PASSIVE HOUSE OBJECT DOCUMENTATION

Fort St. John Passive House – Fort St. John, BC, Canada
(Passivhaus project database ID 5724)

https://passivehouse-database.org/index.php?lang=en#d_5724
(Technical drawings in this document are not to scale)

1. PROJECT OVERVIEW

LEAD PASSIVE HOUSE PLANNER: Alexander Maurer, BBA, LEED AP* – Director of Marken Design + Consult (www.markendc.com)

The Fort St. John Passive House Multifamily Building is located in Fort St. John, British Columbia and is Canada's largest affordable Passive House Building. This collaboration project between **BC Hydro and BC Housing** is scheduled for occupancy **in early 2019** and will be home to some BC Hydro workers and their families and provide affordable rental housing to the community. BC Housing is leading the development, construction, management and operation of the building. Later in 2019, BC Housing will seek a non-profit building operator through a public contracting process. The building operator and BC Housing will share information regarding eligibility and how to apply for the affordable housing units.

SPECIAL FEATURES:
Heat Pump Heating and Cooling
Centralized HRV System
Advanced Wood Frame Construction
Northernmost Passive House Multifamily Building in the world

U-value exterior wall: 0.108 [W/(mK)]
U-value foundation: 0.120 [W/(m2K)]
U-value roof: 0.065 [W/(m2K)]
U-value windows: 0.85 [W/(m2K)]
U-value entry door: 0.85 [W/(m2K)]

PHPP annual heating demand: 11.49 [Kwh/(m2a)]
PHPP primary energy demand: 112 [Kwh/(m2a)]
Pressure test n50 0.20h-1
Effective heat recovery: 85%

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2. PROJECT DESCRIPTION

Occupied since spring of 2019, this six storey , 50 unit and 80,000 sqf apartment building located in Fort St. John is one of Canada's largest Passive House Buildings. It is also a first worldwide, as it is currently the Northernmost multi-storey Multifamily Building to meet the stringent international Passive House Standard.
This collaboration project between BC Hydro and BC Housing is occupied since spring of 2019 and is home to BC Hydro workers and their families and provide affordable rental housing to the community.
BC Housing is leading the development, construction, management and operation of the building. Later in 2019, BC Housing will seek a non-profit building operator through a public contracting process. The building operator and BC Housing will share information regarding eligibility and how to apply for the affordable housing units.
This project had many design challenges to overcome, mainly related to the frigid winter temperatures of up to -40 degrees celsius and a site where the soil was not structurally sound to build such a large building on.
Because of that the foundation sits on over 200 steel piles with concrete beams to accommodate the slab, which brought on quite some challenges to the design team.
Knowing that wrapping the foundation in continuous rigid insulation would be ideal to mitigate potential thermal bridges that could negatively impact the overall performance of the building, the team was looking at different options to apply an efficient and cost effective thermal break.
Having looked at different thermal break products from Europe and the US (including Schoeck or Farrat) and different rigid insulation applications and modelling connection detail variations extensively in THERM, the selected solution ended up to focus on wrapping the steel piles, connections points and grade beams in rigid insulation, at the end resulting in an acceptable thermal bridge ranging from 0.15 to 0.65 W(mK) and adding approximately 2 Kwh/m2/yr to the heat demand of the building.

2.1 ELEVATIONS

WEST Elevation

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EAST Elevation

SOUTH Elevation

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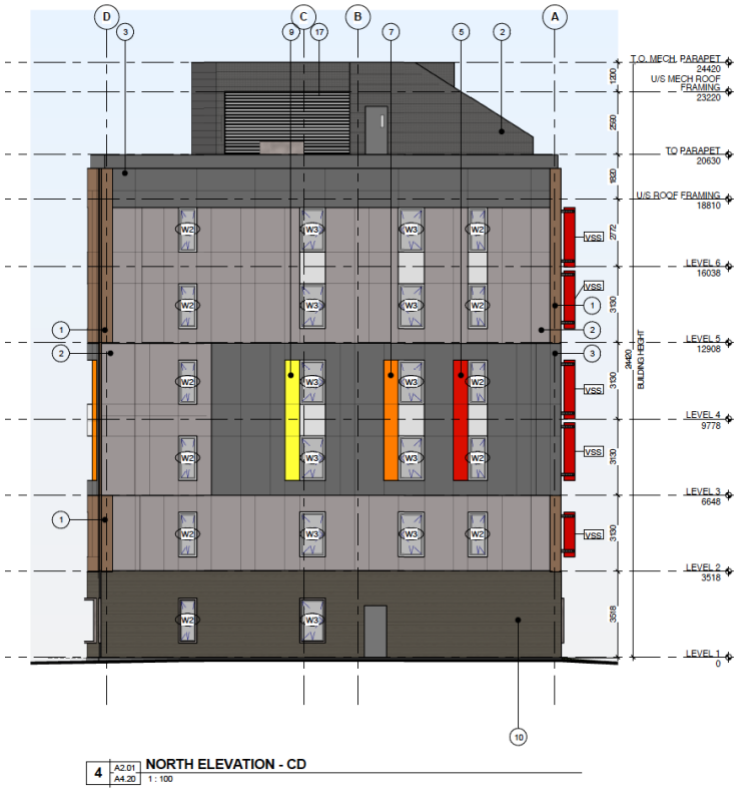

