

FINAL PROJECT

SAULT STE MARIE CANAL SUPERINTENDENT RESIDENCE NET ZERO RETROFIT



Wm Dunlop

*SAULT STE MARIE,
ONT.*

EX 93.18127

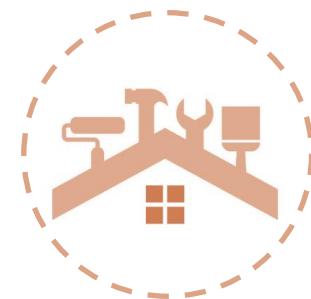
ASSIGNMENT-3-
MIXED-USE OFFICE & TEA SPACE.

GAGAN WADHWA
JHANVI PATEL
RAVINDER KAUR
SALWA BAIG

CONTENT



DESIGN



RETROFIT
OPTIONS



PASSIVE
STRATEGIES



SUSTAINABLE
STRATEGIES



RECOMMENDATION

1. METHODOLOGY



ASSIGNMENT -1 CONTEXT ANALYSIS

Existing conditions analysis	Desktop building analysis	Identifying top constraints	Case study and interpretation with suggestions
------------------------------	---------------------------	-----------------------------	--

- History
- Orientation
- Accessibility
- Climate'
- Related authorities
- Archival drawings
- Building envelope modelling
- Daylight performance factor
- Heat loss factor
- Thermal bridging
- Picking the areas of heat loss and finding a similar case and study to meet the standards of EnerPHit.

ASSIGNMENT- 2 PRELIMINARY DESIGN

Responding client and project requirement	Energy performance improvement and sustainable strategies
---	---

- Based on constraints finding a similar case and study to look for modification solution available in market
- Initiation of planning layout proposal
- Application of solutions found in case study and modification available in market
- Based on finalised layout work on interior design
- Integrating energy and water efficiency for each small areas for meeting the sustainability guidelines of LBC, WELL

ASSIGNMENT- 3 FINAL DESIGN

Demonstrating the proposal from study to outcome
--

- Making change based on reviews
- Producing final drawings and proposal document

