Building Solutions

Canadian Code Assessment Engine and Above Grade Wall Solutions

Dow.com

Presentation Overview

Can we use Foam Plastic Insulation?

- Wall Builder

- Code Assessment Engine

What Above Grade Wall to Choose?

- Interactive/ Consultative Presentation

How Can I Compare Above Grade Wall Assemblies?

- Wall Analysis

Code Assessment Engine

Part 1: Code Tool Development and History (Les Yard)
Part 2: Code Tool Introduction and Use (Keith Calder)

Can we use Foam Plastic Insulation?

- Wall Builder
- Code Assessment Engine

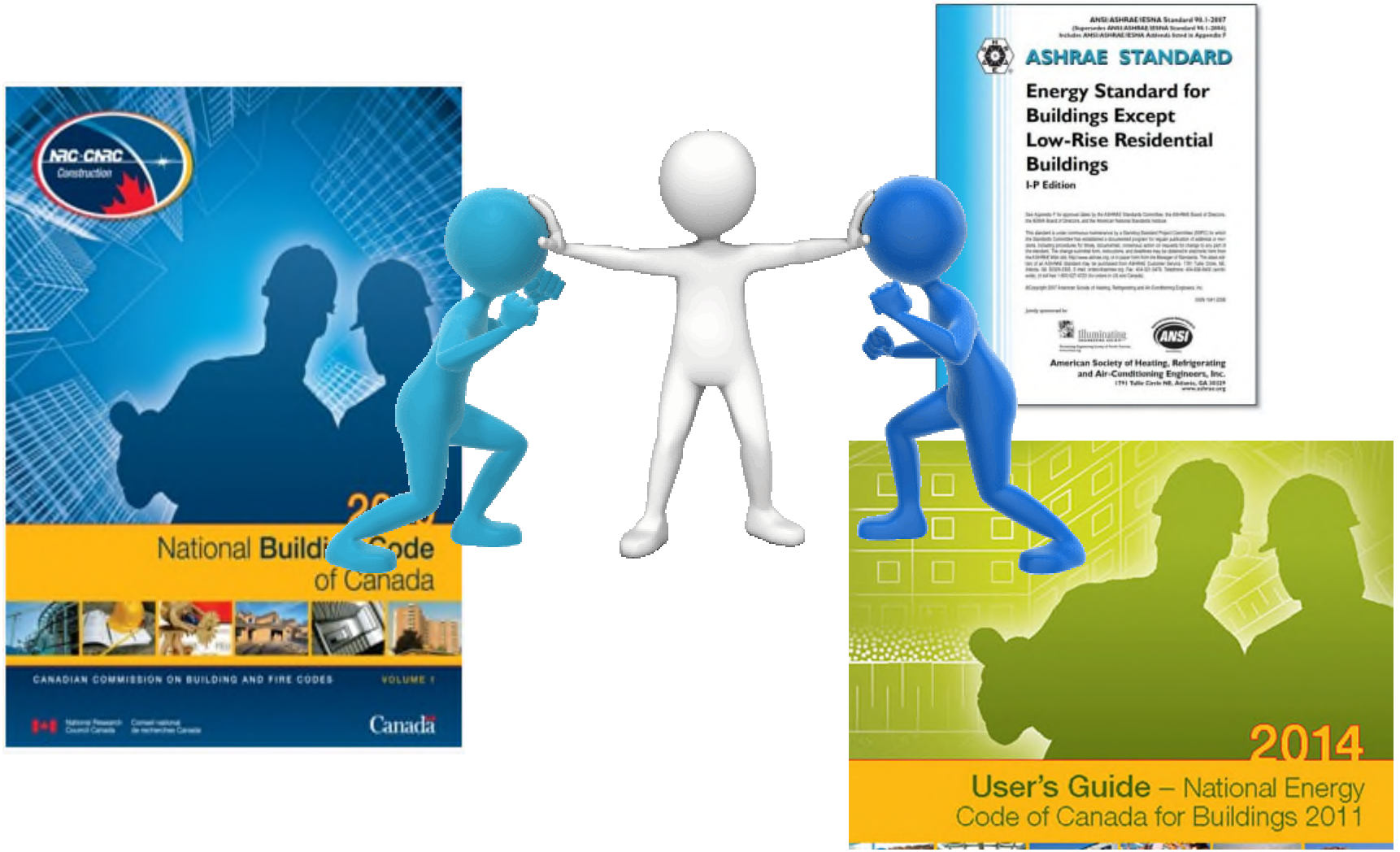
What Above Grade Wall to Choose?

- Interactive/ Consultative Presentation

How Can I Compare Above Grade Wall Assemblies?

- Wall Analysis

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
- ✓ More Thermally Efficient Cladding Attachment Methods (Reduction in Thermal Bridging)
- ✓ Higher Achievable Effective R-Values
- ✓ Thinner Wall Assemblies

How do we know this is so…?

Hugh Bird Vancouver

Surmont II Multipurpose Building Fort McMurray

Ottewell Terrace Edmonton

John Paul 2 Vancouver

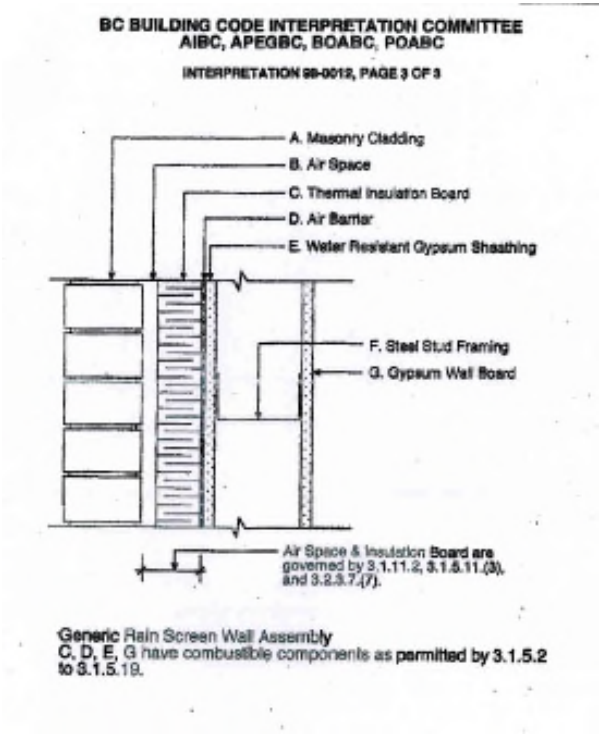
10 Years + US Experience

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

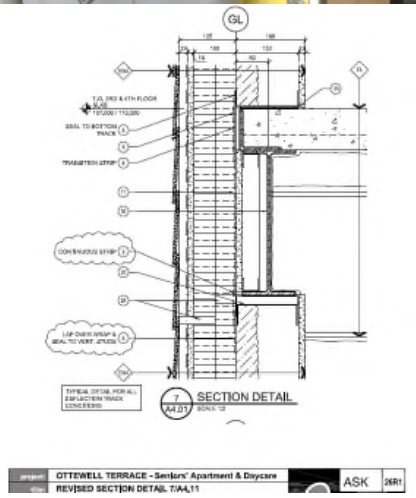
Cladding consisted of 25 mm of masonry or concrete (Clarified in NBC 2015 3.1.5.6)



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)

CITY OF VANCOUVER

CITY OF VANCOUVER
OFFICE OF THE CHIEF BUILDING OFFICIAL
Community Services, 453 West 12th 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 33rd Street, Vancouver, BC — Project Address
July 24, 2013 Revised Nov 6, 13 — Date

For office use only
Payment $ 697.00 — Invoice Number: CE 012384 722037 — AL Number: AL 401472

APPLICANT INFORMATION

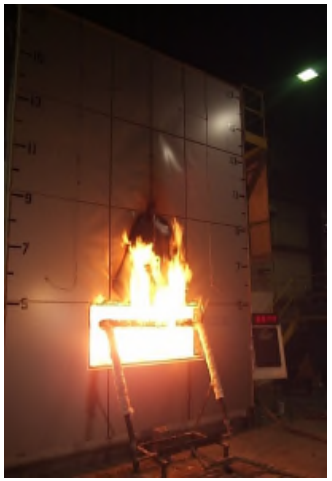
Proposed By: Jun H. Kim, BASc, EIT, / K.M. Gary Chen, MASc, P.Eng
Firm: GHL CONSULTANTS LTD
Address: 950 – 409 Granville Street, Vancouver, BC
Phone: 604 689 4449 Fax: 604 689 4419 Email: jhk@ghl.ca / gc@ghl.ca

(Professional Seal)
PROFESSIONAL ENGINEER — K.M. CHEN — 34184 — BRITISH COLUMBIA

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*



- **If the Construction Industry wants to use Foam Plastics in Above Grade Walls …**
  Why Has This Not Happened?

Main reason is …

CODE Confusion!!!

National Building Code of Canada

Analysis of Combustible and Noncombustible Code Requirements

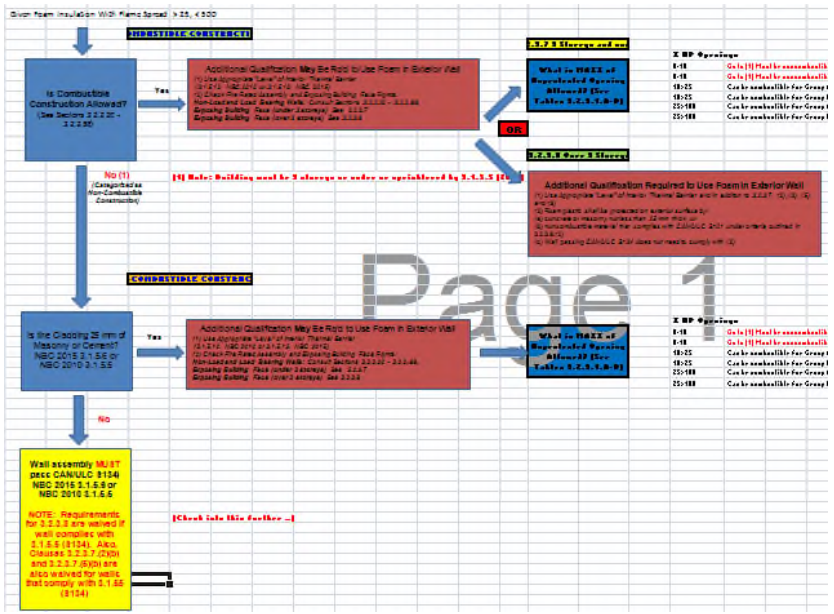
PART 3 (Sections 3.2.2.20 - 3.2.2.88) - NEEDS TO BE CHECKED FOR ACCURACY, BUT GOOD OVERVIEW CONCEPTUALLY

Can be of Combustible Construction (with conditions)

