UNBC
Wood Innovation Research Lab
Project Documentation

Certified
Passive House
Passive House Institute
| classic | plus | premium |

1. Abstract

North-east elevation; Photo: Michael Elkan Photography

a. Building Data

Year of construction	2018	**Space heating**	12 kWh/(m^{2}a)
U-value external wall	0.079 W/(m^{2}K)		
U-value floor	0.166 W/(m^{2}K)	**Primary Energy Renewable (PER)**	61 kWh/(m^{2}a)
U-value roof	0.057 W/(m^{2}K)	**Generation of renewable energy**	0
U-value window	0.77 W/(m^{2}K)	**Non—renewable Primary Energy (PE)**	116 kWh/(m^{2}a)
Heat recovery	86%	**Pressure test n_{50}**	0.1

b. Brief Description

The Wood Innovation Research Lab (WIRL) is a wood science and engineering research facility in downtown Prince George, British Columbia, Canada.

The WIRL provides students, faculty members and researchers from UNBC's Master of Engineering in Integrated Wood Design program with the ability to build and test large-scale integrated wood structures using engineered wood products such as cross-laminated timber, glue-laminated timber and laminated veneer lumber. The building includes a high-head lab for tall projects and a portion of the building consists of a strong floor and wall to support testing equipment and a crane. This building also accommodates associated classrooms and office space.

The structure is comprised of a glulam post and beam superstructure over an insulated raft foundation, featuring an interior concrete strong wall and strong floor to support destructive structural testing. Exterior walls are constructed of vertical light-wood trusses that were pre-fabricated in a local factory.

By using prefabricated components, most of the work could be completed in a controlled shop environment, particularly advantageous for the cold climate of this northern Canadian facility.

c. Responsible Project Participants

Architect: Stantec Architecture

Building Systems: Stantec Consulting

Structural Engineering: Aspect Structural Engineers

Passive House Project Planning: Stantec Consulting

Construction Management: IDL Projects

Certifying Body: Herz & Lang GmbH

Certification ID: 18505-18514_HUL_PH_20180706_FL

https://passivehouse-database.org/index.php?lang=en#d_6748

Author of project documentation: Marc Trudeau P.Eng Architect AIBC

Date, signature:

January 2, 2023

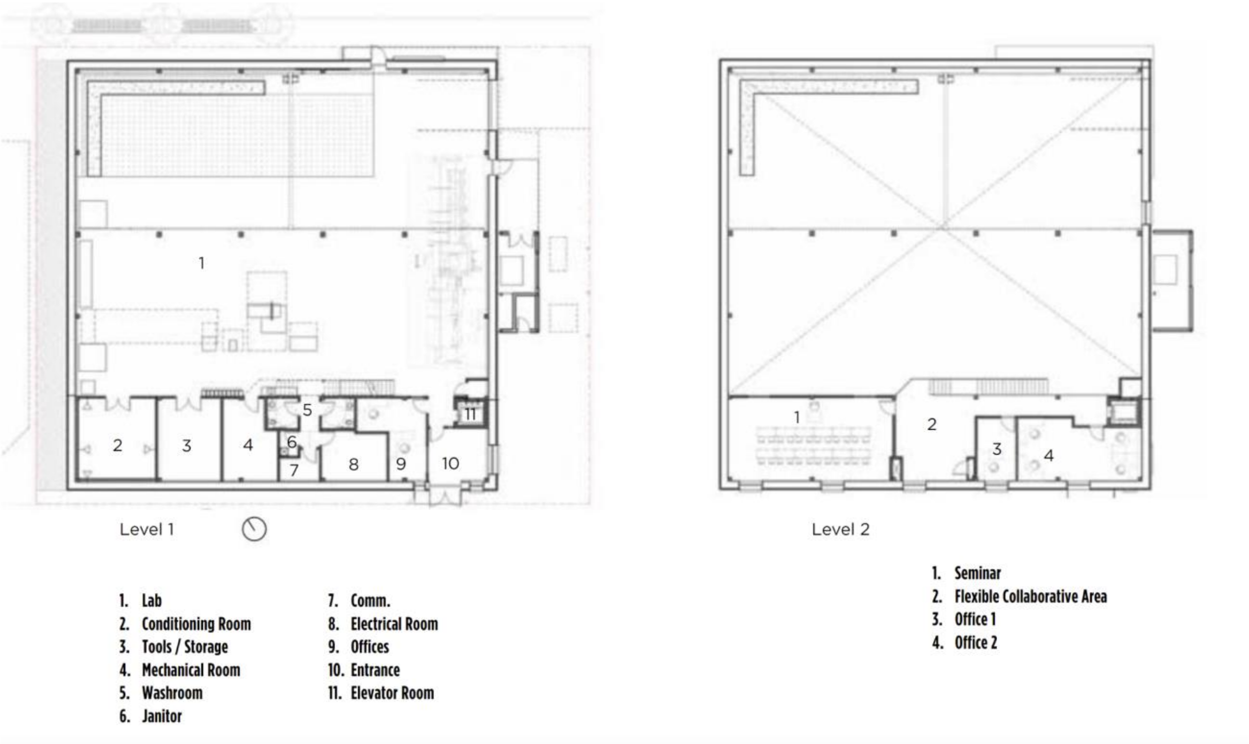
2. Views of the Project

South-east elevation; Photo: Michael Elkan Photography

Interior, workshop area, looking towards the South-east; Photo: Michael Elkan Photography

3. Floor Plans

The building massing is a rectangular box, allowing insulation to fully wrap the perimeter with minimal complication from transition details.



