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CONFERENCE  
& TRADE SHOW  
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**2019**  
NORFOLK  
**VA**  
AIR BARRIER EDUCATION TRACKS FOR  
THE CONSTRUCTION INDUSTRY

# Methodology for Designing Existing and New Exterior Wall Assemblies: What To Look For

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# Learning Objectives

- Identify building codes and industry standards that guide exterior wall design.
- Select materials and identify sequencing for an appropriate air barrier and drainage plane location based on project-specific criteria.
- Identify common constructability pitfalls associated with exterior wall components and assemblies and give examples of ways to resolve the issues.
- Create a structured decision-making process and a customized wall assembly “check list” to select an appropriate assembly based on project-specific criteria.

# Agenda

**Code requirements and where to find them.**

**The four basic barriers and their function:**

- Moisture barrier
- Vapor barrier
- Air barrier
- Thermal barrier

**Peer review process for specific wall assemblies**

- Case study 1- New construction wall assembly
- Case study 2 – Existing Building, change in Use group

# Code Requirements: Where to Find Them

1. 2015 International Existing Building Code (IEBC) Chapter 5 to determine level of alterations.
2. 2015 International Building Code (IBC), or amended state building code, to determine the construction classification type, occupancy group and performance requirements.
  - *Chapter 3 and Chapter 6, Chapter 14*
3. Identify the Fire resistance requirements in IBC Chapter 6
4. 2015 International Energy Conservation Code (IECC) to find energy requirements based on location.



# 2015 – IEBC Code Review: Chapter 5

## SECTION 502 REPAIRS

**502.1 Scope.** *Repairs*, as defined in Chapter 2, include the patching or restoration or replacement of damaged materials, elements, *equipment or fixtures* for the purpose of maintaining such components in good or sound condition with respect to existing loads or performance requirements.

**502.2 Application.** *Repairs* shall comply with the provisions of Chapter 6.

**502.3 Related work.** Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the provisions of Chapter 7, 8, 9, 10 or 11.

## SECTION 503 ALTERATION—LEVEL 1

**503.1 Scope.** Level 1 alterations include the removal and replacement or the covering of existing materials, elements, equipment, or fixtures using new materials, elements, equipment, or fixtures that serve the same purpose.

**503.2 Application.** Level 1 alterations shall comply with the provisions of Chapter 7.

## SECTION 504 ALTERATION—LEVEL 2

**504.1 Scope.** Level 2 alterations include the reconfiguration of space, the addition or elimination of any door or window, the reconfiguration or extension of any system, or the installation of any additional equipment.

**504.2 Application.** Level 2 alterations shall comply with the provisions of Chapter 7 for Level 1 alterations as well as the provisions of Chapter 8.

## SECTION 505 ALTERATION—LEVEL 3

**505.1 Scope.** Level 3 alterations apply where the work area exceeds 50 percent of the building area.

**505.2 Application.** Level 3 alterations shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 alterations, respectively, as well as the provisions of Chapter 9.

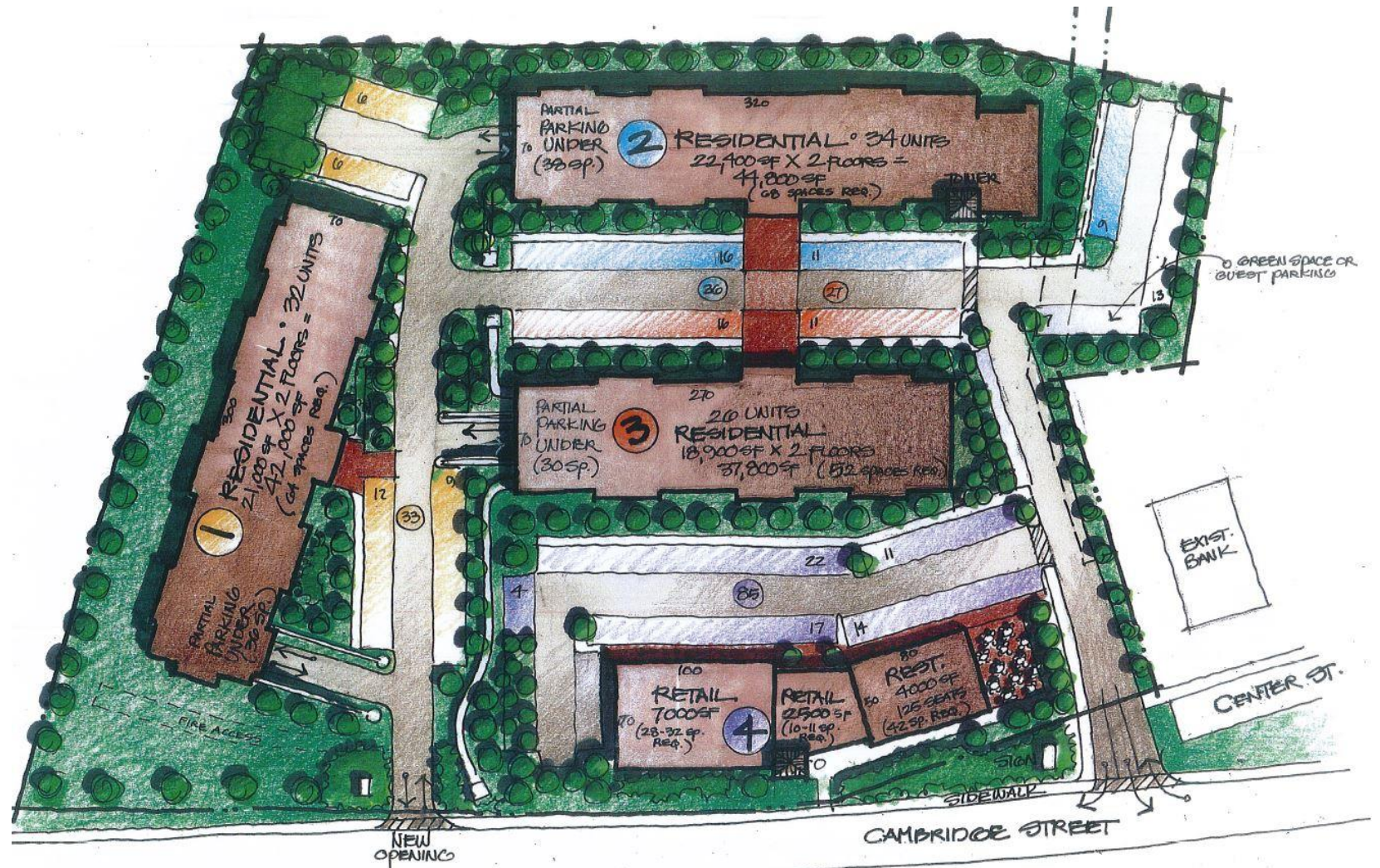
# Check List



Methodology	Code reference
<b>What is the occupancy classification?</b>	<b>IBC Ch. 3</b>
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch.4 Sec C402
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-


# IBC - Chapter 3: Use and Occupancy Classification

- (A) Assembly
- (B) Business
- (E) Educational
- (F) Factory
- (H) High hazard
- (S) Storage
- (I) Institutional
- (M) Mercantile
- (R) Residential
- (U) Utility





# Check List

Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
 <b>What is the building construction type?</b>	<b>IBC Ch. 6 Sec. 602</b>
What are the fire code requirements?	IBC Ch. 6 Sec. 601
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# IBC Chapter 6: Types of Construction


Chapter 6, Section 602:

## Types of Construction

- *Type I & II – Structure of noncombustible materials (steel and concrete)*
- *Type III – Floors, Roof & Exterior walls are noncombustible.*
- *Type IV – Heavy Timber*
- *Type V – Any material permitted by code*



# Check List


Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
 <b>What are the fire code requirements?</b>	<b>IBC Ch. 6 Sec. 601</b>
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# IBC Chapter 6, Section 601: Fire-resistance rating requirements for building elements

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

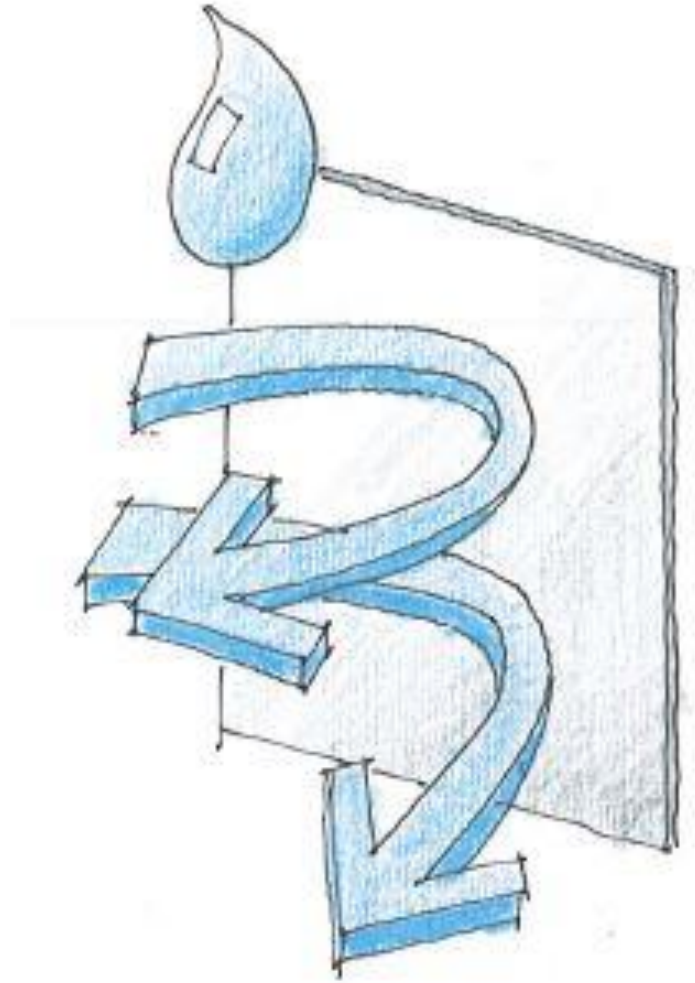
BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A	B	A	B	HT	A	B
Primary structural frame <sup>f</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>e, f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions	0	0	0	0	0	0	See Section 602.4.6	0	0
Interior <sup>d</sup>									
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1½ <sup>b</sup>	1 <sup>b,c</sup>	1 <sup>b,c</sup>	0 <sup>c</sup>	1 <sup>b,c</sup>	0	HT	1 <sup>b,c</sup>	0

# Check List

Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
 What functions are needed in the wall system?	<b>IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402</b>
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# Water - resistive Barriers

