



## Building Solutions



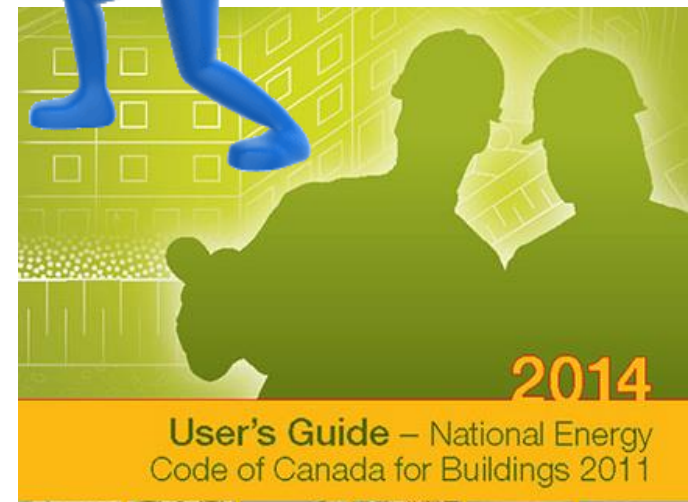
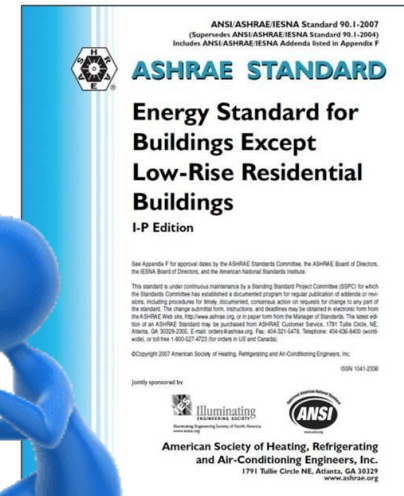
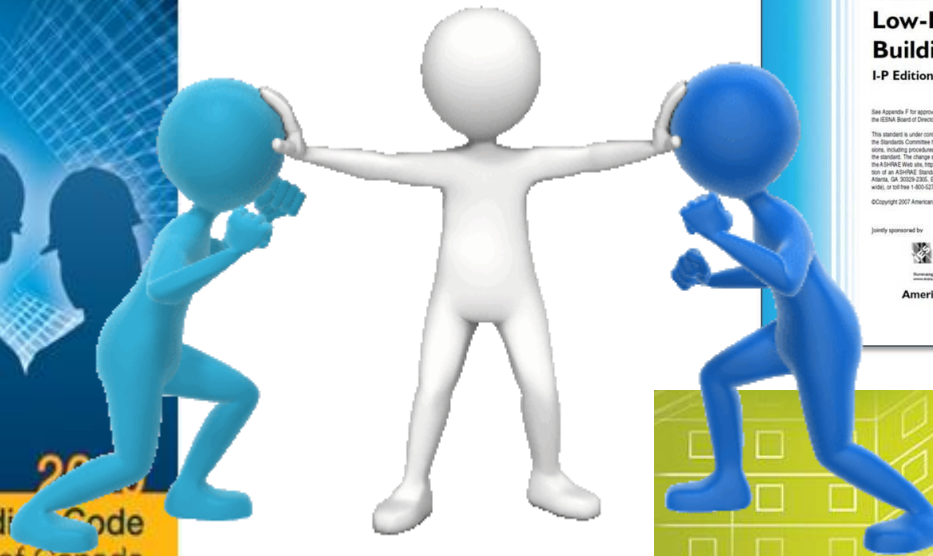
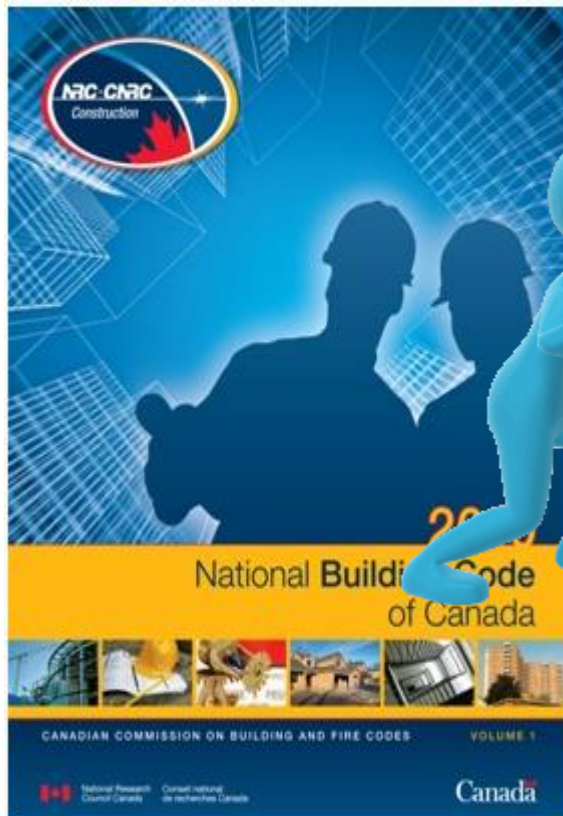
# Canadian Code Assessment Engine and Above Grade Wall Solutions

# Code Assessment Engine & Above Grade Wall Solutions

## Presentation Agenda:

1. Code Tool Development and Early History (Les Yard)
2. Code Tool Introduction and Use (Keith Calder)
3. Industry Meetings & Code Tool Learnings (Les)
4. Online Code Tool Demonstration (Keith)
5. Above Grade Wall: Other Design Considerations (Les)
6. If Time .... Dow Above Grade Wall Solutions, Tools, Support

# Building & Energy Codes are in Conflict!



# ■ Research Has Indicated the Construction Industry wants to make use of Foam Plastics in Above Grade Walls ... **Why?**

*Increasing Energy Code Requirements are leading to ....*

- ✓ Greater Demand for High Performance Insulation
- ✓ Need for Increased Flexibility in Wall Assembly Design
- ✓ Need For More Thermally Efficient Cladding Attachment Methods (Subsequent Reduction in Thermal Bridging)
- ✓ Higher Achievable Effective R-Values
- ✓ Thinner Wall Assemblies

**How do we know this is so...?**





# Hugh Bird Vancouver





# Ottewell Terrace Edmonton



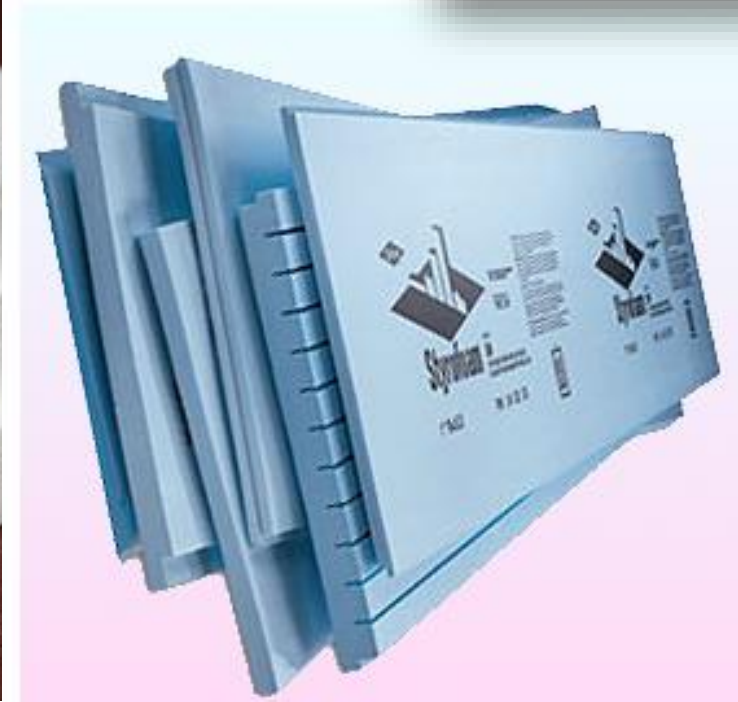


# John Paul 2 Vancouver





10 Years + US Experience





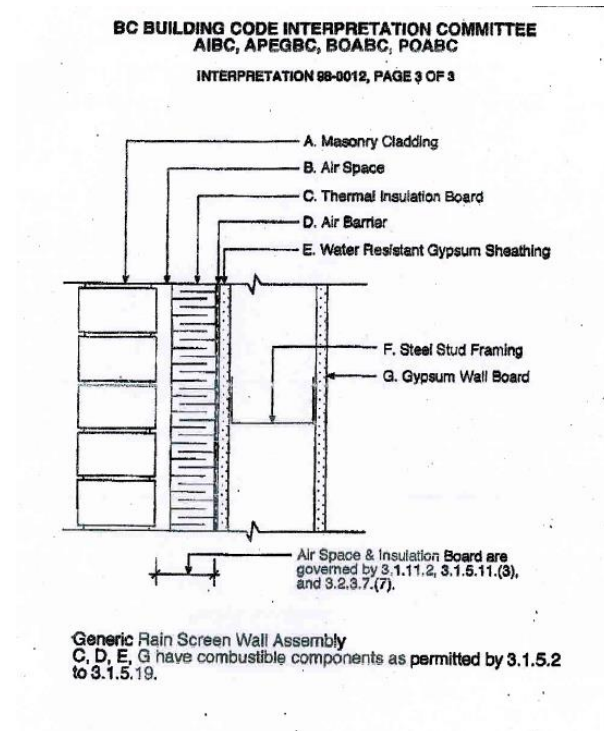


# Hugh Bird – Rainscreen Stucco Wall XPS

## Belt and Suspenders Wall

No Insulation in the Cavity Space, Ext Gypsum, Full Peel'n Stick A/B, 3" of SM, Flash Taped Seams & Penetrations. 7/8's Surface Mounted Z-girt, Paper-backed Lath and 3 Coat Stucco

**Cladding consisted of 25 mm of masonry or concrete (Clarified in NBC 2015 3.1.5.6)**



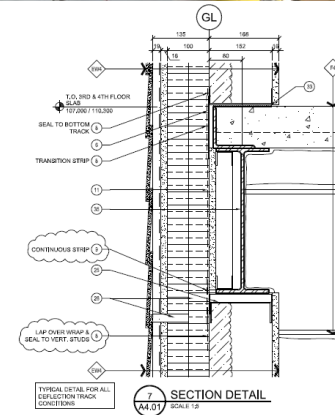




# Ottewell Terrace TWS

## Inverted Wall Assembly

Exterior Gypsum was used as a thermal barrier (met building code / City of Edmonton AHJ)





# John Paul 2 TWS

## Belt and Suspenders Wall

1.55" Thermax, 2" SPF, Aluminum Extruded and Fiber Cement Cladding

**Alternative Solution leveraging NFPA 285 US Fire Testing (City of Vancouver AHJ)**



RECEIVED  
NOV 06 2013  
CITY OF VANCOUVER COMMUNITY SERVICES

(Please print on pink paper)  
CITY OF VANCOUVER  
OFFICE OF THE CHIEF BUILDING OFFICIAL  
Community Services, 453 West 12<sup>th</sup> Avenue, Vancouver, BC, V5Y 1V4  
ALTERNATIVE SOLUTION PROPOSAL  
(In Accordance with Section 2.3 OF Division C of the Vancouver Building By-law)

BU 457878  
Building Permit No. 749 West 33<sup>rd</sup> Street, Vancouver, BC  
Project Address July 24, 2013 Revised Nov 6, 13  
Date

For office use only  
Payment \$ 697.00 Invoice Number: CK 012384 722037 AL Number: AL 401472

APPLICANT INFORMATION  
Proposed By: Jun H. Kim, BASc, EIT / K.M. Gary Chen, MASc, P. Eng  
Firm: GHL CONSULTANTS LTD  
Address: 950 - 409 Granville Street, Vancouver, BC  
Phone: 604.689.4449 Fax: 604.689.4419 Email: jhk@ghl.ca / gc@ghl.ca

CODE REFERENCE(S) & SUMMARY OF DEVIATION(S) FROM VANCOUVER BUILDING BY-LAW  
Alternative Solution 7 - Exterior Wall Assembly

Sentence 3.2.3.8.(1) requires an exterior wall containing foam insulation in a building more than 3 storeys in height to comply with Sentences (1), (2) or (3). Sentence 3.2.3.8.(3) requires an exterior wall using foamed plastic insulation in a building more than 3 storeys in height to meet Sentences 3.1.5.5.(2) and (3) when tested in accordance with CAN/ULC-S134. The proposed exterior wall assembly using Dow Thermax Sheathing with aluminum or Hardi panel cladding has not yet been tested per CAN/ULC-S134. However, the an exterior wall similar to the proposed wall has been tested to and passed a similar standard in the United States, namely NFPA 285, "Standard Fire Test Method for Evaluation of

(Professional Seal)  
PROFESSIONAL ENGINEER  
K.M. CHEN  
#33494  
BRITISH COLUMBIA  
NOV 13





# Thermax Wall System: US Test Approvals

CTQ	TEST	PASS/FAIL	Comments
Fire Performance BRICK, Concrete & Stone	NFPA285	PASS	NFPA285 is IBC Code Requirement for all plastic foam insulations within commercial wall construction.
Fire Performance METAL & MCM	NFPA285	PASS	NFPA285 is IBC Code Requirement for all plastic foam insulations within commercial wall construction.
Fire Performance STUCCO	NFPA285	PASS	NFPA285 is IBC Code Requirement for all plastic foam insulations within commercial wall construction.
Fire Performance Terracotta & Ceramic Tile	NFPA285	PASS	NFPA285 is IBC Code Requirement for all plastic foam insulations within commercial wall construction.
CLASS A THERMAX Ci	ASTM E84	PASS	Commercial insulation must achieve CLASS A ratings in order to used within commercial wall assemblies.
CLASS A CM2030	ASTM E84	PASS	Commercial insulation must achieve CLASS A ratings in order to used within commercial wall assemblies.
CLASS A CM2045	ASTM E84	PASS	Commercial insulation must achieve CLASS A ratings in order to used within commercial wall assemblies.
AIR Barrier	ASTM E2357	PASS	Systems must now be tested in the new Full Scale Wall test.
Water Barrier	ASTM E331	PASS	Systems must now be tested in the new Full Scale Wall test.



# US NFPA 285 ... CND CAN/ULC S134



**National Fire Protection Association**  
The authority on fire, electrical, and building safety





**If the Construction Industry in Canada  
wants to use Foam Insulation in Above  
Grade Walls ...**

**Why Has This Taken Off? Why not just run  
an S134 test (s) to validate?**

*Main reason we uncovered is ...*

**CODE Confusion!!!**



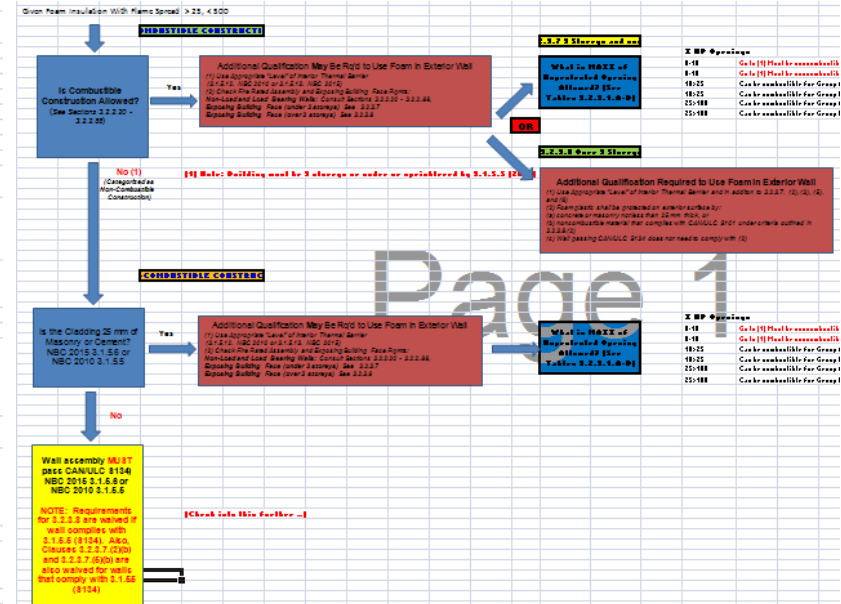
# National Building Code of Canada

## Analysis of Combustible and Noncombustible Code Requirements

**PART 3 (Sections 3.2.2.20 - 3.2.2.36) - NEEDS TO BE CHECKED FOR ACCURACY, BUT GOOD OVERVIEW CONCEPTUALLY**

Can be of Combustible Construction (with conditions)					
Group	Division	Height/ Stories	Area	Sprinkled NC, C, HT	Other Restriction
<b>Protection &amp; Vieweing of the Performing Arts</b>					
A	1	Any	Any	Y	NC
A	1	1	< 600 m <sup>2</sup>	Y	NC, HT
A	1	1	Y	Y	NC, C
<b>Elsewhere Classified in Group A</b>					
A	2	Any	Any	Y	NC
A	2	≤ 6	Any	Y	NC
A	2	≤ 2	Table 3.2.2.25	?	NC, C
A	2	≤ 2	1 Storey ≤ 4800 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	2 Storey ≤ 2400 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	1 Storey ≤ 2400 m <sup>2</sup> (no basement)	Y	NC, C
A	2	≤ 2	1 Storey ≤ 1200 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	2 Storey ≤ 600 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	1 Storey ≤ 400 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	2 Storey ≤ 500 m <sup>2</sup>	Y	NC, C
A	2	≤ 2	3 Storey ≤ 600 m <sup>2</sup>	Y	NC, C
<b>Assembly Occupancies of the Area Type</b>					
A	3	Any	Any	Y	NC
A	3	≤ 2	Table 3.2.2.30	Y	NC, HT
A	3	≤ 2	1 Storey ≤ 1200 m <sup>2</sup>	Y	NC
A	3	≤ 2	2 Storey ≤ 6000 m <sup>2</sup>	Y	NC
A	3	≤ 2	1 Storey ≤ 2400 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	2 Storey ≤ 3000 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	3 Storey ≤ 3600 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	1 Storey ≤ 2400 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	1 Storey ≤ 1000 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	2 Storey ≤ 1250 m <sup>2</sup>	Y	NC, C
A	3	≤ 2	3 Storey ≤ 1500 m <sup>2</sup>	Y	NC, C
<b>Assembly Occupancies in which Occupants are Gathered in the Open Air</b>					
A	4	Any	Any	Y	NC, HT
A	4	Any	Any	Y	NC, HT
<b>Detection Occupancies</b>					
B	1	Any	Any	Y	NC, HT

F = Floor  
M = Mezzanine  
L = Load Bearing Wall  
R = Roof  
  
NC = Noncombustible  
C = Combustible  
HT = Heavy Timber






# Part 2: Code Tool Introduction and Use (Keith Calder)

GLOBAL LEADERS IN FIRE ENGINEERING




**FIRE ENGINEERING** **BUILDING CODE**

**FORENSICS** **RESEARCH**



**JENSEN HUGHES**  
Advancing the Science of Safety




**i NEWS**

- ▶ April 2016 Seminar Series announced for Calgary and Edmonton [Read more](#)
- ▶ Jensen Hughes presents at Weyerhaeuser Wood-Frame Mid-Rise Seminar in Ontario, February 11, 2016 [Read more](#)
- ▶ Sereca hosts Fire and Life Safety Seminar at the University of Waterloo, July 7-9, 2015 [Read more](#)

**Keith D. Calder, M.Eng., P.Eng.**  
Technical Director, Canada

Keith Calder provides leadership with his expertise in building codes, fire safety standards, specialized fire protection systems, and performance-based design. He focuses on assisting clients with alternative solutions for complex and innovative designs. In particular, he specializes in the use of computer fire modelling to assess new construction design with regard to smoke control and people movement.



Complementing his design expertise, Mr. Calder has a wide background in forensic fire investigation. He has investigated and analyzed many fire and explosion incidents, and has conducted forensic audits of building design and construction. An active researcher, he has developed a vast knowledge of current and historical building codes, and continues to coordinate and assist with our ongoing live burn research program.