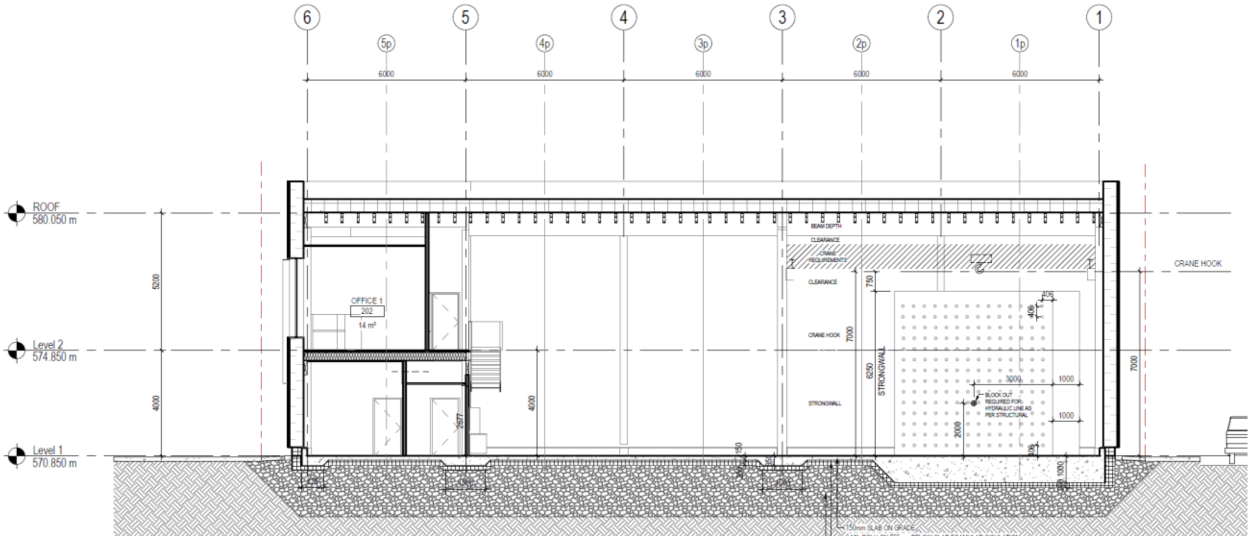
The south side of the building has the largest extent of windows, which offer helpful solar gains, views, and natural light for the office and seminar spaces. The south façade is also where the air intake for the building is located, positioned to draw air from a future adjacent park.

The temperature setpoints are 15 ⁰C for the lab and 20 ⁰C for the office. Heat loss between the two zones was included in the PHPP calculations.

The air handling unit supplies 100% outdoor air to the offices and seminar rooms on the South. Air is then transferred through to the laboratory space which has a low occupancy but needs high levels of air movement to remove potential pollutants such as VOCs before. Exhaust air is returned through the high efficiency energy recovery wheel.

4. Sections

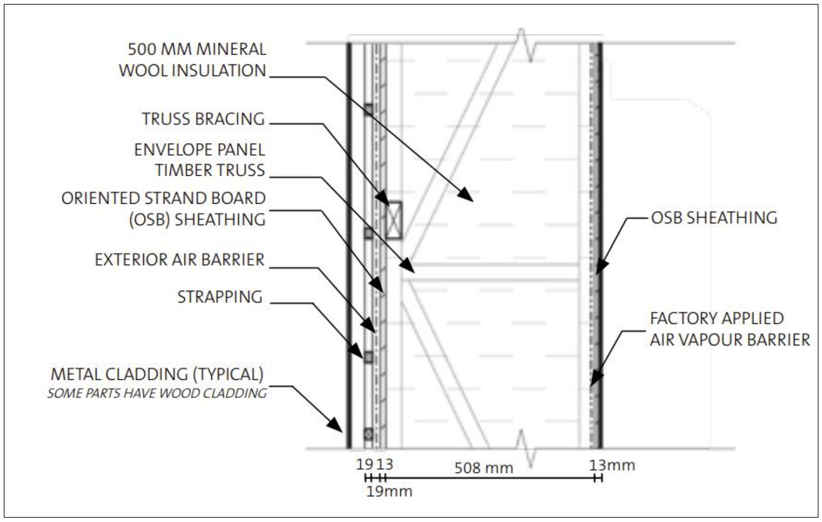
The building is comprised of a glulam post-and-beam superstructure over an insulated raft foundation. The wall assembly consists of a wood trusses with sprayed mineral-wool insulation. The wall and roof structures were made using conventional building materials and fabricated in Prince George by Winton Global, a local residential truss manufacturer. The wall truss sections are 10 metres tall by 2.9 metres wide, designed based on 1.47-metre-wide sheathing modules.

