



Building Solutions



Canadian Code Assessment Engine and Above Grade Wall Solutions

■ 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

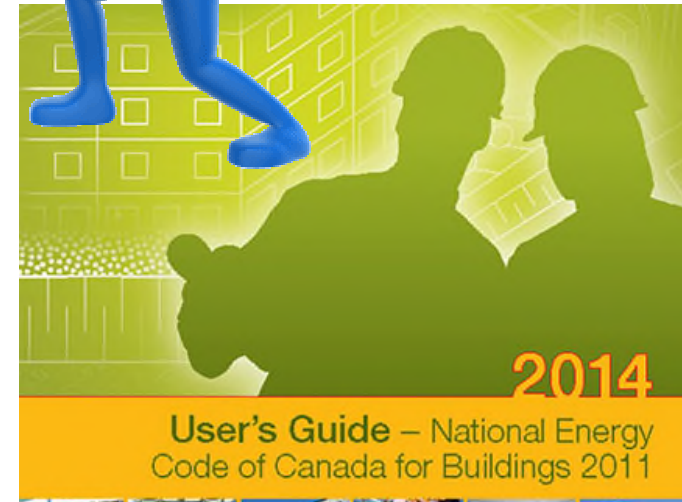
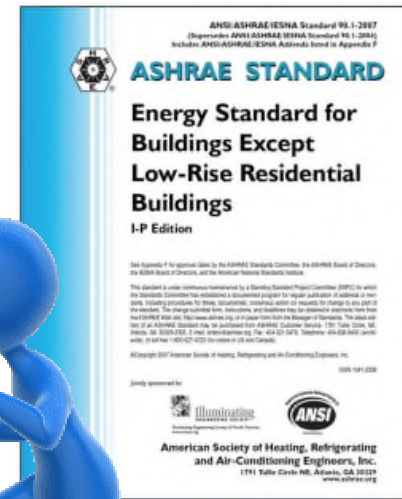
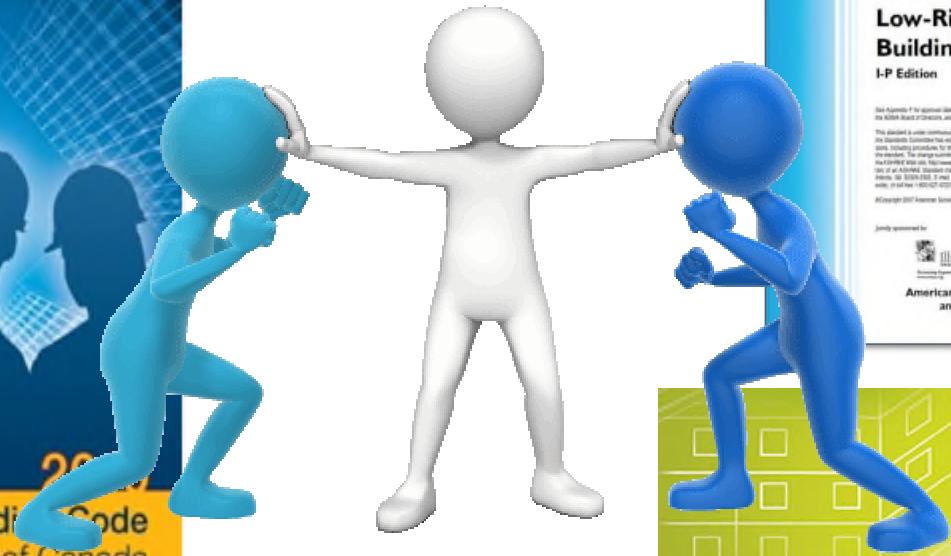
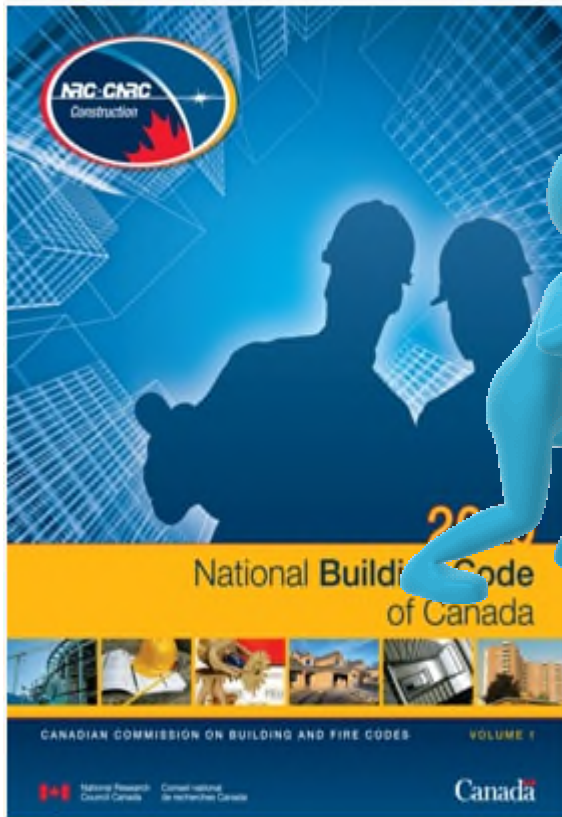


How Can I Compare Above Grade Wall Assemblies?

•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...?



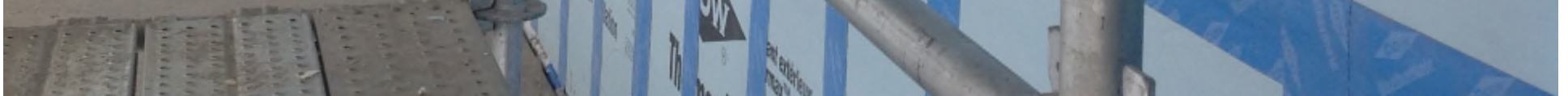
Hugh Bird Vancouver



Surmont II Multipurpose Building Fort McMurray



Ottewell Terrace Edmonton





John Paul 2 Vancouver



10 Years + US Experience

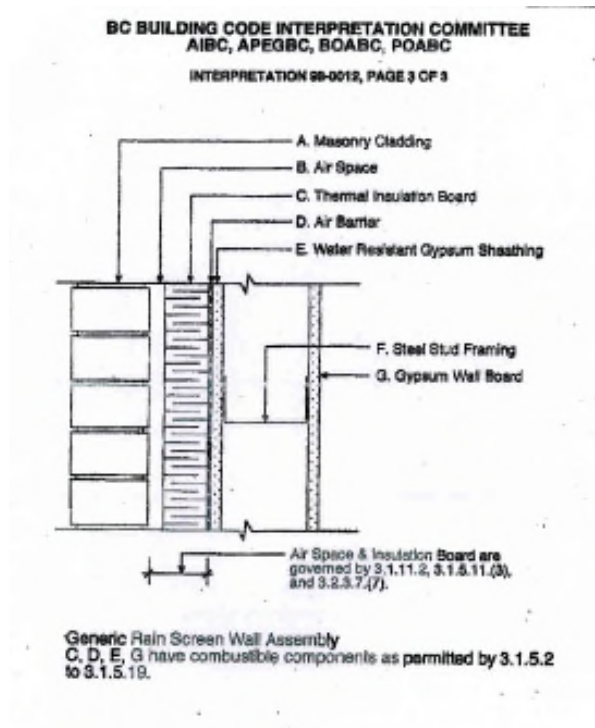


Hugh Bird – Rainscreen Stucco Wall XPS

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)

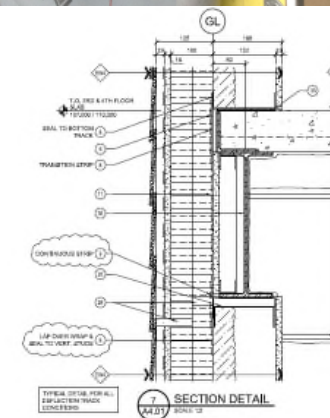




Ottewell Terrace TWS

Inverted Wall Assembly

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



OTTWELL TERRACE - Seniors' Apartment & Daycare
REVISED SECTION DETAIL T/AAL11

ASK 26R1
Building Solutions





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
OFFICE OF THE CHIEF BUILDING OFFICIAL
Community Services, 453 West 11th Avenue, Vancouver, BC, V5Y 1V4

ALTERNATIVE SOLUTION PROPOSAL
(In Accordance with Section 2.3 OF Division C of the Vancouver Building By-law)

BU 457879 Building Permit No. 749 West 35th Street, Vancouver, BC July 24, 2013, Revised Nov 6, 13 Date

For office use only
Payment \$ 697.00 Invoice Number CK 013384 AL Number AL 401472

APPLICANT INFORMATION
Proposed By: Jun H. Kim, B.Sc., P.Eng. / K.M. Gary Chen, M.Sc., P.Eng.
Firm: GHL CONSULTANTS LTD.
Address: 650 - 409 Granville Street, Vancouver, BC
Phone: 604.689.4449 Fax: 604.689.4419 Email: jh@ghl.ca / gk@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 CANULC-S134. The proposed exterior wall assembly using Dow Thermax Sheathing with aluminum or Hord panel cladding has not yet been tested per CANULC-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
K.M. CHEN
604 689 4494
ENGINEER
NOV 21 2013



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

Main reason is ...

