# Navigating MECB Building Envelope Requirements

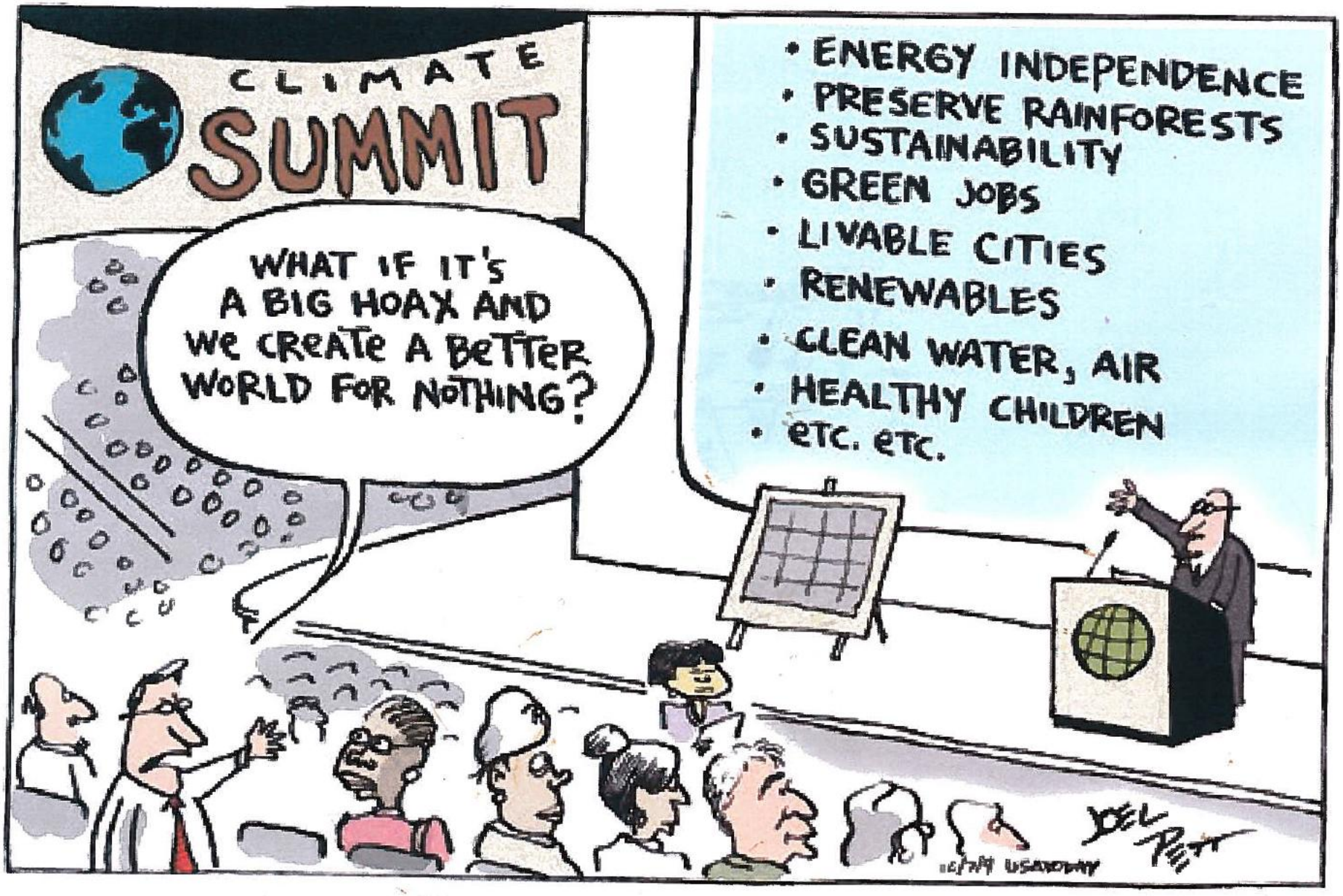
Harry Schroeder
Manitoba Hydro

December 9, 2015

# The Path to Energy Efficiency

* Conviction
* Compulsory Targets
* Communication
* Compliance
* Cash

The cornerstone of a viable Energy Policy for Europe
European Energy Efficiency Industrial Forum 2010

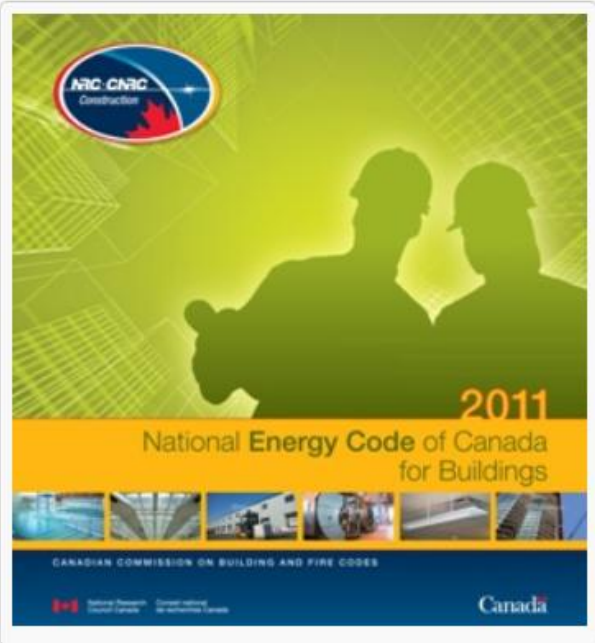

CLIMATE
SUMMIT
WHAT IF IT'S A BIG HOAX AND WE CREATE A BETTER WORLD FOR NOTHING?
• ENERGY INDEPENDENCE
• PRESERVE RAINFORESTS
• SUSTAINABILITY
• GREEN JOBS
• LIVABLE CITIES
• RENEWABLES
• CLEAN WATER, AIR
• HEALTHY CHILDREN
• etc. etc.
JOEL PETT

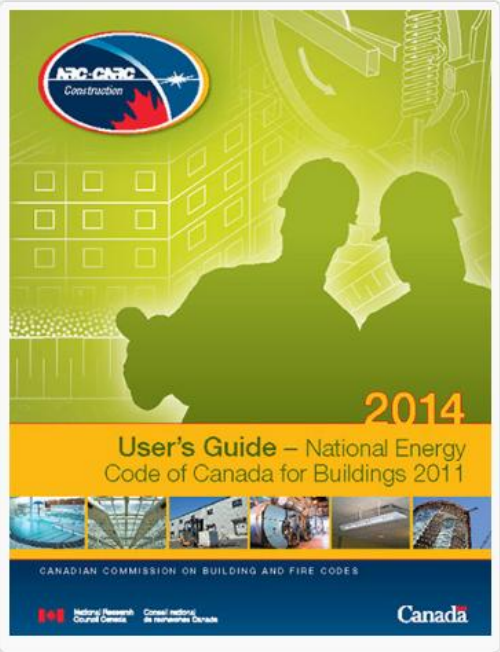
# Think about it…

No single raindrop believes itself responsible for the flood

I thought – why doesn't someone do something? –
then I realized I was someone

# Energy Code Documents




Province of Manitoba Amendments:
http://web2.gov.mb.ca/laws/regs/current/_pdf-regs.php?reg=213/2013

# Energy Code Documents

**Which Code Applies? (General Guideline*)**

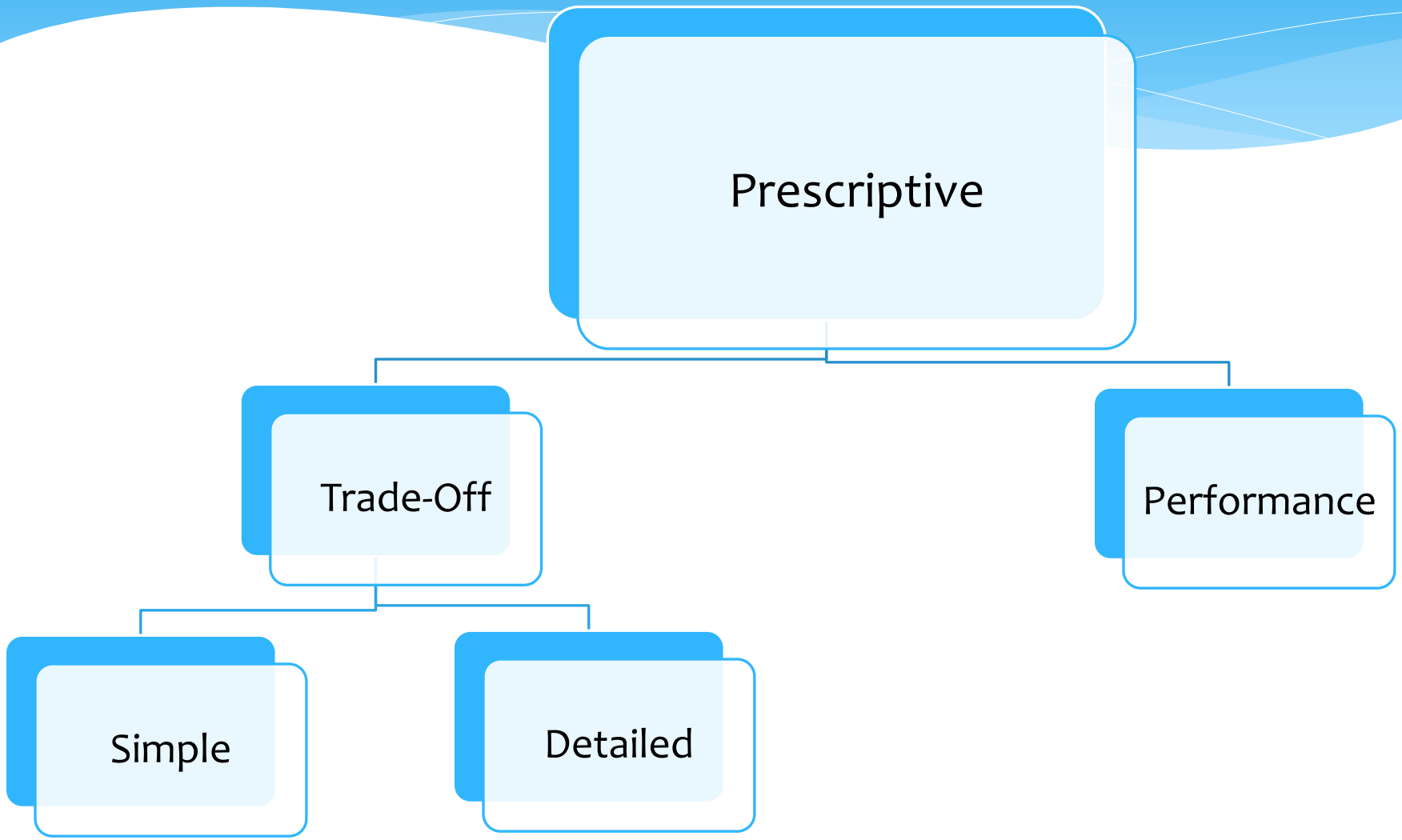
For any Part 3 Building → NECB

For Part 9 Buildings

- C. (600 m2 or less) → Section 9.36
- C. (300m2) + {.D. + .E. + .F3.} (300m2 or less) → Section 9.36
- C. (any area) + {.D. + .E. + .F3.) (> 300m2) → NECB
- {.D. + .E. + .F3.} (300m2 or less) → Section 9.36
- {.D. + .E. + .F3.} > 300m2 → NECB
- F2. (any area) + {.C. + .D. + .E. + .F3.} (any area) → NECB