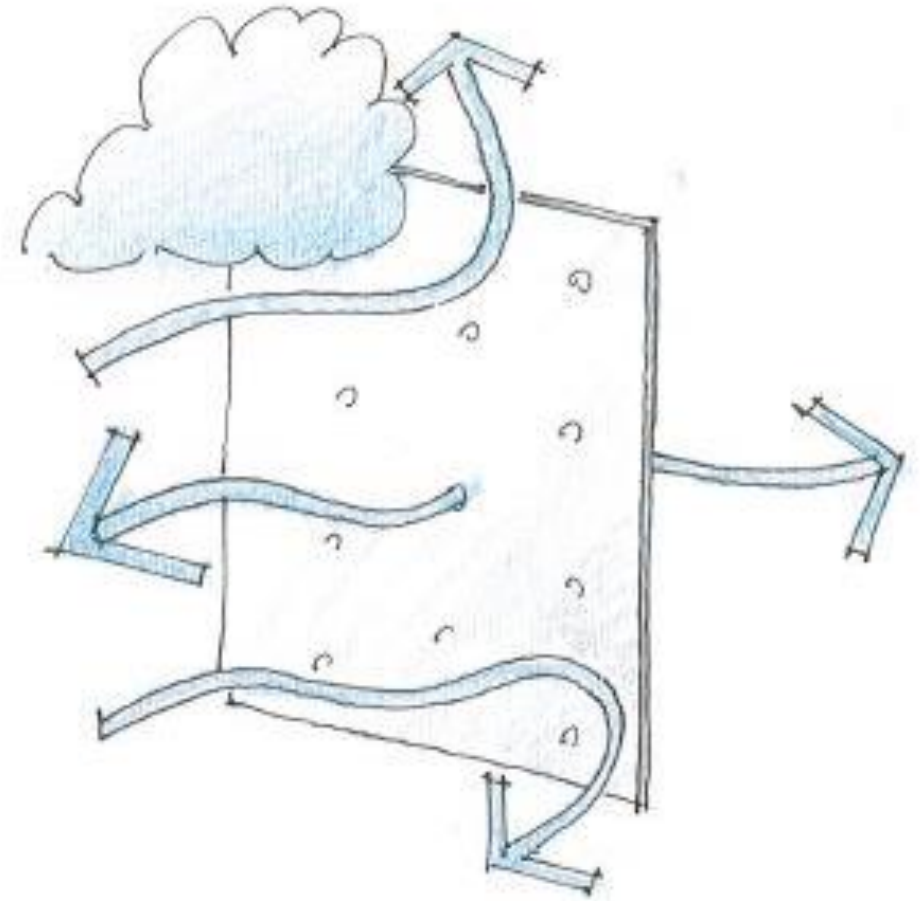
**1404.2 Water-resistive barrier.** Not fewer than one layer of No.15 asphalt felt, complying with **ASTM D 226** for Type 1 felt or other *approved* materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous *water-resistive barrier* behind the *exterior wall veneer*.

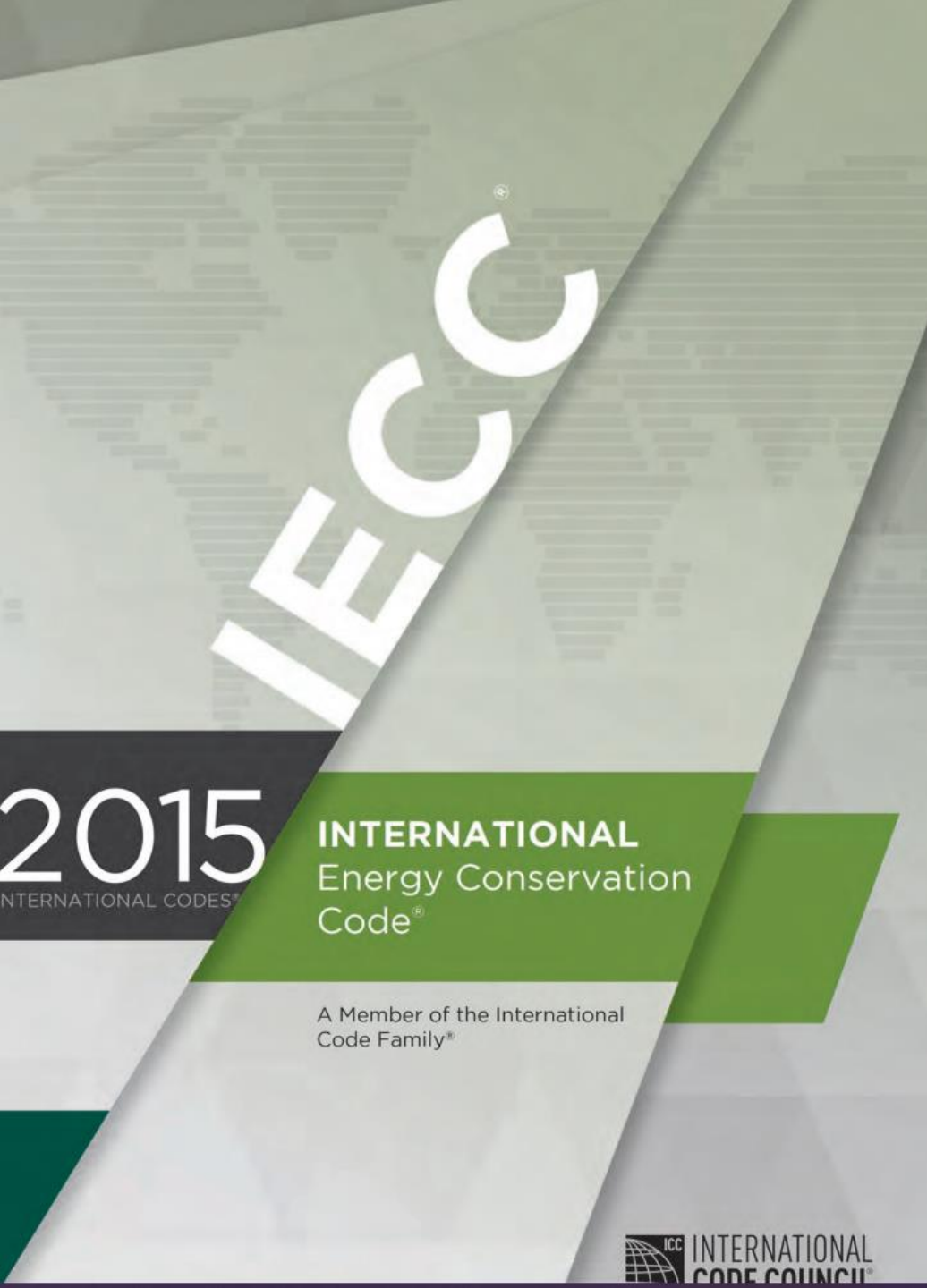


# Vapor Barriers

**1405.3.1 Class I and II vapor retarders.** Class I and II vapor retarders shall not be provided on the interior side of frame walls in Zones 1 and 2. Class I vapor retarders shall not be provided on the interior side of frame walls in Zones 3 and 4. Class I or II vapor retarders shall be provided on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4. The appropriate zone shall be selected in accordance with Chapter 3 of the *International Energy Conservation Code*.

**1405.3.2 Class III vapor retarders.** Class III vapor retarders shall be permitted where any one of the conditions in Table 1405.3.2 is met. Only Class III vapor retarders shall be used on the interior side of frame walls where foam plastic insulating sheathing with a perm rating of less than 1 is applied in accordance with Table 1405.3.2 on the exterior side of the frame wall.





# 2015 INTERNATIONAL ENERGY CONSERVATION CODE (IECC)

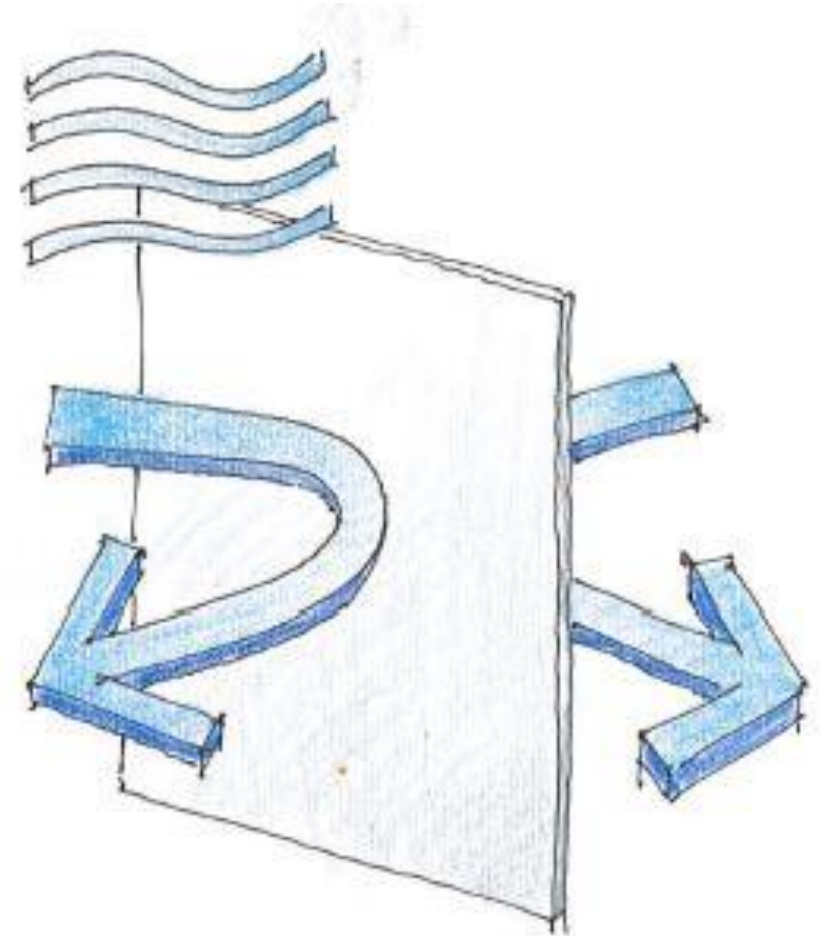


# Air Barriers

**C402.5 Air leakage—thermal envelope (Mandatory).** The *thermal envelope* of buildings shall comply with Sections **C402.5.1 through C402.5.8**, or the building *thermal envelope* shall be tested in accordance with **ASTM E 779** at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft<sup>2</sup> (0.2 L/s · m<sup>2</sup>). Where compliance is based on such testing, the building shall also comply with Sections **C402.5.5, C402.5.6 and C402.5.7.**

TABLE C402.5.2  
MAXIMUM AIR LEAKAGE RATE  
FOR FENESTRATION ASSEMBLIES

FENESTRATION ASSEMBLY	MAXIMUM RATE (CFM/FT <sup>2</sup> )	TEST PROCEDURE
Windows	0.20 <sup>a</sup>	AAMA/WDMA/ CSA101/1.S.2/A440 or NFRC 400
Sliding doors	0.20 <sup>a</sup>	
Swinging doors	0.20 <sup>a</sup>	
Skylights – with condensation weepage openings	0.30	
Skylights – all other	0.20 <sup>a</sup>	
Curtain walls	0.06	NFRC 400 or ASTM E 283 at 1.57 psf (75 Pa)
Storefront glazing	0.06	
Commercial glazed swinging entrance doors	1.00	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
Revolving doors	1.00	
Garage doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf (75 Pa)
Rolling doors	1.00	
High-speed doors	1.30	



