Heavyweight, carbon light

They're hardwearing, long-lasting and, if managed right, eminently recyclable, so, says ROGER HUNT, it's about time the sustainable credentials of brick and block are shouted from the roof tops

ABOVE Variety of Wienerberger products

CLOCKWISE FROM LEFT
Black Architecture's scheme in Poole for Haxted Estates | Lignacite carbon negative masonry block | Laying Wienerberger's Porotherm blocks | Forticrete Concrete Linear Bricks | Brick making at Hanson's Mesham works | Variety of Wienerberger products

Heavyweight construction materials such as bricks and blocks have long been a mainstay of the housebuilding industry, with over 84% of houses built of brick. Brick has been part of the palette of British building materials since Roman times and concrete has made much of the modern world possible, so it is maybe not surprising that, according to a survey by the Concrete Block Association and the Modern Masonry Alliance, 93% of people want to live in a brick and block constructed house.

Opinions as to the sustainability of these products are many and varied and often hotly debated. John Sandford, director for sustainability at Wienerberger, thinks it is important to consider the big picture; not just the carbon footprint of the manufacture and the construction processes, but also building performance and durability. "Only by striking a balance between these factors will the most viable and sustainable options begin to emerge."

John Lambert, general manager at Forticrete, concurs, believing that concrete-based building products have become increasingly popular due to their natural durability, fire resistance, thermal mass and acoustic performance benefits. "When you take into consideration the fact that the materials and their constituents are responsibly sourced, locally where possible, it's clear to see why design teams are utilising concrete-based building blocks for the delivery of sustainable projects."

Sandford believes that clay has the natural properties and design versatility to make it a genuinely sustainable option. "Unlike timber, a material widely considered to be sustainable, clay offers a lifespan of at least 150 years with virtually no required maintenance, employing techniques that have been honed by centuries of usage and methodology. Indeed, even when a clay building's lifespan is up, the brick can still be recycled and reused."

In its publication, Brick: building a sustainable resource for the future, the Brick Development Association points to research from Leeds Metropolitan University that has demonstrated that brick structures can have a lifespan of 500 years or more, and well-constructed brickwork can be expected to last many decades before even minor maintenance is required.

Indeed, Sofie Pelsmakers, the author of The Environmental Design Pocketbook, points to the fact that bricks have a longer lifespan than any building. "It's crucial to design for the deconstruction and reuse of bricks, although, at present, only some 6% of demolished bricks are reclaimed. Around 65% of a typical brick wall's embodied carbon is attributed to the bricks and around 20% to the inner concrete blockwork. This is due to the high firing temperatures of around 500-1000°C used to create bricks."

For reclamation to be successful, one crucial factor has to be considered: the ease with which the bricks

and blocks can be separated from the mortar bonding them. In the past, walling components were generally bonded with lime mortars so are often salvageable as lime-based materials are relatively easily cleaned off when a wall is deconstructed. More commonly today, bricks are bonded with cement-based mortar. "If cement mortar is used it can only be downcycled into crushed aggregate," says Pelsmakers.

With a view to improving efficiency and reducing waste, the clay and concrete industries partnered with WRAP to develop Resource Efficiency Action Plans (REAPs), which include practical recommendations, actions and targets that will directly benefit industry by increasing the opportunity for recycling and reusing recovered materials.

"The REAPs have been developed to assist the supply chain, which ranges from raw material extraction through to the demolition or deconstruction of buildings, in identifying and creating an actionable strategy for reducing waste and improving resource efficiency," explains Simon Hay, CEO of the Brick Development Association.

"It's only because of the existing expertise of the people in the brick industry that the REAP is both comprehensive and inspirational. While the brick industry is already environmentally sound and efficient there's a strong commitment to improve performances, lessen environmental impact and increase efficiency."

At Wienerberger, Sandford points to the investment in new kiln technology, which simultaneously drives down both energy consumption and carbon emissions. "As an example of a clay-based construction system that is at the forefront of both sustainability and modern efficiency, a Porotherm clay block can be made using 30% recycled material, and be constructed on site using 95% less water than traditional masonry," claims Sandford.

Similarly, John Lambert explains that Forticrete is continuously looking to increase the recycled content of its building products where possible, minimising the depletion of natural resources. "We incorporate materials such as ground granulated blast furnace slag in place of cement, converting it to prime concrete products to deliver significant reductions in waste for landfill. The concrete blocks within Forticrete's environmentally friendly Dense Concrete Masonry range, which form part of the company's Ecoblock masonry solutions, are manufactured using up to 45% recycled content, to provide a 'greener' alternative to standard decorative masonry blocks."

