National Energy Code for Buildings Opportunity to Support Larger Housing Projects

Marc Trudeau

P.Eng., Architect AIBC, BEMP, CPHD, LEED AP BD+C

Principal, Building Performance Engineer, AME Group

Advisory Committee Member, ECO Canada

BUILDING LEGACY

1.0 ENERGY EFFICIENCY & SUSTAINABILITY

- Addressing Climate Change
- Environmental Benefits
- Health & Comfort
- Economic Advantages
- Resilience & Reliability
- National & Global Impacts
- Future Proofing Buildings

2.0 ENERGY EFFICIENCY

- Reduces energy consumption & costs
- Reduces greenhouse gas emissions
- Improves health through better air quality
- Increases resilience to extreme weather
- Supports sustainable economic growth

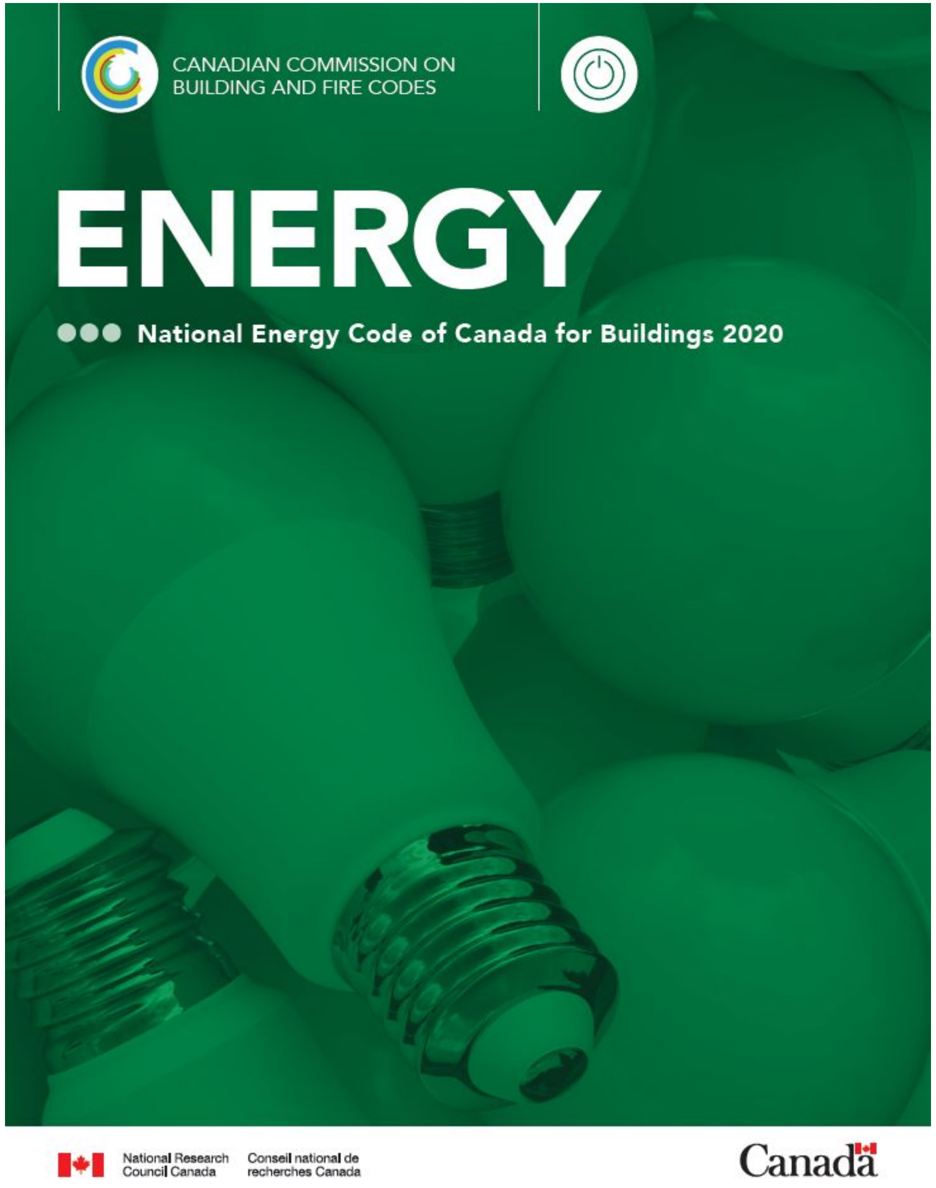
3.0 OVERVIEW & PURPOSE OF CODES

- Developed by the Canadian Commission on Building and Fire Codes
- Codes apply to new construction and alterations
- NBC establishes technical standards for building safety, health, accessibility, fire protection & energy efficiency
- NECB focuses on energy efficiency and reducing greenhouse gas emissions

4.0 ENERGY EFFICIENCY AND THE NECB

- Provides reference to define what is good practice: building envelope, lighting, controls, HVAC systems efficiencies & insulation

- For cold climate projects: requires more detailed representation of wall thermal bridges



5.0 ADDRESSING CHALLENGES IN RURAL & REMOTE AREAS

In response to limited resources & logistical issues, project teams need to consider

- Strategies to Overcome Barriers
- Innovative Housing Solutions
- Energy Efficient & Climate Resilient Construction

6.0 REGULATORY FRAMEWORKS

- Tools for monitoring and inspecting compliance.
- Compliance checklists.
- Align enforcement strategies with local governance.
- Address common compliance barriers with effective solutions.
- Strengthen enforcement through collaboration and capacity-building.

