

# Towering Impact

## Timber construction reaches for the sky

A tranche of twenty-first century timber hi-rise projects are emerging across Europe, aimed at squaring the compact city hi-density circle with the demands of zero energy housing. Oliver Lowenstein looks at WaughThistleton's ground-breaking Murray Grove in London, along with further projects in Germany, Norway and Sweden in the first of this two-part series

It isn't as if it isn't obvious. The planet's population is heaving, and urbanising fast. There isn't enough liveable land, in cities particularly, so where do you build? Up, of course. And voila, the rationale for hi-rise, the world over! But then there's resource wars, and increasing attempts to figure out how to carbon neutralise building stock, something of a problem for steel and concrete laden hi-rise. But what if you could build with carbon neutral materials? What if you could build in timber?

It's an ambition which has been around for decades, though stifled by regulations and the limits of timber performance. But now with developments in engineered timber, with regulations changing all over Europe and with the realisation that the days of sole reliance on hi-energy materials are numbered, the arrival of timber towers has almost arrived, or at least is on the horizon.

Several countries in Europe are in the midst of building medium, to what is technically graded as the lower end of hi-rise (ten storeys.) Unsurprisingly, this is a building aspiration which is unlikely to disappear. While not on the level of the hyper hi-rise buildings found across the planet, from Shanghai to Dubai to New York, timber hi-rise's emergence signals how change is afoot. For some in the green cities firmament it's a critical answer and solution to a key challenge; reconciling zero energy building for high-density contexts. For others, particularly those who believe hi-rise living isn't the answer to living lightly and literally close to the earth, the rise of the timber tower only shifts some radical greens problem's with city livings disconnect with the natural world. But in the super-pragmatic world of housing it's unlikely that timber hi-rise is going to disappear anytime soon. And for those unfamiliar there's a surprise in store as well. The tallest, swankiest piece of towering timber real estate just happens to be in London, paraded by architects, contractors, timber suppliers and the wood industry en masse as the answer to hi-energy cities building and housing woes. For others, particularly those who believe hi-rise living isn't the answer to living lightly and literally close to the earth, the rise of the timber tower only shifts some radical greens problem's with city livings disconnect with the natural world<sup>1</sup>.



Criss-crossing the back streets a year ago, immediately north of inner London's northward boundary line, N1's long City road, I was struck by the sheer scale of ongoing construction work. What would happen, I found myself wondering, to the carbon footprint if all these buildings were constructed from wood? It was fantasy speculation, of course, but I'd just visited the tallest timber residential building to be built yet; a nine storey, mid level hi-rise - and ideas of how this vertical promise for radically recalibrating such hi-density city districts, drawing down footprints into carbon neutral, or even carbon positive terrain, came thick and fast. 24 Murray Grove, or The Stadthaus, as its echt-continental appellation goes, the nine-storey build in question is one of the first major UK housing projects to apply the middle European massive wood panelling system to an entire load-bearing structure. The result for this 29 apartment housing bloc which both massively reduces the footprint and is the tallest structural application of timber to a residential building so far constructed in Europe.

This impressive first is partially down to the pre-fabrication system: the UK division of Austrian KLH, the prefabricated massive wood system arriving flat-packed in weekly artic lorry deliveries, which is already common in many parts of Europe. The project emerged, says director, Andrew Waugh, from many conversations the architects and engineers, Techniker, have knocked around over the years about building hi-rise out of massive wood. When the Stadthaus came on stream Waugh put it to the developers, Telford Homes, who, with new Part L Regs and London's 10% renewable requirement,

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listened attentively. 'Rather than sustainability added on, we wanted to do something which is incorporated into the building itself.' In March 2007, with Hackney planning receptive to the massive wood option, Megan Yates, erstwhile Techniker partner, began a feasibility study. The engineers modelled acoustic separation issues for both walls and lifts and other services, along with checking fire regs. There followed some fine-tuning, thickening of wall depth (up to 128mm wide by 148mm long) including some performance testing requested by Telford Homes, for involving a test rig in Austria, but with these assurances, the developers were fully on board. For project architect, Kirsten Haggert, one of most time-consuming, though essential, elements was checking the plans before they were mailed over to the KLH factory in the Tyrol, where each piece was then cut exactly by CNC-routers before being loaded onto artec lorries.

