KOWHAI HOUSE, Dunedin, New Zealand

1 PHOTOGRAPHS OF THE FRONT VIEW OF THE BUILDING

1.1. BUILDING DATA

Year of Construction	2017	Space Heating	15 kWh(m2a)
U-Value Walls	0.147 W/(m2K)		
U-Value Floor	0.184 W/(m2K)	Primary Energy Renewable	48 kWh/(m2a)
U-Value Roof	0.116 W/(m2K)	Generation of renewable energy	0 kWh/(m2a)
U-Value Windows	0.87 W/(m2K)	Non-renewable Primary Energy	107 kWh/(m2a)
Heat Recovery	82.5%	Pressure test n50	0.13 h-1
Special Features			

1.2. BRIEF DESCRIPTION OF CONSTRUCTION TASK

This house was designed and energy modelled by Rafe Maclean for the use of his own family. The site is steep so a structure on piles is used to navigate the difficult terrain.

Site access was poor, so a prefabricated SIPS panel construction was adopted to quicken the time on site. Windows were fabricated locally. It was the first Passive House constructed by the builders.

1.3 RESPONSIBLE PROJECT PARTICIPANT, CERTIFICATION ID, PASSIVE HOUSE DATABASE ID, NAME AND SIGNATURE OF THE AUTHOR OF THE PROJECT DOCUMENTATION

ARCHITECT: Rafe Maclean Architects Ltd

IMPLEMENTATION PLANNING: Rafe Maclean Architects Ltd

BUILDING SYSTEMS: Fantech NZ Ltd

STRUCTURAL ENGINEERING: Ezed Ltd

BUILDING PHYSICS: Rafe Maclean Architects Ltd

PASSIVE HOUSE PROJECT PLANNING: Rafe Maclean Architects Ltd

CERTIFYING BODY: Jason Quinn, Sustainable Engineering Ltd

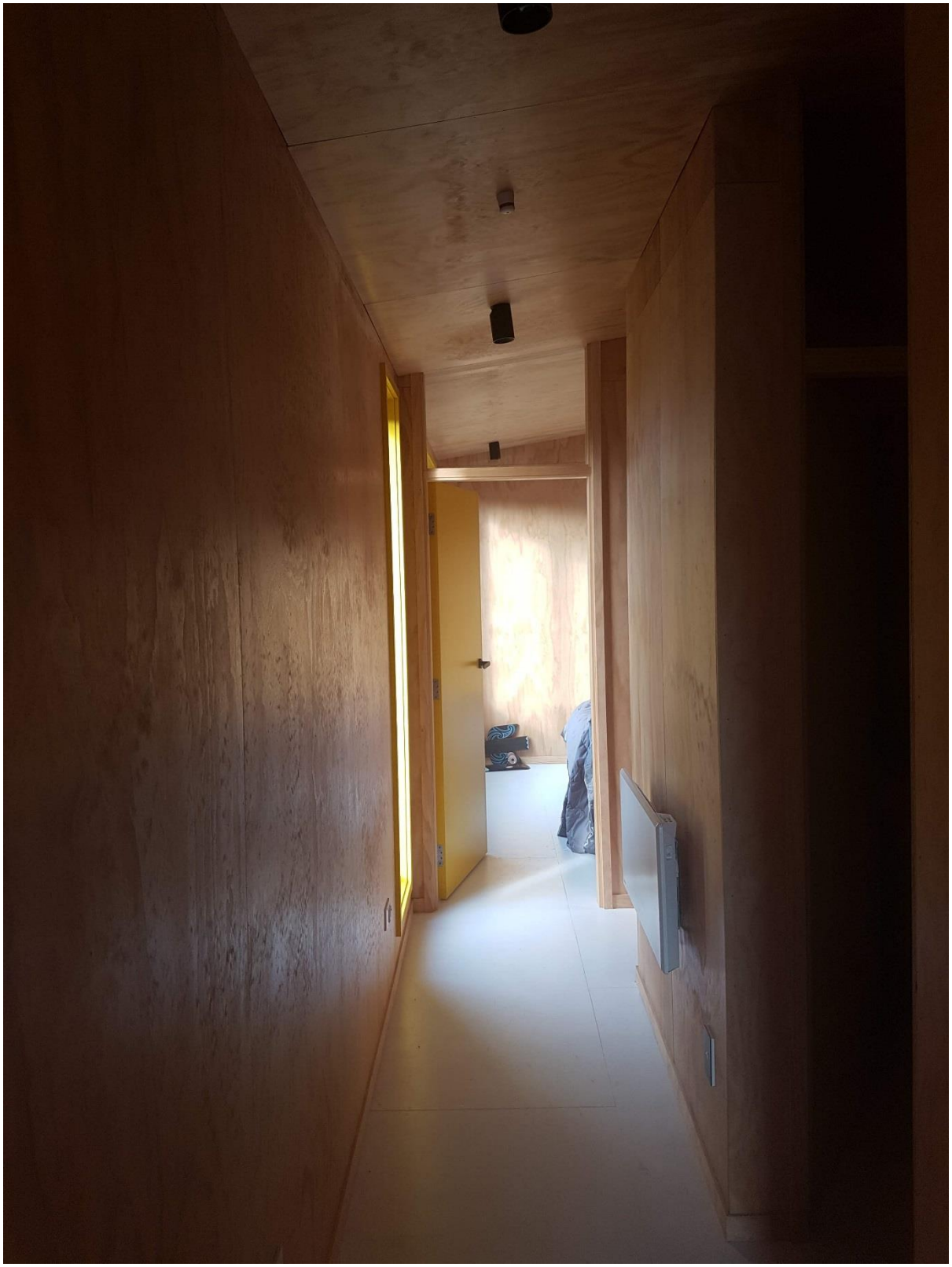
CERTIFICATE ID: 18391_SENZ_PH_20180625_JEQ