Group	Division	Height/ Stories	Area	Sprinkled	NC, C, HT	Other Restriction
A	**1**	**Production & Viewing of the the Performing Arts**				
A	1	Any	Any	Y	NC	FR Rated Assemblies:
A	1	1	< 600 m2	Y	NC, HT	600 Occupants, FR Rated Assemblies
A	1	1		Y	NC, C	< 300 Occupants, FR Rated Assemblies, Autorium Floor Location
A	**2**	**t Elsewhere Classified in Group A**				
A	2	Any	Any	Y	NC	FR Rated Assemblies:
A	2	≤ 6	Any	Y	NC	FR Rated Assemblies:
A	2	≤ 2	Table 3.2.2.25	?	NC, C	FR Rated Assemblies:
A	2	≤ 2	1 Storey ≤ 4800 m2 2 Storey ≤ 2400 m2	Y	NC, C	FR Rated Assemblies:
A	2	≤ 2	1 Storey ≤ 2400 m2 (no basement) 1 Storey ≤ 1200 m2 2 Storey ≤ 600 m2	Y	NC, C	?
A	2	1	1 Storey ≤ 400 m2 2 Storey ≤ 500 m2 3 Storey ≤ 600 m2	?	NC, C	FR Rated Assemblies, if basement
A	**3**	**Assembley Occupancies of the Areas Type**				
A	3	Any	Any	Y	NC	FR Rated Assemblies, F, M, L
A	3	≤ 2	Table 3.2.2.30	Only if > 1500 m2, used for tradeshow exhibits	NC, HT	FR Rated Assemblies
A	3	≤ 2	1 Storey ≤ 1200 m2 2 Storey ≤ 6000 m2	Y	NC	FR Rated Assemblies, F, M, L
A	3	1	1 Storey ≤ 2400 m2 2 Storey ≤ 3000 m2 3 Storey ≤ 3600 m2	Only if > 1500 m2, used for tradeshow exhibits	NC, C	FR Rated Assemblies, F, M, L
A	3	1	≤ 7200 m2	Y	NC, C	?
A	3	1	1 Storey ≤ 1000 m2 2 Storey ≤ 1250 m2 3 Storey ≤ 1500 m2	?	NC, C	?
A	**4**	**Assembley Occupancies in which Occupants are Gathered in the Open Air**				
A	4			Y	NC, HT	?
B	**1**	**Detention Occupancies**				

F = Floor
M = Mezzanine
L = Load Bearing Wall
R = Roof

NC = Noncombustible
C = Combustible
HT = Heavy Timber



NBC is straightforward …. NOT!

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

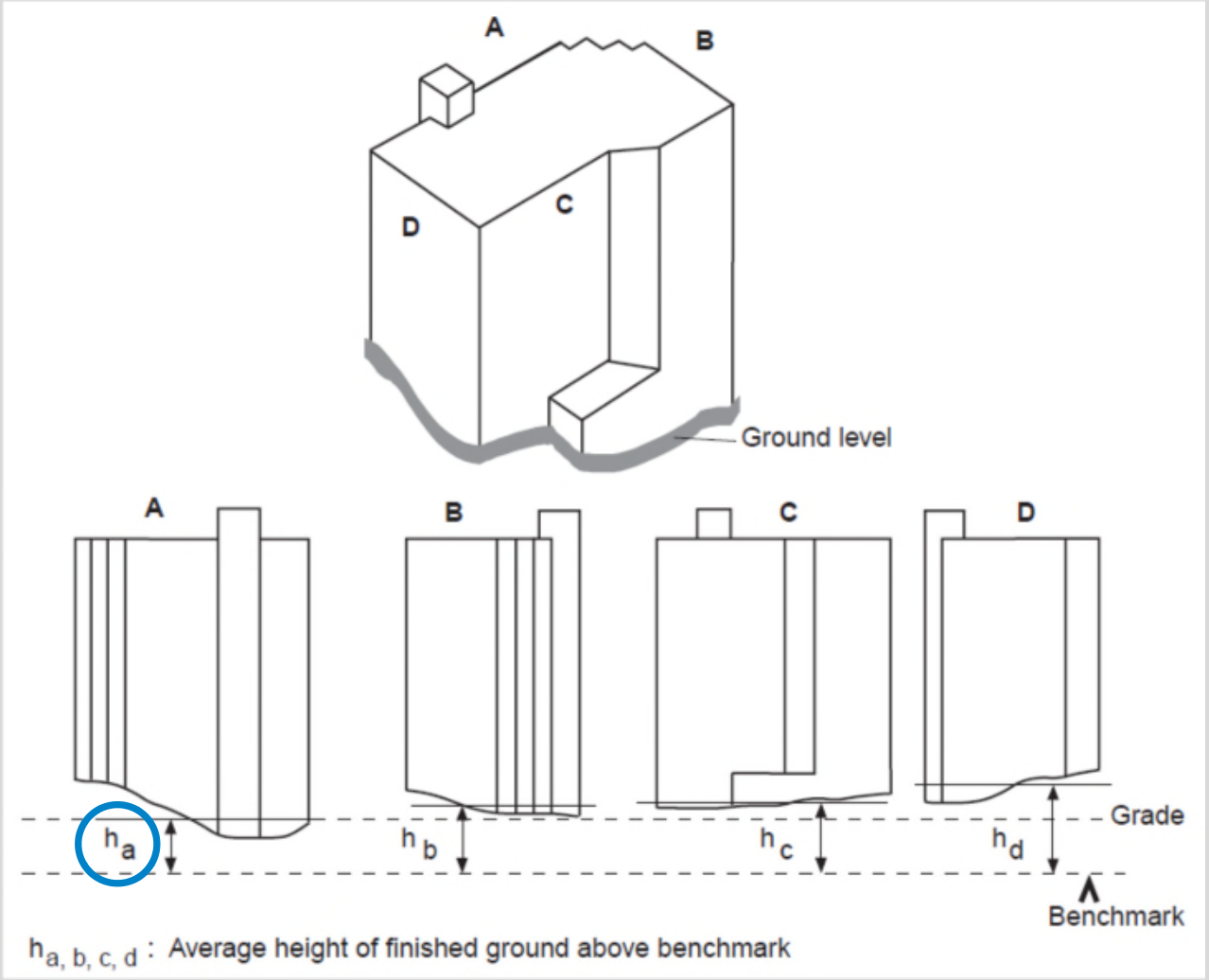
Applicable Building Code

	A
1	**Applicable Building Code:**
2	2015 NBCC

Project Characteristics

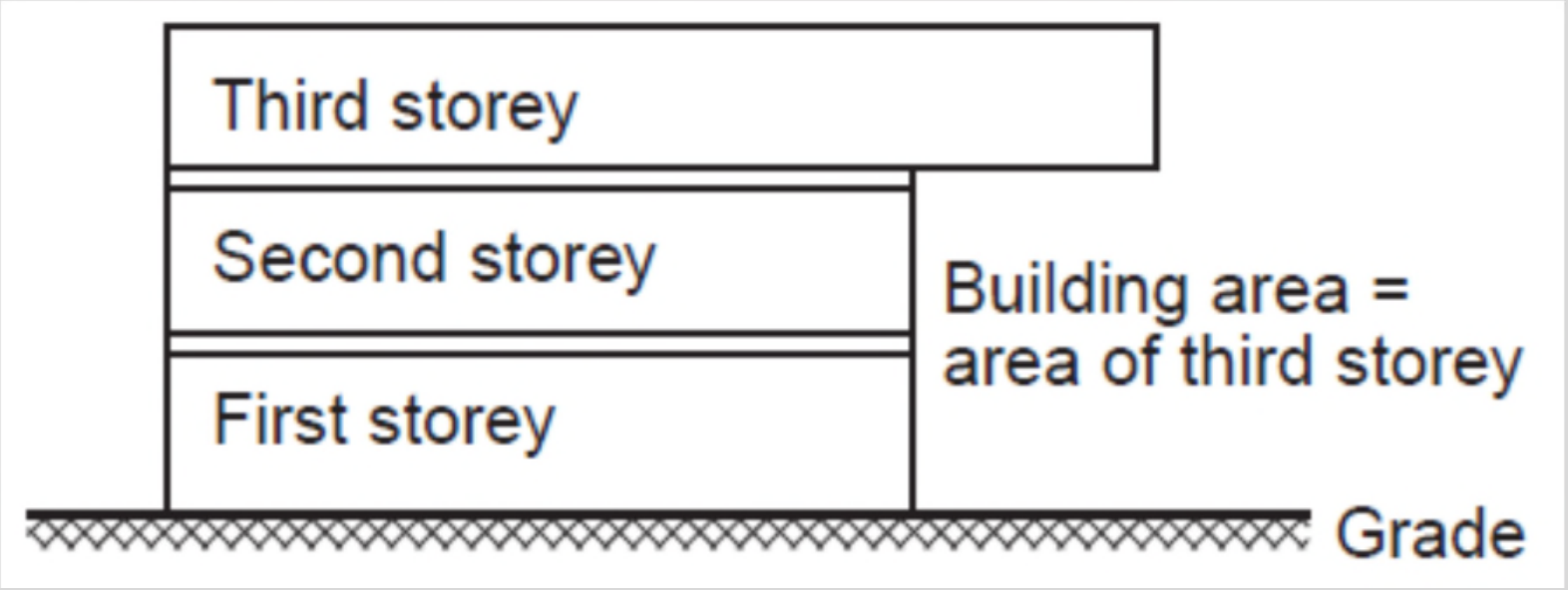
Project Characteristics:	
Building Area (m^2):	1200
Building Height (Storeys):	4
Building Height (m):	17
High Building (Subsection 3.2.6.	No
Streets Facing:	2
Sprinklered:	Yes
Major Occupancies:	C,D,E

