



Whitsbury Road

Passivhaus Design Assessment
for
Stop Domestic Abuse

30 November 2023

DELTAQ

DOCUMENT CONTROL SHEET

Client:	Stop Domestic Abuse
Project:	Whitsbury Road
Report Title:	Passivhaus Feasibility Assessment
Document reference:	10484

Prepared by:	Delta Q Consulting Limited Studio 2 St Andrews Road Bristol BS6 5EH		
Version	Author(s)	Approved by	Date
P01	David Bryan	Piers Sadler	30 November 2023

This report has been produced solely for the use of the above-named client, for the purposes agreed between Delta Q Consulting Limited and the client. Third parties using information contained within this report do so at their own risk.

Contents

1	Introduction	1
2	About Passivhaus	2
3	3D Modelling	4
3.1	Introduction	4
3.2	Modelling	4
4	Construction	6
4.1	Thermal Elements and U-values	6
4.2	Thermal Bridging	6
4.3	Air Tightness	6
4.4	Window and Door Specification	6
4.5	Building Services	7
5	PHPP Modelling Results	9
5.1	Building Details	9
5.2	Model Results	9
6	Conclusions & Recommendations	10
6.1	Conclusions	10

1 Introduction

Delta Q Consulting has been appointed by Stop Domestic Abuse (SDA) to advise on the feasibility of building the proposed women's refuge at Whitsbury Road, Havant to the Passivhaus Classic Standard.

The refuge has been designed as a two-storey building comprising a mixed-use space encompassing the following:

- 2 no. accessible ground floor rooms
- 7 no. first floor rooms
- Ground floor communal living space
- Ground floor office/meeting spaces
- Ground floor ancillary storage/plant areas

The design team is currently made up as follows:

- Architecture – Marlow Architects
- Passivhaus – Delta Q
- Project Management – Colin Salisman

On appointment by SDA, Delta Q developed a PHPP model based on Marlow Architects' designs as well as discussions and clarifications from the team of those designs. This report presents the results of that modelling. The purpose of the modelling was to assess the feasibility of achieving Passivhaus certification as a route to ensuring an energy efficient building is created.

2 About Passivhaus

According to the Passivhaus Trust:

Passivhaus buildings provide a high level of occupant comfort while using very little energy for heating and cooling. They are built with meticulous attention to detail and rigorous design and construction according to principles developed by the Passivhaus Institute in Germany and can be certified through an exacting quality assurance process.

The Passivhaus Standard was developed based on research into thermal comfort in buildings and it is the provision of very high levels of thermal comfort and excellent indoor air quality, achieved with low level heating and cooling energy that defines the standard. This is done through detailed quality assurance to ensure that the thermal model represents the building as designed and that the designs are accurately delivered on site. To achieve the Passivhaus Standard the building design and construction are certified by a Passivhaus Certifier who is independent of the design team.

Passivhaus buildings in cool temperate climates such as the UK must have:

- Very high levels of gap free thermal insulation
- Triple glazed windows
- Thermal bridge free building fabric
- Airtight building fabric
- Balanced heat recovery ventilation.

Thermal modelling to support Passivhaus design and Certification is done using PHPP which is an Excel spreadsheet calculation tool which models

the building heat losses and gains as well as the electrical energy use and generation.

A Passivhaus building must pass the criteria in the following four categories:

- Annual heating (and cooling) demand or heat (cooling) load**
This is the demand of the building and does not consider the efficiency of equipment such as a boiler which is addressed in category iv. The building can pass either by meeting the annual energy demand of 15 kWh/m²/yr OR the instantaneous load for the coldest (or hottest) condition of 10 W/m²
- Air tightness**
This must be demonstrated through an air test carried out according to the required standard. In the UK the test specification is defined in ATTMA Technical Standard L4: Measuring Air Permeability in Passivhaus and Low Energy Buildings. The requirement is for an air test result of 0.6 air changes per hour or less.
- Over-heating**
The over-heating as predicted by the PHPP model should be less than 10% of the time >25°C. We advise that <3% is targeted for this parameter to ensure summer comfort in the heating climate.
- Primary Energy or Primary Energy Renewable**
Primary Energy (PE) is the energy used at source to generate the energy used in the building and includes, for example, losses in electricity generation and transmission as well as losses due to equipment efficiency such as boilers. With increasing electricity generation with renewables Primary Energy is becoming a less useful measure of building performance and to account for this the Passivhaus Institute developed the concept of Primary Energy

