WHY NOT TIMBER HIGH-RISES?

review
Russell Fortmeyer

images
Courtesy AIA

In its simplest form, engineering is a myth-busting exercise. As Russell Fortmeyer describes, the elusive timber high-rise may be one of its greatest challenges and one particularly suited to the Australian temperament.

In Milton Keynes, about 86 kilometres north-west of London, the architectural firm Rogers Stirk Harbour + Partners (RSHP) has designed a prefabricated timber housing estate (called Oxley Woods). It believes it could transform construction. Each of the estate’s 145 homes were built in five days off-site in factory-controlled conditions using precision-cut sustainable timber, shipped to site and then constructed on poured slabs in what amounted to about 24 hours.

If you don’t believe this, you can see a condensed film of the site process on the RSHP website (www.richardstirk.co.uk/press/news/oxley_woods_video).

Iain Harbour, a senior director at RSHP in London and no stranger to Sydney’s design scene (as the RSHP director primarily responsible for the Barangaroo master plan), says the project was motivated primarily by health and safety issues, as limited construction time on-site reduces risk. ‘The purpose is speed and flexibility to manufacture anywhere, since it requires a low skill base,’ says Harbour.

RSHP developed the Oxley Woods model (a single-family home of cloistered timber panels, filled with insulation, waterproofed and used as load-bearing walls clad in a rain screen of sleek Trespa panels, priced at £80,000 or about $110,000) with UK developer George Wimpey and manufacturer Wood Newton. It just so happens the project’s knock-on effects include high energy efficiency and sustainable performance (thanks mostly to the low embodied energy of the oriented strand board for the panels and the elimination of waste), so much so that RSHP has used Oxley Woods as a platform to investigate using the system on other building types. Harbour thinks there’s no reason this approach couldn’t be used in high-rise commercial construction in Australia and he’s determined to prove it.

So, why not timber high-rises? We can call up any number of disproving responses to that question, like durability, strength, uniformity, supply cost, risk, history, modernism, installation, rot, aesthetics and, the grandaddy of them all, fire. Yet, each one of these concerns can be effectively addressed through design, except perhaps for history, which must be dealt with through cultural means. Although no one living today witnessed the great fires that ravaged London in 1666 and Chicago in 1871, or watched Sherman burn Atlanta, the fallout from those historical facts are

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embeed in our modern building codes and industry best practices. Steel and concrete are so ubiquitous and seem to solve so many problems that we have stopped questioning their use. We cling to the myth that timber construction presents risks, while concrete and steel do not. Nonsense. Every residential presents risks, but we manage them in different ways.

RSHP is proposing timber structures for the Brickport Place Hackney residential development in London, which consists of six- and eight-storey buildings. Hackney could be viewed as an extrapolation of Oxley – the same components, arrayed at a larger scale and sat within a discrete frame. To cross-brace the delicate-looking timber structure, the architects have added steel diagonal elements that are expressed at times and concealed behind timber façade elements at others. If we are serious about building taller in timber, we can skirt many of the issues that make engineers squeamish by considering such a hybrid structure. In tall buildings, timber enables us to reduce our dependency on the high-energy, high-carbon materials of concrete and steel, rather than completely eliminate it.

If we’ve pondered the feasibility of timber high-rises at all in the last few years, you would certainly know the Murray Grove project in London by Waugh Thistleton Architects and Tszakow engineers, which lays claim to the title of ‘world’s tallest modern timber residential building’. Dubious qualiﬁers aside, the project is an elegant nine-story approach to the murky concrete-and-brick state of London. Instead, Murray Grove consists of glued cross-laminated timber panels for floors and load-bearing internal and external walls. The panels, manufactured in Turkey by VUK, structurally suit the cellular quality of residential floor plans and can be easily clad, as they are at Murray Grove, with plasterboard and taping slabs. Residents wouldn’t even necessarily know they lived in a timber building.

Perhaps more strikingly, Murray Grove represents an innovative approach to London’s 10 percent carbon emissions reduction plan. Waugh Thistleton estimates the project saves 306,150 kilograms of carbon in construction (compared to steel and concrete equivalents), with an additional 181,360 kilograms of carbon already captured by the trees used for the timber panels. With 29 apartments, that’s roughly 15,810 kilograms of carbon per unit accounted for in the building. As a rough estimate, to offset an equivalent
Want to spend more time actually being an architect?

Rodney Paesler, Managing Director of SCOTTCARVER, certainly does. We asked him to share, in his own words, his experience dealing with the team at Total Synergy and how his Architecture Practice has been enjoying the many benefits of a Total Synergy practice management system.

"There have been several moments throughout my career when I've had to stop and ask myself, am I really doing what I had intended to be doing? I love architecture, and I love the business of architecture. But when I found I was consumed worrying too much about business things and not getting on being the best architect I could be, I knew something was out of sync. Not only was the business not working as effectively as it should, but it was affecting my whole life, even at home."

"I knew I was not alone. We had been spending too much time on administration and not being strategic for our clients. We always wanted to over-deliver for our clients and strive for operational and design excellence by ensuring all aspects of a project were in order. And importantly, I wanted to be confident that that was the case across the whole practice, but in all honesty, it felt like a struggle to achieve our goals. We were all spending too much time on process and administration and were never really certain of what we were in complete control."

"This is going to sound like an ad and, in truth it is, but I was asked to share how we at SCOTTCARVER have clawed back real time into our practice. And what that means is we can actually spend more time doing our real job. Being creative for our clients."