NORTH Elevation

2.2 EXTERIORS

WEST Perspective

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NORTH WEST Perspective

NORTH WEST Perspective

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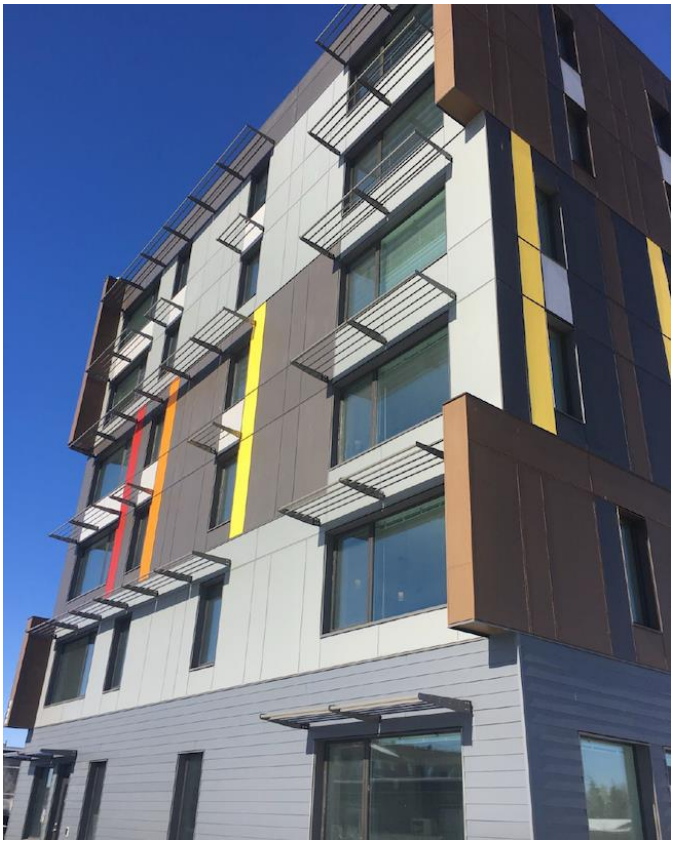

SOUTH Perspective

WEST Perspective – Close Up Vertical Shading

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2.3 INTERIORS

Hallway Main Floor

Kitchen Residential Unit

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Washer/Dryer Residential Unit

Bathroom Residential Unit

Bath Room Residential Unit

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Hallway

Stairway

Lobby - Hallway

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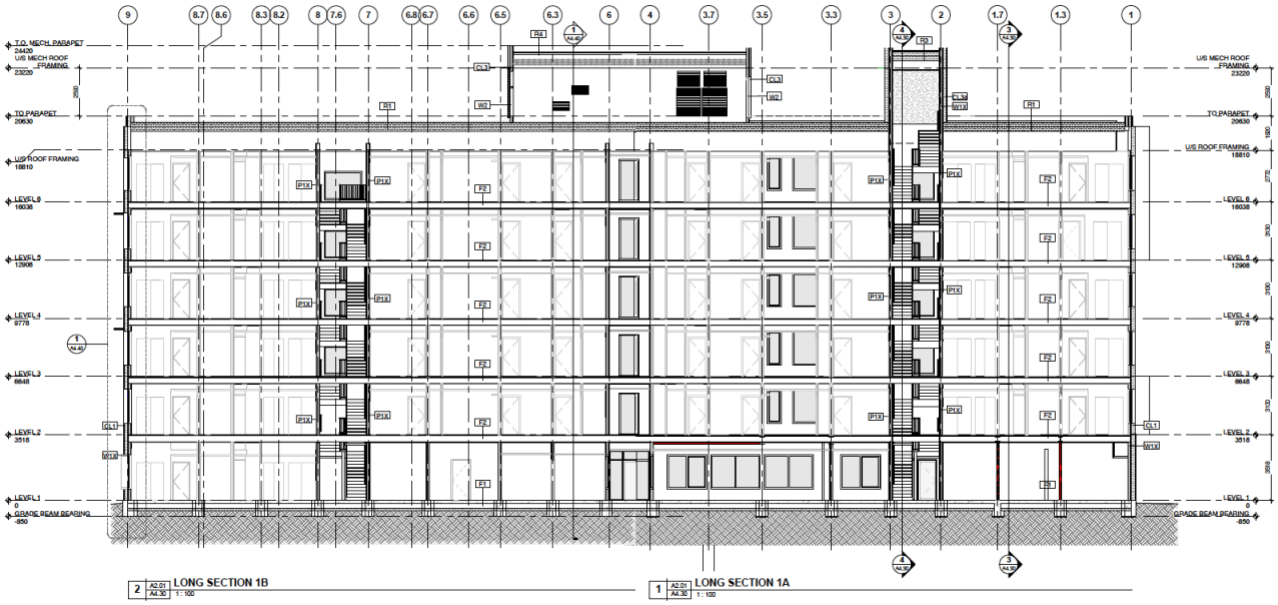
ure 1. Image of completed Amenity Room L1