# Thermal Barriers

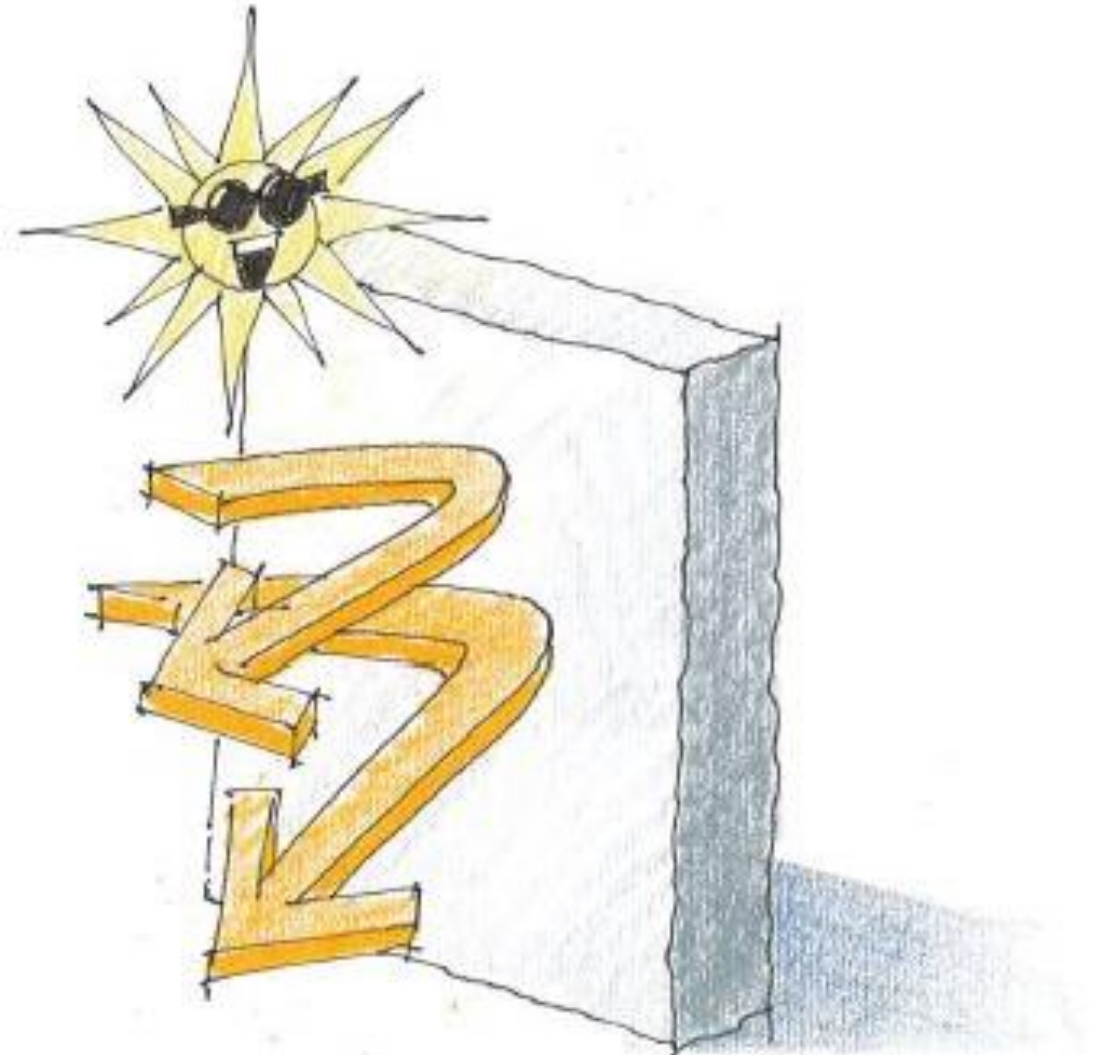
## SECTION C402 BUILDING ENVELOPE REQUIREMENTS

**C402.1 General (Prescriptive).** Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in **Item 2 of Section C401.2**, shall comply with the following:

1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the **R-value-based method of Section C402.1.3; the U-, C- and F-factor-based method of Section C402.1.4;** or the component performance alternative of Section C402.1.5.
2. Roof solar reflectance and thermal emittance shall comply with Section C402.3.
3. Fenestration in building envelope assemblies shall comply with Section C402.4.
4. Air leakage of building envelope assemblies shall comply with Section C402.5.

Alternatively, where buildings have a vertical fenestration area or skylight area exceeding that allowed in Section C402.4, the building and building thermal envelope shall comply with Section C401.2, Item 1 or Section C401.2, Item 3.

Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C403.2.15 or C403.2.16.



# IECC Chapter 3: General Requirements

## Section C301

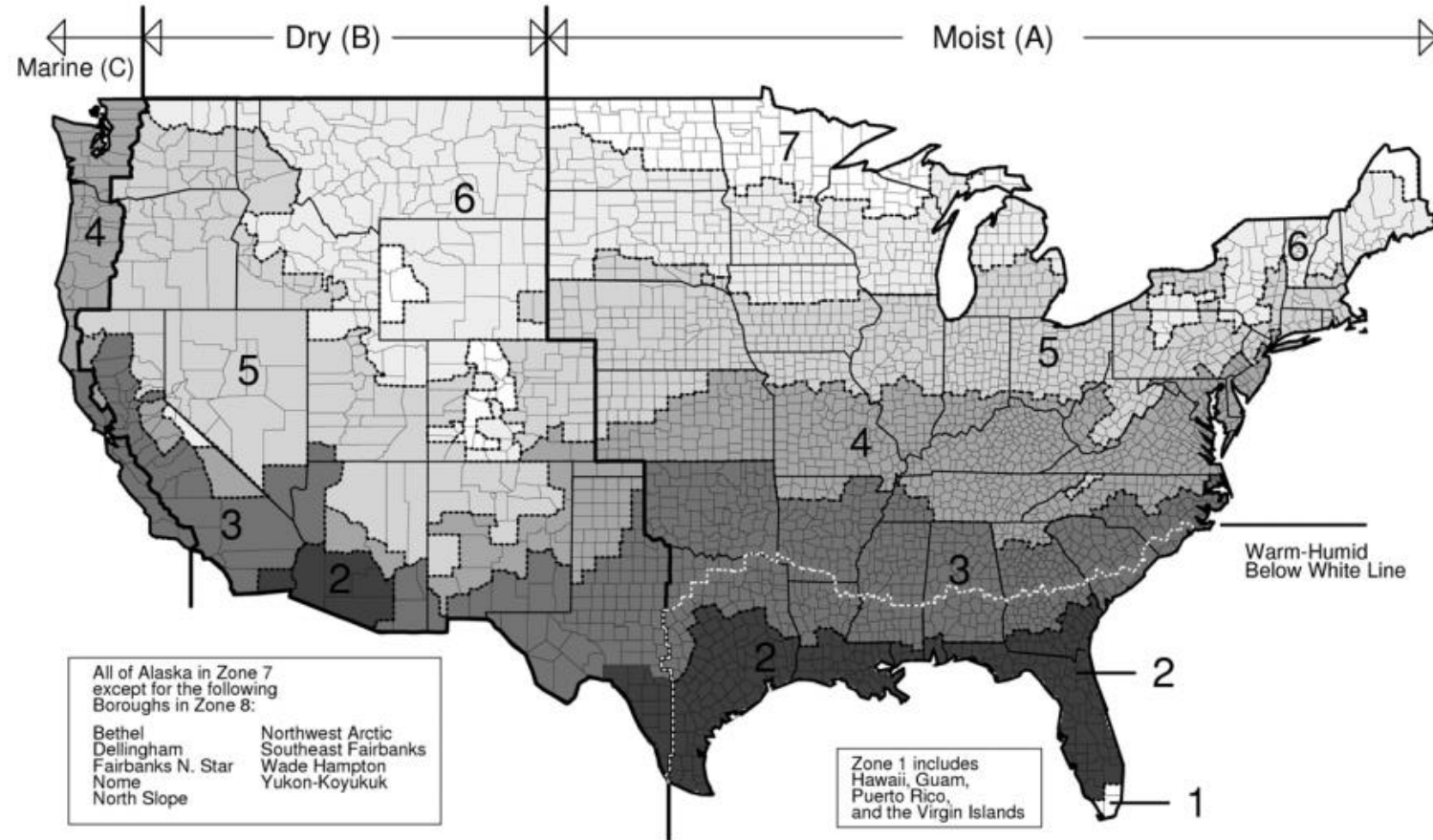



FIGURE C301.1  
CLIMATE ZONES





# Check List

Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
 <b>What are the requirements for materials that perform these functions?</b>	<b>IBC Ch. 14, and reference sections</b>
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# IBC Chapter 14: Exterior Walls

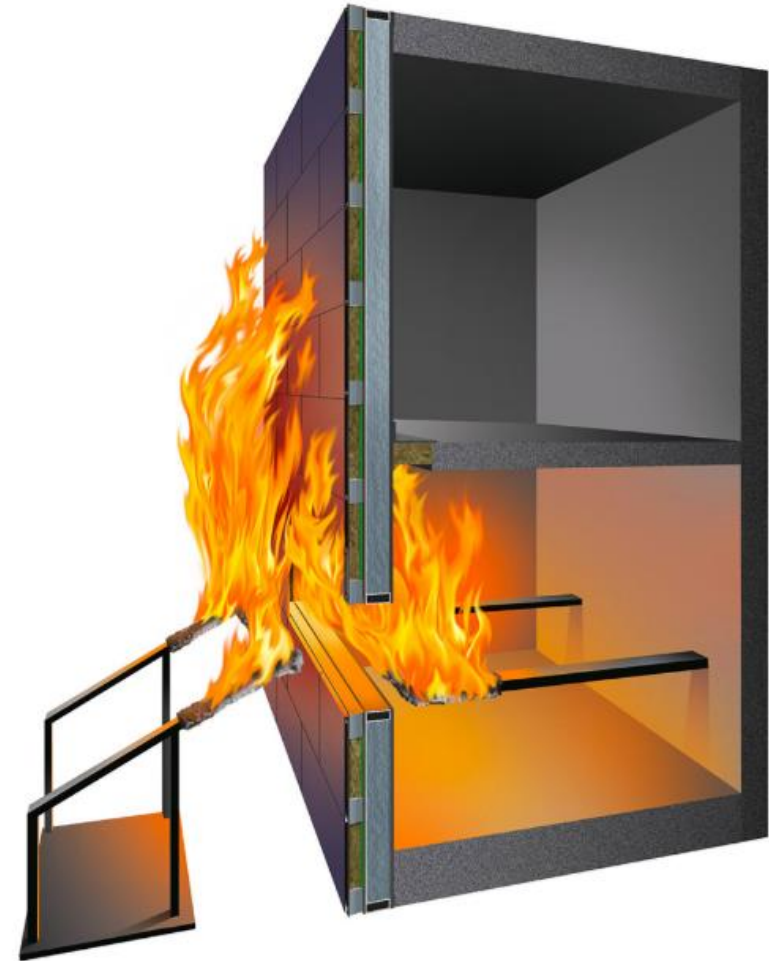
## Section 1402: Definitions

- Adhered masonry veneer.
- Anchored masonry veneer.
- Backing.
- Exterior insulation and finish systems (EIFS).
- Exterior insulation and finish systems (EIFS) with drainage.
- Exterior wall.
- Exterior wall covering.
- Exterior wall envelope.
- Fenestration.
- Fiber-cement siding.
- High-pressure decorative exterior grade compact laminate (HPL).
- High-pressure decorative exterior grade compact laminate (HPL) system.
- Metal composite material (MCM).
- Metal composite material (MCM) system.
- Polypropylene siding.
- Porcelain tile.
- Veneer.
- Vinyl siding.
- Water-resistive barrier.

