

LEGACY PASSIVE HOUSE WHISTLER, BRITISH COLUMBIA

PASSIVE HOUSE DESIGN BRIEF | V0
PREPARED FOR THE PASSIVE HOUSE INSTITUTE
MARCH 3, 2022



PROJECT DATA

| | |
|---|---|
| Project Name | Legacy Passive House |
| Address | 1020 Legacy Way, Whistler BC |
| Building Use | Residential |
| Year of Construction | 2019 |
| Space Heating | 13 kWh/m ² /yr |
| Space Cooling | n/a |
| Primary Energy Renewable | 70 kWh/m ² /yr |
| Generation of Renewable Energy | 0 kWh/m ² /yr |
| Airtightness Test Result at 50 Pa | 0.15 ACH (0.169 L/s/m ²) |
| U-value of external wall | 0.124 W/(m ² K) 71 Btu/(hr-F-ft ²) |
| U-value of floor slab | 0.080 W/(m ² K) 46 Btu/(hr-F-ft ²) |
| U-value of roof | 0.058 W/(m ² K) 97 Btu/(hr-F-ft ²) |
| U-value windows | 0.75 W/(m ² K) |
| Ventilation Heat Recovery Efficiency | 81% |
| Special features | Prefabricated wood panels with 3% wood waste. Dense packed cellulose insulation with 85% post-consumer recycled newspapers. |

BACKGROUND

Developed in the Resort Municipality of Whistler, the apartment building consists of 24 units on 4 floors over a single level of parking built and certified to Passive House standards. There is a mix of 1 bed and 2 bed rental units with a common laundry area. The gross floor area is 17,859 sq.ft. (1,659 m²) achieving a FSR of 1.14. Parking includes 27 surface and underground vehicle spaces with EV stations wired in. In-suite bicycle storage is provided in each unit.

Horizontal solar shades extend south are used to block high solar angles and reflective interior blinds are used to block low solar angles.

The building is owned and operated by the Whistler Housing Authority as part of the municipality's affordable housing inventory for housing Whistler's workforce.



NORTH WEST ELEVATION OF BUILDING.

PROJECT TEAM

| | |
|---------------------------------|------------------------------------|
| Architect | Integra Architecture Inc. |
| Passive House Consultant | RDH Building Science Inc. |
| Electrical | Gager Electrical Consultants |
| Mechanical | Pinchin Ltd |
| Structural | Equilibrium Structural Engineering |
| Building Enclosure | Aqua Coast Engineering |
| Passive House Contractor | BC Passive House |
| Contractor | Durfeld Constructors |
| Passive House Certifier | Peel Passive House Consulting Ltd |

CERTIFICATION ID

6363 Project-ID (www.passivehouse-database.org)

AUTHOR

RDH Building Science Inc.

