Project Documentation

Abstract

6-Storey / 110x Unit Residential Rental Building for Faculty & Staff, University of British Columbia, Vancouver, Canada

Data of building			
Year of construction	2022	Space heating requirement	12 kWh/(m²a)
U-value external wall	0.142 W/(m²K)		
U-value slab on grade - foundation	0.266 W/(m²K)	Primary Energy Renewable (PER)	64 kWh/(m²a)
U-value roof	0.095 W/(m²K)	Generation of renewable Energy	65 kWh/(m²a)
U-value window	0.88 W/(m²K)	Non-renewable Primary Energy (PE)	141 kWh/(m²a)
Heat recovery	82.9 %	Pressurization test n_{50}	0.3 h^{-1}
Special features	100 kW solar photovoltaic rooftop array provides renewable energy Cooling coils within HRV provide tempered air to passively cool interior spaces during warm summer months A combination of operable and fixed shading elements reduce overheating and glare within interior spaces		

Brief Description

Faculty & Staff Rental Housing, University of British Columbia

The first of its kind on UBC's Vancouver campus, Evolve is a Passive House Certified multi-family housing project. Completed in time for the new academic year summer 2022, The fully electrified project considers future occupant comfort in a world where climate conditions are rapidly changing and must be accounted for in the design.

Evolve is a 6 storey rental condominium building reserved for the faculty and staff of the university. The building offers 110 rental units, ranging from studios to 4 bedroom units.

The project received a $3.5 million grant from Natural Resources Canada to support its ambitious performance goals, research and development, a robust post occupancy evaluation programme, all while engaging the UBC School of Architecture and Landscape Architecture and Masters of Engineering Leadership program to confirm its place as a demonstration project on campus.

Building performance was a key factor to the building design, particularly with mitigating solar overheating. The building's orientation was already heavily dictated by the existing urban fabric of Wesbrook Village, so, rather than orientating the building to work best against the sun's path, the building was orientated to work best with its context and urban planning. Each of the building's elevations were then designed and detailed with different applications of passive shading methods based on their orientation to the suns path - The North Elevation will see minimal direct sun, and so has no shading elements applied; the South Elevations will see the midday sun and have fixed shading treatments to windows; and the East and West elevations will see the lower and more direct morning/afternoon sun and so have both fixed and operable shading treatments to the windows. Not only does this offer a practical and passive solution to mitigating solar overheating within the building, it also creates a striking aesthetic to the building's design, and provides an education within the living laboratory of the university, demonstrating how building design can respond effectively and efficiently to its solar orientation. The passive shading methods also supplement the buildings mechanical ventilation system. The HRV system, which offers tempered VFV cooling, can be efficiently sized with the passive shading methods lowering the building's cooling load.

The design team have always questioned 'how can we innovate by keeping things simple', and have strived to achieve a higher performance design and lower energy usage by simplifying the building form and detailing. The wider massing of the project is designed to be a convergence of simple rectilinear forms. This simple approach allows for greater efficiency through stacking floor plates and services, efficiency of construction schedule, and efficiency of construction budget. This convergence of simple rectilinear forms also intends to articulate the overall building mass, reduce its overall apparent size, and create opportunities to express building entries with keyways through the building. The project utilizes key contrasting tones to help highlight these design features: Striking white aluminium fixed shading 'window shrouds', bronze coloured accent (to highlight the operable window shading screens and the main building entry), Subtle light-grey siding (highlighting the simple rectilinear masses and creating a backdrop to the shading features), and contrasting charcoal siding (to form a higher contrast within the window shading system, and corrugated siding to express the 'keyway' recesses within the building masses).

The urban planning approach of the project was designed to complement the existing built form, public realm, and landscape design within Wesbrook Village. Ground orientated dwelling units with outdoor living spaces throughout the scheme enhance their liveability, connection to the community, and provide the neighbourhood with increased security through passive surveillance and an active street frontage.

Responsible project participants

Owner	UBC Properties Trust Evolve - UBC Properties Trust
Architect	ZGF Architects (https://www.zgf.com/) Team: Liam Davis, Ashleigh Fischer, & Kevin Clark
Builder	Peak Construction Group Evolve - Peak Construction Group (peakgrp.com)
Mechanical	AME Group UBC Evolve - AME Group
Enclosure/Envelope	Aqua-Coast Engineering Ltd. https://aqua-coast.ca/
Electrical	Jarvis Engineering Consultants Ltd. Jarvis Engineering Consultants - Electrical Engineering Services
Structural engineering	RJC (Read Jones Christoffersen Ltd.) https://www.rjc.ca/
Passive House Consultant	RDH Building Science Inc. Team: Sherman Wai Building Science Services - RDH | Making Buildings Better™
Measurement & Verification	EnerPro Enerpro Systems | intelligent energy management programs

Certifying body

Passive House Institute Darmstadt www.passiv.de	Certifier: Lois Arena, PE, CPHC Director, Passive House Services Steven Winter Associates, Inc.

Certification ID

7699 **41109-41218_SWA_PH_20231 205_LA**	Evolve – Passive House Canada | Maison Passive Canada

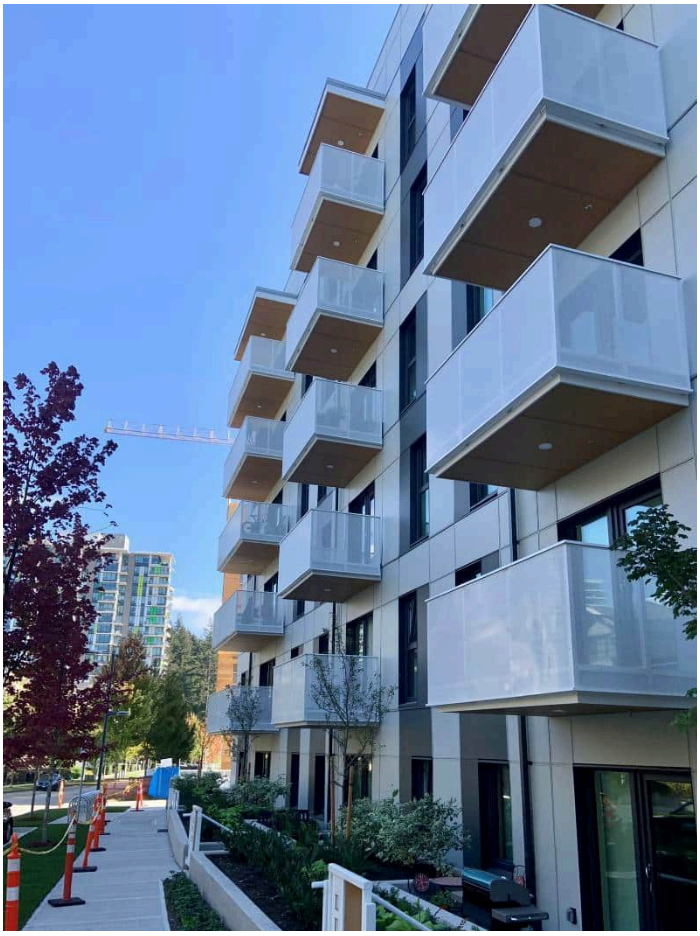
Author of project documentation

Project Architects: Liam Davis, Ashleigh Fischer, & Kevin Clark	ZGF Architects (https://www.zgf.com/)
Date	Signature
May 27, 2024	

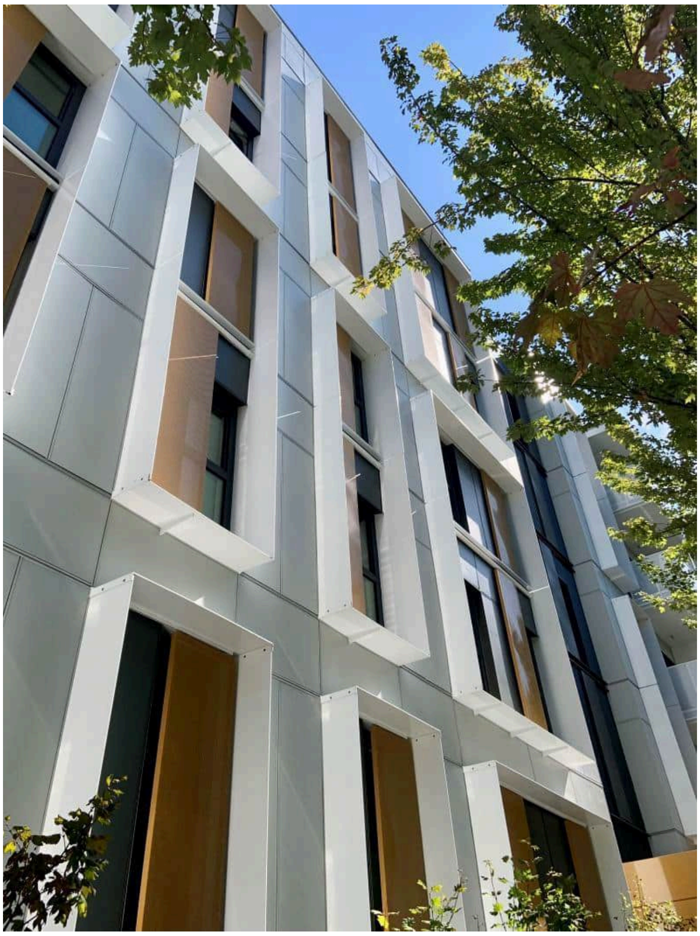
1. Overview Photos

North-West Corner of Building

Rear of Building (East and South face of building)

