BluKube Architecture

# Project Documentation
# Gebäude-Dokumentation

## Abstract | Zusammenfassung

## Ballina Passive House

### Data of building | Gebäudedaten

| | | | |
|---|---|---|---|
| Year of construction<br>Baujahr | 2021 | **Space heating**<br>**Heizwärmebedarf** | **4.62**<br>**kWh/(m²a)** |
| U-value external wall<br>U-Wert Außenwand | 0.292<br>W/(m²K) | | |
| U-value basement<br>U-Wert Kellerdecke | 6.294<br>W/(m²K) | Primary Energy Renewable (PER)<br>Erneuerbare Primärenergie (PER) | 39<br>kWh/(m²a) |
| U-value roof<br>U-Wert Dach | 0.292<br>W/(m²K) | Generation of renewable Energy<br>Erzeugung erneuerb. Energie | 34<br>kWh/(m²a) |
| U-value window<br>U-Wert Fenster | 1.55<br>W/(m²K) | Non-renewable Primary Energy (PE)<br>Nicht erneuerbare Primärenergie (PE) | 83<br>kWh/(m²a) |
| Heat recovery<br>Wärmerückgewinnung | 84 % | Pressurization test n<br>Drucktest $n_{50}$ | 0.1 $h^{-1}$ |
| Special features<br>Besonderheiten | Photovoltaic panels are located on northern roof of the detached garage.<br><br>Photovoltaik-Paneele befinden sich auf dem Norddach der freistehenden Garage. | | |

## Brief Description

### Ballina Passive House

Located in Northern New South Wales, Australia near the Richmond River in Ballina, a certified 'classic' passive house home has been built. This location is considered sub-tropical locally (warm temperate to PHI) where the midges and mosquitoes are required to be kept out of buildings with fly screens and termites kept away through construction methods and materials. This building is of timber construction boldly finished externally, with a more relaxed and lowkey interior, is home to the client who likes to entertain and have guests stay.

The clients brief included aging in place requirements, a quiet space to call home (due to nearby noise sources) and place to play music combined with achieving the certified passive house goal.

The bulk insulated timber framed dwelling is the first residential building in Australia to be fully built with structural OSB-3 covered with an adhesive water-resistant air tight barrier, followed by continuous woodfibre insulation. A ventilated cavity exists around the whole building cladding (walls and roofing) which enables the building to use convection to keep the cavity dry.

## Kurzbeschreibung

### Ballina Passivhaus

Im Norden von New South Wales, Australien, in der Nähe des Richmond River in Ballina, wurde ein zertifiziertes „klassisches" Passivhaus gebaut. Dieser Ort gilt lokal als subtropisch (warm gemäßigt für PHI), wo Mücken und Mücken mit Fliegengittern von Gebäuden ferngehalten werden müssen und Termiten durch Konstruktionsmethoden und -materialien ferngehalten werden.

Die Aufgabenstellung des Kunden umfasste die Anforderungen an die Alterung vor Ort, einen ruhigen Ort, an dem man sein Zuhause anrufen kann (aufgrund nahegelegener Lärmquellen) und einen Ort, an dem Musik abgespielt werden kann, kombiniert mit dem Erreichen des Ziels des zertifizierten Passivhauses.

Das massiv isolierte Holzrahmenhaus ist das erste Wohngebäude in Australien, das vollständig mit strukturellem OSB-3 gebaut wurde, das mit einer klebenden, wasserfesten, luftdichten Barriere bedeckt ist, gefolgt von einer durchgehenden Holzfaserdämmung. Um die gesamte Gebäudeverkleidung (Wände und Dach) herum befindet sich ein belüfteter Hohlraum, der es dem Gebäude ermöglicht, die Konvektion zu nutzen, um den Hohlraum trocken zu halten.

## Responsible project participants
## Verantwortliche Projektbeteiligte

| | |
|---|---|
| Architect<br>Entwurfsverfasser | Kylie Mills<br>BluKube Architecture |
| Implementation planning<br>Ausführungsplanung | Kylie Mills<br>BluKube Architecture |
| Building systems<br>Haustechnik | - |
| Structural engineering<br>Baustatik | Ardill Payne & Partners, Ryan Beavis<br>https://www.ardillpayne.com.au/ |
| Building physics<br>Bauphysik | Sustainable Engineering<br>www.sustainableengineering.co.nz |
| Passive House project planning<br>Passivhaus-Projektierung | Kylie Mills<br>BluKube Architecture |
| Construction management<br>Bauleitung | Scholten Group<br>https://scholtengroup.com.au/ |

## Certifying body
## Zertifizierungsstelle

Sustainable Engineering Ltd
www.sustainableengineering.co.nz

## Certification ID
## Zertifizierungs ID

| | |
|---|---|
| **6848**<br>https://passivehouse-database.org/index.php#d_6848 | Project-ID (www.passivehouse-database.org)<br>Projekt-ID (www.passivhausprojekte.de) |

## Author of project documentation
## Verfasser der Gebäude-Dokumentation

Kylie Mills – Architect BluKube Architecture

| Date<br>Datum | Signature<br>Unterschrift |
|---|---|
| 28 April 2022 | Kylie Mills |

## 1. Exterior photos - Ansichtsfotos

East

West

North

North East

South & West

## 2. Interior photos - Innenfoto exemplarisch

Kitchen as part of the open plan living.

## 3. Sections - Schnittzeichnung

LONGITUDINAL SECTION A-A

CROSS SECTION D-D

## 4. Floor plans - Grundrisse


**FLOOR PLAN**

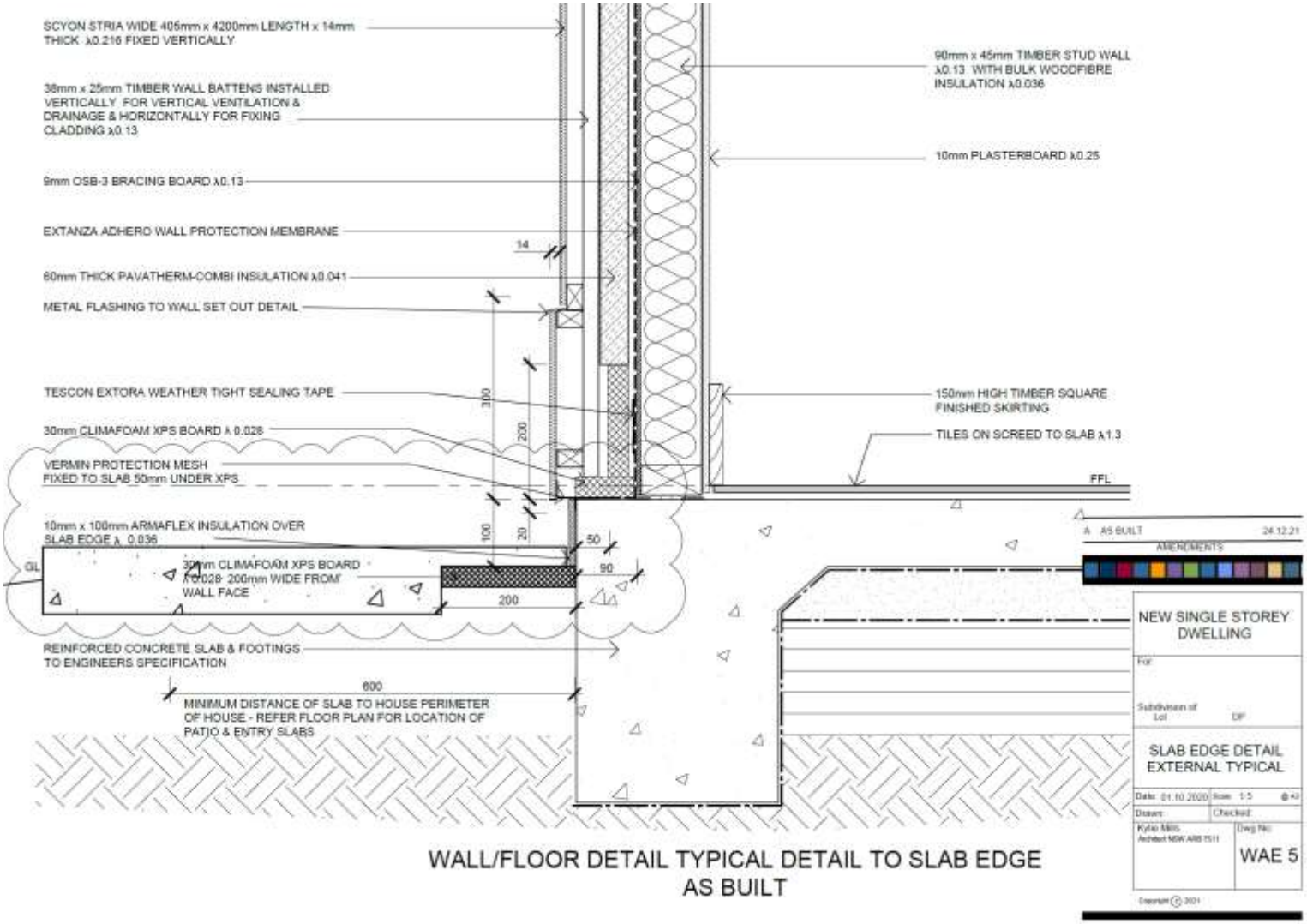
The sites characteristics are defined as an irregular heptagon (boot shaped) appearance entering off a cul-de-sac with a stormwater bio-retention cell to the left front side of the site which must not be built over or altered in any manner. Generally, the site is flat with 5.0m easement to the northwest which falls to the boundary with a height difference of 0.6m to a concrete swale drain. The northeast of the site is constrained by a 5.0m easement which falls approximately 1.80m over 7.0m, then falls to a concrete swale drain.

The site environs, aspect and typology fused together with a detailed 17 page plus sketch drawings provided by the client's detailed brief contributed to the final home design. With aging in place and accessibility a high priority, spaces and ideas developed into functional elements that have proven to work well post construction.

Communication was an extremely import aspect of this project to ensure that all members of the construction team: the builder, architect, engineer and other consultants collaborated with the same intentions and goals. The use of technology made the process possible with the ability to share files and images that may be required for construction or to resolve any issues, share exciting moments (ie: airtightness test results) and obtain a positive outcome for the client. Particularly with the architect being over 700km in distance away in Sydney online site meetings, discussions and emails about materials and performance took place.

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

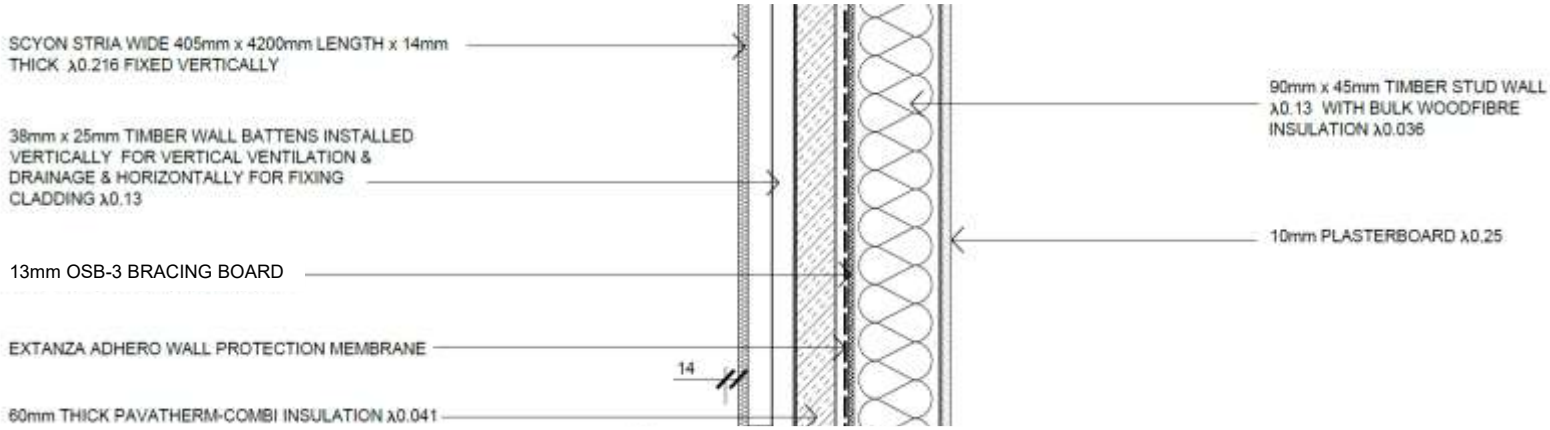
Vapour barrier (**no** under slab insulation) at slab preparation with engineered reinforced slab, beams and piers, during concrete pour and screeding.




WALL/FLOOR DETAIL TYPICAL DETAIL TO SLAB EDGE
AS BUILT

## 6. Wall construction including insulation - Konstruktion der Außenwände

Frame: Timber Frame with bulk insulation and plasterboard painted finish within & woodfibre insulation external of WRB on structural OSB-3 typical U-Value 0.23W/(m2K)

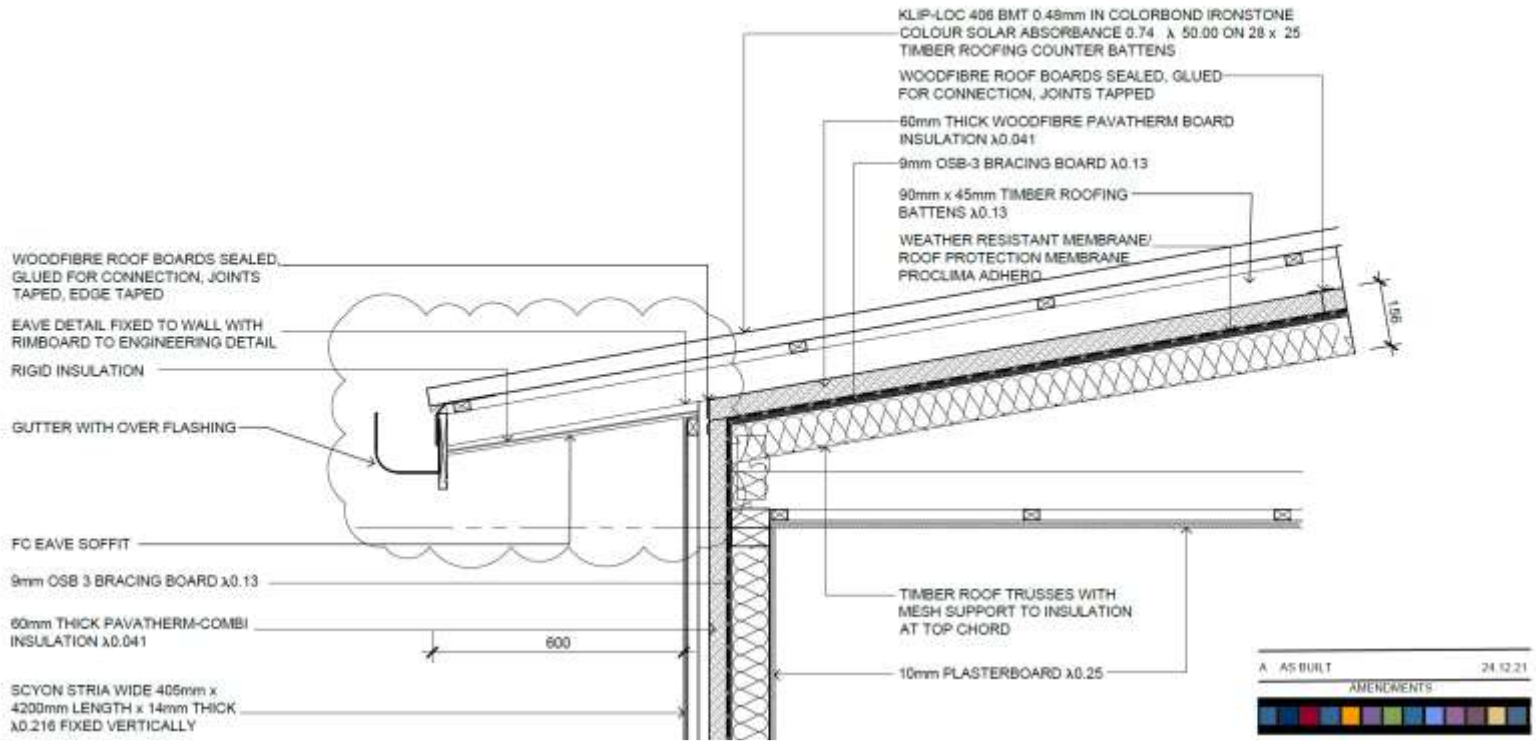



**TYPICAL WALL ENVELOPE DETAIL**

Timber framing prior OSB-3 installation on concrete slab.

Bulk insulation to living room.

## 7. Roof construction including insulation - Konstruktion des Daches




**TYPICAL WALL & TRUSS CEILING DETAIL**

Trussed roof with bulk Earthwool insulation batts R2.7 held in position with netting at top chord. Image also shows ductwork distribution within truss web and access walk in ceiling space.

Ventilated roof frame on woodfibre insulation board λ0.043 prior to metal sheet installation with ventilated ridge and fascia board.

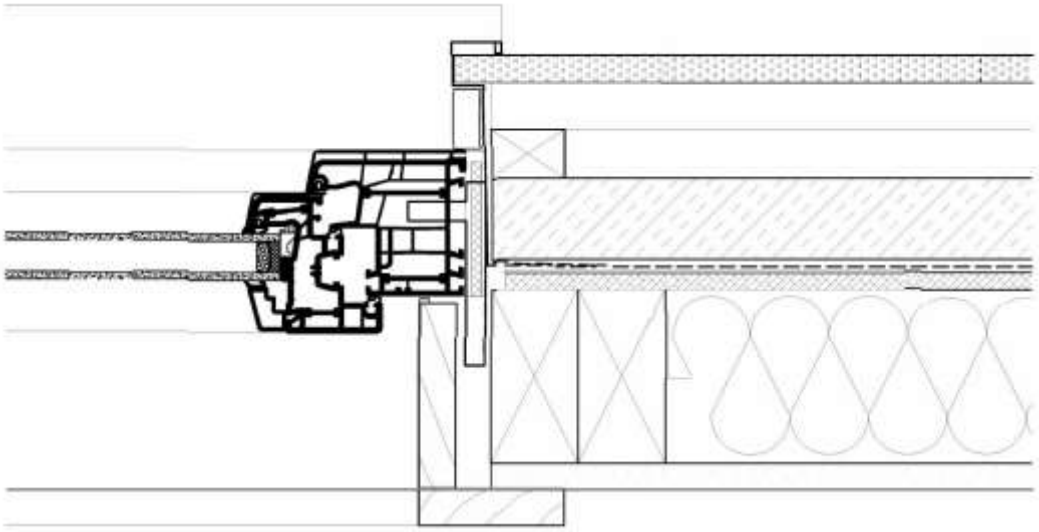
## 8. Window and window installation including glass Ug / g-value and frame performance - Fenster und Fenster-Einbau

Tilt & Turn Windows & Tilt and Slide Doors
Neuffer UPVC Double Glazed
Aluplast 5000 TS
Uw-value 1.55 W/(m2K)
Uf -Value 1.02 W/(m²K)

g–Value 0.65
Ug -Value – 1.12 (W/m²K)

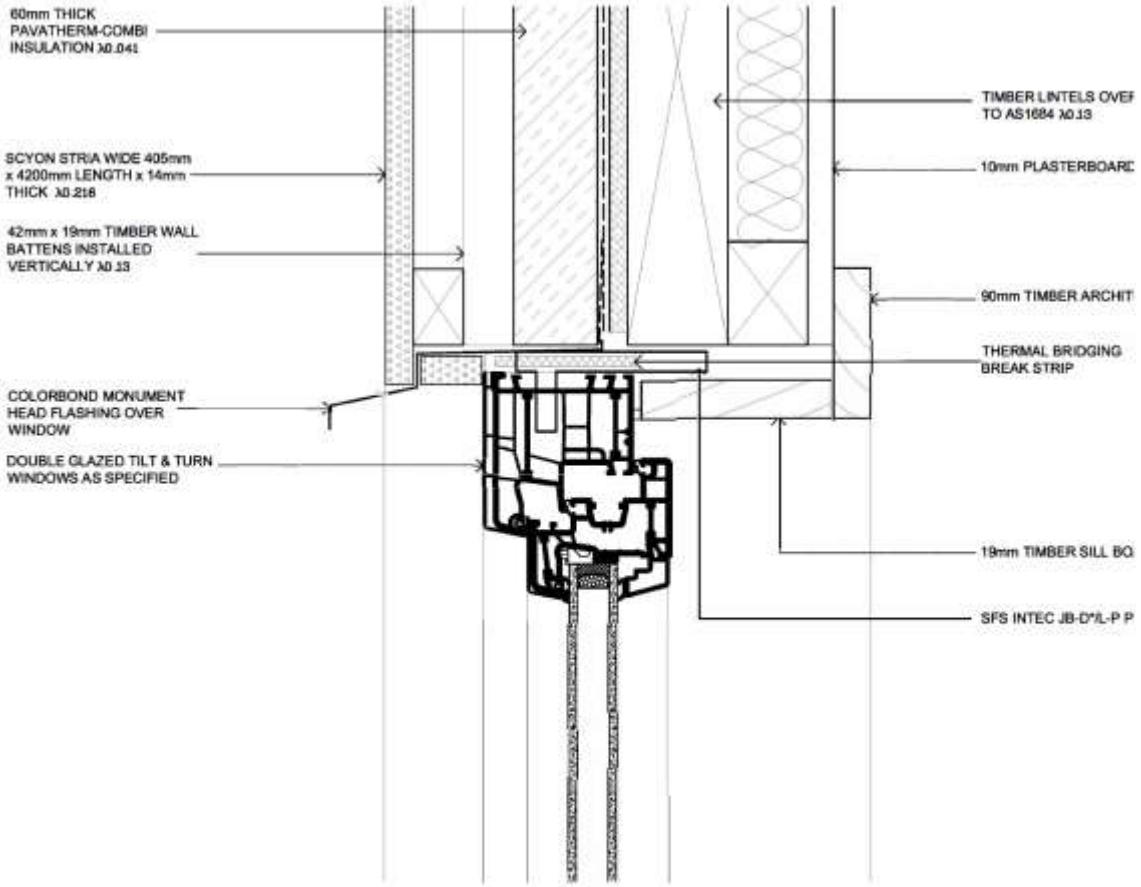
With Swisspacer Ultimate

Doors & Windows installed prior to woodfibre & cladding install taped to air weather barrier.

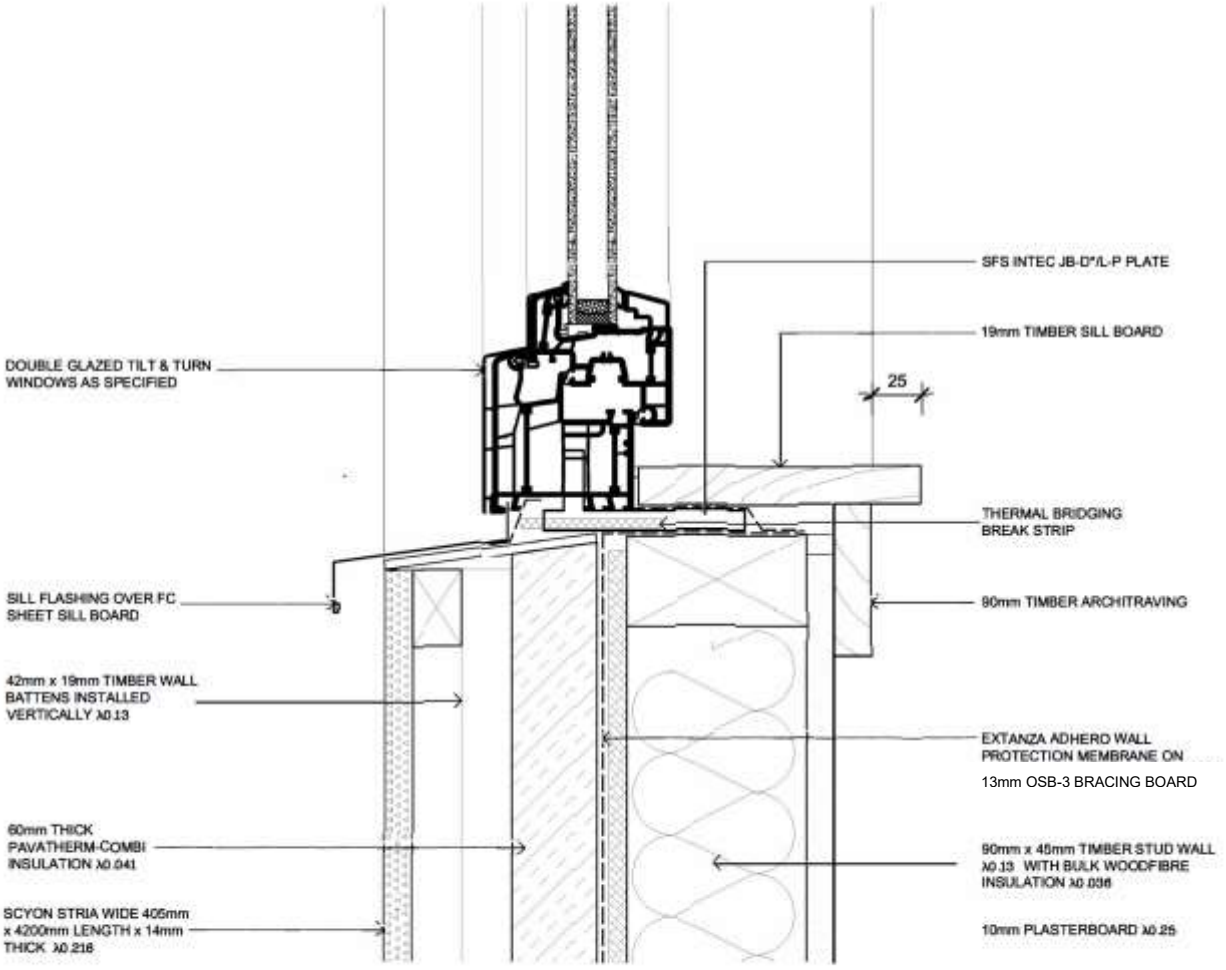


3 TYPCIAL WINDOW JAMB
1 : 2

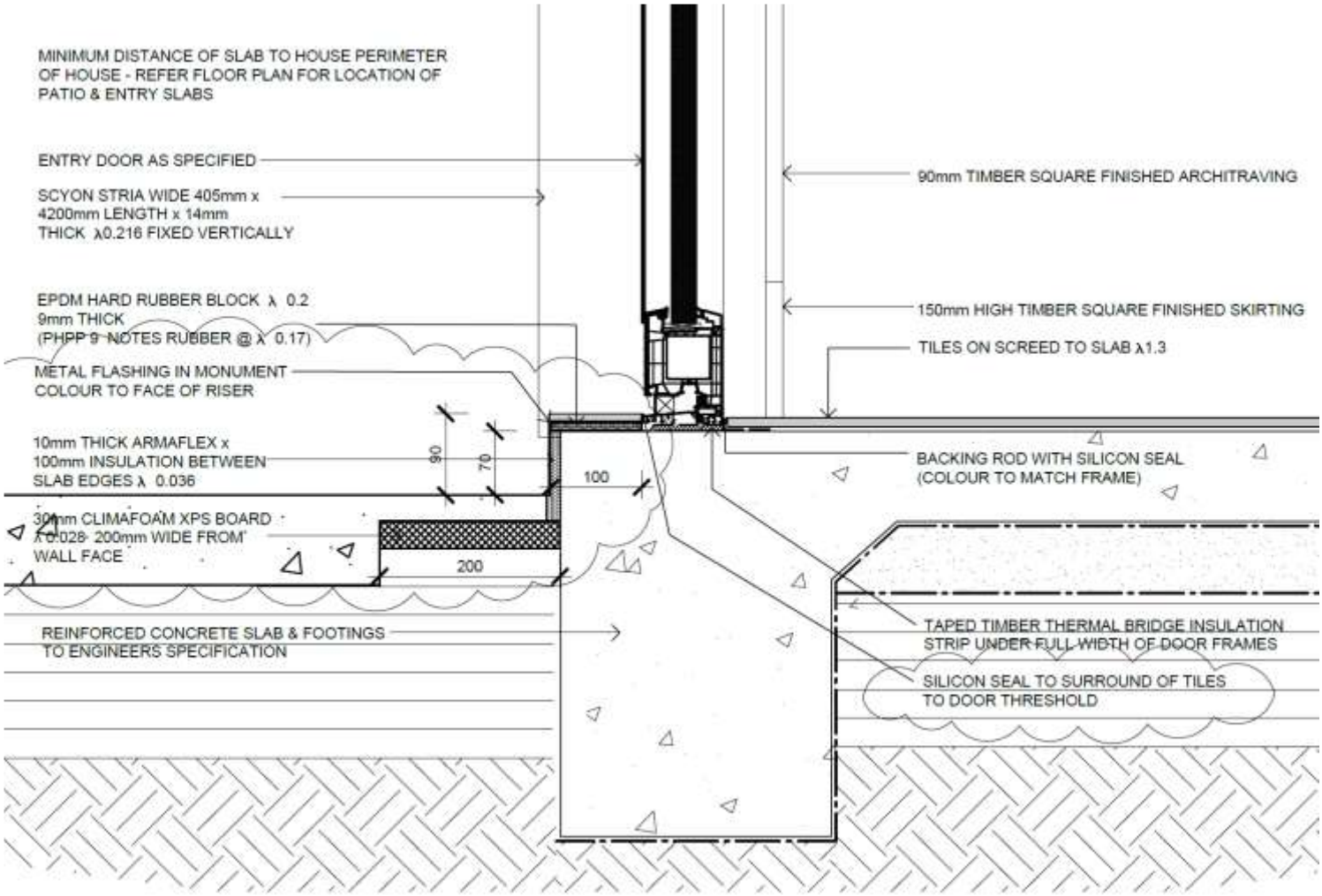
*Detailed section next page.*




1 **TYPICAL WINDOW HEAD**
1 : 2

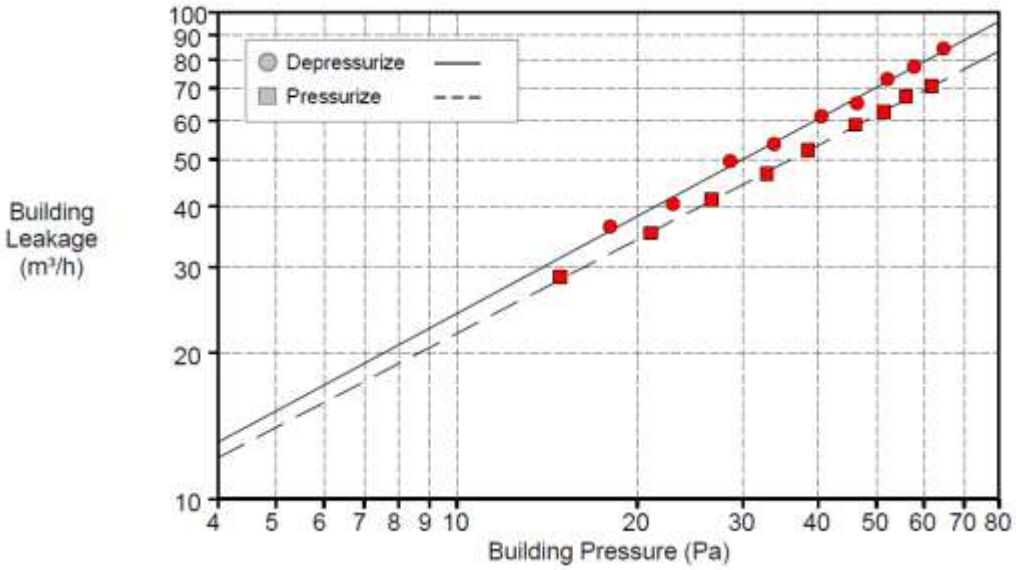



2 **TYPICAL WINDOW SILL**
1 : 2




**TYPICAL DOOR THRESHOLD**

## 9. Air leakage testing – Beschreibung der luftdichten Hülle




| **Test Results at 50 Pascals:** | Depressurization | Pressurization | Average |
|---|---|---|---|
| $q_{50}$ : m³/h (Airflow) | 70 (+/- 2.0 %) | 62 (+/- 0.8 %) | 66 |
| $n_{50}$ : 1/h (Air Change Rate) | 0.11 | 0.10 | 0.10 |
| $q_{F50}$ : m³/(h·m² Floor Area) | 0.28 | 0.24 | 0.26 |
| $q_{E50}$ : m³/(h·m² Envelope Area) | 0.10 | 0.09 | 0.09 |

Air pressure test done by Air Tightness Testing Services Australia Pty Ltd.

Adhesive air control barrier installed on roof, woodfibre panels being installed over.

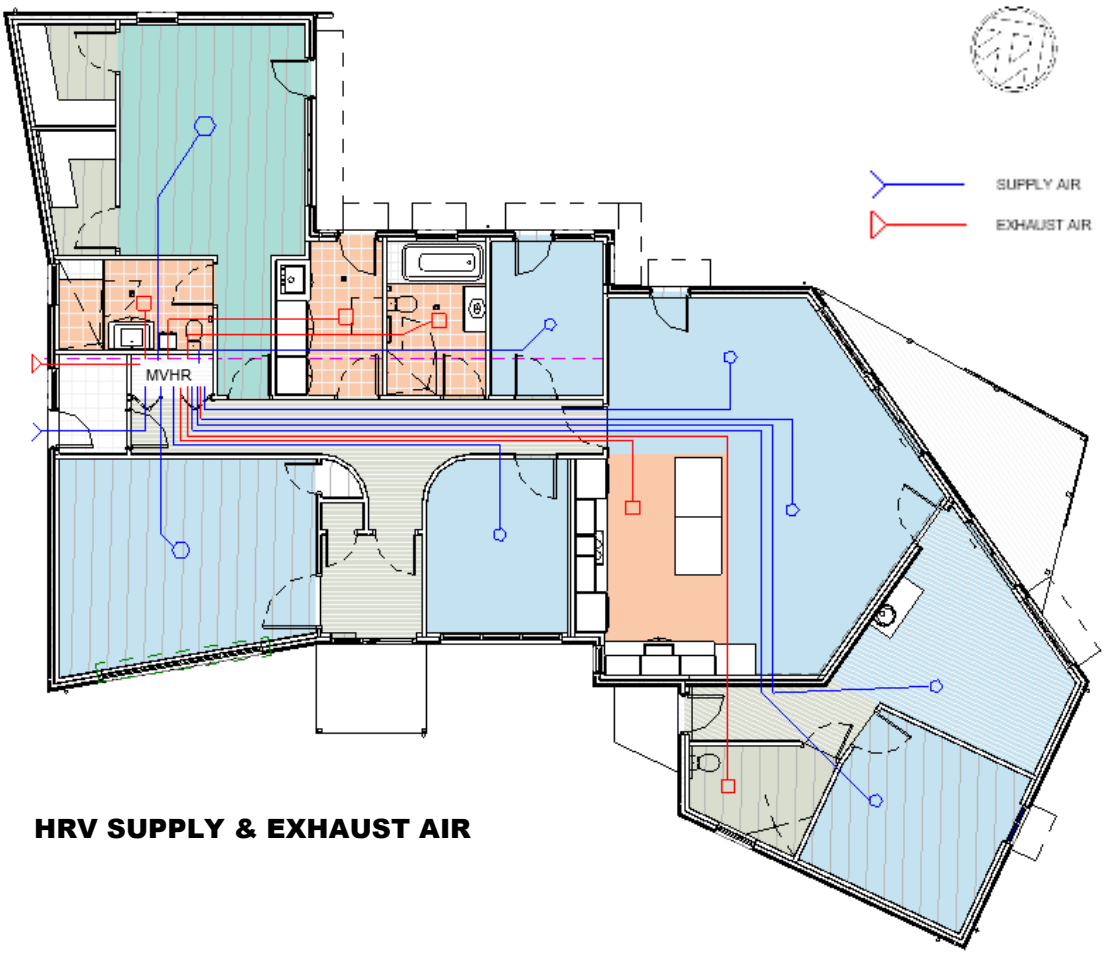
Adhesive air control barrier installed on exterior walls prior to external insulation installation.

## 10. MVHR - Lüftungsgerät

Steible Eltron LWZ 280 HRV
Heat recovery efficiency 0.84
Electrical efficiency 0.27 Wh/m³

Left: Unit installed in MVHR cupboard.
Right: Filters at installation prior commissioning.

## 11. Ventilation ductwork - Lüftungsplanung Kanalnetz




**HRV SUPPLY & EXHAUST AIR**

All 820mm internal wide doors had a 10mm undercut to provide return air within the dwelling.

Ventilation units include:

Stiebel Eltron GmbH & Co. KG
Germany - LWZ 280 (Balance) Air handling unit with heat recovery – STD

- Heat recovery efficiency 0.84
- 0.27 Wh/m³ Electrical efficiency

Daikin US-7 AC/dehumidification

- 75% Humidity recovery efficiency
- 2.5 Wh/m³ Electrical efficiency

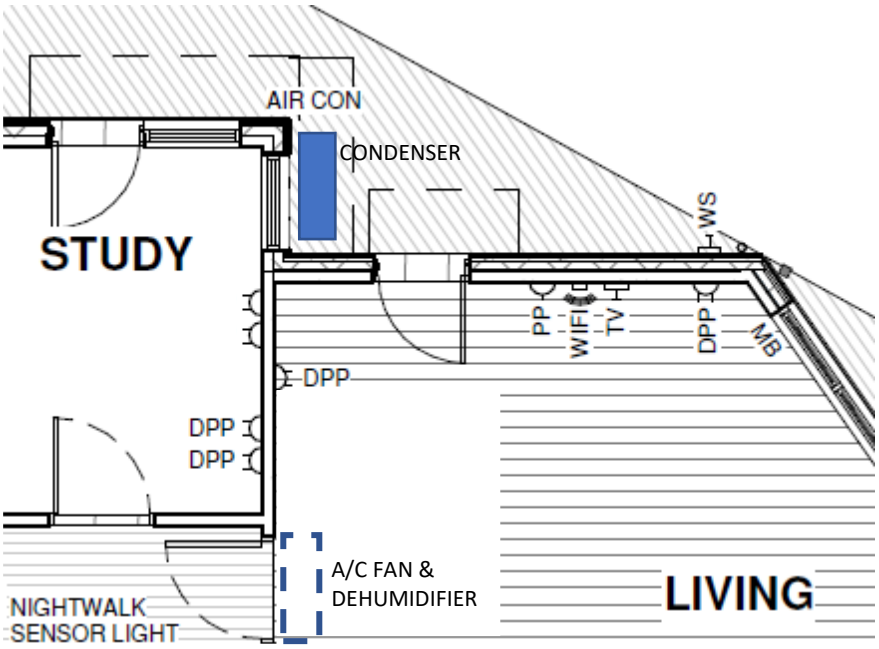
ISODrive 900 Schweigen Silent RangeHood

- 0.57 Wh/m³ Electrical efficiency

Make Up Air TT Pro 200 In line axial fan

- 1.08 Wh/m³ Electrical efficiency

g




*Location of internal (dashed blue line) and external (solid blue rectangle) AC units.*

**COOLING & DEHUMIDIFICATION**

## 12. Heating systems - Wärmeversorgung

Hot Water: Sanden heat pump with storage tank outside the thermal envelope

*HWU & heat pump located externally to ensuite (prior to external building works).*

## 13. Building costs - Baukosten

-

## 14. Publications featuring the building - Literatur

- PASSIVBLOG Yes Passive House Can Exist in the SubTropics (passivehouseaustralia.org)
- Why Passive House Performs | A Sub-Tropic Tale (passivehouseaustralia.org)
- Passive house - passivwatt? | Lakula

## 15. PHPP-Ergebnisse

# Passive House Verification

Photo or Drawing

| | | | |
|---|---|---|---|
| **Building:** | | | |
| Street: | | | |
| Postcode/City: | 2478 | Ballina | |
| Province/Country: | NSW | AU-Australia | |
| Building type: | Residential | | |
| Climate data set: | ud---01-AU0022a-Coolangatta | | |
| Climate zone: | 5: Warm | Altitude of location: | 2.8 m |
| **Home owner / Client:** | | | |
| Street: | | | |
| Postcode/City: | 2478 | Ballina | |
| Province/Country: | NSW | AU-Australia | |

| | | | |
|---|---|---|---|
| **Architecture:** | BluKube Architecture | | |
| Street: | PO Box 6188 | | |
| Postcode/City: | 1466 | UNSW | |
| Province/Country: | NSW | AU-Australia | |
| **Energy consultancy:** | BluKube Architecture | | |
| Street: | PO Box 6188 | | |
| Postcode/City: | 1466 | UNSW | |
| Province/Country: | NSW | AU-Australia | |

| | | | |
|---|---|---|---|
| **Mechanical engineer:** | Builder, Scholten Residential Builders | | |
| Street: | | | |
| Postcode/City: | 2477 | PEARCES CREEK | |
| Province/Country: | NSW Australia | | |
| **Certification:** | Sustainable Engineering Ltd | | |
| Street: | 76 Virgina Road | | |
| Postcode/City: | 4500 | | |
| Province/Country: | Whanganui, New Zealand | | |

| | | | | | |
|---|---|---|---|---|---|
| Year of construction: | 2020 | 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]: | 3.1 |
| No. of occupants: | 3.1 | Specific capacity [Wh/K per m² TFA]: | 84 | Mechanical cooling: | x |

**Specific building characteristics with reference to the treated floor area**

| | | | | Criteria | Alternative criteria | Fullfilled?[2] |
|---|---|---|---|---|---|---|
| | Treated floor area m² | 220.7 | | | | |
| **Space heating** | Heating demand kWh/(m²a) | 4.6263 | ≤ | 15 | - | yes |
| | Heating load W/m² | 10.1744 | ≤ | - | 10 | |
| **Space cooling** | Cooling & dehum. demand kWh/(m²a) | 8.1698 | ≤ | 20 | 20 | yes |
| | Cooling load W/m² | 14.2446 | ≤ | - | 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 | 0.1 | ≤ | 0.6 | | yes |
| **Non-renewable Primary Energy (PE)** | PE demand kWh/(m²a) | 83 | ≤ | - | | - |
| **Primary Energy Renewable (PER)** | PER demand kWh/(m²a) | 39 | ≤ | 60 | 60 | yes |
| | Generation of renewable energy (in relation to projected building footprint area) kWh/(m²a) | 34 | ≥ | - | - | |

[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

## 16. Owner's testimonial/s

It is a great honour to have a client that will stay in touch with you as their architect post completion of their home building experience. Since moving into the home I have received text messages that have covered a wide range of topics that hint to the satisfaction of living in this home - a passivhaus. Some related to working out how to ensure various elements of the home work in sync with the environment, others about how it feels.

For example, technical ones:

- The automated blinds, best time to start blocking out sun and what works and doesn't.
- When the best time is to open windows in summer v the current La Niña weather impacts.
- Lots of [*La Niña*] rain (and flooding in the area March 2022) requiring continuous dehumidification required for longer than modelled.

A few others to share with you:

*Sat 12 Feb 2022*

*"I just noticed how spoilt I am now when it comes to houses - and it's your fault ;-). This morning I visited friends who live in 'average' house and I notice all the little things that bother me. E.g.; narrow hallways, narrow loo spaces, loo roll holders mounted inaccessibly, kitchens with no natural light, aluminium single glazed windows facing west. It makes me appreciate my house so much more. Visitors notice the house is lovely but they don't realise it's these details that make the difference. I could never live in average house again."*

*Thurs 24 March 2022*

*"My friends commented tonight that my house is always comfortable and their hayfever subsides when they are here."*

*Wed 13 April 2022*

*"Just got surprised by the weather again. Went to go outside and it is pouring rain and cold. Inside can't hear or feel a thing [to do with what is happening outside]. [Flood refugee living temporarily with owner] Guest comment 'it's like another world in here'…"*