BUILDING LEGACY

AME Group

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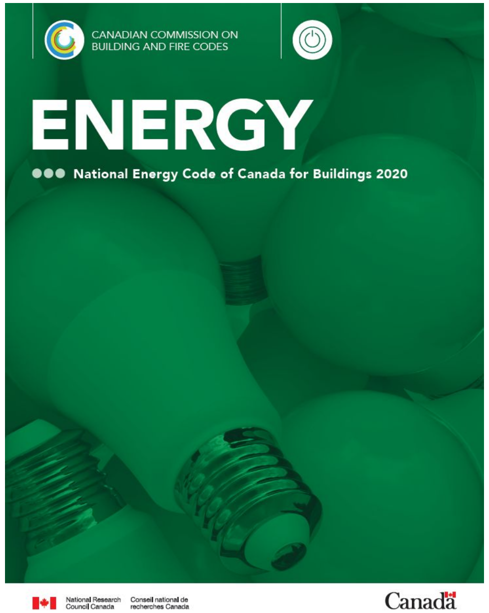
NECB STRUCTURE



Compliance Paths

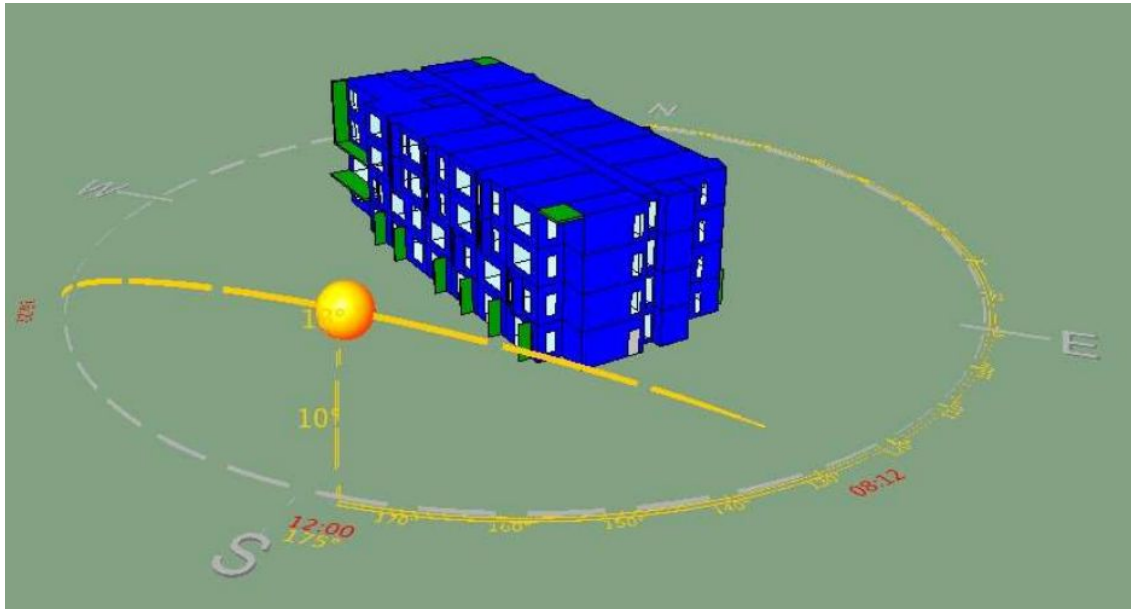
- Prescriptive
- Trade-off
- Performance/ Energy Modelling
- Tiered Performance