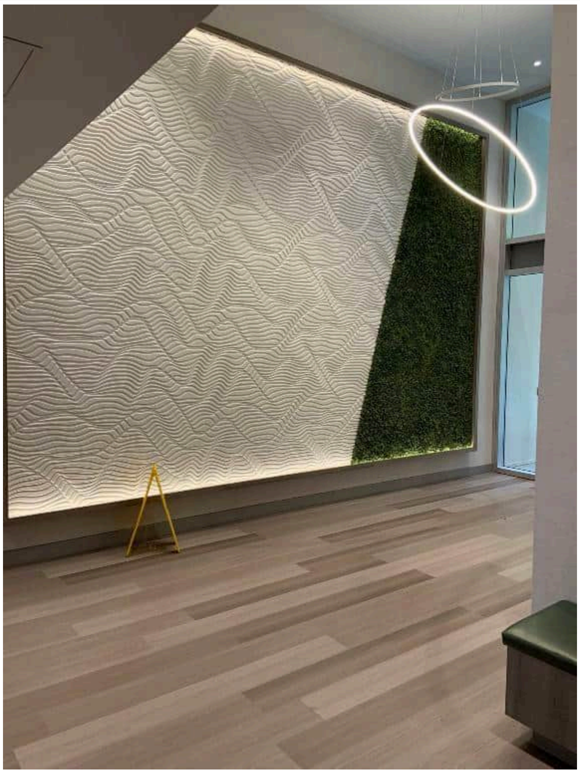


North Building Face



West Building Face

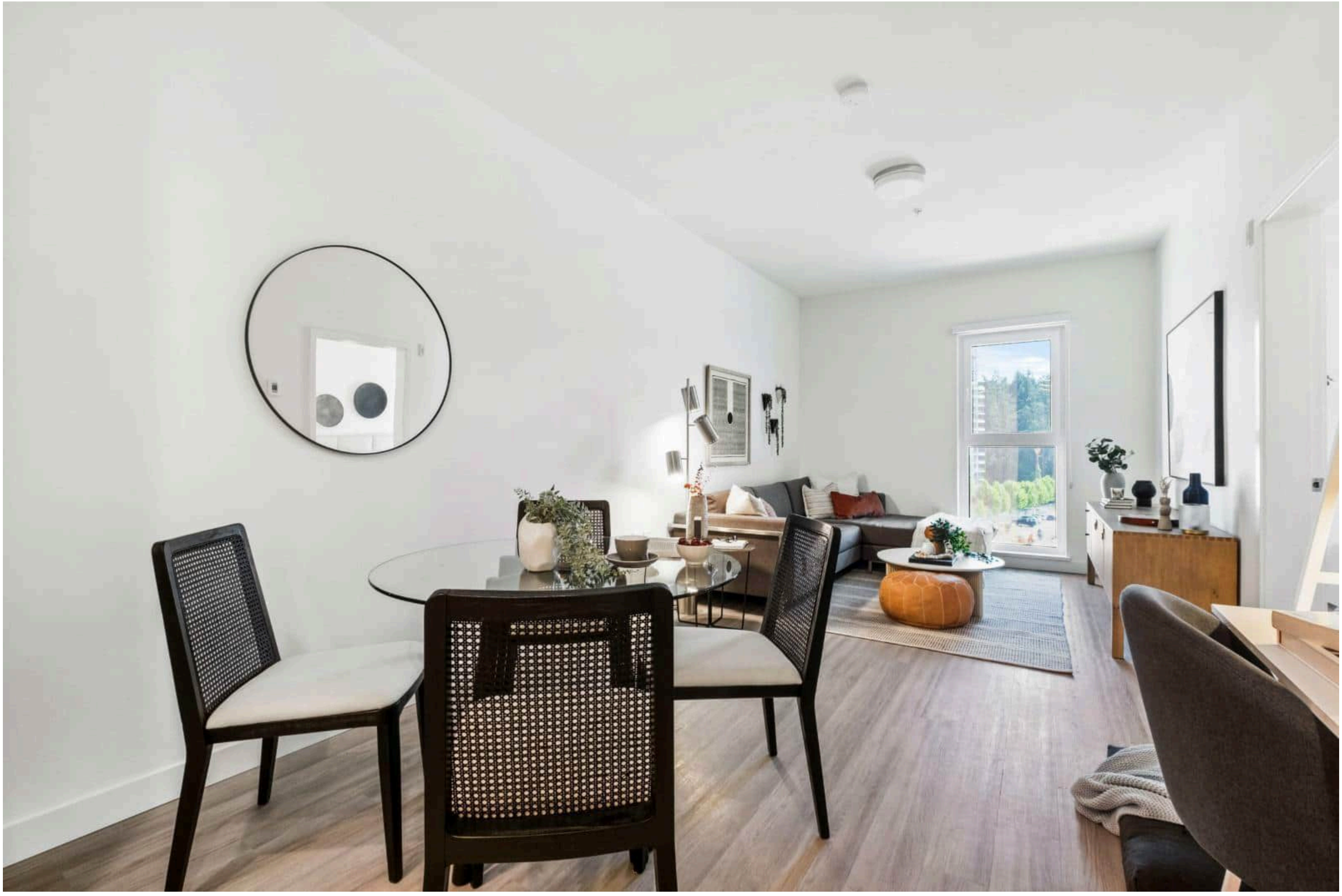
2. Interior Photos



Entrance Lobby Areas

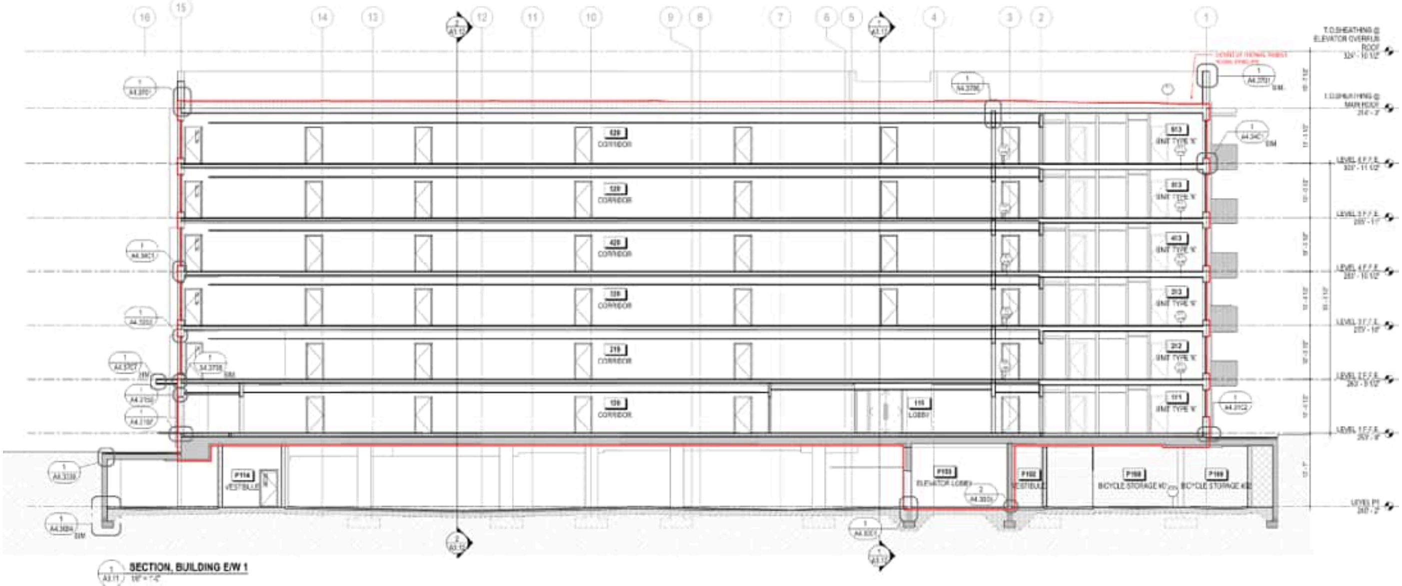
Shared workspace

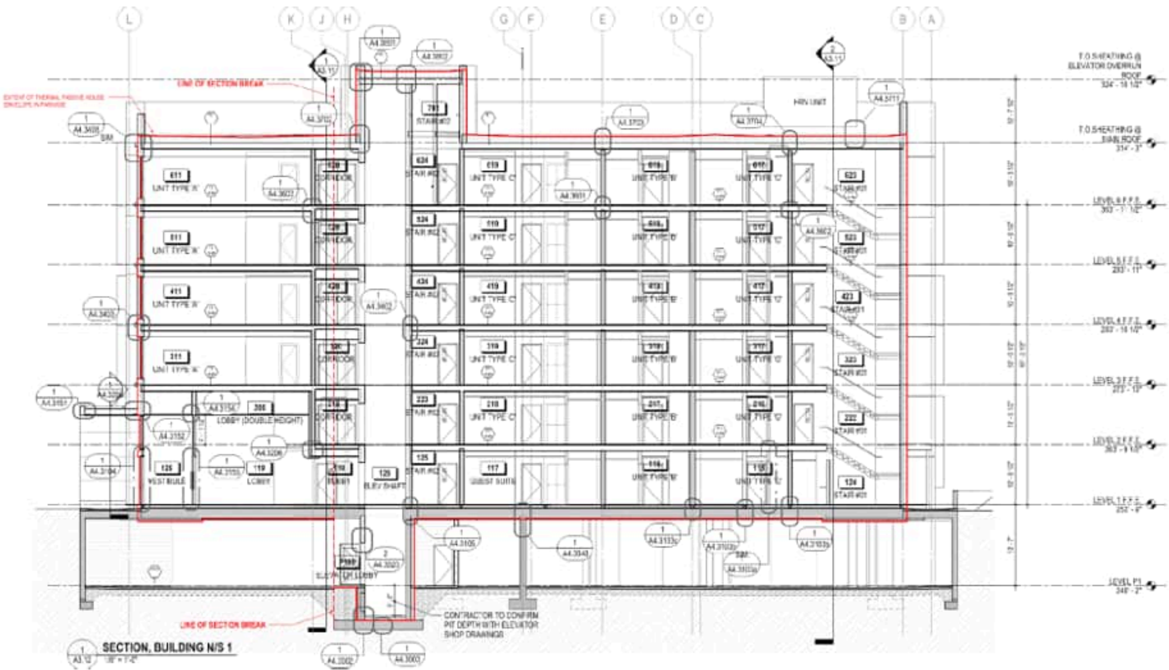
Typical 3-bedroom unit



Typical One Bedroom Unit

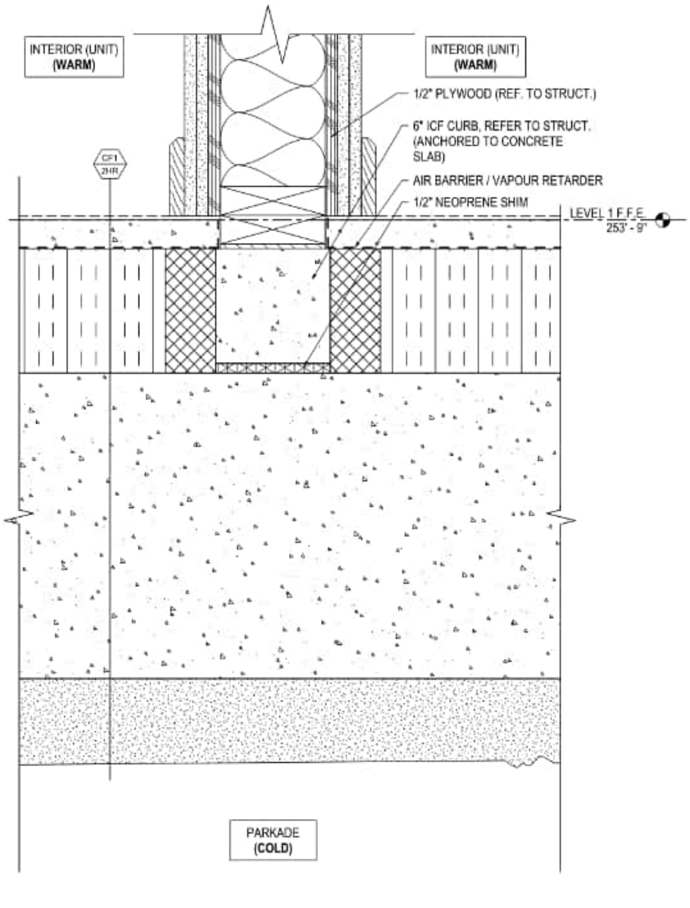
3. Sectional Drawings



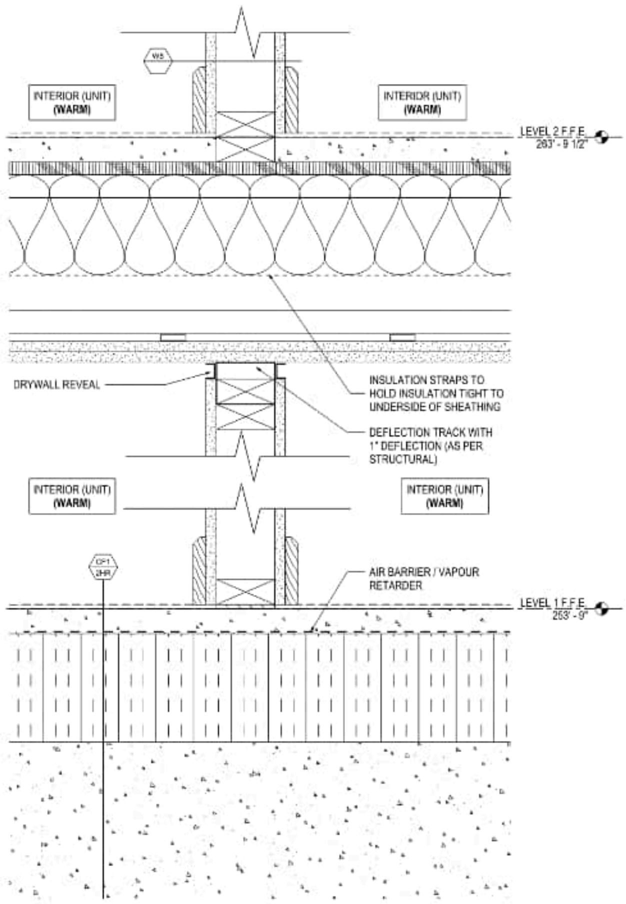


4. Floor Plans

5. Floor Slab Construction



1 A3.12 DETAIL, SECTION - 2X6 SHEAR WALL AT LEVEL1
3" = 1'-0"



1 A3.12 DETAIL, SECTION - 2X4 INTERIOR PARTITION WALL AT LEVEL 1
3" = 1'-0"

The floor slab design utilised a 'sandwich-slab' for the main floor slab construction (which provides the thermal envelope between the unheated basement for parked vehicles below and the residential levels above). The soffit of this slab is insulated with Min.R20 open cell spray foam insulation. The suspended structural slab varies in thickness and is the main structural support for the wood framed building above. Over the structural slab, a continuous layer of 6.5" R-30 rigid EPS insulation was applied, followed by a 6-mil polyethylene air barrier, and finished with a 1.5" concrete topping slab. Interruptions for load bearing walls have been carefully detailed to minimise thermal bridging through the suspended structural floor slab (left detail above), yet still provide the structural bearing and shear capacity required for the building. Any walls not required to be load baring were detailed to be simple light partitions with no interruption of the thermal envelope.

Assembly no.	Building assembly description	Interior insulation?
01ud	CF1 Suspended Concrete Floor Slab below habitable area	x

Heat transmission resistance [m²K/W]

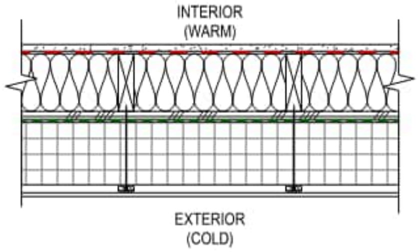
Orientation of building element	3-Floor	interior R_{si}	0.17
Adjacent to	3-Ventilated	exterior R_{se}	0.17