2.4 BUILDING SECTION



Cross Section

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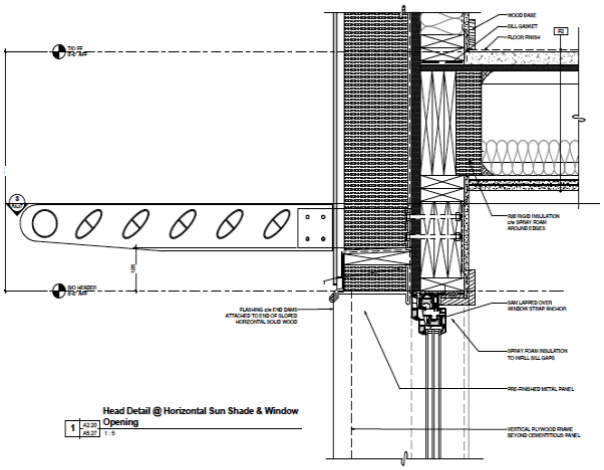
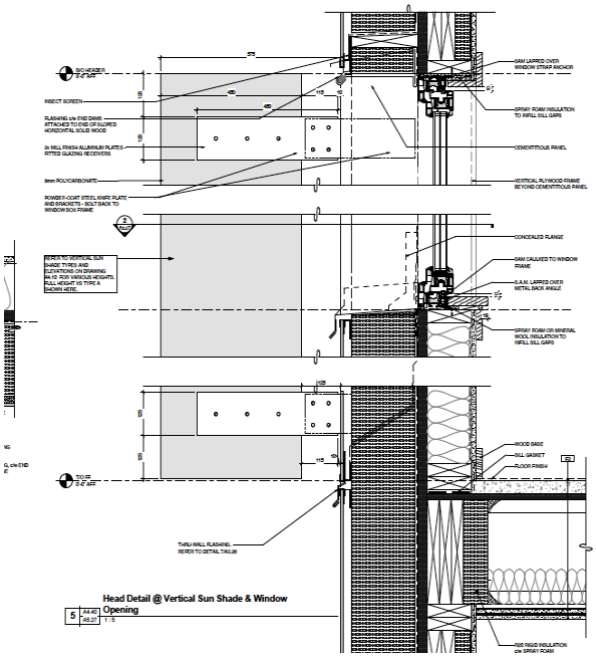
The building envelope of the Fort St. John Passive House is very compact with a Form Factor of 1.04.. The exterior wall system consists of a 2x6 advanced wood construction with exterior Rockwool rigid continuous insulation.
The window system has been optimized to reduce the installation thermal bridge to close to zero.
The brise soleil overhangs are intended to block most of the summer sun to reduce the risk of overheating during hot summer months.

The slab on grad foundation stands on 200 concrete piles insulated with geofoam EPS insulation with thermal bridge detailing.

The roof is a R80 wood truss system with Rockwool cavity insulation and EPS insulation on top.

The Siga Majrex tape was applied to joints, gaps and penetration to ensure an airtight envelope.





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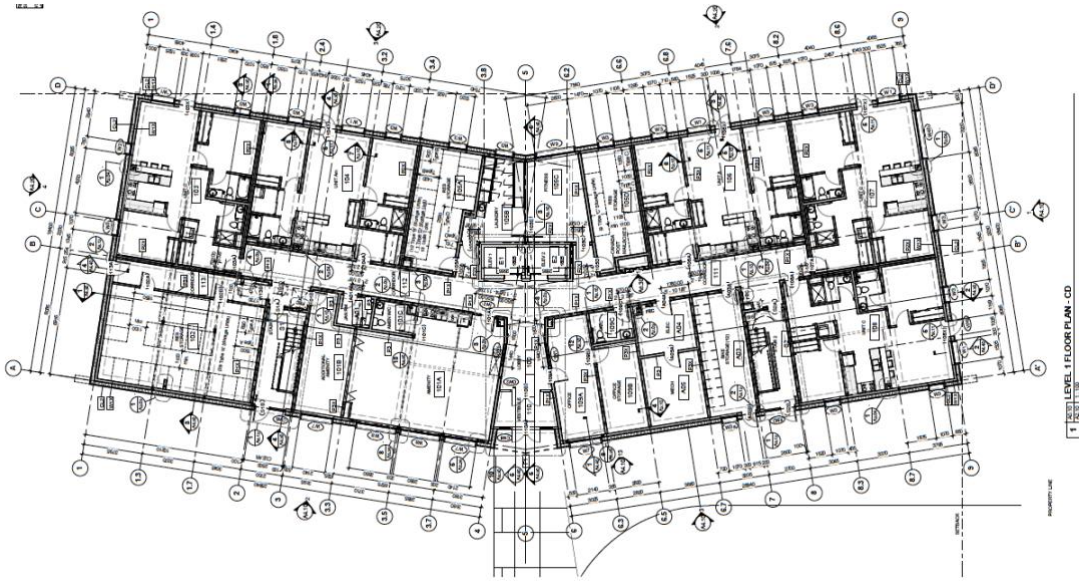
2.5. FLOORPLANS



Main Level

The main level accommodates the lobby, main level suites, amenity rooms, Fitness room, mechanical room, bike and other storage.

