PROJECT DOCUMENTATION
GEBÄUDE-DOKUMENTATION

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

ABSTRACT | ZUSAMMENFASSUNG

Orr's Residence Richmond

BUILDING DATA | GEBÄUDEDATEN

Year of Construction Baujahr	2021/22	Space Heating Heizwärmebedarf	14 kWh/(m²a)
U-Value External Wall U-Wert Außenwand	0.224 W/m²K		
U-Value floor U-Wert Kellerdecke	0.252 W/m²K	Primary Energy Demand (PER) Erneuerbare Primärenergie (PER)	39 kWh/(m²a)
U-Value roof U-Wert Dach	0.116 W/m²K	Generation of Renewable Energy Erzeugung erneuerb. Energie	0 kWh/(m²a)
U-Value windows U-Wert Fenster	1.00 W/m²K	Non-renewable Primary Energy (PE) Nicht erneuerbare Primärenergie (PE)	92 kWh/(m²a)
Heat Recovery Wärmerückgewinnung	84%	Pressurization test n_{50} Drucktest n50	0.25
Special features Besonderheiten	Structural Insulated Panels SIPs for the roof and wall elements SIPs für die dach- und wandelemente		

BRIEF DESCRIPTION

The house is an architecturally designed contemporary house with three bedrooms, an office, two bathrooms and a large double garage. Situated in Richmond, Tasman District, facing north-west the dwelling is elevated with views of Tasman Bay and the Kahurangi mountains on the horizon.

The home features SIP walls and roof on an insulated concrete slab. The building has a combination of cedar and aluminium cladding. Large external pergolas with operable blades were installed on the Northern side of the building (southern hemisphere) to limit excessive solar gains.

KURZBESCHREIBUNG

Das Haus ist ein architektonisch gestaltetes zeitgenössisches Haus mit drei Schlafzimmern, einem Büro, zwei Badezimmern und einer großen Doppelgarage. Das in Richmond, Tasman District, gelegene Wohnhaus ist nach Nordwesten ausgerichtet und bietet Blick auf die Tasman Bay und die Kahurangi-Berge am Horizont.

Das Haus verfügt über SIP-Wände und Dach auf einer isolierten Betonplatte. Das Gebäude hat eine Kombination aus Zeder und Aluminiumverkleidung. Auf der Nordseite des Gebäudes (südliche Hemisphäre) wurden große Außenpergolen mit bedienbaren Lamellen installiert, um übermäßige Sonneneinstrahlung zu begrenzen.

Architecture Entwurfsverfasser	Continuum Architects Ltd www.continuumarchitecture.co.nz
Implementation Planning Ausführungsplanung	Continuum Architects Ltd www.continuumarchitecture.co.nz
Building Systems Haustechnik	Fantech (NZ) Ltd https://www.fantech.com.au
Structural Engineer Baustatik	Constructure Structural Engineering www.constructure.co.nz
Building Physics Bauphysik	Oculus Architectural Engineering Ltd www.oculusltd.co.nz
Passive House Planning Passivhaus-Projektierung	Oculus Architectural Engineering Ltd www.oculusltd.co.nz
Construction Management Bauleitung	L Johnston Construction Ltd
Certifying Body Zertifizierungsstelle	Sustainable Engineering Ltd www.sustainableengineering.co.nz
Certification ID Zertifizierungs ID	6835 https://passivehouse-database.org/index.php?lang=en#d_6835

