



COMMERCIAL SALES

srey@cascadiawindows.com 778.868.32589



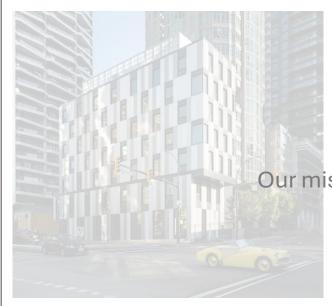
AGENDA: WHAT ARE WE LOOKING AT TODAY?

- Intro to Cascadia Windows & Doors
- Energy Demand and Window Impacts
- Meeting the Passive House Windows Standard
- Selecting Passive House Windows
- Window U-values in the Real World



INTRODUCTION TO CASCADIA WINDOWS & DOORS

FIBERGLASS INNOVATION



COMMERCIAL & MULTI-FAMILY Windows & Window Wall

BUILDING ENVELOPE TECHNOLOGY FIRM

Our mission is to lead North America's transition to energy efficient

and durable building design.

INSTITUTIONAL

Fixed & Operable Windows Swing & Sliding Doors Passive House Windows & Doors



I HERWAL SPACER
Exterior Cladding Assemblies
Low-sloped Roofs & Soffits

INTRODUCTION TO CASCADIA WINDOWS & DOORS CONTINUING EDUCATION PRESENTATION

PASSIVE HOUSE PRODUCTS









HOPPER WINDOW







CASEMENT / TILT & TURN

SLIDING DOOR

WING DOOR



ENERGY DEMANDS & WINDOW IMPACTS CONTINUING EDUCATION PRESENTATION

POLL – PASSIVE HOUSE PROJECTS

HOW MANY PASSIVE HOUSE PROJECTS HAVE YOU BEEN A PART OF?

ENERGY DEMANDS & WINDOW IMPACTS CONTINUING EDUCATION PRESENTATION

PASSIVE HOUSE PRINCIPLES

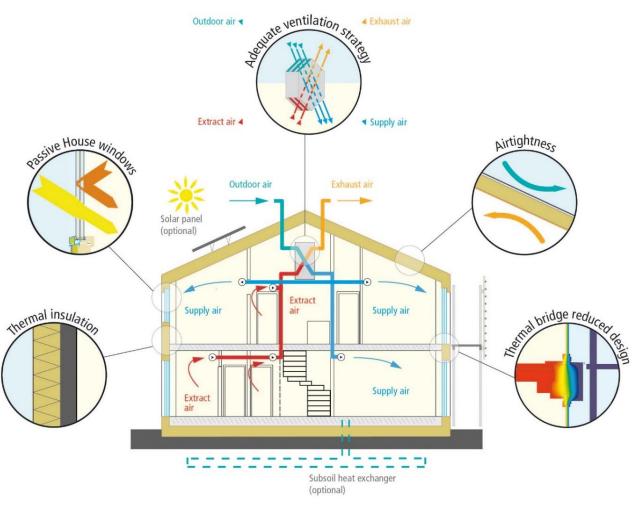


Image courtesy of Passive House Institute

SHIFTING TOWARDS PERFORMANCE































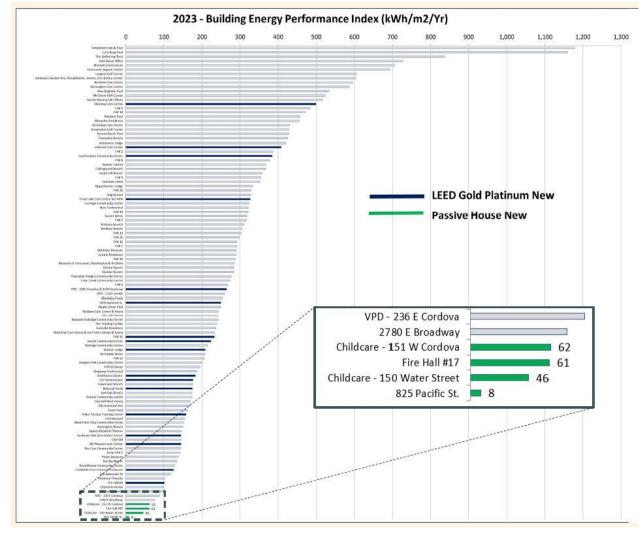




ENERGY DEMANDS & WINDOW IMPACTS CONTINUING EDUCATION PRESENTATION



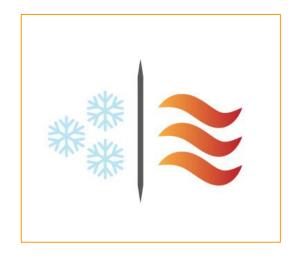




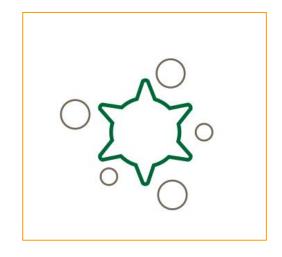
Care of: City of Vancouver + HCMA
Passive House Canada Conference 2024



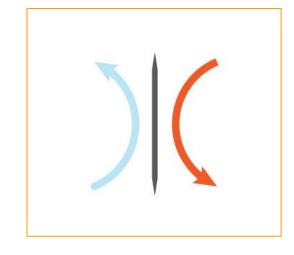
PASSIVE HOUSE WINDOW STRATEGY



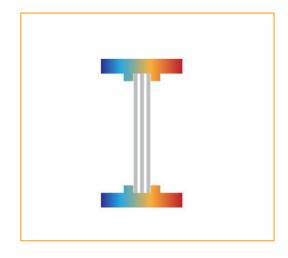
THERMAL COMFORT & DRAUGHT PREVENTION



HYGIENE



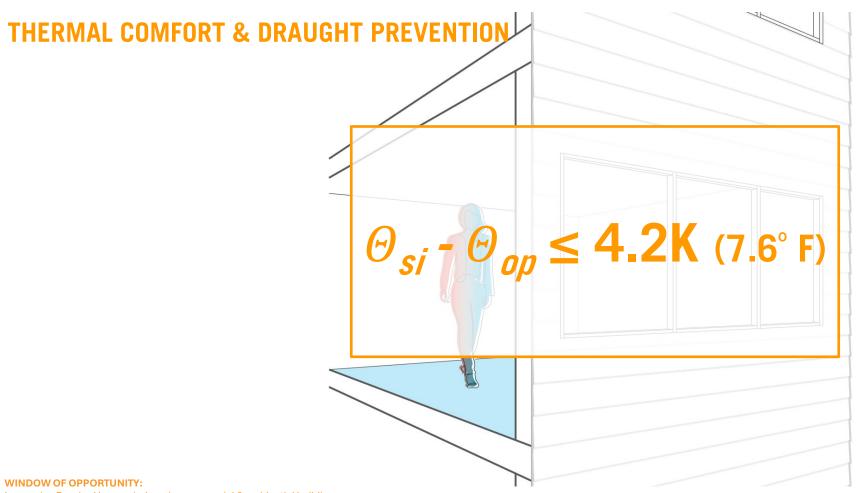
AIR TIGHTNESS



THERMAL PERFORMANCE

PASSIVE HOUSE WINDOW STRATEGY





 \mathcal{O}_{SI} = Average Int. Window Temperature \mathcal{O}_{OP} = Average Ambient Temperature

PASSIVE HOUSE WINDOW STRATEGY

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HYGIENE



Image courtesy of Saga Magazine

WINDOW OF OPPORTUNITY:

Leveraging Passive House windows in commercial & residential buildings

PASSIVE HOUSE WINDOW STRATEGY

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HYGIENE



AW = Relative Humidity

PASSIVE HOUSE WINDOW STRATEGY



HYGIENE

AW < 0.80
RELATIVE HUMIDITY AT SURFACE

AW = Relative Humidity

$$f_{Rsi} = \frac{\Theta_{si} - \Theta_{e}}{\Theta_{i} - \Theta_{e}}$$

 f_{RSI} = Hygiene Factor Θ_{SI} = Int. Cold Point Θ_e = Coldest Day Outdoor Temp. Θ_i = Int. Ambient Temp.

PASSIVE HOUSE WINDOW STRATEGY



HYGIENE

*COLD CLIMATE

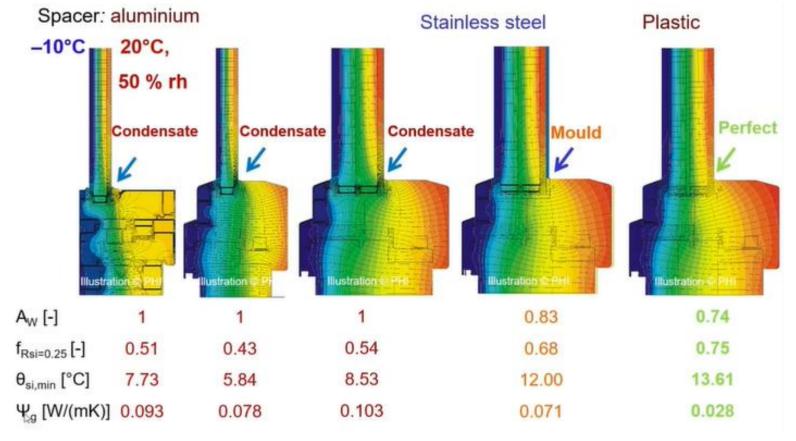


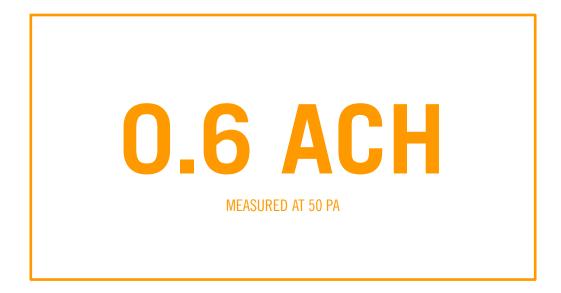
Image courtesy of Peel Passive House

WINDOW OF OPPORTUNITY:

PASSIVE HOUSE WINDOW STRATEGY

)((

AIR TIGHTNESS



ACH = Air Changes / Hour

PASSIVE HOUSE WINDOW STRATEGY



AIR TIGHTNESS

O.6 ACH
MEASURED AT 50 PA

AIR LEAKAGE RESISTANCE

Air test data is indicated in the following table:

Property	Area m² (ft²)	Infiltration Rate	/	Compliance US (CAN)
Overall Assembly @ 75 Pa	3.84 (41.28)	0.00 (0.00)	0.00 (0.00)	Pass (A3)
Overall Assembly @ 300 Pa	3.84 (41.28)	0.00 (0.00)	0.00 (0.00)	Pass (A3)
Allowable Leakage Kates				
Maximum allowable air leakage rate (US):			1.5 L/s*m², 0.3 cfm/ft²	
Maximum allowable air leakage rate (CAN – A3):			0.5 L/s*m², 0.1 cfm/ft²	

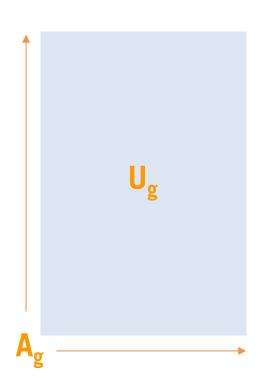
The overall system **met** the US and Canadian performance requirements as reported above when evaluated under NAFS-08, NAFS-11, A440S1-09 and A440S1-17.