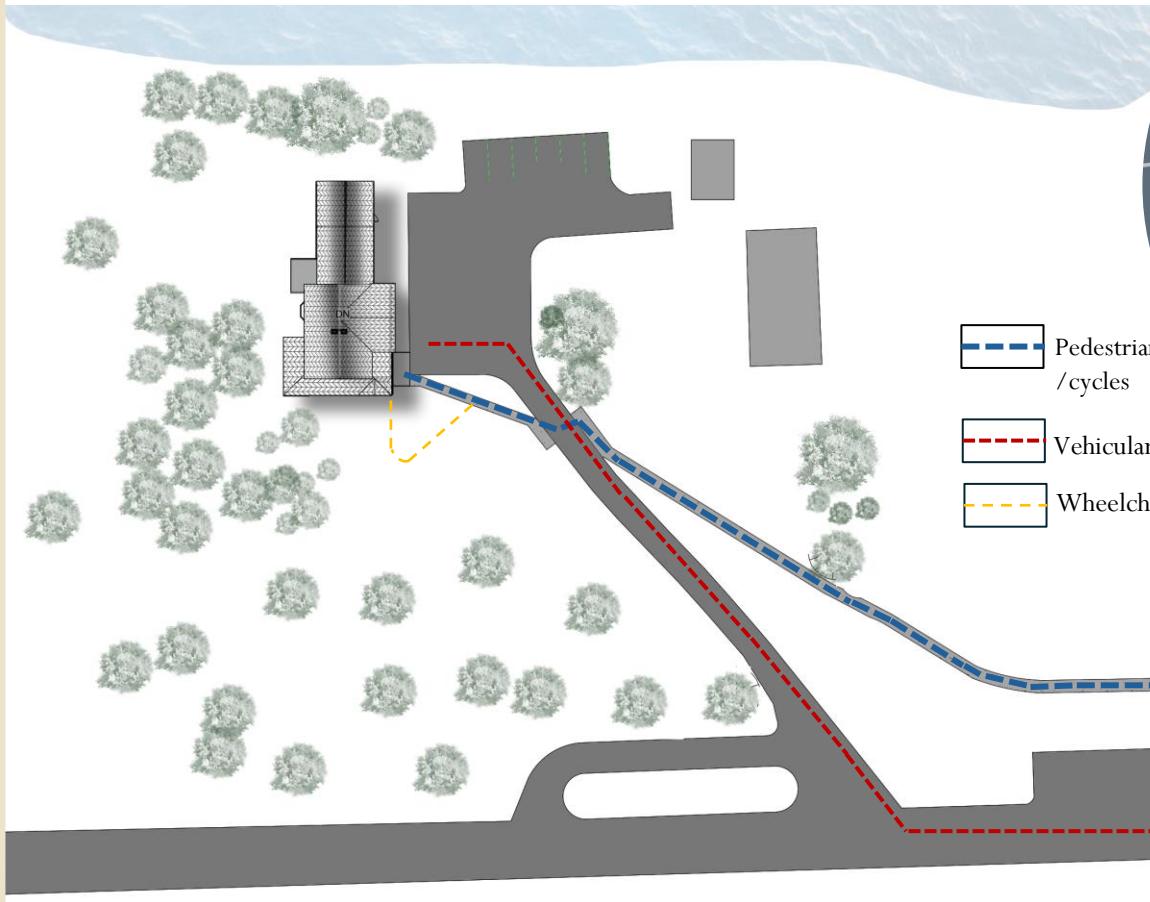


DESIGN

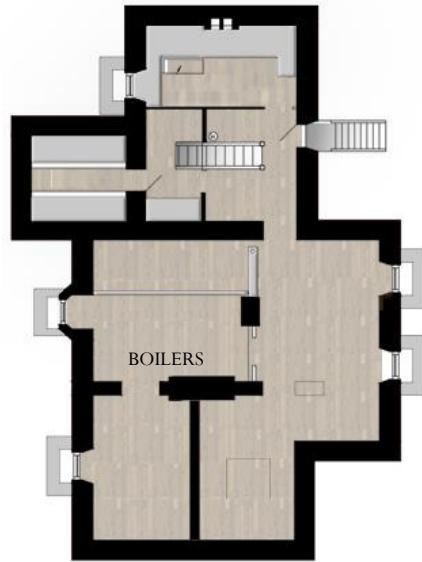
SITE PLAN



DESIGN



PROPOSED LAYOUT TEA SPACE



BASEMENT PLAN



FIRST FLOOR PLAN – TEA
SPACE

OCCUPANCY	10 (24 MAX)
FIRST FLOOR AREA	194.8 Sq.m
AREA DECREASED	5.4%

PROPOSED LAYOUT TEA SPACE



UNFURNITURED



FURNITURED TEA SPACE



UNFURNITURED



FURNITURED TEA SPACE

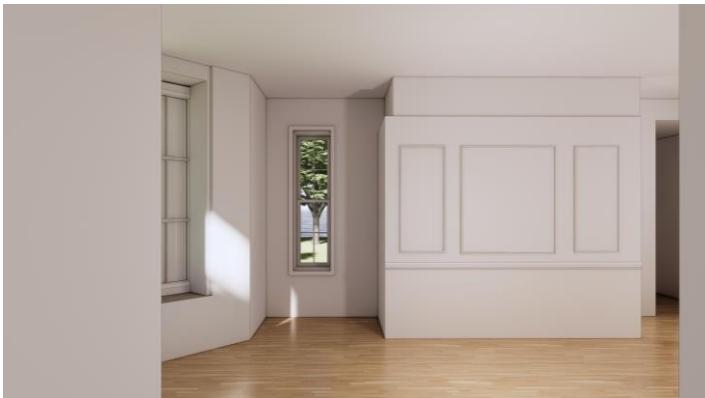
PROPOSED LAYOUT TEA SPACE



UNFURNITURED



FURNITURED TEA SPACE



UNFURNITURED



FURNITURED TEA SPACE

PROPOSED LAYOUT TEA SPACE

DESIGN



ACCESSIBLE WASHROOM



WELCOME DESK AND WAITING

PROPOSED LAYOUT

MIXED-USE OFFICE SPACE



DESIGN



SECOND FLOOR PLAN-
OFFICE SPACE



ATTIC PLAN

OCCUPANCY	11
SECOND FLOOR AREA	148.6 Sq.m
AREA DECREASED	5.4%

PROPOSED LAYOUT

MIXED-USE OFFICE SPACE



UNFURNITURED



FURNITURED WORKSTATIONS



UNFURNITURED



FURNITURED WORKSTATIONS

PROPOSED LAYOUT MIXED-USE OFFICE SPACE



UNFURNITURED



UNFURNITURED



SUPERINTENDENT RESIDENCE SITE MANAGER ROOM

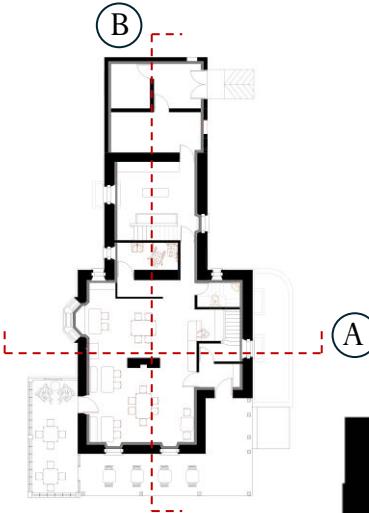


FURNITURED CONFERENCE ROOM

SECTIONS



DESIGN



KEY PLAN



SECTION AT A



ELEVATIONS



DESIGN



EAST ELEVATION



NORTH ELEVATION



WEST ELEVATION

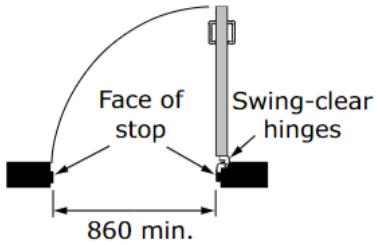


SOUTH ELEVATION

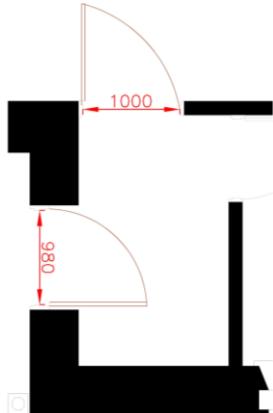


ACCESSIBILITY

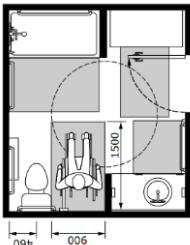
CSA CLAUSE 5.7.2.1 DOOR MANOEUVRING



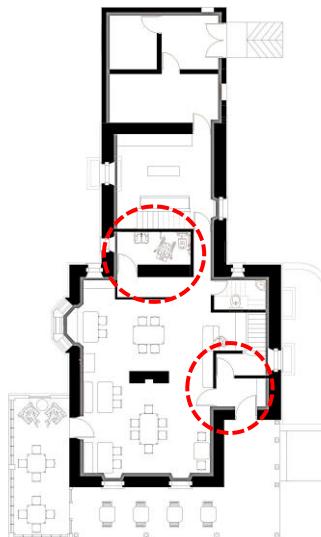
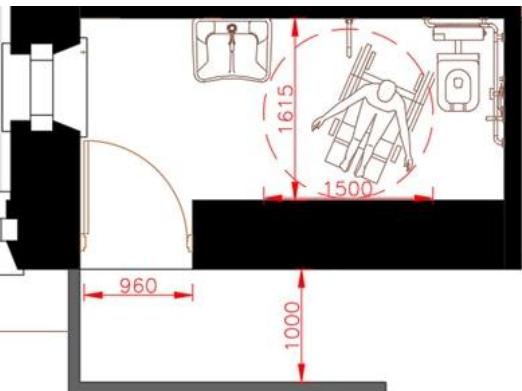
DESIGN SOLUTION PROPOSAL AT THE ENTRANCE OF THE RESTAURANT AND OFFICE



CSA CLAUSE 5.9.10.1 TOILET AREAS



DESIGN SOLUTION PROPOSAL OF THE ACCESSIBLE TOILET IN THE RESTAURANT.



KEY PLAN

WELL STANDARDS

1. 30% of furniture is movable for accessibility





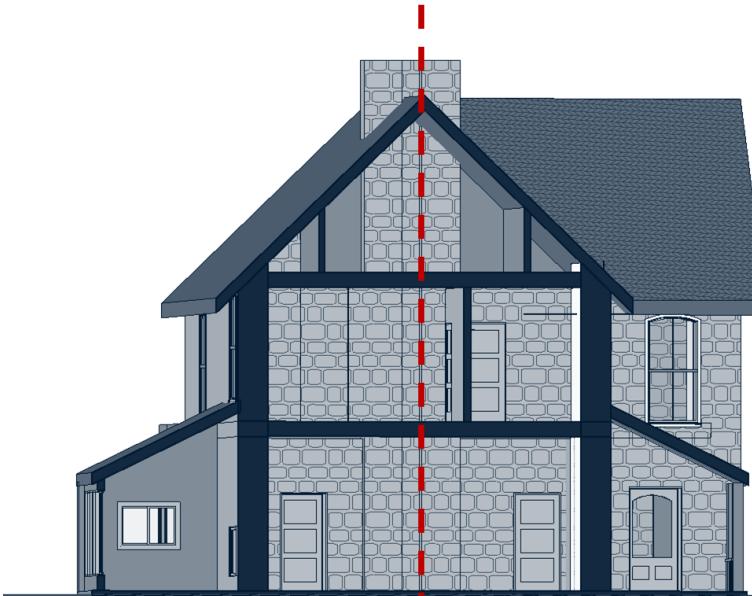
RETROFIT OPTIONS

2. RETROFIT OPTIONS

OPTION-1- OPAQUE ENVELOPE COMPONENT

By changing the opaque component only.

ATTIC
WALLS
BASEMENT WALLS



Climate zone according to PHPP	Opaque envelope ¹ against...			Windows (including exterior doors)			Ventilation			
	...ground		...ambient air	Overall ⁴	Glazing ⁵	Solar load ⁶				
	Insulation	Exterior insulation	Interior insulation ²	Exterior paint ³	Max. heat transfer coefficient (U-value) (U _{D,W,installed})	Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat recovery rate ⁷	Min. humidity recovery rate ⁸	
Cold	Determined in	0.12	0.30	-	0.65	0.70	0.80	U _b - g*1.0 ≤ 0	80%	-
		[W/(m ² K)]	[W/(m ² K)]		[kWh/m ² a]				%	

Climate zone according to PHPP	Opaque envelope ¹ against...			Windows (including exterior doors)			Ventilation			
	...ground		...ambient air	Overall ⁴	Glazing ⁵	Solar load ⁶				
	Insulation	Exterior insulation	Interior insulation ²	Exterior paint ³	Max. heat transfer coefficient (U-value) (U _{D,W,installed})	Solar heat gain coefficient (g-value)	Max. specific solar load during cooling period	Min. heat recovery rate ⁷	Min. humidity recovery rate ⁸	
Cold	Determined in	0.12	0.30	-	0.65	0.70	0.80	U _b - g*1.0 ≤ 0	80%	-
		[W/(m ² K)]	[W/(m ² K)]		[kWh/m ² a]				%	

OPTION-2 COMPLETE COMPONENT CRITERIA

By upgrading to complete Enerphit component pathway.

ATTIC
WALLS
BASEMENT WALLS
WINDOWS
DOORS

BASE CASE

ATTIC

U value— 0.272 (W/(m²K))

R-value- 21 (ft²·°F·h/BTU)

WALL

U value— 1.563 (W/(m²K))

R-value- 4 (ft²·°F·h/BTU)

BASEMENT WALL (below ground)

U value— 1.501(W/(m²K))

R-value- 4 (ft²·°F·h/BTU)

OPTION-1:OPAQUE ENVELOPE COMPONENT

ATTIC

U value— 0.099 (W/(m²K))

R-value- 57 (ft²·°F·h/BTU)

Increase % factor- 171%

WALL

U value— 0.21 (W/(m²K))

R-value- 27
(ft²·°F·h/BTU)

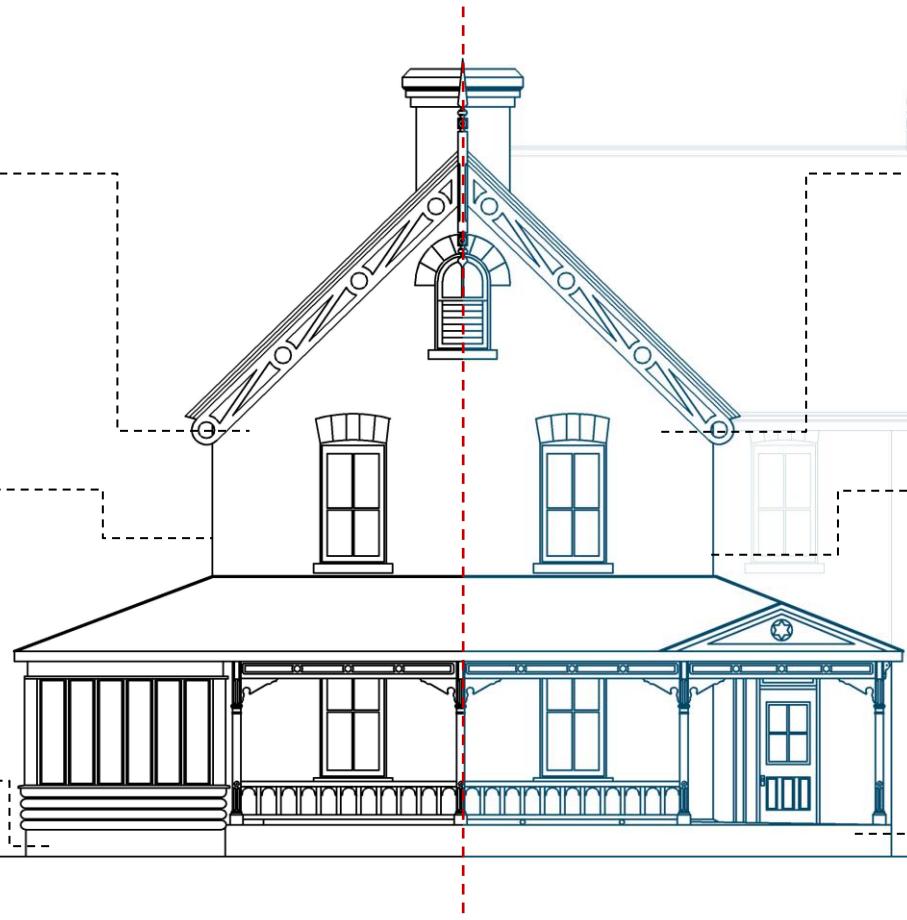
Increase % factor- 575%

BASEMENT WALL (below ground)

U value— 0.20(W/(m²K))

R-value- 28
(ft²·°F·h/BTU)

Increase % factor- 600%



BASE CASE

ATTIC

U value— 0.272 (W/(m²K))
R-value- 21 (ft²·°F·h/BTU)

WINDOW

U value— 4.33 (W/(m²K))
R-value- 1 (ft²·°F·h/BTU)
Type-Single pane

DOOR

U value— 1.94(W/(m²K))
R-value- 3 (ft²·°F·h/BTU)

WALL

U value— 1.563 (W/(m²K))
R-value- 4 (ft²·°F·h/BTU)