Level 2-6

The levels 2-6 accommodate two and three bedroom suites, hallways, electrical rooms and common area balconies.

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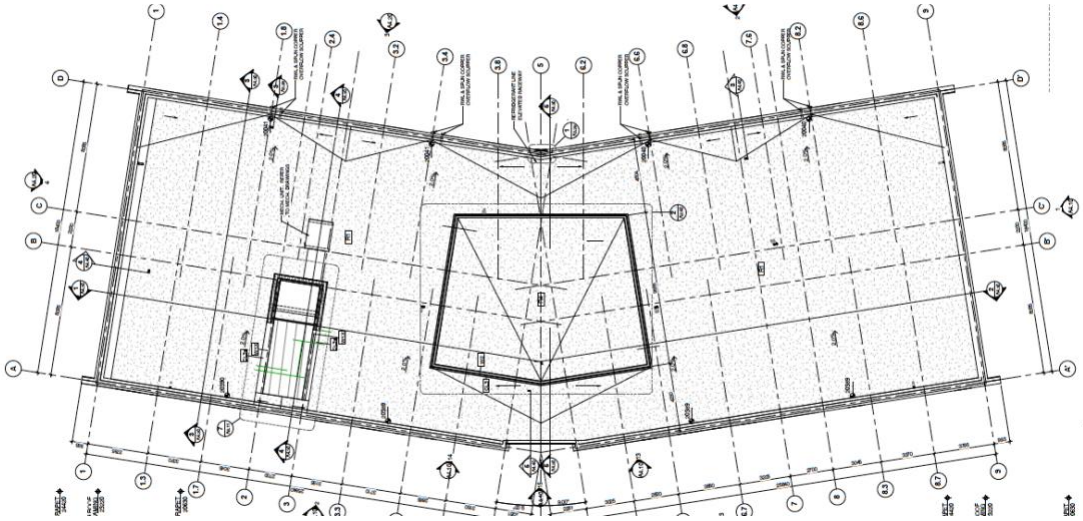
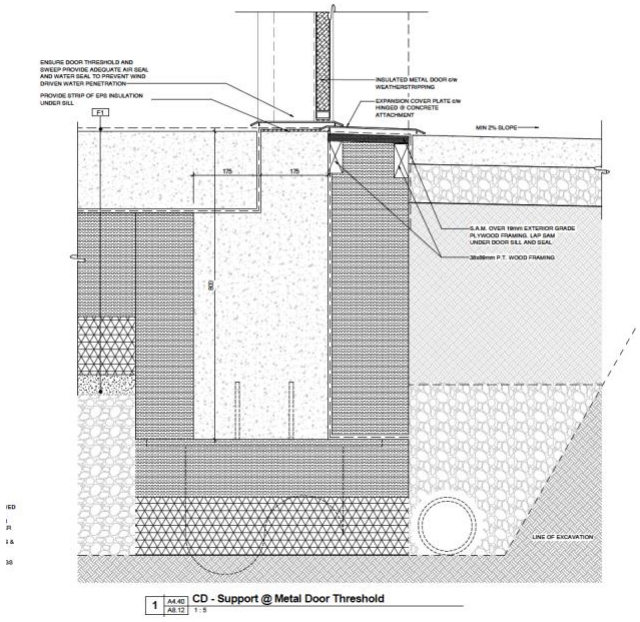


Roof Level

The Roof level accommodates the mechanical penthouse where the heat pump and HRV units are located.

2.6. CONSTRUCTION DETAILS

2.6.1. Pile foundation Detail



Geo Fab Insulation wraps around the foundation and concrete piles – continuous insulation with an average R value of 40.