# IBC Chapter 14: Exterior Walls

## Section 1403: Performance Requirements

**1403.5 Vertical and lateral flame propagation.** Exterior walls on buildings of **Type I, II, III or IV construction** that are **greater than 40 feet** (12 192 mm) in height above grade plane and **contain a combustible *water-resistive barrier*** shall be tested in accordance with and comply with the acceptance criteria of **NFPA 285**. For the purposes of this section, fenestration products and flashing of fenestration products shall not be considered part of the *water-resistive barrier*.



Source: Robyn Feller, (No date). NFPA 285 Fire Test [digital image]. Retrieved from <https://continuingeducation.bnpmmedia.com/courses/owens-corning/mineral-wool-as-a-continuous-insulation-solution/5/>

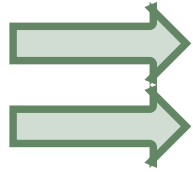


# Case Study 1 – New High School Wall Assembly Design

- Location: Massachusetts
- Building Use: High School
- Building characteristics:
  - 3-story building average height of 46’.
  - 360,000 square feet
  - Structural steel framing, poured concrete floor slabs and metal stud framed exterior walls
- Type of wall assembly: Open joint fiber cement cladding, Plastic foam insulation
- Client objectives: Reduce HVAC equipment and operational costs, simplify construction



# Check List



Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# IBC Code Review

- Chapter 3, Section 305

Occupancy classification:

**Educational Group E** occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade.


- Chapter 6, Section 602

Building Construction Type:

High School Construction type is categorized as **Type IIB**,

“Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 60, Combustible Material in types I and II construction and elsewhere in this code.


# Check List

Methodology	Code reference
What is the occupancy classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
 <b>What are the fire code requirements?</b>	<b>IBC Ch. 6 Sec. 601</b>
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

**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
Primary structural frame <sup>f</sup> (see Section 202)	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	HT	1	0
Bearing walls									
Exterior <sup>e, f</sup>	3	2	1	0	2	2	2	1	0
Interior	3 <sup>a</sup>	2 <sup>a</sup>	1	0	1	0	1/HT	1	0
Nonbearing walls and partitions	See Table 602								
Exterior									
Nonbearing walls and partitions	0	0	0	0	0	0	See Section 602.4.6	0	0
Interior <sup>d</sup>									
Floor construction and associated secondary members (see Section 202)	2	2	1	0	1	0	HT	1	0
Roof construction and associated secondary members (see Section 202)	1 <sup>1/2</sup> <sup>b</sup>	1 <sup>b,c</sup>	1 <sup>b,c</sup>	0 <sup>c</sup>	1 <sup>b,c</sup>	0	HT	1 <sup>b,c</sup>	0

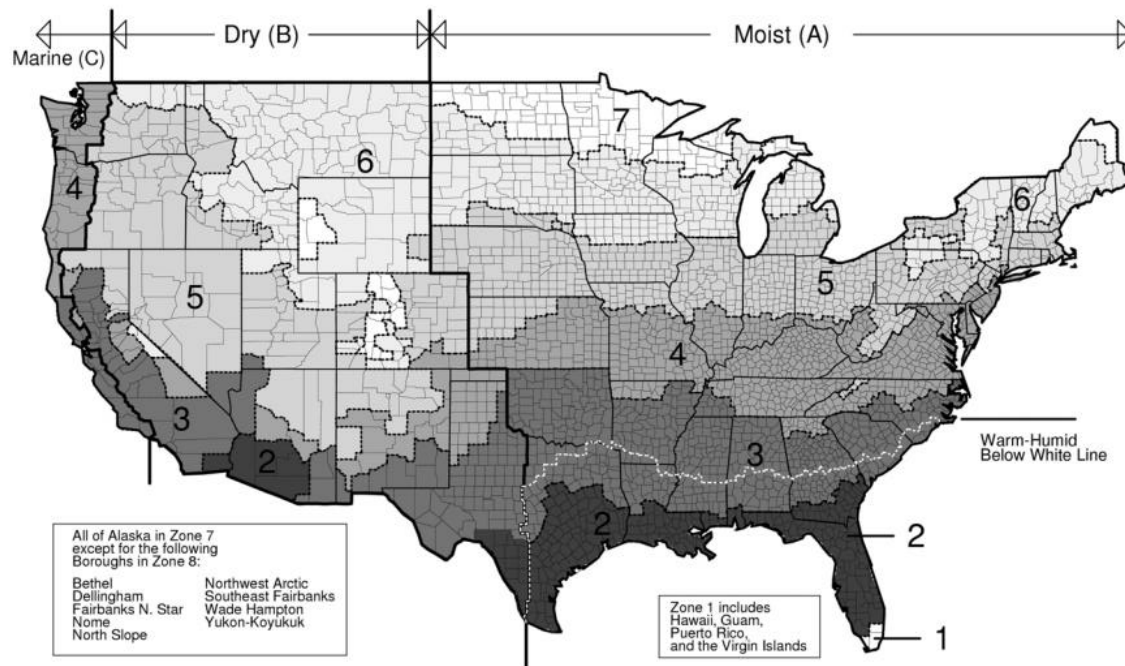
# Check List

Methodology	Code reference
What is the occupancy and classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
 <b>What functions are needed in the wall system?</b>	<b>IBC Ch. 14 Sec 1404, IECC Ch.3 Sec C301.1, Ch 4 Sec C402</b>
What are the requirements for materials that perform these functions?	IBC Ch. 14, and reference sections
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-

# IECC and IBC Code Review

## ■ Chapter 3

Figure C301.1, South High School is located within Climate Zone 5



## ■ Chapter 4,

Section C402, Building Envelope Requirements

- Table C402.1.3 the minimum required R-Value for metal framed walls is **R-13 cavity insulation plus R-7.5 continuous insulation.**
- C402.1.3, **minimum composite panel thickness shall be 2.1", including 5/8" plywood and a minimum of 2" closed-cell spray foam with a R-value greater than R-6.5 per inch must be used for interior cavity insulation**

- Per 2015 IBC Section 1405.3.1 "...**Class I or II vapor retarders** shall be provided on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4."

# Check List

Methodology	Code reference
What is the occupancy and classification?	IBC Ch. 3
What is the building construction type?	IBC Ch. 6 Sec. 602
What are the fire code requirements?	IBC Ch. 6 Sec. 601
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404, IECC Ch. 4 Sec C402
<b>What are the requirements for materials that perform these functions?</b>	<b>IBC Ch. 14, and reference sections</b>
What materials can perform these functions?	-
Confirm compatibility of materials	-
Assign sequence for materials	-
Can functions be combined to simplify the system?	-
How does sequencing effect constructability?	-





# IBC Chapter 14 Exterior Walls

## Section 1403: Performance Requirements

**1403.5 Vertical and lateral flame propagation.** Exterior walls on buildings of **Type I, II, III or IV** construction that are **greater than 40 feet** (12 192 mm) in height above grade plane and contain a combustible *water-resistive barrier* shall be tested in accordance with and comply with the acceptance criteria of **NFPA 285**. For the purposes of this section, fenestration products and flashing of fenestration products shall not be considered part of the *water-resistive barrier*.

# IBC Chapter 14 Exterior Walls

## Section 1403: Performance Requirements

- 1404.10 Fiber-cement siding. Fiber-cement siding shall conform to the requirements of **ASTM C 1186**, Type A (or ISO 18336, Category A), and shall be so identified on labeling listing an approved quality control agency.
- 1404.13 Foam plastic insulation. Foam plastic insulation used in exterior wall covering assemblies shall comply with **Chapter 26.**

# IBC Chapter 26 Plastic

## Section 2603: Foam Plastic Insulation

### ■ 2603.4 Thermal Barrier

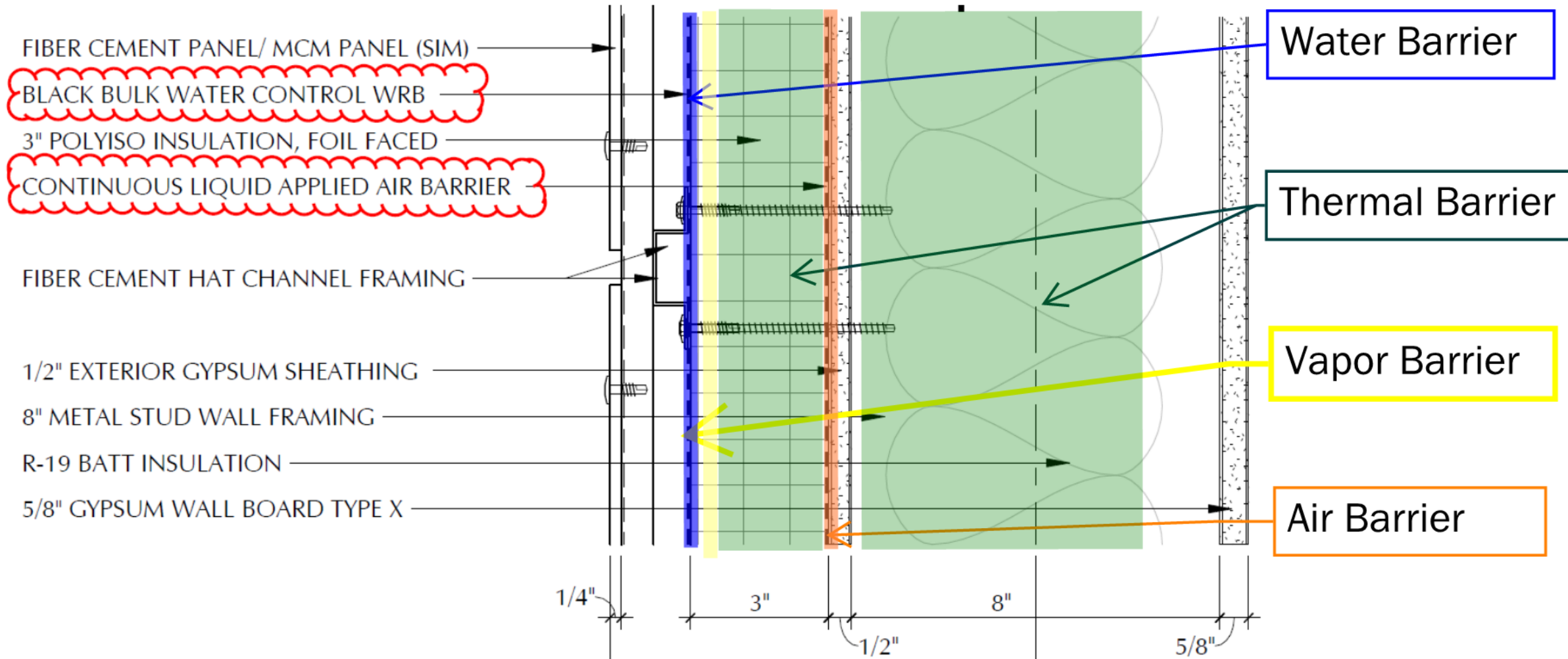
“foam plastic shall be separated from the interior of a building by an approved **thermal barrier of ½” inch gypsum wallboard** or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.”

