Since our formation in 2008, the Zero Carbon Hub continues to work with Government and industry to create a zero carbon definition that 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 energy efficient, low carbon homes.

'Block C' is part of the Rowner Regeneration scheme, a development located in Gosport, Hampshire which will provide 700 dwellings by 2017. The three storey, twelve flat block was the first development in the UK to be built specifically to the Fabric Energy Efficiency Standard (FEES) and alongside another identical block, built to the Code for Sustainable Homes (CSH) level 3 energy requirements, forms the basis of the Rowner Research project.

SPECIAL FEATURES
- Designed and constructed to achieve the FEES in flats for the first time
- Part of the Building Performance Evaluation programme funded by Innovate UK
- Modern Method of Construction used (Thin Joint Masonry)
- Achieved carbon reduction through fabric first approach without on-site renewables
PROJECT STRATEGY

KEY DEVELOPMENT CHALLENGES

Rowner Block C faced a number of challenges during its conception including:

- Designing a block of flats to meet the FEES for the first time.
- Incorporating a requirement from the Homes and Communities Agency (HCA) for the use of a Modern Method of Construction (MMC).
- Ensuring that all teams had the knowledge and skills required to meet unfamiliar design standards.
- Implementing a robust handover process to the occupants providing bespoke and simplified operational instructions alongside detailed product manuals.

DELIVERY PROCESS

PLANNING

Low operational cost for future residents was an important factor considered during the planning stage of the development. Block C design reflected these considerations by targeting a higher energy efficiency standard, following a fabric first approach.

DESIGN

Design standards for the research block were bespoke. Specifications were drawn from a combination of Building Regulations (Part L 2006), developer requirements, ‘Lifetime Homes Standards’ and the target for meeting the FEES.

The requirement to achieve FEES was achieved through a 50mm increase of the external wall insulation, resulting in 150mm of blown bead EPS. This insulation type allowed for the entire width of the cavity to be utilised. In addition the team felt there was no additional skill required to use the system and it helped reduced the importance of site control issues such as installation and taping of rigid insulation panels.

Special consideration was given to junction details corresponding with a global thermal bridging y-value of 0.04W/m²K.

PRODUCTS AND SYSTEMS

FABRIC

- Thin Joint Masonry Cavity external walls
- Party walls fully filled and edge sealed
- Beam and Block suspended floor
- Insulation at ceiling level

BUILDING SERVICES

- MVHR system’s efficiency 91% with an SFP of 0.7 w/l/s
- Gas combi-boiler system’s efficiency 91%

BOILER CONTROLS

- Thermostat
- Programmer
- Thermostatic Radiator Valves

MVHR CONTROLS

- Boost function
- Summer mode
PROJECT SOLUTIONS

PART L 2006

Fabric Energy Efficiency

DESIGNED TO ACHIEVE

<39 kWh/m²/yr

PART L 2006

Carbon Emissions

Flats average regulated (As-built SAP)

TER

25 kgCO₂/m²/year

der

17.6 kgCO₂/m²/year

EXTERNAL WALLS

U = 0.18 W/m²K

103mm facing brick, 147mm full fill cavity, 100mm Thin joint blockwork

PARTY WALLS

U = 0.0 W/m²K

Robust details E-WM-17 edge sealed, 100mm fully filled cavity

GROUND FLOOR

U = 0.15 W/m²K

Insulated beam and block suspended floor, 150mm thick, 75mm screed

WINDOWS

U = 1.50 W/m²K

Double Glazed uPVC Frame

THERMAL BRIDGING

y = 0.04 W/m²K

ACD and manufacturer accredited details

ROOF

U = 0.10 W/m²K

450mm glass mineral fibre insulation

AIRTIGHTNESS AND VENTILATION

The air-tightness layer at Block C was designed to be the inner surface of the plasterboard. The use of Thin Joint Masonry further supported the structural air-tightness of the fabric.

Air-tightness tests were performed during three distinct phases of the construction process to monitor progress (first fix, second fix and upon completion). Information collected helped to identify areas of weakness, gaps in skills and knowledge, and potential design and on-site processes implications.

Information collected was passed to the developers to inform future training material and on-site skills and knowledge.

The flats ventilation strategy relied on the use of whole house Mechanical Ventilation with Heat Recovery (MVHR).

The system, designed to comply with the Approved Document F 2006, contains supply terminals for the lounge area, and all bedrooms. Extract terminals were located in the kitchen and wet service areas.

The predominant glazed facades of all flats were oriented towards the south, maximizing the potential solar gains during cold weather and providing good levels of natural lighting.

In an attempt to mitigate any overheating risks associated with this design, the MVHR system present in the flats included a ‘summer mode’ which was designed to support air circulation during warmer periods.

In addition, half of all flats were multi-aspect with the ability to cross-ventilate.

An in depth study of overheating in the flats was undertaken as part of the research project. The findings were released in March 2015 and can be found on the Zero Carbon Hub Website.
KEY LESSONS

DESIGN AND CONSTRUCTION STAGE

Training in the construction of thin-joint blockwork and installation of MVHR was carried out on-site as the project progressed. Even though the construction team appeared confident in following the design guides, on-site issues were reported on occasions. These included problems with material tolerances and difficulties with the installation of services.

More specifically in the case of the MVHR units, there were problems reported with the ductwork layout, especially in the areas where the rigid ductwork network connects to the MVHR unit using short pieces of flexible ductwork. Incorrect installation would have impacted the system’s performance both in terms of energy consumption and achieved flow rates.

Experiences at Rowner showed that with an increase in the number of trades and specialist skills required on site, it is important to structure clear monitoring procedures for site works, with adequate checks at all stages to ensure the construction reflects instructions from drawings. Failure to do so may result in inaccurate construction and consequently problems that may prove difficult to correct if noticed at later stages. Information from the design team must include sequencing of site activities and procedures for addressing any variations that may occur during construction.

A series of tests, both in-line and end of line were performed during construction at Rowner. These included air-tightness tests at different stages of construction, in-situ U-values measurements, a co-heating test, MVHR units commissioning and flow rate spot checks plus thermographic imaging.

Information obtained from the tests was used to inform the SAP model and a series of ‘alternative’ as-built SAP outputs were produced in an effort to better “predict” expected performance.

POST OCCUPANCY STUDY

The energy performance of Block C was monitored over a period of two years (Sep 2011 – Sep 2013). During this time the consumption of gas, electricity and water was recorded at five minute intervals in all flats. External conditions were also monitored.

Results were analysed and compared to testing observations, information on occupants lifestyles and predicted energy performance results. In addition to the basic equipment, additional monitoring sensors were installed in a number of properties. For more information on the findings of the study please visit Zero Carbon Hub Website.

Highlights of the study included:
- Energy and water consumption trends were significantly influenced by the occupant’s lifestyle
- Predicted electricity and water consumption was higher than measured in most cases
- Indoor air conditions were considered satisfactory, based on temperature, humidity and CO₂ measurements and on occupants responses from surveys