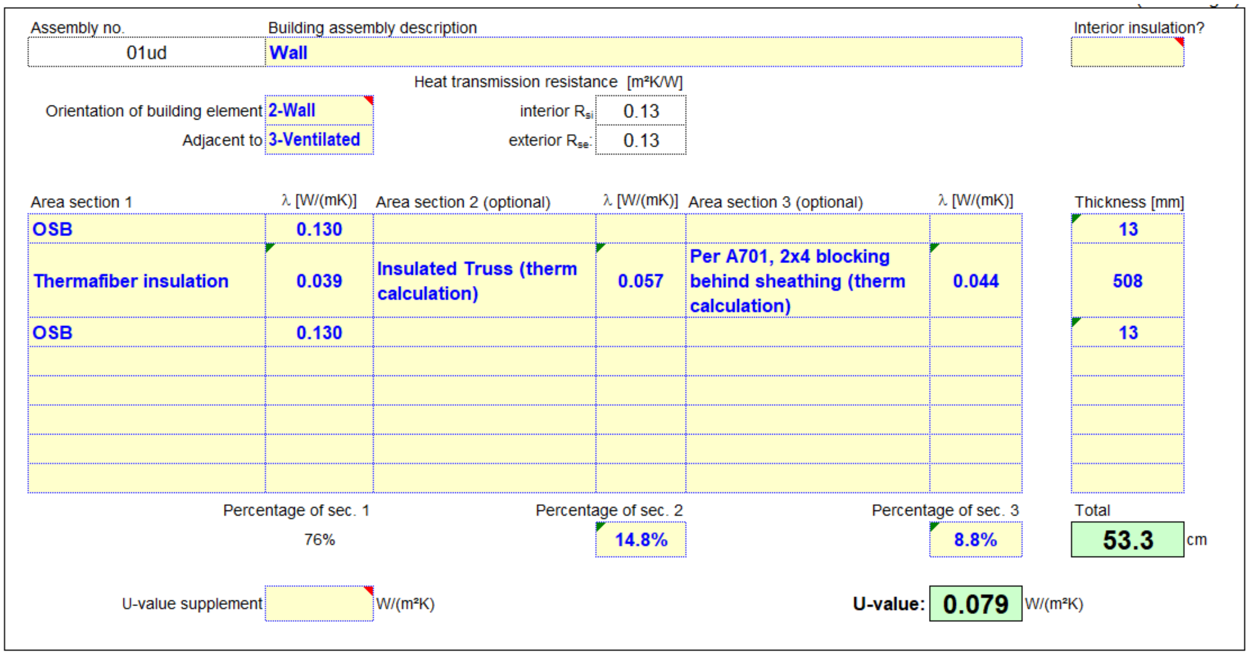


Doors and windows from European manufacturers were selected for performance that meets Passive House requirements. The non-local materials in the envelope are the Intello air/vapour system, developed by Pro Clima in Germany. Blown mineral wool insulation was sourced from Indiana. The overhead door was provided by Hörmann and delivered from Germany.

5. Details and Airtightness

The exterior walls were designed to accommodate 500 mm of mineral wool insulation.





Assembly no. 01ud

Building assembly description **Wall**

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element **2-Wall**

interior R_{si} 0.13

Adjacent to **3-Ventilated**

exterior R_{se} 0.13

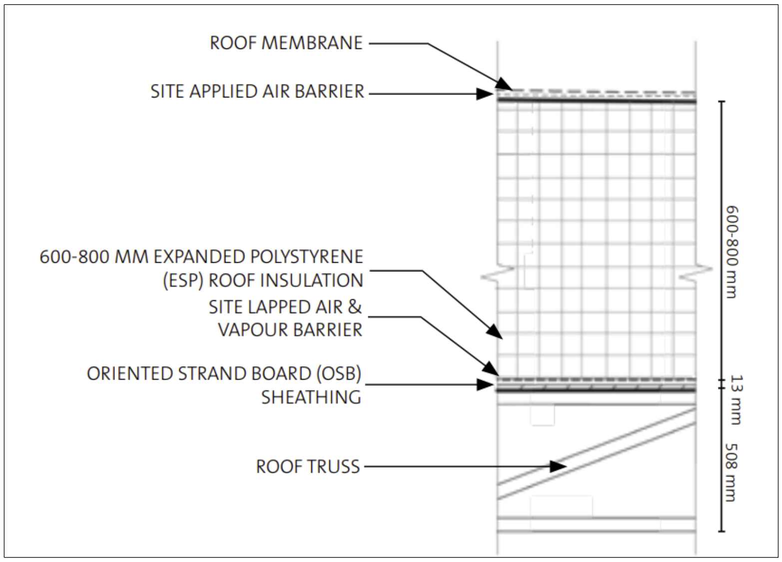
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
OSB	**0.130**					**13**
Thermafiber insulation	**0.039**	**Insulated Truss (therm calculation)**	**0.057**	**Per A701, 2x4 blocking behind sheathing (therm calculation)**	**0.044**	**508**
OSB	**0.130**					**13**

