Passivhaus Documentation

Passivhaus database ID: 4439

Single family free-standing house in Canberra, Australia

Certified Passive House
Passive House Institute

10A Anderson Street Chifley, Canberra, Australia Capital Territory, Australia, 2606

Passivhaus Designer Harley Truong harleytruong@gmail.com

This house is one of two houses built in 2014 on a subdivided block in the city of Canberra. The two houses have nearly identical floor plans except on is a mirror image of the other. The building fabric is made of sandwich panels, both timber and steel types. The owner was also the designer and is now resident in one of the houses.

U-value exterior wall 0.29 W/(m2K)
U-value floor 0.21 W/(m2K)
U-value roof 0.20 W/(m2K)
U-value windows 1.45 W/(m2K)
Heat recovery (87%)

PHPP Annual Heating Demand **15kWh/(m2a)**

PHPP Primary Energy Demand 111 kWh/(m2a)

Pressure test 0.1 ach n50

2.2 Project Description

Initially a 1960s cottage on a 1020m2 block, the owners demolished the existing inefficient house to make way for two 127m2 modern minimalist houses.

The houses were designed to meet the Passivhaus standard from the outset using sandwich panels for the building fabric and total under slab insulation. Both techniques were considered non-conventional compared to the average Australian house.

Airtightness was achieved using specialised tapes and membranes. Double glazing was sufficient to maintain comfort in Canberra's relatively mild climate. Both houses face north to make use of winter solar gains.

2.3 Pictures of elevations

North elevation

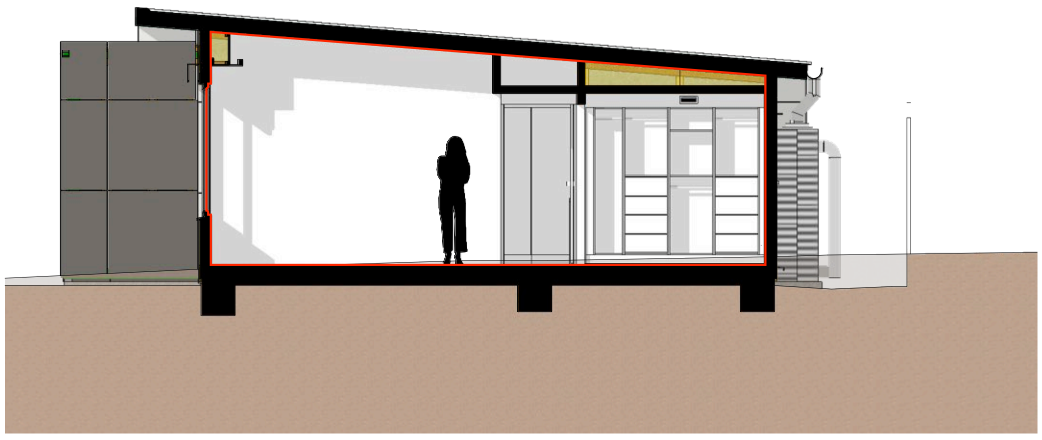
South elevation

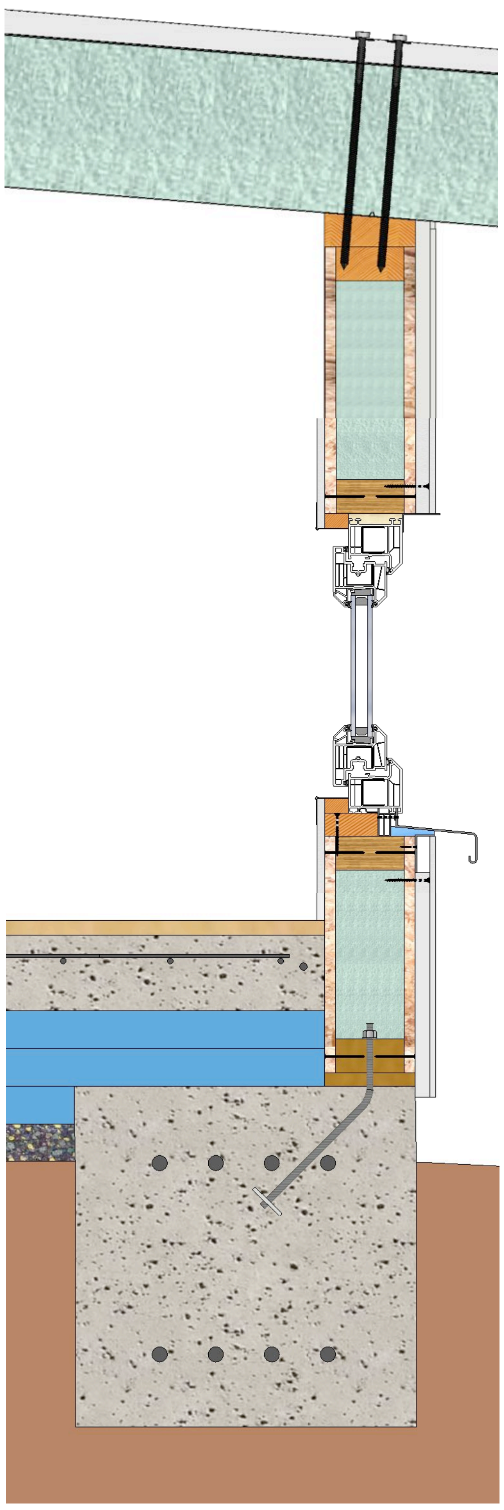
East elevation

West elevation

2.4 Pictures of interiors

2.5 Cross section





Roof
0.6mm Zinc-Aluminium coated steel
200mm XFLAM foam (040)
0.6mm Zinc-Aluminium coated steel

Exterior Walls
8mm Fibre cement cladding
19mm Cavity and fibre cement battens
0.2mm Solitex Mento plus wrap
15mm OSB
90mm PIR foam (024)
15mm OSB
0.2mm Intello airtight membrane
10mm Gypsum plasterboard

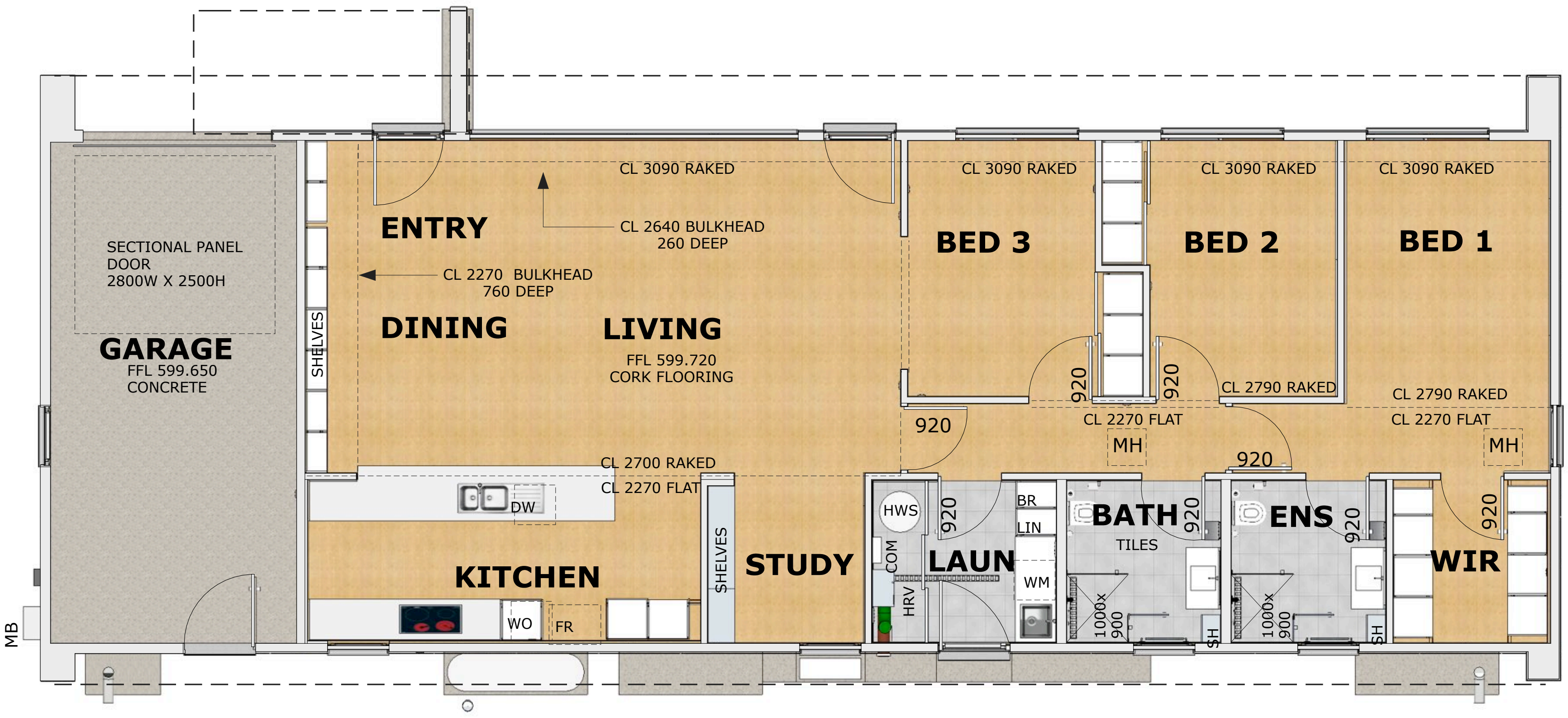
Internal Walls
10mm Gypsum plasterboard
90mm Timber stud walls
90mm Earth wool insulation between studs
10mm Gypsum plasterboard

