Project Documentation

Zertifiziertes Passivhaus
Passivhaus Institut

Abstract

Highcliffe- Individual single dwelling house, Hampshire UK

Data of building

Year of construction	2021	**Space heating**	**12 kWh/(m²a)**
U-value external wall	0,115 W/(m²K)		
		Primary Energy Renewable (PER)	58 kWh/(m²a)
U-value roof	0,091 W/(m²K)	Generation of renewable Energy	67 kWh/(m²a)
U-value window	0,95 W/(m²K)	Non-renewable Primary Energy (PE)	41 kWh/(m²a)
Heat recovery	80 %	Pressurization test n_{50}	0,5 h^{-1}
Special features	Large PV roof, masonry heavy mass constrcution		

Brief Description

Highcliffe new house

This is an individual detached house in a rural location in the south of England, completed in 2023. The overall TFA treated floor area is 280 sq.m. set over Ground, First and attic storeys. The building was designed with a view of achieving the Passivhaus Plus criteria, and as such a key feature was to incorporate a large south facing pitched roof area suitable to carry the PV array. It was also an objective from the beginning to utilise 'heavy weight' construction methods so as to create thermal mass within the house, and thus to obtain the environmental comfort aspects associated with that approach. In that sense some inspiration and guidance was taken from the work carried out on houses built in the North East of England eg PH database ID1779, 'Denby Dale'. These buildings use a wide cavity masonry external wall construction, with the cavity fully filled with mineral-fibre insulation. The airtightness approach is based on the sealing properties of wet applied solid plaster applied to the inside of the walls. This form of construction might be described as an adaptation of typical UK building domestic building methods but upgraded to meet Passivhaus performance requirements.

Building services: Heat is provided by a wood pellet boiler located in the adjoining garage structure, serving a thermal store located in the attic. From this heat is drawn off for hot water, heated towel rails in wet rooms, and also introduced to the supply air of parts of the ventilation system via a duct heater. The ventilation system is based on a unit located at the attic level with ductwork distribution in at that attic level and via a raised floor void at first floor. The rooftop solar PV array is rated at 11kw peak and is associated with a battery storage facility. The owners are also able to charge an electric car with the energy they produce. In combination with the on-site storage of wood pellet boiler fuel, the house is intended to possess good resilience in the event of any interruption to the mains electricity supply. Unfortunately at PH certification stage it was determined that the on-site energy generation (the solar PV array) was just insufficient to meet the output rating that would class the house as Passivhaus Plus, and it is certified instead as Classic. (A further factor was that the building orientation was adjusted away from the optimal solar orientation to meet town planning requirements)

The overall building environment , services performance and different room conditions are closely monitored and recorded by its owner occupiers to assess and appreciate the seasonal variations experienced. Overall the house displays strong 'steady state' characteristics, as would be expected for this heavyweight/ high thermal mass approach, and this offsets the lack of heating finer control, which is limited by the lack of individual room controls.
The building includes some comfort cooling / AC units serving key rooms which intended to future proof the building against the higher extreme temperatures associated with climate change and global warming. These AC installations also are able to provide a space heating function if needed, and the inclusion of these units has provided the occupants with a useful additional degree of environmental control. Summer night purging of heat via open windows has not proved particularly effective, perhaps because many of the windows are fitted with flyscreens, which diminishes airflow.

A laundry drying space is served by the MVHR system and has proved very effective.

There is an effective rainwater harvesting system , highly filtered, which is used for WC's laundry, and garden. Metered mains utility water consumption has proved very low.

Responsible project participants

Architect	Noel Wright Architects Ltd https://www.noelwrightarchitects.co.uk/
Implementation planning	Noel Wright Architects Ltd
Structural engineering	Andrew Waring Associates https://awaengineers.com/
Building physics	Noel Wright Architects Ltd
Passive House project planning	Noel Wright Architects Ltd
Construction Management	Flint Construction Ltd https://www.flintconstruction.co.uk/

Certifying body

Warm Low Energy Building Practice https://peterwarm.co.uk/

Certification ID

7535	Project-ID (www.passivehouse-database.org)

Author of project documentation

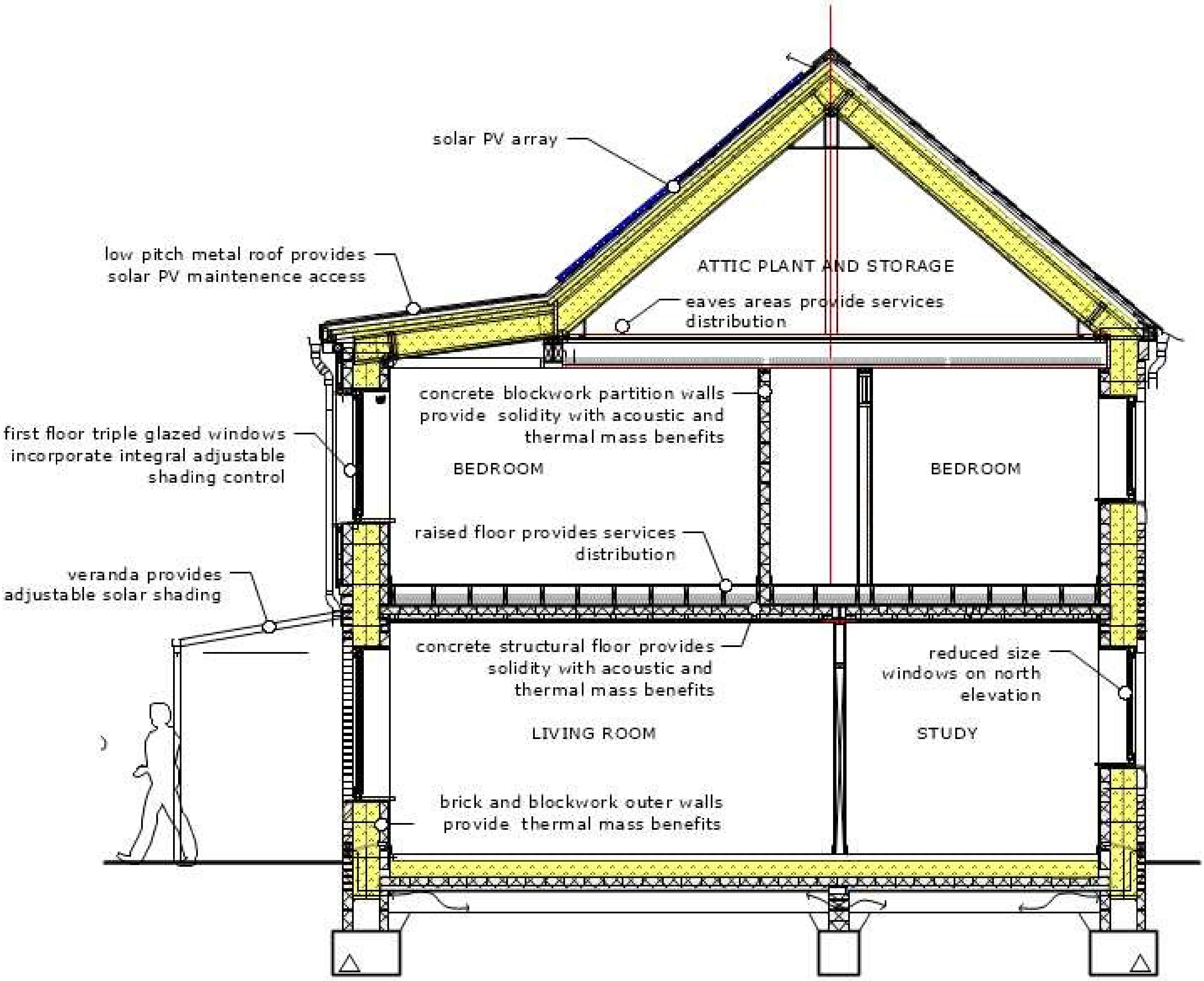
Noel Wright

Date	Signature
22.10.2024	Noel Wright.

1. Photos

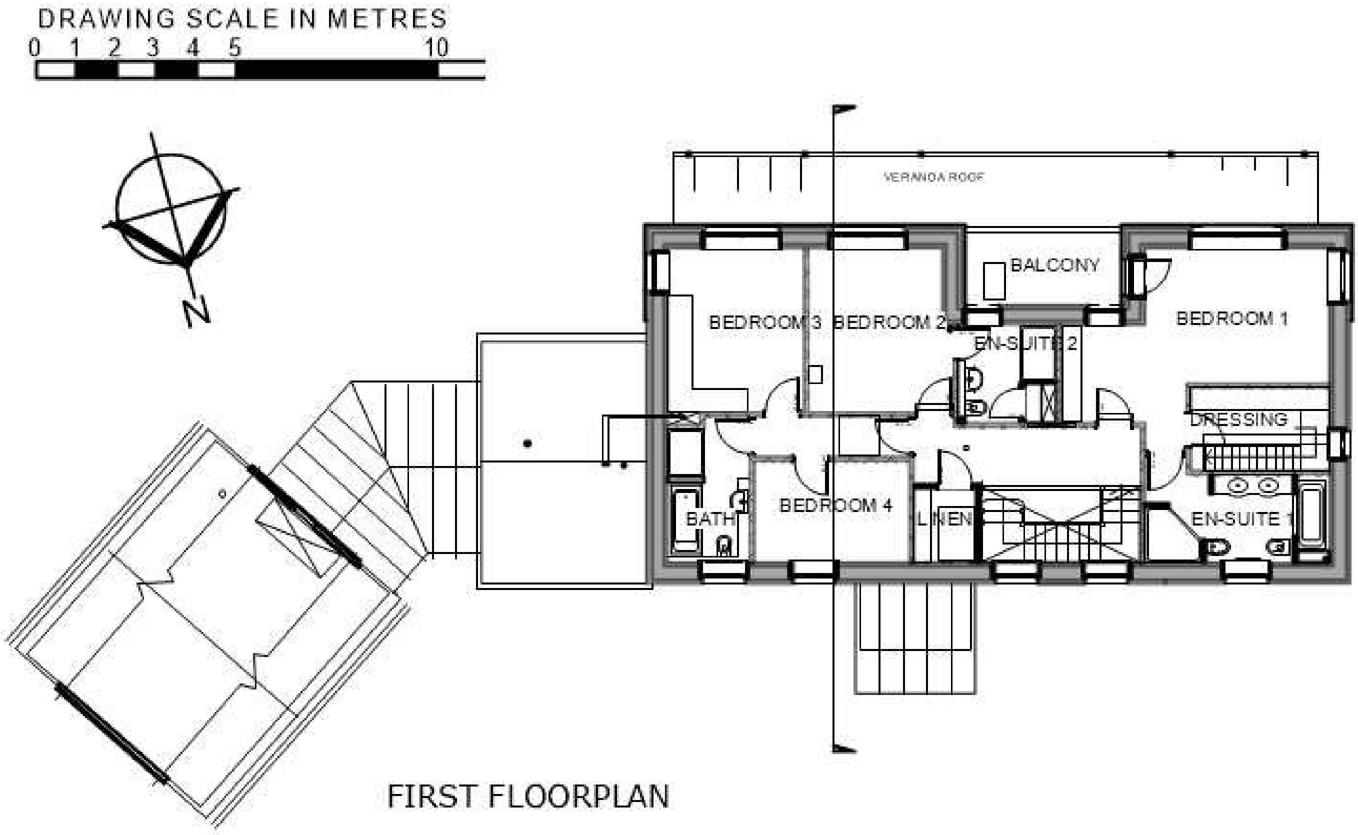
2. Interior example

3. Typical Section

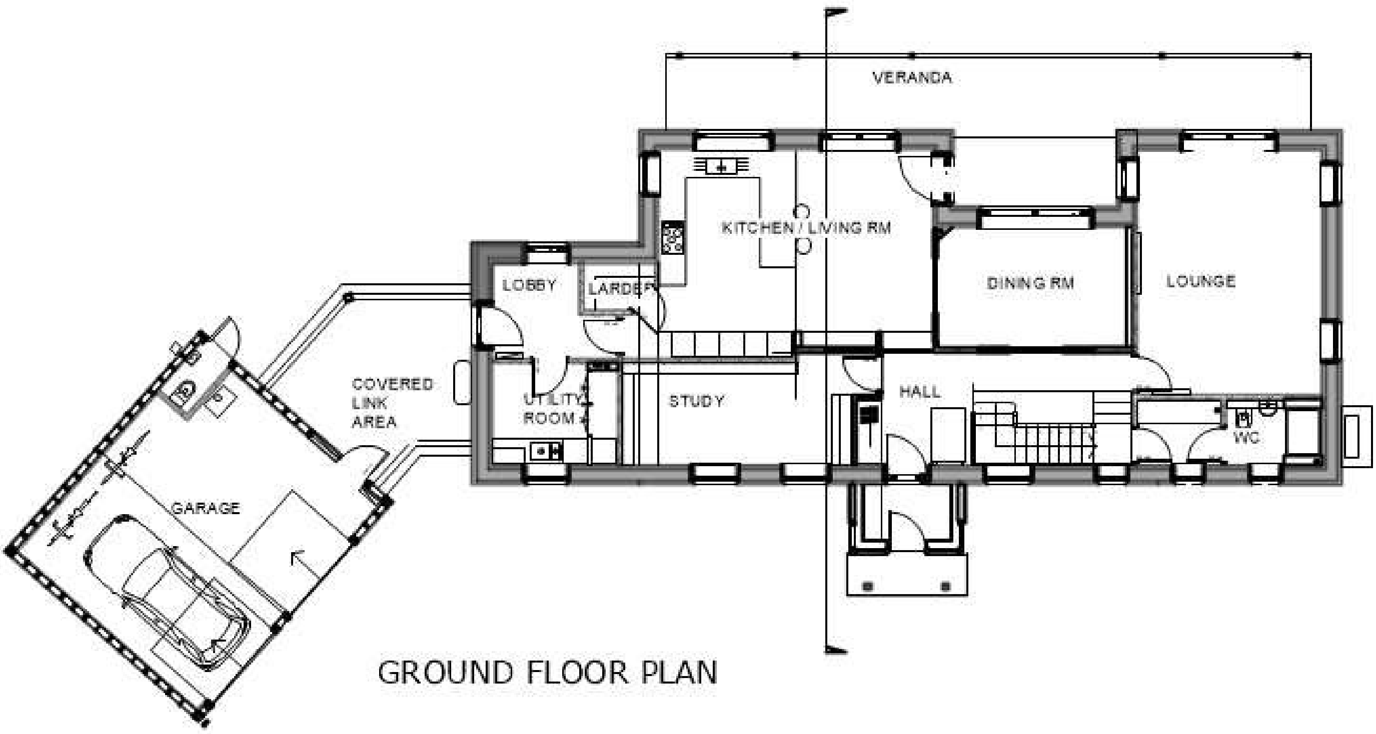


TYPICAL SECTION

4. Ground and First Floor Plans

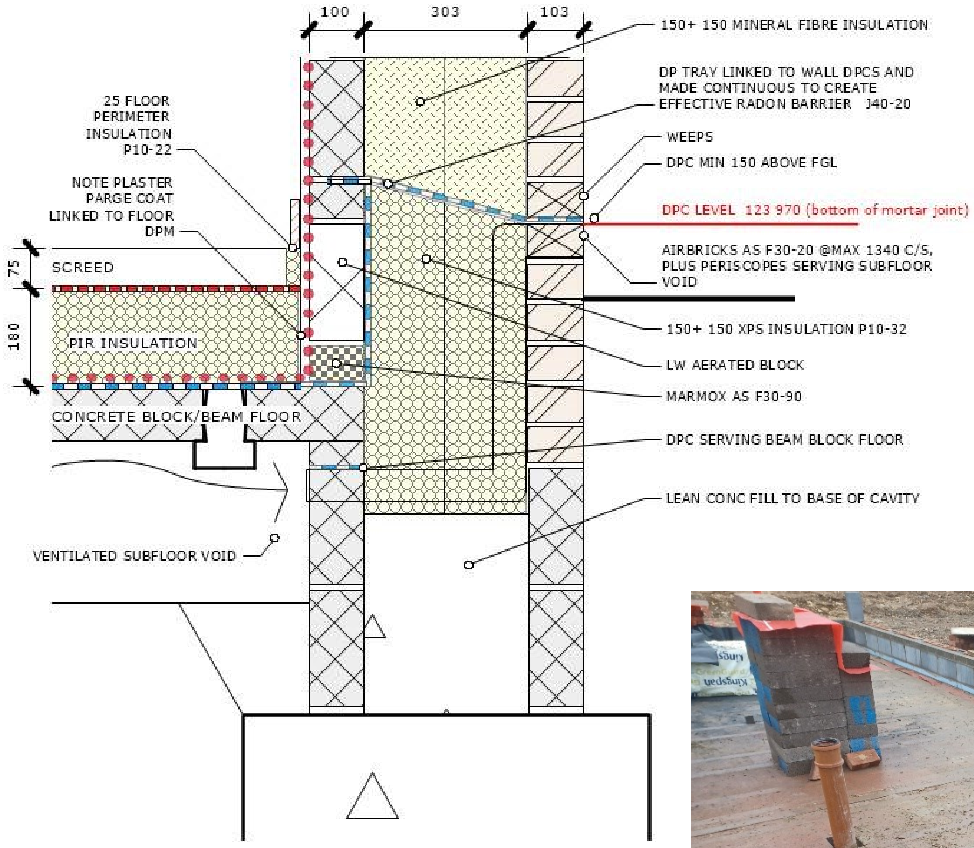


FIRST FLOORPLAN



GROUND FLOOR PLAN

5. Floor Construction



TYPICAL GROUND FLOOR/ EXTERNAL WALL DETAIL SECTION

A moisture resistant insulation material (XPS) was used below the wall DPC , shaped to fit around subfloor vents. The wall/ floor junction utilises Marmox blocks, a product which reduces the cold bridging effect at this point.

Assembly no.		Interior insulation?
06ud	GROUND FLOOR- insu + screed over beam block	

Heat transmission resistance [m²K/W]

Orientation of building element	3-Floor	interior R_{si}	0.17
Adjacent to	3-Ventilated	exterior R_{se}:	0.17

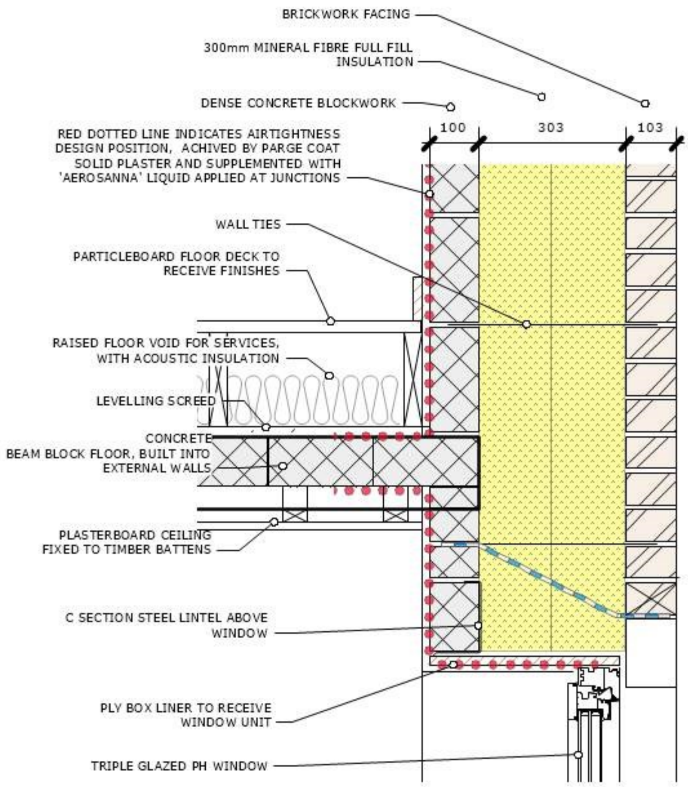
Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
ventilated void beneath						
concrete beam block	1.500					100
Celotex type insulation	0.022					180
screed	1.000					70

Percentage of sec. 1	Percentage of sec. 2	Percentage of sec. 3	Total
100%			35.0 cm

U-value supplement W/(m²K)

U-value: 0.115 W/(m²K)

6. Wall Construction



TYPICAL INTERMEDIATE FLOOR/
EXTERNAL WALL DETAIL SECTION

The fully filled wide (300mm) cavity utilised basalt low conductivity wall ties- the lack of flexibility in these ties and their thickness proved a difficulty and masonry work required undue great precision

Assembly no.	Building assembly description	Interior insulation?
01ud	exterior wall, BRICK FACED 100 BLOCK inner	

Heat transmission resistance [m²K/W]

Orientation of building element: 2-Wall — interior R_{si}: 0.13

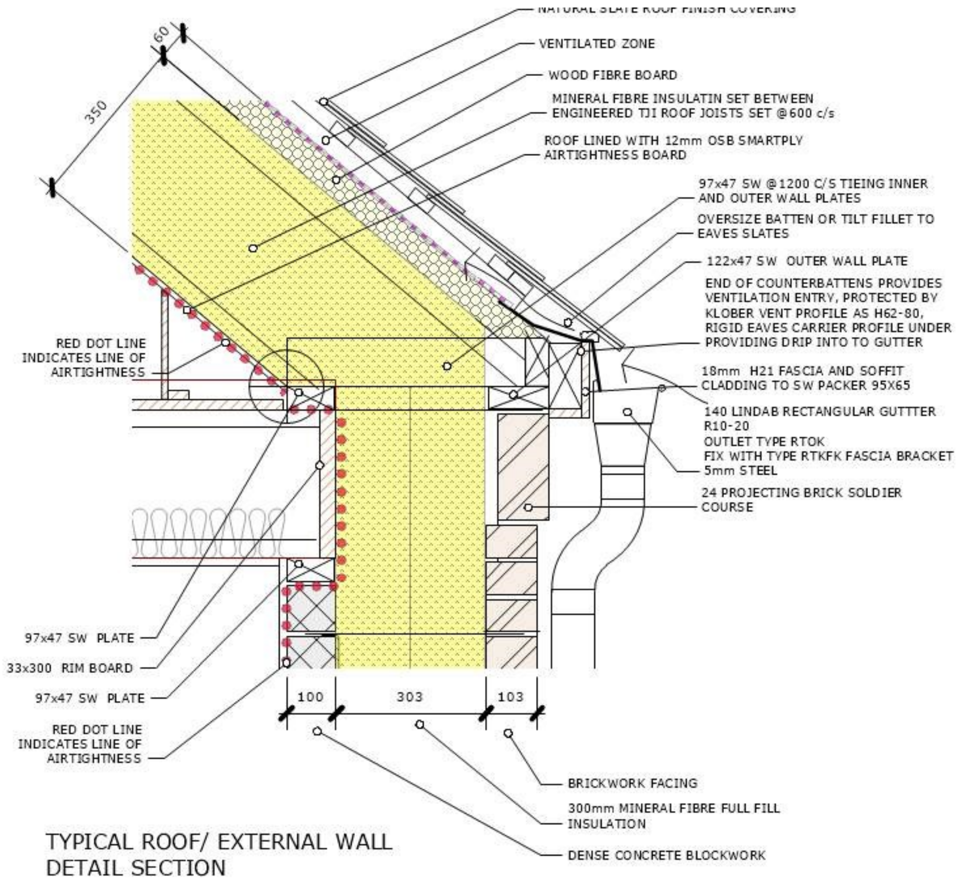
Adjacent to: 1-Outdoor air — exterior R_{se}: 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
external face brick	1.000					102
cavity fill insulation	0.037					300
inner block dense	1.600					100
plaster finish	0.500					12

Percentage of sec. 1: 100% — Percentage of sec. 2: — Percentage of sec. 3: — Total: 51.4 cm

U-value supplement: W/(m²K) — U-value: 0.118 W/(m²K)

7. Roof Construction



TYPICAL ROOF/ EXTERNAL WALL DETAIL SECTION

The timber I beams had the web profile infilled with PIR insulation so as to present a clear space for the mineral fibre insulation infill. The wood fibre board outer sheathing further reduces cold bridging and provides a usable depth for some projecting lateral timbers at the roof verges

Assembly no. 08ud — ROOF, slates or zinc warm roof set on 340mm TJI joists — Interior insulation?

Heat transmission resistance [m²K/W]

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

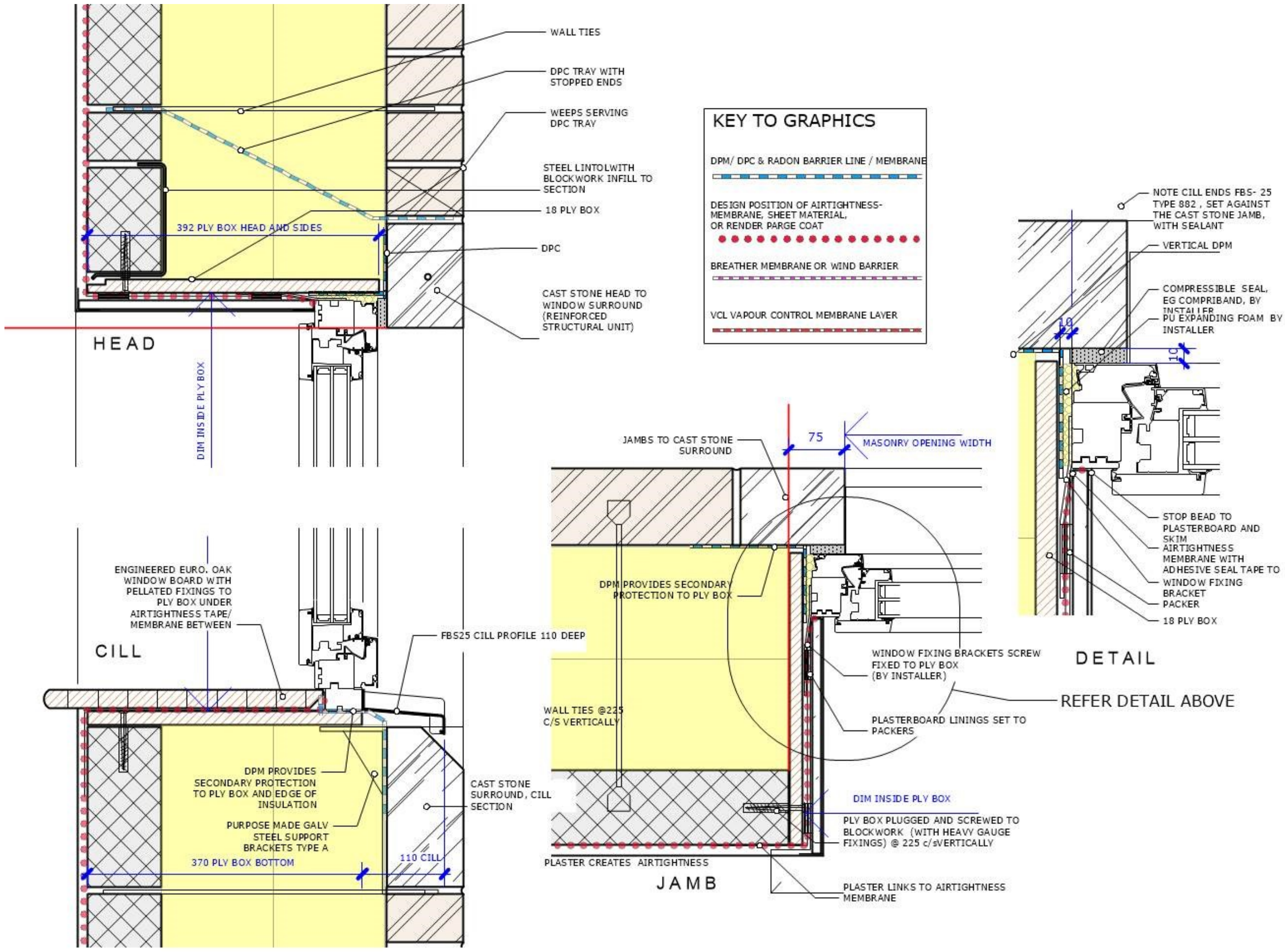
Adjacent to: 3-Ventilated — exterior R_{se}: 0.10

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
roof slating						
ventilated void						50
wood fibre sheathing	0.040					60
Rockwool flexi	0.038	top rib	0.130			81
Rockwool flexi	0.038	celotex rib infill	0.023	centre flange	0.130	230
Rockwool Flexi	0.038	bottom rib	0.130			39
smartply OSB lining	0.130					12
Percentage of sec. 1	88%	Percentage of sec. 2	10.4%	Percentage of sec. 3	1.8%	Total 47.2 cm

U-value supplement: W/(m²K)

U-value: 0.093 W/(m²K)

8. Window Installation and Assembly



The PH windows were supplied by Internorm and mounted to plywood box frames set within walls at wall building stage. Windows are set behind an outer masonry reveal. Due to concern about the weight of the window units, added metal support brackets were built into the outer wall, below the cill.

First floor windows where subject to insolation have integral louvred blinds within the glazing , for solar control

9. Airtightness and Airtightness Construction strategy

Airtightness testing

Pressure testing was carried out by As Built Testing Ltd in accordance with
ATTMA TSL4 – Measuring Air Permeability in Passivhaus and Low Energy Buildings.
The Testing was carried out on April 25th 2023 in ideal conditions and an average result of 0.48 ACH50 was achieved, meeting the Passivhaus requirements of <0.6 ACH50. .
The Building volume for calculation purposes was provided by the Passivhaus Designer

Construction strategy

Walls- the masonry walls utilise solid, wet applied plaster to achieve airtightness. Detail and junctions compliment this with Aerosanna'liquid applied material (to positions that appear awkward to seal) and with overplastered taping to (where wall surfaces meet adjacent elements).

Roof- the roof is lined internally with SmartPly Pro Passiv- an OSB board with a sealed internal surface. This provides a good basis for taping to junctions and adjacent elements

Ground Floor- This is a suspended concrete floor with a polythene damp proof membrane (DPM) set above, also acting as an airtightness barrier. Detailing accessories such as grommets and top hats provide the bais of a seal to service entries and penetrations

Windows- the perimeters of the windows are taped to a plywood carrier box, which provides an airtight support chassis set wthin the depth of the external walls

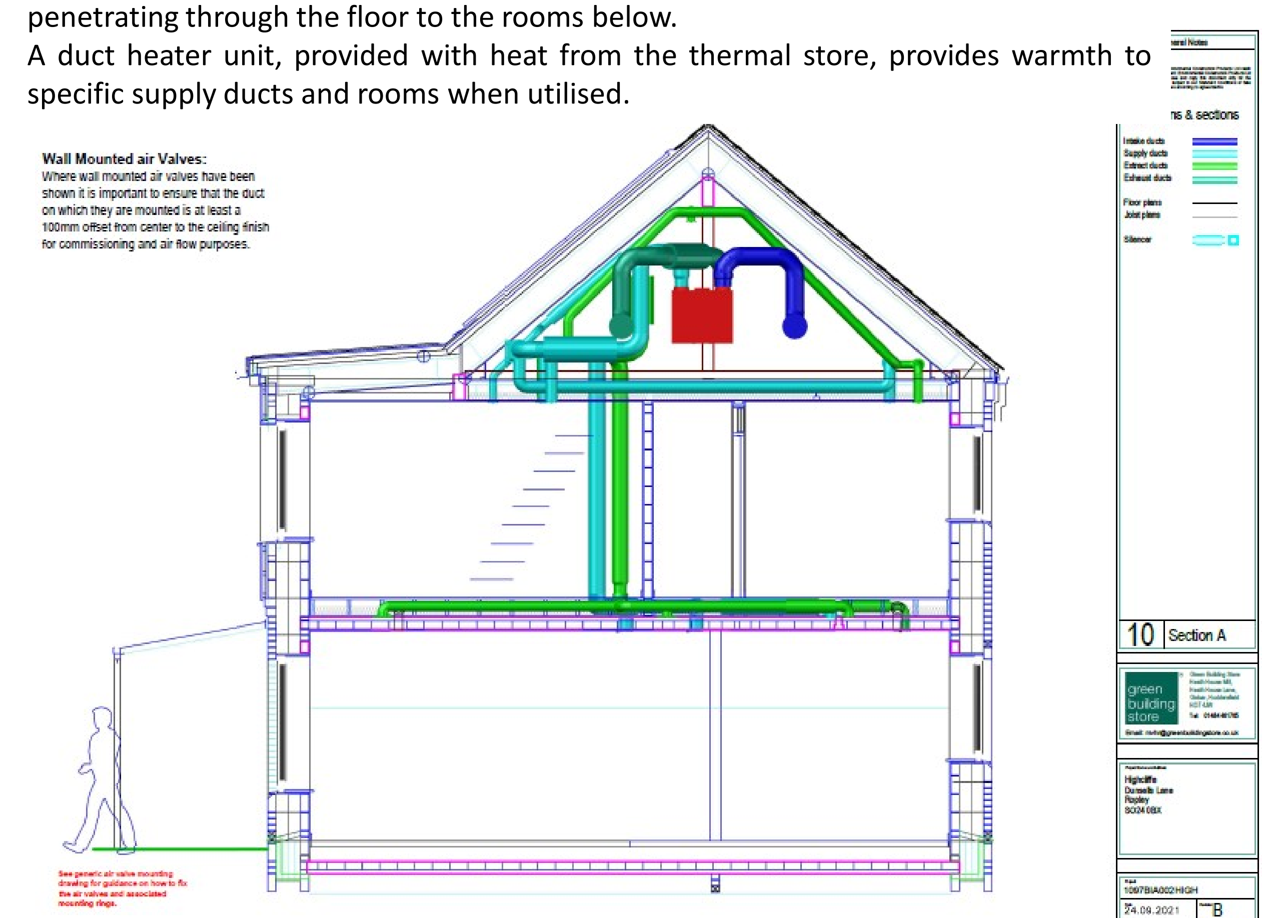
10. Mechanical Ventilation Heat Recovery (MVHR) unit

The MVHR unit is located within the attic storey . It is a Zehender Comfoair Q450 , installed to the design of Green Building Store Ltd and commisioned by their engineer on 27.04.2023

The effective heat recovery efficiency , arrived at via the PHPP calculation is 80.1%

11. Ventilation Distribution

Extract terminals bathrooms and kitchen , plus supply terminals in living rooms, are served by ductwork leading back to the MVHR unit, The ducts for the first floor rooms are located above the floor and within the eaves areas of the attic storey. The ducts for the ground floor rooms are located within a raised floor void at the first floor, then penetrating through the floor to the rooms below.
A duct heater unit, provided with heat from the thermal store, provides warmth to specific supply ducts and rooms when utilised.



(Green Building Store installation drawing)

12. Heating

The house contains a 500 litre Thermal Store set within the attic storey. This thermal store gains its energy from a wood pellet boiler, located in the separate / adjacent garage structure. The transfer is via thoroughly insulated circulating pipework, part of which is below ground.

Windhager BW102K wood pellet boiler

The thermal store (Cordivari provides the basis from which other wet distribution circuits gain their heat energy:
To heated towel rails within bathrooms
To a duct heater located in a part of the ventilation system
To domestic hot water circuits supplying outlets/ taps

The house does not include a conventional heating distribution system, eg UFH, or radiators, other then the towel radiators in wet rooms. It designed to incorporate high thermal mass within its construction and thus provide internal conditions with a reduced tendancy for temperature variation over time. Supplentary space heating may be achived if required via the MVHR duct heater

13. PHPP- Results

Passive House Verification

Building:	Highcliffe
Street:	Dunsells Lane, Ropley
Postcode/City:	SO24 0BX
Province/Country:	England / GB-United Kingdom/ Bri
Building type:	dwelling
Climate data set:	GB0004a-Efford
Climate zone:	4: Warm-temperate; Altitude of location: 124 m
Home owner / Client:	Mr and Mrs Biart
Street:	Dunsells Lane
Postcode/City:	SO24 0BX Ropley
Province/Country:	Hampshire UK / GB-United Kingdom/ Bri

Architecture:	Noel Wright Architects	Mechanical engineer:	Design Heat
Street:	Petersfield	Street:	Bar End Road
Postcode/City:	GU32 3LA	Postcode/City:	SO239NT Winchester
Province/Country:	Hampshire / GB-United Kingdom/ Bri	Province/Country:	Hampshire UK / 1-Residential building
Energy consultancy:	Noel Wright Architects	Certification:	WARM: Low Energy Building Practice
Street:	3 Spain Buildings	Street:	3 Admirals Hard
Postcode/City:	GU32 3LA	Postcode/City:	PL13RJ Plymouth
Province/Country:	Hampshire / GB-United Kingdom/ Bri	Province/Country:	Devon / GB-United Kingdom/ Bri

Year of construction:	2021	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]:	2.3	IHG cooling case [W/m²]:	2.3
No. of occupants:	3.2	Specific capacity [Wh/K per m² TFA]:	104	Mechanical cooling:	x

Specific building characteristics with reference to the treated floor area

					Criteria	Alternative criteria	Fullfilled?²
	Treated floor area	m²	279.8				
Space heating	Heating demand	kWh/(m²a)	12	≤	15	-	yes
	Heating load	W/m²	9	≤	-	10	
Space cooling	Cooling & dehum. demand	kWh/(m²a)	1	≤	15	15	yes
	Cooling load	W/m²	2	≤	-	10	
	Frequency of overheating (> 25 °C)	%	-	≤	-		-
	Frequency of excessively high humidity (> 12 g/kg)	%	0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/h	0.5	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kWh/(m²a)	42	≤	-		-
Primary Energy Renewable (PER)	PER demand	kWh/(m²a)	58	≤	60	60	yes
	Generation of renewable energy (in relation to projected building footprint area)	kWh/(m²a)	67	≥	-	-	

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.

ssive House Classic? **yes**

Task:	First name:	Surname:	Signature:
2-Certifier	Mike	Roe	
Certificate ID	Issued on:	City:	
		Plymouth	