Date Signature

ELEVATIONS



NORTH WEST ELEVATION



SOUTH WEST ELEVATION

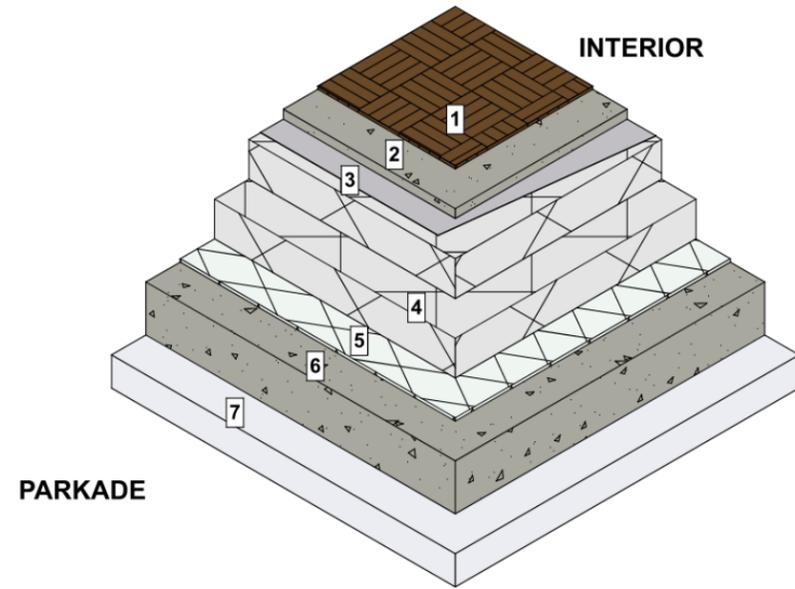


NORTH EAST ELEVATION



SOUTH WEST ELEVATION

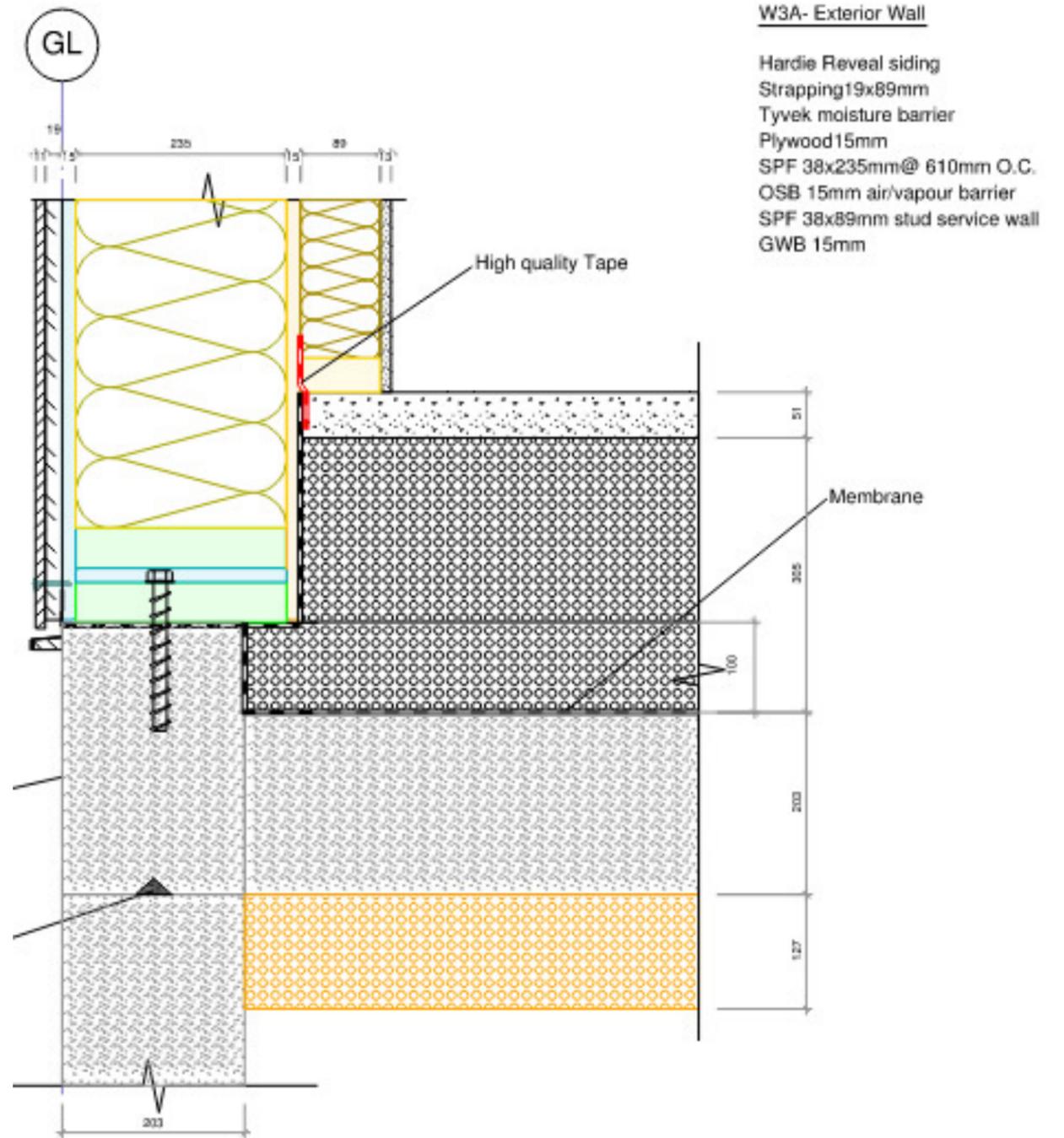
FLOOR CONSTRUCTION



SUSPENDED SLAB ASSEMBLY

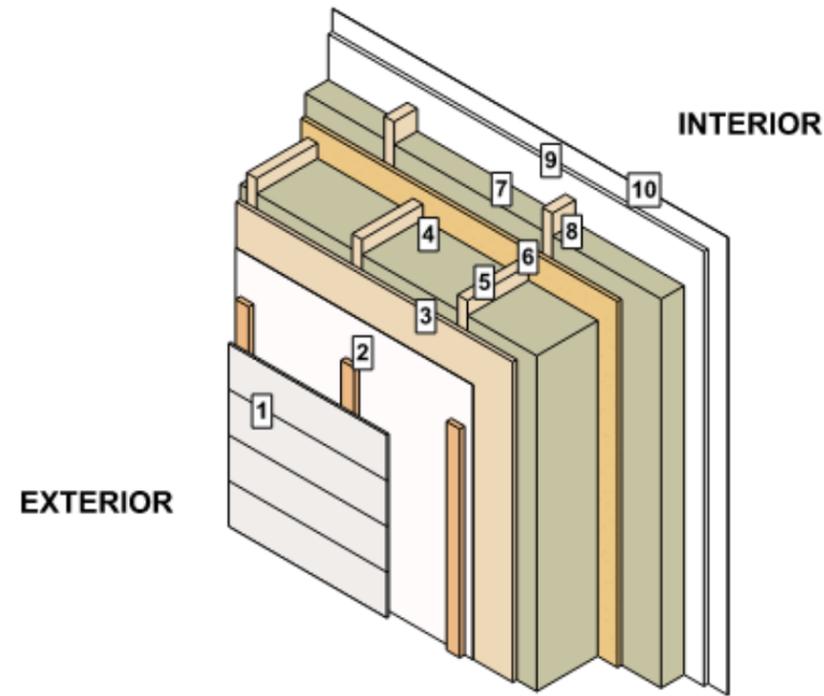
| Assembly no. | | F3A - Suspended Floor Slab | | Interior insulation? | |
|---|------------|---|------------|---------------------------|------------|
| 02ud | | | | | |
| Orientation of building element: 3-Floor | | Heat transmission resistance [m ² K/W] | | | |
| Adjacent to: 3-Ventilated | | interior R _{si} | 0.17 | | |
| | | 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)] |
| 1. Floor finish | 0.220 | | | | |
| 2. Concrete topping | 2.500 | | | | |
| 3. EPS Type II with foil faced vapour barrier | 0.036 | | | | |
| 4. EPS Type II insulation | 0.036 | | | | |
| 5. Drainage mat | | | | | |
| 6. Reinforced concrete suspended slab | 2.500 | | | | |
| 7. Monoglass spray insulation | 0.036 | | | | |
| Percentage of sec. 1 | | Percentage of sec. 2 | | Percentage of sec. 3 | |
| 100% | | | | | |
| U-value supplement | | U-value: 0.080 W/(m ² K) | | RSI R _{eff} | |
| | | | | 12.47 70.80 | |
| | | | | 27.28 In. | |

