Project Documentation
Gebäude-Dokumentation

Abstract | Zusammenfassung

Dunedin City Council Community Housing - West

Data of building | Gebäudedaten

Year of construction Baujahr	2022	**Space heating** **Heizwärmebedarf**	**17** **kWh/(m²a)**
U-value external wall U-Wert Außenwand	0.183 W/(m²K)		
U-value basement U-Wert Kellerdecke	N/A W/(m²K)	Primary Energy Renewable (PER) Erneuerbare Primärenergie (PER)	70 kWh/(m²a)
U-value roof U-Wert Dach	0.102 W/(m²K)	Generation of renewable Energy Erzeugung erneuerb. Energie	0 kWh/(m²a)
U-value window U-Wert Fenster	0.91 W/(m²K)	Non-renewable Primary Energy (PE) Nicht erneuerbare Primärenergie (PE)	155 kWh/(m²a)
Heat recovery Wärmerückgewinnung	81 %	Pressurization test n_{50} Drucktest n_{50}	0.6 h^{-1}

Special features
Besonderheiten

Single cylinder heat pump hot water and ring main system used to supply the 5 units that make up this building and another 5 units in the adjacent building.

Einzylinder-Wärmepumpen-Warmwasser- und Ringleitungssystem zur Versorgung der 5 Einheiten, aus denen dieses Gebäude besteht, und weiterer 5 Einheiten im angrenzenden Gebäude.

Brief Description

Dunedin City Council Community Housing - West

This building is half of a set of twin buildings that form the School Street community housing project. The project commenced on site in November 2019, was completed in July 2022 and achieved certification in December 2022.

The project was designed for the Dunedin City Council (DCC) who were looking to replace the existing social housing units which had fallen into disrepair. The council wanted to provide comfortable accommodation for pensioners with a specific aim to reduce energy use costs to assist the tenants who would typically be living on limited means. The building consists of five fully accessible one-bedroom units, mirrored across their intertenancy walls. The building is located on an L-shaped site in a valley with private outdoor living spaces to the North-West and a communal garden to the South-East. The main street frontage is to the South-West though there is an access road that bounds the site to the North-East.

The building is constructed of structural insulated panels walls on an insulated raft foundation with a traditional timber truss roof. The windows are timber/aluminium composite manufactured in NZ to a European design with triple glazing. All units in the building share a single heat pump hot water cylinder with an insulated ring main and metering system to measure proportion of hot water used and bill accordingly.

Kurzbeschreibung

Gemeindewohnungen des Stadtrats von Dunedin – West

Dieses Gebäude ist die Hälfte einer Reihe von Zwillingsgebäuden, die das Gemeinschaftswohnprojekt School Street bilden. Das Projekt startete im November 2019 vor Ort, wurde im Juli 2022 abgeschlossen und erhielt im Dezember 2022 die Zertifizierung.

Das Projekt wurde für den Dunedin City Council (DCC) konzipiert, der die bestehenden, verfallenen Sozialwohnungen ersetzen wollte. Der Rat wollte Rentnern eine komfortable Unterkunft bieten, mit dem besonderen Ziel, die Energieverbrauchskosten zu senken, um den Mietern zu helfen, die normalerweise nur über begrenzte Mittel verfügen. Das Gebäude besteht aus fünf vollständig zugänglichen Ein-Zimmer-Einheiten, die sich an den Wänden zwischen den Mietwohnungen widerspiegeln. Das Gebäude befindet sich auf einem L-förmigen Grundstück in einem Tal mit privaten Außenwohnräumen im Nordwesten und einem Gemeinschaftsgarten im Südosten. Die Hauptstraßenfront liegt im Südwesten, obwohl es eine Zufahrtsstraße gibt, die das Grundstück im Nordosten begrenzt.

Das Gebäude besteht aus strukturell isolierten Paneelwänden auf einem isolierten Floßfundament mit einem traditionellen Holzfachwerkdach. Bei den Fenstern handelt es sich um in Neuseeland hergestellte Holz-/Aluminium-Verbundfenster nach europäischem Design mit Dreifachverglasung. Alle Einheiten im Gebäude nutzen einen einzigen Wärmepumpen-Warmwasserspeicher mit isolierter Ringleitung und einem Messsystem, um den Anteil des verbrauchten Warmwassers zu messen und entsprechend abzurechnen.

Responsible project participants
Verantwortliche Projektbeteiligte

Architect Entwurfsverfasser	Architype Ltd. www.architype.co.nz
Implementation planning Ausführungsplanung	Architype Ltd. www.architype.co.nz
Building systems Haustechnik	High Performance Building Services Ltd.
Structural engineering Baustatik	Structural Engineering Design Solutions www.seds.co.nz
Building physics Bauphysik	Architype Ltd. www.architype.co.nz
Passive House project planning Passivhaus-Projektierung	Architype Ltd. www.architype.co.nz
Construction management Bauleitung	Stevenson & Williams Ltd www.stevwill.co.nz

Certifying body
Zertifizierungsstelle

Sustainable Engineering Ltd
www.sustainableengineering.co.nz

Certification ID
Zertifizierungs ID

7135

Project-ID (www.passivehouse-database.org)
Projekt-ID (www.passivhausprojekte.de)