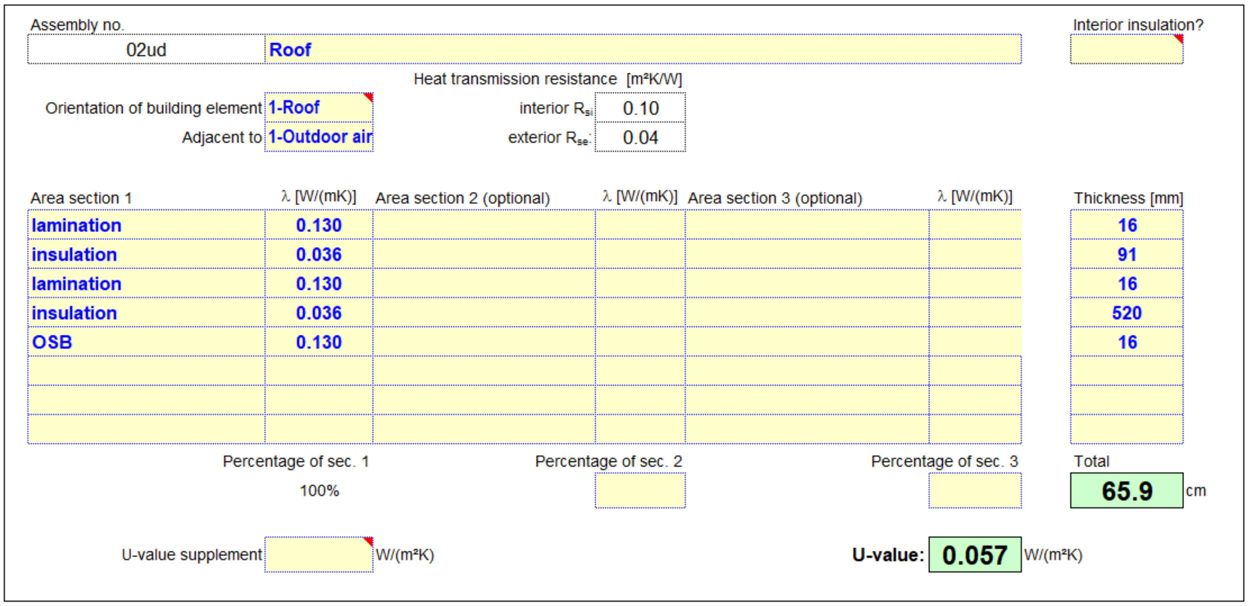
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
76%	**14.8%**	**8.8%**	**53.3** cm

U-value supplement W/(m²K)

U-value: **0.079** W/(m²K)

The roof assembly includes 600-800 mm of sloped expanded polystyrene (EPS) insulation.





Assembly no. 02ud **Roof**

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element **1-Roof**   interior R_{si} 0.10

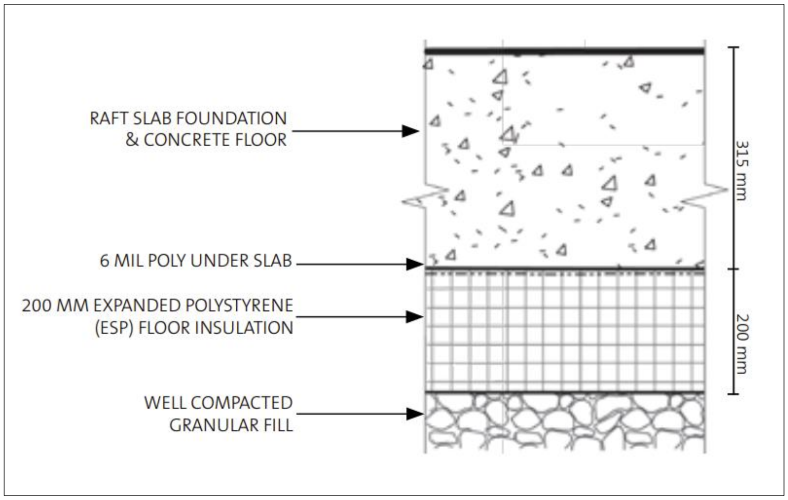
Adjacent to **1-Outdoor air**   exterior R_{se}: 0.04

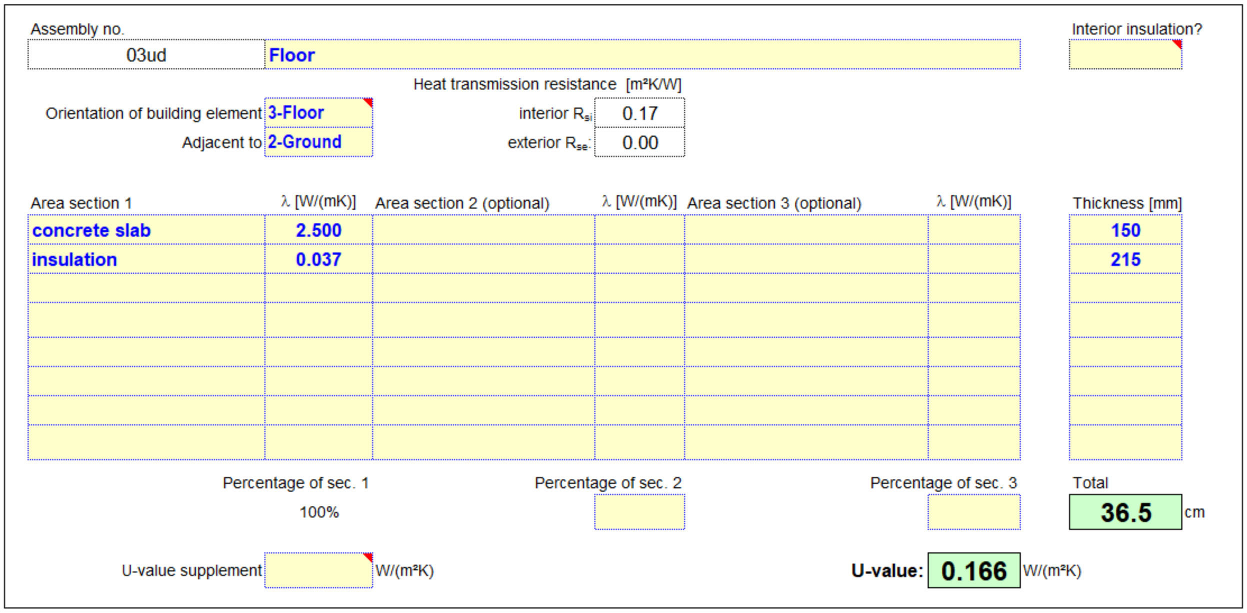
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
lamination	**0.130**					**16**
insulation	**0.036**					**91**
lamination	**0.130**					**16**
insulation	**0.036**					**520**
OSB	**0.130**					**16**

Percentage of sec. 1 100%   Percentage of sec. 2   Percentage of sec. 3   Total **65.9** cm

U-value supplement W/(m²K)   **U-value: 0.057** W/(m²K)

Reducing thermal loss at the concrete slab on grade was challenging because of the structural loading requirements of the slab. A high-density EPS insulation was used below the strong floor, while the rest of the slab was insulated with medium-density EPS.