MODELLED ASSEMBLY IN PHPP



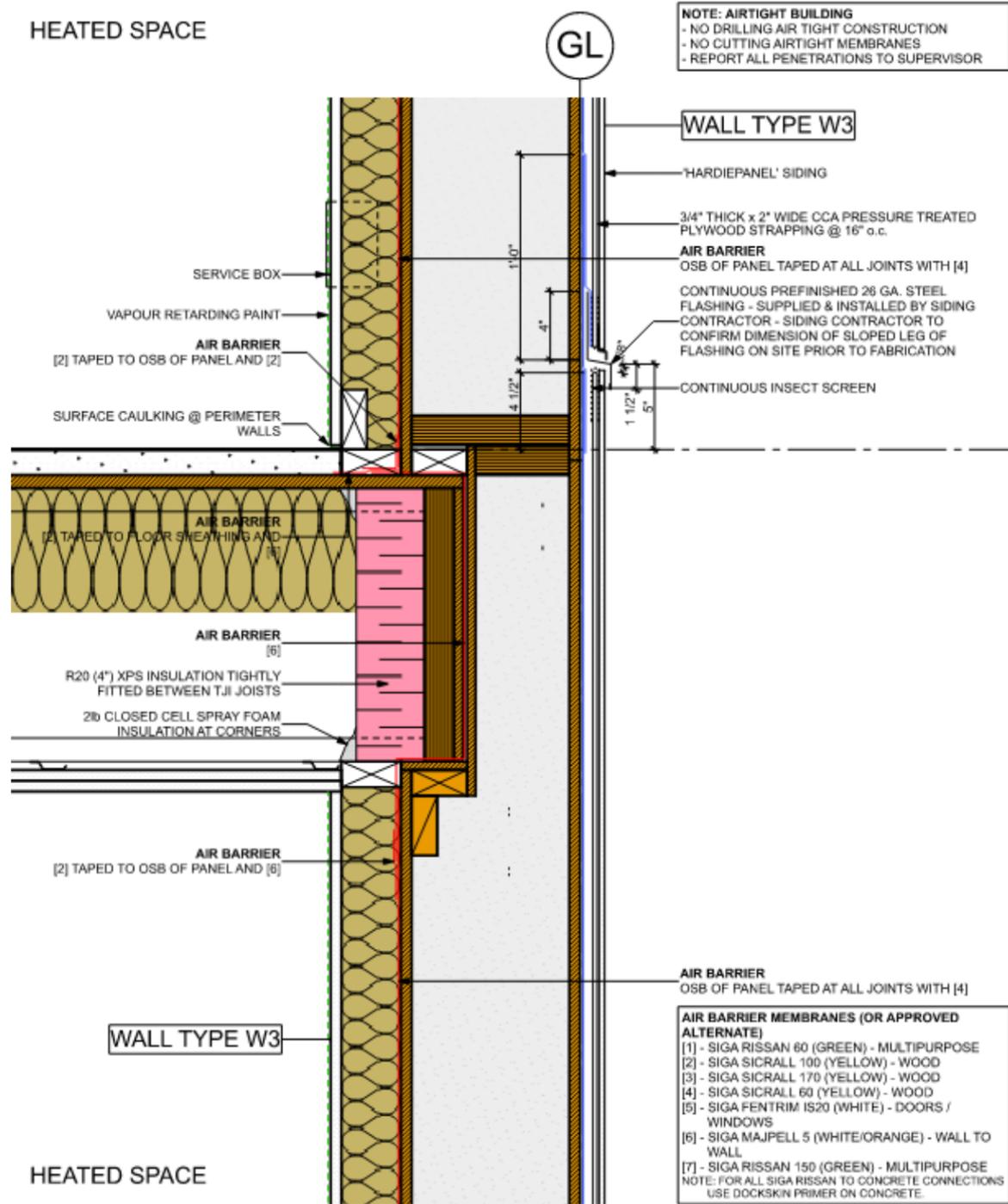
EXTERNAL WALL TO SUSPENDED SLAB INTERFACE DETAIL

WALL CONSTRUCTION



| | | | | | | |
|---|--------------|----------------------------|----------------------------|----------------------------|----------------------|--------------------------|
| Assembly no. | 13ud | | W3A - Exterior Wall | | Interior insulation? | <input type="checkbox"/> |
| Heat transmission resistance [m ² K/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] In. |
| 1. Exterior cladding | | | | | | |
| 2. Moisture barrier | | | | | | |
| 3. Plywood Sheathing | 0.130 | | | | | 16 0.63 |
| 4. Cellulose | 0.038 | 2x10 wood studs @ 16" o.c. | 0.130 | | | 235 9.25 |
| 5. OSB Sheathing | 0.130 | | | | | 16 0.63 |
| 6. Fibreglass batt insulation | 0.036 | | | 2x4 wood studs @ 24" o.c. | 0.130 | 89 3.50 |
| 9. Gypsum board | 0.250 | | | | | 16 0.63 |
| 10. Painted finish | | | | | | |
| Percentage of sec. 1 | | Percentage of sec. 2 | | Percentage of sec. 3 | | Total |
| 84% | | 9.4% | | 6.3% | | 37.1 cm |
| U-value supplement | | U-value: | | 0.124 W/(m ² K) | | RSI R _{eff} |
| | | | | | | 8.06 45.75 |
| | | | | | | 14.63 In. |

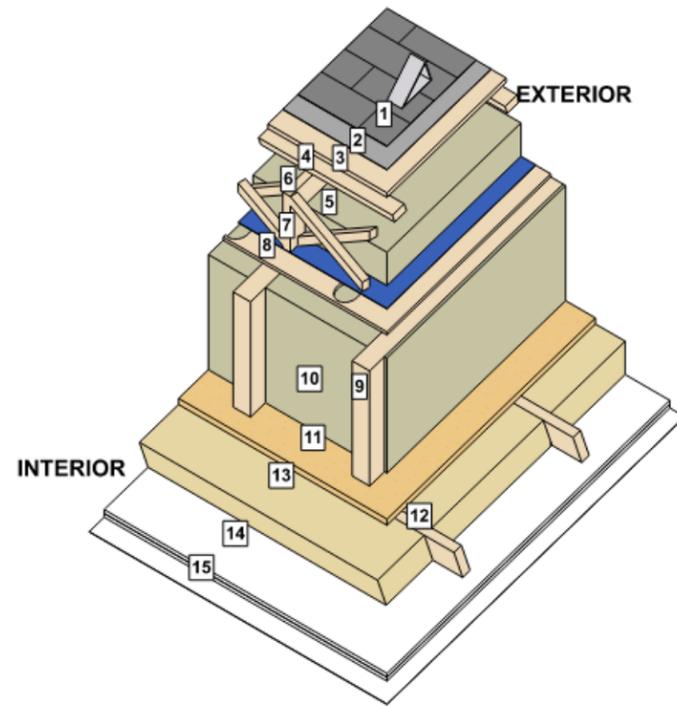
MODELLED ASSEMBLY IN PHPP



NOTE: AIRTIGHT BUILDING