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete topping	2.250					38
EPS Type II	0.036					146
Concrete	2.250					381
Monoglass spray insulation	0.036					127
Percentage of sec. 1	100%	Percentage of sec. 2		Percentage of sec. 3		Total 69.2 cm

U-value supplement: W/(m²K)

U-value: 0.123 W/(m²K)

6. External Wall Construction

EW2 1HR		<u>1 HR RATED EXTERIOR CORRUGATED METAL CLADDING WALL</u> • FINISH ON INTERIOR FACE AS PER ID • 1 LAYER OF 5/8" TYPE X GWB • 6 MIL POLYETHYLENE VAPOUR BARRIER • 2 X 6 WOOD STUDS @ 16" O.C. *(REFER TO STRUCTURAL)* • R22 BATT INSULATION • 1 LAYER OF 3/4 " EXTERIOR GRADE PLYWOOD SHEATHING *(WITH TAPED JOINTS FOR AIR BARRIER)* • AIR AND MOISTURE MEMBRANE • 6" R-25.2 MINERAL FIBER INSULATION • 3/4" P.T. VERTICAL PLYWOOD STRAPPING AT 16" O.C. - FASTENERS AS PER CLADDING ENGINEER • CORRUGATED METAL CLADDING *(SEE ELEVATIONS FOR CONFIGURATION)*	<u>1 HR</u> ULC DESIGN BXUV7.U309	R-42 EFFECTIVE

The light wood framed building is composed mostly of 2x6 dimensional lumber load bearing walls across the exterior. The main structure of this exterior wall is made up of finished drywall on the interior, a 6-mil polyethylene vapour barrier, 2x6 dimensional lumber studs with the cavity filled with R22 Batt Insulation, and exterior plywood sheathing with taped joints and penetrations to form the primary air barrier to the envelope. To the exterior of this main wall structure, we have the taped air and weather barrier, continuous 6” R25 semi rigid mineral wool insulation, held in place by pressure treated plywood strapping fixed in place by 10” stainless steel screws (screwed into the load bearing studs behind), and finished with lightweight cladding (either fibre cement panels or corrugated metal cladding). Other than the enhanced thickness of the continuous exterior insulation, this is considered a typical wall construction in British Columbia.