PASSIVE HOUSE DATA BASE ID: 5662

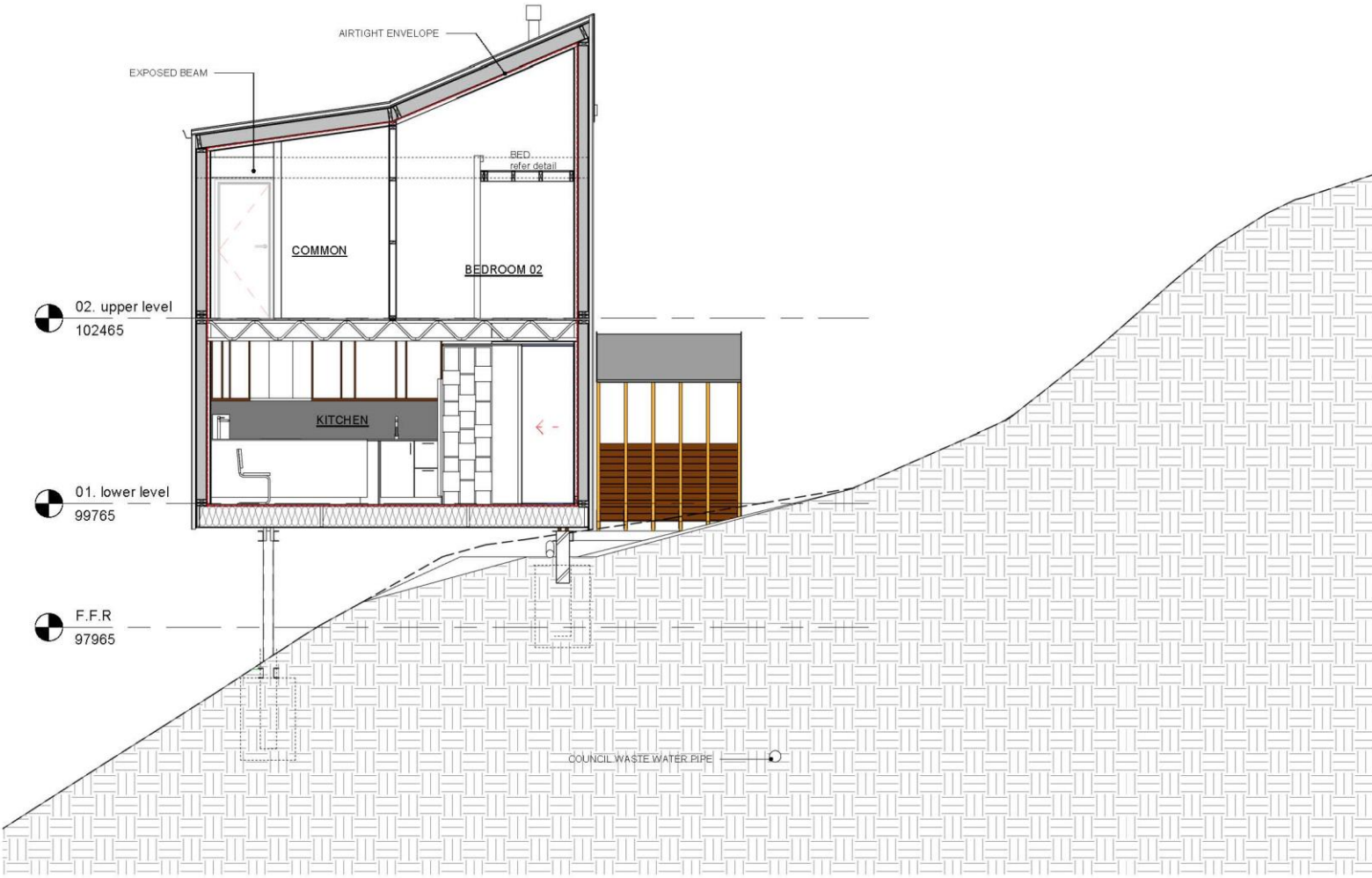
AUTHOR OF DOCUMENTATION: Rafe Maclean

SIGNATURE:
DATE: 20 August 2018.

