ZERO CARBON HUB

DESIGN STRATEGY

Rowner Research Project Phase One

March 2014

First Wessex

Taylor Wimpey

LABC
Delivering building control through local authorities

Technology Strategy Board
Driving Innovation

SAINT-GOBAIN

Homes & Communities Agency

NHBC Foundation

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The Rowner research project was undertaken in Gosport and spanned from 2009 - 2013.

The Project was funded by the Technology Strategy Board (TSB) as part of the Building Performance Evaluation programme (BPE), together with support from First Wessex, NHBC Foundation, LABC, Saint-Gobain, HCA and Taylor Wimpey.

The research project at Rowner investigated the design and delivery of 24 apartments, split equally over two blocks. The developments were part of Phase I of a multi-phased project, the Rowner Renewal project.

The first Block (B) was built to comply with the Code for Sustainable Homes (CSH) level 3 energy requirements, and Block C was built to achieve the Fabric Energy Efficiency Standard (FEES).[1]

This project provided the Hub with the opportunity to investigate the implementation of the FEES in built flats.

The two blocks had different tenancy agreements, with Block B being offered as shared ownership and Block C as simple tenancy.

1. The Fabric Energy Efficiency Standard (FEES) is the proposed maximum space heating and cooling energy demand for zero carbon homes from 2016.

The research project had three phases:

- Design and construction stage
- Post-occupancy evaluation
- And an overheating study

This series of five factsheets cover aspects of the first phase of the project.

This is the second factsheet in the series, covering the design aspect of the research project.

Subsequent factsheets covering the other two phases of the project, and a case study report including all phases, will be produced by the Zero Carbon Hub in due course.

The factsheets can also be found online at: **www.zerocarbonhub.org**

Design brief

The project was realised by a partnership of five members; First Wessex, Gosport Borough Council, Hampshire County Council, Home and Communities Agency (HCA) and Taylor Wimpey, and due to the number of different organisations involved, different standards and requirements had to be met. All properties in the development were designed to meet the 2006 version of the Building Regulations, Housing Quality Indicators and Lifetime Homes standards. The design teams were briefed on the different requirements of these units and the requirements were incorporated.

Code for Sustainable Homes (CSH) Level 3 - Block B

All the flats in Block B had the target of meeting the energy efficiency criteria of CSH Level 3 and the preferred strategy to achieve this was to follow a 'fabric first' approach. This comprised of a well-insulated and airtight building's fabric. Efficient building services were also specified, including a mechanical ventilation system with heat recovery (MVHR).

Fabric Energy Efficiency Standard (FEES) - Block C

All flats in Block C had to meet the then newly developed Fabric Energy Efficient Standard (FEES), as proposed by the Zero Carbon Hub.

At the time that this standard was being considered for this project, an industry-approved tool was not available for assessing the energy efficiency of the fabric. Fabric Energy Efficiency calculations became available as a SAP output in the 2010 version and FEES was included in the CSH in the same year. The specifications for this block were calculated using a consultation version of the SAP2009 tool (cSAP) with assistance from the Hub.[1]

The Fabric Energy Efficiency Standard is benchmarking the minimum performance of fabric and is the standard that houses built from 2016 would be expected to comply with as a first step in order to qualify as Zero Carbon.

1. As the development was being built to the 2006 Building Regulations, all the houses were being assessed using SAP2005. However, the methodology for calculating FEES was embedded within SAP2009 and so, for the purpose of assessing against that target, only the flats in Block C were assessed using cSAP2009 and only for the purpose of the research project.

Fabric Energy Efficiency Standard

The Fabric Energy Efficiency Standard (FEES) is the proposed maximum space heating and cooling energy demand for Zero Carbon houses. This is the amount of energy which would normally be needed to maintain indoor comfort conditions.

FEES ensures that a good minimum standard for fabric will be embedded in all new homes from 2016. FEES allows flexibility in the design approach and can be achieved in a variety of ways, and with combinations of different materials or product specifications. The metric for FEES is kWh/m²yr. Key elements that can impact the fabric performance are:

- Building fabric U-values.
- Thermal bridges, and bypasses.
- Air tightness of the thermal envelope.
- Thermal mass of materials used.
- External heat gains from solar rays.
- Internal heat gains.

Code for Sustainable Homes

The Code for Sustainable Homes is a voluntary national standard that looks at all aspects of sustainability in the construction of new homes. It aims to reduce carbon emissions and promote higher standards of sustainable design above the current minimum standards set out by the Building Regulations.