OPTION-2:COMPLETE COMPONENT CRITERIA

ATTIC

U value— 0.099 (W/(m²K))
R-value-57 (ft²·°F·h/BTU)
Increase % factor- 171%

WINDOW

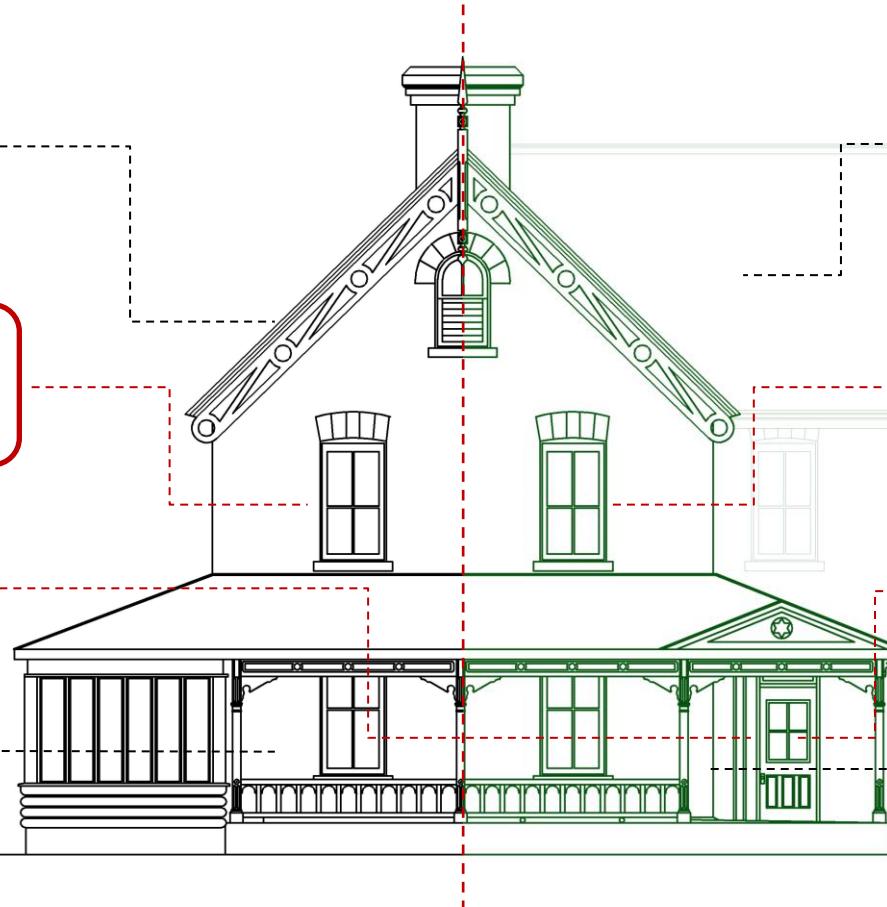
U value— 0.60 (W/(m²K))
R-value- 9 (ft²·°F·h/BTU)
Type- Fixed, Frameless, Triple Pane.
Increase % factor- 800 %

DOOR

U value— 0. 83(W/(m²K))
R-value- 7 (ft²·°F·h/BTU)
Increase % factor- 133%

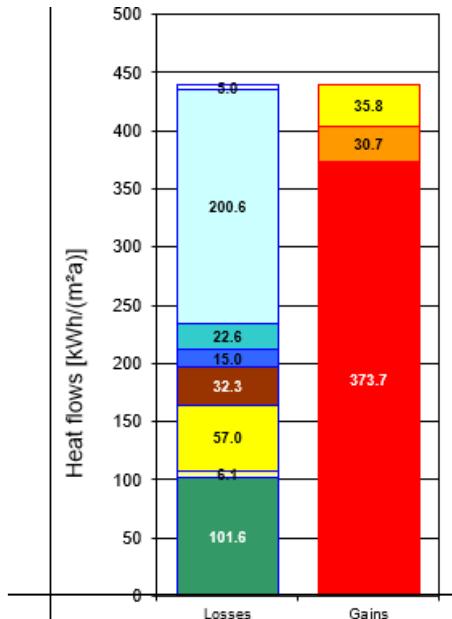
WALL

U value— 0.21 (W/(m²K))
R-value- 27
(ft²·°F·h/BTU)
Increase % factor- 85%



PHPP ANALYSIS

PHPP – BASE CASE

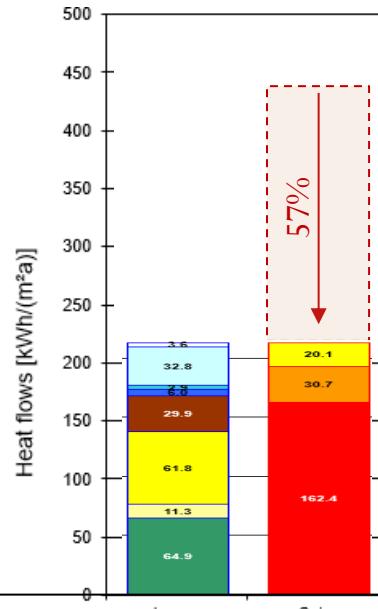


HEATING DEMAND- 373.7

KWh/m²a

TREATED FLOOR AREA- 355 Sq.m.

PHPP – OPTION -1
OPAQUE ENVELOPE
COMPONENT

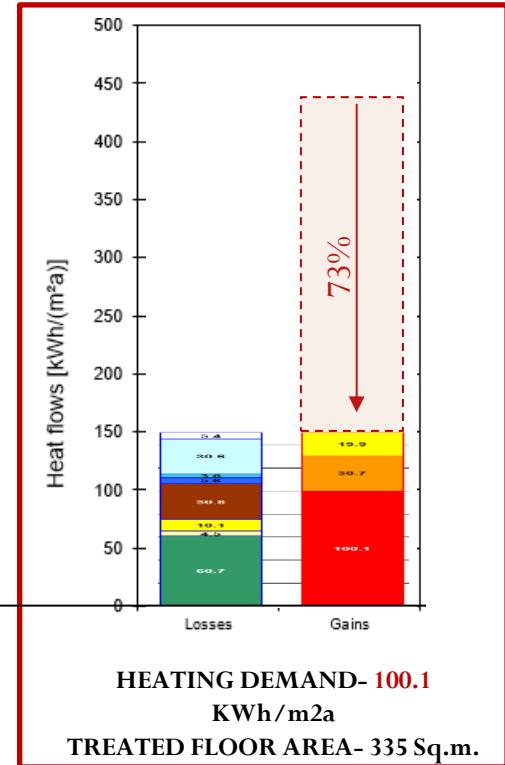


HEATING DEMAND-162.4

KWh/m²a

TREATED FLOOR AREA- 335 Sq.m.

PHPP – OPTION -2
COMPLETE
COMPONENT CRITERIA



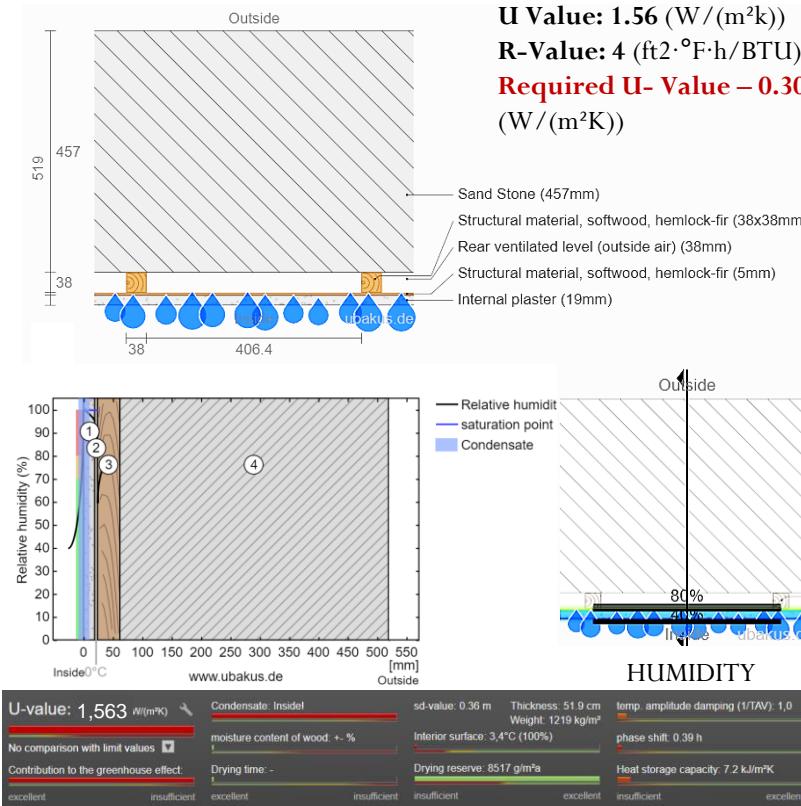
HEATING DEMAND- 100.1

KWh/m²a

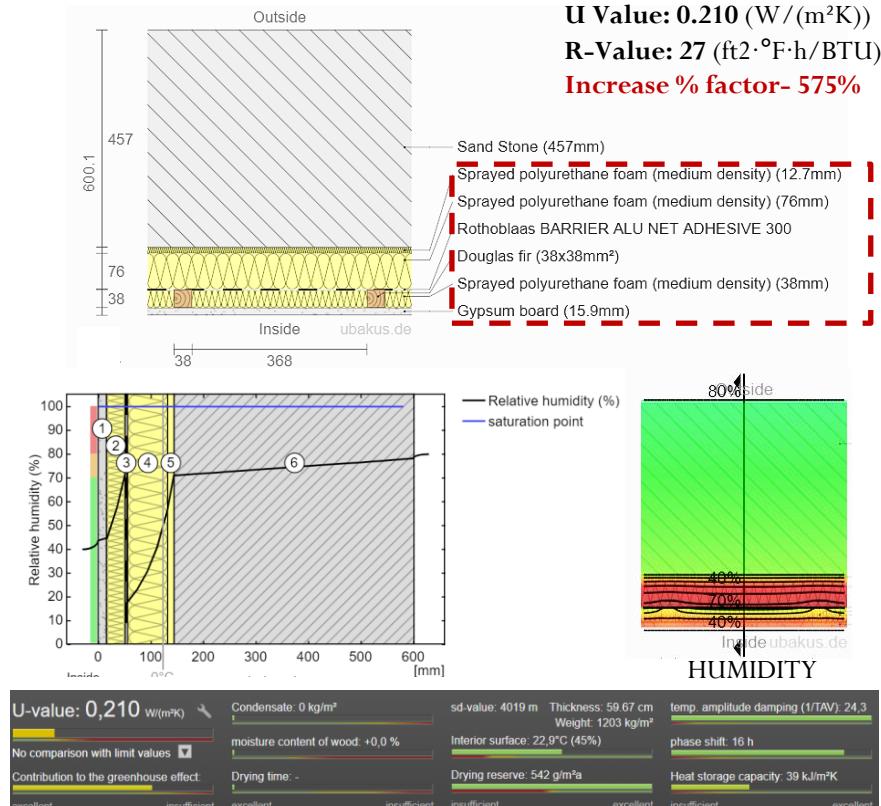
TREATED FLOOR AREA- 335 Sq.m.