 - NO DRILLING AIR TIGHT CONSTRUCTION
 - NO CUTTING AIRTIGHT MEMBRANES
 - REPORT ALL PENETRATIONS TO SUPERVISOR

- WALL TYPE W3**
- 'HARDIEPANEL' SIDING
 - 3/4" THICK x 2" WIDE CCA PRESSURE TREATED PLYWOOD STRAPPING @ 16" o.c.
 - AIR BARRIER**
OSB OF PANEL TAPED AT ALL JOINTS WITH [4]
 - CONTINUOUS PREFINISHED 26 GA. STEEL FLASHING - SUPPLIED & INSTALLED BY SIDING CONTRACTOR - SIDING CONTRACTOR TO CONFIRM DIMENSION OF SLOPED LEG OF FLASHING ON SITE PRIOR TO FABRICATION
 - CONTINUOUS INSECT SCREEN
 - AIR BARRIER**
[2] TAPED TO OSB OF PANEL AND [2]
 - AIR BARRIER**
[2] TAPED TO FLOOR SHEATHING AND [7]
 - AIR BARRIER**
[6]
 - R20 (4") XPS INSULATION TIGHTLY FITTED BETWEEN TJI JOISTS
 - 2lb CLOSED CELL SPRAY FOAM INSULATION AT CORNERS
 - AIR BARRIER**
[2] TAPED TO OSB OF PANEL AND [6]
 - AIR BARRIER**
OSB OF PANEL TAPED AT ALL JOINTS WITH [4]
- AIR BARRIER MEMBRANES (OR APPROVED ALTERNATE)**
- [1] - SIGA RISSAN 60 (GREEN) - MULTIPURPOSE
 - [2] - SIGA SICRALL 100 (YELLOW) - WOOD
 - [3] - SIGA SICRALL 170 (YELLOW) - WOOD
 - [4] - SIGA SICRALL 60 (YELLOW) - WOOD
 - [5] - SIGA FENTRIM IS20 (WHITE) - DOORS / WINDOWS
 - [6] - SIGA MAJPELL 5 (WHITE/ORANGE) - WALL TO WALL
 - [7] - SIGA RISSAN 150 (GREEN) - MULTIPURPOSE
- NOTE: FOR ALL SIGA RISSAN TO CONCRETE CONNECTIONS USE DOCKSKIN PRIMER ON CONCRETE.