*confirm with your AHJ

# Compliance Options



# Calculating Overall Thermal Transmittance (U-value)

* U value – Thermal Transmittance/CondUctivity
* $R_{SI}$ – Thermal **R**esistance (SI/metric)
* $R_{imp}$ – Thermal **R**esistance (imperial)

$$R = \frac{1}{U} \qquad U = \frac{1}{R}$$

$U_{si} = U_{imp} \times 5.678$ $R_{imp} = R_{si} \times 5.678$

# Calculating Overall Thermal Transmittance (U-value)

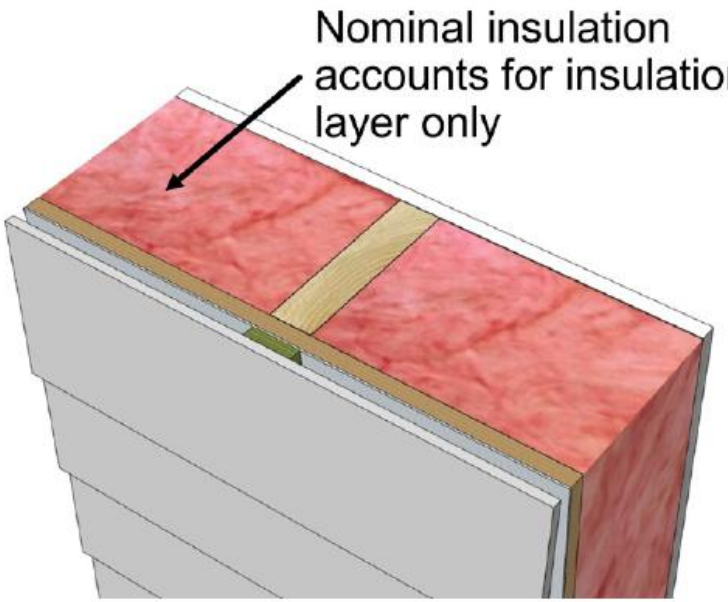
* Effective vs Nominal
* Wood vs Steel Stud
* Metal Framing
* Material properties resources
* Assembly properties resources
  * ASHRAE Fundamentals Handbook(s)

# Calculating Overall Thermal Transmittance (U-value)

* “R” is important

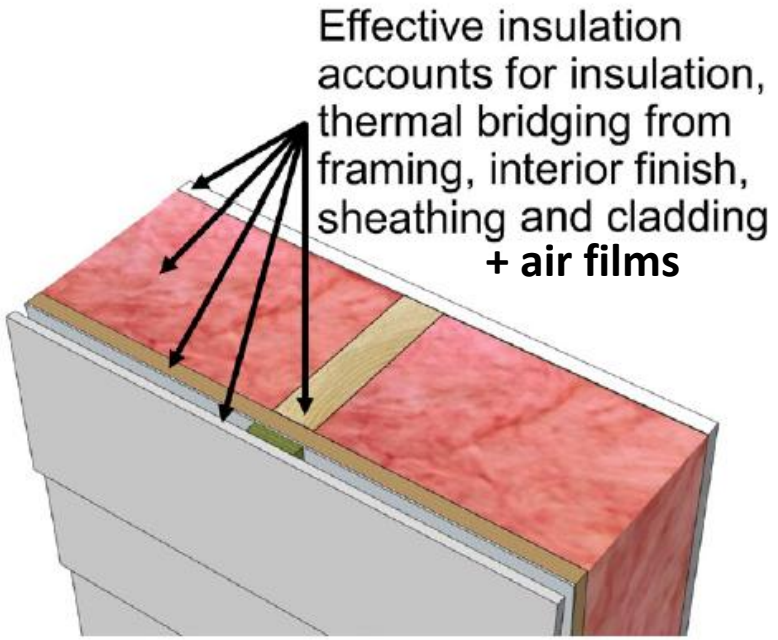
# Calculating Overall Thermal Transmittance (U-value)

## Nominal Insulation



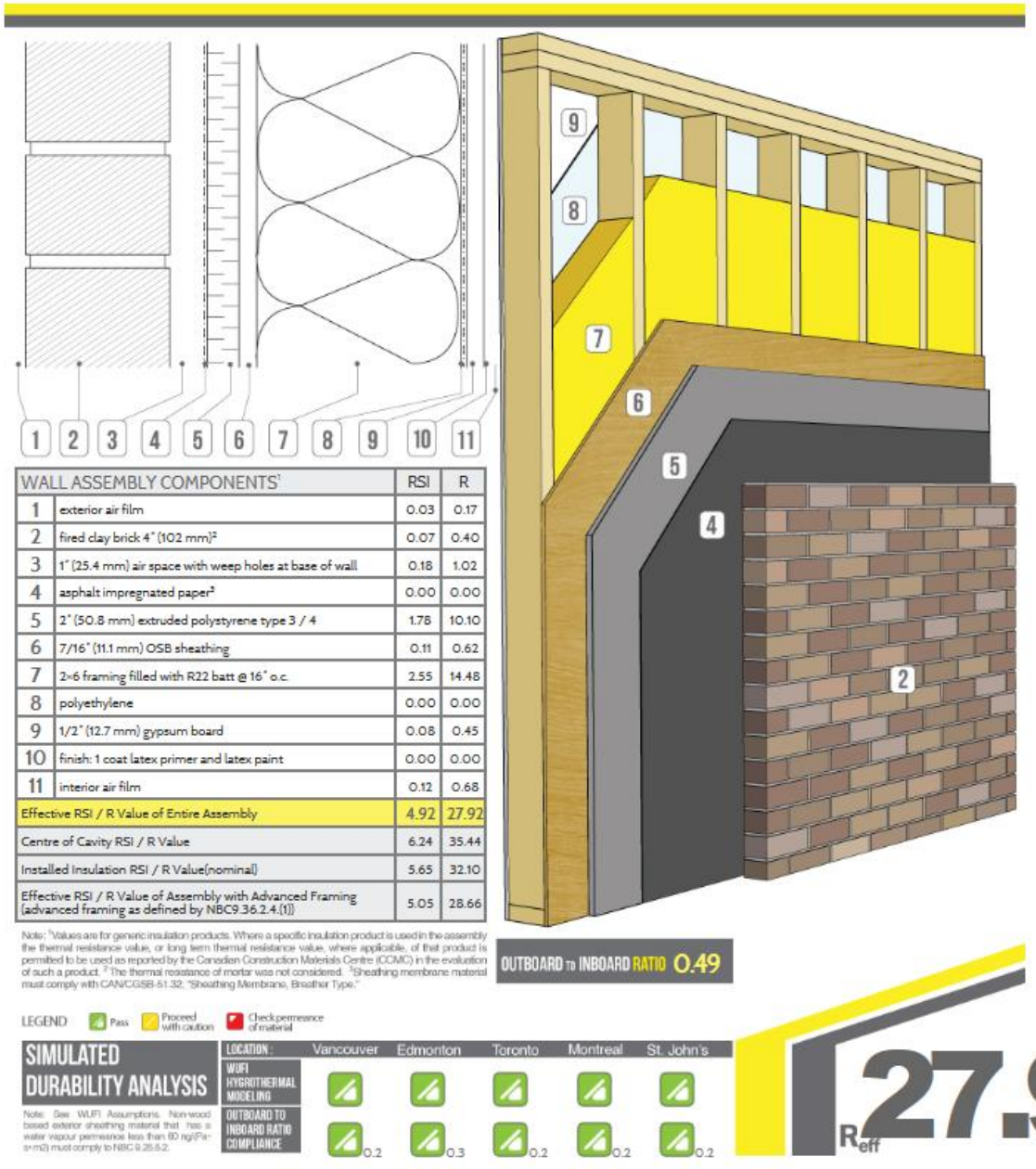

*Nominal* insulation accounts only for thermal resistance of the insulation.

## Effective Insulation



# Calculating Overall Thermal Transmittance (U-value)

Coming soon to a distributor near you . . . or not


| WALL ASSEMBLY COMPONENTS[1] | | RSI | R |
|---|---|---|---|
| 1 | exterior air film | 0.03 | 0.17 |
| 2 | fired clay brick 4" (102 mm)[2] | 0.07 | 0.40 |
| 3 | 1" (25.4 mm) air space with weep holes at base of wall | 0.18 | 1.02 |
| 4 | asphalt impregnated paper[3] | 0.00 | 0.00 |
| 5 | 2" (50.8 mm) extruded polystyrene type 3 / 4 | 1.78 | 10.10 |
| 6 | 7/16" (11.1 mm) OSB sheathing | 0.11 | 0.62 |
| 7 | 2×6 framing filled with R22 batt @ 16" o.c. | 2.55 | 14.48 |
| 8 | polyethylene | 0.00 | 0.00 |
| 9 | 1/2" (12.7 mm) gypsum board | 0.08 | 0.45 |
| 10 | finish: 1 coat latex primer and latex paint | 0.00 | 0.00 |
| 11 | interior air film | 0.12 | 0.68 |
| Effective RSI / R Value of Entire Assembly | | 4.92 | 27.92 |
| Centre of Cavity RSI / R Value | | 6.24 | 35.44 |
| Installed Insulation RSI / R Value(nominal) | | 5.65 | 32.10 |
| Effective RSI / R Value of Assembly with Advanced Framing (advanced framing as defined by NBC9.36.2.4.(1)) | | 5.05 | 28.66 |

Note: [1]Values are for generic insulation products. Where a specific insulation product is used in the assembly the thermal resistance value, or long term thermal resistance value, where applicable, of that product is permitted to be used as reported by the Canadian Construction Materials Centre (CCMC) in the evaluation of such a product. [2]The thermal resistance of mortar was not considered. [3]Sheathing membrane material must comply with CAN/CGSB-51.32, "Sheathing Membrane, Breather Type."

OUTBOARD TO INBOARD RATIO 0.49

LEGEND Pass Proceed with caution Check permeance of material

SIMULATED DURABILITY ANALYSIS

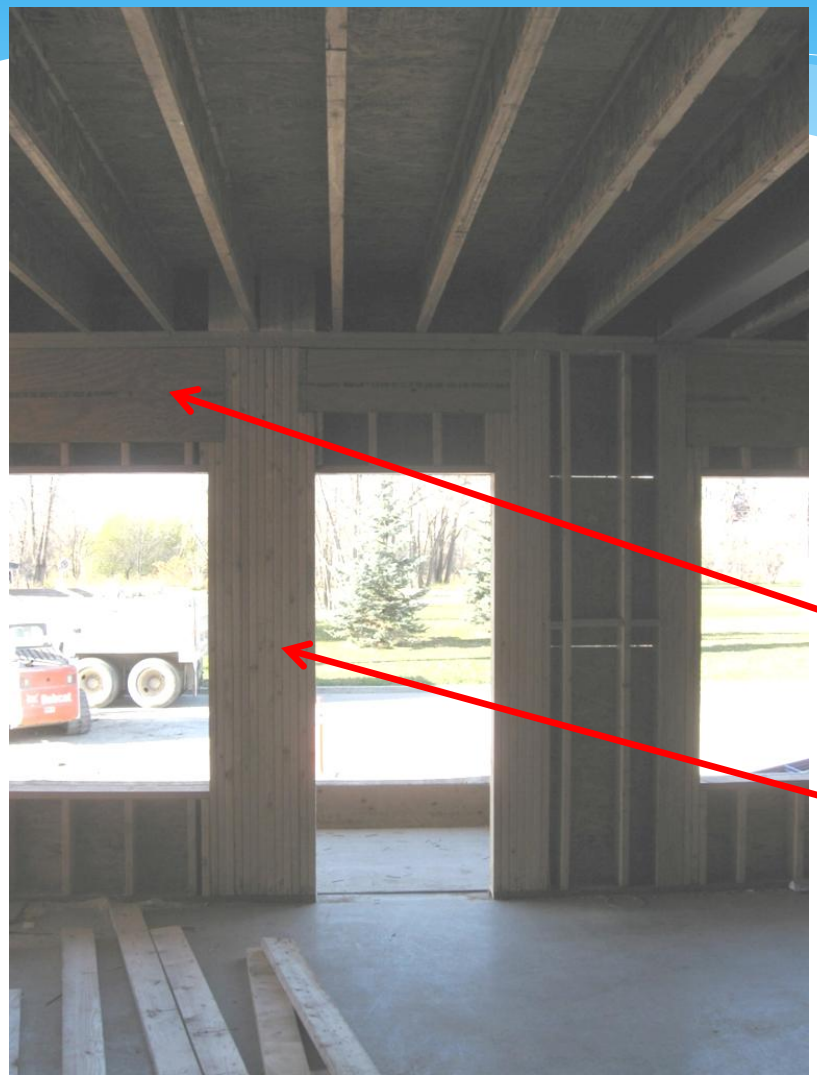
Note: See WUFI Assumptions. Non-wood based exterior sheathing material that has a water vapour permeance less than 60 ng/(Pa·s·m2) must comply to NBC 9.25.5.2.

| LOCATION: | Vancouver | Edmonton | Toronto | Montreal | St. John's |
|---|---|---|---|---|---|
| WUFI HYGROTHERMAL MODELING | | | | | |
| OUTBOARD TO INBOARD RATIO COMPLIANCE | 0.2 | 0.3 | 0.2 | 0.2 | 0.2 |

$R_{eff}$ 27.9

http://cwc.ca/resources/wall-thermal-design/search-go-to-the-calculator/

# Calculating Overall Thermal Transmittance (U-value)




This is not an R-20 wall!!