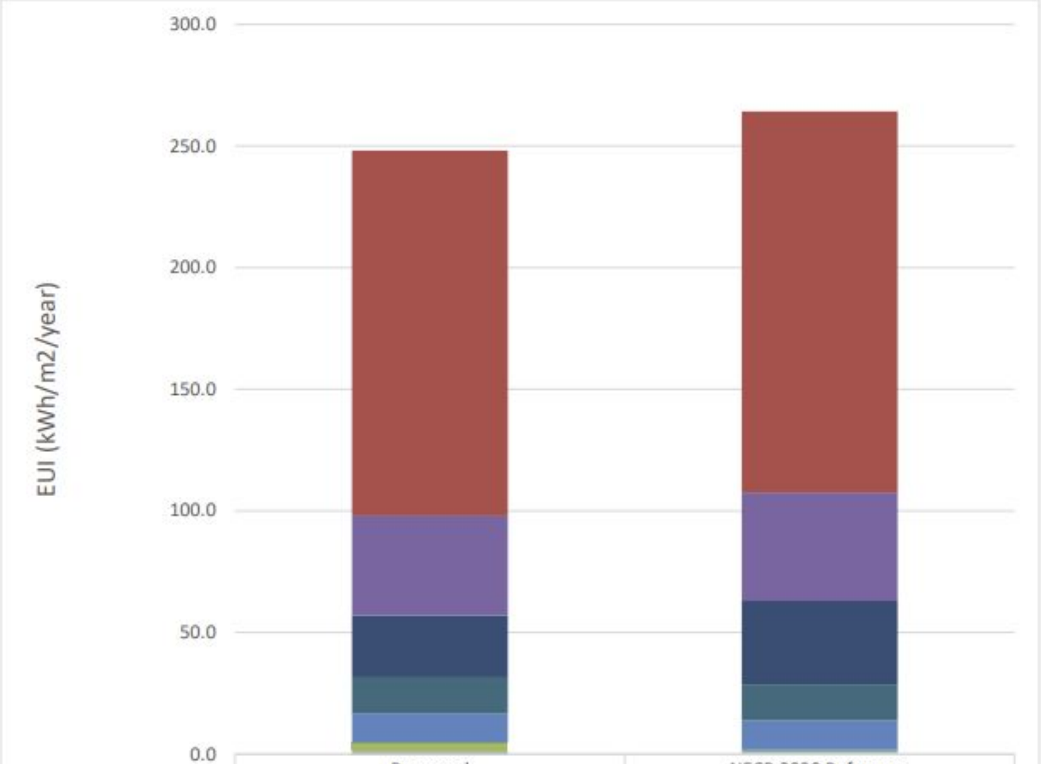
Acceptable Design Solutions

- Envelope
- Lighting
- HVAC
- Service Hot Water
- Electrical

Part 1	General
Part 2	Reserved
Part 3	Building Envelope
Part 4	Lighting
Part 5	Heating, Ventilating and Air-conditioning Systems
Part 6	Service Water Systems
Part 7	Electrical Power Systems and Motors
Part 8	Building Energy Performance Compliance Path
Part 9	Reserved
Part 10	Tiered Building Energy Performance Compliance

ENERGY PERFORMANCE COMPLIANCE PATH - ENERGY MODELLING





	Proposed	NECB 2020 Reference
Total	248.1	264.2
Space Heating - Gas	150.2	156.7
DHW	40.9	44.5
Supply Fans	25.5	34.3
Receptacle	14.8	14.8
Lighting	12.1	12.1
Space Heating - Elec	3.5	0.0
Pumps	0.6	0.5
Space Cooling	0.4	0.8
Heat Rejection	0.2	0.4
Exhaust Fans	0.0	0.0

LIGHTING
SPACE BY SPACE METHOD

Space Type	Lighting Power Density, W/m²	Type of Lighting Control[1]								
		Manual [see 4.2.2.1.(3)]	Restricted to Manual ON [see 4.2.2.1.(6)]	Restricted to Partial Automatic ON[2] [see 4.2.2.1.(8)]	Bi-Level [see 4.2.2.1.(9)]	Automatic Daylight Responsive Controls for *Sidelighting* [see 4.2.2.1.(10)][3]	Automatic Daylight Responsive Controls for *Toplighting* [see 4.2.2.1.(13)][4]	Automatic Partial OFF [see 4.2.2.1.(16)]	Automatic Full OFF[5] [see 4.2.2.1.(18)]	Scheduled Shut-off [see 4.2.2.1.(20)]
Common Space Types[6]										
Atrium										
< 6 m in height	4.2	X	A	A	–	X	X	–	B	B
≥ 6 m and ≤ 12 m in height	5.2	X	A	A	X	X	X	–	B	B
> 12 m in height	6.5	X	A	A	X	X	X	–	B	B
Audience seating area – permanent										
for auditorium	6.5	X	A	A	X	X	X	–	B	B

LIGHTING CONTROLS

4.2.2.1 Interior Lighting Controls, including:

- Manual lighting control devices
- Partial automatic ON
- Bi-Level control
- Photocontrol
- Automatic partial OFF
- Automatic full Off
- Vacancy sensors
- Scheduled shut off

AIR LEAKAGE TESTING

Airtightness compliance in the NECB can be demonstrated by either an air barrier assembly method or by onsite testing

Whole building onsite testing target:
1.50 L/s/m2 façade @ 75Pa

BUILDING ENVELOPE

Table 3.2.2.2.
Overall Thermal Transmittance of Above-ground Opaque Building Assemblies
Forming Part of Sentences 3.2.2.2.(1) and (2)

Above-ground *Opaque Building Assembly*	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, W/(m²×K)					
Walls	0.290	0.265	0.240	0.215	0.190	0.165
Roofs	0.164	0.156	0.138	0.121	0.117	0.110
Floors	0.193	0.175	0.156	0.138	0.121	0.117