The exacting quality was clear to see in the 30mm acoustic separation void between the lift shaft and the main fifth floor space, infilled with rockwool insulation. Applying the panelling to the lift wall chamber, unknown in Europe, was also new, although not in itself complex engineering. At each stage of the build the lift shaft precedes laying down each floor. The speed at which building with massive wood occurs has been a talking point, in Stadthaus's case each floor has taken under a week. Demolition of the previous structure began in November 2007, and actual KLH panelling deliveries began arriving twice a week from early march, being

transferred onto site by a mobile crane with the build aimed to be completed over nine weeks. The panels, which are up to 13m long, by locking carbon in the wood have reduced the carbon factor by 186 tonnes (including accounting for 10 tonnes in transportation of the material from Austria). Four German contractors put in three-day weeks, completing a level by Thursday afternoon, although arguably somewhat undermining the building's footprint credentials by flying home each weekend.

At the time of my visit, the man from Telfords seemed impressed, somewhat blandly stating that they're interested in trying 'different ways forward.' Even so with a - primarily annual portfolio of well over three hundred projects - mainly around London's east and north-east, one such showcase can't be more than a drop in the ocean. Waugh says the practice believes in hi-density and in massive wood's 21st century future, as 'a product we believe in' and in being pioneers of low carbon high-rise. 'It's really exciting, for all of us, that we really do feel we're doing something new has cemented the whole team.' Whether a medium level hi-rise, despite the fancy panelling, which doesn't actually show or express any of its timber-innards structure, is actually that much of a move is for some, inevitably, open to question.

Although there's irony aplenty that Britain, a country with hardly an engineered wood sector to its name, has produced the tallest cross-laminated timber hi-rise across the continent, I still couldn't help musing if this



Opposite page and these photos: The Stradhaus is the UK's first timber panel tower. The nine-storey build is one of the first major UK housing projects to apply the middle European massive wood panelling system to an entire load-bearing structure.

is what timber was meant for. Waugh counters that his involvement with cross-laminated timber is “pure pragmatism... even if I might love wood in the privacy of my own home.” What interests him, he adds, is the opportunities its use allows, although it also appears, the practice’s use of cross laminated didn’t originate in any original commitment to wood as a material, but rather in the realisation that it would facilitate a quicker build at the time. For LCA purists bringing engineered timber 1000 miles from Austria may seem a long eco-haul, one Waugh acknowledges. ‘It’s ridiculous that we have to go to Austria, that we don’t have our own timber from Scotland. But there aren’t any companies.’

Since then Waugh has found himself promoting Stadthaus and timber hi-rise both in Europe and North America. Although early days, the interest at all the talks was palpable, he says, with possible projects in both North Carolina and Vancouver, British Columbia. In Europe, he’s talked in Italy and France. In Rome he was talking to the UN’s FAO directorate, and has now been invited back to a seminar on climate change, focused on climate neutral cities. He’s adamant that there’s no reason why timber shouldn’t replace “steel and concrete wholesale.” If these aren’t the first places you think of regarding timber, there’s also been talks at Helsinki’s Technical University, Finland and in Estonia.

With the building completed for nine months, Waugh believes he has a better understanding of what’s actually been accomplished. While before he felt he had an intuitive sense, with times perspective, this has fleshed out the picture more objectively. Potential snagging issues such as internal living conditions, including acoustics and light, have all brought positive responses in the post occupancy evaluations so far completed, with the Metropolitan Housing Association reporting zero defect returns, in effect 100% tenancy satisfaction. Waugh also feels that you know you’re in a different kind of building, “a different type of environment” when you’re in Murray Grove, and yes, sure, he says he’d have no problem living in it. What was so interesting, he continues, was that Murray Grove went up within 10 metres of other residential dwellings and yet there were no objections.

At the practice, WaughThistleton is working on research for a 17 storey project, “whenever there’s time,” with research focused on problems with slab edge compression which has meant investigating balloon construction. What is again attractive, says Waugh, is the simplicity of building with cross-laminated timber. Not completely surprisingly this fusion of a low energy timber system with a high-density hi-rise is generating a burst of activity which could well turn into a flood. Even so, structural use of timber in residential multi-storey build remains in its early days.