CONDENSATION RISK ANALYSIS

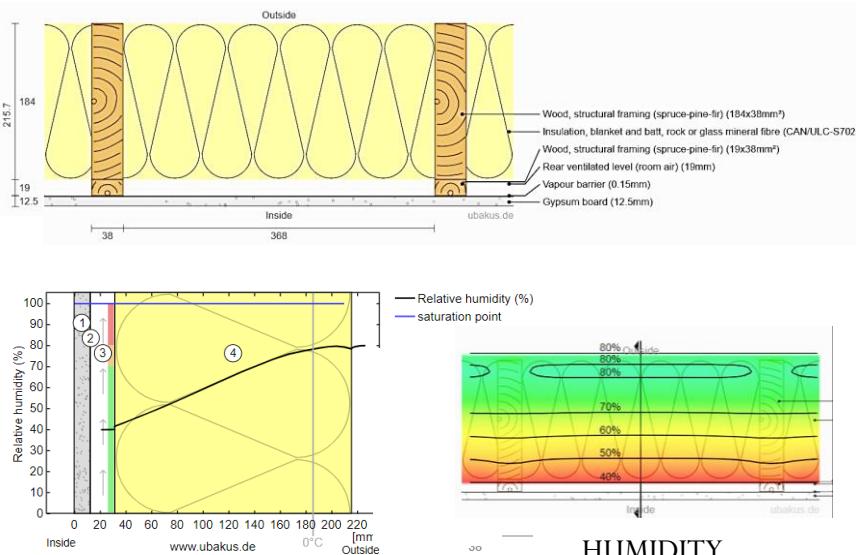
EXTERIOR STONE WALLS – BASE CASE



EXTERIOR STONE WALLS – OPTION -1:OPAQUE ENVELOPE COMPONENT



ATTIC – BASE CASE



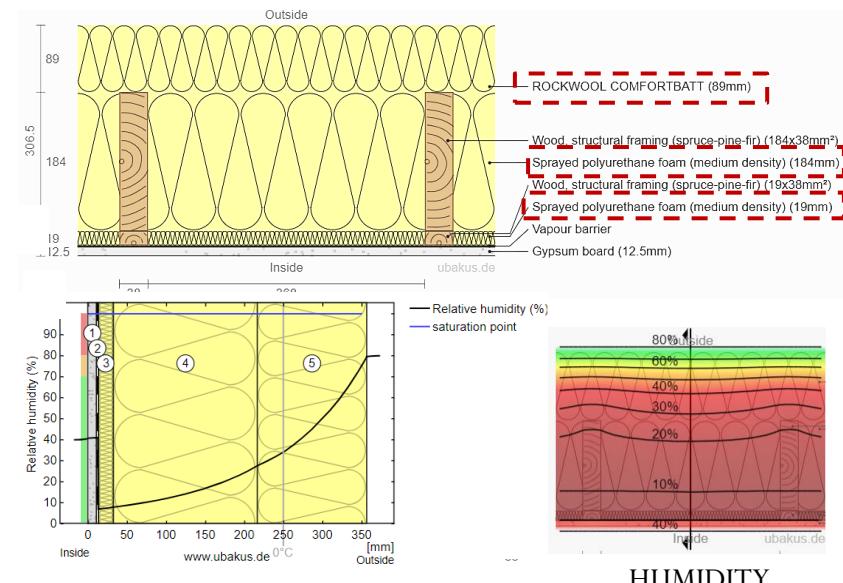
U value—0.272 (W/(m²K))

R-value- 21 (ft²·°F·h/BTU)

Required U- Value – 0.12 (W/(m²K))

U-value: 0,272 W/(m ² K)	Condensate: 0 kg/m ²	sd-value: 0.20 m Thickness: 21.565 cm	temp. amplitude damping (1/TAV): 1,2
No comparison with limit values	moisture content of wood: +0,0 %	Weight: 22 kg/m ²	Interior surface: 25,0°C (40%)
Contribution to the greenhouse effect:	Drying time: -	phase shift: 3.1 h	Drying reserve: 24854 g/m ²
excellent	insufficient	excellent	Heat storage capacity: 8.8 kJ/m ² K

ATTIC – OPTION -1:OPAQUE ENVELOPE COMPONENT



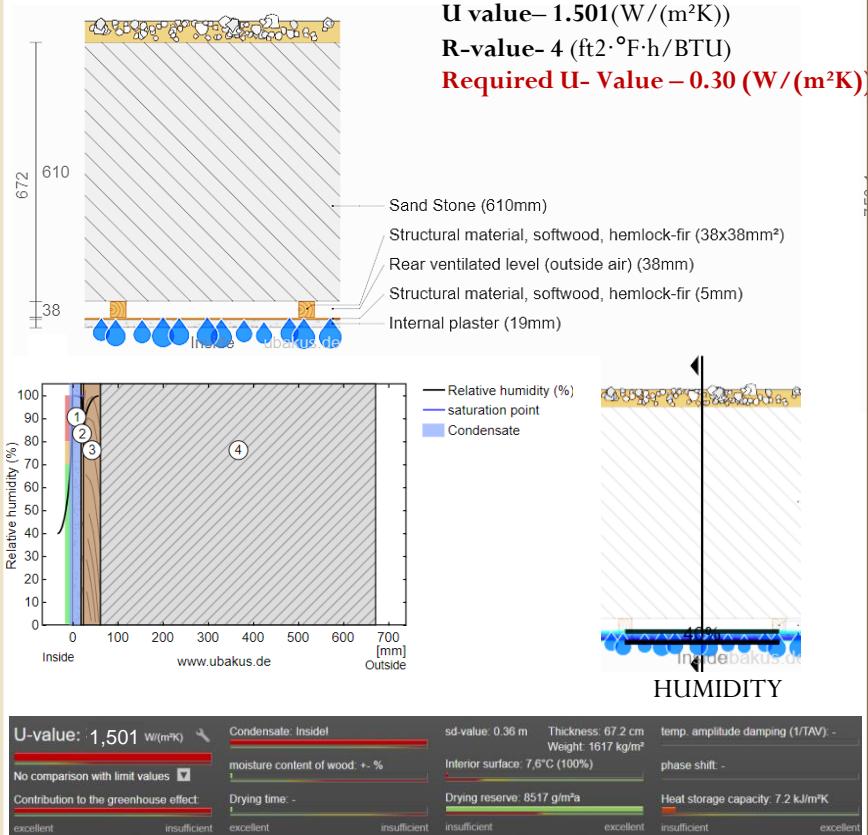
U value—0.099 (W/(m²K))

R-value- 57 (ft²·°F·h/BTU)

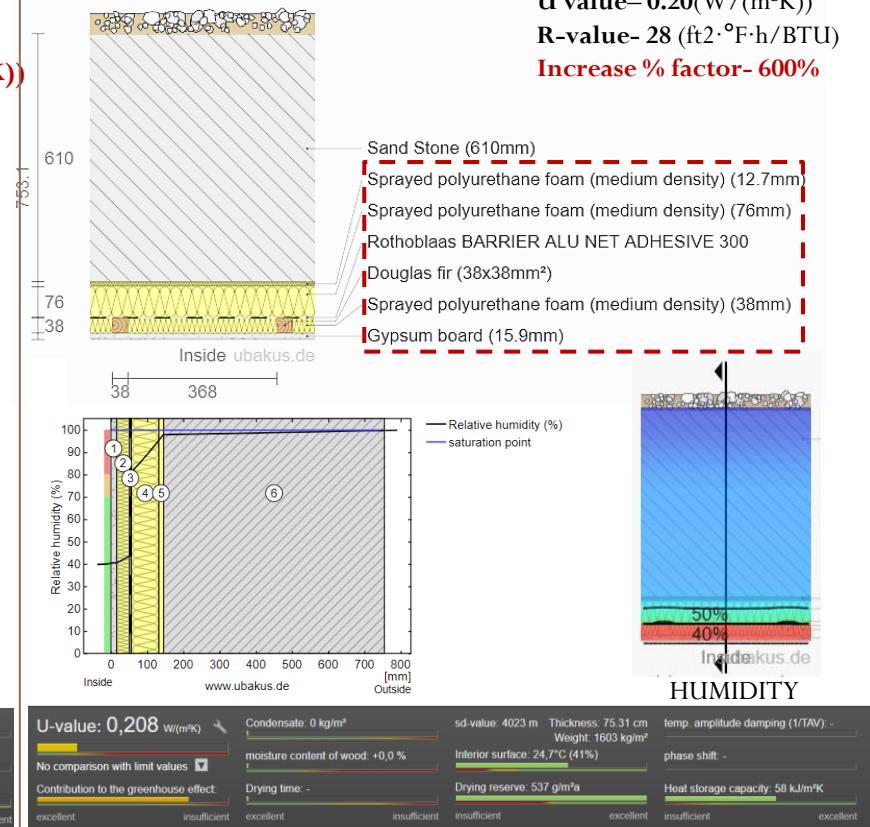
Increase % factor- 48%

U-value: 0,099 W/(m ² K)	Condensate: 0 kg/m ²	sd-value: 4035 m Thickness: 35.6 cm	temp. amplitude damping (1/TAV): 14,8
No comparison with limit values	moisture content of wood: +0,0 %	Weight: 28 kg/m ²	Interior surface: 24,3°C (42%)
Contribution to the greenhouse effect:	Drying time: -	Drying reserve: 42 g/m ² a	Heat storage capacity: 25 kJ/m ² K
excellent	insufficient	insufficient	excellent