Masonry products manufacturer Lignacite has meanwhile developed what it claims is the world's first carbon-negative building block in partnership with Carbon8 Aggregates. The Carbon Buster incorporates more than 50% recycled aggregates and combines this with Carbon8's carbonated aggregates derived from by-products from waste-to-energy plants. The result is a product that has captured 14kg CO_2 per tonne – more than is emitted during its manufacture.

Carbon8's technical director, Dr Paula Carey, explains: "On the back of research carried out at the University of Greenwich's School of Science, Carbon8 identified an end use for thermal residues from waste-to-energy plants. By mixing the residue with water and carbon dioxide, we were able to transform the material into what the Environment Agency has agreed is a product suitable as a virgin aggregate replacement."

H+H is another manufacturer that highlights its environmental credentials. Its aircrete products have a recycled content of between 75% and 80%. For 60 years the company has been using pulverised fuel ash (PFA), a by-product from electricity generation that would otherwise go to landfill. The PFA is mixed with water to create a slurry that is pumped into a mixer where cement and lime binders are added, along with a minute quantity of aluminium powder. The company claims that less than 1% of the raw materials used in the production of its products are imported from overseas.

From a building performance perspective, one reason for using clay- and concrete-based products is that they provide thermal mass. ▶

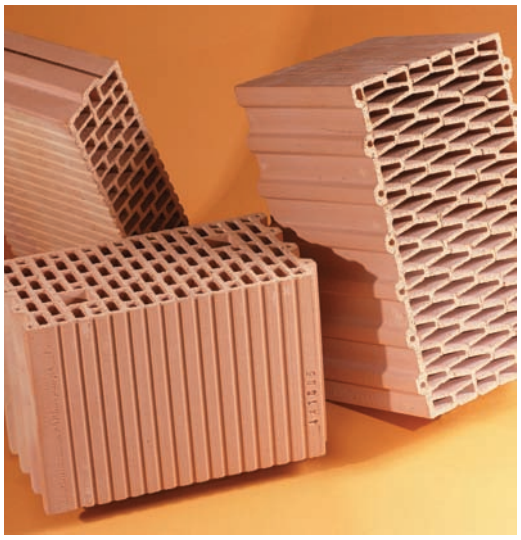
Brick Development Association

BELOW Wienerberger's Porotherm blocks

BOTTOM H+H aircrete: The cake mix is loaded into an autoclave that applies steam at high pressure

RIGHT BELOW Laying H+H aircrete blocks

RIGHT BOTTOM The main constituent of H+H aircrete is pulverised fuel ash (PFA). The PFA is mixed to a slurry with water, prior to being fed through a mixer where cement and aluminium powder are added



Haxted Estates' scheme on Sandbanks Road in Poole – the Silver winner in the Best Luxury Development category at the recent What House? Awards – is an example of this thinking. From the outset, the designer, Black Architecture, made the decision to expose as much thermal mass to the interior as possible to avoid the need for the comfort cooling or air conditioning normally demanded in the luxury market.

"We had quite large amounts of glazing to the south-west, designed to enjoy the views, and it was hard to shade because it's set on a series of terraces for various apartments," explains Paul Hinkin, managing director of Black Architecture. "We developed a construction philosophy where we placed all of the masonry mass of the wall on the inside surface, we then insulated that on the outside and then clad beyond that."

The construction uses a concrete frame and concrete floors with the inner leaf of the walls of 150mm medium density blockwork. This is clad externally with a layer of 'super' insulation and external finishes of zinc, render and brick.

"It wasn't a brick and block heavyweight construction; it was heavy getting lighter, having less embodied energy the further away from the interior it is," says Hinkin. "We coupled that with traditional two-coat, thick plaster finishes on the inside."

Hinkin believes there has been a trend of ever-lighter construction, particularly in the residential sector. "This is beginning to cause real problems in terms of indoor environment conditioning with overheating, particularly on westerly facing elevations. There are real benefits in being able to even out diurnal swings and usefully store thermal energy for reuse by having an element of mass in the interior. Like all these things it has to be incorporated with sensible passive solar design and must incorporate a proper external solar control strategy."

Sofie Pelsmakers acknowledges that benefits such as increased comfort may result from thermal mass but her analysis indicates that high thermal capacity materials, particularly brick and block, significantly increase embodied energy. "The additional embodied carbon is estimated at three to five tonnes of CO_2 for a 100m² house, which would take around 19-25 years to pay back from operational heating energy savings alone." sh

The Environmental Design Pocketbook by Sofie Pelsmakers is published by RIBA Publishing, £25

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