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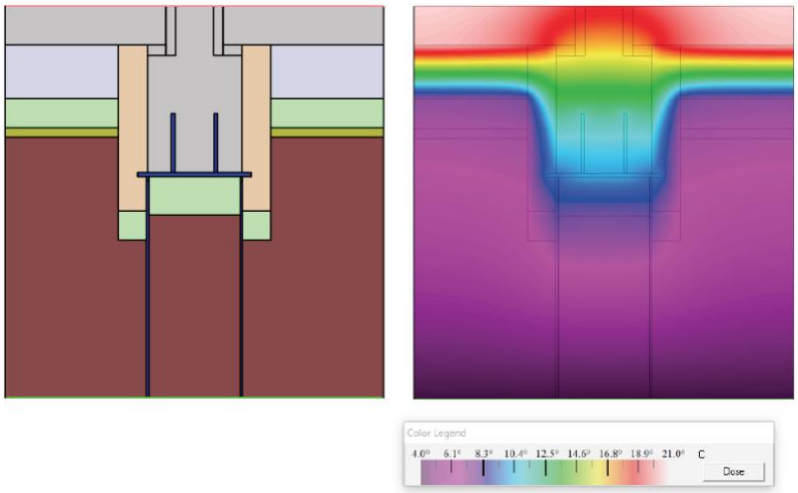
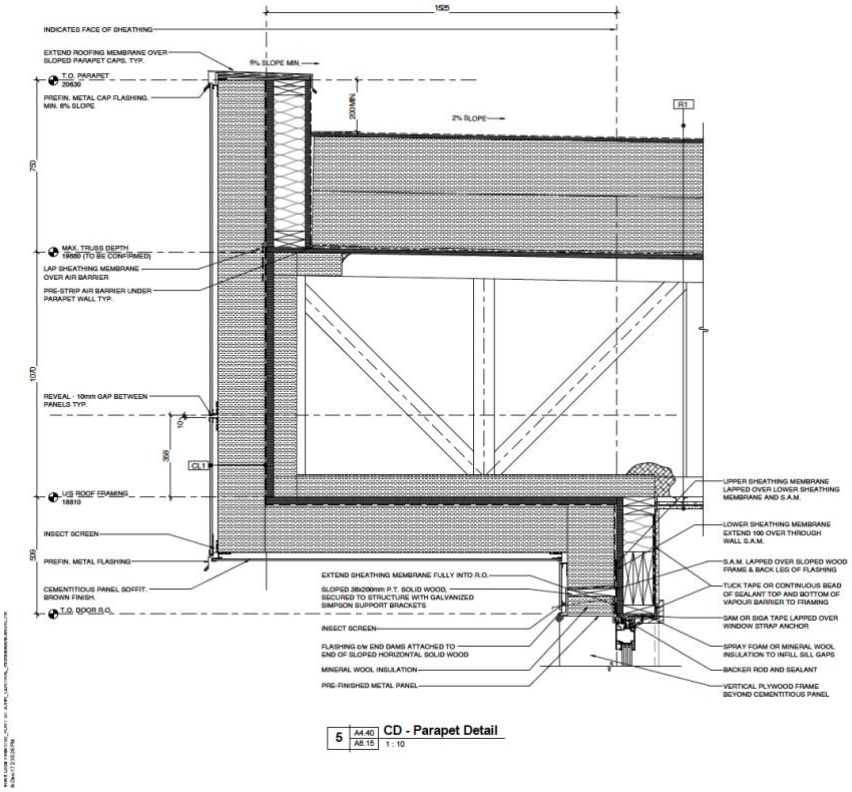


Pile foundation THERM detail

6.2. Exterior wall to Roof detail



The connection details have been designed to minimize thermal bridging applying a continuous layer of insulation around the envelope avoiding envelope penetration as much as possible. Special attention was paid to all connection details where SIGA adhesive tapes where used to seal all joints in order to ensure an airtight envelope. Additional insulation was placed in this area as to minimize thermal bridging.

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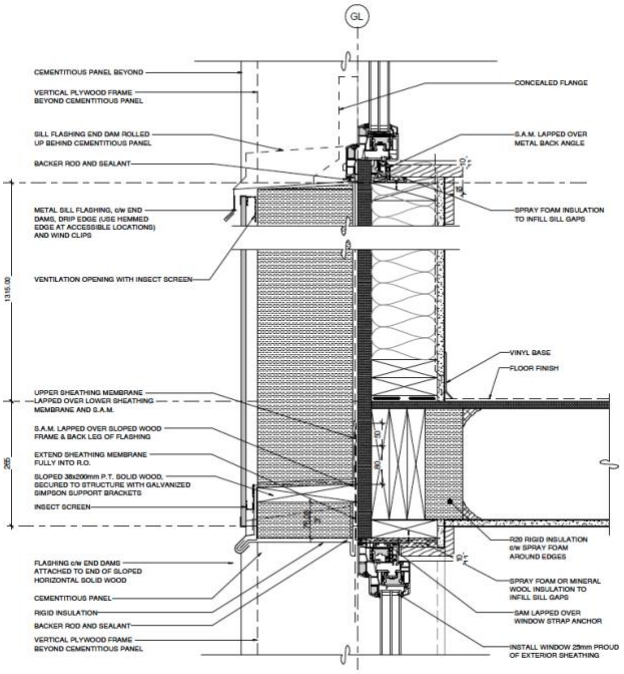
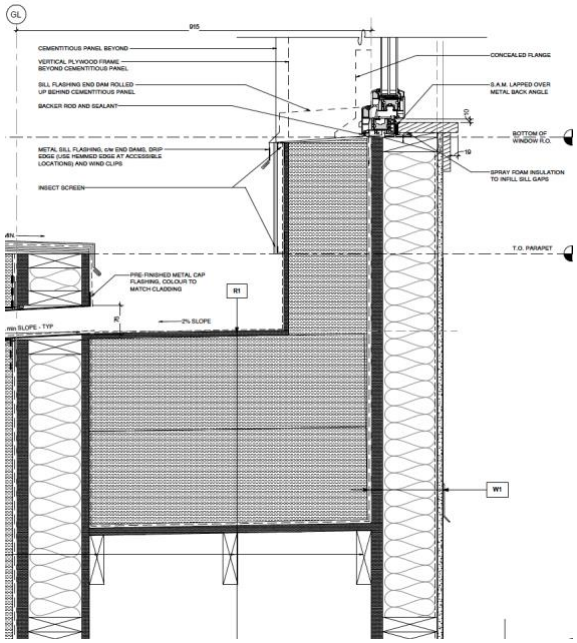
2.6.3. Window Installation details