CODE Confusion!!!



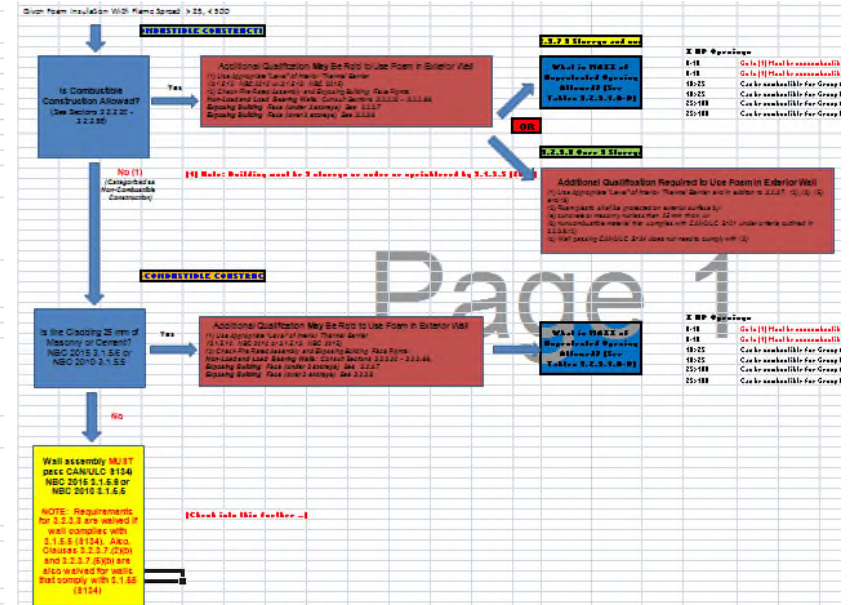
National Building Code of Canada

Analysis of Combustible and Noncombustible Code Requirements

PART 3 (Sections 3.2.2.20 - 3.2.2.36) - 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
Production & Viewing of the Performing Arts					
A	1	Any	Any	Y	NC
A	1	1	< 600 m ²	Y	NC, HT
A	1	1	Y	Y	NC, C
Elsewhere Classified in Group A					
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 ²	Y	NC, C
A	2	≠ 2	2 Storey = 2400 m ²	Y	NC, C
A	2	≠ 2	1 Storey = 2400 m ² (no basement)	Y	NC, C
A	2	≠ 2	1 Storey = 1200 m ²	Y	NC, C
A	2	1	2 Storey = 600 m ²	Y	NC, C
A	2	1	2 Storey = 500 m ²	?	NC, C
A	2	1	3 Storey = 600 m ²	?	NC, C
Assembly Occupancies of the Arena Type					
A	3	Any	Any	Y	NC
A	3	≠ 2	Table 3.2.2.30	Y	NC, HT
A	3	≠ 2	1 Storey = 1200 m ² 2 Storey = 6000 m ²	Y	NC
A	3	1	1 Storey = 2400 m ² 2 Storey = 3000 m ² 3 Storey = 3600 m ²	Y	NC, C
A	3	1	≠ 7200 m ²	Y	NC, C
A	3	1	1 Storey = 1000 m ²	?	NC, C
A	3	1	2 Storey = 1250 m ² 3 Storey = 1500 m ²	?	NC, C
Assembly Occupancies in which Occupants are Gathered in the Open Air					
A	4	Any	Any	Y	NC, HT
Detection Occupancies					
B	1	Any	Any	Y	NC, HT

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)

GLOBAL LEADERS IN FIRE ENGINEERING



FIRE ENGINEERING **BUILDING CODE**

FORENSICS **RESEARCH**




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	<u>Applicable Building Code:</u>	
2	2015 NBCC	

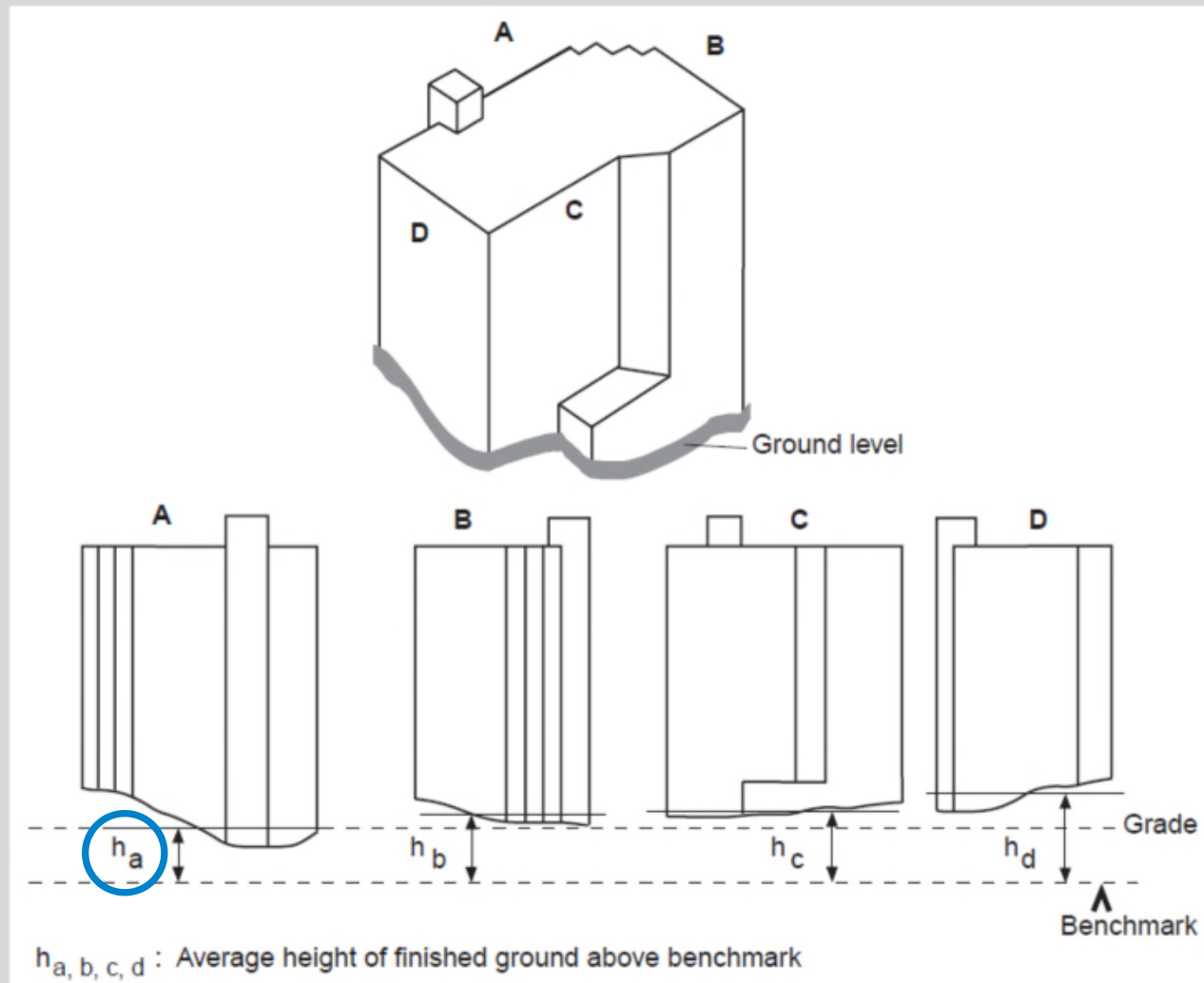


Project Characteristics

<u>Project Characteristics:</u>	
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