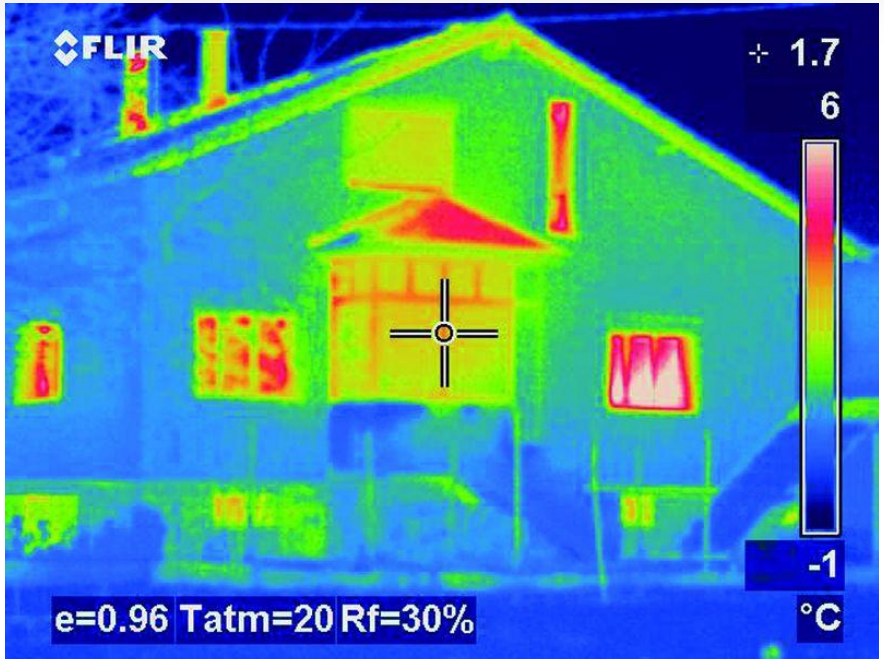
Component	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, W/(m²×K)					
Vertical *fenestration*	1.90	1.90	1.73	1.73	1.44	1.44
Skylights	2.69	2.69	2.41	2.41	2.01	2.01

Zone 8
(IP Units)

R-34
R-52
R-49

U-0.25
U-0.35

BUILDING ENVELOPE THERMAL BRIDGES



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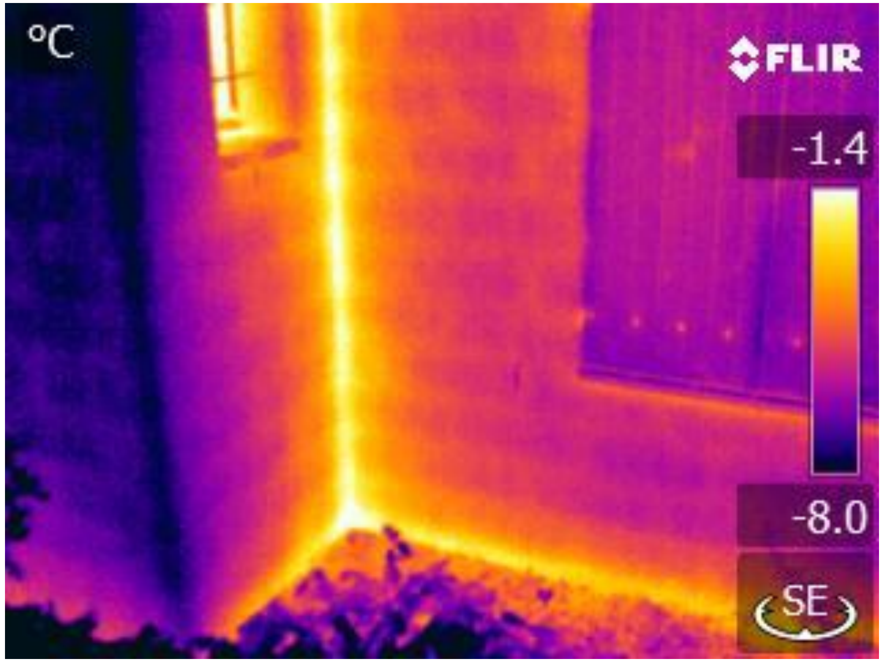
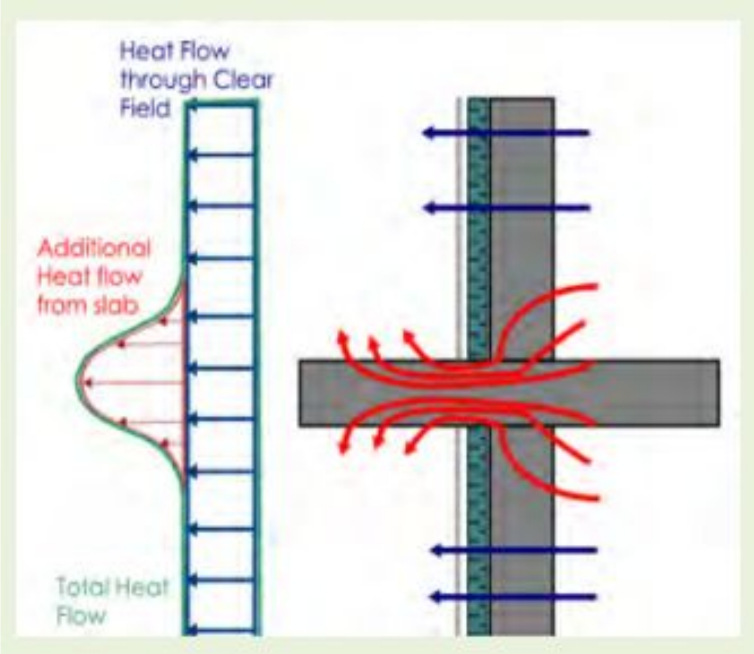
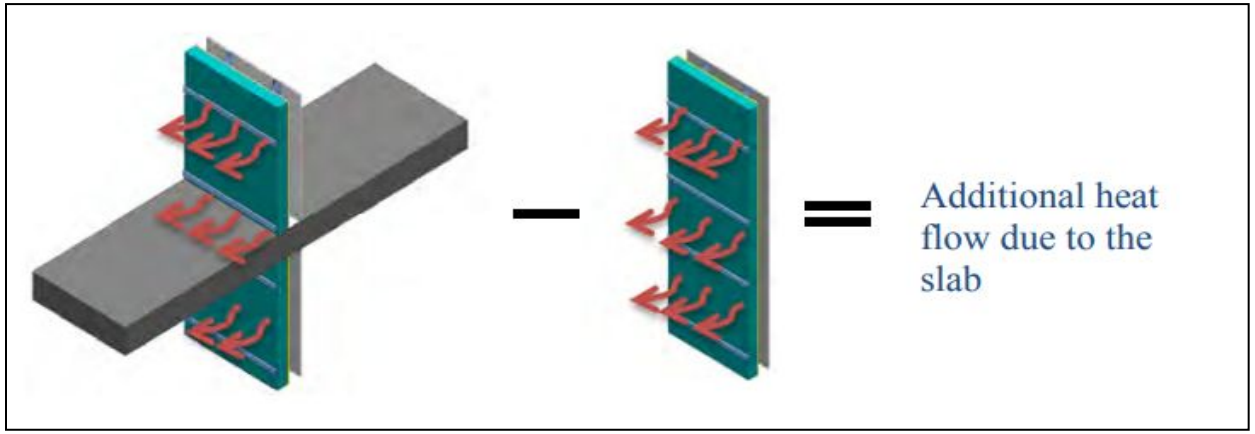