Assembly no. 03ud **Floor**

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element **3-Floor** interior R_{si} 0.17

Adjacent to **2-Ground** exterior R_{se}: 0.00

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
concrete slab	**2.500**					**150**
insulation	**0.037**					**215**

Percentage of sec. 1 100%

Percentage of sec. 2

Percentage of sec. 3

Total **36.5** cm

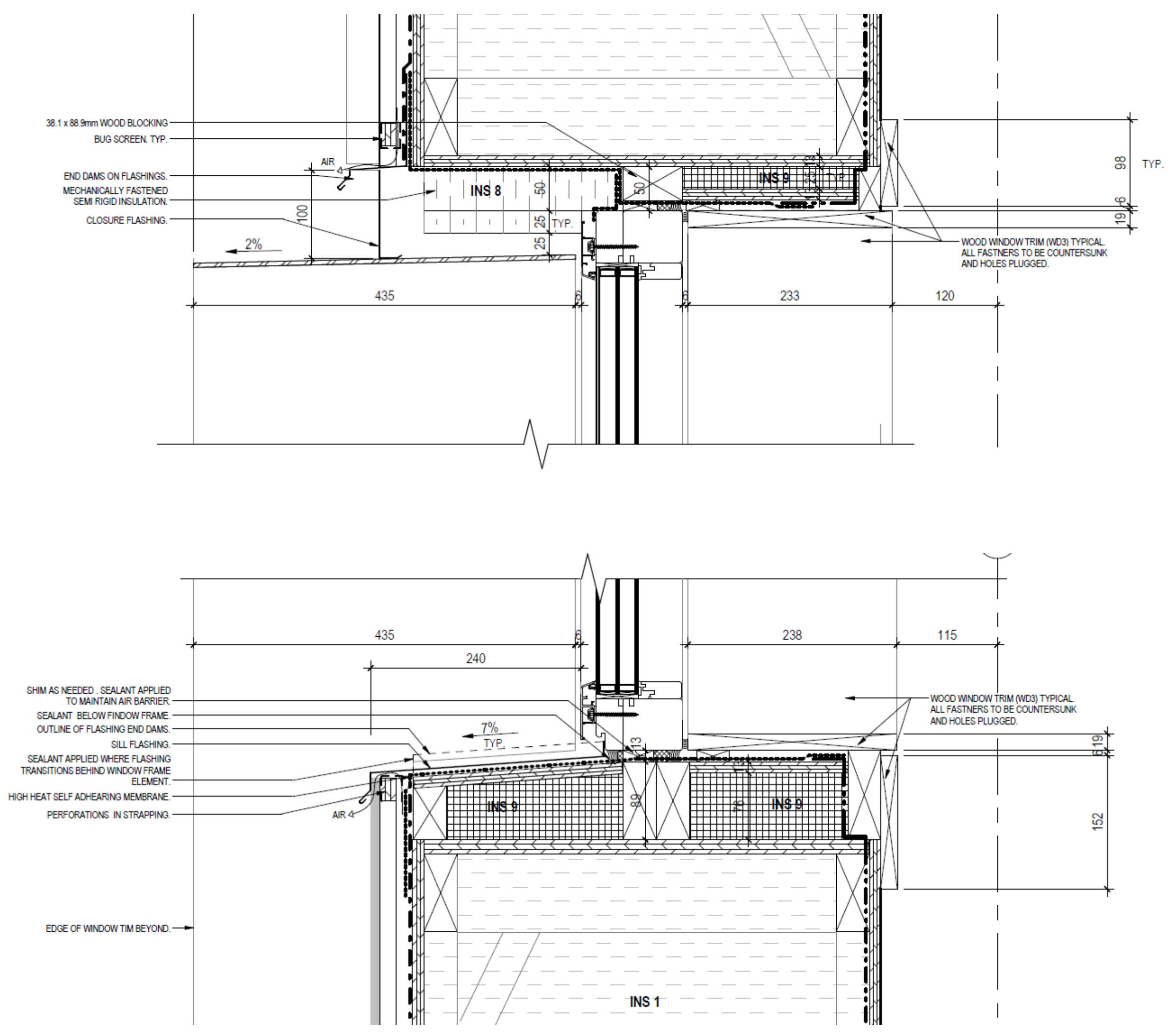
U-value supplement W/(m²K)

U-value: 0.166 W/(m²K)

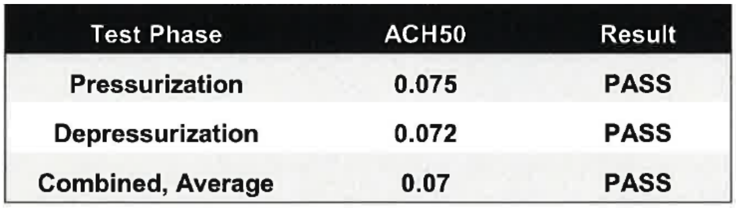
Passive House certified doors and windows with well insulated frames were used. Windows and doors were installed along the midline of the wall assembly to reduce thermal bridging with insulation provided over the frames on the head and jamb.