Project Characteristics – Grade

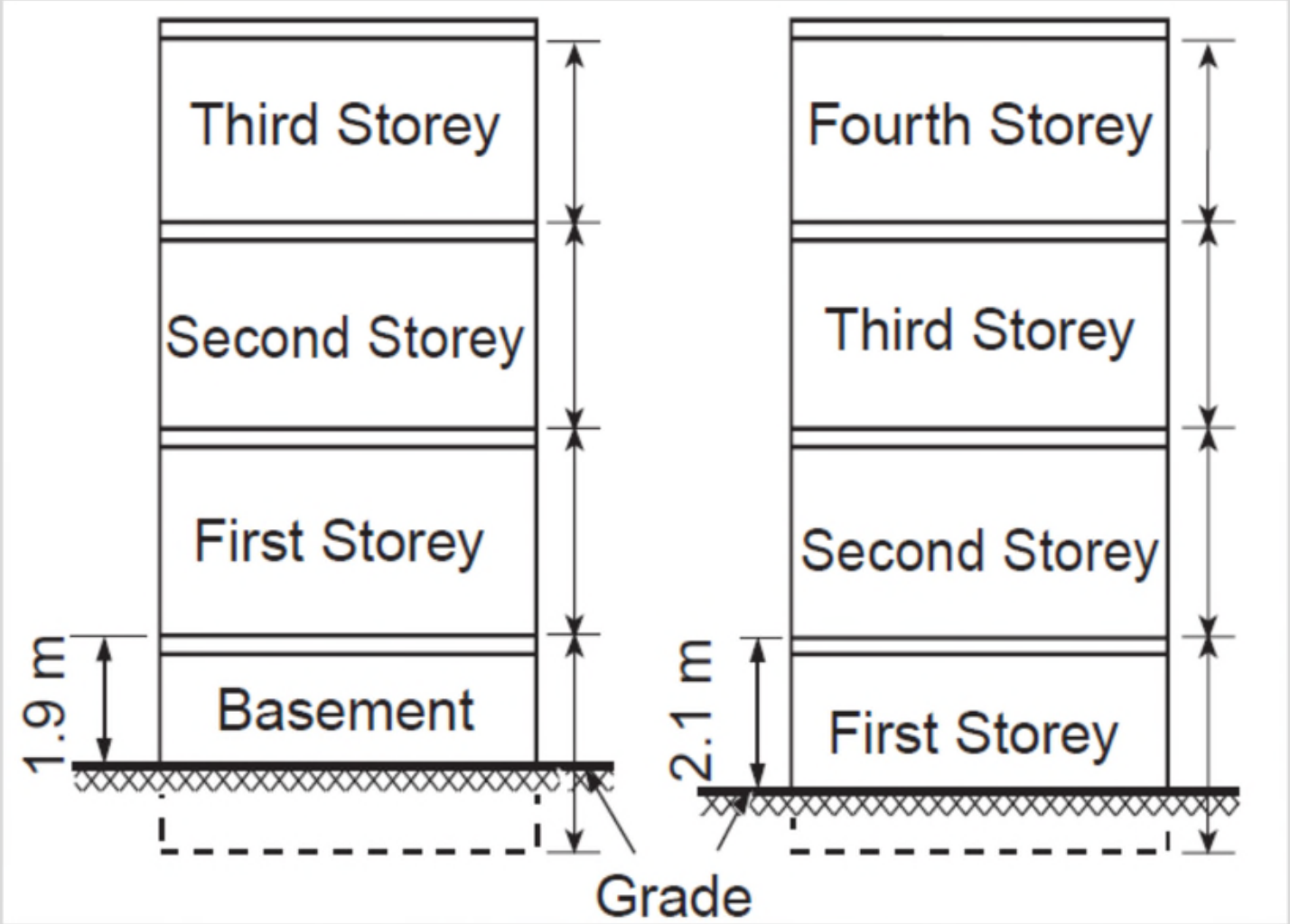


Project Characteristics – Building Area

› Building Area:

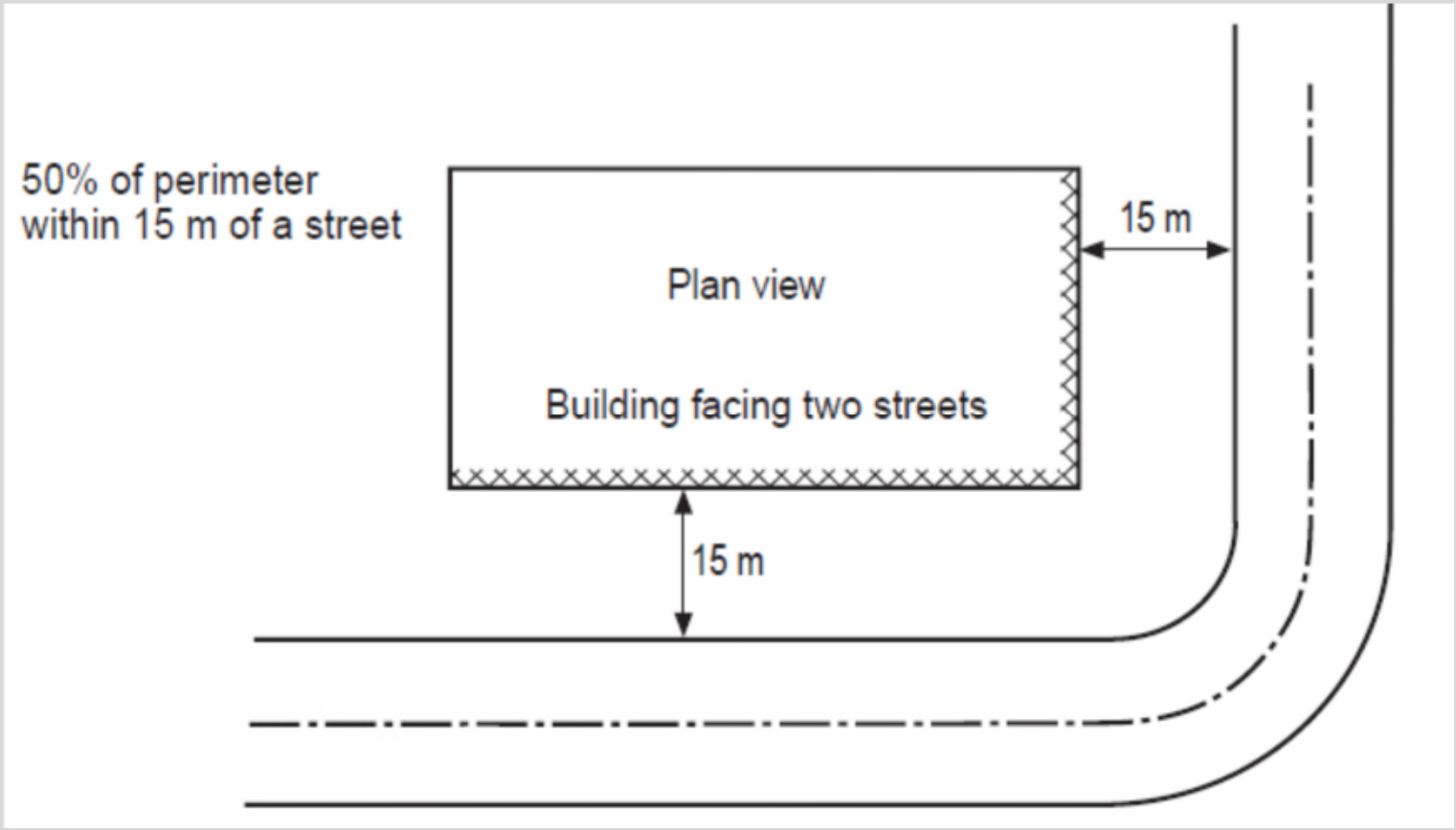


Project Characteristics – Building Height



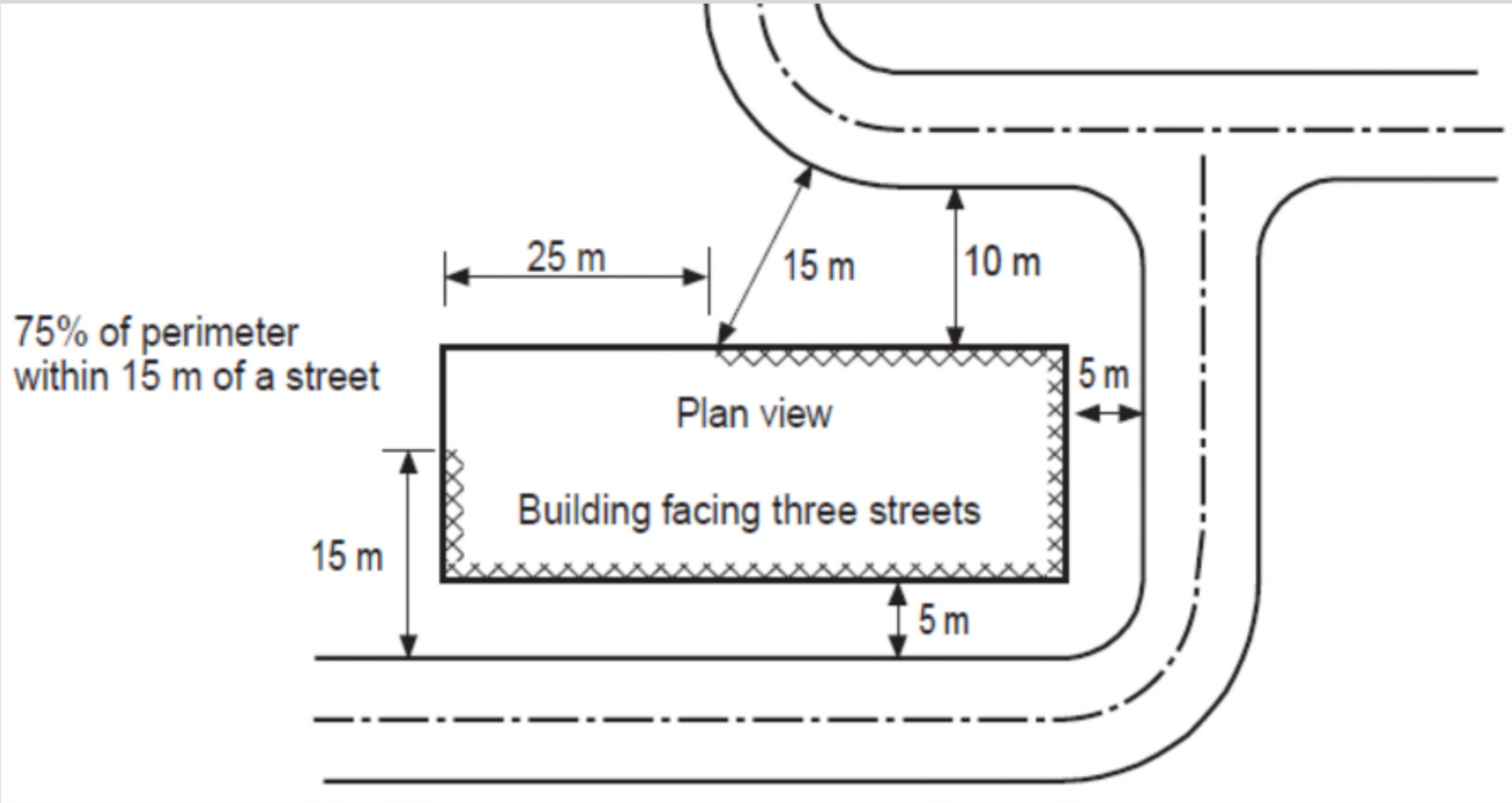
Project Characteristics – Streets Facing

› 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, m²		
	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:

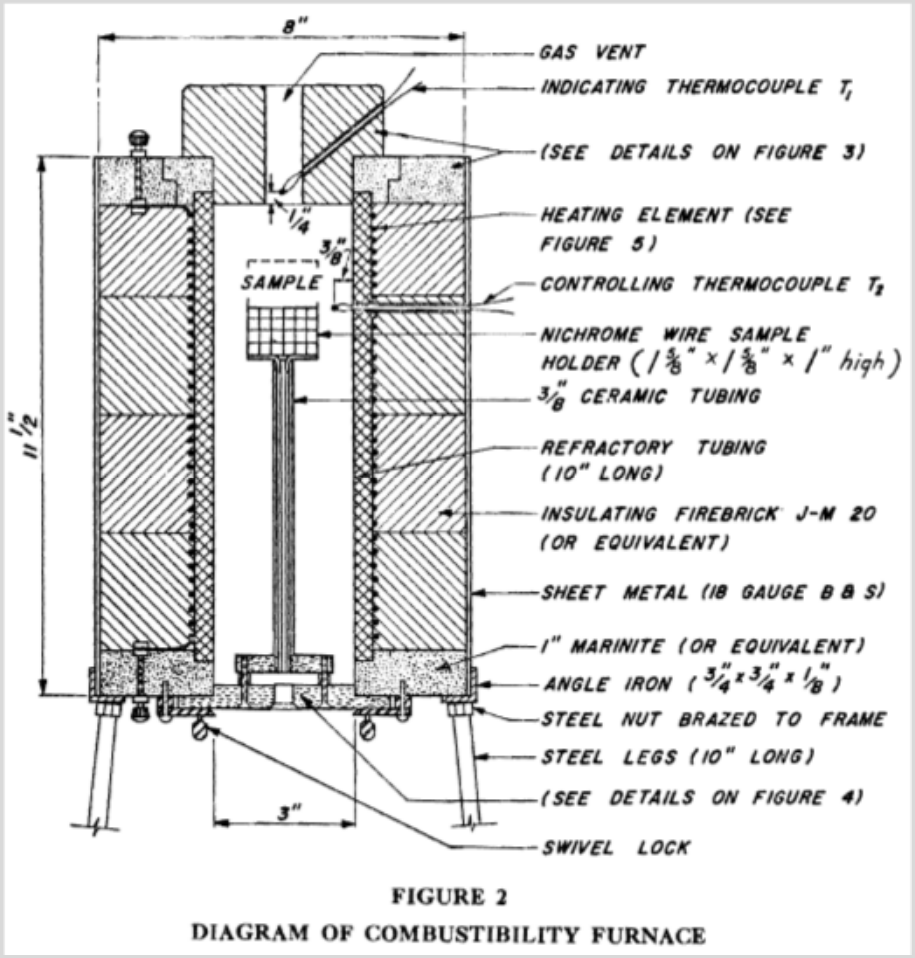


FIGURE 2
DIAGRAM OF COMBUSTIBILITY FURNACE

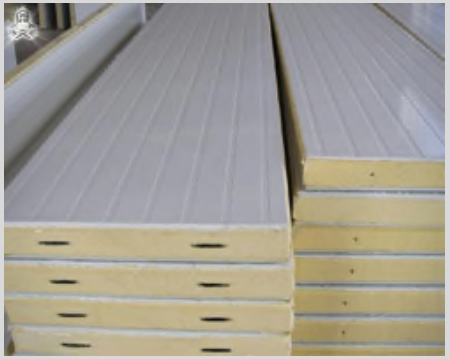
Building Classification - Type of Construction

- **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

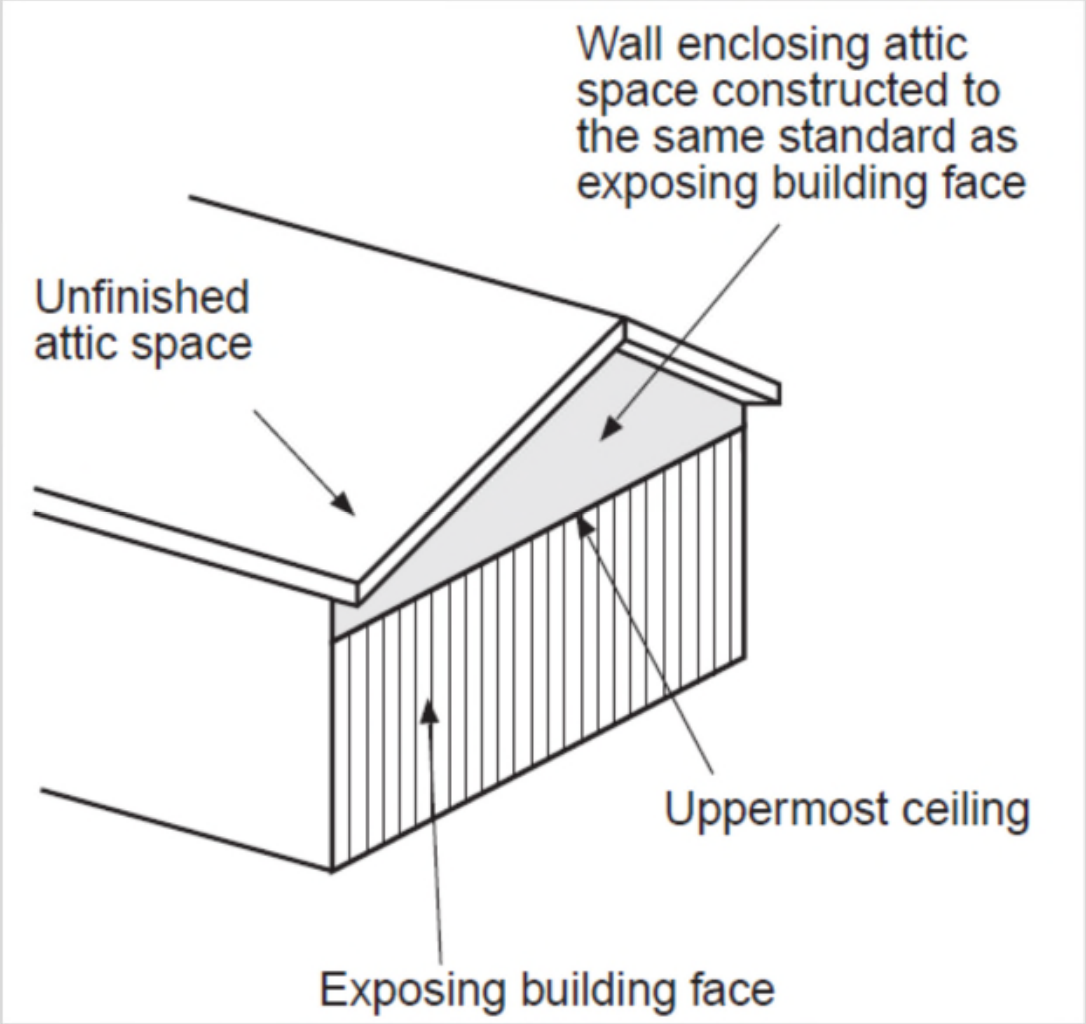
- **Combustible Construction:** “a type of construction that does not meet the requirements for noncombustible construction”


Spatial Separation

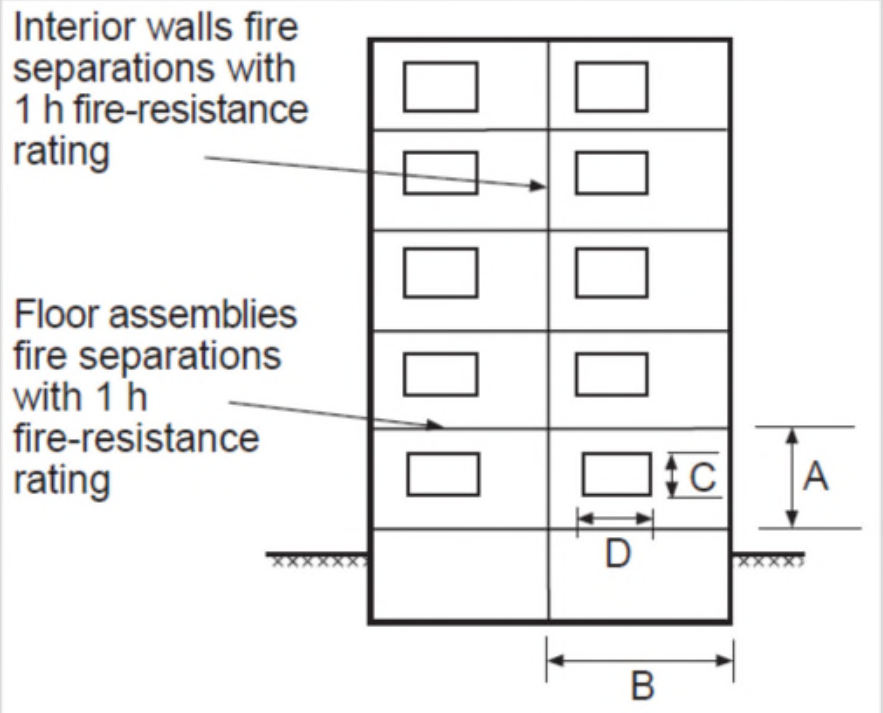
Spatial Separation (Tables 3.2.3.1.-B to 3.2.3.1.-E):	
North Wall	
Occupancy:	C
Wall Height (m):	3
Wall Width (m):	40
Wall Area (m^2):	120.0
Limiting Distance (m):	4
Permitted UPO (%):	33%

Spatial Separation - Exposing Building Face



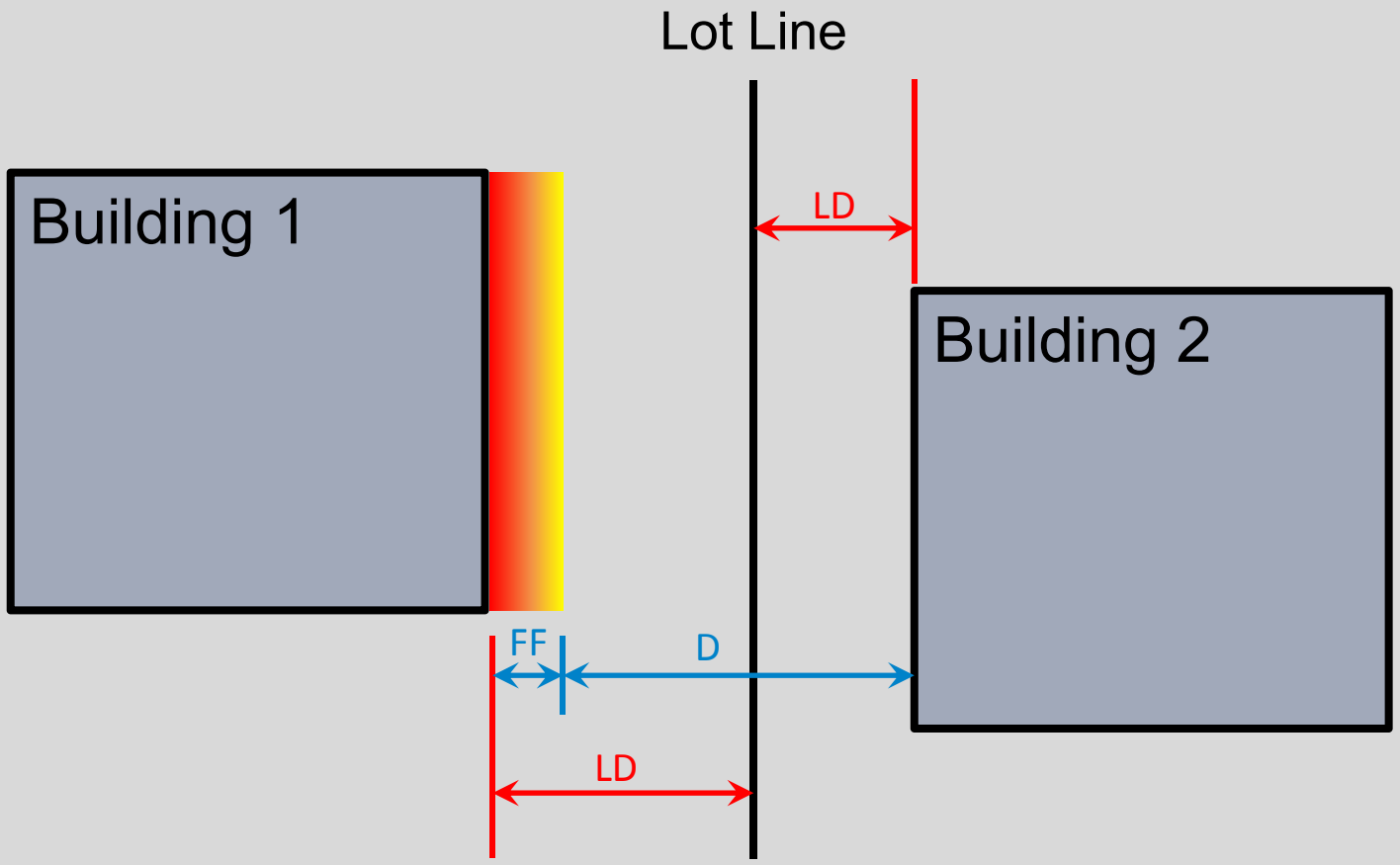
Spatial Separation - Exposing Building Face