https://concord.org/blog/simulating-geometric-thermal-bridges-using-energy2d/

WALL THERMAL PERFORMANCE





https://thermalenvelope.ca/
https://research-library.bchousing.org/Home/ResearchItemDetails/722

WALL THERMAL PERFORMANCE

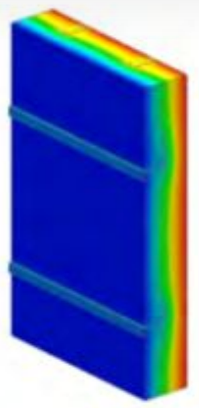


Figure 6: Example clear field assembly

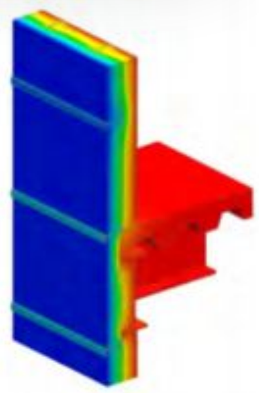


Figure 7: Example linear transmittance of a floor slab detail

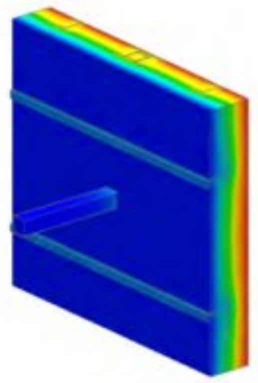
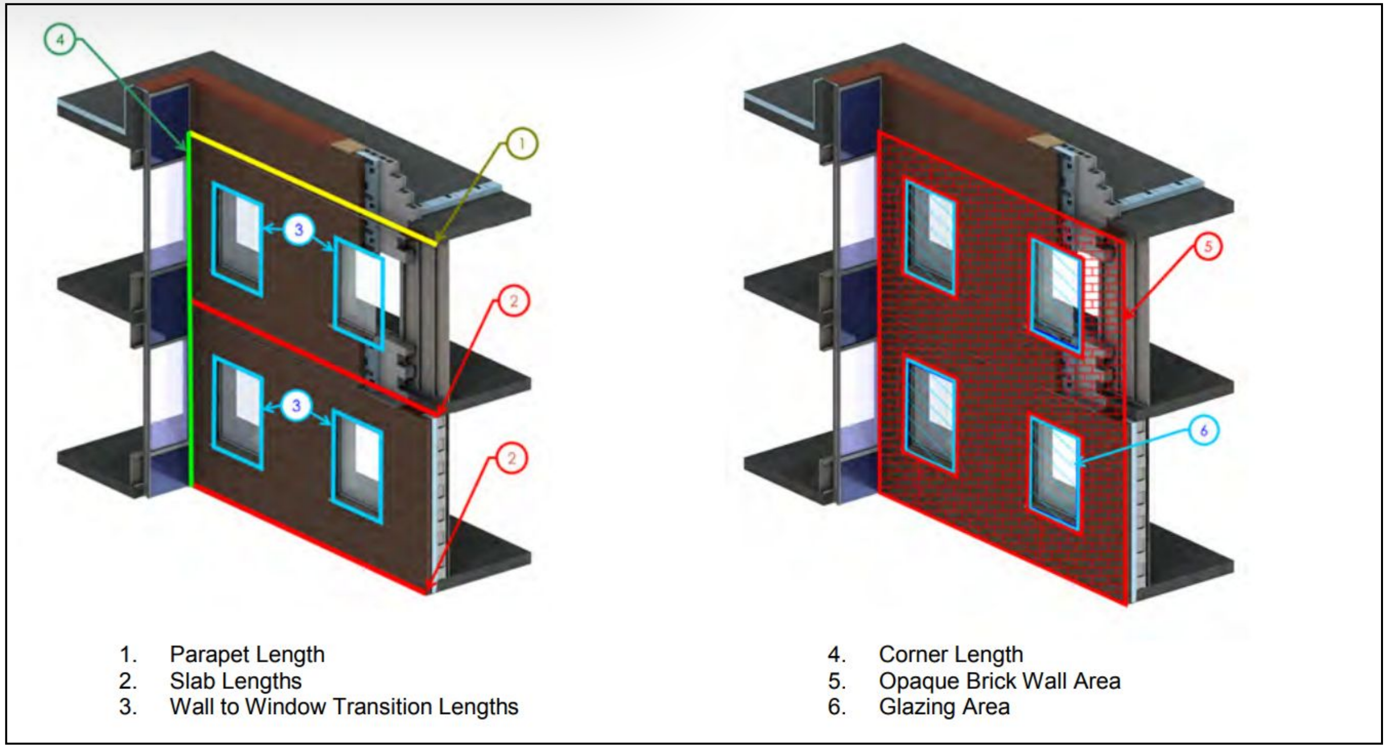


