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Centre for the Built Environment

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Cost of delivering to Passivhaus Standard: Wimbish and Ditchingham case studies

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Briefing Paper 08

Introduction

This paper focuses on the build costs and building performance of two case studies from the Norfolk award-winning Parsons+Whittley Architects: Wimbish Passivhaus in Essex and Ditchingham Passivhaus in Norfolk.

Passivhaus standard and the UK Construction Industry

Thermal comfort and energy efficiency are the two main principles of Passivhaus. The Passivhaus idea has gained considerable momentum within the UK construction industry in recent years. Whilst to date the Government's green building initiatives have concentrated on renewables, Passivhaus is considered as one of the prominent energy efficiency building standards, as it concentrates solely on energy efficiency.

Achieving the major decrease in heating energy consumption required by the standard involves a shift in approach to building design and construction. It is therefore important to ensure that the tradespeople, architects, and clients are aware of and understand key items that are required to achieve this standard and ensure that it is delivered as cost-effectively as possible. For further information regarding the Passivhaus standard, please refer to our **Briefing Paper 04: Introduction to Passivhaus**.

Wimbish Passivhaus, Essex

Figure 1: Wimbish development in Essex. Picture courtesy of: Parsons + Whittley (above) and Mark Baigent (below left and right)

Client: Hastoe Housing Association
Architect: Parsons + Whittley Architects
Passivhaus consultant Inbuilt
M&E Engineers: Robinsons Associates
Structural Engineers: Richard Jackson PLC
Contractor: Bramall Construction Ltd (Keepmoat)
U values of all opaque external elements
Walls and roof: 0.88 W/m2K
Floor: 0.07 W/m2K
Windows: 0.79 W/m2K
Build cost: £1,675,000 (£1,650 per m^2)

Floor areas:
2 beds = 76m^2
3 beds = 88m^2 and
Flats = 61m^2 (Gross internal Floor Area)
Space heating energy demand Ranges from 10 to 15 kWh/(m^2a) across the site. (Taken from certified PHPP)
Systems: 92% efficiency Mechanical Ventilation and Heat Recovery System (MVHR), reinforced concrete raft on 400mm of Dow Floormate carries walls of 190mm Aircrete Blocks with 285mm of Neopor rendered insulation, which in turn carry standard trussed rafter roofs supporting 500mm Crown Loft Roll.

Wimbish development consists of 14 affordable housing units for Hastoe Housing Association. It was designed by Parsons+Whittley Architects to achieve both Passivhaus certification and Code for Sustainable Homes Level 4.

Procurement was one of the main challenges, especially in relation to the Wimbish project. To combine client's preference for Design and Build contracts to reduce risk, yet ensure a reasonable level of post-contract control, Parsons+Whittley designed a scheme to Stage F before tender and were retained by the client to oversee the execution of works. Other challenges included the placing of insulation and air-tightness on site as well as the design and installation of MVHR on site. All these aspects required a cultural shift for the UK construction industry and it is a tribute to the project team that all the problems were collaboratively resolved, which resulted in a successful end project.

Ditchingham Passivhaus, Norfolk

Figure 2: Ditchingham development in Norfolk. Picture courtesy of:Abi Dennington-Price (left) and Parsons+Whittley (middle and right)

Client: Hastoe Housing Association
Architect: Parsons + Whittley Architects
M&E Engineers: ESC Ltd
Structural Engineers: Richard Jackson PLC
Contractor: Bramall Construction Ltd (Keepmoat)
U values of all opaque external elements:
Walls: 0.102 W/m^{2}K
Floor:0.089 W/m^{2}K
Roofs: 0.079 W/m^{2}K
Space heating energy demand: 11kWh/(m^{2}a) (Taken from certified PHPP)

Systems: Water-saving taps and shower fittings, low energy lighting, recycling facilities, bicycle storage, composter, bird boxes and bird tables and the bungalows have solar panels on the roofs which provide some free electricity to residents. Itis built using traditional techniques of brick cavity walls with a dense concrete block inner skin, precast concrete floors and trussed rafter roofs. Genvex compact units have been utilised to provide heating and MVHR, with inlet and exhaust provided through roof punctuating 'chimneys' to reflect the adjacent Tayler & Green oeuvre.