Author of project documentation
Verfasser der Gebäude-Dokumentation

Sam Parish

Date Datum	Signature Unterschrift
9/06/2023	

1. Exterior photos - Ansichtsfotos

North Elevation

East Elevation

West Elevation

South & West Elevations

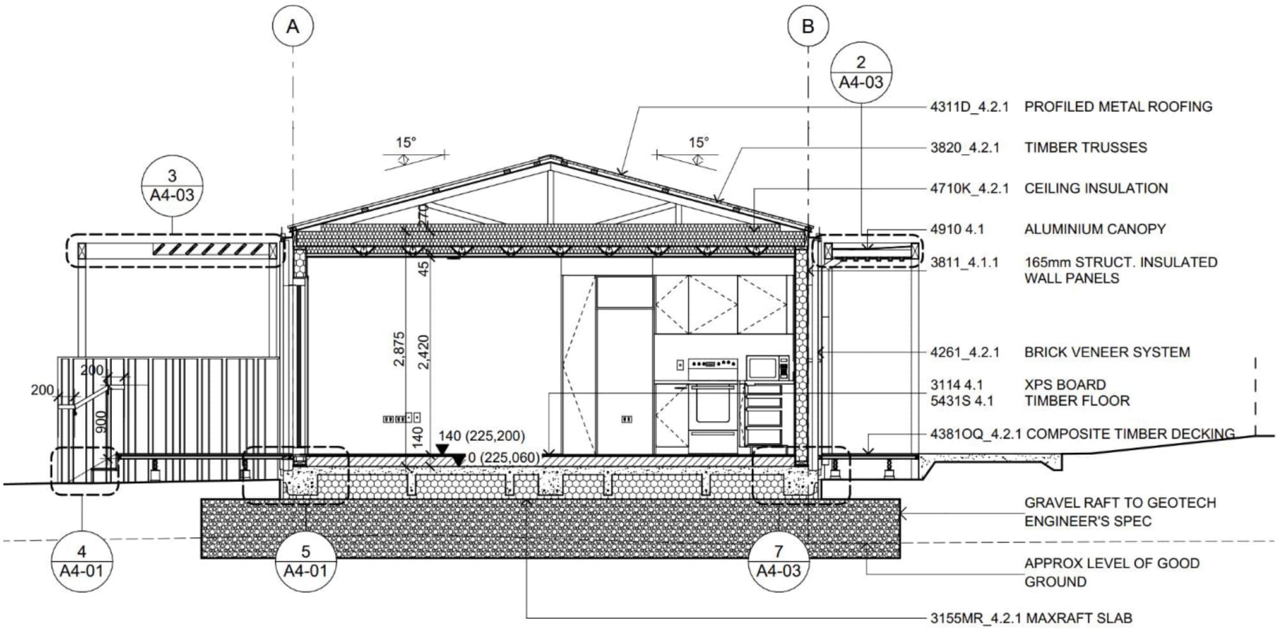
2. Interior photos - Innenfoto exemplarisch

Photo of main living space

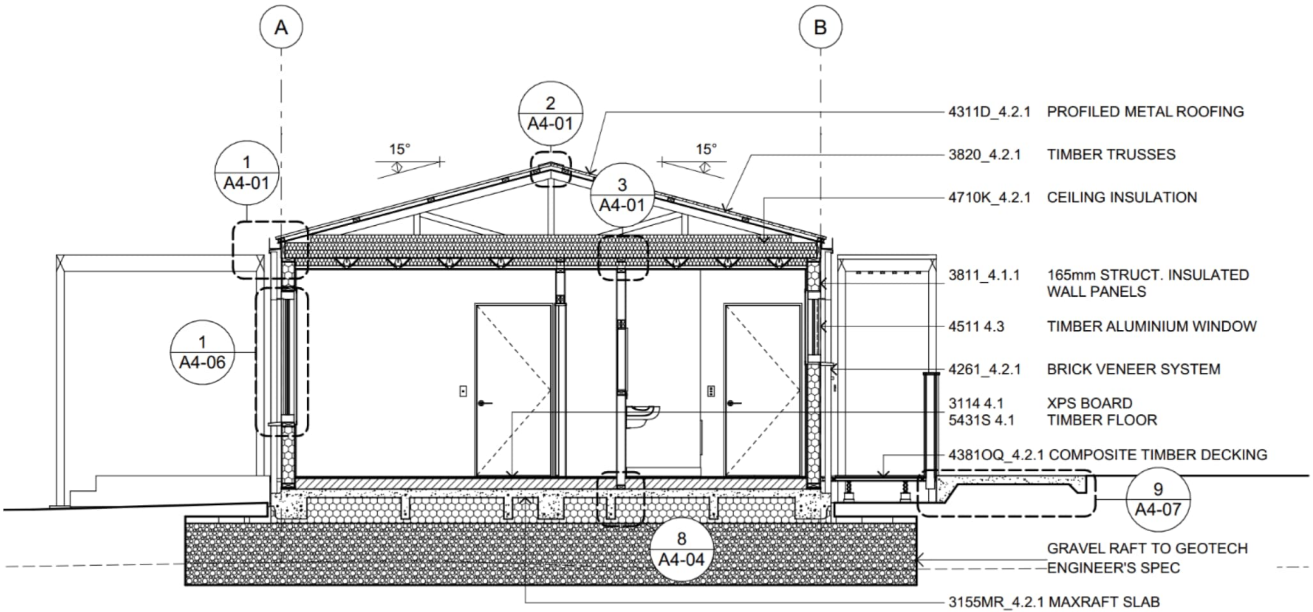
Photo of typical bedroom

Photo of typical bedroom

3. Sections - Schnittzeichnung

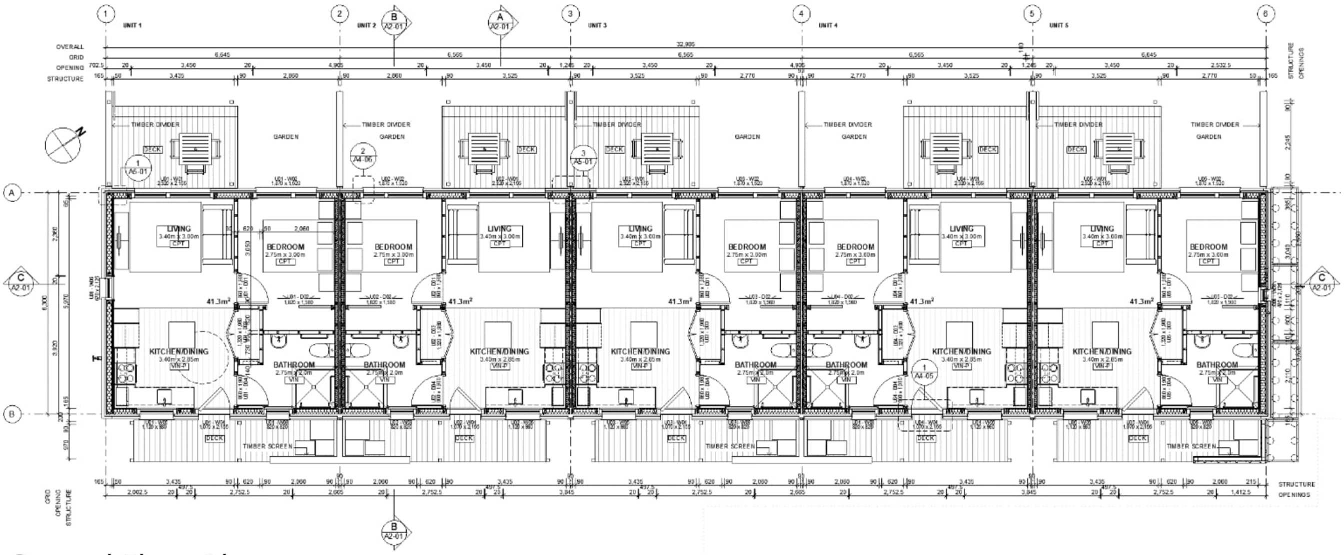


Section A-A



Section B-B

4. Floor plans - Grundrisse



Ground Floor Plan

5. Floor slab/ basement ceiling construction including insulation Konstruktion der Bodenplatte

Due to the poor nature of the ground in a land slip area, the floor slab needed to be provided with very deep fins and perimeter beams. The brick veneer wall cladding also needed to be structurally supported and attached to the perimeter footing to prevent differential separation so an internal insulation strategy of 120mm XPS adhesive fixed to the top of the 100mm reinforced concrete slab was chosen. This provides the benefit of isolating the exposed concrete foundations from the heated space.

The slab was also insulated and isolated from the ground though this was more from a buildability viewpoint as the preformed EPS formwork allowed for an easier setup and pour whilst also mildly increasing the performance of the slab overall. Only the XPS was considered for the PHPP though the insulated footing was allowed for in the perimeter thermal bridge.

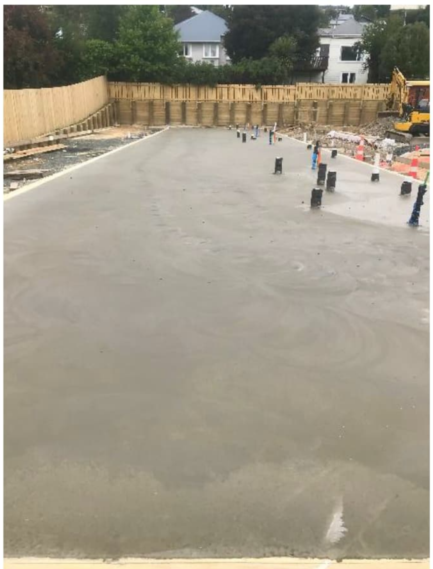
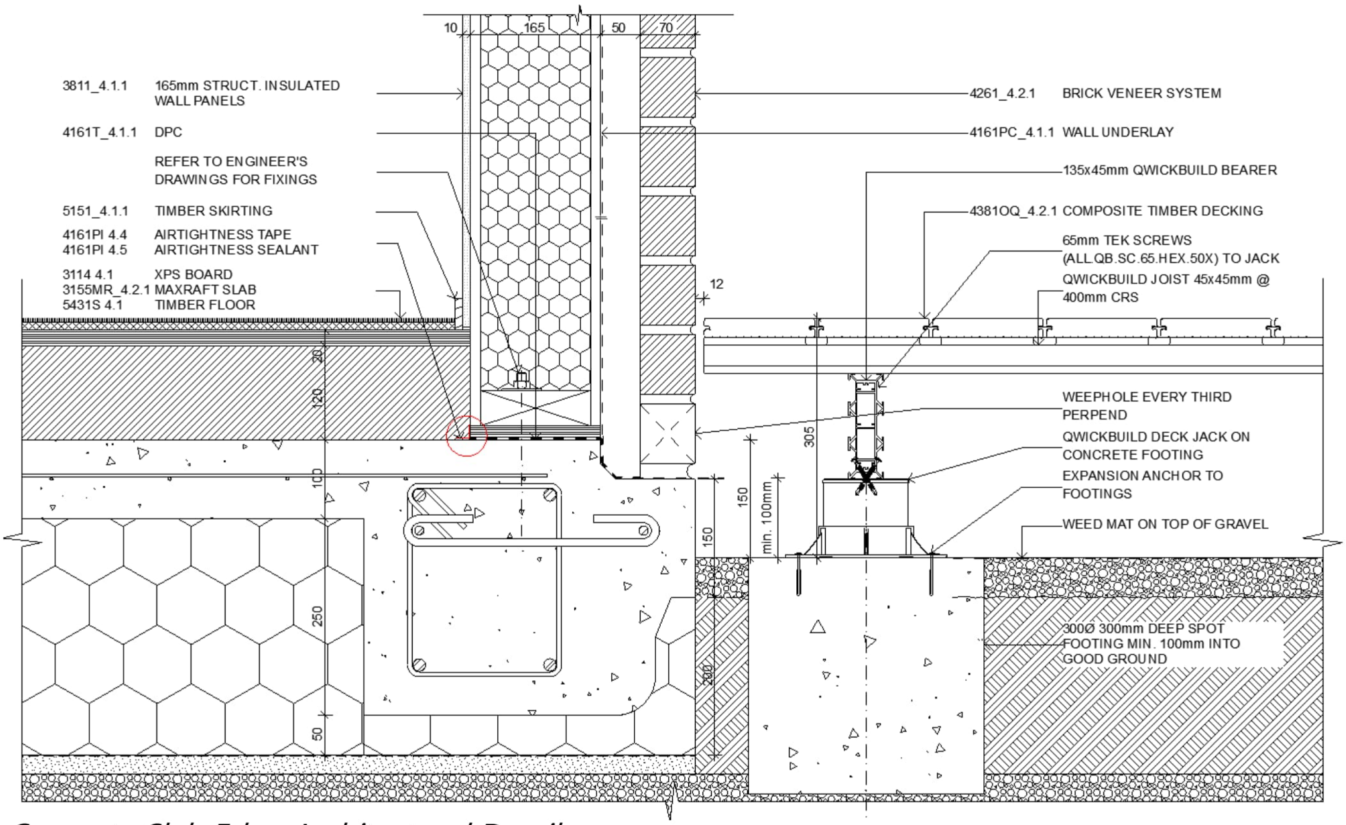


Photo: Slab Reinforcing

Photo: Slab Topping

Photo: Over Slab Insulation



Concrete Slab Edge Architectural Detail

Assembly no.			Interior insulation?
03ud	**Ground Floor Slab**		

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]
OSB	**0.130**					**20**
Goldfoam XPS	**0.028**					**120**

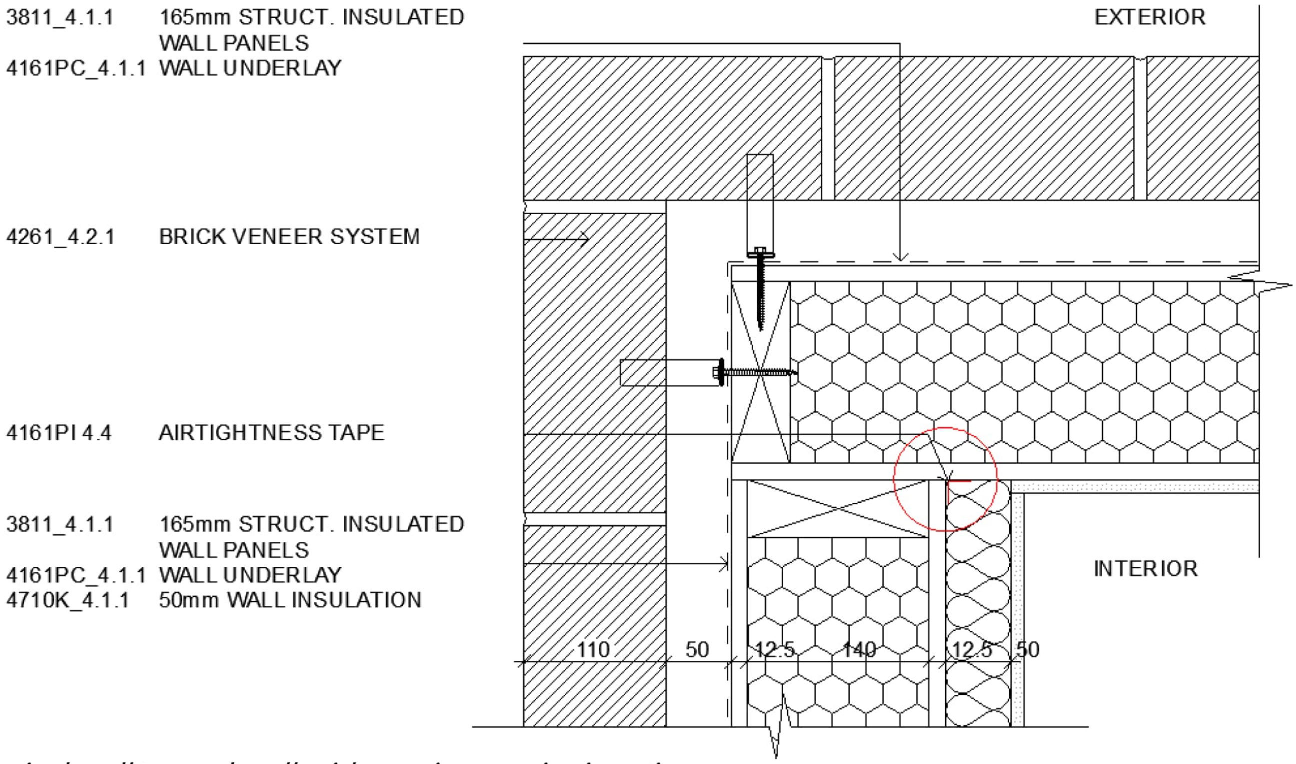
Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			**14.0** cm

PHPP floor slab build-up

6. Wall construction including insulation - Konstruktion der Außenwände

The walls were typically constructed of 165mm structural insulated panels (SIPs) with Polyisocyanurate (PIR) foam core. The SIP had a total thickness of 165mm with 12.5mm OSB either side of the core. The SIP panels have a cam locking system for joining allowing for minimal timber thermal bridging. This wall was supplemented with an insulated service cavity at each end of the block to reduce the additional heat loss that the end apartments would have compared to the central apartments with only two external walls.

The SIP was taped to the concrete floor and formed an integral part of the air tightness strategy. These were lined internally with 10mm plasterboard and services were designed to be kept away from the external walls, limited to internal and intertenancy walls only.



Typical wall to end wall with services cavity junction.

Assembly no.	Building assembly description	Interior insulation?
01ud	165mm SIP Wall	

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]
OSB	0.130					13
PU_NZSIPFoamCoreAgedHFC365	0.025	Timber Plates	0.130			140
OSB	0.130					13
Plasterboard	0.160					10
Percentage of sec. 1	95%	Percentage of sec. 2	5.0%	Percentage of sec. 3		Total 17.5 cm

U-value supplement W/(m²K)

U-value: 0.191 W/(m²K)

Typical SIP wall build-up

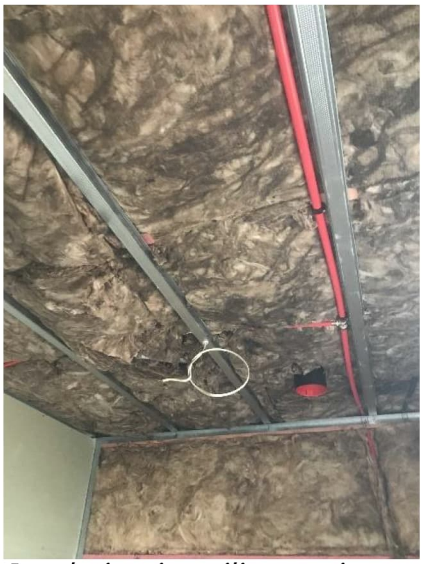
Installation of SIP External Walls

7. Roof construction including insulation - Konstruktion des Daches

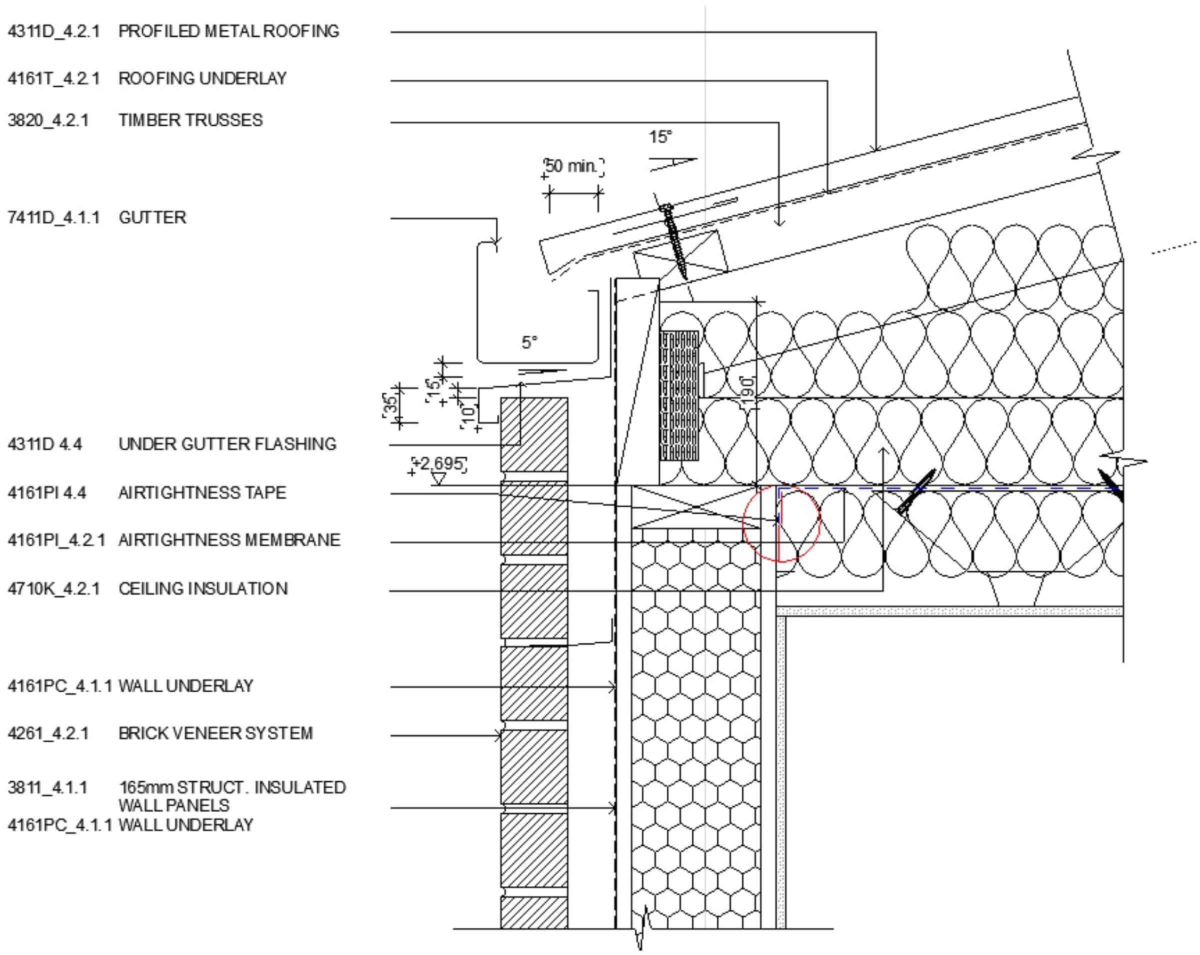
The roof was constructed with traditional timber frame roof trusses with insulation between and over the lower chord of the truss and a cold roof space above. four layers of 90mm glass wool batts formed most of the roof insulation with a reduction to three layers at the eaves where four were not possible. Each layer was staggered to minimise gaps between layers and the final layer was located inside the air tightness membrane in the ceiling cavity to maximise use of the available height.

Insulation installation

Insulation between trusses



Insulation in ceiling cavity



Roof edge to external wall junction showing minimal area of reduced insulation

Assembly no.							Interior insulation?
04ud	Ceiling 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]
GlassfibreKnaufWallR2.6 @90mm	0.035	Timber trusses	0.130			90
GlassfibreKnaufWallR2.6 @90mm	0.035			Timber trusses	0.130	90
GlassfibreKnaufWallR2.6 @90mm	0.035	Timber trusses	0.130			180
Percentage of sec. 1	95%	Percentage of sec. 2	1.0%	Percentage of sec. 3	4.0%	Total 36.0 cm

U-value supplement: W/(m²K)

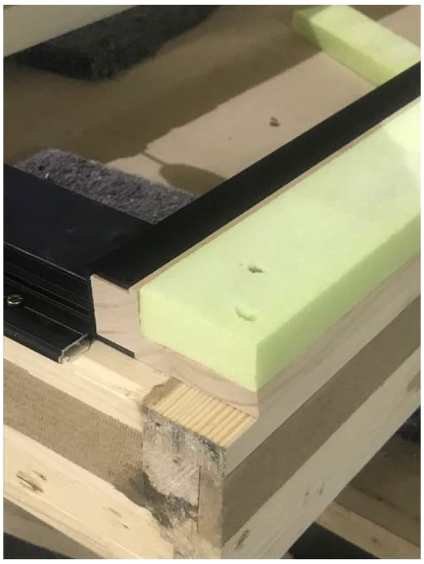
U-value: 0.098 W/(m²K)

Typical roof insulation build-up

8. Window and window installation including glass Ug / g-value and frame perfromance - Fenster und Fenster-Einbau

The windows specified for this project were the SEDA Smartwin aluminium/timber composite windows. These frames were selected due to there price competitiveness and excellent performance with a typical U_f of between 0.53 W/m2.K and 0.71 W/m2.K. Unfortunately, the supplier went into administration with only the frames mostly complete. Thankfully the main contractor had an experienced joinery team who were able to complete the manufacture of the windows to the original specification with some minor alterations due to availability of local materials.

Windows supplied with timber insulation



Windows completed with XPS insulation and aluminium frames

Completed window/door

Glass was locally sourced triple glazed IGU from Metro glass with a U_g of 0.55 W/m2.K and a G value of 0.58 and was installed on site.

The depth of the frame almost matched that of the wall with the rear of the frame being located flush with the inside face of the wall lining to facilitate easy installation of air tightness tape. The brick cladding was dressed over the front of the insulated frame with an aluminium cavity closer installed to leave only the glass visible where possible.

Photo of window installation from exterior

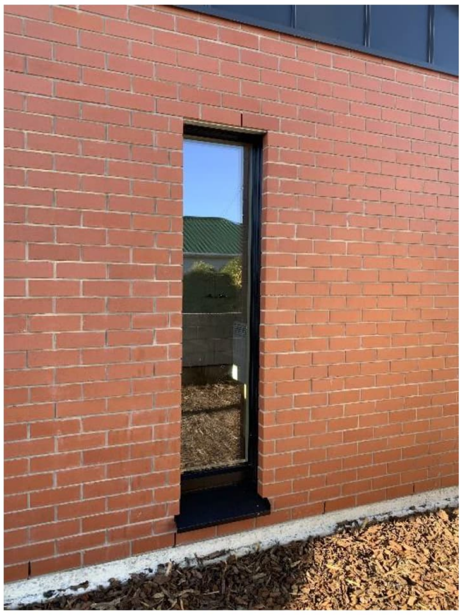
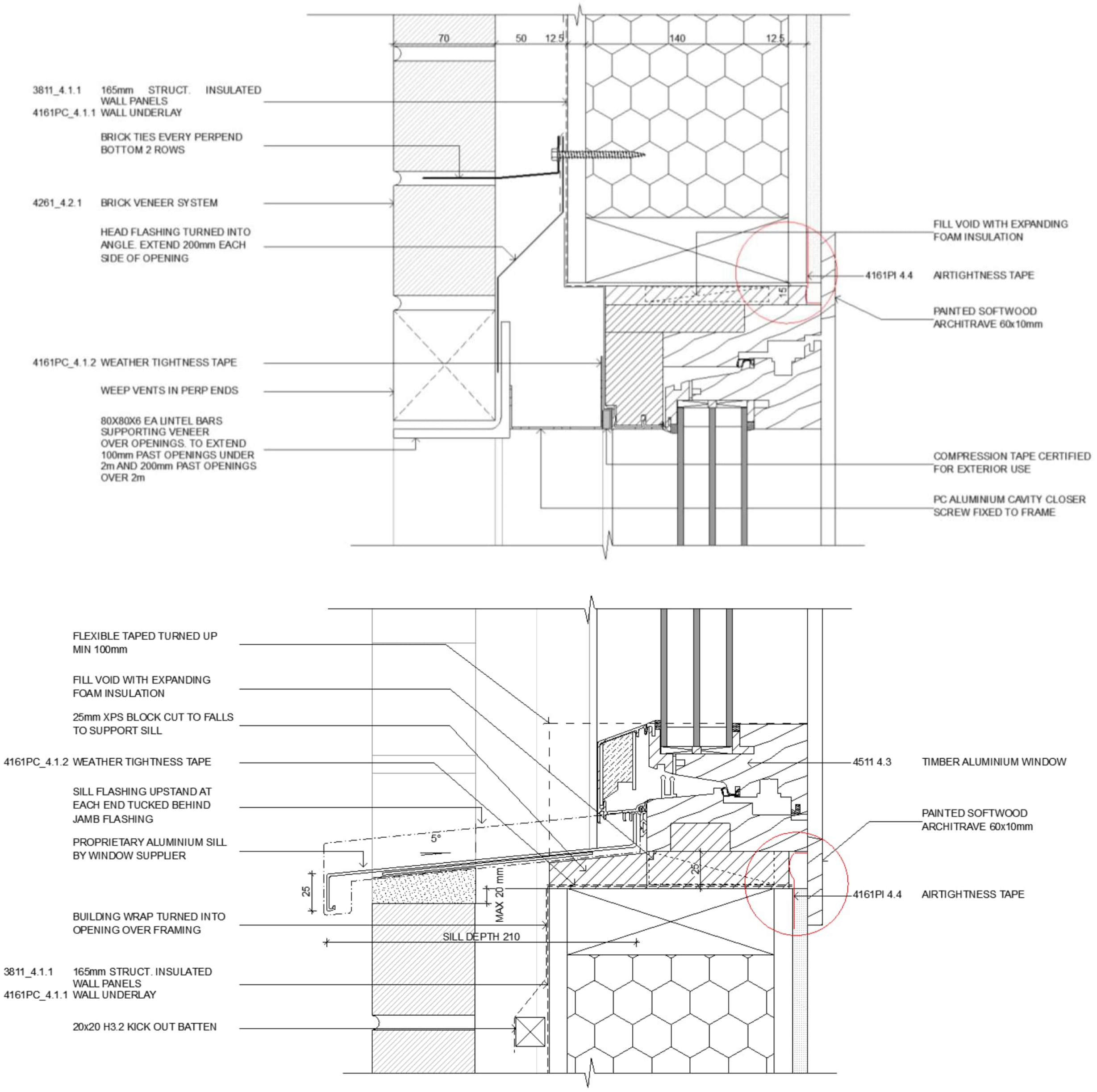


Photo of completed window



Typical window installation detail

9. Air leakage testing - Beschreibung der luftdichten Hülle

The airtight envelope was formed by the concrete slab, the SIP external walls and a Prolcima Intello airtight membrane under the trusses. Additionally, the intertenancy wall for each unit was taped to the external walls to create individual airtight units for ease of testing.

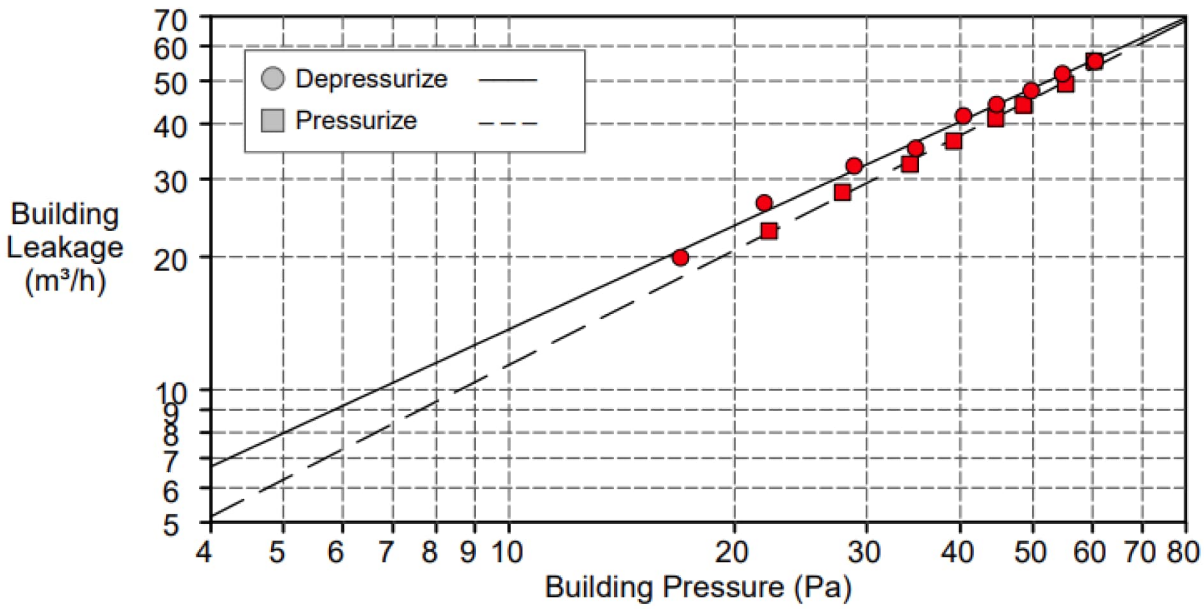
Sealing between elements was achieved using Proclima Tescon Vana tapes. The kitchen extract is a recirculating range hood reducing the required large penetrations through the air tight barrier to only that required for the MVHR system.

The initial testing undertaken before the linings were installed found some significant leakage around the base of the intertenancy walls, this was easily fixed with some additional tape as these had originally been reliant on adhesive at the junction alone.

As noted above the final airtightness testing was undertaken for each unit individually with the overall leakage being the average of all results as each unit had an identical volume.

Test Results at 50 Pascals:	Depressurization	Pressurization	Average
q_{50} : m³/h (Airflow)	48 (+/- 2.9 %)	46 (+/- 2.0 %)	47
n_{50} : 1/h (Air Change Rate)	0.56	0.53	0.54
q_{F50} : m³/(h·m² Floor Area)	1.27	1.20	1.24
q_{E50} : m³/(h·m² Envelope Area)	0.53	0.50	0.51
Leakage Areas:			
ELA_{50} : m²	0.0015 (+/- 2.0 %)	0.0014 (+/- 2.0 %)	0.0014
ELA_{F50} : m²/m²	0.0000388	0.0000367	0.0000378
ELA_{E50} : m²/m²	0.0000160	0.0000152	0.0000156
Building Leakage Curve:			
Air Flow Coefficient (C_{env}) m³/(h·Paⁿ)	2.3 (+/- 20.3 %)	1.6 (+/- 18.2 %)	
Air Leakage Coefficient (C_L) m³/(h·Paⁿ)	2.3 (+/- 20.3 %)	1.6 (+/- 18.2 %)	
Exponent (n)	0.781 (+/- 0.056)	0.863 (+/- 0.049)	
Coefficient of Determination (r^2)	0.99357	0.99676	

Test Standard:	ISO 9972
Test Mode:	Depressurization and Pressurization
Type of Test Method:	Method 1 - Test of Building in use
Purpose of Test:	Final Test PH $n50 \leq 0.6$ 1/h



Results for airtightness testing on Unit 1

School Street West	
Unit	**n50 Result (ach)**
1	0.54
2	0.58
3	0.56
4	0.57
5	0.55
Average	**0.56**

Results for each individual unit and average

Photo of ceiling airtightness layer taped to SIP walls

Photo of airtight sealing around windows

10. MVHR - Lüftungsgerät

Each unit is fitted with a Zehnder Comfoair 180 balanced ventilation system located in an upper cupboard in the kitchen this allowed intake and exhaust runs to be kept very short maintaining the total efficiency of the system.

The Zehnder Comfoair 180 has a certified efficiency of 82% with an electrical efficiency of 0.27Wh/m3. The system typically runs in the 3rd of its four speeds with a boost mode controlled via a controller in the living room and wireless switches in the bathroom.

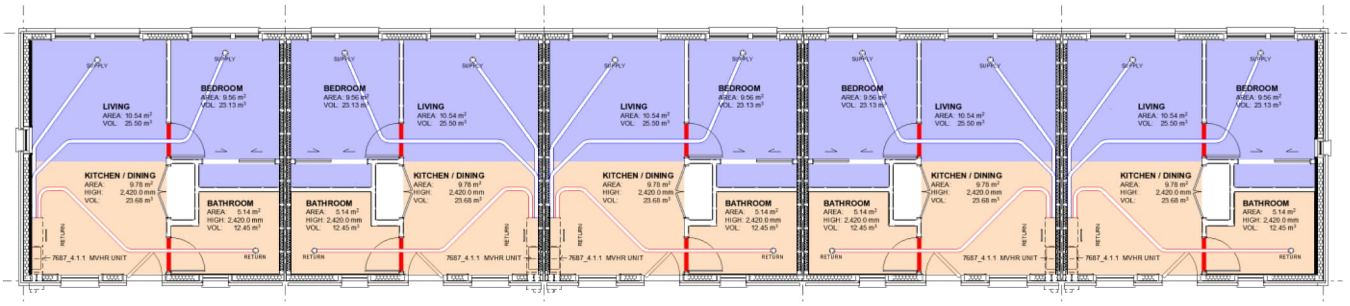
The effective efficiency of the system is 80.9%

Zehnder Comfoair 180 Installed in kitchen

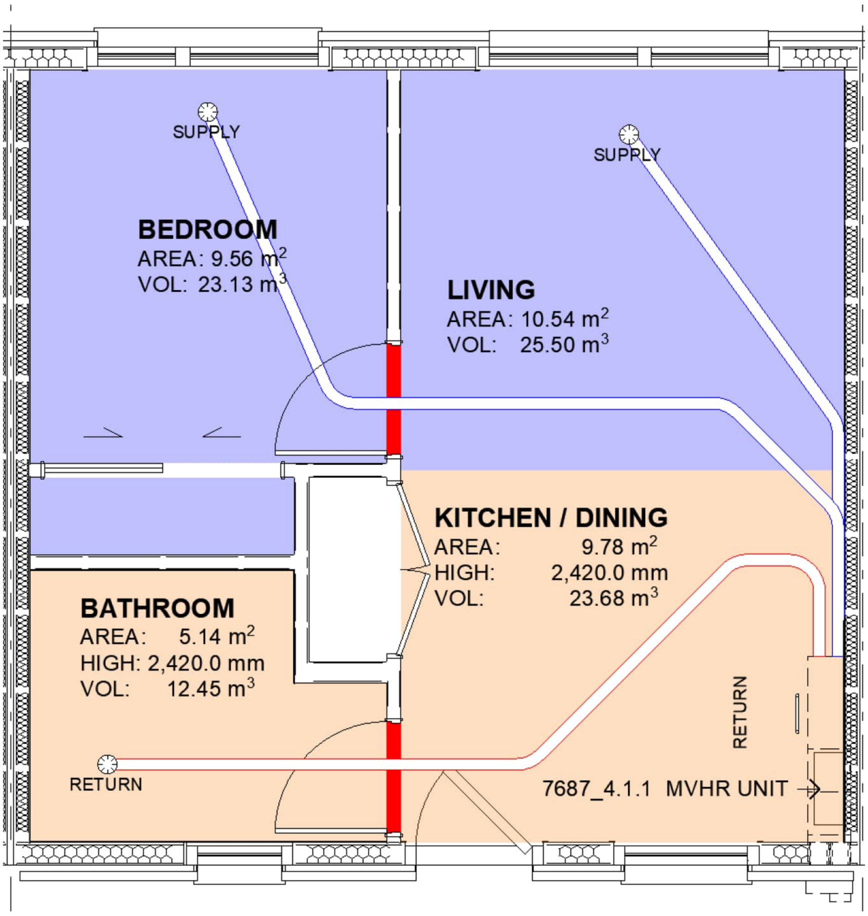
11. Ventilation ductwork - Lüftungsplanung Kanalnetz

As noted above, each unit is provided with its own ventilation system, significantly reducing the complexity of the ventilation install. The Zehnder Comfoair 180 system includes an attenuator/manifold that has a direct extract option directly from the kitchen. An additional extract was run in the ceiling cavity to the bathroom in 90mm diameter tubing (Zehnder ComfoTube) and similar supply ducting was provided to the living room and bedroom. The vents for each of these ducts was located as far into each room as possible to promote even distribution of air throughout the room.

The Bedroom and Bathroom doors were undercut by at least 10mm above the FFL to facilitate movement of air into/out of these rooms.



Ventilation plan for entire block



Typical ventilation plan

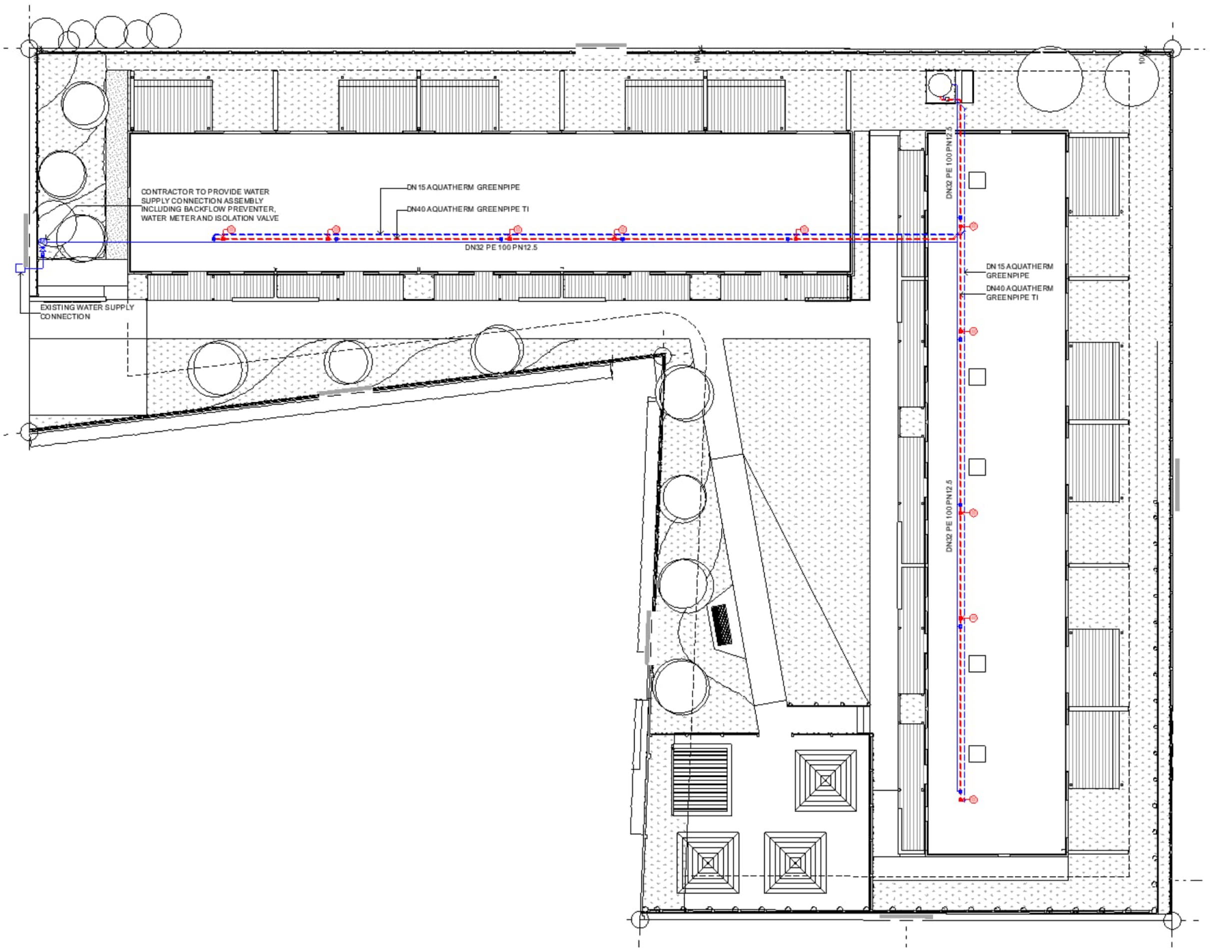
12. Heating systems - Wärmeversorgung

The heating for each unit is supplied via a thermostatically controlled 1.5kW direct electric heater fixed to the wall in the main living space which adequately covers the 358W Heating Load.

Heater installed in main living space.

The hot water for all five units in this block and the five units in the adjacent block is supplied via a combined hot water heat pump system with two ring mains to ensure a good supply of warm water to the furthest units.

The hot water cylinder is located outside at the West end of the North block. The insulated ring main is routed through the under-slab insulation to improve performance with only a small section between the North and West block in the ground. This provides the benefit of the efficiency that comes with a hot water heat pump but also reduces storage heat losses and space use of individual cylinders for each unit. As these are rental properties, it also limits the access requirements for maintenance.



Site plan showing location of shared HWHP cylinder and ring main

Photo of HWHP cylinder & ring main piping

Photo of HWHP housing and external unit

13. Building costs - Baukosten

Data not available

14. Publications featuring the building - Literatur

N/A

15. PHPP-Ergebnisse

Passive House Verification

Building:	Dunedin City Council Community Housing - West
Street:	48 School Street
Postcode/City:	9010 Dunedin
Province/Country:	Otago NZ-New Zealand
Building type:	Multi Unit Resiidential
Climate data set:	NZ0013a-Dunedin
Climate zone:	3: Cool-temperate; Altitude of location: 125 m
Home owner / Client:	Dunedin City Council
Street:	PO BOX 5045
Postcode/City:	9054 Dunedin
Province/Country:	Otago NZ-New Zealand

Architecture:	Architype Ltd.
Street:	42 Queens Gardens
Postcode/City:	9016 Dunedin
Province/Country:	Otago NZ-New Zealand
Mechanical engineer:	(Builder) Stevenson & Williams Ltd
Street:	64 Prince Albert Road, St Kilda
Postcode/City:	9012 Dunedin
Province/Country:	Otago NZ-New Zealand
Energy consultancy:	Architype Ltd.
Street:	42 Queens Gardens
Postcode/City:	9016 Dunedin
Province/Country:	Otago NZ-New Zealand
Certification:	Sustainable Engineering Ltd
Street:	65 Hungerford Road
Postcode/City:	6023 Wellington
Province/Country:	NZ-New Zealand

Year of construction:	2022	Interior temperature winter [°C]:	20.0	Interior temp. summer [°C]:	25.0
No. of dwelling units:	5	Internal heat gains (IHG) heating case [W/m²]:	3.5	IHG cooling case [W/m²]:	3.5
No. of occupants:	6.2	Specific capacity [Wh/K per m² TFA]:	60	Mechanical cooling:	

Specific building characteristics with reference to the treated floor area

		Unit	Value		Criteria	Alternative criteria	Fullfilled?[2]
	Treated floor area	m²	179.0				
Space heating	Heating demand	kWh/(m²a)	19.54	≤	15	-	yes
	Heating load	W/m²	10.01	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	-	≤	-	-	-
	Cooling load	W/m²	-	≤	-	-	
	Frequency of overheating (> 25 °C)	%	1	≤	10		yes
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	20		yes
Airtightness	Pressurization test result n_{50}	1/h	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	154.57	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	69.89	≤	83	93	yes
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	0	≥	-	9	

[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:	2-Certifier
First name:	Jason
Surname:	Quinn
Certificate ID:	37040-37044_SENZ_PH_20221220_JEQ
Issued on:	20/12/22
City:	Wellington
Signature:	