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



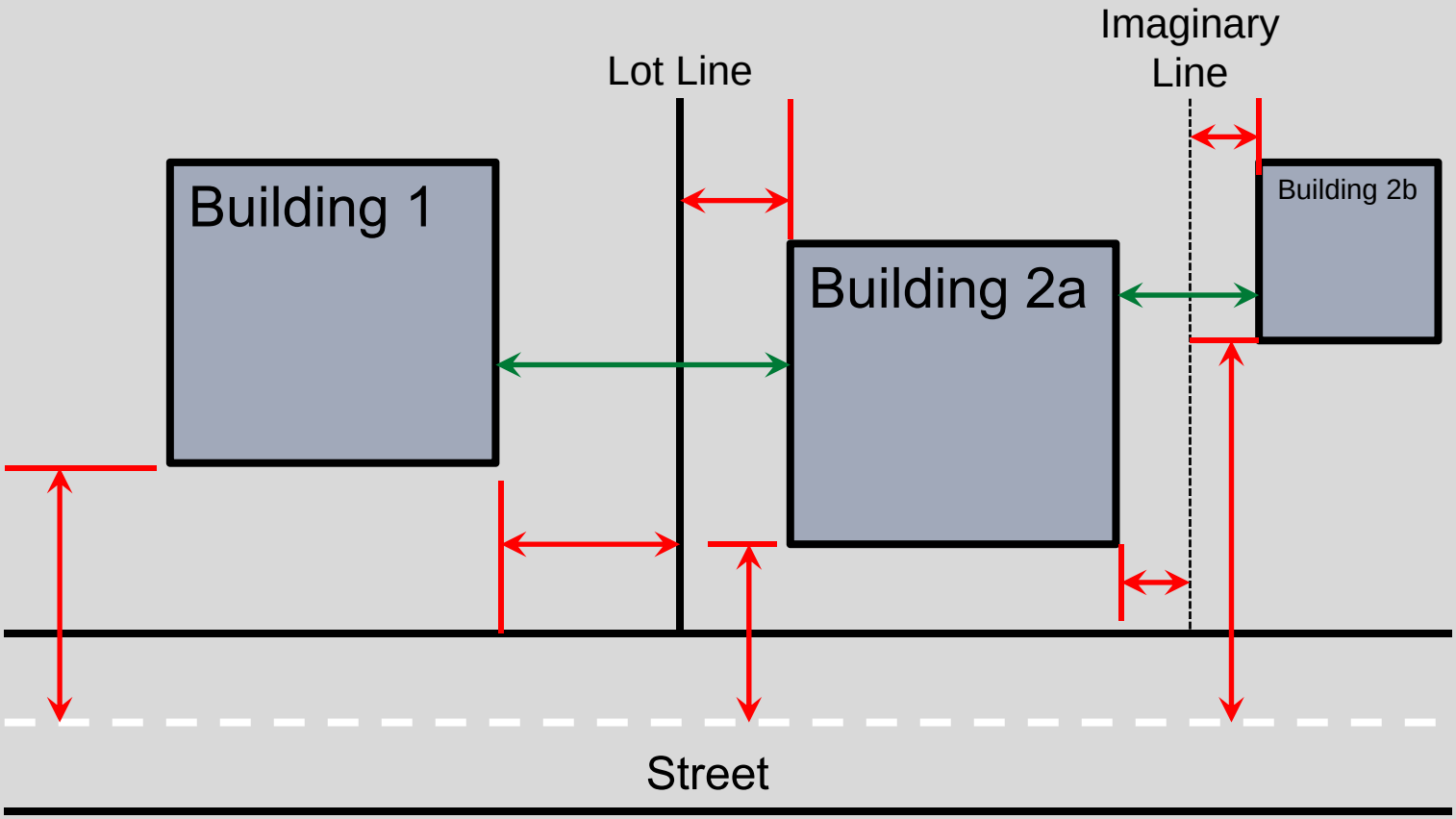
Spatial Separation – Limiting Distance

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



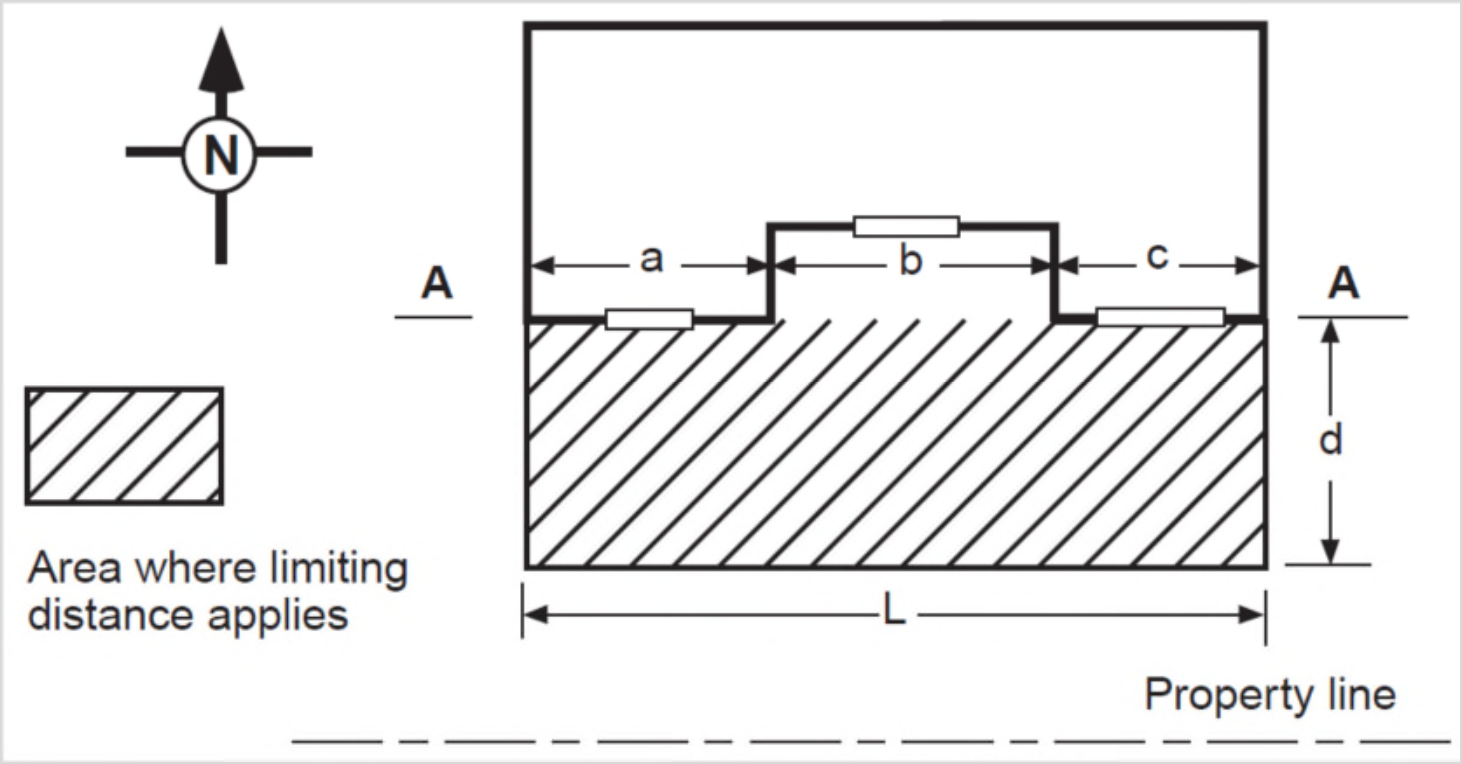
Spatial Separation – Limiting Distance

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

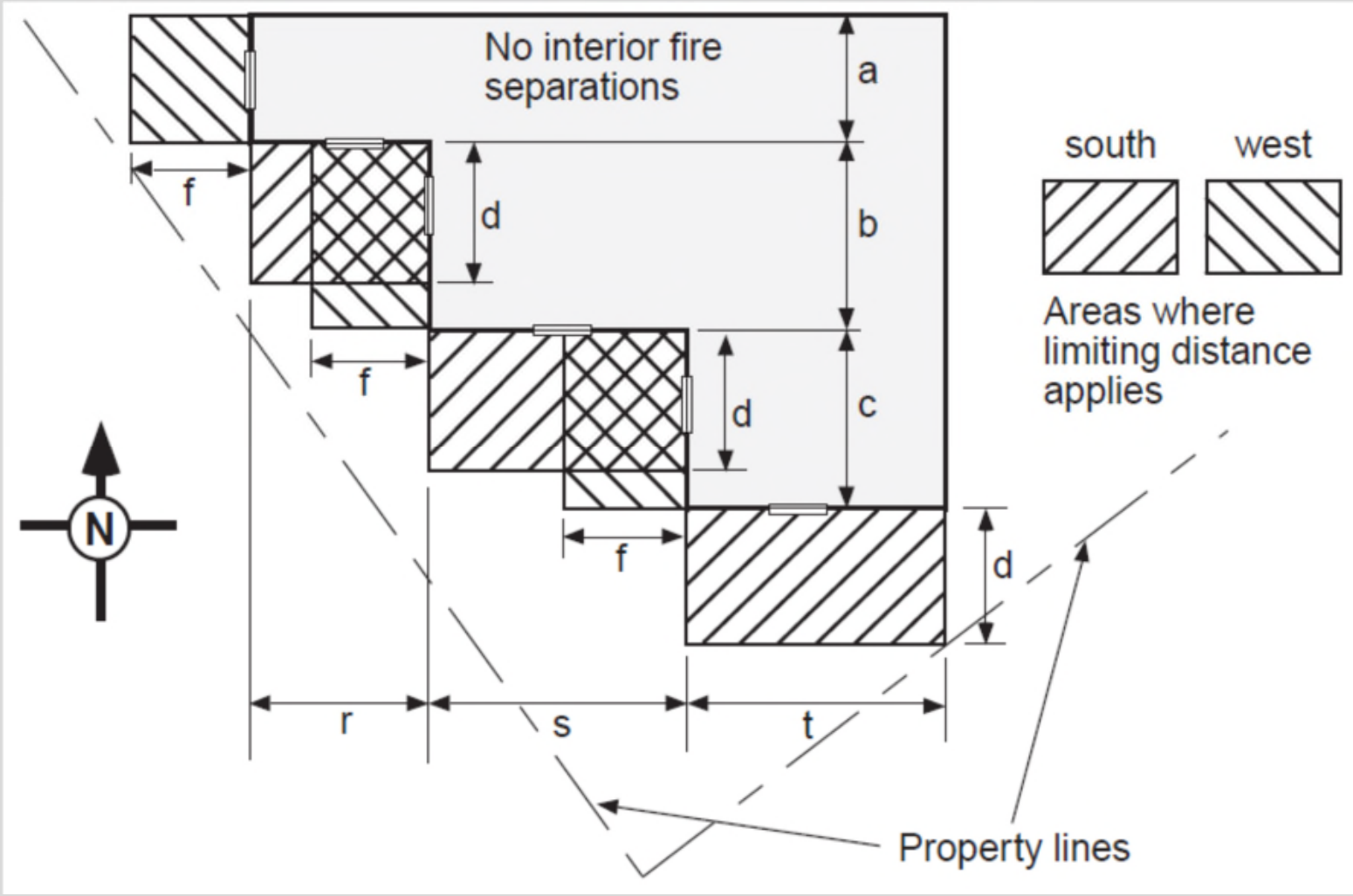


Spatial Separation – Limiting Distance

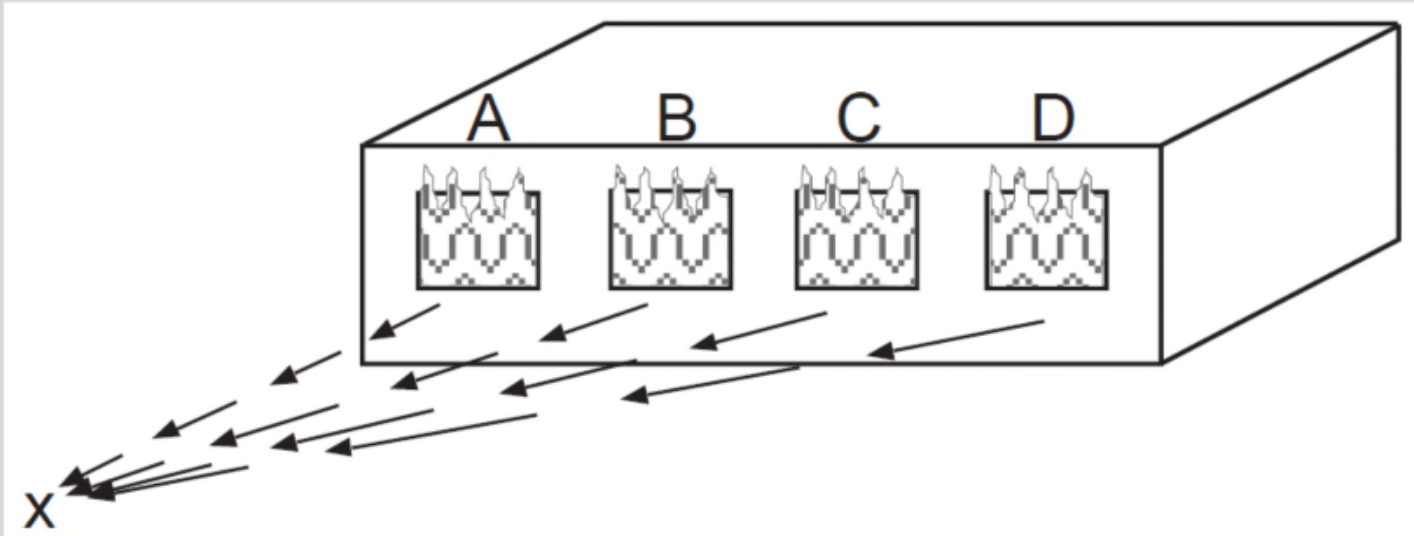
› Limiting Distance – Irregular Building Face - Projection onto Closest Plane Perpendicular to the



Spatial Separation – Limiting Distance



Spatial Separation – Unprotected Opening



area of exposing building face (south side)	$= 15 \times 3 = 45\ m^2$
area of unprotected openings	$= 15\ m^2$
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

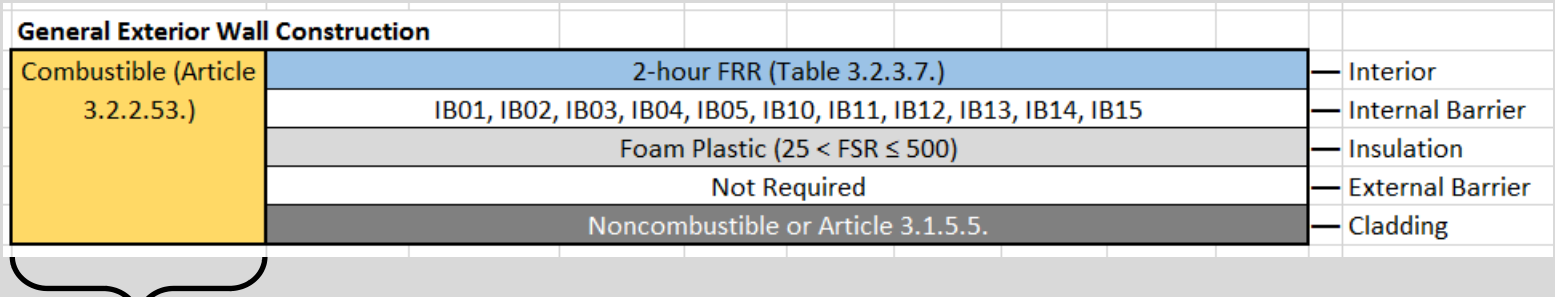