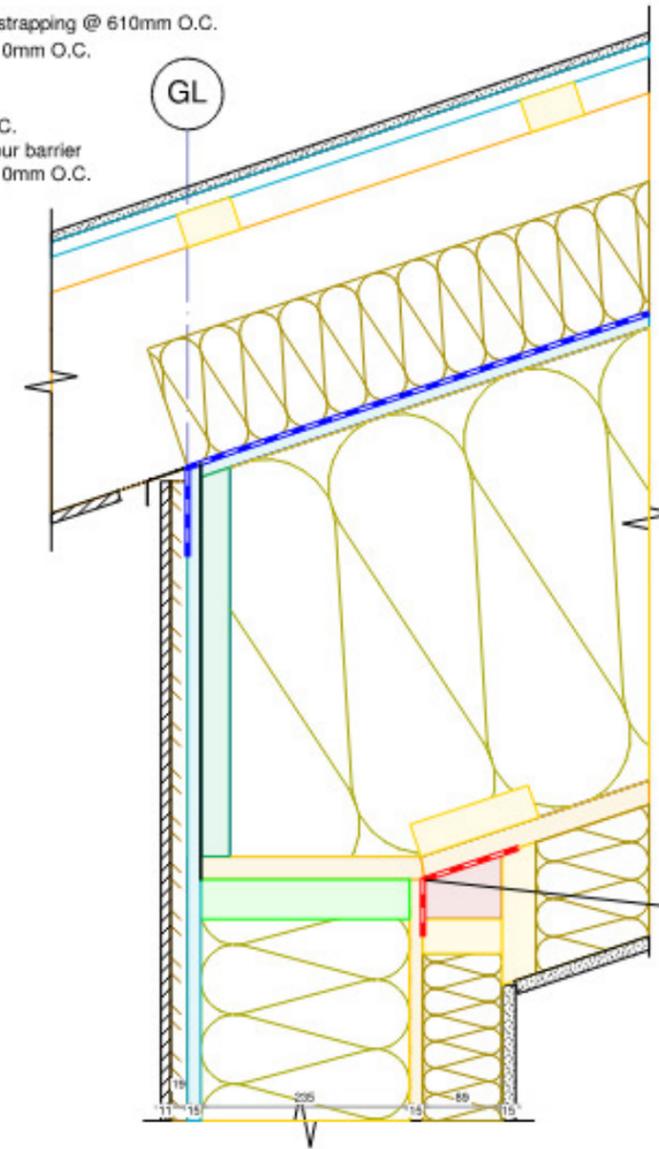
ROOF CONSTRUCTION



MAIN ROOF ASSEMBLY

R1A- Sloped Roof System

- Asphalt shingle
- Synthetic roof underlay
- Plywood 15mm
- SPF 64x38mm cross strapping @ 610mm O.C.
- SPF 38x235mm @ 610mm O.C.
- Siga Majcoat
- Plywood 15mm
- TJI 560 @ 610mm O.C.
- OSB 25.4mm air/vapour barrier
- SPF 38x140mm @ 610mm O.C.



ROOF TRUSS INTERFACE DETAIL

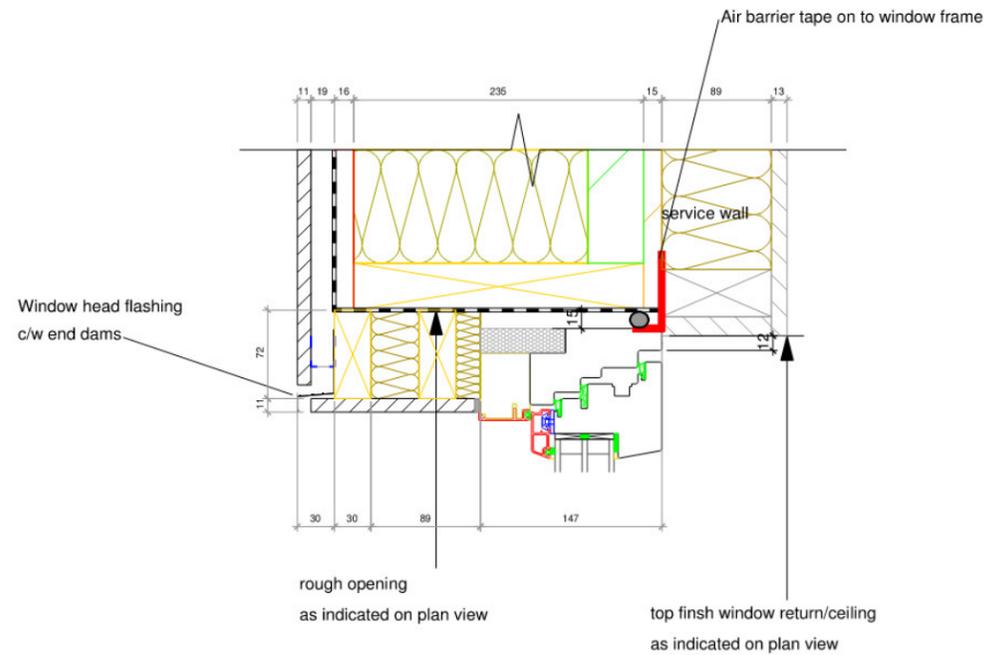
| Assembly no. | | Heat transmission resistance [m ² K/W] | | Interior insulation? | | | |
|---|------------|---|------------|-----------------------------|------------|--------------------------|-------|
| 13ud R1A Main Roof | | | | <input type="checkbox"/> | | | |
| Orientation of building element: 1-Roof | | interior R _{si} : 0.10 | | | | | |
| Adjacent to: 3-Ventilated | | exterior R _{se} : 0.10 | | | | | |
| Area section 1 | λ [W/(mK)] | Area section 2 (optional) | λ [W/(mK)] | Area section 3 (optional) | λ [W/(mK)] | Thickness [mm] | In. |
| 1. Asphalt shingles | | | | | | | |
| 2. Synthetic roof underlay | | | | | | | |
| 3. Plywood Sheathing | 0.130 | | | | | | |
| 4. Cross purlins | 0.130 | | | | | | |
| 5. Mineral wool | 0.036 | 6. 2x10 overframing at 16" o.c. | 0.130 | | | 140 | 5.50 |
| 7. SIGA Majvest | | | | | | | |
| 8. Plywood | 0.130 | | | | | 19 | 0.75 |
| 10. Cellulose | 0.038 | | | 9. PSL Joists | 0.130 | 483 | 19.00 |
| 11. OSB Sheathing | 0.130 | | | | | 25 | 1.00 |
| 12. Fibreglass batt insulation | 0.036 | 13. 2x6 furring at 24" o.c. | 0.130 | | | 140 | 5.50 |
| 14. Gypsum board | 0.250 | | | | | 32 | 1.25 |
| 15. Paint finish | | | | | | | |
| Percentage of sec. 1: 75% | | Percentage of sec. 2: 9.4% | | Percentage of sec. 3: 15.9% | | Total: 83.8 cm | |
| U-value supplement: <input type="text"/> W/(m ² K) | | U-value: 0.058 W/(m ² K) | | RSI: 17.21 | | R _{eff} : 97.73 | |
| | | | | | | 33.00 In. | |

