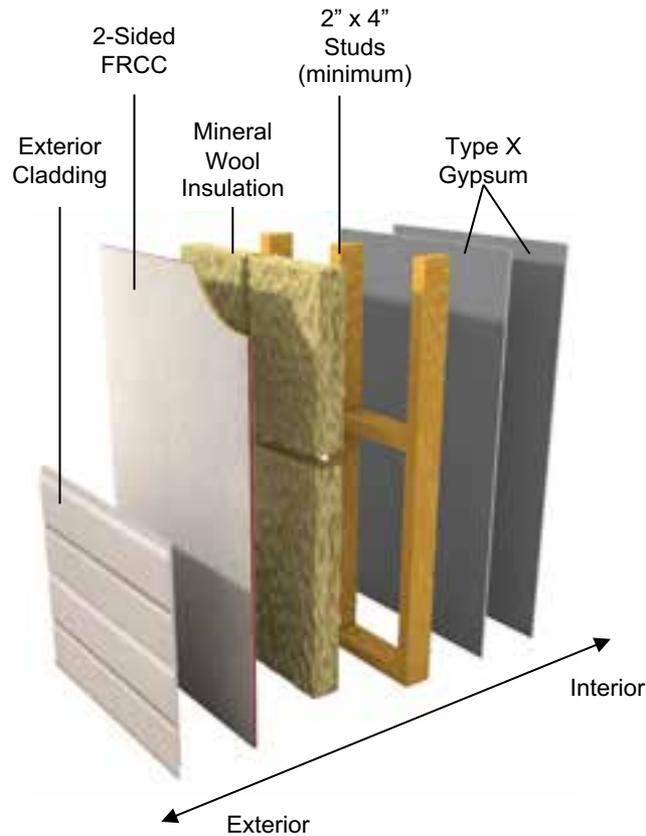


# FRCC ASSEMBLY U349



<b>Application</b>	<ul style="list-style-type: none"> <li>Exterior load-bearing wall</li> </ul>
<b>Fire rating</b>	<ul style="list-style-type: none"> <li>2 hours (from inside only)</li> </ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"> <li>Type III (5-6 story commercial or multi-family)</li> </ul>
<b>Advantages over competing assemblies</b>	<ul style="list-style-type: none"> <li>Removes one layer of gypsum</li> <li>Switches fiberglass in for mineral wool; contractors find that mineral wool is more difficult to install</li> <li>Allows for standard OSB design values, while FRT plywood must take deductions</li> </ul>

# FRCC ASSEMBLY W408



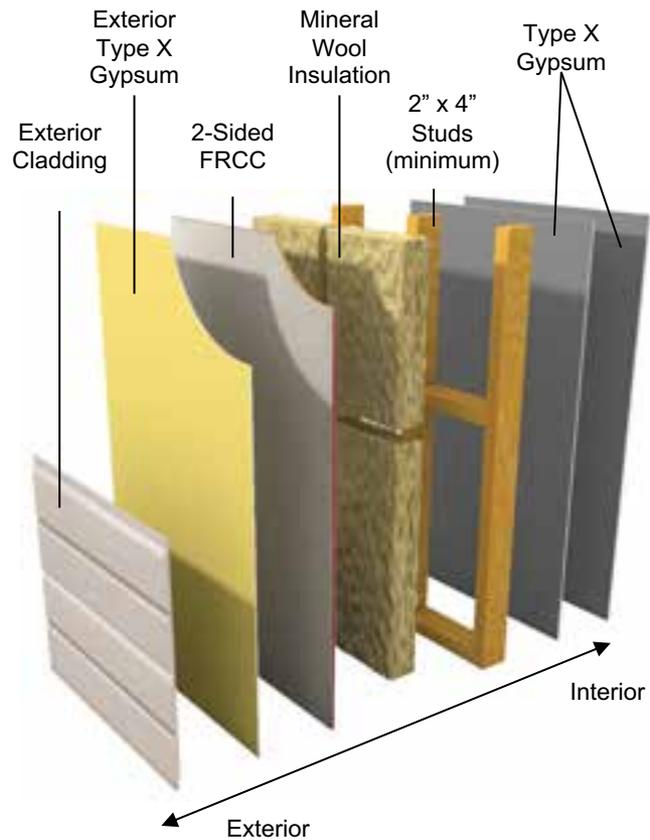
<b>Application</b>	<ul style="list-style-type: none"><li>• Exterior load-bearing wall</li></ul>
<b>Fire rating</b>	<ul style="list-style-type: none"><li>• 2 hours (2 hours from inside, 1 hour from outside)</li></ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"><li>• Type III (5-6 story commercial or multi-family)</li></ul>

# UL DESIGN W408 VARIATIONS, SUPPORTED BY ENGINEERING EVALUATIONS

- 2hr/1hr rating with fiberglass insulation where standard brick is exterior facing
- 2hr/2hr rating where 7/8", 3-coat stucco is exterior facing



# FRCC ASSEMBLY V337



<b>Application</b>	<ul style="list-style-type: none"><li>Exterior load-bearing wall</li></ul>
<b>Fire rating</b>	<ul style="list-style-type: none"><li>2 hours (2 hours from inside, 2 hours from outside)</li></ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"><li>Type III (5-6 story commercial or multi-family)</li></ul>

# 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 the ESR-1365. Code officials have the authority to permit FRCC OSB in various applications