BASEMENT STONE WALLS (BELOW GROUND) – BASE CASE



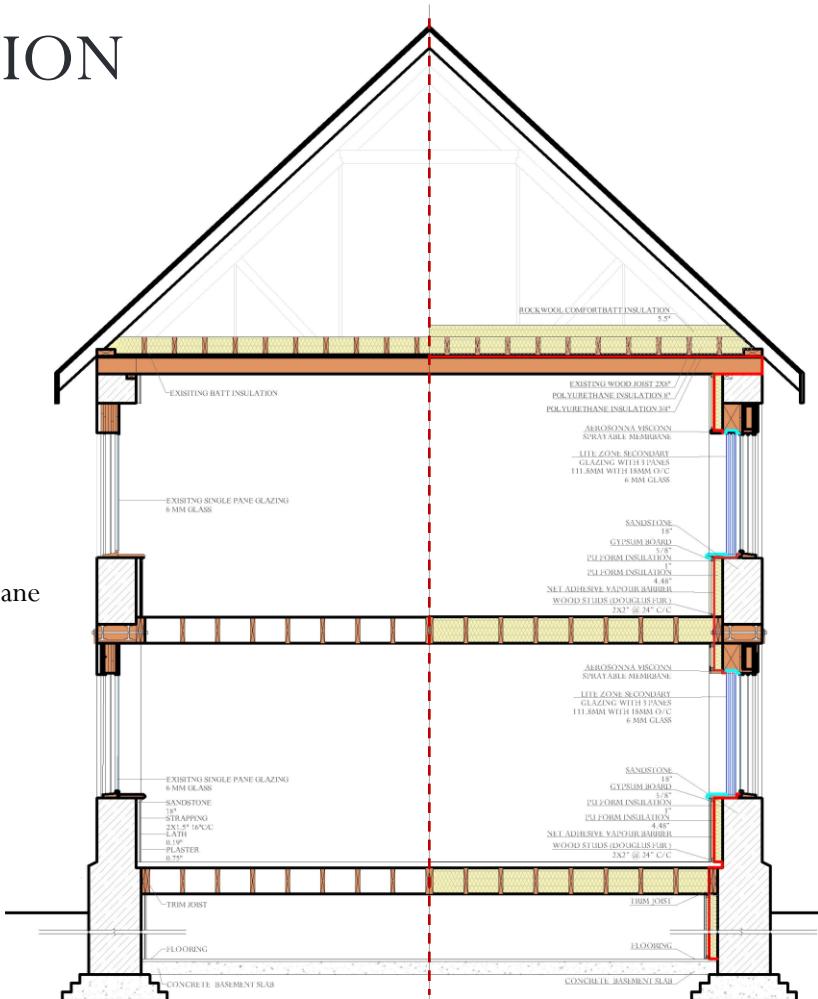
BASEMENT STONE WALLS (BELOW GROUND) – OPTION -1: OPAQUE ENVELOPE COMPONENT



WALL SECTION

BASE CASE

Treated floor area-354.5 sq.m
 Air change rate/ hour- 2.5
 No. of the occupants- 26
 No. of windows – 26- Single pane
 No. of Exterior doors-3

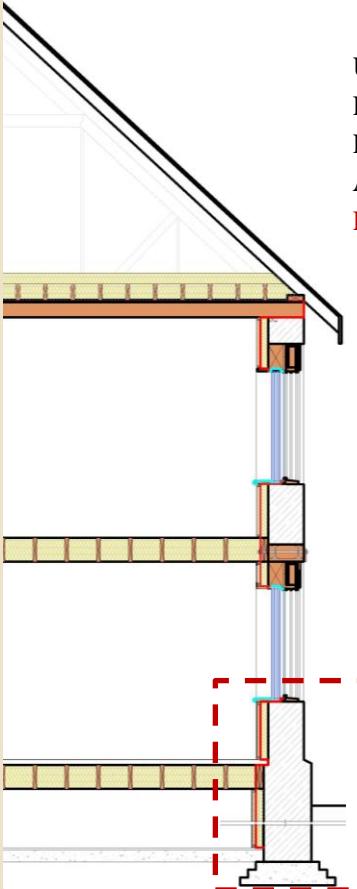


OPTION-2: COMPLETE COMPONENT CRITERIA

Treated floor area-335.2 sq.m
 Air change rate/ hour- 1
 No. Of occupants- 17
 No. of windows – 26- Addition to old windows with **Triple Glazed windows**
 No. of Exterior doors-3

- Insulation
- Sprayable airtightness sealant
- Vapour Barrier

WALL DETAIL



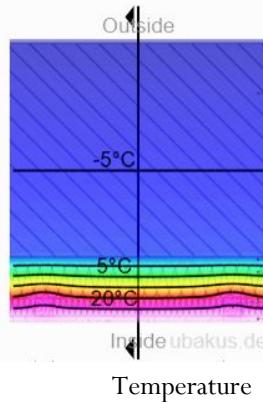
U value: 0.21 (W/(m²k))

R-value: 27 (ft²·°F·h/btu)

Reduction % factor- 85%

Additional added thickness – 80mm

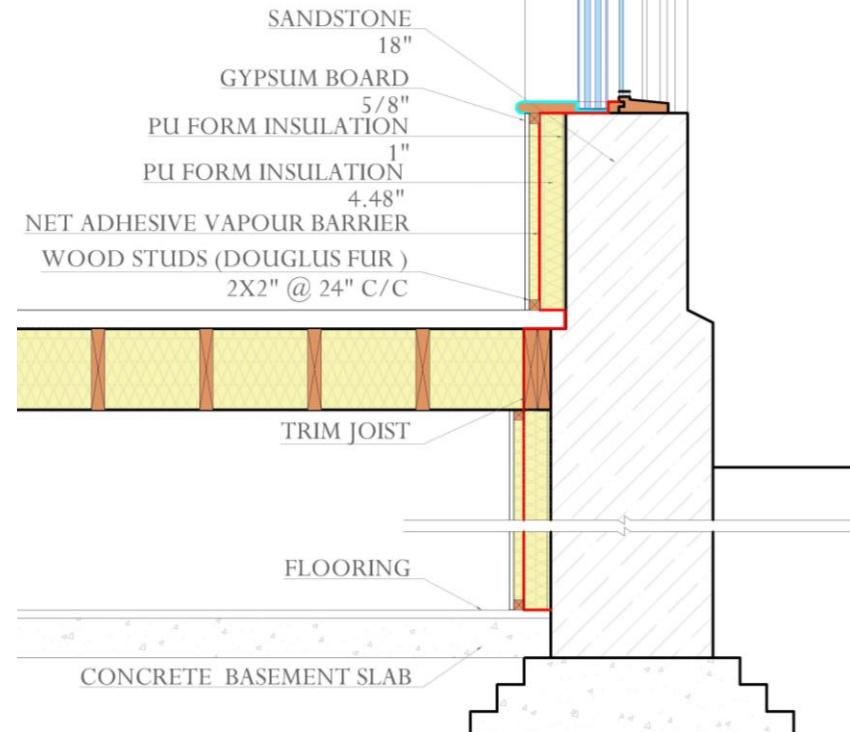
Required U- Value – 0.30 (W/(m²K))



Insulation

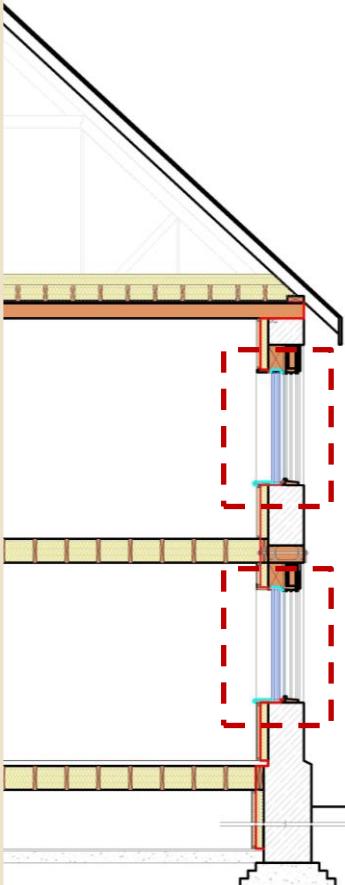
Sprayable airtightness sealant

Vapour Barrier



EXTERIOR STONE WALL AND
BASEMENT WALL
SECTION

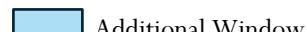
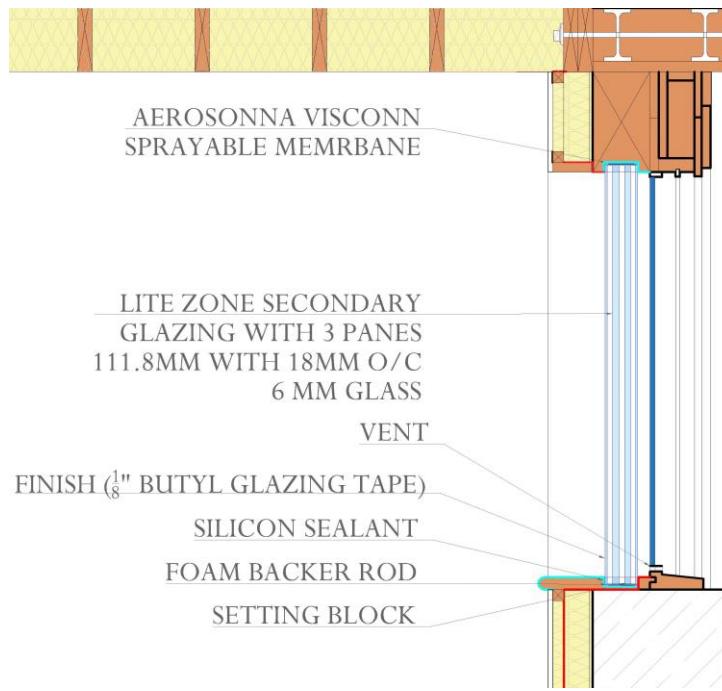
WINDOW DETAIL



Product name: Lite Zone L0679

Manufacturer: 6203 Roper Road,
Edmonton, AB, Canada.

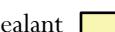
Type: Fixed, Triple pane



Additional Window



Sprayable airtightness sealant



Insulation



Existing Window

Material: GFRP, Fixed glazing with glazing bead and spacer made of glass fiber reinforced plastic (0.45 - 0.50 W/(mK)).