2.0 Photographs of views from all accessible sides and example photograph of the Inside



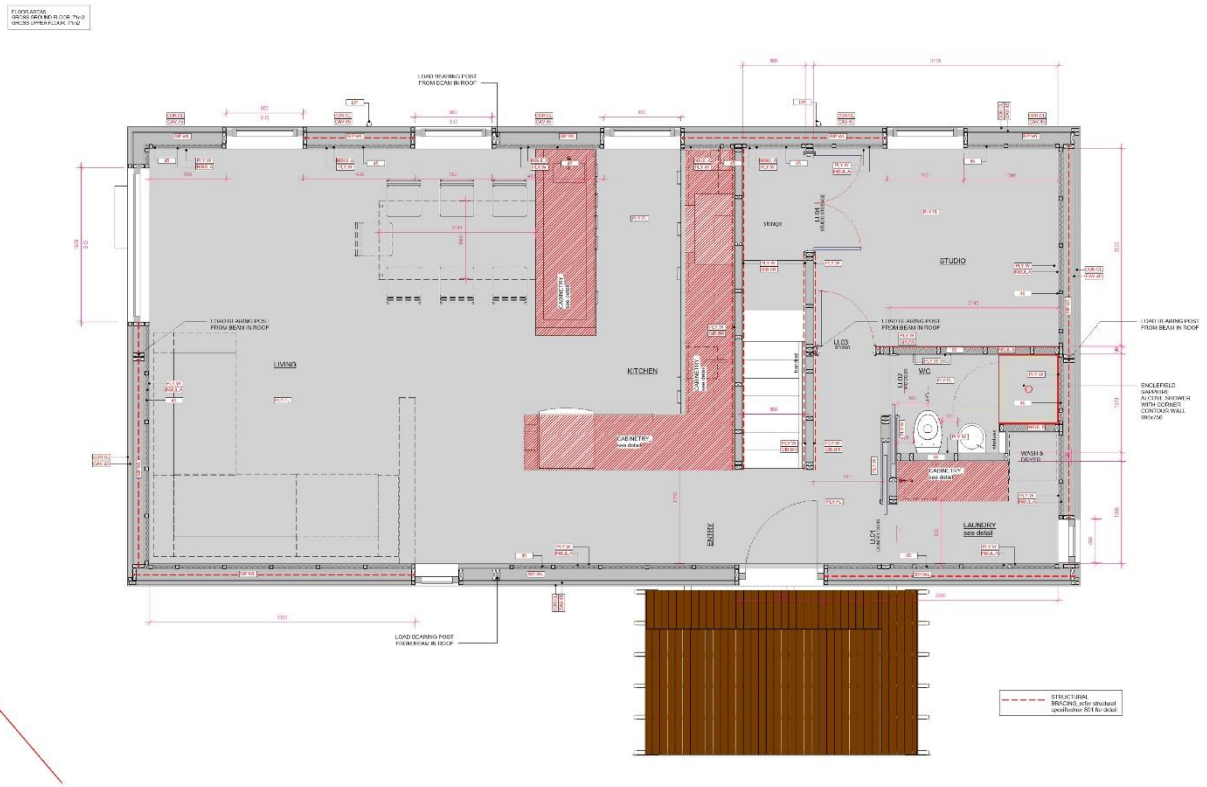
1.2 Sectional drawing

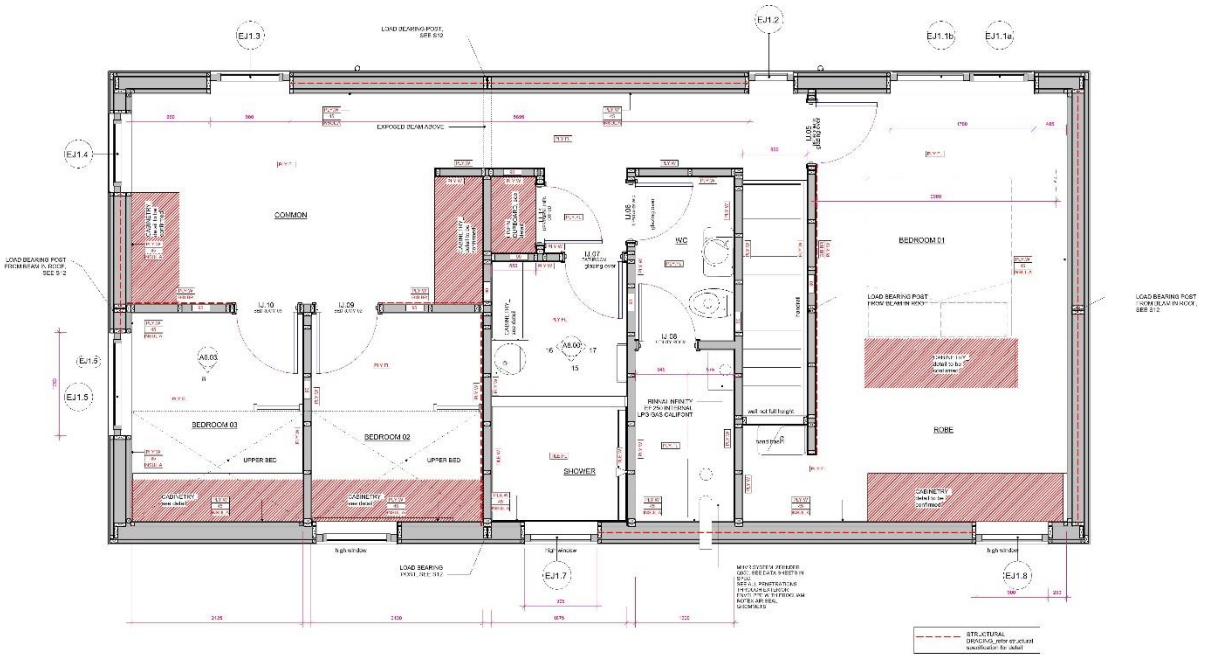


The section drawing show the house on steel piles, with a small strip foundation on the upper slope side. Insulated floor joists sit on the steel beams. Structurally Insulated Panels (SIPs) wall