MODELLED ASSEMBLY IN PHPP

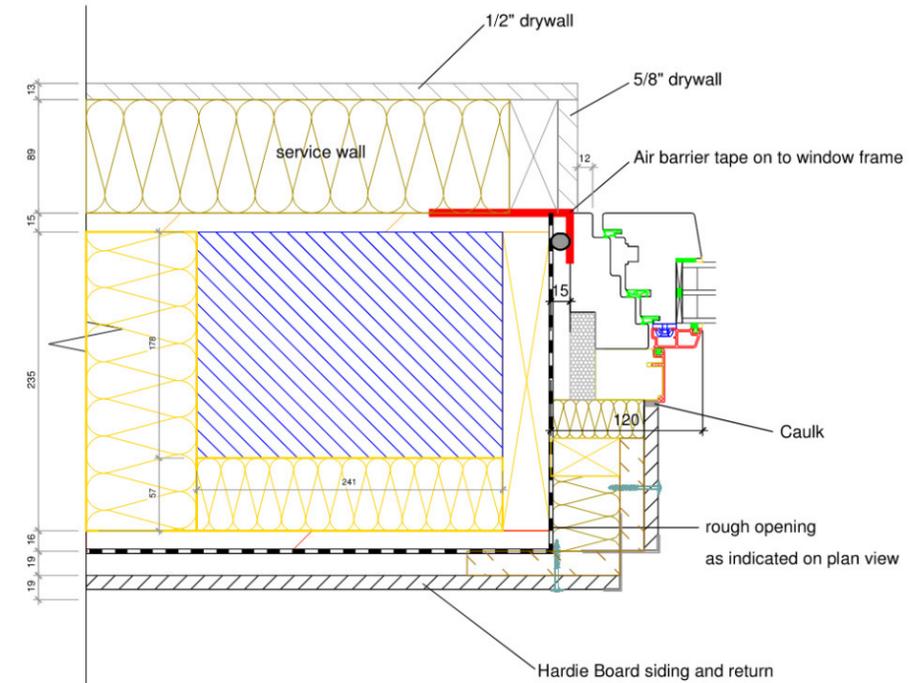
W3A- Exterior Wall

- Hardie Reveal siding
- Strapping 19x89mm
- Tyvek moisture barrier
- Plywood 15mm
- SPF 38x235mm @ 610mm O.C.
- OSB 15mm air/vapour barrier
- SPF 38x89mm stud service wall
- GWB 15mm