Climate zone: Cold

U-value - 0.60 W/(m²K)

R-value - 9 (ft²·°F·h/BTU)

Required U- Value – 0.65 (W/(m²K))

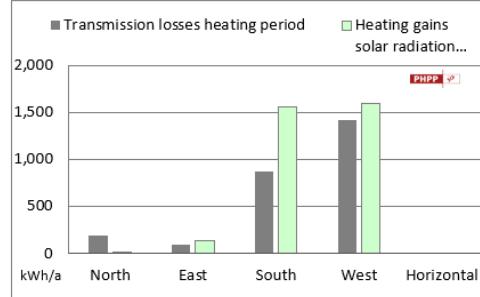
RETROFIT
OPTIONS

Name	Frame width	U-Value	Ψ -Value	Frsi-Value
Mullion Fixed	61 mm	0.33 W/(m ² K)	0.038 W/(mK)	0.780
Bottom Fixed	33 mm	0.34 W/(m ² K)	0.034 W/(mK)	0.790
Top fixed	33 mm	0.34 W/(m ² K)	0.034 W/(mK)	0.790
Lateral fixed	33 mm	0.34 W/(m ² K)	0.034 W/(mK)	0.790

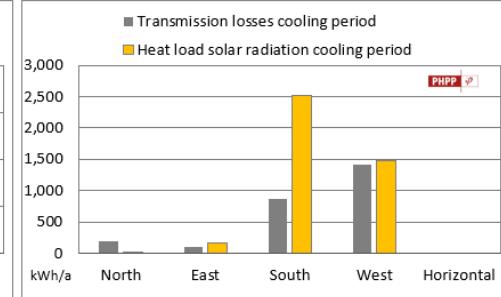


VENT FOR WINDOWS

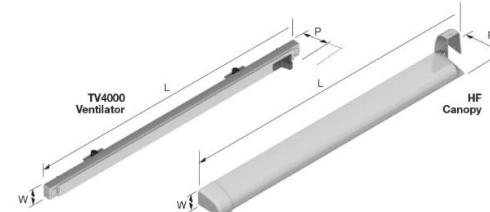
- Titon trim vent 4000 Hi-lift.
- The existing window handle will be replaced to form a vent for the condensation between 2 windows (old and additional).



Summer

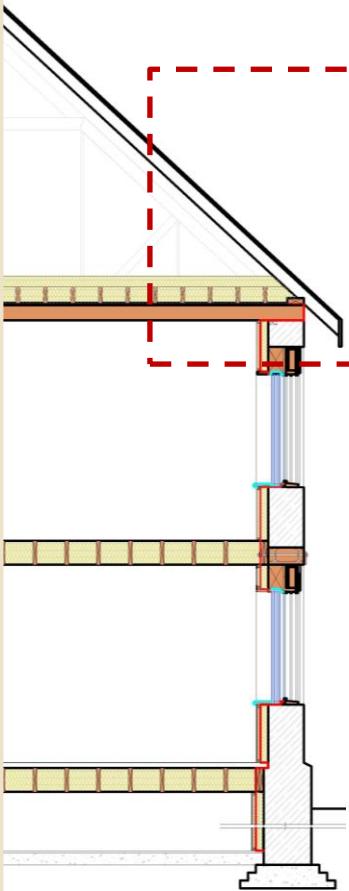


Winter

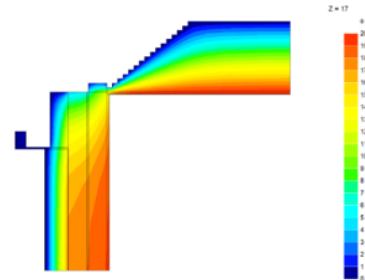


Existing West window

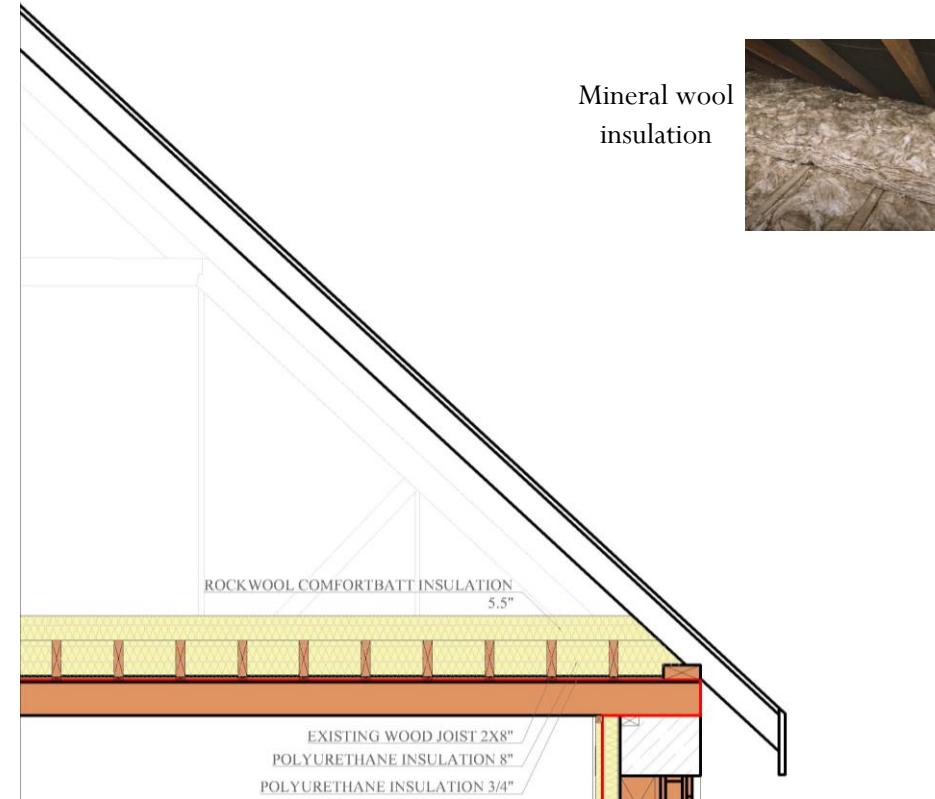
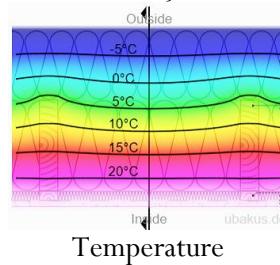
ATTIC DETAIL



U value – 0.099 (W/(m²K))
R-value - 57 (ft² °F·h/BTU)
Increase % factor- 48%
Required U- Value – 0.12 (W/(m²K))



Thermal bridging of
The corner junction



- Insulation
- Sprayable airtightness sealant
- Vapour Barrier

Mineral wool
insulation





PASSIVE STRATEGIES

DOORS

Product name: Wescon Cedar - Wood-Aluminium Entry Door (Glazed)

Manufacturer: 5120 Polkey Road, Duncan, Canada.

Swing - Inside

Material: Timber-aluminium frame with cork insulation (Therma cork 0,045 W/(mK)). Glazing: 4/18/4/18/4, Ug: 0,64 W/m²K; glass intersection: 21 mm; spacer: Super spacer Premium; secondary seal: Butyl

Climate zone: Cold

U-value - 0.80 W/(m²K)

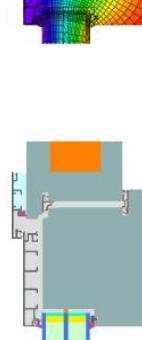
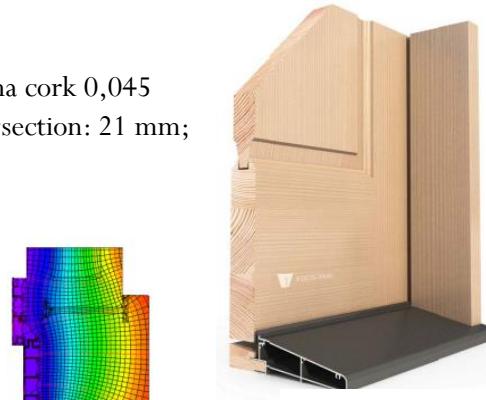
R-value - 7 (ft²·°F·h/BTU)

Type: Custom Made Doors

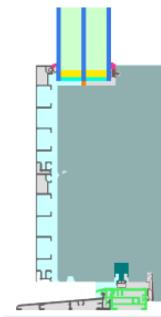
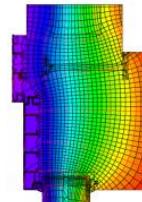
Name	Frame width	U-Value	Ψ-Value	Frsi-Value
Mullion 1 casement	212 mm	0.89 W/(m ² K)	0.021 W/(mK)	0.700
Door hinge side	186 mm	0.83 W/(m ² K)	0.021 W/(mK)	0.720
Door lock side	186 mm	0.84 W/(m ² K)	0.021 W/(mK)	0.720
Bottom Fixed	92 mm	1.74 W/(m ² K)	0.022 W/(mK)	0.590
Top fixed	78 mm	0.79 W/(m ² K)	0.021 W/(mK)	0.710
Lateral fixed	78 mm	0.79 W/(m ² K)	0.021 W/(mK)	0.710
Flying Mullion	254 mm	0.91 W/(m ² K)	0.021 W/(mK)	0.720
Top	187 mm	0.83 W/(m ² K)	0.021 W/(mK)	0.720
Threshold	217 mm	1.02 W/(m ² K)	0.022 W/(mK)	0.590



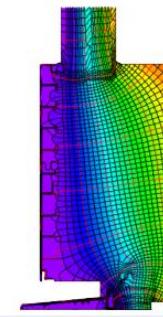
Existing External Main Door



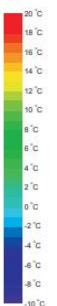
Door



Calculation model



Isothermal



Threshold

CHIMNEY AND FIREPLACE



CHIMNEY BALOON

Blocks the chimney flue when not in use, chimney balloons help prevent warm air from escaping the home during cold weather.



CLOSING FIRE PLACE

Securing the fireplace with insulation and gypsum board .



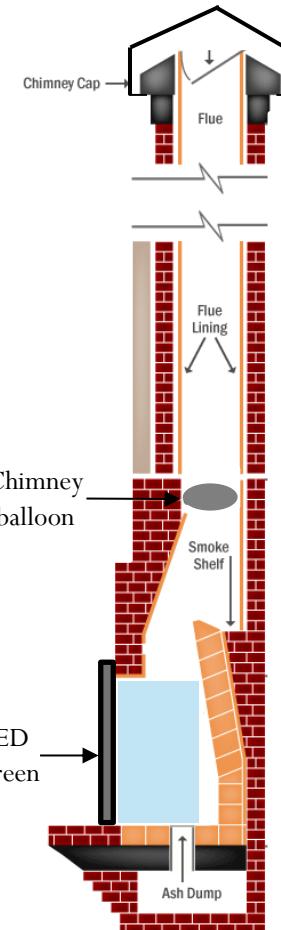
CHIMNEY CAP

A metal chimney cap serves as a protective barrier against rain, snow, sleet, other weather elements and Animals



LED SCREEN

Minimum energy demand by keeping the heritage look and feel of the interiors.