### ■ 2603.5.4 Flame spread and smoke developed indices,

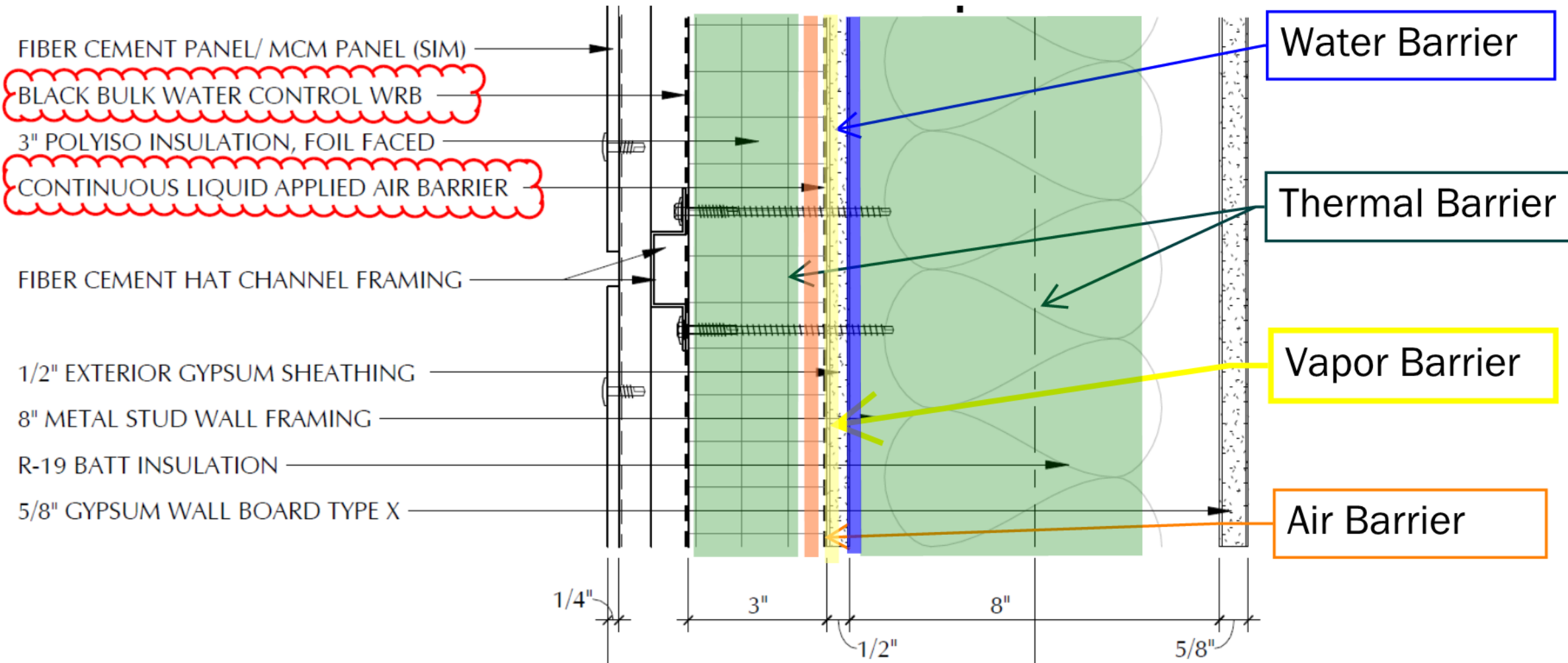
“Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use **but not exceed 4 inches** and shall each have a **flame spread index of 25 or less** and a **smoke-developed index of 45 or less** as determined in accordance with **ASTM E84 or UL 723.**”

Methodology	Code reference	Code requirements
Occupancy classification?	IBC Ch. 3	E – Educational
Building construction type?	IBC Ch. 6 Sec. 602	Type IIB
Fire code requirements?	IBC Ch. 6 Sec. 601, Ch. 14	<ul style="list-style-type: none"> <li>• 0 hour fire rating</li> <li>• NFPA 285 compliant</li> </ul>
What functions are needed in the wall system?	IBC Ch. 14 Sec 1404 IECC Ch.4 Sec C402	<ul style="list-style-type: none"> <li>• Water Barrier- ASTM D226</li> <li>• Vapor barrier – Class I or II</li> <li>• Thermal Barrier – R-value 7.5 continuous insulation and 13 cavity</li> <li>• Air barrier - .06 CFM/sqft</li> </ul>
Requirements for materials that perform these functions?	IBC Ch. 14, Fiber cement	<ul style="list-style-type: none"> <li>• ASTM C 1186, Type A</li> </ul>
	IBC Ch. 2, Foam plastic insulation	<ul style="list-style-type: none"> <li>• Thermal barrier of ½” inch gypsum wallboard</li> <li>• Flame spread index of 25 or less,</li> <li>• Smoke spread index of 45 or less.</li> </ul> ASTM E84 or UL 723.
	IECC Sec C402.1.3, Composite panel	Min. panel thickness of 2.1”, min. 2” of SPF, interior cavity R-value greater than R-6.5 / in

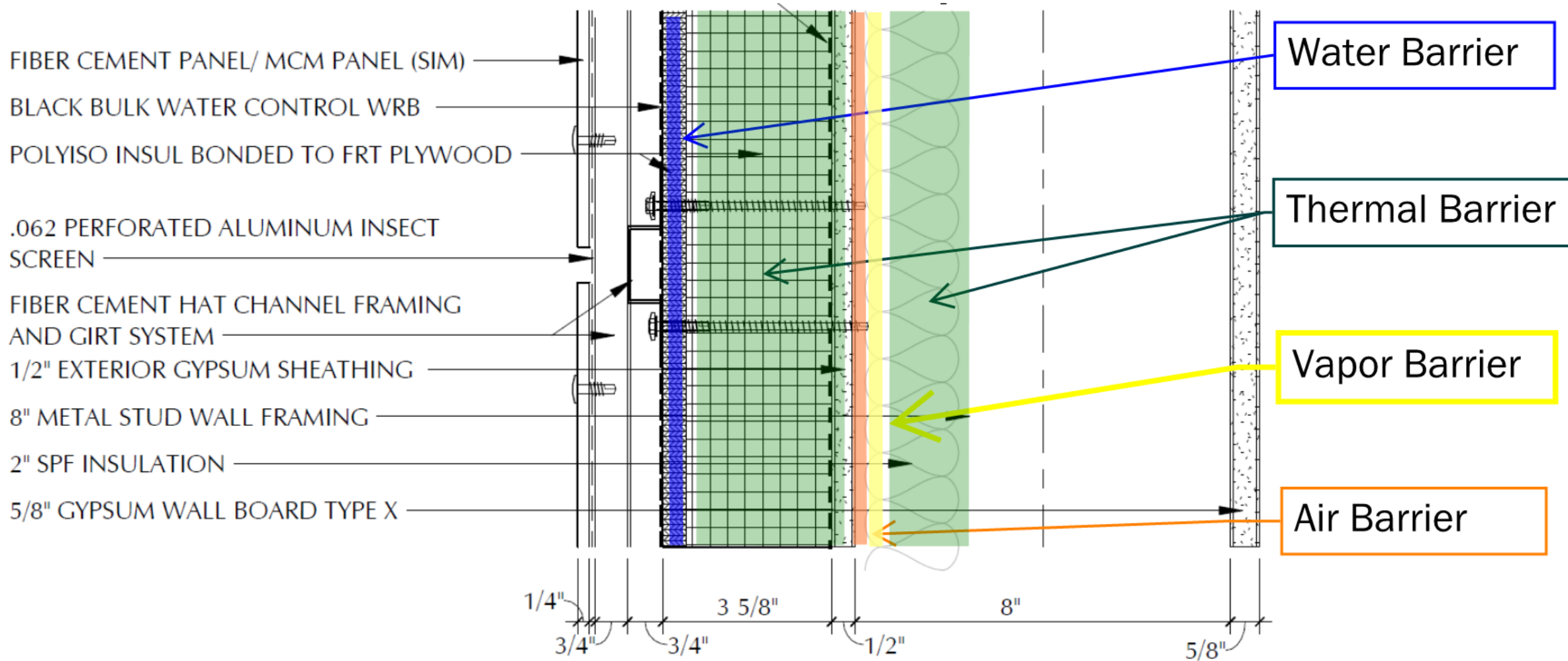
# Type A Wall Assembly



# Type A Wall Assembly



# Type B Wall Assembly



# Constructability Considerations

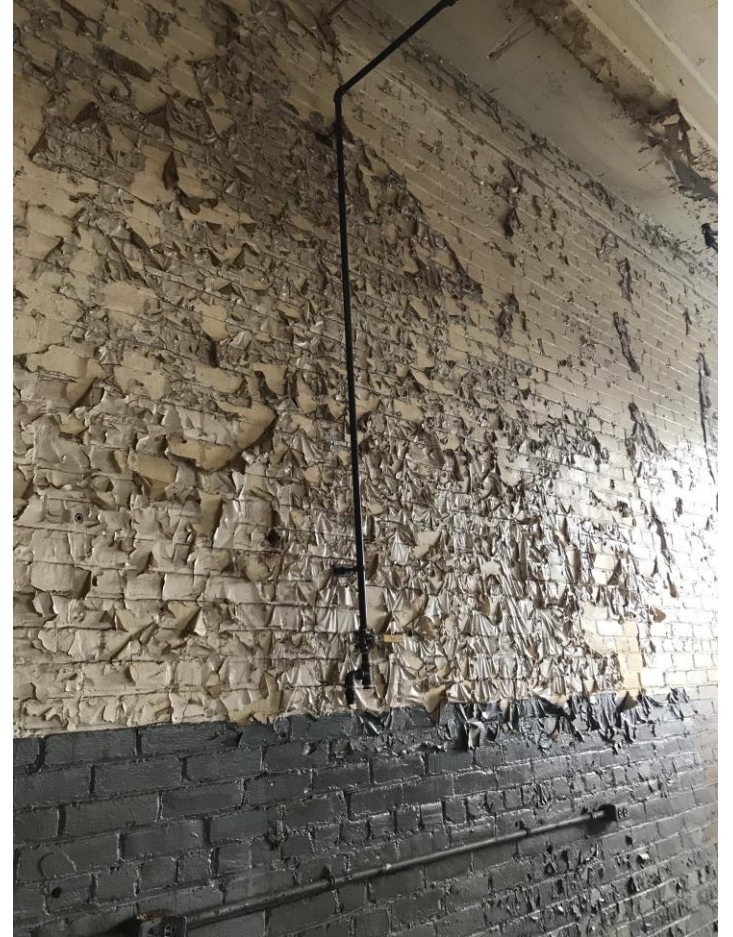
- How does the wall assembly transition to maintain continuity?
- How many times will the wall assembly be accessed?
- How will the materials selected effect sequencing?
- What are the exposure limitations during installation?
- How many trades will be involved?
- How accessible is the assembly to fix repairs if needed?