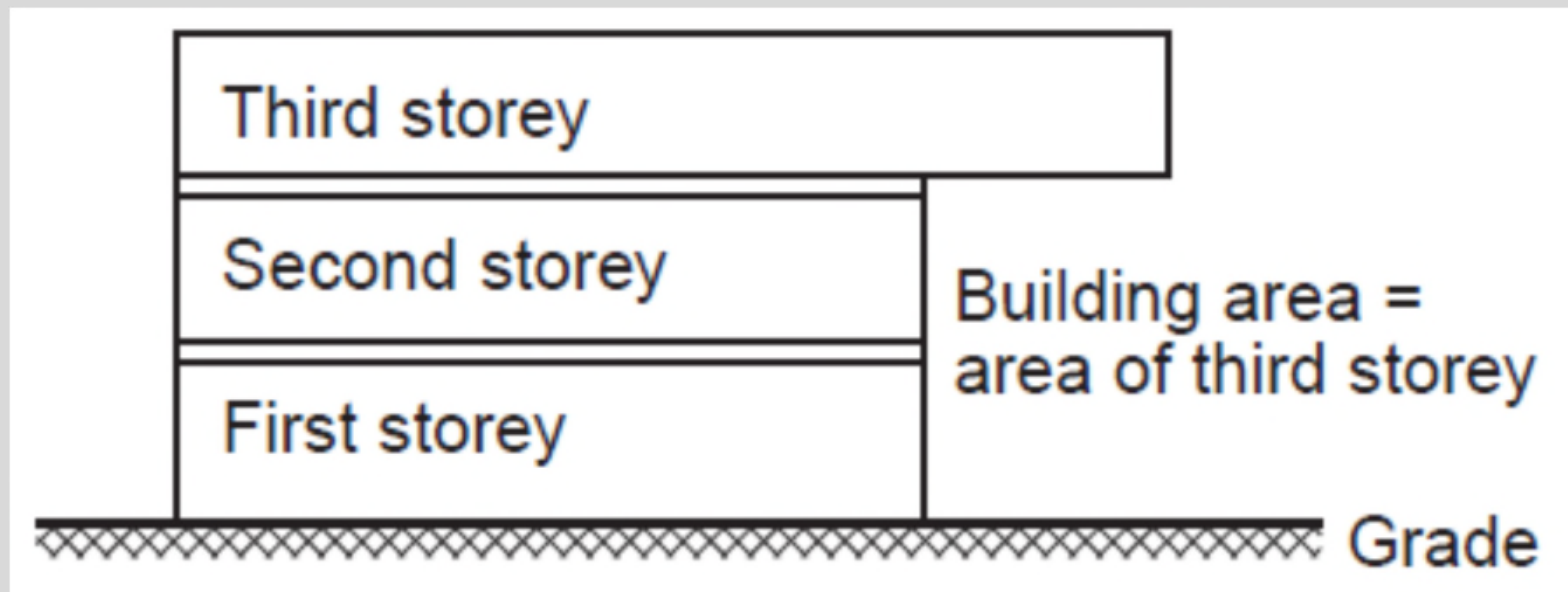


Project Characteristics – Grade

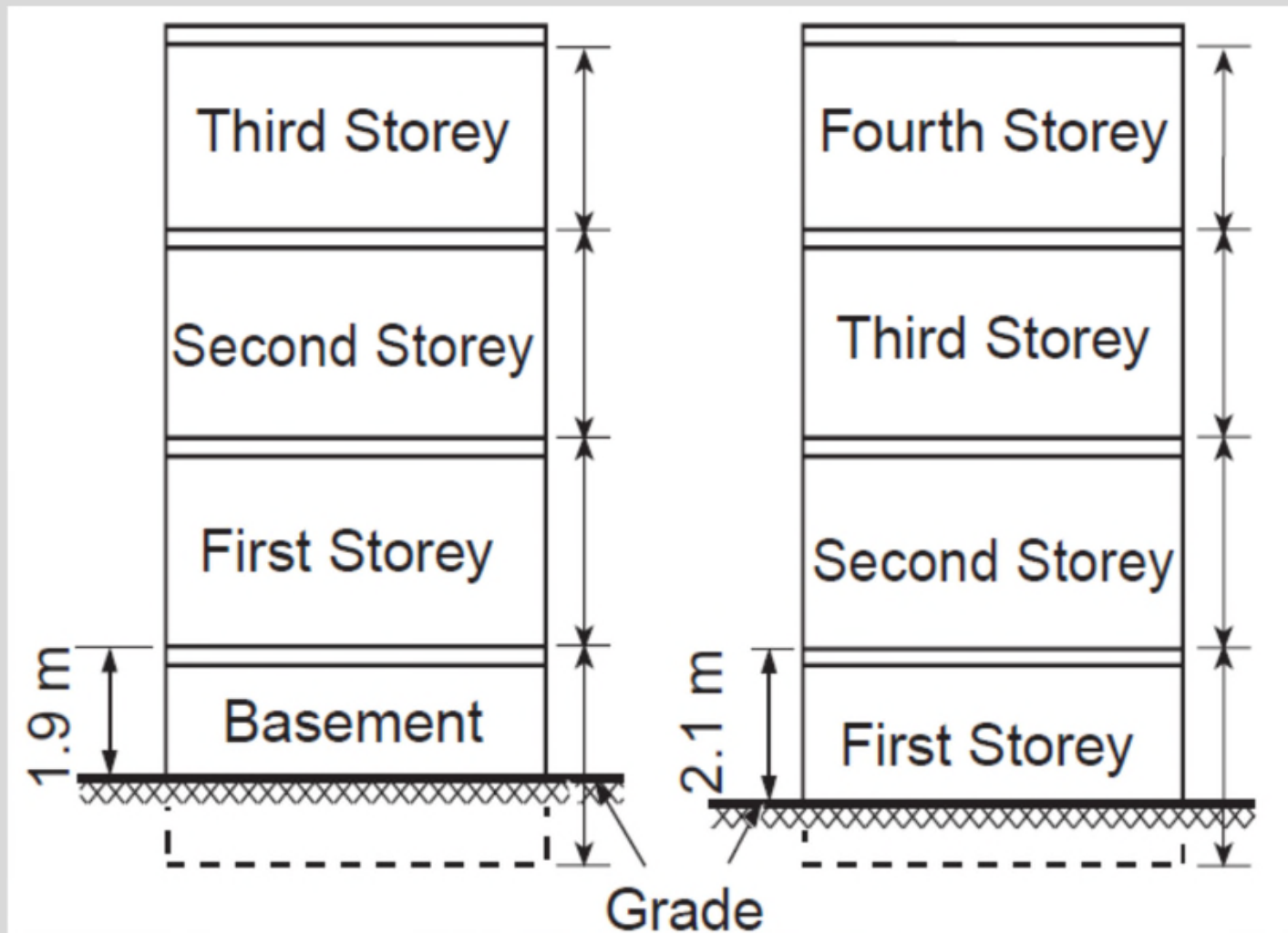


Project Characteristics – Building Area

› Building Area:

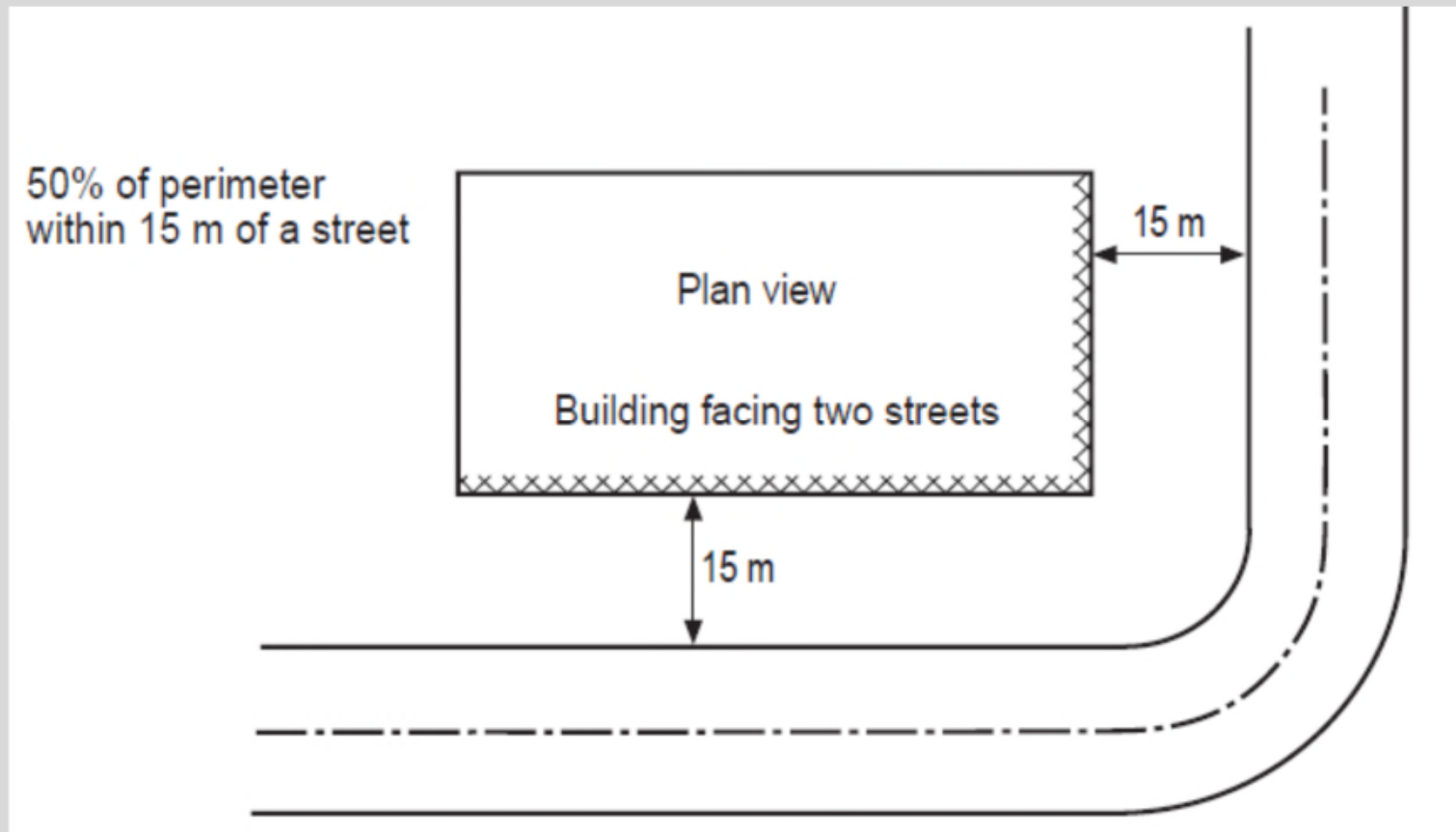


Project Characteristics – Building Height



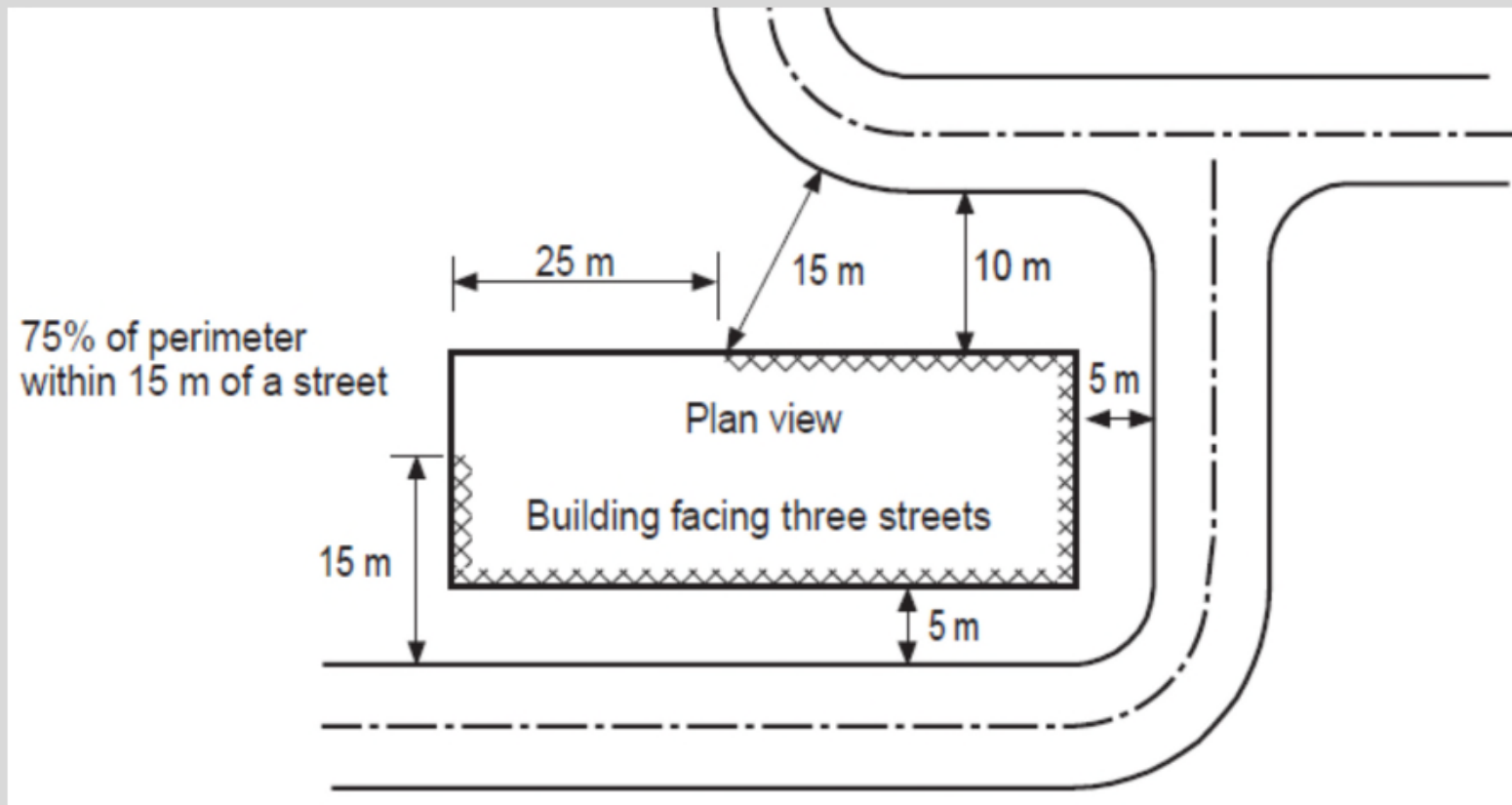
Project Characteristics – Streets Facing

› 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
- it is not more than 3 *storeys* in *building height*, and
 - 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)

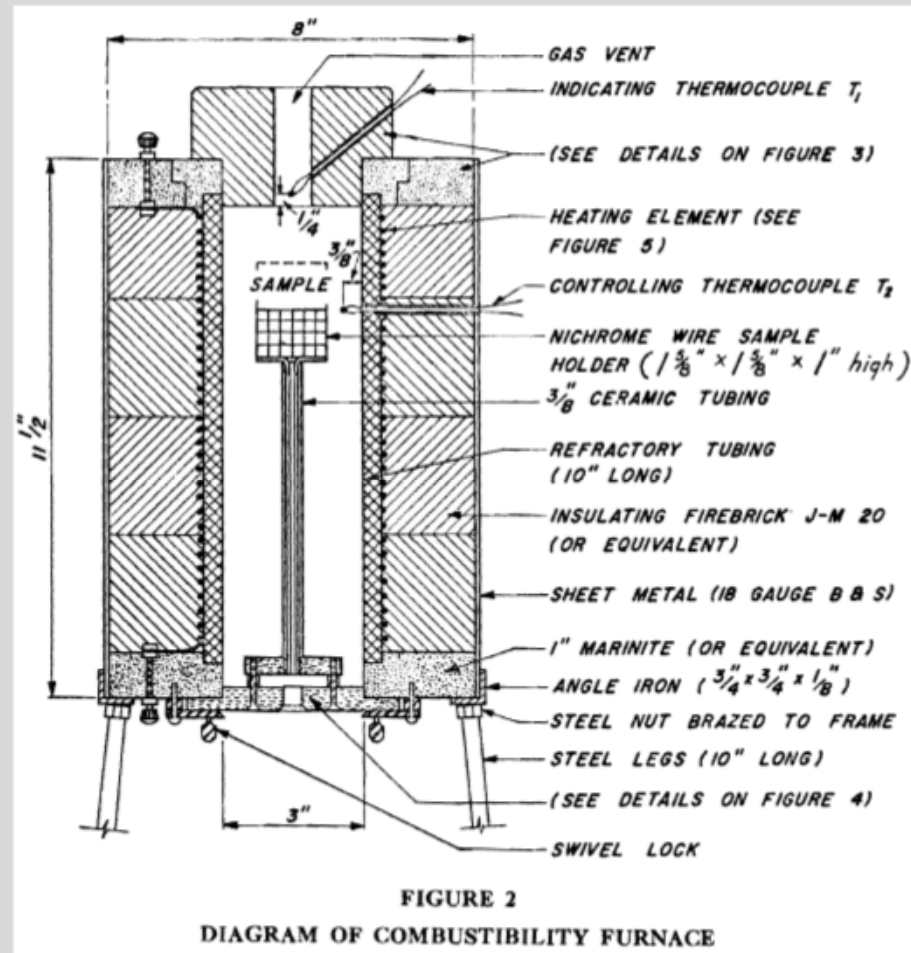
No. of Storeys	Maximum Area, m ²		
	Facing 1 Street	Facing 2 Streets	Facing 3 Streets
1	not limited	not limited	not limited
2	6 000	not limited	not limited
3	4 000	5 000	6 000

- 2)** The *building* referred to in Sentence (1) shall be of *noncombustible construction*, and
- except as permitted by Sentence (3), floor assemblies shall be *fire separations* with a *fire-resistance rating* not less than 1 h,
 - mezzanines* shall have a *fire-resistance rating* not less than 1 h,
 - roof assemblies shall have a *fire-resistance rating* not less than 1 h, and
 - 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:



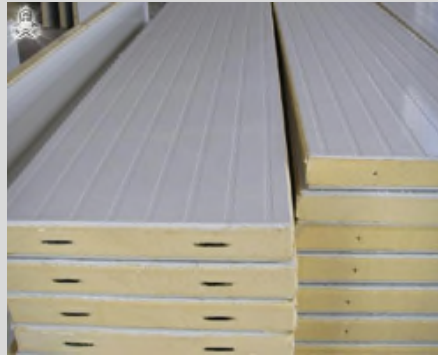
Building Classification - Type of Construction