Image courtesy of Cascadia Windows & Doors

PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE



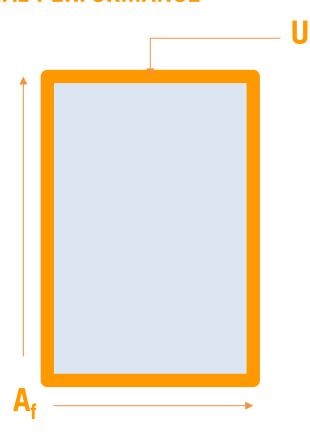
 $U_g = U$ -value of the glass $A_g = G$ lazing surface area

 $\mathbf{U}_{\mathbf{g}} \ \mathbf{x} \ \mathbf{A}_{\mathbf{g}}$

PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE



 $U_g = U$ -value of the glass $A_g = G$ lazing surface area

 $U_f = U$ -value of the frame

 A_f = Window frame surface area

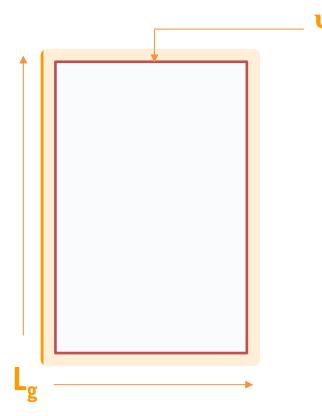
 $U_g \times A_g$

 $U_f \times A_f$

PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE



 $U_g = U$ -value of the glass $A_{\sigma} = G$ lazing surface area

U_f = U-value of the frame A_c = Window frame surface a

 Ψ_g = Glass edge coefficient L_g = Glass edge length

 $U_g \times A_g$

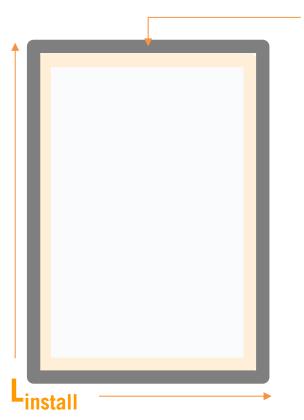
 $U_f \times A$

 $\Psi_g \ x \ L_g$

PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE



Ψinstall

 $U_g = U$ -value of the glass $A_g = G$ lazing surface area

 $U_f = U$ -value of the frame

A_f = Window frame surface area

 Ψ_g = Glass edge coefficien L_g = Glass edge length

 $\Psi_{install}$ = Installed edge coefficient $L_{install}$ = Installed edge length

Ug x Ag

 $U_f \times A_f$

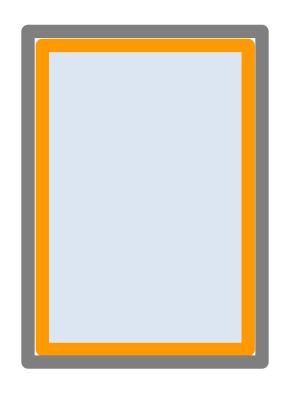
 $\Psi_g \times L_g$

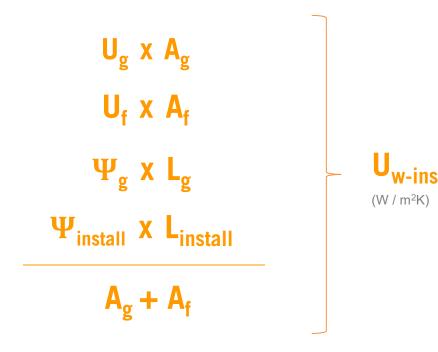
Ψ_{install} x L_{install}

PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE

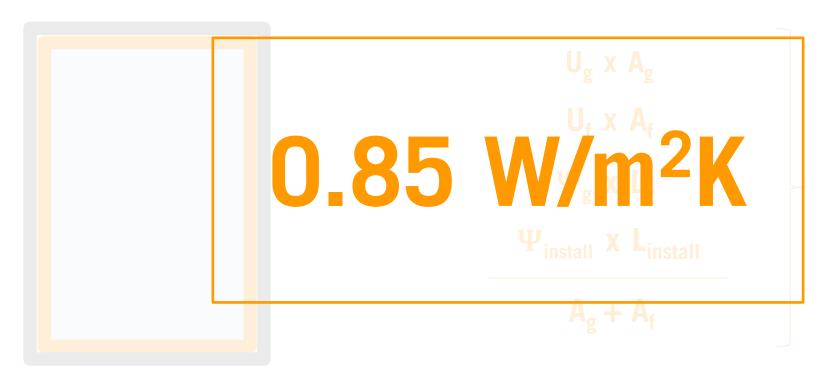




PASSIVE HOUSE WINDOW STRATEGY



THERMAL PERFORMANCE



U_{w-instal}

MEETING THE PASSIVE HOUSE STANDARD

PASSIVE HOUSE MODELLING

CERTIFIED VS NON-CERTIFIED PRODUCTS

CONTINUING EDUCATION PRESENTATION

PASSIVE HOUSE MODELLING

NON-PASSIVE HOUSE CERTIFIED PRODUCT

LOW-E 366 / 180

Uw-0.8
STANDARD TRIPLE-GLAZED IGU /
STANDARD WARM EDGE SPACER
FIXED WINDOW

PASSIVE HOUSE CERTIFIED PRODUCT

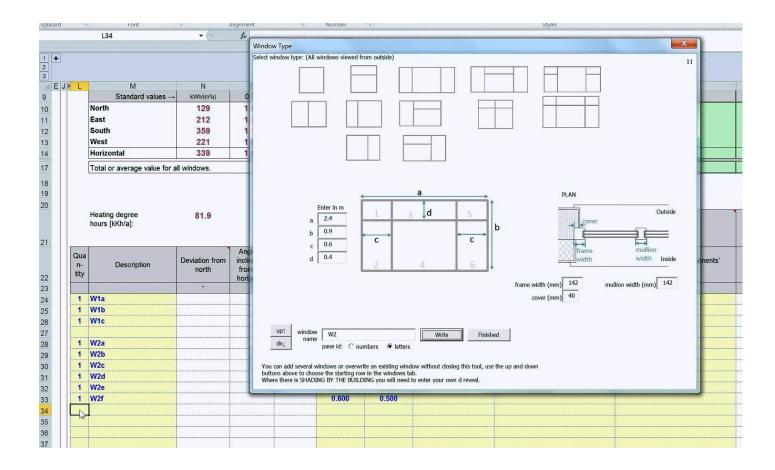
LOW-E 366 / 180 / i89

Uw-0.65

PREMIUM TRIPLE-GLAZED IGU /
TRISEAL SUPER SPACER

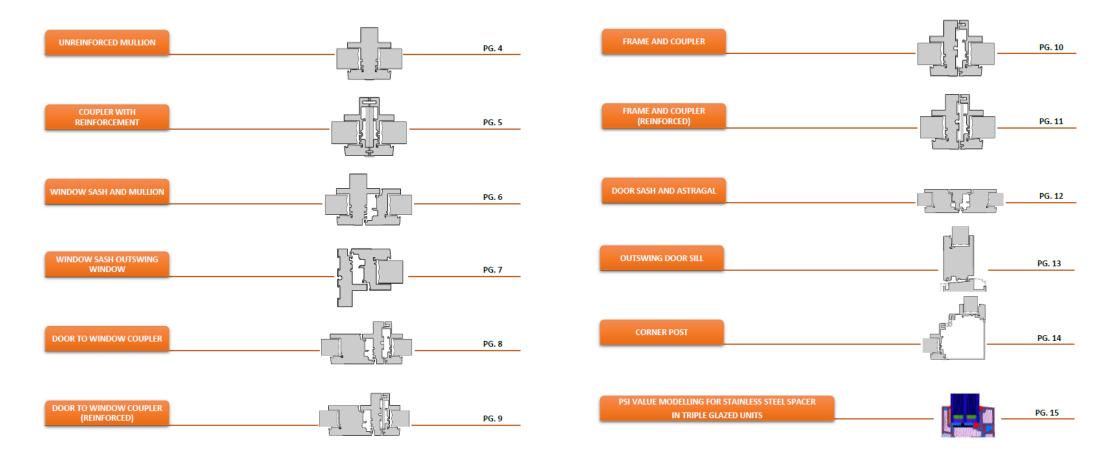
FIXED WINDOW

PASSIVE HOUSE MODELLING





ADDITIONAL PRODUCT PHI INFORMATION



POLL - WINDOW CHARACTERISTICS

POLL – WINDOW CHARACTERISTICS

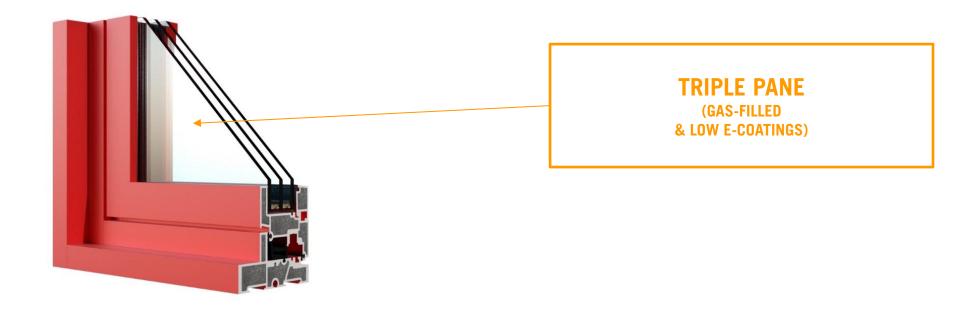
HOW FAMILIAR ARE YOU WITH HIGH-PERFORMANCE WINDOWS?