panels, an inter-floor truss joist system (exposed) and upper level wall SIPs panels with roof SIPs panels. The SIPs wall and wall panels and the ground floor ply flooring form the airtightness layer.

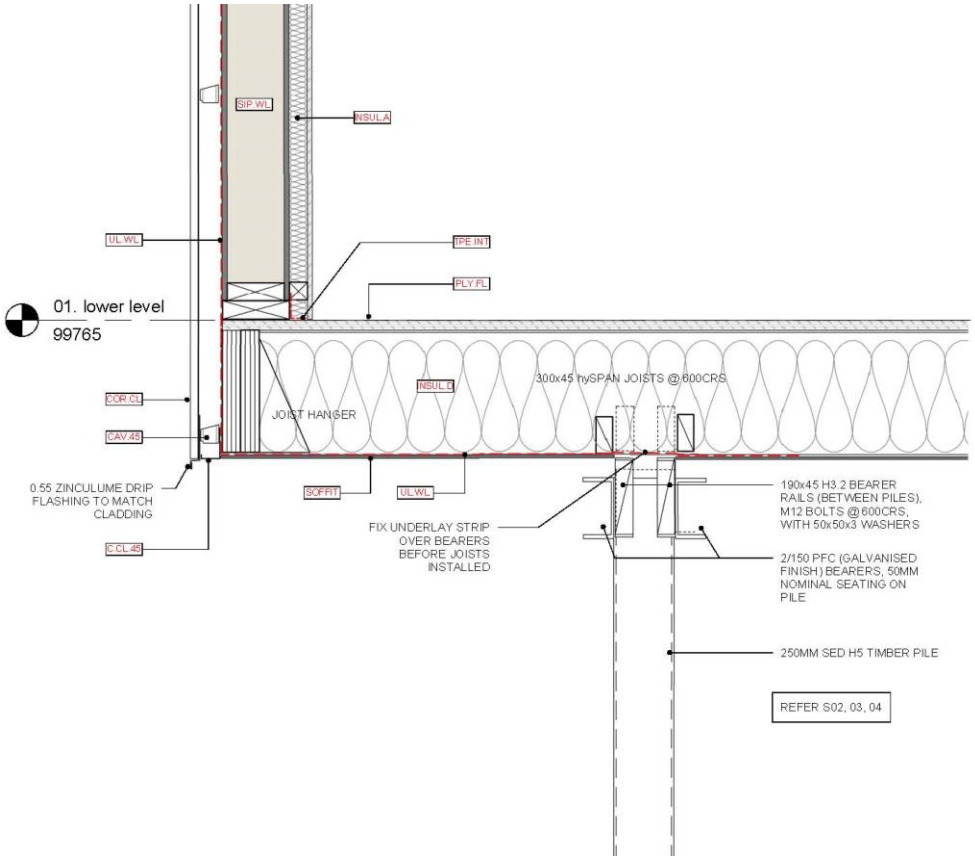
On the ground floor is the entry, living, dining, kitchen, studio, bathroom and laundry. On the upper floor is the 3 bedrooms, utility room, bathroom and WC.

