PHPP Report

Beattie Passive – Inchkeith Drive

1. Introduction

Passive House is the world-leading building standard in energy-efficient construction. It is comfortable, affordable and ecological at the same time. *Passive House* is not a brand name, but a construction concept that can be applied by anyone and that has stood the test of practice – tens of thousands have been built world-wide since the first one had been completed in 1991.

Properties of a Passive House

Comfort

The Passive House Standard offers a new level of quality pairing a maximum level of comfort both during cold and warm months with reasonable construction costs – something that is repeatedly confirmed by Passive House residents.

Quality

Passive Houses are praised for their efficiency due to their high level of insulation and their airtight design. Another important principle is "thermal bridge free design": the insulation is applied without any "weak spots" around the whole building so as to eliminate cold corners as well as excessive heat losses. This method is another essential principle assuring a high level of quality and comfort in Passive Houses while preventing damages due to moisture build up.

Ecology

You may have been surprised by not finding ecological aspects mentioned at the very beginning of this article. Passive Houses are eco-friendly by definition: They use extremely little primary energy, leaving sufficient energy resources for all future generations without causing any environmental damage. The additional energy required for their construction (embodied energy) is rather insignificant compared with the energy they save later on. This seems so obvious that there is no need for additional illustrations. It is rather worth mentioning though, that the Passive House standard provides this level of sustainability for anyone wishing to build a new construction or renovating an older one at an affordable price – A contribution to protecting the environment that is far more effective than talking about protecting the environment.

Affordability

Passive Houses are a good investment since they not only save money over the long term, but are surprisingly affordable to begin with. The investment in higher quality building components required by the Passive House standard is mitigated by the elimination of expensive heating and cooling systems. The financial support increasingly available in many countries makes building a Passive House all the more feasible.

Measurement results

Measurements carried out in 114 Passive House apartments which were part of the CEPHEUS project showed average savings of approx. 90%. In other words, the

Passive House is a “factor 10 house” which only uses one tenth of the energy used by average houses.

Versatility

Any competent architect can design a Passive House. By combining individual measures any new building anywhere in the world can be designed to reach the Passive House standard. The versatile Passive House Standard is also increasingly being used for non-residential buildings such as administrative buildings and schools.

2. Outline of the procedure

· Passive Houses require less than 15 kWh/(m^2yr) for heating or cooling *(relating to the treated floor space)*

· The heating/cooling load is limited to a maximum of 10 W/m2

· Primary energy use may not exceed 120 kWh/(m^2a).

· Passive Houses must be airtight with air change rates being limited to n_{50} = 0.6/h (NB: Not to be confused with the q_{50} value!).

· In warmer climates and/or during summer months, excessive temperatures may not occur more than 10 % of the time.

To pass certification, one of the two initial criteria (15kWh/m_2a or 10W/m_2) plus all the additional ones have to be met.

In order to establish compliance, the **PHPP2007** program is used for both, design and certification.

This initial report will determine the feasibility of the *RPA South Oxford Project* being built according to Passive House standard. A set of data with accompanying comments has been produced to make the project an initial “pass”.

This information can now be used to determine if and how to proceed. If indeed the project is to continue as a certified Passive House, all the initial assumptions and suggestions need to be filled with actual facts and data.

The PHPP will continue as a “living thing”, being fed with new input and feeding back the results thereof, thus developing together with the project.

After completion of the building, and after passing the pressure tests and successful commissioning of the MVHR, the Certifier (authorised by the *Passivhaus Institute* in Darmstadt/Germany) will check all the material (see Appendix A) and – if satisfied – issue the certificate .It is advised to keep a close dialogue with the SPHC during the whole process of the project in order to ensure a positive result

3. Outline of the components used for the initial calculations.

This project is for a pair of semi-detached houses which are being constructed to Passive House via the use of the Beattie Passive thermal bridge free kit. The kit consists of a timber frame construction with blown insulation to fill the voids and provide the high levels of performance and reduction of thermal bridges.

The wall and floor elements are super insulated and air-tight with air-tightness at the roof situated at ceiling level. Nordan windows and doors have been selected for the build along with a Genvex MVHR system.

Additional insulation has been required in some areas and this has been specified as PU boards.

Thermal Performance of components

Specifications used for the PHPP – walls, floors and ceilings

Component	**U-Value**	**Comments**
Walls, ambient air	**0.109 W/(m²k)**	Walls as originally planned
Walls to garage	------	N/A
Walls to ground	W/(m²k)	N/A
Roof/Ceiling	**0.071W/(m²k)**	Additional insulation was added in the loft area.
Roof to ground	W/(m²k)	N/A
Garage Ceiling	W/(m²k)	N/A
Floor Slab	**0.097 W/(m²k)**	Floor slab as originally planned

1) For improved accuracy of the energy demand calculations, the EN ISO 13370 which deals with heat loss via the ground has been modified for the PHPP. The U-Value then is only related to the actual component and excludes the ground – the ground in turn is dealt with separately.

Specifications used for the PHPP – windows & doors

Windows, Uf	0.97 W/(m²k)	Sash/fixed/door/roof light triple glazed.
Windows, Ug	0.6 W(m²k)	All glazing roof lights
Windows, g-value	0.50/0.15	All glazing (this value might be hard to reach with the roof lights) /obscure glazing
Windows Pse spacer sash	0.038 W/(mK)	Thermix spacer or equivalent
Windows, Psi spacer fixed	0.038 W/(mK)	Thermix spacer or equivalent
Windows, Psi installation2	0.030W/(mK)	All windows/ roof lights
Frame width	105mm	Sash/fixed/door/door bottom/roof light
PH-doors, U-value	0.8 W(m²K)	Might be a cost issue; 1.0 W/(m2k) would also be acceptable (but comes with additional heat loss)

2) This value can be improved by incorporating them in the external insulation

Specifications used for the PHPP – additional values

Air Permeability	Max. 0.6 ach/h	Worst acceptable case
Thermal Bridging	TBC	There will be additional losses through TB; this will increase the heating demand – but good detailing can keep these losses small

The *climate data* set used for this initial report was one which is already owned and generated by the SPHC for the local area.

PHPP uses the German “Wohnflächenverordung” to determine the treated floor area. Using this, the resulting treated floor area was 174m².

M&E

The MVHR unit which is being used a Genvex system. Having never used the system before it has been highlighted to the client that the performance of the unit, whilst capable of servicing this building, is not as efficient as other systems which are currently available on the market.

Heating

Heating for the building can be adequately serviced by the MVHR system given that the heating load for the building is **8W/m²**. That is to say there will be enough solar and internal gains within the thermal envelope of these houses and the capacity of the internal air is capable of carrying enough heat to keep the buildings at a comfortable 20°C. We would always recommend as an additional heating source the use of an MVHR post heater as well as towel radiators in the bathrooms. This will help to boost the heating for the building should this be required.

DHW

DHW will be supplied via a small output boiler which needs to be specified and sourced at a sufficiently small performance which is appropriate to a Passive House building.

SUMMER OVER HEATING RISK

There is no risk detected of summer over heating for these properties. Any overheating can be adequately via the use of natural ventilation

4. Results

Results based on above values

Specific space heating demand (based on 319m² treated floor area)	**14 kWh/(m²a)**	Pass[3]
Specific space primary energy demand (rel.to 319² treated floor area)	**100 kWh/(m²a)**	Pass
Frequency of overheating	**2%**	

3) As mentioned before: This value will most likely go up during the process of the project

5. Comments

More information is required in some areas however this can be discussed at a later date. To speed up the information gathering I will produce a list of all information needed.