Renewable (PER). PER considers the condition when all energy in a building and including grid electricity is generated from renewable sources and considers the time offset between renewable energy generation and energy usage in the building. Factors are developed to account for losses associated with short- and long-term energy storage.

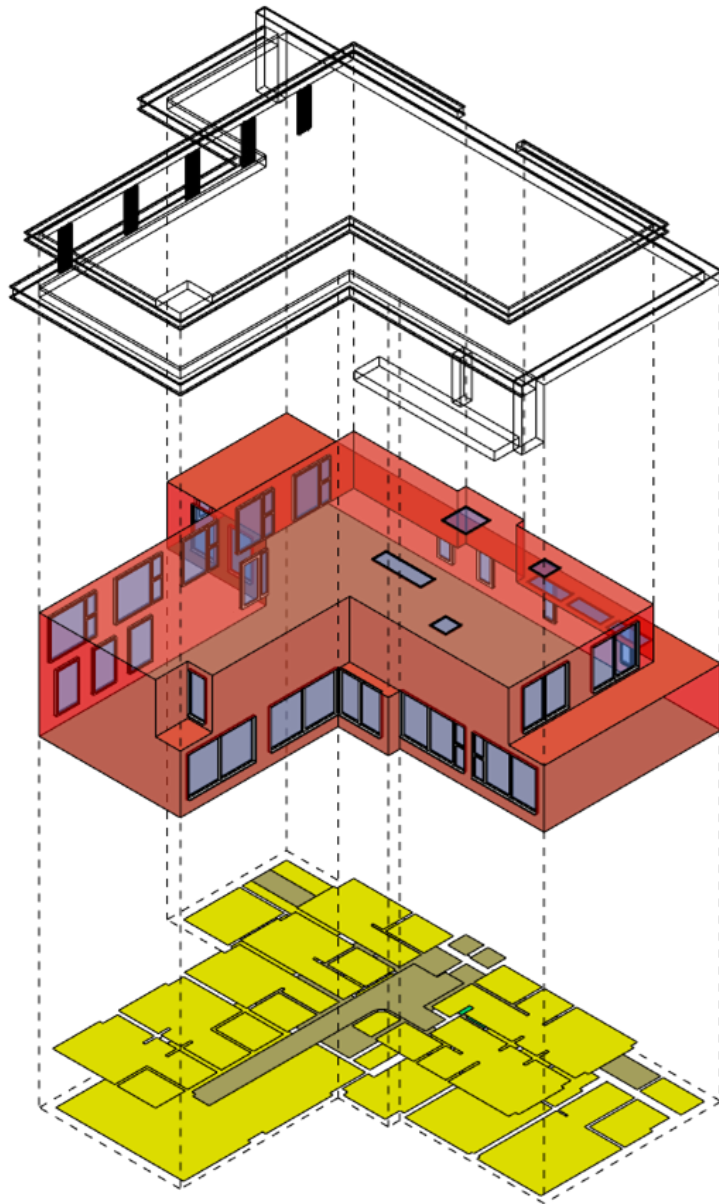
The building can pass in either category with a limit of 60 kWh/m²/yr for PER and 135 kWh/m²/yr for PE. The PER target is variable if there is some renewable energy generation on or associated with the building up to a maximum of 75 kWh/m²/yr. This option is not available with the PE metric.

Using heat pumps for heating and on-site PV will favour the use of the PER metric.