# Calculating Overall Thermal Transmittance (U-value)

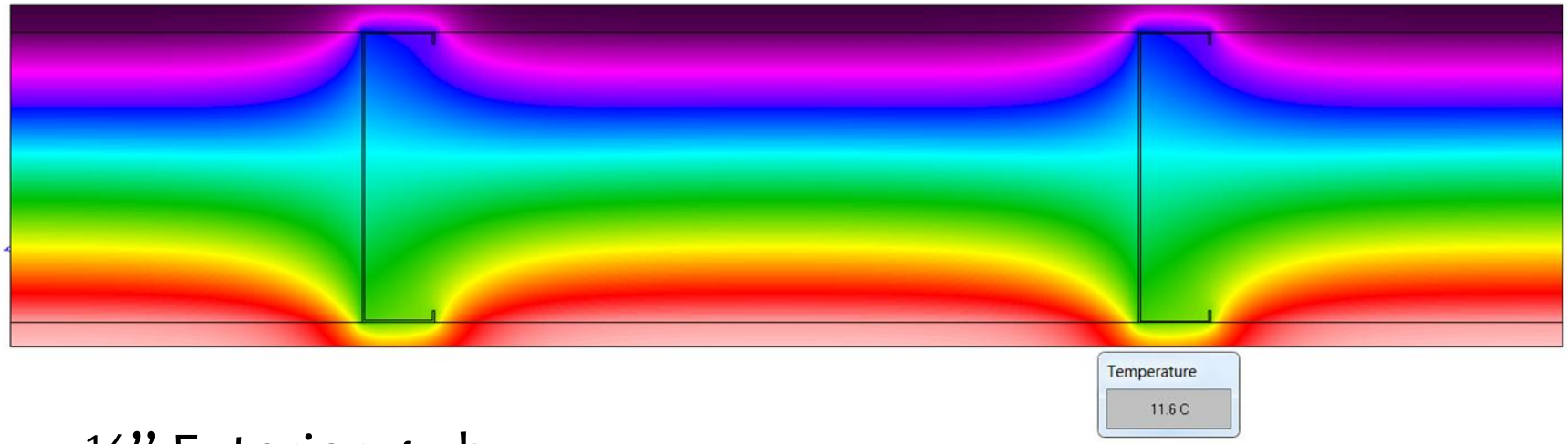
**Table 3-3**
**Effective RSI Values of the Insulation/Framing Layer in Metal-frame Wall Assemblies(1)**

| Nominal Depth of Cavity, mm | Actual Depth of Cavity, mm | Rated RSI Value of Air Space or Insulation | Effective Framing/Cavity RSI Value at 406 mm o.c. | Effective Framing/Cavity RSI Value at 610 mm o.c. |
|---|---|---|---|---|
| Empty Cavity, No Insulation | | | | |
| 100 | 89 | 0.16 | 0.14 | 0.16 |
| Insulated Cavity | | | | |
| 100 | 89 | 1.94 | 0.97 | 1.16 |
| 100 | 89 | 2.29 | 1.06 | 1.27 |
| 100 | 89 | 2.64 | 1.13 | 1.37 |
| 150 | 152 | 3.35 | 1.25 | 1.51 |
| 150 | 152 | 3.70 | 1.30 | 1.58 |
| 200 | 203 | 4.40 | 1.37 | 1.69 |

(1) This Table is reproduced from ANSI/ASHRAE/IES 90.1-2010 with permission (©ASHRAE).

Taken from NECB User's Guide 2014

# Calculating Overall Thermal Transmittance (U-value)




½” Exterior gwb
6” ss @ 16” o/c
6 ” glass fibre batt
½” gwb

Surface Temperature = 11.6 C
Reffective = 10.3
Wall thickness = 7.0”

https://windows.lbl.gov/software/therm/therm.html

# Calculating Overall Thermal Transmittance (U-value)

* "**Steel studs** are designed to provide the **maximum possible conductive energy transfer** across a wall using the **minimum amount of material** — a thin web with cleverly designed heat transfer fins (flanges) on both sides to efficiently absorb heat on one side and reject it on the other. [...] **It is pointless to insulate the cavity to fight this efficiency of heat transfer.**"

  -Joseph W. Lstiburek, Ph.D., in ASHRAE Journal

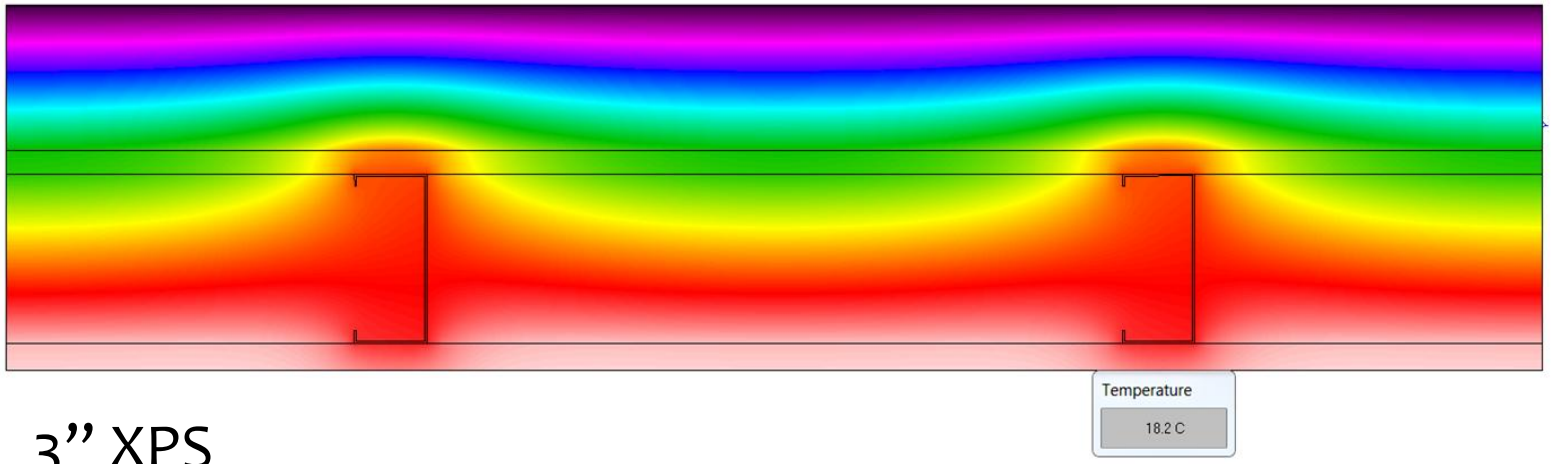
# Calculating Overall Thermal Transmittance (The "bigger" steel stud approach)

## Adding More Insulation to Steel Stud Assemblies to go from an "Effective" R-value of R-15.6 to R-20

| Building Type | Incremental Construction Cost | Energy Cost Savings | Payback (years) |
|---|---|---|---|
| Commercial Office | $ 94,825 | $ 1,116 | 85 |
| High-Rise MURB | $ 153,222 | $ 2,542 | 60 |
| Hotel | $ 64,650 | $ 543 | 119 |
| Large Institutional | $ 150,375 | $ 1,833 | 82 |
| Non-Food Retail | $ 24,192 | $ 461 | 53 |
| Recreation Centre | $ 28,400 | $ 263 | 108 |
| Secondary School | $ 36,325 | $ 306 | 119 |

*The B.C. Experience

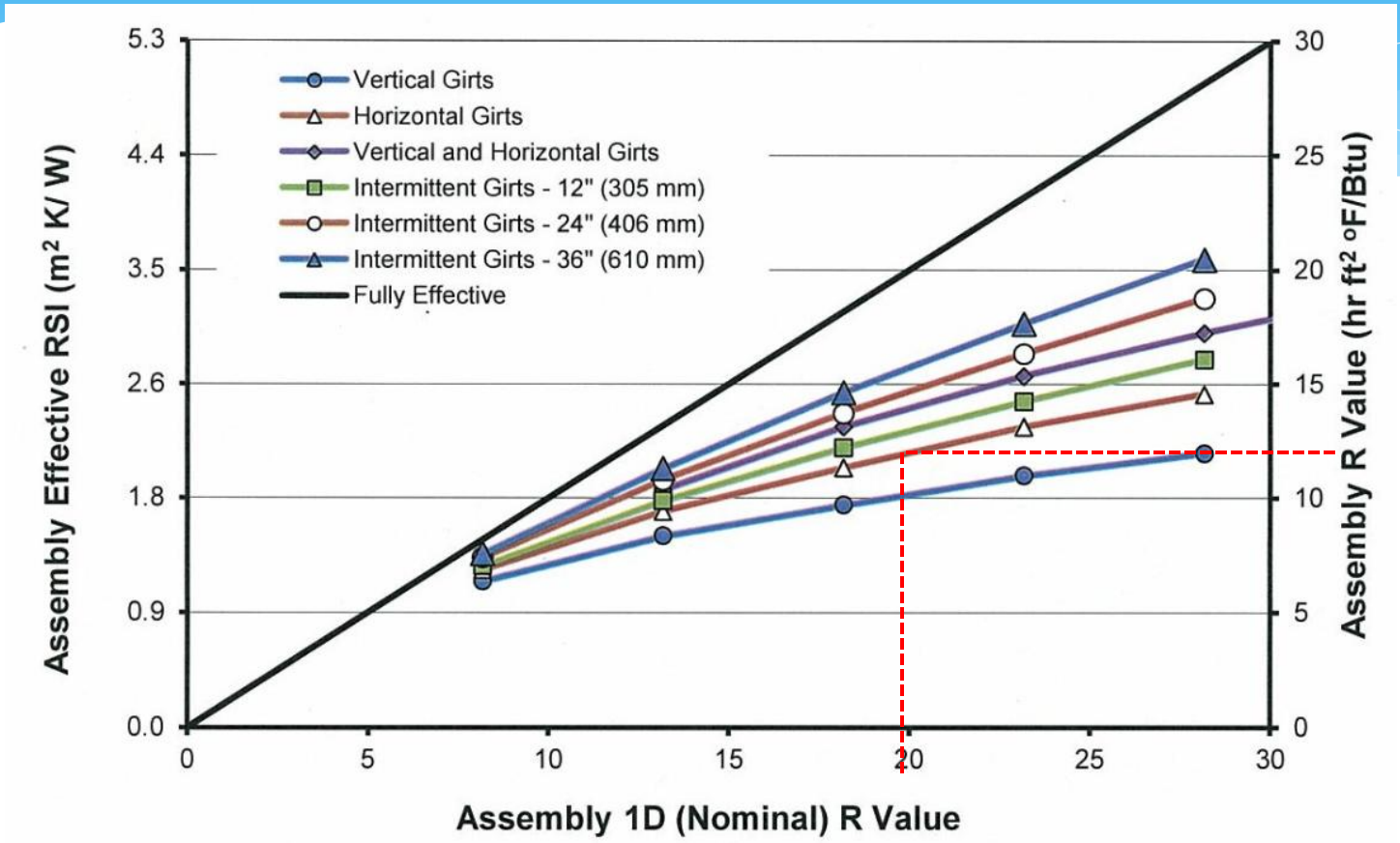
# Calculating Overall Thermal Transmittance (U-value)




3” XPS
½” exterior gwb
3 5/8” ss @ 16” o/c
3 ½ ” glass fibre batt
½” gwb

Surface Temperature = 18.2 C
Reffective = 23.9
Wall thickness = 7.63”