AUTHOR OF PROJECT DOCUMENTATION
VERFASSER DER GEBÄUDE-DOKUMENTATION

Oculus Architectural Engineering Ltd
www.oculusltd.co.nz

Date | Datum
31 May 2022

Signature | Unterschrift
Robyn Ryan

1. BUILDING PHOTOS

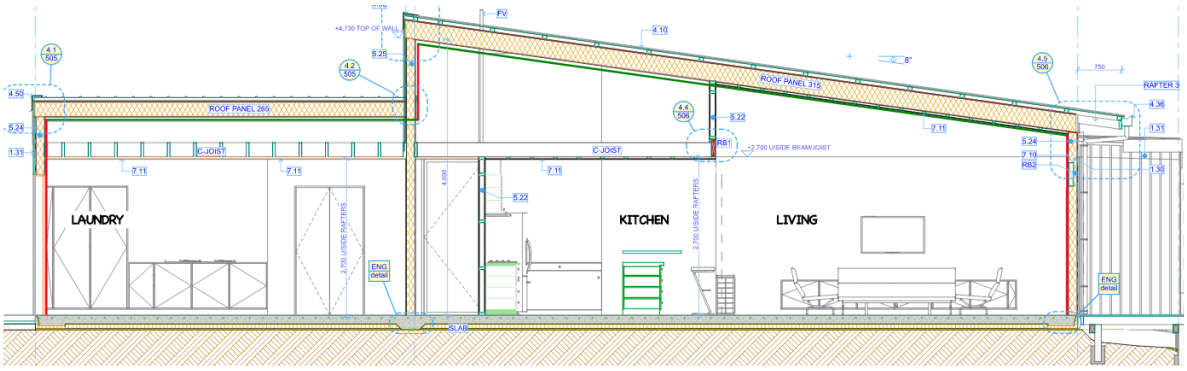
Northeast elevation

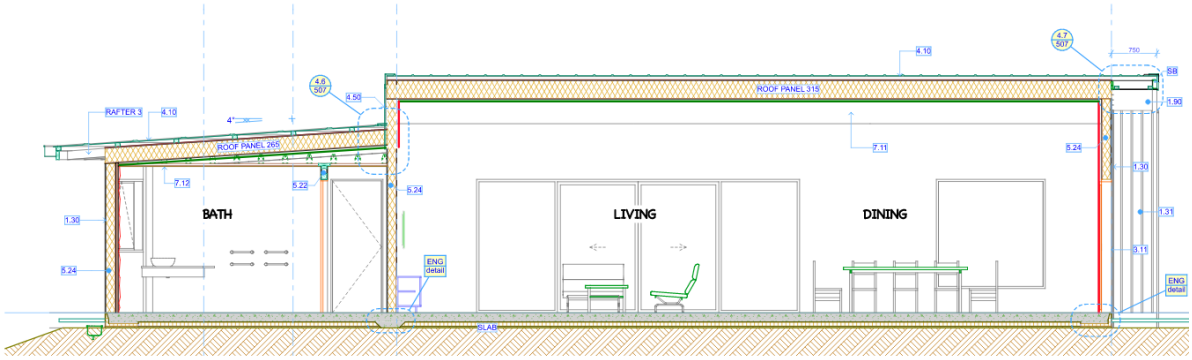
Southwest elevation

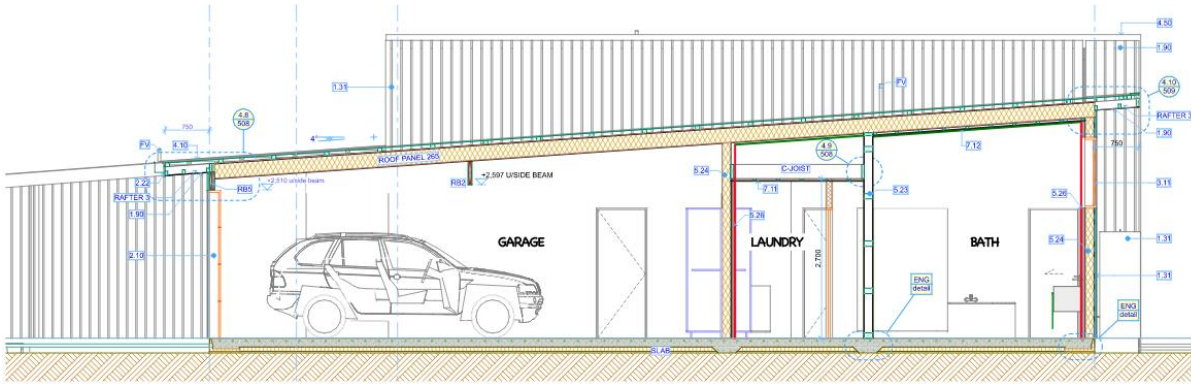
Note that the southeast and northwest elevations are not photographed as they are difficult to access from the sloping property.

