Sustainability 7
Extra
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Miller Zero

Miller Zero is the name given to a collection of five homes on a development of 79 units in Basingstoke, Hampshire. Although almost identical in appearance and layout, the homes have been built to five different levels of the Code for Sustainable Homes. For private sale, the homes will allow Miller Homes to understand the challenges of designing, building and marketing homes built to meet the Code at increasing levels and satisfy increasingly stringent energy standards of building regulations.

Construction

The homes have been built using a variety of different construction methods, including thin joint cavity masonry, SIPS (structural insulated panel system) and a storey-height aircrete panel system. With 200mm of external wall insulation, the Code Level 6 aircrete panel house achieves a wall U-value of 0.09W/m^{2}K; the use of wet plaster in this home enabled an extremely low air permeability figure of 1.48 m^3/m^2/hr to be achieved.

The ground floor construction for each of the homes accommodates approximately 100mm of insulation, although the type of material used varies.

In the case of the Level 6 home the use of urethane insulation together with the reinforced aircrete planks achieves a floor U-value of 0.11W/m^{2}K. Rigid urethane is used to insulate the roofs and in the Level 6 home, a thickness of 190mm is supplemented by a 52mm insulated plasterboard lining, which gives an overall U-value of 0.12W/m^{2}K.

At the lower Code Levels, double glazed low-e units have been installed in PVC-U frames to achieve an overall U-value of 1.7W/m^{2}K. But for the Level 6 home triple glazing was required and this reduced the overall U-value down to 0.68W/m^{2}K.

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The Code Level 6 aircrete panel house under construction

Heating systems

Selected to meet the energy/CO_2 targets of the different Levels of the Code, a variety of systems have been installed at Miller Zero:

- The 10% reduction in CO_2 emissions required at Code Level 1 was achieved with a conventional gas condensing boiler and radiators.
- For Level 3 (25% CO_2 reduction), an air source heat pump used in conjunction with radiators was selected.
- For Level 4 (44% CO_2 reduction), a ground source heat pump connected to an underfloor heating system was used.
- For the Level 5 (100% CO_2 reduction) and Level 6 (zero carbon) homes, the solution chosen was a biomass boiler. Fuelled by wood pellets, a single boiler shared between the two homes is located in an adjacent garage.

Ventilation

All of the homes have been built with high standards of air permeability in mind and, in order to ensure that this does not give rise to poor indoor air quality or high humidity levels (and associated risks of condensation and mould growth), mechanical ventilation systems have been specified for all five homes.

The equipment is located in the first floor airing cupboard to reduce duct lengths and incorporates heat recovery to minimise the amount of heat lost from the outgoing exhaust ventilation air. The units also feature a summer by-pass option for the warmer months of the year.

Renewables

The planning application included a small-scale wind turbine, located in a communal area. However, whilst the local authority was supportive of the development in general, approval for the turbine was not granted.

Other than the biomass boiler serving the Level 5 and 6 homes, the only other renewable technology installed was photovoltaic panels. The monopitch roof of the Level 5 home accommodates panels with an area of 14m^2, whilst the Level 6 home has 38m^2 of panels – well over twice the size. The peak output from the PV installations is 1.7kW and 4.8kW respectively.

Non-energy/CO_2 Code challenges

A variety of other features have been specified to satisfy the other elements of the Code. These include water efficient fittings and appliances, rainwater harvesting, many storey-height windows to maximise daylighting levels as well as providing space for recycling, etc. Great attention has been paid to detailed design, specification and construction on site to pick up required number of points in all categories.

Lessons learned

This project has already given Miller Homes an invaluable insight into the challenges of designing and building homes to meet the increasing demands of the Code and future changes to thermal requirements of building regulations. The exercise also demonstrated the significant additional costs involved, amounting to incremental increase as higher levels of the code are achieved up to £50,000 for the Code Level 6 unit.

