

towards a new architecture of wood: recent developments in timber design & construction in the UK

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Background

The use of timber in UK architecture and construction has until relatively recently, been something of a lost art/skill. True, the country has been importing timber for the past several hundred from Scandinavia and the Baltic States and still today imports around 70% of the timber used in construction from around the world. One reason for this was the almost continuous denuding of UK forests to provide materials for shipbuilding and war. The latter was the motivation for planting much of the forestry we see today – especially in Scotland and Wales – a largely conifer-based resource in which Sitka spruce is the dominant species.

This non-native, fast-growing tree was initially planted following WW1 to provide material for trench linings and pit props should another war arise, but by 1945 the nature of warfare had changed and it was not needed for these purposes. In the aftermath of WW2, new, non-timber forms of construction were deemed necessary to meet the demand for new housing and, by the 1960s, this demand was even greater and prefabricated, concrete and steel based systems became the vogue. Speed of construction, rather than quality, was the principal criterion, although cost was also a significant factor in delivering Prime Minister Harold Wilson's 'white heat of technology'.

At the same time, more Sitka was being planted and throughout the 1970s this continued, aided by considerable tax breaks for wealthy investors. The trees planted in the first of these decades – plus those planted between the wars – were used in pulp and paper production, but by the early years of this millennium this use had diminished and there was much talk in the timber industry of what to do with the 'wall of wood' that was about to reach maturity. Unlike mainland Europe where trees are grown for 80-90 years, economic conditions in the UK demand that the plantation conifer resource be grown for 50 years, a significant factor in its ability to be used in construction. Such timber as was visibly used in the 1960s' building boom tended to be in the form of imported glulam, which despite its use in school halls, churches, swimming pools and other large span structures, did not lead to investment in manufacturing facilities for engineered timber products.

In this context, timber largely went not only out of fashion – it went out of use in almost every building type except housing. In Scotland from the 1980s onwards, platform timber frame construction became the dominant form of construction for housing, so much so that this fast and substantially off-site method of building is currently responsible for over 70% of the housing built in the north of the UK and is nowadays a very sophisticated process. Not so in England however, where a 'World in Action' television documentary in the early 1980s so castigated this technology that it went almost completely out of use and even today provides only around 15% of new housing built in what is the largest part of the UK. Until relatively recently, however very little of this housing, either in Scotland or England, showed much visible evidence of the use of timber, and public perception of the UK's construction history was that of it being a largely stone or brick based building stock.

Environmental imperatives and ever-rising regulatory standards have, however, caused a reappraisal of timber's positive value as a sustainable construction material and with it a growing re-education of design and construction professionals whose training largely ignored what, in the post WW2 period, had been regarded as a traditional and thus old-fashioned and low-quality building material.

Changing Perceptions

The rise in interest in the use of timber amongst architects and, by extension, other construction professionals in the UK, can arguably be dated to the opening in November 1998 of the River and Rowing Museum in Henley-on-Thames by David Chipperfield Architects. More than any other building at the time, this high profile, high quality project

demonstrated that timber – in this instance horizontal oak cladding – could be considered as a modern construction material, and was a profound break with most modernist design thinking, especially in England where the engineering tradition of the Crystal Palace lingered on in the concrete, steel and glass-based designs of the country's 'high tech' architects.

Chipperfield did not select this material in isolation – wood was a traditional boathouse material after all, but around Europe timber was being used extensively – and creatively – in new buildings as a matter of course, particularly in countries with long and uninterrupted carpentry traditions. As indicated above, however, the UK had since the 1960s travelled a very different path and understanding of how to use timber had become something of a lost skill in the bulk of its construction industry.



The River and Rowing Museum in Henley-on-Thames, Oxfordshire
by David Chipperfield Architects

Chipperfield, who had worked for Sir Norman Foster, was not the first of the UK's well-known modernist architects to build with timber, but Henley was the first well-publicised project to be constructed in the UK by one of this group. Richard Rogers was, for example, completing the Law Courts in Bordeaux the same year, a project that had begun in 1992. Although very different from the Henley Museum, its cedar-clad court pods held within a steel frame structure introduced the idea of high quality, hybrid timber civic buildings, a proposition used again by the practice in its design for the National Assembly for Wales, a project that coincidentally began in 1998, the same year that the Henley River and Rowing Museum and the Bordeaux Law Courts were completed.