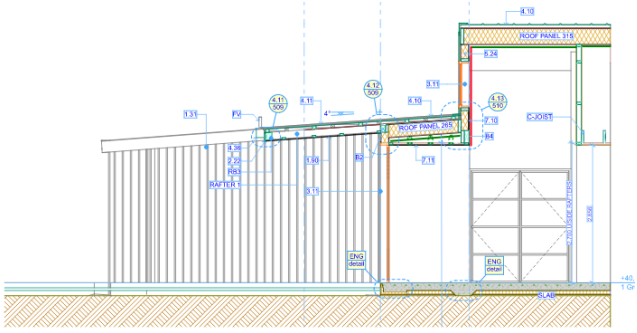
2. INTERIOR PHOTOS

3. SECTIONS

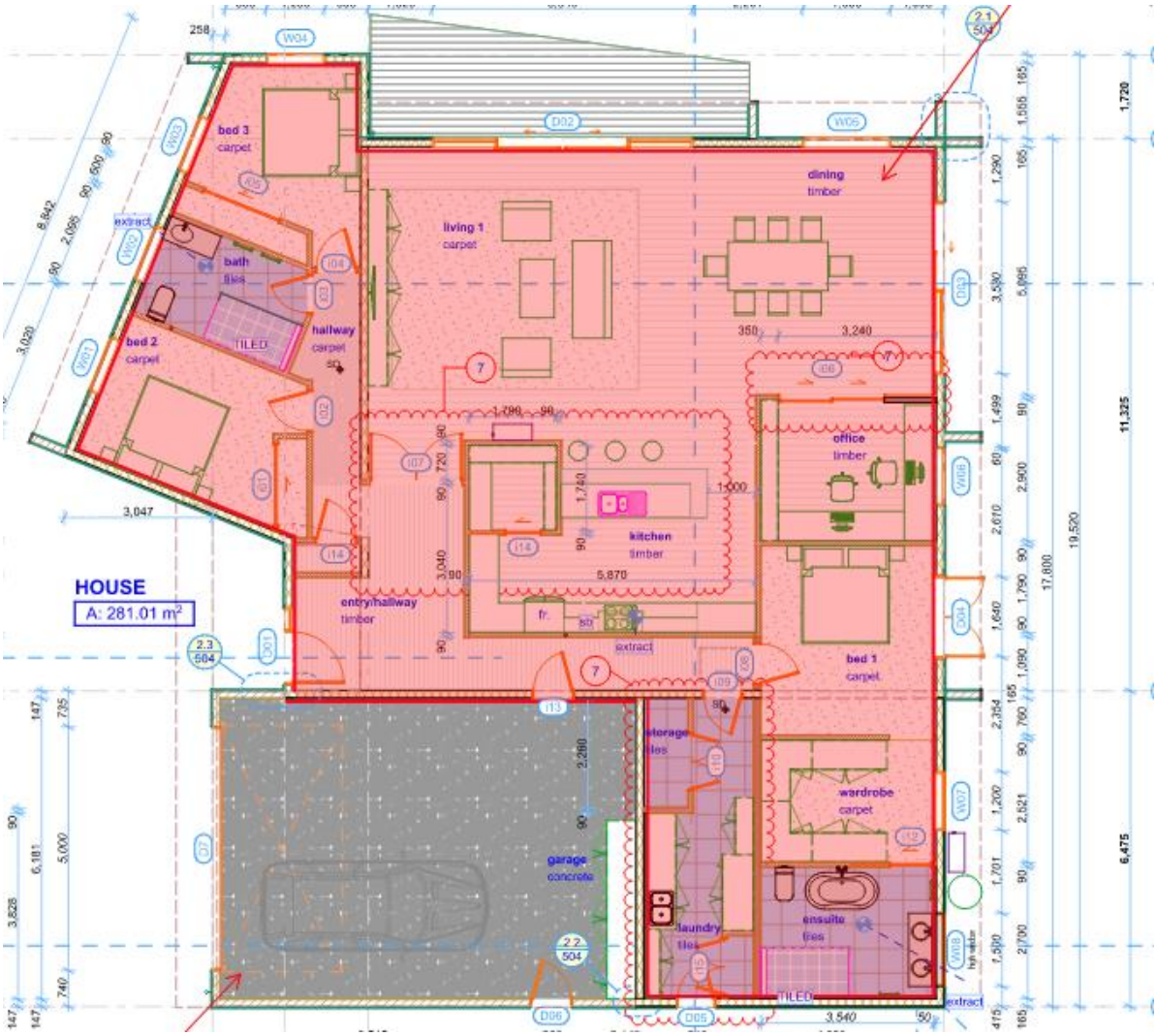

LAUNDRY
KITCHEN
LIVING
ROOF PANEL 265
ROOF PANEL 315
C-JOIST
SLAB


BATH
LIVING
DINING
ROOF PANEL 265
ROOF PANEL 315
RAFTER 3
SLAB


GARAGE
LAUNDRY
BATH
ROOF PANEL 265
C-JOIST
SLAB

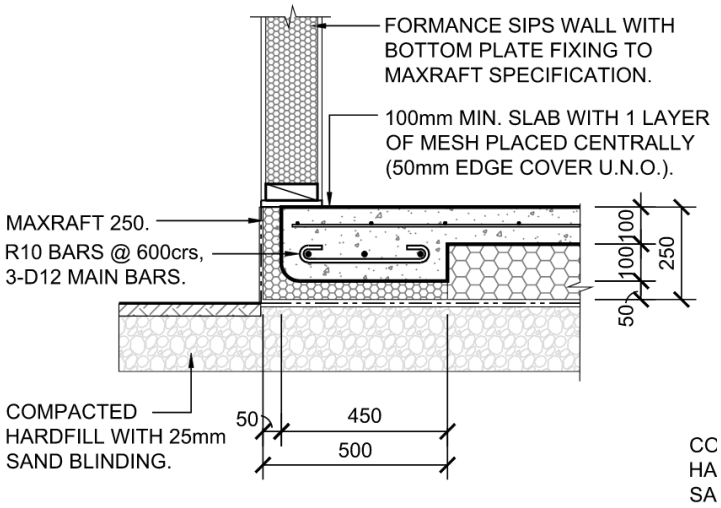

ROOF PANEL 315
ROOF PANEL 265
C-JOIST
SLAB

4. PLAN


HOUSE
A: 281.01 m²
bed 3
carpet
bath
tiles
bed 2
carpet
hallway
carpet
living 1
carpet
dining
timber
office
timber
kitchen
timber
entry/hallway
timber
bed 1
carpet
storage
tiles
wardrobe
carpet
garage
concrete
laundry
tiles
ensuite
tiles
TILED
TILED
extract
extract
extract

5. FOUNDATION AND FLOOR CONSTRUCTION

The floor consists of an insulated concrete slab from the foundation system MAXRaft. The system uses EPS insulation underneath the slab and around the slab perimeter.



EXTERNAL FOOTING DETAIL

Assembly no.: 04ud — MAXRaft Standard — 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 (reinforced)_PHPP	2.100					100