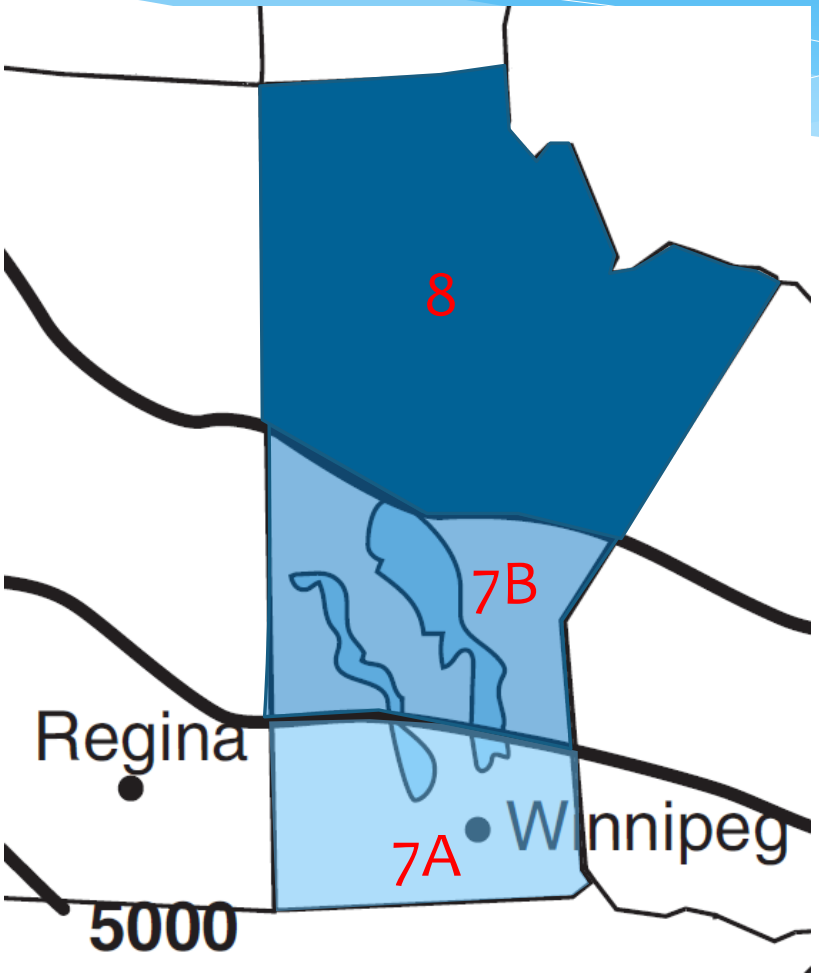
# Calculating Overall Thermal Transmittance (U-value)




ASHRAE RP 1365 - Thermal Performance of Building Envelope Details for Mid- and High-Rise Buildings (Final Report)

http://tc44.ashraetcs.org/research.html

# Calculating Overall Thermal Transmittance (Climate Zones)



# Calculating Overall Thermal Transmittance (Opaque – Above Grade)

**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*, in W/(m²·K) | | | | | |
| Walls | 0.315 | 0.278 | 0.247 | 0.210 | 0.210 | 0.183 |
| Roofs | 0.227 | 0.183 | 0.183 | 0.162 | 0.162 | 0.142 |
| Floors | 0.227 | 0.183 | 0.183 | 0.162 | 0.162 | 0.142 |

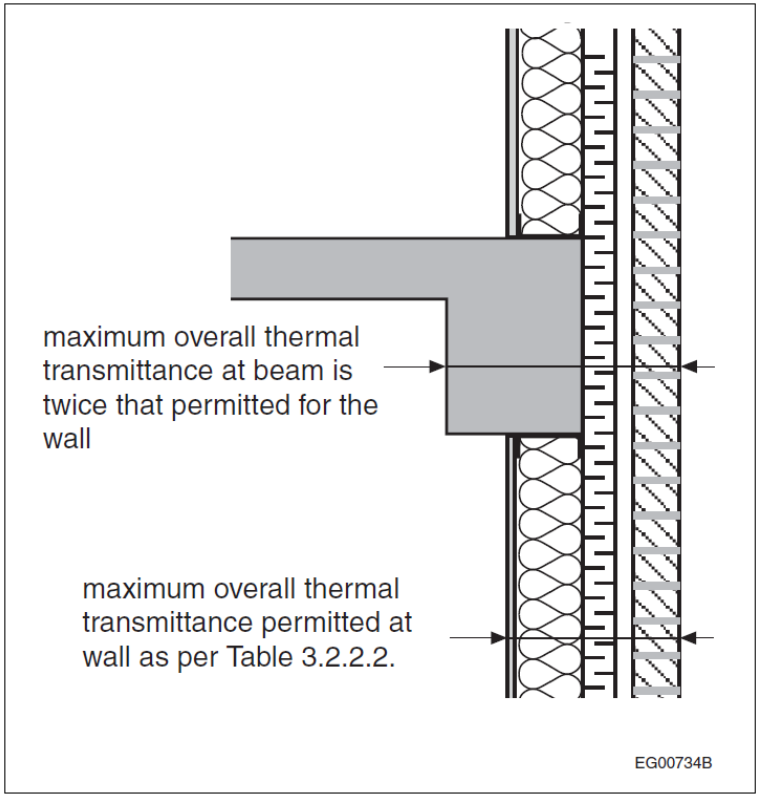
U 0.210 = R27

U 0.162 = R35

# Calculating Overall Thermal Transmittance (What's in-What's out)

* In
  * Studs, joists, lintels, sill, plates
* Sort of in
  * Columns/beams parallel to the envelope
* Sort of out
  * Balcony slabs, beams/columns IF <2% of wall area
* Out
  * Pipes, ducts, HVAC units, shelf angles, anchors, ties

# Calculating Overall Thermal Transmittance (What's in-What's out)



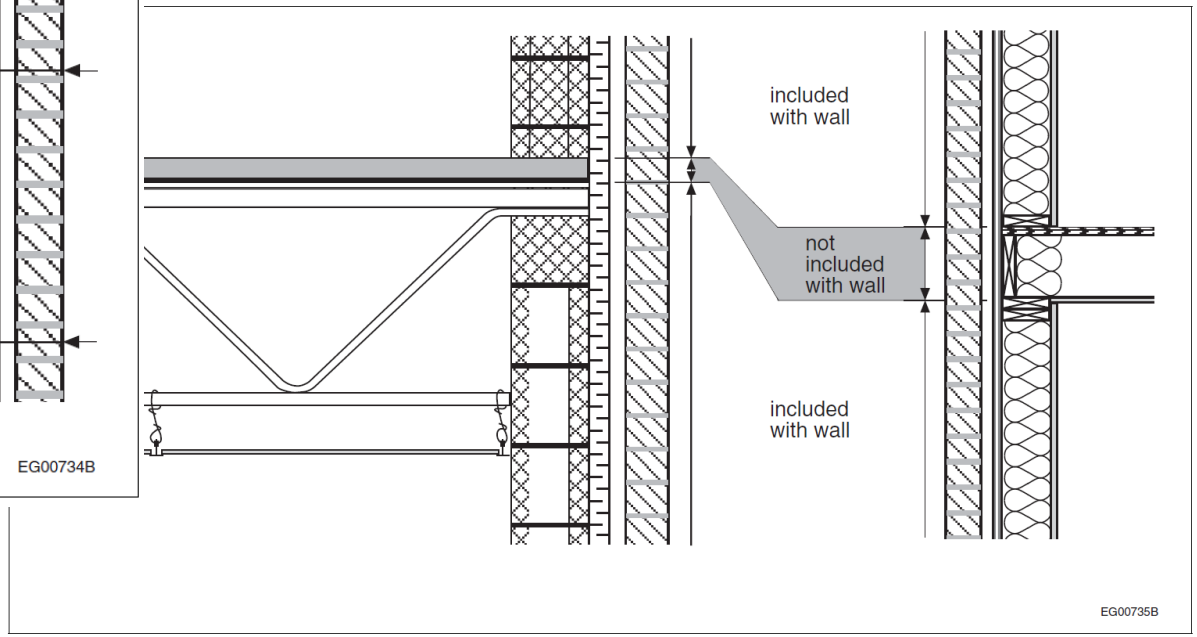
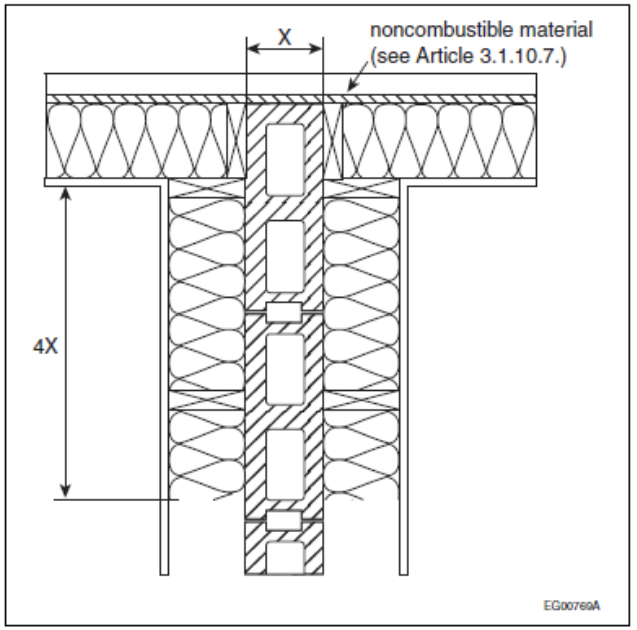




Figure A-3.1.1.7.(8)

NECB Appendix A

# Calculating Overall Thermal Transmittance (What's in-What's out)

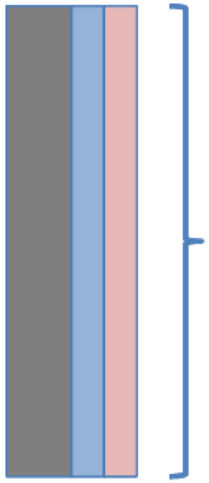
* Expectation is for continuous insulation
* Exception for structural members & switching insulation from interior to exterior
  * -requires insulation for 4x the intersecting distance




* No exceptions for mechanical/electrical components

Figure taken from NBC 9.36 Appendix

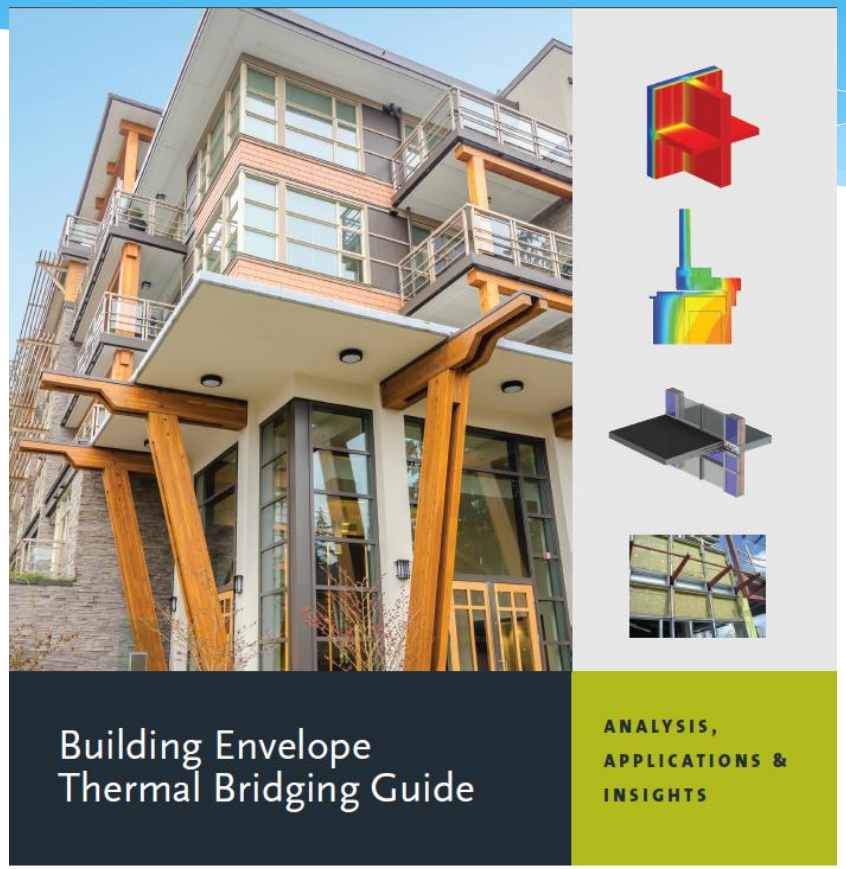
# Calculating Overall Thermal Transmittance (What's in-What's out)