Figure 8: Example point transmittance of a beam penetration detail

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/business/programs/building-envelope-thermal-bridging-guide-version-1.2.pdf

WALL THERMAL PERFORMANCE



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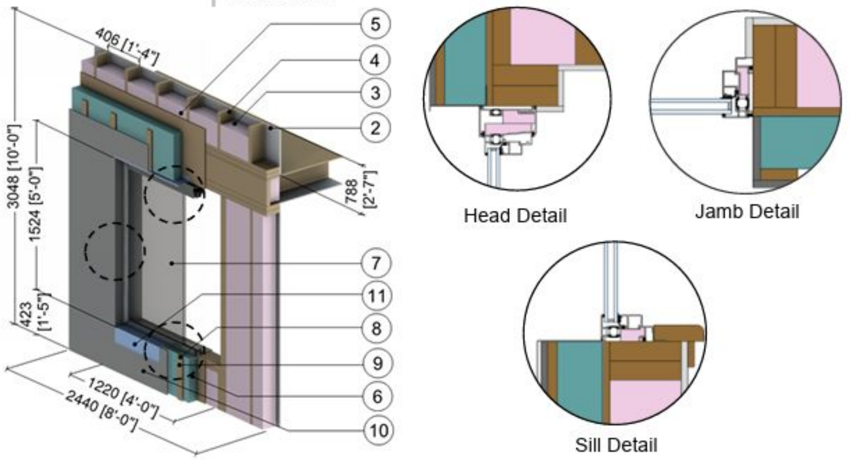
WALL THERMAL PERFORMANCE

Detail 8.3.2

Exterior and Interior Insulated 2x6 Wood Stud (16" o.c.) Wall Assembly with Wood Strapping and Continuous Insulation Supporting Rainscreen Fiber Cement Board – Aluminum Window Intersection