EPS S	0.040					150

Percentage of sec. 1: 100% — Percentage of sec. 2 — Percentage of sec. 3 — Total: 25.0 cm

U-value supplement: W/(m²K)

U-value: 0.252 W/(m²K)

6. EXTERNAL WALL

The external walls are made of structurally insulated panels or SIPs which have EPS insulation sandwiched between two layers of OSB. The wall SIPs are all 165mm thick.

Assembly no.	Building assembly description						Interior insulation?
01ud	Formance 165 Walls						

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]
wall underlay						
Oriented strand board (OSB)_PHPP	0.130					11
EPSFormanceEPSFoam Core20kg/m3	0.038	framing	0.120			143
Oriented strand board (OSB)_PHPP	0.130					11
GlassfibrePinkBattsMasonryWallR1.0@40mm	0.040			framing	0.120	40
air	0.046			framing	0.120	5
Plasterboard	1.250					10

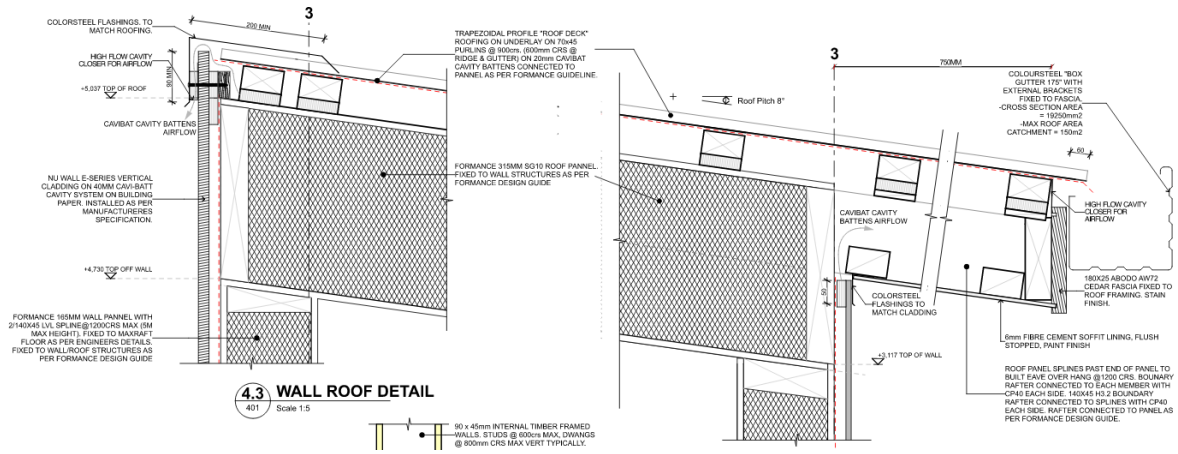
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
80%	15.0%	5.0%	22.0 cm