**R20 for 8'3" wall**

**R2 for 9" slab edge**

# Practical Design Details

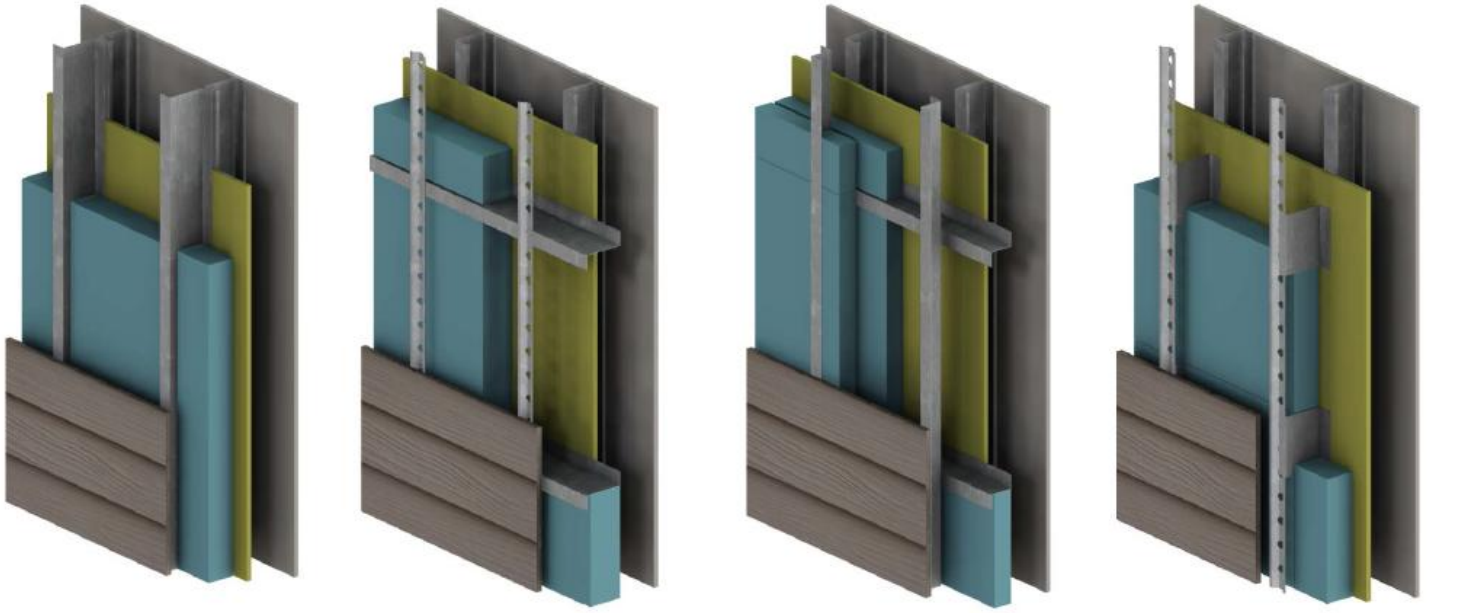



http://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/power-smart/builders-developers/final-mh-bc-part-1-envelope-guide.pdf

# Practical Design Details

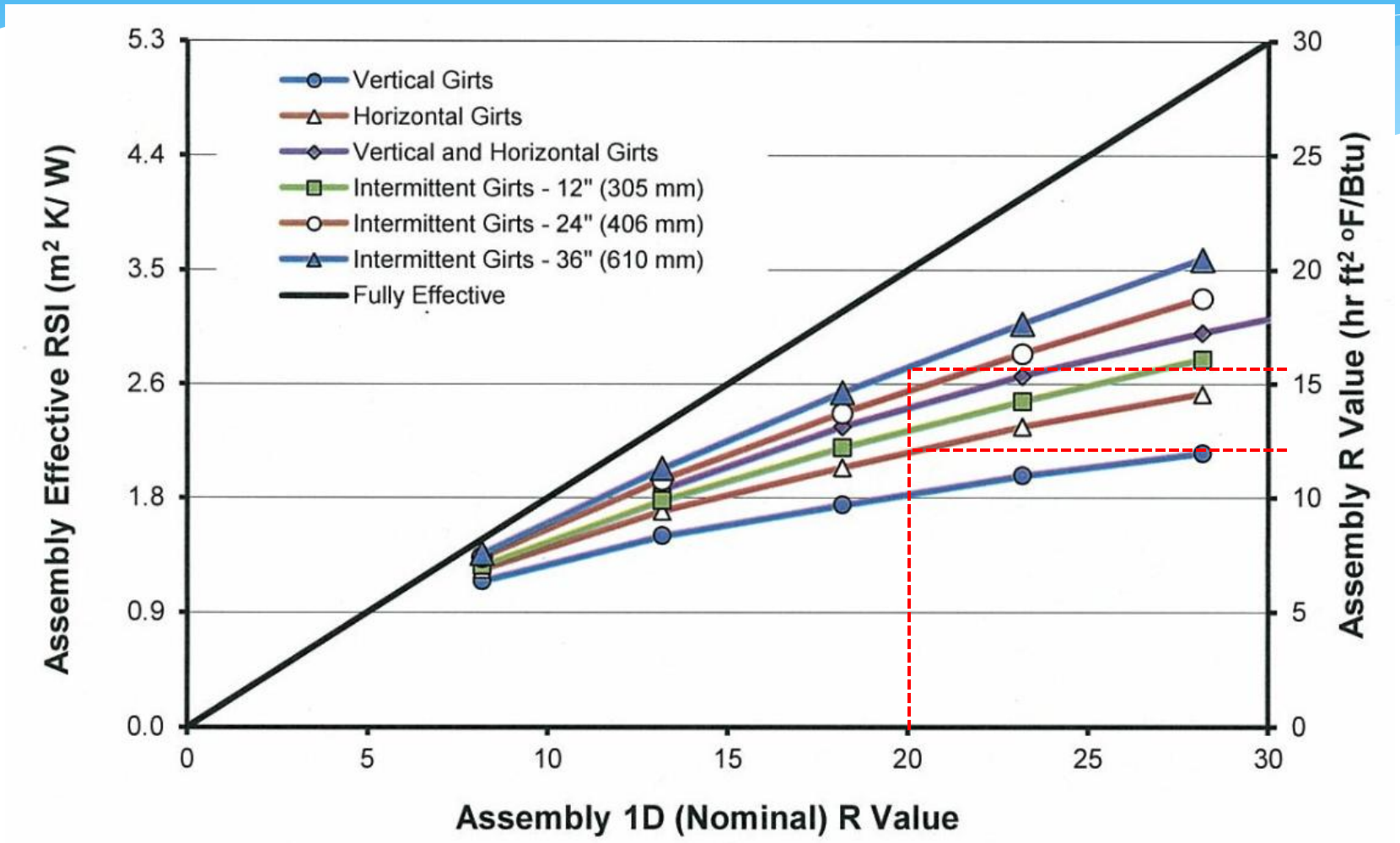
With thanks to:

# Practical Design Details
# Girt Systems

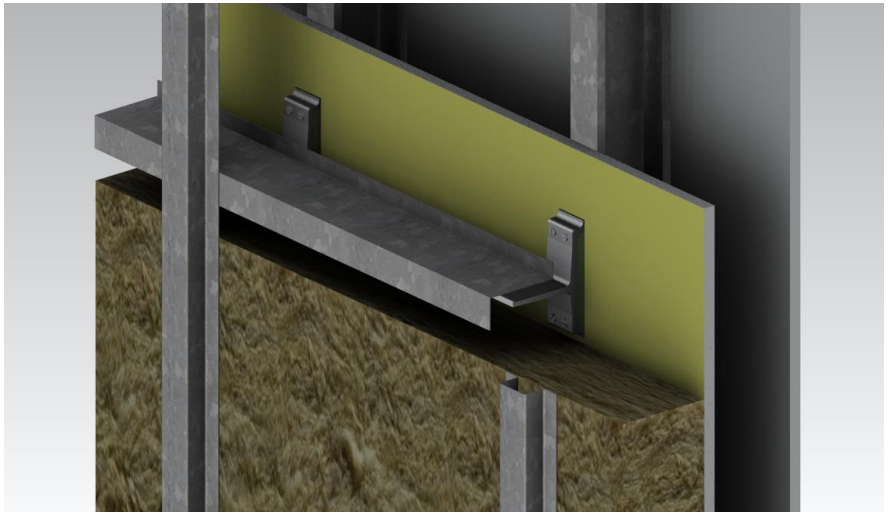


Vertical Z-Girts | Horizontal Z-Girts | Mixed Z-Girts | Intermittent Z-Girts

# Calculating Overall Thermal Transmittance (U-value)



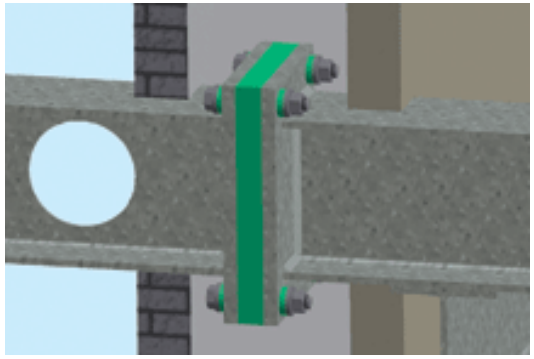
# Practical Design Details
# Cladding Systems



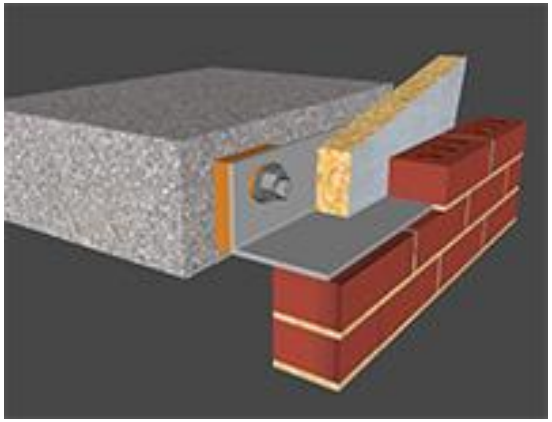
Engineered Assemblies Inc.

Cascadia Clips

# Practical Design Details
# Connection Details



Fabreeka



Armatherm

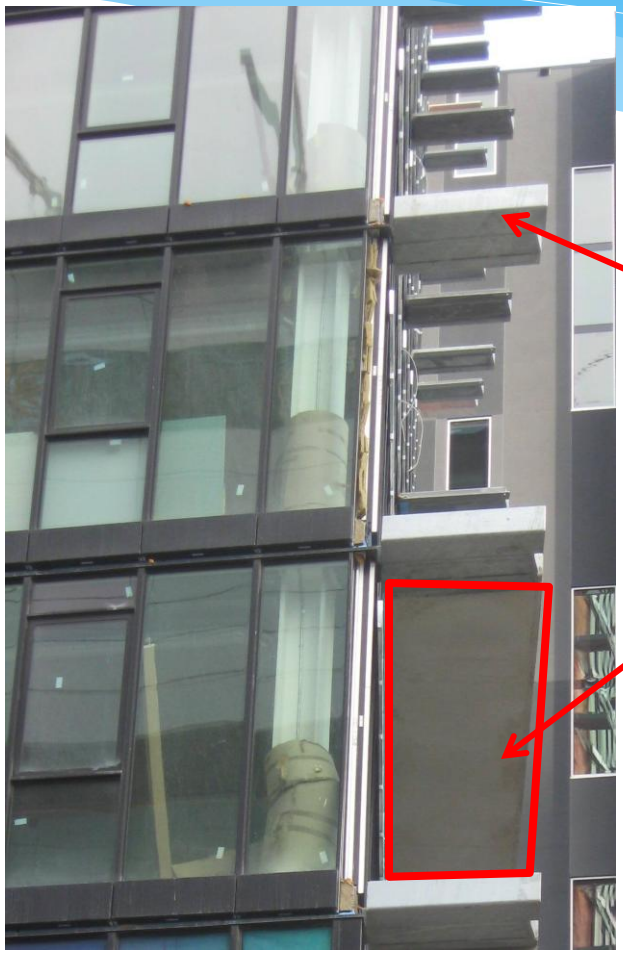
# Practical Design Details
# Slabs/Balconies