Floor area:

No.	Type	Unit Area	Total Area
1	1B/2P Bungalow	54	54
2	2B/4P Bungalow	67	134
1	1B/2P Flat	54	54
2	2B/4P Flat	67	134
3	2B/4P House	77	231
2	2B/4P House (S/O)	77	154
1	3B/5P House	87	87
1	3B/5P House (S/O)	87	87
1	4B/6P House	97	97
		Total	**1032m^2**

Build Costs: £1,517,379 (£1,442 per m^2)

This scheme of 14 homes are set in Ditchingham Conservation Area adjacent to the Tayler and Green properties, which were an innovative 'post-modern' practice producing post-war rural housing in SW Norfolk which has been subsequently listed for special protection. This makes the scheme unique for Passivhaus, as it demonstrates how the methodology can work within a rigid planning framework, within a conservation area and adjacent to important listed buildings. They have proved that overcoming the challenges associated with developing homes for local people, in sensitive rural areas, can go hand-in-hand with cutting edge techniques. Early monitoring indicates that the dwellings are performing exceptionally well. Many Passivhaus schemes are uncompromisingly contemporary, whereas Ditchingham demonstrates that the methodology can be delivered within architecturally sensitive areas and this helps to persuade planners and the profession as a whole that the methodology gives flexibility to design in any idiom or vernacular. Procured using a Design and Build contract through negotiation, the scheme started on site in June 2011 and was completed in the summer of 2012. The scheme received its Passivhaus Certificate direct from Professor Wolfgang Feist on his visit to East Anglia on 5th February 2013.

Experiences

Key lessons learnt include:

- Passivhaus is capable of construction without the need to source new materials or master new and challenging techniques.
- Where the aim is to develop a soft landings approach to occupation; the expectation should be that within affordable housing the tenants are unlikely to be knowledgeable Passivhaus enthusiasts and information will be required to help the tenants make the most of their Passivhaus.
- Early tenancy nominations, allowing the design team to work with the occupants before, during and after occupation, has proved an invaluable learning experience for the project team as well as the tenants.

Based on the Wimbish's Post Occupancy Evaluation (POE) funded by TSB, the 2/3 bed houses use approximately 2,500 kWh of gas per annum, which equates to a gas bill of around £150 per year (for both space heating and domestic hot water. One tenant of a 3 bed house with 4 children is overjoyed with her house and has reported that her first 6 months gas fuel bill, which provides all space heating and domestic hot water has been £30 (€35). All the other tenants are reporting similar experiences varying only with lifestyle choices.

Funding and business support for East of England SMEs

As a condition of the European Regional Development Funding (ERDF) awarded for the Norwich Research Park (NRP) Enterprise Centre, the Centre for the Built Environment (a Centre that draws upon a cluster of expertise within and outside UEA and is responsible for delivery of ERDF outputs and, through Adapt Commercial, the provision of low carbon consultancy services) will provide free business support. This support will be delivered through a series of bespoke CPD accredited seminars, webinars and other support showcasing the design, build and post-occupancy of the building. As part of the ERDF funding, SMEs in the East of England are eligible for up to 12 hours support free of charge. Non SMEs will be charged £30 plus VAT per half day session. The seminars are CPD accredited and suitable for architects, contractors, planners, M & E consultants and other built environment professionals. The seminars will be delivered by a combination of professionals working on the Exemplar Low Carbon Building, other built environment specialists and CBE consultants and will have a maximum capacity of 15 people per session. Events include topics such as Passivhaus, BREEAM, Building Information Modelling (BIM), Ventilation and many more.

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