Components include:

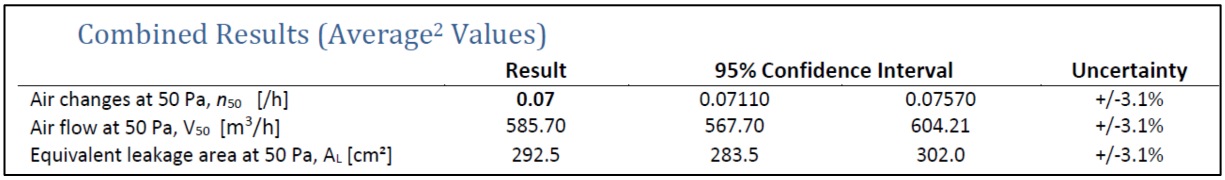
Zola Arctic window frames	U_f-0.73 W/m^{2}K
Triple pane glazing	U_g-0.55 W/m^{2}K, g-value 0.43
Zola ThermoplusClad door	U_f-1.28 W/m^{2}K



The wall assembly includes a sealed Intello membrane on the inside of the insulation layer. The completed construction achieved airtightness n_{50} 0.07 air changes per hour.



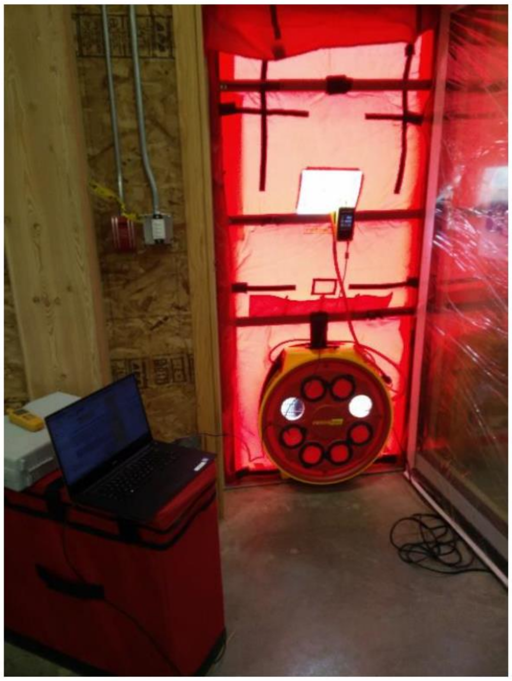
Test Phase	ACH50	Result
Pressurization	**0.075**	**PASS**
Depressurization	**0.072**	**PASS**
Combined, Average	**0.07**	**PASS**



Combined Results (Average² Values)

	Result	95% Confidence Interval		Uncertainty
Air changes at 50 Pa, n_{50} [/h]	**0.07**	0.07110	0.07570	+/-3.1%
Air flow at 50 Pa, V_{50} [m³/h]	585.70	567.70	604.21	+/-3.1%
Equivalent leakage area at 50 Pa, A_L [cm²]	292.5	283.5	302.0	+/-3.1%

Airtightness Test Results
Provided by Morrison Hershfield, testing consultant



Pressure Test Installation, Photo: Morrison Hershfield

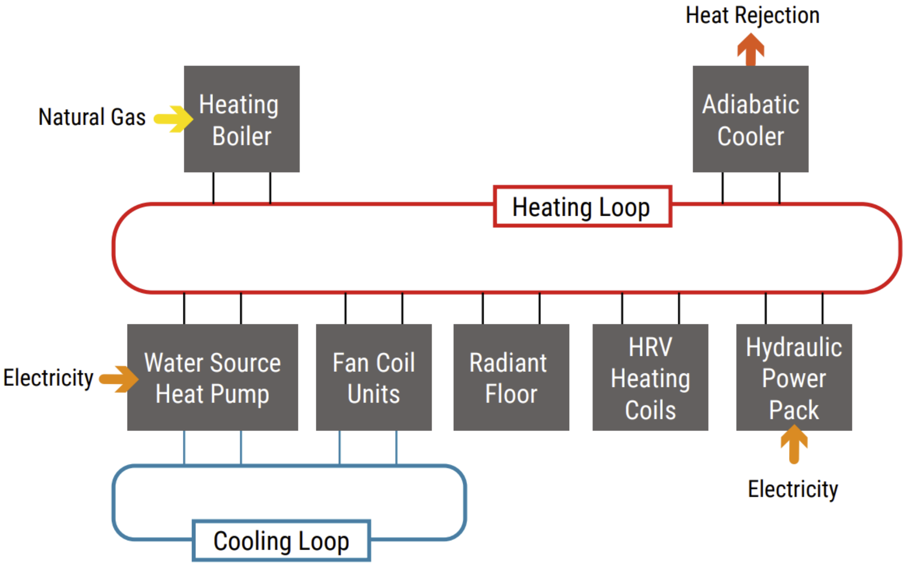
6. Heating, Ventilation, and Cooling Systems

Efficient heat recovery ventilation (HRV) systems are used to recover heat. Two Swegon Gold units are included, with recovery efficiency of 86%. The units have electrical efficiency of 0.45 Wh/m^3.