Schöck Isokorb®

**Thermal Bridging Guide**

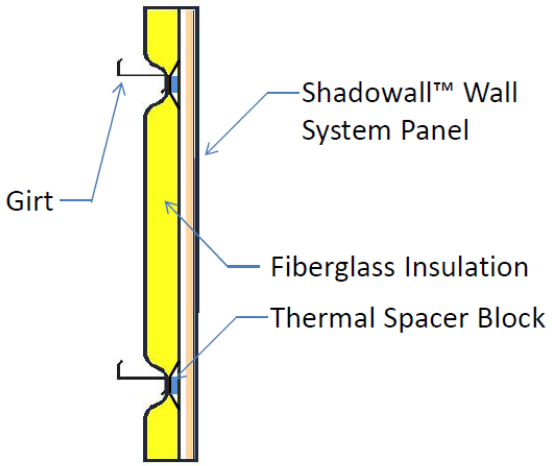
June 2015

# Practical Design Details
# Balconies



# Practical Design Details
# Metal Buildings

U-Facts™ Assembly Snapshot




eShadowall™ Wall System
R-25 fiberglass insulation

| | |
|---|---|
| U-Factor 0.27 | SI |
| U-Factor 0.048 | imp |
| R20.8 | imp |

Not intended for Construction. See test report for full details

BUTLER®

# Practical Design Details
# Insulated Panel Systems

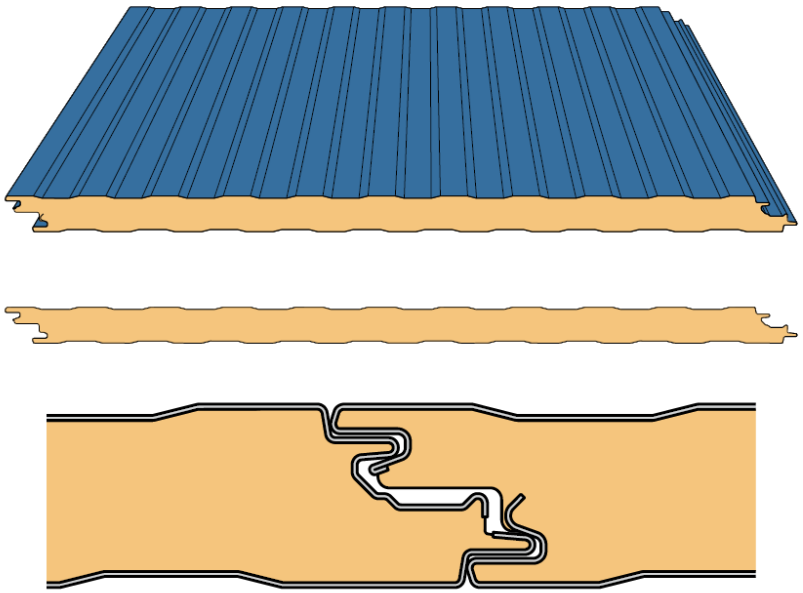


Image courtesy of METL-SPAN

Image courtesy of Canadian Precast/Prestressed Concrete Institute


"I wonder if the lads know there is a big surfing competition this weekend"

# Fenestration

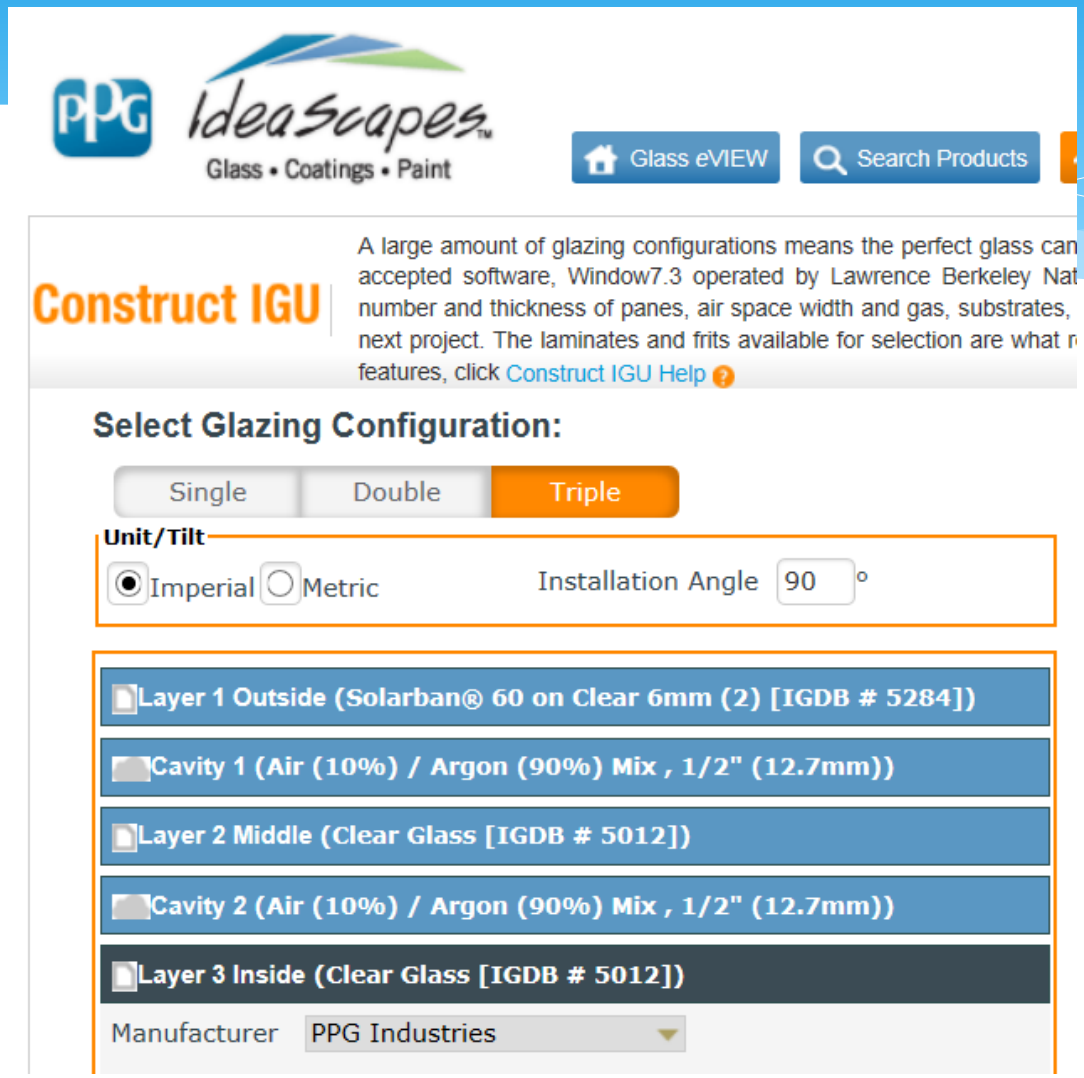
**Table 3.2.2.3.**
**Overall Thermal Transmittance of Fenestration**
Forming Part of Sentences 3.2.2.3.(2) and (3)

| 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*, in W/(m²·K) | | | | | |
| All *fenestration* | 2.4 | 2.2 | 2.2 | ~~2.2~~ 2.0 | ~~2.2~~ 2.0 | 1.6 |

~~ MB Amendment

Currently no Solar Heat Gain (SHGC) requirements

# Fenestration




http://construct.ppg.com/

# Fenestration



## AA™ 6400/6500/6600 Thermal Window

OCTOBER, 2015

THERMAL PERFORMANCE MATRIX (NFRC SIZE)

EC 97911-082

**Thermal Transmittance** [1] (BTU/hr • ft [2] • °F)

| Glass U-Factor [3] | Overall U-Factor [4] |
|---|---|
| 0.30 | 0.35 |
| 0.28 | 0.34 |
| 0.26 | 0.32 |
| 0.24 | 0.30 |
| 0.22 | 0.29 |
| 0.20 | 0.27 |
| 0.18 | 0.25 |
| 0.16 | 0.24 |
| 0.14 | 0.22 |
| 0.12 | 0.20 |
| 0.10 | 0.19 |

**FIXED WINDOW WITH 1-3/4" TRIPLE GLAZING**

**NOTE:** For glass values that are not listed, linear interpolation is permitted.

1. U-Factors are determined in accordance with NFRC 100.
2. SHGC and VT values are determined in accordance with NFRC 200.
3. Glass properties are based on center of glass values and are obtained from your glass supplier.
4. Overall U-Factor, SHGC, and VT Matricies are based on the standard NFRC specimen size of 1200mm wide by 1500mm high (47-1/4" by 59-1/16").

Laws and building and safety codes governing the design and use of glazed entrance, window, and curtain wall products vary widely. Kawneer does not control the selection of product configurations, operating hardware, or glazing materials, and assumes no responsibility therefor.

COG= 0.18 (1.02)

System=0.25 (1.42)

# Fenestration

Manufacturer: Alumicor Limited

Series/Model #: 2600 Thermawall Curtainwall

Spacer: Superspacer

| | | | |
|---|---|---|---|
| Operator Type: | DDSG | Sim Lab Code: | SEEL |
| Model Size: | 2000 x 2000 | Report number: | ALR11004 |
| Thermal Break: | V | Date: | 4/19/2011 |
| | | Revised Date: | |
| | | Rating Procedure: | 2010 |

| Mfr Product Code | Product Number | Gap 1 (mm) | Gap 2 (mm) | Gap Fill 1 | Gap FIll 2 | Emissivity Surface 2 | Emissivity Surface 3 | Emissivity Surface 4 | Emissivity Surface 5 | Tint | Spacer | Grid Type | Grid Size | U-Factor (W/m²K) | VT | *CR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SB60-arg-cl-arg-cl, ss | 0001 | 15.9 | 14.3 | ARG | ARG | 0.03 | | | | CL | ZF-D | N | | 1.28 | 0.58 | 70 |

# Fenestration

Energy Star

| Model<br>Click on a model number for details | Brand | Product Name | U-factor (W/m² - K) | Solar Heat Gain (SHGC) | Energy Rating | ENERGY STAR Zone(s) 2015 | ENERGY STAR Zone(s) 2010 | ENERGY STAR Most Efficient 2015 |
|---|---|---|---|---|---|---|---|---|
| 325HF/272-ARG-CL-ARG-272,XL,FOAM | Duxton Windows and Doors | 325 High Fixed | 0.85 | 0.28 | 38 | 1\|2\|3 | ABCD | Y |

http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.searchrecherche&appliance=WINDOWS

# Fenestration

National Fenestration Rating Council (NFRC)

| GENERAL INFORMATION | |
|---|---|
| Manufacturer: | Accurate Dorwin Ltd. |
| Series Name: | Awning |
| Operator Type: | PRAW |
| Air Leakage: | |

**RATINGS INFORMATION**

Export to Excel

| CPD # | Manufacturer Product Code | U-factor | VT | Condensation Resistance |
|---|---|---|---|---|
| ADL-N-1-00539-00001 | SB60-arg-cl-arg-SB60 5, ss, Rec grill 3/4 | 0.21 | 0.36 | 69 |

Requires conversion to SI

http://search.nfrc.org/search/searchDefault.aspx

# Fenestration (FDWR)

**3.2.1.4. Allowable Fenestration and Door Area**

**1)** The maximum allowable total vertical *fenestration* and door area to gross wall area ratio (FDWR), determined in accordance with Article 3.1.1.6., shall be as follows:

$$\text{FDWR} = 0.40 \text{ for } \text{HDD} \leq 4000,$$
$$\text{FDWR} = (2000 - 0.2 \cdot \text{HDD}) / 3000 \text{ for } 4000 < \text{HDD} < 7000, \text{ and}$$
$$\text{FDWR} = 0.20 \text{ for } \text{HDD} \geq 7000,$$

where

HDD = the heating degree-days of the location of the *building* determined according to Sentence 1.1.4.1.(1).

(See Appendix A.)