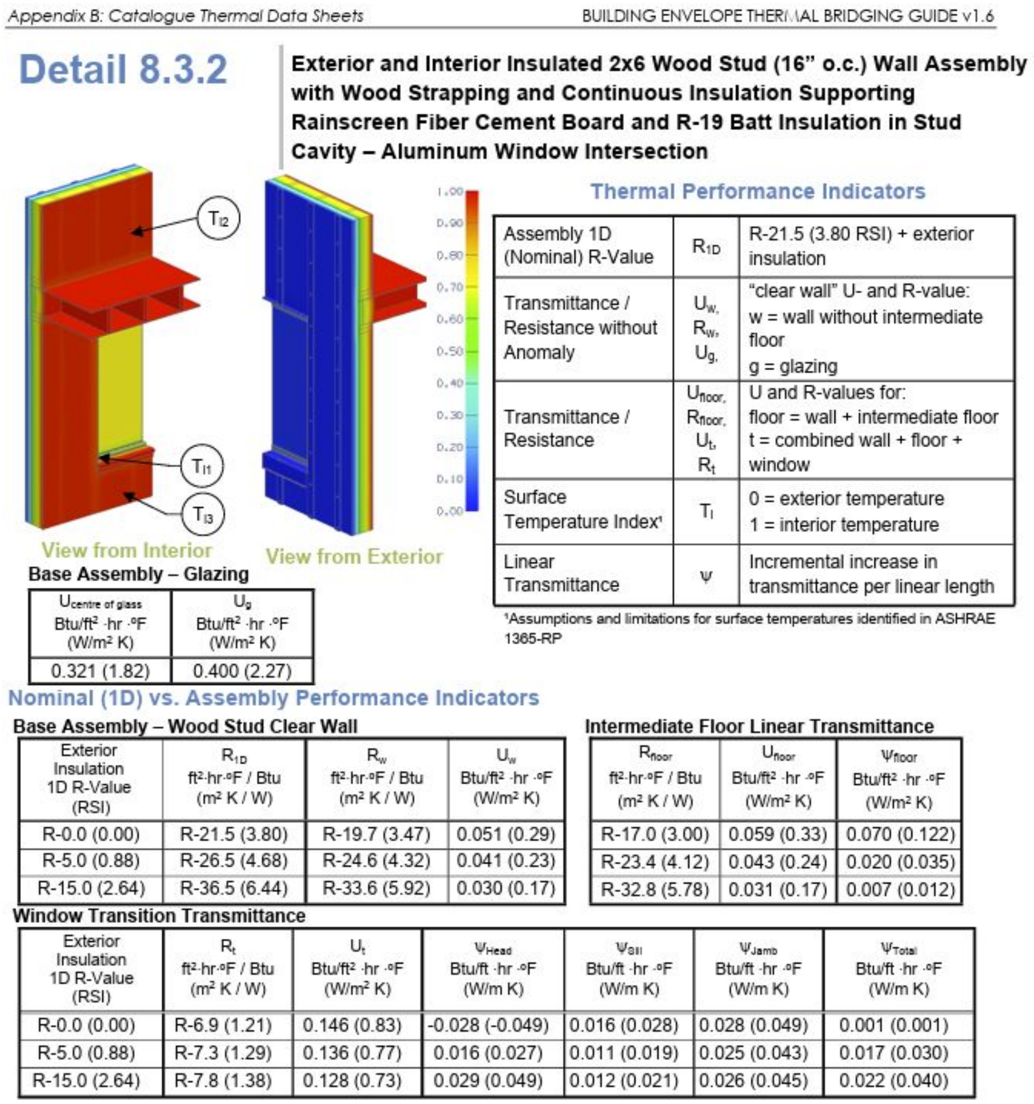


ID	Component	Thickness Inches (mm)	Conductivity Btu·in / ft²·hr·°F (W/m K)	Nominal Resistance hr·ft²·°F/Btu (m²K/W)	Density lb/ft³ (kg/m³)	Specific Heat Btu/lb·°F (J/kg K)
1	Interior Film[1]	-	-	R-0.6 to R-0.9 (0.11 RSI to 0.16 RSI)	-	-
2	Gypsum Board	1/2" (13)	1.1 (0.16)	R-0.5 (0.08 RSI)	50 (800)	0.26 (1090)
3	Fiberglass Batt Insulation	5 1/2" (140)	-	R-19 (3.3 RSI)	0.9 (14)	0.17 (710)
4	2x6 Wood Stud (16" o.c.)	5 1/2" (140)	0.69 (0.10)	-	31 (500)	0.45 (1880)
5	Exterior Wood Sheathing	1/2" (13)	0.69 (0.10)	R-0.7 (0.12 RSI)	31 (500)	0.45 (1880)
6	Exterior Insulation	Varies	-	R-0 to R-15 (0 RSI to 2.64 RSI)	1.8 (28)	0.29 (1220)
7	5' (1.5m) x 6' (1.8m) Aluminum window: double glazed & thermally broken[2], double glazed IGU UIGU = 0.32 BTU/hr.ft².°F (1.82 W/m²K)					
8	1x3 Wood Strapping	3/4" (19)	0.69 (0.10)	-	31 (500)	0.45 (1880)
9	Steel Fasteners (16" o.c.)	0.35" (9) Ø	347 (50)	-	489 (7830)	0.12 (500)
10	Fiber Cement Board Cladding with 3/4" (19mm) vented airspace incorporated into exterior heat transfer coefficient					
11	Aluminum Flashing	18 Gauge	1109 (160)	-	171(2739)	0.21 (900)
12	Exterior Film[1]	-	-	R-0.2 to R-0.7 (0.03 RSI to 0.12 RSI)	-	-

[1] Value selected from table 1, p. 26.1 of 2009 ASHRAE Handbook – Fundamentals depending on surface orientation
[2] The thermal conductivity for air spaces within window framing was found using ISO 10077-2

https://thermalenvelope.ca/pdf/material_data_sheet_8.3.2.pdf?version=v1.7.3

WALL THERMAL PERFORMANCE



Appendix B: Catalogue Thermal Data Sheets — BUILDING ENVELOPE THERMAL BRIDGING GUIDE v1.6

Detail 8.3.2

Exterior and Interior Insulated 2x6 Wood Stud (16" o.c.) Wall Assembly with Wood Strapping and Continuous Insulation Supporting Rainscreen Fiber Cement Board and R-19 Batt Insulation in Stud Cavity – Aluminum Window Intersection

View from Interior

View from Exterior

Thermal Performance Indicators

Assembly 1D (Nominal) R-Value	R_{1D}	R-21.5 (3.80 RSI) + exterior insulation
Transmittance / Resistance without Anomaly	U_w, R_w, U_g,	"clear wall" U- and R-value: w = wall without intermediate floor g = glazing
Transmittance / Resistance	U_{floor}, R_{floor}, U_t, R_t	U and R-values for: floor = wall + intermediate floor t = combined wall + floor + window
Surface Temperature Index[1]	T_i	0 = exterior temperature 1 = interior temperature
Linear Transmittance	ψ	Incremental increase in transmittance per linear length

[1]Assumptions and limitations for surface temperatures identified in ASHRAE 1365-RP

Base Assembly – Glazing

$U_{centre\ of\ glass}$ Btu/ft² ·hr ·°F (W/m² K)	U_g Btu/ft² ·hr ·°F (W/m² K)
0.321 (1.82)	0.400 (2.27)