We used Passive House approved Duxton Fibreglass Windows from Canada with the following performance values:

- Uf – Value: 1.2 [W/(m2K)]
- Ug –Value: 0.56 [W/(m2K)]
- Uw –Value: 0.9 [W/(m2K)]
- g-Value: 0.58
- Glazing; Triple glazing filled with crypton gas

In additional to the shading overhangs and vertical shading fins on the West side, interior retractable Solar blinds were installed to provide additional shading on hot summer days. They can be operated manually. Vertical Fins and Overhangs have been optimized to reduce the risk of overheating during hot summer days.

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2.7.5. DESCRIPTION OF AIRTIGHT ENVELOPE

The envelope exterior wall consists of a 2x6 advanced wood framing construction using taped plywood sheathing as airbarrier and OSB sheathing on the interior as vapour barrier. The roof was construction with 24" trusses partly insulatied with batt insulation fastened to the underside of the taped plywood sheathing, which also acts as the airbarrier. On the exterior EPS insulation adds to a R80 insulation value. On the interior OSB acts as the vapour barrier. All connections, joins, gaps and penetrations are taped and sealed with SIGA building tape and membrane products, maintaining the airtight barrier.

AIR LEAKAGE TEST REPORT

Summary

FanTestic	version: **5.10.78**	licensed to: **e3ecogroup Inc.**
Test date: 2019-01-24	By: Philip Gibney & Loreena Dobson	
Customer:	WCPG Construction Ltd	
Building address:	9404 93rd Avenue, Fort St. John, BC, Canada	

Building and Test Information	
Test file name:	**FSJ PH LBALT EN13829-SE 2019-01-24 1719**
Building volume [m^3]:	**13,500**
Envelope Area [{m^2]:	**4,930**
Floor Area [{m^2]:	**4,992.4**
Building Height (from ground to top) [m]:	**19.5**

Results	
Air flow at 50 Pa, V_{50} [m^3/h]	**2755.0**
Air changes at 50 Pa, n_{50} [/h]	**0.20**
Permeability at 50 Pa, Q_{50} [$m^3/h/m^2$]	**0.559**
Specific leakage at 50 Pa, w_{50} [$m^3/h/m^2$]	**0.552**
Effective leakage area at 50 Pa, A_L [cm^2]	**840.0**
Equivalent leakage area at 50 Pa, A_L [cm^2]	**1375**
Normalized Leakage Area [cm^2/m^2]:	**0.1703**

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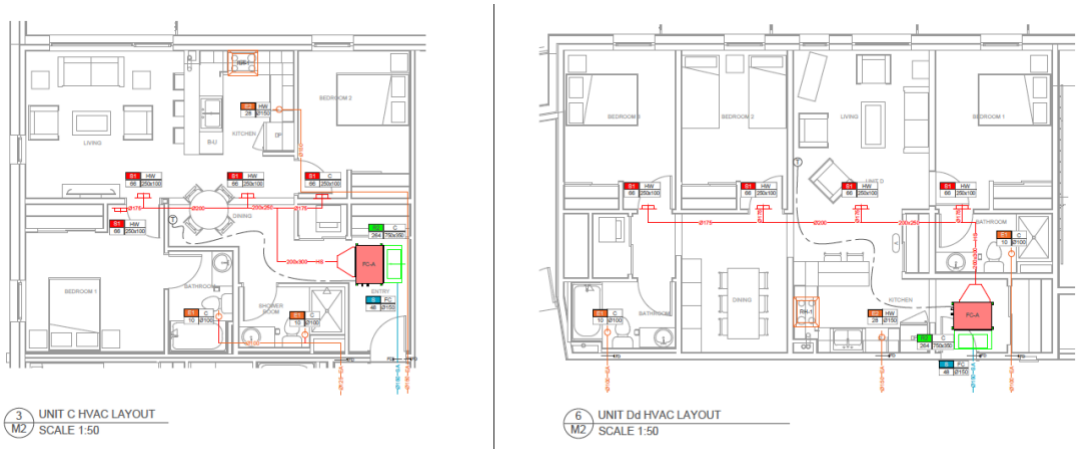
2.7.6. VENTILATION STRATEGY

For ventilation system in the Fort St. John Passive House we decided to go with several ERV's: The Swegon RX series (two units) to serve the residential units and common areas, and a series of Zehnder units (3 units) to serve the amenity, office and fitness room (s).