West Exterior Wall Construction

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



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

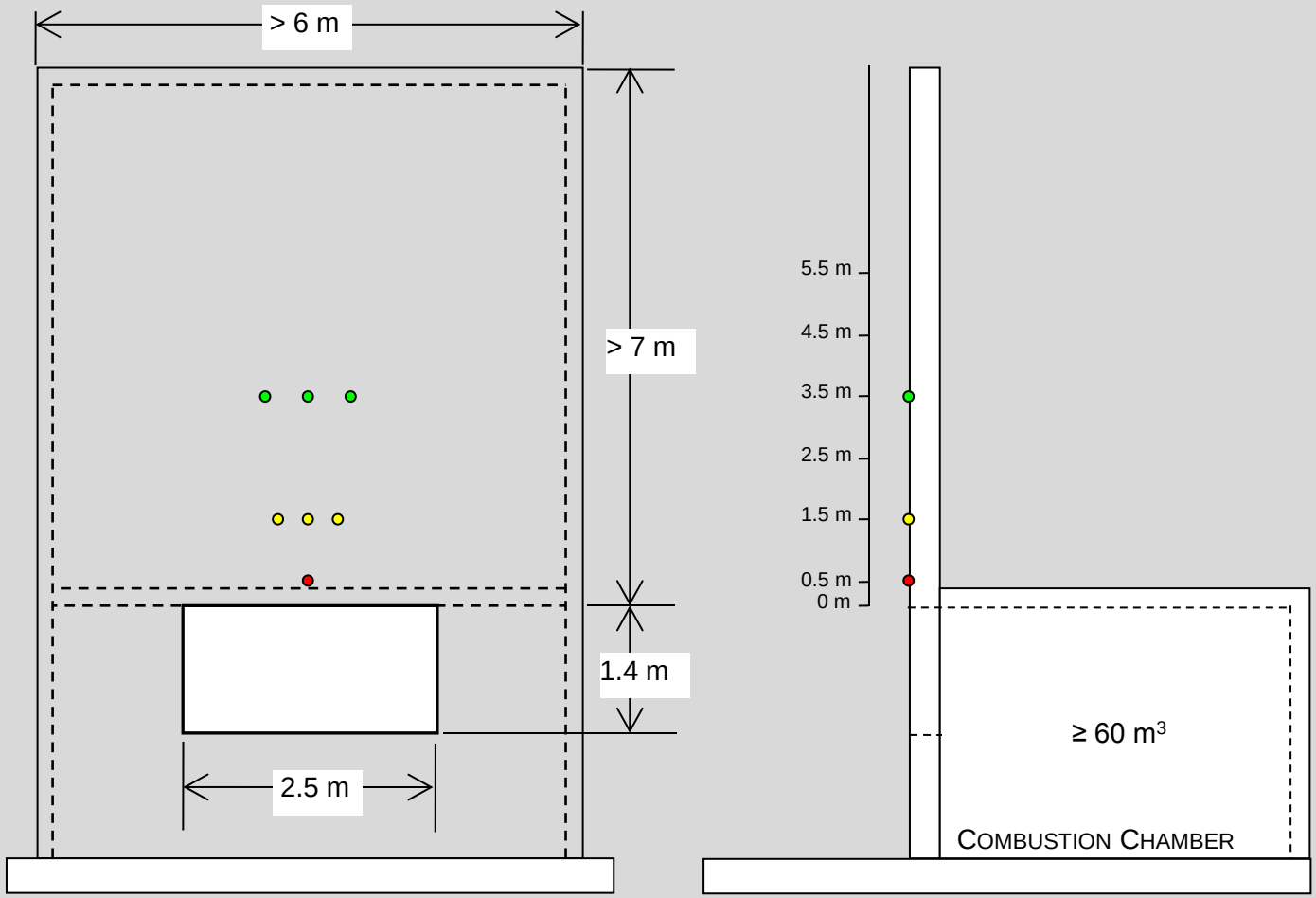
Exterior Wall Construction – Spatial Separation Based

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

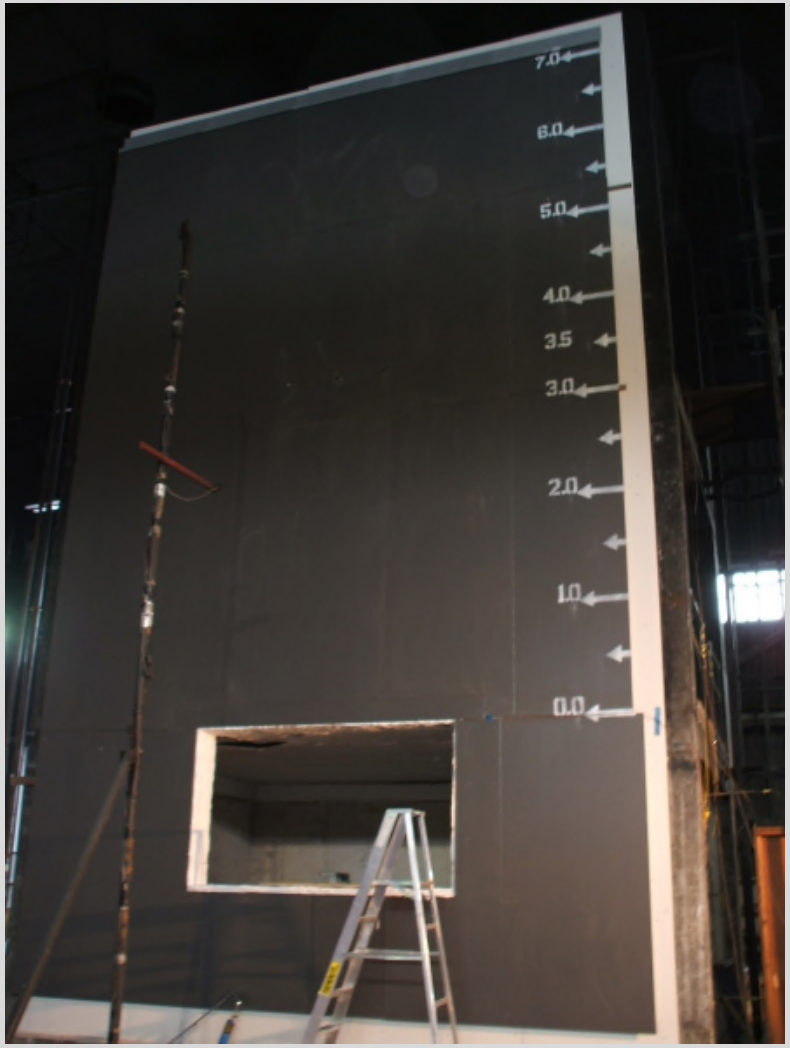
Occupancy Classification of *Building* or *Fire Compartment*	Maximum Area of *Unprotected Openings* Permitted, % of *Exposing Building Face* Area	Minimum Required *Fire-Resistance Rating*	Type of Construction Required	Type of Cladding Required
Group A, B, C, D, or Group F, Division 3	0 to 10	1 h	*Noncombustible*	*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*(1)
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.)	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 – Cladding (3.1.5.5.)