1.3. Floor plans





DESCRIPTION OF THE CONSTRUCTION OF THE FLOOR SLAB/BASEMENT CEILING INCLUDING INSULATION

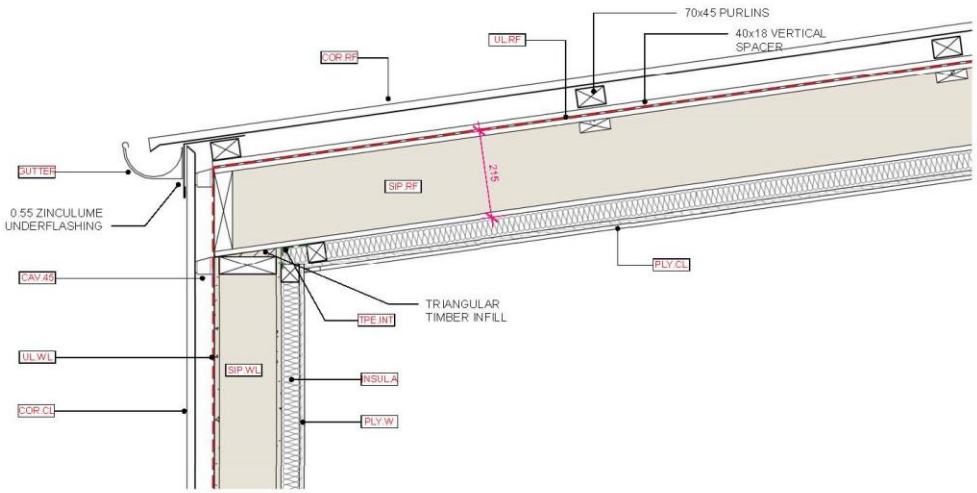


Timber floor joists span on top of steel beams. The timber joists are separated from the steel beams with a timber packer. Wool insulation is used between the joists (lambda value: 0.053W/mK). The airtightness layer is formed by the plywood flooring which was sealed around the edges when laid.

1.4. DESCRIPTION OF THE CONSTRUCTION OF EXTERIOR WALLS

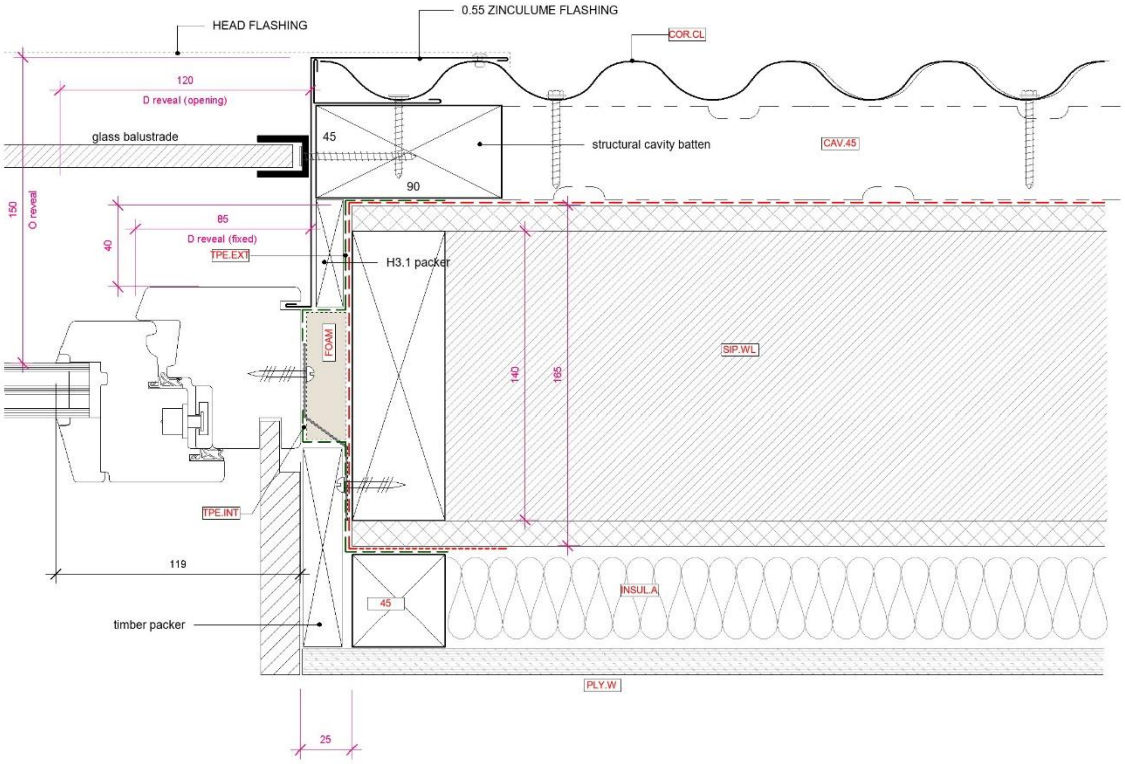
The exterior walls are 165mm Structurally Insulated Panels (core 0.025W/mK) prefabricated locally. They are fixed to the floor joists as per the detail above. Ventilated cavity battens are fixed to the exterior face, and an insulated service cavity (45mm wool insulation 0.042W/mK) is installed to the interior face.