There are also several soft criteria which relate to indoor air quality and thermal comfort including ventilation requirements and surface temperatures within the building fabric. The ventilation requirements are per person, activity, and volume of the building. The surface temperatures define the standard for windows (triple glazed) as well as for thermal bridging. A key effect of the latter is that high conductivity materials such as metal (fixings for example), concrete or masonry are not allowed to pass completely through the insulation zone of the building.

The exacting quality standards mean that Passivhaus buildings have been proven to perform as designed with elimination of the performance gap between design intent and in-use which is ubiquitous in other buildings.

Figure 1: Exploded view of the designPH model



3 3D Modelling

3.1 Introduction

The building was modelled from CAD drawings provided by Marlow Architects, with a thermal envelope and treated floor area created in SketchUp to allow analysis with designPH.

3.2 Modelling

3.2.1 Main Building

Figure 1 shows an exploded view of the building as modelled in SketchUp. The lower element (mainly yellow) shows the floor areas included in the assessment, the mid-level element is the external walls, floor and roof and the uppermost element are the shading elements.

Figure 2: Birdseye view of shading elements



3.2.2 Shading

The context used for shading as shown in figure 2 is taken from the architectural drawings provided by Marlow Architects, with some additional modelling from Google Earth Pro and some distant horizon shading included from geolocation and topographical data within SketchUp. Deciduous pleached trees have been included as detailed in the drawings, two simulations have been run depicting summer and winter conditions, for inclusion in the PHPP model

4 Construction

4.1 Thermal Elements and U-values

The U-values listed in Table 1 have been used in the PHPP modelling. These represent sensible assumptions for a new-build construction of this type.

Table 1: Construction U-values

Item	U Value (W/m ² K)	Indicative Construction comment
Ground floor ¹	0.130	Based on 250 mm XPS insulation below slab
External Walls	0.140	300 mm I-Beams, insulated with Cellulose/Blown Mineral Wool
Roof (flat)	0.130	150mm PIR insulation (warm roof construction)

¹ U-value stated is as per PHPP modelling and does not consider the form of the building (P/A ratio)

4.2 Thermal Bridging

A basic allowance for thermal bridging has been included in the PHPP model. The main areas for consideration in Stage 4 design should be as follows.

- Ground floor to external wall junction
- Parapet walls
- Roof overhang fixings
- Soil and Vent pipes

We have taken a rough estimate of total length of SVPs and included this in the model.

4.3 Air Tightness

The current air tightness assumption is for an air test result of 0.6 ach @ 50 Pa as tested according to ATTMA TSL4 as per the Passivhaus standard limiting value.

4.4 Window and Door Specification

The requirements below set out the thermal specification used in the PHPP modelling:

Table 2: Component Requirements

Window frame U-value (mean)	< 1.3 W/m ² K
Door frame U-value (mean)	< 1.8 W/m ² K
Glass U-value (U _g)	< 0.55 W/m ² K
Frame F _{Rsi=0.25} (doors, windows and curtain walling)	0.75
Spacer bar ψ value	< 0.038
Solar heat gain coefficient (g)	0.5±0.02
Window/door air tightness	Class 4

For the purposes of the PHPP modelling the following window and door types used are as follows:

- Sliding Doors – Josko One S lift & slide
- Single Doors – Josko Platin
- Windows – Josko One Blue fixed and tilt/turn
- Rooflights – Fakro DMF DU8

4.5 Building Services

4.5.1 Ventilation

The ventilation system has been modelled as a single Zehnder ComfoAir Q600 unit providing the ventilation of the whole building. This is a large domestic scale unit. This ventilation requirements of the building are at the upper range of a unit of this type. It is possible that a second identical or smaller unit could be used to increase the airflow.

An MEP or specialist ventilation designer would need to be engaged to provide a design for this system and ensure the correct airflow rates are allowed for based on the occupancy of the building. We recommend, initially a discussion is held with Green Building Store to see whether the ventilation of this building is within the range of the systems they design and supply.