Assembly no.							Interior insulation?
05ud	EW1 Fibre cement panel cladding wall						x

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

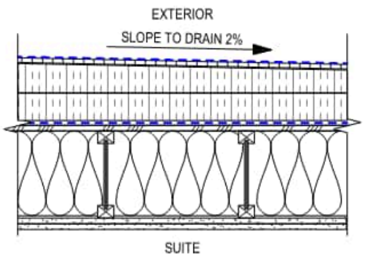
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Gypsum wall board	0.250					16
Fibreglass batt	0.038	2x6 studs at 16"o.c.	0.130			140
Plywood sheathing	0.130					19
Mineral wool insulation	0.036					152

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
91%	9.4%		32.7 cm

U-value supplement 0.01 W/(m²K)

U-value: 0.142 W/(m²K)

7. Roof Construction

R1
1HR
		BUILDING MAIN ROOF (NO ACCESS)
		• 2 PLY SBS MEMBRANE
		• PROTECTION BOARD *(MECHANICALLY FASTENED)*
		• R30 RIGID POLYISO INSULATION *(MECHANICALLY FASTENED)*
		  • MIN THICKNESS 6" INSTALLED IN 2 LAYERS. ENSURE STAGGERED JOINTS BETWEEN LAYERS
		  • SLOPED INSULATION AT MIN. 2%
		• SELF-ADHERED AIR AND VAPOUR RETARDER
		• PLYWOOD SHEATHING - *REFER TO STRUCTURAL FOR PLYWOOD THICKNESS*
		• 9 1/2" TJI *(REFER TO STRUCTURAL)*
		• R28 BATT INSULATION
		• 2 LAYERS OF 5/8" TYPE 'X' GWB
			1 HR
			PER: INTERTEK DESIGN NO.: WNR/FCA 60-01
				R-62.5 EFFECTIVE+ (R-4.2 X AVERAGE SLOPE PACKAGE THICKNESS)	CONTINUOUS INSULATION PLUS SLOPE PACKAGE TO MAINTAIN MINIMUM 2% SLOPE TO DRAINS AND PROVIDE MINIMUM AVERAGE R-62.5

Similar to the walls, other than enhanced thickness of continuous insulation, the roof construction utilises typical construction methods in British Columbia. The main roof structure is made up of roughly 9 ½" deep timber TJI truss joists. The cavity between these joists is filled with R28 batt insulation, and on the interior side, the ceiling is finished with drywall. Above this, plywood sheathing is installed to provide a structural roof deck, on top of this a continuous self adhered air and vapour retarder is installed to provide the roofs main air barrier. Layers of rigid and tapered polyiso insulation boards provide the main thermal performance and drainage slopes for the roof, followed by roofing protection board, and completed with torch on 2 ply SBS roofing membrane.

Assembly no.		Interior insulation?
06ud	R1 Building main roof (no access)	

Heat transmission resistance [m²K/W]

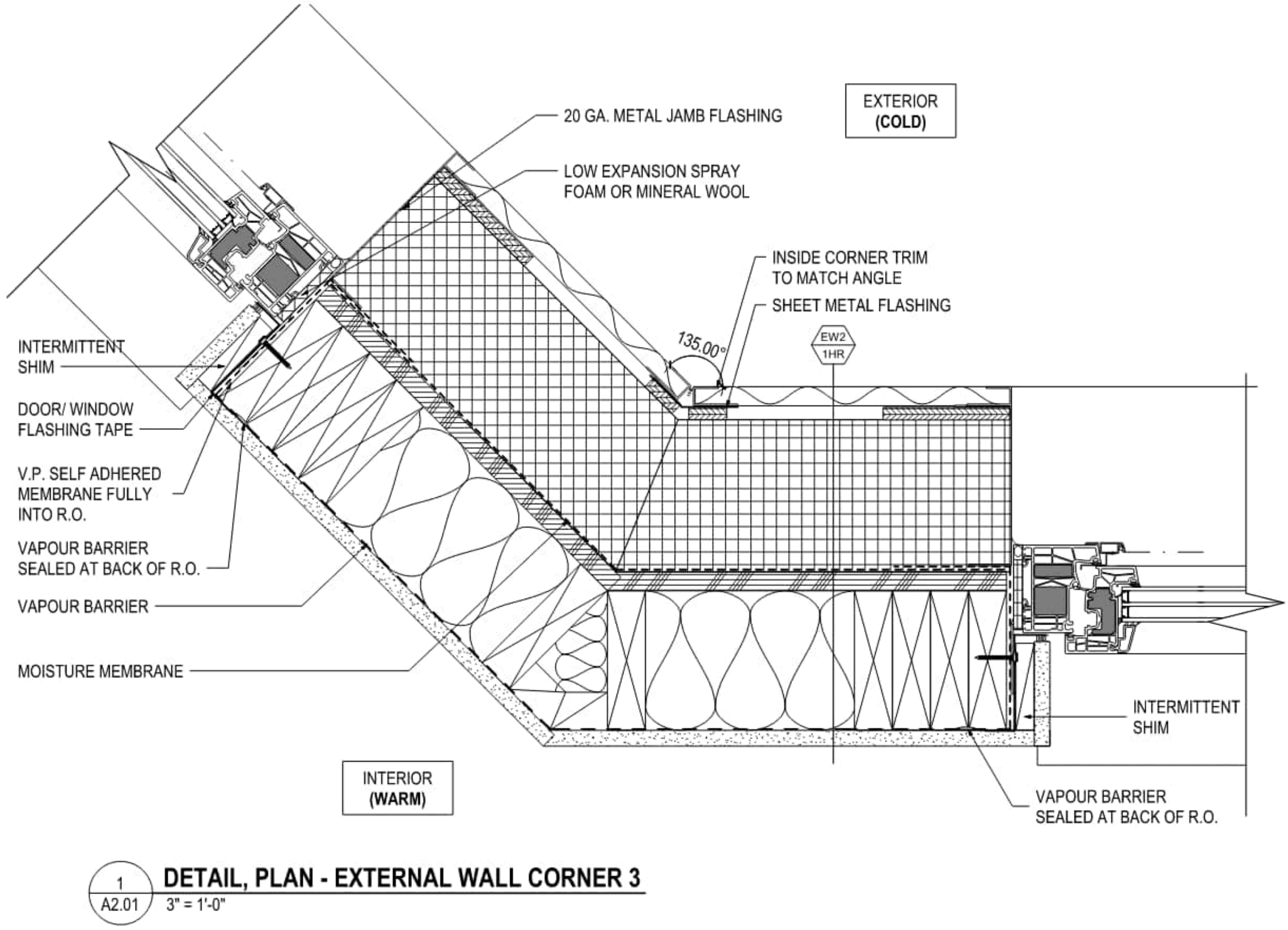
Orientation of building element	1-Roof	interior R_{si}	0.10
Adjacent to	1-Outdoor air	exterior R_{se}:	0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Gypsum wall board	0.250					32
Mineral wool insulation	0.036	J4 9.5 TJI 560 @ 12 o.c. flange	0.130			35
Mineral wool insulation	0.036			J4 9.5 TJI 560 @ 12" o.c. web	0.130	171
Mineral wool insulation	0.036	J4 9.5 TJI 560 @ 12 o.c. flange	0.130			35
Plywood sheathing	0.130					16
Polyisocyanurate	0.030					102
Sloped insulation	0.030					38
Protection board	0.250					13
Percentage of sec. 1	67%	Percentage of sec. 2	29.2%	Percentage of sec. 3	3.6%	Total 44.1 cm

U-value supplement 0.00 W/(m²K)

U-value: 0.095 W/(m²K)