**2)** The total *skylight* area shall be less than 5% of the gross roof area as determined in Article 3.1.1.6.

FDWR ≤ (2000 – 0.2 x 5,670) / 3000 ≤ 0.29 or 29% (Winnipeg)

# Fenestration (FDWR)

We don’t want to go here!

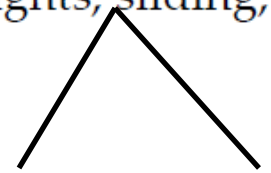
# Fenestration – Curtain Wall

MB Amendment

**1(3) Sentence 1.4.1.2(1) is amended**

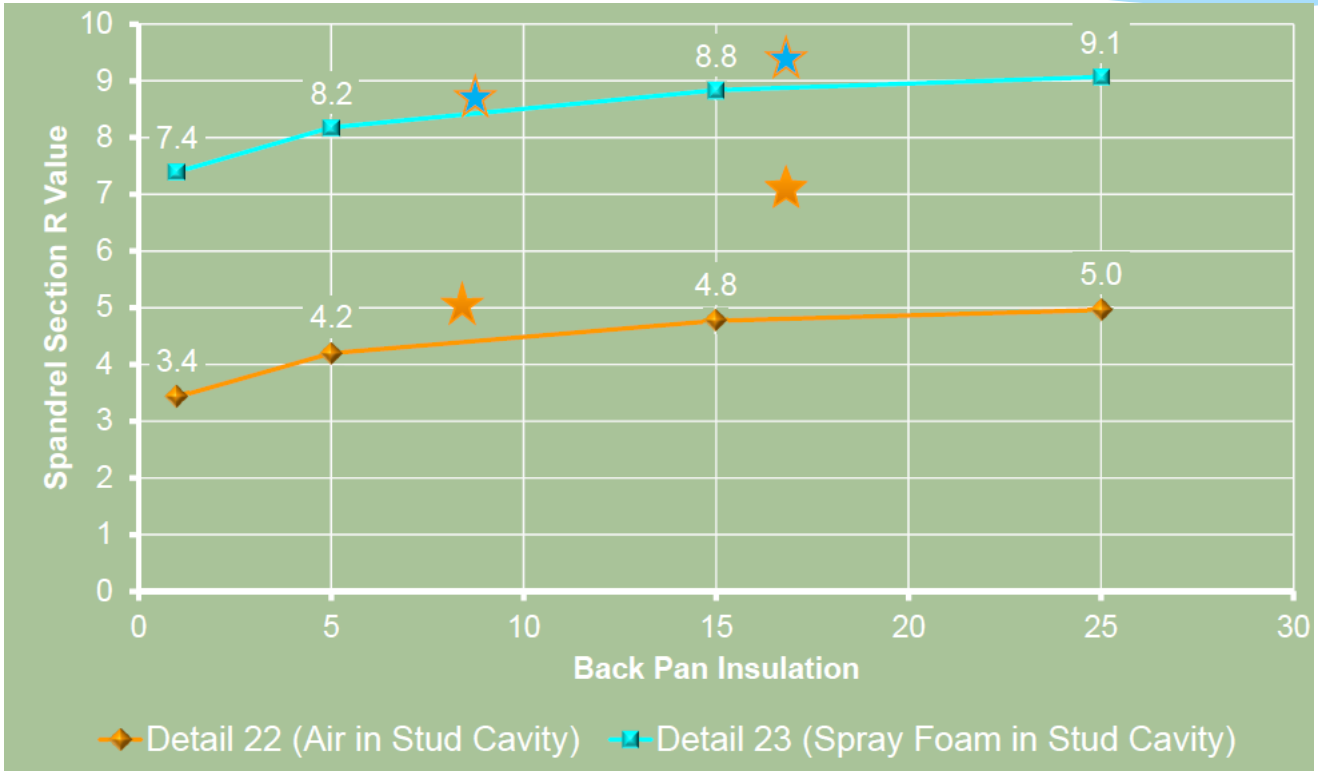
**(b) in the definition "*fenestration*" by adding** "spandrels," **after** "sidelights,".

*Fenestration* means all *building envelope* assemblies, including their *frames*, that transfer visible light, such as windows, clerestories, *skylights*, translucent wall panels, glass blocks, transoms, sidelights, sliding, overhead or swinging glass doors, and glazed inserts in doors, etc.

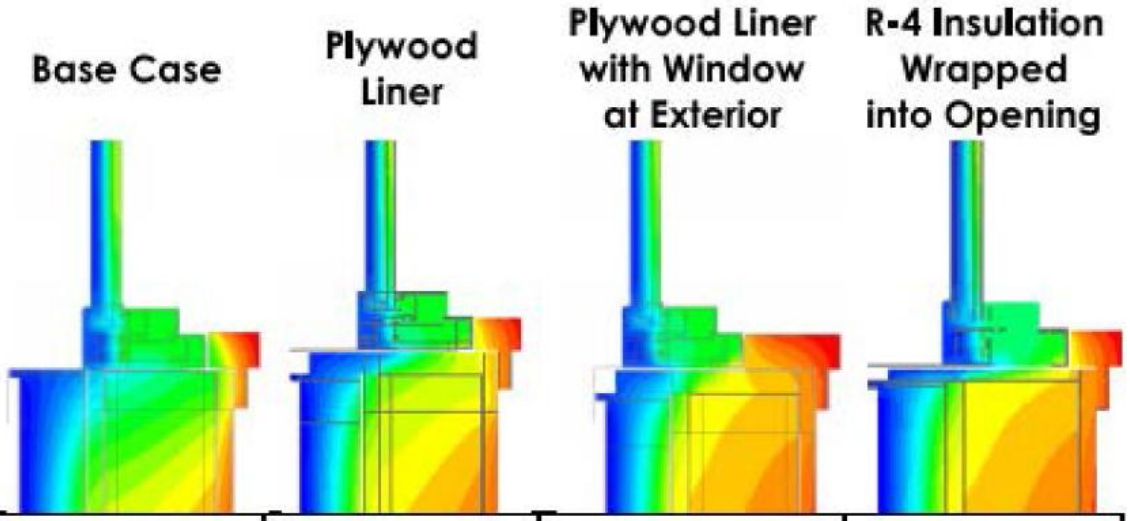


Spandrels

# Fenestration – Curtain Wall



# Practical Design Details
# Some Good News!




| | | | | |
|---|---|---|---|---|
| Linear Transmittance (W/m K) | 0.41 | 0.24 | 0.21 | 0.21 |

# Practical Design Details
# Some Good News

* Passive Solar Heat Gain
  * Good window selection can provide net energy gain
  * South exposure, Winnipeg
    * Up to 100 kWh/$m^2$ net gain
* Offset with solar shading
  * Static
  * Mechanical
  * Dynamic

# Practical Design Details
# Some Good News

# Practical Design Details
# Some Good News

Before

After

# Doors

**Table 3.2.2.4.**
**Overall Thermal Transmittance of Doors**
Forming Part of Sentence 3.2.2.4.(1)

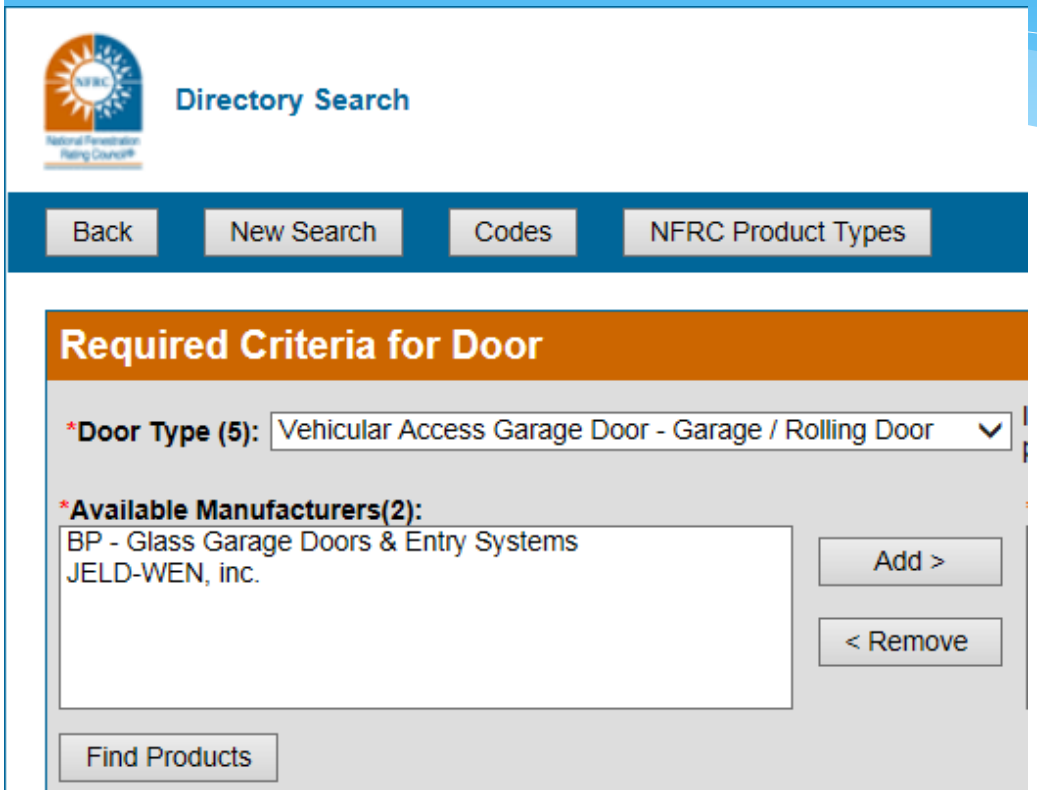
| Component | Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days | | | | | |
|---|---|---|---|---|---|---|
| | Zone 4:(2) < 3000 | Zone 5:(2) 3000 to 3999 | Zone 6:(2) 4000 to 4999 | Zone 7A:(2) 5000 to 5999 | Zone 7B:(2) 6000 to 6999 | Zone 8:(2) ≥ 7000 |
| | Maximum *Overall Thermal Transmittance*, in W/(m²·K) | | | | | |
| All doors | 2.4 | 2.2 | 2.2 | 2.2 | 2.2 | 1.6 |

**Notes to Table 3.2.2.4.:**
(1) See Sentence 1.1.4.1.(1).
(2) See A-Table 3.2.2.2. in Appendix A.

**2)** Doors need not comply with Sentence (1) where
a) their total area does not exceed 2% of the gross wall area calculated in accordance with Article 3.1.1.6., and
b) their *overall thermal transmittance* does not exceed 4.4 W/(m²·K).

**3)** Access hatches that are part of a *building envelope* shall be insulated to a nominal thermal transmittance of not more than 1.3 W/(m²·K), exclusive of stiffeners or edge construction.