# Applicable Building Code

	A	
1	<b><u>Applicable Building Code:</u></b>	
2	2015 NBCC	

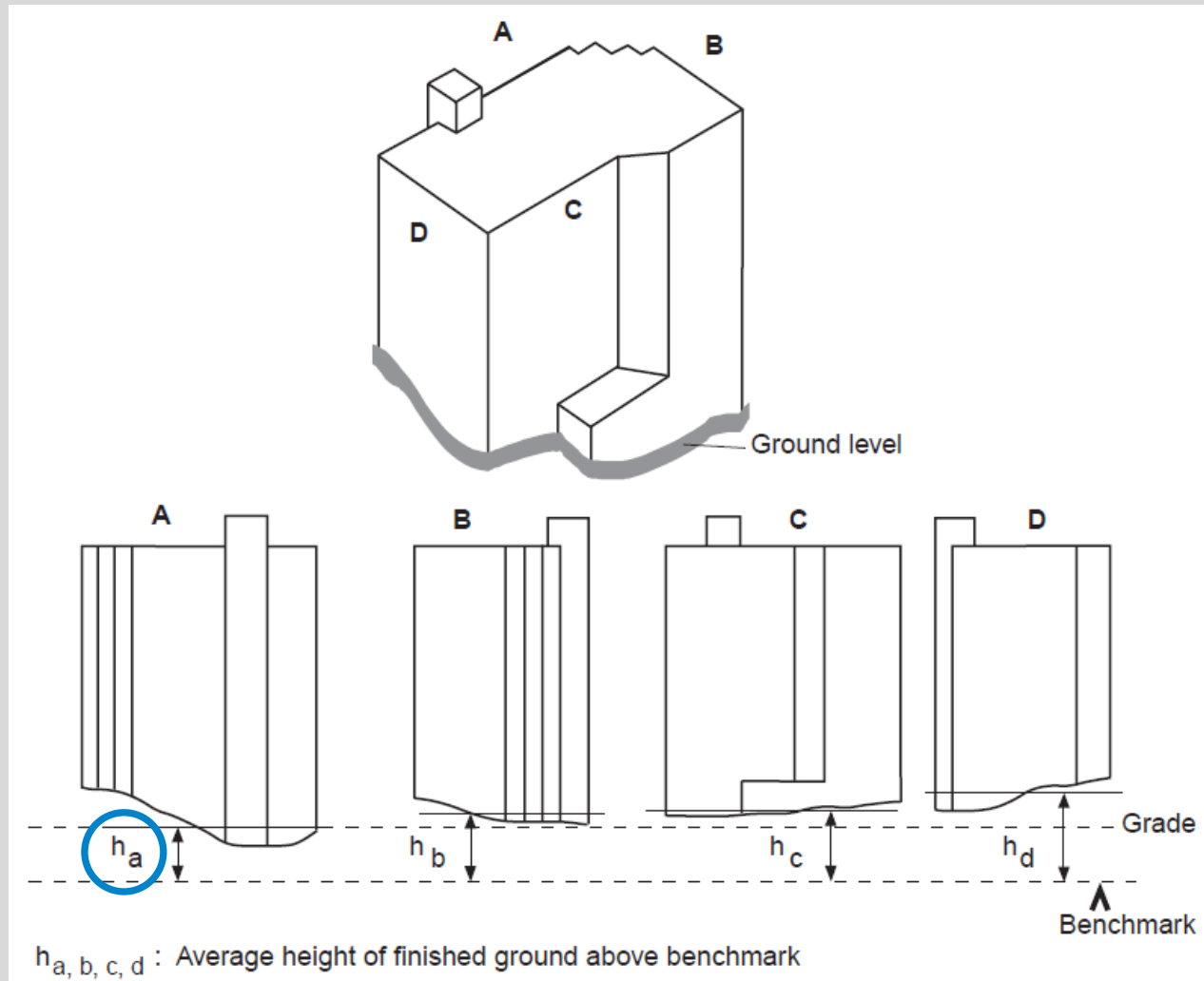


# Project Characteristics

<b><u>Project Characteristics:</u></b>	
Building Area (m <sup>2</sup> ):	1200
Building Height (Storeys):	4
Building Height (m):	17
High Building (Subsection 3.2.6.	No
Streets Facing:	2
Sprinklered:	Yes
Major Occupancies:	C,D,E

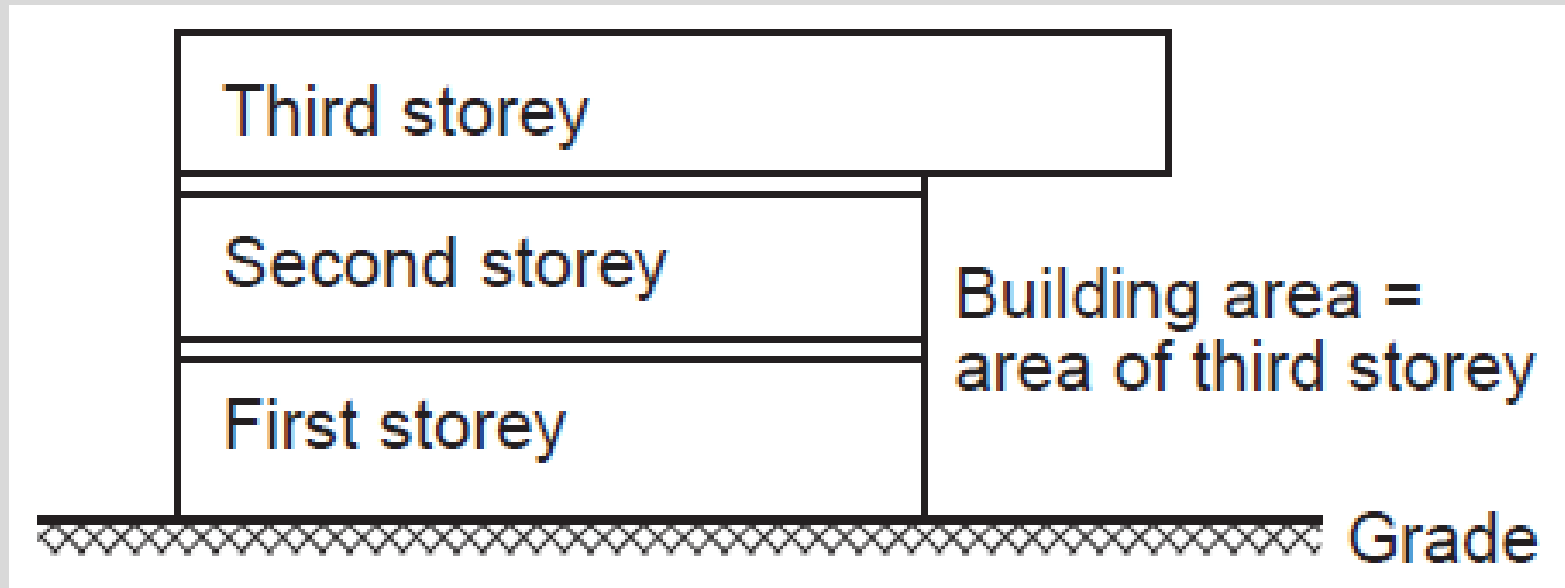


# Project Characteristics – Grade

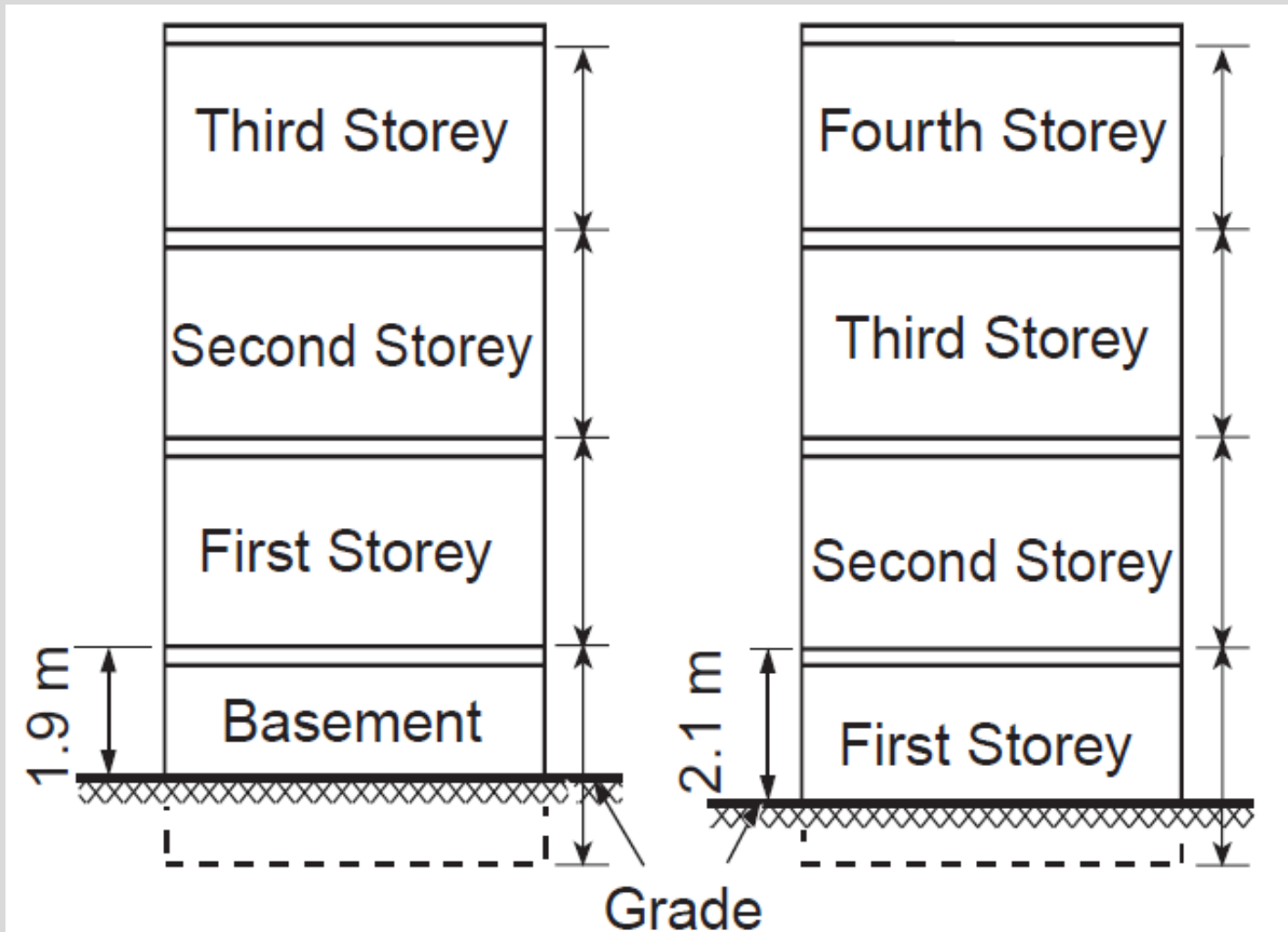


# Project Characteristics – Building Area

## › Building Area:



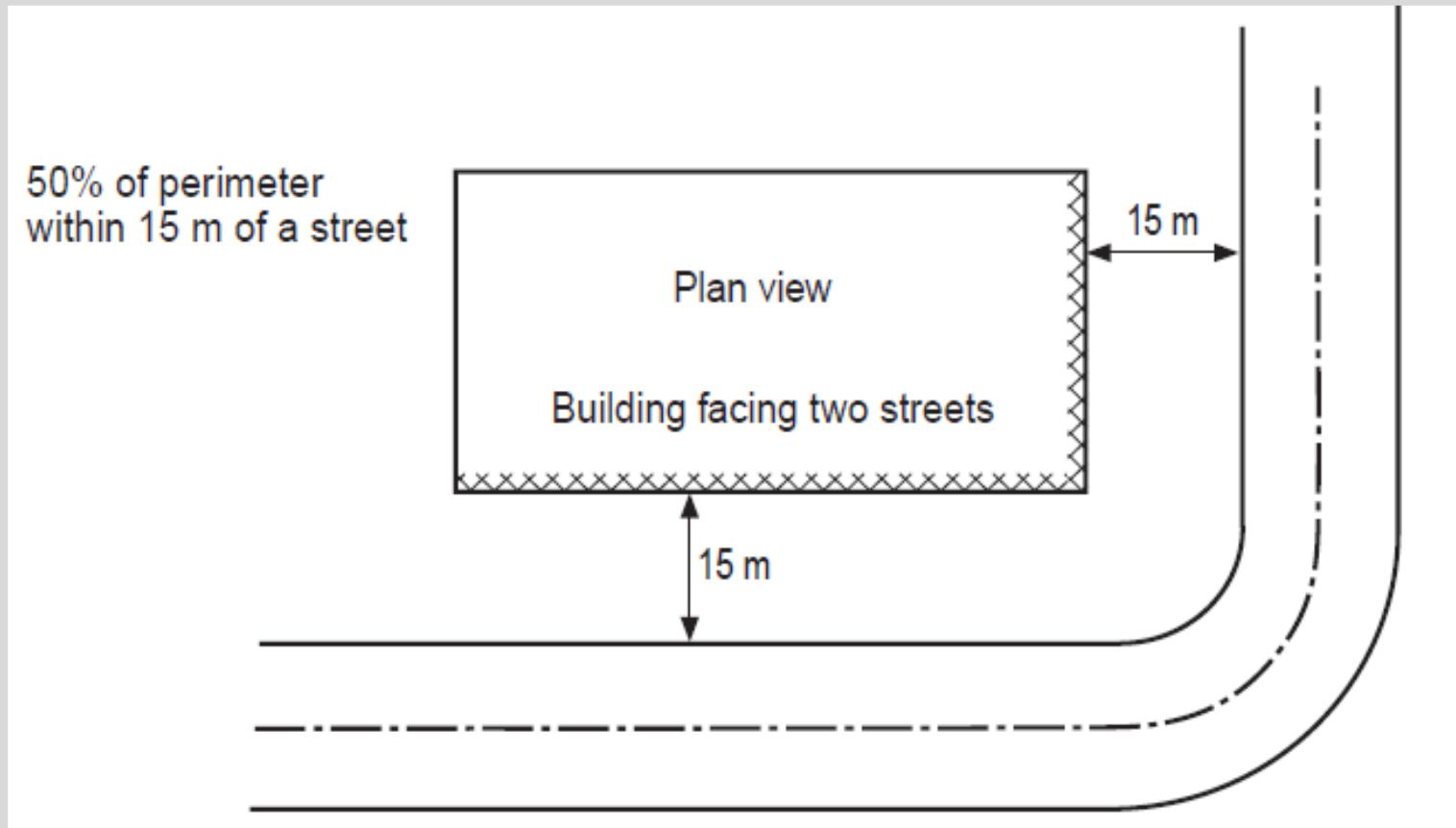
# Project Characteristics – Building Height





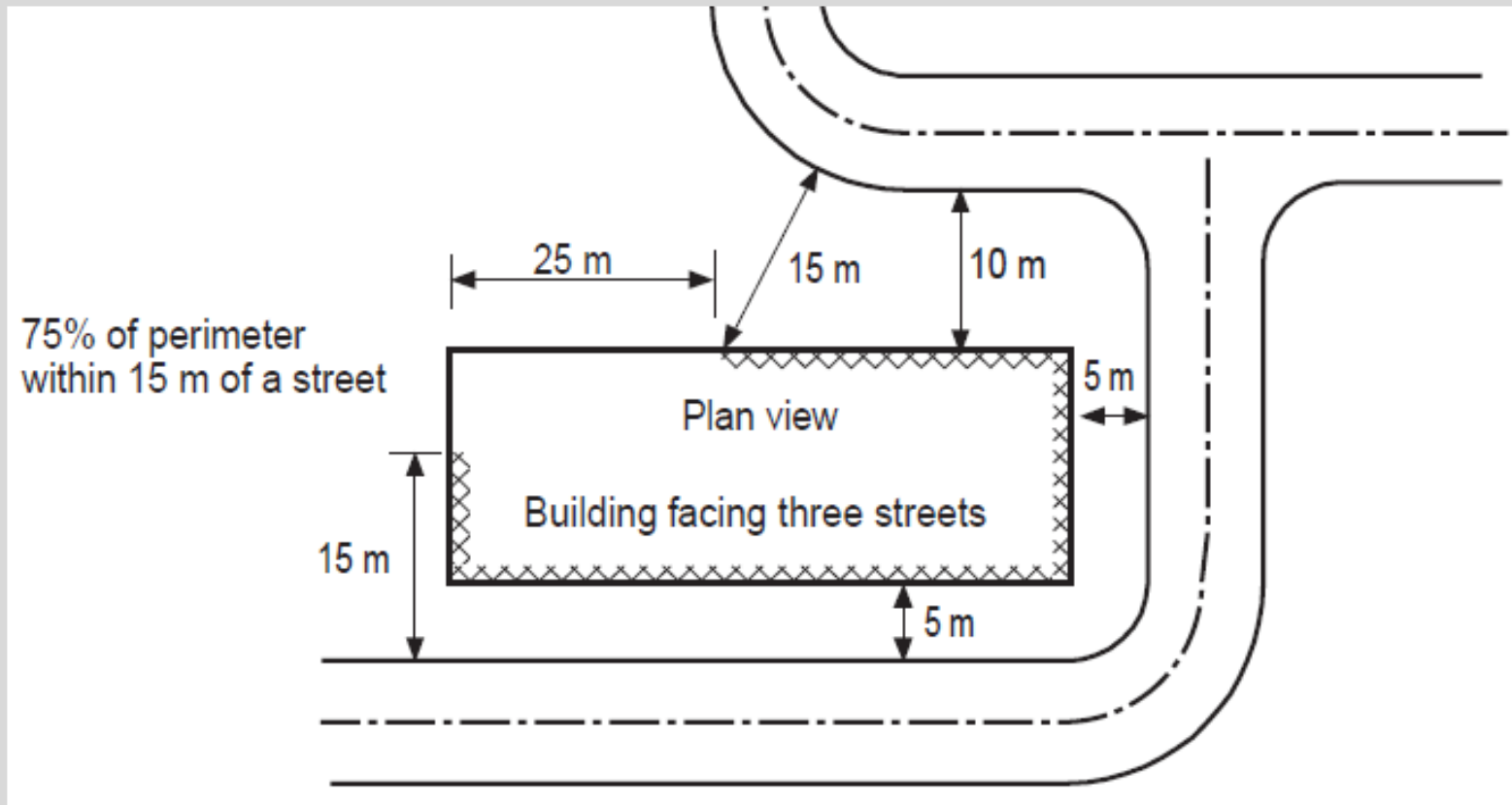
# Project Characteristics – Streets Facing

## › 2 Streets Facing:



# Project Characteristics – Streets Facing

## › 3 Streets Facing:



# Building Classification - Governing Major Occupancy

## 3.2.2.49. Group C, up to 3 Storeys, Noncombustible Construction

**1)** A *building* classified as Group C is permitted to conform to Sentence (2) provided

- a) it is not more than 3 *storeys* in *building height*, and
- b) it has a *building area* not more than the value in Table 3.2.2.49.

Table 3.2.2.49.  
Maximum Building Area, Group C, up to 3 Storeys  
Forming Part of Sentence 3.2.2.49.(1)

No. of Storeys	Maximum Area, m <sup>2</sup>		
	Facing 1 Street	Facing 2 Streets	Facing 3 Streets
1	not limited	not limited	not limited
2	6 000	not limited	not limited
3	4 000	5 000	6 000

**2)** The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and

- a) except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
- b) *mezzanines* shall have a *fire-resistance rating* not less than 1 h,
- c) roof assemblies shall have a *fire-resistance rating* not less than 1 h, and
- d) *loadbearing* walls, columns and arches shall have a *fire-resistance rating* not less than that required for the supported assembly.

**3)** In a *building* that contains *dwelling units* that have more than one *storey*, subject to the requirements of Sentence 3.3.4.2.(3), the floor assemblies, including floors over *basements*, which are entirely contained within these *dwelling units*, shall have a *fire-resistance rating* not less than 1 h but need not be constructed as *fire separations*.



# Building Classification - Type of Construction

## › Combustibility:

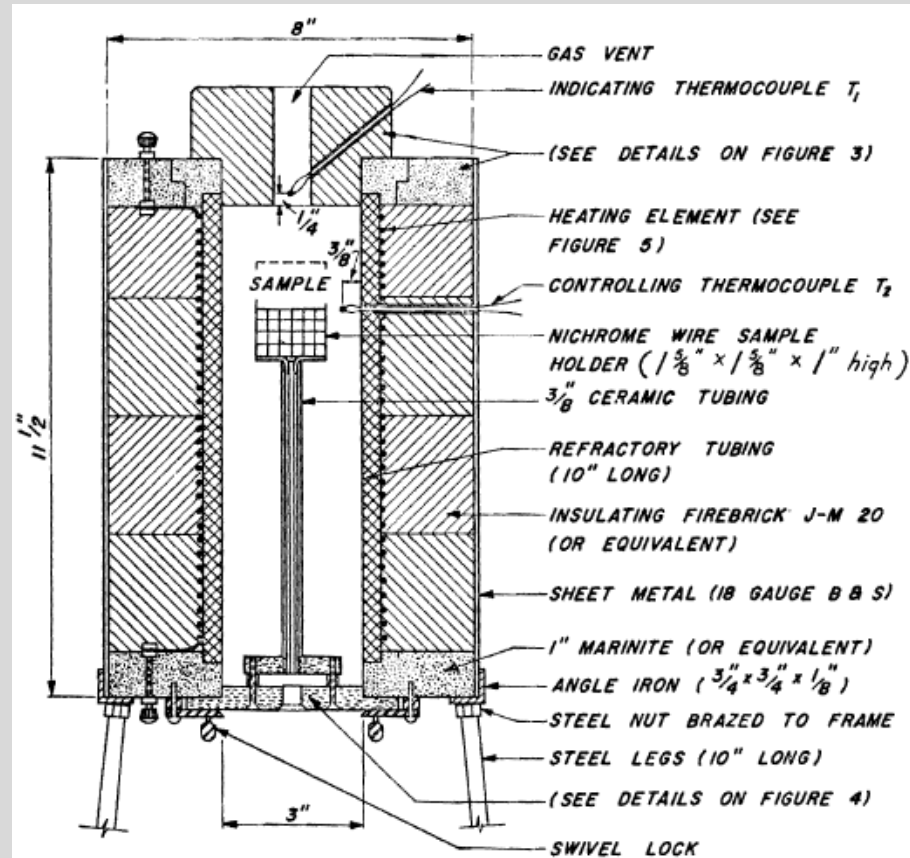


FIGURE 2  
DIAGRAM OF COMBUSTIBILITY FURNACE



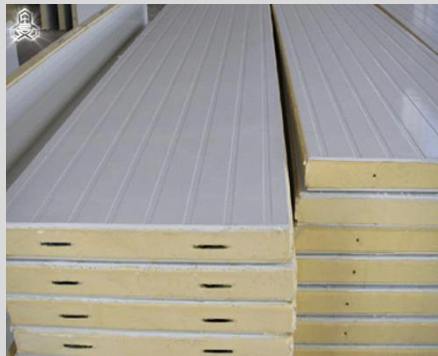
# Building Classification - Type of Construction

- › **Noncombustible Construction:** “a type of construction in which a degree of fire safety is attained by the use of noncombustible materials for structural members and other building assemblies”



# Building Classification - Type of Construction

- › **Combustible Construction:** “a type of construction that does not meet the requirements for noncombustible construction”