2-hour rated wall assembly with FRCC OSB in Type III construction  
(Student housing, College Park, MD)

# ADVANTAGES OF USING FRCC OSB IN TYPE III CONSTRUCTION

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



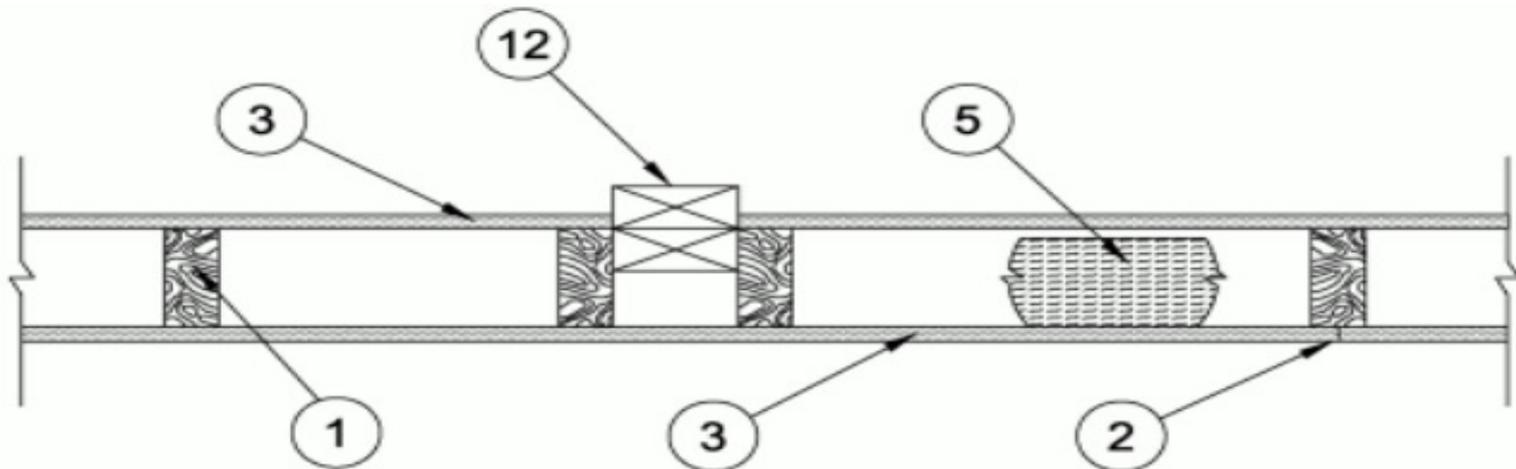
Austin, TX



Issaquah, WA

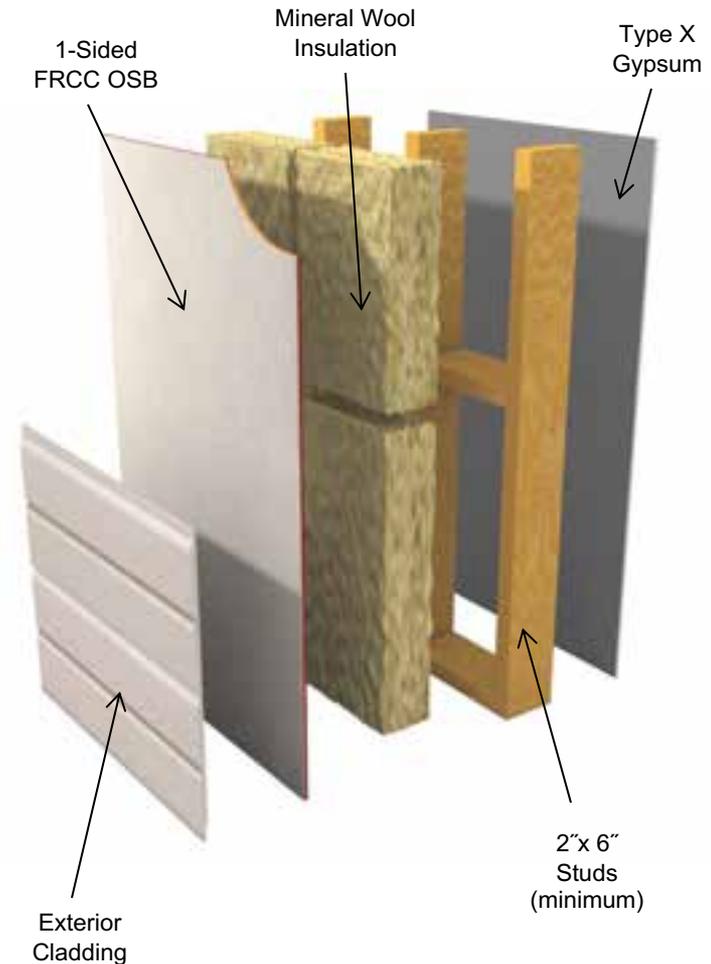
# EXAMPLE: COMMON 1-HOUR EXTERIOR WALL

- 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



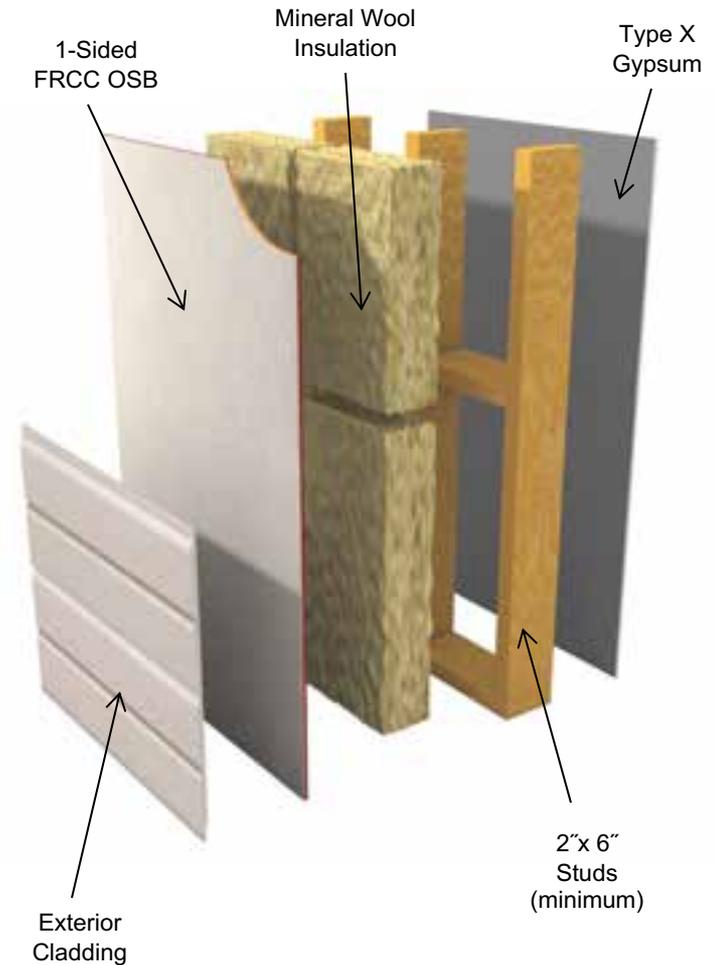
# LPB/WPPS 60-01:1-HOUR WALL ASSEMBLY, FRCC OSB

- 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
- No cladding required with 19/32" FRCC panel



# LPB/WPPS 60-01:1-HOUR WALL ASSEMBLY, FRCC OSB

- Residential Construction
- Type V exterior walls
- Type V fire walls CBC 706.2 (NFPA 221)
- Type III non-bearing walls (2-sided FRCC)
- No exterior gypsum required
- Type I and II non-bearing exterior walls
- Wood and steel studs



