EMH HOMES – TOWN STREET, SANDIACRE

BUILDING PROFILE
PROFILE: 006

OVERVIEW

Since our formation in 2008, the Zero Carbon Hub continues to work with Government and industry to identify risks, remove barriers to innovation and help demonstrate that energy efficient, healthy new homes can be delivered by the mainstream house building industry.

This series of building profiles gives examples of manufacturers, developers and clients who have embraced the challenge and are developing practical, commercially viable ways of delivering the next generation of homes in preparation for the nationwide introduction of Nearly Zero Energy Homes from 2020.

SUMMARY
emh homes have taken the lessons learned from their earlier development of nine units built to Passivhaus standards in nearby Hart Lea, and used them to develop the larger site at Town Street, Sandiacre. This consists of thirty-six houses and four flats all to the same Passivhaus fabric specification. Four of these are to be Passivhaus certified, while the rest have been constructed to exactly the same specification. Delivery of these design standards means occupants and landlord can expect comfortable and reliable housing with extremely low energy bills.

SPECIAL FEATURES
The project team included Encraft (Passivhaus consultant), Halsall Lloyd Partnership (architect), and Westleigh Partnerships (Housebuilder and timber frame supplier). By engaging the supply chain early within the project both product and process improvements have been used to deliver highly energy efficient homes at a cost viable for social housing providers.

DEVELOPER
emh homes

ABOUT
One of the leading housing associations in the East Midlands, emh homes manage around 17,000 homes

START DATE
24 March 2014

COMPLETION DATE
June 2015

Profile supported by
The construction of this 40-unit housing scheme redeveloped a failing residential estate in Sandiacre. Whilst initially appearing to be in many ways unremarkable, the development team has focused on achieving advanced levels of energy efficiency and a correspondingly high quality indoor environment for the occupants. Generously proportioned homes have been delivered via a combination of good design and construction techniques.

One of the central challenges was to work with the selected manufacturer of a conventional timber framed house building system and raise its energy efficiency performance to the Passivhaus standard. This represented a design challenge for both the architects and Passivhaus consultants. There was also a rapid up-skilling challenge for the contractor, who had to deliver a robust strategy for the delivery of airtight construction.

Capital cost was a further challenge. As social housing units these dwellings needed to be rented or sold at affordable rates. Therefore, the increased cost due to higher fabric specifications needed to be offset by capital and lifetime savings. The cost of radiators in all house types was reduced by using the ventilation system to distribute the minimal amount of heat required. The decision to only Passivhaus certify a limited number of homes was due to a combination of capital cost constraints and a strategy to use lessons learned from this more rigorous process to educate the site team and improve energy performance across the development as a whole.

Emh homes engaged Encraft to investigate the feasibility of various options to achieve Code for Sustainable Homes Level 4 housing at Town Street. A range of options were explored ranging from ‘Fabric first’ energy demand reductions to ‘Technology first’ low and zero carbon energy generating systems. The landlord selected a ‘Fabric first’ approach in the form of a Passivhaus specification as this was considered to be a more robust, long term solution for this development.

The contractor, Westleigh, adapted their standard timber frame system to provide the levels of insulation and airtightness to meet the stringent Passivhaus criteria. This required special attention to design out thermal bridging, thermal by-pass and air leakage within the system rather than simply relying on site skills and experience.

**Fabric**
- **External walls** – Timber frame with 140mm mineral wool, 100mm PIR, 50mm cavity with brick or block outer leaf
- **Roof** – 400mm ceiling level low density glass mineral wool insulation
- **Floor** – Screed over 170mm PIR insulation board
- **Windows** – Passivhaus certified triple glazed throughout

**Building Services**
- Gas condensing boiler to provide space and domestic hot water
- Radiator system significantly reduced to only two (upper and ground floor bathrooms)
- Mechanical ventilation with heat recovery

During early stages of the development the airtightness strategy consisted of separate airtight membranes for each wall and floor surface, the junctions between them, on a room by room basis. This resulted in a complex series of steps on site and an unpredictable level of airtightness performance.

The design team worked with the contractor supplying the timber frame to develop a new strategy using OSB3 boarding as the primary air barrier. This was continued across each elevation and the ground floor in a single operation, which proved to be of higher performance and less liable to accidental puncturing. In this way the contractor developed a robust form of Passivhaus timber frame construction.
PROJECT SOLUTIONS

PART L 2010

*Fabric Energy Efficiency*

**ACHIEVED**

29 kWh/m²/yr

**PART L 2010 Carbon Emissions**

**ACHIEVED**

12.5 kgCO₂/m²/year

**AIRTIGHTNESS AND VENTILATION**

- The higher performing results typically related to the fully certified homes
- The Passivhaus certified mechanical ventilation heat recovery system included an automatic summer bypass function plus inline electrical post heater
- Timer button ‘boost’ function in kitchen and bathrooms
- Acoustic attenuation within the pre-insulated rigid circular ductwork system
- Unit installed within a dedicated, locked service room, on the ground floor
- EMH Homes provide annual maintenance support

**WALLS**

U = 0.11 W/m²K

**FLOOR**

0.12 W/m²K

**THERMAL BRIDGING**

y < 0.04 W/m²K

**WINDOWS**

U = 0.84 W/m²K

G = 0.61

Triple Glazed

**ROOF**

U = 0.10 W/m²K

**FIRST FLOOR PLAN**

**GROUND FLOOR PLAN**
KEY LESSONS

CONSTRUCTION AND COMMISSIONING STAGE

The architects, if not Passivhaus or similarly experienced, require careful briefing as to the significance of thermal bridging, thermal bypass and airtightness, and how in practice this may be achieved. Close communication between the architect and Passivhaus consultant needs to be established early and maintained throughout the design process.

On this particular project, as the contractor had already been appointed, they were part of the design development process. This had the major benefit of allowing their preferred build system to be adapted to achieve Passivhaus standards. Even though the parties were fully engaged in the design process there inevitably remained a difference between theory and the actual construction of the homes.

A selection of solutions to reduce this difference were employed, to varying degrees, on this development.

- Architectural details can be supplemented with practical guidance and colour coding to clearly describe the exact sequence of construction required to eliminate air leakage and thermal bridging. The notes, provided in laminated format, need to both describe the process and the reasoning behind it to communicate what may be a new concept to those involved on site.
- MVHR system specification should be considered at an early stage and reviewed by both technical and construction team members as the design develops.
- Regular site inspections focusing on stages critical to energy efficiency should be carried out by members of the design and site management team, including the Passivhaus consultant, to help maintain quality.
- Hands on contractor training should be provided prior to construction including toolbox talks.
- Ensure the requirements for MVHR commissioning are fully understood.

In preparation for their next large project the contractors are developing a specialised set of design details illustrating the construction of their Passivhaus timber frame system in a detailed step by step manner to ensure the correct order and method of construction is achieved.

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