PASSIVE HOUSE STRATEGY



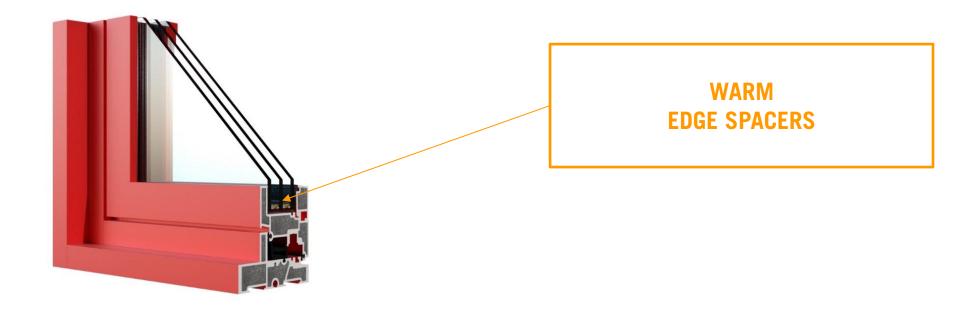
WINDOW PRODUCT STRATEGY

SUMMARY OF GOOD WINDOW DESIGN



WINDOW PRODUCT STRATEGY

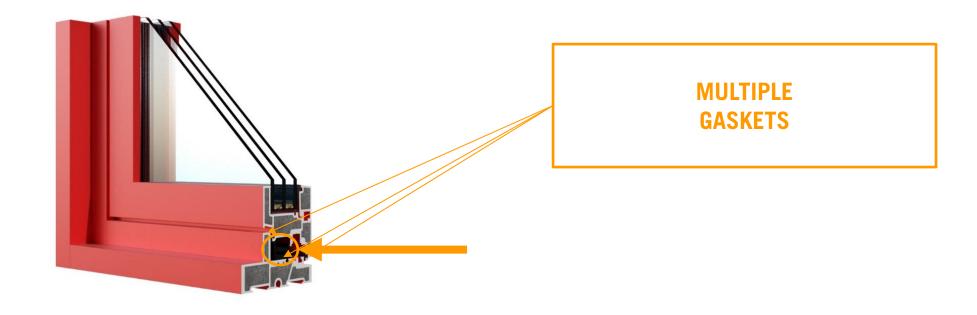
SUMMARY OF GOOD WINDOW DESIGN



TRIPLE PANE
(GAS-FILLED
& LOW E-COATINGS)

WINDOW PRODUCT STRATEGY

SUMMARY OF GOOD WINDOW DESIGN

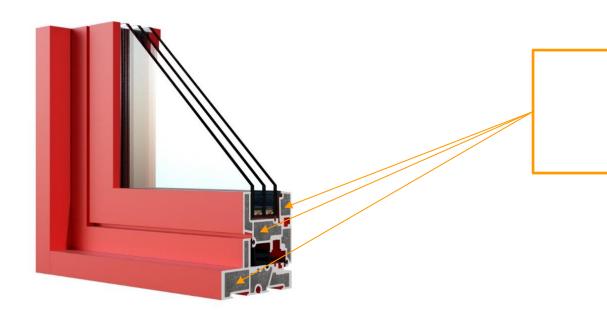


TRIPLE PANE
(GAS-FILLED
& LOW E-COATINGS)

VARM EDGE SPACERS

WINDOW PRODUCT STRATEGY

SUMMARY OF GOOD WINDOW DESIGN



INSULATED FRAME

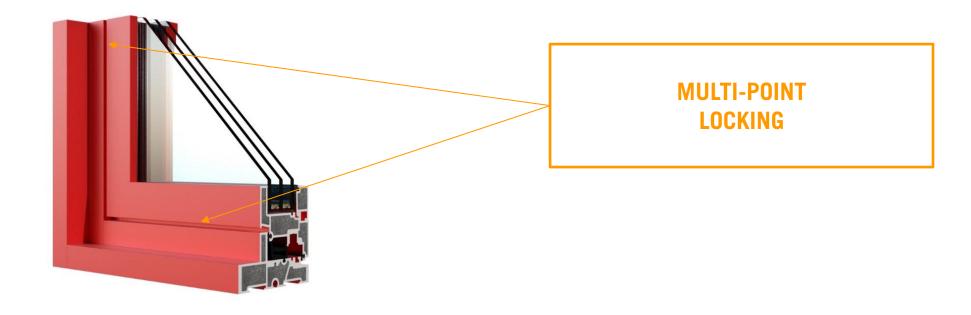
(LOW CONDUCTIVITY &/OR THERMAL BREAKS)

TRIPLE PANE
(GAS-FILLED
& LOW E-COATINGS)

WARM EDGE SPACERS MULTIPLE GASKETS

WINDOW PRODUCT STRATEGY

SUMMARY OF GOOD WINDOW DESIGN



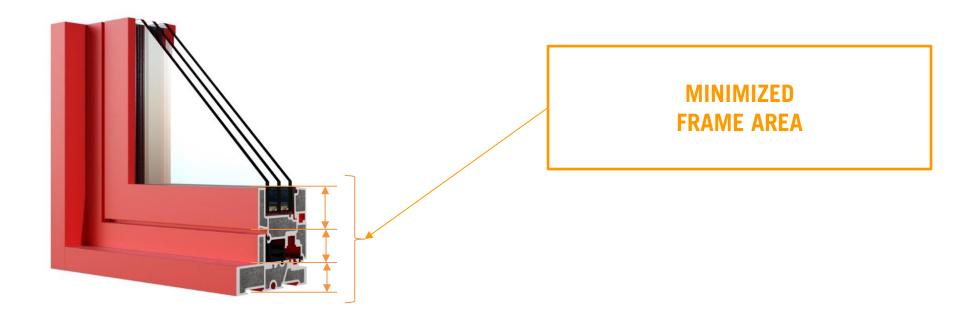
TRIPLE PANE
(GAS-FILLED
& LOW E-COATINGS)

WARM EDGE

MULTIPLE GASKETS NSULATED FRAME
(LOW CONDUCTIVITY
&/OR THERMAL BREAKS)

WINDOW PRODUCT STRATEGY

SUMMARY OF GOOD WINDOW DESIGN



TRIPLE PANE
(GAS-FILLED
& LOW E-COATINGS)

WARM EDGE

MULTIPLE GASKETS (LOW CONDUCTIVITY &/OR THERMAL BREAKS)

/IULTI-POINT LOCKING MINIMIZED RAME AREA

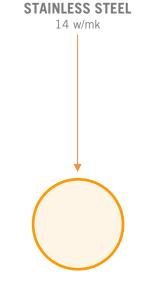
WINDOW PRODUCT STRATEGY



WINDOW PRODUCT STRATEGY

THERMAL CONDUCTIVITY (W/MK)







MEETING THE PASSIVE HOUSE STANDARD

WINDOW PRODUCT STRATEGY

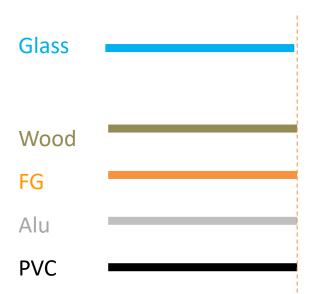
STRENGTH & STIFFNESS

MATERIAL	MODULUS OF ELASTICITY (GPa)
Steel	200
Aluminum	69
Fiberglass (polyester resin)	24
Wood, various	7 - 14
PVC/Vinyl	2.4 – 4.1

SELECTING A PASSIVE HOUSE WINDOW CONTINUING EDUCATION PRESENTATION

WINDOW PRODUCT STRATEGY

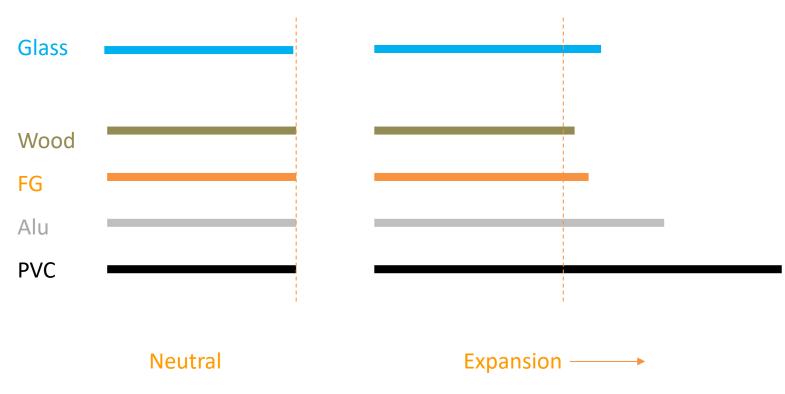
THERMAL EXPANSION COEFFICIENT - 10-6M/(M°C)



Neutral

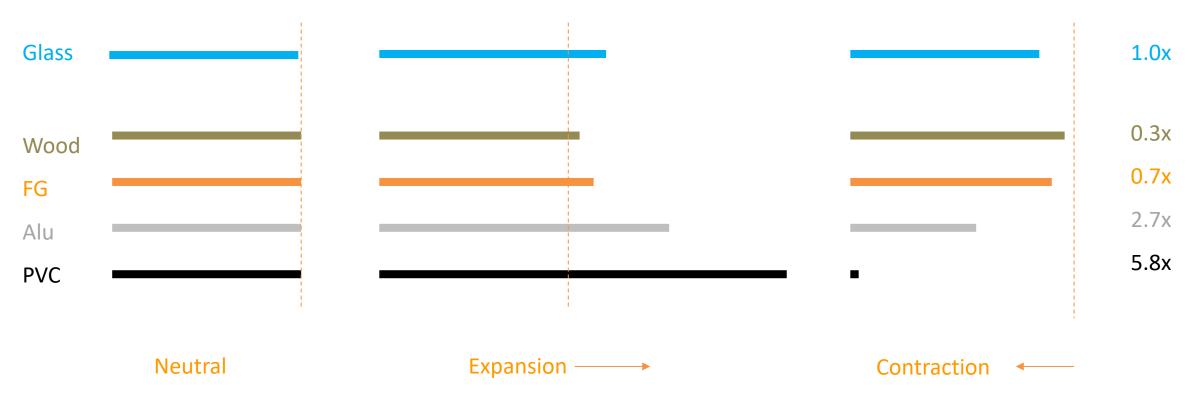
WINDOW PRODUCT STRATEGY

THERMAL EXPANSION COEFFICIENT - 10-6M/(M°C)



