

A 'Passive House' Standard house has been constructed on the former steelworks site in Ebbw Vale, south Wales. It is a 3 bedroom house in light steel framing with insulated render cladding which will be open to the public until mid-2011.

FIRST LIGHT STEEL CODE LEVEL 5 HOUSE IN WALES



Light steel framing is widely used in housing and medium-rise residential buildings because of its speed of installation, dimensional accuracy and excellent performance characteristics. Previous studies, such as the BRE *SmartHouse* project, have demonstrated the site productivity and sustainability credentials of this rapidly developing technology.

When the opportunity arose to demonstrate the use of light steel technologies in the Welsh Future Homes project in south Wales, the consortium of Metcon and Dragonboard conceived a 3 bedroom detached house to satisfy 'Passive House' or Code for Sustainable Homes level 5 standards. The floor area of the house was approximately 100 m². The project was made more complex to build on the former industrial site in Ebbw Vale, which meant that the lightweight and structural robustness of the construction was paramount to avoid problems due to settlement over time.

An innovative sheathing board with 75 mm of insulation externally, 150 mm of blown fibre insulation between the 150mm deep light steel C sections and 35 mm of insulated plasterboard internally achieved the required U-value of 0.12 W/m²K taking account of thermal bridging through the steel elements in the wall. The overall wall thickness of 290 mm was less than a conventional brick and block-work wall. Windows were triple glazed with a U-value of 0.7 W/m²K and the orientation of the house was optimised for solar gain. A mechanical ventilation and heat recovery system backed up by a heat pump reduced unwanted heat loss by air leakage in the winter and controlled temperature rises in the summer.

Other energy generation technologies included roof-mounted PV and solar thermal panels, so that the net energy use per year was calculated to be less than 14 kWh/m² floor area, as required by 'Passive House' standards. The predicted as-built cost range is £950 to 1080 /m² floor area, which is within the normal costs of modern housing. All buildings on the Welsh Future Homes site will be monitored by BRE Wales. There are four other buildings of similar performance on the site, which will be open for visitors until July 2011 and will then be occupied.

Application Benefits:

- Light steel framing provides a U-value of 0.12 W/m²K
- Code Level 5 achieved – the first for light steel framing in Wales
- Wall thickness less than 300 mm
- Excellent air-tightness (<0.3 m³/m²/h)
- Lightweight (less than 30% of brick-block house)

Project Team:

Client: Blaenau-Gwent Council
Architects: Boyce Associates
Light steel framing: Metcon, Ireland
Cladding: Dragonboard
Structural Engineer: Stephen Napper Associates Ltd



Installation of light steel wall panels and roof trusses

Construction Details:

The light steel framework used 150 mm deep to 1.2 mm thick C sections placed at 600 mm centres and constructed or prefabricated storey-high wall panels. The house was assembled in less than two days, and it was made weather-tight and clad in only 10 days. The wall built-up comprised over 250 mm of insulation in three separate layers. The U-value as predicted by thermal simulation models was 0.12 W/m²K, taking account of the small amount of heat transmitted through the thin steel C sections.

The ground floor was an insulated concrete slab, and the floors and walls were built as prefabricated light steel panels. The roof was also designed in light steel framing and was insulated on the loft floor and in the rafters so that it could potentially be used for habitable space. Excellent air-tightness was achieved by use of the internal insulated plasterboard and the external sheathing board. The test value of 0.27 m³/m²/hour easily satisfies *Passive House* standards and is 20 times better than more conventional buildings.

Importantly, the lightweight construction weighed less than 300 kg/m² of ground floor area, which is only 30% of an equivalent brick and blockwork house. This meant that foundation costs are minimised and the effect of long term settlement on this former industrial site is negligible.

The cladding used an innovative sheathing board system called Dragonboard. The board was also used both internally and externally throughout the house. The board has tapered edges and its high impact strength means that taping and jointing was only necessary internally. Externally, the board was sealed at the joints and accepted a one coat render system. Dragonboard was also used in other applications throughout the house normally associated with timber products like internal doors, skirting and architrave, stairs, fascia and soffit, etc. The board has excellent fire-proof and water-proof qualities, and when combined with light steel framework provides an excellent overall building technology .