"We have installed a Total Synergy practice management system that has had a major impact on how our business runs. We've had saved money in real terms, saving over 50% of our time producing bills means savings on salaries now used more productively. Just as important, the reporting gives us the confidence that what we are doing is both clear and accurate, and it enables us to easily see where we need to improve and what to do in business. In short, it has made us better managers and has let us focus on what we really want to do - grow our practice as Architects."

"Our initial attraction to the system was its simplicity. Simple to get up and running, and simple enough for everyone in the practice to quickly and easily start using. It is definitely not an accounting tool for our management tool for our managers."

"It has actually empowered our greater control over their performance to our clients better. They now have a clear picture of how we spend our time and can request specific services."

"As a tool, its focus on managing our time, including invoicing and payments, is far more relevant than billing ledgers, which is where we were before.

"Having experienced the Total Synergy practice management system is invaluable. We have found that by adjusting our time to focus on what we do best, we can now deliver more for our clients and be more successful in the market, which is our primary goal."

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Amanda Garnham 02
The consensus of this group currently rests on two systems - steel columns with 'limbs' supporting timber floor panels and timber facade elements or a primarily concrete structure and core with timber structures filling in three- to four-storey 'fire compartments'. Like any engineered solution, there are variations; but either system could potentially result in substituting timber for nearly 70 percent or more of a building’s structure. The steel-timber hybrid can ensure an 8.4-metre grid, which is commercially viable. Concerns like footfall noise between floors can be mitigated effectively with drop ceilings and carpet or tapping strips. More promising, the concrete-timber hybrid could bring increased flexibility to our buildings. The concrete superstructure could last 100 years or more, while the timber infill could be renewed every 30 years or so. If the timber components were prefabricated modular units, such replacement could be done over a weekend.

The steel-timber hybrid does present a fire issue, however, since you would end up with a void in the timber joist floor. Voids typically gather debris over the years, offering a perfect fuel source for fires. Felix Gaesten, a fire engineer in Arup’s Sydney office and part of the timber working group, says any void over 200 millimetres could potentially require sprinklers. That may present a costly headache. The two big fire issues for timber are the surface spread of the flame and the fire resistance of the timber. The former can be addressed with retardants. The latter mainly concerns char, which is the amount of timber that burns off a wood member in a fire before insulating the core. High char ratings do not bode well for timber buildings (since this can erode the strength of the overall structural system), but we have accepted analytical models for determining char rates and can design timber members to suit. "Structural design for timber in fire is very simple," Gamon says. "But there's a difference between doing regulatory approval and fire engineering." Safely evacuating occupants before the floor of a building burns would satisfy regulations, but it would leave little opportunity post-fire for recladding the structure. The concrete-timber hybrid solution starts to answer this by compartmentalising the timber structural components.

Arup’s Berlin office used concrete to address the fire problem on the Life Cycle Tower project, a speculative model for constructing 20-storey timber high-rises from prefabricated elements. Arup is collaborating with the building contractor Ramboll Bau and timber contractor Wurth, both in Austria. The structure combines a core of 36-centimetre-thick glued laminated timber panels with perimeter timber columns for a floor-to-floor span with a clear height of three metres. A composite slab of precast concrete and timber beams spans approximately 11.3 metres from the core to the perimeter.

Harald Prohaska, a project manager for Ramboll Bau in Austria, says the project was motivated by a desire to shorten construction time and reduce ecological impact. He estimates they could build one level per day, including the facade elements. Ramboll has proposed constructing the basement and ground floor with reinforced concrete, which imparts robustness to the ground level, adds some fire protection from adjacent structures, and addresses termite concerns. The timber structure itself is nested within the building envelope, which further protects it from weather concerns. "The lifetime of a timber house is much longer than a wood plantation, which takes 20 to 30 years to grow," Prohaska says, noting that 300- to 400-year-old timber structures in Austria are not uncommon.

For now, the only thing building back the Tower and codes and recessionary market forces. "In Austria, anything over 22.5 metres high must be constructed with non-combustible products and timber isn’t it," says Professor. "Our challenge is to demonstrate our system is compatible and that we have good ideas to solve it." The recent developments in the UK have largely relied on testing undertaken by BRE, which built a six-storey, timber residential building in its testing facility in Garston. In 1999, BRE investigated the effects of various fires on the building, finding that timber structures contribute 17 percent to the total fire load before concluding that medium-rise, timber-frame structures can meet code requirements for limiting the internal spread of fire and maintaining structural integrity. Although this has inspired the residential developments in the UK (after the usual time-consuming regulatory delays), it has not led to commercial timber high-rise construction.

We are stuck, it seems, weighed down with tradition. Timber could not satisfy the modernist desire for purity and hygiene, which necessitated the 'clean' white surfaces of concrete and plastic and the simplicity of steel. "You can’t design a tree," for the most part, and you certainly can’t specify that ring patterns of wood down to the millimetre. But if we can remove the distractions - the structural issues, the questions of fire resistance, the availability of product, the code restrictions and the lack of experienced labour - we should have no reason to deny timber’s place in our high-rise buildings. It has so much potential to simplify construction by eliminating pouring delays and enabling prefabrication; it’s a pity it’s used mostly as decoration. And if we’re serious about reducing carbon emissions in the building industry, we will have to build a timber high-rise. [End]