WINDOW PRODUCT STRATEGY

THERMAL EXPANSION COEFFICIENT - 10-6M/(M°C)



THERMAL EXPANSION ISSUES

THERMOSET VS THERMOPLASTIC

DIRECT SUNLIGHT + AMBIENT TEMPERATURE



THERMOPLATIC CAN
PERMANENTLY DEFORM

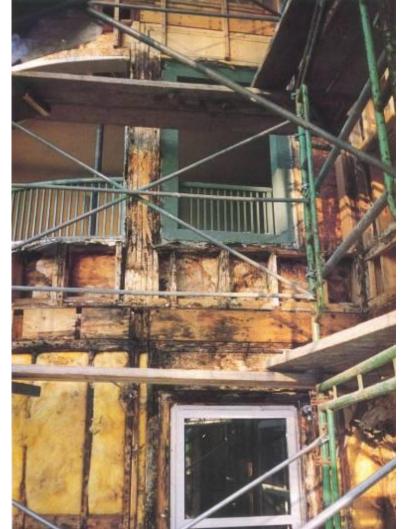




WINDOW PRODUCT STRATEGY



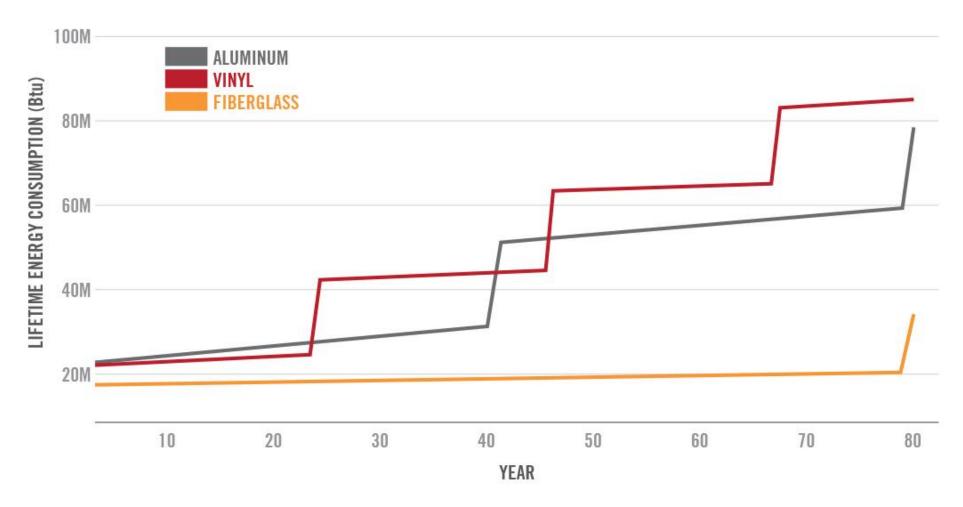
IMPACTS OF SHORT LIFESPANS







LIFECYCLE COMPARISON

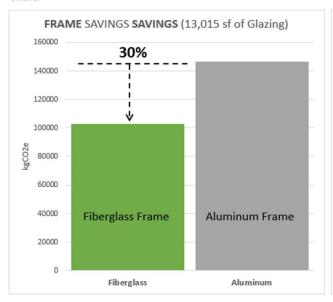


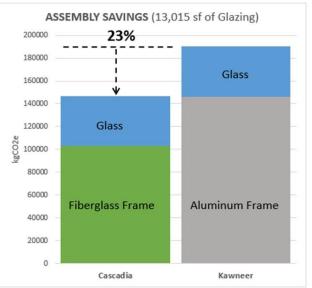
VITALMETRICS (IERS LLC.)

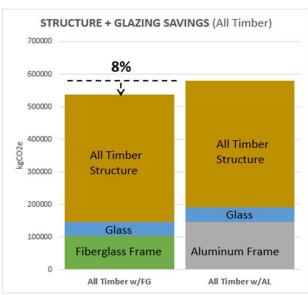
EMBODIED CARBON ANALYSIS

Fiberglass vs. Aluminmum Glazing - SCALES OF ANALYSIS

Smaller







Key assumptions:

Fiberglass data based on study: "Research on the impacts of Innovative Fenestration Materials on the Embodied and Operating Carbon of Buildings." PDF link: https://sustain.ubc.ca/sites/default/files/2022-018_Research%20on%20the%20impacts%20of%20Innovative%20Fenestration%20Materials_Zargar.pdf

Aluminum frame based on Kawneer Fixed & Ribbon Aluminum Windows EPD. This is in liue of comparing against Kawneer storefront product EPD --this EPD better matched up with the window size and frame ratio from the Cascadia study - EPD link:

All-Timber Structure and Hybrid Timber Structure cases from KPFF study sent on 10/5. Athena LCA study, Cradle to Grave, structure only, includes biogenic carbon

Glazing comparisons are Cradle to Gate, A1-A3 only with no replacement cycles

Images courtesy - Confidential

IMPORTANT FACTORS ABOUT EPD DATA

ASK FOR DATA

Embodied carbon data is becoming a key performance metric informing product selection.

CHECK THE PCR

Different manufacturers used different Product Category Rules (PCR) (i.e. declared units, ISO standards, etc).

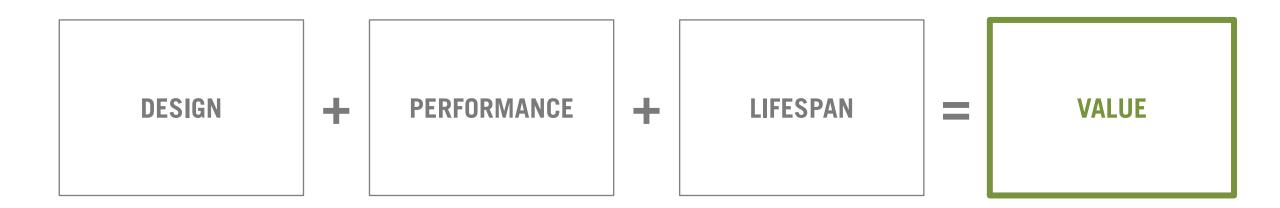
CHECK THE DATE

Environmental Product Declarations (EPDs) are valid for 5-years, then must be renewed.

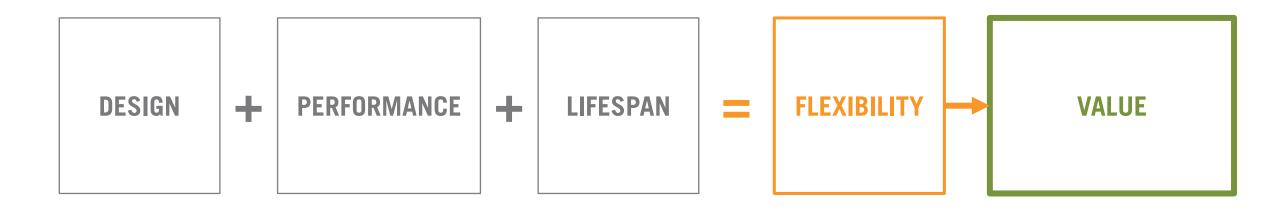
CONFIRM STAGE

Different manufacturers use different Lifecycle Stages for Environmental Product Declarations (EPDs).

WINDOW PRODUCT STRATEGY



WINDOW PRODUCT STRATEGY





GASTOWN CHILDCARE CENTRE

Vancouver, BC

ARCHITECT

ACTON OSTRY ARCHITECTS

CONTRACTOR

HEATHERBRAE BUILDERS CO.

OWNER

CITY OF VANCOUVER



Images courtesy of Acton Ostry Architects & Rikur Energy





Images courtesy of Cascadia Windows & Doors



KEN SOBLE TOWER ENERPHIT

Hamilton, ON

ARCHITECTERA ARCHITECTS

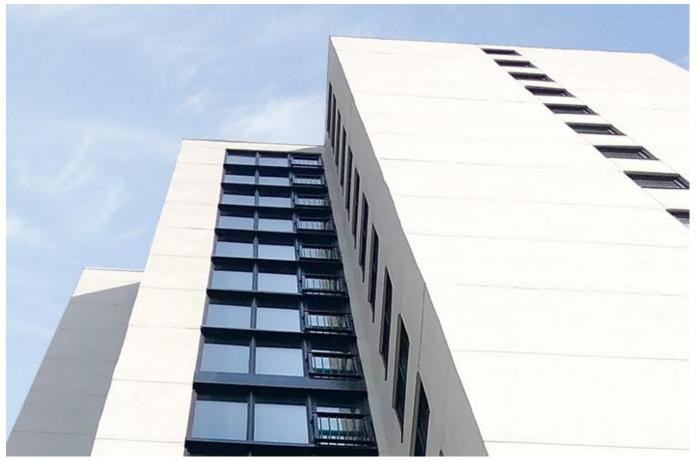
CONTRACTOR
PCL CONSTRUCTION

OWNERCITY OF HAMILTON











PROJECT INNOVATION PRODUCT INNOVATION

COAL HARBOUR PHASE 2

Vancouver, BC

ARCHITECT

HENRIQUEZ PARTNERS ARCHITECTS

CONTRACTOR

HEATHERBRAE BUILDERS CO.

