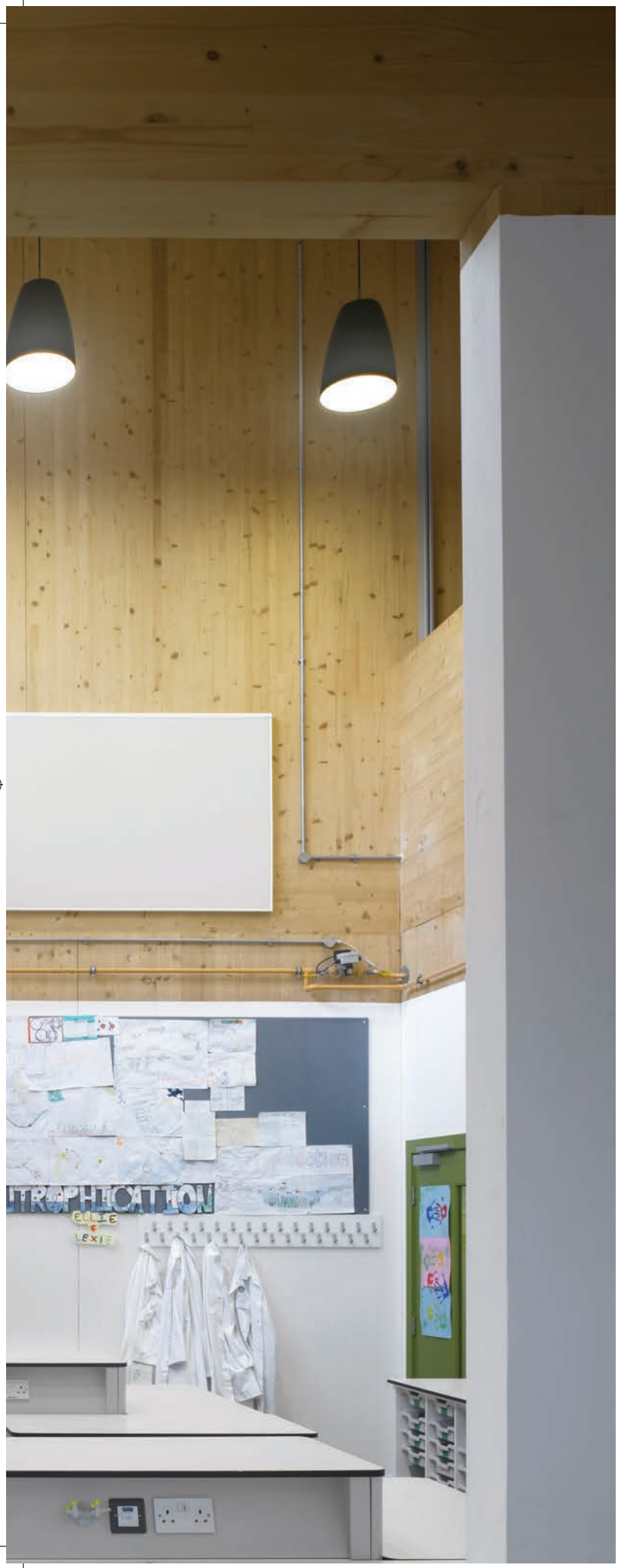
OVERVIEW
TIMBER

The coverage of structural timber in the schools of architecture used to be quite basic. Concrete and steel were taken much more seriously and students weren't taught calculations for timber structures. Today, with the rise of engineered timber technology, it's a different world and one that is interesting to view from the following three perspectives. ***Felix Mara***

HUFTON + CROW



A specialist timber contractor's view

'Timber engineers have different skill sets to those who specialise in concrete and steel,' says architect Liam Dewar, director of timber contractor Eurban, who designed, supplied and installed the structural timber for Sheppard Robson Architects' Waingels College (AJ 15.03.12). 'They have to be carpenters first and need to understand the nature of the material.'