That London is out there with the tallest timber build so far is surprise enough. That there are scant comparable projects in other of the big European urban metropolises adds to this surprise. The only comparable project to Murray Grove is in Berlin, Germany. Here Berlin practice Kaden/Klingbeil completed a seven-storey infill apartment block, which might have been made to be titled Stadthaus. Kaden/Klingbeil, who have been working on



*This photo and opposite: ‘E3’, a seven-storey infill apartment block in Berlin seems to have caught the imagination in Germany’s biggest stone-centric city. Although heavily regulated for fire risk, the architects were able to satisfy the city’s planning officers and fire brigade with the timber system.*

timber buildings in Berlin for 15 years, began about four years ago to get into discussions about how a multi-storey residential building could be designed. In 2007, with a site and the city planners onside, and after further extended discussions, the building, called E3, began to be constructed in an infill space between two similarly sized adjoining tenement blocks. The result is a swish urban building, which looks, from photo’s at least, fashionable and mainstream, each floor sharing open balconies and hardly any wood in sight. Yet, of course structurally, the whole building is standing on timber.

Not perhaps completely surprisingly, E3 has received masses of publicity – apparently around 1000 journalists turned up on its launch day - although this has been across the continent rather than in Britain. The name comes from E3’s address, Esmarchstrasse 3, situated just east of Berlin’s centre in Prenzlauerberg district and seems to have caught the imagination in Germany’s biggest and also stone-centric city. Although heavily regulated for fire risk, the architects were able to satisfy the city’s planning officers and fire brigade with the timber system, designed by Stuttgart based Projekte Holz, and engineered by the renowned German engineer, Julius Natterer, and his Bois consultancy<sup>1</sup>. Berlin’s regulations stipulate buildings over 13 metres in height must be constructed with non-flammable materials, but through testing Kaden/Klingbeil were able to show that the

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stacked brettstapel timber system would withstand fire longer than a comparable steel frame. As an additional safeguard E3 has been given an external concrete staircase as an escape route, adjoining each of the seven floors. By using the cross laminated system Kaden/Klingbeil estimate the structural shell amounts to only 30% of a similar building of comparable scale and design. Both laminated beams and the solid walls have also been covered in fire retardent gypsum fireboard, while the ceilings are made from a commercial version of the wood-concrete composite developed by Natterer when head of Lausanne's I-Bois timber research lab<sup>2</sup>, while fire preventative glazed timber planking covers the ceiling's underside. Apartment floor space is around 140m<sup>2</sup> with underfloor heating and a connection to the district heating network, which brings heating bills down dramatically, apparently in the region of 500 euro's a year.

The practice's Tom Kaden says that they are about to start on four further seven storey hi-rises in Berlin this summer, that interest from city planners, architects and the architectural press has been non-stopped, and that, yes, they are looking at higher-rise in various parts of Europe, including Vienna and Innsbruck, Austria. "It's technically possible," he comments, setting the sights for what happens next.

Apart from WaughThistleton, the only other British practice I've come across actively pursuing timber hi-rise has been London's young dRMM, who through 2007 and 2008 were already attempting to push the height envelope up to sixteen storeys. They've been doing this, though, not in Britain, but on the Norwegian Atlantic coast

town of Stavanger. However, last year this collaborative project with one of the best regarded new Norwegian practices, Stavanger based Helen & Hard, - which would have become the tallest completed timberbuild - was put on hold. Originally dRMM had begun the research when they developed a PCT health centre project proposal, which envisaged a 12/16 hi-rise, exposed timber, along with allotment type vertical gardens. The structural engineering work for this had been carried out by Mike Hadi Associates, previously also one half of Techniker, before a split led Hadi and Wells along separate paths, with Wells retaining the original name.

When dRMM linked up with Helen & Hard and the design transferred to Stavanger, the two practices began looking at the project as reflecting a tree, with plinth-like rows of apartments, comparable to horizontal branches. The main challenge was orienting the tower south, to benefit from optimum light conditions, and enable each of the flats to have winter-gardens included in the design. Helen & Hard worked with the main Norwegian timber research centre, Oslo's Treteknisk Institute, on resolving various of the engineering issues, which the timber hi-rise presented. The tower called for a concrete square around a concrete core, with each floor constructed from massive wood. "Helen & Hard came to us and asked, 'can we do this?'" recalls Treteknisk Institute's resident massive wood specialist researcher, Jarle Aarstad. "And I said 'Of course we can.'" Aarstad worked on the statics, noise and fire research issues, to make the timber tower possible. KLH, who are investing in a big Nordic arm of their European operations, also presented two different design options, although carried out from their Austrian base.