Subject to permission being given by the owners, built-in sensors will be used to monitor the performance of the homes in use for a 12-month period, during which, the reaction of the occupants to the variety of technologies installed will also be recorded. The owners will also be able to closely monitor their own current consumption of energy using 'smart meters' that have been provided.

The biomass boiler for the Code Levels 5 and 6 houses

The air source heat pump of the Code Level 3 house

A mechanical ventilation with heat recovery unit above the hot water cylinder

Homebuilding skills

Understanding the skills and knowledge needed for delivery of zero carbon homes

The transition to zero carbon will require huge changes in the way we plan, design, build and live in new homes. Achieving this important transition successfully will depend on how well the industry is supported, and a foremost challenge will be to ensure that the house-building sector is equipped with the right skills and knowledge.

But, for the professions and trades, what core skills will be needed and what knowledge must be acquired to ensure that we can build to zero carbon standards from 2016?

The Homebuilding Skills Partnership

In mid-2009, the Zero Carbon Hub established a Skills and Training Workstream to provide a forum for debate on future skills and training needs. This Workstream rapidly evolved into a partnership body between NHBC, Construction Skills and the Zero Carbon Hub. This partnership, called Homebuilding Skills is uniquely positioned to understand the complexity of the zero carbon challenge and the practicalities of building homes and delivering training programmes. It set itself the following objectives:

- To develop a Home Building Skills Action Plan for the UK.
- To identify the specific skills and knowledge needed to deliver low and zero carbon homes.
- To support the industry in raising the standards in homebuilding.
- To identify complementary action needed (by those other than home builders).

Progress – developing the Skills Action Plan to 2020

Though the exact definition of a zero carbon home is not yet finalised, there is a growing understanding of what must be achieved in practice. Key steps in delivery are now mapped out chronologically by the Zero Carbon Hub on its timelines which are used to monitor progress to full delivery against zero carbon standards. A major workshop last November gave deeper insights into the 'operational scenarios' which will prevail at the key staging points together with the broad, associated training needs.

That preliminary position was set out for industry consideration as an on-line consultation, which aimed to capture specific training objectives and needs. Each major homebuilding activity, including Building Control and inspection, was given an opportunity to comment. The feedback from the consultation will be collated and key findings reported back to the industry and government policy advisors later this year. The report is expected to trigger wider debate, but in its final form it will provide the evidence to steer the overall Home building Skills Action Plan.

Why it's important

The importance and urgency of this work is well-described by Alastair Collin of Construction Skills who sets out the complexity of the challenge – "Many companies are unable to articulate what they specifically need but definitely know their needs are changing. This means that training providers and assessment centres are also unable to determine specific needs and develop tailored solutions in response – this work will help clarify needs and inform the skills and training response."

Imtiaz Faroohki (NHBC's Chief Executive) sees the work as helping to unite the industry in defining and confronting the skills gap – something that is going to be crucial in meeting tough post-recession output and sustainability targets for housing, while Neil Jefferson of the Zero Carbon Hub sees the work as vital in ensuring that national training is linked to the excellent progress already made by the industry. These strategic considerations are all reflected in the approach taken by Homebuilding Skills and its consultative, inclusive approach.

Future flexibility

There's a busy year ahead to draw up skills and knowledge matrices for each major profession and trade. In some cases it may be a simple extension of existing skills or knowledge. In other situations, crucial new skills or knowledge may be identified. The Zero Carbon Hub will be able to feed in new information to inform training requirements as the year proceeds, particularly on delivering the 70% carbon compliance level for new homes. One thing is certain – the need for the matrices to be responsive to change and future policy clarifications. For example, though it could not be defined today, we can anticipate a major training programme surrounding how to deliver 'Allowable Solutions' – the new part of the definition of zero carbon homes which is under policy development at this time. In contrast it is quite possible to envisage a logical programme of training to support the now well-developed area of Fabric Energy Efficiency.