Sample Ventilation strategy 2nd floor



Sample Ventilation strategy residential units

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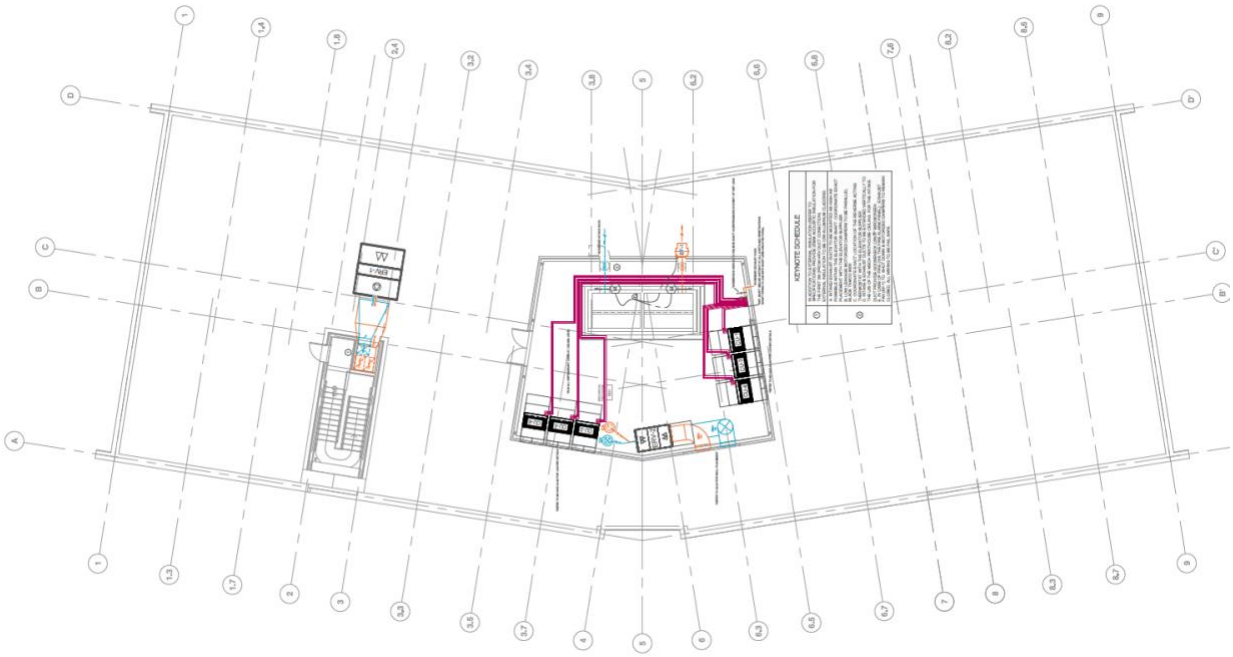

Layout mechanical penthouse unit roof top

Swegon Gold RX Series

The semi central HRV ventilation system was divided into several service areas where one HRV supplies the residential units, one the common areas and a few smaller one's the amenity, office, storage and fitness rooms. The Swegon RX series was selected for this purpose.
The duct system runs inside floor truss system and interior service shafts in order to leave the airtight envelope undisturbed. Fresh air is supplied to the bedrooms and living spaces; stale air (Exhaust Air) is continuously drawn from the kitchen and bathrooms. Adjustable diffusers were used to precisely control air volumes.

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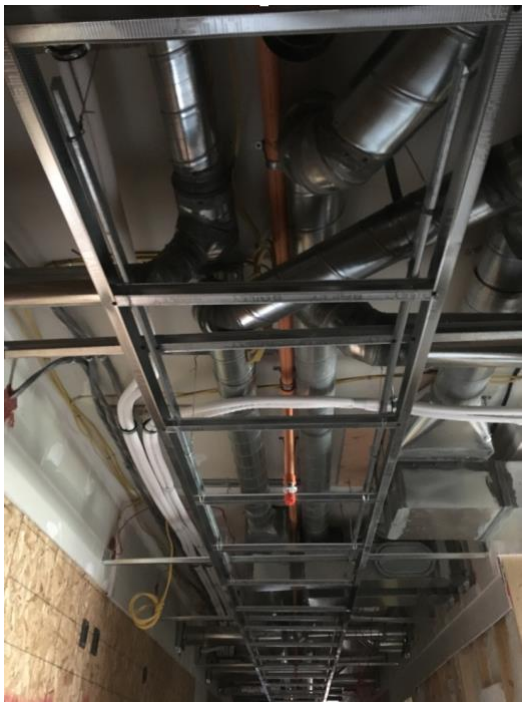
2.7.7. TYPE OF VENTILATION, INSULATION FOR DUCTS, COMMISSIONING



The system was planned by the mechanical engineer for this project, RENU Building Science, installed my Dibauer Mechnical and balanced and commissioned by Swegon and Renu Building Science. The ventilation unit have a summer bypass , which bypasses the ERV core to directly distribute cooler air to the inside during hot summer days, when available.