8. Window and Window Installation



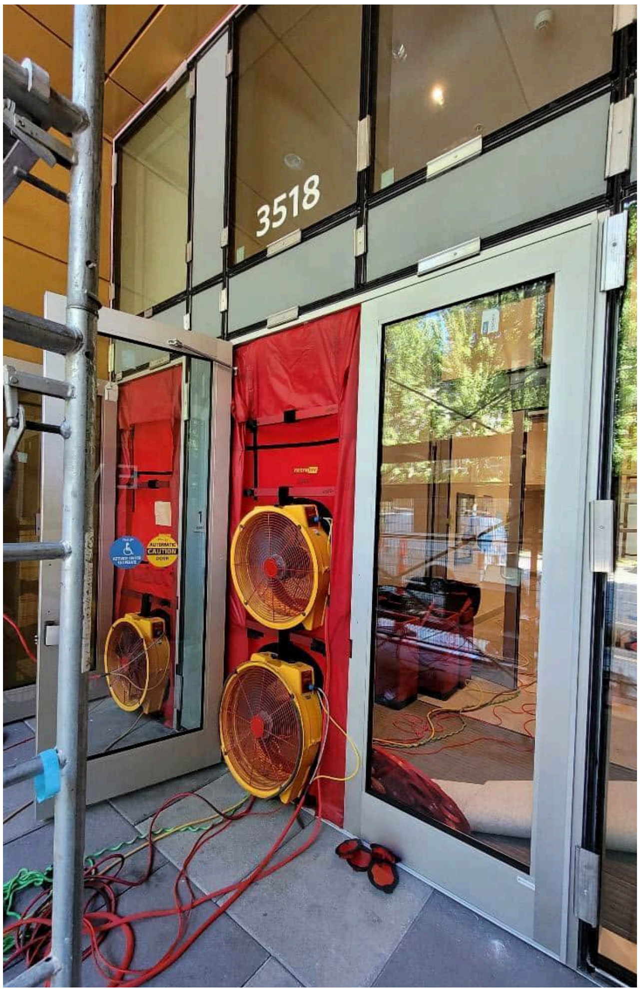
Locally made by Innotech Windows & Doors, Inc., Langley BC, Canada. PVC Vinyl Framed, Triple Glazed Passive House International (PHI) certified windows.

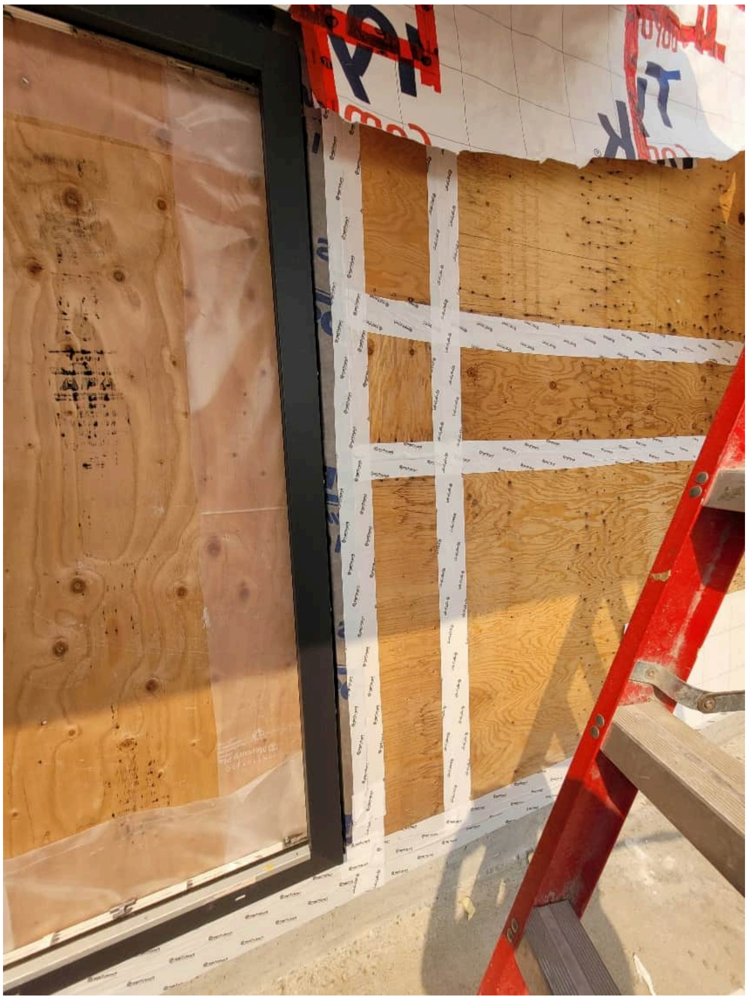
Description of the window (frame) construction, manufacturer	**Innotech Windows & Doors, Inc.**, Langley BC, Canada
Make window (frame; product name)	**Defender 88PH+ XI – Operable (Tilt + Turn) Window** PVC Vinyl-frame partially filled with EPS (0.032 W/(mK)) and high-density EPS (150kg/m³, 0.041 W/(mK)). Pane thickness: 46 mm (4/17/4/17/4), Glass inset: 18 mm. Spacer: SuperSpacer Premium with butyl as secondary seal.
Frame U-value Uf	0.73 W/(m²K) (Average across all frames)
Glazing construction	Argon Filled; 6 | 14 | 6 | 14 | 6
Glass U-value Ug	0.65 W/(m²K) (Average across all panes)
G-value of the glazing	0.27

9. Description of the Airtight Envelope

The result of the building's airtightness testing was 0.3 ACH @ 50 Pascals.

Air tightness concept:
Walls: Plywood sheathing with taped seams and penetrations is the primary air barrier. This system was supplemented by install of a 6-mil polyethylene vapour barrier to the interior, and the air and weather barrier installed to the exterior of the sheathing was also fully taped.
Floor Slab: 6-mil polyethylene air barrier
Roof: Vapour retarder





10. Ventilation Unit

Ventilation to each wing is provided by a Swegon Gold RX unit (25 and 50). The units were carefully sized to meet required ventilation loads for each wing.
Swegon Gold RX Additional Information:

- Max. air flow 39.180 m³/h (Ecodesign)
- Rotary heat exchanger
- Cooling/heating available as an accessory (not integrated)
- Placement indoors/outdoors
- Top, side or L connections
- With controls and HMI
- Certified by PassiveHaus and Eurovent

Ventilation system	Swegon Gold RX
Effective Heat Recovery Rate	82.9 %
Humidity Recovery efficiency	72.1%

Selection of ventilation input - Results

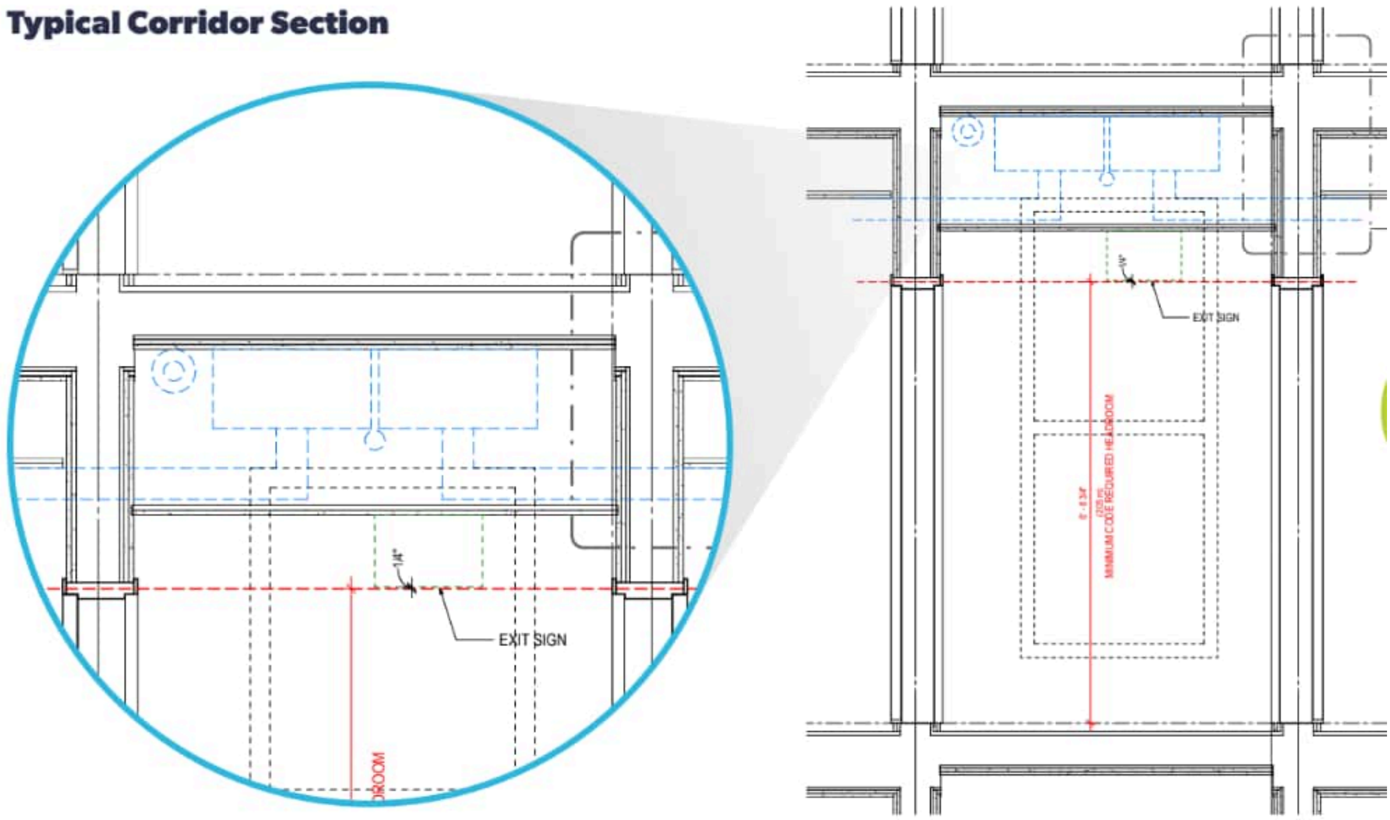
PHPP offers two methods for dimensioning air quantities and choosing the ventilation unit. With "Standard data input for balanced ventilation", supply or extract air quantities for residential buildings and parameters for ventilation systems with a maximum of 1 ventilation unit can be planned. Projects with up to 10 different ventilation units and air quantities determined according to rooms or zones can be entered in the 'Addl vent' worksheet. Please select your design method here:

	Ventilation unit / Heat recovery efficiency design		Average air flow rate m³/h	Average air change rate 1/h	Extract air excess (extract air system 1/h	Effective heat recovery efficiency unit [-]	Humidity recovery efficiency [-]	Specific power input Wh/m³	Heat recovery efficiency SHX [-]
	Standard design	*('Ventilation' worksheet, see below)*							
x	Multiple ventilation units, non-res	*('Addl vent' worksheet)*							
			18336	**0.93**	**0.00**	**82.9%**	**72.1%**	**0.45**	**0.0%**

11. Ventilation Planning Network

Two HRV units are located on the roof at the end of each of the main corridors. HRVs were sized specifically to the thermal demands of each wing of the building, which varied due to orientation and solar heat gain. Ventilation is circulated through the central corridors into each individual unit. Natural ventilation through windows at each unit is also provided for enhanced occupant thermal comfort.

Section showing ventilation strategy



Detailed section showing ductwork within corridor ceiling

12. Heat Supply

Heating in each unit and common areas is provided by the Swegon Gold RX HRV rooftop units with supplemental heating via electric baseboards to provide individualized control to occupants within their spaces. To address the changing climate in Vancouver, BC, passive cooling is provided through DX cooling coils within the HRV, without providing full air conditioning. The passive shading methods supplement this system. The cooling capacity was efficiently sized with the passive shading methods in place, which lowered the buildings cooling load.

Domestic hot water is provided by an air-source heat pump.

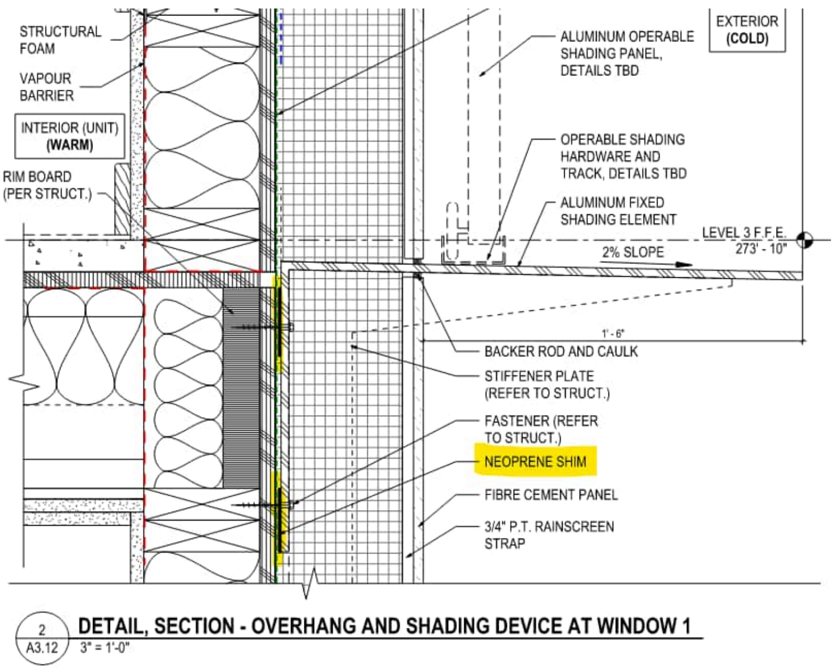
		FAN COIL UNITS		
1	HV ELECTRICAL RM COOLING INDOOR UNIT	MAIN	PARKADE	HV ELECTRICAL ROOM
1	HV ELECTRICAL RM COOLING INDOOR UNIT	MAIN	PARKADE	HV ELECTRICAL ROOM
1	HV ELECTRICAL RM COOLING CONDENSING UNIT	MAIN	PARKADE	HV ELECTRICAL ROOM
1	MAIN COMM ROOM COOLING INDOOR UNIT	MAIN	PARKADE	MAIN COMM ROOM
1	MAIN COMM ROOM COOLING CONDENSING UNIT	MAIN	PARKADE	MAIN COMM ROOM
1	MAIN ENTRANCE LOBBY INDOOR UNIT	MAIN	AMENITY LOUNGE	MAIN ENTRANCE LOBBY
1	MAIN ENTRANCE LOBBY CONDENSING UNIT	MAIN	PARKADE	MAIN ENTRANCE LOBBY
1	AMENITY LOUNGE INDOOR UNIT	MAIN	AMENITY LOUNGE	AMENITY LOUNGE
1	AMENITY LOUNGE CONDENSING UNIT	MAIN	PARKADE	AMENITY LOUNGE
1	ELEV CONTROL ROOM INDOOR UNIT	MAIN	ELEV CONTROL ROOM	ELEV CONTROL ROOM
1	ELEV CONTROL ROOM CONDENSION UNIT	MAIN	ROOF	ELEV CONTROL ROOM
		CONDENSING UNIT SERVING HRV DX COIL		
1	NORTH WING - CONDENSER	MAIN	ROOF NORTH	NORTH WING
2	SOUTH WING - CONDENSER	MAIN	ROOF SOUTH	SOUTH WING
		FORCE FLOW HEATERS		
1	MAIN ENTRANCE VESTIBULE HEATER	MAIN	MAIN ENTRNACE VESTIBULE	VESTIBULE
5	WALL MOUNTED FORCE FLOW HEATERS	MAIN	VARIES (PARKADE)	VARIES (PARKADE)
		UNIT HEATERS		
1	PENTHOUSE ELECTRIC UNIT HEATER	MAIN	MECH. ROOM - ROOF	MECH. ROOM - ROOF
		BASEBOARD HEATERS		
11	300 W BASEBOARD HEATER	MAIN	VARIES	VARIES
4	500 W BASEBOARD HEATER	MAIN	VARIES	VARIES
		INDIVIDUAL UNITS - BASEBOARD HEATERS		
45	300 W BASEBOARD HEATER		UNITS A/B/C/D/E	UNITS A/B/C/D/E
36	500 W BASEBOARD HEATER		UNIT F	UNIT F
18	750 W BASEBOARD HEATER		UNITS G/H/L	UNITS G/H/L
12	1 KW BASEBOARD HEATER		UNITS J/K	UNITS J/K