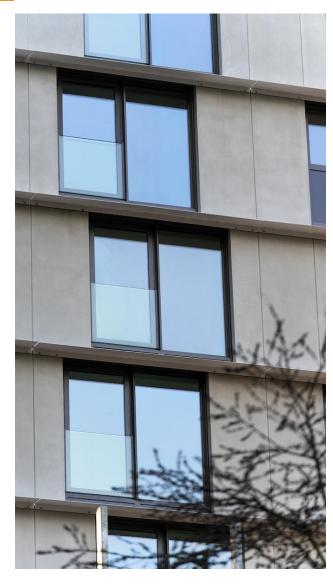
OWNER

CITY OF VANCOUVER

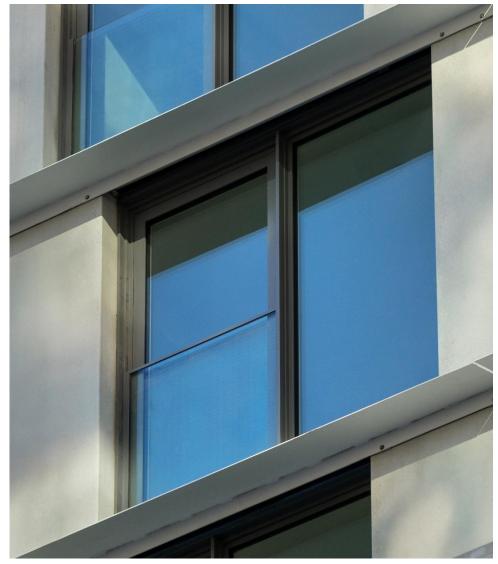


Images courtesy of Henriquez Partners Architects/Vancouver School Board/City of Vancouver

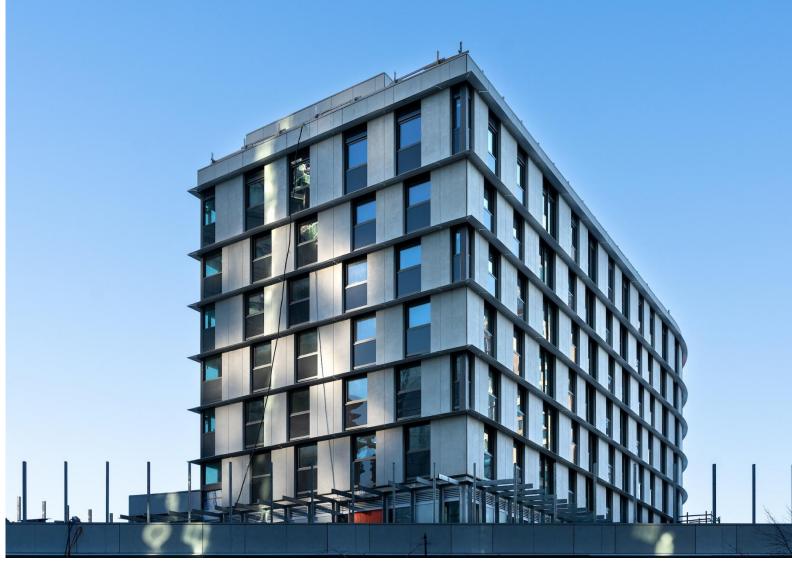
U-VALUES IN THE REAL WORLD - COAL HARBOUR PHASE 2











U-VALUES IN THE REAL WORLD – COAL HARBOUR PHASE 2



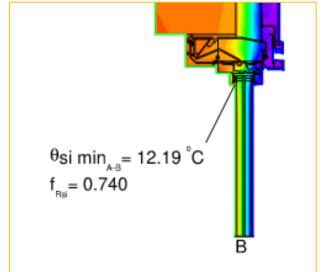


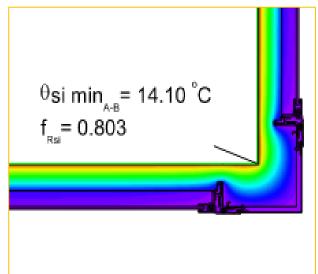


U-VALUES IN THE REAL WORLD - COAL HARBOUR PHASE 2

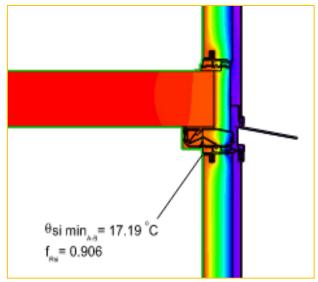


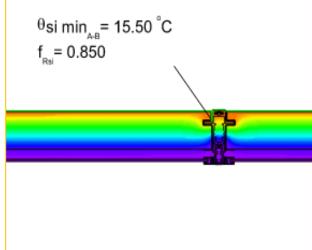
CONSIDER "REAL –WORLD" PERFORMANCE



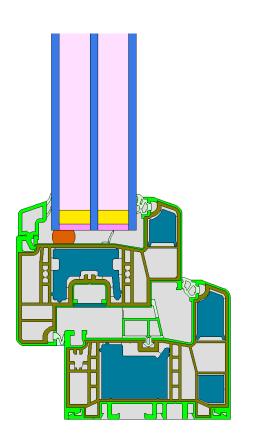


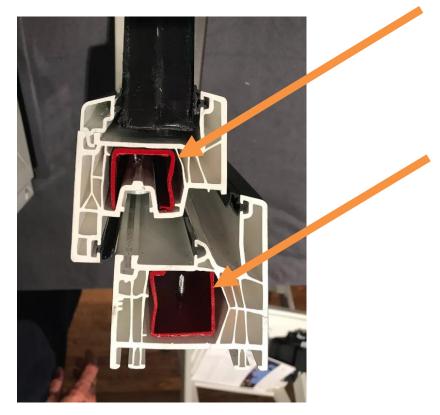
CONTINUING EDUCATION PRESENTATION

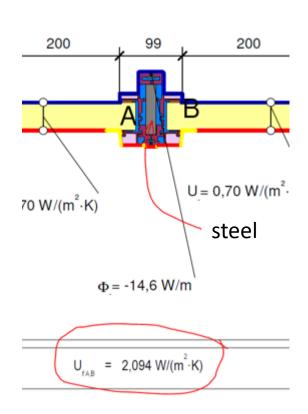




MODELLING COMPLEX WINDOWS







COMMERCIAL PASSIVE HOUSE PROJECTS CONTINUING EDUCATION PRESENTATION

WHAT IS COMMERCIAL GRADE?

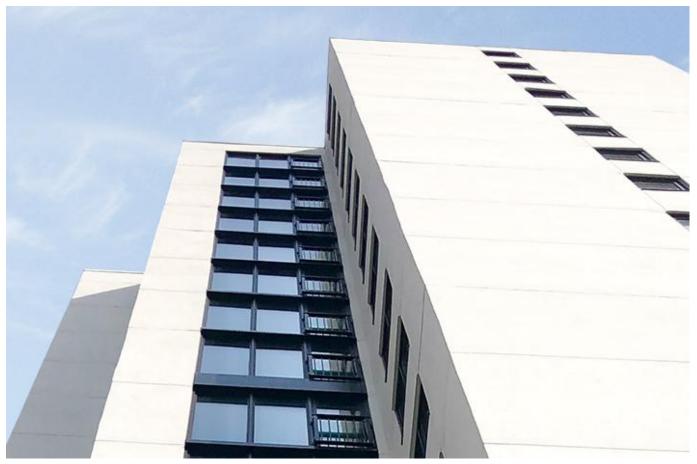
- Large format (full height)
- Withstand high +/- pressure loads with low air leakage
- Withstand wind driven rain with no water leaks
- Withstand extreme temperature ranges (resist condensation)
- Withstand building movement, large deflections during service life as well as seismic event
- Extreme hardware durability
- Combustibility
- All of this and maintain air and water tightness, operability and thermal performance!



PROJECT CHALLENGES

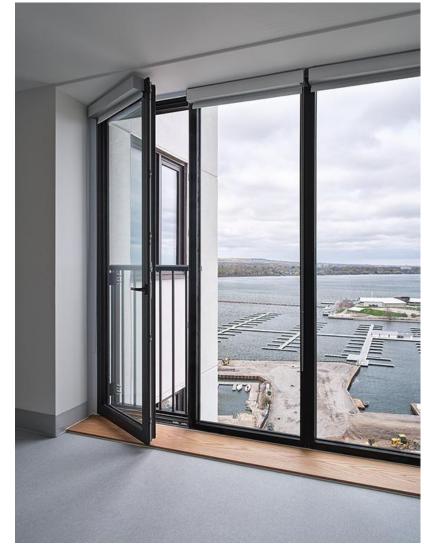
BALCONY THERMAL BRIDGING

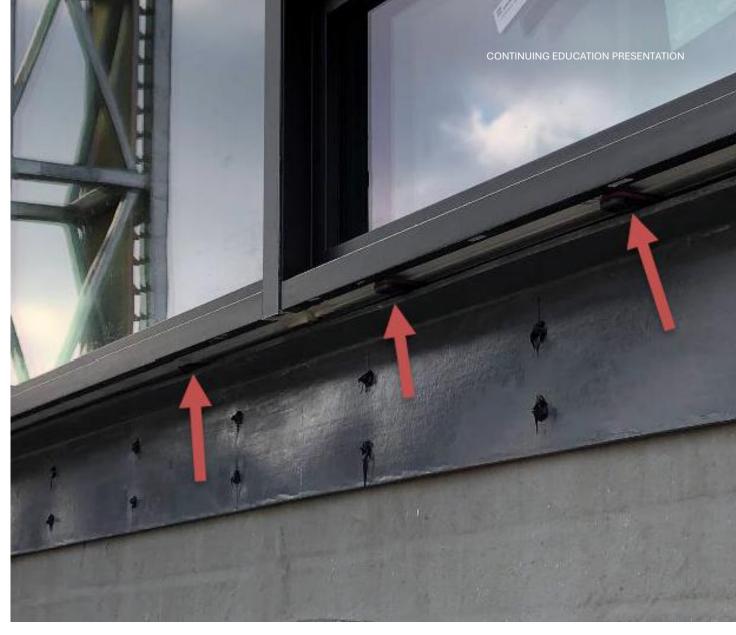
WINDOW SILL THERMAL BRIDGING





WINDOW OF OPPORTUNITY:



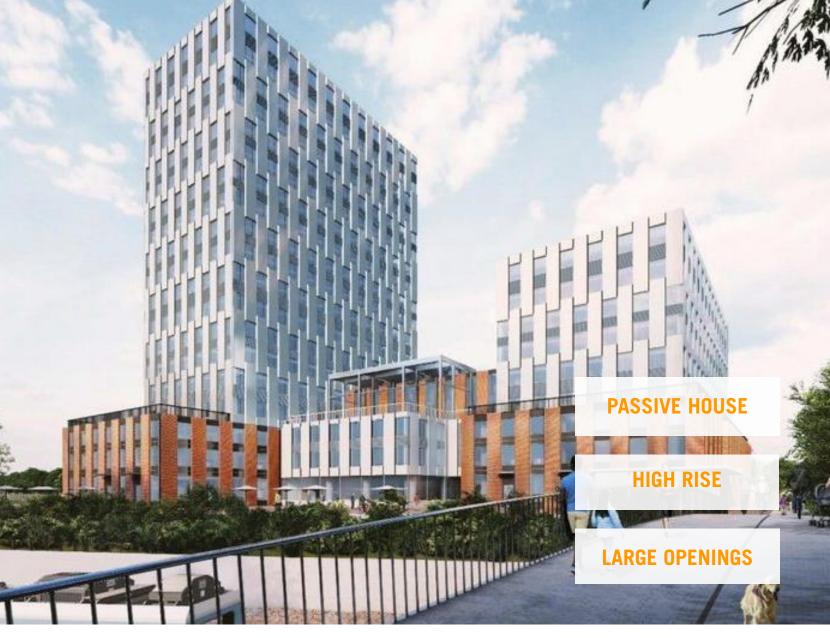


PROJECT INNOVATION PRODUCT INNOVATION

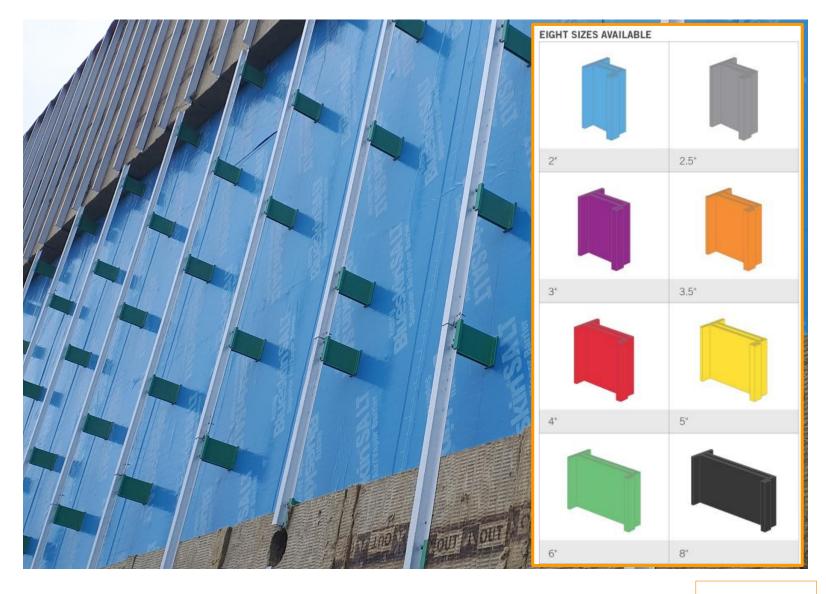
GLADSTONE VILLAGE SOCIAL HOUSING

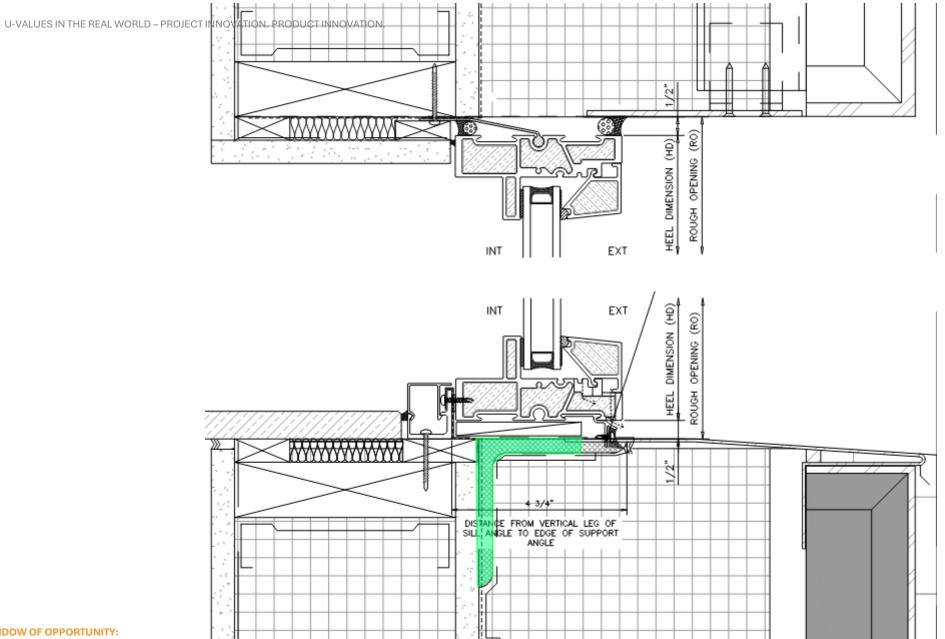
Ottawa, ON

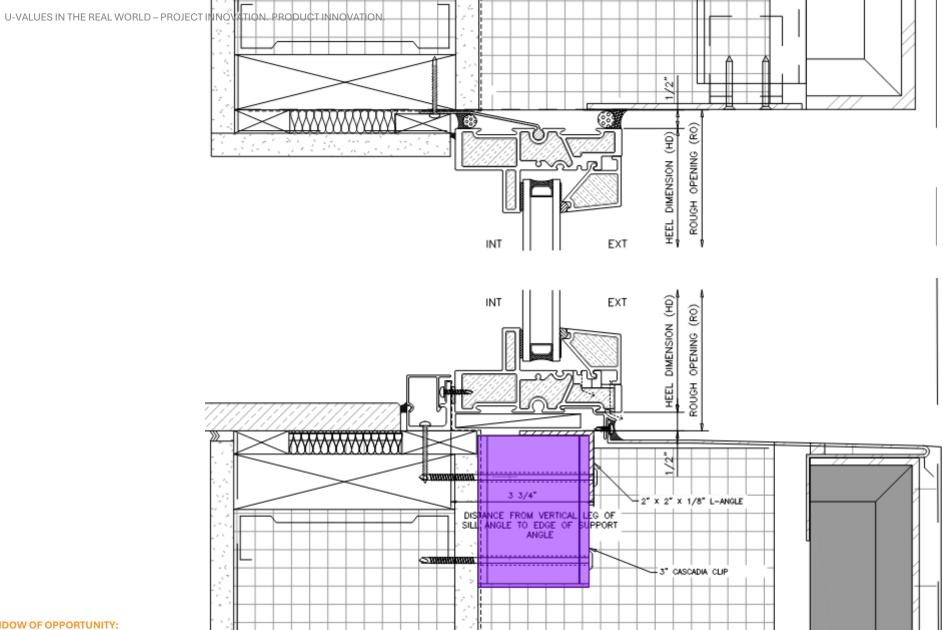






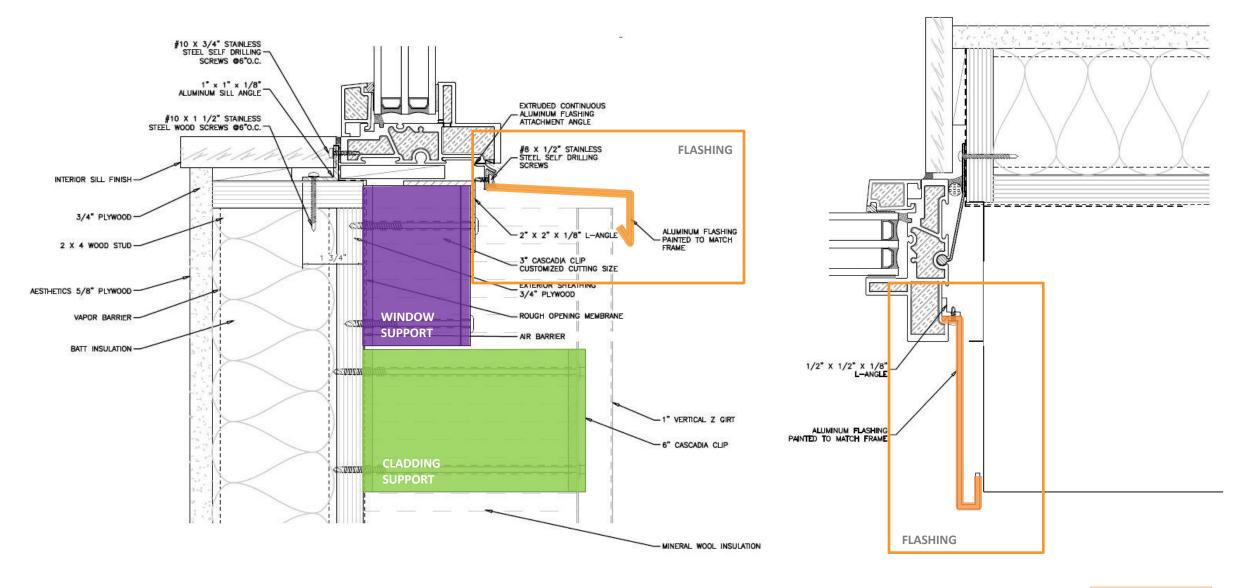


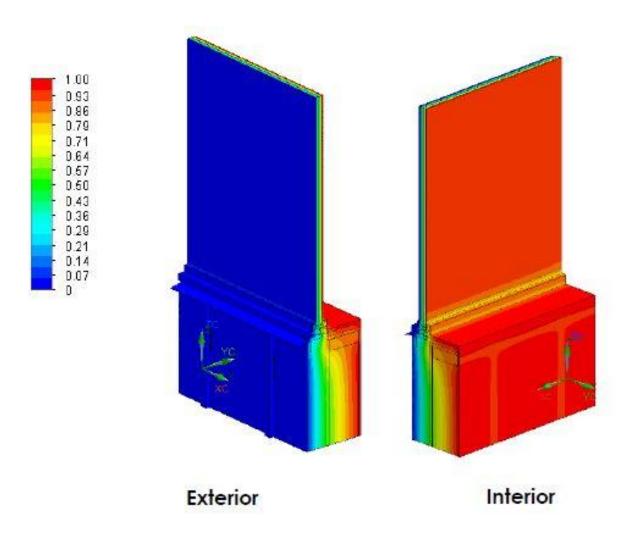


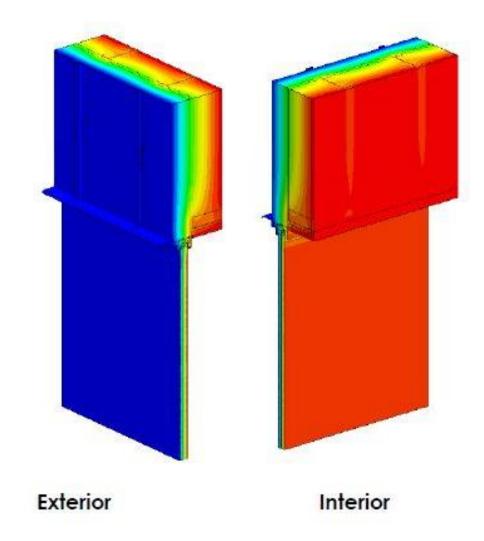


WINDOW OF OPPORTUNITY:

Leveraging Passive House windows in commercial & residential buildings







WATER PENETRATION TESTING

- ASTM E1105
- 15PSF
- 730PA









Victoria, BC

ARCHITECT

PERKINS & WILL

CONTRACTOR

ELLISDON / KINETIC

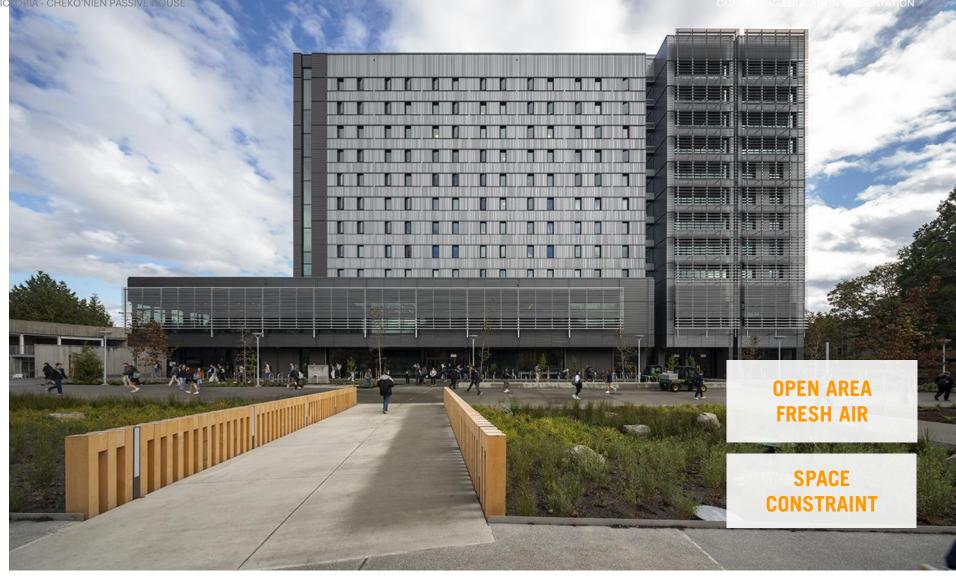
OWNER

UNIVERSITY OF VICTORIA





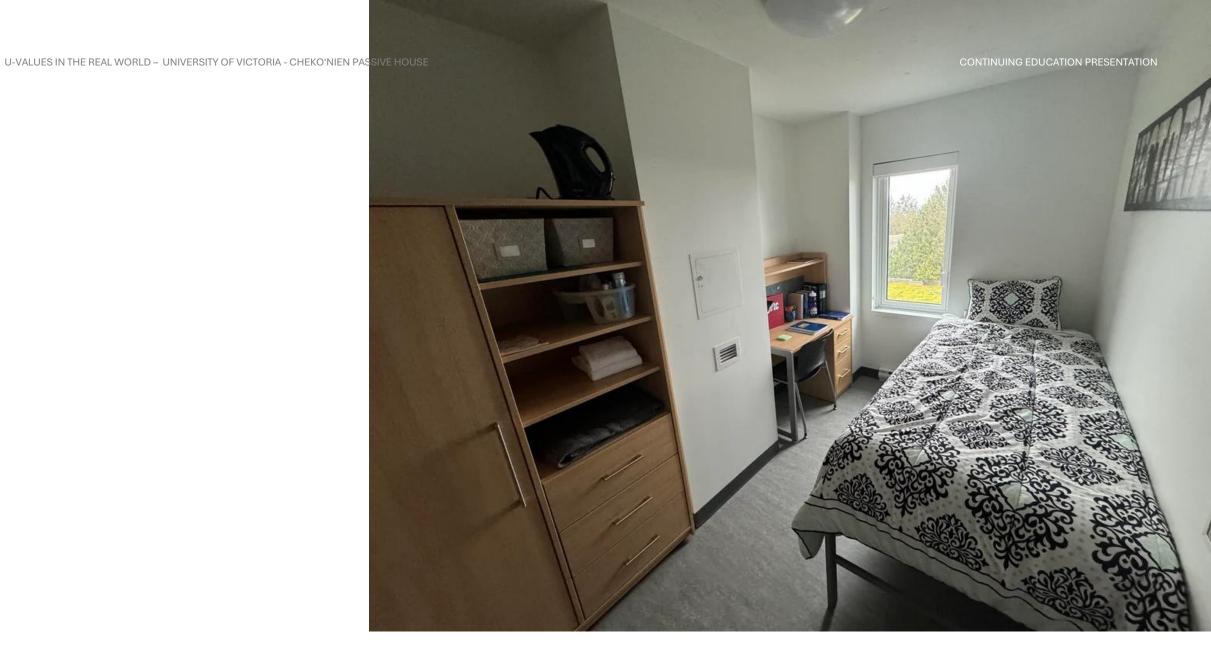








WINDOW OF OPPORTUNITY:





Portland, OR

ARCHITECTZGF ARCHITECTS

ENGINEERS / OWNER PAE











WINDOW OF OPPORTUNITY:







ENGINEER/DESIGNER
RDH BUILDING SCIENCE

CONTRACTOR HIGHRISE GLASS

OWNER STRATA









WINDOW OF OPPORTUNITY:

HIGH-PERFORMANCE CHARACTERISTICS

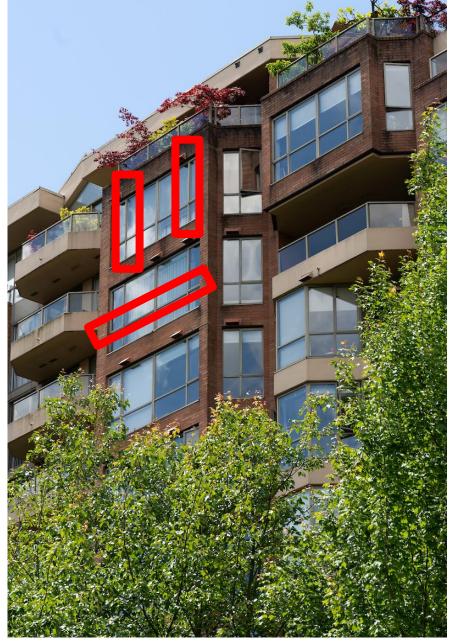


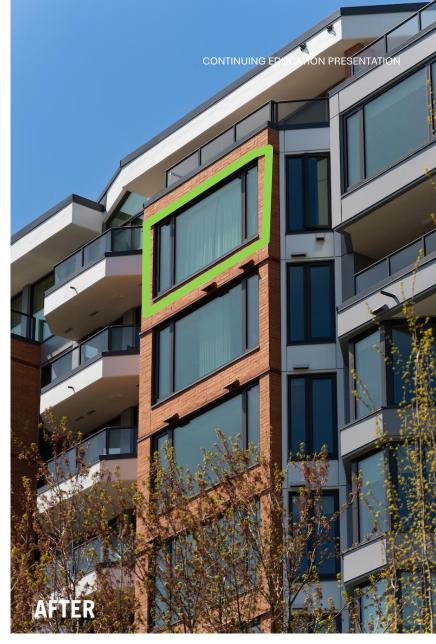
PASSIVE HOUSE PERFORMANCE (NON-CERTIFIED)

R-7.1

TRIPLE GLAZED
THREE LOW-E COATINGS - 270/180

OVER 250% IMPROVEMENT





U-VALUES IN THE REAL WORLD – MERIDIAN COVE REHABILITATION

CONTINUING EDUCATION PRESENTATION











LEARNING SESSION KEY TAKE AWAYS

Simon Fraser University – Courtyard Residence Burnaby, BC

WINDOW OF OPPORTUNITY:

Leveraging Passive House windows in commercial & residential buildings | Passive House Accelerator

LEARNING SESSION – KEY TAKE AWAYS CONTINUING EDUCATION PRESENTATION

KEY TAKE AWAYS

WINDOWS HAVE HUGE IMPACT

Type | Location | Installation

Often the weakest link in a building's envelope, a little extra attention on windows can have large overall impact

PAY ATTENTION TO PRODUCT DETAILS

Material | Modeled vs Real-World

Ensure you're verifying general product details and performance within the context of your project

PASSIVE HOUSE FOR ALL BUILDINGS

Residential | Multi-Family | High-Rise

Building to Passive House standards offers significant environmental and financial incentives for all stakeholders

LEARNING SESSION – KEY TAKE AWAYS CONTINUING EDUCATION PRESENTATION

QUESTIONS



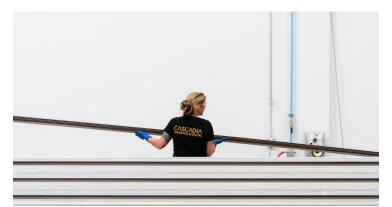
COMMERCIAL SALES

srey@cascadiawindows.com 778.868.32589



COMMON QUESTIONS

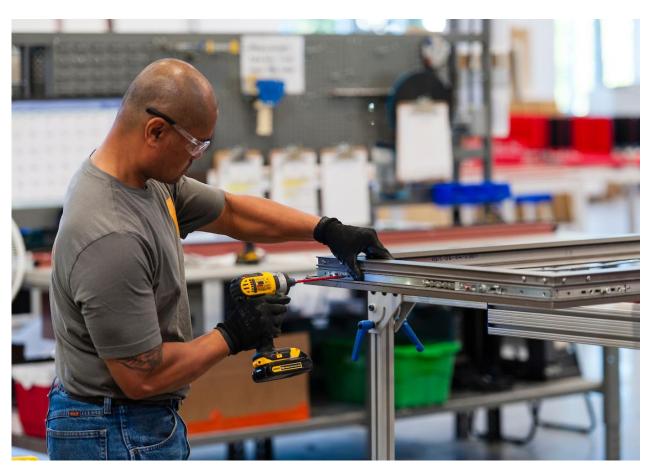
ABOUT CASCADIA WINDOWS & DOORS











VACUUM INSULATED GLASS (VIG) — UNIVERSAL SERIES™

CURRENT UNIVERSAL SERIES™ R-VALUE

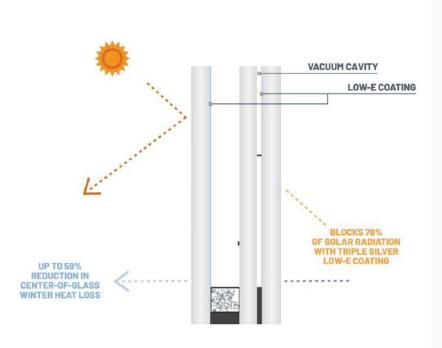
R-7.1

STANDARD TRIPLE GLAZED IGU

PROJECTED UNIVERSAL SERIES™ R-VALUE

R-11+

VACUUM INSULATED GLASS (VIG) UNIT





VACUUM INSULATED GLASS (VIG) – EXISTING WINDOW UPGRADE

CURRENT NON-CASCADIA WINDOW R-VALUE

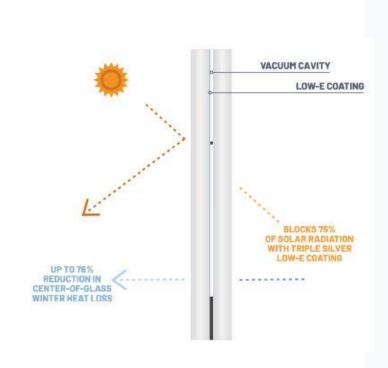
R-1 - R-2

EXISTING IGU

PROJECTED NON-CASCADIA WINDOW R-VALUE

R-3 - R-4

SINGLE PANE VACUUM INSULATED GLASS (VIG)