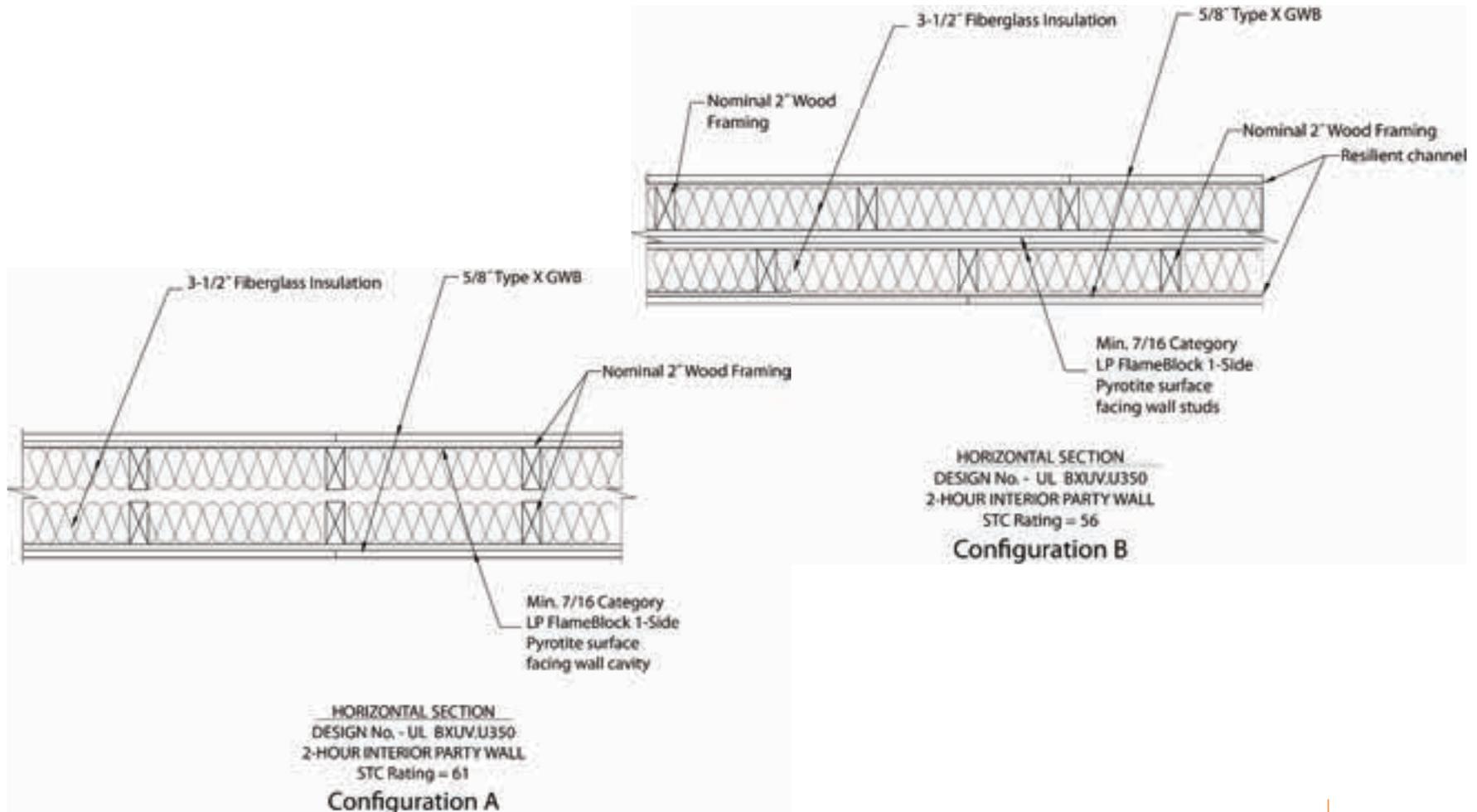
# PARTITION WALLS BETWEEN LIVING SPACES



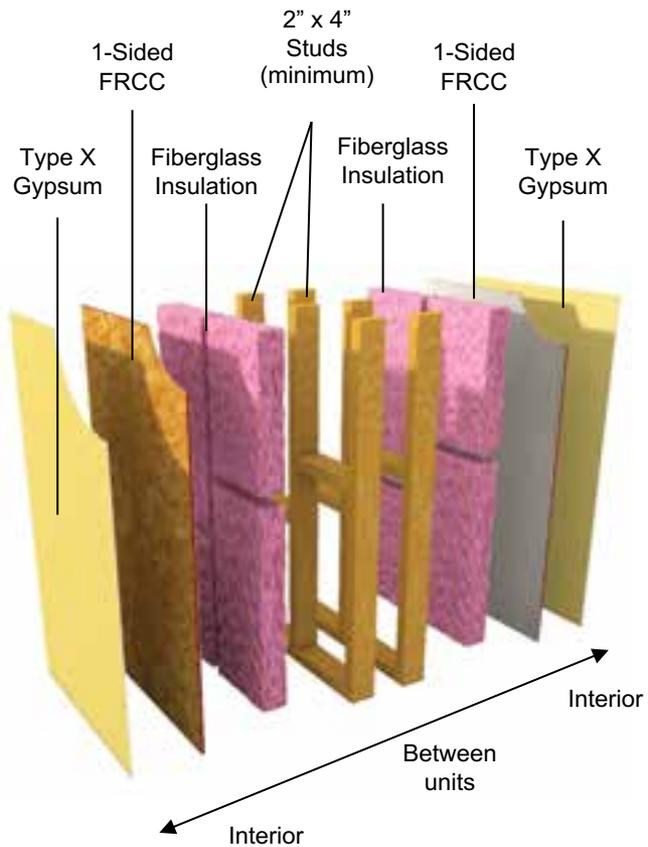
Red Leaf Townhomes, Seattle, WA

# TWO-HOUR EXTERIOR WALL ASSEMBLY FOR MULTI-FAMILY CONSTRUCTION

## BXUV U350 2-Hr Party Wall Assembly

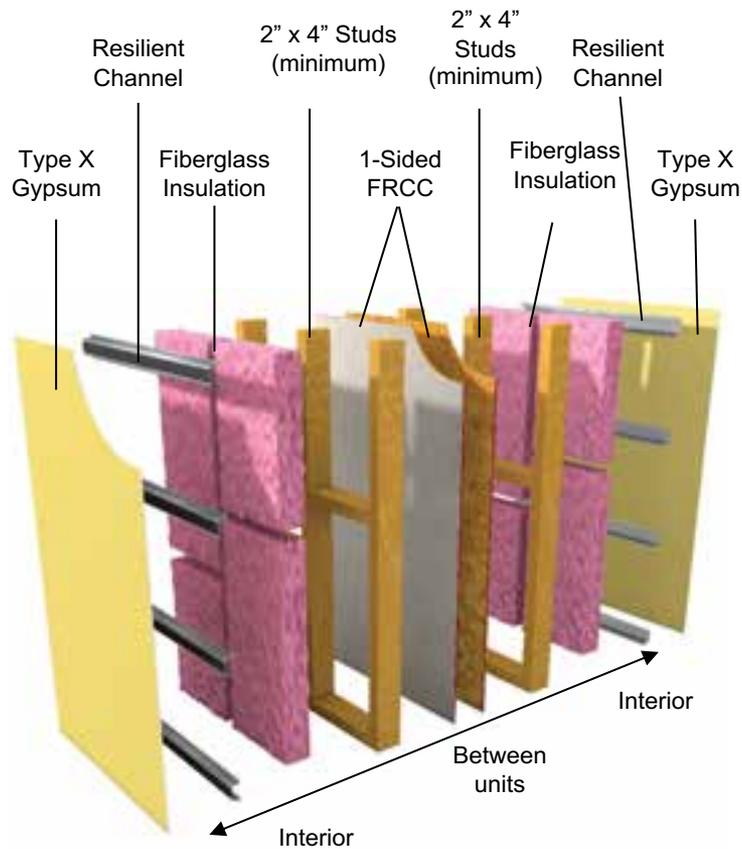


# FRCC ASSEMBLY U350 – TYPE A



<b>Application</b>	<ul style="list-style-type: none"><li>• Interior load-bearing wall</li></ul>
<b>Fire rating</b>	<ul style="list-style-type: none"><li>• 2 hours (2 hours from both sides)</li></ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"><li>• Type III (5-6 story commercial or multi-family)</li><li>• Type V (1-4 story wood-framed single or multi-family)</li></ul>