Law Courts, Bordeaux by Richard Rogers Partnership



The National Assembly for Wales by Rogers, Stirk, Harbour + Partners

Rogers, Stirk, Harbour + Partners has since gone on to complete a number of 'high tech' hybrid timber buildings outside of the UK, notably in Spain with the bamboo-lined Barajas Airport at Madrid (2006) and the double curved glulam structured halls of Bodegas Protos (2008) at Penafiel in the Valladolid region, although both were preceded in the UK by the engineered timber facades and structure of the practice's Mossbourne Community Academy (2004).



Bodegas Protos, Penafiel, Valladolid by Rogers, Stirk, Harbour + Partners



Mossbourne Community Academy by Rogers, Stirk, Harbour + Partners

At the same time as Mossbourne was being completed, Hopkins Architects' 'Inn the Park' restaurant was emerging in London's Green Park, a gem of a building with its colonnade of circular glulam columns and larch cladding inside and out concealing its in-situ reinforced concrete box structure. As a practice, Hopkins Architects has a long tradition of exquisitely conceived and detailed hybrid timber buildings, many of which respond sensitively to existing and often historical structures.



Inn the Park, London by Hopkins Architects

One such is the refectory restaurant and visitor centre at Norwich Cathedral, a freestanding two-storey timber box that sits lightly on the site of the original medieval monastery refectory. Nine pairs of slim, circular glulam columns support splayed finger struts and a stiff roof plate from which lateral loads are transferred to cross braced columns aligned with the end glazed walls. This is hybrid timber engineering of a high order and a design philosophy that the practice has developed in a number of other visitor centre projects such as the Utopia Pavilion at Broughton Hall (2005) and at Alnwick Garden (2006).



Refectory, Norwich Cathedral by Hopkins Architects



Utopia Pavilion, Broughton Hall by Hopkins Architects



Alnwick Garden Visitor Centre by Hopkins Architects

External Timber Cladding

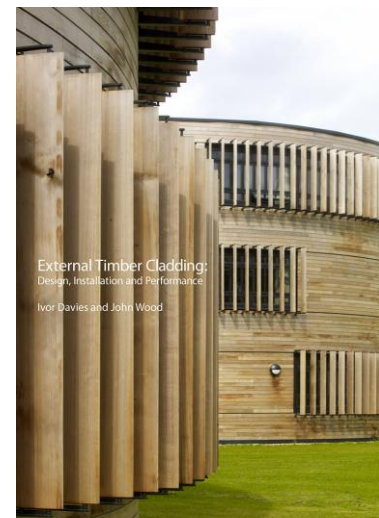
But back to external timber cladding for a moment, because this is the area of timber construction that has not only been the most visible element to the general public over the past 15 years, but the one most easily accessible to architects largely untrained in materials science and especially that relating to natural materials.

There is no question that David Chipperfield's Henley building opened the door to timber being used as the external surface of non-domestic buildings, but Long and Kentish Architects significantly up-scaled the possibilities with the green oak rainscreen on the National Maritime Museum in Falmouth (2002). The building form is based on the vernacular sheds that accommodated the ship builders and timber merchants on the site in the late 19th century and the rear fixed external cladding panels also exhibit an extremely well detailed maritime aesthetic.



National Maritime Museum, Falmouth by long & Kentish Architects

External timber cladding remains popular throughout the UK, although not without mistakes being made in its design and installation across the country's widely differing climatic areas. Astonishingly, British Standards exist for almost every type of external cladding material except timber and in response to this, Edinburgh Napier University's Forest Products Research Institute has produced a definitive technical manual on external timber cladding and is currently leading the development of six new British Standards (four will appear by December 2013) aimed at establishing reliable design and construction parameters.