The main references are Eurocode 5, the DIN standard, British Standards for building tolerances, manufacturing and, most critically, building, '…and our knowledge,' adds Dewar. 'There is no single standardised document.'

Addressing concerns about the relatively low thermal mass of timber, Dewar says. 'The future of office buildings is not a lot of heat-generating computers.' Discussing broader aspects of sustainability, he acknowledges steel's efficiency, but observes that ultimately it may need to be transported five times as far.

'We do everything in 3D, using cadwork, a specialist timber CADCAM- package, and all the information goes into the model, so there's little risk of mistakes.'

Along with the cost and programme benefits of engineered timber, Dewar emphasises the flexibility and freedom it offers designers. 'You can have what you want – it's like baking your own bread.'

A consultant engineer's view

'According to Bath University's carbon and energy inventory, 2.78kg of CO_2 is emitted in the production of every kilogram of virgin steel,' says Steve Webb, a director at structural engineer Webb Yates. 'For engineered timber, this figure is 0.51kg, although steel is stronger so you use less.' Nevertheless, a 300mm-deep x 400mm-wide laminated timber beam weighing 65kg/m has the same stiffness and strength as a 305 x 102 x 33mm steel UB, which weighs 33kg/m, but it generates only 36 per cent as much CO_2. Also, the tree will have absorbed around 1.6kg of CO_2 per kg of timber from the atmosphere. With better building insulation and more efficient services, the proportion of CO_2 emitted in frame manufacture is at a premium.

Timber cannot entirely replace steel or concrete. It isn't strong enough or easy enough to connect. However, engineered timbers, which reshuffle the material >>

Top Frame sections by Performance Window Group member Mumford & Wood
Far left and centre Sheppard Robson's Waingels College, Berkshire (AJ 15.03.12) with engineered structural frame by Eurban and external cladding by Metsä Wood

ARCHITECTURE:WK

Top Webb Yates used an epoxied dowel detail in this portal frame for architecture:wk's Albion Road residential extension in Twickenham. The steel alternative would have generated 3.1 tonnes more CO_2
Left Glued timber oak panels at Waind Gohil Architects' New Dale residence. Structural engineer: Webb Yates

to prevent natural weaknesses such as knots, are quite strong and stiff. A 300mm-wide by 300mm-deep RC beam with two 16mm reinforcement bars would have a safe bending strength of about 30kNm, while a beam made from Kerto laminated veneer lumber, with the same cross-sectional area, would carry 85kNm. After the concrete beam has cracked and shrunk under load it will be about 50 per cent less stiff than the Kerto beam. Also, concrete structures have finite lives, due to progressive carbonation of the cement matrix, leading to re-bar corrosion. Timber structures are often used for low-cost housing, but can sound hollow when you tap on walls or floors. Webb says acoustic problems can be overcome: 'Cross-laminated timber, comprising thick panels of laminated softwood, is heavier and feels more solid.'

Bolts and screws can tear through timber at relatively low loads, making connections difficult. Trusses with flitch plate connectors have lots of bolts and are ugly and expensive, but new connection designs include epoxy-bonded dowels or ferrules.

Glued timbers are common and, if done correctly, perform as one, providing enormous possibilities for stressed skins and composite construction.

'Exposed timber can provide visual warmth, but no one worries about painting steel,' says Webb. 'Hopefully, fewer buildings will show off their timber. The"timber or not?" debate is often clouded by aesthetics.'

A manufacturer's perspective

'Our engineered timber comes from the tree's heart, where the real strength lies,' says Chris Brunsdon, sales and marketing director of the Performance Window Group. It is initially scanned for defects to identify resin pockets and knots. Clear parts are then finger-jointed and glued in six-metre lengths to create top-quality, clear grade timber.

Components are purchased direct from European suppliers, with specified grain directions for each size, improving stability, appearance and the performance of paint finishes, which won't adhere well to over-dry wood. 'Factory-finished windows installed into prepared openings and fitted behind reveals also improve window performance', says Brunsdon.