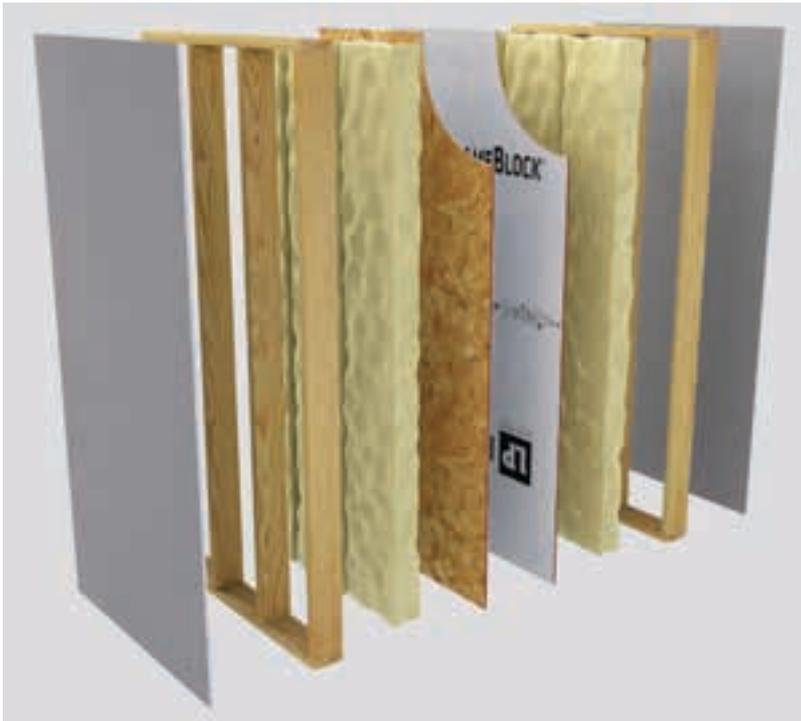
# FRCC ASSEMBLY U350 – TYPE B



<b>Application</b>	<ul style="list-style-type: none"> <li>Interior load-bearing wall</li> </ul>
<b>Fire rating</b>	<ul style="list-style-type: none"> <li>2 hours (2 hours from both sides)</li> </ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"> <li>Type III (5-6 story commercial or multi-family)</li> <li>Type V (1-4 story wood-framed single or multi-family)</li> </ul>

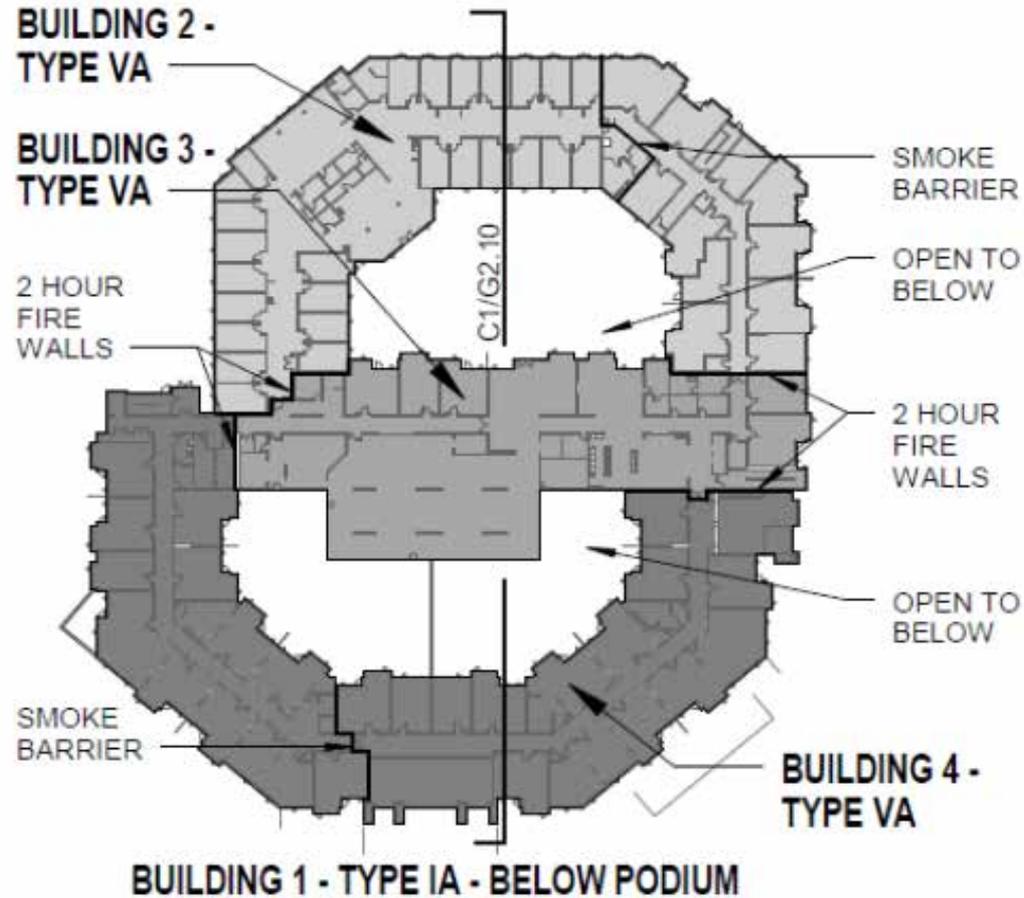
# FRCC ASSEMBLY – BTC/WA-60-01 BACK TO BACK