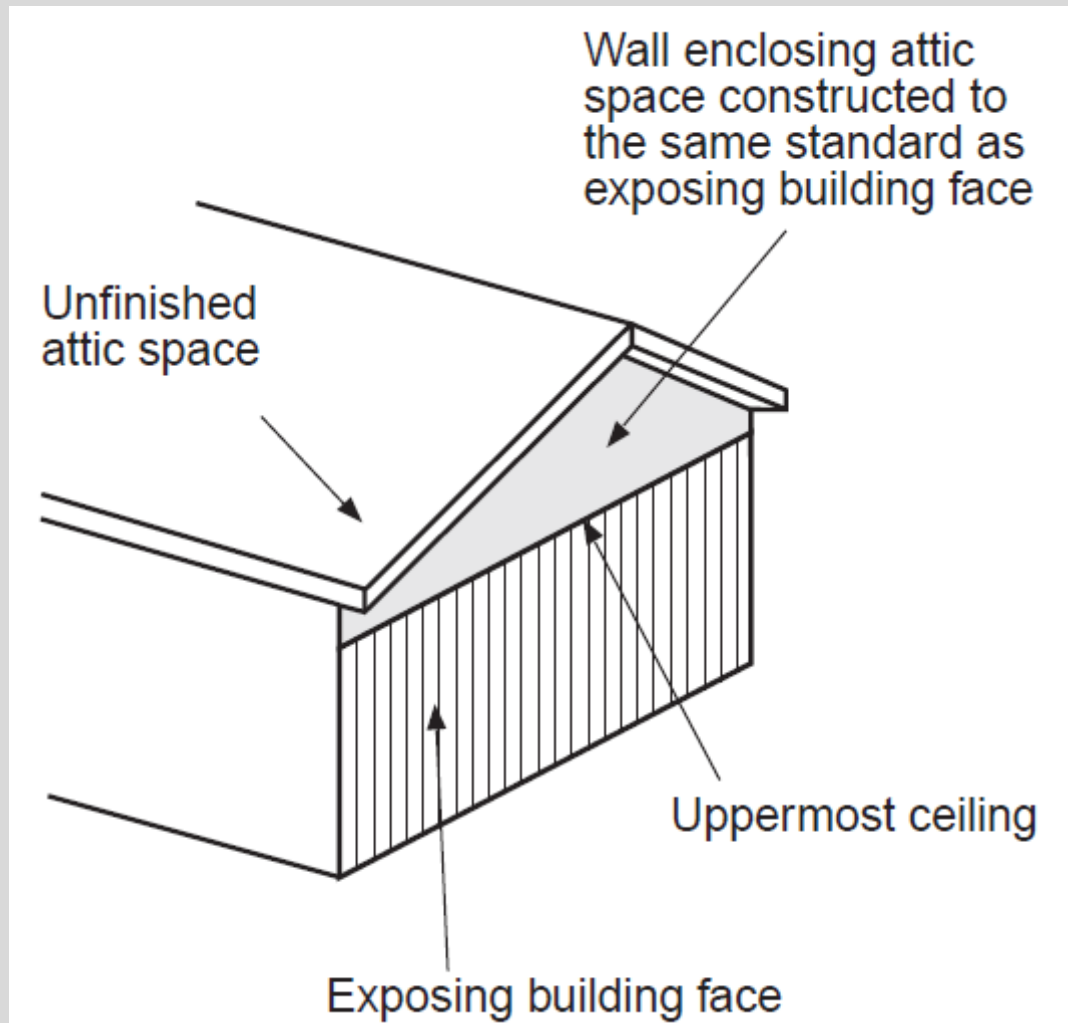


# Spatial Separation

<b><u>Spatial Separation (Tables 3.2.3.1.-B to 3.2.3.1.-E):</u></b>	
<b>North Wall</b>	
Occupancy:	C
Wall Height (m):	3
Wall Width (m):	40
Wall Area (m <sup>2</sup> ):	120.0
Limiting Distance (m):	4
Permitted UPO (%):	33%

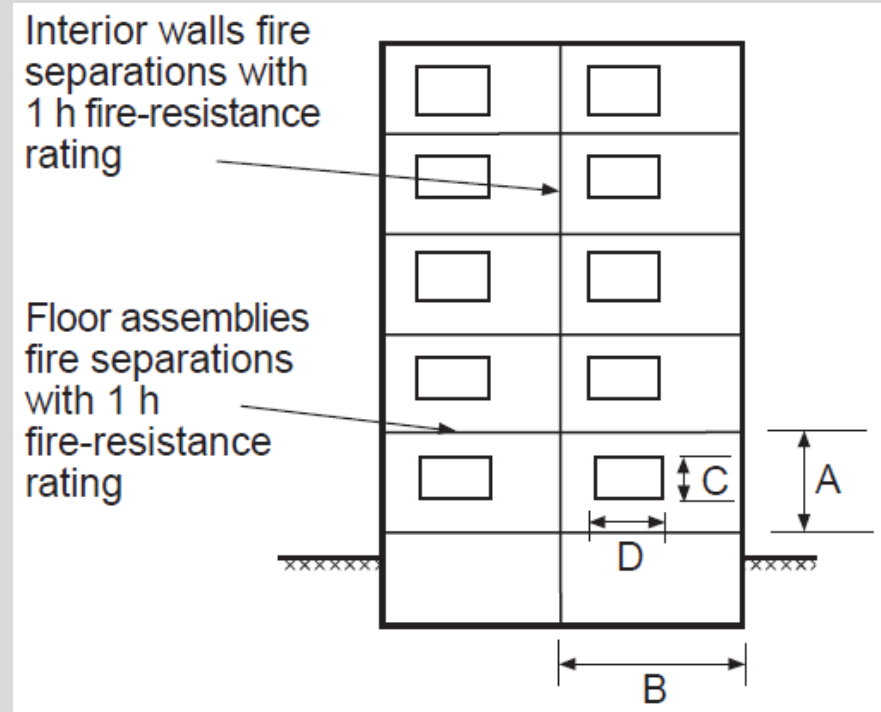


# Spatial Separation - Exposing Building Face



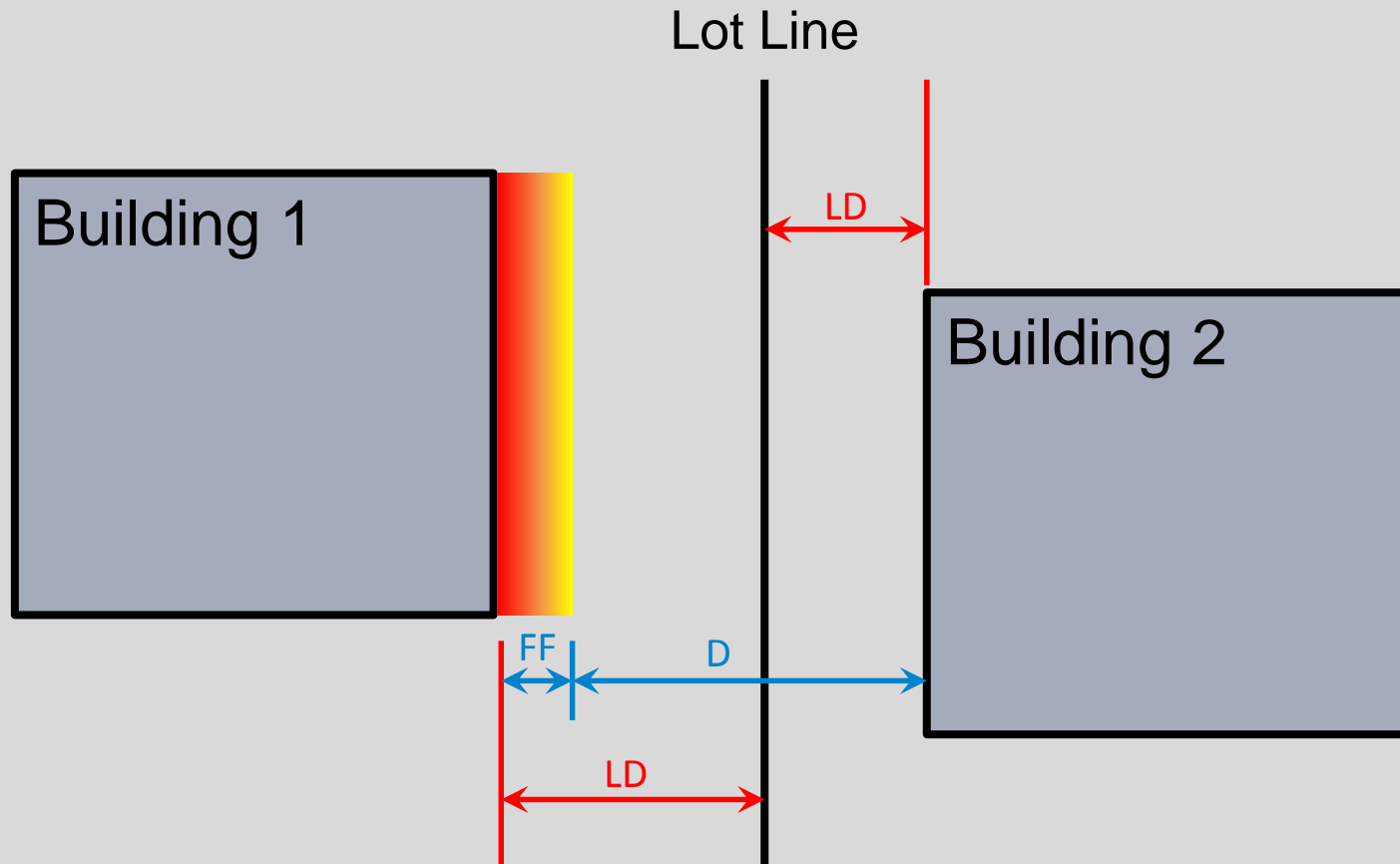
# Spatial Separation - Exposing Building Face

- › Wall Height (A):
  - ◆ The height of the exposing building face
- › Wall Width (B):
  - ◆ The width of the exposing building face
- › Wall Area =  $A \times B$
- › Actual % of Unprotected Openings:
  - ◆  $(C \times D) / (A \times B)$



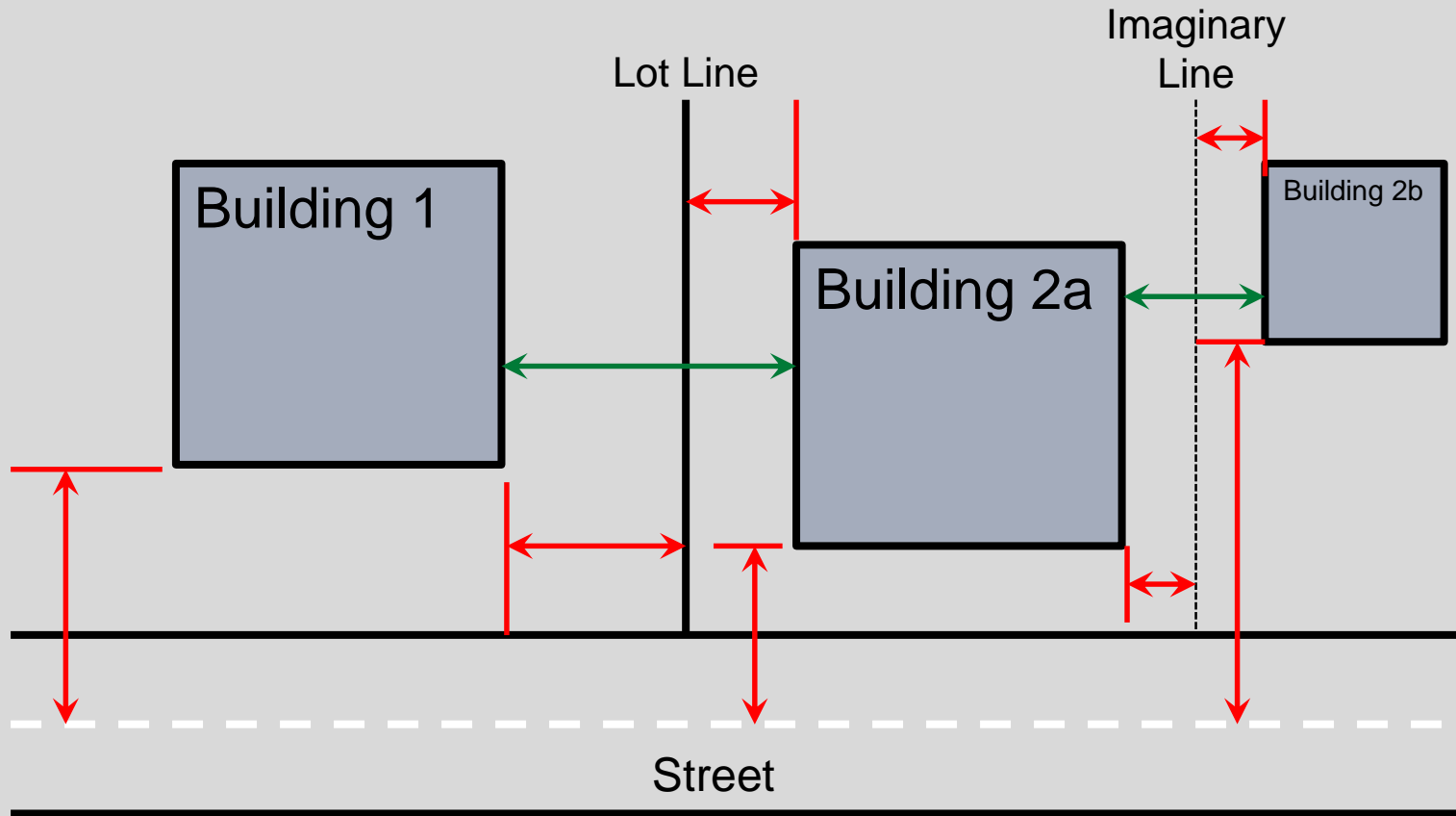
# Spatial Separation – Limiting Distance

## › Limiting Distance (LD) and Absolute Distance (D)



# Spatial Separation – Limiting Distance

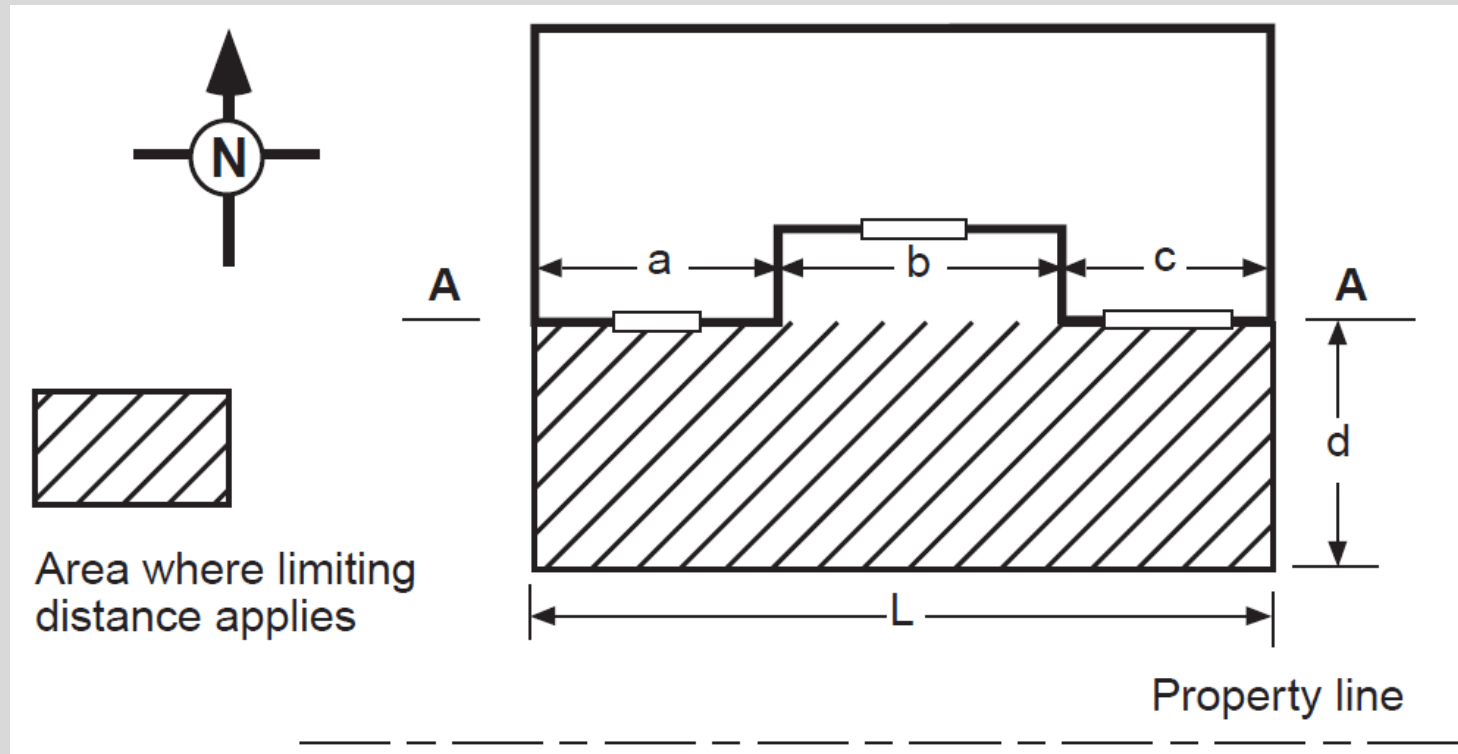
- › Limiting Distance (Red) and Absolute Distance (Green)



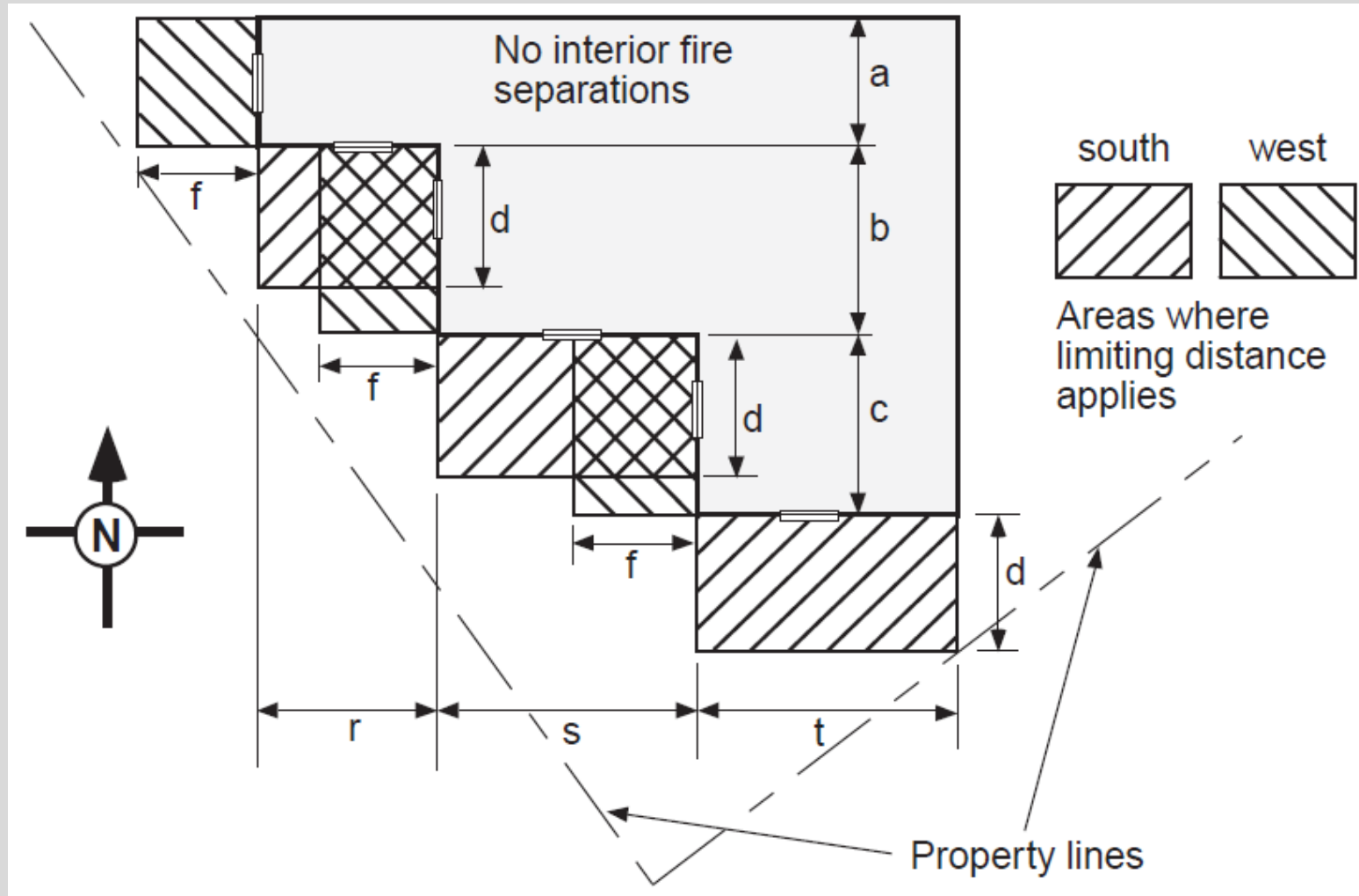


# Spatial Separation – Limiting Distance

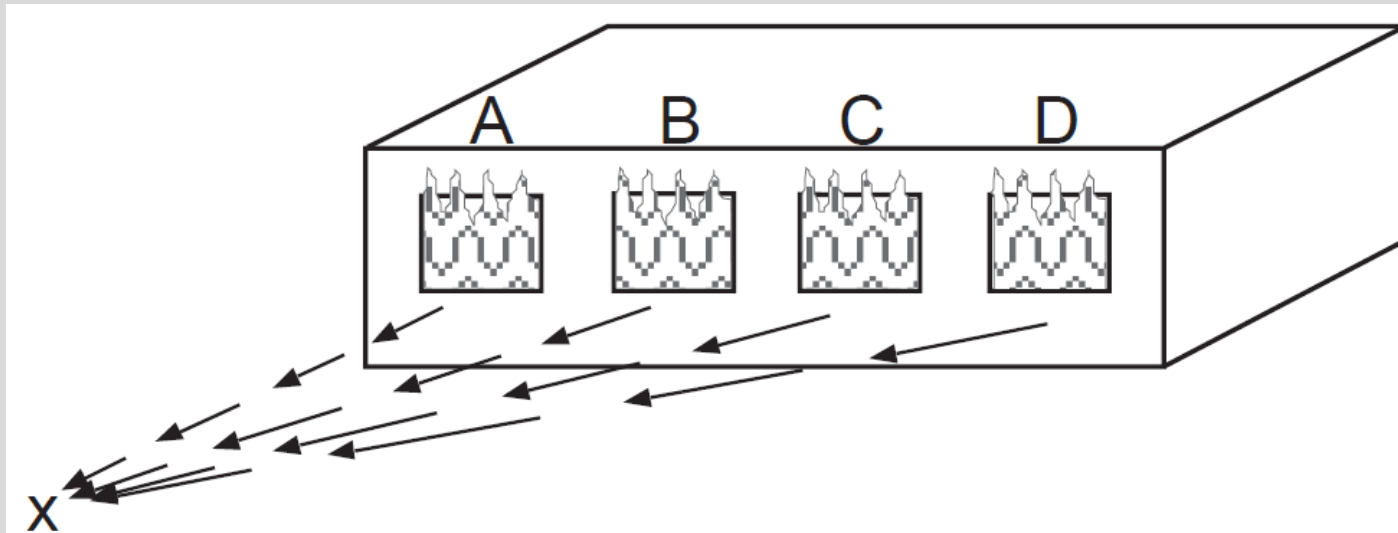
- › Limiting Distance – Irregular Building Face - Projection onto Closest Plane Perpendicular to the



