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PASSIVHAUS + SUSTAINABILITY

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

Project Documentation

1 Abstract

Single family house in Bellbrae, Victoria, Australia

1.1 Data of building

Year of construction	2015	**Space heating**	**16 kWh/(m²a)**
U-value external wall	0.220 W/(m²K)		
U-value basement ceiling	0.284 W/(m²K)	**Primary Energy Renewable (PER)**	- kWh/(m²a)
U-value roof	0.215 W/(m²K)	**Generation of renewable energy**	21.4 kWh/(m²a)
U-value window	1.12 W/(m²K)	**Non-renewable Primary Energy (PE)**	71 kWh/(m²a)
Heat recovery	79.4 %	Pressure test n_{50}	1.0 h-1
Special features	Rainwater utilisation, small phase change inclusion (embedded in the plasterboard)		

1.2 Brief Description

Bellbrae EnerPHit

When home owners Allan and Gail Roberts decided to renovate their cold and draughty weatherboard home they didn't have to look further than son Dale, a registered builder with a passion for Passivhaus.

The building is designed and built to the Passivhaus standard; setting up stringent limits on energy consumption (in particular it's heating and cooling demand), whilst at the same time offering optimum thermal comfort and indoor air quality. The Passivhaus standard differs from traditional energy efficient models in the sense that that it does not rely on thermal mass and passive solar design, which in this case is very beneficial as there is limited ability to incorporate thermal mass into existing lightweight construction.

The use of heat recovery ventilation supports optimal thermal performance with little or no input required on behalf of the occupants. Aside from maintaining the filters in the in the ventilation unit and utilising external shading where necessary there is really no requirement by the occupants to help the house perform. The goal was to make the house as user friendly as possible whilst also achieving the highest possible standards of thermal comfort and energy efficiency.

The detailed use of building physics theory and real life practical application is why the Passivhaus standard has become popular worldwide and why when utilised, one can expect their home to perform to the highest standard as is the case here.

Triple glazed windows and a state of the art energy recovery ventilation system are also an integral part of the refit.

The project took advantage of the Passivhaus standard's non-reliance on thermal mass, as the project was originally lightweight timber construction and used an upgrade in place methodology to retrofit insulation without affecting structure or major built elements.

1.3 Responsible project participants

Architect	Dale Roberts, APHi Projects www.aphiprojects.com.au
Implementation planning	Clare Parry, Grün Consulting www.grunconsulting.com
Building systems	Joel Seagren, Fantech Australia www.fantech.com.au
Building physics	Clare Parry, Grün Consulting www.grunconsulting.com
Passive House project planning	Clare Parry, Grün Consulting www.grunconsulting.com
Construction management	Dale Roberts, APHi Projects www.aphiprojects.com.au

Certifying body	Mead: Energy & Architectural Design Ltd. www.mead.co.uk		
Certification ID	13825_MEAD_EP_20160713_KM	Project-ID (www.passivehouse-database.org)	5193

Author of project documentation	Clare Parry, APHi Projects www.aphiprojects.com.au
Date, Signature	 13 OCT 17

2 Construction Concept

Designed and built by APHi Projects, this project was a retrofit of the Robert's family's much loved existing weatherboard home, in Bellbrae, near the southern coast of Victoria. A three bedroom dwelling, the retrofit included the addition of a small ensuite in the master bedroom.

The building is oriented along the east-west axis with the main entry to the south and views an outdoor decking to the north. The original design remained largely unchanged, with the renovation realising the client's desire for open plan living. The site is in a rural location, with no close neighbouring properties; shading for the home included established trees.

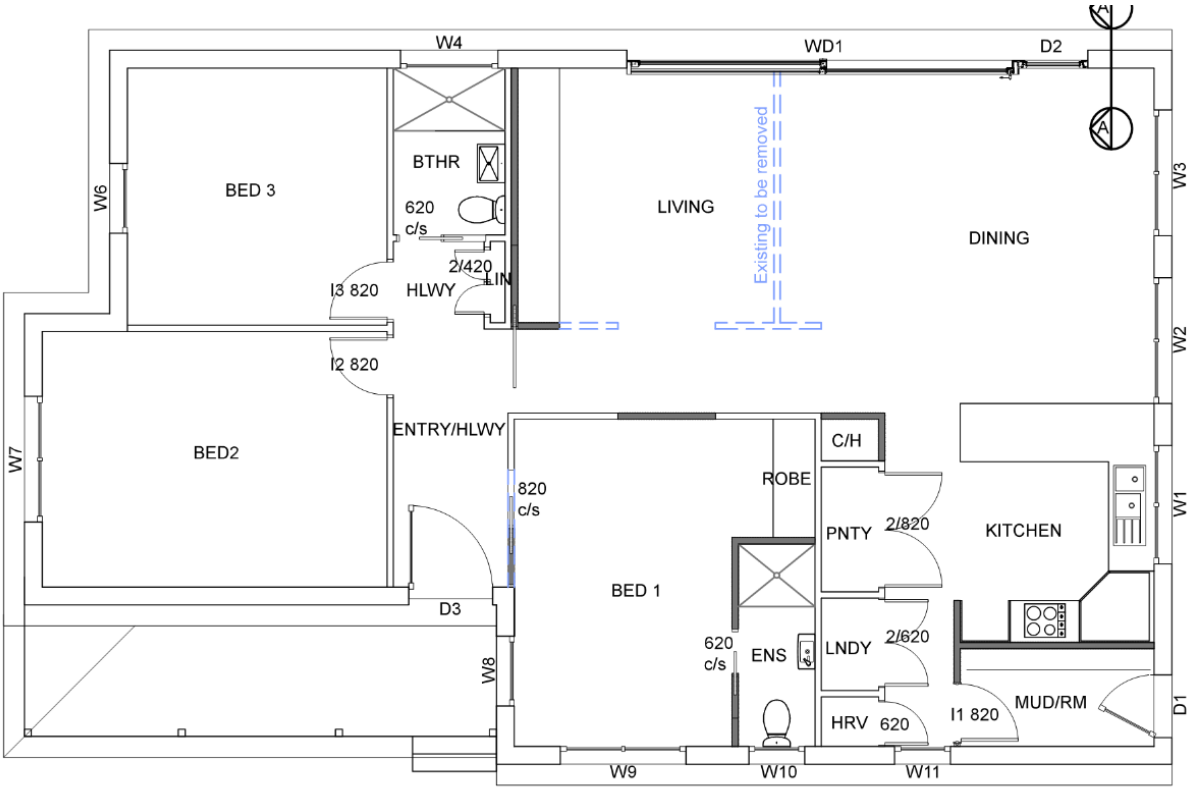


Figure 1: Floor plan (blue lines indicate demolition)

CONSTRUCTION ASSEMBLIES

Assemblies include:

WALLS: Existing construction was a typical wood frame with weatherboard cladding. This was stripped from the inside (old mineral wool insulation fill), and refilled with R2.7Knauf Earthwool (Green Tag certified), with the addition of airtightness wrap (Intello) and new plasterboard. The old weatherboards were left in place, while new wood fibre (Gutex) insulation and new cladding was laid over;

ROOF: existing 210mm R3.5 polyester insulation in good condition was left in between rafters. This was combined with new layer of Intello and 40mm PIR insulation directly underneath, with new plasterboard, reducing the room height by just 40mm. At the pitched roof level there was new reflective sarking and steel (Colourbond) roofing;

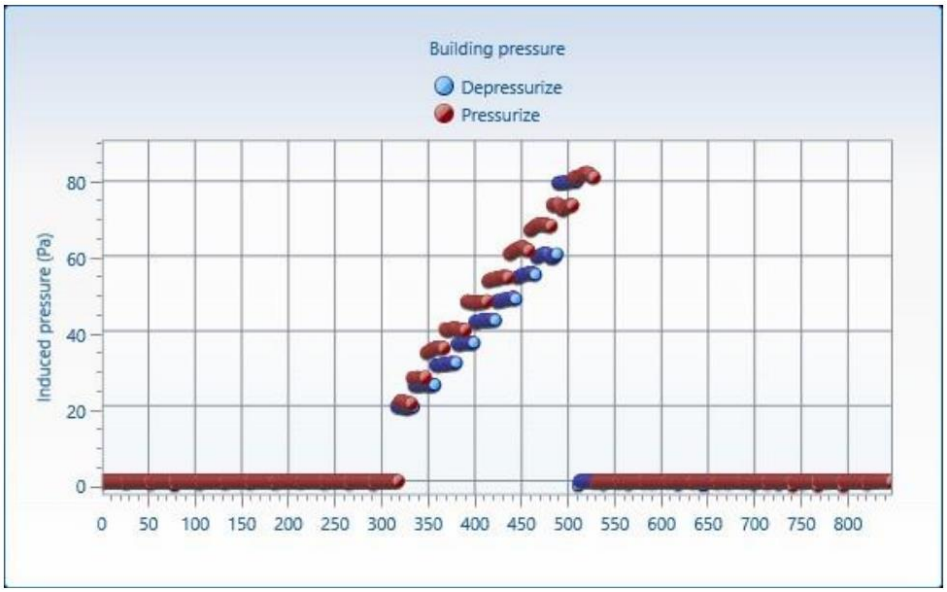
FLOOR: the existing floor was uninsulated. 100mm of rigid wood fibre insulation (Gutex) was fixed between existing timber joists, with addition of 45mm Gutex on top, below floor finishes (timber or tiles);

AIRTIGHTNESS: Intello wrap used for all constructions (wall, floor, roof) to achieve airtight construction;

Testing performed by Efficiency Matrix. Blower door test result: 0.96 h^{-1} (test results shown below);

Building and Test Information	
Testfile name:	**Gundrysrdfinal**
Building volume:	**443.3**
Building Height(from ground to top)	**0**
Floor Area:	**143**
Envelope Area:	**427.6**

Results	
Air flow at 50 Pa, Q_{50} [m^3/h]	**426.5**
Air changes, n_{50}	**0.96**
Equivalent leakage area at 50 Pa [cm^2]	**212.5**
Permeability at 50 Pa [$m^3/h/m^2$]	**0.997**



WINDOWS & INSTALLATION: Windows are solid timber frame Döpfner MIRA IV87 frames with triple glazing. Installation is shown in Figure 5.

- U_f: 1.0 W/m²K
- U_g: 0.8 W/m²K
- g-value: 0.58
- U_W: 0.98 W/m²K

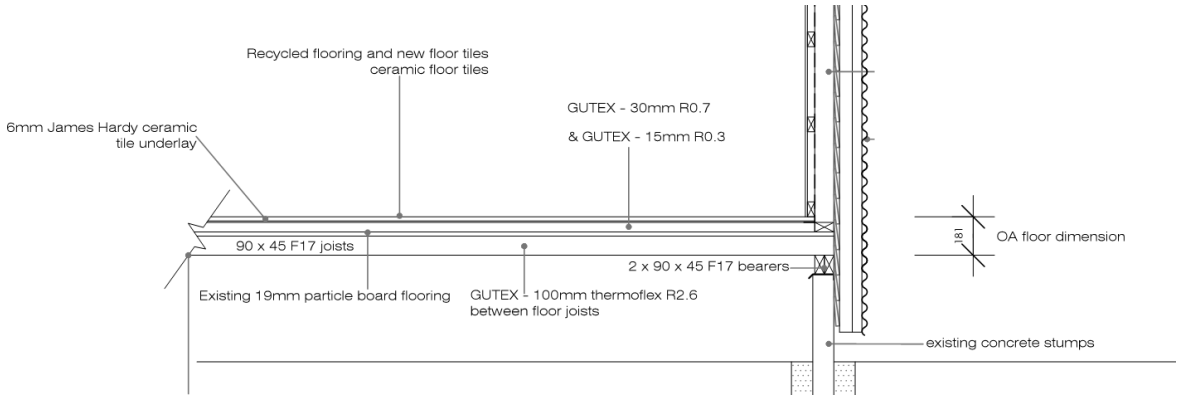


Figure 2 Floor construction

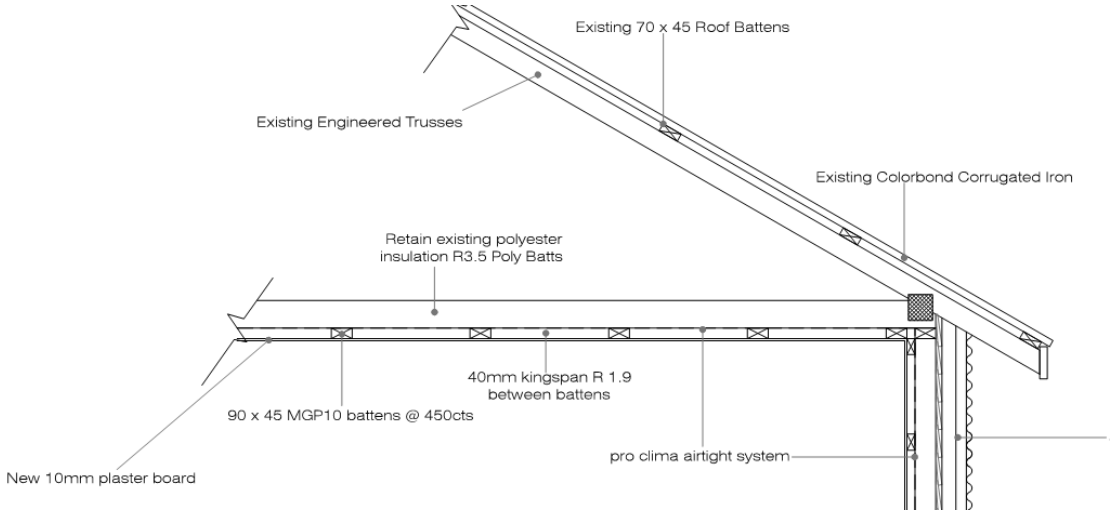


Figure 3 Roof construction

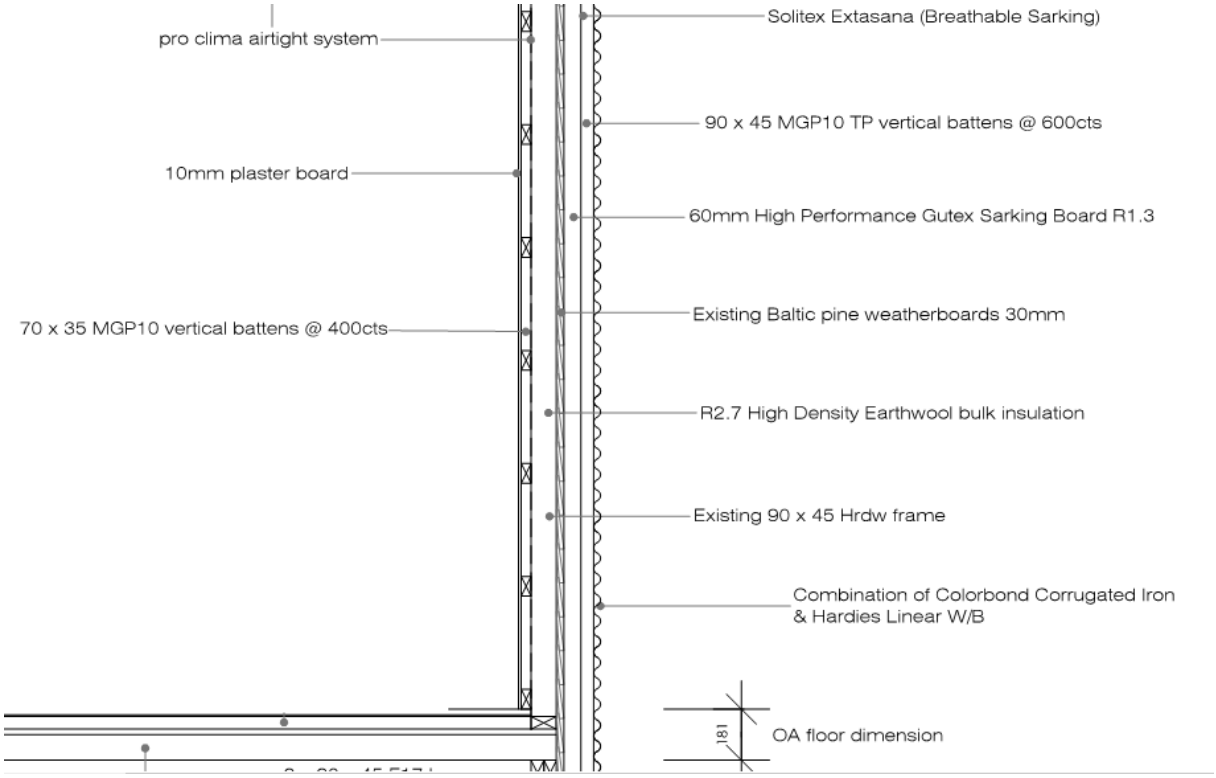


Figure 4 Wall construction

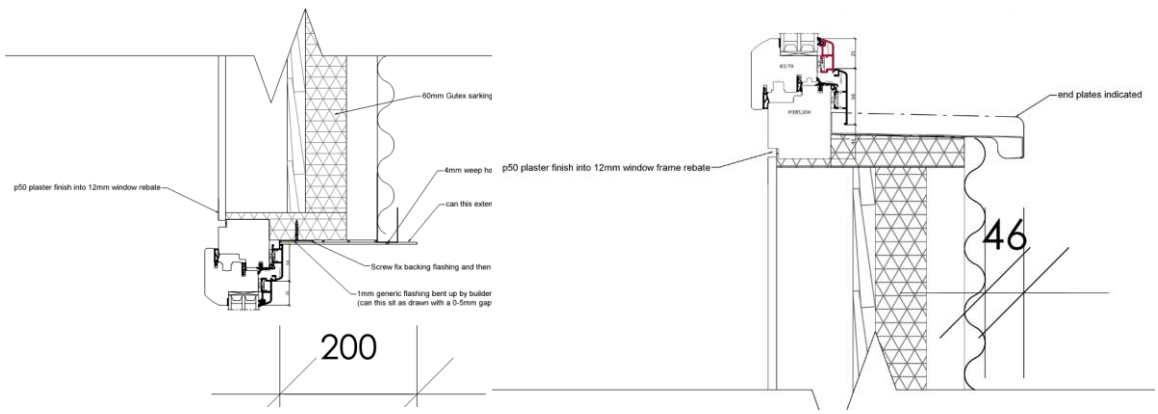


Figure 5 Window instllation – mullion (left) and sill (right)

VENTILATION SYSTEM: A Zehnder ComfoAir350 (efficiency 84%, sensible only; 0.29Wh/m^3) was installed in the home, with a simple layout supplying air to all occupant spaces and extracting from kitchen, bathroom and ensuite. The rangehood for the stove is a recirculating Bora model induction stove, thus not impacting on the envelope or the ventilation system.

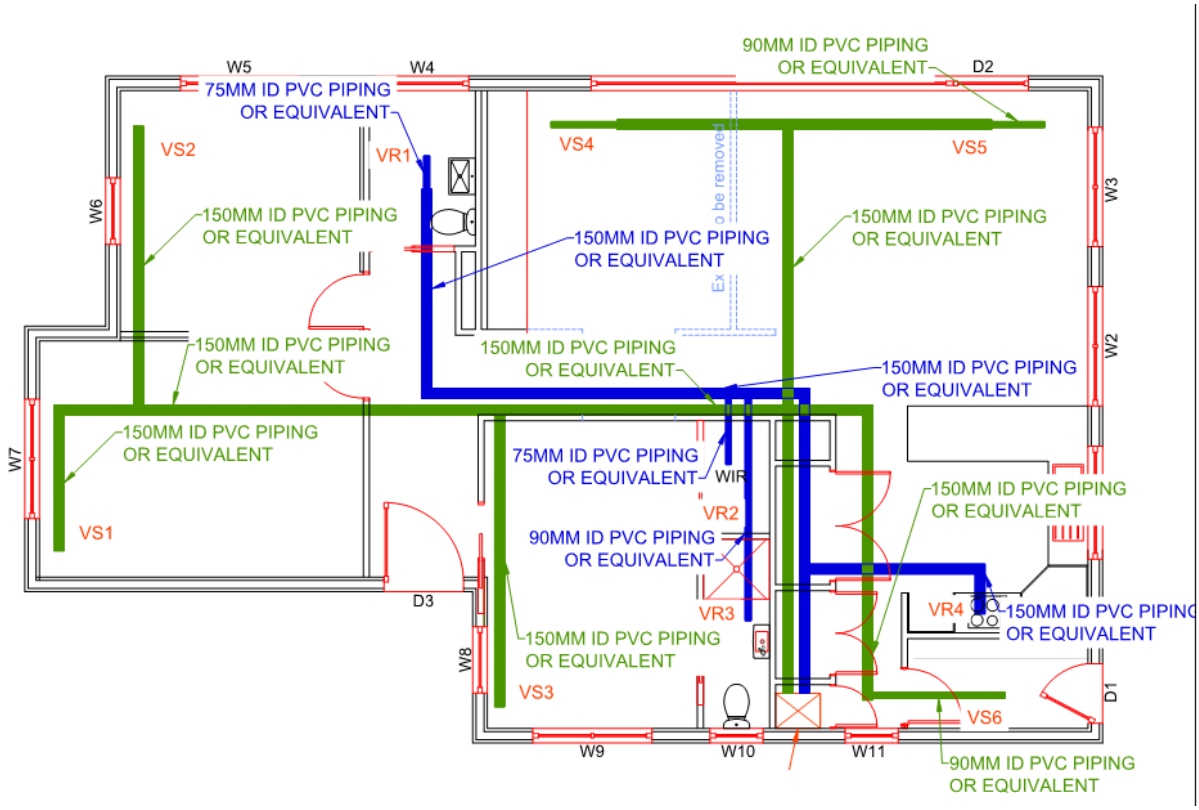


Figure 6 Ducting layout: green = supply air, blue = extract air

EXTERIOR AND INTERIOR PHOTOS

Figure 7 North elevation

Figure 8 Kitchen, including down-draft in-built kitchen hood

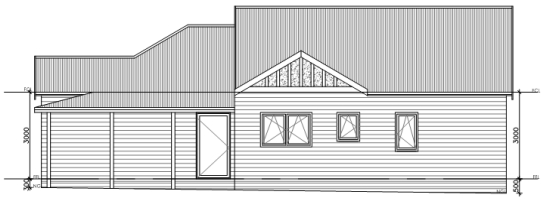
Figure 9 Open plan living, kitchen and dining room, wood heater shown on left

Figure 10 North elevation

Figure 11 West elevation, showing main entrance, south elevation to the right of picture

Figure 12 East elevation

EnerPHit verification



Building:	Bellbrae House				
Street:	635 Gundrys Rd				
Postcode / City:	Bellbrae 3228				
Country:	Australia				
Building type:	Dwelling				
Climate:	Bellbrae VIC			Altitude of building site (in [m] above sea level):	90
Home owner / Client:	Roberts				
Street:	635 Gundrys Rd				
Postcode/City:	3228	Bellbrae	Victoria	Australia	
Architecture:	Aphi Projects Pty Ltd				
Street:	P.O. Box 5157				
Postcode / City:	3219	East Geelong	Victoria	Australia	
Mechanical system:	Fantech Pty. Ltd.				
Street:	42-62 Pound Road West				
Postcode / City:	3175	Dandenong South	Victoria	Australia	

Year of construction:	2015		Interior temperature winter:	20.0	°C	Enclosed volume V_e m³:	373.5
No. of dwelling units:	1		Interior temperature summer:	25.0	°C	Mechanical cooling:	
No. of occupants:	2.0		Internal heat sources winter:	1.0	W/m²		
Spec. capacity:	84	Wh/K per m² TFA	Ditto summer:	4.5	W/m²		

Specific building demands with reference to the treated floor area

				Requirements	Fulfilled?*
	Treated floor area	129.9	m²		
Space heating	Heating demand	**16**	**kWh/(m²a)**	25 kWh/(m²a)	-
	Heating load	**9**	**W/m²**	-	-
Space cooling	Overall specif. space cooling demand		**kWh/(m²a)**	-	-
	Cooling load		**W/m²**	-	-
	Frequency of overheating (> 25 °C)	1.0	%	-	-
Primary energy	Heating, cooling, auxiliary electricity, dehumidification, DHW, lighting, electrical appliances	**75**	**kWh/(m²a)**	121 kWh/(m²a)	yes
	DHW, space heating and auxiliary electricity	48	kWh/(m²a)	-	-
	Specific primary energy reduction through solar electricity	48	kWh/(m²a)	-	-
Airtightness	Pressurization test result n_{50}	**1.0**	**1/h**	1 1/h	yes

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