Two 1-hour assemblies back to back



<b>Application</b>	<ul style="list-style-type: none"><li>• Interior load-bearing wall</li></ul>
<b>Fire rating</b>	<ul style="list-style-type: none"><li>• Two 1 hour walls</li></ul>
<b>Construction type(s)</b>	<ul style="list-style-type: none"><li>• Townhome separations</li><li>• Zero lot line single family</li></ul>

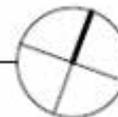
# FRCC OSB APPLICATIONS – 2 HOUR FIRE WALLS TYPE V CONSTRUCTION



D1  
G2.10

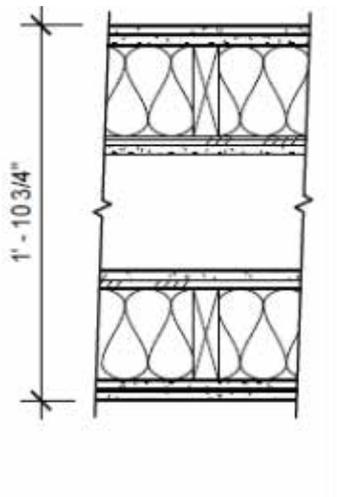
## PROJECT BUILDING SEPARATION DIAGRAM

SCALE: N.T.S.



# FRCC OSB APPLICATIONS – 2 HOUR FIRE WALLS TYPE V CONSTRUCTION

- Traditional 2-Hour Fire wall in Type V



## 2-HR FIRE WALL - WOOD

(2) LAYERS 5/8" TYPE "X" GYPSUM BOARD

5 1/2" WOOD STUDS PER STRUCTURAL

ACOUSTICAL INSULATION

1/2" APA RATED PLYWOOD SHEATHING AS REQUIRED BY STRUCTURAL

(1) LAYER 5/8" TYPE "X" GYPSUM BOARD

7" SEISMIC GAP PER STRUCTURAL

(1) LAYER 5/8" TYPE "X" GYPSUM BOARD

1/2" APA RATED PLYWOOD SHEATHING AS REQUIRED BY STRUCTURAL

ACOUSTICAL INSULATION

5 1/2" WOOD STUDS PER STRUCTURAL

1/2" APA RATED PLYWOOD SHEATHING AS REQUIRED BY STRUCTURAL

(2) LAYERS 5/8" TYPE 'X' GYPSUM BOARD

NOTE: THE SEQUENCE OF CONSTRUCTION MAY REQUIRE THE USE OF WATERPROOF GYPSUM BOARD AT THIS ASSEMBLY

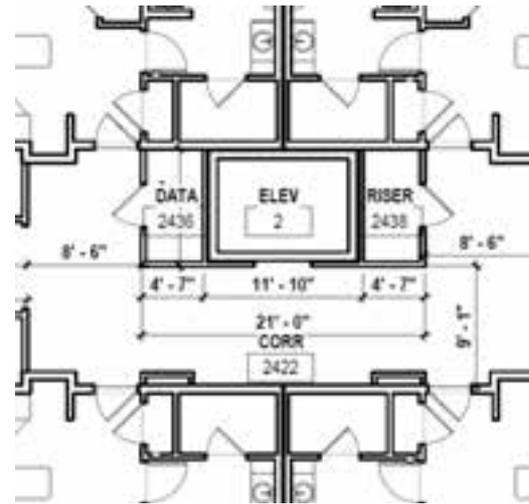
LPB/WPPS 60-01 Assembly Back to Back as solution – Single Sided FRCC in Type V.

Eliminates gypsum in seismic joint.

Facilitates construction.