# Case Study 2 – Existing Mill Building

- Location: Massachusetts
- Original building purpose: Mill building
- Building characteristics:
  - Existing 4 story mill building
  - Built in the 1950's
- Type of wall assembly: Mass masonry exterior walls
- Client objectives:
  - *Change use group of building to accommodate new use as a Growth facility.*
  - *Maintain 77° F for interior spaces*
  - *Maintain 75% relative humidity*

# Existing Conditions



# Existing Observations

- Deteriorating mortar at exterior wythe walls
- Deteriorating/ spalling brick
- Spalling masonry
- Peeling paint
- Rusting window frames

# Site Investigation

- Perform invasive exploratory at key locations
- Test for hazardous materials
- Document existing conditions

# 2015 – IEBC Code Review

## Classification of Work Chapter 5

- Alteration Level 1 Chapter 7
- Alteration Level 2 Chapter 8
- Alteration Level 3 Chapter 9

## SECTION 505 ALTERATION—LEVEL 3

**505.1 Scope.** Level 3 *alterations* apply where the work area exceeds 50 percent of the *building area*.

**505.2 Application.** Level 3 *alterations* shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 *alterations*, respectively, as well as the provisions of Chapter 9.

## SECTION 504 ALTERATION—LEVEL 2

**504.1 Scope.** Level 2 *alterations* include the *reconfiguration of space*, the *addition or elimination of any door or window*, the reconfiguration or extension of any system, or the installation of any *additional equipment*.

**504.2 Application.** Level 2 *alterations* shall comply with the *provisions of Chapter 7* for Level 1 *alterations* as well as the provisions of *Chapter 8*.

## SECTION 505 ALTERATION—LEVEL 3

**505.1 Scope.** Level 3 *alterations* apply where the work area exceeds 50 percent of the *building area*.

**505.2 Application.** Level 3 *alterations* shall comply with the provisions of Chapters 7 and 8 for Level 1 and 2 *alterations*, respectively, as well as the provisions of Chapter 9.

# 2015 – IBC Code Review

## Chapter 10 Change of Occupancy

- (S-1) Storage
- (B) Laboratories
- (F-1) Hemp Products (strictest)

### SECTION 306 FACTORY GROUP F

**306.1 Factory Industrial Group F.** Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

**306.2 Moderate-hazard factory industrial, Group F-1.** Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

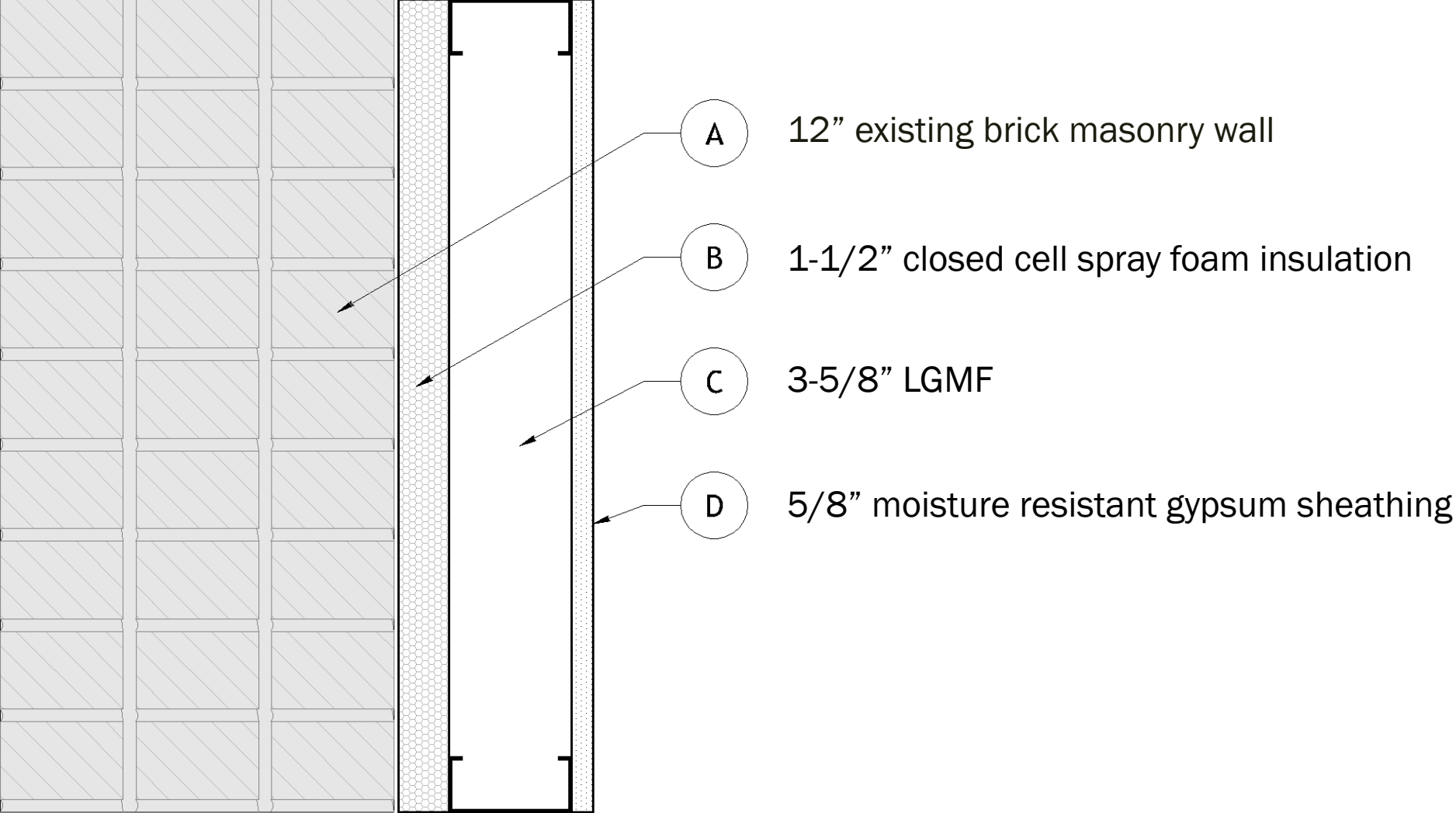
- Furniture
- Hemp Products
- Jute Products
- Leather Products
- Machinery
- Etc.



# What is a WUFI Analysis? and What are the Fail Criteria?

- Relative humidity levels above 80% for prolonged periods of time in the locations where metal items are located in the assembly.
- Increases in moisture content of any assembly component from year to year.
- Moisture content above acceptable levels in any assembly component. Unacceptable moisture content levels are those at which the material would be achieved when subjected to and equalized with an environment with 80% Relative humidity.
- Liquid moisture formation (condensation) within the assembly.

# “As Drawn” Assembly





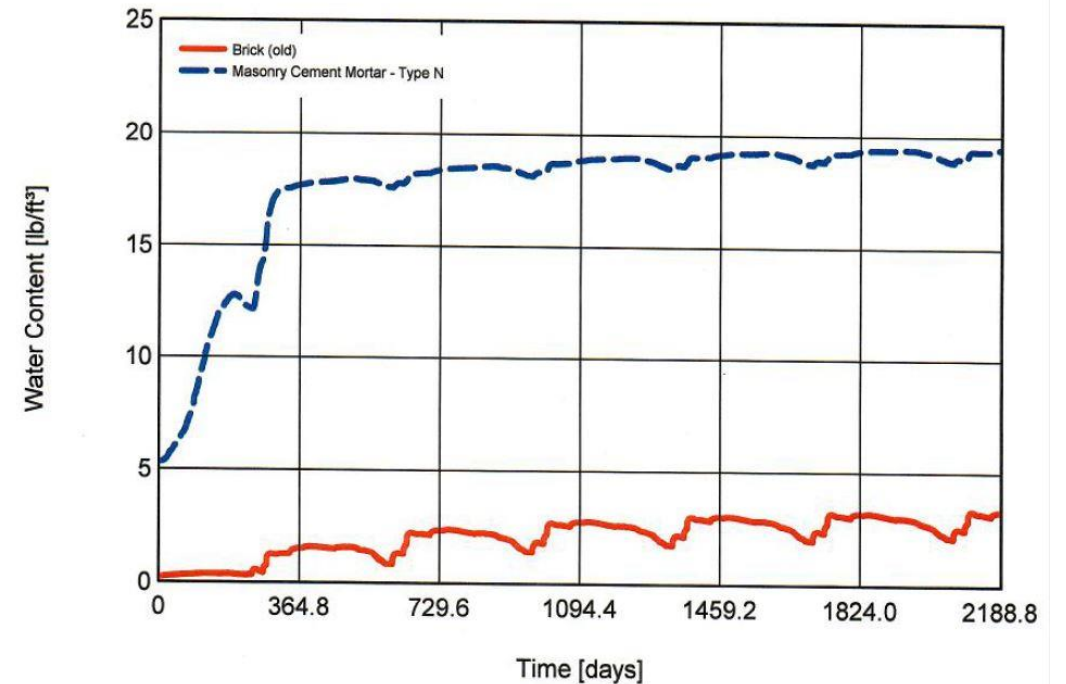
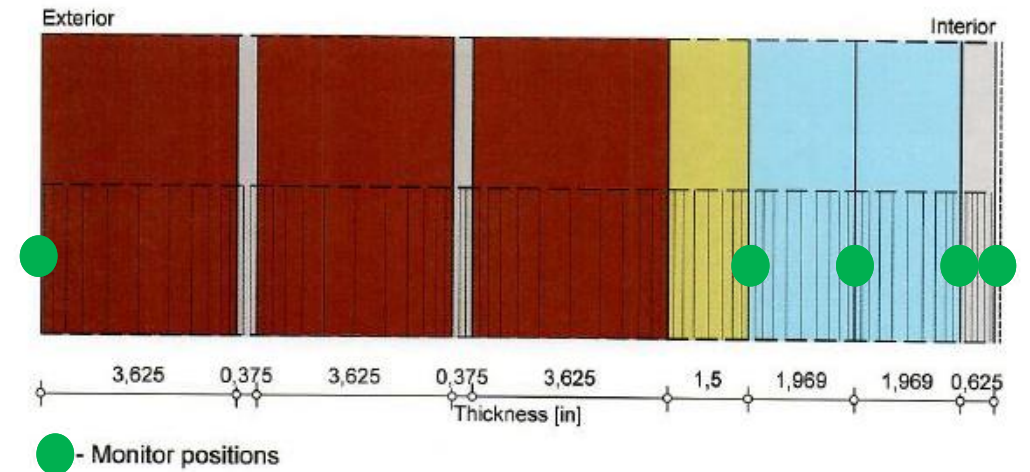
# WUFI Analysis “As Drawn”

