

Background

Lincoln Grove is a development of 9 x 2 and 3 bed homes near Woodstock, 9 miles from Oxford, constructed in 2007. The homes were awarded EcoHomes excellent, scoring 77 credits, the same as BedZED. The homes have been subsequently re-assessed under the Code for Sustainable Homes and achieved level 3



Thermal Design

- The shortcomings and complexity of standard cavity wall construction were clear to the developers Kingerlee Homes, so after considerable research, they specified NBT Thermoplan blocks - a single skin load-bearing wall system. The honeycombed blocks are planed top and bottom, enabling them to be laid to produce a single skin, robust, weather and air-tight structural wall, which is vapour permeable (air-tight and breathable). The blocks interlock on the vertical face and require no vertical mortared joints and the thin horizontal mortar joint increases the overall fabric performance. The wall, whose insulation value is entirely due to the block, is simply constructed without cavities, membranes or additional insulation. A thermal design checklist was drawn up and every junction detailed, to ensure continuity of air barrier and minimise thermal bridging and bypassing. Final airtightness tested at 3.8 – 4.8 m/h@50Pa.
- With **Thermal bridging**: calculated to an exceptionally low y -value = 0.024
- The design changed many times and it was hard for the whole team to keep up. In the end, there was a lack of ownership for the thermal checklist and it was not strictly adhered to.

Construction

- Roof**: 300mm of Warmcell insulation blown in between 250 mm I-beam rafters with 35mm wood fibre insulating sarking board
- U-value: 0.11 kWh/m²k (0.15) y of 0.04
- Floor**: Concrete planks with 150mm Kingspan insulation under a 50mm screed with 50mm edge upstands;
- U-value: 0.12 kWh/m²k (0.20)
- Walls**: 365mm Thermoplan single skin cellular insulation monolithic clay blocks with stone or render facing
- U-value: 0.26 kWh/m²k (0.28) y = 0.05



Materials

Kingerlee wanted to adopt a build system that was simple and effective, with lower embodied energy and with more sustainable materials. The Thermoplan system has very low embodied energy and environmental impact compared to conventional masonry building methods, which is recognised in their 'A' rating in the BREEAM Green Guide. Warmcel is also rated A in the Green Guide and FSC timber was used throughout

Process

- The integrated thermal design and detailing was a collaborative process between the developers and the material suppliers NBT and their consultancy arm NBT consult. The entire team – developers, architect, contracts manager, investors, QS and site manager visited sites in Germany to see the system in action and how quickly the build can progress. They also visited the Thermoplan factory.
- The QS was impressed with his findings and much more confident about costs and timelines
- Onsite training was delivered to the in house construction team and their main subcontractors and the site manager was suitably inspired by his trip to Germany. NBT Consult compiled a check list and details of junctions. Inspections were made by the teams at crucial stages of the build, to ensure the detailing was adhered to and effective, before work continued

Sequencing

- The render finish on the inside of the single skin block walls provides the bulk of the airtightness, so it was essential to ensure a cohesive shell - the render had to follow round the inside and form a continuous unbroken layer, which included rendering behind fitted kitchen cupboards and appliances, before fit out. If walls cannot be plastered before fit out then they should be parged whilst still accessible.

Planning

- There were issues with scaffolding, which took longer to erect than the Thermoplan walls and delayed the build process. The access was very tight for the crane.

Management and Supply chain

- Kingerlee made a Board level decision to move away from standard cavity construction and adopt the principles behind MMC.
- Working closely with NBT, the Thermoplan suppliers on the design for thermal efficiency ensured the forming on an effective collaborative team at an early stage

Ease and Speed of Construction

The developers had been impressed at the speed of construction of the Thermoplan system in Germany and the general understanding of the importance of thermal performance across all the site operatives. The construction system led to vastly reduced build times in Germany, potentially halving build times.

Post-Construction Monitoring

Kingerlee have understood that air tightness testing and thermographic imaging are essential tools during the build process. They also tested at a number of stages in the construction process which allowed easy remedial action at an early stage – much cheaper in the long run and help give better final results.

Post Occupation Monitoring

- Heating costs from the SAP Predicted Energy Assessment, based upon May 2007 fuel costs, are in the region of £150.00 per year, depending upon the size of the units
- On the same basis, the total fuel cost for heating and hot water will be approximately £200 per year including standing charges.
- Early indications from monitoring appear to confirm the performance anticipated in the SAP predictions.
- At Bladon, a whole house monitoring system allows both occupiers and the developers to access energy use across the 8 electricity circuits, the gas, the water and internal and external temperatures and internal humidity.
- Monitoring shows that radiators have been turned off upstairs, the wood burners have not been used, and the passive ventilation system is ensuring comfortable temperature and humidity throughout the homes.
- Kingerlee are also working with Oxford Brookes, who are monitoring the occupants behaviour, to understand better how occupants use their homes and how this behaviour reflects in consumption patterns - the links between energy use and occupancy behaviour will be made clearer