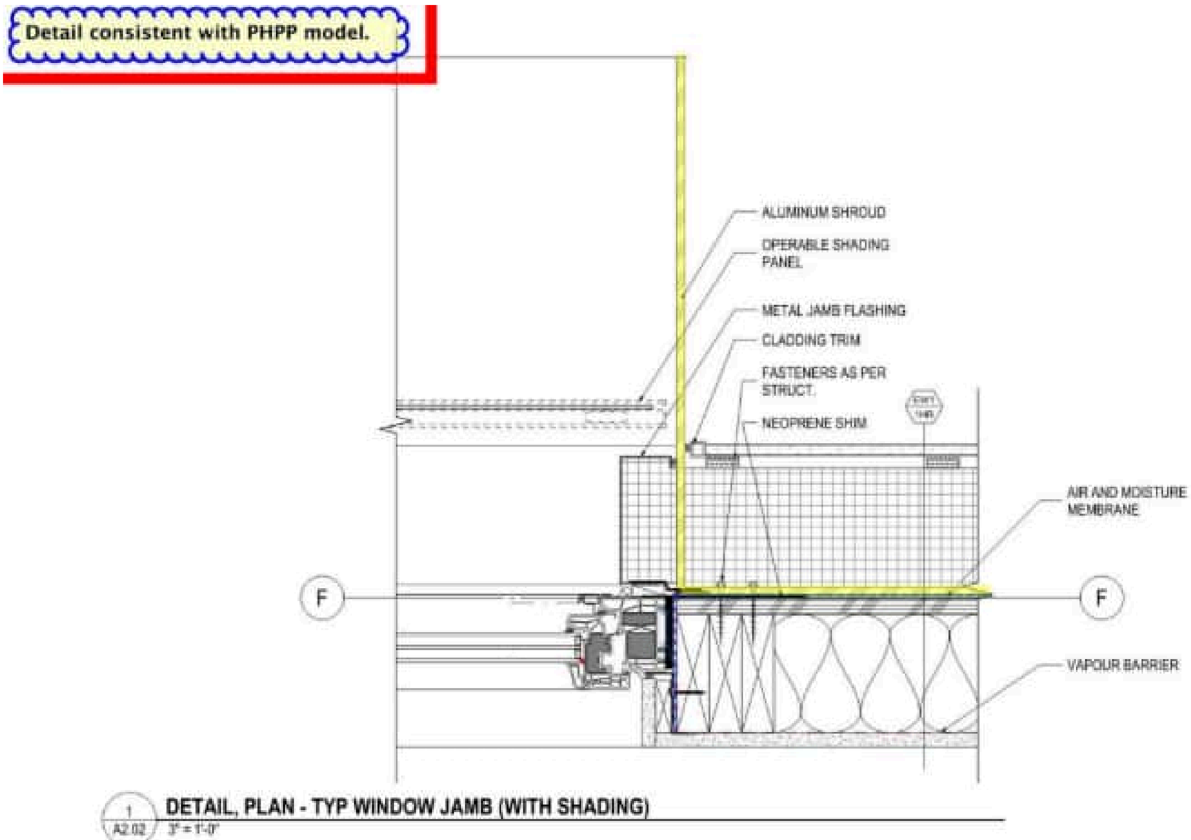
Electrical equipment schedule

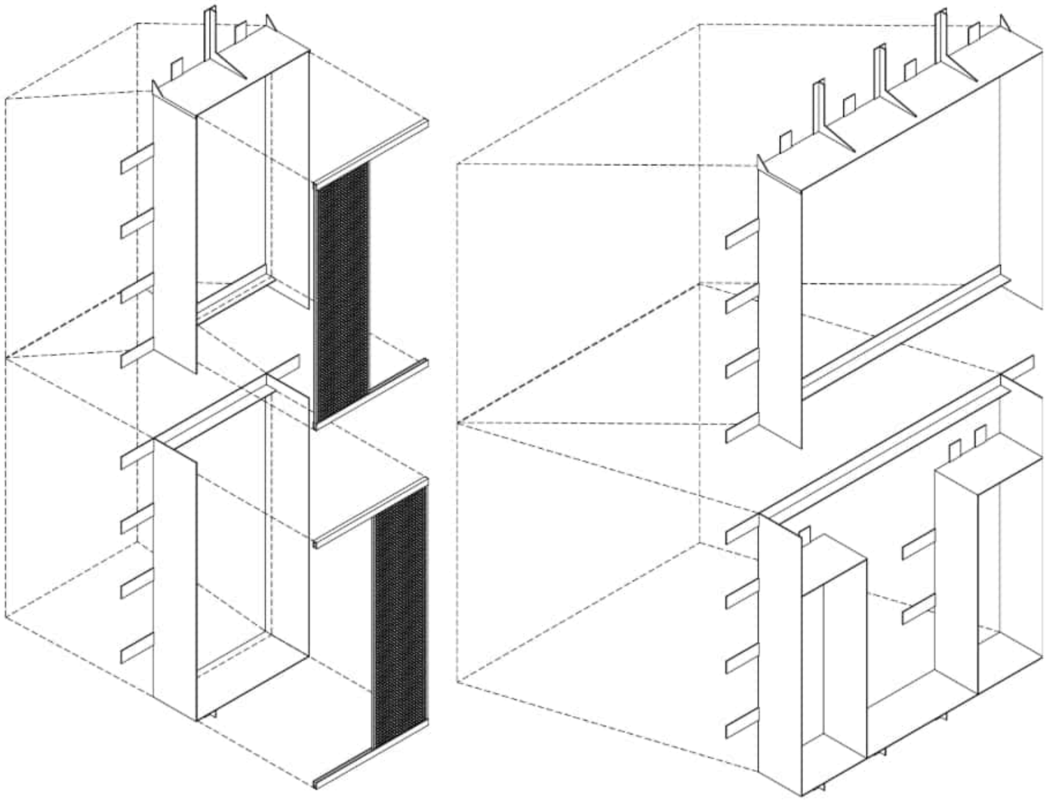
13. Passive Shading Details

The shading solution for the building was developed through collaboration with the architectural, mechanical, structural and envelope consultant teams in order to minimize thermal bridging of the aluminum shades. The shades were developed as a hybrid system of fixed shading and operable panels, all constructed out of aluminum. Each building elevation features a unique shading design combining these two components. The shading system provides personalized comfort for occupants and reduces heating energy loads. The resulting solutions for each elevation were based on solar orientation and corresponding solar heat gain potential. The shading strategy was carefully coordinated with the mechanical and energy modeling team to optimize shading to reduce solar heat gain and mechanical loads. Thermal bridging was minimized through the use of small metal tabs serving as connections to the structure instead of continuous metal connections. Neoprene shims were also integrated to reduce metal contact to the structure, and are located between the structure and each metal connection. Each detail for the shading elements was evaluated in the PHPP to ensure compliance with Passive House thermal bridging criteria.

West Elevation with Operable and Fixed Shading Elements







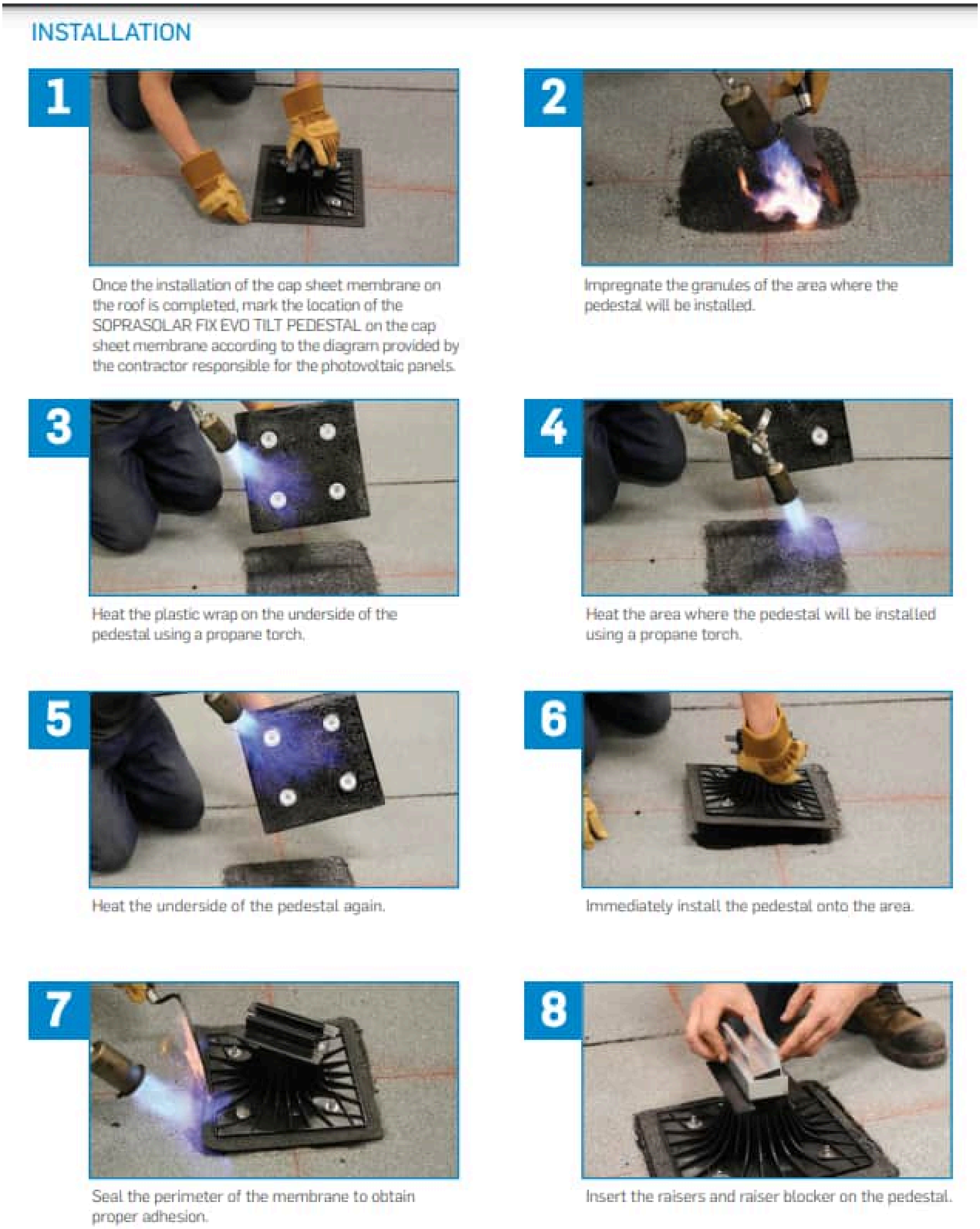
Exploded Axonometric - Operable and Fixed Shading Elements with Connections

14. Renewable Energy Integration

The project team was presented the opportunity to explore innovative solutions to push the boundaries of high performance buildings in British Columbia through the receipt of a $3.5 million grant from NRCan. A key interest from the project team and the developer was to explore the feasibility to integrate renewable energy into the Passive House Multifamily project. The team sought to identify a practical solution for renewable energy that was economically feasible and would not impact the performance of the building envelope.