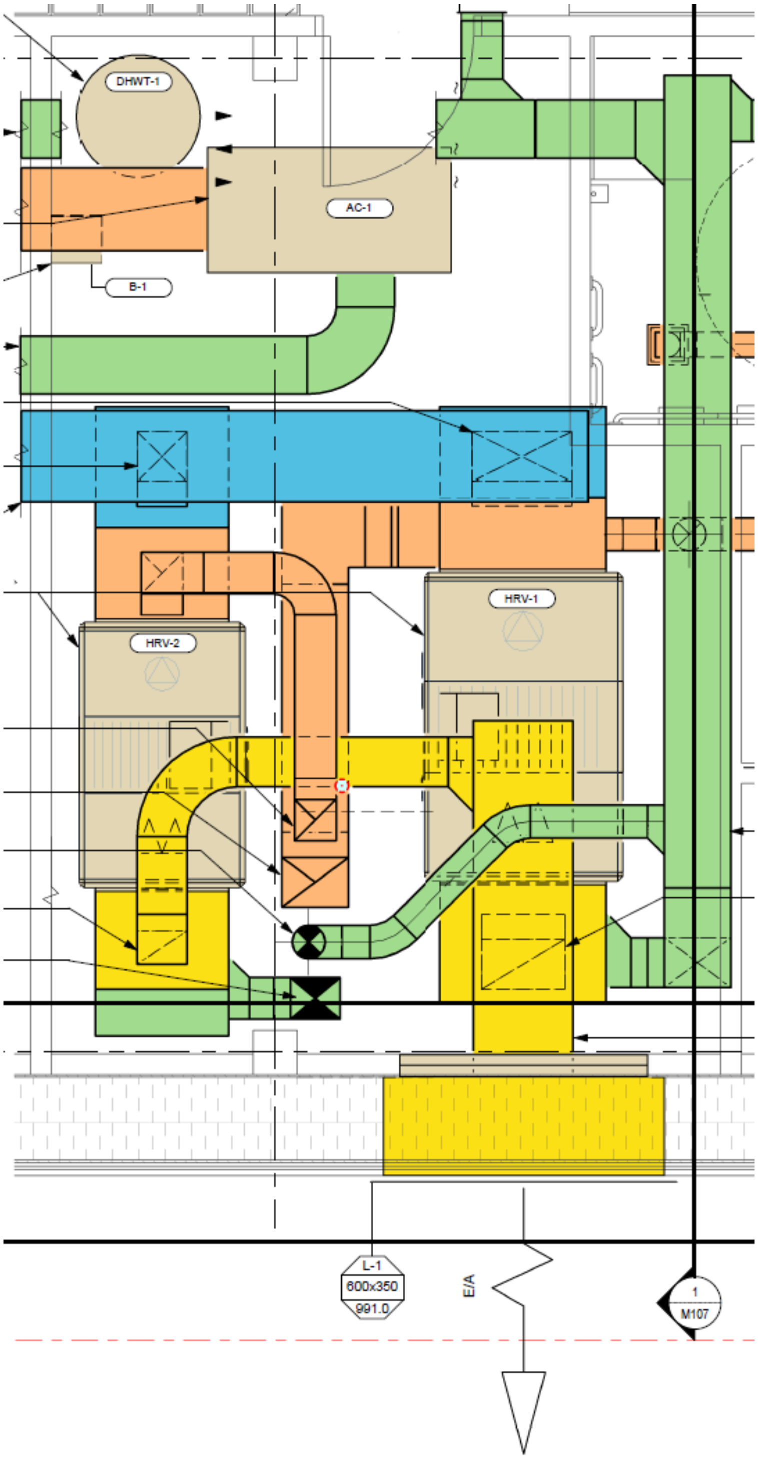
Space heat is provided by a condensing gas boiler. The heat is distributed to the lab space by in-floor radiant heating. Heat to the office areas is provided using fan coils.

Cutting wood pieces results in significant quantities of wood dust, which are both a health and fire safety risk. The lab space in WIRL is served by a large dust extraction system that can operate at approximately 2,400 L/s. The dust extraction system is located outside of the building to minimize the risk of the lab being affected in the event of an explosion caused by the static friction of the wood dust moving through this system. Heat loss in the lab space resulting from circulating warm air through the dust extraction system is included in PHPP calculations.

A heat pump transfers heat from fan coil units cooling the offices and seminar room on the South elevation to the heating loop, allowing heat to be shared with the large north-facing laboratory space. The hydraulic power pack used to support wood working equipment also rejects heat to the heating loop, allowing the heat to be shared. When heat is not needed in the heating loop, the excess heat is rejected using the adiabatic cooler.



Hydronic Heating and Cooling System Schematic Diagram
Diagram credit: Stantec Consulting