- › **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

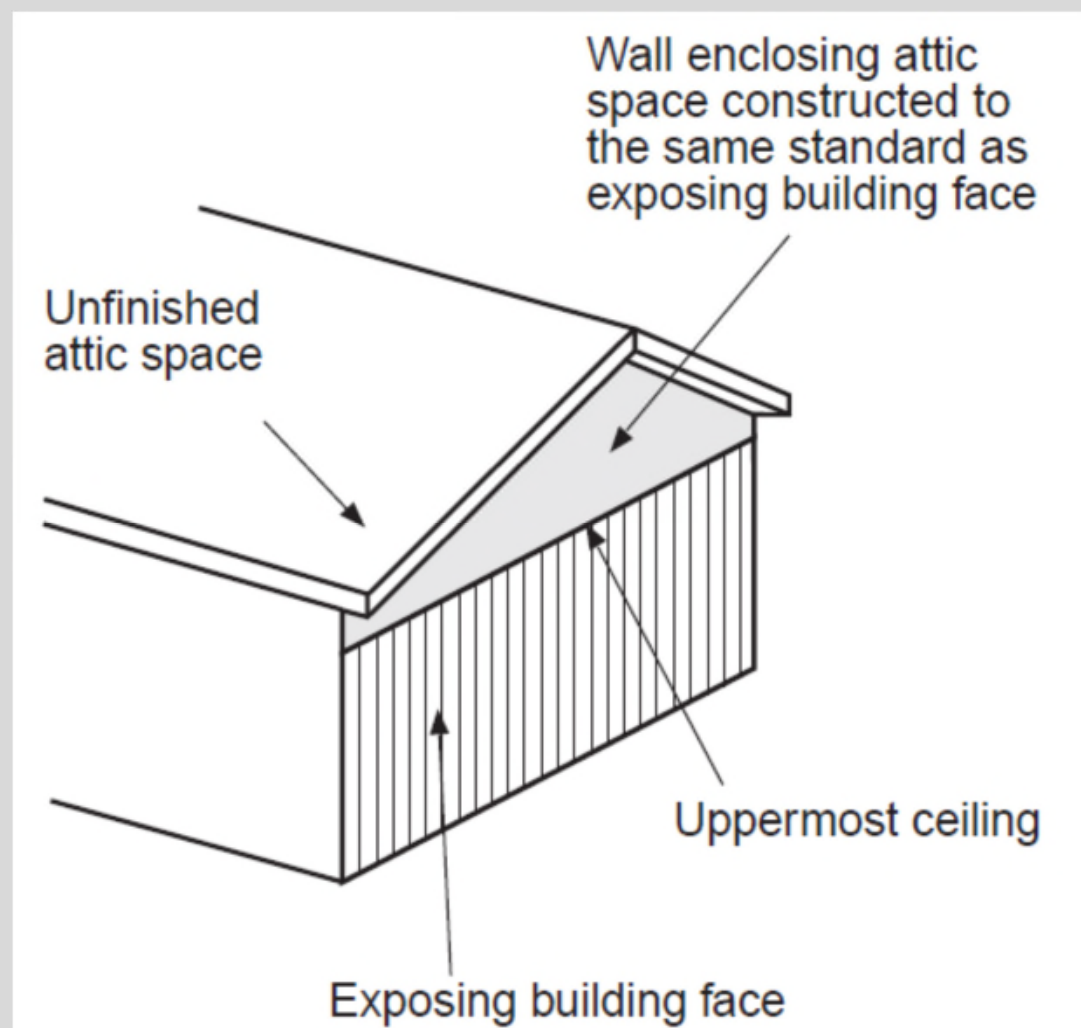
Spatial Separation (Tables 3.2.3.1.-B to 3.2.3.1.-E):

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%

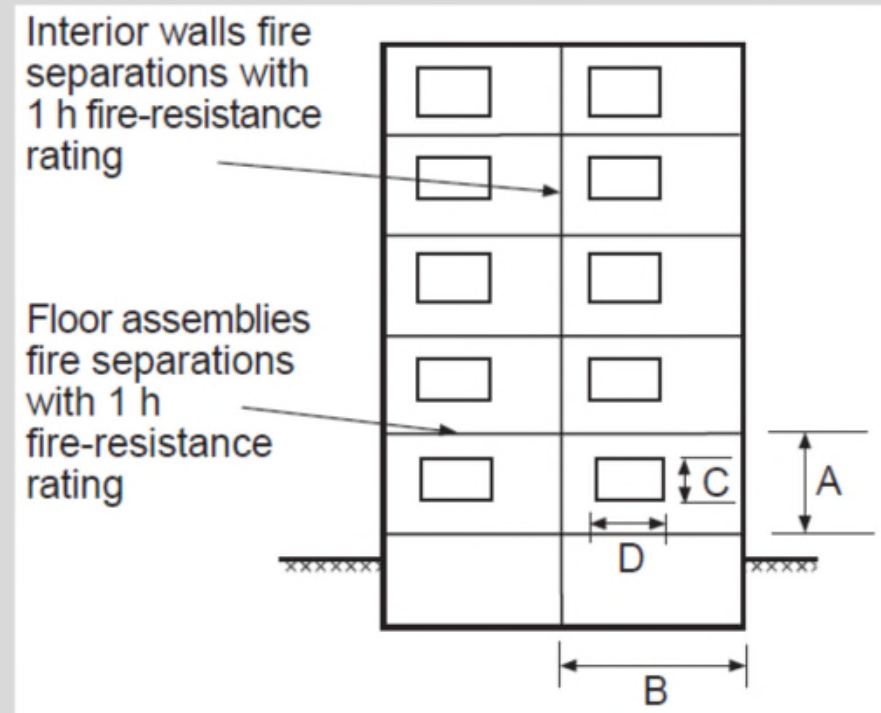


Spatial Separation - Exposing Building Face



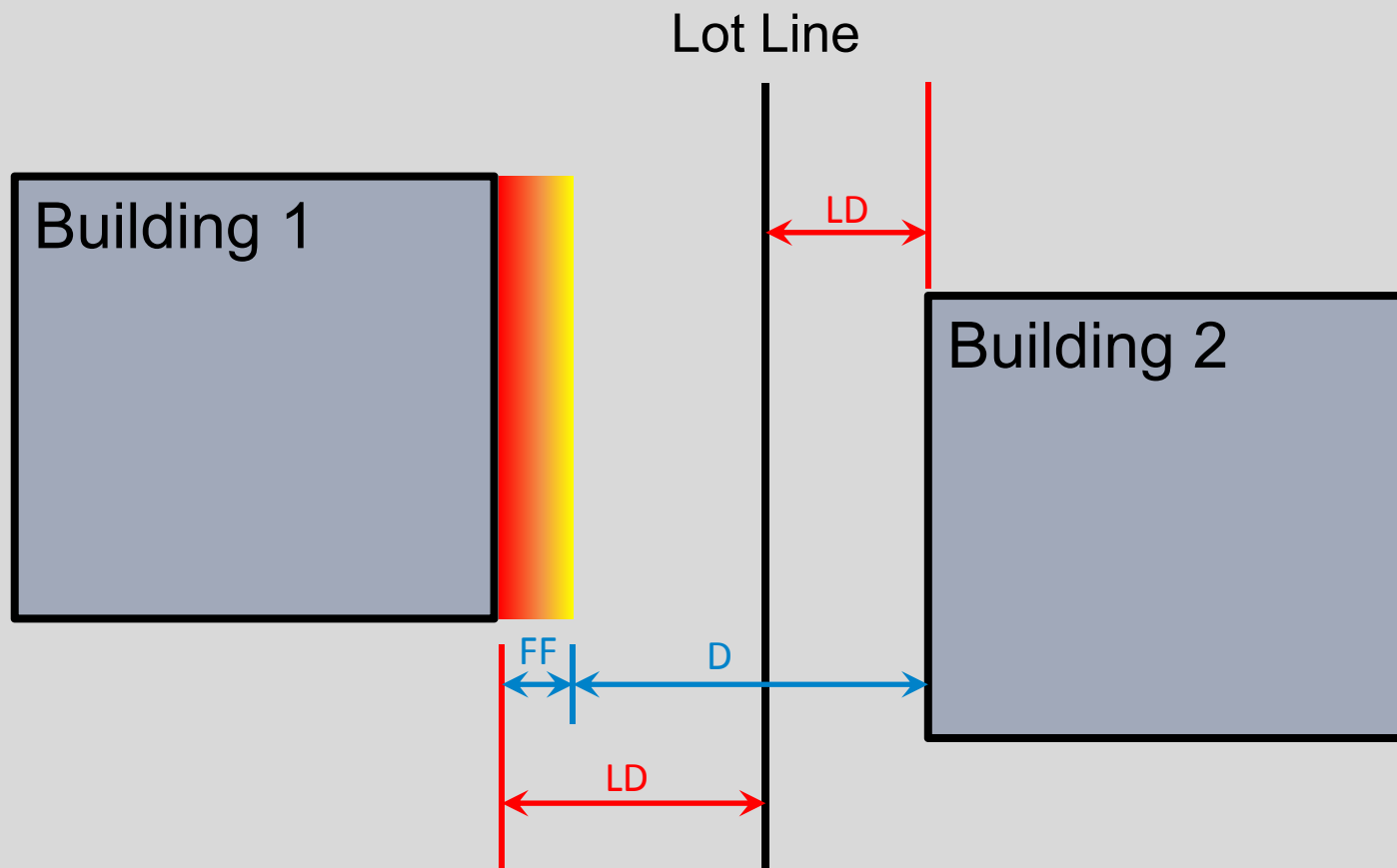
Spatial Separation - Exposing Building Face