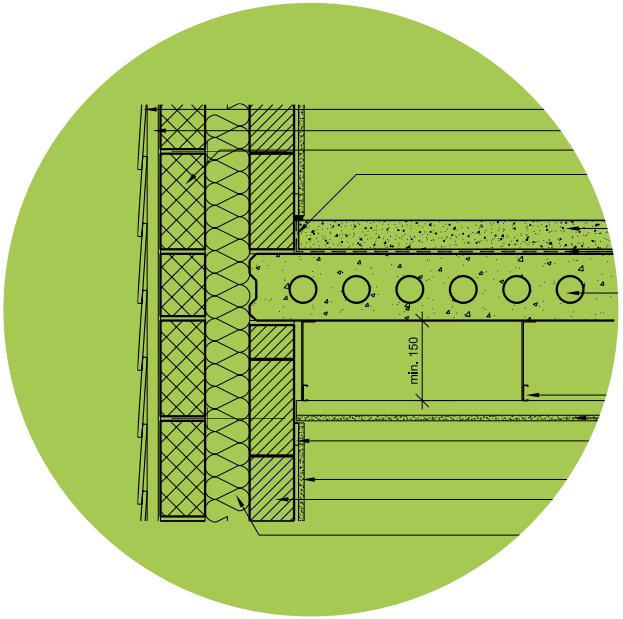
The energy efficiency requirements under the Code, similar to those in Part L of the Building Regulations, are expressed in terms of the CO_2 emissions that would be emitted as a consequence of providing energy for space and water heating, fixed lighting and ventilation to the dwellings. This therefore takes into account the contribution of any low and zero carbon technologies that may be incorporated into the schemes.

The energy efficiency element of the Code was used originally as a reference point for Zero Carbon homes (Code level 6). This was subsequently changed after unregulated (plug) loads were removed from the definition of Zero Carbon.

Design principles

- A combination of a thermally efficient airtight fabric and a mechanical ventilation system were considered to be an appropriate way to ensure high comfort and minimal operating costs to the residents.
- The energy efficiency measures were intended to be as visually unobtrusive and 'built-in' as possible, both internally and externally.
- A significant deviation from the usual fabric specification for the principal contractor/project team was to use a full fill cavity wall system.
- Another deviation from standard practice for the housing association was the use of Thin-Joint block work, classified as a Modern Method of Construction (MMC), a requirement set by the Homes and Communities Agency (HCA) for this project and other key funding bodies for the development.
- In order to comply with various daylighting requirements, large windows were incorporated in the design.
- The SAP assessor determined the performance parameters for the building fabric with assistance from the architects and M&E Consultants, and the main contractor selected the appropriate materials and design methodologies that met the requirements.

BUILDING ELEMENT	BLOCK B U VALUES (W/m^2K)	BLOCK C U VALUES (W/m^2K)
External Walls	0.24	0.18
Party Wall	0.2	0.0
Sheltered Wall	0.24	0.22
Ground Floor	0.15	0.15
Roof	0.1	0.1
Windows	1.4	1.4



Floor detail (Robust Detail E-FC-4)

Observations

- Thin-Joint masonry was a construction system that the design and construction teams were not familiar with.
- There was no clear documentation on the continuity of the air-tightness and thermal barriers, minimising thermal bridging and bypass.
- Like most modern buildings the line of airtightness was designed to be at the inner surface of the plasterboard. Evidence shows that this may have not been the most robust approach to ensuring long-lasting performance.
- Longitudinal sections were not provided and all drawings included a Robust Detail showing the intermediate floor junction with the external wall for sound insulation.
- Information on sequencing had not been provided and there were no references to additional drawings and information.
- The project architects informed that the details used for the development complied with the Approved Construction Details, which allowed for a 'global y-value' of 0.08W/m^{2}K to be used.
- An additional document, comprising construction details, from Hanson was also provided. Using these details allowed for the use of a y-value of 0.04W/m^{2}K in the SAP 2005 calculations.
- In the design stage SAPs provided by the developer, a y-value of 0.04W/m^{2}K was assumed. This corresponded with the use of Enhanced Construction Details (ECD) provided by the Energy Saving Trust (EST), but no detail drawings were available for the audit.

"The original design intentions met the standards, both those of the HCA and internal design requirements, which follow very much the HCA ones, but are influenced by our residents and our design panel."

Member of the design team

Recommendations

- It is important to establish early on in the design process the different standards that developments are to meet, including space standards like Lifetime Homes, and any energy efficiency standards and renewable energy obligations.
- Dwellings are designed to increasingly onerous and complex standards as we drive for low energy use and low carbon emissions. This means adequate time and expertise should be allowed in the development programme for consultants and sub-contractors to be included at the design stage.
- There must be coordination between the teams that work on projects pre- and post-planning stages so that early stage design decisions, including those impacting on the energy efficiency of the buildings, are adequately realised.
- In cases where there are existing purchase agreements in place with suppliers and sub-contractors, it must be ensured that instructions to these companies are up to date and adjusted to the requirements of the project.
- Detailed designs with supportive documents, guidance and information will need to be provided to the teams working on site. This will assist them in understanding better what needs to be achieved and how.
- If new methods and technologies are to be incorporated in the design strategy, it needs to be ensured that specific skill levels are raised in order to deliver these new specifications.
- The use of energy modelling tools, beyond the regulatory mandatory assessment through SAP, may be considered, especially for the assessment of possible overheating in homes.

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