U-value supplement: W/(m²K)

U-value: 0.224 W/(m²K)

7. ROOF CONSTRUCTION

Two different roof SIP thicknesses were used across the project: 315mm and 265mm. During construction, the client decided to add additional 90mm internal rigid insulation to the roof.



Assembly no. 03ud — Formance 315 Roof

Interior insulation?

Heat transmission resistance [m²K/W]

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

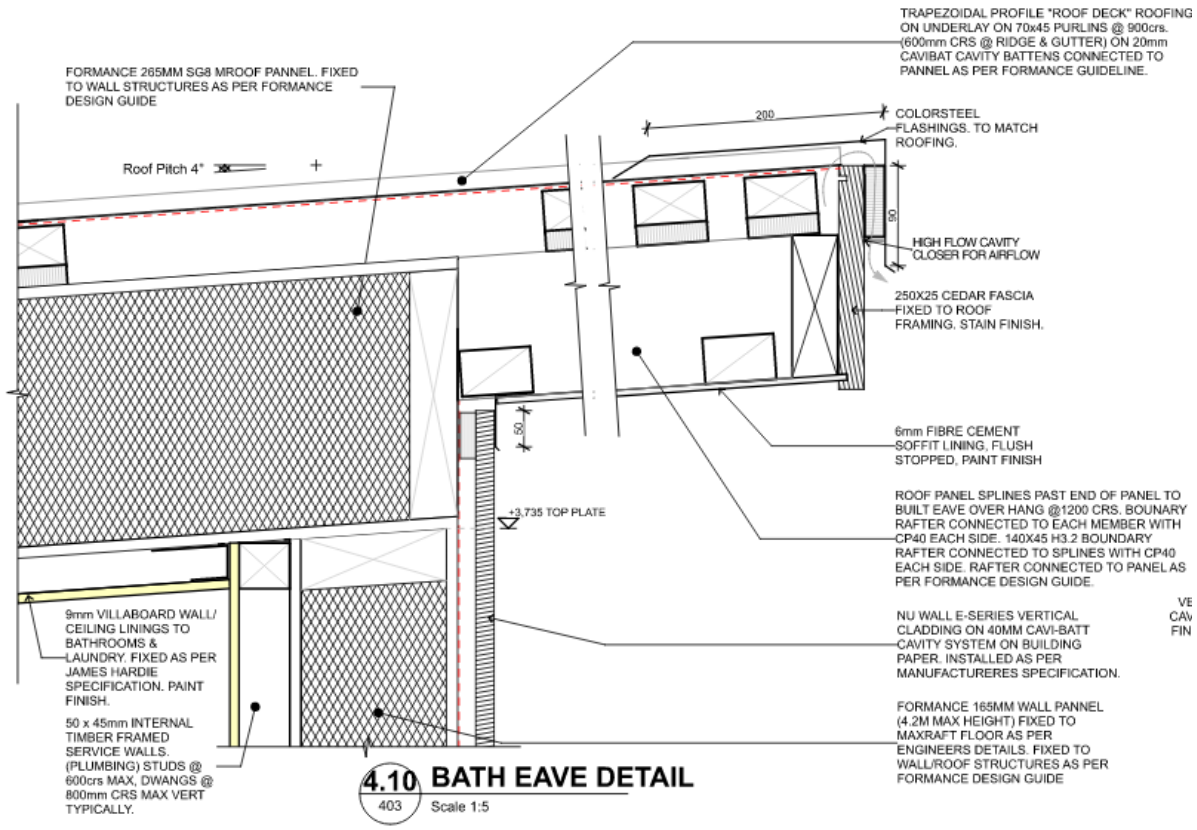
Adjacent to: 3-Ventilated — exterior R_{se}: 0.10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Roof underlay						
Oriented strand board (OSB) PHPP	0.130					11
EPS Formance EPS Foam Core 20kg/m3	0.038	framing	0.120			293
Oriented strand board (OSB) PHPP	0.130					11
Plasterboard	0.250					10
Expol Therma Slab H	0.035					90

Percentage of sec. 1: 85% — Percentage of sec. 2: 15.0% — Percentage of sec. 3: — Total: 41.5 cm

U-value supplement: — W/(m²K)

U-value: 0.110 W/(m²K)



Assembly no. 02ud — Formance 265 Roof

Interior insulation?