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



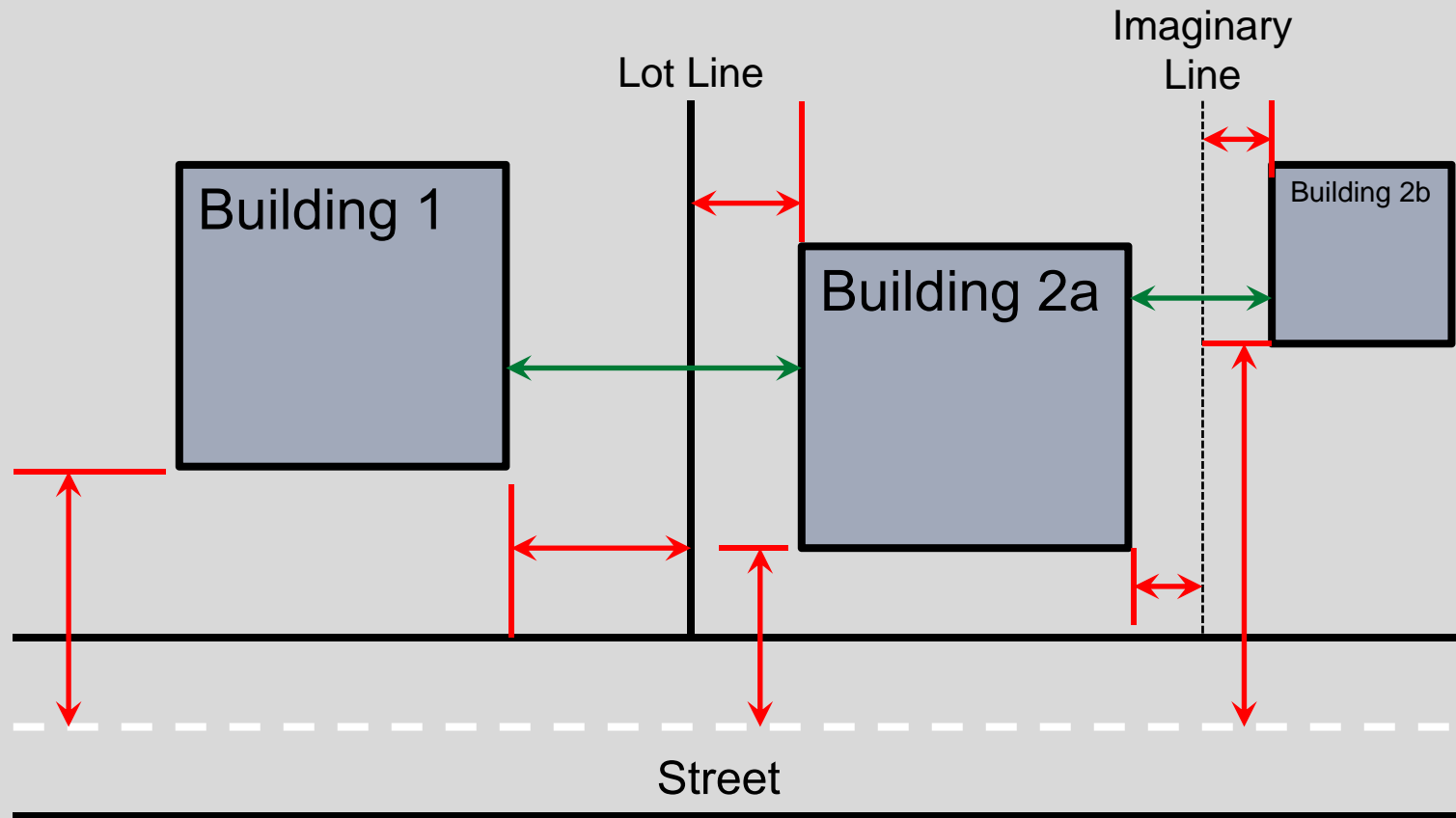
Spatial Separation – Limiting Distance

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



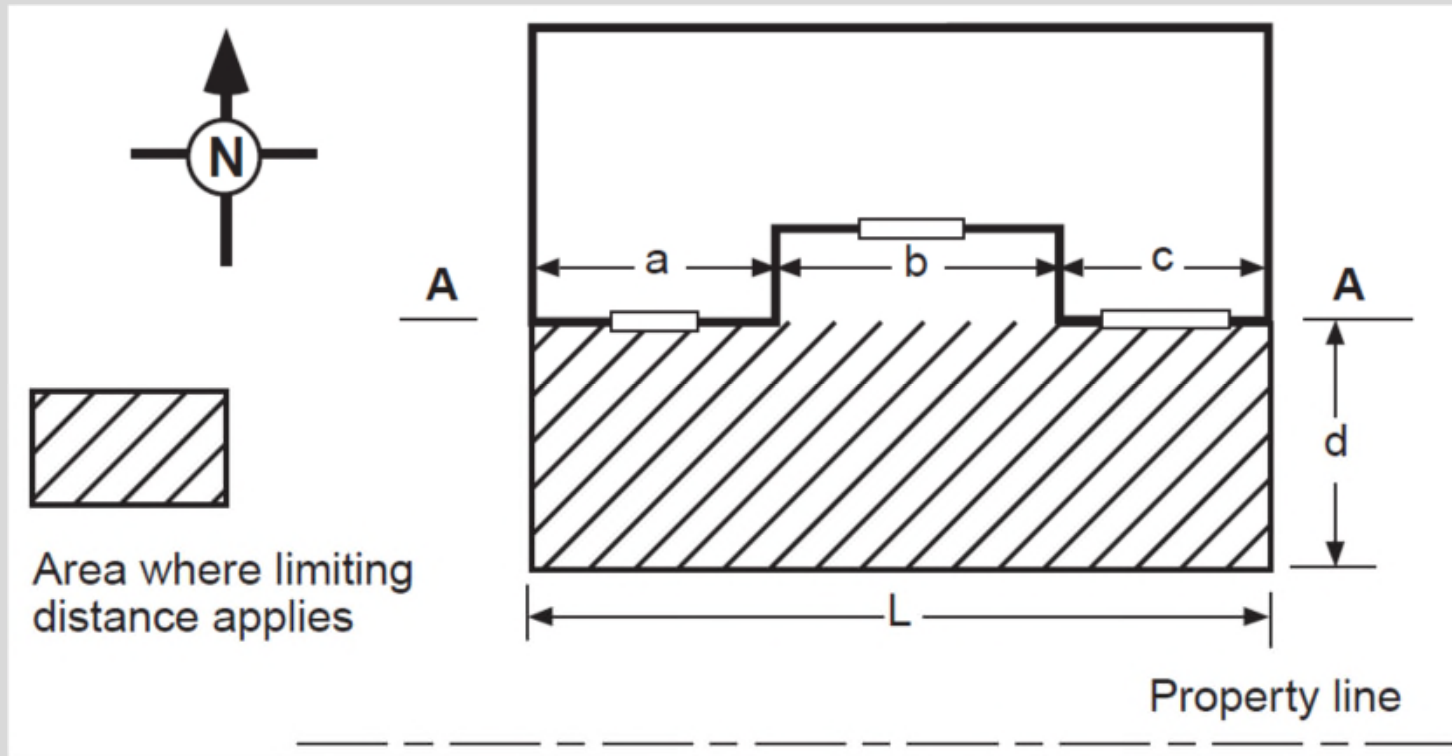
Spatial Separation – Limiting Distance

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

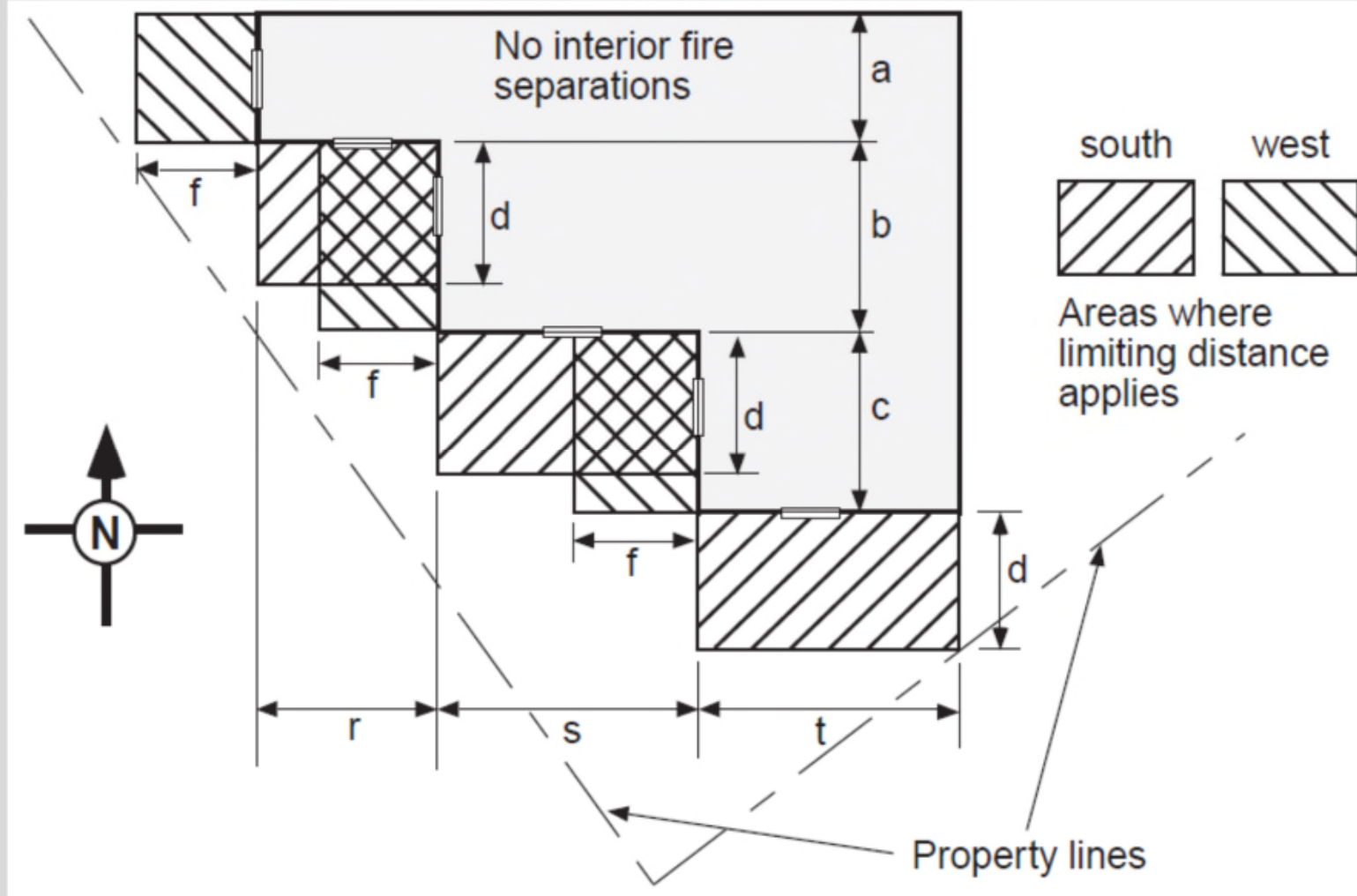


Spatial Separation – Limiting Distance

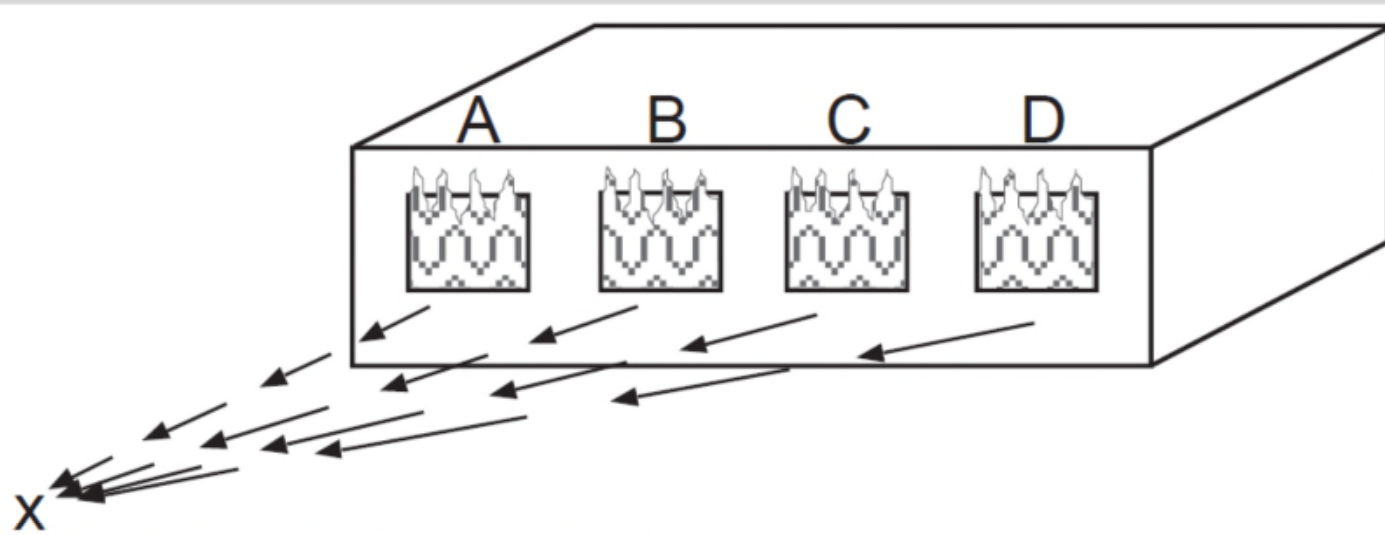