Exterior Wall Construction – Cladding (3.1.5.5.)



Building Solutions

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*

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
- Develop a “Web Interface” so that it can be on everyone’s desktop
- 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)

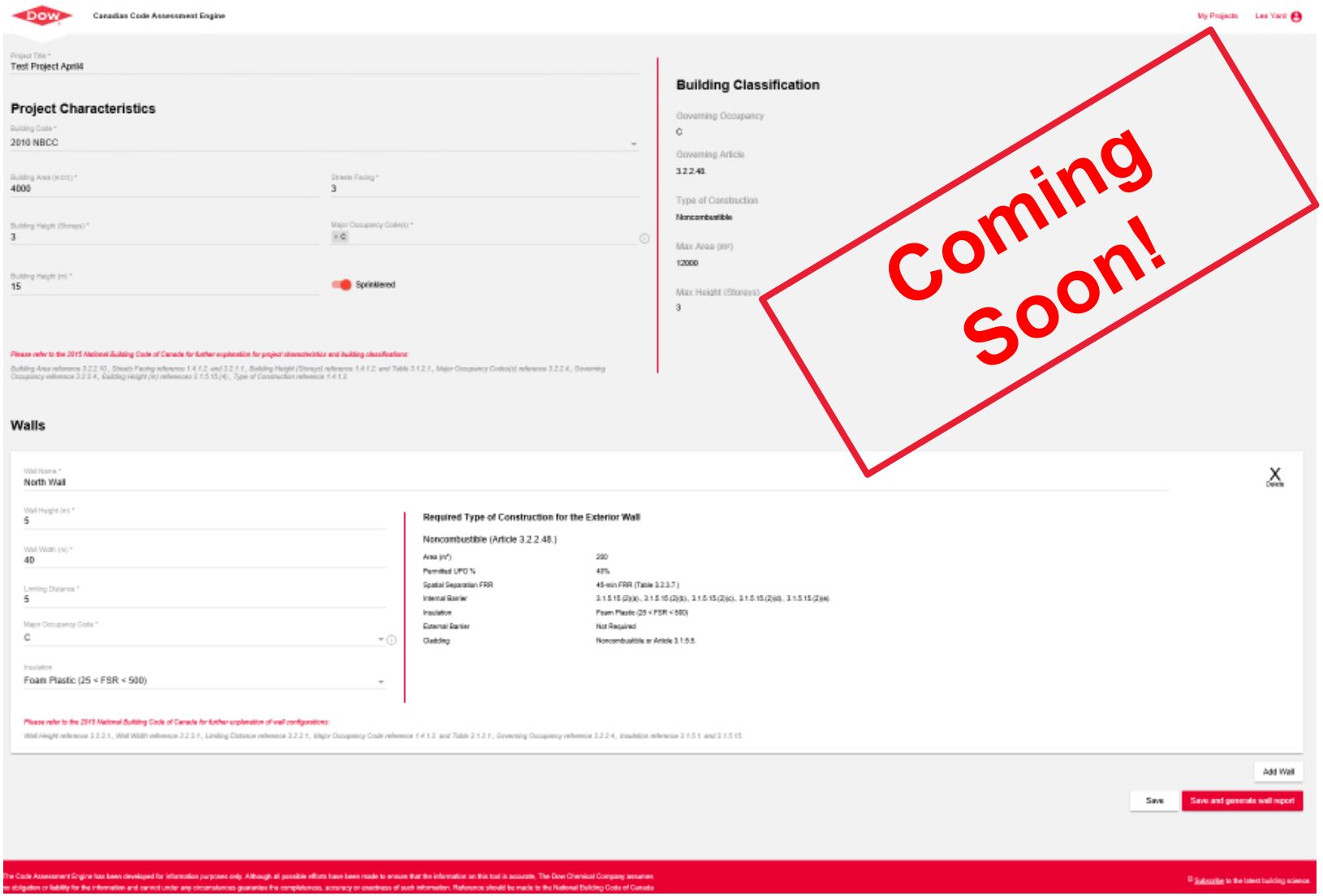
Building Solutions

NBC Building Code Tool

Where do we go from here?

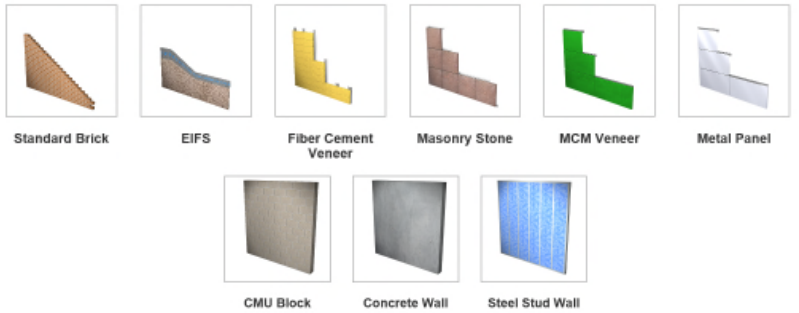
Dow.com

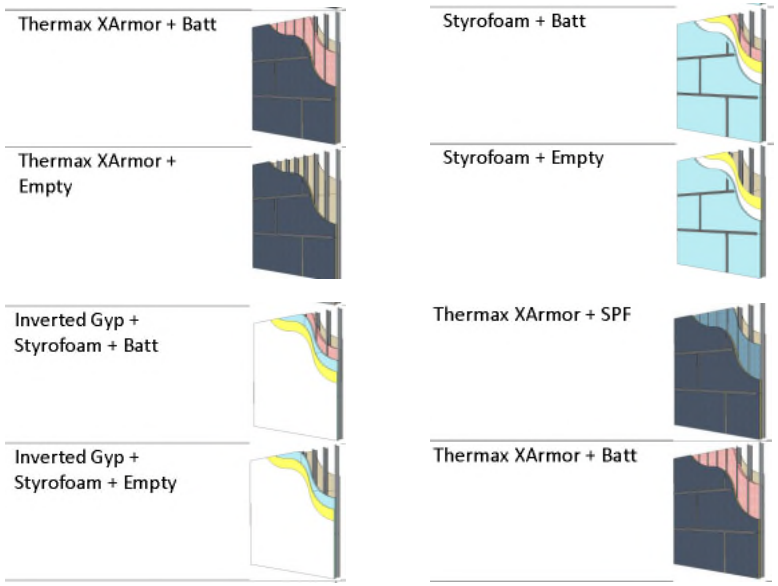
Code Assessment Engine – Web Interface

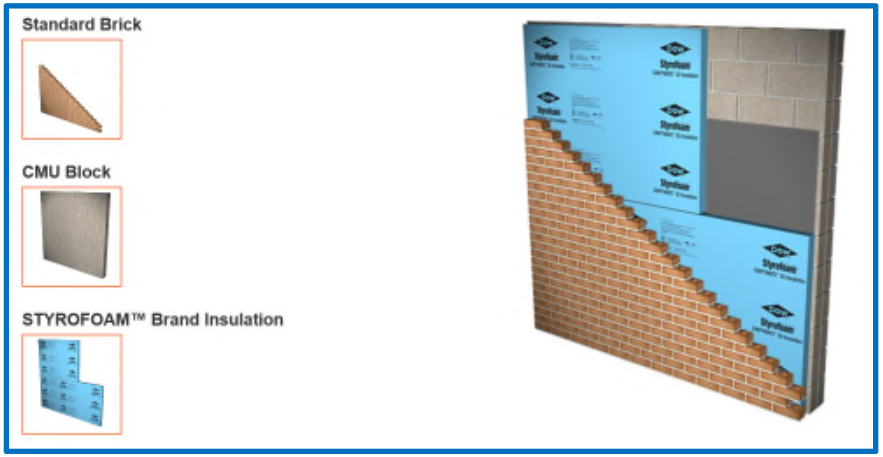


What Wall Configuration?

Many Options …







Successful Wall Design and Construction Requirements Must Meet …

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

Which Wall Assembly?

Can we use Foam Plastic Insulation?

- Wall Builder
- Code Assessment Engine

What Above Grade Wall to Choose?

- Interactive/ Consultative Presentation

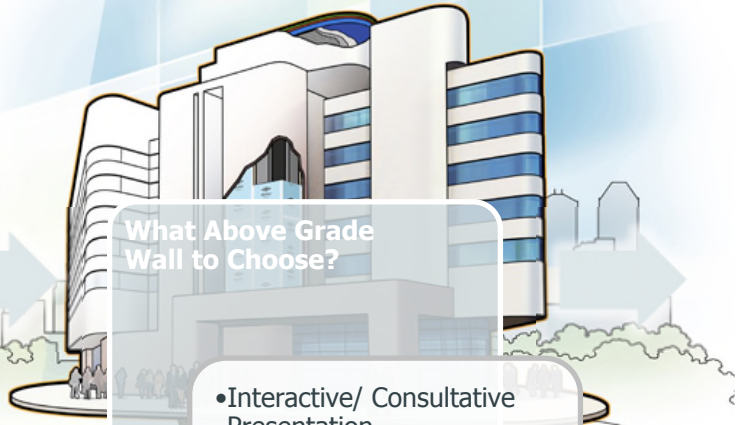
How Can I Compare Above Grade Wall Assemblies?

- Wall Analysis

Which Dow Solution?

Interactive Presentation

How to Compare Wall Assemblies?



Can we use Foam Plastic Insulation?

- Wall Builder
- Code Assessment Engine

What Above Grade Wall to Choose?