2017 - DECLARE LABEL
International Living Future Institute

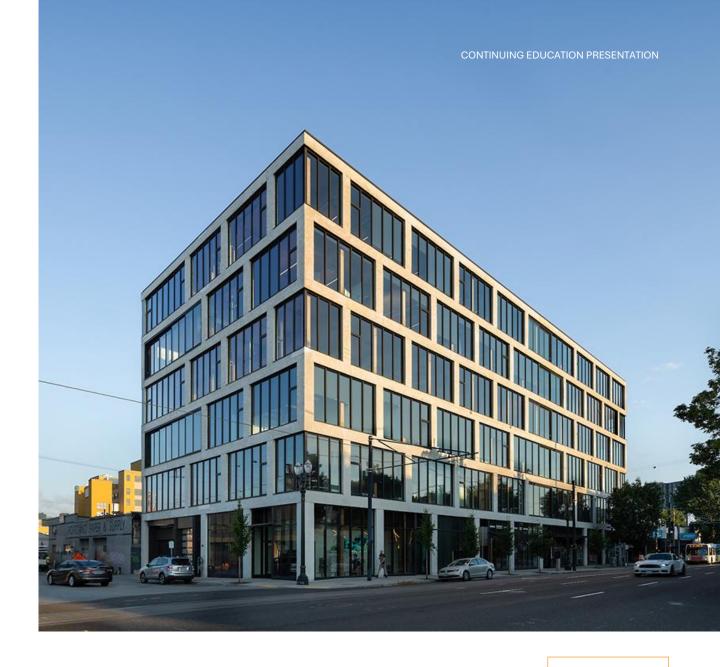
2020 INTERNAL DISCUSSIONS FOR EPD DEVELOPMENT Issues with existing PCR identified

2021 — CASCADIA JOINS PCR WORKING GROUP
Observer role providing feedback

2023 FENESTRATION ASSEMBLIES PCR PUBLISHED
Using latest North American standards and new
functional units based off NFRC (2023 – 2028)

2024 — CASCADIA WINDOW, WINDOW WALL & DOORS EPD PUBLISHED

World's First EPD Published Using Fenestration



Assemblies PCR

CLIP EPD JOURNEY

2015 - DECLARE LABEL

International Living Future Institute

2020 - INTERNAL DISCUSSIONS FOR EPD DEVELOPMENT

2021 — RAINSCREEN ASSOCIATION OF NORTH AMERICA

Working Group Established

SUSTAINABLE MINDS ENGAGED

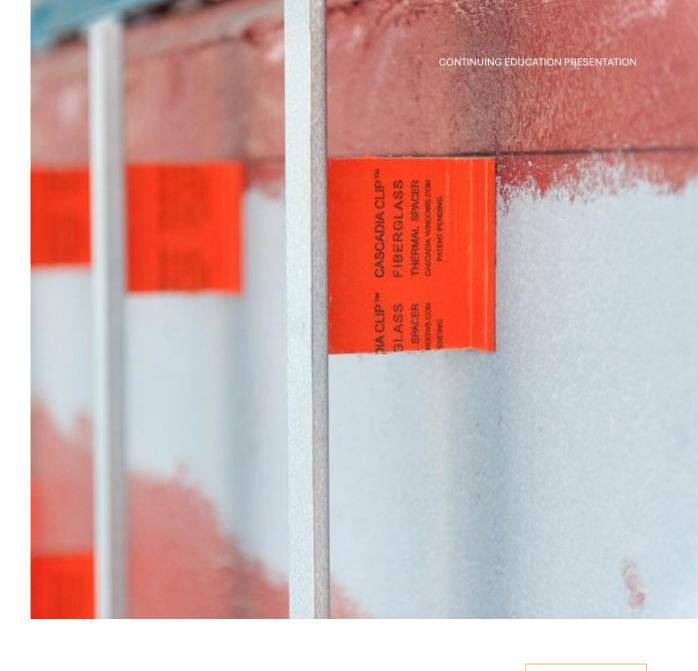
Development of Product Category Rule (PCR) Part B

PCR PART B PUBLISHED

Cladding Support Components & Systems (2022 – 2027)

2022 CASCADIA CLIP EPD PUBLISHED

World's First EPD Published Using Cladding Support Components & Systems PCR



HIGH-PERFORMANCE CHARACTERISTICS



COMMON QUESTIONS

TIMELINE - ROAD TO THE NEW NORMAL

THE CODE-CHANGE IS NOW ACCEPTED FOR THE UPCOMING 2020 NBC

ALTERNATE SOLUTIONS (AS) REFERENCE FUTURE CODE CONFORMANCE AND SUCCESSFUL TEST

Documents have become "cookie-cutter"

AFTER NBC 2020 ADOPTION IN PROVINCES

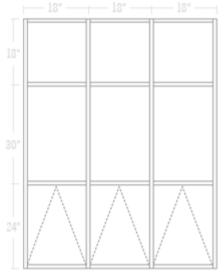
CANADA CATCHES UP TO THE REST OF THE WORLD



COMMON QUESTIONS CONTINUING EDUCATION PRESENTATION

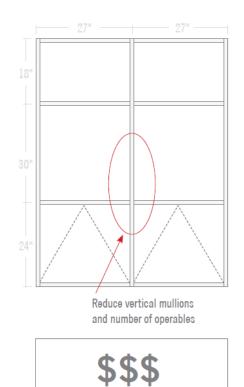
OPTIMIZING WINDOWS

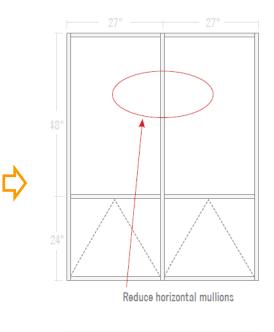
Reduce Mullions

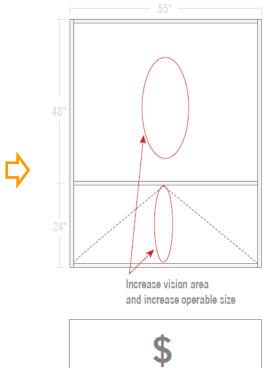








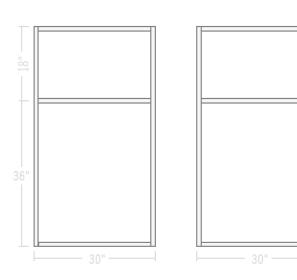






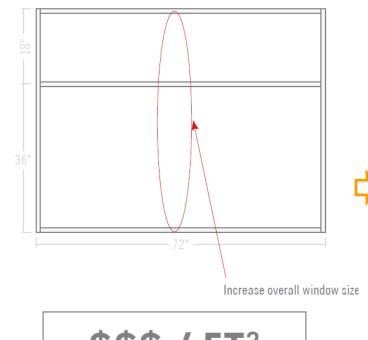
OPTIMIZING WINDOWS

Increase Window Size

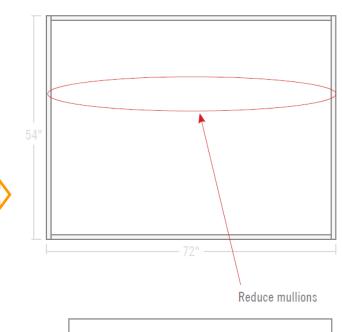


\$\$\$\$ / FT²





\$\$\$ / FT²

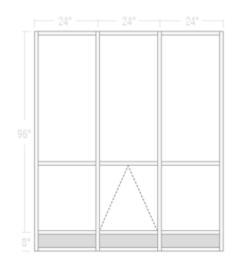


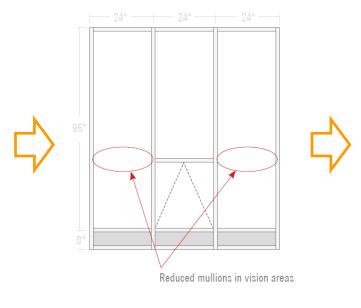
\$\$ / FT²

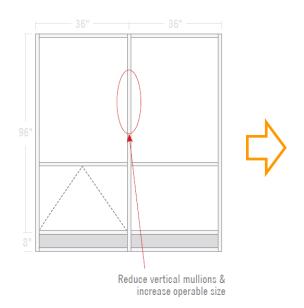
COMMON QUESTIONS CONTINUING EDUCATION PRESENTATION

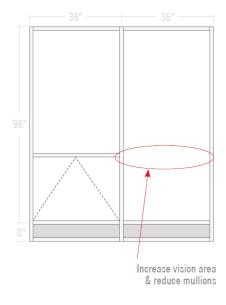
OPTIMIZING WINDOWS

Window Wall









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COMMON QUESTIONS

What color options exist for fiberglass windows?

- Unlimited custom color options
- 10 standard colors
- AAMA 625 performance
- · Dual color frames available
- Non-toxic, waterborne paint manufactured in North America

STANDARD WINDOW COLORS Update 2020