Through discussions with RDH Building Science and a local PV installer, Terratek Energy Solutions, the Soprasolar Fix Evo Tilt Pedestal by Soprema was recommended for the project team to implement as an effective renewable energy system on a super-insulated roof assembly. The pedestal system does not require a heavy ballast connection or a penetration through the roof assembly. Instead, the Fix Evo Tilt Pedestal is torch-welded onto the roof membrane itself, creating a firm connection directly to the roof without creating a thermal bridge through the insulation and membrane. The product was new to the construction market during Evolve's design, and had not yet been tested for compliance with wind and seismic loading criteria in British Columbia's lower mainland. The design team facilitated the testing and verification of the pedestal product through testing at the UBC seismic lab to confirm the product meets code criteria for snow and seismic loads required at the building site. The mock-up PV system and roof assembly used for the test was fabricated to replicate Evolve's roof assembly, including insulation depth and roof membrane materials. The product passed both tests, and was also tested on the same roof assembly for wind up-lift forces. The pedestal passed this test as well, solidifying the product as the design team selection for integrating renewable energy at Evolve.

In addition, the innovative product was surprisingly more cost effective than conventional connection and racking systems. While PV systems mounted with typical ballast or structural penetration connections have a simple payback between 20-25 years, the cost estimate for an equivalent size PV system with the Soprasolar Evo Tilt Pedestal demonstrated only a 9.5 year payback. This payback period was deemed economically feasible by the project owner/developer, and the system was successfully installed at Evolve.



INSTALLATION

1. Once the installation of the cap sheet membrane on the roof is completed, mark the location of the SOPRASOLAR FIX EVO TILT PEDESTAL on the cap sheet membrane according to the diagram provided by the contractor responsible for the photovoltaic panels.
2. Impregnate the granules of the area where the pedestal will be installed.
3. Heat the plastic wrap on the underside of the pedestal using a propane torch.
4. Heat the area where the pedestal will be installed using a propane torch.
5. Heat the underside of the pedestal again.
6. Immediately install the pedestal onto the area.
7. Seal the perimeter of the membrane to obtain proper adhesion.
8. Insert the raisers and raiser blocker on the pedestal.

Soprasolar Fix Evo Tilt Pedestal Installation Instructions

Source: Soprema https://www.soprema.ca/en/products-systems/soprasolar-fix-evo-tilt

15. Project Challenges - District Energy

Prior to committing to pursuing Passive House certification through PHI, it was critical to overcome a major barrier to meeting PH thresholds for PER. The project site is located in a community served by a district energy system (DES) using natural gas as a fuel source. In order to reduce the emissions of the building, the project requested special permission to be excluded from the DES to provide a fully electrified building serviced by BC Hydro, an electric utility sourced by hydro power, a cleaner source of energy than natural gas. This required a collaborative effort by ZGF Architects, the mechanical team (AME), Passive House consultants (RDH Building Science), and the developer (UBCPT), to negotiate with the municipality (UBC) to grant permission to not connect to the DES.

16. Construction Costs & Cost Saving Strategies

The owner / developer has chosen not to disclose construction costs.

However, a key aspiration of this project was to develop affordable, replicable solutions that could be achieved in the local construction market of the lower mainland, British Columbia. The local market is notorious for expensive construction costs and restrictive development budgets due to the cost of land ownership, construction materials, escalation, and lengthy permit approval processes. The project team collaborated with the local jurisdiction (University of British Columbia and City of Vancouver, BC) and the general contractor, Peak Construction, to keep costs to a minimum to meet the pro forma requirements of the developer, UBCPT. The multi-family units owned and operated by UBCPT are rented to university faculty and staff at a discounted rate, approximately 25% below market rate. In order to keep design and construction costs to a minimum, the team implemented the following solutions:

1. Team selection and collaboration: The interdisciplinary project team was selected by ZGF architects and UBCPT to prioritize consultants that had experience at UBC and considered local experts in Passive House design and coordination. The entire project team was also brought on early in design so that coordination would be inclusive from the beginning, and all design decisions were transparent across architectural, mechanical, electrical, structural, envelope, and passive house disciplines.
2. Construction materials: The team prioritized local materials where possible and utilized cost-efficient materials that were familiar to the design team and the trades who would be installing them during construction.
3. Design simplicity: The architectural team maintained a very simple layout for the overall massing and unit design. Almost every floor plate was repeated through each level to simplify and minimize unique details and streamline construction time. The design of the building envelope was also sleek and simple - minimizing penetrations and volumetric variations- reducing the number of unique details required to construct and increasing speed of construction.
4. Amenity selection: The design team collaborated with UBCPT to identify the most essential and useful amenities to include in the design. For example: UBCPT identified that the guest suite and courtyard gathering spaces were the most utilized spaces at their current properties. Therefore, these spaces were included in the design, while others were excluded to save space and costs.

17. Web Links and Press Releases

- Evolve – Passive House Canada | Maison Passive Canada (Passive House Canada Project Page)
- Evolve - UBC Properties Trust (Owner/developer)
- Evolve | Buildings | Village Gate Homes (Leasing Department for UBC)
- Evolve building achieves UBC's second-ever REAP Platinum certification - UBC Properties Trust
- UBC Evolve - Innotech Windows & Doors (innotech-windows.com) (Window Supplier press release)
- Faculty and staff housing targeting Passive House certification opens at UBC (UBC Press Release)
- Evolve: UBC building on the front lines of Passive House construction (constructconnect.com)
- New UBC rental housing building for staff features rooftop solar panels | Urbanized (dailyhive.com)
- UBC Passive House set to be largest most efficient in Canada - Vancouver Is Awesome
- UBC opens new faculty and staff housing targeting Passive House certification - urbanYVR
- British Columbia Focus - Fall 2023 by SAB Magazine - Issuu (Article Page 14)
- Award - December2022 (canadawide.com) (Article Page 51)

18. PHPP Results

Passive House Verification

Photo or Drawing

Building:	UBC BCR8		
Street:	3508 Wesbrook Mall		
Postcode/City:	V6T 1W5	Vancouver	
Province/Country:	British Columbia	CA-Canada	
Building type:	Residential		
Climate data set:	CA0003d-Vancouver		
Climate zone:	3: Cool-temperate	Altitude of location:	78 m
Home owner / Client:	UBC Properties Trust		
Street:	Suite 200 - 3313 Shrum Lane		
Postcode/City:	V6S 0C8	Vancouver	
Province/Country:	British Columbia	CA-Canada	

Architecture:	ZGF Architects		Mechanical engineer:	AME Group	
Street:	355 Burrard St #350		Street:	1100 - 808 W Hastings St.	
Postcode/City:	V6C 2G8	Vancouver	Postcode/City:	V6C 2X4	Vancouver
Province/Country:	British Columbia	CA-Canada	Province/Country:	British Columbia	CA-Canada
Energy consultancy:	RDH Building Science Inc.		Certification:	Steven Winter Associate Inc.	
Street:	4333 Still Creek Dr #400		Street:	307 Seventh Ave, Suite 1701	
Postcode/City:	V5C 6S6	Burnaby	Postcode/City:	10001	New York
Province/Country:	British Columbia	CA-Canada	Province/Country:	New York	US-United States of America

Year of construction:	2020	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	110	Internal heat gains (IHG) heating case [W/m²]:	2.8	IHG cooling case [W/m²]:	3.9
No. of occupants:	204.8	Specific capacity [Wh/K per m² TFA]:	84	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fulfilled?[2]
	Treated floor area m²	7845.6				
Space heating	Heating demand kWh/(m²a)	12.48	≤	15	-	yes
	Heating load W/m²	8	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	0.40	≤	15	15	yes
	Cooling load W/m²	0	≤	-	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	0.3	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	141	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	64	≤	72	64	yes
	Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a)	65	≥	-	18	

[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:
1-Designer	Sherman	Wai	
	Issued on: 02/08/23	City:	