CHIMNEY DETAIL

SHADING

ADDITIONAL WINDOW COVERING - CELLULAR SHADES

COMPANY- GRABER

MANUFACTURE LOCATION –Montgomery, PA 17752, USA

SOURCE - 15-1547 Merivale Rd, Nepean, ON K2G 4V3

SIZE – Custom

FEATURES-

- Reduced VOCs (Volatile Organic Compounds)
- Improved Air Circulation
- Moisture Regulation
- Non-Toxic
- Biodegradable
- cellular shades insulate the windows and can reduce this loss by as much as 74%.



1 1/4" Single Cell

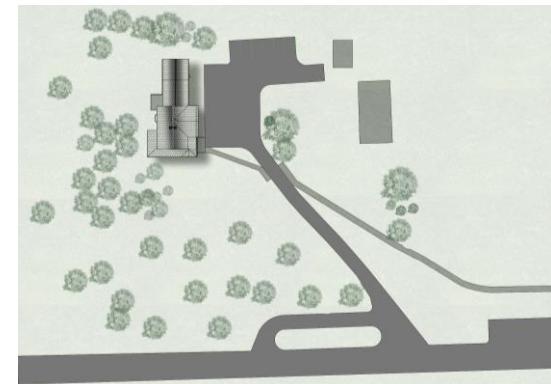


Light Filtering

SITE SHADING WITH RESPECT TO TREES

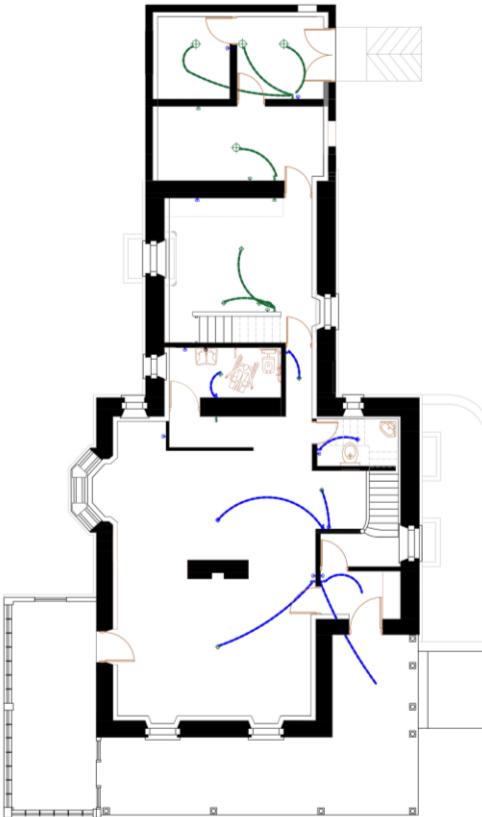


INTERIOR SHADING

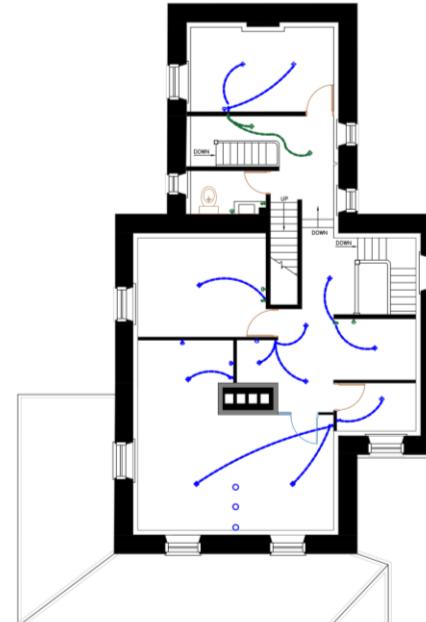


EXTERIOR SHADING

PROPOSED ELECTRICAL LAYOUT.



FIRST FLOOR PLAN – TEA SPACE



SECOND FLOOR PLAN-OFFICE SPACE

Eliminating the risk of non-airtightness by not puncturing any exterior wall and proposing all the electrical conducts in the interior walls.

- Ceiling lights
- Switches
- Plug Points
- Existing to Remain
- Proposed



SUSTAINABLE
STRATEGIES

INSULATION

SPRAYED POLYURETHANE INSULATION

COMPANY- Isolation Majeau et Frère

MANUFACTURE LOCATION –Saint-Esprit, Quebec

FEATURES-

- It has a high R-value: 6 per inch
- It sticks to all substrates (steel, concrete, wood)
- Because it adheres perfectly to substrates, it can be used to seal a structure continuously without creating any joints (a major advantage over polystyrene)
- It serves as an air barrier and vapor barrier
- Leak tightness: high sealing power

Note- Its production, installation, and disposal can have negative environmental impacts if not managed properly but, Sprayed polyurethane foam (SPF) insulation can help balance carbon offsets through its energy-saving properties and potential for reducing greenhouse gas emissions over the building's lifespan.



SUSTAINABLE
STRATEGIES



AIR AND VAPOUR BARRIER

VAPOUR BARRIER

COMPANY- Rothoblaas

MANUFACTURING LOCATION - Suite 500 – 9450 Rue John-Simons, Québec QC, G2B 0S9

FEATURES-

- Thickness -0.5 mm, 20 mil.
- Temperature resistance - -40 / 80 °C
- Thermal conductivity (λ) – 0.39 W/(m·K) , 0.23 BTU/h·ft·°F
- The self-adhesive surface of the membrane allows fast and safe installation without compromising performance.
- It has a Reinforcing grid pattern by which the membrane is not affected by mechanical stress or by staples and nails.
- ability to reflect up to 70% of the heat, the membrane improves the thermal performance of the construction panels.
- Low VOC Product.



AIR BARRIER

COMPANY-Pro Clima

MANUFACTURING LOCATION - 1425 Marine Drive, Suite 207 West Vancouver, BC, V7T 1B9

FEATURES-

- Airtightness – up to 1000 Pa, surrounding
- Temperature resistance -40 °C to +90 °C ; -40 °F to +194 °F(dried)
- Drying approx. 12 - 48 hours (at 20 °C, 65% rel. humidity)
- adhesive properties on all standard construction surfaces.
- Covers cracks and joints of up to 3 mm (1/8") width.
- For robust building components: permanent elasticity and high durability once it has dried.
- Improves surfaces: forms a bonding course between sub surfaces and subsequent coatings





GYPSUM BOARD

ECO SMART

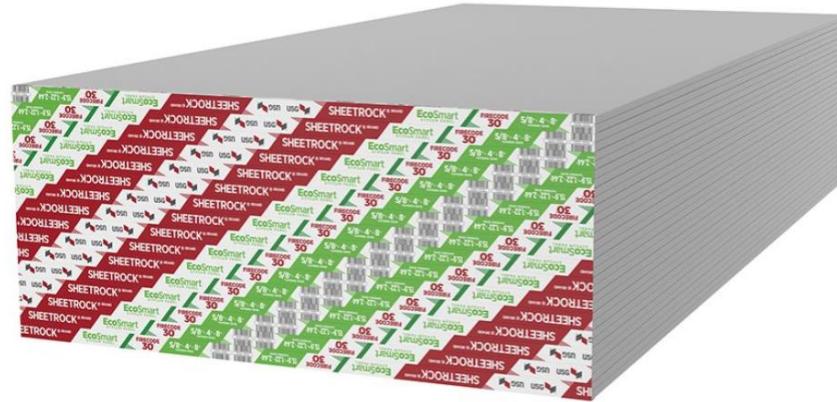
COMPANY- USG (United States Gypsum Company)

MANUFACTURE LOCATION –Chicago, IL 60661

SOURCE -500 Wellington Street West, Sault Ste Marie, ON

FEATURES-

- Thickness- 5/8 in. (15.9 mm)
 - Up to 25% less global warming potential (GWP)1
 - Up to 30% less weight reduces transportation fuel energy by up to 20%
 - Living Building Challenge™ Red List Free
 - Contain 100% USDA certified biobased content
 - Up to 97.3% recycled content (regionally available)
 - Achieved GREENGUARD Gold Certification and qualifies as a low VOC emitting material (meets CA 01350).
 - USGBC® LEED® v4—may assist in achieving additional credits



WATER EFFICIENCY

Water Sense-certified fixtures are part of the Green Building initiative, that improves the environmental impact of that structure.

few ways it will benefit the environment to replace fixtures with Water Sense-certified products.

- Faucets with a Water Sense label can reduce the water flow by 30%, meaning you use less water each time you use the sink/basin and still get the water pressure you expect.
- Reduction in water used for **toilets** by 20 to 60 percent—that's nearly 13,000 gallons of water savings per year per seat.

Total no. of toilet seats = 3 = 39000 gallons of water saved per year



How Does WaterSense Help?

Toilets 20%

Decrease water consumption.



Showerheads 4G

Save around 4 gallons of water every time you take a shower.

Faucets 800G

Save up to 800 gallons of water each year.



Irrigation 15,000 G

Save around 15,000 gallons of water each year.



INTERIOR FINISHES



Porcelain tiles for washroom.

A typical porcelain body is composed of clay, silica, sand, and feldspar.



Acrylic latex paint.
Low VOC
Recycled paint
Less Drying time



FSC certified wood for Wall studs and Furniture.



SUSTAINABLE
STRATEGIES





RECOMMENDATION

HRV

Changing fuel boilers to Electric HRV can save us up to 30% of costs over the long term .