Mechanical Room Plan
Showing location of HRV's and space heating boiler B-1

7. Construction Photos

https://www2.unbc.ca/image-galleries/47078/wood-innovation-research-lab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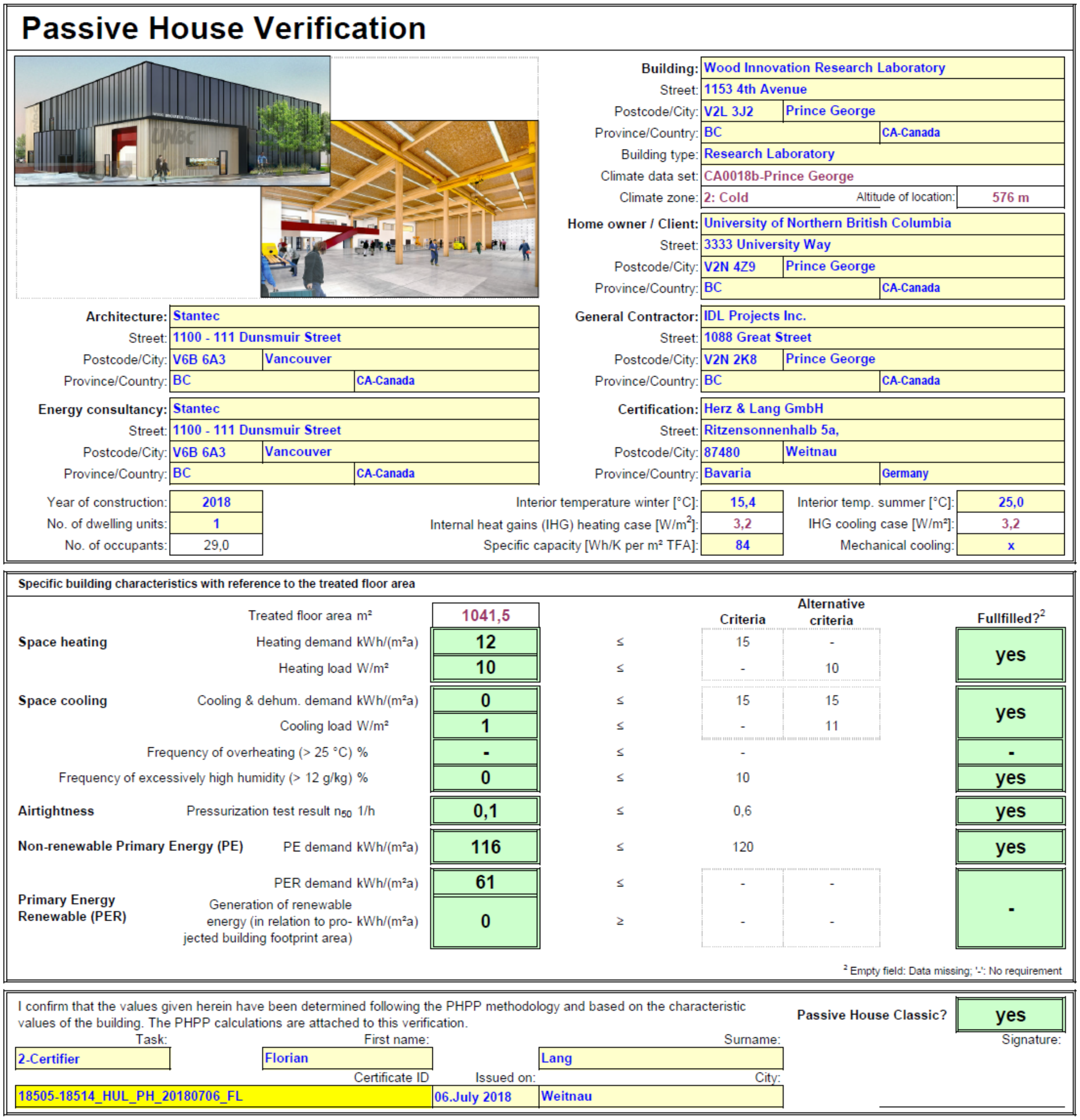
TESCON
vana
pro clima

8. PHPP Calculations



Passive House Verification

Building: Wood Innovation Research Laboratory
Street: 1153 4th Avenue
Postcode/City: V2L 3J2 Prince George
Province/Country: BC CA-Canada
Building type: Research Laboratory
Climate data set: CA0018b-Prince George
Climate zone: 2: Cold Altitude of location: 576 m

Home owner / Client: University of Northern British Columbia
Street: 3333 University Way
Postcode/City: V2N 4Z9 Prince George
Province/Country: BC CA-Canada

Architecture: Stantec
Street: 1100 - 111 Dunsmuir Street
Postcode/City: V6B 6A3 Vancouver
Province/Country: BC CA-Canada

General Contractor: IDL Projects Inc.
Street: 1088 Great Street
Postcode/City: V2N 2K8 Prince George
Province/Country: BC CA-Canada

Energy consultancy: Stantec
Street: 1100 - 111 Dunsmuir Street
Postcode/City: V6B 6A3 Vancouver
Province/Country: BC CA-Canada

Certification: Herz & Lang GmbH
Street: Ritzensonnenhalb 5a,
Postcode/City: 87480 Weitnau
Province/Country: Bavaria Germany

Year of construction:	2018	Interior temperature winter [°C]:	15,4	Interior temp. summer [°C]:	25,0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	3,2	IHG cooling case [W/m²]:	3,2
No. of occupants:	29,0	Specific capacity [Wh/K per m² TFA]:	84	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	1041,5				
Space heating	Heating demand kWh/(m²a)	12	≤	15	-	yes
	Heating load W/m²	10	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	0	≤	15	15	yes
	Cooling load W/m²	1	≤	-	11	
	Frequency of overheating (> 25 °C) %	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	10		yes
Airtightness	Pressurization test result n_{50} 1/h	0,1	≤	0,6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	116	≤	120		yes
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	61	≤	-	-	-
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	0	≥	-	-	

[2] Empty field: Data missing; '-': No requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The PHPP calculations are attached to this verification.

Passive House Classic? yes

Task:	First name:	Surname:	Signature:
2-Certifier	Florian	Lang	

Certificate ID	Issued on:	City:
18505-18514_HUL_PH_20180706_FL	06.July 2018	Weitnau