1.5. DESCRIPTION OF CONSTRUCTION OF THE ROOF INCLUDING INSULATION



The roof is 215mm Structurally Insulated Panels (core 0.025W/mK) prefabricated locally. They are fixed to the top of the walls. Roof purlins exterior face, and an insulated service cavity (45mm wool insulation 0.042W/mK) is installed to the interior face.

1.6. DESCRIPTION OF THE WINDOW SECTIONS

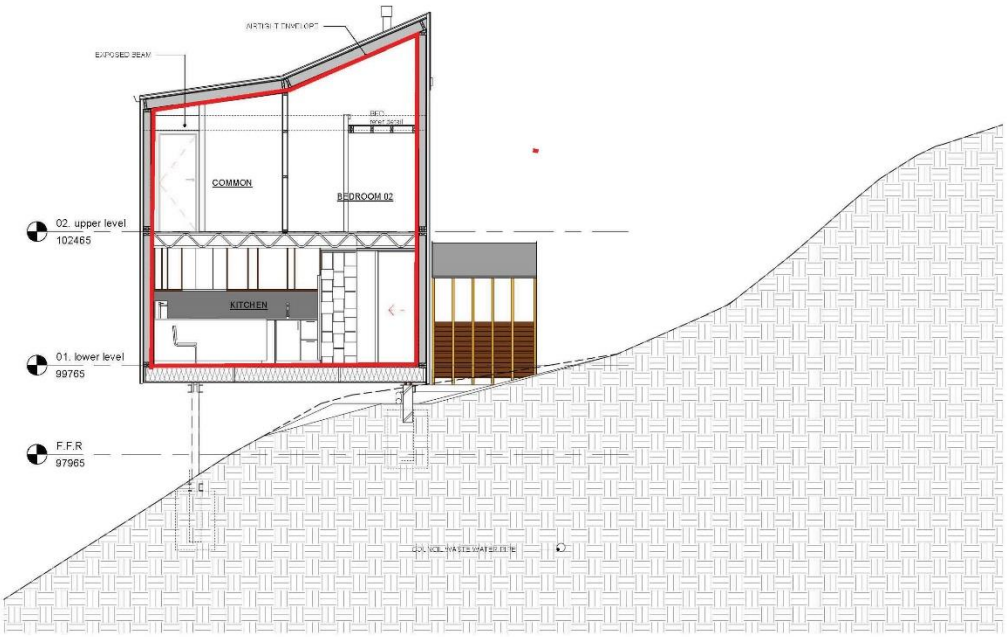


The Windows are european larch timber, and prefabricated locally by Thermadura (Natureline 90). They are fixed with steel fixing tabs. Proclima tape seals the exterior gaps around the window, foam insulation is inserted into the gaps, then Proclima airtightness tape seals the inside perimeter.

Uf: 1.11 W/m2K
Ug: 0.52 W/m2K & 0.55 W/m2K
g value: 0.53 & 0.52
glazing type: Isophon Glas EN2plus (4:/20/4/20/:4 90% Ar), & Isophon Glas EN2plus (6:/18/6/16/:6 90% Ar)

1.7. DESCRIPTION OF THE AIRTIGHT ENVELOPE & PRESSURE TEST RESULT

The airtightness envelope is formed by the SIPs panels, windows and plywood floor. The first airtightness test check was done during construction presented a test result of 0.16 n50/-1. The final airtightness test produced 0.13 n50/-1. This was a very good outcome resulting from very careful attention to taping from the builders.


EXPOSED BEAM
COMMON
BEDROOM 02
KITCHEN
02. upper level
102465
01. lower level
99765
F.F.R
97965

1.8.