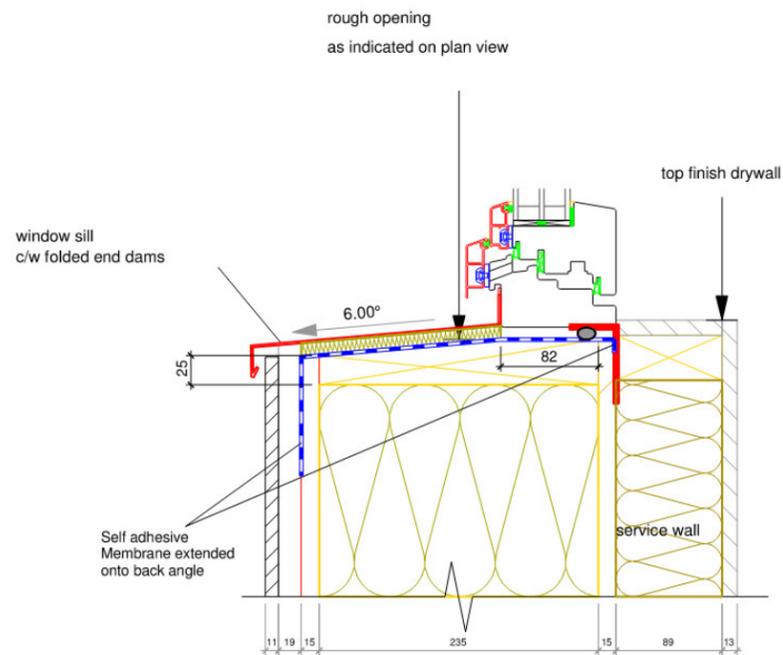
WINDOWS AND WINDOW INSTALLATION



TYPICAL WINDOW HEAD INSTALLATION



TYPICAL WINDOW JAMB INSTALLATION



TYPICAL WINDOW SILL INSTALLATION

| | |
|--------------------------------|--|
| Window manufacturer | Aluron Sp. Z o.o., Zawiercie, Poland |
| Window construction | Aluminum clad wood framed windows |
| U-value frame (Uf) | 0.78 W/(m²K) |
| Insulated glazing unit | 4 mm glass 18 mm 90% Ag 10% Air 4 mm glass 18 mm 90% Ag 10% Air 4 mm glass |
| Centre of glass U-value | 0.528 W/(m²K) |
| g-value | 0.526 |

AIR BARRIER STRATEGY

Mid-construction airtightness testing was conducted on May 17, 2019 and the final airtightness test was conducted on October 3rd, 2019 by RDH Building Science Inc.



TEST FAN WAS INSTALLED AT THE MAIN ENTRANCE ON THE GROUND FLOOR.



TEST FAN SETUP AT THE MAIN ENTRANCE ON THE GROUND FLOOR.

Summary of Testing Results

| | |
|--------------------------|----------------------|
| Volume (Vn50) | 5,744 m ³ |
| Enclosure surface area | 2,482 m ² |
| Pressurization results | 0.1561 ACH |
| Depressurization results | 0.1464 ACH |
| Average | 0.15 ACH +/- 2.8% |

Airtightness Concept

| | |
|-------------------|---------------------|
| Slab on grade | Concrete slab |
| Below Grade walls | Concrete walls |
| Suspended slab | Concrete slab |
| Above grade walls | Taped OSB Sheathing |
| Roof | Taped OSB Sheathing |



TAPED OSB FORMS THE MAIN AIR BARRIER ON THE WALLS AND ROOF ASSEMBLY.

SERVICE WATER HEATING

Service water heating is provided by a water source heat pump that uses Whistler low temperature district energy system. Three storage tanks with thermal jackets help minimize heat losses. Variable frequency drives are provided on circulation pumps. Continuous insulated circulation pipes with oversized pipe hangers were used to further minimize demand.



COLMAC WATER SOURCE HEAT PUMPS WERE USED TO PROVIDE SERVICE WATER HEATING.



THREE SERVICE WATER HEATING STORAGE TANKS WITH THERMAL JACKETS.

HVAC SYSTEM

Ventilation

The entire building is served by a single ERV located in the attic. Each suite has a variable air volume damper in the supply and extract duct runs to allow for suite level ventilation control. Duct runs are kept short and straight to minimize pressure losses. There are three mechanical shafts to distribute the ventilation air through the vertical ducts. All suites are provided with controls for ventilation in their bathrooms and kitchens.



A SINGLE ERV LOCATED IN THE ATTIC SERVES THE WHOLE BUILDING.