# Spatial Separation – Limiting Distance



# Spatial Separation – Unprotected Opening



area of exposing building  
face (south side)

$$= 15 \times 3 = 45 \text{ m}^2$$

area of unprotected  
openings

$$= 15 \text{ m}^2$$

percentage of  
unprotected openings

$$= (15 \div 45) \times 100 = 33\%$$





# Exterior Wall Construction

East Exterior Wall Construction					
Combustible (Article 3.2.2.65.)	45-min FRR (Table 3.2.3.7.)				Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15				Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)				Insulation
	Not Required				External Barrier
	Combustible (Table 3.2.3.7., and Sentence 3.2.3.7.(4))				Cladding
South Exterior Wall Construction					
Combustible (Article 3.2.2.65.)	45-min FRR (Table 3.2.3.7.)				Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15				Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)				Insulation
	Not Required				External Barrier
	Combustible (Table 3.2.3.7., and Sentence 3.2.3.7.(4))				Cladding
West Exterior Wall Construction					
Combustible (Article 3.2.2.65.)	45-min FRR (Table 3.2.3.7.)				Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15				Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)				Insulation
	Not Required				External Barrier
	Combustible (Table 3.2.3.7., and Sentence 3.2.3.7.(4))				Cladding
General Exterior Wall Construction					
Combustible (Article 3.2.2.65.)	2-hour FRR (Table 3.2.3.7.)				Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15				Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)				Insulation
	Not Required				External Barrier
	Noncombustible or Article 3.1.5.5.				Cladding



# Exterior Wall Construction – Building Based

General Exterior Wall Construction					
Combustible (Article 3.2.2.53.)	2-hour FRR (Table 3.2.3.7.)				Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15				Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)				Insulation
	Not Required				External Barrier
	Noncombustible or Article 3.1.5.5.				Cladding

Required type of construction for the whole wall based on the required type of construction for the building. Can be overridden by the Spatial Separation Requirements



# Exterior Wall Construction – Spatial Separation Based

**Table 3.2.3.7.**  
**Minimum Construction Requirements for Exposing Building Faces**  
Forming Part of Sentences 3.2.3.7.(1) and (2)

Occupancy Classification of Building or Fire Compartment	Maximum Area of Unprotected Openings Permitted, % of Exposing Building Face Area	Minimum Required Fire-Resistance Rating	Type of Construction Required	Type of Cladding Required
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	Noncombustible	Noncombustible
	> 10 to 25	1 h	Combustible or Noncombustible	Noncombustible
	> 25 to 50	45 min	Combustible or Noncombustible	Noncombustible
	> 50 to < 100	45 min	Combustible or Noncombustible	Combustible or Noncombustible <sup>(1)</sup>
Group E, or Group F, Division 1 or 2	0 to 10	2 h	Noncombustible	Noncombustible
	> 10 to 25	2 h	Combustible or Noncombustible	Noncombustible
	> 25 to 50	1 h	Combustible or Noncombustible	Noncombustible
	> 50 to < 100	1 h	Combustible or Noncombustible	Combustible or Noncombustible

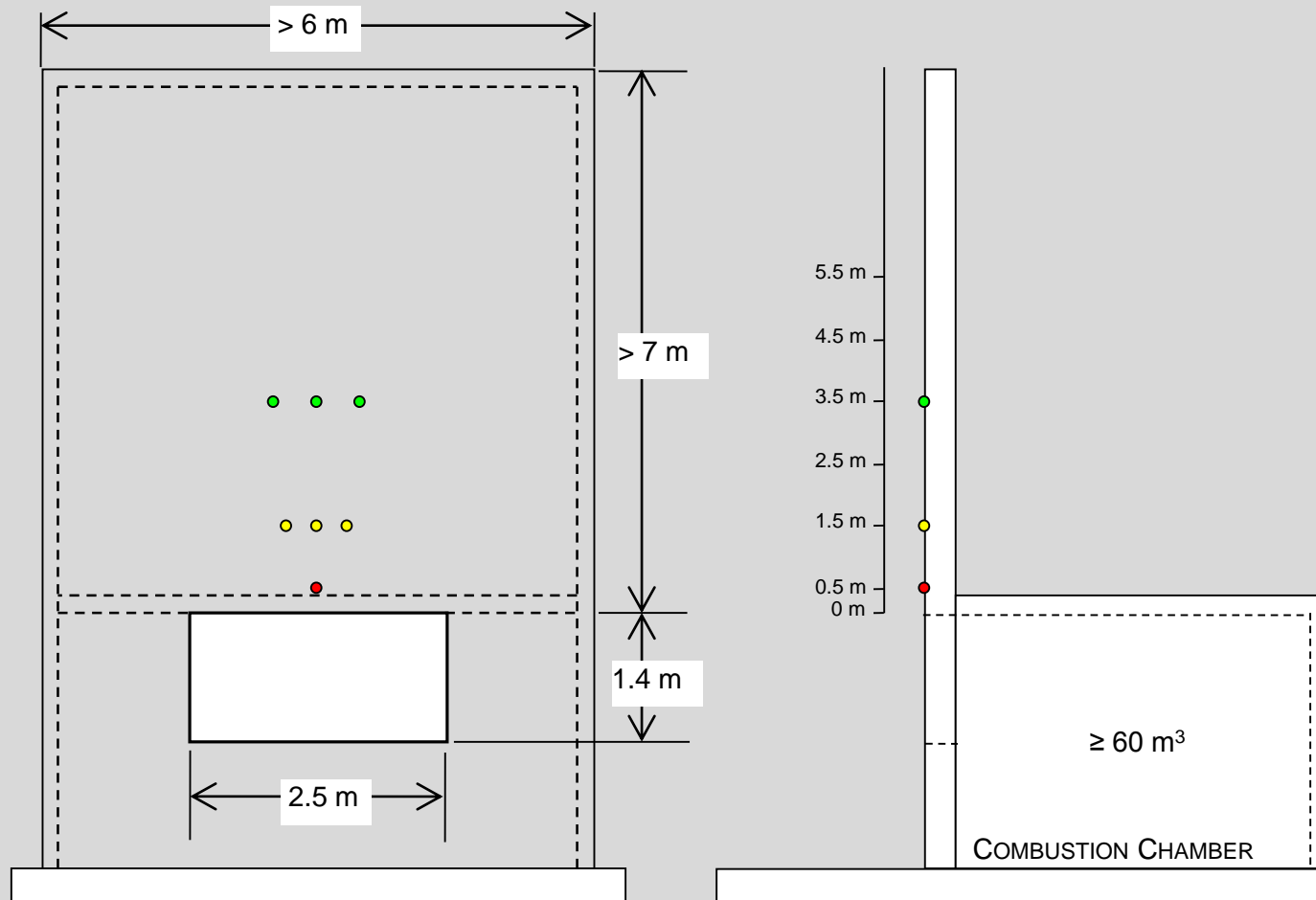
General Exterior Wall Construction	
Combustible (Article 3.2.2.53.)	2-hour FRR (Table 3.2.3.7.)
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15
	Foam Plastic (25 < FSR ≤ 500)
	Not Required
	Noncombustible or Article 3.1.5.5.

- Interior
- Internal Barrier
- Insulation
- External Barrier
- Cladding

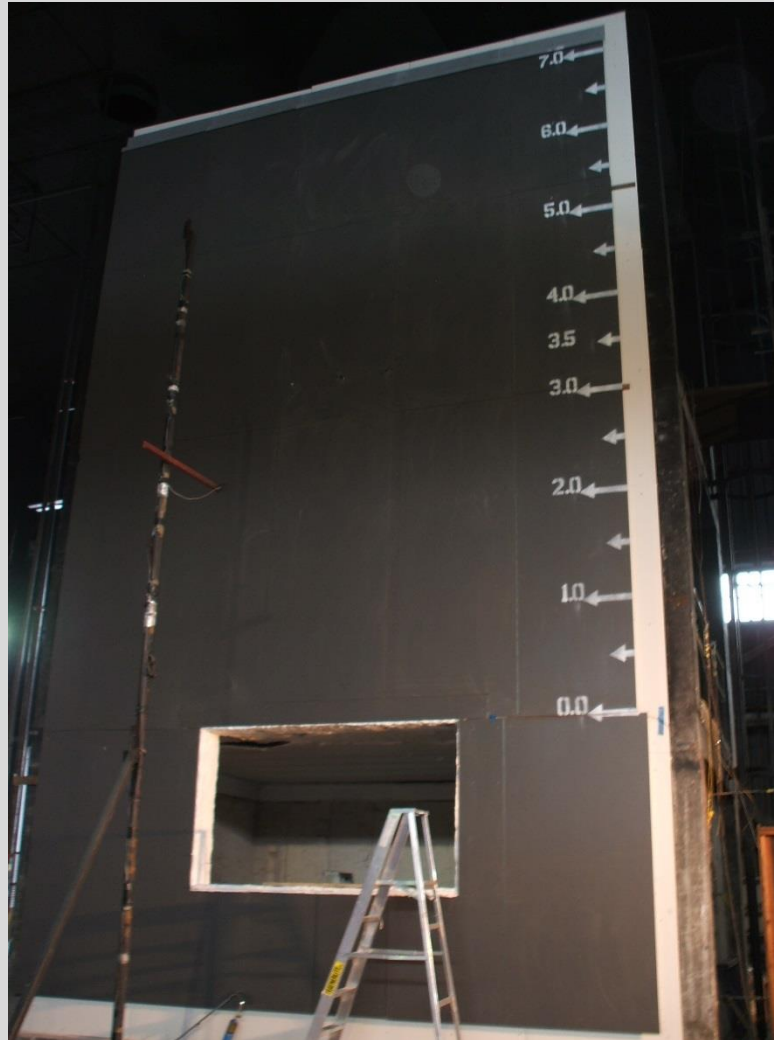




# Exterior Wall Construction – Cladding (3.1.5.5.)



# Exterior Wall Construction – Cladding (3.1.5.5.)



# Part 3: Code Tool Learnings & Dow Above Grade Wall Solutions (Les Yard)



## NBC Building Code Tool

**How has it been Received? Vetted?**

Dialog, Architecture49, Morrison Hershfield, RDH  
Building Engineering, Canadian Code Centre....

Late Spring 2016 ...*Through YE 2016 ... May 2017 ...*

## ...We provided a Simple Output based on Simple Inputs using NBCC 2015

Applicable Building Code:		2015 NBCC		
<b>Project Characteristics:</b>		<b>Legend</b>		
Building Area (m²):	1200	<div></div>	Input cell	
Building Height (Storeys):	4	<div></div>	Calculated cell	
Building Height (m):	12	<div></div>	Combustible	
Streets Facing:	3	<div></div>	Noncombustible	
Sprinklered:	Yes	<div></div>	2-hour FRR	
Major Occupancies:	E	<div></div>	1-hour FRR	
		<div></div>	45-min FRR	
<b>Building Classification:</b>				
Governing Occupancy:	E			
Governing Article:	3.2.2.65. Group E, up to 4 Storeys, Sprinklered			
Type of Construction:	Combustible			
Max. Area (m²):	1800			
Max. Height (Storeys):	4			
Additional Requirements:	None			
<b>Spatial Separation (Tables 3.2.3.1.-B to 3.2.3.1.-E):</b>				
<b>North Wall</b>		<b>North Exterior Wall Construction</b>		
Wall Height (m):	6.6	Combustible (Article 3.2.2.65.)	No Rating	Interior
Wall Width (m):	53.5		IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15, IB16	Internal Barrier
Wall Area (m²):	353.1		Foam Plastic (25 < FSR ≤ 500)	Insulation
Limiting Distance (m):	21		EB01, EB02, Article 3.1.5.5.	External Barrier
Permitted UPO (%):	100%		Combustible (Table 3.2.3.7.)	Cladding
<b>East Wall</b>		<b>East Exterior Wall Construction</b>		
Wall Height (m):	6.6	Combustible (Article 3.2.2.65.)	2-hour FRR (Table 3.2.3.7.)	Interior
Wall Width (m):	9.5		IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15, IB16	Internal Barrier
Wall Area (m²):	62.7		Foam Plastic (25 < FSR ≤ 500)	Insulation
Limiting Distance (m):	3		EB01, EB02, Article 3.1.5.5.	External Barrier
Permitted UPO (%):	16%		Noncombustible or Article 3.1.5.5.	Cladding
<b>South Wall</b>		<b>South Exterior Wall Construction</b>		
Wall Height (m):	6.6	Combustible (Article 3.2.2.65.)	1-hour FRR (Table 3.2.3.7.)	Interior
Wall Width (m):	54.3		IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15, IB16	Internal Barrier
Wall Area (m²):	358.4		Foam Plastic (25 < FSR ≤ 500)	Insulation
Limiting Distance (m):	9		EB01, EB02, Article 3.1.5.5.	External Barrier
Permitted UPO (%):	26%		Combustible (Table 3.2.3.7., and Sentence 3.2.3.7.(4))	Cladding
<b>West Wall</b>		<b>West Exterior Wall Construction</b>		
Wall Height (m):	6.6	Combustible (Article 3.2.2.65.)	2-hour FRR (Table 3.2.3.7.)	Interior
Wall Width (m):	33.6		IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15, IB16	Internal Barrier
Wall Area (m²):	221.8		Foam Plastic (25 < FSR ≤ 500)	Insulation
Limiting Distance (m):	5		EB01, EB02, Article 3.1.5.5.	External Barrier
Permitted UPO (%):	16%		Noncombustible or Article 3.1.5.5.	Cladding

**Fantastic!... NBC 2015 ... but we want to use this now**



# Initial Feedback from Industry Sessions

- This is more than a marketing tool ... it is a Design Tool
- Original version was based on NBC2015. We want to use this now ... please add (NBC2010, BCBC, VBBL, ABC, OBC, QBC capability)
- Keep the Code Tool generic and show your work
- Allow users to Opt-In for more information and access to Dow Solutions (I.E. Keep the Tool Generic and Not Result in Dow Products)
- Code Tool has ability to provide education and consensus on complex articles in Part 3 -- from those who write and develop the code, the design community and code enforcement (AHJ)

**So Keith went back to work... NBCC 2010, OBC 2012, QBC 2013, ABC 2014, VBBL 2014**

Applicable Building Code:		Legend	
2010 NBCC			Input cell
			Calculated cell
<b>Project Characteristics:</b>			
Building Area (m <sup>2</sup> ):	14400		
Building Height (Storeys):	3		
Building Height (m):	17		
High Building (Subsection 3.2.6.):	No		
Streets Facing:	2		
Sprinklered:	Yes		
Major Occupancies:	C,D,E		
<b>Building Classification:</b>			
Governing Occupancy:	E		
Governing Article:	3.2.2.62. Group E, Any Height, Any Area, Sprinklered		
Type of Construction:	Noncombustible		
Max. Area (m <sup>2</sup> ):	Unlimited		
Max. Height (Storeys):	Unlimited		
Additional Requirements:	None		
<b>Spatial Separation (Tables 3.2.3.1.-B to 3.2.3.1.-E):</b>			
<b>North Wall</b>		<b>North Exterior Wall Construction</b>	
Wall Height (m):	3	Noncombustible (Article 3.2.2.62.)	2-hour FRR (Table 3.2.3.7.)
Wall Width (m):	40		IB01, IB02, IB03, IB04, IB05
Wall Area (m <sup>2</sup> ):	120.0		Foam Plastic (25 < FSR ≤ 500)
Limiting Distance (m):	4		Not Required
Permitted UPO (%):	16%		Noncombustible or Article 3.1.5.5.
<b>East Wall</b>		<b>East Exterior Wall Construction</b>	
Wall Height (m):	3	Noncombustible (Article 3.2.2.62.)	2-hour FRR (Table 3.2.3.7.)
Wall Width (m):	87		IB01, IB02, IB03, IB04, IB05
Wall Area (m <sup>2</sup> ):	261.0		Foam Plastic (25 < FSR ≤ 500)
Limiting Distance (m):	4		Not Required
Permitted UPO (%):	14%		Noncombustible or Article 3.1.5.5.
<b>South Wall</b>		<b>South Exterior Wall Construction</b>	
Wall Height (m):	3	Noncombustible (Article 3.2.2.62.)	2-hour FRR (Table 3.2.3.7.)
Wall Width (m):	39		Not Required
Wall Area (m <sup>2</sup> ):	117.0		Noncombustible
Limiting Distance (m):	4		Not Required
Permitted UPO (%):	16%		Noncombustible or Article 3.1.5.5.
<b>West Wall</b>		<b>West Exterior Wall Construction</b>	
Wall Height (m):	3	Noncombustible (Article 3.2.2.62.)	2-hour FRR (Table 3.2.3.7.)
Wall Width (m):	87		Not Required
Wall Area (m <sup>2</sup> ):	261.0		Noncombustible
Limiting Distance (m):	4		Not Required

**Oh and BTW...** This should not be a design tool just for Dow. We want access to it on our desktops ...

100

**Now Active!**

**www.canadabuildingcode.dow.com**

Streets Facing \*

3

Major Occupancy Code(s) \*

C

Sprinklered

Governing Occupancy  
C

Governing Article  
3.2.2.48.

Type of Construction  
**Noncombustible**

Max Area (m²)  
12000

Max Height (Storeys)  
3

Required Type of Construction for the Exterior Wall

Noncombustible (Article 3.2.2.48.)

Area (m²)

Permitted UPO %

Spatial Separation FRR

Internal Barrier

Insulation

External Barrier

Cladding

Minimum FRR (Table 3.1.5.7)

3.1.5.15 (2)(a), 3.1.5.15 (2)(b), 3.1.5.15 (2)(c), 3.1.5.15 (2)(d), 3.1.5.15 (2)(e).

Foam plastic (25 < FSR < 500)

Not Required

Noncombustible or Article 3.1.5.5.

Fire explanation of wall construction

Fire Distance reference 3.2.2.48., Governing Occupancy Code reference 3.2.2.4., Table 3.1.2.1., Governing Occupancy reference 3.2.2.4., Insulation reference 3.1.5.1. and 3.1.5.15.

Add Wall

 [Subscribe](#) to the latest building science.

# Code Assessment Engine – Web Interface

 Canadian Code Assessment Engine

Project Title \*

Test Project April4

Project Characteristics

Building Code \*

2010 NBCC

Building Area (m<sup>2</sup>) \*

4000

Streets Facing \*

3

Building Height (Storeys) \*

3

Major Occupancy Code(s) \*

C

Building Height (m) \*

15

☒ Sprinklered

Please refer to the 2015 National Building Code of Canada for further explanation for project characteristics and building classifications:  
Building Area reference 3.2.2.10., Streets Facing reference 1.4.1.2. and 3.2.1.1., Building Height (Storeys) reference 1.4.1.2. and Table 3.1.2.1., Major Occupancy Codes(s) reference 3.2.2.4., Governing Occupancy reference 3.2.2.4., Building Height (m) references 3.1.5.15.(4), Type of Construction reference 1.4.1.2.

Walls

Wall Name \*

North Wall

Wall Height (m) \*

5

Wall Width (m) \*

40

Limiting Distance \*

5

Major Occupancy Code \*

C

Insulation

Foam Plastic (25 < FSR < 600)

Please refer to the 2015 National Building Code of Canada for further explanation of wall construction:  
Wall Height reference 3.2.3.1., Wall Width reference 3.2.3.1., Limiting Distance reference 3.2.3.1., Governing Occupancy reference 3.2.2.4., Insulation reference 3.1.5.1. and 3.1.5.15.

Building Classification

Governing Occupancy

C

Governing Article

3.2.2.48.

Type of Construction

Noncombustible

Max Area (m<sup>2</sup>)

12000

Max Height (Storeys)

3

Required Type of Construction for the Exterior Wall

Noncombustible (Article 3.2.2.48.)

Area (m<sup>2</sup>)

200

Permitted UPO %

100%

Spatial Separation FRR

3 min FRR (Table 3.1.5.7.)

Internal Barrier

3.1.5.15.(2)(a), 3.1.5.15.(2)(b), 3.1.5.15.(2)(c), 3.1.5.15.(2)(d), 3.1.5.15.(2)(e).

Insulation

Foam Plastic (25 < FSR < 600)

External Barrier

Not Required

Cladding

Noncombustible or Article 3.1.5.5.