Fantech HERO Series 200H HRV

\$1,487.00 CAD

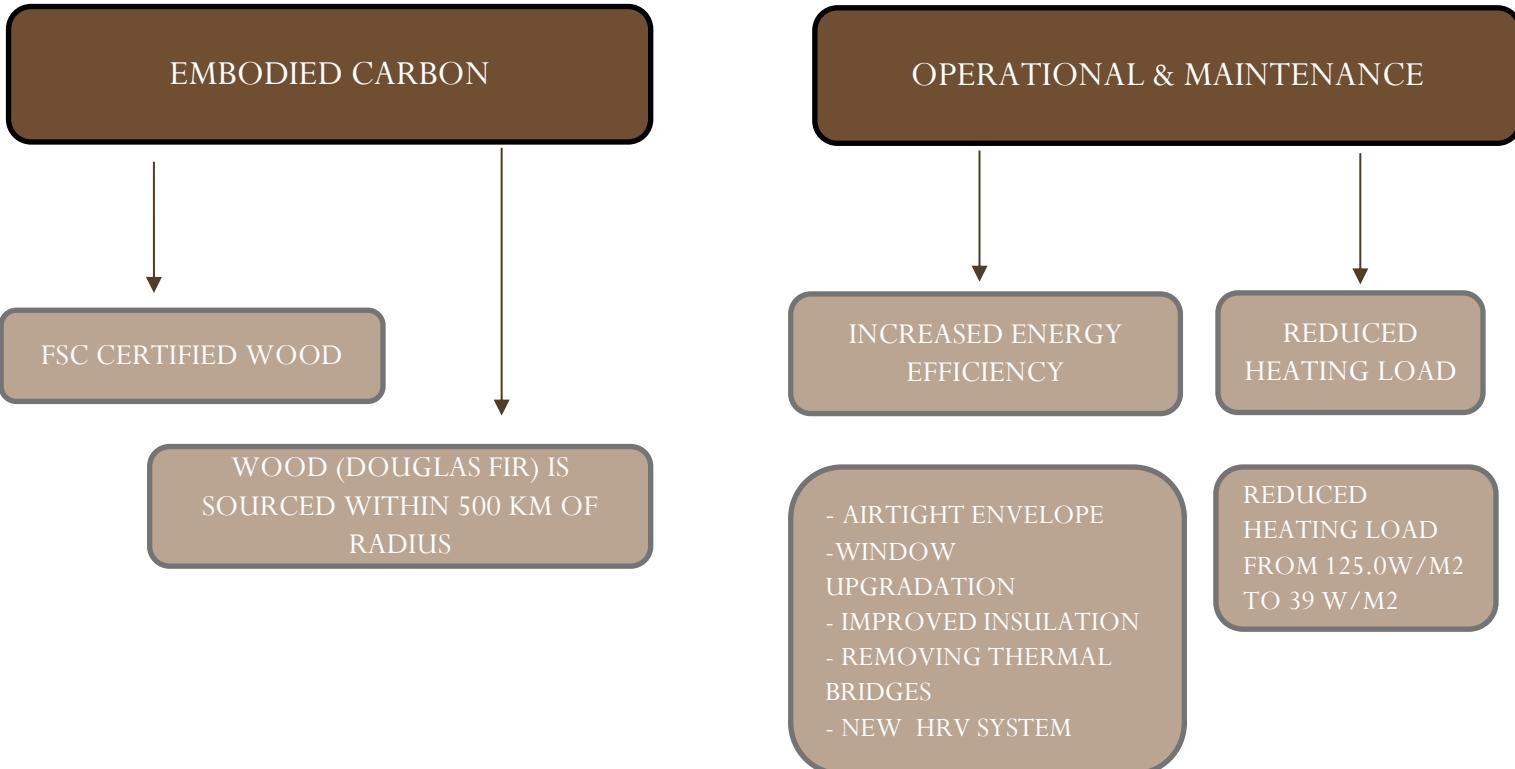
- Manufacturer: **fantech**
- Model Series: **new HERO Series**
- Model Description: **HERO 200H**
- Ventilation Performance: **218 cfm @0.4 in. wg**
- Manufacturers' Part Number: **99402**
- Wall Controller Included: **none *****
- Core Type: **Heat Recovery Ventilator (HRV)**
- Defrost Type: **Damper Defrost**
- Motor Type: **PSC (Standard)**
- Heat Recovery Rate (SRE) : **80%**
- Moisture Transfer rate: **0%**

⟳ Refresh Air

✖ Block Pollutants

ⓧ Recover Heat & Cold

17. CARBON FOOTPRINT REDUCTION



RECOMMENDATION

Budget

The budget has been developed based on the final order for labour costs at retrofit at the superintendent's residence. The renovations proposed are as follows :

1. Wall assembly
2. Replacing windows and doors
3. Replacing bathroom fixtures
4. Assumption of installation of HRV system
5. Insulating junctions

	Description	Total	
WALL ASSEMBLY	2" x 4" miscellaneous wood blocking, to wood construction, per M.B.F. Insulation, polyurethane foam, 2#ICF density, 1" thick, R6.5, sprayed Insulation, polyurethane foam, 2#ICF density, 4" thick, R26, sprayed Gypsum wallboard, 1/4" thick, standard, on walls & ceilings, no finish included miscellaneous surfaces, metallic paint, low VOC, tintable, spray applied	\$ 73,361.03	
WINDOW	commercial grade, stock units, awning type, standard glass, 3'-0" x 5'-4" opening, incl. frame and glazing commercial grade, stock units, sliding, standard glass, 5'-0" x 3'-0" opening, incl. frame and glazing Windows, aluminum, single-hung, impact resistant, 3'-0" x 5'-0", incl. frame and glazing	\$ 49,235.10	
WASHROOM	Waterproofing membrane ceramic tiling, EPS, sloped shower floor, including thinset Waterproofing membrane ceramic tiling, fleece laminated polyethylene grid, 5/16" thick, on floors, including thinset Water closet, tank type, vitreous china, wall hung, close coupled, two piece, includes seat, supply pipe with stop Faucets/fittings, kitchen sink faucets, top mount, cast spout Faucets/fittings, lavatory faucet, automatic sensor and operator, with faucet head, residential	\$ 112,260.06	
DOORS	Toilet accessories, installation only, grab bars, straight, satin finish, 2-1/2" diameter x 42" long Doors & frames, aluminum, entrance, narrow stile, clear finish, 6'-0" x 7'-0" opening, incl. standard hardware, excl. glass	\$ 10,116.84	
	<i>Grand Total</i>		\$ 244,973.03

Based on the installation and labor costs, the total budget costs, including professional fees, will increase to approximately **\$749,129.**



LCC analysis for heating system

Existing Oil based heater Cost analysis:

Heating Demand: 373.7

Treated floor area: 355 sq.m

$$\begin{aligned}\text{Heating demand} &= 373.7 \times 355 = 13266.5 \text{ Kwh} \times \text{yr} \\ &= 477.5 \text{ GJ}\end{aligned}$$

Total Gas consumption =

$$\$ 0.35 \times (477.5 / 0.038) = \$ 4398$$

Based on the LCC analysis tool, it can be determined that in addition to all the retrofit measures proposed, if we add an HRV system, there is a gradual increase through the years, while if we keep the existing system, it changes on a huge scale year to year, making it less efficient.

Proposed HRV for PHPP Cost analysis:

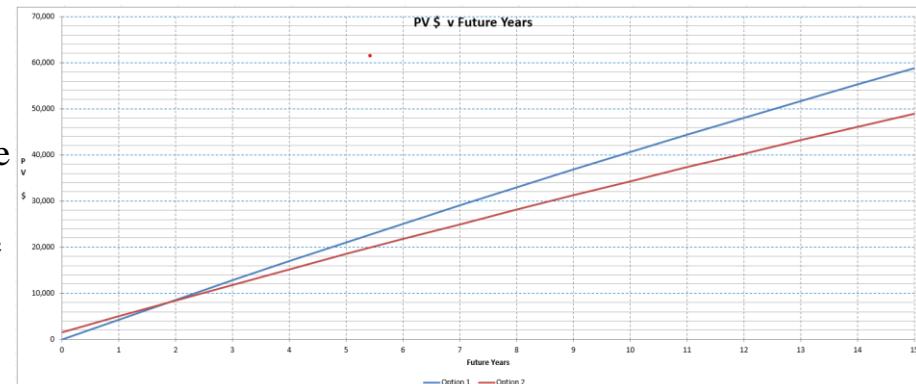
Heating Demand: 100.1

Treated floor area: 335 sq.m

$$\text{Heating demand} = 100.1 \times 335 = 35535.5 \text{ Kwh} \times \text{yr}$$

$$\text{Total Energy consumption} = \$ 0.10 \times 35535.5 = \$ 3553.55$$

$$\text{Total renovation cost} = \$749,129 + \$ 1452 (\text{HRV}) = 750,581$$



Graph for LCC of heating system

CONCLUSION

In Conclusion

- As per ENERPHIT standards, we are achieving **COMPLETE COMPONENT CRITERIA** by upgrading the Interior Envelope Retrofits of the ATTIC ,WALLS, BASEMENT WALLS, WINDOWS & DOORS.
- Reduced Heating Demand from **373.7 kWh/m²a** to **100.1 kWh/m²a3**.
- Reduced water efficiency by 30%.
- If heating systems are changed the cost can be reduced by 10-20%.



RECOMMENDATION

REFERENCES

- https://transcanadagroup.on.ca/species/douglas-fir/?gad_source=1&gclid=CjwKCAjw7-SvBhB6EiwAwYdCAXehKjPJ-MeLWmzHB3AsNif-jk-7Zs8QNNp7zDXOxnNnVne51P8pSxoCgUwQAvD_BwE
- https://cdn.agilitycms.com/mesca/mem-202312_mesca_a-coil_brochure_eng_fa_lr.pdf
- <https://www.arcbuildingsolutions.co.uk/wp-content/uploads/2024/01/DS024-ARC-Retrofit-Eaves-Insulator-v1.2.pdf>
- <https://www.litezone.ca/performance-values.html>
- <https://www.hortongroup.com/log-cabin-extras/windows-and-doors-for-log-cabins/trickle-vents-for-windows>
- <https://well.support/pre-approved-programs~ca36f076-229e-438f-b23f-643626026f74>
- <https://www.rothoblaas.com/products/new-products/barrier-alu-net-adhesive-300>
- <https://proclima.com/service/distribution/canada>
- <https://www.ubakus.de/en-ca/u-wert-rechner/>
- <http://ohioia.com/news/how-to-become-watersense-certified/>
- <https://www.epa.gov/watersense/about-watersense>

THANK YOU

TO BEGIN WITH WALKTHROUGH JOURNEY....