Green Timber

Green timber has not only undergone a renaissance in its use as an external cladding material however – contemporary structural applications have also emerged over the past several years led, in the first instance by remedial work to historic buildings such as the replacement of the hammer beam roof of the Great Hall of Stirling Castle (1999). Scotland has been home to a number of new, large-scale green timber projects such as the ECOspace at Carnegie College in Dunfermline (RMJM, 2007) the headquarters of Loch Lomond & the Trossachs National Park at Balloch (Page\Park Architects, 2008) and the Robert Burns Birthplace Museum, Alloway (Simpson & Brown Architects, 2010), all using Douglas fir in their structure and Scottish-grown larch for their external cladding.



ECOspace, Carnegie College, Dunfermline by RMJM



Carrochan, Balloch by Page\Park Architects



Robert Burns Birthplace Museum by Simpson & Brown Architects

Knowledge and experience of green timber construction has now begun to filter down to more domestic scale projects with the green oak frame of the recent Rosslyn Chapel visitor centre by Page\Park Architects (2012) being perhaps the most unusual example.



Rosslyn Chapel Visitor Centre by Page\Park Architects

Timber Engineering

Prior to the construction of each of these examples, the sustainability credentials of what might be described as a more free-form structure were taken to new levels in the Savill Building Architects at Windsor Great Park (2006). Designed by Glenn Howells Architects, timber engineering expertise (provided by Buro Happold) is combined with traditional craft skills to create the gridshell roof, a flowing organic shape that derives its strength from the grid of its structure and the double curvature of its form and cladding. The gridshell is built from larch laths sourced in the park whilst oak (also from the park) was used for the roof's outer rainscreen. The three-domed double-curved structure, 90 x 25metres on plan, is the largest gridshell roof in the UK and four times larger than its predecessor, the gridshell roof at the Weald and Downland Museum, designed by Edward Cullinan Architects in 2002.



Savill Building by Glenn Howells Architects

But timber engineering of this quality is not now new nor exclusive to the UK – the entrance to the Hannover Expo in 2000 or Shigeru Ban's more recent Pompidou Centre at Metz are outstanding examples to be found elsewhere – and many of the recent developments in timber engineering in the UK have been carried out at a more prosaic, low-cost level. Stress laminated bridges for example, have been the testing ground for the use of home-grown timber in the construction of large span structures and over the past decade some 100+ bridges using this technique have been built in remote parts of Scotland and northern England.



stress laminated bridge at Robert Burns Birthplace Museum, Alloway

The most striking example is perhaps the Far Moor Bridge designed in 2011 by Civil Engineering Design Services Ltd for the Yorkshire Dales National Park Authority. In this example, the three arch structure extends more than fifty metres and uses Scottish larch for the laminates with oak on the outer sections to withstand and spread the stress loadings.



Far Moor Bridge, Yorkshire

Sustainable Construction

The current emphasis on making more use of more home grown timber should be seen in the context of UK imports – as mentioned earlier, more than 70% of the country's construction timber – softwoods, hardwoods and engineered timber products – comes from abroad, a significant challenge to national aspirations for more sustainable construction. In part this is to do with the resource available and in part to lack of knowledge of the properties of the species available. The Observatory in Kielder Forest designed by Charles Barclay Architects (2008) is a striking looking, all-timber building set high above one of the largest forest areas in the north-east of England. Unlike the Savill Building where all of the timber used came from the park within which it sits, in this instance the larch cladding came all the way from Siberia apparently because it was suggested that the timber in the forest wasn't of good enough quality to build with!



Observatory, Kielder Forest, by Charles Barclay Architects

Engineered Timber

Which brings us to the relatively recent enthusiasm for engineered timber products, none of which are currently manufactured at industrial scale – if at all – in the UK. Glulam is the most obvious and has been imported for many years from central and northern Europe. Highly popular in the 1960's for swimming pools and school and church halls, it went out of fashion for a time before re-emerging in the past decade as an alternative to structural steel and concrete. The Winter Garden in Sheffield designed by Pringle Richards Sharratt Architects and Buro Happold (2003) is – at some 70 metres long and 21 metres high – one of the largest glulam structures in the UK.