Add Wall

Save

Save and generate wall report

DEMO

www.canadabuildingcode.dow.com





# Learnings from the Code Assessment Engine

## *Generally ... Where One Can & Cannot Use Foam?*

### Examples of Where Foam Plastic Permitted:

- Combustible Buildings and 3 Stories & Below Non-Combustible ...Above That?
- Behind Concrete and Masonry 25mm and thicker Cladding or Wall Assemblies that meet Article 3.1.5.5. (Assembly has passed the CAN/ULC S134 Fire Test)
- Protected by a Thermal Barrier that meets CAN/ULC S101 (Article 3.2.3.8.(1)(b) PLUS Non-Combustible Cladding
- **Required ...** Fire Block Required At Floors and Ceilings or Every 20 m horizontally and every 3 m vertically if cavity gap is greater than 25 mm (NBC Article 3.1.11.2.)

### Examples of Buildings Where Foam Plastic NOT Permitted:

- Where Spatial Separation allows less than 10% UPO (only non-combustible insulation acceptable)
- High Rise Buildings with Fire Sensitive Claddings (I.E. everywhere where claddings are not 25mm of Concrete or Masonry)
- Unsprinklered Buildings

# ■ Building Code: In Summary Fire ...

- Fire behavior and the associated code requirements are ...  
**Complicated**
- Significant work by professional consultants, researchers and forensic study has resulted in sufficiently complex and well vetted regulations (NBCC Part 9 / Part 3)
- Fire can be managed by preventing it, or controlling it or reducing the impact of fire if it occurs.
- Ensuring the safety of a building's occupants is a fundamental goal of fire design and of The Entire Industry
- A designer must meet multiple criteria to ensure a structure's success while under construction and once in service ... Fire is Number One!
- **A good place to start evaluating the use of Foam Insulation ... is the Code Assessment Engine**

# Did I Mention? ...We are only at Step One

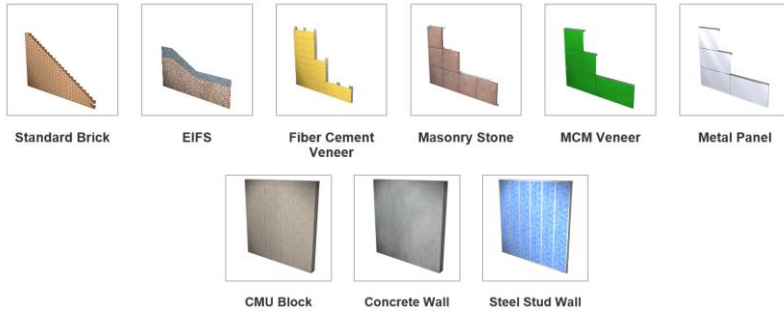
## Can I Use Foam Insulation?



If Yes ...

# Great ... I can Use Foam Insulation ...

## Where do I go from here? So many Options ...?



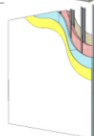
Thermax XArmor + Batt



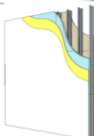
Thermax XArmor + Empty



Inverted Gyp + Styrofoam + Batt



Inverted Gyp + Styrofoam + Empty



Styrofoam + Batt



Styrofoam + Empty



Thermax XArmor + SPF



Thermax XArmor + Batt



Standard Brick



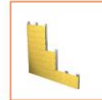
CMU Block



STYROFOAM™ Brand Insulation



Fiber Cement Veneer



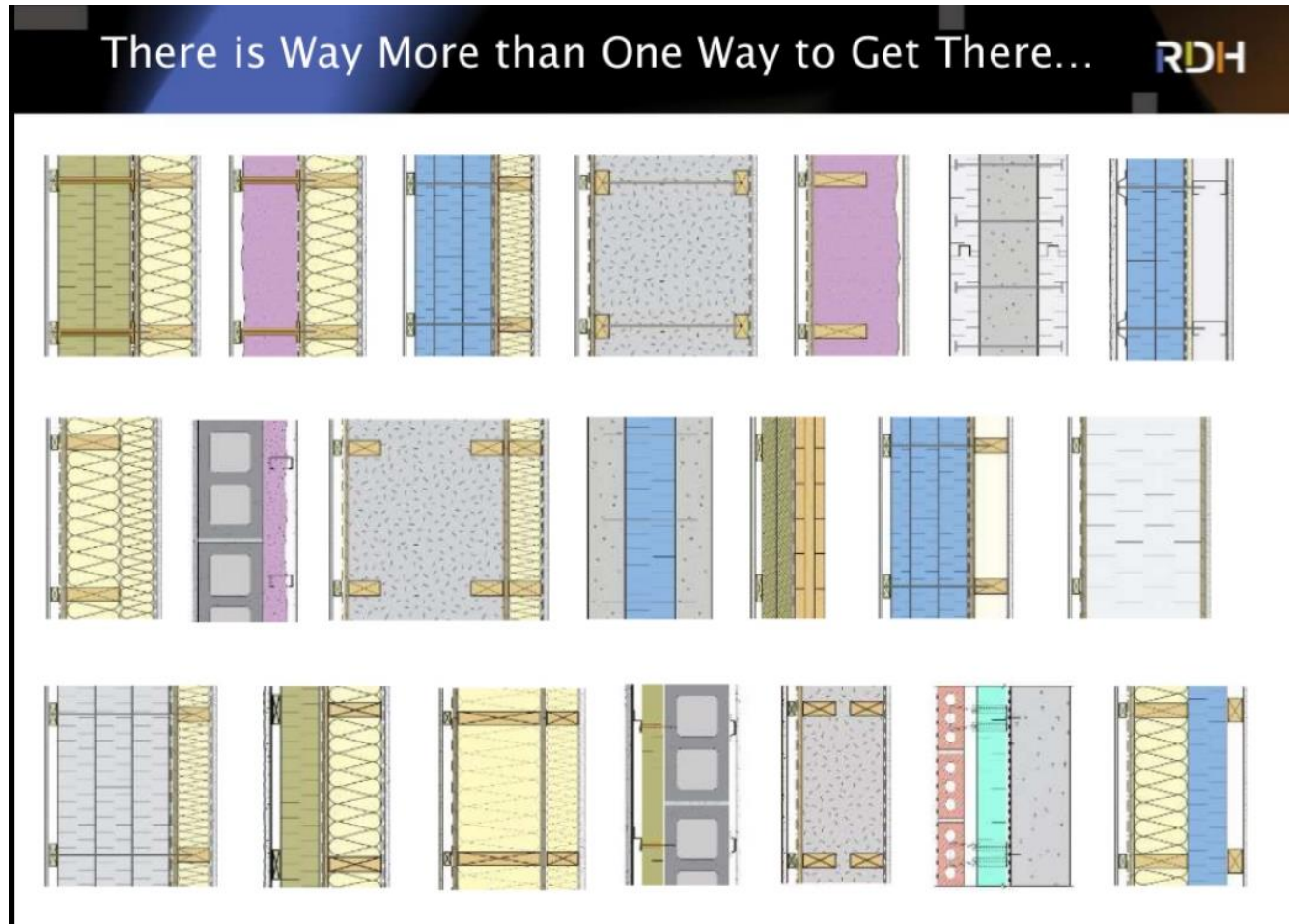
Steel Stud Wall



THERMAX™ Sheathing



**Did I Say ... So Many Options ... Slide from RDH Presentation on CoV's Effective R-22 ... Many Vetted Methods to Approach Walls ...**





# Wall Design and Construction Must Meet:

**Building Code**

**Effective  
Building  
Practice**

**Energy Code**

**Sustainability**

- 1. Structural and Design Safety**
- 2. Fire Safety**
- 3. Bulk Water Control**
- 4. Air Control**
- 5. Vapour Control**
- 6. Thermal Control**
- 7. Thermal Efficiency**
- 8. Environmental Effectiveness**
- 9. Product / System Transparency**
- 10. Product / System Acceptance**

# ■ Wall Design and Construction Must Meet:

**Building Code**

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1. Structural and Design Safety
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9. Product / System Transparency
10. Product / System Acceptance

# Energy & Moisture

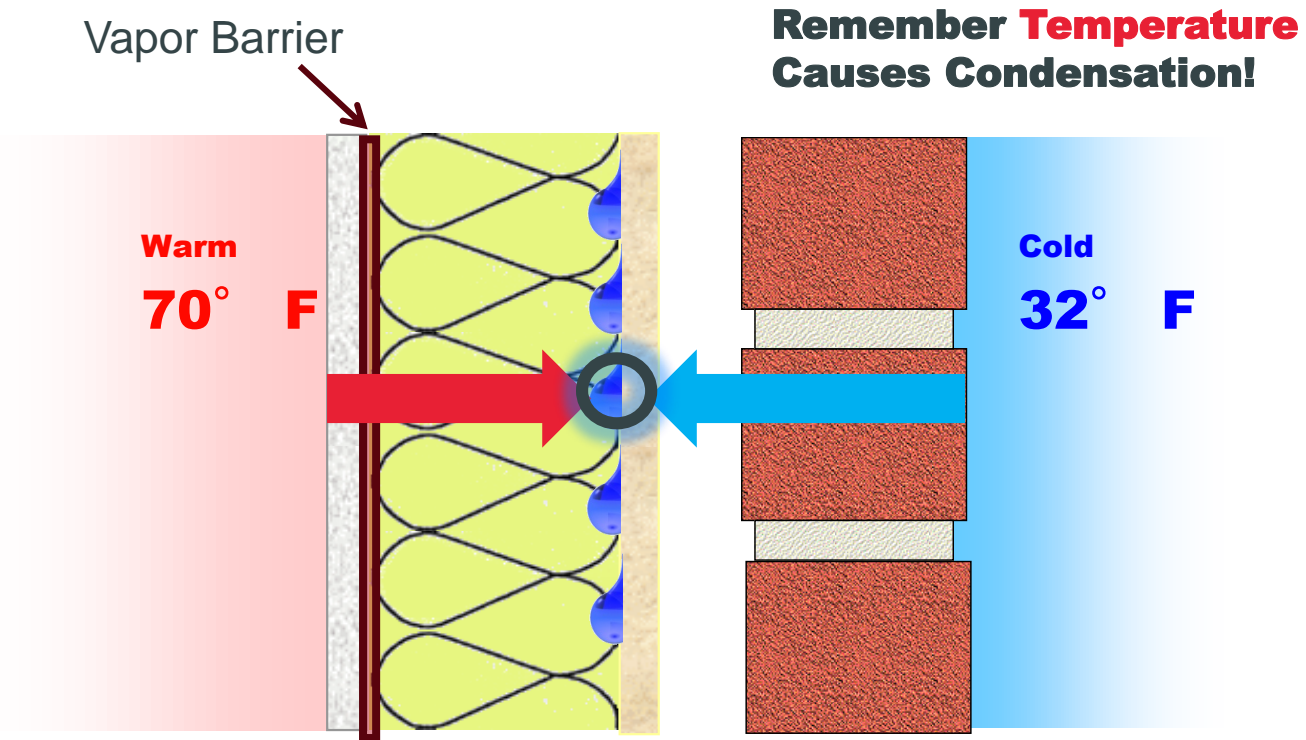


# Effective Building Practice: **Traditional Vapour Control**



Building Code	1. Structural and Design Safety
	2. Fire Safety
Effective Building Practice	3. Bulk Water Control
	4. Air Control
	5. <b>Vapour Control</b>
	6. Thermal Control
Energy Code	7. Thermal Efficiency
	8. Environmental Effectiveness
Sustainability	9. Product / System Transparency
	10. Product / System Acceptance

# Vapor Layer | Building Science

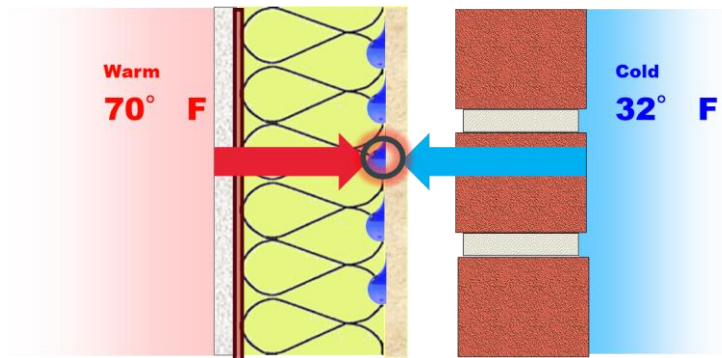




# Vapor Layer | Building Science

## Misconceptions “debunked”

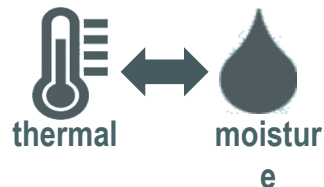
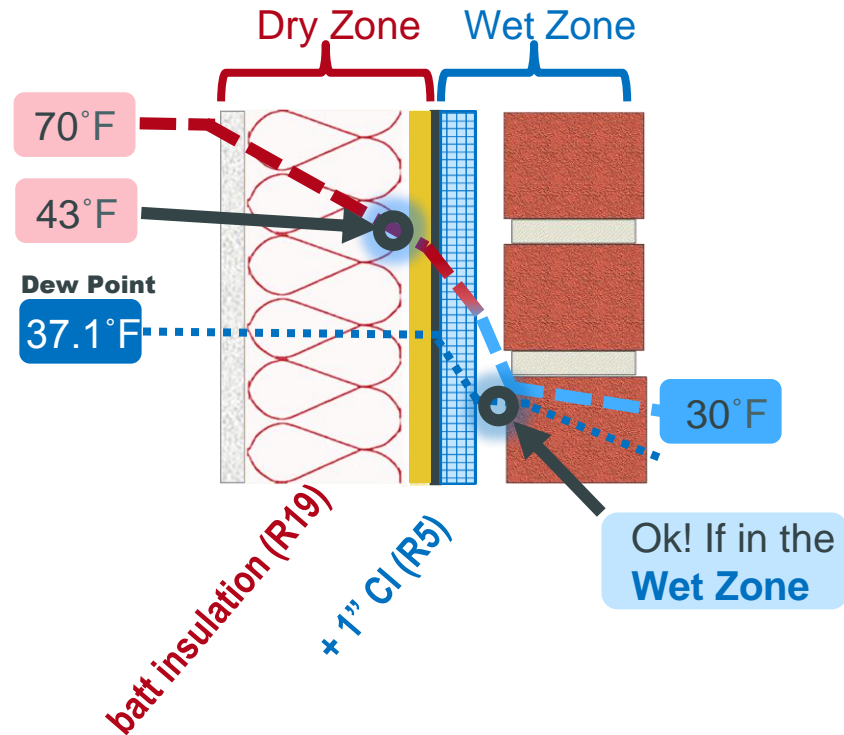
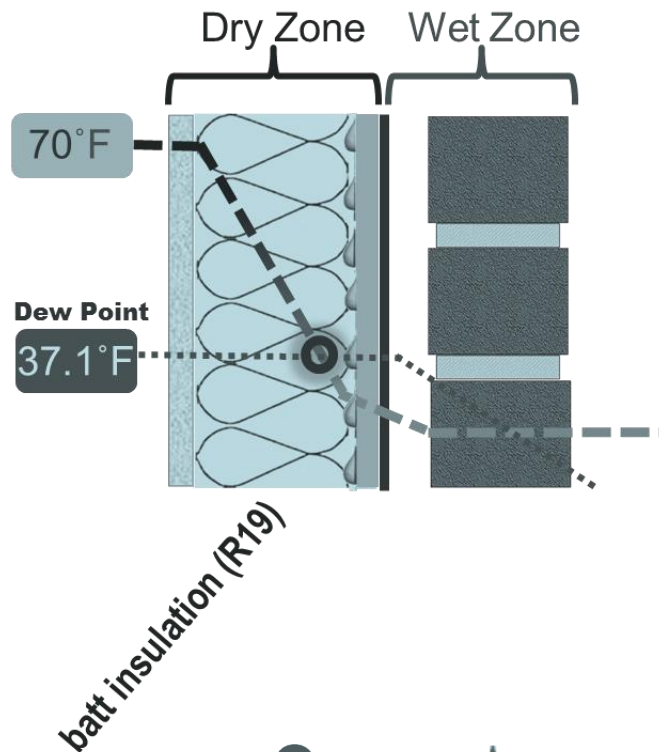
- 1) Vapor is **not bad**
- 2) Vapor & humidity are **almost always present**
- 3) The goal is to **eliminate liquid water**
- 4) Need to **prevent vapor from becoming liquid water**



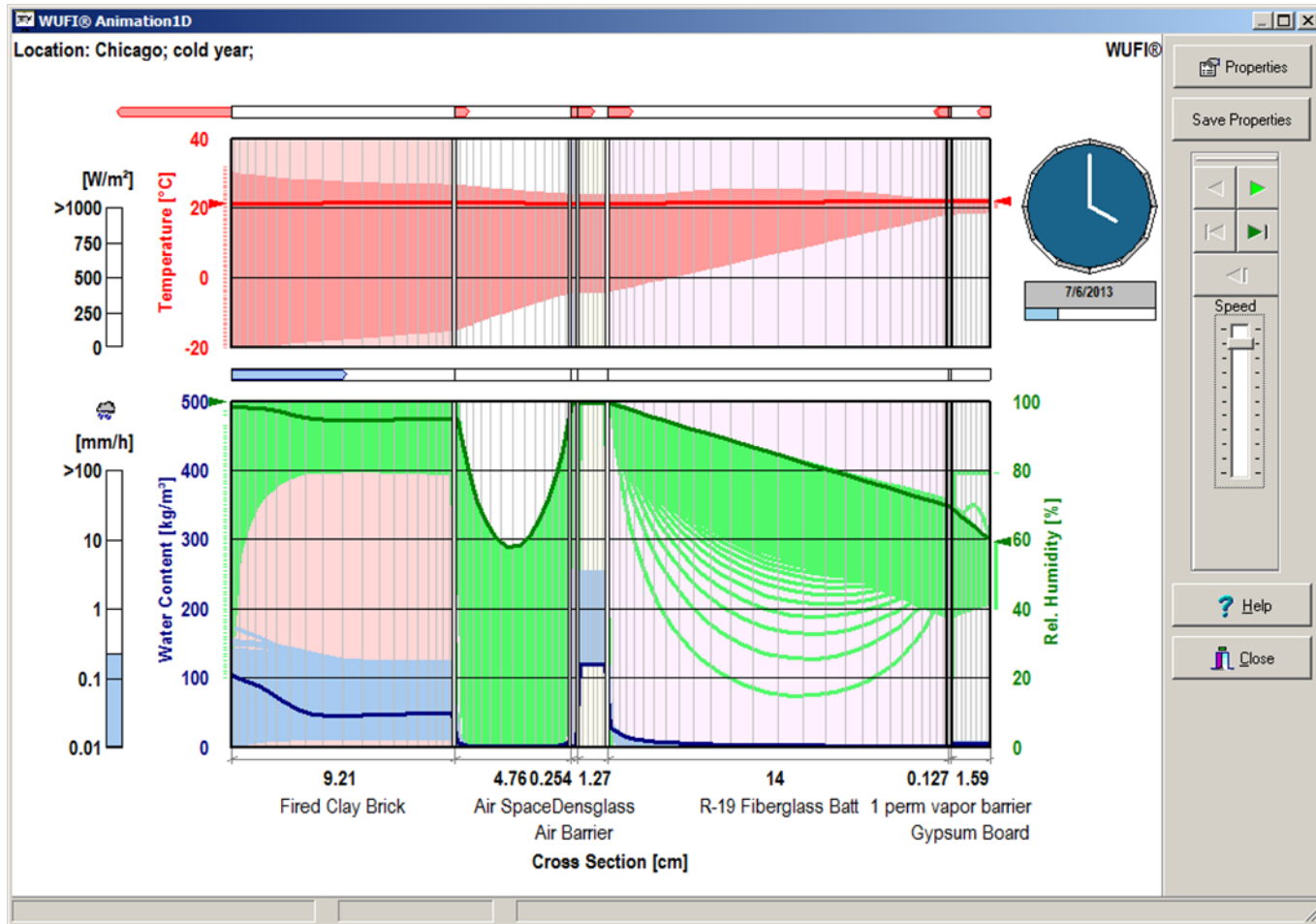
# Thermal Layer | Relating to Moisture

## Example Conditions

Indoor Temperature: 70°F  
Indoor RH(Relative Humidity) 30%  
Outdoor Temperature: 30°F



# WUFI vs Dew Point Analysis



# 3<sup>rd</sup> Party Resources – Exterior Insulation & Condensation Control

## CMHC Best Practice Guide “Brick Veneer Steel Stud”

“Danger of condensation in the stud space is absent in only one instance, where there is 75 mm (3 in.) of cavity insulation and no insulation in the stud space.”

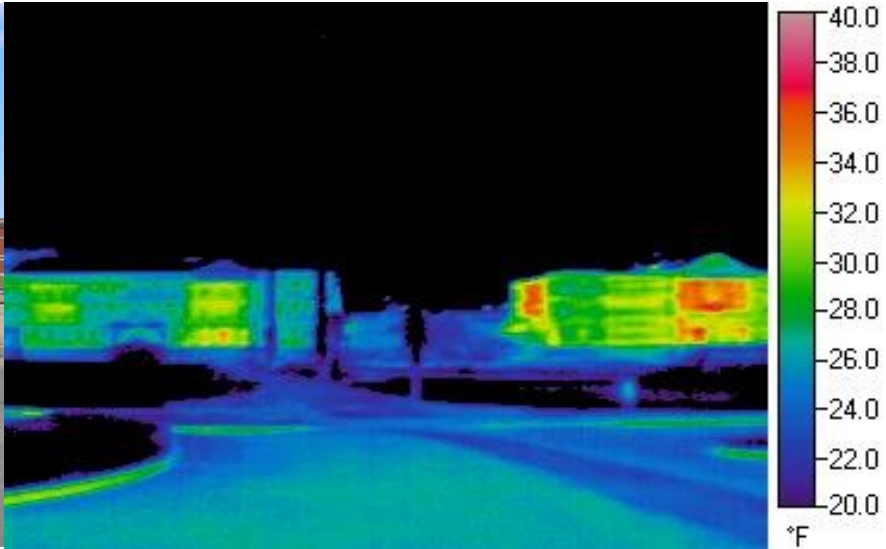
## PERSIST Wall (AB Infrastructure – Red Book / Blue Book)

The design approach recommended may be described as the “Pressure Equalized Rain Screen Insulated Structure Technique”, or “PERSIST”. This approach is characterized by the following:

- An air barrier system installed exterior to and supported by the structure.
- Insulation installed tight to the exterior of the air barrier system.
- A cladding system designed based on rain screen principles, installed over an air space that is pressure equalized with the exterior and drained to the exterior.