- › Limiting Distance – Irregular Building Face - Projection onto Closest Plane Perpendicular to the



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

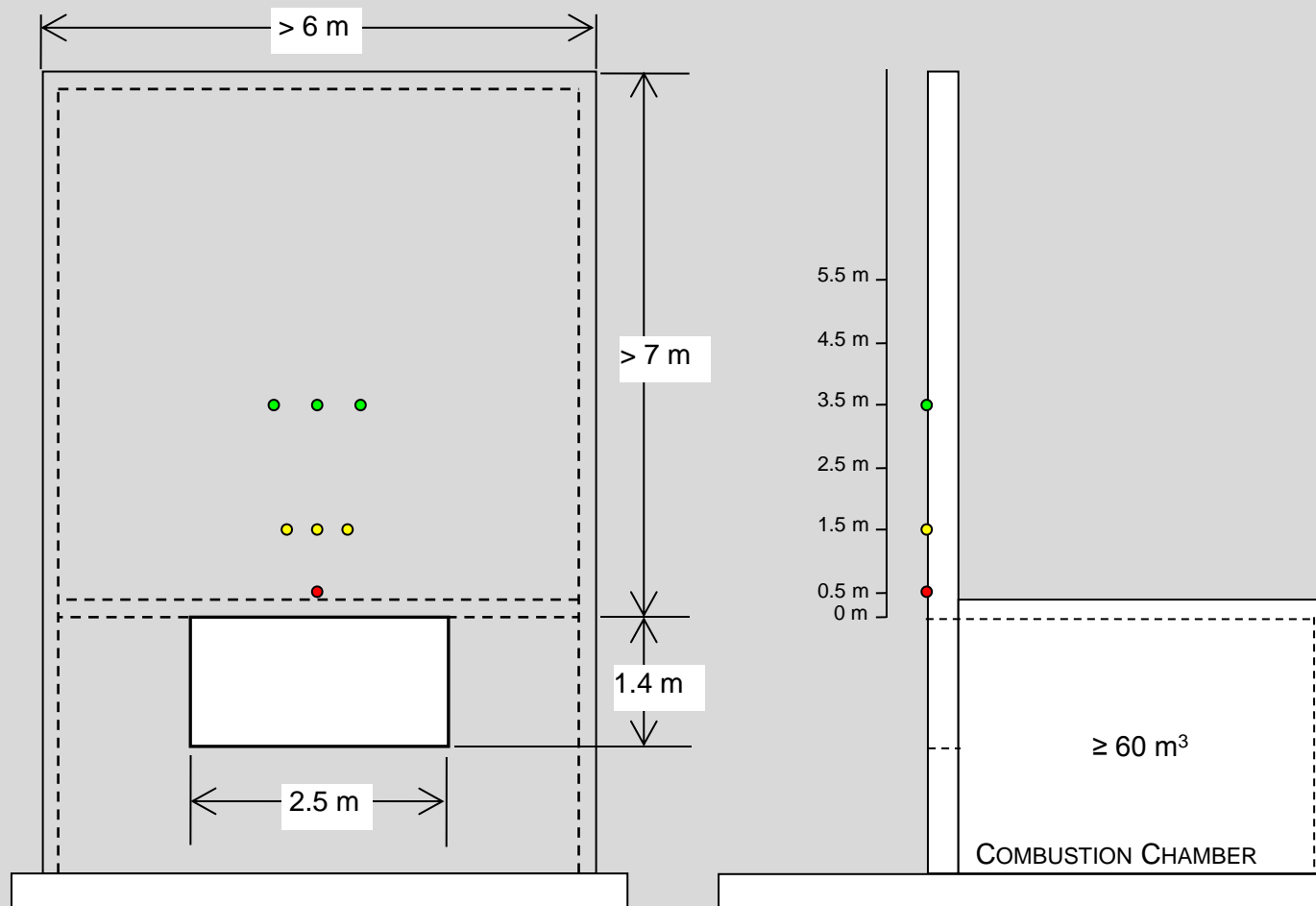
Table 3.2.3.7.
Minimum Construction Requirements for Exposing Building Faces
 Forming Part of Sentences 3.2.3.7.(1) and (2)

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 ⁽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