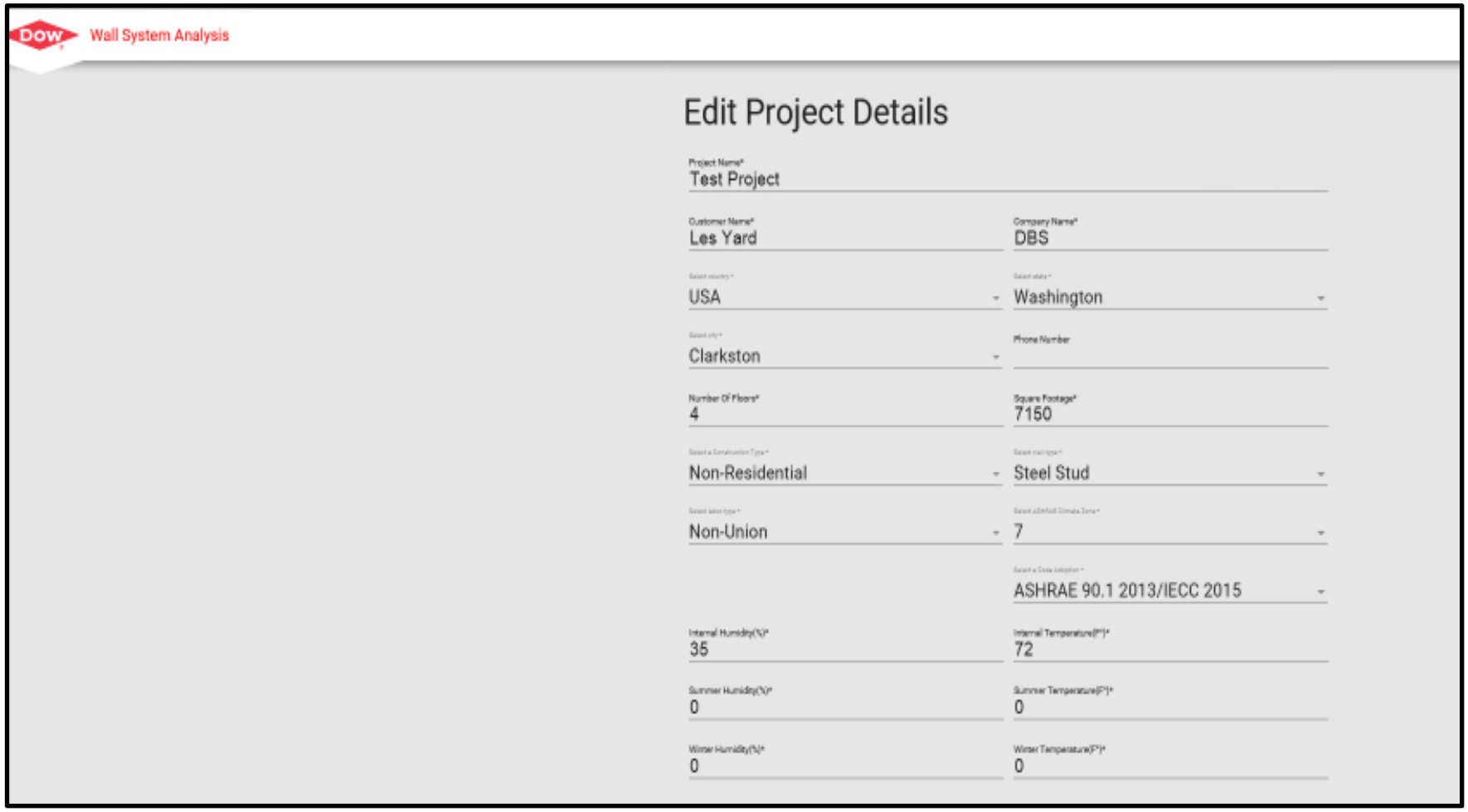
- Interactive/ Consultative Presentation

How Can I Compare Above Grade Wall Assemblies?

- Wall Analysis

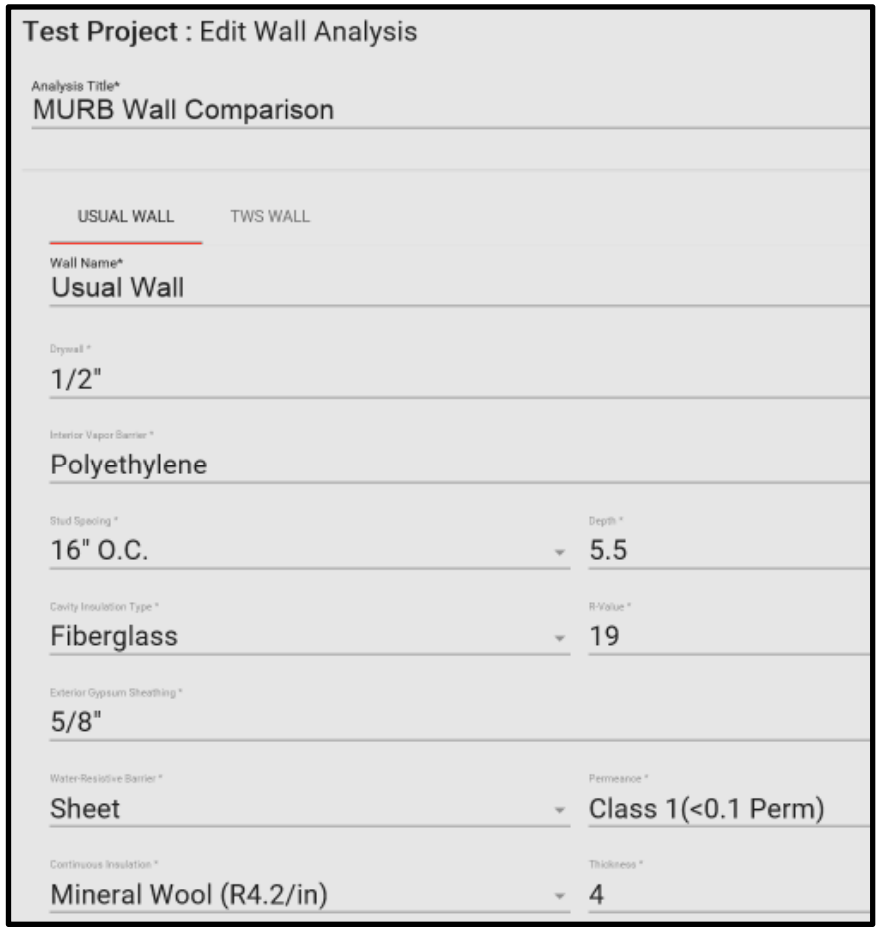
Why Use Dow Products & Solutions?

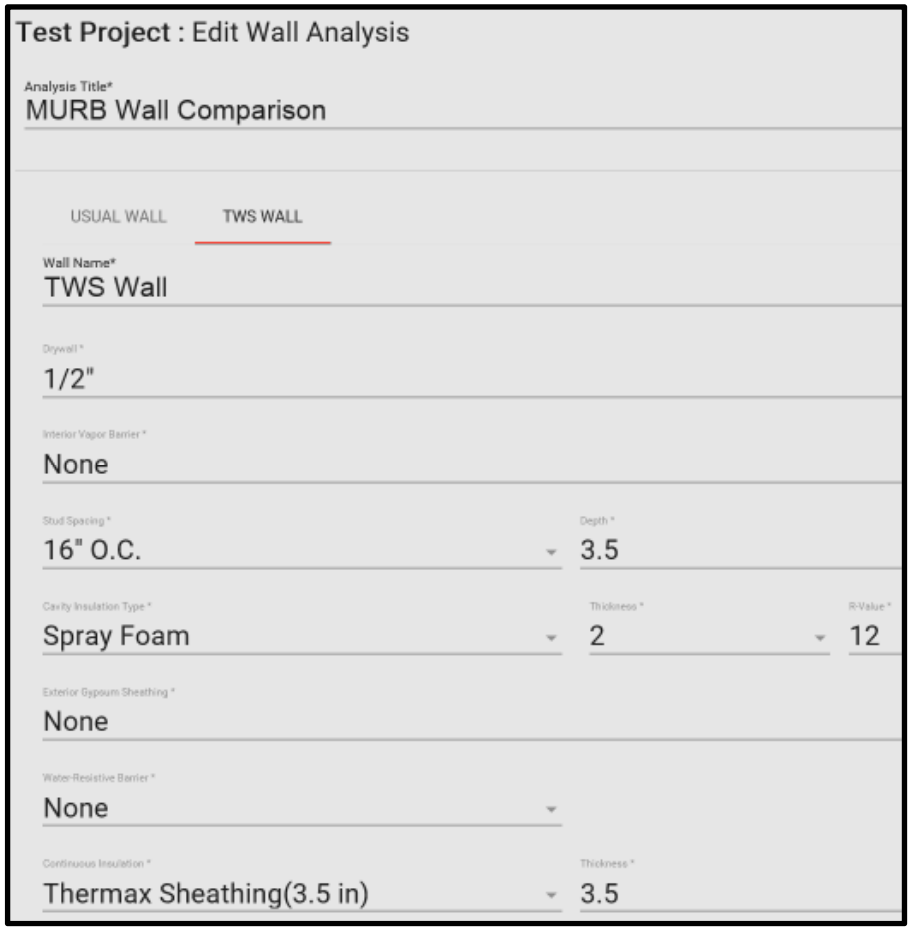
Wall Analysis Tool (Project Input)



Why Use Dow Products & Solutions?

Wall Analysis Tool (Wall Comparison / Input)





Why Use Dow Products & Solutions?

Wall Analysis Tool (Output)

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

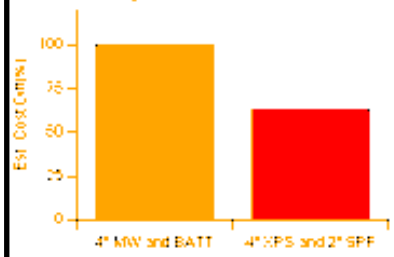
Temperatures & Humidity

Interior - Temperature	70
Interior - Humidity	35
Summer - Humidity	40
Summer - Temperature	80
Winter - Humidity	60
Winter - Temperature	10

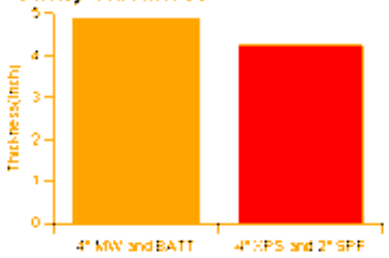
Cost & Performance

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

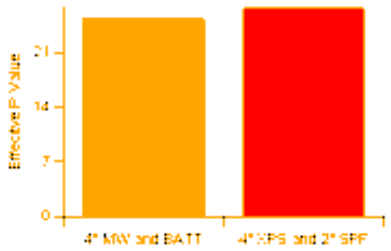
Cost Analysis



Cavity Thickness



R-Value



The Dow Chemical Company
Dow Building Solutions
200 Larkin Center
Midland, MI 48674

Sales and Technical Information
1-800-583-BUILD (2845)

Building Solutions building.dow.com
Masonry Systems dowallsystem.com
Framed Assemblies dowallsystem.com

Presentation Overview

Can we use Foam Plastic Insulation?

- Wall Builder

- Code Assessment Engine

What Above Grade Wall to Choose?

- Interactive/ Consultative Presentation

How Can I Compare Above Grade Wall Assemblies?

- Wall Analysis

Thank You

Q & A?

Les Yard CTR
Building Science Specialist
Dow Building Solutions

Dow Chemical Canada ULC
604-472-7266 | 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
O: +1 604-295-4000 | F: +1 604-295-3434
kcalder@jensenhughes.com | www.jensenhughes.com