**Also ... NRC (1960's), Alaska REMOTE, many others recognize the benefits of an exterior insulated wall with empty cavity**

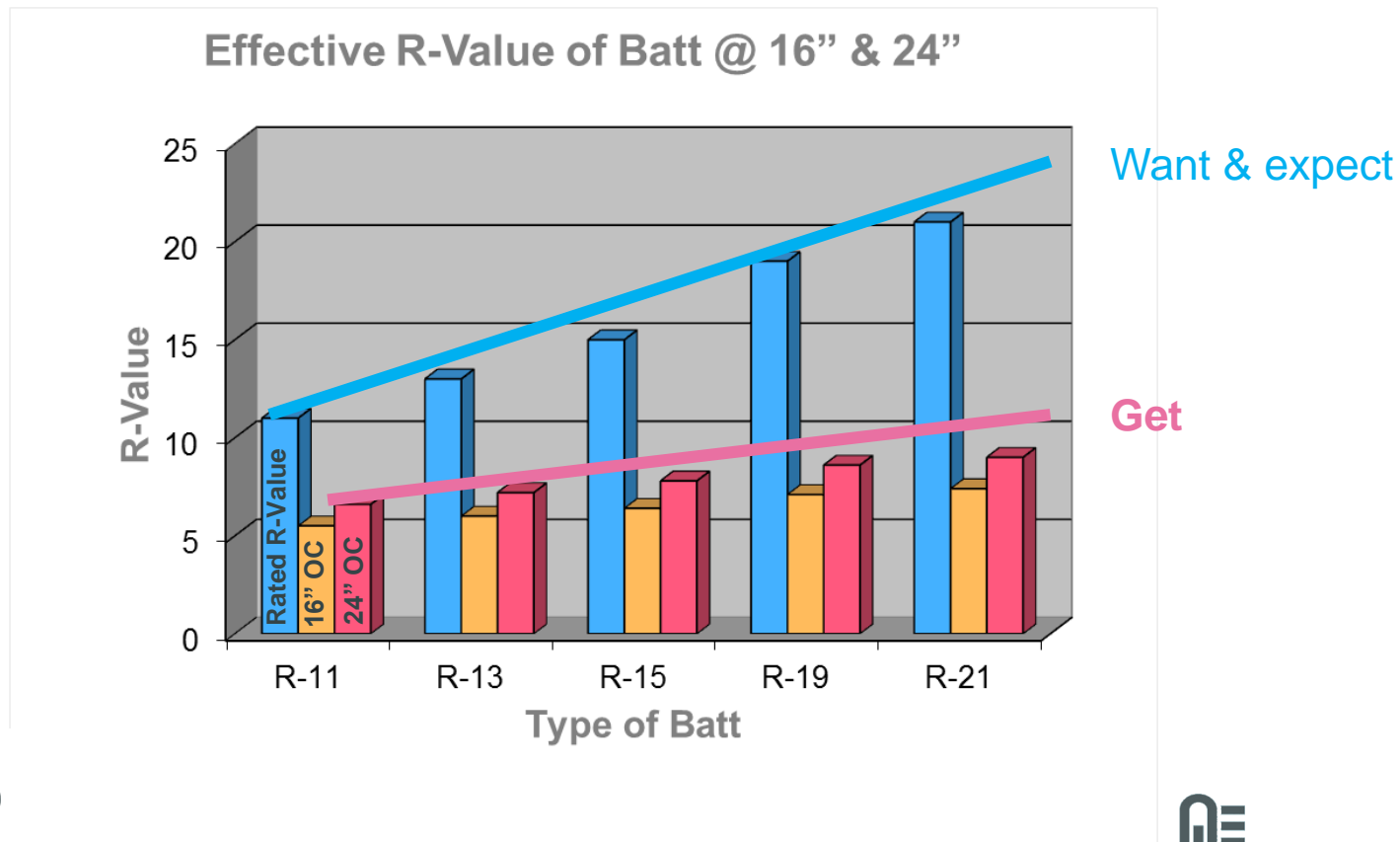
# Effective Building Practice: Thermal Control ... Efficient Use of Materials



Building Code	1. Structural and Design Safety
	2. Fire Safety
Effective	3. Bulk Water Control
Building	4. Air Control
Practice	5. Vapour Control
	6. Thermal Control
Energy Code	7. Thermal Efficiency
	8. Environmental Effectiveness
Sustainability	9. Product / System Transparency
	10. Product / System Acceptance



# Thermal Layer | Building Science



WHO  
SAYS?



# Thermal Layer | Building Science



**TABLE A9.2B Effective Insulation/Framing Layer R-Values  
for Wall Insulation Installed Between Steel Framing**

Nominal Depth of Cavity (in.)	Actual Depth of Cavity (in.)	Rated R-Value of Airspace or Insulation	Effective Framing/Cavity R-Value at 16 in. on Center	Effective Framing/Cavity at 24 in. on Center
Empty Cavity, No Insulation				
4	3.5	R-0.91	0.79	0.91
Insulated Cavity				
4	3.5	R-11	5.5	6.6
4	3.5	R-13	6.0	7.2
4	3.5	R-15	6.4	7.8
6	6.0	R-19	7.1	8.6
6	6.0	R-21	7.4	9.0
8	8.0	R-25	7.8	9.6

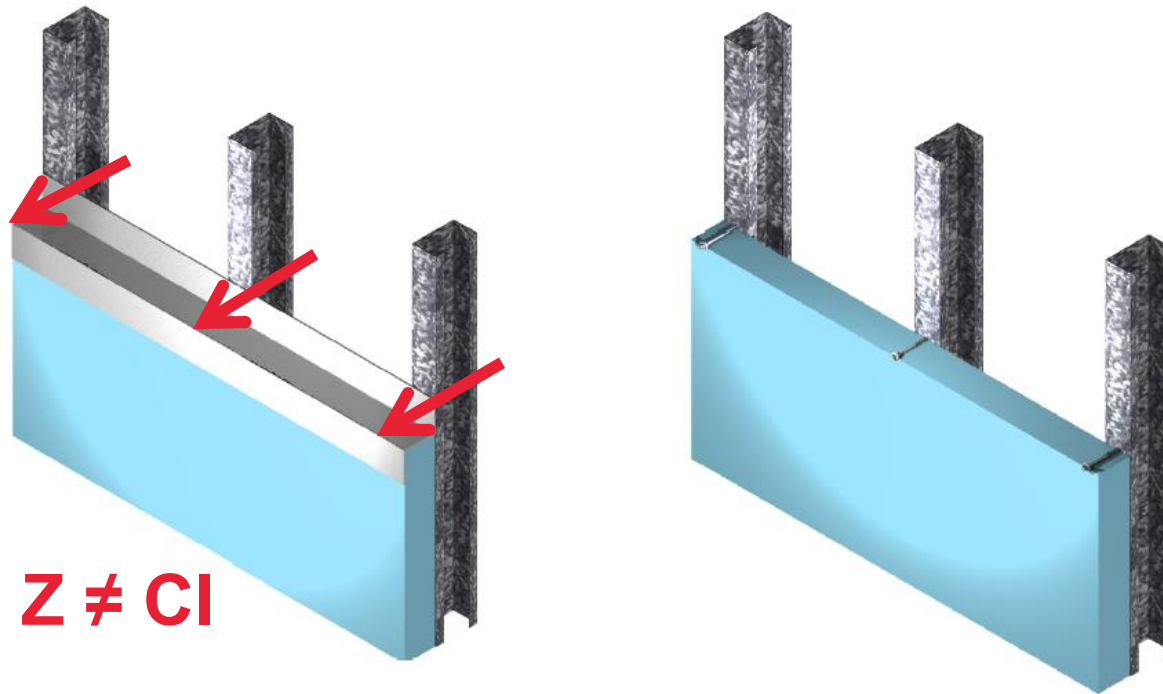
Based on Calculated and Measured Data

Table shown taken from ASHRAE 90.1-2007

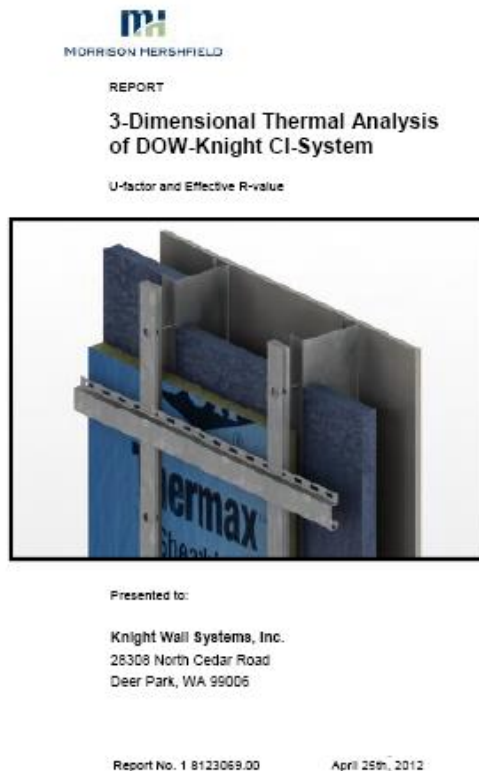


## Thermal Layer | Building Science

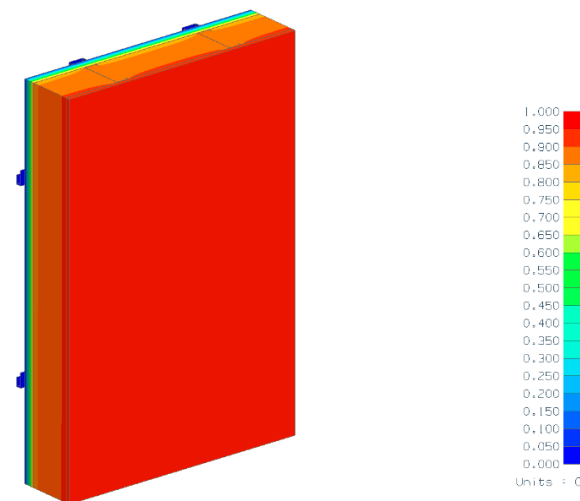
### Fasteners and Thermal Bridging (Effective R-Value)



# Dow – Knight Wall Ci-System & Thermal Bridging



- 3-Dimensional Thermal Analysis of Dow-Knight CI-System
- Morrison Hershfield
- Minimal Thermal Bridge and High Effective R-Value



## Structural & Attachment

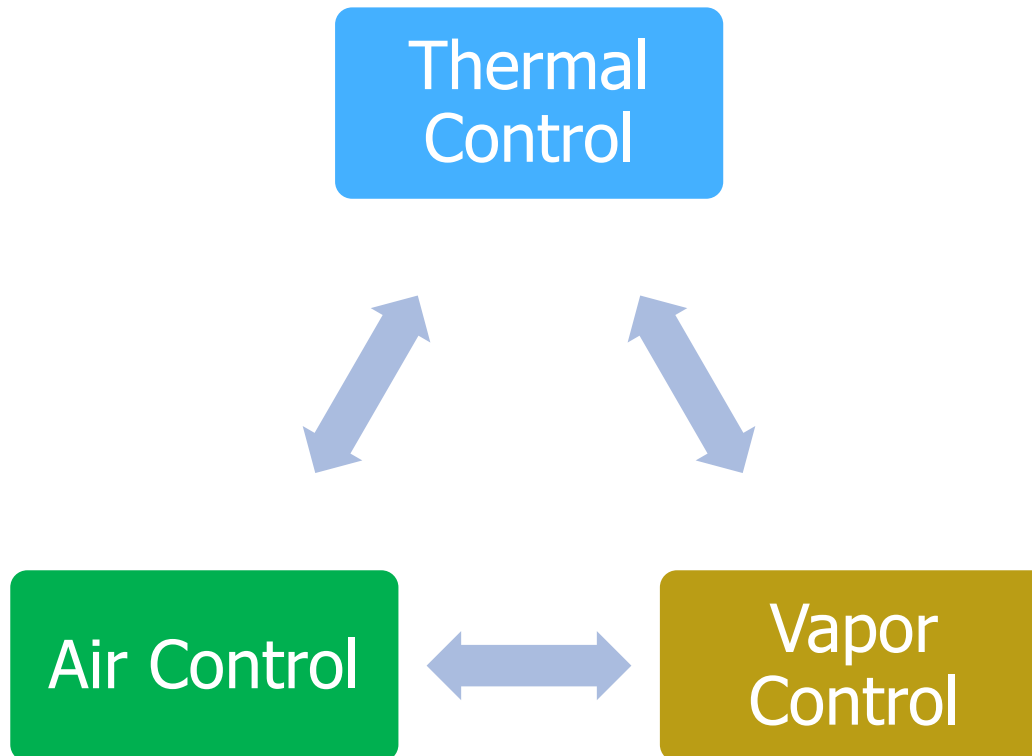
3,500 lb Concrete  
Block supported  
by 4'x8' grid /  
metal furring on  
Dow Thermax  
rigid insulation.

Deflection minimal.

25 PSI = 3600 PSF  
(compressive strength)



# ■ Interrelated System & Performance



Also ... Number of & Sequencing of Layers, Clarity of Material Purpose, Buildability, Cost of Installation, ...



# ■ Wall Design and Construction Must Meet:

**Building Code**

**Effective  
Building  
Practice**

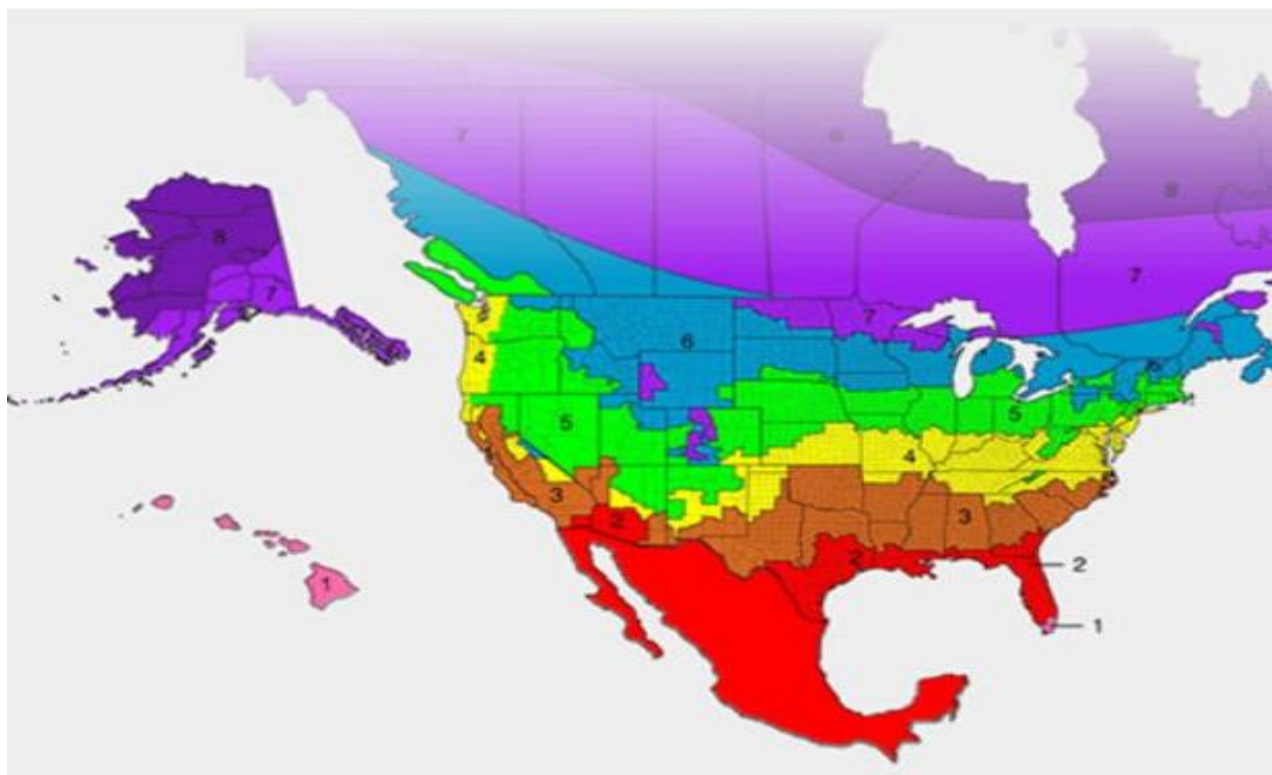
**Energy Code**

**Sustainability**

1. Structural and Design Safety
2. Fire Safety
3. Bulk Water Control
4. Air Control
5. Vapour Control
6. Thermal Control
7. Thermal Efficiency
8. Environmental Effectiveness
9. Product / System Transparency
10. Product / System Acceptance

# Energy Code: Thermal Efficiency

Follow your local Energy Code (ASHRAE 90.1, NECB 2011/2015, NBC 9.36 Provisions) OR Project's Energy Performance Goal



Climate Zone Map

Building Code	1. Structural and Design Safety
	2. Fire Safety
Effective Building Practice	3. Bulk Water Control
	4. Air Control
	5. Vapour Control
Energy Code	6. Thermal Control
	7. Thermal Efficiency
Sustainability	8. Environmental Effectiveness
	9. Product / System Transparency
	10. Product / System Acceptance

# Definitions & Key Terms

## USI or U-Value (Metric or Imperial)

A U value is a measure of heat loss in a building element such as a wall, floor or roof. It can also be referred to as an 'overall heat transfer co-efficient' and measures how well parts of a building transfer heat. This means that the higher the U value the worse the thermal performance of the building envelope.

## R-Value (Imperial) or 1/U

## RSI (Metric) or 1/USI (x 5.678263 for R)

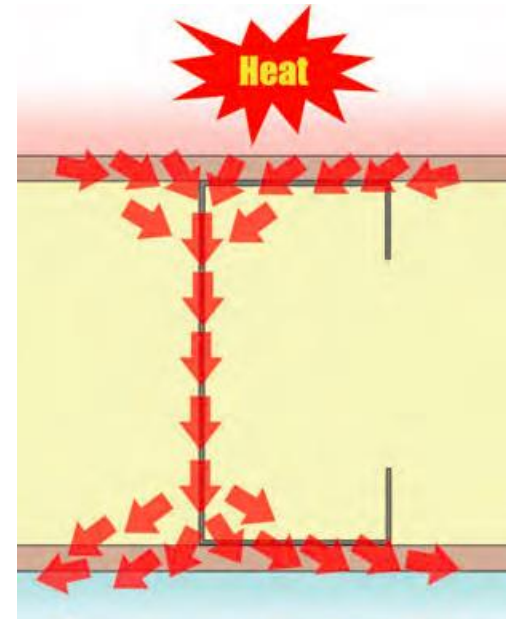
## Nominal R-Value

## Effective R-Value

## Continuous Insulation

## HDD-C (18 C) NECB / NBC 9.36

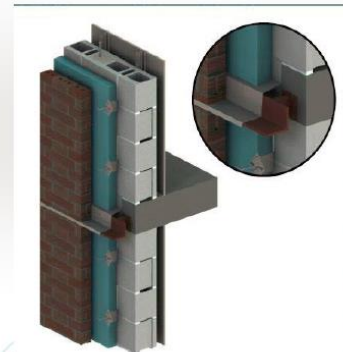
## HDD-F (65 F) ASHRAE 90.1



### Validation of Building Envelope Thermal Characteristics

Opaque Assemblies - Effective "U" values – NOT nominal

- All thermal bridges to be accounted for
- Calculation Procedures per ASHRAE Fundamentals
  - Isothermal Planes Method
  - Isothermal Planes and Parallel Path Method
- Software analysis – 2D or 3D
- Lab Testing in accordance with ASTM 1363



Graphic – Morrison Hershfield Energy and Construction Workshop – 2012

# Long Term Thermal Resistance (LTTR) Styrofoam XPS R5+



## Evaluation Listing CCMC 04888-L

STYROFOAM™ Brand ROOFMATE™, STYROFOAM™ Tech-Crete Blanks, STYROFOAM™ SM, STYROFOAM™ Brand PERIMATE™, STYROFOAM™ HIGHLOAD™ 40, STYROFOAM™ HIGHLOAD™ 60, STYROFOAM™ HIGHLOAD™ 100, STYROFOAM™ Panel Core 30, STYROFOAM™ Panel Core 40, STYROFOAM™ Panel Core 60

MasterFormat: 07 21 13.06  
Evaluation issued: 1994-04-06  
Re-evaluated: 2017-07-18  
Re-evaluation due: 2020-04-06

### 1. Evaluation

The product conforms to CAN/ULC-6701-11.

The long-term thermal resistance (LTTR) for 50 mm is R51 1.80.

### 2. Description

The products are Type 4, blue-tinted, extruded polystyrene rigid board thermal insulation.

### 3. Standard and Regulatory Information

See the Annex, appended to this Listing, which summarizes the product standard.

This/these product(s) was/were evaluated to the product standard referenced in the Annex current as of 2016-10-20. Note that the Annex may have been updated since this Listing was issued to include more recent editions of the applicable product standard. Therefore this Listing may not reflect the requirements contained in any updated version of this product standard.

#### Listing Holder:

The Dow Chemical Company  
1605 Joseph Drive  
200 Larkin Center  
Midland, MI 48674  
USA

Tel.: 866-583-2583

#### Plant(s)

Venezia, QC  
Perely, MO, USA  
Channahon, IL, USA



## Evaluation Listing CCMC 11420-L

STYROFOAM™ CLADMATE™ CM20, Deckmate™ Plus, Deckmate™ Plus FA, STYROSPAN™, STYROFOAM™ Cavitymate™, STYROFOAM™ Cavitymate Ultra, STYROFOAM™ PANELMATE™ Ultra, STYROFOAM™ PanelCore 20, STYROFOAM Ultra SL

MasterFormat: 07 21 13.06  
Evaluation issued: 1987-04-24  
Re-evaluated: 2017-07-18  
Re-evaluation due: 2020-04-24

### 1. Evaluation

The product conforms to CAN/ULC-6701-11.