NFPA 221

# FRCC OSB APPLICATIONS – STAIR TOWERS AND ELEVATOR SHAFTS



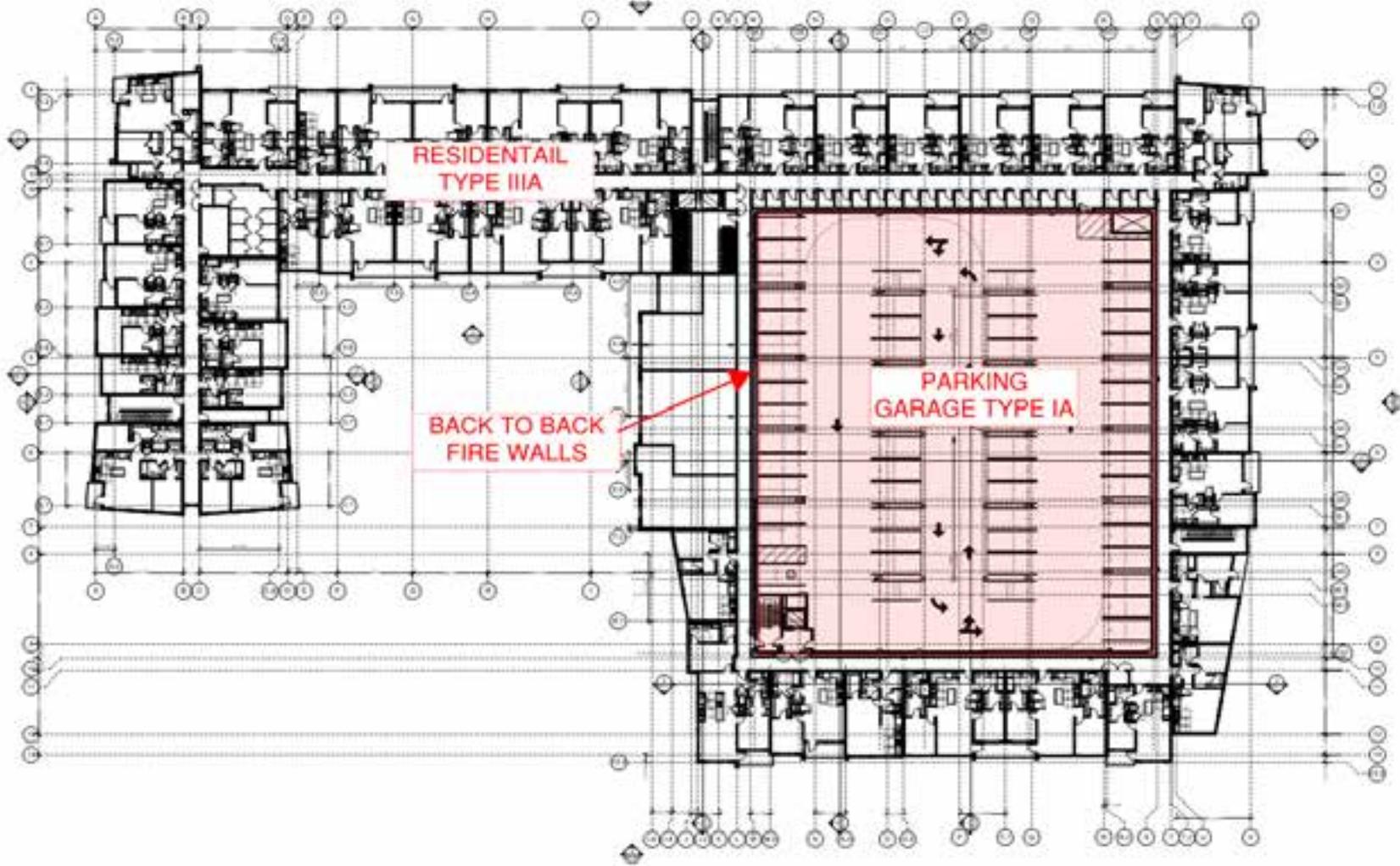
W408 Extended or U350, 2-hour protection.

Thinner wall assembly compared to traditional approach.

Eliminates a trade from project and potentially reduces foundation costs.

Shrinkage concerns and risk associated with CMU and Concrete towers.

# FRCC OSB APPLICATIONS – DIFFERENT CONSTRUCTION TYPES AND FIRE WALLS



# FRCC OSB APPLICATIONS – DIFFERENT CONSTRUCTION TYPES AND FIRE WALLS

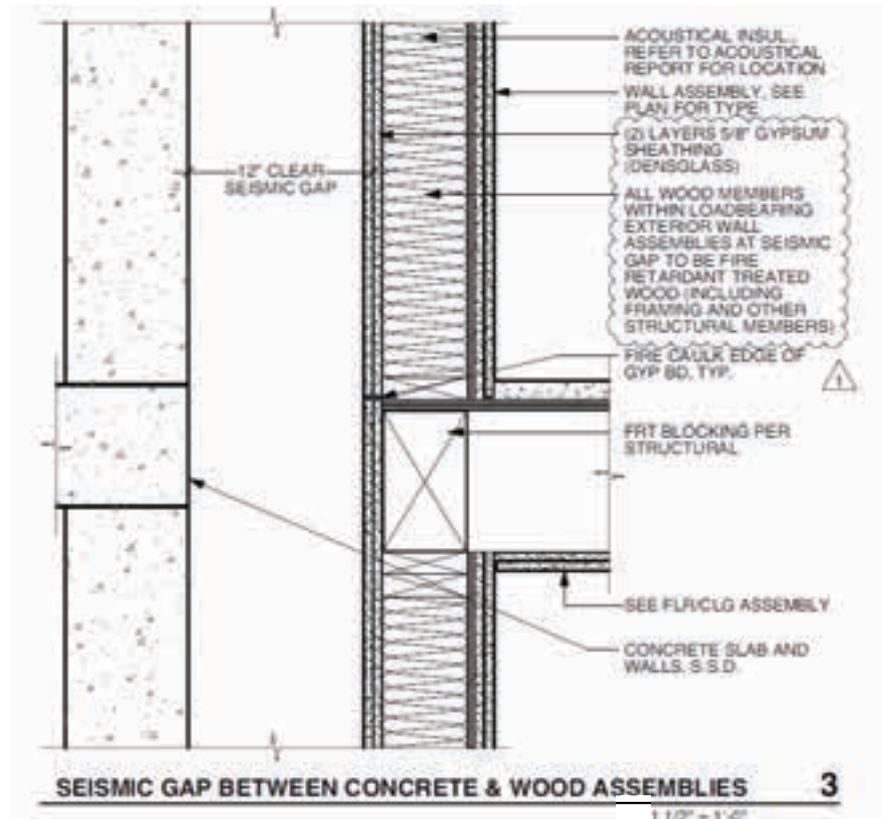
Concrete could produce enough heat to ignite adjacent wall, providing thermal protection good standard of practice.