With a total budget of 20 million Norwegian krone, (about £1.95 million) about 3/4% above the normal cost of a hi-rise of this scale, the building was brought before the six person client group last autumn. Two voted for the project, two were non-committal, and two were against it, which was apparently decisive. Too risky and too radical, the clients committed the project to concrete, although since then it has disappeared in the credit crunches quicksands. Treteknisk's Aarstad believes, that "now we have the documentation and research" something will happen, while de Rijke says Helen & Hard are continuing to put a brave face on it. "What they're saying is that once they get the concept re-established they will complete it as a timber tower" though de Rijke isn't so sure any longer. If he's now somewhat sceptical about Stavanger happening, like Aarstad, he does see the research that's been carried out as moving timber structural engineering on, demonstrating sustainable hi-rise as 'a practical reality.'

By comparison, in neighbouring Sweden, the hi-rise building and research scene may not seem either so exotic or dramatic as the Stavanger hi-rise, but it is bearing physical fruit and results. Not only this but it is happening in a context in which the low energy benefits of timber are only a part of a more substantial story; the attempt to draw down the complete footprint of an 80,000 population municipality, with the practical goal of being carbon neutral within 50 years. This is a larger and more strategic approach to hi-rise, one which other projects may aspire to, but are all but impossible in dense, massively populated cities. While the emerging timber medium-rise is a patchwork of Europe-wide projects - to which might be added the Swiss six storey domestic project by Scheitlin-Syfrig architects in Steinhausen, and research and other work at the Technical University of Vienna, Austria - apart from this Swedish exemplar there isn't anywhere else which is integrating timber medium/hi-rise into the very fabric of overall energy reduction.

The Swedish project in the town of Vaxjo, in the central south of the country, is situated amidst a region with a long timber tradition, has become the, perhaps, unlikely epicentre of timber hi-rise. Hi-rise may be too vertical a description for eight storey buildings but even so what is happening in Vaxjo remains remarkable, and a beacon for what can be achieved. In the last year 4 eight storey cross-laminated apartment blocks have been completed, and by the end of this year 2 further, though this time passive standard, eight storey buildings will also be completed and inhabited in the town's Valle Broar district. Vaxjo's hi-rise initiative comes on the back of the town being one of the early European front-runner urban centres to seriously embrace efforts to green itself, making the reduction of its ecological footprint a serious priority. Led by the local municipality Vaxjo has already brought down its carbon emissions by 32% between 1993 and 2007, mainly by a shift from oil to biomass heating. The aim is to further reduce emissions to 50% by 2010 and 70% by 2025. Both as achievements and ambitions they are being increasingly recognised; Vaxjo won 2007's Europe-wide Sustainable Energy Award. Together the university of Vaxjo, the regional timber industry, the municipal council are developing their unique Valle Broar



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project, which is as a complete wood town, with homes for between 1000 and 1500 people.

Already the university is home to the Institute of Wood, housed within the 15,000 sq metre Timber Research Centre, which at the time it was completed in 2003, was the largest timber building in Sweden. With the highest concentration of academics focused on timber hi-rise in Europe, the Timber Research Centre is spreading its wings. After a focus on Vaxjo and Sweden, the head of structural research, Erik Serrano believes the time is right to look outwards. "We have the buildings, we have the documentation, and we have the answers, the time has come." How Vaxjo became the European leader of the emerging timber hi-rise community, and how they have done so in the wider context of the town radically reducing its carbon and energy footprints will be the subject of the second article on this subject in the next issue of Green Building magazine.

Oliver Lowenstein

1. From a more general social perspective problems with the social dimension of hi-rise living continue to be only too current. For instance, at a discussion introducing the present round of the EU's European urban development programme, the pan-European panel discussed 'how tall should Europe's cities grow?' Oliver Schulze, a director from the respected Copenhagen practice and urban designers, Jan Gehl Architects, pointed out that research they had carried out in Sweden showed that children and others living in the first three floors of a hi-rise were much more likely to use the ground-level outdoors than those living at five or higher tower bloc. The consequence is less urban life and intensity, and for the children, fewer friends. See <http://www.european-europe.com/e10/gb/topics/d1.php>

2. For a detailed interview/overview of Julius Natterer and his work see my article 'Timber Engines for Growth', in Fourth Door Review 7, p53-57.

With thanks to Andrew Waugh for providing links and contacts to some of the European projects.