Ventilation Units: Swegon RX Gold 11 / 3, Zehnder 550/350

Values: Swegon RX Series: 85% Heat Recovery / 0.45 Wh/m3 electric efficiency | Zehnder 550/350: 85% Heat Recovery / 0.29 Wh/m3 electric efficiency

2.7.8. HEATING / COOLING STRATEGY

100% of the heating and cooling load for the building is delivered by an Air-to-Air Heat Pump system by Daikin. Daikin's VRV IV systems integrate advanced technology to provide comfort control with maximum energy efficiency and reliability. The Heat Recovery systems provide a solution for multi-family residential to large commercial applications desiring heating and cooling. It is the first Variable Refrigerant Flow (VRF) system to be assembled in North America. VRV IV's new commissioning tool enables designers to optimize system configurations to take advantage of new system capabilities, as well as new products from Daikin. This allows actual system settings to be optimized for comfort and energy savings from installation, reducing commissioning time.

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2.8. PHPP VERIFICATION SHEET

Passive House Verification

Building:	Fort St. John 50 unit Passive House		
Street:	9404-93 AVE		
Postcode/City:		Fort St. John	
Province/Country:	BC	Canada	
Building type:	Residential MURB		
Climate data set:	CA0026a-Fort St.John		
Climate zone:	2: Cold	Altitude of location:	577 m
Home owner / Client:	BC Housing		
Street:	9404-93 AVE		
Postcode/City:		Fort St. John	
Province/Country:	BC	Canada	
Architecture:	Low Hammond Rowe		
Street:	300-1590 Cedar Hill Rd		
Postcode/City:	V8P 2P5	Victoria	
Province/Country:	BC	Canada	
Mechanical system:	Beairsto Engineers		
Street:	202-10012 97th Street		
Postcode/City:	V1J 5P3	Fort St. John	
Province/Country:	BC	Canada	
Energy consultancy:	Marken Design + Consulting		
Street:	300-225 West 8h AVE		
Postcode/City:	V5Y1N3	Vancouver	
Province/Country:	BC	Canada	
Certification:	Tomaz Stich PH Consulting		
Street:			
Postcode/City:		Invermere	
Province/Country:	BC	Canada	

Year of construction:	2018	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	50	Internal heat gains (IHG) heating case [W/m²]:	2.6	IHG cooling case [W/m²]:	2.7
No. of occupants:	115.1	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	4753.7				
Space heating	Heating demand	kWh/(m²a)	11.40	≤	15	-	yes
	Heating load	W/m²	10	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	1	≤	15	15	yes
	Cooling load	W/m²	0	≤	-	11	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0.2	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	111.46	≤	120		yes
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	86	≤	-	-	-
	Generation of renewable energy	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:
1-Designer	Marken	Consulting	

Issued on:	City:
Feb 21 2019	Vancouver

2.9. CONSTRUCTION COST

Withheld

2.10. COST OF BUILDING

Withheld

2.11. YEAR OF CONSTRUCTION

2018/2019

2.12. DESIGN OVERVIEW

The building was designed with the clear goal to achieve the Passive House standard. An initial DesignPH was performed to assess the massing form factor and positioning of the building on the lot. A preliminary PHPP was completed during the schematic design phase with subsequent updates as design milestones have been accomplished.

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The PHPP was used to optimize window size, placement and shading overhangs. The design team took a holistic approach by implementing additional sustainability features such as the use of local, non-VOC materials where possible, the use of local trades and the use of mostly renewable materials with focus on wood (wood first approach). Additional green features include water conserving fixtures, LED lighting throughout, energy star appliances and native landscaping.

2.13. TECHNICAL DESIGN OVERVIEW

The technical systems were designed by RENU Building Science and Beairsto Engineers.

2.14. PHPP MODELING & CERTIFICATION

The PHPP modeling was done by Marken Design & Consult and the building certified by Tomaz Stich in collaboration with the Passive House Institute in Darmstadt.

2.15. STRUCTURAL ENGINEER

Beairsto Engineers acted as the structural engineers.

2.16. EXPERIENCES

The house is now occupied for six months and the feedback from occupants has been very positive. The energy consumption and indoor conditions are being motored 24/7.

2.17. REFERENCES

- Project website: https://markendc.com/multifamily-passive-house-bc-canada.html

- Project Media coverage:

https://www.sitecproject.com/fifty-new-affordable-housing-units-coming-to-fort-st-john

https://www.alaskahighwaynews.ca/fort-st-john/a-look-inside-the-new-bc-hydro-bc-housing-apartments-being-built-in-fort-st-john-1.23437776

- Project Construction Blog: https://passivegreen.wordpress.com/2019/02/22/passive-house-project-updates-new-york-valleyview-fort-st-john-and-vancouver/