The findings from the consultation exercise will be developed into an online hub, which all those involved in homebuilding (whether site managers, architects, bricklayers or others) will be able to use to establish what training support they need, and where to find it.

For general information on this work please visit **http://www.homebuilding-skills.com.** If you have any queries please contact: Rob Lockey, NHBC Training Services Manager. **rlockey@nhbc.co.uk.**

NHBC Foundation

Set up in 2006, the NHBC Foundation has now completed 25 projects, outputs from which are published on its website at **www.NHBCFoundation.org.** The latest two reports improve our understanding of the efficient use of piled foundations and consider how the performance of drainage systems may be affected if, in future, the volume of water used to flush WCs is further reduced.

Efficient design of piled foundations for low-rise housing: Design guide

Amongst the benefits of using piled foundations are a range of environmental advantages that may help achieve compliance with the Code for Sustainable Homes.

Although the advantages will depend upon the particular development site and the type of piling selected, they can include:

- reduced waste arisings and less waste to landfill
- reduced neighbour nuisance – vibration, noise and air quality
- reduced embodied carbon dioxide emissions due to the reduced volume of concrete used.

In addition to these potential advantages, it is sometimes even possible for the collector loop of a ground source heat pump to be enclosed within piles.

This NHBC Foundation report, prepared with support from Arup, considers these environmental aspects alongside other key considerations relating to the selection and efficient design of piled foundations.

'Pull the chain, fill the drain'

Improvements to the water efficiency of new homes are increasingly being driven by the Code for Sustainable Homes and also (in England and Wales) through Part G of the Building Regulations. One key component of domestic water consumption is that used for flushing WCs, and significant quantities of water can be saved by specifying WCs with lower flush volumes.

This project undertaken by WRc, with support from the Foundation and other research partners, studied the potential consequences of lower flush volumes on the performance of drainage systems. Test rigs were used to identify the how far various solids would travel along a drainage system before coming to a halt as the amount of water used for flushing was reduced.

The principal finding of the project was that the current combination of typical flush volumes together with typical drainage system layouts does provide satisfactory performance. However, if the flush volume is reduced and/or the length of the drain is increased, performance is reduced and could potentially become unsatisfactory, leading to increased problems with blockages. This project provides useful data, which will be used to inform further debate on related standards and regulations.

The drainage test rig

NEWS

The Code for Sustainable Homes: Case studies

Three years on from the introduction of the Code for Sustainable Homes, the Department for Communities and Local Government (CLG) has published its second volume of case studies showing examples of five developments designed and built to comply with the Code. The examples cover a range of development types built in both the private and affordable sectors to achieve between Code Levels 3 and 6, using various construction methods.

The case studies summarise builders' experience of working with the Code. Amongst the comments included is that "unsurprisingly, those projects that planned to build Code homes from the outset found it easier to meet the requirements rather than adapt homes that had been designed to a different standard, as there are significant differences between the Code and previous standards" – a useful tip for builders who have yet to confront the challenges of the Code.

The document is available for free download from: **http://www.communities.gov.uk/publications/planningandbuilding/codecasestudiesvol2**

Code for Sustainable Homes: A cost review

This review published by CLG in March updates the Impact Assessment produced in November 2007 that analysed the costs and benefits of introducing Code ratings on a mandatory basis.

This study considers the extra-over cost of building to the Code above constructing homes to comply with building regulations. Four dwelling types were modelled, combined in a variety of ways (in terms of number of dwellings, dwelling mix and dwelling density) to create development scenarios and cost data were obtained through a direct consultation with the house-building industry.

The overall finding is that there is significant variation in the extra-over costs at each Level of the Code between the dwelling types and across the development scenarios. Typically, however, the extra-over costs expressed as a percentage of base build cost are:

Code Level	Extra-over cost
1	Less than 1%
2	1-2%
3	3-4%
4	6-8%
5	25-30%
6	30-40%

The report is available from the CLG website at: **http://www.communities.gov.uk/publications/planningandbuilding/codecostreview**