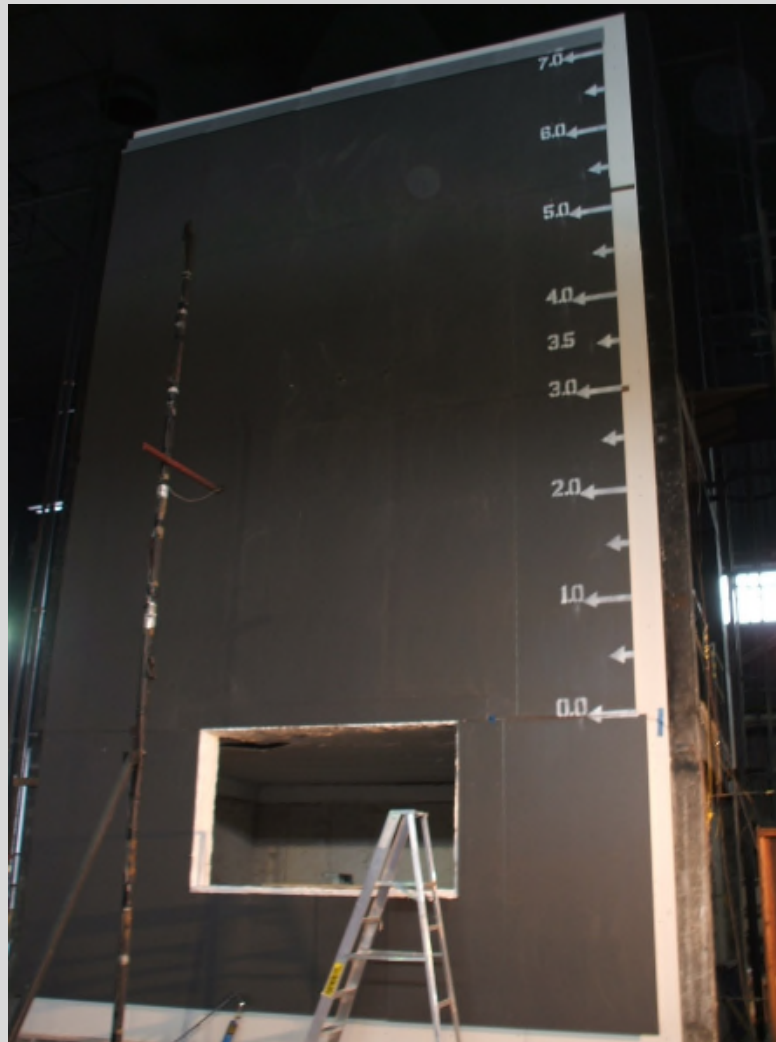
General Exterior Wall Construction		
Combustible (Article 3.2.2.53.)	2-hour FRR (Table 3.2.3.7.)	Interior
	IB01, IB02, IB03, IB04, IB05, IB10, IB11, IB12, IB13, IB14, IB15	Internal Barrier
	Foam Plastic (25 < FSR ≤ 500)	Insulation
	Not Required	External Barrier
	Noncombustible or Article 3.1.5.5.	Cladding



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?

Code Assessment Engine – Web Interface

Canadian Code Assessment Engine

Project Title: **Test Project April4**

Project Characteristics

Building Code: **2010 NBCC**

Building Area (m²): **4000** Streets Facing: **3**

Building Height (Stories): **3** Major Occupancy Code(s): **C**

Building Height (m): **15** Sprinklered: **Yes**

Building Classification

Governing Occupancy: **C**

Governing Article: **3.2.2.4**

Type of Construction: **Noncombustible**

Max Area (m²): **12000**

Max Height (Stories): **3**

Walls

Wall Name: **North Wall**

Wall Height (m): **5**

Wall Width (m): **40**

Limiting Distance: **5**

Major Occupancy Code: **C**

Insulation: **Foam Plastic (25 < FBR < 500)**

Required Type of Construction for the Exterior Wall

Noncombustible (Article 3.2.2.4.8.)

Area (m ²)	280
Permitted LPO (%)	40%
Spatial Separation FRR	45-min FRR (Table 3.2.2.7)
Internal Barrier	2.1.5.15 (2)(a), 2.1.5.15 (2)(b), 2.1.5.15 (2)(c), 2.1.5.15 (2)(d), 2.1.5.15 (2)(e)
Insulation	Foam Plastic (25 < FBR < 500)
External Barrier	Not Required
Cladding	Noncombustible or Article 3.1.5.5

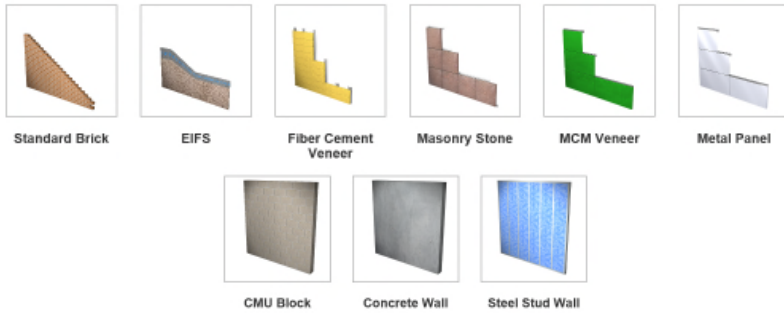
Coming Soon!

Save Save and generate wall report

The Code Assessment Engine has been developed for information purposes only. Although all possible efforts have been made to ensure that the information on this tool is accurate, The Dow Chemical Company assumes no obligation or liability for the information and cannot under any circumstances guarantee the completeness, accuracy or usefulness of such information. Reference should be made to the National Building Code of Canada. [Subscribe to the latest building science](#)

What Wall Configuration?

Many Options ...



Thermax XArmor + Batt



Styrofoam + Batt



Thermax XArmor + Empty



Styrofoam + Empty



Inverted Gyp + Styrofoam + Batt



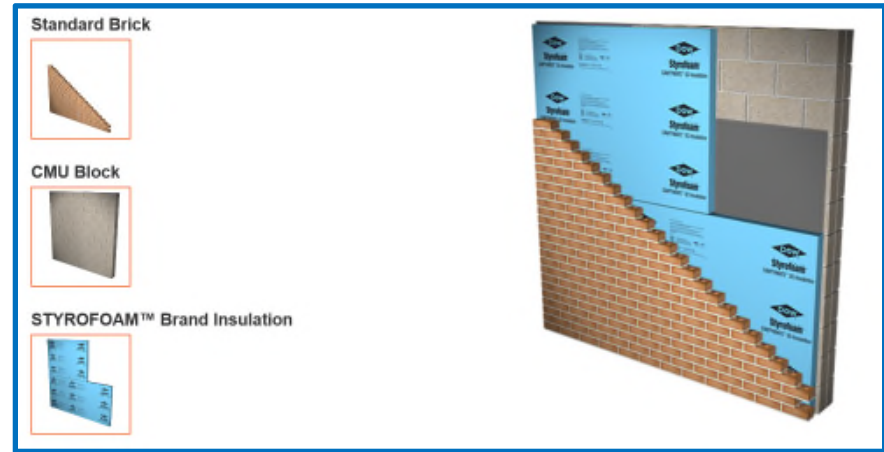
Thermax XArmor + SPF



Inverted Gyp + Styrofoam + Empty



Thermax XArmor + Batt



■ Successful Wall Design and Construction Requirements 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**

Which Wall Assembly?



■ Which Dow Solution?

Interactive Presentation



DOW

BETTER BUILDING **STARTS HERE**

MAXIMIZE PERFORMANCE
MINIMIZE RISK
SIMPLIFY CONSTRUCTION

DOW BUILDING SOLUTIONS

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■ 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)

 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 when type*	Non-Union	Select ASHRAE 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 * Depth *
16" O.C. 5.5

Cavity Insulation Type * R-Value *
Fiberglass 19

Exterior Gypsum Sheathing *
5/8"

Water-Resistive Barrier * Permeance *
Sheet Class 1(<0.1 Perm)

Continuous Insulation * Thickness *
Mineral Wool (R4.2/in) 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 * Depth *
16" O.C. 3.5

Cavity Insulation Type * Thickness * R-Value *
Spray Foam 2 12

Exterior Gypsum Sheathing *
None

Water-Resistive Barrier *
None


Continuous Insulation * Thickness *
Thermax Sheathing(3.5 in) 3.5

Why Use Dow Products & Solutions?

Wall Analysis Tool (Output)

Wall Analysis

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



Project Conditions

Ashrae Climate Zone	7
Code Adoption**	ASHRAE 90.1 2010/ECC 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	0.054
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
ECC Compliance	Yes	Yes

Cost Analysis

System	Est. Cost (cents)
4" MW and BATT	100
4" XPS and 2" SPF	63

Cavity Thickness

System	Thickness (inches)
4" MW and BATT	4.875
4" XPS and 2" SPF	4.25

R-Value

System	Effective R-Value
4" MW and BATT	25.142
4" XPS and 2" SPF	25.572

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1-800-583-BLUE (2588)

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Masonry Systems: masonry.dow.com
Framed Assemblies: framed.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





**Thank
You**

Q & A?

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