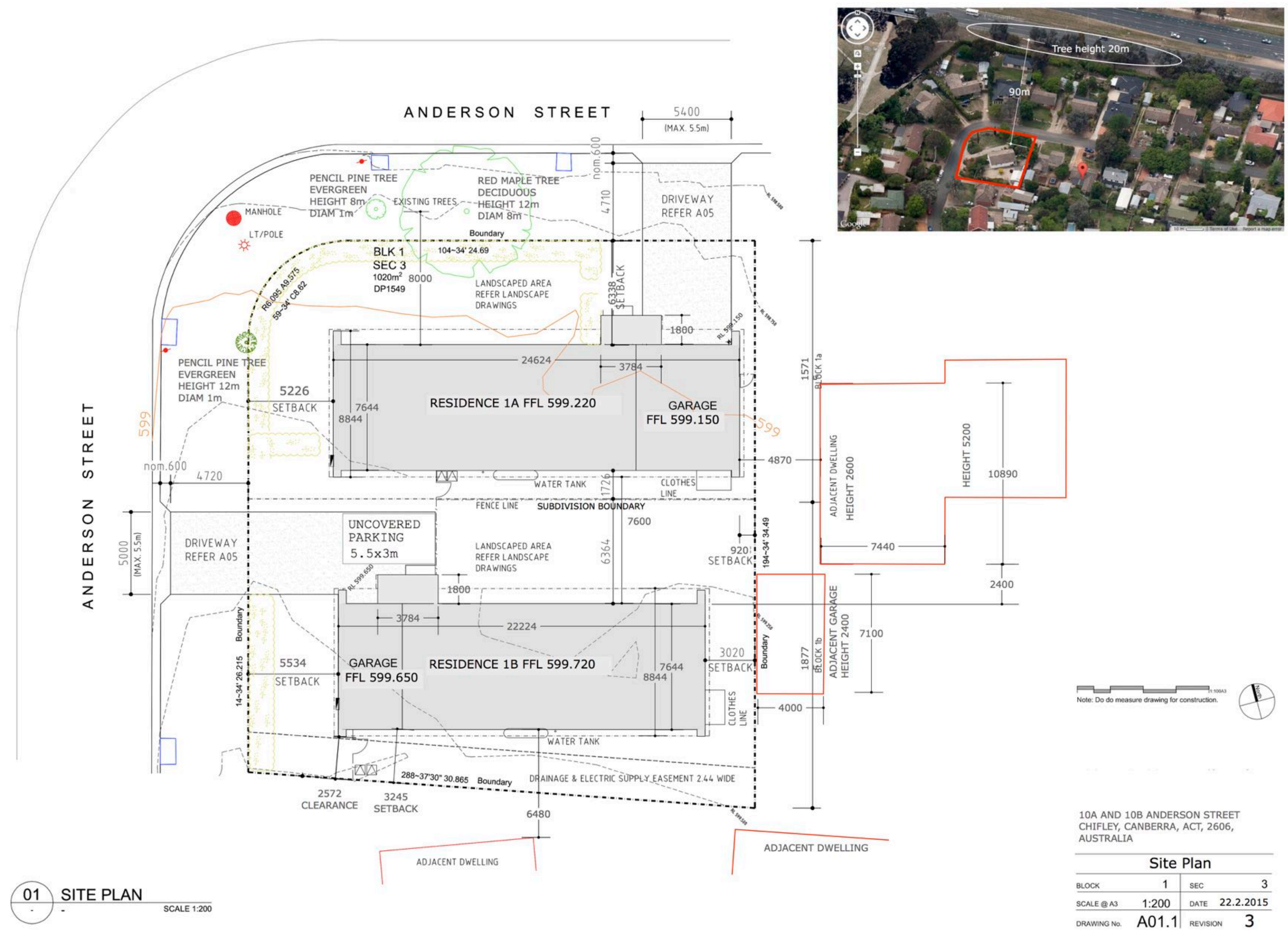
Windows
6/16/6 Double glazed argon filled
uPVC Tilt and turn frames

Doors
6/16/6 Double glazed argon filled
uPVC Frames with aluminium thresholds

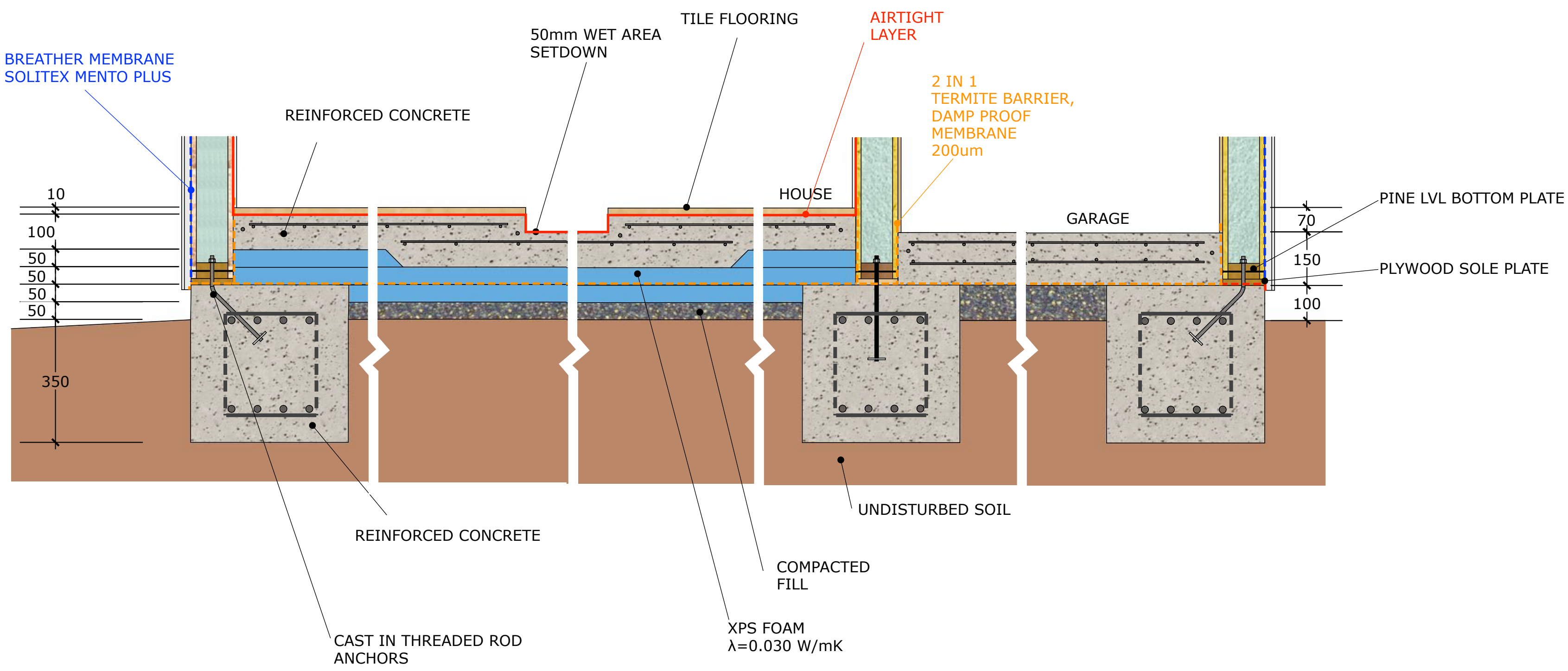
Floor
10mm Porcelain tiles
100mm Reinforced concrete slab
150mm XPS foam (030)
0.2mm Termite and moisture barrier
450mm Reinforced concrete footings

2.6 Floor plan



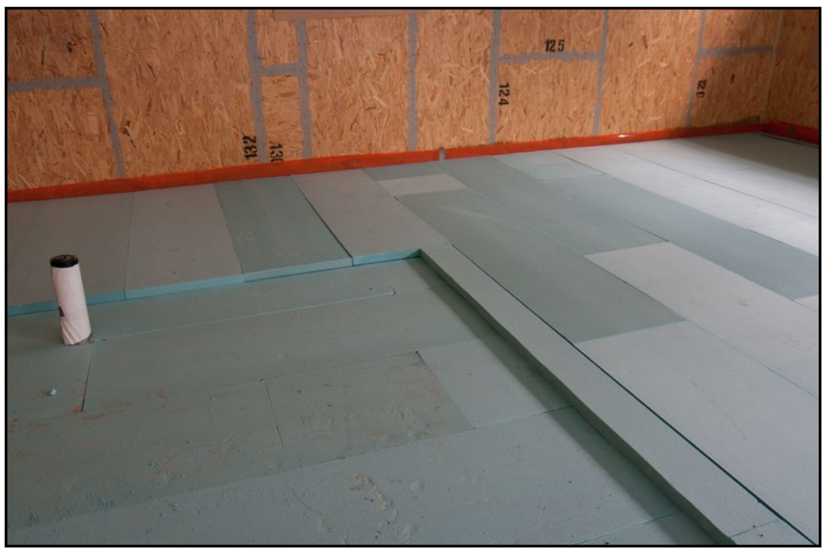


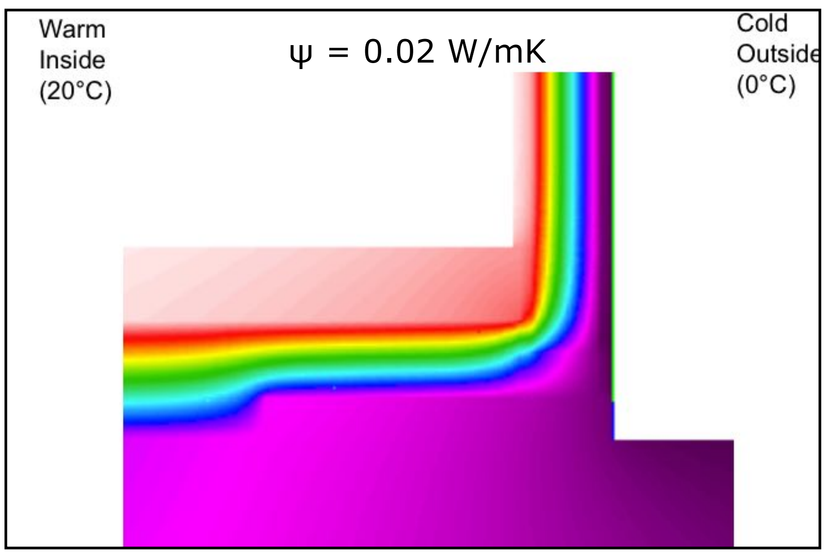
2.7 Construction details
2.7.1 Floor



The floor was constructed as a 100mm concrete slab floating on 150mm of XPS foam. The slab was poured after the walls were constructed, eliminating the need for formwork, and extra slab-edge insulation.

The slab/wall junction, as modelled in Therm, was found to be almost thermal bridge-free at 0.02 W/mK.

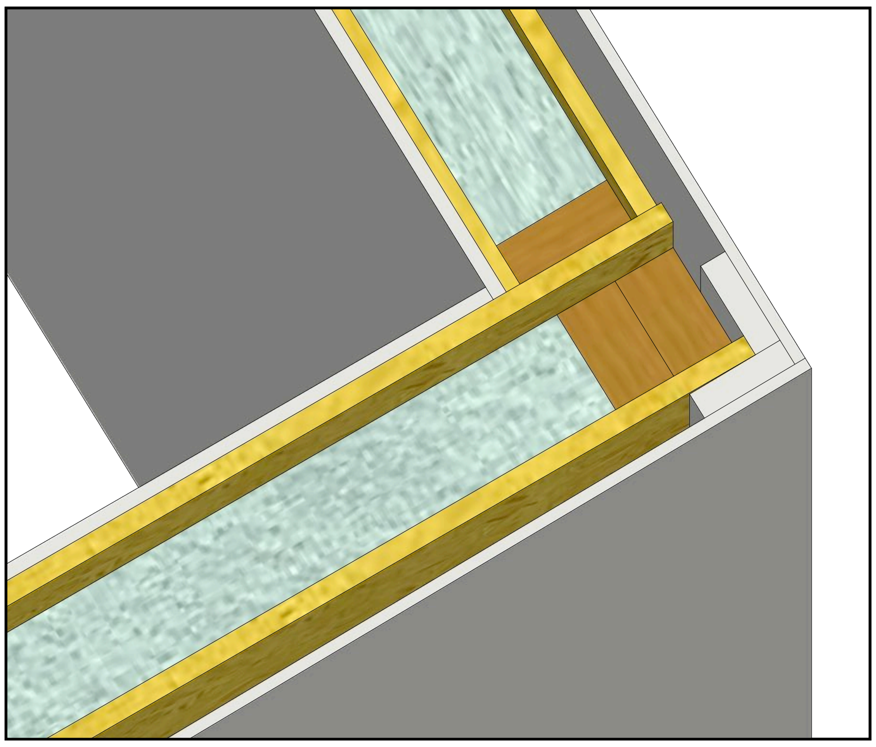




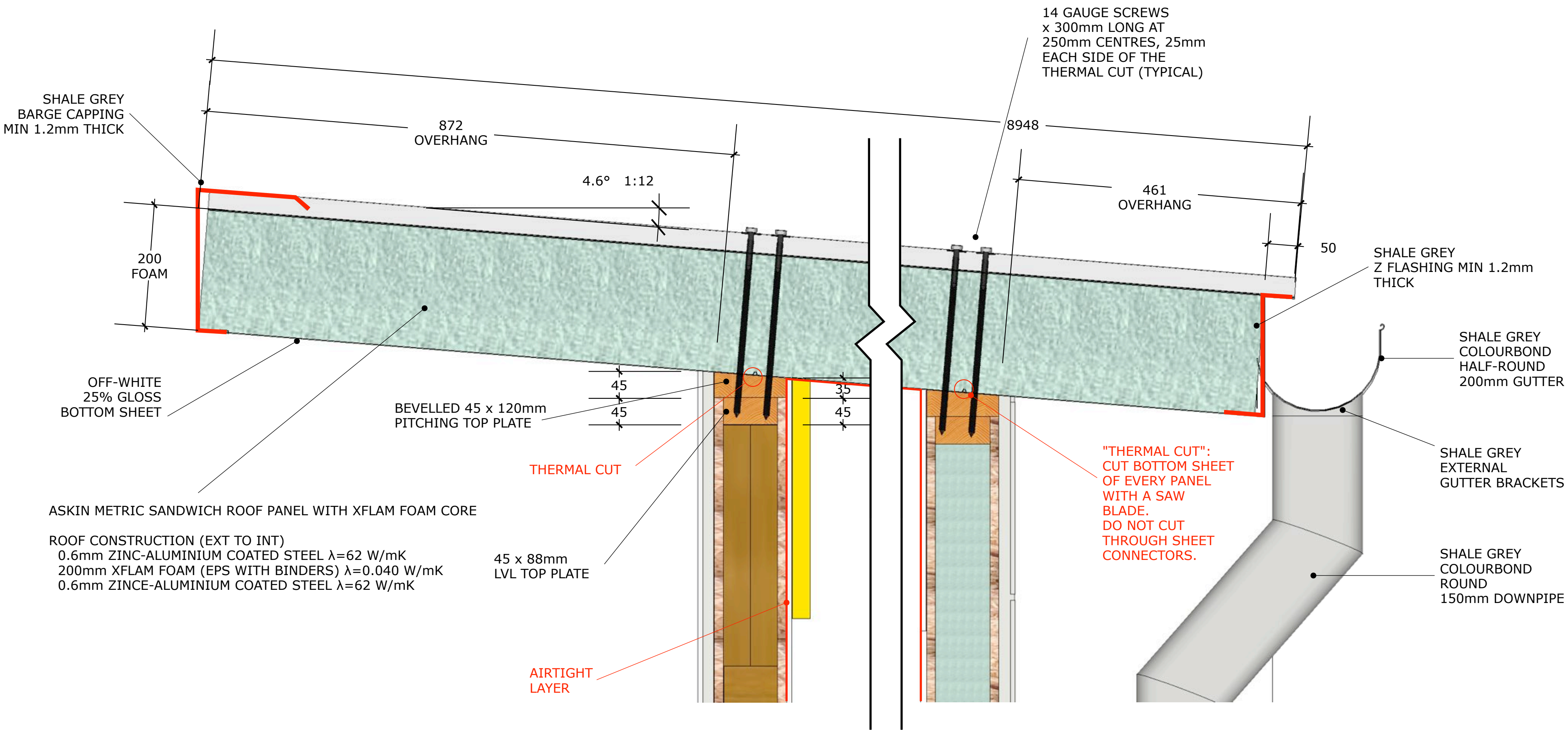
2.7.2 Exterior Walls

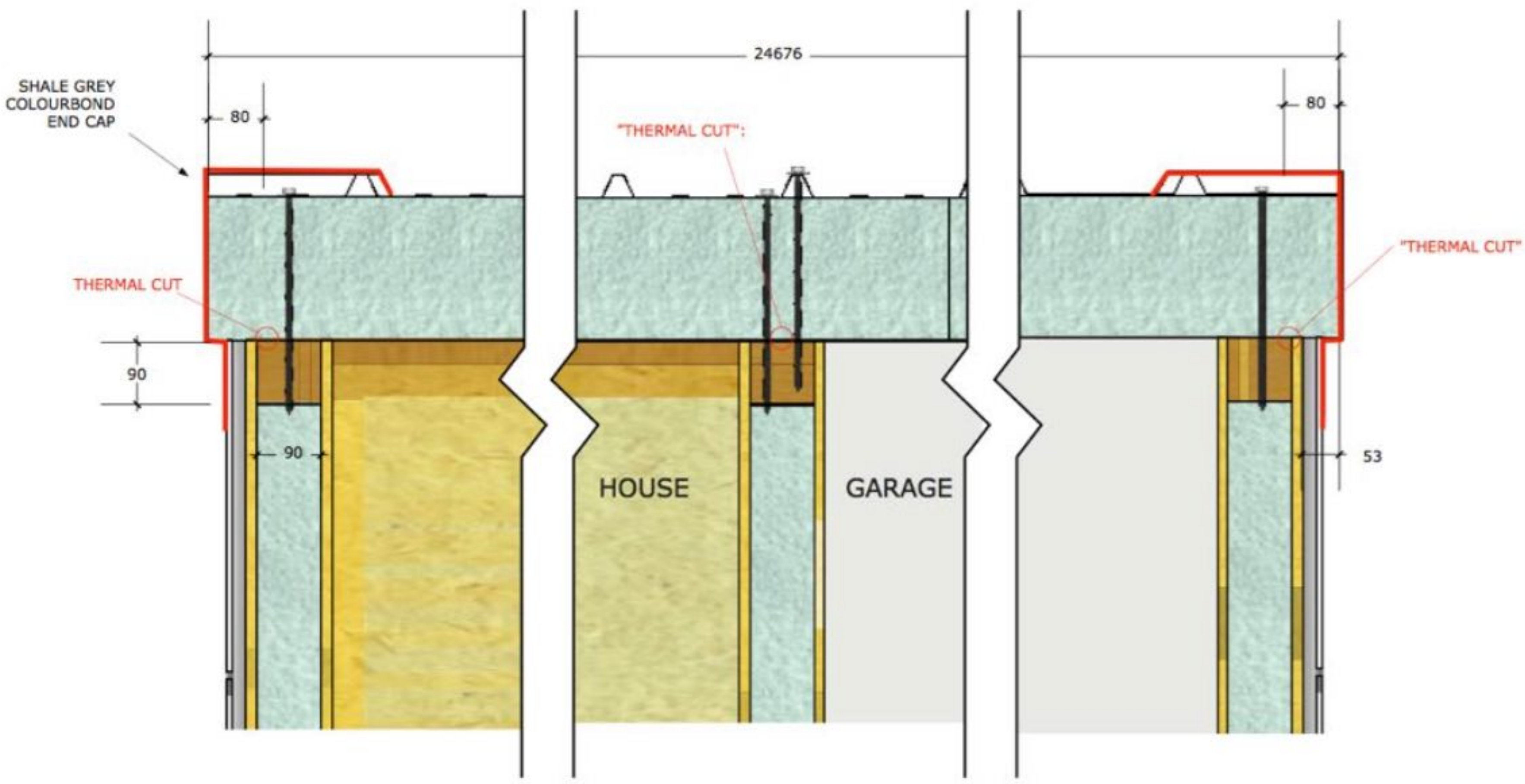
The walls were made from prefabricated Structural Insulated Panels (SIPs). The panels were joined together with 88 x 45mm double LVL studs and all gaps sealed with polyurethane caulking. An airtight membrane on the interior side of the wall ensured longevity of the airtightness of the building.

WALL CONSTRUCTION (EXT TO INT)
8mm FIBRE CEMENT CLADDING
19mm CAVITY + BATTENS
0.2mm BREATHER MEMBRANE
15mm OSB
90mm PIR FOAM λ=0.024 W/mK
15mm OSB
0.2mm AIRTIGHT MEMBRANE
10mm PLASTERBOARD



2.7.3 Roof



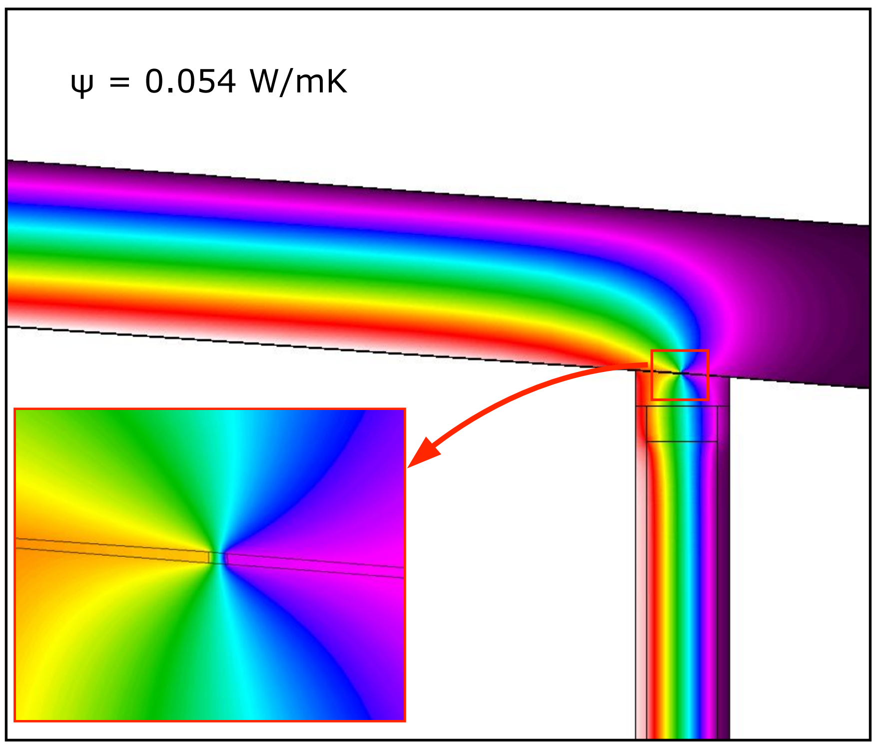


The roof was constructed from sandwich panels made of Zinc-Aluminium coated steel sheets top and bottom with a foam core (λ = 0.04 W/mK). The bottom sheet was the finished ceiling.

The panels spaned the entire 7.3m width of the house without additional structural members.

To minimise the thermal bridging between the ceiling and the eaves, a thermal cut was used to separate the sheets.

Airtight tape was used to seal the joints in the one meter wide roof panels to form the air barrier.

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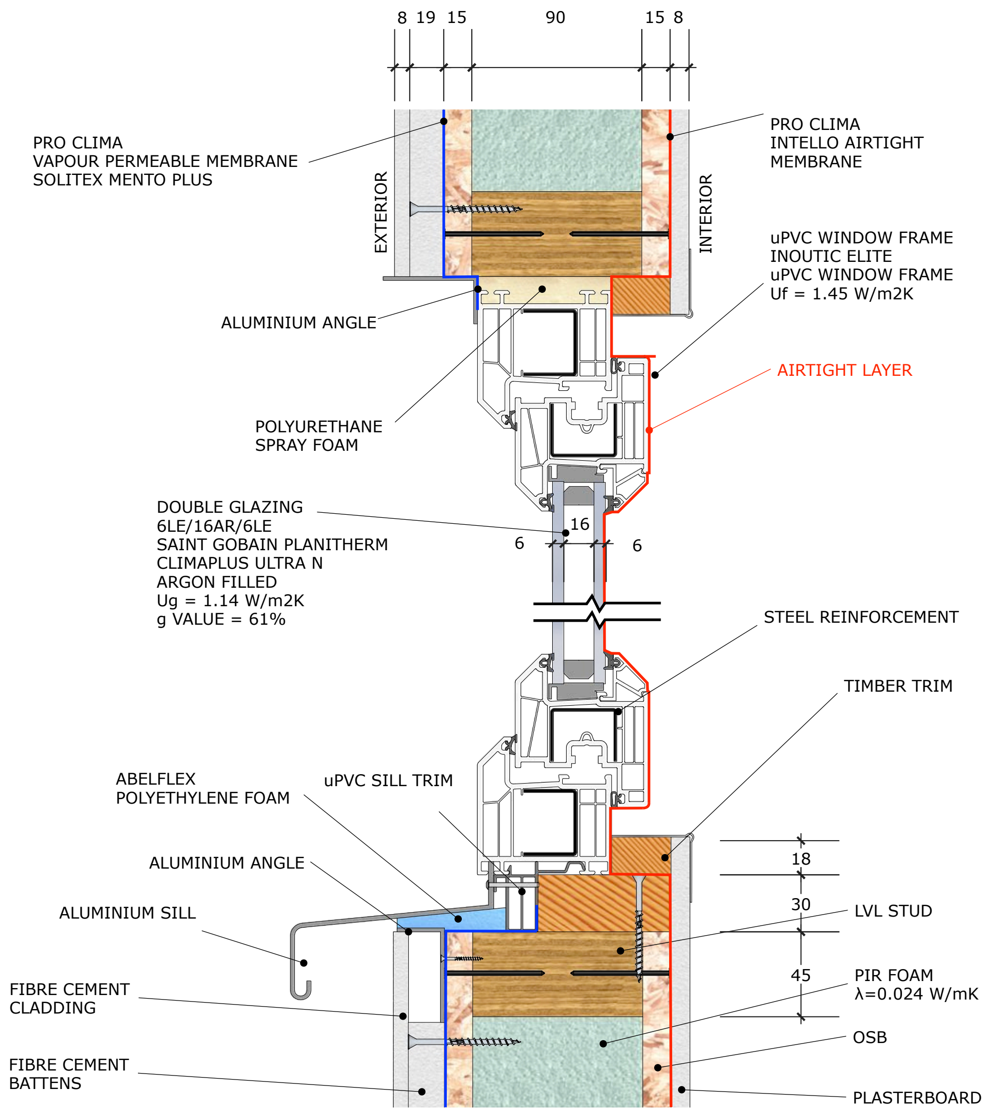
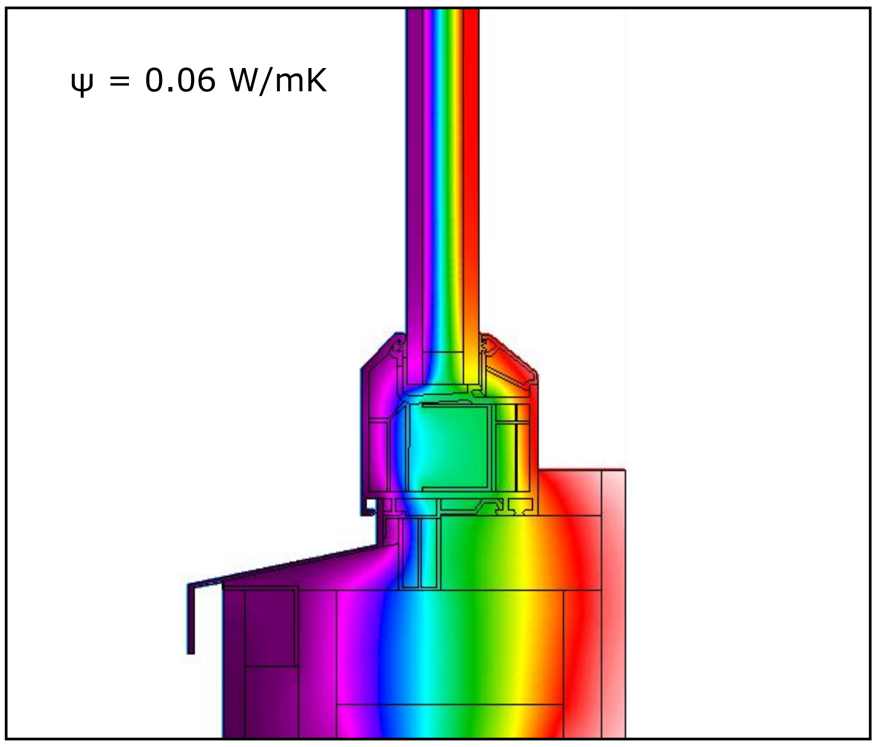
2.7.4 Windows

The windows were chosen to be uPVC double glazed units with a 5-chamber InOutic profile yielding a frame u-value of 1.45 W/m2K.

Double glazing was used throughout with 6mm toughened glass and a 16mm cavity filled with Argon gas yielding a glass u-value of 1.14 W/m2K and g value of 61%.

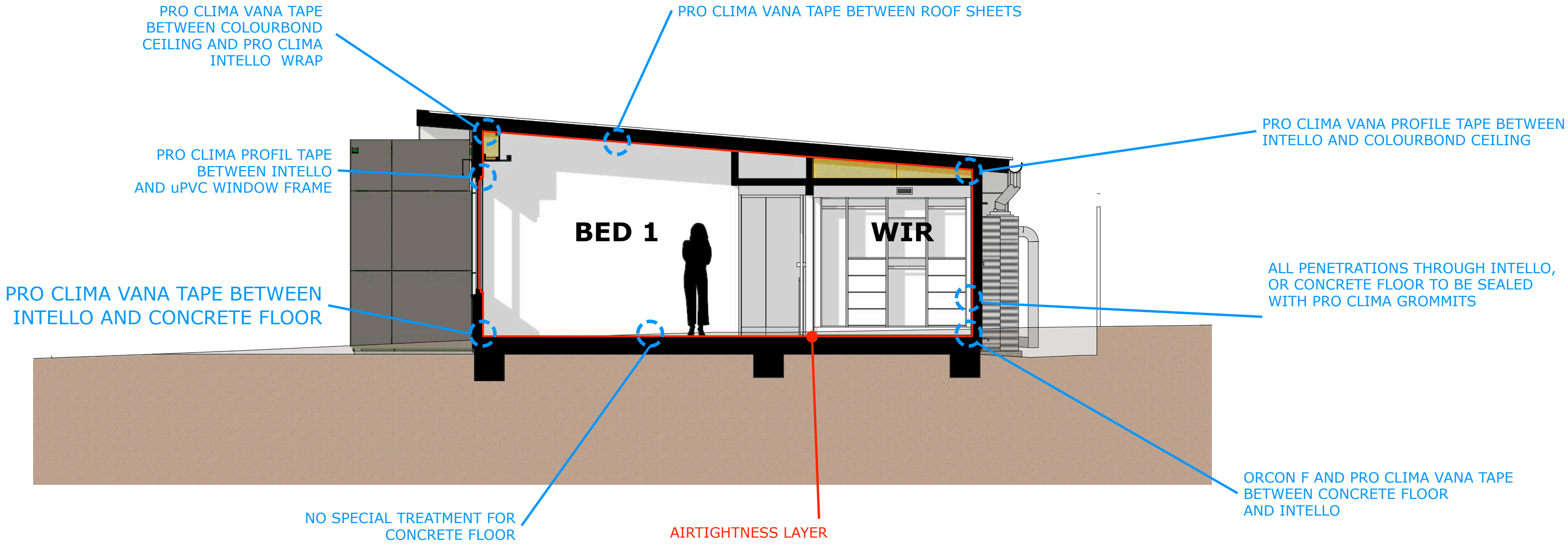
The windows were installed with screws and spray foam and then the air barrier formed using specialised airtight tapes between the window frame and surrounding wall membranes.

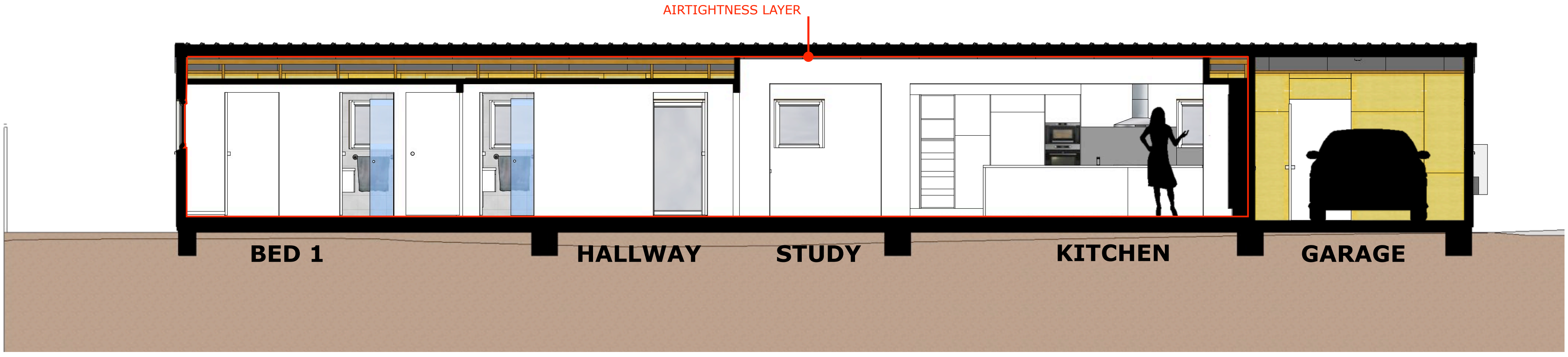


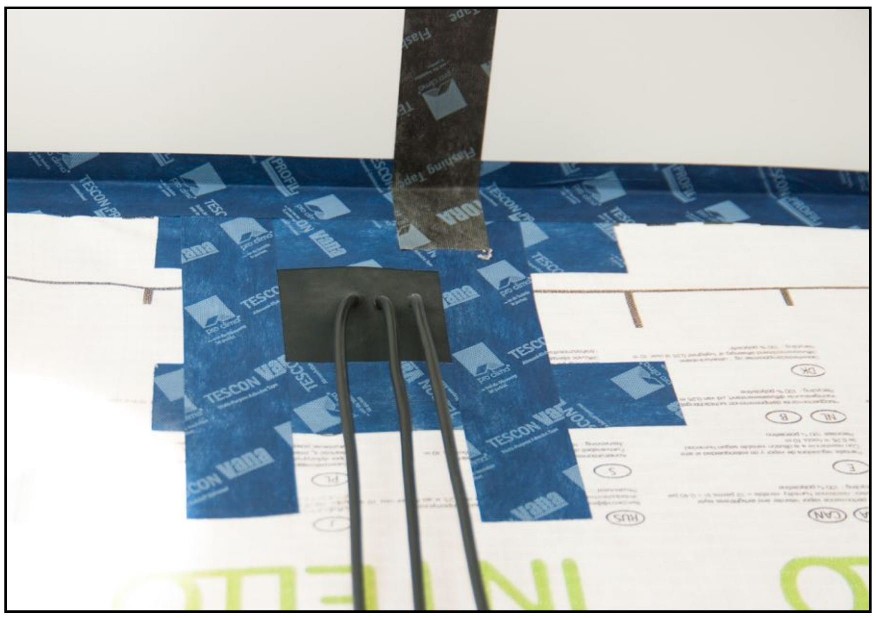


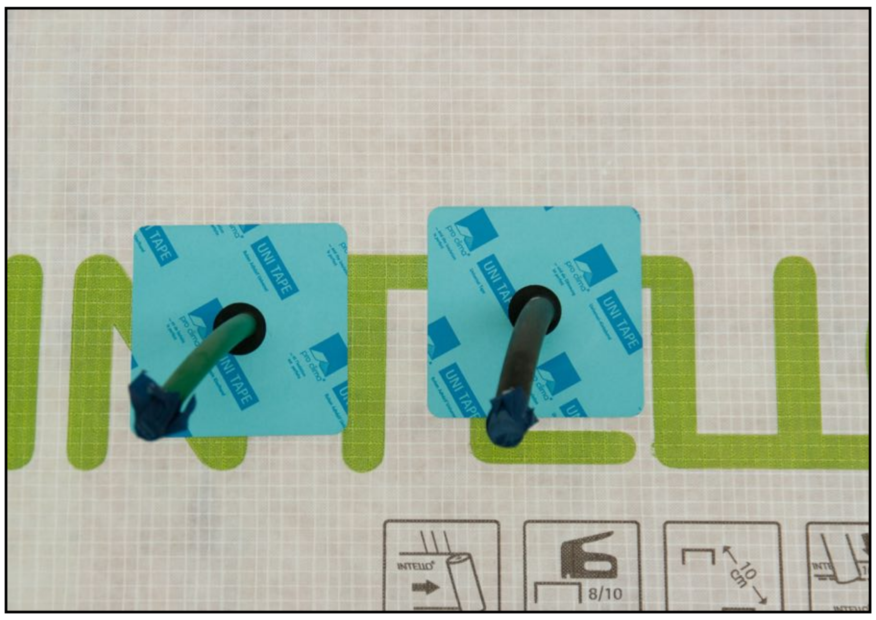
2.7.5 Airtight envelope

The airtightness of the house was independently tested to be 0.1 Air changes per hour at 50Pa. This extraordinarily tight figure was achieved with tight fitting Structural Insulated Panels (SIPs) sealed with additional polyurethane sealant between joints; a weathertight barrier on the outside sealed with airtight tape; an airtight barrier on the inside sealed with airtight tape; and a building design optimised to avoid penetrations. Surface mounted hardware was used where possible, like power tracks, battery operated light switches and track lighting. Where penetrations were unavoidable, grommets were used to seal around the entry points.









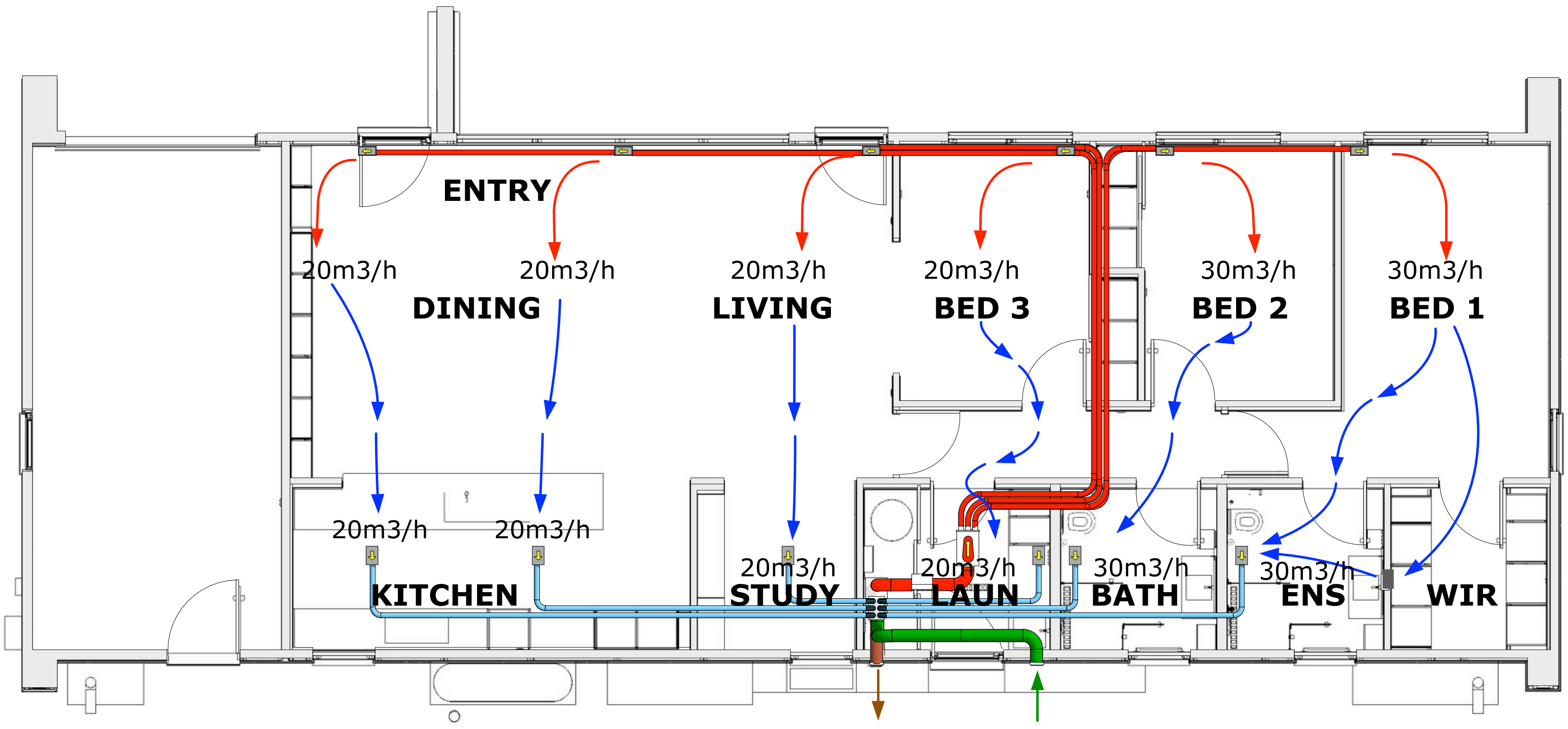
2.7.6 Ventilation ductwork

Fresh air ducts were installed throughout the house using Zehnder Comfotube 75mm diameter smooth walled, flexible HDPE ducts. The ducting ran in the ceiling cavity where possible and elsewhere, inside purpose-built bulkheads.

The main intake and exhaust ducts were Zehnder Comfopipe 150mm diameter rigid Polypropylene ducts with 50mm of foil-faced mineral wool outer insulation.

Dual purpose manifold boxes / silencers were used to distribute ducting from the main unit to six supply ports in the bedrooms and living areas and six extraction ports in the kitchen and bathrooms.

Acoustic door vents allowed overflow ventilation to pass through corridors to reach exhaust vents in neighbouring rooms.



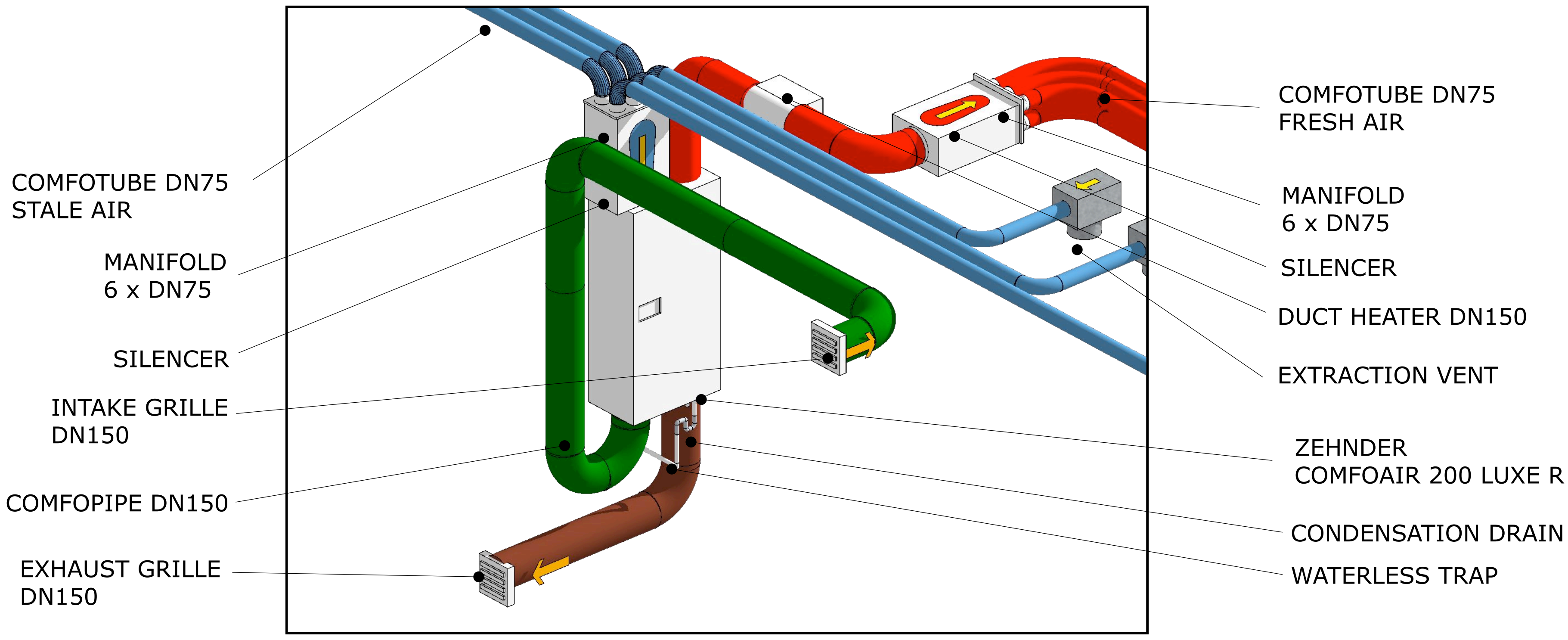
2.7.7 Ventilation central unit

Ventilation and heat recovery was achieved using a Zehnder ComfoAir 200 Luxe with a 87% heat recovery efficiency and 0.42 Wh/m3 electrical efficiency. A fine grade F7 filter was installed to filter out dust and pollen to clean the incoming air and a courser G4 filter used to prevent pollutants and insects inside the house from entering the heat exchanger.

Balancing of the system was undertaken using a calibrated TSI 9565 meter with a 964 hot wire anemometer probe.

Cooking smells were to be filtered out using a carbon filter in the cooker hood and by recirculating the air back into the kitchen before extracting it out of the house via two ventilation ports.

The exterior inlet and exhaust ports were placed 3 meters apart to avoid pollutants re-entering the building. These were protected from insects using a fine filter mesh.



2.7.8 Heating supply

A 1.2kW electric element post-heater was installed inline with the ventilation ducting immediately after the HRV central unit. The unit has a wall mounted thermostat but neither the heater or the thermostat controls were ever wired in as the owners felt the house was comfortable enough to live in without additional heating.

2.8 Important PHPP results

Passive House verification

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Building:	Chifley Passivhaus		
Street:	10A Anderson Street		
Postcode / City:	2606 Canberrra		
Country:	Australia		
Building type:	Detached single family home		
Climate:	Canberra	Altitude of building site (in [m] above sea level):	599
Home owner / Client:	Harley Truong		
Street:	10B Anderson Street		
Postcode/City:	2606 Canberra		
Architecture:	Harley Truong		
Street:	10B Anderson Street		
Postcode / City:	2606 Canberra		
Mechanical system:	Harley Truong		
Street:	10B Anderson Street		
Postcode / City:	2606 Canberra		

Year of construction:	2014		Interior temperature winter:	20.0	°C	Enclosed volume V_e m³:	450.9
No. of dwelling units:	1		Interior temperature summer:	25.0	°C	Mechanical cooling:	
No. of occupants:	3.6		Internal heat sources winter:	2.1	W/m²		
Spec. capacity:	84	Wh/K per m² TFA	Ditto summer:	2.8	W/m²		

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	127.3	m²		
Space heating	Heating demand	15	kWh/(m²a)	15 kWh/(m²a)	yes
	Heating load	15	W/m²	10 W/m²	-
Space cooling	Overall specif. space cooling demand		kWh/(m²a)	-	-
	Cooling load		W/m²	-	-
	Frequency of overheating (> 25 °C)	6.8	%	-	-
Primary energy	Heating, cooling, dehumidification, DHW, auxiliary electricity, lighting, electrical appliances	111	kWh/(m²a)	120 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	75	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity		kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	0.1	1/h	0.6 1/h	yes

* empty field: data missing; '-': no requirement

Passive House?	yes

We 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 application.

Name: Harley	**PHPP Version 8.5**
Surname: Truong	**Issued on:** 13/02/2015
Company:	**Signature:**

2.9 - 2.10 Construction costs

€ 1820 / m2

2.11 Year of construction

2014

2.12 Architectural design

The owner designed the project using the software CAD packages Sketchup and Layout. Of particular use was the shadow analysis tool to help optimise sun penetration and the ability to use the 3D models to visualise airtightness details, thermal bridge-free junctions and to communicate building assembly procedures to construction staff. In addition, the Passive House Planning Package (PHPP) was used from the beginning of the design process, in particular to guide the material selection process.

2.13 Building Services

The building services were designed by the owner/designer using Sketchup. All ventilation, plumbing, electrical and lighting runs were modelled in 3D. Room layouts were chosen to allow for simple ventilation paths and bulkheads, false ceilings, and battened walls were strategically placed to house electrical and ventilation services. The MVHR was also designed and commissioned by the owner.

2.14 Building physics

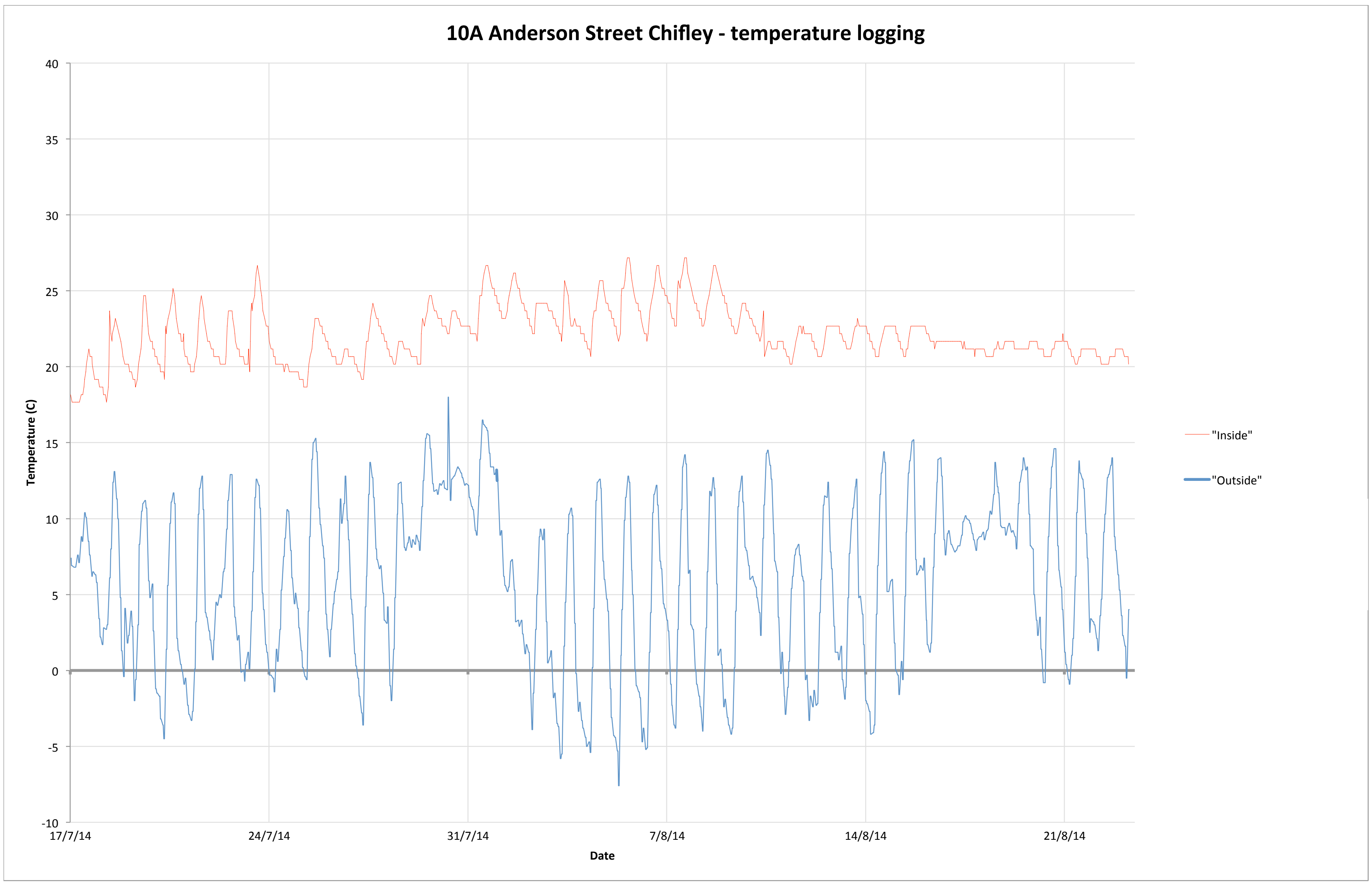
The owner/designer used PHPP and Therm to model the building physics.

2.15 Structural physics

John Skurr Consulting Engineers were responsible for the structural physics throughout the project.

2.16 User experience

The house was designed and part-built by the owner who also lived in the house for 4 months over a cold winter season. During that time, the post-heater was never used but the house remained above a comfortable 19 degrees Celsius despite there being multiple sub-zero mornings. The inside air was always fresh and the tiled floors felt comfortable under foot. Energy consumption for the first winter was 14 kWh / day.



2.16 Research materials and publications

The full set of construction drawings is available to the public on this website:

http://passivehouseaustralia.org/example-project-now-online/

A monitoring system that logs the temperature, humidity and energy usage of the house has been established and is publicly accessible on this website:

https://sensorcloud.microstrain.com/SensorCloud/data/OAPI005D5XDG7KW1/

Tours are frequently run and are open to the public. For details visit:

http://www.see-change.org.au/house-tours/