## Wall Assembly

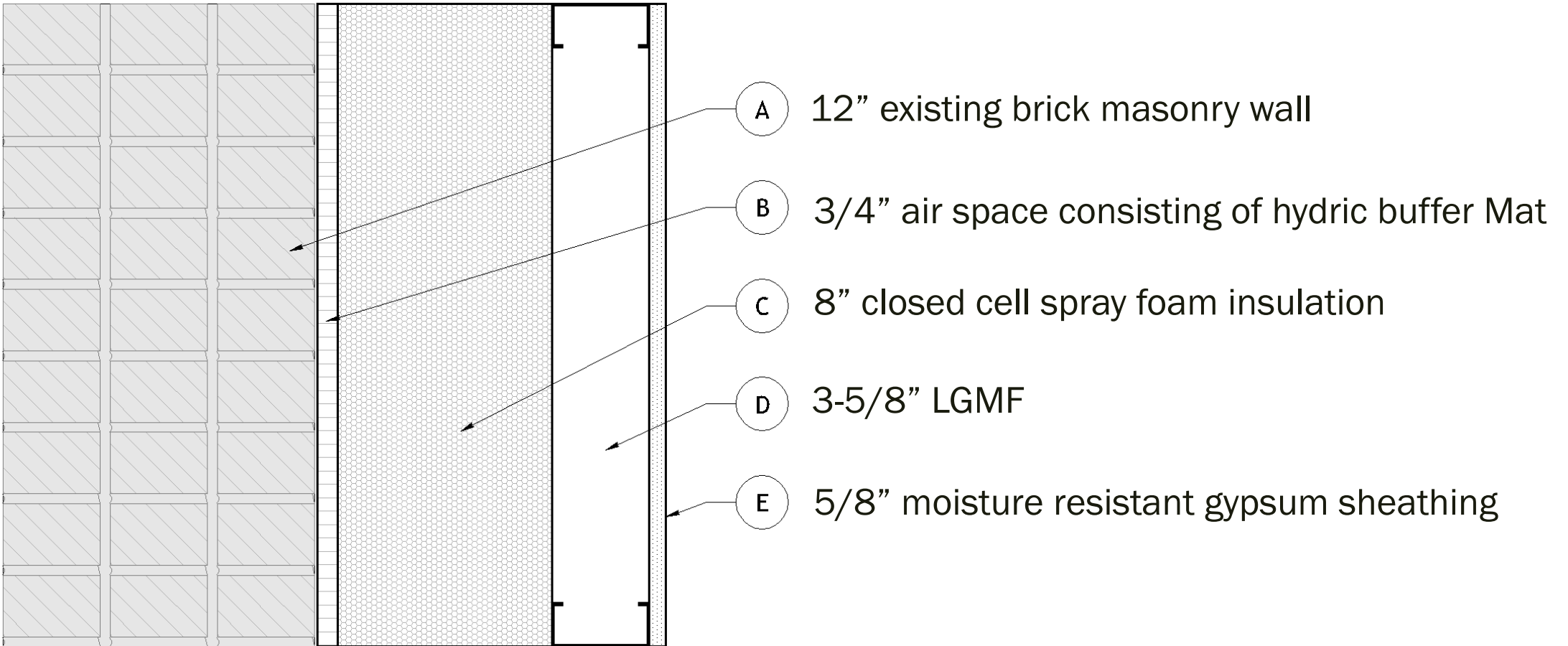
- 12” existing brick masonry wall
- 1-1/2” closed cell spray foam insulation
- 3-5/8” LGMF
- 5/8” moisture resistant gypsum sheathing

## Test Parameters

- Boston, MA
- 77°F Interior
- Relative Humidity 75%
- Initial Relative Humidity set at 80%
- 5 Year cycle period



# Wall Assembly Option 1



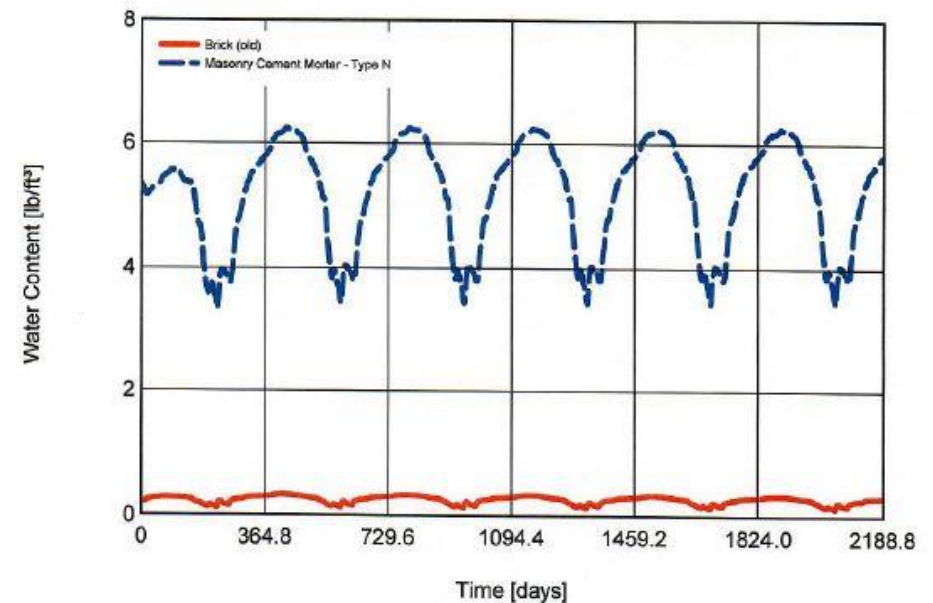
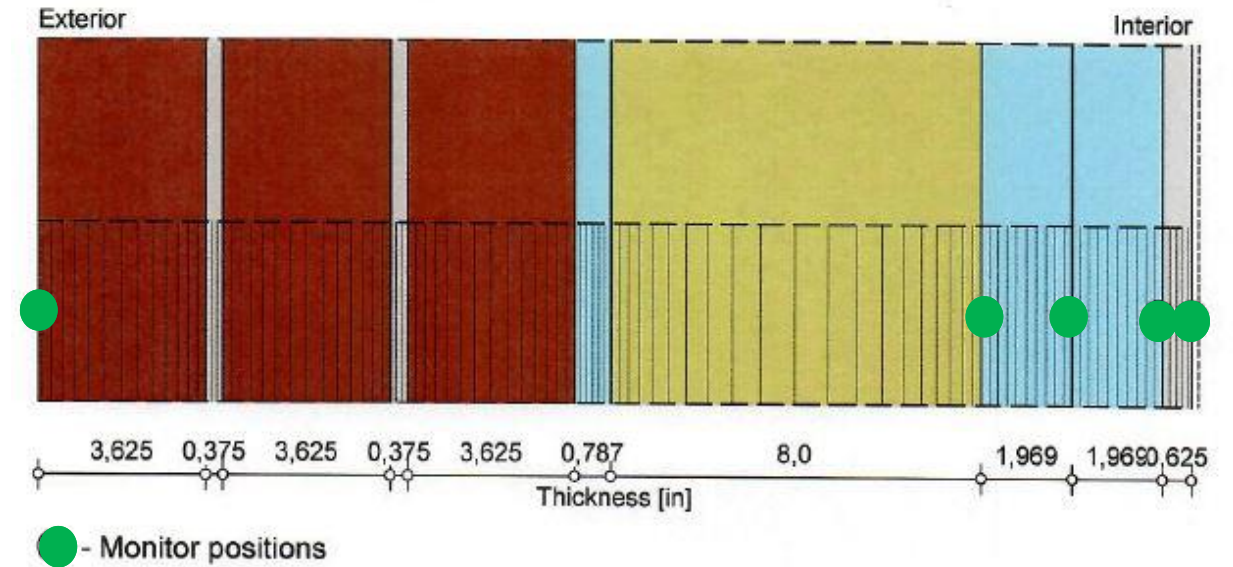
# WUFI Analysis Option 1

## Wall Assembly

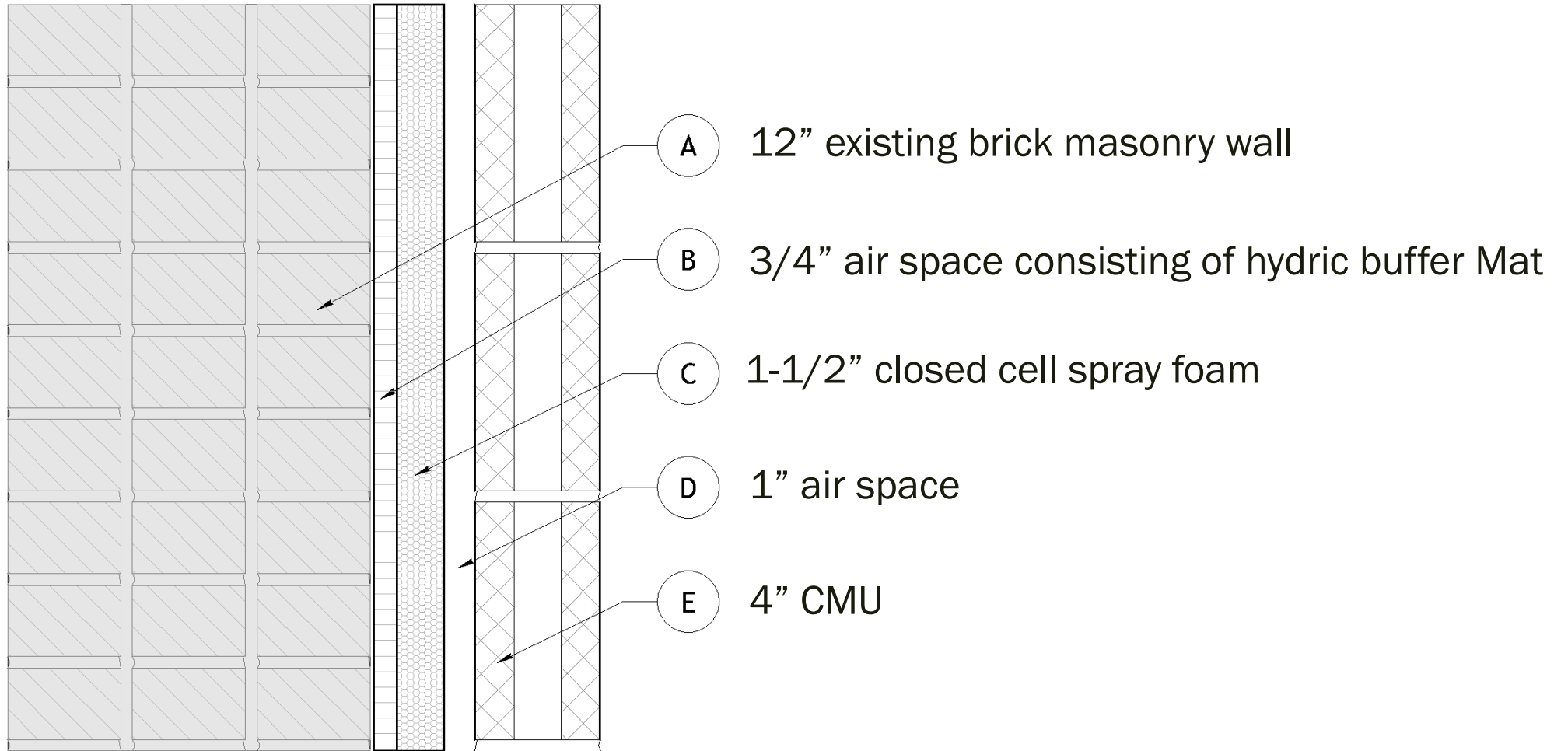
- 12" existing brick masonry wall
- 3/4" air space consisting of hydric buffer Mat
- 8" closed cell spray foam insulation
- 3-5/8" LGMF
- 5/8" moisture resistant gypsum sheathing

## Test Parameters

- Boston, MA
- 77°F Interior
- Relative Humidity 75%
- Initial Relative Humidity set at 80%
- 5 Year cycle period



# Wall Assembly Option 2



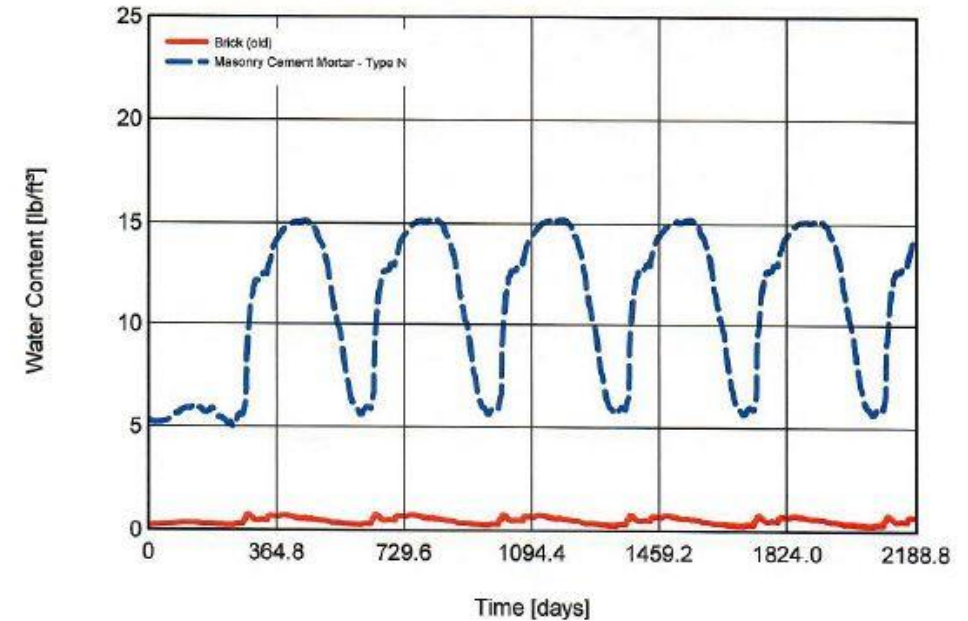
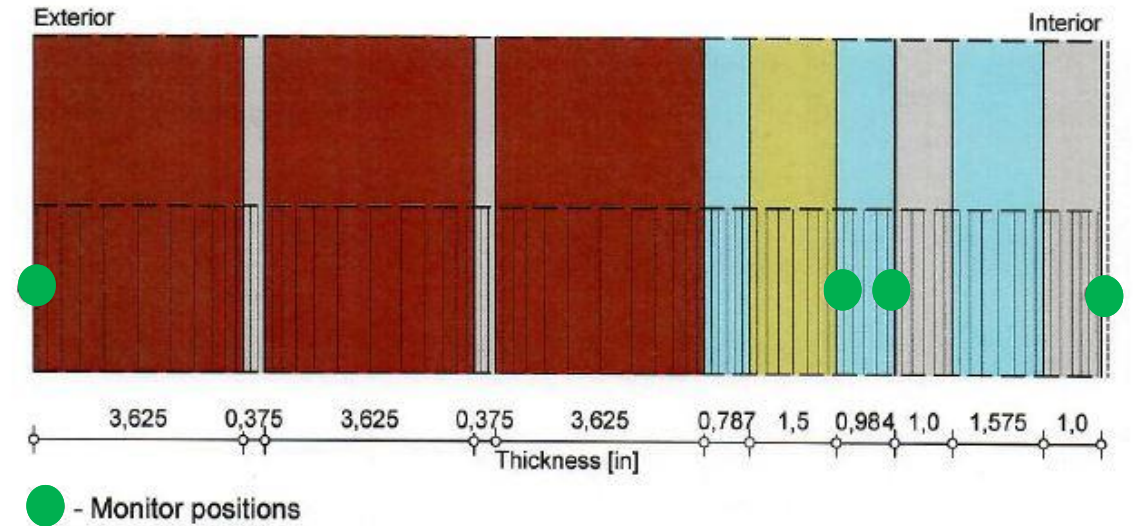
# WUFI Analysis Option 2

## Wall Assembly

- A. 12" existing brick masonry wall
- B. 3/4" air space consisting of hydric buffer Mat
- C. 1-1/2" closed cell spray foam insulation
- D. 4" CMU

## Test Parameters

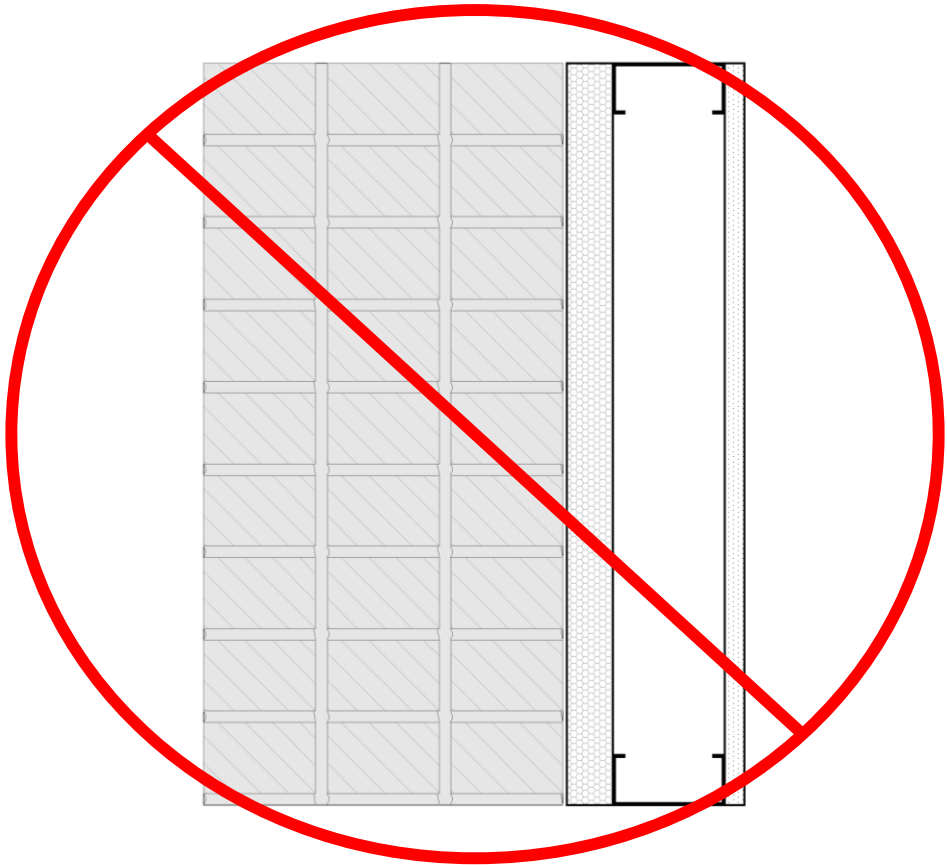
- Boston, MA
- 77°F Interior
- Relative Humidity 75%
- Initial Relative Humidity set at 80%
- 5 Year cycle period



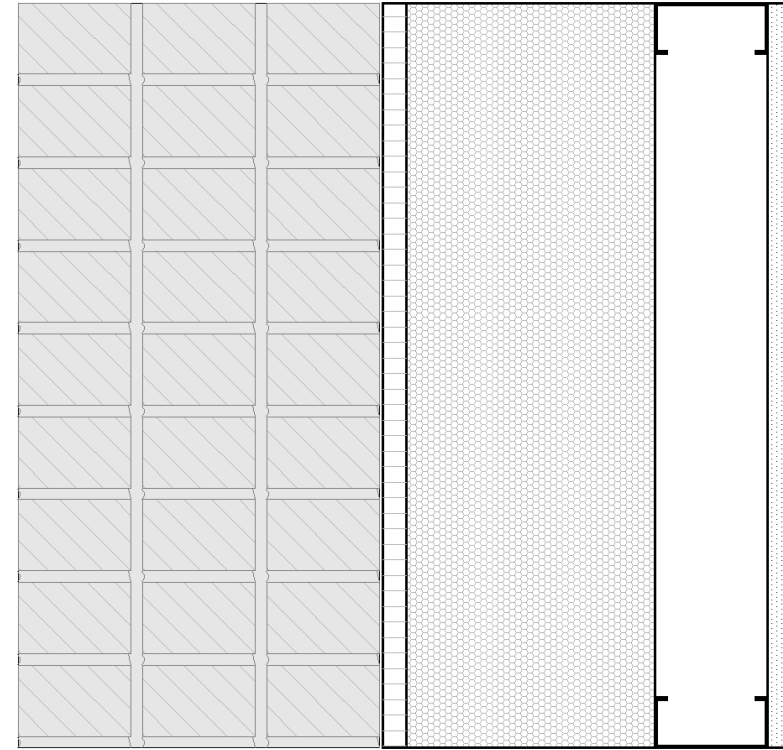
think *function* and *system*

...not materials first

# “As Drawn” Assembly



# Option 1



# Thank You Sponsors!





# References



- IBC 2015
- IEBC 2015
- IECC 2015
- WUFI analysis

- EXOTEC Consulting, Inc.



- Scott Richardson, AIA
- Steve Lewis, AIA
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# Questions and Answers



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