Nominal (1D) vs. Assembly Performance Indicators

Base Assembly – Wood Stud Clear Wall

Exterior Insulation 1D R-Value (RSI)	R_{1D} ft²·hr·°F / Btu (m² K / W)	R_w ft²·hr·°F / Btu (m² K / W)	U_w Btu/ft² ·hr ·°F (W/m² K)
R-0.0 (0.00)	R-21.5 (3.80)	R-19.7 (3.47)	0.051 (0.29)
R-5.0 (0.88)	R-26.5 (4.68)	R-24.6 (4.32)	0.041 (0.23)
R-15.0 (2.64)	R-36.5 (6.44)	R-33.6 (5.92)	0.030 (0.17)

Intermediate Floor Linear Transmittance

R_{floor} ft²·hr·°F / Btu (m² K / W)	U_{floor} Btu/ft² ·hr ·°F (W/m² K)	Ψ_{floor} Btu/ft² ·hr ·°F (W/m² K)
R-17.0 (3.00)	0.059 (0.33)	0.070 (0.122)
R-23.4 (4.12)	0.043 (0.24)	0.020 (0.035)
R-32.8 (5.78)	0.031 (0.17)	0.007 (0.012)

Window Transition Transmittance

Exterior Insulation 1D R-Value (RSI)	R_t ft²·hr·°F / Btu (m² K / W)	U_t Btu/ft² ·hr ·°F (W/m² K)	Ψ_{Head} Btu/ft ·hr ·°F (W/m K)	Ψ_{Sill} Btu/ft ·hr ·°F (W/m K)	Ψ_{Jamb} Btu/ft ·hr ·°F (W/m K)	Ψ_{Total} Btu/ft ·hr ·°F (W/m K)
R-0.0 (0.00)	R-6.9 (1.21)	0.146 (0.83)	-0.028 (-0.049)	0.016 (0.028)	0.028 (0.049)	0.001 (0.001)
R-5.0 (0.88)	R-7.3 (1.29)	0.136 (0.77)	0.016 (0.027)	0.011 (0.019)	0.025 (0.043)	0.017 (0.030)
R-15.0 (2.64)	R-7.8 (1.38)	0.128 (0.73)	0.029 (0.049)	0.012 (0.021)	0.026 (0.045)	0.022 (0.040)

https://thermalenvelope.ca/pdf/thermal_data_sheet_8.3.2.pdf?version=v1.7.3

WALL THERMAL PERFORMANCE

Wall with R19 cavity + R25 exterior
Clear Wall Only: R-40.4
Wall + linear losses: R-28.4
NECB Zone 8 Prescriptive R-34.0

Transmittance Type	Include	Transmittance Description	Area, Length or Amount Takeoff	Units	Transmittance Value	Units	Source Reference	Heat Flow (BTU/hr°F)	%Total Heat Flow
Clear Field	☑	Clear wall (W1)	8034.00	ft^2	0.024	BTU/ hr ft^2 °F	8.1.5	191.7	44%
Clear Field	☑	Clear wall (W2)	4236.00	ft^2	0.026	BTU/ hr ft^2 °F	8.1.5	112.1	26%
Linear Interface Detail	☑	Window transition (W1)	1813.40	ft	0.026	BTU/ hr ft °F	8.3.2	47.1	11%
Linear Interface Detail	☑	Roof to wall	395.74	ft	0.032	BTU/ hr ft °F	8.4.1	12.7	3%
Linear Interface Detail	☑	Corner	808.40	ft	0.020	BTU/ hr ft °F	8.5.1	16.2	4%
Linear Interface Detail	☑	Foundation wall	385.74	ft	0.059	BTU/ hr ft °F	8.6.3	22.8	5%
Linear Interface Detail	☑	Intermediate floor	1179.47	ft	0.012	BTU/ hr ft °F	8.3.2	14.2	3%
Linear Interface Detail	☑	Window transition (W2)	597.60	ft	0.025	BTU/ hr ft °F	8.3.2	14.9	3%

SUMMARY

- Energy efficient buildings improve comfort, resiliency, operating cost, and emissions
- NECB is a helpful regulatory and design tool that defines energy efficient approaches
- Particularly for cold climate projects, NECB's heat loss method allows better assemblies to be designed
- Regulatory frameworks and community level resources need to be established to get effective results

Thank you

BUILDING LEGACY

Discussion Topics

1. What local training programs are needed to help establish better buildings?

2. Can prefabricated housing help mitigate logistical challenges in your community?

3. Have you implemented any innovative solutions to address challenges such as transportation barriers, skilled labor shortages, or funding constraints? If so, what best practices can you share?

DISCUSSIONS & ACTIVITY ON CODE ADOPTION

- How can adopting the 2020 National Model Codes enhance housing?
- Case Based Activity- Identify building performance strategies that can help housing projects

BRAINSTORMING ACTIVITY

To identify and discuss the challenges and opportunities for integrating sustainability into housing projects.

- What are the challenges in integrating sustainability principles in projects?
- What opportunities exist for incorporating energy-efficient solutions?
- How important is collaboration and continued efforts to the integration of sustainability into building projects?