The long-term thermal resistance (LTTR) for 50 mm is R52 1.73.

### 2. Description

The product is a Type 3, blue-tinted or gray-tinted, extruded polystyrene rigid board thermal insulation.

### 3. Standard and Regulatory Information

See the Annex, appended to this Listing, which summarizes the product standard.

This/these product(s) was/were evaluated to the product standard referenced in the Annex current as of 2016-10-20. Note that the Annex may have been updated since this Listing was issued to include more recent editions of the applicable product standard. Therefore, this Listing may not reflect the requirements contained in any updated version of this product standard.

#### Listing Holder

The Dow Chemical Company  
1605 Joseph Drive  
200 Larkin Center  
Midland, MI 48674  
USA

Telephone: 866-583-2583

#### Plant(s)

Venezia, QC  
Perely, MO, USA  
Channahon, IL, USA



## Evaluation Listing CCMC 12085-L

DECKMATE™, STYROFOAM™ CLADMATE™, STYROFOAM™ CLADMATE™ XL, STYROFOAM™ PANELMATE™, STYROFOAM™ WALLMATE™

MasterFormat: 07 21 13.06  
Evaluation issued: 1990-02-06  
Re-evaluated: 2017-03-14  
Re-evaluation due: 2020-02-06

### 1. Evaluation

The products conform to CAN/ULC-6701-11. The classification and design Long Term Thermal Resistance (LTTR) are as listed in the following table:

Product	Classification	Design LTTR* (m <sup>2</sup> C/W)
		Thickness 50 mm
DECKMATE™, STYROFOAM™, CLADMATE™, STYROFOAM™, CLADMATE™XL, STYROFOAM™, PANELMATE™, STYROFOAM™, WALLMATE™	Type 2	1.73

#### Note to Table:

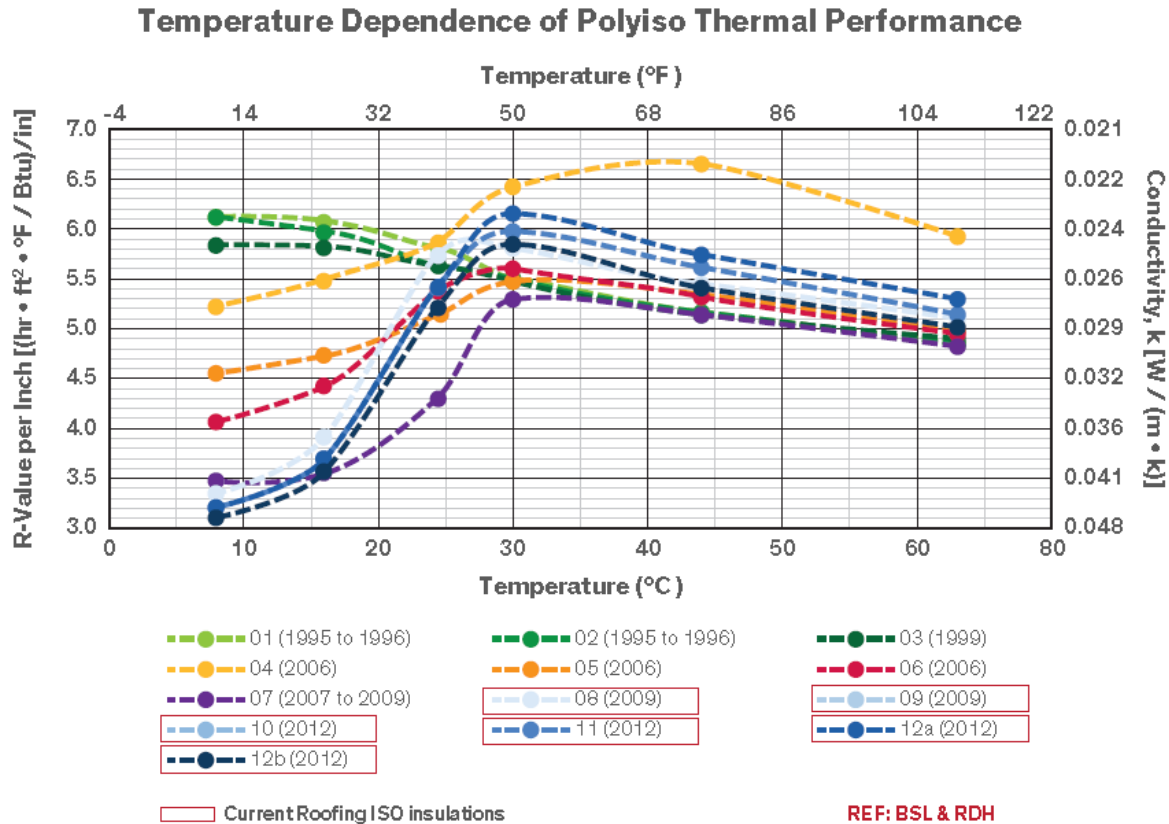
1. The design LTTR value may vary slightly for each product from one plant to another. The laboratory determining compliance with this Standard has established that all plants are producing compliant product.

### 2. Description

The products are a Type 2 blue-tinted, extruded polystyrene rigid board thermal insulation. The products are available in thicknesses of 25 mm, 40 mm, 50 mm, 65 mm, 75 mm and 100 mm.

### 3. Standard and Regulatory Information

# R-Value and Mean Temperature ISO



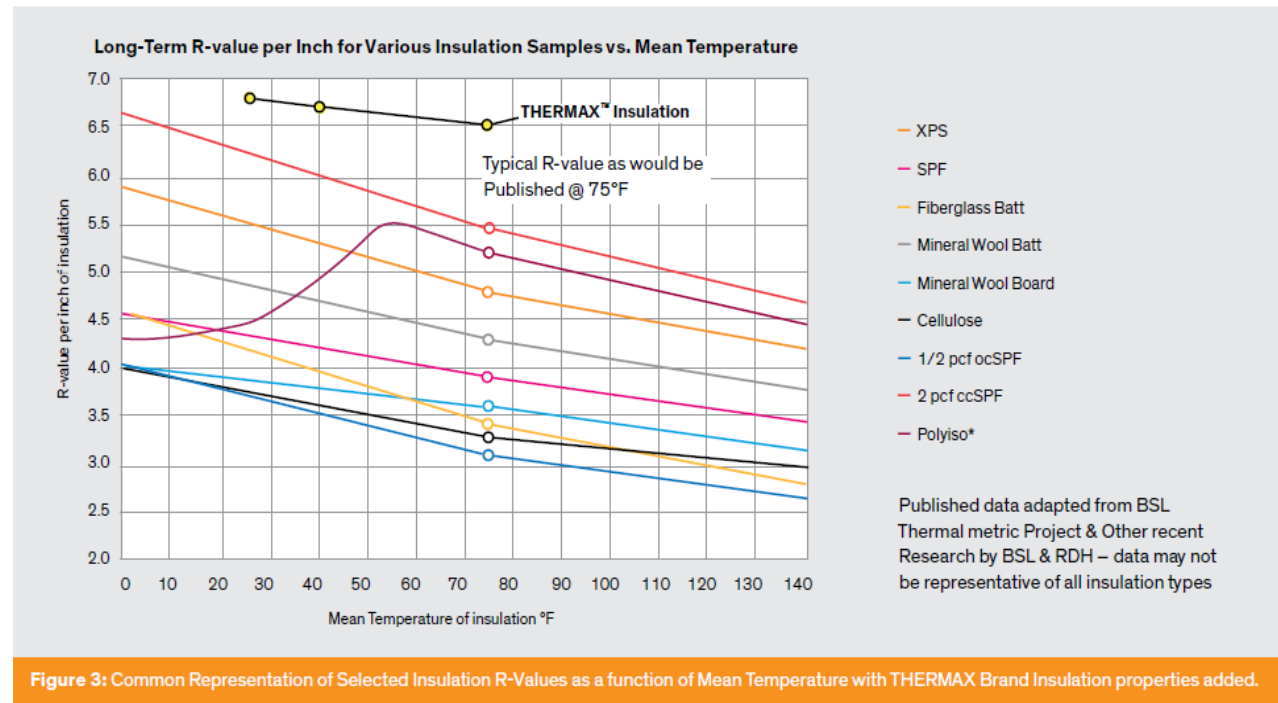
**Figure 2.** Thermal resistance dependency of various Roofing ISO insulations

# THERMAX & Mean Temperature

## Low Mean Temp Performance

- THERMAX outperforms all Competitive ISO's in this Area.
- Only ISO to increase in R-Value below 55 Degrees
- 37% Higher R-Value at 40 Degree Mean Temp

Ask Architect to inquire on competitive ISO's performance at low mean temperatures.





# Energy Code: Thermal Efficiency

Energy Code Requirements will ramp up along with research in resiliency of buildings and infrastructure. New and existing buildings. Both Provincially and Federally

Canada

## BC Energy Step Code

A Best Practices Guide for  
Local Governments



A resident of Fort McMurray, Alta, looks at the damage to homes on Thursday, June 2, 2016. Fires like the one that devastated the city are likely to become more frequent as a result of climate change, scientists have predicted.

# ■ Wall Design and Construction Must Meet:

**Building Code**

**Effective  
Building  
Practice**

**Energy Code**

**Sustainability**

1. Structural and Design Safety
2. Fire Safety
3. Bulk Water Control
4. Air Control
5. Vapour Control
6. Thermal Control
7. Thermal Efficiency
8. Environmental Effectiveness
9. Product / System Transparency
10. Product / System Acceptance

# Sustainability: Environmental Effectiveness

Innovative, High Molecular Weight, Non-PBT  
(Persistent, Bioaccumulative, Toxic)

Polymeric Flame Retardant (Polymeric FR)  
additive for extruded polystyrene (XPS) and  
expanded polystyrene (EPS) foam insulation  
Applications. Dow Trademark BlueEdge™

All Canadian XPS and EPS required to comply.  
Deadline was December 23<sup>rd</sup>, 2016

## POLYMERIC FLAME RETARDANT

Dow's ongoing commitment to sustainable chemistry and to providing brand leading and innovative solutions serves as the foundation from which we continue to build on our commitment to solving world challenges.



In 2011, Dow Global Technologies LLC (DGT), a subsidiary of The Dow Chemical Company, launched the innovative, high molecular weight, Non-PBT (Persistent, Bioaccumulative, Toxic) Polymeric Flame Retardant (Polymeric FR) additive for extruded polystyrene (XPS) and expanded polystyrene (EPS) foam insulation applications.

Dow's Polymeric FR technology is the result of several years of research and development led by DGT, taking full advantage of the company's deep polymer, chemistry process science, applications know-how and EH&S expertise to find more sustainable products.

Dow's Polymeric FR has become the next-generation industry standard flame retardant for use in both extruded polystyrene foam (XPS) and expanded polystyrene foam (EPS) insulation applications globally. The New Polymeric FR has received a number of awards including:

- 2012 R&D 100 Award. This is the 50th Anniversary of the award, given annually since 1963. The winners are selected by an independent judging panel and the editors of R&D Magazine. The award is widely recognized as the "Oscars of Innovation," that identifies and celebrates the top technology products for the year.

Building Code	1. Structural and Design Safety
Effective Building Practice	2. Fire Safety
Energy Code	3. Bulk Water Control
Sustainability	4. Air Control
	5. Vapour Control
	6. Thermal Control
	7. Thermal Efficiency
	8. Environmental Effectiveness
	9. Product / System Transparency
	10. Product / System Acceptance

# Wall Design and Construction Must Meet:

Building Code

Effective  
Building  
Practice

Environmental  
Sustainability

1. Structural and Design Safety

2. Fire Safety

3. Bulk Water Control

4. Air Control

5. Vapor Control

6. Thermal Control

7. Thermal Efficiency

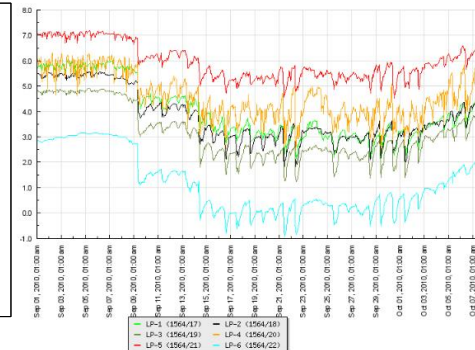
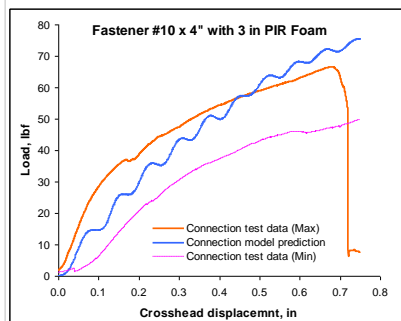
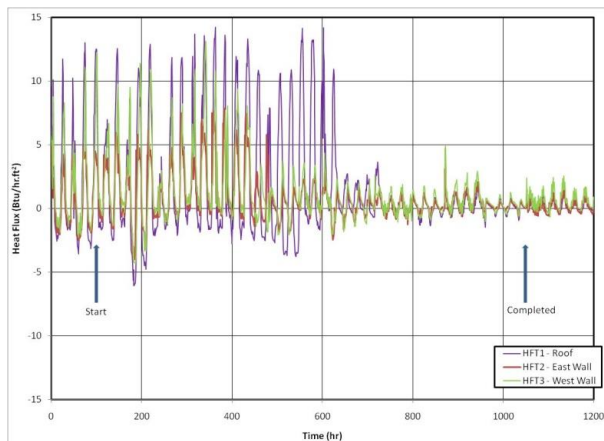
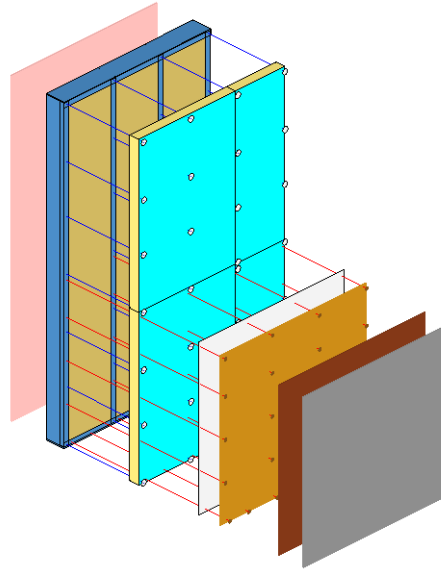
8. Environmental Effectiveness

9. Product / System Transparency

10. Product / System Acceptance

**Time For A Reality Check!**

# Sponsored "ci" Research, Case Studies and Pilot Projects



# ■ Comparing Products / Systems?

## Example “Reality Check” Checklist

- System / Product Tried and Tested? What testing and/or case studies have been done? Lab Only? In Situ?
- Prove It? Research – Manufacturer only? And/or 3<sup>rd</sup> party peer reviewed?
- What is the Cost? Product, System, Installed?
- Buildability? Standard Practice, Differentiated Skills?
- Compatibility? Is the product / system play well with others?
- .....



# ■ Code Assessment Engine & Above Grade Wall Solutions - **Presentation Summary**

- Primary Focus of Presentation: Can we use Foam Insulation in Above Grade Walls? *Use Code Assessment Engine to determine Yes? or No? & what conditions?*
- Bigger Question ...Should We? or Why Would We Consider the Use of Foam Insulation in Above Grade Walls?  
*Does the wall meet the intent of the building code, use sound building science, what about cost (labour & materials), does the wall have a track record (in the lab and in the field), what support is available, .... ???*



# Thank You

## Q & A?

### **Les Yard CTR**

Building Science Specialist  
Dow Building Solutions

### **Dow Chemical Canada ULC**

604-472-7266 | [lyard@dow.com](mailto:lyard@dow.com)



WORLDWIDE PARTNER

**Keith Calder** | Technical Director - Canada

### **JENSEN HUGHES**

Advancing the Science of Safety

13900 Maycrest Way | Unit 135 | Richmond, BC V6V 3E2

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[kcalder@jensenhughes.com](mailto:kcalder@jensenhughes.com) | [www.jensenhughes.com](http://www.jensenhughes.com)

# CCBST 2017

## Vancouver

### November 6-8

### Hosted by BCBECE

[www.ccbst2017.ca](http://www.ccbst2017.ca)



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**THE 15<sup>TH</sup> CANADIAN CONFERENCE ON BUILDING SCIENCE AND TECHNOLOGY**

**NOVEMBER 6-8, 2017**

**VAN COUVER | BC | CANADA | HYATT REGENCY | 655 BURNARD ST**

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**STUDENTS, YOU COULD WIN!**

Enter our video contest at [CCBST2017.ca](http://CCBST2017.ca) winning videos will be featured at CCBST2017.

Sponsored by:





# WARNING! Dow Stuff .....

## Building Solutions



## Canadian Code Assessment Engine and Above Grade Wall Solutions





**10 Years + US Experience**  
**Current Video**





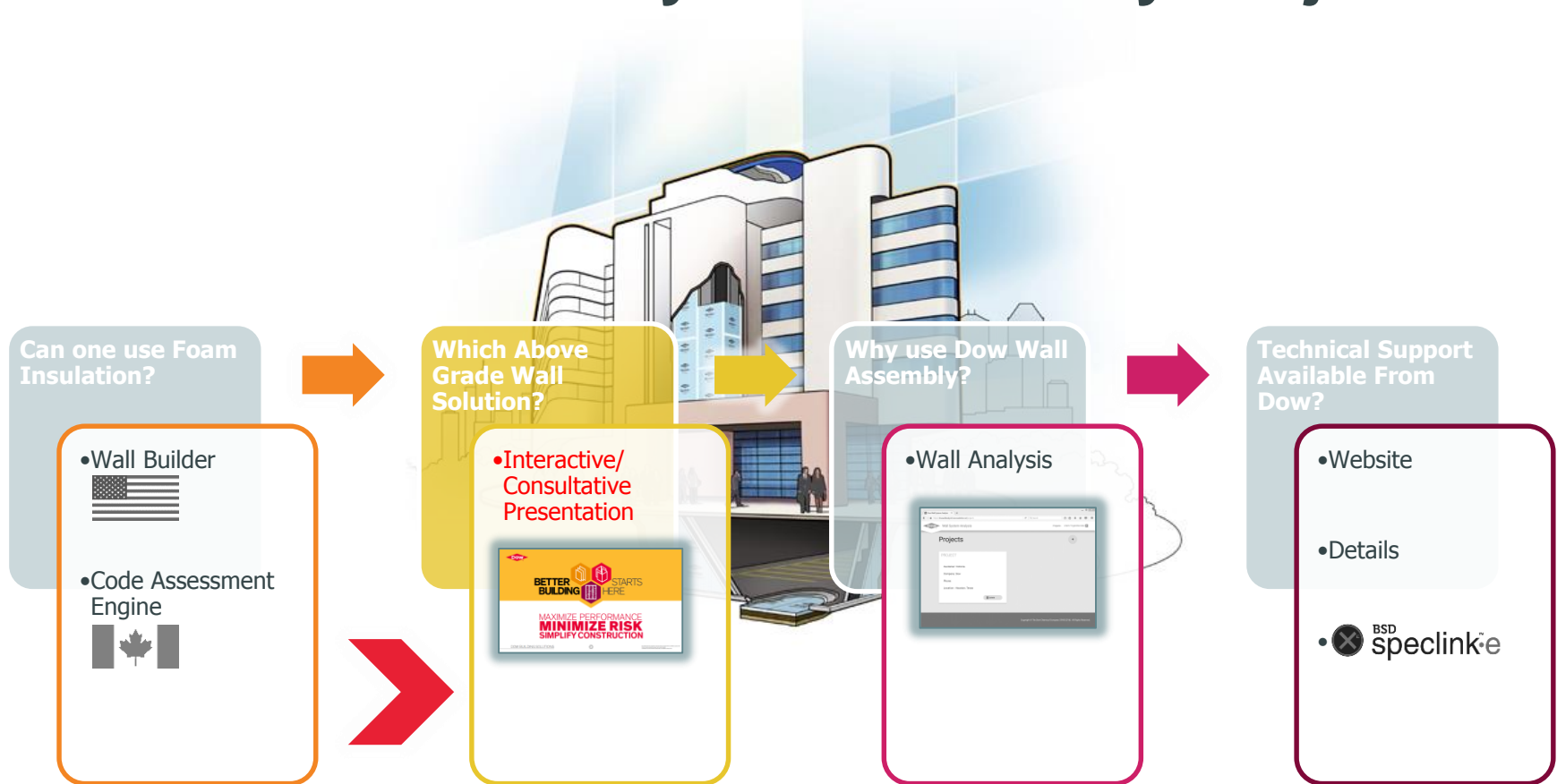
# Did I Mention? ...We are only at Step One

## Can I Use Foam Insulation?



If Yes ...

# What Tools Are Available To Help Determine Which Wall Assembly Is Best For My Project?



# Which Above Grade Wall Solution?

## Interactive Presentation



**BETTER  
BUILDING**



**STARTS  
HERE**

**MAXIMIZE PERFORMANCE  
MINIMIZE RISK  
SIMPLIFY CONSTRUCTION**

DOW BUILDING SOLUTIONS



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® Dow Corning is a trademark owned by Dow Corning Corporation.  
™ Trademark of The Dow Chemical Company ("Dow") or an affiliated company of Dow.

# Which Above Grade Wall Solution?

## Interactive Presentation



## BETTER BUILDING STARTS HERE

### DOW WALL SYSTEMS



#### MAX ARMOR WALL SERIES

Combines all control layers (thermal, water, vapor and air) while acting as primary external sheathing material. Most efficient design with the lowest cost for material and labor.