Heat transmission resistance [m²K/W]

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]
Roof underlay						
Oriented strand board (OSB) PHPP	0.130					11
EPSFormanceEPSFoam Core20kg/m3	0.038	framing	0.120			243
Oriented strand board (OSB) PHPP	0.130					11
Plasterboard	0.250					10
Expol ThermaSlab H	0.036					90

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
85%	15.0%		36.5 cm

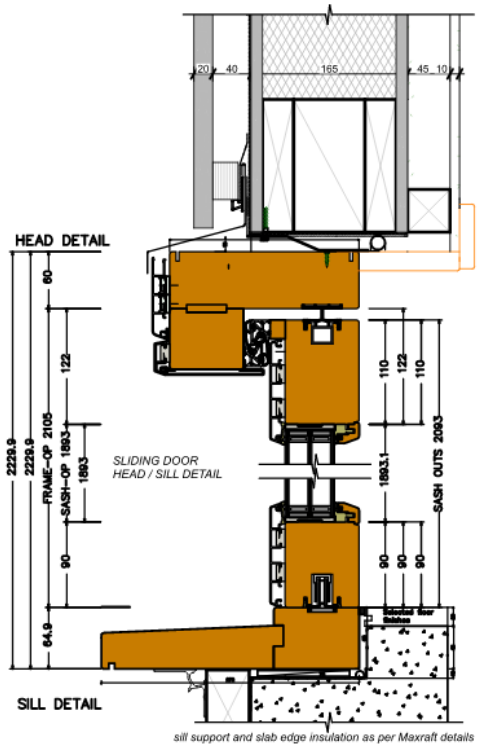
U-value supplement: W/(m²K)

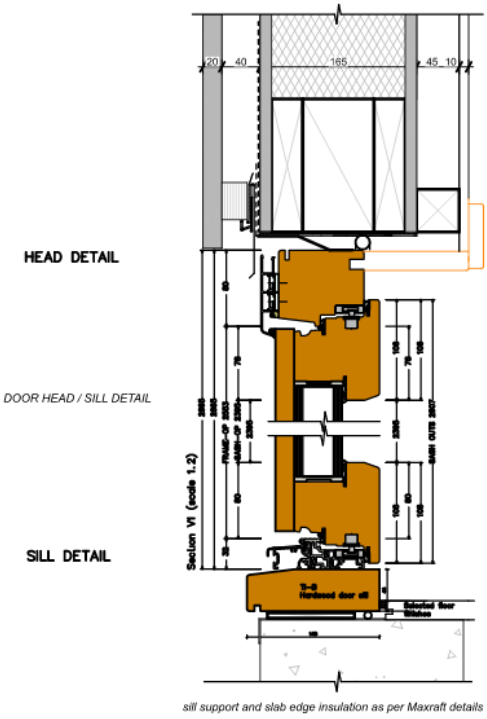
U-value: 0.125 W/(m²K)

8. WINDOWS AND WINDOW INSTALLATION

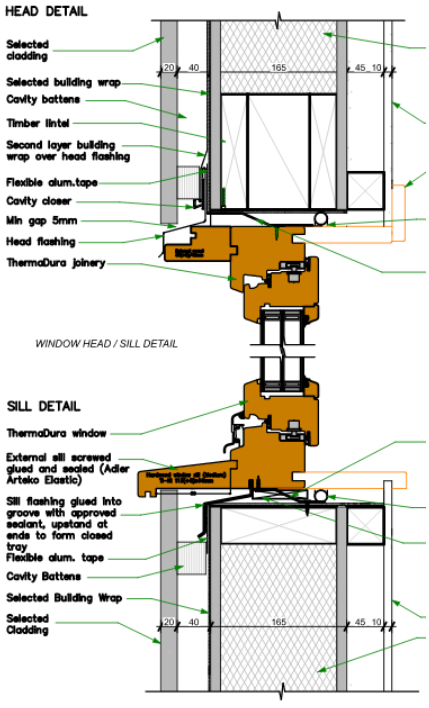
The windows and doors were sourced through the window manufacturer Thermadura in New Zealand. The frames are made of laminated timber (Siberian Larch and Spruce) with exterior aluminium cladding for additional durability.