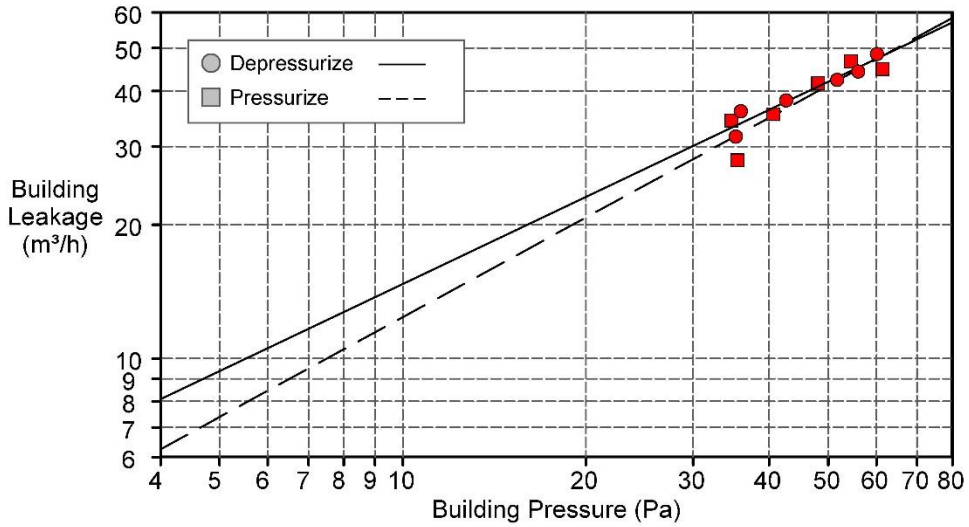
BUILDING LEAKAGE TEST

architype
architects+designers

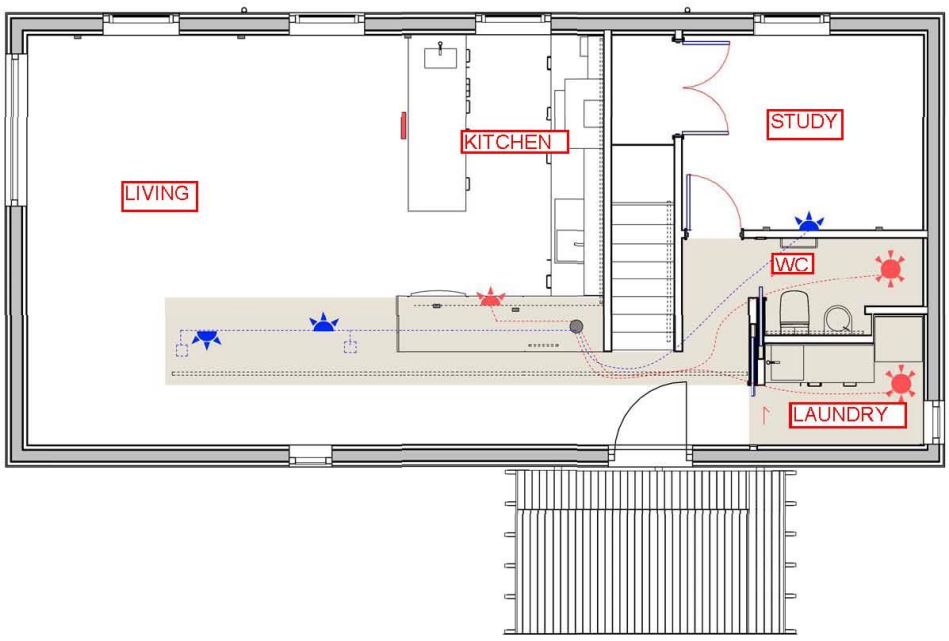
Date of Test: 15/02/2018		Technician:	Sam Parish
Test File: Kowhai A Test - Depressurization & Pressurisatio		Project Number:	
Customer:	Rafe Maclean Kowhai House 40 Braeview Crescent Maori Hill Dunedin, Otago 9010 Phone: Fax:	Building Address:	Kowhai House 40 Braeview Crescent Maori Hill Dunedin, Otago 9010

	Depressurization	Pressurization	Average
Test Results at 50 Pascals:			
V50: m³/h Airflow	42 (+/- 5.6 %)	41 (+/- 12.1 %)	42
n50: 1/h (Air Change Rate)	0.13	0.12	0.13
w50:			
q50:			
Leakage Areas:			
Canadian EqLA @ 10 Pa (cm²)	16.4 (+/- 38.1 %)	13.8 (+/- 76.2 %)	15.1
LBL ELA @ 4 Pa (cm²)	8.7 (+/- 60.6 %)	6.7 (+/- 122.0 %)	7.7
Building Leakage Curve:			
Air Flow Coefficient (Cenv) m³/(h·Paⁿ)	3.3 (+/- 94.8 %)	2.2 (+/- 191.5 %)	
Air Leakage Coefficient (CL) m³/(h·Paⁿ)	3.3 (+/- 94.8 %)	2.2 (+/- 191.5 %)	
Exponent (n)	0.652 (+/- 0.247)	0.746 (+/- 0.503)	
Correlation Coefficient	0.96460	0.89947	