#### DUAL ARMOR WALL SERIES

Multi-functionality of the rigid insulation layer brings complete protection (thermal, water, vapor and air) with an added layer of gypsum for additional protection.



#### CLASSIC WALL SERIES

Long-used wall type using discrete layers for WRB/air barrier, thermal continuous insulation and primary exterior gypsum.



#### OTHER WALL ASSEMBLIES

Limited in functionality, but available for use to meet certain code or project requirements.

DOW BUILDING SOLUTIONS



# Which Above Grade Wall Solution?

## Interactive Presentation

BETTER BUILDING  STARTS HERE



### MAX ARMOR WALL SERIES



**THERMAX XARMORT™**  
Exterior Insulation + SPF



**THERMAX XARMORT™**  
Exterior Insulation + Batt



**THERMAX XARMORT™**  
Exterior Insulation + Empty



**STYROFOAM™ Brand ULTRA**  
SL XPS Insulation + Batt



**STYROFOAM™ Brand ULTRA**  
SL XPS Insulation + Empty

DOW BUILDING SOLUTIONS **MAX ARMOR WALL SERIES**



# Which Above Grade Wall Solution?

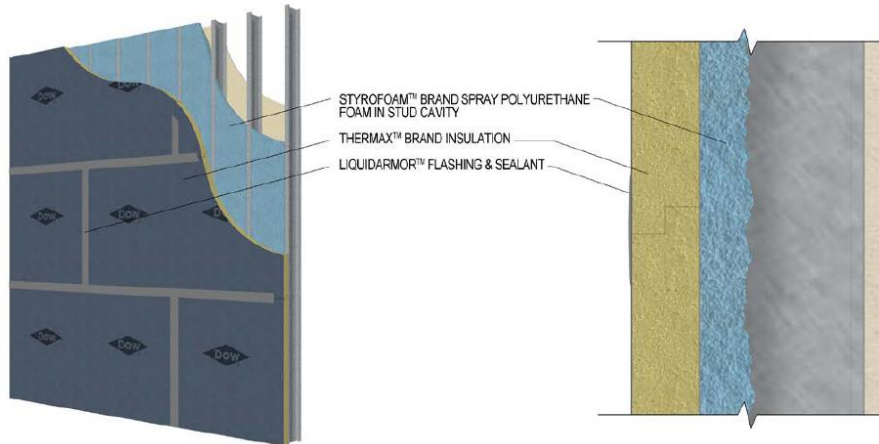
## Interactive Presentation

BETTER BUILDING  STARTS HERE



### THERMAX XARMOR™ Exterior Insulation + SPF

- Most robust performance with thinnest wall profile
- THERMAX XARMOR™ (ci) Exterior Insulation: 4-mil facer offers the most protection from damage during construction
- LIQUIDARMOR™ Flashing and Sealant: the most advanced protection at all seams and punch openings
- STYROFOAM™ Brand SPF Insulation in stud cavity: secondary air/water sealing
- 15-year water resistance and thermal warranty available
- Other THERMAX™ Brand Insulation options available; trade-off provides cost savings



DOW BUILDING SOLUTIONS **MAX ARMOR** WALL SERIES






# Why Use Dow Products and Assemblies?



# Why Use Dow Products & Solutions?

## Wall Analysis Tool (Project Input)

 Wall System Analysis

### Edit Project Details

Project Name* Test Project	
Customer Name* Les Yard	Company Name* DBS
Select country * USA	Select state * Washington
Select city * Clarkston	Phone Number
Number Of Floors* 4	Square Footage* 7150
Select a Construction Type * Non-Residential	Select wall type * Steel Stud
Select labor type * Non-Union	Select a SHRAE Climate Zone * 7
	Select a Code Adoption * ASHRAE 90.1 2013/IECC 2015
Internal Humidity(%)* 35	Internal Temperature(F)* 72
Summer Humidity(%)* 0	Summer Temperature(F)* 0
Winter Humidity(%)* 0	Winter Temperature(F)* 0

# Why Use Dow Products & Solutions?

## Wall Analysis Tool (Wall Comparison / Input)

### Test Project : Edit Wall Analysis

Analysis Title\*  
MURB Wall Comparison

USUAL WALL    TWS WALL

Wall Name\*  
Usual Wall

Drywall \*

1/2"

Interior Vapor Barrier \*

Polyethylene

Stud Spacing \*

16" O.C.

Depth \*

5.5

Cavity Insulation Type \*

Fiberglass

R-Value \*

19

Exterior Gypsum Sheathing \*

5/8"

Water-Resistive Barrier \*

Sheet

Permeance \*

Class 1(<0.1 Perm)

Continuous Insulation \*

Mineral Wool (R4.2/in)

Thickness \*

4

### Test Project : Edit Wall Analysis

Analysis Title\*  
MURB Wall Comparison

USUAL WALL    **TWS WALL**

Wall Name\*  
TWS Wall

Drywall \*

1/2"

Interior Vapor Barrier \*

None

Stud Spacing \*

16" O.C.

Depth \*

3.5

Cavity Insulation Type \*

Spray Foam

Thickness \*

2

R-Value \*

12

Exterior Gypsum Sheathing \*

None

Water-Resistive Barrier \*

None

Continuous Insulation \*

Thermax Sheathing(3.5 in)

Thickness \*

3.5

# Why Use Dow Products & Solutions?

## Wall Analysis Tool (Output = Energy & Condensation Performance and Material & Labour Cost Comparison)

### Wall Analysis

Fiber Cement / Knight CI / XPS / SPF  
Generated on 04/06/2017 for Philip Harms



#### Project Conditions

Ashrae Climate Zone	7
Code Adoption**	ASHRAE 90.1 2010/IECC 2012
Construction Type	Non-Residential
Wall Type	Steel Stud
Labor Type	Non-Union
Project Size (SF of Wall)	20000

#### Project Code Requirements

Prescriptive Requirement	R-13 + R-7.5 ci
Assembly MAX U-Value	0.064
Project State	North Dakota
RS Means Nearest City	Bismarck
Number Of Stories	4

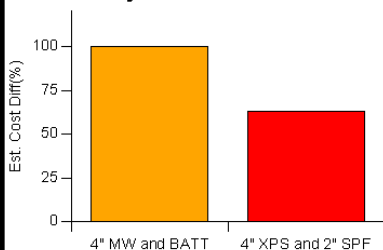
#### Temperatures & Humidity

Interior - Temperature	70
Interior - Humidity	35
Summer - Humidity	40
Summer - Temperature	80
Winter - Humidity	80
Winter - Temperature	10

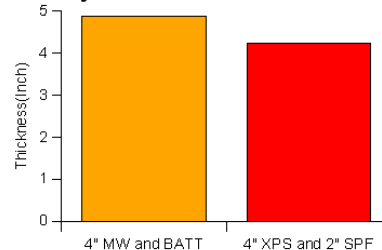
#### Cost & Performance

Est. Savings in Cost & Labor	37%	
Est. Change in R-Value	1.68%	
	4" MW and BATT	4" XPS and 2" SPF
Improvement Over Code	37.85%	38.9%
Effective R-Value	25.142	25.572
Effective U-Value	0.0398	0.0391
Cavity Thickness (in)	4.875	4.25
IECC Compliance	Yes	Yes

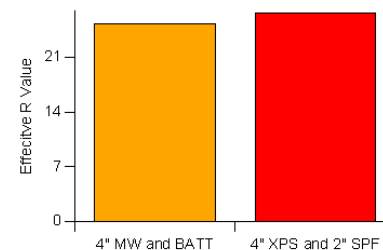
#### Cost Analysis



#### Cavity Thickness



#### R-Value



# What Resources are there to Support? – *Product Information, Details, Specifications*



# What Resources Are Available?

## Website, Product Information, Tech Solutions, White Papers

### THERMAX XARMOR™ (ci)

**1. PRODUCT NAME**  
THERMAX XARMOR™ (ci) Exterior Insulation

**2. MANUFACTURED BY**  
The Dow Chemical Company  
Dow Building Solutions  
200 Locke Middlefield, MI 48274  
1-800-852-8822 (DOW)  
Fax: 1-800-452-2400

**3. PRODUCT DESCRIPTION**  
THERMAX XARMOR™ (ci) Exterior Insulation is the toughest insulation for the potential THERMAX™ Wall System. Blending a strong 45 mil reinforced exterior foil liner, this solution provides builders with more durability for long-term performance. THERMAX XARMOR™ (ci) is the only THERMAX™ insulation with a dark exterior foil optimized to get behind rain screen activities. It is engineered with unique fiberglass reinforced core for enhanced fire performance and a stronger, brighter board. When used as part of the THERMAX™ Wall System, the integral, durable thermoset cross-laminar fiber provides a drainage plane, water resists a barrier and exterior sheathing, eliminating the entire steps of installing a membrane, building wrap and exterior gypsum. The foam core provides one of the highest R-values available (R-12 or R-15) for intermediate insulation and weather protection on the job site, as well as long-term thermal performance and water resistance. It is a UV stable material. THERMAX XARMOR™ (ci) Exterior Insulation can remain uncovered up to six months. With its low permeability and high load-bearing value, THERMAX XARMOR™ (ci) Exterior Insulation reduces the potential for condensation within the wall assembly resulting in long lasting performance.

**4. TECHNICAL APPLICATIONS**  
THERMAX XARMOR™ (ci) Exterior Insulation is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

**5. TYPICAL THERMAL PROPERTIES**  
THERMAX XARMOR™ (ci) Exterior Insulation is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

**6. PRODUCT INFORMATION**  
THERMAX XARMOR™ (ci) Exterior Insulation is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

### THERMAX™ Sheathing

**1. PRODUCT NAME**  
THERMAX™ Sheathing

**2. MANUFACTURED BY**  
The Dow Chemical Company  
Dow Building Solutions  
200 Locke Middlefield, MI 48274  
1-800-852-8822 (DOW)  
Fax: 1-800-452-2400

**3. PRODUCT DESCRIPTION**  
THERMAX™ Sheathing is a non-structural, rigid board insulation consisting of a glass fiber reinforced polyisocyanurate foam core laminated between 1/8 mil smooth, reflective aluminum facers on both sides. The glass fiber reinforcement contributes to improved fire performance and dimensional stability. THERMAX™ Sheathing can be installed exposed to the exterior without a thermal barrier.

**4. TECHNICAL APPLICATIONS**  
THERMAX™ Sheathing is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

**5. TYPICAL THERMAL PROPERTIES**  
THERMAX™ Sheathing is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

**6. PRODUCT INFORMATION**  
THERMAX™ Sheathing is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System. It is designed to be used in conjunction with the THERMAX™ Wall System.

### Dow Building Solution White Paper

## Thermal Behavior of Polyisocyanurate Polystyrene Insulation in Corn

Conventional roofs consist of a supporting structure composed of structural supports and decking upon which layers of insulation are installed to be finally capped off with the waterproofing layer as the final element of the roof assembly. Depending on end use of the building and geographical location, applicable building and energy codes will dictate how much insulation is required. The insulation level, or thermal resistance, is measured in R-values.

Insulation is a material's ability to resist the passage of heat energy. One of the most common methods used for insulation is materials in ASTM C829 "Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus," which provides a quantitative measure that is a function of the temperature gradient used for the testing. For the purpose of manufacturers' technical data sheets and applicable product standards, the thermal resistance needs to be at least 10% above the standard temperature for thermal resistance reporting.

Conventional roof assemblies can utilize a variety of insulation materials to provide the required "R-value." Polyisocyanurate (PIU), extruded polystyrene (XPS), flexible foam, mineral wool boards, high density fiberboard, or rigid polyurethane and insulation panels, each offer unique properties and advantages. Each material has its own set of characteristics and limitations. The choice of material is often dictated by the specific requirements of the application, the climate, and the building's design.

PIU is a rigid, closed-cell foam insulation material that is known for its high thermal resistance and low moisture absorption. It is typically used in a variety of applications, including walls, roofs, and floors. PIU is also known for its fire resistance and durability. XPS is another rigid, closed-cell foam insulation material that is known for its high thermal resistance and low moisture absorption. It is typically used in a variety of applications, including walls, roofs, and floors. XPS is also known for its fire resistance and durability.

Flexible foam is a soft, closed-cell foam insulation material that is known for its high thermal resistance and low moisture absorption. It is typically used in a variety of applications, including walls, roofs, and floors. Flexible foam is also known for its fire resistance and durability. Mineral wool boards are made from mineral fibers and are known for their high thermal resistance and fire resistance. They are typically used in a variety of applications, including walls, roofs, and floors.

High density fiberboard is a rigid, non-foam insulation material that is known for its high thermal resistance and fire resistance. It is typically used in a variety of applications, including walls, roofs, and floors. Rigid polyurethane and insulation panels are made from polyurethane and are known for their high thermal resistance and fire resistance. They are typically used in a variety of applications, including walls, roofs, and floors.

### Installation Procedures for LIQUIDARMOR™ LT Flashing and Sealant

**OVERVIEW**  
LIQUIDARMOR™ LT Liquid Flashing and Sealant is an innovative, abrasion resistant, liquid flashing solution designed to provide commercial buildings advanced moisture and air sealing protection. When LIQUIDARMOR™ LT is used in combination with Dow Commercial Wall Systems, it can decrease labor on the job. LIQUIDARMOR™ LT is a two-part product that is applied as a single coat or two coats. It can be applied at temperatures as low as 40°F.

**What We Do**  
A wet-mix product will help ensure LIQUIDARMOR™ LT Flashing and Sealant is applied at 20-45°F wet mix, optimizing productivity and product performance.

**STEP-BY-STEP INSTALLATION INSTRUCTIONS**

- Before you begin applying LIQUIDARMOR™ LT Flashing and Sealant, prepare the joints.
- After you begin applying LIQUIDARMOR™ LT Flashing and Sealant, prepare the joints.
- Check & Prepare All Insulation Surface

LIQUIDARMOR™ LT Flashing and Sealant is designed to be applied to the exterior of the building. It is designed to be applied to the exterior of the building. It is designed to be applied to the exterior of the building.

**EQUIPMENT GUIDELINES**  
Cleaning a Gun & Nozzle  
LIQUIDARMOR™ LT Flashing and Sealant can be applied using a standard construction sprayer gun designed for 20-45°F wet mix. Use a standard metal nozzle or the nozzle having down a white hose of LIQUIDARMOR™ LT on the substrate can be used. A cleaning tool is then used to remove the flashing over the desired area. Alternatively, LIQUIDARMOR™ LT can be removed from a gun and directly towel applied over substrates.

**Table 1: LIQUIDARMOR™ LT Flashing and Sealant Theoretical Yield**


Application/Details (inches)	Yield at Standard Temperature (Yield at 20-45°F wet mix)	Yield at 100°F (Theoretical Yield of 100°F wet mix)
1	102	1120
2	51	560
3	34	373
4	26	280
5	20	217
6	17	185

**PRODUCT INFORMATION** | United States | COMMERCIAL



# What Resources Are Available?


## Generic Details (Masonry & Cladding Sets Available)



Dow Building Solutions

### Detail Set: Thermax Wall System

General Details (Cladding Neutral)



This detail set outlines the general guidelines for design using the THERMAX™ Wall System, focusing around continuity of the four control layers (thermal, air, vapor, and water).

The THERMAX Wall System is an innovative way to achieve complete, long-term protection. With three simple components — continuous insulation, all-weather flashing, and an insulating air barrier — you get one integrated system that insulates and seals against water, air, and vapor more effectively for ultimate long-term envelope protection.

As codes become increasingly more demanding, designers are constantly challenged to find new ways to meet them. Dow's THERMAX Wall System meets all applicable IBC and ASHRAE requirements using industry-proven products for greater results — saving you money and increasing profitability for your business.

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Supplemental / Cladding-Specific Detail Sets

- Masonry (Brick, Block, etc.)
- Steel Systems (Solid Panel, Tensile Cable, Fiber Concrete Panels, etc.)
- Acrylics (Advanced Stone, Mosaic, etc.)

## Thermax

### THERMAX<sup>®</sup> wallsystem

#### Anchor Guidelines for Studs

##### Design Intent

1. USE SELF-SEALING MASONRY ANCHORS TO MAINTAIN INTEGRITY OF A CONTROL LAYER.
2. SELECT FASTENERS WITH THERMAL BREAKS TO IMPROVE EFFECTIVE R-VALUE OF THE ENVELOPE.
3. USE SAVED-LARGE MASONRY FASTENERS TO REDUCE NUMBER OF PENETRATIONS TO ENVELOPE.
4. SEAL UNPENETRATED FASTENERS WITH SELF-SEALING DOW MEMBRANES.

##### Masonry Anchor Recommendations


SEAL-SEALED SELF-SEALING BARREL STYLE ANCHORS

- ECONOMY FASTENERS WITH INSULATING THERMAL BREAKS
- MINIMUM 3/8" DIA. WASHER, MASONRY ANCHOR MAY BE USED TO REPLACE 1" INSULATED FASTENER AT THAT LOCATION
- THERMAL AREA TEST
- INSULATING GROUT WITH THERMAL INSULATOR


ANCHORS REQUIRE ADDITIONAL FLASHING

- WEATHERING RESISTANT FLASHING
- INSULATING GROUT WITH THERMAL INSULATOR
- INSULATING GROUT WITH THERMAL INSULATOR
- GROUT NOT CONNECTED


##### SELF-SEALING BARREL FASTENERS (RECOMMENDED)



##### ENGINEERED TIE (HIGH RISE), REQUIRES ADDITIONAL FLASHING / SEALANT



##### FACE MOUNTED / PENETRATING ANCHOR, REQUIRES ADDITIONAL FLASHING / SEALANT (NOT RECOMMENDED)



##### ANCHOR GUIDELINES ON STUD

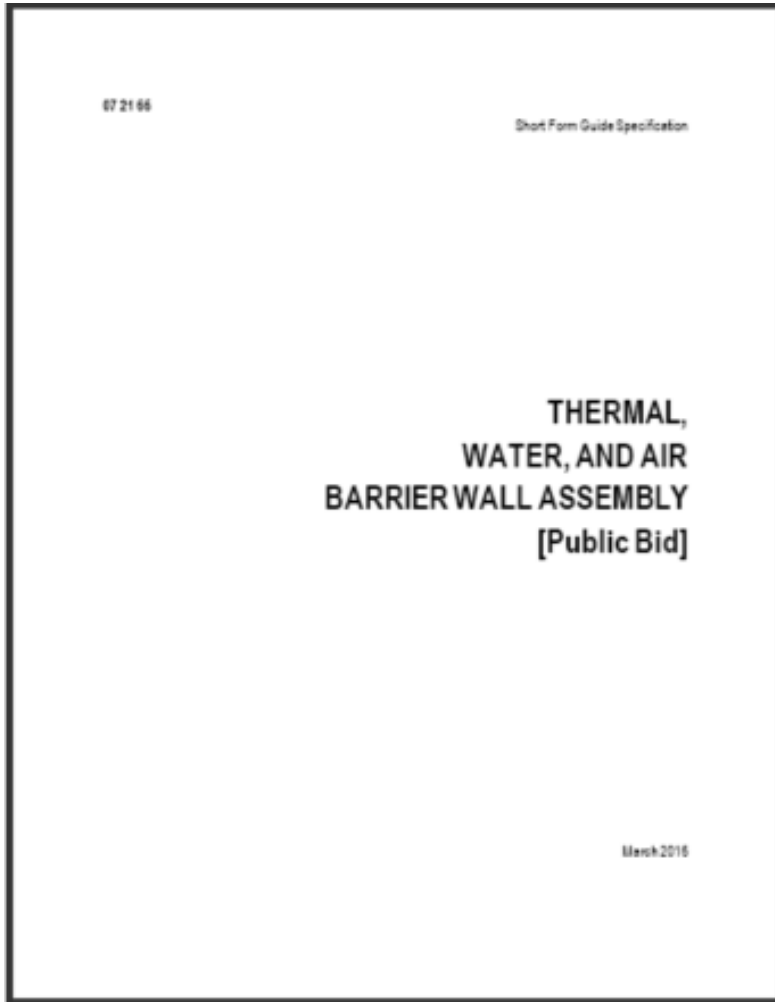
MINIMUM REQUIREMENTS

1. GENERAL FASTENING PATTERNS 16" O.C. VERTICALLY & HORIZONTALLY UNLESS SPECIFIED DIFFERENTLY BY LICENSED ENGINEER.
2. APPROVED ANCHORS MUST INCLUDE WASHERS.
3. WHERE ANCHOR USES 1/2" DIA. WASHER, MASONRY ANCHOR MAY BE USED TO REPLACE 1" INSULATED FASTENER AT THAT LOCATION.
4. ALL PENETRATING ANCHORS MUST BE INSTALLED THROUGH LIQUIDBARRIER OR WEATHER-RESISTANT FLASHING WITH MIN. WIDTH BASED ON DETAIL THIS CODE.
5. MUST SEAL Voids AROUND ALL SHEAR / PLATE ANCHORS WITH GREAT STUFF AND INSULATING FOAM SEALANT OR OTHER APPROVED SEALANT AND FLASH USING LIQUIDBARRIER FLASHING.

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# What Resources Are Available?

## Specifications



# What Resources Are Available?

**SpecLink ... Coming Soon**

A promotional banner for SpecLink-E software. The background is a low-angle, blue-tinted photograph of a modern glass skyscraper. In the upper left, there is a circular logo with a yellow 'X' and a small 'E' in a circle. To its right, the text 'BSD' is in a small, black, sans-serif font, followed by 'speclink' in a large, black, sans-serif font, and a yellow dot followed by a yellow 'e'. Below this, the words 'Intelligent Specifications' are written in a large, white, sans-serif font. Underneath that, a line of smaller white text reads: 'SpecLink-E saves you time when it comes to managing specifications production for your projects.' At the bottom center, there is a dark green rectangular button with a yellow border, containing the text 'FREE EVALUATION COPY' in white, all-caps, sans-serif font.

 BSD  
**speclink**•e

## Intelligent Specifications

SpecLink-E saves you time when it comes to managing specifications production for your projects.

**FREE EVALUATION COPY**



# Thank You

## Q & A?

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