## U301 Cons

- Constructability

## FRCC Pros

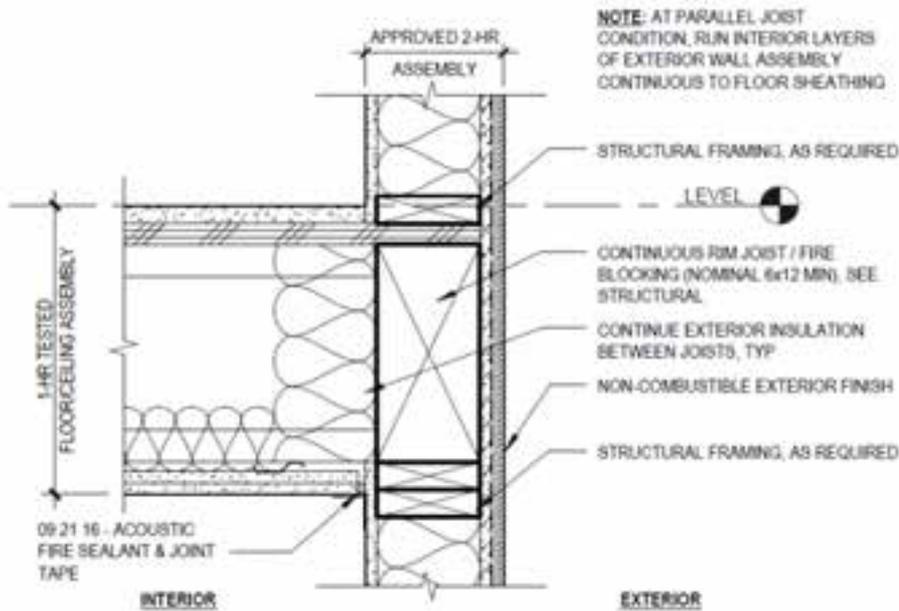
- Simplifies and facilitates construction.
- WA-60-01 (1 hour) non-bearing walls.
- W408 Extended (2 hour) eliminates one layer of gypsum.
- Joint detail to avoid staggering vertical joints.



# FRCC OSB APPLICATIONS – TYPE III 2 HOUR FIRE FLOOR TO WALL CONNECTION

Platform and Modified Balloon Framing

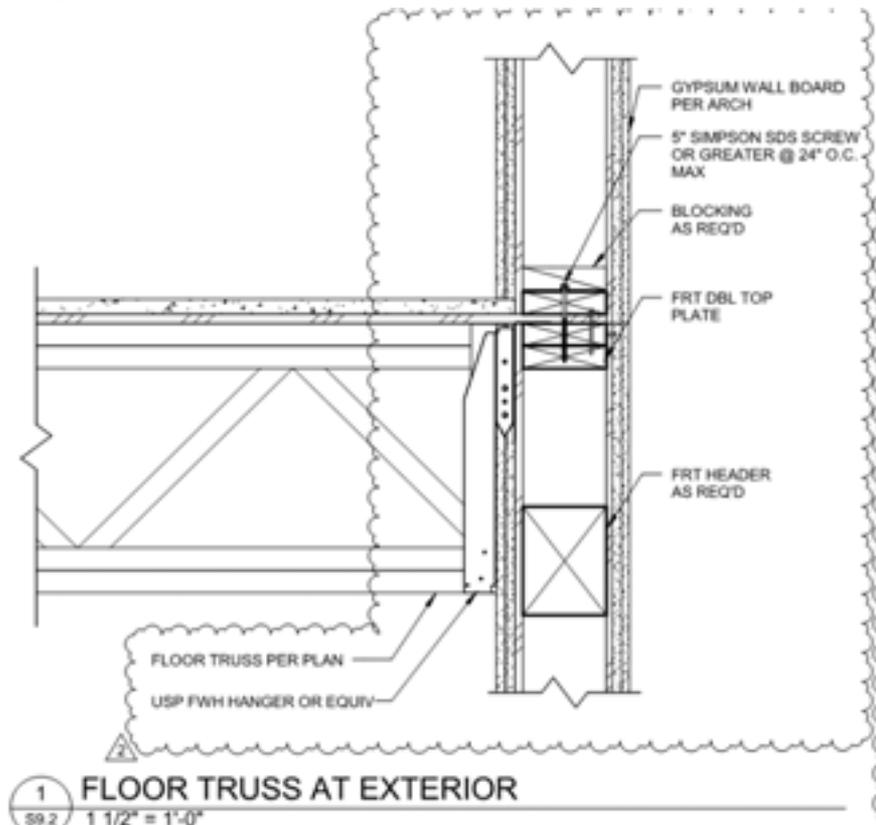
AWC DCA-3 for type III floor to wall – February 2018



1-HR FLOOR TO EXT WALL - SECTION

1 1/2" = 1'-0"

12



FLOOR TRUSS AT EXTERIOR

59.2

# QUESTIONS AND COMMENTS?

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