Winter Garden, Sheffield by Pringle Richards Sharratt Architects

LVL – laminated veneered lumber – has only lately begun to feature in UK architecture, most recently in the new visitor facility adjacent to the Scottish Borders home of Sir Walter Scott, author of *Ivanhoe*. This simple building by LDN Architects (2012) uses LVL portals internally and externally as well as cross laminated timber for its floors and roof.



Abbotsford Visitor Reception Building by LDN

And it is cross laminated timber that has led the engineered timber charge in the UK over the past decade. The earliest projects by Pringle Richards Sharratt were followed in 2003 by the establishment of Eurban, a company specifically set up to engineer and construct cross laminated timber buildings. In the decade since, others such as KLH UK have joined them as major players in a marketplace that is growing exponentially because of the product's many positive attributes.

Several important factors have also helped cross laminated timber to its current pre-eminent position – (1) the previous UK government's 'Building Schools for the Future' programme (now discontinued) that saw remarkable numbers of new schools constructed in England from imported cross laminated timber; (2) the emergence of engineered timbers as materials of choice in large scale supermarket construction; (3) and the development of an eight storey all-timber structure in an inner city area.

The first of these – school building – has seen an extraordinary range of high quality junior and senior facilities built the length and breadth of England. From Dartington CE Primary School (White Design, 2010) in the west to the Open Academy in Norwich (Sheppard Robson Architects, Ramboll Engineers, 2010) in the east, the latter utilising 3095 m³ of CLT and taking only 16 weeks to build.



Open Academy Norwich under construction

Similarly, the design and construction of supermarkets have undergone a radical transformation with many of the UK's largest operators now opting for timber solutions. BK Structures – a company formerly focused on steel erection – has led on this and is now responsible for the largest proportion of cross laminated timber used in the UK. The initial advantages of timber to their clients were measured against customer expectations of each company's purported green credentials, but offsite manufacture, speed of erection, earlier cashflow and internal environments that encouraged customers to stay longer and spend more have seen an almost evangelical conversion amongst supermarket operators to timber and hybrid timber buildings.

Perhaps the most game-changing development in recent years however has been the 2009 erection of the Stadthaus in Hackney's Murray Grove by Waugh Thistleton Architects and engineers Techniker. With eight storeys of structural cross laminated timber on a masonry base obviating the use of concrete or steel, the overall nine-storey building has been something of a revelation for engineers and has led to even higher cross laminated timber buildings being designed and constructed around the world.



Stadthaus, Murray Grove by Waugh Thistleton Architects

Even in its own Hackney backyard, two further large scale CLT buildings – Whitmore Road and Bridport House – have been so successful that moves are afoot for this London Borough to become the first to implement an ‘Timber First’ planning policy. This in a city that has Building Acts established as a consequence of the Great Fire of London.



Whitmore Road by Waugh Thistleton Architects

By contrast Scotland has seen far fewer cross laminated timber buildings constructed – a consequence more of geography and distance from manufacture than any reluctance to see the product used but the impact of the handful of examples erected for Housing Expo in 2010 led to senior politicians in the Scottish Government demanding CLT be manufactured from Scottish grown timber as soon as possible (Scotland contains the bulk of the UK’s plantation forest resource). In the two years or so since, Edinburgh Napier University has carried out a substantial research and development project designed to bring CLT to full commercial manufacture and discussions based on the generic information produced are now ongoing with several possible manufacturers.

It may not be too long therefore before a product that Alex de Rijke of dRMM Architects – himself a major exponent of CLT – describes as the concrete of the 21st century, will be commercially manufactured in the UK using UK grown timber. If and when this takes place, we will indeed have come a very long way in the past 15 years. When David Chipperfield elected to use oak cladding at Henley he could not have foreseen the extraordinary change he was initiating in the perception of timber as a suitable material for high quality buildings.

Further technical development, increased environmental requirements and availability and cost of materials may well bring about a further quantum leap in timber architecture and construction in the UK in the next 15 years. Almost certainly much more if this will use UK grown timber and see more regional variation develop in response to climate and local culture. Achieving this will require serious investment in the UK in timber R&D and a commensurate commitment to transferring the knowledge gained to the construction industry. It also requires a reinvigorated economic climate in which construction once again flourishes – this time led by the one truly renewable construction material we have