Window Installation Head and Sill, Foundation edge details:





Window supplier	Thermadura
Frame description	Natureline 90
Frame U-value	1.2 W/(m²K)
Glass description	Silverstar EN2plus 4-20-4-20-4 90% Ar
Glass U-value	0.53 W/(m²K)
Glass g-value	52%



9. AIRTIGHT ENVELOPE

The airtight envelope was tested once during construction and a final Test was conducted on 13 September 2021 by Brent Chatterton of Chatterton Builders.

n_{50} during Blower Door Test at 50Pa (ISO:9972)

$0.25\ h^{-1}$

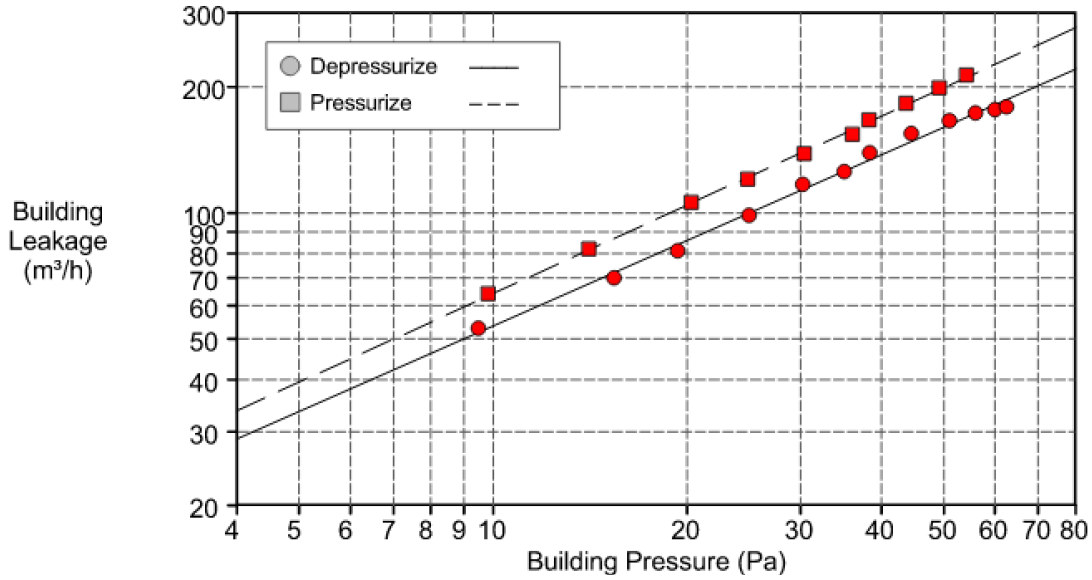
AIRTIGHT CONCEPT

FLOOR	Concrete Foundation and floor slab
EXTERNAL WALLS	SIP's panels with EPS insulation
ROOF/CEILING	SIP's panels with EPS insulation

CONNECTION DETAILING FOR AIRTIGHT CONCEPT

CONNECTION FROM/TO	CEILING/ROOF	EXTERNAL WALL	FLOOR	WINDOWS/DOORS
CEILING/ROOF		Formance SIP tape		
EXTERNAL WALL	Formance SIP tape	Formance SIP tape	Formance SIP tape	Formance SIP tape with sealant
FLOOR		Formance SIP tape		Formance SIP tape with sealant
WINDOWS/DOORS		Formance SIP tape with sealant	Formance SIP tape with sealant	