# Doors




Information primarily on residential style entry and garage doors

National Fenestration Rating Council
http://search.nfrc.org/search/cpd/cpd_search_productline.aspx

http://www.dasma.com/dasma-pages/DASMA-tehnical-data-sheets.asp

# Building Assemblies in Contact with the Ground

**Table 3.2.3.1.**
**Overall Thermal Transmittance of Building Assemblies in Contact with the Ground**
Forming Part of Sentences 3.2.3.1.(1), 3.2.3.2.(1) and 3.2.3.3.(1) to (3)

| Assembly in Contact with the Ground | 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*, in W/(m²·K) | | | | | |
| Walls | 0.568 | 0.379 | 0.284 | 0.284 | 0.284 | 0.210 |
| Roofs | 0.568 | 0.379 | 0.284 | 0.284 | 0.284 | 0.210 |
| Floors | 0.757 for 1.2 m | 0.757 for 1.2 m | 0.757 for 1.2 m | 0.757 for 1.2 m | 0.757 for 1.2 m | 0.379 for full area |

**Notes to Table 3.2.3.1.:**
(1) See Sentence 1.1.4.1.(1).
(2) See A-Table 3.2.2.2. in Appendix A.

0.284 (R20)
0.757 (R7.5)

# Building Assemblies in Contact with the Ground

* Special Considerations
  * Grade beams above/below grade
  * Radiant floors
  * Slab on Grade -depth

# Building Assemblies in Contact with the Ground

## Manitoba amendment

**2(2)** **Sentence 3.2.3.1(4) is replaced with the following:**

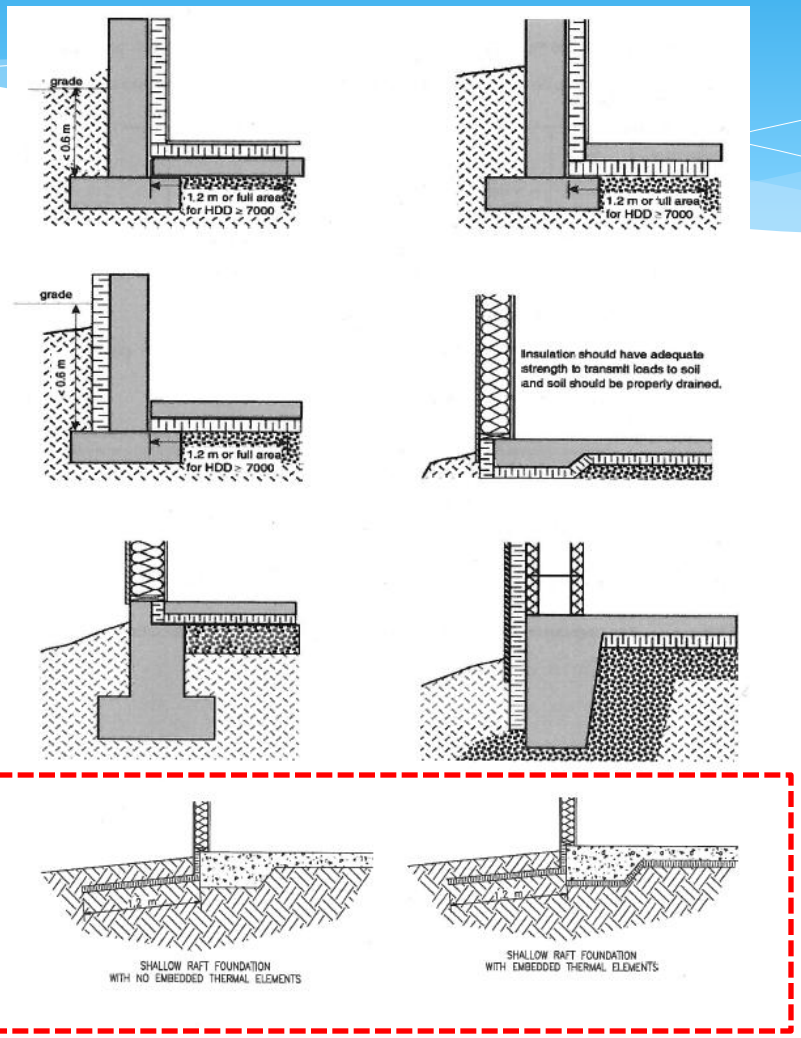
**4)** Where the top of the footing is less than 0.6 m below the exterior ground level, the same level of insulation stated in Sentence (1) shall be placed

a) on the top or bottom surface of the floor for a distance not less than 1.2m from the perimeter, or

b) below grade extending out from the face of the exterior wall for a distance of not less than 1.2.m (See Figure A-3.2.3.3. in Appendix A.)

# Building Assemblies in Contact with the Ground

Manitoba amendment

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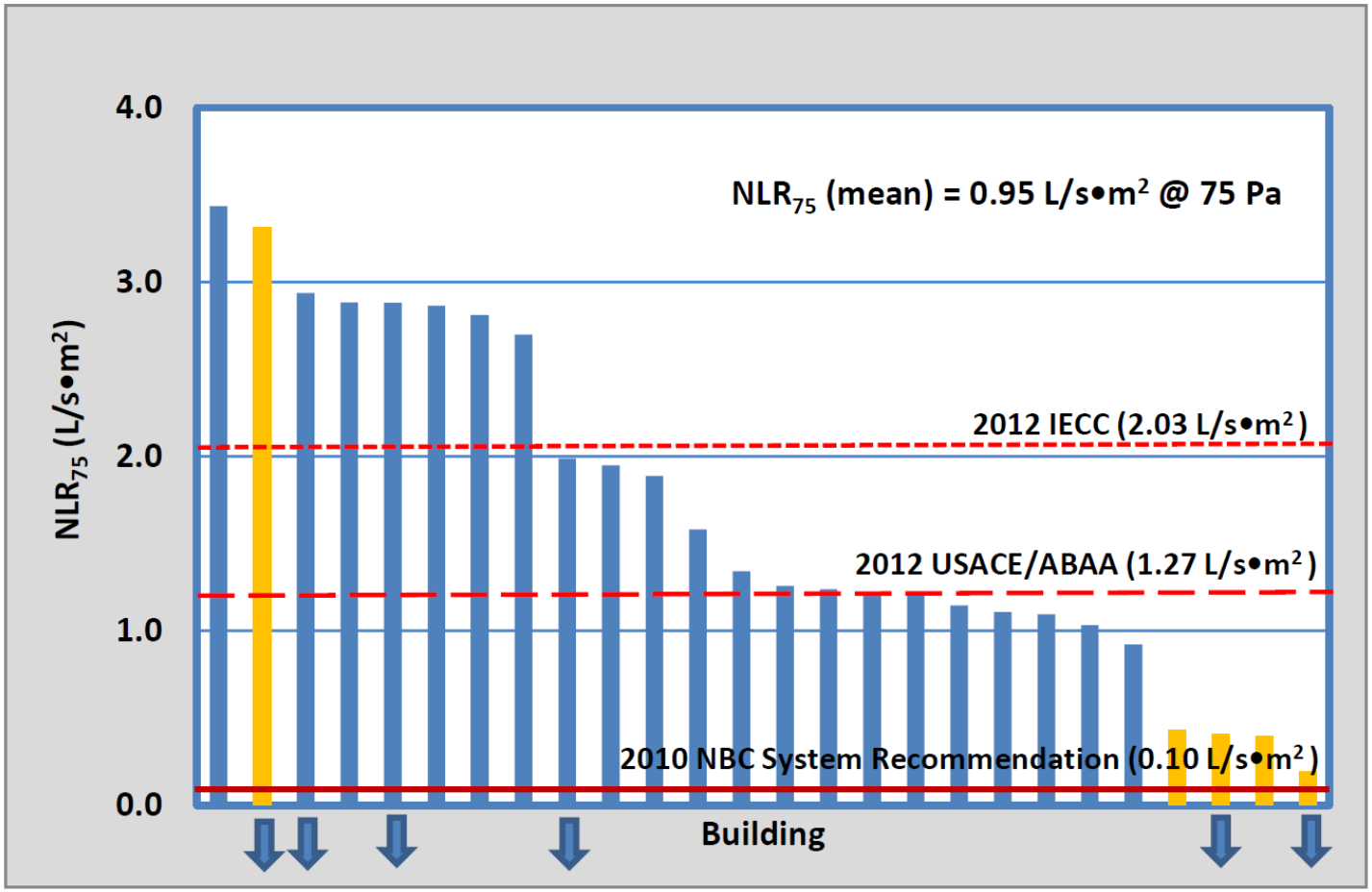
# Air Leakage

* Material properties in NBC
* System properties in NBC & NECB
  * Windows & Doors
  * Walls/Roofs – not so much
* No whole building air tightness requirement in NBC or NECB
  * Recommendation in the Appendix of NBC

# Air Leakage

**Figure 4** – Normalized Leakage Rate for New Buildings (yellow bars)




**An Investigation of Airtightness in Manitoba's Commercial Building Sector**
**Red River College/Proskiw Engineering 2015**

# Air Leakage


Some leaks are more obvious than others!

# Simple Trade Off

* ∑ (summation) UxA (proposed) ≤ ∑ UxA (prescriptive)
  * Some exclusions

Example: (opaque wall area ≤ 0.21)

| | | |
|---|---|---|
| 10% of wall area | U=0.24 | (R23.6) |
| 40% of wall area | U=0.23 | (R24.7) |
| 50% of wall area | U=0.18 | (R31.5) |
| Total | U=0.206 | (R27.6) |

# Simple Trade Off (Fenestration/Opaque)

Building with 25% glazing

Prescriptive $\sum$ UxA

75% x 0.21 + 25% x 2.0 = 0.68

Proposed $\sum$ UxA

U value of opaque wall = 0.28 (R20)

75% x 0.28 + 25% x Uwindow $\leq$ 0.68

U window (max) = 1.88

# Simple Trade Off (Fenestration/Opaque)

Building with 40% glazing

Prescriptive $\sum$ UxA

71% x 0.21 + 29% x 2.0 = 0.73

(maximum FDWR)

Proposed $\sum$ UxA

U value of window= 1.4

60% x Uwall + 40% x 1.4 ≤ 0.73

U wall (max) = 0.28 (R20.0)

# Detailed Trade Off

* Reference building is still from prescriptive approach
* Trade off between any **envelope** components
* Proposed building must not use more energy than the prescriptive building
* Complex calculations when considering above grade vs components in contact with the ground
* Quickly leads to performance path with modeling

# Checklists

Project Name: Date:

## Example of Building Envelope Checklist

| |
|---|
| Project Description: |
| Project Address: |
| Type of Building (new or addition to existing building): |
| Heating Degree-Days (HDD) of Building Location: |
| Climate Zone (based on HDD of building location): |
| Conditioned Area, $m^2$: |

**Compliance path(s) selected:** Prescriptive ___ Simple Trade-off ___

Detailed Trade-off ___ Performance ___

**Prescriptive Path (NECB Section 3.2.)**

| NECB Requirement | Compliance Description | Compliance Achieved? | | |
|---|---|---|---|---|
| | | Yes | No | N/A |
| 3.2.1.1. | The building envelope is designed to protect insulation materials.<br>List applicable exceptions: | | | |
| 3.2.1.2. | Interior building components and structural members that intersect or partly penetrate the building envelope do not break the continuity of the insulation and do not increase the overall thermal transmittance at their projected area to more than is permitted.<br>List applicable exceptions: | | | |

Taken from NECB User's Guide 2014

# Checklists

**MECB 2013 Documentation Submission Checklist** (for NC of Part 3 and some Part 9 Non-residential)

| | | | |
|---|---|---|---|
| Property Address : | | Building Permit Application No.: | |
| Specific Address : | | | |

**This form is to be completed digitally. For ease of use, drop boxes and pop-up instructions are included.**

**Requirement for MECB Compliance**

In accordance with Manitoba Regulation MR 213/2013 Manitoba Energy Code for Buildings,

*1 Subject to the amendments […], the National Energy Code of Canada for Buildings 2011, issued by the Canadian Commission on Buildings and Fire Codes, National Research Council Canada, is adopted as the energy code for Manitoba.*

and, the following deliverables are required to show compliance with this code.

**Building Use, Area & Performance Information**

Type of Work

| | | | |
|---|---|---|---|
| Primary Use & Area: | | Total *Building Area* ($m^2$): | |
| Secondary Use & Area: | | Allowable Fenestration and Door Ratio (%): | |
| Tertiary Use & Area: | | Skylight-Roof Area Ratio (%): | |
| Additional Use & Area: | | Semiheated Space Area ($m^2$): | |
| Additional Use & Area: | | Residential Conditioned Space Area ($m^2$): | |
| Total *Building Area* ($m^2$): | | | |

Overall Thermal Transmittance (in W/($m^2$·K))

| | | | | | |
|---|---|---|---|---|---|
| Above Ground Opaque Assemblies | Walls | | Roofs | | Floors | |
| Assemblies In Contact with the Ground | Walls | | Roofs | | Floors | |
| Fenestration | | Doors | | | | |

http://www.firecomm.gov.mb.ca/codes_energy.html compliance checklist

# Performance

* Still based on Prescriptive values
* Unlimited trade-offs between components and systems
* Design Flexibility
* Case Studies- Sherwood Developments

# Additional Training

* CSC – January 20, 2016
  * Opportunities & Insights with Energy Modeling
* Red River College
  * Intro to the Manitoba Energy Code for Buildings
  * Section 9.36 Energy Efficiency in Housing and Small Buildings (sold out-waiting list)
  * Manitoba Energy Code Exams (MECB or Section 9.36)
  * Introduction to CANQUEST Modeling
  * Advanced CANQUEST Modeling

www.rrc.ca/techsolutions

# Questions/Comments?