4.5.2 Space Heating and Domestic Hot Water

A generic Air Source Heat Pump (ASHP) has been allowed for in the PHPP model. A small number of radiators distributed through the building have been assumed in the PHPP model, again this will need engagement with an MEP consultant to provide a design. The use of an efficient ASHP such as a Mitsubishi EcoDan or Vaillant aroTHERM plus would be more efficient than the standard figures currently used and would therefore give a further reduction in the predicted energy use.

The DHW for the apartments is also produced by the ASHP and stored within the plantroom in well insulated storage vessels.

Standard PHPP usage figures have been used for the calculations.

Dead legs are based on DHW distribution being by 10 mm copper diameter pipes arranged radially.

4.5.3 Electricity

The following assumptions have been made in the PHPP calculation.

- Efficient Fridge/Freezer combinations.
- Induction hobs.
- Clothes washing and drying via 2 no. washing machines and 2 no. tumble dryers
- Dishwashing with efficient, cold-feed machine.
- LED lighting will be used throughout. The lighting should be designed with the use of 120 lm/W efficacy luminaires.

4.5.4 Renewable Energy

Although not required within the Passivhaus Classic certification, a space for solar PV is indicated on the architectural drawings.

Renewable energy generation is calculated with a roof mounted PV arrays of 122 m² as shown in Figure 3.

Inverter efficiency of 95% is assumed in the PHPP calculations.

Figure 3: Illustration of PV layout location (Marlow Architects)



5 PHPP Modelling Results

5.1 Building Details

The building details are shown in Table 3.

Table 3: Building details

Treated Floor Area (TFA)	430 m ²
Gross Internal Area (GIA)	514 m ²
Number of Occupants (approx.)	29 (9 women, 18 children, 2 staff)
Climate Zone	GB0004a-Efford
Elevation	30 m OD
Form heat loss factor	2.93
Airtightness	0.6 ach @ 50 Pa

5.2 Model Results

The headline model results are shown in Table 4.

Table 4: PHPP Results

Category	Result	Target	Pass/fail
Heat demand (kWh/m ² /yr)	13.6	15	Pass
Primary Energy demand (PE) (kWh/m ² /yr)	70	108	Pass
Frequency of overheating (>25°C) %	5	10	Pass
Frequency of excessively high humidity (>12 g/kg) %	8	20	Pass

6 Conclusions & Recommendations

6.1 Conclusions

From the modelling in PHPP, it is apparent that it is feasible for the building to be constructed to the Passivhaus Standard without the need for excessively thick insulation layers. It may even meet the requirements for a Passivhaus Plus with the area available for the PV installation.

There would need to be some additional input from specialist designers or consultants, particularly on the MEP systems. The agreed size and location of the plant room should provide sufficient space for the required plant, but this will have to be confirmed once all the plant needs have been confirmed by the MEP designer. The location of the plant room keeps pipe lengths to a minimum, which helps with energy efficiency.

The building itself is quite difficult to categorise in terms of the application of the Building Criteria as published by the Passivhaus Institut and early engagement with a Passivhaus Certifier would be required to ensure that the correct certification parameters are being adhered to in modelling the building in PHPP.

The benefits of living in a Passivhaus home are well documented and cover both quality of the environment within, and the reduced operating costs. By constructing this building to Passivhaus standards it would enable SDA to offer a high-quality environment to those who need it and be able to deliver this with the least energy and associated running costs to the charity.

6.2 Recommendations

Once planning approval is gained it will be necessary to develop the detailed technical designs for the building, working closely with an experienced Passivhaus Consultant to ensure that the designs are Passivhaus compliant. An MEP designer and potentially a specialist ventilation designer, will need to be engaged to design the building services for the building. The design team will need to work closely together to ensure that Passivhaus compliance is achievable.

Key aspects at the next stage will be:

- Construction method
- Detailing for air tightness and continuity of insulation
- Windows and doors
- Ventilation
- Efficient heating and domestic hot water design
- Efficient equipment selection
- Shading and over-heating assessment
- Procuring a contractor to build to the Passivhaus Standard