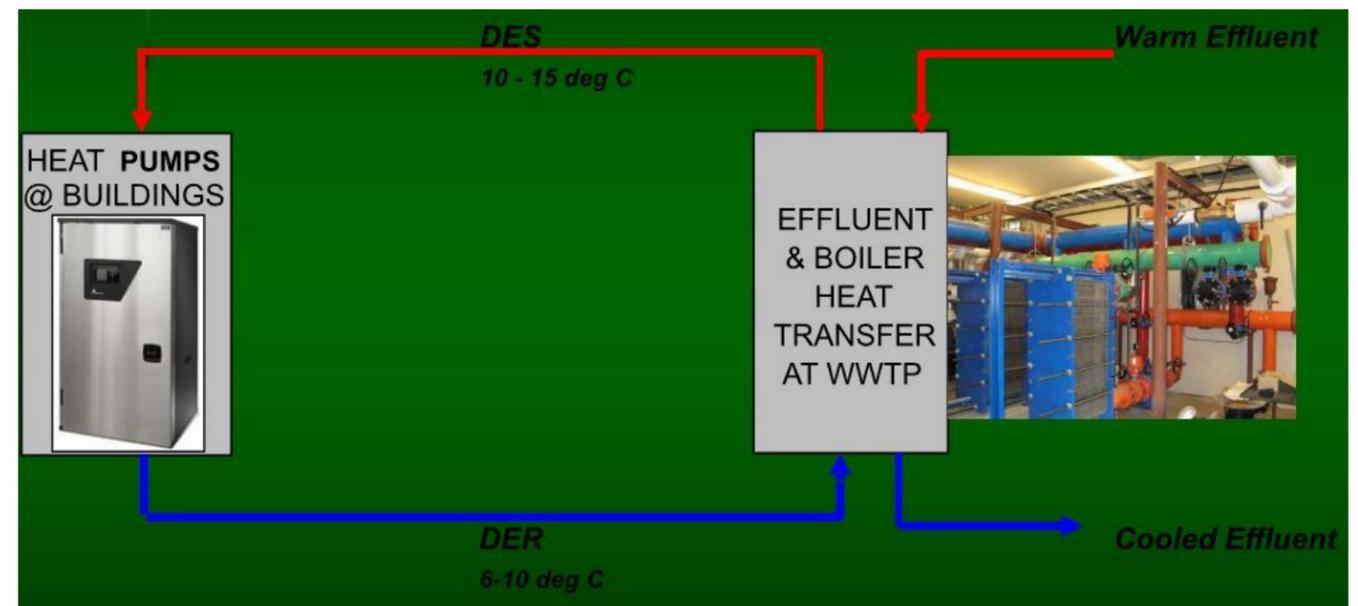
Heating and Cooling

All spaces will be heated and cooled via a water source variable refrigerant flow (VRF) system connected to the ERV main supply air duct. This serves as the primary heating source for the building. When the outdoor air temperature is below 13 °C to 12 °C the supply air setpoint is 22C. When the outdoor air temperature is above 25 °C, the ERV and heat pump will run in cooling mode to maintain supply air temperature to the suites at 13 °C. Each suite has an electric baseboard controlled via local thermostat to provide supplementary heating to meet the demands of the peak heating loads.

The heating/cooling system is connected to Whistler's low temperature district energy system. The building's space heating utilizes the district energy system by means of a water source heat pump. The source of the district energy is from the wastewater treatment plant.



WATER SOURCE VRF HEAT PUMP PROVIDES SPACE CONDITIONING THROUGH THE YEAR. (LEFT) IN SUITE ELECTRIC BASEBOARDS ARE PROVIDED FOR TOP UP HEATING. (RIGHT)



SCHEMATIC OF WHISTLER'S DISTRICT ENERGY. Source: Resort Municipality of Whistler

PHPP RESULTS

Passive House Verification



| | |
|----------------------------|----------------------------|
| Architecture: | Integra Architecture Inc. |
| Street: | 2330-200 Granville Street |
| Postcode/City: | V6C 1S4 Vancouver |
| Province/Country: | British Columbia |
| Energy consultancy: | RDH Building Science Inc. |
| Street: | 4333 Still Creek Dr #400 |
| Postcode/City: | V5C 6S6 Vancouver |
| Province/Country: | British Columbia CA-Canada |
| Year of construction: | 2018 |
| No. of dwelling units: | 24 |
| No. of occupants: | 39.8 |

| | |
|--|------------------------------------|
| Building: | WHA Passive House Employee Rentals |
| Street: | 1020 Legacy Way |
| Postcode/City: | V0N 1B1 Whistler |
| Province/Country: | British Columbia CA-Canada |
| Building type: | Multi-unit Residential Building |
| Climate data set: | CA0022a-Whistler |
| Climate zone: | 3: Cool-temperate |
| Altitude of location: | 611 m |
| Home owner / Client: | Whistler Housing Authority |
| Street: | 2400 Dave Murray Pl #325 |
| Postcode/City: | V0N 1B2 Whistler |
| Province/Country: | British Columbia CA-Canada |
| Mechanical engineer: | Pinchin Ltd |
| Street: | 13775 Commerce Pkwy |
| Postcode/City: | V6V 2V4 Richmond |
| Province/Country: | British Columbia CA-Canada |
| Certification: | Peel Passive House Consulting |
| Street: | 118 Craighleith Road |
| Postcode/City: | L9Y 0S3 Blue Mountains |
| Province/Country: | Ontario CA-Canada |
| Interior temperature winter [°C]: | 20.0 |
| Interior temp. summer [°C]: | 25.0 |
| Internal heat gains (IHG) heating case [W/m²]: | 2.9 |
| IHG cooling case [W/m²]: | 5.4 |
| Specific capacity [Wh/K per m² TFA]: | 60 |
| Mechanical cooling: | |

| Specific building characteristics with reference to the treated floor area | | | | Alternative criteria | | Fullfilled? ² |
|--|---|------|----------|----------------------|----|--------------------------|
| | Treated floor area m² | | Criteria | Alternative criteria | | |
| Space heating | Heating demand kWh/(m²a) | 13 | ≤ | 15 | - | yes |
| | Heating load W/m² | 11 | ≤ | - | 10 | yes |
| Space cooling | Cooling & dehum. demand kWh/(m²a) | - | ≤ | - | - | - |
| | Cooling load W/m² | - | ≤ | - | - | - |
| | Frequency of overheating (> 25 °C) % | 9 | ≤ | 10 | | yes |
| | Frequency of excessively high humidity (> 12 g/kg) % | 0 | ≤ | 20 | | yes |
| Airtightness | Pressurization test result n ₅₀ 1/h | 0.15 | ≤ | 0.6 | | yes |
| Non-renewable Primary Energy (PE) | PE demand kWh/(m²a) | 148 | ≤ | - | | - |
| Primary Energy Renewable (PER) | PER demand kWh/(m²a) | 70 | ≤ | 80 | 70 | yes |
| | Generation of renewable energy (in relation to projected building footprint area) | 0 | ≥ | - | 30 | |

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