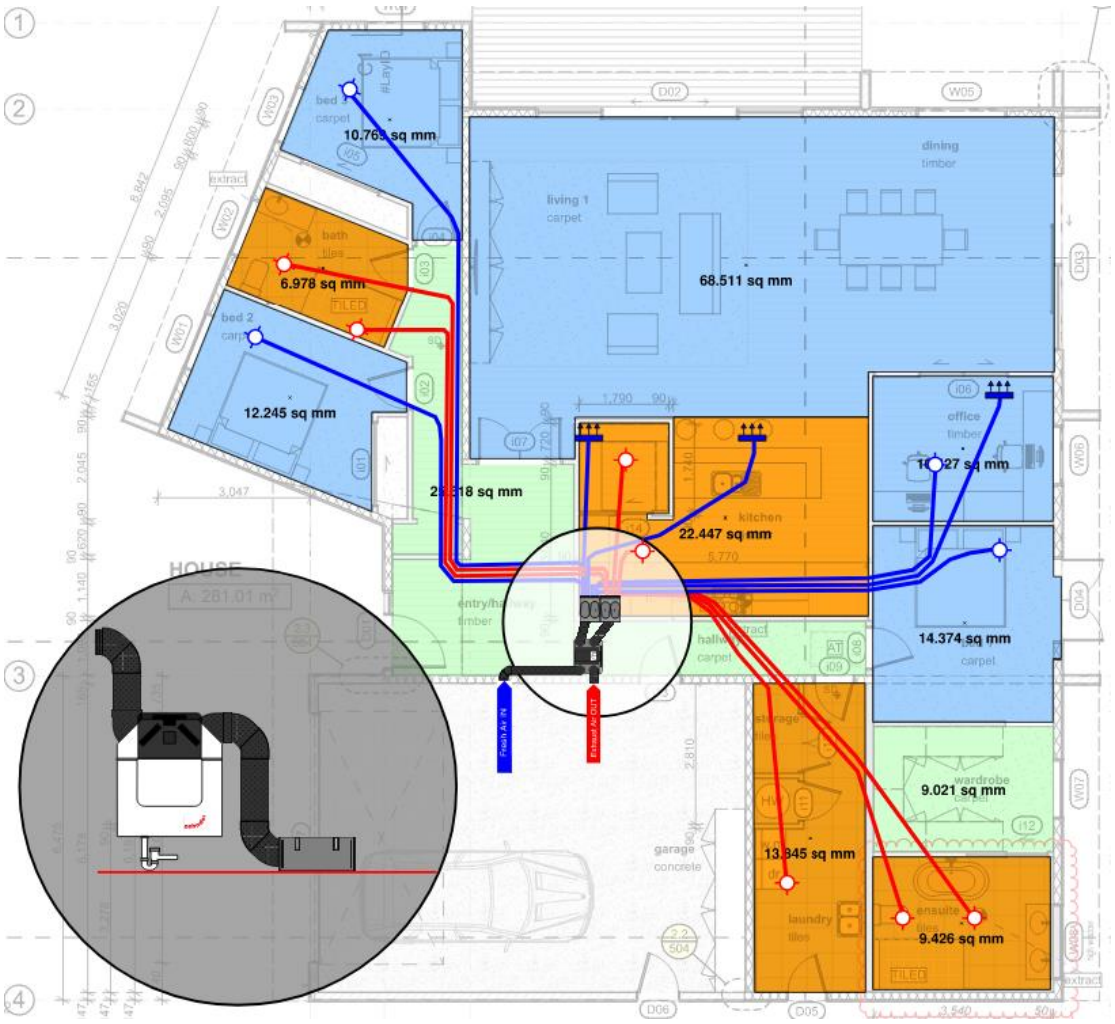
Building leakage graph from Blower Door Test:



10. VENTILATION SYSTEM

The Zehnder Comfoair 350 balanced ventilation with heat recovery is installed inside the building envelope in the attic space above the kitchen. The distribution ducting is installed in the ceiling cavity, see graphic below for distribution arrangement.
The heat recovery efficiency was calculated to be at 84% at an electric efficiency of 0.29Wh/m^3.

11. VENTILATION DISTRIBUTION



Internal doors are undercut to allow circulation of air while the doors are shut.

12. HEATING

A 3.4 kW Daikin air-to-air heat pump was installed to boost potential peak demand during winter. Model Nexura FVXG25K2V1B (indoor unit) RXG25L2V1B (outdoor unit).

13. DOMESTIC HOT WATER

The Stiebel Eltron WWK 22H Hot water heat pump was installed external of the building with insulated supply ducting into the building.

Installing the hot water unit outside the thermal envelope means there are significant losses for storage and distribution. Storage losses accounting for 38% and distribution 13% of the total energy demand for domestic hot water, despite the insulation around the tank.

14. BUILDING COST

Construction costs

Including site development, construction, building services, appurtenant structures, additional costs including Architect, surveyor, Geotech, Engineers, landscaping, external louvres, all flooring, blinds, all kitchen appliances, laundry appliances, heat pump and water heater and some furnishing:

NZD $1,642,255 which equates to **5188 €/m^2**

Building structure costs

Including construction and building services & kitchen units:

NZD $1,211,368 which equates to **3775 €/m^2**