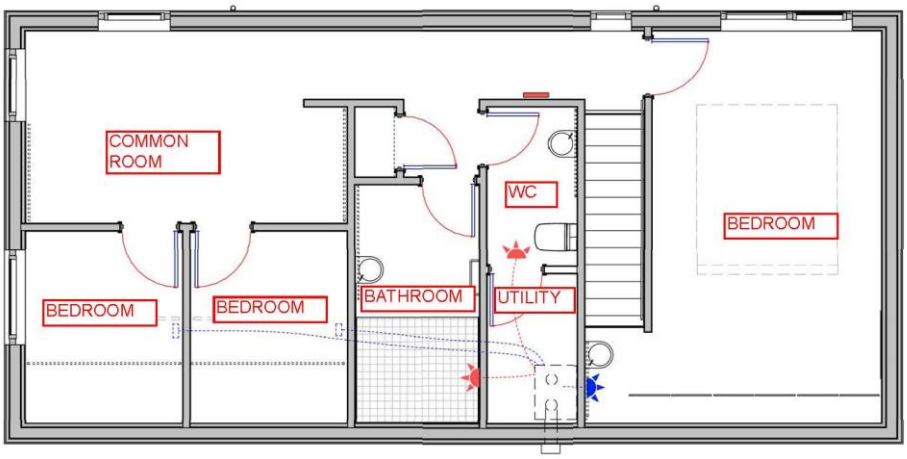
Test Standard:	EN 13829
Test Mode:	Depressurization and Pressurization
Type of Test Method:	A
Regulation complied with:	PassivHaus n50 ≤ 0.6 1/h



1.9. DESCRIPTION OF THE PLANNING OF VENTILATION DUCTWORK



LOWER FLOOR DUCT PLAN



UPPER FLOOR DUCT PLAN

The ducts for the ventilation are all concealed, are all 75mm dia Zehnder ductwork. Transfer between supply and extract is via a 15mm undercut to the doors. (Blue supply and red exhaust ducts.)

1.10. DESCRIPTION OF THE PLANNING OF THE CENTRAL UNIT

The Ventilation unit is a Zehnder Q350 unit. The insulated duct lines to the exterior are kept as short as possible.
Zehnder Q350 has a specific power input: 0.24Wh/m3 and a product heat recovery rate of 90%.

1.11. DESCRIPTION OF THE HEAT SUPPLY SYSTEM

The heating is supply by a direct electricity panel heater (1kW)

1.12. BRIEF DOCUMENTATION OF PHPP RESULTS

Passive House Verification

Building:	Kowhai House
Street:	[redacted]
Postcode/City:	9010 Dunedin
Province/Country:	Otago NZ-New Zealand
Building type:	New house
Climate data set:	NZ0013a-Dunedin
Climate zone:	4: Warm-temperate Altitude of location: 99.7 m
Home owner / Client:	Rafe Maclean & Michelle Mitchell
Street:	[redacted]
Postcode/City:	9382 Wanaka
Province/Country:	Otago NZ-New Zealand

Architecture:	Rafe Maclean Architects Ltd
Street:	83d Blackpeak Road
Postcode/City:	9382 Wanaka
Province/Country:	Otago NZ-New Zealand
Energy consultancy:	Rafe Maclean Architects Ltd
Street:	83d Blackpeak Road
Postcode/City:	9382 Wanaka
Province/Country:	Otago NZ-New Zealand
Mechanical engineer:	Fantech (NZ) Ltd
Street:	7 Lovell Ct
Postcode/City:	632 Auckland
Province/Country:	NZ-New Zealand
Certification:	Jason E Quinn, Sustainable Engineering Ltd
Street:	76 Virginia Rd
Postcode/City:	4500 Whanganui
Province/Country:	Whanganui NZ-New Zealand

Year of construction:	2017	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	1	Internal heat gains (IHG) heating case [W/m²]:	2.5	IHG cooling case [W/m²]:	2.5
No. of occupants:	2.6	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

				Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area m²	116.6				
Space heating	Heating demand kWh/(m²a)	15.4	≤	15	-	yes
	Heating load W/m²	8.2	≤	-	10	
Space cooling	Cooling & dehum. demand kWh/(m²a)	-	≤	-	-	-
	Cooling load W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C) %	7.8	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg) %	0	≤	20		yes
Airtightness	Pressurization test result n_{50} 1/h	0.1	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)	107	≤	-		-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	48	≤	60	60	yes
	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	Jason	Quinn	

Certificate ID	Issued on:	City: