# PassivHaus Project Documentation

Carrigaline Passive House
ID: 2279

Designer: John Morehead
Wain Morehead Architects Ltd. www.wma.ie

Two storey dwelling with semi-basement, using closed wall timber frame construction on upper level, ICF construction on the lower level and optimised to site specific climate data.

Special features:
- Rainwater harvesting (5000 litre).
- Integration of multi-season indoor / outdoor space at upper floor.
- Use of patent Infra-red duct valves to shower/kitchen areas for additional comfort control.
- Integrated vertical clothes-drying shaft.

| | |
|---|---|
| U-value external walls=0.139 /m²K | PHPP Space Heating Demand = 13.1kWh/m²a |
| U-value floor = 0.115W/m²K | PHPP Primary Energy Demand = 86kWh/m²a |
| U-value roof = 0.112W/m²K | Air Test (n50) = 0.6 $h^{-1}$ |
| Uw-value windows = 0.92W/m²K | Heat Recovery Unit Efficiency= 84% |

## 2 Project description

This dwelling is located with a southerly aspect on the shoreline of the upper Owenabue Estuary, a special protection area within Cork Harbour. Our brief was to design a 4 bedroom family home, to be as ecologically friendly as possible within the client's budget. The steep southerly sloping site generated both challenges and opportunities and an early decision to invert the conventional domestic layout with living accommodation on the upper level held true. The dwelling is located on the lower regions of the site acknowledging the position of an adjacent dwelling which was to be redeveloped and taking advantage of the topography and views afforded close to the esturian foreshore.

The shallow form of the dwelling also encouraged the use of the residual garden areas on the Northern side which remain bathed in sunlight despite the intervention. As the site is relatively exposed, generous overhangs are used to trap the prevailing winds, protecting the envelope whilst reducing solar gain during the summer period. All services are tucked in below ground.

The sloping site required an appropriate structural solution that would address both the structural retention qualities and thermal performance levels integral to the walls. An Irish Manufactured ICF (Insulated Concrete formwork) system was employed on the lower ground floor, integrated with a raft type slab on a heavily insulated base. The lack of thermal bridging evident in this form of construction was particularly encouraging and cross wall thermal bridging was eliminated through detailed structural design of the reinforcement system.

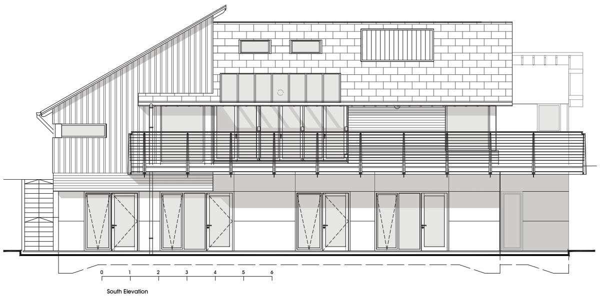
A saving of over 16 tonnes of $CO2$ was achieved by using GGBS concrete instead of conventional concrete in the foundations and walls. These walls were then clad in fibre cement panels which do not require any long term maintenance in such a coastal environment. The upper floor was generally of precast slabs with in-situ concrete in the courtyard area contributing positively to the thermal mass properties of the dwelling. The upper walls and roof construction was of locally produced closed wall timber frame construction, which had exemplary insulation and airtight characteristics. The upper walls were clad with a rain screen of a carefully selected and detailed, untreated Austrian larch cladding. Windows and folding doors are aluminium / larch composite triple glazed with low iron glass providing excellent solar transmission.

The design and specification of the dwelling responded to the site and climatic context, with every component being carefully selected to optimise the energy performance and comfort characteristics of the dwelling, keeping maintenance and ecological issues in mind. Every overhang, glazed area and indent was considered to ensure that a positive energy balance was achieved during the heating period and that overheating was prevented.

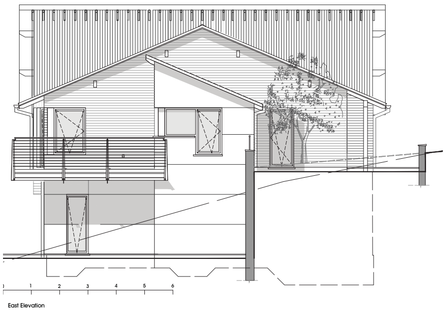
Extensive simulations and modelling using Therm and WUFI at the design stage ensured that construction details would perform as intended and that any chance of a thermal bridge was effectively eliminated cost effectively. The success achieved through this strategy was verifi ed during the final airtight and thermographic tests. The air change of 0.6 ac/h @50Pa was achieved despite the inclusion of folding glass walls and other 'architectural' features which in themselves would not be considered conducive to achieving such levels of performance. An integral drying tower faciliates sustainable and discrete clothes drying from the laundry area.

## 3 Elevations- Drawings and photographs

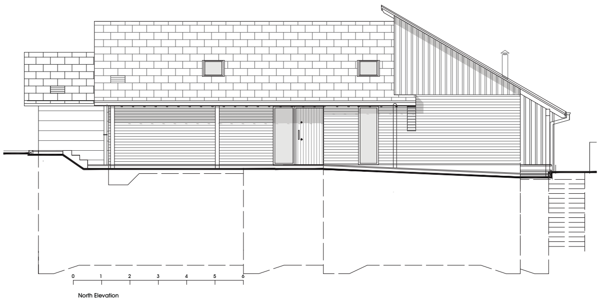
Elevation drawings and corresponding photographs are shown below:



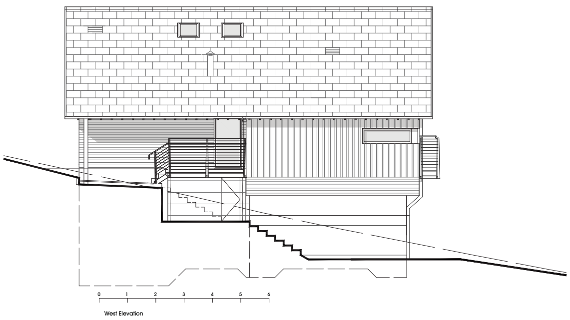
South Elevation



East Elevation



North Elevation

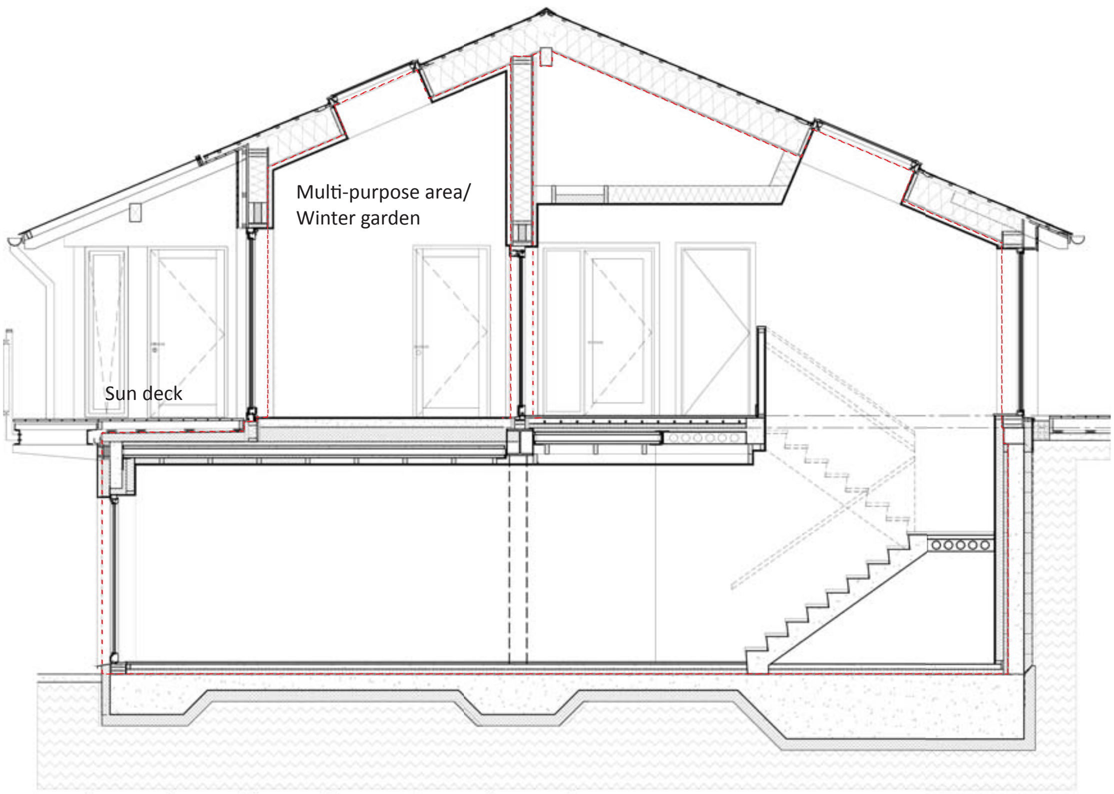


West Elevation

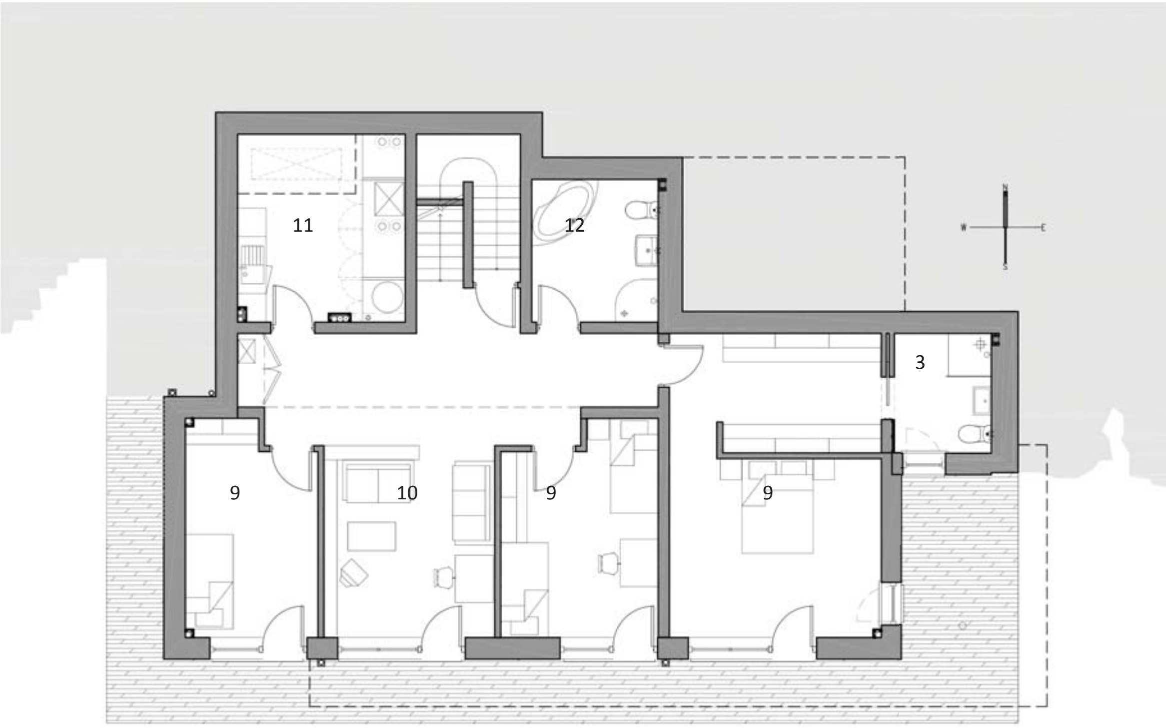
## 4 Exemplary Photograph of the interior

## 5 Cross-section

A cross section highlighting the major envelope components, with the airtight layer highlighted in red. Thermal isolation of the winter garden is also shown.



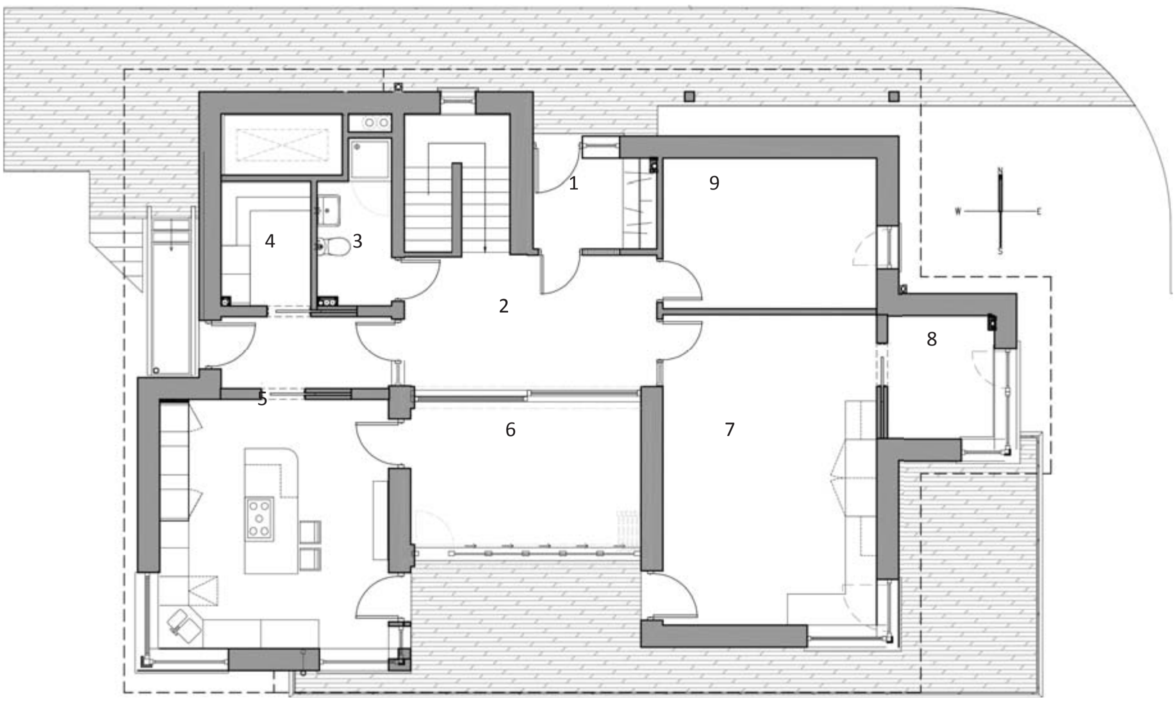
# 6 Floor plans




Lower Floor Layout

**Legend:**

**1. Entrance Lobby**
**2. Hall**
**3. WC**
**4. Pantry**
**5. Kitchen**
**6. Dining/Winter garden**
**7. Living**
**8. Study**
**9. Bedroom**
**10. Family room**
**11. Laundry**
**12. Bathroom**



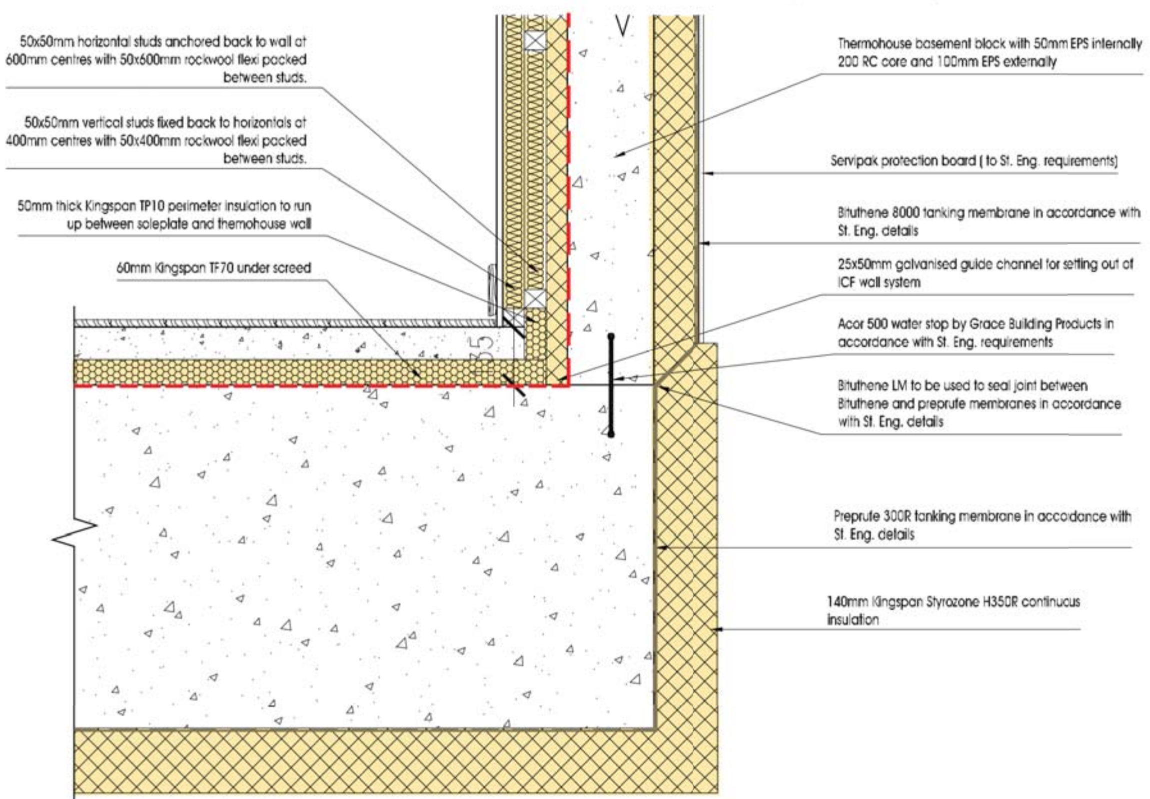

Upper Floor Layout

# 7 Construction-Floor slab

Basement floor / floor slab / raft
Lower Level to ground.

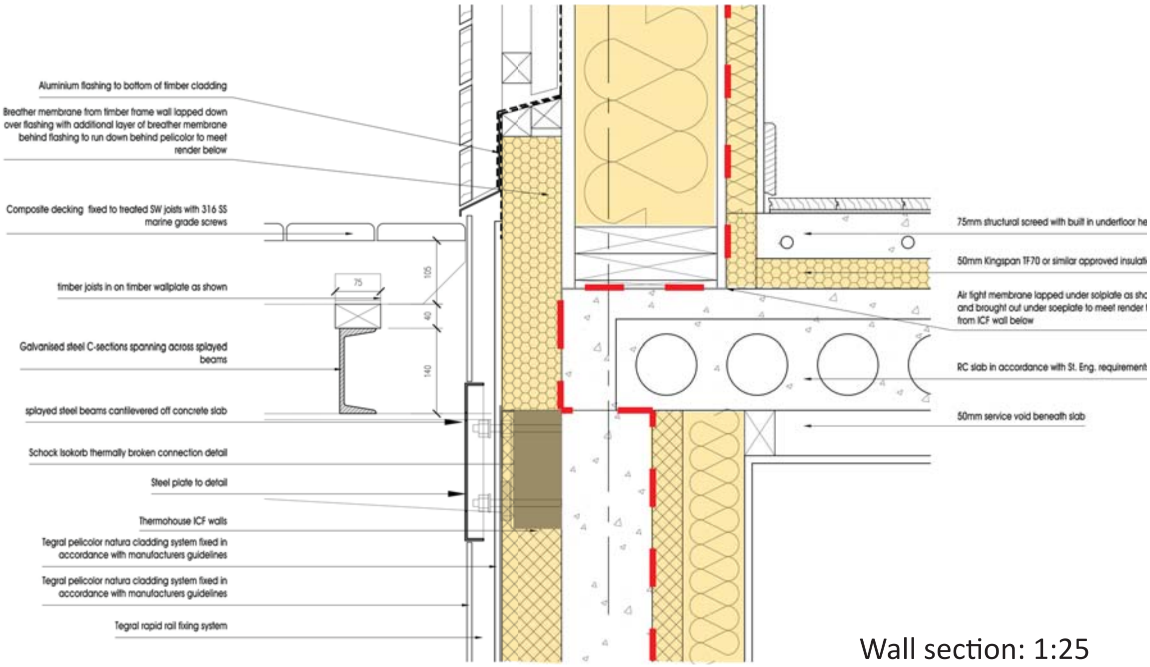
75mm screed layer on 60mm Kingspan TF70 - (rigid foil-faced PIR insulation) on 200mm RC raft slab on Preprufe 300R waterproof/ radon membrane on 140mm Kingspan Styrozone H350r U-value = 0.134 W/(m$^2$K)

Raft foundation with integrated retaining wall. Cross walls pinned to retaining wall through insulation to avoid thermal bridging.




DETAIL 4 - BASEMENT WALL TO SLAB JUNCTION
SCALE 1:10 @ A4

# 8 Construction-Exterior walls




Wall section: 1:25

**Upper Level**

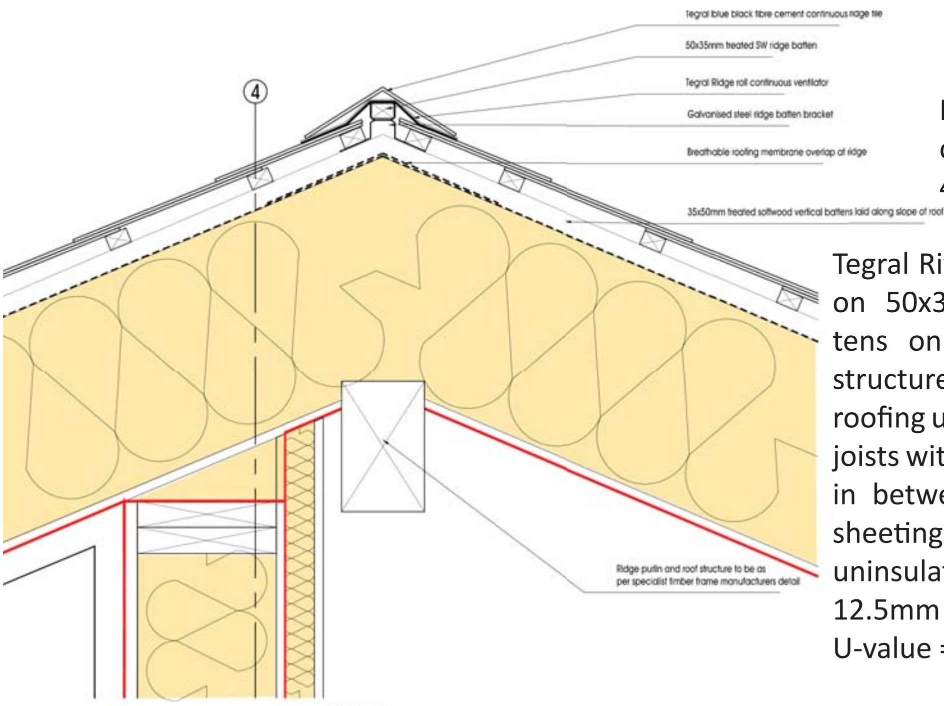
Timber frame (total thickness 459mm)

22mm larch timber cladding on 50x50mm batten/counter-battened ventilated air cavity on Tyvek UV Facade membrane on 22mm wood fibre board on 235x38mm primary timber studs (12,5%) with cellulose full-fill insulation between studs on 15mm OSB sheeting taped at joints on 50mm service cavity with 50mm Rockwool Flexi full-fill insulation between studs (12,5%) on 15mm Fermacell boards
Upper Level U-Value: 0.136 W/(m2K)

**Lower Level**

ICF Wall to ambient (total thickness 467mm)
8mm Tegral Natura Pelicolour horizontally fixed cladding on 38mm ventilated cavity on
6mm proprietary render system on
Thermohouse ICF system comprising of:
100mm external (graphite-based) EPS (030)
150mm RC concrete core/50mm int' EPS (030) on
2x 50x50mm batten/counter-battens (12,5%) with
100mm Rockwool Flexi full-fill (038) insulation
15mm Fermacell boards
Lower Level to ambient U-Value 0.145 W/(m2K)
average U-value = 0.139 W/(m2K)

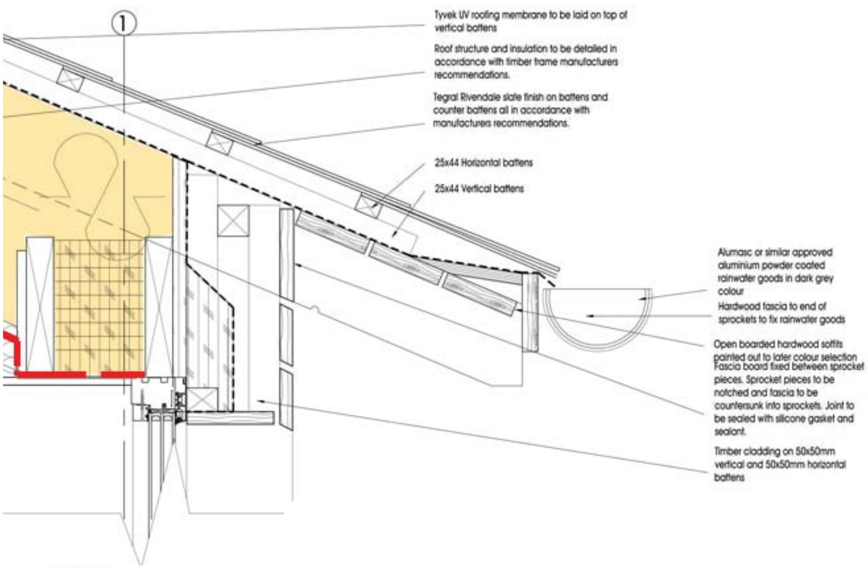
# 9 Construction-Main Roof




DETAIL 9

Pitched roof insulated on slope: (total thickness 485mm)

Tegral Rivendale fibre cement slates on 50x35mm battens/counter-battens on ECO Timber Frame roof structure consisting of breathable roofing underlay on 346mm timber I-joists with full-fill cellulose insulation in between I-joists on 15mm OSB sheeting taped at joints on 50mm uninsulated service cavity Batens on 12.5mm plasterboard ceilings
U-value = 0.112 W/(m2K)




DETAIL 6 -

## 10 Construction-Windows

**Frame**

Katzbeck, Katzbeck - Window Profile D1
Aluminium-clad Larch tilt and turn windows,
Partly fixed glazing, optimized installation

Uw-value = 0.92 W/(m2K)
Uf - value = 1.0 W/(m2K)

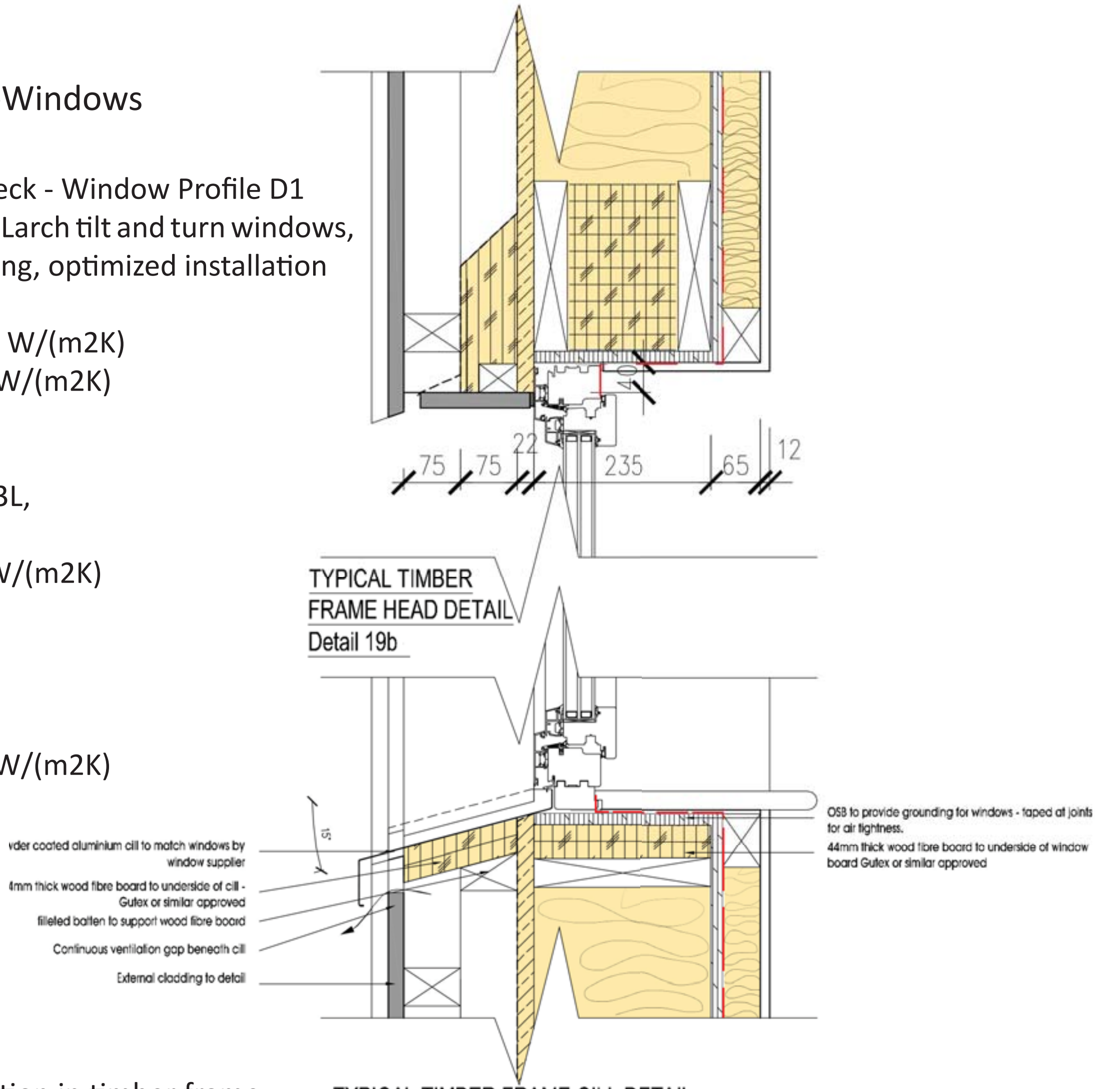
**Glazing**

Interpane iplus 3L,

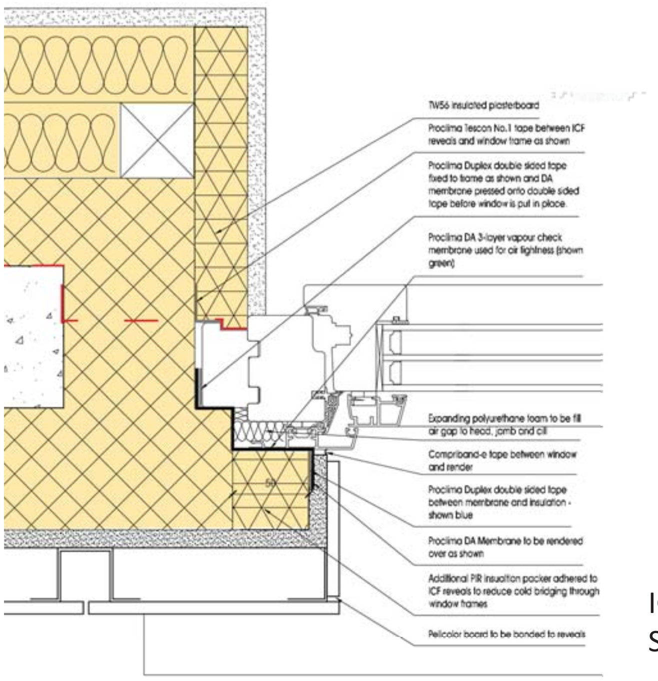
Ug-value = 0.6 W/(m2K)
g -value = 55 %

**Entrance door**

Katzbeck
U d-value = 0.8 W/(m2K)




Window installation in timber frame.
Scale: 1:10



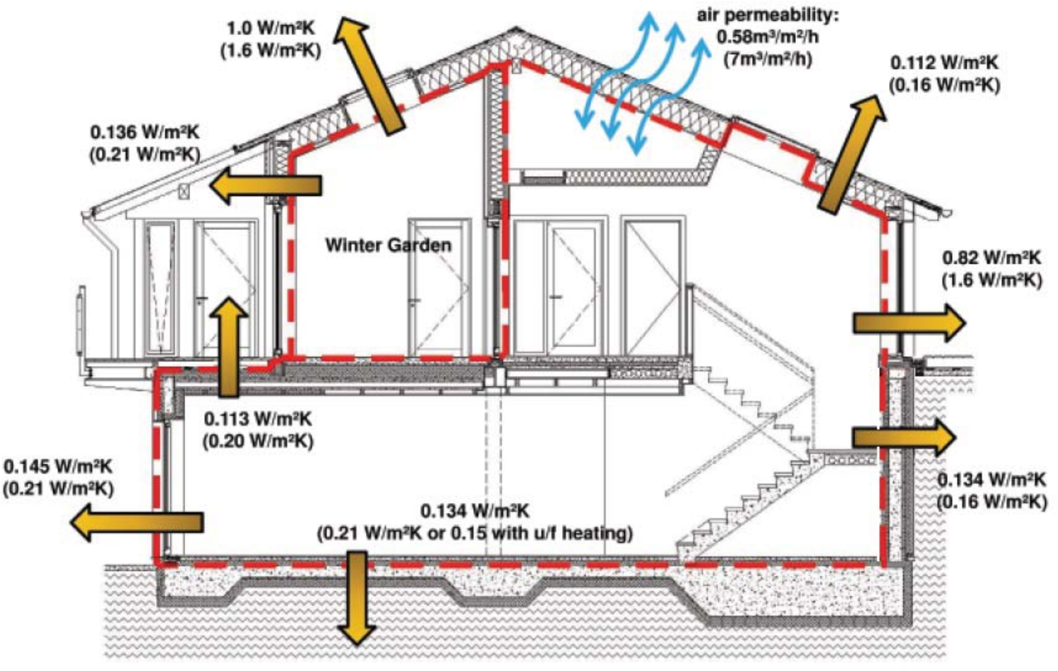

ICF Window Jamb
Scale 1:10

## 11 Airtight envelope

The airtight layer in the roof and upper level walls consists of taped OSB3 panels, while the concrete slab and rising walls provide the airtightness for the lower level. All joints and openings are taped. The multipurpose space / winter garden is isolated from the rest of the house from both an airtighness and thermal perspective.

Combined test n50@50Pa[-h] 0.6255

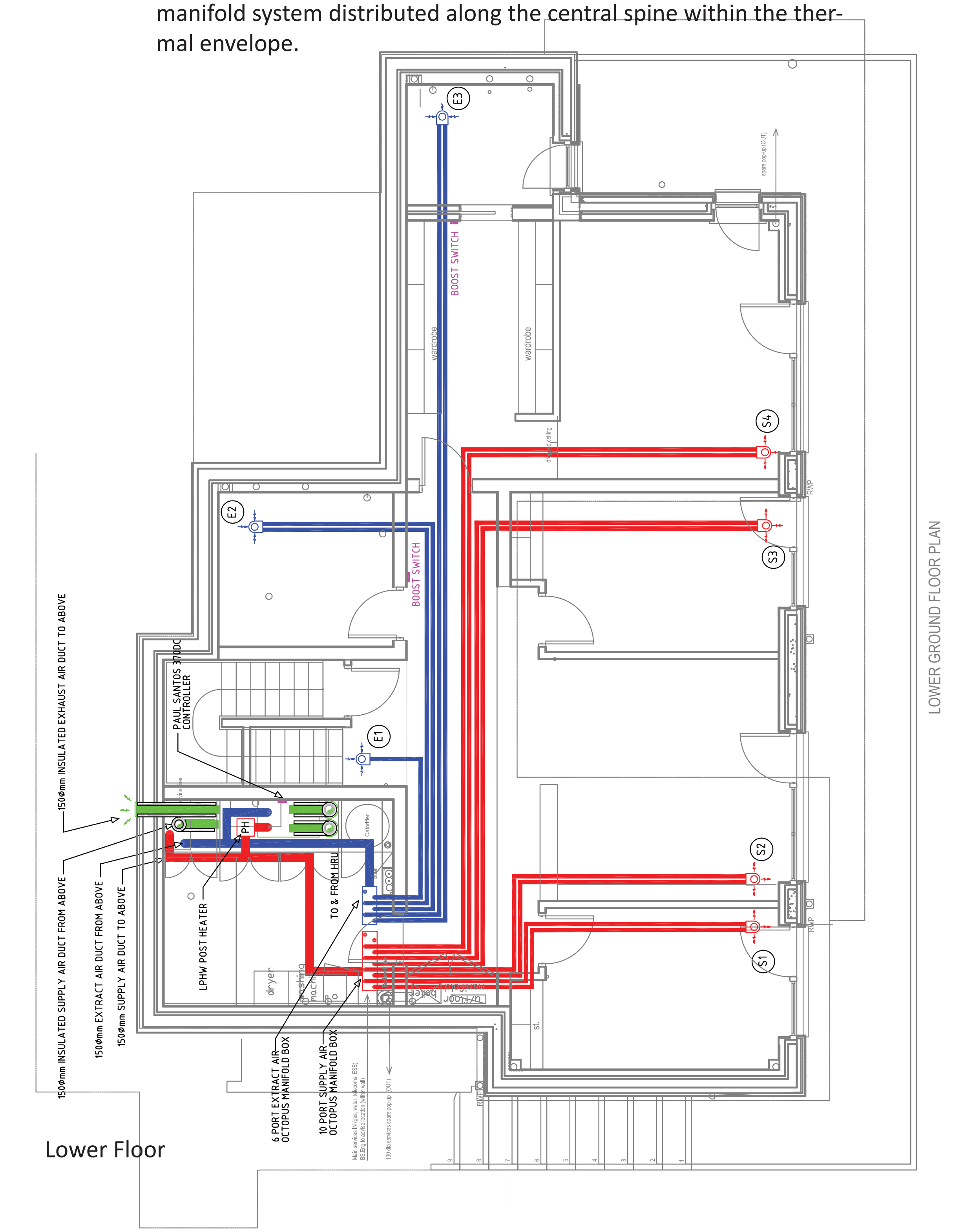
Pressure test n50 @50Pa[-h] 0.6115
Depessure test n50 @50Pa[-h] 0.6395



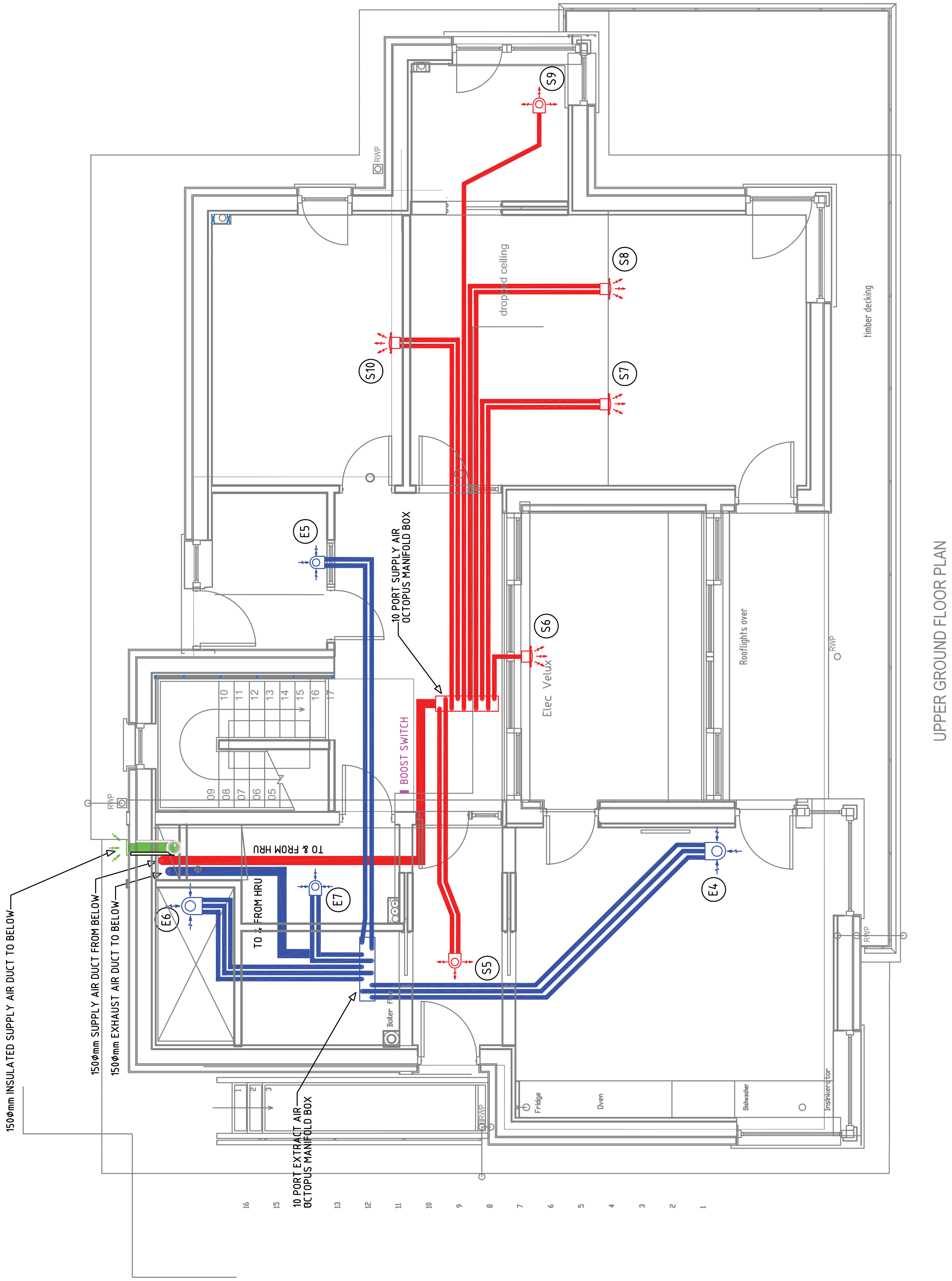

U-values employed with minimum elemental u-values in 2011 **TGD L** building regulations in brackets

## 12 Layout of ventilation system ducting

Intake vent is at ground floor level 2m above footpath with exhaust below on North Facade. Supply air (red below) is delivered to habitable rooms at ceiling level generally with transfer via slotted architraves. Extract is generally at ceiling level within wetrooms through patented IR integrated Cowls to maintain comfort levels. The drying tower is provided with extract at high level from the upper floor distribution riser. Attenuation is provided from within the octupus manifold system distributed along the central spine within the thermal envelope.




Lower Floor


UPPER GROUND FLOOR PLAN
S5
S6
S7
S8
S9
S10
E4
E5
E6
E7
10 PORT SUPPLY AIR OCTOPUS MANIFOLD BOX
10 PORT EXTRACT AIR OCTOPUS MANIFOLD BOX
BOOST SWITCH
TO & FROM HRU
150Φmm INSULATED SUPPLY AIR DUCT TO BELOW
150Φmm SUPPLY AIR DUCT FROM BELOW
150Φmm EXHAUST AIR DUCT TO BELOW
dropped ceiling
timber decking
Rooflights over
Elec Velux
Boiler flue
Fridge
Oven
Dishwasher
RWP

Upper Floor

## 13 Ventilation - Central unit

Ventilation system model: PAUL, Santos 370 DC heat recovery ventilation unit with post heater element. Efficiency of the heat recovery is 0.84. Effective heat recovery efficiency as installed is 77.7%.

It is located within the laundry/utility room on the lower ground floor which also integrates a vertical clothes-drying shaft. The system utilised an octopus ducting arrangement wherby the primary distribution ductwork was connected to an acoustic manifold. A dropped ceiling on the lower floor and attic space on the upper floor enabled easy duct distribution.

Wet rooms used an innovative duct valve with a ceramic core now patented emitting infra-red energy for added comfort control.

## 14 Heat supply

**Heating installation**

Heating is achieved with a high efficiency main gas fired boiler, which supplies 3 no. towel radiators and 1 additional radiator in the laundry/utility room. A 2kW post heater is fitted on the supply side of the HRV distribution system with independent controls for extremely cold conditions. No underfloor heating or other system connected.

**Domestic hot water**

Supplied by gas fired boiler and solar evacuated tubes, stratified solar storage and circulation pipework.

Additional comfort control is provided using Infrared duct valves in key areas

## 15 PHPP results

# Passive House Verification

| | | |
|---|---|---|
| Building: | Owenabue Lodge | |
| e | Cork | 2010 WMA Carrigaline Mean |
| Street: | Riverside | |
| Postcode/City: | Carrigaline | |
| Country: | Ireland | |
| Building Type: | Detached house | |
| Home Owner(s) / Client(s): | John & Sally O'Leary | |
| Street: | | |
| Postcode/City: | | |
| Architect: | Wain Morehead Architects Ltd. | |
| Street: | NSC Campus | |
| Postcode/City: | Mahon, Cork | |
| Mechanical System: | Xavier Dubuisson | |
| Street: | | |
| Postcode/City: | | |

| | | | | | |
|---|---|---|---|---|---|
| Year of Construction: | 2010 | | | | |
| Number of Dwelling Units: | 1 | | Interior Temperature: | 20.0 | °C |
| Enclosed Volume $V_e$: | 809.6 | $m^3$ | Internal Heat Gains: | 2.1 | $W/m^2$ |
| Number of Occupants: | 6.8 | | | | |

Specific Demands with Reference to the Treated Floor Area

| | | | | | |
|---|---|---|---|---|---|
| Treated Floor Area: | 238.0 | $m^2$ | | | |
| | Applied: | Monthly method | | PH Certificate: | Fulfilled? |
| **Specific Space Heating Demand:** | **13** | **$kWh/(m^2a)$** | | **15 $kWh/(m^2a)$** | **Yes** |
| **Heating Load:** | **9** | **$W/m^2$** | | **10 $W/m^2$** | |
| **Pressurization Test Result:** | **0.6** | **$h^{-1}$** | | 0.6 $h^{-1}$ | **Yes** |
| **Specific Primary Energy Demand** (DHW, Heating, Cooling, Auxiliary and Household Electricity): | **86** | $kWh/(m^2a)$ | | 120 $kWh/(m^2a)$ | **Yes** |
| Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity): | 46 | $kWh/(m^2a)$ | | | |
| Specific Primary Energy Reduction through Solar Electricity: | | $kWh/(m^2a)$ | | | |
| Frequency of Overheating: | 0 | % | over | 25 °C | |
| Specific Useful Cooling Energy Demand: | | $kWh/(m^2a)$ | | 15 $kWh/(m^2a)$ | |
| Cooling Load: | 0 | $W/m^2$ | | | |

*We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.*

*Issued on:*

*signed:*

MosArt

ARCHITECTURE LANDSCAPE URBAN DESIGN

*Authorised by:*
*Passivhaus Institut*
*Dr. Wolfgang Feist*
*Rheinstr. 44/46*
*D-64283 Darmstadt*

# Certificate

**MosArt hereby certifies the following building as a**

# Quality Approved Passive House

**Owenabue Lodge, Riverside, Carrigaline, Cork**

Client: **John & Sally O'Leary**

Architect: **John Morehead, NSC Campus, Mahon, Cork**

Building Services: **Xavier Dubuisson, Rocksavage, Clonakilty, Co. Cork**

**This building was designed to meet Passive House criteria as defined by the Passive House Institute. With appropriate on-site implementation, this building will have the following characteristics:**

- Excellent thermal insulation and optimised connection details with respect to building physics. High thermal comfort during the summer has been considered and the heating demand or heating load will be limited to
  - ***15 kWh per $m^2$ of living area and year or 10 W/$m^2$, respectively***
- A highly airtight building envelope, which eliminates draughts and reduces the heating energy demand: The air change rate through the envelope at a 50 Pascal pressure difference, as verified in accordance with ISO 9972, is less than

***0.6 air changes per hour with respect to the building's volume***

- A controlled ventilation system with high quality filters, highly efficient heat recovery and low electricity consumption, ensuring excellent indoor air quality with low energy consumption
- A total primary energy demand for heating, domestic hot water, ventilation and all other electric appliances during normal use of less than

***120 kWh per $m^2$ of living area and year***

This certificate is to be used only in combination with the associated certification documents, which describe the exact characteristics of the building.

Passive Houses offer high comfort throughout the year and can be heated with little effort, for example, by heating the supply air. The building envelope of a Passive House is evenly warm on the inside and the internal surface temperatures hardly differ from indoor air temperatures. Due to the highly airtight envelope, draughts are eliminated during normal use. The ventilation system constantly provides fresh air of excellent quality. Heating costs in a Passive House are very low. Thanks to their low energy consumption, Passive Houses offer security against energy scarcity and future rises in energy prices. Moreover, the climate impact of Passive Houses is low as they reduce energy use, thereby resulting in the emission of comparatively low levels of carbon dioxide ($CO_2$) and other pollutants.

**issued:**
**Broomhall Business Park Wicklow, 29th August 2011**

Tomás O'Leary

**Tomás O'Leary**

***Certificate-ID:*** **2836_MosArt_PH_20110829_APR**

16 Total construction costs

N/A

17 Building Costs

N/A

18 Year of construction

Carrigaline Passive House was completed early in 2011 and was awarded Passive house certification in August 2011.

## 19 Architectural Design

Wain Morehead Architects Ltd, NSC Campus, Mahon, Cork.

## 20 Mechanical Systems

Xavier Dubuisson, Rocksavage, Clonakilty, Co. Cork

## 21 Building Physics

Wain Morehead Architects Ltd.

## 22 Structural analysis

Horganlynch Structural Engineering

23 Experience and monitoring

The property has performed as expected with no overheating and maitains steady 19.5 - 21.0 C year round

24 Studies, Awards and publications

Climate data analysis basis for 26 county analysis 2011. The extensive research carried out by WMA in preparing climate data for Carrigaline PH has proved invalu able for the preparation of site specific climate data for future projects.

Publications: Irish Examiner 26.11.2011
Irish Independent 12.01.2012

Finalists at the 2012 Green Awards Ireland